



FCT

Filter Changer Camera Tilter

FCT I

2459070



for QHY-cameras with Ø 77 mm
(e.g. QHY 163 / 174 / 183)

FCT II

2459071



for QHY-cameras with Ø 90 mm
(e.g. QHY 268 / 294)

Manual

Congratulations on your purchase of the Baader FCCT (Filter Changer Camera Tilter). It allows the comfortable use of filters on the Celestron RASA 8 with suitable QHY cameras, as well as the adjustment of tilt with the camera still attached to the telescope. This manual will show you how to install and operate it correctly. Please take a few minutes to read it before using the FCCT.



– EN ver. 04/2022 –



BAADER PLANETARIUM

Zur Sternwarte 4 • D-82291 Mammendorf • Tel. +49 (0) 8145 / 8089-0 • Fax +49 (0) 8145 / 8089-105
www.baader-planetarium.com • kontakt@baader-planetarium.de • www.celestron.de

GM
BH

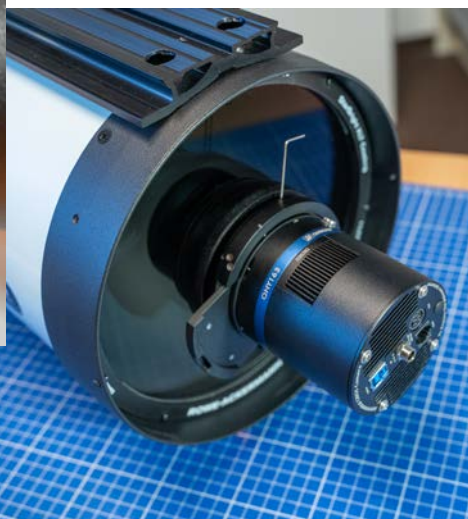
Table of Contents

Baader Filter Changer & Camera Tilter	3
FCCT I and FCCT II Scope of Supply	4
Adjustment and mounting screws	5
FCCT-Mounting instructions	
Preparing the FCCT for Installation	6
Differences between the FCCT I and FCCT II parts.	7
Attaching the FCCT I to the Camera	8
Attaching the FCCT II to the Camera.....	10
Attaching the FCCT to the RASA 8	12
Inserting of Filters	14
Usage of the FCCT Tilter	
Adjusting the image plane at the RASA 8	15
How to adjust tilt and achieve perfect fine-collimation?	16
FCCT Accessories	17



FCCT I

FCCT II



Baader Filter Changer & Camera Tilter

The Baader FCCT has been specially developed for the Celestron RASA 8. It makes it possible to mount various QHY cameras on the RASA 8 in such a short way that sufficient space remains for a filter slider and a tilt adjustment option. This allows the use of unmounted 31 mm, 36 mm or 2" (Ø 47.4 mm) filters from Baader Planetarium (these can be light pollution filters for colour cameras or high-speed narrowband filters for monochrome cameras). At the same time, it allows much more convenient collimation of the optics, as the adjustment screws are no longer blocked by the camera, but are freely accessible on the side of the FCCT.

To make this possible in spite of the short back focus of the RASA 8, a somewhat more complex and very compact adaptation is necessary. Therefore, only some QHY camera models can be used. A list of currently compatible cameras can be found on the product page www.baader-planetarium.com/fcct.

The FCCT is **only** compatible with unmounted filters due to the short backfocus of the RASA 8. You need a separate filter slider for each filter and these sliders are available separately.

For the adaptation, the connecting flange of the camera must be removed. Depending on the camera, you will need the FCCT I #2459070 for QHY cameras with 77 mm diameter (e.g. QHY 174/163/183) or the FCCT II #2459071 for QHY cameras with 90 mm diameter (e.g. QHY 268/294). The two FCCT models differ both by a different camera flange ring (with 77 or 90 mm) and by a shorter or longer RASA-side adapter.

Please read these instructions carefully before mounting the FCCT. With the upgrade set #2459075, the FCCT I can be converted into the FCCT II for larger cameras, should you change cameras later.

