



**LRB 20 000**  
**LONG RANGE**  
**LASER RANGE**  
**FINDER**  
**BINOCULAR**

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## IMPORTANT INFORMATION

### Read prior to activation

You have just purchased a complicated electronic device. To operate it properly, please read this manual carefully. Here are some common precautions that must be noted.

- **NEVER** subject the unit to impact while operating or being transported
- **NEVER** aim the unit at the sun
- **NEVER** measure ranges to mirror reflecting surfaces
- **NEVER** touch optical surfaces with fingers
- **NEVER** operate the range finder unless optical surfaces are free from dirt and condensed moisture
- **NEVER** transport the unit without the case
- **NEVER** disassemble the unit. This device contains high voltage components, which may be hazardous to you!
- **NEVER** reverse the polarity of a battery
- **ALWAYS** remove batteries when not in use for a long period
- **ALWAYS** store in a warm dry place when not in use

## Features of the LRB 20 000 Laser Range Finder Binoculars

- Digital Data Output
- First or Last Target Indication
- Built-in Compass
- Light Weight
- Rugged
- Meet all Military Specifications

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BEFORE USE CAREFULLY READ ALL THE INSTRUCTIONS!

FAILURE TO OBEY THE INSTRUCTIONS WILL VOID THE WARRANTY!

### 1. BRIEF DESCRIPTION

**RANGE FINDER BINOCULARS LRB 20 000** is an advanced Laser Range Finder system that provides instant distance measurements consistently and accurately. The stereoscopic device provides convenient observation with both eyes. Simultaneously, the user can measure the distance to an object without losing Binocular of the target. Therefore, the LRB 20 000 substitutes a need for two separate devices (binocular and range finder) combining both requirements in a single device.

Upon receipt of the range finder and prior to operation the user should proceed as follows:

- check to see that the seals on the wooden and metallic packaged are intact;
- Check completeness of the range finder against Section 5 of Operating instructions;
- Check to see that the serial number of the range finder tallies with that indicated in Sections 3, 17 to 19;
- Make sure that the optical surfaces are free from grease stains, dirt, cracks and condensed moisture. Remove dirt and grease as directed in item 1 of table 11.1;

- Inspect the range finder exterior for physical damage (no cracks, dents, deep rust are admitted);
  - Check the dehydrator for working condition.
- If the silica gel is pink in color, replace it with the new one taken from individual SPTA set (item 11.6.3);
- Place the battery in operation as directed in Section 16 of Operating instructions.
- (The Rechargeable battery is supplied uncharged).

**To secure trouble-free operation of the range finder:**

- Be prompt in replacing the Rechargeable battery by freshly charged when the red LED in the left-hand eyepiece of the range finder starts to illuminate;
- Keep the range finder dry at all times especially in the cold season of the year;
- After exposure to subzero temperatures keep the range finder at room temperature for at least two hours before unpacking and then mop up the condensed moisture;
- While operating the range finder at temperatures above 35° C and exposing to direct sunrays, attach cover AEP 42.63.021 taken from individual SPTA set to keep away sunlight. Moistening the cover with water is permitted to cool off the range finder.

After replacement of emitter and (or) control circuit board make entries in Section 4 of Operating instructions as to their new serial numbers and basic characteristics.

**The following abbreviations are used herein:**

- AC ckt – automatic control circuit,
- AI – Angular Mount,
- CD – charging device,
- DCC – direct current converter,
- ER "0" – zero elevation reference,
- F ckt – firing circuit,
- IDA – information display assembly,
- OP – observation post,
- PD – protective device,
- PhD – photodetector (assembly),
- SB – Rechargeable battery,
- SPTA – spare parts, tools and accessories,
- TSGC – time sensitivity gain control,
- TIC – time-interval counter.

**2. PURPOSE**

2.1. Binoculars range finder LRB 20 000 AEP 36.28.001 is a device of industrial-technical purpose and designed for ground surveillance, observation of individual targets and measurement.

2.2. The range finder complete with the Angular Mount is designed for referencing ground location point by the predetermined landmark coordinates and is capable of:

- measuring horizontal angles and magnetic azimuths;
- measuring vertical angles and angles of elevation;
- determination of target and landmark polar coordinates;
- polar-to-rectangular landmark and target coordinate

conversion and determination of the OP and target coordinates from the predetermined landmark coordinates.

2.3. The range finder may find application in geological and engineering survey, repair works, maritime navigation, meteorology and tourism.

2.4. The range finder is operable in the temperature range between -40 and +50° C, relative air humidity of up to 98% (as taken at 35° C), air pressure of 61 kPa (460 mm Hg) minimum, and in the sea mist conditions.

2.5. Power to the range finder is supplied from rechargeable battery 10 D-0b55C-1. It may also be powered from a vehicle electrical system providing (27±2.7) V, or non-rechargeable battery producing 12 to 14.5 or 22 to 29 V.

**3. TECHNICAL CHARACTERISTICS**

Parameter	Rated and tolerable value	Actual value
1. Binocular magnification	(7±0.3) <sup>x</sup>	
2. Binocular angle of vision	6.7°±20'	
3. Range measurement limits, m	100 to 20,000	
4. Measurement error, m, max	±10	
5. Angle measurement range, mils, min		
- in azimuth	±30.00	
- in elevation	± 5.00	
6. Supply voltage to generate "Low Battery" light warning circuit operation, V	11±0,3	
7. Time of preparation for range measurement upon depressure of MEASURE button, s, max	3	
8. Range information memory storage time, s	3 to 5	
9. Capacity of pumping capacitors, µF	18 to 22	
10. Compass correction, mils	0.05	
11. Mass, kg, max	2.5	
12. Overall dimensions, mm, max	110x215x225	
13. In-service operating life, measurements, minimum	50,000	

EMITTER:

Parameter	Ambient temperature		
	-40° C	Normal Conditions	50° C
1. Minimum operating pumping voltage $U_{oper.min.}, V, max$			
2. Maximum operating pumping voltage $U_{oper.max.}, V, max$			
3. Pumping voltage temperature coefficient $TKH_n, V/^{\circ}C$	-		-
4. Capacity of storage capacitors $C_c$ of emitter test set, F	-		-

CONTROL CIRCUIT BOARD:

Ambient temperature, ° C	Pumping voltage $U_{pump.}, V$
-40	
Normal conditions	
50	

