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Your Complete Guide to Astronomical Equipment

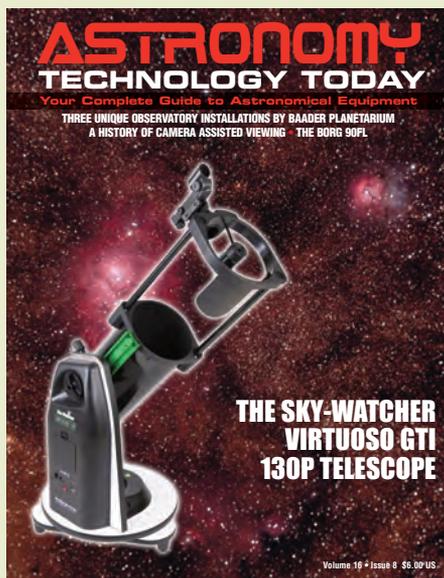
THREE UNIQUE OBSERVATORY INSTALLATIONS BY BAADER PLANETARIUM
A HISTORY OF CAMERA ASSISTED VIEWING • THE BORG 90FL



**THE SKY-WATCHER
VIRTUOSO GTI
130P TELESCOPE**

Cover Article - Page 55

In his cover article Dr. James Dire not only takes the Sky-Watcher Virtuoso GTi 130 through its paces, but he also provides an added bonus building a custom tripod table for the GTi 130. The background astro image was taken by Mark Zaslove and is of the M8/M20 (Lagoon and Trifid nebulae) region of Sagittarius captured with a QHY10 through the Borg 90FL, in which he reviews.



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Phillip Benson has been a life-long amateur astronomer based in SE England. When he was just a year old, his parents bought a house, which was previously owned by the chairman of the local astronomical society. An IT Technician by profession, Phil likes to combine his love of astronomy, photography and technology.



James Dire has a M.S. degree in physics from the University of Central Florida and M.A. and Ph.D. degrees from The Johns Hopkins University, both in planetary science. He has been a professor of chemistry, physics and astronomy and an administrator at several colleges and universities. He has played a key role in several observatory projects including the Powell Observatory in Louisburg, KS, which houses a 30-inch (0.75-m) Newtonian; the Naval Academy observatory with an 8-inch (0.20-m) Alvin Clark refractor; and he built the Coast Guard Academy Astronomical Observatory in Stonington, CT, which houses a 20-inch (0.51-m) Ritchey Chrétien Cassegrain. Dire is a seasoned visual observer and veteran astro-imager.



Curtis Macchioni is a physicist who spent most of his career in Silicon Valley working on magnetic data storage technology. Now retired he enjoys the extra time under the night sky and writing about astronomy equipment and methods on his web site www.californiaskys.com and producing astronomy helpful videos on his YouTube channel "Astronomy Tips and Reviews with Curtis." He hopes to attend many of the major star parties across the country over the coming years.



Stuart Parkerson has been the publisher of Astronomy Technology Today since its inception in 2006. While working primarily in the background of the company's magazine and website business operations, he has recently taken a more active role in contributing content covering industry news and other company centric topics



Michael Risch is part of the Baader Planetarium observatory project team and is an expert consultant for observatories, domes, high end mounts, telescopes and much more. In 1981, he became a member of the Association of Amateur Astronomers in the Saarland and, as a member of the board, accompanied the establishment of the Peterberg Observatory. As co-founder and first webmaster of www.astronomie.de, he contributed numerous ideas and reports on astronomical and space-flight topics to the first German astronomy portal. As a long-time science editor, he has led "Northern lights and stars" trips to the Arctic Circle. Michael has published many of his own photos and articles in professional journals and has written chapters for the books Fotoschule (Photo School) and Extremfotografie (Extreme Photography) with his colleague Martin Rietze for "Color Foto".

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THE SKY-WATCHER VIRTUOSO GTI 130P TELESCOPE

By Dr. James R. Dire

I recently had the opportunity to test the Sky-Watcher USA Virtuoso GTi 130P telescope. I was excited to do this because I was intrigued at yet another innovation offered by Sky-Watcher: a tabletop GOTO alt-azimuth telescope system.

