

PRODUCT INFORMATION

11250 Forest Hills Road
Rockford, IL 61115-8238
USA

Phone: 815-282-1513
Fax: 815-282-9847

www.astro-physics.com
www.digitalskyvoice.com

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Astro-Physics, Inc

ASTRO-PHYSICS has been developing telescopes and accessories for the advanced amateur since 1975. We now offer an extensive line of precision telescopes and mountings, all with outstanding performance for a variety of observing needs. If you have decided that refractors fit your requirements, you will find our line of Apochromats to have the highest performance of any refractor on the market. Our telescopes were developed with the active observer in mind. We have concentrated on those things that make observing a joy: sharp high-resolution optics, rugged vibration-free mountings and easy-to-use, effective accessories.

HISTORICAL PERSPECTIVE

Astro-Physics has been at the forefront of optical design for more than a decade. In the early 1980s, Mr. Roland Christen, founder and president of Astro-Physics, introduced the first high performance affordable apochromats to the amateur market. These early Astro-Physics refractors were quite revolutionary and were a major influence in the rebirth of refractors.

The more common achromats available at that time showed significant chromatic aberration even with focal lengths of f15. They were (and still are) very long and awkward, particularly if portability to a dark sky site is desired. Both 5" f15 or 6" f15 doublet tube assemblies (focal lengths of 75 and 90 inches respectively) require a substantial mount on a tall pier or tripod to accommodate the length of the instrument and counteract the torque reaction that is inevitable when the breezes blow. The chromatic aberration coupled with the enormous size and weight of these instruments and their mountings deterred many amateurs from using refractors larger than 4" in the 1960s and 70s.

As an avid amateur astronomer, Roland was dissatisfied with the telescopes that were available in the 1970s. He knew that even the achromats of the day showed snappier images than his 8" SCT, but he wanted a shorter scope which could be used for photography as well as high-definition planetary images. Over a period of several years, he designed and built several refractors with shorter focal lengths using a triplet design. The color correction was very good even as short as f6.

In the 1980s and 90s, Astro-Physics' optical designs evolved several times and with each new design, new levels of performance were achieved. The quality of construction of the tube assemblies, sophistication of the mounts and range of accessories have also improved each year.

In 1992, we were very proud to introduce our line of refractor lenses which incorporated synthetic fluorite ED glass in various optical designs. This optical material has further revolutionized the modern refractor by all but eliminating the last vestiges of false color in fast refractors.

Since the early 90s, we have expanded our production facilities with the most modern CNC production equipment available. This includes computer automated lathes and machining center complete with a CAD-CAM design center. We have also installed one of the most advanced optical production systems in the world. The Opticam SX, a computer automated precision-lens generator, was originally developed to produce high-end military and space optics. In 1999, we added the OptiPro PX250, a high-tech computer optical polisher.

ASTRO-PHYSICS DESIGN PHILOSOPHY

At Astro-Physics, we are fully committed to the production and development of amateur telescopes and accessories. Our goal is to produce the highest possible quality components and keep them affordable to the average amateur. Amateur telescopes are the only product that we produce; we do not get sidetracked into commercial or military projects. Many of our technical and production staff are amateur astronomers themselves, so they understand the unique needs of our customers. We strive to build almost every part from scratch at our own facility in Rockford,

Illinois. This includes not only the individual optics, but also the critical gears, circuit boards and components right down to the knobs and fittings.

Apochromatic Lens Design

Our objectives are APOCHROMATIC, which means that the images are essentially free of false color, both visually and photographically. We have chosen the most advanced synthetic fluorite E.D. glass to be the heart of our optical designs because of its excellent light transmission and superior correction of all the monochromatic and polychromatic aberrations. There are many less expensive E.D. (Extra low Dispersion) glasses on the market which can be used to make refractor lenses. The most commonly used E.D. materials only partially correct the secondary spectrum errors, while the least expensive versions are little better than traditional crowns used in old-fashioned doublets. Lenses made from these materials can provide satisfactory views for some individuals, but those amateurs who demand that last bit of contrast and definition will find there is no satisfaction in using a lens made from cheaper materials.

The StarFire EDF design was originally developed for our 6" astrograph. We found it to perform superbly as a visual planetary instrument and therefore converted all of our lenses to that design, including the 105 Traveler. The views are extraordinary. The superb color correction of these EDFs surpasses the fluorite doublets, particularly in the far violet part of the spectrum where Technical Pan films have their highest sensitivity. Our latest designs have excellent infrared corrections to 10,000 Angstroms, making them very suitable for CCD imaging.

The fast focal ratio of the StarFire EDF design is particularly attractive to amateurs who long to achieve superb, wide field astrophotos. For avid astrophotographers, we offer these EDF refractors with giant 4" focusers to allow coverage of very large film formats with minimal vignetting. In the hands of knowledgeable astrophotographers, these instruments can produce superb, professional astrophotos of all their favorite deep-sky objects. Images are so sharp, it takes 30" x 40" enlargements to resolve the finest details.

We also offer several models with the EDFS designation that incorporate the 2.7" focuser. These refractors are for those amateurs who desire the ultimate portable, versatile refractor, but who do not require the larger focuser.

One of the important advantages of a short focal length is that the mounting can be smaller, lighter and more compact. The result is a highly portable refractor system with superior imaging qualities, ideal for a wide variety of astronomical work from high-power lunar/planetary to deep-sky astrophotography.

Mountings

Astro-Physics mountings are designed for solid stability under a variety of observing conditions. At the same time, the mounts are truly portable so that amateurs can transport them to their favorite dark-sky site and set them up quickly and accurately. The mountings break down into manageable sizes, but when set up, they are extremely rugged and steady platforms. We have also developed a very accurate worm gear set to insure smooth, effortless tracking of celestial objects for all visual and photographic purposes.

To achieve these performance criteria, we combined the latest technology with time-tested design concepts. The basic mounting configuration was engineered with proper vibration and strength of materials criteria. As in a good building design, all loads are channeled into massive load-bearing cross sections to their final destination - the ground. This is done in a way that minimizes weight and size while maximizing rigidity. To this stability, we have added a go-to servo drive that is accurate and sophisticated enough for the most demanding application. We started with a custom-manufactured fine-pitch worm gear and added a high-resolution DC servo motor drive with a hand-held computer go-to

keypad controller. The drive system allows slewing up to 5 degrees per second, yet smooth guiding motions as well.

Accessories

To these basic telescope components, we have added a whole list of accessories that make our telescopes versatile. From camera adapters to telecompressors, we have carefully designed them for their functionality and compatibility. They are all tested and proven in the field under actual observing conditions.

ASTRO-PHYSICS FACILITY AND STAFF

In September 1990, our dream of moving into a new, specially designed facility came true. Since Astro-Physics is one of the few telescope companies that actually make most of the items in their product line, we needed a building that would allow us to perform each function in the most efficient manner. Over the years, we have assembled a staff of talented, skilled craftspeople dedicated to producing very high quality products. They take personal pride in their accomplishments and in your satisfaction.

Optical Production

We manufacture all of our telescopes in our modern optical facility, so our telescope optics are 100% AMERICAN-MADE. We use only precision "A" grade optical glass, which has high light transmission characteristics and is free of striae and imperfection.

All optical surfaces are finish-polished on pitch and hand-corrected. Each lens is tested, polished and retested repeatedly throughout the production process. We continue until the desired performance is achieved.

In 1995, we installed a new Opticam SX computerized microgrind system to our optical department. Originally developed at the University of Rochester Optics Laboratory for advancing optical technology in America, the Opticam system completely eliminates all traditional tooling and fixturing needed for fabricating precision optics. A raw glass blank is loaded into the machine, and a finished, ready to polish lens element results in only 25 minutes. All this is accomplished without grinding components or grit. The glass surfaces are rough and fine-ground, edged and optically centered with a series of special bound diamond tools. Tool motions are computer controlled with 100 nanometer resolution. Almost any spherical surface can be generated, convex or concave, as well as the most complicated aspheric that can be described by a mathematical expression. This is all done in a clean, temperature-controlled environment that ensures the highest possible accuracy and precision in the final product.

In 1999, the first Optipro PX250 polisher was installed in our facility. This advanced computer polisher is the only machine of its kind. Older high-speed polishers relied on careful cutting of a polishing pad to achieve even action over the optical surface. The PX250 gently oscillates the tool across the surface so that in a typical 20-30 minute cycle, every part of the polisher spends time on every part of the glass surface. This produces and maintains a very accurate spherical surface on the part being polished.

Common high-speed processes run up to 5000 RPM and can distort the glass because of the heat generated. While capable of blasting out parts in just 5-6 minutes, they tend to leave a rough, zony surface that lowers contrast in the final image. Our computer polisher runs at a mere 200 RPM, and consistently produces 1/10 wave surfaces from start to finish. Since it runs automatically, it leaves the optician much more time to do other more critical tasks.

Where the opticians used to spend an inordinate amount of time in the dirty, time-consuming jobs of grinding and polishing, they can now concentrate much more time on figuring the optical surfaces which is still done on pitch. The Opticam SX and PX250 are examples of the total commitment we have at Astro-Physics to the hobby of amateur astronomy.

As part of our overall Quality Program, Astro-Physics installed a Fizeau interferometer that allows us to measure the wavefront error of a lens during the final figuring phases. The lens is held in

a special multi-point flotation cell in a vertical orientation to simulate actual observing conditions. The interferometer uses two wavelengths of light, yellow and green, to fully characterize lens aberrations. The interferometer is used as part of the lens making process, not just as a final quality assurance check. Lenses are finished one at a time until they meet or exceed our quality standards. A lens is finished when it displays a wavefront accuracy of $\lambda/50$ RMS (Strehl Ratio of 98.4%). This is well within the diffraction limit, and a lens with this smooth of a wavefront will be a superb planetary objective.

Design Engineering

We are fortunate to have a full staff of engineering talent with decades of experience in mechanical, electronic and software design. What begins as drawings and calculations on the computer screen eventually ends up in the hands of our top-grade machinist as a finely-crafted work of art. Our CAD-CAM system is so sophisticated that every surface of a part is fine-machined and de-burred automatically. Even parts that are buried deep inside an assembly and may never be seen by anyone are fully machined, de-burred and finished to a high degree with no rough edges or saw marks to mar the integrity of the final product.

Our in-house electronic assembly uses ruggedized components and techniques common to aerospace manufacturing. In fact, our electronic design engineers both have many years of aerospace design background.

Machining Capabilities

Most of our components are machined in-house on our ultra-modern 3-axis CNC (computerized numerical control) lathes and CNC machining center. Our highly skilled machinists maintain very accurate tolerances so that parts fit together precisely with no slop. As a result, our mountings are very rigid and our focusers are smooth with no wobble.

Tube Assembly

Tube assemblies are now fully machined, complete with machined-in baffles, on our CNC lathe. This insures that all mechanical components from the focuser to the lens cell are accurately held in perfect optical alignment. The tubes are finished with a high quality polyurethane paint on the outside, and a flat-black finish on the inside.

Mount Assembly

Our mount assembly department is staffed by highly experienced professional telescope makers who are also advanced users and observers. Consequently, they understand how a precision mounting should feel and be adjusted. This experience is brought to the construction of each mounting. The components of our hand controllers are carefully soldered to the circuit boards and tested prior to shipment. Circuit boards and electronic components are purchased to the more rugged industrial specs instead of the cheaper consumer specs so common in inferior equipment. The components of our telescope drives will perform properly from the coldest Arctic to the hottest desert conditions that an amateur is likely to experience.

Packing and Shipping

When you receive your order, you will discover that a great deal of care was given to the safe packing of each item. It is very rare that any item is damaged during shipment.

Office Personnel

The office staff will be your primary source of information regarding products and prices, estimated delivery dates and the status of your order. If we can be of assistance to you in any way, please ask.

Astro-Physics Achromatic Refractors

Optical Design

The optical design of all lenses currently in production is patterned after the 6" EDF astrograph objective. The EDF design uses synthetic fluorite, FPL53, which has excellent optical, mechanical and thermal properties. Although it is the most expensive E.D. optical glass currently available, its singular ability to bring a wide spectrum of colors to a common focus places it several notches above the nearest rival. The two mating crowns that make up the final triplet assembly are chosen to compliment the E.D.'s optical characteristics as closely as possible, resulting in a well-corrected spectrum range spanning 6000 Angstroms. While the color correction was originally chosen for photographic emulsions, these lenses are especially well-corrected for the critical visual colors from red to violet. This makes them superb planetary instruments, easily rivaling and outperforming the old long-focus doublets.

Optical Production and Testing Standards

Every production run starts with optical glass purchased to our specifications. Each blank is tested by our suppliers to meet H3 optical quality standards and is individually serialized and accompanied by an interferogram. This level of precision is 50 times tighter than that normally guaranteed by the glass manufacturers in a molded blank. We have found it necessary to specify this high purity in order to guarantee that every optic we produce will meet our final quality standard. These blanks are then processed in our computerized facility and hand-figured by experienced opticians. Each surface is polished to a fine sphere and tested by test plate interferometry. Three elements are then matched and assembled as a set. Final figuring on the front and rear surfaces is done using our green light Fizeau interferometer which checks the wavefront accuracy. The interferometer immediately shows when a polishing lap is worn when zones develop on the glass surfaces. A new lap can then be made without guesswork to again produce a smooth surface.

The finished lens is then coated and assembled in a precision cell which is fully temperature-compensated. The cell is attached to the tube assembly and the optical alignment is checked at high power on an artificial star. The lens is serialized and all test data including final interferogram are stored in a computer file along with the customer's name. Our extensive hand-figuring techniques and the use of H3 quality blanks allows us to guarantee that all production lenses will meet the 1/50 RMS (98.4% Strehl ratio) minimum limit.

Construction of the Tube Assembly

The mechanical construction of Astro-Physics refractors makes the scopes completely trouble-free and keeps the optics permanently aligned. Their gorgeous tube assemblies are precision machined in our shop with modern CNC equipment. There are no fragile die casts in these telescopes. Our expert machinists transform solid, aircraft-quality aluminum into a fully baffled tube assembly with a large number of knife-edge baffles. This eliminates as much stray light as possible for maximum contrast at the eyepiece. The exterior finish of the tubes and dewcaps will retain their deep, lustrous beauty for many years.

We have incorporated several significant improvements to the tube assembly to make it easier to transport and set up in the field. The dewcap slides over the lens cell for more compact storage. An aluminum dust cover protects the optical surface when not in use, and a foam-fitted carrying case will help retain the beauty of your tube assembly for years. You will appreciate the unique design and fine craftsmanship of these fine telescopes.

Astro-Physics 2.7" Focuser (27FOCU)

Our superb Astro-Physics focuser is a very finely crafted unit with several unique features. The components are machined to extremely high tolerances, assuring that there is no wiggle between the drawtube and housing. More than a dozen knife-edge baffles are machined into the wall of the drawtube and painted flat black in order to maximize contrast by essentially eliminating any internal reflections. The inside diameter (I.D.) of the drawtube is 2.7" which allows the avid astrophotographer to use a medium-format camera to capture images in a 2.25" x 2.25" format with minimal vignetting. The helical rack and pinion provides smooth motion, free of backlash or wobble, for precision focusing. Our machined aluminum knobs were designed with comfortable, firm handling in mind. The adapter thumbscrews are substantial and easy to grasp.

Brass locking rings are an important feature of our focuser. We realize that many of our customers use a variety of heavy and expensive accessories including 2 lb. eyepieces, 35mm and medium-format cameras, binocular viewers, etc. So, we designed our focuser with recessed brass locking rings at each thumbscrew location. As you tighten the thumbscrew, the brass locking ring clamps onto the part that has been inserted. Consequently, your focuser drawtube, and 2" and 1.25" accessories are held securely in place. As an added advantage, the brass will not mar the surface of your accessories.

This focuser is included with all of our StarFire refractors (except those with a 4" Focuser). The 2.7" focuser is also a first class choice for the do-it-yourselfer who takes pride in constructing his own tube assembly.

- All components are machined of high quality aluminum. Housing is black anodized
- Brass locking rings to secure focuser drawtube, 2" and 1.25" accessories
- 2" adapter is aluminum, black anodized, screws into focuser drawtube, brass locking ring, thumbscrew
- 1.25" adapter is aluminum, black anodized, slips into 2" adapter or 2" diagonal, brass locking ring, thumbscrew, threaded for 48mm filters
- Focuser extension is aluminum, black anodized, threads into focuser drawtube, knife-edge baffles, 2.5" length, use for straight-through viewing
- Inside diameter of focuser draw tube is 2.7"
- Focus travel with the 2" adapter is 4.4"
- Focus travel with telecompressor is 5.0"
- Overall length of the focuser when fully racked in with 2" adapter is 4.8"
- Overall length of the focuser when fully racked in with 1.25" adapter is 5.25"

105mm f6 Traveler EDFS – 4.1 aperture (105EDFS)

Imagine an Apo refractor with a 105mm (4.1") aperture, focal ratio of f6, in a tube assembly that has an overall length of 19"! The 105 Traveler is the culmination of years of optical research by Roland Christen of Astro-Physics aimed at developing a very fast and portable telescope that will allow you to enjoy sharp, high-contrast images wherever you go.

The Traveler is an awesome performer both at night and during the day due to the superb figure of the lens and extremely efficient design of the optical system. Based on light gathering area alone, the Traveler has 36% more light grasp than a 3.5' Maksutov and 10% more light grasp than a 100mm refractor.

