

Kinetix Pre-Arrival Guide

Thank you for your interest in the Kinetix CMOS, the next generation in scientific CMOS.

This is a guide to help you prepare for the arrival of the Kinetix, ensuring that the hardware and software of both your computer and microscope are capable of making the most of the power of the Kinetix and delivering your desired data. Alongside this, we also include detailed steps on setting up the Kinetix upon arrival, making the most of your preparations. The sections are as follows:

1. Pre-Arrival
2. What's In The Box?
3. Setup
4. Troubleshooting

Pre-Arrival

There are four important questions to ask during pre-arrival:

1. Is my PC running Windows 10?
2. Does my PC have a free x8 or x16 Gen 3 PCIe slot?
3. Does my PC have sufficient specifications to optimally run the Kinetix?
4. Does my microscope have the correct camera mount adapter?

Let's answer these questions!

1. Is my PC running Windows 10?

The Kinetix family will **only** run on Windows 10, earlier versions of Windows such as XP, 7, 8, and 8.1 **will not** be able to run the Kinetix.

To find out if you are running Windows 10, go to [Start](#) > [Settings](#) > [System](#) > [About](#) and you should see 'Windows specifications':



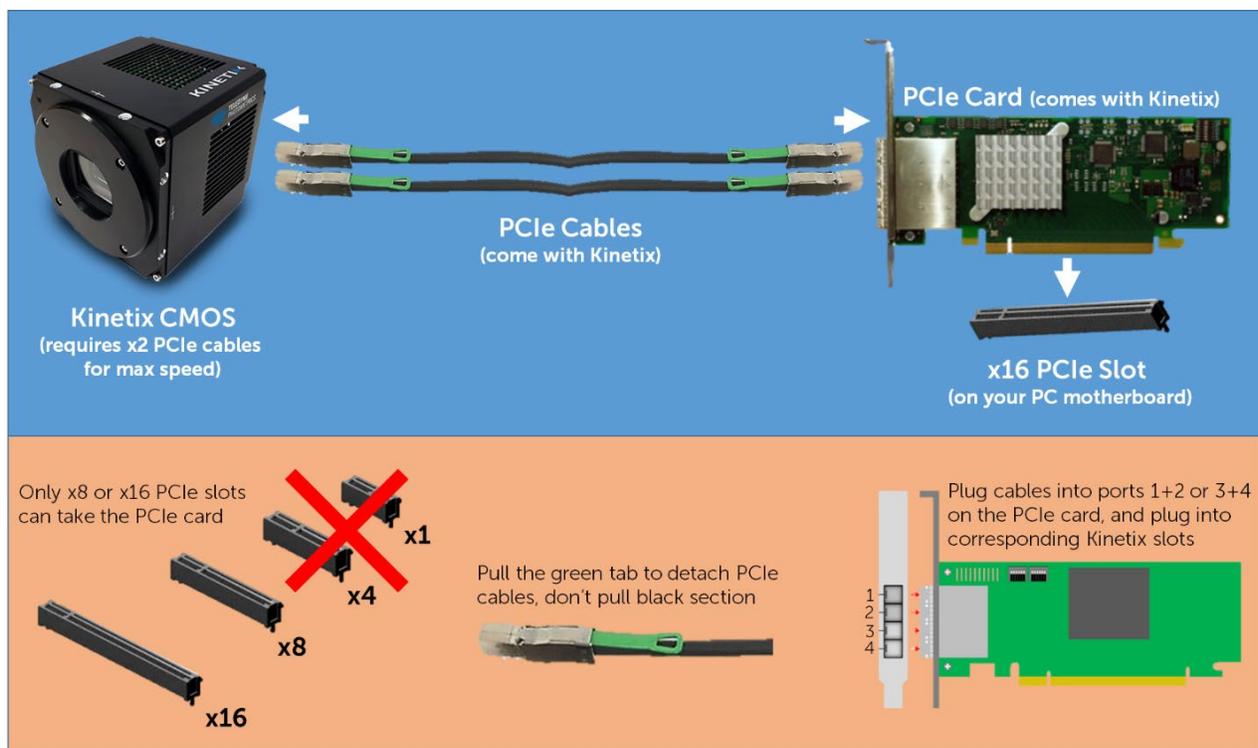
2. If I want to use the PCIe interface, does my PC have a free x8 or higher Gen 3 PCIe slot?

