



INSTRUCTION MANUAL

Automatic Level

AT-B3A/B4A



- Please read this operator's manual carefully before using this product.
- Verify that all equipment is included.
☞ "7. STANDARD EQUIPMENT AND LAYOUT PLAN"
- The specifications and general appearance of the instrument are subject to change without prior notice and without obligation by TOPCON CORPORATION and may differ from those appearing in this manual.
- The content of this manual is subject to change without notice.
- Some of the diagrams shown in this manual may be simplified for easier understanding.

1. PRECAUTIONS FOR SAFE OPERATION

For the safe use of the product and prevention of injury to operators and other persons as well as prevention of property damage, items which should be observed are indicated by an exclamation point within a triangle used with WARNING and CAUTION statements in this operator's manual.

The definitions of the indications are listed below. Be sure you understand them before reading the manual's main text.




Definition of Indication

 WARNING	Ignoring this indication and making an operation error could possibly result in death or serious injury to the operator.
 CAUTION	Ignoring this indication and making an operation error could possibly result in minor injury or property damage.

GENERAL






WARNING

-  Never look at the sun through the telescope. Loss of eyesight could result.
-  Do not look at reflected sunlight from a prism or other reflecting object through the telescope. Loss of eyesight could result.
-  When securing the instrument in the carrying case make sure that all catches, including the side catches, are closed. Failure to do so could result in the instrument falling out while being carried, causing injury.



CAUTION

-  Do not use the carrying case as a footstool. The case is slippery and unstable so a person could slip and fall off it.
-  Do not place the instrument in a case with a damaged catch or belt. The case or instrument could be dropped and cause injury.
-  Do not wield or throw the plumb bob. A person could be injured if struck.

TRIPOD



CAUTION



When mounting the instrument to the tripod, tighten the centring screw securely. Failure to tighten the screw properly could result in the instrument falling off the tripod causing injury.



Tighten securely the leg fixing screws of the tripod on which the instrument is mounted. Failure to tighten the screws could result in the tripod collapsing, causing injury.



Do not carry the tripod with the tripod shoes pointed at other persons. A person could be injured if struck by the tripod shoes.



Keep hands and feet away from the tripod shoes when fixing the tripod in the ground. A hand or foot stab wound could result.





Tighten the leg fixing screws securely before carrying the tripod. Failure to tighten the screws could lead to the tripod legs extending, causing injury.

STAFF



WARNING

-  Do not use under thunderous weather conditions. Staff is conductive and if struck by lightning, death or injury could result.
-  Handle with care when using near high voltage cables or transformers. Staff is conductive and contact could result in electric shock.

