

PENTAX

ELECTRONIC THEODOLITE

ET-C10/C20

INSTRUCTION MANUAL

Distributed by **PENTAX** Corporation

10

△ WARNING

- Never look at the sun through the telescope as this may result in loss of sight.
- Do not use at a place near flammable materials as there is a risk of explosion.

△ CAUTION

- Secure the handle to main unit with handle locking screws . Failure to properly secure the handle could result in the unit falling off while being carried, causing injury.
- Tighten the tribrach clamp knob securely. Failure to properly secure the handle could result in the unit falling off while being carried, causing injury.
- Do not use the carrying case as a footstool as it is slippery and unstable and may cause you to fall, resulting in possible injury.
- When mounting the instrument to the tripod, tighten the center screw securely. Failure to tighten the screw properly could result in the instrument falling off the tripod, causing injury.
- Tighten securely the leg fixing screws of the tripod. A person could be injured by the extended tripod shoes due to loose screw.
- Do not carry a tripod with the metal shoes pointing toward another person as the person may be injured if they strike him or her.
- Make sure that your hands and feet are not in the vicinity of the tripod legs when installing the tripod, or a hand or foot stab would occur.
- Do not wield or throw the plumb bob, or a person could be injured if struck.

CONTENTS

1. Features	4
2. General	5
2.1 Precautions	5
2.2 Standard equipment	9
2.3 Nomenclature of parts	10
2.4 Unpacking and storing	12
2.5 Battery insertion	13
3. Key Operations and Display	14
3.1 Display	14
3.2 Keyboard	14
3.3 Function of each key	15
3.4 Other functions	22
(4) Remaining battery indicator	22
(5) Automatic power-off function	23
(6) Error codes	23
4. Preparation for Surveying	25
4.1 Levelling and centering	25
4.2 Eyepiece adjustment	31
4.3 Object sighting	32
5. Measurement	33
(4) Horizontal angle measurement (right)	33
(5) Horizontal angle measurement (left)	33
(6) Vertical angle measurement	34

5.2	Setting up	39
(1)	Setting up the horizontal angle	39
(2)	Setting up straight lines	40
(3)	Setting up vertical lines	41
5.3	Stadia surveying	42
Function Selection by		
Special Key Operations		43
6.1	Selection of angle mode	43
Maintenance and Inspection		46
7.1	Maintenance	46
7.2	Inspection and adjustment	48
(1)	Perpendicularity of plate vial to vertical axis	48
(2)	Perpendicularity of circular vial to vertical axis	49
(3)	Inclination of reticule pattern cross hairs	50
(4)	Perpendicularity of line of sight to horizontal axis	51
(5)	Vertical angle reading with line of sight horizontal	52
(6)	Coincidence of line of sight of optical plummet with vertical axis	54
(7)	Instructions on inspection and adjustment	55
Optional Accessories		56
Specifications		58

1. Features

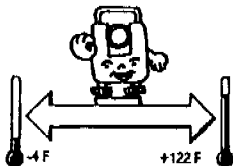
- Rotary encoder provides fast and accurate angle measurement, minimizing reading error. Measured angle is displayed on LCD panel.
- Horizontal and vertical angles can be observed simultaneously on the two line LDC display panel.
- Display panel has a large and easy-to-read segment LCD simple, logical-keyboard and mode display provide maximum operator convenience.
- Simple key operation provide 0 setting of horizontal angle at any position as well as clockwise and counter-clockwise readings.
- Vertical angle can be converted to percentage of slope by one touch of a key, very easy to check grade.
- AA dry batteries are used for power source. Being located in the standard, they can be easily replaced.
- Automatic power down prevents unnecessary battery discharge. The remaining battery capacity is indicated on the display to prevent interruption of work due to lack of capacity.
- Compact and light weight construction equipped with co-axial tangent screws provides easy operation.

2. General

2.1 Precautions

Storing and environmental conditions

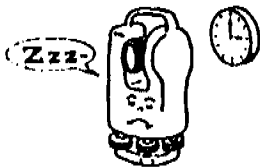
- Avoid operation of the instrument under extremely high & low temperatures and do not subject the instrument to rapid temperature changes. (Refer to ambient temperature range specification.) Instrument may not operate properly when used at other than temperature range specified.



