ASTRO-PHYSICS
900GTO German Equatorial Mount (900GTO)
with GTOCP3 Control Box

Includes GTO Keypad and PulseGuide and PEMProAP software CDs

New in 2005

For the 2005/2006 production run, we incorporated a number of design changes based on our own experiences with the demands of imaging, customer suggestions and available technology. A brief summary of the changes follows below.

- **Mechanical improvements.** Completely re-designed declination axis for excellent stability under all observing conditions; new azimuth adjusters provide smoother, easier adjustment; increased height of the polar forks allow more room for your hand when making altitude adjustments and tightening knobs; improved gear train in the motor gearbox for quieter operation and reduced backlash and additional changes to the internal construction. More ...
- **Two Pier Adapter choices.** The Standard Pier Adapter is no longer included as a component of the 900GTO. You now have your choice of the Standard version or the new Precision-Adjust Rotating Pier Adapter with Azimuth Bearing. More ...
- **GTOCP3 Servo Motor Control Box.** The new control box has increased protection on all input lines, larger memory chip, and additional commands for mount control. More ...
- **GTO Keypad.** Our unique keypad has evolved over the last year or so to include a new circuit board with larger memory capacity, LED fiber optic backlit panel for greater longevity and quieter operation and epoxy coated elastomeric keys. We include the Keypad Protector with all keypads. More ...
- **PulseGuide Software CD.** This powerful utility provides complete remote control of all Astro-Physics GTO mounts, from the 400GTO to the 1200GTO. More ...
- **PEMProAP Software CD.** PEMProAP (Periodic Error Management Professional - Astro-Physics version) is a Windows software application that makes it easy to characterize and reduce periodic error. While the periodic error of your 900GTO will be 7 arc seconds or less, you can reduce it even further to maximize performance without auto-guiding. PEMProAP is a version of PEMPro specifically for Astro-Physics go-to mounts and cannot be used with other mounts. The software CD is included with the 900GTO mounts shipping in 2005 and later. More ...

All of these enhancements are described in detail in 900GTO German Equatorial 2005 Improvements. Best of all, many of these improvements can be made to previous GTO mounts and some of them to all 900 models produced in the past. These and other upgrades to mounts already in the fields are described in 900GTO Mount Upgrades and Spare Parts.

Why a 900GTO?

Stability ... accuracy ... ease of setup ... friendly go-to control interface - these were the primary design goals of the 900GTO. Amateurs today demand a precise mount that will allow them to pursue all aspects of astronomy whether it be observing visually, CCD imaging or photographing with 35mm or 6x7 camera. Many of the finest imagers today have been using our GTO mounts as a solid platform for a wide variety of instruments. The largest of these is our 1200GTO and the next in line is the 900GTO. If your instrument of choice is a medium-sized refractor, Cassegrain, Ritchey-Chretien, Newtonian or astrograph, we invite you to read on.

Since its introduction in 1998, the 900GTO has gained a reputation for both tracking and pointing accuracy, essential to casual visual observation as well as advanced imaging. Quite a few 900GTO and 1200GTO mounts can be found at major star parties throughout the country and the world. It is a favorite of many advanced photographers and imagers. Visit the Cool Sites and Gallery sections of our website to see photos of the mount in action and images taken while using the 900GTO.

These mounts are truly a marvel of engineering - maximum strength and rigidity with minimum weight. Our CNC lathes and mills carve out the excess material in both axes of the 900GTO German Equatorial 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.

The 900 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 and the reasonable weight of each component; the heaviest is only 25 lbs! Telescopes commonly used include Astro-Physics 155-180mm refractors, 10-11" Schmidt-Cassegrains, 10" Maksutov-Cassegrains and 10-12.5" Ritchey-Chretiens and other scopes of similar size and weight.

