



TELESCOPES

TAL-1, TAL-1M, TAL-2,
TAL-150P, TAL-150P8

Instruction manual

NPZ Optics State Corp.
(Novosibirsk Instrument-making plant)

D. Kovalchuk 179/2 Novosibirsk,
630049 RUSSIAN FEDERATION

Fax +7 3832 261594
prinsib@sol.ru;
www.npzoptics.com

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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.

- ❑ 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-1	TAL-1M	TAL-2	TAL-150P	TAL-150P8
Aperture, mm	110	110	150	150	150
Focal length, mm	800	800	1200	750	1200
Mirror Surface	spherical	spherical	spherical	parabolic	parabolic
Focal ratio	1:7.3	1:7.3	1:8	1:5	1:8
Diagonal mirror diameter, mm	26	26	40	40	30
Telescope magnification, x	32; 64; 80;160	32; 64; 80;160	48; 96; 160;320	30; 60; 100;200	48; 96; 160;320
Resolving power	1.3"	1.3"	1"	1"	1"
Limiting visual magnitude	11.5 ^m	11.5 ^m	12.5 ^m	12.5 ^m	12.5 ^m
Finderscope magnification, x	6	6	8	8	8
Finderscope aperture, mm	30	30	50	50	50
Focuser	1.25"	1.25"	1.25"; 2"	1.25"; 2"	1.25"; 2"
Equatorial mount	MT-1	MT-1C	MT-3S	MT-3S	MT-3S

Specification	TAL-1	TAL-1M	TAL-2	TAL-150P	TAL-150P8
Right ascension turning angle	360° (24 h)	360° (24 h)	360° (24 h)	360° (24 h)	360° (24 h)
Declination turning angle	±90°	±90°	±90°	±90°	±90°
Latitude adjustment range	0...70°	0...70°	0...70°	0...70°	0...70°
Input voltage V AC	-	220 (110)	220 (110)	220 (110)	220 (110)
Frequency, Hz	-	50 (60)	50 (60)	50 (60)	50 (60)
Power, Watts	-	10	10	10	10
Output voltage, V	-	12 AC	12 DC	12 DC	12 DC
Dimensions, mm:					
OTA* length	850	850	1200	770	1200
Telescope height	1780	1780	1700	1620	1700
OTA weight, kg	4.5	4.5	8.5	6.5	8.5
Telescope weight, kg	20	22	35	30	35

*Optical Tube Assembly

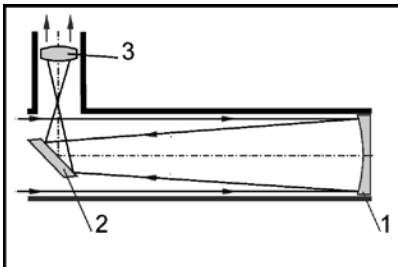
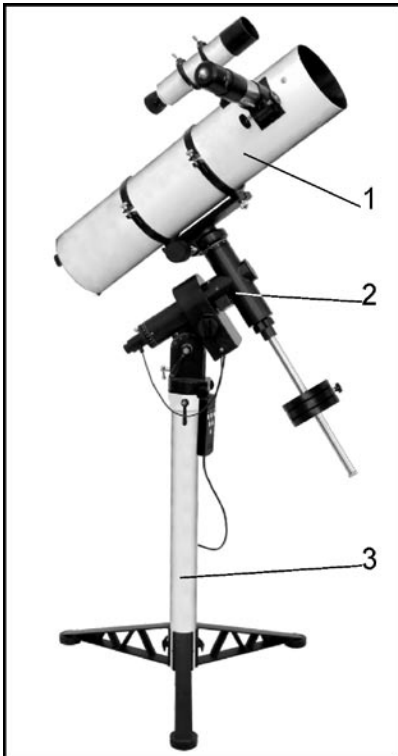
INVENTORY LIST

Component	TAL-1	TAL-1M	TAL-2	TAL-150P	TAL-150P8
Telescope	+	+	+	+	+
Finderscope:					
6x30	+	+	-	-	-
9x50	-	-	+	+	+
Polar axis finderscope	-	-	+	+	+
6x23					
Equatorial mount:					
MT-1 with counter-weight 2.2 kg	+	-	-	-	-
MT-1C with counter-weight 2.2 kg	-	+	-	-	-
MT-3S (MT-3S-2D) with counter-weight 2.2 kg (2 units)	-	-	-	+	-
MT-3S (MT-3S-2D) with counter-weight 3.7 kg (2 units)	-	-	+	-	+
Pier with legs:					
C75 (800 mm)	+	+	-	+	-
C110 (770 mm)	-	-	+	-	+
Power supply:					
direct current (DC)	-	-	+	+	+
alternating current (AC)	-	+	-	-	-
Hand controller:					
for direct current	-	-	+	+	+
for alternating current	-	+*	-	-	-
Power cord (10 m)	-	+	+	+	+
Spare parts and accessories:					
Plössl eyepiece f=7.5mm	-	-	+	+	+
Plössl eyepiece f=10mm	+	+	-	-	-
Plössl eyepiece f=25mm	+	+	+	+	+
2x Barlow lens	+	+	+	+	+
Reticle	+	+	+	+	+
Camera holder	+	+	-	-	-
Plug for photographing	-	-	+	+	+
T-adapter M42x0.75	-	-	+	+	+
Sun projection screen	+	+	+	+	+
Instruction manual	+	+	+	+	+