During the daytime, delicate detail and vivid colors of flowers and wildlife are a true joy to observe. When viewing at night, the high light transmission of the extremely pure optical glass becomes immediately apparent. With a 2" widefield eyepiece, we have seen the entire Veil Nebula, including the very faint inner region, all in one eyepiece field of view. The North American Nebula region is so bright and clear, it looks like a deep-sky astrophoto. Pop in a high-power eyepiece, and you will be rewarded with truly stunning views of the Moon and planets. Jupiter will amaze you with sharp resolution of the bands, festoons, white ovals and the Great Red Spot. This scope shows detail on Saturn and Mars that rival views in much larger instruments.

The Traveler is a fabulous astrograph. With a Pentax 6 x 7cm camera coupled with our 2.7" field flattener specifically designed for this instrument (67PF46), you can capture 5.6 x 6.6 degrees of stunning star fields, clusters and nebulas at f6! If a faster focal ratio in a 35mm format is desired, use our Telecompressor (27TVPH) for f4.5, or our 2x Barlow (BAR2X0) for f12 exposures.

Please refer to the 'Astro-Physics Apochromatic Refractors' section for specific information regarding the optical design and mechanical construction of this fine refractor.

Pairing the Traveler with the 400 German Equatorial (400GTO) will assure your greatest enjoyment of astronomy. The dual-axis drive keeps the object that you are viewing in the center of the eyepiece allowing you to relax and enjoy the fine detail. Nature studies are most easily accomplished with an alt-azimuth mount such as the TeleVue Gibraltar.

Whether traveling to exotic eclipse locations, your favorite camping spot, bird watching expeditions or just into your backyard, this little gem will provide you with hours of observing pleasure.



Traveler, 400GTO German Equatorial, Aluminum Tripod and Accessories

Specifications

Color correction:	Less than 0.01% focus variation from 405nm to 706nm (r to h wavelengths)
Clear aperture:	105mm (4.1")
Focal length:	610mm (24") (actually f5.8)
Resolution:	1.1 arc seconds
Coatings:	Multi-layer, overall transmission greater than 97% in peak visual wavelengths
Magnification range:	12x to 400x
Tube assembly:	Black finish, 19" aluminum tube, fully baffled, permanently aligned cell construction; flat black interior, engraved focuser
Focuser type:	2.7" I.D. Astro-Physics rack & pinion focuser, 4.5" travel; 2" and 1.25" adapters; 2.5" extension
Telescope length:	48cm (19") w/ dewcap fully retracted
Weight with dewcap:	9 lbs. (4 kg)
Carrying-case type:	Custom padded soft case
Case outside dimensions:	21" x 10.8" x 7" (53cm x 27cm x 18cm)
Weight of case:	3.5 lbs. (1.6 kg)

35mm Photographic field at prime-focus:	2.3 x 3.2 degrees @ f5.8
35mm Photographic field with telecompressor:	2.9 x 4.1 degrees @ f4.5
35mm Photographic field with 2x Barlow:	1.1 x 1.6 degrees @ f11.6
6x7cm Photographic field at prime focus:	5.6 x 6.5 degrees @ f5.8 (vignetted)

Specifications subject to change without notice

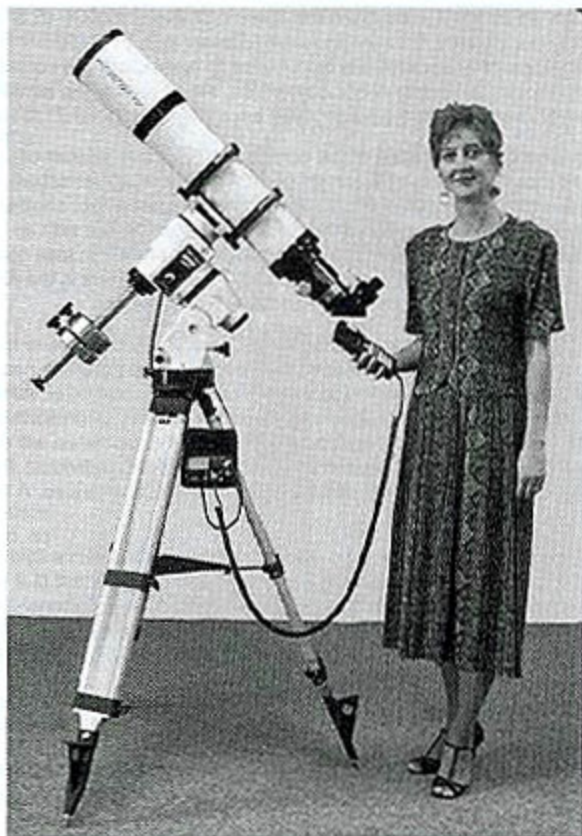
130mm f6 Starfire EDFS – 5.1" aperture (130EDFS)

At last, an easy-to-use amateur telescope that can produce exquisite astrophotos with almost no effort and show excellent planetary images as well. Versatility is the hall-mark of our refractors whether you wish to study the brush-stroke detail of sun spots or lunar crater detail; or enjoy wide-field deep-sky objects and CCD imaging with the fabulous cameras on the market today. Fast, high-transmission optics provide breathtaking wide-field views of your favorite deep-sky objects. Rich-field viewing at its best. Attach your favorite 35mm camera or Pentax 6x7 with our optional 2.7" field flatter for photos worthy of publication. With our telecompressor, you can photograph at a very fast f4.5! Or, attach our Convertible Barlow and enjoy views or photography with an f12 focal length.

This scope has 53 % more light grasp than a Traveler, yet it is still friendly and inviting to set up. The compact size and light weight ensure easy portability. It will pack easily into your car, even with your kids or other gear. Set up is a breeze whether in your backyard or favorite dark-sky site. You will use this scope often.

Please refer to the "Astro-Physics Apochromatic Refractors" section for specific information regarding the optical design and mechanical construction of this fine refractor.

The 130 f6 StarFire is at home on either our 400GTO or 600EGTO German Equatorial Mounts. If astrophotography is your primary love, pair it with our 600EGTO and 40" pier.



130 f6 StarFire EDFS, 600EGTO German Equatorial, Adjustable Wood Tripod and Accessories

Specifications

Color correction:	Less than 0.01% focus variation from 405nm to 706nm (r to h wavelengths).
Clear aperture:	130mm (5.12")
Focal length:	780mm (30.7')
Resolution:	0.87 arc seconds
Coatings:	Multi-layer, overall transmission greater than 97% in peak visual wavelengths
Magnification range:	22x to 500x
Tube assembly:	White, 5.5" aluminum tube, baffled, flat black interior, engraved push-pull lens cell
Focuser type:	2.7" I.D. Astro-Physics rack & pinion focuser, 4.5" travel; 2" and 1.25" adapters; 2.5" extension
Telescope length:	724mm (28.5") w/ dewcap fully retracted
Weight with dewcap:	15 lbs. (6.8 kg)
Carrying-case type:	Wood case with grey vinyl covering and foam-lined interior
Case outside dimensions:	31" x 9" x 9" (79 cm x 23 cm x 23 cm)
Weight of case:	14 lbs. (6.4 kg)

35mm Photographic field at prime focus :	1.7 x 2.4 degrees @ f6
35mm Photographic field with telecompressor:	2.3 x 3.3 degrees @ f4.5
35mm Photographic field with 2x Barlow:	0.9 x 1.2 degrees @ f12
6x7cm Photographic field at prime focus:	4.4 x 5.1 degrees @ f6 (vignetted)

Specifications subject to change without notice.

155mm f7 Starfire EDFS – 6.1" aperture (155EDFS)

with 2.7" Focuser

Although we originally designed the 155mm f7 StarFire EDF (6.1" aperture) featuring our gigantic focuser and field flattener with the avid astrophotographer in mind, we have come to appreciate the versatility of this instrument. At the urging of our customers, we now offer the same excellent 155mm f7 lens in a lighter weight tube assembly with our 2.7" focuser.

We continue to be amazed at the compact size of this instrument. At last, a 6.1" refractor with an overall length of 40" (with dewcap retracted). This is less than half the length of an f15 and approximately a foot shorter than an f9! In fact, it is about the same length as a 130mm f8, but with an inch more of aperture! You can transport it in a smaller car, store it in less space, invest in a smaller mount and shorter pier/tripod. This instrument is the fulfillment of the astronomer's dream for a truly portable 6.1" refractor.

The EDF is superb as a visual instrument. It is easily capable of high-power observations of the moon and planets. Secondary spectrum is nearly absent at any power which allows you to discriminate the subtle color variations on the surface of the planets. Deep-sky views are equally impressive due to the very high transmission of the three glass types. Performance will rival larger obstructed systems because the contrast is excellent. Individual stars of globular clusters are sharply etched against velvet black skies. A beautiful sight!

This refractor can, of course, be used photographically with a 35mm camera at prime focus with only a simple camera adapter or at a fast f5.2 with the optional flat-field telecompressor. A single element field flattener is available for the Pentax 6 x 7 medium-format camera, however the field is vignetted in the corners due to the restrictions of the 2.7" focuser (full coverage requires the 4" focuser/4" field flattener combination). The 2.7" focuser is interchangeable with the 4" model should you choose at some time in the future to upgrade to the full EDF package.

Please refer to the "Astro-Physics Apochromatic Refractor" section for specific information regarding the optical design and mechanical construction of this fine refractor.

Several mount choices are available for the 155 StarFire EDFS refractor. Many of our customers have chosen the 600E mount and hardwood tripod combination for its light weight and easy portability. These astronomers are primarily interested in visual astronomy and occasional astrophotography. For more serious astrophotographers, the 900 or 1200 German Equatorials would provide a more solid base of support in conditions of light wind.

Astronomy Test Report

In the test report entitled "Astro-Physics Refractors Big & Small", in the September 1993 issue of Astronomy, Alan Dyer described the performance of the 155mm f7 EDF during his winter observing sessions. Please note that the article referred to this instrument as an EDT.

"Optical performance of the 155EDT was impressive. It produced nary a trace of false color even on Venus. Equally impressive, this scope provided superb images as soon as it was set outside. Even in sub-freezing temperatures, image quality, though not perfect at first, was surprisingly sharp from the start. In cold weather, after a modest settle-down time of 30 minutes, in-focus star images were textbook Airy disks with a well-defined first diffraction ring and a trace of a second outer ring. There was no sign of spherical aberration, lens figure changes, heat plumes, or distorted Airy disks due to tube turbulence."

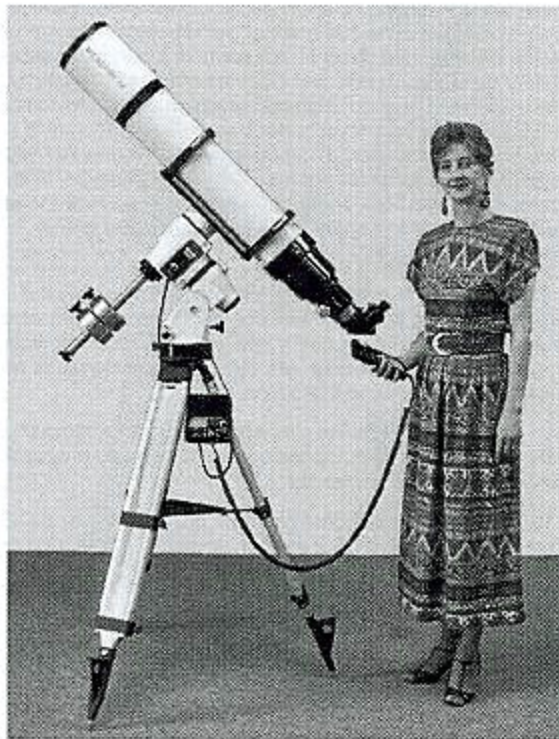
We couldn't have said it better ourselves.

Specifications:

Color correction :	Less than 0.01% focus variation from 405nm to 706nm (r to h wavelengths)
Clear aperture :	155mm (6.1")
Focal length :	1085mm (43") efl
Resolution :	0.74 arc second
Coatings:	Multi-layer, overall transmission greater than 97% in peak visual wavelengths
Magnification range :	20x to 600x
Tube assembly :	White, 6.5" aluminum tube, baffled, flat black interior, push-pull lens cell, engraved retaining ring
Focuser type :	2.7" I.D. Astro-Physics rack & pinion focuser, 4.5" travel, 2.7", 2" and 1.25" adapters, 2.5" extension
Telescope length :	1041mm (41") with dewcap fully retracted
Tube weight :	23 lb
Carrying Case:	Foam-fitted, vinyl-covered plywood case

35mm Photographic field at prime focus :	1.3 x 1.8 degrees @ f7
35mm Photographic field with Telecompressor:	1.7 x 2.4 degrees @ f5.2
35mm Photographic field with 2x Barlow :	0.6 x 0.9 degrees @ f14
6x7 Photographic field at prime focus	3.2 x 3.7 degrees @ f7 (vignetted)

Specifications subject to change without notice



155 f7 StarFire EDFS with 2.7" Focuser, 600EGTO German Equatorial, Adjustable Wood Tripod and Accessories

155mm f7 Starfire EDF – 6.1" aperture (155EDF)

ASTROGRAPH WITH 4" FOCUSER AND 4" FIELD FLATTENER

This 155mm f7 StarFire EDF (6.1" aperture) was designed to be the ultimate astrograph while providing uncompromising visual performance. Outstanding photographs published in *Sky & Telescope*, *Astronomy* and various international astronomy magazines can only hint at the detail of the original prints and negatives. The 30" x 40" prints of the Lagoon/ Trifid and Horsehead Nebulas that are on display in our showroom show incredible pinpoint star images from one side of the print to the other with no sign of image degradation. Truly amazing! Photographic spot diameters measure 15-20 microns over a 5 degree field (4" circle). The fast f7 focal ratio captures elusive and faint deep-sky objects easily with incredible detail. This lens has outperformed mirror type astrographs twice its size, as we had predicted.

The EDF is superb as a visual instrument as well. It is easily capable of high-power observations of the moon and planets. Secondary spectrum is nearly absent at any power. Deep-sky views are equally impressive due to the very high transmission of the three glass types.

In the astrographic configuration, the lens is a 5-element design in 2 groups (3 elements in front, 2 in rear). The heart of the front triplet apochromatic lens is an ED glass and 2 crowns. This combination totally eliminates all secondary spectrum, coma and spherical aberration. The rear lens is a 2-element field flattener that eliminates astigmatism and field curvature. In the visual configuration, the rear 2-element lens is removed and replaced with a standard visual adapter. This adapter allows all our usual accessories to be attached, as well as all standard 2" and 1.25" oculars.

The tube assembly comes fully baffled for a 5 degree 4" field. The giant 4" focuser is silky smooth and can be locked for long time-exposure astrophotography. Although it is possible to attach your own custom-made film holder, we have determined that the most practical camera back is the Pentax 6 x 7cm medium-format camera. Field coverage is 3 x 3.5 degrees. After 4 years of field research, we've chosen this camera because it holds the film critically flat without the use of special vacuum attachments. This is not the case with other, less expensive film backs. The Pentax allows the user to critically focus directly on the ground glass with a high-power magnifier, assuring the highest possible resolution.

Another feature is the extra-large opening and minimum back distance to the film plane which minimizes the inevitable vignetting of the light in the extreme corners of the format. All the important color and black/white films are available in the 120 format, which is not the case with larger formats. It is for these reasons that we have standardized on the Pentax 6 x 7 and offer all the attachments necessary to use with the 155mm EDF.

The Astro-Physics giant 4" focuser is truly versatile. The 4" ID of the drawtube will allow maximum coverage of the Pentax 6 x 7 cm negative for medium format photography. The inside of the drawtube has a series of knife-edge baffles for maximum contrast. When you wish to use your 35mm camera with the Astro-Physics telecompressor (27TVPH) for even faster exposures (f5.2), you can attach the 2.7" reducer and camera adapter (PFCT---) and you are ready to go. The 2" and 1.25" adapters will allow you to use all of our standard accessories to maximize your visual and photographic applications.

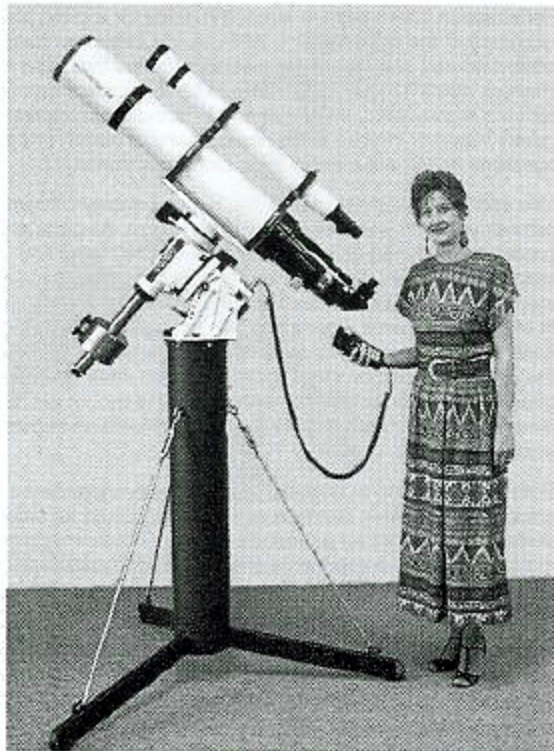
Either the 900 or 1200 German Equatorial is recommended for astrophotography, depending on your requirements for portability and the amount of wind you are likely to encounter at your photographic site.

