

How to Track Satellites with a Skywatcher Telescope Mount

1. Using a Windows PC

1.1 Hardware requirements

- A Skywatcher telescope mount equipped with a generation 3 motor controller whose firmware is version 3.39 or above.
- The motor controller should
 - Connect to the PC with its built-in USB port.
OR
 - Connect its hand control port to the PC with a SynScan USB dongle.
OR
 - Connect its hand control port to the PC with a third-party USB dongle.
OR
 - Connect its hand control port to the PC with a SynScan Wi-Fi dongle running firmware version 1.10 or above.

The latest firmware for the SynScan Wi-Fi dongle can be downloaded at:
<http://www.skywatcher.com/download/software/accessories/>

- Currently supported mounts include:
 - AZ-GTi, AZ-GTe and AZ-GTiX
 - Virtuoso GTi
 - Star Adventurer GTi
 - StarDiscovery ([with built-in Wi-Fi](#))
 - Skyliner Dob-GOTO ([with built-in Wi-Fi](#))
 - CQ350
 - Star Gate GOTO ([with built-in USB port](#))
 - EQ6-R, EQ8-R, AZ-EQ6, EQ6, EQ8 ([with built-in USB port](#))
 - HEQ5 ([with firmware version 3.xx](#))

[Note: Users can contact a local Skywatcher dealer to purchase a generation 3 motor controller and accessories to upgrade the mounts that are currently equipped with generation 1 \(with the version 1.xx firmware\) or generation 2 \(with the version 2.xx firmware\) motor controllers.](#)

1.2 Software requirements

- SynScan Pro app for Windows 2.0.12 or above.
- Skywatcher Satellite Tracker application.
- The PreviSat application in this package or the latest version from [Astropedia \(free.fr\)](http://Astropedia.free.fr), or other applications that can generate the satellite's trajectory data in the format required by the Skywatcher Satellite Tracker application.
- ASCOM Platform, [Download Center \(ascom-standards.org\)](http://Download.Center/ascom-standards.org)
- Microsoft .Net runtime libraries.

1.3 Operation Instructions

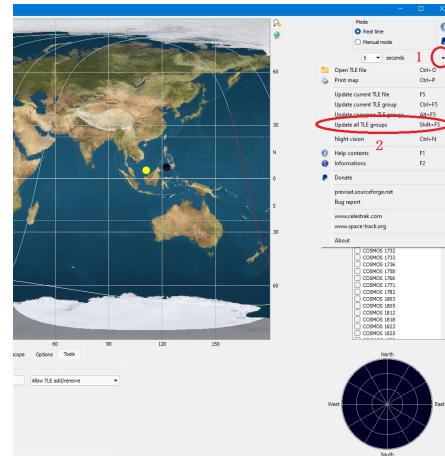
- 1.3.1 Synchronize the PC's Windows time using an internet timer server that has the minimum latency.

1.3.2 Run the SynScan Pro app for Windows and do a 2-Star or a 3-Star alignment.

1.3.3 Use PreviSat to generate the tracepoints data set of a selected satellite.

- Run the executable file in the PreviSat package to install the PreviSat application.

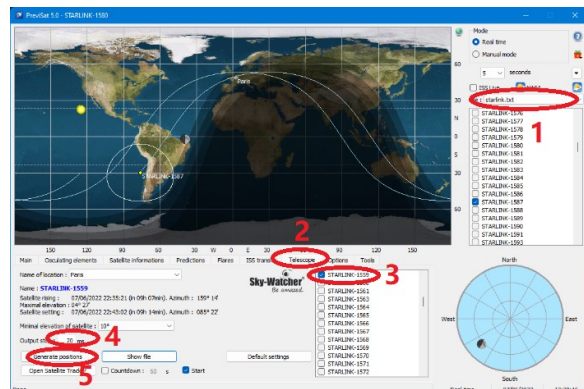
- Run PreviSat application and update its TLE data before each observation.
 - Make sure the PC connects to the internet.
 - Start PreviSat.
 - Click in the order as shown in the picture to the right.



- Input the geographic location of the observing site in PreviSat's "Options\Location" page.

- Follow the orders shown in the picture to the right to generate a satellite's tracepoints data file.

