ATLAS SH20 Manual V18

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1 Safety Information

1.1 Safety Symbols and Signal Words

This manual uses the following signal words to indicate hazardous situations:

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury, or equipment damage.

NOTICE

Indicates important information that helps prevent product malfunction, data loss, or reduced performance.

WARNING	Personal injury/ severe damage risk
CAUTION	Minor injury/ equipment damage risk
NOTICE	Operational/ performance risk

Table 1 Safety Signal Words

1.2 General Safety

- Read this chapter before assembling or powering on the mount.
- Keep children and pets away during setup and operation.
- Do not use the mount for solar observation unless a proper solar filter is securely installed on the front aperture of the optical tube assembly (OTA). Permanent eye damage may occur.

1.3 Electrical Safety (Power, Cables, Moisture)

WARNING— Electrical shock and fire hazard

Use only a regulated DC power supply that meets the mount's specified input voltage and current requirements.

- Do not operate the mount with damaged cables or connectors.
- Do not connect or disconnect power with wet hands.
- Do not expose the mount to rain, standing water, or condensation.

CAUTION — Power stability

Insufficient power delivery (voltage drop due to thin cables or long cable runs) may cause unexpected resets, communication loss, or tracking/slewing failure.

- Use short≤ 2.5m), adequate-gauge power cables to minimize voltage drop.
- If using batteries, ensure stable output under peak load (fast slewing/ GOTO).

NOTICE—Polarity and adapters

Verify connector polarity and pinout before powering on. Using incorrect adapters may damage the mount and is not covered by warranty.

NOTICE—Power protection

The mount includes protection features against common power faults (e.g., overcurrent protection). Protection is not a substitute for using a compliant power supply and correct cabling.

1.4 Operational Safety (Home, Park, EQ/AZ Switching, Limits)

WARNING— Unexpected motion

The mount does not move on its own after power-on. Movement occurs only when commanded. Some control software may issue automatic commands (e.g., resume tracking, unpark, or slew) immediately after connection depending on its configuration. Always keep clear of moving parts

Home and Park

- Use Home as the reference position for safe initialization and consistent operation.
- Use Park before powering off, transporting, or changing major payload configurations.

EQ/AZ Mode Switching

- Switch modes only with Tracking OFF, the mount at Home or Park, and the OTA/payload and counterweight removed.
- After switching, confirm the current mode in the controller/app before issuing GOTO commands.
- Mode switching will change axis behavior, tracking logic, and limits.

Limits and Safety Stops

- Configure software limits (if supported) to prevent collision with tripod legs or camera/OTA interference.
- If a safety stop occurs, clear the cause (collision risk, cable snag, limit reached) before resuming operation.

1.5 Environment, Transport, and Storage

- Keep the operating temperature within the specified range and prevent condensation.
- Allow the mount to reach ambient temperature before precision operation.
- During transport, remove the OTA and counterweight. Secure the mount head to prevent shock and vibration.
- Store in a dry place. Use desiccant if stored long-term.

1.6 Disclaimer and Third-Party Software

This mount may be controlled by third-party software (ASCOM/INDI clients such as NINA, SharpCap, MaxIm DL, KStars, etc.). The user is responsible for ensuring correct configuration, safe cable routing, and collision avoidance when using third-party applications.

2 What's in the Box

2.1 Package Contents

Verify that all items listed below are included in the package:

Equatorial mount head	×1
USB cable, 1.5 m (Type-C to Type-A)	×1
Hand controller	×1
Hand controller cable	×1
Hex key (Allen wrench), 5 mm	×2
Periodic Error (PE) test report	×1
Quick Start Guide	×1
Rugged carrying case	×1



Figure 2-1 Package contents layout.

2.2 Item Description (Quick Reference)

- **Mount head**: The main mount assembly.
- **USB Type-C to Type-A cable**: For PC connection.
- **Hand controller**: Standalone control for slewing, tracking, mode switching, and basic settings.
- **Coiled hand controller cable**: Connects the hand controller to the mount while allowing movement without strain.
- **5 mm hex keys**: For mechanical installation and adjustment tasks specified in this manual.
- **PE test report**: Factory test report for mount tracking periodic error (reference document).
- **Quick Start Guide**: First-night checklist and basic connection steps.

NOTICE

The package includes the mount head and the items listed above. Tripod/pier, counterweight bar, and counterweights are not included unless stated on your order.

The USB Type-C cable is for PC connection and firmware update only. It is not intended for power delivery.

3 Product Overview

This chapter introduces the mount's core features, external interfaces, and key specifications. It is intended as a quick reference. Detailed setup, operation, and software workflows are covered in later chapters and in the **Control Software Guide**.

3.1 Key Features

Item	Specification
Mount Type	Harmonic-drive (strain-wave) equatorial mount
Mode	Equatorial (EQ) / Altazimuth (AZ)
Drive Train	BLDC motor + direct harmonic drive (100:1 reduction ratio)
RA Drive	BLDC motor + size-20 harmonic drive (100:1) + brake
DEC Drive	BLDC motor + size-17 harmonic drive (100:1)
Encoder Resolution (motor)	18bit
Periodic Error (PE)	±15 arcsec
PE Period	432 s
Max Slew Rate	6 °/s
Software Slew Rates	0.25×, 0.5×, 1×, 2×, 4×, 8×, 20×, 60×, 720×, 1440×
HC Slew Presets	10× / 720×
Payload Capacity	Up to 30 kg @ 20 cm. No counterweight is required at or below 20 kg; above 20 kg, use the counterweight calculated in Section 8.7.
Mount Head Weight	5.1 kg
Latitude Adjustment Range	0°–90° (dual-scale: 0–60° / 30–90°)
Azimuth Adjustment Range	±6°
Dovetail Saddle	Dual Losmandy / Vixen (wide & narrow)
Counterweight Shaft Thread	M12 × 1.75 mm
Power Input	DC barrel jack 5.5 × 2.1 mm, center-positive (12 V DC; power-supply rating 3–7 A, 5 A recommended; mount input current 5 A max)
Power Output (DC OUT)	12 V, 5 A max, always-on
Software Compatibility	ASCOM, INDI, native StellaVita
Communication	USB / Wi-Fi / Bluetooth
Firmware update	SH: via PC (USB/Wi-Fi) or mobile APP (Wi-Fi). MHC: Wi-Fi only.
Home Position	Sensor-referenced mechanical zero (RA and DEC home sensors)
Power-Off Brake	RA axis
Park Function	Supported
Operating Temperature	−20 °C to +40 °C
Safety Features	Software limits, stall detection, overcurrent protection.
Warranty	2-year limited

3.2 Mount Anatomy

Refer to the labeled figures below to identify the mount's main mechanical features and external interfaces.



Figure 3-1 Side view — latitude and azimuth adjustment areas.



Figure 3-2 Side view — mount head, saddle, RA/DEC axes.

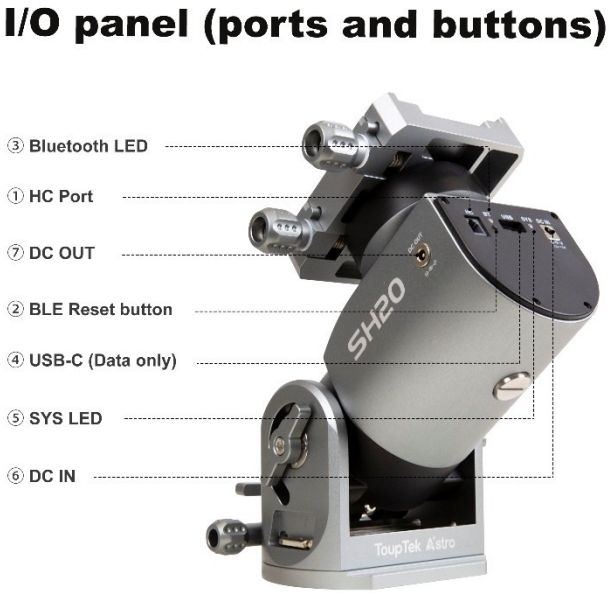


Figure 3-3 I/O panel close-up — ports and buttons.

Primary mechanical elements (typical labels):

- RA axis / DEC axis
- **Saddle:** Losmandy & Vixen dual dovetail saddle
- **Latitude adjustment:** 0–90° range with two-range scale mechanism
- Azimuth adjustment: ±6° range
- Counterweight shaft interface: M12 × 1.75
- Base mounting interfaces: center 3/8 in mounting thread; auxiliary 3-hole pattern for M6 fasteners on a Ø60 mm pitch circle, 120° apart
- Status indicator LED(s): BT LED (blue), SYS LED (red, yellow, green, blue).

3.3 Mechanical Safety (Tip-over, Pinch Points, Collision)

WARNING— Tip-over hazard

A fully assembled imaging system may be top-heavy. Always ensure the tripod/pier is on a stable surface and all clamps/fasteners are tightened before releasing the OTA.

- Do not exceed the specified payload.
- If total OTA-side load exceeds 20 kg, install the counterweight calculated in Section 8.7 before operation.
- Do not leave the mount unattended while slewing during initial setup.

CAUTION —Pinch points

Keep fingers, hair, and loose clothing away from moving axes (RA/DEC) and rotating parts during slewing.

NOTICE— Collision and cable snag

Improper cable routing may cause the mount to snag cables during slews, resulting in tracking errors or mechanical stress.

- Route cables with enough slack for full-range motion.
- Avoid tight loops that can hook on knobs, tripod legs, or accessories.

- Use strain relief where possible.

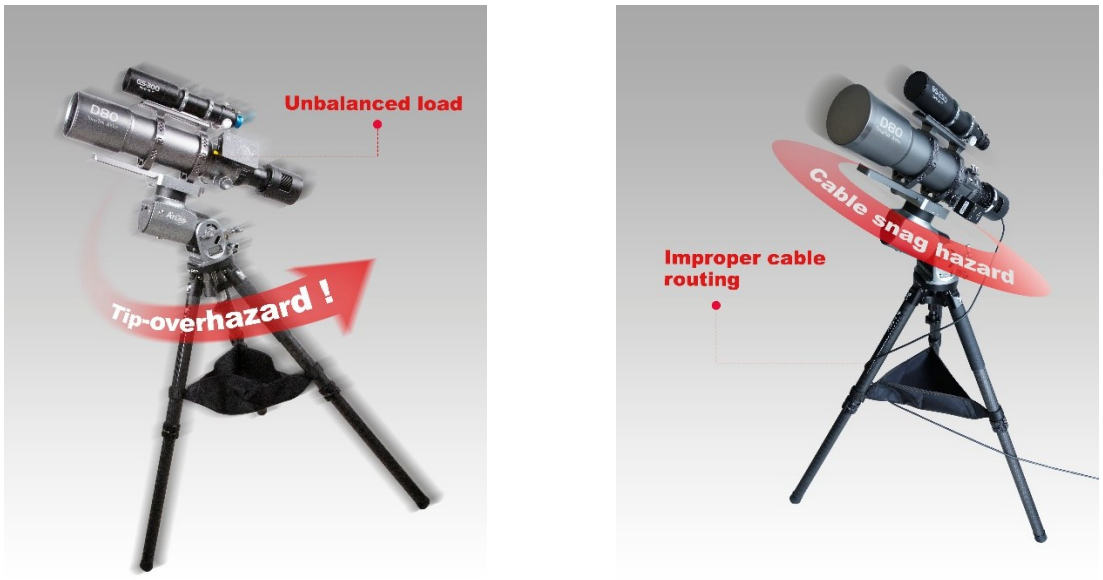


Figure 3-4 Mechanical safety — tip-over, pinch-point, and collision hazard zones.

3.3.1 Strain wave reducer, servo control, and motion performance

- **Strain wave reducers** provide near-zero backlash for precise motion control and durable long-term performance with reduction ratio of 100:1 for both axes.
- **BLDC servo motors** with 18-bit encoders support accurate positioning and responsive motion commands.
- Maximum slew speed: 6°/s (max).
- **Periodic error reference:** ±15 arcsec before correction, single period; **PE cycle time:** approximately 432 s.
  - A factory **PE test report** is included for reference.

3.3.2 Dual mode operation (EQ/AZ) with fast switching

- The mount supports **Equatorial** and **Alt-Azimuth** modes.
- Mode switching does not require rebooting.

CAUTION — Safety requirement (summary)
Switch modes **only** with **Tracking** OFF, the mount at **Home** or Park, and the OTA/payload and counterweight removed.

Detailed procedure and switch behavior: see Section **7**.

3.3.3 Home sensors and power-loss protection

- **Home sensors on both axes** support repeatable initialization by locating the mechanical zero position. Refer to Section 10.9.2 for the correct Find Home procedure.
- **Power-off brake:** RA axis only. This helps hold position in case of sudden power loss.

3.3.4 Protection features

SH20 includes protection features intended to improve robustness during normal use:

- **Software limits** (where supported): mount will stop when reaching the altitude limits
- **Stall detection**: when a stall is detected, the mount will automatically reverse direction to

move away from the obstruction, preventing further collision.

- **Overcurrent protection**: mount will cease movement when an overcurrent condition is detected.

3.4 Interfaces and Connectivity

Port/Function	Connector	Description	Notes
DC IN	5.5 × 2.1 mm	12V DC input	Center-positive; use a 3–7 A supply (5 A recommended); mount input current 5 A max
DC OUT	5.5 × 2.1 mm	12V DC output	Max 5A; Always-on
USB-C (Data)	USB 2.0 Type-C	PC control + firmware update	Not for power delivery
HC	RJ9	Hand controller connection	Coiled cable included
BLE reset	Button on mount panel	Bluetooth connection & reset	See following chapter
Wi-Fi reset	Via HC key combo	Resets Wi-Fi settings	Key combo **section 10.8**

WARNING — DC OUT

Do not use DC OUT on SH20 mount to power another SH20 mount.

NOTICE

- The **USB-C cable is for PC connection and firmware update only**; it is not intended for power delivery.
- Hand controller button definitions are described in **section 10** for details.

Table 2 Ports Summary

3.5 What This Manual Covers

This **Mount Hardware Manual** covers:

- Safety information and mechanical installation
- External interfaces, cabling, and connection overview
- Basic mount operation and EQ/AZ switching (hardware requirements)
- Firmware update entry points and recovery (device-side)
- Troubleshooting and maintenance

Detailed alignment, polar alignment, and software workflows are provided in the Control Software Guide and/or official online resources.

4 Quick Start Checklist (First Night)

This chapter provides a minimal workflow to assemble, connect, and verify basic operation on the first night.

