

user manual

pc_o.panda 26

ultra compact global shutter sCMOS camera



Excelitas PCO GmbH asks you to carefully read and follow the instructions in this document.
For any questions or comments, please feel free to contact us at any time.



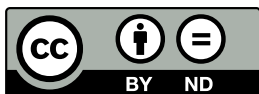
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pco.panda 26 user manual 1.1.2

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1 Safety

This camera system is a scientific measuring equipment and is designed for use by technicians, engineers, and scientists. The camera may only be used according to the instructions of this manual. Provisions, limitations, and operating conditions stated in this manual must be respected. Unauthorized modifications and alterations of the device are forbidden for safety reasons.



DAMAGED POWER CABLE OR POWER PLUG: Danger to life due to electric shock. Each time the camera is used, check the power cable for damage.



ELECTRIC SHOCK WARNING DUE TO VOLTAGE PARTS INSIDE: Risk of injury due to electric shock. Never slide any items through slits or holes into the camera.



MOISTURE: Risk of injury due to electric shock if moisture enters the camera. To avoid the risk of water condensation, protect the camera against extreme changes of ambient temperature.



TRIPPING HAZARD: Risk of injury from tripping over loose cables. Never position the cable in a way that it could become a tripping hazard.



HUMIDITY, DUST OR RADIATION: Humidity, dust or X-rays could damage the camera. Never operate the camera in humid or dusty environments or in places with high levels of X-ray radiation.



SHOCK AND VIBRATION: To avoid damaging the camera, it must be firmly mounted and protected against strong shocks or vibrations. Use the camera's mounting threads to secure it.



LENS MOUNTING: Do not force the lens onto the camera. Screw in the lens gently to avoid thread damage.



LIQUIDS DAMAGE CAMERA: If liquids have penetrated the device: Switch the camera off immediately, detach it from power and contact PCO's customer support.

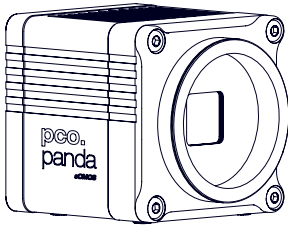
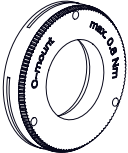
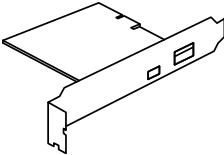


DAMAGED CAMERA HOUSING: If the camera has been dropped or the camera's housing is damaged: Switch the camera off immediately, detach it from power and contact PCO's customer support.

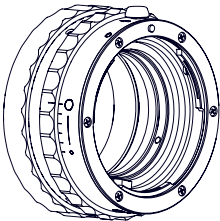
2 System components



The following standard components are included in your scope of delivery:

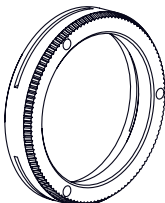
Article	Picture	Details
pco.panda 26 / pco.panda 26 DS		chapter 2.1
C-mount adapter		chapter 2.3.1
USB interface card		chapter 2.2
Cables (USB C-C)		chapter 2.5

There is a range of optional camera accessories available for the pco.panda 26 series:

Article	Picture	Details
F-mount adapter		chapter 2.3.2
Interface cables (SMA - BNC)		chapter 2.5

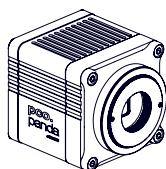
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Article	Picture	Details
TFL-mount adapter		chapter 2.3.3

Please note that all pco.software products can be downloaded for free from the PCO website. For more information see [chapter 7](#).

2.1 Camera pco.panda 26 and pco.panda 26 DS



Thanks for choosing a pco.panda 26 camera. The pco.panda 26 is based on a scientific CMOS image sensor with 26 MPixel. The pco.panda 26 comes in a small form factor with easy-to-use USB 3.1 Gen1 interface.

Main Features

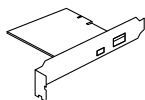
- Available in monochrome and color (pco.panda 26 DS only monochrome)
- True charge domain global shutter
- High resolution 5120 x 5120 pixel
- Exposure time pco.panda 26: 27 μ s to 20 s
- Exposure time pco.panda 26 DS: 6 μ s to 350 ms
- Pixel size 2.5 μ m x 2.5 μ m
- Dynamic range 66 dB
- Frame rate 6 fps @ 26 MPixel
- Up to 65 % quantum efficiency
- USB 3.1 Gen1 data interface
- Dust-protected housing
- Ultra-compact design



Please read the instructions given in this document carefully. It contains useful information and advice to operate the camera in intended way. If there are any questions, please feel free to contact PCO or the local representative.

Areas of application	
Brightfield microscopy	High content screening
Fluorescence microscopy	Biochip reading
Digital pathology	Spinning disk confocal microscopy
Mesoscopy	3D metrology
High-Speed bright field ratio imaging	Industrial quality inspection
High throughput screening	PIV: particle image velocimetry (pco.panda 26 DS)

2.2 USB interface card



An external Delock USB 3.2 Gen 1 host controller card comes along with each pco.panda 26 camera. This frame grabber card can be used to connect the camera to a PC via USB cable if the PC does not have the necessary USB port installed already.

Note: In multi-camera operation, each camera needs its own USB host controller card.

Hardware Installation: First shut down the computer and install the USB 3.2 Gen 1 host controller card.



WARNING: Danger from electrical voltage!

HIGH VOLTAGE: Hardware installation must be performed by a technician, because high voltages can occur on the device. Always pull the main plug before opening the computer. Wear anti-static ESD boots to prevent irreparable damage.

Driver Installation: The included USB 3.2 Gen 1 host controller card (Delock 90096 or Delock 90493) does not require manual driver installation. After hardware installation, the latest Windows driver will be automatically installed on your PC upon restart.

For more information on the installation and operation of the USB interface card, please consult the manufacturer.

2.3 Lens mount adapters



PCO cameras have an interchangeable lens adapter system to use the camera with different standard lenses. The adjustment of the lens mount can be done by the user.

