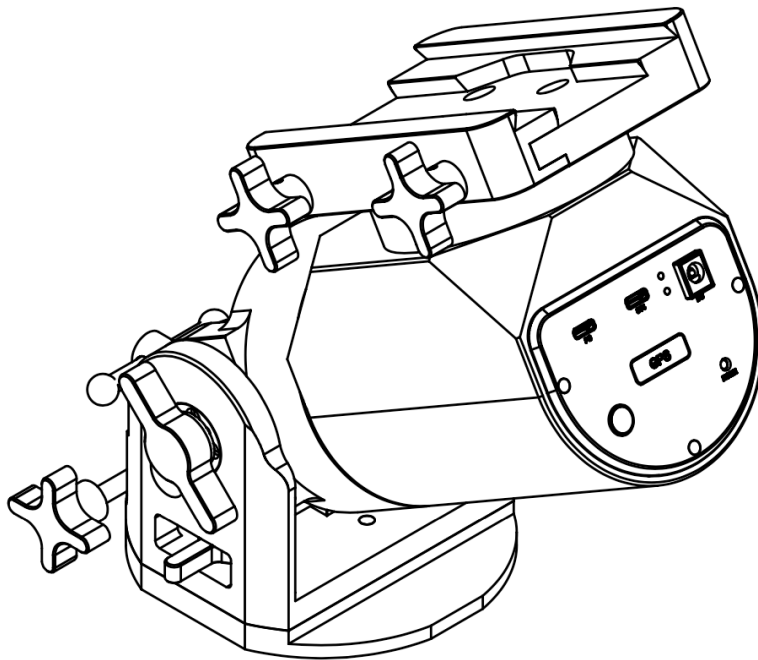


WARPDRIIVE WD-20 Harmonic Equatorial Mount

User Guide



Preface

Thank you for choosing the WARPDRIVE WD-20 Servo Direct-Drive Harmonic Equatorial Mount by WarpAstron. We are proud to offer you a high-precision equatorial mount for astrophotography that combines the advantages of Servo Direct-Drive technology with portability.

The WD-20 utilizes a revolutionary servo motor direct-drive harmonic reducer as its driving mechanism, with no additional reduction gears. It achieves superior guiding accuracy and is a truly low-backlash harmonic equatorial mount. Compared to traditional equatorial mounts using stepper motor drive systems, the servo motor drive offers consistent high precision, silent operation during tracking and GOTO, with maintenance-free.

This user guide is based on the default factory configuration. Therefore, the product you receive may differ from what is described in this guide. To ensure that you have the most up-to-date information, please visit our official website (www.warpastron.com) to access the latest user guide.

To ensure your safety when using this product and to prevent any unexpected property damage, it is crucial to thoroughly read this user guide before your initial use. Make sure you have a complete understanding of the safety precautions and standard operations for using the product.

Revision Log

Version	Date	Revisions Content
V1.0	2024.2	Initial Release
V1.1	2024.2	Update cautions for operating with ASIAIR

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1 Safety Guidelines

In order to make safety precautions more easily understandable to readers, this user guide will use the following symbols and informational cues to explain risks of different categories and levels:

WARNING

Failure to adhere to safety instructions of this nature may result in personal injury to the user. Users are strongly urged to comply with such instructions and avoid prohibited actions.

CAUTION

Failure to adhere to safety instructions of this nature may result in equipment damage or other property losses. Users are strongly urged to comply with such instructions and avoid prohibited actions.

NOTICE

Users should take note of and must comply with the requirements outlined for product use. Users are strongly encouraged to follow these instructions and requirements.

The various safety precautions in this user guide are designed to protect your personal safety and property. Users should read and fully understand the safety precautions before engaging in any operations.

Below is a safety summary from this user guide that you should adhere to during the initial installation and use of the equatorial mount:

 WARNING

- Do not touch power cables while your hands are wet, as it may lead to electric shock.
- Do not pull or tug on the power cord, ensure that the power cord is insulated and in good condition before use to prevent electrical short circuits, fires, or electric shock.
- When using a battery as the power source, make sure to use the DC plug with the correct polarity to avoid incidents such as short-circuiting and battery combustion.
- When transporting or installing the equatorial mount, ensure a firm and secure grip to prevent accidental drops, which could lead to injuries to your feet or other parts of your body.
- When adjusting the angles or installing the equatorial mount, avoid sudden, forceful movements to prevent inadvertent contact with protruding components or edges that could result in scratches or injuries. It is advisable to wear gloves when operating in cold conditions.
- Keep children away from the equatorial mount and its related accessories. This product contains small components that could pose a choking hazard if accidentally swallowed by children. Children under the age of 12 should not operate this product. Minors under the age of 18 could operate and use this product under the guidance of a guardian or adult supervisor.

 CAUTION

- If you encounter any unusual noises or smoke from the equipment during use, immediately disconnect the power and contact customer support.
- Do not attempt to disassemble the equatorial mount on your own, as it may result in product damage or void the warranty.
- Handle the equatorial mount with care to avoid impact during transportation or handling.
- Before installing the mount, ensure that the compatible tripod is securely fastened on a flat and sturdy surface to prevent the mount from falling due to an unstable center of gravity.
- Place the equatorial mount stably on a flat surface. If the mount is placed on the base at an altitude other than 90 degrees, it may accidentally tip over and become damaged.

2 Product Overview

2.1 Introduction

This product is an equatorial mount that utilizes a harmonic drive as its reduction mechanism. It can be used as a German equatorial mount or an alt-azimuth mount for precise tracking and GOTO functionality in astronomical observation, astrophotography, and visual observation of celestial objects. This equatorial mount employs servo motor direct-drive technology as a revolutionary driving mechanism, offering advantages such as low backlash, high precision, and portability when compared to traditional equatorial mounts with stepper motors and multi-stage reduction mechanisms.

Key Features

High-precision servo motor direct drive

- The Right Ascension (RA) and Declination (DEC) axes are driven by servo motors equipped with high-precision encoders. This configuration ensures high positioning accuracy, silent operation, and eliminates drawbacks such as vibration and stepping that can occur with traditional stepper motor-driven systems.
- The motor shafts are rigidly connected to the harmonic input for direct drive, without the need for additional belts or planetary gear reduction mechanisms. This design eliminates issues associated with belt aging, tension variations, and backlash problems that can occur with planetary gear reducers, ensuring consistent precision.

High Load Capacity

- Standard load capacity up to 50NM without using a counterweight.

Lightweight and Portable

- The equatorial mount itself has a weight of 5.4 kg, including the dovetail plate, supporting both Vixen and Losmandy styles.

GPS

- Built-in GPS Positioning Module, Supports Multiple Positioning Systems such as GPS and BeiDou.
- Automatic Date, Time, and Location Setting at Startup

Full Altitude Adjustment

- Supports Full 0° to 90° altitude adjustment with 30° range per step for coarse adjustment.
- Alt-azimuth mode at 90° altitude, mode switching via Hand Controller .

2.2 Specifications

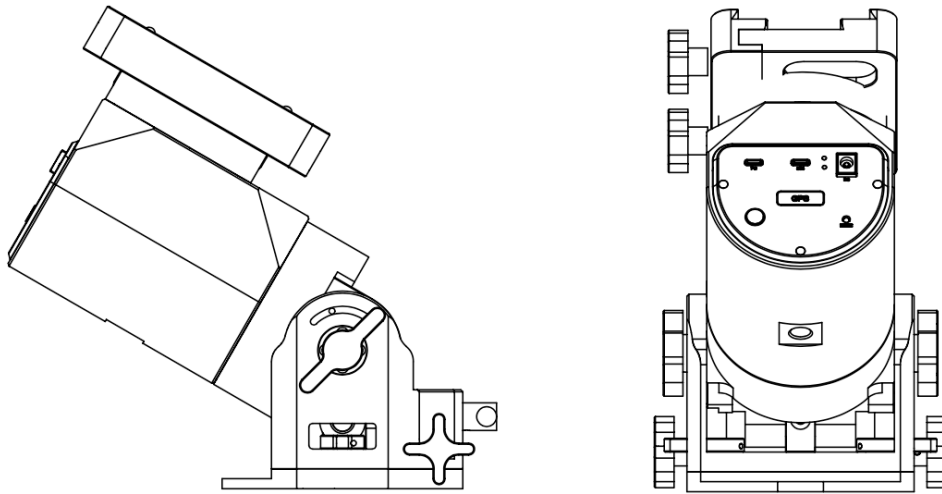


Figure 2-1: Equatorial Mount Diagram

Table 2-1: Specifications

Project	Description
Equatorial Mount Type	German Equatorial Mount / Altazimuth Mount
Reducer	RA: 20-120 Harmonic Drive DEC: 17-100 Harmonic Drive
Motor Type	Brushless DC Servo Motor (BLDC)
Transmission Mode	Motor Shaft Direct Drive
Maximum Load ₁	22kg (Without counterweight) / 30kg (With counterweight)
Weight	5.4 kg (Including dovetail plate)
Material	6061 Aluminum Alloy, 304 Stainless Steel, Acrylonitrile Butadiene Styrene(ABS)
Surface Treatment	Anodizing and Anti-Rust Coating
Brake Protection	Right Ascension Axis Electromagnetic Brake (Brake Torque ~45Nm)
Adjustment Range	Altitude: 0 to 90 degrees Altitude Fine Adjustment: 30 degrees Azimuth Fine Adjustment: +/- 8 degrees
Control System	OnStep
Hand Controller ₂	Wire/Wireless, Rechargeable Battery, Charging Power 5V 1A
Communication Protocol	ASCOM, INDI, LX200 etc.
Communication Interface	USB Type-C
Guiding Interface	ST4 (USB Type-C)

