



# EM31PRO STRAIN WAVE MOUNT USER MANUAL Ver.2



EMCAN

[www.emcanastro.com](http://www.emcanastro.com)

# Reading Tips

## Reading Interpretation




Thank you for choosing EM31Pro Strain Wave Mount.

The manual is based on the factory default specifications. Therefore, some specifications or appearance of your mount may be different. This manual is subject to change without prior notice.

The manual can still be used as a guide when there are differences in appearance or structure but no substantial differences in function or the use methods.

In order to ensure proper use of the mount, please read this user manual carefully before starting to use

## Symbol Description

 forbidden       Important points       Operation instruction










 **Blue stands for counterclockwise rotation**

 **Green stands for clockwise rotation**

Observe in the direction indicated by the dashed arrow.

# Reading Tips

## Security precautions

-  Please install and use the mount in strict accordance with the steps and precautions reminded in this manual, operators shall be responsible for any damage to the equipment or personal injury caused by improper operation.
-  Ensure the mount's time, coordinates, and home position are properly set before use. Incorrect settings can cause GOTO errors or equipment collisions.
-  After installation, carefully check for any interference. Collisions can damage components, causing malfunctions or accuracy issues. Unplug immediately if interference or emergencies occur.
-  Please be careful when you carry, assemble or disassemble the mount and other heavy components and other equipments used on the mount . Or it may cause damage to the equipments or even personal injury.
-  Please ensure the entire setup is placed on a stable, flat surface and confirm the tripod has enough capacity and support area to prevent tipping, which could cause equipment damage or personal injury.
-  If there are children around when using, please pay attention to protecting their safety
-  The operating temperature of this mount ranges from -15°C to 40°C. Please use the mount reasonably under proper environmental conditions
-  Do not wipe the surface with corrosive liquid. Avoid water immersion and exposure to rain.
-  Unauthorized disassembly is strictly prohibited. Any self-disassembly will result in the warranty being voided.

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# Product Overview

## Brief Introduction

The EM31Pro Stain Wave Mount uses **17+17 strain wave reducers**. It is a **lightweight** mount but with a **high payload** capacity and **high-precision**. The EM31Pro supports **three modes**: EQ mode, Alt/Az side mode and Alt/Az top mode.

Mode	Astrophotography	Visual - telescope	Visual- Binoculars
EQ Mode	All objects	Yes	— —
Alt/Az Side	Planets,Sun,Moon	Yes	— —
Alt/Az Top	Planets,Sun,Moon	Yes	Yes

The different modes cater to the needs of both astrophotographers and visual observers.

Its **compact and lightweight design** makes transportation to your photography or viewing location effortless.

The **innovative altitude adjustment mechanism** provides an exceptionally **smooth experience for polar alignment**

The **quick-installation system** simplifies setup, allowing you to begin observing or capturing images faster.

Thoughtful **cable management** ensures tidy wiring and prevents tangling.

The **ergonomic design** enhances user comfort.


Crafted with **precision and premium materials**, the mount combines durability and elegance.

At EMCAN, we are dedicated to delivering a seamless experience, exceeding the expectations of astronomy enthusiasts.

# Product Overview

## Specification

- 1. Weight of the main body:** approx. 4kg (without Dovetail & adapters)
- 2. Payload:**  $\leq 15\text{kg}$  (without counterweight)  
 $\leq 20\text{kg}$  (with counterweight)
- Note:** payload calculated in the condition that the telescope's center of gravity is 20cm from RA axis
- 3. Latitude adjustment:**  $0^{\circ}\sim 90^{\circ}$  (fine adjustment  $\pm 10^{\circ}$ )
- 4. Azimuth adjustment:**  $-8^{\circ}\sim +8^{\circ}$
- 5. RA:** 17 type 100:1 SWG+ Synchronous Belt  
(300:1 reduction ratio )
- 6. DEC:** 17 type 100:1 SWG+ Synchronous Belt  
(300:1 reduction ratio )
- 7. Motor:** 42 Closed-loop stepper motor (RA with Brake)
- 8. Goto speed:** max  $6^{\circ}/\text{s}$
- 9. Power port:** DC5.5-2.1 12V 5A (Cable Management Support)
- 10. Power consumption:** tracking 0.4A, Goto 0.7A
- 11. Communication interface:** usb2.0, Wi-Fi, Bluetooth
- 12. Support:** Asiatic, ASCOM (NINA, PHD2), INDI, SkySafari
- 13. Dovetail:** Vixen  $75^{\circ}$  & LOSMANDY  $60^{\circ}$ ; Arca(Optional)
- 14. Home position:** by bubble levels
- 15. Mode:** Equatorial mode; Altazimuth mode (side & top)
- 16. Hand controller:** Wired hand controller

 The payload capacity is not exactly equal to the total weight of the equipment being mounted. The effective weight that the mount can support depends closely on the center of gravity of the entire setup. Equipment with a higher center of gravity will reduce the mount's load-bearing capacity accordingly.

Before installing heavy equipment with a high center of gravity, please refer to the EM31Pro load formula to ensure it does not exceed the weight limit.

# Product Overview

## Standard Packing



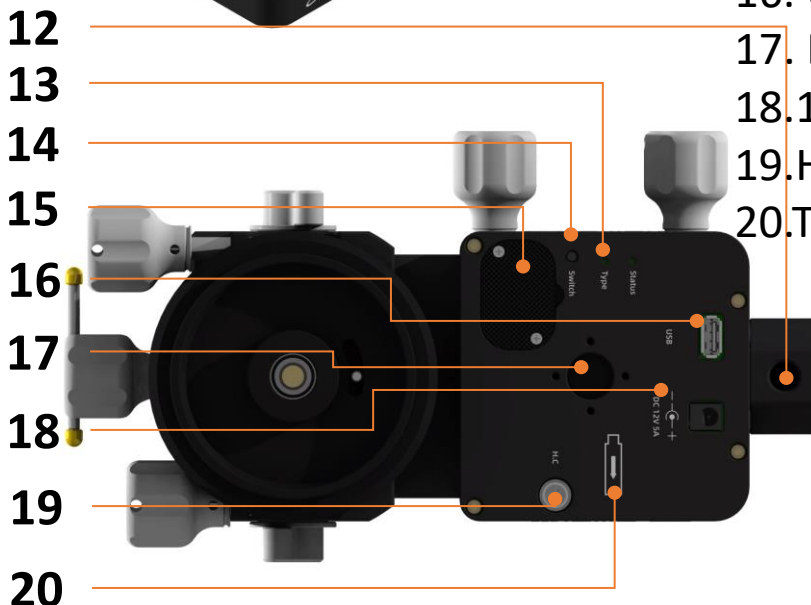
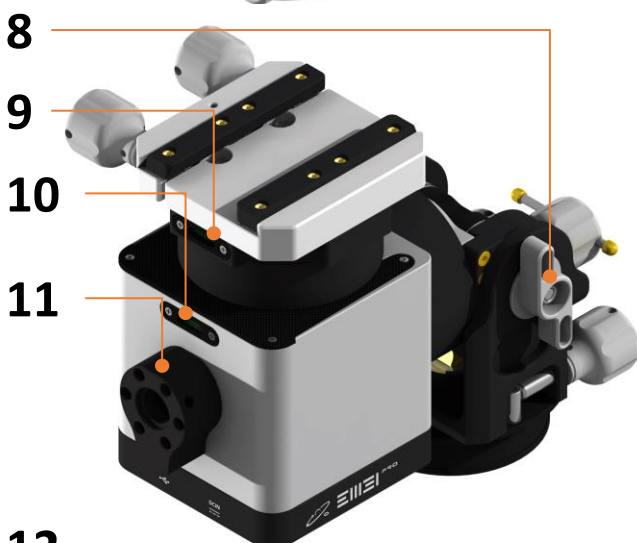
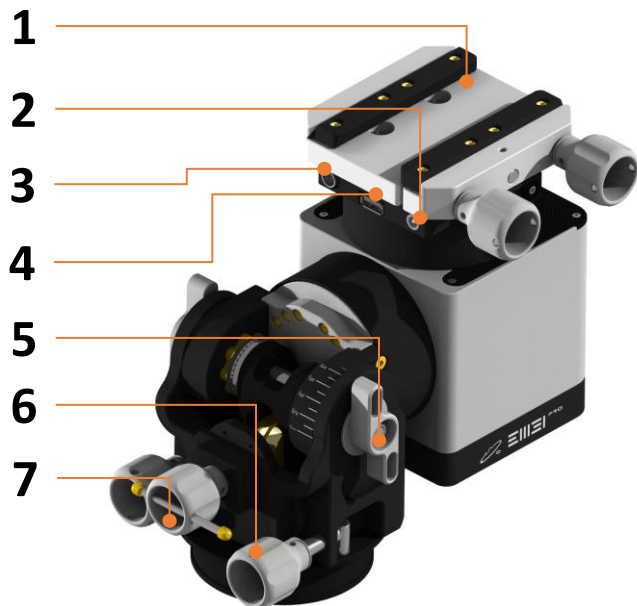
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1	EM31 Pro Body	x1
2	Hand Controller	x1
3	Dovetail (VIXEN & LOSMANDY)	x1
4	Mounting Adapter	x1
5	0.5m USB2.0 Cable	x1
6	2m USB2.0 Cable	x1
7	Shockproof Soft Bag	x1

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# Product Overview

## Components

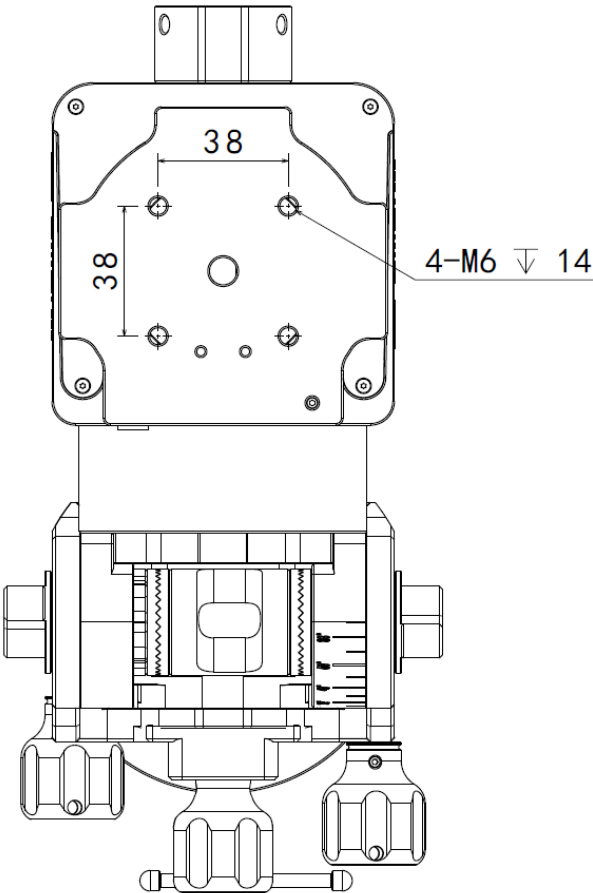


1. Dovetail
2. DEC 12v DC 5.5\*2.1
3. DEC Hand controller port
4. DEC USB port (type A)
5. Main altitude locking knob
6. Azimuth adjustment knob
7. Altitude fine adjustment knob
8. Auxiliary altitude locking knob
9. Bubble level for DEC axis
10. Bubble level for RA axis
11. Multifunctional front support
12. Counterweight bar interface
13. Mode indicator light
14. Mode switching button
15. Battery cover plate
16. USB port (type A)
17. Ball head interface
18. 12v DC 5.5\*2.1 power port
19. Hand controller port
20. Telescope directional mark

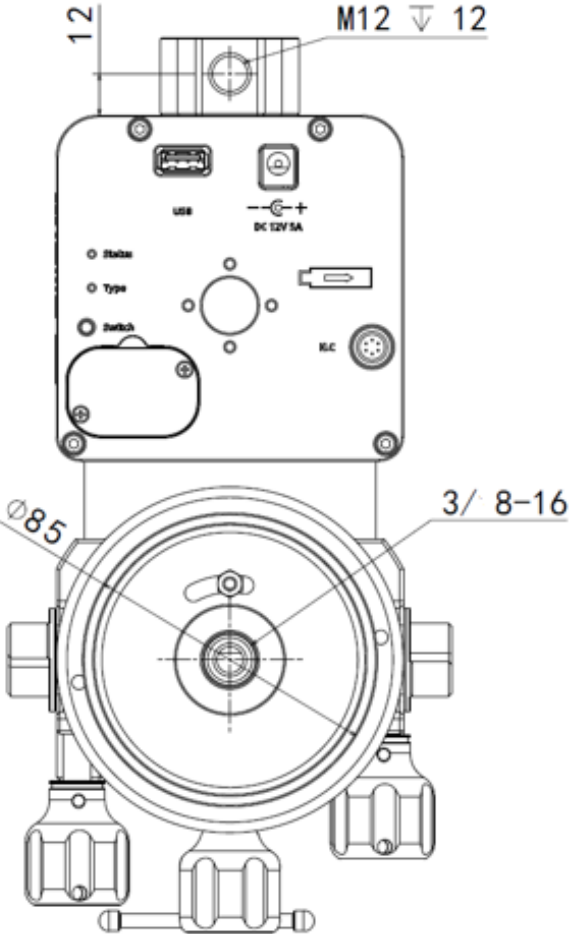
# Product Overview

## Interface Size

The standard dovetail of EM31Pro can be replaced, and the installation dimensions of the dovetail are as follows:



**EM31Pro supports counterweight bar with a diameter less than 20mm, and with length less than 300mm, the counterweight should be no more than 5kg**



**The screw thread length of the counterweight bar shall not exceed 12mm**

# Product Overview

Optional Accessories:

EM TC44S Tripod



RP200 Extension Rod



AD120 Horizontal Adjuster



TC44A  
(TC44S+AD120)



TC44L  
(TC44S+RP200)



TC44U  
(TC44S+AD120+RP200)



Parameters :	
Tripod interface : 85mm	Locking method : 3/8+three screws locked
Carbon fiber tube diameter : 44mm	Carbon fiber tube thickness : 2mm
Storage length :	EM- TC44S 620mm
	EM- TC44A 720mm
	EM- TC44L 850mm
	EM- TC44U 950mm

Size :	
Unfolded height:	EM-TC44S 530mm
	EM-TC44A 620mm
	EM-TC44L 720mm
	EM-TC44U 810mm
Weight :	EM-TC44S approx. 2.5kg
	EM-TC44A approx. 3.4kg
	EM-TC44L approx. 3.3kg
	EM-TC44U approx. 4.2kg

💡 Supports stacking of up to two RP200 Extension Rods for greater height (TC44U+RP200:1010mm).

⚠️ This accessory needs to be purchased separately

# Product Overview

## Optional Accessories:

### EMH150 Fast-assembling pier extension



**Material: Aluminum(AL6061),  
Stainless steel**

**Size: H150mm dia110mm**

**Weight: 1.2kg**



This accessory needs to be purchased separately

# Product Overview

## Optional Accessories:

### EMH200 Fast-assembling pier extension



**Material: Aluminum(AL6061),  
Stainless steel**  
**Size: H200mm dia110mm**  
**Weight: 1.4kg**

---

 This accessory needs to be purchased separately

# Product Overview

Optional Accessories :

## Top-mounted mode supporting bracket



**Material:**

**Aluminum(AL6061),Stainless steel,**

**Titanium alloy(counterweight bar)**

**Size: L350mm**

**Weight: 1.8kg**

**Suitable for Binoculars**



This accessory needs to be purchased separately

# Product Overview

Optional Accessories :

Ball head mount  
adapter



Arca board strips

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 This accessory needs to be purchased separately

# Product Overview

## Optional Accessories :

Adapter for QHY  
Pole master



Adaptor for iPolar  
(Only applicable to  
specific version)



This accessory needs to be purchased separately

# Standard Use Procedure

## Use Procedure

### EQ Mode

Install equipment

※ Set time and coordinates

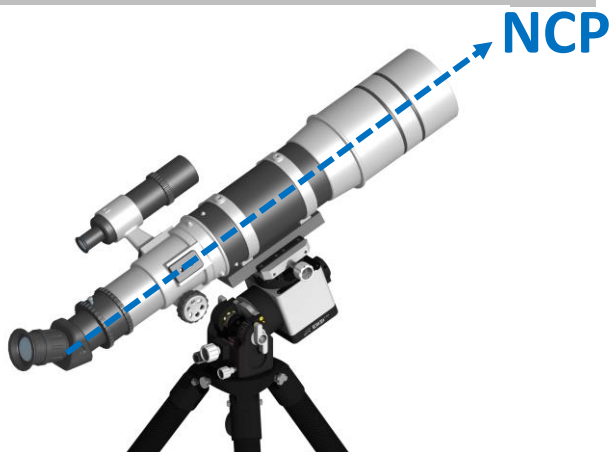
※※ Set home position

Polar alignment

Select target and Goto

Using Target Calibration

Come into use



Ensure that site coordinates, time, and home position are correctly set to avoid GOTO errors or equipment collisions.



For OnStep, South latitude & East longitude (-); North latitude & West longitude (+); UTC: East of the prime meridian (-), West (+) **Auto-sync recommended to avoid input errors.**



EM31Pro retains coordinates and time; no reset is needed if unchanged.

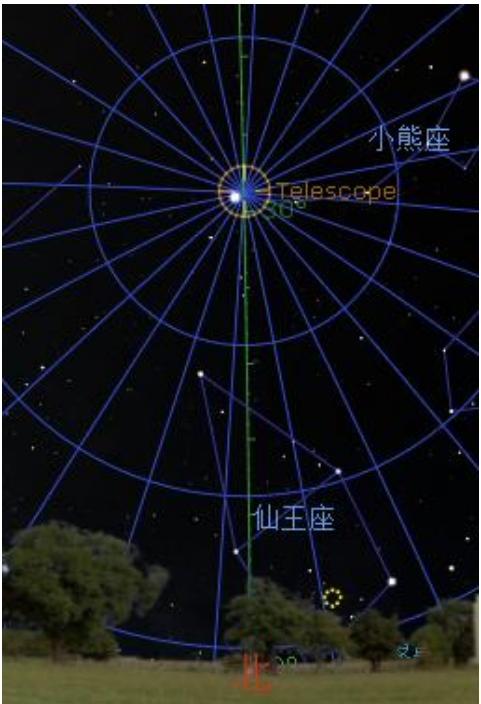
**The mount uses last power-off position as home. Return to home before shutdown or reset next use. (If Park is enabled: execute park before shutdown. Next time, Unpark resumes operation, no need to reset Home.)**

# Standard Use Procedure

## Use Procedure

### Home position of EQ mode

The EQ mode home position is shown in the diagram below. This is the position the mount should be in before power-off, or should be reset manually after each power-on.

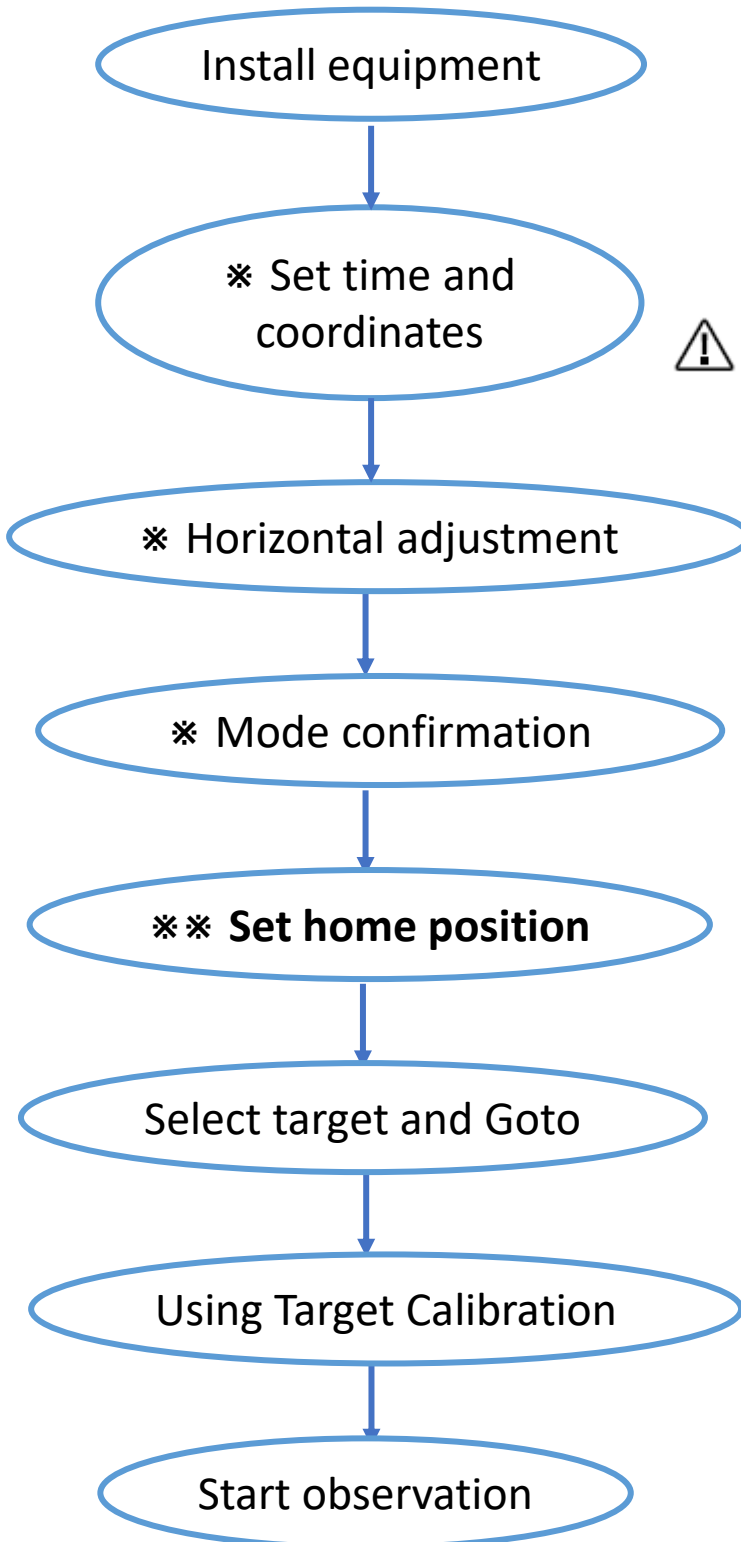


EM31Pro can confirm the EQ mode home position using the bubble levels on the RA and DEC axes.

# Standard Use Procedure

## Use Procedure

### Altazimuth Mode (side & top)



Ensure that site coordinates, time, and home position are correctly set to avoid GOTO errors or equipment collisions.

For OnStep, South latitude & East longitude (-); North latitude & West longitude (+); UTC: East of the prime meridian (-), West (+) **Auto-sync recommended to avoid input errors.**

EM31Pro retains coordinates and time; no reset is needed if unchanged.

**The mount uses last power-off position as home. Return to home before shutdown or reset next use. (If Park is enabled: execute park before shutdown. Next time, Unpark resumes operation, no need to reset Home.)**

# Standard Use Procedure

## Use Procedure

### Home position of Altazimuth Mode (Side & Top)

The home position of the Altazimuth mode is shown in the diagram below, and the telescope points to the NCP.



