EM31Pro
Harmonic Equatorial Mount
USER MANUAL v2.0

EMCAN
www.emcanastro.com

Reading Tips

Reading Interpretation

Thank you for choosing EM31Pro Harmonic Equatorial Mount.

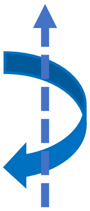
The manual is based on the factory default specifications. Therefore, some specifications or appearance of your instrument may be different. This manual is subject to change without prior notice.

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.

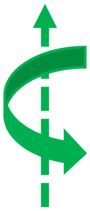
In order to ensure proper use of the equatorial instrument, please read this user manual carefully before starting to use

Symbol Description

⊘ forbidden ⚠ Important points 💡 Operation instruction



Blue stands for counterclockwise rotation



Green stands for clockwise rotation

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.

⚠ The operating temperature of this equatorial mount ranges from -15℃ to 40℃. Please use the equatorial mount reasonably under proper environmental conditions

⚠ After all devices are installed, check for the interference strictly and carefully. Collisions can cause damage to equipment components, causing the equatorial mount malfunction or affecting usage accuracy。 If any interference or other emergency situations are found, immediately unplug the power.

⚠ Please be careful when you carry, assemble or disassemble the main body and other heavy components and other equipments used on the mount . Or it may cause damage to the equipments or even personal injury.

⚠ Please be sure to place the whole equipments on solid and flat ground, Or the mount may fall over, which may cause damage to the equipment or even personal injury.

⚠ If there are children around when using, please pay attention to protecting their safety

⚠ Do not wipe the surface with corrosive liquid.

⊘ Unauthorized disassembly is strictly prohibited. If disassembled by oneself, the warranty is invalid.

Contents

Reading tips p2-3

Product overview

- Introduction P5
- Specification P6
- Packing accessories P7
- Components of main body P8
- Interface size P9
- Optional fittings P10-14

Standard usage process

- Equatorial mode P15-16
- Altazimuth mode P17-18

Installation and commissioning

- Pier extension and tripod installing P19-27
- Latitude and azimuth adjustment P28-31
- Dovetail installing P32-33
- Altazimuth mode (side) P34-39
- Altazimuth mode (top) P40-52
- Cable connection P53-56
- Mode option P57

Installation of accessories P58-59

Installation of battery P60

Onstep quick start guide

- Onstep guide P61-68
- Handle controller instruction P69-76
- Onstep connects to other devices P77-79

Updating of firmware P80-84

Warranty Statement P85-86

Product Overview

Brief introduction

The EM31 Pro Harmonic Equatorial Mount is a lightweight equatorial mount that uses harmonic reducers. EM31 Pro Harmonic Equatorial Mount, with three modes of German equatorial mount, side altazimuth mount and top altazimuth mount, can meet the needs of both astrophotography and sky observation, especially in outdoor environments, its small size and lightweight design can provide astrophotographers and astronomical observers great convenience for carrying and using. Meanwhile, its complete set of fast installation and speed adjustment design system can help users enter the shooting and observation state faster.

Product Overview

Specification

1. Weight of the main body：approx. 4kg (without Dovetail & adapter)
2. Payload：≤15kg (without counterweight)
≤20kg (with counterweight)
Note: payload calculated in the condition that the the distance between telescope’s central axis and the base of dovetail saddle is less than 100mm
3. Latitude adjustment：0°~90°（micrometer adjustment +/-10°）
4. Azimuth adjustment：-8°~+8°
5. RA：harmonic reducer model 17 (reduction ratio 1:100)
6.DEC：harmonic reducer model 17 (reduction ratio 1:100)
7.Motor: 42 Closed-loop stepper motor
8.Goto speed：max 6°/s
9.Power port：DC5.5-2.1 (12v 5A)
10.Power consumption：tracking 0.4A，Goto 0.7A
11.Communication interface：usb2.0，wifi，Bluetooth
12.dovetail：Vixen 75° & LOSMANDY 60°；Arca(Optional)
14.Home position：by bubble levels
15.Mode：equatorial mode; Altazimuth mode (side &top)
16.Hand controller：Wired hand controller

⚠ The payload is not exactly equal to the total weight of the equipment to be loaded. The effective weight that the equatorial instrument can bear is closely related to the center of gravity position of the entire equipment, and the equipment with a high center of gravity will correspondingly offset the load-bearing capacity of the equatorial instrument.

Before installing heavy equipment with a high center of gravity, please refer to the EM31Pro load formula to confirm whether it is overweight.

Product Overview

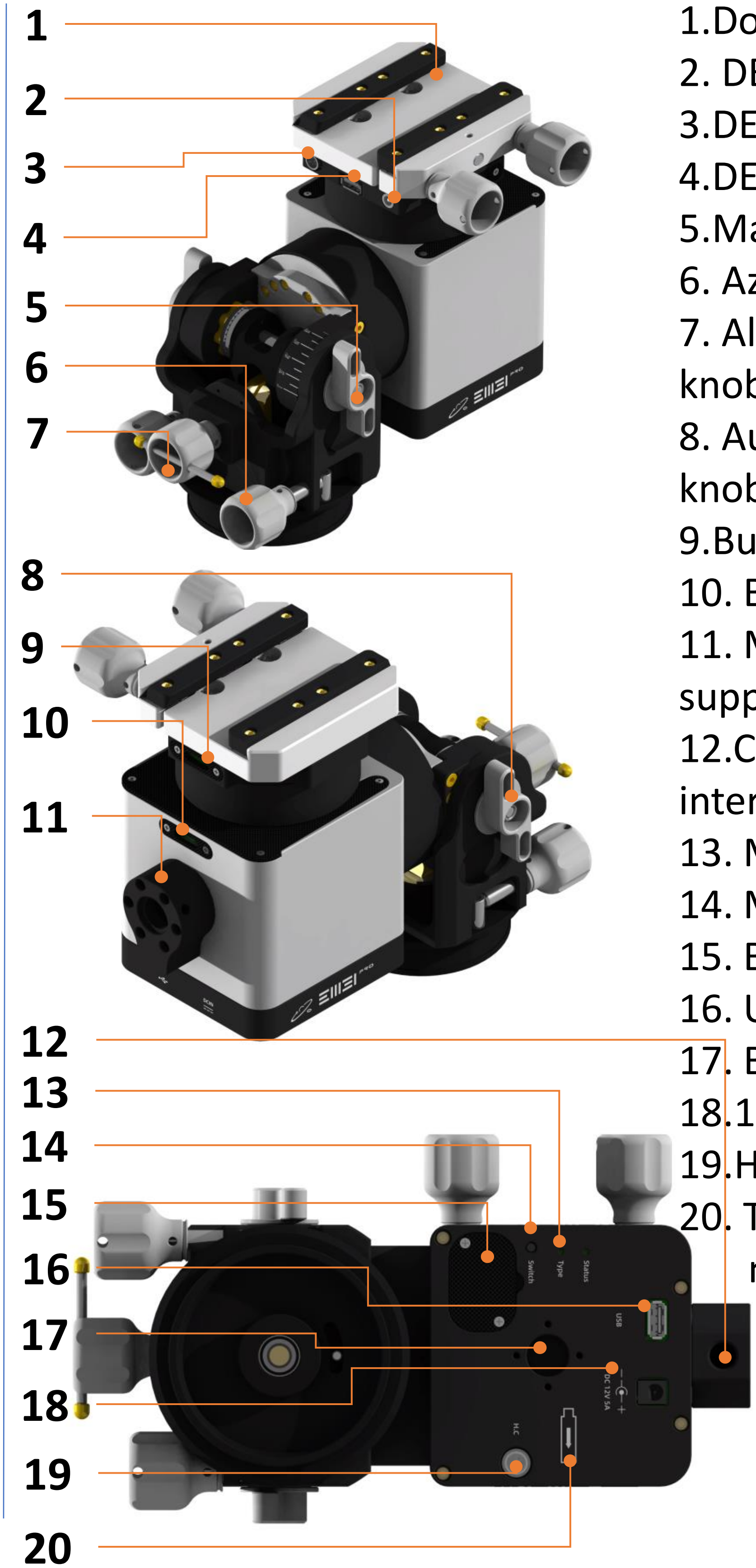
Packing & Accessories

The standard of the harmonic equatorial mount includes components and quantities as follows：

1	EM31 Pro body	1
2	Hand controller	1
3	dovetail（VIXEN & LOSMANDY）	1
4	Front multifunctional bracket	1
5	Adapter	1
6	0.5m USB2.0 cable	1
7	2m USB 2.0 cable	1
8	Soft bag	1

Product Overview

Components name

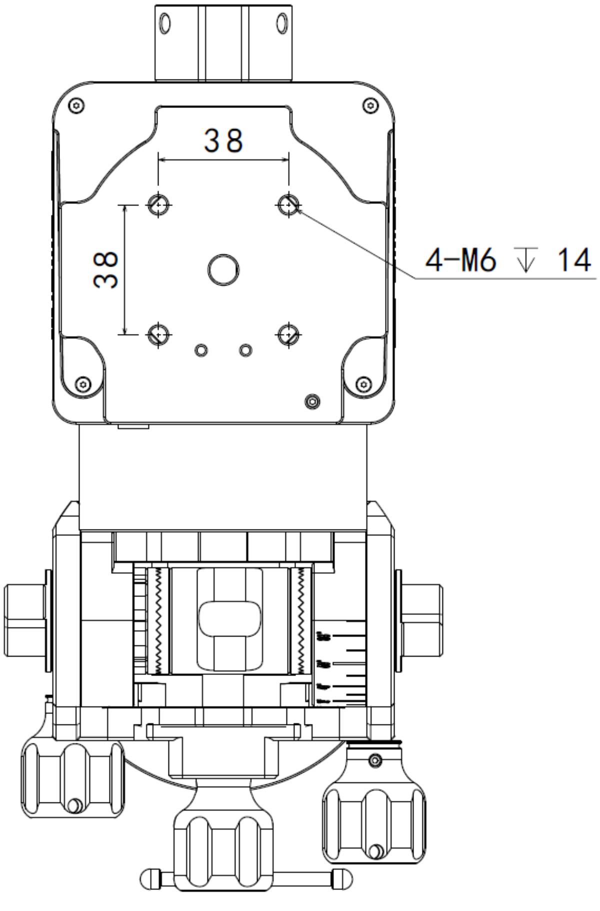

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Switch
Type
Status
USB
DC 12V 5A
HC

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 （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

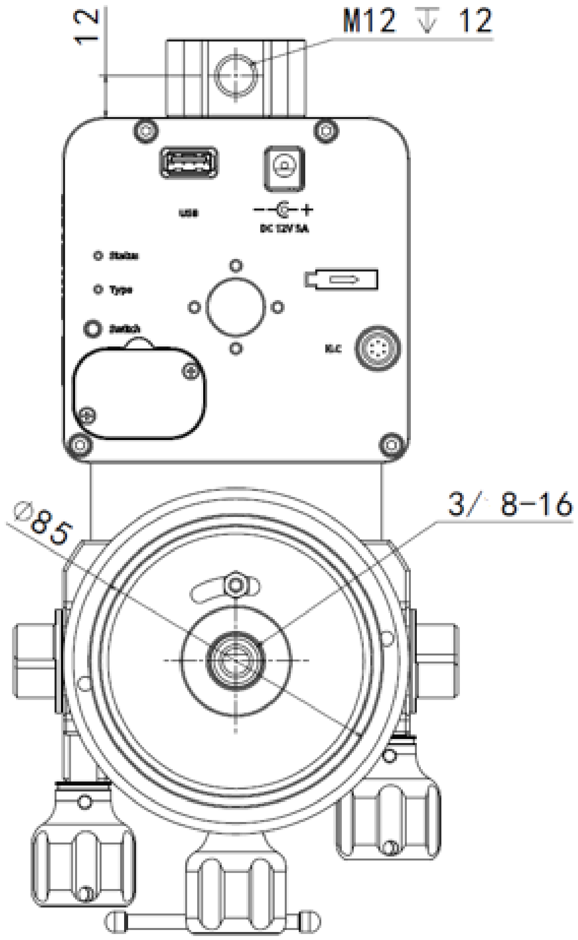
Interface size

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



⚠

EM31 supports counterweight bar with a diameter less than 20mm, and with length less than 300mm, the counterweight should be no more than 5kg


12
M12 ↧ 12
USB
DC 12V 5A
Status
Type
Switch
Ø85
3/ 8-16

⚠

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

Parameters：	
Tripod interface：85mm	Locking method：three screws locked
Carbon fiber tube diameter：44mm	Tube thickness：2mm
Storage length：	620mm （EM-TC44S）
Unfolded height:	EM-TC44S 530mm
	EM-TC44L 720mm
	EM-TC44U 810mm
Weight：	EM-TC44S approx. 2.5kg
	EM-TC44L approx. 3.3kg
	EM-TC44U approx.4.2kg

⚠ This accessory needs to be purchased separately

Product Overview

Optional accessories：

EMH150 Fast-assembling pier extension

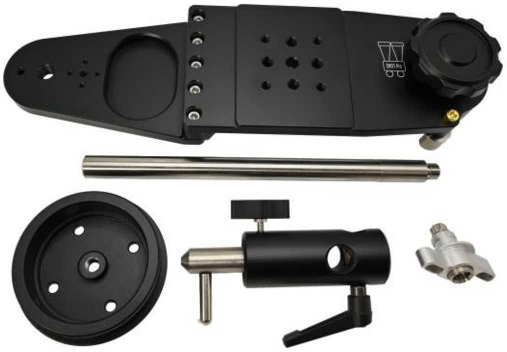
Material: Aluminum(AL6061),
Stainless steel
Size: H150mm dia110mm
Weight: 1.2kg

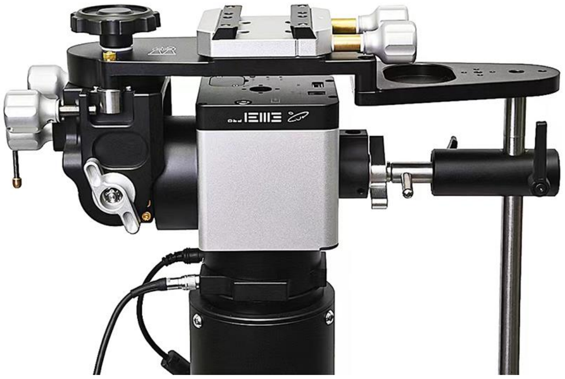
⚠ This accessory needs to be purchased separately

Product Overview

Optional accessories：

Top-mounted mode supporting bracket





Material:
Aluminum(AL6061),Stainless steel,
Titanium alloy(counterweight bar)
Size: L350mm
Weight: 1.8kg

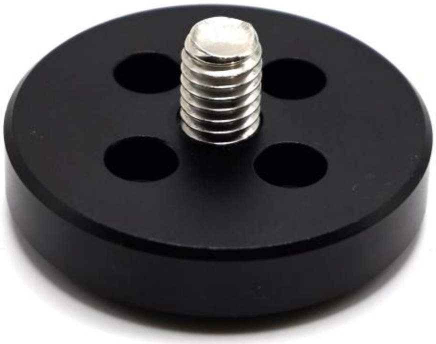
Suitable for binocular telescopes

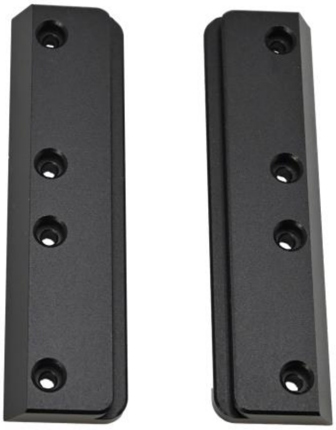
⚠ This accessory needs to be purchased separately

Product Overview

Optional accessories：

Ball head mount
adapter





Arca board strips

⚠ 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

Equatorial mount Mode

Install equipment

Set time and location

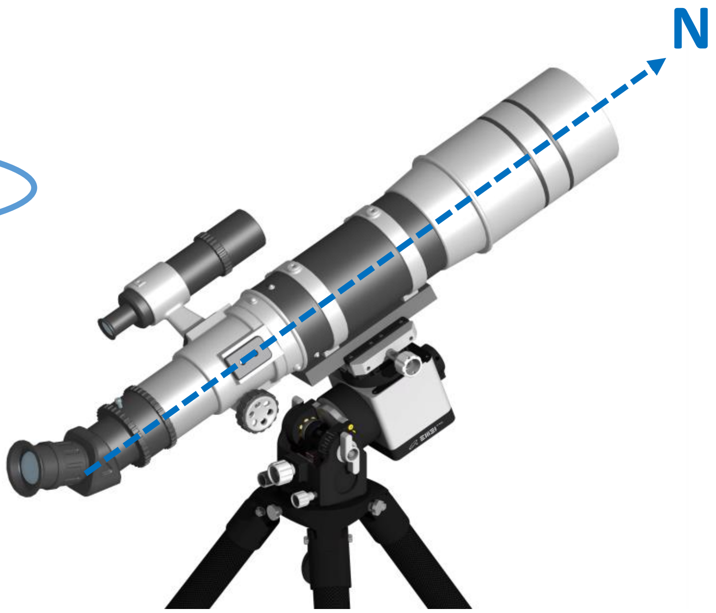
Set zero position

Polar alignment

Select target and Goto

Using Target Calibration

Come into use



⚠

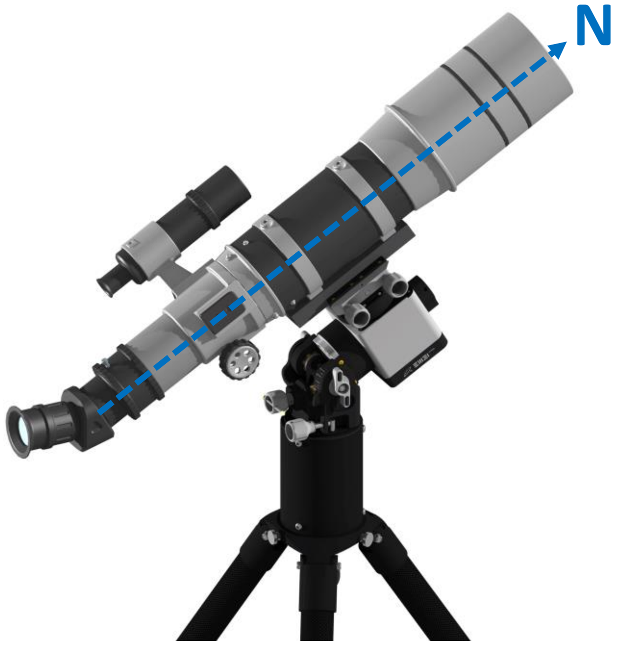
The coordinates and time of the using site must be set correctly, and the zero position must be set correctly, otherwise it may cause target goto errors and even equipment collisions

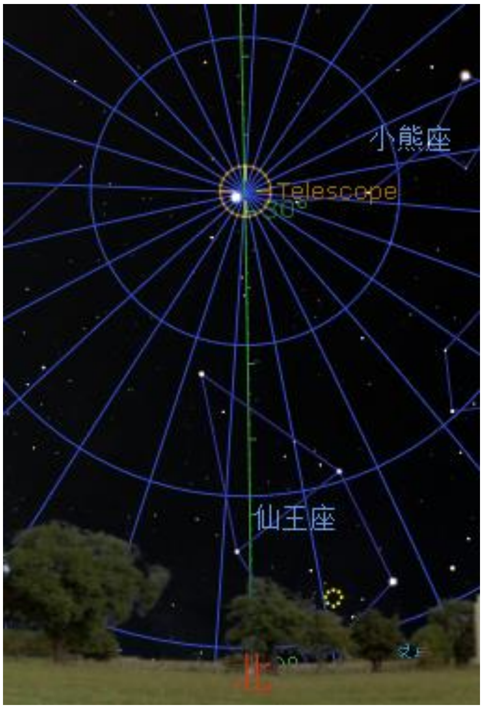
Standard Use Procedure

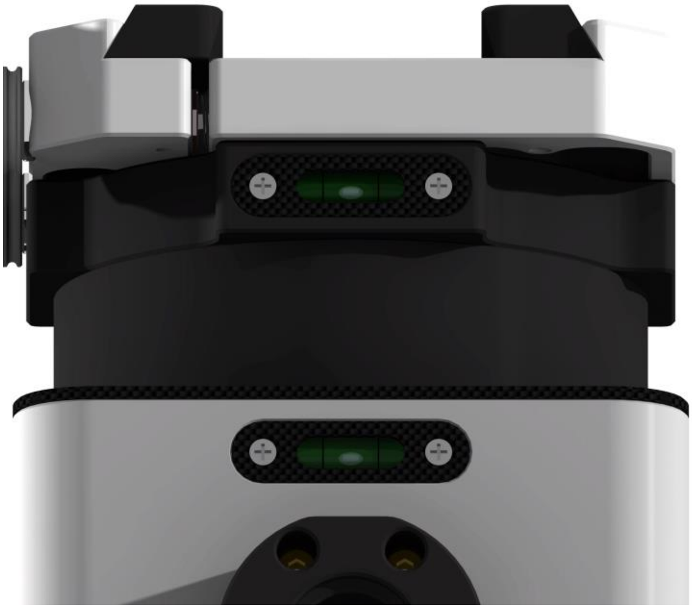
Use Procedure

Zero position of Equatorial mount mode

The zero position of the German Equatorial mount is shown in the diagram below, and the telescope points to the North Pole







EM31 Pro can confirm the zero position of Equatorial mount through RA and DEC axis bubble level

Standard Use Procedure

Use Procedure

Altazimuth Mode (side & top)

Install equipment

Horizontal adjustment

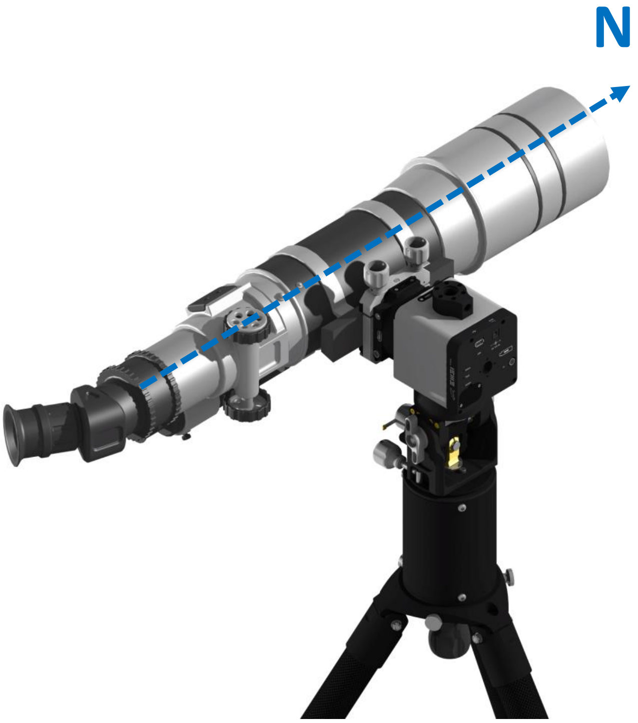
Mode confirmation

Set zero position

Select target and Goto

Using Target Calibration

Start observation



⚠

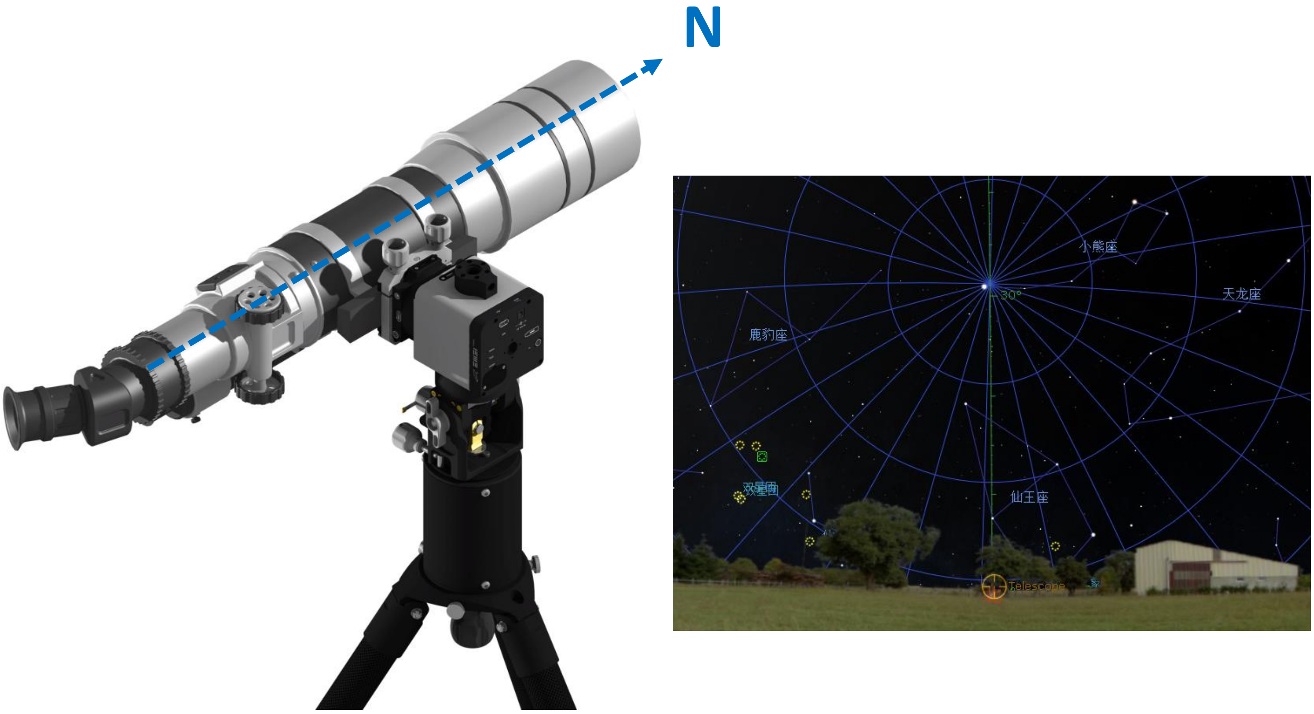
The coordinates and time of the observation site must be set correctly, and the zero position must be set correctly, otherwise it may cause target goto errors and even equipment collisions

Standard Use Procedure

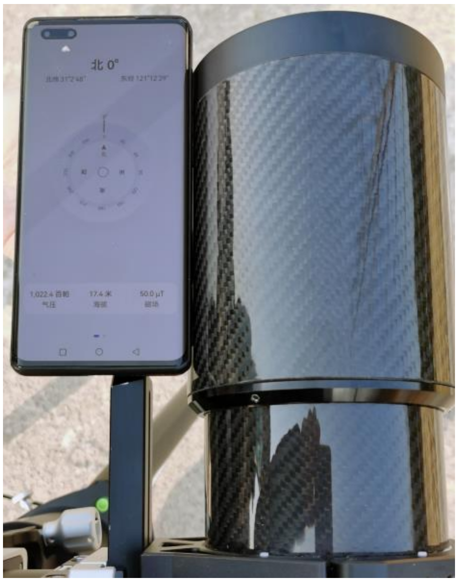
Use Procedure

Zero position of Altazimuth Mode (side & top)

The zero position of the Altazimuth mode is shown in the diagram below, and the telescope points to the North Pole


N
小熊座
天龙座
30°
鹿豹座
双星团
仙王座
Telescope

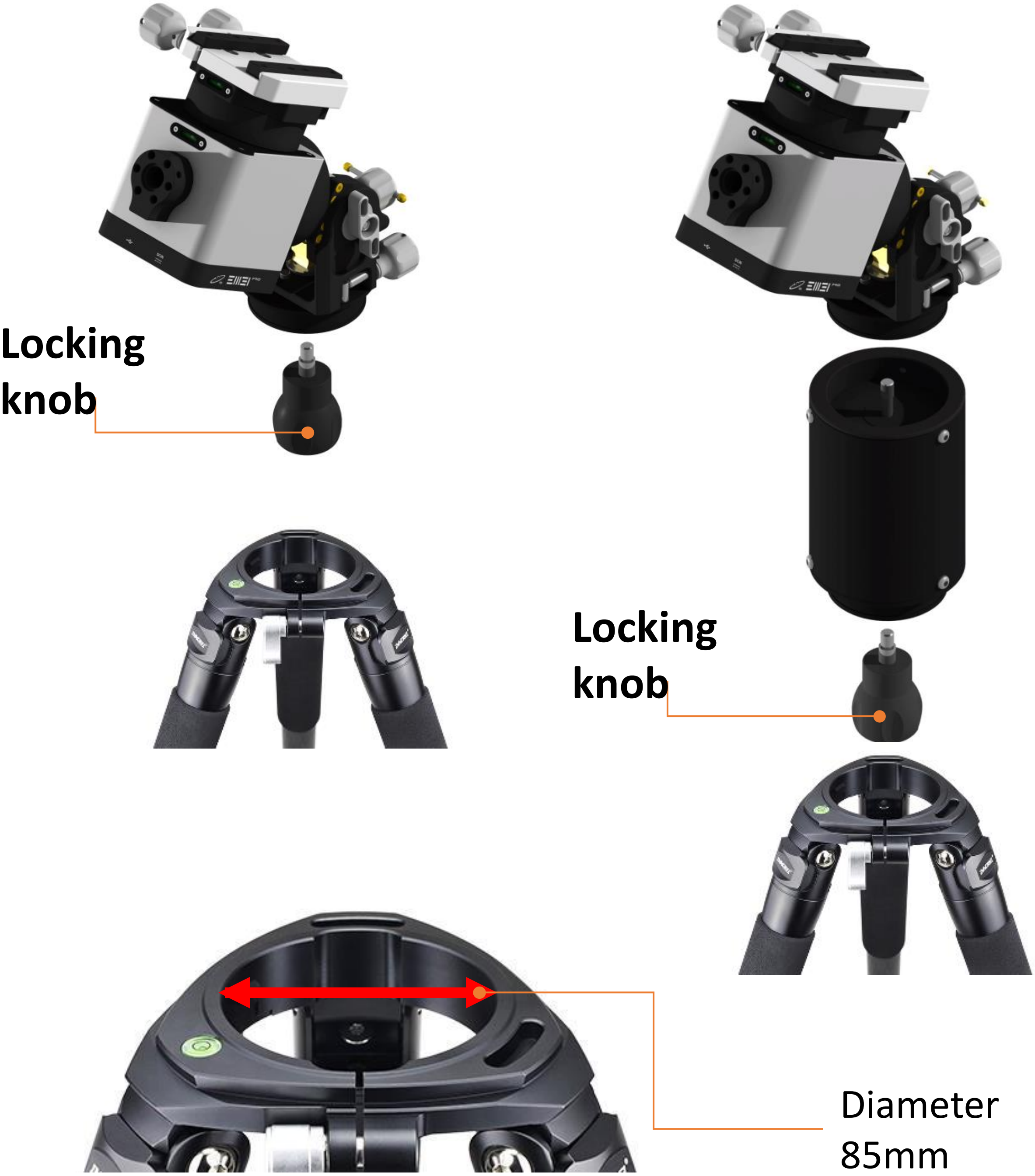
The initial zero position can be confirmed through a mobile compass and level



Installation and Use

Installation of equatorial mount with pier extension and tripod

EM 31 Pro can be installed on non central axis photographic tripod with a bore diameter of 85 mm.