The Virtuoso GTi 130 consists of the Virtuoso GTi mount and a Sky-Watcher Heritage 130 telescope. The telescope is a 130mm $f/5$ collapsible Newtonian telescope. They sell the same GOTO mount with a 150mm $f/5$ collapsible Newtonian and a 90mm $f/13.9$ Maksutov-Cassegrain telescope, among others.

I was a little worried when I saw the box coming out of the delivery truck. There was a big gash in the side of it (**Image 1**). The top of the box had large print saying “FRAGILE HANDLE WITH CARE. DO NOT DROP”. The telescope had an inner box inside the outer box. It too was severely punctured by whatever happened in transit (**Image 2**). Fortunately, Sky-Watcher packs this telescope with lots of Styrofoam. There was no damage to anything inside the box. The single vane secondary was twisted 90° from its working position. But it was easy to realign it.

The telescope comes with the OTA fully collapsed and attached to the mount via the Vixen-style dovetail plate. It comes with a dust caps, two eyepieces and a red dot finder. **Image 3** shows the telescope right out of the box and fully extended. The red dot finder, which I attached, required a small Phillips screwdriver to attach it to the finder base.

The telescope has a 650mm focal length. The 25mm eyepiece provides a magnification of 26x while the 10mm eyepiece yields 65x. The eyepieces are very lightweight and at first glance seem like entry-level oculars. However, they have ample eye relief, large apertures, and provide really nice views.

The telescope comes with a collimation tool, which is es-



entially a cap for the focuser with a small hole in the center. The telescope’s manual explains how to use it to align the mirrors. After aligning the mirrors with the tool, I checked the alignment with a laser collimator. It was dead on. The collimation process requires a 2mm Allen wrench to adjust the secondary mirror (**Image 4**). The wrench is not provided with the telescope. Note in **Image 4** that the primary mirror has a center mark which assists in the collimation process.

The primary mirror is adjusted with the three spring loaded knobs (**Image 5**). There are also three setscrews to hold the primary mirror in position (smaller screws in **Image 5**). Collimation took under five minutes. Every time the telescope is set up, the optics should be collimated. The act of collapsing and expanding the OTA alone will ever so slightly change the mirror alignment. Plus carrying around or transporting the telescope in a vehicle can have a similar effect.

THE SKY-WATCHER VIRTUOSO GTI 130P TELESCOPE



Image 1 - The telescope's shipping box suffered damage during shipping.



Image 2 - The telescope box inside the shipping box appears to have even more damage. Fortunately, the telescope and mount were undamaged!

The entire telescope and mount is shown in **Image 6**. When using the telescope outside on a table, ensure that the table is sturdy, doesn't wobble and is level. There is a leveling bubble on the telescope base (**Image 7**), which I found to be very useful. The GOTO capability



Image 3: The fully extended Heritage 130 telescope attached the Virtuoso GTI mount.

of the telescope requires the base of the mount to be level. Unfortunately, the three feet under the telescope base are fixed and the scope has no leveling screws.

Image 8 shows how the telescope attaches to the mount. The green dovetail plate comes attached to the optical tube assembly (OTA). It is removable, although I am not sure why anyone would need to remove it. The green plate is locked into the mount by tightening an easy-to-use hand-turned knob. The green plate is plenty long enough to slide back and forth to balance the telescope for whatever weight eyepiece is used. Balance is important for the GOTO mount to work properly. **Image 8** also shows a close-up view of one of the two truss arms and the plastic screw that locks this arm into place when expanding the telescope. The other arm is identical.

The best part of this telescope is the GOTO mount. The business end of the mount is shown in **Image 9**. At the bottom is the red on-off button. Above the switch is a stereo jack port, which can be used to control a camera shutter. To

the left of that is a jack that accepts a 12-volt power cord (not supplied). Finally, to the left of the power cord jack is a port to attach a hand controller to use with the mount. In the middle of the business side of the mount is a compartment for inserting 8 AA batteries to provide power to the mount.

