

**OPTICSTAR**

**PX-126**

Video Camera for  
Imaging and Auto-Guiding



## User Manual



## CAUTION



1. Do not drop your camera as this can result in serious damage.
2. Do not point the camera to a bright light source like the Sun without the appropriate filters as this will damage the sensor.
3. Disconnect the camera from the computer when not in use.
4. Treat the camera glass window with the same care as you would of a photographic lens.

### **Manufacturer's Warranty**

This product has a 1 year back to base warranty.  
For after sales support, please contact Opticstar at: [info@opticstar.com](mailto:info@opticstar.com)

Opticstar Ltd, 87 Washway Road, Sale, Greater Manchester, M33 7TQ, United Kingdom.  
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## Overview

The PX-126 series of video cameras include the PX-126C (colour model) and the PX-126M (monochrome model). The PX-126 is suitable for imaging the planets, the Moon and the Sun. It can also be used as an auto-guide camera due to its built-in ST4-compatible auto-guide port. The camera is also suitable for microscopy when fitted with an appropriate attachment.



Please note that for solar photography, the camera should be used only with an appropriate solar telescope and/or solar filters.

## Camera Software

The camera is bundled with the **OpticstarSky** application software for capturing and storing images and video. The software also includes some image processing functionality such as image stacking. Optionally, the camera can be used with some third-party application software that support Microsoft's DirectShow standard. Support is also included for the TWAIN communication protocol that allows third party application software to import images from digital devices such as the PX-126.

In addition, **PHD Guiding** software is bundled with the camera that allows the PX-126 to be used as an auto-guider. Auto-guiding is supported through the ASCOM software standard ensuring wide support by third party applications.

### Package contents:

- Opticstar PX-126 video camera.
- C-mount to 1.25" telescope adapter (nosepiece).
- USB cable.
- Auto-guide cable.
- Setup Guide (printed).
- Software CD.
- User Manual on CD (this document).

## Software Installation

The minimum computer system requirements are the following:

- Microsoft Windows (32-bit or 64-bit) 7/8/10/11 with the latest update.
- USB 2.0 port (or USB 3.0) for the camera.



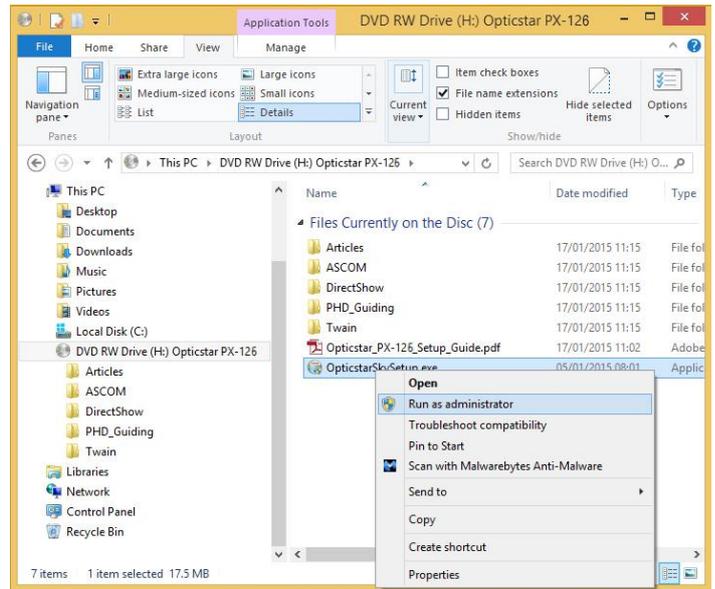
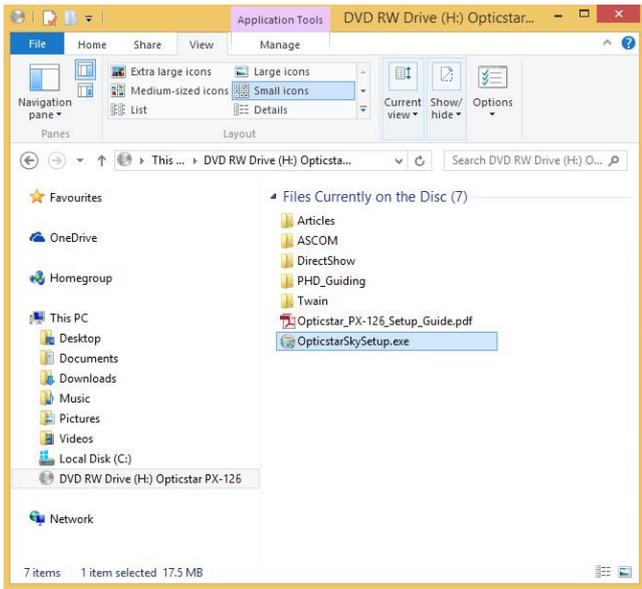
Please ensure that the camera is **not** connected to the computer yet.



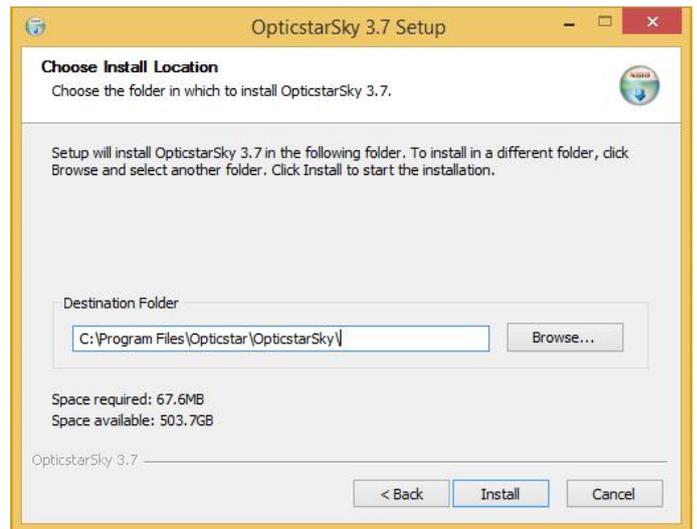
The installation of the software should be carried out by a user with *Windows administrator permissions*. Otherwise, the installation may fail.

Insert the CD into the drive and open the **OpticstarskySetup.exe** file. This program will install two pieces of software:

1. Windows driver software for PX-126.
2. **OpticstarSky** application software.

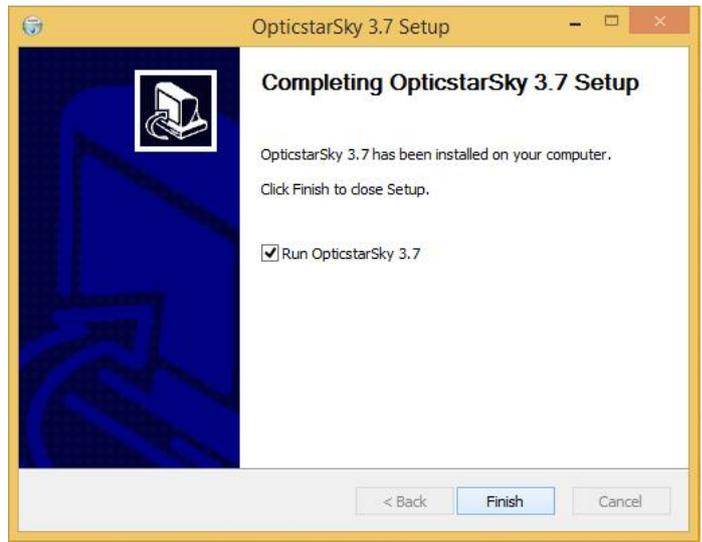
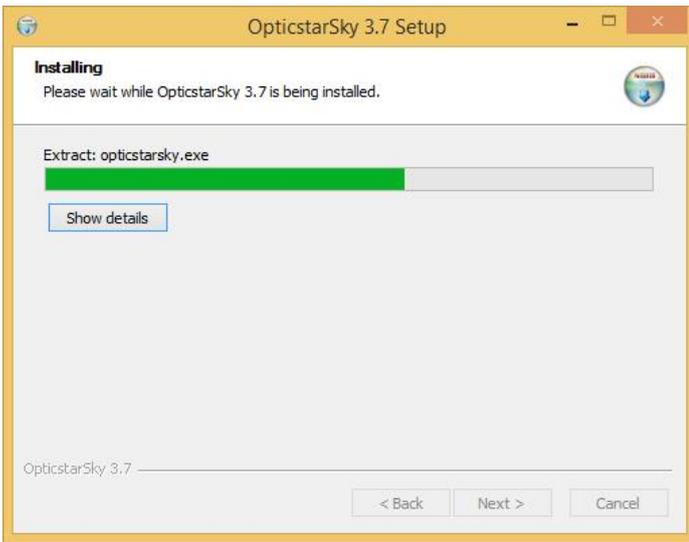


Right-click the installation program and from the pop-up menu select **Run as administrator**. This will start the installation process as shown on the screenshots below. Click **Next** to start. On the following window, you can let the program select the installation location and click the **Install** button.