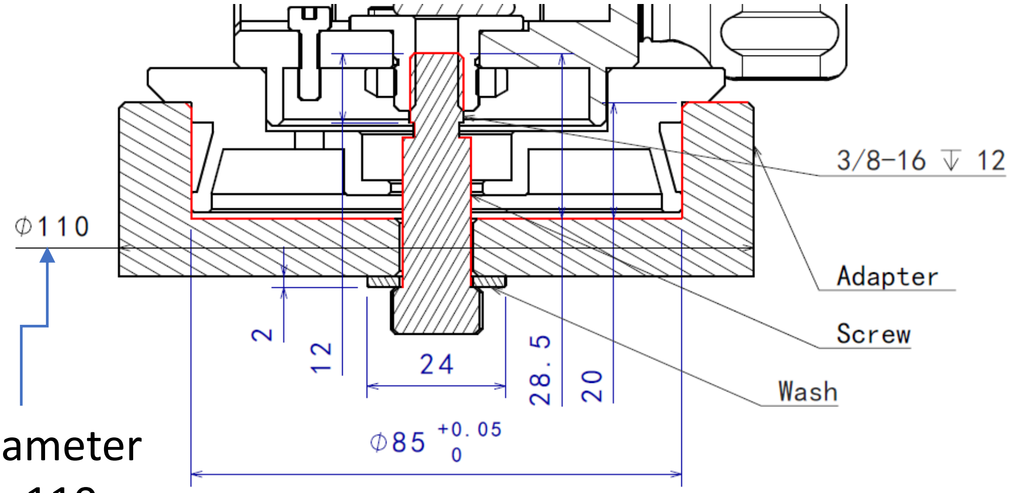

Locking knob
Locking knob
Diameter 85mm

Installation and Use

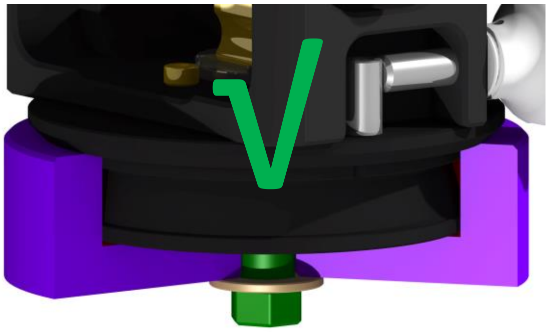
Installation of equatorial mount with pier extension and tripod

Standard accessories for other tripod mounting are not officially available. If users need to mount the equatorial instrument on other tripods, they need to design and process the adapter and mounting bolts by themselves.

The dimensions need to follow the chart below：

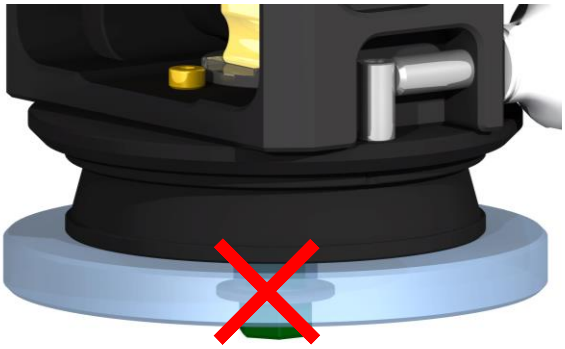


Outer diameter less than 110mm



Correct adapter structure

⊘

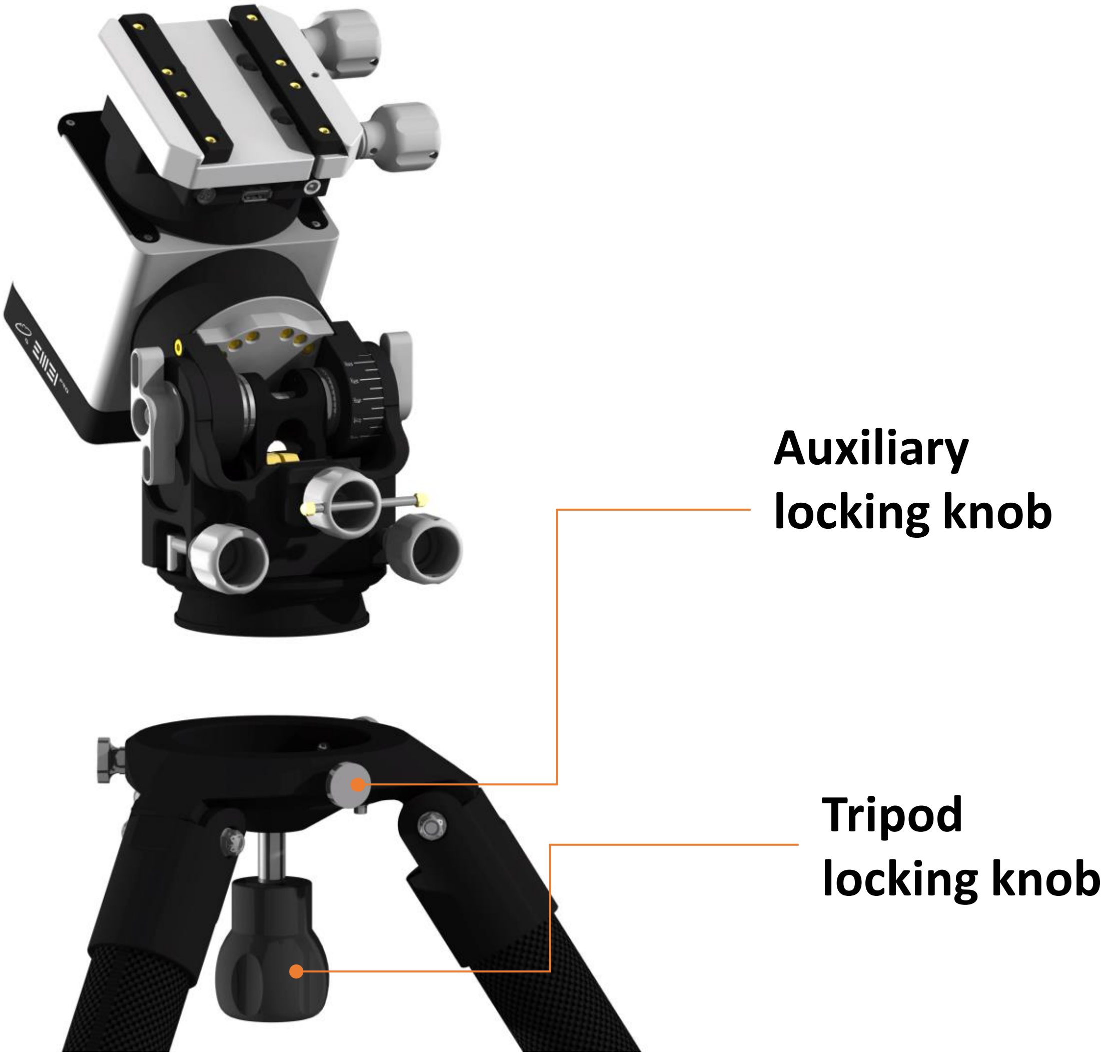


Incorrect adapter structure, it is prohibited to connect to the equatorial instrument through only one plane

Installation and Use

Installation of equatorial mount with pier extension and tripod

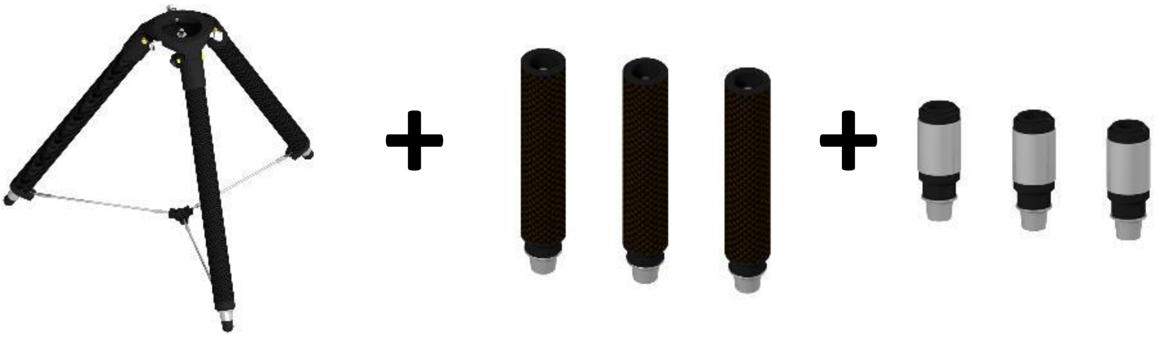
When using the EM TC44 tripod, the equatorial mount body can be directly installed on the tripod through the adapter, and locked by the three knobs of the tripod to achieve more reliable connection.


Auxiliary locking knob
Tripod locking knob

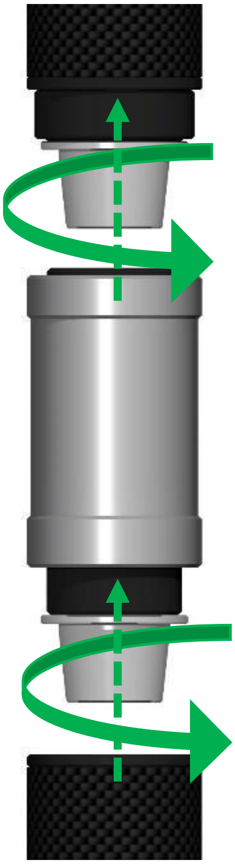
Installation and Use

Installation of equatorial mount with pier extension and tripod

EM TC44S is a high load tripod specially designed for harmonic equatorial mount, in order to improve the rigidity of the tripod, it is designed as a non-retractable structure, and the height and supporting area of the tripod are expanded by installing the heightening section.



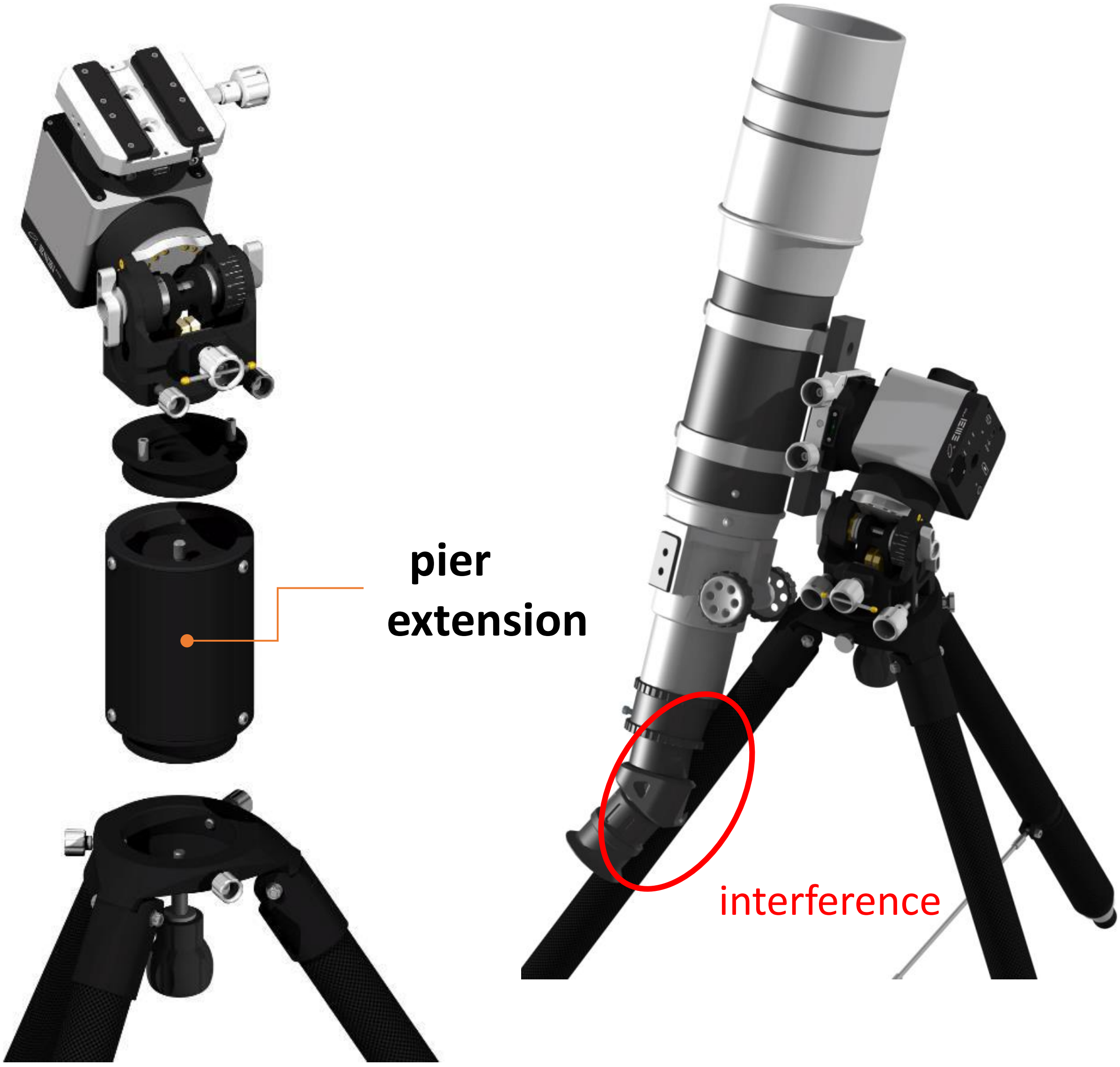
Rotate clockwise to install the extension rod and horizontal adjuster



Installation and Use

Installation of equatorial mount with pier extension and tripod

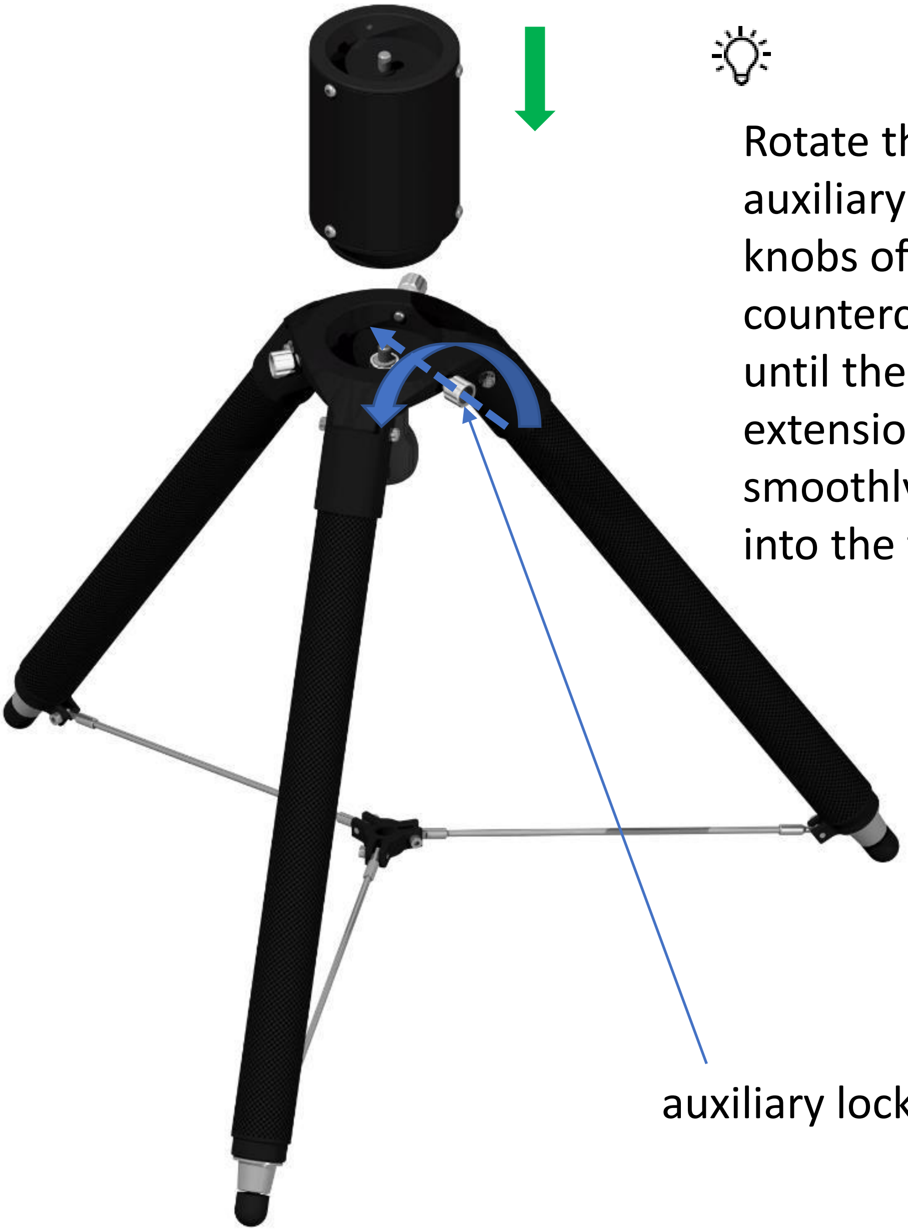
The harmonic equatorial mount is small in size. When a longer telescope is used, there is a problem of interference between the telescope and the tripod near the meridian. At this time, it is necessary to use the pier extension to avoid interference.



Installation and Use

Installation of equatorial mount with pier extension and tripod

Installation steps with the pier extension



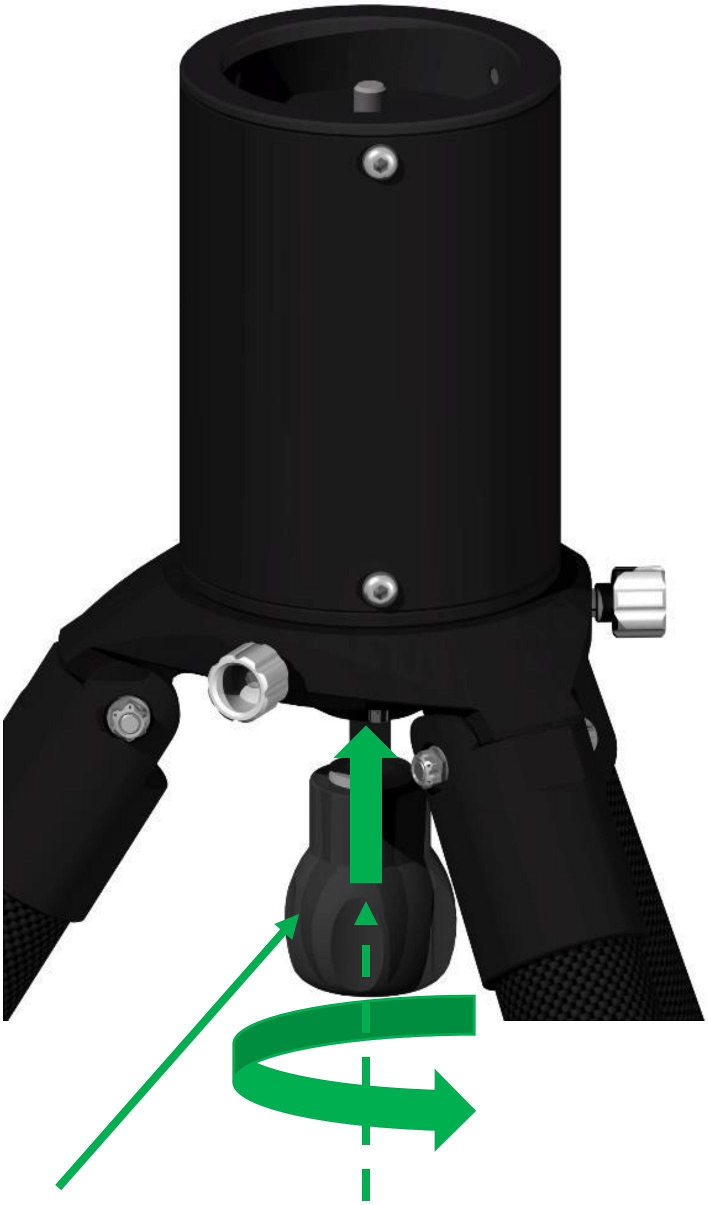
Rotate the three auxiliary locking knobs of the tripod counterclockwise until the pier extension can be smoothly installed into the tripod tray

auxiliary locking knob

Installation and Use

Installation of equatorial mount with pier extension and tripod

Installation steps with the pier extension



💡

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 equatorial mount body and pier extension will not be separated properly when disassembling the equipment.

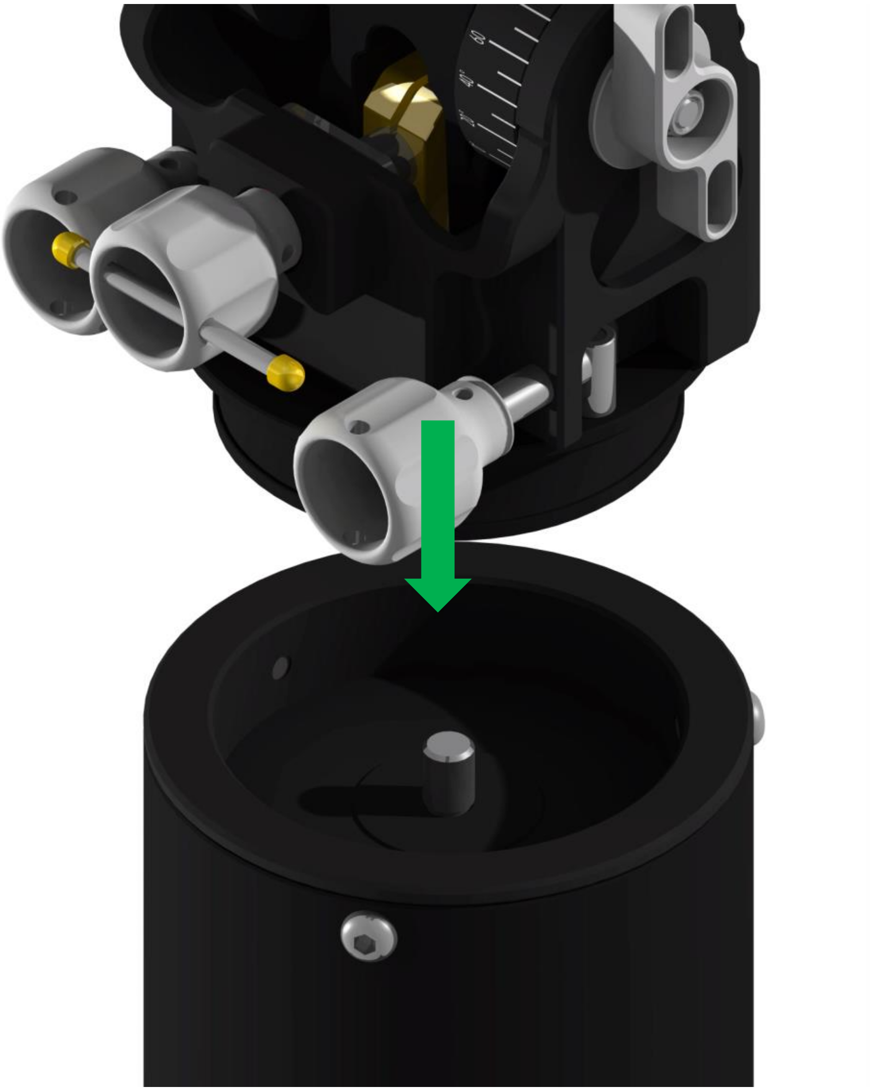
Installation and Use

Installation of equatorial mount with pier extension and tripod

Installation steps with the pier extension

💡

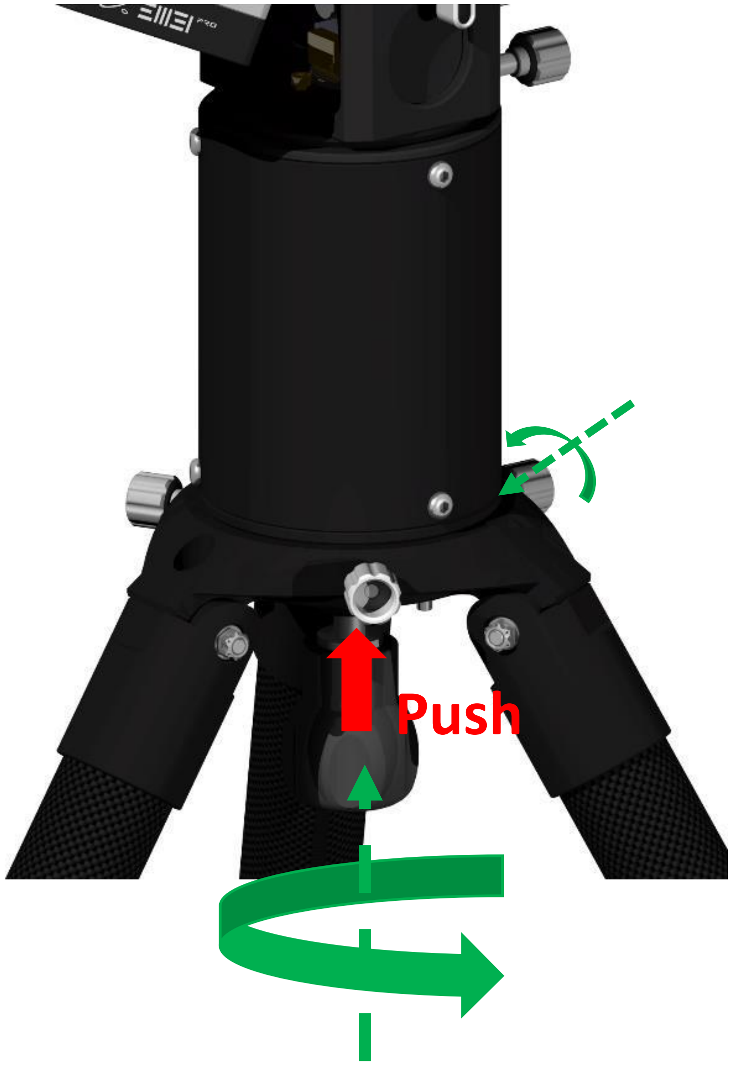
Place the equatorial mount body with the adapter into the pier extension



Installation and Use

Installation of equatorial mount with pier extension and tripod

Installation steps with the pier extension



⚠ **To lock the body, push the main locking knob upwards with slight force first before clockwisely rotating the knob**

Push up and continue to rotate the main tripod locking knob clockwise until it locks tightly

Rotate the three tripod auxiliary locking knobs clockwise until they lock securely

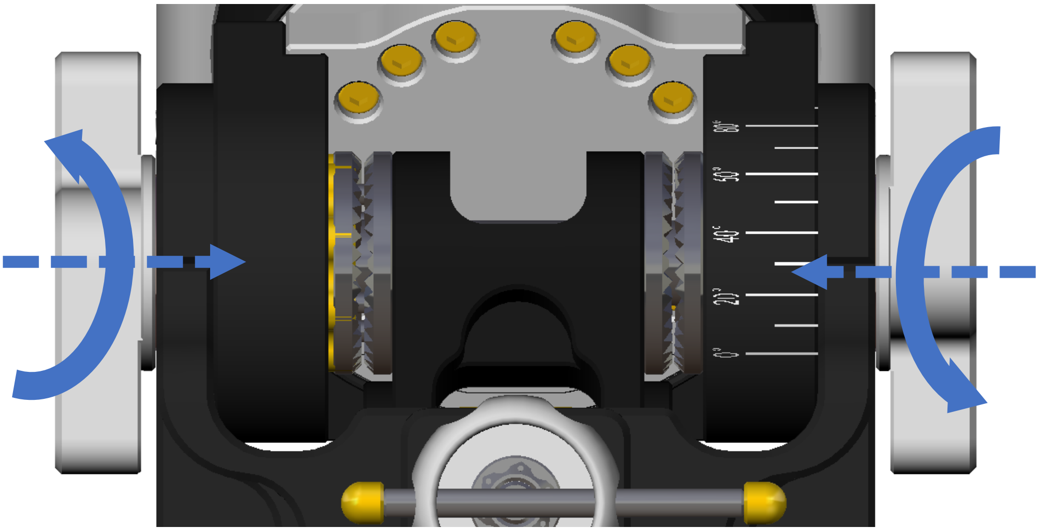
Up to now, the installation of the body, pier extension, and tripod is completed

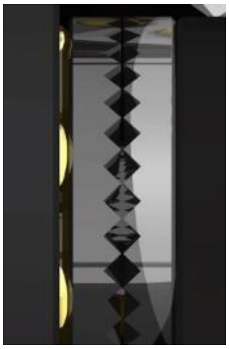
Installation and Use

Adjustment of altitude and azimuth angles of the German equatorial mount

Altitude coarse adjustment

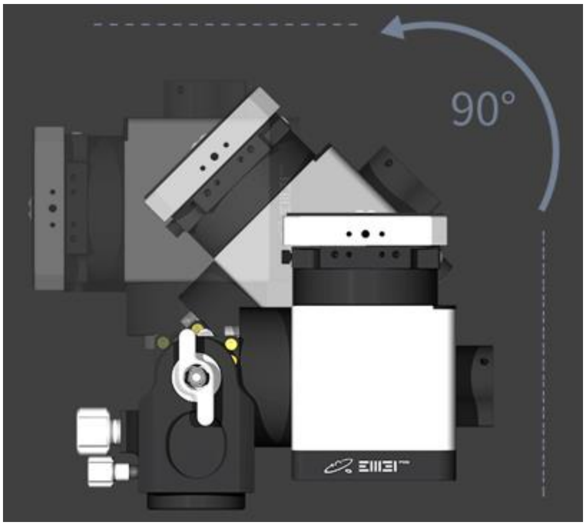
Rotate counterclockwise to release the auxiliary altitude locking knob





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

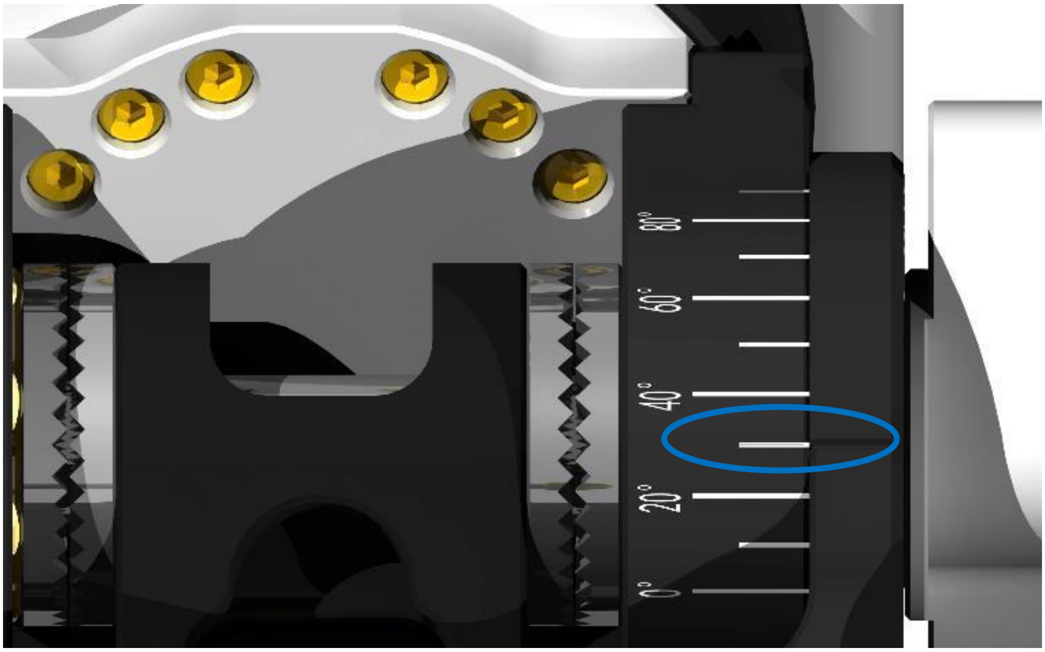
When the main altitude locking knob is loosened, the body will lose its support. During the coarse adjustment process, be sure that there is always a hand to support the body until the main altitude knob is locked again



Installation and Use

Adjustment of altitude and azimuth angles of the German equatorial mount

Altitude coarse adjustment



💡 Refer to the altitude scale, adjust the altitude angle to the approximate local latitude position. (For example, if the local latitude is 31°13'20 ", lock the altitude near 30 °)

⚠

When the main altitude locking knob is loosened, the body will lose its support. During the coarse adjustment process, be sure that there is always a hand to support the body until the main altitude knob is locked again

⚠

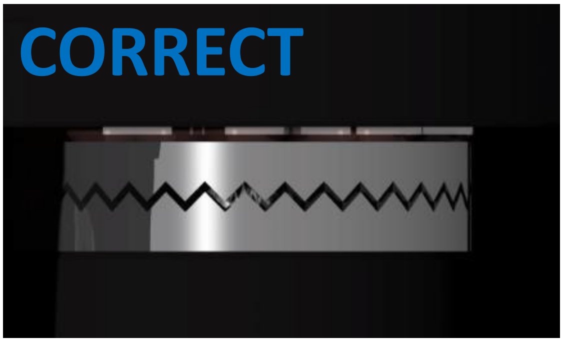
Roughly adjust the altitude angle at 10 ° intervals, such as 0 °, 10 °, 20 °, 30 °... 90 °

