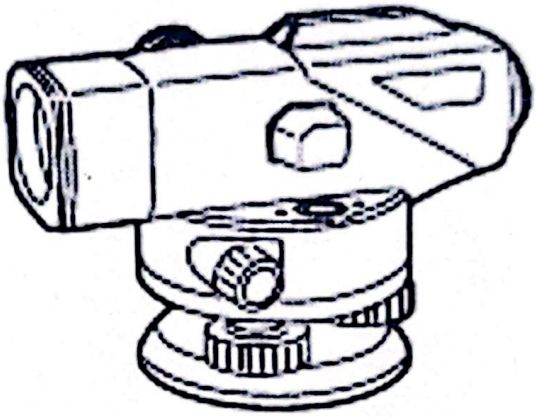


INSTRUCTION MANUAL
AUTOMATIC LEVEL

B20

AT-B2

CONTENTS

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 WARING 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 possible result in death or serious injury to the operator.
⚠ **CAUTION**	Ignoring this indication and making an operation error could possible result in personal injury or property damage.

1.1 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.

1.2 TRIPOD

⚠ CAUTION

- When mounting the instrument to the tripod, tighten the centring screw secuely.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 tripos 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.

1.3 STAFF

⚠ CAUTION

- Do not use under thunderous weather condition. Staff is conductive and if struck by lightnign, 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. FEATURES OF B20/AT-B2

The B20/AT-B2 is equipped with a fast-action, magnetically-damped, automatic compensator. After the instrument has been approximately leveled using the circular level, the line of sight is accurately leveled by the automatic compensating mechanism.
The B20/AT-B2 has been designed to allow stable surveying operations regardless of environmental conditions such as vibration and temperature changes.

The B20/AT-B2 has a magnification ofx32 and a standard deviation for 1 km (1mile) of double run leveling of ± 1.0mm.

The B20/AT-B2 has a simple horizontal circle for angle measurement, and the stadia lines on the reticle can be used for approximate distance measurement.

The B20/AT-B2 is ideally suited for general survey work, civil engineering and construction work.

3. PARTS OF THE INSTRUMENT

(Instrument shown:B20/AT-B2)

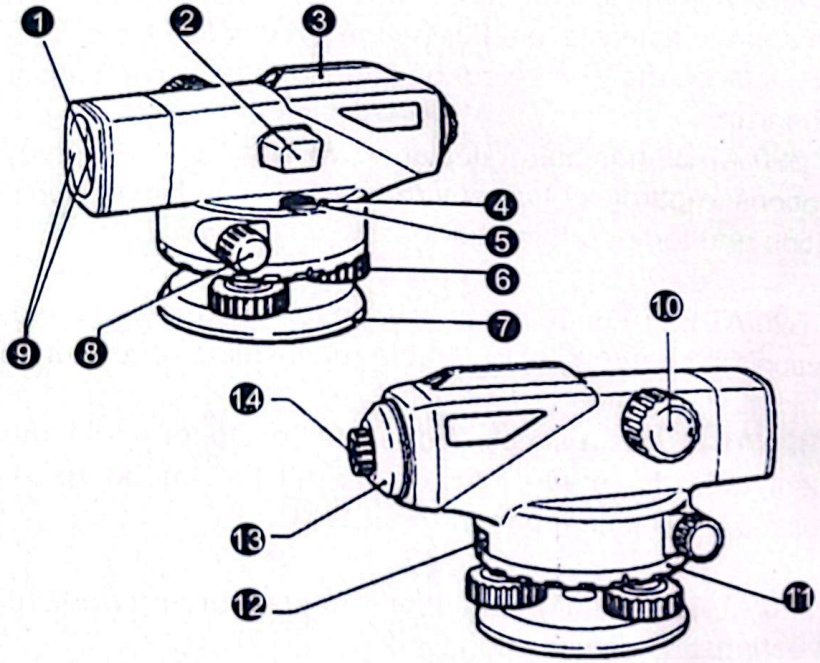


Fig.3.1

1. Lens hood (Sliding type)
2. Reflector
3. Peep sight
4. Circular level adjusting screw
5. Circular level
6. Leveling foot screw
7. Base plate
8. Horizontal fine motion screw
9. Objective lens
10. 2-speed focussing knob
11. Horizontal circle positioning ring
12. Horizontal circle window
13. Reticle adjusting screw cover
14. Eyepiece*

*The B20/AT-B2 eyepiece is detachable.

