FALCON V2 ROTATOR



PRODUCT MANUAL

Version *1.0*
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VERSION HISTORY

Version #	Implemented By	Revision Date	Reason
1.0	*Evans Souglakos*	*01/03/2024*	*Initial Document*

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INTRODUCTION

Thank you for purchasing the Pegasus Astro Falcon v2 Rotator!

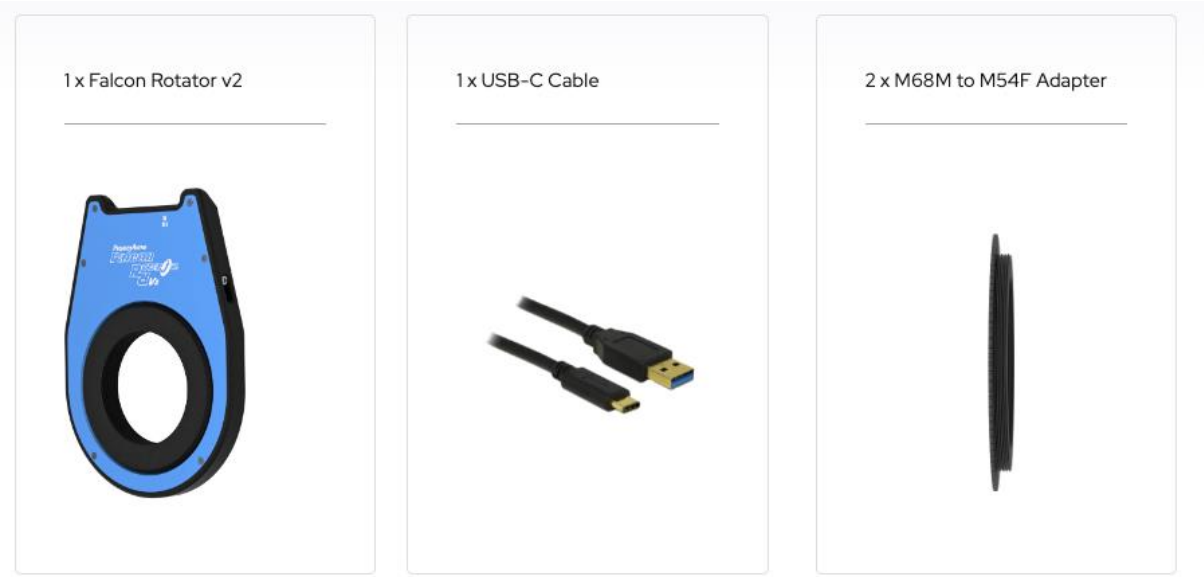
1.1 PURPOSE

The Falcon v2 Rotator is our new large aperture (M68) camera field rotator that impresses with its lightweight, low-profile design. Despite its slim profile, it possesses the remarkable capability to manage and accurately position even heavy image trains.

Operating the Falcon v2 Rotator is a seamless experience, thanks to its compatibility with classic ASCOM, native ASCOM Alpaca drivers and the Unity Platform software. This user-friendly design simplifies the process of automatically and precisely orienting your camera field, making your astrophotography endeavors significantly more convenient and efficient.

1.2 IN THE BOX

The box contains the following items:



- 1 x Falcon v2 Rotator
- 1 x USB-A to USB-C Cable (1.5m)
- 2 x M68 Male to M54 Female Adapter

1.3 DEVICE CARE

The device electronics are housed inside an aluminium blue and black anodized enclosure. The enclosure is made from aircraft aluminum alloy type 6061 which provides very good corrosion resistance.

- While the controller is safeguarded against moisture, it is essential to emphasize that it is not waterproof and should always be maintained in a clean and dry environment.
- Prolonged exposure to excessive moisture can pose a significant risk to the electronics and connectors, potentially causing damage. It is imperative to exercise caution in this regard.
- Avoid any contact between solvents or chemicals and the device, as these substances can have adverse effects on its functionality.

- When the device is not in use for extended periods, it is advisable to store it indoors within a dry room to prevent any potential moisture-related issues.
- Take precautionary measures and refrain from touching the internal components during operation, as they may become hot. Ensuring safety and optimal performance is paramount.

DEVICE DESCRIPTION

1.4 DESIGN OVERVIEW



Side View

- USB-C (power and data socket). Communication is via USB2 protocol.

1.5 FEATURE LIST

- Large Aperture: M68 opening on both sides (actual aperture 67 mm)
- Slim Backfocus: 15.2mm
- De-Rotation support: For Alt-AZ field derotation
- USB-C Connectivity: Single cable for power and data.
- Rotates heavy imaging gear. Up to 6Kg
- Wi-Fi Enabled: Hotspot and Wireless 2.4GHz client support.
- ASCOM Alpaca Support: Seamless integration with popular software.
- Firmware Upgradability: Future-proof with software updates
- Web Browser Access: Control via web browser on any device, making it OS-independent.

INSTALLATION

- Please check the orientation of the Falcon v2 Rotator displayed at the above image **The motor lid of the rotator should face the telescope side.**
  You have the option to reverse the orientation of the rotator but make sure to reverse the motor drive in supplied Unity Platform software.