- Be sure to store instrument in the case. Avoid storing in a place which is subject to vibration, high humidity or dust.



- When storage and usage temperatures are widely different, leave the instrument in the case until it can adjust to the surrounding temperature.



Transportation

- Do not subject to impact or vibration during transportation.



- Transport in carrying case. It's recommended a cushioning material be used around the case.

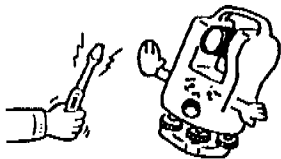


Others

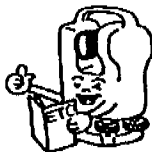
- When not in use for extended periods or having been subjected to impact or vibration, be sure to check the instrument adjustments before starting a job.



- If repair is necessary, contact your local dealer. **Do not attempt to repair it by yourself.**



- To realize full capability of the instrument, adhere to cautions described in each chapter of this manual.

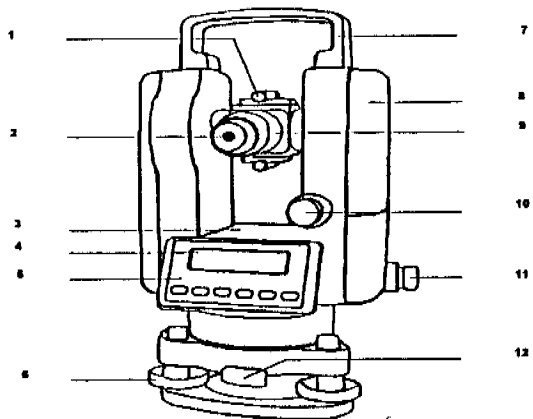


2.2 Standard equipment

● Body (with objective cap).....	1
● A set of Tools.....	1
● Rain Cover.....	1
● Battery Holder.....	2
● AA Dry Battery.....	10
● Carrying Case.....	1
● Instruction Manual.....	1

*The attached AA batteries are samples. Please prepare new batteries before operation, there is risk of low battery due to spontaneous discharge.

2.3 Nomenclature of parts



- 1) Collimator sight
- 2) Eyepiece
- 3) Plate Vial
- 4) Display
- 5) Keyboard
- 6) Level Screw
- 7) Handle
- 8) Battery Box
- 9) Focus Knob
- 10) Vertical Tangent/Lock
- 11) Tribrach Lock

2.4 Unpacking and storing

Unpacking

- ① Gently set down the carrying case so that its cover (side with model plate) is upward.
- ② Unlatch and open the case.
- ③ Take the instrument out of the case.

Storing

Store the instrument in the plastic case as follows.

- ① Set the telescope almost vertical and tighten the telescope clamp screw lightly.
- ② Store the instrument correctly into the case with the tribrach clamp screw facing up.
- ③ Close the case lid and secure the latches.

2.5 Battery Insertion

- (1) Take off the battery box, pressing the button on it.
- (2) Remove the cover from the inside of the battery box.
- (3) Place the batteries properly as indicated into the battery box, pay strict attention to its polarity.
- (4) Put the button of the box into the slot on the standard cover, and press it until it clicks.

Caution

- Pay attention to the battery holder's (+) and (-) marks for proper battery insertion.
- Five 1.2V chargeable batteries (type AA) can also be used. Must use Reliable high quality ones.
- Batteries must be of the same type.
- Do not use a combination of batteries whose remaining capacity differs or mix standard and rechargeable types

3. Key Operations and Display

3.1 Display

welcome
FOIF Co. Ver 2.5

3.2 Keyboard

ON/OFF	Power switch	UNIT	Display back light/Degree or grads
0 SET	H. angle 0 set	R/L	H. Angle right/left
V/%	V. angle/percentage of slope	HOLD	H. Angle hold

3.3 Function of each key

(1) Power switch **on/off**

Vertical index prompt is displayed..

**V Index
Rotate Telescope**

[Vertical angle 0 point indexing]

Turn the telescope upward from the depressed position to index the vertical 0 point. V/H mode will be displayed.

