SADDLE POWERBOX

PRODUCT MANUAL

Version *1.1*
09-Oct-2023

VERSION HISTORY

Version #	Implemented By	Revision Date	Reason
1.0	*Evans Souglakos*	*01/09/2023*	*Initial Document*
1.1	*Elias Dagioglou*	*11/10/2023*	*Minor syntax fixes*

TABLE OF CONTENTS

INTRODUCTION

1.1 PURPOSE

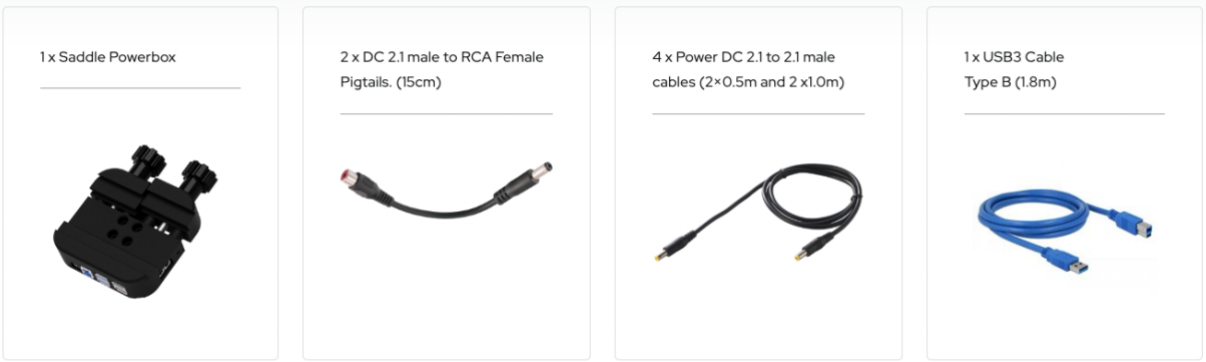
Thank you for purchasing the Pegasus Astro Saddle Powerbox. This device is a versatile and indispensable accessory for astronomy enthusiasts and astro-photographers alike. This innovative device seamlessly combines a telescope saddle and a power-data distribution hub, simplifying the setup and operation of astrophotography equipment.

The saddle securely holds your telescope while also providing multiple power outputs for all your astronomy gear, including cameras, mount, dew heaters, and more.

With its integrated USB ports, input voltage, current monitor, and robust build quality, the Pegasus Astro Saddle Powerbox not only ensures a tidy and organized telescope setup but also reduces cable clutter and minimizes the risk of accidental power interruptions during those crucial imaging sessions under the night sky. It's a must-have tool that enhances the convenience and efficiency of any astrophotography rig.

1.2 IN THE BOX

The box contains the Saddle Powerbox and a range of cables.



- Saddle Powerbox
- 2 x DC 2.1mm male to 2.1mm male power cables / 1 meter length.
- 2 x DC 2.1mm male to 2.1mm male power cables / 0.5-meter length.
- 2 x DC 2.1mm male to RCA female pigtails / 0.15-meter length.
- 1 x USB3 Type A to B / 1.8m length.
- 4 x M5 bolts (for the Saddle connection to mount adapter)

1.3 DEVICE CARE

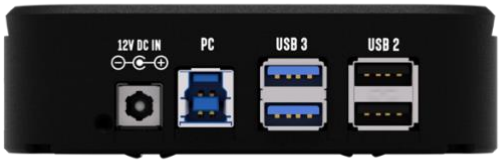
The device electronics are housed inside an aluminium black anodized enclosure. The enclosure is made from aircraft aluminum alloy type 6061 which provides very good corrosion resistance.

- 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 controller 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

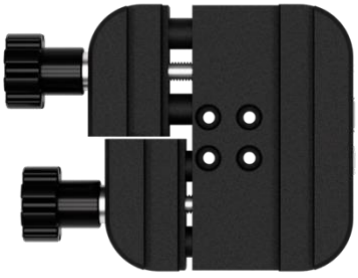


From left to right

- Power DC Input 2.1/5.5 socket.
- USB Type B connector to PC.
- Dual Stack USB3 Ports.
- Dual Stack USB2 Ports.

- Quad Outputs (12V). Single 10A channel.

- Dew heater outputs or stable 12V output channels. (Dual Channel)
- Temperature and relative humidity sensor pinhole.