2.3.1 C-mount adapter

The C-mount adapter is screwed in the front of the camera and fixed with three allen screws (marked in red). In order to set the standard back focal distance of the C-mount (17.526 mm), screw in the C-mount ring until it stands out 1.8 mm from the camera front (see *figure 2.1, right*).

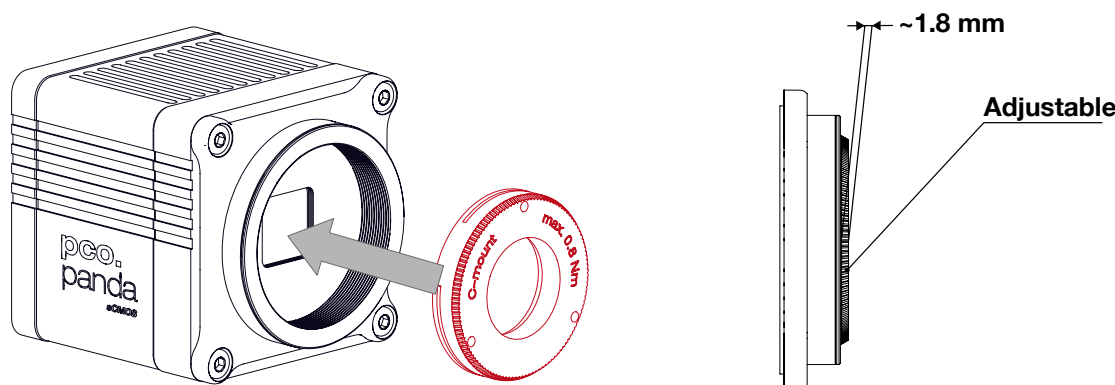


Figure 2.1: C-Mount installation.

Use a suitable lens with a large aperture for fine adjustment.

Follow these steps for the fine adjustment:

- Set the lens focus to infinity and look at an object which is far away.
- Rule of thumb: The distance to the object must be at least 200 times the focal length of the lens. The further away, the better.
- Then turn the lens mount in until the object is sharp.
- Look at an object which is positioned at the minimum working distance of your lens (as described in the corresponding datasheet).
- Set the lens focus to the minimum working distance (the opposite direction of infinity).
- Now adjust the lens mount until this object is sharp.
- Repeat the above steps until the focus is consistently sharp in both positions.



CAUTION: The allen screws are designed for a maximum torque of 1 Nm. All torque values in this manual are recommendations.

Keep in mind that C-mount lenses can cause shadings at the edges of large-sized sensors.

Most C-mount lenses can illuminate a maximum image circle in the range of 9 mm (1/1.8") to 22 mm (4/3") diameter only. The pco.panda 26 has a sensor diagonal of 18.1 mm.

To achieve less shaded images, the ROI function can be used to limit the resolution of the sensor when using lenses with smaller image circles than the sensor diameter.

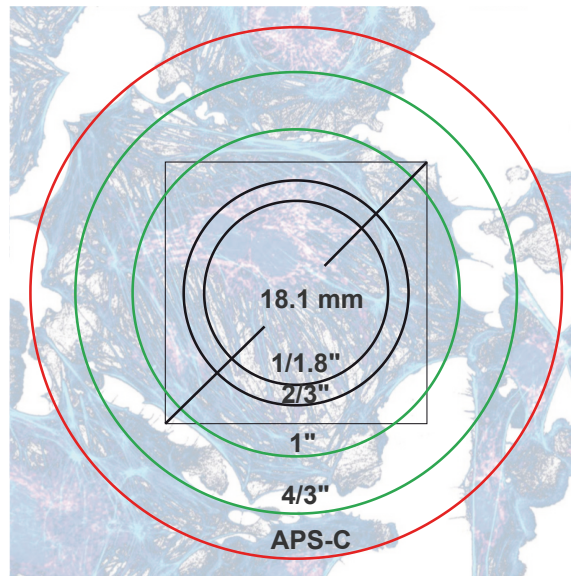


Figure 2.2: sensor size vs. image circles.

2.3.2 F-mount adapter



The optional F-mount adapter is screwed in the front of the camera and fixed by the lower adjustment ring of the adapter. In order to set the accurate back focal distance of the F-mount (46.50 mm), the position of the adapter can be adjusted. The same procedure as described in [chapter 2.3.1](#) is applicable.

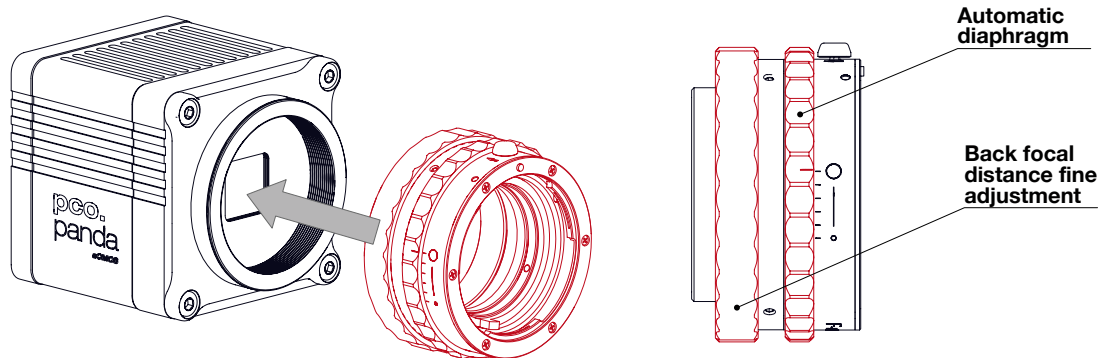


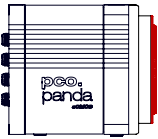
Figure 2.3: F-mount description.

PCO's proprietary F-mount adapter supports lenses with an automatic diaphragm. It manually sets the lens aperture by turning the upper adjustment ring of the adapter. F-mount lenses without an automatic diaphragm can be connected to the mount at the camera, but the aperture cannot be changed.

