TAL TELESCOPES
TAL-150K
TAL-200K
TAL-250K

INSTRUCTION MANUAL

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Due to continuous product improvements, specifications are subject to change without notice.

GENERAL INSTRUCTIONS

Warning!
Never observe the Sun directly through your telescope or its finder scope - permanent eye damage could result.
Do not let children hold observations through telescope without adult's control.

- The telescope is designed for visual observations of celestial objects and for astronomical photography. It requires careful treatment and some knowledge of astronomy. Only in this case the use of telescope will bring satisfaction to its owner.
- The telescope may be used at an ambient temperature ranging from 30° to -30°C.
- When buying the telescope inspect the package to make sure that the original packaging is in good condition, and seals are not broken or missing. Having opened the package, check the presence of all components described in inventory list.
- Read instruction manual first before using the telescope.

TECHNICAL SPECIFICATIONS

Specification	TAL-150K	TAL-200K	TAL-250K
Aperture, mm	150	200	250
Focal length, mm	1550	1700	2130
Focal ratio	1:10.3	1:8.5	1:8.5
Telescope magnification, x	62;124; 155;310	68; 136; 170; 340	85; 170; 213; 426
Resolving power	0.8”	0.6”	0.5”
Limiting visual magnitude	12.8^{m}	13.4^{m}	14.0^{m}
Finderscope magnification, x	6	8	8
Finderscope aperture, mm	30	50	50
Focuser	1.25”	1.25”	1.25”; 2”
Right ascension turning angle	360° (24h)	360° (24h)	360° (24h)
Declination turning angle	±90°	±90°	±90°
Latitude adjustment range	0….70°	0…70°	0….70°
Input voltage V AC	220	220	220
Frequency, Hz	50	50	50
Power, Watts	5	5	5
Output voltage, V	12 DC	12 DC	12 DC
Dimensions, mm:			
OTA* length	425	450	660
Telescope height	1350	1400	1450
OTA weight, kg	6.2	8.5	15.0
Telescope weight, kg	25	28	45

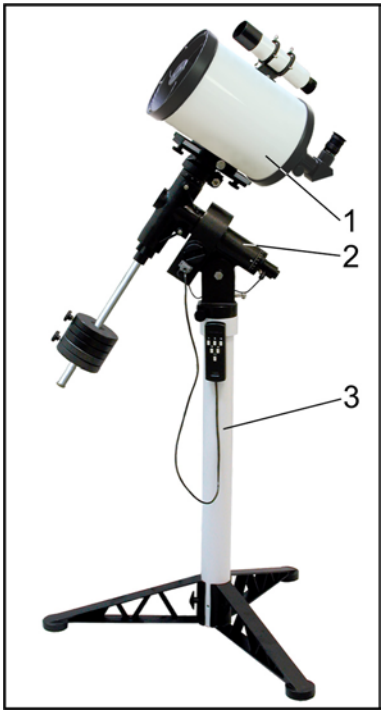
*Optical Tube Assembly

INVENTORY LIST

Component	TAL-150K	TAL-200K	TAL-250K
Telescope	+	+	+
Finderscope:			
6^{x}x30	+	-	-
9^{x}x50	-	+	+
Polar axis finderscope 6^{x}x23	+	+	+
Equatorial mount:			
MT-3S with counterweights:			
3.0 kg (1 unit)	-	+	-
3.0 kg (2 units)	-	-	+
4.5 kg (1 unit)	+	+	+
Pier with legs:			
C75 (800 mm)	+	+	-
C110 (770 mm)	-	-	+
Power supply	+	+	+
Hand controller	+	+	+
Power cord (10 m)	+	+	+
Spare parts and accessories:	+	+	+
Plössl eyepiece f'=10mm	+	+	+
Plössl eyepiece f'=25mm	+	+	+
2x Barlow lens	+	+	+
Reticle	+	+	+
Plug for photographing	+	-	-
T-adapter M42x0.75	+	+	+
Instruction manual	+	+	+
Optional accessories:			
Equatorial mount:			
MT-3S-2D with counterweights:			
3.0 kg (1 unit)	-	+	-
3.0 kg (2 units)	-	-	+
4.5 kg (1 unit)	+	+	+
Tripod	-	-	-
Plössl eyepieces (1.25"):			
f'=6.3mm	-	-	-
f'=7.5mm	-	-	-
f'=12.5mm	-	-	-
f'=17mm	-	-	-
f'=20mm	-	-	-
f'=32mm	-	-	-
f'=40mm	-	-	-

