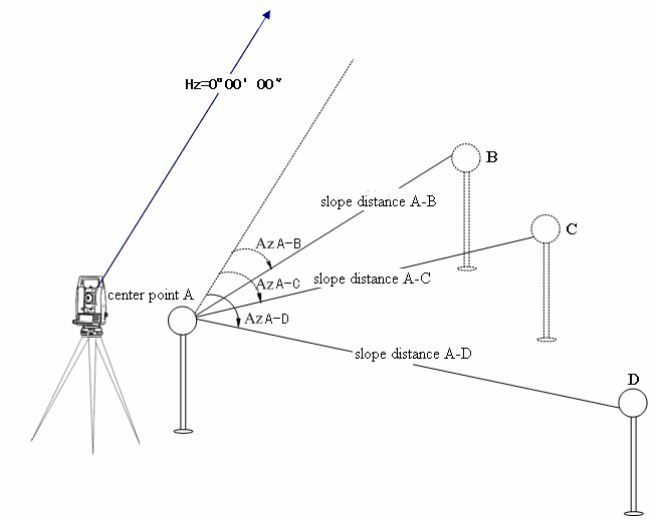
4.4.7 Missing Line Measurement (MLM)

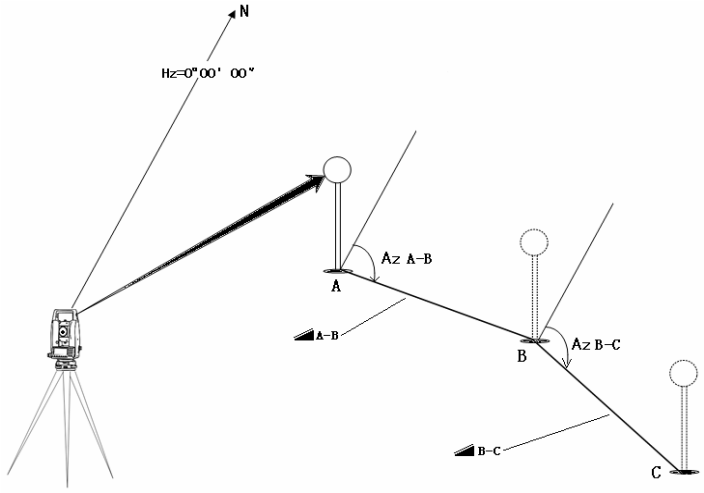
The Missing Line Measurement program calculates the horizontal distance (dHD), slope distance (dSD) and elevation (dVD) between two target prisms.

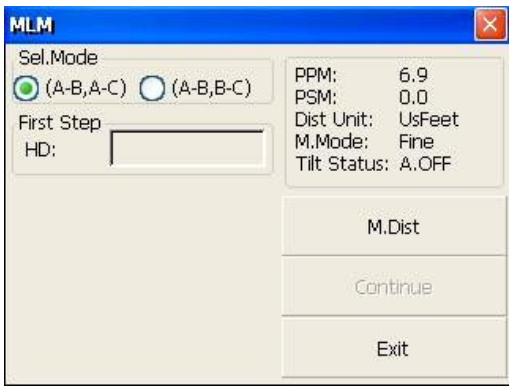
The instruemt can accomplish this in two ways:

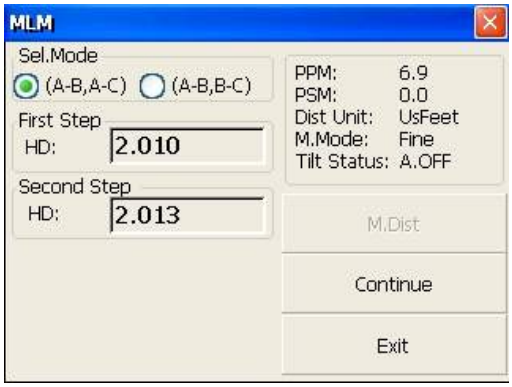
1. MLM Method (A-B, A-C): Measurement is A-B, A-C, A-D, ...



2. MLM Method (A-B, B-C): Measurement is A-B, B-C, C-D, ...



Operation steps	Keys	Display
①Under distance measurement, click “MLM” key to activate Missing Line Measurement.	【MLM】	
②Select method (A-B, A-C) with stylus.		
③Collimate prism A,click “M.Dist” key. Horizontal distance between instrument and prism A will be shown.	【M.Dist】	

④Collimate prism B,click “M.Dist” key.	【M.Dist】	
⑤Click “Continue” key,then horizontal distance(dHD), elevation difference(dVD) and slope distance (dSD) between prism A and prism B will display. ※1）	【Continue】	
⑥In order to calculate the horizontal distance between points A and C,collimate prism C,and click “M.Dist” key again.Thus horizontal distance between instrument and prism C will be shown..	【M.Dist】	

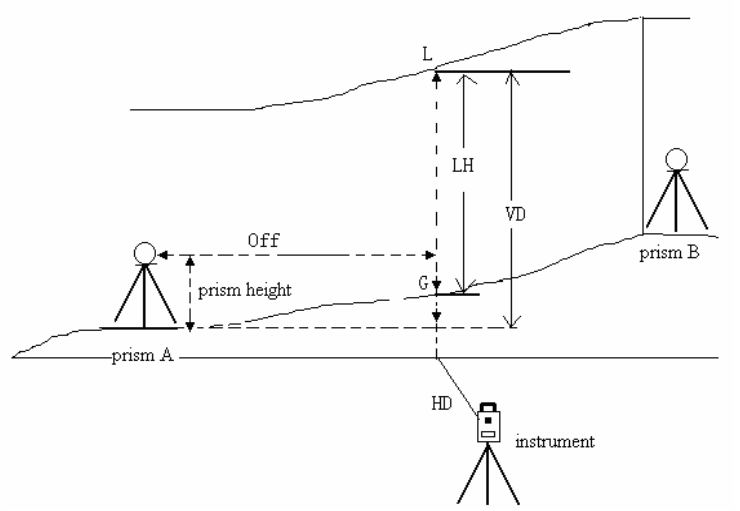
⑦Click “Continue” key,then dHD, dVD and dSD between prism A and prism C will be shown.	【Continue】	
※1）Click “Exit” key to return main menu.		

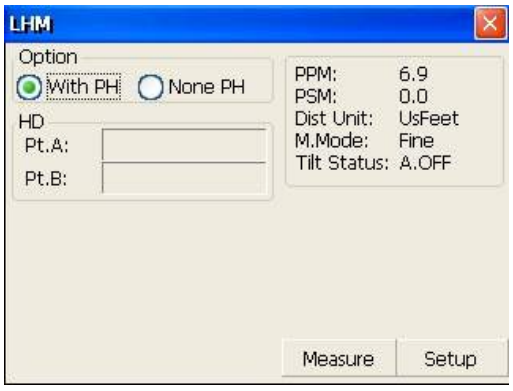
●Procedure of MLM Method (A-B, B-C) is completely same as Method (A-B, A-C) Method.

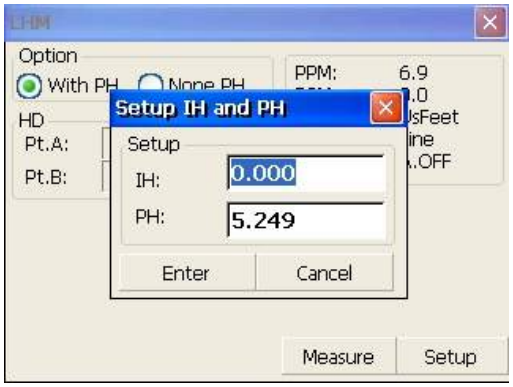
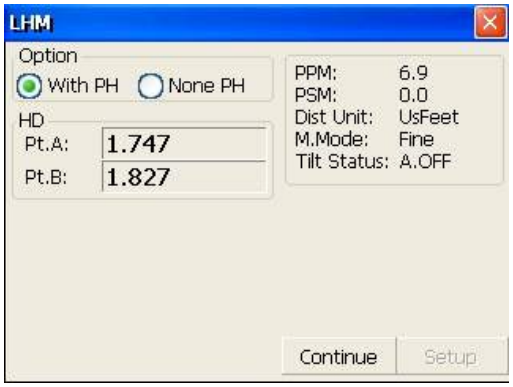
4.4.8 Line-height Measurement

This function is applied for measuring and determining a height of line(like electric wire)above ground which is hard to reach.

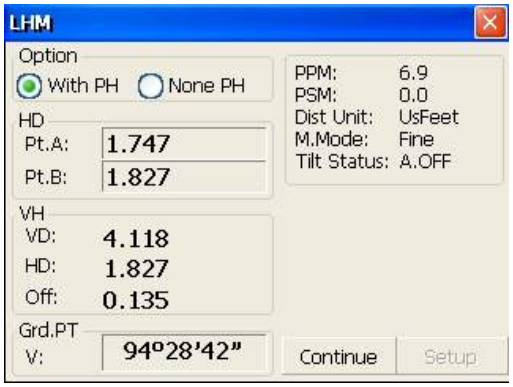
See following image, L is point on the overhead line, G is projective point on the ground, which is also difficult to set target, A and B are baseline which are set up in a certain distance under line. After measuring horizontal distances from instrument to prisms A/B and confirm the base line, VD between A and B, VD between L and G, HD between instrument and L(G),offset distance from A to L(G) will be determined and shown.



