

AUTOMATIC LEVEL
AL-C SERIES

AL-C32 · AL-C28
AL-C24 · AL-C20

INSTRUCTION MANUAL

Distributed by
PENTAX
Corporation

For Proper Operation of Instrument

Automatic level AL-C series consists of four models to suit a wide range of leveling applications.

These levels are precise in function and precision made. Surveying instruments do not either work well nor have value unless they are carefully handled and operated. For the instrument to function efficiently and have a useful long life, please read through this instruction manual.

Storage

This instrument should be stored in a dry, dust-proof room, which does not have big temperature changes. When the instrument is stored for a long time, it must occasionally be taken out of the case and air circulated freely around the instrument. When storage or transportation temperature is extremely different from the working temperature, the instrument must be allowed to come to the ambient temperature. Exposure time required is approximately one minute per one degree temperature difference.

Transport

For shipment, the instrument should be packed with cushioning material with reasonable thickness on all sides. Insurance coverage is recommended. Vehicle transportation does not require packing but movement should be restricted by securing it. When heavy vibration or rough travel is encountered, it is recommended that the instrument be secured in a padded box.

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 needs to be checked. This procedure is also recommended during long intervals of non-use or after a long journey. At least once per year, or more often, it is recommended that the instrument should be checked by a qualified Pentax dealer.

Unpacking

When removing an instrument from its carrying case, pay attention to how it is positioned so that it can be returned properly. Grasp the instrument securely when removing or returning it from or to the case.

Setting Up

When installing or removing the instrument on or from the tripod, the instrument should be securely held with one hand while the other hand manipulates the tripod center screw. The instrument should never be left on the tripod without being fastened down. Failure to carry out these instructions can result in a bad accident. Careful operation and handling of the instrument in accordance with these instructions and plain common sense will provide long and useful service.

Contents

1. Features
2. Description
3. Standard Equipment
4. Specifications
5. Operation
 - 5.1 Preparation for surveying
 - 5.1.1 Setting up the tripod
 - 5.1.2 Setting up the instrument
 - 5.1.3 Leveling
 - 5.2 Observation
 - 5.2.1 Reticle collimation
 - 5.2.2 Sighting
 - 5.2.3 Reading the staff
 - 5.3 Surveying
 - 5.3.1 Leveling
 - 5.3.2 Stadia Surveying (Distance Measurement)
 - 5.3.3 Angle Measurement
6. Maintenance and Packing
7. Precautions
8. Inspection and Adjustment
 - 8.1 Circular vial
 - 8.2 Leveling line of sight
9. Compensator Checker

Features

Waterproof

Highly accurate

Precision optics

Short focusing

Endless tangent screw

Sighting collimator

Rubber covered knobs

Recessed objective lens

Metal base plate

0 constant stadia

High visibility color

Horizontal circle

Alloy ribbon compensator

Left & Right tangent

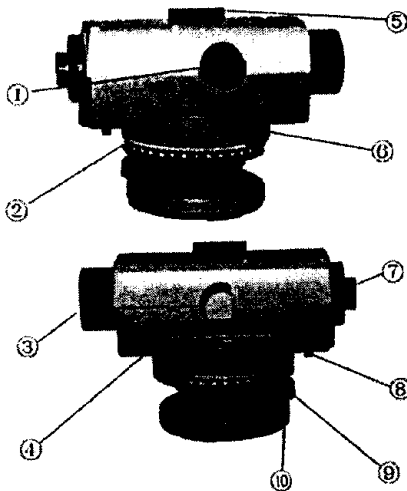
Flat or Dome tripod mount

Compensator checker

Heavy duty body

ISO 9001 quality control

2. Description



- ① Focus Knob
- ② Circle
- ③ Objective Lens
- ④ Mirror (Prism)
- ⑤ Collimator Sight
- ⑥ Tangent Knob
- ⑦ Eyepiece
- ⑧ Compensator Checker
- ⑨ Circular Vial
- ⑩ Leveling Screw

