



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

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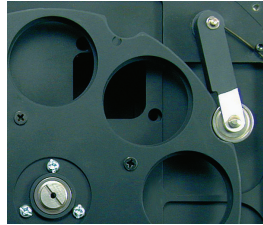
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## Introduction

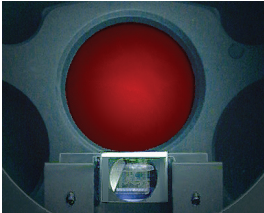
SBIG's STT series cameras contain several innovative features that can be found in no other astro-imaging camera. This innovation extends to STT accessories as well, including the integrated design of the FW8S-STT and FW8G-STT filter wheels. These filter wheels share common mechanical and electronic design, the only difference being the type of housing that is used as a front cover and some included items (see page 6). The FW8S-STT standard filter wheel can therefore be upgraded to an FW8G-STT 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 STT 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. [Note: The filters offered by SBIG with the STT series wheels are 36mm round unmounted filters needed by the largest sensor in the STT camera series, the KAF8300. However, the STT-3200ME and STT-1603ME can also use 1.25" filters without vignetting. If you already have 1.25" filters and wish to use them with the STT, inserts are available that reduce the filter slots to 1.25".]



## 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 Camera

1. Remove the Front Cover Plate of the STT camera by unscrewing the eight 4-40 x 1.25" hex head screws around the perimeter of the face plate (Fig. 1). You can use the 3/32" hex wrench that came with your STT camera to loosen the front plate screws. You will reuse these screws to attach the filter wheel base plate to the STT camera body.



Figure 1

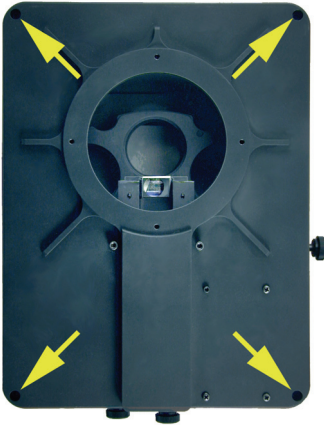


Figure 2

2. Remove the Front Cover Plate of the Filter Wheel in the same manner, unscrewing the four screws (4-40 socket head cap screws) that attach the cover to the base plate (Fig 2

3. Separate the filter retainer from the carousel by unscrewing the 8 Philips Flat Head screws that attach the filter retainer to the carousel. The filter retainer is the same size and shape as the carousel and simply attaches to the carousel over the filters to hold them in place. (Fig. 3).

4. Attach the filter wheel base plate to the STT camera body with the eight x 4-40 x 1.25" hex head screws that you previously removed from the camera front cover plate in Step 1. You may have to rotate the filter carousel slightly to see all eight of the holes (Fig.4).

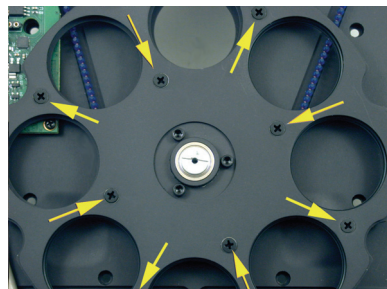
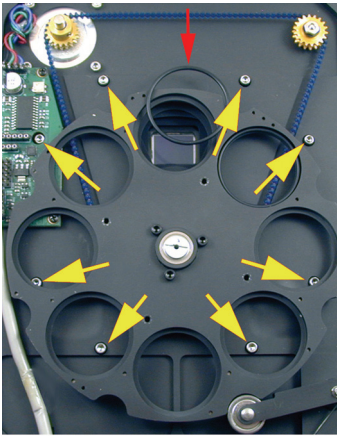


Figure 3



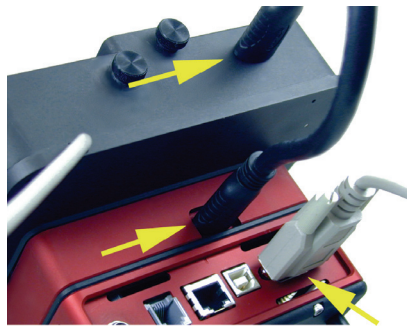
**Figure 4**

5. Determine the location you would like for each filter. The carousel slots are numbered 1-8. You can put any filter in any numbered position and then tell the software which filter is number 1,2,... etc. In CCDOps, starting with number 1, the default order is Red, Green, Blue, Clear. If you are using filters that are 3mm thick, put one of the supplied o-rings into the filter slots before dropping in the filter. If the filters are less than 3mm thick (e.g., Baader) put the filter in first, then the o-ring. For filters over 3 mm thick, do not use the o-ring (Fig. 4).