2. PRECAUTIONS AND MAINTENANCE

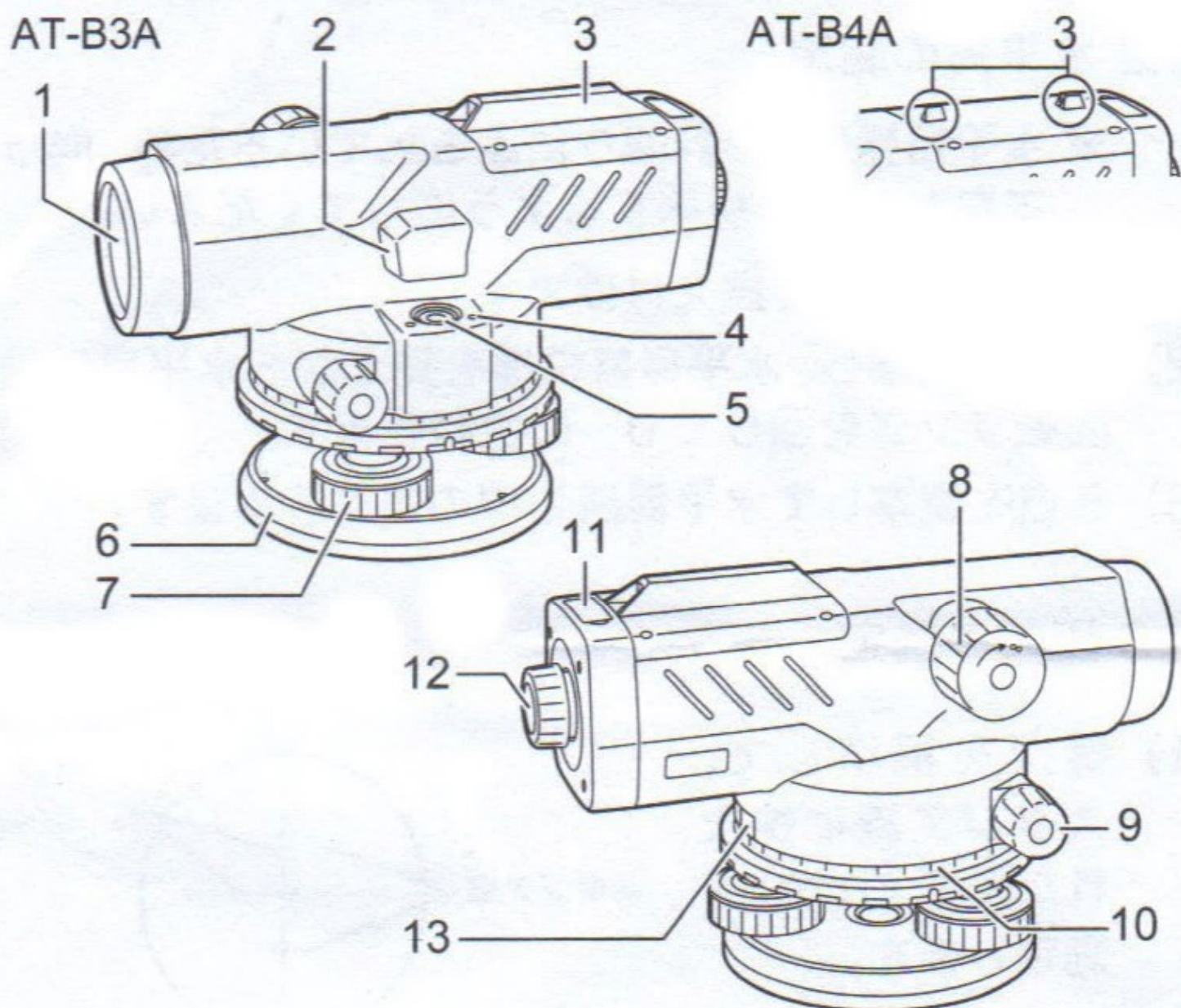
GENERAL

- The AT-B3A/B4A is a precision instrument. Handle with care and avoid heavy shocks and vibration.
- Never place the instrument directly on the ground.
- When the instrument is left on the tripod, cap the objective lens and cover the entire instrument with the vinyl cover.
- Never carry the instrument on the tripod to another site.
- When the instrument is placed in the case, store the accessories in their specified places.

MAINTENANCE

- Wipe off moisture completely if the instrument gets wet during survey work.
- Always clean the instrument before returning it to the case. The lens requires special care. Dust it off with a clean cloth first to remove tiny particles. Then, after providing a little condensation by breathing on the lens, wipe it with a soft clean cloth or lens tissue.
- To clean the instrument or carrying case, lightly moisten a soft cloth in a mild detergent solution. Wring out excess water until the cloth is slightly damp, then carefully wipe the surface of the unit. Do not use any organic solvents or alkaline cleaning solutions.
- Check the tripod for loose fit and loose screws.
- If any trouble is found on the rotatable portion, screws or optical parts (e.g. lens), contact your local dealer.
- Check the instrument for proper adjustment periodically to maintain the instrument accuracy.