Matching lenses with automatic diaphragm

Manufacturer	Lens type
Nikon	Nikkor Type D, Nikkor Type G
Zeiss	ZF.2 (Otus, Milvus, Interlock, Distagon, Planar)
Tamron	Type 35 mm: A012, A007, A009, A011, F012, F013
	Type APS-C(H): B001, B005, G005

2.3.3 TFL-mount adapter



The optional TFL-mount adapter is screwed in the front of the camera and fixed with three allen screws (marked in red). In order to set the standard back focal distance of the TFL-mount (17.526 mm), screw in the TFL-mount ring until it stands out around 1.8 mm from the camera front (see *figure 2.4, right*). The TFL mount supports lenses with a maximum sensor diagonal of 28.3 mm.

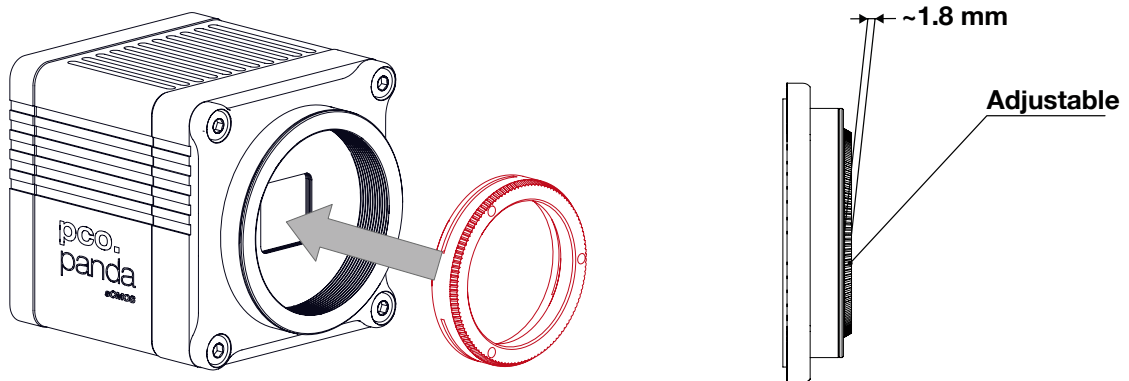


Figure 2.4: TFL-mount installation.

The fine adjustment is done in the same way as described in **chapter 2.3.1**.

2.4 MachVis software



The MachVis Software can be used to select a suitable lens for a camera or optical setup. With its help it's possible to find fitting lenses for variable types of cameras. More information can be found on the [web](#).

2.5 Cables

The pco.panda 26 is delivered with a USB interface cable for power supply and data transfer.

Article	Length	Description	Scope of delivery
USB cable	2 m	USB 3.1 type C-C, DELOCK 83668	Included
Interface cable	0.3 m	Coaxial cable type SMA-BNC	Available on request

Please note that other cables may not be suitable for your camera. If a cable is equipped with a screwable mount, make sure to attach it to the camera accordingly.



NOTE Only use cables which are approved by PCO. Otherwise full functionality cannot be guaranteed.

3 Camera overview

The following chapter provides an overview of the pco.panda 26.

3.1 Camera interfaces

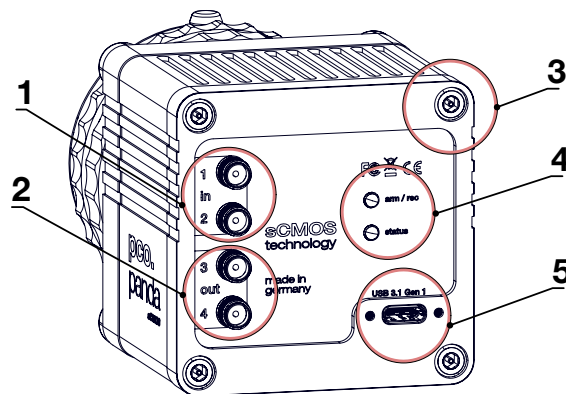


Figure 3.1: pco.panda 26 rear panel interfaces.

Interfaces	
1	input SMA connector
2	output SMA connector
3	tamper protection
4	status LEDs
5	power and data interface via USB 3.1 Gen 1

Hardware setup

Connect the camera to the PC with the included USB-C cable.

- The USB cable manages both: the data transfer from the camera to the PC and the power supply for the camera.
- If the PC does not have a USB-C port: use the included USB interface card/frame grabber (see [chapter 2.2](#)).

Connect the SMA plugs with coaxial cables for status or trigger functionality to the equipment (see [chapter 3.4](#)).



NOTE Please note that removing the tamper protection will void the camera warranty.

3.2 Data and power interface

The pco.panda 26 is available with the following interfaces :

Camera	Interface	Interface connector
pco.panda 26	USB 3.1 Gen 1	USB-C socket
pco.panda 26 DS	USB 3.1 Gen 1	USB-C socket

3.3 LEDs

The functionality of the LEDs on the rear panel of the camera is listed in the following table.

LED "arm/rec"		LED "status"		Meaning
OFF		Orange		Camera is booting
OFF		Green		Camera is ready for operation
OFF		Red		Error
Orange		Green		Arm camera / rec state off
Orange blinking		Green		Recording
OFF		OFF		Camera without power

3.4 Trigger and status interfaces

The pco.panda 26 provides different operation modes (see **chapter 4**). These can be controlled and monitored via control signals at the rear panel of the camera. In total, there are four trigger and status interfaces. Of these, there are two signal inputs (frame trigger, acquire enable) and two signal outputs (exposure, busy).

Functional behavior

The assignment of functionality of the signals at the SMA interfaces can be done by software (e.g. pco.camware). The inputs and outputs can be either switched ON (with different functionality) or OFF. Further the signal polarity can be selected (level-sensitive or edge-sensitive respectively).

