Description and Instruction Manual

for the

BAADER FlipMirror II

VARIOUS PORTS - VARIABLE WORK

 # 2458055

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Scope of Delivery

of the Baader FlipMirror II (BFM II)

1. Baader FlipMirror II – with fine-optically polished, movable mirror
2. Laterally adjustable T-2a top ring
3. 2x M48i / S52 Dovetail ring made of hardened stainless steel *#2958552*
4. Reducing ring M48a / T-2i *#2958553*
5. Reducing ring M48a / T-2a *#2958554*
6. Inverter ring M48a / M48a *#2958555*
7. Pin type face wrench for M48 / T-2 and M4 counter nuts
8. 3 mm screwdriver for M4 brass adjustment screws
9. 4x hex keys (2.5 / 2.0 / 1.5 / 1.3 mm).
   The 2.0 mm wrench has a ball head to reach screws even when accessories are mounted by holding the wrench at an angle.
10. AUX-port bottom flange (laterally adjustable 1mm) for off-axis guide or calibration lamp for spectroscopy
11. 19 mm dust cap for AUX-Port
12. T-2i dust cap
13. M48a dust cap
14. 2 x T-2a dust caps

Baader FlipMirror II star diagonal

Various Ports, Variable Work

Congratulations on your purchase of the Baader FlipMirror II (BFM II) star diagonal. This compact, versatile and configurable flip mirror offers more options than our previous model, as well as other competing units. In this manual we want to present some of its possible uses. The most important features of the BFM II are:

- Three connecting ports:
  1. Straight light path (S52, M48 and T-2 on both sides) for full-format cameras, spectrographs and other instruments
  2. Adjustable T-2 thread on top for eyepiece clamps, video modules (up to 32 mm image circle) or even a binoviewer
  3. Bottom flange for the optional Off-Axis-Guider for Baader FlipMirror II (BFM-OAG) *#2956951* or for an optional calibration lamp for quick calibration of spectra without removing the spectrograph
- Precise surface-mirrored flip mirror with multi-layer Al coating, for high-resolution images with cameras with small pixels
- The back of the flip mirror is also Al coated and masked to direct the light of an optional calibration lamp onto the slit of a spectrograph.
- Enables precise adjustment of all light paths
- Shortest possible overall length for any application – compatible with a large number of adapters from the Baader Astro T-2 system, the M48 system and the UFC system (Universal Filter Changer)
- Rotatable M48 connection rings made of hardened, stainless steel on front and rear, backlash-free adapted to the BFM housing. Can be fixed in the optimum position to rotate any accessory around the optical axis.
- Prepared for an optional toothed belt for motorization (e.g. by Steeldrive II Controller) – basic requirement for image acquisition, guiding and spectroscopy in remote observatories

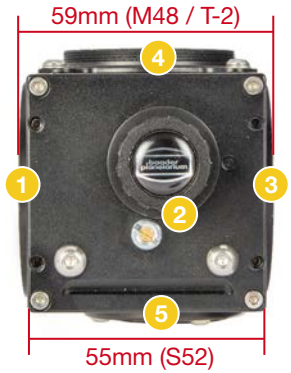
Technical Data

SKU #	2458055
Connections	S52, M48, T-2
Material	Aluminium, stainless steel
Mirror Material	Multilayer aluminium coating with dielectric protective layer
Optical Pathway	55 mm with S52 59 mm with M48/T-2
Weight	195 g
Dimensions (with all adapters)	63 x 77 x 69 mm

BFM II with DADOS-spectrograph and CCD-camera – no other flip mirror can carry such a heavy load (with such a lever) without bending, which would ruin the precise measurements.

Using the FlipMirror II

The FlipMirror II allows a variety of permanent adaptations to your telescope 1. Use the rotary knob 2 to switch between the rear port 3 and the top port 4; you can use an optional toothed belt to operate it with a motor (not included). An autoguider or a calibration lamp can be connected to the bottom port 5.