The 900GTO mount is built from the ground up to be a precision imaging platform while still being totally user friendly. Consider these advantages and features:

Flexibility

Portable.
Extremely solid, rugged, high payload mount, yet comes apart in two reasonably light-weight components for hassle-free field setup. No tools needed to assemble the mount in the field.

Operate with 12V battery.
You can take it to the darkest skies and power it with a commonly available 12V battery. In the observatory, we suggest a minimum 5 amp filtered, regulated power supply.

Clutches and setting circles.
Allow manual operation if power is not available.

Image past the meridian.
The mount will track and guide well past the meridian in either direction if the object is located such that the telescope will clear the pier. This allows the user to set up the mount for a long series of exposures without stopping in the middle to flip sides. One can start the telescope under the mount while pointing at an object in the eastern part of the sky and track it all the way deep into the western sky. This is very useful for long exposure H-alpha or in cases where a large number of individual exposures are needed for stacking.

Easy alignment for non-critical viewing.
Can align with a polar alignment scope to quickly zero in on the pole for most non-critical observing or to get close before tweaking in for CCD. You can even align it during the day for solar observing or viewing the planets at twilight.

External computer not needed.
The keypad is a handheld computer with all of the features, functions and databases you need to tour the universe night after night. The unique firmware allows you to precisely polar align your mount in the field, even in broad daylight! The vacuum-fluorescent display with a temperature range of -40 degrees F (and C, they are the same in this instance), allows hardy observers to use this mount on cold winter nights. You can't do that with a PC or PDA! As new firmware versions are released in the future, you can upgrade your keypad directly from the download section of our website - free of charge!

Control with personal computer, if desired.
All functions of the servo drive can be commanded from a laptop or desktop computer using popular planetarium software. Depending on the features of the program, you can position your telescope, center your image and control tracking rate, remote focusing, reticle brightness and park at the end of your observing session. Examples of currently available software:

- PulseGuide by Ray Gralak (included with the 900GTO)
- Software Bisque's suite which includes TheSky Astronomy Software, CCDSoft CCD Astronomy Software, TPoint Telescope Pointing Analysis Software and Orchestrate Scripting Software.
- Desktop Universe by Main Sequence Software

- Earth Centered Universe (ECU) by David Lane of Nova Astronomics
- SkyMap Pro by Chris Marriot
- Starry Night Pro
- DigitalSky Voice Software by Charles Sinsofsky
- Any software that is ASCOM compliant.

Write your own computer program.
The Astro-Physics GTO protocol for the GTOCP3 Control Box is freely available to those who would like to write their own computer program for controlling the mount.

Precise Mechanical Fabrication

Highly accurate mechanics
Using modern CNC machining techniques, we make all components to a high precision level, which results in a final package that is solid and accurate in all respects. The critical angles are accurately machined so that the mount is orthogonal to a very high degree. This results in pointing accuracies well below 1 arc minute for a properly aligned mount.

Worm gear accuracy
Critical worm gear accuracy is maintained by special machining techniques developed at Astro-Physics after extensive studies and actual field operation. Our worm accuracies are second to none and are guaranteed to be 7 arc seconds or less peak-to-peak. The periodic error of each mount is verified during our extensive testing procedures. With good alignment and PEM training with the Keypad or PEMProAP software, it is quite practical now to achieve unguided CCD images with today's hi-resolution cameras coupled to a 6" to 12" telescope.