**Vz: 125°29'40"
Hr: 000°00'00"**

- When indexing the vertical circle, the zero point is detected as the telescope is rotated in elevation from slightly depressed.

(2) Selection of zenith angle/percentage of slope/compass angle

Zenith angle, percentage of slope, and compass angle are alternately displayed each time the key is pressed.

Vz: → V% → Vv: → Vz:

Vz: 125°29'40"
Hr: 000°00'00"

V%: -71.31%
H : 000°00'00"

Vv: -035°29'40"
Hr: 000°00'00"

■ In % graduation mode, when elevated or depressed angle of the telescope exceeds 45° (100% in display), error message (H Over range H) is displayed

(3) Horizontal angle 0 set key. **0 SET**

Horizontal angle is set to $0^{\circ}00'00''$. This function is valid for both horizontal angle right and left. However, the function of this key is not valid for vertical angle.

Vz: $125^{\circ}29'40''$
Hr: $039^{\circ}53'40''$

0 SET is pressed.

Vz: $125^{\circ}29'40''$
Hr: $000^{\circ}00'00''$

■ To prevent accidental mis-operation, be careful not to press OSET key by accident.

(4) Horizontal angle right/left key **R/L**

This key is used to select the angle reading mode of the horizontal angle right or left. Right or left reading is alternately displayed each time the key is pressed. This key will not work for vertical angle.

Vz: 125°29'40"
Hr: 017°26'40"

Vz: 125°29'40"
Hl: 342°33'20"

(6) H. angle hold key **HOLD**

Horizontal angle value on display can be retained.

Vz: 125°29'40"
Hr: 017°26'40"

Press **HOLD**

Vz: 125°29'40"
Hold status !

Horizontal angle value now remains unchanged when turning the instrument.

■ Press **HOLD** once to release "HOLD" mode.

(7) Illumination key UNIT

LCD panel is illuminated.

Press and release UNIT key quickly to turn on. Press again to turn off.

Vz: 125°29'40"
Hr: 000°00'00"

(8) Grads **UNIT**

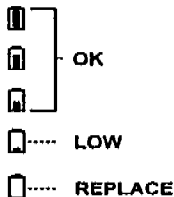
Vz: 125°29'40"
Hr: 017°26'40"

Press and hold down for 2 seconds. Angle display changes to (or from) grads when the key is released.

Vz: 139.4382gon
Hr: 019.3827gon

(2) Remaining battery indicator

The status of the remaining battery capacity is displayed on the bottom right on the display.



(3) Automatic power-off function

No operation on the instrument for about 30 minutes makes the power automatically turn off to prevent unnecessary battery discharge.

- With the auto power off being effective, the power automatically turns off when neither key operation nor turning the angles horizontally and vertically more than 1° is done for about 30 minutes.

(4) Error Codes

!! Over range !!

Displayed when percentage of slope exceeds +100% or -100%.

4. Preparation for Surveying

4.1 Leveling and centering

(1) When coarse centering using a plumb bob is performed.

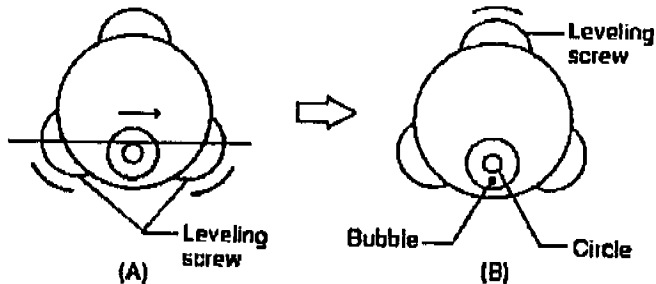
1 Setting Up The Instrument And The Tripod

- ① Adjust tripod legs so a height suitable for surveying is obtained when instrument is set on the tripod.
- ② Hang the plumb bob on the hook of the tripod, and carry out coarse centering to the station on the ground. At this time, set the tripod and fix the metal shoes firmly into the ground so that the tripod and tripod head is as level as possible, the center screw is at the center of its moving range, and the plumb bob coincides with the station on the ground.
- ③ If the tripod head is disturbed by the action of fixing the metal shoes into the ground correct the level by extending or retracting each leg of the tripod.

