

user manual

pco.GigE installation



pco.

An Excelitas Technologies Brand

PCO asks you to carefully read this manual before using the pco.GigE installation and follow the instructions.

In case of any questions or comments, please contact us at PCO.



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The cover photo shows an exemplary PCO camera system.
The lens is sold separately.

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Released May 2022 © Excelitas PCO GmbH

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1. INTRODUCTION

This manual describes the installation and configuration of a PCO camera with GigE interface.

For a better distinction:

The ***Gigabit Ethernet network technology*** in this manual is referred to as ***GbE***, however the Gigabit Ethernet camera interface is abbreviated as GigE in order to conform with technical nomenclature.

Gigabit Ethernet is not just the most commonly used network standard. Since 2006 GigE is an interface standard for high-performance scientific and industrial cameras. A group of more than 50 companies developed this standard. The GigE interface standard is based on the Gigabit Ethernet standard which uses standard Ethernet category cabling. The standard is trying to unify protocols currently used in machine vision industrial cameras and let 3rd party organizations develop compatible software and hardware (www.machinevisiononline.org).

System requirements

- PCO camera with GigE interface
- GigE driver Generation 2 V4.x.x.xx
- Recommended Hardware see **2.2.3**
- Camware software package
- Network patch cables and max. length see **2.2.4**
- Check PCO Website for latest versions

1.1 WHAT TO USE?

Which network standard should I use? 100BASE-T / GbE / 10GbE

It is possible to use 100BASE-T 100 Mbit/s network cards for a GigE connection (but ***only*** with PCO ***Gen2*** driver and the max. data transfer rate is just 12 MB/s, that means data transfer is very slow), but ***recommended*** are ***Gigabit Ethernet network cards*** that provide the necessary transfer rates for PCO cameras.

Such cards should be designated with a maximum data transfer rate of 1000 Megabits per second (120 MB/s). See chapter **2.2.2**.

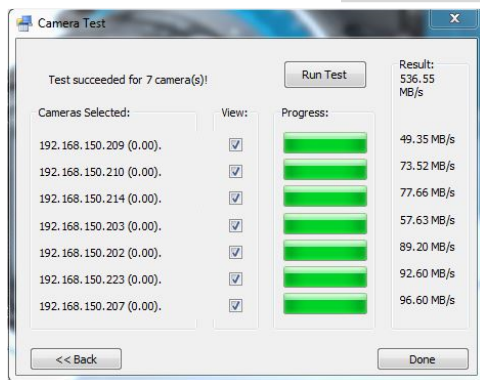
10GbE: High performance ***10 Gigabit Ethernet network*** interface cards with data transfer rates of up to 1200 MB/s work with PCO cameras. See chapter **1.2**

1.2 10 GIGABIT ETHERNET

This network standard will enable you to connect multiple cameras using a **10GbE switch** without causing **transmission bottlenecks** as known from GbE network technology.

These 10GbE components should be recommended, if you:

- use more than one camera connected to one PC via a switch and
- the PCO cameras' maximum data throughput of the GigE interface should be available and
- PCO's GigE Gen2 (V4.x.x.x) driver is used or
- more than 4 PCO GigE camera should transfer their images in parallel to a PC using a switch and PCO's GigE Gen2 (V4.x.x.x) driver
- Recommended hardware see chapter **2.2.3**



Example measurements:

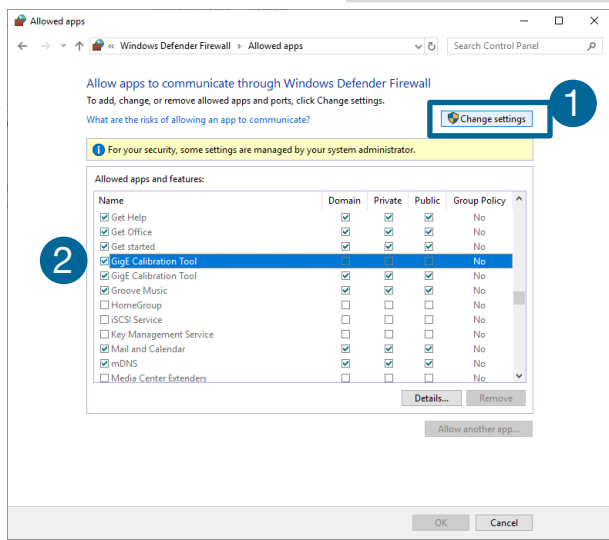
This measurement with seven cameras shows the performance of 10GbE network technology: five pco.dimax cs and two pco.dimax HD cameras connected to a **Netgear ProSAFE XS716T** switch. This switch is connected to an **Intel Ethernet Converged X550-T2** network interface card.

For each camera a Packet Delay of **0** is set. So each of those cameras transfers with a maximum data throughput via it's GigE interface. As you can see no Ethernet packets get lost. Compared to GbE components 10GbE reaches 536 MB/s instead of about 100 MB/s.

1.3 SOME HELPFUL EXPLANATIONS

Term	Explanation
NIC	Network Interface Card
UDP	User Datagram Protocol
Image Packet	UDP packets transmitting image content.
Packet Delay	Delay between two image packets.
Lost Packet	Image packet that got lost during transfer from camera to computer.
DHCP-Server	The Dynamic Host Configuration Protocol (DHCP)-Server is used by networked devices (<i>clients</i>) to obtain the parameters necessary for operation in a network.
Persistent IP	IP address used, if no DHCP server is available
OS	Operating System e.g. Windows 7
Camware	PCO's camera control software
100BASE-T	Network data transfer rate theoretical up to 12 MB/s
Gigabit Ethernet (GbE)	... up to 120 MB/s
10 Gigabit Ethernet (10GbE)	... up to 1200 MB/s

1.4 WINDOWS FIREWALL CONFIGURATION



In order to ensure proper functioning of the GigE driver and the pco.camware software, it is necessary to configure the Windows Firewall under Windows 10.

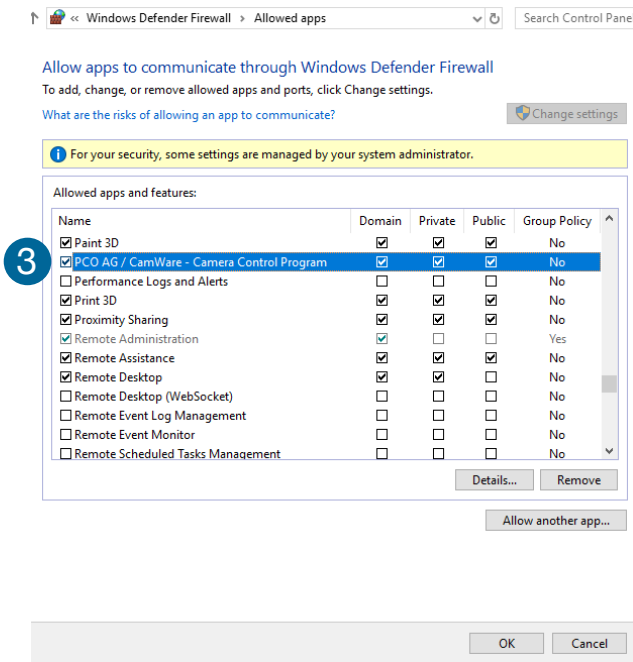
If the firewall is not configured, it may happen that in the GigE Calib Tool, the camera is not recognized or in pco.camware no pictures can be retrieved from the camera.