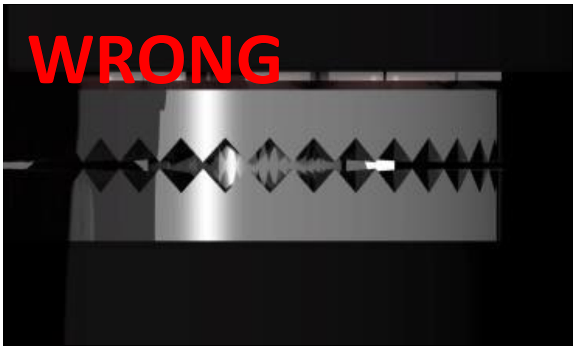
Installation and Use

Adjustment of altitude and azimuth angles of the German equatorial mount

Altitude coarse adjustment

Rotate the main altitude locking knob clockwise at the rough latitude position until the flat gear engages again. 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 body will lose its support. During the coarse adjustment process, be sure that there is always a hand to support the body until the main altitude knob is locked again

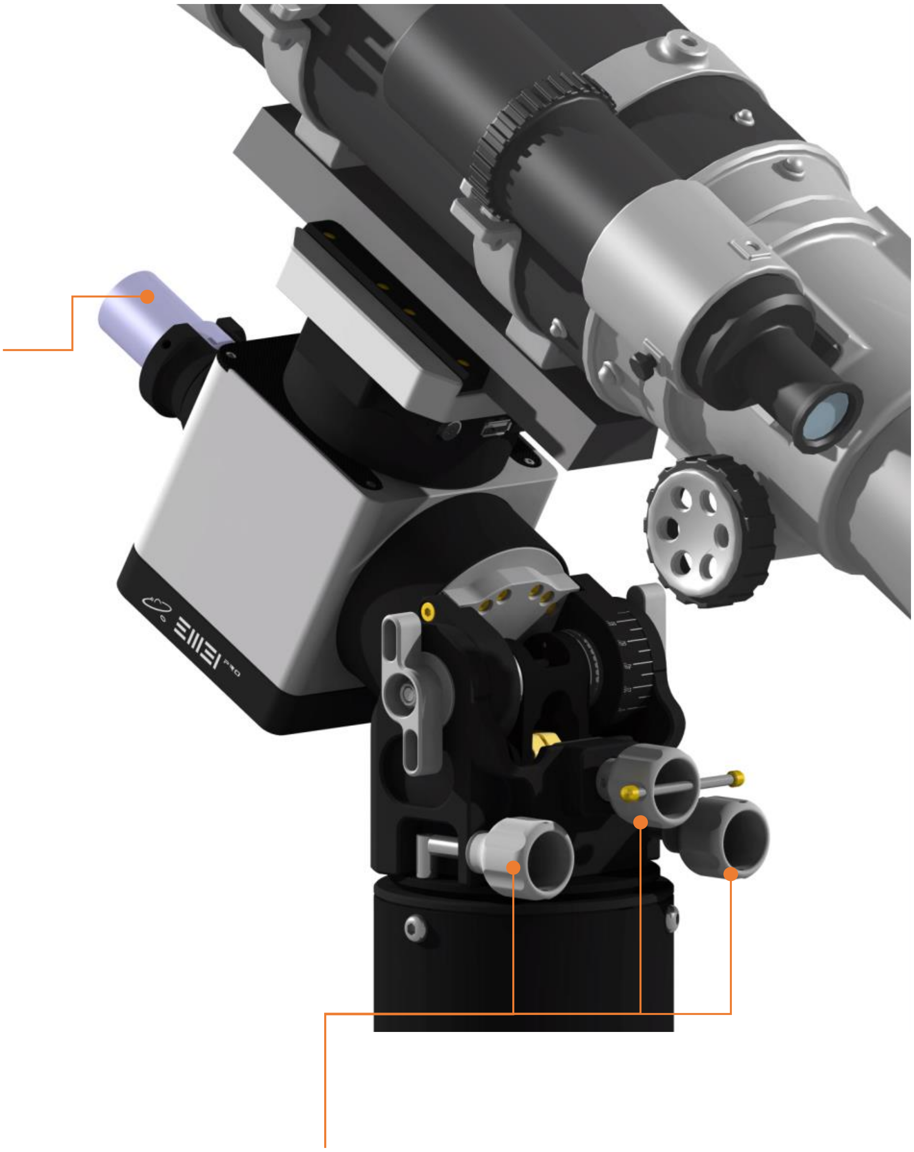
Altitude angle coarse adjustment completed

Installation and Use

Adjustment of altitude and azimuth angles of the German equatorial mount

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

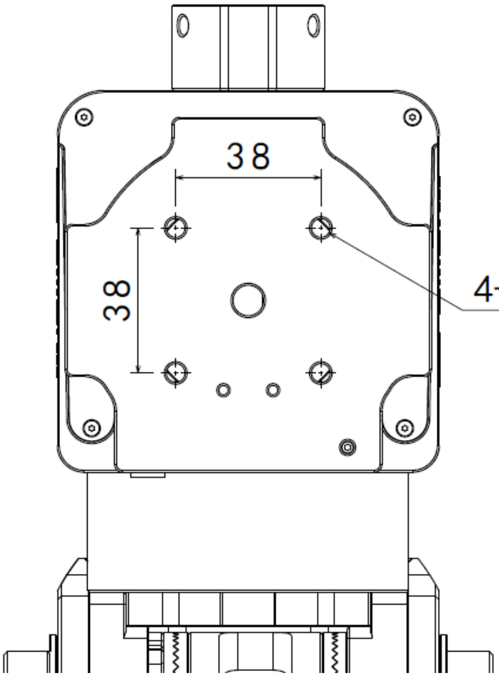
After all equipment installation is completed, precise calibration of the polar axis is completed by rotating the azimuth adjustment knob and altitude fine adjustment knob

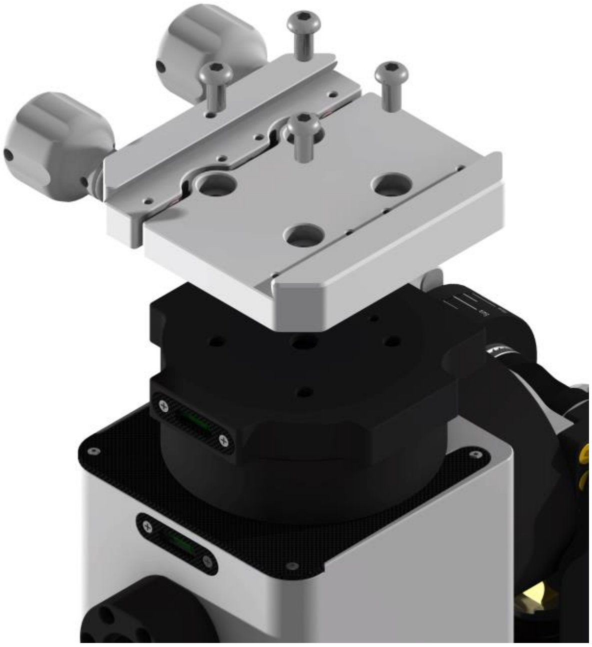
Accessory Installation

Installation of dovetail

Dovetail

The interface on EM31 Pro DEC top plate is suitable for installation with most dovetails, users can replace the dovetail according to their needs





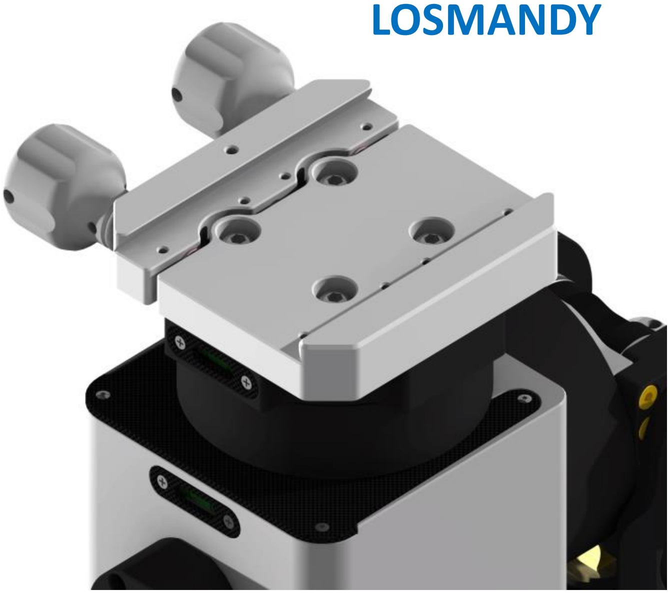
Accessory Installation

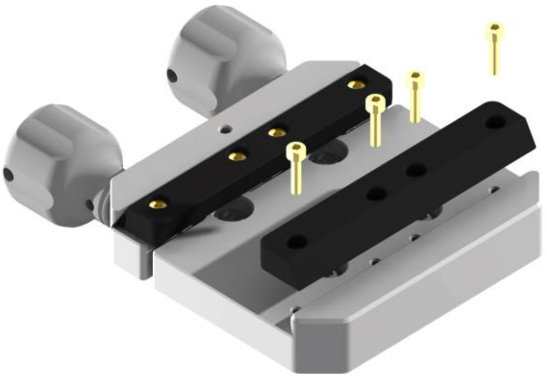
Installation of dovetail

Dovetail

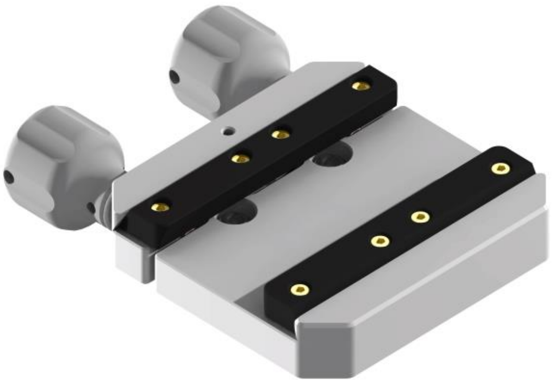
EM31 Pro has a dovetail of LOSMANDY 60 °. Vixen 75 ° and Arca specifications can be achieved by installing the dovetail strips.

LOSMANDY

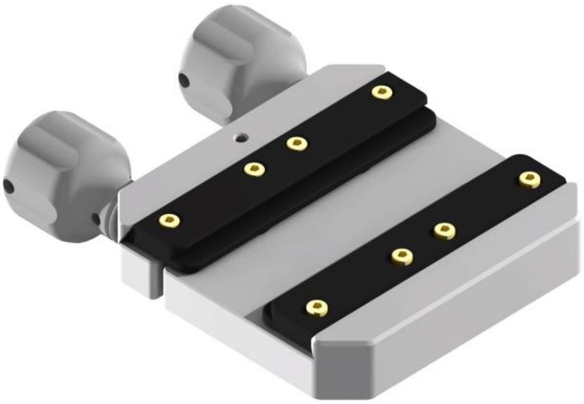




VIXEN



ARCA

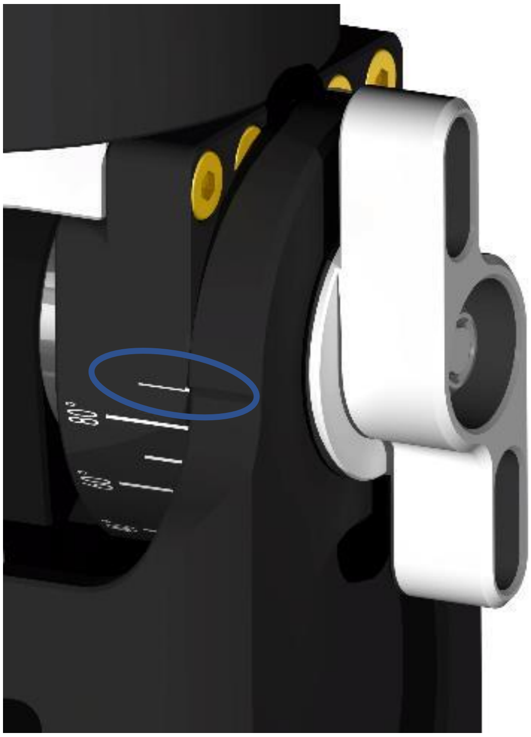


Installation and Use

Altazimuth mount

Structure Switching

The installation method of EM31 Pro pier extension and tripod in altazimuth mode is the same as that of German equatorial mount. It is necessary to adjust the altitude angle to 90 degree, and the adjustment method is same as that of the German equatorial mount.



Installation and Use

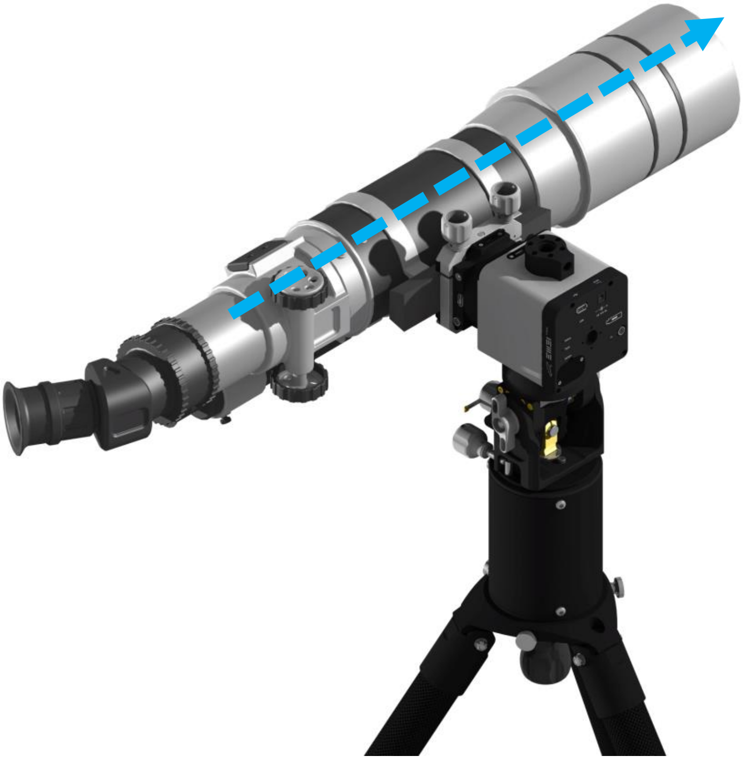
Altazimuth mount

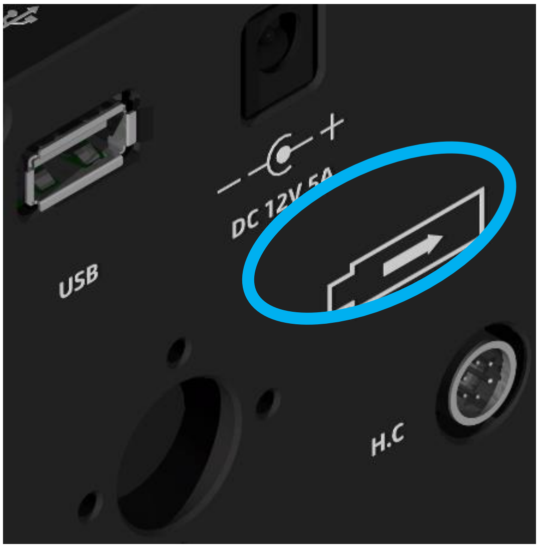
Installation of telescope

💡

Confirm that the installation direction of the telescope is consistent with the direction marked on the bottom of the body

⚠



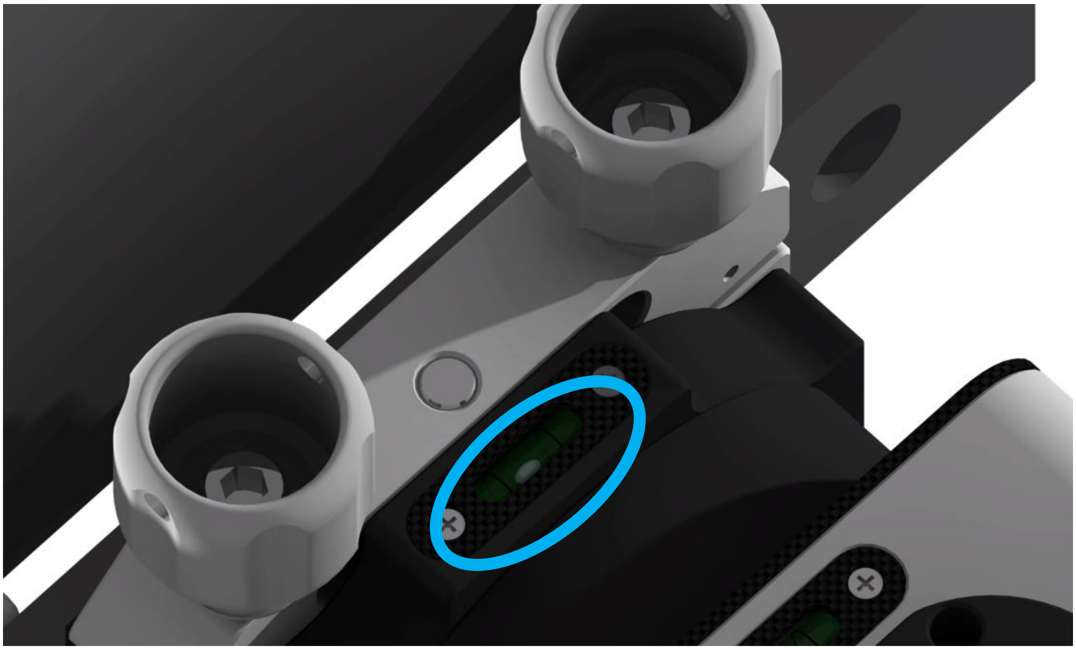


Installation and Use

Altazimuth mount

Horizontal calibration

The prerequisite for achieving accurate goto and stable tracking in altazimuth mode is that the azimuth rotation axis is perpendicular to the ground. EM31 Pro can confirm the status through the RA axis horizontal bubble

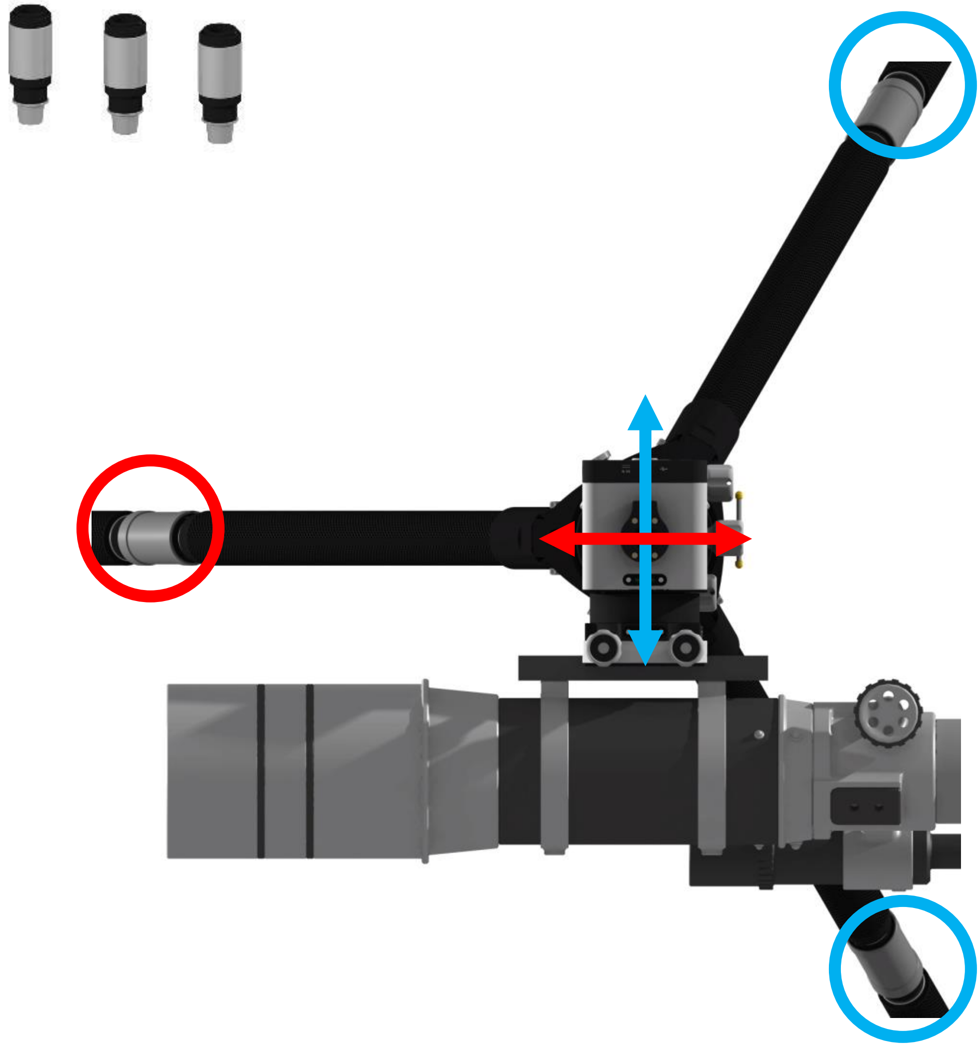


Installation and Use

Altazimuth mount

Horizontal calibration

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



⚠ All equipment need to be installed before starting to adjust the horizontal state

Installation and Use

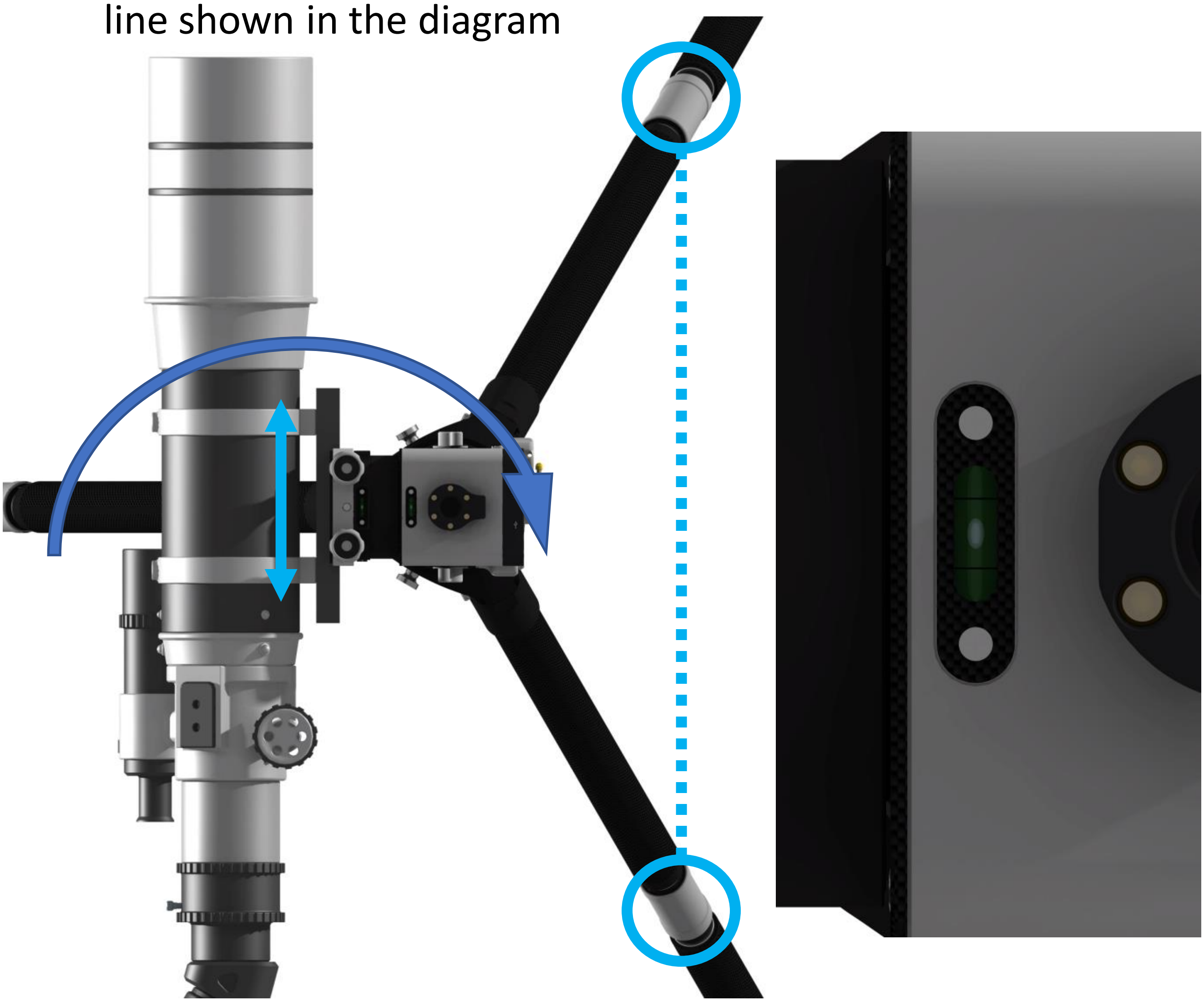
Altazimuth mount

Horizontal calibration

Obtain accurate horizontal state

- Power on the equatorial mount and manually rotate the RA axis to make the horizontal bubble 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



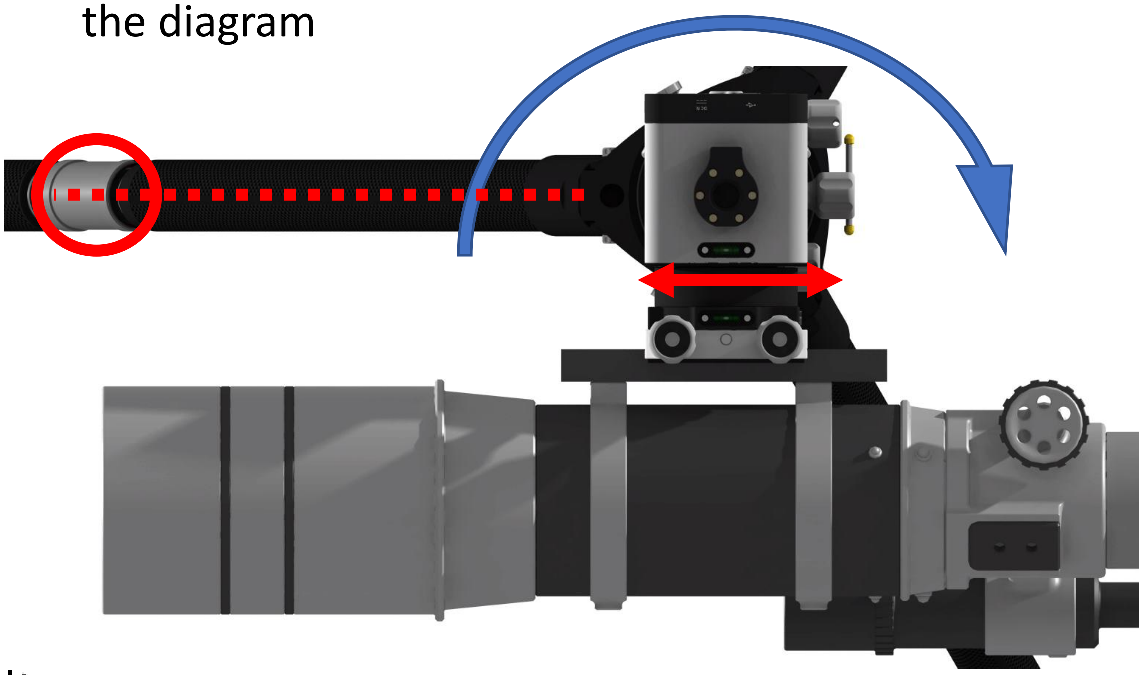
Installation and Use

Altazimuth mount

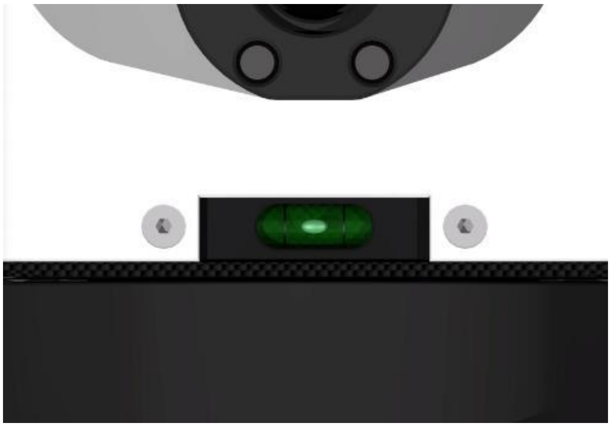
Horizontal calibration

Obtain accurate horizontal state

Power on the equatorial mount and manually rotate the RA axis so that the horizontal bubble is parallel to the red dashed line in the diagram



Adjust the horizontal adjuster inside the red circle until the horizontal bubble is centered, and then the horizontal adjustment is completed