Losmandy 3" and Vixen clamp mounting systems with two individual knobs.

1.5 FEATURE LIST

• **Versatile Connectivity:** Enjoy expandable functionality with 4 + 2 x 12V DC power outlets, catering to a wide range of equipment needs. A single channel allows simultaneous software-controlled activation of all four outputs, with the option to switch the Dew Heater outputs to a constant 12V supply.

• **Ample Power:** With a robust total distributed current of 10 amps (120W), this device provides abundant power to meet diverse equipment requirements.

• **Integrated USB Hub:** The built-in powered USB3 Hub boasts 2 x USB3 Ports and 2 x USB2 Ports, ensuring seamless connectivity for a variety of devices. USB Ports deliver up to 3 amps of power, ideal for Raspberry PI 3/4 requirements.

• **Environmental Sensing:** Monitor your observatory's surroundings with the integrated ambient temperature and humidity sensor, enhancing your environmental monitoring capabilities.

• **Precision Control:** Utilize 2 Channels of PWM Dew Heaters with 2.1mm outputs, offering software-controlled power level adjustments. Included cable adapters transition from DC 2.1 to RCA for added flexibility.

• **Automated Dew Control:** Experience hassle-free operation as Dew Heater outputs automatically adjust to maintain optimal conditions.

• **Comprehensive Metrics:** Monitor critical parameters with the integrated power, current, and input voltage meter.

• **Safety First:** Benefit from a range of protective features, including reverse polarity protection.

• **Versatile Control:** Enjoy flexible control options, from USB/PC-controlled operation to standalone functionality right out of the box.

• **Mount Compatibility:** Compatible with Losmandy and Vixen Clamps, accommodating various mounting configurations.

• **Extended Compatibility:** Explore expanded compatibility with available pucks designed for popular third-party mounts, including RST, EQ6, and AM5, ensuring a seamless integration experience.

SETUP AND OPERATION

I. Initial Connection:

1. **USB3 Cable**: Carefully insert the USB3 cable into the designated port on the Saddle Powerbox and connect the other end to your computer.
2. **Power Supply**: Connect the power supply, which may be either a battery or a compatible power pack, to the "12V DC IN" socket. We strongly recommend using our certified power supply capable of delivering DC 12V and 10 Amps. (**PEG-PSU-21**)

II. Device Boot-up:

3. Upon connecting the power supply, the device will commence its boot sequence. Observe the LED indicator, which will perform three rapid blinks before transitioning to a steady, solid red illumination. This confirms the successful loading of firmware and signifies that the device is now in full operational mode.

III. Default Device Configuration:

4. By default, the Saddle Powerbox is pre-configured to provide DC pass-through voltage to all four outputs. Additionally, the Dew Heater outputs are set to auto-dew mode by default.

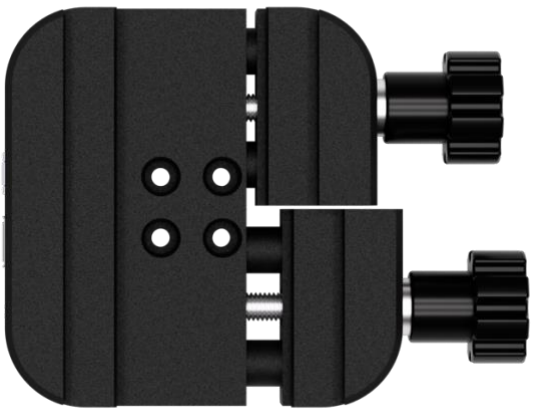
IV. Software Installation:

5. To establish seamless communication with the device, please visit our official website at pegasusastro.com. Download the Unity software package, which includes all requisite ASCOM drivers, to facilitate connectivity with the Saddle Powerbox.

DUAL SADDLE TYPE

The Saddle Powerbox is compatible with both Losmandy 3" and Vixen Clamp mounting systems, providing you with versatile options for securing and integrating your equipment.

Two separate and adjustable knobs provide you with precise control to securely fasten your telescope and gear, ensuring stability and ease of use.



POWER INPUT

The accepted voltage range for this device is limited to a precise window, falling within the parameters of **11 to 14.5 Volts**. Operating outside of this prescribed voltage range may result in malfunction or damage to the device, emphasizing the critical importance of adhering to this specified voltage range for safe and optimal performance.