Wireless Communication ₃	Bluetooth/WIFI
Power Supply	12V 5A 5.5*2.1mm
Power Consumption	Standby 0.3A, GOTO 1~2A
Electrical Protection	Overcurrent Protection, Surge Protection

Note:

1. The standard load of 20kg without a counterweight is based on the standard torque load on the Right Ascension (RA) axis harmonic reducer, measured 25cm from the RA axis. Users should consider to use counterweights in a manner that ensures the stability of the tripod, taking into account the equipment's center of gravity, to avoid compromising guiding accuracy or the risk of tipping due to the absence of a counterweight.
2. The default factory mode of the hand controller may vary depending on the sales region or customer customization. The default mode for international customers is wire.
3. Bluetooth and WiFi wireless communication cannot operate simultaneously. The default factory setting is WiFi wireless communication.

Parts List

Here is the parts list for the factory packaging:

Table 2-2 Parts List

Serial Number	Name	Quantity
1	WD-20 Harmonic Equatorial Mount	1
2	Smart Hand Controller (SHC)	1
3	Power Cord (DC 5.5*2.1mm)	1
4	USB Type-A to C Data Cable	1
5	4mm Allen Wrench	1
6	Transport Aluminum Case	1
7	USB Type-C to C Cable for SHC	1

Note: This user guide may not be updated when there are changes in the factory configuration. If the product you receive does not match the list above, please refer to the order configuration information at the time of purchase or contact the sales representative for your order.

The various parts of the mount are labeled as follows:

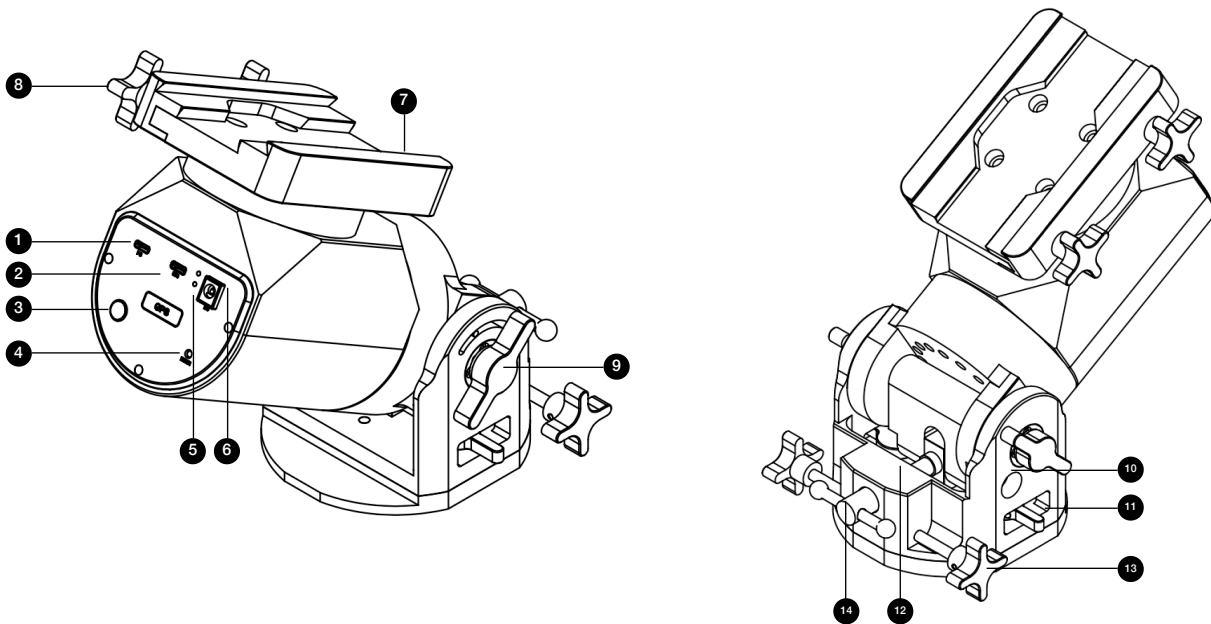


Figure 2-2 Parts Diagram

Table 2-3 Parts description

Serial Number	Name	Serial Number	Name
1	Computer Data Socket (USB Type-C)	8	Plate Locking Knobs*2
2	ST-4 Guiding / SHC WireSocket (USB Type-C)	9	Altitude Locking Knob*2
3	Power Switch	10	Altitude Range Adjustment Screw
4	Homing Button	11	Azimuth Locking Knob*2
5	Power Indicator Light (Red) Status Indicator Light (Blue)	12	Horizontal Bubble*2
6	DC Power Connector	13	Azimuth Fine Adjustment Knob*2
7	Dovetail Plate (Vixen/Losmandy)	14	Altitude Fine Adjustment Knob

3 Installation and Usage

3.1 Connect mount to the Tripod/Pier Extension.

The tripod serves as the supporting structure for the equatorial mount and can include options such as photography extendable tripods, specialized astronomy tripods, or piers. Pier extension are used to increase the mounting height of the equatorial mount relative to the tripod, reducing the risk of collisions between the equatorial mount and the tripod during its rotation, especially when carrying OTA.

WARNING

- The equatorial mount can cause injury if it falls due to its own weight. Please be cautious and ensure a firm grip when transporting and securely installing the equatorial mount to prevent it from slipping out of your hands.
- When transporting and installing the equatorial mount, be careful to avoid crushing or injuring your fingers or hands.

CAUTION

- Do not forcefully strike or press the equipment. If you encounter resistance during installation, please verify if any interference or mismatches existed, and avoid using excessive force.
- Do not install the equatorial mount on an unstable or uneven surface, as it may lead to the equatorial mount or tripod tipping over, causing equipment damage.
- Do not use a tripod that has threads incompatible with the equatorial mount's mounting mechanism.
- Do not place the equatorial mount on the tripod or an unstable surface without completing the installation and securing it properly. This will prevent the equatorial mount from being in an upright position and potentially tipping over, causing equipment damage.

NOTICE

- Please use screws and tools that are compatible with the installation thread.
- When the equatorial mount's load exceeds 10kg or when using a pier extension, it is advisable to prioritize the M6 threaded connection method for improved stability.
- The threaded length of the locking screws should not exceed 10mm to avoid issues such as inhibiting azimuth rotation or damaging the equatorial mount due to excessive length.

The equatorial mount baseplate connection, as shown in Figure 2-3, has two types of threaded connection methods.:

- The 3/8-inch thread is located at the center of the baseplate and is primarily used for usually attaching a photographic tripod.
- The three M6 threads are evenly spaced at 120-degree intervals and are primarily used for connecting a pier extension or a specialized astronomical tripod.

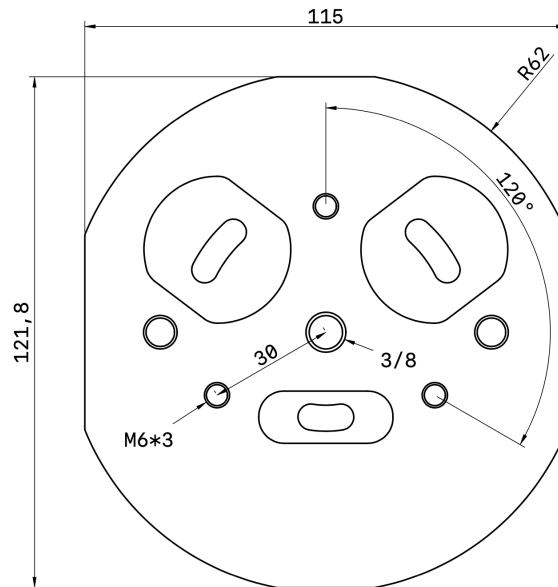


Figure 2-3: Mount Base Plate

The following is an introduction to the installation steps for equatorial mounts:

- The mount is directly connected to the tripod.
- The mount is connected to the tripod via an extension pillar.