Mechanical Features

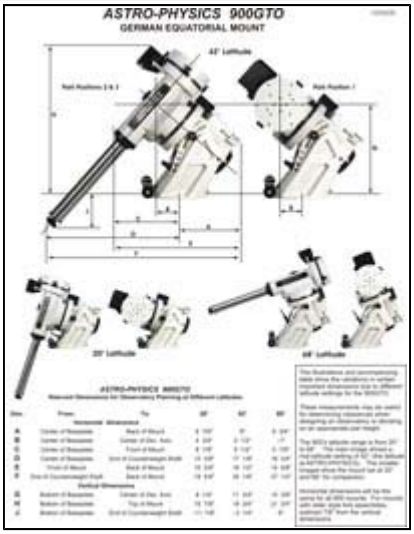
- All machined mounting made from aluminum barstock and stainless steel. All fasteners are stainless steel.
- Motors and all electronic components are enclosed
- Massive thrust bearings and preloaded shaft bearings for excellent stability under all imaging situations.
- 14.25" removable 1.875" diameter counterweight shaft. Optional 19.5" counterweight shaft (M12601-B) with 18.5" useable length is available.
- 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" (18.3cm), 225 tooth aluminum
Declination worm wheel	6" (15.2cm), 225 tooth aluminum
Worm gears	Brass
R.A. thrust surface	7.0" (17.8cm)diameter
Declination thrust surface	6.0" (15.2cm) diameter
R.A. shaft	2.2" (5.6cm) diameter

Declination shaft	1.75" (4.4cm) diameter
Latitude range	20 to 68 degrees 0 to 20 degrees when using 900 Wedge (900WDG)
Azimuth adjustment	Approximately 14 degrees
Setting circles	Porter Slip Ring design, engraved
Right ascension	4 minute increments, pointer, engraved both Northern/Southern
Declination	1 degree increments, pointer
Capacity	Approximately 70 lbs. (31.8kg) scope and accessories (not including counterweights), depending on length. Will accommodate Astro-Physics and similar refractors up to 180mm f9, 12" Cassegrains, 12-14" Ritchey-Chretiens These are only guidelines. Some telescopes are long for their weight or very heavy for their size and will require a larger mount.
Weight of equatorial head	54 lbs (24.5 kg), Declination axis is 17 lbs. (7.7 kg) right ascension axis is 26.5 lbs.(12.0 kg), counterweight shaft with washer and knob is 10.5 lbs. (4.8 kg)

Dimensions for Observatory Planning



People often ask us what the 900GTO's dimensions are. The answer is: It depends. Different latitude settings can drastically affect the shape and dimensions of the mount. To answer this question we have prepared the following PDF document. 900GTO Dimension Sheet Please note: this sheet shows the latest version of the 900GTO with the new improved Polar Fork. To see an example of an older polar fork style, go to the History section of our website. As the dimension sheet points out, all horizontal dimensions are the same for ALL versions of the 900 mount. If you have a different looking polar fork from the one pictured on the 900GTO Dimension Sheet, simply subtract 7/8" from the vertical dimensions.

Servo Motor Drive

The drive system uses a high-quality Swiss 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. Please refer to GTOCP3 Control Box and Keypad for Servo Drive for additional information.

Pier Adapter Options

The 900 Standard Pier Adapter (900SPA) was included with 900 mounts sold in the past. However, in 2005, we plan to offer two choices. We ask that you add one of these options to your mount order. If you plan to have multiple pier installations, perhaps one permanent and another portable, you may wish to purchase an extra adapter to install on the the second pier. This will make your setup and switchover much quicker. Many customers have found this to be advantageous.

If you do not purchase one of our pier adapters described below, for instance, if you purchase the Monolith Pier from Particle Wave Technologies, you will need to purchase the Pier Adapter Knob Kit (part# 9KBKIT) in order to attach your mount to the Monolith.

Standard Pier Adapter (900SPA)

This 900 Pier Adapter is similar to those that we have included with mounts in the past, however the azimuth adjustment block is slightly taller to accommodate the new azimuth adjustor assembly. If you have a permanent installation, this base is a good choice since you will not have to set up every session.

The adapter includes the machined flat plate, four machined aluminum lock knobs with washers, the azimuth adjuster block, center pivot screw and six 5/16-18 x 5/8 side bolts and washers. All machined parts are black anodized and the fasteners are stainless steel. The adapter plate will either fit into your Astro-Physics Portable Pier and be bolted from the side or you can bolt it to the top of a flat surface. Refer to the diagram for bolt pattern information. If we ship an Astro-Physics pier to you at the same time that your mount is shipped, the Pier Adapter will be installed on the pier prior to shipment for your convenience. If you plan to use an ATS pier, the O.D. of the plate will need to be modified by ATS for an additional charge.

