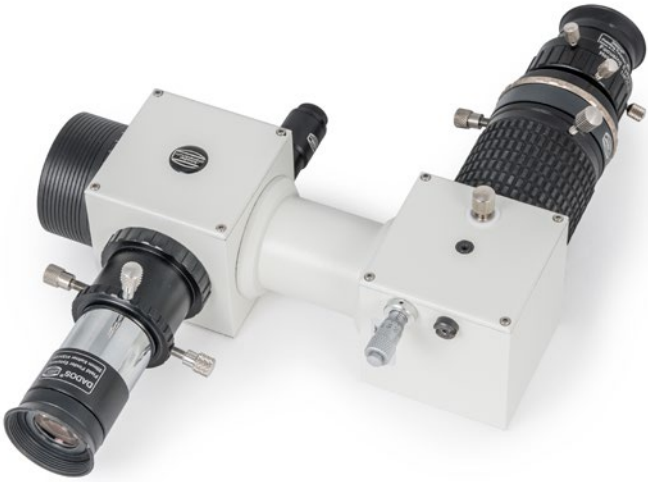
BAADER

DADOS

Slit Spektrograph



Manual and Application Tipps

Thank you for your purchase of the Baader DADOS spectrograph. This classical slit spectrograph is perfect for visual and photographic use with or without a telescope. It is designed for fast and efficient observations in school and amateur astronomy.

For best results, we recommend that you spend a few minutes reading this manual before using the Baader DADOS slit spectrograph.

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DE

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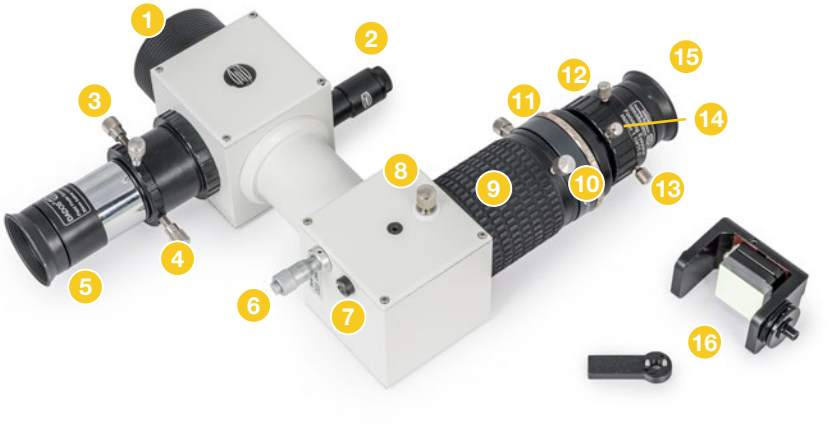
Quick Start

When you take it out of the box for the first time, the DADOS is prepared for connecting it to a telescope via a standard 2" nose piece. To use it, you only need to screw the eyepiece clamp onto the Zeiss micro bayonet and insert them into the rotary focuser, or connect a camera via an optionally available T-2 ring.



You can also point the DADOS at a bright light source or at the sky (not at the sun) without additional optics. Focus the spectrum with the rotary focuser 9. Use the micrometer 6 to move the spectrum in the eyepiece so that you can see either the three slits or the first or second order spectrum. The 1¼" eyepiece tube 3 is used to connect a guiding eyepiece or to locate a target.

The parts of the DADOS

1. 2" nosepiece
2. Illumination of the slit
3. 1¼" eyepiece clamp with locking screw for guiding camera/eyepiece
4. 1¼" stop ring with two locking screws for guiding camera/eyepiece
5. Guiding eyepiece
6. Micrometer for moving the spectrum
7. Setting screw for the grating holder *(pre-set, do not change)*
8. Locking screw for the angle of the grating
9. Rotary focuser
10. Locking screw of the rotary focuser
11. Quick changer with Zeiss-Microbayonett
12. Eyepiece clamp (can be replaced by camera and T-ring, not included)
13. Locking screws for eyepiece
14. Locking screw for the focusing mechanism of the eyepiece clamp
15. Eyepiece
16. optional replacement grating/holder

Content

DADOS Slit Spectrograph

Thank you for purchasing this Baader Planetarium product. To get the most out of your DADOS Spectrograph, please read this instruction manual thoroughly before starting to work with the spectrograph. Keep this User's Guide available for future reference and visit the Baader Planetarium website *www.baader-planetarium.com* for up-to-date information about the product.

The DADOS spectrograph is an instrument that displays the spectra from different light sources. The name DADOS means "dice" in Spanish.

It was designed to be used either as a spectroscope or as a spectrograph, mainly for astronomical and instructional purposes. The device is very easy to use, robust, and versatile.

Please read this entire manual carefully to achieve the maximum use from it.

The main features of the DADOS

- Optimized for telescopes up to 14" aperture at f/10
- Choice of 3 slits: 25, 35 and 50 µm.
- A red LED provides background illumination of the slits for easier focusing of an autoguider camera.
- Default grating of 200 lines/mm for low resolution, optional gratings with 900 lines/mm *(#2458556)* or 1200 lines/mm *(#2458559)* for higher resolution are available.
- Micrometer for fine positioning of the central wavelength.
- Camera port with a wide focusing range of up to 55 mm, accepts most CCD and DSLR cameras (with optional adapters).
- The camera interface is a T2 adapter with a standard M42 x 0.75 thread, a Zeiss dovetail or optional adapters

Warning!

Never aim DADOS straight at the Sun!

Irreversible eye damage will occur!

Scope of Delivery

As you unpack the spectrograph, check the list below and make sure that all items shown above are included. If anything is missing contact your original retailer.