Installation Method 1: Direct Connection of the Mount to the Tripod

A Place the tripod on a level surface and adjust the tripod to make it level.

B Adjust the mount to the vertical position at an **Altitude of 90 degrees** and place it on the tripod's mounting plate. If the mount is not in a perfectly vertical position, ensure that you hold it steady with your hand during the installation process to prevent it from falling.

C Use either a **3/8-inch screw** or **three M6** screws to connect the mount and the tripod, and tighten them securely.

D After tightening, perform a thorough check to confirm that the mount is securely fastened and doesn't have any wobbling or movement. This completes the installation of the mount.

Installation Method 2: Connecting the Mount to the Tripod via an Extension Pillar

A Place the tripod on a level surface and adjust the tripod to make it level.

B Place the extension pillar on the tripod's mounting plate, and use **three M6 screws** to connect the extension pillar and the tripod, tightening them securely.

C Adjust the mount to the vertical position at a **altitude of 90 degrees** and place it on the upper plate of the extension pillar. If the mount is not in a perfectly vertical position, ensure that you hold it steady with your hand during the installation process to prevent it from falling.

D Use **three M6 screws** to connect the mount to the extension pillar and tighten them securely.

E After tightening, perform a thorough check to confirm that the mount, extension pillar, and tripod are all securely fastened with no wobbling or movement. This completes the installation of the mount.

3.2 Altitude Range Adjustment

The adjustment of the mount's altitude angle is divided into two steps: Altitude Angle Range Adjustment and Altitude Angle Fine Adjustment. The Altitude Angle Fine Adjustment has a range of 15 degrees. Therefore, when adjusting the altitude angle, you should first set the Altitude Angle Range to match your approximate location within a 30-degree range. Then, proceed to the Altitude Angle Fine Adjustment for precise alignment.

CAUTION

- Do not place the mount that is not in a vertical position at 90 degrees on its base as the contact surface on a tabletop or any other location. An equatorial mount that is not at a 90-degree angle may tip over easily due to an unstable center of gravity.
- Please avoid from adjusting the altitude angle range while your telescope equipment is still mounted on the mount. Prior to making any altitude angle adjustments, be sure to remove your telescope to avoid any potential damage to the equipment.
- Be sure to securely tighten the altitude adjustment locking knobs to their maximum extent after completing the altitude angle range adjustment. This will prevent any potential equipment wobbling or slipping due to insufficient locking.
- Please use a matching or compatible manual wrench to adjust the altitude adjustment gear screws. Avoid using power tools or tools with incompatible specifications, as they may damage the equipment.

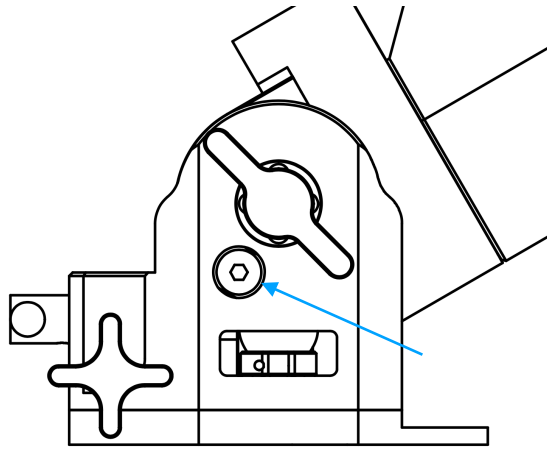
NOTICE

- The mount is shipped with a altitude angle of 30~50 degrees in its factory aluminum case. Therefore, it's essential to adjust the altitude angle range before using it for the first time. This adjustment ensures that the equatorial mount is set to the appropriate altitude for your observing location and prevents any issues during operation.
- After loosening the altitude adjustment gear screws, adjust them to the appropriate angle and promptly tighten them. Never move or transport the equatorial mount without securing these screws in place.
- The mount's altitude adjustment range is 30 degrees per position.

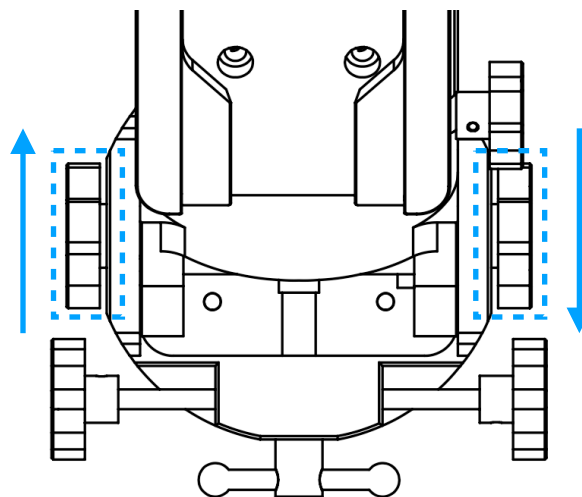
Operation Steps

A Confirm that the equatorial mount is securely installed on the tripod or attached to the extension pillar, with no risk of tipping over.

B Rotate the altitude adjustment fine-tuning knob to align the **range adjustment screw** (as indicated by the arrow in the diagram below) completely within the view of the adjustment hole.



C Rotate counterclockwise to loosen the altitude locking knobs on both sides of the equatorial mount (rotate the two knobs in opposite directions, as indicated by the arrows in the diagram below).



D Support the bottom of the mount body by hand to prevent it from falling, and use a **4mm hex wrench** to rotate the **range adjustment screw** counterclockwise until it is completely loosened.

E After loosening the **range adjustment screw**, manually adjust the mount body to the appropriate altitude position. Then, use the 4mm hex wrench to rotate the screw clockwise until it is fully tightened into the thread.

F Once you have ensured that the **range adjustment screw** is fully tightened, you can release your hand from supporting the mount. Then, rotate the altitude locking knobs on both sides of the mount clockwise until they are fully locked (rotate the two knobs in opposite directions).

3.3 Altitude Fine Adjustment

Altitude Fine Adjustment is used to make finer adjustments to the altitude of the polar axis after completing the altitude range adjustment.

NOTICE

- When performing altitude fine adjustments within a small range (± 5 degrees), there is no need to loosen the altitude locking knobs. However, if you need to make larger altitude adjustments, it is advisable to loosen the altitude locking knobs before making the adjustments in order to reduce wear on the screw.
- Clockwise rotation of the altitude fine adjustment knob increases the altitude, while counterclockwise rotation decreases the altitude.

Operating Steps

A Confirm the range of angles that need fine adjustment. If the angle adjustment required is greater than 5 degrees, it is advisable to first loosen the altitude locking knobs.

B Rotate the **altitude fine adjustment knob** clockwise or counterclockwise to the desired angle. One full rotation of the knob corresponds to an altitude adjustment of 1.5 degrees.

3.4 Azimuth Fine Adjustment.

The equatorial mount's azimuth locking knob and azimuth fine adjustment knob are used to precisely adjust the polar axis. They are located on both sides of the equatorial mount.

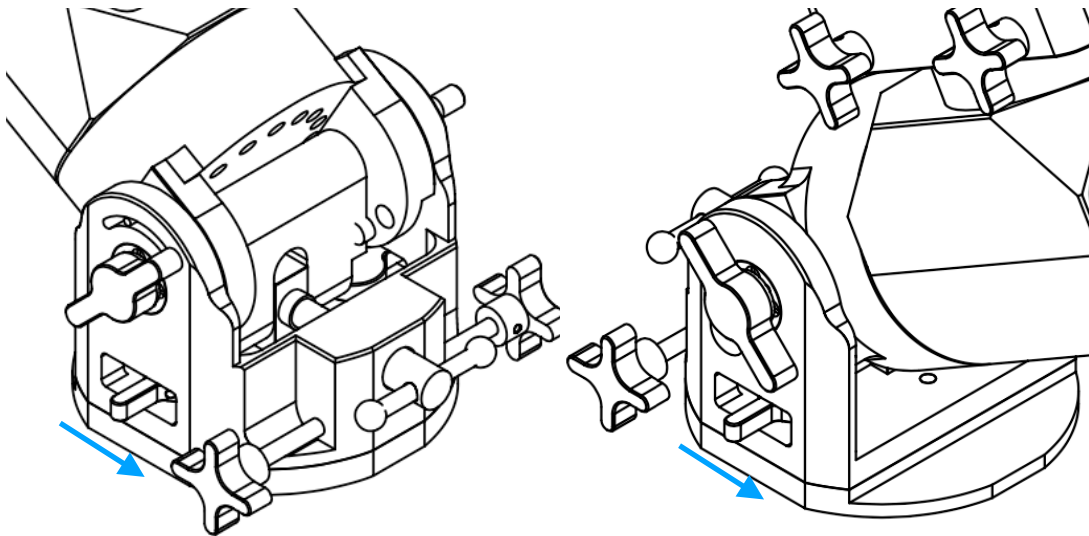
NOTICE

- The azimuth fine adjustment range is ± 8 degrees. Before performing adjustment, start by roughly aligning the tripod to the NCP or SCP that depending on your hemisphere.
- Do not fully loosen or unscrew the azimuth locking knob, as this may result in the equatorial mount losing its stability, potentially causing tilting or significant polar alignment errors

Operating Steps

A The azimuth locking knob is in the retracted position. Lift the azimuth locking knob upward (as indicated by the arrow in the diagram) and then rotate it to a convenient angle for operation, then release the knob to allow it to retract.