You don't need a hand controller to use this mount if you have an Android or iOS mobile phone or tablet. The mount broadcasts a wifi signal for connecting these devices. Using the Sky-Watcher SynScan Pro app allows full control of the mount. The app has to be downloaded to your device. It has a library of ~10,000 stars and deep space objects. The SynScan Pro app is very easy to use. A superb manual for the app can be downloaded from Sky-Watcher's website.

I downloaded the SynScan Pro app to my iPhone 13. I tried using it on my older iPhone 6 and my 10-year-old iPad. But the app would not work on those older devices. To use the SynScan Pro app, first connect the mobile device to the mount's wifi broadcast. Then launch the SynScan Pro app.

THE SKY-WATCHER VIRTUOSO GTI 130P TELESCOPE



Image 4 - The inside of the optical tube assembly. Note the single arm secondary vane, the three adjustment screws for the secondary mirror, and the center mark on the primary mirror.



Image 5 - This view shows the adjustment screws and locking screws for the primary mirror. Note the helical focuser at the far end of the OTA.



Image 6 - The Virtuoso GTi 130P can be set up on any sturdy table. The celestial views are much better when the table is outside under clear, dark skies.

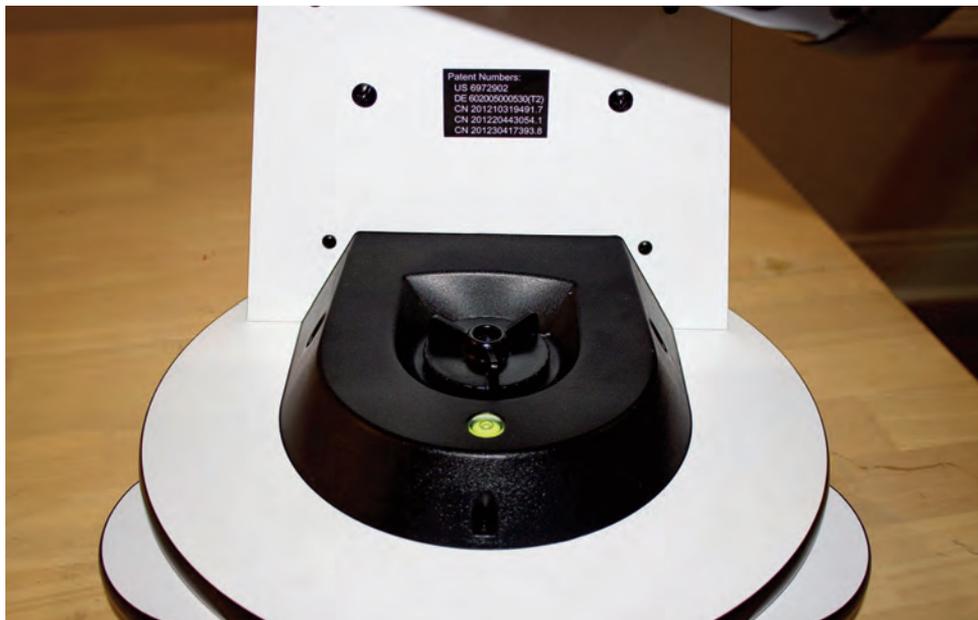


Image 7 - The azimuth motor housing has a bubble level and an easy to turn clutch release knob!

The Home screen of the app is shown in **Image 10**. There are 6 menu items to choose: Alignment, Star, Deep Space, Utilities, User Objects, and Settings. At the bottom of this screen is a 3x3 matrix with 8 buttons for slewing

the telescope. The number in the middle block shows the current slew speed. The slew speeds run from 1-9 and are raised or lowered by pressing the blue greater than (>) or less than (<) symbols. The actual speeds range from 0.5x to



Image 8 - This view shows how the telescope's dovetail plate attaches to the mount.

more than 600x the sidereal rate.

If your iOS or Android device does not have cellular service or GPS, the settings must be used to enter the location. Otherwise the cellular device automatically sets the location. The settings also

THE SKY-WATCHER VIRTUOSO GTI 130P TELESCOPE



Image 9 - This view shows all of the port and indicators, as well as the battery compartment. The mount can be powered with 8AA batteries or an external 12V power supply.

contain a feature to limit the maximum pointing altitude. This is useful if using a longer OTA that might hit the base of the mount. The settings also allow the tracking rate to be set for sidereal, solar or lunar. You can also specify northern or southern hemisphere.