First click **Change settings** ①, otherwise you cannot set any checkmarks.

Then search for the entries of **GigE Calibration Tool** ② and **PCO AG / Camware** ③.

All checkmarks must be set for all **GigE Calibration Tool** entries and also for all available **PCO AG** entries.

Note: if drivers and software have already been installed several times, there is an entry for each installation attempt. So all checkmarks must always be set for all entries!



2. PCO GigE INSTALLATION

This chapter explains all details of the PCO GigE installation.

2.1 INSTALLATION ORDER

Please follow the steps in this order. Additional information can be found in the respective subchapters.

First Step NIC	Install network interface card (NIC) See chapter 2.2
Second Step IP Address	Configure the IP address of your NIC See chapter 2.2.1
Third Step Driver	Install GigE driver Please follow instructions. See chapter 2.4
Fourth Step Uncheck	Deactivate (uncheck) the GigE driver <i>pco.camera with GigE</i> at each NIC that will not physically be connected to your camera (Win 7/8) See chapter 2.4.2
Fifth Step Calib Tool	Apply PCO GigE Calibration Tool for camera calibration See chapter 2.5
Sixth Step Test	Test your calibration see chapter 2.5.6
Final Step	After successful calibration Install and start Camware

2.2 NETWORK INTERFACE CARD

Your computer must have a network interface card (NIC) to connect the camera via GigE. This can be an onboard NIC (mainboard) or a plug-in card.

PCIe

Ideally it is a PCI Express NIC to bring out the best data transfer rates.

The PCI Express interface allows a faster and more stable data transfer rates than ordinary PCI interfaces. Finally, NIC's vary in the used chipset. Recommended are chipsets from Intel.

Driver

Please make sure that the **specific driver** of the NIC is installed to your Operating System (OS) - If not, your OS may use a standard plug & play driver not performing perfectly with the hardware.

Configuration

If you want to check your network connection or change parameters please open the **properties dialog** of your LAN connection. See chapter 2.2.1.

Mainboard Slot for NIC

If you install a NIC in a **PCIe** slot of your computer, please check the data transfer rates of the preferred slot. Some mainboards do not provide the required data transfer rates on all **PCIe** slots. See 2.6.

2.2.1 IP ADDRESS CONFIGURATION

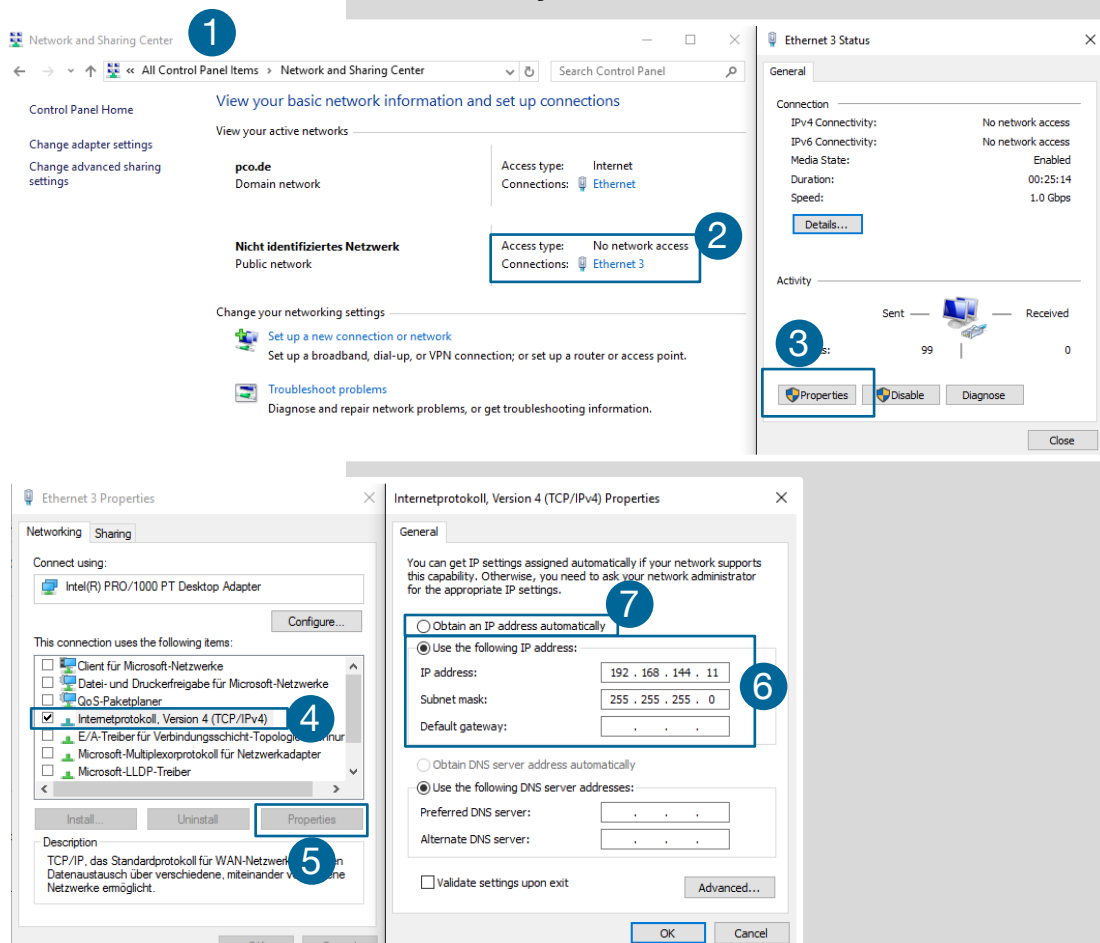
How to configure an IP address manually: Exemplary for Windows 10 (configuration for Win 7/8 is identical)

- 1 Start → Control Panel → Network and Sharing Center
- 2 Select your GigE network connection
- 3 Properties
- 4 Internet protocol version 4 (TCP/IPv4)
- 5 Properties
- 6 Use the following IP address

Only use internet protocol **version 4** (TCP/IPv4), TCP/IPv6 is not supported by PCO cameras.