Standard Scope of Supply:

1. DADOS Spectrograph
2. 1¼" Stop Ring *# 1905131*
3. 20 mm Low Power Eyepiece
4. 10 mm High Power Eyepiece
5. T-2 Change Ring *# 2456320* (for installation at the eyepiece clamp)
6. T-2 Quick Changer *# 2456313* (preinstalled at the Dados)
7. Slit Viewer Assembly (Guiding lens with M28.8-thread for 1¼" filter thread)
8. Baader Focusing Eyepiece Holder 1¼" / T-2 *# 2458125*
9. Allen Wrench 1.3 mm
10. Allen Wrench 1.5 mm
11. Gloves for replacing the grating (not shown)
12. Storage box and Manual (not shown)

Quick setup

Attaching an eyepiece to the focuser

To use the DADOS with an eyepiece, screw the T-2 quick changer *#2456313* 6 onto the rotary focuser 9 of the DADOS, if it is not already pre-installed. Loosen the clamping screw 16 to remove its dust cap.

Screw the T-2 change ring *#2456320* 5 onto the eyepiece holder *#2458125* 8 and insert it into the T-2 quick changer. Secure the two parts with the clamping screw 16.

Insert the DADOS 20 mm eyepiece 3 (or the DADOS 10 mm eyepiece 4 for higher magnification) into the focusing eyepiece holder. Lock the eyepiece with the three locking screws 13, and tighten the locking screw 14 for the focusing mechanism of the eyepiece clamp, too.

Loosen the locking screw 10 of the rotary focuser and point the 2" nose piece 1 onto a bright fluorescent light source or a neon lamp. ***Never point the DADOS directly at the Sun!***

Rotate the focuser in order to focus the spectrum. If you don't see the spectrum at all, loosen the Locking screw for the angle of the grating 8 a little bit and turn the micrometer 6 carefully, until you can see either the spectrum or the three slits.

Using an eyepiece with the DADOS

Once sharp focus is achieved, lock the focus with the locking screw 10, and also tighten the locking screw 8 for the angle of the grating, if necessary.

For fine focusing, you can unlock the screw 14 and rotate the eyepiece holder, until you can see a perfectly sharp image.

Changing the position of the spectrum

To better place the spectrum in the eyepiece or on the camera sensor, slightly loosen the grating angle locking screw 8 a little bit.

Now you can carefully use the micrometer 6 untill you can see the interesting part of the spectrum. Then, keep the grating in place by locking the screw 8 again.

Setting the spectral range with the mikrometer 6 after loosening the locking screw 8

Observing some common light sources

DADOS lets you observe and analyze a large variety of light sources. Specifically, you can quickly set up the instrument to observe:

- **Neon lamps**
  (e.g. some pilot lights in washing machines, multi-outlet power strips, etc.)
- **Fluorescent lamps**
- **Continuous spectral sources**
  (like tungsten or halogen lights)
- **Bright daylight**
  Aim at the clear blue sky well away from the sun to see the solar spectrum

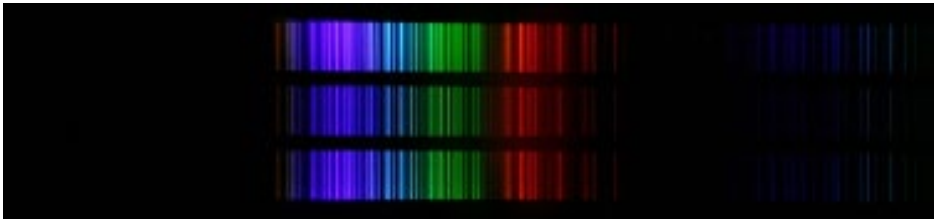
Warning!

Never aim DADOS straight at the Sun!

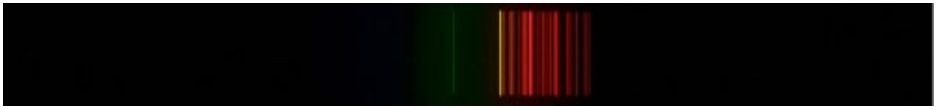
Irreversible eye damage will occur!

Examples of spectra taken with DADOS and a 200 lines/mm grating:

HeAr calibration lamp

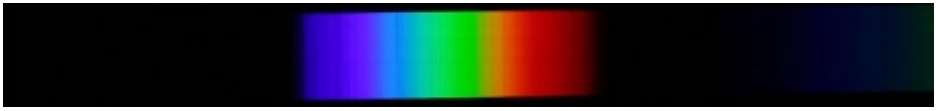


Neon



Continuous spectrum of 1. and 2. order

Solar spectrum



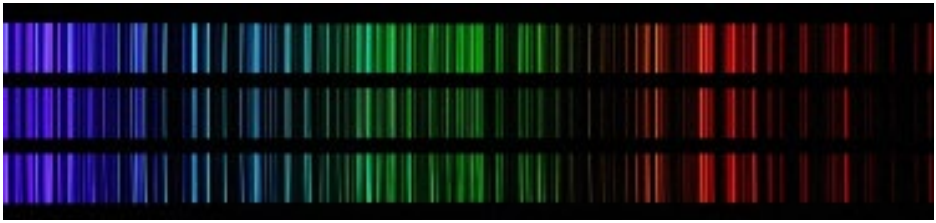
Note:

Spectra obtained with Canon 10D EOS DSLR camera at different grating angles.

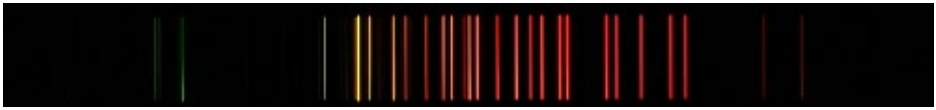
The optional calibration lamp is only visible in the dark. Shield it from daylight or connect it to DADOS.

