PegasusAstro

Powered by SkySafari

SmartEye

Product Manual

Version 1.2

Version History

Version #	Implemented By	Revision Date	Reason
1.1	PegasusAstro	06/May/2025	Initial Document
1.2	PegasusAstro	20/Jun/2025	Corrections and clarifications, addition of how to update firmware via SD-Card.

Introduction

Thank you for choosing SmartEye, the world’s first smart eyepiece—designed by Pegasus Astro to elevate your stargazing experience by blending classic observation with cutting-edge technology.

Powered by the award-winning SkySafari app and featuring the Sony IMX533 color CMOS sensor, SmartEye delivers sharp, vivid images even in low light. The live view is projected onto a 2560×2560 OLEDoS display with a wide 90° field of view, offering a truly immersive visual experience.

Built-in thermoelectric cooling minimizes sensor noise, while real-time auto-stacking and enhancement bring out faint deep-sky objects, even under urban skies. SmartEye also functions as a capable astro-camera, capturing raw FITS files for post-processing.

Fully integrated with SkySafari, you can identify objects, control your telescope, and share what you see, all from one device.

Whether you’re just starting out or you’re a seasoned observer, SmartEye redefines visual astronomy, without losing the magic of the eyepiece.

Aim of this document

The purpose of this document is to support the user in the operation of the SmartEye.. Please read this manual carefully before using the SmartEye device.
Any equipment damage or injury caused by improper device operation is the end user's responsibility.
Pegasus Astro has developed this instruction manual to inform all users about the product and the correct methods of interaction with the device and guarantee optimum safety conditions during its entire life cycle: transport, storage, installation, usage, and maintenance.

Warranty Period

The product guarantees quality for two years from the date of purchase. If defects are found in the product, please contact us to examine the issue and we will either repair it or replace the product/part with a new one. Damage caused by consumer responsibility, normal wear and tear, and minor defects that do not interfere with use are not covered by warranty or replacement, even within the warranty period.

Pegasus Astro will not be liable for any problems caused by the installation of parts purchased or manufactured separately by the customer. For hardware warranty issues, please contact via email: support@pegasusastro.com

Product Overview

Key Features:

- **Sony IMX533 Color CMOS Sensor**
  High-resolution sensor optimized for astrophotography with exceptional low-light performance.

- **Ultra-High Definition OLED Display**
  2560×2560 resolution with a wide 90° field of view, delivering a fully immersive visual experience.

- **Integrated SkySafari App Compatibility**
  Connects seamlessly with SkySafari Pro for real-time plate solving, SmartEye camera sequence control, and full telescope operation through an interactive planetarium map.

- **Real-Time Image Stacking & Enhancement**
  Live stacking and noise reduction reveal faint deep-sky objects, even under light-polluted skies.

- **Thermoelectric Cooling (TEC)**
  An actively cooled sensor reduces thermal noise, resulting in clearer images.

- **Dual Functionality: Viewer & Astro-Camera**
  Functions as both a digital eyepiece and a high-performance camera for saving RAW FITS images to microSD Card.

- **Built-In microSD Card Slot**
  Stores image and calibration files directly to a removable microSD card, supporting astronomical RAW FITS format.

- **Wi-Fi Connectivity**
  Enables wireless control (selective Dual Band 2.4GHz or 5 GHz), firmware updates, easy image sharing and device control.

- **Intuitive User Interface**
  Designed for ease of use, whether you're a beginner or an experienced astronomer.

- **Onboard Power Management**
  Efficient power usage with cooling control, ensuring stable operation during long observation sessions.

Packaging

SmartEye comes securely packaged inside a protective hard-shell carry case. All components are carefully arranged and cushioned within the case to ensure safe transport. Upon receiving your new SmartEye device, please inspect the contents immediately and verify that no parts have been damaged during shipment.

What's in the Box

- **Protective Hard Case** - A rugged and reliable case designed to safeguard your SmartEye and included accessories.
- **The SmartEye** - Equipped with protective caps on both ends to ensure safety during transport and storage.
- **USB-C to USB-C Power Cable (1.0m)** - A high-quality, durable cable for powering your SmartEye device with compatible power sources.
- **Power Adapter** for 12V DC to 5V (USB-C) conversion.
- **2" Nose Piece** - Features an M54 male with an M48 female thread for attaching filters.

Hardware Overview

Display Screen

SmartEye features an Ultra HD display with a 90° field of view and 12mm eye relief for sharp, comfortable viewing—even with glasses. The screen sleeps after 20 minutes of inactivity to prevent OLED wear and wakes with a button press, making it efficient for extended use under the night sky.

Astro-Crown Button

SmartEye's "Astro-Crown" is a physical rotary button that allows easy menu navigation and setting adjustments with turn-and-press actions. It offers tactile, glove-friendly control ideal for field use without interrupting your view.

Diopter Adjustment Ring

SmartEye includes a diopter ring around the eyepiece for fine-tuning the display focus to your eyesight, with an adjustment range of +1 to -5 diopters. A calibration screen on startup helps set it once, and it usually remains fixed unless another user makes changes, ensuring clear and comfortable viewing.

USB-C Port

SmartEye includes a USB-C port on the front for power input (5V/3A) and firmware updates (port allows USB2 signalling). Use the supplied cable for both powering the device and performing software upgrades when needed - lookup to "Upgrading SmartEye" section of this manual.

ST4 Guiding Port

Located on the side of the device, the ST4 port allows SmartEye to interface directly with your telescope mount. This port enables the device to send guiding correction signals for accurate tracking, particularly beneficial during long-exposure astrophotography sessions. It is also helpful for mounts that lack built-in autoguiding capabilities, offering users the flexibility to improve tracking accuracy without additional guiding equipment.

Note: ST4 functionality is currently not fully supported by the SmartEye software. Full integration is planned for a future software update, which will enhance compatibility with autoguiding methods.

Red LED Indicator

SmartEye features a red LED indicator that lights up when the device is powered on, providing clear visual confirmation of operation even in low-light conditions.

MicroSD Card Slot

Device features a MicroSD card slot for storing FITS images and calibration files, allowing users to easily collect and transfer their imaging data. This enables convenient access to raw FIT images files and dark calibration frames for further processing on a computer.

The device supports MicroSD cards up to 2TB in capacity, providing ample space for extended observation sessions. Please note that the MicroSD card must be inserted in a reverse orientation (label side facing down), which is intentional due to the device's compact design. For optimal performance, we recommend using high-quality UHS-I or UHS-II MicroSD cards to ensure fast and reliable file writing during operation.

📌 **Please Note:** The SmartEye operates without the need for an SD card. However, inserting one is necessary to enable storage and retrieval of FIT raw files and PNG stacked files.

Wi-Fi Antenna

SmartEye features a removable external dual-band Wi-Fi antenna, providing fast and reliable wireless performance on 2.4 GHz or 5 GHz networks. This ensures stable connections for remote control, image shares, firmware updates, and planetarium software. The SMA connector enables the antenna to be replaced with a higher-gain option if extended range is required, offering flexibility tailored to your observing environment.

Thermoelectric Cooling (TEC) System

SmartEye is equipped with a Thermoelectric Cooling (TEC) system designed to significantly reduce sensor noise and enhance image quality during long exposures. The TEC can cool the image sensor to as much as 30°C below ambient temperature, enabling cleaner, sharper images with reduced thermal noise. To support this cooling process, SmartEye features an integrated active cooling fan that efficiently pushes warm air away from the device, maintaining optimal thermal conditions both for the TEC module and the internal electronics. This dual cooling approach ensures consistent performance and longevity, even during extended imaging sessions or in warmer environments.

Eyepiece Barrel (2-Inch)

SmartEye features a 2-inch eyepiece barrel, compatible with standard 2-inch focusers, offering a wider field of view and better light gathering. Features an M54 male with an M48 female thread for attaching 2-inch filters, such as UV/IR cut, light pollution, or narrowband filters. For smaller telescopes, a 1.25-inch converter can be used for compatibility with 1.25-inch focusers.

