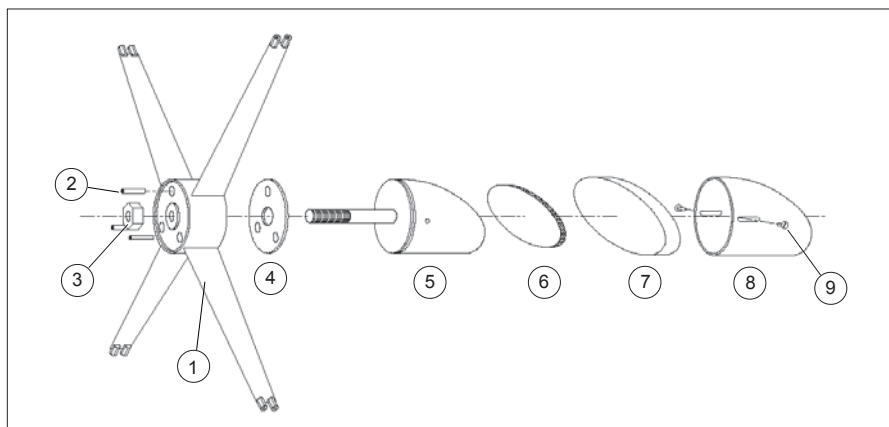




Installation Instructions

3-Vane and 4-vane Secondary Mounts



List of Parts Included With Each Kit

<u>ITEM</u>	<u>DESCRIPTION</u>
1	Spider
2	Collimating adjustment screws, 3 pcs.
3	Tensioning nut
4	Clutch disk
5	Mirror holder body
6	Mirror pad
7	Secondary mirror (not included - available separately)
8	Mirror shroud (not included on 0.75" and 1.00" models)
9	Shroud mounting screws
10	Nylon mirror spacers, 3 pcs (not shown)
11	Drill bit (not shown)
12	Collimation adjustment tool (not shown)
13	Spider mounting screws, quantity varies (not shown)

INSTALLATION

Install the Mirror Into the Holder

The secondary mirror can be installed in the holder by two different methods; shroud mounting or adhesive mounting. (*Note:* 0.75" and 1.00" models only use the adhesive mounting method.) The metal shroud can be used (**Method #1** below) when the mirror is the same size as the holder body (e.g., a 2.14" mirror in a 2.14" holder). For non-standard or oversized mirrors, the mirror should be glued to the face of the holder as described in **Method #2** below.

Method #1: Using the metal shroud

Remove the screws holding the metal shroud, and remove the shroud. Place the mirror on the holder face with the foam pad under the mirror. Slip the shroud over the mirror and holder, and loosely install the side retaining screws. Position the shroud onto the mirror until the tabs lightly contact the mirror surface. Do not push the shroud too tightly against the mirror, or you may deform the optical surface or damage the optical coatings. Snug tighten the shroud retaining screws.



Figure 1: Shroud-mounted secondary mirror

Important Note: Secondary mirrors made from glass castings vary in size. If your secondary mirror does not seat properly in the mirror shroud, it is probably slightly larger than the advertised size. In this case, mount the mirror with the adhesive method (**Method #2** below). Mounting an oversized mirror in the shroud can result in unacceptable surface deformation, or "pinched optics". (ProtoStar secondary mirrors are CNC machined to size to ensure a proper fit.)

Method #2: Adhesive attachment

If you are using an oversized or non-standard size secondary mirror, you can glue it to the face of the mirror holder. Use a silicone-based adhesive only, and use a fresh tube (there is a catalytic component that evaporates with time). Make sure both the mirror back and diagonal head are clean and free of oils prior to applying the adhesive.

First, glue the supplied plastic spacers to the face of the diagonal head



Figure 2: Common silicone adhesives

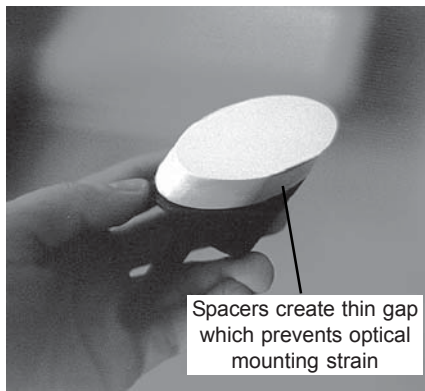
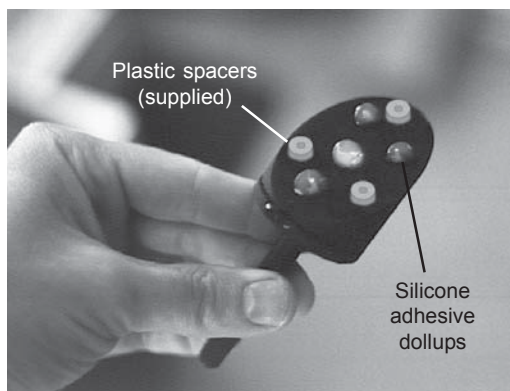