4. PRELIMINARIES

4.1 SETTING UP THE INSTRUMENT

1) Unbuckle the band around the tripod legs and loosen the extension clamp screws.(Fig4.1)

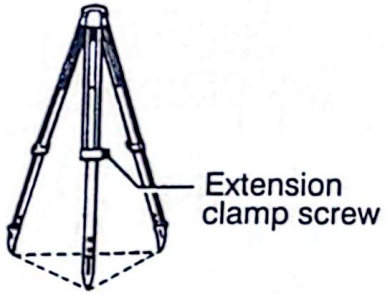


Fig.4.1

2) With the tripod closed, extend the tripod legs until the tripod head is roughly at eye level,then re-tighten the clamp screws.

3) Spread the tripod legs so that the leg tips form a regular triangle on the ground.

4) Make sure that the tripod head is approximately level.Fix the tripod shoes firmly into the ground. (Fig.4.2)

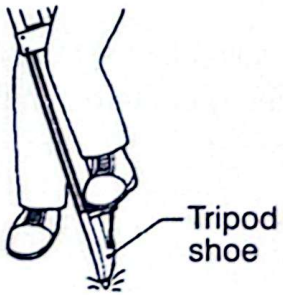


Fig.4.2

5) Hold the instrument on the tripod head and tighten the centering screw. (Fig.4.3)

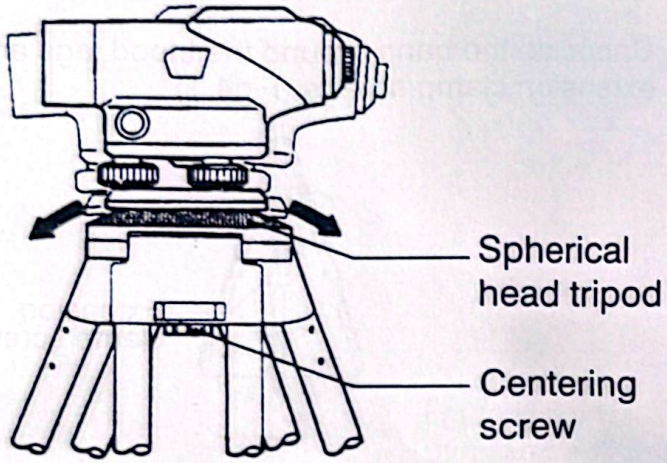


Fig.4.3

6) When using the spherical head tripod, slightly loosen the centering screw, hold the base plate ❼ in both hands, and slide it across the tripod head until the bubble is in the proximity of the circular level ❺ (Fig.4.4)

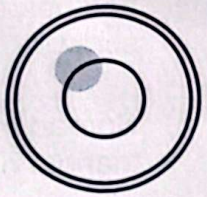


Fig.4.4

7) Tighten the centering screw.

8) Adjust the leveling foot screws ❻ until the bubble is exactly centered in the center circle.(Fig4.5)

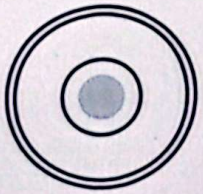


Fig.4.5

4.2 FOCUSSING AND SIGHTING

1) Use the peep sight ❸ to point the objective lens ❾ at the target.

2) Gradually turn the eyepiece ⓮ until just before the reticle cross-line becomes blurred. (Fig.4.6) Use the lens hood ❶ in strong light conditions.

