



INSTRUCTION MANUAL

AUTO LEVEL
AT-G4
AT-G6

TopCon AT-G6 Survey Set Ma




U46826X

Display for Safe Use

In order to encourage the safe use of products and prevent any danger to the operator and others or damage to properties, important warnings are put on the products and inserted in the instruction manuals.

We suggest that everyone understand the meaning of the following displays and icons before reading the "Safety Cautions" and text.

Display	Meaning
 WARNING	Ignoring or disregard of this display may lead to the danger of death or serious injury.

- Injury refers to hurt, burn, electric shock, etc.
- Physical damage refers to extensive damage to buildings or equipments and furniture.

Safety Cautions

WARNING

- **Aiming the instrument directly into the sun can result in serious damage to your eye.**

Do not aim the instrument directly into the sun.

It is suggested to pay close attention when the position of the sun is low such as in the morning or evening, or when the sunlight is coming directly at the objective lens. Cut off the sunlight with your hand or use an umbrella.

The user of this product is expected to follow all operating instructions and make periodic checks of the product's performance. The manufacturer or its representatives assumes no responsibility for results of misuse including any direct, indirect, consequential damage, and loss of profits.

Congratulations on your choice of the TOPCON Auto-Level, in the AT-G Series, which we are sure will serve you well and continue to give you full satisfaction for many years to come.

The TOPCON Auto-Levels are precision instruments, which should be handled in the recommended manner. Therefore, it is recommended that you carefully read this manual before you use the instrument in the field, even if you have had previous experience with TOPCON surveying instruments.

This manual will not only introduce you to its operation, but will give you some information on its construction, as well as adjustments, so that you may use the instrument with maximum efficiency and obtain optimum performance from it, as well as extend its service-life.

Specifications and designs of the AT-G Series Auto-Levels are subject to changes, when found necessary to improve the quality of the instrument, without advance notice.



IMPORTANT

- (1) Readings will be incorrect, if the eyepiece has not been properly adjusted for the user's eyesight and/or if focusing is improper, since this will introduce parallax and, therefore, give wrong results.
- (2) Always rotate the fine horizontal knob in the tightening direction, or in the clockwise direction, and stop, when fixing a sight.
- (3) For high precision surveying operations, always cover the instrument and tripod with some type of awning or umbrella to shield them from strong sunlight.
- (4) Protect the instrument from shock and vibrations, when carrying or transporting the instrument.
- (5) After using the instrument, brush away dust on all exposed surfaces, then wipe clean and dry and, finally, store (in the carrying case) in a well-ventilated location.
- (6) When the lens surface must be cleaned, always brush or blow dust or dirt away first, with the cleaning brush or a rubber-ball air blower. Then, wipe the surface gently with a soft well-washed cotton cloth or lens cleaning tissue. If necessary, dip lightly in alcohol or a mixture of alcohol and water and then wipe the lens surface gently with ever-widening circular motions, from the center out.
Do not rub the lens surface on any condition but repeat, if found necessary.
- (7) Clean the plastic carrying case with neutral detergent or water. Do not use benzine, thinner or any other chemical solutions.
- (8) Use tripods with a tripod screw of 5/8 in. diameter and 11 threads per inch, as per J I S B standards.
- (9) Do not dismantle the telescope or revolving parts of the instrument. Contact the nearest experienced and well-equipped factory, if you think that the instrument must be overhauled or repaired.

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FEATURES

* Fast in Speed and Stable Automatic Leveling Action

The AT-G Series incorporates a magnetically-damped compensator which is not affected by fine vibrations and realizes very stable precision, thus enables to speed up the automatic leveling action greatly and precisely. Four special plastic ribbons are used for hanging the magnet damper compensator system and, therefore, there receives no influence from the magnetic field.

* Water Resistant Telescope Construction

The instrument has a completely water resistant telescope and thus is ideal even in the wet-surveying operations, such as in light rains or in the tunnel, with dry gas (nitrogen) sealed inside the telescope tube which effectively prevents condensations on the lens surface.

* Clampless Fine Horizontal Adjustments

Fine horizontal adjustments are possible at any point through 360° (400^g) of the arc, without clamping action, thus speeding up target alignment, and fine horizontal knobs are available on both sides, for very easy and speedy adjustments.

* Horizontal Circle

The horizontal circle is graduated from 0° to 360° ($0g$ to $400g$) in clockwise direction in 1° ($1g$) spacing, and a value is indicated for each 10° ($10g$).