The alignment choices are shown in **Image 11**. To start an alignment, the telescope must be pointed north (for northern hemisphere users) and the OTA must be horizontal. The 1-star alignment is meant for permanently polar aligned equatorial mounts, not this telescope. There are three choices for 2-star alignments. But for this mount, I would recommend always performing the 3-three star alignment. This will provide the best GOTO accuracy in finding objects!

Once aligned, the optical encoders contained along both axis of the mount will ensure accurate GOTO functions. I should point out the clutch knobs along both axes. These are large round black handles with three gripping vanes visible in Images 7 and 9. Loosening these

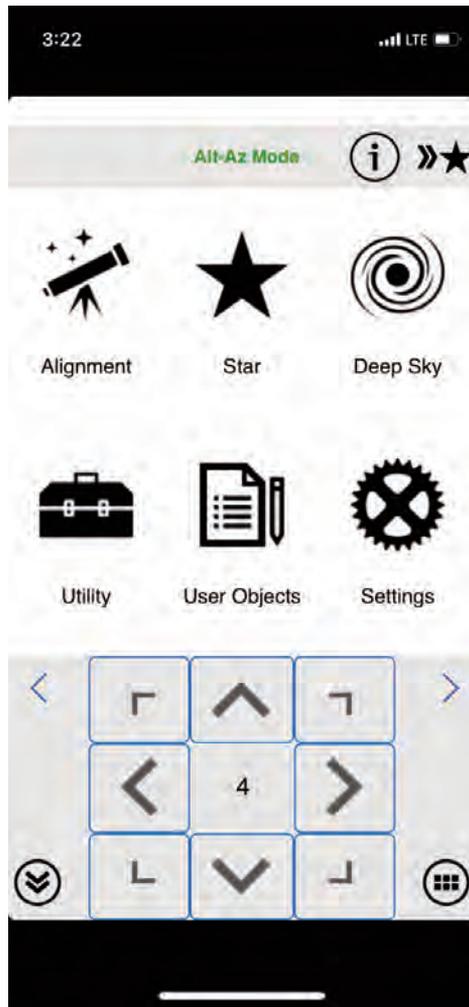


Image 10: The main menu of the SynScan Pro App. The arrows at the bottom are used to slew the telescope in any direction at the selected speed (here speed 3 of 9 levels).

knobs allow the scope to be moved manually. However, the optical encoders will still keep track of the telescope's pointed location for new GOTO commands once the clutch knobs are locked down.

To find objects after the initial alignment, use the back button to return to the Home menu. To locate stars or solar system objects, select Star. From there you can select Solar System (for the Sun, Moon or planets), comets, named stars, and double stars (**Image 12**). Objects below the horizon may not appear in those menus!

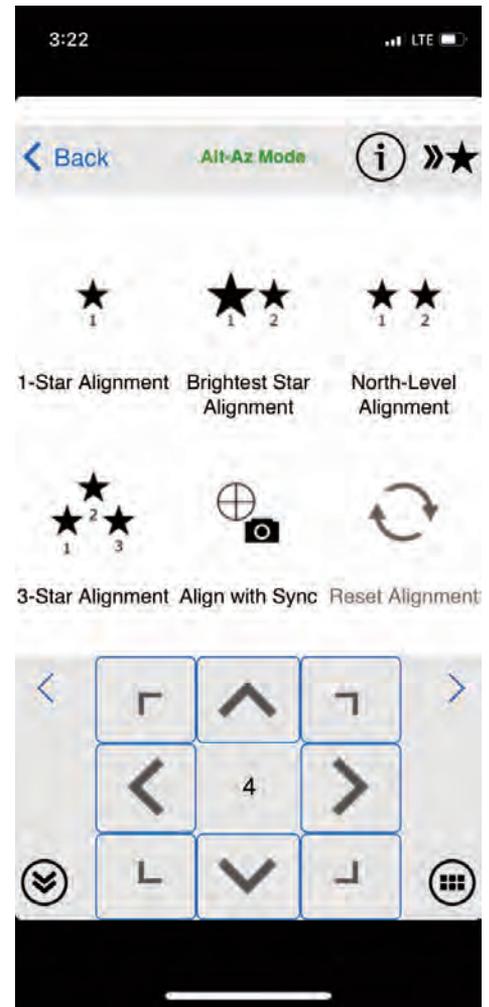


Image 11: There are many choices for aligning the mount. The 3-Star alignment provides the best GOTO pointing accuracy.

