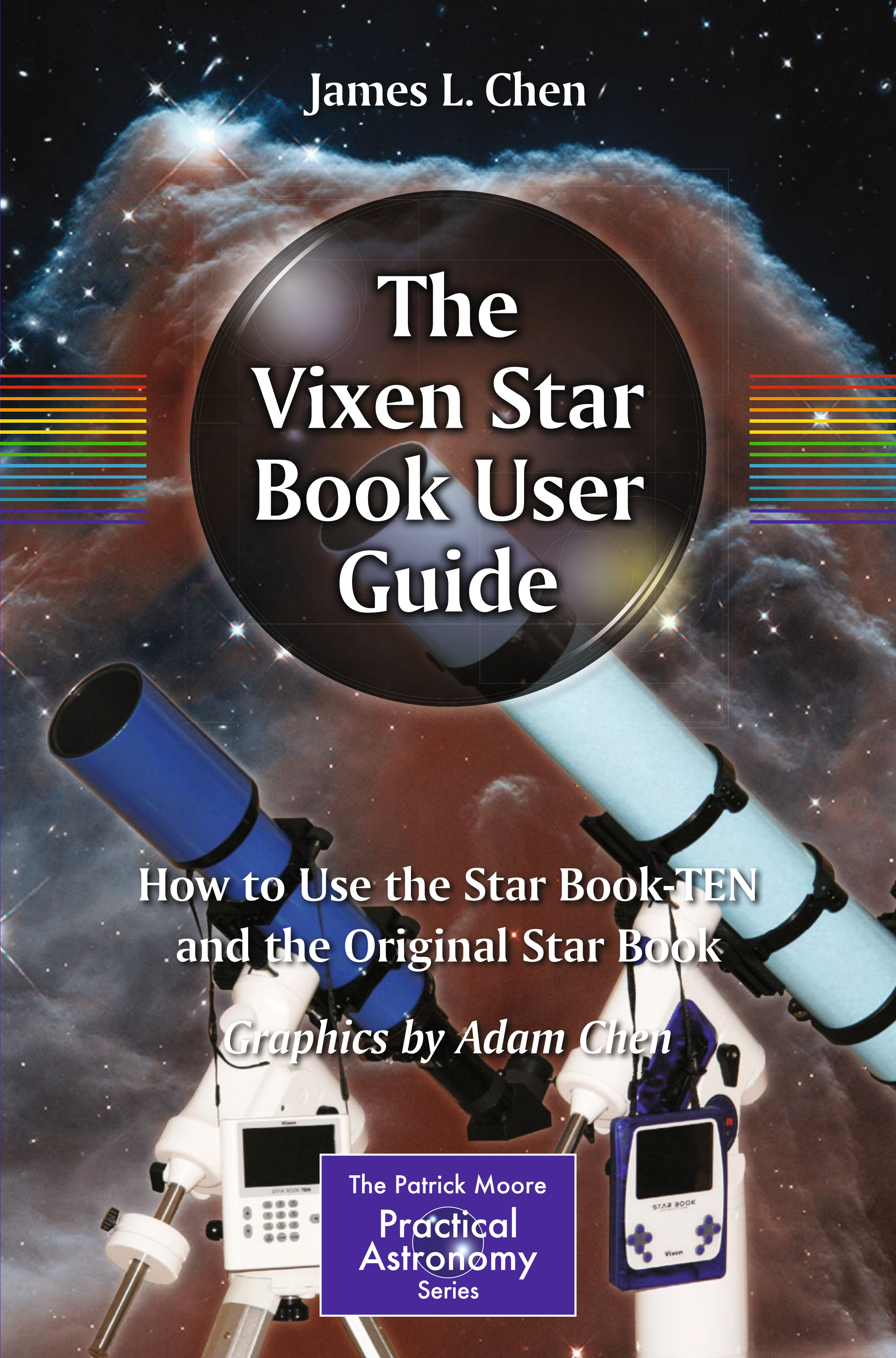
James L. Chen

The Vixen Star Book User Guide

How to Use the Star Book-TEN and the Original Star Book

Graphics by Adam Chen



The Patrick Moore Practical Astronomy Series

The Patrick Moore Practical Astronomy Series

More information about this series at http://www.springer.com/series/3192

The Vixen Star Book User Guide

How to Use the Star Book TEN and the Original Star Book

James L. Chen
Adam Chen

Springer

James L. Chen
Shenandoah Astronomical Society
Gore, VA, USA

Adam Chen
Baltimore, MD, USA

ISSN 1431-9756 ISSN 2197-6562 (electronic)
The Patrick Moore Practical Astronomy Series
ISBN 978-3-319-21592-1 ISBN 978-3-319-21593-8 (eBook)
DOI 10.1007/978-3-319-21593-8

Library of Congress Control Number: 2015946604

Springer Cham Heidelberg New York Dordrecht London

Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media (www.springer.com)

This book is dedicated to my friends Gary and Sherry Hand,
whose support for all of my books
has been invaluable.

Introduction

One evening, around 8 o'clock on a cold, clear winter's evening, I received a distressed phone call from a teenager who had received as an extraordinary Christmas gift a Vixen VC200L 8″ catadioptric telescope on a Vixen SXD equatorial mount with the Star Book GoTo computer system. She was having extreme difficulties getting the telescope to work.

My contact information had been given to her by the local telescope shop that had sold the telescope and telescope mount to her mother. I was (and still am) the shop's local expert on using the Star Book equipped mounts. The teenager on the phone lived in an affluent suburb of Washington, D.C., and I was over an hour-and-a-half away by car. I tried to solve her telescope problems over the telephone, since instructing her in person was inconvenient and would be a last resort.

The teenager's problem was, using the Star Book to search for a planet or star, the equatorial mount motors would whirr, and the gears would grind, and the telescope would then point directly to the ground! Obviously, something went wrong!

Gradually, I stepped the young lady through the setup process for the Star Book, making sure the longitude and latitude of her location had been properly entered into the Star Book's memory, along with the date and all the time data. Being assured that the polar axis of the mount was aimed northward, and that she was following the alignment procedures, I realized her problems were occurring during the initial alignment of the mount. The Star Book wasn't cooperating and continually pointed to the ground. In a flash, I recognized the problem. At the beginning of the alignment process, the