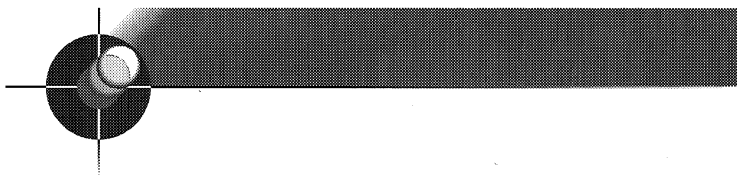


***Nikon***

**Automatic Levels**

**AE-7 / AE-7C**

**Instruction Manual**



Thank you for your purchase of Nikon automatic levels AE-7/AE-7C. These instruments are designed for the precision surveys as in civil engineering and architectural constructions.

With these instruments, only rough adjustment is needed to get the exact horizontal line, enabling uniform surveying accuracy without sighting errors.

Moreover, with their waterproofed\* telescopes, they can be used in moist circumstances such as in rain or in tunnel constructions.

AE-7C, is identical with AE-7 except that it is provided with a horizontal circle.

Please read this instruction manual thoroughly to get fully acquainted with the product.

**\*Waterproofed:**

Shows no trace of water intrusion when left in the water for 30 minutes with its upmost part 150mm, and its lowest part 1m below the water surface.

Nikon reserves the right to make such alterations in design as may be considered neccessary in the light of experience. For this reason, particulars and illustrations in this handbook may not conform in every detail to models in current production.



# CARE AND MAINTENANCE

## 1. When carrying

The instrument should be carried encased. If you insist on carrying it while left attached to a tripod, keep them vertical. Never support them on the shoulder.

## 2. Rain

The instrument can be used in the rain, but be sure to wipe off the moisture after use.

## 3. Storage

Store the instrument in a shady dry place.

## 4. Cleaning lens

Remove the smudges and finger marks from the lens using soft tissue or soft washed-out cotton cloth free from lint and grease.

## 5. Cleaning plastic case

Use the neutral detergent. Never use any organic solvents (such as thinner, ethyl alcohol, xylene.)

## 6. Do not turn the attaching screws

Do not overturn or release the attaching screws since the firmness of the screws are all figured out to maintain the best performance of the instrument.

# CONTENTS

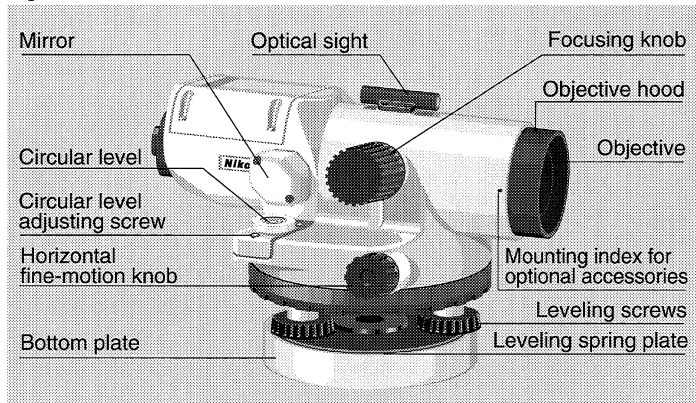
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# I

## NOMENCLATURE

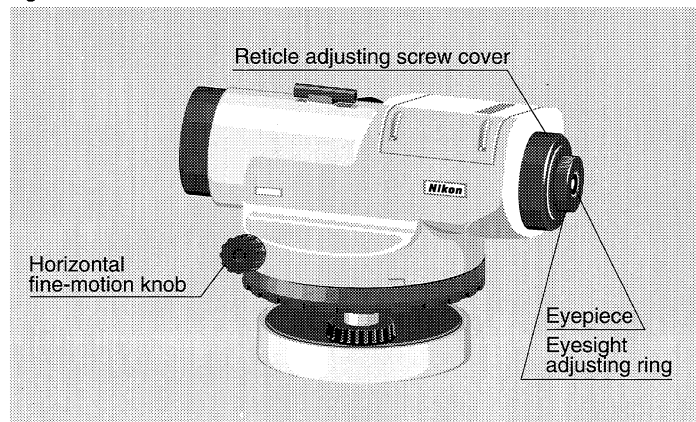
### 1. Right Side (for AE-7/AE-7C)