Operation steps	Keys	Display
①Under distance measurement mode, click "LHM" key to activate line-height measurement program.	【LHM】	
②Select "With PH" button with stylus.	With PH	

③Click “Setup” key to input instrument height(IH) and prism height(PH).After that click “Enter” key.	【Setup】	
④Collimate prism A, click “Measure” key, and distance measurement begins. After that click “Continue” key.	【Measure】	
⑤Collimate prism B, click “Measure” key, and distance measurement begins.	【Measure】	

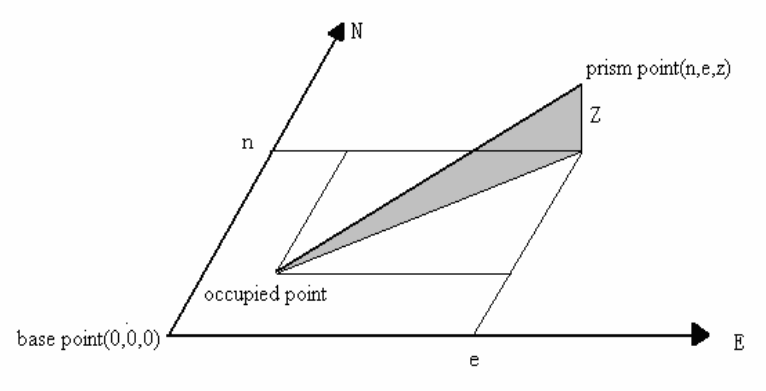
⑥After measurement click “Continue” key.	【Continue】	
⑦Collimate point L on overhead line. The screen displays measuring data of collimating L. VD ： Vertical distance between A and L. HD ： Horizontal distance between instrument and L. Off ： Horizontal distance between A and L.		
⑧Click “Continue” key which is used for measuring height between overhead line and ground. Operation steps: ●Collimate point on overhead line before clicking “Continue” key. ● Lock instrument on hori zontal direction, move tele scope on vertical direction until aim at ground point G.	【Continue】	

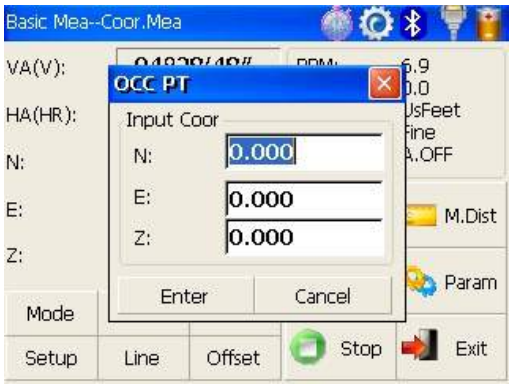
⑨Collimate ground point G by screwing vertical tangent part.	Collimate G	
⑩Click "Continue" key again, and then height of overhead line(LH) and horizontal distance(Off) will display. ※1)～※3)	【Continue】	
※1) Click "X" key to end measurement. ※2) Click "VH" key to return operation step⑦.		

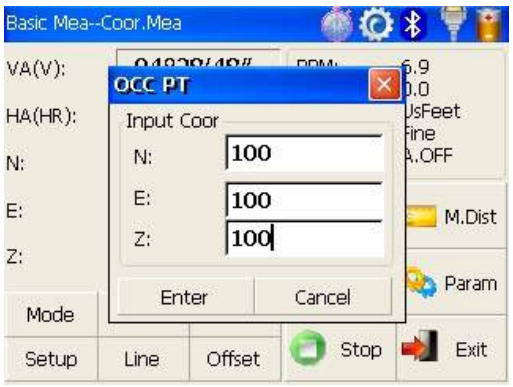
4.5 Coordinate Measurement Mode

4.5.1 Setting coordinate of occupied point

After input coordinate of occupied point(instrument location), unknown point coordinate will be measured and displayed with this program.



Operation steps	Keys	Display
①Click “M.Coor” key to enter coordinate measurement mode.	【M.Coor】	
②Click “OCC PT” key.	【OCC PT】	

③Input coordinate of occupied point from N to Z.		
④Finishing data entry,click “Enter” key and return coordinate measurement interface.	【Enter】	

4.5.2 Setting backsight point

Operation steps	Keys	Display
①Click “S.BS” key to set backsight point.	【S.BS】	

②Input coordinate of backsight point and click “Enter” key.	【Enter】	
③A dialog box is ejected as figure shows.		
④Collimate backsight point, click “Yes” key. And then the system will define backsight azimuth angle which displays in the upper left corner of coordinate measurement screen.	【Yes】	

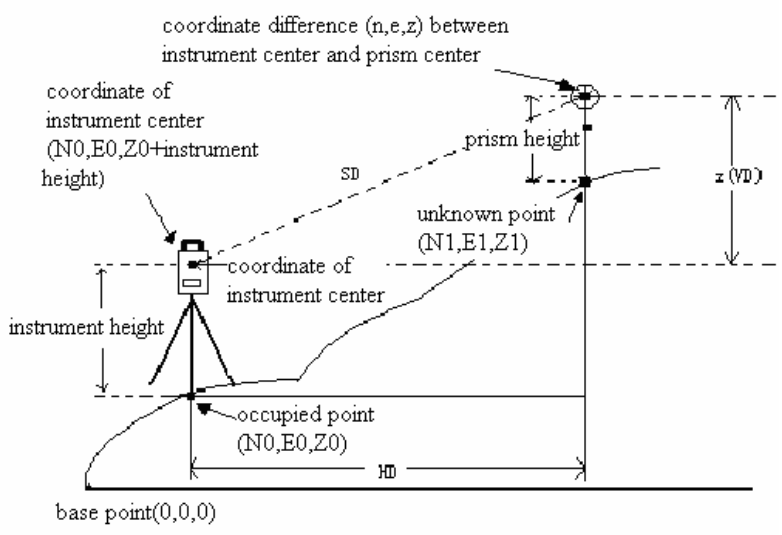
4.5.3 Setting instrument height and prism height

Coordinate measurement must be based on instrument height and prism height, thus coordinate of unknown point can be calculated easily and directly.

Operation steps	Keys	Display
①Click “Setup” key.	【Setup】	
②Input instrument height (IH)and prism height(PH).	Input IH and PH	
③Finishing data entry, click “Enter” key to return coordinate measurement screen.	【Enter】	

4.5.4 Operation of coordinate measurement

With coordinate of occupied point, backsight azimuth angle, Instrument height and prism height set up,you can directly calculate coordinate of unknown point.

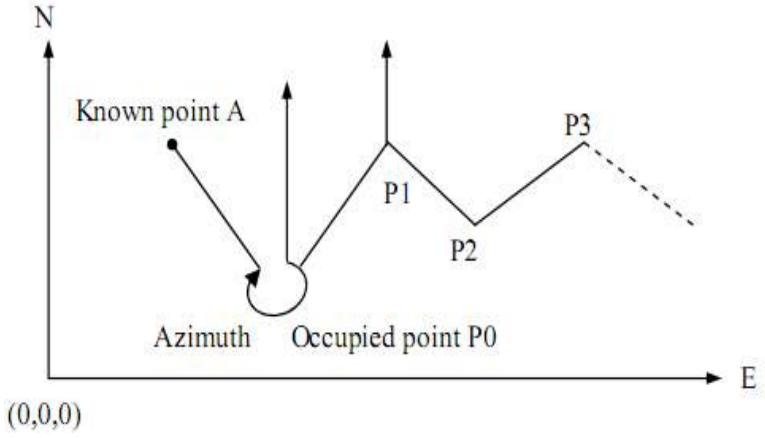


Operation steps	Keys	Display
①Set coordinate of occupied point and instrument height/prism height. ※1) ②Set backsight azimuth angle. ※2) ③Collimate target. ※3)		

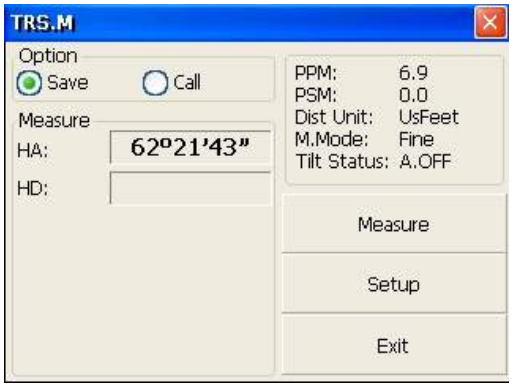
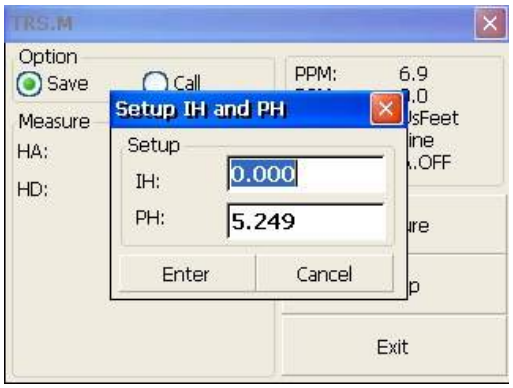
④Click “M.Coor” key to finish operation. ※4)	【M.Coor】	
※1)If don’t input coordinate of occupied point, previous coordinate of occupied point is set as default. If don’t input instrument height and prism height, the previous is set as default too. ※2)refer to “4.3.4 Setting horizontal angle with the S.Angle key” or “4.5.2 Setting backsight point”。 ※3)Click “Mode” key to change distance measurement method(Fine/N Fine/Loop Fine/Track) ※4) Click “M.Angle” or “M.Dist” to return normal angle or distance measurement mode.		

