CONTENTS

1. FEATURES

1. Abundant Functions

   This series of total station have different kinds of measurement programs and many strong functions such as data storage and parameter setting, suitable for all kinds of engineering measurement and professional requests.

2. Colorful Touch Screen

   This series of total station use 3.0 inches colorful touch screen, which can enrich the display and simplify the operation.

3. SD Card Support

   Supporting 32G SD memory card in maximum, and the data can be exported to the SD card in any time.

4. Automatic Data Collection

   Automated field data collecting program, can record measurement data and coordinate data automatically, N3 can also transfer data to PC directly, realize the real digital survey.

5. Lighter Telescope Lens

   The total station of new generation have more scientific and reasonable design in appearance and internal structure, the smaller telescope makes the measurement more convenient.

2. PREPARATION

2.1 Precautions

1). Please do not aim at the sun. If you need to do the outside working under sunshine, please use a filer.

2). Please do not store the instrument in extreme temperatures and also avoid sudden change.

3). When not using the instrument, please place it in the case to avoid shock, dust, and humidity.

4). If there is a great difference in temperature between the working place and storage location, leaving the instrument in the case until it adjust the surrounding temperature.

5). Please remove the battery for separate storage if do not use the instrument for a long time. The battery should be charged once a month.

6). The instrument should be placed in its carrying case during transportation. It is recommended that the original packing case should be used for cushioning during extended transportation.

7). Please hold the instrument in one hand when mounting or removing it from the tripod.

8). Please cleaning the optical parts with cotton or lens tissue only.

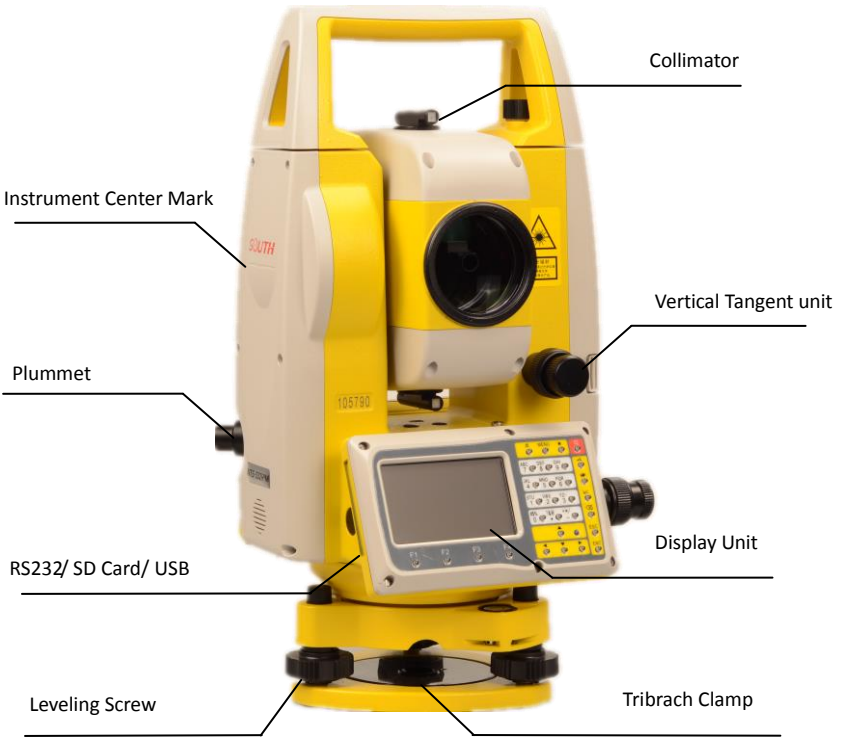
9). Please clean the dust with a woolen cloth when finished to use it. If the instrument get wet, please power off then cleaning the surface and also waiting for drying.

10).Check the battery, functions, and indications of the instrument as well as its initial setting and correction parameters before operating.

11). Please do not disassemble the instrument without authorize to escape the damage.

12). DO NOT stare into the beam or laser source when instrument is operated.

2.2 Appearance




Object Lens
Battery
Horizontal Tangent Unit
EDM Trigger Key
Circular Vial

2.3 Unpacking and Storage of the Instrument

Unpacking of the Instrument

Place the case lightly with the cover upward, unlock the case and take out the instrument.

Storage of the Instrument

Replace the cover on the telescope lens, place the instrument into the case with the vertical clamp screw and circular vial upward (objective lens toward the tribrach), tighten the vertical clamp screw, close and lock the case.

2.4 Instrument Set Up

Mount the instrument onto the tripod and secure firmly. Level and center the instrument precisely to ensure the best performance. Use the tripod with a tripod screw.

Operation Reference: Leveling and Centering the Instrument

1). Setting up the tripod

First extend the extension legs to suitable length and tighten the screws, firmly plant the tripod in the ground over the point of beginning.

2). Attaching the instrument to the tripod

Secure the instrument carefully on the tripod and slide the instrument by loosening the tripod mounting screw. If the optical plumb site is positioned over the center of the point tighten the mounting screw.

3). Roughly leveling the instrument by using the circular vial

Turn the leveling screw A and B to move the bubble in the circular vial, in which case the bubble is located on a line perpendicular to a line running through the centers of the two leveling screw being adjusted. Turn the leveling screw C to move the bubble to the center of the circular vial. Recheck the position of the instrument over the point and adjust if needed.

4). Leveling by using the plate vial

Rotate the instrument horizontally by loosening the Horizontal Clamp Screw and place the

plate vial parallel with the line connecting leveling screw A and B, then bring the bubble to the center of the plate vial by turning the leveling screws A and B.

Rotate the instrument 90° (100gon) around its vertical axis and turn the remaining leveling screw or leveling C to center the bubble once more.

Repeat the before procedures for each 90° (100gon) rotation of the instrument and check whether the bubble is correctly centered in all directions.

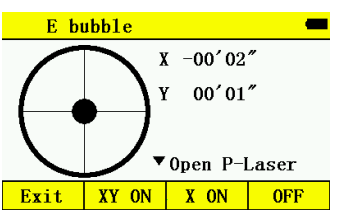
5). Centering by using the optical plummet(or laser plummet)

Adjust the eyepiece of the optical plummet telescope to your eyesight. Slide the instrument by loosening the tripod screw; place the point on the center mark of the optical plummet. Sliding the instrument carefully as to not rotate the axis will allow you to get the least dislocation of the bubble. (Press ★ after power on, then press **[▶]** (LASER) key to turn on the laser plummet.Slide the instrument by loosening the tripod screw; Place laser facular on the occupied point, sliding the instrument carefully as to not rotate the axis will allow you to get the least dislocation of the bubble. The last, press **[▶]** key, and laser plummet will be turned off .)

6). Complete leveling the instrument

Level the instrument precisely as in Step 4. Rotate the instrument and check to see that the bubble is in the center of the plate level regardless of the telescope direction then tighten the tripod screw firmly.

Press ★ key,then press 2 key to enter the E bubble page.



2.5 Battery Removal & Insertion – Information and Recharging

Insert the battery into the battery slot and push the battery until it clicks.

Press the right and left buttons of the battery compartment to remove the battery.

Battery information

Please stop the operation when battery is in low voltage, and change a recharged battery for operation.

Note:

1) The working time of the battery is determined by environment conditions, such as: surrounding temperature, recharging time and recharging frequency. For safety, recharge the battery in advance or prepare a recharged battery for use.

2) The display level of leftover battery capacity is related to current measurement model,even the leftover battery is enough to in angle measurement mode,but you cannot make sure it is enough to use in distance measurement mode. Because the power consumption of distance measurement model is higher than angle measurement model,when turn the angle measurement model to distance measurement model, sometimes it may stop measure distance and the instrument shut down because of insufficient capacity of battery.

Battery Recharging :

Battery should be recharged only with the specified charger.

The charger should be connected with 220V power supply first when recharging ,then remove the battery from instrument ,put the plug of the charger into the socket.

Battery Removal Caution

▲Before you take the battery out of the instrument, make sure that the power is turned off. Otherwise the instrument would be damaged.

Recharging Caution

▲The charger has built-in protection circuit from overcharging. However, do not leave the charger plugged into the power outlet after recharging is completed.

▲Be sure to recharge the battery at a temperature of 0℃~45℃, recharging may be abnormal beyond the specified temperature range.

▲When the indicator lamp does not light after connecting the battery and charger the battery or the charger may be damaged.

Storage Caution

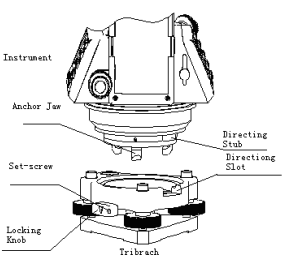
▲Complete discharge of battery may shorten its service life.

▲In order to get the maximum service life be sure to recharge the battery at least once a month.

2.6 Assemble and Disassemble the Tribrach

Disassemble

If necessary, you can disassemble the tribrach from N3. Loosen the tribrach locking screw in the locking knob by a screwdriver. Turn the locking knob 180 degrees counter-clockwise to disengage anchor jaws and remove the instrument from the tribrach.



Assemble

Insert three anchor jaws into holes and line up the directing stub on the instrument with the directing slot of the tribrach. Turn the locking knob 180 degrees clockwise and tighten the locking screw by a screwdriver

2.7 Eyepiece Adjustment and Object Sighting

Method of Object Sighting (for reference)

1) Sight the telescope to the sky and rotate the eyepiece tube to make the reticle clear.

2) Collimate the target point with top of the triangle mark in the collimator.(keep a certain distance between eye and the collimator).

3) Make the target image clear with the telescope focusing screw.

If there is parallax when your eye moves up and down or left and right this indicates the diopter of the eyepiece lens or focus is not adjusted well and accuracy will be effected. You should readjust the eyepiece tube carefully to eliminate the parallax.

2.8 Power On & Off

Power on

1) Be sure that the instrument is leveled.

2) Press and momentarily hold the power (POWER) key.

3) Rotate the EDM head in an upwards direction to initialize.

4) To turn OFF press and hold the power key until instrument powers down

Be sure about there is sufficient battery power when operating. If 'Low Battery' is shown on the display, the battery should be recharged or replaced.

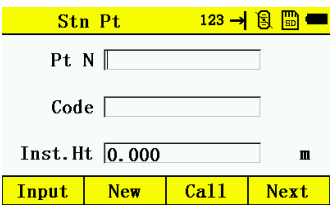
*** DO NOT remove the battery during measuring, otherwise the data will be lost and the instrument would be harmed!!***

2.9How to Enter Alphanumeric Characters

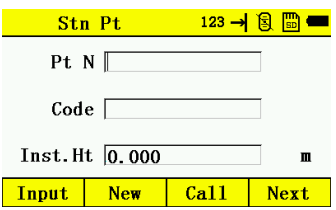
This Chapter is introducing how to input the alphanumeric characters, such as Instrument height, Prism height, station points and BS point etc, selecting * item and input of numbers.

[Example 1] Select I.HT (instrument height) in the data Set Stn (first press the MENU button then 5: Set Stn and then press F4,. Press 1(Known Pt), then get into the setting page.

The arrow (→) indicates an item to enter. Press [▲] [▼] key to move the arrow line up or down



Press [▼] move →I.HT

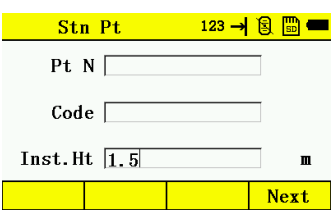


Press 1 to input “1”

Press . to input “. ”

Press 5 to input “5 ”

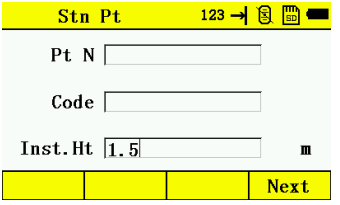
Then I. HT =1.5 m



*How to enter characters

[Example 2] Input the code “ABCDE” for measuring point in Set Stn Mode Known Pt.

1.Press [▼] or [▲] key to move the arrow,when move to the inputting item,press the switch key α



2. Press [7] key once for “A”

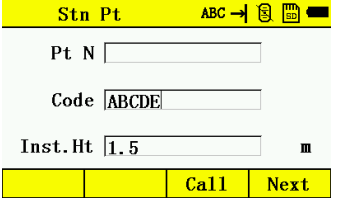
Press[7] key twice for “B”

Press [7] key three times for “C”

Press [8] key once for “D”

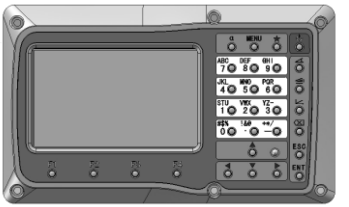
Press [8] key twice for “E”

Press enter key to finish input



3. FUNCTION KEY AND DISPLAY

3.1 Operating Key



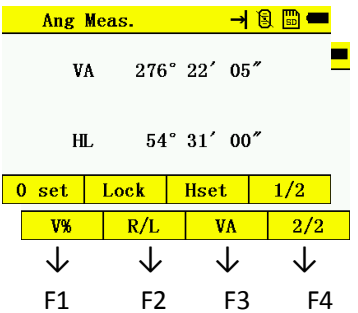
Keys	Names	Function
	Angle meas.	Angle measurement mode
	Distance meas.	Distance measurement mode
	Coordinate meas.	Coordinate measurement mode
	Backspace	Delete characters before cursor
▲ ▼	Direction key	[▲] Up [▼] Down
◀ ▶	Direction key	[◀]Left [▶]Right
ESC	Escape	Return to the measurement mode or previous page
ENT	Enter	Inputting values or OK.
MENU	Menu	Switches menu mode and normal mode
α	Conversion key	Switch character and number
★	Star key	Quick setting
	Power key	On/Off key press and hold
F1—F4	Function key	Responds to the message displayed
0—9	Number key	Input numbers and letters
—	Minus key	Input minus ,plus ,multiply ,division sign
.	Point key	Input point character

Display marks:

Display	Content
V%	Vertical angle as a percentage (Gradient display)
R/L	Horizontal angle (right/left)
PPM	Atmospheric correction

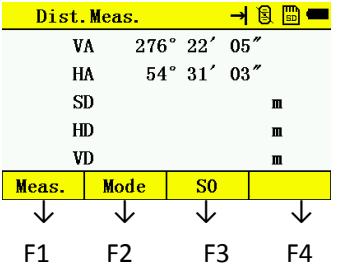
3.2 Function Key

Angle measurement mode



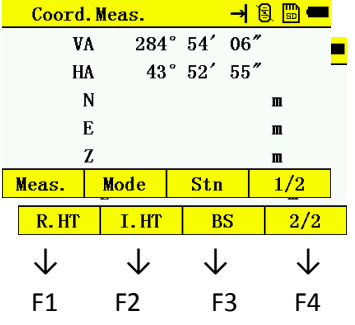
Page	Soft keys	Display marks	Function
1/2	F1	0SET	Horizontal angle is set to 0°0′0″
	F2	HOLD	Hold the horizontal angle
	F3	HSET	Set a required horizontal by entering numbers
	F4	1/2	Scroll to the next page(P2)
2/2	F1	V%	Vertical angle percent grade(%) mode
	F2	R/L	Switches Right/Left rotation of horizontal angle
	F3	Vertical Angle	Switch vertical angle and zenith distance
	F4	2/2	Scroll to the first page

Distance measurement mode



Page	Keys	Display	Function
1/1	F1	MEAS	Begin measuring
	F2	MODE	Sets measuring mode, Fine/--/Tracking
	F3	SO.	Select Stake Out measurement mode

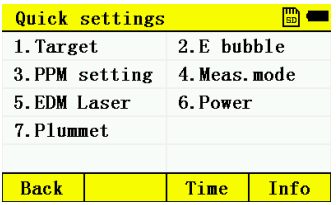
Coordinate measurement mode



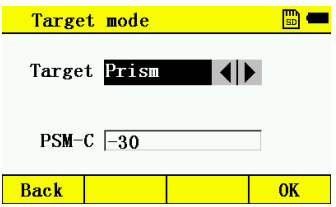
Page	Keys	Display marks	Function
1/2	F1	MEAS	Start measuring
	F2	MODE	Sets a measuring mode, Fine/Tracking
	F3	STN	Sets instrument coordinate
	F4	1/2	Shows the function of soft keys on page 2
2/2	F1	R.HT	Sets prism height
	F2	I.HT	Sets instrument height
	F3	BS	Setting coordinate for back sight orientation
	F4	2/2	Shows the function of soft keys on page 1

3.3 Star-key

Press the star key, following is displayed:



1. Press cooperation mode, shown as below:

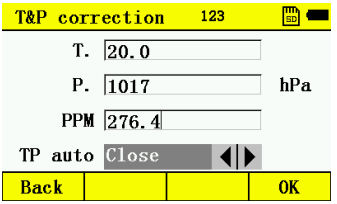


Three cooperation target could choose: Non-prism, Prism and Sheet, choose one mode then press [OK] return the last page.

Note: In the prism mode, you can change the prism constant, as the default setting is “-30”.

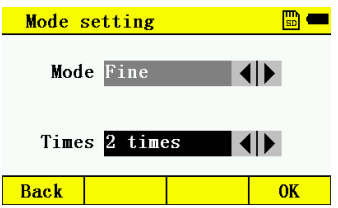
2. E bubble: electronic bubble can be adjust in this page..
3. Press PPM Setting to enter meteorology value setting page. If TP auto show “close” , then you should measure the surrounding temperature and pressure of station point, and input the values. If it show “open” , it will show the Temperature and Press value measured by the T&P sensor.

If it shows “close”, for example: Temperature: 20℃, Pressure: 1017hPa, it will shown as following page:



4. Meas mode: Press [◀] or [▶] to switch Fine, Repeat and tracking measurement, press “OK” to confirm.

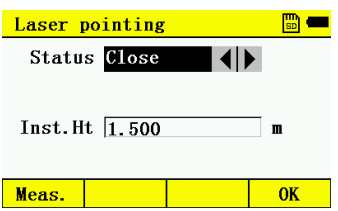
Note: You can choose the measurement times in Fine measurement mode, as following image:



5. EDM Laser: On or off the EDM laser pointer

6. Power : Setting for Battery management, Back-light setting, Cross-hair back-light

7. Laser plummet(Only for TS with Laser plummet): Control the on/off and luminescent of Laser plummet, choose [OK] to finish, as following image:

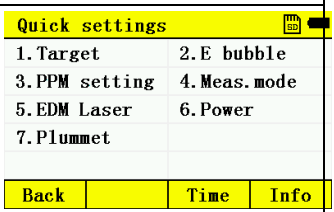
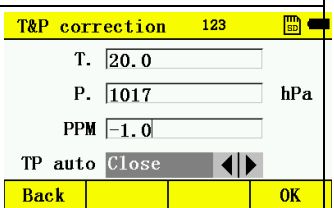
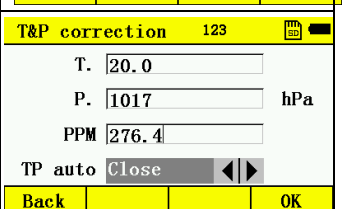


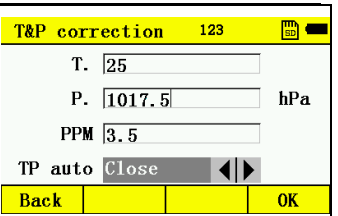
4. INITIAL SETTINGS

4.1 Setting the Temperature and Atmospheric Pressure

If the T&P correction of the Total Station is closed, you should follow the steps below; If it is opened,there is no need to set the Temperature and Atmospheric Pressure,the instrument will detect the Temperature and Atmospheric Pressure automatically,and make the correction with PPM.

Measure the temperature and air pressure of the station point in advance. For example: Temperature +25℃, Air pressure 1017.5hPa.