Examples of spectra taken with DADOS and a 900 lines/mm grating:

HeAr calibration lamp



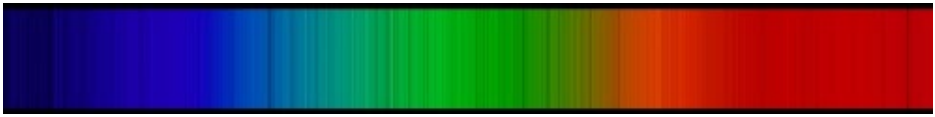
Neon



Fluorescent

Continuous spectrum of 1. and 2. order

Solar spectrum



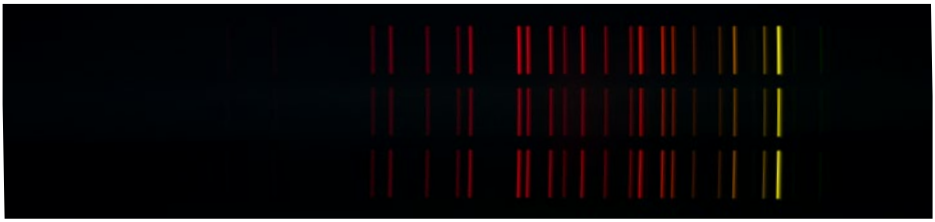
Note:

Spectra obtained with Canon 10D EOS DSLR camera at different grating angles.

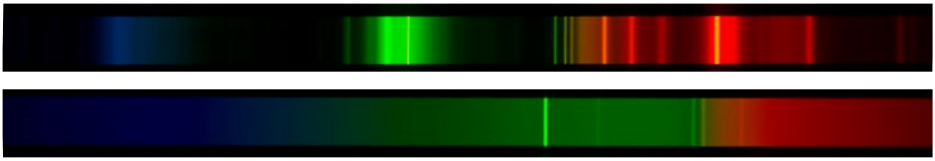
The optional calibration lamp is only visible in the dark. Shield it from daylight or connect it to DADOS.

Examples of spectra taken with DADOS and a 900 lines/mm grating:

Neon Calibration Lamp *#2458590*



Several flurescent lamps



Kontinuous – bulb

Solar spectrum

Note:

Spectra obtained with Nikon D7100 DSLR camera at different grating angles. Shows the full length of the APS-C-sensor (23,5 mm × 15,6 mm).

The optional calibration lamp is only visible in the dark. Shield it from daylight or connect it to DADOS.

Configuring DADOS for astronomical observation

The spectrograph should be set up correctly to ensure proper function.

Astronomical CCD / CMOS cameras

The DADOS optical design is optimized for camera sensors with a dimension of 13,8 × 9,2 mm and a pixel size of 9 µm. Detectors having larger chip size than 13,8 × 9,2 mm may be used; however, the optical image quality, and therefor the resolution, will slightly decrease at the edges.

For demonstration purposes, a larger sensor is not a problem; for scientific work, please limit yourself to the optimum sensor format, for example the monochrome IMX428 sensor. As of 2024, we particularly recommend the Moravian C2-7000A camera, in which this sensor is installed. If you prefer a colour sensor, we remonned the IMX304 sensor, which is used e.g. in the Moravian C2-12000A.

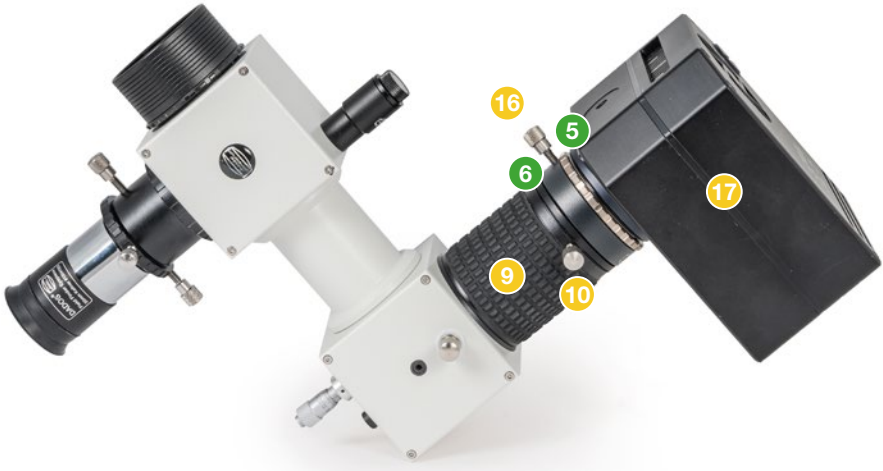
To connect a camera 17, attach the T-2 quick changer *#2456313* 6 to the rotary focuser 9 of the DADOS.

Install the 5 T-2 change ring *#2456320* at the T-2-thread of your camera.

Now place the camera with the change ring into the quick changer and lock it securely with the locking screw 16.

Loosen the locking screw 10 to focus the spectrum. The camera doesn't rotate when you turn the focuser.

By loosening the locking screw 16 of the rotary focuser ever so slightly, you can rotate the camera in such a way that the pixel rows correspond the orientation of the spectrum.



Using an astronomical camera with the DADOS

Digital SLR Cameras

Please remember that the DADOS optical design is optimized for camera sensors with a dimension of 13,8 × 9,2 mm and a pixel size of 9 µm. Most DSLRs have got larger chips and pixel sizes, which is no problem for demonstration purposes; for scientific work, please limit yourself to the optimum sensor format to avoid distortions at the edges.

To connect a DSLR, you need a matching T-2-ring for your camera bayonet. Please note that the older T-rings do not have a rotatable inner thread and thus the camera orientation can't be adjusted.

The inner thread of a T-2 ring (shown here: Baader Wide-T-Ring for Nikon Z #*2408335*) can be rotated into a conveniant position by loosening three small setting screws.

Remove the T-2 quick changer from the rotary focuser 9 of the DADOS, if it is installed. Now you can screw the T-2-Adapter 18 (in the image: #*2408330* for Micro Fourthirds-cameras) onto the now accessible T-2-thread. Then, you can attach your camera 17 as usually.

To align the camera to the spectrum, loosen the three locking screws of the T-2 ring, rotate the camera to the desired position and tighten the screws again slightly. Do not tighten them too much so that you do can still to unscrew it – otherwise, you would fix the threaded ring permanently on the thread of the DADOS.