Anti-virus software may attempt to block the software installation. In such cases the anti-virus software should be temporarily disabled. Otherwise, when prompted, add the installation files to the trusted list.

The following window will display a progress bar during the installation. Once the installation is complete, the final installation window will display the **Finish** button. If the option to **Start OpticstarSky** is ticked, pressing the **Finish** button will start **OpticstarSky**.



OpticstarSky

Plug the camera to a USB 2.0 or USB 3.0 port on your computer. The camera will be identified as PX-126 in Windows Device Manager and in **OpticstarSky**. If **OpticstarSky** is not already running, click the program icon on the Windows Desktop.

In some cases, the camera may not be identified by Windows or **OpticstarSky** immediately after the installation. In such cases, unplug the camera and restart the computer before continuing. Once Windows has restarted, plug the camera to the computer and open **OpticstarSky**.

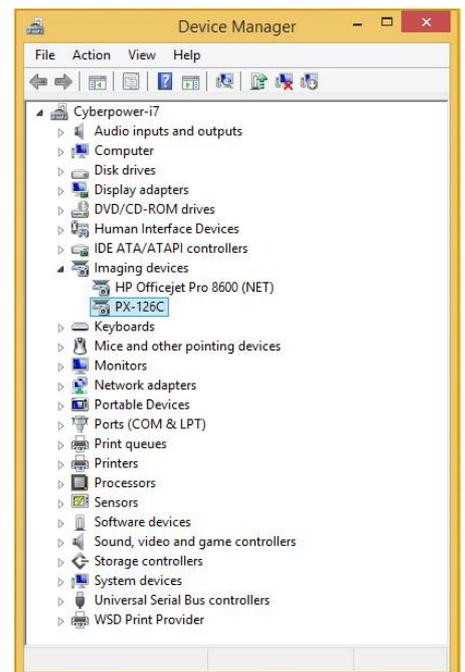


The camera does not incorporate any optics and therefore it cannot reach focus by itself. A C-mounted lens must be used with the camera or it must be attached to a telescope with the nosepiece adapter that is included with the camera. To attach it to a microscope, please use an appropriate attachment.

It is possible to check whether the installation has completed successfully even before running **OpticstarSky**. Plug the camera to the computer and open the Windows **Device Manager**. The camera will be listed under the “Imaging devices” node.

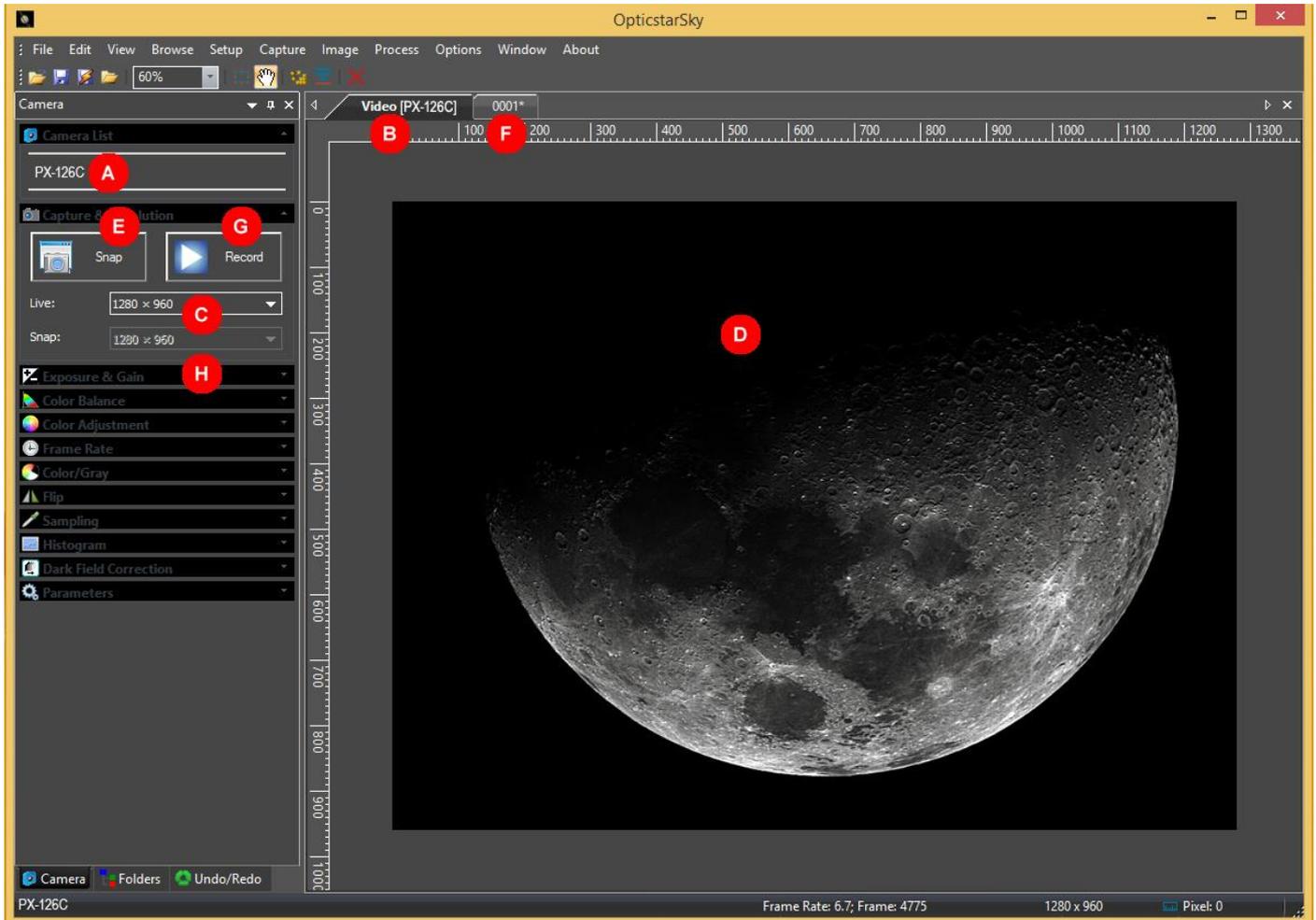
To access the **Device Manager**, open the Windows **Control Panel**. In Windows 8 or later, this can be done by right-clicking on the Windows **Start** button on the bottom left corner of the screen and on the popup, menu select **Device Manager**. In earlier operating systems click the **Start** button and then select **Settings > Control Panel**.

The screen-shot on the right-hand side shows a successful installation with the camera identified as PX-126. If the camera is not identified correctly then the installation has not been carried out successfully and an exclamation mark icon will appear next to the camera entry. Refer to the trouble shooting section later in this manual for details.



## OpticstarSky

Once **OpticstarSky** is running, it will list any connected cameras on the left-hand panel as **PX-126C** or **PX-126M** (A). Click on the listed camera to activate it. The camera will display video on the main pane (D). A tab (B) will also appear with the heading “Video [PX-126]”. The tab allows quick access to the video pane during the imaging session.



### Capturing Images

Single-shot images can be captured by clicking the **Snap** button (E) and can be accessed from the new tab titled **0001\*** at the top of the image pane (F). Images are displayed and captured at the selected resolution (C). The screenshot on the right shows the graphics resolutions that can be selected. The highest resolution is selected by default.

