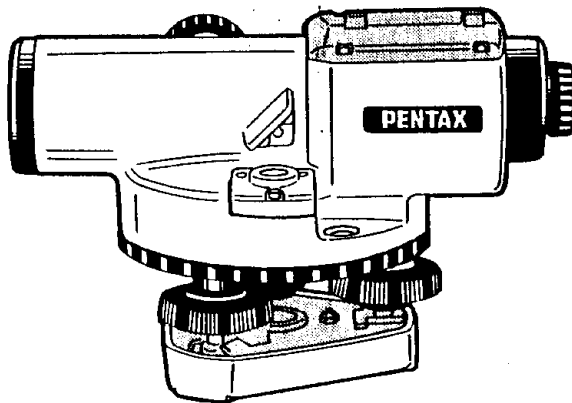


PENTAX®
CERTIFIED ISO 9001

**AUTOMATIC LEVEL
AL-SERIES**

AL-180 · AL-200 · AL-220

INSTRUCTION MANUAL



ASAHI PRECISION CO. LTD



WARNING

⊙ Looking directly at the sun without attaching a filter to the telescope can result in a loss of eyesight. Always use an objective filter when observing the sun.

(When observing the sun, always attach the solar filter, designed especially for this purpose by Pentax, to the objective lens.)

For proper operation of our surveying instruments

Our surveying instruments are so precise instruments that careful handling is requested. The instruments neither work well nor become of value unless they are properly handled or operated. To let instruments work effectively and be of use for long time, read through this instruction manual carefully.

Storage

The instrument should be stored in a dry, dust proof room, which does not have a big temperature range. When the instrument is stored for a long time, it must be from time to time taken out of the carrying case and exposed to the air. If the inside temperature of storage place in a room or in a car were extremely different from outside temperature, that is, measuring place, leave the instruments exposed to the ambient temperature until temperature of it becomes as close as to ambient temperature.

The exposure time to the instrument will be about one minute per one degree temperature difference.

Transport

For a long journey, by rail or road, the instrument should be packed using enough cushioned materials to prevent any hard knock or shock. If possible, it's recommendable that the expert should pack the instrument for a long journey. If you transfer the instrument by your own car, it is not necessary to pack it but you had better leave it on the seat and fix it.

In case it is put in the car trunk, wrap it well in blankets and so forth and fix it by some method so as to prevent any hard knock or shock.

Checking

Before measurement, an instrument should be examined according to this instruction book. If necessary the instrument should be adjusted. Even a new instrument or completely repaired instrument need to be checked. This procedure is also recommended during long intervals of non-use or after long journey. At the end of field season, it is recommendable the instrument should be checked by repairman with a distributor.

Storing

When taking the instrument out from the case, please notice carefully and remember how it is housed in the case so that re-storing after use may be correctly and easily done.

Take the instrument out from the case with both hands.

Refer to page 11 storing item concerning other details.

Setting up

When installing or removing the instrument on or from the tripod the instrument should be kept with one hand.

The instrument should never be left on tripod with the center screw not being tightened.

Unless such step is taken, big accident would happen. Careful and sensitive operation and handling of the instrument in accordance with the instructions with plain common sense will surely provide long and good service.

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1. Equipment

- 1 Instrument
- 1 Objective cap
- 1 Hexagonal wrench
- 1 Plumb bob
- 1 Plastic carrying case

