

# Instruction Manual

omegon



## ***Omegon® Pro Cameras veLOX, veTEC, GUIDE***

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## ***The Omegon® Pro Cameras veLOX, veTEC, GUIDE***

Congratulations to your new Omegon® Pro Camera. This camera is designed for astrophotography in conjunction with a telescope and GoTo- or tracking mount. It is very different from common cameras you might be familiar with (for example the camera in your smartphone).

### **Differences to traditional cameras:**

#### **No lens**

A common camera usually consists of a lens and a sensor. The lens is necessary to project an image onto the sensor. Astro cameras do not have a lens. Instead, they need to be connected to a telescope. You can think of the telescope as your camera's lens.

#### **Not stand-alone**

Your phone's camera or a DSLR camera can be used without any additional device. They have buttons or a touchscreen to make an exposure and to control all the cameras parameters. They also have some internal memory or card to store all the images. Astro cameras need to be controlled by a separate device (usually by a PC). The software Omegon AstroPhotoCapture was designed to operate your Omegon Pro camera and save your exposures on your computer's hard drive. In addition, the cameras can be controlled by other common astrophotography software.

#### **No snapshots**

Common cameras can show you a finished image usually right after taking it. Capture and processing of the image is done automatically in a blink of an eye by your phone or DSLR camera. Unfortunately, that isn't possible in astrophotography. The capture and processing are two separate steps that both must be done manually by yourself. Depending on your equipment or target, different techniques are necessary to produce a final image. Capturing can take hours or even several nights to complete. Processing your exposures into a final image often takes longer than capturing them. In other words, "snapping" an image is impossible in astrophotography.

### **What your camera is suited for:**

	<b>GUIDE</b>	<b>veLOX</b>	<b>veTEC</b>
<b>Deep Sky</b>	ok	ok	very good
<b>Planetary (incl. Moon, Sun)</b>	ok	very good	very good
<b>Autoguiding</b>	very good	very good	not suited

- The small and compact GUIDE and veLOX cameras are perfectly suited for autoguiding. Their ST4 port offers a convenient way to transfer guiding commands to your mount.
- Planetary astrophotography requires high framerates. It is recommended to use the veLOX or veTEC cameras with their USB3 port.
- Deep-Sky astrophotography works best with large and cooled sensors. The veTEC cameras fit those requirements.

### veLOX & GUIDE - Explaining all the parts:



- 1. CNC Aluminium body:** The light but sturdy body protects the camera from damage.
- 2. 1.25" neck:** The front part of the GUIDE and veLOX cameras has a diameter of 1.25", ideal to fit on most telescopes (just like a 1.25" eyepiece). An additional 1.25" extender is supplied. It can be attached to the CS- or C-mount of the camera. The extender is equipped with a 1.25" filter thread that fits to most astronomical filters.
- 3. CS-mount:** The GUIDE and veLOX cameras are equipped with a CS-mount thread. It can be used to attach accessories, for example small CCTV lenses. The camera is also supplied with a 5mm spacer. This will convert the CS-mount into a C-mount.
- 4. ST4 port:** The GUIDE and veLOX cameras are equipped with an ST4 autoguider port and ST4 cable. This makes it easy to use them as autoguider.
- 5. USB2 or USB3 Port:** Use this port and the supplied USB cable to connect the camera to your computer. It transfers the data to your PC and supplies the camera with electric power at the same time. The veLOX and veTEC camera families are equipped with a USB3 port. If possible, connect it to a USB3 port on your computer (they are usually marked with blue, to distinguish them from regular USB2 ports). High framerates are only possible through a USB3 connection on your PC.
- 6. Sensor plane marking:** This symbol marks the plane of the camera's sensor. This can be helpful for ensuring the correct sensor position in your setup (for example if you need to keep a specific backfocus distance from a corrector).