* Very Fast Instrument Set-Up

Very fast instrument set-up is possible because the base plate can be used for fixing on top of dome head tripods, such as the TOPCON Dome Head Aluminum Tripod, in addition to standard flat head tripods.

STANDARD SET COMPOSITION

A	Model AT-G4 or AT-G6	1 each
B	Plastic carrying case	1 each
C	Lens cap	1 each
D	Instruction manual	1 each
E	Hexagon wrench	1 each



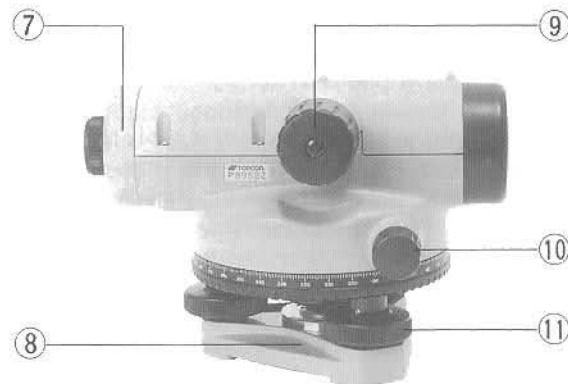
OPTIONAL ACCESSORIES

1. Dome head aluminum tripod
2. Type E aluminum tripod
3. Plump bob set

NOMENCLATURE



- 1) Aiming sight
- 2) Objective lens
- 3) Circular level viewing mirror
- 4) Telescope eyepiece
- 5) Circular level
- 6) Horizontal circle



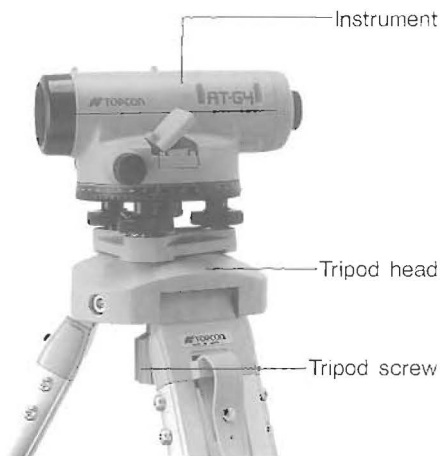
- 7) Eyepiece cover
- 8) Base plate
- 9) Focusing knob
- 10) Fine horizontal knob
- 11) Leveling screws

BASIC OPERATING PROCEDURES

1. Setting Up the Tripod

Use tripods with a tripod screw of 5/8 in. diameter and 11 threads per inch, as per J I S B standards, such as the TOPCON Type E Aluminum Tripod or Wide-frame Wooden Tripod and the Dome Head Aluminum Tripod.

- 1) First, extend the extension legs to suitable lengths and tighten the wing nuts on their mid-sections.
- 2) Tighten the hexagonal key fastening system on the side of the tripod head so that the tripod legs don't fall too loosely. Place the tripod over the required point, with legs spread about a meter apart or at such angle as will insure stability of the tripod. Place one tripod leg in position and then use the other two to approximately level the tripod head. If necessary, adjust leg extension, too.
- 3) Press the shoes on the tripod legs firmly into the ground and anchor the tripod securely.



2. Attaching the Instrument to the Tripod Head

Take the instrument carefully out of the carrying case and place it on the tripod head.

- 1) Align the tripod screw to the socket on the base of the instrument. And, when aligned, screw in the tripod screw until the instrument is securely fixed on the tripod head.
- 2) If the horizontal circle is being used for measuring angles or establishing a line, the instrument must be set up exactly over the point with the plumb bob.
- 3) Use three leveling screws and center the bubble of the circular level or, in other words, level the instrument. If a dome head tripod is being used, in this case, however, simply loosen the tripod screw slightly and move the instrument around on top of the tripod head, while checking the circular level. When the bubble is located inside the red-colored circle, in this case, tighten the tripod socket.

3. Setting the Instrument Up Over the Point

When the instrument is used to measure angles or to establish a line, the instrument must be set up exactly over a particular point, with the plumb bob.

