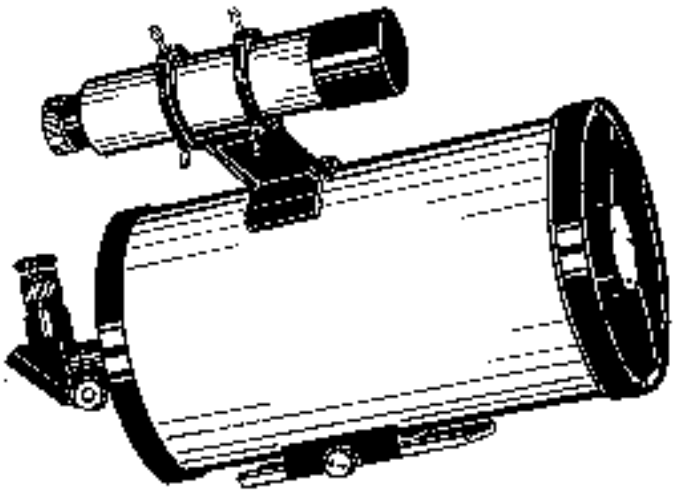
TELESCOPE TAL-150K
TELESCOPE TAL-200K



Service manual

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The telescope is subject to continuous development and improvement, consequently it may incorporate minor changes in detail from the information contained herein.

05.04

1. GENERAL DIRECTIONS

ATTENTION!

Telescope TAL-150K,TAL-200K (hereinafter in the text referred to as «telescope») is not intended for direct visual observation of Sun at full operating aperture. Because of high light intensity an image of Sun in focus of primary mirror has a high temperature. To avoid on overheating of corrector it is recommended to avoid any direct observation of Sun disk.

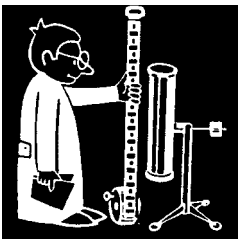
One should remember that overheated corrector being in field of direct sunlight can be out of order or make a turbulent air torrents in telescope tube that to reduce considerably a quality of image.

Also if it is necessary to leave a telescope out of door (for example, to dry it) one should orient it so that the direct sunlight do not get into the optical system.

The telescope can operate normally at the ambient temperature from 30°C to minus 30°C.

It is a precise powerful amateur astronomer telescope. It demands a careful handling and certain knowledge in the field of astronomy. Only in this case user will be fully satisfied.

When buying the telescope one should pay attention to the package safety ensured by the seal of the manufacturing plant. After unsealing the case one should check compliance of the complete set denoted in the list of enclosure. Prior to using the telescope one gets acquainted with its handling and order of operation.



2. SPECIFICATIONS

Name	ТАЛ-150К	ТАЛ-200К
Diameter of objective lens (operating aperture), mm	150	200
Focal length, mm	1500	2000
Relative aperture	1:10	1:10
Magnification and angle field of view (changeable):		
- with the eyepiece f'=25 mm	60^{x} 40'	80^{x} 30′
- with the eyepiece f'=10 mm	150^{x} 16′	200^{x} 12′
- with the eyepiece f'=25 mm and Barlow lens	120^{x} 20′	160^{x} 1 5 ′
- with the eyepiece f'=10 mm and Barlow lens	300^{x} 8′	400^{x} 6 ′
Photographic angle field of view	40′ (23.3mm)	40′ (23.3mm)
Screening of pupil in center	13%	12%
Resolution limit	0.8″	0.6″
Pellucid capacity	12.8^{m}	13.4^{m}
Angular field of view of the finderscope	8°	7°
Magnification of the finderscope	6^{x}	8^{x}
Length tube, mm	425	550
Weight of the telescope, Kg	7.5	11

3. STANDARD EQUIPMENT

Name	Qty
Telescope	1
Supply unit	1
Eyepiece of f'=25mm	1
Finderscope	1
Accessories and Parts	
Eyepiece of f'=10 mm	1
Barlow lens	1
Reticle	1
Blind	1
Bushing	1
Adapter	1
Stopper	1
Housing	1
Service manual	1