3. PARTS OF THE INSTRUMENT

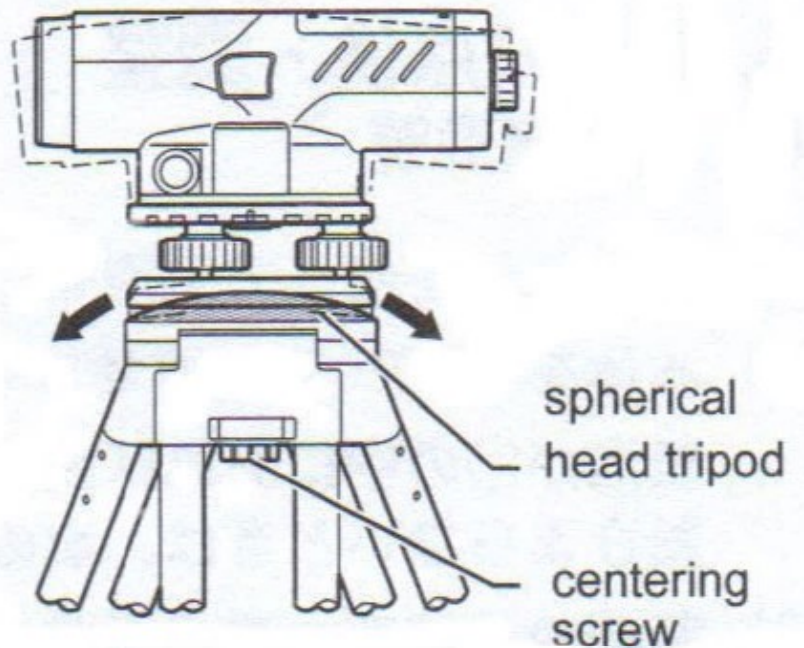


1. Objective lens
2. Reflector
3. Peep sight (AT-B3A) / Gun sight (AT-B4A)
4. Circular level adjusting screw
5. Circular level
6. Base plate
7. Leveling foot screw
8. Focussing knob
9. Horizontal fine motion screw
10. Horizontal circle positioning ring
11. Reticle adjusting screw cover
12. Eyepiece
13. Horizontal ring index

4. PRELIMINARIES

4.1 SETTING UP THE INSTRUMENT

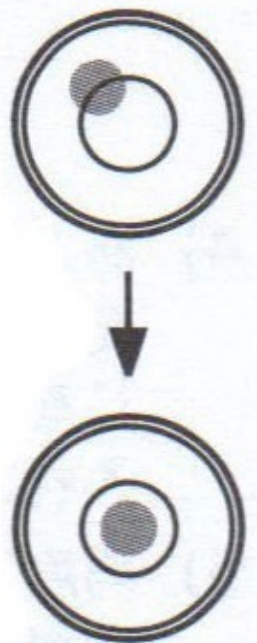
1. Spread the tripod legs about the same distance apart so that the tripod head is approximately level. Fix the tripod shoes firmly into the ground.



2. Hold the instrument on the tripod head and tighten the centering screw.
3. Level the instrument.

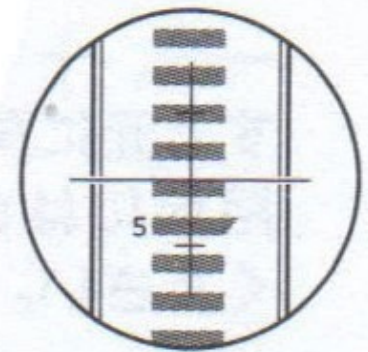
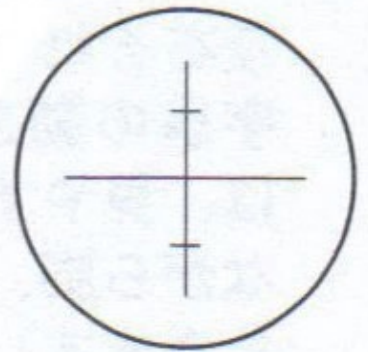
When using the spherical head tripod, slightly loosen the centering screw, hold the base plate in both hands, and slide it across the tripod head until the bubble is in the proximity of the circular level.

4. Tighten the centering screw.
 5. Adjust the leveling foot screws until the bubble is exactly centered in the center circle.
- The instrument is accurately leveled when the bubble is within the center circle of the circular level.



4.2 FOCUSING AND SIGHTING

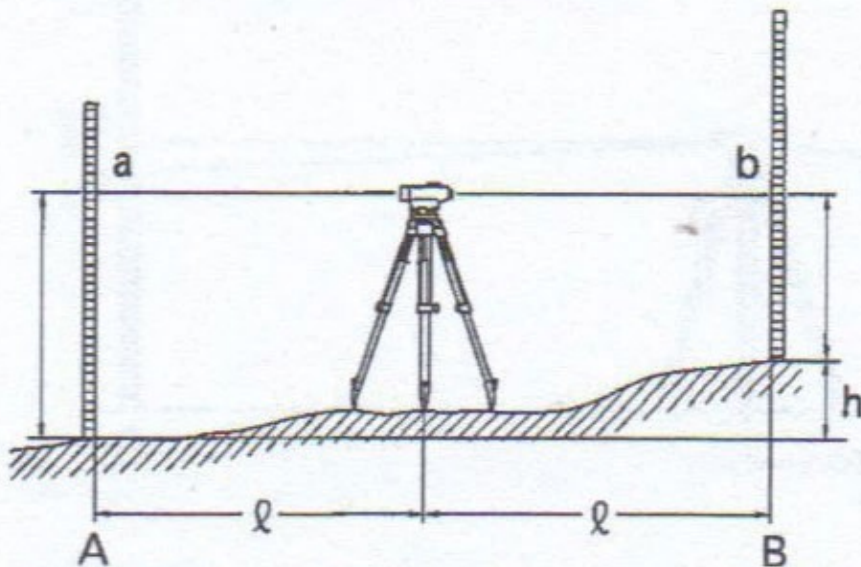
1. Use the peep sight/gun sight to point the objective lens at the target.
 2. Gradually turn the eyepiece until just before the reticle cross-line becomes focussed.
 3. Use the horizontal fine motion screw to center the target in the field of view. Turn the focussing knob to focus on the target.
 4. Looking through the telescope, shift your eyes slightly in the horizontal and vertical directions.
 5. If there is no parallax between the target image and the reticle, preparations for measurement are complete. If there is parallax, repeat the above procedure from step 2 in order to refocus the reticle.
- If there is parallax, measurement errors may result, so make sure to adequately focus the target.