**4. SUPPLIED ACCESSORIES**

Table 4.1

Description	Designation	Q-ty	Serial No.	Remarks
1. Range finder	AEP 41.46.712	1		
2. Tripod (optional)	G 42.14.067	1		
3. Angular Mount (optional)	G42.21.812	1		
4. Rechargeable battery	10D-0,55C-1	2		
5. Fuse link VP1-1 1,0 A 250 V		5		
6. Sealing ring	G 68.79.193-02	2		
7. Framed lens	G 44.21.885	1		
8. Membrane	AEP 75.48.092	2		
9. Eye shield	G 47.92.131	2		
10. Diaphragm	AEP 73.54.031	1		
11. Pencil TM, M, CT, T		1		
12. Wrench	AEP 87.61.505	1		
13. Synthesized fibre brush KXOOK No. 7		1		
14. Coordinate converter	G 42.41.211	1		
15. Cable	AEP 48.44.037	1		
16. Cable	AEP 48.44.038	1		
17. Cable	AEP 48.44.039	1		
18. Cable	48.44.040	1		

Table 4.1, continued

Description	Designation	Qty	Serial No.	Remarks
19. Cable	AEP 48.44.120	1		
20. Eraser		1		
21. Cloth	G61.93.516	2		
22. Charging device	AEP 43.79.608	1		
23. Protection device	AEP 43.79.607	1		
<b>Materials</b>				
24. Silica gel, indicating GOST 8984-75		50 g		
<b>Package</b>				
25. Package	AEP 42.86.186	1		
26. Package	AEP 42.83.368	1		
27. Package	AEP 42.86.184	1		
28. Casing	G 42.62.345	1		
29. Casing	AEP 45.71.018	1		
30. Cover	AEP 42.63.021	1		
31. Cover	AEP 42.63.030	1		
32. Cover	G 42.63.332	1		
<b>Documents</b>				
33. Operating Instructions	AEP 36.28.001 PE	1		

## **5. APPEARANCE OF THE DEVICE**

**5.1.** As it is set up for operation, binoculars range finder LRB 20 000 (see Fig.1) is essentially range finder 1 mounted on Angular Mount 2 . The latter is mounted on tripod 3.

**5.1.1.** Range finder (Fig.2) is intended for terrain observation and measuring the distance to the closest or next-in range target caught in the beam.

The range finder works on the principle of measuring the light pulse round-trip time.

The measurement result is displayed in meters on digital range indicator and also stored in the computer in binary code for further calculations.

The schematic circuit diagram of range finder (Fig.3) shows Rechargeable battery designated (G1), controls designated (S1- S4), pumping and firing elements (ref. designations C1-C3, E1, L1, T1, V1-V2), control circuit board (A1), display circuit board (A2), counter circuit board (A3), and photodetector assembly (A4).

Toggle switch S1 is operated to energize the range finder, and toggle switch S4 – to light up the light-emitting diode (LED) H1 which illuminates the reticule pattern.

Button switches S2 and S3 labeled (MEASURE 1) and (MEASURE L) respectively are used to prepare the range finder for taking a measurement (by depressing one of those buttons), and to perform the measuring operation (for which the button is released).

Button S2 is operated to range the closest target, whereas button S3 is used to engage the next-in-range target caught in the beam.

Connector X1 couples the controls and the Rechargeable battery to control circuit board (A1).

C1 and C2 are energy storage capacitors placed in the pumping circuit. They are charged up to 700-1000 V through a special contact designated A on control circuit board A1. Capacitor C3 and diodes V1, V2 are placed in the pumping circuit to prevent RF oscillations or reversal of the voltage polarity across capacitors C1, C2. E1 – is a pumping flashtube. Transformer T1 produces 10-15 kV firing voltage pulses to be fed to tube E1. For the purpose, the primary winding of the transformer is furnished with a negative voltage of 130 to 185 V fed from control circuit board A1. The flashtube is externally fired, that is, the firing voltage pulse is fed to the metal-clad envelope of the tube E1.

On circuit board A1 are mounted the DCC, AC ckt, power supplies of the TIC and PhD assembly, and one circuit to analyze the battery charge.

On counter circuit board (A3) are arranged the counting-logic circuit of the TIC and the TSGC of the PhD assembly.

A2 is the information display assembly board. Arranged thereon is the indicating circuit of the TIC: digital range indicator, multiple target indicator, outgoing pulse absence indicator, ranging readiness indicator (green) and battery discharged condition indicator (red). Through display circuit board A2 control signals and supply voltages are fed from control circuit board A1 to circuit board A3 and to the PhD assembly.

Circuit boards A1, A2 and A3 are connector-coupled with the PhD assembly.

Plug X2 couples the cable of the remote control set to receive range data in binary code.

**5.1.2.** Angular Mount (Fig. 4) is intended for mounting range finder on a tripod, to lay the range finder on the target and to read the azimuth and elevation. The Angular Mount (AI) is essentially body 15, which incloses the elevation, and azimuth worm gear drives.

To lay the range finder accurately on the target, adjustment knobs 1 and 7 are rotated. To coarsely lay the range finder, it is turned through the desired angle. For the purpose, normally engaged clutches are provided in the elevation and azimuth drives.

The angles are read on azimuth circle 14 and scale 5, with verniers provided to make it accurate to 1/10 of a division.

Lenses 6 and 10 also contribute to the reading convenience and accuracy. Azimuth circle 14 may be set to zero with knob 11 locked in this position. The horizontal adjustments are made on the Angular Mount by using level 13, and the magnetic meridian orientation is achieved by the use of compass 8.

The range finder is fitted on to the guides of bracket 3 of the AI, and secured thereon by means of lever 2. The clamping assembly allows adjustment of retainer 4 by rotation of nuts 9.

The AI is installed on the tripod through the use of ball mount 12. **5.1.3.** The tripod mount (Fig.5) is designed to adjust the height of the range finder and Angular Mount as required for the particular lay of the ground. The tripod consists of three telescoping legs 3 whose top sections are assembled with one common base 2. Each leg may be deflected through the angle desired relative to the base. Mounting head 1 is provided on the base to fasten the AI. Retracting or extending the moving section adjusts the length of each leg. For the purpose, collet nut 4 is first loosened.

In the bottom portion of the head is a stay block designed to secure the AI on a log, a stump of a tree or any such piece of wood suitable for the job.

## **6. SAFETY PRECAUTIONS**

6.1. Range finder is an opto-electronic device emitting high-density pulses of dark light at wavelength of 1.06  $\mu\text{m}$ , characterized by the following dangerous factors according to GOST 12.1. 040-83:

- direct laser radiation;
- mirror-reflected laser radiation;
- diffuse-reflected laser radiation.

Direct and mirror-reflected laser radiation of range finder is dangerous for eyes at 1700 m distance from range finder when observing with the naked eye.

Diffuse-reflected laser radiation is dangerous at 0.43 m distance from reflecting surface.

When observing laser radiation through optical devices these distances increase according to optical device magnification ratio.

Laser radiant energy density at the outlet of range finder exceeds permissible level for skin on 16% and when decreasing it reaches permissible level at 3.77 m distance from range finder.

6.2. According to the degree of laser radiation danger the range finder pertains to third class laser by GOST 12.1.040-83.