Procedure	Operation	Display
①Press star key to enter quick settings	★	
②Enter PPM setting. Measure the temperature and air pressure of the station point in advance	3	
③Press [▲]or[▼] to temperature setting	[▲]or[▼]	

④Input temperature, press OK to confirm. The same setting for Air pressure. The instrument will calculate atmospheric correction value automatically	Input temperature *1）	

Remarks:

*1) Please refer to 2.10 “How to Enter Alphanumeric Characters”

Temperature operating range: -30°~+60℃(interval 0.1℃) or -22~+140℉(interval 0.1℉)

Air pressure range: 560~1066hPa (interval 0.1hPa) or 420~800mmHg (interval 0.1mmHg) or 16.5~31.5inHg (interval 0.1inHg)

The setting of Air pressure is same as temperature setting

If the atmospheric correction value calculated from the temperature and air pressure exceeds the range of $\pm 999.9\times10^{-6}$ PPM, the operation will return to step 4 automatically, and you should enter the data again

4.2 Setting of the Atmospheric Correction

The infrared emitted by the Total Station varies with the air temperature and pressure. Once the atmospheric correction value is set ,the instrument will correct the distance measuring result automatically.

Air pressure： 1013hPa

Temperature： 20℃

The calculation of atmospheric correction ：

$\Delta S = 273.8 - 0.2900\ P / （ 1 + 0.00366T ）$ (ppm)

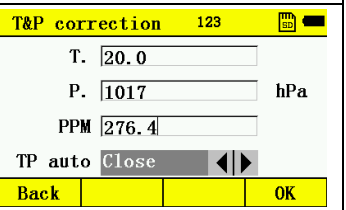
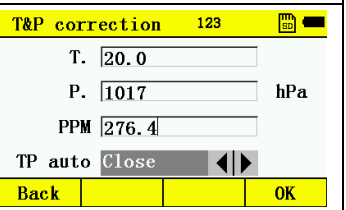
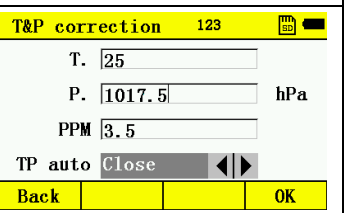
ΔS：Correction Coefficient （Unit ppm）

P: Air Pressure （Unit : hPa If the unit is mmHg , please convert using

1hPa = 0.75mmHg 1mmHg = 1.333hPa

T: temperature （ unit℃）

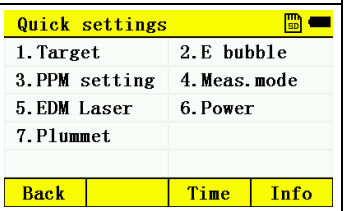
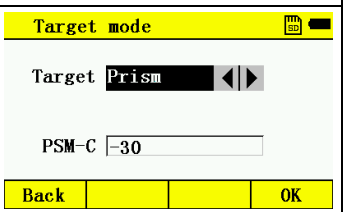
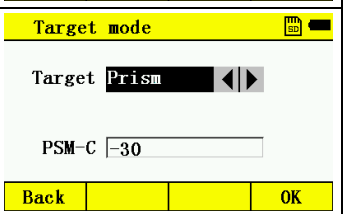
Direct Setting Method of Atmosphere Correction Value

Operation Procedure	Operation	Display
①Press star key into quick setting, then press 3	3	
②Press [▲] or [▼] to PPM	[▲]or[▼]	
③Input data and press [OK]	Input data	
*1）Refer to 2.10“How to Enter Alphanumeric Characters” Input range：-99. 9PPM to +99. 9 Interval: 0 .1PPM *2）If Temperature and Air Pressure are reset, the PPM will be recalculated automatically.		

After measuring the temperature and air pressure, the atmosphere correction value can be obtained from an atmospheric correction chart or correction formula (PPM).

4.3 Setting of the Prism Constant

The default setting of prism constant for the total station is -30mm. If the constant of the prism is not -30mm, you must change this setting. Once the prism constant is set ,it will become the new default value until changed.

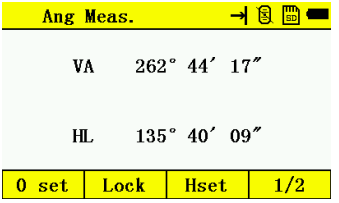
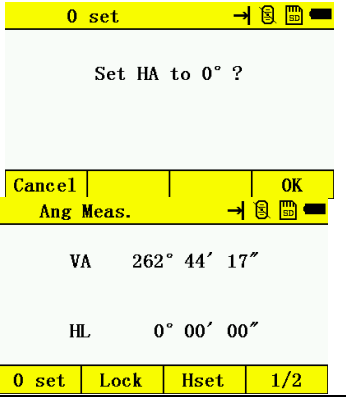
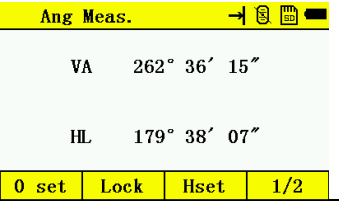
Operation Procedure	Operation	Display
① Press star key into quick setting	Press ★ key	
②Press 1 key to choose Target	1	
③Input prism constant correction *1), press ENT	Input data	
*1) Refer to 2.10 “How to Enter Character” Input range: -99.9mm to +99.9mm Step length 0.1mm		

*The total station in reflectorless measuring mode sets the prism constant to 0 automatically.

5. ANGLE MEASUREMENT

5.1 Measuring Horizontal Angle Right and Vertical Angles

Make sure the angle measurement mode is selected

Operation Procedure	Operation	Display
①Aim at the first target (A)	Aim Target A	
②To set horizontal angle of target A at 0°0′0″. Then press the F1 (0SET) key and then press the F4 (OK) key	F1 F4	
③Aim at the second target (B). The required V/H angle to target B will be displayed	Aim Target B	

Note : The horizontal angle will be saved when the instrument is powered off and displayed when powered on.

Reference: How to Aim at the Target

①Point the telescope toward a light surface or sky. Rotate the eyepiece ring and adjust the focus so that the cross hairs are clear in your view.

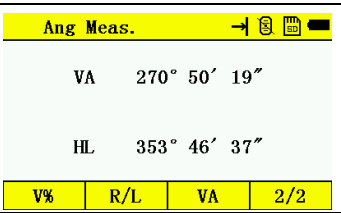
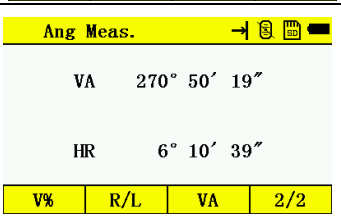
②Aim the target by the peak of triangle mark on the EDM. Allow a certain space between the sighting collimator and yourself.

③Adjust the optical lens to clear the target.

If parallax is occur between the cross hairs and the target when viewing vertically or horizontally while looking into the telescope, focusing is incorrect or eyepiece adjustment is poor. This adversely effects precision in measurement. Please eliminate the parallax by carefully focusing and adjust the eyepiece before working.

5.2 Switching Horizontal Angle (Right/Left)

Make sure the angle measurement mode is selected

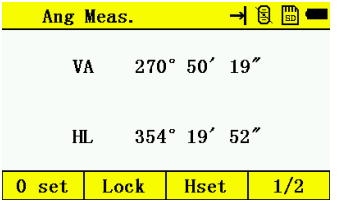
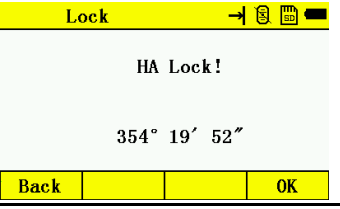
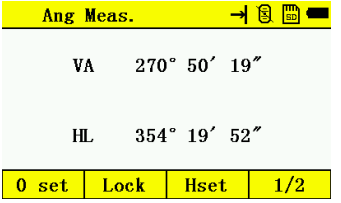
Operation procedure	Operation	Display
①Press F4 (1/2) key to get the menu to page 2.(P2)	F4	
②Press the F2(R/L) key. The Horizontal Right angle mode (HR) Switches to Horizontal Left mode(HL)	F2	

③Measurement same as HL mode		
*Each time the F2 (R/L) key is pressed the HR/HL mode switches		

5.3 Setting of the Horizontal Angle

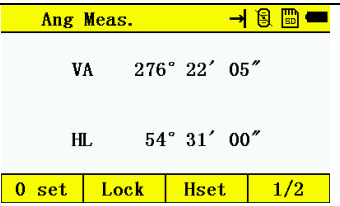
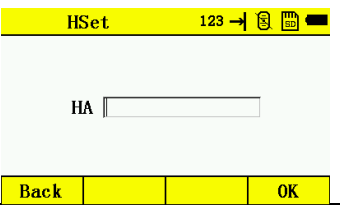
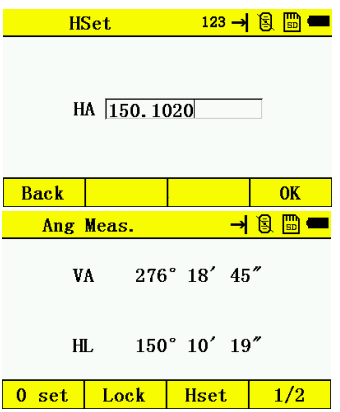
5.3.1 Setting by Holding the Angle

Make sure the angle measurement mode is selected

Operation procedure	Operation	Display
① Set the required horizontal angle using the horizontal tangent screw	Display angle	
② Press the F2 (LOCK) key	F2	
③Aim the target	Aim	
④Press the F4 (OK) key to finish holding the horizontal angle*, the display turns back to the angle measurement interface	F4	

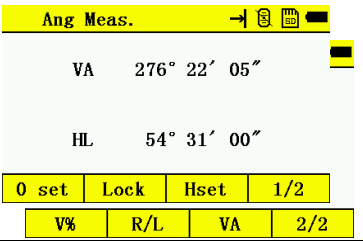
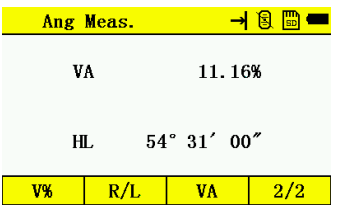
5.3.2 Setting the Horizontal Angle by Manual

Make sure the angle measurement mode is selected.

Operation procedure	Operation	Display
①Aim the target	Aim	
②Press the F3 (HSET) key	F3	
③Input the required horizontal angle by using the keys*, for example：150.10.20, inputs 150º10′20″. Press ENT Carry on normal measurement after entering the required horizontal angle	Eg. Input 150.1020 F4 ENT	
*Refer to 2.10 “How to Enter Alphanumeric Characters”		

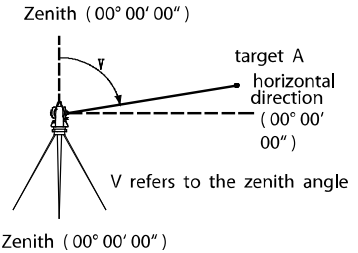
5.4 Vertical Angle Percent Grade (%) Mode

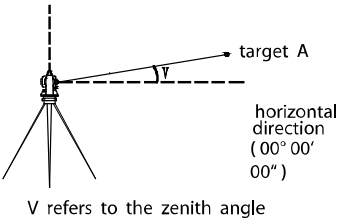
Make sure the angle measurement mode is selected.

Operation procedure	Operation	Display
①Press F4 key to get the function on menu page P2	F4	
②Press the F1 (V%) key *	F1	
*Each time the F1 (V%) key is pressed the display mode switches. When the angle measured is over 45° (100%) from the horizontal <OVERTOP> is displayed.		

5.5 Setting the Initial Zenith Angle

Vertical angle is displayed as shown below:





Make sure the angle measurement mode is selected.

Operation procedure	Operation	Display
①Press F4 key to get the menu on page 2	F4	Ang Meas. VA 72° 44′ 11″ HL 171° 19′ 24″ V% R/L VA 2/2
③ Press the F3 (VA) key *	F3	Ang Meas. VA 17° 15′ 51″ HL 171° 19′ 21″ V% R/L VA 2/2
* Each time the F3 key is pressed the display mode switches.		

6.DISTANCE MEASUREMENT

Before distance measurement, it usually need to confirm the setting of atmospheric correction and prism constant. It is necessary to check I angle of the instrument at first. Please refer to the setting steps of V0 ADJUSTMENT(I angle)

N3 series have three kinds of measuring mode in distance measurement: 1)Prism, need to aim at the target prism. 2).Sheet, need to aim at the target sheet. 3).Non-Prism, only need to aim at the target subject.

6.1 Setting the Atmospheric Correction

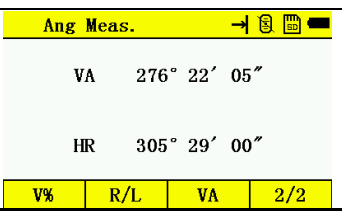
The atmospheric correction can be settled to the correction value by measuring the temperature and pressure. Refer to section 4.2 “Setting of the Atmospheric Correction”.

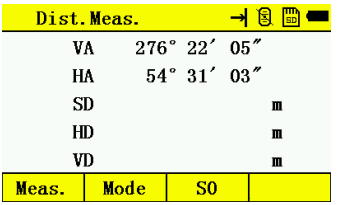
6.2 Setting the Prism Constant

The default value of prism constant is -30mm. If you need to choose the other prism for measurement, please setting the correct prism constant before working. Refer to Chapter 4.3 “Setting of the Prism Constant”. The updated value is kept in the instrument even after power off.

6.3 Distance Measurement (Continuous Measurement)

In angle measurement mode:

Operation procedure	Operation	Display
①Aim at the center of prism	Aim	

②Press the key, distance measurement starts *1)-*4)		

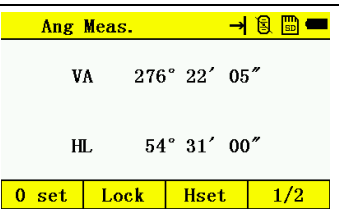
*1)If you want to set automatic distance measurement after power on, please refer to the steps in Chapter 14 “Setting”.

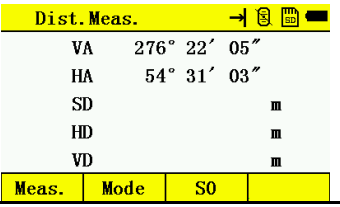
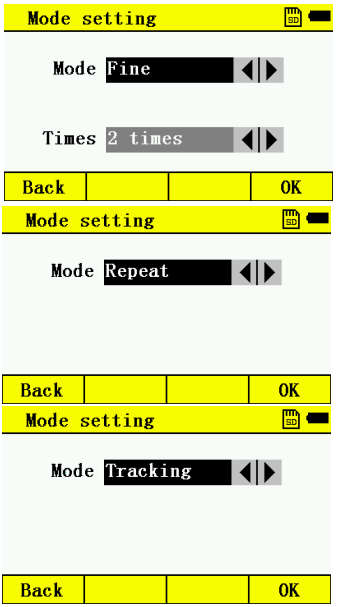
*2)The unit of distance is “m” (meter) in default ,the distance data will be updated after each measurement finished along with the beep.

*3)If the measurement result is affected by the atmospheric agitation,the instrument can repeat the measurement automatically.

*4)If you want to return to the angle measurement mode from the distance measurement mode, pls press ANG key.

6.4 Changing the Distance Measurement Mode(Repeat Measurement / Single Measurement/ Track Measurement)

Operation procedure	Operation	Display
①Aim at the center of the prism	Aim	

②Press key*1)		
③Press F2 to enter, then press [◀]or[▶] to switch between fine mode, repeat mode and tracking mode	F2,then press[◀]or [▶]	

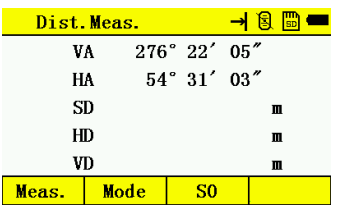
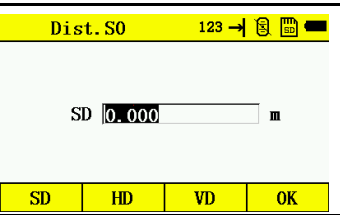
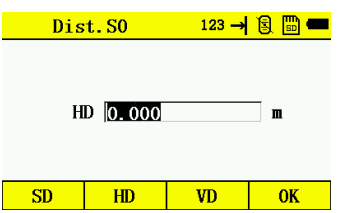
*1)You can set the measuring mode when N3 is power on

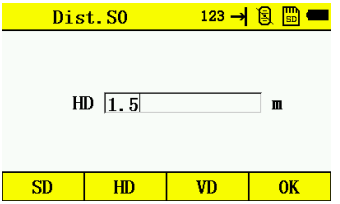
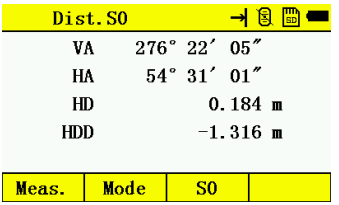
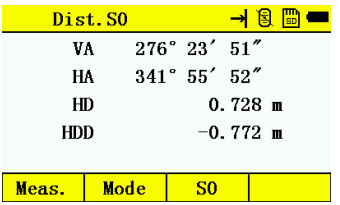
In angle measurement mode:

6.5 Stake Out(S.O.)

This function can show the difference between measured distance and the input stake out distance; Measured distance - Stake out distance = Displayed value

In a stake out operation you can select either horizontal distance (HD), relative elevation (VD), and slope distance (SD.)

Operation procedure	Operation	Display
①In the distance measuring mode		
②Press F3（S.O）key, the data previously set is shown	F3	
③Select the measuring mode by pressing the F1 to F3 keys. F1: SD， F2: HD， F3: VD eg: HD	F1	

④Input S.O. distance, press ENT	Input 1.5 ENT	
⑤Aim at the target (Prism), and start measurement. The difference between the measured distance and the stake out distance is displayed.	Aim the Prism	
⑥Move the target until the value becomes 0		
If the value come to zero or switch to other measurement mode, N3 will back to normal distance measurement surface.		

7.COORDINATE MEASUREMENT

By entering the coordinate of station point, instrument height ,prism height and the azimuth of Back-sight point, 3D coordinate of Measuring Point can be measured automatically.

7.1 Procedures of Coordinate Measurement

Measure the coordinates by entering the instrument height and prism height, coordinates of unknown Point will be measured directly.

* Please setting coordinate values of occupied point refer to Section 7.2 “Setting Coordinate Values of Occupied Station Point”.

* Please setting the instrument height and prism height, refer to Section 7.3 “Setting Height of the Instrument” and 7.4 “Setting Height of Target (prism Height)”.

* Back-sight point is needed and then find the back-sight azimuth before the normal coordinate measurement.

The coordinates of the unknown point are calculated as shown below:

Coordinates at occupied point：(N0 , E0 , Z0)

Coordinates at the center of prism, originated from the center point of the instrument：(n , e , z)

Instrument height :INS.HT　　Coordinates of unknown point：(N1 , E1 , Z1)

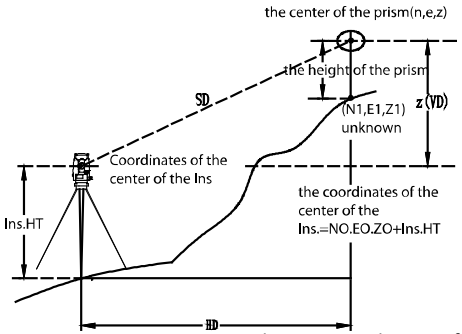
Prism height: R.HT　　Vertical distance (Relative elevation)：Z (VD)

N1=N0+n

E1=E0+e

Z1=Z0+INS.HT+Z - R.HT

Center point of the instrument (N0, E0, Z0+Inst.Ht)



When doing coordinate measurement, you need to set coordinates of occupied point, the instrument height, the prism height and back-sight azimuth at first.

Operation procedure	Operation	Display
①Set the direction angle of known point A *1）	Set direction angle	Ang Meas. VA 276° 22′ 05″ HL 54° 31′ 00″ 0 set | Lock | Hset | 1/2
②Aim at target prism B, and press [key] key	Aim at target prism [key]	Dist.Meas. VA 276° 22′ 05″ HA 54° 31′ 03″ SD m HD m VD m Meas. | Mode | S0

*1)Refer to Section 5.3 “Setting of Horizontal Angle”.