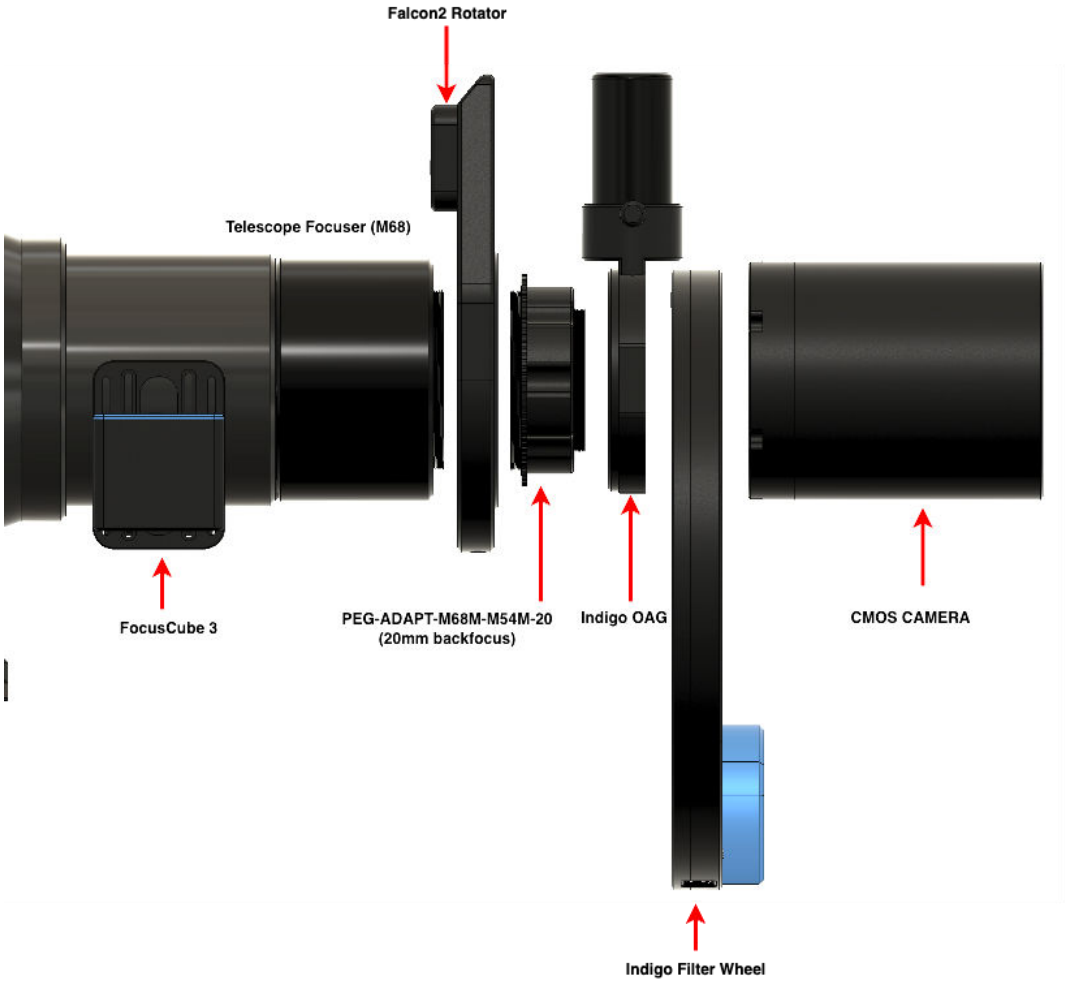
- **Important Note: Please make sure that all of your cables are loose enough to allow a half rotation without cable twist or stretch.**

- **Below image shows a generic example of a modern imaging equipment and how to connect the Falcon2 rotator with your telescope.**

- If your telescope or equipment requires a M54 thread please use the included 2 x M68M to M54F adapters. Note the extra backfocus you are going to add (1.40 mm for each adapter)

- For other adapters (M42, M48 etc) please check below for optional adapters.

IMPORTANT: The Falcon Rotator has been calibrated at the factory to minimize backlash or flexure, making it ideal for modern CMOS imaging. However, in the event of a severe collision with an object, such as during mount slew out of limits, there is a high possibility of damaging the internal gearbox or mechanical structure and introducing flexure along its mechanical axis.



Optional Adapters

There is a wide selection of optional adapters with different aperture opening to connect your equipment with the Falcon 2 Rotator.



- Backfocus Thickness: 1.40 mm
- Thread Length: 4.0 mm
- M48 adapters have internal M42 thread.
- M54 adapters have internal M48 thread.

You can purchace the adapters below:
from Left to Right:

Female Adapters

1. **M68M to M42F** (ADAPT-M68MM42F)
2. **M68M to M48F** (ADAPT-M68MM48F)
3. **M68M to M54F** (ADAPT-M68MM54F)

Male Adapters

1. **M68M to M68M** (ADAPT-M68MM68M)
2. **M68M to M54M** (ADAPT-M68MM54M)
3. **M68M to M48M** (ADAPT-M68MM48M)
4. **M68M to M42M** (ADAPT-M68MM42M)

OPERATION

I. Initial Connection:

1. **USB Cable**: Carefully insert the USB type C cable into the designated port on the Falcon2 Rotator and connect the other end to your computer.

