



TELESCOPE•TELESKOP  
TELESCOPE

ТАСМ



PRODUCTION AMALGAMATION  
"NOVOSIBIRSK INSTRUMENT-MAKING PLANT"



Order-narjad No. . . . .

# TELESCOPE ТАЛ-М

SERVICE MANUAL

3.807.010 РЭ





# CONTENTS

	Page
1. General Directions . . . . .	3
2. Specifications . . . . .	3
3. Standard Equipment . . . . .	4
4. Telescope Design and Principle of Operation . . . . .	4
4.1. Telescope Design . . . . .	4
4.2. Principle of Operation . . . . .	6
4.3. Optical Train . . . . .	6
5. Order of Operation . . . . .	9
5.1. Telescope Assembling . . . . .	9
5.2. Operation with Telescope . . . . .	9
6. Maintenance . . . . .	10
7. Possible Derangements and Methods of Their Elimination . . . . .	11
8. Rules of Storage . . . . .	12
9. Acceptance Certificate . . . . .	12

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

## ATTENTION!

The telescope forms an inverted image like any astronomical instrument does.

The direct observations of the Sun are permitted only with the use of a black light filter.

# 2

# 1

### GENERAL DIRECTIONS

Telescope ТАЛ-М (hereinafter in the text referred to as "telescope") is designed for visual observations of the celestial objects and phenomena which take place there.

The telescope can be used for individual observations by amateur astronomers and in astronomical circles.

The telescope can operate normally at the ambient temperature from 30 to minus 30°C and relative humidity of maximum 80 per cent when it is fine.

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 whether the telescope serial number is in compliance with the number shown in the service manual as well as whether the complete set is in compliance with the list of enclosure which is available inside the case.

Prior to using the telescope one should get acquainted with the present service manual.

### SPECIFICATIONS

Diameter of the primary mirror, mm	80	
Relative aperture	1:6.58	
Focal length of the primary mirror, mm	526	
Resolution, ..."	1.85	
Limiting magnitude	12 <sup>m</sup>	
Visible changeable magnification of the optical system	×20.8; 35; 96.8; 139	
Angle of field of view at magnification:		
20.8	2°18'	4 mm
35	1°24'	2,3 mm
96.8	0°28'	0,8 mm
139	0°21'	0,6 mm
Visible magnification of the finderscope	×5	
Angle of field of view of the finderscope, ...°	8	
Range of the slow-motion control relative to both axes, ...°	±5.5	
Minimum distance of observation, m	80	
Overall dimensions, mm, maximum;		
length	530	
width	500	
height	1,400	
Mass of the telescope, kg, maximum	12	



## STANDARD EQUIPMENT

Designation	Name	Qty
3.807.009	Telescope	1
5.923.459	Eyepiece of F=25 mm	1
6.126.112	Support	3
6.367.062	Hinge	1
6.452.087	Tube	1
9.067.100	Post	1
<b>Changeable parts</b>		
5.923.458	Eyepiece of F=15 mm	1
5.932.551	Barlow lens	1
5.940.608	Yellow light filter	1
-01	Black light filter	1
-02	Blue light filter	1
-03	Red light filter	1
6.434.379	Mount	1
<b>Accessories</b>		
6.395.096	Wrench	1
6.057.207	Cap	1
-01	Cap-diaphragm	1
8.057.208	Cap	1
6.890.030-08	Screwdriver	1
	Brush	1
<b>Market Containers</b>		
4.161.856	Case	1
<b>Service Documents</b>		
3.807.010 PЭ	Service manual	1

TELESCOPE DESIGN  
AND PRINCIPLE OF OPERATION

## 4.1. TELESCOPE DESIGN

The telescope consists of the following units: a telescope tube, universal mounting, post with three supports, hinge.

**Tube 1** (Fig. 1) is the basic part of the telescope where the following optical pieces are mounted: a primary spherical mirror, plane diagonal mirror, finderscope combined with a focusing mechanism. Eyepieces and Barlow lens are inserted in the focusing mechanism.

