Instruction Manual

Omegon® Pro Cameras
veTEC, veLOX, GUIDE

English Version 12.2024 Rev. C Art.-Nr. 61033, 61034, 61035, 61036, 61037, 61038, 61039, 61040, 61041, 61042, 61043, 61044, 61045, 63068, 63069, 63070, 67319, 67320, 67338, 68722,68723, 69424, 79827, 80354, 80355, 80356, 80357, 82022, 83445, 83739, 84990, 85085

The Omegon® Pro Cameras veTEC, veLOX, 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 camera's 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 running special astro photography software, see section 1.4. Included 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. In astrophotography, that is different so that one can gain better results. The capture and processing are two separate steps that both are 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. That being said, the capturing and processing can be streamlined and modern software often offers so-called "live stacking" features.*

1. What your camera is suited for

Application	GUIDE	veLOX	veTEC
Deep Sky	🆗	🆗	👍
Planetary (incl. Moon, Sun)	🆗	👍	👍
Autoguiding	👍	👍	❌

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.

1.1. In the box

Apart from the camera body, these items are delivered:

GUIDE and veLOX cameras

1. USB cable
2. ST-4 cable
3. Extender with 17.5mm flange focal distance
4. C-Mount - M28.5 adapter (for 1.25" filters)

veTEC cameras

1. USB cable
2. Power supply
3. Nosepiece(s) for 2” connection
4. Carrying case

ℹ️ A desiccant plug was included before 2024. Newer cameras don’t need it. We strongly recommend contacting us before using the desiccant plug, even if it should be included with your camera. Please **do not open the respective screw** without talking back to Omegon support!

💡 If you encounter issues with humidity inside the camera, please contact us via 📧 service@omegon.eu before trying to solve the problem yourself. We are happy to advise.

1.2. Explaining the parts

<u>veLOX & GUIDE</u>

1. CNC Aluminium body: The light but sturdy body protects the camera from damage.

2. 1.25” nosepiece: 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 (3). The extender is equipped with

<u>veTEC</u>

Images are slightly different for full-frame cameras

1. CNC Aluminium body

2. Connection thread: The camera can be connected to your equipment by its inner (female) thread. The backfocus distance from the outer edge of the thread to the sensor is 17.5mm. A different flange is available as part #83140, offering an outer (male) thread and reducing the flange distance to 12.5mm. The camera is also supplied with a 2” nosepiece adapter. It fits on the camera’s thread and allows you to insert the camera in your telescope like a 2” eyepiece. Newer models come with adapters

a 1.25” filter thread that fits 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 (spare part #60655). This will convert the CS-mount into a C-mount.

Part 3 contains the protective window. On color cameras, it works as an IR filter and blocks infrared light, so that the camera is sensitive for a natural color balance. On monochrome cameras, the window only works as an anti-reflection (AR) filter. That part can be unscrewed. Please only do that if you have a reason to change the protective window, for example if you want your color camera to become sensitive to IR light. Two spare parts are available:
#66044: AR window front piece
#66046: IR cut window front piece

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 (see below).

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 frame rates are only possible through a USB3 connection on your PC.

which give a back focus distance of 55mm.

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. 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 frame rates are only possible through a USB3 connection on your PC.

4. 12V DC power input: 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 a 5.5x2.1 center 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 an autoguider while the veTEC camera is used as the main imaging camera. Note that only USB2 connections are possible through 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 30-40°C[1] 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.

1.3. Other Properties

1.3.1. 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 sensor's cooling function: Any moisture from the environment would freeze over the cold sensor, if it wouldn’t be protected by the window.

[1] For the exact cooling range, look up the technical specifications in our product description online.

⚠️ **Please do not open the sensor chamber!** It is carefully sealed in the factory and prevents moisture from entering into the camera body. If you have issues with your camera and suspect a leakage, please first contact your dealer for an after-sales service. Repairs have to be performed by a specialist workshop.

1.3.2. 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.