The home position can be confirmed through a mobile compass and bubble levels



# Installation and Use

## Installation of the mount with pier extension and tripod

EM 31 Pro can be mounted on center-column-free tripods with a bore diameter of 85 mm, such as RT90C, Gitzo5

 **Size and style of the 3/8-16 locking screw should be proper.**



Diameter  
85mm



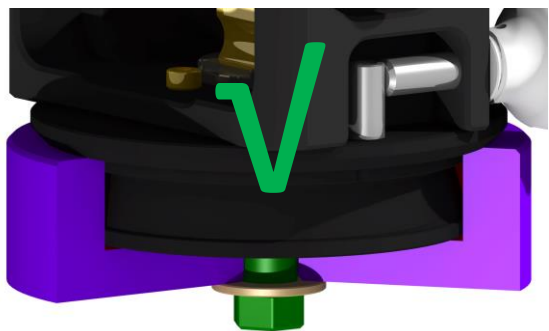
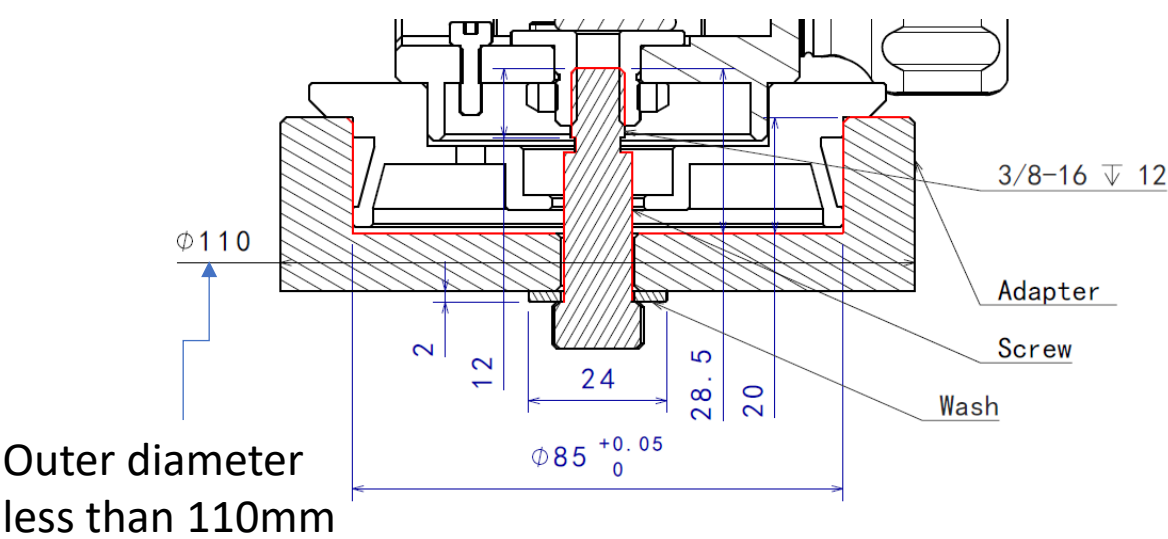
**Ensure that non-official tripods are compatible with the mount and securely attached, with no wobbling or movement, to avoid precision issues or potential equipment falls.**

# Installation and Use

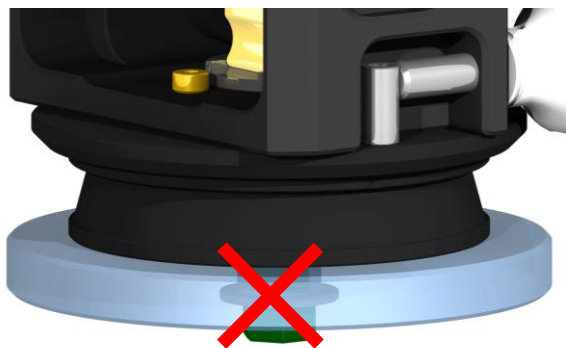
## Installation of the mount with pier extension and tripod

The standard setup does not include accessories for mounting the EM31Pro on non-compatible tripods. Users who wish to install the mount on a different tripod will need to design and fabricate a custom adapter and appropriate mounting bolts.

**The dimensions should follow the chart below :**



Correct adapter structure



Incorrect adapter structure, it is prohibited to connect to the mount through only one plane

# Installation and Use

## Installation the mount with pier extension and tripod

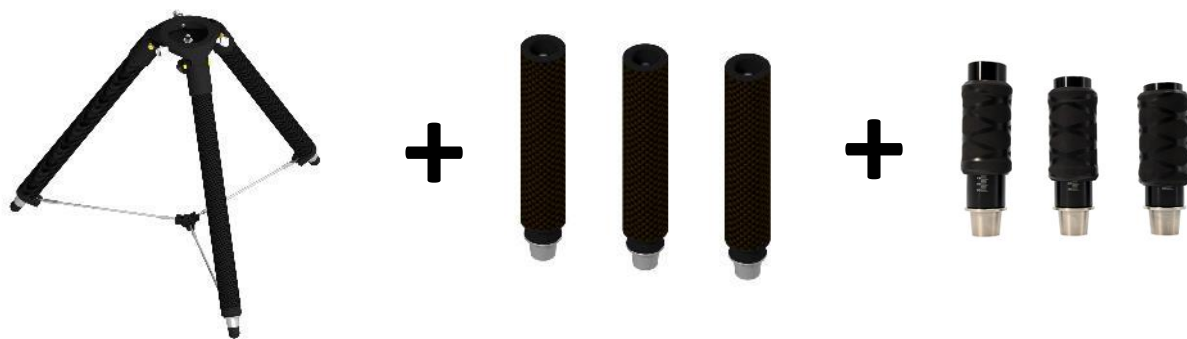
When using the EMTC44 tripod, the mount body can be directly attached to the tripod via the officially supplied mounting adapter and secured with the tripod's three knobs for a more reliable connection.



# Installation and Use

## Installation of the mount with pier extension and tripod

The EMTC44S is a high-load tripod specifically designed for astronomical applications. Its rigidity is enhanced by a non-retractable structure crafted from 44mm/2mm carbon fiber tubes. Additionally, the tripod's height and support area can be extended using the heightening section.



Rotate clockwise to install the extension rod and horizontal adjuster



# Installation and Use

## Installation of the mount with pier extension and tripod

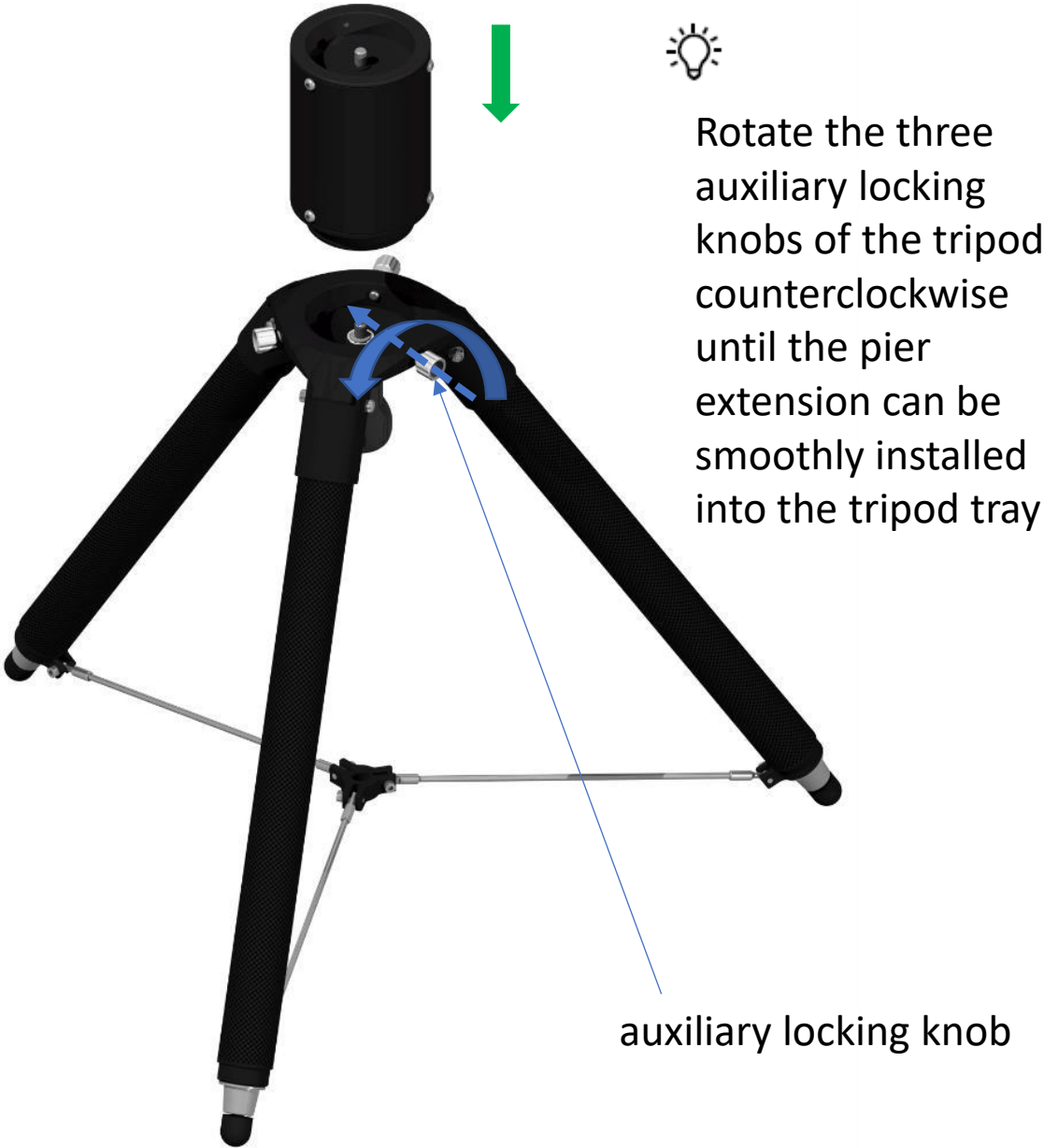
The strain wave mount is compact, and when using a longer telescope, there is a risk of collision between the telescope and the tripod, especially near the zenith or the meridian. In this case, a pier extension is needed to avoid collisions.



# Installation and Use

Installation of the mount with pier extension and tripod

## Installation steps with the pier extension



# Installation and Use

## Installation of the mount with pier extension and tripod

### Installation steps with the pier extension



Main locking knob



Gently Push up the main tripod locking knob and rotate it clockwise until the knob and pier extension cannot rotate relative to each other



Note that if this step is not performed correctly, the mount body and pier extension may not be separated properly when disassembling the equipment.

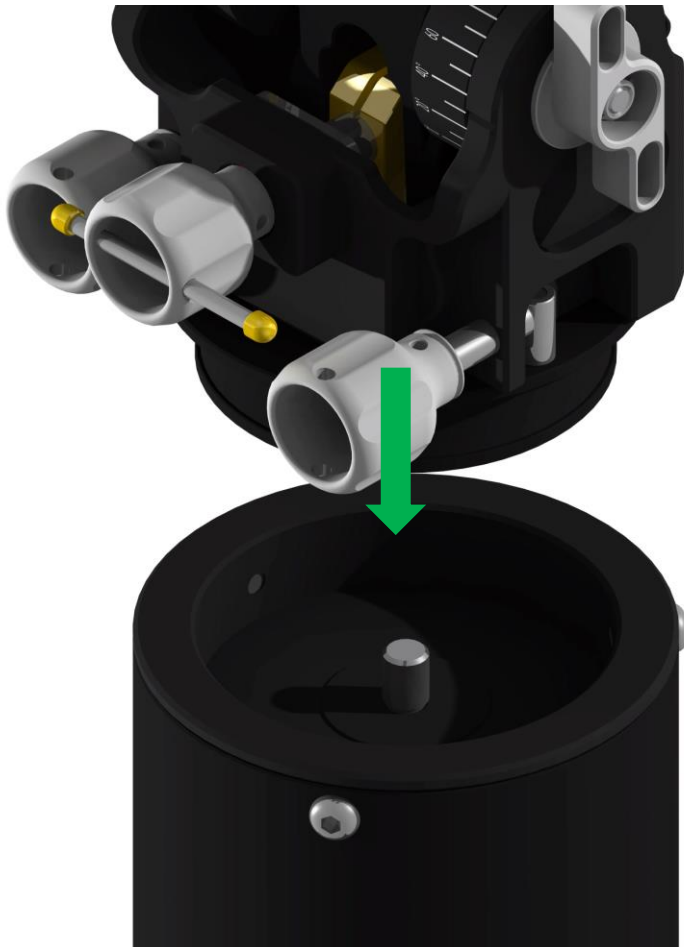
# Installation and Use

Installation of the mount with pier extension and tripod

## Installation steps with the pier extension



Place the mount body with the mounting adapter into the pier extension



# Installation and Use

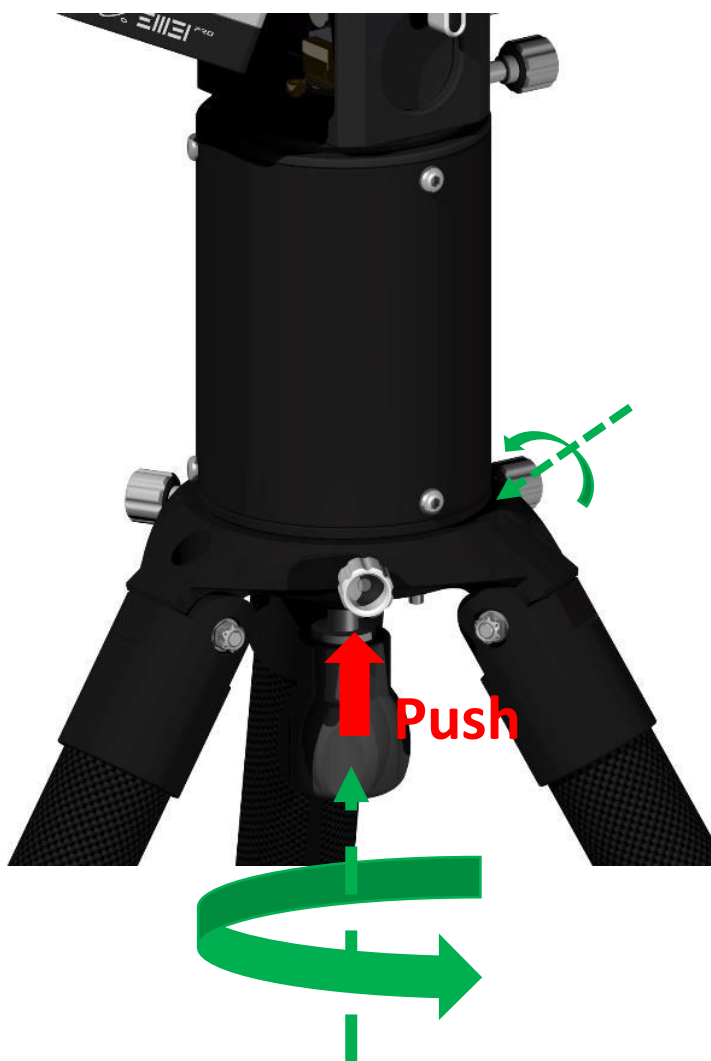
## Installation of the mount with pier extension and tripod

### Installation steps with the pier extension

💡 Push upward and continue rotating the main tripod locking knob clockwise until it is tightly secured.

Next, rotate the three auxiliary tripod locking knobs clockwise until they are firmly locked.

At this point, the installation of the mount body, pier extension, and tripod is complete



To lock the mount body, first push the main locking knob upward with slight force, then rotate the knob clockwise to secure it.



# Installation and Use

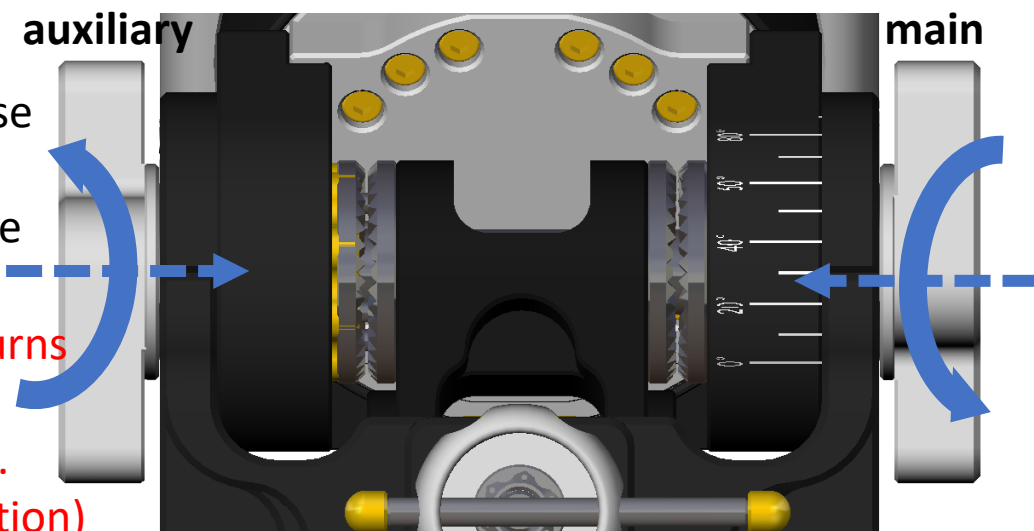
Adjustment of altitude and azimuth angles of the equatorial mode

## Altitude coarse adjustment



Step1. Rotate counterclockwise to release the auxiliary altitude locking knob

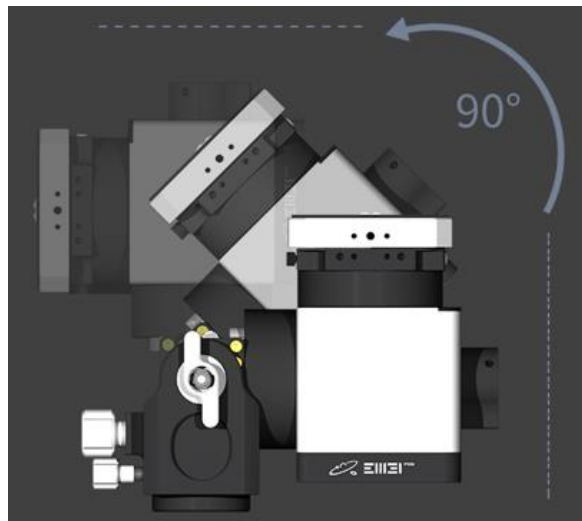
(Rotate 1–1.5 turns or until slight loosening is felt. Avoid over-rotation)



Step2. Rotate the main altitude locking knob counterclockwise until the two pairs of flat gears are completely separated. At this point, the altitude angles can be freely adjusted



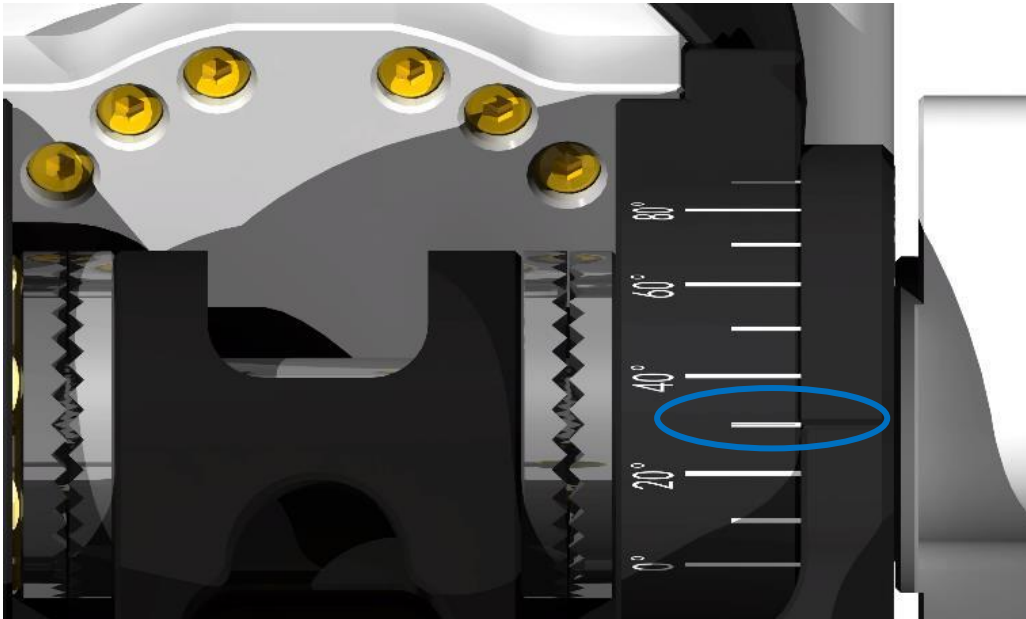
**When the main altitude locking knob is loosened, the mount loses its support. During the coarse adjustment process, ensure that the mount is always supported by hand until the main altitude locking knob is securely tightened again.**



# Installation and Use

Adjustment of altitude and azimuth angles of the equatorial mode

## Altitude coarse adjustment



Refer to the altitude scale and adjust the altitude angle to approximately match the local latitude. (For example, if the local latitude is  $31^{\circ}13'20''$ , set and lock the altitude near  $30^{\circ}$ )



**When the main altitude locking knob is loosened, the mount loses its support. During the coarse adjustment process, ensure that the mount is always supported by hand until the main altitude locking knob is securely tightened again.**



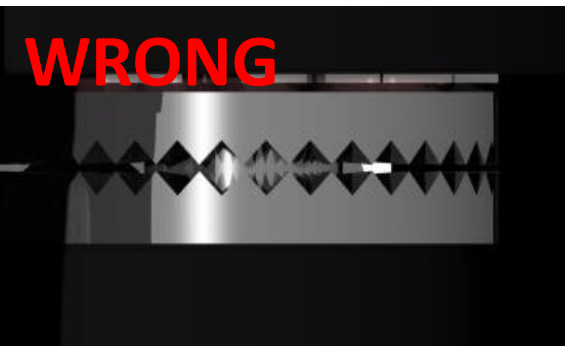
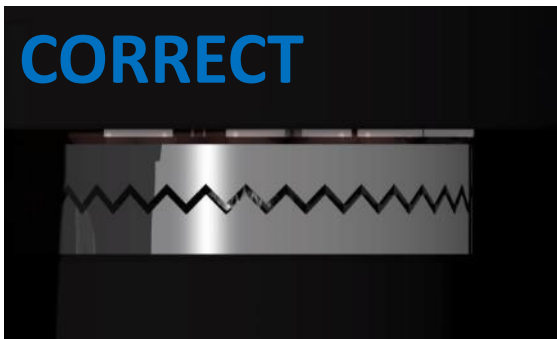
Roughly adjust the altitude angle at  $10^{\circ}$  intervals, such as  $0^{\circ}$ ,  $10^{\circ}$ ,  $20^{\circ}$ ,  $30^{\circ}$ ...  $90^{\circ}$

# Installation and Use

## Adjustment of altitude and azimuth angles of the equatorial mode

### Altitude coarse adjustment

- 💡 Rotate the main altitude locking knob clockwise at the approximate latitude position until the flat gear engages. Then, rotate the auxiliary altitude locking knob clockwise to complete coarse adjustment of the altitude angle



**Note that the flat gear must engage correctly, as shown in the left diagram. Incorrect engagement may cause the equipment to slip**



**When the main altitude locking knob is loosened, the mount loses its support. During the coarse adjustment process, ensure that the mount is always supported by hand until the main altitude locking knob is securely tightened again.**

**Altitude angle coarse adjustment completed**



# Installation and Use

Adjustment of altitude and azimuth angles of the equatorial mode

## Precise alignment of polar axis

1. For astrophotography, polar calibration can be completed through plate solving
2. EM31 Pro supports the installation of Pole master or iPolar to complete polar calibration

Adapter for  
electronic  
polar  
alignment  
scope



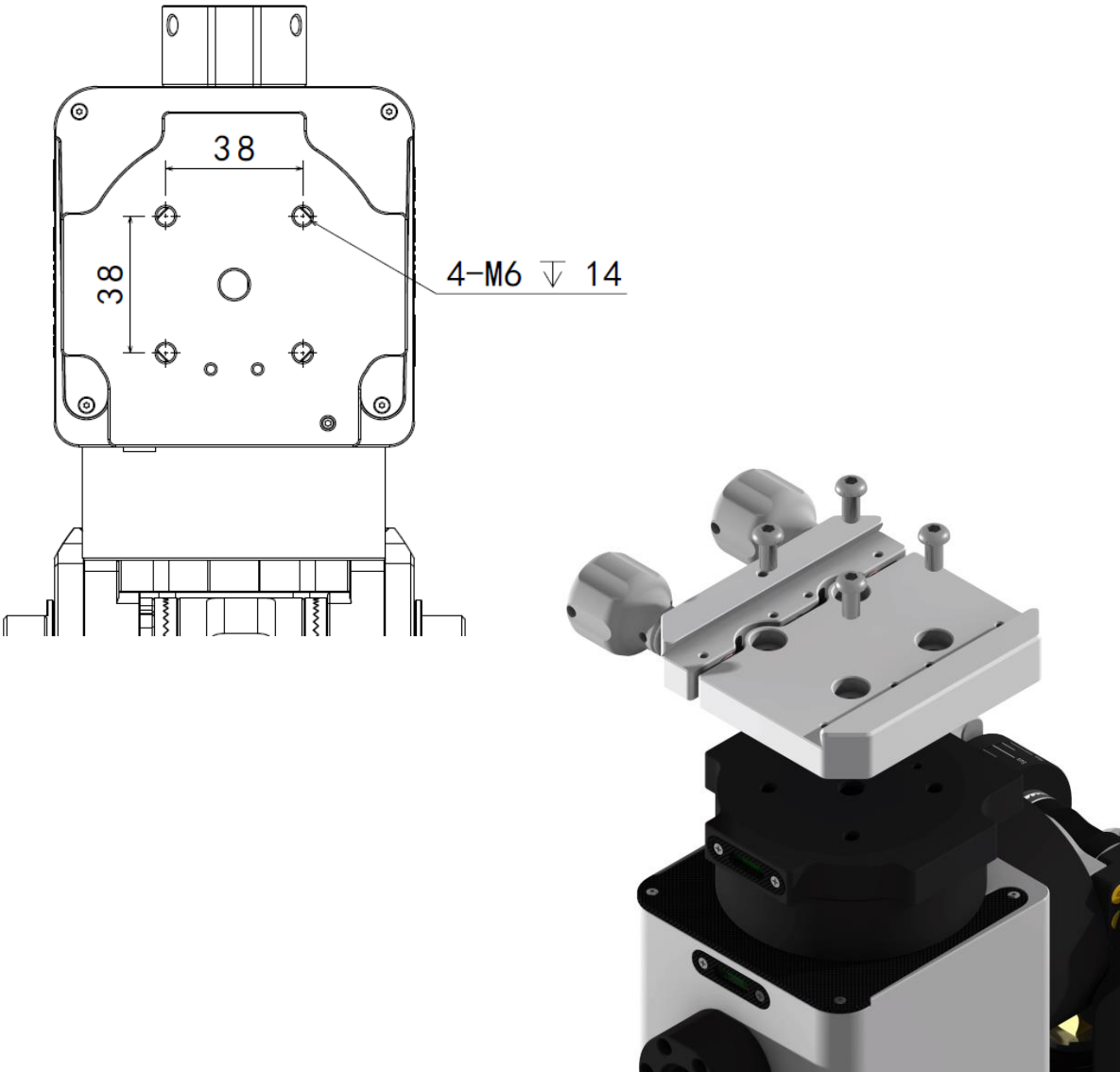
Once all equipment is installed, precise polar alignment can be achieved by rotating the azimuth adjustment knobs and altitude fine adjustment knob

# Accessory Installation

## Installation of dovetail

### Dovetail

The interface on the EM31Pro DEC top plate is compatible with most dovetails, allowing users to replace the dovetail as needed.