5. OPERATION

5.1 MEASURING HEIGHT DIFFERENCE

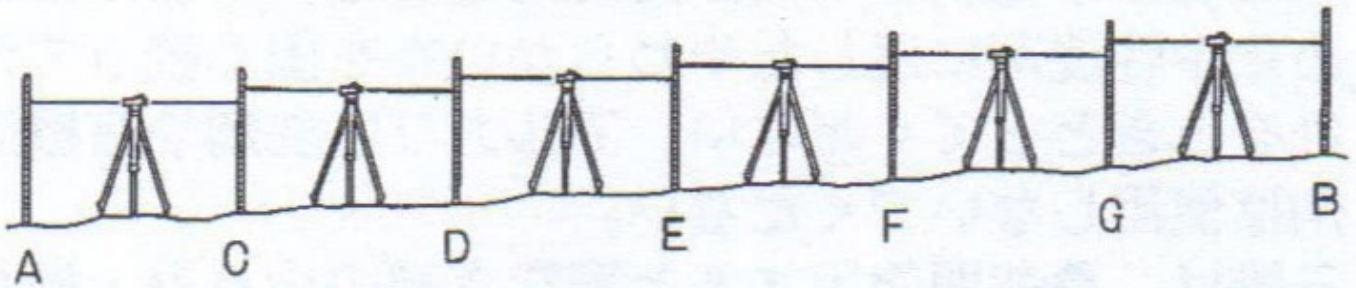
1. Set up the instrument at a point approximately halfway between points A and B.
 - For more accurate measurement, set the instrument as close to halfway as possible, to eliminate errors due to sighting axis misalignment.



2. Position the staff vertically at point A and take the reading a (backsight) on the staff at point A.
3. Then sight the staff at point B and obtain the reading b (foresight).
4. The difference $a - b$ is the height difference h of B from A.

Example: $h = a - b = 1.735\text{m} - 1.224\text{m} = 0.511\text{m}$

<When the distance between points A and B is large or if the height difference is great>



Divide the distance into a number of sections and determine the height difference of each section. The height difference between points A and B is the total of the height differences of all the sections using the following formula.

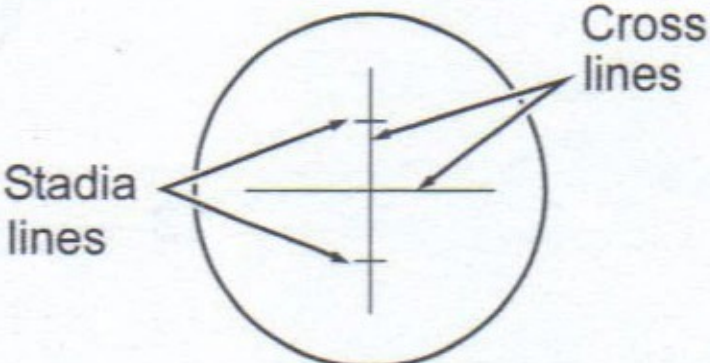
Altitude of the required point = altitude of known point + total of backsight values - total of foresight values.