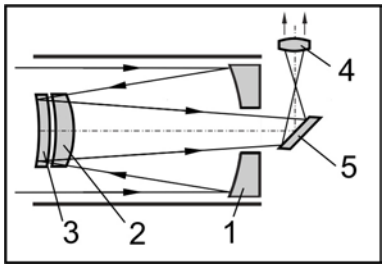
Component	TAL-150K	TAL-200K	TAL-250K
Super wide angle eyepieces (1.25''):			
f'=10mm (60°)	-	-	-
f'=15mm (65°)	-	-	-
f'=20mm (65°)	-	-	-
Ultra wide angle eyepieces (80°):			
f'=15mm (1.25'')	-	-	-
f'=20mm (2'')	-	-	-
f'=24mm (2'')	-	-	-
f'=25mm (2'')	-	-	-
3x Barlow lens	-	-	-
Guide eyepieces 12.5mm (1.25'')	-	-	-
Off-axis guider (2'')	-	-	-
Color filters M28.5x0.6:			
black	-	-	-
neutral	-	-	-
yellow	-	-	-
blue	-	-	-
red	-	-	-
green	-	-	-
Color filters M48x0.75:			
black	-	-	-
neutral	-	-	-
yellow	-	-	-
blue	-	-	-
red	-	-	-
green	-	-	-
Plug 1.25''	-	-	-
Plug 2''	-	-	-
Power cord extension cable with car adapter (10m)	-	-	-

CONSTRUCTION OF THE TELESCOPE



- The telescope consists of three main parts: optical tube assembly (OTA) (1), german equatorial mount (2), a pier or tripod (3).

The optical tube is a basic component of the telescope. It includes all main optical units such as a primary mirror, a corrector and an eyepiece unit with focusing mechanism.

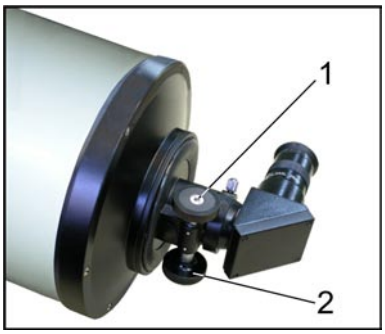


- A Catadioptric Telescope (Klevtsov System): beams of rays, reflected from the primary mirror (1), pass through the corrector lenses (2) and (3) and having reflected from the smooth surface of the lens (3), go back through corrector, forming the object's image at the focal plane of the eyepiece (4).
  For comfort observations of celestial objects close to zenith, eyepiece unit is inclined on 90° relatively to the optical axis of the telescope with help of flat diagonal mirror (5).

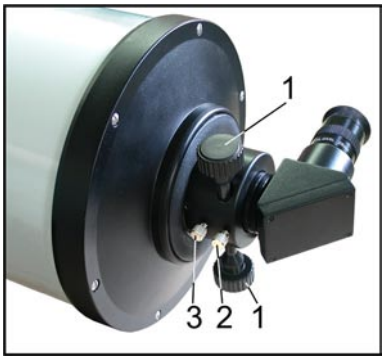
- A standard set includes two eyepieces and a Barlow lens, which allow observing celestial objects with various rate of magnification.

- The OTA supplied with a finder-scope, makes searching for celestial objects easier.

- Mirrors' effective areas are covered with high reflection aluminum coatings with protective level.
- All lenses surfaces are covered with antireflecting coating.
- The eyepiece unit includes a focuser with an eyepiece tube.
- Focuser consists of rack and pinion. The pinion axis has focus knobs, which help move the eyepiece tube in order to focus telescope.



- To provide the smoothness of TAL-150K and TAL-200K telescopes focusers, hold the left focus knob (1) with one hand and turn the right focus knob (2) clockwise (with a little effort) with other hand.
- Fix the position of the focuser, if necessary, using the same procedure.



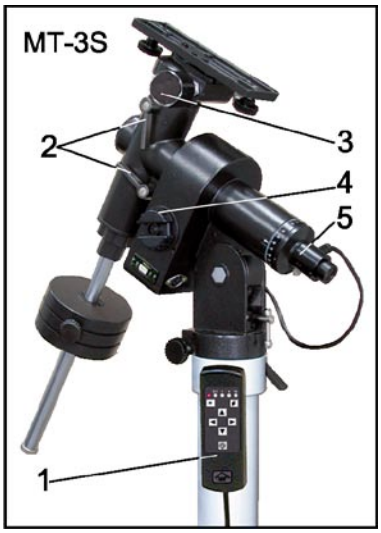
- The lens-focusing mechanism of TAL-200K and TAL-250K has friction-type. It includes the axis with the handweel (1) with the help of which moves the eyepiece tube. The smoothness of the tube is adjusted with the help of the screw (2). The screw (3) is used to fix the eyepiece tube in a chosen position.

