# Collimating telescopes with the

# TSCOLLIT-G2

## Contents



**Note:**

Some of the photos in these instructions show the predecessor model TSCOLLIT; the respective procedure for the TSCOLLIT-G2 is identical.

## • General information

### Scope of delivery

The scope of delivery of the TSCOLLIT-G2 includes two eyepieces.

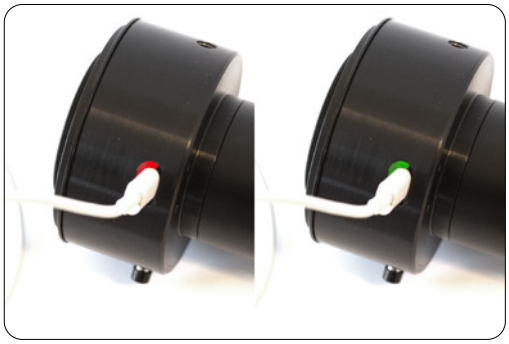
One of the eyepieces is already mounted on the collimating telescope, the corresponding 1.25” socket is included.

### Integrated rechargeable battery/USB-C charging port

The TSCOLLIT-G2 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 in the connection window during charging. This changes to green when the battery is fully charged.



### Information about the TSCOLLIT-G2

The TSCOLLIT-G2 is designed so that no maintenance or adjustment of the device is required.

Depending on the intended use, the TSCOLLIT-G2 can be adapted to the telescope to be adjusted with additional T2 extensions, which are used in addition to the existing extenions.

Do not attempt to disassemble the TSCOLLIT-G2 further, as this may damage the optical or elec-tronic components used.

Because each TSCOLLIT-G2 is tested, the threads and the sleeves of the focuser usually show slight signs of use.

### Using a camera

The field of view of cameras with small sensor is sufficient for adjusting the secondary mirror of RC telescopes. A camera with 1.25” housing can be inserted into the TSCOLLIT-G2. Depending on the camera model, it may be necessary to mount an extension to reach the focus. You can use the extension sleeves mounted on the TSCOLLIT-G2’s eyepiece for this purpose. A camera with a larger housing is attached to the TSCOLLIT-G2 using a 1.25” adapter. This allows you to achieve focus by moving it. For cameras with larger backfocus, it may be necessary to remove one of the TSCOLLIT’s T2 extension rings.

If you have a helical focuser, you can remove both extension rings and, if necessary, one of the clamping rings and use the helical focuser to create a completely screwed camera adapter.With the large field of view of an APS-C camera, it is also possible to adjust the main mirror via the camera image.

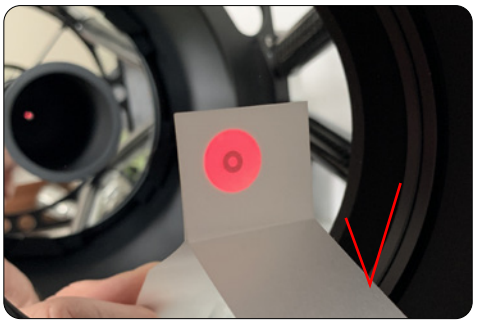
## Using the eyepieces for observation

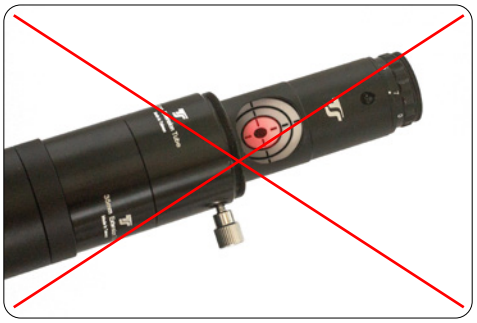
The Plössl eyepieces used in the TSCOLLIT-G2 can also be used for observation. On delivery, the body of the 15 mm eyepiece is mounted on the TSCOLLIT-G2, the sleeve is enclosed separately. Unscrew the sleeves used in the TSCOLLIT-G2 and mount the enclosed sleeve to use the eyepiece on your telescope.

## Using an alignment laser with 1.25” connection

You can use an alignment laser with a 1.25” connection instead of the eyepiece tube. Because of the optical elements integrated in the TSCOLLIT-G2, not a dot but a circle several millimeters in size is then projected onto the secondary mirror.

It is possible to adjust the focuser flange with it without any problems. Please note, however, that the laser dot (or circle) cannot be clearly seen on the ground-glass screen of the alignment laser because internal reflections are superimposed on it.





## • RC telescopes

### Prerequisites

The procedure described below assumes that the telescope to be adjusted is mechanically in order and roughly pre-adjusted, i.e. that, for example, the position of the parts corresponds to the nominal values/specifications. In RC telescopes, the distance from the main to the secondary mirror plays a decisive role due to the principle. 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.