Fig. 1



### 2. Left Side (for AE-7)

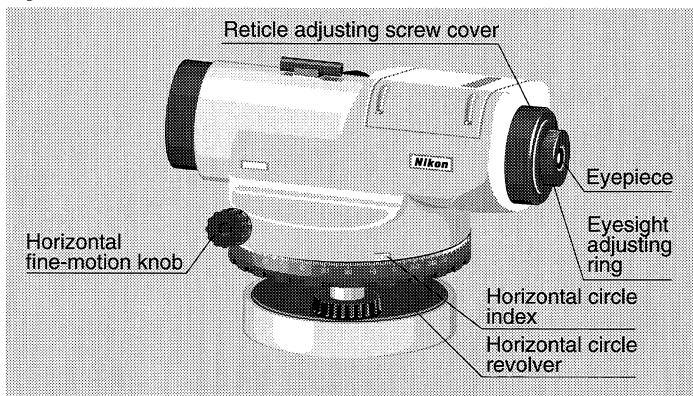
Fig. 2

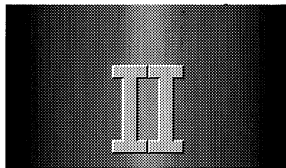





### 3. Left Side (for AE-7C)

Fig. 3





## USAGE



### 1. Set a tripod.

Set a tripod on the ground. Make sure that its head is approximately level.



### 2. Mount the instrument.

Gently take out the instrument from its plastic case. Mount it on the tripod. Secure it by the lock screw from underside.



### 3. Level the instrument.

The circular level shows the inclination of the instrument. When its air bubble is placed inside the brown circle, the instrument is within its automatic compensation range ( $\pm 16'$ ). If not, adjust three leveling screws to bring the air bubble inside the brown circle.

When more accuracy is required, place the air bubble exactly at the center of the brown circle.

#### **When spherical head tripod is used:**

Slightly loosen the lock screw. Hold the bottom plate of the instrument and slide it along the spherical head to bring the air bubble inside the brown circle. Tighten the lock screw.

When more accuracy is required, place the air bubble exactly at the center of the brown circle.



### 4. Adjust the diopter.

Remove the objective cap and look into the eyepiece. Turn the eyesight adjusting ring to focus on the crosshairs inside the viewfield.

## 5. Focus on the target.

Aim on a target using the optical sight. Bring the target to the center of the viewfield using horizontal fine-motion knob. Focus on the target using focusing knob. Make sure that there is no parallax existing. (See page 5.)

## 6. Check the horizontality.

Check the circular level from the eyepiece side using the mirror. If the air bubble is inside the brown circle, the line of sight inside the viewfield is showing the exact horizontal line. If not, adjust the leveling screws to bring the bubble inside the circle.

## 7. Survey.

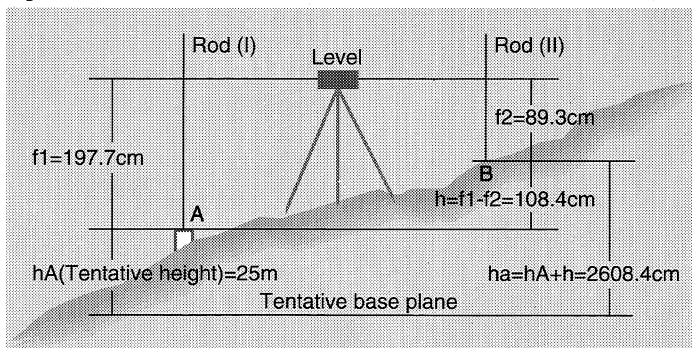
### Measuring height difference between points A and B

Set the instrument halfway between points A and B and read the rods (I) and (II). The difference between the readings is the height difference.

