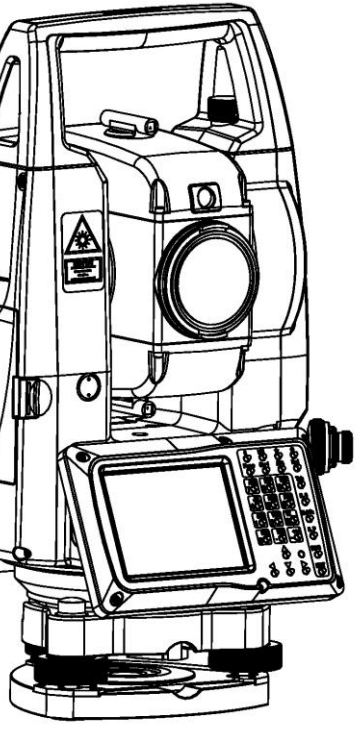
Operation Manual



N40 Series

Mechanical Total Station

SOUTH

Target your success

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PRECAUTIONS

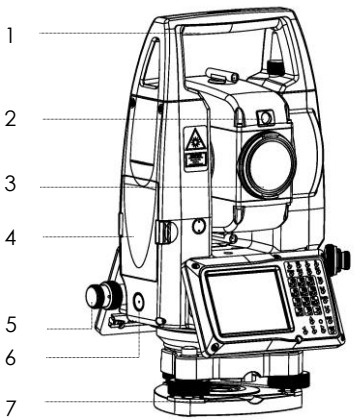
Congratulations on the purchase of SOUTH N40 Series Total Station!

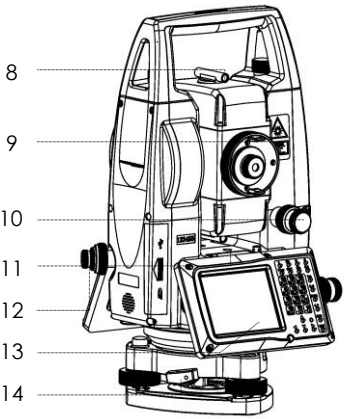
Please read carefully through the User Manual before you switch on the product.

1. Do not collimate the objective lens directly to the sunlight without a filter.
2. Do not stare at the laser beam, or point the laser to the others' eye!
3. Do not store the equipment in extremely high or low temperature.
4. When the equipment is not in use, store it in the case to avoid dust and humidity.
5. If there is a great difference between the temperature in work field or store place, you should leave the equipment in the case until it adapts to the temperature of environment.
6. If the equipment has not been used for a long time, you should remove the battery for separate storage. The battery should be charged once a month.
7. When shipping the equipment, please place it in the carry case. The cushioned material should be used to cover around the case for support.
8. Clean the optical parts by absorbent cotton or lens-paper only!
9. Clean the surface softly with a woolen cloth. If it gets wet, you should dry it immediately before switch-on.
10. Please check the power supply, functions, indications and parameters of the equipment goes well before operation.
11. Do not disassemble the total station by yourself. Please contact your authorized agency or SOUTH Service Team when you find the equipment abnormal.

1. INTRODUCTION

1.1 Appearance

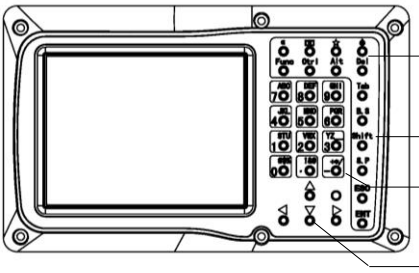




No.	Description
1	Handle
2	Camera (Optional)
3	Objective Lens
4	Battery Unit
5	Horizontal tangent Screw
6	EDM Trigger Key
7	Tribrach

No.	Description
8	Collimator
9	Eyepiece
10	Vertical Tangent Screw
11	Vial Bubble
12	Plummet
13	Display Unit with Keypad
14	Tribrach Lock

1.2 Keyboard



a) Quick Access Key

b) Functional Key

c) Alphanumeric Keypad

d) Navigation Key

Key	Description
α	Shift the case of alphabets.
⊡	Activate the soft-keypad
★	Star-key
⏻	Power On/Off.
Func	Quick-access to angle measurement
Ctrl	Quick-access to distance measurement
Alt	Quick-access to coordinate measurement
Del	Delete characters before cursor
Tab	Switch the cursor in different widget
B.S	Backspace.
Shift	Shift the input mode between alphabets and numbers
S.P	Space.
ESC	Escape.
ENT	Enter.
0-9, ., -	Input numbers, dots, minus, and the other symbols.
▲▼◄ ►	Navigation keys.

1.3 Screen

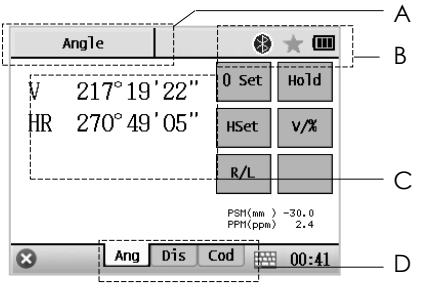
It can be divide into four parts:

A) Title

B) Status Bar

C) Active Field

D) Tab Bar



1.4 Status Icon

Icon	Description
	Display the battery status. Click for power manage.
	Bluetooth status.
	Star-key. Click to activate the quick-setting page.
	Soft-keypad. Click to on or off the soft-keypad.
19:42	Current time. Click to reset time and date.
	Click to display the information of the instrument.
	Escape to the previous page.
	Save the data on the current page.

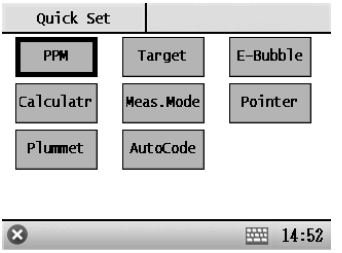
1.5 Abbreviation

Abbr.	Description
V	Vertical angle
HL/HR	Horizontal left/ right
SD	Slide Distance
HD	Horizontal distance
VD	Vertical distance
N/ E/ Z	North/ East/ Zenith

1.6 Star Key

Click [★] key in any page to activate the quick-setting page.

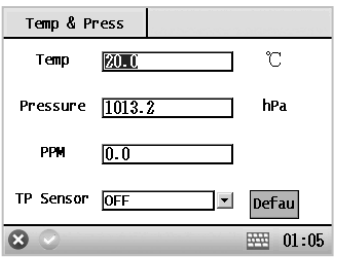
1) PPM
2) Target
3) E-Bubble
4) Calculator
5) Meas. Mode
6) Pointer
7) Plummet
8) Auto Code



▶ Star Key

1.6.1 PPM

The value of temperature, pressure and PPM can be detected or calculated by T&P sensor, or inputted by manual.



▶ PPM

Input range:

Temp: -40 ~+60 C° or -22~+140 F°

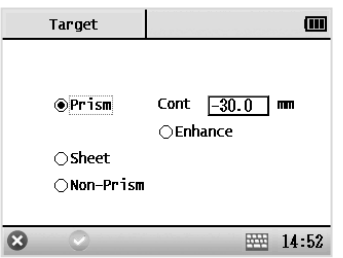
Press.: 560~1066 hPa, 420~800 mmHg or 16.5~31.5 inHg

PPM: -99. 9 to +99. 9, Interval: 0 .1PPM

1.6.2 Target

Click or use the navigation key to select the target among Prism, Sheet and Non-Prism mode.

The default value of prism constant is -30, which can be defined by manual.



▶ Target

1.6.3 E-Bubble

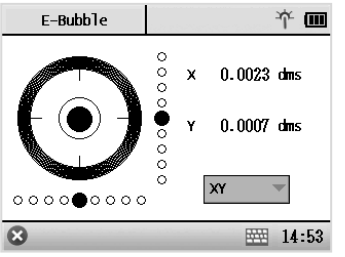
Activate the tilt sensor (electronic bubble) for levelling.

X: Turn on the sensor by single axis.

XY Turn on the sensor by dual axis.

OFF: Turn off the sensor.

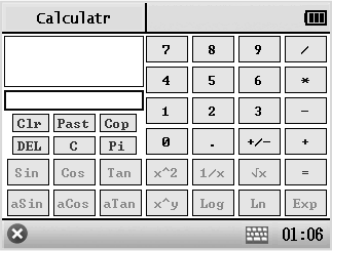
: Click to turn on or off the laser plummet.



▶ Electronic Bubble

1.6.4 Calculatr

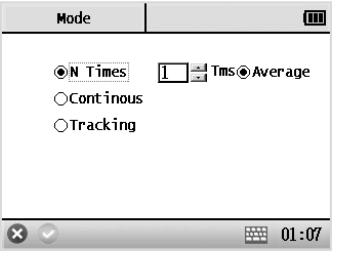
The calculator can handle the simple formula calculation, like Sin, Cos, Tan, Log, Square, etc. Refers to Chapter 5.1 Calculatr for further information.



▶ Calculator

1.6.5 Meas. Mode

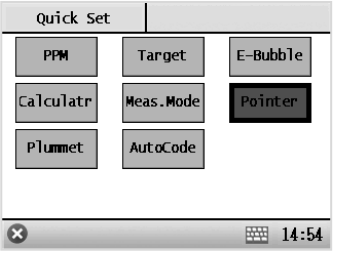
Select the measurement mode among N times (1-99 times, average), Continuous or Tracking mode.



▶ Measure Mode

1.6.6 Pointer

Click to turn on or off the laser pointer for easier target aiming.

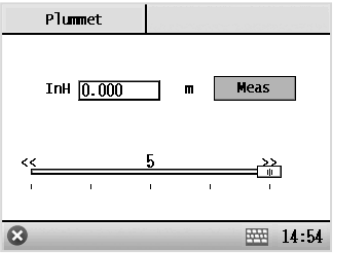


▶ Laser Pointer

1.6.7 Plummet

Click the status bar to set the illumination level from class 1 to 5.

If your total station features the Auto Height function, click **[Meas]** to measure the instrument height.