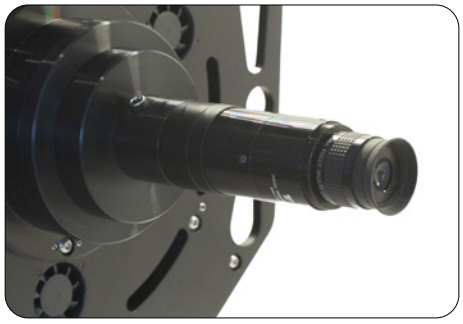
The first section of this manual applies to RC telescopes where the main mirror cell can be moved independently of the focuser (focuser flange) and which have a tilt plate for the focuser. Starting on page 10, the procedure to be followed when the focuser is connected to the main mirror cell is explained.

### · RC telescopes with focuser mechanically separated from the main mirror and focuser tilt plate

### Preparation

· Remove any dew cap or tube cover that may be present.
· Unscrew the focuser and any spacer rings.
· Unscrew the baffle tube, which is located in the center of the primary mirror. To do this, place the tube horizontally and make sure that you do not touch/damage the primary mirror.

· Attach the TSCOLLIT-G2 to the focuser flange using the appropriate adapters.
· Point the telescope at a flat, homogeneous and well-lit surface, such as a white wall.



## What can be seen when looking through the TSCOLLIT-G2?

At first glance, what you see when looking through the TSCOLLIT-G2 seems confusing, so the individual elements will first be explained using the image.

A distinction is made between directly visible, single and multiple mirrored elements.

The view through the collimating telescope shows what can be seen in the secondary mirror. Directly visible is only the center marking of the secondary mirror (turquoise semicircle), everything else is already a reflection. These single mirrored elements are marked with orange semicircles and are (from the outside to the inside):

· Edge of the aperture tube holder

· Tube in the center of the primary mirror

· Collimating telescope

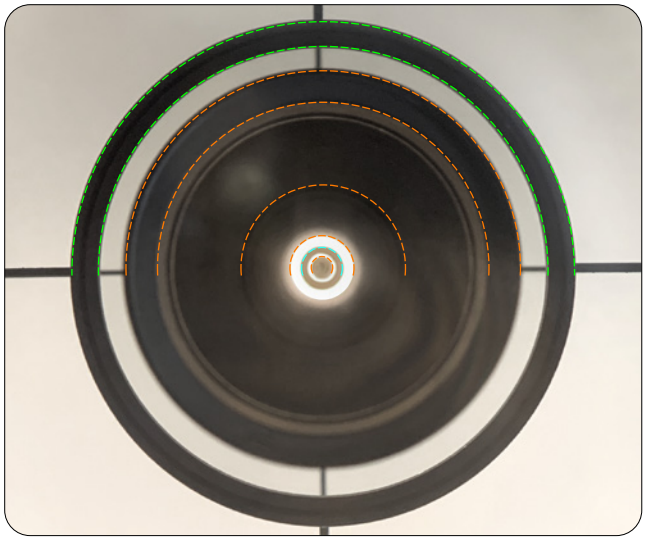
· Illumination of the collimating telescope

· Center of the collimating telescope

The green semicircles indicate the elements that are first reflected in the primary mirror and then can be seen in the secondary mirror (from the outside to the inside):

· Edge of the secondary mirror stray light protection

· Secondary mirror with the reflection of the primary mirror

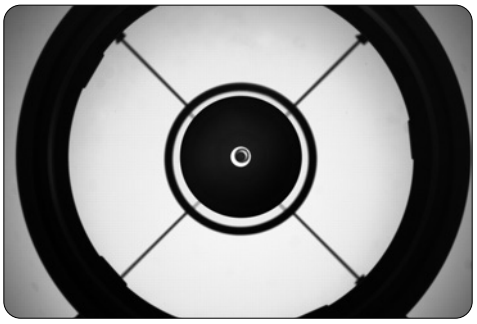


The mountings of the secondary mirror can be seen both as a double reflection (primary mirror-secondary mirror, outer part) and as a quadruple reflection (inner part).
Because the distance to the struts in the quadruple reflection is about twice as large as in the double reflection, the struts appear thinner.

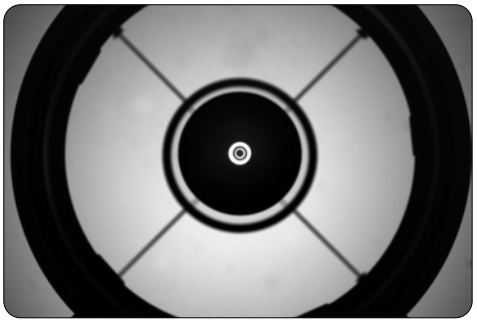
## Checking the alignment condition of the telescope

Look through the TSCOLLIT-G2 and check whether an adjustment is required. If the secondary‘s mark is exactly in the center and the directly and mirrored visible parts of the secondary are in line, the adjustment is OK. If this is not the case, your telescope must be adjusted.