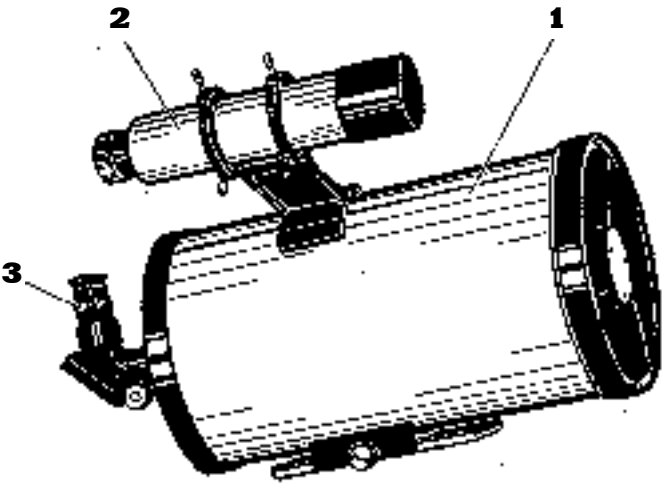


Fig.1. **General view:**

1 – telescope tube; 2 – finderscope; 3 – eyepiece

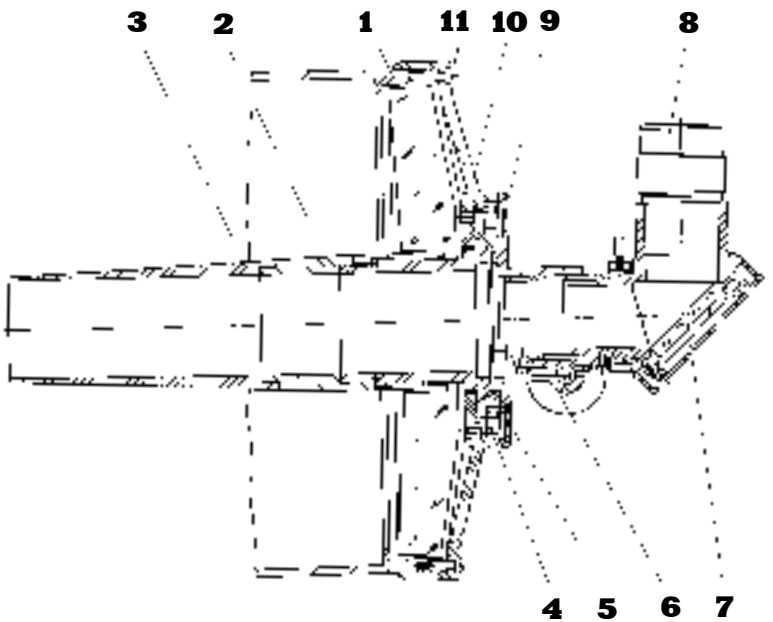


Fig.2.**Assemble ofprimarymirrortogetherwitheyepiece set:**

1 – mirror; 2 – bushing; 3 – blending tube; 4 – screws;
5 – ball hinge; 6 – focusing mechanism; 7 – diagonal mirror; 8 – eyepiece;
9 – cover; 10 – back flange; 11 – screw