**Sensor chamber protection window:** A thin window protects your sensor from dirt and dust. The window is coated in anti-reflective layers to prevent internal reflections and flares. In Omegon veTEC cameras, the protection window is crucial for the sensors cooling function: Any moisture from the environment would freeze over the cold sensor, if it wouldn't be protected by the window.

**Protective cover:** All cameras come with a protective cover on the front. It protects the window from scratches and dust during transport or storage of your camera.

### veTEC - Explaining all the parts:



- 1. CNC Aluminium body:** The light but sturdy body protects the camera from damage.
- 2. T2 thread:** The camera can be connected to your equipment by its female M42x0.75 (T2) thread. The backfocus distance from the outer edge of the thread to the sensor is 17.5mm. The camera is also supplied with a 2" nosepiece adapter. It fits on the camera's T2 thread and allows you to insert the camera in your telescope like a 2" eyepiece.
- 3. USB3 Port:** Use this port and the supplied USB cable to connect the camera to your computer. It transfers the data to your PC and supplies the camera with electric power at the same time. The veLOX and veTEC camera families are equipped with a USB3 port. If possible, connect it to a USB3 port on your computer (they are usually marked with blue, to distinguish them from regular USB2 ports). High framerates are only possible through a USB3 connection on your PC.
- 4. 12V DC power input:** While the USB port already supplies the camera with enough power to make exposures, this isn't enough for the thermoelectric cooling. Connect the 12V 3A DC power supply to enable the cooling. We recommend using the power supply that comes with the camera, however you can connect any 12V 3A DC power supply with 5.5x2.1 centre positive plug.
- 5. USB hub:** Instead of connecting all your devices to your computer separately, you can connect some to the USB hub integrated into the veTEC cameras. If the veTEC camera is connected to your PC, all devices will appear as connected to it. The most common example would be to plug a GUIDE series camera into the USB-Hub of the veTEC camera. The GUIDE camera can work as autoguider while the veTEC camera is used as main imaging camera. Note that only USB2 connections are possible through the USB hub. It is also recommended to connect the 12V power supply to the camera, if other devices are drawing power from the USB hub.
- 6. Status lights:** These LEDs show you if the camera is currently connected to a 12V power supply (PWR), connected to a capture program on a PC (SYS), or if cooling is enabled (TEC, FAN).

7. **TEC cooling:** A simple fan wouldn't be able to cool the camera below ambient temperature. Therefore, all veTEC cameras have a powerful thermoelectric cooling element installed. It sits right behind the sensor and can cool down to 40°C below the ambient temperature. While this keeps the sensor very cool and reduces noise, it produces a lot of waste heat (the same way the back of a fridge gets very warm). This heat is conducted to the cooling fins in the middle of the camera body. A small fan constantly blows outside air through the cooling fins, making sure the camera doesn't overheat. Do not cover the ventilation slits on the side and back of the camera during operation, otherwise the airflow is disrupted. In addition to cooling the sensor, the protective window of the sensor chamber is slightly heated. This prevents dew from forming on the outside of the window.
  
8. **Sensor plane marking:** This symbol marks the plane of the camera's sensor. This can be helpful for ensuring the correct sensor position in your setup (for example if you need to keep a specific backfocus distance from a corrector).
  
9. **Desiccant plug:** Over extended periods of time, moisture can creep into your camera's sensor chamber. It can freeze over your cooled sensor and make imaging impossible. You can carefully remove the flathead screw (do not lose it) to expose the sensor chamber and screw in the supplied Desiccant plug. Thanks to a rubber O-ring, the connection will be airtight. The desiccant will absorb moisture and dry the air in the sensor chamber. You can leave it attached even during operation of the camera.

If you have frost appearing inside the sensor chamber while the desiccant plug is attached, then the desiccant needs to be dried out before being effective again. The desiccant is a granular substance inside the desiccant plug. Pull off the head of the plug and empty the desiccant onto a small plate (be careful to not spill any desiccant, do not eat the desiccant). Bake the desiccant for 2 hours in an oven at 90°C (200°F). Refill and seal the desiccant plug.