telescope and mount needed to be aimed to the West as its "Home" position. She had been pointing the telescope East. She had misinterpreted the picture displayed on the Star Book screen and pointed the telescope to the East, a Home position that was 180° from the proper direction. After making that correction, and following my instructions, her telescope was up and running, finding galaxies, nebulae, and planets to her hearts content. I haven't heard from her since.

As for me, for years, I had my 130 mm f/8 apochromatic refractor mounted on an early 1950s Unitron equatorial mount equipped with a mechanical Polarex clock drive. The mount was heavy and bulky, and the clock drive, although a curiosity at star parties, was a maintenance hog, needing continual lubrication and subject to wear and breakage to the weight drive cable that powered the device. Although fun to watch in action, with the weight descending, rotating gimbals and spinning flywheels, the Unitron mount was ancient, cumbersome, and labor-intensive to use. On top of all that, it really didn't track that well. It is difficult for me to read the 1950s advertisements touting this mount as photographic ready. A review of my observing log books revealed that I had used this telescope and mount combination only twice in the previous 5 years! It was time for a change. With the help of friends in the amateur astronomy world, I gathered information and managed to get some hands-on time with several commercially available equatorial mounts that would handle the payload that my telescope presented. In the end, I chose the Vixen Sphinx SXW as the most portable and capable mount. I have used this mount for several years now, with my usage of my 130 mm apo and SXW combination expanding to at least once or twice a week! The Star Book GoTo system has been a joy to use, and invaluable in locating deep sky objects in an efficient and precise manner. When I used it, I would average three or four objects observed for the night with my old Unitron mount. With the Vixen SXW and Star Book, I now observe between 10 and 15 deep sky objects on an average night. According to my observing logs, I have actually peaked at 25 deep sky and planet observations during an exceptional evening!

It's stories like these that made me decide to write this book. As with computer GoTo telescopes made by other manufacturers, there is a learning curve involved in using the Vixen Star Book. As good as the Vixen manual is, users benefit from an experienced hand at the controls. This book's goal is to provide hints, tips, and aid in using the Star Book TEN and the original Star Book, and make the learning curve shorter and effortless.