Specifications

Color correction :	Less than 0.01% focus variation from 405nm to 706nm (r to h wavelengths)
Clear aperture :	155mm (6.1")
Focal length :	1085mm (43") efl
Resolution :	0.74 arc second
Coatings:	Multi-layer, overall transmission greater than 97% in peak visual wavelengths
Magnification range :	20x to 600x
Tube assembly :	White, 6.5" aluminum tube, baffled, flat-black interior, push-pull lens cell, engraved retaining ring
Focuser type :	4.0" I.D. Astro-Physics rack & pinion focuser, 4.5" travel, 2.7", 2" and 1.25" adapters, 2.5" extension
Telescope length :	1041mm (41") with dewcap fully retracted
Tube weight :	27 lbs
Field Flattener:	4" diameter 2-element with multi-coatings
Carrying Case:	Foam-fitted, vinyl-covered plywood case

35mm Photographic field at prime focus :	1.3 x 1.8 degrees @ f7
35mm Photographic field with Telecompressor:	1.7 x 2.4 degrees @ f5.2
35mm Photographic field with 2x Barlow :	0.6 x 0.9 degrees @ f14
6 x 7 cm Photographic field at prime focus :	3.2 x 3.7 degrees @ f7

Specifications subject to change without notice



155 f7 StarFire EDF with 4" Focuser, 900GTO German Equatorial, 48" Pier, 80mm Guidescope and Other Accessories

400GTO German Equatorial Mount (400GTO)

Includes Go-to Keypad Controller and DigitalSky Voice™ software

The two most important considerations in mount design and construction are maximum strength/rigidity for a given size and accuracy of the drive system. Without this basic foundation, all other features of a mount are just superfluous frills. The Astro-Physics 400GTO was engineered to be a compact, firm platform for your high-resolution instrument. Whether your interests are purely visual or include astro-photography, a steady image in the eyepiece or camera viewfinder is extremely important.

The 400GTO is constructed of the highest quality components to provide you with years of observing pleasure. All parts are precisely machined on our computerized CNC lathe and machining center using solid or thick-wall aluminum and stainless steel. Machining tolerances are very high to achieve a tight, solid fit of all components. These are not thin-wall, weak, porous die castings as in most other mounts of comparable size. We avoid the use of any carbon steel shafts or plated steel fasteners because they will deteriorate with time. This mount will not rust or bind up and will retain its appearance and function throughout the years.

Both axes respond to fingertip pressure with unparalleled smoothness. Built-in clutches can be disengaged for smooth sweeping or locked for astrophotography. The worm gears, motors and drive components are enclosed to protect them from dirt and dust. With the 105 Traveler, the 400 mount damps out in one second when mounted on the lightweight aluminum tripod.

Your 400GTO mount can grow with your skills and interests in astronomy. You can enjoy the visual pursuits using the go-to keypad controller and/or DigitalSky Voice software to help you find many fascinating objects. If you plan to take astro-photos, you will be pleased with the solid stability and inherent accurate tracking capability of the drive system. The GTO Control Box contains a plug-in for the CCD auto-guiding and imaging systems. These units will allow you to auto-guide astronomical photos and explore CCD imaging.

When coupled with the options described separately, the 400GTO German Equatorial Mount will be your portable observatory. This handy mount can be lifted easily into your backyard, packed conveniently into your car or carried aboard an airliner for travel to another hemisphere.

Features

- Precision-machined aluminum with radiused edges
- Gears and motors are fully enclosed
- Gear in declination axis allows full 360 degree continuous rotation; scope can move through the zenith for photography
- 2.5" (6.4cm) hollow right-ascension and declination shafts maximize strength at minimum weight
- Large thrust bearings form highly-stable thrust surfaces for tremendous rigidity in a small package
- Removable stainless steel counterweight shaft for compact storage
- Fine altitude and azimuth adjustments for quickly and accurately zeroing in on the pole in the field
- Black anodized finish will retain its lustrous beauty for years
- Base fits into 6" diameter pier with 0.083" wall thickness

Specifications of Equatorial Head

Worm wheel:	3" (1.18 cm), 192 teeth, fine-pitched bronze wheel
Worm gear:	Stainless steel
Latitude range:	10 to 64 degrees
Azimuth adjustment:	Approximately 25 degrees
Setting circles:	Porter Slip Ring design
Right ascension:	10 minute increments, pointer engraved both Northern/Southern
Declination:	1 degree increments, pointer
Capacity:	Will accommodate refractors up to 5", reflectors to 6", Cassegrains to 8"
Weight of equatorial head:	21 lbs. (9.5 kg)



400GTO with 130EDFS, Adjustable Wood Tripod and Accessories

Servo Motor Drive

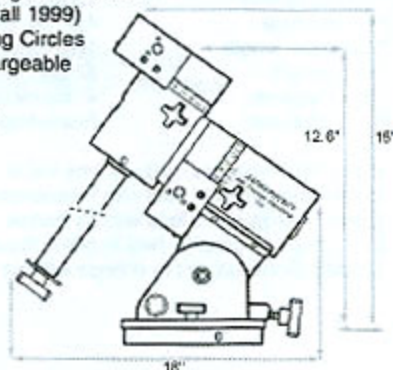
The drive system uses a high-quality, zero-cogging DC servo motor controlled by a microprocessor to an accuracy of 0.2 arc seconds per step. Tracking is very smooth, noticeably smoother than any stepper motor drive. The system can be accurately controlled over a speed range of 4800:1 (0.25x sidereal for guiding to 1200x sidereal for 5 degree per second slewing). The circuit draws only 0.3 amps when tracking the stars, 1.2 amps with both motors slewing and requires 12 volts to operate. The servo drive will satisfy the requirements of the sophisticated, advanced astrophotographer, yet is easy for the casual, visual observer to use. Please refer to the separate section entitled "GTO Control Box and Keypad for Servo Drive".

DigitalSkyVoice™ Software

DigitalSky Voice is a terrific observing companion offering lots of observing ideas and information. If you plan to use an IBM-compatible personal computer to control your telescope, you will have lots of fun with this program. The software is included with the mount. Please refer to the sheet entitled "DigitalSky Voice Software" for additional information.

Available Options

SBIG ST-4, ST-6, ST-7, ST-8 CCD Star Tracker/Imaging System
Portable Pier - 6" diameter, heights 42", 48" 54" or 62"
Mounting plates: FP1500, DOVE08, DOVE15, and DOVELM
Adjustable Hardwood Tripod with shell and carrying case
Lightweight Davis & Sanford Adjustable Aluminum Tripod
Stainless Steel Counterweights: 6 & 9 lbs.
Carrying Case (available fall 1999)
Encoders for Digital Setting Circles
17 Amp-hr, 12 Volt Rechargeable
Battery Pack
JMI Digital Setting Circles
Kendrick Power Supply
Mounting Rings



400GTO Dimensions Based on 42 Degrees Latitude
Measurements for Your Latitude May Vary

600EGTO German Equatorial Mount (600EGTO)

Includes Go-to Keypad Controller and DigitalSky Voice™ software

The Astro-Physics 600E German Equatorial mount offers many fine features to provide superb performance in a compact, portable package. It was engineered to provide a firm, steady platform for your high-resolution instrument. Both axes respond to fingertip pressure with no hint of backlash. Built-in clutches can be disengaged for ultra-smooth sweeping or locked for astro-photography.

The 600E is constructed of the highest quality components to provide you with years of observing pleasure. All parts are machined of aluminum and stainless steel. We avoid the use of any carbon steel shafts or plated-steel fasteners because they will deteriorate with time. This mount will not rust or bind up and will retain its appearance and function throughout the years.

Rigid aluminum castings enclose the worm gears and the right-ascension and declination motors. Drive components are protected from dirt and dust, extraneous wires and gearing are eliminated, and the overall appearance is enhanced.

When coupled with the options described separately, the 600E will be your portable observatory for home or dark-sky site. Within minutes, you will be assembled and polar-aligned, ready to enjoy the wonders of the night sky.

Features

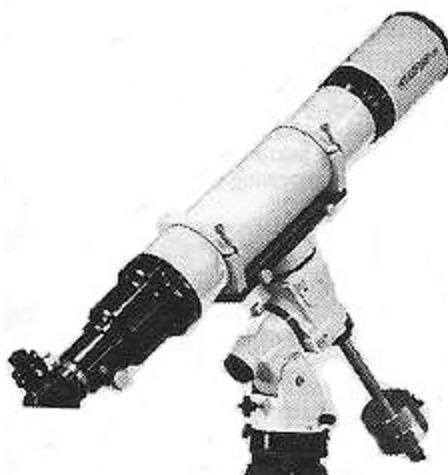
- Virgin aluminum sand castings, precision hollow cast and machined for light weight and rigidity
- Gears and motors are fully enclosed
- Gear in declination axis allows full 360 degree continuous rotation; scope can move through zenith for photography
- Large thrust bearings form stable thrust surfaces for tremendous rigidity in a small package
- Hollow right-ascension and declination shafts maximize strength at minimum weight
- Removable stainless steel counterweight shaft for compact storage
- Fine altitude and azimuth adjustments for quickly and accurately zeroing in on the pole in the field
- Base fits into 6" outside diameter pier with 0.083" wall thickness

Specifications of Equatorial Head

Worm wheel:	4", 192 teeth fine-pitched bronze wheel
Worm gear:	Stainless steel
Latitude range:	15 to 57 degrees
Azimuth adjustment:	Approximately 17 degrees
Setting circles:	Porter Slip Ring design, engraved
Right ascension:	10-minute increments, 2-minute vernier
Declination:	1-degree increments, pointer
Capacity:	Will accommodate refractors up to 6" f9, reflectors to 8", Cassegrains to 10"
Weight of head:	27 lbs. (12.3 kg)

Servo Motor Drive

The drive system uses a high-quality, zero-cogging DC servo motor controlled by a microprocessor to an accuracy of 0.2 arc seconds per step. Tracking is very smooth, noticeably smoother than any stepper motor drive. The system can be accurately controlled over a speed range of 4800:1 (0.25x sidereal for guiding to 1200x sidereal for 5 degree per second slewing). The circuit draws only 0.3 amps when tracking the stars, 1.2 amps with both motors slewing and requires 12 volts to operate. The servo drive will satisfy the requirements of the sophisticated, advanced astrophotographer, yet is easy for the casual, visual observer to use. Please refer to the separate section entitled "GTO Control Box and Keypad for Servo Drive."



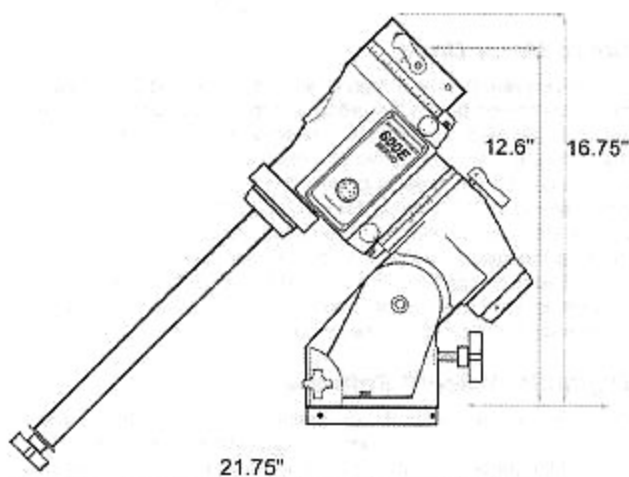
600EGTO with 155EDFS and Accessories

DigitalSkyVoice™ Software

DigitalSky Voice is a terrific observing companion offering lots of observing ideas and information. If you plan to use an IBM-compatible personal computer to control your telescope, you will have lots of fun with this program. The software is included with the mount. Please refer to the sheet entitled "DigitalSky Voice Software" for additional information.

Available Options

Please see the accompanying information for descriptions:
SBIG ST-4, ST-6, ST-7, ST-8 CCD Star Tracker/Imaging System
Adjustable Hardwood Tripod with shelf and carrying case
Mounting Plates: FP1500, DOVE08, DOVE15, DOVELM
Portable Pier - 6" diameter, heights 42", 48", 54", 62"
17 Amp-hr, 12 Volt Rechargeable Battery Pack
Stainless Steel Counterweights- 6 lbs., 9 lbs.
Carrying Case (available Fall 1999)
Encoders for Digital Setting Rings
JMI Digital Setting Circles
Kendrick Power Supply
Mounting Rings



600EGTO Dimensions Based on 42 Degrees Latitude
Measurements for your Latitude May Vary

900GTO German Equatorial Mount (900GTO)

Includes Go-to Keypad Controller and DigitalSky Voice™ software

Modern CNC machining methods inspired our mount designer to carve out the excess material in both axes of the 900 and 1200 German Equatorials while retaining a heavily ribbed structure for internal strength and rigidity. A unique dovetail was machined into the mating surfaces of the R.A. and Dec axes. This feature allows quick and easy assembly in the field without any tools. These mounts are truly a marvel of engineering - maximum strength and rigidity with minimum weight.

Features

- All machined mounting made from aluminum barstock and stainless steel. All fasteners are stainless steel.
- Motors and all electronic components are enclosed
- Ball bearing races
- Removable 1.875" stainless steel counterweight shaft
- Polar and declination axes come apart quickly without tools for light-weight, easy handling and ease of transport
- Fine altitude and azimuth adjustments for quickly and accurately zeroing in on the pole in the field
- Engraved setting circles are Porter Slip Ring Design
- Electronic components rated for industrial and automotive applications
- Base fits into 8" outside diameter pier with 0.125" wall thickness

Specifications of Equatorial Head

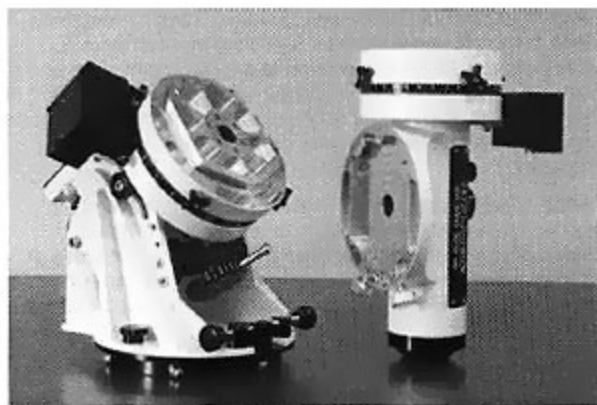
R.A. worm wheel:	7.2", 225 tooth aluminum
Declination worm wheel:	6", 225 tooth aluminum
Worm gears:	Brass
R.A. thrust surface:	7.0" diameter
Declination thrust surface:	6.0" diameter
R.A. shaft:	2.2" diameter
Declination shaft:	1.75" diameter
Latitude range:	20 to 68 degrees
Azimuth adjustment:	0-20 degrees w/ latitude wedge
Setting circles:	Approximately 14 degrees
Right ascension:	Porter Slip Ring design, engraved
Declination:	4-minute increments, pointer
Capacity:	1-degree increments, pointer
Weight of equatorial head:	70 lbs depending on size
	50 lbs (22.2 kg), dec. axis is 15 lbs.,
	right ascension axis is 25 lbs.,
	counterweight shaft is 10 lbs.

Servo Motor Drive

The drive system uses a high-quality zero-cogging DC servo motor controlled by a microprocessor to an accuracy of 0.05 arc-seconds per step. Tracking is very smooth, noticeably smoother than any stepper motor drive or inexpensive servo motor. The system can be accurately controlled over a speed range of 4800:1 which allows 0.25x sidereal for guiding to 1200x sidereal for 5 degree per second slewing. The circuit draws only 0.4 amps when tracking the stars, 2 amps with both motors slewing and requires only 12 volts to operate. The servo drive will satisfy the requirements of the sophisticated, advanced astrophotographer, yet is easy for the casual, visual observer to use.

DigitalSkyVoice™ Software

DigitalSky Voice is a terrific observing companion offering lots of observing ideas and information. If you plan to use an IBM-compatible personal computer to control your telescope, you will have lots of fun with this program. The software is included with the mount. Please refer to the sheet entitled "DigitalSky Voice Software" for additional information.

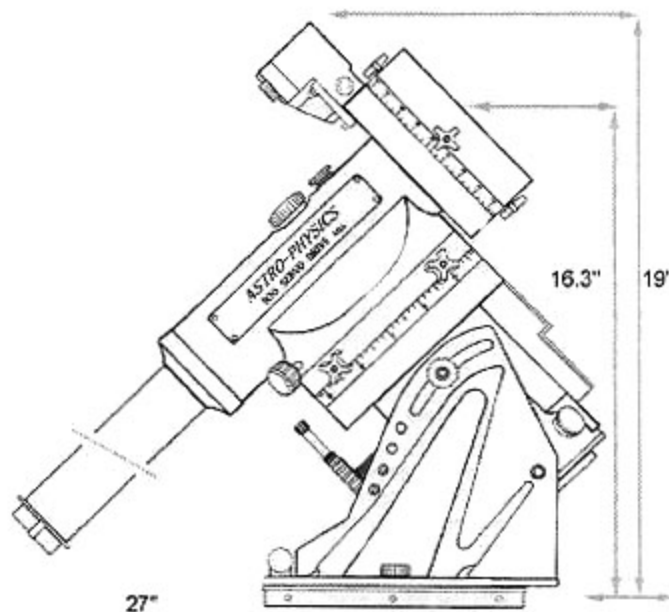


900GTO RA and Dec Axes Disassembled
Dovetail Allows Assembly without Tools

Available Options

Please see accompanying information sheets for description SBIG ST-4, ST-6, ST-7, ST-8 CCD Star Tracker/ Imaging System Portable Pier - 8" diameter, heights 24", 32", 42", 48", 54", 62" Mounting Plates- FP1800, DOVE15, DOVELM, 900RP, DOVE08 with Q4047

17 Amp-hr, 12 Volt Rechargeable Battery Pack
Stainless Steel Counterweights - 10, 18 lbs
Cable for SBIG ST-4, ST-6, ST-7, ST-8
Pier Accessory Trays and Support Bar
Encoders for Digital Setting Circles
0-20 degree Lower Latitude Wedge
JMI Digital Setting Circles
Kendrick Power Supply
Mounting Rings



900GTO Dimensions Based on 42 Degrees Latitude
Measurements for your Latitude May Vary

1200GTO German Equatorial Mount (1200GTO)

Includes Go-to Keypad Controller and DigitalSky Voice™ software

Modern CNC machining methods inspired our mount designer to carve out the excess material in both axes of the 1200 and 900 German Equatorials while retaining a heavily ribbed structure for internal strength and rigidity. A unique dovetail was machined into the mating surfaces of the R.A. and Dec axes. This feature allows quick and easy assembly in the field without any tools. These mounts are truly a marvel of engineering - maximum strength and rigidity with minimum weight.