*Optional

Component	TAL-1	TAL-1M	TAL-2	TAL-150P	TAL-150P8
Optional accessories:					
Tripod	-	-	-	-	-
Plössl eyepieces (1.25"):					
f'=6.3mm	-	-	-	-	-
f'=12.5mm	-	-	-	-	-
f'=17mm	-	-	-	-	-
f'=20mm	-	-	-	-	-
f'=32mm	-	-	-	-	-
f'=40mm	-	-	-	-	-
Super wide angle eye- pieces (1.25"):					
f'=10mm (60°)	-	-	-	-	-
f'=15mm (65°)	-	-	-	-	-
f'=20mm (65°)	-	-	-	-	-
Ultra wide angle eye- pieces (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	-	-	-	-	-
Power cord extension cable with car adapter	-	-	-	-	-

CONSTRUCTION OF THE TELESCOPE

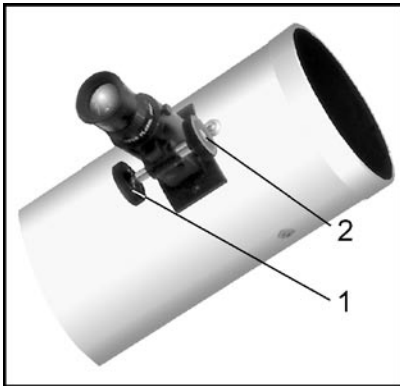


- ❑ The telescope consists of three main parts:
 - Optical tube assembly (OTA) (1),
 - German equatorial mount (2),
 - A pier or tripod (3).

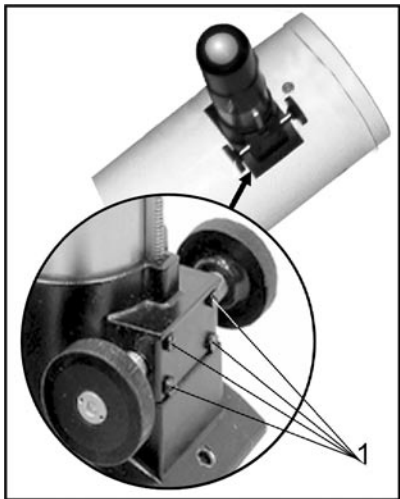
The optical tube is a basic component of the telescope. It includes all main optical units such as a primary mirror, a diagonal mirror and a focuser.

- ❑ A Newtonian Reflectors Telescope: parallel beams of rays enter the tube of the telescope and is projected at the focal plane of the eyepiece (3) with the help of primary (1) and diagonal (2) mirrors.
- ❑ 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 finderscope, makes searching for celestial objects easier.
- ❑ The primary mirror is fastened in a cell and installed in a tube.
- ❑ The diagonal mirror is flat. It is glued to the holder and fixed inside of the OTA with the help of four vane spiders. Both mirrors are made of a high quality optical glass with high reflection aluminum coatings with protective level.

- ❑ 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-1 telescope focuser, 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.

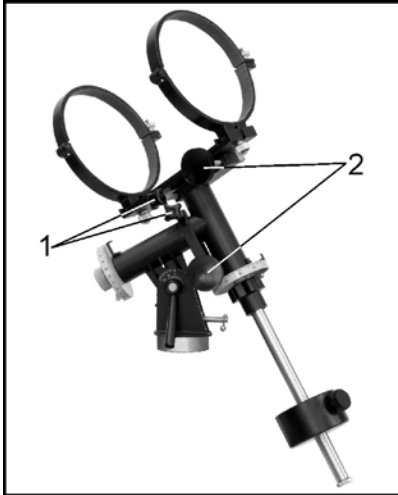


- ❑ For telescopes TAL-2, TAL-150P, TAL-150P8 the smoothness of the focuser can be adjusted with the help of four screws (1).