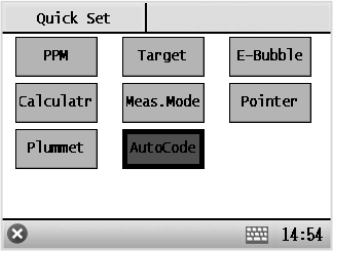


▶ Laser Plummet

1.6.8 Auto Code

Click to activate the Auto Code function.

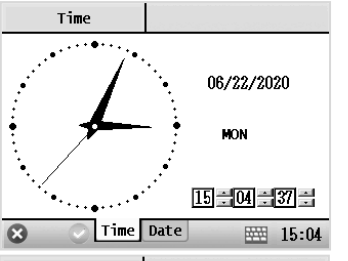
Note: Please refers to Chapter 4.3 P-Code for further information.

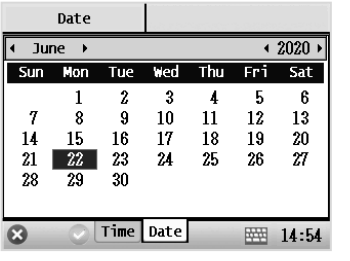


▶ Auto Code

1.7 Time & Date

Click the time (eg.14:55) on the right corner of screen to check or set the time and date.





2. OPERATION

2.1 Preparation

Unpacking

Lay down the case lightly with the cover upward. Unlock the case, and take out the instrument.

Storage of Instrument

Cover the cap, put the instrument into the case with the vertical clamp screw tightened and circular vial upwards (lens towards tribrach).

2.2 Instrument Setup

1) Setting up the tripod

A. Loosen the screws on the tripod legs, pull out to the required length and tighten the screws.

B. Make the center of tripod and the occupied point approximately on the same plumb line.

C. Step on the tripod to make sure if it is well stationed on the ground.

2) Instrument setup (Laser plummet)

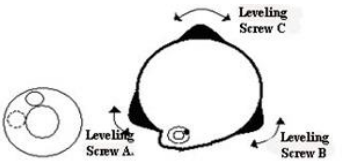
A. Place and fix the instrument carefully on the tripod

B. Press **[★]** and select **[7]LaserPlt** to turn on the laser plummet. Hold the two legs which are not fixed on the ground and decide the position to fix according to the laser dot. When the laser dot is roughly on the station point, fix those 2 legs.

Instrument setup (Optical 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.

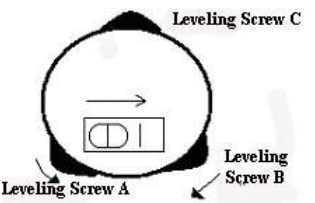
3) Roughly leveling by the circular vial



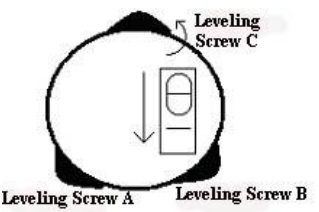
A. Rotate the foot-screw A and B to move the bubble in the circular vial, in which case the bubble is located on a line perpendicular to a line running through the centers of the two leveling screw being adjusted .

B. Rotate the foot-screw C to move the bubble to the center of the circular vial.

4) Leveling by the plate vial



A. Rotate the instrument horizontally by loosening the horizontal clamp unit and place the plate vial parallel to the line connecting rotating the foot-screw A and B, and then bring the bubble to the center of the plate vial by rotating the foot-screw A and B.



B. Rotate the instrument in 90° (100gon) around its vertical axis and turn the remaining leveling screw or leveling C

to center the bubble once more.

C. Repeat the steps and check whether the bubble is correctly centered in all directions.

If the laser or optical plummet doesn't stay at the center position after levelling, please slightly loosen the screw under the tripod head and move the instrument (don't rotate the instrument) until the equipment is on the station point. Tighten the screw and level the instrument again. Repeat these steps until the instrument is precisely centered and leveled.

Note:

You can also level the instrument precisely by the E-bubble.

When the tilt is over ±4', the system will enter the adjusting page of tilt sensor automatically.

2.3 Battery

Inserting

Put the battery into the instrument, push it. Check and insert it correctly to side into the housing.

Replacing

Press the battery lock on both sides, remove the battery. When the remaining voltage is less than one grid, please stop your operation and charge it as soon as possible.

Before remove the battery from the instrument, make sure that the power is turned off. Otherwise, the instrument may be damaged.

Charging

The battery must be charged prior to using before the first time operation.

The battery LI-39 should be charged only by the official charger NC-III, which packed together with the instrument. Please connect the power supply in 220V, among 0°~±45°C.

When the indicator on the charger is red, the charging process has begun. When indicator turns green, the charging has finished. For safety, please pull out the battery and charger in time.

In order to get the maximum service life, please charge the battery at least once in a month.

Note:

a) *The operating time depends on the outside conditions, such as ambient temperature, charging time, the cycles of charging, etc. It is recommended for safety to charge the battery beforehand or to prepare spare full-charged batteries.*

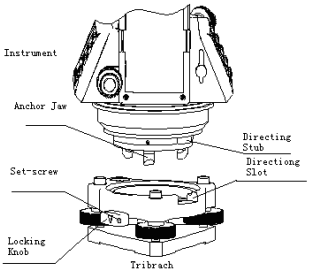
b) *The remaining voltage of battery shows the power regarding to the current measure mode. The consumption of distance measurement is higher than angle measurement in normal. When switching the measurement mode from angle to distance in a low battery voltage, the equipment might be interrupted.*

2.4 Tribrach

Dismounting

If necessary, the instrument can be dismounted from tribrach. Turn the locking knob in 180° counter-clockwise to disengage anchor jaws,

and take off the instrument.



Mounting

Insert three anchor jaws into holes of tribrach and line up the directing stub. Turn the locking knob about 180° clockwise to mounting the instrument.

2.5 Eyepiece Focusing

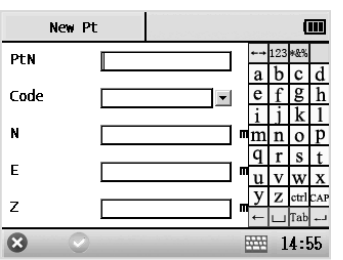
Sight the Telescope to bright place and rotate the eyepiece tube to make the reticle clear. Roughly collimate the target by the top of the triangle mark on EDM cover.

Rotate the focusing screw on eyepiece to make the image clear.

2.6 Input Mode

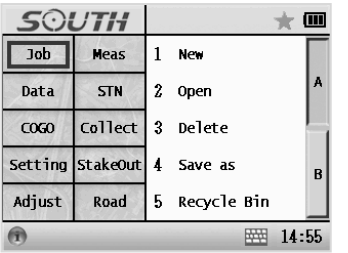
Swift the input mode between numbers and alphabets by **[Shift]** on keyboard or **[123]/[abc]** on soft-keypad.

Swift the case of alphabets by **[a]** on keyboard.

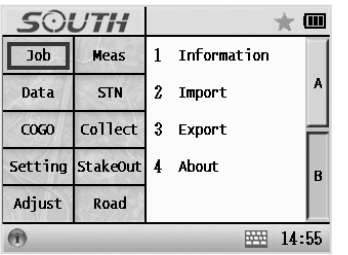


3. JOB

In job management, you can create, open, delete or save job as the other file, recover the job from recycle bin, check the information, or import / export data via SD card, flash disk, Bluetooth or Comm Port.



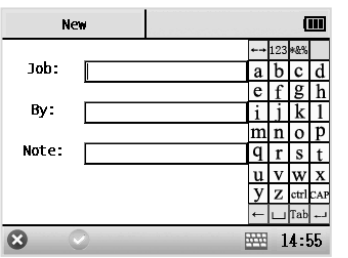
Every time when turn on the instrument, it will open the previous job as default.



Click the left top-corner of screen to check the current job.

3.1 New

Create and open a new job, and the last job will be saved.



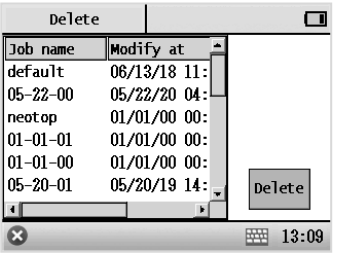
The default name of job is the current date, which can be modified by maximum 8 characters.

3.2 Open

Open the job from list. The previous job will be saved at the same time. The current job will be shown in blue.

3.3 Delete

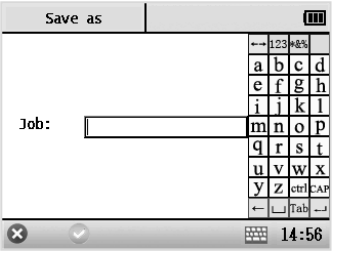
[Delete]: Delete the chosen job. It will be moved into recycle bin.



3.4 Save As

Save the current job as a new job.

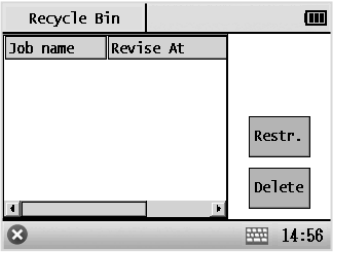
Job: Input the name which will be saved as. Maximum 8 characters.



3.5 Recycle Bin

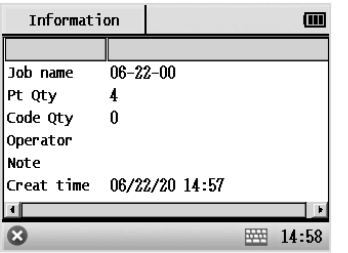
Recover or delete the files in recycle bin.

[Restr.]: Restore the chosen job from recycle bin.
[Delete]: Delete the job permanently from recycle bin.



3.6 Information

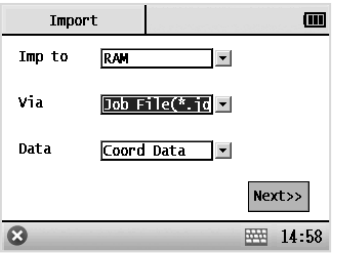
Check the information of current job. Including the quantity of points & codes, the name of operator, note and create time.



3.7 Import

Import data to current job.