Parameter		Option
SMA 1	input	exposure trigger
		auto sequence, soft trigger, external exposure start, external exposure control, low latency trigger
		off
		signal polarity
		rising (default)
		falling

Continued on next page

Continued from previous page

		Parameter	Option
SMA 2	input	acquire enable	external, sequence, auto
			off
		signal polarity	high (default)
			low
SMA 3	output	status busy	on
			off
		signal polarity	high (default)
			low
SMA 4	output	status exposure	on
			off
		signal polarity	high (default)
			low

The active states (high/low, rising/falling edge respectively) can be set by software commands or in pco.camware. The default values are listed in the table above.

A functional description of the trigger modes and corresponding output signals is given in **chapter 4**.

Status signals

Status signals are signals generated by the camera for synchronization purposes.

The **busy** signal (SMA 3) is active if the camera is recording or when it is switched on. Occasionally, a “false or low busy” signal is read. This happens when the camera setup is complete and no trigger has been detected, meaning that the camera is ready to receive trigger signals for exposures.

The **exposure** signal (SMA 4) is active during exposure and inactive at all other times.

Electrical properties

Input (1 = Exposure Trigger; 2 = Acquire Enable)	
Type	digital
Level	3.3 V LVTTTL (5 V tolerance)
Coupling	DC
Impedance	1 k
Slew rate	> 1 V/ms

Output (3 = Status Busy; 4 = Status Exposure)	
Type	digital
Level	3.3 V LVTTTL
Coupling	DC

4 Operation modes

The camera can be used in different modes. These will be introduced in the following chapter.

4.1 Global shutter

Image acquisition and readout with the pco.panda 26 is based on global shutter mode. That means, each pixel in the sensor begins and ends the exposure simultaneously. After the exposure phase and a small defined time slot, the readout phase of the pixels starts directly. During the readout phase, the next exposure phase can be started.

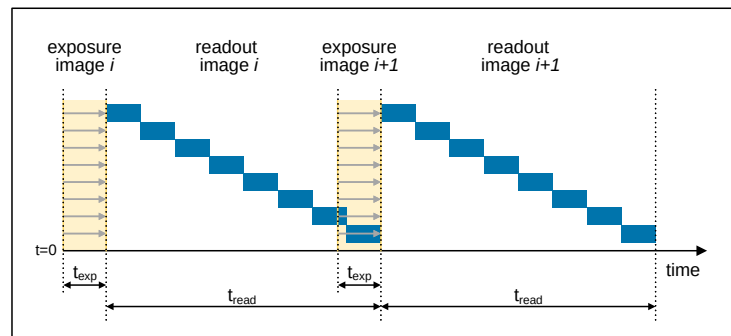


Figure 4.1: global shutter explanation.

The overall readout time of the sensor is determined by the line time, i.e. the time needed to readout one line. Depending on the number of lines to be readout (ROI settings), the total time of the readout phase can be calculated:

$$t_{readout} = N_{lines} \cdot t_{line}$$

With a line time of 32 μ s and 5120 lines, the total readout time results to 164 ms. For simplicity, the line time value is rounded. The exact value is 31.886 μ s.

Timing

The exposure and delay time (programmable time between acknowledge of a trigger input and start of exposure) can be set in steps of one line time.

Camera	Exposure time	Delay time	Step size
pco.panda 26	32 μ s to 20 s	32 μ s to 60 s	32 μ s
pco.panda 26 DS	6 μ s to 350 ms	-	-

4.2 Trigger modes

The pco.panda 26 incorporates several trigger modes. In this context trigger means exposure trigger, i.e., the trigger signal that controls the exposure time of single image (light integration time). Trigger modes can be set via software (e.g. pco.camware, SDK command), trigger related input and output signals are accessible via the SMA interfaces (see [chapter 3.4](#)).

trigger
auto

Auto sequence mode

In the Auto Sequence mode, the camera determines the highest possible frame rate for the defined exposure time and the time required for a frame readout. After a start command is given, the sequential recording is started, until a stop command is given. These commands can be set by software. Any signals at the trigger input (hardware I/Os) are irrelevant.

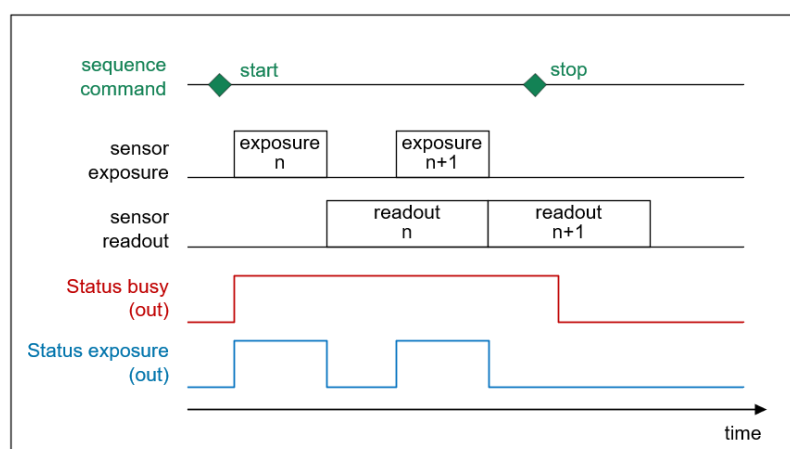


Figure 4.2: auto sequence explanation.

trigger
soft

Soft(ware) trigger mode

Within this trigger mode, recording of single images can be triggered by software with corresponding commands.

trigger
EES

External exposure start

In the external exposure start mode, single images are recorded with each rising or falling edge of the signal at the input trigger interface (SMA 1). The resulting frame rate is defined by the frequency of this trigger signal. However, the predefined exposure time and ROI settings affect the maximum possible frame rate.