The primary mirror (Fig. 2) is placed in the cell and can be adjusted with the help of screws 1 and 2 if necessary.

The diagonal mirror (Fig. 3) is mounted on the bracket and can be adjusted with the use of screws 1 and 2 if necessary.

The inlet of the tube is to be covered with cap 7 (Fig. 6) after operation.

Finderscope 2 (Fig. 1) operates together with eyepiece 3 and is composed of an objective and diagonal mirror 6 (Fig. 4).

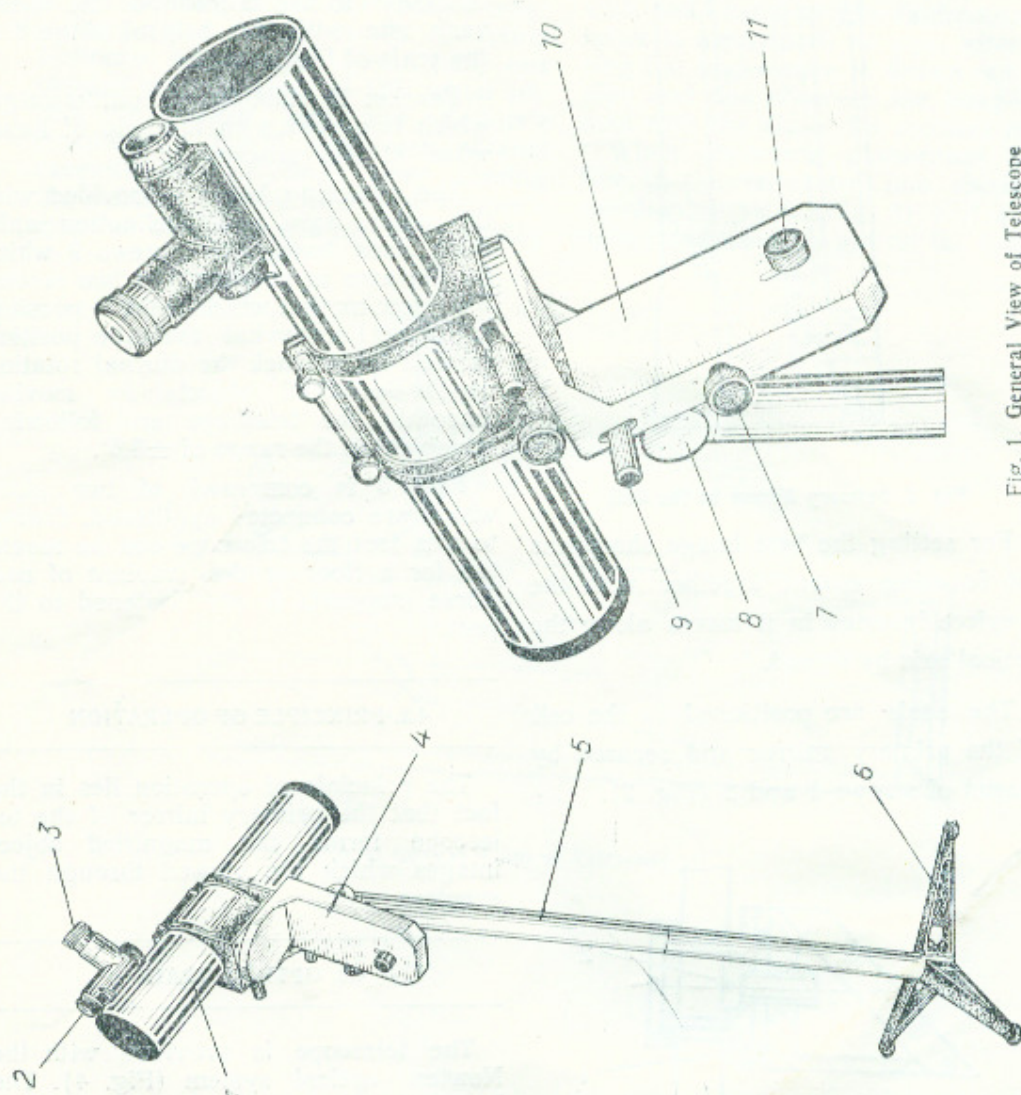


Fig. 1. General View of Telescope



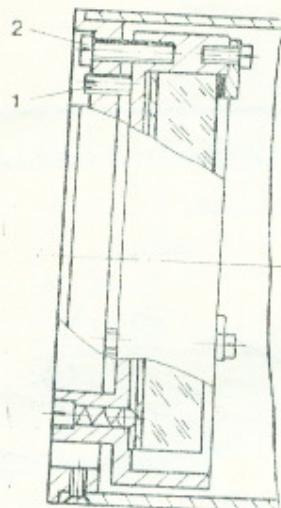


Fig. 2. Primary Mirror in the Cell

For setting the best image sharpness the focusing mount together with the eyepiece inserted in it moves along the optical axis by thread.

The seals are positioned on the cell of the primary mirror and secured by means of screws 1 and 2 (Fig. 2).

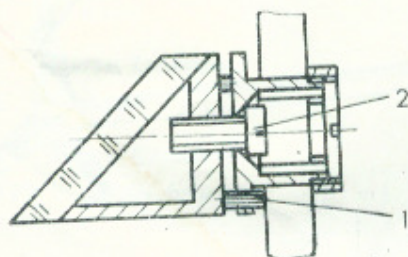


Fig. 3. Diagonal Mirror

Universal mounting 4 (Fig. 1) can be used as an altazimuth or equatorial mounting. It is possible to set the telescope to the latitude of the observer's site with the help of hinge 8 of the scale of latitudes.

Bracket 10 embodies a counterweight which is moved with the help of hand-wheel 11 after unscrewing it.

The mounting head is provided with the polar axis and declination axis. Both axes have lock screws 9 which fix the axes in position and two screws 7 of slow motion which make it possible to correct somewhat the tube position as well as to track the diurnal rotation of the celestial objects by moving smoothly the telescope and following the object in the range of  $\pm 5.5^\circ$ .