**Internal DDR3 RAM:** Each veTEC camera is supplied with a generous 4GB internal Buffer memory. This ensures that no frames are lost during high framerate video recordings or when using a USB2 connection.

**Sturdy carrying case:** The veTEC cameras are supplied with a sturdy carrying case. It is recommended to use it for storing and transporting the camera.

**Protective cover:** All cameras come with a protective cover on the front. It protects the window from scratches and dust during transport or storage of your camera.

### **Integrated Filter**

**Color Cameras - UV-IR-cut filter:** In Omegon Pro color cameras, a UV-IR-cut filter removes all ultraviolet and infrared light before it reaches the sensor. This allows for an accurate capture of visible color information. The filter allows transmission from 400 nm to 700 nm, so the important H-alpha wavelength at 656 nm isn't blocked.

**Mono Cameras - no filter:** In Omegon Pro mono cameras, the ultraviolet, visible and infrared light is transmitted. This makes the mono cameras sensitive to a wide range of wavelengths. If you are only interested in a specific range of wavelengths, you need to obtain a suitable filter. We strongly recommend using a UV-IR-cut filter for refractor telescopes. Many narrowband and nebula filters are also transparent to infrared light. Make sure to either use narrowband filters that are marked as "CCD", or use an additional IR-cut filter.

## Included Software

All software and drivers can be found on the supplied CD-ROM or USB drive. We recommend downloading the newest versions from the camera's product page on the [www.omegon.eu](http://www.omegon.eu) website.

The following software is included:

- **Omegon AstroPhotoCapture:** This capture software provides a basic interface to control the astro camera for capturing images and videos.
- **ASCOM Camera Driver, ASCOM ST4 Driver:** Use the Omegon Pro Camera with popular astrophotography software (for example SharpCap) using the ASCOM platform on Windows. The ASCOM camera control is suited for deep-sky astrophotography.
- **DirectShow Driver:** Use the Omegon Pro Camera with popular astrophotography software (for example SharpCap) using the DirectShow drivers on Windows. The DirectShow interface is suited for solar-system astrophotography
- **Omegon Pro SDK:** The Software Development Kit (SDK) gives all the tools and documentation to developers to make their applications compatible with Omegon Pro cameras.

## Installing Omegon AstroPhotoCapture & connecting Camera

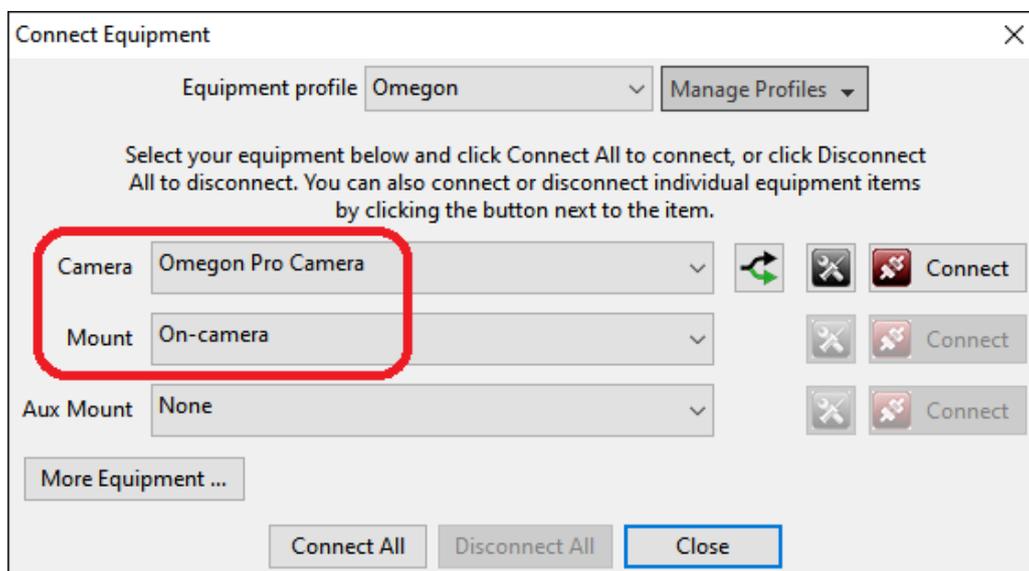
1. Install the application **AstroPhotoCapture** by running **AstroPhotoCapture.exe**.
2. Start the application **AstroPhotoCapture** and connect your camera to the PC via the supplied USB cable. On the right part of the screen you can find a drop-down list. All connected Omegon Pro cameras will appear in this list. Click on one camera model to activate it.