For other cameras, depending on the backfocus, it is possible to use the Baader Universal Filter Changer UFC by means of the UFC S70 / RASA 8" telescope adapter (height: 1.4 mm) #2459136; however, this does not offer the possibility of adjusting the image plane without removing a larger camera, if necessary, if the diameter of the selected camera covers the adjustment screws of the telescope.



Scope of supply of FCCT I and FCCT II

Scope of supply

Before starting, please check the scope of supply. You should find:

- 1 FCCT I or FCCT II with Dark-Slider 2 inside (is used as dust cover and for taking dark frames)
- 3 Two spacer rings, each 0.5 mm thick
- 4 2 mm Allen key, 28 cm long (33 cm with handle)
- 5 0.9 mm, 1.3 mm and 1.5 mm Allen Key
- 6 Filter-Extractor-Tool to insert the filter slider into the FCCT
- 7 Storage bag for up to four filter sliders (filter sliders are not included, see [page 15](#))
- 8 One pair of cotton tricot gloves #2905050
- 9 Three hexagon socket screws (1.5 mm spanner size) to attach the FCCT camera flange to the QHY camera body

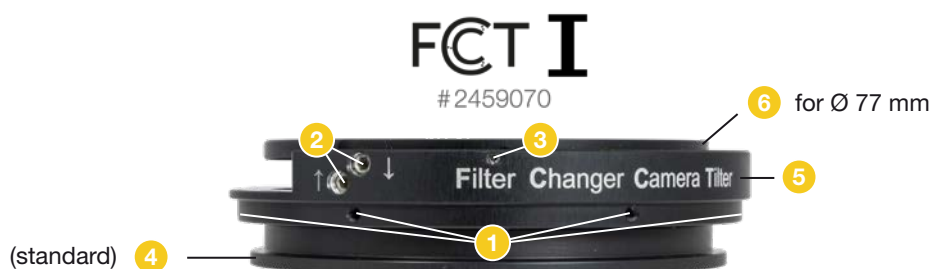
You will also need FCCT filter sliders (not included) and a suitable crosshead screwdriver (not included) to be able to remove your camera's ring dovetail.



Adjustment and mounting screws

Side view of the FCCT I and FCCT II. Both contain the following screws and components, some of which are of different design for FCCT I and FCCT II:

- 1 Six mounting screws for the RASA-flange – 1.3 mm spanner width
- 2 Six adjustment screws for the tilter (in pairs) – 2 mm spanner width
- 3 Two safety screws for the tilter – 0.9 mm spanner width
- 4 FCCT-RASA-flange (connects to the Celestron retaining ring)
- 5 FCCT-Basis (with the chamber for the filter sliders)
- 6 FCCT-QHY-flange (to adapt 77 mm or 90 mm QHY-cameras)



FCCT I, designed for QHY-cameras with 77 mm diameter
(z.B. QHY 174/163/183).



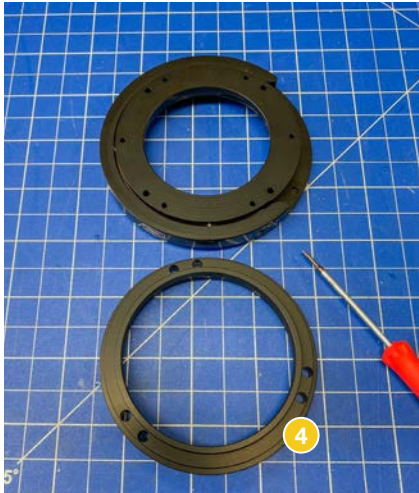
FCCT II, designed for QHY-cameras with 90 mm diameter
(e.g. QHY 268/294).

Preparing the FCCT for Installation

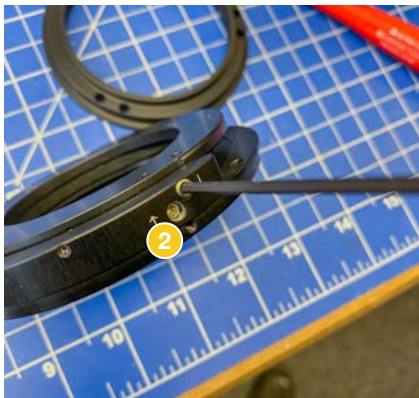
The pictures show the FCCT I. The procedure is the same for the FCCT II, only the FCCT-RASA-flange and the FCCT-QHY-flange look different.