Post 5 is composed of two pipes which are connected by thread. Owing to this fact the telescope can be mounted for a floor or desk variant of use. Three supports 6 are fastened to the post.

#### 4.2. PRINCIPLE OF OPERATION

The principle of operation lies in the fact that the primary mirror of the telescope forms the magnified object images which are viewed through the eyepiece.

#### 4.3. OPTICAL TRAIN

The telescope is provided with the Newton optical system (Fig. 4). The beam of rays enters the tube, falls on primary spherical mirror 1 and, after reflecting from it, forms a cone of rays

which reflects at  $90^\circ$  from plane diagonal mirror 2 and gets in eyepiece 3.

By putting the eyepiece of  $F=25$  mm in the focusing mount one obtains magnification of  $\times 20.8$ ; when inserting Kellner's eyepiece of  $F=15$  mm, one obtains magnification of  $\times 35$ ; when setting the Barlow lens and Kellner's eyepiece of  $F=15$  mm, one obtains magnification of  $\times 96.8$ ; when placing the Barlow lens, a cell and Kellner's eyepiece of  $F=15$  mm in the focusing

mount, one obtains magnification of  $\times 139$  (see Fig. 5).

When the objects are to be searched with the help of the finderscope, the latter is moved into its pipe, after pointing the finderscope is drawn out of its pipe and one observes the images formed with the aid of the primary mirror.

When observing phenomena on the Sun in the telescope, one should use cap-diaphragm 6 (Fig. 6) and a black light filter which is put on the eyepiece.