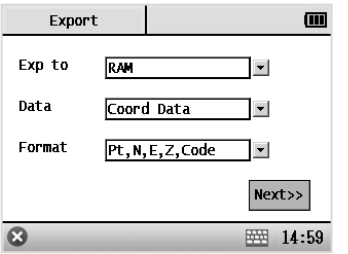
Imp to: RAM, SD Card, U-Disk and Bluetooth.
Via: Txt or Job.
Data: Choose data type among Coordinate Data, Code, or Road.



3.8 Export

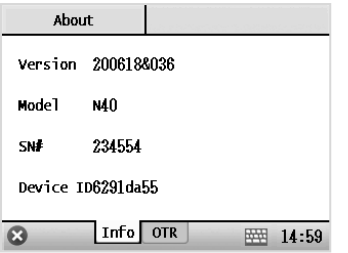
Export the current job.

Exp to: RAM, SD Card, U-Disk, Bluetooth and Comm Port.
Data: Choose data type among Coordinate Data, Code, Raw Data, Road and DXF File



3.9 About

Check the information of total station.

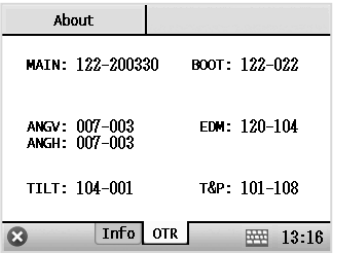


Version: Firmware version.

Mode: Model name.

SN#: Serial number.

Device ID: Unique device ID for this unit



MAIN: Mainboard version.

Boot: Boot version.

ANGV/ANGH: Version of vertical and horizontal angle.

EDM: Version of EDM board.

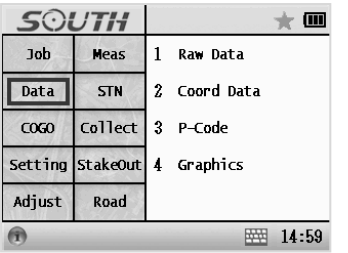
TILT: Version of tilt sensor.

T&P: Version of temperature and pressure sensor.

4. DATA

You can view, add, delete or edit the data under current job.

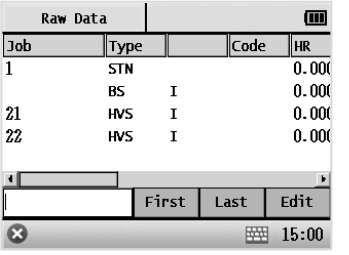
1) Raw Data
2) Coord Data
3) P-Code
4) Graphics



4.1 Raw Data

Check and edit the raw data.

[First]: Check the first data.
[Last]: Check the last data.
[Edit]: Edit the selected data. Only point name and code can be edited.

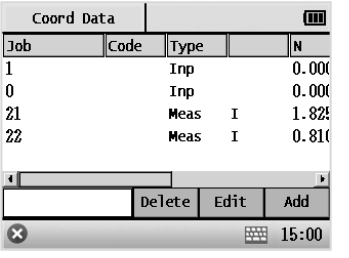


4.2 Coord Data

Delete, edit or add the coordinate.

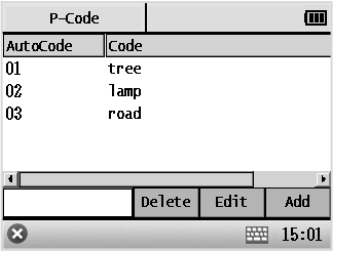
There are three types: **Meas** for measured data, **Inp** for inputted data and **cal** for calculated data.

Note: Only point name and code can be edited.



4.3 P-Code

Delete, edit or add the codes.

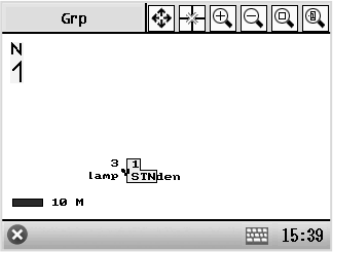


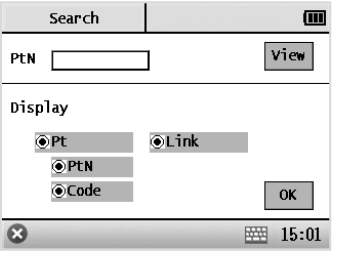
Auto Code: Enter the auto code (eg. 01, 02, 03), N40 will input the code (eg. tree, lamp, tower) automatically.

Note: the auto code function can be turn on or off under Star Key.

4.4 Graphics

View and search points by graphics.





: View all those points.

: View the station and backsight point.

: Zoom in.

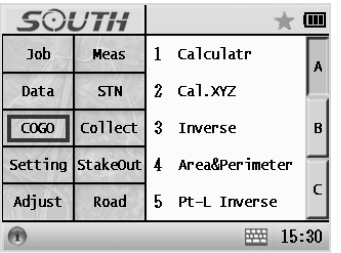
: Zoom out.

: Partly enlarge.

: Set the display method or search points.

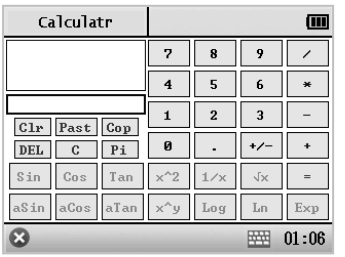
5. COGO

1) Calculator
2) Cal.XYZ
3) Inverse
4) Area & Perimeter
5) Pt-L Inverse
6) 2 Pts Intersection
7) 4 Pts Intersection
8) Volume
9) Unit Switch
10) Meridian Con
11) Traverse Ad.



5.1 Calculatr

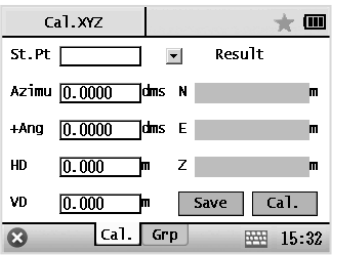
[Clr]: Clear all the calculation.
[Past]: Paste the data from the clipboard to the edit box.
[Cop]: Copy the calculated result.
[DEL]: Delete the characters.
[C]: Clear the edit box.
[Pi]: Input the approximate value of π.



5.2 Cal. XYZ (Coordinate)

Calculate the unknown coordinate based on the known relationship (angle, HD, VD) between two points.

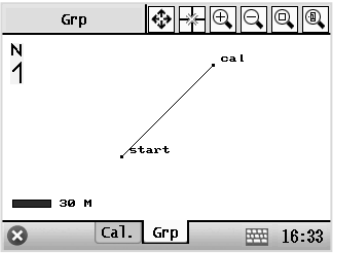
St.Pt: Start point. It can be selected from data list, inputted or measured by manual.

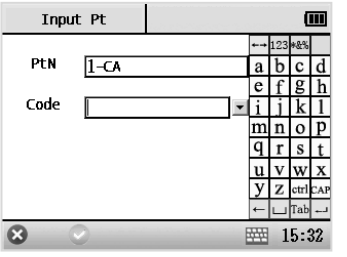


Azimu: The initial azimuth.

+Ang: The angle which added from the start point.
HD: The horizontal distance which added from the start point
VD: The vertical distance which added from the start point

[Cal.]: Calculate the coordinate
[Save]: Save the coordinate



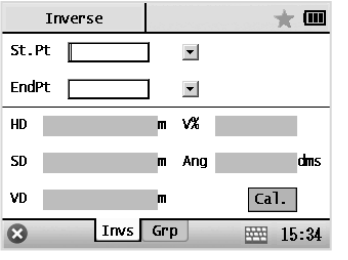


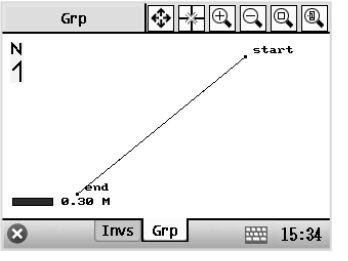
5.3 Inverse

Calculate the unknown relationship (azimuth, HD, SD, VD and slope rate) between two known points.

St.Pt: Start point.
EndPt: End point. Those two points can be selected from data list, inputted or measured by manual.

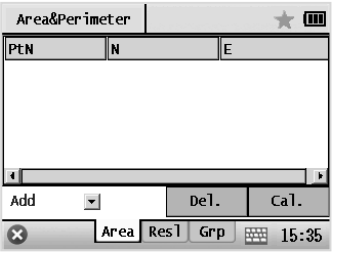
V%: Slope rate between two points.
Ang: Angle between two points.



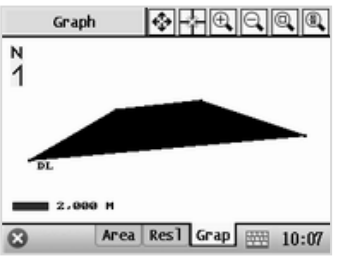


5.4 Area & Perimeter

Calculate the area and perimeter by at least 3 points.



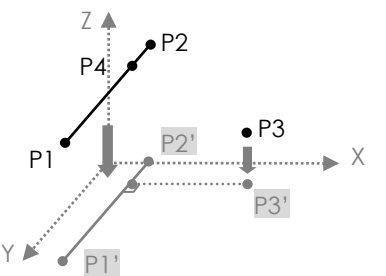
[Add]: Add a new point to the end of list. The points can be created, inputted or selected from data list.
[Insert]: Insert a new point before the selected point.



Note: Area calculation calculates the area of graphic, which is created by projection on the horizontal plane.

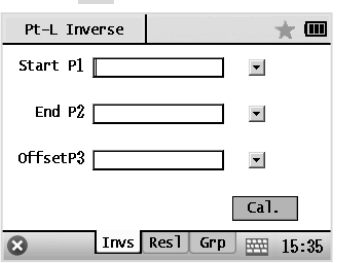
5.5 Pt-L Inverse

This function calculates the coordinate and horizontal distance of the perpendicular point P4 between offset point P3 and Line P1-P2.



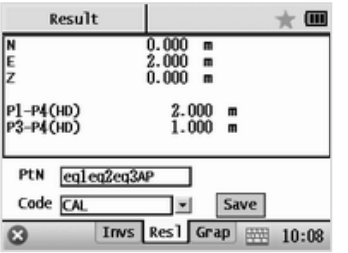
[Start P1]: Start point P1.
[End P2]: End point P2.
[Offset P3]: Offset point P3.