# Accessory Installation

## Installation of dovetail

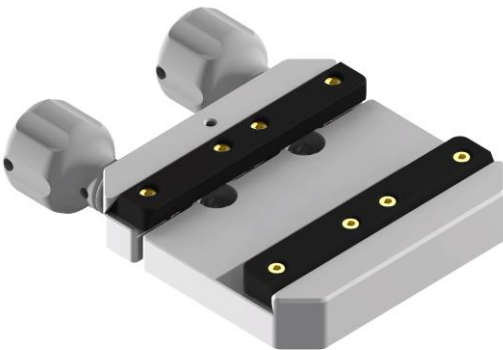
### Dovetail

The EM31Pro comes with standard LOSMANDY 60° and Vixen 75° dovetail compatibility. Arca specifications can be achieved by installing the dovetail Arca strips (optional)

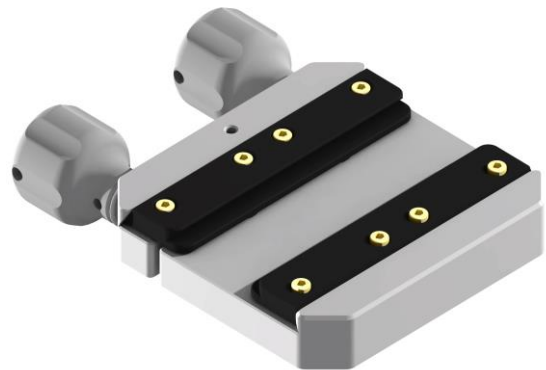
LOSMANDY



VIXEN



ARCA(optional)



# Installation and Use

## Altazimuth Mode

### Structure Switching

The installation method for the EM31Pro pier extension and tripod in altazimuth mode is identical to that in equatorial mode. Adjust the altitude angle to 90 degrees using the same procedure as in equatorial mode.



# Installation and Use

## Altazimuth mode

### Installation of telescope



Confirm that the installation direction of the telescope is consistent with the direction marked on the bottom of the body. **Installing the telescope in reverse can result in GOTO errors and may even lead to collisions that could damage the equipment.**



# Installation and Use

## Altazimuth Mode

### Horizontal calibration

Accurate GOTO and stable tracking in altazimuth mode require the azimuth rotation axis to be perpendicular to the ground. The EM31Pro allows users to confirm this alignment using the horizontal bubble on the RA axis.

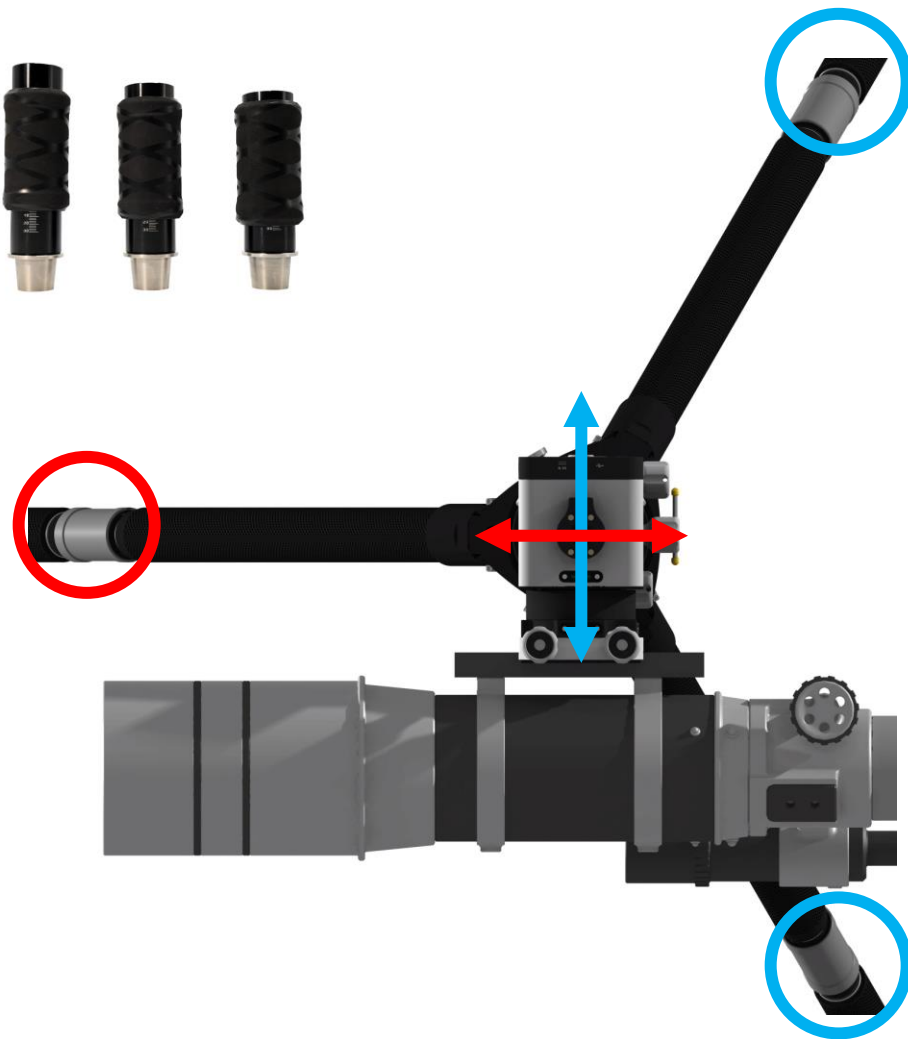



# Installation and Use

## Altazimuth Mode

### Horizontal calibration

When using the AD120 horizontal adjuster, the level state can be achieved by adjusting the horizontal adjusters



 All equipment need to be installed before starting to adjust the level state

# Installation and Use

## Altazimuth Mode

### Horizontal calibration

Obtain accurate horizontal state

💡 Power on the mount and manually rotate the RA axis until the horizontal bubble is parallel to the blue horizontal adjuster line shown in the diagram.

💡 Adjust the two horizontal adjusters inside the blue circles until the horizontal bubble is centered



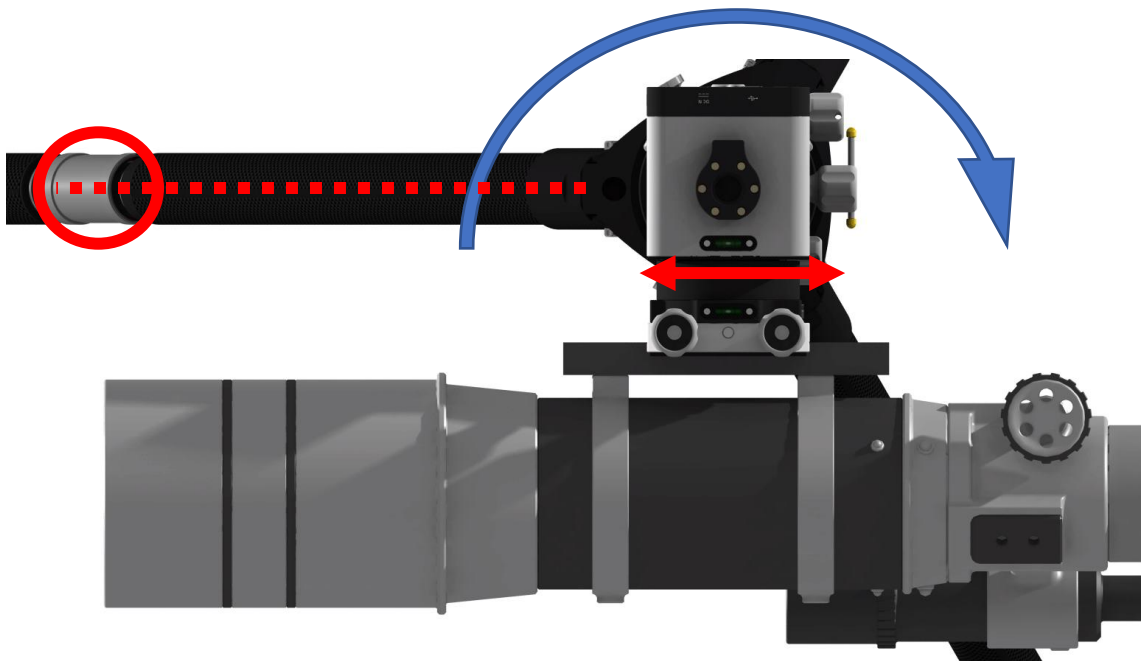
# Installation and Use

## Altazimuth Mode

### Horizontal calibration

Obtain accurate horizontal state

- 💡 Manually rotate the RA axis until the horizontal bubble aligns with the red dashed line in the diagram.



- 💡 Adjust the horizontal adjuster inside the red circle until the horizontal bubble is centered, indicating that the horizontal adjustment is complete.



# Installation and Use

## Altazimuth Mode-Top mounting

### Structure Switching

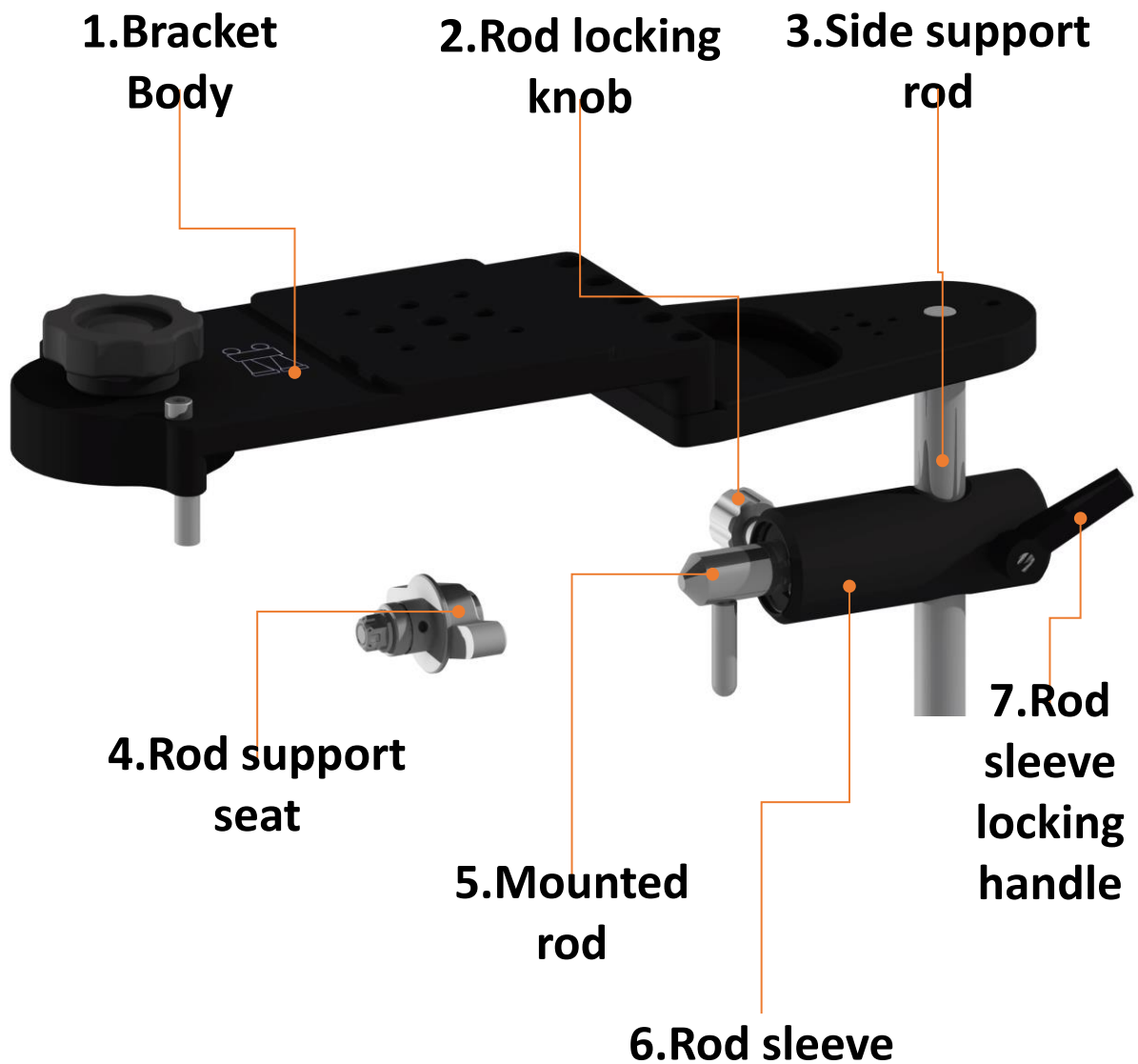
EM31 Pro can achieve the altazimuth top mode by installing a supporting bracket on top



# Installation and Use

## Altazimuth Mode-Top mounting

### Top mode supporting bracket structure




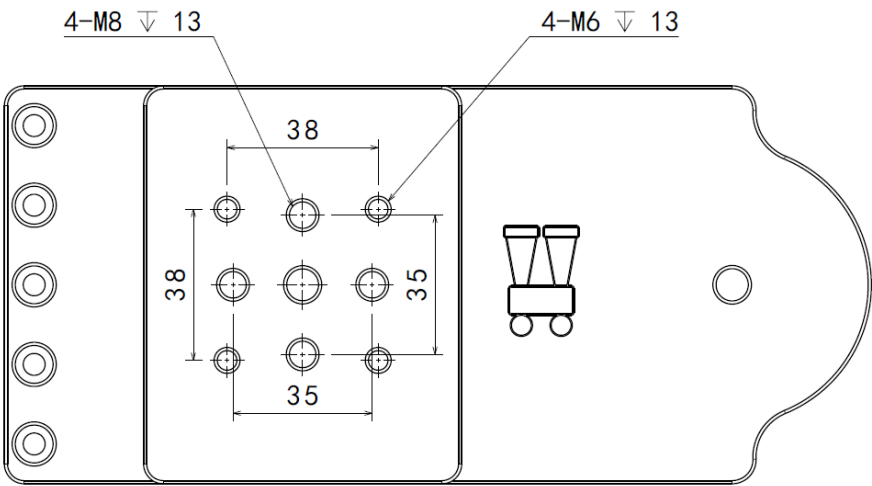
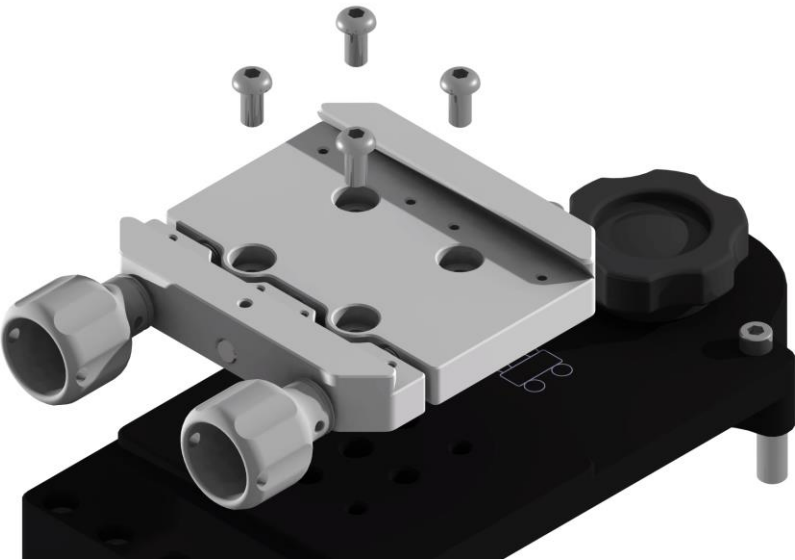
# Installation and Use


## Altazimuth Mode-Top mounting

### Structure Switching

The supporting bracket interface is compatible with most dovetails.

 Pay attention to the installation direction of the dovetail knobs, as shown in the diagram.



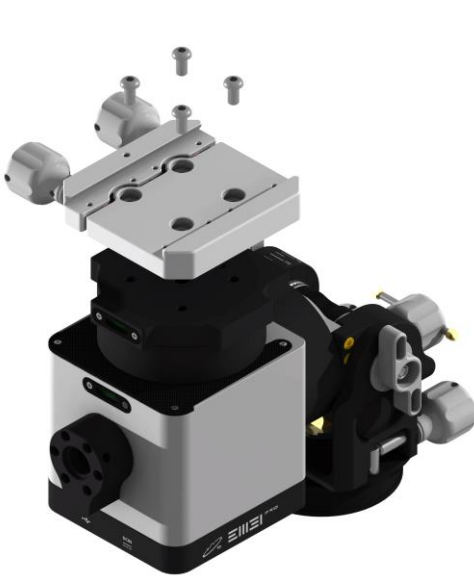
 The top mode supporting bracket does not come with a dovetail, you can use the dovetail on the EM31Pro body or choose your own.

# Installation and Use

## Altazimuth Mode-Top mounting

### Structure Switching

- 💡 Replace the dovetail on the mount body with a supporting bracket connecting adapter and adjust the altitude angle to 0 degrees



# Installation and Use

## Altazimuth Mode-Top mounting

### Structure Switching



Invert the mount body and install it with the pier extension and tripod, following the same steps as in Equatorial mode.

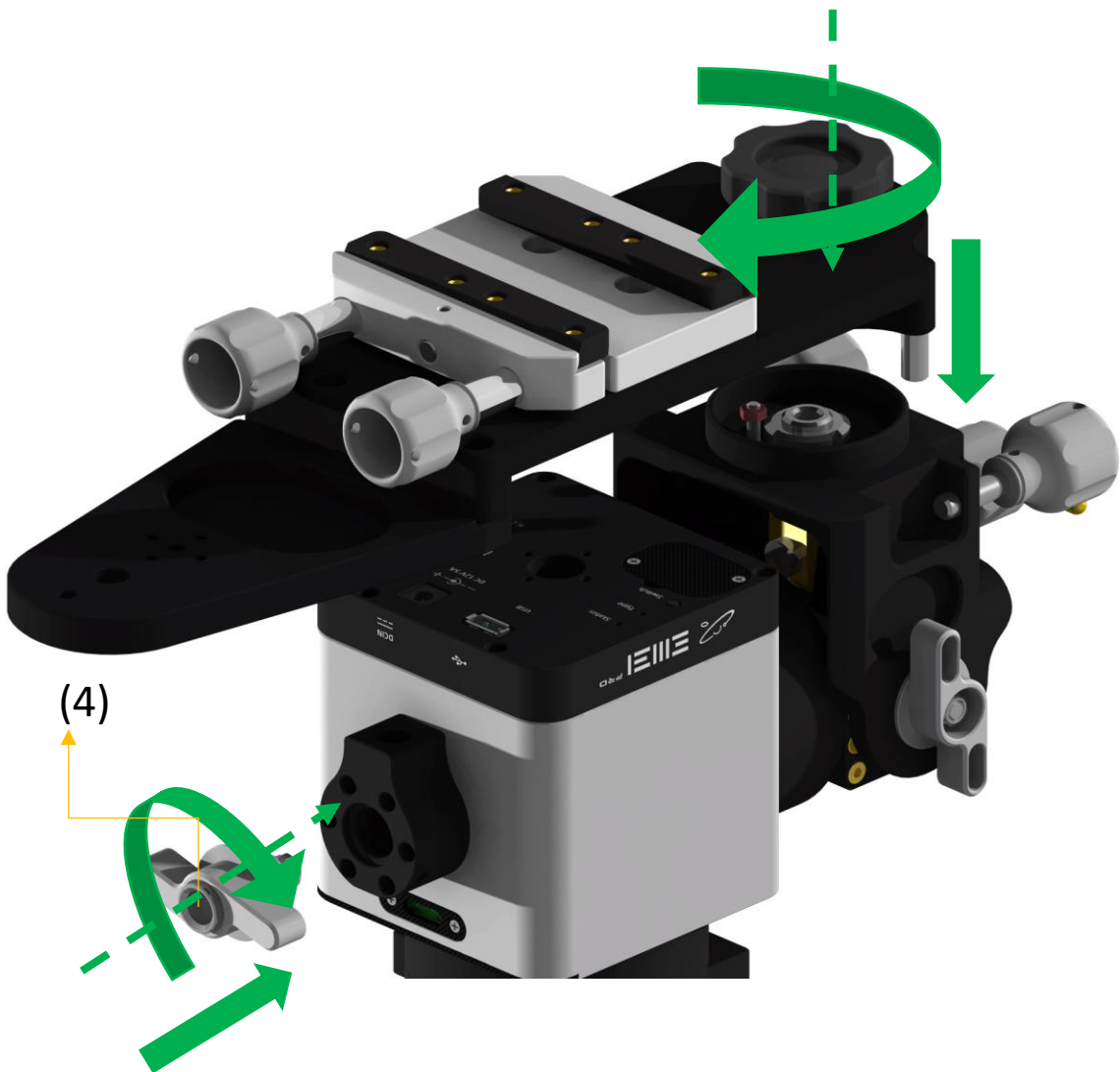


# Installation and Use

## Altazimuth Mode-Top Mounting

### Structure Switching

- 💡 Insert the supporting bracket into the mount body base and rotate the knob clockwise until it is locked. Then, rotate the Rob support seat(4) clockwise until it reaches the bottom but do not lock it tightly

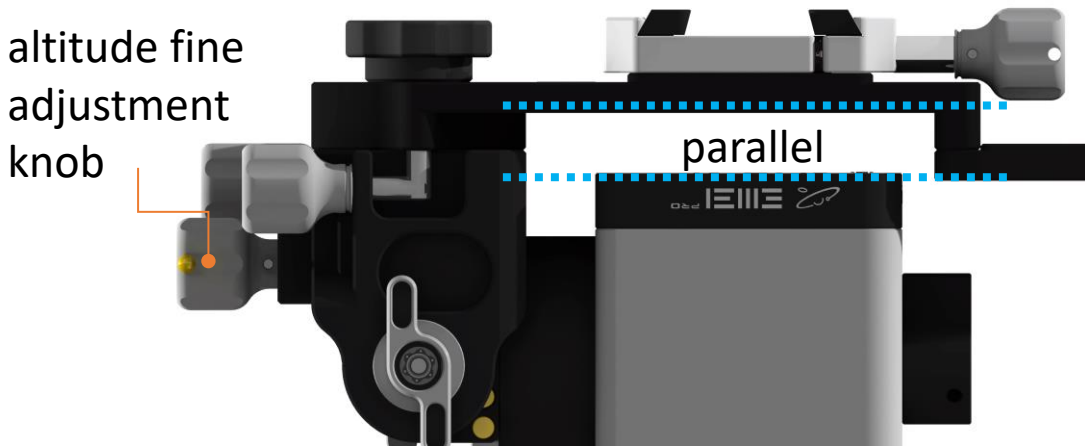


# Installation and Use

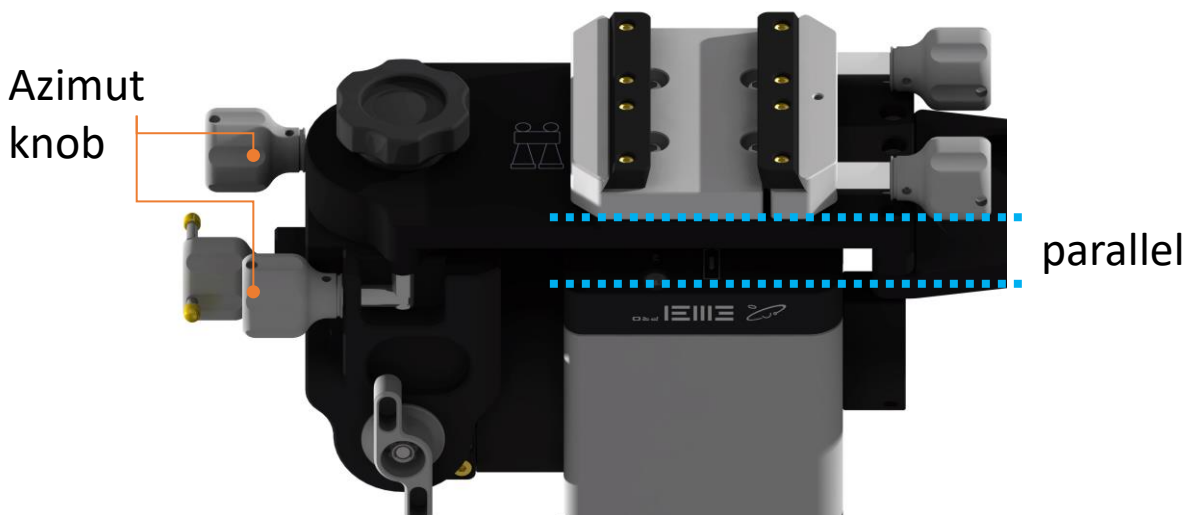
## Altazimuth Mode-Top Mounting

### Structure Switching

- 💡 Adjust the altitude fine adjustment knob until the lower edge of the top-mount bracket is parallel to the edge of the mount body's base.