Figure 3: Gluing the mirror to the holder with spacers

as shown in photos above. Leave the spacers in place, and glue the secondary mirror on with several small dollops of adhesive. Let the adhesive cure for 24 hours at room temperature.

It is a good idea to cover the exposed edge of the secondary mirror to suppress stray light. You can make a wrap-around shield that conforms to the edge of the mirror, and either paint it flat black paint, or cover it with a scrap of flocked light trap material.

Install the Spider

Measure the overhang dimension

Before drilling spider mounting holes, determine what the *overhang dimension* is for your assembled secondary mount. The overhang is the distance from the spider mounting holes to the center of the secondary mirror (which is also the focuser's axis), and is shown as dimension 'A' in **Figure 4**. It's not necessary to measure with high precision because the secondary's position can be later fine-tuned within a range of adjustment.

To make this measurement, turn the three collimation screws in the spider's hub until they protrude about 1/8" (3 mm) out the back of the hub. Next, install the mirror holder (with mirror installed) into the spider until the collimation screws seat into the dimples of the clutch disk. Install and finger tighten the main tensioning nut by hand. Measure the overhang by eye directly along the midline of the secondary using a ruler or tape measure.

Mounting the spider

It is generally easier to combine the spider and holder outside the telescope before installing into the tube. This permits a visual inspection to ensure the collimation screws are engaged into the clutch dimples, and the anti-dew connecting wire (if equipped) is stowed properly.

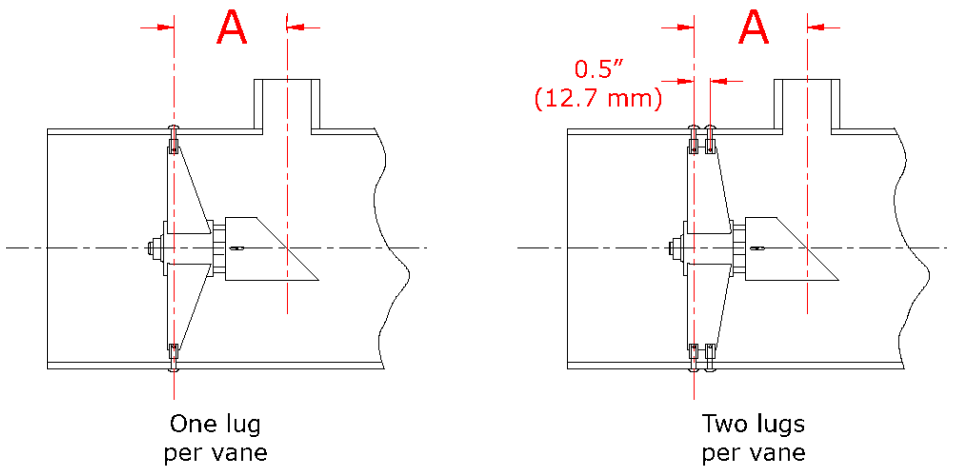


Figure 4: Spider overhang dimension

Drill the spider mounting holes in your tube or upper cage using the supplied drill bit. For solid tube telescopes, a wrap-around paper template is useful for making sure the holes are accurately located. Install the spider with the supplied #8-32 screws (M5-0.8 for metric spiders). **Start the screws with your fingers only.** The stainless steel screws are much harder than the soft aluminum vane lugs, and it's easy to cross-thread the screws. Finger turning allows you to feel the screw threads engaging properly. Finish tightening with a screwdriver. **Do not overtighten the vane screws**, as highly tensioned vanes are not required to achieve collimation stability.

Note: Protostar spiders are normally sized so that there is a small gap between the tip of each vane and the tube's inside wall. This gap permits precise centering adjustments, and ensures the vanes will always remain in slight tension.

