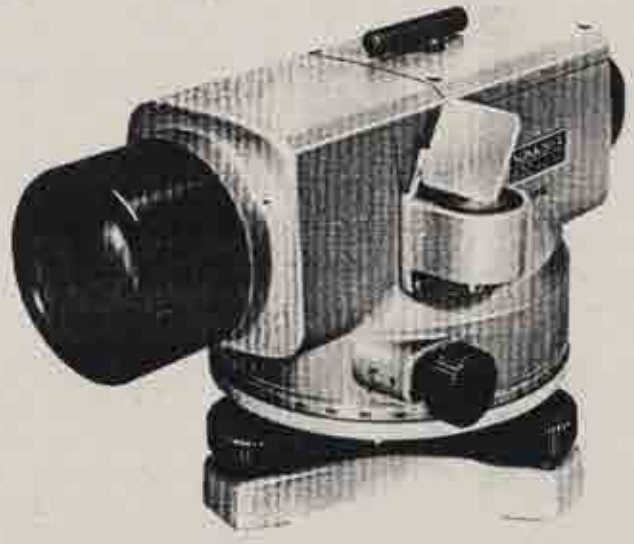
AUTOMATIC LEVEL

B2C

OPERATION MANUAL



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SOKKISHA

AUTOMATIC LEVEL B2C

CONTENTS

AUTOMATIC LEVEL B2C

Sokkisha Automatic Levels have proved to be highly accurate, efficient, and durable. More than 100,000 of these units have already been used all over the world. The newly introduced Automatic Level B2C, an embodiment of Sokkisha's technological achievements, features excellent performance and functions.

FEATURES

(1) The automatic compensator uses the well-known magnetic damper to steady the image in a mere 0.5 sec. or less and guarantees high accuracy and a stable line of sight even under considerable vibration.

(2) The pendulum mechanism has sufficient strength. It is hung by four stable wires, so that there is no fear of breaking. The mechanism provides high accuracy over a broad range of working temperature and is not affected even by strong shocks and vibrations.

(3) The telescope has a high magnification of X32.

(4) The B2C has been designed for use in all conditions. It is water-resistant for wet weather and tunnel levelling.

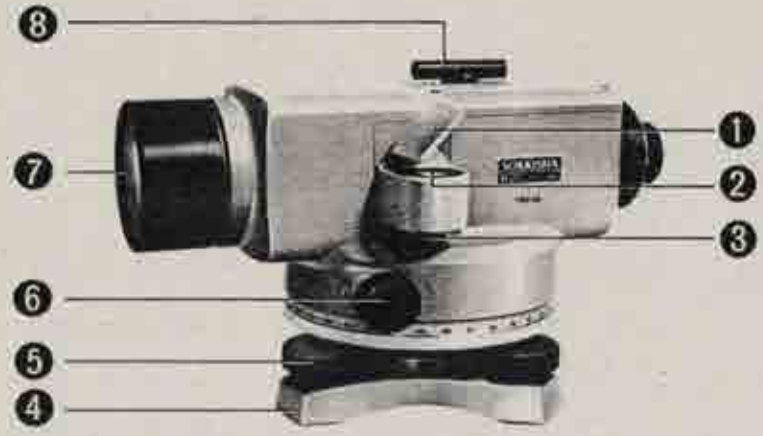
(5) The horizontal circle with 1° (or 1^g) graduation and vernier reading 10′ (or 20^c) is so easy to read.

(6) The instrument can be mounted on either the spherical or flat head tripod. Sokkisha's unique spherical head tripod makes the B2C easy to set up whatever the ground conditions.

(7) The optional Optical Micrometer is available for precision levelling.

(8) It's easy to see the bubble in the circular level. Just tilt the reflector.

