THE CELESTRON® RADIAL GUIDER

Photographing deep-sky objects, that is objects outside our solar system, requires long exposures to collect enough light to produce an image on film. While an equatorial mount with a drive system tracks these objects, the motion is not perfect. A telescope left to track by itself will produce elongated star images. To get perfectly round star images, you must guide the telescope throughout an exposure. The Celestron® Radial Guider is specifically designed for this purpose. This device allows you to simultaneously photograph and guide through the telescope. This type of guiding produces the best results since what you see through the guiding eyepiece is exactly reproduced on the processed film. Guidescopes, which offer another avenue for guiding deep-sky photographs, are often inadequate since the field of the guidescope can shift relative to the field being photographed through the telescope. This shift, known as differential flexure, produces elongated star images on film. Since the Radial Guider allows you to guide and photograph through the telescope simultaneously, differential flexure is NOT a problem.

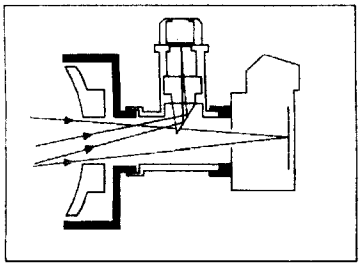


Figure 1

Here's how it works. The Radial Guider is a "T"-shaped assembly that attaches to the rear cell of the telescope. As light from the telescope enters the guider, most passes straight through to the camera. A small portion, however, is diverted by a prism at a right angle up to the guiding eyepiece. Figure 1 shows the cross section of a Schmidt-Cassegrain telescope with Radial Guider, camera body, and guiding eyepiece installed.

The new Celestron® Radial Guider offers significant refinement to conventional off-axis guiders. Here are just a few features:

- **Fixed camera orientation while the user is free to move the guiding eyepiece radially, independent of the camera body.**
- **Adjustable prism angle sweeps in the axis perpendicular to the radial motion in order to center a guide star.**
- **Matched body length (compact design) to assure best optical characteristics with the new f/6.3 Reducer/Corrector Lens.**
- **Minimal prism shadowing on film.**
- **Most rigid guider available.**

These new features combine to deliver fast and simple guide star acquisition while maintaining maximum guider rigidity.

Celestron offers two Radial Guiders. Model **#94176** for the C8, C11 and C14. Model **#94176-5** is specifically for the C5 telescope. Use the illustration on the following page (figure 2) to familiarize yourself with the various parts of the Radial Guider for installation and on-going use.

A Few Considerations

In order to use the Radial Guider, you need a guiding eyepiece. Recommended are the Micro Guide Eyepiece (#94171) and/or the Illuminated Reticle Ocular (#93324). The Micro Guide Eyepiece is a multifunction ocular that offers several ways to guide. First, there are concentric circles offering different guiding tolerances depending on the focal length of your telescope.

Additional lines on the reticle allow you to use it like a conventional guiding eyepiece with cross hairs. The laser-etched reticle offers sharp lines for the best possible definition. In addition, the variable brightness illuminator makes it easy to use even on faint stars. (The Micro Guide Eyepiece contains other scales for additional applications.) The Illuminated Reticle Ocular has a focal length of 6mm to give you the highest guiding magnification in a fixed focal length eyepiece. This eyepiece has a moveable reticle making the acquisition of a guide star much easier.

To attach your camera to the Radial Guider you will need a T-Ring designed for your particular camera make. You will also need a drive corrector to override the telescope's drive motors and compensate for any tracking errors. A dual axis drive corrector is preferable since corrections to both telescope axes can be made from the control paddle. Generally, a drive corrector must be purchased separately. (The C5+, Powerstar 8-PEC, Ultima 8-PEC, and Ultima 11-PEC telescopes come standard with the electronics for drive correction built into the drive base and a hand controller to operate the electronics. All you need is the optional declination motor.)