Motions are smooth and positive in RA and Dec with the hand controller or when manually moving the telescope. Each shaft is supported by 5 bearing elements, two preloaded ball bearings and 3 sets of massive thrust bearings. The result is very low friction, which is constant with the load.

The 1200 equatorial is equally at home in a permanent observatory or as a portable mounting for remote star parties thanks to the ease with which the two axes come apart. This is the perfect mount for a large refractor, Newtonian, Cassegrain or astrograph.

Features

- All machined mounting made from aluminum barstock and stainless steel. All fasteners are stainless steel.
- Motors and all electronic components are enclosed
- Both axes set in precision preloaded ball bearings
- Removable 1.875" counterweight shaft can hold up to seven 18 lb. counterweights
- Polar and declination axes come apart quickly without tools for light-weight, easy handling and ease of transport
- Fine altitude and azimuth adjustments for quickly and accurately zeroing in on the pole in the field
- Engraved setting circles are Porter Slip Ring Design
- Electronic components rated for industrial and automotive applications
- Base fits into 10" diameter pier with 0.094" wall thickness

Specifications of Equatorial Head

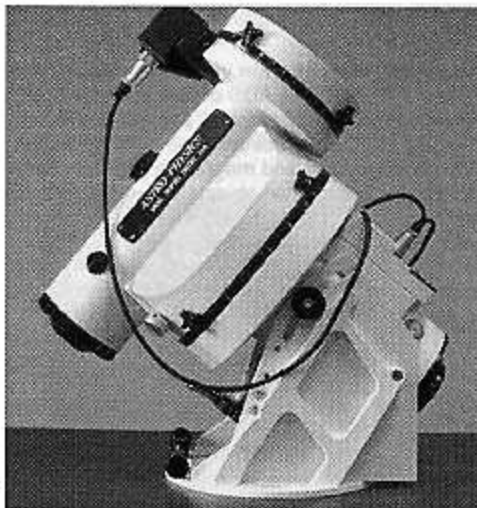
RA. worm wheel:	10.3", 225 tooth aluminum
Dec worm wheel:	7.2", 225 tooth aluminum
Worm gear:	Brass
RA shaft:	3.35" diameter
RA thrust bearings:	9.5" diameter
Dec shaft:	2.36" diameter
Dec thrust bearings:	6.5" diameter
Latitude range:	20 to 68 degrees
Azimuth adjustment:	Approximately 14 degrees
Right ascension:	4-minute increments, pointer
Declination:	1-degree increments, pointer
Capacity:	140 lb. instrument, depending on length
Weight of equatorial head:	91 lbs. (42.7 kg), Dec axis is 30 lbs., RA axis is 47 lbs., counterweight shaft is 14 lbs.

Servo Motor Drive

The drive system uses a high-quality zero-cogging DC servo motor controlled by a microprocessor to an accuracy of 0.05 arc seconds per step. Tracking is very smooth, noticeably smoother than any stepper motor drive or inexpensive servo drive. The system can be accurately controlled over a speed range of 4800:1 which allows 0.25x sidereal for guiding to 1200x sidereal for 5 degree per second. The circuit draws only 0.4 amps when tracking the stars, 2 amps with both motors slewing and requires only 12 volts to operate. This servo drive will satisfy the requirements of the sophisticated, advanced astrophotographer, yet is easy for the casual, visual observer to use.

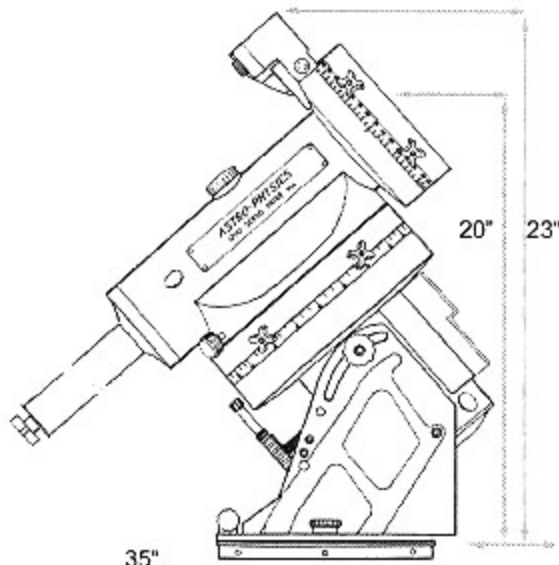
DigitalSkyVoice™ Software

DigitalSky Voice is a terrific observing companion offering lots of observing ideas and information. If you plan to use an IBM-compatible personal computer to control your telescope, you will have lots of fun with this program. The software is included with the mount. Please refer to the sheet entitled "DigitalSky Voice Software" for additional information.



Available Options

Please see accompanying information sheets for description:
SBIG ST-4, ST-6, ST-7, ST-8 CCD Star Tracker/ Imaging System
Portable Piers - 10" diameter - heights 24", 32", 42", 48", 54", 62"
Mounting Plates - FP1800, DOVELM, 1200RP, 1200RP15
17 Amp-hr, 12-Volt Rechargeable Battery Pack
Stainless Steel Counterweights - 10, 18 lbs.
Special 26.9" Counterweight Shaft (M12661)
Pier Accessory Trays and Support Bar
Encoders for Digital Setting Circles
0-19 degree Lower Latitude Wedge
JMI Digital Setting Circles
Kendrick Power Supply
Mounting Rings



1200GTO Dimensions Based on 42 Degrees Latitude
Measurements for your Latitude May Vary

GTO Control Box and Keypad for Servo Drive

Astro-Physics 400GTO, 600EGTO, 900GTO and 1200GTO mounts feature a high-quality DC servo motor drive electronics, computer Keypad Controller and *DigitalSky Voice™* software.

Astro-Physics mounts can be operated with the GTO handheld computer keypad controller alone or in conjunction with *DigitalSky Voice™* software (included) on your PC. The keypad allows you to control all the essential telescope functions such as selection of tracking and guiding/centering or slewing rates, PEM (permanent error memory), declination backlash control, RA/Dec reversal, polar alignment, brightness of the crosshair of your illuminated guiding eyepiece and movement of N-S-E-W directional keys.

The advanced keypad features allow you to slew automatically to objects in the Messier, NGC, IC, ADS double star and Abell galaxy cluster databases; bright stars; all planets; the Moon; Sun; as well as any RA/Dec coordinate. The search function locates objects based on type and magnitude. The tour function guides you on a tour of interesting objects by constellation. Both the search and tour features provide you with lots of observing ideas. The rapid slew rate of 5 degrees per second (1200x) allows you to locate objects very quickly and accurately. You will be very pleased with the intuitive operation of this controller. There are no complicated sequences of keystrokes to remember. It is so easy to use that even if you don't use it for a few months, you will feel at home with the keypad very quickly.

DigitalSky Voice™ software provides additional capabilities to control the movement of your telescope by using two-way verbal communication or by a few clicks of your computer mouse (or touchpad). The features are too numerous to list here so please refer to the *DigitalSky Voice™* information sheet. Software Bisque's *TheSky™* software can also be used with our GTO Computer mounts.

New and experienced observers will appreciate the many advantages of the GTO computer system. It allows you to locate objects easily in light-polluted areas where star hopping is very difficult. Even if you only recognize a few of the major stars in the night sky, you can explore the beauty of the universe. You can even find bright stars and planets in the daytime! The system also serves as a powerful educational tool, providing descriptive information regarding the object you are observing. CCD imagers and astrophotographers will set up their shots quickly to maximize the number of images that can be captured in a single night. You can even preprogram a series of objects that you plan to observe or photograph to be sure that you don't forget your favorites or new objects that you wish to explore.

The GTO Computer System essentially eliminates the need to purchase additional accessories such as a polar alignment scope or mounted encoders and digital setting circles. Most of the functions of these accessories are included in the GTO Computer System.

GTO CONTROL BOX

The GTO control box contains all of the circuitry to drive the two servo motors and the logic required to circumnavigate the sky. This electronics box is mounted directly on the polar axis of the 1200 and 900 mounts and is a stand-alone unit for the 400 and 600E mount. We provide a pouch with a handle for the freestanding unit.

Features

- Machined aluminum housing provides robust protection for electronics
- Dovetail construction allows quick removal from 900 and 1200 mounts
- Removeable microprocessor chip allows upgrades in future
- 12V connector for locking power cable
- SBIG ST-4, ST-6, ST-7 and ST-8 Star Tracker/Imaging Systems or any CCD with modular RJ-11 connector

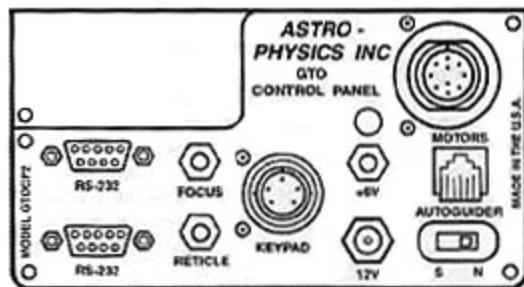
- Two 9-pin RS-232 serial ports (DB9 female connectors) so that user can use *DigitalSky Voice™* and Software Bisque's *TheSky™* software simultaneously, if desired. The user must have two COM ports available on their personal computer to use the software together.
- Focus connector - for 2.5mm phono plug (JMI or Meade electric focusing motors)
- Reticle connector - for guiding eyepiece with an illuminated reticle that has a 2.5mm phono plug
- 6 volt output accepts 2.5mm phono plugs to power Pentax 6x7 camera directly from the mount
- Northern and Southern Hemisphere switch
- GTO Keypad Controller locking connector



GTO Control Panel on 900GTO Mount

Specifications

- Dimensions of servo box: 4.9"x4.9"x1.8" (12.5x12.5x3.4cm)
Weight: 1.5 lbs. (0.7 kg)
Suggested power sources: Portable battery pack, auto or marine battery, 110 to 12V DC Power Supply (3-5 amp range, regulated and well-filtered to prevent spikes).



Layout of GTO Control Panel

GTO KEYPAD CONTROLLER

The keypad hand controller is the communication center for the operation of your GTO mount. We have designed this unit to be as intuitive and easy to use as possible while filling it with terrific features to make your observing session productive and pleasurable.

Each button is assigned to one function only. You do not have to remember shift key patterns or complex keystroke sequences. The directional buttons are shaped like arrows to help you find them in the dark without looking at your keypad. The stop button is readily accessible if you need to cancel any slewing request immediately.

The menu system is very easy to navigate. Each screen will display several choices which correspond to a number button. Simply press the number button to initiate the command, e.g. "1=M, 2=NGC." When you press "1" the Messier entry screen will display and you can enter the number of the object that you wish to see. Press GOTO which will cause the mount to slew. The <PREV and NEXT> buttons will allow you to scroll quickly through the lists of common names or from one menu to another.

Features

- Handheld keypad controller with red backlit alphanumeric keypad and red 4-line by 20-character data display
- Directional N-S-E-W keys provide immediate response when you wish to center an object or cruise the surface of the moon
- R.A. and declination reversal for correct object orientation and movement in eyepiece
- PEM - Permanent Error Memory correction. Make your correction just once, remains in memory permanently
- R.A. and declination backlash control
- Stores 3 observing site locations
- Specify safety zone so that tripod does not interfere with telescope during slewing operation
- Quick and easy polar alignment routines
- Adjust brightness of the reticle output for your illuminated guiding eyepiece
- Automatic meridian swapping in go-to slewing mode
- Continues to track at sidereal rate, even while slewing so that your position is always accurate
- More than 17,000 objects in extensive databases: Messier (110), NGC (7840), IC (5,386), ADS double stars (215), Abell galaxy clusters (2,715), calibration stars by common name (200), Greek star names by constellation (1053), common objects (100), planets (8), Moon and Sun
- Enter catalog or common star number, solar system object, RA/Dec coordinates or common name of object; press GO TO and your telescope will automatically slew to the object.
- Search and tour functions assist you to plan observing session.
- Display will indicate if object is below horizon and cancel slewing request
- STOP button to cancel your slewing request when the telescope is already moving
- Display information about objects: object type and magnitude
- Timer will let you know when the exposure time of your astrophoto is complete
- Three park positions from which to choose
- Retractable hanger

Specifications of the Keypad Controller

Dimensions:	7.2x4.1x1." (181.6x104.1x24.6mm)
Weight:	8 ounces (227 grams)
Keypad:	Red LED backlit alphanumeric
Display screen:	4x20 character alphanumeric
Drive rate:	King sidereal, solar and lunar
Guiding/ Centering rates:	0.25x, 0.5x, 1x, 12x, 64x
Rapid slewing rates:	600x, 900x and 1200x (5 degrees per second)

KEYPAD PROTECTOR (KEYPRO)

Optional Accessory

The KEYPRO keypad protector is a heavy-duty molded rubber casing with a full 1/4" thickness on all impact surfaces. If you accidentally drop your keypad, the rubber casing will absorb much of the blow. Your display, keypad, electronics and the case itself will be protected from damage. In addition, the rubber prevents the keypad from sliding when placed on a table or other flat surface and the keypad will feel secure in your hands as you observe. The KEYPRO also offers protection during transport and storage.

The black case is designed with cutouts for the cable and retractable hanger.



GTO Keypad with Keypad Protector

DigitalSky Voice™ Software

IMAGINE a voice-activated, computer-controlled mount slewing from one end of the sky to the other with simple commands like "M1" or "Find Neptune." Visit our web site www.digitalskyvoice.com for further information.

DigitalSky Voice™ software ushers in a new era in telescope control systems. You can now establish two-way verbal communication with your mount, slewing with ease from one object to another. Or, if you prefer, you can direct the movement of your scope with a few mouse clicks at the computer. Couple this revolutionary software with a computerized Go-To mount and enjoy a view of the universe from your own starship.

DigitalSky Voice is:

- An observing companion who guides you through the universe offering suggestions of objects that are fun and interesting to observe.
- An educational tutor providing you with information on the objects you observe.
- A terrific planning tool for your next observing, photographic or CCD imaging session.
- A powerful search engine which organizes information so that you can maximize your viewing session.

Use with these mounts

- Astro-Physics 400GTO, 600EGTO, 900GTO, 1200GTO
- Meade Computerized LX200, LX200GPS, LX200GPS-SS and DS-Series Mounts
- Meade ETX-90/EC with Autostar, ETX-125/EC with Autostar
- Vixen SkySensor 2000-PC
- Celestron Ultima 2000
- Any mount that uses the Meade protocol; or you can use it in Emulation Mode without a mount

Catalogs

- Messier (110), NGC (7840), IC (5,386), ADS double stars (16,959), Hershel (2468), Abell Galaxies (2,712), Uppsalla Galaxies (UGC) (12,921), General Catalog of Variable Stars (31,220), Common star names (200), Greek star names by Constellation (1,012), Common object names(100), Planets (8), Moon, Sun

These are Just a Few of the Features

- **Intuitive computer interface:** Extremely easy, yet powerful, to use.
- **Simple command structure that goes right to the point:** Simply state the catalog and number.
- **Ask, "What's Up DigitalSky?"** DigitalSky will suggest objects for you to view that are currently visible in the night sky and within the magnitude limit that you specified.
- **Constellation Ticker:** You always know which constellations are up by looking at the DigitalSky screen. Select one of these constellations for a search or tour.
- **Cool Objects window:** This window will display a list of interesting and fun objects within the constellation that your scope is pointing. Have you ever wondered "What else should I look at?" This will give you lots of observing ideas. You can also add your own favorites.
- **Objects can be requested by their common name:** What can be easier than "Find the Ring Nebula?"
- **Object data:** Request the data on any object by stating "Object data." DigitalSky Voice will report the type, size, magnitude, and characteristics. Planetary information will include the current distance from the earth. This data will also display on the screen for your reference.
- **Bright common stars:** Major bright stars can be requested by their proper names.
- **Set Magnitude limit for non-stellar objects:** If you are using a 4" telescope, you may not want the program to display objects that are fainter than you can view. Customize your magnitude limit and only the objects below this limit will be suggested in the Cool Objects window. The magnitude limit will not affect verbal commands; you can go to any object.
- **Search for objects based on criterion you select:** Narrow your search to the current constellation or across the entire sky and set the magnitude limit. Select the database and object type (galaxy, globular cluster, open cluster, planetary nebula, and nebula). Searches can be accomplished with verbal commands while you are at the eyepiece or with the mouse at the keyboard.
- **Constellation tours:** These are pre-defined object constellation tours for all 88 constellations, all user-modifiable with the included Tour Builder Utility. The telescope will move from one object to another at your request. You simply state "next" or "previous." You can skip ahead to any object on the tour by clicking the object name on the screen.
- **User defined tours:** Prepare tours of your favorite objects or plan your CCD imaging session in the comfort of your home. Tours you might create: Messier marathon, favorite galaxies or globular clusters or supernova search areas.
- **Voice output:** There are several voices from which to choose. Some of them are for fun (extra echoes, etc). The voice output feature can be turned on or off to suit your preference.
- **Voice or keyboard commands:** DigitalSky Voice will allow voice, or keyboard and mouse (or touchpad) commands, as you wish. If you do not have a microphone or would prefer to turn the voice recognition off, you can do so. Since the keyboard is not easily visible at night, all inputs can be accomplished with your mouse or touchpad.
- **Stop command:** Your telescope will stop slewing when you state "stop", "stop now", "halt" or "quit". A stop button is also available on the screen. This feature is not available for the ETX due to limitations in its command language.
- **Phrases button:** Are you worried that you won't remember what to say? No problem. Select this button and the phrases that DigitalSky recognizes will display in the Cool Objects window for your review.
- **High coolness factor!**

Minimum Computer System Requirements:

Microsoft Windows™ 95/98/NT Operating System
Pentium™ 100MHz (can be a clone of the Intel™ chip)
32 MB RAM
70 Megabytes of available disk space
1 Serial Port available for use

Sound Blaster™ or compatible sound card (16 bit or higher)
Mouse Input Device (mouse, touchpad, eraser head, etc)
External microphone with an on-off switch (if you plan to use voice control)

Mounting Accessories

MOUNTING RINGS

Mounting rings manufactured by Astro-Physics and Parallax Instruments attach to the cradle plate of the mount and hold your tube assembly firmly in place. The tops of the rings are also flat which allows you to support your guidescope, camera or other accessories. The rings feature a hinged assembly with thumbscrew closure. They are felt-lined to prevent marring of your tube. Please order the size that corresponds to the outside diameter of your tube assembly.