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

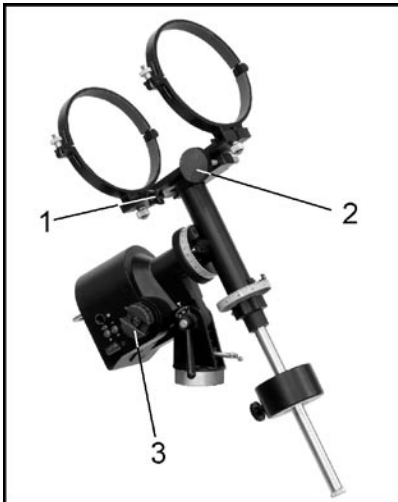
- ❑ The equatorial mount consists of two axes square with each other: the polar axis and the axis of declination. There is a mounting plate with OTA rings on the top point of the declination axis, and a counter-weight shaft with counterweights on the other side.

It is possible to place all types of the mounts on a pier or tripod. Different models of telescopes are provided with different mounts.



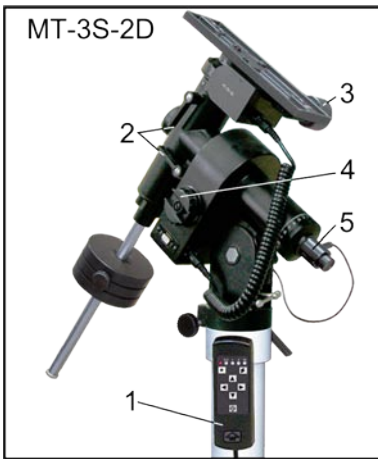
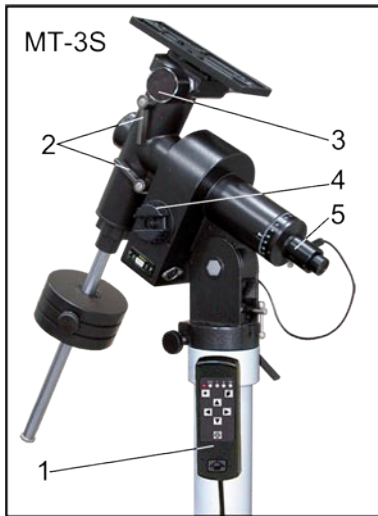
The mount MT-1 has manual slow-motion controls on both axes and is used with TAL-1 telescope.

- ❑ For the first sight-in on the object, loosen the telescope's Dec. and R.A. locks (1) and move the telescope to center an object in the field of view.
- ❑ The fine alignment is done by manual slow-motion controls (2) within $\pm 4^\circ$ on each axis.
- ❑ The polar axis is fixed in a tripod (pier) mounting head with a latitude dial.



MT-1C mount is equipped with a clock R.A. drive along with manual slow-motion controls on both axes. The clock drive enables tracking of celestial objects.

- ❑ For the first sight-in on the object, loosen the telescope's Dec. lock (1) and turn Dec. axis to move the telescope in order to center an object in the field of view.
- ❑ The fine alignment is done by manual Dec. slow-motion control (2) within $\pm 4^\circ$ on Dec. axis, and R.A. slow-motion control (3) embedded into the clock drive. The design of the mount allows manual corrections without stopping the clock drive, and also to use hand controller as an additional accessory tool.



MT-3S mount is used with telescopes with primary mirror diameter of 150mm and above. 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 (1) and move the telescope to center an object in the field of view.

- ❑ The fine alignment is done by manual Dec. slow-motion control (2) on Dec. axis, and R.A. slow-motion control (3) embedded into the clock drive.

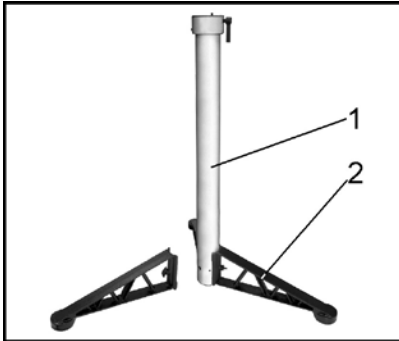
The polar axis has embedded polar axis finderscope (optional) (4) and is fixed in a tripod (pier) mounting head with a latitude dial.

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

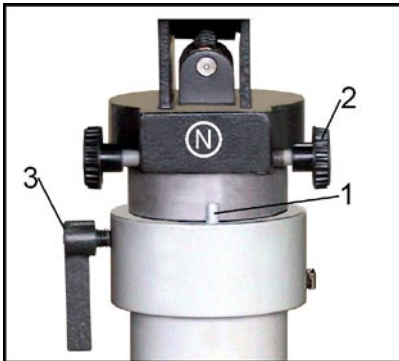
The tripod can be better used on a rugged terrain. For comfort observing it is equipped with an accessory shelf (1).