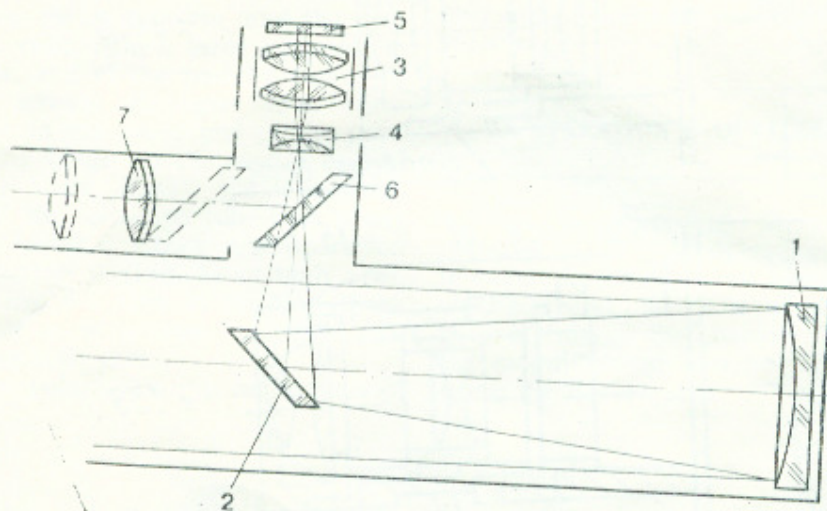


Fig. 4. Optical Train of Telescope



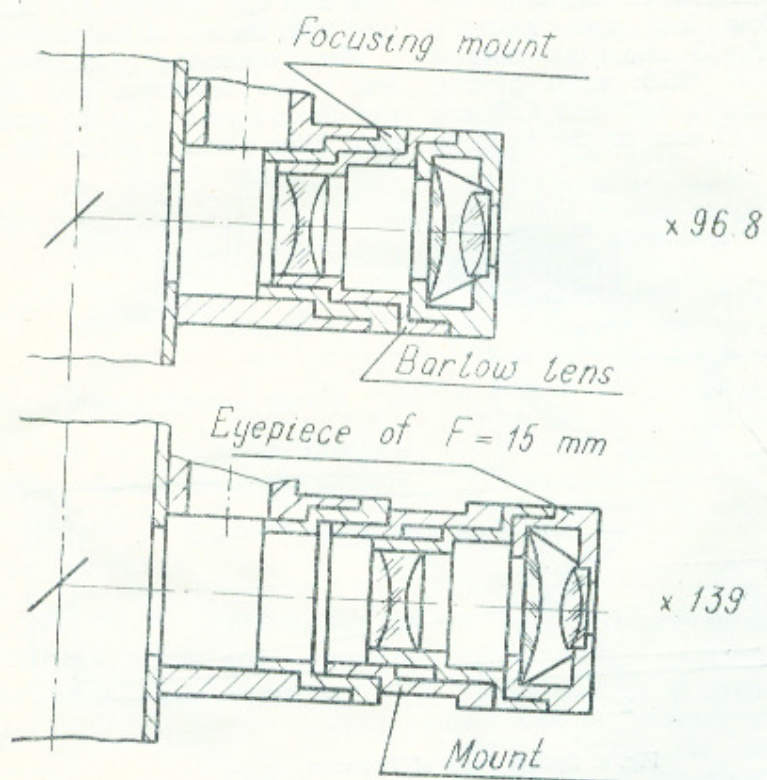


Fig. 5. Diagram of Setting Magnifications

## ORDER OF OPERATION

### 5.1. TELESCOPE ASSEMBLING

Prior to assembling clean the units and parts from the slushing compound of the manufacturing plant.

Assemble the telescope as follows.

Remove three supports and the post from the case. Attach three supports to the lower end of the post by means of captive screws through three holes available on the lower end of the post. Screw the hinge on the upper end of the post, then install the mounting. Take out the telescope tube and insert it in the bracket. Check the operation of lock screws 9 (Fig. 1) of both axes. After fixing the axes in position check the operation of screws 7 of slow motion along both axes.