INSTRUMENT NOMENCLATURE



NAME OF PARTS

1. Reflector
2. Circular level
3. Circular level adjusting screw
4. Base plate
5. Levelling screw
6. Fine motion screw
7. Objective lens
8. Peep sight
9. Focusing knob
10. Horizontal circle
11. Horizontal circle index
12. Reticle focusing ring
13. Eyepiece
14. Adjusting screw cover

SPECIFICATIONS

Telescope	360° (400^g)
Length	220 mm
Image	Erect
Objective aperture	40 mm
Magnification	X32
Field of view (at 100 m)	1°20′ (2.3 m)
Resolving power	3″
Minimum focusing distance	1.4 m
Stadia ratio	1:100
Horizontal circle	
Diameter	109 mm
Graduation	1° (1^g)
Vernier reading	10′ (20^c)
Automatic compensator	
Accuracy	±0.3″
Range	±10′
Circular level	
Sensitivity	10′/2 mm
Standard deviation for 1km double run levelling	±1.0 mm
Minimum reading on the optical micrometer	0.1 mm
Weight	
Instrument	2.2 kg
Case	1.9 kg
Wooden telescopic tripod	5.2 kg
Metal telescopic tripod	4.5 kg
Accessories	
Lens cap	1
Lens hood	1
Plumb bob	1
Vinyl cover	1
Lens cloth	1
Adjusting pin	2
Screw driver	1
Operation manual	1

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PRELIMINARIES

1. SETTING UP THE INSTRUMENT

(1) Unbuckle the band around the tripod legs. Loosen the extension clamp screws A (Fig. 1).

(2) Extend the tripod legs until the tripod head is roughly at eye level. Then retighten the clamp screws.

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

(4) While confirming that the tripod head is approximately level, fix the tripod shoes firmly into the ground (Fig. 2).

(5) Tighten the wing nuts B at the tripod head.

(6) Set the instrument on the tripod head. Insert the centring screw into the base plate, taking care to align the threads properly. Tighten the centring screw.

(7) When using the spherical head tripod, slightly loosen the centring screw, hold the instrument in both hands, and slide it backwards and forwards across the tripod head until the bubble is approximately centred in the circular level (Fig. 3).

(8) Finally, slightly turn the levelling screws until the bubble is centred exactly within the centre circle. The instrument is now ready for sighting (Fig. 4).

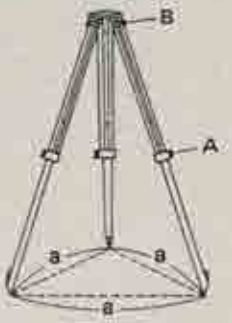


Fig. 1

Fig. 2

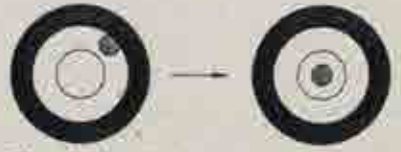


Fig. 4

Fig. 3

2. SIGHTING

(1) Sight the staff through the peep sight.

(2) Look through the eyepiece ⓭ and focus on the reticle by gradually turning the reticle focusing ring ⓬ counterclockwise. (Stop just before the reticle grows dim. This will cause less eye fatigue and eliminates the need for readjustment over a long period of time.)

(3) Looking through the peep sight, direct the telescope to the target.

(4) Turn the fine motion screw to centre the staff in the view field. Focus on the staff to eliminate parallax between the object image and the reticle.

* Eliminating parallax

Parallax-free focusing occurs when the object image and cross-lines show no deviation even if the eyes are shifted slightly in the vertical and horizontal directions. If there is a parallax, large measurement errors may result. Be sure to eliminate the parallax.

MEASURING METHOD

1. HEIGHT DIFFERENCE (Fig. 5)

* When determining the height difference between points A and B.

(1) Place the instrument at a point approximately halfway between points A and B.

(2) Sight the staff at point A and obtain the reading a (backsight). (Example: a = 1.735 m)

(3) Then sight the staff at point B and obtain the reading b (foresight). (Example: b = 1.224 m)

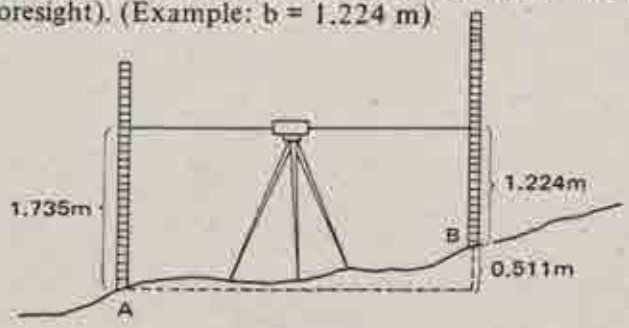


Fig. 5

(4) The difference a – b is the height difference (h) of B against A.

Sample calculation

h = a – b = 1.735 – 1.224 = +0.511

Thus point B is 0.511 m higher than point A. (The value h will be negative if point B is lower than the point A.)