To find deep sky objects, select Deep Sky from the Home menu. The Deep Sky menu is shown in **Image 13**. The user must select a catalog: Messier, Caldwell, NGC or IC. After selecting a catalog, the user must select "Done". A catalog object number must then be entered. A description of the object immediately appears (**Image 14**). Selecting "more" provides additional information about the selected object. Selecting "Go To" causes the telescope to slew to the selected object. The controls at the bottom of the screen can then be used to center the object in the eye-

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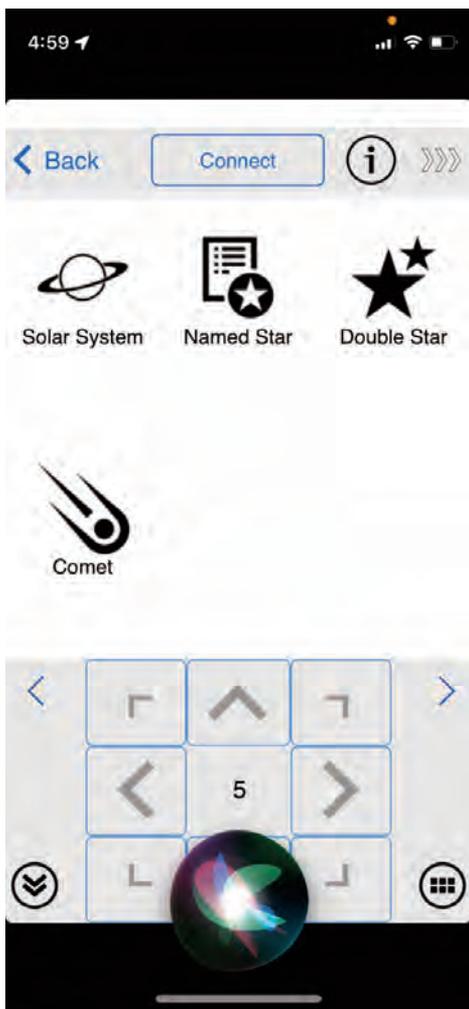


Image 12: The star menu not only allows finding named and double stars, but also contains choices for solar system objects and comets (as a separate class of solar system objects).

piece.

If the ~10,000 objects in the SynScan Pro app are not enough, the telescope can be controlled using an optional Sky-Watcher SynScan hand controller. Version 5 of the hand controller contains 42,000 objects. But also, if you want hundreds of millions of stars, millions of galaxies and hundreds of thousands of solar system objects (with comets and asteroids), the mount can be controlled using the SkySafari Pro app.