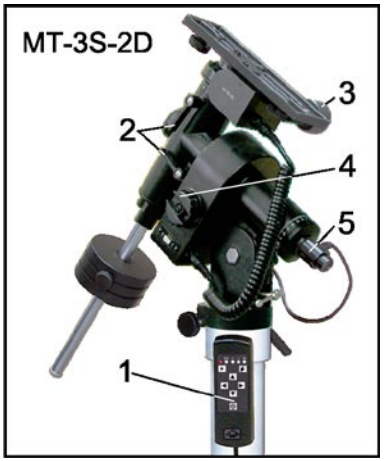
The equatorial mount is designed for pointing the telescope at the celestial objects and tracking their movement.

MT-3S (MT-3S-2D) mount consists of two axes square with each other: the polar axis and the axis of declination. There is a mounting plate with OTA rings on the top point of the declination axis, and a counter-weight shaft with counter-weights on the other side.

It is possible to place all types of the mounts on a pier or tripod.

The mount head has a clock drive embedded, which enables tracking of celestial objects with user defined speed.





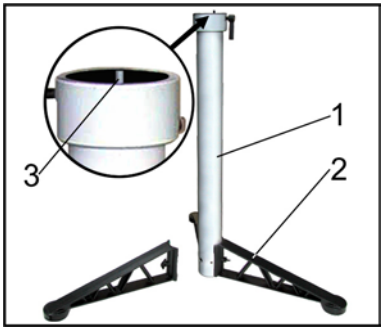
- The speed is set by a hand controller and has three tracking rates: solar, lunar and stellar, as well as two additional correction speeds - acceleration and deceleration at 50%. Hand controller has a night light lamp.
- For the first sight-in on the object, loosen the telescope's Dec. and R.A. locks (2) and move the telescope to center an object in the field of view.
- The fine alignment is done by manual Dec. slow-motion controls (2) on Dec. axis, and R.A. slow-motion controls (3) embedded into the clock drive.
- The polar axis has embedded polar axis finderscope (optional) (5) and is fixed in a tripod (pier) mounting head with a latitude dial.
- Mount MT-3S-2D has a drive according to the axis of declination.

The pier serves for holding an equatorial mount with an OTA. It consists of the tube and three attachable legs.

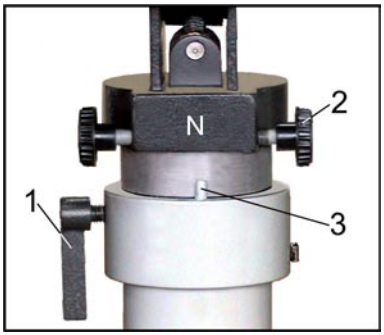
The tripod can be better used on a rugged terrain. For comfort observing it is equipped with an accessory shelf (1).

PREPARING TELESCOPE FOR OBSERVATIONS

ASSEMBLING THE TELESCOPE

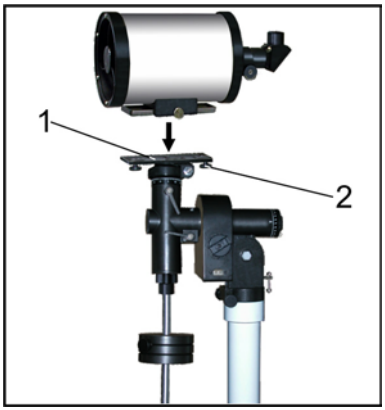


- ❑ Take a pier (1) and legs (2) out of the package. Attach tightly three legs to the bottom point of the pier using the captive screws. The pier must not swing on the legs.
- ❑ Place the pier on a firm plain surface. The pin should be oriented to the North.

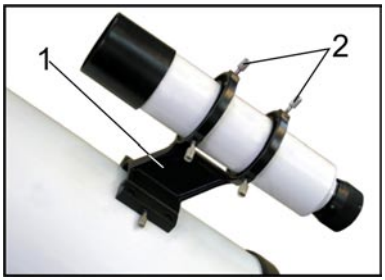


- ❑ Take the equatorial mount and place it on the top of the pier. Check the pin (3) to be on the pier lines up with the azimuth adjustment knobs (2).
- ❑ Turn the handle (1) clockwise to fix the mount on the pier tightly. Make sure there is no wobbling of the mount on the pier.

- ❑ Thread the counterweight shaft (2) into the base of the Declination axis (6) of the equatorial mount and fix it with the lock-nut (5). Unscrew the safety washer/knob (1) and slide the counterweight (3) to the midpoint on the counterweight shaft and secure it in place with the lock knob (4). Screw back in the safety washer/knob (1), which will not let the weight slide entirely off the counterweight shaft if slipped.