The Kinetix features both USB and **PCI Express (PCIe)** ports, and in order to achieve the maximum speeds of the Kinetix the PCIe interface should be used. Not all computers come with PCIe interfaces, so we supply a **PCIe interface card** in the Kinetix box, which attaches to a **PCIe slot** on your computer motherboard and allows you to use PCIe cables with the Kinetix and achieve maximum speeds.

However, the PCIe card **only fits into size x8 or x16** PCIe slots. If you don't have an available slot or only have smaller slots (x1 or x4), then you won't be able to install the PCIe card, and won't be able to use this interface with Kinetix.

As long as you have an **x8 or x16 PCIe slot** and **at least 8 CPU-connected PCIe lanes** available, you can reliably use the included PCIe card. Please check your computer motherboard for slots in order to use the included PCIe card and maximum Kinetix speeds.

The figure below details the PCIe process for Kinetix (in blue) and some potential pitfalls (in orange).



If you don't need to operate the Kinetix at high speed, the alternative is USB. Again, we supply USB cables and USB interface cards, so please check for PCIe slots if your computer doesn't have high speed USB 3.1 Gen 2 slots (10 Gbps data rate).

3. Does my PC have sufficient processing power (CPU, RAM) and storage (SSD) to optimally run the Kinetix?

The Kinetix has a **10 megapixel sensor** that can run at up to **500 fps full frame**, meaning it can put out **5 gigabytes per second**. This is a high data rate and it is important to use the Kinetix with a sufficiently powerful computer in order to get optimal performance, especially if looking to do lengthy high speed imaging experiments and rapidly stream data to disk.

We have put together a list of **recommended PC specifications**. If your PC does not match these, be warned you may **not** be able to operate the Kinetix as intended.

- **OS:** Windows 10 64-bit **only**
- **CPU:** 3.0 GHz or faster, for example Intel Xeon or Core i5 with 4 or more cores
- **RAM:** 32 GB DDR4 or more (2666 MHz 4-channel or 3200 MHz 2- or 4-channel)
- **Storage:** 256 GB or larger SATA SSD for OS as a boot drive
 - Additional PCIe/NVMe data storage SSD, e.g. Samsung 960/970 Pro series
 - If streaming to disk, we recommend PCIe RAID controller such as HighPoint SSD7101A-1 with 4x NVMe SSD in RAID-0 configuration
- **GPU:** 1 GB or more, either dedicated PCIe GPU or integrated graphics
- **Motherboard:** Containing enough slots for both the PCIe interface card and the RAM, with extra slots for future upgrades optional but useful
- **I/O:** The Kinetix comes with USB 3.2 and PCIe interface cards that will add these I/O ports. While PCs can feature existing USB and PCIe ports, these may not necessarily work well with the Kinetix and we recommend the use of the included interface cards

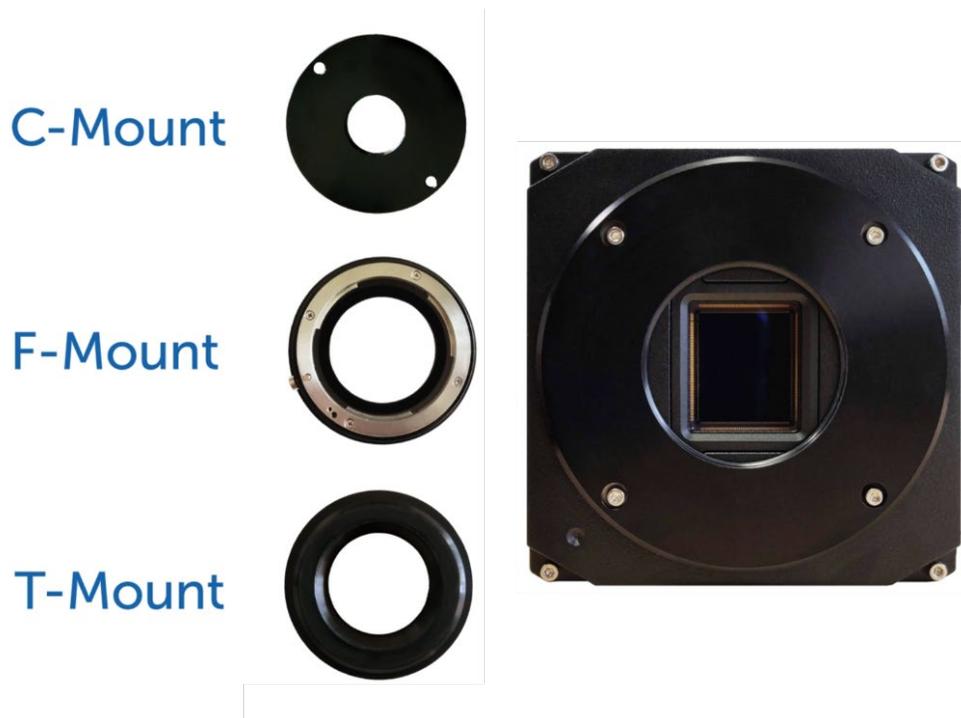
If your PC does **not** meet these specifications it may not be able to operate the Kinetix optimally. We also recommend several pre-built PC systems which we use for in-house testing, including the **Dell Precision Tower 5820** and the **HP Z4 G4 Workstation**.