**NEVER:**

- Binocular switched-on range finder on the friendly personnel and materiel;
- Measure distance through window and door glasses;
- Measure distance to mirror-reflecting surfaces (mirrors, car and building windows, optical components, grinded and polished surfaces), which are nearer to range finder than 1700 m;

- Direct radiation to diffuse-reflecting surfaces (walls, curtains, papers), which are nearer to range finder than 0.43 m;
- Inspect the range finder optical components on the housing side with MEASURE 1 or MEASURE L button depressed.

6.3. Persons who happen to be in a dangerous zone of laser radiation due to production necessary must put on goggles ZH22-72-CZC-22-6 GOST 12.4.013-75 or OZP for eyes protection.

6.4. Admitted to work with the range finder are the following persons:

- Those who reached the age of 18 years old and have no medical contra-indications on operation with laser emission;
- Instructed on and having studied safe methods of operation with the range finder according to safety rules;
- Appointed responsible for safe operation of the range finder by order of the leader of organization where the range finder is used.

6.5. Generated in assemblies and units of the range finder during its operation is life-hazardous high voltage.

NEVER disassemble the range finder with the power cut in. Repair the range finder only in specialized shop.

6.6. Between operation periods, be sure to cover the range finder objective lens with special cap fastened to its housing.

6.7. The persons operating the range finder should be instructed on methods of giving first medical aid when laser emission affects eyes and skin.



## **7. PREPARING FOR USE**

**7.1.** Choose an observation post.

**7.2.** Rotate the objective frame to bring the reticule in sharp focus.

**7.3.** Check range finder for proper operation:

- Battery voltage;
- The range finder for proper functioning.

**7.3.1.** To analyze the battery voltage, set the ON-OFF selector switch to the ON position and check if the Low Battery indicator glows red in the left-hand eyepiece. If it does, replace the battery.

BEFORE REPLACING BATTERY, SET SELECTOR TO OFF.

**7.3.2.** To check the range finder for proper functioning, proceed as follows:

- Binocular the range finder on the target;
- set the ON-OFF selector switch to ON;
- depress the MEASURE 1 button;
- as the readiness indicator comes on, release the MEASURE 1 button and read the measured range;
- compare the range measurement result with the actual distance.

The range finder is in good working order if the range measurement is accurate to 5 m.

If no precise target range is available, the range finder is checked for proper functioning by measuring the range three times on the same target. The range finder is functioning properly if the measurements differ within a maximum of 5 m. In the absence of the returned signal, zeroes are displayed in all the digit positions of the range indicator (00000). In the absence of the outgoing pulse, zeroes are displayed in all the digit positions and the decimal point, in the third position.

**7.4.** To use AI and tripod for observation, proceed as follows:

Arrange the tripod on selected site;

Extend the telescoping legs at the desired length so that one of them aligns with the ranging direction. Level the base as far as practicable.

In case you do not use the tripod proceed as follows:

- unscrew the ball-mount seat from the tripod base;
- fit the stay block on to the wooden object and tighten it up pressing lengthwise.
- The AI is installed and leveled through the use of ball-mount by turning AI in ball-mount seat and putting the level bubble into the center of ring marks.
- Secure AI by clamp.
- Sliding the range finder along the AI bracket guides, fit the AI clamp into the T-shaped opening in the range finder bracket, and turn the handle of the clamp to lock the range finder in position.

**7.5.** Use the AI compass or the reference directional angle to align the range finder with the base line.

**7.5.1.** To align the range finder with the base line, proceed as follows:

find the base reference (BR) from the formula:

$$BR = \alpha_{\text{base}} - \alpha_{\text{ref}} \pm 30.00'$$

Where  $\alpha_{\text{base}}$  is the base line directional angle;

$\alpha_{\text{ref}}$  is the directional angle of the given reference line;

Binocular the range finder on the reference point;

rotate the azimuth dial to align the base reference value read thereon with the venire zero. Now, the range finder is aligned with the base line within 30.00 mils;

turn the clamping handle to lock the azimuth dial in position.

**7.5.2.** To orient the range finder by using the reference directional angle, proceed as follows:

- Binocular the range finder on the reference point whose directional angle has been known;
- rotate the azimuth dial to set the reference directional angle;
- turn the clamping handle to lock the azimuth dial in position.

With the range finder thus oriented, the measurements are taken from the location point relative to the directional angle of the object (reference object).

**7.5.3.** For the magnetic orientation of the range finder, proceed as follows:

- Unscrew the plunger knob all the way out to release the magnetic needle of the compass;
- Turn the AI about the vertical axis to obtain precise alignment of the index mark of the circle with the magnetic needle;
- Operate the azimuth dial to set the magnetic azimuth index correction as specified in Section "Basic Specifications" 4 of the present Operating instructions.

When using the compass to orient the range finder, bear it in mind that the nearby objects of iron or steel affect the indexing accuracy of the magnetic needle. See that motor vehicles, bulldozers and such like objects are at least 10 m away, medium-size objects (pick hammers, crows, etc.) are at least 0.5 m away, and small-size things (flash-light, knife, screwdriver, etc.) are 20 cm away from the instrument.

**7.6.** To check the range finder for proper operation when using the AI and the tripod:

- Check the AI zero elevation reference (ER "0");
- Check the AI compass.

ER "0" is the setting of the elevation scale that corresponds to the horizontal position of the range finder Binocular axis.

**7.6.1.** To check the zero elevation reference, proceed as follows:

- Stick a stake 50 to 100 m away from the unit and mark it with the range finder objective height above the ground level;
- Binocular the reticule cross-hairs on the stake to read the tilt angle (A1);
- Swap the range finder and stake positions, and apply another mark to the stake in accordance with the new height of the range finder objective;
- Binocular the cross-hairs on the new mark of the stake and read again the tilt angle (A2);
- Find the ER "0" from the formula:

$$ER "0" = \frac{A1 + A2}{2},$$

The A1 and A2 values are reckoned in with their respective signs. If the ER "0" value is other than zero, the respective correction is to be taken into account while operating the range finder. The error value is subtracted from the elevation measurement if on the positive side, and added if negative.

**7.6.2.** To check compass, set up the AI for operation. Then, check the sensitivity and balance of the needle.

For the purpose proceed as follows:

- Level the AI;
- Engage the needle;
- Unbalance the needle by using a knife, screwdriver and the like.

To make sure that the needle is free from defects, check that:

- The needle oscillates in a smooth and uniform manner to regain balance;
- The position of the needle end is the same relative to the mark when the needle settles;
- The needle ends are level with the marked plates within  $\pm 0.5$  mm.

The compass needs triple checking. If even a single requirement is not satisfied, turn in the AI for repair.

7.7. After the check set the controls to their initial positions, namely:

- The ON-OFF and ILLUM. selector switches, to the OFF position.