Recommended: configure your IP address **manually**.

The use of **Dynamic Host Configuration Protocol (DHCP)** is not recommended. DHCP is active if **obtain an IP address automatically** is selected **7**.



2.2.2 JUMBO PACKETS / BUFFER SETTINGS

NOTICE

These settings are just for expert use!

To change these settings:

Win7/8/10: Start → control panel → network and sharing center → change adapter settings → select network connection e.g. Ethernet 2 connected to your camera → right-click → properties → configure → advanced

Jumbo Packets and **Transmit / Receive Buffer** are settings of your network card and can be changed with the windows control panel.

These **buffer settings** help to decrease the loss of data packets (images) while transferring data from camera to network interface card.

Transmit / receive buffer (only recommended for GbE network)

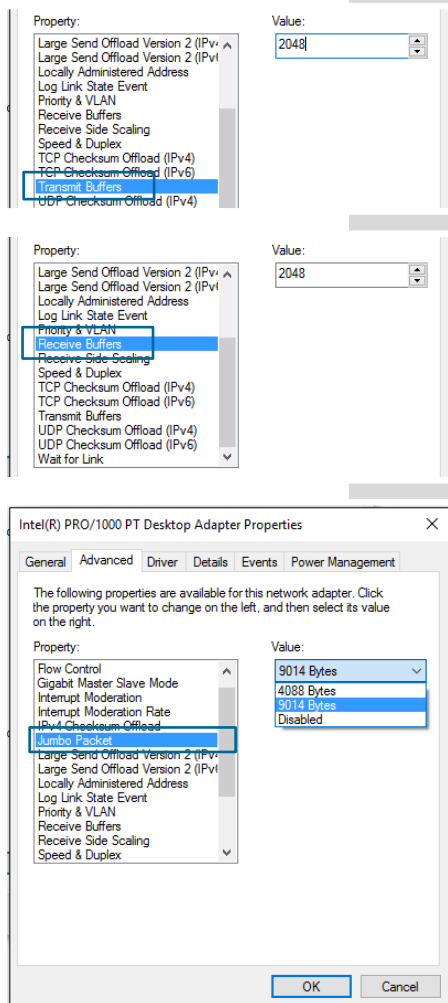
For some NIC's you have the opportunity to set parameters manually affecting the stability of the data transfer. The most important ones are **Transmit and Receive Buffer**. Always set the value of these parameters to its **maximum**.

Jumbo packet (only expert use – only use with one camera)

If your network adapter supports **Jumbo Packet(s)** please activate them, because overheads and CPU cycles are reduced.

All of your network components must be Jumbo Packet compatible.

You must use **Calib Tool** to set Packet Size of your camera, **only** possible for pco.dimax cs series, see 2.5.



2.2.3 RECOMMENDED HARDWARE

The following hardware components are tested by PCO. The use guarantees stable data transfer rates.

Hardware	GbE	10GbE
NIC	Intel Ethernet Server Adapter I210 T1	Intel Ethernet Converged Network Adapter X550-T2
NIC	Intel Ethernet Server Adapter I350 T2 (2 port)	
NIC	Intel Ethernet Server Adapter I350 T4 (4 port)	
Switch	Standard 1 Gbit switch	Netgear ProSAFE XS716T

2.2.4 NETWORK ENVIRONMENT/PATCH CABLE

A correct configuration of the network is important for the transfer rates of the image data which could be achieved. It is mandatory that **any component** used for the network connection between camera and computer is compatible with a data transfer rate of 1000 MBit/s for Gigabit Ethernet or 10 Gigabit/s for 10 Gigabit Ethernet.

Some of these components are the NIC, router, hub, switch, etc., but also the patch cable.

The quality of patch cables is specified in categories. It is necessary to use **category 5e-, 6-, or 7- patch cables** for a network connection with a data transfer rate of **GbE**, for **10GbE** network only **Twisted Pair Cat 7e**.

	GbE	10GbE
Network cable	Cat 5e, 6, 7	TP Cat 7e
Max. cable length	100m	100m

2.2.5 CABLE LENGTH

Available cable lengths:

	length
standard	10 m
optional	0.5 m; 2 m; 5 m; 12.5 m; 30 m; 50 m
maximum	100 m
included	10m cable is included in the camera system

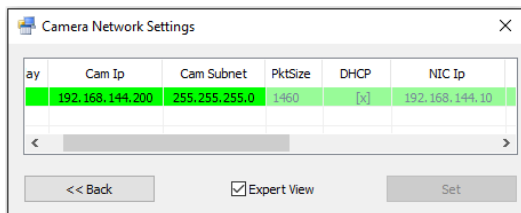
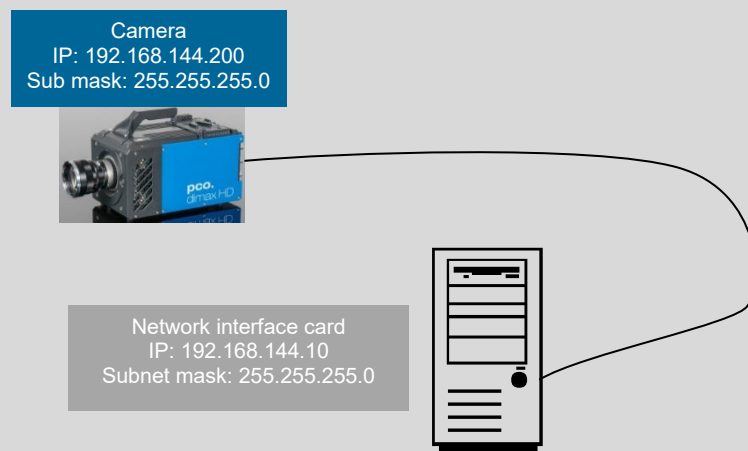
2.3 SINGLE/MULTIPLE CAMERA OPERATION

2.3.1 SINGLE CAMERA

Single camera operation means camera and computer are connected via **Point to Point** connection, i.e. direct connection via LAN cable between the GigE connector of the camera and the network interface card of your computer.

- Connect **NIC** and **camera** via **patch cable** directly.
- Configure the IP address and Subnet mask of your NIC, see **2.2.1**

Configuration example:



Calibration Tool:

Use the **Calibration Tool** to configure these settings, see chapter **2.5** (e.g. configuration of a pco.dimax camera connected to a NIC).

2.3.2 MULTIPLE CAMERAS

There are two basic ways to connect **multiple cameras** to a computer: with a **switch** or with one network interface **port per camera**.

2.3.2.1. SWITCH

The network settings using a switch can be configured manually or with a DHCP server.