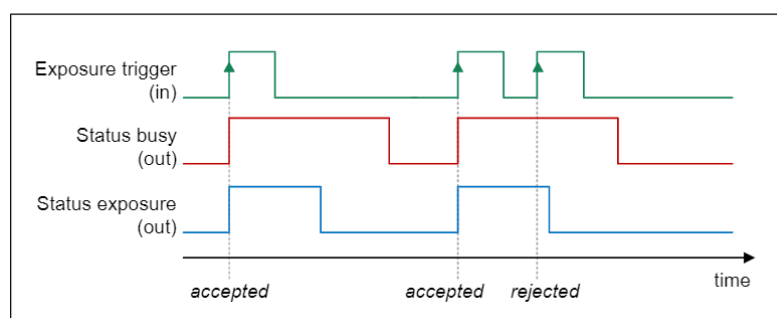


Figure 4.3: external exposure start explanation.

The status exposure output indicates the time of the active exposure phase. The status busy output indicates whether the camera is ready to process and accept a new trigger signal. A trigger signal during active state of the signal *status busy* will be rejected.

The exposure time is started in steps of the line time. That means, the exposure time can start up to approximately 65,1 μ s after the respective trigger signal.

If the rate of the external trigger input signal is close to the maximum possible frame rate (1 ms difference), it will be random whether the trigger is accepted or not.

The maximum exposure time of the camera is limited. The exposure time will be stopped automatically if the maximum exposure time is reached.

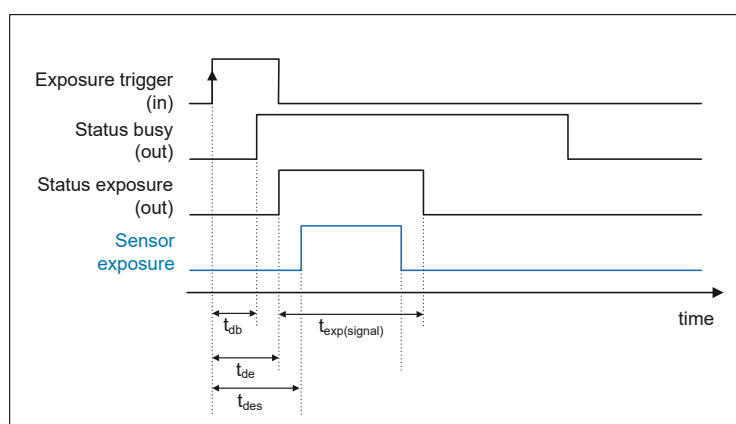


Figure 4.4: exposure trigger.

Delay time		pco.panda 26	pco.panda 26 DS
Delay busy	t_{db}	180 ns $\pm$ 23 ns	240 ns $\pm$ 23 ns
Delay exposure time	t_{de}	65,1 μ s $\pm$ 23 ns	2400 ns $\pm$ 23 ns
Delay trigger to sensor exposure	t_{des}	66 μ s $\pm$ 23 ns	2400 ns $\pm$ 23 ns

trigger
EEC

External exposure control

Within this trigger mode, the externally applied signal (SMA 1) defines the start and the duration of the exposure time. A new exposure is started by rising or falling edge of the trigger signal and end when the opposite edge is detected. The image sequence is completely controlled by the external signal. Any defined delay and exposure time values are ineffective.

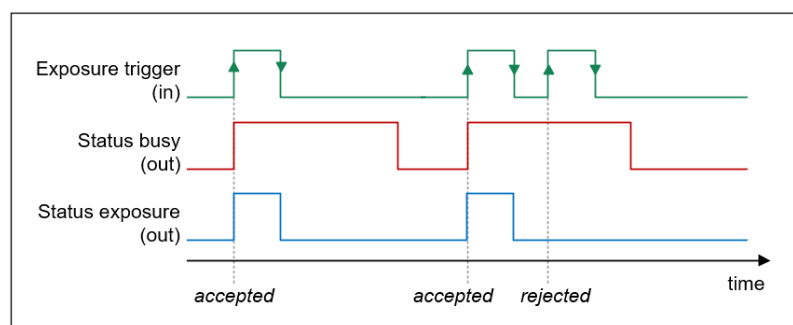


Figure 4.5: external exposure control explanation.

The status exposure output indicates the time of the active exposure phase. The *status busy* output indicates whether the camera is ready to process and accept a new trigger signal. A trigger signal during active state of the signal *status busy* will be rejected.

The exposure time is started in steps of the line time. That means, the exposure time can start up to approximately 65,1 μs after the respective trigger signal.

If the difference of the time period of the trigger rate and the time period of the maximum possible frame rate is smaller than 1 ms, it will be random whether the trigger is accepted or not.

trigger
LES

Low latency exposure start

In the low latency exposure start mode¹, single images are recorded with each rising or falling edge of the signal at the input trigger interface (SMA 1). The resulting frame rate is defined by the frequency of this trigger signal. However, the predefined exposure time and ROI settings affect the maximum possible frame rate.

Contrary to the EES mode, the exposure time is started directly and not in steps of a line time. During readout no trigger will be accepted. That means, the overall frame rate is lower than in EES mode.

¹not available on pco.panda 26 DS

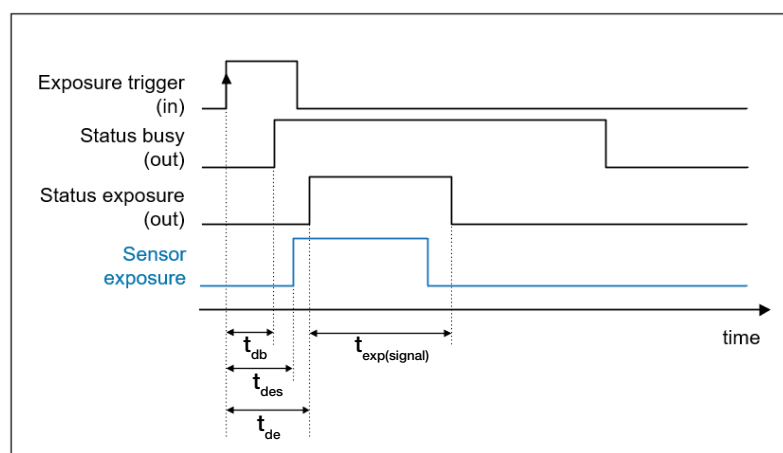


Figure 4.6: low latency exposure start explanation.