General Function of the FlipMirror II

The BFM II lets you switch between a straight light path (**Position A**) for a camera or other measuring instruments and an angled light path (**Position B**), e.g. for an eyepiece. The following figure shows how it works. In addition, a calibration lamp for spectrographs or an Off-Axis-Guider pickoff-prism (that is not affected by the mirror position) can be connected at the **AUX-port** on the bottom.

Connection to the telescope

For connection to the telescope 1 you can choose between an S52 dovetail ring, an M48 thread or a T-2 thread. To use the M48 thread, remove the pre-installed reducing ring from M48 to T-2, using the supplied tool 7.

Based on these threads, various adaptation options are available. We recommend screw connections so that even heavy accessories can be securely fastened to the telescope. Furthermore, you can use the following adapters if your telescope does not already have a T-2 or M48 connection thread:

- Baader Nosepiece 1¼" / T-2 *#2458105*
  for use with 1¼" eyepiece clamps
- Baader 2" / T-2 Nosepiece and Camera adapter *#2408150*
  for use with 2" eyepiece clamps
- Baader SC / HD Ultra Short T-Adaptor, 7mm optical length *#2958500B*
  for use with Schmidt-Cassegrain- and EdgeHD-telescopes
- M68 to T-2 Conversion Ring *#2458233*
- Diamond Steeltrack® M48 adapter *#2957204* for direct connection to Diamond Steeltrack® focusers

You can also remove the M48 thread-adapter (see below image) to access the S52 dovetail ring. This way, you can attach the flipmirror with the largest possible aperture and the shortest optical path length to fit e.g.:

- 2" / S52 Nosepiece *#2958551* for use with 2" eyepiece clamps
- S52 dovetail Camera-Adapter for Wide-T-rings *#2459119*
- the UFC Universal Filter Container system in front of the BFM II. To mount the UFC between FlipMirror and telescope, you need the S52 dovetail Camera-Adapter for Wide-T-rings *#2459119*. You can find more about this on page 8 (connecting a filter slider).

On the telescope side, the BFM II is equipped with a female T-2 thread (image to the left).
If you remove this threaded ring, you can use the M48-thread (central image). There are four grub screws at the side of the housing (red arrows) which secure the M48 ring. If you loosen them with the 1,5mm hex key, you can rotate the BFM II (for both M48 and T-2 thread – see also page 10) and/or use the S52 dovetail ring (right image).

Attaching an Imaging Camera or other Instruments to the rear Port (Straight Light Path)

The connections on the camera side correspond to those on the telescope side, but with external threads. A camera with a large sensor can be mounted via the T-thread or the M48 threaded ring at the rear (3) of the FlipMirror. The mirror flips upwards; for large, rectangular sensors, align the long side parallel to the flipped up mirror, if necessary, to use the maximum aperture.

You can connect your camera using a standard T-ring or M48 adapter. Spectrographs like the DADOS can also be screwed directly to the FlipMirror for the shortest possible connection. Simply remove the 2" nosepiece from the spectrograph.

The FlipMirror is delivered with a T-2 male thread onto which an M48 threaded ring is screwed. Unscrew the M48 ring if necessary.

As with the telescopic connection, there are four grub screws which can be used to rotate or remove the connection threads. An S52 ring dovetail is then available for further adaptations.

With a Varilock on the camera side (right) and a focusing eyepiece clamp (top), you can easily bring both ports into focus. CCD sensors require less back focus than DSLR cameras. To bring the camera or eyepiece into focus at the upper port, you may need extension sleeves.

Attaching an Eyepiece or a Video Module to the upper Port

To find or center an object, you can equip the T-thread of the upper port (4) with an eyepiece clamp of the matching height. For a very short adaptation, you can attach the illuminated 25mm Polaris I – Measuring- and Guiding-Eyepiece *#2954325* with T-2-thread. The field stop of the eyepiece (which is usually located at the connection point from the eyepiece body to its nosepiece) needs about the same distance to the flip mirror as the camera sensor, so that both are in focus at the same time. The required distance depends on the backfocus of your camera. We recommend the use of a focusing eyepiece holder *#2458125* for quick and easy correction of focus (e.g. if you wear glasses) as well as extension tubes (fixed or variable length) from our T-2 or M48 lines.