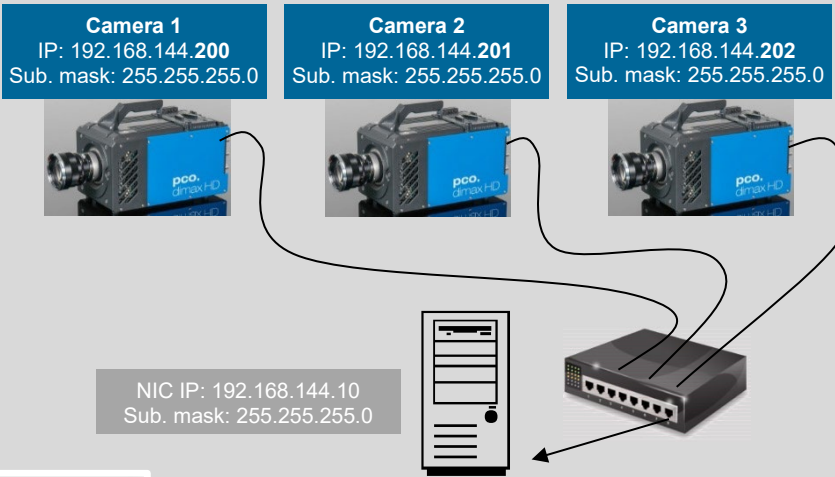
NOTICE

Using a switch can cause network **performance problems**: if the connected cameras require more bandwidth than can be provided by the switch and the associated network card. See also Network and Packet Delay **2.5.3**.

Via switch without a DHCP server:

- Camera and NIC IP addresses have to be set manually.
- The **subnet** of camera and NIC must be **identical**, that means the first three sections of camera and NIC IP address must be identical (see configuration example).
- The next section of each camera and NIC IP can be any value **between 1 and 254**, but may not be the same for both devices.
- For example: NIC IP **192.168.144.10**; a proper camera IP would be **192.168.144.100**. The Subnet mask must be exactly the same, e.g **255.255.255.0**.

Configuration example:



Camera Network Settings						
	Cam Ip	Cam Subnet	PktSize	DHCP	NIC Ip	
y	192.168.145.200	255.255.255.0	1460	[x]	192.168.145.10	2
	192.168.144.200	255.255.255.0	1460	[x]	192.168.144.10	2
< >						
<< Back <input checked="" type="checkbox"/> Expert View Set						

Calibration Tool:

Use the **Calibration Tool** to configure these settings, see chapter **2.5** (e.g. configuration of a switch with two pco.dimax cameras).

Via switch with DHCP server:

- NIC and cameras obtain the IP addresses automatically by a DHCP server.

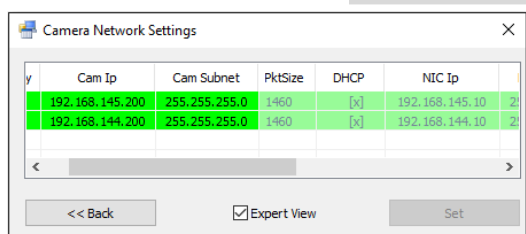
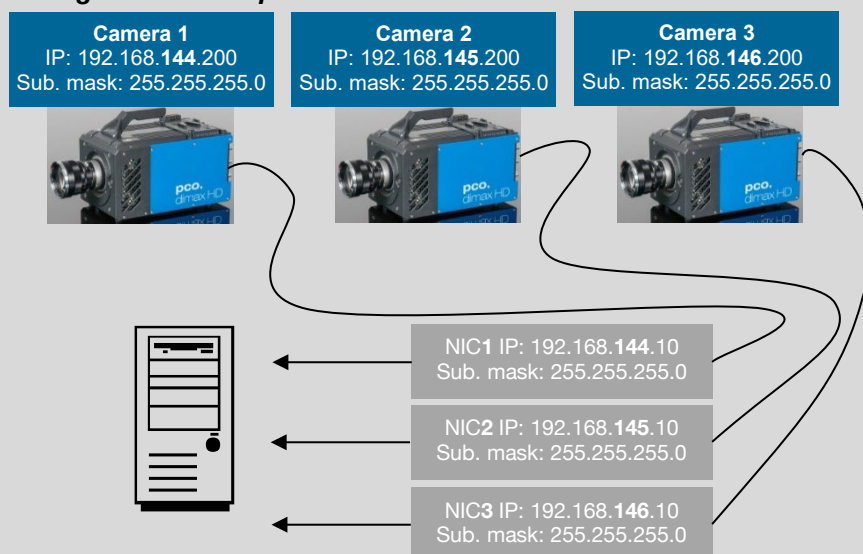
2.3.2.2. SEVERAL NICs

Via several NIC's (or NIC ports) at one computer:

- Camera and NIC IP addresses have to be set **manually**.
- Each **camera and NIC** pair needs its own subnet (see configuration example).
- If you use NICs with multiple ports: check the bandwidth of the PCIe slot.

The following example shows how to calibrate IP addresses when connecting cameras to individual NIC's. Most **important** is that **each camera & NIC combination needs its own subnet** and the camera IP address and subnet and NIC IP address and subnet have to match.

Configuration example:



Calibration Tool:

Use the **Calibration Tool** to configure these settings, see 2.5 (e.g. configuration of two NIC's with two pco.dimax cameras).

2.4 DRIVER INSTALLATION

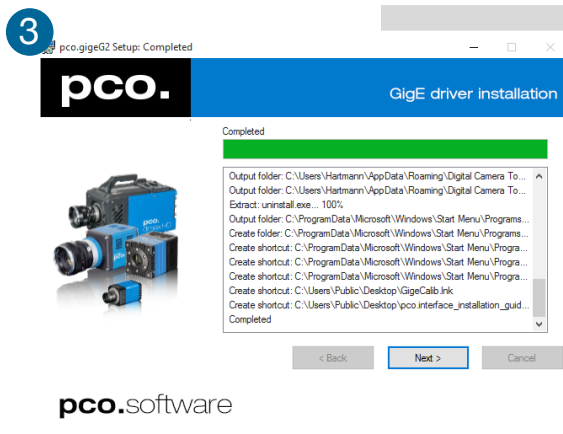
NOTE

If installer fails, please use uninstaller, remove all old files and then try again.

Install the PCO GigE driver to your computer, which can be found on the attached **usb flash drive** or on the **PCO website**.

You must remove an older GigE driver version, before starting the installation. The installer will do this for you.