Set the polar axis by inclination of

the mounting by the scale of latitudes. To perform this unscrew a cap on hinge 8 (Fig. 1) with the use of wrench 8 (Fig. 6), untighten a nut and incline the axis to the latitude of the observer's site and point it to the celestial pole (Polaris). Then tighten the nut again, screw in the cap. When observing earthly objects and searching comets, it is better to set the polar axis vertically. Insert the eyepiece or the eyepiece with the Barlow lens in the focusing mount.

The image quality can be checked only out of doors by sufficiently remote objects.

### 5.2. OPERATION WITH TELESCOPE

Prior to observing at night it is required to train in operation with the telescope in the day time using the local objects. First use low magnifications without using the Barlow lens, then the magnification can be increased by using the Barlow lens.

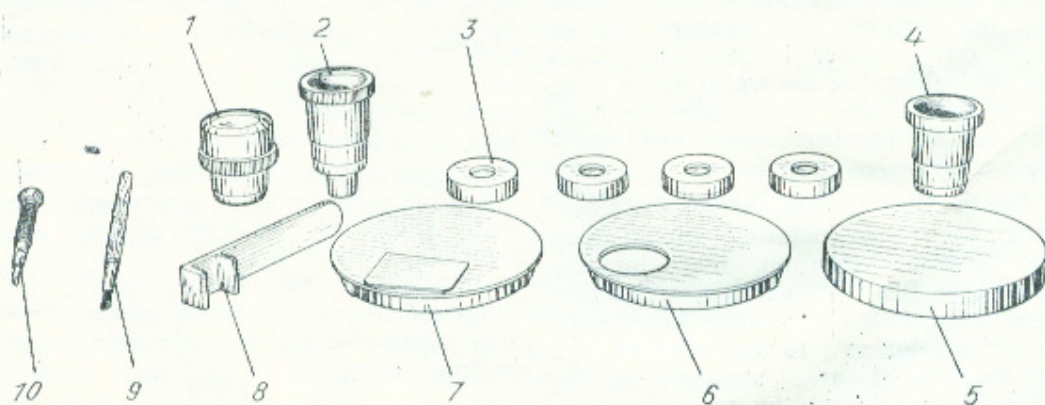


Fig. 6. Tools and Accessories:

- 1 — eyepiece of  $F=15$  mm; 2 — Barlow lens; 3 — light filters; 4 — mount; 5 — cap;  
6 — cap-diaphragm; 7 — cap; 8 — wrench; 9 — brush; 10 — screwdriver



Low magnifications are used when a large field of view is required. Usually it occurs in observations of star clusters, nebulae, comets, the Sun and the Moon.

One should keep in mind that in observations of the local objects in the day time the image quality is distorted very much with haze or currents of warm air, therefore one has to use only low magnifications.

The telescope mirror is sensitive very much to the sharp fluctuations of temperature, therefore in winter after putting the telescope out of doors keep it for 10–15 minutes idle in order to make the mirror acquire the ambient temperature, then observations are carried out. But in observations out of doors the great disturbance of atmosphere may take place at night, that leads to bad images of the celestial objects. It is quite possible that at those nights the observations of the fine details of the planets and the Moon are unsuccessful.

The observations in the cold seasons through the window of the room make sense if the temperature in the room and the ambient temperature out of doors do not differ in more than 2–3 degrees, otherwise the warm air coming out of the window deteriorates the images so that the observations are impossible whatsoever.

For qualitative observations the telescope should be installed on an even site to avoid vibration, sharp impacts (pushes). Best of all it is a concrete section of 1.5×1.5 m size. After pointing the polar axis to the celestial pole the position of three supports of the telescope post should be marked on this site. It is enough to mount the telescope out of doors according to the marks on the concrete.