You can use a T-2 quick changer to switch between several combinations (e.g. various eyepieces or cameras) without having to refocus each time.

The Polaris Guiding Eyepiece directly screwed to the variable 12-16 mm T-2-extension. A 15mm T-2 extensions sets the right working distance for the camera on the right hand side.

You can also use it to easily rotate the camera into a desired position.

T-2 extensions with fixed length:

- T-2 Extension Tube 40mm *#1508153*
- T-2 Extension Tube 15mm *#1508154*
- T-2 Extension Tube 7,5mm *#1508155*
- T-2 Fine-Adjustment Rings 0,3 / 0,5 / 1 mm *#2457910*

T-2 extensions with variable length:

- VariLock 46, lockable T-2 ExtensionTube 29-46mm *#2956946*
- VariLock 29, lockable T-2 ExtensionTube 20-29mm *#2956929*
- Variable locking T-2 Extension (12-16mm) incl. Lock Ring *#2958130*

Eyepiece Clamps:

- Focusing Eyepiece Holder 1¼" *#2458125*
- Variable Locking / Sliding T-2 Focuser) *#2458010*
- ClickLock Eyepiece Clamp 1¼" with built in diopter-adjustment *#2458100*

Quick Changer:

- TQC/TCR Heavy duty T-2 Quick Changing System *#2456322*
- Standard T-2 Changer System *#2456321*

Incomplete selection of 1¼" eyepiece clamps and T-2 spacers:

Cross Hair Eyepieces:

- Polaris I – Measuring- and Guiding-Eyepiece, 25mm, T-2, illuminated *#2954325*, for direct adaptation to a T-2-thread, or with optional 1¼" nosepiece *#2458105*
- Baader Micro Guide Eyepiece with Log-Pot illuminator *#2404300*

You can also use the T-thread on the top port to attach a **bino-viewer** (with a glasspath corrector), if there is enough back focus and and if you find a comfortable viewing position. This is especially interesting for larger telescopes with Nasmyth- or Coudé-focus!

Another option:
Attaching a bino-viewer with a glasspath corrector.

Attaching an Autoguider, a calibration lamp or other accessories to the bottom port

There is a third port (5) at the bottom of the FlipMirror, where you can attach e.g. the pick-up-prism of an autoguider or a calibration lamp for a spectrograph. You can attach accessories either via the three screw holes (M3, 15 mm radius) or with the three locking screws at the side of the 19mm large adapter plate.

The Off-Axis-Guider for Baader FlipMirror II. Here, the spacer ring (right) has already been removed. (#2956951)

You can attach the **Off-Axis-Guider for Baader FlipMirror II (BFM-OAG)** *#2956951* directly to the FlipMirror. You only have to remove the included small spacer ring (as shown in the image to the left), so that the prism is fully inserted into the light path of the BFM II.

Then simply remove the lower dust cap from the lower port of the BFM II, loosen the three lateral hexagon socket screws (see photo), slide the BFM-OAG into the port and tighten the screws again. The Guider has a tilting prism for easier adjustment of a guide star. Please note that the vertical side of the prism must face the telescope.

The adapter flange at the lower plate. The red arrows mark the locking screw for a pick-up prism. Loosen the larger hex screws to temove the flange, e.g. to adapt a calibration lamp. You can also see the masked mirror inside of the BFM II.

The BFM-OAG is also part of the **Off Axis Guider for RCC (RCC-OAG)** *#2956950*. To use this item with the BFM II, you will need to remove the unit with the pick-up prism from the T-2-ring as described on the next page; then you need to remove the spacer ring from the pick-up prism exactly as with the Off-Axis-Guider for BFM II. As described above, you can then insert the prism unit into the BFM II and lock it with the three screws. Remember that the vertical side of the prism must face towards the telescope.

The old **Celestron Radial Guider** *#94176* – which is no longer in production – can be attached the same way. Both models were sold in high numbers and may be purchased second-hand at a very good price.