PREPARING TELESCOPE FOR OBSERVATIONS

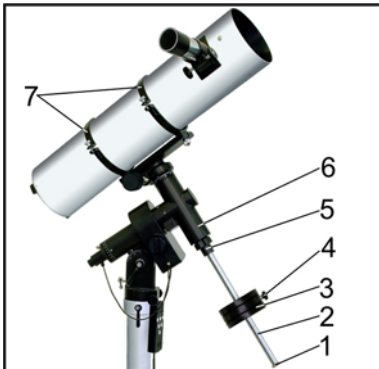
ASSEMBLING THE TELESCOPE



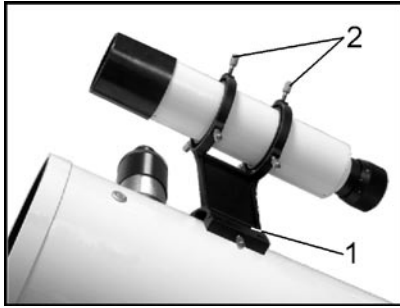
- ❑ Take a pier (1) and legs (2) out of the package. Attach tightly three legs to the bottom point of the pier using the captive screws. The pier must not swing on the legs.
- ❑ Place the pier on a firm plain surface.



- ❑ Take the equatorial mount and place it on the top of the pier.
- ❑ When using MT-3S orient equatorial head so that the pin (1) on the pier lines up with the azimuth adjustment knobs (2).
- ❑ Turn the handle (3) clockwise to fix the mount on the pier tightly. Make sure there is no wobbling of the mount on the pier.



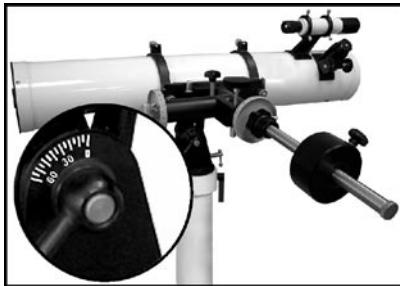
- ❑ Thread the counterweight shaft (2) into the base of the Declination axis (6) of the equatorial mount and fix it with the lock-nut (5). Unscrew the safety washer/knob (1) and slide the counterweight (3) to the midpoint on the counterweight shaft and secure it in place with the lock knob (4). Screw back in the safety washer/knob (1), which will not let the weight slide entirely off the counterweight shaft if slipped. Fix the tube rings (7) on the mounting plate and lay the OTA in the rings.



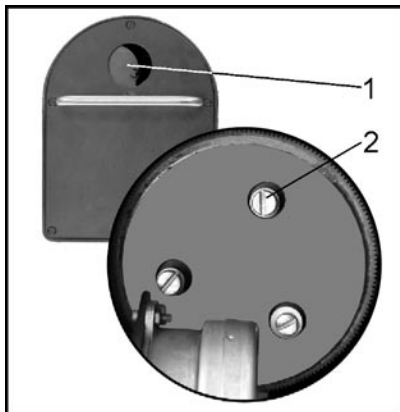
- ❑ Place the finderscope bracket (1) in the wedge slides for TAL-2, TAL-150P, and TAL-150P8 telescopes. Tal-1 and TAL-1M telescopes have finderscope bracket mounted directly on the OTA. Fix the finderscope with six thumbscrews (2).

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).
- ❑ Enable unrestricted motion of the polar axis with R.A. lock released. Slide the counterweights along the counterweight shaft until they counterbalance the OTA.
- ❑ For MT-1C mount polar axis balancing release each of the three screws (2) through the cover (1).

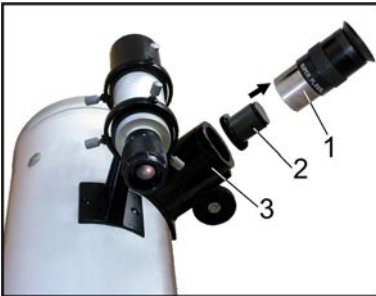


- ❑ After telescope balanced fix the screws (2) so that the polar axis could not rotate.
- ❑ Now with Dec. lock released, loosen the tube ring lock clamps and slide the OTA forward or back in the tube rings until balanced.
- ❑ Fix the tube ring lock clamps.
- ❑ Fix the Dec. axis.
- ❑ Repeat balancing 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.

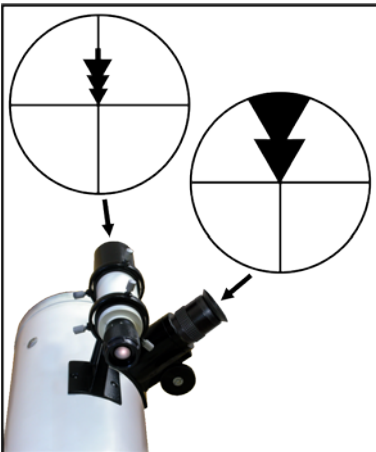
Keep in mind that if the telescope is not balanced properly, the clock drive periodic error will increase.

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.