Those known points can be measured, inputted or selected from data list.



[Cal.]: Calculate the coordinate and distance between P1-P4/P3-P4.

[Save]: Save the coordinate of P4.



5.6 2 Pts Intersec

According to two start points, and the relationship (angle/ distance) between these two points, the coordinate of intersection point can be calculated.

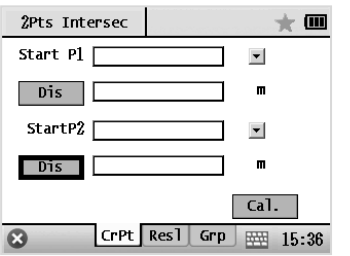
The known point P1 and P2 can be measured, inputted or selected from data list.

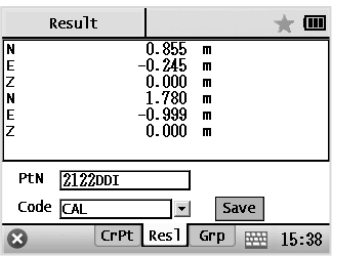
Start P1/P2: Select, create or measure two points.

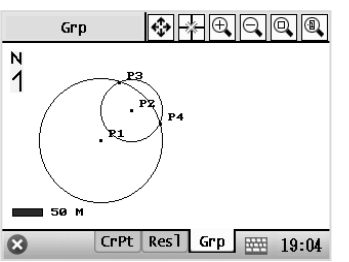
[Azimu]: The azimuth angle between P1 and P2. Click to switch to distance.

[Dis]: The distance between P1 and P2.

The intersection point can be displayed by graphics and saved by manual.

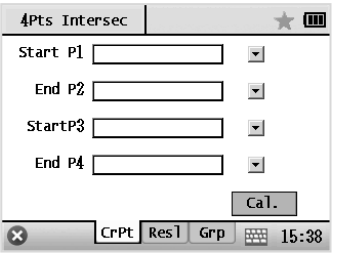






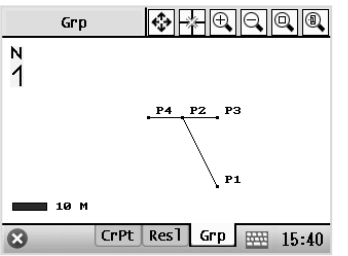
5.7 4 Pts Intersec

Calculate intersection point of two lines (P1-P2 and P3-P4)which are formed by four points.



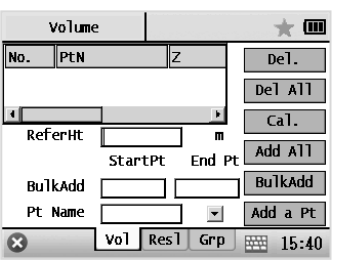
Start P1: The start point of line P1-P2
End P2: The end point of line P1-P2
Start P3: The start point of line P3-P4
End P4: The end point of line P3-P4

The intersection point can be displayed by graphics and saved by manual.



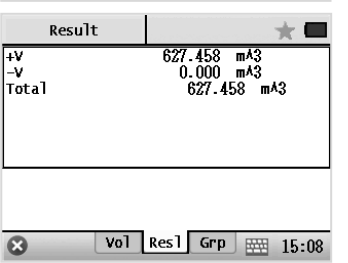
5.8 Volume

The system will create a triangulation network with the points from the list, and take the reference height as the reference plane to calculate the volume.



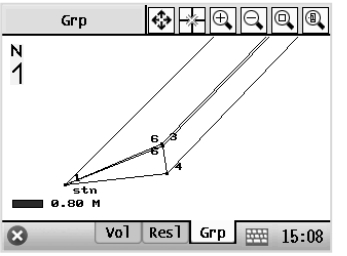
Refer HT: Input the reference height.

+V calculate the volume above the reference.
-V is below the reference.



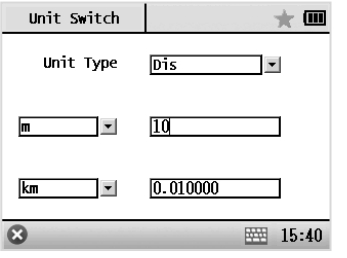
[Del.]: Delete the selected point.
[Del All]: Delete all points in the list.
[Cal.]: Calculate the volume.

[Add All]: Add all the points from current job. Maximum 200 points.
[Bulk Add]: Add several points.
[Add a Pt]: Add a single point.



5.9 Unit Switch

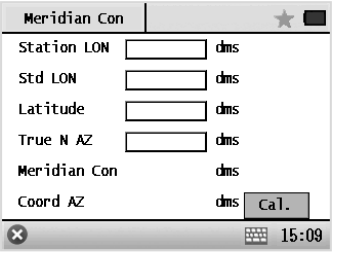
Switch the unit among distance, angle, area, volume and temperature.



5.10 Meridian Convergence

Calculate convergence of meridian with known information. Use this function when connect to gyroscope.

Please check the further details with gyroscope.

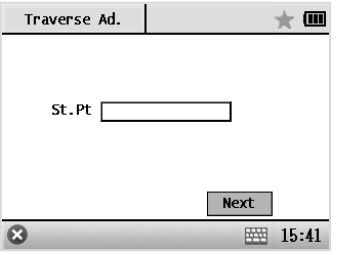


5.11 Traverse Ad.

St.Pt: Input start point of traverse.

End Pt: Input end point of traverse

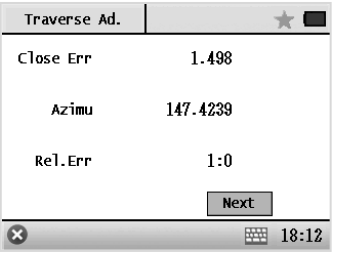
KnownPt: The known point which corresponding to the End point.



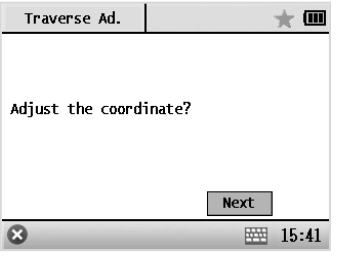
Close Err: Close error

Azimuth: Azimuth angle

Refer.Err: Reference error



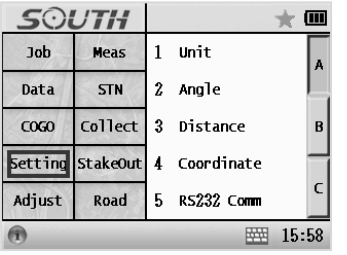
Adjust the coordinate and elevation for the traverse.



6. SETTING

Change the settings of below items:

1) Unit
2) Angle
3) Distance
4) Coordinate
5) RS232 Comm
6) Bluetooth
7) Power Manage
8) Others
9) Upgrade
10) Format
11) Initialize
12) App Install



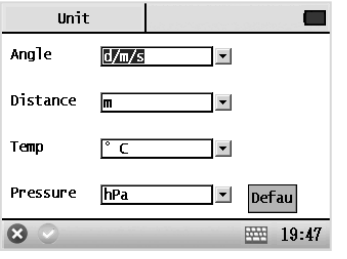
6.1 Unit

Angle: d/m/s, Gon, Mil

Distance: m, intnl.Feet

Temp: C°, °F

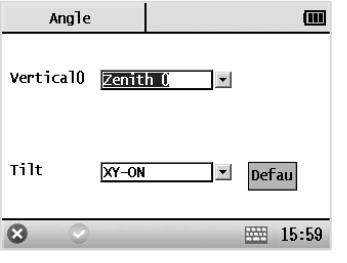
Pressure: hPA, mmHg, inHg



6.2 Angle

Vertical 0: Zenith 0, Horizontal 0

Tilt: OFF, X-ON, XY-ON



6.3 Distance

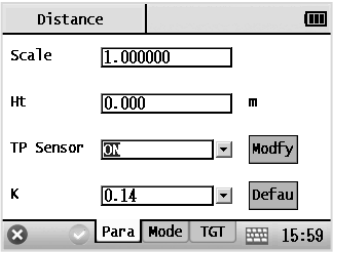
6.3.1 Para (Parameter)

Scale: 1.000000 in default, can be inputted by manual

Ht: Station height

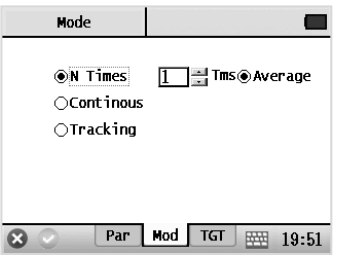
TP Sensor: ON, OFF. It can be modified by manual.

K: 0.14, 0.20



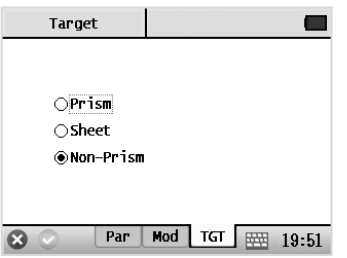
6.3.2 Mode

Click to select the measure mode among N Times (1-99), Continuous, and Tracking mode.



6.3.3 TGT (Target)

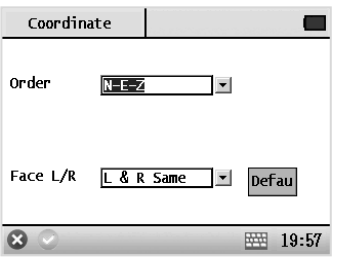
Click to select the target among Prism, Sheet and Non-Prism mode.



6.4 Coordinate

Order: N-E-Z, E-N-Z

Face L/R: L & R Same, L& R Symetric



6.5 RS232 Comm

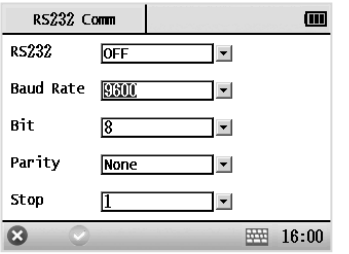
RS232: OFF, ON

Baud Rate: 4800, 9600, 19200

Bit: 8, 7

Parity: None, Odd, Even

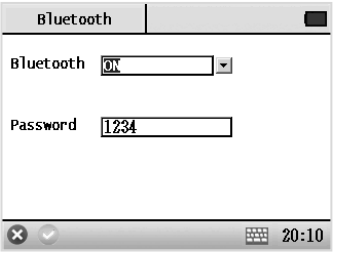
Stop: 1, 2



6.6 Bluetooth

Bluetooth: ON/OFF

Password: Input by manual.