## **8. OPERATING PROCEDURE**

8.1. The range finder is designed to:

- survey the ground;
- range fixed targets;
- range moving targets;
- take azimuth and magnetic azimuth measurements;
- take elevation and vertical angle measurements;
- find polar coordinates of targets and reference objects;
- convert the polar coordinates of the target and reference

object into rectangular coordinates, and find the target and observation post coordinates from the predetermined reference coordinates.

8.2. To use the range finder for ground surveillance, proceed as follows:

- gripping the range finder with both hands, Binocular it coarsely in azimuth and elevation on the objects to be observed;
- mount the range finder on the AI and rotate the azimuth and elevation knobs to smoothly scan the ground or lay the range finder on the target (reference object).

8.3. When ranging fixed targets, proceed as follows:

- set the ON-OFF selector switch to the ON position;
- lay the range finder on the target so that the latter, or its visible portion is observed in the central gap of the reticule as close as possible to its center, and the screening objects (that is, bushes, trees, terrain elevations, buildings and such like closer-range features located near the target or partially masking it) are beyond the gap.

When aiming the range finder at open-ground targets, see the target in the lower portion of the gap, touching the bottom mark of the reticule;

- depress the MEASURE 1 button, wait until the readiness indicator comes on and release the button taking care not to upset the aiming;
- read the measured range.

The measured value is displayed in the range indicator for 3 to 5 seconds.

With several targets being on beam of the range finder (that is, observed in the reticule gap), the decimal point is displayed in the least significant digit position of the range indicator. In this event, the range finder may be used as aimed, to range the first or the last target by depressing the MEASURE 1 or MEASURE L button respectively.

If practicable, repeat the target ranging once or twice. If the obtained range is correct, at least two results will not differ by more than 5 m.

8.4. To range a moving target, proceed as follows:

- Observing the target through the Binocular eyepiece, aim the range finder to track the target in elevation and azimuth;
- depress the MEASURE 1 button (or MEASURE L button, when engaging the last-in-range target);

- As the readiness indicator comes on, aim the range finder at an off-set point forward of the target;
- As the target aligns with the reticule gap, release the MEASURE 1 (MEASURE L) button;
- Read the measured range.

**8.5.** To take azimuth and magnetic azimuth measurements, proceed as follows:

- Align the vertical mark of the Binocular objective reticule with the right-hand object;
- Read and note down the azimuth dial indication accurate to 1/10 of a division on the vernier;
- Align the vertical mark of the reticule with the left-hand object and read the angle again;
- Determine the measured angle.

Measure the angle by subtracting the latter value from the former one. Add 60.00 mils to the former value if exceeded by the latter one.

During the magnetic orientation of the range finder, the angles read off the azimuth dial are the magnetic azimuth values (bearings) of the target (or reference object).

The magnetic azimuth correction is to be inserted (see under 7.5.3.).

If the measurement has to be precise, take 3 or 4 angle measurements to calculate the mean value. After each measurement of the magnetic azimuth value (bearing), upset the range finder orientation and change the azimuth dial reading.

An azimuth or magnetic azimuth measuring under 0.80 mils may be read off the reticule with a maximum accuracy of 0.05 mils (small division value of the reticule is 0.05 mils, large division value is 0.10 mils).

**8.6.** To measure vertical and elevation angles, proceed as follows:

- Align the horizontal mark of the range finder Binocular reticule with the upper object;
- Read the vertical angle scale using the vernier and note down the reading;
- Rotate the azimuth and elevation knobs to align the horizontal mark of the reticule with the lower object and read the scale again;
- Determine the vertical angle by subtracting the smaller value from the greater one if both have the same sign (are of the same color), or by adding them, if the signs are opposite.

The elevation is measured with reference to the Binocular axis of the range finder. Hence, the range finder should be thoroughly leveled before taking the elevation measurements.

Vertical angles up to 0.80 mils and elevation angles falling within  $\pm 0.40$  mils may be read off the reticule with a maximum accuracy of 0.05 mils.

**8.7.** To determine the polar coordinates, proceed as follows:

- Use the compass to orient the Angular Mount as directed under 7.5.3;
- Binocular the range finder on the object;
- Read the azimuth of the object;
- Range the object as directed under 9.3.

**8.8.** To convert the polar coordinates into rectangular coordinates, proceed as follows:

- Remove the coordinate converter from the case;
- Release the clamp and detach the rule from the reverse side of the plotting board;
- Determine the polar coordinates of the reference point and the target as directed under 9.7 and note them down on the plotting board or a special card;

- Calculate from the determined magnetic azimuth  $A_m$  of the reference point and the target to find the directional angles, reckoning in the compass correction  $\Delta A$  obtained from the formula:

$$\alpha = A_m - \Delta A_m$$

- Read the compass correction  $\Delta A_m$  of the map;
- Note down the reference point target directional angles on the plotting board of card;
- Mark numbers of the plotting board with respect to the selected scale (1:25, 000 or 1:50,000) and the reference point, observation post and target location;
- Read the rectangular coordinates of the reference point from the map and note them down on the plotting board or card;
- Align the circular scale zero of the plotting board with vernier zero;
- Use the reference grid of the plotting board to plot the reference point on the circular scale in accordance with the map coordinates;
- Set the circular scale of the board to read the directional angle as determined for the reference point from the observation post;
- Draw a vertical line from top downwards through the reference point marked on the circular scale. See that the line is parallel with the grid lines;
- Use the rule to lay off the OP-to-reference point range on the drawn line. Mark the obtained OP location point on the circular scale;

- Adjust the circular to read the directional angle as determined for the target from observation post;
- Pass a vertical line from bottom upward through the OP point in parallel with the grid lines on the circular scale;
- Use the rule to lay off the OP- to-target range on the drawn line. Mark the target location with a dot and symbol;
- Setting the circular scale to zero, read the target and OP rectangular coordinates off the board. Note down the coordinates on the board or card;
- Plot the target on the map using the obtained rectangular coordinates.

**8.9.** When using the range finder under the conditions of insufficient light set the ILLUM. Selector switches to ON the range finder.

**8.10.** A necessity may arise to range a target located against an intense background (bright sky, sunlit snow or sand, etc.) In this case, the left-hand eyepiece may indicate as if more than one target is caught in the beam, and the range indications may differ every time that MEASURE L button is depressed. To eliminate the adverse back ground effects, the frame of the Binocular objective should be fitted with the diaphragm 22 (Fig. 6) secured by means of a pin and rubber clamp on the case over.

The diaphragm is not to be used at critical subzero temperature, in mist and limited visibility conditions.

**9. SERVICEABILITY TEST**

The principal tests to be performed on the range finder are listed below.