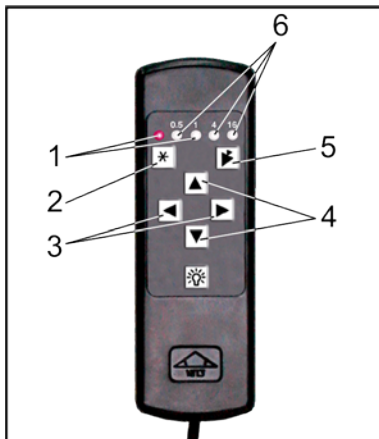


- ❑ Place the crosshair (2) into the eyepiece $f=25\text{mm}$ (1) and then insert the eyepiece in the focuser tube (3).
- ❑ Point the telescope at the distant object (at least 400meters/yards away), and then center it in the telescopic field of view using the reticle. Fix telescope in this position with 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 co-alignment of the telescope and the finder scope prior to observations.

POWER SUPPLY AND HAND CONTROLLER

Warning!

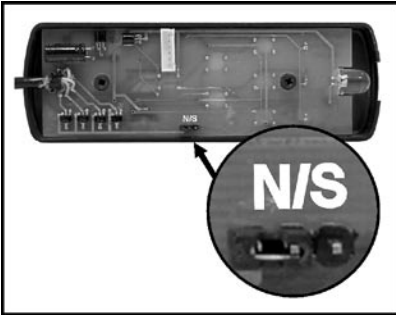
Always connect power supply to the mount using the power cord with power supply disconnected from the power outlet. Use only original manufacturer's power supply fuse or analogue (consult your dealer). Always disconnect all the power, if replacing the power supply fuse.



- ❑ 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 “1” position. The LED light on the power supply should turn on.
- ❑ **For MT-1C** mount place the left switch in “*” position.
- ❑ Turn on the mount clock drive by placing the second switch in “1” position. The LED light on the power supply should turn on.
- ❑ Connect hand controller to the mount and place the left switch in “*” position (see picture).
- ❑ 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.



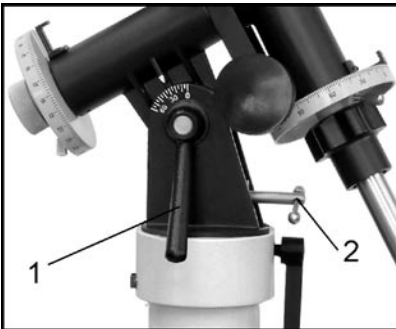
- ❑ **For MT-3S mount** connect the hand controller to the socket (1). Then follow the same procedure as for MT-1C mounts.



- ❑ If the telescope is used in the Southern hemisphere, the direction of the clock drive rotation must be changed.
- ❑ For MT-3S mount open the hand controller cover and place the inside switch with "N/S" (North/South) markings in the required position.

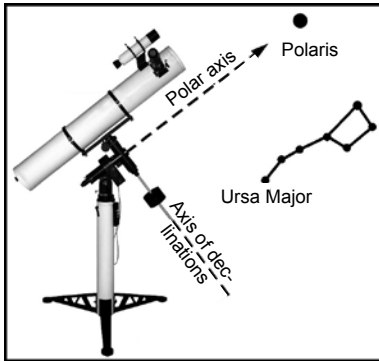
POLAR ALIGNMENT

Due to the Earth's rotation, celestial objects move in the telescope field of view (the higher telescope magnification - the faster those movements appear).

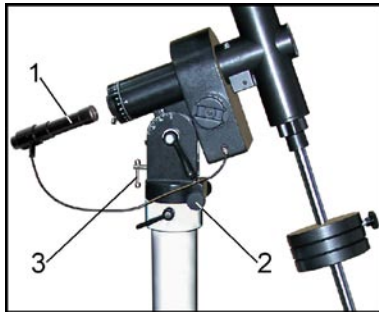


Polar alignment of the telescope allows more comfortable observations, because you can follow objects by moving the telescope about one axis, the polar axis (or Right Ascension (R.A.) axis), which is in parallel with the Earth's axis. See Appendix A for details.

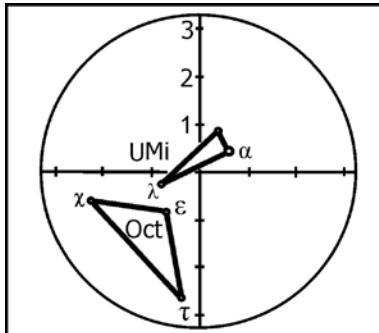
- ❑ Release the latitude lock (1). Using latitude adjustment knob (2), move R.A. axis up or down in order to set the latitude of your location (see latitude dial).
- ❑ Re-tighten the latitude lock (1).



- ❑ 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 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.
- ❑ For MT-1 and MT-1C mounts use precise polar alignment procedure described in Appendix B.

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.