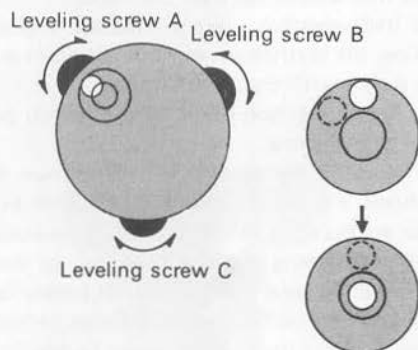
- 1) Hang the plumb bob hook on the plumb bob hanger of the tripod screw.
- 2) Next, suspend the plumb bob string from the plumb bob hook and adjust string length with the slipping device so that the plumb bob is at a suitable height.
- 3) If the instrument has not been set up over the required point, move the instrument bodily over to the point, without disturbing the relation between tripod legs and tripod head. Place down in position so that plumb bob is about one centimeter or so directly over the point.

Grasp two of the tripod legs and adjust with respect to the third leg so that the tripod head is level at a convenient height, with sufficient spread of the legs, when the two legs are allowed to touch ground.

- 4) Finally, press each leg firmly into the ground while watching the plumb bob and tripod head.
- 5) Next, loosen the tripod screw slightly and slide the instrument on top of the tripod head, if further adjustment is required to position the plumb bob directly over the point. Then, tighten the tripod screw.

4. Leveling the Instrument

- 1) Use the two leveling screws (which are farthest from the circular level) to move the bubble of the circular level. In other words, rotate the screws in the arrow-indicated opposite directions which will shift the bubble of the circular level so that it is located on a line perpendicular to a line running through the centers of the two leveling screws being adjusted, as illustrated.
- 2) Next, revolve the remaining leveling screw and shift the bubble towards the center of the circular level.



If the bubble cannot be centered properly, repeat the operation from the beginning.

NOTE:

Do not touch the telescope during this procedure.

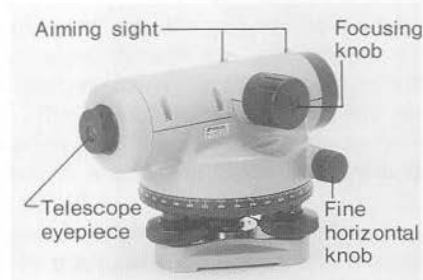
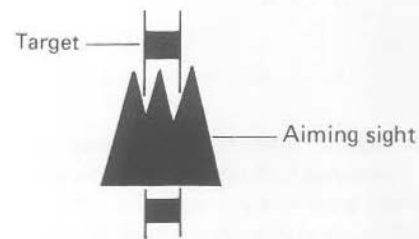
5. Adjusting the Eyepieces

The telescope eyepiece should be adjusted to the user's eyesight before conducting surveying operations.

- 1) First, point the telescope towards the light and rotate the eyepiece adjustment ring fully, by revolving it in the counter-clockwise direction. (The reticule cross-hairs will be observed blurred and indistinct, at this time.)
- 2) Next, slowly rotate the ring in the clockwise direction. Stop revolving when the cross-hairs are seen clearly and distinctly in the field of view. Always stop adjustments while racking the eyepiece ring in.

6. Sighting and Focusing

- 1) Point the telescope in the direction of the target. Then, sight through the aiming sight and align the target to the apex of the triangular mark in the field of view, as illustrated.



- 2) Next, focus on the target, by revolving the focusing knob in either direction, as required.
- 3) Finally, use the fine horizontal knob for precise alignment of the target.

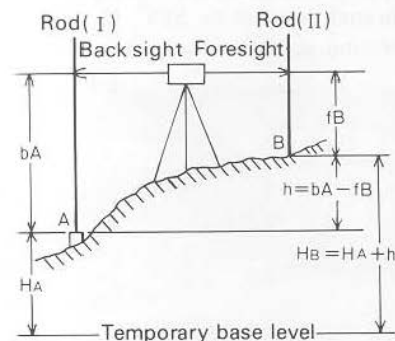
NOTE:

When precisely aligned, shift the eye to the left and right, while looking through the telescope eyepiece. There should be no deviations between the reticule cross-hairs and the target, in this case. If there is parallax, which means that either focusing is incomplete or that the adjustment of the eyepiece was not done properly or both. In any case, the focusing error must be eliminated by carefully focusing or adjusting the eyepiece to the user's eyesight.

OPERATIONS

1. Leveling or Determining the Differences in Elevation

The primary use of the Auto-Level is, of course, for leveling. The purpose of leveling is, of course, to determine the elevation of a point or the difference in elevation between points. Since the line of sight through the telescope of the Auto-Level, which is properly set up, is horizontal, the differences in elevation is determined by measuring from this horizontal line of sight.