*Example:*

$$\begin{aligned} &\text{Height difference between the points A and B} \\ &= \text{Reading on the rod (I)} - \text{Reading on the rod (II)} \\ &= 197.7\text{cm} - 89.3\text{cm} = 108.4\text{cm} \end{aligned}$$

Fig. 4





## Measuring distance from the instrument center to the target (Stadia measurement)

Stadia lines inside the viewfield is used for distance measurement. Read out the length  $\ell$  on the rod imaged between the two stadia lines. Multiply the length  $\ell$  by 100 to get the distance  $L$  from the instrument center to the target.

Fig. 5

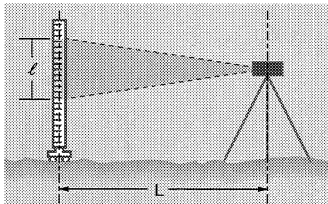
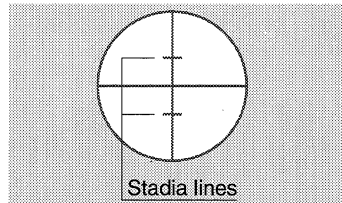


Fig. 6



### •About the focusing knob

The focusing knob functions as coarse focus knob and fine focus knob. Due to this coaxial coarse/fine focusing mechanism, the rotation torque changes during rotation. When felt heavy, the knob is under coarse focusing motion and when felt light, under fine focusing motion. The coarse/fine switching is performed automatically. The rotation starts with fine focusing motion, and switches to coarse motion after turned for approximately  $120^\circ$ . When turned to opposite direction, it returns to fine focusing motion. The rotation speed of coarse and fine focusing motion is about 5:1.

### •About parallax

When there is a parallax (focusing difference between the crosshairs and the target), your eyes will feel deep fatigue and the measurement will show the incorrect value.

To check the existence of parallax, look through the eyepiece and move the eye vertically and horizontally to check if the relative position of the

target and the crosshairs changes.

If the relative position does not change, there is no parallax.

If the relative position changes, there is a parallax. Refocus on crosshairs and the target respectively to eliminate the parallax.

•**About automatic compensation**

The adjusting mirror inside the instrument automatically compensates the inclination of the instrument body. The automatic compensation range is  $\pm 16'$ .

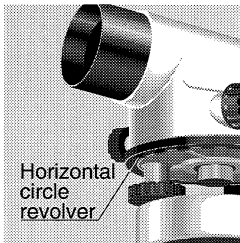
When the air bubble is inside the brown circle, the inclination of the instrument body is within  $\pm 16'$ , thus providing exact horizontal line of sight.

When this automatic compensating function is working correctly, the target image moves inside the viewfield when the tripod is tapped lightly.

•**About horizontal circle (AE-7C only)**

The horizontal circle can be set at the desired position by the horizontal circle revolver. One division represents  $1^\circ$  or 1 gon.

Fig. 7



# III

## CHECKING AND ADJUSTMENT

The instrument should be checked periodically to assure its best performance.

### 1. Circular level

The circular level axis should be set parallel to the vertical axis of the instrument.

#### Checking

Set the instrument so that the air bubble is at the very center of the brown circle. Turn the telescope 180° or and check if the air bubble is not moving away from the center of the brown circle. If it does, adjustment is needed.

Fig. 8

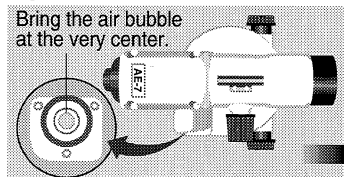
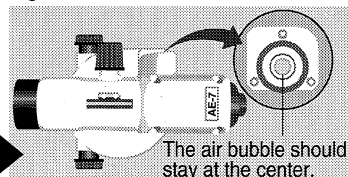


Fig. 9



## Adjusting

Use the leveling screws to move back the air bubble half the way of its displacement.

Then, use the supplied hexagonal wrench to turn the circular level adjusting screws to move back the air bubble to the very center of the brown circle.