Table 9.1

What is checked, tools, instruments, equipment. Test procedure	Technical requirement
1. Range finder completeness	Range finder is complete with all components listed in Section 5
2. Range finder exterior	Exterior surfaces are clean and free from cracks, dents and rust
3. Exterior of range finder optical parts (to be checked visually). Make sure the unit is off!	Optical surfaces are free from cracks, scratches, chips, dirt, grease stains (on exterior) and condensed moisture (inside)
4. Dehydrator case of range finder ( to be checked visually)	Silica gel is bluish in colour
5. Battery voltage. Proceed as directed under 8.3.1.	Red glow not observed in left eyepiece of range finder
6. Illumination of range finder Binocular reticule. Check that front cover is closed on range finder and set ILLUM. selector switch to ON	Binocular reticule is illuminated
7. Functioning of range finder. Proceed as directed under 8.3.2.	Measurement results are within 5 m of predetermined range or on another ER "O" error determined for vertical angle scale is to be reckoned in while measuring target elevation
8. Setting of zero elevation reference (ER "0"). Proceed as under 8.6.1.	

Table 9.1, continued

What is checked, tools, instruments, equipment. Test procedure	Technical requirement
9. Sensitivity, indexing uniformity and balance of magnetic needle. Proceed as under 8.6.2.	Turn in unit for repair if even a single requirement of 8.6.2. is not satisfied
10. AI azimuth and elevation adjustment knobs for play	If necessary, tighten bushings on knob end faces to eliminate play

**10. MAINTENANCE**

10.1. Maintenance Organization and Procedure. General Instructions.

10.1.1. This Section deals with the maintenance services prescribed for the range finder, excepting the battery servicing procedure. For the latter procedure, refer to Section 16.

10.1.2. The range finder is serviced to ensure its operability and readiness for operation.

The range finder is subject to timely full-scope servicing, unless premature wear should occur resulting in shorter periods between repairs.

10.1.3. While preparing for and carrying out the maintenance services, observe the safety precautions as outlined in Section 6.

10.2. Maintenance Service Types and Intervals.

10.2.1. While in use, the range finder is subject to the following types of maintenance services:

- Check inspection;
- Daily (routine) service;
- In-service maintenance.

10.2.2. The same servicing intervals are established for the component parts and the entire range finder.

Check inspection is carried out before using the range finder.

Daily servicing is performed after use. If the range finder is out of operation the servicing within daily scope may be abridged to biweekly visual inspection of the dehydrator condition and, if need be, replacement of the silica gel and charging of the rechargeable battery.

In-service maintenance is performed every six months and before placing the range finder in short-term storage.

10.3. Check Inspection.

10.3.1. During the check inspection is ascertained the serviceable condition of the range finder as directed in Steps 1 through 7 in Table 10.1.

10.3.2. The check inspection scope is outlined in Table

10.1.

Table 10.1

Operations	Procedure as per	Materials, tools and accessories
1. Cleaning external optical surfaces (when so required)	Para. 11.6.2	Lens Brush KXOOK No. 7 (made from synthetic fibre) Absorbent optical cotton Alcohol Ether
2. Charging of rechargeable battery (when so required)	Section 16	

10.4. Daily Servicing.

10.4.1. During the daily servicing, the range finder is checked for serviceable condition in accordance with Steps 1 through 10 of Table 10.1.

10.4.2. For the daily servicing scope see Table 10.2.

Table 10.2

Operations	Procedure as per	Materials, tools and accessories
1. Servicing within check inspection scope	As in Table 11.1	As in Table 11.1
2. Cleaning range finder to remove Dust, dirt and Moisture		Cloth
3. Touching up painted exterior of range finder (when so required)		Brush, painting Enamel, grade GF-1426, GOST 6745-79
4. Drying and repair of straps (when so required)		
5. Replacing silica gel (when so required)	Para. 11.6.3	Silica gel, indicating GOST 8984-75, metal vessel
6. Replacing defective Components with spares to be taken from individual SPTA set	Para. 12.3	Individual SPTA set
7. Tightening sleeves on knob end faces	Table 10.1, para.10	

10.5. In-service Maintenance.

10.5.1. During in-service maintenance, the range finder is checked for serviceable condition in accordance with Steps 1 through 10 of Table 9.1.

10.5.2. The unit is not to be dismantled during in-service maintenance.

10.5.3. For the servicing scope, refer to Table 10.3.

Table 10.3.

Operations	Procedure as per	Materials, tools and accessories
1. Servicing within daily scope	As in Table 10.2.	As in Table 10.2.
2. Cleaning contacts of charging device, protection device, wires and battery section	Para 10.6.1.	Absorbent optical cotton, alcohol
3. Repair of packing case (when so required)		Equipment, appliances and tools available in repair shop

10.5.4. During in-service maintenance, the cycle life of the range finder may not be spent by more than 10 measurements.



## 10.6. Maintenance Servicing Procedure.

10.6.1. To clean the contacts in the battery section, do the following:

- Wind some cotton wool around one end of a wooden stick;
- Moisten the cotton wool with alcohol;
- Wipe the contacts several times by means of cotton wool moistened with alcohol.

10.6.2. To remove dust and dirt from the optical surfaces, use the brush 23 and clean cloth 7 supplied in the individual SPTA set (see Fig. 6).

To remove greasy stains from the optical surfaces, do the following:

- Wind some cotton wool around one end a wooden stick;
- Moisten the cotton wool with an alcohol and ether mixture (1:1) and gently shake the stick to remove excess mixture;
- Wipe the glass surface several times with the cotton wool, avoiding contact with the frame;
- Change the cotton wool and move the stick end spiral style from the center towards the periphery to wipe the surface clean;
- While cleaning, see that the mixture does not stain the frame, for it may dissolve the sealing mastic, causing leakage or ungluing of the lenses.

10.6.3. The dehydrator case should be filled with fresh silica gel in a closed room. Under the field conditions, replace the silica gel when the weather is dry and calm. Never keep the case with fresh silica gel open for more than 1 or 2 minutes.

To change the silica gel, proceed as follows:

- Prepare fresh silica gel 13 (see Fig. 6);
- Unscrew the cover of the dehydrator case by means of wrench 9 (Fig. 6);

- remove the moist silica gel from the case and fill the case with the fresh one.

Moist silica gel may be subjected to multiple recalculation at  $(120\pm 3)$  °C without any deterioration of its properties. Using a microwave oven is allowed.

To recalculate the silica gel, proceed as follows:

- Place the silica gel in a clean metal vessel;
- Place the vessel on the heat source providing heating up to  $(120\pm 3)$  °C. Measure the temperature directly on the silica gel;
- See the silica gel changing its colour.

The silica gel is dry and good for use when it turn bluish from pink. When heating up, keep the silica gel away from open flames.

