

user manual

# pc<sub>o</sub>.camera adaptor for matlab



pc<sub>o</sub>.

This adapter is included in the zip file: pco.matlab\_adaptor\_V101

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

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## 1. GENERAL DESCRIPTION

This manual describes the use and the features of the pco camera adaptor for the Matlab image acquisition toolbox.

The **PCOCameraAdaptor.dll** represents the actual adaptor which is used. Additionally a readme.txt is provided giving installation instructions. The **pco\_adaptor\_example.m** file is a small program to set properties and acquire images using the adaptor functions. The **pco\_imaqregister.m** provides the registration of the adaptor.

After having installed the adaptor according to the readme file it is possible to acquire images from pco cameras in two ways: It is possible to completely work with commands either in the command window or by creating m-files for the image acquisition. The second possibility is to use the image acquisition GUI provided by Matlab with graphical elements for properties and acquisition commands.

This adaptor is supported for **MATLAB R2013b** and later versions.

## 2. MATLAB IMAGE ACQUISITION GUI

The Image Acquisition GUI provided by Matlab is an easy way to acquire images. The available cameras and their attributes are clearly arranged. The previewing and recording can be controlled by several buttons.

If you use the adaptor with this GUI there are a few restrictions:

- Before changing the camera in the hardware browser, both preview and acquisition has to be stopped.
- When having connected a camera with a high data transfer rate using MATLAB R2015b, previewing and recording should be performed in the Matlab command window, because the GUI buttons will react with a certain delay. A practical way would be to adapt the camera settings in the GUI and after that create a video input and a video source object in the command window and copy the session log from the GUI to the command window.

## 3. RELATED MANUALS

To get more information on working with the image acquisition toolbox, have a look at the Matlab **Image Acquisition Toolbox User's Guide**.

For further information on the camera properties, read the latest PCO SDK manual.

## 4. GENERAL PROPERTIES

Every adaptor provides two general properties. Those are independent from adaptor type.

**FramesPerTrigger:** Set the number of images that should be acquired when starting the acquisition. (This value can also be set to infinite, and then an acquisition can only be stopped by calling **stop**.)

**ReturnedColorspace:** Set the color of the returned image. (The values that can be set here depend on the image type delivered by the camera. Using b/w cameras this property is not useful because it is not possible to get color information out of a grayscale image. For color cameras it is possible to switch between grayscale, RGB color and YCbCr representation.)

## 5. DEVICE SPECIFIC PROPERTIES

Most of the camera settings available in Camware are also available in the adaptor. Due to the structure of adaptor properties they are arranged in a different way. The device properties don't belong to a video input object but to a video source object. Besides delay time, exposure time and frame rate, acquisition or preview is automatically stopped when changing a property, afterwards it will be restarted.

## 5.1 OVERVIEW

The following table shows an overview of all described device properties in alphabetical order and indicates if they are read-only and available for all cameras. Properties where the availability is specific are only visible if the camera supports them.

Property	Description	Read-only	Availability
AMAcquireMode	Acquire mode of the camera auto, extern or sequence triggered	No	Specific
AMImageNumber	Images to acquire for one acquisition pulse Will be ignored if acquire mode is auto or extern.	No	Specific
B1BinningHorizontal	Horizontal binning of the camera The binning will reduce the resolution of the camera by the binning factor. This also effects the hardware ROI Binning may change the pattern of color cameras	No	Always
B2BinningVertical	Vertical binning of the camera The binning will reduce the resolution of the camera by the binning factor This also effects the hardware ROI Binning may change the pattern of color cameras	No	Always
CFConversionFactor_e_co unt	Conversion factor of the camera	No	Always
D1DelayTime_unit	Time base of delay time (ns, us, ms)	No	Always
D2DelayTime	Delay time of the camera. Value is in the selected unit Can only be set for some cameras Will be ignored if FMFpsBased is set to on	No If selectable	Always
D3DelayMin_time_ns	Min delay time in nanoseconds	Yes	Always
D4DelayMax_time_ms	Max delay time in milliseconds	Yes	Always
D5DelayMin_step_ns	Min delay step in nanoseconds	Yes	Always
E1ExposureTime_unit	Time base of exposure time (ns ,us, ms)	No	Always
E2ExposureTime	Exposure time of the camera Value is in the selected unit	No	Always
E3ExposureMin_time_ns	Min exposure time in nanoseconds	Yes	Always
E4ExposureMax_time_ms	Max exposure time in milliseconds	Yes	Always
E5ExposureMin_step_ns	Min exposure step in nanoseconds	Yes	Always
FMFpsBased	Select if exposure time is set together with delay time (off) or frame rate (on) Can only be set to on if trigger mode is not hardware triggered	No	Specific
FRFrameRate	Frame rate of the camera in mHz Will be ignored if FMFpsBased is off	No	Specific
H1HardwareROI_X_Offset	Horizontal offset for HW ROI Can only be set for some cameras Changing Hardware ROI may change the pattern of color cameras	No if selectable	Always
H2HardwareROI_Width	Width for HW ROI Can only be set for some cameras Changing Hardware ROI may change the pattern of color cameras If horizontal ROI has to be symmetric, changes in width will be reset. Horizontal ROI can only be changed by the x offset	No if selectable	Always