1. Remove the dark-slider. You'll notice that it is held in place by three neodymium magnets, which ensure filters can be easily removed and precisely returned to the same position.



2. Remove the FCCT-RASA-flange 4 by loosening the six screws 1 (see page 5) with the 1.3 mm Allen key. You don't have to remove them, loosening them is enough



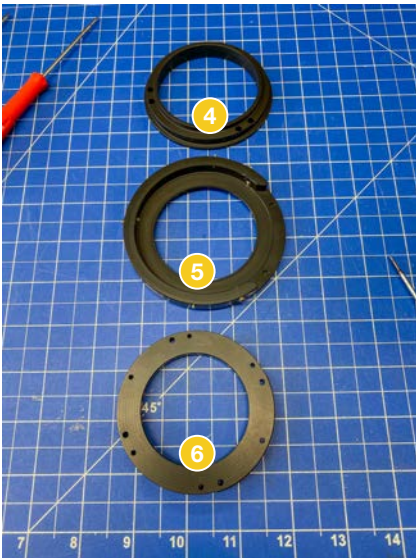
3. Now turn the FCCT on the other side and loosen the three pairs of adjustment screws of the tilter 2 with the extra-long 2 mm Allen key. You don't have to remove them, it is enough if they stand out a little bit.

Preparing the FCCT for Installation



4. Now loosen the safety screws **3** of the FCCT QHY camera flange. You don't have to remove them, it is enough if they stand out by about 2 mm.

These screws are very important: They fit into a very small groove in the inner ring and make sure that the parts of the FCCT can't fall apart at the telescope in case of an operating error.



5. Now you have disassembled the FCCT into its three parts:

- 4** – FCCT-RASA-flange (with three pairs of holes)
- 5** – FCCT-base with tilt screws
- 6** – FCCT-QHY-flange (on its back is a chamber for the filter slider)

Now you can attach the FCCT-QHY camera-flange **6** to your QHY-camera as shown on the following pages.

For the FCCT I, please continue reading on [page 8](#), for the FCCT II on [page 10](#).

Please note: Differences between the FCCT I and FCCT II parts

FCCT I



The FCCT-QHY-flange of the FCCT II is the same $\varnothing 77\text{mm}$ flange as that of the FCCT I, but there is an additional $\varnothing 90\text{mm}$ adapter on top.

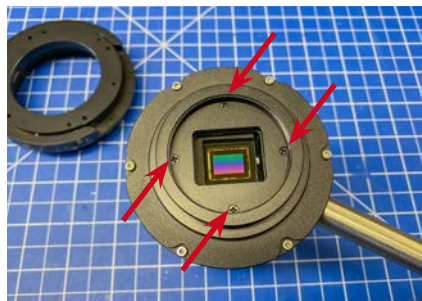


The FCCT-RASA-flange of the FCCT II is shorter, in order to achieve the same optical length as with the FCCT I.

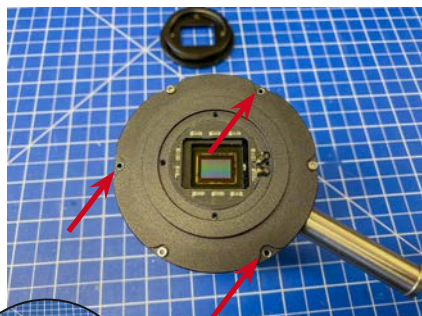
FCCT II



Camera shown with included removable desiccant plug for the sensor chamber.

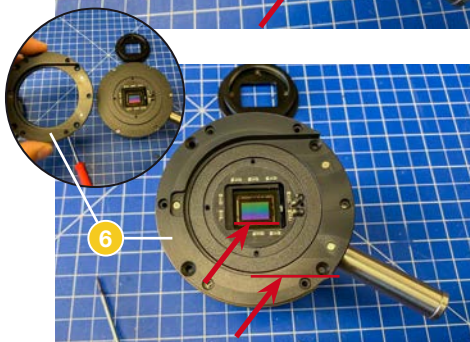


6. First remove the ring dovetail from your QHY camera, as here in the example of the QHY174 with the QHY dry cartridge attached. To do this, you need a normal, small Phillips screwdriver (not included in the scope of delivery). Store the screws and the ring dovetail carefully. Make sure that the screws do not fall onto the cover glass of the chip chamber!