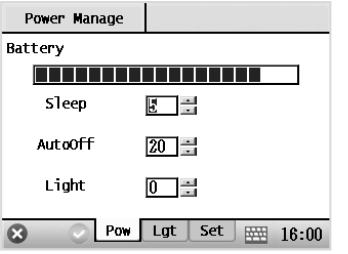
6.7 Power Manage

6.7.1 Powr (Power)

Sleep: Set the sleep mode from 0-10 minutes.

AutoOff: Set the auto-off mode from 0-60 minutes.

Light: Set the backlight auto-off from 0-5 minutes.

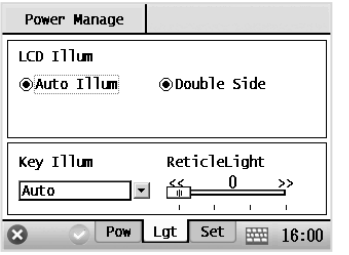


6.8.2 Lgt (Backlight)

LCD Illum: Activate the auto-backlight mode and double-side mode of LCD display

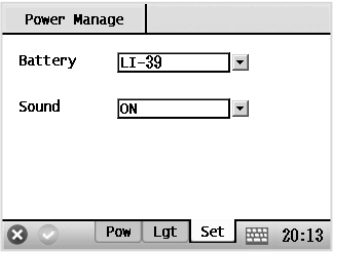
Key Illum: Turn on, off the backlight of keyboard, or set it as auto.

Reticle Light: The illumination level of reticle can be selected among 0 to 3.



6.8.3 Set

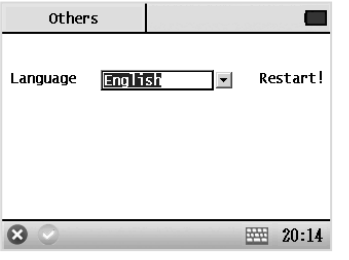
Sound: Turn on or off the sound of operation



6.8 Others

Choose the language.

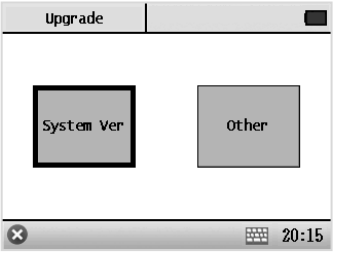
Note: Please contact your local dealer for further help.



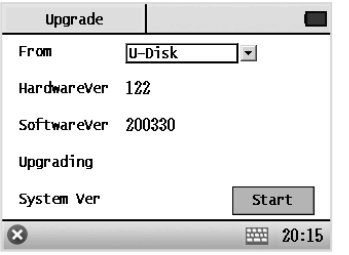
6.9 Upgrade

Please contact your local dealer and request for the upgrade software.

Copy the package to the RAM, SD

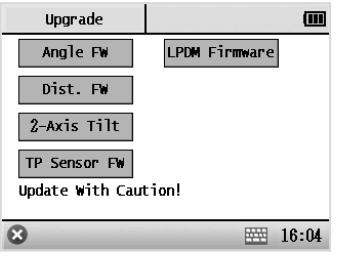


card or U-disk. The software cannot be renamed. Only one upgrade software can be stored in a storage media.



6.9.1 System Ver.

Select the storage media, then start the upgrading process. The version will be shown on the screen.

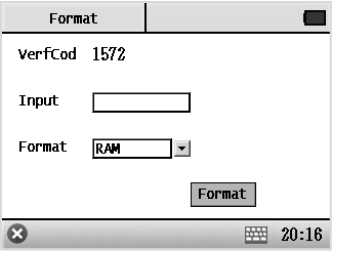


6.9.2 Other

Upgrade the firmware of angle, distance, dual-axis tilt sensor and T-P sensor.

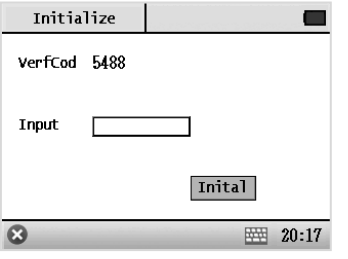
6.10 Format

Input the VerfCod on the blank to format the RAM, SD Card or U-Disk.



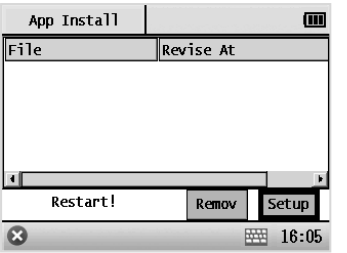
6.11 Initialize

Input the VerfCod on the blank to initialize the system settings back to default.



6.12 App Install

Install the third-party software on N40 series total station, if available.

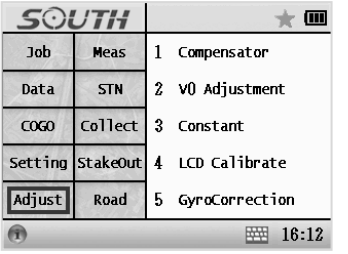


Remov: Remove the software

Setup: Setup the software

7. ADJUST

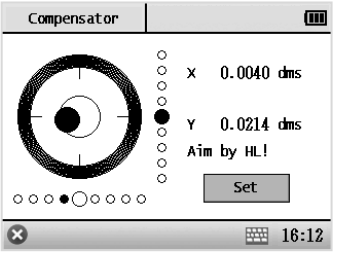
1) Compensator
2) V0 Adjustment
3) Constant
4) LCD Adjustment
5) Gyro Correction



7.1 Compensator

Please adjust and level the plate vial before calibration of compensator.

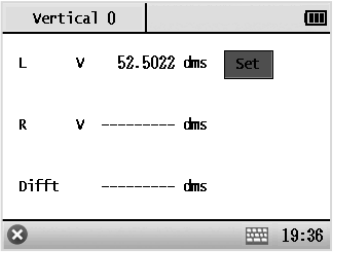
Aim at a same target precisely by HL/HR and then press **[Set]** to confirm the adjustment.



7.2 V0 Adjustment

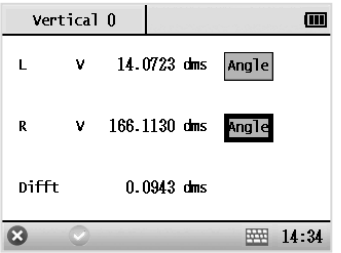
Please adjust the compensator and reticle unit before the vertical 0.

1. Aim at a target in Face 1 (HL).
2. Rotate the telescope and then aim at the same target in Face 2 (HR)
3. Press **[√]** in the bottom of screen to confirm the revised I-Angle



Note: If the index difference does not meet your requirements, please redo the steps.

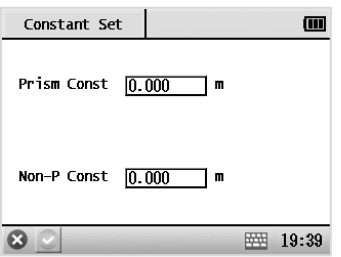
Or contact your local dealer for further help.



7.3 Constant

The constant has been checked and adjusted before the shipment, K=0. It's stable and we advise to check it once or twice in a year. The adjustment should be operated on the base alignment. Please refers to Chapter 13.9 Instrument Constant (K) for further information.

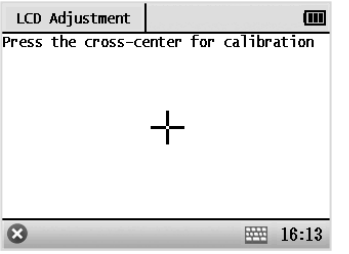
Prism Const: The additive constant of the prism mode.
Non-P Const: The additive constant of non-prism mode.



Note: Set the orientation through the vertical reticle to ensure Point A,B, and C on the same line. It must has a fixed and clear centering mark on Point B.
We suggest to use a tripod or a common-used tribrach. It is possible to reduce the inconsistency when changing the upper parts only.

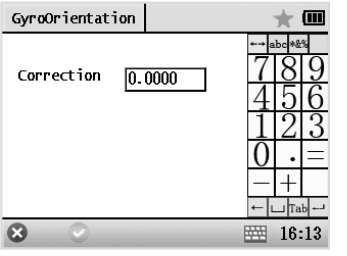
7.4 LCD Adjustment

Click the cross-line on the screen to calibrate the sensitivity of LCD display.



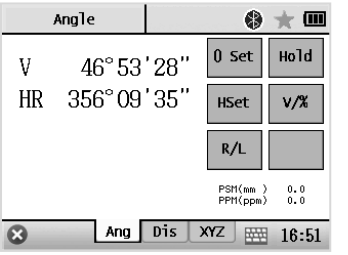
7.5 Gyro Correction

Input the value of gyro correction, this function only apply to total station which connect with Gyroscope.



8. MEASUREMENT

8.1 Angle



V: Vertical Angle

HR/HL: Horizontal Angle

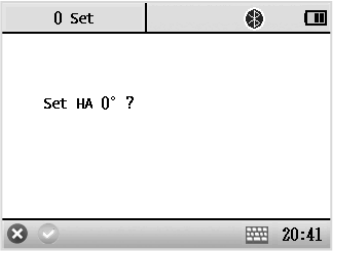
[0Set]: Set the horizontal angle as 0°.

[Hold]: Hold the horizontal angle until releasing it.

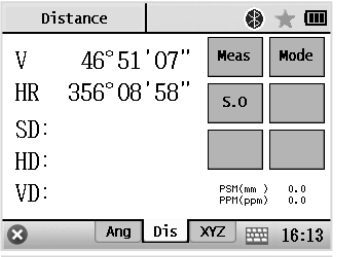
[HSet]: Set the horizontal angle by manual.

[V/%]: Switch the display method of vertical angle between value and percentage.