4.1 Quick Start Checklist (Do / Verify)

Step	Do	Verify	Notes / References
1	Place tripod/pier on a stable surface and level it.	Tripod/pier does not wobble; all leg clamps are tight.	Recommendation: keep the tripod low in wind. Figure 4-1
2	Secure the mount head to the tripod/pier.	Mount head is firmly attached; no play at the base.	Base mounting interface: Figure 4-2
3	Ensure mount mode (EQ or AZ) before installing the OTA.	Intended mode is selected/confirmed in controller/app/software.	Safety requirement: switch modes only with Tracking OFF, the mount at Home or Park, and the OTA/payload and counterweight removed (see Section 7).
4	(Optional) Roughly set altitude and azimuth adjustments for EQ use.	Latitude/azimuth adjusters are within mid-range and free to adjust.	altitude 0–90°; azimuth ±6° (12° total). (Detailed procedure in Chapter 8.)
5	Install OTA onto the saddle.	OTA is secured; saddle clamp fully tightened. Balance Dec axis.	Saddle: Losmandy & Vixen dual.
6	Route cables with slack; add strain relief (tie to OTA/saddle).	No cable becomes taut through expected motion range.	Avoid cable snag/collision. Figure 4-4
7	Calculate and install the counterweight if total OTA-side load exceeds 20 kg.	System does not “fall” aggressively when released in a controlled test (if applicable).	Counterweight mass = total OTA-side load − 20 kg. Maximum total OTA-side load: 30 kg; maximum total counterweight mass: 10 kg. See Section 8.7.
8	Connect 12V DC IN and Power on.	Mount powers on reliably; no reset during idle.	Power-supply rating: 3–7 A (5 A recommended); mount input current: 5 A max. USB-C is data only.
9	Ensure mount is at safe state: Home or Park.	Mount is idle/ready; no unexpected motion at rest.	LED/status: green means at home, red means at park, no LED on means idle.
10	Connect and control the mount.	You can move axes at low speed and stop reliably.	See Section 4.2 / Tables 4–6.
11	Start tracking (EQ: sidereal rate).	Targets remain relatively stationary in field of view.	
12	End of session: stop tracking, Home or Park, power off,	Mount is at Home or Park; power is removed.	Recommendation: remove OTA for transport/storage.

Table 3 First Night Quick Start (Summary)

4.2 Connection Paths (Choose One)

Step	Do	Verify	Notes / References
A1	Connect the hand controller to port “HC”.	Hand controller backlight is on and joystick can move mount.	Coiled cable included.
A2	Confirm current mode (EQ/AZ).	Mode shown matches intended use.	If switching modes: stop Tracking, move to Home or Park, and remove the OTA/payload and counterweight.
A3	Test low-speed motion; test stop.	Movement is smooth; the mount stops after the joystick is released.	Keep clear of moving parts.
A4	Test Home function on HC	The mount moves to the established Home reference position.	After A3
A5	Start/stop tracking (EQ: sidereal).	Tracking toggles correctly. Yellow LED indicator works properly	Targets remain relatively stationary in field of view.

Table 4 Path A — Hand Controller (HC)

Step	Do	Verify	Notes / References
B1	Connect via Bluetooth (BLE 5) or Wi-Fi 2.4 GHz.	App shows connected state and mount info.	Network mode details in Software Guide.
B2	Confirm EQ/AZ mode and time/site on app	Mode/time/site are correct.	Mode switching requires Tracking OFF, Home or Park, and no OTA/payload or counterweight.
B3	Test low-speed motion; test stop.	Mount responds correctly; no lag/unexpected move.	Keep clear of moving parts.
B4	If Bluetooth pairing fails, use the Bluetooth reset button on the mount head.	Pairing succeeds after reset.	Reset action: Section 9.8. Figure 4-7
B5	If Wi-Fi connection fails, reset Wi-Fi via HC key combo.	Wi-Fi settings reset successfully.	Key combo: Section 9.8/ 10.8.

Table 5 Path B — Mobile App (Wi-Fi / Bluetooth)

Step	Do	Verify	Notes / References
C1	Connect PC to mount via USB-C (USB 2.0 data).	PC detects device / driver can connect.	USB-C is not for power.
C2	Install and select driver (ASCOM or INDI).	Driver connects without error.	Download link: Ascom-standards.org; indilib.org
C3	Confirm mode (EQ/AZ) and time/site in software.	Values match your setup.	Alignment workflows are in Software Guide.
C4	Connect from client software	You can issue a small slew and stop.	Keep test moves slow at first on software (e.g., NINA/SharpCap/Kstars).

Table 6 Path C — PC Control (ASCOM / INDI)

4.3 First Night Quick Troubleshooting (Mini Table)

Symptom	Likely Cause	Quick Fix
Mount resets during slews	Power drop (thin/long cable or weak supply)	Use a regulated 12 V supply rated at 3–7 A (5 A recommended); shorten the cable and use thicker conductors
No response to move commands	Connection issue / mount is parked	Set unpark; Re-plug and connect; retry
Bluetooth won't pair	Stale pairing	Use mount head Bluetooth reset: see section 9.8
Wi-Fi won't connect	Wrong network state	Reset Wi-Fi via HC combo: see section 9.8
Unexpected motion or near-collision	Wrong mode / cables snag	Stop, Park, power off; re-route cables; confirm EQ/AZ mode

Table 7 First Night Troubleshooting



Figure 4-1 Tripod / pier set-up and leveling.

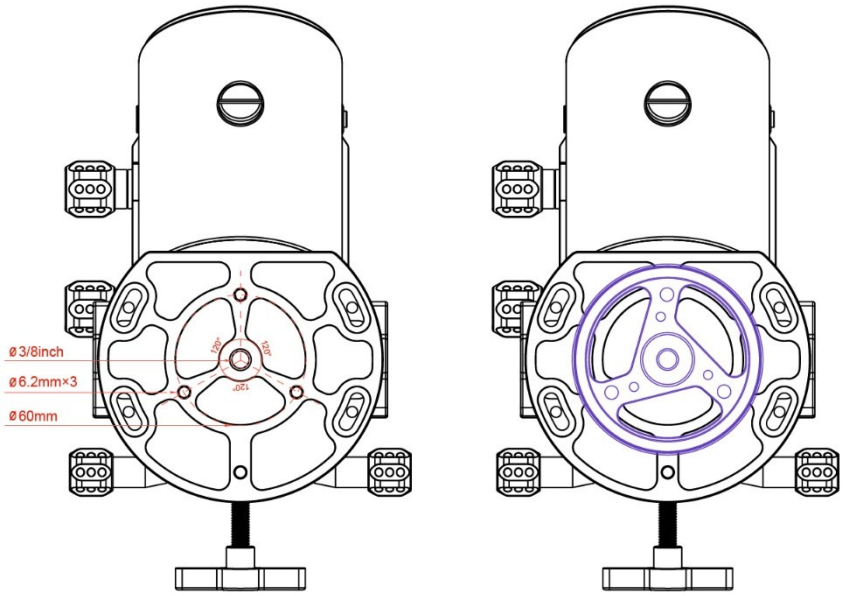


Figure 4-2 Base mounting interface — bolt pattern callouts.

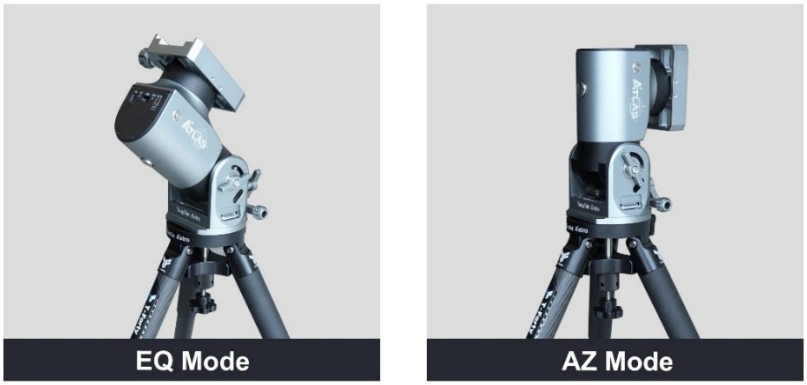


Figure 4-3 EQ mode vs AZ mode orientation.

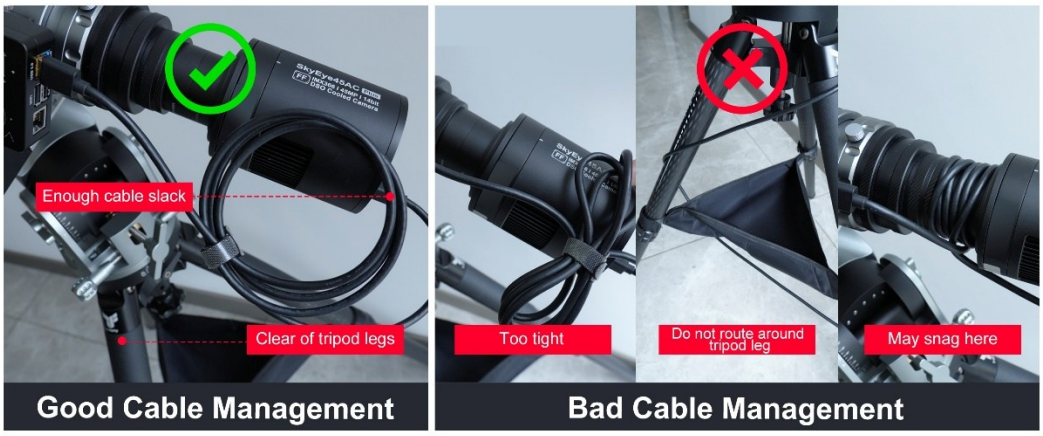


Figure 4-4 Good cable management vs bad cable management.

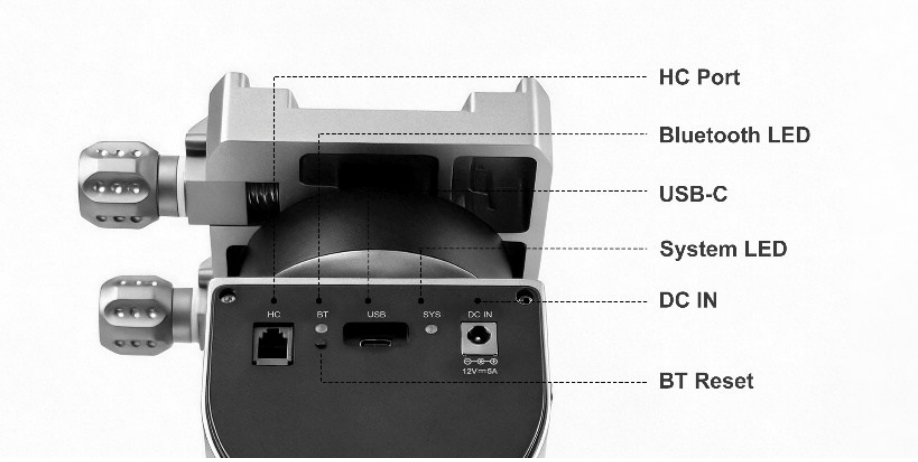


Figure 4-5 I/O panel labels — DC IN / DC OUT / USB-C / HC / BT reset.



Figure 4-6 Hand controller — front view with key labels.



Figure 4-7 Reset methods — BT reset button location and HC key combination.

5 Power-On, Home, Park, and Safe State

This chapter defines the mount's basic operational states and provides a minimal, safe power-on workflow. These definitions are referenced throughout this manual.

5.1 Power-On Checklist (Pre-flight)

Before applying power:

- Verify that a regulated **12 V DC** power supply rated at 3–7 A is available; 5 A is **recommended**.
- Use short, adequate-gauge power cables to minimize voltage drop.
- Confirm the mount head is securely fastened to the tripod/pier (no wobble).
- Ensure cables are routed to avoid snagging during motion.
- Keep clear of moving parts before connecting control devices.

5.2 State and Term Definitions

The mount uses the following terms and states. Understanding these definitions will prevent common first-night issues.

Term / State	Meaning	Recommended User Action	Notes
Safe State	A condition suitable for connection, configuration, and mode switching without unexpected hazards.	Move the mount to Home or Park and ensure clearance.	For EQ/AZ switching, Safe State also requires Tracking OFF and removal of the OTA/payload and counterweight.
Home	Reference position used for consistent initialization.	Command Go Home (method depends on control path).	Home may be found via built-in home sensors. Refer 10.9 for correct find home operation.
Park	User-defined safe parking position for power-off/transport.	Command Park before power-off.	Park may be configured to the same physical position as Home.
Parked	Park state is active; movement commands are blocked.	Unpark to enable motion.	All motion commands are rejected while parked, except Unpark.
Unparked	Park lock is cleared; motion commands are allowed.	Unpark after setup, then issue Slew (manual move) /GOTO.	Recommended before any motion test.
Idle	The mount is not executing Slew (manual move) /GOTO and is not tracking.	None.	Status indication: No LED shines.
Tracking	Tracking is enabled (continuous micro-motion).	Start/Stop tracking.	Tracking is not considered "Moving."
Moving	The mount is executing Slew (manual move) /GOTO commands.	Slew (manual move) /GOTO; Stop.	Keep clear of moving parts.

Table 8 State & Term Definition

5.3 First Power-On Procedure (Minimal Safe Workflow)

Use the following steps for first power-on and initial verification. These steps are intentionally control-method agnostic (HC / APP / PC).

Step	Do	Verify	Notes
1	Connect the 12V supply to DC IN (5.5×2.1 mm, center-positive).	Connector is fully seated; cable strain is relieved.	Use a 3–7 A supply (5 A recommended); mount input current is 5 A max. Avoid long/thin cables.
2	Power on the mount.	Mount powers on without reset.	Indicator/ready status:
3	Connect your control method (HC / App / PC).	Connection is stable.	USB-C is data only (not for power).
4	Confirm whether the mount is Parked. If Parked and a Home operation is required, command Unpark; if Park is the intended Safe State, leave the mount Parked.	Parked state is known; after Unpark, motion commands are accepted.	Parked rejects all motion commands except Unpark.
5	If the Home reference is missing or uncertain, perform Find Home; otherwise command Go Home. To use a user-defined Safe State instead, command Park.	Mount reaches Home or Park and becomes stable.	Find Home re-establishes the Home reference; Go Home uses an established reference; Park is user-defined.
6	Confirm operating mode (EQ or AZ).	Mode shown matches intended use.	Mode switching rule: only with Tracking OFF, the mount at Home or Park, and the OTA/payload and counterweight removed.
7	Perform a low-speed motion test (small move) and then Stop.	Motion responds correctly; Stop works immediately.	Keep test moves small and slow initially.
8	Start tracking if required (EQ: sidereal).	Status shows Tracking (not Moving).	Targets remain relatively stationary in field of view as track is enabled.

Table 9 First Power-On Steps

NOTICE

On power-up, the mount and HC display the same mode sequence (Section 10.7.1):

red-yellow-green EQ mode

red-yellow-blue AZ mode

5.4 Park / Unpark Behavior

Park is a safety lock. While the mount is **Parked**, the system will **reject all motion commands**, including:

- Slew (manual move) / GOTO through software command.
- Manual motion (directional moves) through hand controller
- Any client-issued motion commands via ASCOM/INDI
- **Unpark is required before motion commands can be executed. Supported non-motion configuration operations remain available while Parked.**

After **Unpark**, motion commands are accepted normally.



Figure 5-1 Park / Home / Unpark state diagram with LED indications.

5.5 Power Loss and Recovery

If power is interrupted during operation, use this recovery workflow.