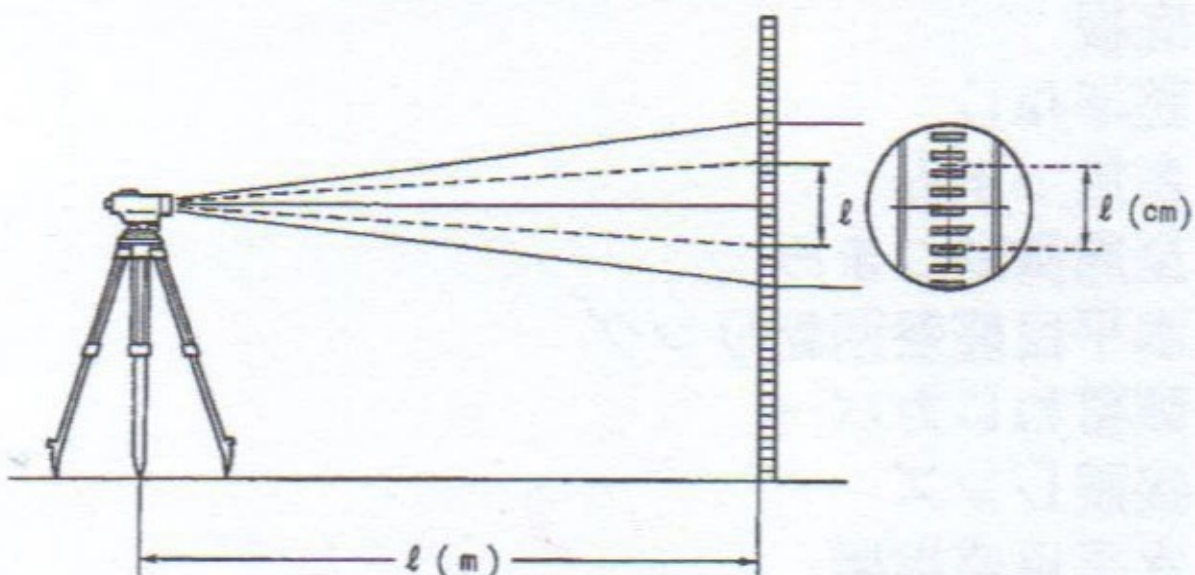
- This simple leveling technique has no error check. It is better to measure from A to B and back to A so that the error of closure can be calculated.

5.2 MEASURING HORIZONTAL ANGLE

- The horizontal circle graduations are annotated in a clockwise direction. As a result, sighting is performed from left to right.
1. Set up the instrument directly above the surveying point.
 2. Sight point A, and set the horizontal circle to 0° by turning the horizontal circle positioning ring.
 3. Sight point B and take the angle reading.

5.3 MEASURING DISTANCE USING THE STADIA LINES

1. Sight the staff, and count the number of centimeters, ℓ , between the two stadia lines.
- 
2. This number is equivalent to the distance in meters between the staff and the instrument.
- If the length (ℓ) is 32 cm, the horizontal distance from the instrument center A to the staff B is 32 m.



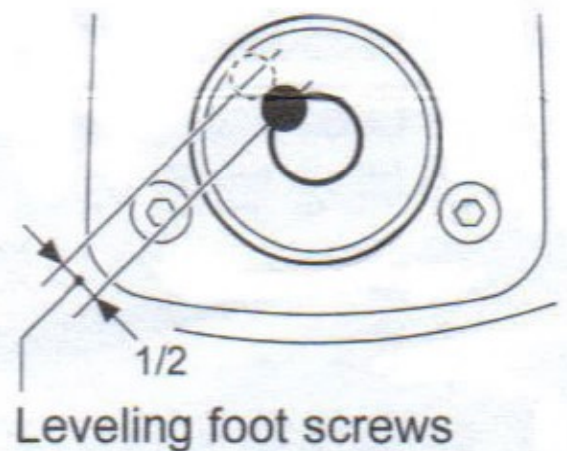
6. CHECKS AND ADJUSTMENTS

6.1 CIRCULAR LEVEL

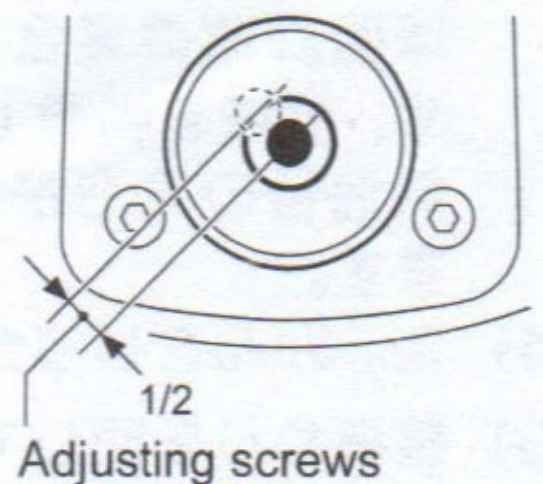
1. Adjust the leveling foot screws to center the bubble in the circular level.
2. Turn the instrument 180° (or 200gon).