James L. Chen
May, 2015

Acknowledgements

A big Thank You to the following people who made this book possible:

To Brian Deis, Mr. Star Guy and to Vixen Optics, for the loan of the Vixen SX2 and Star Book TEN and Star Book One. And for the access to Vixen official photo files and documentation. Your support was invaluable.

To Gary and Sherry Hand of Hands-On-Optics, for providing technical support, conceptual ideas, and encouragement.

To my wife Vickie for her encouragement, support, and her proofreading and critiquing skills.

To my son Adam for his graphics abilities and valuable photographic suggestions and contributions.

To my son Alex for serving as a soundboard for some of my ideas for the book, and making valuable suggestions and contributions.

And to Nora Rawn of Springer, who gave a fledgling first-time author a chance, for supporting my book concepts, and being a good audience for my jokes.

Contents

1 A Brief History of Vixen Computerized Telescope Mounts for Amateurs 1

2 Vixen Sphinx Mounts Using Star Book Technology 7

3 Introduction to the Star Book TEN 15

4 Basic Operation of the Star Book TEN 21
Polar Alignment of the Sphinx Mount 22
Initializing the Star Book TEN 23
GoTo Search Operation 31
System Menu 46

5 Learned Lessons in Using the Star Book TEN 53
Lessons Learned on Using the Star Book TEN 53
Trouble Shooting the Star Book TEN 55

6 Introduction to the Original Star Book 61

7 Basic Operation of the Star Book 69
Polar Alignment of the Sphinx Mount 70
Initializing the Star Book 71
GoTo Search Operation 80

8 Learned Lessons in Using the Original Star Book 99
General Comments on Using the Sphinx SXW Mount and Star Book 99
Trouble Shooting the Star Book 101

9 Notes on the Star Book-One and Star Book-S Systems 105
Star Book One 105
Star Book-S 120

10 Accessories for Vixen Sphinx Mounts 123

11 Mounting Other Optical Tubes on the Vixen Mounts 137

12 Maintenance and Care of the Star Book Electronics and Sphinx Mounts 141
General Maintenance and Care 141
Mechanical Adjustments 143
Firmware Updates 143
Transporting Advice 143

Appendix A Troubleshooting Checklist 147

Appendix B Messier Catalog 149

Appendix C Selected Non-Messier Catalog NGC Objects 153

Appendix D Websites for Comet and Satellite Orbital Elements 159

Appendix E Glossary 161

Appendix F Star Book TEN Updates 165

Appendix G Star Book Updates 205

Appendix H Entering Comet Orbital Elements in the Original Star Book 239

Biographies 289

Index 291

Chapter 1

A Brief History of Vixen Computerized Telescope Mounts for Amateurs

In the ultimate mating of two hobbies, computers and astronomy, computer controlled telescopes have captured the backyard astronomer's imagination and pocketbook. Known collectively as GoTo telescopes, this advanced technology is fascinating to watch the mount as it proceeds to point the telescope from object to object with precision, accompanied with the sounds of motors whirring and gears meshing.

A GoTo telescope mount is quite simply a telescope system that is able to find celestial objects in the night sky, and then track them. The GoTo mount can be set up in an alt-azimuth or equatorial fashion, and after the proper alignment procedure, the finderscope is no longer needed for the rest of the evening. Some of the newer GoTo telescopes have electronics and CCD cameras that will perform the alignment procedure automatically.

These telescope mounts are wonderful pieces of technology. The GoTo technology allows for more efficient use of observing time by quickly finding objects in the night sky. Built into the hand controller is a microprocessor, firmware, and built-in memory catalog of the positions of thousands of stars, galaxies, nebulae, open star clusters, globular clusters, planetary nebulae, our solar system planets, and the Moon. Complex algorithms developed and refined over years with improvements in encoders and motor technology have made the GoTo telescope an accepted and desirable telescope feature. Computer controlled telescopes can help it's owner to overcome the fear of looking ridiculous while others watch; no longer will the telescope owner appear incompetent as he tries to find celestial wonders—now he only looks ridiculous as he tries to remember how to set up his telescope!