II. Device Boot-up:

3. Upon connecting the USB-C cable, the device will commence its boot sequence and fully load its firmware in about two seconds.

III. Software Installation:

5. To establish communication with the device, please visit our official website at pegasusastro.com. Download the Unity software package from https://pegasusastro.com/download/, which **includes the requisite ASCOM driver**, to facilitate connectivity with the Falcon2 Rotator. You can also connect the device with ASCOM Alpaca. Check ASCOM Alpaca section in this manual.

USB CONNECTIVITY

The unit requires USB2 signaling and features a USB Type-C port, designed to seamlessly accommodate the included 1.5-meter USB-C cable, ensuring a hassle-free setup right out of the box.

Additionally, the same USB cable serves a dual purpose by not only connecting the Falcon v2 Rotator but also supplying power to the device. It delivers a current of up to 700mA to the stepper motor, ensuring efficient and reliable operation.

- Please note that USB2 limitation is 500mA but all modern computers nowdays have a USB3 port able to deliver at least up to 900mA of current.

It is strongly recommended to limit the **maximum USB2 cable length less than 5 meters**. Adhering to this guideline ensures optimal data transmission rates and minimizes the potential for signal degradation over longer distances, thereby promoting stable and reliable USB2 connectivity for your device.

While USB extenders may function on a case-by-case basis, it is important to note that we cannot provide a guarantee of compatibility or performance with third-party devices. The efficacy of such extenders can vary depending on numerous factors, and users should exercise caution and conduct their own testing when integrating third-party USB extenders with our products.

BACKFOCUS DISTANCE AND CLEAN APPERTURE

The backfocus distance, or thickness, of the Falcon 2 Rotator measures 15.2mm. The clear apperture is 67 mm. Both openings of the rotator feature M68 threading with 1mm pitch size.

Additionally, two adapters are included to convert M68 to M54 threads if your setup requires it. Each adapter adds 1.40mm of backfocus.

RATED LOAD

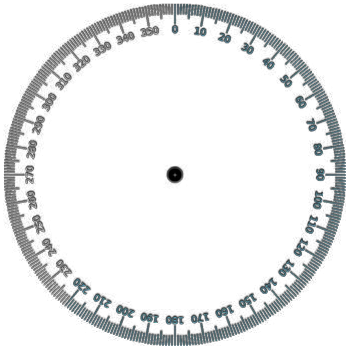
Falcon 2 Rotator has been tested with 6Kg / 13.2lbs of imaging setup.

ROTATOR MOVEMENT

Rotator can perform two movements:

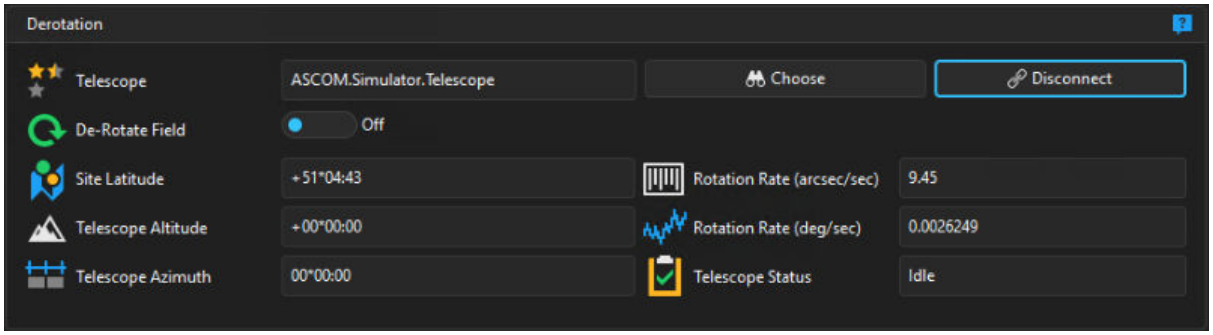
⇒ From 0 -> 220 degrees (clockwise)
⇒ From 0 -> 220.1 degrees (anticlockwise)

Please check the image below for available movements (Blue degree index is the clockwise / **Black Index** is the anti-clockwise movement). This limit configuration enforced in current firmware avoids any cable twist of your imaging equipment.



DE-ROTATION SUPPORT FOR ALT/AZ MOUNTS

Rotator has the step precision to support rotation compensation on an ALT-AZ mount. Unity Platform calculates the paralactic angle (rate of rotation) and continously sends the required commands to the Falcon2 rotator.



Unity Platform needs conectivity with your ALT-AZ mount via ASCOM Client. It receives your site latitude and longitude along with the celestial target coordinates (target altitude and azimuth). Having these information it continously updates the paralactic angle and pushes the rate of rotation commands to the Falcon v2 rotator.

BRAKE LOCK

If an adapter becomes stuck and cannot be removed from the rotator, we strongly recommend to secure the rotator internal mechanical gear by tightening the M6 grub screw indicated by the red arrow below.