Precaution:

A slight deviation of the sighting axis will not cause a measurement error, as long as the instrument is placed exactly halfway between points A and B.
Place the instrument halfway between the points.

When placing the instrument, equalize the backsight and foresight distances by the stadia method described below.

* If the distance between points A and B is large (Fig. 6)

(1) Divide the distance into an even number of sections, and determine the height difference of the respective sections (A and C, C and D, ...) as described above.

(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

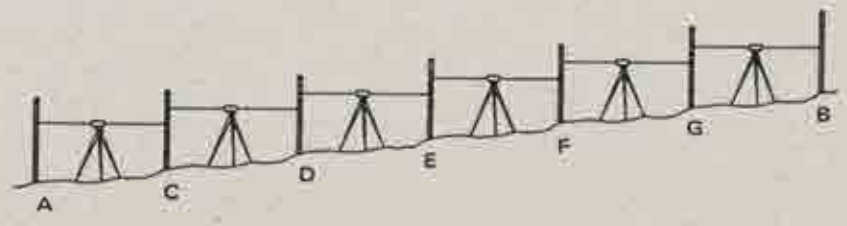


Fig. 6

* When obtaining height with high accuracy

Measure by placing the instrument halfway between points A and B (Fig. 5). In this case, no error will occur even if there is some deviation in the horizontal line of sight. The instrument can be centred conveniently by using the stadia method described below.

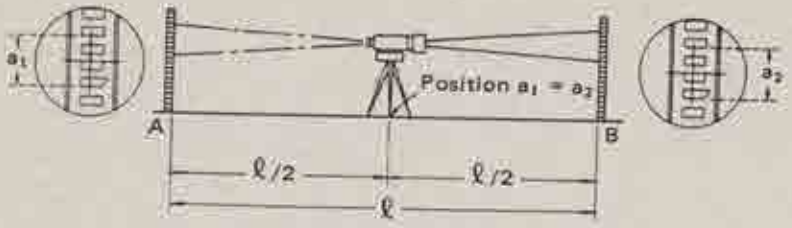


Fig. 7

2. STADIA METHOD (Fig. 8, 9)

The stadia lines are drawn on the reticle as shown in Fig. 8.
Sight the staff, count number of centimeters between the stadia lines. The number is the distance in meters between the staff and the instrument centre (Fig. 8, 9).

Fig. 8

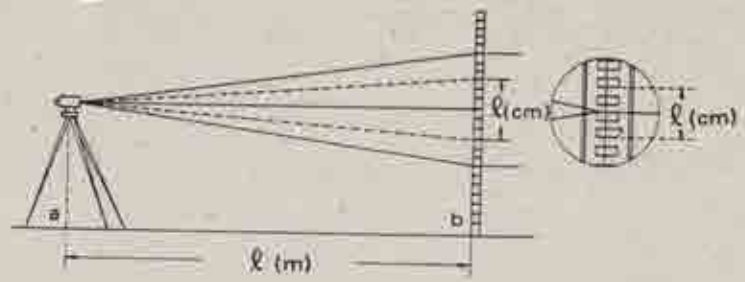


Fig. 9

3. HORIZONTAL ANGLE (Fig. 10)

It is easy to read the horizontal angle from the horizontal circle ⑩. Since the horizontal circle is of the friction type, any graduation on it can be aligned manually with the index. (Normally, preset the initial sighting direction to zero.)

Precaution:

For precise angle measurement, use any Sokkisha theodolite or transit.

Fig. 10

SIMPLE CHECKING METHOD

With the automatic levels it is advisable to check the movement of the automatic compensator before surveying.
A simple test can be performed as follows.

Checking the circular level:

Slide the instrument across the tripod head and adjust the levelling screws to centre the bubble into the circular level.
Then turn the telescope 180° (or 200ᵍ).
If the bubble moves off centre, bubble adjustment is incorrect (refer to 1. **'CIRCULAR LEVEL'** in **'CHECKING AND ADJUSTING'**).

Checking the automatic mechanism:

Centre the bubble in the circular level. Tap the tripod legs or main body lightly while sighting a clear target.
The cross-lines should bounce, but immediately return to their original position, thus indicating that the automatic compensator mechanism is working normally.