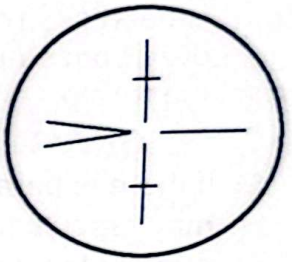


Fig.4.6

3) Use the horizontal fine motion screw ❽ to center the target in the field of view. Turn the 2-speed focussing knob ❿ to focus on the target. (Fig4.7)

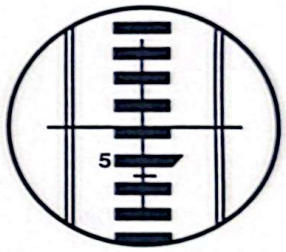


Fig.4.7

※ Focussing is coarse while the focussing knob feels heavy to rotate. Rotating in the reverse direction (less heavy) will give a fine focussing motion.

4) Looking through the telescope, shift your eyes slightly in the horizontal and vertical directions.

Therefore point B is 0.511m higher than point A. (The value of h will be negative is point B is lower than point A.)

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

1) Divide the distance into a number of sections and determine the height difference of each section.

Fig.5.2

2) The height difference between points A and B is the total of the height differences of all the sections.

The general formula is:
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 every 10° (360°) or 10 gon (400 gon) in a clockwise direction. As a result, sighting is performed from left to right.

1) Use the plumb bob ⑮ to set up the instrument directly above the surveying point. (Fig.5.3)

Fig.5.3

2) Sight point A, and set the horizontal circle ⑫ to 0° by turning the horizontal circle positioning ring ⑪ .(Fig.5.4)

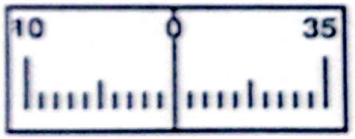


Fig.5.4

3) Sight point B and take the angle reading.
Example: 91.5° (or 91.5 gon) in (Fig.5.5) below.

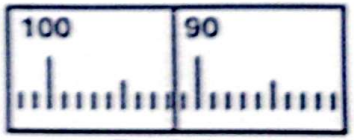


Fig.5.5

5.3 MEASURING DISTANCE USING THE STADIA LINES

The stadia lines etched on the reticle can be used for distance measurements.

1) Sight the staff, and count the number of centimeters, ℓ, between the two stadia lines. (Fig.5.6)

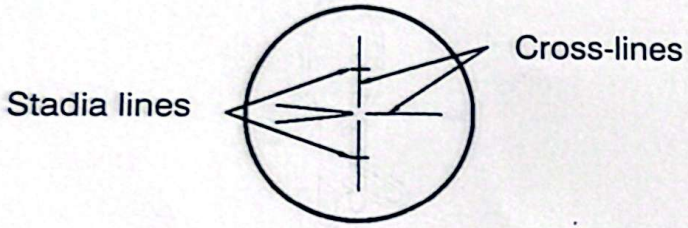


Fig.5.6

2) This number is equivalent to the distance in meters between the staff and the instrument.

Example:
If the length (ℓ) is 32 cm, the horizontal distance from the instrument center A to the staff B is 32 m.

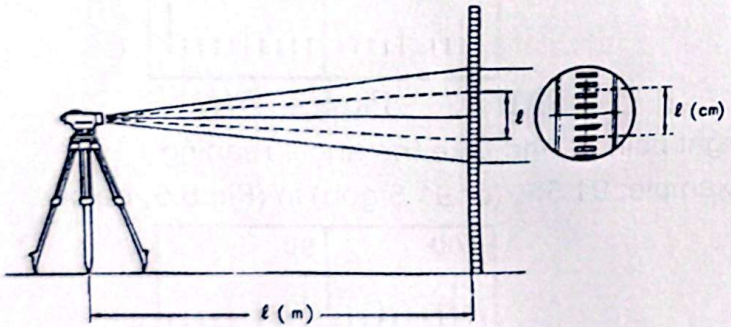


Fig.5.7

6. CHECKS AND ADJUSTMENTS

6.1 CIRCULAR LEVEL

1) Adjust the leveling foot screws ❻ to center the bubble in the circular level ❺ .