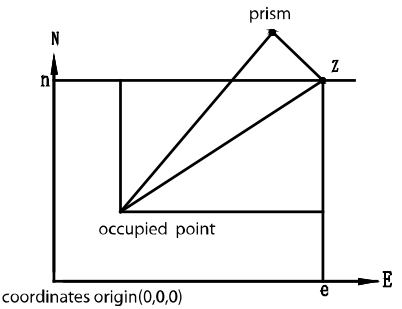
In the condition of lacking the coordinate of station point, (0,0,0) or the coordinate you input last time, will be used as the default station point.

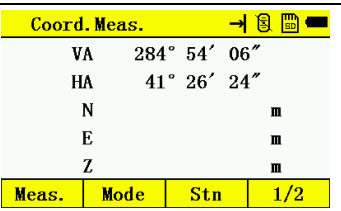
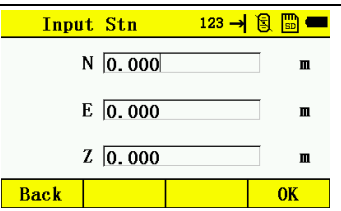
The prism height will be 0 if the prism height hasn’t been set.

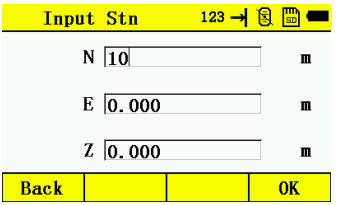
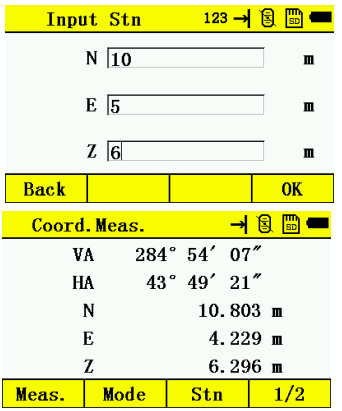
7.2 Setting Coordinate Values of Station Point

Set the coordinates of the instrument (Station point) refer to the origin points in coordinates, then N3 can automatically converts and displays the unknown point (prism point) coordinates into this exist coordinate system.

The instrument will keep the data of station point after power off.

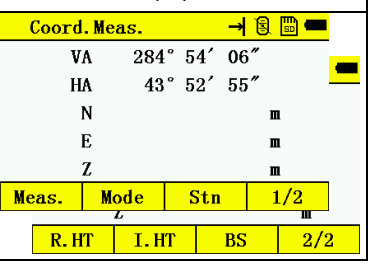


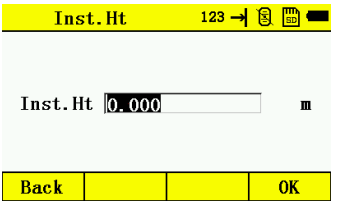
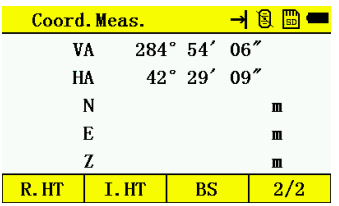
Operation procedure	Operation	Display
①In coordinate measurement mode		
②Press F3 （Stn） key	F3	

③Enter N coordinate value*1)	Enter coordinates	
④Enter E and Z coordinate values in the same way. Then the display returns to the coordinate measuring display menu.	Enter data ENT	

7.3 Setting Height of the Instrument

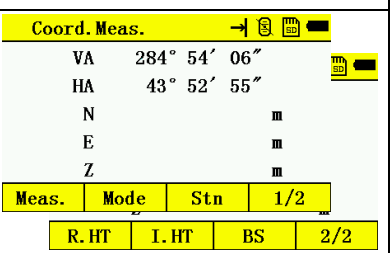
The instrument height value will be retained after power off.

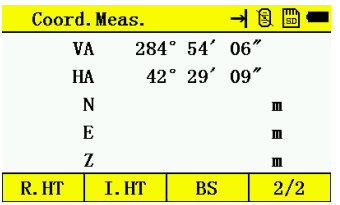
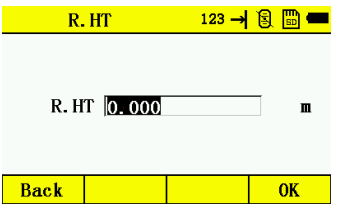
Operation procedure	Operation	Display
①Press the F4 (1/2) in the coordinate measurement mode to access the P2 menu screen.	F4	

②Press the F2 (I.HT). The value will show the current Inst.Ht.	F2	
③Enter the instrument height and press the ENT key to back to the coordinate measuring function.	Enter the I.H. ENT	

7.4 Setting Height of Target (Prism Height)

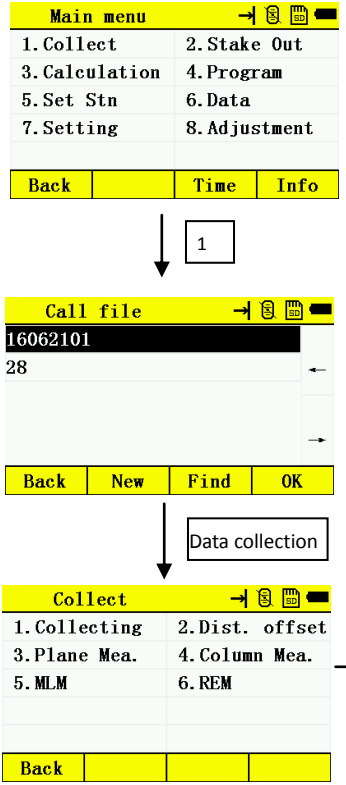
This mode can be used to calculate z coordinate values. The target height value will be saved after power off.

Operation procedure	Operation	Display
① In coordinate measurement mode, press F4 (1/2) to enter P2	F4	

② Press F1 R.HT to display the current prism height	F1	
③ Input the prism height and press ENT to confirm and back to coordinate measuring function	Enter the R.HT. ENT	

8.DATA COLLECTION

Data collect menu operation



- Point Measurement (refer to 8.1)
- Distance Offset Measurement (Refer to 8.2)
- Plane Offset Measurement (Refer to 8.3)
- Column Offset Measurement (refer to 8.4)
- Missing Line Measurement (refer to 8.5)
- Remote Elevation Measurement (refer to 8.6)

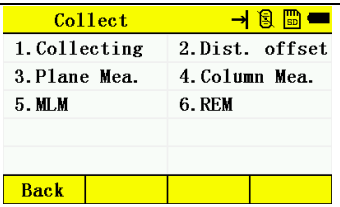
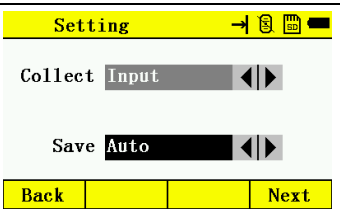
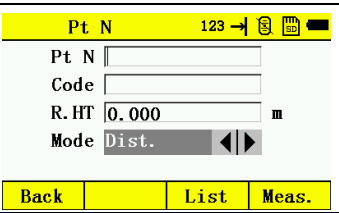
8.1 Point Collect

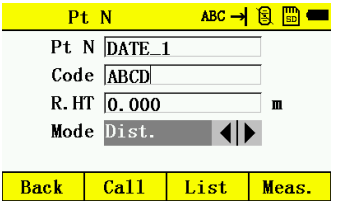
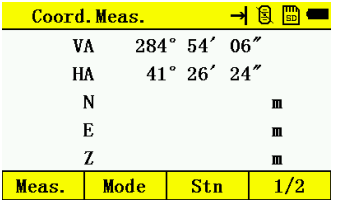
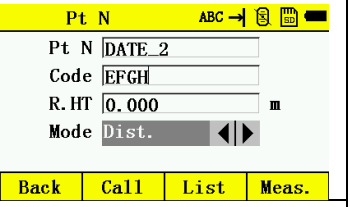
Point Collect has two different modes①: Measure first ②Input first. The difference between two modes is input point name and code at first or not.

Choose “Auto” when automatic save is needed. Otherwise, choose“Manual”.

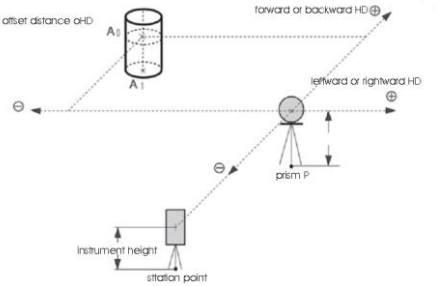
Coordinate measurement, angle measurement and distance measurement can be switched anytime when measuring.

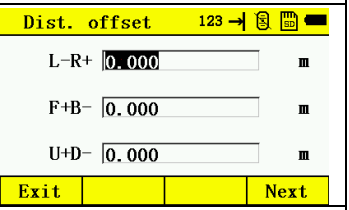
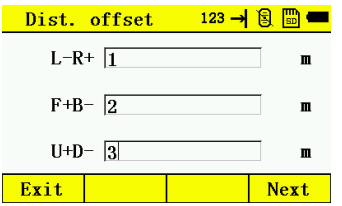
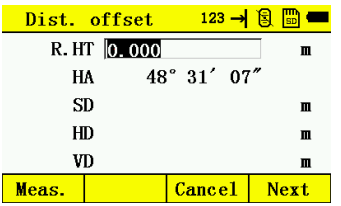
Take [Input first] mode as an example,other measurement operation are similar. Press α to switch the alphabet to numbers when input point name.

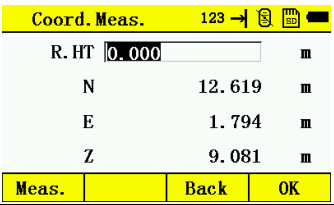
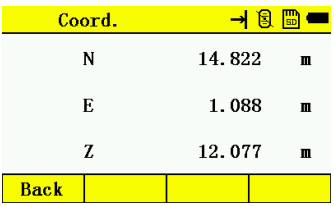
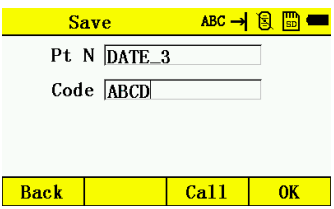
Operation procedure	Operation	Display
①Press 1(Pt collect) from collect menu.	1	
②Collect setting choose “Input”, automatic save choose “Auto”.	press[◀]or[▶]to switch	
③Press F4 (next) into input point page	F4(next)	

④ Input Point name and code first, then press[◀]or[▶] to switch Eg: Distance	F3	
⑤Aim at target point	Aim	
⑥Press F4 to measure and save automatically	F4	
⑦Input the next point name and code, aim at the target		
⑧Repeat steps from ④to⑥		

8.2 Distance Offset Measurement



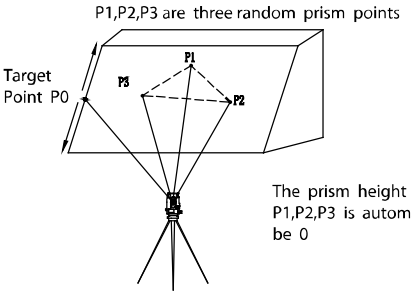
Operation procedure	Operation	Display
① Press 2 key from collect mode	2	
②Input L/R, F/B, U/D offset distance	Input data	
③ Press F4 key (Next)	F4	

④Press F1 key (Measure)	F1	
⑤Press F2 key (Coordinate) to get the coordinate of offset point	F2	
⑥Press F4 (Next) in step ④, record the measurement data, then measuring the next point	F4	

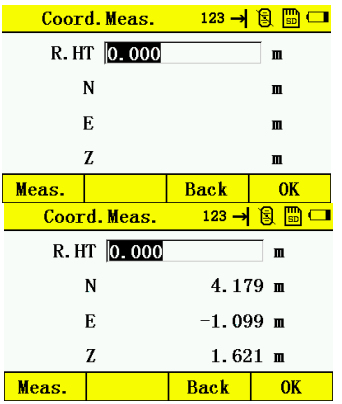
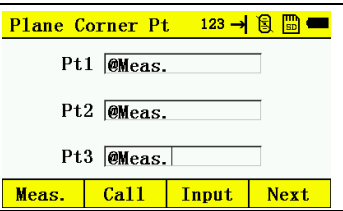
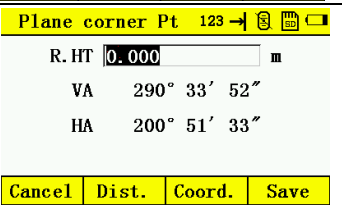
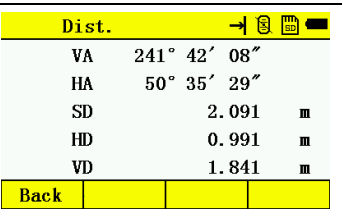
8.3 Plane Offset Measurement

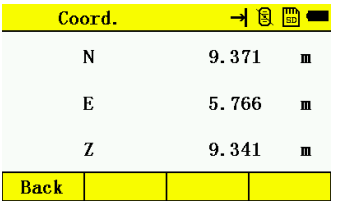
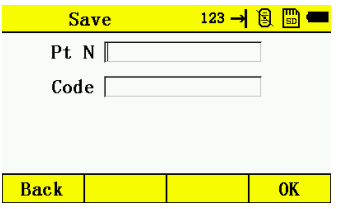
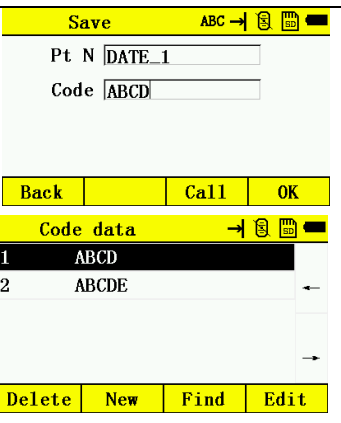
This function is used for the point cannot be measured directly, such as the distance or coordinate of the points on border.

Three random prism points (P1, P2, P3) on a plane should be measured at first in the plane-offset measurement mode, to determine a measured plane. Aim at the measuring target point (P0) then the instrument will calculate and display coordinate and distance values of the cross point between collimation axis and this plane; also you can input coordinate or call the coordinate file to take measurement



Operation procedure	Operation	Display
① Press 3key from collect mode to enter Plane Offset Measurement. Then choose F1/F2/F3 for measurement, call or input coordinates.	3 F1	Plane Corner Pt 123 Pt1 Pt2 Pt3 Meas. Call Input Next
② Aim at prism point 1, press F1 (Meas.) key	Aim point1 F1	Coord. Meas. 123 R.HT 0.000 m N 13.738 m E 3.051 m Z 9.111 m Meas. Back OK
③ Press F4 (OK) key	F4	Plane Corner Pt 123 Pt1 @Meas. Pt2 Pt3 Meas. Call Input Next

④ The second and third point should be measured in same way	Aim point2 F1 Aim point3 F1	
⑤ Press F4 (Next) key	F4	
⑥ Aim at the target point on the plane, the display will show horizontal and vertical angle of the point*1) *2)		
⑦ Press F2(Distance), SD, HD and VD of the point will be shown on the display	F2	

⑧ Press F3 (Coordinate) key, show the coordinate of the target point	F3	
⑨ Press F4 (ok) key to save the measured data	F4	
⑩ Input point name and code(Code also can be called by Press F3 from Code data	F3	

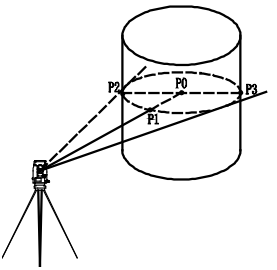
*1) If three measured point cannot define a plane by calculation,the display will show no intersection ,then the measurement should start from the 1st point again.

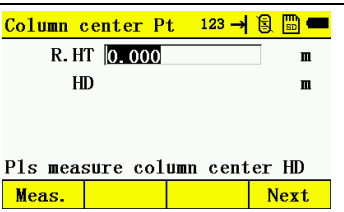
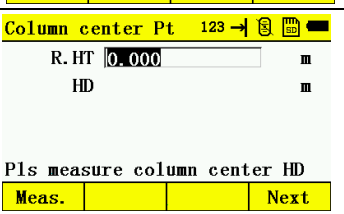
*2) No intersection will be displayed when target point and defined plane have no intersection.

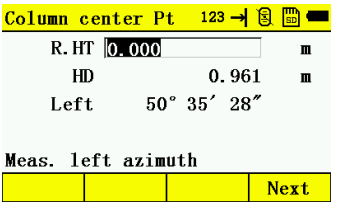
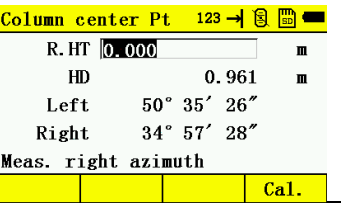
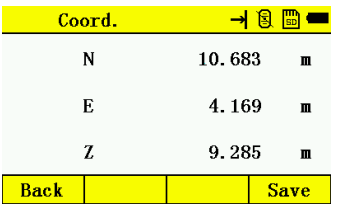
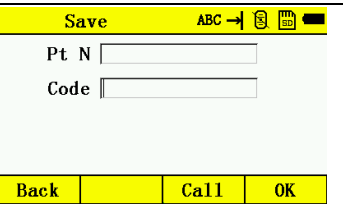
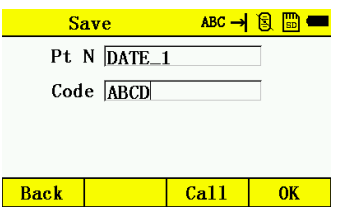
8.4 Column Offset Measurement

Measuring circumscription point (P1) on column at first, then the distance to the center of the column (P0) can be calculated by measured direction angle of circumscription points (P2) and (P3).

The angle of center point is equals to the average value of direction angle about P2 and P3.



Operation procedure	Operation	Display
①Press 4 from collect mode to enter Plane Offset Measurement		
② Press F1 (Measurement)	F1	

③Press F4 (Next)	F4 Aim at the left direction	
④Press F4(Next)	F4 Aim at the right direction	
⑤Press F4 (Cal.) to calculate the coordinate of center point Press F4 (Save) to save data	F4 F4	
⑥Input Point name and Code	F4	 

8.5 Missing Line Measurement (MLM)

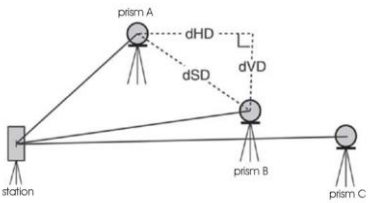
Measurement for horizontal distance (dHD) , slope distance (dVD),elevation relative(dVR) and horizontal bearing (HR) between two target prisms.

It is possible to enter the coordinate value directly or calculate from coordinate data file.