6. Replace the filter retainer plate over the filters and fasten it to the carousel using the eight flat head screws and washers that you removed in step 3, above.

7. Replace the filter wheel cover being careful not to pinch any wires or the I2C cable. Fasten the cover to the base plate using the four 4-40 socket head cap screws that you removed in step 2, above.

10. The filter wheel has a short cable extending from it with a 9-pin (DB9) connector. Plug this connector into the I2C port on the camera. This cable is the same for both standard and self-guiding filter wheels and supplies power and control signals to the filter wheel carousel. If you have the FW8G-STT Self-Guiding filter wheel, also attach the supplied HDMI cable between the HDMI port on the self-guiding filter wheel cover and the Remote Guide Head port on the camera. (Fig. 5).



**Figure 5**

If not already attached, install the t-thread adapter plate in the FW8S-STT standard filter Wheel, or the STL thread (2.156" opening) adapter plate in the FW8G-STT self-guiding filter wheel.

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

The STT 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 (Figure 6). 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

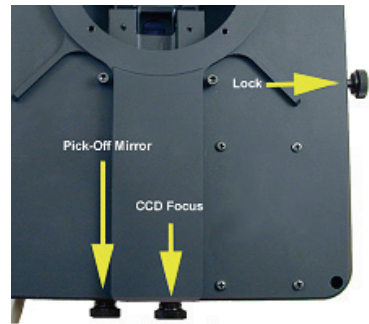


Figure 6

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.]

## **Adjusting the CCD Focus (FW8G-STT)**

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.

## **In the Box**

There are different items included with the different models and replacement covers. The self-guiding filter wheel requires a larger aperture than the t-thread adapter so it includes an STL 2.156" thread adapter along with a special STL to 2" nosepiece. The standard model uses a t-thread adapter and can therefore accept the t-thread to 2" nosepiece that comes with the STT camera.

Listed below are the items included with each model and replacement cover of STT filter wheel:

**FW8S-STT Standard Filter Wheel**

Filter Wheel with I2C pigtail  
Standard Cover  
T-thread Adapter Plate  
Eight O-rings

**FW8G-STT Self-Guiding Filter Wheel**

Filter Wheel with I2C pigtail  
Self-Guiding Cover  
Short HDMI Cable  
STL Thread Adapter Plate and STL Thread to 2" Nosepiece  
Eight O-rings

**Replacement FW8S-STT Standard Front Cover**

Standard Front Cover Housing  
Four 4-40 x 3/8 inch socket head cap screws

**Replacement FW8G-STT Self-Guiding Front Cover**

Self-Guiding Cover Housing  
1' HDMI Cable  
STL Thread Adapter Plate and STL Thread to 2" Nosepiece  
Four 4-40 x 1 inch socket head cap screws

**Options**

Adapter plates:

STL (2.156"), Part No. 40-12053-00  
SCT (2.00"), Part No. 40-12052-00  
T-thread (M42) Part No. 40-12051-00  
*(T-thread is not recommended for self-guiding filter wheel).*

**AO-8T Adaptive Optics**

The AO-8T Adaptive Optics accessory is compatible with the FW8G-STT self-guiding filter wheel. The AO-8T is identical to the AO-8 except for the bottom plate which has been modified to match the hole pattern on the STT cameras. The AO-8T cannot be used with the standard filter wheel cover because it requires a guiding CCD to monitor the guide star.

## Canon EOS and Nikon Lens Adapters

Canon EOS and Nikon lens adapters are compatible with the FW8S standard filter wheel. They cannot be used with the self-guiding filter wheel because the backfocus 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.

### Cleaning Filters

Filters can be cleaned with cotton swabs and isopropyl alcohol. A can of compressed air is good for removing dust. Do NOT tip the can or shake it when dusting - tilt the filters (or the whole camera if attached) up slightly instead.

### Specifications:

Model	FW8G-STT (Self-Guiding)	FW8S-STT (Standard)
Dimensions	8.3 x 6.3 x 1.5" (210 x 160 x 38mm)	8.3 x 6.3 x 0.8" (210 x 160 x 20mm)
Weight	39.7 oz (1150g)	28.5 oz (825g)
Mechanical Backfocus	2.128" (54.06mm)	1.425" (36.2mm)
Telescope Adapter	STL thread with 2" nosepiece	T-thread
Filter Size	36mm	36mm
Filter Positions	8	8
Suggested Focal Ratio	F/4 or slower	F/2 or slower
Camera Lens Adapters	Not Available	Canon EOS, Nikon
Guiding CCD	KAI-0340	---
Array	648 x 484	---
Pixel Size	7.4 u	---
A/D Resolution	16-bit	---
Imaging Exposure Time	0.12 to 600 sec.	---
Guiding Exposure Time	0.001 to 600 sec.	---