Collimation of Ritchey-Chrétien telescopes and refractors with the

Pocket Collimator

Inhalt

Note:

Some of the photos in these instructions show the previous models TSRCKOLLI-G2/-G3; the function or procedure described in each case is identical for the Phoenix Pocket Collimator.

Pocket Collimator: Operation and functions

Integrated rechargeable battery/USB-C charging port

The Pocket Collimator is equipped with an integrated rechargeable battery that provides several hours of operating time.

Connect the device to a suitable USB port for charging. This must be able to supply a current of at least 500 mA.

A red light is visible during charging. This changes to green when the battery is fully charged.

Connecting to the telescope

The Pocket Collimator has a 2” barrel and thus fits into the common focusers with this receptacle size.

The M48 female thread integrated into the barrel allows a screw connection. This is superior to the plug-in connection in terms of reproducibility and should be used whenever possible, and can be connected to all common threads using suitable adapters.

If you want to adjust a refractor, the adapter must not be too small, otherwise the LEDs may be obstructed.

Illumination

The Pocket Collimator can be used to adjust RC telescopes and refractors.

Two different illumination elements are available for this purpose, which can be activated using the slide switch (front: RC mode, middle: off, rear: refractor mode).

In RC mode, you can rotate the Pocket Collimator so that the markings or LEDs are aligned with the adjustment screws. This makes it easier to identify the screw that needs to be adjusted.

Using a smartphone as a camera

The easiest way to work with a camera is to attach a smartphone. There are numerous smartphone adapters with integrated clamps.

Due to the large number of adapter and smartphone models, it is not possible to make a specific recommendation here.

Collimating an RC telescope

Prerequisites

The procedure described below assumes that the telescope to be adjusted is mechanically OK and roughly pre-adjusted, i.e. that, for example, the position of the parts corresponds to the nominal values/specifications.

For RC telescopes, the distance between the main and secondary mirrors plays a decisive role. This is determined during the design of the telescope and should be set correctly upon delivery. The setting of the mirror distance is not part of the adjustment procedure and is not described in this manual.

Preparation

· Remove the dew shield or tube cover.

· Set the tilt of the focuser or tilt adapter to zero (if this adjustment option is available). Important: If your telescope has a tilting mechanism that is decoupled from the primary mirror cell AND if this has already been used to align the focuser flange with the secondary mirror mount, you should retain this setting.

· If the outer light ring (see below, *What can be seen when looking through the Pocket Collimator?*) is not visible, the tube, which is located in the center of the main mirror, must be unscrewed. To do this, place the tube horizontally and take care not to touch/damage the primary mirror.

· Remove any spacer rings present between the tube and focuser and retract the focuser completely.

· Screw the Pocket Collimator to the focuser or clamp it carefully. Make sure that it is not tilted.

· Turn the Pocket Collimator until the positions of the three LEDs match those of the adjustment screws on the secondary mirror. This makes it easier for you to select the correct screw during adjustment.

· Point the telescope at a flat, homogeneous and well-lit surface, such as a white wall.

· Connect a suitable power supply to the socket marked with the dot to activate the red lighting.

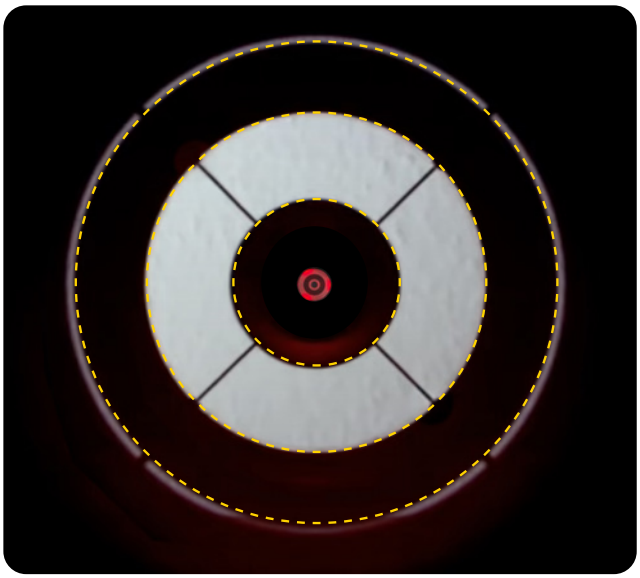
What can be seen when looking through the Pocket Collimator?

At first glance, what you see when looking through the Pocket Collimator seems confusing, so the individual elements will first be explained using the adjacent graphic.