- 💡 Adjust the azimuth knob until the side edge of the top-mount bracket is parallel to the edge of the mount body's base.



- 
- ⚠️ Parallel alignment of the edges can be determined by adjusting the viewing angle.

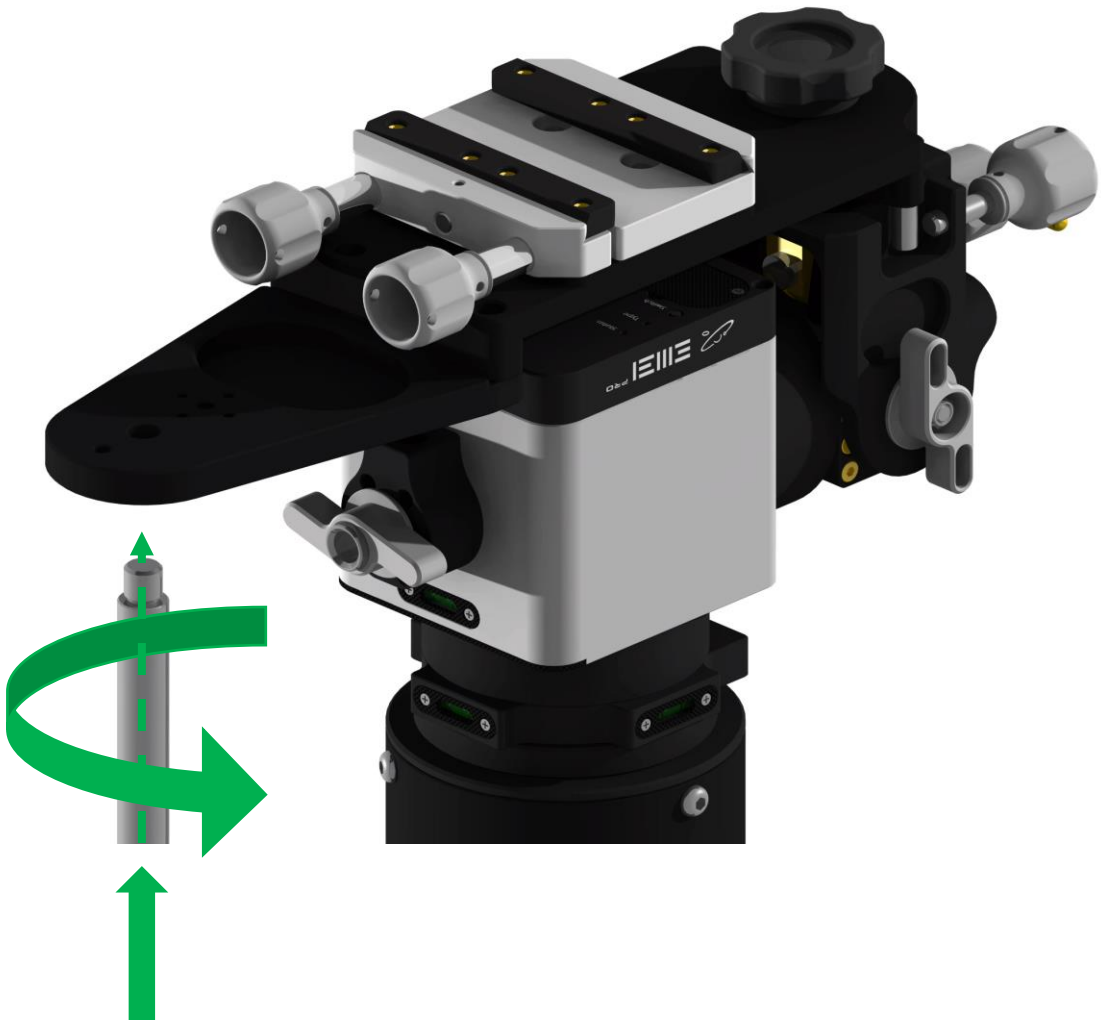
# Installation and Use

## Altazimuth Mode-Top mounting

### Structure Switching



Clockwise into the Side support rod



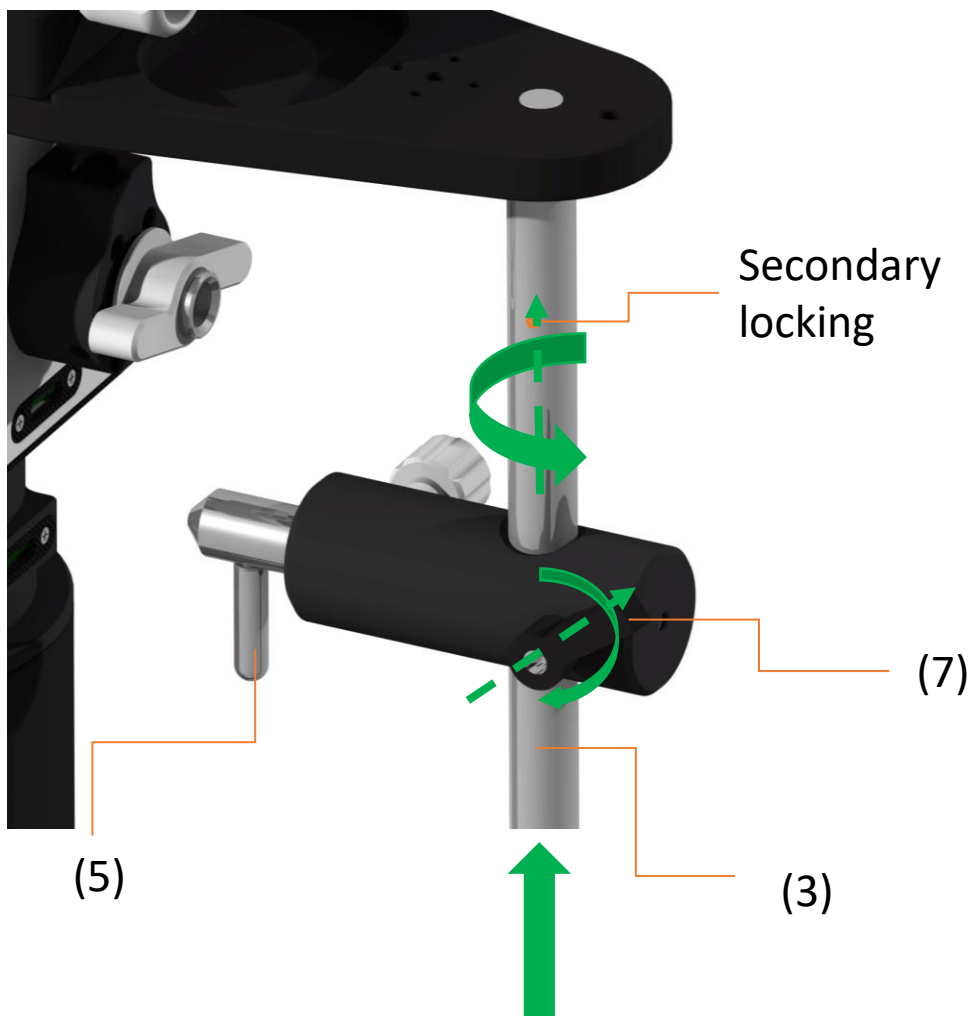
# Installation and Use

## Altazimuth Mode-Top mounting

### Structure Switching



Turn the Mounted rod(5) into the Side support rod(3), and rotate the Rod sleeve locking handle(7) clockwise to lock it. After locking, hold the Mounted rod(5) tightly and rotate it clockwise to lock the Side support rod(3) again



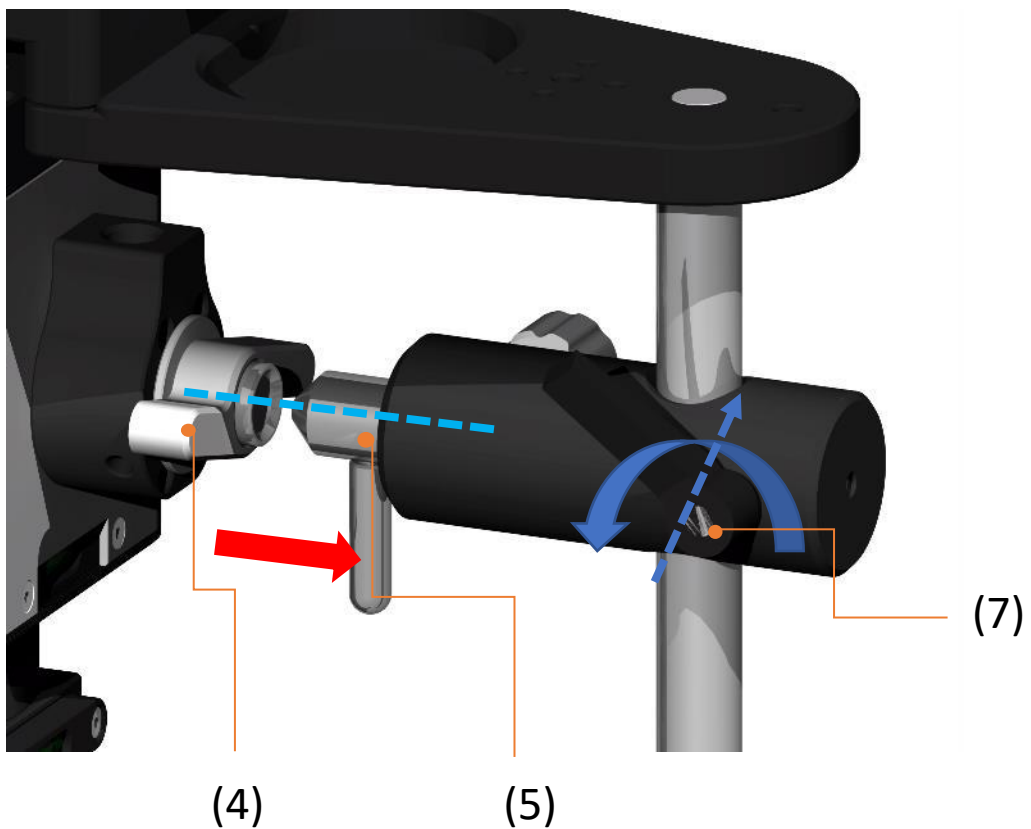
# Installation and Use

## Altazimuth Mode-Top mounting

### Structure Switching



Loosen the Rod sleeve locking handle(7) counterclockwise and press the Mounted rod(5), while aligning the Mounted rod(5) with the Rod support seat(4) and releasing the Mounted rod(5)



# Installation and Use

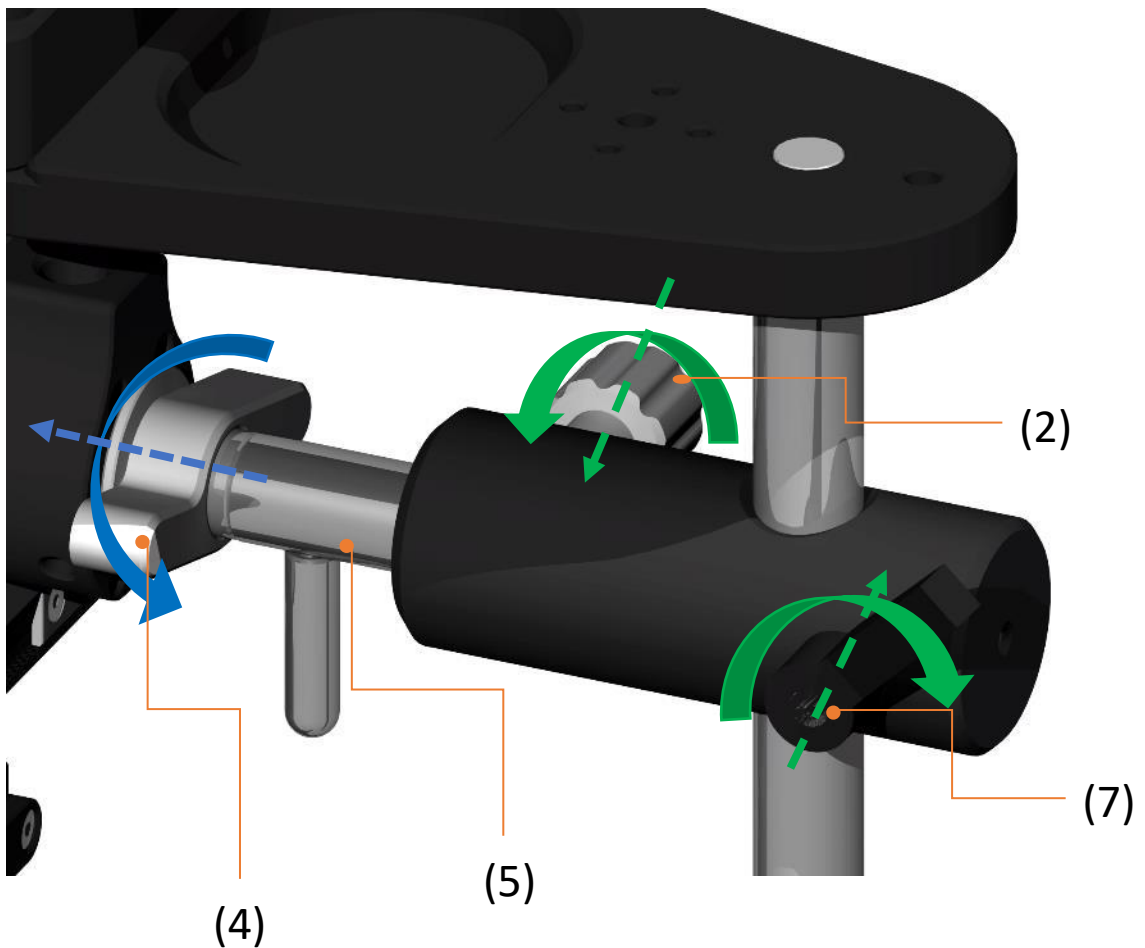
## Altazimuth Mode-Top mounting

### Structure Switching



Rotate the Rod sleeve locking handle(7) and Rod locking knob(2) clockwise

Rotate Rod support seat(4) counterclockwise half a turn to one turn to fully lock the Mounted rod(5) and complete the installation of the top mode supporting bracket



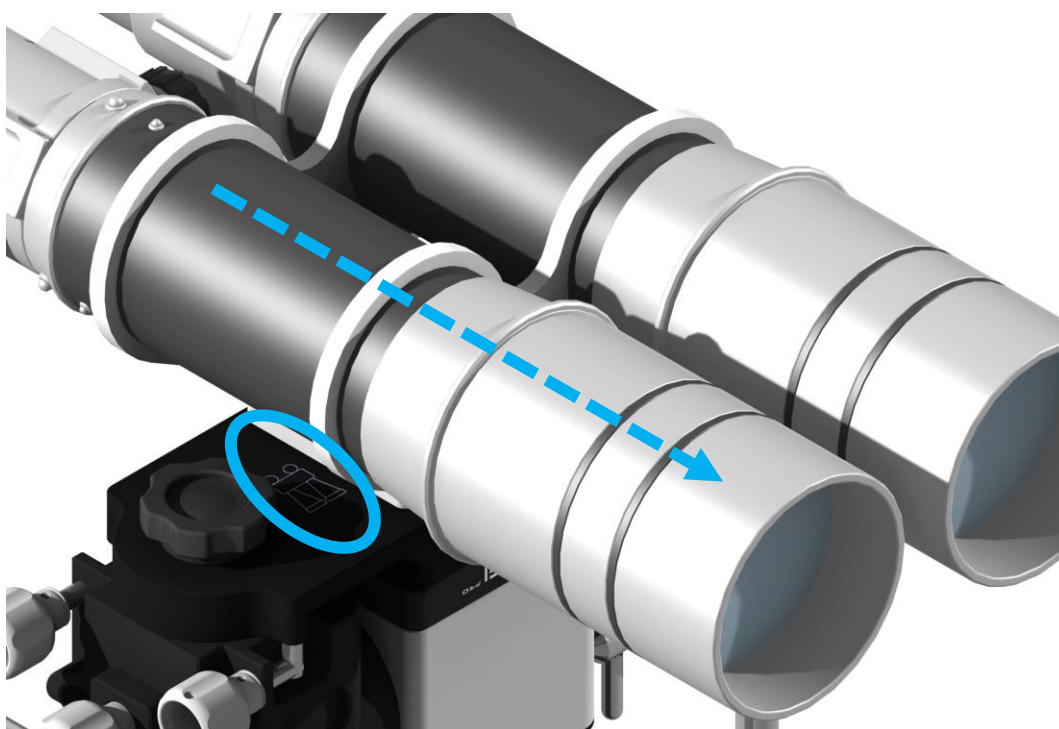
# Installation and Use

## Altazimuth Mode-Top mounting

### Telescope installation



Install the telescope into the upper dovetail, ensuring that the installation direction of the telescope is consistent with the direction marked on the top mode supporting bracket, **Installing the telescope in reverse can result in GOTO errors and may even lead to collisions that could damage the equipment.**

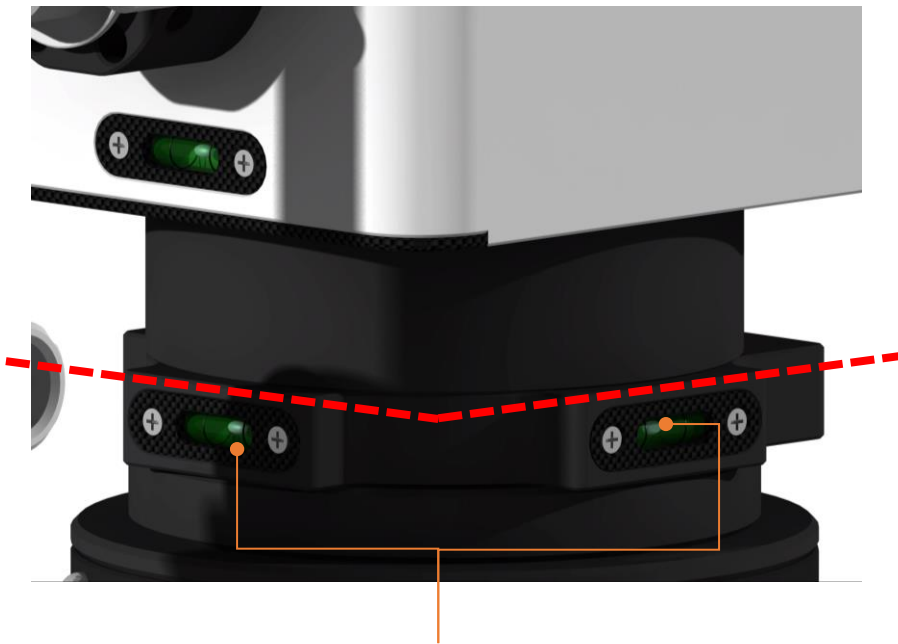


# Installation and Use

## Altazimuth Mode-Top mounting

### Level adjustment

The top mode is Altazimuth mode, it is necessary to adjust the horizontal state. Accurate horizontal state can be obtained through horizontal bubbles on the DEC axis



DEC axis level  
bubble



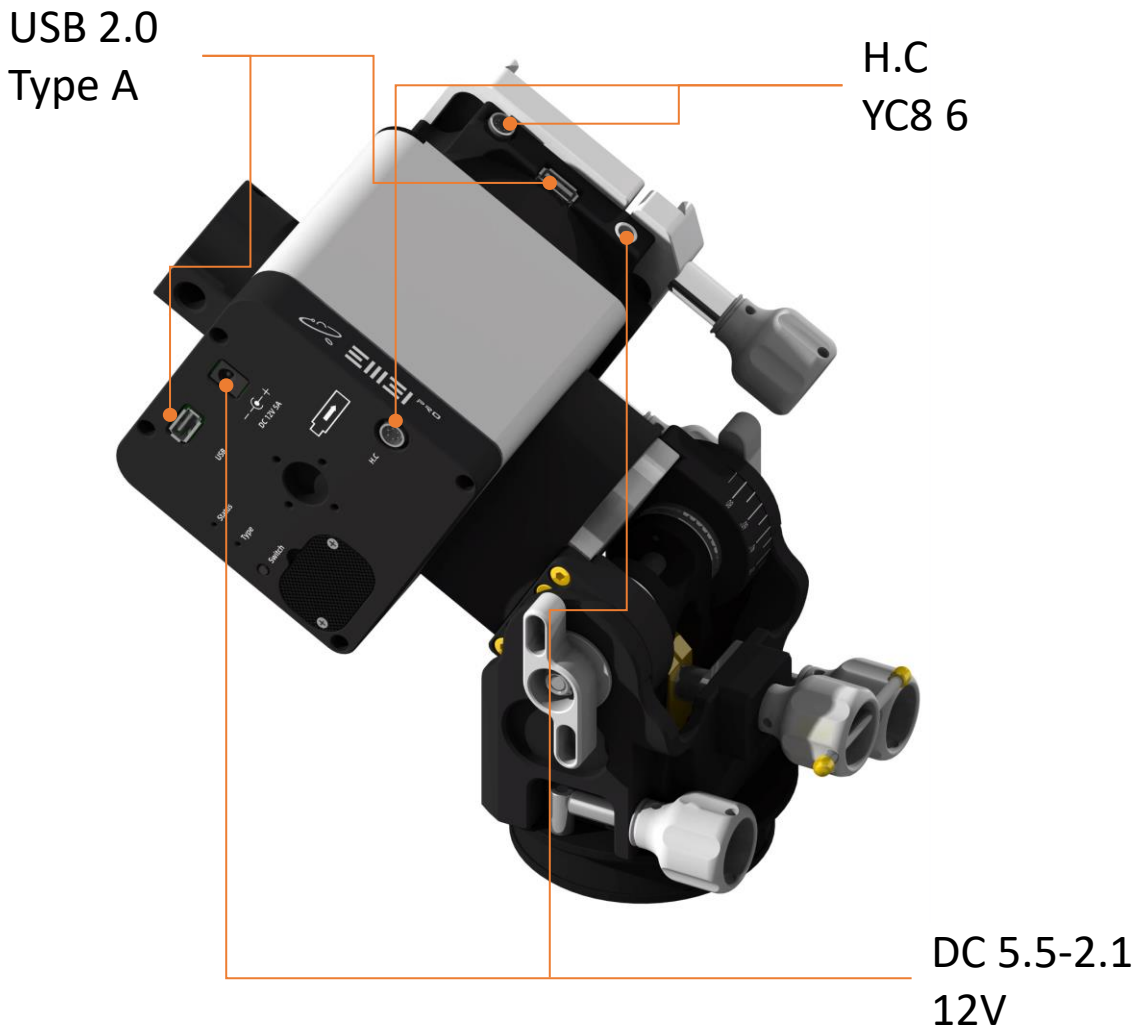
Complete the horizontal adjustment by adjusting the horizontal adjuster installed on the tripod, using the same method as in the side-mounted Alt-Az mode.