If the bubble is inside the circle, no adjustment is necessary. If the bubble shifts from within the circle, adjust as follows:

3. Compensate for one-half of the shift by adjusting the leveling foot screws.

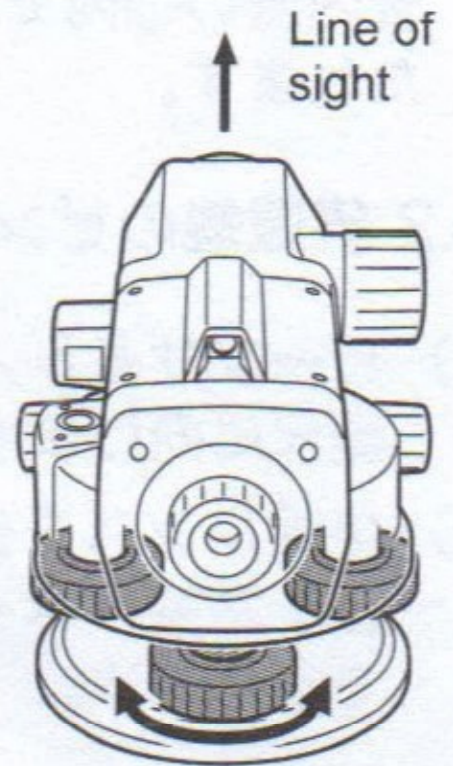


4. Eliminate the remaining half shift with the circular level adjusting screws using the hexagonal wrench.
5. Turn the instrument 180° (or 200gon). If the bubble remains in the circle, adjustment is complete.



6.2 AUTOMATIC COMPENSATOR

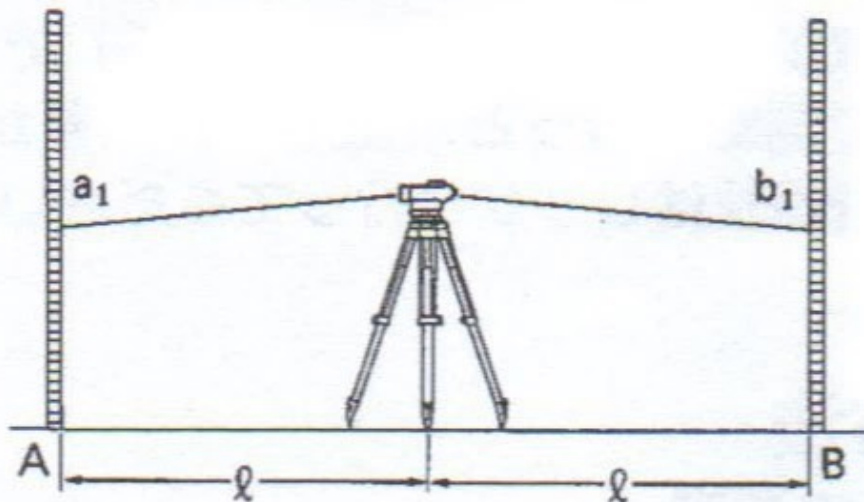
1. Center the bubble in the circular level.
2. While turning the nearest leveling screw to the sighting axis $1/8$ of a turn to the right or left, check the movement of the horizontal cross-line. (Another method is to tap the tripod legs or the main body while sighting a clear target.)



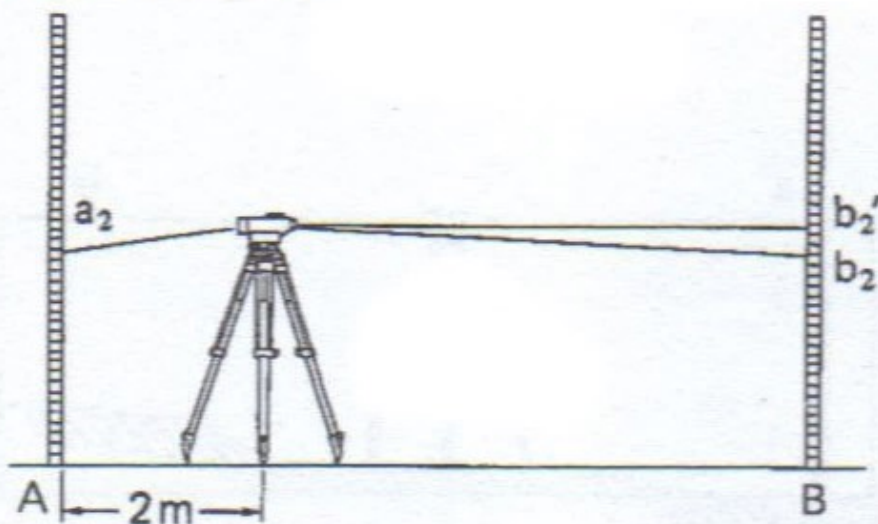
If the automatic compensator mechanism is working normally the cross-line should bounce, then immediately return to the original position. It is advisable to check the movement of the automatic compensator before use.