The circles mark (from outside to inside):

1. Edge of the secondary mirror baffle
2. Secondary mirror with the reflection of the primary mirror
3. Reflection in the secondary mirror: Focuser with the Pocket Collimator.

The somewhat blurred dark ring in the center of the image is the center mark of the secondary mirror.



Look through the central hole of the Pocket Collimator and check whether an adjustment is required. If the secondary's mark is exactly in the center and all elements are concentric/symmetrical, the adjustment is OK. If this is not the case, your telescope needs to be adjusted.

On some telescope models, the main mirror adjustment can be judged by the outer annular light gap. If this gap is not visible, you need to pay attention to the tube-side attachment points of the secondary.

These must protrude about the same distance into the field of view. In both cases, due to mechanical tolerances, the achievable accuracy may not be sufficient for a perfect image. Therefore it is necessary to check the alignment on an artificial or real star and correct it if necessary.

The picture below left shows the contradiction due to the possible tolerances: If you use the light ring as orientation, the alignment is perfect. If, on the other hand, one pays attention to the mounting points of the secondary, readjustment is necessary.

Well-adjusted RC telescope

Misaligned RC telescope

Adjusting the secondary mirror

The secondary mirror is adjusted by means of the three adjustment screws, which are arranged at a distance of 120° from each other around the retaining screw.

IMPORTANT: The retaining screw in the center must not be loosened under any circumstances!

Turn the adjustment screws in small increments to move the secondary's mark exactly to the center. If your telescope has adjustment and counter screws, you will need to loosen or tighten the counter screw associated with each adjustment screw as needed. After the first few tries, you will quickly see the effect of the adjustment and more easily recognize which screw to turn in which direction to cause the desired movement of the secondary mirror mark.

The markings on the ground glass of the Pocket Collimator help you to select the correct screw for the desired setting.

Always make sure that the adjustment screws are not too loose or too tight. if this is the case with one screw, the other two screws may have to be loosened or tightened minimally.

If the screws are too tight, the mirror cell will be distorted, and if the screws are loose, the adjustment will not be permanently stable.

If all elements are now already concentric, the telescope is collimated and an adjustment of the primary mirror is not necessary.

Often, however, this picture appears:

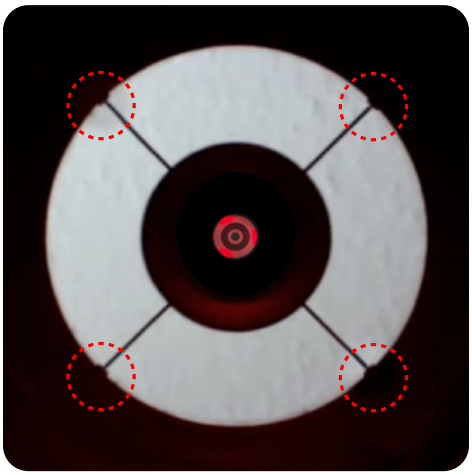
RC telescope with correctly adjusted secondary but misaligned primary mirror.

Adjusting the main mirror

When adjusting the primary mirror, you must pay attention to the outer bright ring. To the inside, this gap is limited by the stray light protection of the secondary mirror, to the outside by the front tube aperture. In order to perform the adjustment precisely, the light slit/ring must be as narrow as possible, because this is the only way to detect minimal deviations. The width of the ring changes with the position of the focuser: the farther you move the focuser outwards, the narrower the ring becomes. In this way, if necessary, you can gradually adjust the ring width to the decreasing deviation in the course of the adjustment process.

The main mirror is adjusted via three pairs of screws (adjustment and counter screw). Here, too, proceed in small steps until the optimum result is achieved. This is the case when the light ring has the same width all around. Here, too, make sure not to tighten the screws too much.

If you use the secondary mirror mounts as a reference, they should appear at the end of the adjustment process as shown in the image below.



Reviewing and correcting the result

It is not uncommon to see a deviation in the secondary mirror again after adjusting the primary mirror.
If this is the case, simply repeat the steps of secondary and primary mirror adjustment until no deviation is seen. This procedure is common with RC telescopes and is not an indication of a defect or error.

Very good results can be achieved with the TSRCKOLLI. As with any adjustment, a certain experience in handling the instrument and also the behavior of the telescope is necessary for this. Therefore, it is usually useful to check the adjustment in the starry sky and eliminate any residual errors.

This also reveals any tilt of the sensor. This can be compensated – depending on the telescope model – either with the tilting mechanism provided at the focuser flange or a separate tilting flange.