Precision-Adjust Rotating Pier Adapter with Azimuth Bearing (900RPA)

This pier adapter was designed for very accurate and smooth adjustment of the azimuth angle without loosening the lock-down knobs on the base of the mount. Upgrade your previous model 900 mount (any version) and enjoy the ease of use.

The adapter includes two machined flat plates, four machined aluminum lock knobs with washers, a tall version of the azimuth adjuster block, center pivot screw and six 5/16-18 x 5/8 side bolts and washers. All machined parts are black anodized and the fasteners are stainless steel. The adapter plate will fit into your Astro-Physics Portable Pier and be bolted from the side. If we ship an Astro-Physics pier to you at the same time that your mount is shipped, the Pier Adapter will be installed on the pier prior to shipment for your convenience.

The Precision-Adjust Rotating Pier Adapter must fit inside another part and be bolted from the side. It cannot be bolted through the top as you can with the Standard Pier Adapter. If you plan to use an ATS pier, the O.D. of the plate will probably be modified by ATS for an additional charge.

PulseGuide™ Software

PulseGuide is a stand-alone Windows (98, ME, 2000, NT4, XP only) utility that provides complete remote control of Astro-Physics GTO400, GTOE600, GTO900, and GTO1200 mounts. It derives its name from its most distinctive feature, pulse guiding, which can improve unguided tracking. Specifically, it can help correct tracking errors caused by polar misalignment and atmospheric refraction. You can also train PulseGuide to track objects moving relative to the stars, such as asteroids, comets, and the moon. In addition to pulse guiding, PulseGuide also has many useful utility features. With just a few exceptions, it supports the entire serial Astro-Physics command protocol. More ....

PulseGuide was written by Ray Gralak of Sirius-Imaging. Please refer to his web site http://www.pulseguide.com for further developments and enhancements. The software will be provided on a CD-ROM with your 1200GTO mount. Previous owners of any Astro-Physics mounts can download the software free-of-charge, courtesy of Ray. Many, many thanks to Ray for this powerful program.

PEMProAP Software

PEMProAP (Periodic Error Management Professional - Astro-Physics version) is a Windows software application that makes it easy to characterize and reduce periodic error. While the periodic error of your 900GTO will be 7 arc seconds or less, you can reduce it even further to maximize performance without auto-guiding. PEMProAP is a version of PEMPro specifically for Astro-Physics go-to mounts and cannot be used with other mounts. The software is included with the 900GTO mounts shipping in 2005 and later. More ...

Recommended Accessories

- Mounting Plates- DOVELM16S, FP1800, DOVE15, DOVELM, 900RP,DOVE08 with Q4047
- Kendrick Astro Instruments 18 Amp-hr. 12 Volt Rechargeable Battery Pack
- Astro-Physics Portable Pier - 8" diameter, heights 24",32",42",48",54",62
- Santa Barbara Instrument Group All CCD Star Tracker/Imaging Systems
- Advanced Telescope Systems (ATS) Portable Piers - 8" diameter
- Cable for SBIG Autoguiders and CCD Imaging Cameras
- Pier Adapter Knob Kit for 900 Mounts (900KBKIT)
- 900 Wedge for 0-20 Degrees Latitude (900WDG)
- Stainless Steel Counterweights – 10, 18 lbs
- Pier Accessory Trays and Support Bar
- Cord for Pentax 6x7 camera (CORD01)
- 19.5" Counterweight Shaft (M12601-B)
- Polar Alignment Scope (PASILL4)
- Precision-Adjust Rotating Pier Adapter (900RPA)
- Standard Pier Adapter (900SPA)
- Mounting Rings

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