# Installation and Use

## Cable Connection

EM31 Pro has two sets of cable ports, located on the base of the mount and on the DEC rotation axis, both with identical functions.



**Do not connect two power sources simultaneously.  
Do not connect two hand controllers simultaneously.  
Do not connect two astronomical control devices  
simultaneously (such as any PC, astronomy box, or Mini PC).**

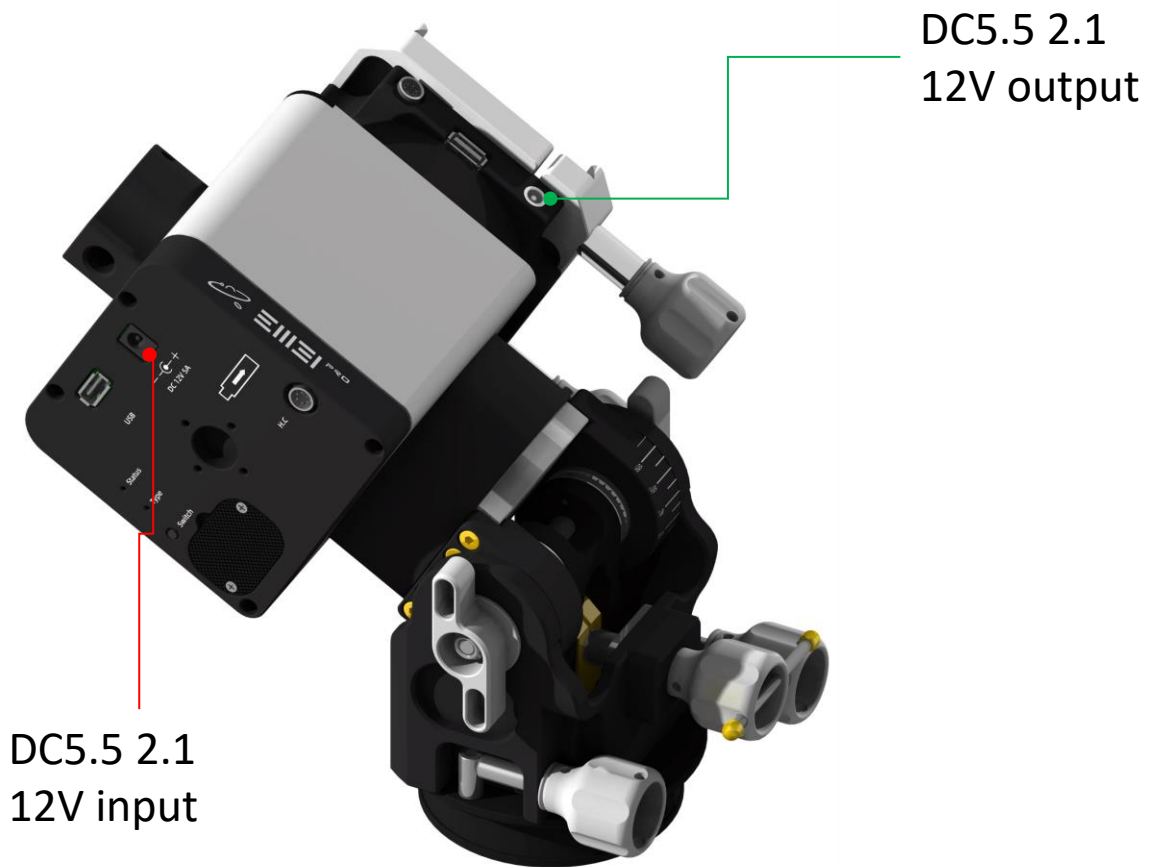
# Installation and Use

## Cable Connection

### Power connection method

EM31Pro features two DC 12V ports. Either port can serve as a power input, while the other can be used as a power output to supply power to other astronomical devices.

💡 For astrophotography, it is recommended to use the port on the base of the mount as the power input and the DEC axis port as the output.



⊘ Do not connect two power sources simultaneously. The load on the output port must not exceed 12V 5A.

⚠ When powering only the mount, it is recommended to use a DC 12V 2A power supply or higher. When powering other devices as well, use a DC 12V 5A power supply or higher.

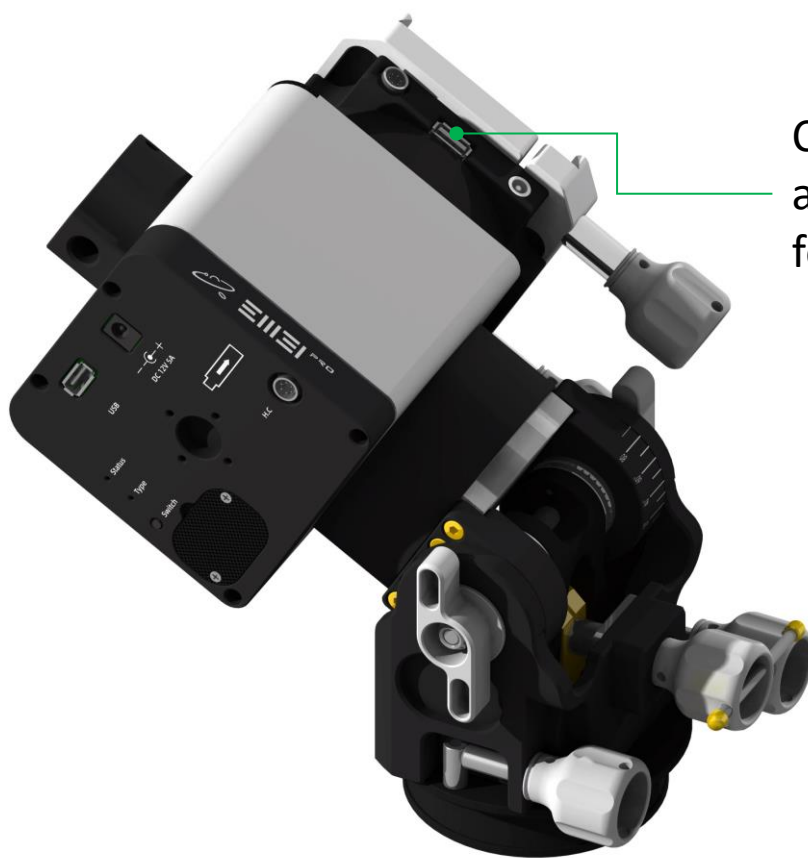
# Installation and Use

## Cable Connection

### USB cable connection method

EM31 Pro has two USB ports, each capable of connecting the mount to a control device (such as a PC, astronomy box, Mini PC).

💡 For astrophotography, it is recommended to connect the astronomy box or PC to the DEC axis port . This allows the USB and power output cables to rotate in sync with the telescope, effectively preventing cable tangling.



Connection of an astronomy box or PC for astrophotography

- 
- ⊘ Prohibit connecting devices other than PCs, Astro Boxes, and Mini PC...  
**Do not connect the mount through any USB hub.**

# Installation and Use

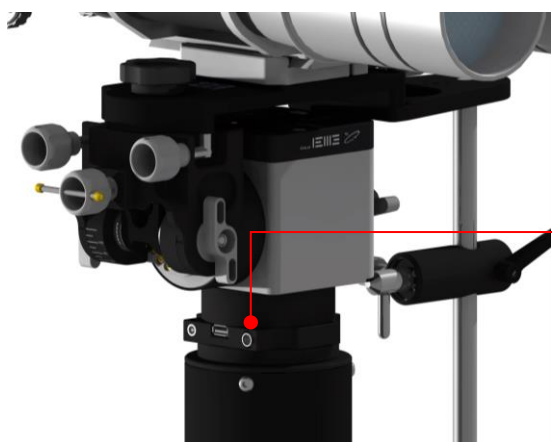
## Cable Connection

### Handle connection

EM31 Pro has two handle controller ports, each capable of connecting the handle controller



Handle connected to the bottom of the mount in EQ and Alt/Az side modes.



Handle connected to DEC axis cable management in Alt/Az top mode

- 
- ⊘ **Prohibit connecting two handle controllers simultaneously**  
**Do not plug and unplug the handle controller while the mount is powered on**

# Installation and Use

## Mode Selection

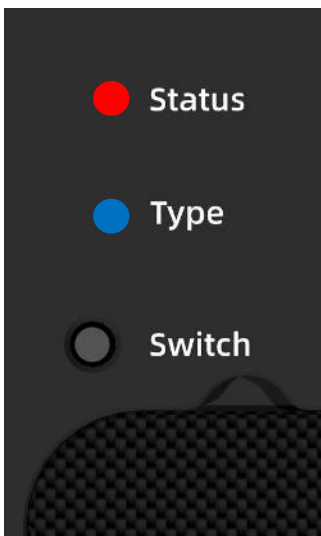
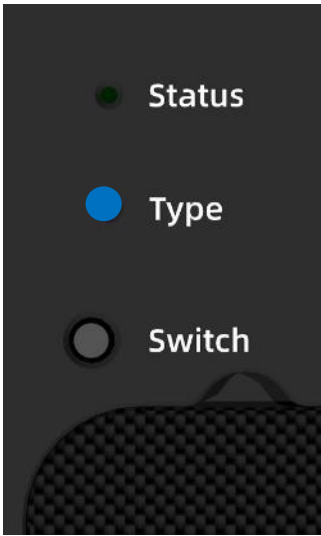
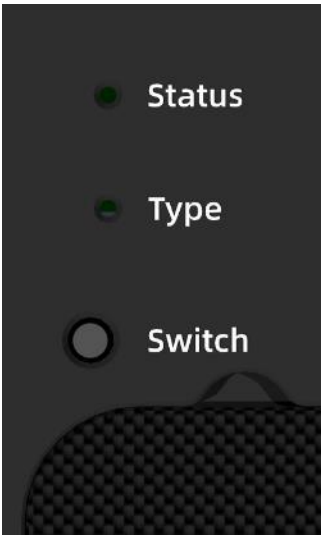
### Mode selection


EM31 Pro mode selection indicated by the “Type” light ,  
**Blue is Altazimuth side-mounted mode**, **Red is Altazimuth top-mounted mode**, **Light out for Equatorial mode**

Wait for 5 seconds when the mount is powered on, and enter mode switching after the Status light flashes off

By clicking the Switch button, the Type light will begin to change, blue-red-off, and the Type light will be switched once per key press, which can be switched cyclically.

After confirming the required mode, wait for 10 seconds, the Status light will remain on after flashing, and the mode switch is complete



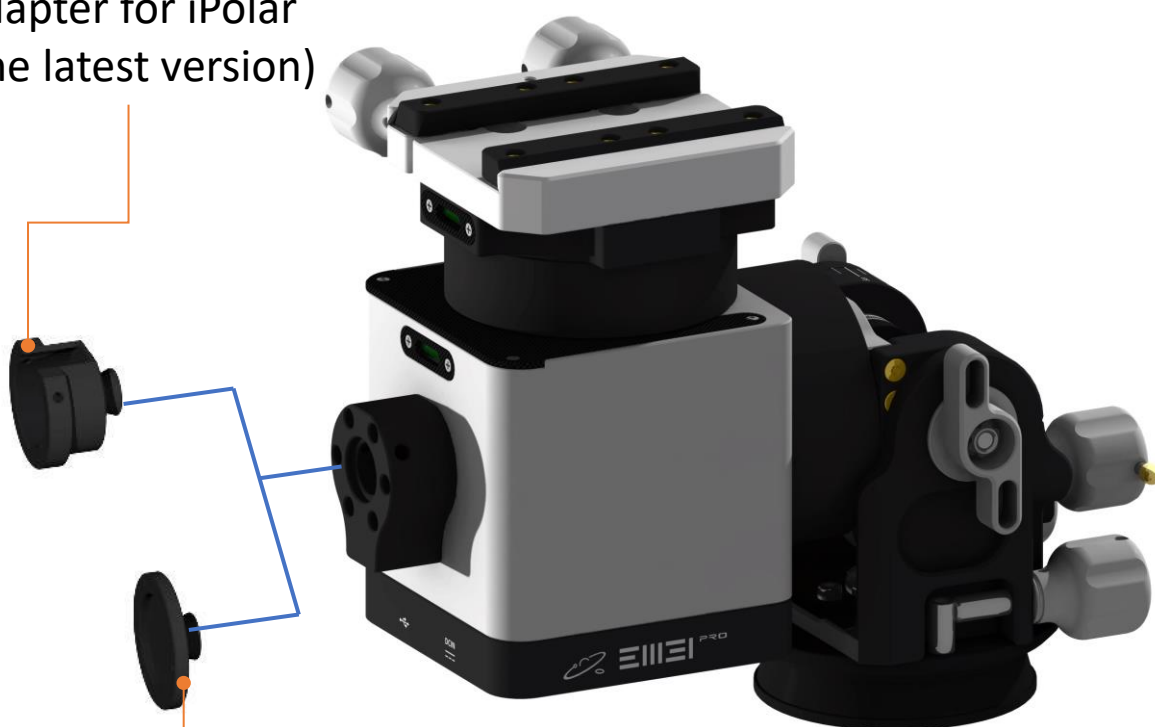
 When the mount is in operation, the Status light will remain on and will start flashing once tracking is activated.

# Accessory Installation

## Adapter for electronic polar alignment scope

The electronic polar scope can be connected to EM31Pro via an adapter (optional accessory).

Adapter for iPolar  
(the latest version)



Adapter for QHY Pole  
Master

# Accessory Installation

## Ball head adapter

EM31 Pro can mount a DSLR through the ball head adapter (optional), allowing for wide-field astrophotography while capturing astronomical images.



3/8 16  
bolts

# Battery Installation

Install and replace the battery

## Battery replacement



Battery model CR1220

💡 The battery stores the time and location coordinates. It is recommended to replace it every 12 to 18 months.

⊘ Do not replace the battery while powered on

# OnStep Quick Start Guide

## OnStep Guide

Android users can set and control the mount through OnStep APP or webpage



**IOS system cannot use APP, webpage is workable**



**Connect to the web via WiFi:**

Search for WIFI hotspot OnStep connection through PC or mobile phone, password: password

Enter "192.168.0.1:9999" or "192.168.0.1" into the browser

**OnStep** WiFi Server 2.1i (OnStep 4.24a)

Status Control Library PEC Settings Config WiFi

**Site:**  
7/30/22 04:44:59 UT (web browser)  
1/01/00 00:04:27 UT (06:44:19 LST)  
Long. = +000°00, Lat. = +00°00

**Coordinates:**  
Current:  $\alpha=18:44:24$ ,  $\delta=+89^{\circ}26:29$   
Target :  $\alpha=00:00:00$ ,  $\delta=+00^{\circ}00:00$   
Pier Side=**None** (meridian flips **On**)


**Polar Alignment:**  
◀ 0" ▲ 0" (Mount relative to NCP)

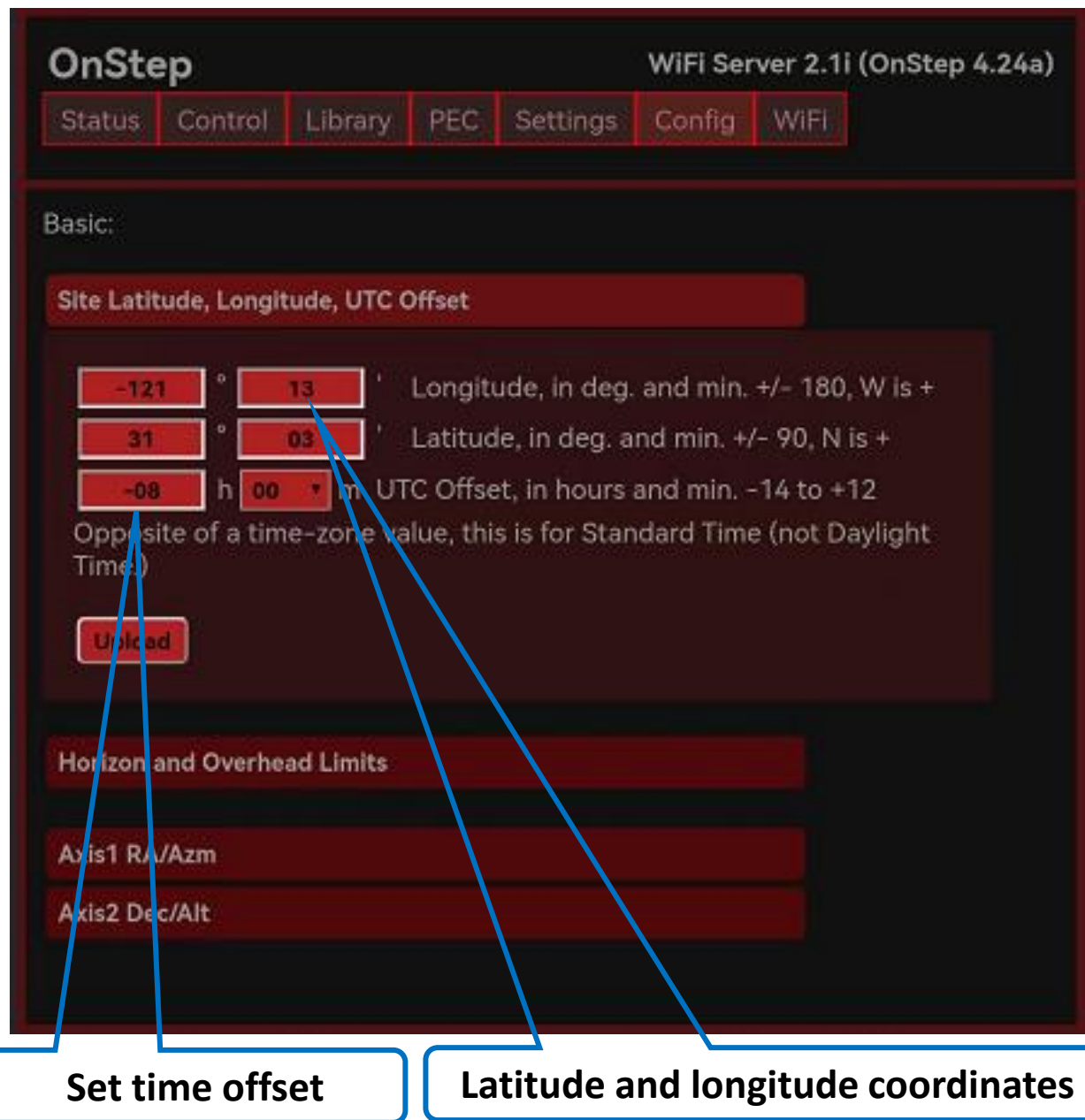
**Operations:**  
Parking: **Not Parked (At Home)**  
Tracking: **Off**  
Tracking Rate: 0.000Hz  
Maximum slew speed: 1.5°/s

**State:**  
Last General (Background) Error: **None**  
Workload: **5%**  
Wireless signal strength: **31dBm (100%)**

# OnStep Quick Start Guide

## OnStep Guide

 For the first use or when using the mount at a new location, set the mount's latitude and longitude coordinates and local time (can be synced via NINA or Asiair)



**OnStep** WiFi Server 2.1i (OnStep 4.24a)

Status Control Library PEC Settings **Config** WiFi

Basic:

Site Latitude, Longitude, UTC Offset

°  ' Longitude, in deg. and min. +/- 180, W is +

°  ' Latitude, in deg. and min. +/- 90, N is +

h  m UTC Offset, in hours and min. -14 to +12

Opposite of a time-zone value, this is for Standard Time (not Daylight Time)


Horizon and Overhead Limits

Axis1 RA/Azm

Axis2 Dec/Alt

**Set time offset**

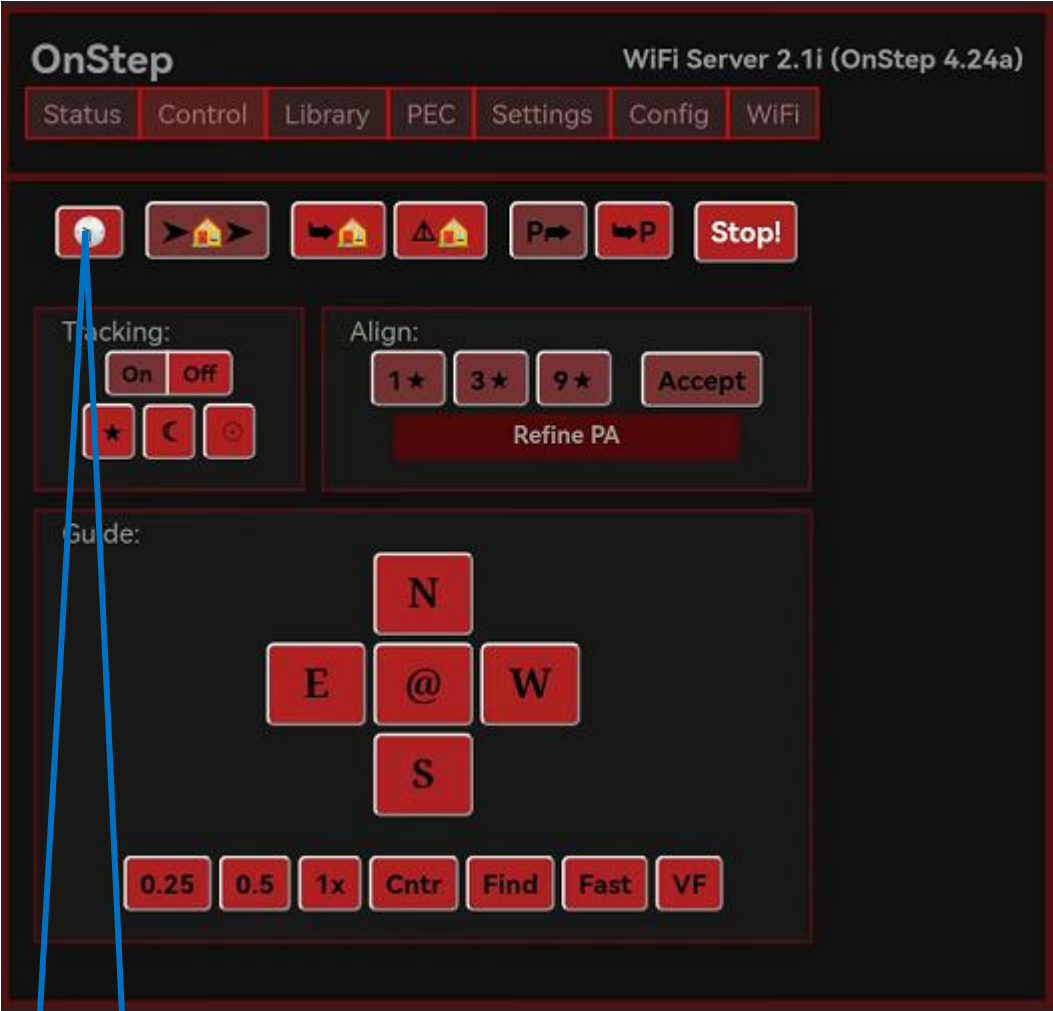
**Latitude and longitude coordinates**

 In the OnStep system, east longitude is (-), west longitude is (+), north latitude is (+), and south latitude is (-). For UTC, east of the prime meridian is (-), and west is (+).