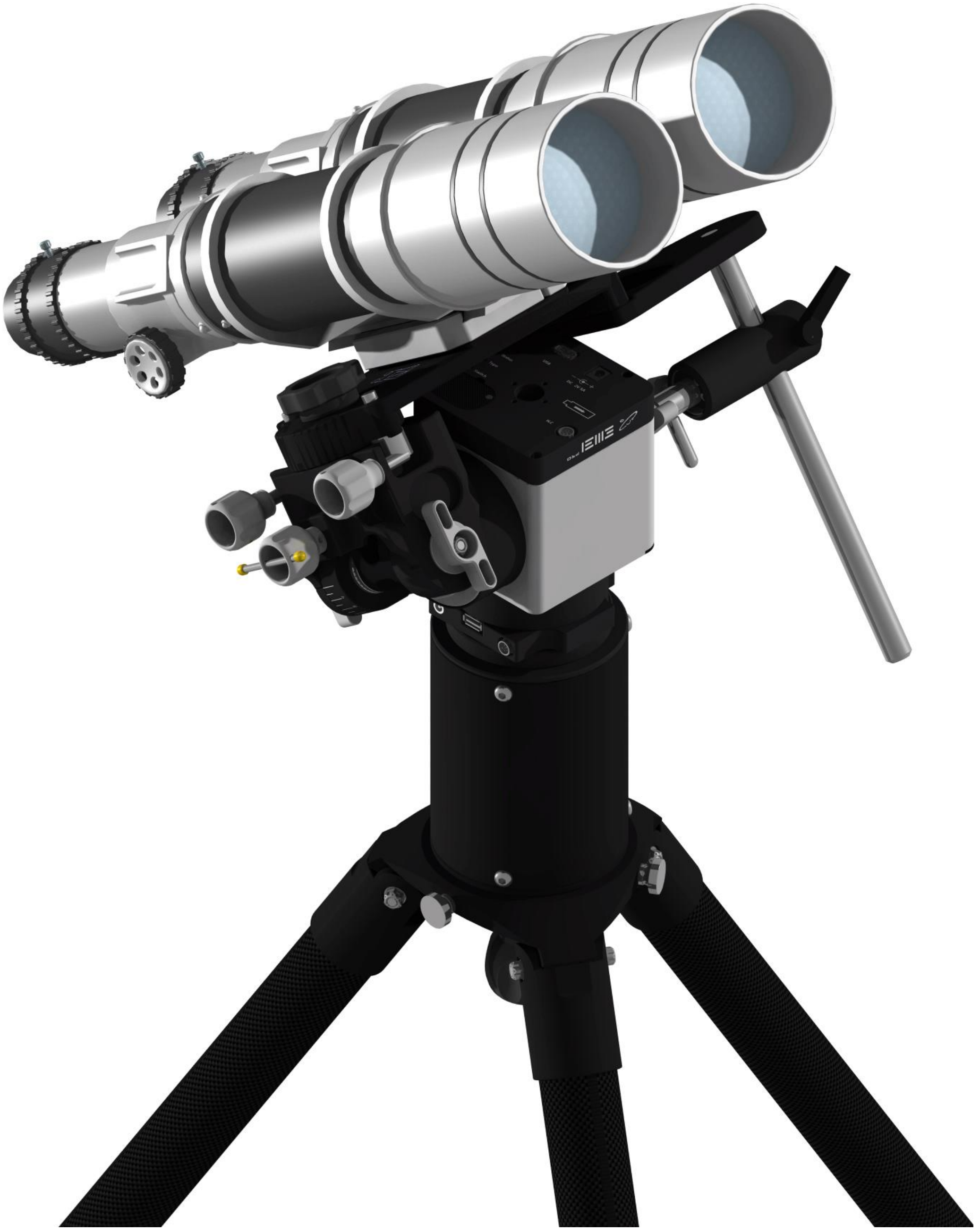


Installation and Use

Altazimuth mount-top mode

Structure Switching

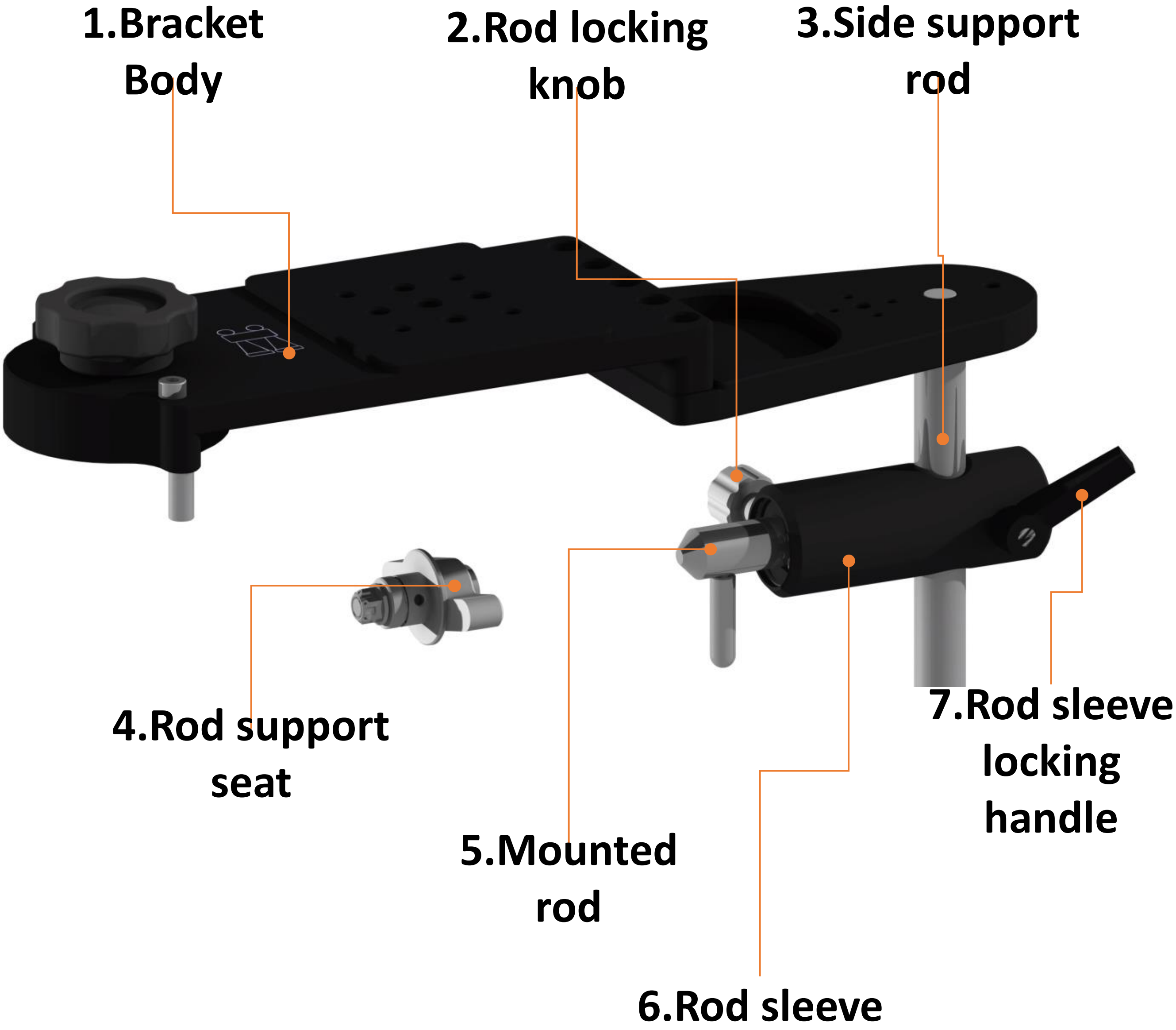
EM31 Pro can switch to altazimuth mount top mode by installing a supporting bracket on top



Installation and Use

Altazimuth mount-top mode

top mode supporting bracket structure

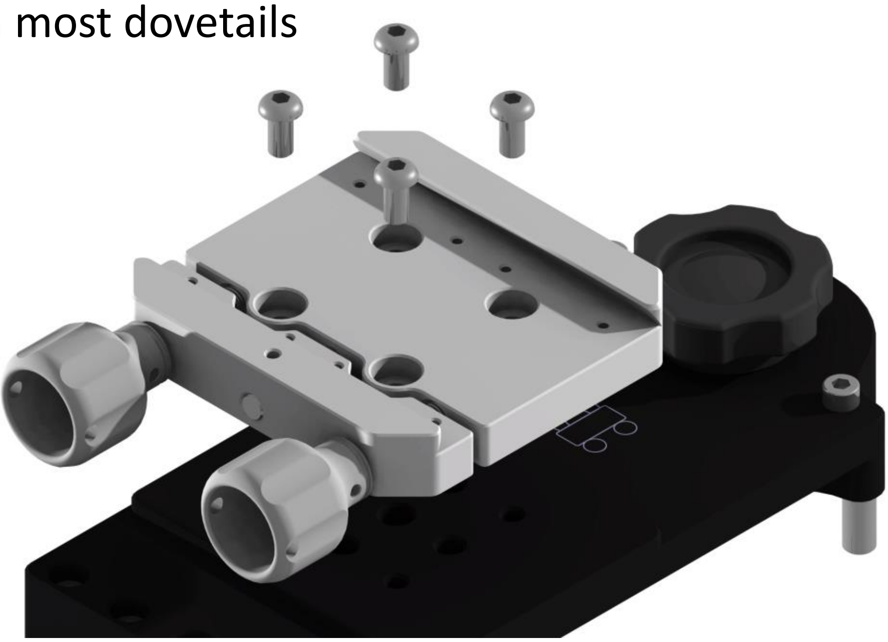

1.Bracket Body
2.Rod locking knob
3.Side support rod
4.Rod support seat
5.Mounted rod
6.Rod sleeve
7.Rod sleeve locking handle

Installation and Use

Altazimuth mount-top mode

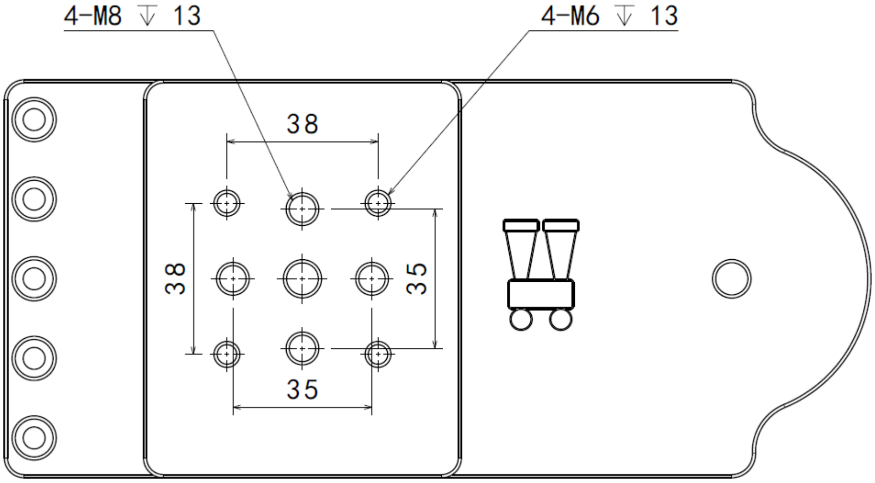
Structure Switching

The supporting bracket interface is suitable for installation with most dovetails



⚠

Note the installation direction of the dovetail slot knob, as illustrated



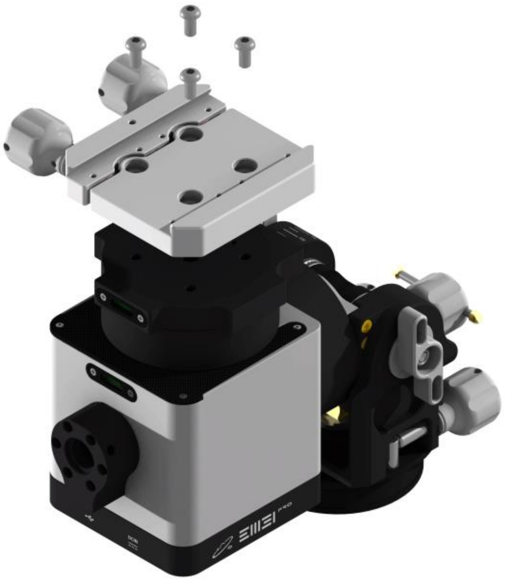
⚠ The top mode supporting bracket does not come with a dovetail, you can use the dovetail on the body or choose your own.

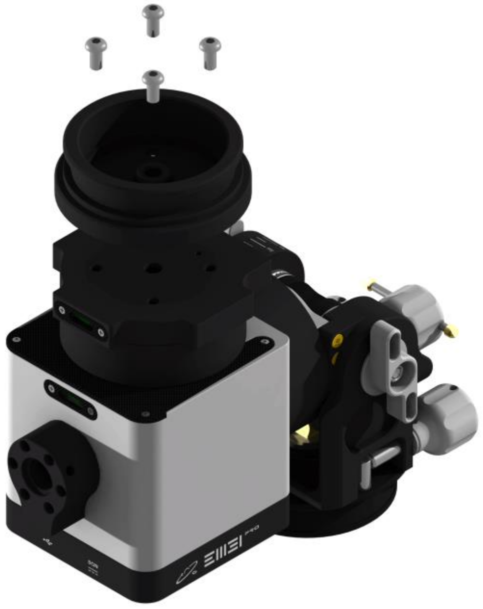
Installation and Use

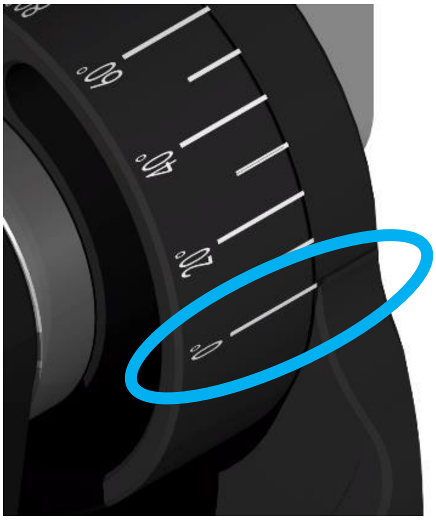
Altazimuth mount-top mode

Structure Switching

Replace the dovetail on the equatorial mount body with an supporting bracket connecting adapter and adjust the altitude angle to 0 degrees







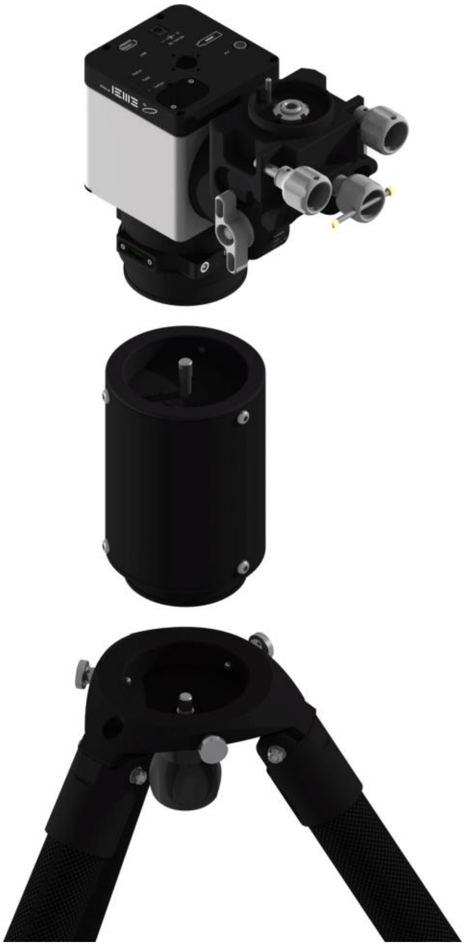
Installation and Use

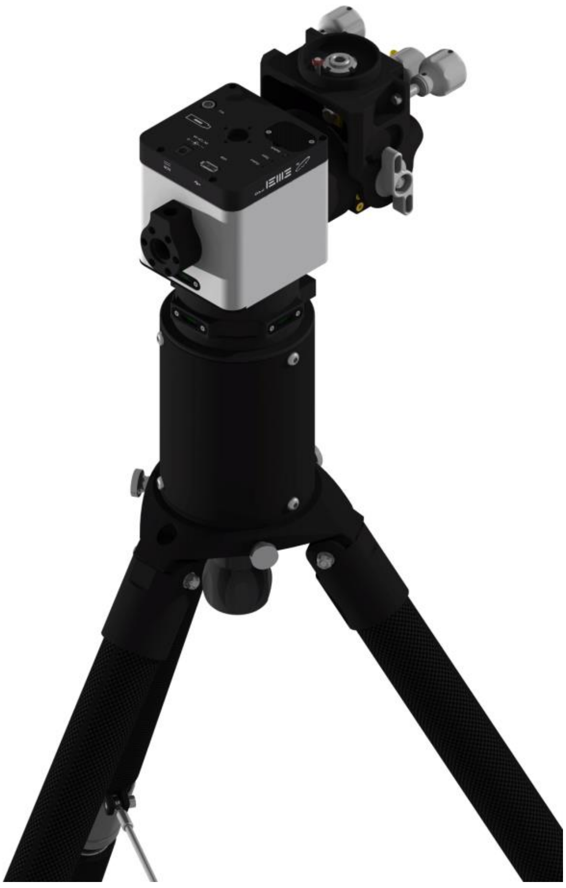
Altazimuth mount-top mode

Structure Switching

💡

Invert the body of the Equatorial mount and install it with the pier extension and tripod in the same way as in the German Equatorial mount mode



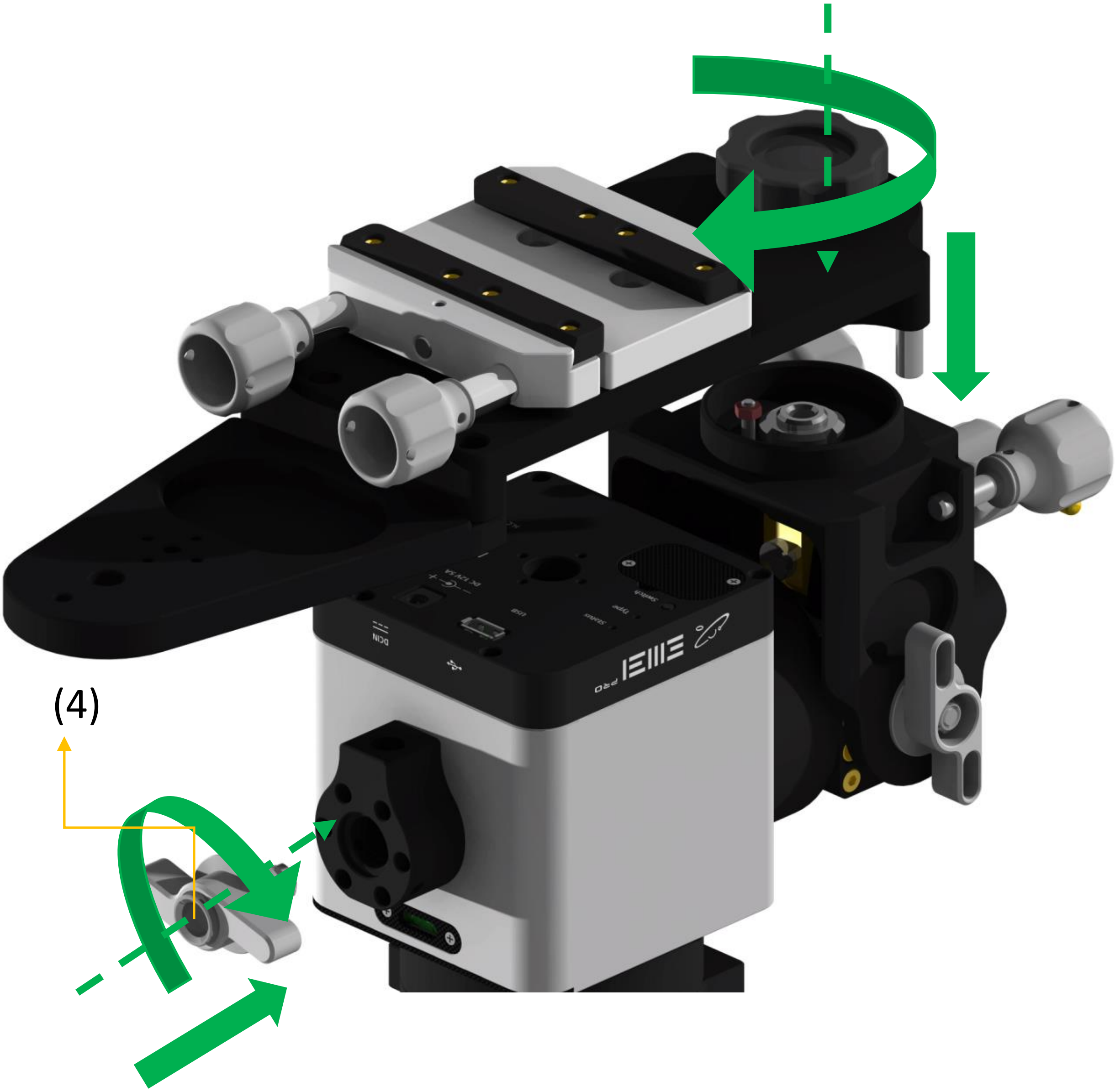


Installation and Use

Altazimuth mount-top mode

Structure Switching

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

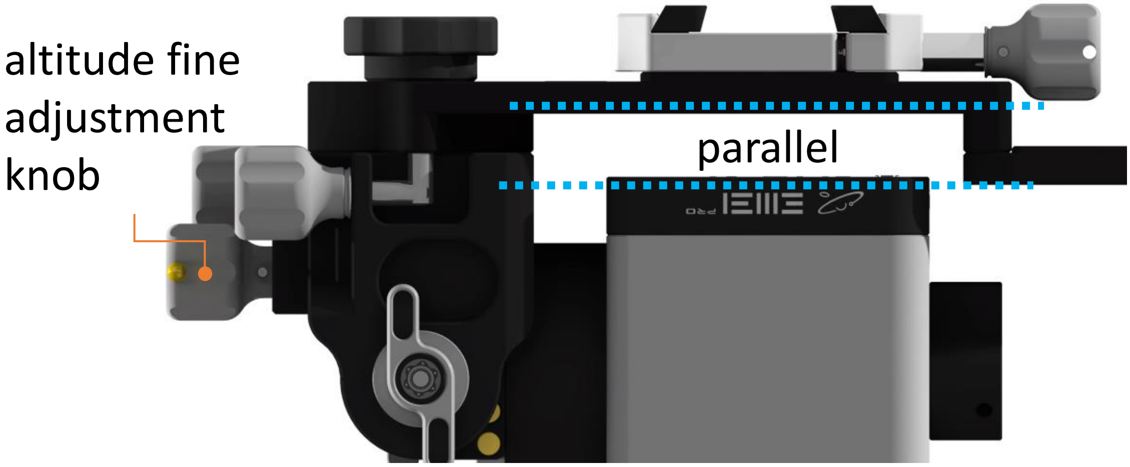


Installation and Use

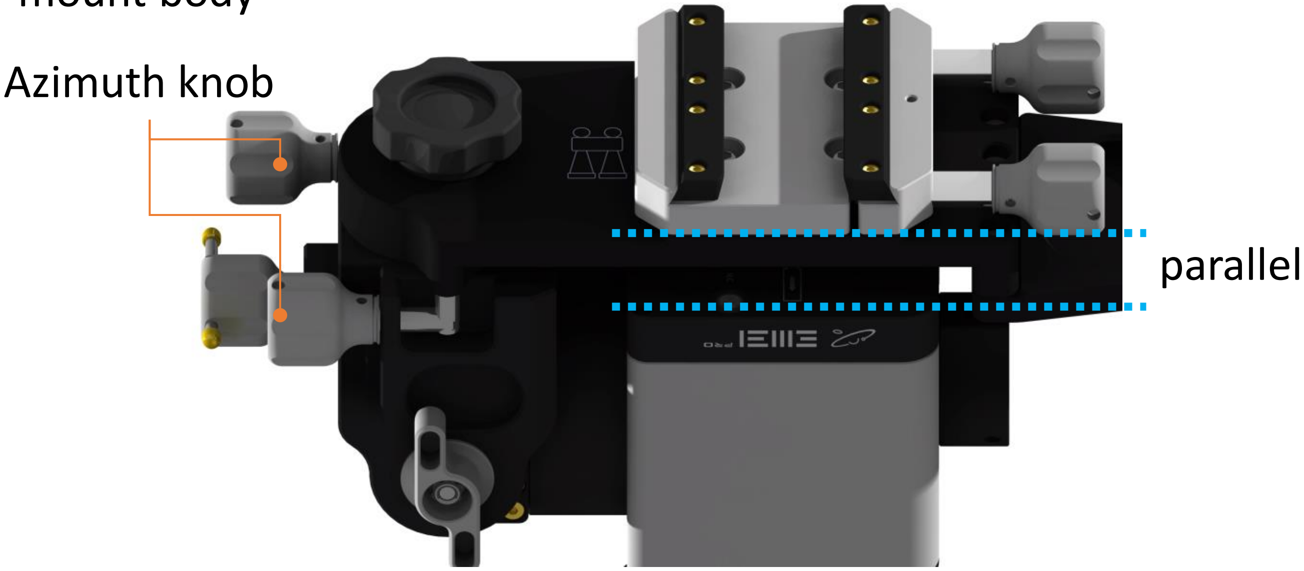
Altazimuth mount-top mode

Structure Switching

Adjust the altitude fine adjustment knob so that the lower edge of the upper mounting bracket is parallel to the edge of the bottom shell of the equatorial mount body


altitude fine adjustment knob
parallel

Adjust the azimuth knob so that the side edge of the upper bracket is parallel to the edge of the bottom cover of the mount body


Azimuth knob
parallel

⚠ Boundary parallelism can be judged by adjusting the perspective observation

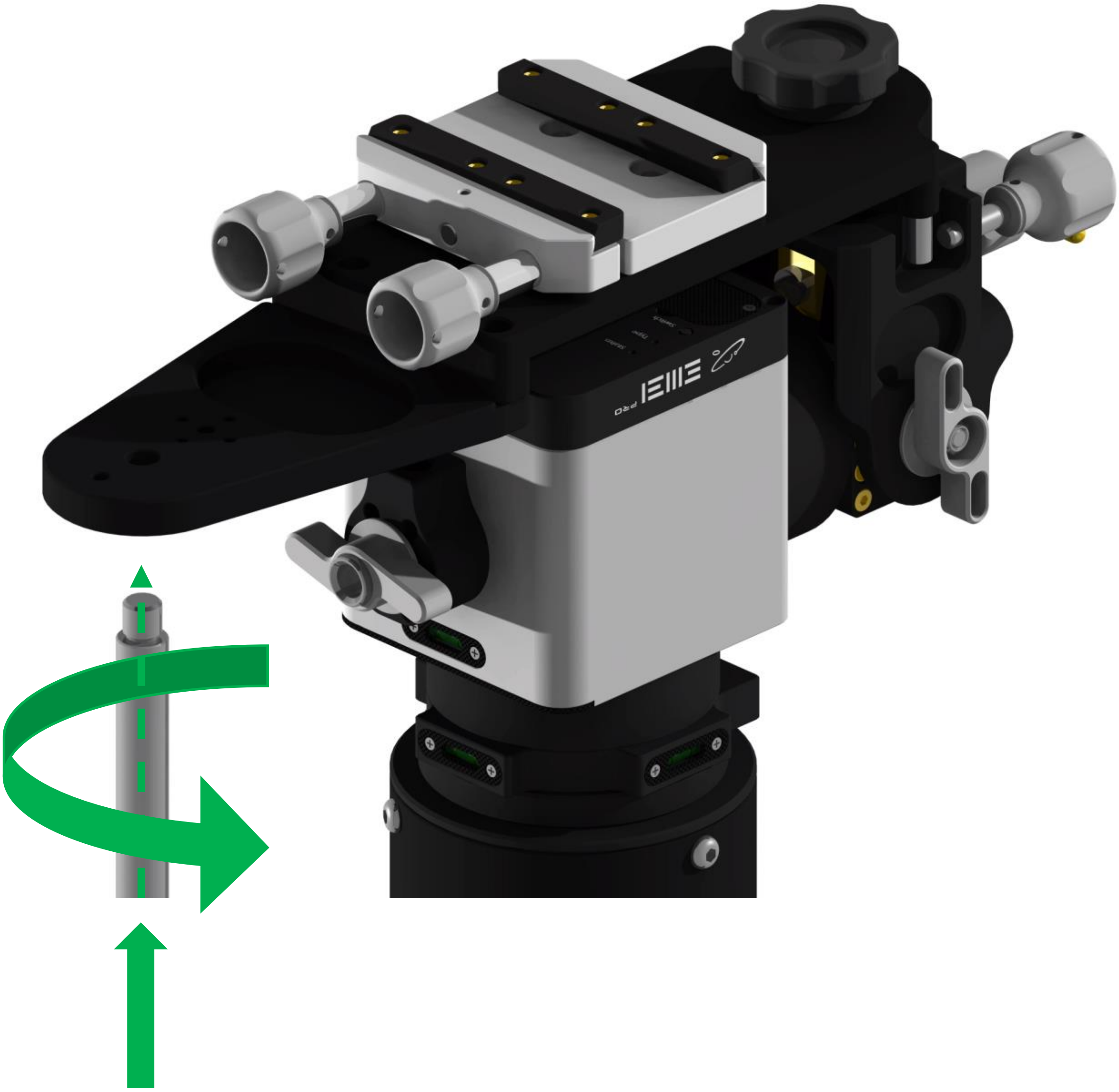
Installation and Use

Altazimuth mount-top mode

Structure Switching

💡

Clockwise into the Side support rod



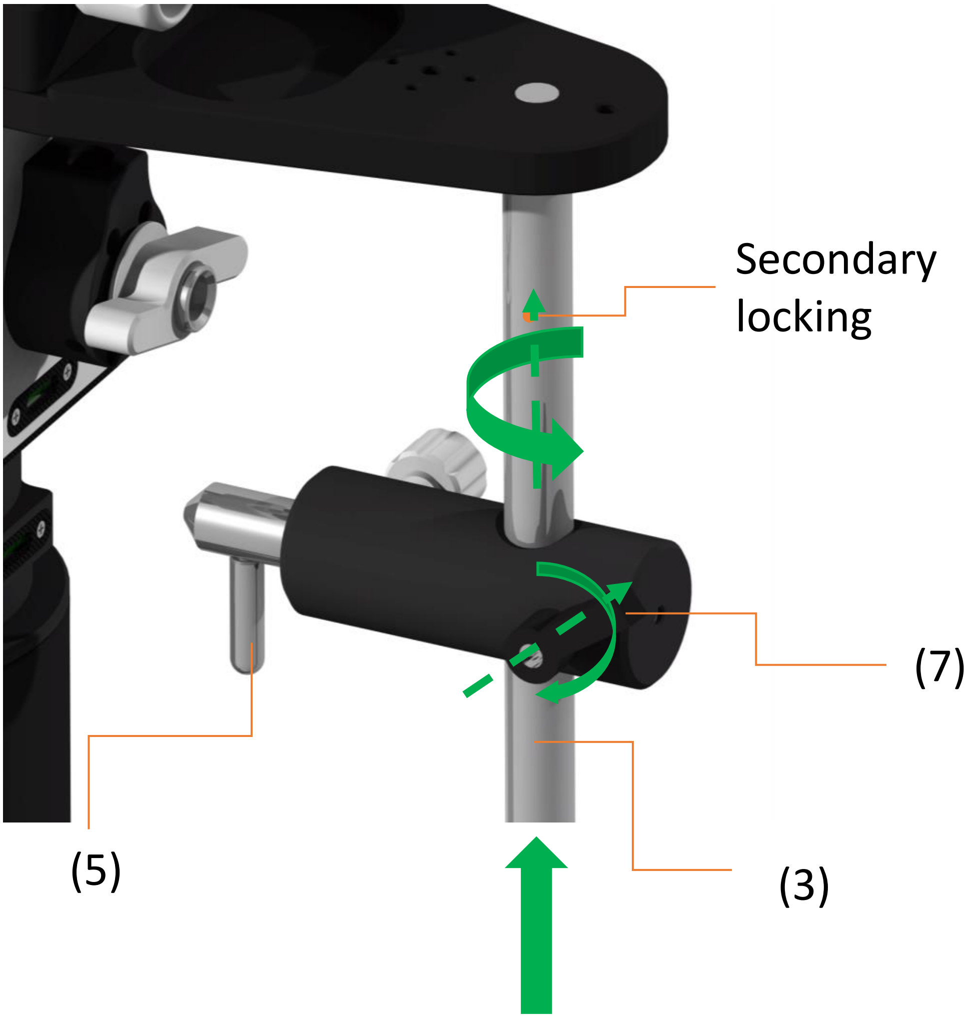
Installation and Use

Altazimuth mount-top mode

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



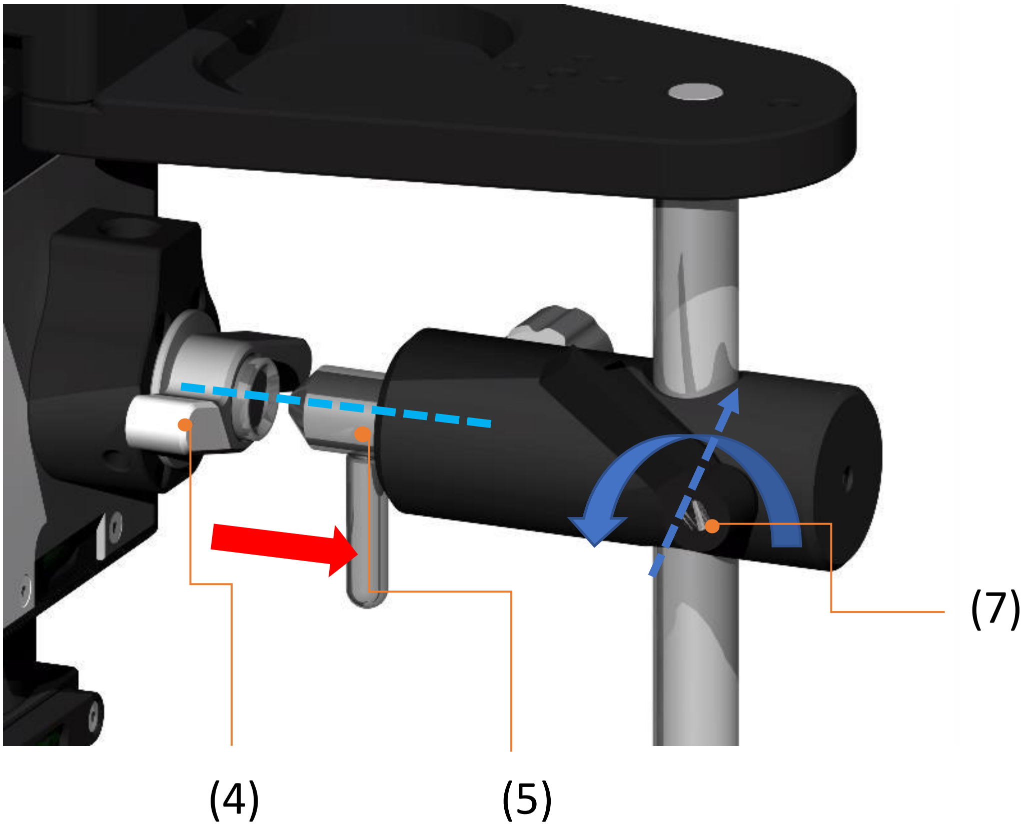
Installation and Use

Altazimuth mount-top mode

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)