Diagonal Usage

For comfortable viewing, a diagonal is recommended when using SmartEye with refractors, most reflectors, and Schmidt-Cassegrain (SCT) telescopes, as it provides a more ergonomic observation angle. However, Newtonian (including Dobsonian) telescopes do not require a diagonal, and SmartEye can be attached directly to the focuser.

While diagonals add convenience, it’s important to use a high-quality diagonal, as additional optical surfaces can slightly degrade image quality. For the best imaging performance, especially during astrophotography sessions, we recommend connecting SmartEye directly to the telescope’s focuser to maintain the sharpest image possible.

Filter Recommendation

To achieve optimal image quality with SmartEye, a **2-inch UV/IR cut filter is highly recommended**. This filter helps eliminate unwanted ultraviolet and infrared light that can reduce image sharpness, especially when using refractors.

Depending on your observing site and the level of ambient light pollution, you may also benefit from using light pollution filters to enhance contrast and reveal fainter celestial objects. For more advanced imaging, narrowband filters such as H-alpha (Ha) can be used to isolate specific wavelengths, particularly useful for capturing emission nebulae.

However, please note that narrowband imaging requires significantly longer exposures and is most effective when used with fast optical systems (low f-ratio telescopes).

Hardware Prerequisites

SmartEye requires installation on a motorized equatorial or altazimuth mount that supports sidereal tracking. While high-precision tracking is not required, basic sidereal movement is essential to ensure continuous object tracking during visual observation or astrophotography.

Although both mount types can work with SmartEye, an equatorial mount offers significantly better tracking performance, especially for long-duration imaging or precise object alignment. This is because:

- ➔ Equatorial mounts track using a single axis (Right Ascension), naturally matching the Earth's rotation. This minimizes tracking errors and eliminates field rotation during long exposures.
- ➔ Altazimuth mounts, on the other hand, require simultaneous movement on two axes (azimuth and altitude) and can introduce field rotation, which must be corrected either through SmartEye software or an additional derotator.

For best results, particularly in applications involving plate solving, GoTo accuracy, or astrophotography, an equatorial mount is strongly recommended.

Thanks to SmartEye's integrated image stacking and alignment algorithms, minor tracking inaccuracies, periodic errors, or lack of autoguiding are automatically corrected during live image processing. Additionally, when used on altazimuth mounts, SmartEye automatically performs field derotation, eliminating the need for external hardware or software correction.

For best results, we recommend using short exposures of 5 to 10 seconds. This allows SmartEye to quickly accumulate and enhance your image while minimizing the impact of any residual tracking errors, ensuring a smooth and efficient observing experience.

Tip: Some telescope mounts may not track objects accurately. Before using SmartEye, it's a good idea to insert a standard optical eyepiece (at around 11mm) and confirm that your mount can keep a target object within the field of view for at least 5 minutes. This helps ensure smooth tracking and reliable image capture.

Telescope Recommendations

SmartEye is compatible by default with all telescopes featuring a 2-inch focuser. The device includes a detachable 2-inch barrel, which can be replaced with an optional 1.25-inch barrel for use with smaller focusers. Alternatively, 1.25” to 2” eyepiece adapters, widely available on the market, can also be used for compatibility with 1.25” focusers.

For optimal imaging performance, we recommend using telescopes with a focal ratio of f/7 or lower. Faster systems collect more light in shorter exposures, allowing SmartEye’s real-time stacking engine to produce clean, detailed images more efficiently. If you’re using a longer focal length telescope, such as a Schmidt-Cassegrain (SCT), a focal reducer can help bring the system to a more suitable f-ratio. In such cases, a low-profile (we are working on that) diagonal may be required to maintain adequate backfocus.

While SmartEye can still deliver good results with slower optical systems (higher f-ratios), faster telescopes are generally preferred for achieving quicker, high-quality results.

You’ll be amazed by what SmartEye can reveal through even a compact 4-inch refractor. Its advanced imaging capabilities make it the perfect companion for travel telescopes, unveiling colorful deep-sky targets that would remain invisible to the naked eye, even when viewed through a 20-inch telescope.

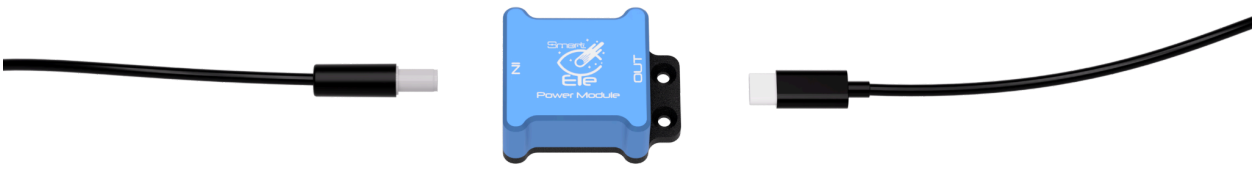
Power Requirements

SmartEye is a high-power device, as it features a quad-core CPU capable of performing real-time image stacking, alignment, and other essential image processing tasks. Additionally, the thermoelectric cooling system required to maintain clear images also demands a significant amount of power. To ensure optimal performance, SmartEye requires a stable power supply of 5V with a current draw of 3A, with occasional spikes that may exceed 3A during peak usage.

For reliable power delivery, we strongly recommend connecting the device using the provided USB-C to USB-C cable, which ensures a stable and sufficient power supply. Additionally, for convenience, we include a 12V to 5V (up to 6A) power adapter that provides the necessary power to keep the device running smoothly. This adapter is especially useful when operating in the field, as it allows you to convert power from a 12V battery (via a 2.1mm DC barrel connector) to 5V (USB-C connector), ensuring you can use SmartEye with ease during extended observation sessions.

12V DC Battery or Power Adapter

to SmartEye device (USB-C to USB-C)



SmartEye and NYX88 Harmonic mount.

The SmartEye power module can be mounted directly onto the Pegasus Astro NYX-88 Harmonic mount, which includes a dedicated attachment point for this purpose.

To power this module, use the PEG-CABL-GX12 cable (shown below). Simply connect it to the “Out” power port of the NYX-88, and the module will receive power through this connection.

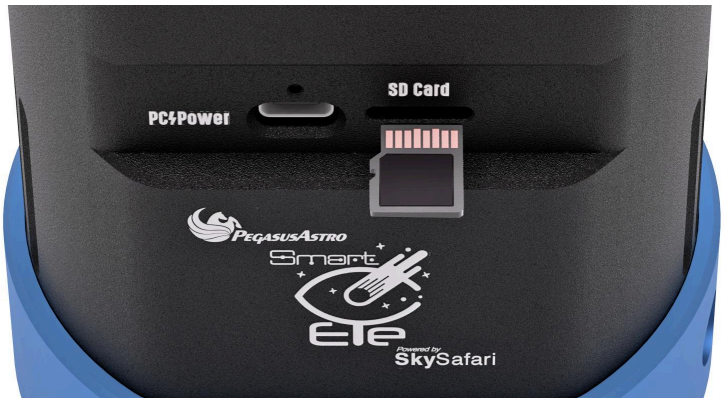
Power Consumption Table

Here's a table showing how long SmartEye, which draws 3A at 5V, can run on different power banks (10Ah, 20Ah, and 50Ah) rated at 3.7V (a common internal voltage for Li-ion cells before being boosted to 5V via USB).

Power Bank Capacity	Voltage (Nominal)	Energy (Wh)	Estimated Runtime (at 3A, 5V)
10,000 mAh (10Ah)	3.7V	31 Wh	~2.1 hours
20,000 mAh (20Ah)	3.7V	62 Wh	~4.2 hours
50,000 mAh (50Ah)	3.7V	152 Wh	~10.5 hours

Inserting an SD Card

To insert the microSD card into SmartEye, ensure that it is placed in reverse orientation (upside down), with the label facing inward. Push the card until you feel a click/latch lock. Please check the image below regarding the correct card orientation placement into the microSD card socket.