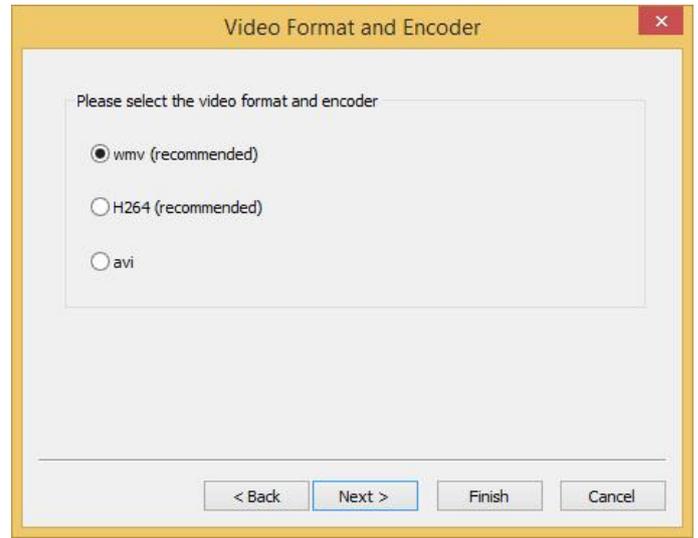
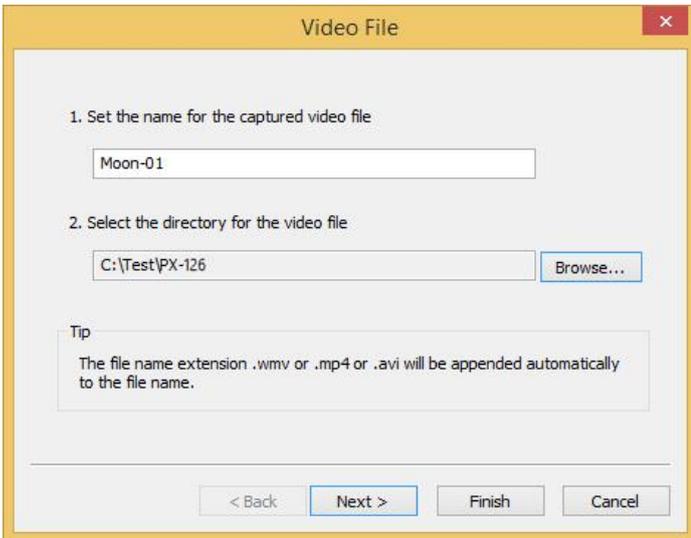
Captured images can be saved to disk from the **File** menu.



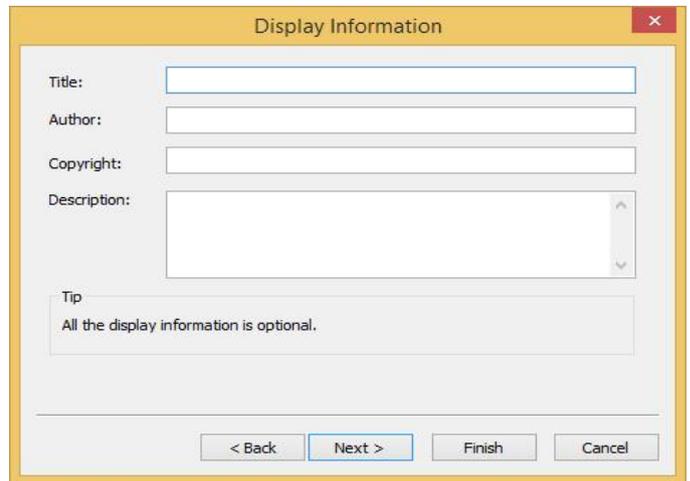
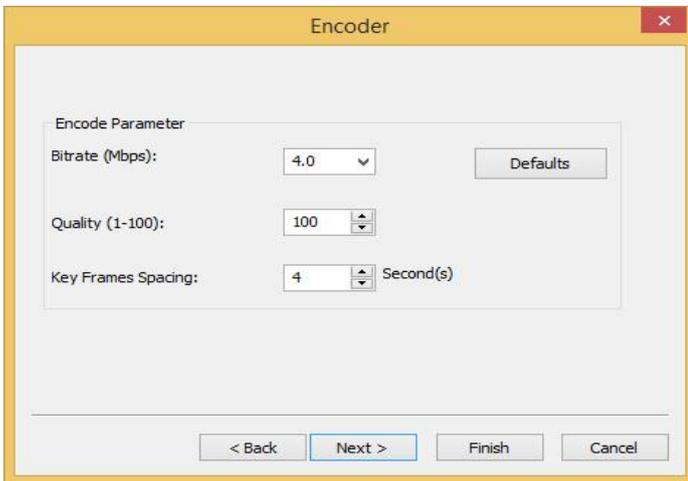
### Capturing Video

Video can be captured by clicking the **Record** button (G). A dialog window will appear asking to enter the file name and folder that the video file will be stored.

On the following window select the type of video compression to be used. If you are not sure what to select, just leave it at the default option which is usually the WMV format.



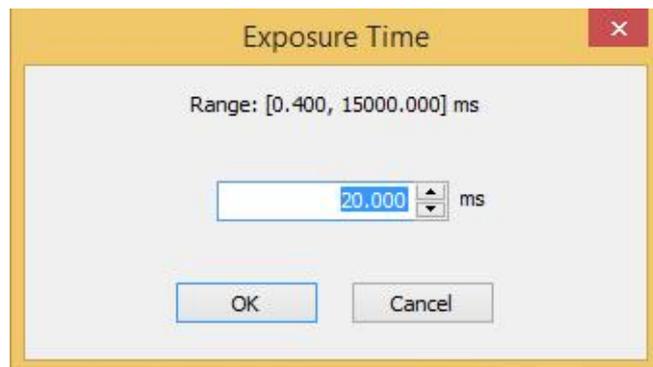
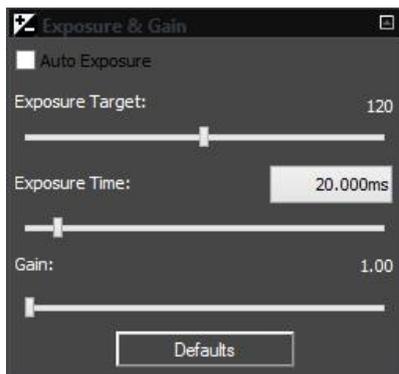
On the following window the video capture parameters can be set. These values can be left at default settings but the user has the options to modify these values. The bitrate can be increased if the computer's USB bandwidth is fast enough to handle it. The quality setting determines the degree of data compression. If quality is set at 100 then the images are captured at the highest quality resulting in larger video files on the disk.



The **Key Frames Setting** determines how frequently video frames are shown on the monitor while video is being captured on the hard disk. If this value is set too high, then the captured video will be slow and jerky. In the final window it is possible to enter information to identify the video to be captured.

### Exposure Time

In astronomy, the exposure time should be selected manually from pull down menu (H) on the left panel. Un-tick the **Auto Exposure** option and set the exposure time from the sliding bar or by clicking on the time and typing the exposure time manually in milliseconds.



The valid exposure time range of the PX-126 is from 0.4 milliseconds up to 15,000 milliseconds (15 seconds).

The appropriate exposure time depends primarily on the brightness of the target and the aperture of the telescope. The Moon for example will require a very short exposure time, typically less than 20ms (milliseconds) and a planet less than 50ms.

The **Exposure Target** option is relevant if **Auto Exposure** is used. It adds a user set bias value to the default automatic exposure time.

## Gain

The *Gain* can be set from 1.00 up to 3.00. By markedly increasing the **Gain** value the light sensitivity of the camera increases significantly but the image quality degrades. As a general rule, using gain at lower values is beneficial because the exposure times may be shorter, hence minimising the side effects of the Earth's atmosphere whilst maintaining high image quality.

## Configuration Options

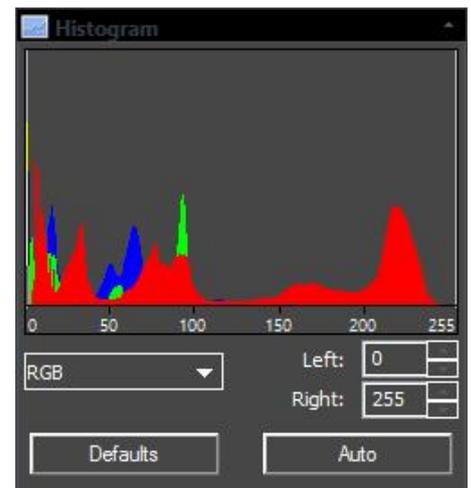
In addition to the exposure time and gain, other camera parameters can be configured by accessing the pull-down menus underneath **Exposure & Gain (H)** on the left-hand panel. The default values will work well for most imaging sessions and are self-explanatory. However, some of the options are explained below.

## Histogram

The histogram helps to visualise the composition of the captured data. The histogram on the right represents colour image data of a single frame. The Red, Blue and Green (RGB) graphs represent the three individual channels that constitute the colour image. Each graph shows the number of image dots (pixels) depending on their brightness. The horizontal graph axis represents the brightness of the data from 0 (totally dark) to 255 (totally bright). The vertical axis represents the number of pixels of a particular brightness.