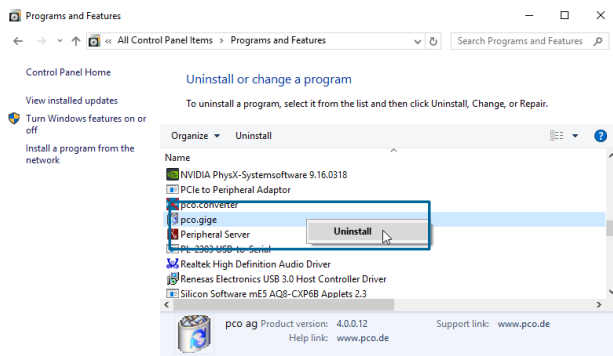
- 1 Start the GigE driver setup DI_GIGE_W7_W8_W10 _V4.X.X.X and follow the instructions.
- 2 Choose installation directory.
- 3 Now GigE driver installation is completed.
- 4 Please reboot your computer to complete the installation. In case of Win 7/8 install GigE intermediate driver
- 5 Start **Calib Tool**



NOTE

This installation file installs both drivers: the Gen2 and the former Gen1 V3.1. This allows all GigE cameras to operate properly.

2.4.1 UNINSTALL DRIVER



Open the file **GigE_Uninstall.exe** (Win7/8: Right-click and select **Run as Administrator**)

Win 7/8/10

Click Start → Control Panel → Programs and Features → Select: **pco gige** and double-click to uninstall

Or on Win7/8: Start → Programs → Digital Camera Toolbox → pco.gige/pco.gige2 → Uninstall

2.4.2 DE/ACTIVATING FILTER DRIVER (WIN7/8)

NOTICE

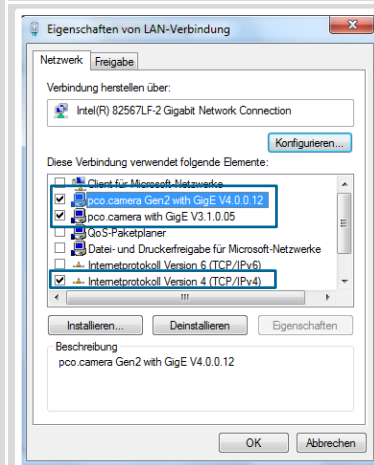
It is absolutely essential that the PCO GigE driver is only activated at the specific NIC that is physically connected to your camera. In addition, just the service **pco.camera with GigE** and the **Internet protocol Version 4 (TCP/IPv4)** should be activated for each NIC used for PCO cameras.

It is possible that, if virus scan/firewall is enabled, a connected camera is not recognized.

The **check box** next to **pco.camera with GigE** is checked for activating and unchecked for deactivating.

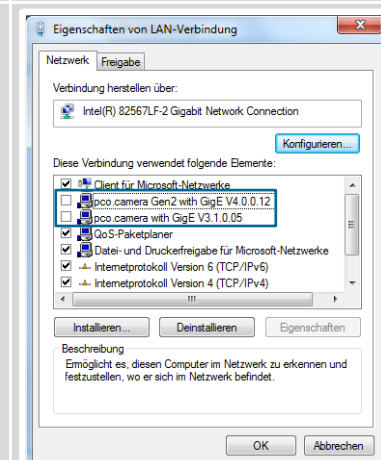
Camera is operated with this network card.

Activate **both GigE drivers** and **internet protocol version 4 TCP/IP**. Deactivate all other elements.



Camera is **NOT** operated with this network card.

Deactivate **both GigE drivers**. Activate all other elements.



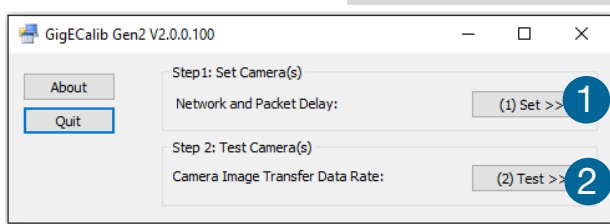
2.5 CALIBRATION TOOL

The PCO GigE Calibration Tool is part of the PCO software package and is started automatically after the PCO GigE Driver installation and is automatically linked to your desktop.

- **Win 7:** Start → All programs → Digital Camera Toolbox → pco.gigeG2 → GigECalib
- **Win10:** Start → All Apps → Digital Camera Toolbox → GigECalib

The purpose of this software:

- To set camera network parameter (Packet Delay **2.5.3**).
- To change the network settings (IP address & subnet mask **2.5.4**) of the camera.
- Display connected PCO GigE cameras.
- To check if the network is configured correctly.
- To test the data transfer rate (Test **2.5.5**).

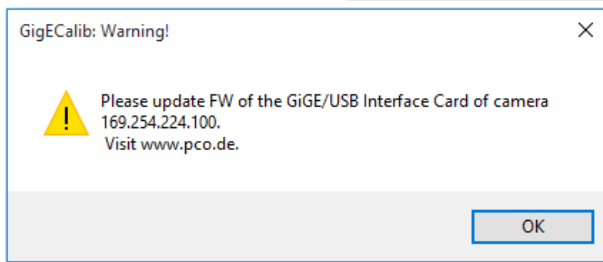


How does it work?

The **Start Dialog** offers two possibilities:

- 1 Choose **Set Network and Packet Delay (SET>>)** to calibrate network parameters like IP address, Subnet mask and **Packet Delay**. See chapter **2.5.3** and **2.5.4** of all connected cameras.
- 2 Or choose **Test Camera Image Transfer Datarate (TEST>>)** to test the image transfer data rate of all PCO GigE cameras correctly connected to your PC. See chapter **2.5.6**.

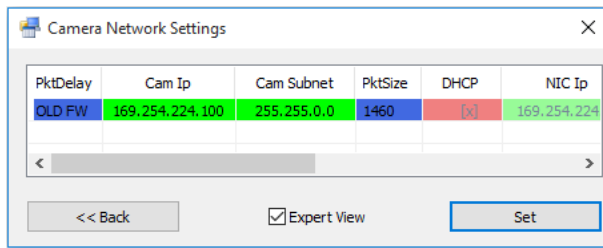
2.5.1 FIRMWARE WARNING



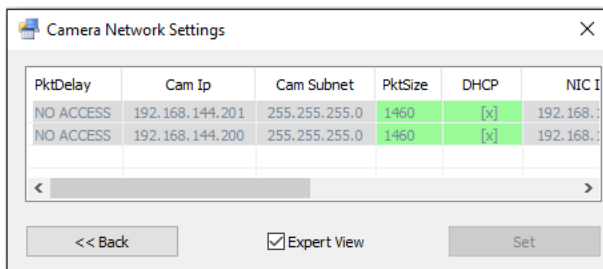
If this message pops up after you click **SET»**, you need to update the firmware of the camera's GigE interface card.

Please download the latest firmware from pco website. Select **Support** and your camera model.

Otherwise the calibration is not possible, because the driver needs a new firmware version to work properly.