There is an ongoing debate within the amateur astronomy community on the merits of computer guided and computer controlled telescopes. The hardcore

J.L. Chen, A. Chen, *The Vixen Star Book User Guide*, The Patrick Moore Practical Astronomy Series, DOI 10.1007/978-3-319-21593-8_1

conservative backyard astronomers argue that a beginner or novice individual is better served learning the skies without electronic aids, as generations of stargazers have done. There is merit to this argument. However, in these days of increasing light pollution in urban and suburban neighborhoods, seeing landmark stars used for "starhopping" to locate deep sky objects is becoming increasingly difficult and frustrating to a backyard astronomer, particularly to the beginner or novice. A computerized GoTo telescope and mount that relies on alignment with bright first or second magnitude stars greatly eases the frustrations of the hobby. The search time for a celestial object can be reduced from tens of minutes to mere seconds! With the electronics aiding the observer in finding the deep sky objects, a suburban observer can then take advantage of modern filter technology in overcoming the light pollution in their area. Cheers to the miracle of nebula filters, light pollution filters, and color filters!

Of course, in the worst of urban environments, even using a GoTo telescope and mount can be challenging, especially if bright stars are impossible to see for alignment purposes or otherwise. For instance, in the middle of brightly lit Las Vegas, the only bright stars visible are Wayne Newton, Celine Dion, and a variety of Elvis impersonators!

The era of computerized GoTo telescopes began in 1984. Computer controlled telescopes took form during the same period as the development of personal computers. During the 1980s, the U.S. telescope company Celestron formed a business relationship with Vixen Company, Ltd of Japan. The American company featured its home grown Schmidt-Cassegrain telescope, while importing the Japanese refractors, eyepieces, and equatorial mounts from Vixen, and marketing them under the Celestron brand. Introduced in 1984, Celestron Compustar 14 was the first computer controlled telescope offered for the consumer. The Compustar 14 is a large and heavy catadioptric telescope, designed for permanent installation in an observatory. Concurrently, Vixen of Japan developed the Sky Sensor, an economical system consisting of a Go To computer control system with motors designed to attach onto their portable German equatorial mount known as the Super Polaris.

The landmark Sky Sensor system was remarkable for its time. As the first consumer affordable GoTo system, it had 472 nebulae, star clusters, and galaxies stored in its memory. This is small, as compared to today's GoTo systems that have 30,000, 40,000, or more stored in their databases.

The reader is cautioned to understand that database claims are sometimes inflated and not necessarily truthful. There are a number of multiple counts for a single object. For instance, the Andromeda Galaxy counts as one object; M31 is an additional object; NGC 224 as another object. Thus the same object is counted as three separate objects in some manufacturer's database claims.

In 1984 standards, the Sky Sensor was revolutionary. The Sky Sensor data base contained all the Messier objects, NGC objects brighter than 10th magnitude, and 285 stars brighter than 3.5 magnitude.

Installation of the Sky Sensor onto a Super Polaris mount required a little mechanical dexterity, but could handled by the end user. And if not, the local dealers were experienced in installing of the right ascension motor and electronics card,

Fig. 1.1 The Sky Sensor computer controller (Hands-on-Optics Used Equipment archives)

declination motor and electronics card, gear shafts and pressure plates, and clutch knobs. Plug in the Sky Sensor controller and power supply, and the system was ready for use.

The keyboard, as seen in Fig. 1.1, was a bit archaic. Note the use of CR for carriage return instead of an Enter key! The art of human factors engineering had not yet entered into the design of telescope control. The end user faced a bit of a learning curve in operating the Sky Sensor. The system was not as responsive, accurate, nor as quick as today's modern GoTo systems, but as a first generation device it showed the way to the future.

In 1992, Meade Instruments introduced the LX200 series of fork mounted Schmidt-Cassegrain telescopes (SCT). Early 8 and 10 in. models were produced contained software bugs and were unreliable telescopes. Over time Meade was able to refine the LX200 models to become a very capable platform, with the product line extending to larger models, of 12 and 16 in. sizes, telescopes more at home in a college or NASA observatory than in the backyard. In August 1996 Celestron countered with the Ultima 2000 series telescopes—but they delayed shipping until 1997 until the software bugs were worked out. The initial offering was an 8 in. SCT Ultima 2000, which was a lightweight, rigid, and easy to use telescope (Fig. 1.2).