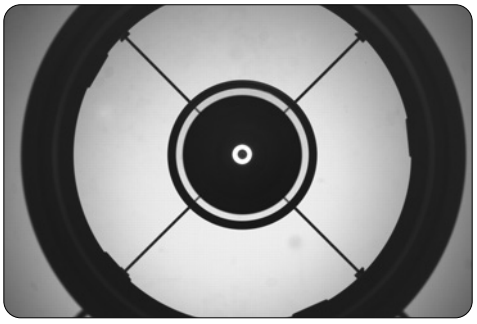
*Note: The images were taken with an ASI2600 on a 10“ RC Truss telescope.*



*Misaligned RC telescope*



*RC telescope with correctly adjusted secondary mirror, but slightly misaligned primary mirror; TSCOLLIT-G2 focused on center mark.*



*Adjusted RC telescope, TSCOLLIT-G2 focused on secondary mirror holder.*

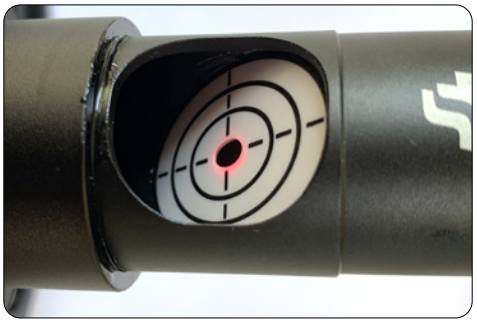
## Adjusting the focuser flange

If your telescope is severely out of alignment, you should definitely check the focuser flange and adjust it if necessary. If the flange is not adjusted correctly, this will inevitably lead to a wrong reference point when adjusting the secondary mirror and you will not achieve a perfect adjustment result.

If you have adjusted the focuser flange earlier and only need to readjust the telescope, you can continue with the section „Adjusting the secondary mirror“.

An adjustment laser is used to adjust the flange, e.g. LA1 with the adapters T2a-T2a and T2i-125.

First make sure that the laser is adjusted. Then remove the collimating telescope and screw the laser to the telescope. Even if the laser dot appears exactly centered as in the picture, this is no guarantee for a completely correct adjustment at this point!
It may be that only the secondary mirror and the focuser flange are on one axis.

*Note: Adjusting an RC telescope is an iterative process because several parts must be aligned to each other without an external reference.*

*Theoretically, the secondary mirror could be removed and the focuser flange aligned to the center of the secondary mirror mount; this would establish a reference axis. However, because the exact distance between the mirrors must be maintained at all costs and can only be set precisely with additional equipment, this procedure is not practical.*

With normal handling of the telescope, it can be assumed that even with a clearly misaligned secondary mirror, the center mark is only minimally off-axis. It is therefore absolutely sufficient to use the center mark as a reference point at the beginning of the procedure.

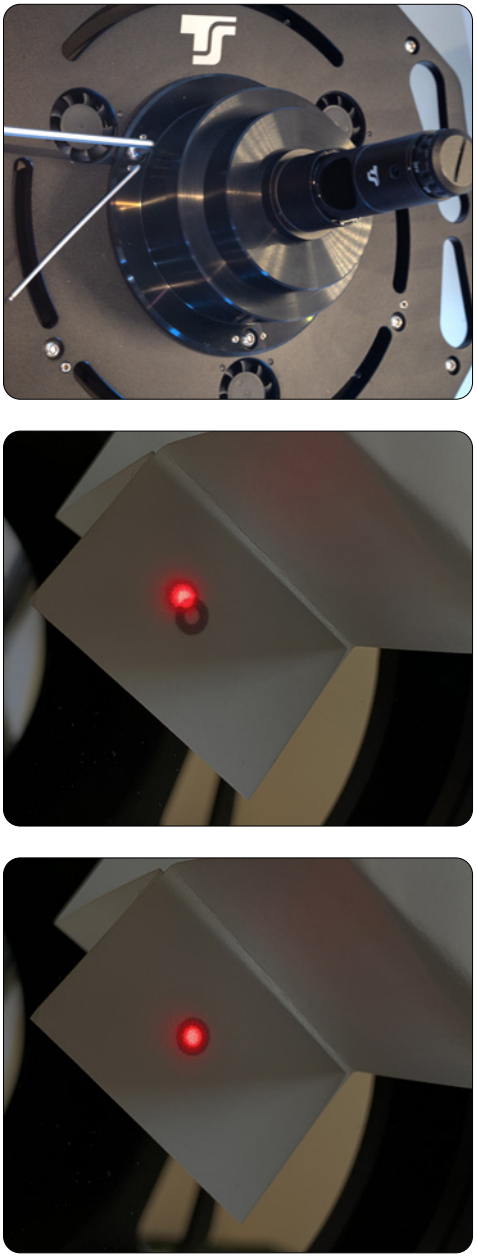
The exact position of the dot generated by the adjustment laser is difficult to see on the mirror. A strip of translucent paper facilitates the adjustment of the focuser flange.

Hold the end of the paper strip over the center of the secondary mirror as shown in the pictures.

Adjust the focuser flange so that the center of the laser dot and the center mark are concentric.

To do this, first reset any existing tilt by loosening the push screws (six in the case of the telescope shown) and carefully tightening the pull screws.

Adjust the focuser flange starting from this „home position“.