# OnStep Quick Start Guide

## OnStep Guide

### Set Time

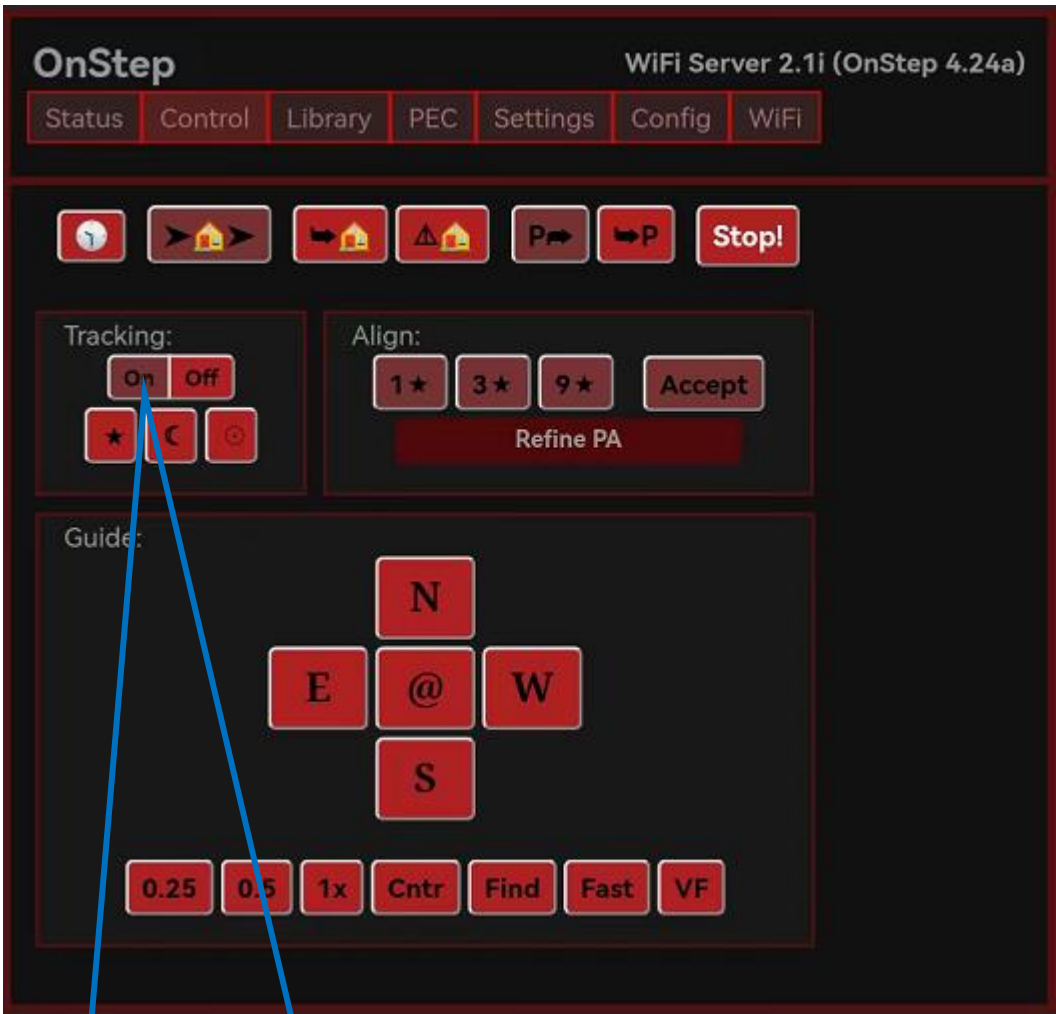


set time

# OnStep Quick Start Guide

## OnStep Guide

### Start Tracking



Turn on Tracking, and the rotation of the mount can be controlled by operating the direction keys.

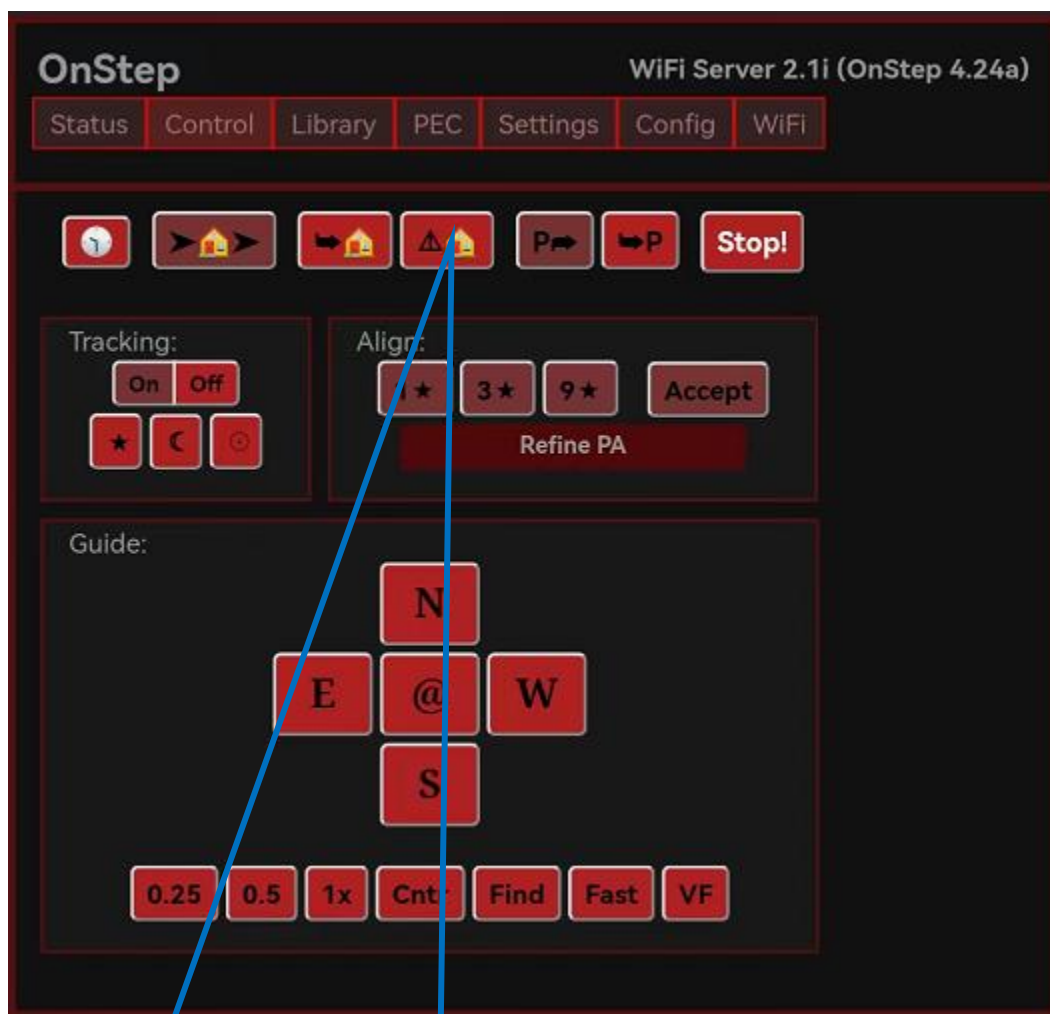


OnStep system option, gray indicates ON status

# OnStep Quick Start Guide

## OnStep Guide

 **The home position differs in the three modes of EM31Pro, so it should be set before using the mount**




After enabling tracking, manually rotate the mount to the home position, and click the “At Home” button to save the home position of the mount.

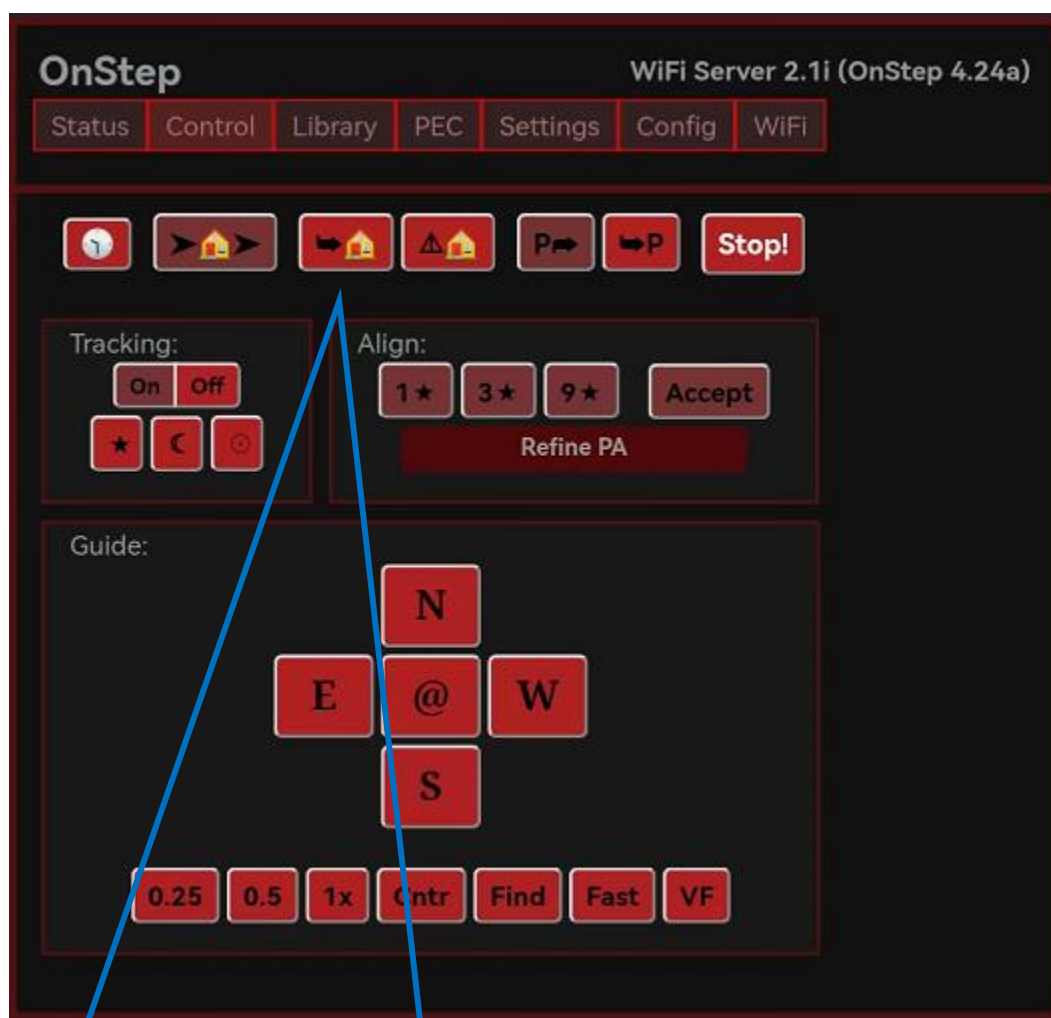


**Note: After setting the home position, the mount will return to the “Untracking” state. Click “Tracking ON” again to enable tracking**


# OnStep Quick Start Guide

## OnStep Guide

 **The home position is different in the three modes of EM31pro, so it should be set before using the mount**



Click “Go Home” button to return mount to the home position.

 After powering off and on, the mount defaults to the power-on position as the home position. For accuracy, always reset the home position before each use. Alternatively, you can click the 'Go Home' button to return the mount to the home position before powering off, or, if using control software, configure the plan to execute the 'Go Home' command automatically after each session to avoid the need for a manual reset next time.

# OnStep Quick Start Guide

## OnStep Guide

### Limit position setting

OnStep WiFi Server 2.1i (OnStep 4.24a)

Status Control Library PEC Settings Config WiFi

Basic:

Site Latitude, Longitude, UTC Offset

Horizon and Overhead Limits

-10 Horizon, minimum altitude in degrees +/- 30

90 Overhead, maximum altitude in degrees 60 to 90

Upload

Axis1 RA/Azm

Axis2 Dec/Alt


Minimum & Maximum Altitude  
Limits setting



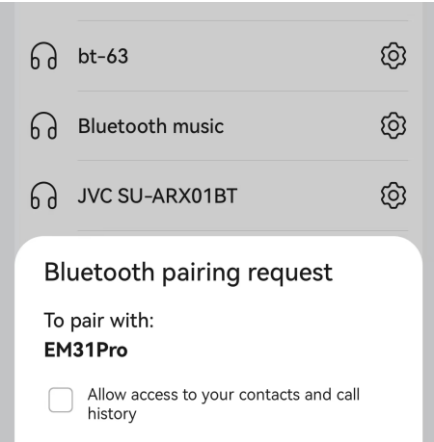
**Note :** When the manual operation of the mount rotation exceeds the set limit, the mount will stop rotating, press the key again, the mount will only move a small angle. Once the GOTO target exceeds the limit, GOTO will stop. The limit position is related to the time, latitude and longitude coordinates and home position setting of the mount.

# OnStep Quick Start Guide

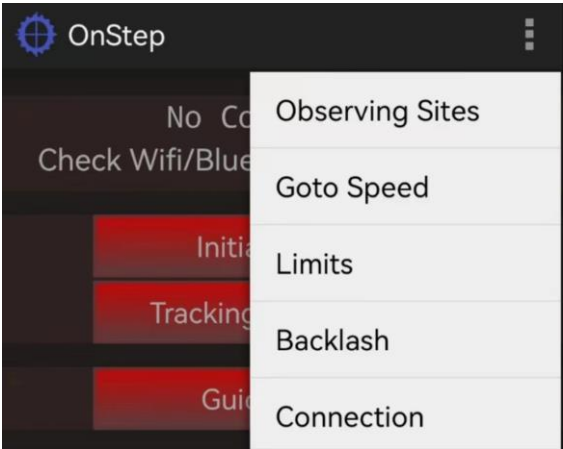
## OnStep Guide

 **Connect to the Android app via Bluetooth.**  
( app only supports Android system, Apple system needs to be set through the webpage )

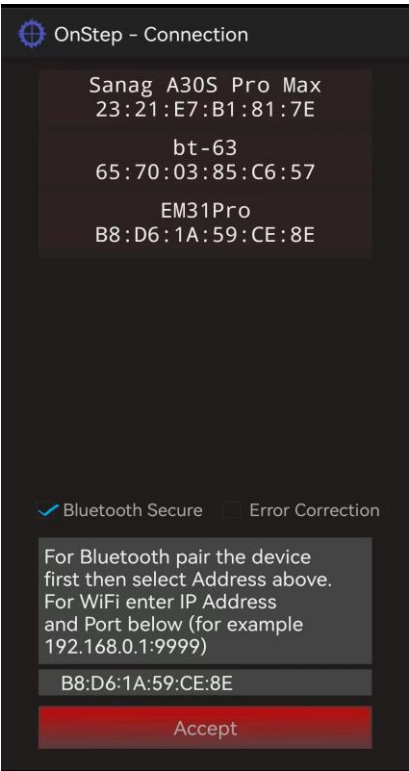
① Matching Bluetooth



② Select Connection in the APP



③ Choose Bluetooth



④ Complete connection



**The first connection may be very slow. Please allow some time for the process to complete.**

# OnStep Quick Start Guide

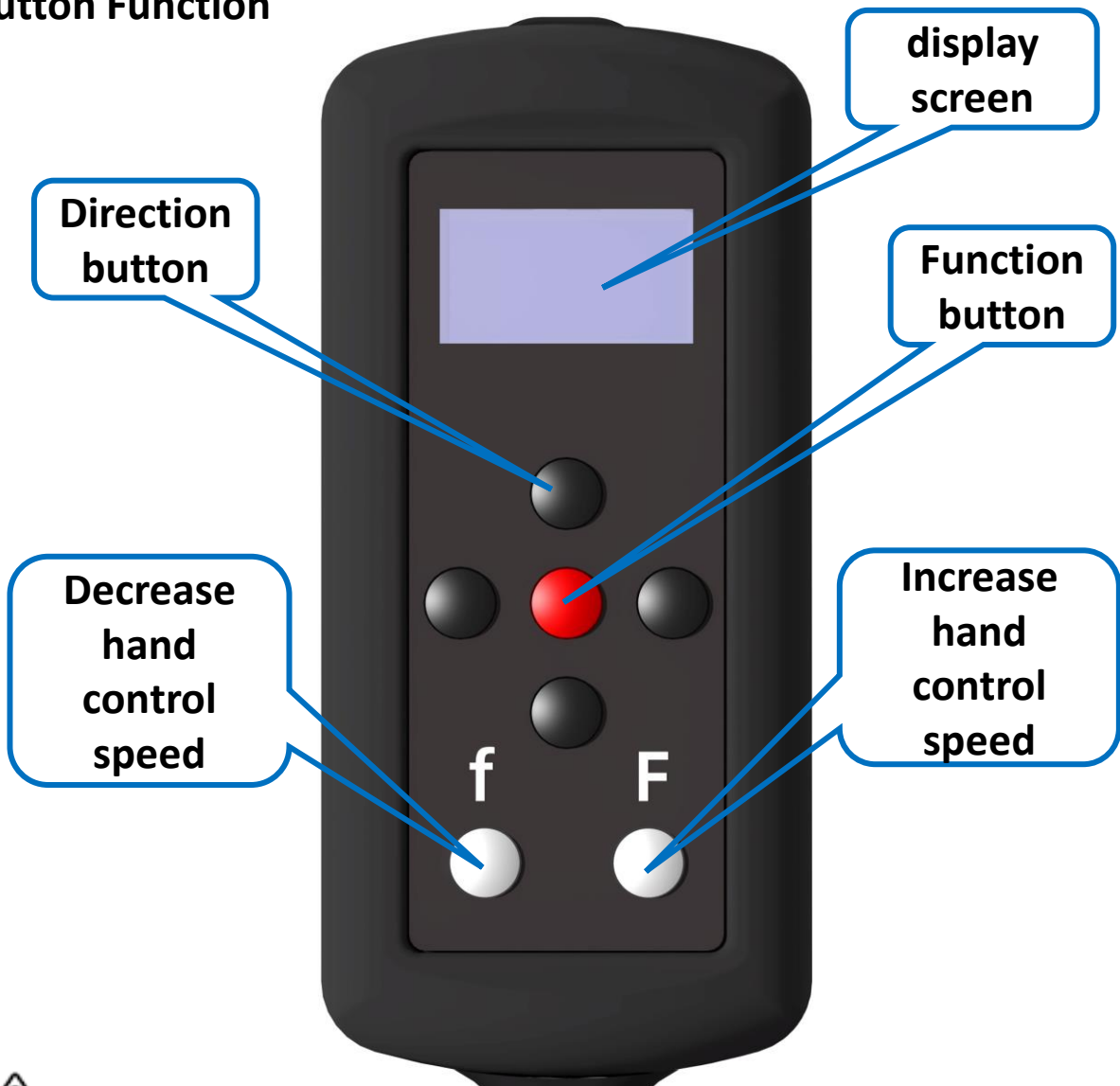
## OnStep Guide

### EM31 Pro Hand Controller



**Keep the hand controller connected to the mount even when not in use, or inquire about firmware options to disable its function.**

#### Button Function



**For safety, the hand controller defaults to a low speed (20X) upon startup. Press 'F' to increase the speed.**

# OnStep Quick Start Guide

## OnStep Guide

### EM31 Pro Hand Controller

#### Button Function



1. Short Press = switching display information
2. Long Press = entering Main Menu
3. Double Click = Feature Menu

# OnStep Quick Start Guide

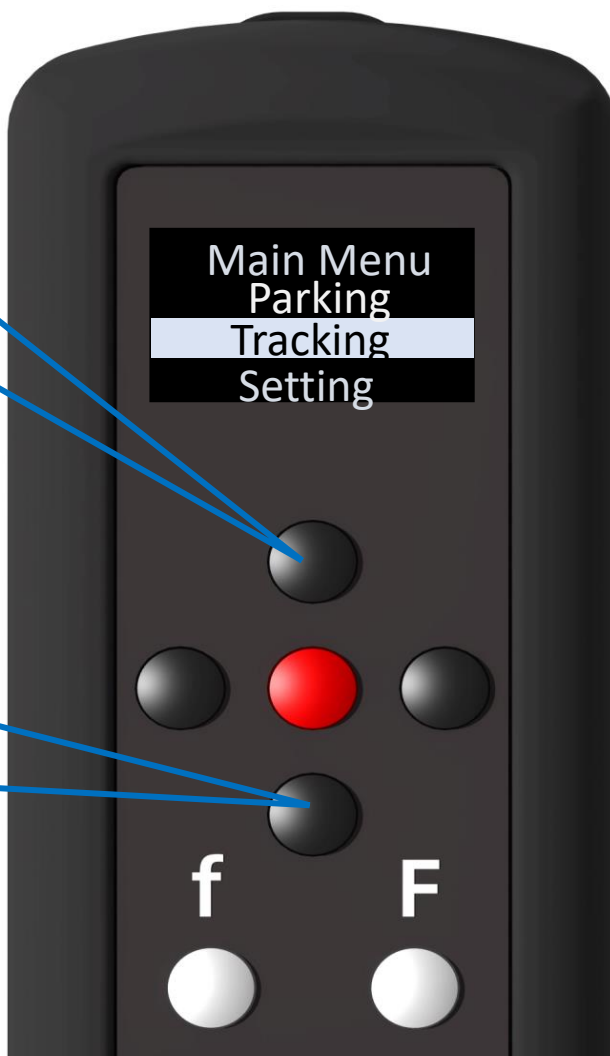
## OnStep Guide

### EM31 Pro Hand Controller

#### Button Function

1. North when tracking
2. Scroll Up while in Menu's

1. South when tracking
2. Scroll Up while in Menu's



#### N and S Button Note

Near the celestial pole, the N and S buttons may behave unexpectedly. This is normal. The system always tries to move North when you press the N button. If it can't, it will move South until you release the button.