Please note: Many DSLR cameras have got a cover for the finder, so that no stray light can enter through the optical finder and influence the image during long exposures. Use it for longer exposures, if possible.

A Micro Fourthirds camera at the DADOS. The display shows the first order spectrum and a part of the second order spectrum.

Fine focusing the camera

To focus a camera (no matter if DSLR or astronomical camera), loosen the locking screw 10 of the rotary focuser as described above. Now you can focus the image with the rubberized rotary focuser 9.

Set the exposure time and sensitivity (Gain/ISO) so that the image is not overexposed when focusing. You can focus on the slits or even better directly on the spectrum.

Using a light source that is too bright can lead to overexposure at the edges of the slit and therefore to less than optimal focusing results. Therefore, do not use a light source that is too bright.

When finished, lock the focus position by tightening the locking screw 10 again.

The necessary parts for focusing a camera and selecting the wavelength range, shown here with a DSLR

Selecting the wavelength range

To place the spectrum or individual wavelength ranges on the sensor, first loosen the locking screw for the grating adjustment angle 8 slightly.

Now you can center individual spectral lines with the micrometer 6. Then tighten the locking screw 8 again to fix the grating position.

The complete spectrum only fits on the defined sensor size with the 200 line/millimeter grating. Therefore, only parts of the spectrum can be seen with the 900 or 1200 line/millimeter gratings.

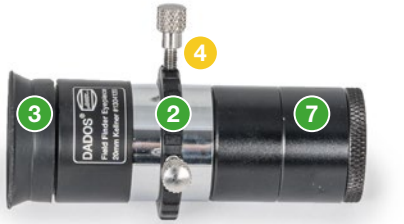
Tipp: Prepare some spectral charts for laboratory lamps. If you want to download the spectral charts of some laboratory lamps go, for example, to

www.eso.org/projects/caos/

Using the slit-viewer

Using an eyepiece with the slit-viewer

To see the slits, you need the slit viewer assembly 7. It is connected to the eyepiece 3 exactly like a 1¼"-filter. Also place the stop ring 2 on the eyepiece lock it with the two clamping screws 4 in such a way that it is approximately centered on the chrome nose piece of the eyepiece. This way the slit viewer can't hit the sensible slit plate inside of the DADOS.



The guiding eyepiece with slit viewer and stop ring.

Move the eyepiece up and down, until you can see the three slits sharp, thenlock it in place.

Now you can insert eyepiece and slit viewer into the 1¼" eyepiece holder of the DADOS. Move it inwards or outwards until you can see a sharp image of the three slits. You can turn the red backlight illumination on to better see the slits. Then you can lock the eyepiece in its place with the locking screw 3 of the eyepiece holder.

Finally, loosen the locking screws of the stop ring 2, slide it all the way to the eyepiece holder and tighten the locking screws again. This way, you can remove the eyepiece together with the slit viewer and do not have to refocus when you insert them again into the eyepiece holder.

The DADOS with guiding eyepiece.
The stop ring marks the position of the focus.

Using a guiding-camera

Depending on the camera, you may have to remove the 19 mm extension tube from the slit viewer.

- For cameras with a seperate 1¼" nose piece, where the camera sensor is deep inside of the body, the extension tube should be removed. Screw the slit viewer into the filter thread of your camera's nose piece.
- For cameras where the sensor is close to the front of the body, the slit viewer assembly is placed into the filter thread on the front of the camera with the 19 mm extension tube.

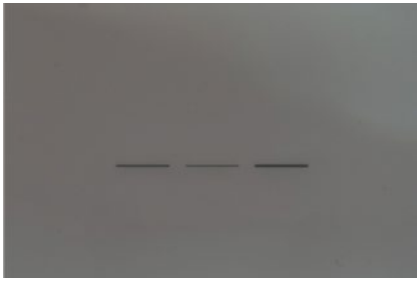
The 19 mm extension tube (left) can easily be unscrewed from the lens element (right).

The slit viewer assembly with extension tube on a camera with 1¼"-body.

The slit viewer assembly with out extension tube (show on the left) on a camera with a seperate 1¼" nose piece.

Slide the stop ring ❷ onto the 1¼" nose piece of your camera and insert the camera with the slit viewer carefully into the 1¼" eyepiece holder of the DADOS. Activate the camera and focus it by moving the camera inside or outside. Then secure the camera with the locking screw ❸ of the eyepiece holder. Align the camera in such a way that the slits are parallel to the camera sensor.

Now loosen the locking screws of the stop ring ❷, slide it to the eyepiece holder and tighten the screws again. This way you don't have to refocus when you remove them from the DADOS.

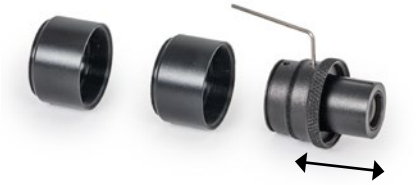


Camera view of the three slits in focus during daylight

The DADOS with guiding and imaging camera. The stop rings marks the focus position.

Zooming the slit viewer in and out

The lens inside the slit viewer can be adjusted in order to magnify the image size of the three slits on the detector of the guiding camera. To do so, remove *both* extension tubes from the slit viewer assembly.



Remove both extension tubes to access the lens cell. Use the Allen wrench to unlock the lens cell and to slide it in or out.

Now you can loosen the headless set screw inside the slit viewer body by only ½ turn, using the supplied Allen wrench (1.3mm).

- Slide the lens holder tube towards the camera to reduce image size.
- Slide the lens holder tube away from the camera in order to magnify the image.

Lock the new position of the lens holder tube by tightening the headless set screw. Reattach the extension tube(s) and test the new configuration. If necessary, repeat this procudere until you are satisfied with the magnification.

Please note: Depending on the size of the camera sensor, it may be a good idea not to use the maximum magnification.