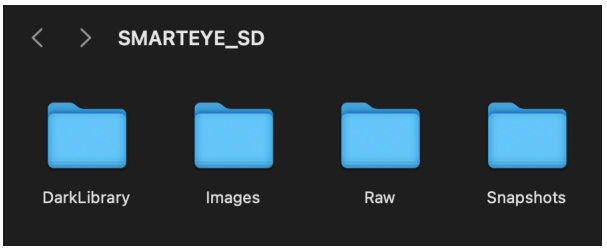
The card should be formatted with FAT32 for optimal compatibility. If your card is not already formatted in this way, SmartEye offers an option in the menu to format it correctly. It is also important to safely unmount the microSD card through the SmartEye menu before physically removing it, as this prevents potential data corruption. For best results, it is recommended to insert the microSD card before turning on the device.

⚠️ **Important: Do NOT remove the SD card while the system is writing data or powered on without ejecting first. Improper removal may result in corrupted images, lost recordings, or permanent damage to the card.**

“Take a moment to eject safely - it protects your data.”

SD Card Directory Structure

When an SD card is inserted or formatted, SmartEye automatically creates the following directory structure:



- **DarkLibrary**
  Contains master dark calibration files in FIT format, categorized by camera temperature and exposure time.

  Example filename: StackDark_20C_25_350.fit
  (Represents a 25-second dark frame taken at 20°C)

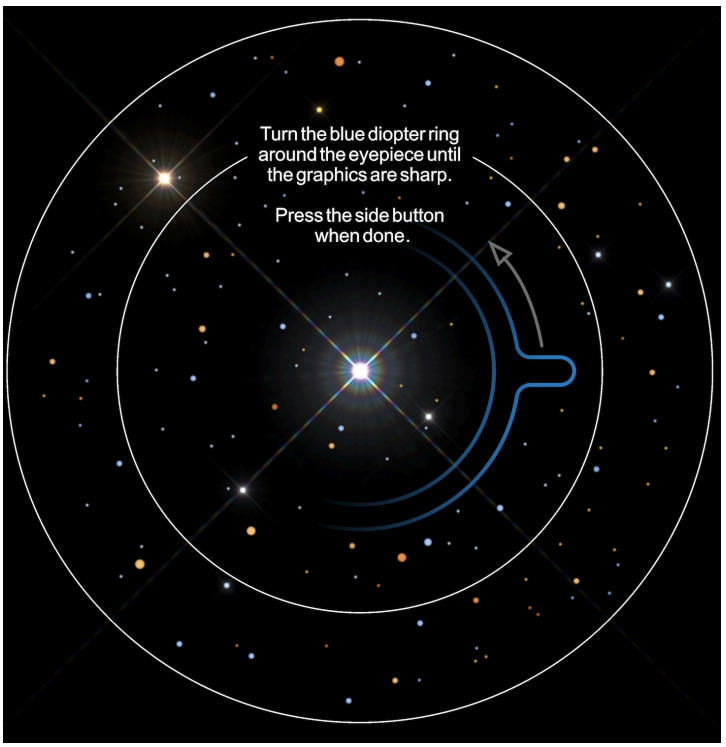
- **Images**
  Includes final stacked images in PNG format, accompanied by a JSON file containing metadata such as camera details and exposure settings.

- **Raw**
  Contains uncalibrated raw image files in FIT format.

  Example filename: exp_000092_0001_0001_25sec_20C.fit
  (Indicates a 25-second exposure taken at 20°C.)

Booting Up SmartEye

1. Remove both protective caps from the camera sensor and the eyepiece display.
2. Attach the 2” barrel adapter to the camera side by securely screwing it into place.
3. Install a 2” filter (such as a UV/IR cut filter) by threading it onto the end of the barrel adapter, if desired. (highly recommended).
4. Mount the SmartEye onto your telescope:
    a. For refractors, SCTs, and most reflectors, insert it into a diagonal.
    b. For Newtonians or Dobsonians, insert it directly into the telescope’s focuser.
5. Connect the USB-C power cable:
    a. Plug one end into the USB-C port on the SmartEye.
    b. Plug the other end into the provided power adapter.
    c. Then, connect a 12V power source to the adapter using the standard 2.1mm barrel connector.
6. Power On: SmartEye will automatically start. A red LED will illuminate, indicating power.
7. Startup Sequence: Device loads and after 10-15 seconds, the SmartEye boot logo will appear in the eyepiece display.
8. Cooling Activation: Shortly after boot, the internal fan and thermoelectric cooler (TEC) will activate. The TEC will then begin cooling the camera sensor to the user-configured target temperature, ensuring optimal performance for image capture.
9. Display DIopter Calibration: On startup, a calibration screen will appear, prompting you to adjust the diopter ring until the display text is sharp and clear. Once properly focused, press the “Astro-Crown” button to proceed to the main menu and begin using the device.



Operating SmartEye

Main Menu Overview

To access and navigate the main menu on SmartEye, use the “Astro-Crown” button located on the side of the device. Press the button once to enter the menu. Turn the dial to scroll through the available options, and press again to select a highlighted item.

Main Menu

Live View

New Observation

Resume Observation

Settings

- Display
    - Brightness
        - 5% to 100%
    - Modes
        - Color or Monochrome
- Light Sensor
    - Sensor Temperature
        - 20, 10, 5, 0, -5, -10, -15 (° Celsius)
    - Integration Time
        - 5s, 10s, 15s, 20s, 25s, 30s
    - Take Dark Frames
    - Alpaca Mode
- Localization
    - Wi-Fi Region
- Storage
    - Storage & Capacity
    - Eject SD Card
    - Format SD Card
- General
    - About
    - SmartEye WI-FI
    - Guest View Sharing
    - Web Dashboard
    - Factory Reset
- Shut Down

Using the Live View

Live View provides a fast and effective way to focus and center your target. The SmartEye uses 0.5-second exposures at high gain to quickly reveal faint details, allowing you to center your target and focus stars easily.

Starting a New Observation (Live Stacking)

When initiating **Live Stacking**, SmartEye follows a precise sequence to ensure optimal image quality and stability:

- **TEC Temperature Check**: The device first verifies that the thermoelectric cooler (TEC) has reached the user-defined target temperature, ensuring imaging sensor stability before imaging begins.

- **Sub-Exposure Capture:** Once thermal equilibrium is confirmed, SmartEye begins capturing sub-exposures based on the configured integration time and gain settings.

- **Dark Frame Calibration:** SmartEye applies the master dark calibration frame on each light frame, captured at the same temperature and exposure settings, to reduce thermal noise and correct fixed-pattern artifacts.

- **Image Alignment:** Each new frame is aligned in real time with the master light reference image to correct for any drift or motion. If the image is not suitable for alignment due to vibrations or very poor tracking, it is automatically discarded.

- **Stacking Process:** Aligned frames are stacked continuously, improving the signal-to-noise ratio (SNR) and revealing finer details with each additional exposure.

- **Real-Time Enhancements:** After stacking, SmartEye performs color calibration, boosts color saturation, applies noise reduction, and adjusts brightness to bring out structure and vibrance in the target.

- **Real-Time Preview:** The evolving stacked image is displayed live to the eyepiece.

This automated process allows for deep-sky imaging with minimal effort, even under moderate tracking conditions.

📌 **Please Note**: As SmartEye begins stacking sub-exposures, the initial frames appear in monochrome, allowing you to quickly see the shape and structure of the target while the signal-to-noise ratio (SNR) is still low. As more frames are stacked and the SNR improves, color gradually starts to emerge, revealing the object's natural hues and finer details. Over time, the image evolves from a faint outline into a vivid, high-contrast view, with rich colors and sharp structures fully visible. This dynamic stacking process allows you to witness your celestial target come to life in real time, with each frame adding clarity, brightness, and depth.

Gamma Adjustment During Stacking

While SmartEye is stacking your images, you can turn the rotary knob to adjust the gamma of the resulting stacked image in real-time.

- What does Gamma do:
    - Gamma controls the brightness curve of the image.
    - Turning the knob adjusts how bright or dark the background and structures appear.

This allows you to:

- Brighten faint features without overexposing the image.
- Darken the background to enhance contrast.
- Fine-tune the visibility of structures based on your viewing preferences.