Step	Do	Verify	Notes
1	Stop issuing commands from HC/App/PC.	No further motion commands are sent.	Prevents conflicting state after reboot.
2	Restore stable 12V power.	Mount powers on without repeated resets.	Check cable gauge/length and supply rating.
3	Confirm whether the mount is Parked. If Parked and motion is required, command Unpark.	Parked state is known; after Unpark, motion commands are accepted.	Parked rejects all motion commands except Unpark.
4	If the Home reference is missing/uncertain, run Find Home; otherwise use Go Home or Park for a Safe State.	Mount reaches Home or Park and becomes stable.	Find Home restores the reference; Go Home uses it; Park is user-defined.
5	Confirm operating mode (EQ/AZ).	Mode matches intended use.	For mode switching: Tracking OFF; mount at Home/Park; OTA/payload and counterweight removed.
6	Reconnect your control method and perform a small low-speed motion test.	Motion and stop operate correctly.	Then resume tracking if required.

Table 10 Power Loss Recovery

RA axis power-off brake:

The mount includes a power-off brake on the RA axis to help hold position during sudden power loss.

5.6 Safe State Rules for EQ/AZ Mode Switching

Mode switching is supported without rebooting. For safety:

- Switch modes only when the mount is **at Home or Park** and Tracking is OFF
- Remove the OTA, all payloads, and the counterweight before switch**ing**
- Confirm the mode before reinstalling the OTA or issuing GOTO commands

Detailed procedure and behavior: see Section 7.

5.7 Common Issues (Power/State Related)

Issue	Likely Cause	Quick Action
Mount will not move	Mount is Parked	Issue Unpark, then retry
Random resets during motion	Power drop	Use a short, thick cable and a regulated 12 V supply rated at 3–7 A (5 A recommended)
Tracking appears as “not moving”	Normal by design	Tracking is reported separately (not Moving)
Connection unstable	Power, cable, or wireless pairing	Stabilize power; reset BT/Wi-Fi as needed (9.8/10.8)

Table 11 Common Issues (Power/State Related)

6 Software Connection

This chapter explains how to connect the ATLAS SH20 to the ToupTek Mount ASCOM Server (TMount) application on a Windows PC, how to operate the main control window, and how to configure mount-side parameters (site, time, guiding, limits, load mode, meridian behavior, beep, and mode). The ASCOM Server exposes the mount to any ASCOM-compliant client (NINA, APT, SharpCap, MaxIm DL, TheSkyX, Stellarium via ASCOM bridge, etc.), and can also be used standalone for basic jogging, Home, Park, and Track.

Polar alignment, plate-solving, and imaging workflows are covered by the third-party client documentation. See Chapters 9–10 for HC connections. Full mobile-app workflows are outside this manual; refer to the Software Guide when available.

6.1 Safety Rules (Read First)

WARNING — Unexpected motion hazard

Slew, GOTO, and Home commands may produce immediate, relatively fast axis motion. Unpark only releases the Park lock; Track starts continuous low-speed tracking motion. Always verify the mount's collision envelope, cable slack, and payload balance before connecting or issuing commands from software. Keep a hand near the DC IN or power switch for the first connection of each session.

Required conditions before connecting (non-negotiable):

- The tripod/pier top is level and the mount head is securely attached.
- If a payload or counterweight is installed, ensure it is securely mounted and properly balanced.
- Cables are routed so they do not snag across the full motion range.
- Mount is powered ON with a stable 12 V DC supply.
- Mount is in a known state: Home (after first power-on and Find Home), or Parked (loaded from previous session).

One-line rule: Do not send motion commands from software until you have verified the mount posture (Home or Parked), the active mode (EQ or AZ), and a safe collision envelope.

6.2 TMount Overview

TMount is the single application that:

1. Connects the PC to the mount over one of three physical links: Serial (USB-C), Network (Wi-Fi), or Bluetooth.
2. Installs the ToupTek ASCOM Telescope driver so third-party clients can control the mount.
3. Provides a built-in control panel for Move, Home, Park, Track, mode switching, and advanced setup.
4. Delivers firmware updates to the **mount** and to the **hand controller**.

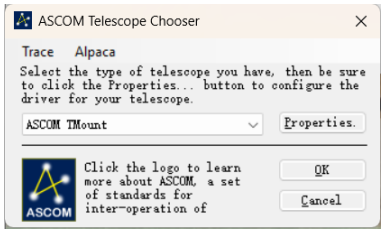


Figure 6-1 ASCOM Chooser — select TMount and press Properties.

6.3 How to Connect (Choose One Connection Method)

Method	Physical Link	When to Use	Notes
Serial	USB-C cable between PC and mount head USB-C port	Observatory / fixed-desk setup; most stable and lowest latency	USB-C is data-only; does not power the mount. See Section 9.6.
Network	Wi-Fi through the Hand Controller (HC-hosted AP; default IP 192.168.4.1). Bridge mode is also available.	Laptop-based field setup; hand controller required; no cable between PC and mount	2.4 GHz only; credentials: Sections 6.3.2 / 6.3.2.1.
Bluetooth	BLE in the mount head (device name SH20_xxxxxx)	Short-range control; simple pairing; low power; no hand controller required.	Not recommended for long imaging sessions; bandwidth is lower than Wi-Fi/USB

Table 12 Connection Method Comparison

6.3.1 Serial Connection (Through Cable)

Step 1: check Serial Port option and select the correct COM port.

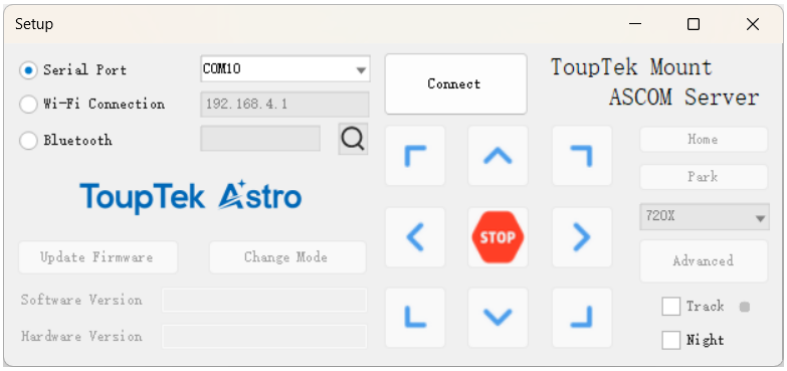


Figure 6-2 TMount Setup dialog — Serial Port option and COM port selector.

Open device manager and under the Ports (COM & LPT) tab where you can find COM number for the mount. It is usually named “USB Serial Device (COMx)”.

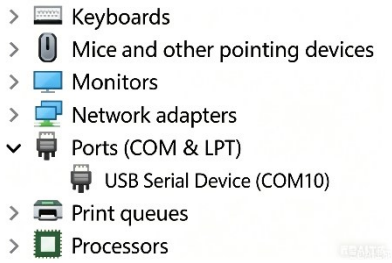


Figure 6-3 Windows Device Manager — locate the mount COM port under Ports (COM & LPT).

Step 2: press Connect button to establish connection with the mount.

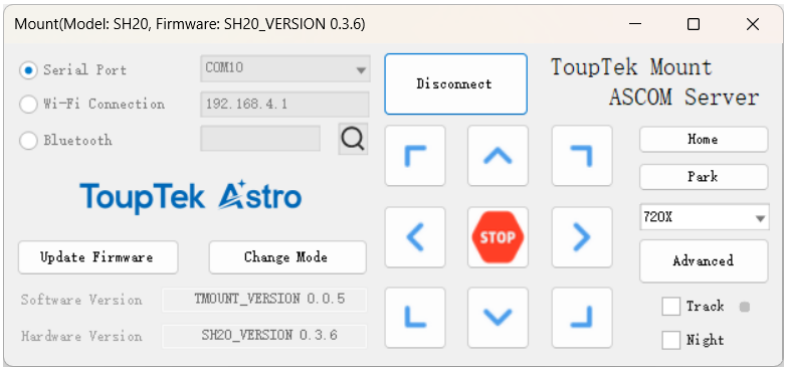


Figure 6-4 TMount main window after a successful Serial connection.

6.3.2 Network Connection (Through Wi-Fi from Hand Controller)

The mount uses the Hand Controller (HC) as its Wi-Fi access point. When the HC is powered and connected to the mount, it broadcasts a Wi-Fi SSID that the PC running TMount can join to reach the mount at **192.168.4.1**.

Step 1: power on the HC and connect it to the mount. The default Wi-Fi credentials are printed on the HC label and can also be viewed in TMount (see "Viewing and Editing Wireless Credentials" below).

- Default SSID format: **MHC_xxxxxx** (the six-character suffix is unique per HC).
- Default password: **12345678**.

Step 2: on the PC, open the Windows Wi-Fi list and join the **MHC_xxxxxx** network with the default password.

Step 3: in TMount Setup, check **Wi-Fi Connection**. The IP field auto-populates with **192.168.4.1**. Leave it as is unless a custom bridge has been configured.

Step 4: press **Connect**. TMount opens and reports **Wi-Fi Connection**. In AP mode, the default IP is **192.168.4.1**; use the configured address for bridge mode.



Figure 6-5 TMount main window after a successful Wi-Fi connection.

6.3.2.1 Viewing and Editing Wireless Credentials

Manage Wi-Fi, BLE, and Bridge settings in TMount: open **Advanced → Setup → Wireless**. Wi-Fi Info and BLE Info support editing; use SAVE to store changes and FACTORY to restore defaults.

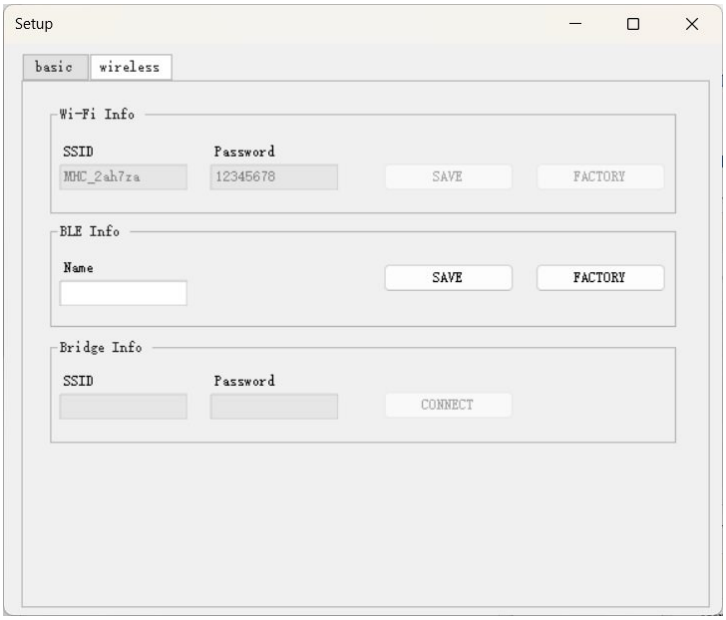


Figure 6-6 Advanced Setup → Wireless tab — Wi-Fi and BLE information.

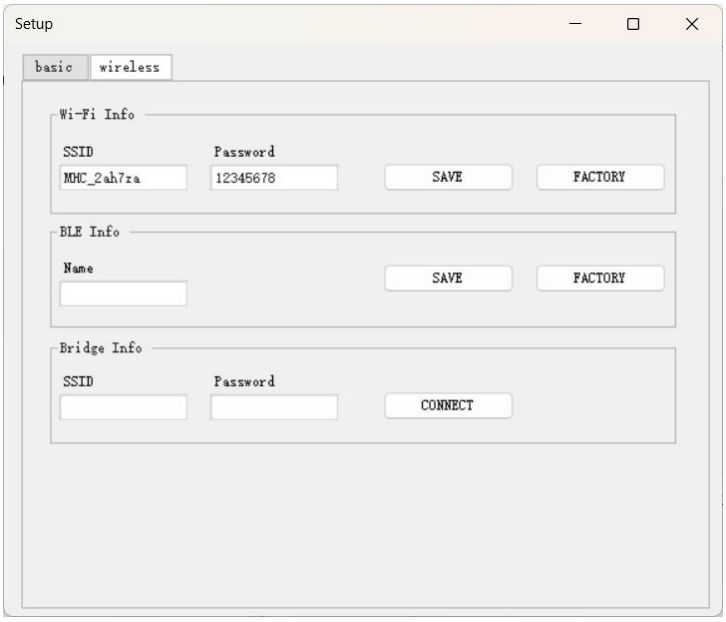


Figure 6-7 Advanced Setup → Wireless tab — wireless settings.

The Wireless tab is organized into three groups:

- **Wi-Fi Info** — the SSID and password broadcast by the HC.
- **BLE Info** — the Bluetooth device name advertised by the mount-side BLE module (see § 6.3.3).
- **Bridge Info** — used when the HC bridges to an upstream Wi-Fi network instead of acting as a standalone AP. Enter the upstream SSID/password and press **CONNECT** to start the bridge.

Editing wireless settings:

- Wi-Fi Info: **edit** the HC SSID and password.
- BLE Info: **edit the** mount BLE device name.

- SAVE stores the settings in non-volatile memory (NVM).
- **FACTORY** restores the selected group to defaults (Wi-Fi: **MHC_xxxxxx** / **12345678**).

NOTICE

Changing the Wi-Fi SSID or password disconnects the current Wi-Fi session immediately after pressing **SAVE**. Re-join the Windows Wi-Fi list using the new credentials, then press **Connect** again in TMount.

NOTICE

Wi-Fi credentials persist across power cycles. If the password is lost, use **FACTORY** in Wi-Fi Info or the HC reset combination in Section 10.8.2.

6.3.3 Bluetooth Connection (Through BLE in the Mount)

Step 1: check Bluetooth Port option and click **Search** icon.

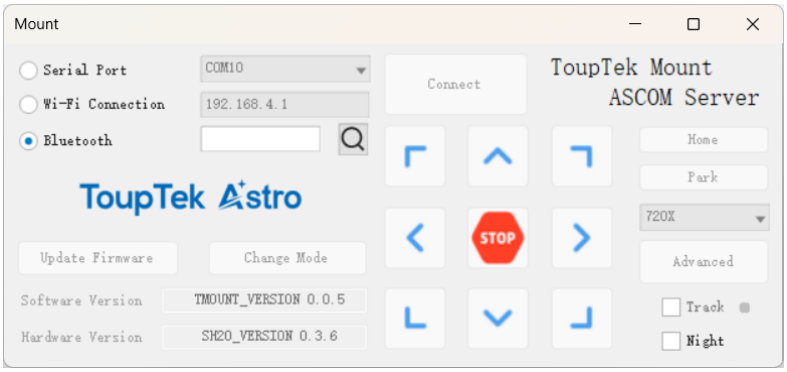


Figure 6-8 TMount Setup dialog — Bluetooth Port option with Search icon.

Step 2: press Start Scanning button to start scanning the Bluetooth device name of the mount.



Figure 6-9 Bluetooth scan dialog before scanning.

Step 3: once the device name is found, double click the name to establish connection.

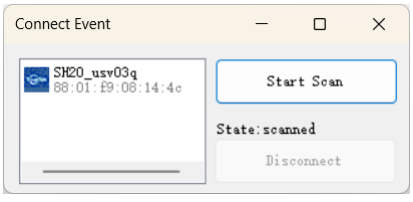


Figure 6-10 Bluetooth scan result — SH20_xxxxxx device entry with MAC address.

Once the connection is established, the TMount interface will look like this.