Meanwhile in the late 1990s, Vixen issued a revised version of their GoTo system, named the Sky Sensor 3. The Sky Sensor 3 featured an updated hand controller and other hardware. The database was still the same size (Fig. 1.3).

Fig. 1.2 The Vixen Sky Sensor 3 (Hands-on-Optics Used Equipment archives)

Fig. 1.3 The Sky Sensor 2000 series (Hands-on-Optics Used Equipment archives)

By 2000, Vixen introduced another revision to their venerable Sky Sensor series, now known as the Sky Sensor 2000. The SkySensor 2000 system was vastly refined and improved over the previous Sky Sensor models. The SkySensor 2000 could be retrofitted for use with the Vixen GP, GP-DX, GP-E, SP or SP-DX equatorial mounts to provide highly accurate “Go To” pointing and tracking of celestial objects in a vastly expanded data base that now included the planets, Moon, Sun, and thousands of deep sky objects from Messier, NGC, IC, UGC, SAO, GCVS catalogs, for a total of 13,942 celestial objects. The revised system simplified the initial setup and was easier to operate. The slewing rate was improved up to 1200× that of Sidereal rate (5–3/4 Deg. per second). The Sky Sensor 2000 incorporated the most accurate of the tracking control systems for the time by including Periodic Error Correction (PEC) circuitry to reduce the amplitude of worm gear periodic errors.

In the new millennia, major developments in GoTo telescope technology has been introduced into the consumer market. Meade and Celestron have introduced and refined their Autostar and Nexstar GoTo systems for fork mount and German mount designs. Databases of these telescope computer systems have been expanded to the 30,000–40,000 celestial objects range. Pointing precision and tracking accuracies have been greatly improved. The ease of setup has been improved. Many other manufacturers have joined the GoTo mount revolution, with offerings from Losmandy, Orion, Astro-Physics, Takahashi, iOptron, and many more. The computerized GoTo telescope mount has come of age.

Vixen did not stand on its laurels. The drawback of all previous GoTo telescope computer systems, including the Autostar, Nexstar, and even the early Vixen Sky Sensor systems, is the reliance on text as the mode of user interface and operation. Modern desktop and laptop personal computers have long since graduated to graphics-based operating systems, such as Microsoft Windows and Apple OS. Vixen recognized the trend in the personal computer world and applied graphics technology to their latest designs. In 2004, Vixen introduced the revolutionary Sphinx SXW equatorial mount, equipped with the first computer GoTo system to use a graphics user interface, the Star Book. By 2013, the major re-design and upgrade of the Vixen GoTo system was introduced, the Star Book Ten, with improved user-interface and a database exceeding 272,000 objects!.

The chapters that follow will cover in depth the Vixen mounts equipped with the Star Book Ten and original Star Book GoTo systems. An effort is made to clarify the sometimes confusing instruction manuals, while providing tips and hints on the Star Book TEN and Star Book use. The Vixen instructional manuals are well written, but often an alternative description of how things work is helpful to a newcomer to the Star Books.

Most importantly, the lessons learned from an experienced Star Book TEN and Star Book owner are offered in separate chapters for the Star Book TEN and the original Star Book.

There is also a chapter on Vixen’s variations on the Star Book theme, the Star Book S and the Star Book One. As with all Vixen products, there are a myriad of accessories for Sphinx mounts that are also highlighted in a chapter within.

Included in the appendices are firmware update procedures for both the Star Book TEN and the original Star Book. Also included is an appendix is the procedure for loading into the Star Book firmware comet orbital elements. These procedures are available on Vixen's website, and are provided in this book as a courtesy. The reader is cautioned to throughly study the update procedures, reference and study the Vixen website for any changes before attempting any firmware updates or comet data download. Please note: the author recommends all updates to the Star Book TEN or Star Book be accomplished by the Vixen dealer or by Vixen itself.