⚙️ Adjust it live during stacking to get the most optimal view, your changes are applied immediately to the display!

Resuming an Observation

If live stacking is interrupted, for example, by opening the menu or adjusting settings, SmartEye allows you to resume the session using the “Resume Observation” option in the main menu. This function restores the stacking process from where it left off, preserving the current stacked image and settings. It ensures minimal disruption and lets you continue imaging without starting over.

Settings Menu

Display Settings

Adjusting Brightness

SmartEye allows you to adjust the display brightness from 5% to 100%, ensuring optimal viewing comfort under varying lighting conditions. Whether you’re protecting your night vision or need maximum clarity, the setting is easily accessible through the main menu. Once adjusted, the brightness level is stored in the device’s memory, so your preferred setting is automatically restored on the next startup.

Display Modes: Color vs Monochrome

SmartEye gives you the flexibility to view the stacked image in either full color or monochrome mode. This allows you to choose between the vivid, realistic appearance of color for general observation or the high-contrast clarity of monochrome, which can sometimes help reveal faint structures and details. You can toggle between modes directly from the menu based on your observing preferences.

Camera Settings

Setting Sensor Cooling Temperature

This menu allows you to adjust the camera sensor’s thermoelectric cooling (TEC) temperature to improve image quality and reduce thermal noise during long exposures. You

can choose from preset target temperatures: 20°C, 10°C, 5°C, 0°C, -5°C, and -10°C. Lower temperatures are ideal for deep-sky imaging, as they minimize dark current and enhance signal clarity.

⚠️ Please note:

- The TEC system can cool the sensor up to 30°C below ambient temperature (ΔT = -30°C).
- Ensure your target temperature is realistically achievable based on your environmental conditions.
- Lower TEC temperatures increase power consumption, so plan accordingly, especially during field use or battery operation.

The selected temperature is automatically regulated and maintained throughout the session for consistent performance.

Selecting Light Integration Time

With SmartEye, you can select the light integration time by choosing sub-exposure durations of 5, 10, 15, 20, 25 or 30 seconds. This setting allows you to optimize your imaging based on both target brightness and your telescope's optical system. Shorter exposures are ideal for bright objects or when using mounts without precise tracking. For fainter deep-sky targets, longer exposures help gather more light to improve image detail. If your telescope has a slower focal ratio (f/7 or higher), using longer sub-exposures is recommended to ensure enough light is collected for effective stacking. SmartEye will automatically apply your chosen exposure time throughout the stacking process to gradually enhance image quality.

Astro-Camera Mode (ASCOM Alpaca)

SmartEye includes an ASCOM Alpaca server mode, which can be enabled to allow the device to function as a standalone astro-camera on your Wi-Fi network. When activated, SmartEye announces itself as an ALPACA-compatible camera, making it accessible to external imaging software that supports the ALPACA protocol, such as N.I.N.A. In this mode, SmartEye's internal menus are disabled, and all camera control is handed over to the external software. To return to standard operation, simply press the "Astro-Crown" button again — this will shut down the ALPACA server and restore full control to SmartEye's internal interface.

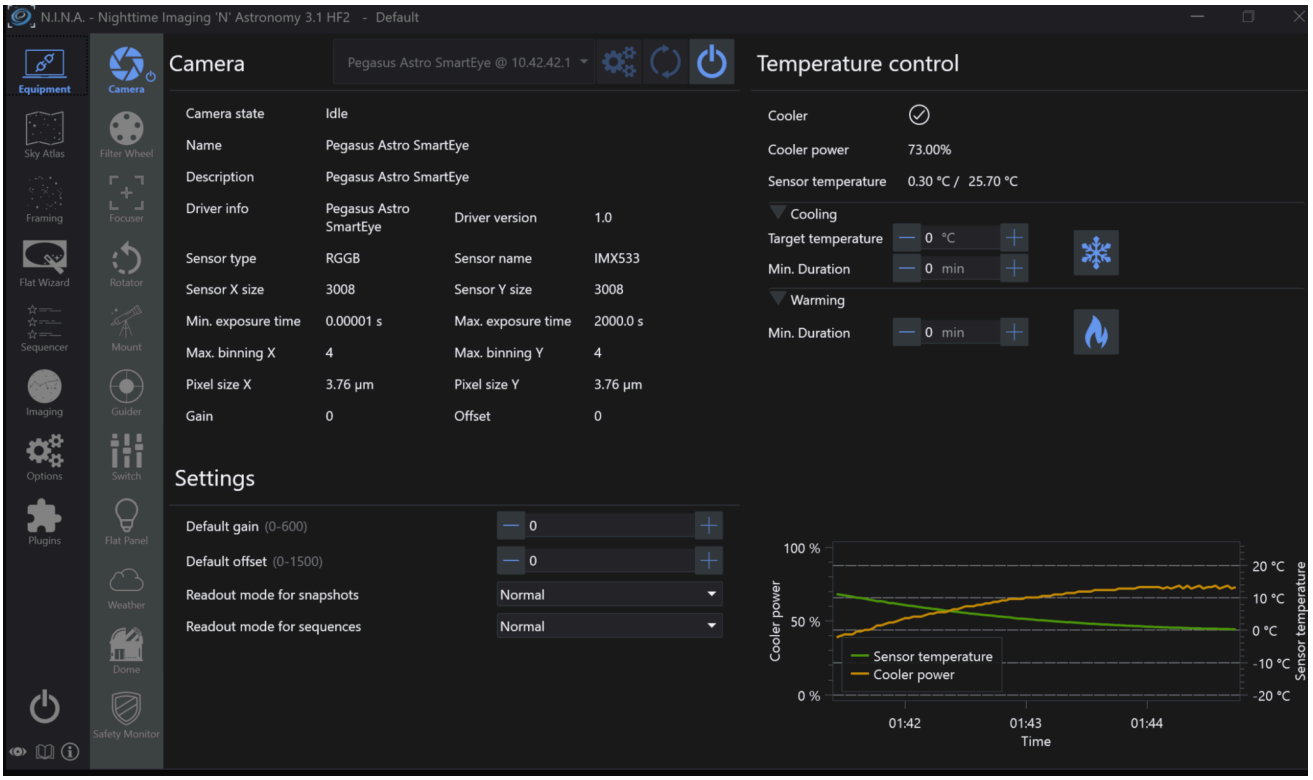
To use SmartEye as an ASCOM Alpaca camera over Wi-Fi:

- Select “Alpaca Mode” from the light sensor menu.
- Press “Start Alpaca” to activate it. SmartEye will now be exposed as an Alpaca-compatible camera device.
- Connect your computer to the SmartEye hotspot. The Wi-Fi password can be seen in the SmartEye Wi-Fi menu.

Hotspot Name	SmartEye-**XXXXXX**
Default Password	PW**XXXXXX**

The 6-character alpharithmetic sequence **XXXXXX** is the unique ID of each SmartEye device. (e.g 8EE6E1)

- Open an imaging application that supports ASCOM Alpaca, such as N.I.N.A.
- Search for available Alpaca cameras, you will see “Pegasus Astro SmartEye” discovered and listed.
- Select the SmartEye device and connect. You can now use SmartEye just like any other astrophotography camera.



Calibration Frames

Taking Dark Frames

SmartEye offers an automated dark frame capture function to improve image quality by reducing sensor noise and thermal artifacts. When selecting this option, the device will capture a series of dark frames—images taken with no light exposure—and generate a master dark frame. This master dark is then automatically applied to all future subexposures, enhancing signal-to-noise ratio during live stacking and live view.

You can select the desired integration time for which you want to create darks, matching your usual subexposure settings. SmartEye also takes separate darks for live view, helping provide a cleaner preview image.

SmartEye automatically checks the TEC sensor temperature and adjusts it to the configured level before capturing any flat frames. It also captures multiple dark calibration frames to generate a master dark file, which is stored in the device's internal memory.