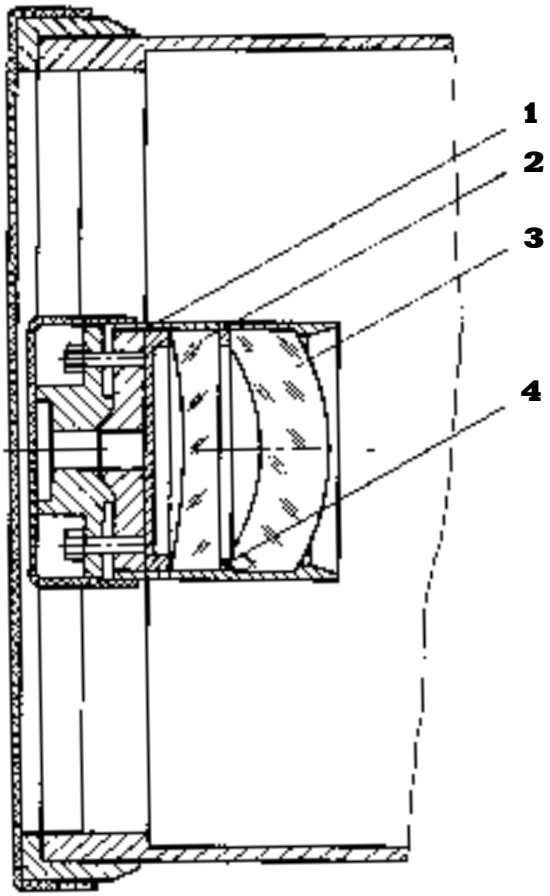
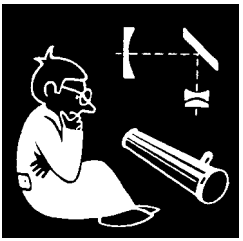


Fig. 3. **Corrector:**

1 - mounting; 2 - reflecting lens; 3 - meniscus lens; 4 - padding ring



4. DESIGN AND PRINCIPLE

The tube 1 (fig.1) is the basic part of the telescope, which embodies the optical units such as a primary mirror, corrector, eyepiece set and finderscope.

The primary mirror 1 (fig. 2) is fastened with the collet bushing 2 in the center hole. The blending tube 3 on the collet bushing prevents stray light.

The corrector (fig.3) consists of reflecting lens 2 and meniscus lens 3 spaced by means of padding rings 4 in the mounting 1.

Eyepiece set (fig.2) consists of focussing mechanism 6, diagonal mirror 7, set of symmetrical eyepieces f'=25mm and f'=10mm with barrel diameter 31.8mm (1.25"), Barlow lens mounted in the same one.

Finderscope 9 (fig.1) is a telescope with 6^x (8^x) magnification and view field 8° (7°).

5. OPTICAL TRAIN

Telescope is developed on the basis of Klevzov's original optical train, which does not use any aspherical surfaces. Klevzov's optical train (fig.4) consists of primary concave mirror 1 and correcting unit consisting of two single lenses 4,5. The lens 5 is made in form of negative meniscus directed by concave side to the observed object. The lens 4 is negative one having a reflecting surface.

Reflecting from the primary mirror 1 a beam passes through correcting lenses 4,5, reflects from the reflecting surface of lens 4, passes through correcting lens forming an image of observed object in the focal plane which is located behind a primary mirror 1.

In the main the Klevzov's optical train is an improved Kassegran optical train, which has a spherical primary mirror and double lens corrector having a reflecting surface that to allow reducing an aberration. A meniscus 5 corrects a spherical aberration and coma and fully compensates a little longitudional chromatic aberration with the help of negative lens 4. Because two lenses of corrector are made of the same mark of glass a secondary color of system is extremely little one, and correction of the residual aberration is perfect that to allow obtaining an image of observed object which can be compared with the image of object obtained with the help of mirror telescope. Besides, Klevzov's optical train is not subject to unadjastment.

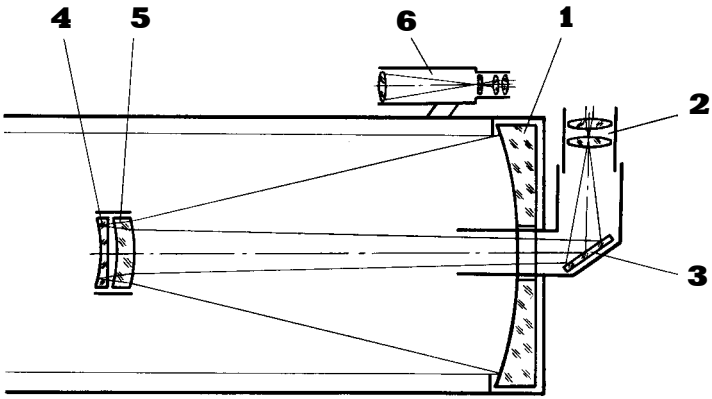
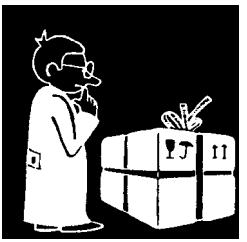


