



# Installation Instructions FW8S-STXL / FW8G-STXL Filter Wheel

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## Introduction

SBIG's STXL series cameras contain several innovative features that can be found in no other astro-imaging camera. This innovation extends to STXL accessories as well, including the integrated design of the FW8S-STXL and FW8G-STXL filter wheels. These filter wheels share common mechanical and electronic design, the only difference being the type of housing that is used as a front cover and some included items. The FW8S-STXL standard filter wheel can therefore be upgraded to an FW8G-STXL self-guiding filter wheel by simply adding a replacement self-guiding front cover. Conversely, if you have the self-guiding version and want to use a camera lens adapter you can simply add the standard front cover which accepts Canon EOS or Nikon lens adapters.

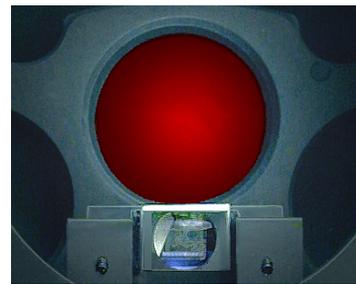
## Micron-Precision Filter Positioning

When taking flat field frames of filtered images, the flat field frame must show exactly the same optical characteristics to be most effective. If there is dust on the filter, or uneven illumination caused by the filter, this must be represented precisely as seen in the light image to be corrected by the flat field frame. The STXL filter wheels are designed to provide a new level of accuracy when taking flats through filters by repositioning filters to within a few microns of the same position every time they are centered over the imaging CCD. This degree of precision allows the imager to take extremely accurate flat field frames even after rotating the filter out of the field of view and even after a loss of power.



## Self-Guiding In Front of the Filters

Self-guiding has long been acknowledged as the best, most accurate way to guide long exposure astrophotos, particularly with commercial SCTs. The single most common complaint however is the difficulty of finding bright stars when guiding through dark or narrowband filters. The FW8G filter wheel incorporates the self-guiding CCD inside the front cover of the filter wheel so that the guider picks off light from the guide stars before passing through the filters. There are two adjustment knobs on the filter wheel base: one for moving the guiding CCD to achieve good focus and one for moving the pick-off mirror. A third knob on the side locks the adjustments in place.



## Attaching the Filter Wheel to the STT Camera

1. Note that the that the STXL filter wheel comes with a red spacer attached to the bottom plate as shown in the picture at right. You must remove this red spacer and attach it to the camera after removing the camera's front cover.



2. Remove the front cover of the filter wheel and the front cover of the camera. Re-use the 8 screws from the camera front cover to attach the red spacer that you previously removed from the back plate of the filter wheel.



3. Attach the filter wheel base to the red spacer that is attached to the camera body. At this point you should install the filters if not already installed.



4. Replace the filter wheel front cover being careful not to pinch the cable that extends from one end.



5. Both the FW8S-STXL and FW8G-STXL filter wheels have this "pig tail" cable with a DB9 connector on the end. Plug this connector into the I<sup>2</sup>C port on the camera. .

6. If you have the FW8G-STXL Self-Guiding filter Wheel, also attach the short black HDMI cable between the filter wheel and the camera's remote guide head port as shown in the picture at right. Note: The FW8S-STXL Standard filter wheel does not use the HDMI cable



7. Finally, remove the 3" adapter ring from the camera front cover being careful to note the location of any shims used to assure orthogonal camera position and attach this adapter plate to the front cover of the filter wheel replacing the shims, if any, in the same locations.