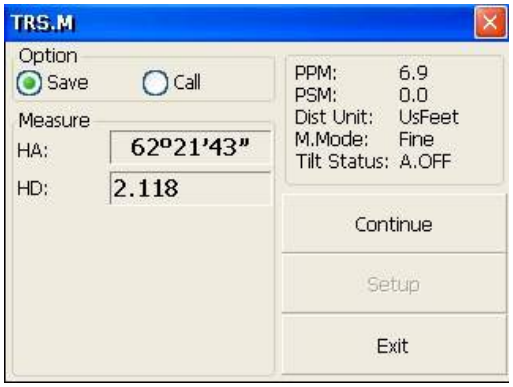
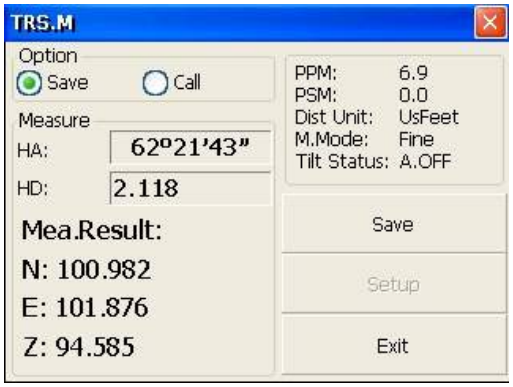
4.5.5 Traverse Surveying

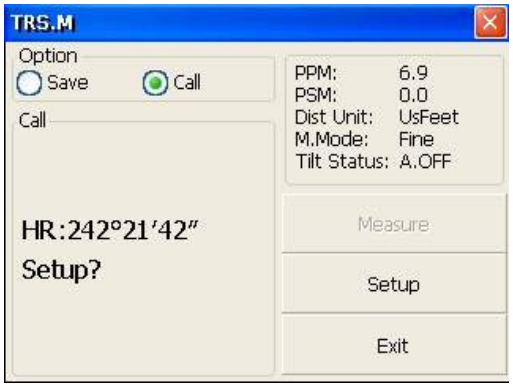
Measure the coordinate of foresight point and save it in the list, this point would be taken as the occupied point after transferring to point 2, and the previous occupied point will be taken as the backsight point, the azimuth angle will be calculated and set.



- Set coordinate of occupied point p0 and azimuth angle from point P0 to known point A.

Operation steps	Keys	Display
①Click “Line” key.	【Line】	
②Click “Save” key with stylus.	【Save】	
③Click “Setup” key to reset instrument height and prism height. And then click “Enter” key.	【Setup】	

④Collimate prism in target point P1 where instrument will be transferred. Meantime click “Measure” key.	【Measure】	
⑤Click “Continue” key and coordinate of Point P1 displays in the lower left corner of screen.	【Continue】	
⑥Click “Save” key. Coordinate of P1 can be ascertained and it will return main menu.At last power off and transfer instrument to P1(transfer prism from P1 to P0 meantime).	【Save】	

⑦After instrument is established in P1,enter into traverse surveying of coordinate measurement and select “Call” button with stylus. ※1)		
⑧Collimate last occupied point P0. Click “Setup” key, then coordinate of P1 and azimuth angle from P1 to P0 will be ascertained. And it returns to main menu at the same time.		
⑨Repeat steps①～⑧，and carry on according to the sequence of guidelines till the end.		
※1) Click “Exit” key to finish Traverse Surveying.		

4.5.6 Offset Measurement Mode

There are four kinds of Offset Measurement Modes:

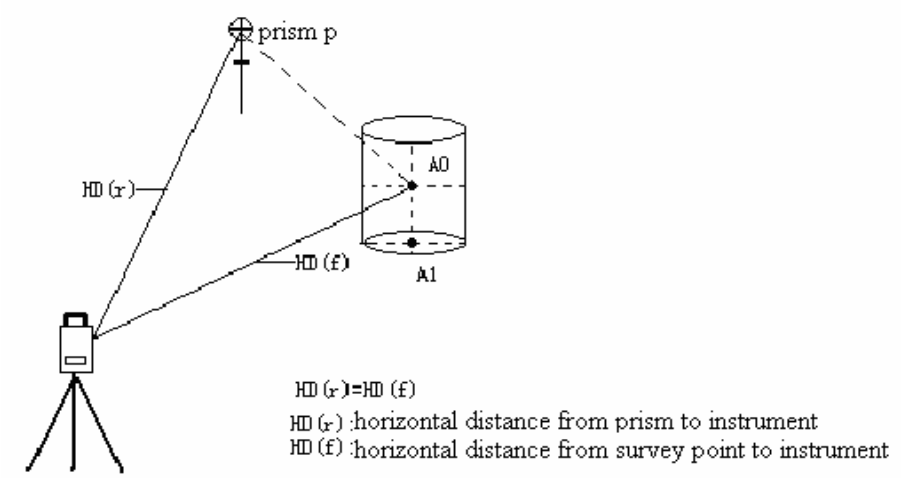
- Angle Offset Measurement
- Distance Offset Measurement
- Plane Offset Measurement
- Column Offset Measurement

1) Angle Offset Measurement

This program is used to measure the point where it’s difficult to set prism. Place the prism at the same horizontal distance from the instrument as that of point A0 to measure.

●When measuring coordinate of ground point A1(projection of point A0),set instrument height and prism height.

●When measuring coordinate of point A0,set instrument height only(Prism height is set as 0).

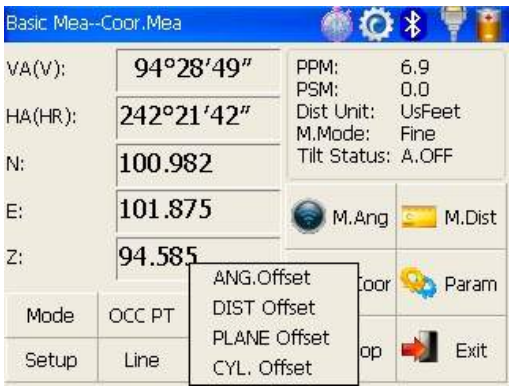
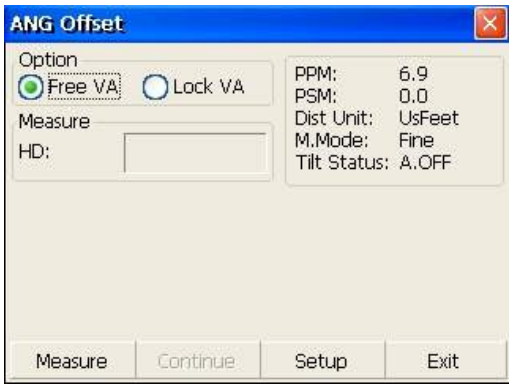
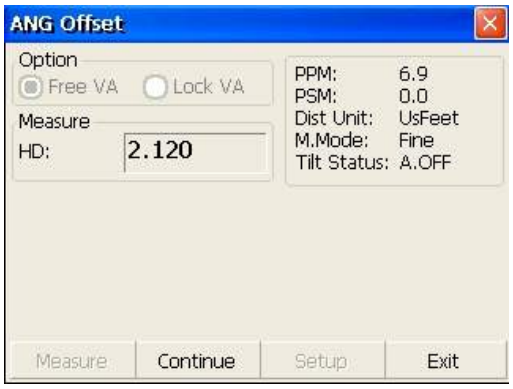


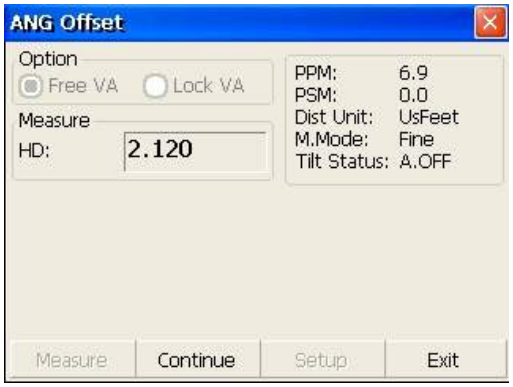
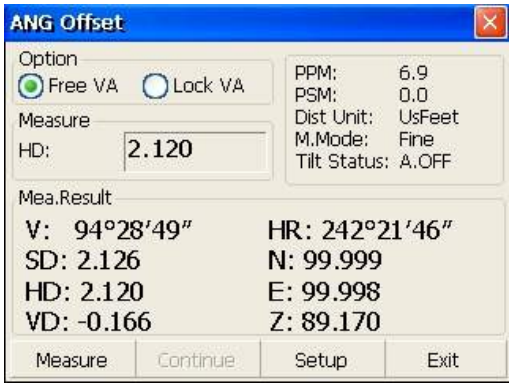
●Under angle offset measurement mode,there are two methods to set vertical angle:

1.Free vertical angle: vertical angle ranges from up-and-down movement of telescope.