[R/L]: Switch between HR/HL



8.2 Distance



SD: Slope Distance

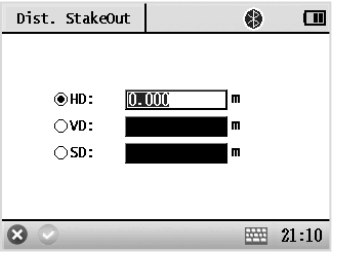
HD: Horizontal Distance

VD: Vertical Distance

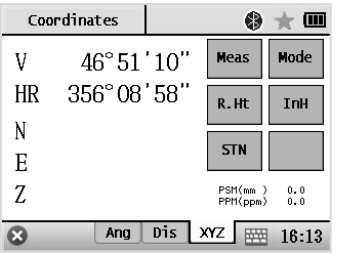
[Meas]: Start measurement.

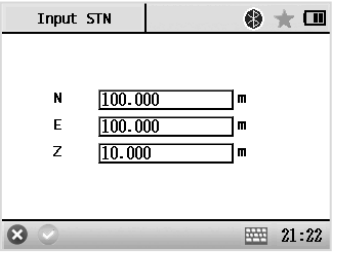
[Mod]: Change measurement mode among N times, Continuous and Tracking.

[S.O]: Enter the stake-out mode by input HD, VD and SD.



8.3 Coordinates





N: North coordinate.

E: East coordinate.

Z: Elevation

[Meas]: Start measurement.

[Mod]: Change measurement mode among N times, Continuous and Tracking.

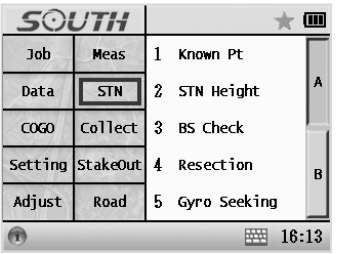
[R.Ht]: Input the reflector height.

[InH]: Input the instrument height

[STN]: Input the coordinates of station. The backsight should be reset.

9. STATION

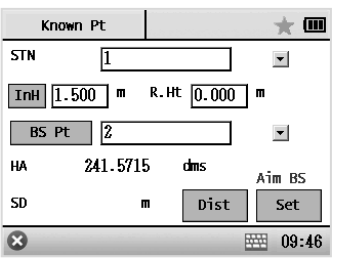
1) Known Point
2) Station Height
3) BS Check
4) Resection
5) Gyro Seeking
6) Point to Line
7) Multi-Direction



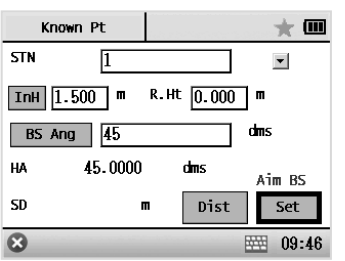
9.1 Known Point

Setup the station by known points. The backsight can be defined by coordinate or by angle.

Station: Input or select a point from the memory.
[InH]: Input the instrument height. If your total station features Auto Height function, click it to get the instrument height.
R.Ht: Input the reflector height.



BS Pt: Input or select a point as backsight. Click to switch.
BS Ang: Input the angle to define the backsight.
HA: Current horizontal angle.
[Dist]: Measure the distance of target.
[Set]: Set the angle of backsight point.



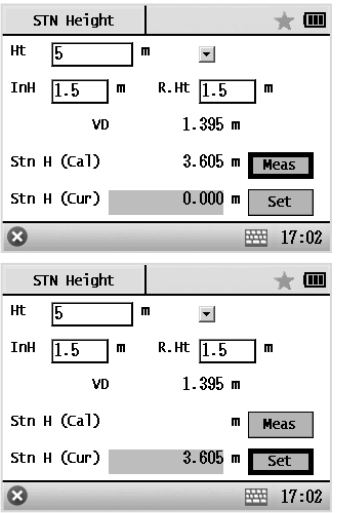
9.2 Station Ht

Calculate the station height by measuring a point with known height. User should setup the station before calculation.

Ht: Input or select the height of known point from data list.
InH: Input the instrument height.
R.Ht: Input the reflector height.

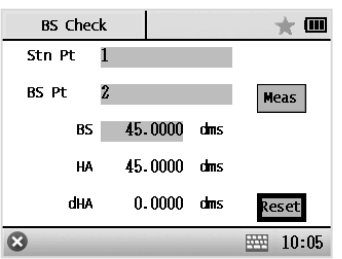
VD: Vertical distance
StnH(Cal.): the result of calculated station height.
StnH(Cur): Current station height.

[Mea]: Measure the known point.
[Set]: Set the calculation result as the current station height.



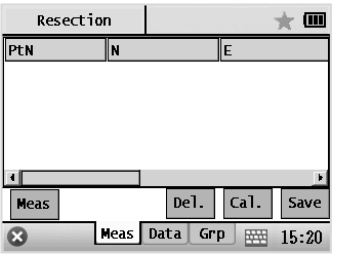
9.3 BS Check

Double check the backsight
BS: Backsight angle.
HA: Current horizontal angle.
dHA: Difference between backsight and horizontal angle.
[Reset]: Reset the backsight.

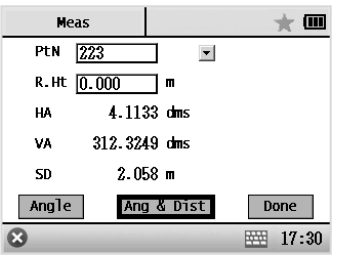


9.4 Resection

Resection calculate the coordinate of station by known points.



[Meas]: Measure the known points.
[Del.]: Delete the selected points.
[Cal.]: Calculate the points.
[Save]: Save and set the station.



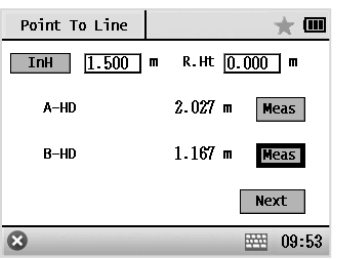
PtN: Input or select a known point
R.Ht: Reflector height.
[Angle]: Angle measurement only.
[Ang&Dist]: Angle and distance measurement.
[Done]: Save and back to point list.

9.5 Gyro Seeking

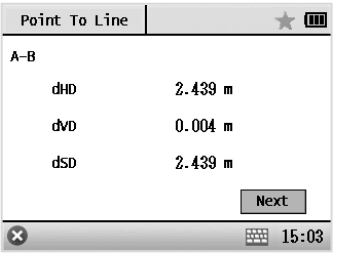
This function only apply to total station which connect with gyroscope. Please check gyroscope manual for details.

9.6 Point to Line

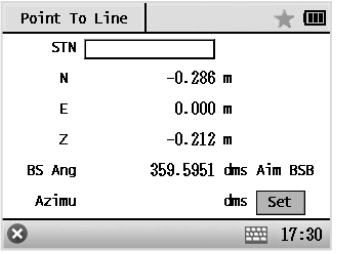
This function calculates the coordinate of unknown occupied point from two known points.



[InH]: Input or click the button (if your total station features Auto Height function) for instrument height.
[Meas]: Measure two points to define a line.



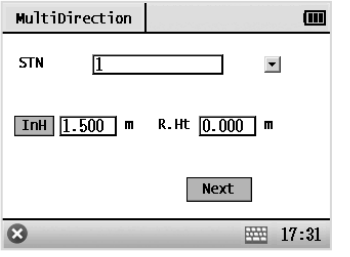
d HD: Difference of horizontal distance
d VD: Difference of vertical distance
d SD: Difference of slope distance



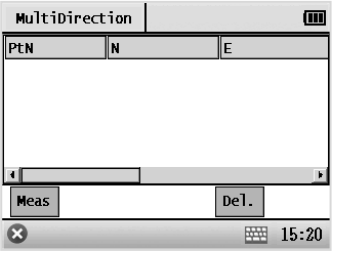
[Set]: Click to set the current result as station.

9.7 Multi Direction

Multi-direction correct the deviation and azimuth of coordinate by define the station point and the other known points.



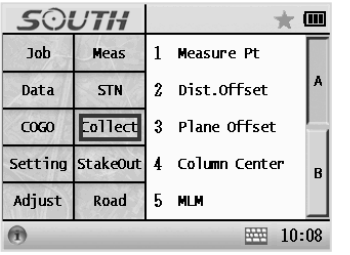
Station: Input or select a point from data list.
[InH]: Input or click the button (if your total station features Auth Height function)



[Meas]: Measure the known points.
[Del.]: Delete the selected points.

10. COLLECT

1) Measure Point
2) Dist. Offset
3) Plane Offset
4) Column Center
5) MLM
6) Line & Ext.Dist.
7) Line & Ext.Ang.
8) REM
9) F1/F2



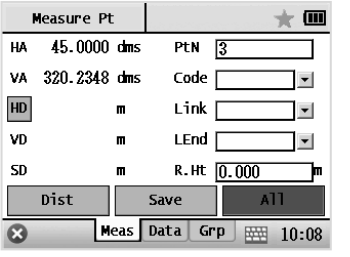
10.1 Measure Pt

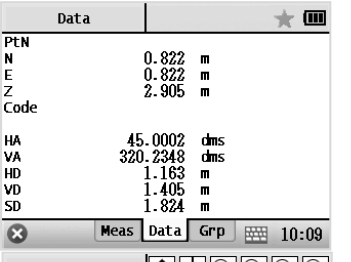
HD/VD/SD: Measure the point with HD/VD/SD. Click to switch it as N/E/Z.
N/E/Z: Measure the point with N/E/Z

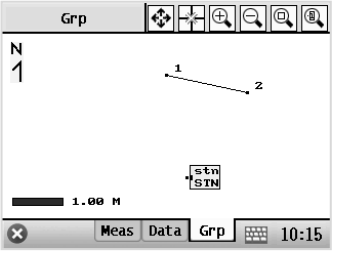
PtN: Input the point name
Code: Input or select the code from code list.
Link: N40 will create a link from the known point to current point, and this line will display in graphics.
L End: Input a point name for ending.

[Dist]: Measure the distance
[Save]: Save the previous result.
[All]: Measure and save.