3. Standard Equipment

Instrument

Carrying Case

Plumb Bob

Hex Wrench 2.5mm

Hex Wrench 2.0mm

Desiccant Pack

Rain Cover

Instruction Manual

Specifications

	AL-C32	AL-C28	AL-C24	AL-C20
Magnification	32X	28X	24X	20X
Effective Aperture (mm)	40	40	36	36
Field of View (at 100m / ft.)	2.3	2.6	3.2	3.2
Minimum Focus (m / ft.)	0.8m / 2.6ft.		0.6m / 2.0ft.	
Stadia Ratio / Stadia Constant	1:100 / 0			
Compensator Range	± 15'			
Compensator Setting Accuracy	± 0.3"	± 0.4"	± 0.5"	± 0.5"
Standard Deviation (1km double run)	± 1.0mm	± 1.5mm	± 2.0mm	± 2.5mm
Circular Vial Sensitivity	8' / 2mm			
Circle Graduation	1 degree			
Circle Estimation	0.25 degree			
Leveling Base	3 Screw			
Dimensions – Instrument (mm)	140H x 133W x 230L			
Dimensions – Instrument (inch)	5.52H x 5.22W x 9.06L			
Weight – Instrument	2.0 kgs. / 4.4 lbs.			
Weight – Carry case	1.0 kgs. / 2.2 lbs.			

5. Operation

5.1 Preparation for surveying

5.1.1 Setting up the tripod

- 1) Use a tripod having a center locking screw with 5/8"x11 thread.
- 2) Set the legs firmly into the ground and adjust the tripod to the height suitable for observation when the instrument is mounted.
- 3) For angle measurement, set the tripod so that the center of the tripod head is positioned directly above the ground point.

5.1.2 Setting up the Instrument

- 1) Mount the instrument on the tripod head and secure it using the tripod center lock screw.
- 2) Suspend the plumb bob from the hook and adjust string length (for angle measurement).
- 3) Loosen the center lock screw to move the instrument. Tighten the screw when the plumb bob tip coincides with the ground point (for angle measurement).

5.3.1 Leveling

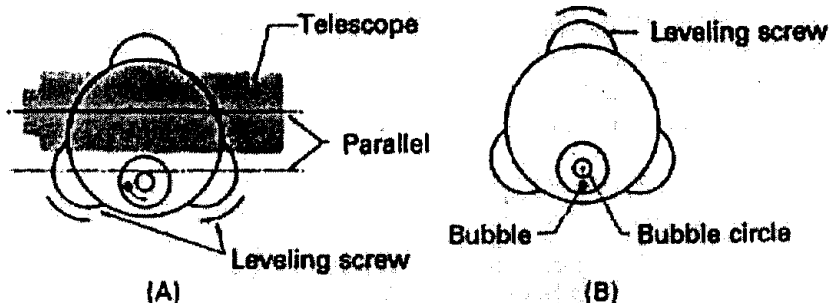
1) Place the telescope in parallel to the line connecting two optionally selected leveling screws and turn them to move the bubble of the circular level at a position even to the left and the right. (Fig. A)

- Turn the two leveling screws in opposite directions.

2) Turning the remaining leveling screw, shift the bubble to the center. (Fig. B)

3) Make sure that the bubble stays at the center of the circle even after turning the telescope 180°.

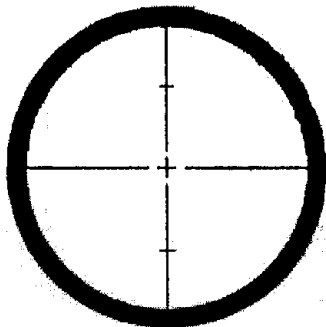
- If the bubble is out of the center, in step 3, "Adjustment of the Circular Vial" is needed.



5.2 Observation

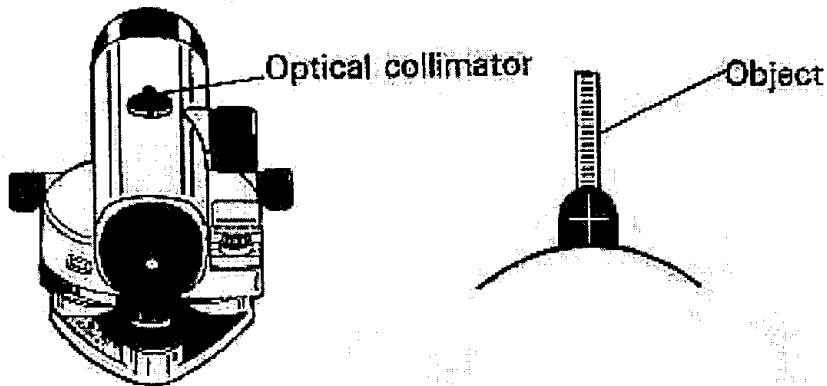
5.2.1 Reticle collimation

- 1) Directing the telescope to a bright background, rotate the eyepiece counterclockwise to draw out the eyepiece ring.
 - 2) While looking into the eyepiece, rotate it clockwise until the reticle comes to its extreme sharpness.
- It is advisable to relax when looking into the eyepiece. An intense look at the reticle tends to cause parallax or eye fatigue.