Check that the air bubble does not move away from the center of the brown circle whichever position the telescope is turned.

Flip up the mirror (Refer to Fig.11) when adjusting the bubble position. Mirror can be turned 90°.

Fig. 10

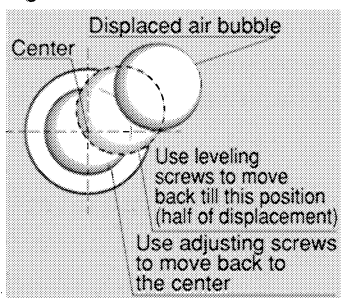
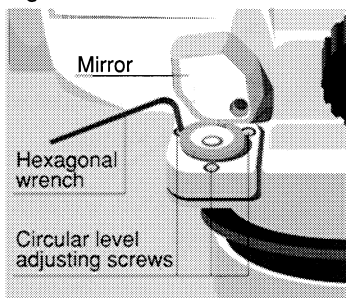


Fig. 11



## 2. Horizontality of the line of sight

The line of sight seen through the eyepiece is etched on the reticle inside the eyepiece. This reticle should be set at the right position, or the line of sight will not show the exact horizontal line.

### Checking

- (1) Set two rods F and R, 70 - 100m apart from each other. Set the instrument halfway between them. (Mount it on the tripod and bring the air bubble inside the brown circle.)
- (2) Sight two rods and take readings of rod F as  $F_1$ , and rod R as  $R_1$ . Calculate  $F_1 - R_1$  to get the height difference between two points.
- (3) Reset the instrument at 2m distance from rod R. Sight two rods and take readings of rod F as  $F_2$ , and rod R as  $R_2$ . Calculate  $F_2 - R_2$  to get the height difference between two points.
- (4) No adjustment is needed when  $F_1 - R_1 = F_2 - R_2$ . If  $F_1 - R_1 \neq F_2 - R_2$ , perform the adjustment.

Fig. 12

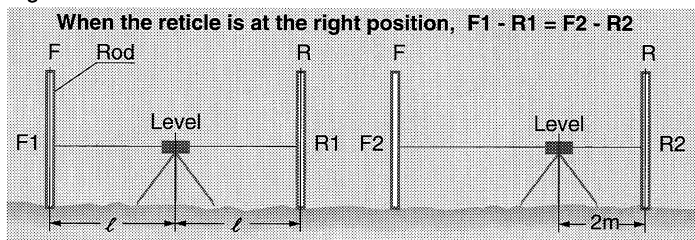
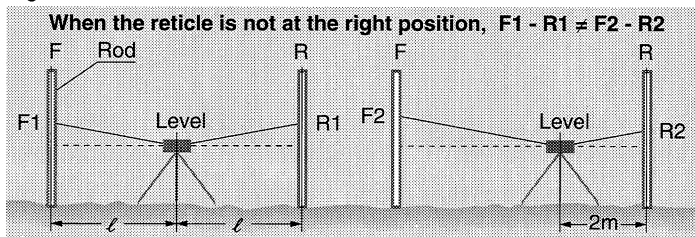


Fig. 13



## Adjusting

- (1) Calculate  $F3=R2+(F1-R1)$ .
- (2) Screw off the reticle adjusting screw cover near the eyepiece.
- (3) Sight the distant rod (rod F). Adjust the reticle adjusting screw by the supplied hexagonal wrench to make the line of sight pointing out the F3.
- (4) Perform above checking to ensure that  $F1-R1=F2-R2$ .