*Pull (large) and push screws (upper image); Laser dot and center mark before and after adjusting the focuser flange.*

For telescopes with a conventional tube, it is not possible to look directly at the secondary mirror. However, you can judge the position of the laser dot from the image mirrored in the primary mirror.

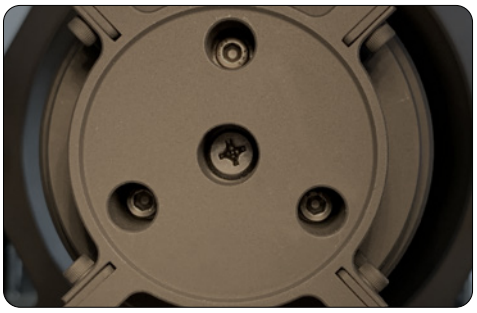
## Adjusting the secondary mirror

With the next steps, the collimating telescope is used again.
Adjust the sliding focuser so that you can see both the center mark of the secondary mirror and the center of the collimating telescope slightly out of focus.

If the secondary mirror mark is offset, this must be compensated for with the three adjustment screws, which are arranged at a distance of 120° from each other around the central retaining screw.

Turn the adjustment screws in small increments to move the secondary mirror mark exactly to the center.
If your telescope has adjustment and counter screws, you must loosen or tighten the counter screw associated with each adjustment screw as needed.

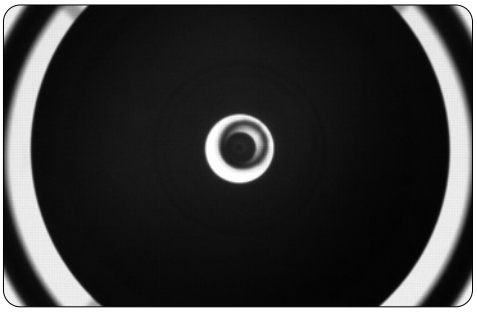
After the first few tries, you will quickly see the effect of the adjustment and more easily recognize which screw to turn in which direction to achieve the desired movement of the secondary mirror marking.



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

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 respectively tightened minimally.

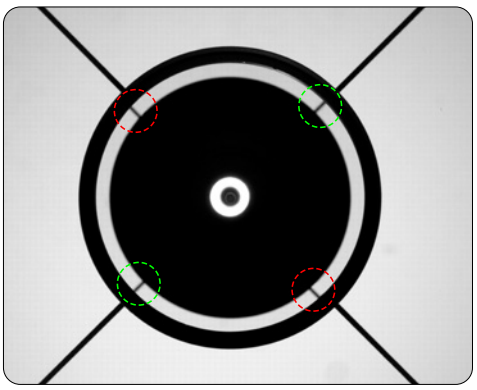
If the screws are too tight, the mirror cell is strained; if the screws are loose, the adjustment is not permanently stable. If the center mark and TSCOLLIT-G2 center are concentric, the secondary mirror is correctly adjusted.



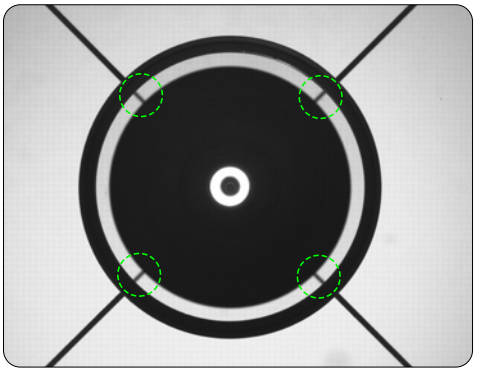
## Adjusting the main mirror

When adjusting the primary mirror, you must pay attention to the secondary holders.
Adjust the eyepiece of the TSCOLLIT-G2 so that you can clearly see both the parts of the secondary that are directly visible and those that are visible as a reflection.

If an offset is visible in one or both directions, the primary mirror must be adjusted. This is done with three pairs of screws (adjustment and counter screw or pull and push screw).



Avoid loose or over-tightened screws by loosening or tightening the counter screw belonging to the respective adjustment screw as required. Here, too, proceed in small steps until the optimum result is achieved.



**Note:** Due to manufacturing tolerances (on the telescope), it is possible that even with a correctly collimated telescope – all the elements described on page 6 are concentric – an offset can be seen on the secondary mirror holder.

If this is the case with your telescope, you must not use the secondary mirror holder as an adjustment aid, but must only pay attention to the concentric position.

## Correcting the adjustment of the focuser flange

Screw the alignment laser again onto the telescope and check the alignment of the focuser flange using the method described at the beginning. If the alignment is perfect, the laser dot will be seen exactly centered on both the secondary mirror and the ground glass of the alignment laser.

If you had to change the adjustment of the eyepiece extension flange to move the laser dot to the center of the secondary mirror, it is necessary to recheck and possibly correct all the settings in the order described above.

Repeat the entire procedure until all the settings are perfect.

## Mounting and checking the focuser

Remove the TSCOLLIT-G2 and any adapters used from the telescope and attach the focuser.