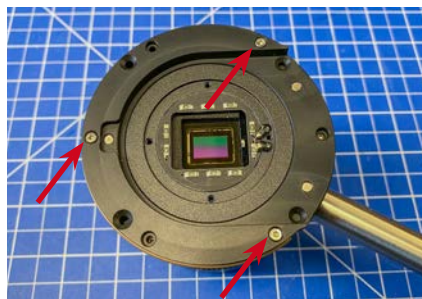


7. Now remove only the arrowed three of the six screws (1.5 mm spanner size) on the outermost edge of the camera housing, as shown in the illustration.

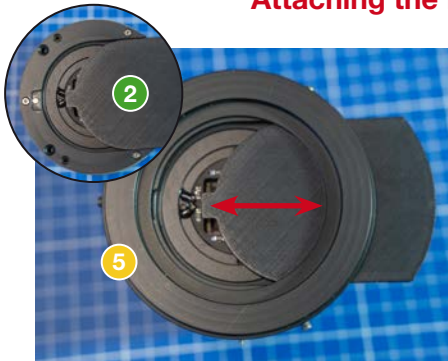
Caution: Do not remove all six screws, as this could cause the chip chamber to leak. However, removing only three screws at 120° intervals does not reduce camera tightness.



8. Place the FCCT-QHY-flange **6** in such a way onto the camera that the filter slider will later be parallel to the long side of the camera sensor, when it is pushed into the FCCT (as indicated with the red lines).



9. Now secure the FCCT-QHY-flange **6** with the three M2 hex screws **9** in the scope of delivery on page 4) instead of the original screws supplied by QHY which you have removed previously.



10. Now put the FCCT-base **5** onto the camera flange that the cut-outs for the filter slider match.

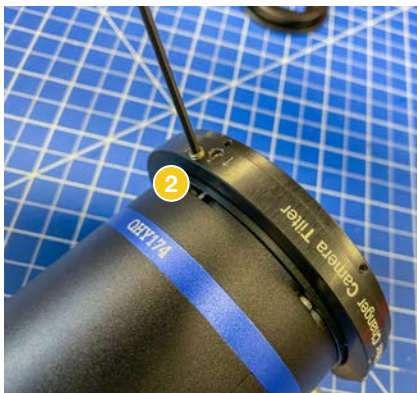
To do so, at first bring the dark-slider **2** into its position and check if can be moved easily, while you attach the upper part **5**. In this case, the dark-slider acts as an adjustment tool.



11. This side view (with the dark slider removed) shows the correctly fitted upper part. If you look closely, you can see that the lower adjustment screw of the facing pair of screws is still screwed outwards here.

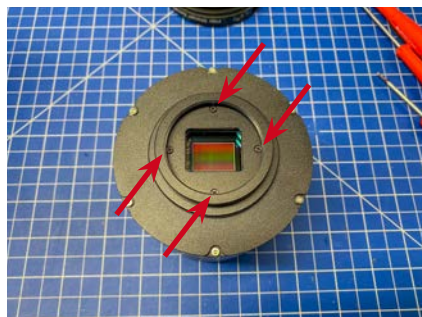


12. Now first screw the two 180° opposite locking screws **3** back in until the visible end of the grub screw is flush with the outer edge (and thus engages in the groove on the inner ring), but does not protrude deeper – otherwise the tilter function may be blocked.

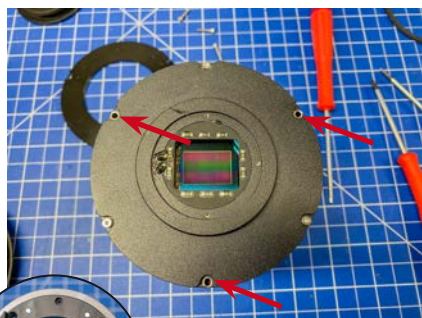


Now hand-tighten the three tilt screws **2** on the camera side. All six tilt screws should be equally deep in the FCCT to ensure that the camera is initially aligned parallel to the axis. If possible, check the alignment with a caliper gauge – the more precisely the body parts of the tilter are leveled, the easier it is to adjust the camera.