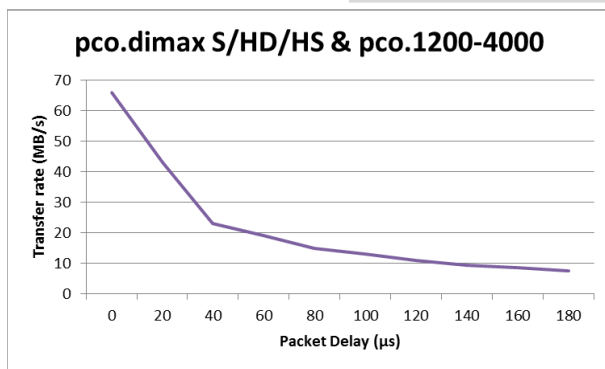
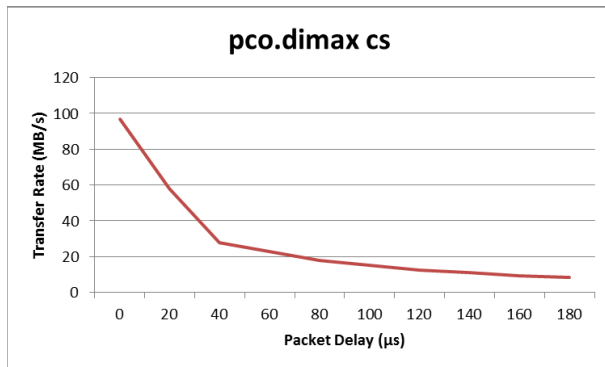
2.5.2 NO ACCESS



If you can't change the configuration (all fields are grayed out) other software accessing the camera is active (e.g. Camware).

To solve this problem please close applications that directly access the camera.

2.5.3 NETWORK AND PACKET DELAY



The dialog **Camera Network Settings** allows to set the **Packet Delay** and to change the PCO GigE Camera network settings.

The **Packet Delay** value indicates the **delay (in μs)** inserted between each ethernet packet of the image payload data.

This can be used as a crude flow-control mechanism, if the application or the network infrastructure cannot keep up with the ethernet packets coming from the device. A packet delay **always slows down** transfer data rate.

Example: if two PCO GigE cameras are connected to a single Gigabit Ethernet Port (for example via a network switch) the sum of the bandwidths has to be smaller than the maximum possible transfer data rate that can be transferred by GigE (100 MB/s).

NOTICE

If **Packet Delay** is increased, the data transfer rate is decreased.

Table Delay Time and transfer rate pco.dimax cs

Delay/μs	0	20	40	60	80	100	120	140	160	180
MB/s	97	58	28	23	18	15	12.5	11	9.5	8.8

Table Delay Time and transfer rate pco.dimax HD/S/HS and pco.1600-4000

Delay/μs	0	20	40	60	80	100	120	140	160	180
MB/s	66	43	23	19	15	13	11	9.5	8.5	7.5

2.5.4 SET CAMERA IP ADRESS & PACKET DELAY

Camera Network Settings

PktDelay	Cam Ip	Cam Subnet	PktSize	DHCP	NIC Ip
0	169.254.228.100	255.255.0.0	1400	disabled	169.254.224

<< Back Expert View Set

Make sure that the Camera IP Address (Cam IP) and the Camera Network Mask (Cam Subnet) fit to the Network Interface Card (NIC IP & NIC Subnet) connected to. Everything is correct if all values are highlighted in **green**.

Camera Network Settings

PktDelay	Cam Ip	Cam Subnet	PktSize	DHCP	NIC Ip
INVALID	168.255.100	255.255.255.0	1460	[x]	169.254.224

<< Back Expert View Set

Numbered callouts: 1 points to Cam Ip, 2 points to Cam Subnet, 3 points to the Set button.

If Camera IP or Subnet is **not correct**, it will be highlighted in **red** ①. The first three sections of Camera and NIC IP must be identical. The fourth section between 1 and 254.

For example: NIC IP **192.168.144.49**; a proper camera IP would be **192.168.144.100**.

The Subnet mask must be exactly the same, e.g **255.255.255.0**.

Set **Packet Delay**, standard is **40**. Please read **2.5.3** before you set the **Packet Delay**.

Progress Network Settings

Camera(s) configured successfully.

There is(are) no changed Packet Delay(s) or Size(s).

There is(are) no changed GigE Configuration(s).

<< Back Done

Numbered callout: 4 points to the Done button.

You can only change **Camera** IP & Subnet with this tool, but **not** NIC IP & Subnet (for NIC configuration see **2.2.1**).

Please double-click onto the table ② to manipulate the value. Press the **Set** ③ button to validate the changings. After configuration is finished click **Done**. ④

GigECalib Gen2 V2.0.0.100

About Quit

Step 1: Set Camera(s) ⑤

Network and Packet Delay: (1) Set >>

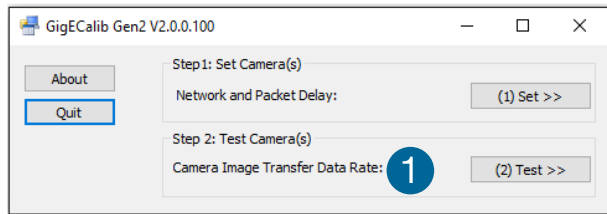
Step 2: Test Camera(s) ⑥

Camera Image Transfer Data Rate: (2) Test >>

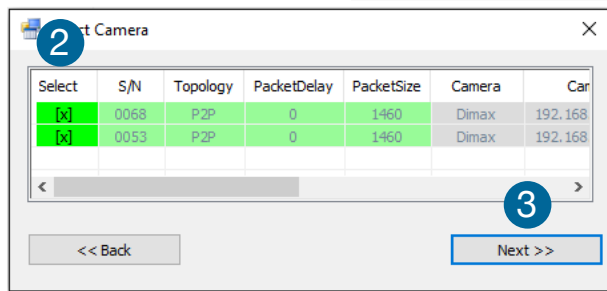
The next step is to check if IP and Subnet configuration is correct: click **Set>>** ⑤ again to check if all values are highlighted in **green**.

Finally always **Test>>** ⑥ your settings. See chapters **2.5.5** and **2.5.6**.