It is now useful to check that the focuser‘s longitudinal axis is exactly on the axis of the flange. To do this, place the alignment laser in the focuser and check the position of the laser dot on the secondary mirror. Move the focuser to determine whether the position of the laser dot changes during this process. This is an indication of too much and/or uneven play in the focuser.

It is often recommended to compensate a possibly deviating axis orientation of the focuser with the adjustment screws of the flange. This procedure is possible in principle, but it results in the loss of the reference axis determined during the adjustment process (namely that of the flange).

It makes more sense to use a tilt plate to compensate for the tilt of the camera sensor relative to the optical axis resulting from a deviation of the focuser axis.

## Final works

Check that the main mirror and focuser flange adjustment screws are sufficiently tight. If you need to retighten one or more screws, the adjustment result must also be checked and corrected if necessary.

When the adjustment is finished, you can reattach the baffle tube.

## · RC telescopes with focuser mounted to the main mirror cell

### Notes

Some RC telescopes, especially inexpensive models, have a simpler design. Often the focuser flange is directly screwed to the main mirror cell. This leads to the fact that a different procedure is necessary when adjusting.

An focuser that is fixed to the main mirror cell does not offer the possibility of setting the position of the reference axis independently of the alignment of the main mirror. Attaching a tilt plate between the main mirror cell and the focuser does not solve the problem, because the focuser continues to move together with the main mirror. However, there is then at least the possibility of (more or less) compensating for a possible misalignment of the focuser.

A tilt plate is therefore definitely recommended.

### Attaching the 25 mm eyepiece (for 6“ and 8“ RC telescopes)

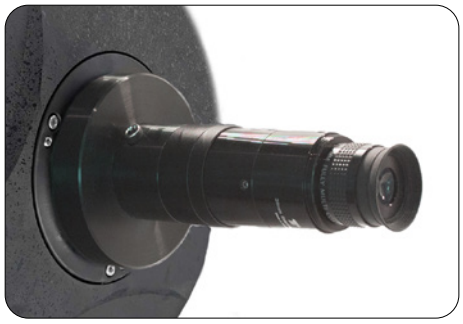
On delivery, a 15 mm eyepiece is mounted on the collimating telescope. Due to the smaller tube dimensions, an eyepiece with a longer focal length is required for small RC telescopes, as this is the only way to make all components required for adjustment visible in the then larger field of view.

· Unscrew the sleeve from the 25 mm eyepiece and swap the eyepieces.

Do not use the eyepieces with the standard (silver-colored) sleeve. With this, the eyepiece is not positioned precisely enough and there is a lack of focusing travel.

### Preparation

· Remove any dew cap or tube cover that may be present.
· Unscrew the focuser and any additional parts such as spacer rings and tilt adapters.
· Attach the TSCOLLIT-G2 to the focuser flange using the appropriate adapters.
· Point the telescope at a flat, homogeneous and well-lit surface, such as a white wall.



If your telescope allows you to remove the aperture tube centered in the primary mirror, you can use the procedure described on page 8 to adjust the primary mirror.

· Unscrew the baffle tube. To do this, place the telescope horizontally and make sure that you do not touch/damage the main mirror. With some telescopes, the baffle tube consists of two parts; it is sufficient to remove the front part.

· With smaller telescopes, it is not possible to remove the diaphragm tube from the tube because there is not enough space next to the secondary mirror. In this case, place the baffle tube in the tube.

Remember not to lift the telescope during adjustment work, otherwise there is a risk that the baffle tube will damage the main mirror.

**Important: If you do not remove the baffle tube, you must check whether there is an additional ring on the front end of the tube. This ring can limit the field of view in a disturbing manner and must be removed if necessary.**

## What can be seen when looking through the TSCOLLIT-G2?

At first glance, what you see when looking through the TSCOLLIT-G2 seems confusing, so the individual elements will first be explained on the basis of the image.

A distinction is made between directly visible elements and those that can be seen as a reflection in the secondary mirror.

The view through the collimating telescope shows what can be seen in the secondary mirror. Directly visible is only the center marking of the secondary mirror (blue semicircle), everything else is a reflection.
These mirrored elements are marked with orange semicircles and are (from outside to inside):

· Main mirror

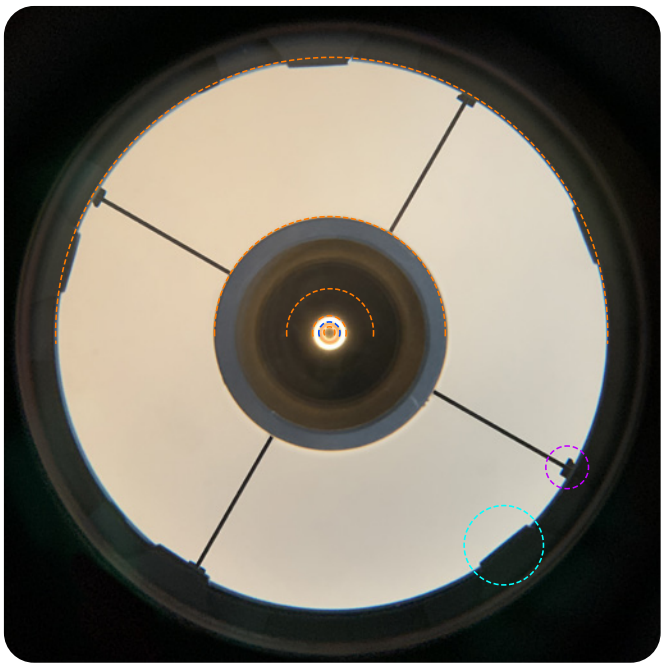
· Baffle tube; the width of the border may differ from that shown in the picture.