By changing the distance, the slits can be magnified to fill the view

Using the Guiding Port

Please note that the slit plate is a foil-like piece of metal that is only 0.01 mm thick which was manufactured by an application process. This method was deliberately chosen in order to achieve the highest possible efficiency and sharpness of the slit. However, the reflective surface that is seen by the guiding camera/eyepiece is not completely flat due to the foil-like properties of the plate. Deviations in the image around the slit and small defects in the surface are caused by the production method and cannot be prevented.

The guiding of a slit spectrograph works differently to what you are used to with classic off-axis guiders. The image is not picked up by a prism located above the camera sensor. Instead, a reflective plate directs almost all of the light to the guiding camera/eyepiece. Only the star that is positioned in the slit is invisible – its light falls through the slit onto the grating; brighter stars are still noticeable through some scattered light.

Thus, the eyepiece holder therefore fulfills two purposes. On the one hand, it allows you to position a star exactly over the desired slit. Use the slit illumination 2 to illuminate the slit at night so that you can find it more easily. As soon as the star is exactly on the slit, it disappears from the image field. Remember to switch off the slit illumination again before you look at the spectrum!

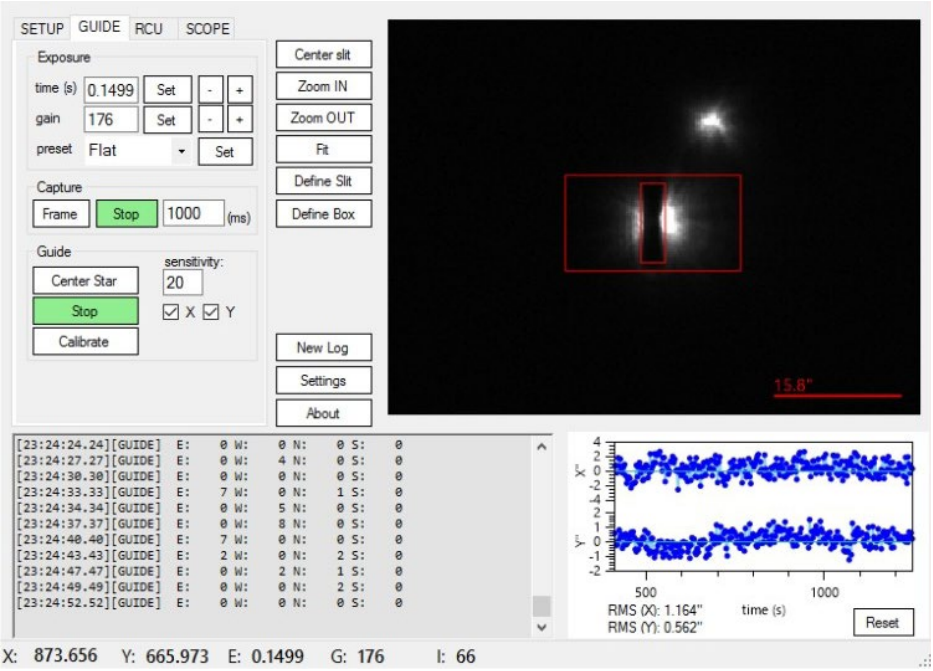
The micrometer for adjusting the slit illumination.

It is also used as (auto) guider port. In order to obtain a spectrum of a star, as much starlight as possible must pass through the slit, which is only 25 µm in size, for example – the demands on the tracking accuracy are therefore extremely high. On the telescope, the slit should be aligned as parallel as possible to the right ascension axis so that it remains on the slit, even if the periodic worm error causes tracking errors.

With classic guiding software, you only have the option of using a sufficiently bright field star for guiding control – it is not designed to correct when a star becomes brighter.

The software SpecTrack, on the other hand, was not developed for guiding on a star, but on the slit once the star disappears in it – and to send guiding pulses when the star reappears. Unfortunately, development was discontinued; the software can still be downloaded – without support – from www.baader-planetarium.com/spectrack.

Some other software suites like AstroArt (*msb-astroart.com*) and IRIS (*astrosurf.com/buil/iris-software.html*) are also made for guiding on a slit or the halo of a bright star in a slit. Please contact the respective manufacturers for questions regarding operation and supported cameras.



Guiding with SpecTrack. In the middle of the camera image, a star is centered on the slit. Above is a weaker star besides the slit.

Operating the Spectrograph at the Telescope

Possible Adaptions of the DADOS

Out of the box, the DADOS is equipped with a 2" nose piece which fits to every standard 2" telescope focuser.

If you unscrew the 2" nose piece, you can use a female T-2 thread (M42×0,75) to attach the DADOS securely to your telescope.

You can also remove the ring with the T-2 thread to access the 2" female thread in the housing of the DADOS. This is the standard 2" thread used on Schmidt-Cassegrain telescopes.

Note: To remove the T-2-thread, you need the Adjustable Pin Type Face Wrench ø 2 mm *#2450062*. You can also put the DADOS with its T-2-thread onto a piece of sticky tape which is on a flat surface. Then you can rotate the DADOS to unscrew the adapter ring, which sticks to the tape on the table.

DADOS with 2"nose piece (left), T-2 thread (middle) and SC thread (right).

Installing the DADOS at a Telescope

Before attaching DADOS to the telescope, make sure you have already focused the spectrum on the camera's focal plane, with the proper orientation regarding the pixel rows, and that you can see the three slits in the guiding eyepiece/camera.

With the 2" nose piece, just install the the DADOS in the 2" eyepiece clamp of your telescope as any other accessory. Align the the DADOS to your mount – if you are using an equatorial mount, the slits should be parallel to the R.A. axis. Lock it in the eyepiece clamp and check that the secure hold.

If you are using one of the adapter threads, you can rotate the DADOS either with a counter nut or a quick changer in the desired orientation. You can use e.g. the following parts:

The DADOS with two additional T-2 extension tubes, to reach focus e.g. on lens telescopes without a star diagonal.