To ensure the utmost reliability and longevity of the device, we strongly recommend utilizing our proprietary power supply unit (PSU), the PEG-PSU-21. This specialized PSU is designed to deliver up to 10 amperes of current, precisely tailored to meet the demands of the device within its specified voltage range of 11 to 14.5 volts. By using our PEG-PSU-21, you not only guarantee consistent and stable power delivery but also safeguard the device against potential voltage fluctuations, contributing to its overall performance and durability.

For optimal performance, we highly recommend utilizing a 12-14V LiFePo battery as your mobile power source. To ensure sufficient power delivery, it's essential to select a power supply capable of providing a minimum of 8 amps of current. In scenarios where your observatory demands peak power, such as during equipment operation or data collection, you may require up to 10 amps of current to meet these heightened power requirements. This power solution will not only enhance the efficiency of your observatory but also prolong the lifespan of your equipment by ensuring consistent and reliable power delivery.

- **Under no circumstance exceed DC 15.0V input as you will cause severe damage to the electronic board**

Safety is a paramount feature of this unit's design, as it incorporates robust reverse polarity protection. In the event of an accidental reversal of the power source polarity, the unit will automatically cut off power, preventing potential damage. To power on the controller, simply insert the 2.1mm DC plug into the corresponding DC power cable socket. Upon doing so, the controller will initiate its start-up sequence, and within moments, the status LED indicator will transition from three quick blinks to a solid and reassuring red glow, signalling that the unit is operational and ready for use.

It's essential to note that in addition to reverse polarity protection, the unit is equipped with a voltage safeguard feature. Any voltage exceeding the upper limit of 14.5 volts will trigger an automatic power cut-off to all outputs. This protection mechanism is in place to prevent any potential overvoltage situations, ensuring the safety of the device and the connected equipment. Thus, users should exercise caution and adhere to the specified voltage range to maintain uninterrupted and secure operation.

USB INPUT

The unit features a USB3 Type B port, designed to seamlessly accommodate the included 1.8-meter USB3 Type B cable for effortless PC connectivity, ensuring a hassle-free setup right out of the box.

It is strongly recommended to limit the **maximum USB3 cable length to 3 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 USB3 connectivity for your devices and peripherals.

While USB3 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 USB3 extenders with our products.

USB OUTPUTS

The device has a powered USB3.1 Hub and a USB2 Hub that enhances connectivity with 2 x USB3.1 SuperSpeed Ports and 2 x USB2 High-Speed Ports.

- *Notably, the USB3 ports maintain backward compatibility with the USB2 protocol.*

This versatile hub extends support to various data transfer speeds, encompassing Hi-Speed (HS), Full Speed (FS), and Low Speed (LS). SuperSpeed hub operate seamlessly in tandem with the USB 2.0 controller, ensuring that lightning-fast 5 Gbps SuperSpeed data transfers remain unaffected by any concurrent USB 2.0 traffic, guaranteeing efficient and uninterrupted data flow. (Both USB hubs support MTT - Multi Transaction Translator- operation).

It's essential to take note that each of the USB ports is capable of delivering a robust 2.5 amps of current, ensuring ample power for your connected devices. However, it's crucial to bear in mind that the total current draw from all USB ports combined should not surpass 3.5 amps. Exceeding this limit, the device will reboot as a protection measurement. This prudent consideration ensures the safe and efficient functioning of the USB ports and the connected peripherals.

QUAD POWER OUTPUT

The device is equipped with 4 x 12V outlets, offering ample power for your various equipment needs. Additionally, you have the flexibility to repurpose the 2 x Dew Heater outlets, converting them into continuous 12V power sources. The device employs robust MOSFET transistors to deliver reliable electrical current to your valuable equipment. It's important to note that the quad port can be switched on or off collectively, while the heater ports offer individual control. This single channel has the capacity to provide a substantial 10 amps of current to all ports, with the current being distributed evenly among the 4 x 12V outlets, ensuring steady and consistent power delivery.

- Voltage type Output Port 12V-13.8V DC unregulated.
- 4 x 2.1/5.5mm Power Sockets / Center Positive.

