NYX HAND-CONTROLLER

PRODUCT MANUAL

Version *1.1*
16-Jul-2024

VERSION HISTORY

Version #	Implemented By	Revision Date	Reason
1.0	*Evans Souglakos*	*01/06/2024*	*Initial Document*
1.1	*Evans Souglakos*	*16/07/2024*	*Add DateTime and Location section.*

TABLE OF CONTENTS

INTRODUCTION

Thank you for purchasing the Pegasus Astro NYX Hand-Controller.

1.1 PURPOSE

The NYX Hand-Controller is designed to manage NYX mounts with ease. Its comprehensive internal database grants access to over 30.000 celestial objects, enabling even novice astronomers to explore the night sky. The large, illuminated buttons and 2.4-inch OLED screen ensure effortless operation, even in the dark or while wearing gloves. The system assists in aligning with the North Pole and allows you to view the electronic leveller directly on the display, simplifying the alignment process. Additionally, the control software is network-updateable, ensuring you always have the latest features and enhancements.

1.2 IN THE BOX

The box contains the following items:

- NYX Hand-Controller.
- Silicon Protective Case (fitted to the hand-controller enclosure).
- Spiral Cable (RJ12 to RJ12).

1.3 DEVICE CARE

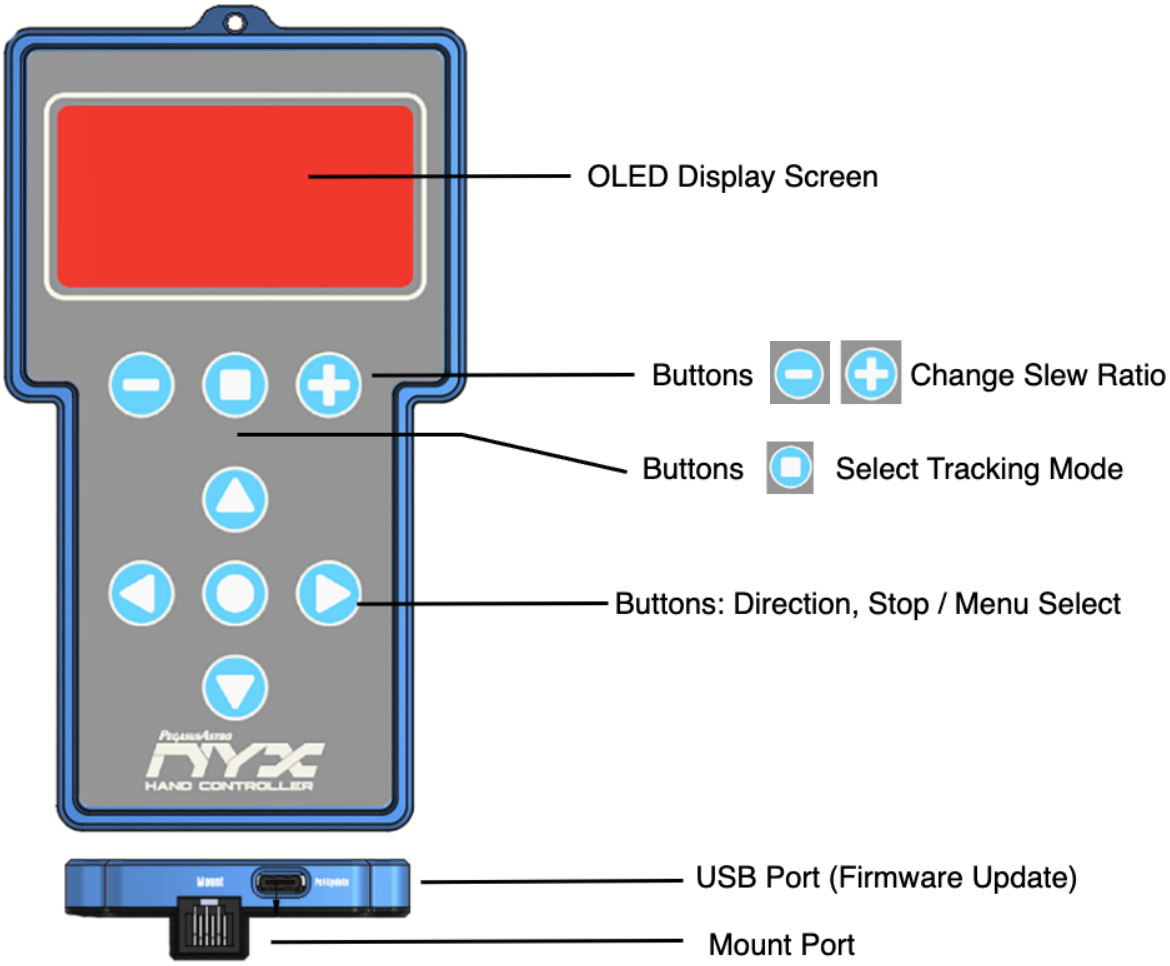
The device electronics are housed inside an aluminium blue and black anodized enclosure. The enclosure is made from aircraft aluminum alloy type 6061 which provides very good corrosion resistance.