For more information on recommended PC specs, please see our dedicated webpage: <https://www.photometrics.com/support/recommended-pc-specifications>

4. Does my microscope/imaging system have the adapter for the mount I want to use, either C, F or T?

The **mount** is the interface between the camera and the microscope/imaging system. The Kinetix supports **C-, F- and T-mounts**, thanks to an interchangeable faceplate, but be warned your microscope will need to have an imaging port with a **suitable adaptor** to mount the Kinetix. If you have a particular brand of microscope and want to use an F-mount with the Kinetix, you will need the relevant F-mount adapter.

The mount affects the Kinetix **field of view**, with a C-mount limiting to ~22 mm, while an F-mount or T-mount can make use of the whole 29 mm Kinetix sensor, depending on the output of the microscope or imaging system used. **What is the maximum field of view your microscope can use?** If it is 22 mm or below, we recommend a C-mount or the **Kinetix22**. For up to 29 mm, use the F- or T-mount with Kinetix.



What's In The Box?

The box you will receive should contain the following components:

- Kinetix CMOS (with F-mount front plate installed)
- PCIe interface card
- PCIe data cable, 3 m (x2)
- USB 3.2 interface card
- USB 3.2 A to C cable, 90 cm
- USB 3.2 C to C cable, 3 m
- Power supply (12V/10A DC) with international power cord set
- BNC trigger cable
- C-mount front plate
- T-mount front plate
- USB stick containing PVCAM drivers and software
- Quick Installation Guide



Providing the [pre-arrival](#) steps were completed, the box contains all you need to get imaging! While unlikely, if items are missing, please contact Teledyne Photometrics Customer Service.

Please note that, as stated in [pre-arrival](#), you need to check if the PCIe interface card is compatible with your computer motherboard, and you also need to check if you have the correct adapters for the mount type you wish to use with your microscope. Finally, the computer you wish to use with the Kinetix **must** be running Windows 10.

Here are some additional details about the box contents:

- The Kinetix typically comes with the F-mount attached, while T- and C-mounts are separate. Swap over to your mount of choice using the faceplate screw threads, ensuring you have the correct adapter for your microscope or imaging setup.

Kinetix
with F-mount



C-mount



T-mount

- The PCIe interface card slots into your motherboard (x8 or x16 PCIe slot **only**), and comes with four ports (1-4 top to bottom). The two PCIe cables are **both** needed to operate the Kinetix at maximum speeds, typically plugged into ports 1 and 2.

PCIe card



PCIe cable (x2)



- The USB 3.2 interface card allows you to use high speed USB ports with your computer, and we recommend only using the supplied USB interface card, rather than existing USB ports on your computer. Please bear in mind **only** the PCIe interface can operate the Kinetix at maximum speeds.
 - Two USB cables are included, a 90 cm A-C cable and a 3 m C-C cable. The Kinetix has a USB C port, so we give you the choice of USB A or C at the PC end.
 - The USB C-C cable is uni-directional, and only works when the **blue end (host)** is plugged into the PC and the **red end (sink)** is plugged into the Kinetix.