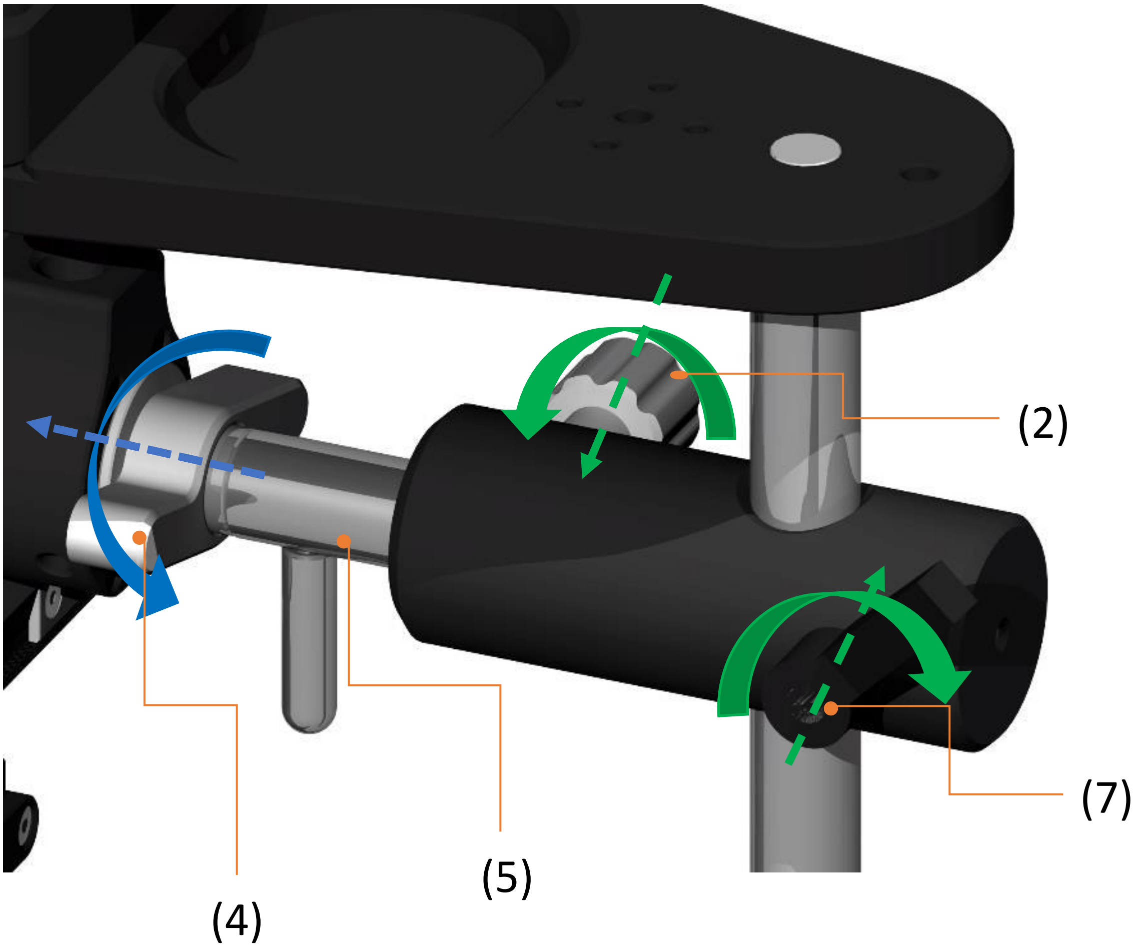
Installation and Use

Altazimuth mount-top mode

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



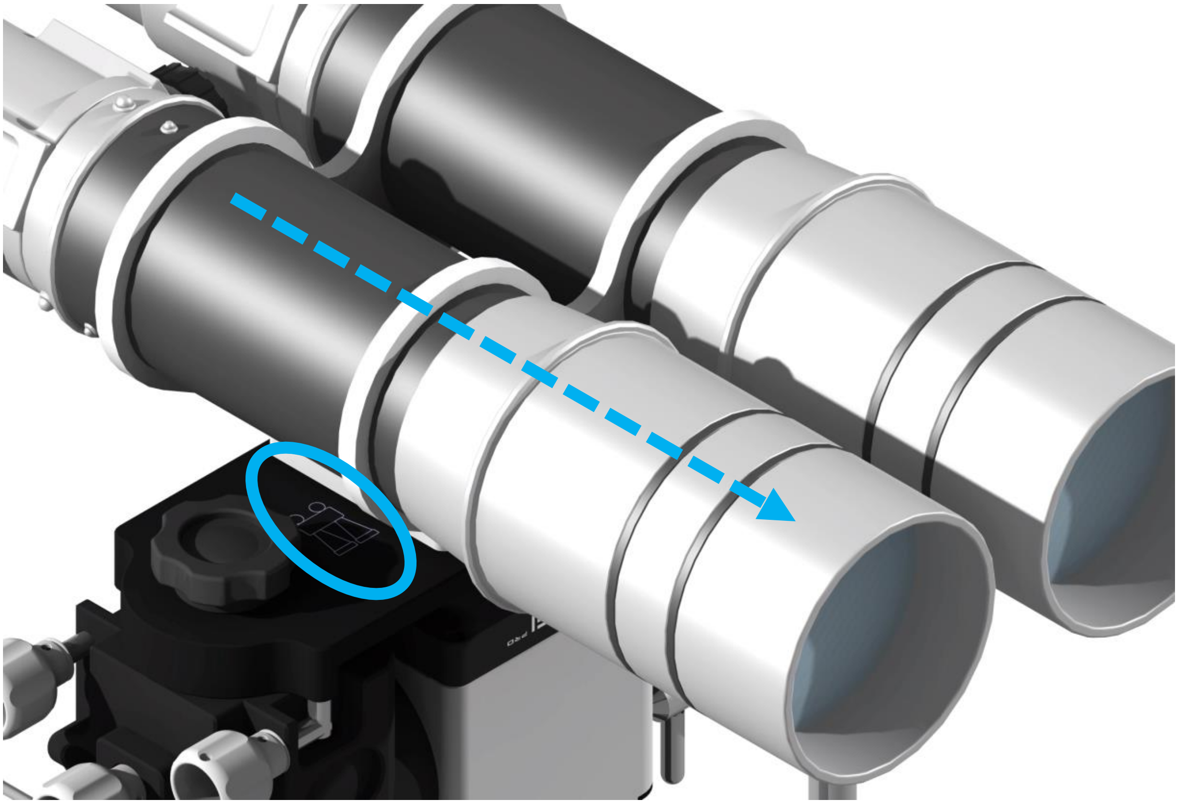
Installation and Use

Altazimuth mount-top mode

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

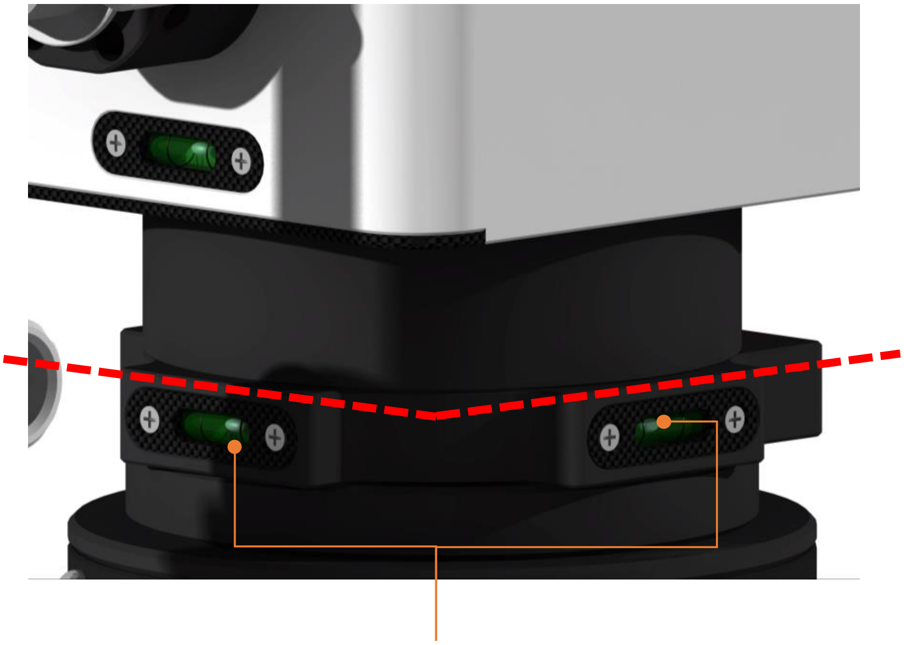


Installation and Use

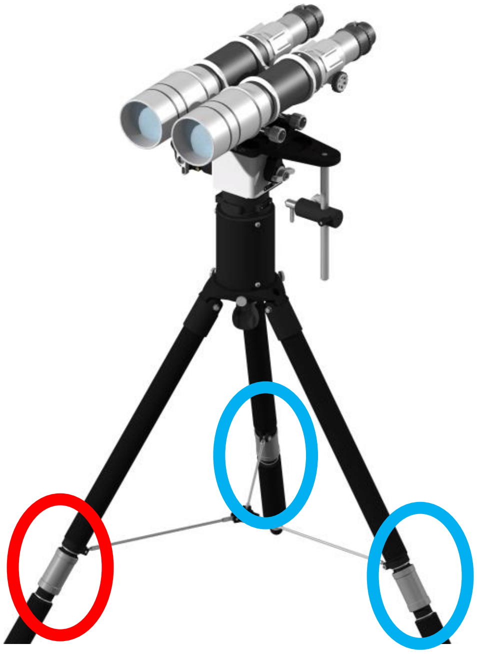
Altazimuth mount-top mode

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



Complete the horizontal adjustment by adjusting the horizontal adjuster installed on the tripod, using the same method in the same way as the Altazimuth side mounted mode

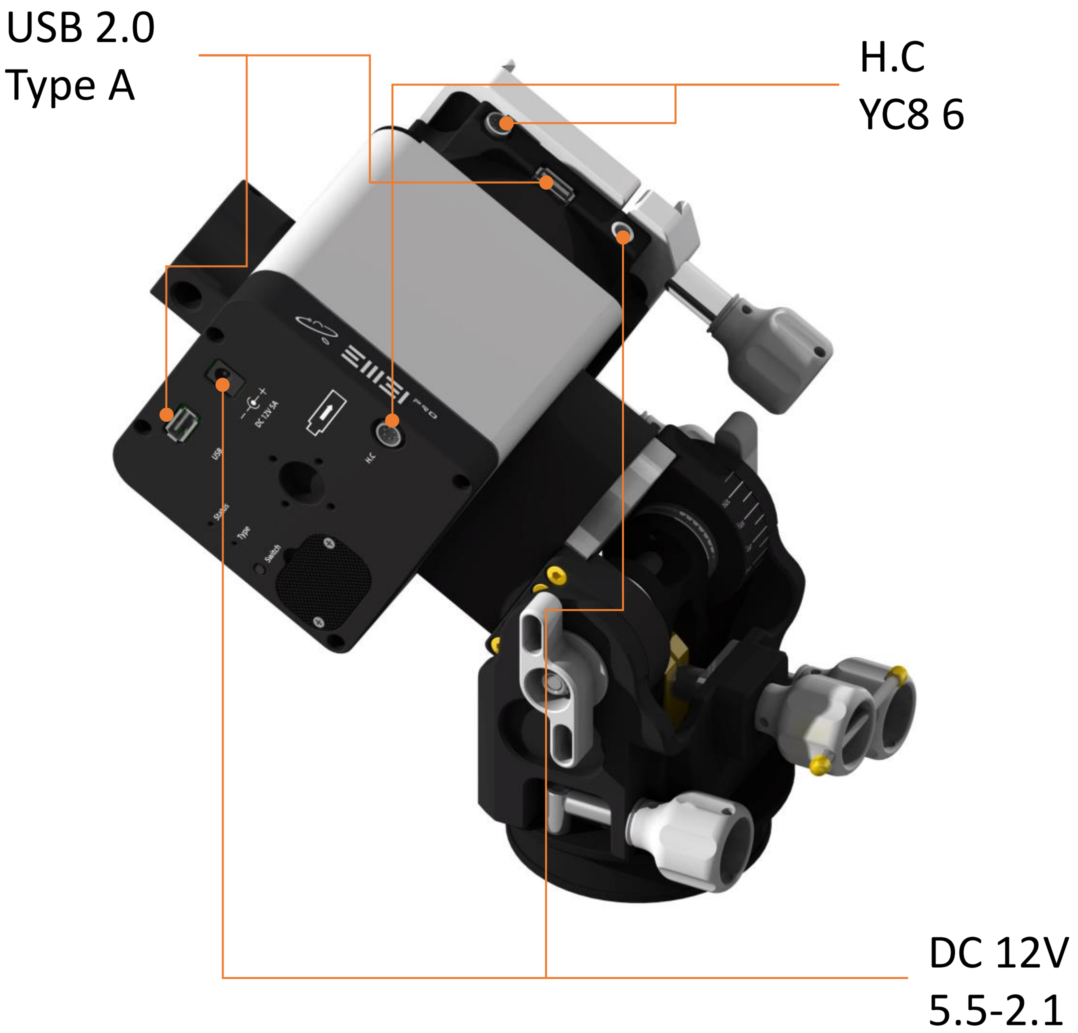


Installation and Use

Cable connection

Cable connection

EM31 Pro has two sets of cable connections, one on the bottom of the body, the other on the DEC rotation axis, both are identical in function



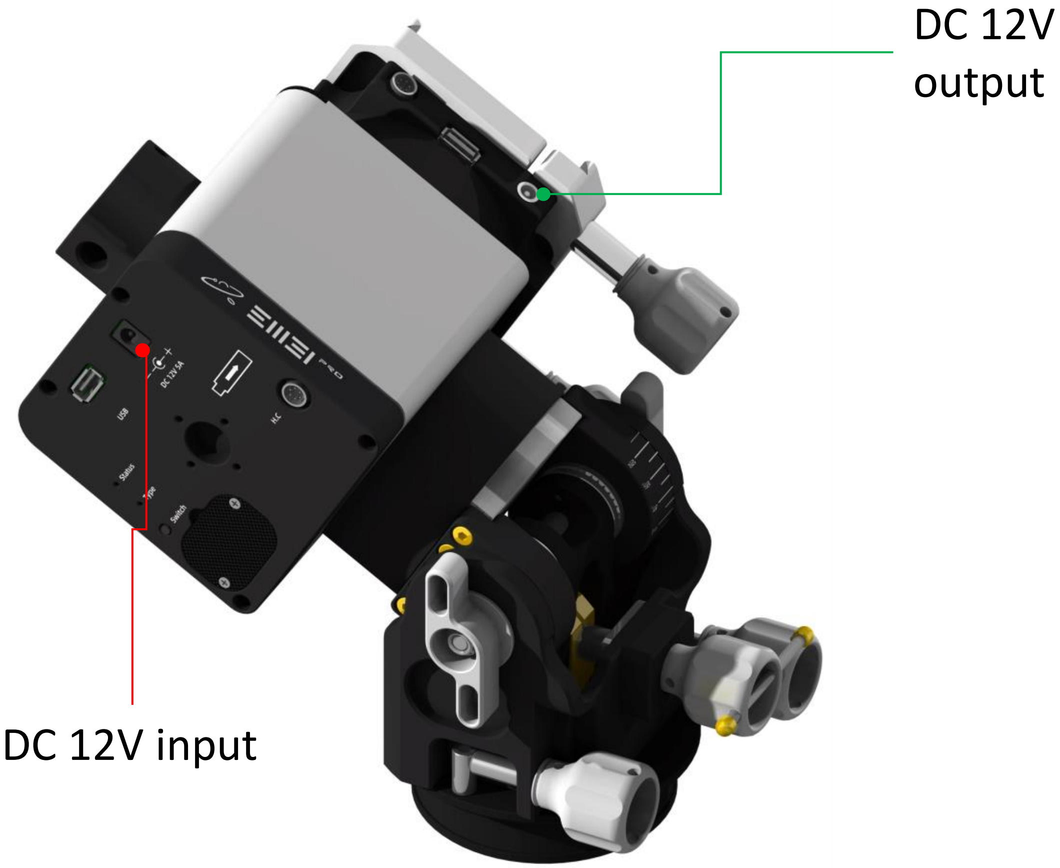
⊘ Prohibit simultaneous connection of two power sources
Prohibit simultaneous access to two controllers
Prohibit simultaneous access to two astronomical controller (any PC, astronomical box, mini PC)

Installation and Use

Cable connection

Power connection method
There are two DC 12v connector in the body of EM31 Pro
Any connector can be used as a power input, and the other connector can be used as a power output to supply power to other astronomical devices.

For astrophotography, it is recommended to use the bottom connector of the body as the power input and the DEC axis connector as the output connector



⊘ Prohibit simultaneous access to two power supplies, the output connector device load shall not exceed 12v 5A

⚠ When only the equatorial mount is used, it is recommended to use DC 12V 2A or more power supply. When other equipment is used, it is recommended to use DC 12V 5A or more power supply. The power output interface can provide 5A stable current.

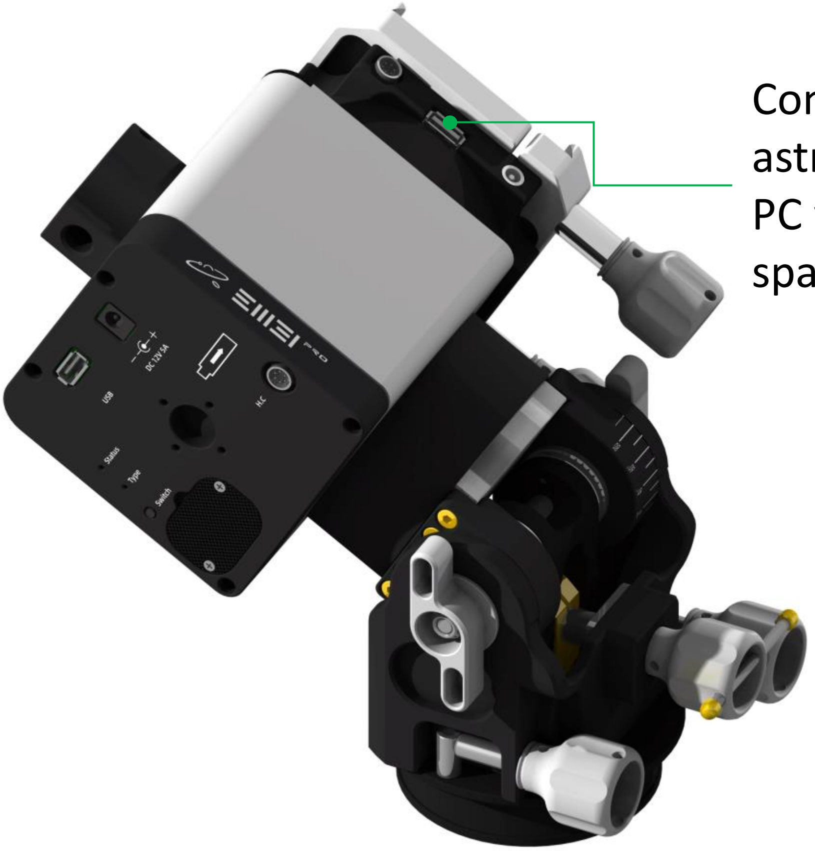
Installation and Use

Cable connection

USB cable connection method

EM31 Pro has two USB interfaces, each of which can be connected to the equatorial mount and the host computer (PC, astronomical box, mini PC).

For astrophotography, it is recommended to use the DEC axis interface to connect the astronomical box or PC. At this point, the USB and power output cables can rotate synchronously with the telescope, effectively preventing cable entanglement



Connection of astronomical box or PC when deep space photography

---

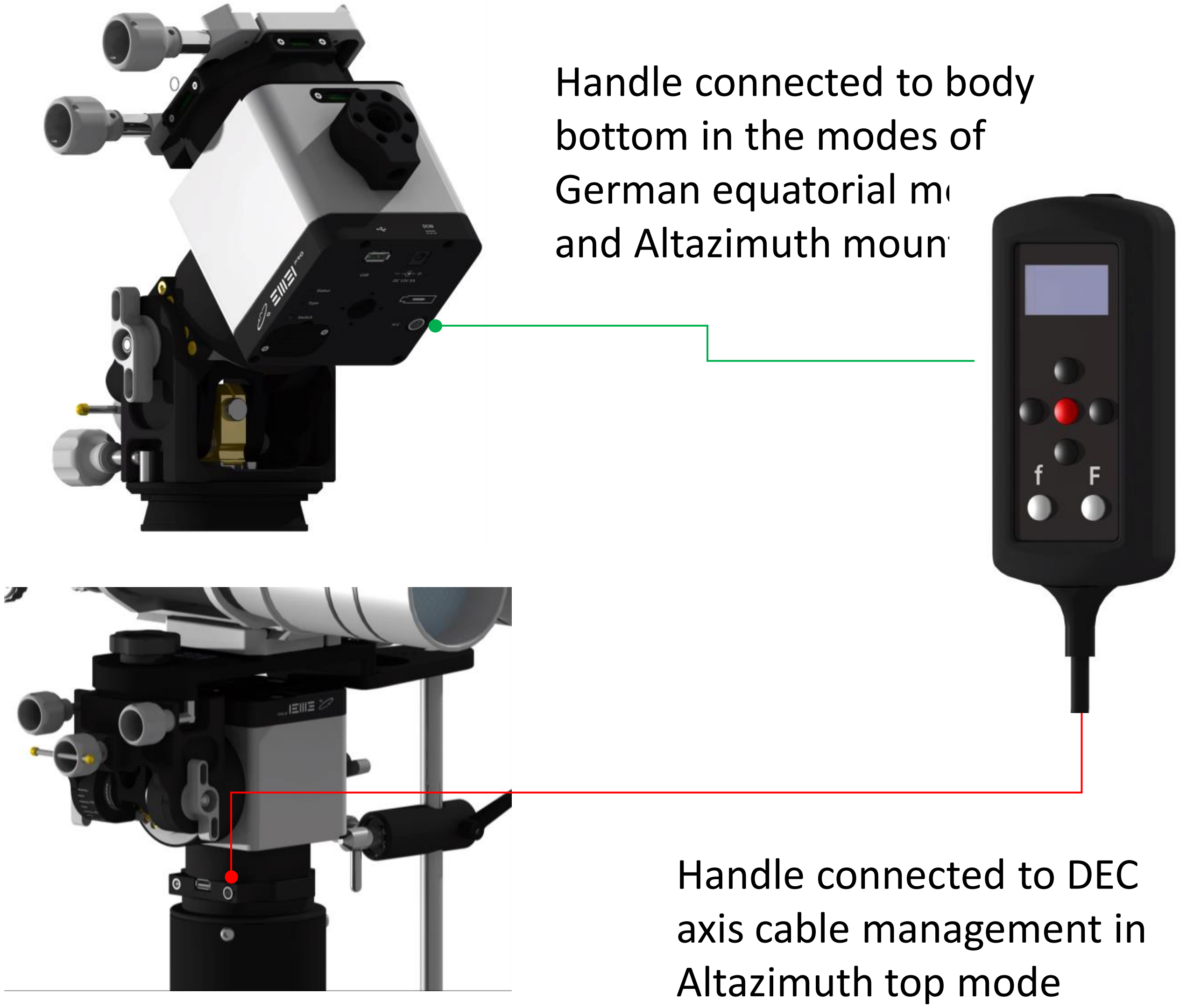
Prohibit connecting devices other than PCs, Astro Boxes, and Astro Industrial Controls.
Prohibit connecting the equatorial mount through any USB hub

Installation and Use

Cable connection

Handle connection

EM31 Pro has two USB interfaces, each of which can be connected to the equatorial mount and the host computer (PC, astronomical box, mini PC).



Handle connected to body bottom in the modes of German equatorial m
and Altazimuth moun

Handle connected to DEC axis cable management in Altazimuth top mode

---

⊘ **Prohibit connecting two handle controllers simultaneously**
Prohibit the plugging and unplugging of the handle controller in the charged state of the equatorial mount

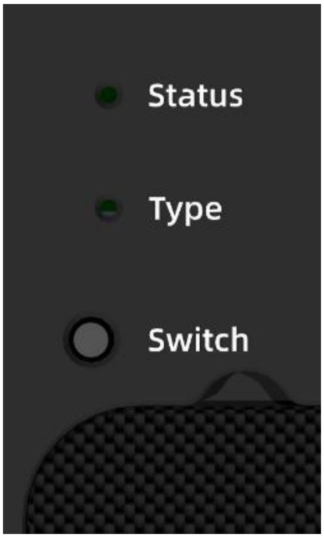
Installation and Use

Mode selection

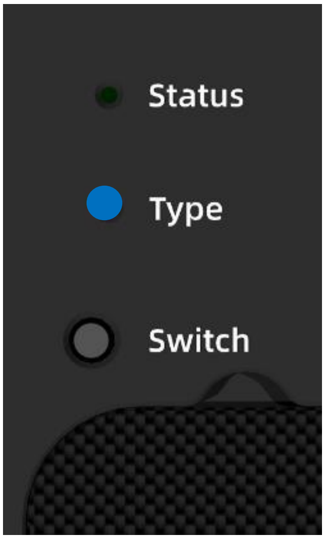
Mode selection

EM31 Pro mode selection indicated by the “Type” light，**Blue is Altazimuth Mount side mode**， **Red is Altazimuth Mount top mode,** **Light out for German equatorial mount**

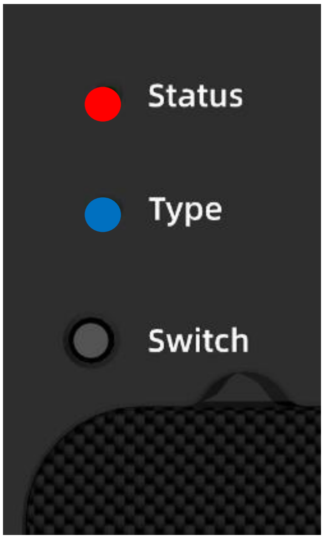
Wait for 5 seconds when the Equatorial mount is powered on, and enter mode switching after the Status light flashes off



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

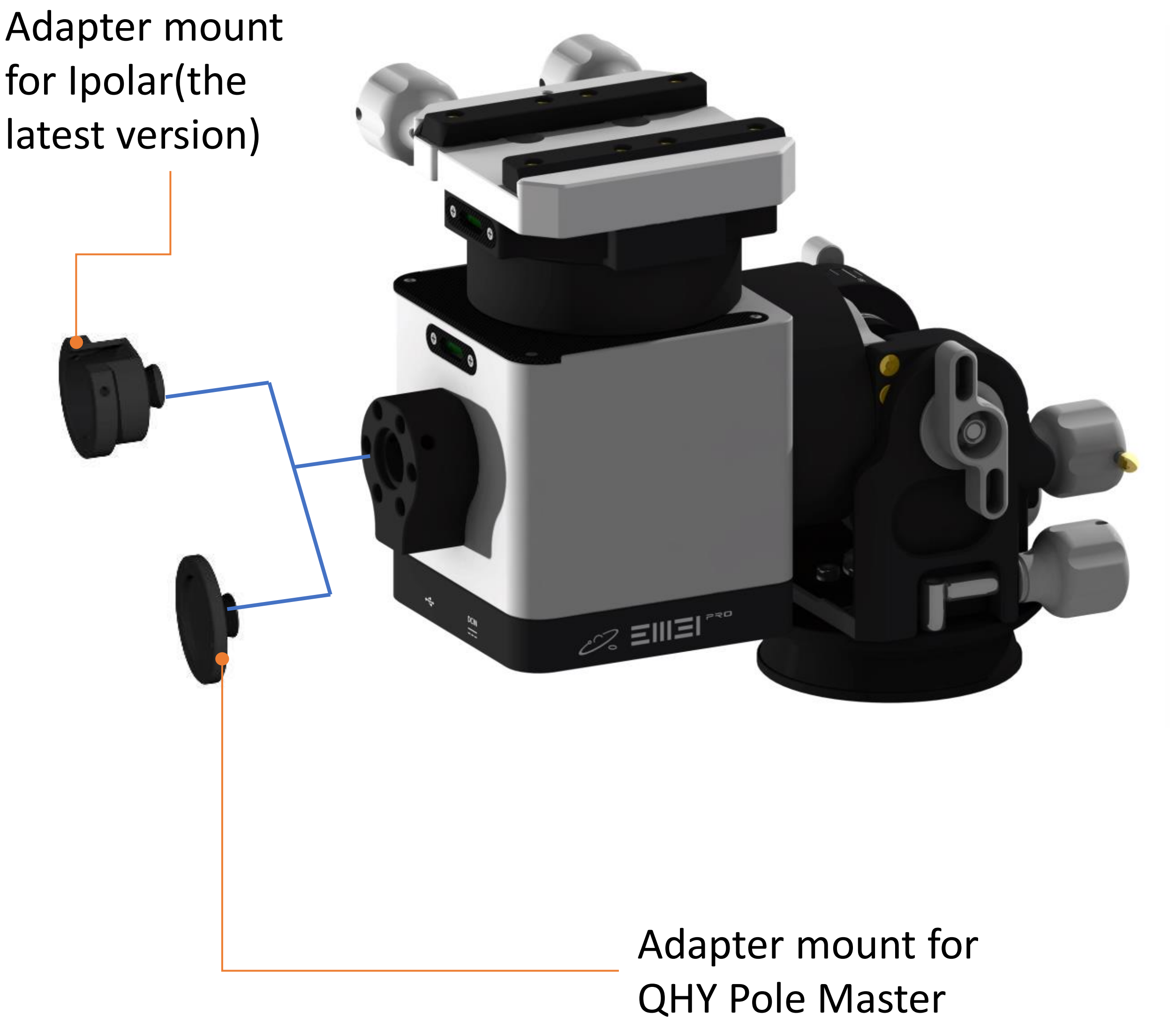


⚠ When the mount is in operation, the Status light will be on constantly and will start flashing when tracking is turned on

Accessory Installation

Adapter Mount for electronic polar alignment scope

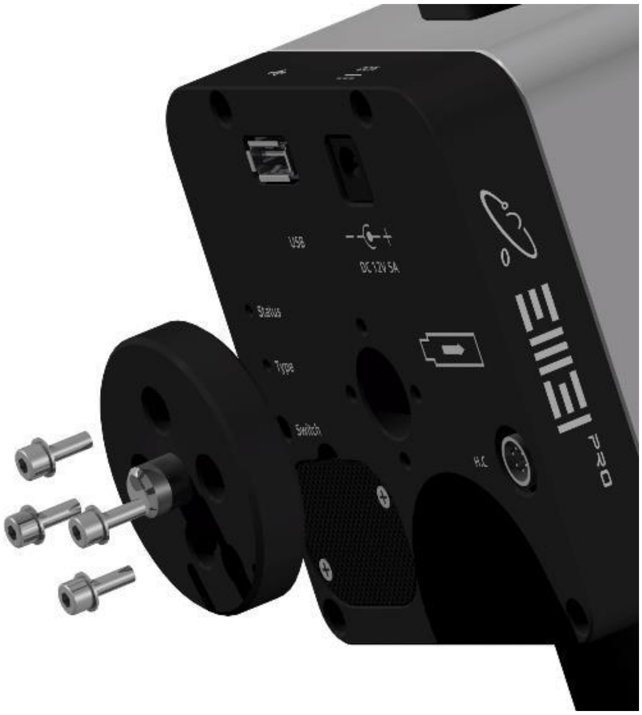
The electronic polar scope can be connected to EM31Pro via an adapter mount.