This prevents any gear teeth damage by applying extra force to unstuck your adapter from the Falcon v2 Rotator's threads.

Use a 3mm Allen hex key to tighten the grub screw and lock the rotator gearbox. Subsequently, carefully attempt to unscrew the adapter.

Please ensure to release the brake (untighten the M6 screw) after successfully removing your adapter.



RESET WATCHDOG

In the realm of operational integrity, an invaluable safeguard is in place: a hardware watchdog mechanism that diligently resets the device should the controller fail to respond within a mere three (3) seconds. This feature,

though seldom required, provides a notable reassurance, especially in the context of remote observatory management, where absolute operational reliability is imperative. In this rare occurrence of a microcontroller freeze, it guarantees that your remote observatory functions seamlessly, assuring the highest level of operational assurance.

WIFI CLIENT

Falcon v2 Rotator seamlessly operates as a client, connecting to a 2.4GHz WiFi network. Notably, it stands out by functioning concurrently **as both a WiFi hotspot and a WiFi client.**

To link up with a WiFi network, navigate to the Unity platform, access the WiFi tab, and initiate a scan to discover networks in your area. Simply select the desired network, input the WiFi password and your preferences are stored.

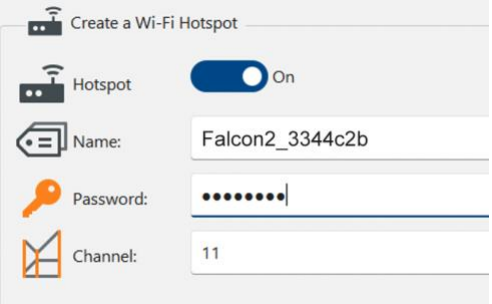
With each reboot, the device effortlessly connects to the configured wireless network. The device retrieves your selection on every boot and automatically connects to the configured wireless network.

WIFI HOTSPOT

Falcon2 Rotator has a Wi-Fi Access point (hotspot) at 2.4 GHz. The hotspot is enabled by default. The SSID name is compiled from the prefix `Falcon2_` and the unique device ID e.g. `0043c88c`.

You can easily control the hotspot settings from the Unity Platform.

- Open Unity Platform, click on the discovered Falcon2 Rotator, and locate the Wi-Fi settings tab.
- There you will see the below screen which allows you to control the WiFi hotspot.
- You can easily change the SSID name, enable, or disable the Wi-Fi hotspot, or switch to another channel number.



➢ You will have to change the hotspot channel if your area is fully crowded with Wi-Fi networks. **Channels 1, 6, and 11 [default] are the best channels for 2.4 GHz Wi-Fi.** These are the only channels in the 2.4 GHz frequency band that don't overlap with each other. You'll only want to consider using a different channel if each of these channels is overcrowded in your coverage area.

1.6 CONSIDERATIONS ABOUT WI-FI CHANNELS TO IMPROVE NETWORK CONNECTION

- Wi-Fi is a line-of-sight radio technology, which means that it operates not by surrounding your device with a wireless signal, but by connecting directly to it, through whatever walls, subflooring, or other electronic devices are in its way. Each solid object between the antenna of your wireless access point (router/modem) and your computer will diminish the signal. Repositioning things by inches can make a world of difference.
- Sources of interference are not always obvious. Many times, you may be receiving interference from hidden wireless networks or even some electronics. Interference from electronics is more prevalent with the 2.4 GHz radio spectrum. If you are using a low channel width on a free channel and are still seeing wireless disconnects (even while near your wireless access point), then the issue could be something else occupying that spectrum. Try experimenting with other channels.

- In a crowded wireless landscape, wireless performance will often degrade and improve on its own, as other people use their Wi-Fi networks. Experimenting with channel settings can help here as well, since some of your competition may rarely use their Wi-Fi, while others are continually transferring data from many devices. If you live in an apartment complex, for example, and your neighbor has their router against a shared wall, sharing a wireless channel will not become a noticeable problem until they get home, connect with their smartphones, and start streaming to their television. However, at that point, your Wi-Fi may become completely unusable until you change the wireless channel.

WEB DASHBOARD

Upon connecting to the Falcon2 Rotator hotspot or any Wi-Fi network, you can conveniently access it from any web browser by simply typing "**`falcon2.local`**" in the address bar. The device announces itself as *falcon2.local* in your local network.