- The BNC cable is used for **advanced hardware triggering**, it plugs into the back of the Kinetix and comes with eight different cables for input and output hardware triggering, typically used to synchronise your light source and camera



Setup

Now that you've performed your pre-arrival steps and got the box, it's time to get imaging! Setup comes in two main sections, **hardware** and **software**, and details everything you need to get the Kinetix up and running for your imaging experiments.

Software Setup

Teledyne Photometrics cameras use a driver known as **PVCAM** (Programmable Virtual Camera Access Method) to communicate with the computer. PVCAM **must** be installed on the host computer before the Kinetix can be used. The USB stick that comes in the box contains the latest version of PVCAM, or you can download it from our website: <https://www.photometrics.com/support/download/pvcam>.

In addition to the camera driver, PVCAM also contains two advanced imaging applications, **PVCamTest** and **VersionInformation**, the former allowing you to test the camera connection and take live images, and the latter reads firmware information, useful for technical support.

Please note that PVCamTest is **not** software for acquiring images, and should be used for testing purposes only.

Start by installing PVCAM on your PC, either from the included USB stick or our website: <https://www.photometrics.com/support/download/pvcam>

Hardware Setup (when using a PCIe connector)

1. Shut down and unplug your PC.
2. Open your PC case to access motherboard and PCIe slots (circled in white on image).



3. Locate an available **x16** or **x8** PCIe slot and install the PCIe interface card, it should slide into place with minimal resistance, you will hear a click when fully inserted. The below image shows the PCIe card in a x16 slot (left) and a x8 slot (right, has overlapping pins).

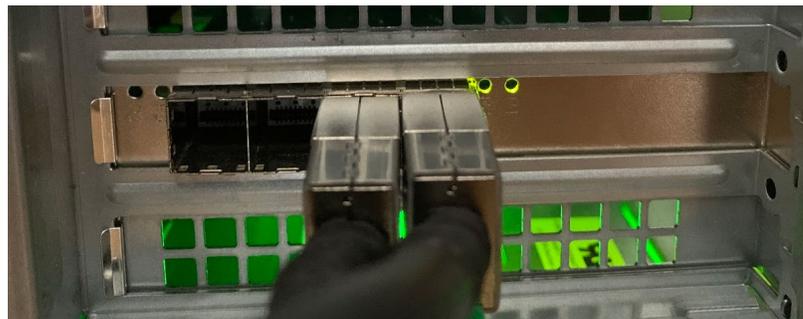


4. Close your PC case and locate the newly available PCIe ports on the card.

5. Insert the two PCIe cables into the **top two ports (1 and 2)** of the PCIe card. The cable in port 1 should then plug into the **top port (1)** of the Kinetix, and the cable in port 2 should plug into the **bottom port (2)** of the Kinetix.
 - a. A marker or tape is useful to differentiate the cables in case they are unplugged in the future. The below image shows an example setup, with the Kinetix on the left (tape on port 2) and the computer on the right (tape on port 2).



6. Plug the power cable into the Kinetix and a suitable socket, then power on the Kinetix. The **initialising light** will flash orange, once the flashing stops the Kinetix is ready.
7. Plug in and power on the PC.
8. If the link between PC and Kinetix is successful, there will be **two green LED lights** on the PCIe card. If one or both lights are **orange**, make sure the cables are connected to the correct ports and are undamaged.



9. The link can also be confirmed using **PVCamTest**, try to acquire some live images. You can also check your **Device Manager** and see if your PC has identified a PVCAM device.

If wanting to use a USB connection, install the included USB 3.2 interface card in the same manner to installing the included PCIe card. The Kinetix only requires one USB cable for operation, but will not operate at maximum speed.

Imaging In Software

The Kinetix is supported by a range of third party imaging software provided by external organizations and companies, including [MATLAB](#), [Micro-Manager](#), [LabVIEW](#), [Open CV](#), [Python](#), and more to come!