2. Description

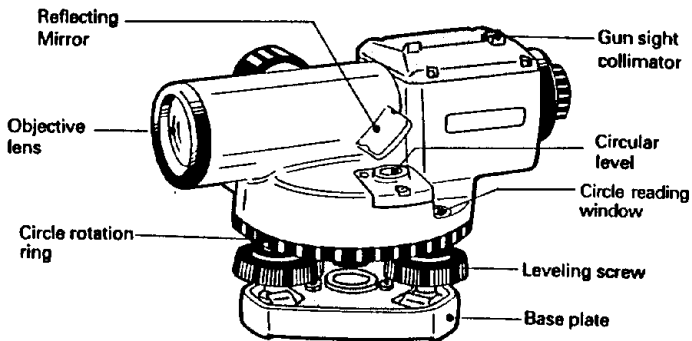


Fig. 1

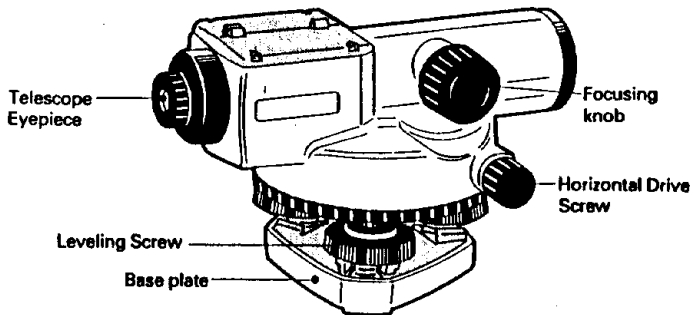


Fig. 2

3. Technical Data

Telescope	AL-180	AL-200	AL-220
Magnification	18X	20X	22X
Effective aperture(mm/in)	30/1.2		32/1.3
Field of view at 100m/100ft	2.6m/2.6ft		
Shortest focusing distance	0.9m		
Resolving power	4"		
Multiplication constant	100		
Additive constant	+10cm		
Circle			
Graduation	1' or 1g		
Reading	1' or 1g		
Estimation reading	6' or 10c		
Automatic compensator			
Range	+12'		
Sensitivities of circular level			
Per 2mm	8'		
Setting accuracy			
Automatic compensator	±0.5"		
Standard deviation			
1 km double run leveling	±2.5mm		
Dimensions			
Instrument	L189×H122×W122mm		
Case	L260×H153×W178mm		
Weight			
Instrument	1.1kg/2.4lb		
Case	0.8kg/1.8lb		

4. Preparations for Measurement

4-1 Setting up the instrument and the tripod

Adjust the tripod to the height suitable for observation when the instrument is mounted, and set it up on the ground. For angle measurement, set the tripod on the ground point using the plumb bob, and firmly dig the legs into the ground. Set the instrument on the tripod head and secure it tightening the center screw. (For measuring angles, lightly tighten the center screw and properly shift the instrument on the tripod head so that the tip of plumb bob may coincide with the ground point.)

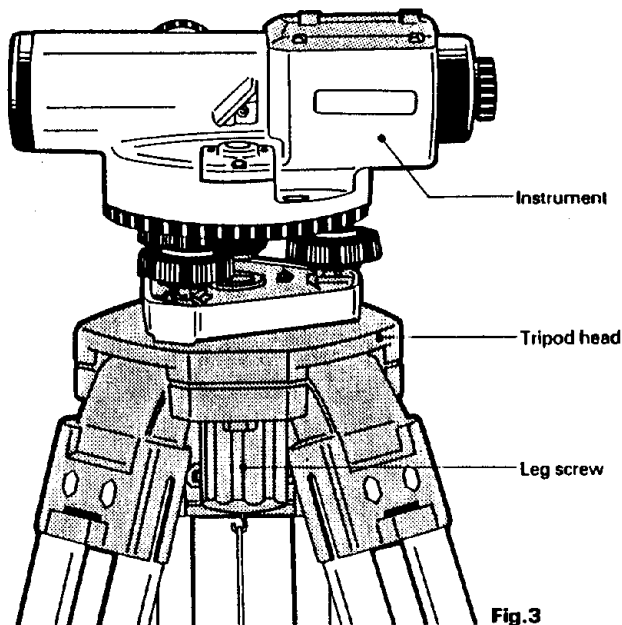


Fig.3

4-2 Leveling with the circular level

Set the telescope in parallel to the line connecting two optionally selected leveling screws, and turn them to position the bubble of the circular level right at the center.

The bubble travels in the same direction that your left thumb moves to turn the leveling screws. With the bubble positioned at the center, turn the other leveling screw to bring the bubble into the center of the circle.

Before any survey work, be sure to turn the telescope 180° in the opposite direction to check that the bubble remains in the center of the circle. Also check that the automatic compensator operates properly, in accordance with Chapter 8-3. If the bubble is out of the circle center, "The adjustment of circular level" is needed.

(See page 13).