To use the pick-up prism of the Baader Off Axis Guider for RCC (left) or of older Celestron Radial Guiders, you first need to remove the T-2-sleeve by opening screw 1. Now loosen the the screws 2 to remove the spacer ring (grey arrow), and reattach the prism unit again at the eyepiece clamp. Screw 3 is used to tilt the prism.

The prism is always below the mirror so that it can also be used when the mirror is down, e.g. to guide a planetary camera connected to the upper port. When the mirror is up, the camera at the rear port should be aligned in such a way that the prism is under the long side of the sensor.

The Off-Axis-Guider mounted under the BFM II. The prism is visible in the housing, under the mirror.

When using an Off-Axis-Guider, you need to match its focal point to that of eyepiece and camera. This can be done with (variable) extension tubes for camera/eyepiece, or with DT-4-sleeves for an autoguider camera as described in the "**Focusing**" section on the next page.

The ***back of the mirror is also aluminised and masked***, to bring, for example, the light of a calibration lamp to a spectrograph at the rear port. The aluminium-multicoating of the mirror with its dielectric protective coating ensures a strict separation of both light paths.

Attaching a filter changer

The BFM II can be combined with the Baader UFC Universal Filter Changer, or with other filter changers which provide S52, M48 or T-2 connections.

To mount the Baader UFC *behind* the BFM II, you will need either the UFC M48 camera-adapter *#2459116* or the S52 dovetail Camera-Adapter for Wide-T-rings *#2459119*. To use the S52-adapter, you will need to remove the M48-ring as described above by loosing the four small grub screws.

The UFC can be mounted on both sides of the BFM II

The UFC with a 50x50 filter slider, which requires a only a minimum of space when the UFC is attached directly to the BFM II

To mount the BFM II *in front of* the UFC, you can equip the UFC base unit with the UFC S70 / M48 (f) Telescope-Adapter *#2459129*. Its female M48 thread fits to the male M48-thread of the BFM II.

Focusing

The focus position at the upper and rear ports is approximately the same if the T-2 adapters are used for each port. However, we recommend that you make one connector focusable in order to be able to accommodate tolerances, deviating focus positions of eyepieces or diopter compensation.

If you ***do not use an off-axis guider***, you can simply attach the eyepiece to the top and the camera to the rear port of the BFM II. First focus the camera with the telescope's focuser, then fix its position if possible. Now focus the eyepiece, e.g. over a focusing eyepiece clamp, or by pulling it slightly out. With most 1¼" eyepieces, the focus plane is approximately at the transition from the housing to the nosepiece. Take into account the length of the eyepiece clamp and the back focus of the camera for the setup.

If you ***are using an off-axis guider***, you must also consider the focus position of the guiding camera. If you use the Off-Axis-Guider for Baader FlipMirror II (*# 2956951*) as well as a guiding camera whose image plane is at the upper end of the Off-Axis-Guider (i.e. without additional back focus), the image plane of the camera and eyepiece is about 24mm behind the two T-2 threads of the BFM II. A CCD camera with a short back focus, for example, can be adjusted to this distance with a VariLock 29, as can the Polaris I crosshair eyepiece when connected directly to the VariLock 29 via T-2. Thus, a very short adaptation is possible.

Setting and "saving" the focus position of an eyepiece or camera module with an FR-4 Focusing Ring Collar and a DT-4 extension

If you use a *DSLR* via a T-2 adapter, or an eyepiece clamp for the eyepiece, you need more back focus. Then, the guiding camera must be placed at a greater distance from the BFM II.

The easiest way to do this is to use the DT-4 nosepiece extension *# 1905130* with an overall length of 18.5mm. It has the diameter of a 1¼" eyepiece and is screwed into the 1¼" filter thread of the guiding camera. With one or two of these extensions, you can place virtually any camera over the off-axis guider so that it is parfocal with the recording camera. Tip: With the FR-4 adjusting ring 1¼" *# 1905131* you can fix the insertion depth so that you "save" a focus position.