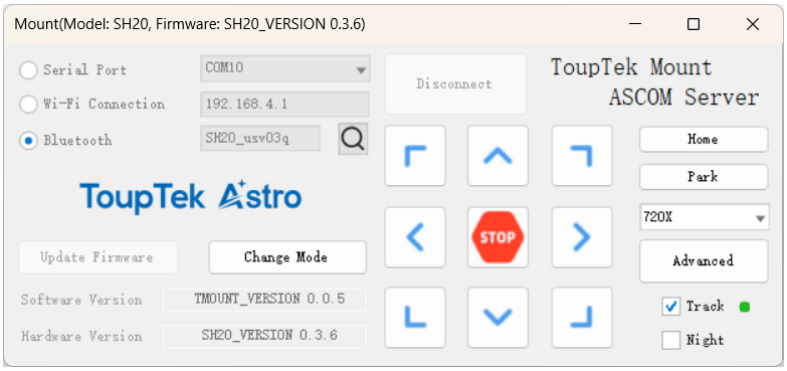


Figure 6-11 TMount main window after a successful Bluetooth connection.

6.4 Basic Control

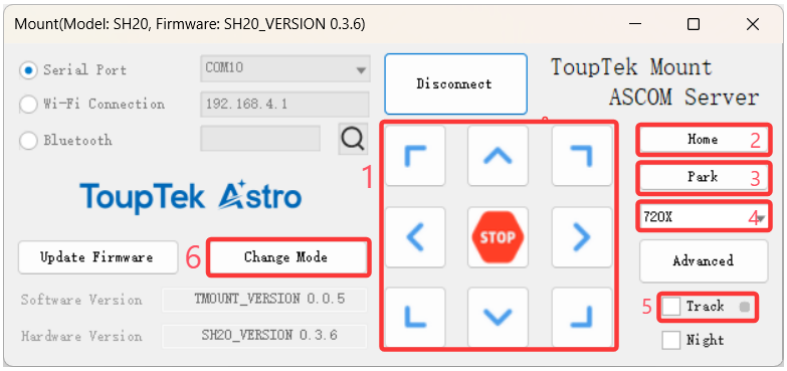


Figure 6-12 TMount main control window — slew pad, status, and command callouts.

1. Use **arrow keys** to move mount in desired direction. Press **Stop** to interrupt current movement (operation such as Home, Park and GOTO)
2. Use the Home button to move the mount to the established Home reference position.
3. Use the Park button to move the mount to the configured Park position. When the mount is **Parked, all motion commands are rejected**; Unpark before any other motion operation.
4. Select desired movement speed from 0.25x to 1440x sidereal speed (720x at heavy load mode).
5. Enable and disable track function.
6. Switch between EQ and AZ modes. Before switching, stop Tracking, move to Home or Park, and remove the OTA/payload and counterweight.

6.5 Advanced Setup

The Advanced Setup dialog groups all mount-side parameters that are not exposed on the slew pad. Changes are applied to the mount in real time and persist across power cycles unless noted otherwise.

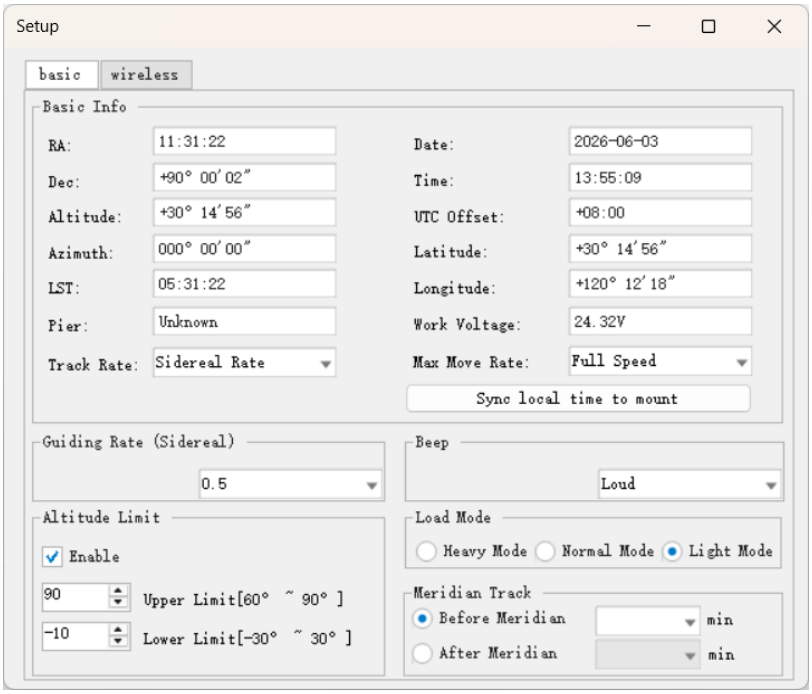


Figure 6-13 Advanced Setup dialog.

6.5.1 Basic Info

Shows live telemetry and mount status. All values are read-only except the Track Rate drop-down.

Field	Type	Meaning
RA	Read-only	Current right ascension (hh:mm:ss); EQ only. AZ mode shows the last-known value.
Dec	Read-only	Declination of the current pointing (±dd:mm:ss). EQ mode only.
Alt	Read-only	Altitude above the horizon (°).
Az	Read-only	Azimuth (° from North, clockwise).
LST	Read-only	Local Sidereal Time (hh:mm:ss), computed from site and time.
Pier	Read-only	Pier side: East or West. Relevant for meridian flip logic.
Track Rate	Editable drop-down	Selects the tracking rate. Sidereal (default), Solar, Lunar.

Table 13 Basic Info — Fields

6.5.2 Date / Time / Site / Voltage

Sets the mount's internal clock and observing site and displays live power telemetry.

Field	Type	Meaning / Default
Date	Editable	Local date.
Time	Editable	Local time.
UTC	Editable	UTC offset in hours (e.g. +08:00).
Lat	Editable	Observing latitude in decimal degrees (positive = N).
Lon	Editable	Observing longitude in decimal degrees (positive = E).
Work Voltage	Read-only	Live DC IN voltage (e.g. 12.1 V).
Sync Local Time to Mount	Button	Sends the PC date, time, and UTC offset to the mount.

Table 14 Date / Time / Site / Voltage — Fields

Recommended workflow: click Sync Local Time to Mount after every fresh power-on. The mount has no RTC-backup battery and will lose the clock on power-off.

6.5.3 Guiding Rate

Field	Type	Meaning
Guiding Rate	Editable (decimal)	Guide-pulse speed as a fraction of sidereal. Default: 0.5. Typical range: 0.3–0.9.

NOTICE

Guiding Rate is a fraction of sidereal speed. Default: 0.5; typical range: 0.3–0.9. Select the value to suit the guiding setup.

Table 15 Guiding Rate

6.5.4 Beep

Field	Type	Meaning
Beep	Drop-down	Sets buzzer volume: Off (muted), Normal, or Loud.

Table 16 Beep

Alerts cover GOTO completion, Home/Park reached, low voltage, and stalls. Off mutes the sound; the events still occur. Use Normal or Loud when audible confirmation is needed.

6.5.5 Altitude Limit

Software altitude limits help reduce the risk of altitude-related collisions and prevent the mount from entering user-defined altitude ranges.

Field	Range	Meaning
Upper	60° – 90°	Maximum allowed altitude. Mount stops before crossing.
Lower	−30° – 30°	Minimum allowed altitude. Negative values are permitted for pier-mounted setups.

CAUTION — Altitude limit is not a complete collision-avoidance system.

Actual clearance depends on the OTA length, camera configuration, mount orientation, tripod/pier geometry, and cable routing. Always perform the clearance check described in Section 8.8.

Table 17 Altitude Limit

6.5.6 Load Mode

Mode	When to Use	Effect
Light	When OTA is lighter than 8 kg	Less power consumption.
Normal	Standard payloads from 8kg to 15kg	Default current / speed profile.
Heavy	15–20 kg without counterweight; above 20 kg and up to 30 kg, counterweight mass = total OTA-side load − 20 kg. The 20 cm rating is measured from the RA-axis center to the telescope optical center.	Increased holding current; maximum slew rate limited to 720×.

NOTICE

Changing Load Mode changes the motor current configuration and may affect tracking or guiding. Select the load mode before starting an exposure sequence.

Table 18 Load Mode

6.5.7 Meridian Track

Meridian Track defines the before-meridian and after-meridian thresholds for EQ operation. This setting does not perform an automatic meridian flip; configure and supervise any required flip in the imaging client.

Field	Range	Meaning
Before meridian	0 – 60 min	Defines the threshold before the target crosses the meridian. Set to 0 to disable this field.
After meridian	0 – 60 min	Defines the threshold after the target crosses the meridian. Set to 0 to disable this field.

Table 19 Meridian Track

7 EQ/AZ Mode Switching (No Reboot)

This chapter explains how to switch the mount between **Equatorial (EQ)** and **Alt-Azimuth (AZ)** modes without rebooting. Mode switching changes the mount's kinematics and collision envelope. Follow the safety requirements and verification steps to avoid issuing motion commands under the wrong axis interpretation and to prevent equipment damage.

7.1 Safety Rules (Read First)

WARNING— Mode switching changes motion behavior
Switching EQ/AZ changes the mount's axis interpretation, tracking behavior, and collision envelope. Confirm the active mode before issuing any motion command.

Required conditions (non-negotiable):

1. **Remove the optical tube assembly (OTA)** and all heavy payloads from the saddle.
2. Remove counterweight on mount head, if it is installed.
3. Stop Tracking, then place the mount in a **Safe State**: **Home or Park**.
4. Ensure **cables do not snag** during the operation.

One-line rule (for quick reference):

Switch modes only with **Tracking OFF,** the mount at Home or **Park, and the OTA/payload and counterweight remove**d.

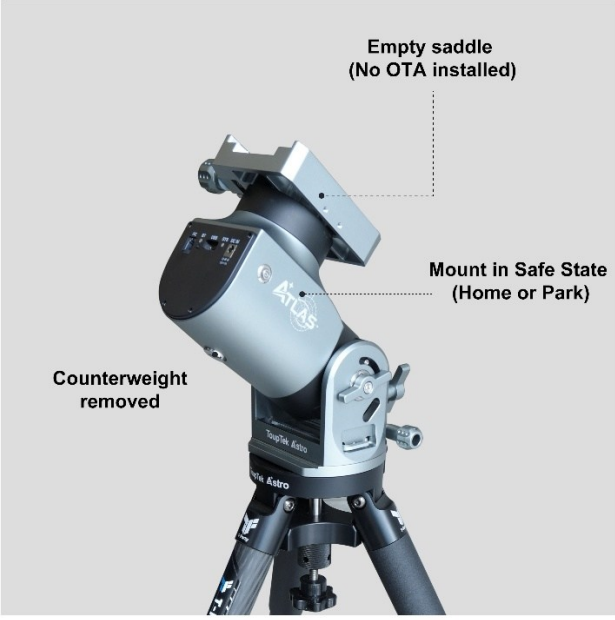


Figure 7-1 Required setup before EQ/AZ mode switching.

7.2 Definitions

- **EQ mode:** The mount behaves as **RA/DEC** and supports sidereal tracking for astrophotography workflows.
- **AZ mode:** The mount behaves as **Azimuth/Altitude** for visual use and quick setup workflows.
- **Safe State:** The mount is in **Home** or **Park** (see Chapter 5).

Park gating reminder:

When the mount is **Parked**, the system rejects all motion commands except **Unpark** (see Chapter 5).

7.3 When to Use EQ vs AZ

Mode	Typical Use	Advantages	Notes
EQ	Astrophotography, long exposures	Best tracking performance for deep-sky imaging	Polar alignment is performed using software tools
AZ	Visual observation, quick setup, short exposure / EAA-style workflows	Fast setup and intuitive pointing	Field rotation considerations apply

Table 20 Recommended Use Cases

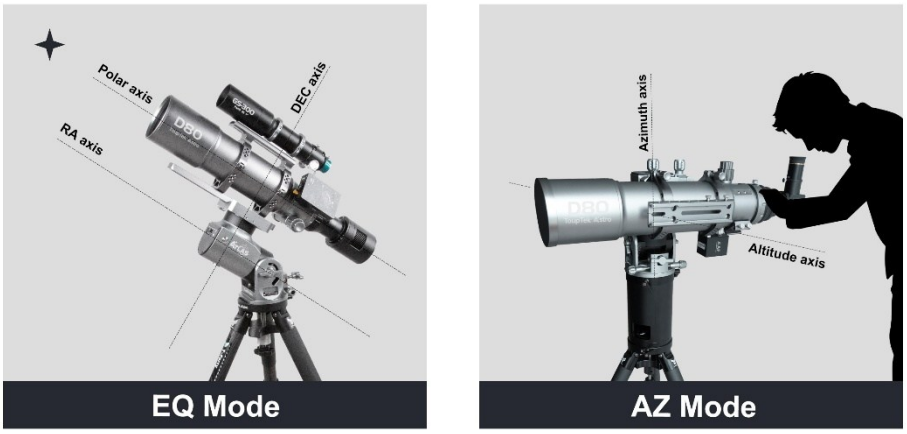


Figure 7-2 EQ mode axes (RA / DEC) vs AZ mode axes (Az / Alt).

Mode switching can be performed from the control interface or with the HC key combination.

7.4 Preconditions (Before Switching)

Item	Requirement	User Check	Notes
OTA / payload	Must be removed	Saddle is empty and secured	Required for safety
Counterweight	Must be removed if installed	Counterweight removed	Required for safe mode switching
Mount posture	Home or Park	Confirm Safe State	See Chapter 5
Tracking	Must be OFF	Confirm not tracking	Reduces surprises
Cables	Must not snag	Visual clearance check	Especially power cable
Power	Stable 12V input	No resets	Power-supply rating 3–7 A (5 A recommended); mount input current 5 A max

Table 21 Preconditions and User Checks

7.5 Mode Switching Procedure (Do / Verify)

NOTICE — Direct EQ/AZ Switching

ATLAS SH20 supports direct switching between EQ and AZ modes while powered on. No power cycle, reboot, or reconnection is required. EQ/AZ switching involves both the mount's mechanical posture and its control-system operating mode; complete the mechanical adjustment before confirming the operating mode.

Step	Do	Verify	Notes
1	Stop Tracking.	Tracking is OFF.	Before adjusting the mechanical posture.
2	Move the mount to Home or Park.	Mount stable; no motion in progress.	Home = reference; Park = user-defined safe position.
3	Remove the OTA, all imaging payloads, and the counterweight.	Saddle empty; counterweight removed.	Required for safe mode switching.
4	Secure all cables with slack for axis motion and latitude adjustment.	No cable can become taut or snag.	Include power and communication cables.
5	Set the latitude mechanism to 90° for AZ or to local latitude for EQ. If the angle is out of range, switch ranges per Section 8.4.3.	Mechanical posture matches the target mode.	Support the mount head firmly during adjustment.
6	Retighten the latitude locking mechanism.	Latitude does not shift under light pressure.	Do not over-tighten.
7	Switch the EQ ↔ AZ mode using software or the hand controller.	Mount reports the new mode.	No power cycle, reboot, or reconnection required.
8	Wait for switching to complete and confirm the mode.	Confirm the mode from the mount SYS LED, HC system LED, or connected software. Switching via HC also beeps when Beep is Normal or Loud.	Mode sequence: see Section 10.7.1. Red → Yellow → Green: EQ. Red → Yellow → Blue: AZ.
9	Reinstall the OTA and accessories, plus any counterweight required by Section 8.7.	Equipment secure; cables have slack.	Do not reinstall the payload until the mode is confirmed.
10	Recheck balance, cable slack, and the collision envelope.	Payload is balanced; full travel is clear.	Perform the clearance check in Section 8.8.
11	If Parked, command Unpark, then perform a low-speed motion test.	Direction is correct; Stop works normally.	Begin with small movements at low slew speed.