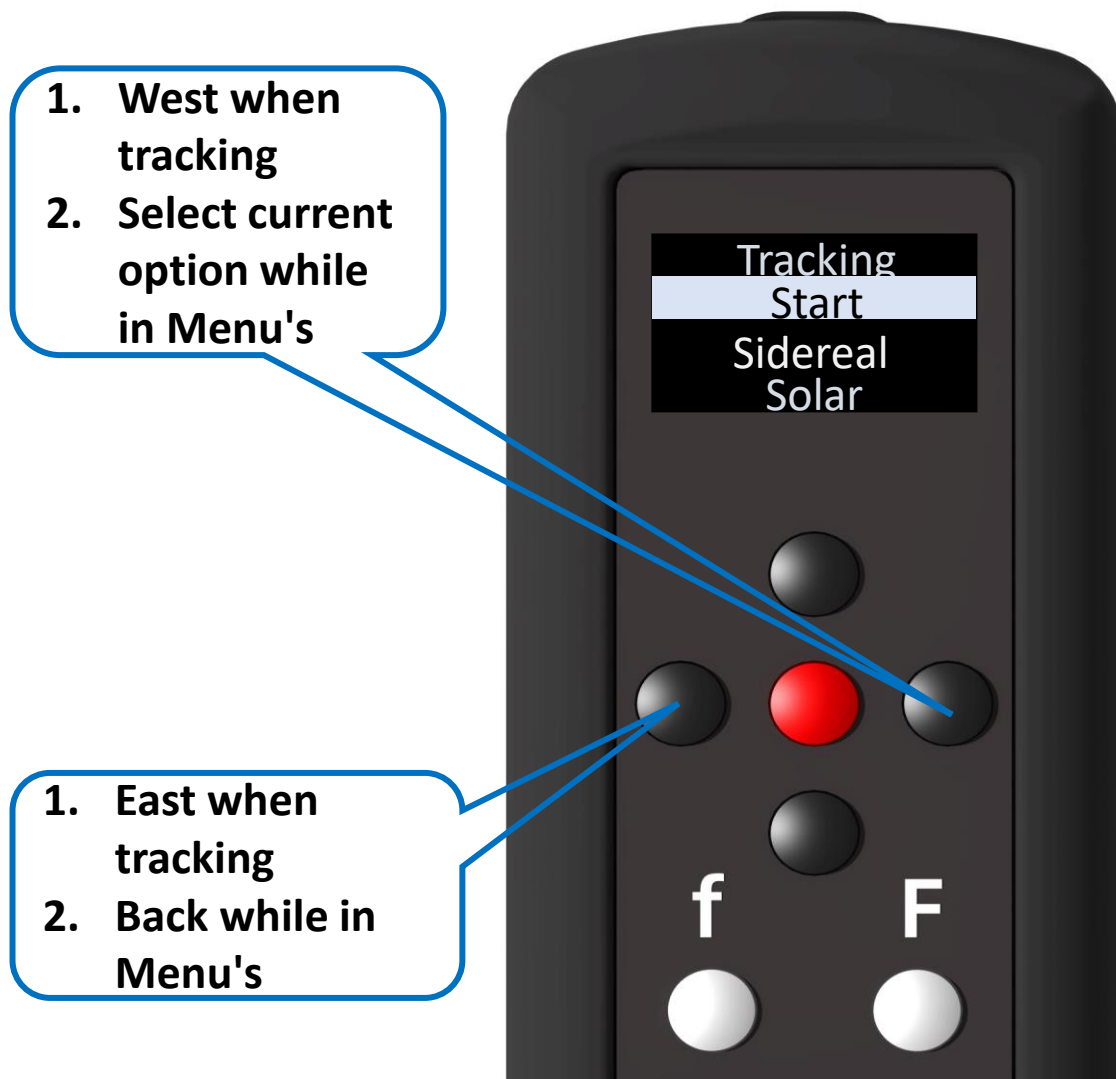
**Tip:** This behavior is expected near the pole and will make more sense with practice. In the Southern Hemisphere, this will be reversed.

# OnStep Quick Start Guide

## OnStep Guide

### EM31 Pro Hand Controller

#### Button Function


















Refer to the OnStep website for detailed menus and usage instructions. <https://onstep.groups.io/g/main/wiki/28605>

# OnStep Quick Start Guide

## OnStep Guide

















### Common status icons for the Hand Controller

-  Alignment Star #1
-  Alignment Star #2 (#3 thru #8 not shown)
-  Alignment Star #9 (last possible)
-  Telescope is at home position. Tracking is OFF
-  Unknown error. Tracking has stopped
-  Telescope position exceeds user defined Meridian limit. Tracking has stopped
-  Telescope position exceeds user defined RA limits "Under Pole". Tracking has stopped
-  Telescope position exceeds user defined Azimuth limits. Tracking has stopped
-  Telescope position exceeds user defined Declination limit. Tracking has stopped
-  Telescope limit sensed. Tracking has stopped
-  Telescope position exceeds user defined Horizon or Overhead limit. Tracking has stopped
-  Motor fault. Tracking has stopped
-  East side of pier. Declination is between 90 and -90
-  West side of pier. Declination is between 180 and 90 or -90 and -180
-  PEC, paused

# OnStep Quick Start Guide

## OnStep Guide

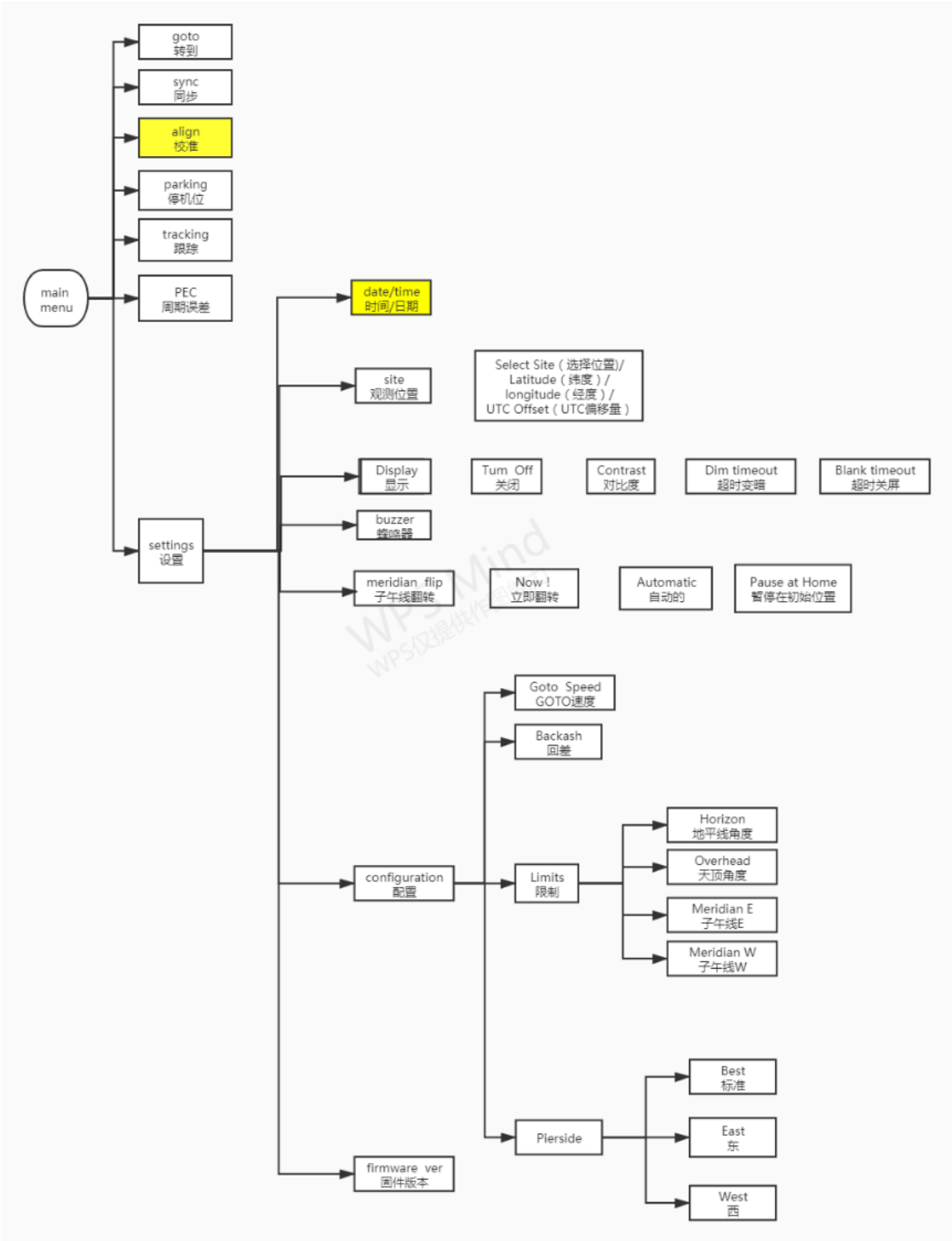
### Common status icons for the Hand Controller

-  PEC, recording
-  PEC, playing
-  Telescope is slewing
-  Lunar Tracking rate is selected
-  Solar Tracking rate is selected
-  King Tracking rate is selected
-  Sidereal Tracking rate is selected
-  Sidereal Tracking, refraction compensated (RA-axis only)
-  Sidereal Tracking, refraction compensated (Dual-axis)
-  Sidereal Tracking, refraction and pointing model compensated (Full)
-  Sidereal Tracking, refraction and pointing model compensated (Full, Dual-axis)
-  Tracking is OFF
-  Telescope is guiding
-  Park failure
-  Telescope is slewing to park position
-  Telescope is parked

# OnStep Quick Start Guide

## OnStep Guide

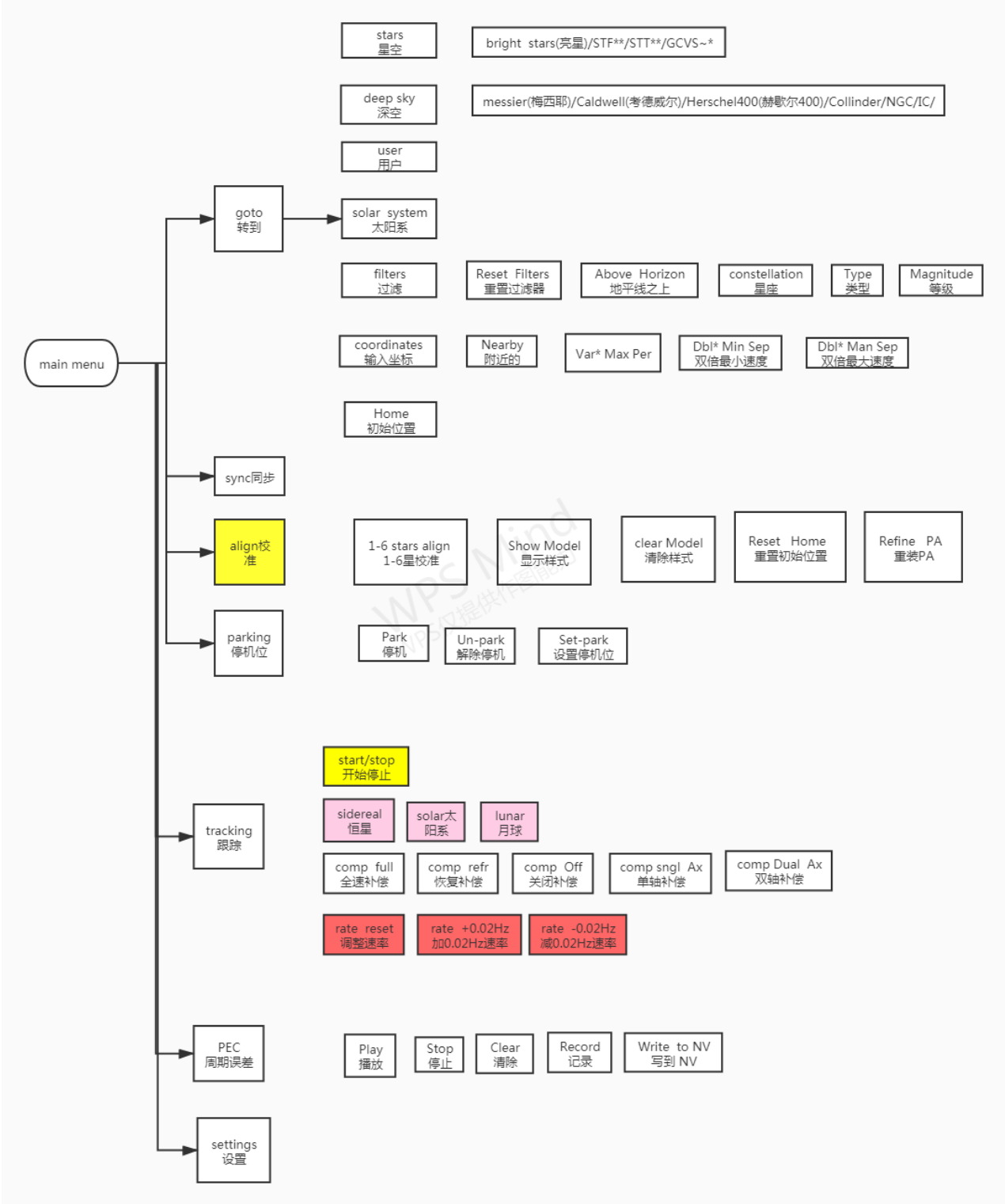
### Hand Controller menu structure diagram



# OnStep Quick Start Guide

## OnStep Guide

### Hand Controller menu structure diagram

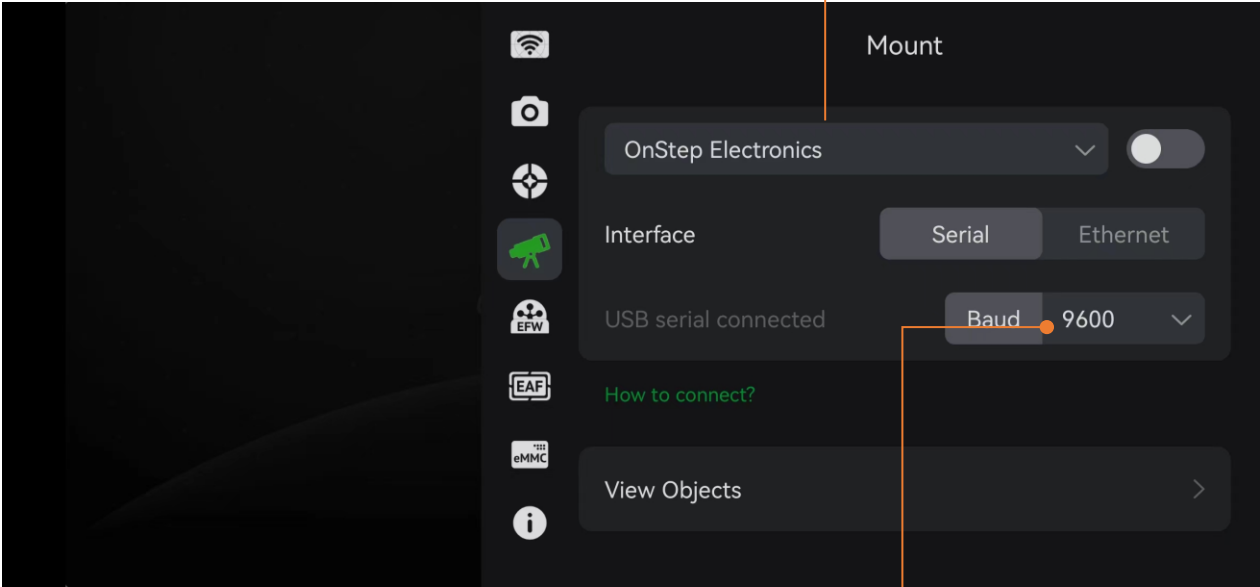


# OnStep Quick Start Guide

## OnStep Guide

### OnStep and ASIAIR connection

Mount selects “OnStep Electronics”



Serial port baud rate 9600

# OnStep Quick Start Guide

## OnStep Guide

### OnStep and PC connection

#### Step ① Installing the mount serial port driver cp2102

 **Confirm that the mount serial port connection is normal in Windows Device Manager**



#### Step ② Install ASCOM platform

<https://www.ascom-standards.org/>



#### Step ③ Install OnStep ASCOM driver

<https://emcanastro.com/downloads/>


# OnStep Quick Start Guide


## OnStep Guide

### OnStep and PC connection


Select the correct serial port (check the correct port number in Device Manager) and connect the mount

OnStep Telescope Setup ✕



3.7 

Port: COM5 IP Address: 192.168.0.1:9999

Retry Timeout (3000ms): 

Currently connected to: OnStep 4.25a ☒ Enable Serial Port DTR Control ☐ Use Error Correction Protocol

Site Information

Latitude (N is +): +31°02:59

Longitude (W is +): -121°13:00

Elevation (m): 0

UTC Offset (opposite of a): -8

Date/Time

Date: 12/17/21

Standard Time: 09:37:30

Time (UTC): 01:37:30

Time (LST): 15:26:01

Set Date/Time on Connect: ☐

Optics

Aperture (m): 0

Aperture Area (m<sup>2</sup>): 0

Focal Length (m): 0

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)

Limits

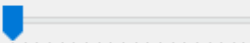
Horizon: -10 (deg)

Overhead: 90 (deg)

Meridian E: 8 (deg)

Meridian W: 8 (deg)

Max. Goto Rate

 31.25 us

(6 deg/sec)

☐ Trace on

# OnStep Quick Start Guide

## OnStep Guide

### SkySafari Connection

Scope Type:  
Meade  
LX200 Classic

Mount Type: Choose  
Equatorial or Alt-Az  
depending on EM31Pro  
mode.

Scope Setup

EQUIPMENT SELECTION

Scope Type -- Meade LX200 Classic

Mount Type -- Equatorial GoTo (German)

COMMUNICATION SETTINGS

☒ Connect via Bluetooth (EM31Pro)

☐ Connect via WiFi

COMMON SETTINGS

☐ Set Time & Location

☐ Tilt Device to Slew

☐ Save Log File

Readout Rate -- 4 per second



**Note:**

Selecting to synchronize time and location information will slow down the mount connection startup, adding approximately 30 seconds, please wait patiently.

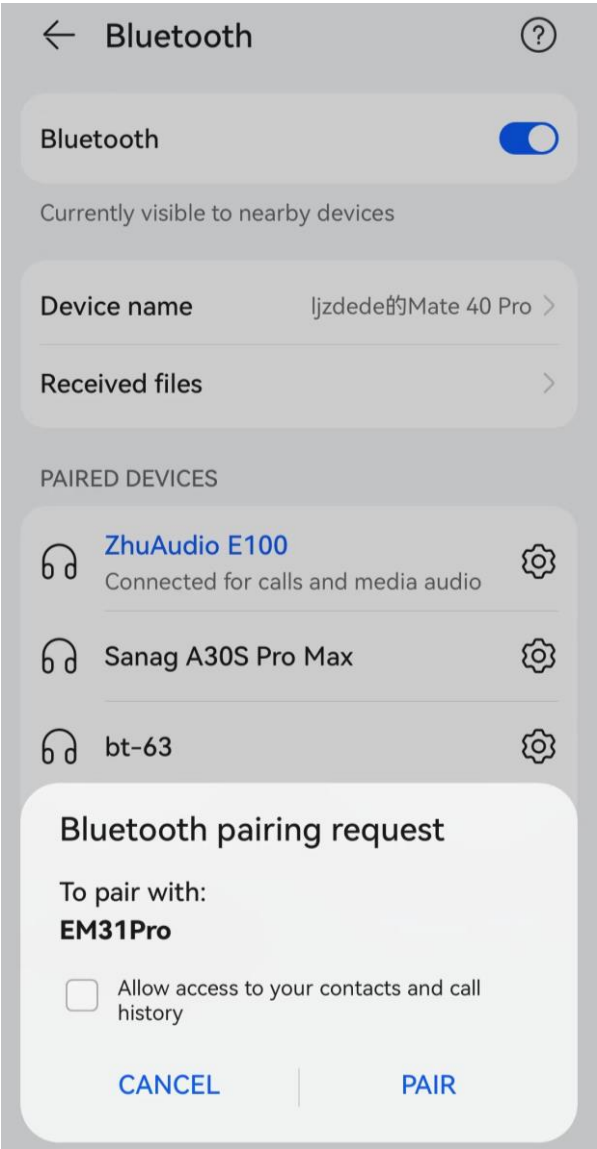
# OnStep Quick Start Guide

## OnStep Guide

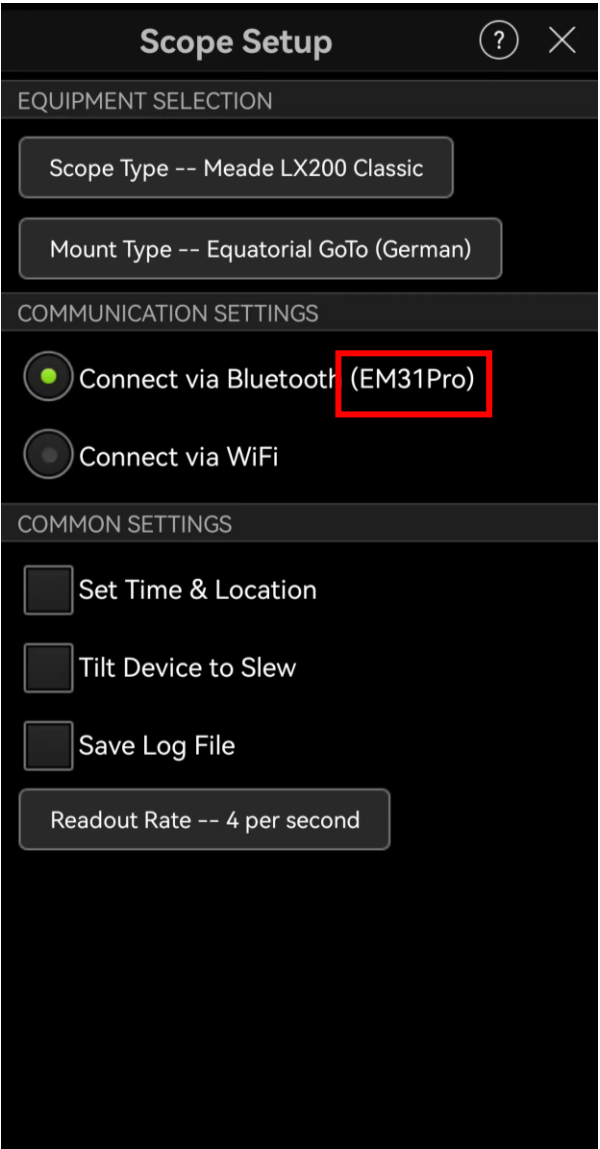
### SkySafari Connection

#### 1. Via Bluetooth (Android only)

Pair with EM31Pro via Bluetooth.



Bluetooth settings, select EM31Pro.



#### Note:

Using Bluetooth to connect to EM31Pro will take around 40–60 seconds to initiate the mount connection.

# OnStep Quick Start Guide

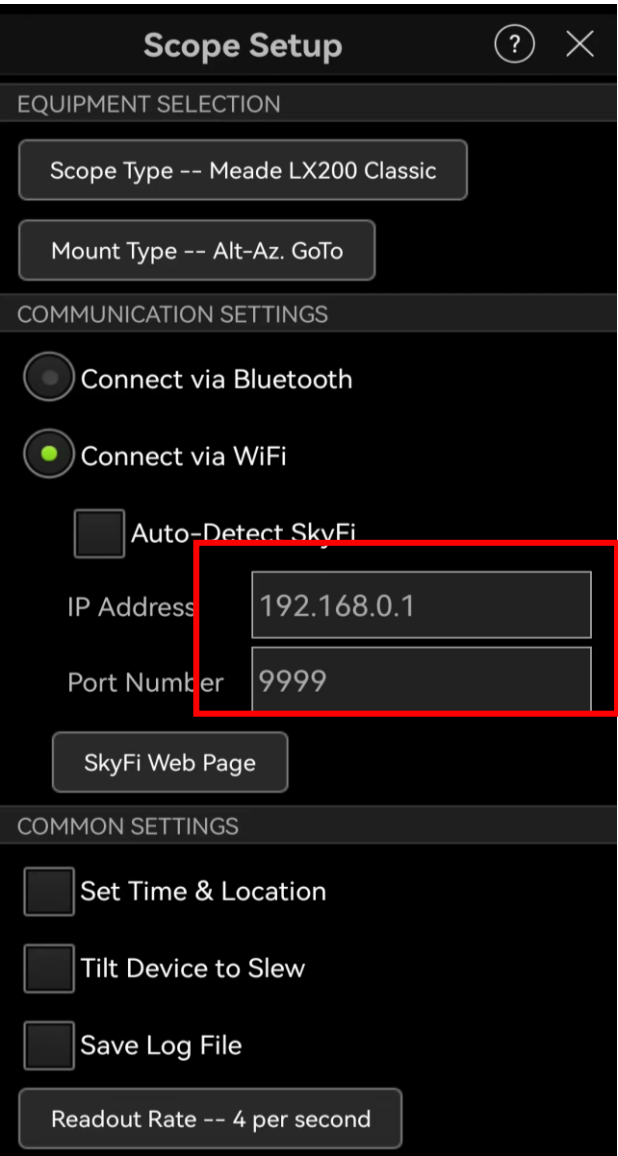
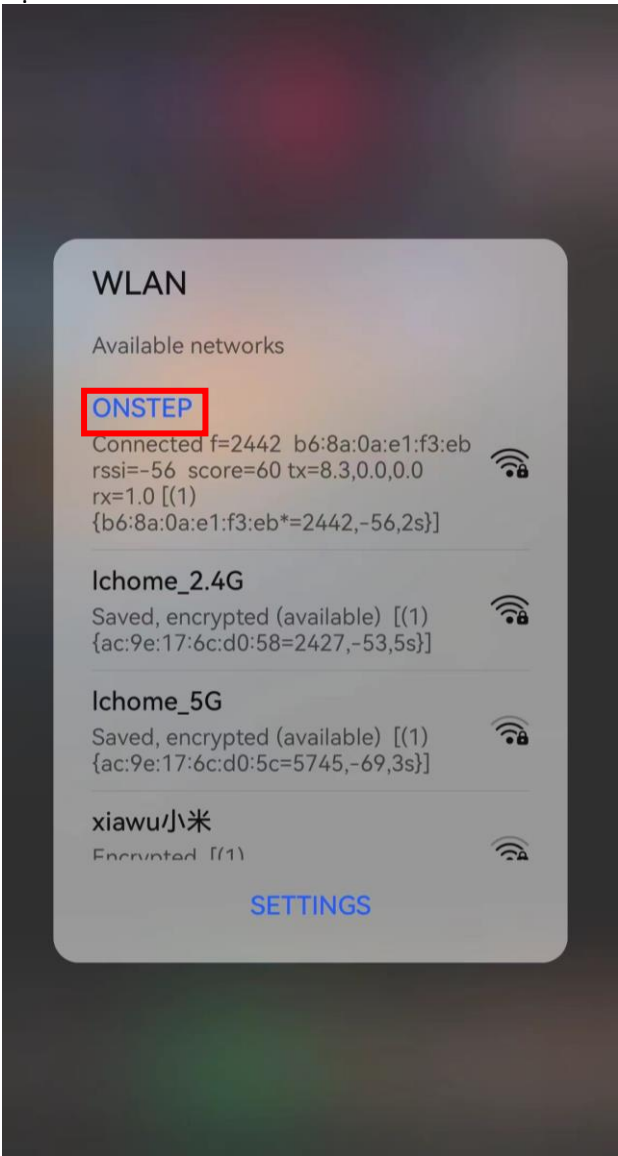
## OnStep Guide

### SkySafari Connection

#### 2. Via Wi-Fi (Android + Apple)

Connect to the mount's Wi-Fi hotspot.