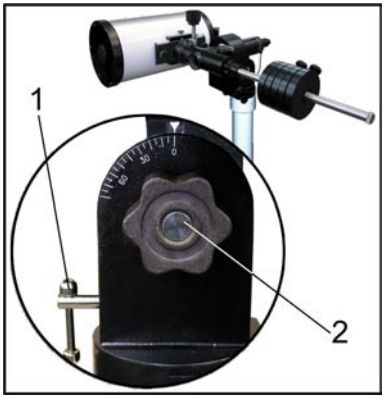
- ❑ Take the OTA accurately from the packing, place it on the mounting plate (1) and fix the OTA by captive screws (2).
- ❑ Certain of the security of attachment.



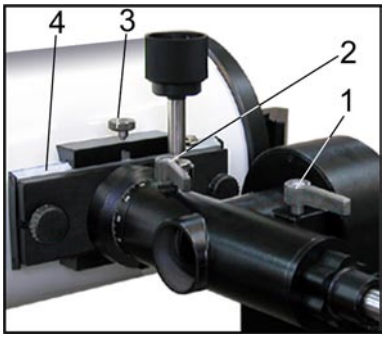
- ❑ Place the finderscope bracket (1) in the wedge slides for (TAL-200K and TAL-250K telescopes). TAL-150K telescope has finderscope bracket mounted directly on the OTA. Fix the finderscope with six thumbscrews (2).

BALANCING THE TELESCOPE

To provide a smooth motion of the telescope and reliable operation of equatorial mount drives, the balancing of the telescopes is required.



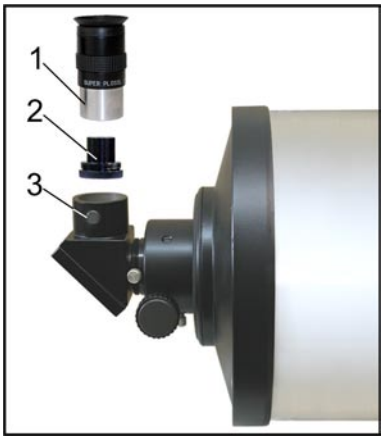
- ❑ Place the polar axis in the horizontal position (0° on the latitude dial), using the width adjustment mechanism (1) with the loosen slow-motion control (2).
- ❑ Enable unrestricted motion of the polar axis with R.A. lock released.
- ❑ Slide the counterweights along the counterweight shaft until they counterbalance the OTA.
- ❑ Fix the polar axis.



- Now with Dec. lock released, loosen the tube ring lock clamps and slide the OTA forward or back in the tube rings until balanced.
- Fix the tube and the Dec.axis.
- Repeat balancing each time when placing additional accessories on the telescopic tube, such as photo and video cameras, eyepieces, guides and other devices, which enlarge the weight of the OTA. Keep in mind that if the telescope is not balanced properly, the clock drive periodic error will increase.

ALIGNING THE FINDER SCOPE

High magnification of the main telescope makes it difficult to find a required celestial object in the sky because of the small field of view. This is why the telescope is equipped with a low-power finder scope with a wide field of view. The finder scope makes it easier to locate the object you want and then to observe it in the field of view of the telescope. However, for the proper use of the finder scope, it must be aligned with the main telescope, so that both the finder scope and the telescope point at the same position in the sky.

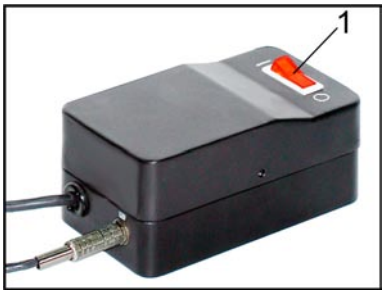


- Place the crosshair (2) into the eyepiece f'=25mm (1) and then insert the eyepiece in the focuser tube (3).
- Point the telescope at the distant object (at least 400meters/yards away), and then center it in the teles-copic field of view using the reticle. Fix telescope in this position with the R.A. and Dec. locks.

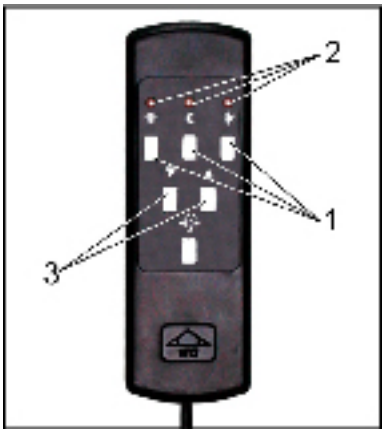
- Now, looking through the finder scope and using the six alignment thumbscrews, center the object on the intersection of the crosshairs of the finder scope. In future, check the coalignment of the telescope and the finder scope prior to observations.

POWER SUPPLY AND HAND CONTROLLER

Warning!
Always connect power supply to the mount using the power cord with power supply disconnected from the power outlet.
Use only original manufacturer's power supply fuse or analogue (consult your dealer).
Always disconnect all the power, if replacing the power supply fuse.