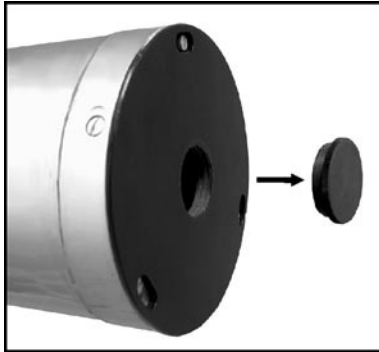
Level the Dec. axis (put it in the horizontal position) and by rotating R.A. setting circle put it in a "0" (zero) position (see picture).



- ❑ 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. For better air circulation inside of the OTA the primary mirror cell has special holes. TAL-1 telescope has an end cap, which needs to be removed prior to observations (see picture).
- ❑ 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-1; TAL-1M	
Plössl f=25 mm	Plössl f=10 mm
32 ^x	80 ^x
TAL-150P	
Plössl f=25 mm	Plössl f=7.5 mm
30 ^x	100 ^x
TAL-2; TAL-150P8	
Plössl f=25 mm	Plössl f=7.5 mm
48 ^x	160 ^x



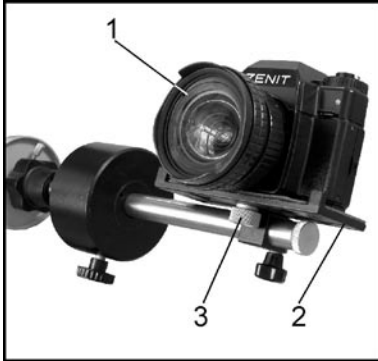
- ❑ For higher magnification, use Barlow lens with one of the eyepieces (see picture). 2x Barlow lens doubles magnification of the telescope.

TAL-1; TAL-1M	
Plössl $f'=25$ mm, 2x Barlow	Plössl $f'=10$ mm, 2x Barlow
64 ^x	160 ^x
TAL-150P	
Plössl $f'=25$ mm, 2x Barlow	Plössl $f'=7.5$ mm, 2x Barlow
60 ^x	200 ^x
TAL-2; TAL-150P8	
Plössl $f'=25$ mm, 2x Barlow	Plössl $f'=7.5$ mm, 2x Barlow
96 ^x	320 ^x



- ❑ Sun projection screen can be used for solar observations. Place the screen on the counterweight shaft and fix it with a screw so that the widest part of the screen is opposite to the top point of the tube of the telescope.
- ❑ Loosen the tube rings and rotate the OTA so that the eyepiece is perpendicular to the screen. Fix the OTA in this position.
- ❑ Attach a thick white paper sheet to the screen using clamps.
- ❑ Use the $f'=25$ mm eyepiece to get an optimal (approximately 100 mm) Sun image. In order to change size/brightness of the image, move the screen along the counterweight shaft. Use focus knobs for sharpness regulation.

ASTROPHOTOGRAPHY



- ❑ For astrophotography with TAL-1 and TAL-1M telescopes mount a camera (1) on the camera holder (2), which is attached to the counterweight shaft. Fix the camera to the holder using the lock knob (3).

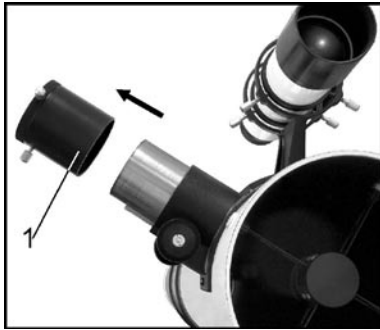
- ❑ As a long exposure is required for the astrophotography, it is necessary for a camera during this time precisely to follow the sky in its diurnal rotation.

- ❑ Place the crosshairs into the eyepiece $f'=25\text{mm}$, attach the Barlow lens and then insert them in the focuser tube.

- ❑ Point the telescope at any bright star near the center of the camera field of view. The star should stay in the reticle during the exposure time. For more comfortable guiding bring the star a bit out of focus.

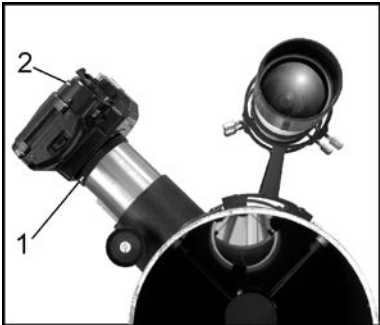
- ❑ Use slow motion controls to avoid shifting of the star from the reticle. To minimize such adjustments and for better photography quality more precise polar alignment is required.

- ❑ For astrophotography with TAL-2, TAL-150P and TAL-150P8 telescopes use the same procedure as described above. However prime focus photography is also available when using M42x1 objective thread cameras (M42x0.75 thread camera adapter is also supplied with the telescope).



- ❑ For the prime focus setup unscrew the objective lens from the camera and remove the 2" and 1.25" adapters from the focuser drawtube. Screw the camera adapter into the focuser drawtube. Attach the T-ring (T-adapter) to the camera and thread it onto the camera adapter.