Fig. 4. **Optical train of telescope:**

1 - primary mirror; 2 - eyepiece; 3 - diagonal mirror;
4 - reflecting lens; 5 -meniscus lens; 6 - viewfinder

The lacks of aspherical surfaces, high quality of correction of the residual aberration in the wide range of spectrum and small length are indisputable advantages of Klevzov's optical system, that to allow satisfying all requirements of amateur astronomer.

Telescope is completed with two symmetrical eyepieces f'=25mm and f' = 10 mm and 2^{x} Barlow lens. For easy observation of celestial objects near by zenith an eyepiece set of telescope is turned to optical axis of tube by 90° with the help of diagonal mirror 5. To locate an object in the center of view field the telescope is completed with finderscope 6, which consists of objective lens, reticle with the cross and eyepiece.



6. TELESCOPE ASSEMBLING

Prior to assembling the units and parts should be cleaned from the sluicing compound of the plant.

The telescope is assembled in the following way.

The finderscope is mounted on the tube in two rings and fixed with six set screws available on the rings.

In transportation and storage a hole in the eyepiece tube is plugged with a stopper which should be removed and put in the case in preparation for operation.

For obtaining the required magnification of the telescope the respective eyepiece or the eyepiece with Barlow lens (fig. 4) is inserted in the eyepiece tube.

7. ORDER OF OPERATION

7.1. Operation with telescope

The magnification of the telescope is large and consequently its field of view is low. Therefore the telescope is provided with the viewfinder.

The optical axes of telescope and viewfinder must be aligned. Set the reticule 8 (fig.5) into the eyepiece 25 mm and then mount them into the focuser. Aim the telescope at a remote object. Align the object's image with the crosshair by means of six setting screws.

After aiming of polar axes the setting circles can be used to find a celestial object by its coordinates.

7.2. Photographic observations

Photographing star fields is carried out with the use of the telescope in the main focus. To make it one should use a small size 35-mm camera or other devices having fitting thread of 42x1.0mm or 42x0.75mm. To mount a camera it is necessary to remove eyepiece from tube and to mount a bushing with the thread 10 (fig.5) of 42x1.0mm. If it is necessary one should mount an adapter 9 on the bushing when using the telescope with camera provided with the thread 42x0.75.

Mounted a camera one should make a focus it and to balance the telescope.

The exposures, which are required for photographing the star fields, are tenths of minutes without hindrance of the street lighting. Therefore, for this period of time one should see to it that the camera follows the sky precisely in its diurnal rotation. Near the center of the field of view of the camera one chooses the bright star to which the telescope is pointed. To keep the star on the reticle cross hairs of the finderscope is the problem for an observer for the whole period of exposure. As the cross-hairs of the finderscope is not illuminated, the image of the guide stair should be slightly defocused in order to cross a light circle of the unsharp image of the star by the cross-hairs and to keep the star in this position for the period of exposure.

One applies minor corrections for a clockwork drive keeping the star on the cross hairs for the whole period of exposure. One corrects the position of the guide star with the micrometer screw of the declination axis if necessary. To obtain the minimum corrections in declination the polar axis should be set as precisely as possible to the celestial pole. One should remember that if the polar