### Connecting to PHD2 for autoguiding (optional)

The Omegon Pro GUIDE and veLOX cameras are equipped with an ST4 Port and are ideal to use as an autoguider. For autoguiding, we recommend the free and open source application **PHD2 (Open PHD Guiding)**.

1. Download and install the latest stable version of PHD2 from: [www.openphdguiding.org](http://www.openphdguiding.org). The latest developmental version is available at [www.openphdguiding.org/development-snapshots/](http://www.openphdguiding.org/development-snapshots/)
2. Connect the camera to your PC via the included USB cable. Connect the camera to the autoguiding port of your mount via the included ST4 cable.
3. In the **Connect Equipment** menu, select **Omegon Pro Camera** in the corresponding drop-down list.
4. When choosing the connection to your mount, select **On-camera** to use the ST4 autoguiding port. Note: If you have a direct connection from your mount to your PC (for example via RS232 or USB cable), we recommend installing your mount specific ASCOM drivers and selecting those, instead of the **On-camera** option.



5. Detailed instructions on how to use PHD2 can be found on [www.openphdguiding.org](http://www.openphdguiding.org).

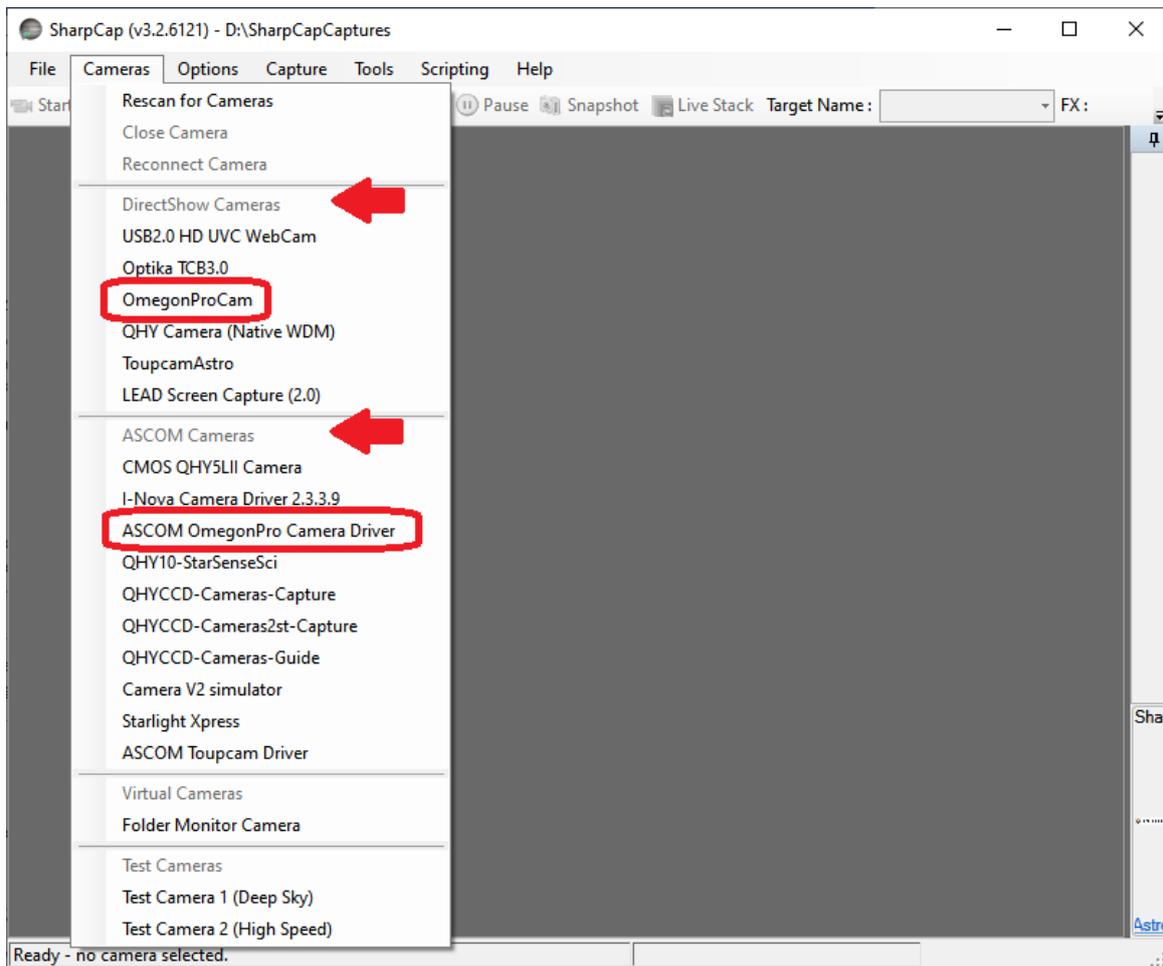
### Installing ASCOM & DShow drivers, e.g. for use with SharpCap (optional)