2) Turn the instrument 180° (or 200 gon). (Fig.7.1)

Fig.7.1

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 ❻ .(Fig.7.2)

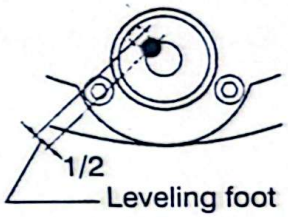


Fig.7.2

4) Eliminate the remaining half shift with the circular level adjusting screws ❹ using the hexagonal wrench ⓰ .(Fig.7.3)

5) Turn the instrument 180° (or 200 gon). If the bubble remains in the circle, adjustment is complete.

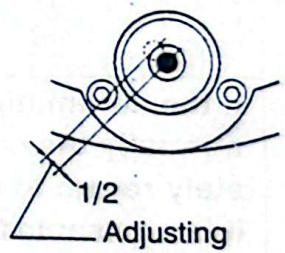


Fig.7.3

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.)

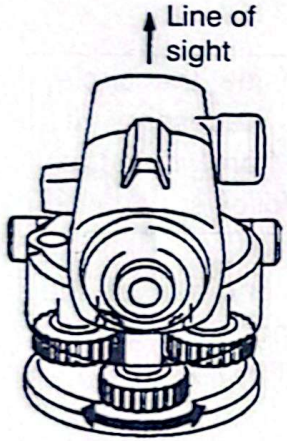


Fig.7.4

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 a1 and b1. (Fig.7.5)

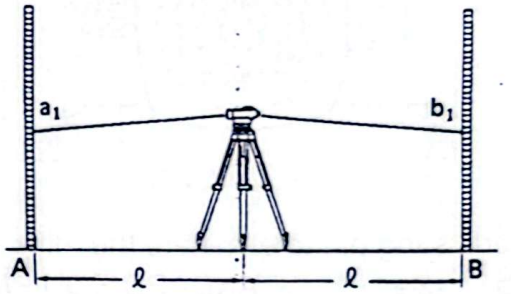


Fig.7.5

2) Set te instrument at a point 2 m from point A. Take readings a2 and b2. (Fig.7.6)

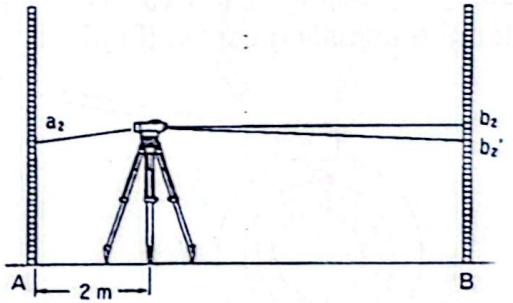


Fig.7.6

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 coross-line as follows:

3) Unscrew and remove the adjusting screw cover ⑬ .

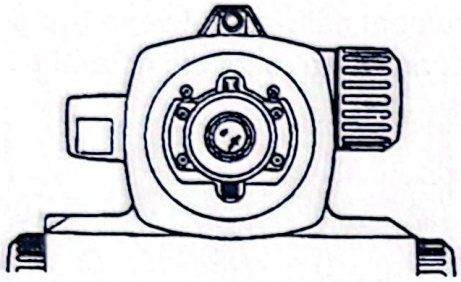


Fig.7.7

4) Use the adjusting pin to eliminate the difference between b_2' and b_2. (See "11. STANDARD EQUIPMENT".) In the example shown if Fig.7.6 b_2 is larger than b_2'. The horizontal line needs to be lowered. To lower the borizontal line, carefully loosen the adjusting screw by a small amount using the adjusting pin ⑰ . To raise the horizontal line, tighten the adjusting screw. (Fig.7.8)

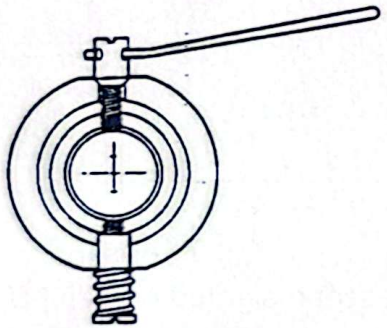


Fig.7.8

5) Repeat steps 1) and 2) of the adjustment procedure until the difference between b_2' and b_2 is small.

7. GENERAL PRECAUTIONS

1) The B20/AT-B2 is a precision instrument.
Handle with care and avoid heavy shocks an vibration.