Prior to installing and using your Radial Guider, you must accurately polar align your telescope mount. The best and most effective method is called declination drift. Please consult any of the Celestron telescope manuals for more information on this method of polar alignment.

Finally, you will need to balance your telescope to ensure that the drive motors track accurately. This is done after your Radial Guider with camera and guiding eyepiece have been installed and your target selected. The correct procedure for doing so should be in your telescope's instruction manual.

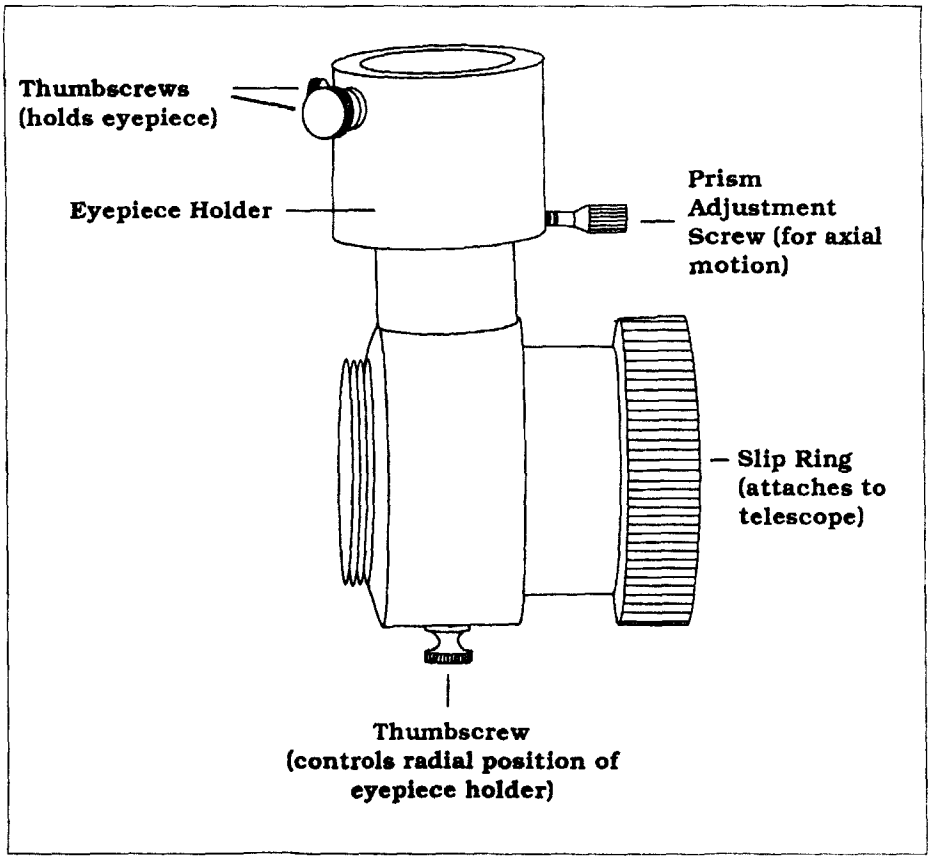


Figure 2

Installing Your Radial Guider

The installation of your Radial Guider varies depending on the type of telescope to which you attach it. For the catadioptric telescopes, like the C5 and C8, it threads directly onto the rear cell. For the larger catadioptric telescopes, like the C11 and C14, it threads onto the reducer plate. Here's how to install your Radial Guider.

1. Remove all the visual accessories from the back of the telescope.

2. Thread the Radial Guider onto the telescope (rear cell or reducer plate) by rotating the slip ring clockwise until tight.

The Radial Guider was designed to work with the Reducer/Corrector which allows the C5, C8, and C11 telescopes to work at f/6.3 and the C14 to work at f/7. This accessory is designed to assure the best optical characteristics for wide field, fast astrophotography. If using this optional accessory, thread the Radial Guider directly onto the reducer.