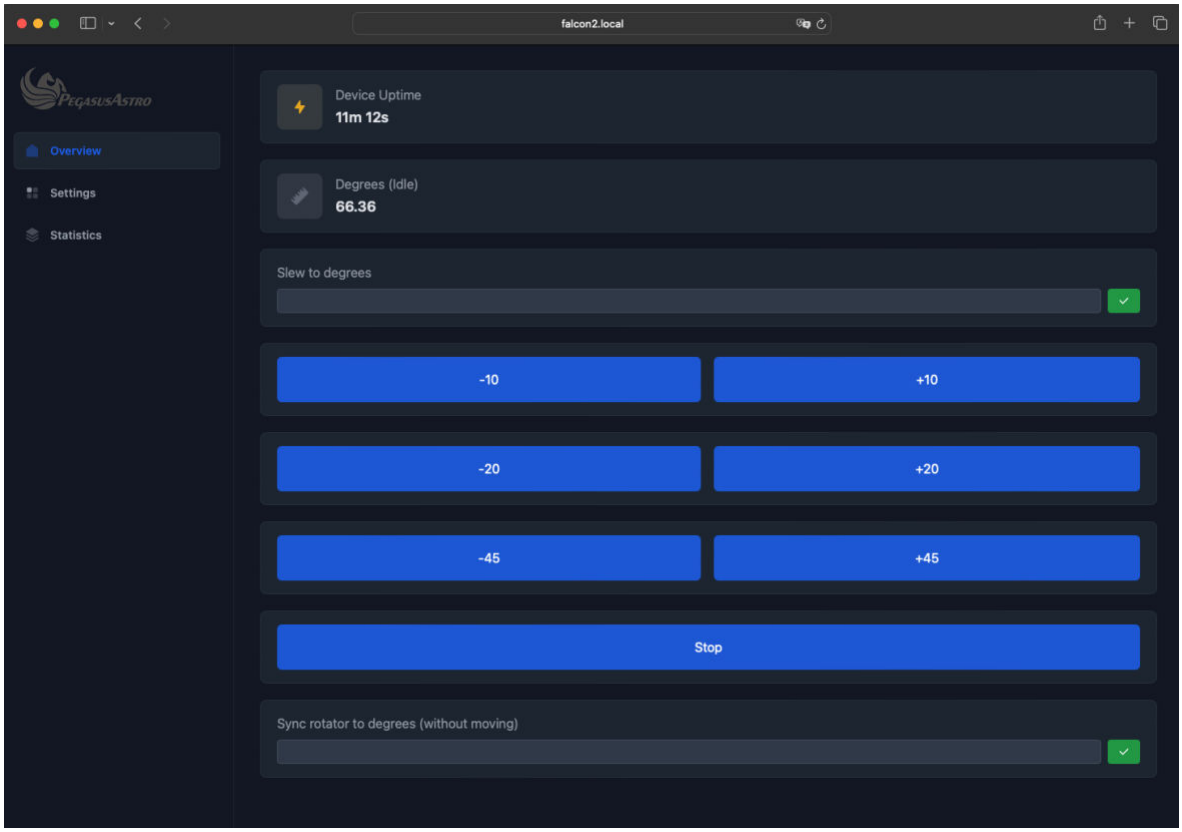
For security reasons, the web dashboard has a simple authentication process and requires a username and aa password upon login. The dashboard password is always the Wi-Fi hotspot password.

Default credentials are:

Username	`admin`
Password (always same as hotspot password)	`12345678`

This feature is operating system-independent and functions seamlessly alongside USB control.

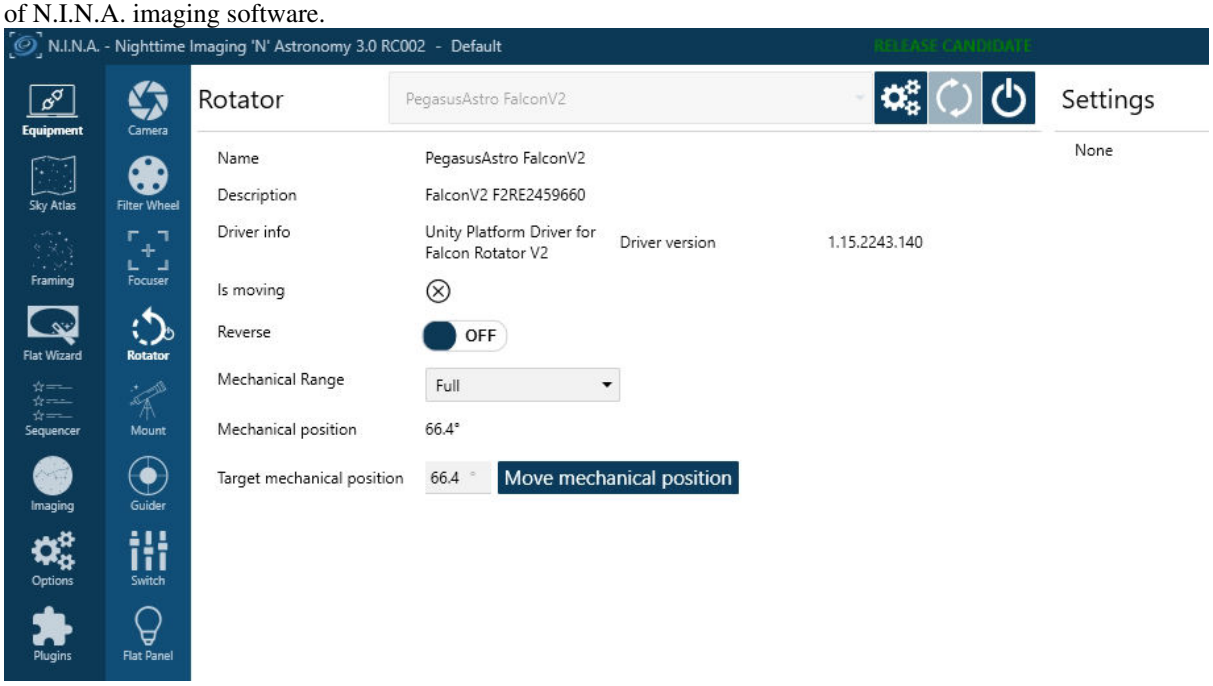
The web dashboard offers full control of the device, configuration of backlash, and motor position along with statistics and information about Falcon v2 Rotator.