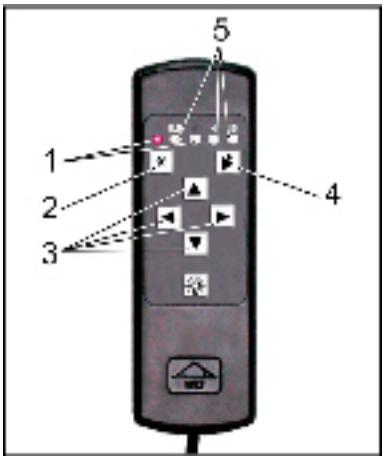


- Place the switch of the power supply in the "0" position.
- Connect the power supply 12V output with the mount socket using the power cord.
- Plug in the power supply into the 220/110 V AC power outlet.
- Place the switch of the power supply in the "I" position. The LED light on the power supply should turn on.
- Connect hand controller to the mount with the special cutoff point (1).



- Press one of the speed buttons (1) to start the clock drive. The LED light on the hand controller should turn on (2). Push the same button again to stop the clock drive.

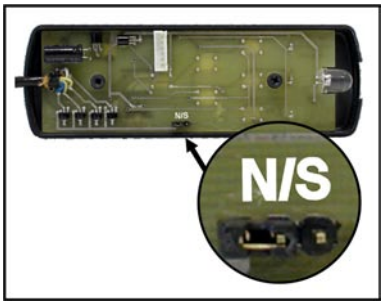
- Press one of the two speed correction buttons (3) while clock drive is working, if necessary. The LED light on the hand controller should blink (2) while button is pressed down.



- For mount MT-3S-2D launch the clock drive by pushing the button (2), at the same time the LED (1) must light up. The drive switches off with pushing the button again.

- To correct the speed of monitoring by two axes, push and hold one of the corresponding buttons (3) with continuously working drive, at the same time the one of LED of correcting speed (5) must blink. Choose the correct speed (0.5; 1; 4; 16) with the button (4).

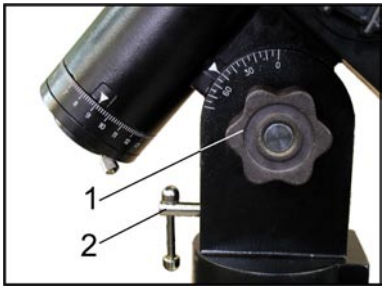
- If the telescope is used in the Southern hemisphere, the direction of the clock drive rotation must be changed.



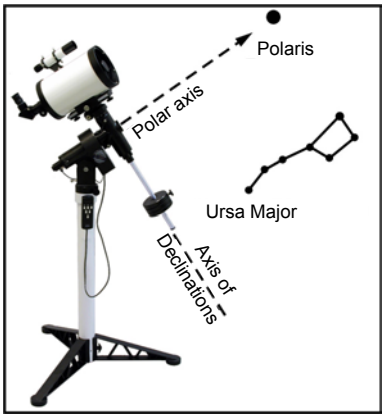
- For MT-3S (MT-3S-2D) mount open the hand controller cover and place the inside switch with «N/S» (North/South) markings in the required position.

POLAR ALIGNMENT

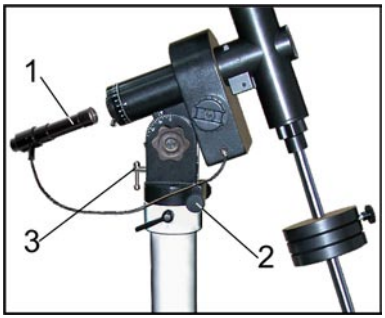
Due to the Earth's rotation, celestial objects move in the telescope field of view (the higher telescope magnification - the faster those movements appear).
Polar alignment of the telescope allows more comfortable observations, because you can follow objects by moving the telescope about one axis, the polar axis (or Right Ascension (R.A.) axis), which is in parallel with the Earth's axis.



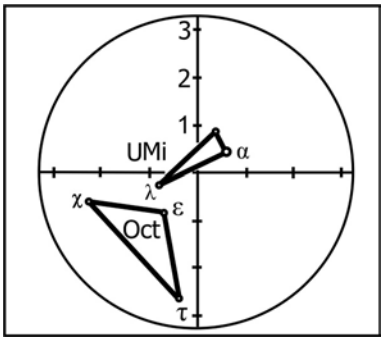
- ❑ Release the latitude lock (1). Using latitude adjustment knob (2), move R.A. axis up or down in order to set the latitude of your location (see latitude dial).
- ❑ Re-tighten the latitude lock (1).



- ❑ For visual observations point the R.A. (polar) axis of the telescope towards Polaris (α UMi). See the picture.
- ❑ With this level of pointing accuracy, very little use of the Dec. slow-motion control is necessary for celestial objects tracking. Less correction is required, when polar alignment is done more precisely.
- ❑ More precise polar alignment is required for astrophotography.