MLM Mode has two modes:

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

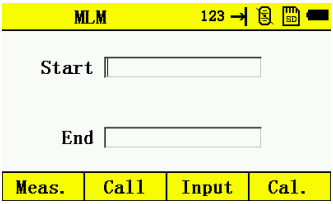
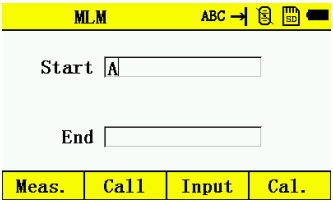
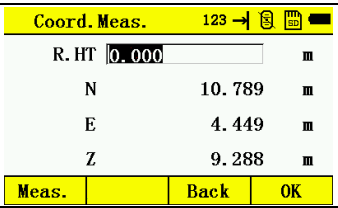
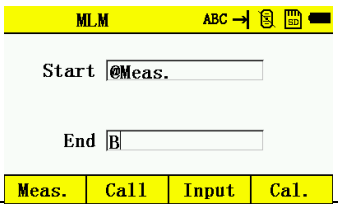
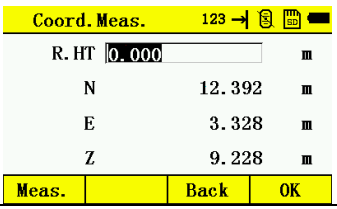
2. MLM-2 (A-B, B-C): Measurement A-B, B-C, C-D

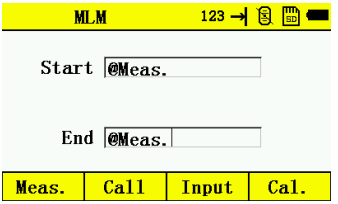
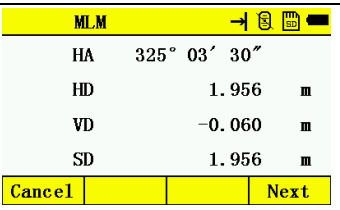
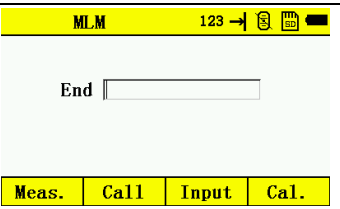
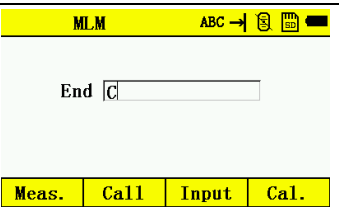
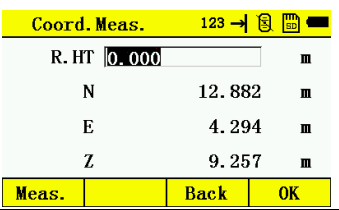


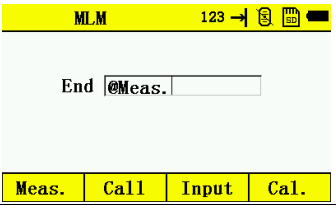
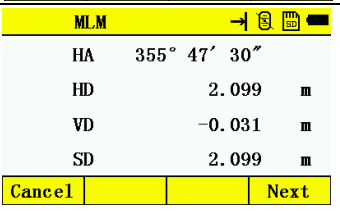
[Example] MLM-1 (A-B, A-C)

Procedure of MLM-2 (A-B , B-C) mode is completely the same as that of MLM-1 mode.

Operation procedure	Operation	Display
① Press MENU key Press the 1 key, choose a file to enter MEAS PROGRAMS	1	Collect 1.Collecting 2.Dist. offset 3.Plane Mea. 4.Column Mea. 5.MLM 6.REM Back
② Press the 5 (MLM) option	5	MLM 1.MLM1[A-B A-C] 2.MLM2[A-B B-C] Back

③ Press 1 as an example	1	
④ Input start point name. Eg: A	Input character	
⑤ Aim prism A, and press the F1 (MEAS) key	F1 (MEAS)	
⑥ Press F4 to return step ⑤, then input end point name, Eg:B	Press F4, then press keyboard	
⑦ Aim at prism B and press the F1 (MEAS) key	F1 (MEAS)	

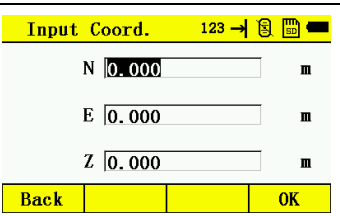
⑧ Press F4	F4	
⑨ Press F4 (Calculate) key. HD, VD and SD between A and B will shown as picture	F4	
⑩ Measure the distance between points A and C, press F4 (Next) key*1)	F4	
⑪Input end point name, Eg: C	Press F4	
⑫Aim at prism C and press the F1 (MEAS) key	F1	

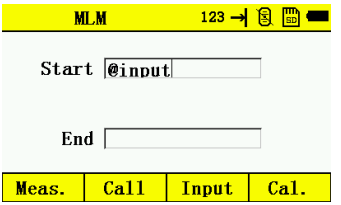
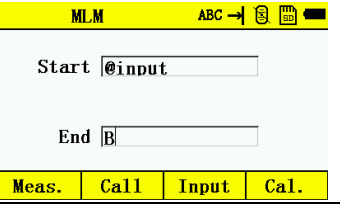
⑬ Press F4	F4	
⑭Press F4 (Calculate) key. HD, VD and SD between A and C will be shown	F4	
⑮ Measure the distance between points A and D, repeat procedure ⑩ to ⑭ *1)		
*1) Press the ESC key to return to previous surface		

HOW TO USE COORDINATE DATA

It is possible to input coordinate values directly or calculate from a coordinate data file.

[Example] Input the data (NEZ) directly:

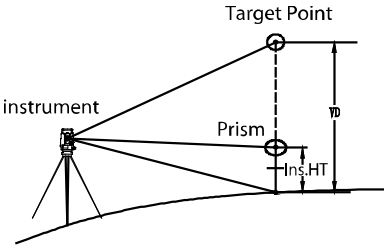
Operation procedure	Operation	Display
① Press the F3(Input) key	F3	

② Press F4 (coordinate) key	F4	
③ Input the end point, continue to measure		

*To return to Menu, press the ESC key.

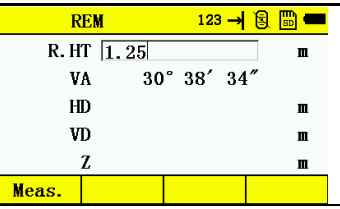
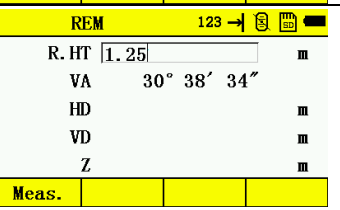
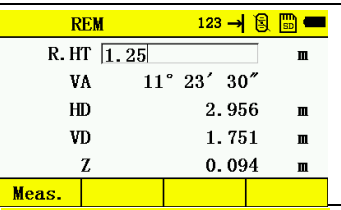
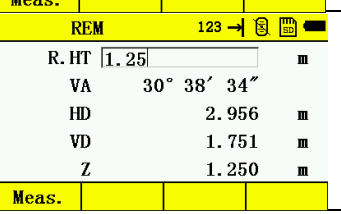
8.6 Remote Elevation Measurement（REM）

To obtain elevation of the point where setting the target prism is not possible, place the prism at any point on the vertical line from the target then carry out REM procedure as follows.



1)With prism height (h) input

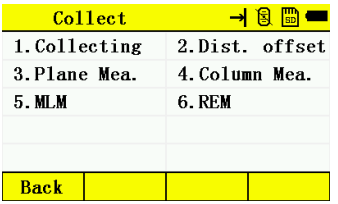
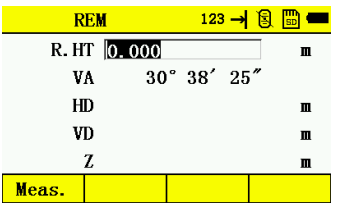
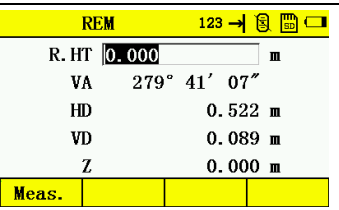
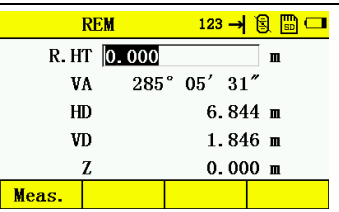
Operation procedure	Operation	Display
① Press the MENU choose a file to enter REM program	MENU 1 6	Collect 1.Collecting 2.Dist. offset 3.Plane Mea. 4.Column Mea. 5.MLM 6.REM Back
② Move the cursor to R.HT input		REM 123 R.HT 0.000 m VA 30° 38′ 25″ HD m VD m Z m Meas.

③ Enter prism height *1）	Input prism height	
④ Aim at prism	Aim P	
⑤ Press the F1 (MEAS) key, measurement starts. Index value between instrument and prism will be shown	F1	
⑥ Aim target K. the elevation (Z) will be shown. *2）	Aim K	

*1） Refer to 2.10 “How to Enter Alphanumeric Characters”.

*2） To return to COLLECT Menu, press the ESC key.

2)Without prism height input

Operation procedure	Operation	Display
① Press 1 key, enter the COLLECT menu	1	
② Press 6 key, enter REM	6	
③Aim the prism and press F1 (MEAS) and start measurement. Index value between instrument and prism will be shown	Aim target	
④ Aim target K, the elevation (Z) will shown.	Aim K	

9.Stake Out

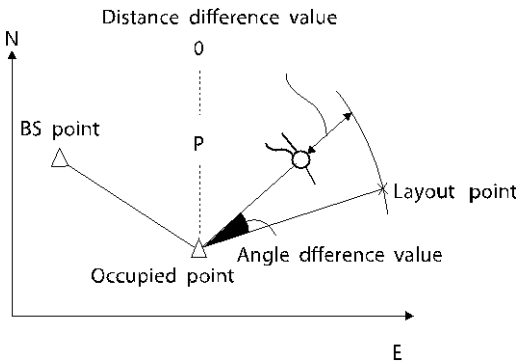
The Stake Out mode have two functions, measuring the location of the stake out point and stake out by the known coordinate from internal memory.

The coordinate data is stored in a COORD. DATA file.For internal memory, please refer to Chapter “DATA”

*1) Please confirming that the instrument is in the main menu or angle measurement mode when power off. It will make sure that the whole process of data import and export already done, also prevent the data lost.

*2) It is recommended for safety to fully charge the batteries before operation.

*3) Please consider whether the internal memory is enough for recording new points.



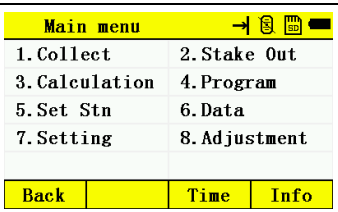
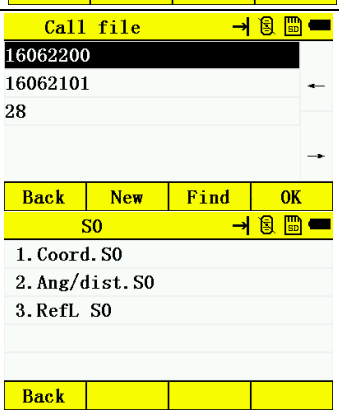
For Stake out procedure as below:

1. Choose coordinate data file
2. Set station point
3. Input or call the needed Stake-Out coordinate, and start.

9.1 Choose data file

In stakeout mode, you should choose a coordinate data file first, which will be used for station point and data calling. Also the new measured data can be saved in selected coordinate data file.

When stake out mode is operating, you can select file in the same way.

Operation procedure	Operation	Display
①Press 2 (Stake Out) from main menu	2	
②Scroll the file list or new built file by pressing the [▲] or [▼] key. Press F4 (OK) to enter stake out page	F4	

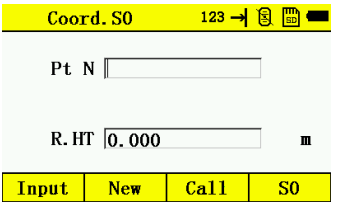
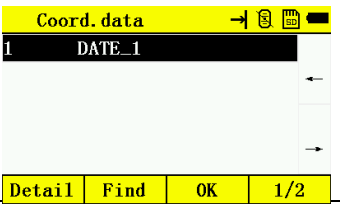
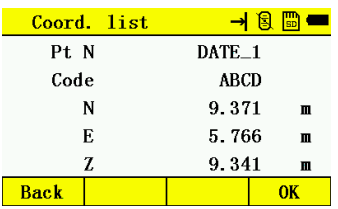
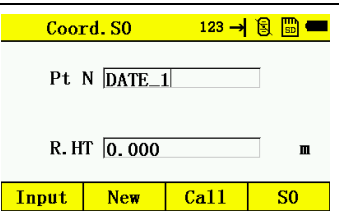
9.2 Coordinate stake out

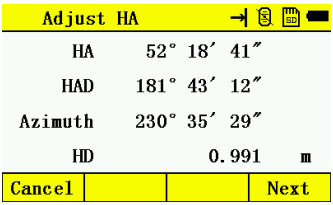
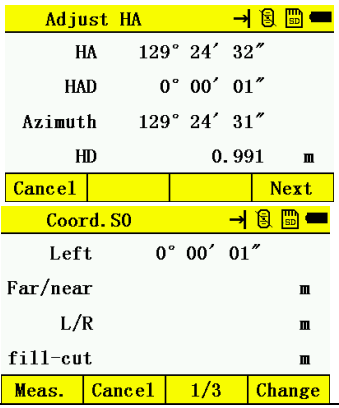
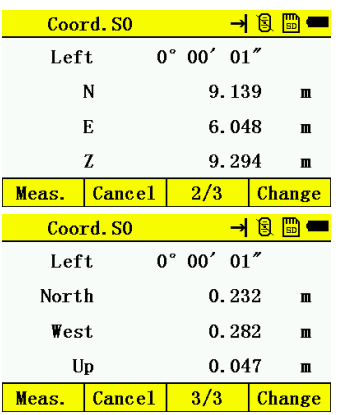
The coordinate of stake out point can be input in two methods:

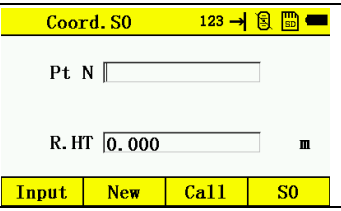
1. Built new coordinate point or input coordinate point

2. Call from the coordinate data file

For example: Call coordinate from the coordinate data file.

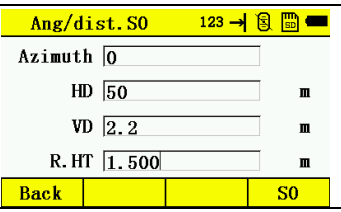
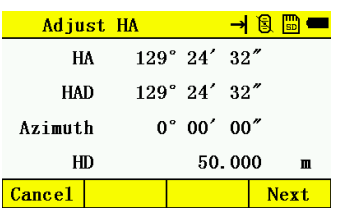
Operation procedure	Operation	Display
① Press 1 (coordinate stake out) key .	1	
②Press F3 (call)	F3	
③Choose points from coordinate data, press F1 key to check coordinate	F1	
④Press F3 (OK)	F3	

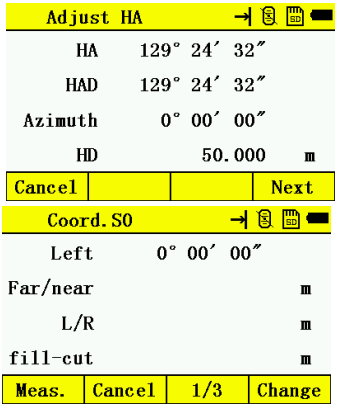
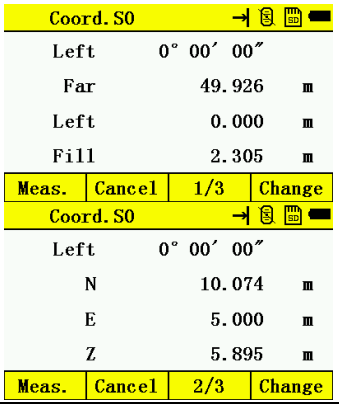
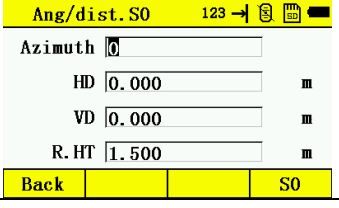
⑤Press F4 (SO) to start stake-out	F4	
⑥Adjust the leveling screw to make the HAD(Horizontal angle difference) become value 0, then press F4 Press F1 (Meas.)	Move level screw F4 F1	
⑦Press F3 (1/3) to switch	F3	
⑧When all value become 0,		

the test built of layout point has completed		
⑨Press F4 (change) key, into next point stake-out	F4	

9.3Angle/distance stakeout

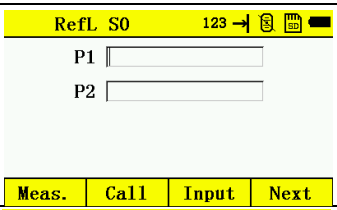
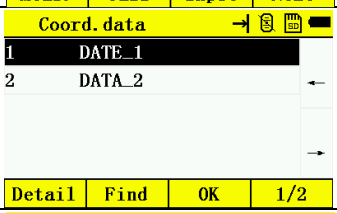
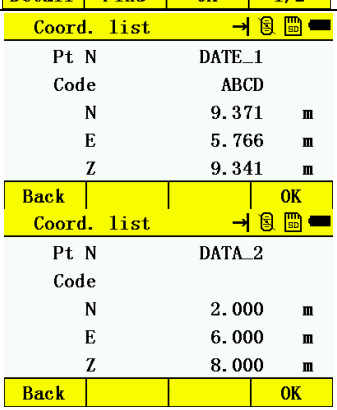
Angle/distance stakeout can be carried on by inputting the relative position relation between stakeout point and station point.

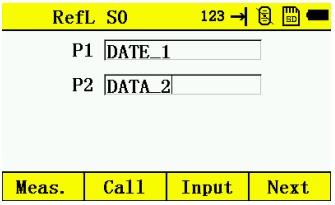
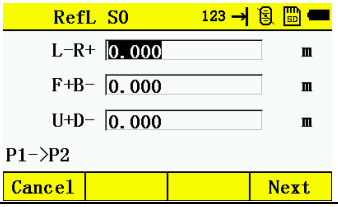
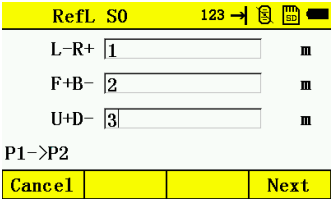
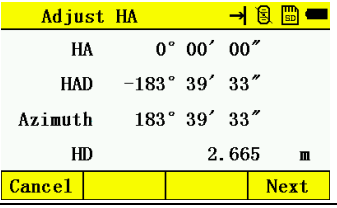
Operation procedure	Operation	Display
① Input angle, distance, vertical distance	Input	
②Press F4 (SO) to start stake out	F4	

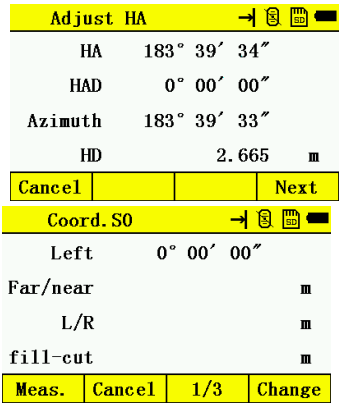
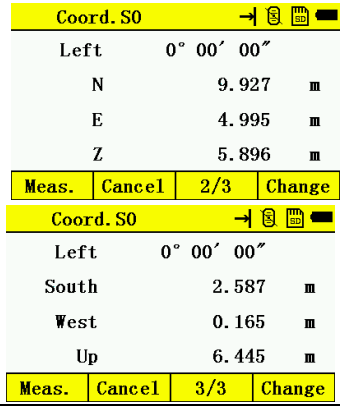
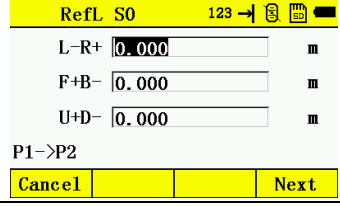
③Adjust the leveling screw to make the HAD(Horizontal angle difference) becomes value 0, then press F4 Press F1 (Meas.)	Move level screw F4 F1	
④Press F3 (1/3) to switch When all value become 0, the test built of layout point has completed	F3	
⑥Press F4 (change), into next stakeout point	F4	

9.4 Reference Line Stakeout

Reference line stakeout is a new developed module of N3 series, the target point will be stake out by comparing the distance relation between stakeout point and the line connected by two known points.