- While the hand-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 hand-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



- **Display** is a 2.4-inch OLED screen with a vibrant red film display. The contrast and the brightness of the red backlight are adjustable. The screen brightness has been optimized to protect your vision during night sessions.
- **Buttons** are eight (8) in number and red illuminated. Upper buttons control mount slew rate and tracking. Lower arrow buttons control mount direction in both axes and menu access to different functionalities.
- **Mount Port** connects the hand-controller on a PegasusAstro NYX mount. The hand-controller can get power from this port.
- **USB-C port** communicates with a PC via a USB interface. This is required only to update firmware when it is available.

1.5 CONNECT TO NYX MOUNT

1. Connect the RJ12 cable to the NYX Hand-Controller and plug the other end into the EXT port of the NYX Mount.
2. The Hand-Controller display will light up and display the Pegasus logo for a few seconds.
3. Then, the device will show "**`Searching for NYX mount`**." Once the cable connection is established, the mount will be detected, and this message will disappear, displaying the NYX mount information below.

1.6 SET DATE AND TIME

When the mount boots up, it requires accurate date and time information to perform all GoTo slews and limit calculations. If the date and time are not set, for security reasons, to protect your equipment, the mount **will not allow you to slew on any axis**.

The time required is **standard time**, meaning it should not account for daylight savings. If the mount lacks proper date and time information, the hand-controller will prompt you to set the current date and time. Remember, if you are setting the time during daylight savings, set "`Local Time DST?`" to "`Yes`."

1.7 SET SITE LOCATION

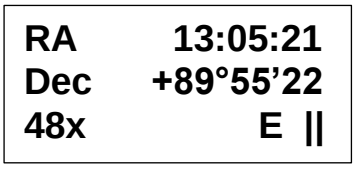
The mount retains the last site location and uses these coordinates when it boots up. If you need to change the site location, press the circular button for 2 seconds, then navigate to Settings -> Site -> Latitude, Longitude, and UTC offset.

The UTC offset is the number of hours needed to convert your local time to GMT (Greenwich Mean Time). For example, if you are in a location with GMT+2, you need to set the value to 2.

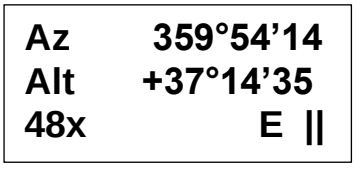
1.8 MOUNT INFORMATION

The mount displays information across four different pages. You can move between these pages by pressing the 'circle'  button.

The first page shows the Right Ascension and Declination coordinates. Additionally, on the bottom, you can view the tracking rate of both axes, the current side of the mount (East or West), and the mount status, which includes states such as mount idle, sidereal, solar, lunar tracking, at home, parked, etc.

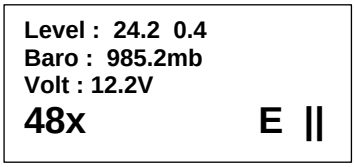


The second page displays the Azimuth and Altitude coordinates.



The third page shows Universal Time and Sidereal Time.

The fourth page provides information of the electronic leveller, barometric (absolute) pressure, and the input voltage of the mount.



1.9 SLEW MOUNT WITH DIRECTION KEYS

- Press  or  button to select the slew ratio of mount for both axes. You have the option to select: `2x, 4x, 8x, 20x, 48x, ½ Max, Max.`

  Note1 : Speed is represented as multiples of the Earth's rotation speed.
  Note2 : For NYX 101 Mount, Speed of ½ Max is 2.5 degrees and Max is 5 degrees per second.

- Use the arrow buttons () to move the mount in the desired direction. The up arrow moves the mount north, the down arrow moves it south, the left arrow moves it west, and the right arrow moves it east.

1.10 SELECT TRACKING MODE

- Press  button to select the tracking mode. You have the options of:

```
Stop
Sidereal
Solar
Lunar
```

Stop: Stops the mount.
Sidereal: Enables the mount to track celestial objects at the sidereal rate for observing the stars, deep sky objects, and planets.
Solar: Enables the mount to track at the solar rate for observing the Sun.
Lunar: Enables the mount to track at the lunar rate for observing the Moon.

- You can navigate between modes using the up and down arrow buttons. Once you have selected your desired mode, press the right  arrow button to confirm your choice. Note that pressing the left arrow button will exit the tracking mode menu without applying any changes.