⚠️ **Important**:

- Always close the telescope's front cap or cover the optics when taking dark frames to ensure no light leaks into the sensor.
- If you change the TEC cooling temperature, you'll need to retake dark frames, as noise characteristics vary with temperature.
- SmartEye automatically tags each master dark frame with the specific temperature at which it was captured and stores it in internal memory. Creating a new dark frame for a given temperature will overwrite the existing one for that setting.

Localization

Setting Your Region

This menu allows you to configure your geographic location, enabling SmartEye to automatically apply the correct time zone and Wi-Fi region settings. Accurate regional configuration ensures proper time stamping of captured images, compliance with local wireless regulations, and optimal performance of Wi-Fi connectivity and plate-solving operations.

Storage Management

Viewing Storage & Capacity

This menu provides a clear overview of the device's internal memory and external storage status. It displays the total internal memory in megabytes (MB), along with how much of it is currently used by user data. If an SD card is inserted, the menu also shows its total capacity, the amount of space used, and the corresponding usage percentage.

Safely Ejecting the SD Card

A safe eject of the microSD card ensures that all read and write operations to the card are properly completed before removal, preventing data corruption or loss. Users are advised to always use this option before physically removing the SD card from the device.

Once SmartEye confirms that the card can be safely removed, it is disconnected from active use, ensuring the integrity of stored data and the longevity of the card itself.

Formatting the SD Card

This option allows users to prepare the card for use by erasing all existing data and applying the FAT32 file system along with SmartEye directory structure. This format ensures compatibility with the device and supports SD cards with capacities up to 2TB.

Users should be aware that formatting will permanently delete all files on the card, so backing up important data beforehand is recommended. Once formatted, the card is ready for reliable data storage and optimal performance within the system.

General Settings

About SmartEye

The About menu shows the current firmware version, software version, device board revision and copyright information.

SmartEye Wi-Fi

The Wi-Fi menu shows the current mode: either Access Point (hotspot) or Wi-Fi Client (connected to a local network).

By tapping “How to connect”, you can view the hotspot SSID and password. A QR code is also displayed on-screen, which can be easily scanned with your mobile phone to connect directly to the SmartEye hotspot — no typing required.

The web dashboard allows you to switch between Hotspot and Wi-Fi Client modes. If you switch to Wi-Fi Client mode and SmartEye is unable to connect to your network, it will automatically fall back to Hotspot (direct) mode.

If you experience any connectivity issues, you can easily reset all settings to default either through the web dashboard or via the SmartEye device menu.

Guest View Sharing

The Guest View Sharing feature allows others to easily view the latest image captured by SmartEye.

This page shows the latest stacked image, along with important details such as integration time, total stacked duration and count of valid stacked captures.

For convenience, if scanning the QR code isn’t possible, a direct link is also shown:

Guest Dashboard URL	http://smarteye.local

This makes it simple to share your observations in real time without requiring app installations or special setup

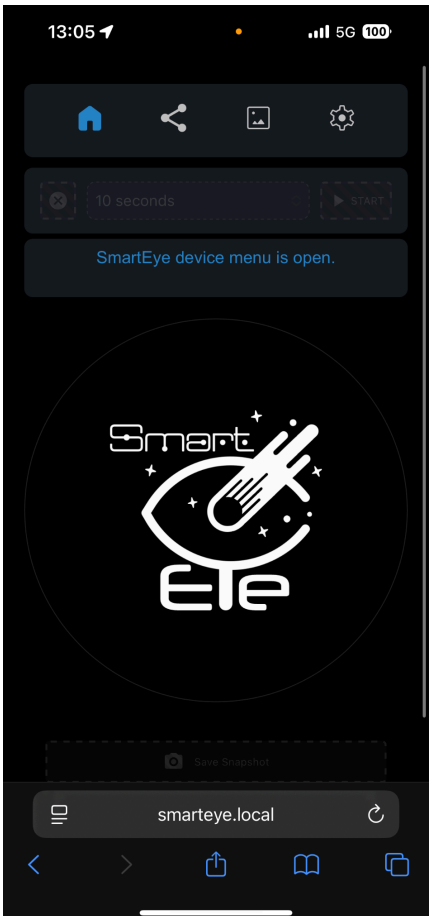
📌 **Please Note**: To use Guest View, the client device must be connected either to the SmartEye hotspot or to the same Wi-Fi network that SmartEye is connected to as a client. This ensures the device can communicate with SmartEye and access the live image preview and related information through the local network.

Connect your computer to the SmartEye hotspot. The Wi-Fi password can be seen in the SmartEye Wi-Fi menu.

Factory default Wi-Fi (hotspot) credentials

Hotspot Name	SmartEye-**XXXXXX**
Default Password	PW**XXXXXX**

The 6-character alpharithmetic sequence **XXXXXX** is the unique ID of each SmartEye device. (e.g 8EE6E1)