Delay time		Value
Delay busy	t_{db}	150 ns $\pm$ 23 ns
Delay exposure time	t_{de}	660 ns $\pm$ 23 ns
Delay trigger to sensor exposure	t_{des}	400 ns $\pm$ 23 ns

4.3 Acquire mode

The **Acquire mode** is an additional instance to control image acquisition by an external signal. Like a master signal, the *acquire enable* signal enables or disables a time slot in which images are recorded according to the selected trigger mode.

The acquire enable signal is active high by default. That means, a high-level enables image acquisition and a low-level disables it (or vice versa if the signal level is changed to low active).

There are two configurations of the acquire enable mode: **auto** and **external**.

acquire
auto

If acquire enable mode is set to **auto**, any signal at the acquire enable input interface is ignored. There is no logical connection between the input and the trigger modes.

acquire
external

If acquire enable mode is set to **external**, the camera records images only, if enabled by an external acquire enable signal at SMA 2.

Example timing diagram: Trigger mode is set to *external exposure start* and acquire mode is set to *external mode*. The image acquisition is paused once the acquire enable signal turns low, signals at the external trigger input are ignored. Image acquisition is resumed as soon as the acquire enable signals turns high.

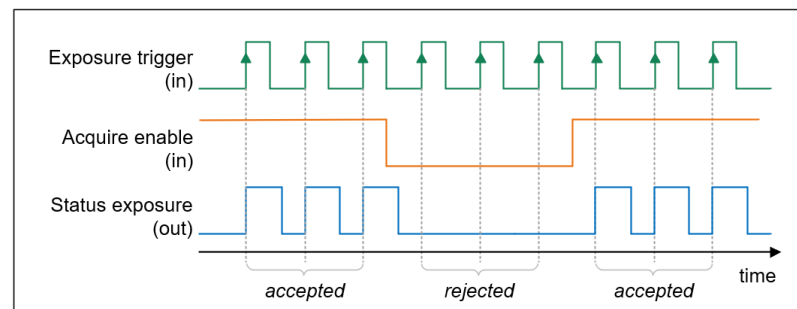


Figure 4.7: acquire mode explanation.

4.4 Double shutter mode



In double shutter (DS) mode¹ two consecutive images A and B are recorded. The fixed time between the two exposure times is called interframing time t_{if} . The exposure time t_{exp2} of image B cannot be directly adjusted. This time is defined by the readout time t_{readA} of the first image.

Exemplary timing diagram for trigger mode *external exposure start*:

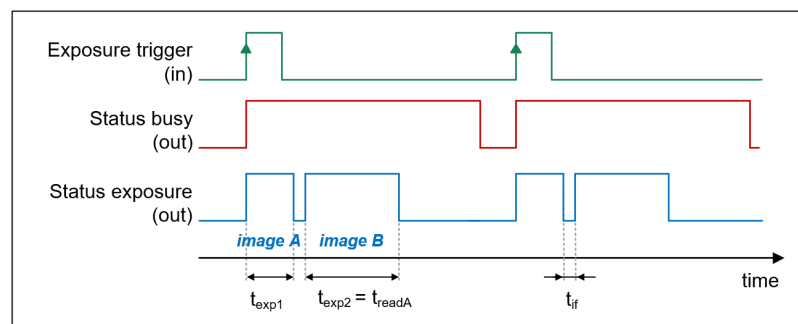


Figure 4.8: timing diagram for trigger mode external exposure start.

The interframing time t_{if} denotes the transition time between end of exposure 1 (t_{exp1}) and start of exposure 2 (t_{exp2}). This transition from image A to image B creates an undefined sensor situation. There is no clear separation of the images possible. Light entering the pixel during this time slot might be detected within image A, image B, or not at all.

¹only available on pco.panda 26 DS

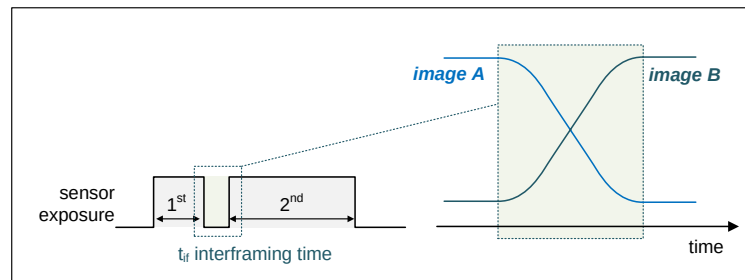


Figure 4.9: interframing time explanation.

Camera	Interframing time
pco.panda 26 DS	1 μ s

Note for PIV applications: Due to the double shutter interframing time of 1 μ s, it is recommended to place the end of the 1st light pulse 500 ns prior to the end of the first exposure time. The 2nd light pulse should be timed not earlier than 500 ns after the end of exposure 1.

Detailed timing diagram for the **double shutter** mode and trigger mode *external exposure start*:

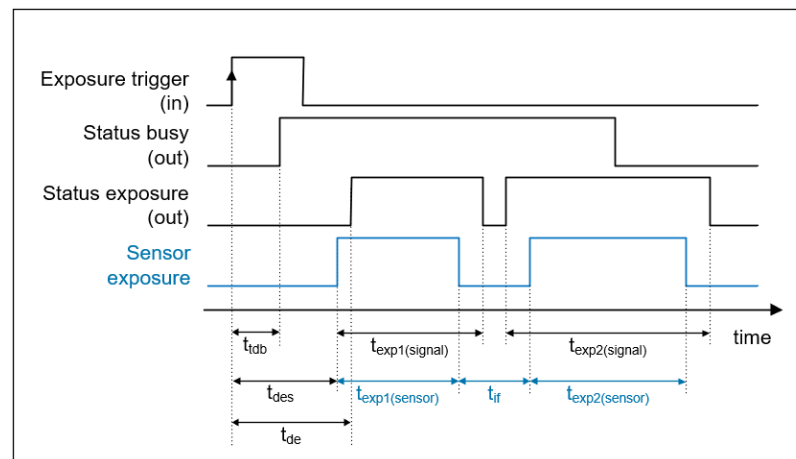


Figure 4.10: time diagram for the double shutter mode.