ASCOM 6

Classic ASCOM 6 (32 and 64-bit compatible) drivers are bundled along with the Unity Platform.

The driver is named as "`PegasusAstro FalconV2`" and an example can be found in the below screenshot of N.I.N.A. imaging software.



ASCOM ALPACA

ASCOM Alpaca outshines classic ASCOM drivers with its platform independence, modern web standards, streamlined installation, remote control capabilities, extensibility, and open-source options. This ensures superior compatibility and user-friendly performance, making it the preferred choice for advanced astronomy applications.

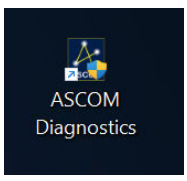
Falcon 2 Rotator comes equipped with an integrated web server that seamlessly communicates with Alpaca clients natively. This integration enhances the user experience by providing easy access to image field rotation control through ASCOM Alpaca but also monitoring from any device with a web browser such as a smartphone.

To use ASCOM Alpaca make sure that the Falcon 2 Rotator is connected to your WiFi network or you use its hotspot feature and you are connected to it.

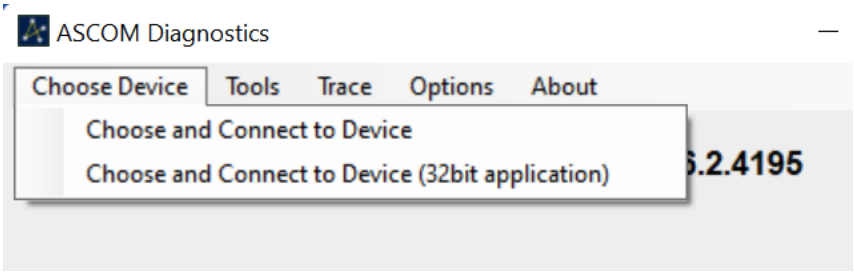
This is a one-off action and it is required to discover Falcon2 Rotator and automatically create the appropriate ASCOM Alpaca driver.

To do that:

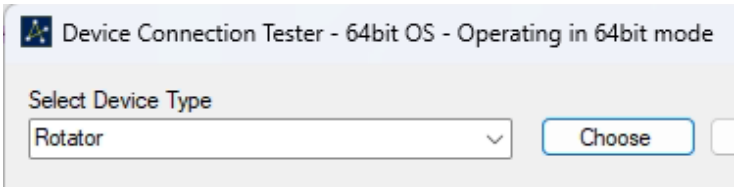
Open ASCOM Diagnostics (you should have this software once you install ASCOM)



Choose: Device -> Choose and Connect to Device

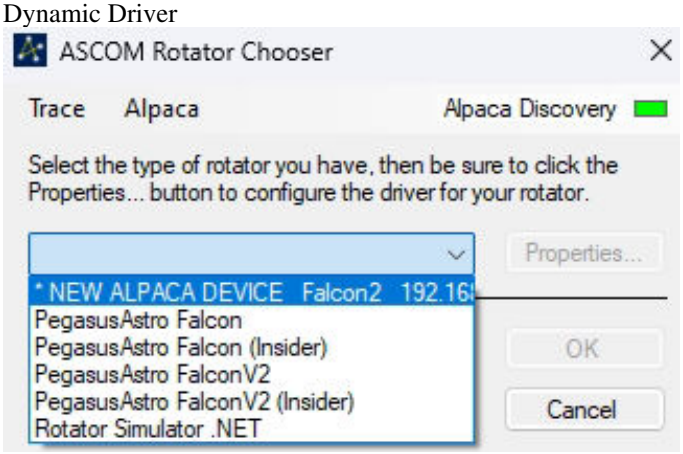


Select Rotator in the drop-down line of device types and press **Choose** button.

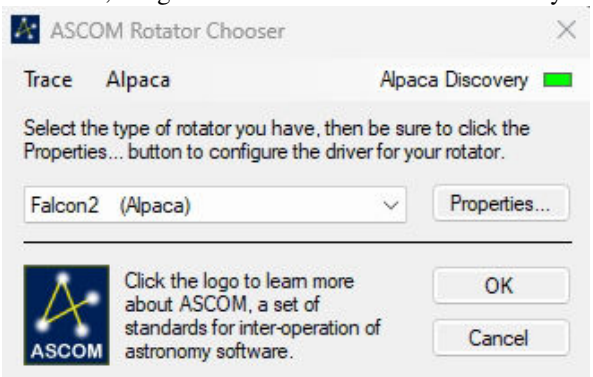


ASCOM Alpaca Discovery will flash on the top right and will be converted to a green rectangular meaning that a new alpaca device has been discovered.