- ❑ Mount the camera (2).



- ❑ Precise guiding can be done with an off-axis guider or a guide-telescope (sold separately).

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.

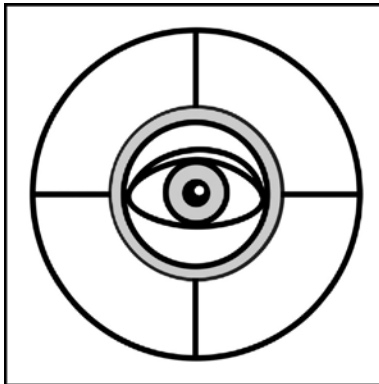
Optics self-cleaning only permitted after expiration of manufacturer limited warranty!

- ❑ Keep telescope clean and protect it from any physical damage. Use a dry cloth to remove dust from all metallic surfaces.
- ❑ The primary and the secondary mirrors of the telescope are front-surface aluminized. Improper cleaning can scratch mirror coatings, so one should use blower bulb or special brush to remove dust from their surfaces.
- ❑ Spots of grease and smudges may be washed away.
- ❑ To clean the primary mirror, carefully remove the mirror cell from the telescope by loosening screws, which hold it inside the OTA. Do not remove mirror from the mirror cell. Carefully wet the mirror surface with a lot of pure spirit (alcohol) using the cotton cloth. Using the same cloth without pressure clean the mirror surface and then rinse the mirror under a stream of water. Wait till the water trickles away.
- ❑ Swab remaining water drops from the surface with a dry cloth edge.
- ❑ To clean the secondary mirror use the same procedure.
- ❑ Use only quality optical lens cleaning tissue and optical lens cleaning fluid specifically designed for multi-coated 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.

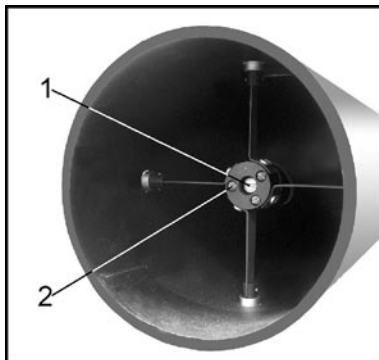
COLLIMATION (ALIGNMENT) OF THE OPTICS

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.

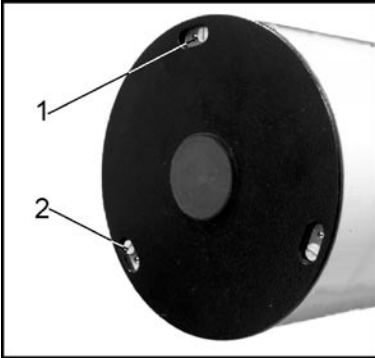


- ❑ To inspect the view of the mirror collimation, look down the focuser drawtube with the eyepiece and the Barlow lens removed. If optics are properly aligned you should see the secondary mirror centered in the drawtube, as well as reflection of the primary mirror centered in the secondary mirror, and the reflection of the secondary mirror (and your eye) centered in the reflection of the primary mirror (see picture).

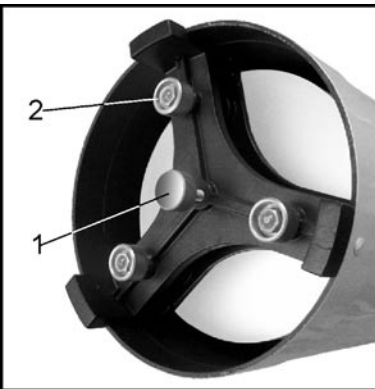


- ❑ During the collimation process the primary and/or secondary mirror will need alignment. If the reflection of the primary mirror is not centered in the secondary mirror, aligning of the secondary mirror is required. Loosen the central screw of the secondary mirror holder (1) and use the three alignment screws (2) to center the reflection of the primary mirror in the secondary mirror.

- ❑ If the primary mirror is misaligned, the reflection of the secondary mirror with spider vanes will be out of center.



- ❑ For TAL-1 and TAL-1M collimation, loosen the three small screws that lock the primary mirror (1). Then adjust the tilt of the primary mirror using larger adjustment thumb-screws (2), so that the reflection of the secondary mirror is centered. Fix the mirror position after collimation is done.



- ❑ Use analogous procedure to collimate TAL-2, TAL-150P and TAL-150P8 telescopes.

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 _____

Precise polar alignment for the MT-1 and MT-1C mounts

For precise polar alignment for MT-1 and MT-1C mounts observe two bright stars in the west and in the east by turns, using the eyepiece $f'=25\text{mm}$ with reticle.

If during the observation of the star in the east it slowly shifts, so that you have to lower the top end of the telescope to follow it, then the northern (upper) side of the R.A. (polar) axis of the mount should be slightly lifted up.