Attaching Your Camera

To mount your camera body to the Radial Guider you will need a T-Ring (purchased separately) designed for your particular camera make. Before you attach the camera, loosen the thumbscrew on the Radial Guider that is opposite the eyepiece holder. This will allow you to swing the eyepiece holder approximately 145° about the center. Orient the eyepiece holder so that the prism is in the center of the travel groove and tighten the thumbscrew to hold it in place. To attach your camera:

1. Thread the T-Ring on the back of the Radial Guider by rotating it clockwise until tight.

2. Remove your camera's normal lens from the camera body and store it in a safe, dust-free environment.

3. Mount your camera body to the T-Ring the way you would to any other lens (see figure 3). The T-Ring has a red dot to indicate the correct coupling point with the camera body.

For best results, orient the camera so that the prism is above the long dimension of the 35mm frame (see figure 4). If it is not, you must loosen the three set screws on the T-Ring to reposition the camera body. For more information on this procedure, see the section on Changing the Camera Orientation. Once this has been set, the camera will return to this orientation every time you attach it to the Radial Guider.

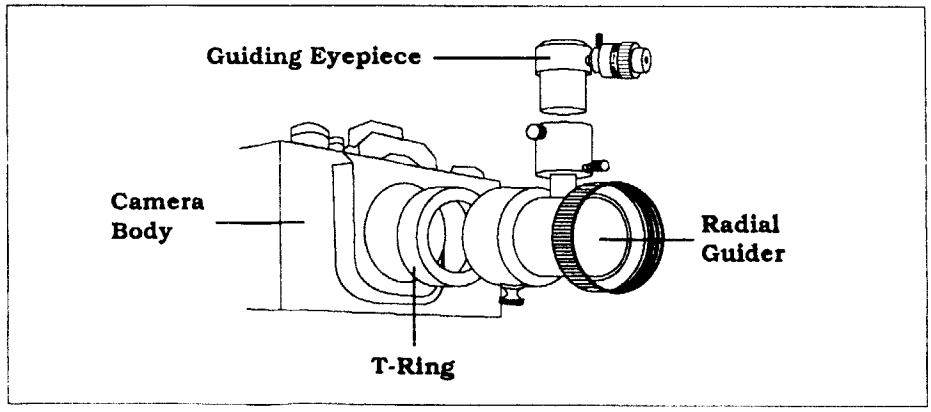


Figure 3

Installing the Guiding Eyepiece

With the camera attached to the Radial Guider, you are ready to install the guiding eyepiece. To do so:

1. Loosen the thumbscrews on the eyepiece holder of the Radial Guider.
2. Insert the guiding eyepiece (about halfway) into the eyepiece holder.
3. Tighten the thumbscrews to hold the eyepiece in place.

The Radial Guider uses two thumbscrews to hold the eyepiece which prevents it from pivoting.

Using Your Radial Guider

Prime focus photography with an off-axis guider is one of the most challenging forms of celestial photography. Here are a few techniques, in the order they should be performed, to make the job a little easier.

Focusing the Camera

Begin by placing the target to be photographed in the field of view as seen through the camera. Focus the camera using the focus knob on the telescope. If your subject is faint, you can focus on a nearby bright star. Final focus should be made by turning the focus knob counterclockwise. This procedure moves the telescope's primary mirror forward and ensures that it will not move during the exposure. Once in sharp focus, turn the focus knob approximately 1/12th turn counterclockwise to help minimize any field curvature effects.

Don't be too concerned about centering at this point since you may need to change the placement of your target to get a suitable guide star into the field of the guiding eyepiece.

Focusing the Eyepiece

To focus the guiding eyepiece, slide it up or down inside the eyepiece holder until the guide star is as sharp as possible. If you use the focus knob on the telescope it will alter the focus of the camera which was set previously. You want to focus the eyepiece at this time to make it easier to see the stars in the field. Out-of-focus stars are diffuse making them difficult to see. Keep in mind that the stars you focus on at this point may not be used as a guide star.