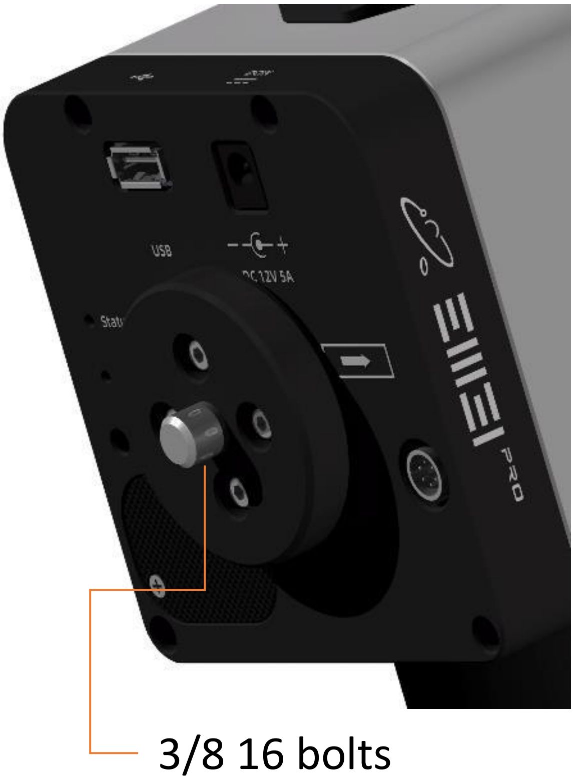

Adapter mount for Ipolar(the latest version)
Adapter mount for QHY Pole Master

Accessory Installation

Ball head mount

EM31 Pro can install a DSLR gimbal through the Ball head mount

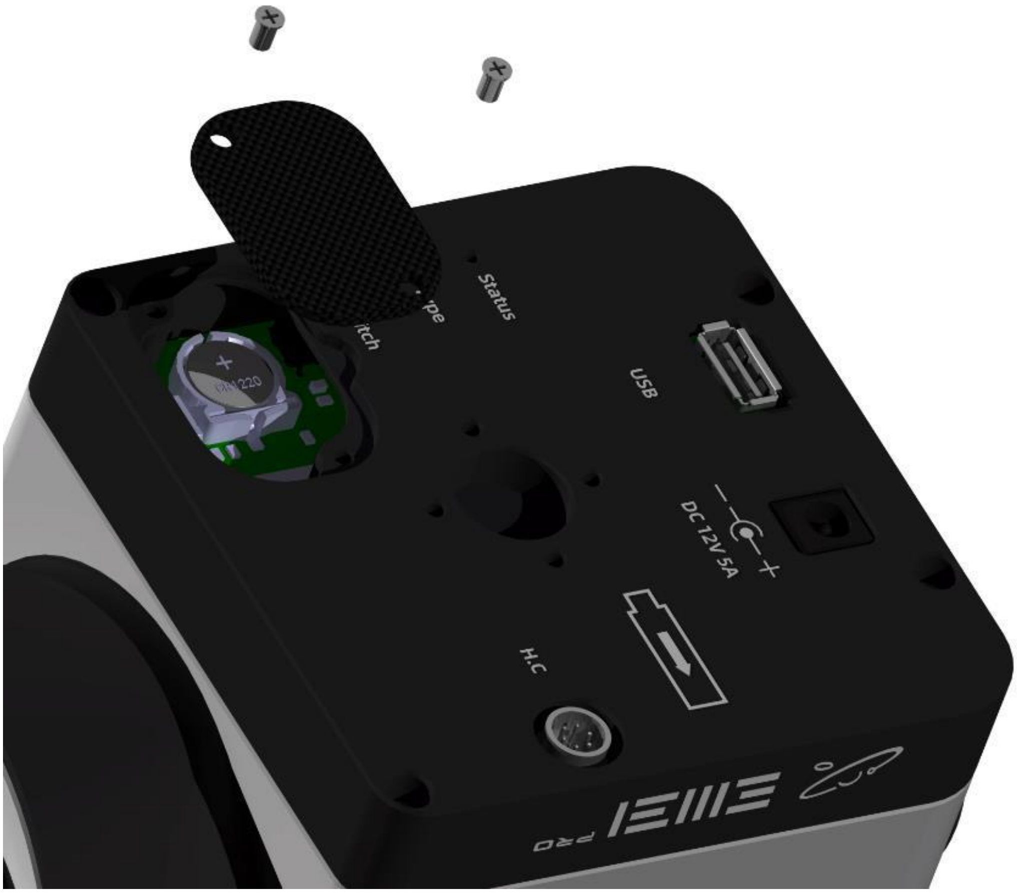

USB
DC 12V 5A
Status
Type
Switch
H.C
PRO


USB
DC 12V 5A
PRO
3/8 16 bolts

Battery Installation

Install and replace the battery

Battery replacement


CR1220
Status
USB
DC 12V 5A
H.C
PRO

Battery model CR1220

⊘ **Do not replace batteries while powered on**

Onstep Quick Start Guide

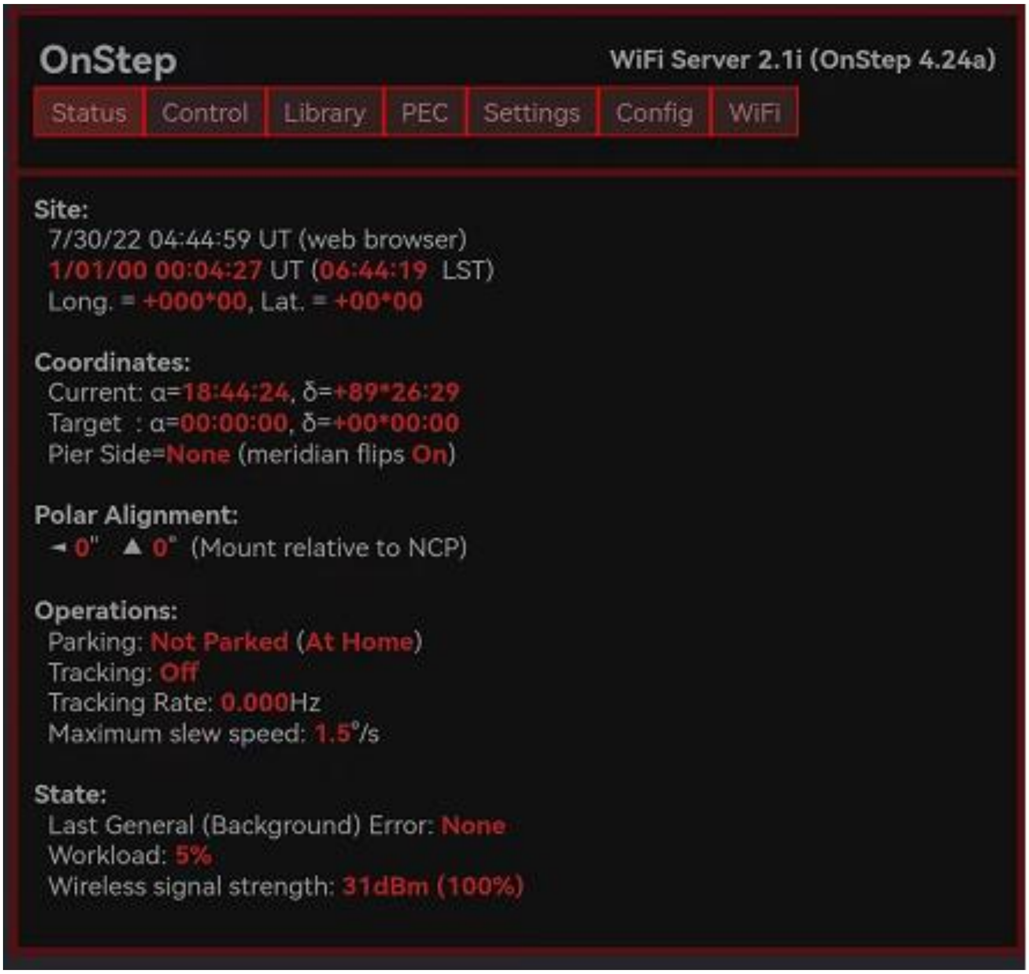
Onstep guide

Users can set and control the Equatorial mount through Android Onstep APP or webpage

IOS system cannot use APP， webpage is workable

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: α=18:44:24, δ=+89*26:29
Target : α=00:00:00, δ=+00*00:00
Pier Side=None (meridian flips On)

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

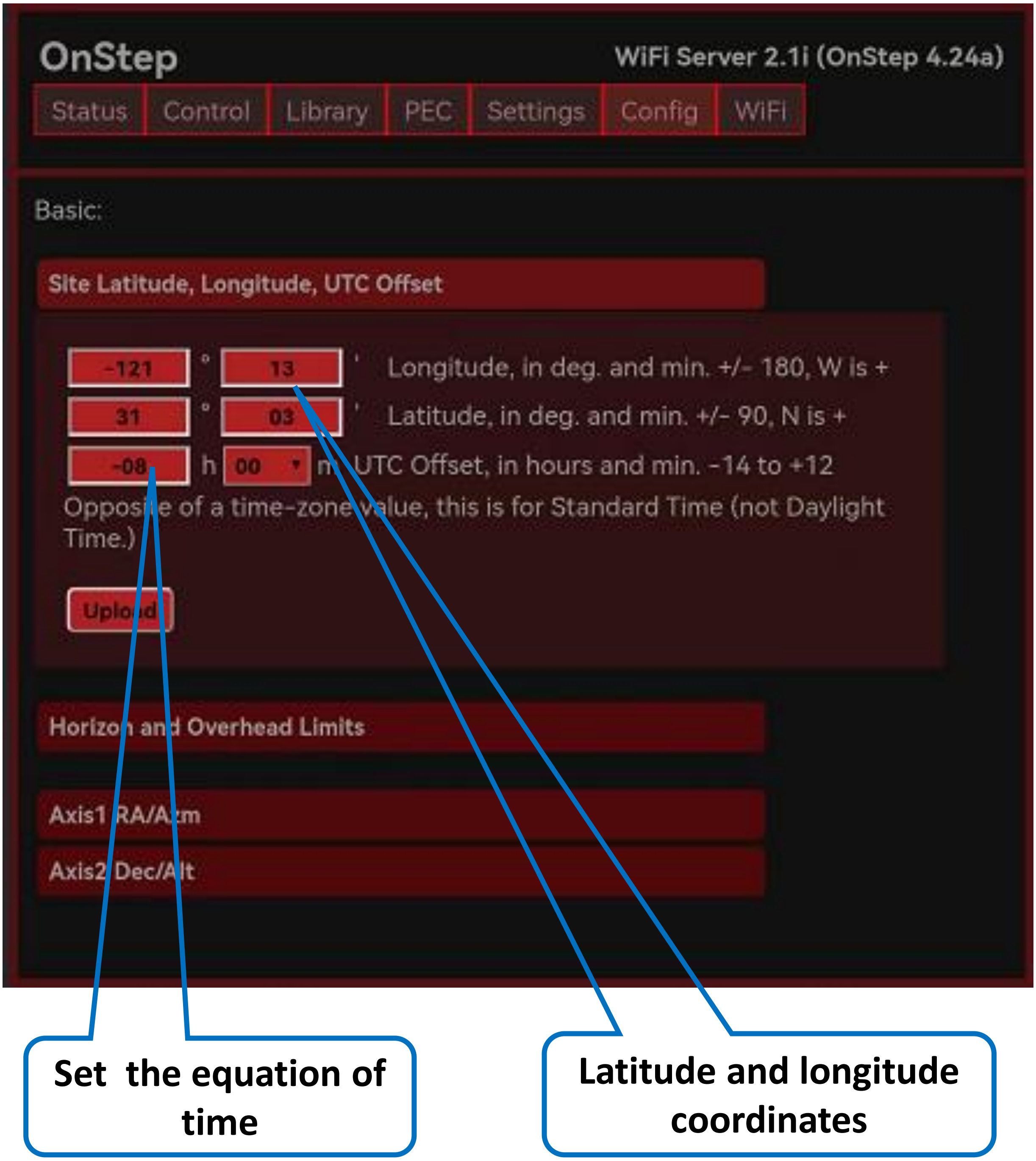
Operations:
Parking: Not Parked (At Home)
Tracking: Off
Tracking Rate: 0.000Hz
Maximum slew speed: 1.5°/s

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

Onstep Quick Start Guide

Onstep guide

When using the Equatorial mount for the first time or changing the address, you need to set the longitude and latitude coordinates and local time of the Equatorial mount (can be synchronized through NINA or the Asiair)


OnStep
WiFi Server 2.1i (OnStep 4.24a)
Status
Control
Library
PEC
Settings
Config
WiFi
Upload
Horizon and Overhead Limits
Axis1 RA/Azm
Axis2 Dec/Alt

Basic:

Site Latitude, Longitude, UTC Offset

-121 ° 13 ' Longitude, in deg. and min. +/- 180, W is +

31 ° 03 ' Latitude, in deg. and min. +/- 90, N is +

-08 h 00 m UTC Offset, in hours and min. -14 to +12

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

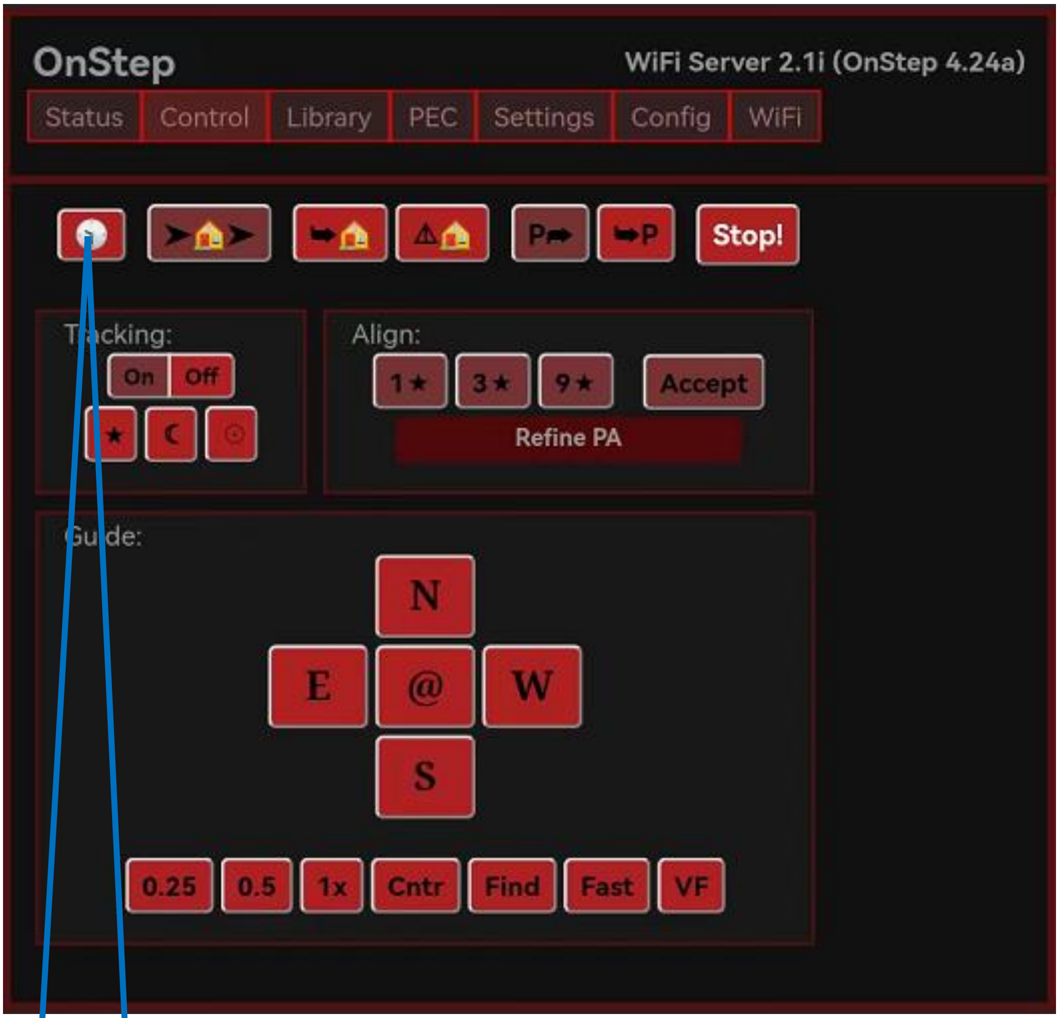
Set the equation of time

Latitude and longitude coordinates

Onstep Quick Start Guide

Onstep guide

set time

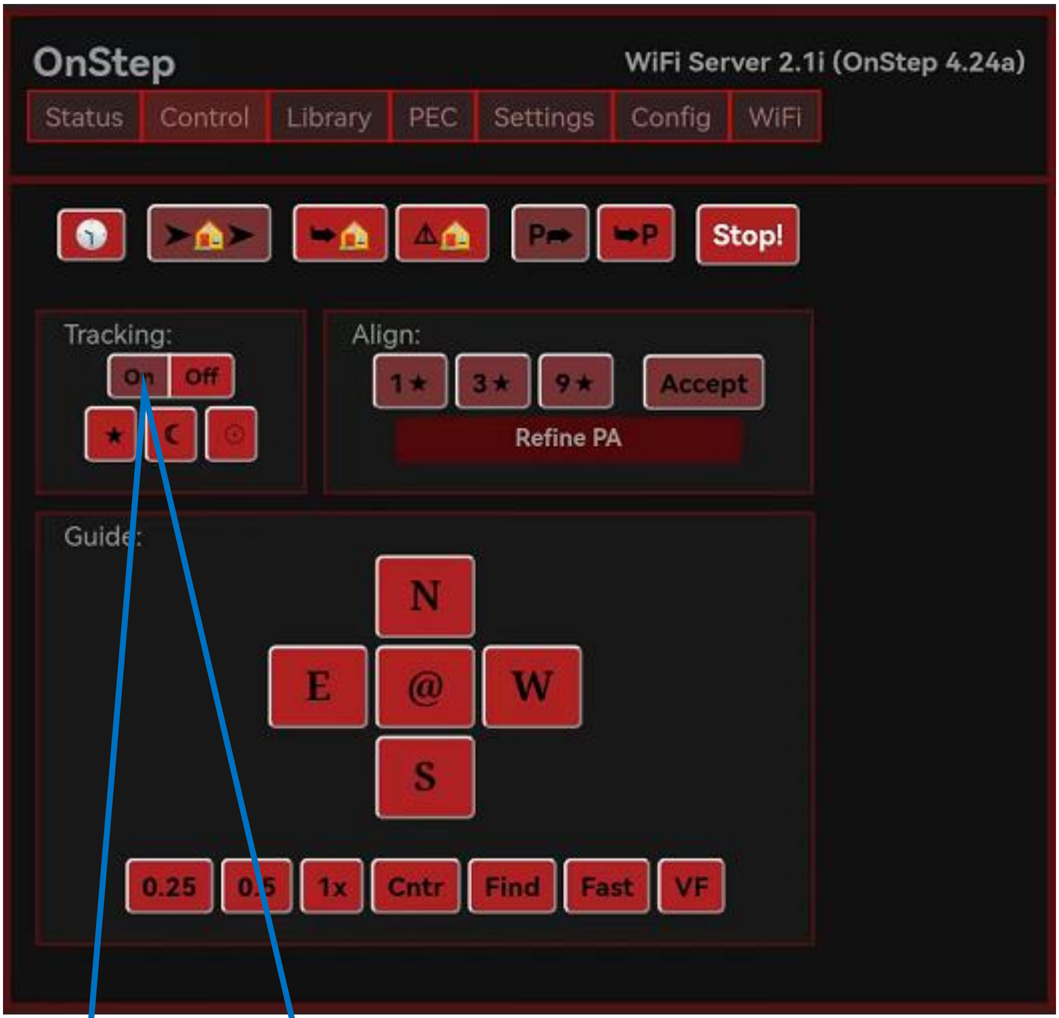

OnStep
WiFi Server 2.1i (OnStep 4.24a)
Status
Control
Library
PEC
Settings
Config
WiFi
Stop!
Tracking:
On
Off
Align:
1★
3★
9★
Accept
Refine PA
Guide:
N
E
@
W
S
0.25
0.5
1x
Cntr
Find
Fast
VF

set time

Onstep Quick Start Guide

Onstep guide

Start Tracking


OnStep
WiFi Server 2.1i (OnStep 4.24a)
Status
Control
Library
PEC
Settings
Config
WiFi
Stop!
Tracking:
On
Off
Align:
1★
3★
9★
Accept
Refine PA
Guide:
N
E
@
W
S
0.25
0.5
1x
Cntr
Find
Fast
VF

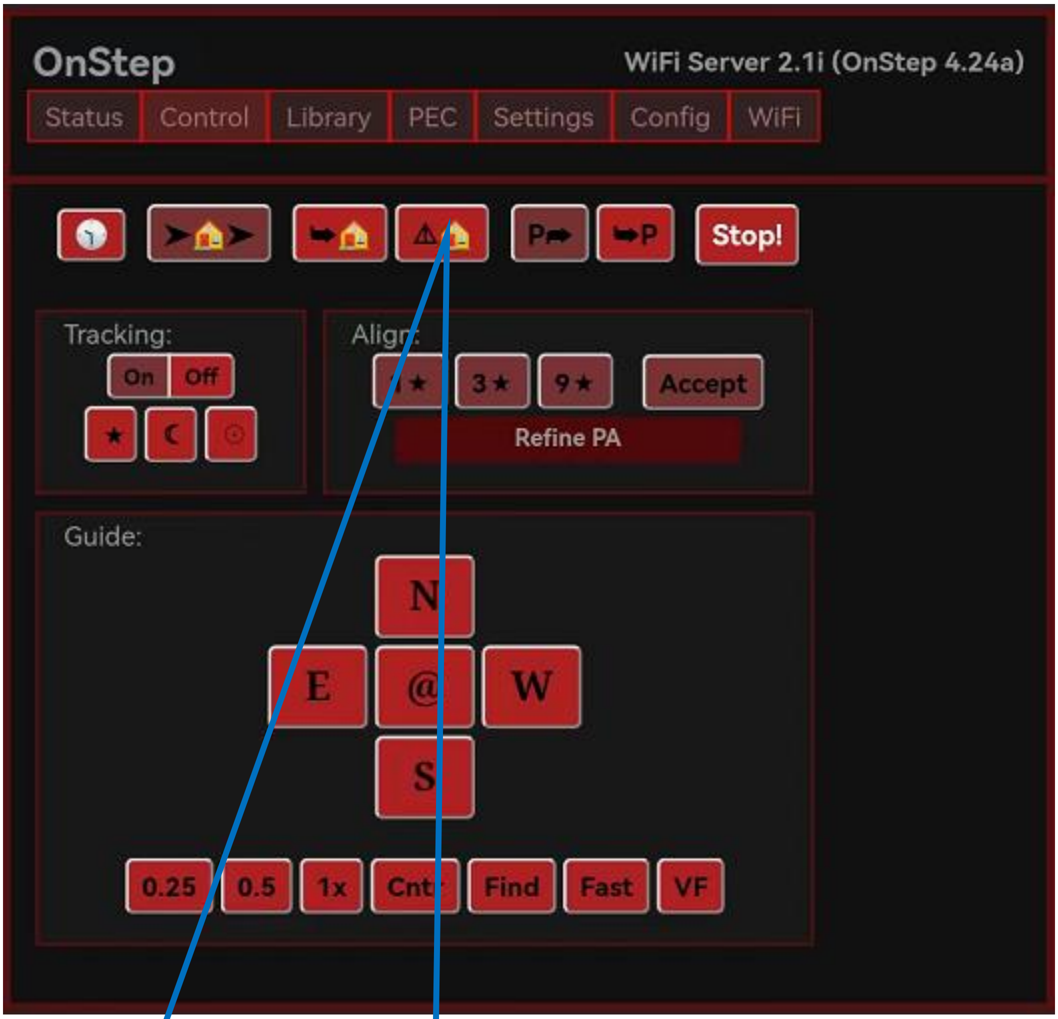
Turn on Tracking, and the rotation of the equatorial mount can be controlled by operating the direction keys.

⚠ Onstep system option, gray indicates ON status

Onstep Quick Start Guide

Onstep guide

⚠ **The physical zero position is different in the three modes of EM31 pro, so it needs to be set before using the equipment**


OnStep
WiFi Server 2.1i (OnStep 4.24a)
Status
Control
Library
PEC
Settings
Config
WiFi
P➡
➡P
Stop!
Tracking:
On
Off
Align:
1★
3★
9★
Accept
Refine PA
Guide:
N
E
@
W
S
0.25
0.5
1x
Cntr
Find
Fast
VF

After the tracking is enabled, manually control the Equatorial mount to rotate to the zero position, and click the "at home" key to remember the zero position of the mount.

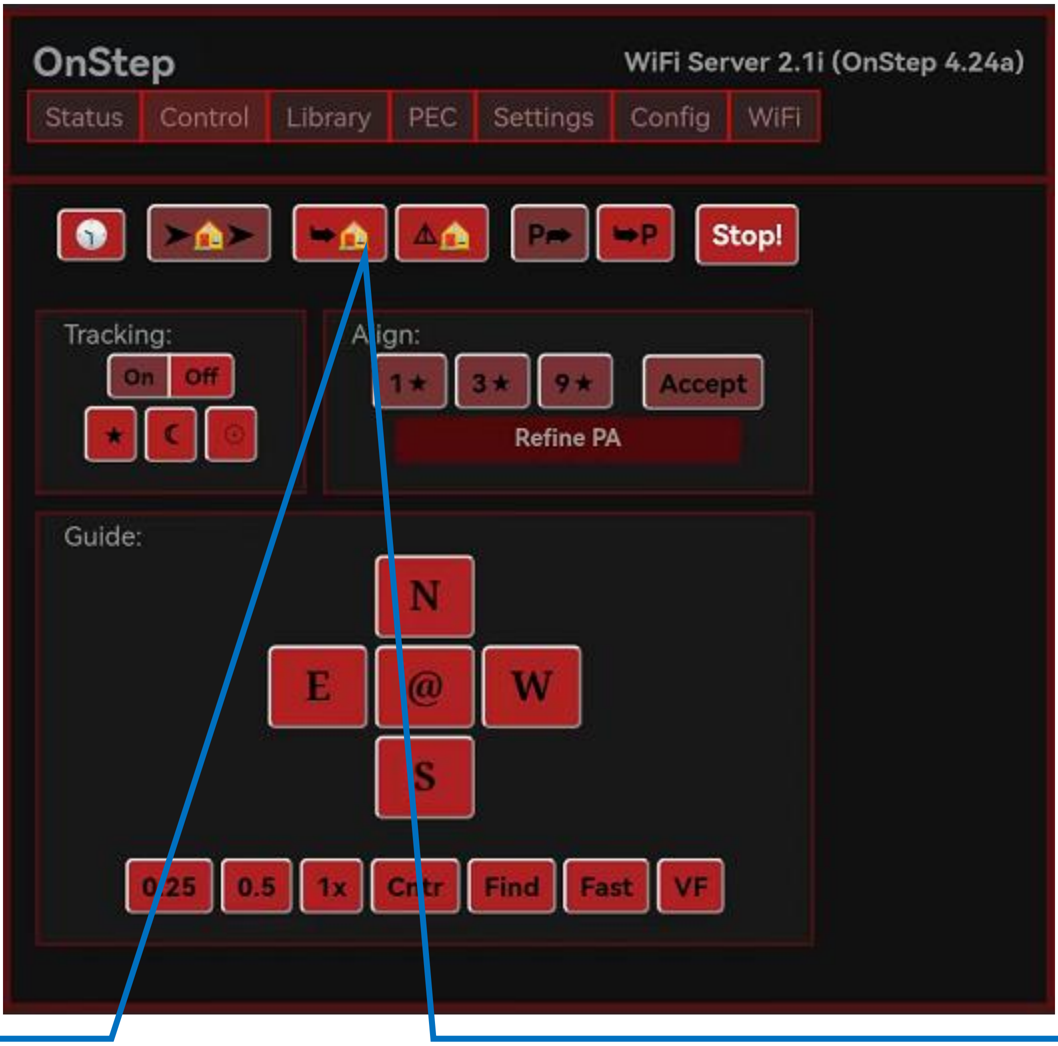
⚠

Note: After setting the zero position, the Equatorial mount returns to Untracking status, and you need to click Tracking On again to start tracking

Onstep Quick Start Guide

Onstep guide

The physical zero position is different in the three modes of EM31 pro, so it needs to be set before using the equipment


OnStep
WiFi Server 2.1i (OnStep 4.24a)
Status
Control
Library
PEC
Settings
Config
WiFi
P
P
Stop!
Tracking:
On
Off
Align:
1★
3★
9★
Accept
Refine PA
Guide:
N
E
@
W
S
0.25
0.5
1x
Cntr
Find
Fast
VF

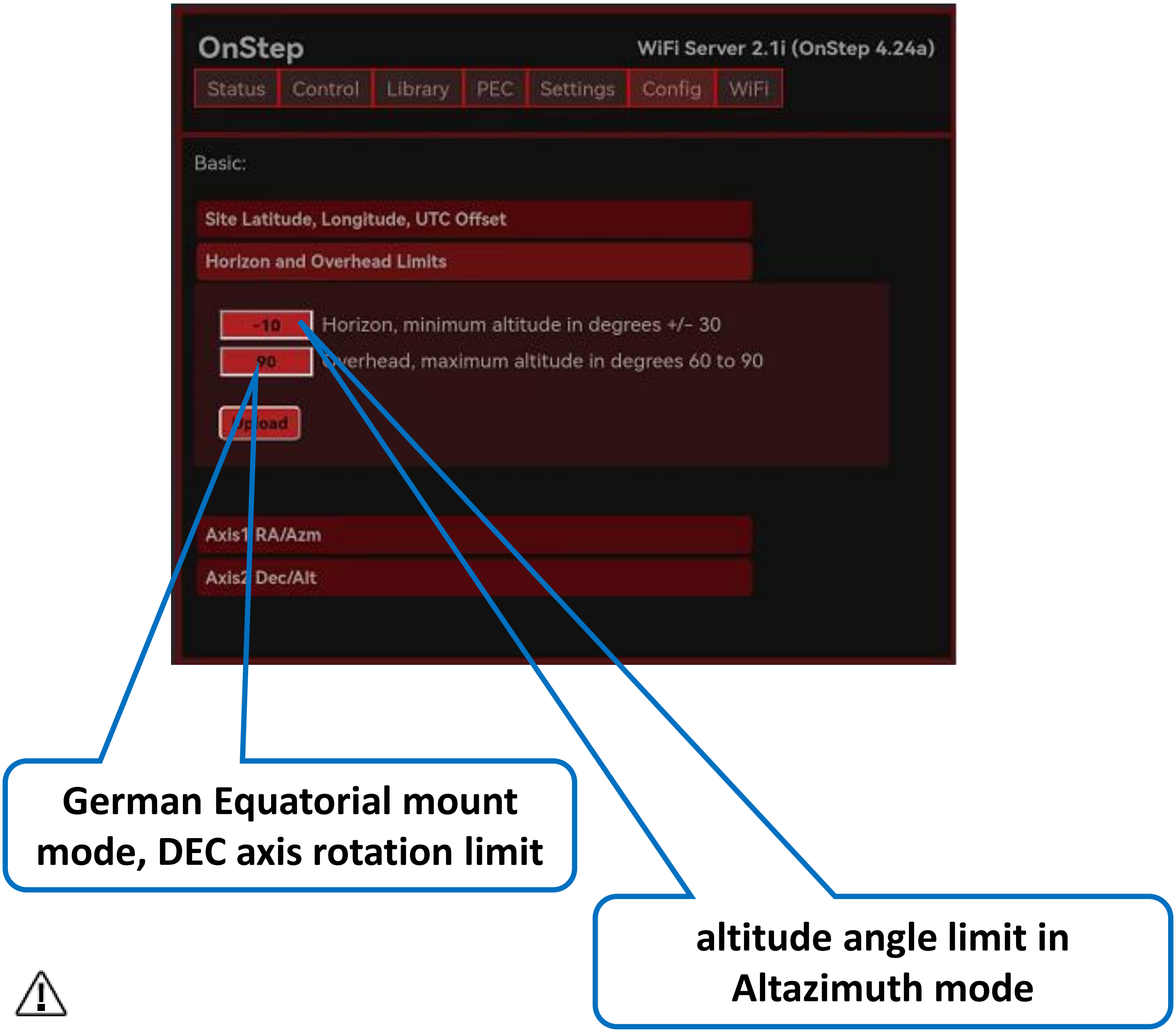
Click the "go home" button to make the mount return to the set zero position.