DEW OUTPUTS

Have precise control over your dew heaters with the device's dual dew heater outputs. These outputs offer fine-grained control over heater intensity, allowing you to tailor your equipment's performance to your exact needs. What's more, the device features an intelligent auto-dew function that can automatically adjust heater intensity by monitoring the onboard temperature and humidity sensor, ensuring optimal conditions for your setup.

Additionally, you have the flexibility to **re-purpose (via software) the 2 x Dew Heater outlets, converting them into continuous 12V power sources.**

For added convenience, the package includes a pair of handy cable adapters, converting from DC 2.1 to RCA, expanding your compatibility options. Each output is capable of delivering a substantial 5 amps of current, providing ample power for your dew heating requirements. This versatile system empowers you to maintain clear and dew-free conditions, enhancing your observatory or photography experience.

- Voltage type Output Port 12V-13.8V DC unregulated or PWM 1KHz frequency
- 2 x Pocket Sockets 2.1/5.5mm / Center Positive

These dew heater outputs offer PWM (Pulse Width Modulation) operation at a frequency of 1 KHz, granting you precise control over the duty cycle to fine-tune the heating intensity according to your specific needs. This PWM

capability enhances your ability to maintain optimal conditions for your equipment, ensuring that dew and moisture do not interfere with your observations or photography.

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.

AUTO-DEW CONTROL

The controller includes an advanced feature that enables automatic adjustment of heater power levels based on data from the environmental sensor, specifically the Dew Point reading. With the simple selection of the "Auto" option (factory default), you can entrust the Saddle Powerbox to autonomously determine the optimal activation and precise tuning of your dew heaters. This sophisticated capability streamlines the dew control process, enhancing your observatory or photography experience with efficiency and precision.

It's worth noting that you have the flexibility to control this feature directly from the software interface, allowing you to effortlessly enable or disable this automatic heater power adjustment capability as per your specific requirements and preferences.

STANDALONE OPERATION

The Saddle Powerbox is engineered for convenient standalone operation right out of the box. With a simple cable connection setup and the "autodew" functionality already enabled by default, your preferred settings are ready for immediate use each time you power up the device. Additionally, it's important to note that all ports are configured to deliver power by factory settings, ensuring a hassle-free and user-friendly experience from the moment you begin using the device.

BUILT-IN POWER SENSORS

The device is equipped with an integrated input voltmeter, meticulously designed to continuously monitor and track the incoming voltage. Additionally, it features a precise current meter that diligently oversees and records the overall power consumption, ensuring a comprehensive and real-time assessment of your electrical parameters.

It's important to note that in the event of an unexpected voltage surge or overvoltage condition, the Saddle PowerBox incorporates a safety mechanism that promptly cuts off power to the output sockets. This proactive measure is implemented to safeguard your valuable equipment from potential damage or harm caused by voltage irregularities.

BUILT-IN ENVIRONMENTAL SENSORS

The device comes equipped with built-in sensors that elevate its functionality to a new level. These sensors include temperature, humidity and dew point monitoring, ensuring that you can keep a close eye on environmental conditions during your observation sessions. This sensor integrated into the Saddle PowerBox offers advanced automation capabilities by continuously monitoring environmental conditions. The sensor plays a crucial role in maintaining optimal performance, particularly in scenarios where the formation of dew can impact your sensitive

equipment. The sensor actively calculates the dew point, and based on its real-time readings, it automatically adjusts the power levels of the dew heater. This dynamic control ensures that the dew heater operates efficiently, preventing the accumulation of moisture on your optics. By seamlessly adapting to changing conditions, the sensor not only safeguards equipment but also minimizes energy consumption, making it a valuable asset for precise and energy-efficient control.

LED INDICATION

Located on the right front side of the unit, a prominent red LED serves as a visual indicator, conveying the operational status of the device through distinct light patterns. This LED's functionality can be conveniently controlled via the software interface, granting you the flexibility to activate or deactivate it as needed to suit your preferences and operational requirements.

Permanently Light	Device is up and running.
Blinking Light	A power issue exists: In case of over-voltage (> 14.5V) controller cuts off all output ports. In case of under-voltage (< 11.0V) the LED light blinks only.
Light Off	Device not operational or LED switched off from software.