13. Now the FCCT is mounted on the camera. Insert the dark slider as dust protection before mounting the FCCT on the RASA 8 as described from [page 12](#) on.

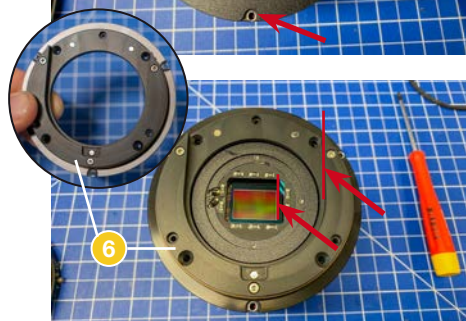


6. First remove the ring dovetail from your QHY camera, as here in the example of the QHY294. To do this, you need a normal, small Phillips screwdriver (not included in the scope of delivery). Store the screws and the ring dovetail carefully. Make sure that the screws do not fall onto the cover glass of the chip chamber!

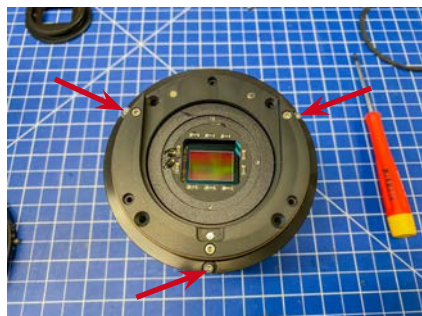


7. Now remove only the marked three of the six screws on the outermost edge of the camera housing, as shown in the illustration.

Caution: Do not remove all six screws, as this could cause the chip chamber to leak. However, removing only three screws at 120° intervals does not reduce camera tightness.



8. Place the Ø 90 FCCT-QHY-flange (6) in such a way onto the camera that the filter slider will later be parallel to the short side of the camera sensor, when it is pushed into the FCCT (as indicated with the red lines).



9. Now secure the FCCT-QHY-flange (6) with the three M2 hex screws (9) in the scope of delivery on page 4) instead of the original screws by QHY which you have removed before.

Attaching the FCCT II to the Camera **FCCT II**

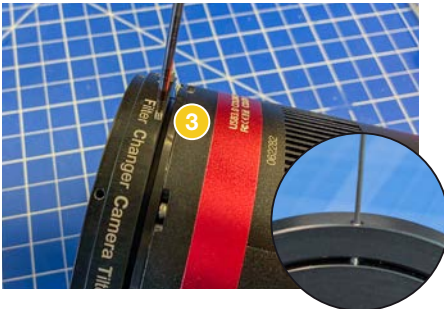


10. Now put the FCCT-base **5** onto the camera flange that the cut-outs for the filter slider match.

To do so, at first bring the dark-slider **2** into its position and check if can be moved easily, while you attach the upper part **5**. In this case, the dark-slider acts as an adjustment tool.



11. This side view (with the dark slider removed) shows the correctly fitted upper part. If you look closely, you can see that the lower adjustment screw of the facing pair of screws is still screwed outwards here.



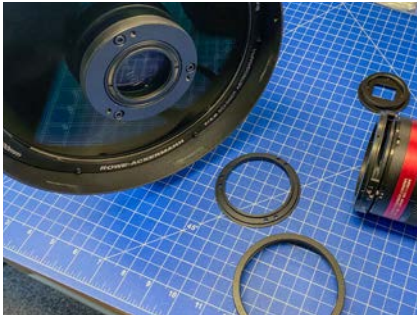
12. Now first screw the two 180° opposite locking screws **3** back in until the visible end of the grub screw is flush with the outer edge (and thus engages in the groove on the inner ring), but does not protrude deeper – otherwise the tilter function may be blocked.



13. Now hand-tighten the three tilt screws **2** on the camera side. All six tilt screws should be equally deep in the FCCT to ensure that the camera is initially aligned parallel to the axis. If possible, check the alignment with a caliper gauge – the more precisely the body parts of the tilter are leveled, the easier it is to adjust the camera.