{Data}: Display the calculated result.
{Grp}: Display the points by graphics.

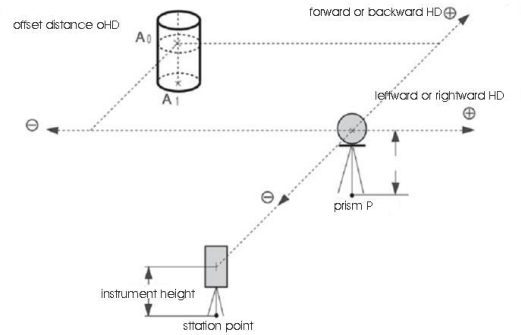






10.2 Dist. Offset

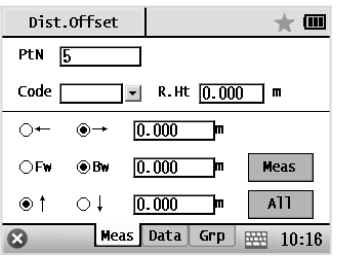
This function calculates the coordinate of an unknown point based on lateral and longitudinal offset or height difference.



←/→: Left/Right. Select and input the value.

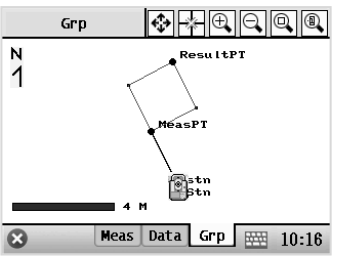
Fw/Bw: Frontward and backward. Select and input the value.

↑/↓: Upward/Downward. Select and input the value.



[Meas]: Measure the point based on offset value.

[All]: Measure and save.

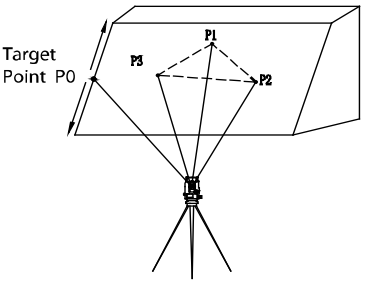


{Data}: Display the calculated result.

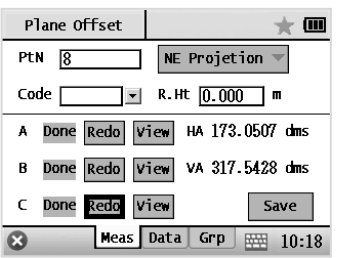
{Grp}: Display the graphics of distance offset.

10.3 Plane Offset

This function calculates the point which cannot be measured directly. N40 will calculate the other three points (A/B/C) in same plane at first. Then aim at the target (P0) to calculate the coordinate and SD/HD/VD



[NE Projection]: User can choose the projection among NE/ZE/ZN Projection.

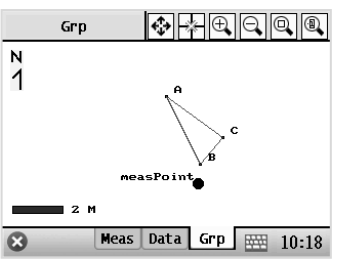


[Meas]: Measure three points in a same plane.

[Redo]: Re-do the measurement.

[View]: View the result of 3 points.

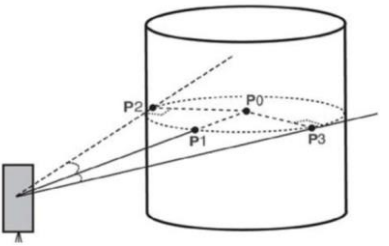
Rotate the EDM to find the unknown target. N40 will calculate the coordinate and HD/VD/SD.



[Save]: Save the calculation result.

10.4 Column Center

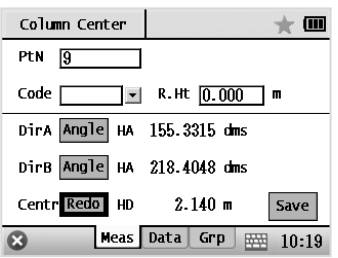
This function calculates the coordinate of a hidden point (P0) that is not directly visible inside from the surface center (P1) and edge (P2/P3) of column.



DirA: Collimate one side of column, press, press **[OK]** to measure

DirB: Collimate the other side of column, press **[OK]** to measure

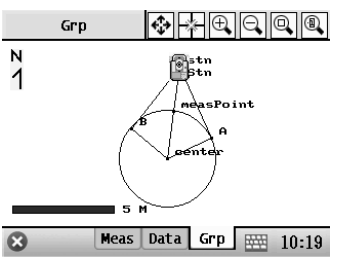
Centr: Collimate the surface center and press **[Dist]** to measure.



HA: Horizontal angle of column edge

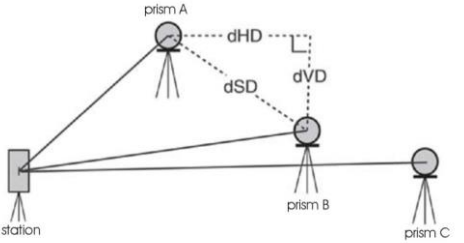
HD: Horizontal distance from instrument to column surface.

[Save]: Save the calculation result.



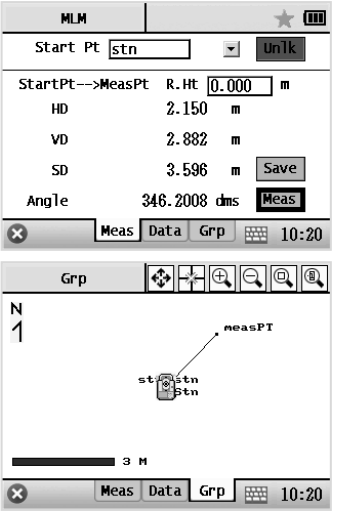
10.5 MLM

MLM, is mainly used to calculate the HD/ VD/ SD between A-B, A-C or A-B, B-C, etc.



Start Pt: Input, select or measure the start point.

[Lock]: Lock the start point. Otherwise, it will use the last point as start point.



HD: Horizontal distance between start point and measured point.

VD: Vertical distance between start point and measured point

SD: Slide distance between start point and measured point.

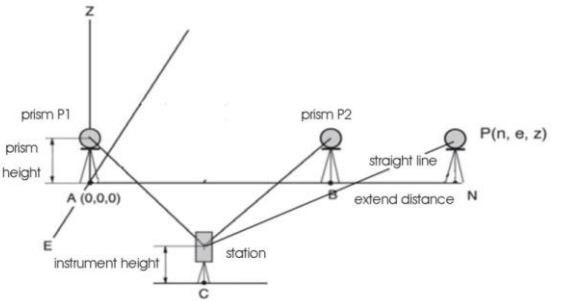
Angle: Azimuth angle from start point to measured point.

[Meas]: Measure the target

[Save]: Save the calculation result.

10.6 Line & Ext Dist

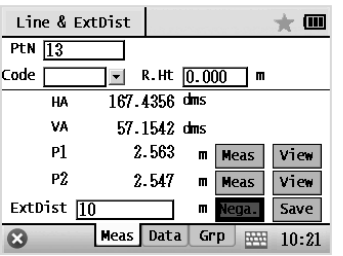
Line & extended distance, this function calculate the unknown point by a line defined by two points and an extent distance

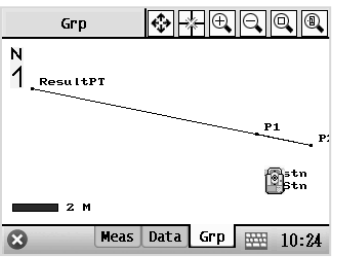


HA: The current horizontal angle.
VA: The current vertical angle.

P1: The slope distance to the first point.
P2: The slope distance to the second point.
[Meas]: Measure two points to define a line.
[View]: Check the coordinate.

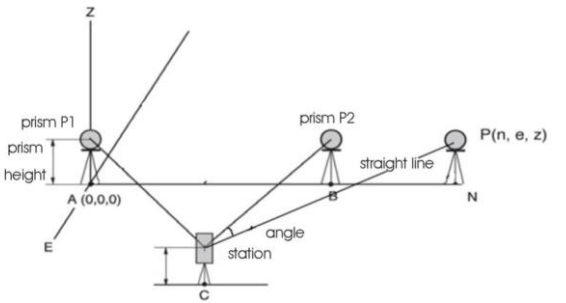
ExtDist: Input the extend distance.
[Posi.]: Positive direction, means the calculation starts from P2. Click to switch it to negative direction.
[Nega.]: Negative direction. The calculation starts from P1.
[Save]: Save the extended point.





10.7 Line & Ext Ang

Line & extended angle, this function calculate the unknown by a line defined by two points and an extended angle.

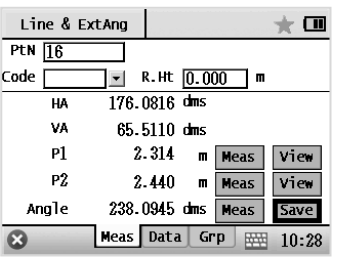


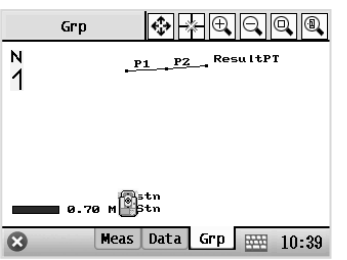
HA: The current horizontal angle.
VA: The current vertical angle.

P1: The slope distance to the first point.
P2: The slope distance to the second point to define a line.
Angle: The angle of extended point.

[Meas]: Measure two points to define a line.
[View]: View the measurement result.

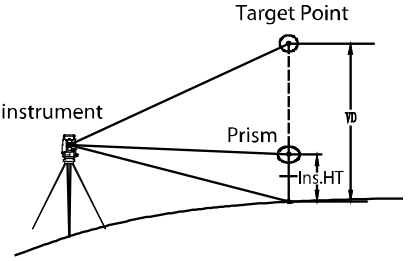
[Save]: Save the coordinates of extended point.