⚠ Note:, After powering off and powering on the mount again, the power-on-position will be zero by default. So it is necessary to reset the correct zero position. Alternatively, it is recommended to click the "go home" button to return the mount to the set zero position after each shooting is completed in order to avoid setting it again in the next use

Onstep Quick Start Guide

Onstep guide

Limit position setting



WiFi Server 2.1i (OnStep 4.24a)

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

Axis1 RA/Azm

Axis2 Dec/Alt

German Equatorial mount mode, DEC axis rotation limit

altitude angle limit in Altazimuth mode

⚠

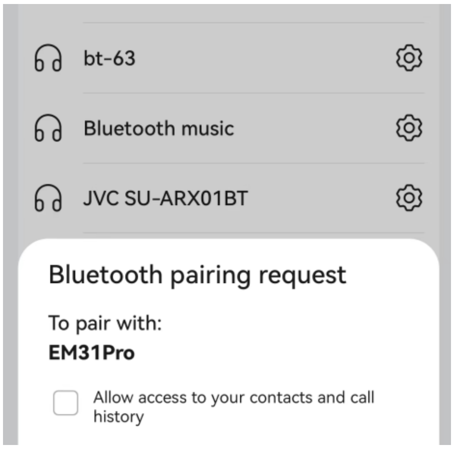
Note : When the manual operation of the mount rotation exceeds the set limit, the mount will stop rotating, press the key again, the mount will only move a small angle.
Once the Goto target exceeds the limit, Goto will stop.
The limit position is related to the time, latitude and longitude coordinates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

Onstep Quick Start Guide

Onstep guide

The above operation can be connected through the mobile phone APP (app only supports Android system, Apple system needs to be set through the webpage)

Matching Bluetooth

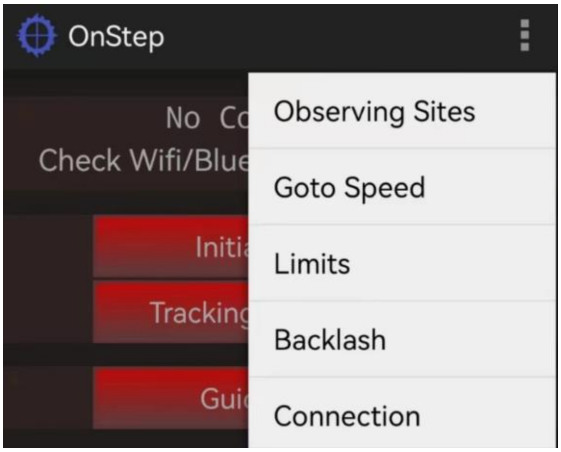

bt-63
Bluetooth music
JVC SU-ARX01BT

Bluetooth pairing request

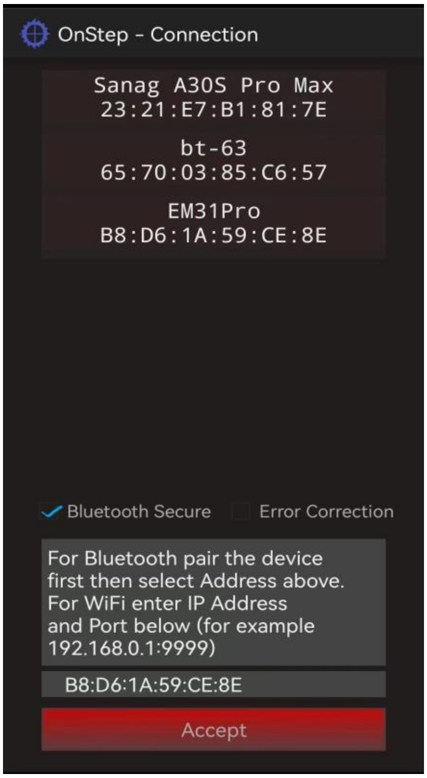
To pair with:
EM31Pro

☐ Allow access to your contacts and call history

Select Connection in the APP


OnStep
No Co
Check Wifi/Blue
Initi
Tracking
Gui
Observing Sites
Goto Speed
Limits
Backlash
Connection

Choose Bluetooth


OnStep - Connection
Accept

Sanag A30S Pro Max
23:21:E7:B1:81:7E

bt-63
65:70:03:85:C6:57

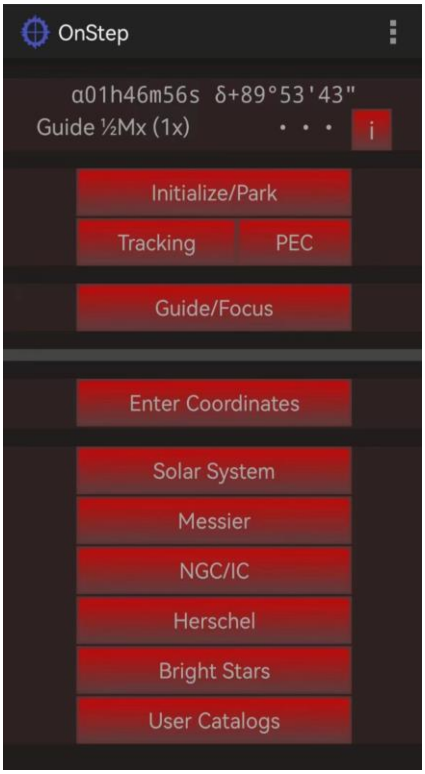
EM31Pro
B8:D6:1A:59:CE:8E

☑ Bluetooth Secure ☐ Error Correction

For Bluetooth pair the device first then select Address above. For WiFi enter IP Address and Port below (for example 192.168.0.1:9999)

B8:D6:1A:59:CE:8E

Complete connection

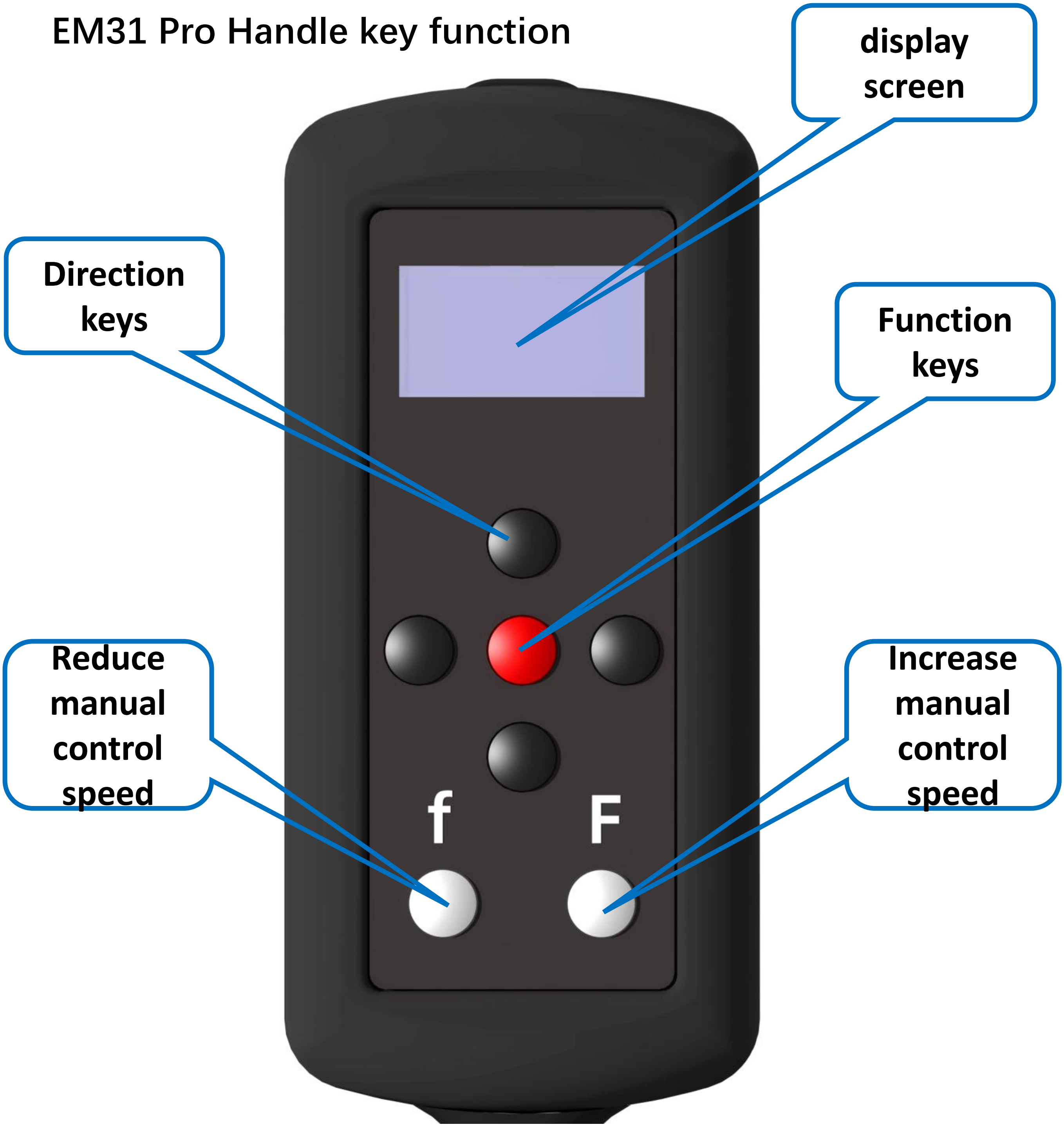

OnStep
i
Initialize/Park
Tracking
PEC
Guide/Focus
Enter Coordinates
Solar System
Messier
NGC/IC
Herschel
Bright Stars
User Catalogs

α01h46m56s δ+89°53'43"
Guide ½Mx (1x) • • •

Onstep Quick Start Guide

Onstep guide

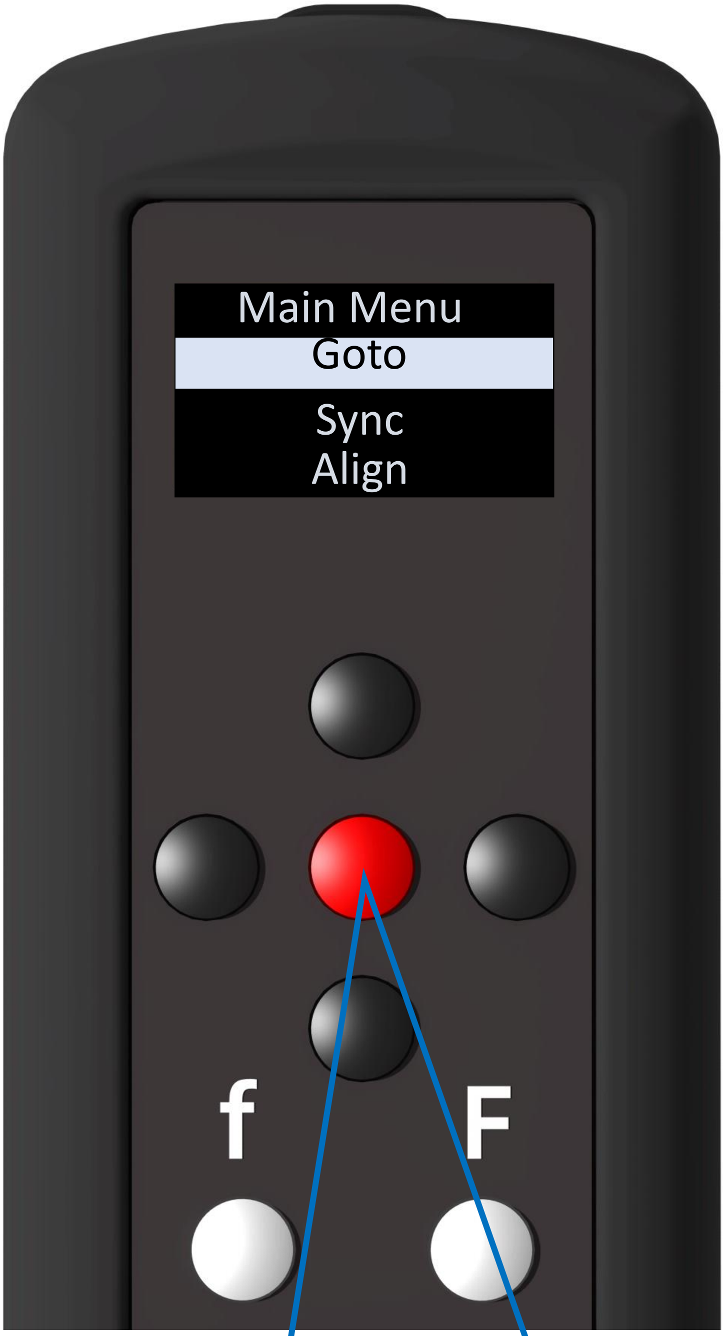
EM31 Pro Handle key function


display screen
Direction keys
Function keys
Reduce manual control speed
Increase manual control speed
f
F

Onstep Quick Start Guide

Onstep guide

EM31 Pro Handle key function

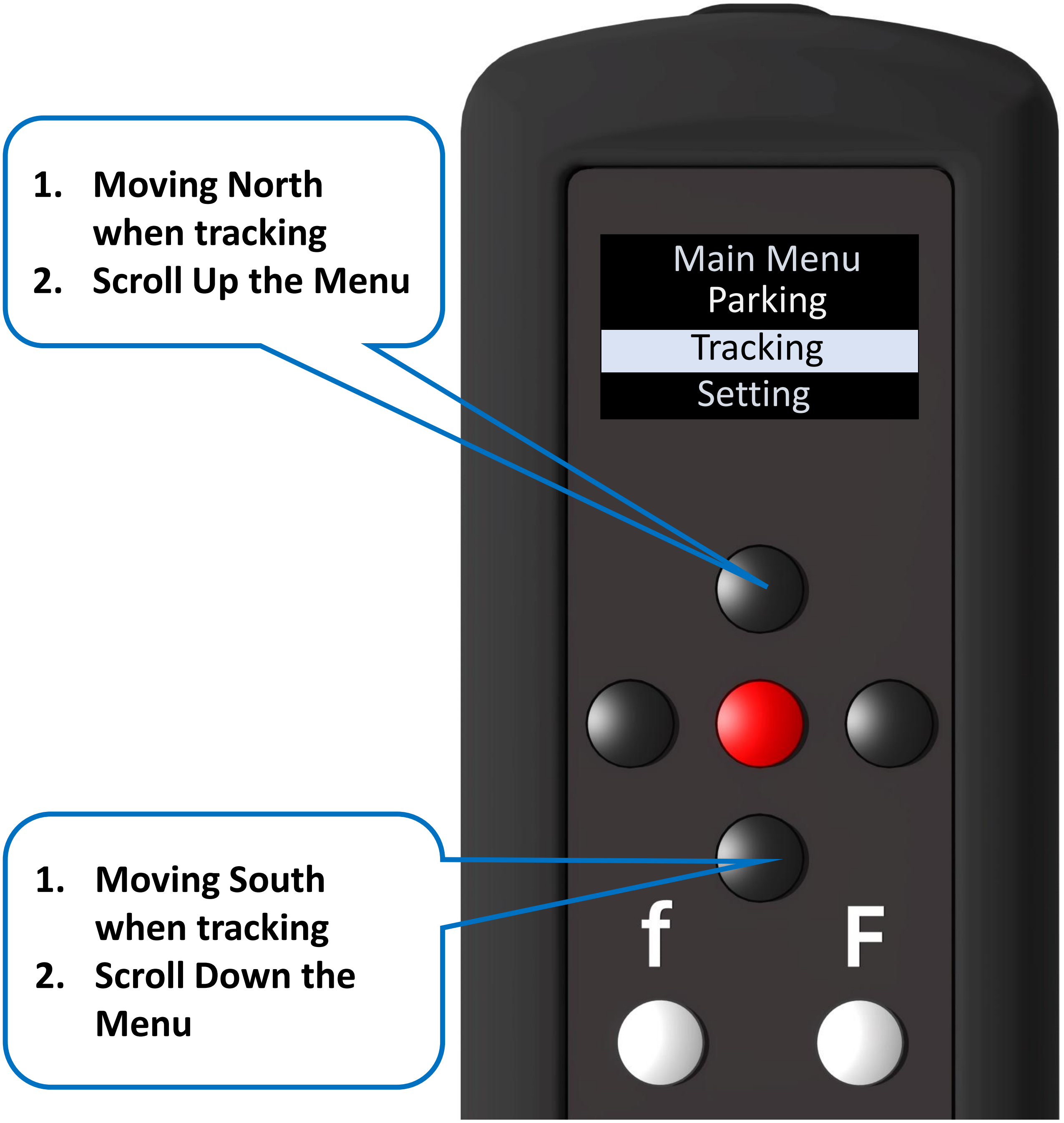

Main Menu
Goto
Sync
Align
f
F

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 Handle key function


Main Menu
Parking
Tracking
Setting
f
F

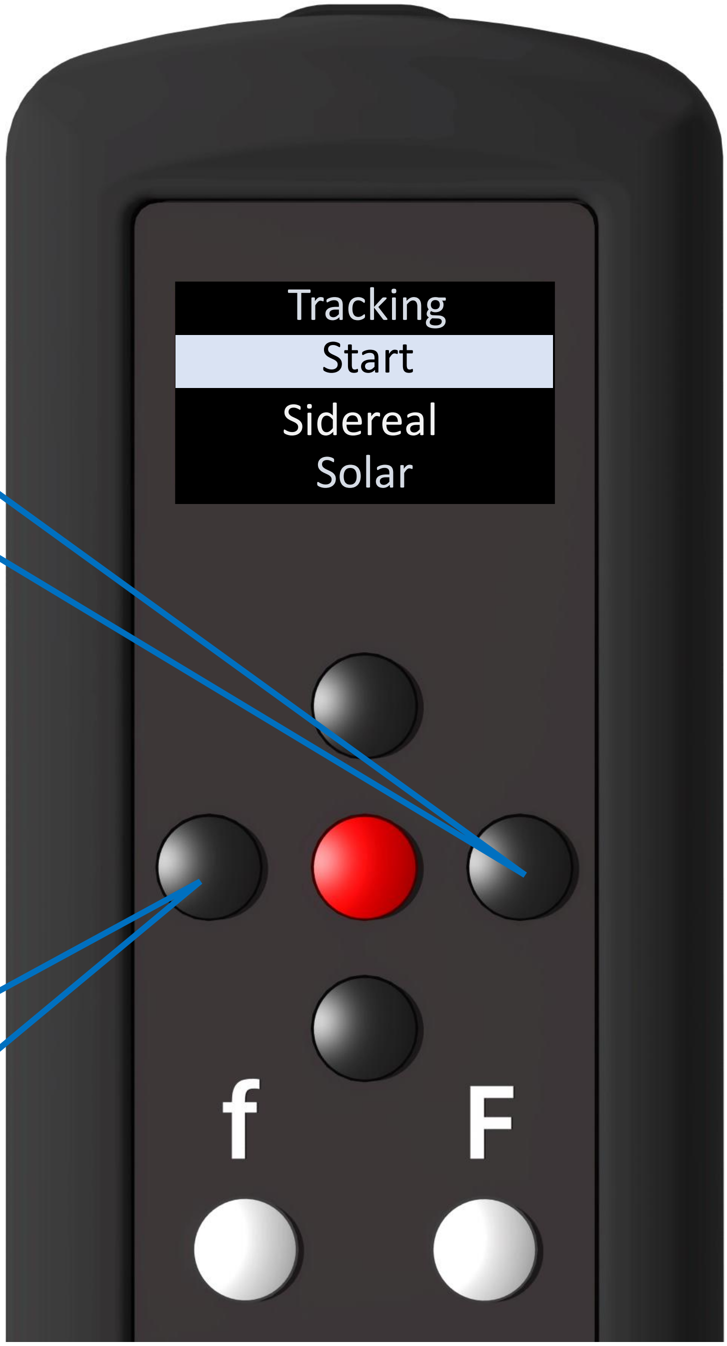
1. Moving North when tracking
2. Scroll Up the Menu

1. Moving South when tracking
2. Scroll Down the Menu

Onstep Quick Start Guide

Onstep guide

EM31 Pro Handle key function


Tracking
Start
Sidereal
Solar
f
F

1. **Moving west when tracking**
2. **Select current option while in Menu's**

1. **Moving east when tracking**
2. **Back while in Menu's**

Onstep Quick Start Guide

Onstep guide

Common status icons for the handle controller

1↖	Alignment Star #1
2↖	Alignment Star #2 (#3 thru #8 not shown)
9↖	Alignment Star #9 (last possible)
H	Telescope is at home position. Tracking is OFF
Err ?!	Unknown error. Tracking has stopped
Err Me!	Telescope position exceeds user defined Meridian limit. Tracking has stopped
Err Up!	Telescope position exceeds user defined RA limits "Under Pole". Tracking has stopped
Err Az!	Telescope position exceeds user defined Azimuth limits. Tracking has stopped
Err De!	Telescope position exceeds user defined Declination limit. Tracking has stopped
Err →|!	Telescope limit sensed. Tracking has stopped
Err ↖↘!	Telescope position exceeds user defined Horizon or Overhead limit. Tracking has stopped
Err Mf!	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
·P·	PEC, paused

Onstep guide

Common status icons for the handle 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

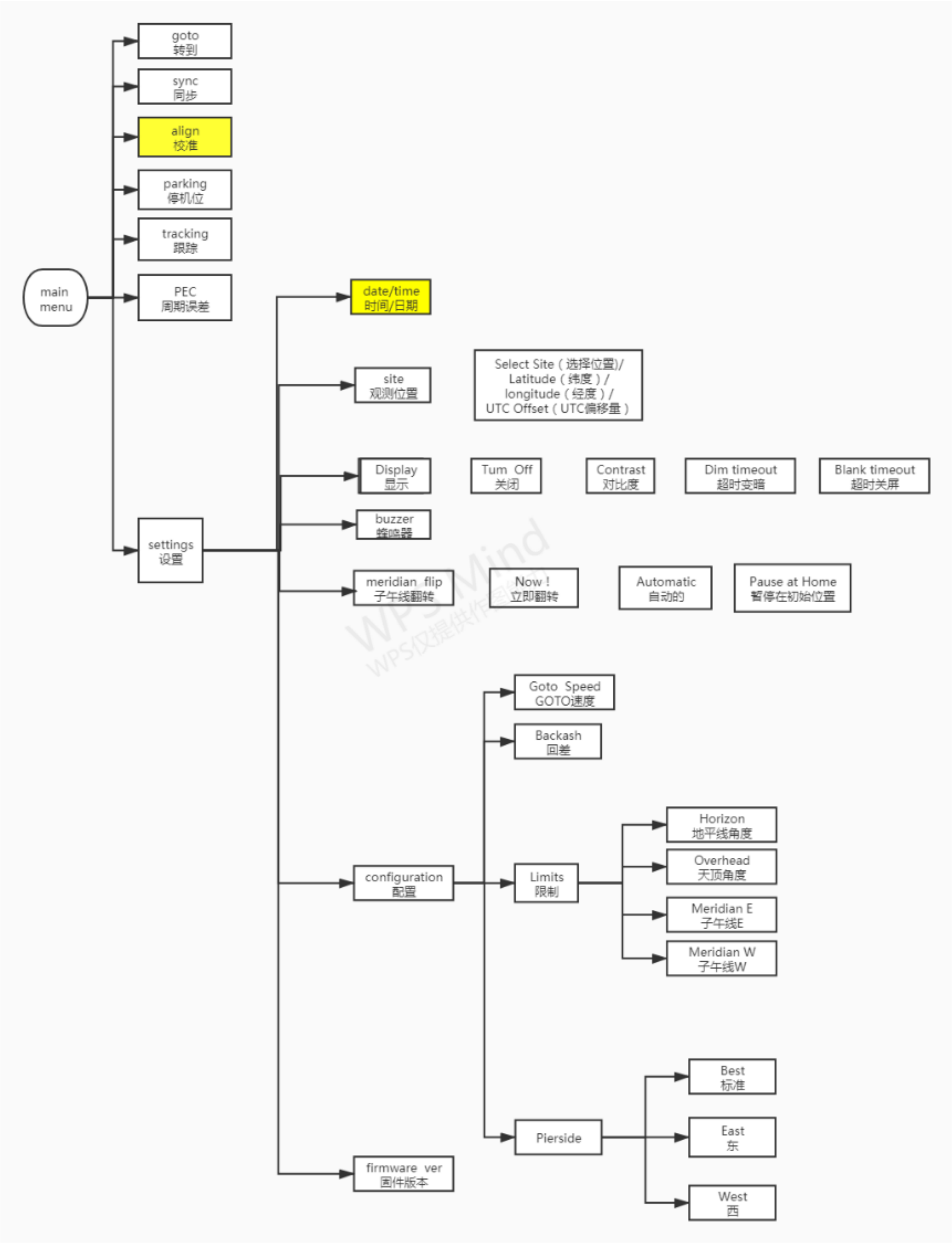
Telescope is slewing to park position

Telescope is parked

Onstep Quick Start Guide

Onstep guide

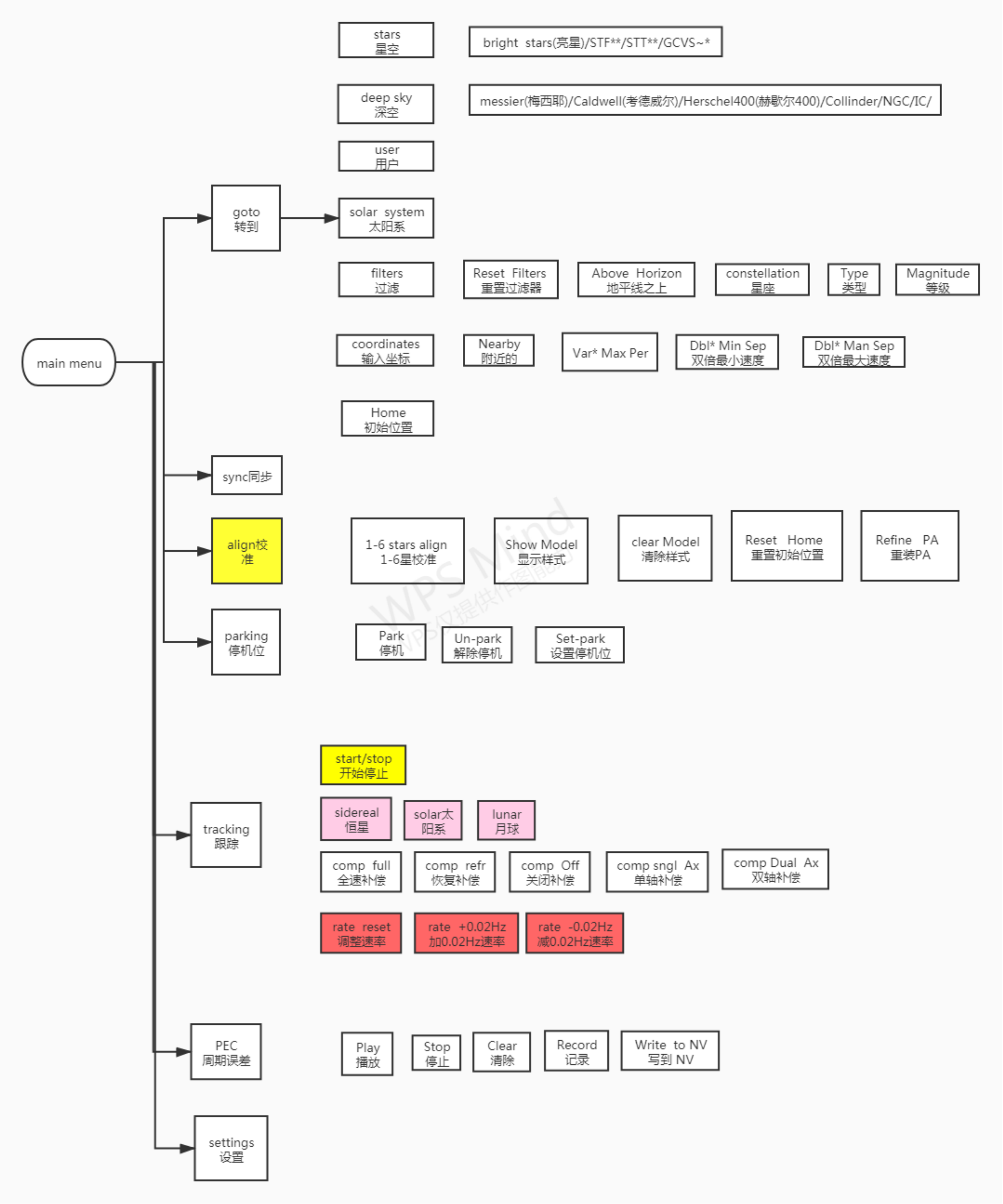
Handle menu structure diagram


main menu
goto 转到
sync 同步
align 校准
parking 停机位
tracking 跟踪
PEC 周期误差
settings 设置
date/time 时间/日期
site 观测位置
Select Site (选择位置)/ Latitude (纬度) / longitude (经度) / UTC Offset (UTC偏移量)
Display 显示
Tum Off 关闭
Contrast 对比度
Dim timeout 超时变暗
Blank timeout 超时关屏
buzzer 蜂鸣器
meridian flip 子午线翻转
Now ! 立即翻转
Automatic 自动的
Pause at Home 暂停在初始位置
configuration 配置
Goto Speed GOTO速度
Backash 回差
Limits 限制
Horizon 地平线角度
Overhead 天顶角度
Meridian E 子午线E
Meridian W 子午线W
Pierside
Best 标准
East 东
West 西
firmware ver 固件版本

Onstep Quick Start Guide

Onstep guide

Handle menu structure diagram

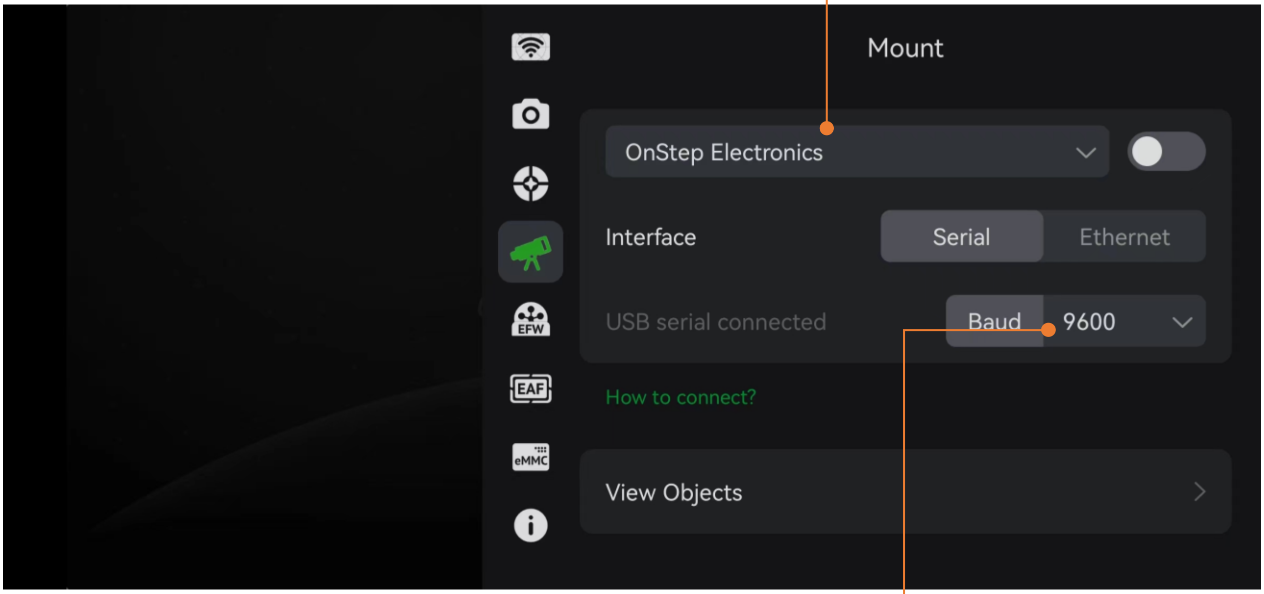

stars
星空
bright stars(亮星)/STF**/STT**/GCVS~*
deep sky
深空
messier(梅西耶)/Caldwell(考德威尔)/Herschel400(赫歇尔400)/Collinder/NGC/IC/
user
用户
goto
转到
solar system
太阳系
filters
过滤
Reset Filters
重置过滤器
Above Horizon
地平线之上
constellation
星座
Type
类型
Magnitude
等级
main menu
coordinates
输入坐标
Nearby
附近的
Var* Max Per
Dbl* Min Sep
双倍最小速度
Dbl* Man Sep
双倍最大速度
Home
初始位置
sync同步
align校准
1-6 stars align
1-6星校准
Show Model
显示样式
clear Model
清除样式
Reset Home
重置初始位置
Refine PA
重装PA
parking
停机位
Park
停机
Un-park
解除停机
Set-park
设置停机位
start/stop
开始停止
tracking
跟踪
sidereal
恒星
solar太阳系
lunar
月球
comp full
全速补偿
comp refr
恢复补偿
comp Off
关闭补偿
comp sngl Ax
单轴补偿
comp Dual Ax
双轴补偿
rate reset
调整速率
rate +0.02Hz
加0.02Hz速率
rate -0.02Hz
减0.02Hz速率
PEC
周期误差
Play
播放
Stop
停止
Clear
清除
Record
记录
Write to NV
写到 NV
settings
设置