B Rotate the azimuth locking knobs on both sides of the mount counterclockwise to slightly loosen the locking.



C Rotate the azimuth fine adjustment knob by counterclockwise on the side where you intend to orient the equatorial mount. Then, rotate the azimuth fine adjustment knob clockwise on the opposite, the mount will rotate to your desired direction. One full rotation of the fine adjustment knob corresponds to about 1.5 degree rotation in azimuth.

- When you need to **turn the mount to the left**, loosen the **azimuth fine adjustment knob** on the left side counterclockwise, and then tighten the **azimuth fine adjustment knob** on the right side clockwise.
- When you need to **turn the mount to the right**, loosen the **azimuth fine adjustment knob** on the right side counterclockwise, and then tighten the **azimuth fine adjustment knob** on the left side clockwise.

D After adjusting the mount to the desired azimuth, rotate the azimuth locking knobs on both sides clockwise to securely lock them in place, completing the azimuthal fine adjustment.

3.5 Telescope (OTA) Installation

This chapter will introduce the operational steps for installing the telescope on the equatorial mount.

WARNING

- Telescopes, cameras, and other equipment can be heavy, so when handling and installing them, be careful to avoid dropping them to prevent injury or damage your equipment.

CAUTION

- Before installing equipment such as a telescope, it is essential to ensure that its weight within the permissible range of the equatorial mount. Overloading (load torque > 60Nm) can potentially lead to damage to the mount and other equipment.
- The equatorial mount's electromagnetic brake can provide a braking torque of ~45Nm in the event of a power failure. If the installed telescope equipment exerts a torque exceeding 45Nm, there is a risk of brake failure and potential equipment drop. **If you still need to use the equatorial mount with a load torque exceeding 45Nm, please ensure that you power on the equatorial mount before mounting the telescope. Also, make sure that the equatorial mount remains powered on while the load is in place, until the load is removed from the equatorial mount.**
- Before removing your hand from the mount and ensuring that the telescope equipment is securely fastened to the mount, to prevent the telescope equipment from falling and getting damaged due to improper locking.
- When the mount is in operation, any collision between the telescope equipment and the equatorial mount can result in severe damage to both the mount and the equipment. Before starting the rotation of the equatorial mount, it is crucial to inspect whether there are any potential collision position for the telescope and its mounted equipment during movement or rotation. Take preventive measures such as using an extension pillar, adjusting the equipments' position, and setting limits in the mount system to mitigate the risk of collisions.
- Please ensure that the total combined load weight on the equatorial mount must not exceed 35kg to avoid damaging the harmonic drive reducer bearings.

NOTICE

- When installing telescope, it is essential to consider the center of gravity and other installation requirements specified by the manufacturers of the telescope and related equipment.
- Depending on the dovetail plate type compatible with the telescope, choose either Losmandy (wide) or Vixen (narrow) for the connection. Before installation, make sure that the dovetail plate you are using is of the standard Losmandy or Vixen size.
- The equatorial mount supports a standard M12 counterweight shaft.
- For large reflector or catadioptric telescopes, due to their complex shapes and center of gravity with additional equipment, it is crucial to accurately assess the mount's load capacity before use.

Operating Steps

Part I Calculate and Assess The Load of Telescope Equipment

To ensure the accuracy of equatorial mount operation and avoid accelerated wear or damage to its mechanical components due to overloading, it is important to calculate the weight of the load that the equatorial mount is intended to carry and assess whether the load torque falls within the operational range of the equatorial mount before installing telescope equipment.

Load Weight: The total weight of the telescope and its attached accessories, measured in kilograms (kg).

Counterweight Weight: The total weight of the counterweight and counterweight shaft, measured in kilograms (kg).

Load Torque: The torque exerted by the telescope and its attached accessories on the mount, measured in Newton-meters (Nm).

Load Moment of the Force: The distance between the center of gravity of the telescope and its attached accessories and the axis of the mount's right ascension, measured in centimeters (cm).

Counterweight Moment of the Force: The distance between the center of the counterweight and the axis of the mount's right ascension, measured in centimeters (cm).

$\text{Load Torque} = \text{Load Weight} * \text{Load Moment} * 0.098$

$\text{Counterweight Torque} = \text{Counterweight Weight} * \text{Counterweight Moment} * 0.098$

A-1 Assessing the Mount's Load Capacity without Counterweights Installed

When using the mount without counterweights, the maximum load should meet the following condition:

Load Torque < 50Nm

A-2 Evaluating the Load Capacity of the Mount with Counterweights Installed

When using the mount with counterweights, the maximum load should meet the following condition:

Load Torque - Counterweight Torque < 50Nm

NOTICE

- The guiding accuracy of the mount is influenced by various factors such as load torque, moment of inertia, tripod stability, and more. Even if the equatorial mount meets the load capacity requirements when used without counterweights, the actual guiding accuracy can still be affected by factors like instability or deformation of the tripod due to a heavy load. Users

should conduct a comprehensive assessment considering factors such as the actual tripod, equipment, and environmental conditions. Properly using counterweights can help improve system stability and enhance guiding accuracy. It is advisable to keep the maximum load torque within 50Nm for optimal performance.

Part II Telescope Installation

Operating Steps

A Rotate the two dovetail groove locking knobs counterclockwise to loosen the dovetail groove clamps.

B Depending on the type of dovetail plate used by the telescope (Vixen or Losmandy), place the dovetail plate into the corresponding dovetail groove.

C Rotate the two dovetail groove locking knobs clockwise to securely fasten the telescope as tightly as possible within the dovetail groove.

D Check and confirm that the telescope's dovetail plate is securely locked in place, with no loose or unsecured conditions.

NOTICE

- The center of gravity of the telescope should be aligned as closely as possible with the center position of the dovetail plate or the distance between them should be minimized. Additionally, adjustments to the telescope's position should be made based on accessories such as filter wheels, motorized focusers, cameras, etc., to reduce the risk of collisions during mount movements.

3.6 Cable Connection

The equatorial mount requires various cable connections while in operation, such as DC power cables and USB computer communication cables.

WARNING

- Do not operate the power cable with wet hands as it may result in an electric shock.
- Avoid pulling or tugging on the power cord, and ensure that the insulation is intact before use to prevent electrical short circuits, fires, or electric shocks.
- **When using a battery as the power source, make sure it is a DC 12V power supply and use the correct polarity of DC plug to prevent incidents like battery combustion due to a short circuit.**
- Ensure that the power cable you use meets the voltage and current requirements of 12V 5A to prevent short circuits or improper equatorial mount operation due to insufficient cable capacity.

CAUTION

- Do not use USB communication cables with external or insulation damage, as it may lead to equipment damage.
- When using battery-powered emergency power supplies or AC power adapters, ensure that the power source used is a qualified product that has undergone mandatory safety certification (3C certification).
- Do not insert USB communication cables connected to PCs or other voltage output interfaces into the ST4 USB Type-C port, as the voltage fluctuations caused by such cables may damage the equatorial mount control board.

NOTICE

- Please confirm that the USB Type-C cable you are using is a data communication cable. Some USB Type-C cables may only support charging and cannot be used for regular data communication.
- The ST-4 autoguider cable (USB Type-C to RJ12) is an optional accessory and is not included in the default factory configuration. If needed, please contact Customer Support.
- The smart remote controller configured for wireless connection mode and cannot be used in wired mode

Part I: Connecting the Mount to Power

A Insert one end of the 12V DC power cable into the DC socket of the equatorial mount.

B Connect the 12V DC power supply, press the equatorial mount's power switch, and the equatorial mount will power on. The power indicator light will be solid red.

