Setting up a 6″ Sky-Watcher Startravel-150 refractor on an HEQ-5 PRO mount

Disclaimer: This article is provided for informational purposes only. I am sharing a story about what has worked for me, not professional advice. Your equipment, environment, and experience will be different to mine. Please research carefully and make your own decisions before attempting any setup changes with your own equipment, as any modifications or use of this article is entirely at your own risk.

Introduction

This article is a summary of how I currently set up my OTA and mount.

My initial GoTo errors were of the order of 40-60” (arcseconds) and often outside of the field of view of a low power eyepiece. It was so bad, and so very different to what I had expected from a GoTo ‘scope, that I suspected a fault with the mount. It took me exactly 12 months to work out why the GoTo accuracy of this OTA and mount assembly was so poor.

Methodical working, recording every observation and planning deliberate sessions to help identify the source of the errors identified three main causes:

- some bad hardware,
- poor instructions, and
- new skills that I needed to learn.

A year later, I am still learning but now achieving a GoTo accuracy of around 3-5”, which is more than good enough for visual use.

Hardware Actions

Fitting the latitude bolts on the mount: not a cause of error – I mention it because these are obviously needed, yet the manual supplied with the mount did not have an ***explicit*** step to do it! I have carefully oiled these twice with WD40 (removed from the mount!) and may need to repeat, as they are quite stiff in use.

Dovetail Bar: I presumed that the (short) Vixen-style dovetail bar pre-fitted to my OTA was suitable for use - that assumption was wrong. The objective lens is quite heavy and it was not possible to properly balance the tube in DEC as the pre-fitted bar was too short. I had to buy and fit a longer one (but also see *‘Imperial-sized hardware’* next).

I then attached the old bar across the top of the OTA, opposite the new bar. In this position the old bar provides extra rigidity to the OTA set up and acts as a handle (important, as this OTA is quite heavy).

Imperial-sized hardware: This SkyWatcher OTA and mount use USA-sized fittings, despite all of Europe using metric measures. Why on Earth would a major brand sell equipment needing USA-sized fittings in Europe? That was a

shock, and it meant having to buy Imperial-sized allen keys, small spanners, and a stock of nuts and bolts.

Polar scope reticle: The reticle is not properly aligned in my polar scope. Examining its alignment visually, when the mount is vertical around the RA axis, I see it is offset by about +10' of RA that I need to account for when polar aligning. I have not wanted to try realigning the reticle as it is fragile and easily damaged.

I also bought a right-angle viewer that slips over the polar scope. Using this means I can work comfortably when polar aligning, and hence take my time to get it right. This viewer also has a x2 magnification setting which helps to ensure that polar alignment is as accurate as possible.

Finder-scope: The provided finder scope was "straight through", mounted close to the telescope tube, and very uncomfortable to look through. I replaced it with a 50mm RACI (right-angle, correct image) finder.

Now I don't have to contort my neck when using it, and it shows a true image of the sky (not reversed).

I also bought a vixen-style finder bracket, fitted it to the old dovetail bar and moved my finder-scope to that more comfortable position.

Lubricated the dovetail clamp bolts: after limited use in cold weather, the dovetail clamp bolts on the mount became very stiff. I very carefully lubricated these with WD40, ensuring the oil only sprayed on the bolts, not on the saddle or elsewhere on the mount. I have only had to do this once.

Replaced the rack-and-pinion focuser with a Crayford focuser: The provided focuser was introducing circa 30" or more of GoTo error into my setup. This error was swamping everything else and making it very hard to use the telescope. It was necessary to work very carefully so that not a single speck of white paint from the outside of the tube fell inside it – there are videos online showing how to do this upgrade.

Purchased an illuminated reticle, cross-hair eyepiece: For star alignments, this helps to ensure that stars are accurately centred - an essential step for accurate pointing.

With those hardware changes having been done…
… <u>this is *MY* method for Setting Up The Mount</u>

I'm not suggesting this is a good or best way to set up this telescope. It is the method I am currently using.

Note: I polar align before fitting the counterweights and OTA as my tube is quite heavy – with lighter equipment you may not need to do that.

Tripod

1. Place the tripod on a solid surface, with the mount and accessory tray already fitted, facing towards the North.
2. Fully extend the tripod legs (to avoid the eyepiece being too close to the ground for comfortable use).

3. Shift the tripod by eye to roughly align the direction of the RA-axis towards Polaris.

4. Check the tripod is **absolutely level**. This is essential, as a skewed tripod would lead to skewed GoTo's later on.

   My tripod has a built-in spirit level.