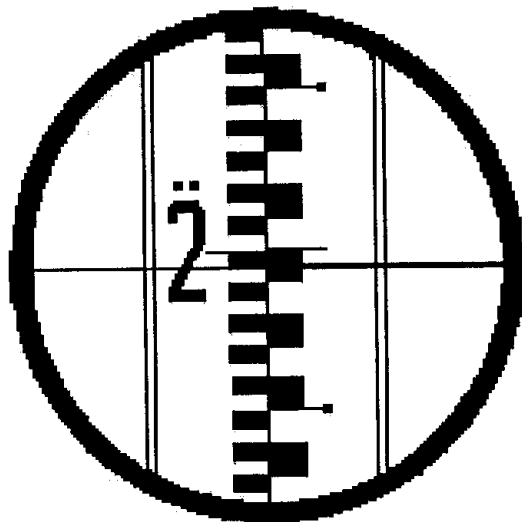
5.2.2 Sighting

- 1) Sight the telescope at the object by looking into and around the collimator.
 - 2) Looking into the eyepiece, rotate the focusing knob until the object becomes clearly visible. Make sure that the relationship between the object and the reticle does not change even when you move your eye up or down.
- If parallax exists in step 2), the relationship between the object and the reticle will change. This can cause error. Begin from step 5.2.1 again.



5.2.3 Reading the leveling rod.

- Reading of the leveling rod should be done at the center of the reticle.



5.3 Surveying

5.3.1 Leveling

- How to get the difference in height and the elevation.
Difference in height (Δh) = backsight (b) - foresight (f)

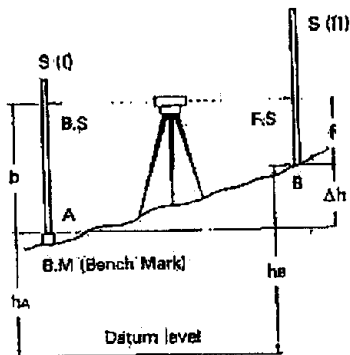
Elevation at point B (h_B) = Elevation at point A (h_A) + Δh

S (I): Level rod (I)

S (II): Level rod (II)

B.S: Backsight (Rod reading at the point where the elevation is known.)

F.S: Foresight (Rod reading at the point where the elevation is unknown.)

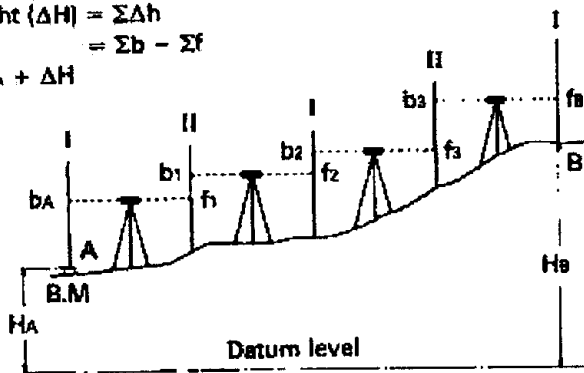


$$\text{Difference in height } (\Delta H) = \frac{\sum \Delta h}{\sum b - \sum f}$$

$$\text{Elevation } H_B = H_A + \Delta H$$

$$\begin{aligned} \text{Difference in height } (\Delta H) &= \sum \Delta h \\ &= \sum b - \sum f \end{aligned}$$

$$\text{Elevation } H_B = H_A + \Delta H$$



- Set the instrument at center of the two leveling rods.
- When reading the rod, try to get the least reading by tilting the rod back and forth slightly.
- For more precise surveying, use the double run method.

5.3.2 Stadia Survey (Distance Measuring)

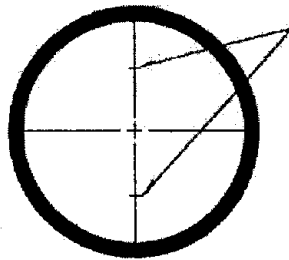
Distance from the instrument to the leveling rod can be measured by the stadia lines, of the reticle, visible within the field of view of the telescope.

- To measure the distance is easy as the stadia constant is 0.