14. Now the FCCT is mounted on the camera. Insert the dark slider as dust protection before mounting the FCCT on the RASA 8 as described from [page 12](#) on.

Attaching the FCCT to the RASA 8



15. Remove the large retaining ring from your RASA 8, which is also used to attach Celestron's original T-2 or C-mount camera adapters.



16. Remove the protective optical window that is factory fitted to the lens group cell of the RASA 8 (or any other filter that may be present at this point) to be able to use the maximum diameter of the RASA 8's field flattening optics with larger camera formats.

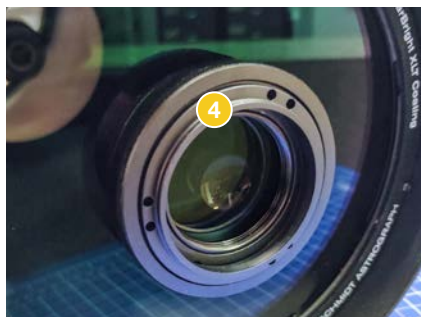


17. There is a plastic ring in the previously removed Celestron retaining ring, which must be removed too.



18. Now place the FCCT-RASA flange **4** with one of the two supplied 0.5 mm metal spacer rings **3** in the scope of supply on page 4) in the inside of the retaining ring. If necessary, you can insert a second spacer ring here if the manufacturing tolerances in the RASA 8 require a slightly wider focus position (for more on this, see [page 15](#)).

Attaching the FCCT to the RASA 8

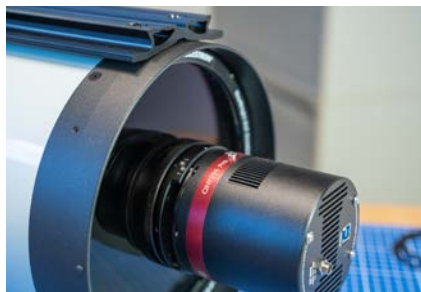


19. Now place the three parts shown above on the thread of the RASA 8 lens group cell and screw the Celestron coupling nut together with the 0.5 mm spacer ring and the FCCT RASA flange **4** slightly hand-tight. Now centre the telescope flange as best as possible in the union nut and then tighten it further.

Caution: Always tighten this retaining ring only hand-tight, never with force!



20. Place the camera with the previously mounted FCCT filter chamber in the desired orientation on the RASA telescope flange of the FCCT and hand-tighten the six screws **1** (spanner size 1.3 mm). Please be careful not to damage the Schmidt corrector plate with the hexagonal spanner!



21. Rotate the camera so that the long or narrow sides of the sensor point exactly to the dovetail rail of the tube. In this way, the camera is aligned with the R.A. and DEC axes of the mount (see also [page 15](#)).

Inserting of Filters



1. Now insert the desired filters into one of the separately available filter drawers using the enclosed tricot cotton gloves.

To do this, place the filter drawer with the flat side down on a clean, dust-free cloth. The side of the filter drawer that will later face the telescope is now facing down. Insert the filter with the side facing upwards that is supposed to face the camera (e.g. with CMOS-optimised Baader filters, the black filter edge now faces upwards).

2. Now click the filter into the mount by applying light pressure from above so that it sits flush. See also the videos on the product pages of the filter drawers: www.baader-planetarium.com/fcct



3. Use the Filter Extractor Tool (6 in the scope of delivery on [page 4](#)) to remove the dark slider from the RASA, after you have taken your dark frames ideally in a darkened room (or with a dark opaque cloth wrapped around).



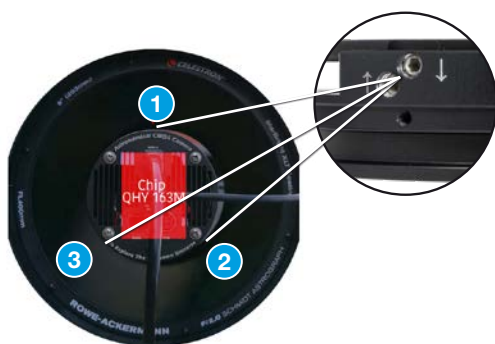
4. Now use the Filter Extractor Tool to reinsert the filter drawer with the desired filter. The built-in neodymium magnets ensure that each drawer is always held in the same position and cannot fall out.