2.Lock vertical angle:vertical angle is locked and can't range from up-and-down movement of telescope.

Thus,if collimate A0 with the first method, vertical angle ranges from up-and-down movement of telescope,and meantime slope distance(SD) and elevation difference(VD) will change too.But if collimate A0 with the second method,vertical angle is locked in the direction where prism is located and can't range from up-and-down movement of telescope.

Operation steps	Keys	Display
① Click “Offset” key.	【Offset】	
② Click “ANG.Offset” key in ejecting dialog box. ③ Select “Free VA”(or “Lock VA”) with stylus to to start angle offset measurement.(User makes a choice on the basis of own demand)		
④ Collimate prism P,and click “Measure” key.	Collimate prism P	

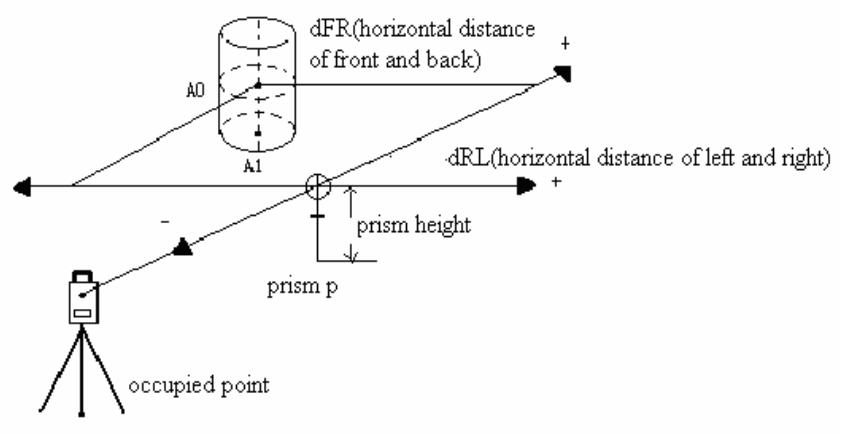
⑤Collimate target A0 with horizontal clamp and tangent part.	Collimate A0	
⑤ Click "Continue" key.Then slope distance,horizontal distance and elevation difference from instrument to A0 and coordinate of A0 will be shown. ※1), ※2)	【Continue】	
※1) Click "Setup" key to set instrument height and prism height. ※2)Click "Exit" to finish Angle Offset Measurement		

●Set instrument height/prism height before Offset Measurement.

●Refer to "4.5.1" to set coordinate of occupied point.

2) Distance Offset Measurement

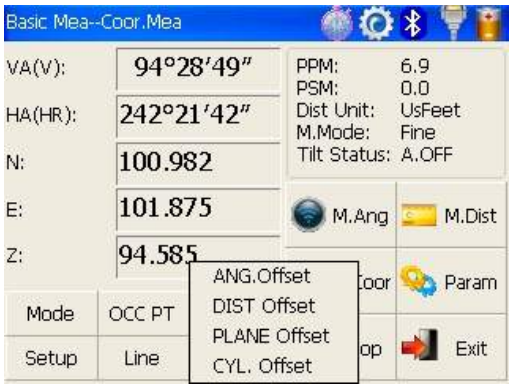
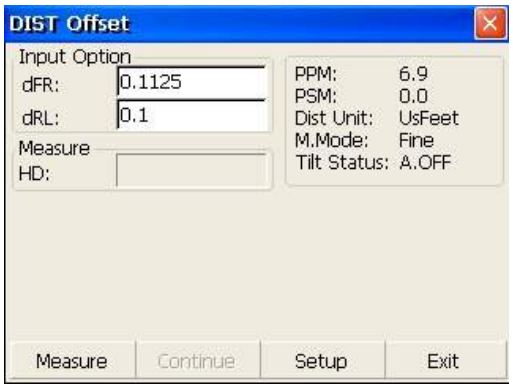
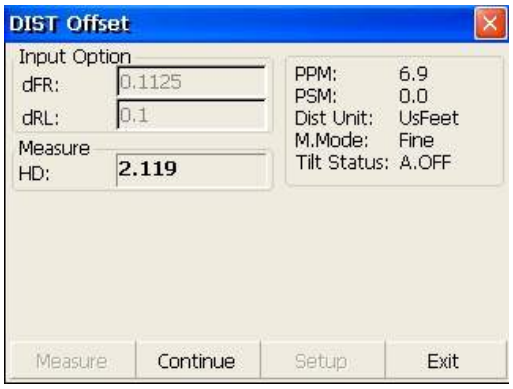
The measurement of a target point apart from a prism is possible by inputting offset horizontal distance of front and back/left and right.

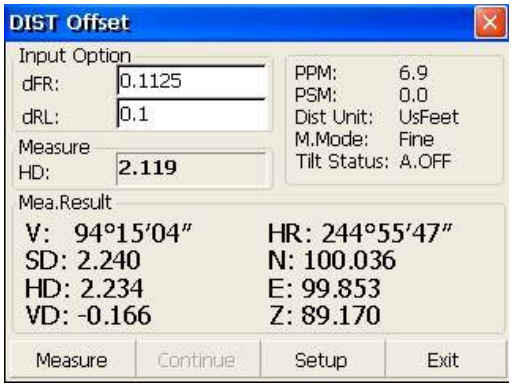


●When measuring coordinate of ground point A1,set instrument height and prism height.

●When measuring coordinate of point A0,set instrument height only(Prism height is set as 0).

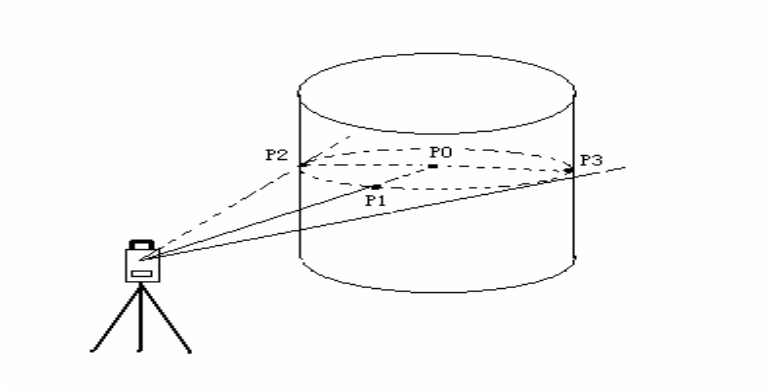
●Refer to “4.5.1” to set coordinate of occupied point.

Operation steps	Keys	Display
① Click “DIST Offset” key in ejecting dialog box.	【 DIST Offset】	
②Finish data entry with stylus.		
③Collimate prism and click “Measure” key.	【Measure】	

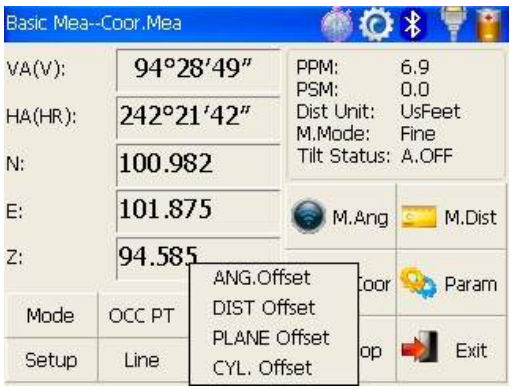
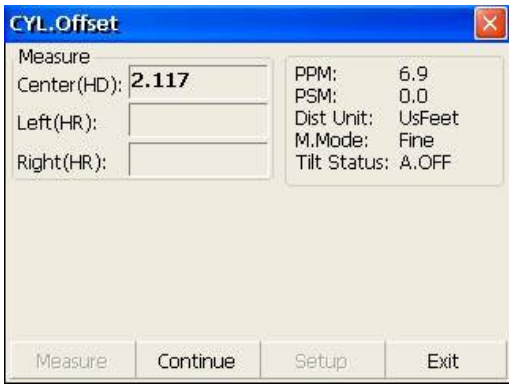
④Click “Continue” key,and result displays with the correction of offset distance. ※1)，※2)	【Continue】	
※1) Click “Setup” key to set instrument height and prism height. ※2) Click “Exit” key to finish Distance offset measurement.		

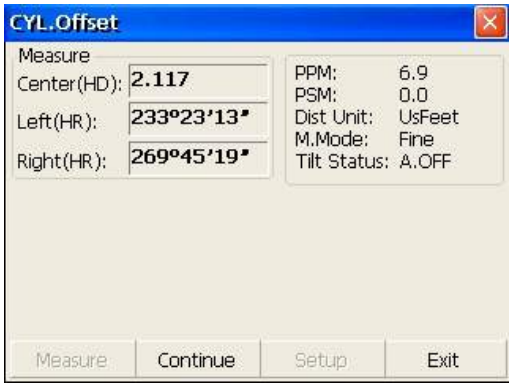
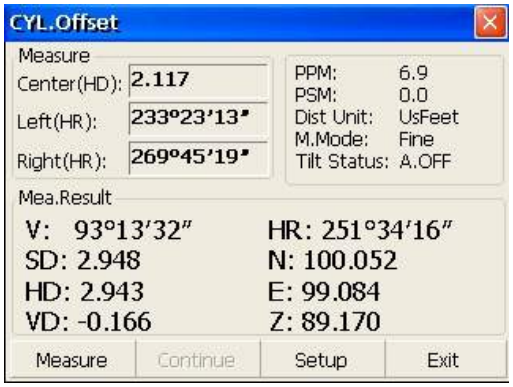
3) Column Offset Measurement

It is possible to measure circumscription point(P1) of column directly,the distance to the center of column(P0),coordinate and direction angle can be calculated by measured circumscription points P2 and p3.The direction angle of the center of column is 1/2 of total direction angle of circumscription points P2 and P3.