1.11 MAIN MENU

You can access the main menu by pressing and holding the circle button  for 2 seconds.

Main Menu

Goto
Sync
Home
Align
Parking
Tracking
Settings

Move with up or down arrow  button and select your choice by clicking the right arrow  .

1.12 GOTO

Users can access several popular celestial object catalogs stored in the NYX Hand Controller and use it to control the telescope mount, enabling precise location of specific objects within the catalogs.

Warning: Never Look at the Sun Through a Telescope
Looking at the sun directly through a telescope can cause permanent eye damage or blindness. Always use a proper solar filter that covers the front of the telescope if you intend to observe the sun. Never use an eyepiece filter for solar observation, as it can crack under intense heat. Ensure that anyone using the telescope is aware of this danger. Safety first!

Available set of catalogs:

- Stars
  - Bright Stars
    Bright stars are catalogued by their asterism name and star catalog designation, for example, A Cygnus [Albireo].
  - Struve SST
    The Struve Double Star catalog includes information such as the positions and separations of double stars, as well as their magnitudes and observational details.
  - Carbon Stars
    This catalog focuses on carbon stars within our Milky Way galaxy, providing detailed information about their positions, magnitudes, spectral types, and other relevant data.
- Deep Sky Objects
  - Messier
  - Caldwell
  - Hershel 400
  - Collinder
  - NGC
  - IC
- Solar System
  Planets, Moon and Sun

- Filter Catalogs
- Coordinates
- Home

Note: When you select a target, the mount will begin slewing towards it. To cancel slewing, press any arrow button. Display will show "**Slew to target aborted**".

1.13 SYNC

Select this menu to sync the telescope to a known target. The catalog available is the same as before, but in this option, you sync the telescope to the selected target.

Select the target and when ready press the left arrow button. The mount position will be synced with the target.

1.14 HOME

- Goto Home
- Reset Home

Select **Goto Home** to move the mount to the home position in both axes.

Reset Home resets the current position of both axes to zero, essentially telling the mount that its current position is the home position.

Note: Reset Home should not be used as it resets the actual position of both axes to zero. You need to reset axes in case your mount has lots its position (e.g axes collapse due to very high load). Before using "Reset Home," ensure that both axes are already manually moved to the home position (NCP or SCP in case of sidereal mode) to avoid incorrect positioning.

1.15 ALIGN

Star alignment ensures that the mount operates effectively by establishing correct polar alignment (in EQ mode), enabling accurate tracking of celestial objects, reducing field rotation effects, and improving overall pointing accuracy for observational and imaging purposes.

You can align up to 9 stars.

- 1-Star Align
- 2-Star Align
- 3-Star Align
- 4-Star Align
- 5-Star Align
- 6-Star Align
- 7-Star Align
- 8-Star Align
- 9-Star Align

- Select “Align” and choose the number of stars you wish to use for alignment. The mount will guide you to each star sequentially. The hand control will generate a list of the bright stars within the selected horizontal region and prompt you to select a star from this list. The display will also indicate the star number for alignment, such as Star #1.
- After selection, mount will start slewing to the star.
- When mount reached the target, use the arrow keys to center the star in your field of view as precisely as possible. Once centered, press the circle button to proceed to the next star and repeat the process.
- After aligning all selected stars, the mount will create an alignment model based on your inputs.

Cancel Alignment

To cancel alignment, press the left button multiple times until you see “Alignment Aborted” on the display. Also, while the mount is slewing during alignment, you can press any arrow button key to stop the mount. You have the option to display the alignment model created from your inputs or to completely clear the model and redo the star alignment.

- `Show Model`
- `Clear Model`

Improving Alignment

Alignment accuracy can also be influenced by the selection of alignment stars. Choosing suitable alignment stars that are well-spaced and easily identifiable can enhance the overall accuracy of the alignment process.

We recommend performing a minimum 3-star alignment for good pointing accuracy, even if there is cone error in the telescope-mount system, especially beneficial for visual observation where precise polar alignment is not necessary. When choosing alignment stars:

- Spread the 3 alignment stars on both sides of the meridian.
- For alignment stars on the same side of the meridian, ensure their Right Ascension (R.A.) deviation is greater than 3 hours, and the absolute difference in their declinations is between 10 to 30 degrees ($10° < |Dec1 – Dec2| < 30°$).
- If cone error is suspected or uncertain, avoid selecting alignment stars with small declinations (close to the celestial equator).

For Alt-Azimuth mode:

- Align the altitude of the two alignment stars between 15 and 60 degrees, with an altitude deviation between 10 and 30 degrees.
- The azimuth deviation of the two alignment stars can range between 45 and 135 degrees, ideally close to 90 degrees for optimal alignment accuracy.