· Collimating telescope

· Illumination of the collimating telescope

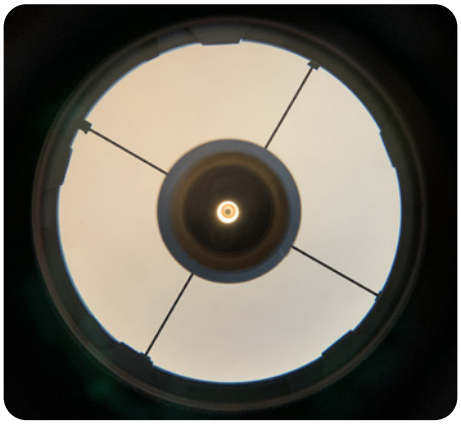
· Center of the collimating telescope

In addition, the holders of the main mirror (turquoise) and - as a reflection in the main mirror - the tube-side holders of the secondary mirror (violet) can be seen.

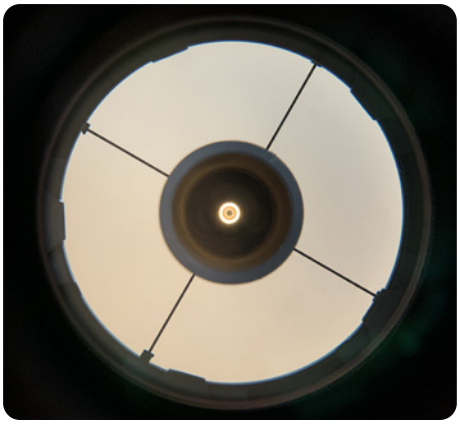


## Checking the alignment condition of the telescope

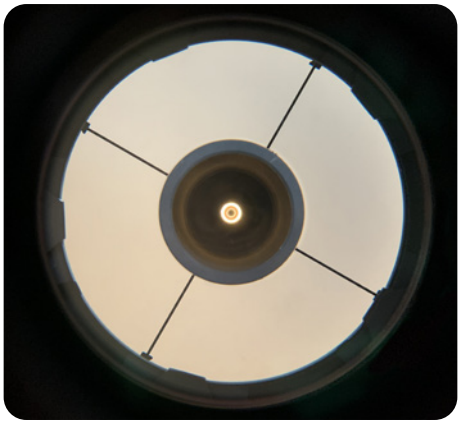
Look through the TSCOLLIT-G2 and check whether an adjustment is required. If the secondary‘s mark is exactly in the center and the tube-side secondary holders extend the same distance into the image of the primary mirror, the adjustment is OK. If this is not the case, your telescope must be adjusted.



*Misaligned RC telescope*



*RC telescope with correctly adjusted secondary mirror, but misaligned primary mirror; TSCOLLIT-G2 focused on secondary mirror spider.*



*Adjusted RC telescope, TSCOLLIT-G2 focused on secondary mirror spider.*

## Notes on the adjustment process

Mostly, the method of adjusting the secondary mirror first is also recommended for the smaller RC telescopes.However, depending on the type of adjustment error, this procedure can lead to magnifying the misalignment of the secondary mirror first, because the reference axis, namely the center axis of the primary mirror, points in the wrong direction as a result of a misalignment of the primary mirror.

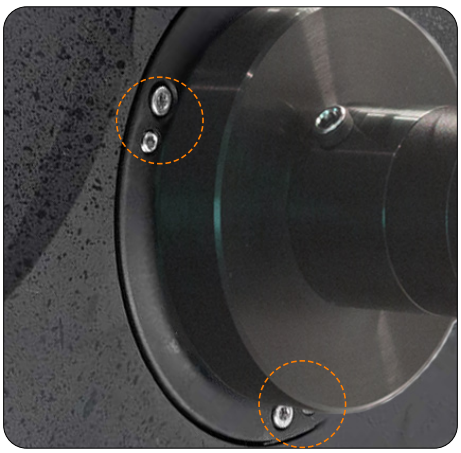
Basically, the settings influence each other, so usually several iterations are necessary to achieve the optimal result anyway.