Note: Whenever manipulating a filter holder, you can slide a finger between the arms of the extractor tool for safety's sake, so that the filter drawer cannot fall to the floor under any circumstances.

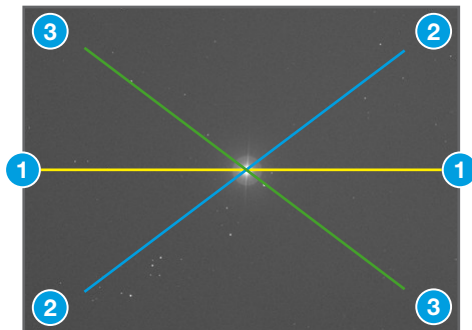
Adjusting the image plane at the RASA 8

The adjustment itself is done on the starry sky. The FCCT is designed to maintain the correct working distances when using the appropriate QHY camera and unmounted 31 mm / 36 mm or 2" (47.4 mm) Baader filters with 2 mm glass thickness, together with one of the enclosed 0.5 mm spacer rings (3 in the scope of supply on page 4). The clear glass filter built into the RASA should be removed, as each additional filter shifts the focus outwards by about a third of its glass thickness.

The second of the two 0.5 mm thick rings is used to compensate for manufacturing tolerances – only if a satisfactory result cannot be achieved when focusing on the centre of the image. In this case, you can add the second 0.5 mm ring, or even remove both rings (e.g. if you use filters from other manufacturers).



1. The camera sensor is aligned with the filter drawer and the adjustment screws as shown in the illustration on the left, if it was installed according to this manual. The orientation of the camera to the RASA can also be rotated by 90° without losing the orientation to the axes of the mount. The numbers 1 to 3 mark the pairs of adjustment screws; screw pair 1) is now opposite the filter drawer.



2. For the adjustment of the image plane, the stars in the **centre of the image** must first be focused as small and round as possible. Only then each corner of the image can be examined separately and adjusted by moving the respective screw pairs. The diagram shows the function of the screw pairs: :
 - 1 tilts the camera along the Longitudinal axis
 - 2 and 3 tilt the camera the diagonal axes



3. Use the extra-long Allen key with handle to align the camera by loosening and tightening each pair of screws so that the stars are as small and round as possible, even in the corners of the picture.

Do not overtighten the screws (see next page)!

Please note: At f/2, even small changes have a big effect!

How to adjust tilt and achieve micron adjustment with the FCCT?

The FCCT (like the UFC and M68 Baader tilters) essentially consists of 3 pairs of opposing set screws which independently move the inner tilt mechanics and are easily accessed from the side using the included hex key (Allen wrench). These screws have tapered and hardened points that bear against a precision hardened 'zero-clearance' steel-counterpart. The direction that each set screw moves the tilter is shown with an etched arrow next to the individual screw. On the FCCT the extra-long hex-key with handle also serves as torque-control against overtightening. As soon as the handle starts to rotate (to "flex") without continuing to turning the screw then the maximum torque allowed is reached and instead of continuing to increase pressure on that screw, the other screw in that pair first must be unlocked by a very small amount.

CAUTION: Never tighten a screw too firmly, only light to medium tension is required to hold the tilter with zero play. Tightening the screws too hard may damage the hardened screw tips.

1. Check each set screw to make sure it is **lightly** tightened down (seated). The screws only need to bear against the internal mechanism with light pressure.
2. To move the tilter in a particular direction, first loosen the opposite direction screw a very small amount, then lightly tighten the screw that moves the tilter in the direction you want it to go. Only very small adjustments are needed to square the mechanical axis, so only move the screws a small amount.
3. Final small tweaks may be made by very slightly increasing the pressure of just a single screw, or very slightly decreasing the pressure of the opposing screw.