6.3 RETICLE CROSS-LINE (LINE OF SIGHT)

1. Set the instrument halfway between two points, A and B, 30 to 50m apart. Take readings a_1 and b_1 .



2. Set the instrument at a point 2m from point A. Take readings a_2 and b_2 .



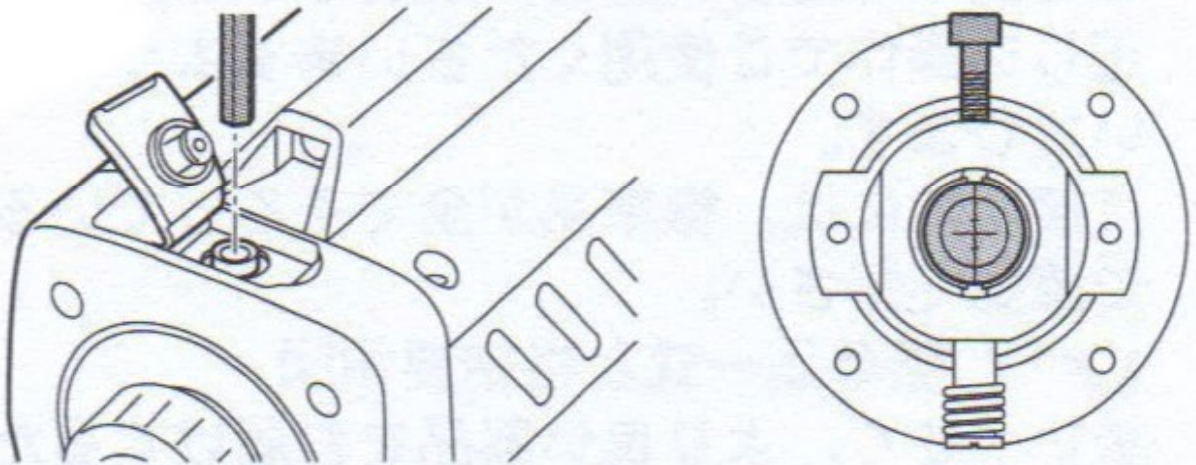
Leave the telescope sighted on point B.

Calculate $b_2' = a_2 - (a_1 - b_1)$

If $b_2' = b_2$, the horizontal cross-line is normal and no adjustment is necessary.

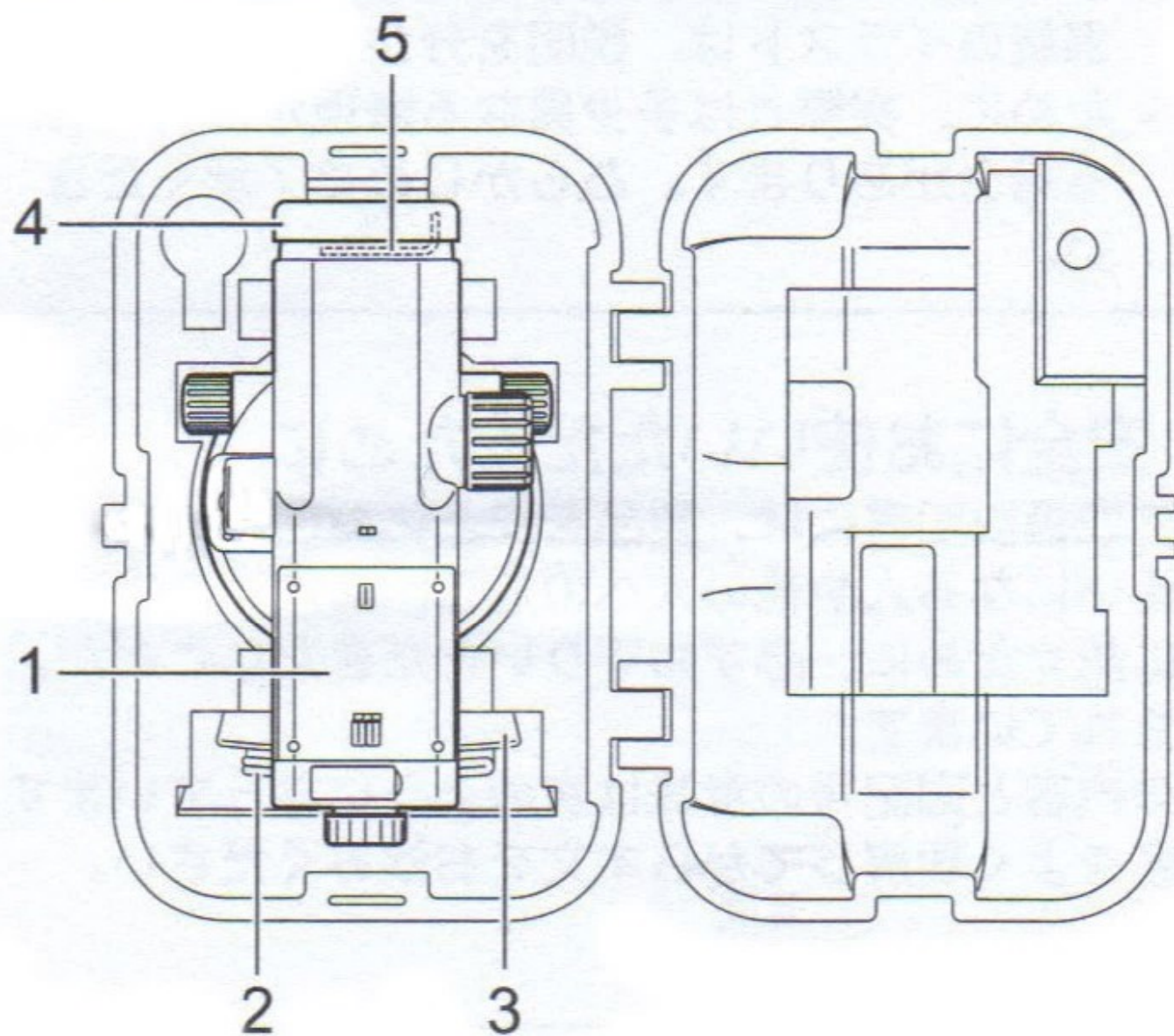
When b_2' and b_2 are different, adjust the cross-line as follows:

3. Open the adjusting screw cover.
4. Use the hexagonal wrench to eliminate the difference between b_2' and b_2 . In the example shown in step 2 b_2' is larger than b_2 . The horizontal line needs to be lowered. To lower the horizontal line, carefully loosen the adjusting screw by a small amount using the adjusting pin. To raise the horizontal line, tighten the adjusting screw.



5. Repeat steps 1 and 2 until the difference between b_2' and b_2 is small.
6. Close the adjusting screw cover.

7. STANDARD EQUIPMENT AND LAYOUT PLAN



1.	Main unit	1
2.	Cleaning cloth	1
3.	Operator's manual.	1
4.	Lens cap	1
5.	Hexagonal wrench	1
6.	Vinyl cover (AT-B3A only)	1
7.	Plumb bob (AT-B3A only).	1

8. SPECIFICATIONS

	AT-B3A	AT-B4A
Telescope		
Length	214mm (8.42 in.)	
Image	Erect	
Objective aperture	36mm (1.42 in.)	32mm (1.26 in.)
Magnification	28X	24X
Field of view (at 100m/328ft.)	1°25' (2.5m/8.2ft.)	
Resolving power	3.5"	4.0"
Minimum focus	0.3m (1ft.)	
Stadia ratio	1:100	
Additive constant	0	
Horizontal circle		
Diameter	99mm (3.9in.)	
Graduation	1° / 1gon	
Automatic compensator		
Range	±15'	
Circular level		
Sensitivity	10' / 2mm	
Standard deviation for 1 km of double run leveling		
	1.5mm (0.06in.)	2.0mm (0.08in.)
Water resistance	IPx6 (IEC60529:2001)	
Operating temperature range	-20 to 50°C (-4 to 122°F)	
Storage temperature range	-40 to 70°C (-40 to 158°F)	
Size	122 X 214 X 140mm (4.80 X 8.42 X 5.51in.)	
Weight	1.5kg (3.3lbs)	

Exceptions from responsibility

- The user of this product is expected to follow all operating instructions and make periodic checks (hardware only) of the product's performance.
- The manufacturer, or its representatives, assumes no responsibility for results of faulty or intentional usage or misuse including any direct, indirect, consequential damage, or loss of profits.
- The manufacturer, or its representatives, assumes no responsibility for consequential damage, or loss of profits due to any natural disaster, (earthquake, storms, floods etc.), fire, accident, or an act of a third party and/or usage under unusual conditions.
- The manufacturer, or its representatives, assumes no responsibility for any damage (change of data, loss of data, loss of profits, an interruption of business etc.) caused by use of the product or an unusable product.
- The manufacturer, or its representatives, assumes no responsibility for any damage, and loss of profits caused by usage different to that explained in the operator's manual.
- The manufacturer, or its representatives, assumes no responsibility for damage caused by incorrect operation, or action resulting from connecting to other products.

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