Chapter 2

Vixen Sphinx Mounts Using Star Book Technology

It is important to get familiar with the family of Vixen telescope mounts with the integrated Star Book and Star Book TEN GoTo technology. In Vixen nomenclature, these equatorial mounts are their Sphinx line (Fig. 2.1).

Common to all of the Sphinx mounts, first- and second-generation, is the unique internal mounting of the right ascension (RA) and declination (DEC) motors. This internal location of the motors, electronics, and gears within the declination housing of the Sphinx mount acts as a built-in counterweight. Therefore, the amount of actual counterweights used to balance the mount with its telescope is less, resulting in an overall lighter and more portable equatorial mount. All wiring for the RA and DEC motors are also internal, achieving a clutter-free telescope setup.

The Vixen Sphinx mount system is designed in a modular fashion, allowing the user the flexibility for adapting the mount in a multiple of configurations. A more detailed discussion of the various configuration options will be addressed in a later chapter.

The original Vixen Sphinx mounts, with the original product introduction in 2004, included the original Sphinx SXW, the somewhat heavier duty SXD, and the king of the Sphinx line the ATLUX (Fig. 2.2).

The Sphinx SXW specifications, aside from the Star Book (more details later in the book), are quite respectable: 180-tooth worm gears driving it (implying smoothness and accuracy suitable for astrophotography), and the full-up weight of the equatorial head, tripod, and one counterweight is about 30 lb, with a rated capacity of 26.5 lb. Applying excellent system engineering principles to the SXW design, the Sphinx mount features a retractable counterweight shaft, fully enclosed servo motors placed inside the mount housing to provide counterbalance and minimize (but not eliminate!) the role for counterweights, and no external cables except to

J.L. Chen, A. Chen, *The Vixen Star Book User Guide*, The Patrick Moore Practical Astronomy Series, DOI 10.1007/978-3-319-21593-8_2

Fig. 2.1 Vixen equatorial mounts family picture (Vixen)

Fig. 2.2 The original Vixen SXW (shown with Vixen ED81S apochromat refractor) (Vixen)

connect to power and the Star Book. The SXW design is elegant, light, clean, and compact. Using the Vixen dovetail system, the Sphinx mount can accommodate a wide variety of optical tubes, either Vixen's or other makes. A variant tabletop version was marketed by Vixen as the SWC, to be used on a special tabletop tripod without counterweight (Fig. 2.3).

Fig. 2.3 The Vixen Sphinx SXD (Vixen)

The heavier duty Sphinx SXD can be viewed as a SXW on steroids. Using the basic housing as the SXW, the SXD is supplied with the identical Star Book system of electronics and motors as the SXW, but mechanically beefed-up, with the mount, tripod, and counterweights weighing in at 44 lb and a load capacity of 33 lb. The main difference between the SXD and the SXW was the use of improved bearings on the axises, and steel shafts instead of aluminum shafts (Fig. 2.4).

At the top of the line, the original Star Book equipped mounts culminated with the ATLUX model. With the mount, counterweights, and tripod, the ATLUX total weight comes in at almost 75 lb. This increased size allowed the use of optical tubes weighing up to 50 lb to be attached via the Vixen dovetail system. The ATLUX is viewed as a highly stable platform for astrophotography.

Beginning in 2013, Vixen began introducing its updated and upgraded line of mounts. Featuring the next generation Star Book Ten (Ten is not the number 10, but the Japanese word for heavens) computer/controller and new high resolution digital stepping motors, and in ascending order of cost and payload, the Vixen family equatorial mounts currently include the SX2, SXD2, SXP, and the AXD (aka the ATLUX DELUX) (Fig. 2.5).

The SX2 represents the second generation of the entry level Sphinx mount, replacing the SXW in the Vixen line. The quieter digital stepping motors replaced

Fig. 2.4 The Vixen ATLUX mount (shown with Vixen VMC 260L catadioptric telescope) (Vixen)

the original DC servo motors, providing smooth, quiet slewing with quick response to commands. The load capacity of 26.4 lb and a mount weight of 27 lb enables the SX2 to be a very portable equatorial mount. The axis shafts are aluminum alloy, and aluminum gears are used for the drive system (Fig. 2.6).