- 1) Set up and level the instrument about halfway between two points, say, A and B, if possible.
- 2) Sight through the telescope on a leveling rod(I) held on top of point A and note the rod reading. (Say, the line of sight is back towards the starting point, or the "back sight", and the rod reading is bA .)
- 3) Next, sight through the telescope on a leveling rod (II) held on top of point B and also note the rod reading. (The line of sight, of course, will now be in the direction that the surveyor is going forward to and, therefore, will be the "foresight", with the rod reading, say, fB .)
- 4) Since both sights through the telescope are horizontal, in this case, the difference in the rod readings is

also the difference in elevation or height(h), or
 $h = bA - fB$.

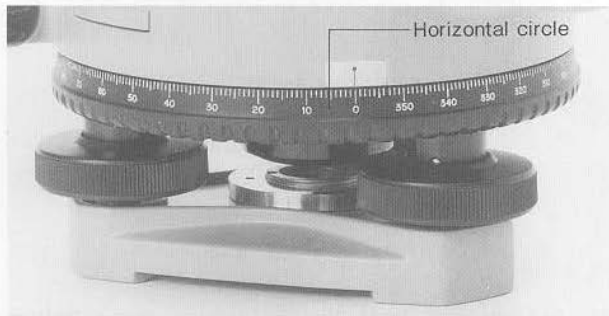
The height from the base surface or level, in this case, can be obtained from the formula –

$$H_B = H_A + h$$

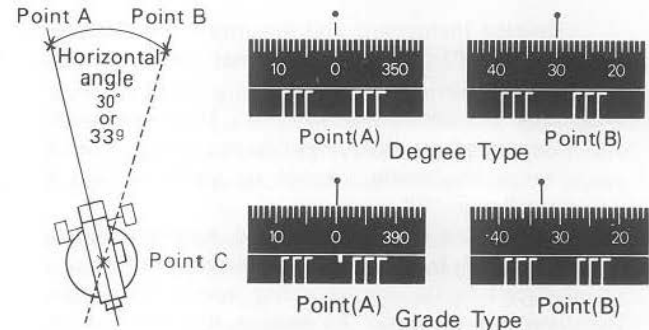
2. Measuring a Horizontal Angle

The AT-G series has a horizontal circle which can be used for measuring an angle.

The horizontal circle is graduated in one degree (19) divisions but numbered every 10 degrees (109), with the scale calibrated from 0 to 350° (0 to 3909), with the value increasing as the instrument is revolved clockwise.



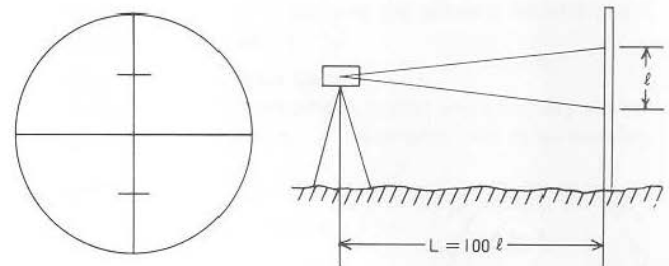
- 1) First, set up and properly level the instrument at the starting point, say, Point C.
 Then, sight through the telescope on the base target, say, Point A. Align the rod set up on top of Point A precisely to the vertical cross-hair line of the telescope reticule with the fine horizontal knob.
 Then, rotate the horizontal circle ring to make zero setting of the scale.
- 2) Next, sight through the telescope on a rod held on top of Point B and precisely align with the fine horizontal knob. The reading at this time will, of course, be the horizontal angle between Points A and B, from Point C, or the angle ACB.



3. Stadia Surveying

The AT-G Series Auto-Levels can be used for stadia surveying, which is simply a convenient method for measuring distances with the stadia hairs of the instrument, in combination with a graduated rod, such as leveling rod or stadia rod (which is preferable for long distances).

The distance from the center of the instrument to the rod is found by sighting through the instrument on to the rod and multiplying the stadia interval or reading (i. e., the interval between the apparent locations of the bottom and top stadia hairs on the rod) by 100.



- 1) First, set up the rod on the point.
- 2) Then, sight through the telescope of the properly

leveled instrument and determine the distance or interval "ℓ" on the rod between the bottom and top stadia hairs.

- 3) The horizontal distance "L" from the plumb line center of the instrument to the rod is equal to 100 times the stadia interval or stadia reading or rod reading or "ℓ".