1.3.3. Integrated Filter:

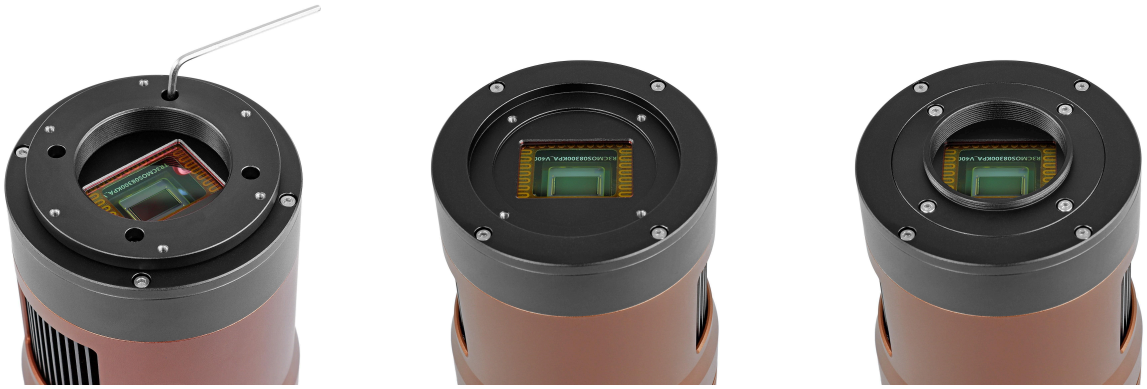
Color Cameras - UV-IR-cut filter: In Omegon Pro color cameras, a UV-IR-cut filter removes all ultraviolet and infrared light before it reaches the sensor. This allows for an accurate capture of visible color information. The filter transmits light from 400 nm to 700 nm, so the important H-alpha wavelength at 656 nm can pass.

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.

1.3. Changing veTEC connecting flange

Newer body versions of veTEC cameras allow to convert the original flange with inner thread by an outer thread. This is particularly useful if you want to connect your camera to a filter wheel and save some millimeters of optical path.

⚠️ Please be very careful not to scratch the protective window!



1.4. Included Software

All software and drivers can be found for download on the camera’s product page on the 🔗 www.omegon.eu website. The following software is available:

- ToupTek ToupSky: 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 your Omegon Pro Camera with popular astrophotography software (for example SharpCap) via 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.

2. Usage examples

We hope on your understanding that we can not explain how to use third-party software here. There are many different programs available for different platforms and purposes. If you are unsure which to use, we recommend you ask our customer support for advice. As the program ToupSky supports all Omegon cameras natively and is relatively user-friendly, the following examples refer to ToupSky.

⚠️ Keep in mind that you need to install a driver if your software does not support the camera natively.

Linux software can work with indi_omegonprocam_ccd / indi_toupcam_ccd on INDI or you can try INDIGO.

Apple Mac users please refer to https://www.macobservatory.com/mac-astronomy-software

💡 Note: In Astroshop's magazine section, you find a variety of tips and tricks about astrophotography. Refer to https://www.astroshop.eu/magazine

2.1. 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 centered 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 (e.g. ToupSky). On the left part of the screen you can find a camera 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 is currently 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. 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.

2.2. Connecting to PHD2 for autoguiding (optional)

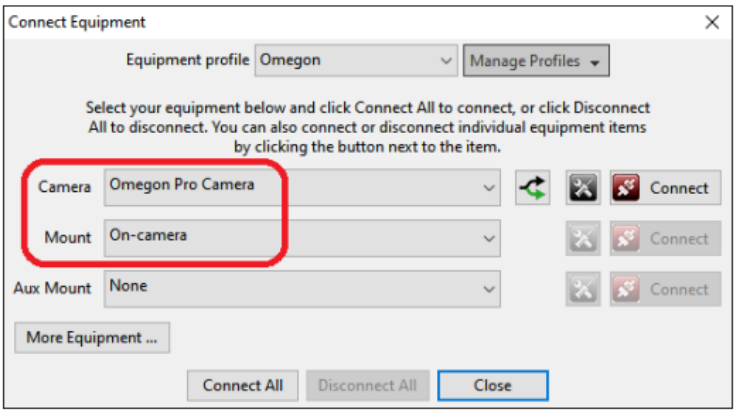
The Omegon Pro GUIDE and veLOX cameras are equipped with an ST4 Port and are ideal to use as an autoguider. For autoguiding, we recommend the free and open source application PHD2 (Open PHD Guiding).