If the **Exposure Time** and **Gain** values are not set appropriately, the graphs will be clipped on the far left (if exposure/gain are too low) or on the far right of the graph (if the exposure/gain are too high).

If all three RGB values are at zero, this represents black. If all three RGB values are at 255, this represents white.



## Dark Field Correction and Dark Frames

All scientific cameras introduce minute imperfections to the image inherently present in their electronics. Such factors include signal-to-noise (S/N) ratio and thermal noise. In astronomy, *dark frames* can be used to counteract these factors. Select the **Dark Field Correction** menu and tick the **Enable** option. Before clicking the **Capture** button, ensure that the camera's cap is fitted on the camera so that no light can reach the camera's sensor at all. The number of dark frames to be captured can be selected by changing the **Quantity** value. Typically, 10 frames is a good number of dark frames. Clicking the **Capture** button will capture the number of dark frames specified. These frames will be averaged out automatically creating a master dark frame.

Remove the cap from the camera and continue imaging as normal. From now on any images (light frames) captured by the camera, will have *dark frame subtraction* applied to them. Effectively, the master dark frame data will be subtracted from the light frame data to remove any imperfections.

For best results, a master dark frame should be created for each specific imaging session because the ambient temperature between sessions can vary greatly. A dark frame created for one session may not work as well in another session. It is also good practice to create a new dark frame when the **Exposure Time** and **Gain** settings change significantly even within the same session.

## Parameters

The various values entered during an imaging session can be stored to disk for future sessions. This can save time in future imaging sessions by loading the parameters from a previous session. These parameters include such values such as **Exposure Time**, **Gain** and others.

## Main Menu and Icons

Most of the camera functions outlined above can also be accessed from **OpticstarSky's** main menu and icons at the top of the program window.

Selecting the various options from the main menu and the icons, allows the user fine control over the various functions. These options are better suited for experienced users who already understand how the camera works.



The **Image Select** icon allows the user to select a rectangular region that is smaller than the full image area. Any imaging enhancement functions such as colour balance, contrast and others are only performed based on the data contained within the selected region. If no region is selected, the imaging enhancement functions use the data of the whole image area. By default, no region is selected.

## Image Stacking

In astronomy, it is not possible to capture a single image that is sharp due to the Earth's atmosphere. Atmospheric turbulence, sky transparency and high humidity levels all play a major role on the quality of the captured images. These conditions can vary greatly between imaging sessions. To minimize these undesirable effects, we apply to the captured images a process called *image stacking*.

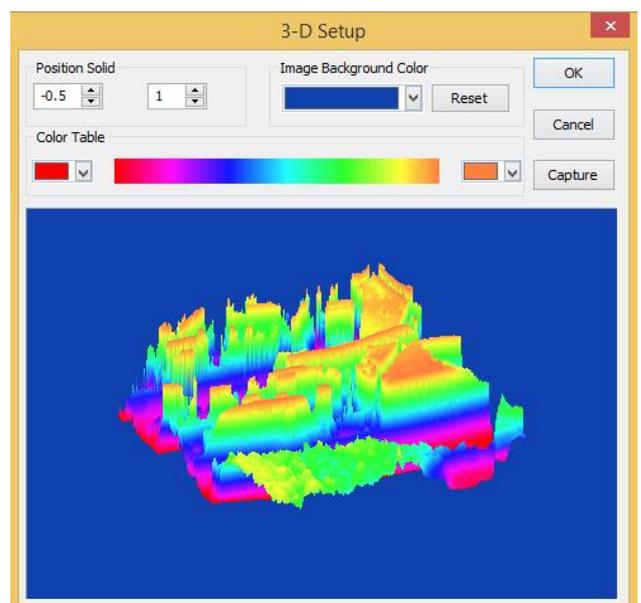
Stacking is the process of merging the data of many image frames into a single frame. This operation applies mathematics to select the best parts of each frame and accumulate that information into a single frame that is of much higher quality than any of the single frames used to construct the final image. This technique is known as stacking and it can be accessed from the main menu at the top **Process > Imaging Stacking**. Stacking is applied to a video file stored on the disk. It is *not* possible to capture video and apply stacking in a single operation.

## Processing and Visualising Data

Many other image processing options can be accessed from the **Process** pull down menu that perform advanced functions such as noise reduction, sharpening, histogram equalization, filtering, etc.

In addition to these functions, image visualisation tools are included such as **Surface Plot** and **Line Profile** to help understand the captured data. These tools will be especially useful to more experienced users.

One other notable function is *stitching*. The **Stich** button opens a series of options that can be customised in such a way that a series of images can be attached next to each other to create a single image that is much larger in size. The **Stitch** icon can be accessed from the menu bar.



## Third Party Software

The PX-126 may be used with third party software that is compatible with *Microsoft's DirectShow* multimedia standard. *DirectShow* is widely supported by many imaging software applications. This functionality allows them to control imaging devices such as the PX-126. In addition, the PX-126 includes *ASCOM* support. *ASCOM* is a software interface standard for Microsoft Windows that allows *ASCOM* compliant software and devices to work together. The following sections explain how the PX-126 can be used with third party software through its *DirectShow* and *ASCOM* support.



Please note that Opticstar does *not* provide technical support on third party software. The *DirectShow* and *ASCOM* support is provided "as-is". The information provided on these topics does not imply that Opticstar endorses third party software in any way. The information is merely presented for the benefit of the customer.

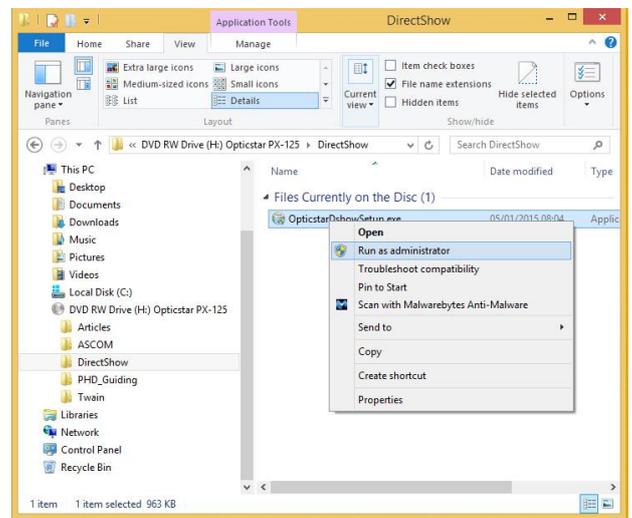
### Adding DirectShow

Installing *DirectShow* support allows the PX-126 to be used with third party software for imaging and auto-guiding.

To install *DirectShow* support, open the **DirectShow** folder on the CD, run **OpticstarDshowSetup.exe** and follow the installation instructions.

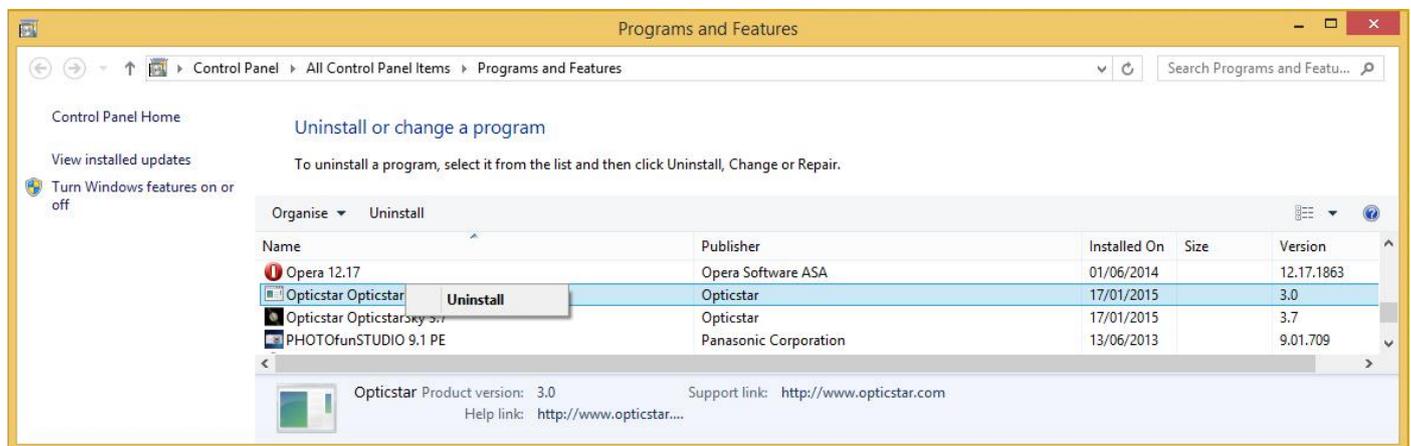
It is recommended that the installation is performed with Windows administrator permissions. Right-click on the file and from the pop-up menu, select **Run as administrator**. Follow the instructions to complete the installation.