Part II: Connecting the Communication Cable Between the Computer and the Mount (USB Type A-to USB Type-C)

A Insert one end of the USB communication cable with a USB Type-C connector into the equatorial mount's USB Type-C port labeled "PC".

B Insert the USB communication cable's USB Type A end into your computer's USB Type A port.

Part III: ST-4 Autoguider Cable Connection

A Insert the USB Type C end of the ST-4 autoguider cable into the equatorial mount's USB Type C port labeled "ST4".

B Insert the RJ12 end of the ST-4 autoguider cable into the autoguider device.

Part IV: Wired Connection Between the Hand Controller and Mount (USB Type-C to USB Type-C)

A Insert one end of the USB communication cable with a USB Type-C connector into the mount's USB Type-C port labeled "ST4".

B Insert the other end of the USB communication cable with a USB Type-C connector into the USB Type-C port on the top of the handset.

3.7 ASCOM Driver Installation and Configuration

When connecting the mount to a Windows platform, the OnStep system of the mount needs to have ASCOM platform software installed on the PC. This allows software like NINA or Virtual Astronomy to connect to the OnStep mount. Before installing the ASCOM driver, you should first install the mount's serial communication driver.

Please visit the official website's service and support page to download the ASCOM Windows driver program.: www.warpastron.com

Please prepare the following driver files before installation:

- CP210X Windows Driver
- ASCOM Windows Driver
- OnStep ASCOM Driver

Part I: Installation of the Mount Serial Communication Driver (CP2102 Driver)

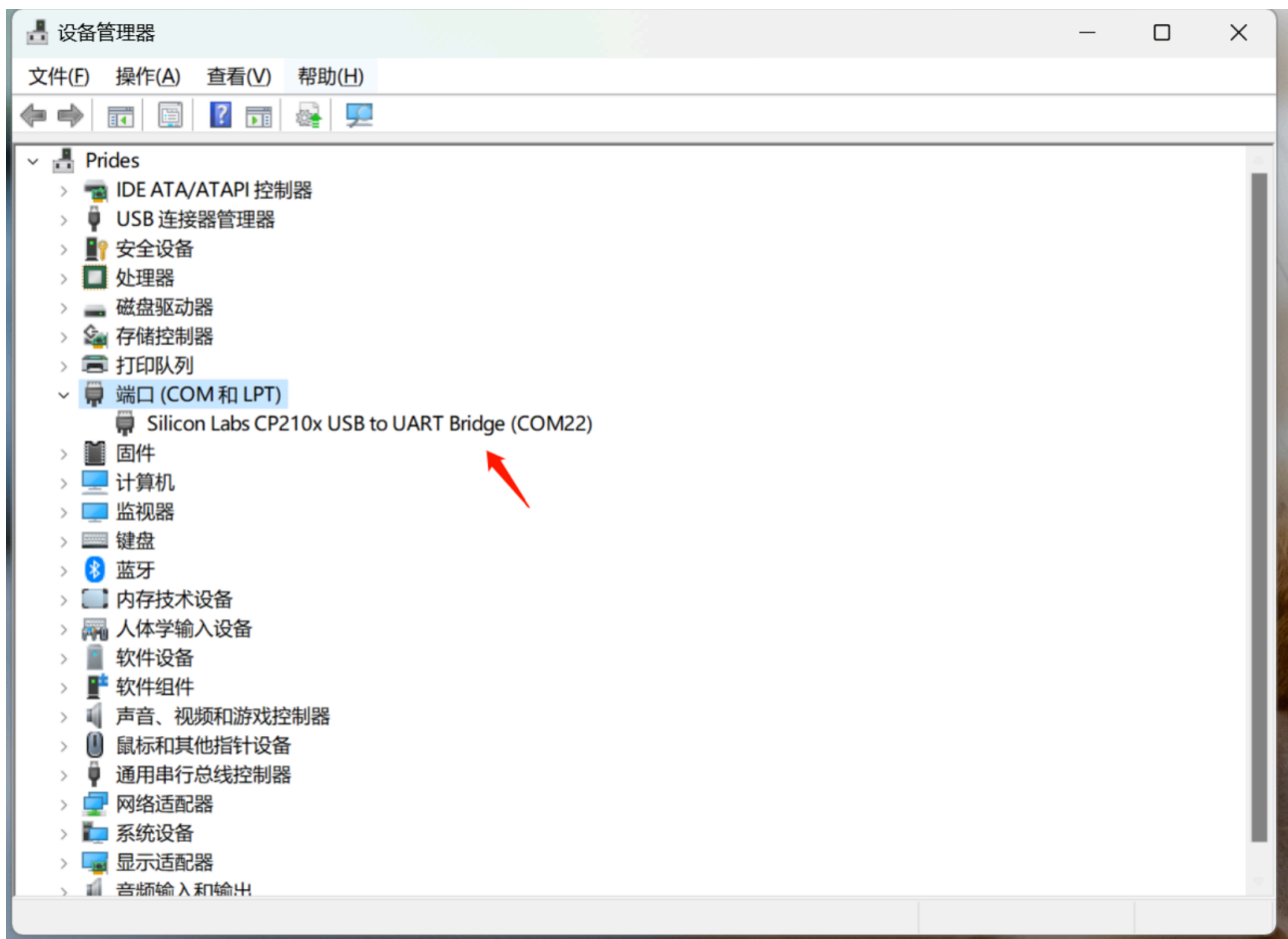
A Connect the mount's PC port to the computer's USB port using a USB data cable, and plug in the mount's 12V power supply. Press the mount's power switch to turn it on.

B Unzip the “CP210X Windows Driver” compressed file.

C If you are using a Windows 64-bit system, please click on 'CP210xVCPInstaller_x64.exe' and follow the prompts to complete the installation, as shown in the image below



D After the installation program is complete, open the Device Manager on your computer. You should see the serial port “Silicon Labs CP210x COMXX” , indicating that the serial port driver installation has been successful, as shown in the image below:



Part II: ASCOM Platform Driver Installation

A Unzip the “ASCOM Windows Driver” compressed file.

B Run the “ascomPlatformXXX.exe” program by clicking on it and follow the prompts to complete the installation.

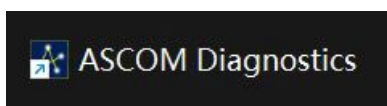
Part III: OnStep ASCOM Driver Installation

A Unzip the “OnStep ASCOM Driver” compressed file.

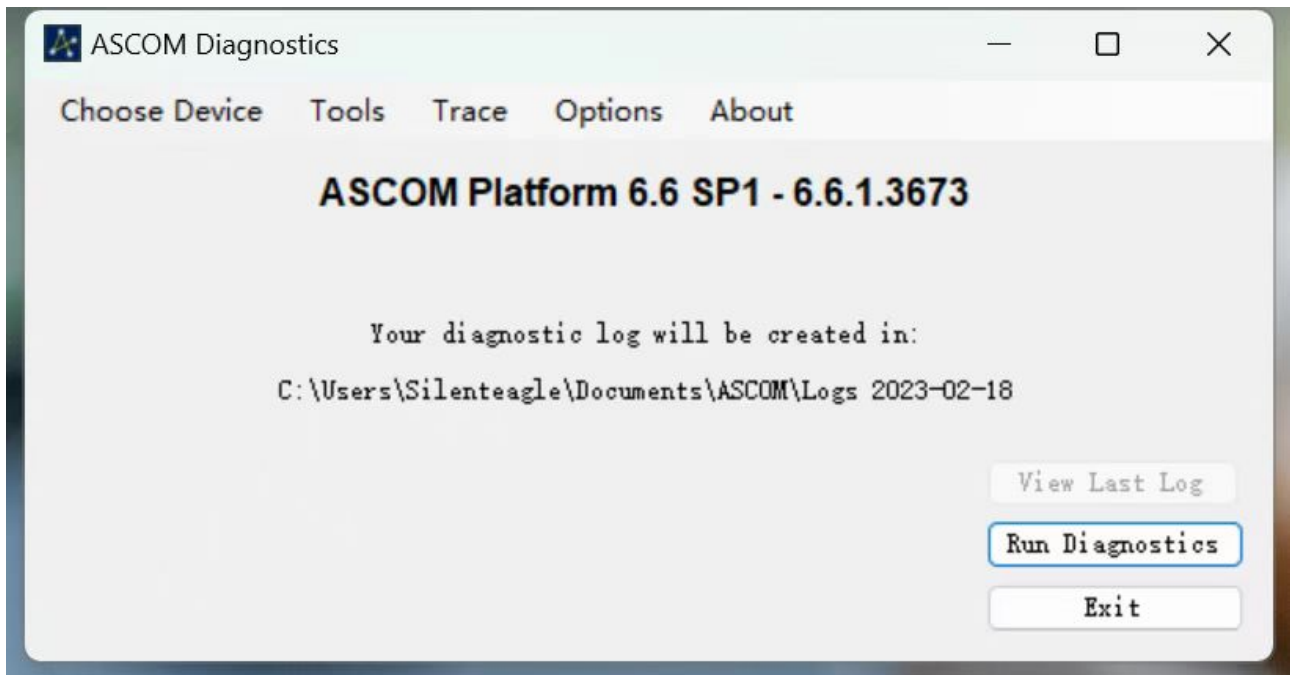
B Click to run the “OnStep Setup.exe” program and follow the prompts to complete the installation.