USE and MAINTENANCE

How it works

Unlike traditional ball and socket pivot designs, *Protostar* secondary mounts use a semi-rigid shaft which permits the range of secondary mirror tilt required. Three collimating screws press against a clutch disk on the back of the mirror holder. The clutch restricts the action of the collimating screws to tilt adjustment only, and prevents the mirror holder rotation while you turn the collimation screws. **It is important that the collimation screws are seated in the recessed dimples on the clutch disk.** There are small notches on the outside of the clutch disk to permit a visual check that the collimation screws are aligned with the dimples.

A major benefit of the design is that it simplifies collimation of the secondary mirror. The tilt adjustment of the secondary mirror can be done directly, without the need to unlock a nut first. Similarly, nothing needs to be “locked down” to hold collimation in place. The *system tension* (see below) is relied upon to hold all adjustments in place. In addition, the design permits most collimating screw adjustments to be made independently (i.e., you can tighten one without having to also loosen others).

System tension

The schematic below shows how system tension is created. Tension is developed in the semi-rigid stem by tightening the tensioning nut, which causes a reactive compressive force between the clutch disk and diagonal head. In order for the diagonal mount to maintain collimation, there needs to be enough system tension to prevent the clutch from slipping. This can usually be achieved by hand tightening the tensioning nut. A good way to check for sufficient system tension is by trying to rotate the diagonal head. It should turn by hand, but with considerable frictional drag.

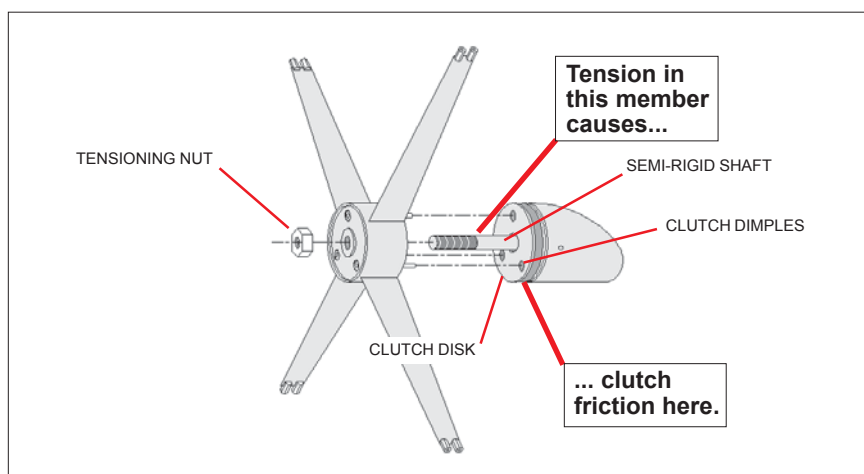


Figure 5: How it works

Collimation tips

Protostar secondary mounts work a bit differently than most other commercial secondary mounts. Here are a few important tips to remember:

> It is usually easier to marry the secondary holder and spider together outside the telescope, and install as one unit. This is especially true for units with the built-in dew heater.

> For precise axial positioning of the secondary mirror under the focuser, move the holder to/from the primary mirror by alternately adjusting the collimation screws and tensioning nut.

To move the secondary closer to the primary mirror, first loosen (counterclockwise) the tensioning nut a half turn, and then tighten (clockwise) the three collimation screws until you feel resistance (make sure they remain aligned with the clutch dimples). Repeat as necessary.

To move the secondary away from the primary mirror, first loosen (counterclockwise) the three collimation screws by about one turn each, and then finger tighten (clockwise) the tension nut until it is snug. Repeat as necessary.

Positioning the secondary axially may take several repetitions, but keep in mind you only need to do this for the very first collimation. Subsequent collimation will go much faster.

> Start the collimation process with the tensioning nut only finger tight. If most of your subsequent turns of the collimation screws are clockwise, this is usually enough to tighten and lock the system in place with no further action. If you find the secondary holder is still too loose, you can manually tighten the tensioning nut another half turn. Do not tighten the tensioning nut more than is needed to just keep the holder from rotating freely. The secondary mount is designed to hold collimation with very little friction and tension in the system.

> After completing collimation with the tool of your choice (Cheshire, laser, etc.), just take your hands off. You're done! It is not necessary to tighten anything else.

Service and replacement parts

Protostar secondary mounts can be returned for a factory refurbishment and refinish for a modest fee (see our website for details). Most of the major components can also be purchased as replacement parts.



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P.O. Box 448
Worthington, Ohio 43085
U.S.A.

technical support: (614)-785-0245
e-mail: protostar@fpi-protostar.com

www.fpi-protostar.com