Sometimes, it is necessary to re-start the computer after the *DirectShow* installation. The PX-126 will be identified as **Opticstar** by third party programs. If it does not, unplug the camera from the computer and restart the computer. Once Windows has started, connect the camera to the computer and continue.



### Removing DirectShow

*DirectShow* compatibility can be removed at any time. In Windows 8 or later this can be done by right-clicking on the Windows **Start** button on the bottom left corner of the screen and on the popup, menu select **Programs and Features**. In earlier operating systems click the **Start** button and then select **Settings > Control Panel > Add/Remove Programs**.



Right-click on **Opticstar OpticstarDshow** entry and select **Uninstall**.

## Adding ASCOM



Installing the ASCOM software enables the PX-126 to be used as an auto-guide camera. ASCOM support also allows the PX-126 to be used for imaging as an ASCOM compliant imaging device. There are three steps in adding ASCOM functionality:

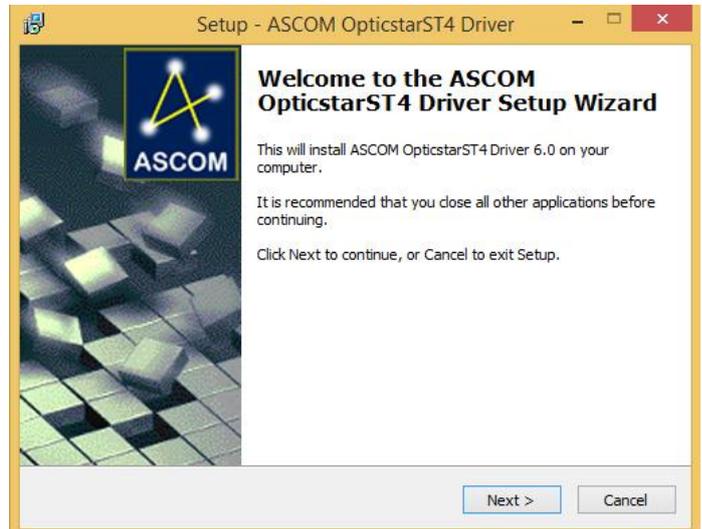
1. Install the ASCOM software platform.
2. Install the PX-126 ASCOM camera driver for imaging support.
3. Install the PX-126 ASCOM ST4 driver for auto-guide support.

The ASCOM software platform is freely available and can be downloaded at <http://ascom-standards.org>. Follow the instructions on the downloads section of the website on how to download and install it.

Once the ASCOM platform has been installed, proceed to install ASCOM support for the PX-126, open the **ASCOM** folder on the CD, run the following two installation programs:

- **ASCOMOpticstarCamSetup.exe** for PX-126 imaging support.
- **ASCOMOpticstarST4Setup.exe** for PX-126 ASCOM auto-guide support.

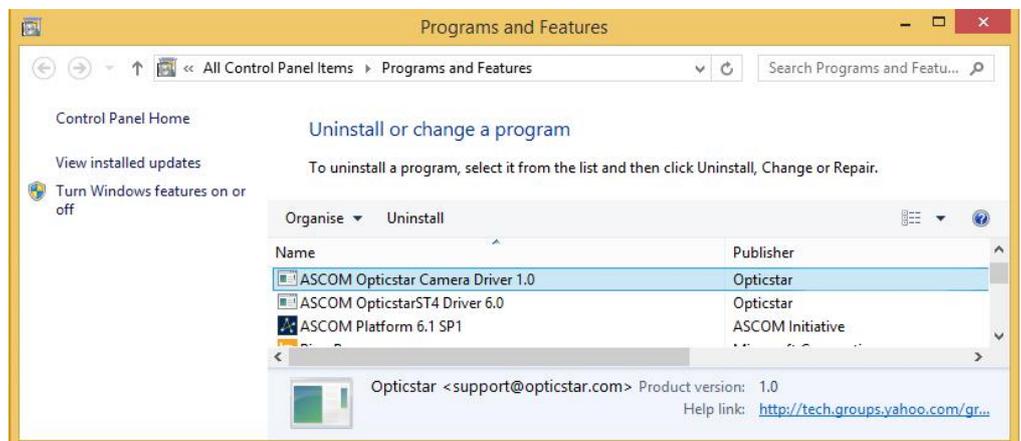
It is recommended that the installation is performed with Windows administrator permissions. Right-click on the file and from the pop-up menu, select **Run as administrator**. Follow the on-screen instructions to complete the installation of both programs.



## Removing ASCOM

ASCOM compatibility can be removed at any time. In Windows 8 or later, this can be done by right-clicking on the Windows **Start** button on the bottom left corner of the screen and on the popup, menu select **Programs and Features**.

In earlier operating systems click the **Start** button and then select **Settings > Control Panel > Add/Remove Programs**.



The two sets of PX-126 ASCOM drivers can be removed one at a time by right-clicking on each driver and select **Uninstall**.

## Imaging in DirectShow and ASCOM

This section demonstrates how the PX-126 can be used in third party programs as a *DirectShow camera* or as an *ASCOM camera*. It is assumed that all the DirectShow and ASCOM software outlined in the previous sections have already been installed.

### SharpCap



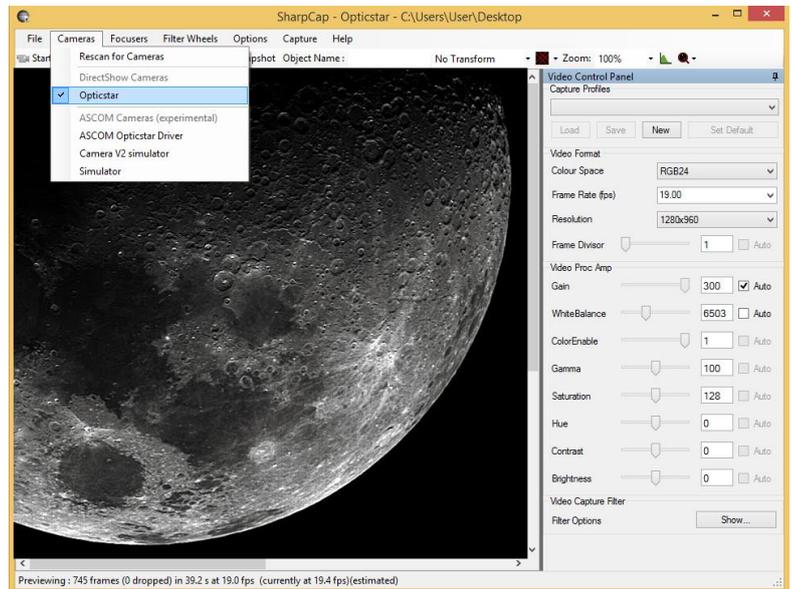
**SharpCap** is a simple imaging software application designed for video astronomy. It supports cameras that offer DirectShow or ASCOM camera functionality. **SharpCap** can be freely downloaded at [www.sharpcap.co.uk](http://www.sharpcap.co.uk). Please, follow the instructions on the website to how to download and install it.

Once the program has been installed and running, the camera can be selected from the **Cameras** menu at the top of **SharpCap**'s main window. The camera must be connected to the computer at this point.

The first **Opticstar** entry refers to the PX-126's DirectShow support as shown on the screenshot on the right-hand side.

There is also a second Opticstar camera entry referred to as **ASCOM Opticstar Driver**. Selecting this option instructs SharpCap to use the ASCOM driver to communicate with the camera instead of the DirectShow driver.

Please note that **OpticstarSky** provides more functionality than **SharpCap** and is better suited for the PX-126.



## Auto-Guiding in DirectShow and ASCOM

This section demonstrates how the PX-126 can be used in third party programs as a *DirectShow camera* and as an *ASCOM auto-guide device*. It is assumed that all the DirectShow and ASCOM software outlined in the previous sections have already been installed.