Table 22 Mode Switching Steps

In PC software, click “Change Mode” and select the corresponding mode. Confirm completion from the reported mode and LED sequence.

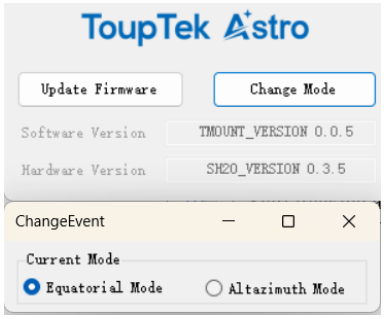


Figure 7-3 Change Mode dialog in TMount — choose EQ or AZ.

Users can also change mode through hand controller.

1. Set LOCK = OFF.
2. Press and hold Button 1 + Button 2.
3. While holding the buttons, switch LOCK from OFF to ON.
4. Continue holding for 3 seconds. Release the buttons when the mode indication sequence starts; if Beep is set to Normal or Loud, a short beep is also heard.

8 Mechanical Setup and Mounting

This chapter describes the physical setup of the tripod/pier and mount head, installation of the optical tube assembly (OTA), and recommended cable routing practices.

8.1 Safety and Preparation

Before you begin

- For general mechanical installation and payload changes, power the mount OFF. EQ/AZ mode switching is an exception; follow Section 7. No **power cycle or reboot is required**.
- Keep clear of moving parts during mechanical installation.
- For EQ/AZ mode switching, **stop Tracking, move to Home or Park, and remove the OTA/payload and counterweight** as specified in Section 7.

Required tools

- Hex key: **5 mm** ×2 (included)
- Recommendation (not included): Velcro ties, small flashlight/headlamp, soft cloth

NOTICE

Do not force adjustment knobs or clamps. If resistance is **unusually high**, verify that the corresponding lock is released.

8.2 Tripod/Pier Setup and Stability

Stable support is essential for safe operation and good tracking performance.

8.2.1 Site selection

1. Choose a firm surface with minimal vibration.
2. Avoid steep slopes. If unavoidable, position a tripod leg downhill for stability.
3. In windy conditions, lower the tripod height and consider adding ballast.

8.2.2 Tripod setup (typical procedure)

1. Fully spread the tripod legs and lock all leg clamps.
2. Install and secure the spreader (if equipped).
3. Rough level the tripod using the built-in bubble level (if equipped) or a separate level.

Verification

- The tripod does not rock when pressed lightly from the side.
- All clamps are fully locked and the spreader is seated.



Figure 8-1 Tripod setup overview — legs spread, spreader installed, leveling reference.

8.3 Installing Mount Head on the Tripod/Pier

This section covers attaching the mount head to the tripod/pier top interface.

8.3.1 Base mounting interface

Parameter	Value
Center mounting thread	3/8 in
Auxiliary mounting pattern	3 holes for M6 fasteners, Ø60 mm PCD, 120° apart
Mounting direction	M6 fasteners installed from below the mounting plate
Recommended tightening method	Hand-tighten firmly

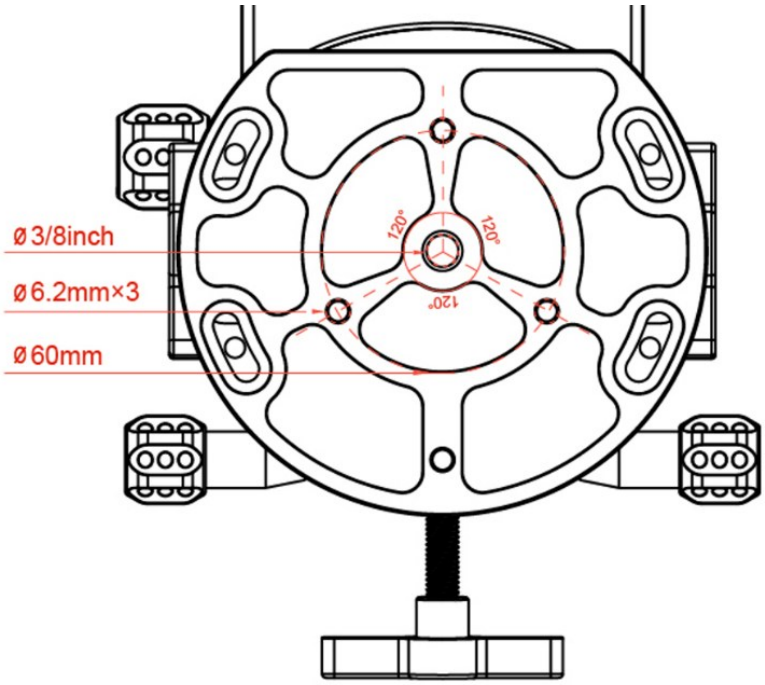


Figure 8-2 Base mounting interface — bolt pattern callouts.

8.3.2 Mount head installation steps

WARNING—Tip-over and pinch hazard

Support the mount head with both hands during installation. Do not install mount with the tripod unsecured.

Steps

1. Confirm the tripod/pier top plate is clean and free of debris.
2. Loosen the tripod's side locking screw to open the clamp.
3. Secure the mounting plate to the bottom of the mount using three M6 screws.
4. Place the mount onto the tripod and fully seat the mounting plate into the tripod receptacle. Tighten the side locking screw to clamp the mounting plate and secure the mount.
5. Insert the 3/8 in center bolt from below and hand-tighten it.
6. Tighten firmly until the mount head cannot rotate on the tripod.

Verification (pass/fail)

- **PASS:** No rocking; the mount head cannot be rotated by moderate hand force.
- **FAIL:** Any looseness, creaking, or rotation → remove, re-seat, and re-tighten.



Figure 8-3 Mount-head-to-tripod base mounting — place → align → tighten → verify.

8.4 Latitude Adjustment (EQ Mode)

Latitude adjustment sets the mount angle for your observing latitude when using EQ mode. This is a **coarse mechanical step**; final polar alignment is performed using software tools (Software Guide).

8.4.1 Adjustment range and scale

- Latitude adjustment range: **0° to 90°**
- Two-range latitude scale mechanism: **0–60°** and **30–90°**



Figure 8-4 Latitude adjustment — knobs, lock points, and scale callouts.

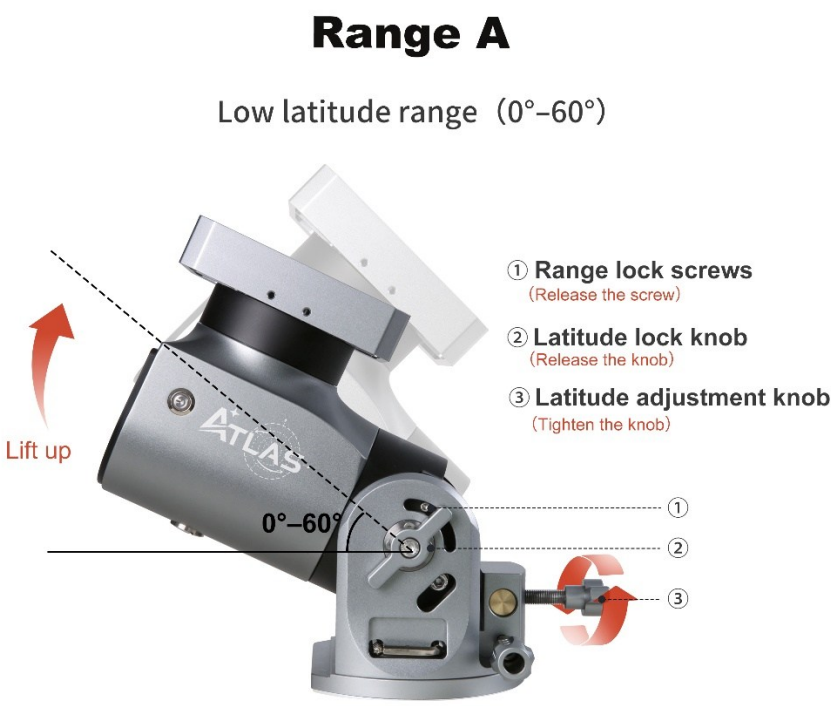


Figure 8-5 Range A — low-latitude (0°–60°) configuration.

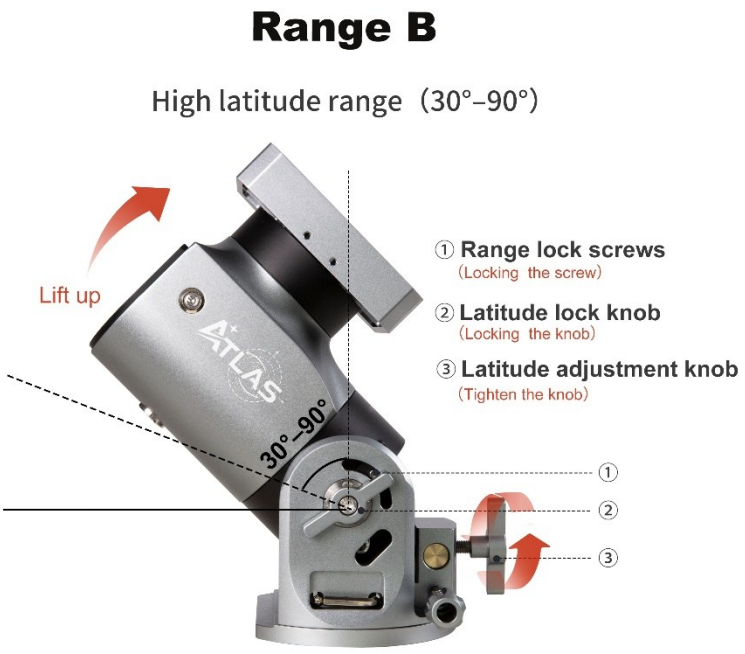


Figure 8-6 Range B — high-latitude (30°–90°) configuration.

8.4.2 Latitude adjustment steps

Step	Do	Verify	Notes
1	Ensure the mount head is securely attached to the tripod/pier.	No wobble at the base.	See Section 8.3
2	Release the latitude lock (if equipped).	Adjustment knob turns smoothly.	Lock location: on both sides
3	Adjust latitude to your site latitude using the scale.	Scale reading matches target latitude.	Coarse only; fine alignment in software
4	Re-tighten the latitude lock (if equipped).	Latitude does not drift under light pressure.	Do not over-tighten

Table 23 Latitude Fine Adjustment (EQ Mode)

8.4.3 Latitude scale switch steps

When to switch the scale. The mount provides two mechanical latitude ranges — a low range (0–60°) and a high range (30–90°) — that overlap between 30° and 60°. If your observing site's latitude falls outside the currently selected range, you must physically reposition the head onto the other scale before you can fine-tune to your local latitude. Use Table 24 to find the correct procedure for your starting scale.

CAUTION — Remove all payloads before changing the latitude range

Before loosening the latitude range locking screws, **remove the OTA, imaging payload, and counterweight. Do not change** the latitude range with any payload installed. Support the mount head firmly by hand while the locking screws are released.

Initial Latitude Scale Range	Initial Altitude Reference	Procedure	Target Altitude Range
0–60°	Approx. 25°	1. Adjust the altitude to approximately 25°. 2. Expose the latitude scale locking screws. 3. Loosen the locking screws on both sides. 4. Hold the mount head firmly and push it upward to the 45–50° position. 5. Tighten the latitude scale locking screws.	45–50°
30–90°	Approx. 48°	1. Adjust the altitude to approximately 48°. 2. Expose the latitude scale locking screws. 3. Loosen the locking screws on both sides. 4. Hold the mount head firmly and push it downward to the 25–30° position. 5. Tighten the latitude scale locking screws.	25–30°

Table 24 Latitude Scale Switch

After the switch, adjust the altitude normally to match your local latitude on the newly selected scale.

8.5 Azimuth Adjustment (EQ Mode)

Azimuth adjustment is used to point the mount roughly toward true north (or south in the southern hemisphere) and to provide fine left/right adjustment capability.

- Adjustment range: **±6°**

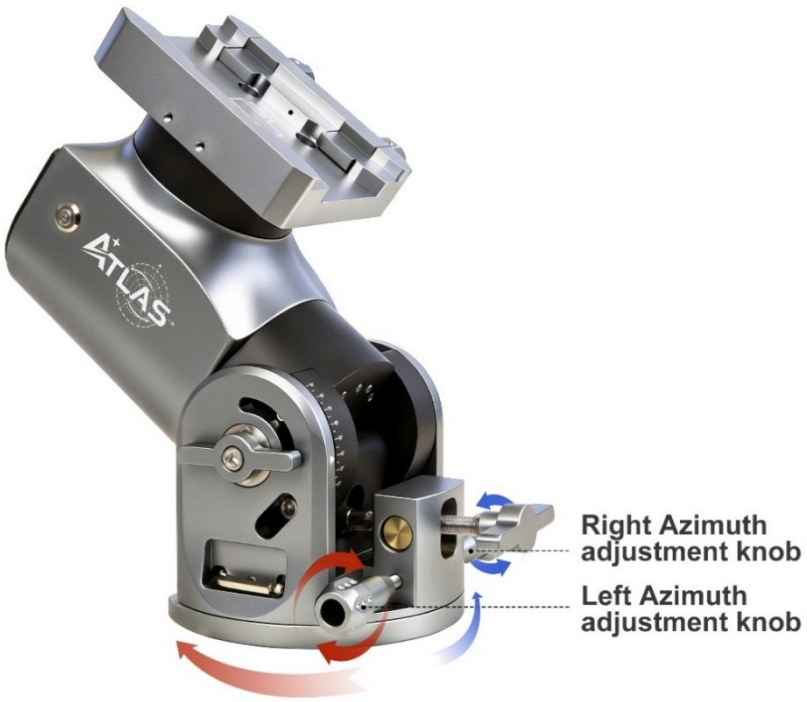


Figure 8-7 Azimuth adjustment knobs (left / right) and direction arrows.

Step	Do	Verify	Notes
1	Center the azimuth adjuster range (recommended).	Both directions have remaining travel.	Avoid operating at end-stops
2	Adjust azimuth to roughly face the pole direction.	Mount orientation is approximately correct.	Fine alignment in software
3	Finely adjust azimuth based on polar alignment guide on software	Recommended: reach within 1 arc-minute.	
4	Re-check stability	No looseness introduced by adjustment.	

Table 25 Azimuth Adjustment Guide

If Azimuth angle is far away from the true north, it is recommended to rotate the tripod (extender) by hand first.