## Adjusting the Pick-Off Mirror (FW8G-STXL)

The STXL guider assembly has three black knobs that the user can adjust externally without opening the cover. The knob by itself on one side is a lock knob that, when tightened clockwise, will press against the Mirror and CCD slides and lock them both down. Of the pair of knobs on the other side of the assembly, the knob closest to the centerline adjusts the CCD focus slide, and the one farther to the side adjusts the mirror slide. They are easily set for optimal operation as follows:

First, mount the camera/wheel/guider assembly to the telescope. Point the telescope at a nearby wall or flat field screen illuminated by ambient light or a penlight of some kind. Total darkness is not necessary. Start up the imaging CCD in focus mode with an exposure adequate to get a uniform, not saturated field. A count level of 5,000 to 50,000 counts should be fine. The CCD does not need to be focused on a star field first. Loosen the lock knob on the side of the guider assembly so the slides are free to move (about a turn). Next, while watching the image updating on the computer screen, rotate the mirror slide knob counter-clockwise, which will push the mirror closer to the optical axis. There is no danger of the screw falling out: when you

reach the limit of its travel it will jam up. You should eventually see a shadow start to appear at the bottom of the image, which is the shadow of the mirror vignetting the imaging CCD. This is undesirable. Adjust the image brightness in focus mode so that the contrast is not too stretched, and then back out the mirror by rotating the knob clockwise until the shadow is fully off the screen. This adjustment depends on telescope choice and F/number, which is why we cannot preset it at the factory. Also, it is important to get the mirror as far in as you can without vignetting – popular Schmidt-Cassegrain telescopes have limited exit apertures and can barely illuminate a guide chip off-axis. [TIP: Once this knob has been positioned we recommend putting some tape over it so you don't accidentally grab the wrong knob in the dark and change the adjustment – Its easy to do! Black electrical tape is best since it can be removed in the future with the least mess.]

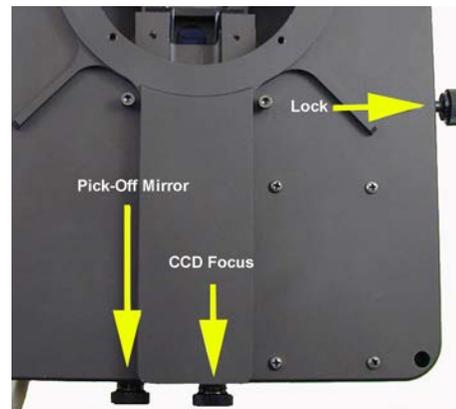


Figure 6

## Adjusting the CCD Focus (FW8G-STXL)

Once the mirror slide is adjusted, point the telescope at the sky and focus the imaging CCD on a star field using the telescope focuser controls. If you plan on using filters do this with a filter installed. Next, view the field hitting the guide CCD by starting it up in focus mode with an exposure of 1 to 3 seconds, and focus that image by turning the more central knob on the assembly, the CCD slide, back and forth. Finding stars initially can be a bit tough, so go to an open cluster or crowded area to facilitate this. Once you see stars, focusing on them is easy due to the action of the built-in focal reducer. A critical focus is not required for the guider. If you change filter thicknesses over the imaging CCD the guider focus may need to be adjusted, but with reasonably matched filters this is not necessary. You will probably see a gradient in the sky background due to the apertures upstream of the assembly limiting the field of view, but this does not affect guiding. It merely causes stars farther off-axis to be dimmer, if it is occurring.

Once the focus is good, rotate the knob on the side of the assembly clockwise to lock the two slides, which should not perturb the focus. If it does, you may need to repeat the CCD focusing step. Do not over-tighten the lock knob: just snugging it up is fine. You are now ready for guided imaging with your STT camera.

Note: the star images on the tracking CCD may not be as good as your imaging CCD since the focal reducer reduces the F/number by 0.7X, and you are quite a ways off axis. This is not a problem for guiding.

## **Software Settings**

If your software supports SBIG cameras and you have the latest drivers, you should be able to select the FW8-STT filter wheel in the software setup. If for some reason you do not see this filter wheel in the list of supported SBIG filter wheels, try selecting select FW8-STL or CFW10 as these older models use the same control codes.

## **Canon and Nikon Lens Adapters**

Canon EOS and Nikon lens adapters are compatible with the FW8S-STXL standard filter wheel. They cannot be used with the self-guiding filter wheel because the back focus requirements of the lenses are too short for the self-guiding version. In this case, one can use the self-guiding cover for longer focal length telescopes and add the standard cover for use with camera lenses where external guiding is quite acceptable. Guiding with the standard filter wheel can be accomplished using the remote guide head or separate guider like the ST-i.