Adjustment of the FlipMirror II

There are many set screws to adjust the BFM II perfectly to your imaging setup.

1) Rotating the Housing and Camera/Main Instrument

The M48 threads on both sides (and with them also the T-2 threads inserted into them) can be rotated and fixed in the socket via the four M3 grub screws on the sides, so you can rotate the FlipMirror housing into any desired position when screwed to the telescope. An instrument firmly connected to the straight beam path can also be rotated into the desired position.

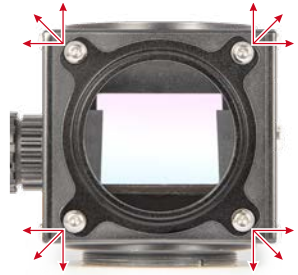
The orientation of the adapter threads on both sides can be changed with the four grub screws. This way, you can align instruments like the DADOS spectrograph in this image to the BFM II, or you can rotate the whole BFM, if it is screwed directly to the telescope.

Use the 1,5mm Allen key to loosen the grub screws and retighten them again. They grip into the S52 dovetail ring made of steel. Loosen these screws only so much that you can rotate the threaded and. Once you're satisfied with the orientation, tighten them again hand-tight.

2) Adjusting the upper T-2-thread

The adjustable T-2 top-ring can be moved sideways on the housing, to center an eyepiece or video module onto an object which is centered in the main instrument.

Firstly, center a star in the main unit mounted on the rear port with the mirror up (position A). Then flip down the mirror (position B) and view the image e.g. in the eyepiece or camera on the top port. If the star is not placed in the center, loosen the four screws with the supplied 2mm hexagon wrench, move T-2 top-ring adapter plate with the T-thread on the housing and fix it in the desired position by tightening the screws again.

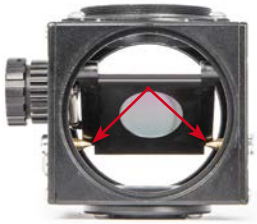


BFM II – seen from above. Use the screws for adjusting the thread.

3) Adjusting the mirror

The mirror is held in position by a spring mechanism. When it is flipped down, it rests on two conical pins. If necessary, the inclination of the mirror can be adjusted by adjusting the two pins in opposite directions. The two tools 7 and 8 are used for this purpose.

Always turn both screws by the same amount and then check whether the mirror rests on the sharpened surfaces of the two brass screws. This allows the image to be moved along the optical axis. For this adjustment our LaserColli Mark III *# 2450343* can be used for example.



The two pins on which the mirror lays on

4) Adjusting the bottom port

You can adjust the bottom port similarly when an off-axis guider is connected. To do this, check the orientation of the prism and make sure that the vertical surface points towards the telescope – if necessary, loosen the small grub screws to rotate the prism unit.

Then center the reference object in the rear beam path and check where it appears in the guiding camera.
If necessary, loosen the three fastening screws (red arrows) with the 2mm hexagon wrench supplied.
They have a rounded head so that you can loosen the screws even if a wider instrument is connected to the lower port. Then move the Off-Axis-Guider as necessary to center the star (you may have to check the tilt of the prism of the radial guider).

The screws for adjusting the bottom port of the BFM II.

Strain Relief for Cables

The two screws on the side of the housing can be used to attach additional accessories. You can, for example, connect a strain relief holder for cables by forming a loop out of a small plastic strip or alternatively purchase a finished cable holder.

A small plastic loop can act as strain relief for cables

Motorization

The two screws and the flat recess in the side of the housing are intended for the connection of a future motorization, e.g. in combination with the Steeldrive II motor focusing unit *#2957165*. It can be connected via a toothed belt which runs over the recess on the knob of the BFM II.

The BFM II is prepared for future motorization. The selection knob has a recess for a drive belt.

The Future

We have tried to show you examples of how the BFM II can be used. Of course, there are many more possibilities, which we will present in due course and in future blog posts on our website.

To stay up to date, why not sign up for our newsletter at www.baader-planetarium.com/en/newsletter.

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