8.6 Installing the OTA (Payload) on the Saddle

The mount includes a dual-format saddle supporting **Vixen** and **Losmandy** dovetails.

WARNING—Drop hazard

Always support the OTA with one hand until the saddle clamp is fully tightened.

8.6.1 Payload guidance

- Maximum total OTA-side load (EQ/AZ): **20 kg @ 20 cm without counterweight; up to 30 kg @ 20 cm with the counterweight calculated in Section 8.7.**

8.6.2 OTA installation steps

Step	Do	Verify	Notes
1	Open the saddle clamp enough to accept the dovetail.	Dovetail can slide in without forcing.	
2	Insert the dovetail fully and seat it against the reference surface.	Dovetail is fully seated (not partially engaged).	
3	Tighten the clamp firmly.	OTA cannot slip under gentle lift/rock test.	
4	Confirm clearance for camera/accessories.	No contact with tripod/legs at expected angles.	See Section 8.8

Table 26 OTA Installation

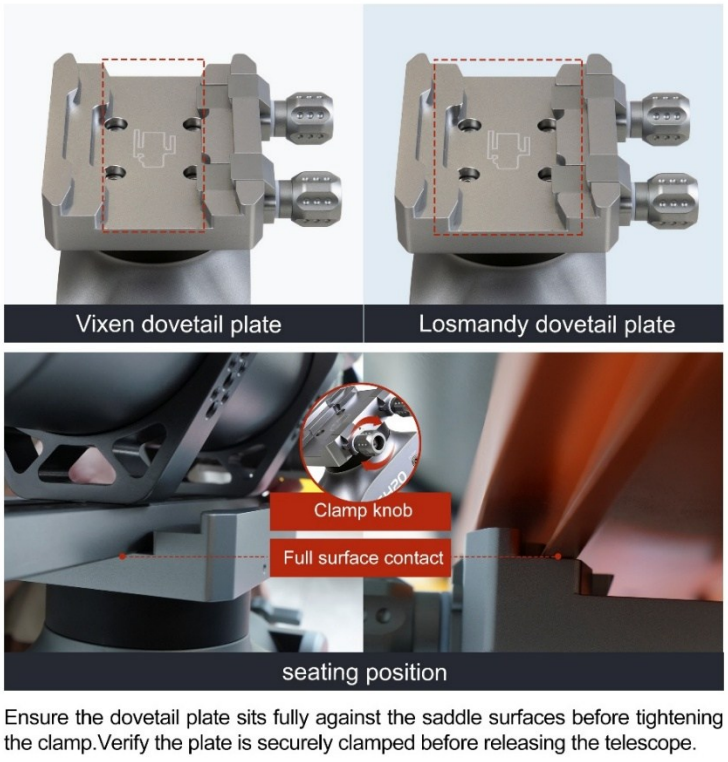


Figure 8-8 Dovetail saddle — Vixen and Losmandy seating positions.

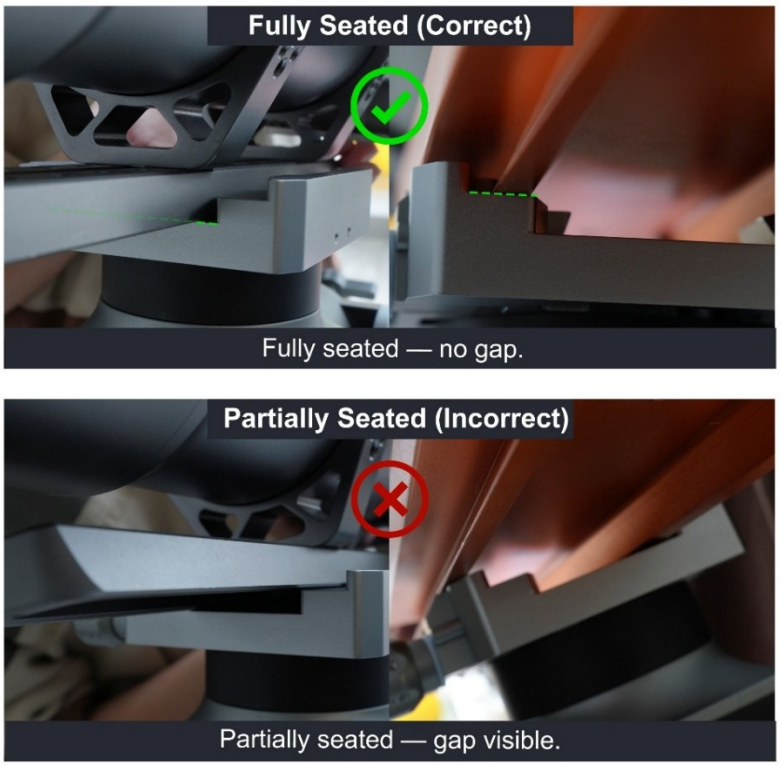


Figure 8-9 Fully seated vs partially seated dovetail comparison.

8.7 Load, Balance, and Counterweight Guidelines

Total OTA-side load is the mass of the OTA plus all saddle-mounted accessories. No counterweight is needed up to 20 kg. Above 20 kg, counterweight mass = total OTA-side load − 20 kg. Limits: 30 kg OTA-side load and 10 kg counterweight. The 20 cm distance is measured from the RA-axis center to the telescope optical center. Check balance after installation.

- Counterweight shaft interface: **M12 × 1.75**
- Maximum total counterweight mass: **10 kg**

Check	Pass Criteria	If Fail
Low-speed motion test (small move)	No sudden “drop” tendency; motion is smooth	Reduce the moment arm; above 20 kg, install the calculated counterweight; re-route cables
Holding position at rest	System does not swing unexpectedly when gently released (controlled)	Above 20 kg, install the calculated counterweight; otherwise reduce front-heavy accessories

NOTICE

Even with harmonic reducers, excessive imbalance increases motor load and can reduce tracking performance. We recommend balancing the OTA's center of gravity along the DEC axis before operation.

Table 27 Quick Load/Balance Check



Figure 8-10 Counterweight shaft, counterweight, lock knob, and safety stop installation.

8.8 Clearance Check (Collision Envelope)

Before powering on and before issuing any large slews, perform a clearance check.

Step	Do	Verify
1	With power OFF, visually inspect the OTA + camera + cables envelope.	No obvious contact points with tripod legs.
2	Ensure cables have slack at expected angles (near horizon and near zenith).	No cable becomes taut or can hook a leg.
3	Perform a slow, small movement test after power-on (see Chapter 5).	No contact; Stop works immediately.

Table 28 Clearance Check (Recommended)



Figure 8-11 Typical collision points — OTA / camera against tripod leg.

8.9 Cable Management (Best Practices)

Good cable routing prevents tracking issues, disconnects, and collisions.

Recommendations

- Create a **strain-relief loop** near the mount head so connectors are not loaded.
- Secure cables to the OTA or saddle area using Velcro ties.
- Avoid routing cables across rotating axis envelopes.
- Keep the DC power cable away from snag points and sharp bends.

8.10 Transport and Storage (Mechanical)

- Recommended end-of-session order: **Stop tracking → Home (or Park) → Power off → Remove OTA → Pack**.
- Protect the saddle and all connectors during transport.
- Store in a dry environment. Use desiccant if needed.

8.11 Mechanical Troubleshooting (Quick Reference)

Issue	Likely Cause	Quick Fix
Mount head wobbles on tripod	Base fastener not tight / debris on contact surface	Remove, clean, re-seat, tighten evenly
OTA slips in saddle	Dovetail not fully seated / clamp insufficient	Re-seat dovetail fully; tighten clamp; verify with lift test
Latitude/azimuth feels stuck	Lock not released / end-stop reached	Release lock; center adjusters; do not force
Cable snag during motion	Poor routing / insufficient slack	Re-route with strain relief; retest at low speed

Table 29 Mechanical Issues and Fixes

9 Electrical Interfaces, Power, and Status LEDs

This chapter describes the mount's electrical interfaces, recommended power practices, and the BT/SYS LED indications. It is intended to prevent common issues such as unexpected resets, unstable connections, and port damage.

9.1 Safety Notices (Read First)

WARNING—Polarity and overcurrent hazard

- **DC IN** is **12V DC, center-positive**. Reverse polarity may cause damage.
- Do not exceed the rated current of **DC OUT**. Overcurrent may cause malfunction or damage.

WARNING—Cable snag and unexpected motion

Loose cables can snag during motion and may cause sudden disconnects or stalls. Always route cables with strain relief and sufficient slack.

NOTICE— Moisture

Do not connect/disconnect power in wet conditions. Keep connectors dry and clean.

Quick rules

1. Use a regulated **12 V DC** supply rated at 3–7 A; **5 A is recommended**.
2. Verify **center-positive** polarity on DC IN before powering on.
3. Use short, adequate-gauge power cables to avoid voltage drop and resets.
4. **USB-C is data only** (not for power).
5. Keep cables strain-relieved and clear of moving parts.

9.2 I/O Panel Overview

The following interfaces are available on the mount head I/O panel.

Figure 9-1 shows all ports and LED numbers.

Interface	Number	Function	Key Notes
Hand Controller Port	1	Hand controller connection	RJ9 (4P4C), 4-pin
Bluetooth Reset	2	Clears Bluetooth pairing state	Hold for 3 seconds; see Section 9.8.1
Bluetooth LED	3	Bluetooth link indication	Blue only, see Section 9.3
USB-C (Data)	4	PC control and firmware update	USB 2.0 data only, not for power
System Status LED	5	Mount state indication	Mount status and power-on mode indication; see Section 9.3.
DC Power Input	6	Main power input for the mount	12 V DC; power-supply rating 3–7 A (5 A recommended); mount input current 5 A max; center-positive
DC Power Output	7	Power output for accessories	12V DC, max 5A, behavior: Section 9.5

Table 30 I/O Panel Interfaces

I/O panel (ports and buttons)

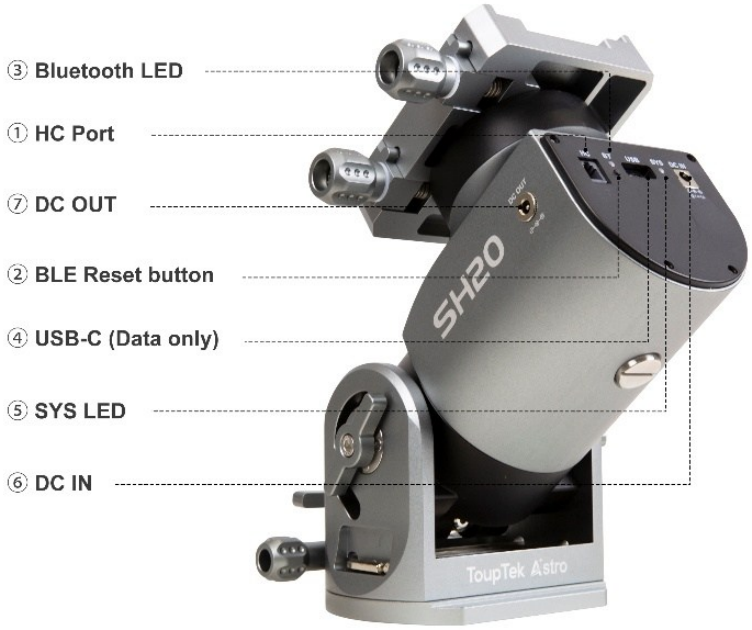


Figure 9-1 I/O panel — numbered callouts of all ports and LEDs.

9.3 Status LEDs (BT / SYS)

The mount provides two status indicators on the I/O panel:

- **BT LED (Blue only):** Bluetooth connection indication.
- **SYS LED: Mount status and power-on mode indication (Red / Yellow / Green / Blue).**

NOTE

Guiding does not have a dedicated LED indication.

LED	Color / Pattern	Meaning	Notes
BT	Blue ON (steady)	Bluetooth not connected	Ready to pair/connect
BT	Blue OFF	Bluetooth connected	If pairing fails, use Bluetooth reset (Section 9.8)
SYS	Red ON (steady)	Parked	Motion commands are rejected until Unpark (Chapter 5)
SYS	Red blinking	Parking (in progress)	Wait until parking completes
SYS	Green ON (steady)	Homed	Home reference established
SYS	Green blinking	Homing (in progress)	Do not power off during homing
SYS	Yellow blinking	Tracking	Tracking is not “Moving” (Chapter 5)
SYS	Yellow ON (steady)	Slewing (manual move)/ GOTO	Keep clear of moving parts
SYS	All OFF	Idle	No Park/Tracking/Slew/Homing active

Table 31 LED Indications

9.4 DC Power Input (DC IN)

9.4.1 Specification

- Connector: **5.5 × 2.1 mm**
- Input: **12V DC**
- Power-supply rating: 3–7 A (5 A recommended); maximum mount input current: **5 A**
- Polarity: **center-positive**

9.4.2 Recommended power practices

- Use a regulated 12 V DC power supply rated at 3–7 A; 5 A is recommended.
- Avoid thin DC cables; voltage drop can cause resets (especially during slews).
- Provide strain relief for the DC plug to prevent intermittent contact.

9.5 DC Power Output (DC OUT)

DC OUT may be used to power external accessories within the rated limit.

9.5.1 Specification

- Connector: **5.5 × 2.1 mm**
- Output: **12V DC**
- Maximum current: **5A**
- Output behavior: **always-on**

9.5.2 Usage guidelines

- Budget total downstream load. Do not exceed **5A** combined output.

- Avoid connecting/disconnecting high-load devices while slewing (recommended).
- If the accessory load causes mount resets, power the accessories from a **separate supply**.

Item	Do	Verify
Current	Keep total load ≤ 5A	No resets / no protection trips
Cabling	Use proper connectors and cable gauge	No heating at connector
Hot-plug	Prefer connecting loads when idle	Stable operation after connection

Table 32 DC OUT Usage Checklist



Figure 9-2 DC OUT location and 12 V / 5 A max rating callout.

9.6 USB-C (Data Only)

The USB-C port is used for PC control and firmware update.

- Interface: **USB 2.0, data only**
- Functions: **PC control** and **firmware update**
- Not supported: powering the mount via USB-C

Check	Pass Criteria	If Fail
Cable seating	Firm insertion; no wobble	Re-seat; try another cable
Strain relief	Cable does not pull-on port	Add slack loop / tie-down
Stability	No random disconnection	Avoid cable tension; use shorter cable

Table 33 USB-C Quick Checks

Firmware update procedure: see **Chapter 11**.

9.7 Hand Controller Port (HC)

- Connector type: **RJ9 (4P4C), 4-pin**
- Panel label: **HC**

Handling recommendations

- Connect/disconnect the hand controller when the mount is idle (recommended).

- Avoid pulling on the coiled cable; use strain relief if needed.

9.8 Wireless Reset (Bluetooth / Wi-Fi)

This section provides quick reset methods for connectivity recovery.

9.8.1 Bluetooth reset (mount head button)

- Location: on the I/O panel (BT button)
- Purpose: clears Bluetooth pairing state
- Action: press the button to disconnect Bluetooth. Press and hold for 3 seconds to reset Bluetooth.

9.8.2 Wi-Fi reset (via hand controller key combo)

- Wi-Fi operates on **2.4 GHz**
- Wi-Fi reset: LOCK OFF → hold Button 3 + Button 4 (HOME/PARK buttons) → LOCK ON → keep holding for 3 s.
- Result: resets Wi-Fi settings to default. Wi-Fi password is set to default.