## **11. TROUBLE SHOOTING**

11.1. Observing malfunctioning of the range finder or its components, proceed to check that:

- The range finder is properly set up;
- The controls have been operated in the proper succession;
- The optical parts are free from dust, dirt and oil stains on the exterior;
- The battery is charged.

11.2. The problems likely to occur in the range finder are listed with their causes and remedies below in Table 11.1

Table 11.1

Possible problems	Probable cause	Remedy
1. Picture blurred in right-hand eyepiece	Condensed moisture, dirt on external optical surfaces Condensed moisture on internal optical surfaces	Clean exterior of optical parts as directed under 11.6.2 Dry range finder as directed under 11.6.3
2. Readiness indicator remains dark after depressure of MEASURE 1 (MEASURE L) button	Open circuit in battery section (when standard battery is used) Blown fuse in protection device when vehicle electrical system is used Open circuit in battery section when vehicle electrical system is used	Clean contacts as directed under 11.6.1 Replace fuse as directed under 12.3.1 Clean contacts as directed under 11.6.1
3. Red glow is observed in indicator eyepiece	Unallowably low battery voltage	Replace the battery with a newly charged one as directed under 12.3.2

11.3. To correct problems by using the individual SPTA set proceed as follows (see Fig. 6).

11.3.1. To replace the fuse link 2 in the protection device:

- Unscrew the threaded cover from the housing of the protection device;

- Remove the defective fuse link;

- Insert the spare fuse link from the SPTA set;

- Screw the cover on the housing of the protection device.

11.3.2. To replace the rechargeable battery 1:

- Open the cover of the battery section;

- Remove the used battery;

- Fit the new battery in the section so that the "+" terminal of the battery is connected with the bottom contact of the section;

- Close the cover of the battery section.

11.3.3. To replace the fuse link in the charging device:

- Unscrew the outer threaded covers from the fuses;

- Unscrew the bayonet of the fuse link holders;

- Remove the fuse links;

- Fit in good fuse links;

- Close the holder covers;

- Screw on the outer threaded covers.

11.3.4. The individual SPTA set includes the following tools and accessories:

- Charging device 11, operated to charge Rechargeable battery 10D-0, 55C-1 from a vehicle electrical system (27±2.7) V DC or 22-29 V and from a commercial line 220 V 50 Hz;

- Protection device *12*, used to supply the range finder with (27±2.7) V DC or 22-29 V from a vehicle electrical system, or with 22-29 V or 12-14.5 V from external batteries;
- Cable *14*, used to couple the protection device to the electrical system of a track-laying vehicle;
- Cable *15*, used to connect the protection device to external Rechargeable battery type 6CT70 (or analogous);
- Cable *16*, used to connect the protection device or charging device to the electrical system of a wheeled truck;
- Cable *17*, used to couple the charging device to a mains of 220 V 50 Hz;
- Cable *18*, used to couple the protection device to external battery type 21NKBN-3, 5;
- Pencil *3* and eraser *8*, used while working with the map and coordinate converter;
- Coordinate converter *10*, used for polar-to-rectangular coordinate conversion, reference location of the observation post and orientation of the range finder;
- Sealing ring *4*, used to seal battery section;
- Eye shield *5*, used to exclude incident light in the eyepiece;
- Framed lens *6*, used to contribute the angle reading convenience and accuracy when operating the AI;
- Membrane *19*, used to seal the MEASURE button assembly;
- Cover *20*, used to protect the range finder against direct sun rays;
- Cover *21*, used to protect the Rechargeable battery against damages.

11.3.5. The individual SPTA set is stowed in packing case *4* (Fig. 7).

The spare Rechargeable battery, pencil, eraser, cloth and coordinate converter are stowed in the case.

## **12. LONG TERM STORAGE**

To preserve the range finder, proceed as follows:

- Cap the range finder connectors by paper and tie a cord round;
- Coat the range finder bright work with grease GOI-54P GOST 3276-89;
- Pack up all range finder components in metallic package;
- Secure all locks and hinges of package and with grease GOI-54P;
- Pack up the tripod in recess on package cover and fasten by belt;
- Insert range finder unit into polyethylene bag;
- Insert the sack with silica gel into the bag and weld it.

## **13. STORAGE RULES**

13.1. The range finder is stored in closed rooms specially equipped to provide weather protection, i.e. , protection against atmospheric precipitation , solar effects, dust, sand, wind, sharp fluctuations of temperature and outside air humidity.

The storage room temperature is to be maintained between – 40 ° C and +50 ° C and relative humidity of up to 98% taken at 35 ° C and below. Condensation of moisture is not to be tolerated.

13.2. Each range finder unit in wooden package is kept on a wooden package is kept on a wooden rack or shelf with handle up.

NEVER store the range finder on the floor near heaters.

The range finders are arranged in the storage room so that steel and iron objects are at least 2 m away.

To prevent demagnetizing of the needle, the latter should be aligned with the magnetic meridian.

Arranging the packing case so that the arrow marked on top points North provides this.

Charged batteries may be stored together with the range finder unit for up to three months.

13.3. The range finder placed in short-term storage (up to 3 months) is subject to inspection as directed in Section 11.5 and Long Term Storage as directed in Section 13.

13.4. If the range finder is to be stored for over three months, discharge the batteries as directed in Section 16.

#### **14. SHIPMENT**

14.1. The range finder unit is to be shipped in wooden package AEP 42.83.368. The range finder is shipped by any transport over distances unlimited in case it is protected from precipitation, spray and sun rays.

14.2. Before transit, the range finder is closed down and all its components are secured in the metallic package AEP 42.86.184 (Fig. 7). All locks and hinges of package and case are secured.

14.3. When carrying the range finder in a truck body, stow it in the front with the cover up and secure so as to prevent impact.

#### **15. RECHARGEABLE BATTERY HANDLING**

15.1. The rechargeable battery is supplied in discharged condition.

15.2. While handling the battery, be certain to:

- Avoid contact with any bare circuit components while charging the battery;
- Strictly comply with the prescribed charging/discharging procedures.

NEVER:

- Dismantle the battery;
- Store the battery together with acids, or batteries using acids.

15.3. The battery is subject to charging at an ambient temperature of  $(20 \pm 5)$  °C.

To charge the battery, do the following:

- Unscrew the cover of the battery section on the charging device;
- Place the battery in the section coupling the "+" terminal with the bottom contact of the section, and screw the cover on;
- Couple the charging device to the power source using the appropriate cable (see in Section 11.3).

15.3.1. The battery that has been stored in the discharged condition for a maximum of 28 days is to be charged for 15 hours. The toggle switches are placed in the CHARGE and MAIN positions on the charging device.

15.3.2. If the battery has been stored in the discharged condition for a time between 28 days and 3 months, it should be cycled as follows:

- Charged as under 15.3.1;

- Discharged by setting the toggle switches to the DISCHARGE and MAIN positions until the DISCHARGED light emitting diode flashes on and off to indicate the discharged condition. Charge up the operating voltage for 15 hours as directed under 16.3.1.