Most astronomy software uses the free ASCOM platform as a standard to connect and control different hardware, such as telescope mounts, cameras, filter wheels, etc. Even if there is no native compatibility between the astronomy software of your choice and your Omegon Pro camera, it can be connected through ASCOM. The ASCOM platform is only available for the Windows operating system.

1. Download and install the newest version of the **ASCOM platform** from: [www.ascom-standards.org](http://www.ascom-standards.org)
2. Install the Omegon Pro ASCOM drivers by running **ASCOMCameraDriver.exe**. If your camera has an ST4 autoguiding port, install **ASCOMToupST4Setup.exe**.
3. You can now control the camera by choosing **ASCOM Omegon ProCamera Driver** in the camera select menu of your astrophotography software (for example SharpCap). You can control the ST4 port for autoguiding by choosing **OmegonST4 (ASCOM)** in the corresponding select menu of your astrophotography software.

Imaging through the ASCOM Platform is only recommended for **deep-sky astrophotography**. High framerates (recommended for **solar-system astrophotography**) are usually not possible via ASCOM. Windows DirectShow driver allow high framerate video capture when using the Omegon Pro cameras with third party software (e.g SharpCap). As a downside, the DirectShow interface doesn't allow full control of all camera parameters.

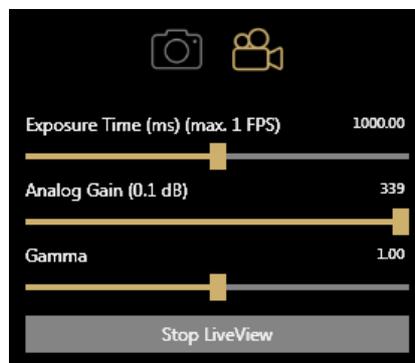
1. Install the Omegon Pro DirectShow drivers by running **DShowCameraDriver.exe**.
2. You can now control the camera by choosing **OmegonProCam** in the **DirectShow** camera select menu of your astrophotography software (e.g. SharpCap).



## Finding focus

If this is your first astrophotography camera, it can be a challenge to find the correct focus.