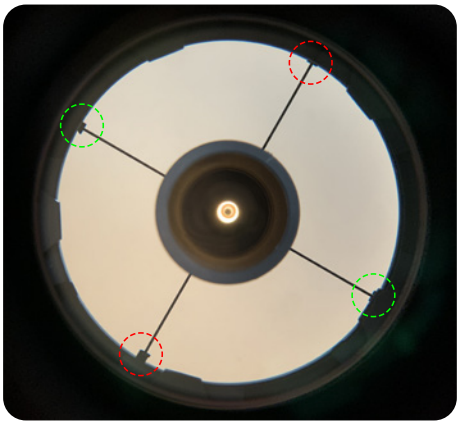
To keep the number of these iterations low, the main mirror is adjusted first.

## Adjusting the main mirror

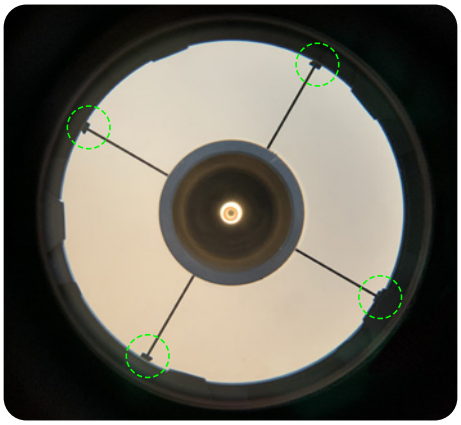
When adjusting the primary mirror, you must pay attention to the secondary mirror holders. Focus the TSCOLLIT-G2 on these.

If an offset is visible in one or both directions, the primary mirror must be adjusted. This is done with three pairs of screws (adjustment and counter screw or pull and push screw). Avoid loose or over-tightened screws by loosening or tightening the counter screw associated with each adjustment screw as needed. Proceed in small steps until the optimum result is achieved.





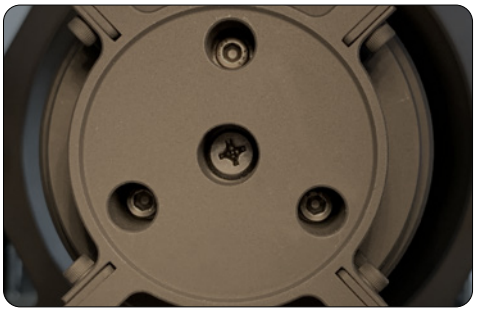
*Misaligned RC telescope; the secondary mirror holder on the lower right is partially covered by a primary mirror holder.*



*RC telescope after adjusting the primary mirror*

### Adjusting the secondary mirror

If the secondary mirror marking is offset, this must be compensated with the three adjustment screws, which are spaced 120° apart around the central retaining screw.Turn the adjustment screws in small increments to move the secondary mirror marking exactly to the center.

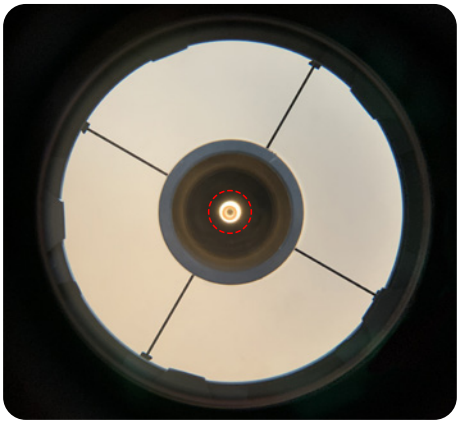


After the first few tries, you will quickly see the effect of the adjustment and more easily recognize which screw to turn in which direction to cause the desired movement of the secondary mirror mark.

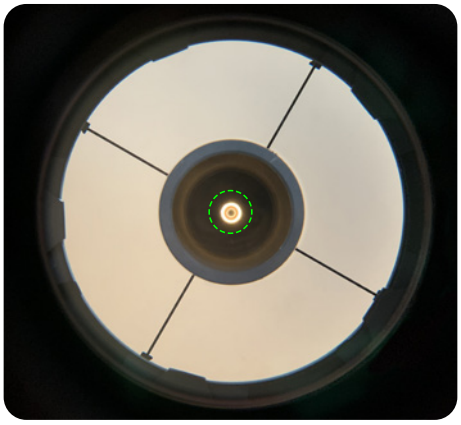
**IMPORTANT: The retaining screw in the center must not be loosened under any circumstances!**

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.

Screws that are too tight distort the mirror cell, and loose screws do not provide long-term stability for the adjustment.
If the center mark and TSCOLLIT-G2 center are concentric, the secondary mirror is adjusted correctly.



*Misaligned RC telescope*



*Correctly adjusted RC telescope*

Now check the adjustment of the primary mirror. If you had to change the secondary mirror setting considerably, it is quite possible that the main mirror will show a misalignment again.
Adjust the primary mirror and then the secondary mirror again and carry out these two steps alternately until no more deviation is visible.

Check whether the pull screws for the main mirror adjustment are sufficiently tight. If you have to retighten one or more screws, the adjustment result must also be checked and corrected if necessary.

## Adjusting the focuser with a tilt adapter

Even if both mirrors are correctly adjusted, the longitudinal axis of the focuser flange may not be on the optical axis of the mirrors.