2 Leveling with the circular vial

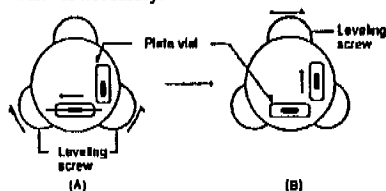
- ① By adjusting any two leveling screws, position the bubble in the center of the vial (see (A)). (To adjust the screws at the same time, turn them in opposite directions).
- ② Adjust remaining leveling screw, and position the bubble in the center of the circle (See (B)).

For the relation between the screw adjusting direction and bubble moving direction, see the arrow marks in (A) and (B). Bubble moves in the same direction of the movement of a thumb on the left hand or in the opposite direction on the right hand.



3 Leveling with the plate vials

- ① Place the plate vial in parallel with a line joining any two of the leveling screws. Adjust two screws, and position the bubble in center of the level (A). (To adjust the screws at the same time, turn them in opposite directions.
 - ② Rotate the plate vial through 90° around the vertical axis. Adjust the remaining leveling screw so that the bubble comes to the center of plate vial.
 - ③ Repeat ① and ② by rotating the plate vial through 90° so that the bubble is positioned in the center when the plate vial is moved in any direction.
- See arrows in Fig. below for the relation between the direction of leveling screw rotation and the bubble shifting direction.
 - If the bubble is not positioned stable, "Adjustment of the plate vial" is necessary.



- ③ Loosen the center screw of the tripod. Look through the optical plummet, and move the bottom plate on tripod head taking care to avoid rotating the instrument until the center mark coincides with the station.
- ④ Ascertain that the bubble stays positioned in the center when rotating the plate vial position in steps of 90° . If the bubble is not positioned in the center, adjust the leveling screw.
 - The focusing device permits focusing from 0.5m to ∞ with the optical plummet.
 - Even if the bubble is shifted by one graduation in Φ , deviation of centering is just 0.2mm at the instrument height of 1.4m, giving little effect on survey result.

4 Centering With The Optical Plummet

After 1, 2 and 3 are completed, center correctly in the following manner using optical plummet.

- ① First remove the plumb bob. Look through the optical plummet eyepiece, and rotate the eyepiece knob until the center mark can be seen clearly.
- ② Rotate the focusing knob of the optical plummet and adjust the focus to the station on the ground.



(2) When coarse centering using a plumb bob is not performed

1 Setting up the instrument and tripod

- ① Adjust the tripod so that a height suitable for surveying is obtained with enough extension/contraction margin left when the instrument is set on the tripod. Observing the station, extend the tripod legs and fix the metal shoe firmly into the ground so that the tripod center is positioned almost right above the station.
- ② Set the instrument on the tripod head.

2 Centering and leveling with optical plummet

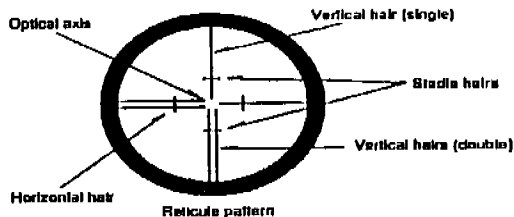
- ① Look through optical plummet eyepiece, rotate the eyepiece until the center mark can be clearly seen.
- ② Rotate the focusing knob of the optical plummet and focus on the station.
- ③ Looking through the optical plummet, rotate the three leveling screws to tilt the instrument so that the center mark coincides with the station.
- ④ Adjust the length of each tripod leg by extending or contracting it, and position the bubble of the circular vial in the center of the circle. (When doing this, place a foot on the metal shoe of the tripod to hold it in that position.)

3 Leveling With The Plate Vial

- ① Level the instrument as indicated in [] "Leveling with the plate vials" on Page 27.
- ② After leveling the instrument, re-adjust center by moving instrument on tripod head if necessary

4.2 Eyepiece adjustment

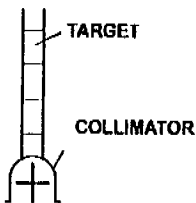
- ① Remove the telescope lens cap.
- ② Point the telescope at a bright object, and rotate the eyepiece ring full counterclockwise.
- ③ Look through the eyepiece, and rotate the eyepiece ring clockwise until the reticule appears as its maximum sharpness.