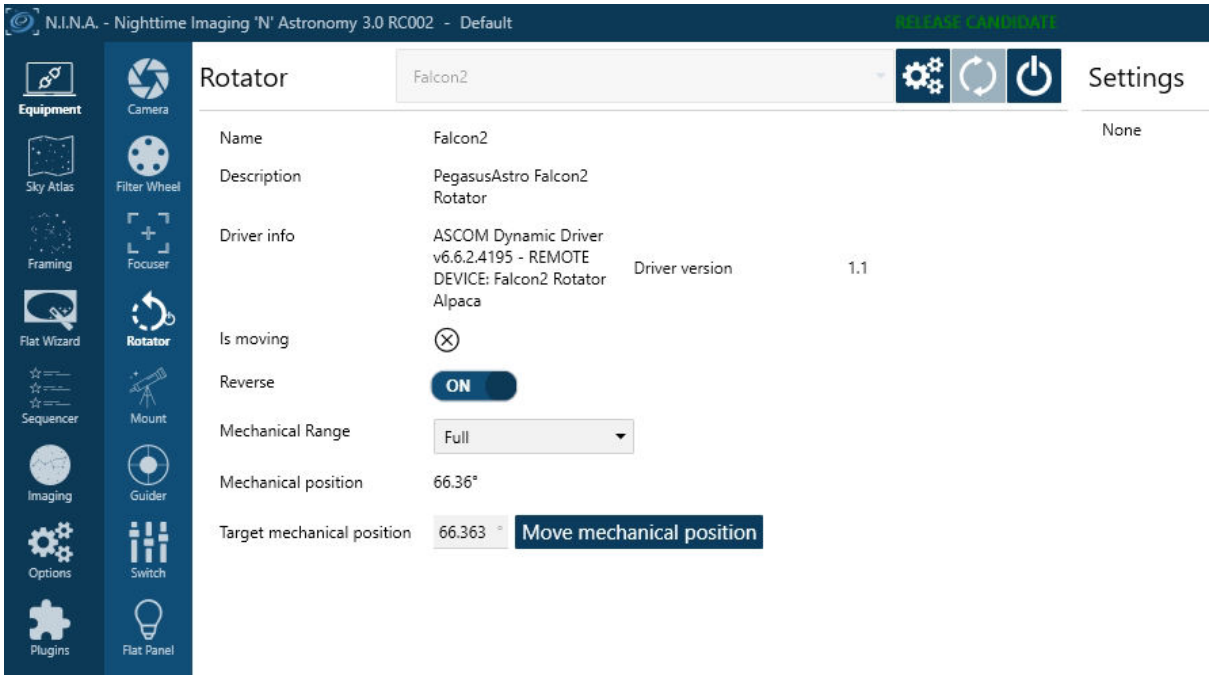
Select from the drop-down list the "`NEW ALPACA DEVICE Falcon2`" and press OK to create the Alpaca Dynamic Driver



After that, the generated driver will be automatically renamed to `Falcon2 (Alpaca)`.



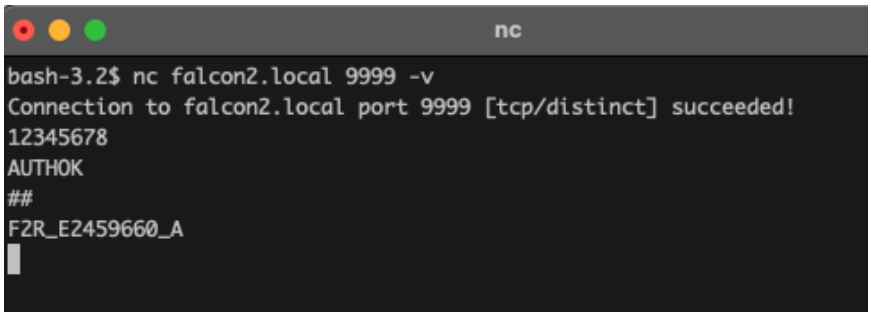
You are ready to go. You can use the **Falcon2** driver on your selected imaging software.
The below screenshot is an example from NINA using the Alpaca Falcon2 driver.



COMMAND SOCKET VIA TCP PORT

Falcon v2 Rotator spawns TCP port number 9999 and accepts the same command set like USB serial port.
The only difference is that you need to provide the access point password before any interaction with the device.

In the below example, we send the default password "`12345678`" and receive an `AUTHOK` reply.
After that, we can communicate and control the device. In case the password is wrong the Falcon 2 Rotator will close the connection.



For the complete command set please check the Falcon v2 Rotator product page at the PegasusAstro website.