If the line of sight is inclined, however, the distance obtained by the above stadia method must be reduced to its corresponding horizontal distance and vertical distance. To reduce the inclined or slope distance "S", in this case, the following formulas can be used:—

$$L = S \cdot \cos a$$

$$V = 1/2 S \cdot \sin 2a$$

When L is the horizontal distance, V the vertical distance and S the slope distance.

ADJUSTMENT

The Auto-Levels in the AT-G Series are all exceptionally sturdy and ruggedly constructed instruments, in spite of incorporating automatic leveling systems and featuring very high precision, and, therefore, should seldom require adjustments.

Furthermore, all instruments delivered undergo strict and rigid inspections, from the time the raw material is delivered to the factory until the final equipment is thoroughly inspected and precisely adjusted, by experienced technicians, and then carefully packed for shipment to you. Therefore, unless the instrument is subject to excessive rough handling during transportation, it should arrive properly adjusted and ready for immediate use.

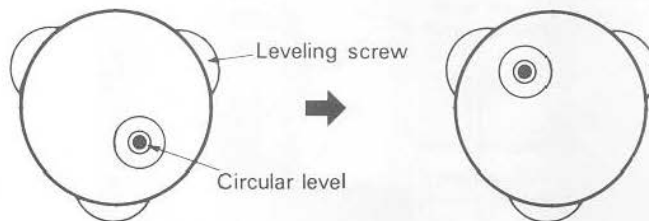
Even if it is suspected that the instrument has been subject to excessive rough treatment by the carrier, be absolutely certain that adjustment is required before making the adjustment. In other words, check the instrument until it is absolutely certain beyond doubt that adjustment is actually required and then proceed as explained following.

After adjustments are made, check the instrument once more to see whether the adjustments have been properly made.

Of course, the adjustments noted following are also important for the purpose of obtaining the greatest accuracy and service from the instrument.

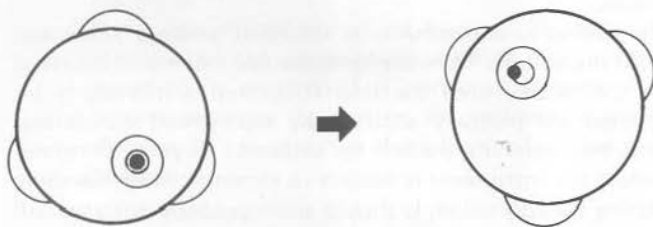
Adjustment of the Circular Level

- (1) Set the instrument up on the tripod and carefully center the bubble of the circular level with the three leveling

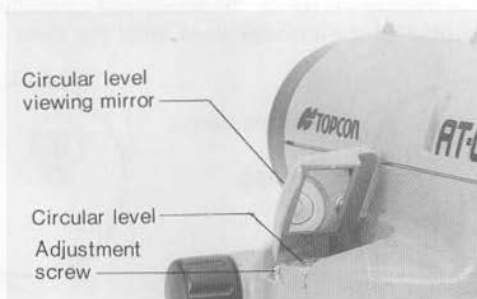


screws.

- (2) Revolve the telescope 180° around its vertical axis. If the bubble remains centered, adjustment is not required. If the bubble moves from the center, however, adjustment must be made, as follows.

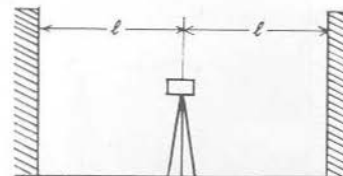


- (3) Tighten the circular level adjustment screw on the side that the bubble has moved to, with the accessory adjusting wrench. This will return the bubble towards the center. However, return the bubble by only one-half the amount of error, by this method.
- (4) Re-center the circular level bubble with the three leveling screws.
- (5) The bubble should now remain centered, as the telescope is revolved around its axis. If not, however, repeat the adjustments noted above until the bubble remains centered when the instrument is revolved on its axis.

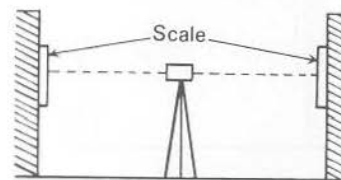


Collimation of the Instrument

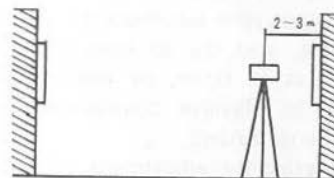
- (1) Set the instrument up on a tripod at a point midway between two walls, which are approximately 50 meters apart.