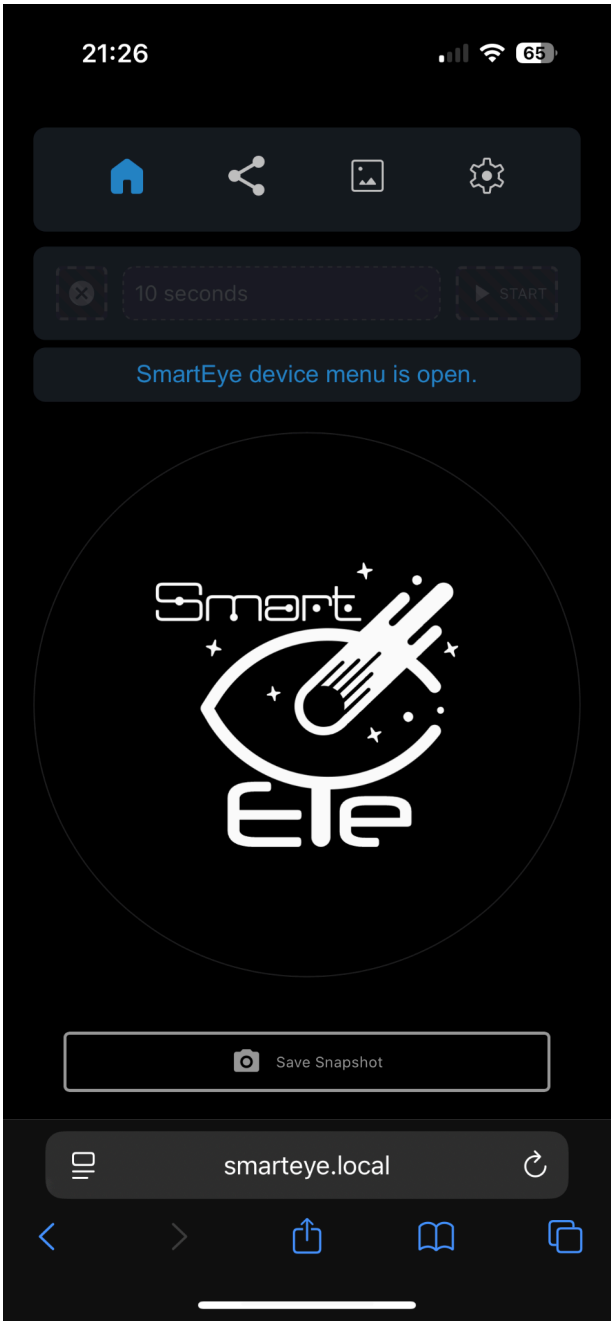


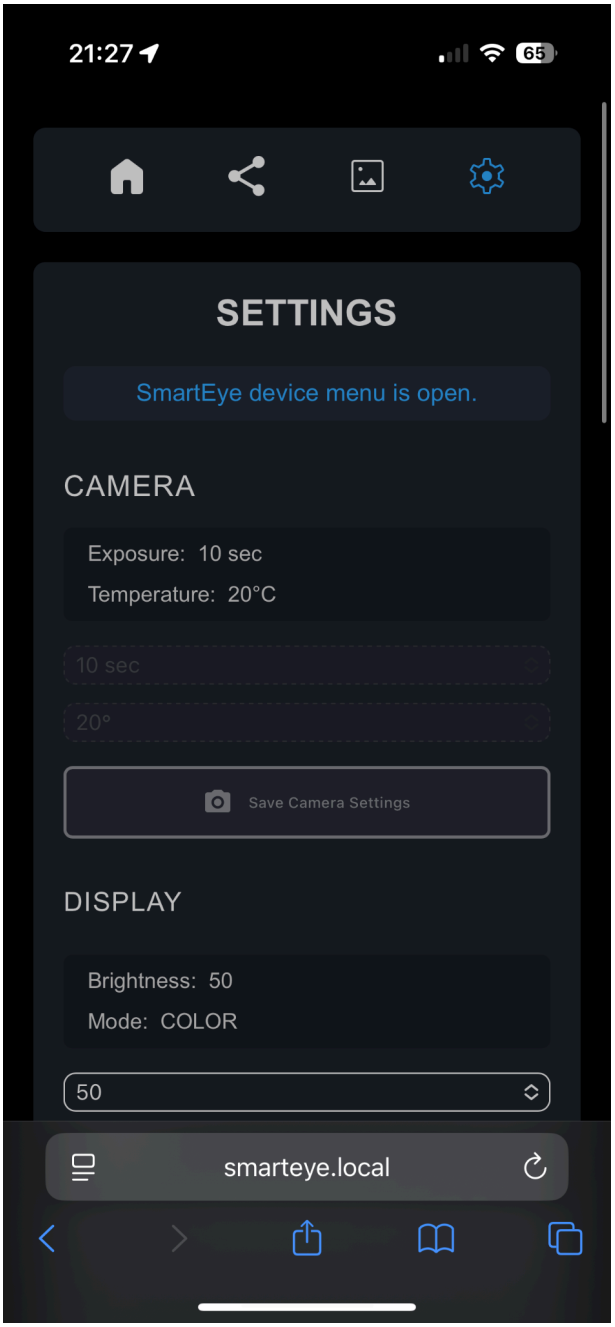
Accessing the Web Dashboard

The Web Dashboard allows you to control SmartEye's settings, view system information, and configure features — all through your web browser. A QR code is displayed that links directly to:

SmartEye Dashboard URL	**http://smarteye.local/dashboard**

Simply scan the QR code with your mobile device or enter the address in your browser to access the dashboard and manage your device with ease.


21:26
65
10 seconds
START
SmartEye device menu is open.
Smart
ETe
Save Snapshot
smarteye.local



Resetting to Factory Default

The Factory Reset option restores SmartEye to its original settings, erasing all user configurations, saved Wi-Fi networks, and custom preferences.

Use this option if you encounter persistent issues or need to prepare the device for a new setup. Resetting ensures a clean start, just like when the device was first powered on.

Connect SkySafari to SmartEye and telescope mount.

Your telescope mount should support Wi-Fi connectivity with SkySafari, either natively via ASCOM Alpaca or through an external device like SkyFi.

In the example below, we use our PegasusAstro NYX-88 harmonic mount, which has built-in ASCOM Alpaca support and connects directly to SkySafari Pro without any additional hardware.

SmartEye functions as a Wi-Fi access point by default, allowing both the mount and your mobile device to connect to it.

📌 **Please Note:** Most telescope mounts do not support the 5 GHz Wi-Fi band, so it's important that SmartEye operates its access point on the 2.4 GHz band only to ensure compatibility.

This setup enables SkySafari to communicate with the mount over the same network. You can:

- Perform plate solving on captured images.
- Automatically sync the mount to the solved celestial coordinates.
- Use SkySafari's catalog to send GoTo commands directly to the mount.

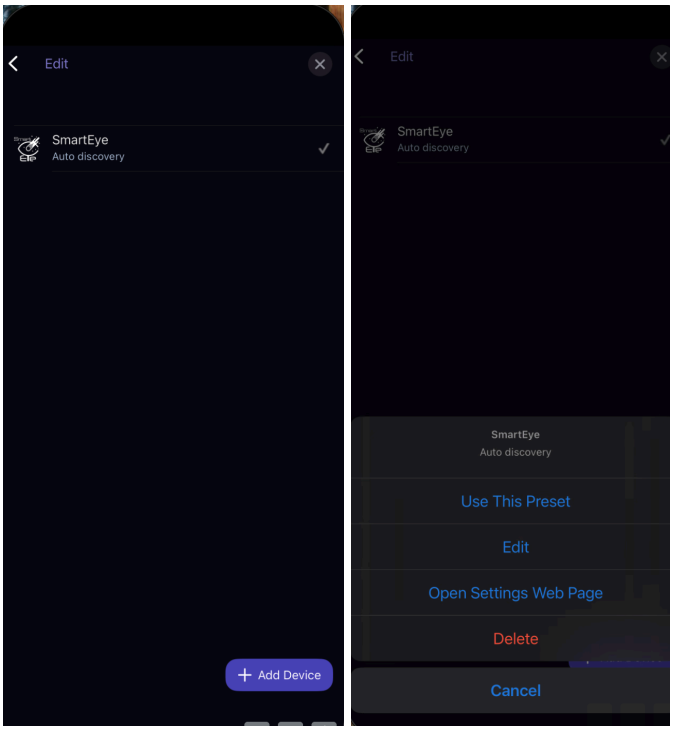
Using SmartEye with SkySafari

📌 To interact with the SmartEye, you will need **SkySafari Plus** or **SkySafari Pro**.

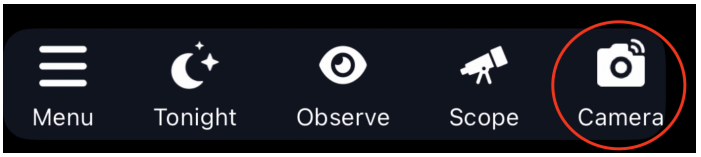
SkySafari Plus & Pro can connect directly to SmartEye and trigger plate-solving operations on the device. Plate solving is performed internally by SmartEye with a local database, and the resulting sky coordinates are sent back to SkySafari. If a telescope is also connected to SkySafari, it can then synchronize the telescope's position with the plate-solved coordinates, allowing for precise alignment.

How to achieve that:

- Open SkySafari Plus or Pro on your mobile device.
- Press "**Observe"** Icon -> "**Camera and Imager Configuration"**
- Press **(+ Add Device)** button.
- Choose "**SmartEye**". Keep the default options and choose **Next** to save the preset.



- Press the "**Camera"** icon on the toolbar. When the Camera control is opened, it will automatically attempt to connect to the current Camera / Imager as selected before.