- ❑ MT-3S (MT-3S-2D) mount equipped with a polar axis finder scope (1), for precise polar alignment, with a reticle illumination. The reticle also has major stars of the Ursa Minor constellation, including Polaris, depicted for the Northern hemisphere, and stars of the Octans constellation for the southern hemisphere.

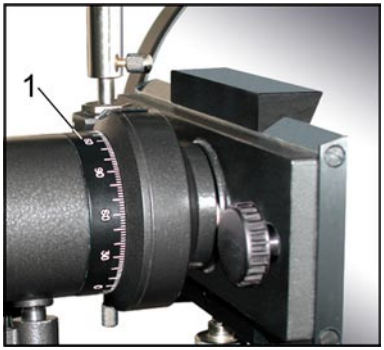


❑ Match stars depicted on the reticle with the celestial objects in the sky, using azimuth (2) and latitude (3) adjustment knobs and rotating the polar axis finder scope around its axis.

CALIBRATING THE SETTING CIRCLES

R.A. and Dec. axes have setting circles, which enable observer to locate an object in the sky by its celestial coordinates – right ascension (R.A.) and Declination (Dec.).
Calibration of setting circles is done after polar alignment of the telescope.

❑ Level the Dec. axis (put it in the horizontal position) and by rotating R.A. setting circle put it in a «0» (zero) position (see picture).



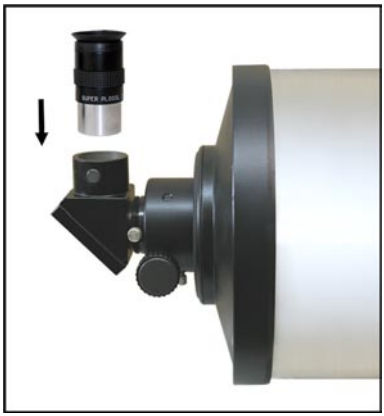
❑ For the Dec. setting circle calibration find bright star from the star atlas, and bring selected object to the center of the telescopic field of view. Rotating Dec. setting circle, set the Declination of the star observed. Correct Dec. setting circle calibration by selecting next star.

OBSERVATIONS

When using higher magnification not only the visible image size appears larger in the telescope, but also blurring and distortion of the image, star twinkle, caused by atmosphere become more significant.
To achieve maximum stability of the visible image and best performance of the telescope, all parts of the telescope need to reach thermal equilibrium with the ambient air.
Please note that some nights could have bad observation conditions because of the atmospheric turbulence. Even observing fine Moon surface details can be difficult.
Avoid observations through a window, because of the window glass aberrations, and temperature differences between inside and outside air, which will cause images to look blurred and distorted.
Put a soft cover on the telescope and its power supply after observations, or to protect it from rain/snow.

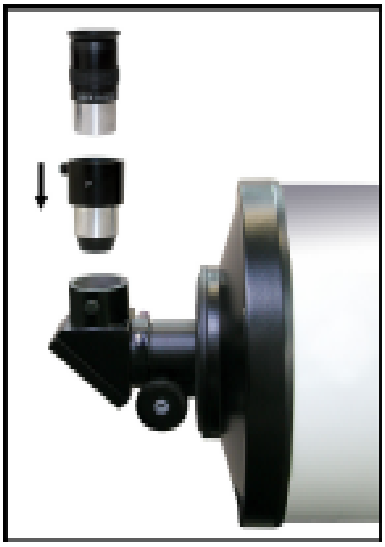
VISUAL OBSERVATIONS

- Point the telescope at any chosen object, and do some coarse adjustments to put it in the finder scope field of view. Then center the object using slow motion controls – first in the finderscope and then in the main telescope field of view, when observing through the eyepiece.



- Use focus knobs to focus, when changing eyepieces.
  Provided eyepieces give several magnification options for an observer.

TAL-150K	
Plössl f'=25 mm	Plössl f'=10 mm
62x	155x
TAL-200K	
Plössl f'=25 mm	Plössl f'=10 mm
68x	170x
TAL-250K	
Plössl f'=25 mm	Plössl f'=10 mm
85x	213x

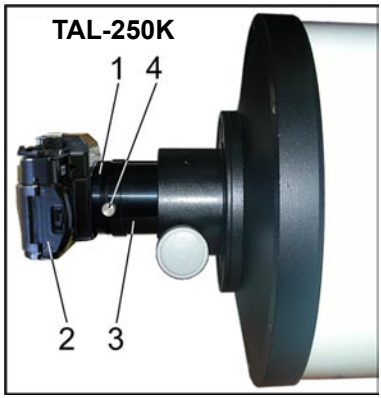


- For higher magnification, use Barlow lens with one of the eyepieces (see picture). 2x Barlow lens doubles magnification of the telescope.