Fig. 14

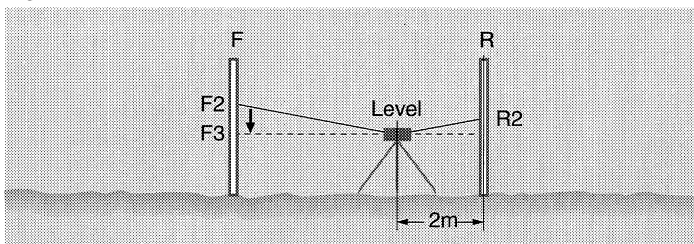
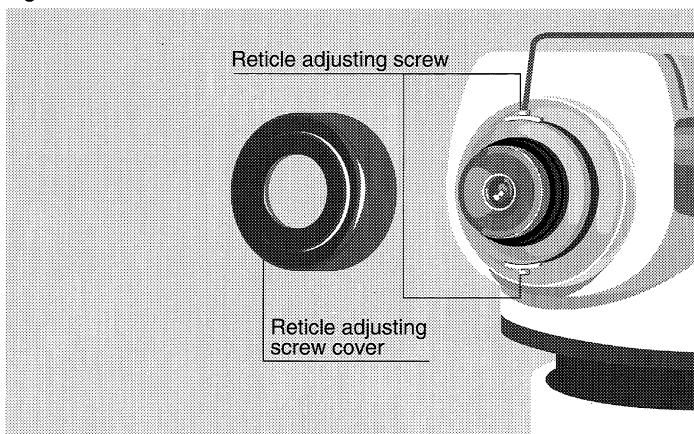


Fig. 15



# IV

## OPTIONAL ACCESSORIES

### 1. Plane parallel micrometer-3

Plane parallel micrometer-3 enables the parallel vertical translation of the optical axis. The amount of translation is indicated on the micrometer drum, thus enabling the fraction reading of the precision rod down to a unit of 0.1mm.

#### Attachable type

Measuring range :  $\pm 5\text{mm}/100$  divisions

Minimum reading :  $0.1\text{mm}/1$  division

Measuring accuracy : within  $0.05\text{mm}$

Fig. 16

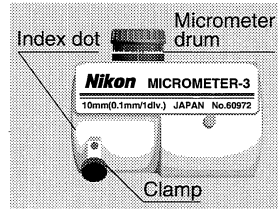
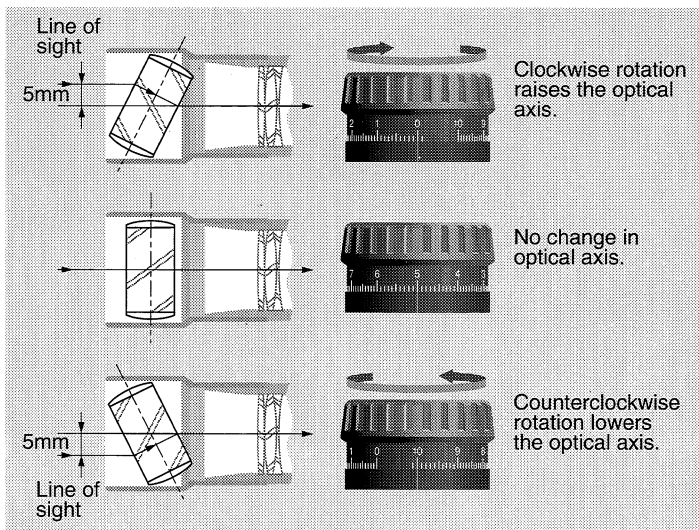


Fig. 17





## 2. Illuminator-3

Illuminator-3 is used to light up the crosshairs inside the viewfield. It is useful in dark circumstances such as in night or in tunnel construction sites.

### Attachable type

Power source:

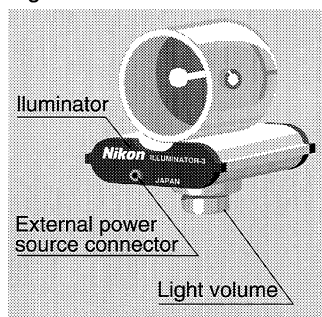
External power source , or

Two AA-type batteries (1.5V)  
connected in series

Lamp bulb:

Specified miniature lamp bulb (3V)

Fig. 20



### Usage

#### (1) When using batteries:

Remove the upper cover of the illuminator and set the batteries.