2.5.5 IMAGE TRANSFER DATA RATE

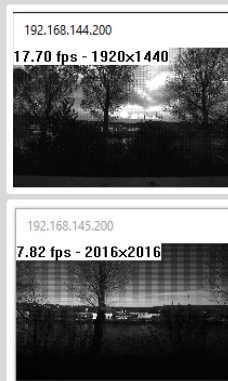
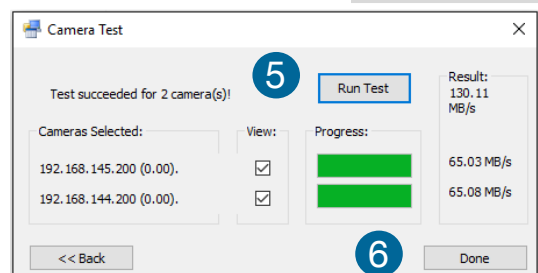


First click **Test >>** ① then please double-click into the **Select** ② column of the table to select the camera. If a camera is not highlighted in **green** the camera cannot be selected for testing. If more than one camera is selected, the cameras are going to be tested in parallel. ③



Please press the **Next >>** ③ button to open the **Camera Test** dialog.

2.5.6 CAMERA TEST



All cameras selected in the **Select Camera** dialog are listed here. If the **View box** is checked the transferred images are displayed. Please click the **Run Test** ⑤ button to begin the **Camera Transfer Test**. The test grabs images from **each** camera listed – the images from each camera **are transferred in parallel!**

The whole **Camera Transfer Test** succeeds only, if each **Single Camera Transfer Test** succeeds. With a **Single Camera Transfer Test** 100 Images are transferred, and it fails, when more than 0.1% of all transferred ethernet packets got lost.

If a **Single Camera Transfer Test** and so the **Camera Transfer Test for all connected cameras** fails, the first thing to do is to check the **Packet Delay** value. It indicates the delay (in μ s) inserted between each ethernet packet of the image payload data.

If the application or the network infrastructure cannot keep up with the ethernet packets coming from the device. So, if a **Single Camera Transfer Test** fails, increase the **Packet Delay** value (see 2.5.3). If everything is finished click **Done** ⑥.

NOTICE

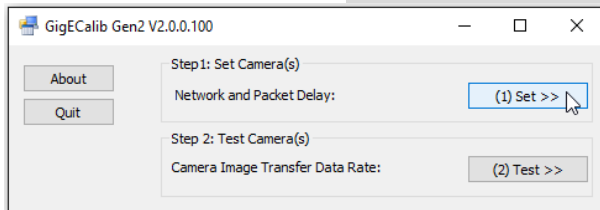
The Gen2 GigE maximum transfer data rate is about 100 MB/s, if you have a pco.dimax camera with the Gen1 GigE interface card, the maximum data rate is up to 68 MB/s.

2.5.7 RESET IP ADDRESS

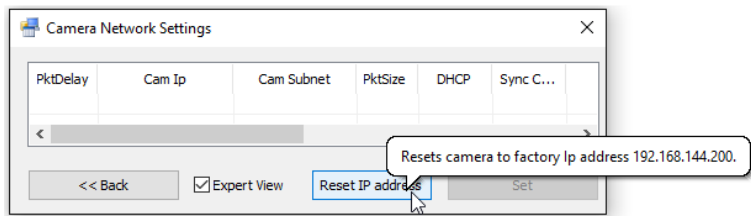
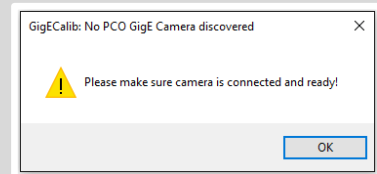
NOTICE

This is a **special function**, which is not necessary for normal configuration. It is required if the camera is properly connected, but is not found by the **Calib Tool** because it has an incorrect IP address.

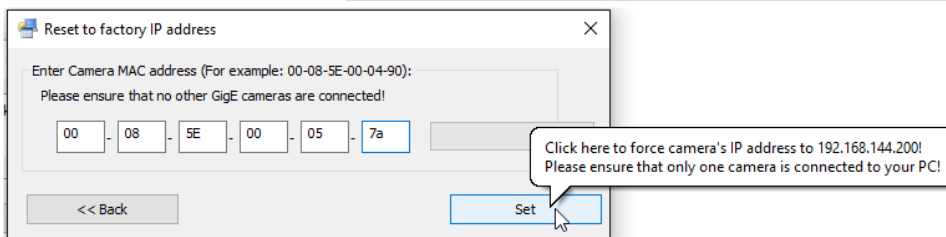
Please only connect one camera to your computer, if you want to use this function.



Click **Set**. If **Calib Tool** can not find a correctly connected camera an error will be displayed.

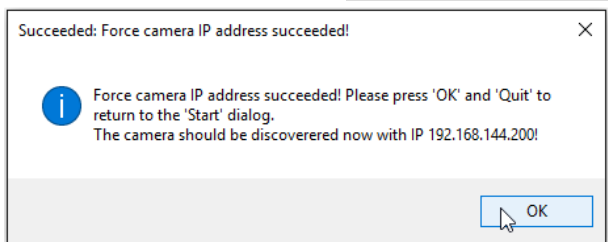


Now it is possible to **Reset IP address** of your camera.



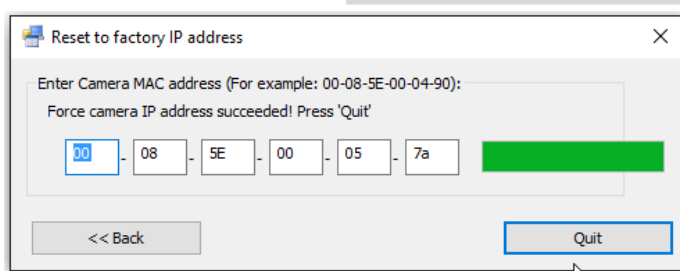
Enter **MAC address** of your camera (see sticker on the camera).

Press **Set** to reset the current IP address of your camera to the **factory default IP address**.



When you see this pop-up window, the IP address reset was successful.

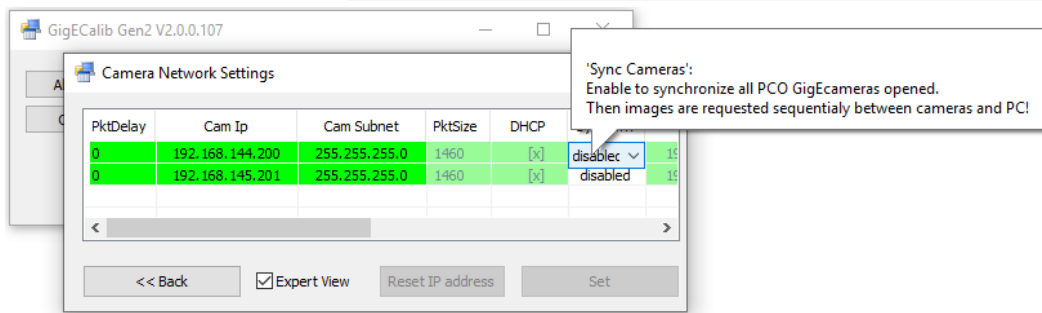
Press **OK** to return to the **Reset to factory IP address window**.