TAL-150K	
Plössl f'=25 mm, 2x Barlow lens	Plössl f'=10 mm, 2x Barlow lens
124x	310x
TAL-200K	
Plössl f'=25 mm, 2x Barlow lens	Plössl f'=10 mm, 2x Barlow lens
136x	340x
TAL-250K	
Plössl f'=25 mm, 2x Barlow lens	Plössl f'=10 mm, 2x Barlow lens
170x	426x

ASTROPHOTOGRAPHY

Astrophotography is executed with compact reflex camera with objective thread M42x1 (M42x0.75 thread camera adapter is also supplied with the telescope).

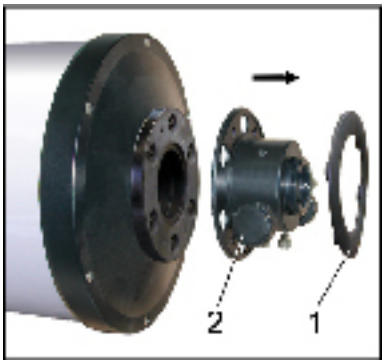


- ❑ To mount the camera on the telescope, take the diagonal mirror away and unscrew the camera objective.
- ❑ For telescope TAL-150K screw the bushing for taking pictures in the camera.
- ❑ Place the camera (1) with the bushing (2) in the ocular tube (3) and fasten with screws (4).
- ❑ For telescope TAL-200K fasten the camera (1) by the thread on the focusing tube (2).
- ❑ For telescope TAL-250K screw the plug 2" to 1.25" (1) in the camera (2).
- ❑ Place camera with a plug in ocular tube (3) and fasten with screw (4).
- ❑ Precise guiding can be done with an off-axis guider or a guide-telescope (sold separately).
- ❑ Use slow motion controls and buttons of hand controller to avoid shifting of the star from the reticle.
- ❑ To minimize such adjustments and for better photography quality more precise polar alignment is required Mount the camera (2).

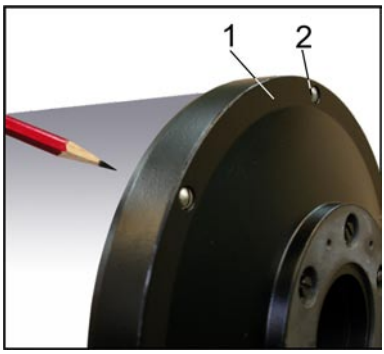
MAINTENANCE

In order to keep telescope in good operating condition one should provide good care and maintenance for the instrument. Please note that lens or mirror surfaces should be cleaned as infrequently as possible, only when absolutely necessary.

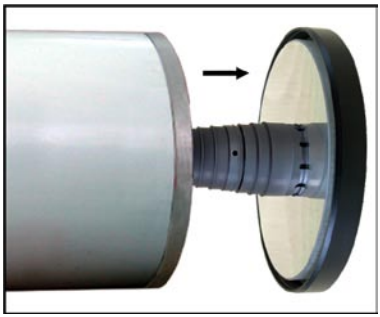
Optics self-cleaning only permitted after expiration of manufacturer limited warranty!



- ❑ Keep telescope clean and protect it from any physical damage.
- ❑ Use a clean, soft cloth to remove dust from all metallic surfaces. Then wipe them with a cloth wetted in acid-free vaseline and dry with a napkin.
- ❑ To clean the primary mirror remove the ring (1) and ocular unit (2) by loosening the screws.



- ❑ Remove the primary mirror unit (1) by loosening the screws (2).
- ❑ Mark the primary mirror frame position relatively to the tube to avoid additional telescope adjustment
- ❑ Improper cleaning can scratch mirror coatings, so one should use blower bulb or special brush to remove dust from their surfaces. Use the cotton cloth, wetted with the pure spirit (alcohol), without pressure to clean the mirror surface and then rinse the mirror under a stream of water.



- Set the primary mirror main unit back into the tube in reverse sequence.

- Corrector disjointing is not recommended.

- Use only quality optical lens cleaning tissue and optical lens cleaning fluid specifically designed for multicoated optics to clean your eyepieces and finderscope.

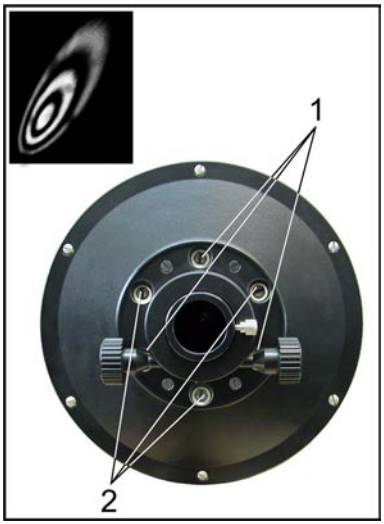
- Keep the dust cover on the front of the telescope and the end cap on the focuser tube when not in use.