Astro-Physics Rings

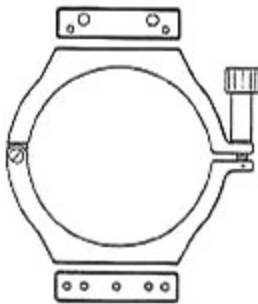
55RING - 130mm Astro-Physics refractors or other telescope tubes of 5.5" diameter
65RING - 155mm Astro-Physics refractors or other telescope tubes of 6.5" diameter



Parallax Rings

Refer to the price list for a list of the most commonly ordered rings. If you don't see what you need, ask and we will let you know if it is available. Parallax rings are special ordered with the same hole pattern as our rings, except for the Parallax 4" rings.

Hole patterns



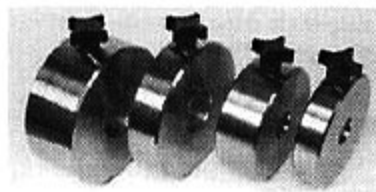
Bottom of rings: Drilled and tapped for 1/4-20 screws. The hole patterns fit the following mounts: Astro-Physics 400, 600E, 800, 900 and 1200 mounts; Carton alt-azimuth; Vixen DX and Super Polaris; and the TeleVue Systems mount.

Top of rings: Pairs of 10-32 and M8 holes for GR4400 and GR34FB (guidescope rings), PGBCBR (piggyback camera bracket with flat plate), DOVE08 (8" dovetail plate), DOVE15 (15" dovetail plates), and Losmandy D series plates. The plates are used to attach accessories to the top of the rings.

STAINLESS STEEL COUNTERWEIGHTS

Our counterweights are precision machined from 303 stainless steel. A bronze sleeve is press fit into the center hole to prevent marring of your counterweight shaft as you adjust the position of the counterweights. The weights slip easily onto the counterweight shaft and are secured in position with a large hand knob/brass pin assembly. The brass pin will not mar your shaft.

Keep in mind that you can adjust the position of the weights to counterbalance varying loads. However, the addition of a guidescope, camera and other heavy accessories may necessitate an additional counterweight. If you plan to mount your catadioptric, Newtonian or any other scope, figure that you will need a counterweight total equal to approximately 80% of your tube assembly weight. We recommend the following combinations of weights for our refractors:

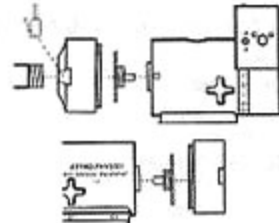


6 lb. Counterweight (6SLCWT) - For 400, 600E, 800 mounts
9 lb. Counterweight (9SLCWT) - For 400, 600E, 800 mounts
 Recommendations for specific telescopes:
 105 Traveler EDF Tube Assembly - one 9 lb.
 130 StarFire EDF Tube Assembly - one each 6 and 9 lb.
 155 StarFire EDF Tube Assembly (2.7" focuser) - two 9 lb.

10 lb. Counterweight (10SCWT) - for 900 and 1200 mounts
18 lb. Counterweight (18SCWT) - for 900 and 1200 mounts
 Recommendations for specific telescopes:
 155 StarFire EDF Tube Assembly (2.7" focuser) - one 18 lb.
 155 StarFire EDF Tube Assembly (4" focuser)-one 10 and 18 lb.
 180 StarFire EDF Tube Assembly (4" focuser) -two 18 lb.

HIGH RESOLUTION MOUNTED ENCODERS

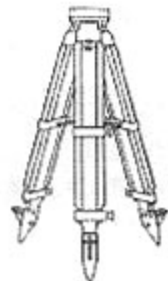
Our mounted encoders will allow you to use digital setting circles with your Astro-Physics mounts. The high-resolution encoders are enclosed in machined aluminum housings that were designed to look like an integral part of your mount, rather than an after-market add-on. The encoders read the movements of the shaft directly. One encoder is mounted securely to the declination axis just above the counterweight shaft and the other to the polar axis housing. You can order your new mount with the encoders or upgrade your present 400, 600E, 800, 900 and 1200 German Equatorial Mounts. If you have a GTO model mount, you will not need these encoders, however you can add them if you like.



ADJUSTABLE WOOD TRIPOD (AWT000)-400,600E

This superb hardwood tripod surpasses any portable tripod that we have seen anywhere. The unique method of attaching the legs to the tripod top was carefully engineered so that there is minimal side to side movement. The tripod comes with fabric carrying case.

Recommended height: 42"-55"
 Weight: 18 lbs.
 Maximum diameter: 6"
 Minimum length: 45"



ADJUSTABLE ALUMINUM TRIPOD (SDS400)-400

The adjustable Davis and Sanford (Tiffin) tripod is offered for light weight, compact transport. The legs retract and fold into a relatively small unit. It is recommended as the primary tripod for the 400 mount and 105 Traveler (or similar sized instruments). While it is not our first choice for the 400 mount and our 130mm refractors, it's a very portable option for people who plan to transport their equipment as airline baggage for observing in exotic locations (or on a business trip). This is the tripod that we transported by air to Baja, Mexico for the solar eclipse in 1991.

The tripod is constructed of black anodized aluminum and black painted aluminum castings.

Possible height: 29"-51"
 Recommended height: 29"-45"
 Weight: 11 lbs.
 Maximum diameter: 6.5"
 Minimum length: 40"

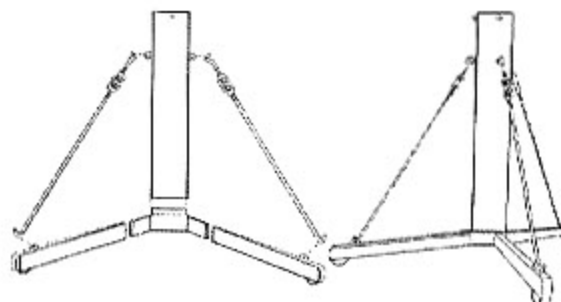


PORTABLE PIERS

These piers feature a unique tension design that combines rugged construction with light weight while eliminating flexure and annoying vibrations. Legs and tension rods attach without hardware, allowing field assembly in seconds. Stainless steel tension rods do not interfere when the telescope is pointed at the zenith. Tumbuckles allow you to tighten the rods and are the secret to the firm base of support that this pier provides. The center posts are constructed of aluminum tubing, the base construction is aluminum and the legs are steel.

Pier for 400 and 600 E Mounts

part nos.	6X42PP	6X48PP	6X54PP	6X62PP
height of pier	42"	48"	54"	62"
diameter of post	6"	6"	6"	6"
length of legs	25"	25"	25"	25"
weight of pier post	6 lbs	7 lbs	8 lbs	9 lbs
weight of pier base	6 lbs	6 lbs	6 lbs	6 lbs
weight of 3 legs	15 lbs	15 lbs	15 lbs	15 lbs
weight of 3 struts	5 lbs	5 lbs	5 lbs	5 lbs
total weight assembled	32 lbs	33 lbs	34 lbs	35 lbs



Pier for 800 and 900 Mounts

part nos.	8X24PP	8X32PP	8X42PP	8X48PP	8X54PP	8X62PP
height of pier	24"	32"	42"	48"	54"	62"
diameter of post	8"	8"	8"	8"	8"	8"
length of legs	25"	25"	25"	25"	25"	25"
weight of pier post	6	8	11	14 lbs	16 lbs	18 lbs
weight of pier base	11 lbs	11 lbs	11 lbs	11 lbs	11 lbs	11 lbs
weight of 3 legs	20 lbs	20 lbs	20 lbs	20 lbs	20 lbs	20 lbs
weight of 3 struts	5 lbs	5 lbs	5 lbs	5 lbs	5 lbs	5 lbs
total weight assembled	42 lbs	44 lbs	47 lbs	50 lbs	52 lbs	54 lbs

Pier for 1200 Mount

part nos.	10X24PP	10X32PP	10X42PP	10X48PP	10X54PP	10X62PP
height of pier	24"	32"	42"	48"	54"	62"
diameter of post	10"	10"	10"	10"	10"	10"
length of legs	25"	25"	25"	25"	25"	25"
weight of pier post	8 lbs	10 lbs	13 lbs	15 lbs	17 lbs	19 lbs
weight of pier base	18 lbs	18 lbs	18 lbs	18 lbs	18 lbs	18 lbs
weight of 3 legs	20 lbs	20 lbs	20 lbs	20 lbs	20 lbs	20 lbs
weight of 3 struts	5 lbs	5 lbs	5 lbs	5 lbs	5 lbs	5 lbs
total weight assembled	51 lbs	53 lbs	56 lbs	58 lbs	54 lbs	62 lbs

SUPPORT BAR FOR PIER ACCESSORY TRAYS (TRAYSB) - FOR ALL PIERS

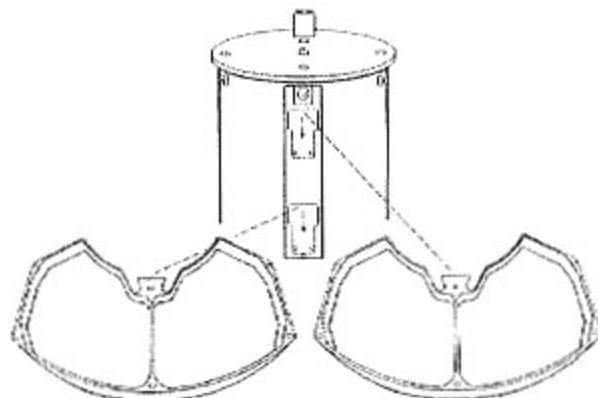
ACCESSORY TRAY FOR 6 & 8" DIAMETER PIERS (TRAY08)

ACCESSORY TRAY FOR 10" DIAMETER PIERS (TRAY10)

The support bar attaches to the holes at the top of the pier post and can hold 2 trays, one above the other. These handy trays will keep accessories close at hand during your observing sessions. In addition to serving as a storage shelf, the top tray will protect items in the bottom tray from dew. Each tray spans 1/3 of the pier (8" and 10" diameter piers), so you can construct a complete circular tray around the pier post with just three trays and three support bars. For the ultimate system, we suggest six trays and three support bars, two complete levels around the post.

Although you can use the TRAY08 tray for the 6" pier, it will not fit flush against the post. This does not affect its function, but you are limited to one support bar and two trays with this pier (one above the other).

These trays cannot be used with Astro-Physics piers that are less than 48" tall.



CORD FOR PENTAX 6X7 CAMERA (CORD01, CORD02)

Power your Pentax 6 x 7 camera directly from your mount, rather than small camera batteries which may not function reliably in the cold. This cord plugs directly into your camera and into the 6 volt output of your mount.

CORD01 For all models of our 400, 600E, 900 and 1200 Mounts

CORD01 For previous 600 and 800 models of our mount (both of these had tangent arm assemblies)

Mounting Plates

TYPES OF MOUNTING PLATES

Flat and Ribbed Mounting Plates

These plates provide the most solid connection of your telescope to your mount. We recommend them for the most critical applications and larger telescopes. The ribbed mounting plates are thicker, yet much of the material is removed to provide strength without excess weight. Use these plates for the largest instruments.

Dovetail Plates and Sliding Bars

Dovetail plates add a new level of convenience and ease of use to our mounts and tube assemblies. These are a few of the handy applications:

- Aid in rebalancing your scope after switching from featherweight orthoscopes to hefty 2 lb. eyepieces or camera back
- Quickly interchanging scopes when used as a mounting plate
- Quickly interchanging accessories when used as an accessory plate

Although listed separately, the dovetail plates and sliding bars are used together (the exception is the 7" sliding bar when used as a stationary mounting plate). The narrow sliding bar moves within the channel of the dovetail plate until the desired position is achieved. Tightening the knobs of the dovetail plate secures the sliding bar.

Dovetail plates:

- The knobs have machined brass tips to protect the sliding bar
- Built-in safety feature to prevent the sliding bar from slipping completely through the dovetail plate if the knobs are accidentally loosened.
- Very easy to insert and remove sliding bars

Sliding Bars:

- Multiple holes allow a variety of items to be attached.

15" FLAT MOUNTING PLATE (FP1500) - 400, 600E



This machined aluminum mounting plate measures 15" x 4.6" x 0.5". Two keyhole slots that measure 3.2" between centers are provided at each end of the plate. The distance between these pairs of holes is 13.75". You can drill additional holes to suit your needs. The plate weighs 3.3 lbs.

18" FLAT MOUNTING PLATE (FP1800) - 900, 1200



A larger machined aluminum plate is available for the 900 or 1200 mounts. It is 18" long and 7.5" at its widest point in the center. The width of the plate tapers to 5.5" at each end. Four pairs of keyhole slots that measure 3.2" between centers are provided. The two inner pairs are 13.75" apart and the outer two pairs are 17" apart. You can drill additional holes to suit your needs. The plate weighs 6.2 lbs.

15" RIBBED MOUNTING PLATE (900RP) - 900



Our CNC machining center started with thick aluminum plate and carved out the excess material leaving a strong rib support structure. The finished plate is 0.75" thick, 15" long and 6.5" at its widest point. The width of the plate tapers to 4.75". At each end, a pair of keyhole slots that measure 3.2" between centers are provided at each end. The distance between these pairs of holes is 13.75". Due to the ribbed structure, you may not be able to drill additional holes to suit your mounting rings. The plate weighs 2.3 lbs.

15" RIBBED MOUNTING PLATE (1200RP15)-1200



This plate is 14.75" long, 7.75" at its widest point 5" at each end and 1" thick. The underside of the plate is carved into a ribbed pattern to maximize the strength and minimize the weight - 3 lbs. A pair of keyhole slots that measure 3.2" between centers are provided at each end. The distance between the pairs is 13.75".

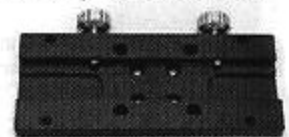
24" RIBBED PLATE (1200RP) - 1200



For larger instruments, the ribbed structure of this plate provides the maximum support. Again, we start with thick aluminum plate and carve a strong rib structure. The final result is 1.5" thick, 24" long and 7.6" at its widest point. The width of the plate tapers to 5.5" at each end. A pair of keyhole slots that measure 3.2" between centers are provided at each end. The distance between these pairs of holes is 23". Due to the ribbed structure, you may not be able to drill additional holes to suit your mounting rings. The plate weighs an amazing 9.5 lbs.

8" DOVETAIL PLATE (DOVE08) - 400, 600E, 900

This versatile plate is suited for the 105 f6 Traveler and 130 refractors (we prefer the 15" dovetail plate for most applications of the 130 f8 StarFire EDT) and other



short instruments. Use with the SB0800 sliding bar, which is sold separately. Repositioning the sliding bar will aid in adjusting the balance of your instrument.

Mounting cradle plate - Attach to either the 400 or 600E German equatorial mounts. Use part # Q4047 to attach this plate to a 900 mount.

Accessory plate - Attach to the top of our Astro-Physics mounting rings (diameters 5"-8"). For the 105 Traveler EDT use the Traveler dovetail accessory plate.

8" DOVETAIL PLATE FOR SUPER POLARIS (DOVESP)

Same as the plate above with the addition of two adapter blocks, which allow it to be used on the Vixen Super Polaris Mounts.