Final step: press quit to return to the **Start Dialog**.

Now your camera should be correctly displayed and it is possible to continue GigE configuration.

2.6 SYNC CAMERAS

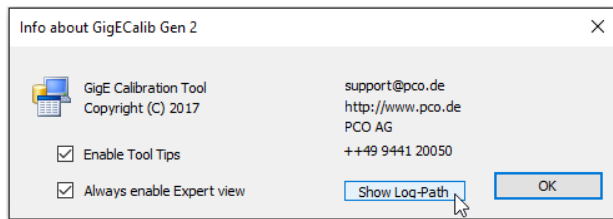


Man kann dies auf enabled setzen sofern mehrere Kameras angeschlossen und fertig konfiguriert sind.

Dieser Modus bezweckt, dass Kameras, die mit einem Rechner verbunden sind, Bilder nicht parallel zum Rechner schicken. Der Anwender holt die Bilder der Kameras zwar parallel ab bzw. fordert diese parallel über pco.camware oder den SDK an, aber der GigE Treiber merkt sich diese Anfragen in einer Queue und arbeitet diese sequentiell ab (nach dem Windhund-Prinzip). Somit ist die Transferrate zwischen Kameras und PC das arithmetische Mittel aus den Transferraten der einzelnen Kameras.

Then images are requested sequentially between cameras and PC.

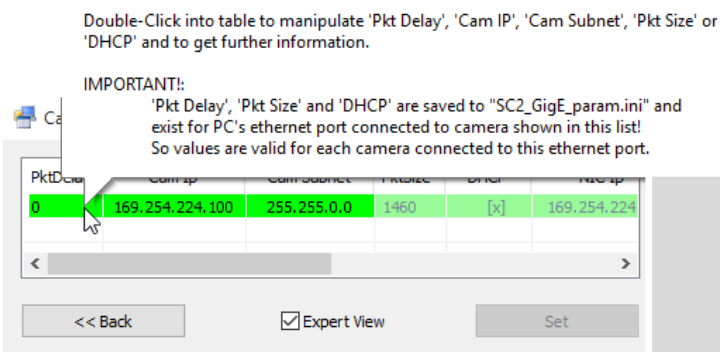
2.6.1 TOOL TIPS



If you want to enable/disable **Tool Tips** please run the PCO GigE Calibration Tool. Click the **About** button of the **Start Dialog** and activate/deactivate the **Enable Tool Tips** check box.

Enable Expert view: all setting options are enabled.

Show Log Path will open a windows explorer with the log path.



Tool Tips can help you to understand the functionality of the calibration tool. Packet Delay and other settings are explained in detail.

2.7 HELP GUIDE

Firewall	If your camera is not recognized, please deactivate Firewall and Antivirus programs.
Driver (NIC)	Install original driver of your network interface card (e.g. intel driver) guaranteeing full performance.
Latest Driver	Always install the latest PCO GigE driver (see https://www.pco.de/support).
Buffer	Pay attention to the network interface card buffer settings (see 2.2.2).
Firmware	If the calib tool tells you to update the firmware , please download and install the latest firmware for your camera.
Slow data transfer rate (NIC)	If your computer has a network card installed (PCI / PCI express slot) and the data transfer rate is slow or data transfer is only working with a high packet delay (see 2.5.3): please remove the NIC and select a different slot of your mainboard. It is quite possible, that some slots do not reach the specified data transfer rate. Please also check the wiring diagram of your mainboard to be able to select the fastest slot. If you have a mainboard with e.g. two network ports , the same problem can occur.
Windows Update	Install the latest windows updates. This can prevent problems with the GigE driver installation

2.8 PERFORMANCE

The following table gives example configurations: minimum and recommended. The specified values are only valid for these configurations and should act as an orientation.

Setup

	Minimum	Recommended	
Network interface card (NIC)	100 Mbps NIC with standard PCI interface (only working with GigE Gen2 driver)	GbE NIC with PCI Express interface Recommended NIC see 2.2.2	10GbE NIC Recommended NIC see 2.2.2
NIC configuration	Receive / transmit buffer is set to maximum		
Network connection	P2P or via switch	P2P	
Patch cable	Cat5e	Cat5e or higher	TP Cat7e
Additional network components	switch, hub, router are compatible to 100 Mbps	no additional components	no additional components
Network environment	-	virus protection/ firewall inactive	
Driver	PCO GigE driver installed		
Packet delay /max speed mode	20 µs / off	0 µs / off	0 µs / off
Computer	INTEL® Core™ i5 CPU; 2.4GHz; 4GB RAM	INTEL® Core™ i7 CPU; >2.8GHz; 8GB RAM	
Operating system	Win 7 – x64/x86	Win 7/8/10 – x64	

NOTICE

Data transfer rate performance depends on sensor resolution.

ABOUT PCO



pco.

pco.history

“PCO” stands for what we are: a Pioneer in Cameras and Optoelectronics. With 30 years of expert knowledge and experience PCO has forged ahead to becoming a leading specialist and innovator in digital imaging used in scientific and industrial applications such as life and physical science, high-speed imaging and machine vision. However, the beginning of PCO’s story of success dates back to the 1980s and a research project of the founder, Dr. Emil Ott, who was working at the Technical University Munich for the Chair of Technical Electrophysics. While performing measurements with intensified slow scan cameras, Dr. Ott realized that the existing standard did not meet the sophisticated requirements of scientific applications – and so PCO came to life in 1987. With a small team of engineers Dr. Ott began to develop his first image intensified camera followed by several variations on the original model, geared to overcoming all the existing flaws and surpassing standards of the day. During these early years PCO developed a now well established core of advance technologies used as the foundation to develop cutting edge products. In the early 1990s PCO expanded its business activities to the global market by successfully establishing an international network of highly trained sales partners and customers. We entered additional fields beyond traditional scientific research expanding the potential for our cameras’ applications in life science, automotive testing and even broadcasting. This step paved the way for a wide range of innovative highlights: As of 2017, PCO has three decades of technical know-how and expert knowledge in the development and manufacturing of high-performing camera systems. In-house competence of all significant technical disciplines and partnering with leading image sensors manufactures ensures cutting edge sCMOS, CMOS and CCD technology for all PCO cameras.

pco.prospect

“If you want to do something special, particularly in the high end fields, you have to develop your own image sensors. So we work with partner companies who develop tailored sensors made especially for us. This is something we are doing continuously, so we’re already working on the next generation of cameras that we will introduce in the coming years” – Dr. Emil Ott.

In PCO’s first 30 years, Dr. Emil Ott took a company that he started right after finishing university and has built it into a major player in scientific and industrial cameras – and there’s plenty more to come.

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