The revised SXD2 Equatorial Mount built on the success of the original Sphinx SXD. The quieter stepping motors replaced the original DC servo motors, providing smooth, quiet slewing with quick response to commands. Heavier components, nine bearings, and increased loading capacity enables the SXD2 to be a solid platform for observing or astrophotography. The SXD2 differs from the SX2 mechanically with use of carbon steel axis shafts and brass wheel gears in place of the SX2 aluminum components. The mechanical upgrades enable the SXD2 to have a load capacity of 33 lb while avoiding any weight gain from the previous SXD model (Figs. 2.7 and 2.8).

Fig. 2.5 The Vixen SX2 with Star Book Ten (Vixen)

Fig. 2.6 The Vixen SXD2 (Vixen)

Fig. 2.7 Upgraded mechanical parts in the SXD2 (Vixen)

If the SXD2 can be viewed as the SX2 on steroids, the SXP should be viewed as the SXD2 on steroids, a high protein diet, growth hormones, and a lot of gym work. Seriously, the SXP, which stands for the Sphinx Professional, is the ultimate expression of the Sphinx mount lineup and is optimized or astrophotography. Armed with a 40 mm diameter carbon steel declination shaft and low-friction ball bearings, the SXP takes the Sphinx architecture to a load capacity of 35.2 lb, while only being 5 lb heavier than the SXD2 (Fig. 2.9).

The flagship of the Vixen equatorial mounts is currently the AXD, the successor to the ATLUX mount. Sometimes called the ATLUX DELUX, the AXD is the ultimate expression of a Star Book Ten equipped equatorial mount, weighing in at 55.1 lb, excluding counterweights, the pier, or tripod. The AXD is designed for a load capacity of 66 lb!

Fig. 2.8 The Vixen SXP (with Vixen AX103S refractor and optional half-pillar) (Vixen)

Fig. 2.9 The Vixen AXD (ATLUX DELUX) (shown with Vixen VMC-260L Catadioptric) (Vixen)

Chapter 3

Introduction to the Star Book TEN

Fig. 3.1 The Star Book Ten (Vixen)

J.L. Chen, A. Chen, *The Vixen Star Book User Guide*, The Patrick Moore Practical Astronomy Series, DOI 10.1007/978-3-319-21593-8_3

The Star Book TEN represents the latest, most powerful, most capable, and the most current of the Star Book series of Vixen's GoTo computer controllers for the Sphinx line of equatorial mounts. TEN in Japanese means "The Heavens", and is not any reference to the version number of the software or hardware. Designed specifically to drive the new stepper pulse motors that operate at 250 pulses per second (pps), the Star Book TEN provides smooth, quiet, and accurate movement of the Sphinx mount (Fig. 3.1 and Table 3.1).

Table 3.1 The Star Book TEN specifications (Vixen)

CPU	32 bit RISC Processor 324 MHz SH7764
Display	5″ TFT color LCD WVGA (800×480 pixels), with backlighting
Electricity terminal	DC12V EIAJ RC5320A Class 4
Autoguider port	6 pole 6 wired modular jack (for external unit)
LAN port	10Base-T
Mount connector port	D-SUB 9 Pin male plug
Extension slot	For an optional Extension unit (Autoguider)
R.A. and DEC display	R.A.: 1sec. increment, DEC: 0.1 minute increment
Power source	DC12V (Power is supplied from the mount side)
Poser consumption	About 0.25 W (Stand alone unit)
Dimensions	169 mm×154 mm×30 mm
Weight	14.11 oz (400 g) excluding the cable and optional extension unit
Celestial object database	272,342 (SAO: 248997, NC Objects: 784; IC Objects: 5386; Messier Objects: 109*; 7 Planets; 1 quasi-planet, the Moon and the Sun) *M40 is a missing number. M91 and M102 are also listed as NGC4548 and NG5866 in the database
Menus and major functions	Automatic GoTo Slewing; Sidereal tracking and different tracking rates for the Sun , Moon, planets, comets, and artificial satellites; Backlash compensation; VPEC; Permanent PEC; Autoguider application; Night Vision Screen; Bilingual interaction; Brightness control, Hibernate control; Built in Speaker; LAN connection updating
RA coordinate display	STAR BOOK Full Color LCD screen; 0.1 min increments
DEC coordinate display	STAR BOOK Full Color LCD screen ; 1.0 arc min sec increments