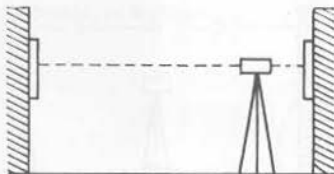
- (2) Level the instrument properly, by centering the bubble of the circular level with the three leveling screws.
- (3) Place identical scales against both walls and alternately collimate both scales on a horizontal line of sight, using the same number on both scales for this purpose. Thus, if necessary, adjust the scales up or down, for alignment to the same scale division or figure.



- (4) Move the instrument to a position about 2 or 3 meters from one of the scales and center the level bubble once more, with three leveling screws.

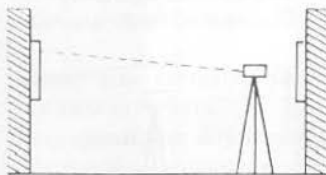


- (5) Collimate both scales once more, on a horizontal line of sight, and read the number on the scales.
If the readings on both scales are identical, there will be no need for adjustment.



If the readings are different, however, adjustment is required, in the following manner.

- (6) Sight the farther scale and shift the horizontal cross-hair line up or down, as required, until the line is coincided to the same reading as that of the nearer scale, with the adjustment screws which are exposed when the eyepiece cover is unscrewed.

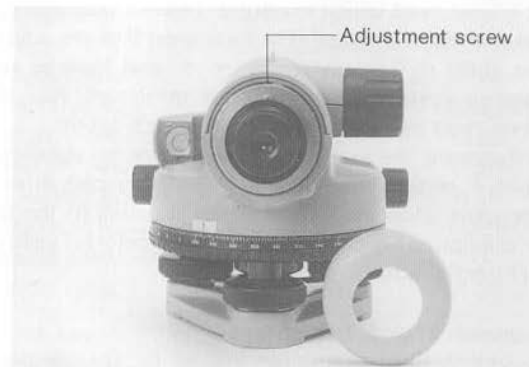


First, loosen the adjustment screw, on the side to which the horizontal cross-hair line has shifted. Then, tighten the adjustment screw, on the opposite side to which it must be moved; by an equal amount.

When making this adjustment, do not loosen the screw too much at one time but make the adjustment as slight as permissible, and try to keep the tensions of the screws same at all times, by revolving the screws by equal amounts. Revolve counterclockwise to loosen and clockwise to tighten.

- (7) Upon completing the adjustment, check once more to

see whether the same numbers are observed on the scales when checked in the above manner. If not, repeat the adjustment once more.



OPTIONAL ACCESSORIES

1. Aluminum Tripod, Type E

The Type E Aluminum Tripod has a smooth surface finish flat tripod head which measures 145mm diagonally, with a 56mm diameter bore. The extension legs are adjustable from 0.98 to 1.65 meter in length and have an unique fastening system which requires minimum adjustments and no need to loosen or tighten for each set-up.

Furthermore, the extension legs have greater stability with a special section shape, while heavy-duty cast shoes with large spurs allow easier and firmer planting of the tripod. For maximum visibility the tripod is a colorful yellow and silver combination.

2. Aluminum Tripod, Dome Head

The dome head aluminum tripod is, for all practical purpose, identical to the Type E aluminum tripod but in place of the flat tripod head has a dome tripod head with a 150mm radius, which greatly speeds up instrument set-up, when used with the AT-G Series Auto-Levels which have a corresponding base plate.

3. Plump bob set



SPECIFICATIONS

	AT-G4	AT-G6
Telescope		
Length	192mm	193mm
Magnification	26X	24X
Objective lens	30mm	30mm
Relative brightness	1.3	1.6
Field of view	1° 30'	1° 30'
Resolving Power	3.5"	4.0"
Minimum focus	0.5m	0.5m
Stadia constant	0	0
Stadia ratio	100	100
Circular Level		
Sensitivity	8' / 2mm	8' / 2mm
Automatic Leveling		
Setting accuracy	± 0.3"	± 0.3"
Compensating range	± 15'	± 15'
Accuracy in 1 Km double run leveling	± 2.0mm	± 2.0mm
Horizontal Circle		
Diameter	117mm	117mm
Minimum division	1° (1g)	1° (1g)
Weight		
Instrument	1.6 kgs	1.6 kgs
Plastic carrying case	1.3 kgs	1.3 kgs



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