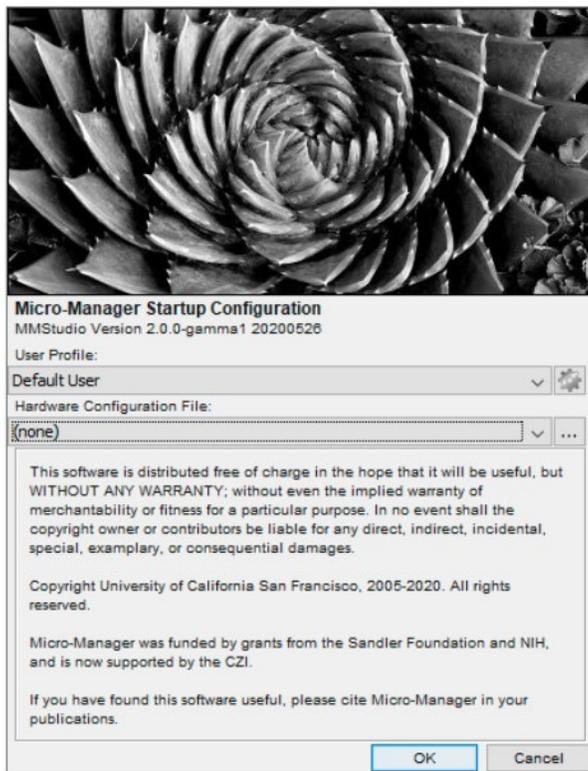
Micro-Manager

MicroManager ([μManager](#)) is open source software for control and automation of imaging hardware. μManager 2.0 is fully compatible with the Kinetix CMOS camera and can be downloaded at the following address:

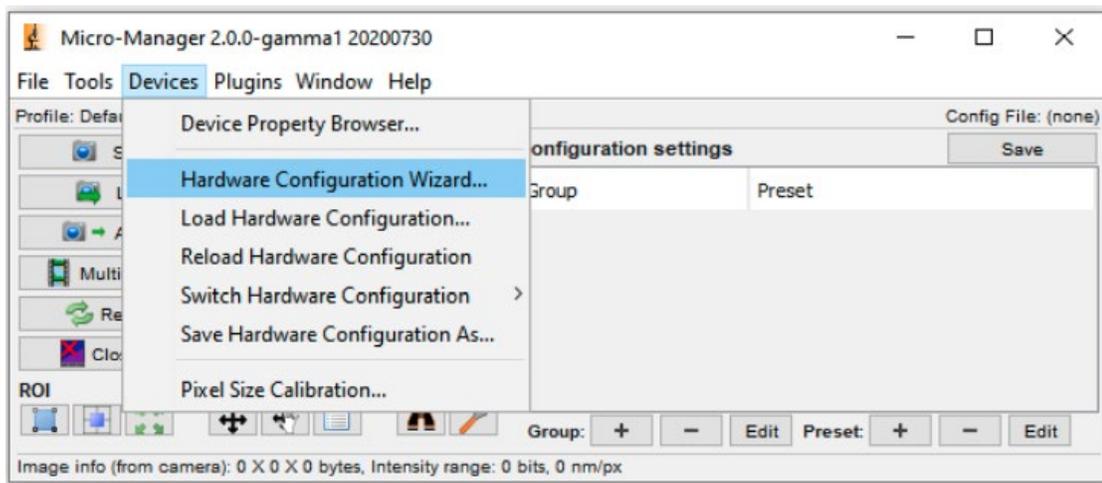
https://micro-manager.org/Download_Micro-Manager_Latest_Release

μManager uses a [configuration file](#) to control the Kinetix, here's how to get set up:

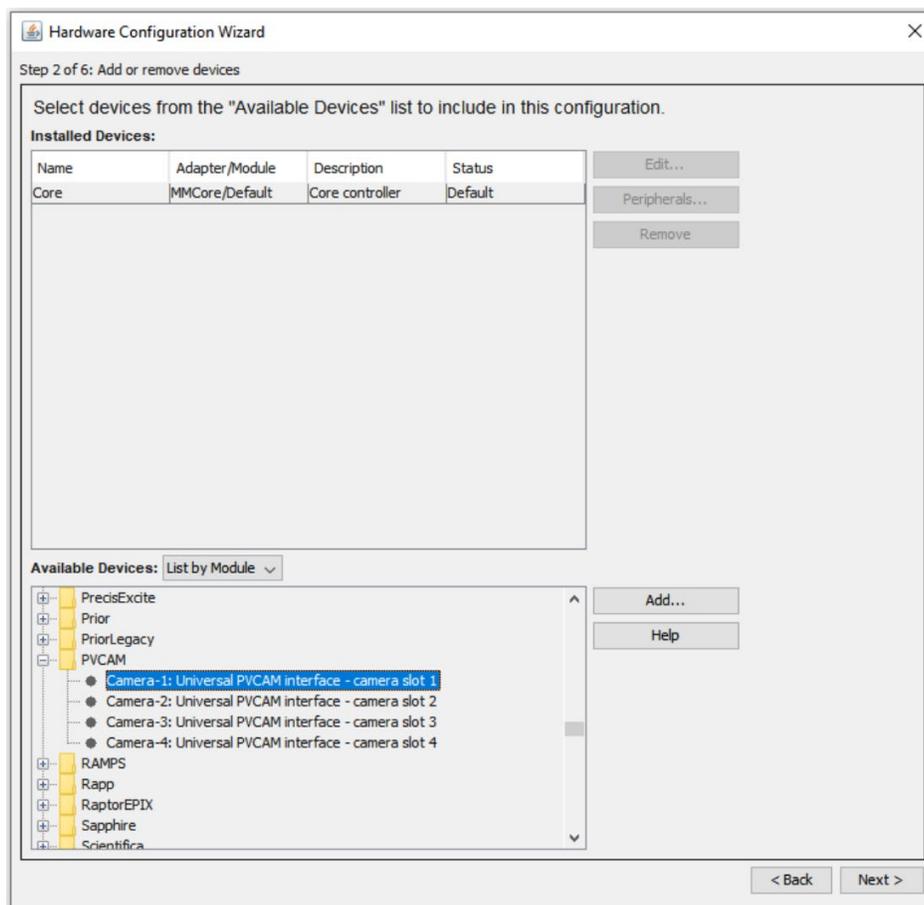
1. Make sure the Kinetix and any additional imaging hardware is plugged in, turned on, and successfully connected to the PC.
2. Open [μManager](#), when prompted for a [Hardware Configuration File](#), select '(none)'.



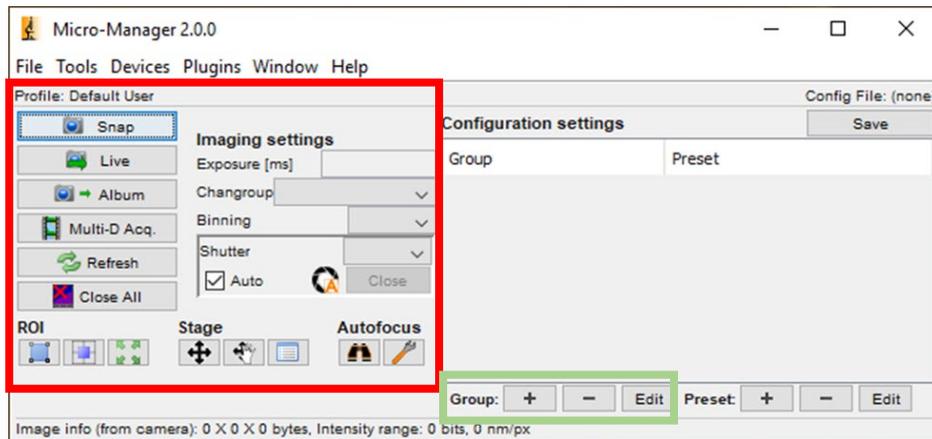
- Under the 'Devices' dropdown menu, choose 'Hardware Configuration Wizard' and create a new configuration.