- For the T-2 thread:
  - Baader TQC/TCR Heavy duty T-2 Quick Changing System #*2456322* or
  - Baader T-2 Locking Ring with female T-2 thread #*2408190A*
- For the SC thread: NexStar Locking Ring 2" #*2458270*

Use the focuser of your telescope to focus the stars close to the slit, and check the sharpnes with the guiding eyepiece or camera.

Please note: If you are using the DADOS on a lens telescope without a star diagonal, you may need one or two 40 mm T-2 extension tubes #*1508153* to reach focus.

Use the illumination of the slits to better see them at night. Position your telescope so that the star is exactly in one of the slits. Switch of the illumination before you take a look at the spectrum.

You can check the alignment of the slit to the R.A. axis by moving the telescope in R.A. The star should then move along the slit.

The DADOS at a telescope

The Spectroscopy Barlow #*2458645* for Optics faster than f/10

The DADOS is designed for an f/ratio of f/10. On faster telescopes, the collimator will cause vignetting – due to the steeper beam of light, this vignetting will increase with the changing f/ratio. For telescopes with f/7 or faster, it is thus a good idea to increase the focal length.

The Spectroskopy Barlow #*2458645* was designed for the PlaneWave CDK 17 and 20 telescopes with f/6,8 and works also with similar telescopes. When used in the correct distance from the slit, it provides a magnification factor of 1.5x to make efficient use of your telescope. It is inserted into the SC-thread of the DADOS and replaces the 2" nose piece.

Spectroscopy Barlow
#*2458645*

To install it, remove both the 2" nose piece and the ring with the T-2-thread to access the SC-thread, as described on the prevoius page. Now you can screw the Barlow lens directly into the SC-thread and use your telescope with the optimal f/ratio of f/10.

The DADOS with the 1.5x Barlow instead of the 2" nose piece.

Replacing the Grating

Each individual grating undergoes an efficiency analysis. This ensures that the grating meets the technical requirements. Cosmetic surface defects can occur! However, these either have no effect on the quality because the measurement has shown that the grating still meets the requirements, or they are outside the optically usable range of the beam of light. Cosmetic defects on the gratings are therefore not a reason for complaint.

Warnung!

Touching the grating will destroy it beyond repair!

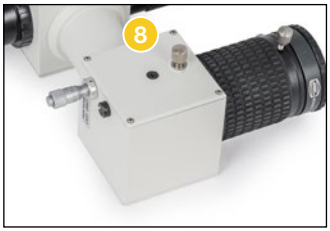
Do not attempt to remove dust by breathing or blowing air onto the grating! Small droplets of moisture and saliva can permanently damage the grating as well.

Do not use compressed or canned air! This will likewise transport moisture, grease or propellant onto the grating.

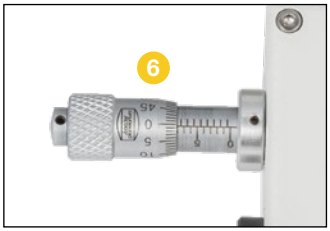
Any exchange of grating holders should always be performed in clean surroundings, free of dust and static build up.

Arrange your workplace for ensure a quick and clean grating exchange. Keep the new grating and the 1.5 mm Allen wrench at hand.

The Baader Blaze Reflection Grating 1200 L/mm #*2458559* in its box

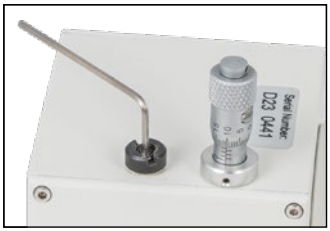


Loosen the grating angle locking screw 8 by one turn only (counterclockwise).

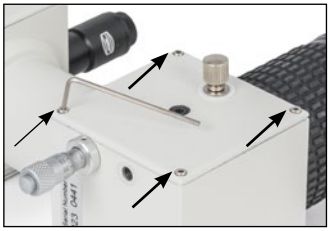


Rotate the micrometer 6 backwards to show the 8 mm setting on the Vernier scale.

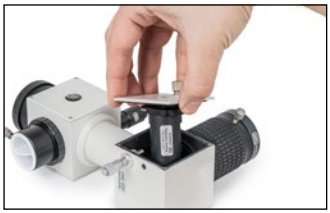
Loosen the counter nut of the setting screw for the grating holder 7 with the small tool which was included with the replacement grating.



Remove both the setting screw for the grating holder and the counter nut with the 1.5 mm Allen wrench.

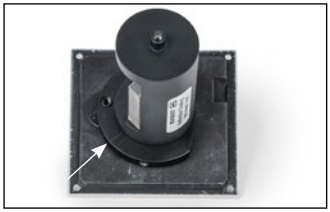


Use the 1.5 mm Allen wrench to remove the four hex-head screws.



Take off the side plate/grating holder assembly.

Be careful not to touch the grating.



The 200 l/mm grating has got a round holder. Pay attention to which of the marked lines (on both sides of the grille) the grating holder is aligned with and how the grating is aligned with the flattened side of the side plate.

Release the headless set screw inside of the pressure plate by two full turns counterclockwise using the 1.5 mm Allen wrench.

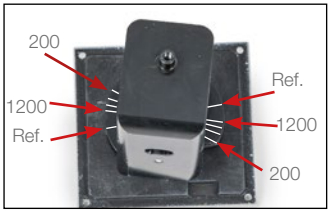
Remove the grating holder from the pressure plate.

Take the new grating from its box and put the old one into the box.

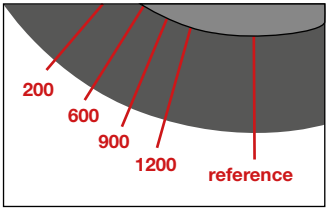
If you place the grating on a table, make sure that the grating faces down, as in the image. This way, no dust can fall onto the grating.

Place the new grating holder into the pressure plate.

The grating holder is above the flattened side of the pressure plate, the grating faces towards the round edge.