7" SLIDING BAR (SB0800)



These are a few of the possible uses:

- Attach mounting rings - 105 Traveler EDT, 130 StarFire EDT or EDF, TeleVue Genesis or Renaissance refractors or other similar instruments. Use with 8" Dovetail Plate.
- Attach accessories - 60x700mm guidescope with 3.4" guidescope rings, piggyback camera bracket, our bracket for 8x50 finder, TeleVue Starbeam or Qwik-Point Finder. Use with either 8" dovetail plate or Traveler dovetail accessory plate
- Attach mounting rings - 105 Traveler EDT. The bar functions as stationary mounting plate for either a heavy-duty camera tripod or TeleVue Gibraltar mount. The bar does not "slide" when used in this manner.

10" SLIDING BAR (SB1000)



Can be used the same as the 7" Sliding Bar. You will need the extra length to counterbalance the Traveler when doing eyepiece projection.

15" DOVETAIL PLATE (DOVE15)



The 15" version of our dovetail plate is suited for the 130 f8 StarFire EDT, 155 f7 StarFire EDF, Celestron or Meade 8" SCTs, ARO Maksutovs and other instruments of similar size. Use with the SB1500 sliding bar, which is sold separately. These are some of the applications:

- Mounting cradle plate - Attach to either the 400, 600E, 900 or 1200 German equatorial mounts.
- Accessory plate - Attach to the top of our Astro-Physics mounting rings (diameters 5"-8").

15" SLIDING BARS (SB1500)



Use with 15" Dovetail Plate. These are a few of the possible uses:

- Attach mounting rings - 130 StarFire EDT, 155 f7 StarFire EDF or any rings with flat mounting surface and 1/4-20 hole.
- Attach to tube assembly - ARO Maksutovs and other similar instruments.
- Attach accessories - 60x700mm guidescope with 3.4" guidescope rings, 80x900mm guidescope with 3.9" guidescope rings, piggyback camera bracket, our bracket for 8x50 finder, TeleVue Starbeam or Qwik-Point Finder

ADAPTER TO USE DOVE08 WITH 900 MOUNT (Q4047)

Since the 8" Dovetail Plate is so short, an adapter is required to raise it up above the top of the 900 declination axis so that the knobs clear.

ADAPTER FOR TAKAHASHI EM-10 MOUNT (Q4045)



Use this adapter to attach our DOVE08, DOVE15 or DOVELM to your Takahashi EM-10 Mount. You will also need the corresponding sliding bar.

TRAVELER DOVETAIL ACCESSORY PLATE (ACPLTR)



Mount this accessory plate atop your Traveler to enable you to use the 8x50 right-angle or straight-through finders with our quick release bracket (please note that quick release brackets shipped prior to June 1994 cannot be used in this manner), 3.4" guidescope rings, piggyback camera bracket and TeleVue Starbeam or Qwik-Point Finder. The plate measures 2.75"x7" and weighs only 8 oz. Use with 7" Sliding Bar.

Please note that the Traveler mounting rings must be 6.3" apart (center to center) to accommodate this plate. If your scope is mounted in any of the following configurations, the correct spacing will be achieved: Astro-Physics 400/600E mounts with 8" dovetail plate, Vixen DX mount, Celestron (Vixen) Super Polaris or Great Polaris mounts, TeleVue Gibraltar mount with our 7" sliding bar as a mounting plate, very heavy-duty camera tripod with 7" sliding bar as a mounting plate.

DOVETAIL FOR LOSMANDY D SERIES PLATE (DOVELM)

This Astro-Physics plate attaches to the 400, 600E, 900 and 1200 mounts. If you already own the Losmandy D series plate (comes with most C11s), this is the dovetail for you. Features the same locking knobs and excellent construction as our other dovetails.



LOSMANDY D SERIES PLATES

These dovetail plates are used in conjunction with our DOVELM described above. The Losmandy D Series Plate attaches directly to your telescope or your telescope mounting rings. The most common sizes are listed below. If you have other requirements, please call.

The plates are produced by Hollywood General Machining (makers of Losmandy products).

LMDAP4/5	13.5" plate with adapters for Astro-Physics rings
LMDA6/7	17.25" plate with adapters for Astro-Physics rings
LMDC8	13.5" plate for Celestron 8" SCT
LMDC11	17.25" plate for Celestron 11" SCT
LMDC14	23.75" plate for Celestron 14" SCT
LMDM8	13.5" plate for Meade 8" SCT
LMDM10	17.25" plate for Meade 10" SCT
LMDM12	19" plate for Meade 12" SCT
LMDUP	13.5" Universal plate for the Traveler; TeleVue, Takahashi, Vixen and Meade Refractors; Parks and Questar scopes

Visual Accessories

2" CONVERTIBLE PHOTO-VISUAL BARLOW (BARCON)

Use this two-part accessory in several configurations to increase the focal length of the objective for high-power visual observation and lunar-planetary photography. We do not recommend the Barlow for deep-sky photos when using a scope that has a fast focal ratio. These photos will exhibit significant field curvature, which will limit the usable portion of the negative.

The 2-element design uses special glasses to preserve the fine color correction of the main objective. The optical elements are hand-corrected and precision centered to insure that no aberrations are introduced into the system. The Barlow focal length is 127 mm which is longer than conventional types. This minimizes the divergence of the edge rays and therefore reduces the apparent vignetting common in many eyepieces (Plossls and Panoptics). The Barlow features a brass locking ring as described for the 2.7" focuser. Note the following positions and resulting magnifications:

- 1.7x after the diagonal
- 2x before the diagonal or camera adapter
- 2.4x before the Zeiss binocular viewer
- 3.2x before the Zeiss binocular viewer used with an extension



MAXBRIGHT DIAGONAL (PMDMAX)

The Astro-Physics 2" Maxbright Diagonal was designed with several unique features to provide optimum performance and years of use.

Dielectric Coatings

The Astro-Physics 2" diagonal has a very high-tech dielectric coating that was developed originally for military optics used in hostile environments such as blowing desert sand. There is no aluminum or other reflective metal used. The reflective surface consists of multiple layers of thin film oxides, similar to those used in anti-reflection coatings. The coatings are deposited by an electron beam evaporator at a high temperature.

Reflectivity - Reflectivity is above 99% over the entire 4000 to 7000 Å photo-visual range. Thin film coatings have extremely low surface scatter compared to aluminum or enhanced aluminum coatings. Examination with a laser source shows approximately a 5 fold improvement in surface scatter.

Durability - The coating is extremely durable compared to metal coatings and can be cleaned repeatedly.

Mechanical Features

Our customers have appreciated the brass locking ring on our adapters and 2" Barlow and have urged us to develop a diagonal with this feature. The recessed brass ring is under the thumbscrew location. As you tighten the thumbscrew, the brass locking ring clamps onto your eyepiece. This provides a more secure grip for your expensive eyepieces than the head of a single screw can provide. As an added advantage, the brass will not mar the surface of your accessories.

The diagonal is baffled and painted flat black to allow maximal light transmission. It is threaded for 48mm filters so that you can change eyepieces with ease without changing the filter.

1.25" AMICI PRISM DIAGONAL (APD125)

This right-angle diagonal contains a roof prism erecting system, which allows normal orientation of the subject in your eyepiece. No more inverted or upside-down images! Terrestrial viewing is more enjoyable when using the Amici or Porro prism diagonal

with your favorite eyepiece. Amici prism diagonals are suited only for low-power daytime use and not recommended for astronomical use.



1.25" PORRO PRISM DIAGONAL (PPS125)

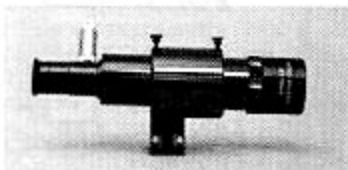
The Porro prism diagonal provides straight-through viewing. Image orientation of the subject in your eyepiece is normal so it is easy to observe deer grazing in a distant meadow. Recommended for low-power daytime nature study with your refractor when straight-through viewing is preferred. Porro prism diagonals are not recommended for astronomical use.



8X50 STRAIGHT-THROUGH FINDER WITH ILLUMINATED RETICLE AND QUICK RELEASE BRACKET (850STI)

Our imported finder features a crosshair eyepiece, which can be illuminated with the matching self-contained, battery-powered LED. The eyepiece provides a wide 5.6° field of view to assist you in locating your favorite objects.

The finder is black and includes a dustcover for the lens and a built-in dewcap. The rheostat control on the illuminator allows you to control brightness of the reticle. You will really appreciate the handy quick release finder bracket, which is described below.



QUICK RELEASE FINDER BRACKET (850QRB)

The quick release finder bracket was developed by Astro-Physics to make your life easier. Now, you can attach and detach your finder in seconds while retaining the alignment. The base of the bracket mounts onto the predrilled holes of your Astro-Physics refractor. The remainder of the assembly with the finderscope slips into the groove of the base bracket and tightens quickly with two thumbscrews. Now you are ready to go! There are no mounting screws to get lost in the grass or snow and your fingers won't freeze as you struggle with tools. To use with the Traveler accessory plate (ACPLTR), attach the bracket part to the 7" sliding bar (SB0800). This accessory is a must!

You may want to consider purchasing extra bases that you can mount permanently on your other telescopes. This will allow you to use the same bracket and finder interchangeably.

This bracket can be used with our 8x50 Straight-through Finder above or other similar finder that you may already own.



EXTRA BASE FOR QUICK RELEASE BRACKET (QRBASE)

You can mount this extra base onto another telescope so that you can use the Quick Release Finder Bracket interchangeably or attach a base to the opposite side of your refractor so that you can use a modified TeleVue StarBeam (STARMD) or Qwik Point (QWIKMD) finders (we add our part #A3251 male dovetail piece that allows these finders to be used with the base).

BINOCULAR VIEWER FROM BAADER PLANETARIUM (BPBINOV)

Optics and Design made by Carl Zeiss Jena

Several years ago, Carl Zeiss Jena manufactured an excellent Binocular Viewer which we were pleased to offer to our customers. When the amateur telescope division was closed in the Fall of 1995, the binocular viewers were no longer produced. In 1996, the Baader Planetarium company took over service for Zeiss telescopes and also acquired the rights, patterns and drawings for the Zeiss Binocular Viewer.

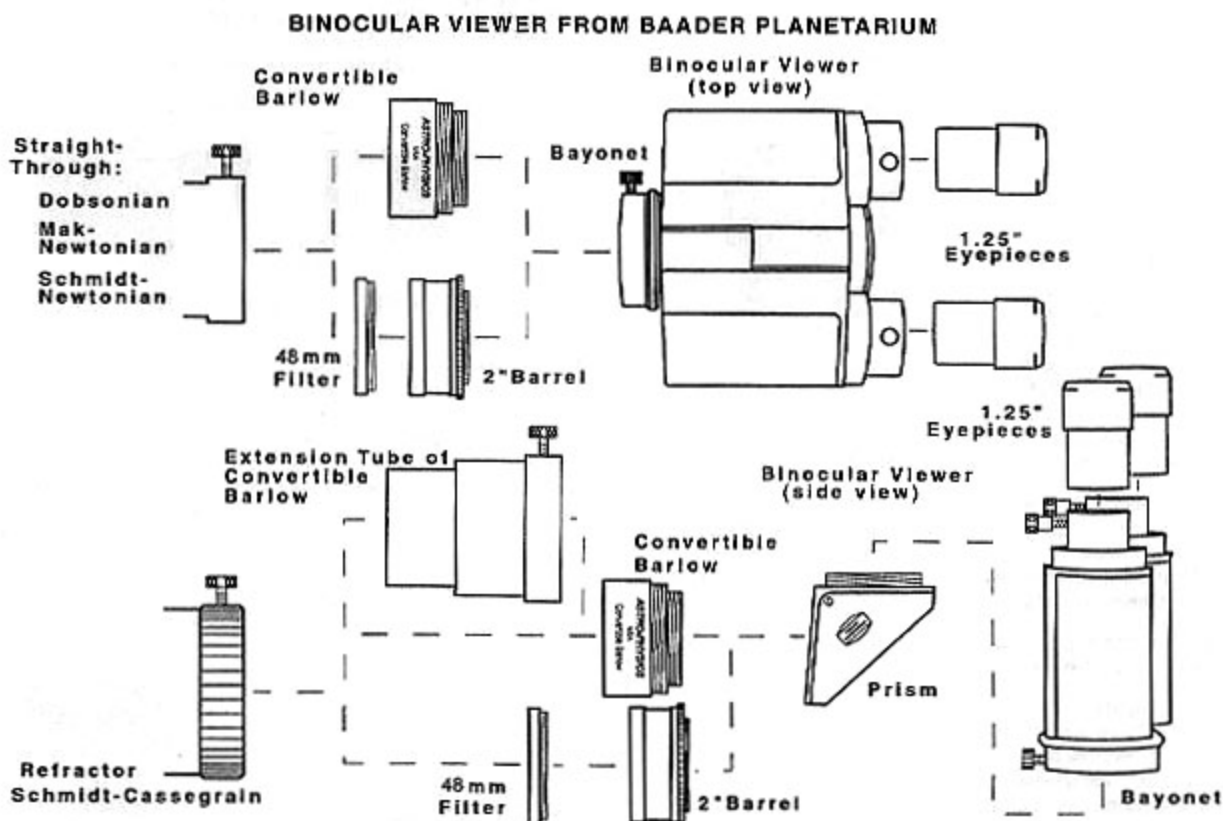
We are very pleased to offer this fine Binocular Viewer once again. We have thoroughly tested the new unit against the original Zeiss Binocular Viewer and have found the performance and mechanical construction to be excellent. The prisms in the viewer itself are still made by Carl Zeiss and coated with the world-famous Zeiss T-coat. This special multi-coating has high efficiency and high contrast characteristics allowing maximum transmission and image quality. The body and mechanical works are produced and assembled by Baader Planetarium according to the original specifications by Carl Zeiss.

This accessory was developed specifically for amateur telescopes unlike others which were adapted from microscopes (small prisms designed for .965" eyepieces). The large multi-coated prisms of the Zeiss unit allow full illumination of 1.25" oculars. Interocular separation adjustment (eyepiece spacing) does not affect focus. Excellent low-power deep-sky views can be obtained with 22mm Panoptic eyepieces or other similar eyepieces. We typically use a set of Plossis in a medium power range.

The binocular viewer has a removeable 1.25x compensating optical element which eliminates the slight color error and spherical aberration that a prism beam splitter naturally introduces into the light path. While the binocular viewer works extremely well for showing subtle features on the lunar surface and for bringing out planetary detail, we recommend that you thread in part of our Convertible Barlow (effective magnification 2.6x) to the front of the viewer for critical high-power observing (such as double star observations). This optional accessory lens narrows the incoming beam and results in the sharpest possible images at the eyepiece end of the binocular viewer.

The Zeiss Binocular Viewer includes the viewer itself with removeable compensating element, prism, and the 2" barrel as shown below. Optional items include: eyepieces, the Convertible Barlow and filters.

The backfocus required will vary depending upon your configuration. Please note that this viewer may not reach focus with some instruments including some earlier models of our refractors. Determine the backfocus of your instrument by measuring the distance from the 2" opening of your scope to the focus point.



Photographic Accessories

2" CONVERTIBLE PHOTO-VISUAL BARLOW (BARCON)

Refer to description in the Visual Accessories section

PHOTOGRAPHIC-VISUAL TELECOMPRESSOR (0.75X) (27TVPH)

We have increased the versatility of our telecompressor by designing it for both visual and photographic applications. Slip in a 2" diagonal with most eyepieces (some eyepieces may not focus) or our camera adapter with your camera. The effective focal length will be 0.75x the focal length of the instrument. Deep-sky objects are recorded on film in a fraction of the time needed at prime focus. This well-corrected accessory lens preserves the high contrast and superb color correction of the main objective. A must for the serious astrophotographer. Threaded for 58mm filters. The telecompressor can only be used with Astro-Physics fociers. Thread the telecompressor directly onto the focuser drawtube, next thread the 2" adapter onto the other end. Then you can use your 2" accessories. Please note that you must purchase the Astro-Physics camera adapter with t-ring for photography.



CAMERA ADAPTER WITH T-RING FOR 35MM CAMERA (PFCT - -)

(PFCT - - -, last 3 letters indicate t-ring)

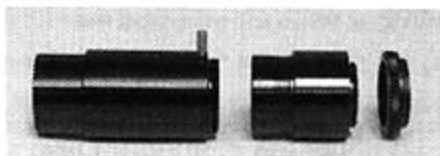
This camera adapter allows you to attach your 35mm camera to any focuser that accepts 2" slip-in accessories. It is machined of aluminum and black anodized. The camera adapter is threaded for the popular 48mm filters. Please specify the type of camera you plan to use.



Camera Adapter with T-Ring Attached

EYEPIECE PROJECTION TELE-EXTENDER (CEP000)

The eyepiece projection unit is used in conjunction with the camera adapter (PFCT- - -) described above and a 1.25" eyepiece. Use this combination to achieve higher powers and closer views of your object, particularly when photographing the moon or planets. The eyepiece projection unit contains a brass locking ring to hold your eyepieces firmly in place.



Eyepiece Projection Unit. Camera Adapter with T-ring

2.7" PRIME FOCUS FIELD FLATTENER WITH CAMERA ADAPTER FOR PENTAX 6 X 7 CM CAMERA (67PF46, 67PF56, 67PF58, 67PF69, 67PF79)

This accessory allows you to couple the medium-format Pentax camera to your StarFire telescope for truly superb wide-field photographs. The built-in field 2.7" field flattener lens produces sharp star images over the entire format. Enlargements of 16"x20" are possible without fuzzy images or loss of detail. Each field flattener is designed for a particular focal length for optimal results. They are not interchangeable.