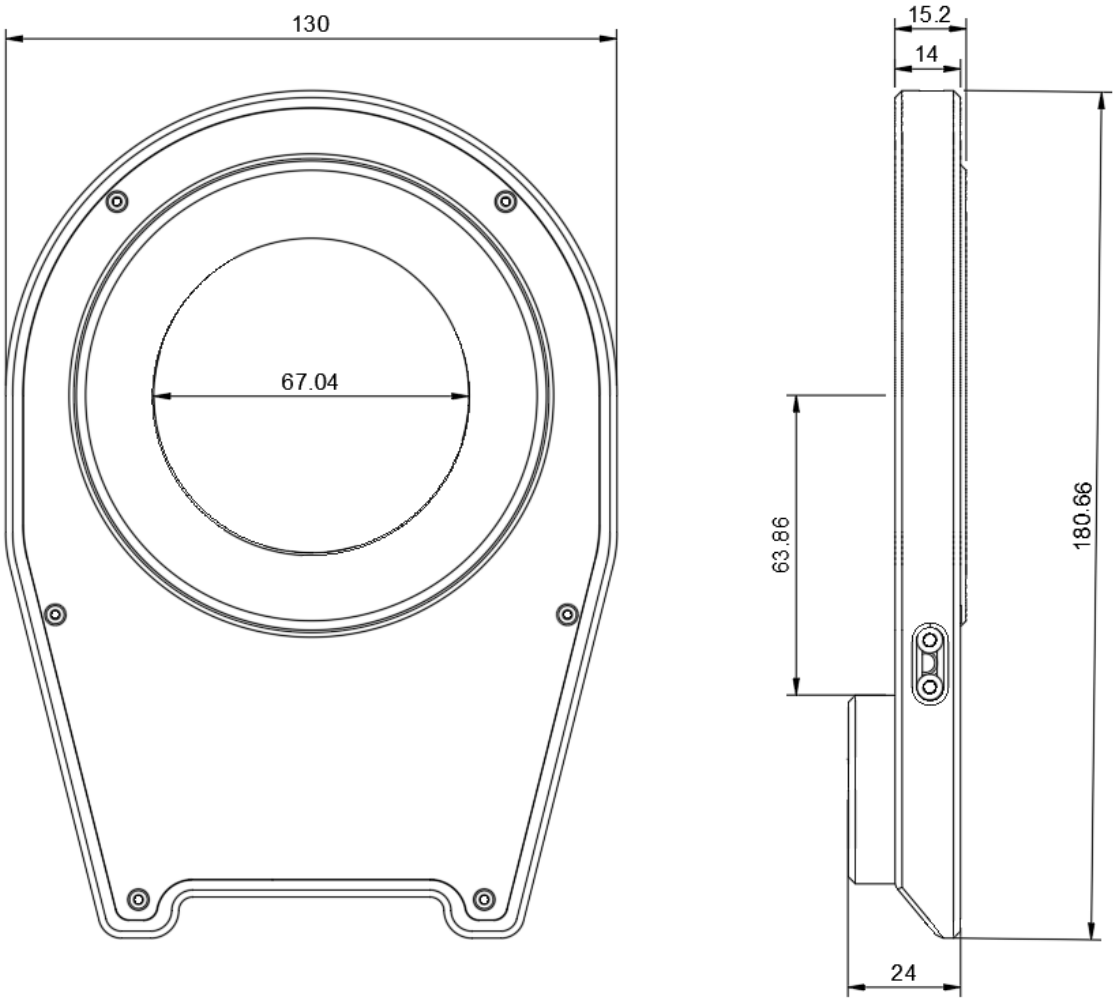
STANDALONE OPERATION

The Falcon v2 Rotator is engineered for convenient standalone operation right out of the box. With a simple USB-C cable connection setup and the Wi-Fi hotspot functionality already enabled by default, your preferred settings are ready for immediate use each time you power up the device.

UPGRADABLE FIRMWARE

The device offers firmware upgradeability, a valuable feature that not only ensures the flexibility to accommodate future enhancements but also allows for the seamless rectification of any potential bugs or issues.

DIMENSIONS



TECHNICAL SPECIFICATION

Physical Size	130 x 180 x 24 (mm)
Material	Anodised Aluminium
Clear Aperture	67mm, M68 thread / 1mm pitch
Steps per degree	Supports micro-stepping (x2,4,8,16,32) – Default to x4
Payload	6Kg / 13.2lbs
Telescope Side	M68
Camera Side	M68
Back Focus	15.2mm
Weight	0.7Kg / 1.54 lbs)
Connectivity	USB 2.0 with USB-C
Operating Power	5V, 0.7A

ENVIRONMENT

The device's electronic components and materials have undergone a meticulous selection process to ensure its robust performance across a wide range of environmental conditions. With an operational capability spanning from -30°C to +80°C, coupled with the ability to withstand humidity levels of up to 99%, this device has been engineered to excel even in the most challenging of climates.

WARRANTY

The device is covered by a comprehensive 2-year warranty. Within the warranty period, we offer free repair services to address any issues that may arise. Following the expiration of the warranty period, we continue to provide repair support and service, which will be subject to a fee. It is important to note that this warranty does not extend to damage resulting from abuse, misuse, accidental falls, or other incidents occurring after the purchase of the product. The customer is responsible for shipping the product to our designated return address for either repair or replacement. For more information please read: https://pegasusastro.com/returns

SUPPORT

For any issues, questions or feedback and recommendations please contact us via email: support@pegasusastro.com