Part IV: Configuring OnStep ASCOM

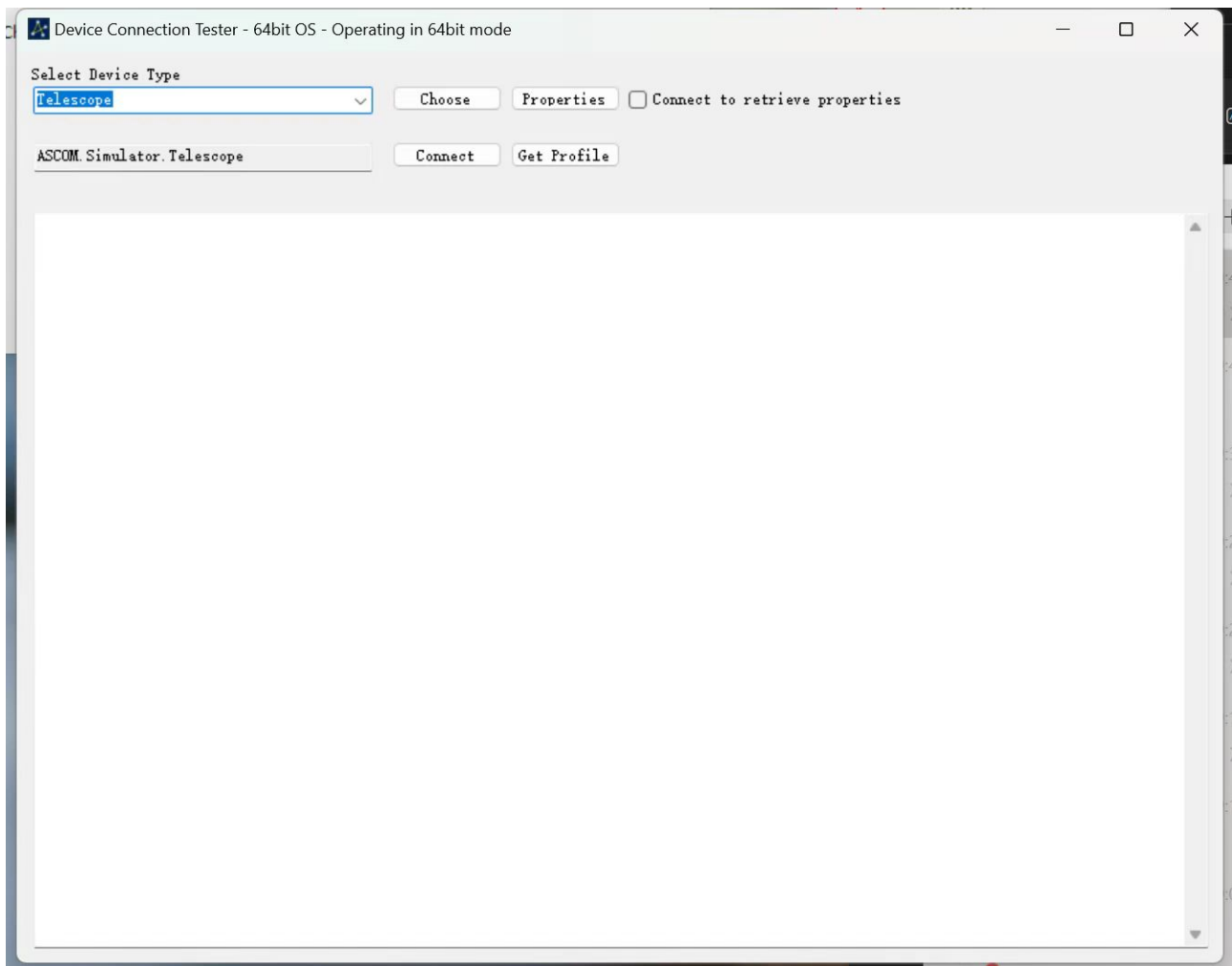
A Click to run the “ASCOM Diagnostics” program on your computer desktop.

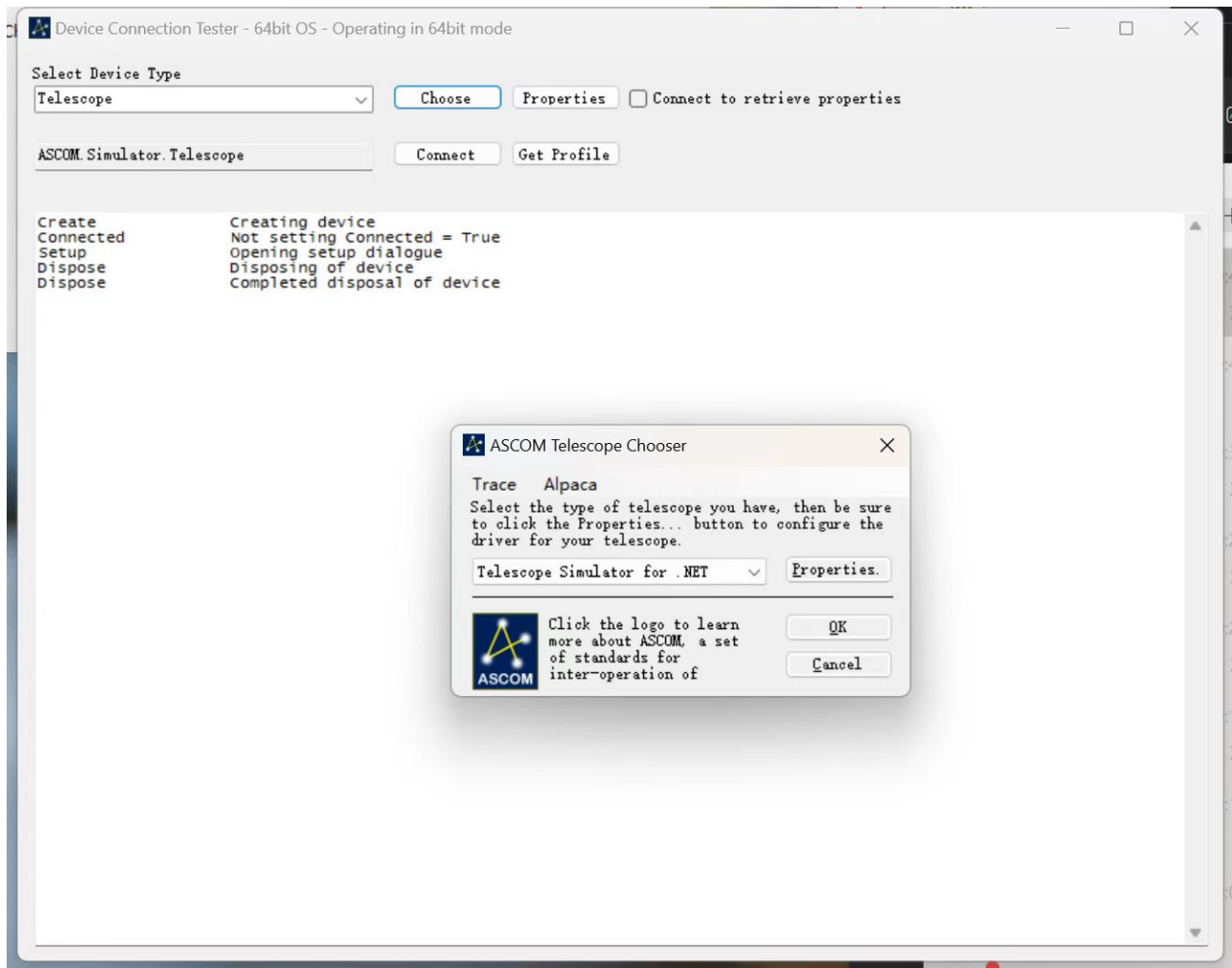


B Click on the “Choose Device” option in the window's menu bar to select a device.