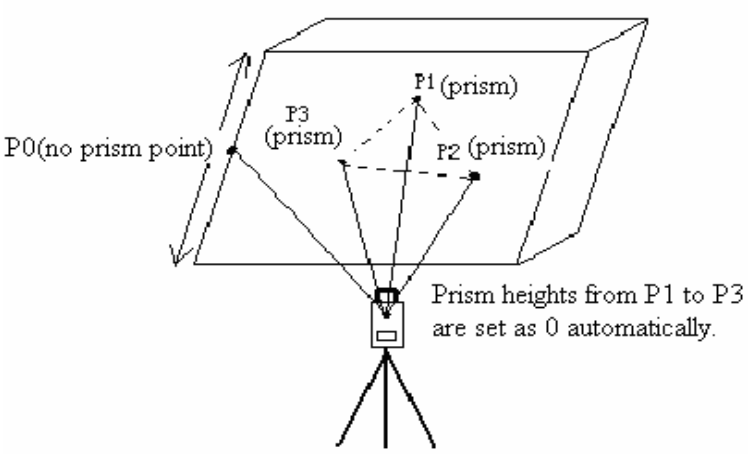
- Refer to “4.5.1” to set coordinate of occupied point.

Operation steps	Keys	Display
① Click “CYL.Offset” key.	【 CYL.Offset】	
②Collimate the center(P1) of column surface,and then click “Measure” key.	【Measure】	
③Collimate left point(P2) of column surface,and then click “Continue” key.	【Continue】	

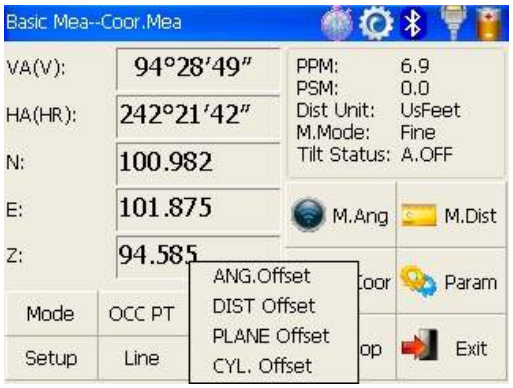
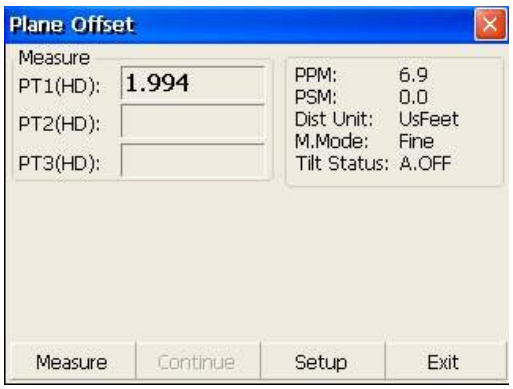
<table>
<tr><td>④Collimate right point(P3) of column surface.</td><td></td><td> 
</td></tr>
<tr><td>②
Click “Continue ” key,and relational values between instrument and the center of column(P0) can be calculated and shown.
※1)，※2)</td><td>【Continue】</td><td> 
</td></tr>
<tr><td colspan="3">※1) Click “Setup” key to set instrument height and prism height.
※2) Click “Exit” key to finish column offset measurement.</td></tr>
</table>

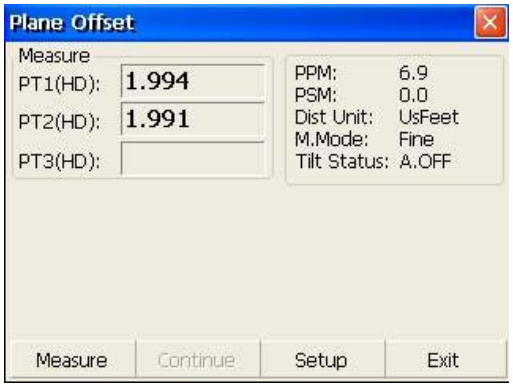
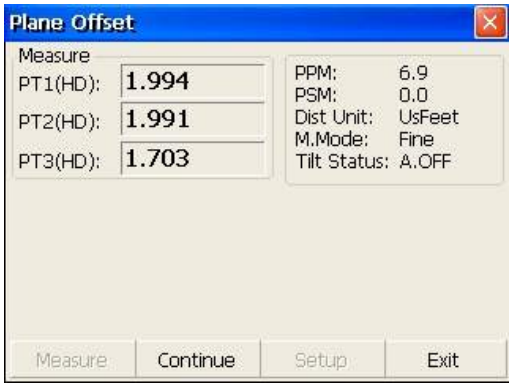
4) Plane Offset Measurement

Measuring will be taken for the place where direct measuring can not be done,for example distance or coordinate measuring for an edge of a plane.Three random points(P1,P2,P3) on a plane will be measured at first in the plane offset measurement to determine the measured plane,collimate the measuring point(P0),the instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane.



● Refer to “4.5.1” to set coordinate of occupied point.

Operation steps	Keys	Display
① Click “PLANE Offset” key.	【 PLANE Offset】	
②Collimate prism P1,and click “Measure” key.	【Measure】	

③Collimate prism P2,and click “Measure” key.	【Measure】	
④Collimate prism P3,and click “Measure” key.	【Measure】	
⑤Click “Continue” key to calculate relational values between collimation axis and plane. ※1)	【Continue】	
※1)Click “Setup” key to set instrument height and prism height.		

●If the three observing points can’t determine a plane,the system will display error message.Thus observe the first point once again.

●When collimation axis doesn’t intersect with determined plane, the system will display error message.

4.6 About

Operation：

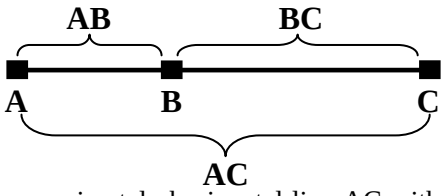
1. Click “about” icon on desktop.
2. Press “Exit” to return the basic measurement.

5. Check and Adjustment

5.1 The Instrument Constant

1) Check

It is suggested to observe and compare the instrument with a testing line which is set on stable ground with a particular accuracy, though error is not generally included in the instrument constant. If the testing line is unavailable, you can set it for 20 meters or so by yourselves, then check and compare it with your new instrument.



1. Select a point B on the approximately horizontal line AC with about 100 meters long. Measure the distances of lines AB , AC and BC .

2. The instrument constant can be calculated;

instrument constant =AB+BC-AC

3. If there is a difference between the instrument standard constant and the calculated value , colligate the measured constant and the prism constant to get a new value ,then input the value into the instrument as a prism constant .

4. Compare length of the instrument's testing line again with a certain standard testing line .

5. If the difference is over 5 mm after the preceding operations, it is necessary to reset the instrument constant .

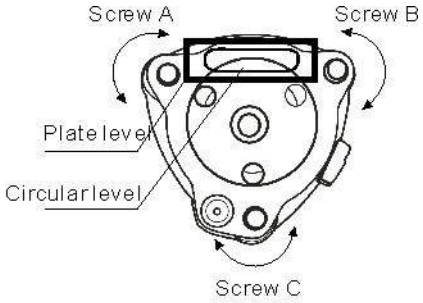
2) Adjustment

About instrument constant setting, you must contact FOIF distributor to do that.

5.2 Plate Level and Circular Level

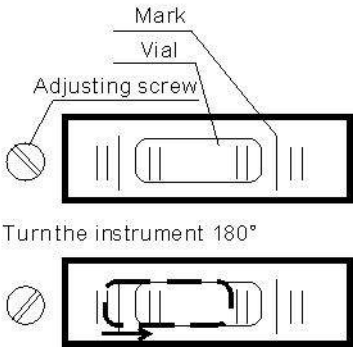
5.2.1 Plate Level

1) Check



1. Mount the instrument on a stable device (as tripod , adjusting device),and fix it.
2. Level the instrument until the plate level is parallel to a line linking leveling foot screws A and B, then adjust the two screws to center the air bubble.
3. Turn the instrument 180°, observe the moving direction of the bubble, if it is still centered, no adjustment is necessary, if not, you have to adjust it.

2) Adjustment



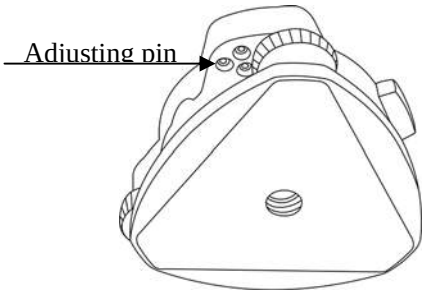
1. Mount the instrument on a stable device and fix it.
2. Level it roughly.
3. Turn the instrument and make the plate level be parallel to a line linking two leveling foot screws, then adjust the two screws to center the air bubble .
4. Turn the instrument 180°, adjust the Adj-screw with adjustment pin slightly to correct half of the bubble's displacement when it doesn't move,
5. Repeat the operation (3) and (4) until the air bubble remains centered in any position .