OPTIONAL ACCESSORY

OPTICAL MICROMETER

Specifications

Graduation range	0 ~ 10 mm
Minimum graduation	0.1 mm
Accuracy	0.05 mm

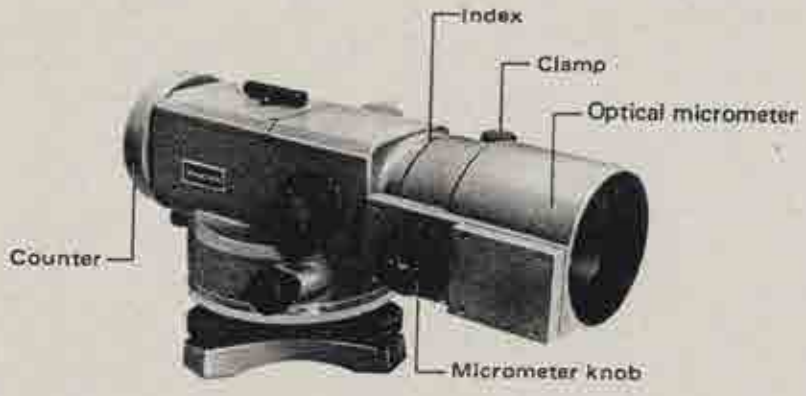
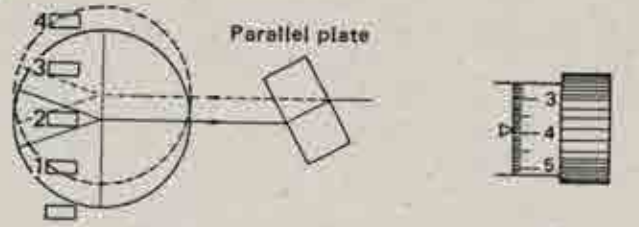


Fig. 11

The detachable Optical Micrometer is available for high precision levelling.
Slide the Optical Micrometer to the object lens, until the indices are aligned and tighten the clamp.
Turning the micrometer knob shifts the line of sight of the telescope vertically to a maximum of 10 mm. This shift can be measured in 0.1 mm graduations. The graduations on the staff must be between the wedge reticle lines in order to make any measurements.
Use first-order staves with 1 cm graduations or similar precision staves. (Fig. 11)



Micrometer reading + 2 / 0.39
2.39 cm

Fig. 12

CHECKING AND ADJUSTMENT

1. CIRCULAR LEVEL (perpendicular alignment with the vertical axis) (Fig. 13)

Checking:
Adjust the levelling screws to centre the bubble in the circular level (A), and turn the instrument 180° (or 200ᵍ). The bubble should not shift from the centre.

Adjustment:
If the bubble does shift (B), compensate for one-half of the shift by adjusting the levelling screws ❺(C), and eliminate the remaining half with the circular level adjusting screws ❸(D). Repeat the above check and adjustment until no bubble shift occurs in any telescope direction.

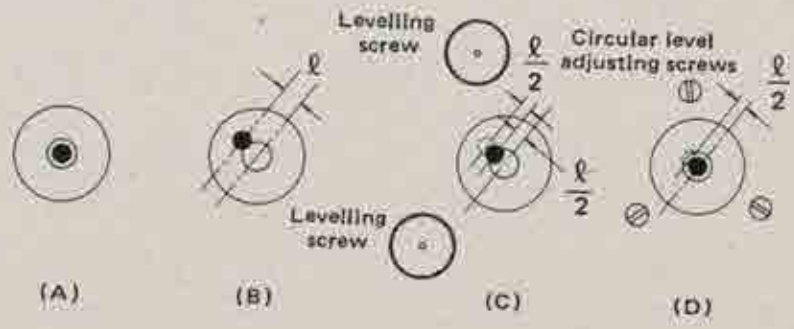


Fig. 13

2. CROSS-LINES OF RETICLE (level of sighting axis)

Checking:

(1) Set the staves at points A and B spaced about 30~40 m apart, and set the instrument approximately halfway C between points A and B.

(2) Take the reading a_1 on the staff at point A (backsight), and then take the reading b_1 on the staff at point B (foresight) (Fig. 14).