COLLIMATION (ALIGNMENT) OF THE OPTICS

Collimation (alignment) of the optics is permitted only in case of absolute necessity, and after expiration of manufacturer limited warranty.

In case of accidental mirrors misalignment or after cleaning optical parts, telescope collimation might be necessary.

- ❑ Set the eyepiece f'=10mm with the Barlow lens into the tube.
- ❑ Watch attentively the reflection and note the rotation direction for achieving diffraction star image.

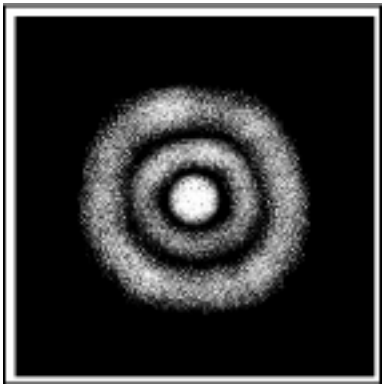


- ❑ Loosen 3 screws (1) on 1-2 turns.
- ❑ To adjust use three screws (2), rotating them in the direction needed.

Attention!
Do not remove all 6 screws to avoid the primary mirror falling.

Star diffraction image should have round kernel and not more than 2 round rings. Breaks and kernel form change are not allowed.
Effectiveness reduction within first diffraction ring is allowed only.

- ❑ The diffraction image is achieved, tighten all 6 screws, while observing and correcting the diffraction image if needed.
- ❑ Set the ring back.



- ❑ If the weather does not allow getting the clear diffraction image of the star, make the adjustment orienting on slightly out-of-focus image, but the energy should be spread equally around the kernel.

STORAGE

- The telescope must be kept in a clean, dry (humidity must not exceed 80%), dust-free place with an ambient temperature between +5° and +40°C.

- Avoid collision and shaking of the telescope.

- It is prohibited to store acids, alkalis, and any chemically active substances, which may produce evolved gas or vapor harmful for the optics, at the same place with the telescope.

ACCEPTANCE CERTIFICATE

Telescope _____ , serial # _____

Equatorial mount, serial # _____

Passed the product approval and found serviceable.

Manufacturing date _____

Signatures _____

Appendix A

Brightest stars visible in the Northern Hemisphere

Star		Constellation	R. A. 2000.0	Declination 2000.0	Visible magnitude
Alpheratz	α And	Andromeda	0^h08^m	$+29^o05'$	2.07^m
Mirach	β And	Andromeda	1^h09^m	$+35^o37'$	2.07^m
Polaris	α UMi	Ursa minor	2^h31^m	$+89^o15'$	1.97^m
Mirfak	α Per	Perseus	3^h24^m	$+49^o51'$	1.79^m
Aldebaran	α Tau	Taurus	4^h35^m	$+16^o30'$	0.87^m
Rigel	β Ori	Orion	5^h14^m	$-8^o12'$	0.18^m
Capella	α Aur	Auriga	5^h16^m	$+45^o59'$	0.08^m
Betelgeuse	α Ori	Orion	5^h55^m	$+7^o24'$	0.45^m
Sirius	α CMa	Canis Major	6^h45^m	$-16^o42'$	-1.44^m
Castor	α Gem	Gemini	7^h34^m	$+31^o53'$	1.58^m
Procyon	α CMi	Canis Major	7^h39^m	$+5^o13'$	0.40^m
Pollux	β Gem	Gemini	7^h45^m	$+28^o01'$	1.16^m
Regulus	α Leo	Leo	10^h08^m	$+11^o58'$	1.36^m
Merak	β UMa	Ursa Major	11^h01^m	$+56^o22'$	2.34^m
Dubhe	α UMa	Ursa Major	11^h03^m	$+61^o45'$	1.81^m
Phecda	γ UMa	Ursa Major	11^h53^m	$+53^o41'$	2.41^m
Alioth	ε UMa	Ursa Major	12^h54^m	$+55^o57'$	1.76^m
Mizar	ζ UMa	Ursa Major	13^h23^m	$+54^o55'$	2.23^m
Spica	α Vir	Virgo	13^h25^m	$-11^o09'$	0.98^m
Alcaid	η UMa	Ursa Major	13^h47^m	$+49^o18'$	1.85^m
Arcturus	α Boo	Bootes	14^h15^m	$+19^o10'$	-0.05^m
Vega	α Lyr	Lyra	18^h36^m	$+38^o47'$	0.03^m
Altair	α Aql	Aquila	19^h50^m	$+8^o52'$	0.76^m
Deneb	α Cyg	Cygnus	20^h41^m	$+45^o16'$	1.25^m