5.2.2 Circular Level

1) Check

1. Mount the instrument on a stable device and fix it.
2. Level it accurately by the plate level.
3. Observe the bubble of the circular level, if it is centered, no adjustment is necessary, if not, you have to adjust it.

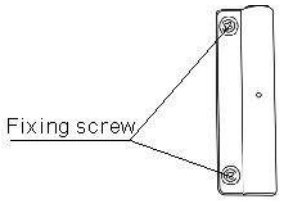
2) Adjustment



4. Mount the instrument on a stable device and fix it.
5. Level it accurately by the plate level.
6. Adjust the three adjusting screws to center the bubble by a wrench.

Note: Be careful when adjusting the three screws, and the tightening tension is identical for them.

5.3 The Optical Sight



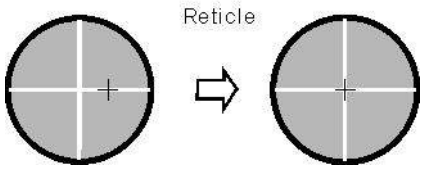
1) Check

1. Mount the instrument on a tripod and fix it.

2. Set a cross mark target which apart from the instrument about 50m.

3. Take the telescope sight the cross mark.

4. Observe the optical sight collimator whether collimating the cross mark, if collimate the mark, adjustment is not necessary; if not, adjust it.



2) Adjustment

1. Mount the instrument at the tripod and fix it.

2. Set a cross mark target which apart from the instrument about 50m.

3. Take the telescope sight the cross mark.

4. Loosen two fixing screws, adjust the collimator, then fix the two screws again.

5.4 Optical Plummet and Laser Plummet

5.4.1 Optical Plummet(factory optional)

1) Check

1. Mount the instrument at the tripod and fix it.

2. Set a cross mark under the instrument

3. Coincide the center mark of the optical plummet with the cross mark by adjusting three leveling foot screws.

4. Turn the instrument 180°, check the center mark and cross mark, if they are coincide, no adjustment is necessary, if not, adjust it.

2) Adjustment

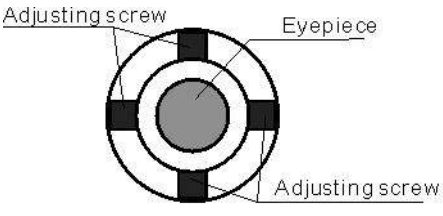
1. Set the instrument on stable device and fix it.

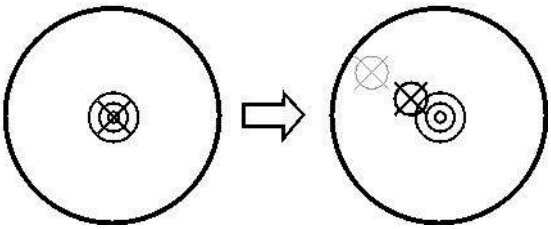
2. Set a cross mark under the instrument.

3. Use the three leveling screws and coincide the center mark of plummet and cross mark on the ground.

4. Rotate the instrument 180°around and take off the cover of the optical plummet eyepiece, adjust the four adjusting screws with the adjusting pin to shift the center mark to the cross mark, correct only one-half of the displacement in this manner.

(5) Repeat the operation in (3) and (4) until coincide the center mark of the plummet and cross mark on the ground.





NOTE:

1. When adjust the screws of plummet reticle, firstly loosen the screw on the moving direction of reticle, secondly tighten another screw by the same mount, clockwise turning is for tightening, and anticlockwise turning is for loosening, the turning mount for tightening or loosening should be same.

5.4.2 Laser Plummet

Check

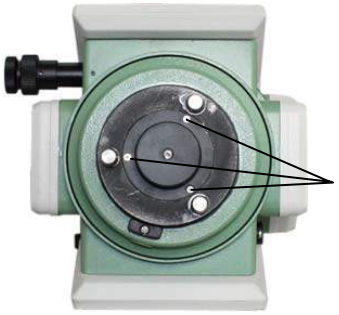
(1)Set the instrument on stable device and fix it.

(2)Set a cross mark on the ground under the instrument.

(3)Turn the laser switch on and focus it accurately.

(4)Turn the three leveling screws until the instrument keeps leveling and the laser spot coincides with the cross mark on the ground.

(5)Rotate the instrument 180° (200g) around and check the laser spot and cross mark，if they coincide, adjustment is not required. Otherwise, adjust it.



Adjustment

1. Setting up the instrument on the checking tool or tripod which is 1.5m apart from ground.

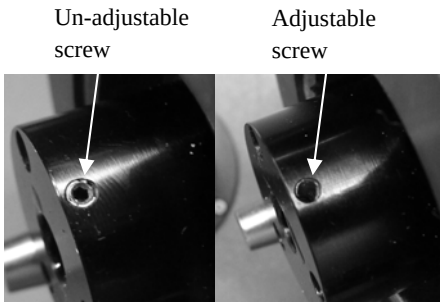
2. Turn on laser plummet, turn tribrach foot screws until laser spot coincide with cross mark. If you use tripod, make a cross mark on the laser spot directly.

3. Rotate instrument 180° around, if the laser spot is over 2mm apart from cross mark, remove the protecting cover firstly, adjust two screws with 1.5mm hexagon wrench to move laser spot to the cross mark, correct only one-half of the displacement in this manner.

Adjusting details see attached figure.

4. Repeat steps 2 and 3 until laser spot coincides with cross mark always when rotate instrument.

Note: there are three screws amounted around laser plummet part, only two screws are used for laser accuracy adjustment.



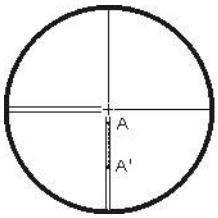
5.5 Vertical Cross-hair on Telescope

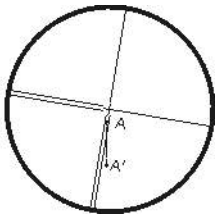
1) Check

(1) Set the instrument up the tripod and carefully level it.

(2) Set a point A front the instrument 50m apart;

(3) Collimate the point A and adjust the vertical tangent screw; If the point appears to move continuously on the hair, adjustment is not required. Otherwise, adjust it.

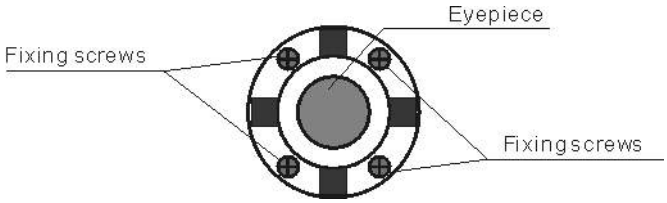




2) Adjustment

(1) Set the instrument, and set the point A front the instrument 50m apart.

(2) Take off cover of telescope eyepiece, there are 4 screws for the reticle part.



(3) Loosen all four fixing screws slightly with the cross screw-drive.

(4)Revolve the eyepiece section so that the vertical cross-hair coincides to point A, finally, re-tighten the four screws.

(5) Repeat the checking and adjusting until there is no deviation.

NOTE:

1）After the adjustment of cross-hair, please check the collimation error and vertical index error.

2) Refer to the chapter “5.9 EDM Optical Axis and the Telescope Sighting Axis Error” to check the axis. At last check the collimator error again.

5.6 Horizontal Collimation Error C

If the telescope's sight line isn't perpendicular to the horizontal axis, the collimation error will appear. The assembling, transportation and operation will cause this error.

If the collimation error isn't over the permitted range, with the program the instrument can correct this collimation error.

NOTE: After the program correction this deviation error is also on the instrument.

1) Check

(1) Set-up the instrument on tripod or adjustment platform and leveling accurately.

(2) Aim at the cross-hairs of collimator or the obvious target at a distance. Get the face left angle reading H1 and the face right angle reading Hr.

(3) Calculating the horizontal collimation error C according to C=（Hl- Hr±180°）/2,if C<8″, no adjustment will be necessary. If C>8″, proceed with the following adjustment.

2) Adjustment by program:

Set-up the instrument on tripod or adjustment platform, and leveling accurately.

Procedures:

1. Power on, run the software "TS810Setup", on the screen tap ◄ or ► keys until Collimation displays, tap it to display collimation error and vertical index error setting menu.

2. Aim at the cross-hair of collimator at telescope left, tap "Left value" to read the horizntal and vertical angles.

3. Aim at the cross-hair of coillmator at telescope right, tap "Right value" to read the horzontal and vertical angles.

4. The software will calculate the new collimation error and vertical index error automatically.

5. Tap "Enter" to save the new values, or tap "Cancel" to use old values.

Note:

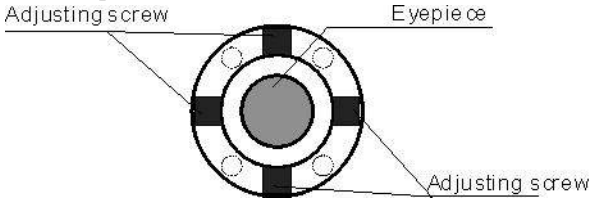
The adjustment can be performed by the program when C<30″, if C>30″, adjust the

reticle.