15.3.3. The battery that has been stored in the discharged condition for over 3 months is subject to two processing cycles before use.

#### Cycle 1

Charging for 24 hours with the toggle switches set to the CHARGE and PREPARATORY positions on the charging device;

Discharging with the toggle switches in the DISCHARGE and PREPARATORY positions, until the LED labeled DISCHARGED flashes.

#### Cycle 2

Charging as directed under 15.3.1.;

Discharging with the toggle switches set to the DISCHARGE and MAIN positions on the charging device, until flashing of the DISCHARGED diode.

If the minimum discharging time is 5 hours, charge the battery up to the operating voltage as directed in 15.3.1.

If the discharging time is between 5 and 3.5 hours, subject the battery to another Cycle 2 as directed in 15.3.3, then charges it up to the operating voltage as directed in 15.3.1.

With the discharging time under 3.5 hours, the battery is not to be used.

15.3.4. The battery that has not been fully run down during the operation is to be discharged before recharging. To completely discharge the battery, set the toggle switches to the DISCHARGE and MAIN positions on the charging device and wait until the LED labeled DISCHARGED flashes on and off.

15.4. The in-service storage of the battery is permitted both in the charged and discharged conditions.

The charged battery may be used without any preparatory processing if it has been stored for less than 28 days.

If the battery has not been used on the expiry of 28 days, it should be discharged as directed under 15.3.4.

Before use, the battery is to be charged as directed under 15.3.1 through 15.3.3.

15.5. Before recharging the battery that has been used at subzero temperatures, keep it at  $(20\pm 5)$  °C for at least 12 hours. See the charging procedure under 15.3.4.

15.6. On charging the battery, do the following:

- Deenergize the charging device;
- Unscrew the cover of the battery section of the charging device;
- Remove the battery;
- Screw the cover on.

## 16. DATA OUTPUT TO EXTERNAL EQUIPMENT

The data on measured range is output to a remote display or computer across connector X2.

To output the data, it is necessary to apply the supply voltage of 3 to 8 V from the equipment to be connected to the range finder to pin 9 of connector X2. The amplitude of the output signals will depend on the value of the supplied voltage.

The measured range information is output in cycles by a binary decimal code through four data and three address buses according to Table 16.1.

The signal on the beginning of the data output is brought to pin 8 of connector X2 in form of a positive pulse edge.

Table 16.1

Address			Data
X2/7	X2/6	X2/5	X2/1, X2/2, X2/3, X2/4
0	0	0	Ones of meters (0000 or 0101)
0	0	1	Tens of meters (from 0000 to 1001)
0	1	0	Hundreds of meters (from 0000 to 1001)
0	1	1	Thousands of meters (from 0000 to 1001)
1	0	0	Tens of thousands of meters (from 0000 to 0011)

In each cycle, the digits of the binary decimal data code are brought to the pins of connector X2 according to the schematic circuit diagram of the range finder given in Fig.3.

## 17. ACCEPTANCE CERTIFICATE

Binoculars range finder LRB 20 000 AEP 36.28.001,  
Serial

No. \_\_\_\_\_, is found fit for service.

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

**Representative** \_\_\_\_\_ **of**

Stamp here

**Inspection department** \_\_\_\_\_

**18. LONG TERM STORAGE CERTIFICATE**

Binoculars range finder LRB 20 000 AEP 36.28.001,  
Serial No. \_\_\_\_\_, has been preserved.

Date of Long Term Storage \_\_\_\_\_

Name and grade  
Of preservative \_\_\_\_\_

Long Term Storage period \_\_\_\_\_

Preserved by \_\_\_\_\_

Accepted after \_\_\_\_\_ Stamp here  
Long Term Storage by \_\_\_\_\_

**19. PACKING CERTIFICATE**

Binoculars range finder LRB 20 000 AEP 36.28.001,  
Serial No. \_\_\_\_\_, has been packed.

Date of packing \_\_\_\_\_

Packed by \_\_\_\_\_

Accepted after \_\_\_\_\_ Stamp here  
Packing by \_\_\_\_\_

## **20. WARRANTY**

**NEWCON OPTIK** warrants this product against defects in material and workmanship for one year from the date of the original date of consumer's purchase, but no more than 18 months from the date of manufacturing. Should your Newcon product prove defective during this period, please bring the product securely packaged in its original container or an equivalent, along with proof of the date of original purchase, to your Newcon Dealer. Newcon will repair (or at its option replace), the product or part thereof, which, on inspection by Newcon, is found to be defective in materials or workmanship.

### *What This Warranty Does Not Cover:*

**NEWCON** is not responsible for warranty service should the product fail to be properly maintained or fail to function properly as a result of misuse, abuse, improper installation, neglect, damage caused by disasters such as fire, flood, lightning, improper electrical current, or service other than by a NEWCON Authorized Service. Postage, insurance, or shipping costs incurred in presenting your NEWCON product for warranty service are your responsibility. Please include a check or money order made out to NEWCON OPTIK for the amount of \$15.00 to cover shipping and handling. This covers products shipped in USA or Canada only.

## **21. CUSTOMER SUPPORT**

Should you experience any difficulties with your Newcon OPTIK product, consult the enclosed manual. If the problem remains unresolved, contact our customer support department at (416) 663-6963 or Toll free at 1-877-398-6666. Our operating hours are 9am-5pm, Monday - Friday, Standard East Time.

**At no time should equipment be sent back to Newcon without following the instructions of our technical support department.**

**Newcon accepts no responsibility for unauthorized returns.**

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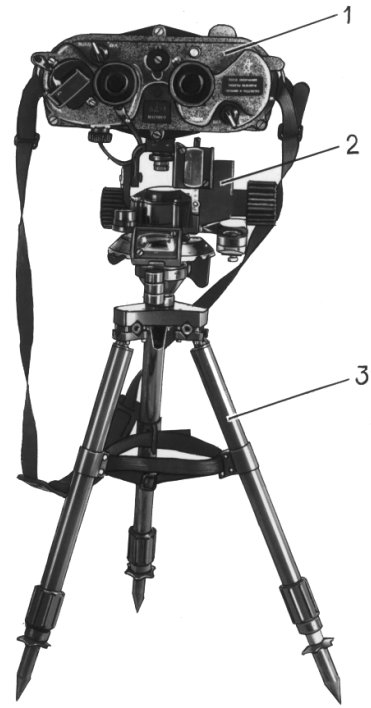
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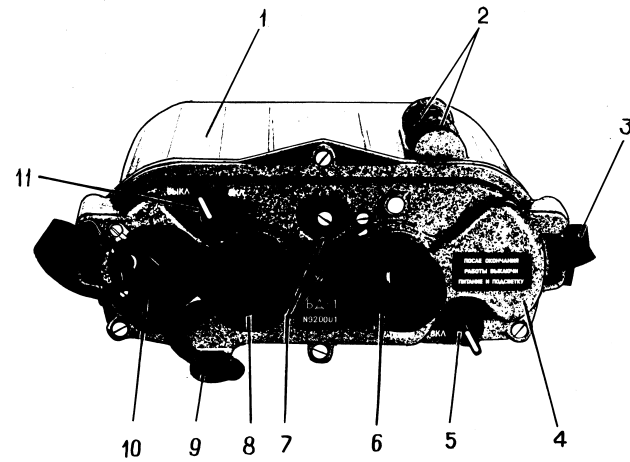