67PF46 - 105 Traveler
67PF56 - 130 StarFire EDF
67PF58 - 130 StarFire EDT, 155 StarFire EDFs, Star130ED, Star12ED, 5" f8 StarFire, Standard

67PF69 - 155 StarFire EDT, previous 6" f9 and Star155ED
67PF79 - 180 StarFire EDT, 7" f9 StarFire

35MM CAMERA ADAPTER WITH T-RING TO USE WITH 2.7" AND 4" FIELD FLATTENERS (67RT--)

(67RT - - -, last 3 letters indicate t-ring)

Use this adapter with the prime focus field flatteners to obtain the best results with your 35mm camera. The t-ring is included. Please specify the t-ring that you wish to use. This part can be used only with field flatteners shipped after May 1994. If you have an earlier model field flattener, please call.



GELATIN FILTER HOLDER FOR 2.7" FIELD FLATTENER (27GEL1, 27GEL2)

This two piece filter holder was designed to hold gelatin filter sheets which may be used for deep-sky tricolor photography. Clear aperture of the filter is 2.35" (60mm). Purchase gelatin filter sheets from a camera store, cut into a circle approximately 2.5" in diameter and install. We suggest that you purchase a separate filter holder for each color filter that you plan to use. Part # 27GEL2 fits all field flatteners shipped after May 1994. If you have an earlier model, we offer part # 27GEL1 with a slightly different thread.



Gelatin Filter Holders

GELATIN FILTER HOLDER FOR 4" FIELD FLATTENER (40GEL1)

Same as above to fit 4" Field Flatteners.

6X7 PENTAX CAMERA ADAPTER FOR USE WITH TELECOMPRESSOR (ADA67P)

This adapter allows you to use the Telecompressor (27TVPH) with your Pentax 6 x 7 Camera. Your image circle will be approximately 2" fully illuminated.



PIGGYBACK CAMERA BRACKET (PGBCBR)

The unique micro-adjust knobs allow you to frame star fields easily in 2 axes. The camera bracket comes with a flat base and screws that enable you to attach it to the predrilled rings on the top of our mounting rings. Attach your favorite 35mm camera with wide-field lens and take some terrific Milky Way shots.



PIGGYBACK CAMERA BRACKET (PGBCNB)

Same as the above bracket without the flat base. PGBCNB attaches to the 7" (SB0800) or 10" sliding bar (SB1000) for use with either the Traveler accessory plate (ACPLTR) or 8" Dovetail plate (DOVE08). It also attaches to the 15" sliding bar that is used with the 15" Dovetail plate (DOVE15).

80 X 900 MM GUIDESCOPE (80GUID2)

For serious astrophotography, a full 80mm f11 (3.1" aperture) provides bright star images to facilitate guiding. Our imported guidescope includes a fine achromatic lens coupled with a smooth 1.25" helical rack and pinion focuser with a full 5.5" of travel and locking screw. A dewcap, dustcover and 1.25" diagonal are included. Two half-inch wide aluminum bands are attached to the optical tube in order to protect the finish from marring. The position is adjustable. Choose the 4.4" I.D. guidescope rings (sold separately) which mounts onto these aluminum bands. The three alignment thumbscrews are adjusted to position the scope.

For manual guiding, we suggest using a 12.5mm illuminated eyepiece and 3x Barlow. For autoguiding, use the Santa Barbara Instrument Instrument Group ST-4 or other auto-guider.



80mm Guidescope with 4.4" Rings

CARRYING CASE FOR 80MM GUIDESCOPE (C0023)

Protect and carry your 80 x 900mm guidescope with this handy case. We designed it to allow our 4.4" guidescope rings to remain in position on the scope. You don't have to take them off! The case measures 39.25" x 9.5" x 10.25" and is built like our refractor cases of quality plywood with grey vinyl exterior. The inside is lined with 1" foam. An essential addition if you transport your guidescope.

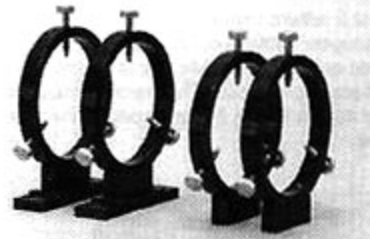
4.4" GUIDESCOPE RINGS (GR4400)

These rings were designed for guidescopes that have an outside tube diameter of approximately 3.5" (88mm). Each ring has three alignment screws, which are adjusted to position the scope. These rings attach directly to the top of our mounting rings or to the 15" sliding bar (SB1500) for use with 15" Dovetail plate (DOVE15).



3.4" GUIDESCOPE RINGS (GR3400, GR34FB)

If you own a 60mm guidescope, choose a pair of 3.4" I.D. guidescope rings with three alignment thumbscrews on each ring. GR34FB includes a flat machined plate that attaches directly to the top of our mounting rings. GR3400 attaches to the 7" (SB0800) or 10" sliding bar (SB1000) for use with either the Traveler accessory plate (ACPLTR) or 8" Dovetail plate (DOVE08). It also attaches to the 15" sliding bar that is used with the 15" Dovetail plate (DOVE15).



Guidescope Rings with and without Base

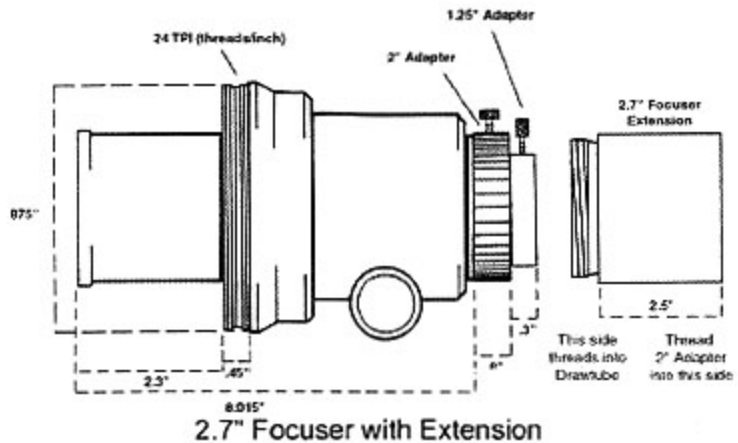
Focusers, Adapters and Extensions

ASTRO-PHYSICS 2.7" FOCUSER (27FOCU)

If you are a do-it-yourselfer constructing a first-class tube assembly, you may want to consider our 2.7" focuser. It is a very finely crafted unit with several unique features. The components are machined to extremely high tolerances, assuring that there is no wiggle between the drawtube and housing. More than a dozen knife-edge baffles are machined into the wall of the drawtube and painted flat black in order to maximize contrast by essentially eliminating any internal reflections. The inside diameter (I.D.) of the drawtube is 2.7" which allows the avid astrophotographer to use a medium-format camera to capture images in a 2.25" x 2.25" format with minimal vignetting. The helical rack and pinion provides smooth motion, free of backlash or wobble, for precision focusing. Our machined aluminum knobs were designed with comfortable, firm handling in mind. The adapter thumbscrews are substantial and easy to grasp.

Brass locking rings are an important feature of our focuser. We realize that many of our customers use a variety of heavy and expensive accessories including 2 lb. eyepieces, 35mm and medium-format cameras, binocular viewers, etc. So, we designed our focuser with recessed brass locking rings at each thumbscrew location. As you tighten the thumbscrew, the brass locking ring clamps onto the part that has been inserted. Consequently, your focuser drawtube, and 2" and 1.25" accessories are held securely in place. As an added advantage, the brass will not mar the surface of your accessories.

- All components are machined of high quality aluminum. Housing is black anodized
- Brass locking rings to secure focuser drawtube, 2" and 1.25" accessories
- 2" adapter is aluminum, black anodized, screws into focuser drawtube, brass locking ring, thumbscrew
- 1.25" adapter is aluminum, black anodized, slips into 2" adapter or 2" diagonal, brass locking ring, thumbscrew, threaded for 48mm filters
- Focuser extension is aluminum, black anodized, threads into focuser drawtube, knife-edge baffles, 2.5" length, use for straight-through viewing
- Inside diameter of focuser draw tube is 2.7"
- Focus travel with the 2" adapter is 4.4"
- Focus travel with telecompressor is 5.0"
- Overall length of the focuser when fully racked in with 2" adapter is 4.8"
- Overall length of the focuser when fully racked in with 1.25" adapter is 5.25"



1.25" ADAPTER (ADA125)

Our 1.25" adapter is included with our focusers (and refractors), however we offer it as an accessory to use with any telescope. It slips into a 2" opening and is used for 1.25" accessories. It features a brass locking ring and is threaded for 48mm filters.

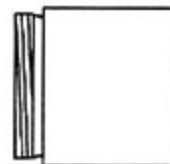


2" ADAPTER (ADA200)

Our 2" adapter is threaded to attach to Astro-Physics focusers (2.7" or 4" models). We offer this item as a replacement if yours is damaged or lost.

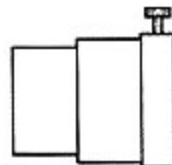
THREAD-ON EXTENSION FOR 2.7" FOCUSER- LENGTH 2.5" (A1008)

This is the same extension that is included with our 2.7" focuser. It threads directly into the drawtube and contains the same knife-edge baffles. Note, these extensions can thread together to form a longer tube.



2" EXTENSION - LENGTH 1.75" (ADA202)

This extension slips into a 2" opening and can be used with 2" accessories or the 1.25" adapter. It features our brass locking ring to hold your accessories firmly. The overall length is 3". It is already included with our 2.7" Newtonian Focuser and is part of our Convertible Barlow.



2" EXTENSION - LENGTH 3.6" (EXTTLR)

Use this extension when you require additional length. It slips into a 2" opening and can be used with 2" accessories or the 1.25" adapter. It features our brass locking ring. The overall length is 5.8".

2" ADAPTER FOR 2.7" FOCUSER TO USE SCT ACCESSORIES (ADA204)

If you own one of our refractors (or built your scope with our 2.7" focuser) and own thread-on accessories for an SCT, you will appreciate this item. This adapter threads into our drawtube and has SCT threads on the accessory side. It is ideal for the new Adaptive Optics (AO) from Santa Barbara Instrument Group (SBIG).



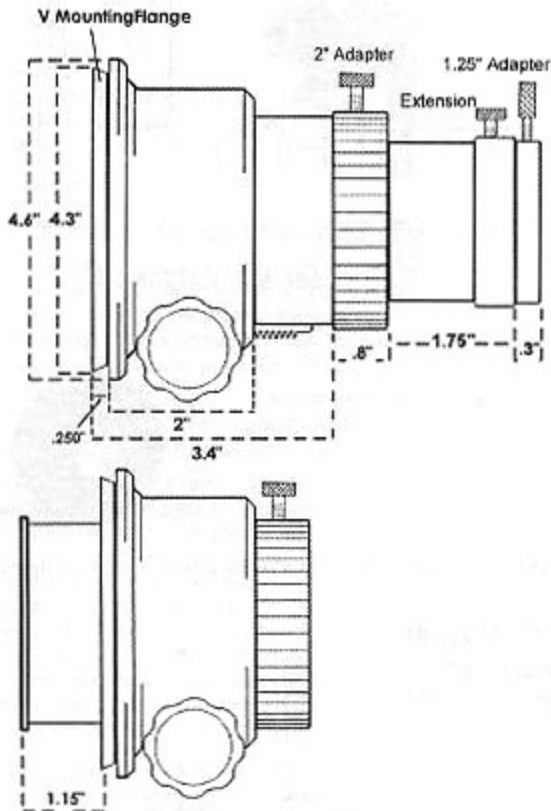
2" SCT ADAPTER WITH BRASS LOCKING RING (ADASCT)

This adapter threads onto your SCT focuser or DayStar T-Scanner. It allows you to use 2" accessories that slip in, i.e. 2" diagonals, Barlows or 2" eyepieces. The brass locking ring sets this adapter apart from others on the market. It will hold your expensive accessories with ease.



2.7" NEWTONIAN FOCUSER (27NFOC)

The Astro-Physics Newtonian focuser has all of the fine features of the 2.7" focuser described above. In fact, many components are identical. Note that the drawtube and overall length is shorter, and the focuser extension is a different style. This solid focuser will hold your heavy accessories and cameras with ease. It is ideally suited to large Newtonians which will be used for photography.



2.7" Newtonian Focuser

Baader Planetarium Filter Material

ASTROSOLAR™ – SOLAR FILTER MATERIAL

Astro-Physics has been chosen sole US importer for BAADER AstroSolar™, an exciting new solar filter material that promises to revolutionize high-resolution solar observing.

The Quest for High-Quality Solar Filters

For years our customers have been asking us to recommend a solar filter that would not degrade the image of our fine refractors. Originally, aluminized Mylar material was sold in very thin sheets, and was quite good for high-resolution visual and photographic work. The material had several drawbacks - it was metallized only on one side and so was prone to multiple pinholes. It required 2 sheets back to back which allowed rubbing of the surfaces in windy conditions causing degradation of the metallization. The film had a grain structure and produced a strong cross pattern of a pinhole test source (it was not diffraction-limited). This produced a hazy bluish, low contrast final image, although sunspot detail was quite good. In the following years, the original thin aluminized Mylar was discontinued to be replaced by a thicker double-coated film that did not have the sharpness of the original. On top of that, the contrast was even more degraded.

Along came cheap commercial glass solar filters made from plate glass. We tested a number of these and found them to have extremely poor optical figure and thus could not recommend them to any of our customers. This situation has not changed to this day.

For those wishing the ultimate resolution and definition, we sold a number of limited-production glass filters several years ago from Baader Planetarium that were made in Germany. These were diffraction-limited, produced a pleasing neutral color of the sun and showed extremely high contrast. The alternative was to use a Herschel Wedge prism (available from Baader Planetarium in Germany). The problem with this approach was one of safety. The full sunlight enters the telescope aperture and 95% of the energy is then sent out the side of the prism, leaving 5% to be filtered further before entering the eye. If this filter was chosen incorrectly, it could pass a tremendous amount of infrared and visible light to the retina. The potential for eye damage was too great. In addition, the intense heat that was directed out the side of the prism would burn clothing or skin. For these reasons Astro-Physics did not sell these prisms.

Technical Specifications

Enter the new BAADER AstroSolar™ safety film. This new high-strength polymer is unlike anything sold today. Thomas Baader tested hundreds of films on a double-pass autocollimator before discovering this special material that produced a high contrast, scatter-free diffraction-limited image. He told me that all the other films, including Mylar, produce a significant cross pattern of a pinhole source, and show a high degree of scatter due to internal strains and grain structures. To produce this special film, the manufacturer uses a patented high-temperature process, similar to annealing, to eliminate internal strains. The material is then ion implanted and metallized with a tough, color neutral layer on both sides of the film. This ion implantation/metallization process (also patented), produces a pinhole-free, high-contrast film that stands up to considerable abuse, unlike the metallized mylar materials used in virtually every other commercial solar filter today. The coating cannot easily be rubbed off, and in that respect is actually safer than coated glass filters. Unlike commercial film and glass filters, Baader's AstroSolar™ will not significantly degrade the imaging capabilities of your telescope. I have checked out samples of this material on a double-pass interferometer and measured a 94% Strehl Ratio when placed flat over a 6" test optic. Compare this to Strehl ratios of 45% for aluminized Mylar and less than 24% for inexpensive glass solar filters. (Yes, cheap glass filters are far from being diffraction-limited!).

Performance

Theory is fine, but what will this new material show you? We asked two prominent solar observers, Wally Piorkowski and

Gordon Garcia to test the material and give us their opinion. Both observers used high quality Apo refractors in their evaluations. Gordon was indeed impressed by the resolution and contrast, and is actively spreading the word to all his solar colleagues. When Wally and I tested the filter at our facility, he noted the pleasing, almost neutral color on the surface, and the black background sky due to the lack of scatter and pinholes. We could see extensive solar granulation all over the surface, as in any high-resolution glass filter. Sunspots showed detail deep within the umbra and the penumbral brushes were so finely resolved, they looked like eyelashes. But what surprised Wally most was that he could see for the first time white filamentary faculae all over the sun's surface, not just at the edge.

Order Information

BAADER AstroSolar™ film is available in two densities, ND 5 (0.0001 transmission) for direct visual use, and ND 3.8 (0.0016 transmission) for photography only. It is also available in clear form under the trade name TurboFilm™ for those wishing to protect their telescope optics from heavy dewing or windblown sand, salt spray or dust. TurboFilm™ is not a solar filter material.

Each order will come with instructions to make a simple and effective solar filter for your telescope. We do not offer pre-made solar filter cells.

AstroSolar™ is available in the following sizes at these introductory prices. No additional shipping charges for the 48 contiguous states:

Baader AstroSolar™ Density 5 - Visual

AS50A4 - A4 size 200 x 290mm (7.9" x 11.4")

AS50HM - 1/2 meter size 500 x 1000mm (19.7" x 39.4")

Baader AstroSolar™ Density 3.8 – Photographic only

AS38HM - 1/2 meter size 500 x 1000mm (19.7" x 39.4")

TURBOFILM™ - PROTECTIVE FILTER MATERIAL

TurboFilm™ is made from the same material as the BAADER AstroSolar™ solar filters, however it is not coated for solar filter use. Many people use a clear filter in front of their camera lenses to protect the coatings from dust and fingerprints. Use TurboFilm to make a protective filter for your telescope optics that will serve the same purpose. Since this clear material is diffraction-limited, it will not degrade the quality of your image.

DO NOT use this material as a solar filter to observe the sun. Irreversible eye damage will occur.