2) Never place the instrument directly on the ground.

3) When the instrument is left on the tripod, cap the objective lens ㉑ and cover the entire instrument with the vinyl cover ⑲ provided.(See "11.STANDARE EQUIPMENT".)

4) When the instrument is placed in the case, store the accessories in their specified places.

8. SPECIFICATIONS

Telescope	**B20/AT-B2**
Length:	215 mm (8.5 inch)
Image:	Erect
Objective aperture:	42 mm (1.7 inch)
Magnification:	32x
Field of view:	1° 20'(2,3 m at 100m)
Resolving power:	3"
Minimum focus:	0.3 m (1ft) (from instrument center)
Stadia ratio:	1:100
Additive constant:	0
Horizontal circle	
Diameter:	103 mm (4.1 inch)
Graduation:	1° or 1 gon
Automatic compensator	
Range:	±15'
Circular level	
Sensitivity:	10'/2 mm
Standard deviation for 1 km (1mile) of double run leveling:	± 1.0mm
Water resistance:	IPX6
Size:	130 (W) x 215 (D) X 140 (H) mm 5.1 (W) x 8.5 (D) x 5.3 (H) inch
Weight: Instrument:	1.8 kg (4.1 lbs)

9. MAINTENANCE

1) Check the tripod for loose fit and loose screws.

2) Wipe off moisture completely if the instrument gets wet during survey work.

3) 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.

4) To clean the instrument or carrying case, lightly moisten a soft colth 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.

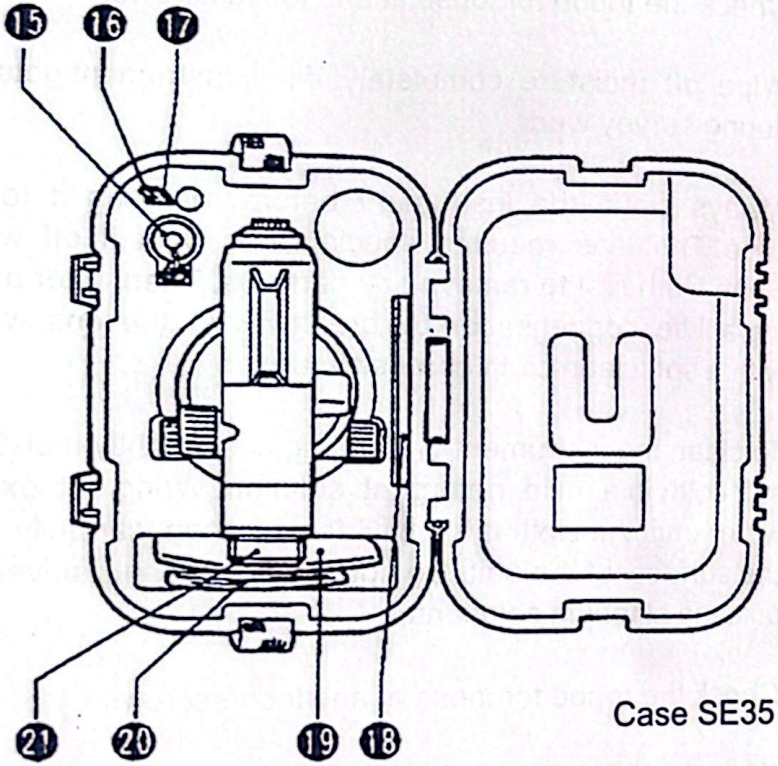
5) Check the tripod for loose fit and loose screws.

6) If any trouble is found on the rotatable portion,screws or optical parts (e.g. lens), contact your local dealer.

7) Store the instrument in a dry room where the temperature remains fairly constant.

10. STANDARD EQUIPMENT

(Packing layout)



Case SE35

Fig.11.1

⑮ Plumb bob.....1
⑯ Hexagonal wrench....1
⑰ Adjusting pin.....2
⑱ Operator's manual....1
⑲ Vinyl cover.....1
⑳ Cleanin cloth.....1
㉑ Lens cap.....1