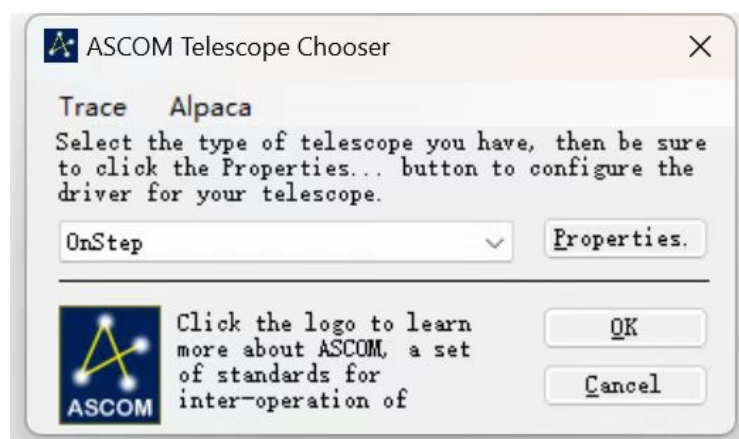


C Click “Choose” and select “OnStep Telescope” from the dropdown menu in the pop-up window.

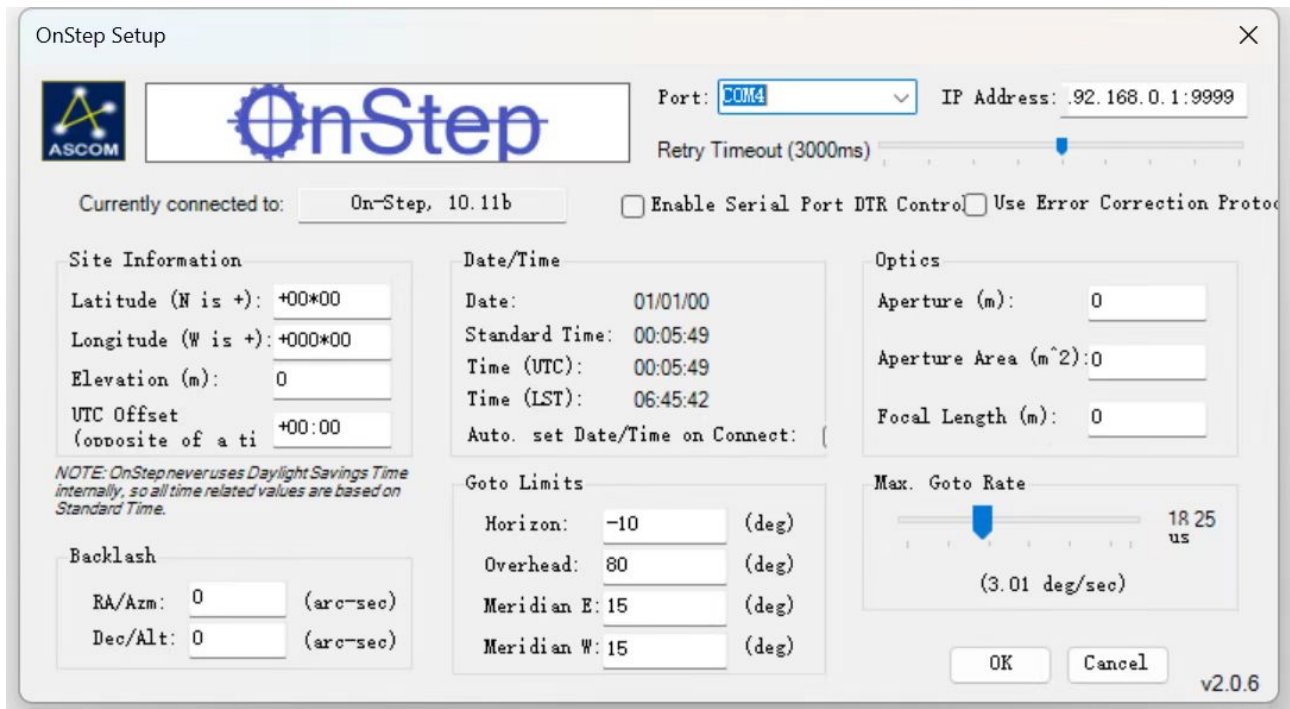




D Click the “Properties” button to open the OnStep configuration panel.



In the “Port” dropdown menu, select the mount's serial port recognized by the computer, which should be “COMXX”. If the connection is successful, the panel will display information about the mount.



The image shows the "OnStep Setup" dialog box. At the top left is the ASCOM logo and the "OnStep" text with a gear icon. To the right, there's a "Port:" dropdown menu set to "COM4", an "IP Address:" field with ".92.168.0.1:9999", and a "Retry Timeout (3000ms)" slider. Below this, it says "Currently connected to: On-Step, 10.11b" and has checkboxes for "Enable Serial Port DTR Control" and "Use Error Correction Protocol". The main area is divided into three sections: "Site Information" with fields for Latitude, Longitude, Elevation, and UTC Offset; "Date/Time" with fields for Date, Standard Time, Time (UTC), Time (LST), and an auto-set checkbox; and "Optics" with fields for Aperture, Aperture Area, and Focal Length. Below "Site Information" is a "Backlash" section with fields for RA/Azm and Dec/Alt. Below "Date/Time" is a "Goto Limits" section with fields for Horizon, Overhead, Meridian E, and Meridian W. To the right of "Goto Limits" is a "Max. Goto Rate" slider set to 18.25 us (3.01 deg/sec). At the bottom right are "OK" and "Cancel" buttons and the version "v2.0.6". A note at the bottom left states: "NOTE: OnStep never uses Daylight Savings Time internally, so all time related values are based on Standard Time."

OnStep Setup

ASCOM OnStep

Port: COM4 IP Address: .92.168.0.1:9999

Retry Timeout (3000ms)

Currently connected to: On-Step, 10.11b ☐ Enable Serial Port DTR Control ☐ Use Error Correction Protocol

Site Information

Latitude (N is +): +00*00

Longitude (W is +): +000*00

Elevation (m): 0

UTC Offset (opposite of a ti +00:00)

NOTE: OnStep never uses Daylight Savings Time internally, so all time related values are based on Standard Time.

Backlash

RA/Azm: 0 (arc-sec)

Dec/Alt: 0 (arc-sec)

Date/Time

Date: 01/01/00

Standard Time: 00:05:49

Time (UTC): 00:05:49

Time (LST): 06:45:42

Auto. set Date/Time on Connect: (

Goto Limits

Horizon: -10 (deg)

Overhead: 80 (deg)

Meridian E: 15 (deg)

Meridian W: 15 (deg)

Optics

Aperture (m): 0

Aperture Area (m²): 0

Focal Length (m): 0

Max. Goto Rate

18.25 us (3.01 deg/sec)

OK Cancel v2.0.6

After clicking “OK”, close the window. The OnStep ASCOM wired connection configuration is complete.

3.8 ASIAIR Connection Configuration Instructions

ASIAIR is a portable embedded astronomy computer product. If you are using the ASIAIR astronomy box, you can follow the steps below to connect the equatorial mount to ASIAIR.

Operating Steps

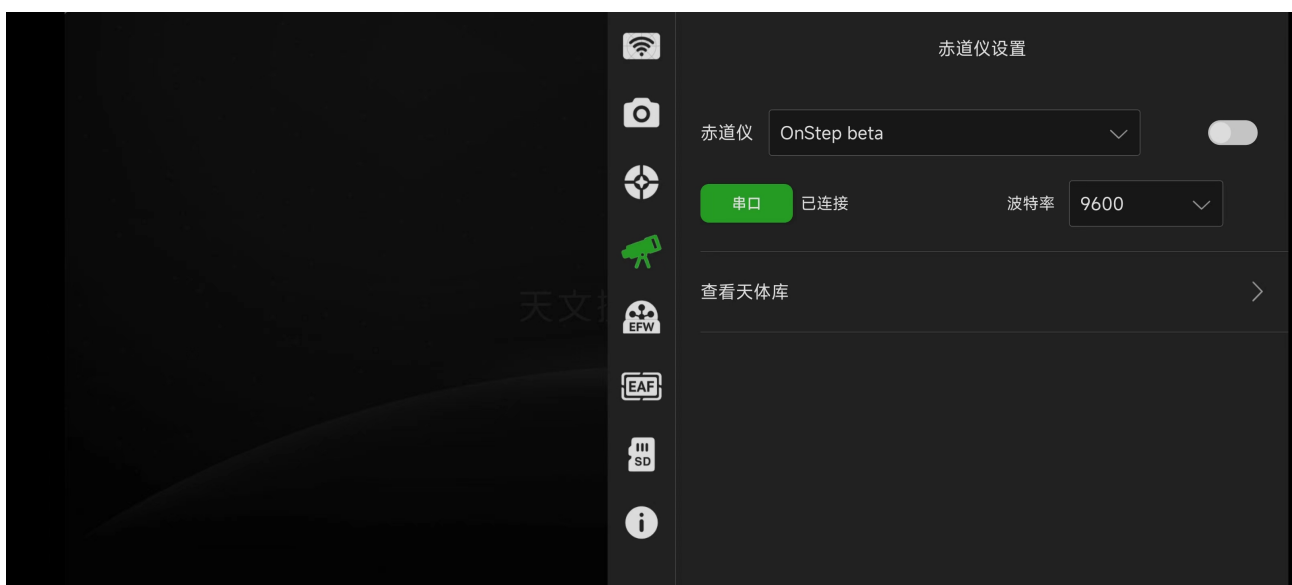
A Use a USB data cable to connect the equatorial mount's USB Type-C port labeled 'PC' to the ASIAIR's USB interface. Plug in the equatorial mount's 12V power supply, and press the equatorial mount's power switch to turn it on.