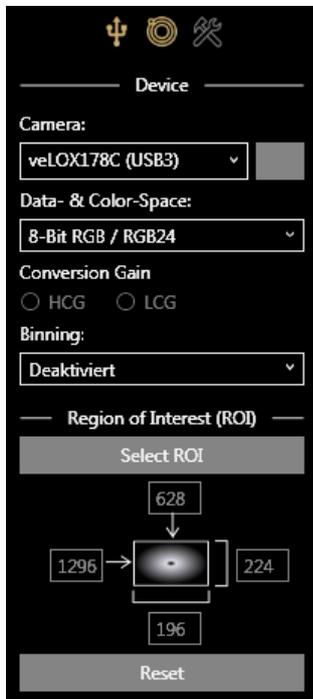
1. Point your Telescope to a bright star. Use an eyepiece and make sure that the star is centred in your field of view. If you are using a GoTo or tracking mount, make sure that everything is set up correctly and the star is not moving out of your field of view.
2. Remove the front cover of the camera and insert it into the telescope in place of the eyepiece. Connect the camera to your PC via the supplied USB cable.
3. Start the application **AstroPhotoCapture**. On the right part of the screen you can find a drop-down list. Click on one camera name to activate it.
4. Select **Video Mode** and choose an **Exposure Time** of approximately 1 second (ca. **1000 ms**). Select the highest possible **Gain**. Start the live view (if it isn't already started).



5. If you are completely out of focus, there might not be anything visible on the live view yet. Slowly turn your focus adjustment knob of the telescope. Consider that the image in the live view currently is refreshed only about once per second. If you get closer to the correct focus, you will notice the stars as large discs of light. Turn the focus knob slowly to shrink those discs in size.
6. Touching the focus knob of your telescope will likely introduce vibrations to your image. Let go of the focus knob after each slow adjustment and wait for the vibrations to stop. This makes it easier to judge how close you are to the correct focus.
7. Once you are close to the correct focus, decrease the **Exposure Time**. This will increase the frame rate of the live view and allow you to reach a finer focus. Don't decrease the exposure time too much, otherwise the stars might become invisible.
8. Use the scroll wheel of your mouse to zoom onto a star. The optimal focus is reached where the stars appear the smallest. Due to the diffraction limit of the telescope and movement of the atmosphere (seeing), the stars will never appear as perfect points of light.
9. All objects in the night sky share the same focal plane. After setting the correct focus, you can change the exposure settings or move the telescope to a different target without having to refocus.

## Recording a Video – Solar-System Astrophotography

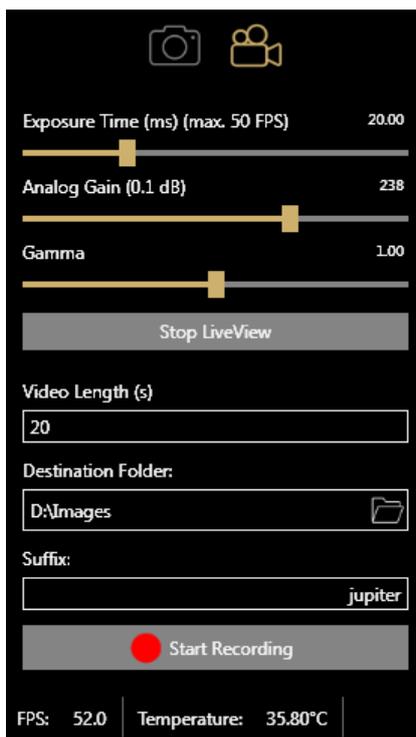
Taking high quality images of planets, the sun or the moon often requires the use of lucky imaging techniques. A video recording of the object with a high framerate is needed for that. In each frame of this video, the random seeing will be frozen in time. By selecting the few lucky frames with minimal seeing and stacking them, a sharp and clear image of the object can be created. This quick guide assumes planetary photography, but imaging the sun or moon works similar. (Use an appropriate solar filter for imaging the sun, otherwise your camera and/or telescope will be damaged.)