Collimating a refractor

Prerequisites/Instructions

First, find out how the objective of your telescope is constructed and what adjustment options it has.

Without this information, you run the risk of loosening or stressing individual optical elements and damaging the objective irreparably.Some telescopes have fixed optical elements in addition to the objective, for example a (non-adjustable) lens system in the focuser.

This optical assembly should be coaxial with the objective. If this is not the case, there may be an option to correct the alignment by adjusting the focuser.Optimizing at this point may conflict with rotating the focuser as described in *Checking the focuser and the collimation*. If this is the case, you must find the most favorable compromise.

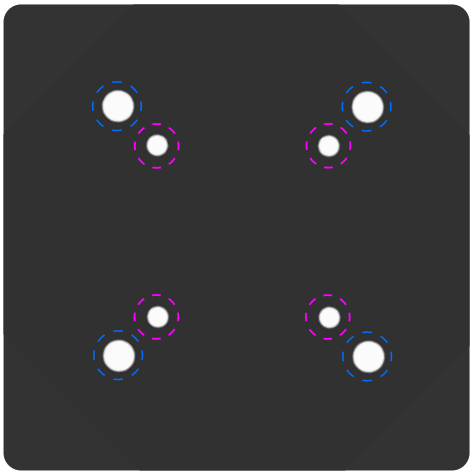
Preparation

· Remove any flattener or reducer.
· Place the lens cover on the telescope. If you don‘t have a cover, you can point the telescope at a dark surface.
· Retract the focuser fully.
· Screw the Pocket Collimator to the focuser or clamp it carefully. Make sure that it is not tilted.
· Connect a suitable power supply to the unmarked socket to activate the white illumination.

What can be seen when looking through the Pocket Collimator?

If you look through the Pocket Collimator, you will see several groups of four reflections each arranged in a square. The adjacent image shows two of these, but depending on the construction of the objective, you may also see three or more groups of four.

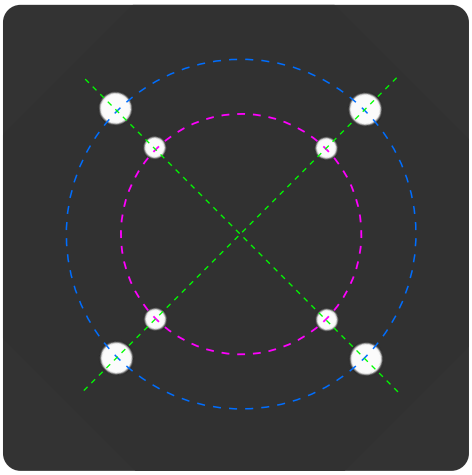
The orientation depends on how you have inserted the Pocket Collimator into the focuser. In the case shown, the LEDs opposite each other are aligned exactly vertically or horizontally.



Checking the focuser and the collimation

Look through the central hole of the Pocket Collimator and check if an adjustment is necessary.

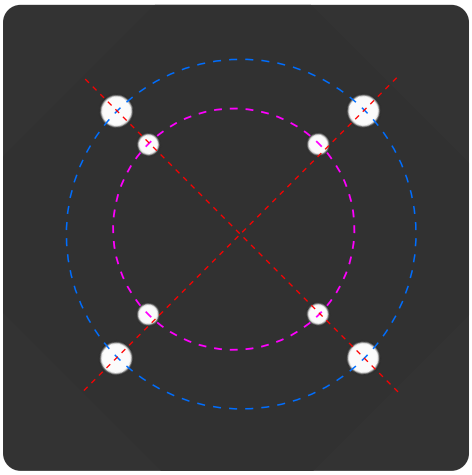
If the reflections are exactly concentric or in line as shown in the picture below, the telescope is perfectly adjusted.



Perfectly adjusted refractor

If the groups of four are shifted against each other as shown in the second picture, the objective may be slightly out of alignment

However, such a slight shift can also be caused by a misalignment of the focuser.



A slight misalignment or possibly a problem with the focuser can be seen here.

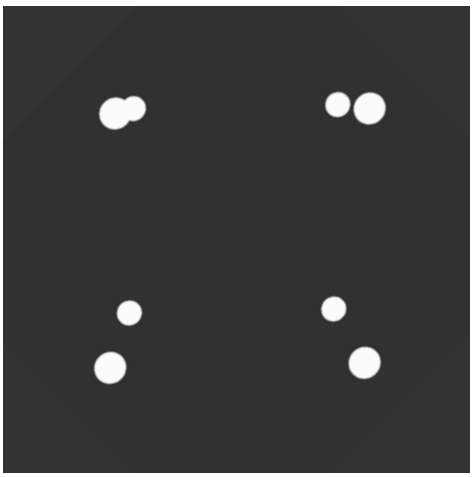
To determine whether the deviation in the dot pattern is caused by the focuser, you can proceed as follows if your focuser has a rotation mechanism:

Rotate the focuser slowly and observe the dot pattern. If this changes significantly during rotation, this is an indication that the focuser is not mechanically perfect. In this case, rotate the focuser to the position where the deviation is smallest. If you use the telescope for photography, you should use a separate rotator for any necessary rotation of the camera and leave the focuser in the determined position.