I have SkySafari 6 Pro on my iPhone. To use it to control the Virtu-

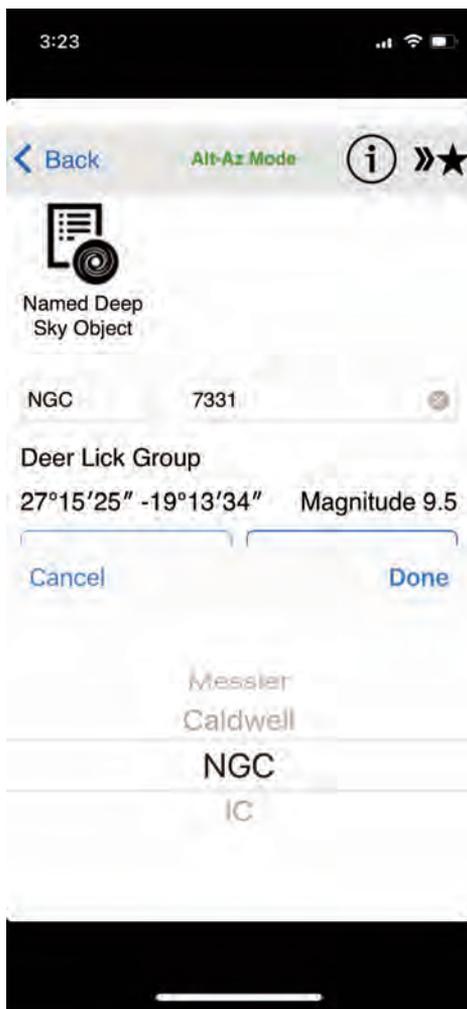


Image 13 - To find Deep Sky objects in the SynScan Pro software, one of four object catalogs must be selected.

oso GTi 130P, I first had to connect the SynScan Pro app and perform an alignment. Then I launched SkySafari Pro 6 and under the settings selected "SynScan Pro Link" for the telescope and Alt-Az for the mount type. When connected, SkySafari 6 Pro is linked to the SynScan Pro app and telescope control was passed off to SkySafari Pro, thus enabling the telescope to go to any object in the SkySafari Pro database!

Using the telescope requires a sturdy outside table. Unfortunately, I don't have the prerequisite table in my yard. All of the parks nearby with pic-

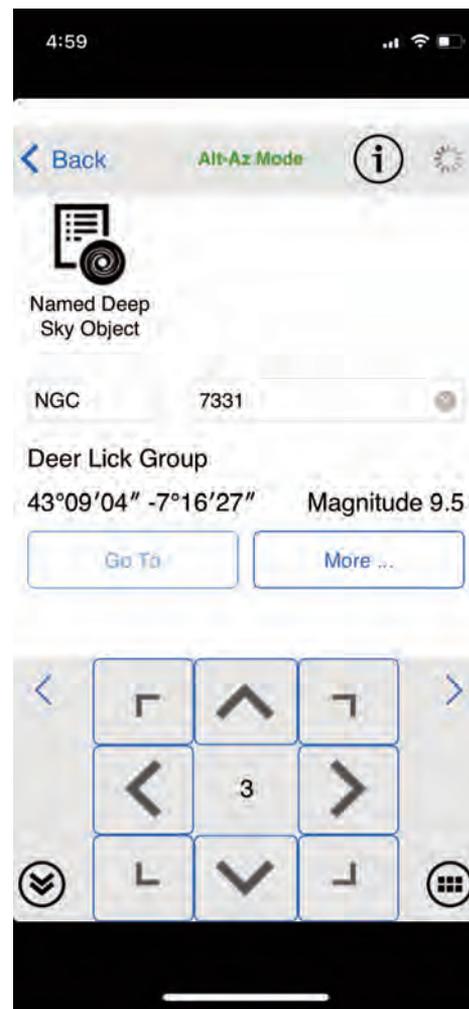


Image 14 - Once a catalog is selected the catalog number should be entered (here NGC7331). The "More" button provides additional object information, while the "Go To" button slews the telescope to the object.

nic tables are filled with trees and streetlights. So I could not make use of those tables.

However, I did happen to own several tripods for EQ-6 telescope mounts. So I decided to build a custom tabletop for one of the tripods which would allow me to set up the Virtuoso GTi 130P anywhere (Image 15). The tabletop consists of two parallel sheets of 3/8-inch plywood separated with eight small 2x2 blocks for support.

The center hole on the EQ-6 tripod is threaded for an M12 (12mm) screw, which holds on the EQ-6 mount. I de-

THE SKY-WATCHER VIRTUOSO GTI 130P TELESCOPE



Image 15 - The author crafted a table for the mount that attaches to one of his EQ-6 mount tripods.



Image 16: The middle hole allows the threaded rod to be lowered through the table/tripod system. The other three holes hold the feet of the mount base in position.

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Image 17 - A 3/8-inch threaded rod with a wing nut firmly holds the telescope table to the tripod. A second wing nut keeps the tripod leg spreader in place.

decided to use a 3/8-inch threaded rod, which easily fits through the M12 hole. The top of the rod has two nuts and a washer that hold down the bottom plywood plate.