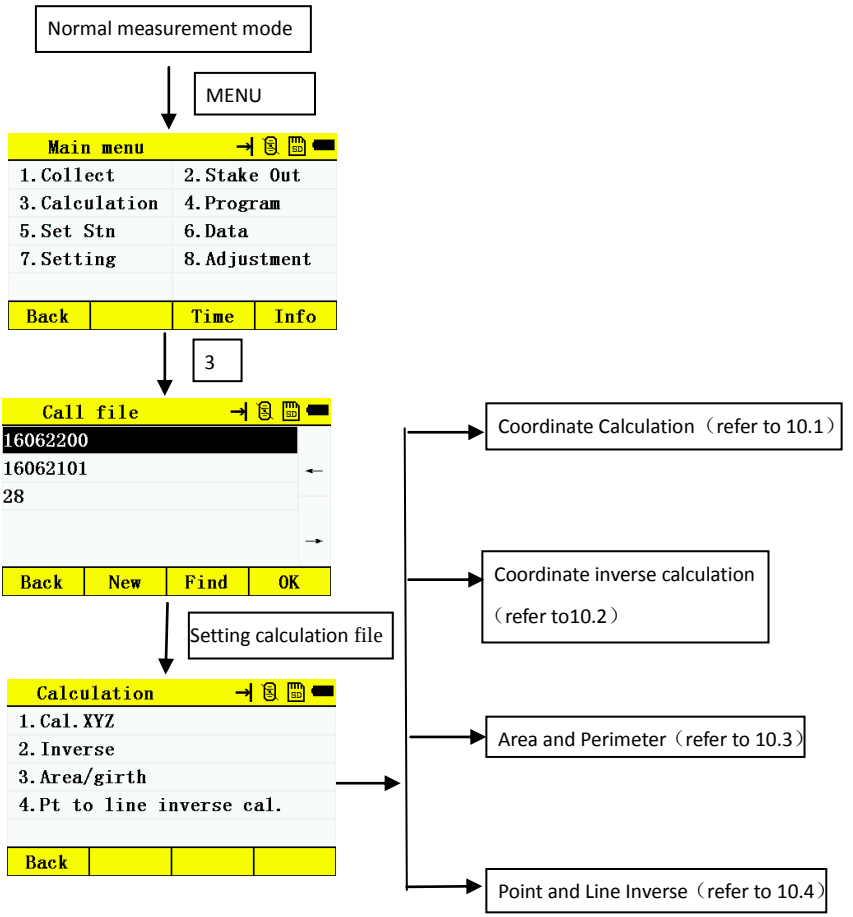
Operation procedure	Operation	Display
① Press the3 (Refl. SO) key from the stakeout menu	3	
②Press F2 (call)	F2	
③Choose the point from coordinate data, view the details then press F3(OK) For example: P1 choose point name DATE_1 P2 choose point name DATE_2	P1 F4	

	P2	
④Press F4 (Next)	F4	
⑤Input setting out point, start from P1, P1P2 as the datum	keypad	
⑥ Press F4 (Next) to enter stakeout page	F4	

⑦ Adjust leveling screw to make the HAD value becomes 0, then press F4 Press F1 (Meas.)	Move leveling screw F4 F1	
⑧Press F3 (1/3) to switch When all value become 0, the test built of layout point has completed	F3	
⑨Press (change) key, into next stake-out point	F4	

10.Calculation

Calculation menu operation procedure



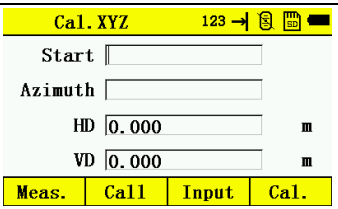
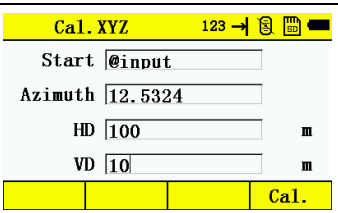
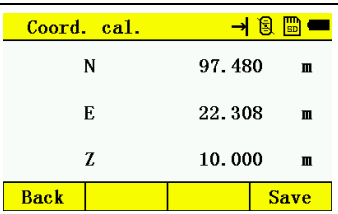
10.1 Cal.XYZ(Coordinate Calculation)

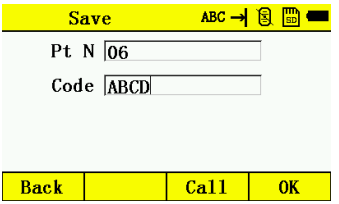
Input or measure starting point, then get the coordinate of target point by measuring the azimuth, horizontal distance and vertical elevation.

The coordinate of starting point has two ways to input:

1. Built new coordinate point or input coordinate point
2. Call from the coordinate data file

For example: Get the coordinate of new point by measurement

Operation procedure	Operation	Display
① Press 1 (Cal. XYZ) from Calculation menu	1	
② Input azimuth, horizontal distance, vertical distance	keypad	
③Press F4 (Cal.)	F4	

④ Press F4 (Save) to save the data of the point	F4	

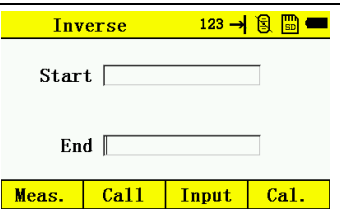
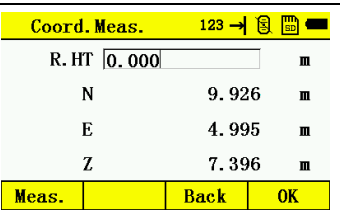
10.2 Coordinate inverse calculation

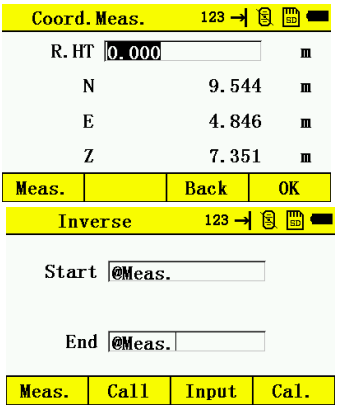
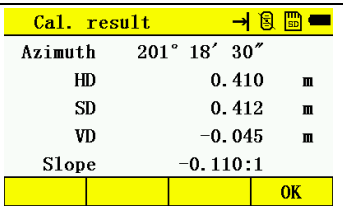
Input or measure the starting point and end point, then the instrument can calculate the HD(horizontal distance), SD(slope distance), VD(vertical distance) and azimuth for the line connected by the two points.

The coordinate of starting point and end point have two ways to input:

1. Built new coordinate point or input coordinate point
2. Call from the coordinate data file

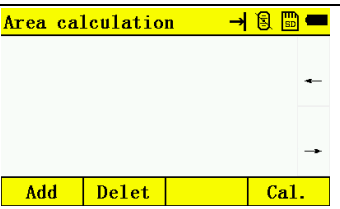
For example: Get the coordinate of new point by measurement

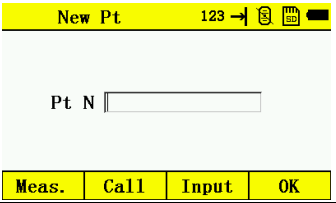
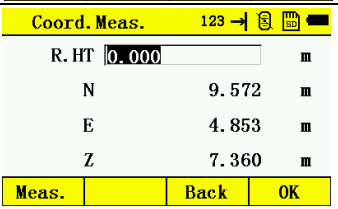
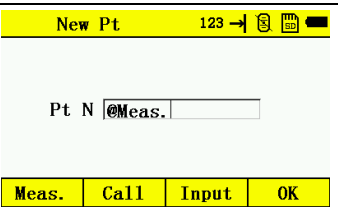
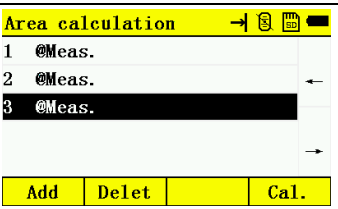
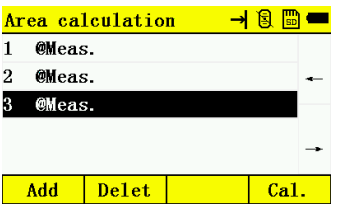
Operation procedure	Operation	Display
① Press 2 (inverse) key from Calculation menu	2	
② Press F1 (Meas.) start point Press F4 (OK)	F1	

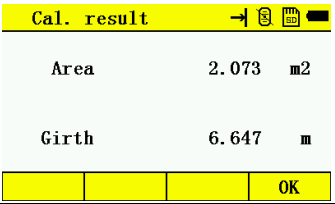
③ Repeat step ② to measure end point		
④ Press F4 (Cal.)	F4	

10.3 Area/ Perimeter

The area and perimeter of graph which composed by those measured points can be calculated by measuring 3 or 3 more points.

Operation procedure	Operation	Display
①Press 3 (Area and Perimeter.) from calculation	3	

②Press F1 (Add)	F1	
③Press F1 (measure)	F1	
④Press F4 (OK)	F4	
⑤Press F4 (OK)	F4	
⑥Repeat step ②and⑤ to measure other new add point		

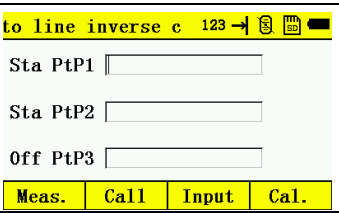
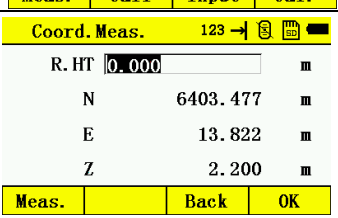
⑦Press F4 (Cal.)	F4	

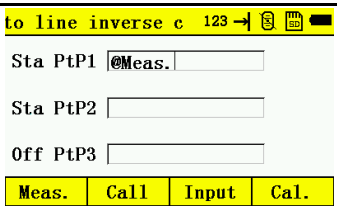
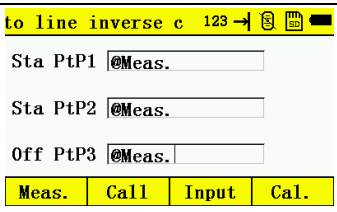
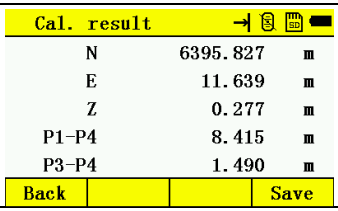
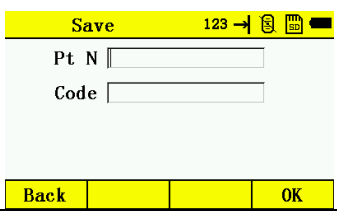
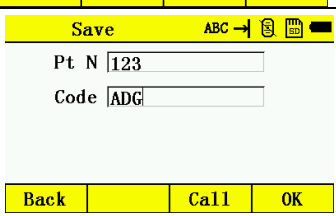
10.4 Point to Line Inverse

Measure 2 starting points P1 and P2 to define a straight line at first, then measure a setting point P3, you can get the coordinate of foot point from P3 to the straight line at last.

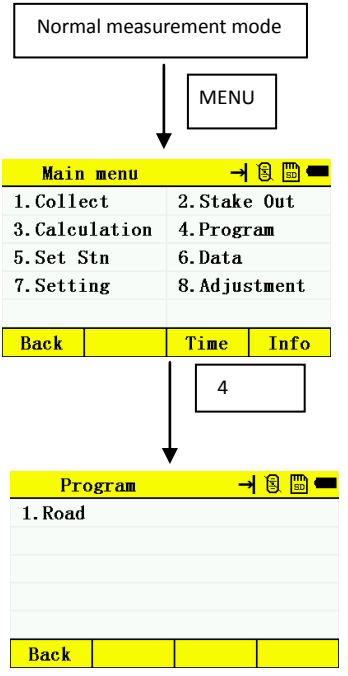
The coordinate of each points has two ways to input:

1. Built new coordinate point or input coordinate point
2. Call from the coordinate data file

Operation procedure	Operation	Display
①Press 4 (Pt to line inverse)key from calculation menu	4	
②Press F1 (measure) P1	F1	

③Press F4 (OK)	F4	
④Repeat step ②and③ to measure P2 and P3	F4	
⑤Press F4 Cal.	F4	
⑥Press F4 (Save)	F4	
⑦Input this point's name and coordinate, press F4 (OK)	F4	

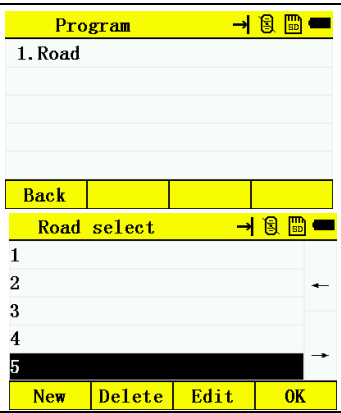
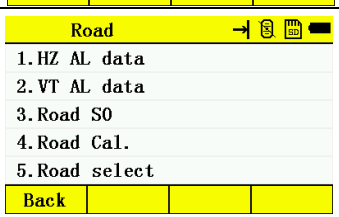
11. PROGRAM


Normal measurement mode
MENU
Main menu
1. Collect
2. Stake Out
3. Calculation
4. Program
5. Set Stn
6. Data
7. Setting
8. Adjustment
Back
Time
Info
4
Program
1. Road
Back

11.1 Road

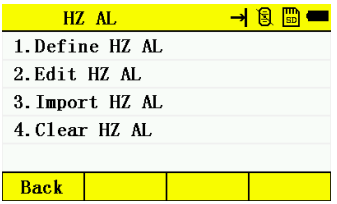
In ROAD program, you can define a curve formed by straight line, circular curve or transition curve as a reference to take measurement and stake out. The program will take coordinate calculation and stake out to designed point according to the confirmed stake number and difference of road design.

Before road design and stake out, you should set the project, station point and back-sight azimuth.

Operation procedure	Operation	Display
①Enter the road program from menu	1	
②Press [▲]or[▼] to choose road or built new road. Press F4 (OK) enter road page	F4	

11.1.1 Horizontal Alignment Data

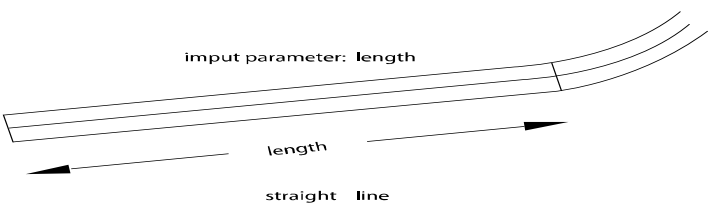
Horizontal Alignment Menu



Horizontal alignment consisted of following elements: starting point, straight line, circular curve , transition curve.

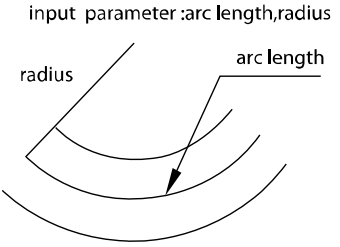
Straight line

When the starting point or other line type is well defined it allows you to define a straight line. A straight line parameter only include length, the value should larger than zero.



Circular Curve

Press F2 key (ARC) in the “HZ AL Screen” to define a circular curve. Circular curves consists of Arc length and the Radius. The radius value rule: Looking along the forward direction of the curve, when the curve rotates to right, the radius value is positive. When the curve rotates to left, the radius value is negative.



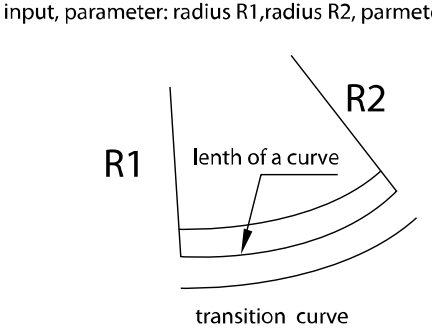
circular ares

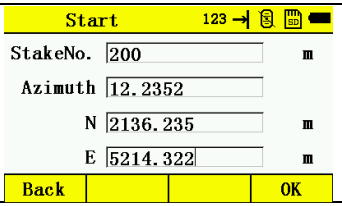
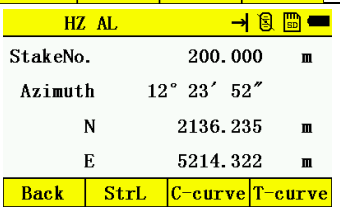
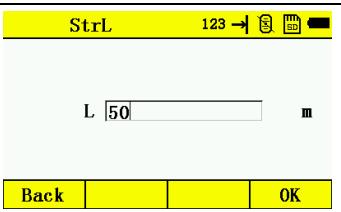
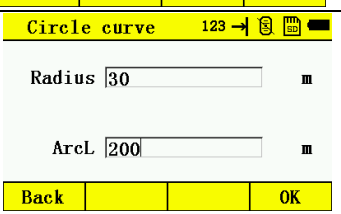
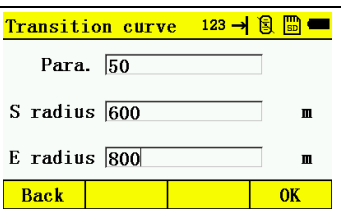
Transition curve

Press F3 key in the "HZ AL Screen" and a transition curve can be defined. The inputting of transition curve consists of transition curve parameter "Para" , starting radius , and ending radius . If the input radius is ∞ you can input 0 as its value.

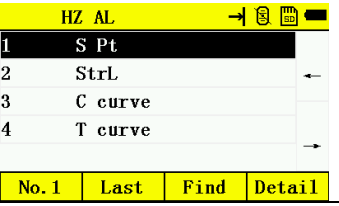
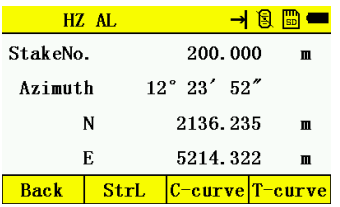
When Rs and Re value is positive, transition parameter A is symbolic number.

The rule of transition curve parameter A : Looking along the forward direction of the curve. When the curve rotates to right, the radius value is positive. When the curve rotates to left, the radius value is negative.

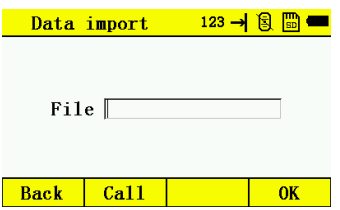


Operation procedure	Operation	Display
① Enter define horizontal alignment, if it is not defined, the display will show the start point page	1 Enter	
②Enter alignment data input page by press (OK) key	F4	
③Choose different alignment to input, then finish the horizontal alignment design	Strl	
	C-curve	
	T-curve	

Edit horizontal alignment

Operation procedure	Operation	Display
①Choose 2 in HZ AL surface. Enter edit horizontal alignment	2 Enter	
② Choose the horizontal alignment to check and edit.	Choose F4	

Import horizontal alignment

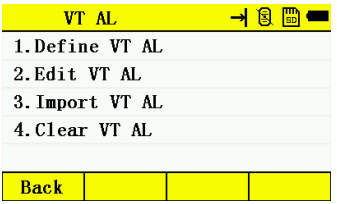
Operation procedure	Operation	Display
Enter import horizontal alignment	Enter	

Clear horizontal alignment

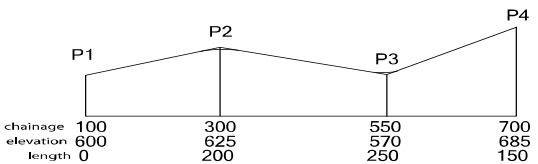
Click to CLEAR to delete all the saved horizontal alignment data.

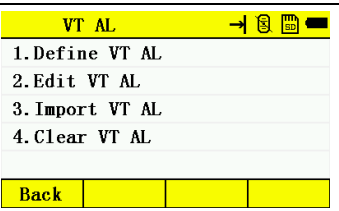
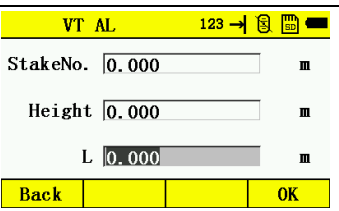
11.1.2 Vertical Alignment Data

Vertical Alignment Menu

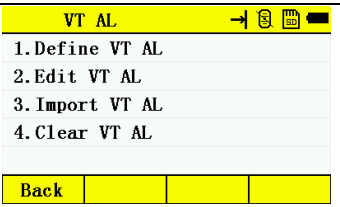
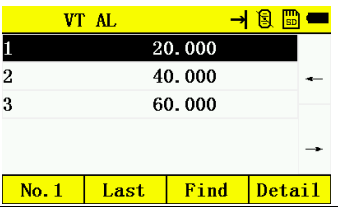


A vertical curve consists of series of intersection points. The intersection point consists of a stake number, elevation and curve length. The start/end points and end curve length must be a zero.