Note: Omegon AstroPhotoCapture is just the capture program to operate the camera and save the individual frames on your PC. Processing the exposures into a presentable picture requires additional software.

1. A high frame rate is important! If you have a veLOX or veTEC camera, make sure that it is connected to a USB 3 port on your PC (usually marked by the color blue)!
2. Set the cameras Data-&Colorspace to 8-bit RGB.
3. Focus and center the planet in the cameras field of view.
4. Use **Video Mode** and a short **Exposure Time** of ca. 10-30ms. Adjust the **Gain** so that the planet doesn't appear too dim but also not overexposed (white).
5. Use the option **Region of Interest (ROI)** on the right side to specify a smaller **Region of Interest** and it set it around the Planet. This vastly improves the frame rate (shown on the bottom of the screen) by cutting away the uninteresting regions in the image.

Note that the maximum frame rate is limited by the selected **Exposure Time**: At 30ms you can't have a frame rate of more than 33FPS (Frames Per Second). At 10ms a frame rate of more than 100FPS is impossible. The frame rate is also limited by the camera model, the type of connection (USB 2 or USB 3) and your PC.



6. Specify a desired length of the video. It is recommended to collect at least 1000 frames of your target. So if you have a frame rate of (e.g.) 50 fps, set a video length of 20 seconds to capture about 1000 frames.
7. Specify the folder where the finished video will be saved by the software. Choose a suffix to help identifying the video later. The name of the video file will contain the current date and time (in UT) and your suffix.
8. Now start taking your video by clicking the big **Start Recording** button on the left side.
9. After capturing your frames, you need to continue with processing to transform the video into a single sharp image of a planet. We recommend the free programs **RegiStax** or **AutoStakkert!** For this step.

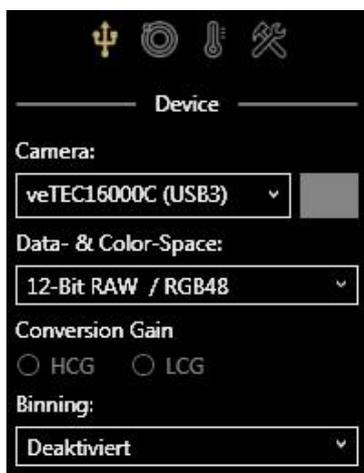
Note: The captured video file might appear to have a different length than specified when captured. Many video players show a video at a set rate of 25 fps. If you recorded 20 seconds of video at 50 fps, the resulting video can appear to have a duration of 40 seconds. If you recorded at a very low framerate, the video file can appear to be very short. Don't worry: All your captured frames are included in the video file for later processing.

## Taking long exposures – Deep Sky Photography

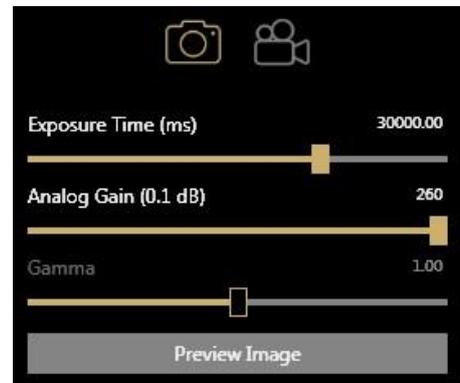
Astrophotography of faint deep sky objects like nebulae or galaxies requires long exposures. Usually, those exposures are then being stacked into one final image with lower noise. The biggest obstacle for this kind of photography is your mount: Unsteady tracking or poor alignment will limit your exposure time and stars will appear as streaks instead of points.

Note: Omegon AstroPhotoCapture is just the capture program to operate the camera and save the individual frames on your PC. Processing the exposures into a presentable picture requires additional software.