### PHD Guiding 2

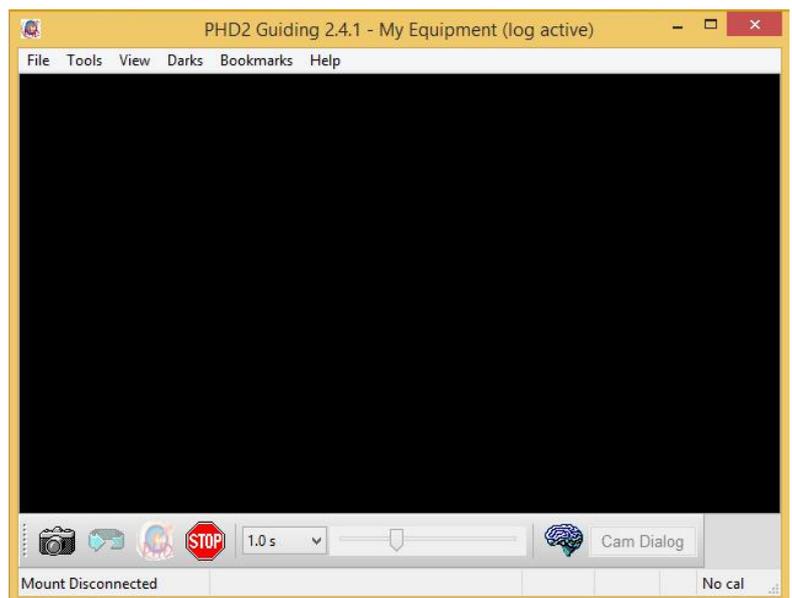


**PHD Guiding 2** is a popular auto-guide program. It supports auto-guide cameras that offer DirectShow camera support, ASCOM camera support and ASCOM guide-port (ST4) devices.

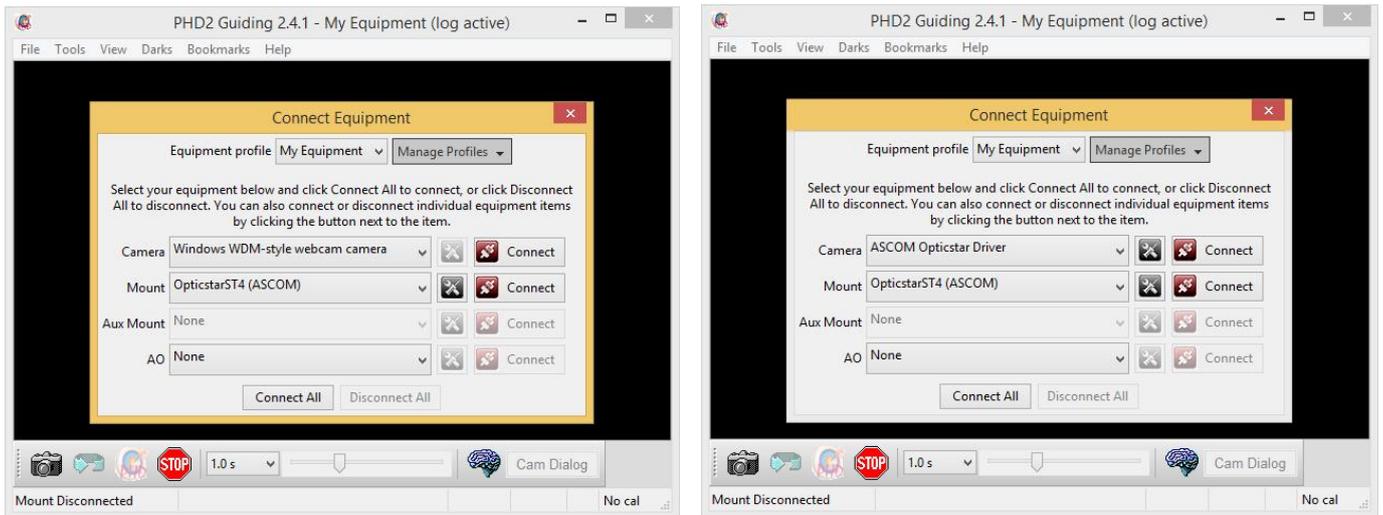
**PHD Guiding 2** can be freely downloaded at <http://openphdguiding.org/>. Please follow the instructions on the website to how to download and install it.

Once **PHD Guiding 2** has been installed and running, click the **Camera** icon on the bottom left-hand corner of the program window to select the devices that will be used to capture the image and provide auto-guide functionality.

The PX-126 can be selected either as a DirectShow camera or as an ASCOM camera. Additionally, the PX-126's auto-guide port must be selected as an ASCOM device.



The PX-126 must be connected to the computer's USB 2.0 or USB 3.0 port. Additionally, the camera's auto-guide port must be connected to the telescope mount's auto-guide (ST4) port with the RJ cable that is bundled with the camera.



The screenshots above demonstrate the two ways of configuring the PX-126 as the auto-guide camera. On the screenshot on the left, the camera has been selected as **Windows WDM-style webcam camera** which is another way of describing a DirectShow camera. The telescope mount connectivity must be made by selecting **OpticstarST4 (ASCOM)**.

The screenshot on the right demonstrates that the camera may also be selected as **ASCOM Opticstar Driver**. Once again for telescope mount connectivity **OpticstarST4 (ASCOM)** has been selected.

Click the **Connect All** button when ready to start auto-guiding.

## Auto-Guiding Components

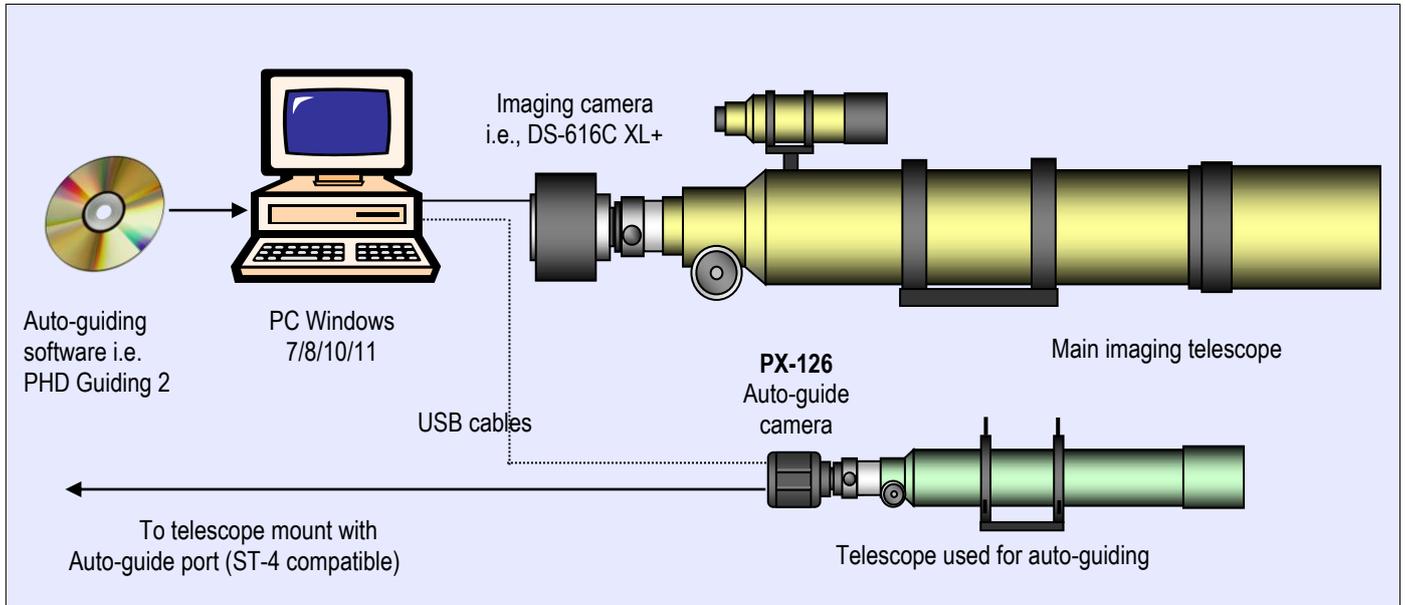
There are a number of ways you can guide a telescope but there are mainly two ways of doing so. The most versatile method is to use two telescopes mounted on the same mount, one for imaging and the second for guiding. Alternatively, you could use a single telescope to perform this function. While the latter method is easier, it will limit your choice of locating a suitable guide star.