Telescope Leveling screw Bubble Setting circle (A) (B) Fig. 4 Circular level

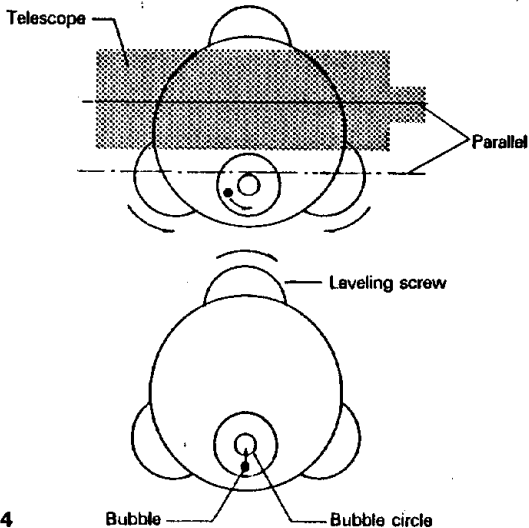


Fig.4

5. Measurement

5-1 Focusing and sighting

Aiming the telescope at the target, rotate the eyepiece counter-clockwise to draw out the eyepiece ring. While looking into the eyepiece, rotate it clockwise until the cross hair of the reticle becomes first clearly visible.

It is advisable to relax when looking into the eyepiece. An intense look at the reticle may tend to cause parallax or eye fatigue.

Then, aim the telescope at the target, looking through sighting points. Rotate the focusing knob so that the target becomes clearly visible.

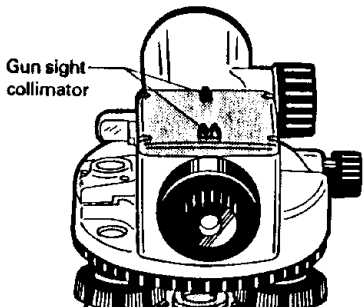


Fig.5

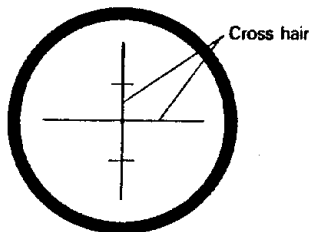


Fig.6 Reticle Supplied

5-2 Reading the staff

Reading of the staff should be done at the center of the cross hair on the reticle. For a reading example, refer to Fig.7

2.195m

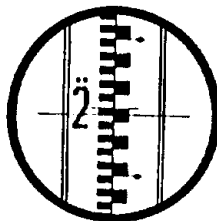


Fig.7 Reading example

5-3 Distances

Distance from the instrument to the staff can be measured by the stadia hairs charted on the reticle. Read the graduation interval on the staff put between the upper and lower stadia hairs and multiply the value by 100 and add to 10cm to measure the distance.

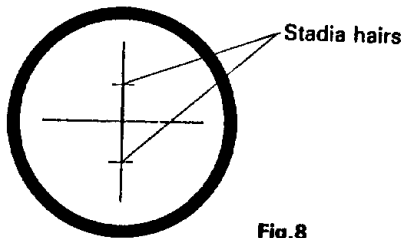


Fig.8

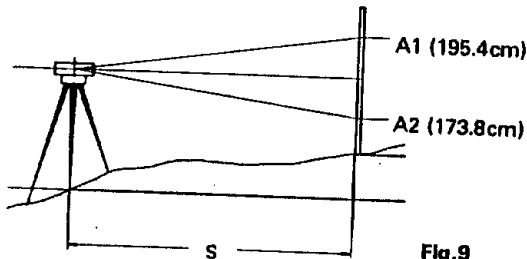


Fig.9

This is formulated as follows: $s = (A1 - A2) \times 100 + 10\text{cm}$

wherein, S= distance

A1= reading of the upper stadia hair

A2= reading of the lower stadia hair

Example: A1 = 195.4 cm

A2 = 173.8 cm

A1 - A2 = 21.6 cm

$\times 100$

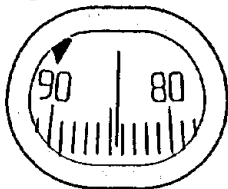
21.6 m

+ 0.1 m (= 10 cm)