■ When looking into the eyepiece, avoid intense look to prevent the parallax and eye fatigue.

4.3 Object sighting

- ① Point the telescope at the object using the collimator sight. Tighten all clamp screws.
- ② Look through telescope eyepiece and finely adjust the focusing knob until object is perfectly focused. If focusing is correct, the cross hairs will not move in relationship to the object when you move your eye slightly left and right while looking through the eyepiece. This will eliminate any parallax.
- ③ Accurately align the cross hairs with the object, using each tangent screw.



- Turn focusing knob clockwise to focus on near objects and counter clockwise to focus faraway objects
- In ②, parallax may ruin the relation between the object and cross lines resulting in the survey error.
- When aligning to an object using the tangent screw, always align by rotating the screw clockwise. If the screw is turned past the object, turn it counter clockwise to the original position then turn the screw clockwise to align the cross hair on the object.
- Even when vertical angle measurement is not required, it is recommended that the object in the reticule pattern be placed as close to the center of the reticule pattern and that the bold object be placed between two vertical lines on the reticule pattern.

5. Measurement

5.1 Angle measurement

1) Horizontal angle measurement (right)

① Level the instrument and turn the power on.

② Sight first object using the horizontal clamp/tangent screw and telescope clamp/tangent screw.

Vz: 125°29' 40"

Hr: 017°26' 40"

③ Press **0 SET** to set the horizontal angle to 0°00'00".

Vz: 125°29' 40"

Hr: 017°26' 40"

④ Collimate second object using horizontal clamp/tangent screw & telescope lamp/tangent screw.

⑤ Read the displayed value ().

Vz: 125°29' 40"

Hr: 000°00' 00"

(2) Horizontal angle measurement (left)

① Press **R/L** after turning the power on.

Vz: 125°29'40"
Hl: 276°34'40"

Horizontal angle measurement switches from horizontal right to horizontal left.

② Subsequent operation will be done as in (1) Horizontal angle measurement (right), except that the order of collimation is reversed.

(3) Vertical angle measurement

① Set up the instrument over the station point. Level it and turn the power **on**.

V Index
Rotate telescope

② Turn the telescope to index the vertical 0 point.

④Sight object A using the horizontal clamp/tangent screw and telescope clamp/tangent screw.

⑤Vertical angle () is displayed.

Vz: 087°28'20"

Hr: 000°00'00"

■ Initial display is Zenith 0° as shown above.

5.2 Setting out

(1) Setting out the horizontal angle

Setting out a specific angle (Ex: 90°) from a reference point in civil engineering and other work:

- ① Point the telescope to the reference point accurately, and set the horizontal angle at 0° by pressing the 0 set key.

Vz: $125^\circ 29' 40''$
Hr: $030^\circ 41' 40''$

- ② Loosen the horizontal clamp knob, and rotate the instrument around the vertical axis. Tighten the clamp knob when the displayed number comes close to the specific angle.
- ③ Operate the horizontal tangent screw, and precisely set the displayed number to the specific angle.

Vz: $125^\circ 29' 40''$
Hold status !

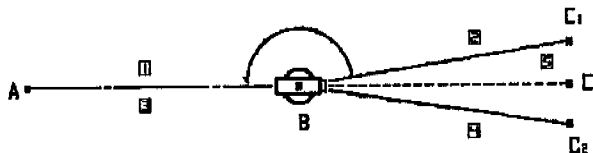
Vz: $125^\circ 29' 40''$
Hr: $030^\circ 41' 40''$

- ④ The point the telescope is aiming is marked and becomes a setting out point.

(2) Setting up straight lines

A line joining points collimated to an object, near or distant, is a straight line. This fact is used in setting up straight lines. Setting up a point C on the extension of the straight line AB is carried out as follows.

- ① Set up the instrument at point B on the straight line and level it. Then, sight point A.
- ② Loosen the telescope clamp screw and reverse the telescope about its horizontal axis. Set a point on the line of sight and call it point C.