S: Horizontal distance

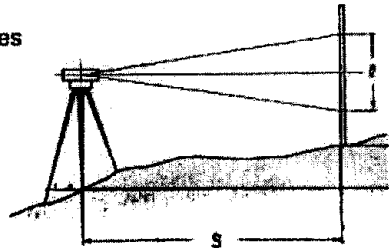
t : Difference in reading of the upper and of the lower stadia lines

$$S = 100t$$



(A)

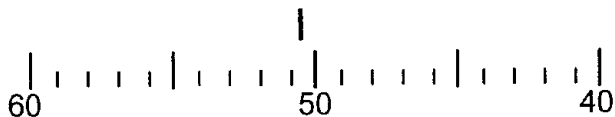
Stadia lines



(B)

5.3.3 Angle Measurement

Example $51^{\circ} 30'$



When reading a horizontal angle, be sure to align your eye directly in front of the index mark.

6. Maintenance and packing

6.1 Maintenance

- 1) Clean dust or water from the instrument and put it back into the case after using it.
- 2) Brush dust off, wipe off moisture on exposed parts with a soft cloth.
- 3) Wipe off the moisture on the surface of the lenses with a cotton cloth, using light pressure, after brushing the dust off.

6.2 Packing

- 1) Gently put the instrument into the case, facing the focusing knob towards you.
- 2) Close the case and secure the latch by sliding it to the right.

7. Precaution

- Operate the instrument carefully. Do not apply excessive pressure to it.
- Store the instrument in a dry place, removing dust or moisture after use of it.
- Be careful not to subject the instrument to impact or vibration during transport.
- When moisture or other problem is found inside the lens, contact your dealer, do not attempt to dismantle the instrument by yourself.
- When any malfunction due to falling down or some other cause is recognized, contact your dealer, do not attempt to forcibly dismantle the instrument by yourself.
- Check all parts of the tripod are firmly secured.

8. Inspection and adjustment

8.1 Circular vial

8.1.1 Inspection

- 1) Fasten the instrument to the tripod, level it so that the circular vial bubble is positioned at the center of the circle. (Refer to 5.3.1)
- 2) Turn the instrument 180° .
- 3) No further adjustment is necessary if the bubble stays in the center of the circle.

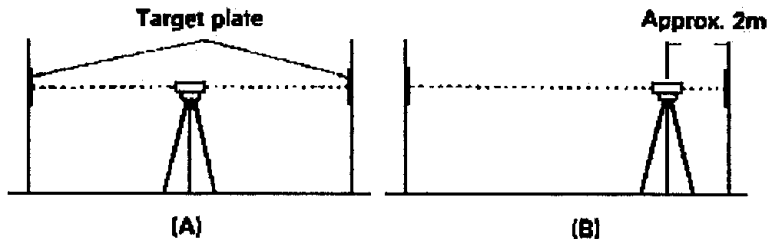
8.1.2 Adjustment

- 1) If the bubble moves out of the center of the circle, turn the leveling screws to shift the bubble halfway back to center.
- 2) Shift the bubble the remaining halfway by turning the adjustment screws.
- 3) Turn the telescope 180° to check to see if the bubble stays at the center of the circle.
- 4) Repeat again from step 1) if the bubble moves.

8.2 Leveling line of sight

8.2.1 Inspection

- 1) Use two targets. Set up the instrument midway between two walls (or other fixed objects) at a distance of 150 feet to 300 feet. Level the instrument. (A)
- 2) Sighting both walls alternately, adjust the targets to the same height so that their readings are identical and secure them in position.
- 3) Move the instrument to a position approximately 6 feet from one target. Level the instrument. (B)
- 4) Read both target plates.
- 5) No adjustment is necessary if readings of both targets are identical.



8.2.2 Adjustment

- 1) Aim the telescope at the far target if the readings of both targets are not identical.
- 2) Adjust the reticle by rotating the reticle adjusting screw (located in the D shaped hole just in front of the compensator checking button and under the eyepiece) with the 2.0mm hex key until the far target reads the same as the near target.
- 3) Repeat from 8.2.1 step 4) to check if adjustment is correct.

9. Compensator Checker

After leveling the instrument, focus on a target. Press the compensator checker button. The target image should "swing smoothly away and then float gently back" to its original position with respect to the horizontal reticle line. The observer is then confident that the compensator is working and can return the line of sight consistently.

This check does not confirm that the line of sight is level. See section 8. Inspection and Adjustment.

**Pentax Corporation
35 Inverness Drive East
Englewood, CO 80112**

Survey Instrument Division

Phone 800-330-3336

303-728-0351

Fax 303-728-0253

Email surveyinfo@pentax.com

Web www.pentaxsurvey.com