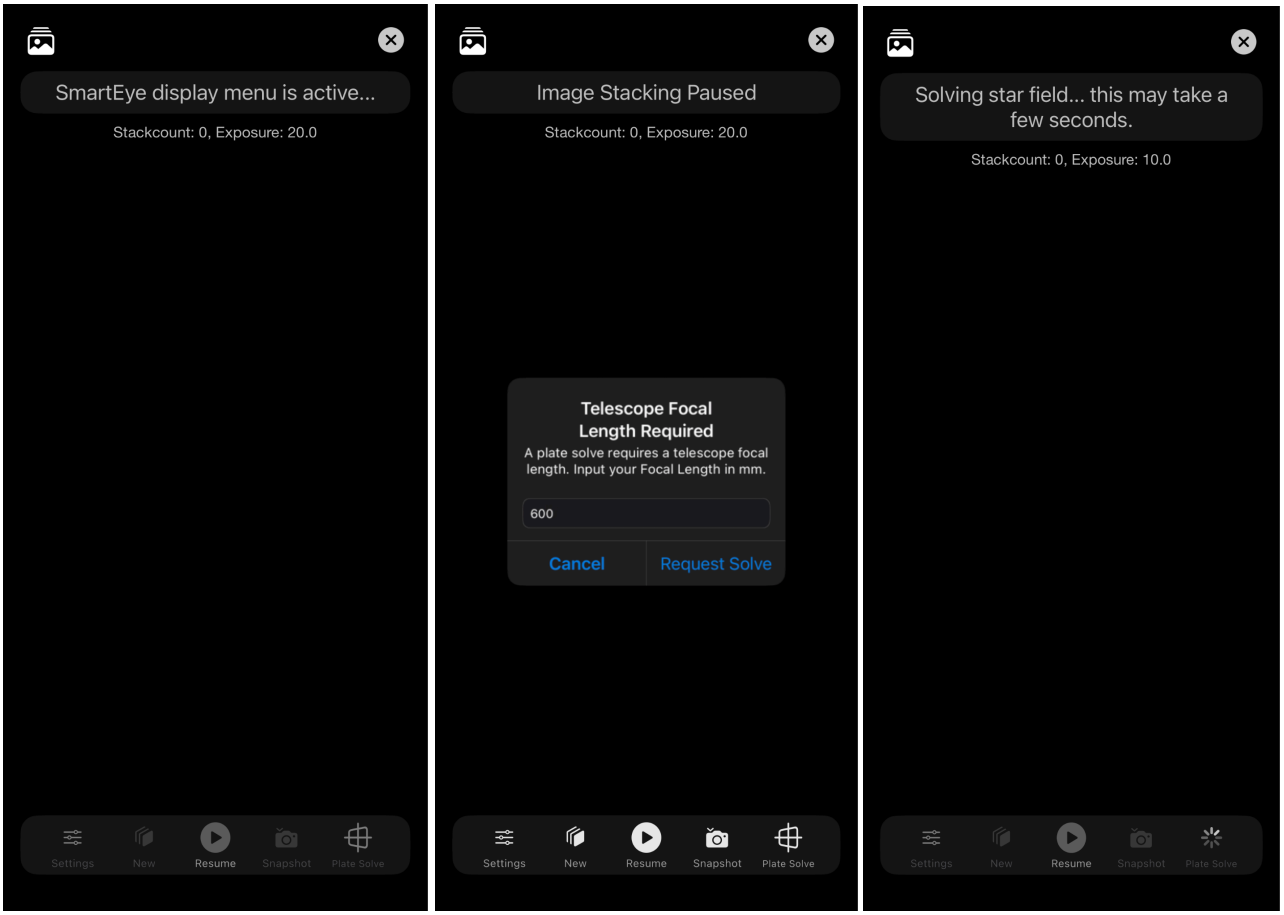


Plate Solving Image

Tapping the “Plate-Solve” button on the button right opens the plate-solving interface. The “Telescope Focal Length” field is automatically pre-filled based on the following logic:

- **Previously Used Value:**
  If you’ve performed a plate solve before, the field will be populated with your last entered value. This is stored as a user preference.
- **FOV Indicator with Telescope:**
  If an active Field of View (FOV) Indicator includes a telescope, the focal length of that telescope will be used as the default.
- **Default Fallback:**
  If neither of the above applies, the field defaults to 600mm.

Updating SmartEye

The SmartEye device is continuously improved through frequent updates that include new features, performance enhancements, and important bug fixes. We strongly recommend always upgrading to the latest release using the SmartEye Update software to ensure optimal functionality and the best user experience.

The SmartEye Update software is available for download from the official website at https://smarteyepiece.com

SmartEye supports two ways to get updated.

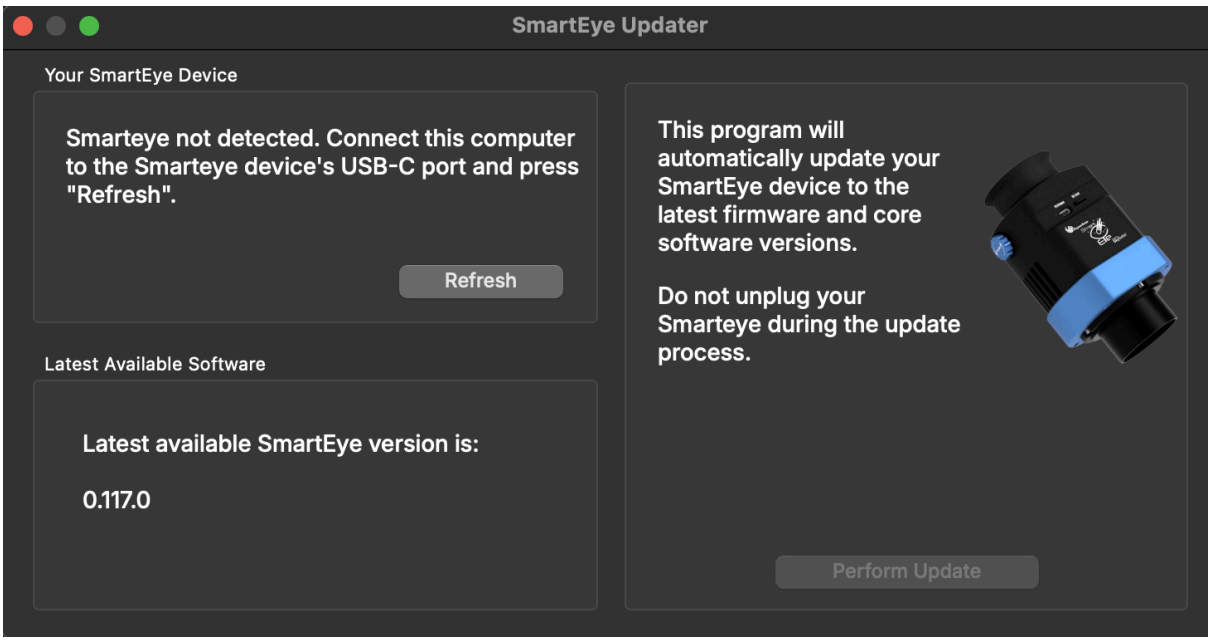
- Via USB-C port
- Via SD-Card

Update via USB-C port

📌 **Please Note:** *Firmware upgrades via USB-C port require a computer USB port capable of delivering up to 2A of power. If your computer's USB port cannot supply sufficient power, you may encounter errors such as "USB port disabled" or "excessive power draw detected." In such cases, we strongly recommend using the* ***SD card update*** *way instead.*

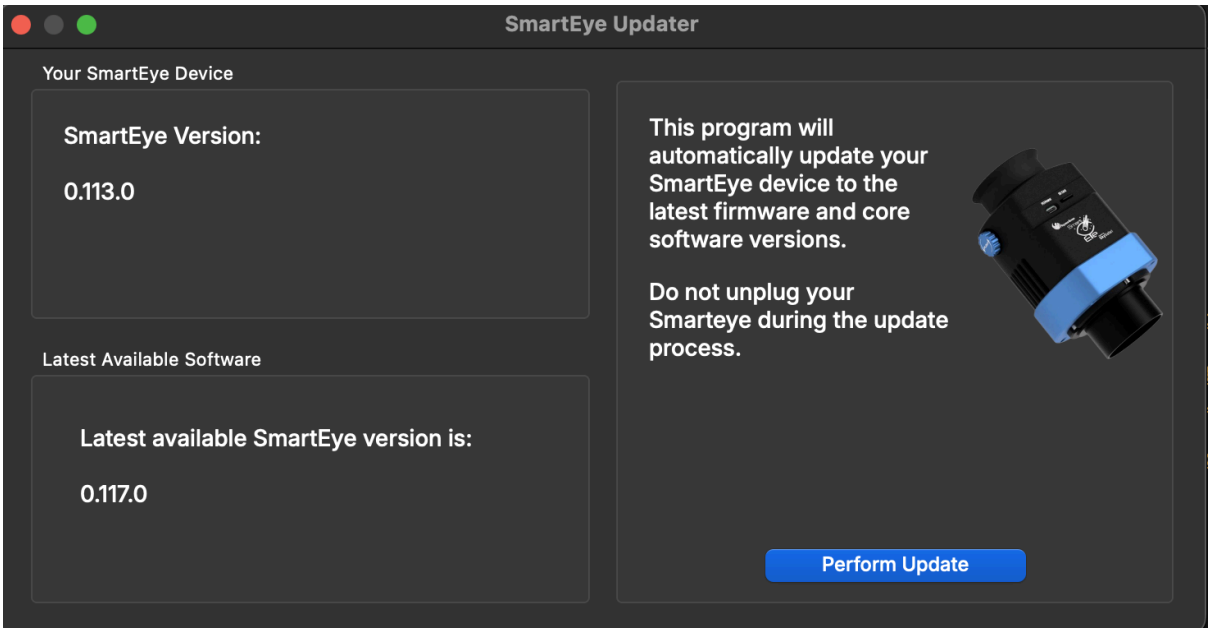
Ensure your computer's USB-C port supports Power Delivery (PD) output. Most modern computers and laptops do. If SmartEye is not detected when connected, try using a powered USB-C hub with PD pass-through or refer to Updating via SD Card below.