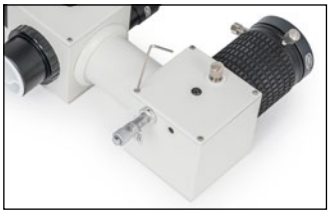


Rotate the grating holder to adjust the proper position in regard to the markings in the pressure plate. Each marking shows the correct position for one kind of grating. For best results, use the marking which corresponds to your grating. To adjust the holder as precisely as possible, take a look at it from some distance, so that you can see both sides.

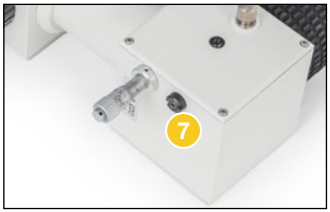


Each mark indicates the position of a specific grating: 200 l/mm, 600 l/mm, 900 l/mm and 1200 l/mm. Be sure to use the proper mark to achieve the optimal throughput. There are different grating holders: Some are round like the preinstalled 200 l/mm, others are rectangular like the 1200 l/mm shown here as replacement.

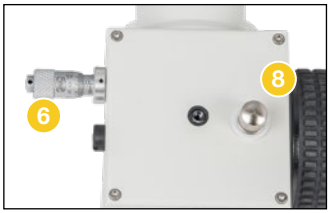
Lock the pressure plate by tightening the headless set screw clockwise.



Carefully replace the side plate/grating holder assembly. Replace and tighten the four screws that secure the side plate.



Screw the counter nut so far onto the setting screw for the grating holder 7 that it is flush with the end of the screw. Then screw it into the DADOS as far as possible and lock the counter nut again with the small tool.



Adjust the micrometer 6 to a Vernier position of approximately 2.5.

Lock the grating tilt mechanism 8 by rotating the grating angle locking screw clockwise.

Appendix A: Battery Replacement

Simply turn the back of the Illuminator counterclockwise to open the battery compartment. For easier handling, you can also unscrew the complete illumination unit from the DADOS.

Replace dead batteries with two round “hearing aid” batteries 1.5V (such as Camilion AG 3 SR 41 *#2454306*). The wider, flat plus pole faces the on/off-switch, the minus pole faces the LED.

Then turn the back of the illuminator clockwise till it is completely closed.

Please note: Since the first production run of the DADOS, several slightly different illumination units were used. If you have got an older DADOS, the unit may be opened in a slightlv different wav.

The illumination unit. The plus pole of the batteries faces to the right.

Appendix B: Care of the Optical Components

If you always use dust caps after working with the DADOS, no cleaning should be necessary.

Dust can only be cleaned from the grating and slit by Baader-Planetarium. Do not clean gratings or slit yourself as this may void the warranty.

Lenses must be cleaned with common cleaning agents.

Use only Baader Planetarium Optical Wonder fluid *#2905007* to clean the lenses.

www.baader-planetarium.com/de/optical-wonder

Appendix C: Technical Data

Mechanichal

Weight (without cameras and eyepieces)	0.85 kg
Dimensions (see figure in part description)	80 × 150 × 205 mm

Electrical

Red LED battery	SR 41 or equivalent

Environmental

Operating temperature	-10 to +30°C
Storage temperature	-30 to +35°C
Humidity (relative)	0 to 80 %
Storage humidity	0 to 60 %

Optical

Collimator focal ratio	f/10 *
Collimator focal length	80 mm
Objective focal length	96 mm
Collimator - Camera angle	90°
Dispersion on axis at 550 nm	
• Grating with 200 lines/mm	39,7 nm/mm
• Grating with 900 lines/mm (optional)	10,6 nm/mm

* Using the DADOS with a telescope of lower focal ratio than f/10 degrades the resolving power and increases the vignetting

Performances

Resolving power $\lambda / \Delta\lambda$ on camera objective axis and 25 µm slit:

Grating	Theoretical	Measured
200 lines/mm	578	765
900 lines/mm	4274	3850
1200 lines/mm	8251	4840 (5148 with 2,9 µm large pixels)

The measurements were performed with a QHY 5 III 200M with 4×4 µm large pixels at a wavelength λ of 585 nm. The measured resolution of the gratings with 900 and 1200 lines/mm was limited by the pixel size. With smaller pixels, a higher resolution can be achieved. The value in brackets for the grating with 1200 lines/mm was obtained in a seperate measurement with a camera with 2,9 µm large pixels.

Limiting magnitude for a telescope with an aperture of 30 cm with S/N 50 and an exposure time of 20 minutes:

Grating with 200 lines/mm: $m_v = 8$

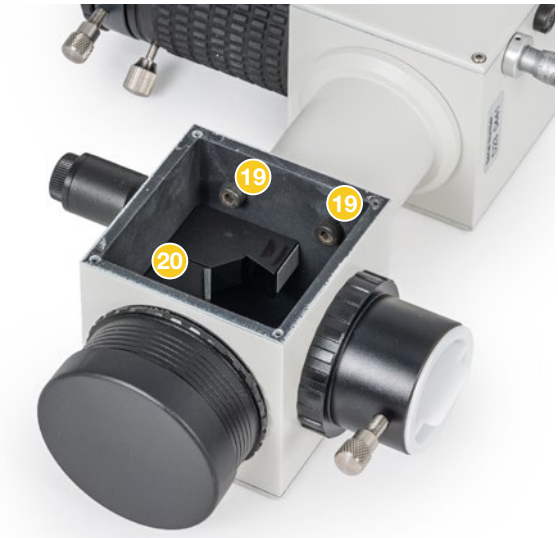
Grating with 900 lines/mm: $m_v = 6$

Appendix D:
Optional Alignment of a camera body

The parts inside of the DADOS are perfectly aligned to each other. It may be the case that the spectra are not perfectly aligned to the edges of the DADOS, but this doesn't affect the function!

If you want, you can slightly readjust the two cube-shaped housings of the DADOS. To do so, remove the two side plates of the cube by loosening the four 1,5 mm screws which keep them in place. You can now loosen the four screws 19 that secure the cube to the cylindrical middle part and readjust the alignment. Then tighten the screws again and replace the covers.