Reset Type	How	When to Use	Result
Bluetooth reset	Hold the BT reset button on the mount I/O panel for 3 seconds.	Cannot pair / stale pairing / Disconnect last session.	Bluetooth pairing state cleared
Wi-Fi reset	LOCK OFF → hold Button 3 + Button 4 (HOME/PARK) → LOCK ON → hold 3 s	Cannot connect / wrong Wi-Fi state / forget Wi-Fi password	Wi-Fi settings reset to default

Table 34 Reset Quick Reference

9.9 Electrical Troubleshooting (Quick Reference)

Symptom	Likely Cause	Quick Action
Mount resets during slews	Voltage drop (cable/supply)	Use a regulated 12 V DC supply rated at 3–7 A (5 A recommended); shorten/thicken the cable and add strain relief.
No power	Wrong adapter / wrong polarity / loose plug	Verify 12V center-positive; re-seat plug
USB disconnects	Cable tension / unstable connection	Shorter cable; add slack loop; avoid pulling
Bluetooth won't connect	Stale pairing	Use Bluetooth reset (Section 9.8)
Wi-Fi won't connect	Wrong Wi-Fi state/settings	Use HC Wi-Fi reset combo (Section 9.8)
Accessories fail on DC OUT	Overload / DC OUT behavior	Reduce load; separate supply.

Table 35 Common Electrical Symptoms

Golden recovery sequence (recommended)

1. Stop commands → Park if possible
2. Power off → verify wiring and cable routing
3. Power on → Home or Park → Unpark → low-speed motion test

10 Hand Controller (HC): Controls and Basic Operations

This chapter describes the hand controller (HC) layout, button functions, LED indications, and the lock switch. It focuses on safe, minimal operations such as **Stop**, **Tracking**, **Park/Unpark**, **Find Home**, and **Wi-Fi reset**.

Reference

- Mount status LEDs (BT/SYS) are described in **Chapter 9**.
- Park gating behavior (Park blocks motion until Unpark) is described in **Chapter 5**.

10.1 Overview

The hand controller provides direct, night-friendly control of the mount for basic operations. It includes:

- One joystick for 8-direction manual movement
- Four backlit function buttons
- A side **LOCK** slide switch to prevent accidental touches



Figure 10-1 Hand controller overview — joystick, buttons 1–4, MHC label.

10.2 Connecting the Hand Controller

- Connect the HC cable to the mount head port labeled **HC** (RJ9, 4-pin).
- Recommended: connect/disconnect the HC when the mount is **Idle** (not slewing).

NOTICE - Do not pull the cable to unplug.

10.3 LOCK Slide Switch (Anti-mis-touch)

The side **LOCK** slide switch prevents accidental input during transport or handling.

LOCK State	Joystick / Buttons	Button backlight	Wi-Fi status indication	Other indicators
ON	Enabled	On (steady)	Not affected	Not affected
OFF	Disabled (no input)	Off	Not affected	Not affected

NOTE

LOCK OFF stops joystick motion and disables joystick/buttons, including Stop. Wi-Fi and status LEDs are **unaffected**.

10.4 Button and Joystick Functions

The HC provides the following controls. “Short press” and “Long press” are distinct actions.



Figure 10-2 Hand controller — button-ID overlay (Button 1–4).

Control	Short press	Long press
Joystick	8-direction manual movement	Hold joystick down: **speed multiplier**; release to restore preset (Section 10.5).
Button 1	**Track Enable**	**Track Disable**
Button 2	**Speed preset: from ×10 to ×720**	
Button 3	**Interrupt / Stop ongoing movement**	**Go Home**
Button 4	**Unpark**	**Park**

Table 36 Control map (Short press / Long press)

10.5 Slew Speed Indication and Speed Multiplier

10.5.1 Speed preset (Button 2)

Button 2 sets the manual slew speed preset. Short-press Button 2 to switch the preset speed between **×720** and **×10**.

Button 2 backlight indication (speed preset):

- Button 2 backlight **ON (steady)**: speed preset **×720**
- Button 2 backlight **OFF**: speed preset **×10**

NOTICE

Use **×10** for the first motion test after setup and whenever clearance is uncertain.

10.5.2 Joystick press (speed multiplier)

During manual slewing, hold the joystick down to apply the speed multiplier. Release the press to restore the preset speed:

- **×10 → ×20**

- **×720 → ×1440**
- **Heavy-load mode:** ×720 remains; ×720 (no increase)

Heavy-load mode rule: **heavy-load mode can be turned on through mobile APP or PC software.**

10.6 Tracking Indication (HC system LED)

Tracking state is indicated by the HC system LED:

- **Tracking ON:** Yellow LED **blinking**
- **Tracking OFF:** Yellow LED **OFF**

10.7 Mode Indication and Mode Switching (EQ / AZ)

10.7.1 Power-on mode indication

On power-up, the mount SYS LED and the HC system LED display the same mode sequence:

- **EQ mode:** Red → Yellow → Green (1 s per color, two cycles, 6 s total)
- **AZ mode:** Red → Yellow → Blue (1 s per color, two cycles, 6 s total)

10.7.2 Mode switching (EQ ↔ AZ) via HC (requires LOCK transition)

Mode switching requires deliberate action to reduce accidental switching.

Steps

1. Set **LOCK = OFF**.
2. Press and hold **Button 1 + Button 2**.
3. While holding, switch **LOCK from OFF → ON**, continue holding for **3 seconds**.
4. After 3 seconds, the mount mode switches and the mount SYS LED and HC system LED display the mode indication sequence. If Beep is set to Normal or Loud, a short beep is also heard; **Button 1** and **Button 2** can then be released.

WARNING

Follow Section 7 safety rules: switch modes only with Tracking **OFF, the mount at Home or Park,** and the **OTA/payload and counterweight removed**.

10.8 Wi-Fi Status and Wi-Fi Reset

10.8.1 Wi-Fi status indication

The HC system LED indicates a phone or PC connection to the HC's hotspot. The indication is the same in AP and bridge modes:

- **Wi-Fi connected:** HC system LED **is steady blue**
- **Wi-Fi connecting:** HC system LED blinks **blue; not connected: HC system LED is OFF**

NOTICE

Wi-Fi indication is not affected by LOCK.

10.8.2 Wi-Fi reset (requires LOCK transition)

Wi-Fi reset is performed via a deliberate key combo to prevent accidental reset.

Steps

1. Set **LOCK = OFF**.
2. Press and hold **Button 3 + Button 4** (HOME/PARK buttons).
3. While holding, switch **LOCK from OFF → ON**, continue holding for **3 seconds**.

4. During reset, the HC system LED **blinks** blue. After reset is completed, the HC system LED **turns OFF**.

10.9 Home Operation

10.9.1 Normal HOME via Button 3 (long press)

- With LOCK = ON, long press **Button 3** to return to the established Home position (Go Home).
- With LOCK = ON, short press **Button 3** to interrupt/stop ongoing mount movement.

10.9.2 Find Home via key combo (requires LOCK transition)

NOTICE

Use **Find Home** when the mount is out of sync with the current coordinates and needs to re-establish its **HOME reference position** and sync again.

Steps

1. Set **LOCK = OFF**.
2. Press and hold **Button 2 + Button 3**.
3. While holding, switch **LOCK from OFF → ON**, continue holding for **3 seconds**.
4. Find Home begins.

Important requirement

- Before running Find Home, use the HC joystick or software direction controls at low speed to place both axes within **±30°** of the default Home position (mechanical zero).

NOTICE

Do not power off during homing. (SYS LED: Green blinking indicates Homing; see Chapter 9.)

10.10 Common Issues (HC Quick Troubleshooting)

Symptom	Likely cause	Quick fix
Buttons/joystick do nothing	LOCK is OFF	Set LOCK to ON
Mount won't move	Mount is Parked	Press Button 4 (short) to Unpark
Tracking won't start/stop	Wrong press type	Button 1 short = enable; long = disable
Wi-Fi cannot connect	Stale Wi-Fi state	Perform Wi-Fi reset (Section 10.8.2)
Find Home fails	Not near home region	Use HC/software controls to place both axes within ±30° of Home; retry

Table 37 Common HC issues and quick fixes

11 Firmware Update and Recovery

The SH20 platform carries two independent firmware images:

- **SH (Mount Firmware)** — runs on the mount controller. Field name: **SH20_VERSION**.
- **MHC (HC Firmware)** — runs on the Hand Controller. Field name: **MHC_VERSION**.

Both images are updated from TMount through a single dialog. The mount must be connected (see § 6.3) and powered by a stable supply before the update is started.

11.1 Update Capability by Connection Method

Update Firmware support depends on the active connection mode. Use the table below to confirm both components can be updated before starting.

Connection Method	Update SH (Mount)	Update MHC (Hand Controller)
Wi-Fi Connection	Supported	Supported (Wi-Fi only)
Serial Connection (USB-C)	Supported	Not supported
Bluetooth (BLE)	Disabled — Update Firmware button grayed out	Disabled — Update Firmware button grayed out

Table 38 Firmware Update — Connection Method Support

NOTICE

MHC firmware can only be updated when the PC is connected to the mount via **Wi-Fi Connection**. Serial connections expose Update SH only. BLE connections disable the entire Update Firmware dialog.

11.2 Opening the Update Event Dialog

In the TMount main window press **Update Firmware** (lower-left). The **Update Event** dialog opens and reads the current firmware versions from the mount and HC, then queries the latest version available from the bundled firmware package.

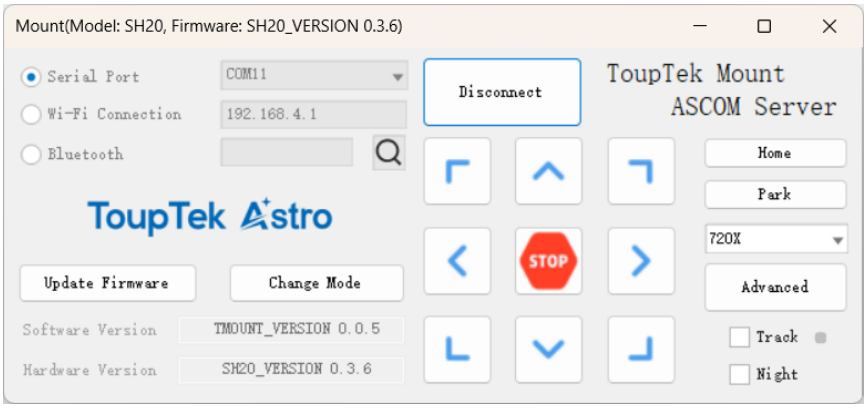


Figure 11-1 TMount Main window — Update Firmware button.

11.2.1 Reading the Update Event Dialog

Each row controls one firmware image. The two read-only fields on the right show the version currently installed on the device and the latest version shipped with TMount.

Field	Type	Meaning
Update MHC	Button	Starts the Hand Controller firmware update. Disabled when not Wi-Fi connected.
Update SH	Button	Starts the Mount firmware update.
Current Version	Read-only	Firmware string currently flashed on the device (e.g., MHC_VERSION 0.3.4, SH20_VERSION 0.3.4).
Latest Version	Read-only	Latest firmware string bundled with the installed TMount build (e.g., MHC_VERSION 0.3.5, SH20_VERSION 0.3.6).
Progress bar	Status indicator	Shows transfer/flash progress during an active update. Green = in progress, full = complete.

Table 39 Update Event Dialog Fields

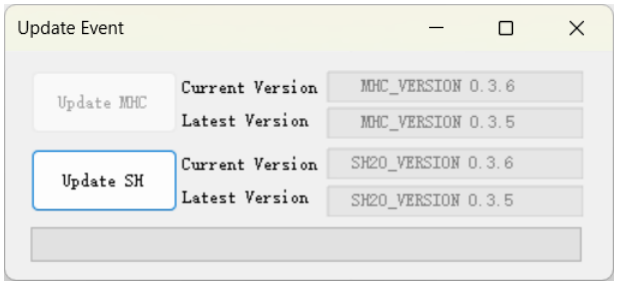


Figure 11-2 Update Event dialog — Current and Latest Version fields.

11.3 Mount Firmware Update Procedure (Update SH)

WARNING — Power loss during update

Loss of power during a firmware update can leave the mount in a non-bootable state requiring service-mode recovery. Before starting:

- Use a stable regulated 12 V DC supply rated at 3–7 A (5 A recommended). Do not use a nearly depleted battery.
- Do not unplug the DC IN connector, cycle the power switch, or detach the HC during the update.
- Set Beep to Normal or Loud before updating. Keep TMount open, the PC awake, and the active link connected until the final beep sequence completes.

Step-by-step procedure:

- **Step 1:** connect the mount via Wi-Fi (preferred) or Serial. Confirm the connection mode and version strings in the main window status area.
- **Step 2:** click **Update Firmware**. The Update Event dialog opens.
- **Step 3:** click **Update SH**. A warning prompt is displayed reminding you to maintain stable power throughout the update.

- **Step 4:** press **OK** to confirm. The update starts immediately.
- **Step 5:** the mount sounds one short **beep** (update started). The progress bar in the Update Event dialog begins to advance.
- **Step 6:** wait for transfer and flash to complete. Do not interact with the mount, the HC, or TMount during this period.
- **Step 7:** a second **beep** is sounded when the new image has been written. The mount drops the TMount connection automatically and reboots into the new firmware.
- **Step 8:** wait for the third tone — a **two-tone "beep beep"**. This indicates the reboot has finished and the mount is ready to accept new connections.
- **Step 9:** reopen TMount and reconnect using the same method as before. Open the Update Event dialog again to confirm **Current Version** now matches **Latest Version**.

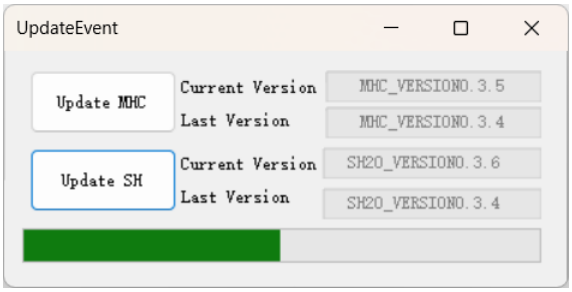


Figure 11-3 Update Event dialog — Update SH in progress.



Figure 11-4 TMount Main window after reboot — reconnect to verify.

11.4 Hand Controller Firmware Update Procedure (Update MHC)

The Hand Controller is updated through the same dialog. **Update MHC is enabled only when the PC is connected to the mount over Wi-Fi.** In Serial or BLE mode the button is grayed.

Procedure:

- **Step 1:** connect the PC to the HC-hosted Wi-Fi (see § 6.3.2 Network Connection).
- **Step 2:** in TMount, click **Update Firmware** to open the Update Event dialog.
- **Step 3:** click **Update MHC**. A warning prompt is displayed; press **OK** to start.
- **Step 4:** follow the same beep sequence as the mount update: first beep at start, second beep at completion (HC auto-reboots and the Wi-Fi link drops), third "beep beep" when the HC is back online.