During the alignment process, it's crucial to center the alignment stars precisely at the center of the telescope's eyepiece field of view (FOV). Using a reticle eyepiece is recommended for accurate alignment. If a reticle eyepiece is not available, using an eyepiece with a shorter focal length can yield a smaller FOV, making it easier to center the star. Another technique is to slightly defocus the telescope to create a larger star disk in the FOV, which is easier to center than a sharp star. Throughout the alignment process, avoid changing or rotating the eyepiece and diagonal mirror to maintain stability and accuracy.

Polar Alignment

- `Polar Align`

Polar aligning an equatorial mount is crucial for several reasons.

Polar alignment ensures that the mount's right ascension (RA) axis is aligned with the Earth's rotational axis. This alignment allows the mount to track celestial objects accurately across the sky with minimal adjustments, maintaining the object's position in the field of view during long observations or astrophotography sessions. With a well-aligned equatorial mount, only the RA motor needs to run continuously to compensate for Earth's rotation, while the declination (DEC) motor makes occasional minor corrections.

A equatorial mount with GoTo capabilities rely on precise alignment to accurately locate and track objects in the sky. Proper polar alignment improves the accuracy of the mount's GoTo functionality, making it easier to find and observe specific celestial objects.

Note: Polar alignment is specific to equatorial mount mode, which needs to align with the Earth's rotational axis for accurate tracking. Alt-Azimith mount mode, on the other hand, moves in altitude (up and down) and azimuth (left and right) and does not require alignment with the Earth's axis.

To perform a Polar Alignment with the Hand-Controller.

1. Start by aligning the mount with three or more stars.
2. Then, GoTo a bright star near the NCP or SCP with a Declination between 50 and 80 degrees and center it.
3. Select the **Polar Align** option from Align Menu. The mount will then shift the star out of the center based on its alignment model.
4. Use the altitude and azimuth knobs of the mount to re-center the star.
5. Optionally, you can repeat this process one more time for greater accuracy.
6. After polar alignment**, remember to clear the model and redo the n-star alignment**, especially if you've adjusted the polaris position using the knobs. This ensures accurate tracking and alignment with celestial objects.

1.16 PARKING

- Park — Park the mount to last set park-position.
- Un-Park — Unpark mount from park position.
- Set-Park — Set a new park position where mount is.

1.17 TRACKING

- Stop — Stop Any Tracking.
- Sidereal — Set Sidereal Tracking.
- Solar — Set Solar Tracking.
- Lunar — Set Lunar Tracking.

1.18 SETTINGS

- Date/Time — Manually set Date and Time of mount.
- Site
  - Latitude — Set Site Latitude.
  - Longitude — Set Site Longitute.
  - UTC Offset — Set Site UTC Offset.
- Display
  - Turn Off — Turn Off Display.
  - Contrast — Set Display Contrast.
  - Dim Timeout — Set Dimmer Display interval in seconds.
  - Blank Timeout — Set Blank Display Timeout in minutes.
- Meridian Flip
  - Now — Perform a meridian flip.
  - Automatic — Set Automatic Meridial flip.
- Configuration
  - Goto Speed — Set Default GoTo speed.
    - Default Speed (5x)
    - Slower (3x)
    - Slowest (2.5x)
  - Limits
    - Horizon — Set Horizon Limit in degrees.
    - Overhead — Set Overhead Limit in degrees.
    - Meridian E — Set Meridian East in minutes.
    - Meridian W — Set Meridian West in minutes.
  - Mount Type
    - Equatorial — Set mount to Equatorial mode.
    - Altazimuth — Set mount to Altazimuth mode.
- Version — Shows Mount and Hand Controller firmware version.

1.19 UPDATING FIRMWARE

- Connect the USB-C cable to the hand-controller and your PC.
- Launch the Unity Platform software.
- If a firmware upgrade is available, a prompt will appear to update the device.
- If no upgrade is needed, the device will not be listed.

1.20 TECHNICAL SPECIFICATION

Type	**Value**
Supported Mounts	PegasusAstro NYX (EQ or ALTAZ mode)
Display	OLED Red Film, 2.4-inch with adjustable contrast and backlight.
Object Catalog	Messier, NGC, IC, Caldwell, Herschel 400. Collinder, Bright Stars, Struve SST, Carbon Stars, Planets.
Tracking Rate	Sidereal, Solar, Lunar
PC Connectivity	USB-C socket (USB2)
Mount Connectivity	RJ12 Connector (6P6C)
Operating Tempetature	-30 °C to +50 °C

1.21 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 +50°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.

1.22 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

1.23 SUPPORT

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

1.24 DISCLAIMER

The core functionality of the hand controller is powered by the Smart-Handcontroller component from the OnStep Open Source project.

1.25 MECHANICAL DRAWING