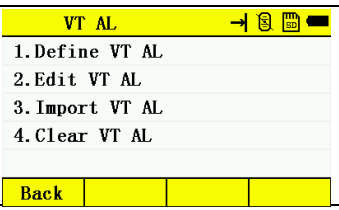
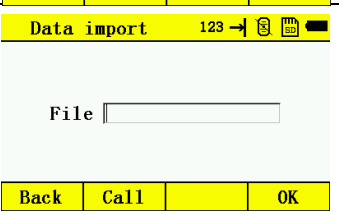


Operation procedure	Operation	Display
① Enter define vertical alignment	1	
②After input stake number, elevation and length, press (OK) key to finish setting		

Edit Vertical Alignment

Operation procedure	Operation	Display
①Enter edit vertical alignment	2	
② You can find/check the inputted vertical alignment data, also can edit when you enter check detail information		

Import Vertical Alignment

Operation procedure	Operation	Display
① Enter define vertical alignment	3	
②Finish the design of vertical alignment by import data		

Clear vertical alignment

Click to CLEAR to delete all the saved vertical alignment data.

11.1.3 Road Stake Out

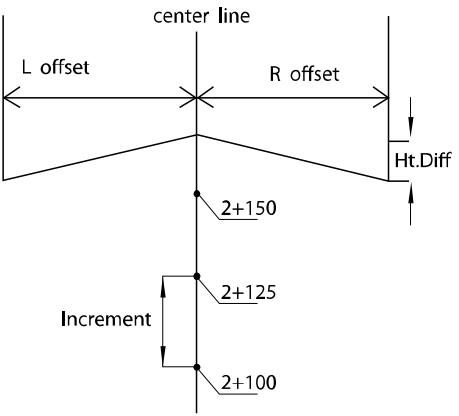
For the road stake out, the line type must be defined. Horizontal and vertical alignment can be defined according to the procedures in the previous sections.(If it does not need to fill or cut,user does not need to define the vertical alignment)

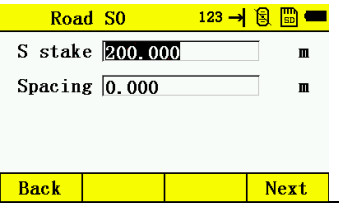
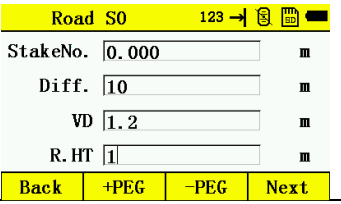
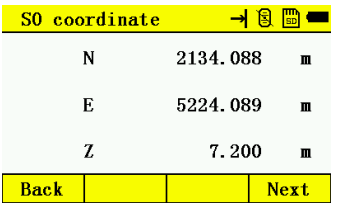
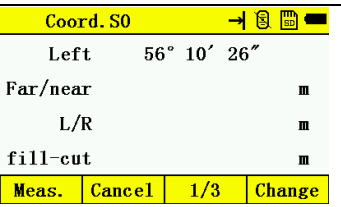
Offset Left: the HD between left stake and center line

Offset Right: the HD between right stake and center line

VD Left : the VD between left stake and center line

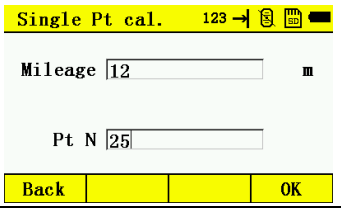
VD Right : the VD between left stake and center line



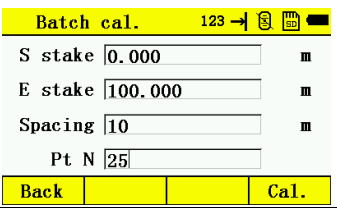
Operation procedure	Operation	Display
① Enter Road SO program, input start stake-No., interval, difference and vertical distance, then enter next step	3	
② Show the stake-No. and difference information of stakeout point, press F4(Next) to start	F4	
③ Show the information of stakeout point. Press F4(Next) to start stakeout	F4	
④Start stakeout		

11.1.4 Calculation

Single-point coordinate calculation

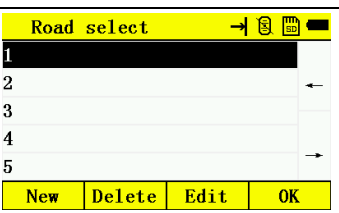
Operation procedure	Operation	Display
Enter single-point coordinate calculation, input mileage and point name, instrument will calculate automatically and save it	F4	

Batch coordinate calculation

Operation procedure	Operation	Display
Enter batch coordinate calculation, input mileage and point name, instrument will calculate automatically and save it	F4	

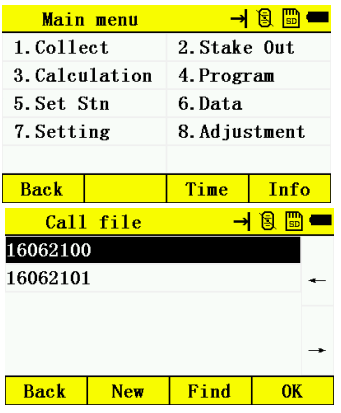
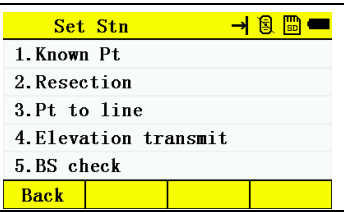
11.1.5 Road select

In the Road select, the selected road is the current operating road file.

Operation procedure	Operation	Display
Enter road select page, choose the road file, then press (ENT) confirm and exit	Enter	

12.Set Station

Select a coordinate data file before enter setting a station, used for station measurement and data calling. It can also save the data of new point into the selected coordinate data file.

Operation procedure	Operation	Display
① Press 5 (Set Stn) from the menu	5	
②Choose the correct file and press F4 (OK) to enter setting station page	F4	

12.1 Known Point

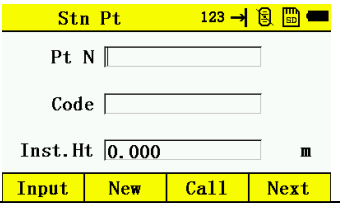
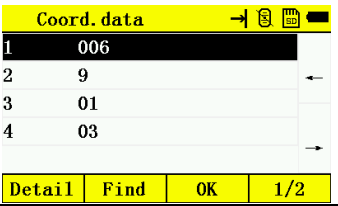
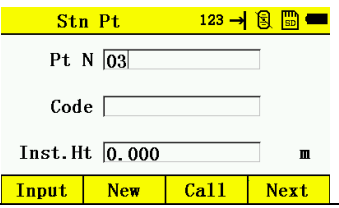
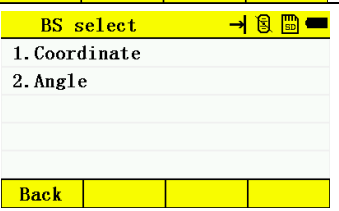
Station point and back-sight point can be set by two ways:

1) Call the coordinate setting from internal memory

2) Directly input the coordinate data or create new coordinate data

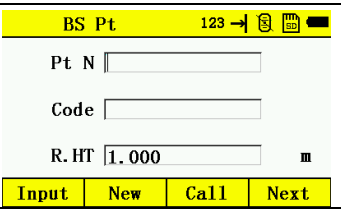
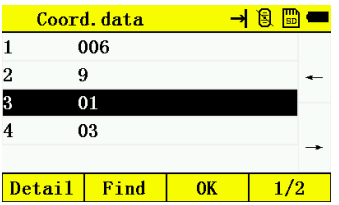
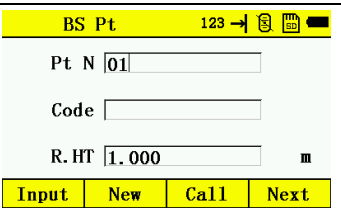
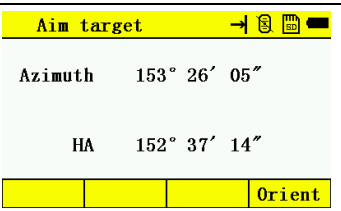
*Station coordinate be saved in the selected coordinate data file

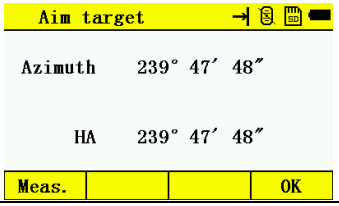
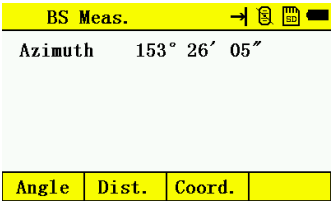
Eg: Set station point from the internal coordinate data file.

Operation procedure	Operation	Display
① Press 1 (Known Pt) from the set station menu	1	
② Press F3 (Call)	F3	
③ Choose a point and press F3 (OK)	F3	
④Press F4 (Next) to forward back-sight select	F4	

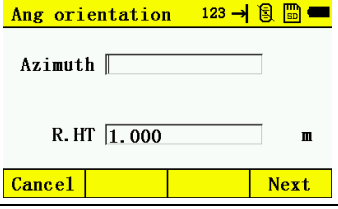
*There are two different choose of back-sight

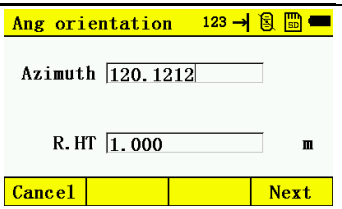
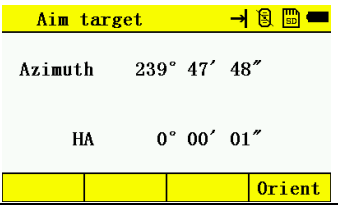
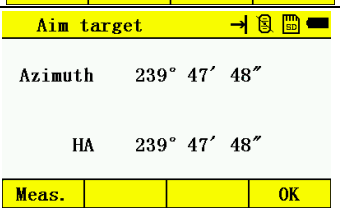
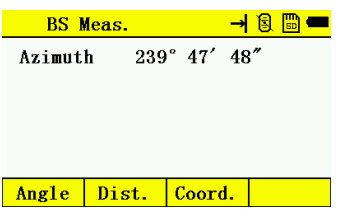
1) Coordinate

Operation procedure	Operation	Display
①Press 1 to select coordinate	1	
②Press F3 (Call)	F3	
③Press F3 (OK)	F3	
④Press F4 (Next)	F4	

⑤Press F4 (Orient)key	F4	
⑥Press F1 (Measure) key if need	F1	
⑦Press F1 (Angle), F2 (Dist.), F3 (Coord.) to get the results, then finish the measurement.		

2) Angle

Operation procedure	Operation	Display
①Press 2 to select angle	2	

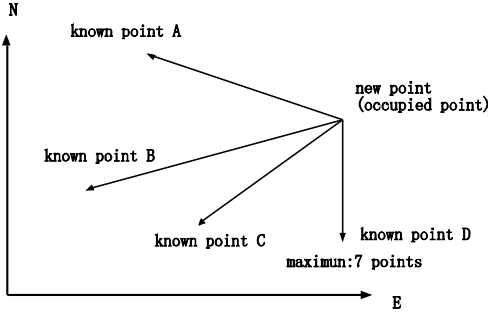
②Input azimuth	keyboard	
③Press F4 (Next)	F4	
④Press F4 (Orient)	F4	
⑤Press F1 (Meas.) if needed	F1	
⑥ Press F1 (Angle), F2 (Dist.), F3 (Coord.) to get the data,then finish the measurement.		

12.2 Resection

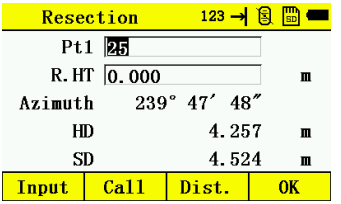
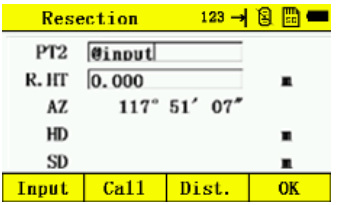
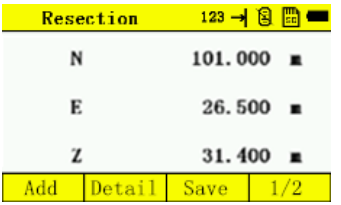
The location of a new point can be determined by observing up to a maximum of seven known points.

*Resection by distance measurement: 2 or more points must be measured, the angle between two points should not exceed 180°.

The station point coordinate value will be calculated using the least squares method. (except in the case of 3 known points measured by angle measurement only).

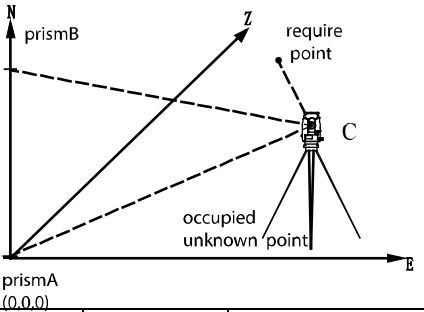


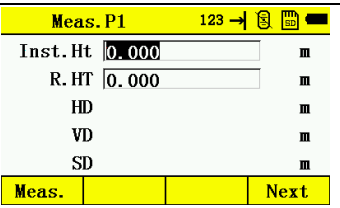
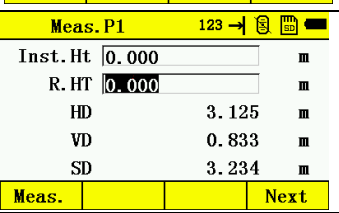
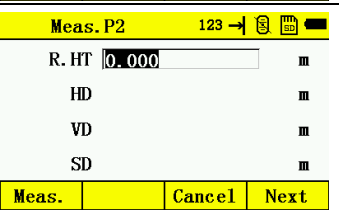
Operation procedure	Operation	Display
①Enter resection function	2	Resection 123 Pt1 25 R.HT 0.000 m Azimuth 239° 47′ 48″ HD m SD m Dist. OK

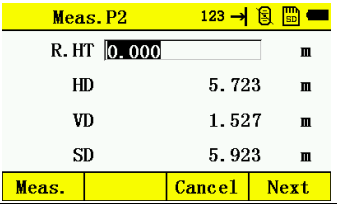
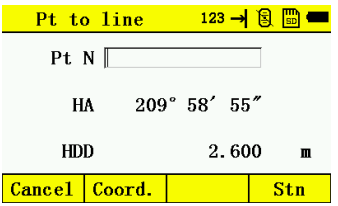
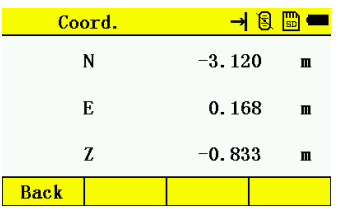
②Input Point name and prism height, then press Dist. key to get the result	F3	
③Press F4 (OK) key to complete the measurement of first point	F4	
④Repeat step ①to③ to measure several points, it can calculate automatically and show the result once meet the calculation condition, also can check and save the result		

12.3 Point to Line Measurement

This mode is used to obtain the coordinate data of an unknown occupied point from a known point and a known line. An observation will need to be taken at the known point A(0,0,0) and along the line N designated for the example as B. After measuring the 2 points the coordinate and the direction angle of the instrument will be calculated and recorded.



Operation procedure	Operation	Display
①Press 3 (Point to line) from set station menu	3	
②Press F1, measure the distance from point A to station point	F1	
③Press F4 Next	F4	

④Press F1 (Meas.) , measure the distance from point B to station point	F1	
⑤Press F4	F4	
⑥Press F2 (Coord.) to check station point coordinate. Input the point name to save the coordinate.		

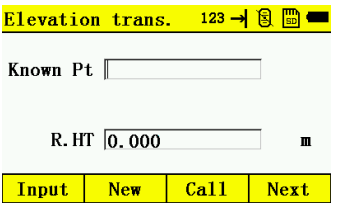
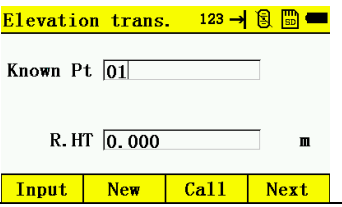
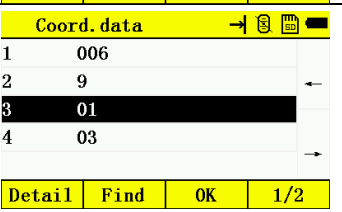
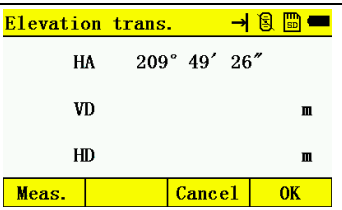
12.4 Elevation Transmit

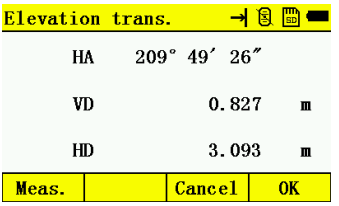
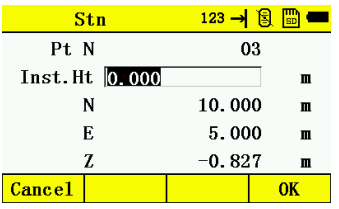
This mode is used for adjust the elevation of station point , calculate the elevation of station point by measuring a coordinate of known point.