- **Step 5:** the HC re-broadcasts its Wi-Fi SSID after reboot. Re-join the Wi-Fi network on the PC and reconnect in TMount to verify the new MHC_VERSION.

NOTICE

Because the HC update temporarily disables the Wi-Fi access point, the PC will report the **MHC_xxxxxx** network as unavailable for several seconds during reboot. This is expected — wait for the third "beep beep" before re-joining.

11.5 Beep Sequence Reference

The buzzer is the authoritative status indicator during a firmware update. The TMount progress bar and on-screen messages may stop updating before the device has actually rebooted; only the beep sequence below confirms the real state.

Event	Tone	Meaning
Update started	1 short beep	The OK button has been pressed and the device has begun writing the new image. Do not interrupt power.
Image flashed	1 short beep (second)	The new firmware image has been written. The device drops the TMount connection and reboots automatically.
Reboot complete	beep beep (third event, two tones)	The device has finished rebooting into the new firmware and is ready to accept new connections.

Table 40 Firmware Update — Beep Sequence

11.6 Recovery from a Failed Update

If an interrupted update leaves the mount or HC unable to start or connect, contact ToupTek Support for recovery instructions.

12 Maintenance, Storage, and Transport

This chapter explains basic user-serviceable maintenance, safe storage, and transport practices. Proper handling reduces the risk of damage, connection failures, and performance issues.

12.1 User-Serviceable vs. Not User-Serviceable

User-serviceable tasks

- Exterior cleaning (housing, ports, hand controller)
- Checking external fasteners (base mounting, saddle clamping)
- Inspecting cables and connectors (DC IN, DC OUT, USB-C, HC cable)
- Proper packing and moisture control during storage/transport

Not user-serviceable tasks

- Opening the mount housing or servicing internal components
- Adjusting motors, reducers, sensors, or internal wiring
- Lubrication or mechanical tuning

NOTICE

There are no user-serviceable parts inside the mount. Opening the housing may void warranty.

12.2 Recommended Maintenance Schedule

Item	After each session	Monthly	Quarterly	Before long-term storage
Wipe exterior surfaces	✓			✓
Inspect DC/USB/HC connectors	✓	✓		✓
Check base mounting tightness	✓	✓		✓
Check saddle clamp and dovetail seating	✓	✓	✓	✓
Check visible external screws for looseness		✓	✓	✓
Inspect power supply and cables for heat/damage	✓	✓		✓
Clean and dry storage case			✓	✓

Table 41 Maintenance Schedule

12.3 Cleaning and Protection

12.3.1 Exterior cleaning

- Use dry microfiber cloth for routine cleaning.
- For stubborn dirt, use a slightly damp cloth with mild detergent.
- Do **not** use strong solvents (e.g., acetone, gasoline) on painted/anodized surfaces.

12.3.2 Port cleaning (DC IN / DC OUT / USB-C / HC)

- Power off before cleaning.
- Keep ports dry and free of dust.
- Do not spray liquid into connectors. Use a dry swab or compressed air (low pressure) if needed.



Figure 12-1 Port cleaning — recommended (left) vs not recommended (right).

12.4 Fastener and Mechanical Checks

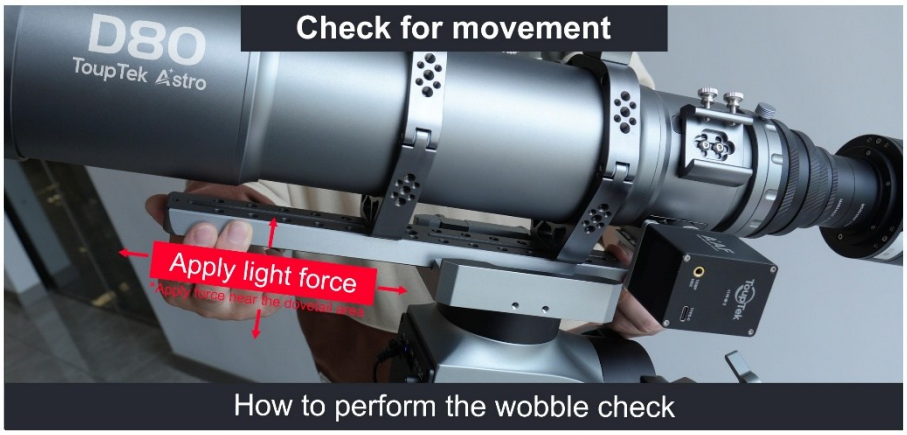
Loose mounting interfaces are the most common cause of wobble, slip, and unexpected behavior.

Item	Do	Verify
Base mounting (mount head ↔ tripod/pier)	Tighten evenly (cross pattern if applicable)	No rocking or rotation by moderate hand force
Saddle clamp	Seat dovetail fully, then tighten firmly	No slip in a gentle lift/rock test
External visible screws	Visual check for looseness	No abnormal gap, no rattling sound

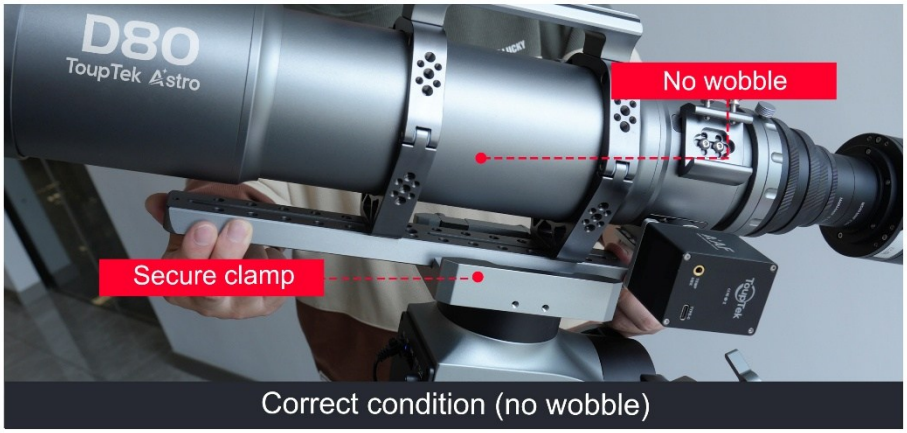
NOTICE

If the mount shows wobble after tightening, remove and re-seat the interface surfaces (debris can prevent proper seating).

Table 42 Mechanical Checks (Do / Verify)



After installing the telescope, gently apply light force to check for any movement.



The telescope should remain secure with no noticeable wobble.

*If wobble is detected, recheck the saddle clamp and dovetail seating.

Figure 12-2 Wobble check — apply light force and verify no movement.

12.5 Transport and Carrying

Your mount is supplied with a protective weather-resistant carrying case (“rugged case”). Proper packing is required to prevent impact and connector damage.

12.5.1 Before transport (recommended procedure)

1. Stop any motion and park the mount (recommended).
2. Power off.
3. Disconnect external accessories:
    - Remove the OTA and heavy imaging train (camera, filter wheel, OAG, guidescope).
    - Unplug external cables (DC IN/DC OUT/USB/HC) and secure them separately.
4. Protect connectors (use caps if provided).

WARNING— Tip-over and drop hazard

Always remove the OTA before carrying the mount/tripod assembly.

Carrying guidelines

- Do not lift the mount by cables or connectors.
- Do not use the saddle as a carry handle unless explicitly designed for that purpose.
- Keep the mount close to the body during lifting.

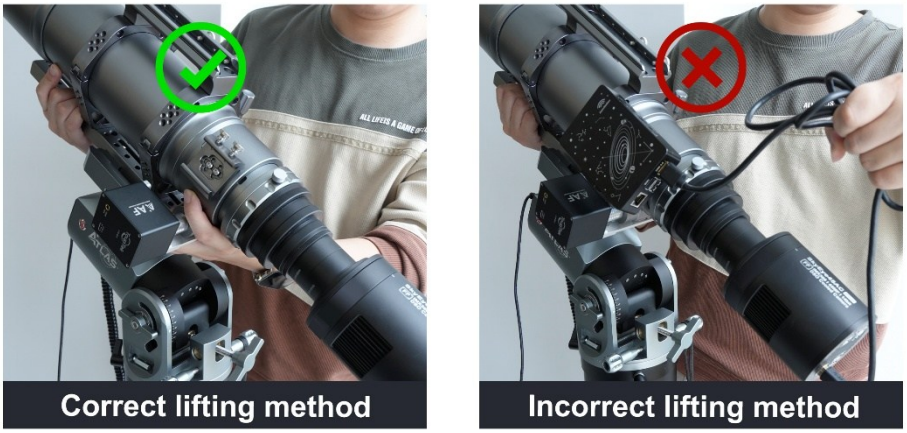


Figure 12-3 Correct vs incorrect lifting method.

12.5.2 Packing in the rugged case

- Place the mount into the foam cutout in the intended orientation.
- Ensure no cable is trapped between the foam and the housing.
- Store the hand controller and cable in the designated compartment to avoid connector stress.

12.6 Storage and Moisture Control

12.6.1 Short-term storage

- Power off, cover the mount, and store in a dry place.
- Coil cables loosely (avoid sharp bends near connectors).

12.6.2 Long-term storage

- Store the mount in the rugged case with desiccant packs (recommended).
- Keep the case in a cool, dry environment.
- If stored in a high-humidity region, check desiccant condition periodically.

NOTICE— Condensation risk

If the mount is moved from a cold environment to a warm indoor environment, allow it to reach room temperature before powering on.

Scenario	Recommended actions
Normal indoor storage	Cover ports, keep dry, avoid dust
High humidity / coastal	Use desiccant; clean ports more frequently
Long-term storage (weeks+)	Rugged case + desiccant; periodic inspection

Table 43 Storage Checklist

12.7 When to Contact Support

Stop using the mount and contact support if any of the following occurs:

- Burning smell, smoke, or visible scorch marks on connectors
- Repeated random resets after confirming a stable 12V supply and cable integrity
- Uncontrollable motion, persistent stalling, or mechanical binding
- Loose ports or damaged connectors

13 Troubleshooting

This chapter provides symptom-based troubleshooting to quickly restore normal operation. Start with the "Golden Recovery Sequence," then use the tables to identify likely causes and corrective actions.

13.1 Golden Recovery Sequence (Recommended)

1. **Stop**: with LOCK = ON, short-press **Button 3**  on the hand controller to interrupt/stop motion.
2. If controllable, **Park** the mount (HC Button 4 long press). Returning the mount to Home is also acceptable.
3. Power off. Inspect:
    - DC IN connection and polarity
    - Cable routing (no snags, sufficient slack)
    - Any overloaded accessories on DC OUT
4. Power on. Confirm normal LED indications (Chapter 9 and Chapter 10).
5. Unpark, then test a low-speed manual move (×10 or ×20) to verify control.
6. If out-of-sync or position reference is uncertain, run **Find Home** (Chapter 10).

13.2 Power and Reset Issues

Symptom	Likely cause	Quick fix	Escalation
Resets during slews	Voltage drop (supply/cable)	Use a regulated 12 V DC supply rated at 3–7 A (5 A recommended); shorten/thicken the DC cable and add strain relief.	If persists with verified supply, contact support
No power	Wrong adapter / wrong polarity / loose plug	Verify 12V center-positive; re-seat plug; try known-good supply	If still dead, contact support
Accessories cause instability	DC OUT overload or transient load	Disconnect accessories; power them separately; keep DC OUT ≤ rated limit	If DC OUT trips repeatedly, contact support

Table 44 Power / Reset Troubleshooting

13.3 Connection Issues (Wi-Fi / Bluetooth / USB / Hand Controller)

Symptom	Likely cause	Quick fix	Reference
Wi-Fi cannot connect	Wrong Wi-Fi state / stale config	Perform **Wi-Fi reset** (HC key combo)	Section 10.8
Bluetooth pairing fails	Stale pairing state	Use **Bluetooth reset** on mount head	Section 9.8
USB disconnects	Cable tension / poor cable	Use shorter data cable; add slack loop; avoid pulling on port	Section 9.6

HC does not respond	LOCK is OFF / RJ9 not seated	Set LOCK=ON; re-seat RJ9; avoid cable strain	Section 10.3

Table 45 Connectivity Troubleshooting

13.4 Motion Issues (Mount does not move / cannot stop)

Symptom	Likely cause	Quick fix	Notes
Mount will not move	Mount is Parked	**Unpark** (HC Button 4 short press)	Park blocks motion until Unpark
Joystick/buttons do nothing	LOCK is OFF	Set LOCK = ON	Wi-Fi and indicators still work when LOCK is OFF
Cannot stop motion	Wrong control used	Set LOCK = ON; short-press **Button 3** to stop	Keep clearance in mind
Motion direction feels wrong	Mode mismatch (EQ/AZ)	Confirm current mode; Switching mode refers to Section 7	Mode switch requires safe state

Table 46 Motion Troubleshooting

13.5 Tracking and State Confusion

Users often confuse tracking with motion. Tracking is considered a normal operating state and may not look like “movement.”

Observation	Meaning	What to do
SYS LED Yellow blinking	Tracking ON	Normal; tracking is not “moving”
SYS LED Yellow steady	Slewing (manual move) /GOTO	Keep clear; verify cable clearance
SYS LED Red steady	Parked	Unpark to accept motion commands
SYS LED Red blinking	Parking in progress	Wait until parking completes
SYS LED Green blinking	Homing in progress	Do not power off
SYS LED Green steady	At Home	Home reference established
SYS LEDs all OFF	Idle	Normal idle state

Table 47 State Confusion (LED-based)

13.6 Home / Find Home and Sync Issues

Symptom	Likely cause	Quick fix	Reference
Position is out-of-sync	Reference lost or incorrect	Run **Find Home** to re-establish HOME	Section 10.9.2
Find Home fails	Not near home region	Use HC/software controls to place **both axes within ±30°** of Home; retry	Section 10.9.2
Homing interrupted	Power loss / user stop	Ensure stable power; restart home operation if required	SYS green blinking indicates homing

Table 48 Home / Sync Troubleshooting

13.7 LED Quick Diagnosis (One-page)

Indicator	Pattern	Diagnosis
BT LED	Blue ON	Bluetooth not connected (ready)
BT LED	Blue OFF	Bluetooth connected
SYS LED	Red steady	Parked (motion rejected)
SYS LED	Red blinking	Parking in progress
SYS LED	Green blinking	Homing in progress
SYS LED	Green steady	Homed
SYS LED	Yellow blinking	Tracking
SYS LED	Yellow steady	Slewing
SYS LED	All OFF	Idle
HC system LED	Blue steady / blinking / off	Connected / connecting / not connected
HC Button 2 backlight	ON / OFF	×720 preset / ×10 preset

Table 49 LED Quick Diagnosis

13.8 When to Escalate to Support

Stop using the mount and contact support if:

- Any connector shows burn marks, melting, or abnormal odor
- The mount resets repeatedly with a verified stable supply and short cable
- Motion is uncontrollable, persistent stalling occurs, or mechanical binding is observed
- Ports are loose or physically damaged

Revision History

Version	Date	Changes
V17	2026-10-27	Corrected the azimuth adjustment range to ±6° (12° total) and added revision history.
V18	2026-10-29	Updated periodic error to ±15 arcsec and removed the hand controller cable length from the package list.