1. Download and install the latest stable version of PHD2 from: www.openphdguiding.org . The latest developmental version is available at 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, unless you control your mount directly (see 4).
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.



2.3. 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 frame rate 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 similarly. (Use an appropriate solar filter for imaging the sun, otherwise your camera and/or telescope will be damaged.)

💡Note: ToupTek ToupSky is just the capture program to operate the camera and save the individual frames on your PC. Its processing abilities are very limited. Stacking 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 bit-depth to 8 bit.
3. Focus and center the planet in the camera's 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 left side to specify a smaller Region of Interest and 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 33 FPS (Frames Per Second). At 10ms a frame rate of more than 100 FPS 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. For example, you may want to capture 1000 frames of your target. 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 identify the video later.
8. Now start taking your video!
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.

2.4. 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 telescope mount: Unsteady tracking or poor alignment will limit your exposure time and stars will appear as streaks instead of points.

💡 Note: ToupTek ToupSky is just the capture program to operate the camera and save the individual frames on your PC. Its processing abilities are very limited. Stacking 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 camera's 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 Bit-Depth to 12-, 14, or 16-bit and RAW.
4. Use Photo Mode and an Exposure Time of ca. 30 seconds 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 camera's field of view.

   💡 Note: Even if you use a color camera, the RAW image can appear in grayscale. The color information will only become visible after the so-called debayering during later processing.
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 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 stabilizes 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 FITS. 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. For more sophisticated needs you can try out the open-source software Siril.

💡 Hint: To get best results, you should not only take exposures of the object itself (so-called “light” frames”), but you should also capture additional exposures for calibration purposes. These include “flat” frames with uniform illumination (to reduce shadows and vignetting caused by the optics), “dark” frames with covered telescope or camera (to reduce thermal noise) and “bias” frames with shortest possible exposure time (to reduce electronic read-out noise). To learn more about that, we recommend using literature.

3. Security and longevity

3.1. General safety instructions

Please keep this guide safe so you can refer to it. Pass it on to subsequent owners.

This device is not intended to be used by persons (including children) with reduced physical, sensory or mental capabilities or who lack experience and/or knowledge, unless they are supervised or given instructions by a person responsible for their safety, how to use the device.

The device is not a toy for children. Therefore, keep children away from it. Children must be supervised so that they do not play with the camera.

Converting or changing the device impairs product safety.

Changes and repairs to the device may only be carried out by the manufacturer or by persons expressly authorized by the manufacturer.

Never open the device yourself. Don't do any repairs yourself!

Handle the device carefully. It can be damaged by shocks, blows or falls from even a small height.

Keep the device away from moisture and extreme heat.

Never immerse the device in water or other liquids.

Do not touch the device with wet or damp hands.

Check the device for damage before using it for the first time. Do not use it if there is visible damage.

Never use the device after a malfunction, e.g. if it has been dropped into water, dropped or otherwise damaged

3.2. Disposal instructions

Cameras must not be disposed of in household waste. You can hand in your camera at public collection points in your community.

Electrical devices contain valuable resources, but also pollutants. The collection points give them to certified waste disposal companies who check whether the devices can be reused. Ideally, old devices can be refurbished. If not, pollutants are removed from the devices and valuable resources are recycled if necessary. This protects the environment.

Note on waste avoidance

According to Directive 2008/98/EC on waste and the legislation of the Member States of the European Union, waste prevention measures generally have priority over waste management measures. In order to avoid waste, the main aim of electrical and electronic devices is to extend their service life by repairing defective devices and selling functional used devices instead of disposing of them. The federal waste prevention program contains further information.