There are two ways to input the coordinate of known point

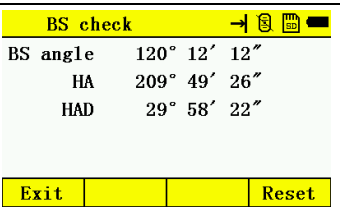
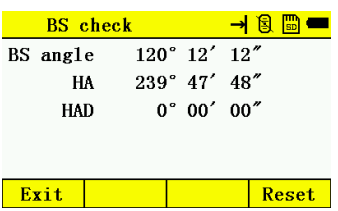
1) Create a new coordinate point or input coordinate point
2) Call the point coordinate from the file

Eg: Call the point coordinate from the file

Operation procedure	Operation	Display
①Press 4 (Elevation transmit) from set Station menu	4	
②Press F3 (Call)	F3	
③Press F3 (OK)	F3	
④Press F4 (Next)	F4	

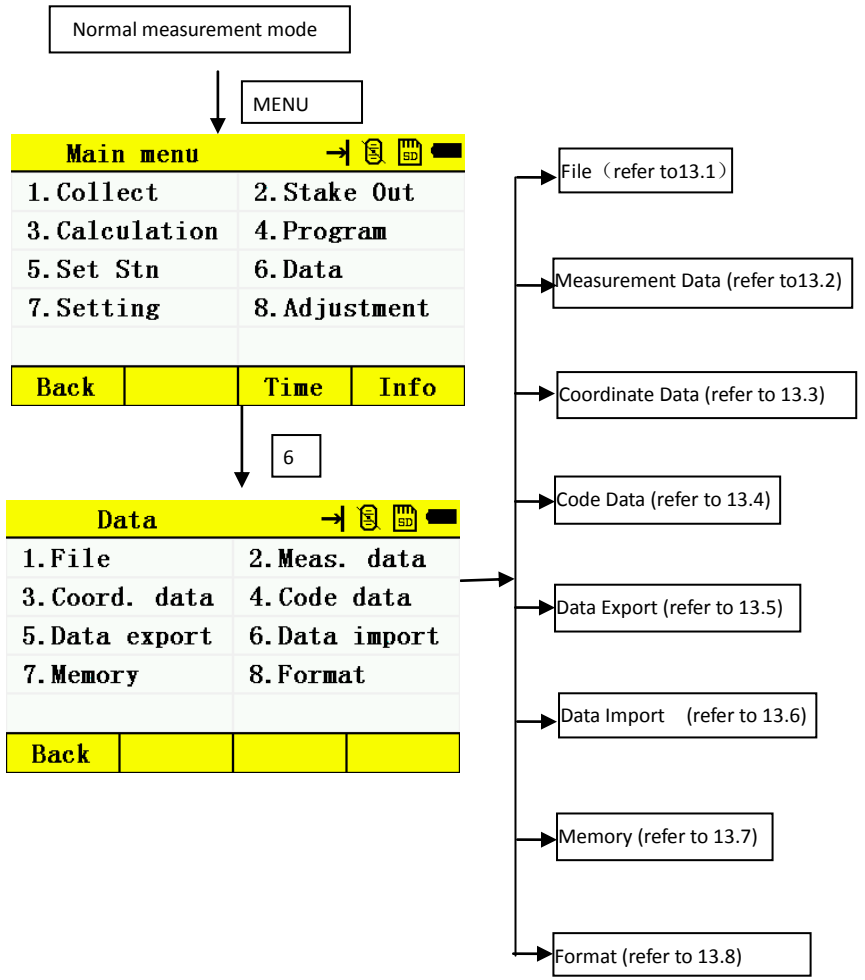
⑤Press F1 (Meas.)	F1	
⑥Press F4 (OK) to get the elevation of new station point		

12.5 Back-sight Check

Operation procedure	Operation	Display
①Press 5 (BS check) from Set Stn menu	5	
②Press F4 (Reset) key to reset the horizontal angle	F3	

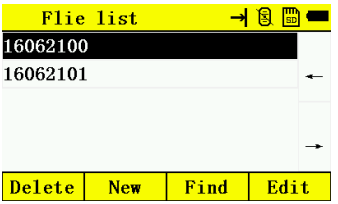
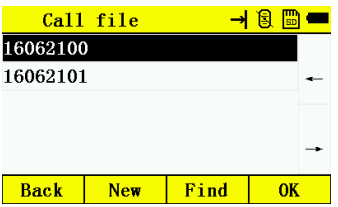
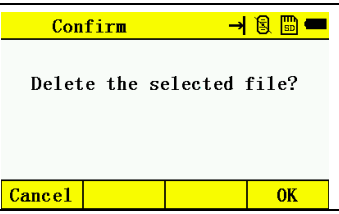
13.DATA

Data collect menu operation:

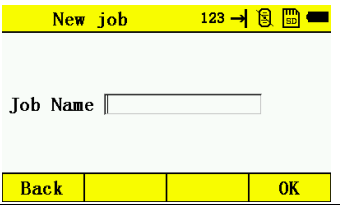
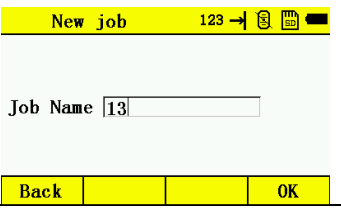


13.1 File Management

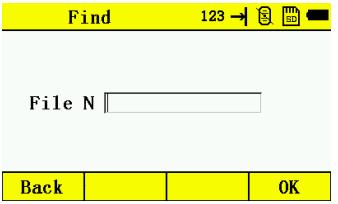
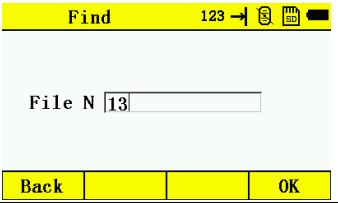
13.1.1 Deleting a File

Operation procedure	Operation	Display
①Press 1 (File) from data menu	1	
②Press [▲]or[▼] key, choose file which to be deleted	[▲]or[▼]	
③Press F1 (Delete)	F1	
④Press F4 (OK) key to delete this file ⑤Press ESC key to return Data menu	F4	

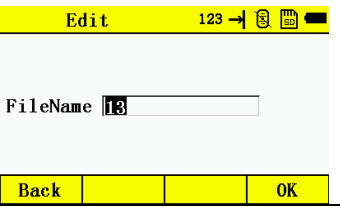
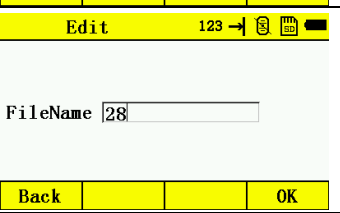
13.1.2 Built a New File

Operation procedure	Operation	Display
①Press 1 (File) from data menu	1	
②Press F2 (New)	F2	
③Input the Job Name	keyboard	
④Press F4 (OK) key to finish the new job	F4	
⑤Press ESC key to return the data menu		

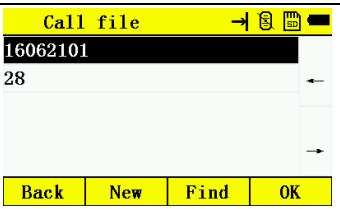
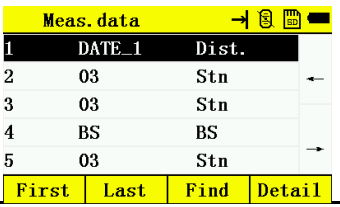
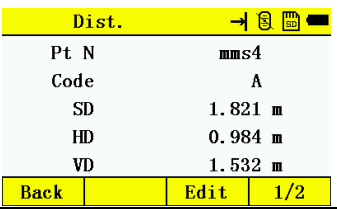
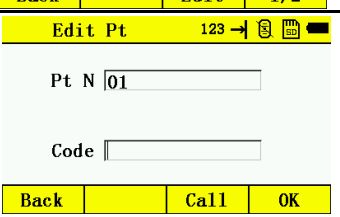
13.1.3Find a File

Operation procedure	Operation	Display
①Press 1 (File) from data menu	1	
②Press F3 (Find)	F3	
③Input File name	keyboard	
④Press F4 (OK) to find the file	F4	
⑤Press ESC to back to data menu		

13.1.4 Edit File

Operation procedure	Operation	Display
①Press 1 (File) from data menu	1	
②Press F4 (Edit)	F4	
③Input the New file name	keyboard	
④Press F4 (OK) to finish the Edit	F4	
⑤ Press ESC to back to data menu		

13.2 Measurement Data

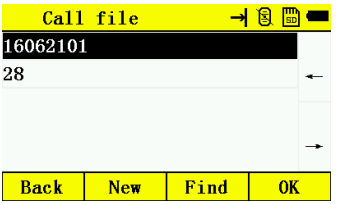
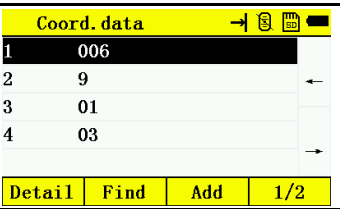
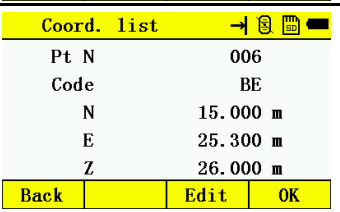
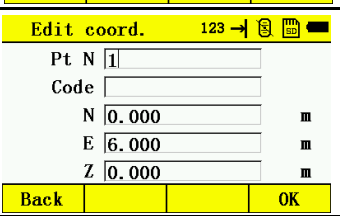
Operation procedure	Operation	Display
①Press 2 (Meas. data) from data menu*1)	2	
②Press F4 (OK) *2)	F4	
③Press F4 (Detail)	F4	
④Press F3 (Edit) to edit point name and code*3)	F3	

*1） Press F2 (New) to create a new file, press F3 (Find) to find the file

*2） Press F3 (Find) to find data

*3） Press F2 (Call) to call data

13.3Coordinate Data

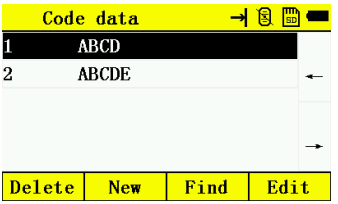
Operation procedure	Operation	Display
①Press 3 (Coord. data) from the menu*1)	3	
②Press F4 (OK) *1)*2)	F4	
③Press F1 (Detail)	F1	
④Press F3 (Edit) to edit point name, code and coordinate*3)	F3	

*1） Press F2 (New) to create a new file, press F3 (Find) to find the file

*2） Press F1 (Delete) to delete data

*3） Press F2 (Call) to call data

13.4Code Data

Operation procedure	Operation	Display
Press (Code data) from the menu*1)*2)*3)*4)	4	

*1）Press F1 (delete) key to delete data

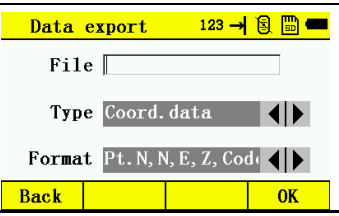
*2）Press F2 (New) to create a new file, press F3 (Find) to find the file

*3）Press F3 (Find) to find data

*4）Press F4 (Edit) to edit data

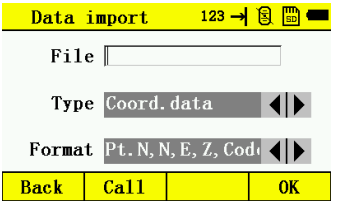
Press the [▲]or[▼] to show the next or last point

13.5 Data Export

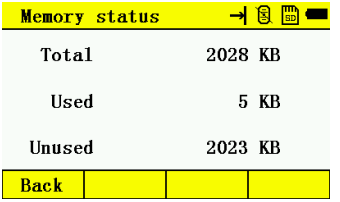
Operation procedure	Operation	Display
Press 5 (Data export) from the menu*1)	5	

*1)First input the SD card, input export file name, data type, data type, then press F4 (OK) to finish.

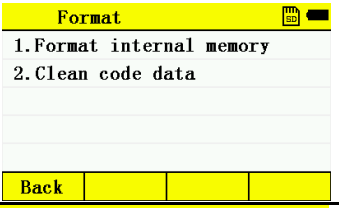
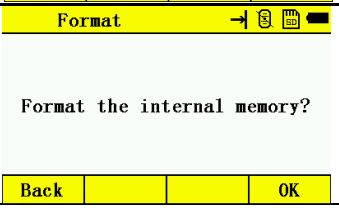
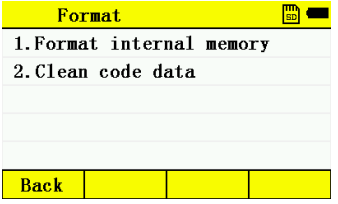
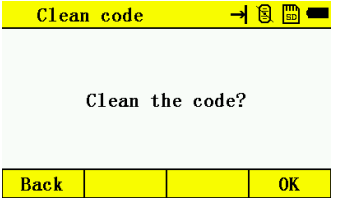
13.6 Data Import

Operation procedure	Operation	Display
Press 6 (Data import) from the menu	6	
*1) First input the SD card, input export file name, data type, data type, then press F4 (OK) to finish. *2） Press F2 (Call), can directly call the file from SD card		

13.7 Memory

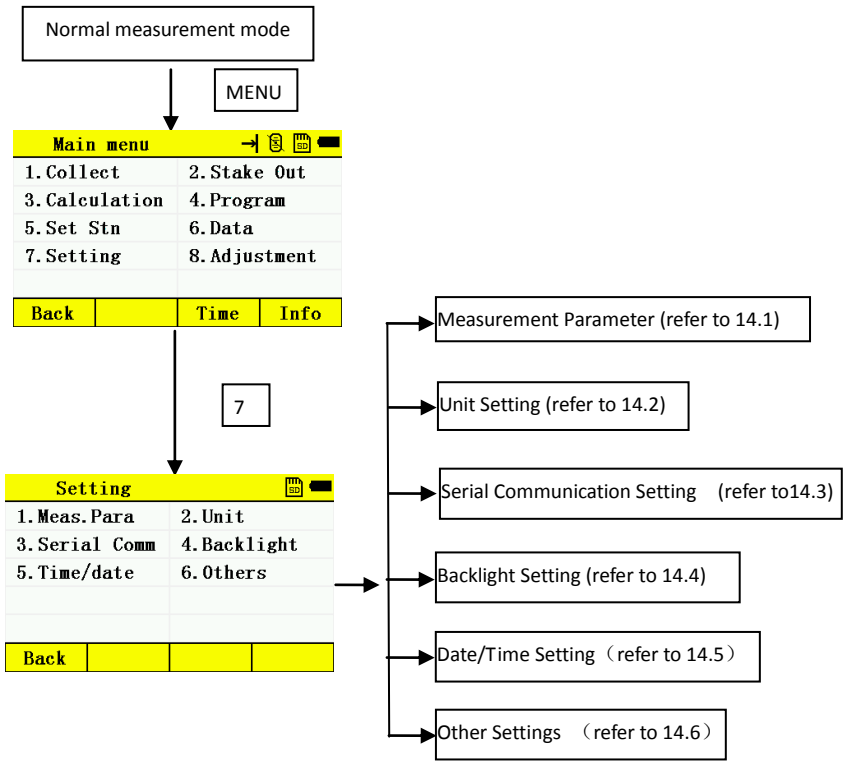
Operation procedure	Operation	Display
Press 7 (Memory) from the menu, can check the memory status of the instrument	7	

13.8 Format

Operation procedure	Operation	Display
①Press 8 (Format) from the menu, then press 1	8	
②Press F4 (OK) to format memory		
③Press 2 to enter the clean code data	2	
④Press F4 (OK) to format memory		

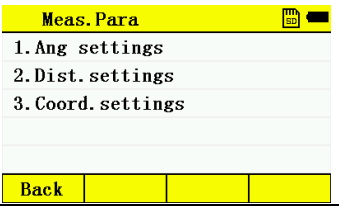
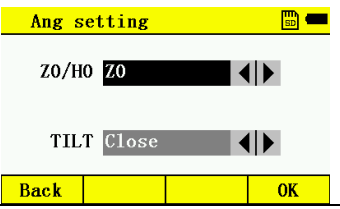
14.SETTING

Setting menu operation

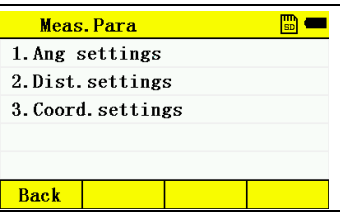
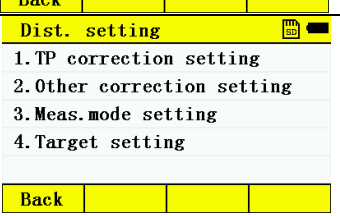


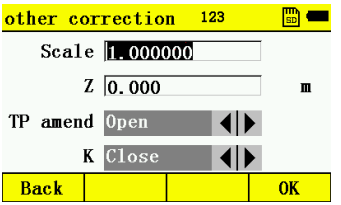
14.1Measure Parameter

14.1.1Angle Parameter

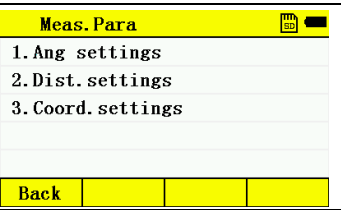
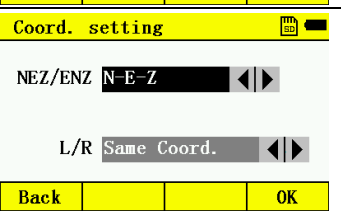
Operation procedure	Operation	Display
①Press1 (Meas. parameter) from the menu	1	
②Press (Ang setting) to adjust vertical zero bit, tilt on/off Press F4 (OK) to confirm	1 F4	

14.1.2 Distance Setting

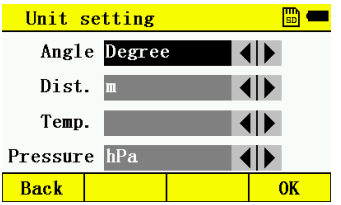
Operation procedure	Operation	Display
①Press1 (Meas. Para) from the menu	1	
②Press 2 (Dist. settings) *1)*2)*3)	2	

③Press (other correction setting) to adjust Scale, Elevation. Press F4 (OK) to finish	2 F4	
*1） Press 1 (TP correction setting),refer to previous Temperature&Pressure setting. *2） Press 3 (Meas. mode setting), refer to previous Measurement mode select *3） Press 4 (Target setting), refer to previous Target mode select		

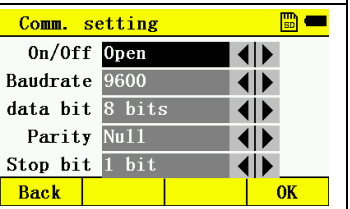
14.1.3 Coordinate Settings

Operation procedure	Operation	Display
①Press 1 (Meas. Para) from the menu	1	
②Press 3 (Coord. setting) to adjust coordinate order, face left and right coordinate to display mode	3	
③Press F4 (OK) to finish	F4	

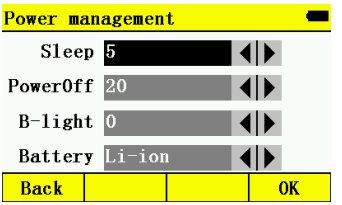
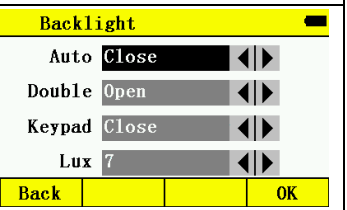
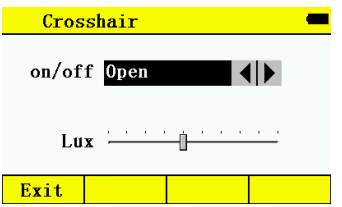
14.2 Unit Setting

Operation procedure	Operation	Display
①Press 2 (Unit setting) from the menu	2	
② Adjust each unit, then press F4 (OK) to finish	F4	

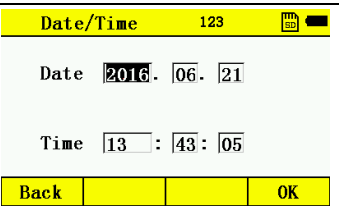
14.3 Serial Comm Setting

Operation procedure	Operation	Display
①Press 3 (Serial Comm) from the menu	3	
② Adjust each option, then press F4 (OK) to finish	F4	

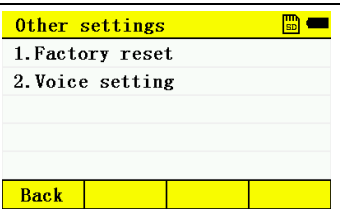
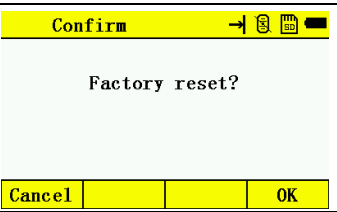
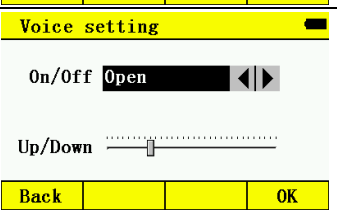
14.4 Back-light Setting

Operation procedure	Operation	Display
① Press 4 (Back-light) from the menu	4	
② Press 1 and 2 to adjust each option, press F4 (OK) to finish; Press 3 to enter cross-hair back-light setting, press F4 (OK) to finish.	1	
	2	
	3 F4	

14.5 Time/date Setting

Operation procedure	Operation	Display
①Press 5 (Time/date) from the menu press F4 (OK) to finish	5 F4	

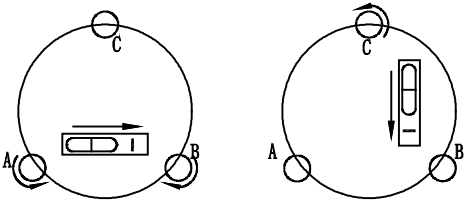
14.6 Other Setting

Operation procedure	Operation	Display
①Press 6 (others) from the menu	4	
② Press 1 and 2 key to adjust each option , press F4 (OK) key to confirm	1	
	2 F4	

15.CHECK AND ADJUSTMENT

The instrument has been checked and adjusted thoroughly at the factory to insure the instrument meets our quality requirements. But long distance transportation and the change of the environment could cause the instrument to go out of adjustment. It is recommended before using the instrument it should be checked and adjusted according to the procedures outlined below.