### Imaging and Auto-Guiding with Two Telescopes

In general to be able to auto-guide with the Opticstar PX-126 camera you will require the following items:

1. An imaging camera, i.e., Opticstar DS-616C XL+.
2. An imaging telescope, i.e., Opticstar/Ascension 102ED Triplet APO.
3. A secondary telescope for auto-guiding, i.e., Opticstar AR80S f/5 Gold.
4. An auto-guide (ST-4) compatible mount, i.e., EQ5 PRO, EQ6 PRO, etc.
5. PC with USB2.0 or USB 3.0 ports running Windows 7/8/10/11.
6. **The Opticstar PX-126 camera and software to be used as a guide camera.**
7. *ASCOM software platform.*
8. Auto-guiding software, i.e., PHD Guiding 2.

The diagram on the following page demonstrates how the components listed above are assembled together into a complete imaging and auto-guiding setup.



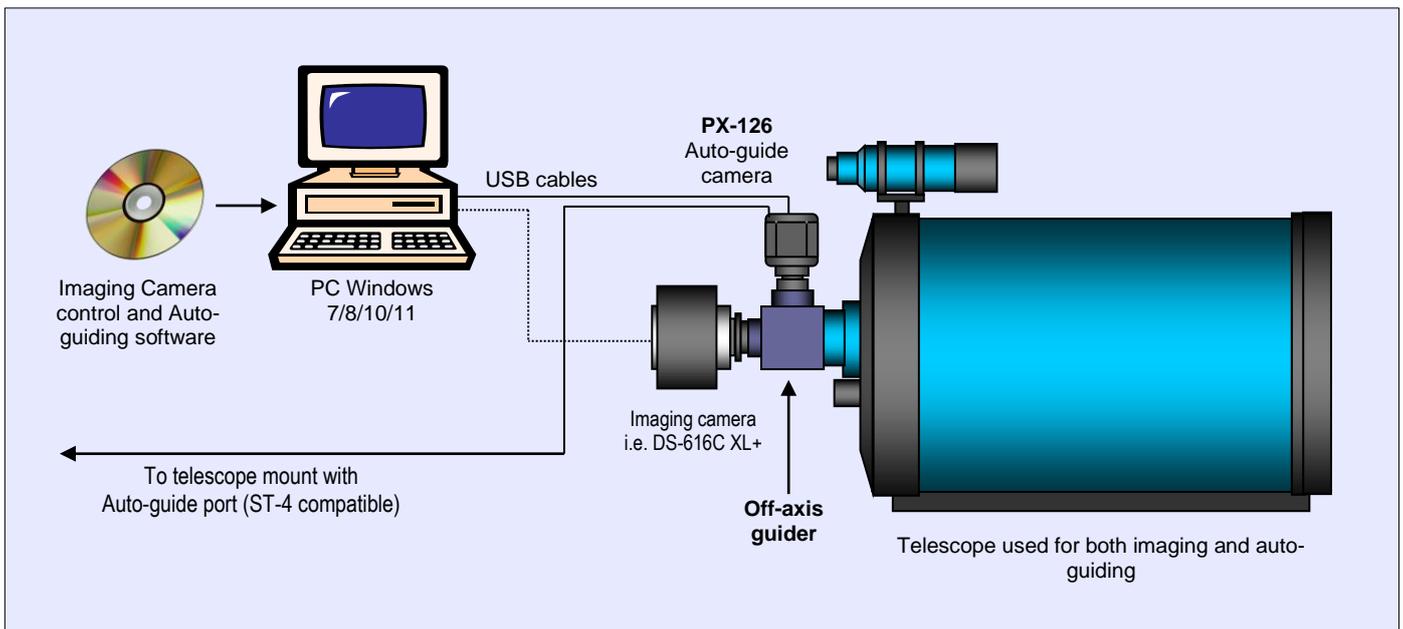
Please note that the secondary telescope that is used for auto-guiding would further increase your choices for locating a suitable guide star if it is held in collimating rings, like a huge finder scope. This would allow you to easily locate a suitable guide-star even under very difficult conditions.

### Imaging and Auto-Guiding with a Single Telescope

An alternative setup will involve a single telescope for imaging and auto-guiding purposes instead of two different telescopes. As such you will require the following items to be able to image and auto-guide.

1. An imaging camera, i.e., Opticstar DS-616C XL+.
2. An imaging telescope, i.e., Opticstar/Ascension 102ED Triplet APO.
3. An off-axis guider
4. An auto-guide (ST-4) compatible mount, i.e., EQ5 PRO, EQ6 PRO, etc.
5. PC with USB2.0 or USB 3.0 ports running Windows 7/8/10/11.
6. **The Opticstar PX-126 camera and software to be used as a guide camera.**
7. *ASCOM software platform.*
8. Auto-guiding software, i.e., PHD Guiding 2.

The following diagram demonstrates how the components listed above are assembled together into a complete imaging and auto-guiding setup using a single telescope.



An off-axis guider provides an easy and affordable way to auto-guide with a single telescope. It minimises possible tube flexure but has the disadvantage of having a limited field of view. Also, the amount of light that hits the prism/mirror is relatively small making less bright stars more difficult to see and track.



## Troubleshooting

If you experience difficulty in installing the camera software and drivers this may be due to a number of reasons related to your computer, operating system and other devices already connected to it. The following sections outline the most common issues and suggest ways in which you should be able to resolve them. Please also refer to the documents in the **Articles** folder on the CD.

### USB Requirements



Please ensure that your computer runs Windows 7/8/10/11 or later, has the latest service pack updates from Microsoft. Your computer must also have USB 2.0 or USB 3.0 ports. The PX-126 camera will not work with USB1.1. If your computer has USB1.1 ports you will need to obtain a PCI USB2.0 or USB3.0 type card if you have a desktop computer. Likewise, a laptop computer can be fitted with an Express USB2.0 or USB3.0 card. The ExpressCard (or equivalent alternative) will need to be fully supported by your computer, in some entry level laptops full ExpressCard support is not fully implemented.

If you have a desktop, try both the USB ports on the front and back of your PC if the camera is not recognised on a particular USB port. USB ports attached directly to the motherboard are more efficient. Please note that PCMCIA USB2.0 cards typically do not provide the full USB2.0 bandwidth and will not work optimally with the PX-126 camera.

### Express Card

To resolve such issues an ExpressCard (with USB2.0 or USB3.0 ports) should be used instead of a PCMCIA/CardBus card due to the ExpressCard's superior speed of 2.5Gbit/s (480 Mbit/s through USB 2.0) per slot, for comparison PCMCIA/CardBus devices connected to a computer would share a total 1.06 Gbit/s bandwidth. Express type cards use a 34mm slot where PCMCIA/CardBus cards use 54mm slots. An ExpressCard should be connected directly to the computer and not via a PCMCIA/CardBus card.