TF2050 - 51 x 127 cm (20" x 50")

Making an Inexpensive Filter Cell for Baader Astrosolar™ or Turbofilm™ Material

The film must be mounted reasonably flat and free of any tension. It is more desirable to have slight wrinkles than to stretch the material, which will damage the optical quality and possibly the coatings.

When mounted carefully, AstroSolar™ Film can reach the quality levels of truly precision-made, diffraction-limited glass filters (not to be confused with inexpensive glass filters made of thin, machine-polished plate glass).

The "Cylinder"

Construct a cylinder out of posterboard to fit over the front aperture of your telescope or dewcap. Start by cutting several long strips of the posterboard approximately 2" wide and wrap these around the lens cell or dewcap until you have 3 or 4 layers. Glue the layers to each other to form a thick, sturdy cylinder approximately 1/4" thick (do not glue this to the scope, please!). The finished cylinder should fit snug on the scope yet slide easily on and off.

Hint: For small aperture telescopes, you might be able to find just the right-sized cardboard tube to fit over the aperture. Simply cut off 2" and use that as your cylinder. If the tube is slightly too large, use an adhesive felt liner or cork pads to make it fit snugly.

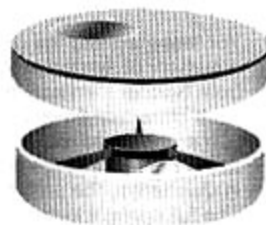
The "Filter Cell"

Cut out two rings of posterboard or cardboard with the outer diameters equal to your fabricated cylinder. The inner diameter should correspond to the actual aperture of your telescope. On one side of each ring near the outer edge, attach a number of pieces of double-sided tape.

Now comes the tricky part – how to get the AstroSolar™ film onto the taped ring without wrinkles or ripples. The film must not be scratched. So, put one sheet of Kleenex™ (or other soft tissue) onto a flat table. Tape the tissue onto the table so that it is stretched out evenly and cannot move. Now put a square piece of AstroSolar™ material (slightly larger than the outer diameter of the cardboard rings) onto the piece of soft tissue. Do not tape the film and do not stretch it! Just let it rest relaxed and flat on the tissue.



Now, take one of the cardboard rings with the sticky tape face down and lower it straight down onto the film until the entire ring has made contact with the film. Turn this assembly around and tape the other ring onto the opposite side of the film. Now you can trim away any overhanging parts of the film. Your AstroSolar™ film should now be free from strain and wrinkles, sandwiched between the two cardboard rings. Finally, glue this "filter cell" assembly onto your prefabricated "cylinder." Lift the filter up to the sky and inspect the cell for light leaks prior to using it on your telescope or binoculars. Now your "do-it-yourself" filter is ready. Enjoy it! You just saved about \$100 for the filter cell alone.



When covering a larger Newtonian or Schmidt-Cassegrain Telescope for solar observation, it may be that "Less is More"! Do not try to make a filter as large as the telescope aperture. The bigger aperture will be greatly affected by air turbulence, which can ruin fine detail. We suggest that you produce an off-axis filter cell, to observe the sun with a smaller (but much improved) telescope.

Storing Your Filter

It is very important to store your filter safely so that it will not be damaged. If the filter is small enough, we suggest that you use a plastic food storage container with a cover. In addition to protecting the filter material, it will keep the cardboard material from becoming wet and soft.

If your filter is damaged in any way, it must be replaced. DO NOT use if the AstroSolar™ material has any holes or the cell is weakened and will not stay on the telescope.

Please observe the following safety precautions with EVERY solar observation

Prior to each and every solar observation session, check the filter's fit and, if necessary, tape it to the telescope to prevent slipping.

- NEVER use the filter at the eyepiece, it will burn up in less than a second! It will not filter out the concentrated and very dangerous light energy at the eyepiece end. Unfiltered solar light can and will cause blindness. The filter will ONLY work when attached to the FRONT aperture of a refractor objective, in front of the Schmidt plate (Schmidt-Cassegrain telescope) or in front of the tube of a Newtonian telescope.
- If you use a binocular, protect both objectives with a filter.
- Be sure that the viewfinder of your telescope is properly covered, either with a solar filter made as described above or with the original dust cover. Unprotected views through your finderscope would have the same catastrophic consequences for your eyes as a look through the main telescope itself!
- A filter made of AstroSolar™ filter material is relatively resistant to breakage in comparison to a glass filter. However, care should be taken with sharp pointed objects. A punctured filter should be thrown away and replaced with a new one (same as with a cracked glass filter).
- Emphasize the importance of safety to those observing with you, especially children. Intentionally removing or damaging the filter can endanger their eyesight. This is no place for jokes. Never leave the telescope outside unattended during the daytime!

TurboFilm™

Although the same procedure is used to make a filter with TurboFilm™, this material is NOT a solar filter and must not be used to observe the sun. TurboFilm™ is used only to protect optics from heavy dewing, or windblown sand, salt spray or dust.

Frequently Asked Questions

DELIVERY SCHEDULE

Why can't I order a refractor or mount right away?

Unfortunately, our current production runs, which will take us to March 2000, have been filled and we are unable to accept additional orders.

We plan our production runs every 12-18 months, deciding which instruments we will produce in the coming months and how many. Then we lay out our production schedule, estimating delivery of various products. When all the plans have been made, we accept orders for the instruments that have been scheduled. When all of the planned scopes and mounts have been sold, we do not accept additional orders. It would be irresponsible to accept orders beyond our planned production schedule.

We anticipate that we will plan our next production schedule in the Fall of 1999 and will accept orders toward the end of the year. These instruments will be delivered in mid to late 2000 and early 2001.

How will I know when you are accepting orders again?

If you would like to order a scope or mount, please give us a call, drop us a line or send e-mail. Let us know which instruments interest you. We will place your name on our notification list or lists. Please provide us with complete contact information including name, address, day and evening phone numbers, fax number and e-mail address.

When a scope is available for you to order, we will notify you by phone, mail or e-mail. Instruments may become available if we have a cancellation or open another production run. Unfortunately our notification lists have become quite long. We know that we will be unable to meet the demand and cannot guarantee that you will be offered an opportunity to order a scope or mount in the next production run cycle.

Why doesn't Astro-Physics expand and increase its production?

Astro-Physics is a small company of dedicated and talented individuals who take a great deal of pride in their work. We are all committed to excellence in telescope and mount production and providing outstanding service. Although we have expanded throughout the years (some may remember when we started in our home more than 25 years ago), we cannot keep pace with the demand for quality products. Since we realize that maintaining our reputation is crucial to our continued success, we cannot grow in a rapid and uncontrolled manner in an effort to sell as much product as possible. We would rather sell the best telescopes and mounts than the most.

We will continue to grow and add modern machinery to become more efficient and productive. Most of all, we promise to maintain our quality standards and produce the finest instruments available today.

PRODUCT DEVELOPMENT

Why doesn't Astro-Physics produce 180 and 206mm refractors any longer?

Several years ago, we decided to limit the aperture of our refractors to 155mm (6.1") or less. Although we produced some very nice 180mm and 206mm refractors in prior years, these instruments were very time-consuming, expensive and frustrating to produce. We found that it was difficult to obtain glass blanks in these diameters that meet our homogeneity specifications consistently. The specialized glasses that we use are very expensive and are not readily available. When one of these pieces must be rejected and replaced because it does not meet spec, it is very costly and delays production of all instruments. After a series of frustrating production runs, we felt that the lost hairs were not worth it. Roland has just one life to give to astronomy and these instruments were shortening it.

Does Astro-Physics plan to produce any larger telescopes?

We have been researching alternative optical designs for larger aperture instruments. Specifically, we have been evaluating and testing prototypes of various compound optical systems like Maksutov-Cassegrains and Maksutov-Newtonians. The glasses used for these instruments are more commonly available in large blanks of high-quality than apochromatic refractor glass types. If you wish to be informed about possible future production of these instruments, please give us a call or drop us a line. We do not have any specific information available at this time.

Why doesn't Astro-Physics offer refractors with longer focal lengths?

Our customers voted on this issue with their orders several years ago and again last year. We offered shorter and longer focal length refractors of the same diameter simultaneously. The overwhelming response favored the shorter instruments that are more portable and can be used on a smaller mount. Since most customers don't have the luxury of an observatory, the instruments they use must fit into their cars (along with the kids and other gear) or be carried easily into the yard. Also, more people are traveling with their scopes to far away locales. The scope they take must be small enough to carry along. The Traveler fits this requirement beautifully since it is within the airlines' tough, new carry-on requirements.

Can I obtain an interferogram showing the performance of my refractor?

No. Each optic that we produce is evaluated throughout the final figuring stage with interferometry. When the figuring is complete, we store the final result for our future reference. We considered providing these with each refractor, however decided that it would cause confusion as most people do not know how to interpret such results. The largest factor was concern that our customers would compare their results with one another in order to assert the superiority of their own instrument. This, in turn, would result in craziness on the used market. Such comparisons are meaningless since each lens is figured to our very high standard and any differences are insignificant at that level.

ASTRO-PHYSICS SERVO DRIVE MOUNTS

Why did Astro-Physics choose a servo motor drive system rather than stepper motors?

Stepper motors have limited slewing ability and lose torque at high slew rates. They can stall without warning while slewing. Even when driven in the micro-step mode, they are not as accurate as a zero-cogging servo drive. Steppers take more power to run and will drain batteries much more quickly.

What is the pointing accuracy?

The inherent pointing accuracy of Astro-Physics mounts and the positioning software is very high. At two star parties in 1997, we used the following system: computerized 1200GTO mount, Astro-Physics 180 f7 StarFire EDF and IMG260 CCD camera (512 x 512 pixels) from Finger Lakes Instrumentation. Once polar alignment was achieved, we selected images from one side of the sky to the other. Each time the image appeared on the screen, it was located on the same part of the chip as the previous images. We were very impressed with the consistency of the system. The IMG260 chip is very fast, achieving excellent results in just 5 minutes for most objects. The images were not guided, yet were sharp, a testament to the accuracy of the drive system itself and the fine resolution of the motors. This pointing accuracy is consistently repeated when observing visually.

If you wish to see these images yourself, check out the web page for Finger Lakes Instrumentation at <http://www.fli-cam.com> or the DigitalSky Voice website <http://www.digitalskyvoice.com>. Keep in mind that the sky background was rather hazy (Starfest) or light polluted (Astrofest) so the images don't have as much contrast as they would at a darker site or on a more transparent night.

DigitalSky Voice™ software contains an algorithm to compensate for atmospheric refraction. For maximum accuracy, you can enter the temperature and pressure at the time of your observing session. The hand controller also has compensation for refraction. It is a fixed value.

Many factors will enter into the pointing accuracy - precise polar alignment, orthogonality of the telescope to the mount (is the optical axis of the telescope parallel to an imaginary line drawn through the center of the right ascension axis pointing to Polaris?). Some of the reasons that the orthogonality may not be parallel are: mounting ring diameters are not even, the optics are offset slightly in the tube, or the cradle plate is not parallel to the polar axis.

Is polar alignment necessary for computer slewing?

Accurate polar alignment is necessary to assure that the image will appear in the center of your eyepiece or on the CCD chip as you move from object to object. The keypad controller will guide you through polar alignment with an easy procedure to get you up and running quickly. As you polar align, you are calibrating your mount.

If I move the telescope by hand will I lose my calibration?

Yes, but recalibration is very easy with either the GTO keypad controller or *DigitalSky Voice™* software.

During the initial stages of development, we considered this question carefully since there is an obvious advantage to maintaining calibration whether the scope is moved by hand or with the motor drive. We discovered that the encoders available for reading the position of the shaft (4000 or 8000 steps) are very coarse (324 arc seconds and 162 arc seconds respectively) compared with the encoders that are built into the motor itself (.05 arc seconds). The encoders in the motor are scanned 300 times per second to provide precise sidereal tracking. As a result, the position and the rate are accurately controlled. We decided not to compromise the accuracy of the system by attempting to use the motor encoders and shaft encoders together.

When you are using the computer go-to functions, we recommend that you do not move your telescope by hand. The mounts are rugged enough so that accidental bumping of the tube or movement of the focuser knob will not generally cause any loss of position. For casual observing, you can simply sight Polaris up the bore hole in the polar axis for rough polar alignment and use all of the controller functions except go-to. The telescope can be moved easily and smoothly by hand.

Do I need to order the shaft encoders to operate the computer drive?

No, the shaft encoders are not used in the operation of the computer drive (please refer to the preceding question). Optional 4000 step encoders are available for all Astro-Physics mounts so they can be used with JMI digital setting circles, if you wish.

Why should I use a computer drive?

Let's face it, many of us live in light-polluted areas so star hopping is a real challenge. We've been amazed how easy it is to find objects with the computer drive that are embedded in the haze and sky glow. Even when star hopping with the best maps, you have to identify nearby star patterns so that you can zero in on the obscure object you are seeking. This is not always possible.

If you wish to be adventurous and find objects on your own, you can simply drive the mount at sidereal rate and move the telescope wherever you wish. The Astro-Physics mounts were designed so that you move your telescope easily by hand even with the clutches engaged normally. You don't have to engage and disengage the clutches each time you move the scope. In other words, you have full flexibility.

Why are there two COM ports on the servo drive electronics box?

You can use *DigitalSky Voice™* software (included with your mount), in conjunction with Software Bisque's *TheSky™*. You will need two available serial ports on your computer since both programs must obtain positional data from mount continuously. Our computer drive system was designed to input/output RA and Dec numbers (same protocol as the Meade LX200, LX650 and LX750 mounts). Other programs written with this protocol should also work.

Why did you discontinue the SMD model of Astro-Physics mounts?

Very few customers ordered the SMD drive system (servo motor drive with a micro-drive controller that allows basic mount function without the go-to capabilities). We determined that the demand for this model was too low to continue production.

Can I upgrade my current Astro-Physics mount to go-to function?

Initially, our goal was to allow upgrades for older 400, 600E, 900 or 1200 stepper motor mounts. However, the accuracy demanded of a go-to mount is much higher than a conventional mount. As the GTO model of each mount was developed, we redesigned various mechanical components to achieve optimal performance. These changes cannot be made to existing mounts. The cost of updating the electronics of an existing mount would probably be at least \$2,000 (the entire drive system and controller would have to be replaced), yet an older mount would not be as accurate as the newer mounts. As a result, we determined that upgrading would not be cost effective for the customer. We have decided that upgrades will not be made available.

The 800, early 600, 706 and 504 mounts also cannot be retrofit with the computer drive due to the tangent arm declination drive.

DIGITALSKY VOICE SOFTWARE

Is DigitalSky Voice™ software easy to use?

Very easy. The screen layout was designed to be as intuitive as possible. You can slew to any object you wish with a minimum of mouse clicks. The program was written from a voice-centric point of view and not just an overlay of voice onto a graphical program. As a result, you can accomplish any of the functions of the program with either voice or your mouse (or touchpad), as you wish.

Why should I use voice control?

Once you use it and realize that you are simply speaking in your normal tone of voice, it will seem natural to give verbal commands.

- It is a pleasure to stand at the telescope and say "Find the Wild Duck Cluster" rather than trying to remember the catalog number and general location, then returning to your computer to enter the information (or flipping through your star charts to find the object).
- Your eyes can remain dark-adapted since you don't have to look at the computer screen or turn on your flashlight.
- On cold nights, you can leave your computer in a warm location and control the telescope by microphone.

Do I have to train DigitalSky Voice™ to understand my voice? Will it understand foreign accents?

DigitalSky Voice™ uses a natural English grammar compiler for true voice recognition and doesn't use pattern or phoneme matching. It does not require training to understand your voice. You will use easy-to-remember words and phrases to give the commands.

These are some examples of commands you will say:

- "M1." *DigitalSky* will slew to any Messier, NGC, IC or ADS object when you simply say the name of the database and the number. If the object is below the horizon, *DigitalSky* will let you know.
- "Find the Crab Nebula." *DigitalSky* will slew to the names of common objects.
- "Object data." *DigitalSky* will tell you the object that you are looking at, the type of object and the magnitude. Additional information is provided for double stars and planets.
- "Report position." *DigitalSky* will tell you the constellation that you are in and give you the RA and Dec numbers of your current position.
- "Local time." *DigitalSky* will tell you the time.

DigitalSky Voice™ has been used successfully with a variety of US and foreign accents, however we cannot guarantee that it will work with all accents or speech patterns.

A voice recognition practice feature is provided in the menu. Before your first observing session, you can practice the verbal commands with your computer at home.

Sometimes I want to use the voice input/output and sometimes I want to sit at the computer and enjoy the quiet of the night. Can I do this?

Flexibility was an important goal in development of the software. You can use the screen display with or without the voice output and voice recognition. The software can operate in conjunction with the hand controller or on its own (for remote astronomy), as you wish.

Can I add my own objects to the computer database?

Yes. You can add your favorite objects to a user defined "cool objects" list. The object list will display on the screen whenever you are observing within that constellation. You can also add your objects to other parts of the program.

What other mounts can use DigitalSky Voice™ software?

You can use *DigitalSky Voice™* with the Meade computerized LX200, LX650, LX750 and DS Series; Meade ETX-90/EC and ETX-125 with AutoStar; Celestron Ultima 2000 and NexStar 5; Vixen SkySensor 2000-PC and other mounts which use the same protocols.

Do I need an expensive microphone?

Although we have not tested all the microphones on the market, we have been pleased with the response of microphones as inexpensive as \$40 from Radio Shack. Several less expensive ones were tried with poor results. You will need an external microphone with an on-off switch. Wireless microphones are an excellent choice, however they are more expensive. If you try to use the microphone that is built into your computer, the program will hear itself speak and become confused.

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