Image 16 shows the top of the portable table. There are four one-inch holes drilled into the tabletop. The center hole is for inserting the threaded rod with the nuts and washer through a smaller hole drilled on the lower plywood plate. The other three holes form an equilateral triangle 12.75 inches on each side, the exact spacing of the feet on the Virtuoso GTi base plate. The holes do not allow the mounts base feet to go all the way down (due the bearing assembly between the feet), but just enough to keep the mount from sliding anywhere.

In **Image 17**, you can see that I used a 3/8-inch wing nut to tighten the plywood assembly onto the top plate of the tripod, and another wing nut to at-



Image 18 - With this set up, the Virtuoso GTi 130T can be used at any location!

tach the tripod spreader. The hardware, plywood and 2x2s all cost under \$20. It only took one evening to cut and the wood, drill the holes and assemble everything. The telescope fits on the table perfectly (**Image 18**). Unlike a large outdoor table, this set up makes it easy to get to the eyepiece regardless of where the telescope is pointed. I can also adjust the length of the tripod's legs for leveling the mount and for the most comfortable height to use the telescope for my almost 6-foot frame.

I set up the telescope on my driveway and collimated the optics. Using the SynScan App I performed a 3-star alignment and began to slew around to objects. The 130mm aperture was great for viewing star clusters and double stars. I particularly enjoyed the views of M22 and M13. The moon was superb. Jupiter with its belts and zones and four Galilean moons was a treat. Saturn with its rings and large moon Titan were easy to see. I did have to use my 2x Barlow with the 10mm eyepiece to enlarge those planets enough for good views.

A few cool things about the Syn-

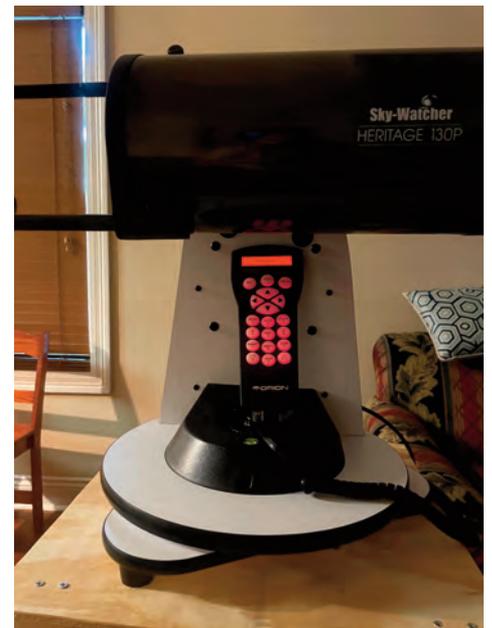


Image 19 - The Sky-Watcher SynScan hand controller can be used to operate the telescope in lieu of using a phone or tablet.

Scan Pro app is that it caused my iPhone to vibrate when it was done slewing to the next object, so I knew it was in the eyepiece. Next when slewing to an object, syncing the app on it allows the software to improve its mount model. After 5-6 synced objects, the mount was homing in on subsequent targets quite well.

I next switch over to SkySafari 6 Pro on my iPhone to control the scope through the SynScan App. SkySafari also allowed me to sync on object which improved its GOTO accuracy, too.

After testing the Virtuoso GTi 130P telescope with the apps on my phone, I plugged in the Sky-Watcher SynScan hand controller that came with my Orion Atlas mount (**Image 19**) to test it. The hand controller does not have as many alignment options as the SynScan Pro app. Missing is the 3-star alignment. So I aligned the telescope with a 2-star alignment. The pointing accuracy was just as good, but I was unable (or didn't know how) to sync on subsequent objects. So ulti-

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Image 20 - The SynScan hand controller has a USB port on it. Connecting a USB cable from the hand controller to a computer allows the telescope to be controlled by myriad software programs such as The SkyX, Voyager 4.5, and SkySafari Pro (Macintosh version).



Image 21 - The Virtuoso GTi mount can hold a payload up to 11 pounds. Here the author has attached an 11-pound payload to test the limits of the mount.