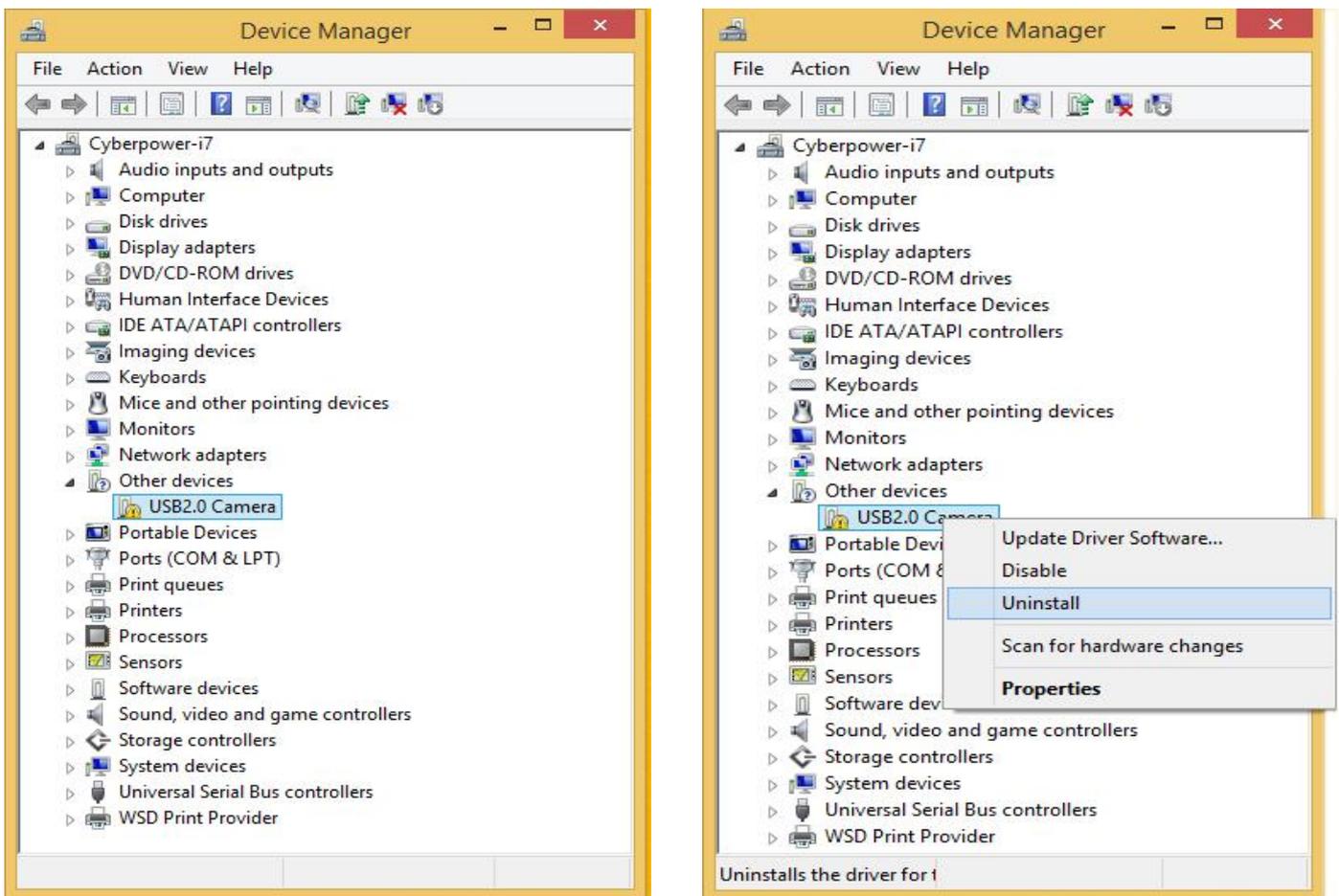
## Re-Installing the Software Drivers

If the camera cannot be identified by Windows, then it is possible that the software drivers have not been installed correctly or they have been corrupted and an exclamation mark will be shown next to the camera entry in **Device Manager**. In such cases, it is best to uninstall the camera. This can be done from the **Device Manager** in Windows. As this point the camera must be connected to the computer.

To access the **Device Manager**, open the Windows **Control Panel**. In Windows 8 or later, this can be done by right-clicking on the Windows **Start** button on the bottom left corner of the screen and on the popup, menu select **Device Manager**. In earlier operating systems click the **Start** button and then select **Settings > Control Panel**.

1. Right-click on the **PX-126** entry.
2. On the pop-up menu and select **Uninstall**.
3. If Windows asks to restart the computer, click yes and continue. When the computer restarts, please re-install the software as normal.

To re-install the software please follow the instructions outlined at the start of this manual.



To uninstall the DirectShow and ASCOM software please refer to pages 11 and 12 respectively. Likewise, to uninstall OpticstarSky follow the same procedure as for the removal of DirectShow and ASCOM software drivers. Right-click on the entry **Opticstar OpticstarSky** and select **Uninstall**.

Once the software has been uninstalled, unplug the camera from the computer and restart the computer. Before proceeding, ensure that the latest Windows service pack has been installed from Microsoft's *Windows Update*. After any such installation, restart the computer once again. Now you are ready to re-install all the software starting with **OpticstarSky** as shown at the beginning of this manual.

## Support

For support regarding the PX-126 please email Opticstar at: [info@opticstar.com](mailto:info@opticstar.com).

## Other Software

There is some freely available third-party software that may be of interest to some users. Please note that Opticstar cannot guarantee the suitability of the software.

- RegiStax: <http://www.astronomie.be/registax/>
- Deep Sky Stacker: <http://deepskystacker.free.fr>

These programs can be used to post-process video files captured in **OpticstarSky** or other image capture software. They can stack, align and enhance video files or multiple images into a single high quality "master" image.

## Microscope Attachments

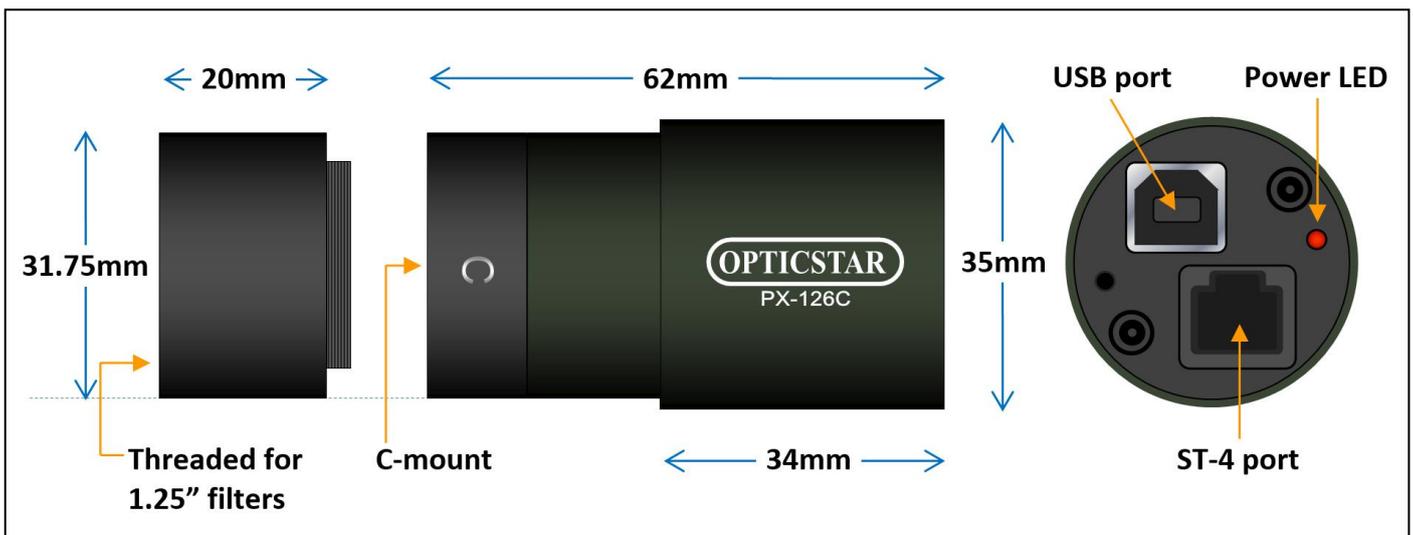
In order to use the camera with a microscope, one or more attachments must be used. The attachments shown from left to right are:

- C/CS to 23mm (x0.5),
- C/CS to 23mm (x1),
- C/CS to 30mm and C/CS to 30.5mm.

These attachments are not bundled with the camera.



## Camera Dimensions



## Camera Specification

Specification	Opticstar PX-126
Image sensor type	1/3" CMOS
Light Sensitivity	5.5v/Lux-sec at 550nm
Sensor model	Aptina AR0130
Pixel size	3.75µm x 3.75µm
Max. Resolution	1280 x 960 pixels
Speed	28fps at 1280x960 30fps at 640x480
Data Readout	Raw at 8-bit per pixel, monochrome; RGB colour 24-bit (PX-126C model only)
Data Output	Video and still images
White Balance	ROI White Balance/ Manual Temp-Tint Adjustment
Gain	In hardware
Auto-Guide Support	ASCOM ST4
Binning modes	1x1
Exposure	Automatic or Manual (0.4ms to 15 seconds)
Image Output	USB 2.0, 480 Mb/s (USB 3.0 compatible)
Power Requirements	DC 5V over PC USB port
Lens Mount	C Mount
Mounting Tube	23.2mm (1.25")
Shutter type	Electronic
Mounting to telescope	C to 1.25" adapter (included)
Mounting to lens	C to T-thread M42x0.75 (not included)
Mounting to microscope	C to 23mm, C to 30mm, C to 30.5mm (not included)
Dimensions	35mm (diameter) x 63mm (length)
Weight	70g
Operation temperature	-10°C to 50°C
Storage Temperature	-20°C to 60°C
Operating Humidity	30 to 80%RH
Storage Humidity	10 to 60%RH
Computer requirements	Microsoft Windows (32-bit or 64-bit) 7/8/10/11, USB 2.0 or USB3.0
Software included	OpticstarSky, Microsoft DirectShow imaging support, ASCOM support for imaging and auto-guiding, TWAIN support



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