Tips:

- It is recommend that you start with the tilter set at its nominal midway position with both parts flush. The tilt allowed is approx 0.4 mm to either side.
- The amount of loosening and tightening controls the amount of tilt movement. Always put the image center into perfect focus first and then work out the edges.
- A simple way to check if overtightening occurs is to closely inspect each single image frame taken during the adjustment procedure to see if some upper or lower-side movement (that is: lateral movement) is visible when trying to move one screw in the system to adjust for more angular tilt. Even slightest lateral movement would indicate that at least one of the three pairs of screws is severely overtightened, as each tilter-system is mechanically matched to zero-play.
- In case lateral movement is visible at all in the image frame, then loosen the opposing screw by the same amount and it will cause a tilt action immediately. You will need some time to "get the right feel" just how finely each these three pairs of screws work as a team, to increase pressure and reduce pressure in order to do the adjustment in very minute increments. In this way, micron movements are possible.

- The FCCT is designed to carry up to 2 Kg of camera equipment (the larger M68 and UFC-tilter can take up to 5 Kg of camera total weight).
- The tilter should be positioned close to the camera, to reduce additional loads from having the camera cantilevered far from the tilter.

FCCT Accessories

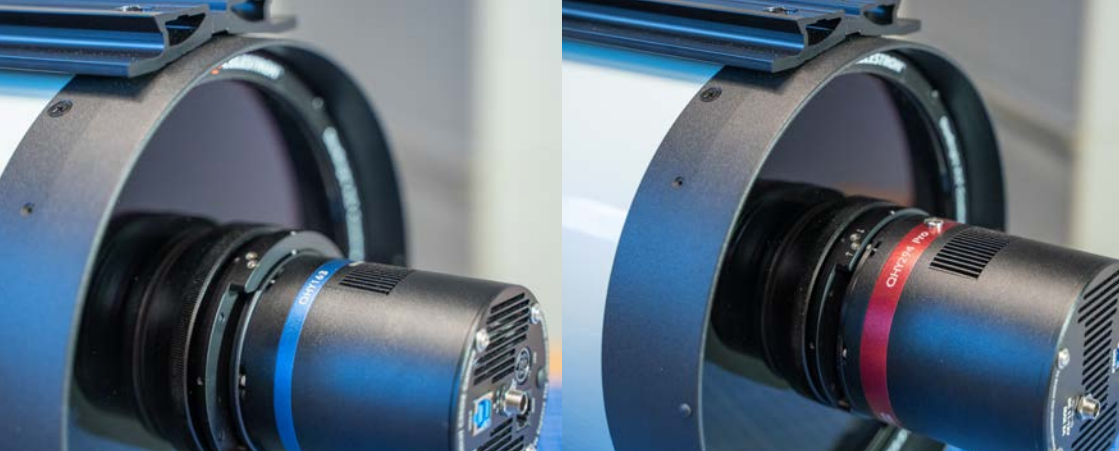
For the FCCT, we offer (in addition to spare parts and extensions) three sizes of high-quality 3D-printed filter drawers that exclusively hold unmounted filters with diameters of 31 mm / 36 mm and 2" (unmounted diameter = 47.4 mm). Of the unmounted 2" filters, we offer selected filters for immediate purchase, but any 2" Baader filter will work when removed from the mount.

Filters smaller than 31 mm very often lead to vignetting in the corners of the image, even with small chip sizes, and force cropping of the image content.

Available Accessories

- 31 mm filter slider, 3D-printed (single #2459087 or set of four #2459097)
- 36 mm filter slider, 3D-printed (single #2459088 or set of four #2459098)
- 2" (Ø 47,4 mm) filter slider, 3D-printed (single #2459085 or set of four #2459095)
- Adapter kit from FCCT I to FCCT II for QHY 268/294 #2459075
- 1x Additional 0.5 mm spacer (2 pieces are already included) #2459080
- Unmounted 2" (Ø 47,4 mm) L-RGB-C and (Ultra-) Highspeed-Filter especially for the FCCT can be found in our FCCT category: www.baader-planetarium.com/fcct





www.baader-planetarium.com

© Baader Planetarium. All Rights reserved. Products or instructions may change without notice or obligation. Images and illustrations may differ from the original products. We reserve the right of errors. Reproduction of this instruction manual, complete or in parts, only with written permission by



BAADER PLANETARIUM

Zur Sternwarte 4 • D-82291 Mammendorf • Tel. +49 (0) 8145 / 8089-0 • Fax +49 (0) 8145 / 8089-105
www.baader-planetarium.com • kontakt@baader-planetarium.de • www.celestron.de