Unlike the RC telescopes mentioned in the first section of this manual, it is not possible to set a reference axis independent of the optics in the devices described here, so a tilt adapter (usually not included in the scope of delivery) should be used to set the axis of the focuser flange.

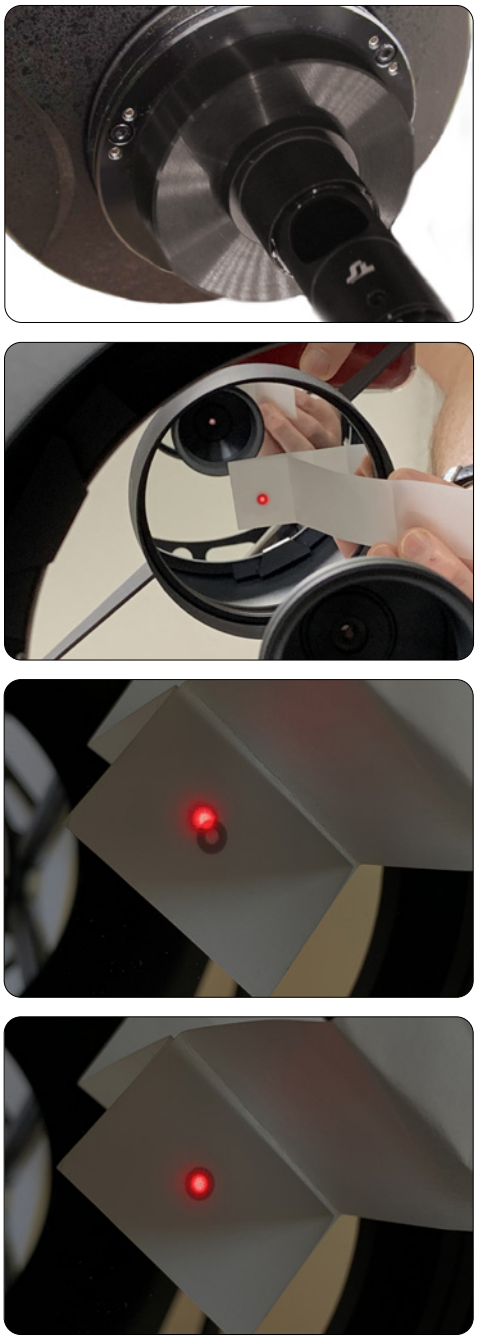
Often, a tilt adapter on the telescope focuser mount is also used to correct a misalignment of the camera sensor.
This is possible in principle, but an additional tilt plate on the camera can make your work easier when readjusting later: If the focuser is aligned to the optical axis as described below, a tilt adapter on the camera corrects the residual error without changing the telescope-side settings.

Because the focuser can also have certain tolerances, the tilt adapter is adjusted without the OAZ. You should use an adjustment laser with screw connection for this (e.g. SKLAM482 with TSM48a-T2a).

The exact position of the dot generated by the alignment laser is difficult to see on the mirror. A strip of translucent paper facilitates the adjustment of the tilt adapter.

Hold the end of the paper strip over the center of the secondary mirror as shown in the pictures. Adjust the adapter so that the center of the laser dot and the center mark are concentric. To do this, first reset any existing tilt by loosening the (three or six) push screws and carefully tightening the pull screws. Adjust the adapter starting from this „home position“.

Because it is not possible to look directly at the secondary mirror, the position of the laser spot must be judged from the image reflected in the primary mirror.



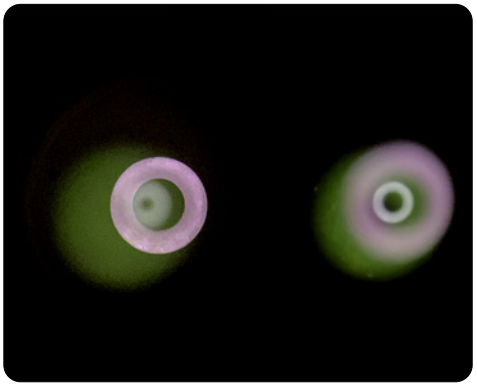
*Pull (large) and push screws · View of the main mirror · laser dot and center mark before and after adjusting the focuser flange.*

## Final works

When the adjustment is finished, you can reattach the baffle tube or the aperture ring.

## • Refractors

Thanks to the bright integrated illumination, the TSCOLLIT-G2 can also be used for adjusting refractors. The ring-shaped reflections on the surfaces, which are of different colors (depending on the coating) and sizes, can be highlighted or dimmed via the sliding focusing.



For adjusting refractors with a short focal length, it may be necessary to extend the focus adjustment range of the collimating telescope. Commercially available T2 extensions can be used for this purpose. To do this, unscrew the collimating telescope at the extensions already present and insert additional extensions. For short focal length refractors, it may be necessary to extend the telescope by 100 to 150 mm.

Due to the large number of different refractor objectives, no general procedure can be described here. Proceed according to the specifications for the respective telescope.



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