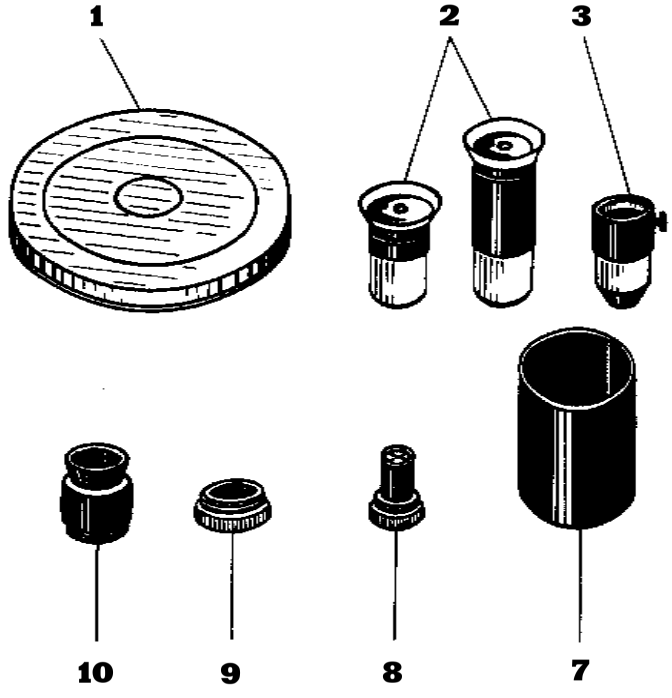


Fig. 5. **Tools and accessories:**

1 – cap; 2 – eyepieces; 3 – Barlow lens; 7 – blind; 8 – reticule; 9 – adapter; 10 – bushing

axis is set incorrectly, even in the case when the star image is kept on the cross-hairs, the images of the stars at the edges of the field of view appear as dashes.

7.3. Telescope and atmospheric conditions

Telescope has a high magnification. In this case one should remember the following feature. When increasing a magnification of telescope a distortion of image to be made by aerial heterogeneity becomes more visible. It is a scintillation and distortion of image of remoted objects, scintillation and distortion of image of stars, reduction of sharpness of small parts of Moon and stars. So, one should make a testing of telescope resolution by double pares of equal brightness and permeability by photometric standards, observation of little contrast parts of planets in good atmospherical conditions such as calm, high transparence of atmosphere and low turbulent air torrents.

Because a resolution of telescope is sufficiently high the testing should be made in atmospherical conditions which are valued by Pikering's scale. It is 6 scopes that to allow obtaining the satisfactory and good images when diffractional disk of star is visible constantly.

There are some meteorological factors, which can reduce a quality of image such as mist, dust and so on. These factors reduce a transparence of atmosphere that to reduce a permeability of telescope considerably. This factor is especially noticeable in observation of remoted objects, but sharpness of image is not changed.

It is not necessary to remind that observation through the window is possible if the ambient temperature in the room and temperature out of door are not different. Otherwise the warm air coming out of the window deteriorates the images so that observations are impossible whatsoever. Besides, inequality of surfaces of window can distort an image.

If it is necessary to make an observation out of door, one should stay the telescope in the street within 30 minutes so that all parts of telescope have the same temperature.

In observation at cold damp nights a moisture can penetrate into the telescope tube. If the telescope is covered, optical surfaces can get misted under direct sunlight. So, one should protect the telescope from the direct sunlight. It is recommended to stay it in dark cold room for some time. But if the mirror got misted it is not necessary to wipe it. One should open the telescope and stay it within 30 minutes in daylight. The moisture is evaporated in full.

After operation one should pack the telescope and store it according to the rules of storage.

8. MAINTENANCE

For faultless operation the telescope should be kept in cleanness and protected against mechanical damage. The metal surfaces are periodically cleaned by using clean soft napkins, then wiped with a napkin impregnated with acidless vaseline, after that with a dry napkin.

The aluminized mirrors require particular care. The accumulated dust is removed only with the use of a soft brush or cotton wool tampon. If a visual inspection reveals the need to clean the main mirror prepare it as follows: remove the eyepiece assembly with gearing, remove the screws 11 (fig. 3), mark the position of thread holes in mirror assembly for following reassembly, extract the mirror assembly and place it with mirror surface upward. Clean the surface with soft brush and then with cotton wool swab wetted with ether or alcohol. Residual cotton fibers can be removed by air blasting.