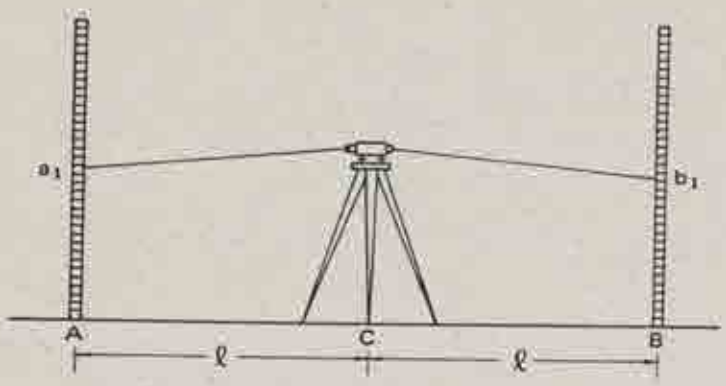


Fig. 14

(3) Set the instrument at point D about 2 m from point A (Fig. 15).

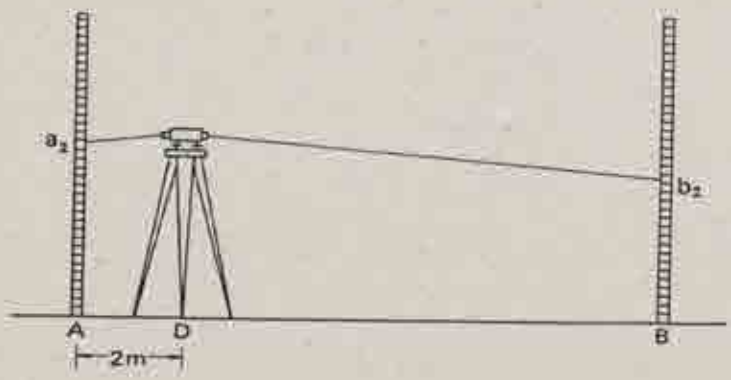


Fig. 15

(4) Take backsight reading a_2 and foresight reading b_2. Leave the telescope in the foresight position.
Then calculate b'_2 by:

$$b'_2 = a_2 - (a_1 - b_1)$$

No adjustment is necessary if the reading b_2 equals the value b'_2.

Adjustment:

(5) When b'_2 is not equal to b_2. Remove the adjustment screw cover ⓭. Loosen the right and left adjusting screws slightly. If b'_2 is smaller than b_2, the horizontal reticle line should be lowered until the reading is equal to b'_2. To do this, first loosen the top adjusting screw and tighten the bottom adjusting screw to the same degree, and repeat the operation until the reading b'_2 is obtained. Then retighten the right and left adjusting pins. Confirm that the reading b'_2 remains the same. It is important that after the adjustment, the horizontal reticle line remains in the correct position.

N.B.
Do not tighten the adjusting screws too hard. Keep a slight margin when tightening, otherwise any unnecessary mechanical stress may damage the instrument.

Repeat steps (2) through (5) until b_2 equals b'_2.

Fig. 16

[illegible] PRECAUTIONS

1. Be sure to carry the instrument to the job site in the plastic case.
2. Handle with care.
3. Do not place the instrument directly on the ground.
4. After taking the instrument and accessories out of the plastic case, be sure to close the case cover to keep out dust and dirt.
5. Use both hands to hold the instrument when carrying it at the job site. When carrying the instrument mounted on the tripod, do not bang it against obstacles.
   Keep the instrument in the vertical position.
6. If the instrument is left mounted on the tripod for any length of time, cap the objective lens and cover the entire instrument with the vinyl cover provided.
7. Be careful not to expose the instrument to direct sunlight and rain. If it gets wet, wipe it with a dry cloth before putting it back in the plastic case.
8. Store the accessories in the specified places in the case.

MAINTENANCE

1. Moisture affects the surveying instrument. Completely wipe off any moisture if the instrument gets wet during surveying work.
2. After use, clean every part of the instrument before putting it back in the case. Breathe on the lenses to moisten them and gently clean them with the lens cloth provided, a clean cloth (preferably, wornout cotton), or soft tissue paper.
3. The tripod shoes may become loose or the legs may become shaky due to faulty wing nuts when used for a long period. Check them periodically.
4. If foreign matter appears to have entered any movable parts or screws or when condensation or fungi appears on the lenses, prisms, etc. in the telescope, promptly consult the nearest Sokkisha sales office or agency.
5. It is recommended to subject the instrument to annual or semi-annual checking and inspection to maintain the high quality necessary for your surveying work.