# 6

## MAINTENANCE

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

The aluminized mirror requires particular care. The accumulated dust is removed only with the use of a soft brush or cotton wool tampon. Cleaning should be carried out without excessive effort to avoid formation of thin scratches on the mirror surface which deteriorates the image. If some fat spots are found on the mirrors, never wipe them. In this case the mirrors are to be washed. The primary mirror (Fig. 2) is taken out of the tube after undoing the screws which fix the cell to the tube. Without removing the mirror from the cell, the mirror surface is wetted considerably with pure alcohol with the help of a cotton wool tampon, then wiped without excessive effort, then the mirror is put under a stream of pure water and dried. The drops of water are removed with a blotter by touching them slightly with a blotter corner. The diagonal mirror is cleaned in the same way. After cleaning the mirrors are put in their places.

The eyepiece lenses are given an anti-reflection coating. The lenses are wiped with a dry linen napkin. The fat spots are removed with a cotton wool piece



impregnated with alcohol.

**One should dismantle the optics only in case of necessity.**

In non-operating position the telescope tube must be covered with the caps from both ends.

Two interperpendicular axes of the mounting head should be regularly lubricated with vaseline oil once in two years. All screws used in the telescope are secured with butvar-phenolic adhesive БФ-4. In order to undo the screw one should use a drop of alcohol.

## 7

### POSSIBLE DERANGEMENTS AND METHODS OF THEIR ELIMINATION

When manufacturing the telescope at the plant, the optical pieces are carefully set (adjusted) relative to each other. However in the process of transportation or in case of great impacts the optical pieces may be displaced (the adjustment is disturbed). In this case it is required to readjust the telescope. Before this operation one should remove the eyepiece from the eyepiece pipe, push out the finderscope and check whether the mirrors are displaced from the given places. For this purpose it is necessary to look through the eyepiece pipe. If the telescope is adjusted, the plane diagonal mirror must be concentric relative to the brim of the focusing mount. The reflection of the primary mirror in the diagonal one must be concentric as well. The ref-

lection of the diagonal mirror together with the post is visible in the primary mirror. This reflection must be at the centre of the primary mirror. If the reflection is displaced, adjustment is required. In adjustment it is required to correct the position of the diagonal or primary mirror. If the image of the primary mirror in the diagonal one is non-concentric, it is necessary to change the position of the diagonal mirror. For this purpose one undoes screw 2 of the cell of the diagonal mirror (Fig. 3) and, operating with one of three screws 1, brings the reflection of the primary mirror in the diagonal one to the centre of the diagonal mirror.

If the position of the primary mirror is disturbed, the reflection of the diagonal mirror together with the post is seen not at the centre. In this case one undoes screws 2 of the cell of the primary mirror and, by operating with three screws 1 (Fig. 2) sets the primary mirror so that the reflection of the diagonal mirror in it is found at the centre (becomes concentric). After setting the mirror in the correct position, one fixes the cell in position by means of screws 2. The telescope adjustment requires care and knowledge and should be carried out only in case of emergency, when it is clear that the telescope is misadjusted.

If the observations at high magnifications are difficult due to the unsharp image of the star, it may be caused by great disturbance of atmosphere. The telescope should be pointed to the zenith and one observes the stars in this case. If they are sharply seen, the observations should be carried out at more calm nights.



## RULES OF STORAGE

It is recommended practice to store the telescope in the heated premises with relative humidity of maximum 80

per cent at the ambient temperature from 5 to 40 °C.

The impacts and sharp shaking should be avoided.

It is forbidden to store the telescope together with acids, alkalies, matters which liberate moisture or chemically-active gases and vapours.

## 9. ACCEPTANCE CERTIFICATE

Telescope ТАЛ-М, serial No. 0309, is found fit for service.

Date of manufacture \_\_\_\_\_

Signatures \_\_\_\_\_

06-95

Телескоп ТАЛ-М. Руководство по эксплуатации на английском языке.