The reassembly is done in reverse order. To avoid a readjustment of main mirror the position of mirror assembly must correspond to the mark made previously.

The corrector should not be disassembed for cleaning. In the case of need the meniscus surface is cleaned with removed main mirror assembly.

A cleaning of optical parts and adjusting of telescope is prohibited before warranty expiration. It requires care and thoroughness and should be fulfilled in the case of absolute necessity only.

After unintentional disalignment, cleaning or reassembling an adjustment of the telescope can be need. In that case remove the cover 9 (fig.2), aim the telescope at a star of $4\text{-}5^{m}$ at maximal magnification and adjust the mirror 1 on ball hinge 5 by means of adjusting screws 4 to get diffraction image of the star.

To adjust the primary mirror 1, loosen three of the screws 4 (next nearest order) by one or two turns and use the others three for adjusting. Loosen or tighten according screws depending on deformation direction of focused star image. Needed screw and action is found easy by trial method. Do not loosen or remove all six screws since the mirror can fall out.

If weather does not allow viewing stars, the adjustment can be made with slight defocused image. For such image proper adjustment is achieved when energy is distributed uniform around center.

After adjustment, tighten all screws successively when viewing and in the case of need correcting diffraction image of the star. Set the cover 9.

Remember that the adjustment procedure requires some experience and skill.

9. RULES OF STORAGE

It is recommended practice to store the telescope in the heated room with the relative humidity of maximum 80% at the temperature from 5° C to 40° C.

It is recommended to avoid any strokes and shakes.

It is forbidden to store any acid, alkali and materials educing moisture or chemical active gas and streams.

10. ACCEPTANCE CERTIFICATE

Telescope serial . . . . . is found fit for service.

Date ofmanufacture andslushing_____

Signatures _____

Table of close stellar pairs for testing image quality of the telescope

Name of star	Coordinates		Magnitude, m	Visible distance, ang. s.	Constellations
	h, m	ang. degrees, ang. min.			
αPsc	$1^h59.4^m$	+02°31′	4.3-5.3	1.9′′	Pisces
γCet	$2^h40.7^m$	+03°02′	3.4-4.4	2.8′′	Cetus
ξOri	$5^h38.2^m$	-01°58′	2.0-4.2	2.5′′	Orion
αGem	$7^h31.4^m$	+32°00′	2.0-2.8	1.8′′	Gemini
εHyd	$8^h44.1^m$	-06°36′	3.5-6.9	2.9′′	Hydra
σ^2Uma	$9^h06.0^m$	+67°20′	4.9-8.2	2.7′′	Ursa Major
38Lyn	$9^h15.8^m$	+37°07′	4.9-6.0	2.8′′	Lynx
ξUma	$11^h15.6^m$	+31°49′	4.4-4.8	2.9′′	Ursa Major
ξBoo	$14^h38.8^m$	+13°56′	4.6-4.6	1.2′′	Bootes
εBoo	$14^h42.8^m$	+27°17′	2.7-5.1	3.0′′	Bootes
μDra	$17^h04.3^m$	+54°32′	5.8-5.8	2.2′′	Draco
τOph	$18^h00.4^m$	-08°11′	5.4-6.0	2.0′′	Ophiucus
70 Oph	$18^h02.9^m$	+02°31′	4.0-6.0	2.4′′	Ophiucus
ε^1Lyr	$18^h42.7^m$	+39°37′	5.1-6.2	2.7′′	Lyra
ε^2Lyr	$18^h42.7^m$	+39°37′	5.1-5.4	2.2′′	Lyra
δCyg	$19^h43.4^m$	+45°00′	3.0-6.5	2.2′′	Cygnus
μCyg	$21^h41.9^m$	+28°30′	4.7-6.1	1.8′′	Cygnus
ξAqr	$22^h26.3^m$	-00°17′	4.4-4.6	1.8′′	Aquarius