B Turn on the ASIAIR power, start the ASIAIR, and complete the app connection.

C Open the ASIAIR equatorial mount settings and select 'OnStep Electronic' or 'OnStep' from the dropdown menu.



D Confirm that the serial port baud rate is set to the default "9600".



E Click the 'Connect' button to establish the equatorial mount connection.

CAUTION

- When connecting ASIAIR to the mount, users may encounter analyzer/solving failures or software compatibility issues. These software compatibility issues may arise due to differences in ASIAIR controller hardware models or software versions. For example, OnStep users may encounter problems such as polar alignment failure or homing failure. It's essential to understand such potential software compatibility issues and adopt best user practices to resolve or partially resolve them.
- Users need to be aware that when performing polar alignment or GOTO target/sync with ASIAIR, controller analyzer/solving failures/errors may result in the risk of incorrectly synchronizing the mount coordinate system. This could lead to GOTO to the wrong target, wrong home position, or even failure of the mount's limit protection due to coordinate system errors, resulting in serious consequences such as collision and equipment damage. Users should monitor the operation of the equatorial mount throughout the ASIAIR operation and take immediate emergency actions such as stopping or powering off when encountering the above issues.
- As ASIAIR is a closed-source system, It's hard to identify the specific reasons for mount issues encountered while using ASIAIR to resolve them. If users have high reliability requirements for remote control, it is recommended to use open-source control software such as NINIA or KStars.

NOTICE

- In the ASIAIR mount settings, it is recommended to check the 'Automatically Homing' option, allowing the mount to automatically return to the home position after completing the operation.
- After successfully connecting ASIAIR to the mount, synchronize the date, time, and location information with the mount.
- During the polar alignment procedure using ASIAIR, if you encounter issues such as the mount not moving or moving incorrectly, please do not cancel or exit the app. Instead, wait for the polar alignment page to report an error. Then, perform the mount homing and restart the polar alignment process.

4 Appendix

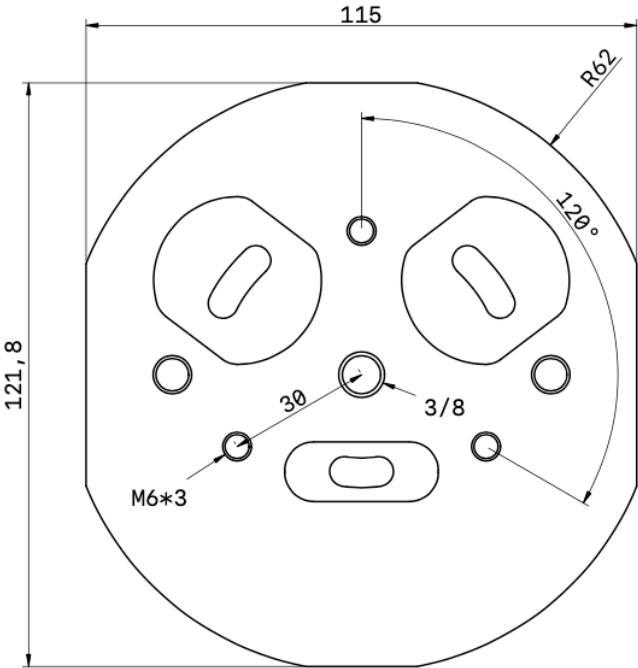
4.1 Warranty

- **Thank you for choosing WarpAstron's WARPDRIVE Harmonic Drive Equatorial Mount. We provide a 3-year free warranty service for products purchased by users from our company and authorized distributors. The warranty period starts from the day the user receives the product.**
- **The 3-year free warranty service provided by our company does not cover damages caused by accidents or normal wear and tear resulting from regular use, such as:**
 - Damage occurring after the expiration of the free warranty period.
 - Damage caused by external forces, such as dropping or collisions during operation.
 - Loss or damage resulting from improper use of the product, not following the product's user guide
 - Unauthorized disassembly, third-party repairs, modifications, or firmware flashing without explicit written authorization from WarpAstron's official customer service.
 - Damage caused by exposure to unsuitable environmental conditions, such as water immersion or exposure to rain.
 - Damage resulting from unforeseeable external forces.
 - Products for which the serial number and purchase records cannot be provided.
- For products that not in the scope of the free warranty, we can provide repair services to users, and charges will be assessed based on the specific circumstances.
- If the product has been intentionally damaged or severely damaged to the extent that it has no apparent repair value, our company reserves the right to refuse repair services.
- **Return Policy**
 - Customers who purchase products from our company or authorized dealers can enjoy a **7-Days No-questions-asked Return Policy** if the product is unused and both the product and packaging are in sealed/good condition. The return shipping cost is borne by the customer.
 - If customers discover quality issues within 15 days of receiving the product and contact our company or authorized dealer, and after official confirmation by our after-sales team that the product indeed has quality problems, we will provide a free exchange service.
- **Transportation Issues:** If customers receive a product with obvious packaging deformation or damage, they should immediately contact the official store or authorized dealer through which they placed the order. If the official customer service confirms and agrees, customers can refuse to accept the shipment and have it returned by the carrier. Our company or authorized dealer will then provide return or exchange services. If customers discover damage after accepting the shipment, they should provide proof of the product's external packaging or third-party certification from the carrier. If the official customer service verifies that the damage was caused during transportation, our company or authorized dealer will provide return or exchange services.

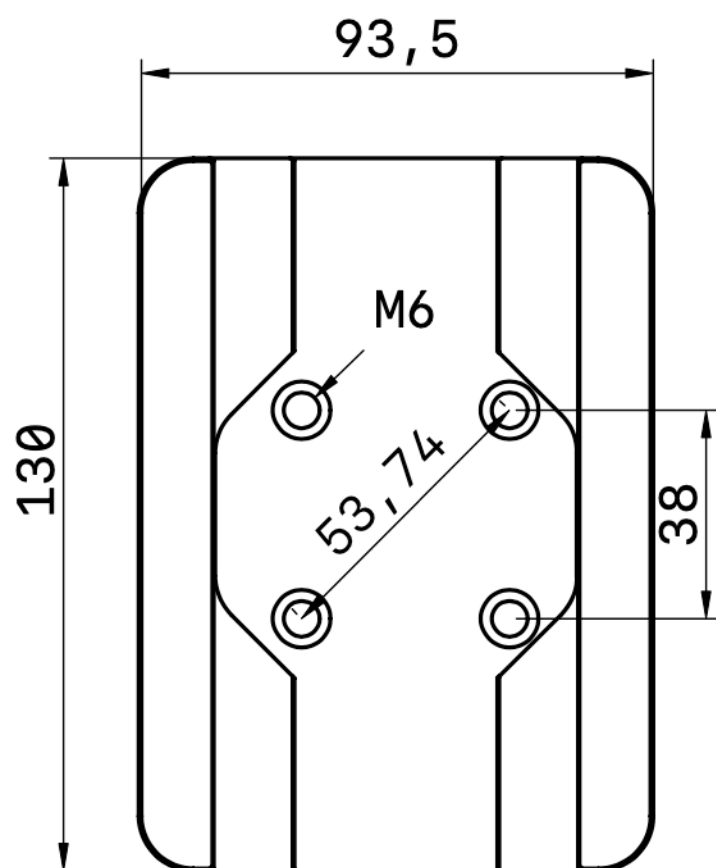
- Our after-sales service will be depending on the actual problems with the product and may include options such as firmware upgrades, sending replacement parts, factory repairs, or exchanges.
- For international customers, specific warranty terms and related costs may vary depending on the purchase channel. Please contact your dealer for further information.

4.2 Related Drawings

Note: The units in the drawings are in mm



Base Plate



Dovetail Plate