If the dot pattern still shows a slight misalignment after checking and adjusting the focuser, you should only make changes to the objective adjustment if you can perceive this minimal error in your photographs or visual observation.
Refractor lenses are very sensitive to adjustment errors and you run the risk of degrading the image.

If necessary, find out what imaging quality can be achieved with your refractor. There are design-related residual errors which you cannot eliminate even with perfect adjustment.

However, if the dot pattern looks like the one shown below, adjustment is usually required.



Heavily misaligned refractor

Adjusting the telescope

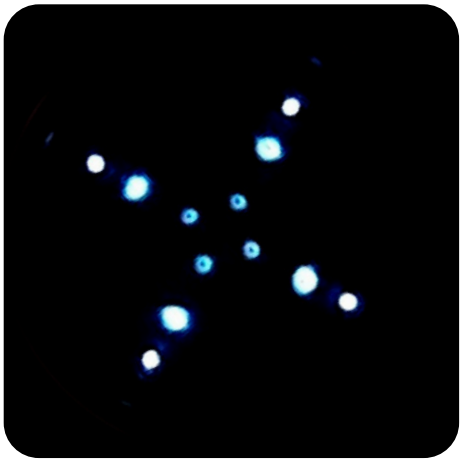
There is a large number of different lenses and lens mounts. There may be adjustment mechanisms for individual lens groups and/or the entire lens. For this reason, no generally applicable procedure can be described.

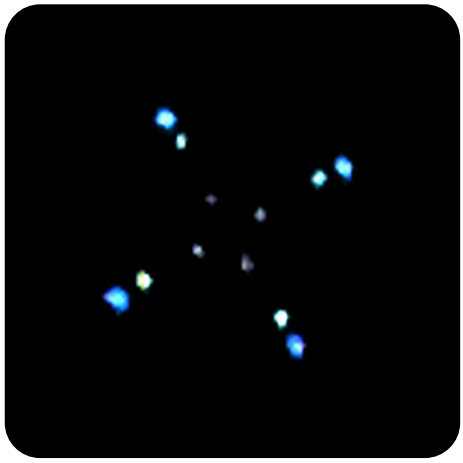
The goal is always to achieve as uniform an appearance of the dot pattern as possible.

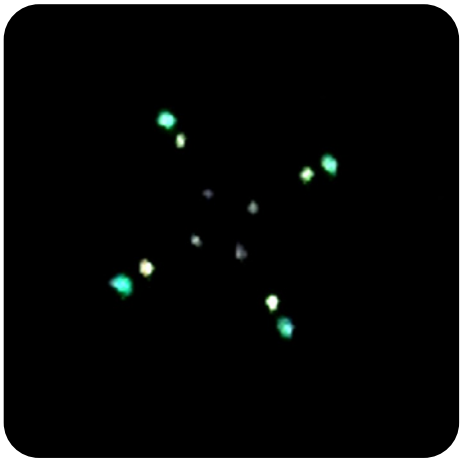
If it is not possible to adjust the objective even approximately correctly, there may be a defect. In this case, you should have the telescope checked by qualified personnel.

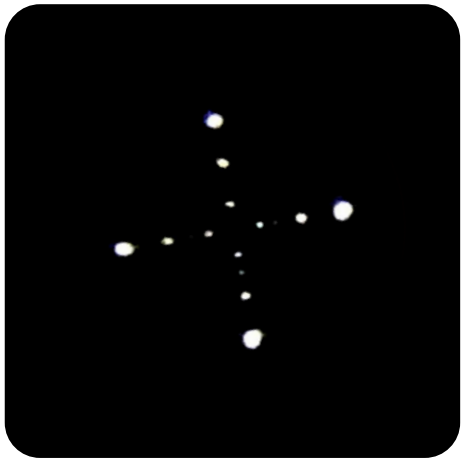
Examples

The pictures show examples of point patterns. Depending on the refractor model, the number, the arrangement and the coloring of the reflections varies.









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