Onstep Quick Start Guide

Onstep guide

Onstep and ASIAIR connection

Equatorial mount selects “OnStep Electronics”



Mount

OnStep Electronics

Interface: Serial

USB serial connected

Baud: 9600

Ethernet
How to connect?
View Objects
EFW
EAF
eMMC

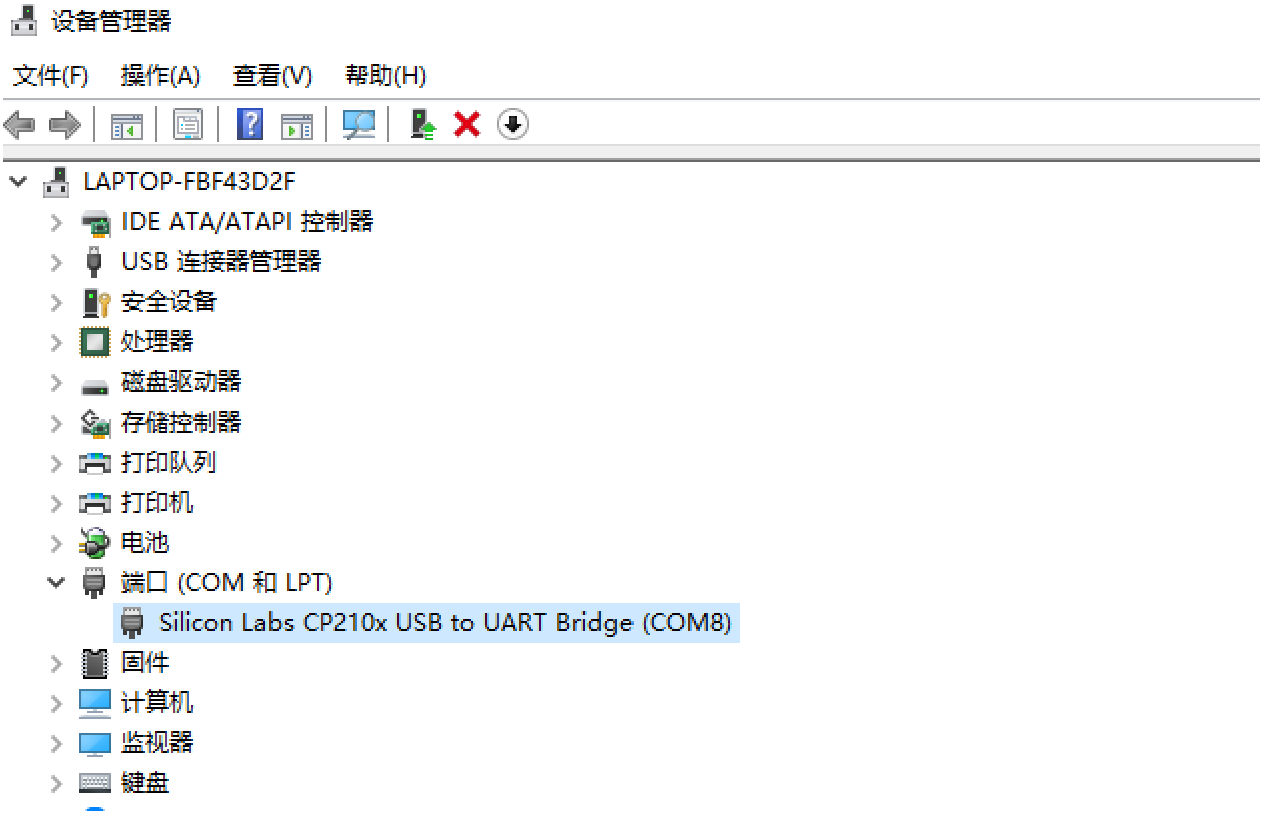
Serial port baud rate 9600

Onstep Quick Start Guide

Onstep guide

Onstep and PC connection

Installing the mount serial port driver cp2102，
Confirm that the mount serial port connection is normal in Windows Device Manager



- LAPTOP-FBF43D2F
  - IDE ATA/ATAPI 控制器
  - USB 连接器管理器
  - 安全设备
  - 处理器
  - 磁盘驱动器
  - 存储控制器
  - 打印队列
  - 打印机
  - 电池
  - 端口 (COM 和 LPT)
    - Silicon Labs CP210x USB to UART Bridge (COM8)
  - 固件
  - 计算机
  - 监视器
  - 键盘

Install ASCOM platform

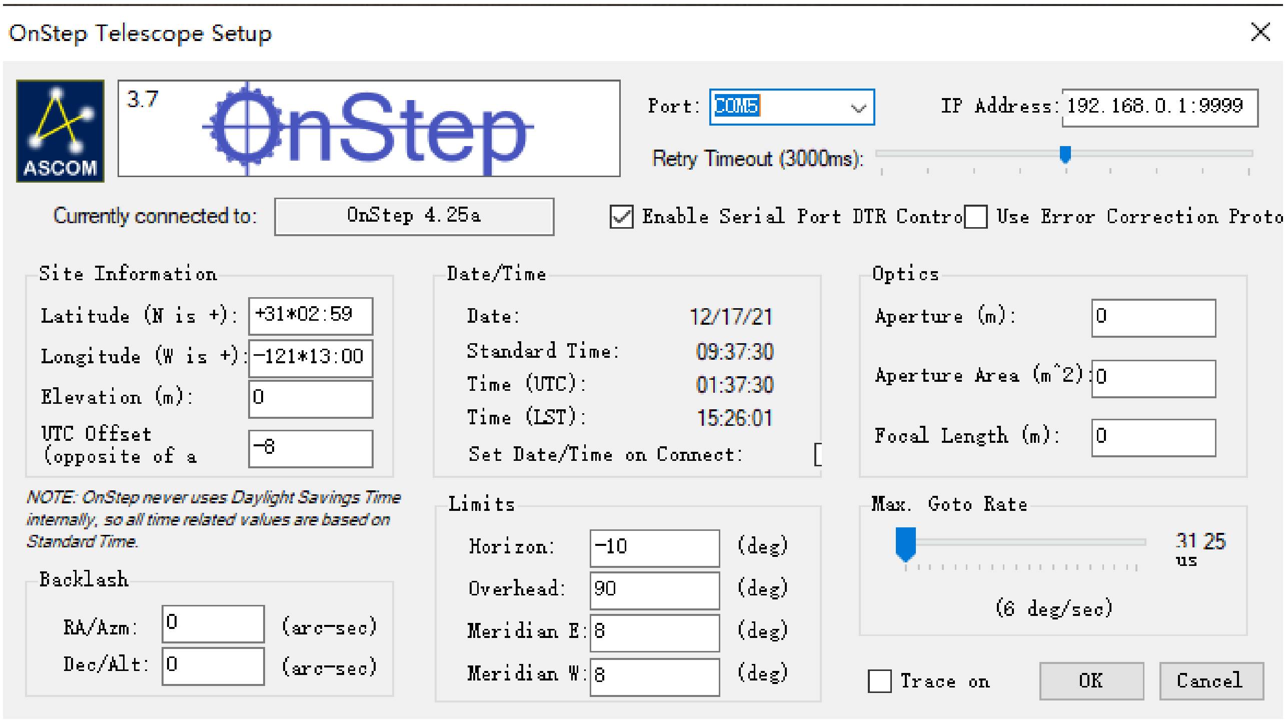
Install Onstep ASCOM driver

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 Contro ☐ Use Error Correction Proto

Site Information

Latitude (N is +): +31*02:59

Longitude (W is +): -121*13:00

Elevation (m): 0

UTC Offset (opposite of a: -8

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: 12/17/21

Standard Time: 09:37:30

Time (UTC): 01:37:30

Time (LST): 15:26:01

Set Date/Time on Connect: ☐

Limits

Horizon: -10 (deg)

Overhead: 90 (deg)

Meridian E: 8 (deg)

Meridian W: 8 (deg)

Optics

Aperture (m): 0

Aperture Area (m^2): 0

Focal Length (m): 0

Max. Goto Rate

31 25 us

(6 deg/sec)

☐ Trace on

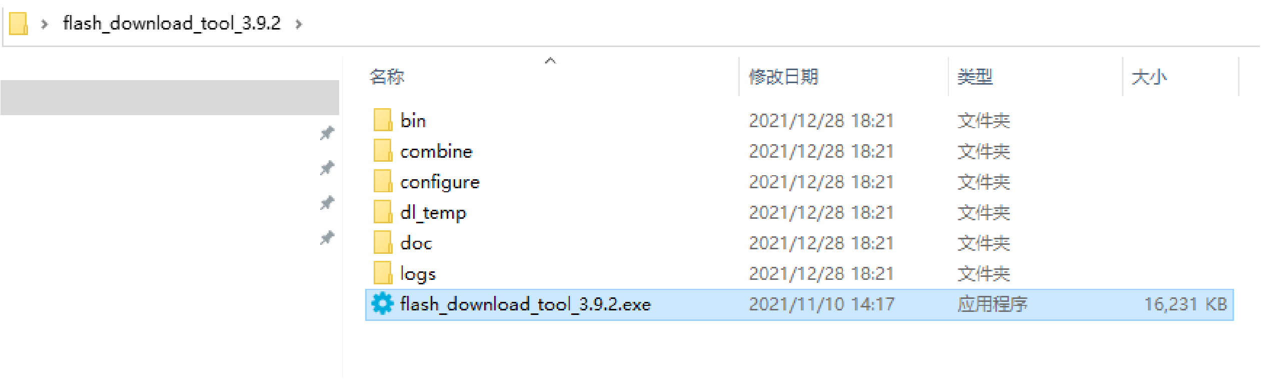
Firmware Update

Firmware update

Connect the 12v power supply for the equatorial mount and power on

Use the USB cable to connect the equatorial mount and PC (test is windows 10 system)

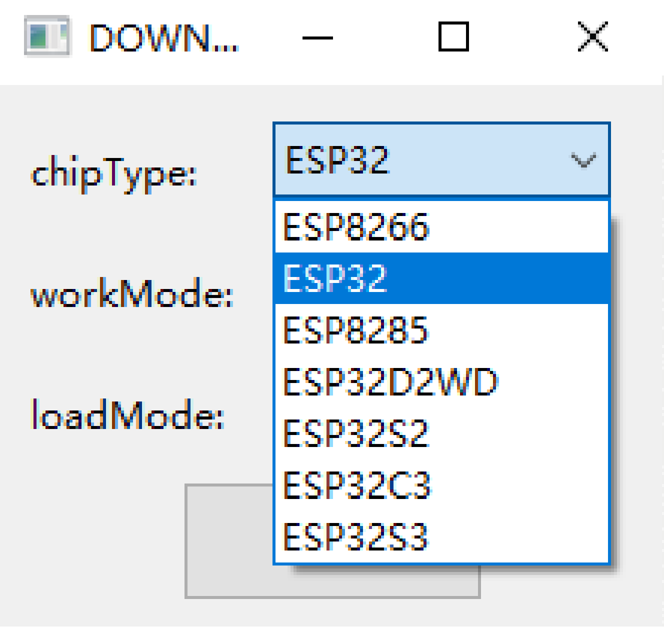
Open the firmware programming software



› flash_download_tool_3.9.2 ›

名称	修改日期	类型	大小
bin	2021/12/28 18:21	文件夹	
combine	2021/12/28 18:21	文件夹	
configure	2021/12/28 18:21	文件夹	
dl_temp	2021/12/28 18:21	文件夹	
doc	2021/12/28 18:21	文件夹	
logs	2021/12/28 18:21	文件夹	
flash_download_tool_3.9.2.exe	2021/11/10 14:17	应用程序	16,231 KB

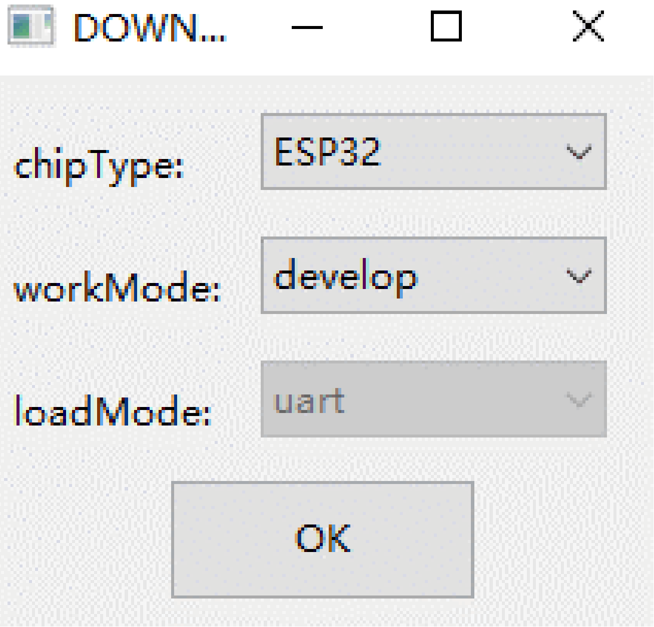
Select ESP2 and develop and confirm



DOWN...

chipType: ESP32

ESP8266
ESP32
ESP8285
ESP32D2WD
ESP32S2
ESP32C3
ESP32S3
workMode:
loadMode:



DOWN...

chipType: ESP32

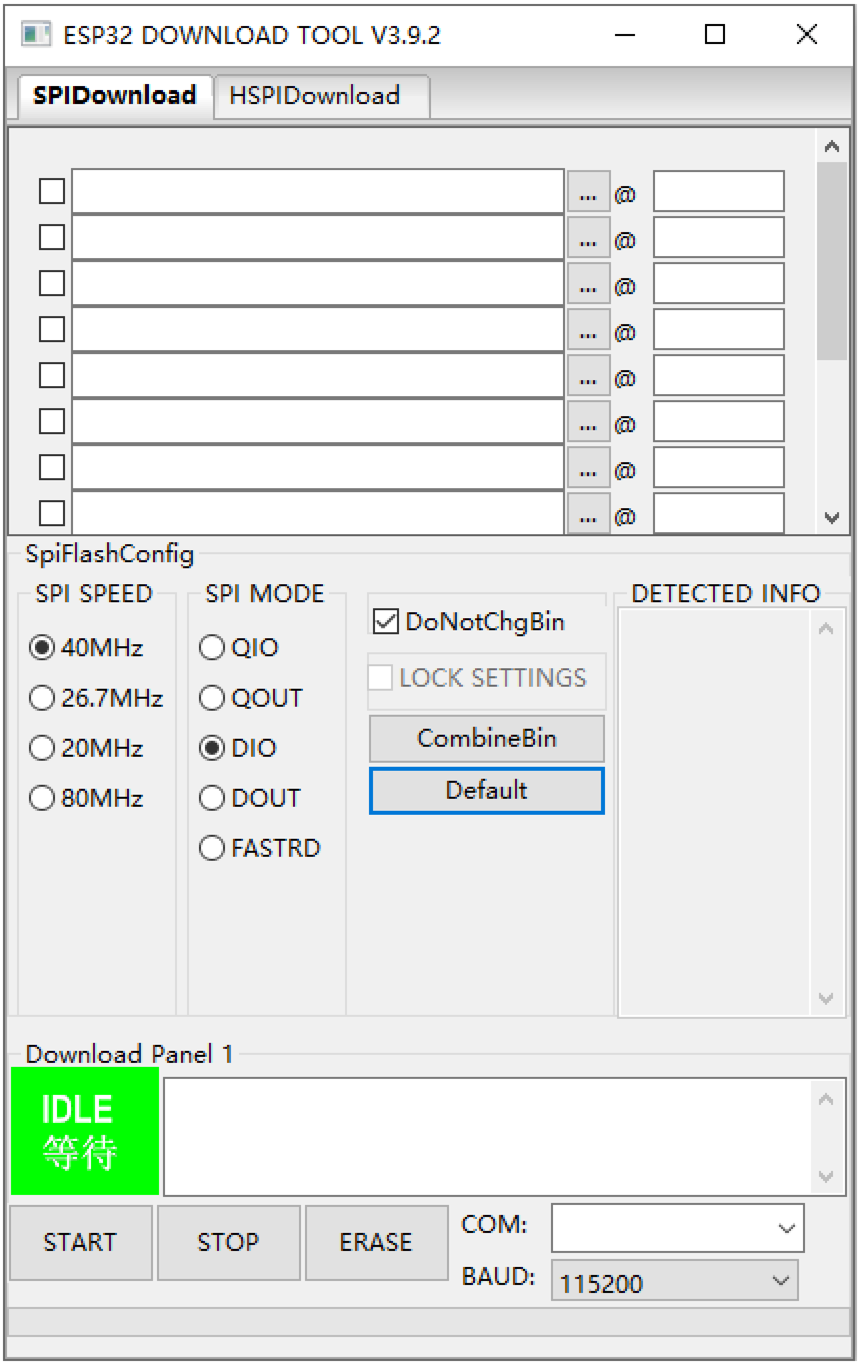
workMode: develop

loadMode: uart

Firmware Update

Firmware update

Upload interface


ESP32 DOWNLOAD TOOL V3.9.2
SPIDownload
HSPIDownload
SpiFlashConfig
SPI SPEED
SPI MODE
DETECTED INFO
LOCK SETTINGS
CombineBin
Default
Download Panel 1
IDLE
等待
START
STOP
ERASE
COM:

SPI SPEED: ● 40MHz ○ 26.7MHz ○ 20MHz ○ 80MHz

SPI MODE: ○ QIO ○ QOUT ● DIO ○ DOUT ○ FASTRD

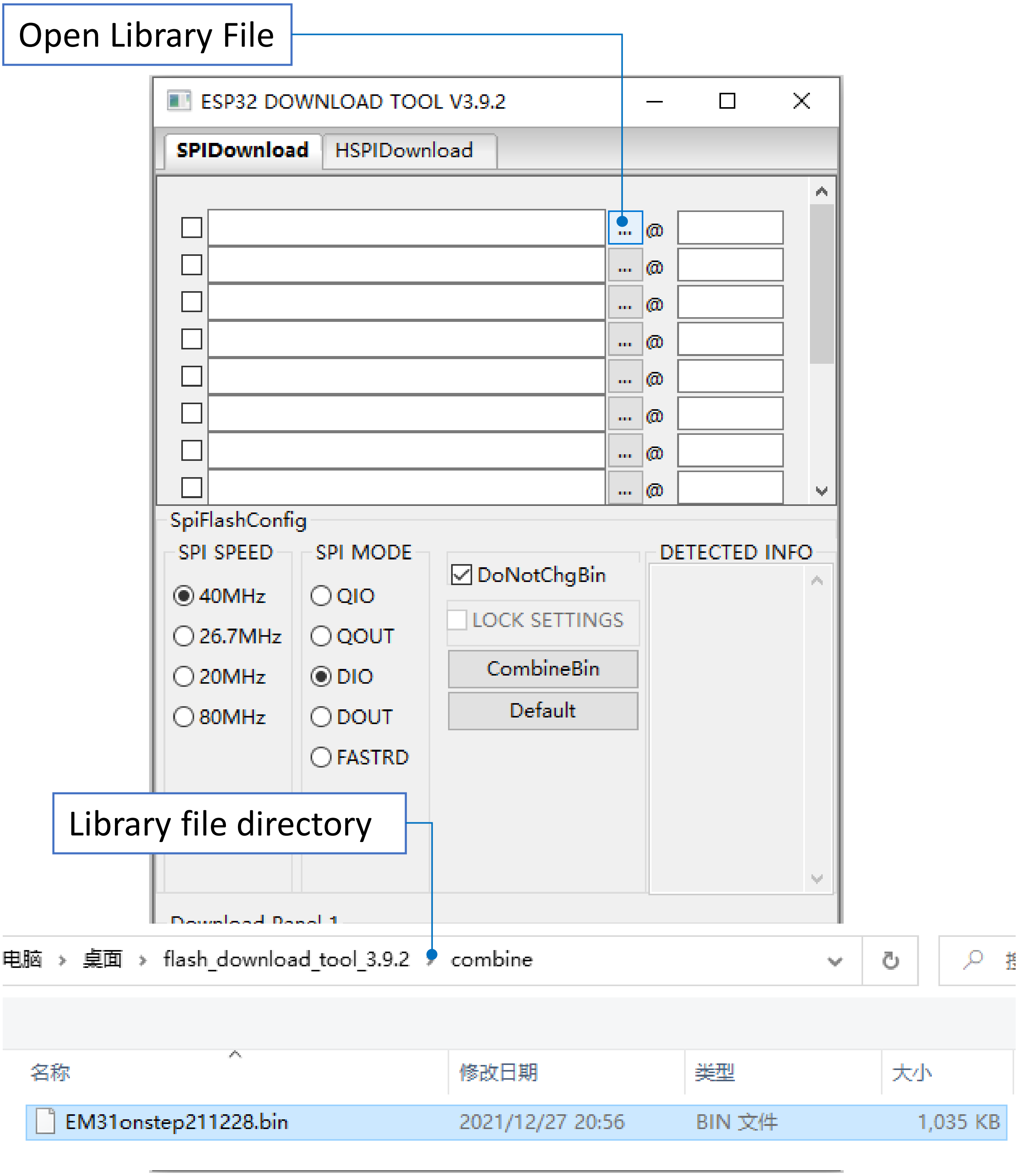
☑ DoNotChgBin

☐ LOCK SETTINGS

BAUD: 115200

Firmware Update

Firmware update



Open Library File

ESP32 DOWNLOAD TOOL V3.9.2

SPIDownload
HSPIDownload
...
@
SpiFlashConfig
CombineBin
Default
DETECTED INFO
Download Panel 1

SPI SPEED: ● 40MHz ○ 26.7MHz ○ 20MHz ○ 80MHz

SPI MODE: ○ QIO ○ QOUT ● DIO ○ DOUT ○ FASTRD

☑ DoNotChgBin

☐ LOCK SETTINGS

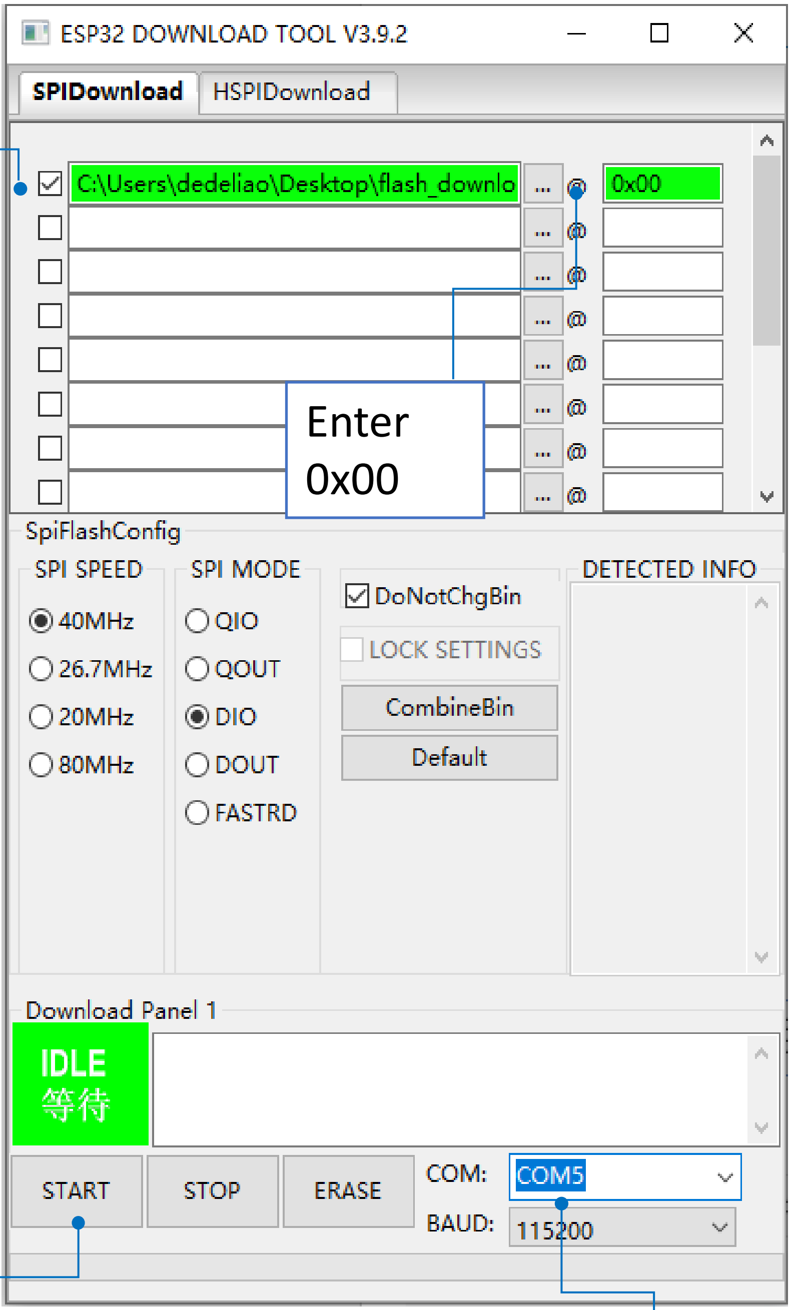
Library file directory

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


ESP32 DOWNLOAD TOOL V3.9.2
SPIDownload
HSPIDownload
...
@
SpiFlashConfig
SPI SPEED
SPI MODE
DETECTED INFO
CombineBin
Default
Download Panel 1
START
STOP
ERASE

☑ C:\Users\dedeliao\Desktop\flash_downlo @ 0x00

SPI SPEED: ● 40MHz ○ 26.7MHz ○ 20MHz ○ 80MHz

SPI MODE: ○ QIO ○ QOUT ● DIO ○ DOUT ○ FASTRD

☑ DoNotChgBin

☐ LOCK SETTINGS

IDLE
等待

COM: COM5

BAUD: 115200

Tick

Enter
0x00

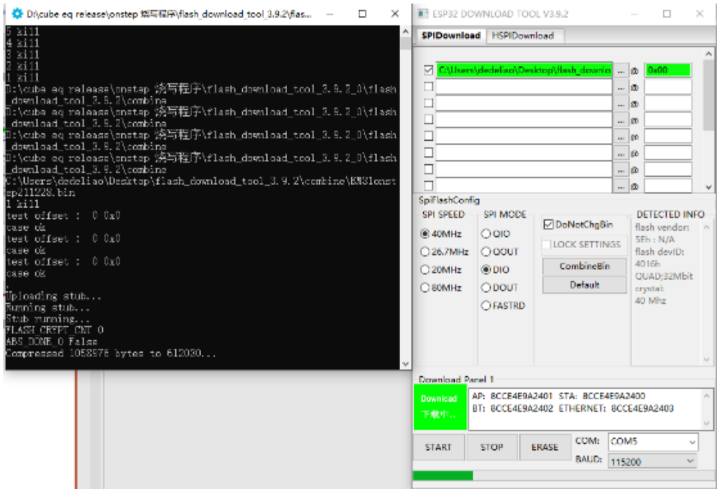
Click START to start uploading after the interface is set up

Select serial port

Firmware Update

Firmware update

Start the upload process



D:\cube eq release\onstep 烧写程序\flash_download_tool_3.9.2\flas...

```
5 kill
4 kill
3 kill
2 kill
1 kill
D:\cube eq release\onstep 烧写程序\flash_download_tool_3.9.2_0\flash
_download_tool_3.9.2\combine
D:\cube eq release\onstep 烧写程序\flash_download_tool_3.9.2_0\flash
_download_tool_3.9.2\combine
D:\cube eq release\onstep 烧写程序\flash_download_tool_3.9.2_0\flash
_download_tool_3.9.2\combine
D:\cube eq release\onstep 烧写程序\flash_download_tool_3.9.2_0\flash
_download_tool_3.9.2\combine
C:\Users\dedeliao\Desktop\flash_download_tool_3.9.2\combine\EMSlonst
ep211228.bin
1 kill
test offset :  0 0x0
case ok
test offset :  0 0x0
case ok
test offset :  0 0x0
case ok

Uploading stub...
Running stub...
Stub running...
FLASH_CRYPT_CNT 0
ABS_DONE_0 False
Compressed 1058976 bytes to 612030...
```

ESP32 DOWNLOAD TOOL V3.9.2

SPIDownload | HSPIDownload

☑ C:\Users\dedeliao\Desktop\flash_downlo... @ 0x00

SpiFlashConfig

SPI SPEED: ● 40MHz ○ 26.7MHz ○ 20MHz ○ 80MHz

SPI MODE: ○ QIO ○ QOUT ● DIO ○ DOUT ○ FASTRD

☑ DoNotChgBin

☐ LOCK SETTINGS

DETECTED INFO
flash vendor:
5Eh : N/A
flash devID:
4016h
QUAD;32Mbit
crystal:
40 Mhz

Download Panel 1

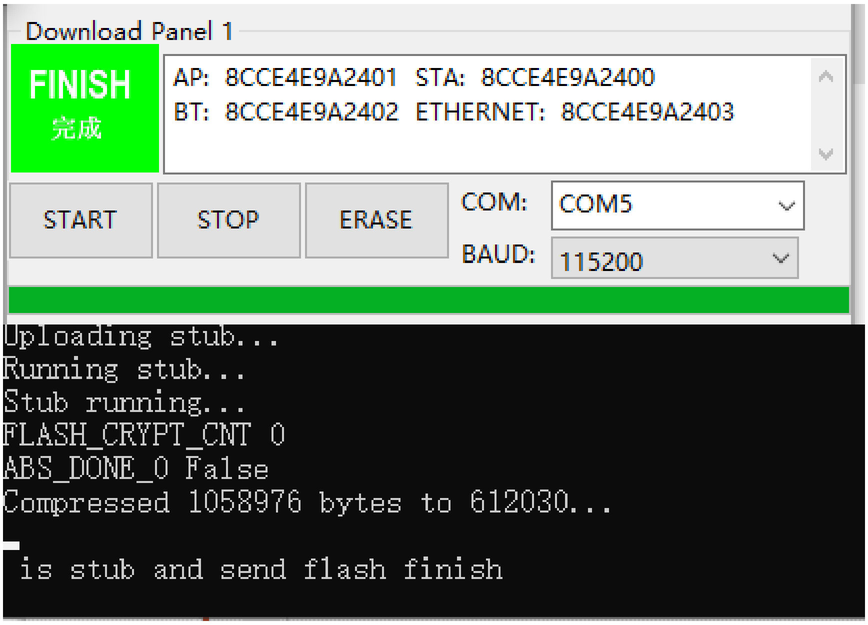
Download 下载中...

AP: 8CCE4E9A2401 STA: 8CCE4E9A2400
BT: 8CCE4E9A2402 ETHERNET: 8CCE4E9A2403

COM: COM5

BAUD: 115200

The upload program is complete, and the status bar on the left shows “is stub and send flash finish”



Download Panel 1

FINISH 完成

AP: 8CCE4E9A2401 STA: 8CCE4E9A2400
BT: 8CCE4E9A2402 ETHERNET: 8CCE4E9A2403

COM: COM5

BAUD: 115200

```
Uploading stub...
Running stub...
Stub running...
FLASH_CRYPT_CNT 0
ABS_DONE_0 False
Compressed 1058976 bytes to 612030...

 is stub and send flash finish
```

After the firmware update is completed, disconnect all power connections (including the 12V power supply and USB cable) to disconnect the equatorial mount, and then turn on the power after 6s, the equatorial mount will enter into normal working status.

Warranty Statement

Warranty

Thank you for purchasing the EM31Pro Harmonic Equatorial Mount. To ensure you have the best experience with our product, we provide a two-year warranty service for the EM31Pro Harmonic Equatorial Mount. 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

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: emcan.em31@gmail.com

Thank you for your understanding and support