Delay time		Value
Delay busy	t_{db}	150 ns $\pm$ 23 ns
Delay exposure time	t_{de}	660 ns $\pm$ 23 ns
Delay trigger to sensor exposure	t_{des}	400 ns $\pm$ 23 ns
Exposure 1 (sensor)	$t_{exp1(sensor)}$	6 μ s - 350 ms
Exposure 2 (sensor)	$t_{exp2(sensor)}$	t_{readA} (readout time of first image) ¹
Interframing time	t_{if}	1 μ s

¹For further information on how to calculate the readout time by using the line time see chapter 4.1.

5 Operation



In the following chapter the system requirements in terms of connection and memory needed to use the camera will be explained. The table below shows the required GPU memory for different camera types and modes.

5.1 System requirements

System Requirements	
Interface	USB 3.1 Gen 1

The following values are suggested minimum requirements for the used PC to facilitate smooth operation:

GPU Memory

Operation mode & sensor	Resolution < 10 MPixel	Resolution ≥ 10 MPixel
Single shutter monochrome	≥ 1 GB	≥ 2 GB
Single shutter color	≥ 2 GB	≥ 4 GB
Double shutter monochrome	≥ 2 GB	≥ 4 GB

5.2 Quick start guide

The following instructions will guide the user through the first startup of the camera.

Step 1

Install the latest version of pco.camware (see **chapter 7**) and PCO USB driver (**chapter 2.2**).

Step 2

Connect the camera to the PC via the USB cable. Make sure that the status LED turns green. The camera is ready for operation.

Step 3

Start **pco.camware**.



The software should find your camera automatically. If not, the user can do a rescan to connect with your plugged camera. The command **Scan cameras** can be accessed via the **Main toolbar** or the **Camera Overview** window.

Menu -> Camera -> Rescan

A new view window should open automatically. The user can also open a new **View Window** manually via the button **New View Window** located in the **Main toolbar** or the **Camera Overview** window.

Menu -> View -> New View Window**Step 4**

Start the **Live Preview** by clicking the button in the **Main toolbar** or the **Camera Overview** window. The arm/rec LED starts flashing in orange.

**Menu -> Acquisition -> Live Preview**

Right click in the **View Window** and apply **Continuous Auto Range**. The user may now have to adjust exposure time of the camera as well as aperture and focus of the mounted lens. The user should now see the object clearly in the **View Window**.

Note: Live Preview is useful for fast and easy camera adjustment and focusing. It does not record or store images.

For more information, please check the user manual of **pco.camware** available at the PCO website.

6 Camera mechanics

At this point, the mechanics of the camera are presented. The illustrations show contours and size of the pco.panda 26.

6.1 Mechanical outlines

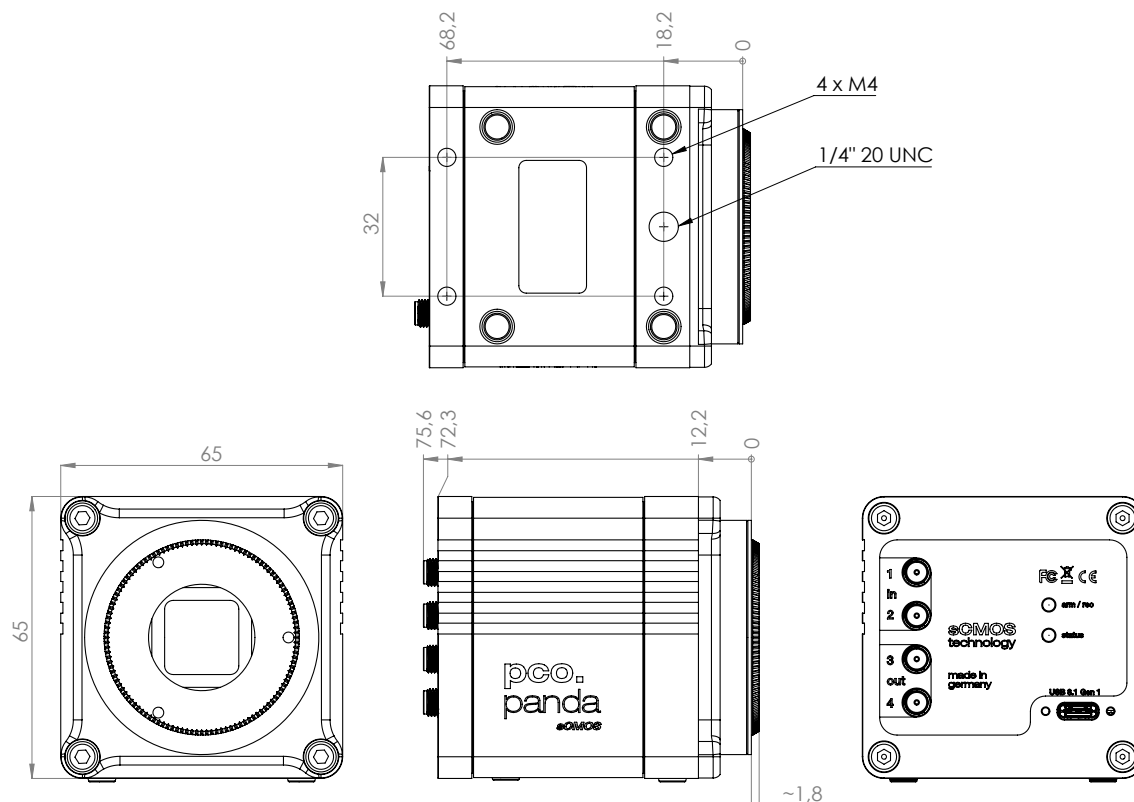


Figure 6.1: outlines pco.panda 26 (all dimensions given in mm).

Detailed drawings, step files and 3D PDFs are available at our [homepage](#) or on request.