Acquiring a Guide Star

Once your target is focused, locate the guide star in the guiding eyepiece by rotating the eyepiece holder around the main optical path. This adjustment allows you to rotate the eyepiece holder approximately 145° around the light path without loosening the slip ring. To do this:

1. Loosen the thumbscrew on the Radial Guider that is opposite the eyepiece holder.

2. Rotate the eyepiece holder around until a suitable guide star is visible in the eyepiece.

3. Tighten the thumbscrew to secure the position of the eyepiece holder.

If rotating the eyepiece holder is not enough, loosen the slip ring and rotate the entire housing until the eyepiece holder is in the desired position.

To increase the availability of guide stars, the prism angle can be changed by turning the prism adjustment screw. Since the screw is spring-loaded, final acquisition of the guide star should be made by turning the screw inward (clockwise).

NOTE: Finding a good guide star is one of the most time-consuming activities required before you can take the picture. Be prepared to reposition your target within the field so that the guide star can be seen in the guiding eyepiece. Remember that whatever you see in the guiding eyepiece is NOT in your picture.

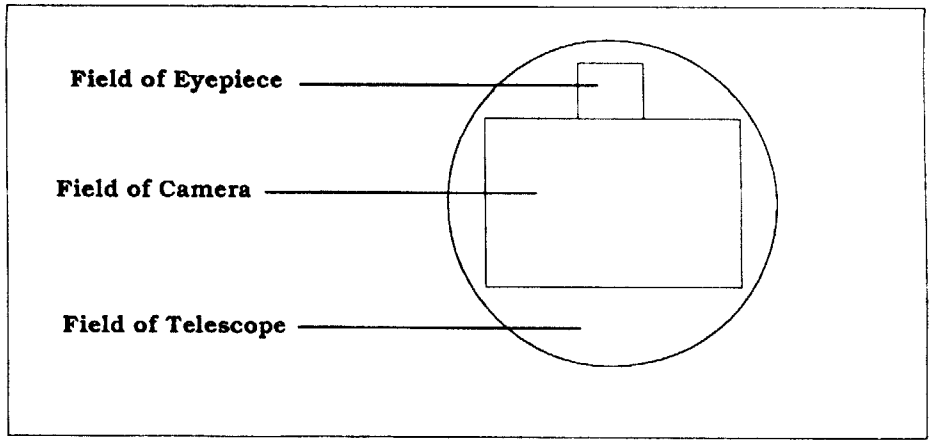


Figure 4

This illustration shows the relative fields of the eyepiece, camera, and telescope. Note that what you see through the guiding eyepiece does not show up on film. Also note that rotating the eyepiece holder rotates the prism as well. In certain positions, the prism may cut into the light that should go to the film (i.e., at the corners of the photographic emulsion).

Changing the Camera Orientation

With the subject and guide star in their respective fields of view, you may find that the camera is not oriented the way you want it (i.e., vertically or horizontally). The camera body should be oriented so that the long dimension of the 35mm frame is either parallel or perpendicular to the right ascension axis of your telescope. To change the orientation without affecting the position of your subject or guide star, you will need to adjust the three set screws on the T-Ring. To do this:

1. Hold the camera body with one hand.

2. Loosen the three set screws on the T-Ring. You will need a small flat blade screwdriver to loosen the screws. **Be sure you have a firm grip on the camera while loosening the set screws on the T-Ring. If you do NOT, the camera may separate from the T-Ring and fall off!**

3. Rotate the camera to the desired position.

4. Tighten the set screws on the T-Ring.

5. Check to see if the subject and guide star are properly centered.

Note that this process may have to be repeated for each object photographed.

Adjusting the Cross Hair Orientation

The last thing you will need do before you take the photo is to orient the cross hairs of your guiding eyepiece so that one is parallel to the declination axis while the other is parallel to the right ascension axis. This makes it easier to determine the direction of drift and correct it quickly.