15.1 Plate Vial



Inspection

Refer to Instrument Set Up and “Leveling by using the plate vial”

Adjustment

1. If the bubble of the plate vial moves away from the center, bring it half way back to the center by adjusting the leveling screw, which is parallel to the plate vial. Correct the remaining half by adjusting the screw of plate vial with adjusting pin.

2. Confirm whether the bubble is in the center by rotating the instrument 180º. If not, repeat Step 1.

3. Rotate the instrument 90ºand adjust the third screw to center the bubble in the vial.

Repeat checking and adjustment steps until the bubble remains in the center with the vial in any direction.

15.2 Circular Vial

Inspection

No adjustment is necessary if the bubble of the circular vial is in the center after inspection and adjustment of the plate vial.

Adjustment

If the bubble of the circular vial is not in the center bring the bubble to the center by using the adjusting pin or hexagon wrench to adjust the bubble adjusting screw. First loosen the screw opposite to the offset side and then tighten the other adjusting screw on the offset side, bringing the bubble to the center. After the bubble stays in the center each of the three adjustment screws should be tightened in a uniform manner.

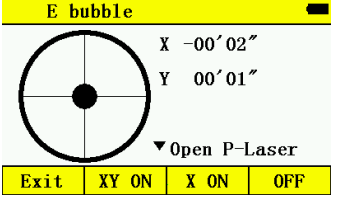
15.3 Compensator

After leveling the instrument accurately, the tilt angle should be close to 0, otherwise it exist zero error of tilt sensor, which will affect the measurement result.

Inspection

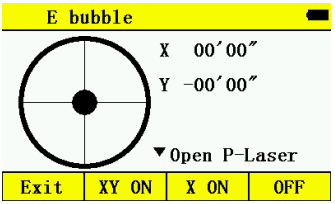
1. Leveling instrument accurately.

2. Open the XY in the E bubble page, details refer to 3.3



3. Read compensation tilt angle value X1 and Y1 after the display stable

4.Rotate telescope 180°, read the compensation tilt angle value X2 and Y2 after the display stable



5.Calculate the zero deviation of tilt sensor by using following formula:

Deviation X=(X1+X2)/2

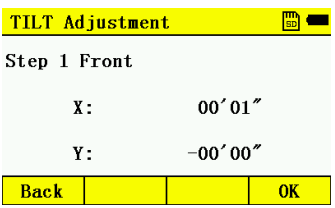
Deviation Y=(Y1+Y2)/2

Adjustment

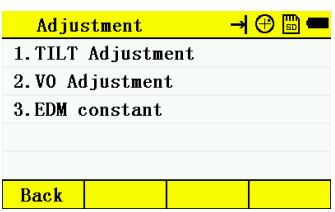
If the deviation value within ±20″, then no need adjustment, otherwise need adjustment as following:

1.Enter Tilt adjustment page in Adjustment function

2.Collimate a target in the right position



3.Press (OK), collimate the same target in the reverse position



4. Confirm whether the adjustment correction value within the range. If X value and Y value are within the adjustment range, then press F4 (OK) to update the correction value,

otherwise, exit the adjustment operation, and contact with the local dealer.

5.Follow the inspection step 1 to 5 again. If the result with ±20", then the adjustment is over, otherwise, should adjust again. If it is still out of range after 2 to 3 times adjustment, please contact with the local dealer.

15.4 Inclination of Reticle

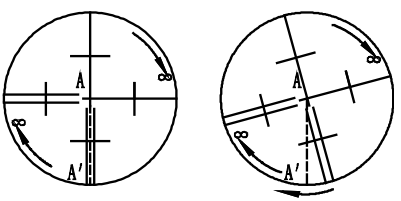
Inspection

1. Sight object A through the telescope and lock the horizontal and vertical clamp screws.

2. Move object A to the edge of the field of view with the vertical tangent screw (point A').

3. No adjustment is necessary if object A moves along the vertical line of the reticle and point A' is still in the vertical line.

As illustrated A ' offsets from the center and the cross hair tilts, then the reticle needs adjustment.



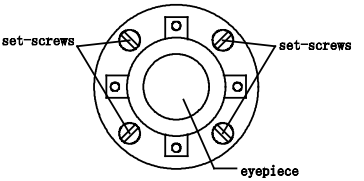
Adjustment

1. If the object A does not move along the vertical line, first remove the eyepiece cover to expose the four reticle adjusting screws.

2. Loosen the four reticle adjusting screws uniformly with an adjusting pin. Rotate the reticle around the sight line and align the vertical line of the reticle with point A '.

3. Tighten the reticle adjusting screws uniformly, pepeat the inspection and adjustment to see if the adjustment is correct.

4. Replace the eyepiece cover.



15.5 Perpendicularity of Line of Sight to Horizontal Axis (2c)

Inspection

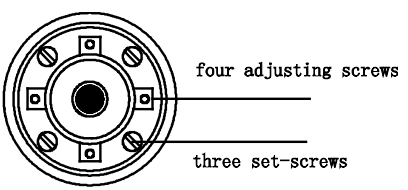
1. Set an object A at a far distance the same height as the instrument, then level and center the instrument and turn on the power.

2. Sight object A in the left position and read the horizontal angle value

(horizontal angle L=10°13 '10").

3. Loosen the vertical and horizontal clamp screws and rotate the telescope. Sight object A in right position and read the horizontal angle value.(horizontal angle R = 190°13′40") .

4 . 2 C = L - (R ±180°) = - 30"≥±20" , adjustment is necessary.



Adjustment

1. Use the tangent screw to adjust the horizontal angle reading.

2. Take off the cover of the reticle between the eyepiece and focusing screw. Adjust the two adjusting screws by loosening one and tightening the other. Move the reticle to sight object A exactly.

3. Repeat inspection and adjustment until | 2C | < 20".

4. Replace the cover of the reticle.

15.6 Adjustment of Vertical Index Difference (I angle) and Vertical Angle 0 Datum

Inspect the item after finishing the inspection and adjustment of item 15.3 and 15.4.

Inspection

1. Power on after leveling the instrument. Sight object A in left position and read the Verticail angle value L.

2. Rotate the telescope. Sight object A in right position and read the Verticail angle value R.

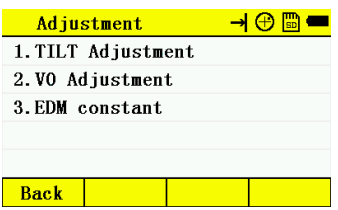
3.If the vertical angle is 0 °in zenith, $i = (L + R - 360°) / 2$

If the vertical angle is 0 °in horizon $i = (L + R - 180°) / 2$ or $(L + R - 540°) / 2$.

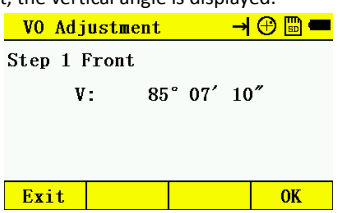
4. If $|i|$ ≥10" set the Vertical Angle 0 Datum again.

Adjustment

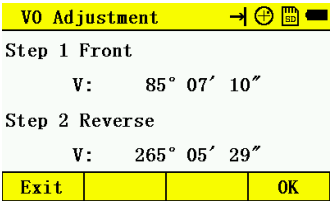
1.After leveling the instrument, enter the adjustment mode:



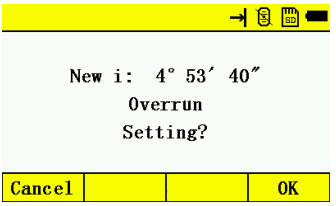
2.Press 2 , in left position rotate the telescope. Precisely sight any target A at the same height as the instrument, the vertical angle is displayed.



3.Rotate the telescope and precisely sight the same target A, press F4



4.Press F4 , display follow, then press (OK) key to finish.



5. Repeat the inspection steps to measure the Index difference (I angle). If the Index Difference does not meet requirements redo the steps above. Please carefully repeat these steps to ensure the proper result.

6. If Index Difference does not meet the requirements after the repeated operation the instrument should be returned to factory for inspection and repair.

15.7 Optical Plummet

Inspection

1. Set the instrument on the tripod and place a piece of white paper with two perpendicular lines under the instrument.

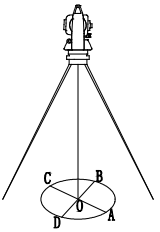
2. Adjust the focus of the optical plummet and move the paper so that the intersection point of the lines on the paper comes to the center of the field of view.

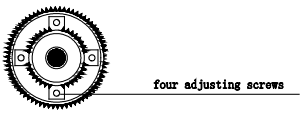
3. Adjust the leveling screws so that the center mark of the optical plummet coincides with the intersection point of the cross on the paper.

4. Rotate the instrument around the vertical axis and at every 90° observe whether the

center mark position coincides with the intersection point of the cross.

5. If the center mark always coincides with intersection point no adjustment is necessary. Otherwise, the following adjustment is needed.





Adjustment

1. Take off the protective cover between the optical plummet eyepiece and focusing knob.

2. Fix the paper. Rotate the instrument and mark the indicated point of the center of the optical plummet on the paper at every 90°. As illustrated: Point A, B, C, D.

3. Draw lines that attach AC and BD and mark the intersection point of the two lines as O.

4. Adjust the four adjusting screws of the optical plummet with an adjusting pin until the center mark coincides with Point O.

5. Repeat the inspection and adjusting steps to be sure the adjustment is correct.

6. Replace the protective cover.

15.8 Laser Plummet

Inspection

1. Set the instrument on the tripod and place a piece of white paper with two perpendicular lines under the instrument.

2. Open the laser plummet, move the paper to make the laser point coincide with the center of two perpendicular lines..

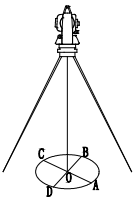
3. Rotate the plummet to make the laser point coincide with the intersection point on the

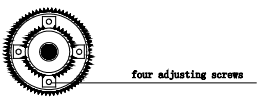
paper..

4. Rotate the instrument, every 90° check contact ratio of laser point and intersection point.

5. If the laser point always coincided with the intersection point, no adjustment is necessary.

Otherwise, the following adjustment is required..





Adjustment

1. Take off the protective cover

2. Fix the paper and mark the laser point on the paper every 90°. As shown in the picture: Point A, B, C and D.

3. Line the Point AC and BD, the intersection point is 0.

4. Use Allen Key to adjust the four adjusting screws to make the center of the laser point coincide with point 0..

5. Repeat the inspection and adjusting steps to be sure the adjustment is correct.

6. Replace the protective cover.

15.9 Instrument Constant (K)

The instrument constant has been checked and adjusted in the factor, K=0. It changes seldom and it is suggested to check one or two times every year. The inspection should be made on a base line but also can be made according to the following method.

Inspection

1. Mount and level the instrument on Point A in a flat area. Use the vertical hair to mark

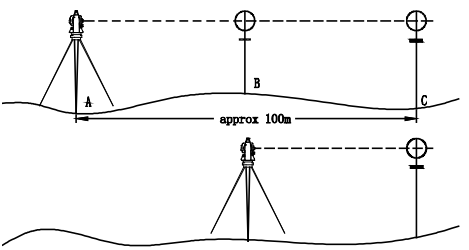
Point B and Point C on the same line with the distance of 50m between each point. Set the reflector accurately on each point when measuring.

2. After setting temperature and air pressure in the instrument measure the Horizontal Distance of AB and AC accurately.

3. Set the instrument on Point B and center it accurately, measure the Horizontal Distance of BC accurately.

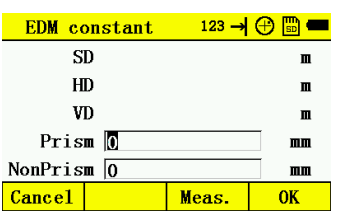
4. Then you can calculate the Instrument Constant:K=AC-(AB+BC)

K should be very close to 0, If | K | > 5 mm the instrument should be inspected at a standard baseline site and adjusted according the inspection value.

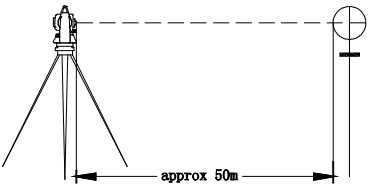


Adjustment

If a strict inspection proves that the Instrument Constant K has changed the operator can change the constant by entering the adjustment amount. Press 3 in ADJUSTMENT mode and key in the new constant.



15.10 Parallel between Line of Sight and Emitting Photoelectric Axis



Inspection

1. Set the reflector 50m from the instrument.
2. Sight the center of the reflector prism with reticle.
3. Power on and enter Distance Measurement Mode. Press MEAS to measure. Rotate the Horizontal Tangent Screw and Vertical Tangent Screw, to do electric collimation and make the light route of EDM unblocked. In the bight zone find the center of emiting photoelectric axis.
4. Check whether the center of reticle coincides with the center of emiting photoelectric axis. If so, the instrument is up to grade.

Adjustment

If there is great difference between the center of reticle and the center of emitting photoelectric axis the instrument needs repair.

15.11 Tribrach Leveling Screw

If the leveling screw becomes loose adjust the two adjusting screws in the leveling screw to tighten appropriately.

15.12 Related Parts for Reflector

1. The Tribrach and Adapter for Reflector

The plate vial and optical plummet in the adapter and plate vial should be checked, refer to Session 15.1 and 15.7

2. Perpendicularity of the prism pole

As shown in picture in Session 13.8, mark '+' on Point C, place the tine of the prism pole on the Point C and do not move it during the inspection. Place the two feet tine of Bipod on Point E and F on the cross lines. Adjust the two legs to make the bubble on the prism pole centered.

Set and level the instrument on Point A near the cross. Sight tine of Point C with the center of reticle, and fix the Horizontal Clamp Screw. Rotate the telescope upward to make D near the horizontal hair. Flex the prism pole Leg e to make the D in the center of reticle. Then both Point C and D are on the central line of reticle.

Set the instrument on Point B on the other cross lines. Flex the leg F and make point D on the prism pole overlapped with central line of the point C's cross lines.

Through the collimation on Point A and B, the prism pole has been set perpendicular. If then the bubble deviates from the center, adjust the three screws under circular vial to make the bubble centered, refer to Session 13.2.

Check and adjust again until the bubble is in the center of the vial from both directions.

16.Specifications

Model	N31	N3
TELESCOPE		
image	erect	
magnification	30x	
effective aperture	45mm (distance meter: 47mm)	
resolving power	3″	
field of view	1°30′	
minimum focus	1.5m	
telescope length	152mm	
ANGLE MEASUREMENT		
measuring method	absolute encoding	
diameter of disk	79mm	
minimum reading	0.1″	1″
detection method	horizontal: dual vertical: dual	
unit	360 DEGREE/400 GON /6400 MIL optional	
vertical angle 0°	Azimuth 0 / Horizontal 0 optional	
accuracy	1″	2″
DISTANCE MEASUREMENT		
single prism	3.5km	
triple prism	6km	
sheet	1.2km	
Reflectorless(white) ※1	600m	

Model	N31	N3
unit		m/ft
accuracy	±(1+1x10-6·d)mm w/o prism: ±(3+2x10-6·d)mm	±(2+2x10-6·d)mm※2 w/o prism: ±(3+2x10-6·d)mm※2
measuring time (initial)	single fine measure: less than 1.3s; tracking: 0.4s; Repeat: 0.2s	
measuring system	basic frequency: 70-150 mhz	
wave length	685nm	
atmospheric correction	auto correction	
atmospheric refraction & earth curvation correction	auto correction. k=0.14/0.20	
reflector constant correction	Input parameter and auto correction	
VIAL		
circular vial	8'/2mm	
plate vial	30"/2mm	
COMPENSATOR		
system	Dual axis Liquid-electric Sensor Compensation	
compensating range	±4'	
resolving power	1"	
OPTICAL PLUMMET (OR INTERNAL LASER PLUMMET)		
image	erect	
magnification	3x	

focusing range	0.3m ~ ∞
field of view	5°
DISPLAY	
type	3.0 inches LCD graphics, colorful and touch screen
INPUT MODE	
type	alphanumeric with numbers keyboard
DATA TRANSFER	
RS232	yes
USB interface	yes
Bluetooth	yes
SD CARD	yes
STORAGE	
SD card	8GB SD card as default
BATTERY	
battery	Li-battery
voltage	7.4V(dc)
operating time	up to 8 hours
OPERATION ENVIRONMENT	
operation temperature	-20℃ ~ +50 ℃
SIZE & WEIGHT	
size	206mm x 200mm x 353mm
weight	6.0kg

17. ERROR DISPLAYS

Error code	Description	Countermeasures
ERROR 01-06	Angle measurement system abnormal	If the error code appears continuously the instrument needs repair.
ERROR 31 ERROR 33	Distance measurement system abnormal	If the error code appears continuously the instrument needs repair.

18. SAFETY INSTRUCTIONS

18.1 Integrated EDM（Visible Laser）

Warning：

Total station with EDM of laser class 3A resp.a-identifiable by：

Warning decal is above the vertical braking screw in Face 1: “Class III Laser Product”.

The product is a class 3A laser product in accordance with:

IEC 60825-1:2001 “Radiation safety of laser products”.

Class 3A laser products：

Direct beam viewing is always hazardous. Avoid direct eye exposure. The accessible emission limit is within five times the accessible emission limits of Class 2 in the wavelength range from 400nm to 700nm.

Warning：

Direct beam viewing is hazardous for eyes.

Precautions：

Do not stare into the beam or direct it towards other people unnecessarily. These measures are also valid for the reflected beam.

Warning：

Looking directly into the reflected laser beam could be dangerous to the eyes when the laser beam is aimed at areas that reflect like a mirror or emit reflections unexpectedly (e.g. prisms, mirrors, metallic surfaces, windows).

Precautions：

Do not aim at areas that are essentially reflective, such as a mirror, or which could emit unwanted reflections. Do not look through or beside the optical sight at prisms or reflecting objects when the laser is switched on (in laser pointer or distance measurement mode). Aiming at prisms is only permitted when looking through the telescope.

Warning：

The use of Laser Class 3A laser equipment can be dangerous.

Precautions：

To counteract hazards, it is essential for every user to respect the safety precautions and control measures specified in standard IEC60825-1:2001 within the hazardous distance range.

Below is an interpretation of the main points in the relevant section of the standard quoted.

Class 3R laser products used on construction sites and outdoors (surveying, alignment, leveling):

a) Only qualified and trained persons should be assigned to install, adjust and operate the laser equipment.

b) Areas in which these lasers are used should be posted with an appropriate laser

warning sign.

c) Precautions should be taken to ensure that persons do not look directly, with or without an optical instrument, into the beam.

d) The laser beam should be terminated at the end of its useful beam path and should in all cases be terminated if the hazardous beam path extends beyond the limit (hazard distance *) of the area in which the presence and activities of personnel are monitored for reasons of protection from laser radiation.

e) The laser beam path should be located well above or below eye level wherever practicable.

f) When not in use the laser product should be stored in a cool and dry location.

g) Precautions should be taken to ensure that the laser beam is not unintentionally directed at mirror-like (mirrored) surfaces (e.g. mirrors, metal surfaces, windows) and more importantly, at flat or concave mirror-like surfaces.

* The hazard distance is the distance from the laser at which beam irradiate or radiant exposure equals the maximum permissible value to which personnel may be exposed without being exposed to a health risk.

Products with an integrated EDM of laser class 3R resp. III a has a hazard distance of 1000m (3300ft). After this distance, the laser beam rates as Class 1 (= direct beam viewing is not hazardous).

18.2 Laser Plummet

This instrument is Class2/Ⅱ product, Class 2 level products have follows standards:

IEC60825-1:1993 “Radiation safety of laser products”

EN60825-1:1994+AⅡ:1996 “Radiation safety of laser products”

Do not stare at the laser beam or push it to others. Avoiding dangerous.