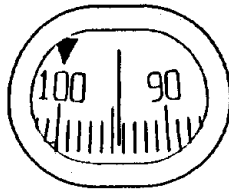
$S = 21.7\text{m}$

5-4 Circle reading

Equipped with a horizontal circle AL-180/AL-200/AL-220 are capable of horizontal angle measurement or setting. Graduation reading is of the index reading type. This provides direct reading of 1' or 1g. The unit of 1/10 of the graduation i.e. 0.1' or 0.1g can be read in estimation. (See Fig. 10)

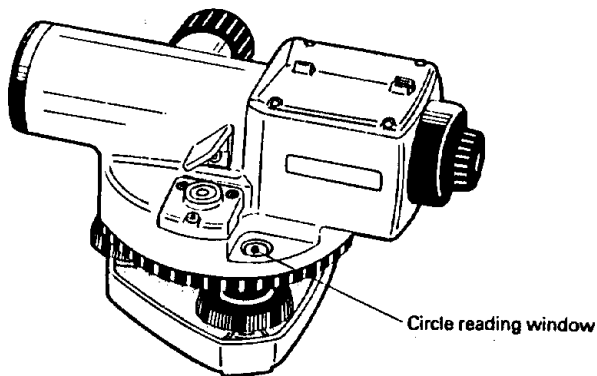


(A) 84°30' (360°)



(B) 94.5g (400g)

Fig.10 Metal circle



Circle reading window

6. Storing the Instrument.

Take off the accessories, if attached, before dismantling the instrument from the tripod.

Put the cap back on the objective lens. Wipe the instrument clean using a soft cloth. Carefully wipe the instrument, if damp or wet, with a soft cloth to dry it completely before storage into the case. Never store the instrument into the case unless dried up, since moisture will affect it adversely. Neatly secure the accessories into their original positions in the case so that they never move inside. Store the instrument into the case while gently dropping it in position with the Pentax mark on the body facing towards you. If the case cover does not close smoothly, the instrument is housed improperly, and store it again correctly with reference to the photo.

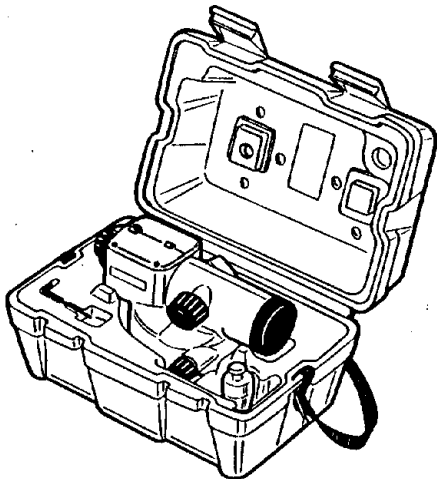


Fig. 11

7. Tests and Adjustments

7-1 Circular level

For adjustment of the bubble on the level being off-center in the circle as described in Chapter 4-2, follow the procedure below:

- (1) Turn the leveling screw to bring the bubble to the center.
- (2) Turn the instrument 180° , check that the bubble remains at the center, if not, half of the bubble run should be corrected by rotating leveling screw, and another half of the bubble run should be corrected by turning the adjusting screws by means of the adjusting pin.
- (3) Turn the instrument 180° again, check that the bubble remains at the center. If not, repeat the adjustment procedure from the start until the bubble stays at the center of the circle when the instrument is rotated in any direction.

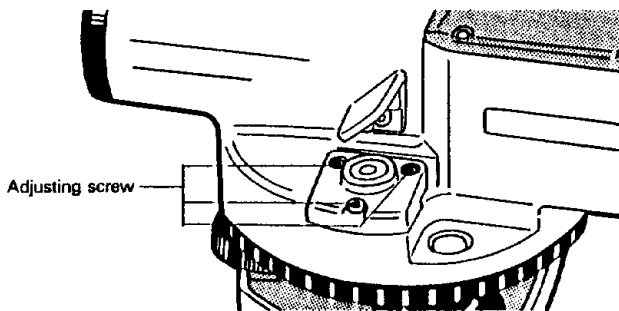
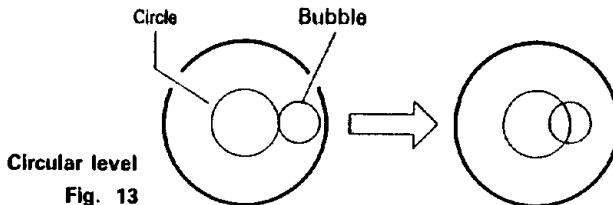


Fig.12



7-2 Automatic compensator

After the correct setup of the instrument as in Chapter 4-2 and circular level adjustment as in Chapter 7-1, check the automatic compensator.