- In the "File" section, choose a catalog of satellites.
- Click the "Telescope" tag.
- Choose the satellite.
- Input the interval time of the tracepoints.



- If the SynScan Pro application uses a wired connection to control the mount, the recommended interval time is 20ms for smoother slewing.
- If the SynScan Pro application uses a wireless connection to control the mount, the recommended interval time is 200ms for more reliable communication to reduce tracking interruption.
- Click "Generate Positions" to generate the tracepoints data file. The data file is stored in the folder "\Documents\Astropedia\PreviSat".

1.3.4 Observing the satellite with the Satellite Tracker application, Procedure 1:

1.3.4.1 Connect to the SynScan Pro app in the Satellite Tracker

- The Satellite Tracker application communicates with the SynScan Pro application using the network interface, thus users should make sure both the PC running the

Satellite Tracker and the device running the SynScan Pro app is in the same network. For example:

- A PC runs both Satellite Tracker and the SynScan Pro for Windows
- The device (can be a PC, an Android device, or an iOS device) that runs the SynScan Pro app controls the mount via the mount's Wi-Fi access point, and the PC that runs the Satellite Tracker application also connects to the mount's Wi-Fi access point.
- Click the “Connect” button in the Satellite Tracker application, it will search and connect to the SynScan Pro application running in the same network. If it fails, click the “Settings...” button and try to set the IP address of the device that runs the SynScan Pro app.
- If the Satellite Tracker application and the SynScan Pro application run on the same PC, it is recommended to click the “Settings...” button, clear “Search devices when connecting”, and fill the “Connect to IP” with the local host IP address “127.0.0.1”

1.3.4.2 Load the satellite's tracepoints

- Click the “Open .csv” button in the Satellite Tracker application to load the data file generated by PreviSat, it is stored in the folder “\Documents\Astropedia\PreviSat”.
- If the R.A. / Declination coordinates in the data file are in J2000 epoch, check the “J2000” checkbox; otherwise, clear the checkbox.

1.3.4.3 Test run

Check the “Test run” checkbox in the Satellite Tracker application, then click the “Start” buttons to simulate the tracking. Users can set a longer “X” value to reserve sufficient time for the mount to slew to the first tracepoint.

1.3.4.4 Realtime observing.

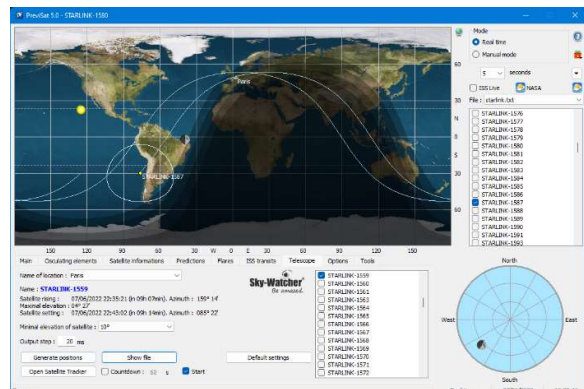
Make sure the “Test Run” checkbox is cleared. Click the “Start” button to start observing. The mount will slew to a tracepoint that is at least 20 seconds later than the current time and wait for the satellite.

1.3.5 Observing the satellite with the Satellite Tracker application, Procedure 2:

1.3.5.1 Follow instructions in sections 1.3.1, 1.3.2, and 1.3.3.

1.3.5.2 Click the “Open Satellite Tracker” button. On the first run, the PreviSat will ask for the location of the Satellite Tracker application’s “EXE” file.

1.3.5.3 The PreviSat will launch the Satellite Tracker application and pass the file path of the



generated data file to the Satellite Tracker application.

1.3.5.4 If the “Start” checkbox has been checked, the Satellite Tracker application will connect to the SynScan Pro application, and start tracking the satellite automatically.

1.3.5.5 If both “Start” and Countdown” checkboxes have been checked, the Satellite Tracker will start a test run automatically.

1.3.6 Manual guiding (Adjust the satellite's position in FOV)

- While the mount is tracking a satellite, the user can use the direction buttons in either the Satellite Tracker application or the SynScan Pro application to change the satellite's position in the telescope's FOV. Use the “+” or “-” button to choose the manual guiding speed.

1.3.7 Photography

- Satellite Tracker supports using an ASCOM-compatible camera to take pictures while tracking satellites.