Upon launch, the update program automatically checks for both an active Internet connection and a connected SmartEye device. If either is not detected, the user is prompted with a message instructing them to connect the device and/or ensure Internet access, then click the "Refresh" button to retry.



Once both conditions are met, the software compares the device's current version with the latest version available on the server. The user is then either prompted to perform an update or informed that the device is already up to date.

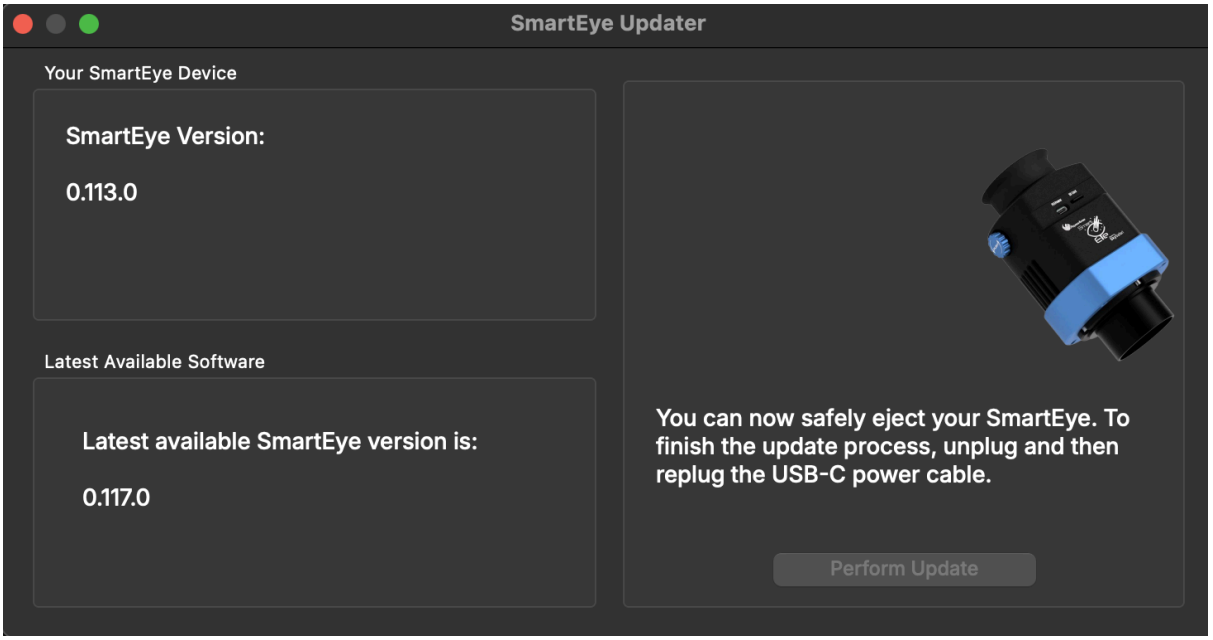
Below is the interface shown when an update is available.



Once the user clicks the "Perform Update" button, it downloads the update from the remote server, and copies it to the device. A progress indicator is displayed during the download.

It does take a few seconds after the download to upload the update to the device via USB cable.

When the initial step is complete, the user will be prompted to restart the device. At this point, we strongly recommend unplugging the USB-C cable and connecting the device to its standard **12V -> USB-C stock power module t**o ensure the upgrade process continues smoothly.



After restarting, the device will begin the upgrade process of the uploaded file and will reboot one more time when the update is fully completed.

Please wait for the welcome message (diopter adjustment) to appear on your device before starting any new operation.

Update via SD-Card

- Insert the **microSD card** into your **SmartEye** device.
  Format the card using the SmartEye interface:
  Menu → Settings → Storage → Format SD Card
- Remove the microSD card and insert it into your computer using an SD card slot or reader.

- Launch the **SmartEye Updater** on your computer and select **Perform Update** when prompted.
- Once the update is complete, safely eject the microSD card, reinsert it into the SmartEye, and **restart the device** to complete the process.
- Please wait until you see the diopter adjustment screen. **The update process may take up to 5 minutes, and the device may reboot one or more times during the update. This is normal behavior—please do not interrupt the process.**

Troubleshooting Table

Symptom	**Suggested Solution**
Device power or fan switches off randomly.	USB power may be insufficient. Please use the provided power adapter or connect to a high-power USB 3.0 or USB-C port capable of delivering up to 3 A for reliable operation.
USB-C cable is plugged, but SmartEye's LED does not turn on.	Make sure you use the provided power adapter. If the problem remains, please contact support.
The stacking count does not increase. I do not see a change in the produced image.	Polar alignment may be significantly off, or the current field may not contain enough stars for the alignment process to match frames. Try pointing to a different area of the sky or increase the exposure time to capture more stars in the field.
Telescope mount cannot discover SmartEye hotspot.	Ensure that the SmartEye hotspot is set to 2.4 GHz, as most telescope mounts do not support the 5 GHz band. You can switch the Wi-Fi band at any time from the SmartEye dashboard.
The screen is too bright or too dim.	Adjust screen brightness from the menu or dashboard. 5% - 100%.
Camera TEC cannot reach the configured temperature.	Maximum ΔT (temperature difference) is limited to 30 °C. Please reduce the camera's cooling power and ensure that your dark frames were captured at or near the current sensor temperature for best

	results.
ST4 port does not work	ST4 functionality is not currently supported by the software. However, support for guiding via the ST4 port is planned for a future software update.
My microSD card is plugged but is not recognized	Make sure the SD card is formatted with the VFAT (FAT32) file system, or format it directly using the SmartEye menu for optimal compatibility.

Technical Data

Feature	Specification
Sensor Type	Sony IMX533 Color CMOS
Sensor Resolution	9 MP (3008 x 3008 pixels)
Sensor Distance	Backfocus 12mm
Pixel Size	3.76 µm
Sensor Format	1-inch square format
Cooling	Thermoelectric (TEC) with active fan, user-controllable, Cooling down to 30°C below ambient temperature.
Display Type	OLEDoS (OLED on Silicon)
Display Resolution	2560 x 2560
Field of View (Display)	90° circular
Diopter Adjustment	Range from +1D to -5D, catering to various visual acuity needs.
Data Storage	microSD card slot (supports RAW FITS image storage)
Plate Solving	Real-time, onboard plate solving
Telescope Control	Fully compatible with SkySafari Pro; supports GoTo commands via planetarium map
Camera Control	Built-in sequence control for image capture and stacking
Image Processing	Live stacking, contrast and color enhancement, noise reduction
Connectivity	Dual-band Wi-Fi support (2.4 GHz or 5 GHz 802.11 b/g/n/ac). (Direct - HotSpot & Client modes). Bluetooth 5 with Bluetooth Low Energy (BLE) support.
Software Compatibility	SkySafari Pro, INDI, ASCOM (planned), web-based interface.

Power Requirements	USB-C 5V (~3A recommended).
Operating Temperature	-20°C to 40°C (non-condensing).
Weight	795g (28 oz)
Mount Compatibility	2-inch eyepiece barrel, compatible with standard 2-inch focusers.
Construction Material	Anodized aluminum with thermal dissipation design
Mobile Apps	Compatible with both iOS and Android devices.
ASCOM Alpaca	Announced in Wi-Fi as an Alpaca camera.

Mechanical Drawing