When using external power source:

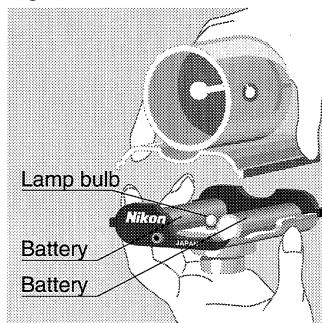
Use the specified cord to connect the external power source and the external power source connector on the illuminator.

#### (2) Attach the illuminator to the object hood of a instrument.

#### (3) Turn the light volume to light up the lamp and adjust its brightness.

#### (4) When exchanging the lamp, turn off the power and remove the upper cover of the illuminator. Wait till the lamp bulb cools enough before exchanging it.

Fig. 21

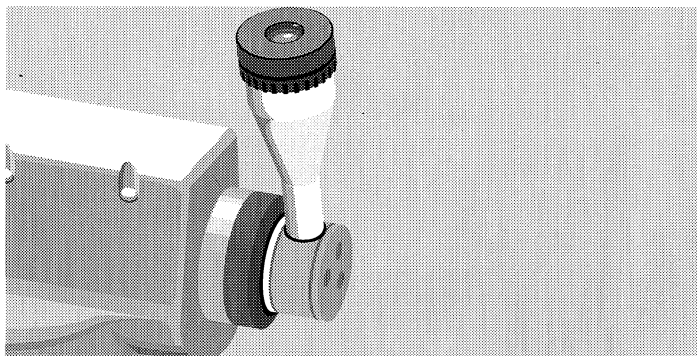




### **3. Diagonal eyepiece prism**

To install, unscrew the eyepiece and replace with the diagonal eyepiece prism, then mount the eyepiece onto the open end of the diagonal eyepiece prism.

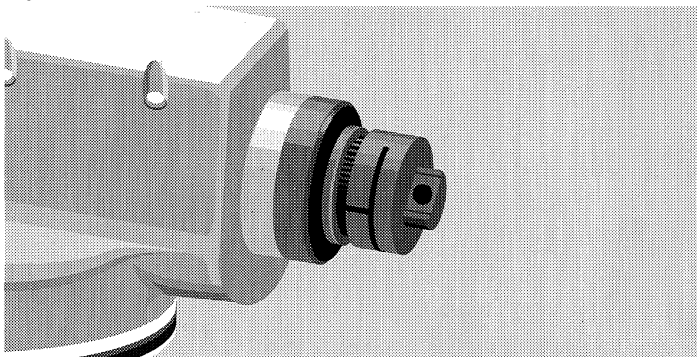
Fig. 22

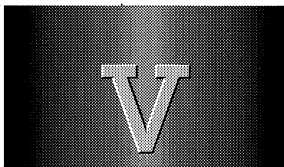


### **4. Zenith prism**

Attach the zenith prism to the eyepiece.

Fig. 23





## SPECIFICATIONS

### Telescope

Internal focusing, anallactic optical system	
Image	Erect
Magnification	30X
Effective aperture of objective	40mm ( 1.57in )
Angle of viewfield ( at 100m / 100ft )	1°30' ( 2.6m / 2.6ft )
Shortest focusing distance	0.3m ( 0.98ft )
Stadia multiplying constant	100
Stadia additive constant	0

**Automatic level compensation range** — ±16'

**Sensitivity of circular level** — 10'/2mm

**Horizontal circle (AE-7C only)** — Minimum increment 1°(1gon)

### Weight and dimensions

AE-7 Instrument	220 x 136 x 142mm, 1.70kg ( 8.7 x 5.4 x 5.6 in, 3.7lb )
AE-7C Instrument	220 x 136 x 142mm, 1.70kg ( 8.7 x 5.4 x 5.6 in, 3.7lb )
AE-7 Plastic case	379 x 195 x 197mm, 1.80kg ( 14.9 x 7.7 x 7.8in, 4.0lb )
AE-7C Plastic case	379 x 195 x 197mm, 1.90kg ( 14.9 x 7.7 x 7.8in, 4.2lb )

### Complete equipment

Main body	1
Objective cap	1
Plastic case	1
Hexagonal wrench	2
Plumb bob (AE-7C only)	1



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