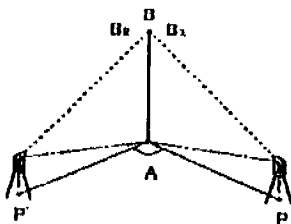
- ③ Loosen upper clamp screw. Rotate instrument about its vertical axis and sight on point A again.
- ④ Loosen telescope clamp screw. Reverse telescope on its horizontal axis again. Set a point on the line of sight and call it point C.
- ⑤ Set point C in the center of points C and C. This point B and C is an extension of the straight line AB.

■ When extending the straight line in a rather long distance, repeat the extension of the straight line in a way that distance of AB and BC is limited up to about 300 feet, respectively.

(3) Setting up vertical lines

When the instrument is leveled and the telescope is rotated about its horizontal axis, the line of sight generates a vertical plane, and a vertical line can thus be set up. Setting up a point B on the perpendicular at point A is carried out as follows.

- ① Set the instrument on point P at a distance equal to or longer than AB. Level the instrument and sight point A.
- ② Loosen the telescope clamp screw. Point the telescope upward at the same angle as point B and set a point on the line (point B)
- ③ Move the instrument to point which is at right angles to line AP and at the same distance as AP from from point A. Level the instrument and sight point A.



- ④ Loosen the telescope clamp screw, and point the telescope upward at the same angle as point B and set a point on the line (point B)
- ⑤ Set point B at the crossing point of the extended lines of B. The line joining A & B is perpendicular

- When sighting point A in procedures ① and ③, be sure that the bubble is in center of the plate vial.
- When more precise results are required, repeat ① ② and ③ ④ respectively using the telescope in the normal and reverse positions. And set B1 and B2 at the centers of the points obtained using the telescope in the normal and reverse positions.
- The telescope normal position means the state where the vertical circle is positioned on the left of the telescope eyepiece. The reverse position is the state where the vertical circle is positioned on the right of the eyepiece.

5.3 Stadia surveying

The stadia hairs on the reticle provide the method of measuring distance and height from the instrument center to a leveling rod.

- Calculations are easy since the stadia constant is 0.

When the line of sight
is inclined

When the line of sight
is horizontal

6. Function Selection by Special Key Operations

- ① Press and release **ON** key.
- ② Press and hold **V/%** key.
- ③ Rotate telescope (as in vertical indexing)

ET-C20 changes from 20" to 10" or 10" to 20"

ET-C10 changes from 10" to 5" or 5" to 10"

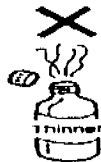
- Display will show the new setting until you release the **V/%** key.
- Unit will turn OFF when you release the **V/%** key and store the new setting

7. Maintenance and Inspection

7.1 Maintenance

Stain on the main body

- ① Brush dust off and wipe off moisture with tissue paper.
- ② Clean off any stains with a soft, dry cloth.
- ③ Excessive stains should be removed with a soft cloth soaked in a water-diluted neutral detergent and squeezed dry.



Stains on the lens surface

- ① First, brush dust off.
- ② Gently wipe off stains with a silicone cloth or a cleaning cloth for eyeglass lenses.
- ③ Excessive stains should be wiped off with soft cotton cloth and cleaning liquid for eyeglasses.

Handling the battery

If the instrument is not to be used for a long period of time, be sure to remove the batteries from the instrument, and then store it.



Note:

- Be sure not to use such chemicals as benzene, thinner or gasoline.
- Be careful not to scratch the lens surface.
- Leaving the batteries in the instrument for extended period may cause power consumption even if it is not in use.
- If used batteries are left in the instrument, it may be damaged by the battery fluid leakage.

7.2 Inspection and adjustment

(1) Perpendicularity of plate vial to vertical axis

1 Inspection

- ① Align the plate vial in parallel with a line joining any two of the leveling screws. Then adjust the two leveling screws to center the bubble in the vial.
- ② Rotate the plate vial through 90° around the vertical axis. Adjust the remaining leveling screw to bring the bubble to the center. (Be sure not to operate 2 leveling screws adjusted ①.)
- ③ Rotate the plate vial through 180° around the vertical axis.
- ④ No adjustment is necessary if the bubble of the plate vial is in the center.