1. If you have a veLOX or veTEC camera, make sure that it is connected to a USB 3 port on your PC (usually marked by the color blue)!
2. Focus and center the object you want to capture in the cameras field of view. Often, it is impossible to see the object itself. Instead, the visible stars must be used for orientation. Setting the Gain to its maximum value and exposure time to ca. 5 seconds allows you to see fainter objects, while still providing an almost live image. Searching the object with an eyepiece before connecting the camera can also be helpful.

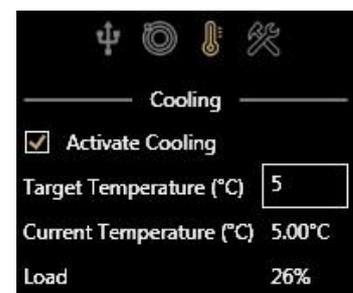


3. Set the cameras Data- & Colorspace to 12-, 14, or 16-bit RAW.
4. Use **Photo Mode** and an **Exposure Time** of ca. 30 seconds (30.000 ms) at highest Gain. Create a preview image. Most Deep-Space objects should now be vaguely visible if they are in the field of view. If the image is overexposed (white), reduce the value for **Gain** and try again. Incrementally adjust the telescope and make test exposures until the DSO is located in the center of the cameras field of view.

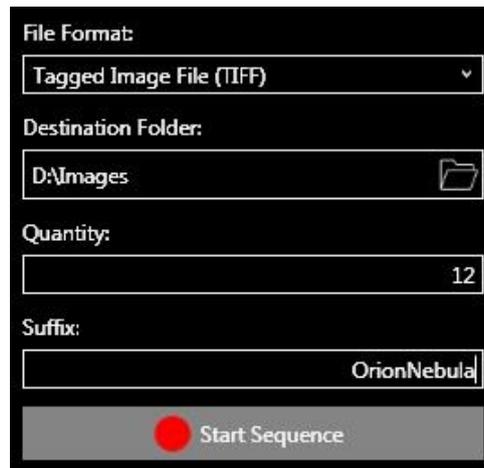


Note: Even if you use a color camera, the RAW image will appear in grayscale. The color information will only become visible after the so called debayering during processing. If you prefer to automatically debayer your exposures during capture, select the RGB color-space instead of RAW. Your images will then be displayed and saved in in color.

5. Find the maximum exposure time for your setup. Since the tracking of the telescope is not perfect, there is a maximum possible **Exposure Time** before tracking errors make your stars look like lines or instead of dots. Make preview exposures with increasing exposure times to find your optimal setting. If your stars don't appear as dots, reduce the exposure time.
6. Adjust Gain to prevent overexposure. Set the Gain slider to some value approximately in the lower third of its range. This will give the image a darker appearance (after making another test exposure). It is recommended to choose a value for gain, so that stars are not overexposed: Stars shouldn't appear as completely white dots.
7. The veTEC cameras can be cooled to reduce noise. Select the cooling tab to turn it on. Specify a desired temperature. There is already a significant reduction in noise at temperatures of approximately 5°C. The current sensor temperature is shown in the lower right corner of the screen. Wait for a few minutes until it stabilized around your target temperature.



8. To actually start a series of exposures, enter the number of desired images in the Quantity field. We recommend taking as many pictures as possible. For Deep-Sky astrophotography, we recommend the file format TIFF. The images will be saved without compression in their full bit-depth.
9. Choose a destination folder. All the images of the sequence will be saved there. Click the Start Sequence button to begin your exposures.
10. The more images you take and subsequently combine (stack), the lower will be the noise in the resulting image. For stacking the images, we recommend the free program **DeepSkyStacker**.



The image shows a software interface with a dark background. It contains several input fields and a button. At the top, the label 'File Format:' is followed by a dropdown menu showing 'Tagged Image File (TIFF)'. Below that, the label 'Destination Folder:' is followed by a text box containing 'D:\Images' and a folder icon. The label 'Quantity:' is followed by a text box containing '12'. The label 'Suffix:' is followed by a text box containing 'OrionNebula'. At the bottom, there is a large grey button with a red circle icon and the text 'Start Sequence'.