WARNING: Never touch the slit plate 20! It is made of a thin and very sensitive material that would be destroyed if touched. Do not touch the grid in the other cube either. Only work in a dust-free environment.



Inside of the DADOS are the fastening screws 19 for the cylindrical connecting tube. You can loosen them to align the two cubes of the DADOS. Do not touch the slit plate 20 under any circumstances and only work in a dust-free environment.

Appendix E: Optional Accessories

T-2 Adapters
for many SLR camera models, for example:
Nikon *#2408300*
Canon EF *#2408319*
You can find a complete list at
www.baader-planetarium.com

Reflection Grating

Replacement grating 200 lines/mm, mounted on holder. Also included with the DADOS.
#2458557

Reflection grating 900 lines/mm, mounted on holder.
#2458556

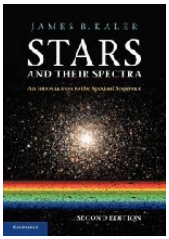
Reflection grating 1200 lines/mm, mounted on holder. Optimized for H-alpha, doesn't show the complete spectrum at once.
#2458559

Calibration Neon Lamp for DADOS
with 220V power cord, 2" adapter and sensor; emits light only in darkness or when connected to the DADOS
#2458590

Tube Ring with 3/8" and 1/4" Photo Thread
for mounting on tripods or optical bench
#2458593

Spectroscopy Barlow for DADOS/BACHES
for telescopes with f/6,8, replaces the 2" nose piece
#2458645

Appendix E: Bibliography



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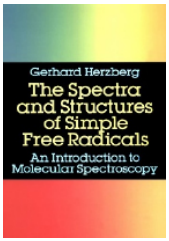
ISBN: 0521899540



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The spectra and structures of simple free radicals: An introduction to molecular spectroscopy
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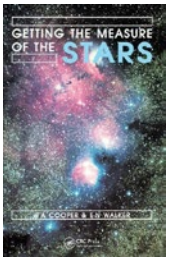

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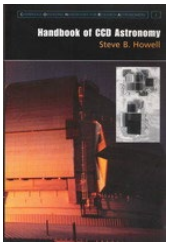

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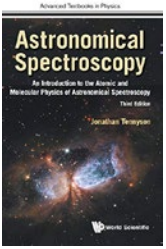

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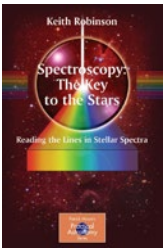

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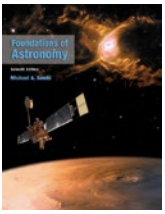

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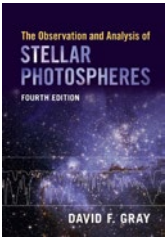

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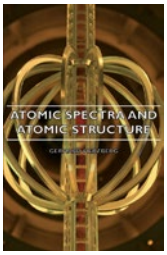

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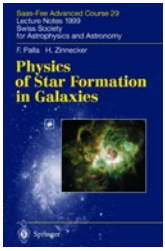

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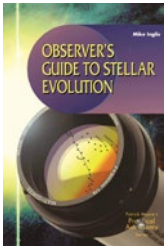

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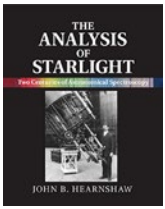

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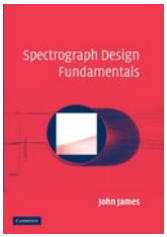

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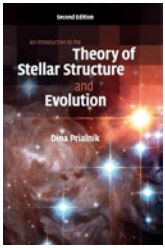

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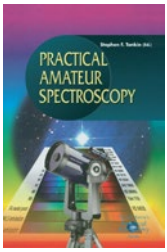

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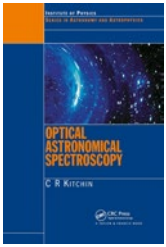

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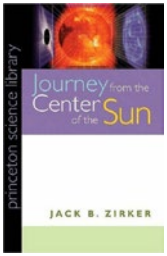

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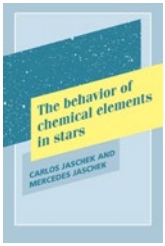

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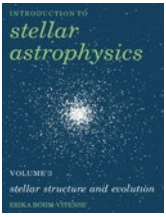

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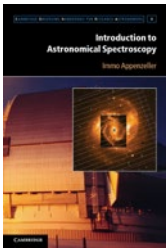

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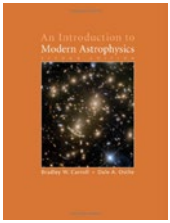

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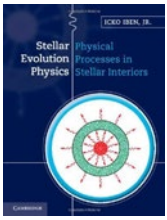

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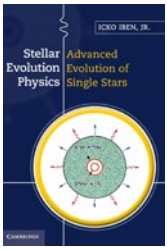

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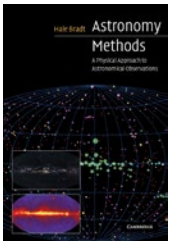

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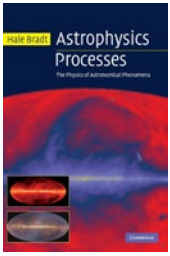

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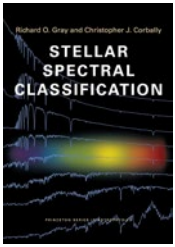

Richard O. Gray, Christopher J. Corbally

Stellar Spectral Classification

Year: 2009
Pages: 612
ISBN: 0691125112

WAVELENGTH SETTINGS

Camera model: _____

Grating: _____

Micrometer position	Central wavelength

Camera model: _____

Grating: _____

Micrometer position	Central wavelength

Camera model: _____

Grating: _____

Micrometer position	Central wavelength

Camera model: _____

Grating: _____

Micrometer position	Central wavelength

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