2 Adjustment

- ① If bubble of the plate vial moves from the center, bring it half way back to the center by adjusting the leveling screw which is parallel to the plate vial.
- ② Correct the remaining half by adjusting the bubble adjusting nuts with the adjusting pin.
- ③ Confirm that the bubble does not move from the center when
- ④ When the bubble moves, start from ① once again.

(1) Perpendicularity of circular vial to vertical axis

1 Inspection

No adjustment is necessary if the bubble of the circular vial is in the center after inspection and adjustment of "Perpendicularity of the Plate Vial to the Vertical Axis."

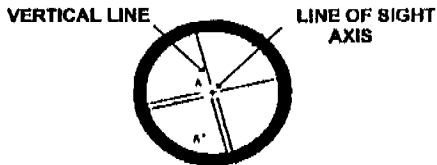
2 Adjustment

If the bubble of the circular vial is not in the center bring the bubble to the center by turning the bubble adjusting screws with the adjusting pin.

(3) Inclination of reticule pattern cross hairs

1 Inspection

- ① Set an object point A on the line of sight through the telescope.
- ② Move point A to edge of field of view by adjusting the telescope tangent screw (point A)
- ③ No adjustment is necessary if point A moves along the vertical line of the reticule.



2 Adjustment

Return to qualified repair facility for adjustment

(4) Perpendicularity of line of sight to horizontal axis

1 Inspection

- ① Set an object point A at a distance of 30 to 50m away from the instrument and sight it through the telescope.
- ② Loosen the telescope clamp screw and reverse the telescope around the horizontal axis. Mark a point set on the line of sight at about the same distance to the object point A, and call it point B.
- ③ Loosen horizontal clamp screw. Rotate instrument around vertical axis. Sight point A again.
- ④ Loosen the telescope clamp screw, and reverse the telescope around the horizontal axis. Mark a point on the line of sight at about the same distance as point B, call it mark C. (The telescope has now returned to its normal position.)
- ⑤ No adjustment is necessary if point B and C coincide.



2 Adjustment

- ① If points B & C do not coincide, set up a point C located $\frac{1}{4}$ of the length BC from the point C toward B.
- ② Turn the two cross hair adjusting screws opposed horizontally by first loosening one, then tightening the other with the adjusting pin. Move cross hair so point D is set on line of sight.
- ③ Repeat the inspection and check that the adjustment is correct.

(5) Vertical angle reading with line of sight horizontal

1 Inspection

- ① Set up as usual and turn the power on. (Set the mode to V/H)
- ② Sight the telescope at any reference target A. Obtain vertical angle (r).
- ③ Reverse the telescope and rotate the alidade. Sight again at A and obtain vertical angle (r).
- ④ If $r + = 360^\circ$, no further adjustment is required. If the difference $d (r + - 360^\circ)$ is greater than the rated value adjustment is required.

■ If the horizontal 0° mode is used, $r + = 180^\circ$ or 540° .

2 Adjustment

- ① Turn the power off.
- ② Press **ON/OFF** to turn the power on.
- ③ While pressing **0 SET** key, index the vertical 0 point.
- ④ Release **0 SET** key.

Modify Index
sel. a target (I)

4. Sight the object A, and press **O SET**

turn 180← (I)
aim at it again

5. Reverse the telescope and rotate the Instrument. Sight object A again with the telescope reversed, and press **O SET** (Adjustment completed).

2I is OK!
Turn off the ins

6. Repeat from Inspection 1 to make sure that adjustment is properly done.

- Do not sight a target that is more than $\pm 10^\circ$ from level.
- Be sure to precisely sight the telescope at the object.

- 7. Coincidence of line of sight of optical plummet with vertical axis.**

1 Inspection

- (2) Set the instrument on the tripod and place a piece of white paper with a cross drawn on it right under the instrument.
- (2) Look through the optical plummet and move the paper so the intersecting point of the cross comes to the center of the field of view.
- (3) Adjust the levelling screw so the center mark of the optical plummet coincides with the intersection point of the cross.
- (4) Rotate the instrument around the vertical axis. Look through the optical plummet each steps of 90° rotation, and observe the center mark position against the intersection point of the cross.
- (6) If the center mark always coincides with the intersection point no adjustment is necessary.