Laser range finder binoculars LRB 20 000



1 - range finder; 2 - Angular Mount; 3 - tripod  
Fig. 1

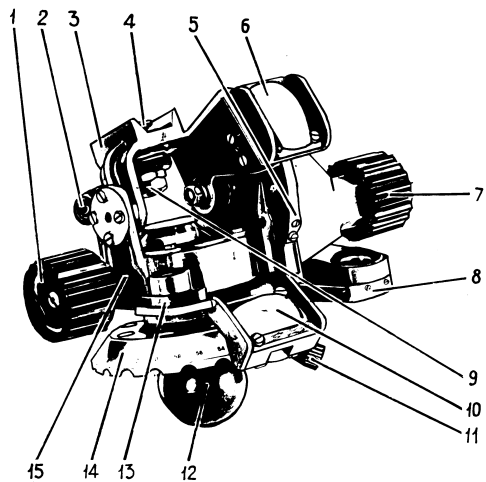
Range finder (viewed on the side of eyepiece)



1 - housing; 2 -MEASURE 1 and MEASURE L buttons; 3 - belt; 4 - panel; 5 - ILLUMINATION toggle switch lever; 6 - Binocular eyepiece; 7- screw; 8 - indicator eyepiece; 9 -plug MP-1; 10 - battery section cover; 11 - ON-OFF toggle switch lever

Fig. 2

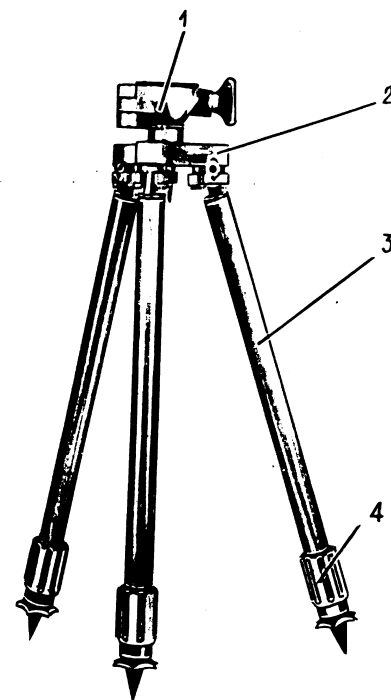
### Angular Mount



1 - adjustment knob; 2 - lever; 3 - bracket; 4 - retainer; 5 - scale; 6 - framed lens; 7- adjustment knob; 8 - compass; 9 - nut M8; 10 - framed lens; 11 - knob; 12 - support; 13 - level YK-10; 14 - azimuth circle; 15 - body

Fig. 4

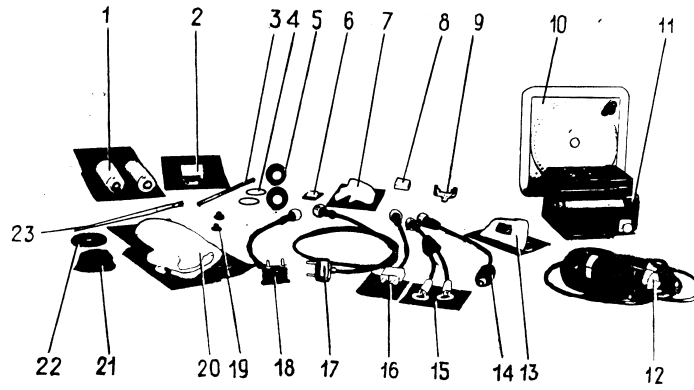
### Tripod mount



1 - mounting head; 2 - base; 3 - leg; 4 - nut

Fig. 5

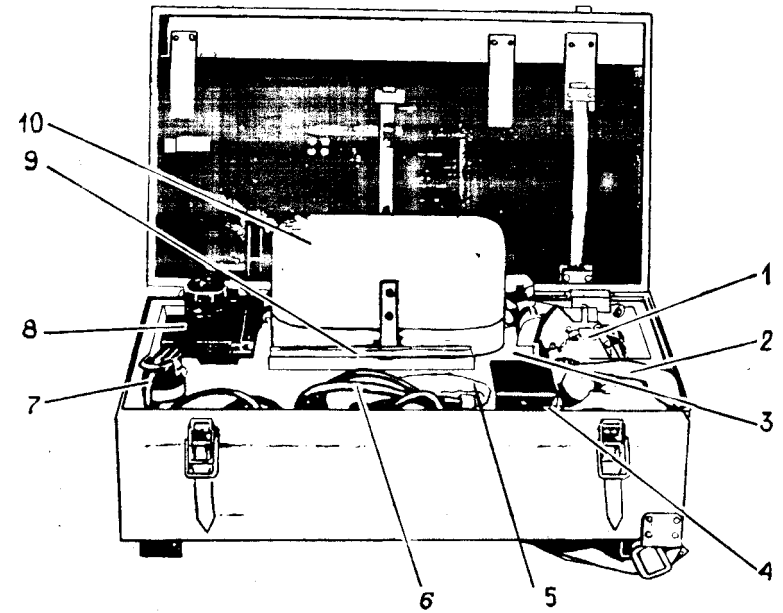
Individual SPTA set



1 - Rechargeable battery 10D-0, 55C-1; 2 - fuse link VP1-1 1,0A 250 V; 3 - pencil; 4 - sealing ring; 5 - eye shield; 6 - framed lens; 7 - cloth; 8 - eraser; 9 - wrench; 10 - coordinate converter; 11 - charging device; 12 - protection device; 13 - indicating silica gel; 14 through 18 - cable; 19 - membrane; 20, 21 - cover; 22 - diaphragm; 23 - brush KXOOK No. 7 (made from synthetic fibre)

Fig. 6

Binoculars range finder unit LRB 20 000  
in packing case AEP 42.86.184



1 - Angular Mount; 2 - cover; 3- Rechargeable battery 10D-0,55C-1; 4 -SPTA package; 5 -cover; 6 -cable; 7 -protection device; 8 - charging device; 9 - Operating instructions; 10 - range finder in case

Fig.7

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