Property	Description	Read-only	Availability
H3HardwareROI_Hor_Sym	Indicator if horizontal hardware ROI has to be symmetric	Yes	Always
H4HardwareROI_Y_Offset	Vertical offset for HW ROI Can only be set for some cameras Changing Hardware ROI may change the pattern of color cameras	No if selectable	Always
H5HardwareROI_Height	Height for HW ROI Can only be set for some cameras Changing Hardware ROI may change the pattern of color cameras	No if selectable	Always
H6HardwareROI_Vert_Sym	Indicator if vertical hardware ROI has to be symmetric	Yes	Always
IO_x_SignalEnableDisabel	Enable/disable IO signal at port x	No	Specific
IO_x_SignalName	Select name of signal that should be connected with IO port x	No	Specific
IO_x_SignalPolarity	Polarity of IO signal at port x	No	Specific
IO_x_SignalType	Type of IO signal at port x	No	Specific
NFNoiseFilter	Switch noise filter on/off	No	Specific
PCPixelclock_Hz	Pixel rate Will set the FMFpsBased to off if available	No	Always
SMShutterMode	Shutter mode <b>If shutter mode is changed, the adaptor has to be refreshed/reset</b>	No	Specific
TMTimestampMode	Timestamp mode No Stamp, Binary, BinaryAndAscii, Ascii	No	Specific

Table 1 – properties overview

## 5.2 ANNOTATIONS

### **AMAcquireMode:**

If acquire mode is set to extern or sequence triggered, the acquisition is controlled by an external source. If high or low state is effective depends on the settings of the IO signal properties for the acquire enable port. AMImageNumber property will only be created, if sequence trigger mode is available.

### **FMFpsBased:**

If frame rate and exposure time are set, it can occur that the values are trimmed by the camera. If the selected exposure time is too high for the current frame rate, the frame rate will be trimmed and updated. If the selected frame rate is too high, the exposure time will be trimmed and updated.

## 6. LOGGING ACQUIRED IMAGES

For saving acquired images the toolbox provides three options:

- **Memory:** Log the images to memory. They can be exported after acquisition.
- **Disk:** Log the data directly to disk. Therefore a file has to be selected / created where the images will be saved.
- **Disk&Memory:** Log to memory and to disk.

## 7. TRIGGERING

For triggering two parameters can be changed.

**Number of triggers:** Set the number of triggers you want to wait for. Using as a command you have to set the **TriggerRepeat** property, which is always one less than the number of triggers.

**Trigger type:** This parameter sets the trigger type. Here three options are available:

- **Immediate:** Acquisition is started directly by calling **start**
- **Manual:** Calling start enables acquisition. Acquisition starts by calling the trigger command
- **Hardware:** Acquisition is controlled by an external source. The availability of trigger sources depend on the camera type
  - **ExtemExposureStart:** An image is taken when an external signal rises or falls (depends on the IO settings)
  - **ExtemExposureCtrl:** An image is taken when an external signal rises or falls (depends on the IO settings). The exposure time is controlled by the length of the external pulse.



## 8. REGION OF INTEREST

In addition to the hardware ROI property provided by the camera, Matlab is also able to perform **software ROI**. You can select the **horizontal** and **vertical offset** and also the image **width** and **height** you want to have. According to these settings the toolbox cuts the delivered image. The range of the four values is limited by the camera resolution, the selected hardware ROI and binning.

## 9. TROUBLESHOOTING

The camera adaptor also supports a troubleshooting. If there are problems, you can force the adaptor to write the workflow into a log file by creating a file called **sc2\_imaq\_adaptor.log** in the following directory (CSIDL\_COMMON\_APPDATA\pco):  
On Windows 7 (or Vista): <systemdisc>\ProgramData\pco\

## 10. SUPPORTED CAMERA TYPES

Currently the adaptor supports these camera types:

- pco.edge
- pco.pixelfly
- pco.ultraviolet
- pco.1200-4000

## ABOUT PCO



pco.

**In 1987**, PCO was founded with the objective to develop and to produce specialized, fast and sensitive video camera systems, mainly for scientific applications. Meanwhile the product range of PCO cameras covers digital camera systems with high dynamic range, high resolution, high speed and low noise, which are sold in the scientific and industrial market all over the world.

**Currently** PCO is one of the leading manufacturers of scientific cameras. Worldwide representatives, together with our own sales department and technical support assure that we keep in touch with our customers and their needs. The actual wide range of specialized camera systems is the result of technical challenge and product specific know-how. A design according to advanced techniques, a high standard of production and strict quality controls guarantee a reliable operation of the cameras. Our own developments in conjunction with an excellent contact to leading manufacturers of image sensors ensure our access to state-of-the-art CCD and CMOS technology for our cameras.

**Since 2001**, PCO is located in its own facility building in Kelheim at the shore of the beautiful and international river Danube. Here in the county Bavaria, which is well known for its excellent support and conditions for high technology companies, we share the benefits of the simple access to high performance products and services in the surrounding area.

**Kelheim** itself is a historical town, first documented in 866. The small city is founded at the confluence of the Danube and the Altmühl, which has been converted into the Rhine-Main-Danube bypass channel for water transport. Located in Danube valley, it is the heart of a beautiful river and forest covered lime plateau landscape. It's landmark, the Hall of Liberation, was built by Ludwig I. in 1863 on the Mount Michael and is visible from all over the city and valley. The beautiful Danube Gorge, which is protected as natural monument since 1840, is located between Kelheim and the famous abbey Weltenburg.

**pco.**