Reticle Adjusting:

1. Rotate the instrument in face right position, turning horizontal tangent screw until Hr′=Hr+C.

2.Loosen the shield of telescope's reticle.



3. Adjusting two screws at left and at right until the vertical hairs of telescope's reticle coincides with the cross-hairs of collimator or target.

4. Repeat the check and adjustment procedure until the error is accepted.

NOTE:

1. When adjust the screws of reticle, firstly loosen the screw on the moving direction of reticle, secondly tighten another screw by the same mount, clockwise turning is for tightening, and anticlockwise turning is for loosening, the turning mount for tightening or loosening should be same.

2. After the reticle adjustment, it is necessary to adjust the vertical index error by program.

5.7 Vertical Index Error

The deviation between vertical circle zero position and horizontal direction is vertical index (i), it is necessary to concern this error when measure vertical angle. The instrument program applied a formula to remove this error. This correction can offer the index for the formula.

Warning: Before starting this operation, be sure to read manual carefully, otherwise it may cause data faulty.

Because of the close relationship between vertical index and compensator zero position, it is necessary to check and adjust compensator zero position when adjust the vertical circle, the value should be stable when reading.

1) Check:

Please adjust the reticle of telescope and correct the collimation error before this operation.

(1) Mount the instrument at the tripod or a stable device and level it accurately, then turn on the instrument.

(2) Aim at the cross-hairs of collimator or the obvious target at a distance, VA should be

about ±10°. Read the face left angle Vl and face right angle Vr.

(3) Calculate the index error according to the formula below:

i = (Vl+Vr-360°)/2

(4)If I<10″ , no adjustment is necessary , or you have to adjust it .

2) Adjustment by program:

Set-up the instrument on tripod or adjustment platform, and leveling accurately.

Procedures

1. Power on, run the software “TS810Setup”, on the screen tap ◄ or ► keys until Collimation display, tap it to display collimation error and vertical index error setting menu.

2. Aim at the cross-hair of collimator at telescope left, tap “Left value” to read the horizntal and vertical angles.

3. Aim at the cross-hair of coillmator at telescope right, tap “Right value” to read the horzontal and vertical angles.

4. The software will calculate the new collimation error and vertical index error automatically.

5. Tap “Enter” to save the new values, or tap “Cancel” to use old values.

5.8 EDM Optical Axis and the Telescope Sighting Axis Error

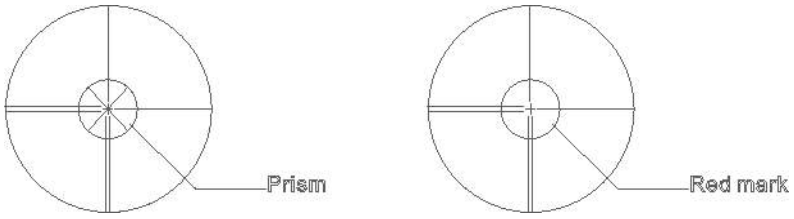
It is necessary to check this error after the adjustment of telescope reticle error.

1）Checking (For 350 series)

(1) Install the instrument at the tripod or a stable device and level it accurately, then power on the instrument.

(2) Set a prism about 2m far away from the instrument.

(3) Aim at the prism center with telescope reticle.



(4) Enter EDM signal testing screen.

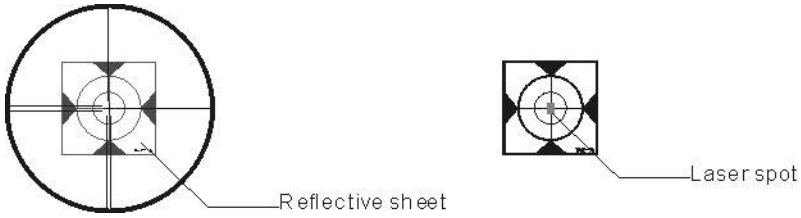
(5) Observe through eyepiece, turn the focusing knob until the red mark is clear, if the deviation between mark and cross-hair is not over 1/5 of red mark diameter, adjustment is unnecessary.

2）Checking (For RTS350 series)

(1) Install the instrument at the tripod or a stable device and level it accurately, then power on the instrument.

(2) Set a reflective sheet about 5m-20m far away from the instrument.

(3) Aim at the sheet cross-mark with telescope reticle.



(4) Enter EDM signal testing screen.

(5) Observe the laser spot, if the laser spot coincides with the cross-mark of reflective sheet, adjustment is unnecessary.

NOTE:

Laser radiation do not stare into beam.

3）Adjustment

If the instrument needs adjustment, please contact with our dealers.

6. Specifications

RTS350 series

Telescope

Length	156mm
Image	Erect
Magnification	30×
Aperture	45mm
Field of view	1°30′
Minimum focus	1.0m

Angle measurement

Reading system	Absolute encoder
Circle diameter	79mm
Angle unit	360degree/400gon/6400mil, selectable
Minimum display	0.5″/1″/5″,selectable
	0.1mgon/0.2mgon/1mgon, selectable
Detecting mode	Double
Accuracy	2″/5″

Distance measurement(R500)

Display resolution(m/inch selectable)	0.1mm/1mm	
Laser class	Prism	Class 1
	Reflectorless/Reflective sheet	Class 3R
Distance unit	m/ft, selectable	
Measurement range(good condition)	Single prism	1 to 3000m
	Reflective sheet/RP60	1 to 800m
	Reflectorless	1 to 500m
Mini-reading	Fine mode	0.1mm/1mm(0.001ft/0.01ft)
	Tracking mode	10mm (0.1ft)
Accuracy	Prism:2mm+2ppm/1mm+1.5ppm(Optional)	
	Reflective sheet/RP60:3mm+2ppm	
	Reflectorless:1-200m:3mm+2ppm/≥200:5mm+3ppm	
Measurement time	Initial: 2.5s	
	Fine mode: 1.5 s	
	Rapid mode: 0.9s	
	Tracking mode: 0.5s	
Prism	typ.1.0-1.5s	
Reflective sheet/Rp60	typ.1.5s	

Reflectorless	typ.1.5-5s,max.20s
Temperature unit	℃/℉, selectable
Pressure unit	hPa/mmHg/inchHg, selectable
Temperature input range	-30℃ to +60℃ (1℃ steps)
Pressure input range	510hPa to 1066hPa(1hPa setps)
Prism constant condition	-99.9mm to +99.9mm
Refraction and earth curvature correction	OFF/0.14/0.2, selectable
Reflecting prism constant correction	-99.9mm to +99.9mm

Distance measurement(R1000)

Laser class

Prism standard mode/Prism long mode	Class 1/ Class 2
Reflective sheet	Class 2
Reflectorless standard mode	Class 2
Reflectorless long mode	Class 3R

Measurement range(good condition)

Standard mode/Prism	1 to 3500m
Long mode/Prism	1 to 6000m
Reflective sheet/RP60	1 to 1200m
Reflectorless	1 to 1000m

Accuracy/typical measuring time(max.20s)

Prism standard mode:1mm+1.5ppm/1.0s-5.0s

Prism long mode:2mm+2.5ppm/0.7s-6s

Reflective sheet/RP60:2mm+2ppm/1s-5s

Reflectorless:1-500m:2mm+2ppm/0.7s-6s>500m:4mm+2ppm/3s-12s

Level vial sensitivity

Plate level	30″／2mm
Circular level	8′／2mm

Compensation

Dual-axis

System	Liquid type
Range	± 3′
Resolving power	1″

Data processing system

Operating system	Windows CE
CPU	32 bit

Optical plummet(Factory optional)

Accuracy	±0.8mm/1.5m
Image	Erect

Magnification	3×
Focusing range	0.5m～∝
Field of view	4°

Laser plummet(Standard)

Accuracy	±1.0mm/1.5m
Laser class	Class 2/IEC60825-1
Laser spot size/brightness	Adjustable
Laser wave length	635nm

Display

LCD	3.5″ color TFT LCD(320×240dots), touch screen transflective sunlight readable display

Internal memory

Internal memory	SD Card

Power

Battery	3400 mAh Li-ion Rechargeable battery
Voltage	7.4Ⅴ DC
Continuous operation time	About 10 hours(single distance measurement every 30 seconds)
Chargers	FDJ6-Li(100V to 240V)
Charging time (at +20℃)	Approx. 4 hours

Application programs

Data collection/Stake out/Resection/REM/MLM/Point to line

AREA/Z coordinate/OFFset/3D Road/Traverse adjustment

Tape measurement/section/axis positioning measurement

Others

CPU	ARM9 Core
Memory	2G internal memory
Guide Light System	Factory optional
Sensors	Built-in temperature and pressure sensors
Keyboard	Alphanumerical illuminated key board,both sides
Operating temperature	-20°～+50℃
Storage temperature	-40°～+70℃
Dimension(W×D×H)	210×210×360ｍｍ
Weight(including batteries)	5.5kg
Dimensions(Ｗ×Ｄ×Ｈ)	185×220×360㎜
Interface	USB host/USB slave/RS-232C/Bluetooth(Optional)
Water and dust protection	IP55 (IEC60529)
Data collector	PS236,fully rugged PDA(Optional)

8. Standard components

● Carrying case	1 each
● Instrument	1 each
● Battery	2 each
● Charger	1 each
● Adjusting pins	2 each
● Cleaning cloth	1 each
● Cleaning brush	1 each
● Screwdriver	1 each
● Wrench	2 each
● Silica gel	1 each
● Instruction manual	2 each
● CD	1 each
● USB Communication cable	1 each
● RS232C Communication cable	1 each
● Rainproof	1 each
● Reflective sheet/RP30	4 each
● Reflective sheet/RP60	1 each
● Laser caution sign board	1 each

Appendix I: Atmospheric correction formula and chart(Just for reference)

Factory setting: temperature: 20℃, pressure:1013hpa, 0ppm （RTS）
temperature: 20℃, pressure:1013hpa, 0ppm （RTS）

The correction:

Kpt＝274.417-0.2905*p/(1＋0.0036*t)…….. RTS

Kpt＝278.960-0.2902*p/(1＋0.0036*t)……...RTS

Where: p--Pressure value (hPa)

t--Temperature value (℃)

Kpt--Atmospheric correction (ppm)

Example:

t=20℃, p=1013hpa, L0=1000m.