1.3.8 Limitation

On a site that has multiple Wi-Fi networks, using a wireless connection to control the mount might introduce a high ratio of tracking interruption.

1.4 Warning:

- On an equatorial mount, while tracking a satellite, the SynScan Pro app for Windows (version 1.19.18) will automatically control the mount to do a meridian-flipping after the satellite passes the meridian for approximately 5 degrees.

Credit:

PreviSat application is developed by Fabrice Dupré in France (<http://astropedia.free.fr/>). We appreciate that he allows us to include PreviSat application in this package.

For 3rd party software developers:

- Skywatcher welcomes developers to write their own code to control a Skywatcher's mount. Limited development supports are available upon request, please contact:

app@skywatchertelescope.net.

- The Skywatcher Satellite Tracker application supports the following command line parameters.

--infile Specify the .csv file to load.

--epoch Epoch of the RA/Dec data in the .csv file. Either 'J2000' or 'JNow'.
If not specified, use the last value that was set in UI.

--countdown Set test run countdown seconds.

Without this argument, tracking starts at the time specified in the .csv file.
With this argument, tracking starts countdown seconds after the time sending data to the SynScan app began. This means that the mount has about countdown seconds to slew to the first point.

--start With this argument, the Satellite Tracker will start tracking the satellite at

program launch, including connecting to the SynScan app and sending a set mount clock command. When using this argument, the 'infile' argument is required.

--help Display this help screen.
--version Display version information.

Example of true tracking:

```
"Satellite Tracker.exe" --infile "path/to/data.csv" --epoch jnow --start
```

Example of a test run:

```
"Satellite Tracker.exe" --infile "path/to/data.csv" --epoch jnow --countdown 20 --start
```

2. Using an iOS Device

2.1 Hardware requirements

- A Skywatcher telescope mount equipped with a generation 3 motor controller whose firmware is version 3.22 or above.
- The motor controller has a built-in Wi-Fi module; or, connects to a SynScan Wi-Fi dongle running firmware version 1.10 or above. The latest firmware can be downloaded at: <http://www.skywatcher.com/download/software/accessories/>
- Currently supported mounts include:
 - AZ-GTi, AZ-GTe and AZ-GTiX
 - Virtuoso GTi
 - Star Adventurer GTi
 - StarDiscovery (with built-in Wi-Fi)
 - Skyliner Dob-GOTO (with built-in Wi-Fi)
 - CQ350
 - Star Gate GOTO (with built-in USB port)
 - EQ6-R, EQ8-R, AZ-EQ6, EQ6, EQ8 (with built-in USB port)
 - HEQ5 (with firmware version 3.xx)

Note: Users can contact a local Skywatcher dealer to purchase a generation 3 motor controller and accessories to upgrade the mounts that are currently equipped with generation 1 (with version 1.xx firmware) or generation 2 (with version 2.xx firmware) motor controllers.

- An iPhone or an iPad.

2.2 Software requirements

- SynScan Pro app for iOS
- Luminos or Luminos Pro app

2.3 Operation instruction

- Run the SynScan Pro app and do a 2-Star or a 3-Star alignment.
- In Luminos app, choose SynScan Link as the telescope device; in Luminos Pro app, choose SynScan/SynScan Pro app as the telescope device.
- Turn on telescope connection in Luminos.
- In Luminos, choose the satellites to be observed, and then tap the GOTO icon.
- While the mount is tracking the satellites, use the slewing controls to re-position the satellite in the telescope's FOV.

2.4 Limitation

- On a site that has multiple Wi-Fi networks, there might be a high ratio of tracking interruption. In this case, tap the GOTO icon in Luminos again to resume tracking.

2.5 Warning:

- The current iOS app does NOT support automatic meridian flipping on an equatorial mount while tracking a satellite. We do NOT recommend using an equatorial mount for tracking satellites.

- If a user does want to use an equatorial mount to track a satellite, please cancel the tracking in the mobile app (Luminos) before the satellite passes the meridian; or, start satellite tracking after the satellite has passed the meridian.

3. Other applications

- SkyTrack

Website: www.heavenscape.com

Requirments:

- A Skywatcher mount running firmware version 3.39 or above
- SynScan Pro app 2.0.12 or above