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

110mm x 110mm x 32mm

RECOMMENDATIONS

- We highly recommend the selection and use of high-quality, shorter-length USB cables to ensure optimal connectivity and data transfer reliability.
- Similarly, exercise caution when choosing power cables, favoring shorter and thicker variants to mitigate voltage drops. Extended, thin power cables may adversely affect the image quality of your camera (CCD or CMOS) or the tracking performance of your mount.
- Ensure the utilization of a robust DC input socket paired with a substantial power cable, featuring a diameter of 1.5mm for each pole. Vigilantly inspect for any gaps that could potentially lead to power interruptions.
- Avoid the practice of looping USB or power cables, as this can introduce communication issues and disrupt the seamless operation of your equipment.
- To prevent potential interference issues, it is advisable to avoid tightly bundling power and data cables together. USB 3.0 (USB 3.1 Gen 1) cables, in particular, can be susceptible to interference from nearby power cables. To maintain optimal signal integrity and minimize the risk of data transfer problems, it's recommended to keep power and data cables separated and routed in a way that minimizes their proximity to each other. This practice helps ensure the reliable performance of USB 3.0 devices and mitigates the risk of electrical noise or interference that can impact data transmission.
- If you find it necessary to employ a "step-up voltage converter" in the DC input, be mindful that a minimum of 6 amps is required to power all connected devices. While not recommended, if you choose

to use such converters, consider acquiring a reliable battery source or explore our certified 12V/10A power supply options for enhanced performance and peace of mind.

- USB 3.0 (and its successor, USB 3.1 Gen 1) can generate electromagnetic interference that may impact the performance of nearby Wi-Fi devices operating in the 2.4GHz frequency band. This interference occurs because USB 3.0 cables and connectors emit radio frequency interference (RFI) as a byproduct of their high-speed data transfer. To mitigate these interference issues and maintain good Wi-Fi quality:
  a. Use Shielded Cables: Consider using shielded USB 3.0 cables and connectors. Shielding can help contain RFI and reduce its impact on nearby devices.
  b. Increase Separation: Physically separate the USB 3.0 and Wi-Fi devices, or use longer cables to increase the distance between them. This can reduce the proximity of the sources of interference.
  c. Use 5GHz Wi-Fi: If possible, use a 5GHz Wi-Fi band for devices that require a stable and interference-free connection. The 5GHz band is less susceptible to interference from USB 3.0.

ASCOM SUPPORT

The Saddle Powerbox is fully ASCOM protocol-compliant, offering ASCOM **switches** and **observing conditions** ASCOM drivers. This compatibility ensures seamless integration with astronomy software and equipment, providing users with precision control and real-time monitoring capabilities for an enhanced astronomical experience.

Our Unity Platform package includes a comprehensive collection of ASCOM drivers, providing users with a complete and streamlined experience.

OPTIONAL PUCKS

The Saddle Powerbox can be seamlessly affixed to the NYX-101 mount without the need for additional components. For compatibility with other mount types, the use of an additional puck is necessary. At present, our product supports a range of mounts, which includes:

- Puck (PEG-PUCK-AM5) can be used to attach the Powerbox Saddle onto the ZWO-AM5 mount
- Puck (PEG-PUCK-EQ6R) can be used to attach the Powerbox Saddle onto Skywatcher NEQ6 and EQ6-R mounts.
- Puck (PEG-PUCK-RST) can be used to attach the Powerbox Saddle onto RST 135 and RST 300 mounts.

TECHNICAL SPECIFICATION

Dual Saddle	Supports Losmandy and Vixen plates
Supply Voltage	12V – 14V DC
Power Input and Output Connectors	5.5 x 2.1mm Barrel (center positive)
Connectivity	USB3 Type B Connector
4 x 12 Outputs	Maximum Current 10 Amps in total. 5.5 x 2.1mm Barrel (center positive) Software: Turns ON/OFF all ports.
2 Channel PWM Outputs	Maximum Current 4A each) Software: Duty Cycle % / OFF 5.5 x 2.1mm Barrel (center positive) Both can be tuned, via software, to constant 12V outputs and increase the 12V output count to six (6).
Built in temperature and humidity Sensor	0-100% humidity readings with 2-5% accuracy -40 to 80°C temperature readings ±0.5°C accuracy
Voltmeter	Measures 5 – 15V
Maximum Electric Current	10A

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 -20°C to +60°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 two years of warranty.

SUPPORT

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