2. Adjustment

- ① If the center mark does not coincide with the intersection point rotate counter clockwise the cap put on focusing knob of optical plummet and then remove it.
- ② Mark the point set on the line of sight at each step of 90° on the white paper and call them A, B, C and D.
- ③ Join opposed points (A, C and B, D) with a straight line, and set intersecting point O.
- ④ Turn four optical plummet adjusting screws with a screwdriver so that the center mark coincides with the intersecting point O.
- ⑤ Repeat the intersection procedures starting with Inspection ④, and confirm if the adjustment is correct or not.

(7) Instructions on inspection and adjustment

- When inspecting and adjusting the instrument, take steps in numerical order as much as possible.
- Pay special attention to articles 3 4 and 4 5 so that steps for adjustment and inspection may be taken in numerical order.
- When adjustment is completed, be sure that adjusting screws are firmly tightened. Tighten the adjusting screw by turning the screw to the direction for tightening. When turning the screw back, tighten the screw after it is rotated too much.
- Repeat inspection after adjustment and check if the instrument has been adjusted properly.

8. Optional Accessories

(2) Diagonal Eyepiece (SBC20)

The diagonal eyepiece can be attached to the telescope eyepiece for convenience in observing the zenith or surveying in confined spaces. To attach the diagonal eyepiece to the telescope, turn the telescope eyepiece ring counterclockwise to remove the eyepiece, and attach the diagonal eyepiece by turning its ring clockwise. The eyepiece can be

rotated

through 360°. When sighting is made through the telescope with the diagonal eyepiece attached, the reticule may be seen deflected vertically or horizontally, but this has no influence upon accuracy.

9. Specifications

•Telescope

Magnification	30x
Effective aperture	40mm
Resolving Power	3"
Field of view	2.5m/2.5 ft.
Minimum focus distance	2.0m/6.6 ft.
Stadia ratio	100
Stadia constant	0

•Angle measurement

Type	Incremental rotary encoder
Detection mode (V)	1 side 2 side
Minimum Display	C10 : 05" or 10" C20 : 10" or 20"
Accuracy (DIN18723)	C10 :10" C20 :20"

•Display

Type	Segment LCD in two lines
Display	Dual

•Vertical axis	Single
•Sensitivity of vials	
Plate vial	40"/2mm
Circular vial	8"/2mm
•Tribrach type	Detachable
•Optical Plummet	
Magnification	2x
Focusing range	0.5 – Infinity
Field of view	5°
Power source	
Type	AA x 5 each
•Ambient temperature	
Operating range - C	-20° to +50°
Operating range - F	-4° to +122°
•Dimensions	
Instrument	165 x 174 x 318mm
Carrying case	470 x 255 x 350mm
•Weight	
Instrument	5.0 kgs. / 11.0 lbs.
Carrying Case	3.0 kgs. / 6.6 lbs.

This device complies with protection requirements for residential and commercial areas. If this device is used close to Industrial area's, or transmitters the equipment could be influenced by electro-magnetic fields.

Safety Precautions (Must be Followed)

The following items are intended to prevent possible injury to the user or other people and/or damage to the instrument before it occurs. These safety precautions are important to the safe operation of this product and should be observed at all times.

Distinctive Displays

The following displays are used to distinguish precautions by the degree of injury or damage that may result if the precaution is ignored.

WARNING Items indicated by this display are precautions which if ignored could result in death or serious injury.

CAUTION Items indicated by this display are precautions which if ignored may result in injury or material damage.

Here "injury" refers to injuries such as cuts, burns or electric shock the treatment of which will not likely require hospitalization or long term attention.

"Material damage" refers to damage to facilities, buildings, acquired data, etc.

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

Survey Instrument Division

Phone	800-330-3336 303-728-0351
Fax	303-728-0253
E-mail	<u>surveyinfo@pentax.com</u>
Web	<u>www.pentaxsurvey.com</u>