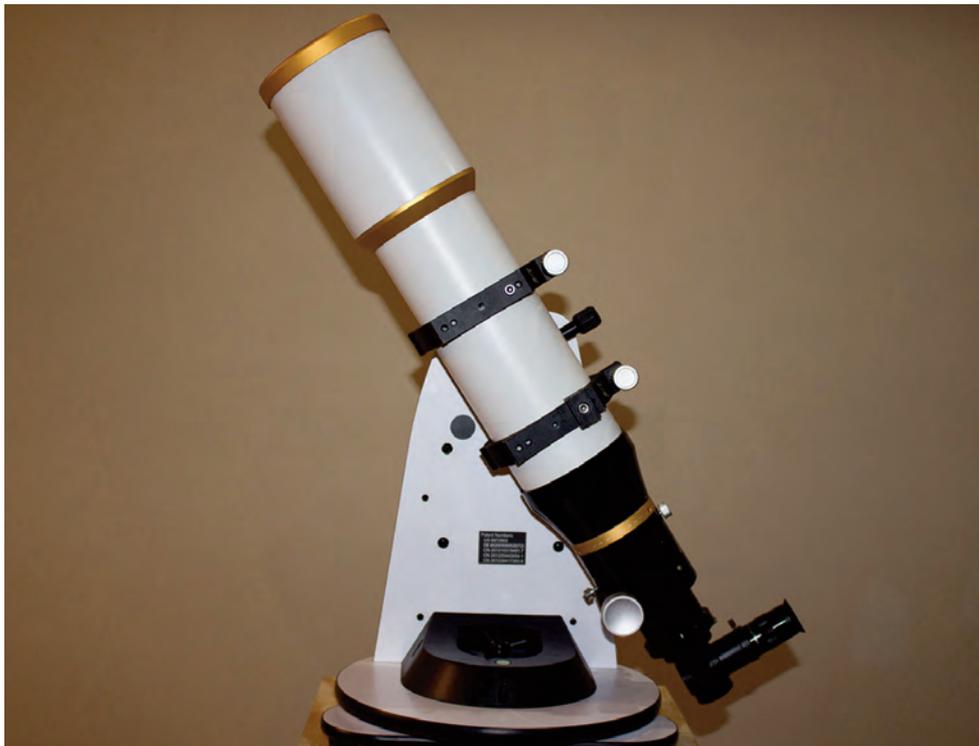


Image 22: Although the heavier scope performs well with the mount, the scope cannot be pointed higher than shown in this picture without risking the diagonal hitting the mount's base.

mately I had better accuracy with the iPhone after syncing on many stars. It was also easier to read the screen on my phone, even with night vision mode enabled, than reading the hand controller screen in the dark without my reading glasses.

I plugged a USB cable into the hand controller (**Image 20**) and connected it to my MacBook Pro. I then controlled the telescope with Voyager 4.5 (Carina Software) and then SkySafari Pro 6. Both did a good job of driving the telescope to objects I selected.

The Virtuoso GTi mount can be used with many telescopes besides those Sky-Watcher sells. I own several 70mm refractors and a 50mm solar telescope. The mount works great with those scopes.

The maximum payload of the mount is 11 pounds. I decided to test the mount with the telescope shown in **Image 21**. This 110mm $f/6$ refractor weighs nine pounds. After adding the tube rings, dovetail plate, 1.25-inch diagonal and eyepiece, everything weighed in slightly more than 11 pounds. Once balanced, the mount had no problem handling this instrument.

Unlike the Sky-Watcher 130P Heritage 130P OTA and my smaller refractor, the 110mm $f/6$ refractor cannot point near the zenith (Dobson's Hole) since the focuser and eyepiece would run into the base of the mount (**Image 22**). That is where the maximum altitude feature in the SynScan Pro app comes in handy. It prevented me from slewing to an object that would drive the bottom of the scope into the base.

The Virtuoso GTi 130 is a fun telescope to use. The 130mm aperture exceeds that of any refractor the mount can hold. More celestial objects are available for this size telescope than most of us can observe in one night, or a lifetime! 