A frequently asked question is: Can an owner of an older first generation Sphinx mount with an original Star Book upgrade his/her Sphinx mount with a Star Book TEN. The simple answer is no. Since the Star Book TEN is designed to drive pulse motors instead of the original Sphinx DC servo drive motors, the Star Book TEN controller cannot be substituted for the original Star Book used on the original Sphinx mounts. The Star Book TEN, the motherboard within the new Sphinx mounts, bearing design, gear design, and the stepper pulse motors are designed as a system. There is no Vixen update kit available for the older mounts, since the labor and the skills needed for making such an upgrade is most likely beyond the average owner's capability, and if installed improperly can easily compromise the mount's performance. Such an upgrade results in a major rebuild of the mounts, with the labor costs exceeding the cost of buying a new Sphinx mount!

Star Book TEN features a revised control layout from the original Star Book, with a numeric keyboard, with each key doubling as function keys for pull down menus (Fig. 3.2).

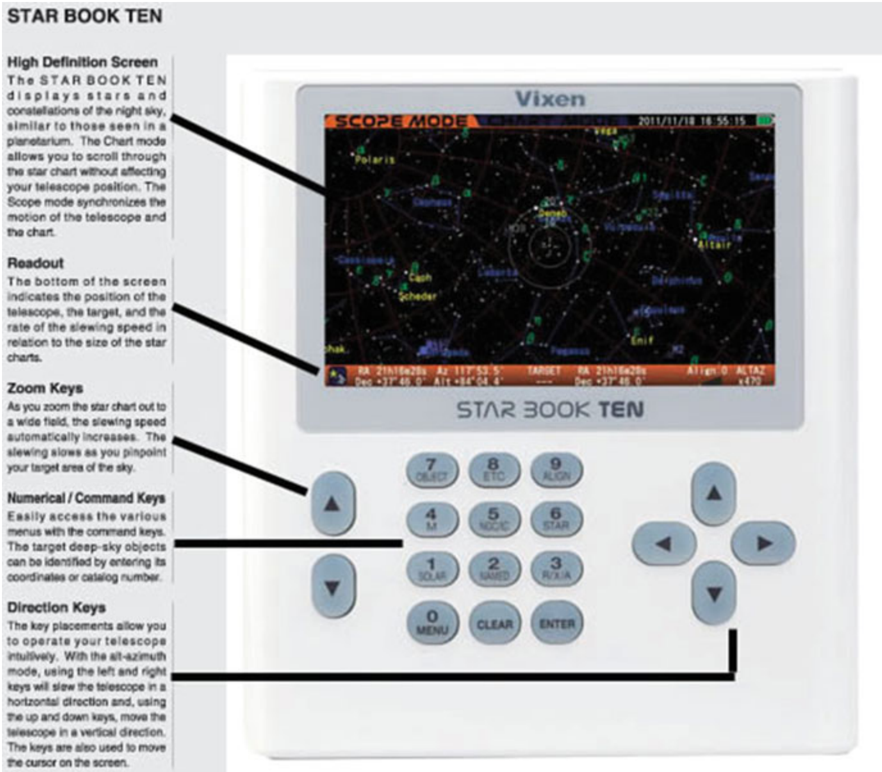


Fig. 3.2 Star Book TEN controller layout (Vixen)

The Star Book TEN plugs into the Sphinx mount through a nine-wire cable with D-SUB9PIN male connectors at both ends. The female connection port for the controller cable is located near the counterbalance bar of the Sphinx mount on the underside of the declination housing. According to the Vixen instruction manual, connect the cable end without the ferrite core at the mount, and the cable end with the ferrite core at the controller. The cable supplied with the author's SX2 mount had ferrite cores at both ends (Fig. 3.3).

Adjacent to the controller cable D connector is the power supply plug. Either a 12 V battery or an AC-to-DC 12-V power supply may be used to power both the