With the instrument set so that the objective lens is positioned above an optionally selected leveling screw, sight the staff or an appropriate target.

Sighting the staff or the target, lightly rotate the leveling screw just below the telescope. At this time, the staff or the target sways vertically within the telescope.

It is proper functioning that when it comes to a standstill, the sighting position should be returned to the initially sighted position. If, however, not returned to the first sighted position or the staff simply moves vertically without swaying in accordance with the leveling screw, they are all improperly functioning and adjustment or repair is needed. In this case, contact a dealer.

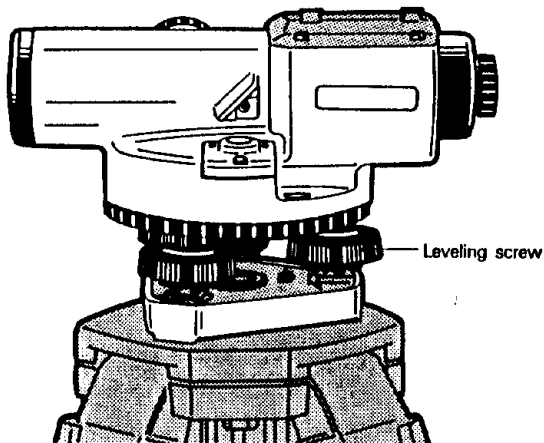


Fig.14

7-3 Horizontal collimation

Checks

1. Prepare two identical target plates and set up the instrument in the middle between two walls at a distance of 50 to 100 meters. (Fig. 18)
2. Sighting both walls alternately, adjust the target plates to the height so that readings on the target plates are identical, and secure them in position.
3. Shift the instrument to a position approx. 2 meters from one target plate and level it for readouts of both targets. If, in this case, reading of both targets is identical, no adjustment is required. If not, adjust as follows:

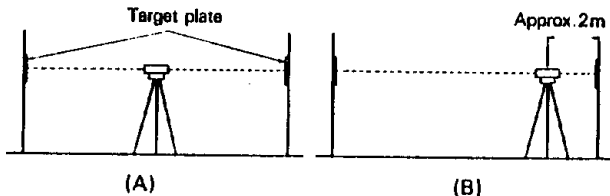


Fig.15 Horizontal collimation

Adjustments

- (1) Sight the farthest target plate through the telescope.
- (2) Remove the eyepiece cover, rotate the reticle adjusting screw using the adjusting pin and adjust the reading to be identical to that of the closest target.
- (3) After checking that correct adjustment has been made, mount the eyepiece cover back in place.

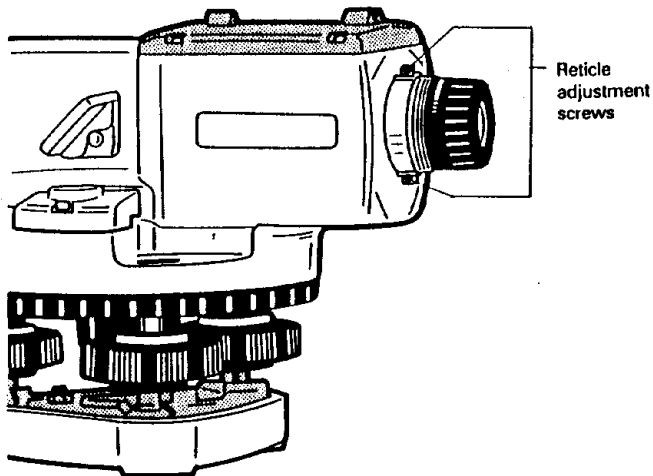


Fig.16

MEMO



Certificate No: 10660



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ASAHI PRECISION CO., LTD.

1-1-21, Shirako, Wako-Shi,
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