6.2 Mounting

The pco.panda 26 provides different options for mounting. Please make sure that the camera is mounted in a stable way to avoid vibrations, which might disturb image quality.

Bottom mounting

The camera can be mounted via the threads at the bottom of the housing.

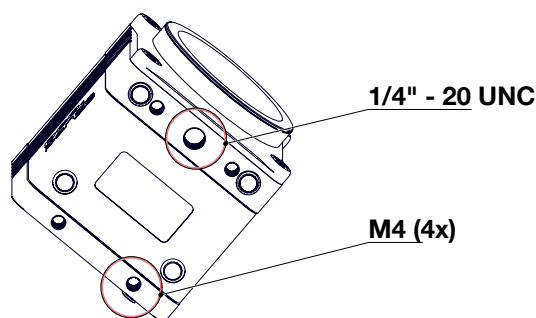


Figure 6.2: bottom view of the camera (threads marked in red).

Front mounting

The camera can be directly mounted via its front for shortest distance between the cameras' focal plane and object. Therefore, the lens adapter needs to be removed. A circular groove within the front serves as light trap. For direct mounting, it is essential to use a rubber ring between camera and mounting surface to block any parasitic light.

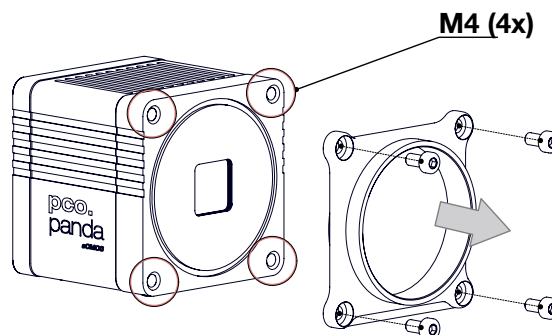


Figure 6.3: front view of the camera without lens adapter (threads marked in red).



CAUTION Do not exceed the maximum recommended torque for the mounting screws. Maximum recommended torque for M4: 2.2 Nm; 1/4" - 20 UNC: 7 Nm



NOTE For direct mounting via the front of the camera, it is essential to use a rubber ring to block any parasitic light.

7 Software

The main camera control software **pco.camware** is the first choice get started with the camera. It enables full control of all camera settings and makes image acquisition and storage very easy. Using different layouts, stiles and features the user can customize it exactly to his needs.

The use case is in the field of microscopy: PCO cameras are also integrated in **µManager**.

To create an own application for the camera: PCO offers a wide range of Software Development Kits (SDK) for different programming languages, both for Windows and Linux. **pco.sdk** and **pco.recorder** are designed for **C**, **C++**, and **C#** apps. With **pco.python**, **pco.matlab**, **pco.labview**, and **pco.java** the user can control the camera in **python**, **matlab**, **labview** and **java** applications, respectively.

In case of using a different software: PCO cameras are also integrated in a variety of microscopy and high-speed software applications, like **FalCon eXtra**, **Leica LAS X Life Science**, **NIS-Elements**, **VisiView** and many more. Check the manufacturers homepage to find a list of all applications that support PCO cameras.

The user can access and download the latest versions of all software products for free on the PCO [website](#).

7.1 Software requirements

Software requirements	
Operating system	Windows 10 or higher or Linux (Windows 10 recommended)
CPU	i7 or XEON > 2.5 GHz
RAM	16 GB
Display/Graphics	Full-HD resolution display
	monochrome: Nvidia GPU recommended
	color: Nvidia GPU essential

7.2 USB 3.0/3.1 driver

PCO USB 3 driver Installation

Follow these steps to install the **PCO USB 3 driver** under Windows 10.

- Download the latest USB driver for Windows 10 from <https://www.excelitas.com/de/product/pco-interface-drivers>.
- Follow the instructions of the Installer.

8 Troubleshooting

If any questions or problems should arise, feel free to use the following options:

- Contact us via email: pco@excelitas.com
- Fill out the [support ticket](#) on our website (Click [here](#) for the chinese version)
- Read the pco.troubleshooting manual for help with PCO software product

9 Warranty

Excelitas PCO GmbH warrants the original purchaser for a period of one (1) full year, calculated from the date of purchase, that the equipment sold is free from defects in material and workmanship. In the event of a claim under this guarantee, the equipment is to be sent, including a description of the fault, to Excelitas PCO GmbH. Returned equipment will not be accepted without a ticket number, issued by the support team, pco@excelitas.com.

Follow shipping instructions provided by the service technician. The unit should be returned in its original packaging if possible. In the case of damage caused by wear and tear, careless handling, neglect, by the use of force or in the case of interventions and repairs not carried out by Excelitas PCO GmbH, the guarantee ceases to be valid. This guarantee may not form the basis for any claims for damages, in particular not for compensation of consequential damages. The warranty is not transferable.

10 Recycling



To dispose your camera, send it to **PCO** or take it to a local recycling center.

The camera includes electronic devices, which contain materials harmful to the environment. These electronic devices must be recycled.

11 About Excelitas PCO

PCO, an Excelitas Technologies brand, is a leading specialist and Pioneer in Cameras and Optoelectronics. With more than 35 years of expert knowledge and experience of developing and manufacturing high-end camera systems, PCO has grown into a leading specialist and innovator in digital imaging for scientific and industrial applications.

In-house competence of all significant technical disciplines and partnering with leading image sensor manufacturers ensures cutting edge sCMOS and high-speed imaging technology. The company's customers' input has a direct path back to its product development and support teams, enabling the constant advancement of hardware and software.

PCO is supporting the constant advancement of science and industry by relentlessly pursuing technological perfection. The company's cameras are used in scientific and industrial research, automotive testing, quality control, metrology and a large variety of other applications all over the world.

PCO represents a world renowned brand of high-performance scientific CMOS, sCMOS, CCD and high-speed cameras that complement Excelitas' expansive range of illumination, optical and sensor technologies and extends the bounds of our end-to-end photonic solutions capabilities.

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