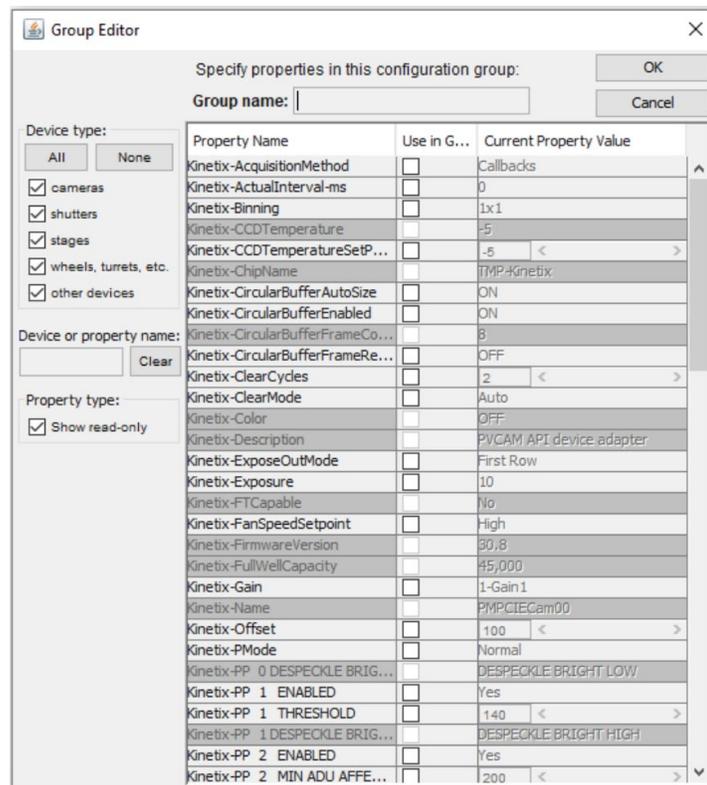
- You'll see a list of available devices, go to PVCAM, select 'Camera-1', and click 'Add', then name the device.



5. Add in any additional hardware such as motorized stages, light sources, etc. if needed.
6. Click through 'Next' to add and change additional hardware settings, please note that, PVCAM devices need no additional settings changing at this stage.
7. Name and save your Hardware Configuration File and put it in an easy to access location, as you'll need to select this **.config** file every time you open μ Manager.
8. The Kinetix is now set up in μ Manager and you can use the basic functions, such as changing the exposure and starting an acquisition (in the red square below).



9. For Kinetix specific settings, it is necessary to add 'Groups' for each desired setting.
10. Click the plus symbol next to Group (green square) to see a list of all available hardware settings for the Kinetix.



11. We recommend first adding 'Ports' as this allows access to the **four modes** of the Kinetix, namely Speed, Sensitivity, Dynamic Range and Sub-Electron.
12. Select the 'Use in Group' tick box, name the Group, click OK, this adds the Group to the μ Manager window.
13. Add any other relevant Groups for settings you wish to control, such as fan speed, scan direction, triggering, and more.
14. You will also need to add Groups to control aspects of your other imaging hardware (if included in the config file), such as channels for your light source, etc.
15. By saving the config file, all your Groups will be preserved for the next time you open μ Manager.
16. See our full guide on what you can do with μ Manager here:
<https://www.photometrics.com/wp-content/uploads/2020/11/How-to-use-Micro-Manager-Rev-A2-03112020.pdf>

Troubleshooting

- *Why isn't my Kinetix running at maximum speed in Speed Mode?*

In order to get the full 500 fps across the full frame in 8-bit Speed Mode, you will need to use the PCIe connection (with two cables) with a sufficiently powerful PC. The PC can be a limiting factor with the Kinetix, so it is vital to have enough RAM and a modern CPU. It is also vital to consider software limitations and updating to the latest drivers.

Using USB and/or a PC with older parts will limit the data rate of the Kinetix, meaning full speed will not be achievable. In addition, if you don't have enough RAM, even opening other applications can limit the bandwidth available for the Kinetix, and in turn limit the maximum achievable speed.

If you are using PCIe with a modern PC and still not getting the full speeds, check your imaging settings and exposure time. The 8-bit Speed Mode is needed for the maximum speeds, and in order to achieve >1000 fps (>1 kHz) it is necessary to use an exposure time of 1 ms or less.

- *I have orange lights on my PCIe card*

When successfully connecting the Kinetix and your host PC, the PCIe card will display two green LED lights. If these lights are orange it means there is an issue with the connection.

Ensure that the PCIe cables are fully inserted on both the PCIe card and the Kinetix. If removing the cables to reattach, remember to pull on the green tab, not the wire itself.

Check that the cables are plugged into the top two ports (1+2) on the PCIe card, and each cable corresponds to the same ports (1+2) on the Kinetix. If lights are still orange, try ports 3+4 on the card (with 3 going to 1 on Kinetix and 4 going to 2). Once you find an orientation that works, mark the cables. Finally, ensure that the camera was turned on and fully initialised before the PC was turned on.