1. Loosen the thumbscrews on the eyepiece holder of the Radial Guider.

2. Move the telescope back and forth in declination using the slow motion control knob. This allows you to determine the orientation of the DEC axis.

3. Rotate the eyepiece until the motion of the guide star is parallel to one axis of the cross hairs. Don't move the eyepiece up or down in the eyepiece holder or you will change the focus of the eyepiece.

4. Tighten the thumbscrews to hold the proper orientation.

This procedure must be repeated each time the position of the guiding eyepiece is changed (i.e., rotated around the optical axis of the Radial Guider).

Optional Accessories

There are several accessories that will enhance the use of your Radial Guider. A brief list with an explanation of each accessory's function follows.

Illuminated Guiding Eyepiece - 6mm (#93324)

When it comes to guiding eyepieces, you can't get more magnification in a single ocular. The reticle is illuminated making it easy to see the cross hairs. The X and Y axis of the cross hairs are adjustable making it easy to center a guide star and the variable brightness illuminator makes it easy to use even on faint stars. The LED is battery operated so there are no cords or wires to get in the way.

Light Pollution Reduction (LPR) Filters (#94129)

If you plan to photograph deep-sky objects from the city, you will need a Light Pollution Reduction (LPR) Filter. LPR Filters selectively reduce the transmission of certain wavelengths of light, specifically those produced by artificial lights. This includes mercury and high and low pressure sodium vapor lights. In addition, they also block unwanted natural light (sky glow) caused by neutral oxygen emission in our atmosphere. Celestron offers a model that attaches to the back of the Radial Guider which allows you to guide on an unfiltered star while the light from your subject passes through the filter to a camera. This gives you a greater selection of guide stars.

The Micro Guide Eyepiece - 12.5mm (#94171)

For guiding deep-sky astrophotos, the Micro Guide Eyepiece is ideal. The laser-etched reticle offers sharp lines for the best possible definition and the variable brightness illuminator makes it easy to use even on faint stars. Concentric guiding circles offer different guiding tolerances depending on the focal length of your telescope.

In addition to the guiding reticle, there are additional functions that make the Celestron Micro Guide Eyepiece useful for other applications. You can measure the separation of double stars, the position angle of a comet's tail, or determine the periodic error of your drive system. The Micro Guide Eyepiece is like having four oculars in one!

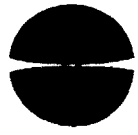
MFFT-55 (#94200)

The Celestron MFFT-55, short for Multi Function Focal Tester-55, is a very unique focusing aid developed and successfully used in Europe for years. This tool allows you to accurately evaluate your telescope's focal plane in three main areas of interest; focus, collimation (squareness), and curvature of field. With the MFFT-55 it is now possible to focus on and off the optical axis at 3, 16, 22, and 30mm diameters in four quadrants in a single setup. When used as a null focus tool for long exposure astrophotography, focus results are consistently excellent.

Reducer/Corrector (#94175)

Designed specifically for Celestron Schmidt-Cassegrains, the Reducer/Corrector is a lens that reduces the focal length and f/ratio of your telescope by 37 percent, turning your long focal length telescope into a fast, short focal length instrument. An f/10 instrument now works at f/6.3 while an f/11 instrument works at f/7. Photographically this means much shorter exposures plus a wider field. A 60-minute exposure at f/10 is reduced to only 24 minutes at f/6.3! In addition to reducing the focal length and f/ratio, the Celestron Reducer/Corrector also reduces field aberrations significantly so you get a flatter, well-corrected field. This fully multicoated lens provides maximum light transmission with near full-field illumination. All this without astigmatism, coma, or chromatic aberration. It is the perfect accessory for getting started in long exposure deep-sky astrophotography.

Please consult the Celestron Accessory catalog (#93685-91) for a full description of these and other accessories.



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