If you have to lift up the top end of the telescope to follow the star in the east during the observation, then the northern (upper) side of the R.A. (polar) axis of the mount should be slightly lowered down.

For the precise azimuth adjustment follow the same procedure to observe a bright star on a celestial meridian in the south. If during the observation the star slowly shifts, so that you have to lower the top end of the telescope to follow it, then the northern (upper) side of the R.A. (polar) axis of the mount should be slightly moved west.

If you have to lift up the top end of the telescope to follow the star in the south during the observation, then the northern (upper) side of the R.A. (polar) axis of the mount should be slightly moved east.

After 20-30 minutes of such observations and adjustments, it is possible to achieve a precise polar alignment, when any observed star would stay on the intersection of the crosshairs (reticle) of the eyepiece for 10-15 minutes without additional correction needed on the Dec. axis.

Double stars list for telescope image quality test

Star	Coordinates		Magnitude, m	Visible distance	Constellation
	R. A. 2000.0	Declination 2000.0			
α Psc	2 ^h 02 ^m	+02°45'	4.3-5.3	1.9"	Pisces
γ Cet	2 ^h 43 ^m	+03°14'	3.4-4.4	2.8"	Cetus
ζ Ori	5 ^h 40 ^m	-01°56'	2.0-4.2	2.5"	Orion
α Gem	7 ^h 34 ^m	+31°53'	2.0-2.8	1.8"	Gemini
ε Hya	8 ^h 46 ^m	+06°25'	3.5-6.9	2.9"	Hydra
38 Lyn	9 ^h 18 ^m	+36°48'	4.9-6.0	2.8"	Lynx
ε Boo	14 ^h 44 ^m	+27°04'	2.7-5.1	3.0"	Bootes
μ Dra	17 ^h 05 ^m	+54°30'	5.8-5.8	2.2"	Draco
70 Oph	18 ^h 05 ^m	+02°30'	4.0-6.0	2.4"	Ophiuchus
δ Cyg	19 ^h 44 ^m	+45°07'	3.0-6.5	2.2"	Cygnus

Brightest stars visible in the Northern Hemisphere

Star		Constellation	R. A. 2000.0	Declination 2000.0	Visible magnitude
Alpheratz	α And	Andromeda	0 ^h 08 ^m	+29°05'	2.07 ^m
Mirach	β And	Andromeda	1 ^h 09 ^m	+35°37'	2.07 ^m
Polaris	α UMi	Ursa Minor	2 ^h 31 ^m	+89°15'	1.97 ^m
Mirfak	α Per	Perseus	3 ^h 24 ^m	+49°51'	1.79 ^m
Aldebaran	α Tau	Taurus	4 ^h 35 ^m	+16°30'	0.87 ^m
Rigel	β Ori	Orion	5 ^h 14 ^m	-8°12'	0.18 ^m
Capella	α Aur	Auriga	5 ^h 16 ^m	+45°59'	0.08 ^m
Betelgeuse	α Ori	Orion	5 ^h 55 ^m	+7°24'	0.45 ^m
Sirius	α CMa	Canis Major	6 ^h 45 ^m	-16°42'	-1.44 ^m
Castor	α Gem	Gemini	7 ^h 34 ^m	+31°53'	1.58 ^m
Procyon	α CMi	Canis Minor	7 ^h 39 ^m	+5°13'	0.40 ^m
Pollux	β Gem	Gemini	7 ^h 45 ^m	+28°01'	1.16 ^m
Regulus	α Leo	Leo	10 ^h 08 ^m	+11°58'	1.36 ^m
Merak	β UMa	Ursa Major	11 ^h 01 ^m	+56°22'	2.34 ^m
Dubhe	α UMa	Ursa Major	11 ^h 03 ^m	+61°45'	1.81 ^m
Phecda	γ UMa	Ursa Major	11 ^h 53 ^m	+53°41'	2.41 ^m
Alioth	ϵ UMa	Ursa Major	12 ^h 54 ^m	+55°57'	1.76 ^m
Mizar	ζ UMa	Ursa Major	13 ^h 23 ^m	+54°55'	2.23 ^m
Spica	α Vir	Virgo	13 ^h 25 ^m	-11°09'	0.98 ^m
Alkaid	η UMa	Ursa Major	13 ^h 47 ^m	+49°18'	1.85 ^m
Arcturus	α Boo	Bootes	14 ^h 15 ^m	+19°10'	-0.05 ^m
Vega	α Lyr	Lyra	18 ^h 36 ^m	+38°47'	0.03 ^m
Altair	α Aql	Aquila	19 ^h 50 ^m	+8°52'	0.76 ^m
Deneb	α Cyg	Cygnus	20 ^h 41 ^m	+45°16'	1.25 ^m