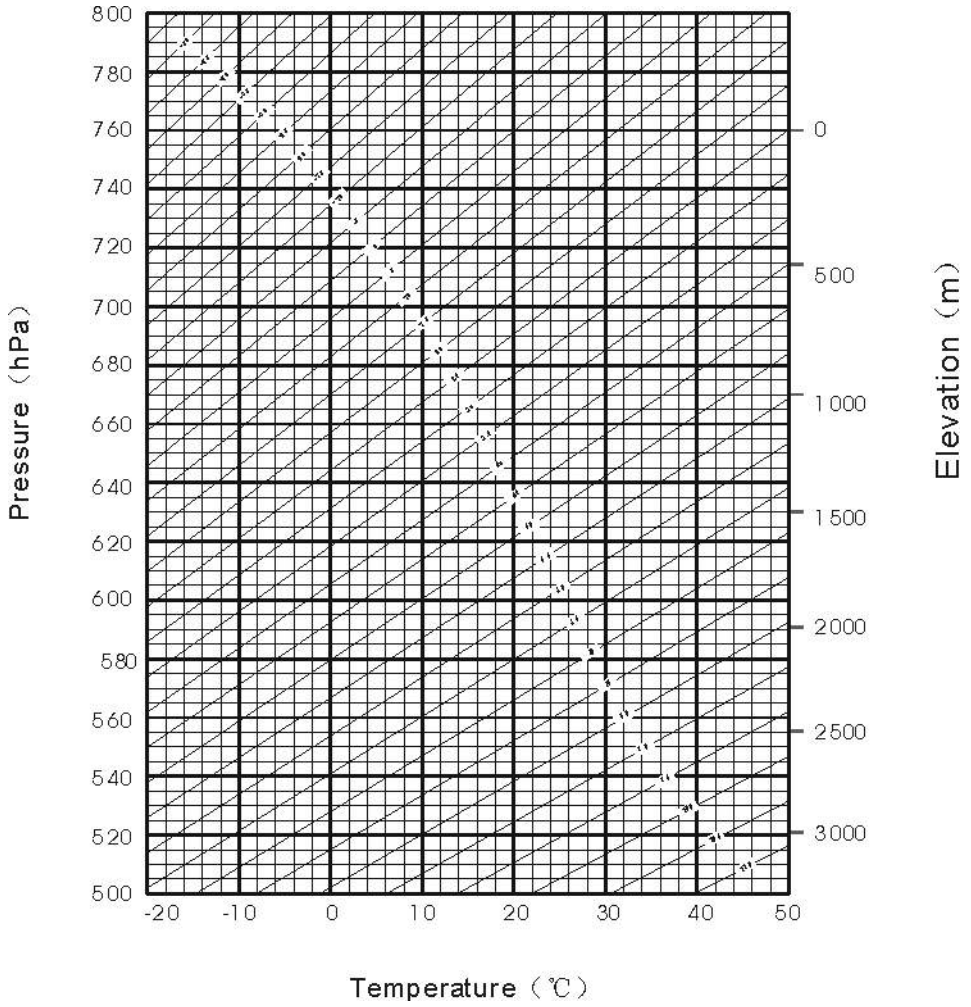
Then: Kpt=0ppm (RTS) Kpt=4ppm (RTS)

$L=L_0(1+Kpt)=1000\times(1+0\times10^{-6})=1000.000m$ (RTS)

$L=L_0(1+Kpt)=1000\times(1+4\times10^{-6})=1000.004m$ (RTS)

The atmospheric value is obtained easily with the atmospheric correction chart. Find the measured temperature in horizontal axis, and pressure in vertical axis on the chart.

Read the value from the diagonal line, which is the required atmospheric correction value.



For RTS series

Appendix II: Correction for refraction and earth curvature

Considering the correction of refraction and earth curvature for distance measurement, the formula for slope distance, horizontal distance and vertical distance applied in the instrument are as followings:

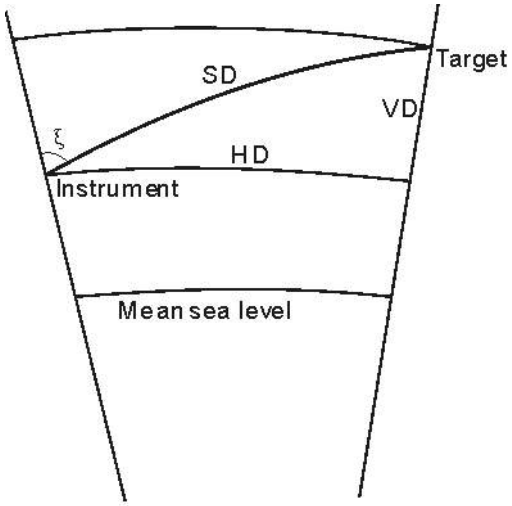
$SD=D_0 \times (1+ppm \times 10^{-6}) + mm$

SD－－Displayed slope distance（m）

D_0－－Real measured distance（m）

ppm－－Scale coefficient（mm/km）

mm－－Target constant (mm)



Elevation measurement

$HD=Y - A \times X \times Y$

$VD= X + B \times Y^2$

HD－－Horizontal distance（mm）

VD－－Vertical distance（mm）

$Y = SD.|\sin \zeta|$

$X = SD.\cos \zeta$

ζ －－Zenith angle

$$A = \frac{1 - K/2}{R}$$

$$B = \frac{1 - K/2}{2R}$$

K = 0.142 or 0.20

$R = 6.37 \times 10^6$（m）

The conversion formula for horizontal and vertical distance is as follows when correction for refraction and earth curvature is not applied:

HD=SD COS§ VD=SD ｜SIN§｜

NOTE:

The factory setting for the refraction coefficient K is 0.142.

Refer to the section 3.10 to change the value of K.

Appendix III: Assembling and disassembling for three-jaw tribrach

It is convenient to assemble or disassemble the instrument from tribrach by loosen or tighten the tribrach clamp.

Disassemble

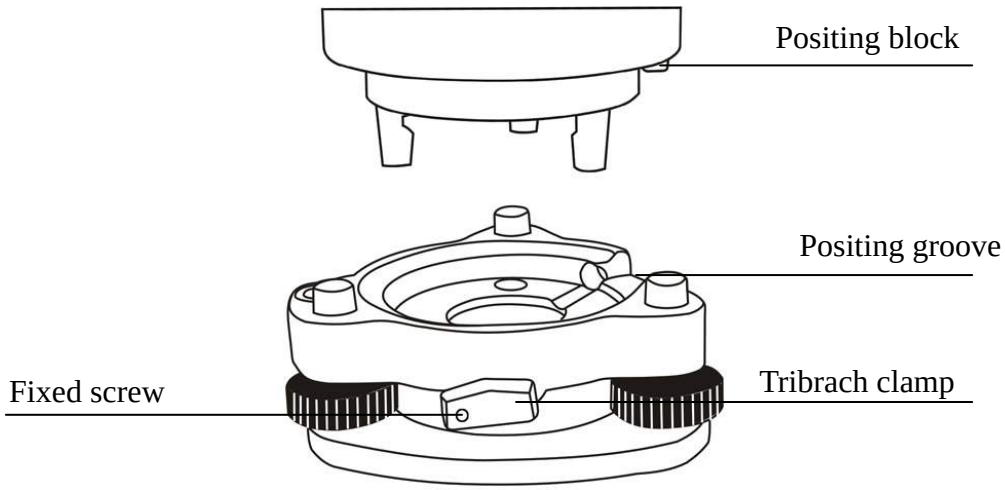
(1) Rotate the tribrach clamp anticlockwise until the lever is loosen.

(2) One hand hold up the tribrach, another hand hold the carry handle of the instrument and lift out the instrument from the tribrach.

Assemble

(1) Put the instrument into the tribrach lightly, let the communication port against in the indentation of the tribrach..

(2) Rotate the tribrach clamp clockwise until the lever is tighten.



Note: Fix the tribrach clamp

If the instrument don’t need assembly or disassembly from tribrach frequently, it is necessary to fix the tribrach clamp by fixed screw to avoid the disassembly by accident.

Screw out the fixed screw by driver to fix the clamp.

NOTE:

These designs, figures and specifications are subject to change without notice. We shall not be held liable for damages resulting from errors in this instruction manual.

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