Now constantly repeat the mantra ***"do not kick the tripod… do not kick the tripod…!***"

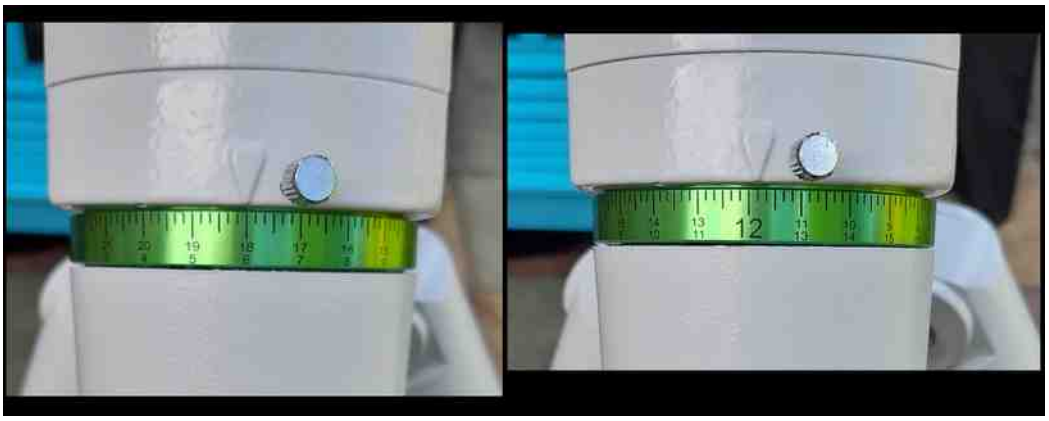
Polar Alignment

5. Plug in the power supply to the mount, but do not turn the power on at the mains yet.
6. Plug in the Synscan handset.

7. Remove the front and rear covers over the polar alignment scope in the mount.
8. Extend the counterweight bar, and rotate the DEC axis to see through the polar scope.
9. Attach the magnified, right-angle viewer to the polar scope, to make it easier to read.

10. With the RA clutch disengaged, rotate the mount to the horizontal position around the RA axis, **checking it is absolutely level** with a small spirit level.

11. Once the mount is horizontal, set the RA dial to 6h / 18h.
12. Rotate the mount in RA back to 11:50 mins.
    If your polar scope reticle is fitted vertically, you would rotate back to 12h, but I have a 10mins of RA error on my reticle alignment that I need to work around.



13. Lock the RA clutch.

14. Turn on mains power.
15. Turn on the mount.
16. Adjust the brightness of the polar scope illuminator using the SynScan handset.

17. Using an app like *'Polar Finder Pro'*, identify the required position of Polaris in the polar finder reticle.
18. Use the azimuth and latitude bolts to move Polaris to the required position on the polar finder reticle. **Take as long as needed on this step, making the alignment as accurate as is possible by eye.**
19. Remove the right-angle viewer, replace the polar scope caps and turn the mount off.

Fitting the OTA

20. Fit the counterweights, **being very careful now not to disturb the mount head or tripod**. Using a small stool, fit the telescope tube onto the saddle. Check that it is properly in place and that the saddle bolts are tightened.

21. Insert the illuminated reticle eyepiece used for star alignment.

22. Release the RA and DEC clutches.
23. Rotate the telescope tube about both axes, checking how it is balanced. **Aim to have the tube PERFECTLY balanced.**
    i. Adjust the counterweights to correct any imbalance about the RA axis.
    ii. Adjust the tube in the saddle to correct any imbalance about the DEC axis.
24. Lock the tube into a comfortable position in DEC and rotate the mount in RA until it is **absolutely horizontal** (checking with a spirit level).
25. Make sure the RA dial is set to 6h / 18h.
26. Rotate the mount head in RA back to 12h and lock the RA clutch.
27. Rotate the tube about the DEC axis until it is **absolutely horizontal** (checking with a spirit level).
28. Make sure the DEC dial is set to 0 degrees.
29. Rotate the tube in DEC until the dial reads 90 degrees and lock the DEC clutch.
30. The mount is now in the “Home Position”.

Star Alignment

31. Turn the mount on.
32. Enter the latitude, longitude and altitude of the observing site as requested by the handset. **Double-check these are entered correctly at each step.**
33. Enter the current date and time in **UTC**. **Double-check these are entered correctly.**
34. As time has been entered as UTC, set the time zone to +0h and say no to daylight saving. This totally avoids any confusion about how the mount may be translating local time to UTC.
35. Now complete a star alignment.

    When 2-star aligning and setting PAE’s, **it is critical to**:

    a) take as much time as is needed to ensure that the alignment stars are as close to the centre of the field of view as possible, and

    b) finish each movement of the ‘scope with an “up and right” motion, backing up and trying again if you ‘overshoot’.

(this takes up the slack in mount, ensuring that the mount's record of where it is pointing is accurate, and significantly improves the accuracy of subsequent movements).

In my observing location I cannot see West, and very little to the SW or NW. I also have a cluttered view near the horizon. I therefore cannot see enough stars to complete a 3-star alignment.

I have learnt that, for my telescope and observing site, the best I can do is to complete a 2-star alignment. This means that the global map of the sky in my mount is inaccurate. I partially compensate for this by choosing alignment stars suited for the local area of sky that I have planned to be observing in. My workflow is to use ChatGPT to help select these alignment stars, but you may well have other/better ways of doing that if your site is similarly constrained.

Having 2-star aligned, I then go to 7-8 brighter stars around and at the centre of the local area I will be observing in. After accurately centering these stars, for each one I use the handset's ***"PAE" function*** to improve the accuracy of the local sky model in the mount.

I have found that after completing these steps, as carefully and accurately as possible, my GoTo accuracy for the objects I have planned to observe is around 3-5", and about as good as I expect to get from this setup for visual use.