Enter the following details:  
IP: 192.168.0.1 Port: 9999 or 9998.



# Firmware Update

## Firmware Update

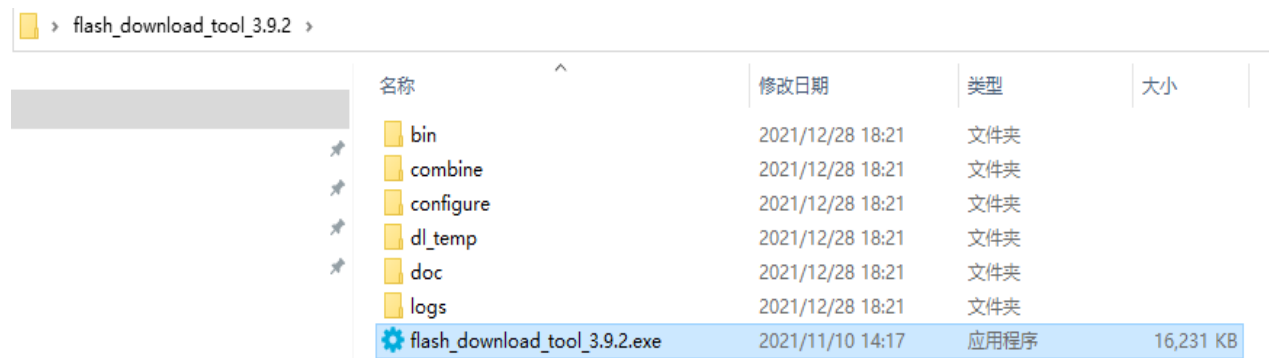
(Demonstrated using Windows 10)

### ① Connect the device to the PC

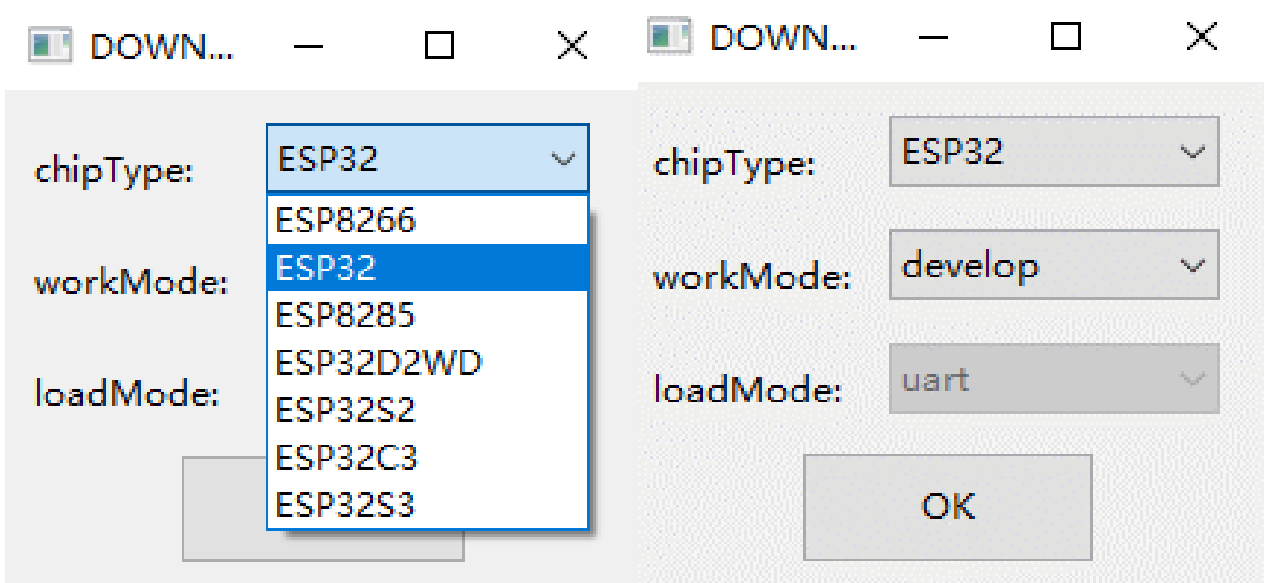
- If updating the Mount: Connect the mount to the PC via USB. If the PC's USB port provides insufficient power, please connect a 12V power supply to the mount.
- If updating the Hand controller: Simply connect the hand controller to the PC via USB. No need to connect the mount.

**⚠ Note:** The mount and hand controller use separate firmware files and do not require simultaneous updates.

### ② Open the firmware flashing software.



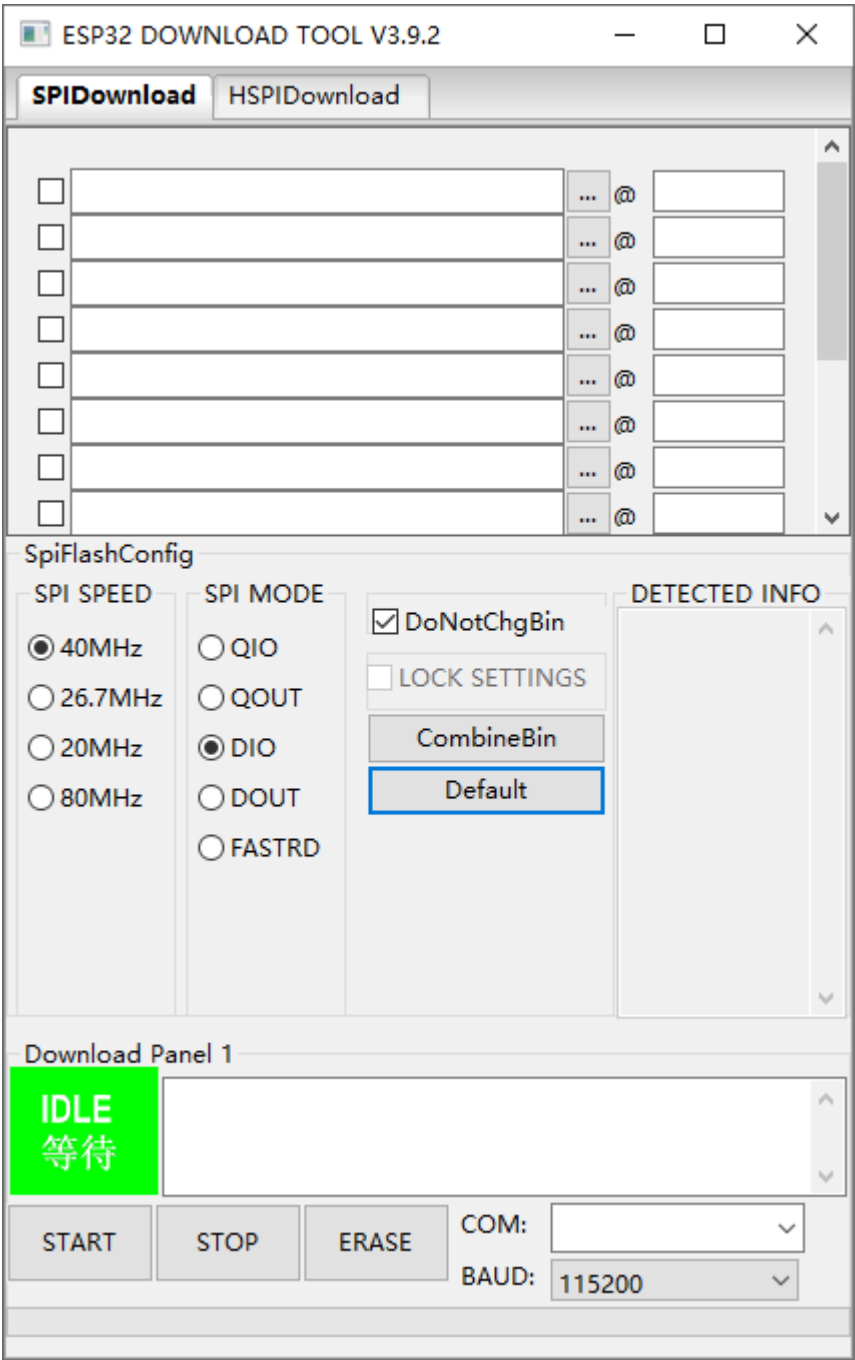
### ③ Select “ESP32” and “develop” and confirm



# Firmware Update

## Firmware Update

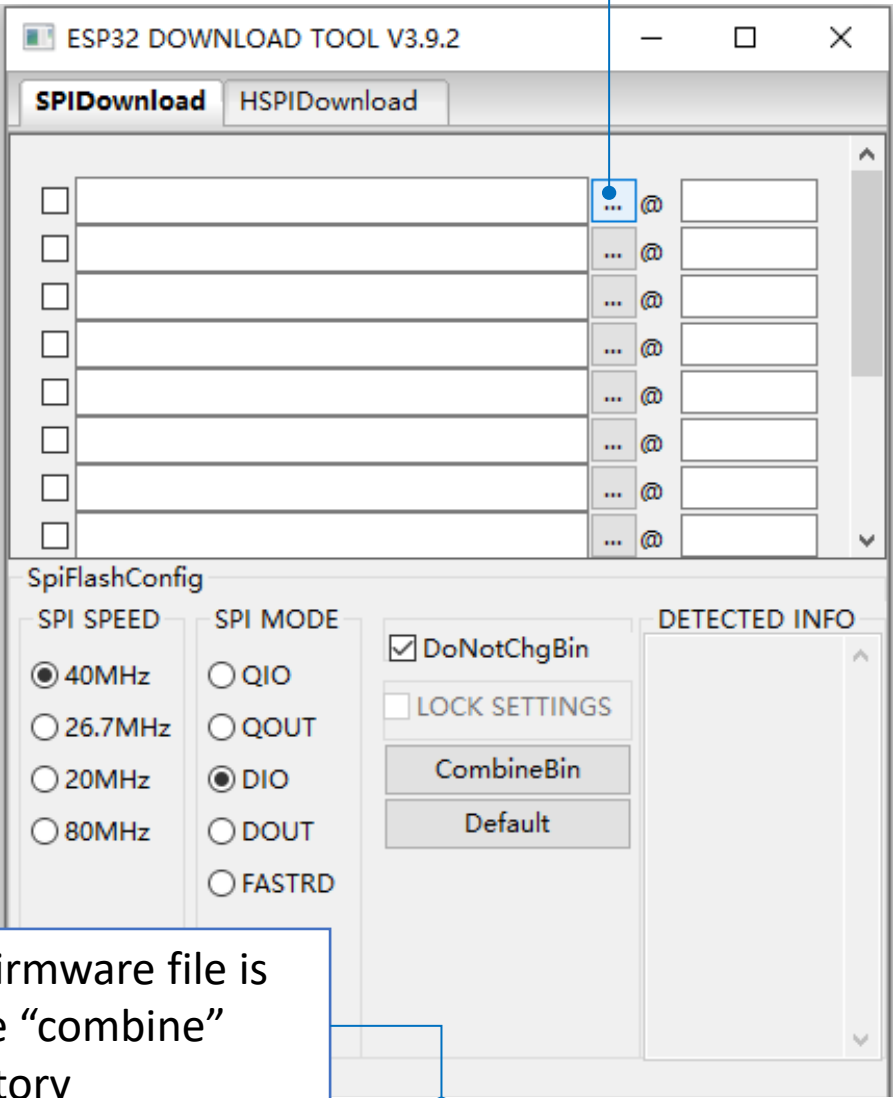
Firmware flashing software interface.



# Firmware Update

## Firmware Update

④ Open Firmware File



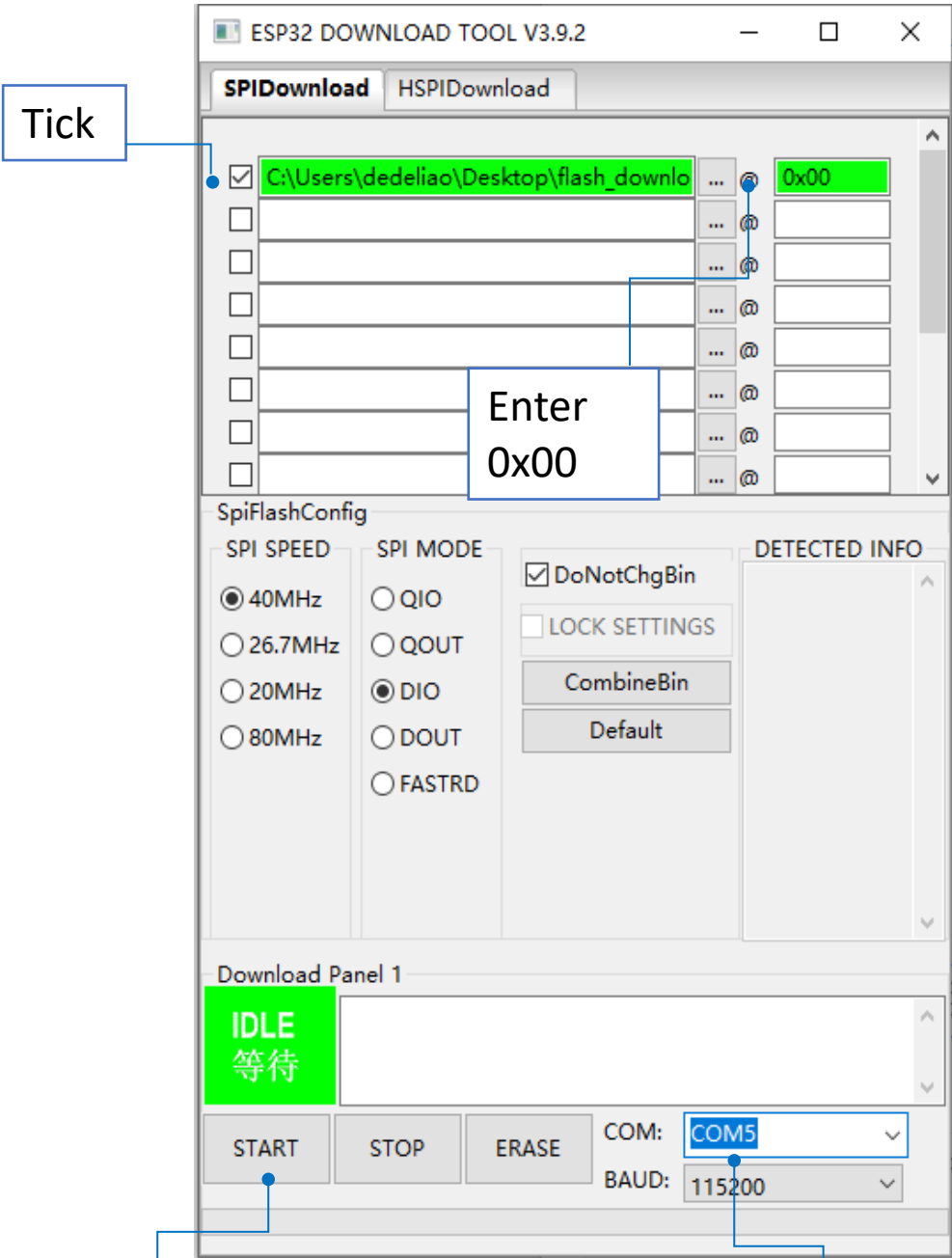
电脑 > 桌面 > flash\_download\_tool\_3.9.2 > combine

名称	修改日期	类型	大小
EM31onstep211228.bin	2021/12/27 20:56	BIN 文件	1,035 KB

# Firmware Update

## Firmware Update

⑤ Set parameters as shown in the figure below



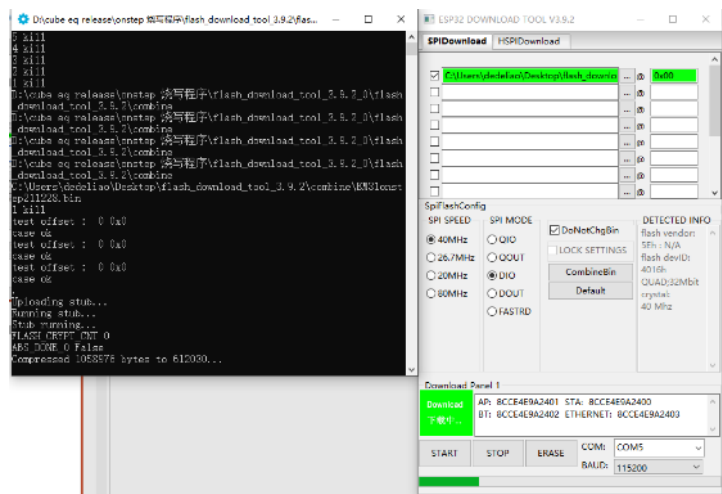
⑥ After setup, click "START" to flash the firmware.

Select serial port

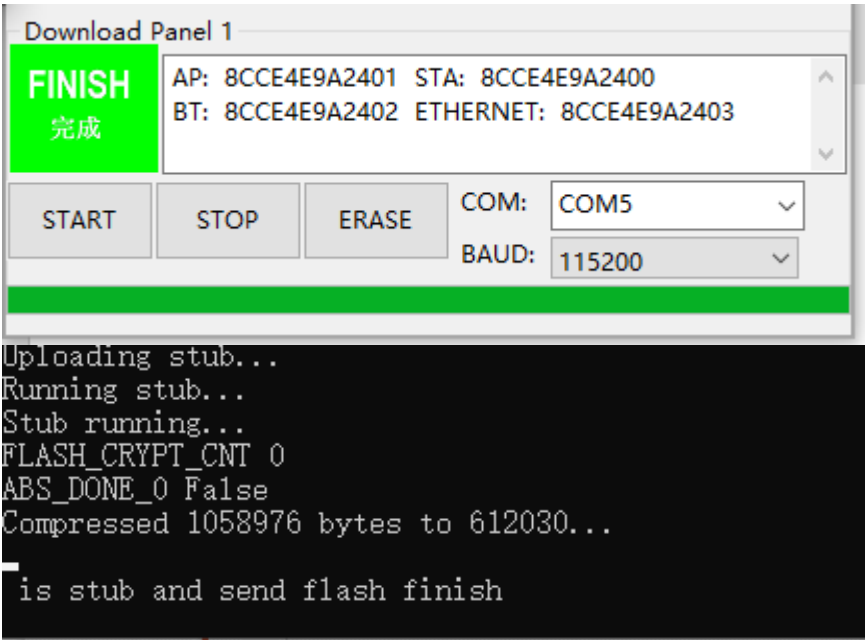
# Firmware Update

## Firmware Update

Firmware flashing begins.



Flashing complete, status bar shows "is stub and send flash finish."



⑦After the firmware update, disconnect all connections (including the 12V power supply and USB cable) for 6 seconds, then reconnect the power to resume normal operation.

**⚠ Note:** After the firmware update, some existing settings, such as GOTO speed, may be changed. Please check and reset them as needed before using the mount.

# Warranty Statement

## Warranty

Thank you for purchasing the EM31Pro Strain Wave Mount. To ensure you have the best experience with our product, we provide a two-year warranty service for the EM31Pro. Below are the specific warranty terms and conditions:

### Warranty Period

This product is covered by a two-year warranty starting from the date of purchase.

### Warranty Coverage

During the warranty period, if the product exhibits any material or workmanship defects under normal use, we will provide free repair or replacement services. This includes, but is not limited to:

- Motor failure
- Control board failure
- Mechanical structure damage

### Warranty Exclusions

The warranty does not cover the following situations:

1. **Human-induced damage:** Including but not limited to damage caused by dropping, impact, submersion, excessive use, etc.
2. **Unauthorized repair or modification:** If the product has been repaired or modified by an unauthorized service provider, the warranty will be void.
3. **Accidents or natural disasters:** Including but not limited to fire, earthquake, flood, lightning, etc.

# Warranty Statement

## Warranty

**4. Normal wear and tear:** Such as normal wear and tear, scratches on the exterior, etc.

### Warranty Service Procedure

**1.Contact Customer Service:** If your product requires repair, please first contact the after-sales service of the purchase channel or directly contact our customer service center. Provide a detailed description of the fault.

**2.Fault Diagnosis:** We will conduct a preliminary diagnosis of the reported fault via email. If further inspection is needed, we will guide you to send the product to the designated repair center.

**3.Repair or Replacement:** Once the product is confirmed to be within the warranty conditions, we will provide free repair services. If the product cannot be repaired, we will replace it with the same model or an equivalent product of the same value.

**4.Return Shipping:** The repaired or replaced product will be shipped back to you via courier.

### Important Notes

- Before sending the product, please ensure it is properly packaged to avoid further damage during transit.
- When shipping, include a description of the fault.

If you have any questions or need further assistance, please feel free to contact our customer service team. We are dedicated to serving you.

Customer Service Email: [support@easeastro.com](mailto:support@easeastro.com)

Thank you for your understanding and support.

# Appendix

## EM31Pro Tutorial Videos

To help you get started and operate the EM31Pro effectively, we have prepared a series of instructional videos. You can find detailed guides via the links below:

### **EM31Pro Installation**

Learn how to properly install the EM31Pro and ensure stable operation.

<https://www.youtube.com/watch?v=KfCiDCdeQ50>

### **EM31Pro Altitude Adjustment**

A guide to adjusting the altitude for different observation needs.

<https://youtu.be/oWRaSYimG0c>

### **EM31Pro EQ Mode Home Position Setup**

Quickly learn how to set up the home position in EQ mode.

<https://www.youtube.com/watch?v=81gaRCINgCw&t=51s>

### **EM31Pro Mode Switching**

Step-by-step instructions on switching between different modes, including EQ and Alt-Az modes.

<https://youtu.be/K9rK1uqSFIQ>

# Appendix

## EM31Pro Tutorial Videos

To help you get started and operate the EM31Pro effectively, we have prepared a series of instructional videos. You can find detailed guides via the links below:

### **EM31Pro Side-Mounted Alt-Az Mode and Home Position Setup**

Learn how to configure the side-mounted Alt-Az mode and set the home position.

<https://youtu.be/uJGSUqnAcHc>

### **EM31Pro Top-Mounted Alt-Az Mode**

Demonstrates how to set up the top-mounted Alt-Az mode.

<https://youtu.be/I4pH3T3Topw>

### **EM31Pro Tripod (TC44)**

An overview of the tripod, step-by-step assembly guide, and various configuration options for different needs.

<https://www.youtube.com/watch?v=xt3OhjC8vtE>



Before operating, please ensure you have read the full manual carefully and follow the steps shown in the tutorial videos for optimal performance and safety.

For further assistance or technical support, feel free to reach out to us anytime.