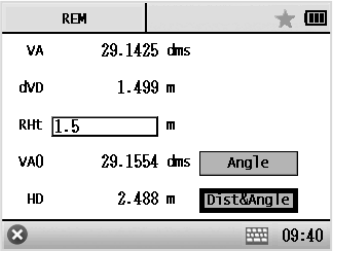


10.8 REM

Points directly above the prism can be determined without a prism at the target point.



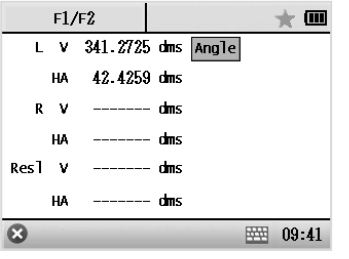
VA: Current vertical angle.
dVD: Vertical distance of target
R.Ht: Reflector height.
VA: Vertical angle of prism point
HD: Horizontal distance of prism point



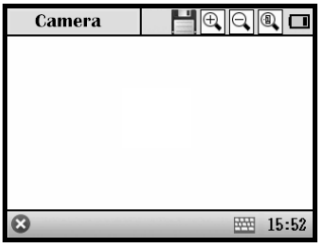
[Angle]: Measure the angle
[Dist&Angle]: Measure the angle and distance together.

10.9 F1/F2

Measure angle by Face 1 and Face 2 to get the final reading.



10.10 Camera (Optional)



You can do the target shooting, display setting, saving in this program

Setting the camera images

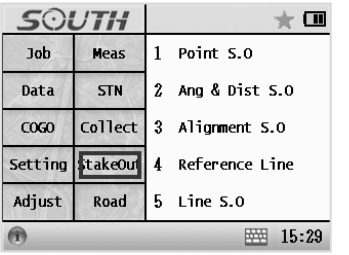
Zoom in

Zoom out

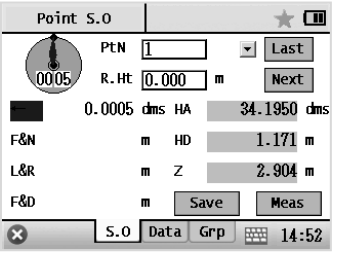
Save

11. STAKE OUT

1) Point S.O
2) Angle & Distance S.O
3) Alignment S.O
4) Reference Line
5) Line S.O

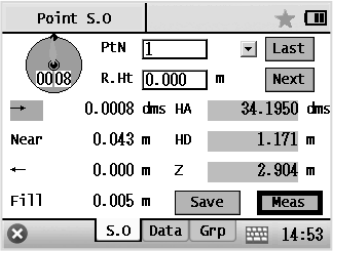


11.1 Point S.O

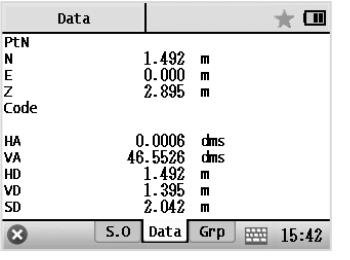


Pt: Input, measure or select a known point.
[Last]: Back to the last stake-out point.
[Next]: Select the next stake-out point.

HA: Horizontal angle of stake-out point.
HD: Horizontal distance of stake-out point.
Z: Elevation of stakeout point.

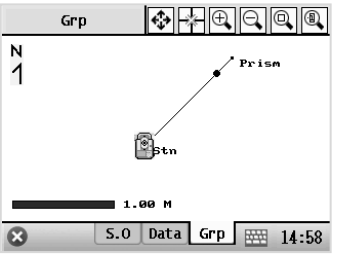


←/→: Rotate the EDM until it becomes 0. The e-compass will help you find the direction easier.



F&N: Move the target far away from or near to the equipment, until 0.
L&R: Move the target to the left or right side, until 0.

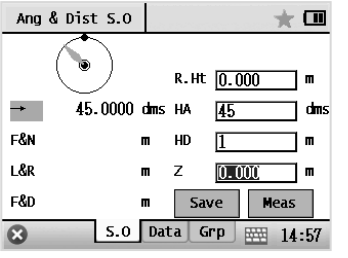
F&D: Move the target upward (Fill) or downward (Dig), until 0.



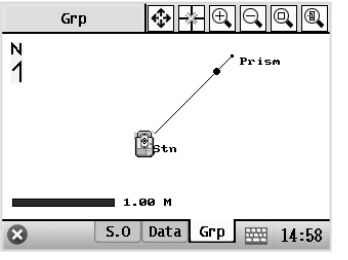
[Meas]: Measure the target, then move it based on the guidance.
[Save]: Save the current point.

11.2 Ang & Dist S.O

Stake out a point by angle (azimuth) , distance (HD) and elevation (z). The HA, HD and Z are based on station.

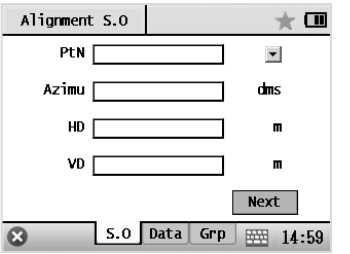


HA: Input the horizontal angle for stake out.
HD: Input the horizontal distance for stake out.
Z: Input the elevation (vertical distance) for stake out.



Find the stake-out point until the value becomes 0.

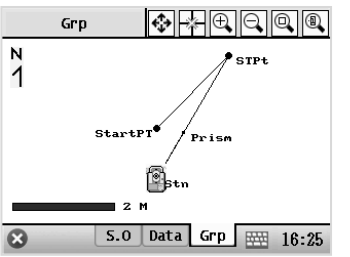
11.3 Alignment S.O



Stake out a point by a known point and the related angle (HA), distance (HD) and elevation (Z).

PtN: Input, measure or select a known point.
Azimu: Input the azimuth angle from the known point to the stake-out point.
HD: Input the horizontal distance.
VD: Input the vertical distance.

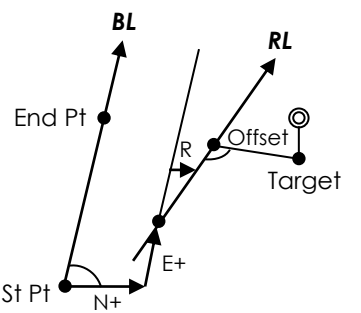
Find the stake-out point until the value becomes 0.



11.4 Reference Line

This function calculates the coordinate of stake-out points by a known base line (defined by two known points), and the related offset.

The reference line can be offset either longitudinally, in parallel or vertically to the base line, or be rotated around the first base point as required.

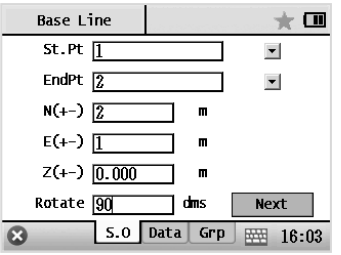


▶ ***BL:*** Base Line

▶ ***RL***: Reference Line

1) Define the base line

The base line is fixed by two known points – start point and end point. Those two points can be inputted, selected or measured.



▶ Define the reference line

2) Shift the reference line

The base line can be offset longitudinally, parallel and vertically or rotated. This new line is called the reference line.

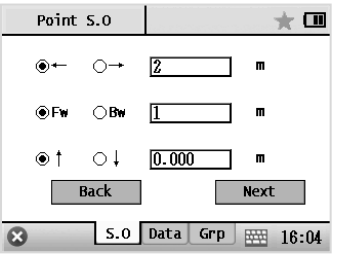
All measured data refers to the reference line.

N(+/-): Longitudinal offset.

E(+/-): Parallel offset.

Z(+/-): Vertical offset.

Rotate: Rotated angle.



▶ Define the offset of target

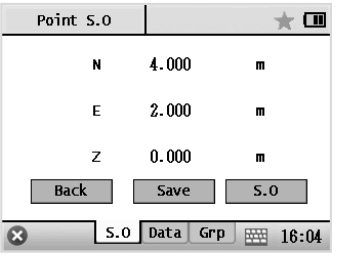
3) Define the offset of target

Then, it calculates the coordinate of target from longitudinal, parallel offsets and vertical difference of the target point relative to the reference line.

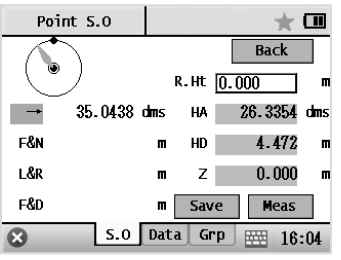
←/→: Parallel offset

Fw/Bw: Longitudinal offset

↑/↓: Vertical difference



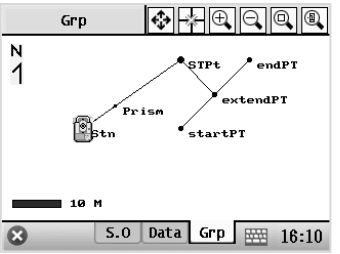
▶ The coordinate of target



▶ Stake out

4) Stake-out the target

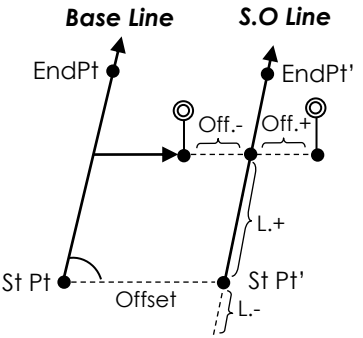
The program calculates the difference between the measured point and the calculated target point.



Find the stake-out point until the value becomes 0.

11.5 Line S.O

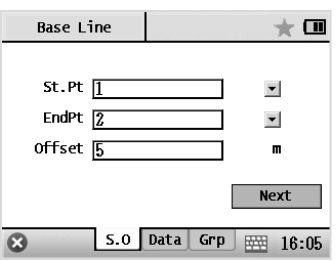
This function calculates the coordinate of stake-out points by a base line (defined by two known points) and the offset distance.



1) Define the base line

The base line is fixed by two known points – start point and end point. Those two points can be inputted, selected or measured.

Offset: Input the offset distance to find the stake-out line. The value can be negative or positive.



▶ Define the baseline and offset

2) Stake out the points

The program calculates the difference between the measured point and the

calculated target point.

Off.: Move parallelly to find the stake-out points, until it becomes 0.

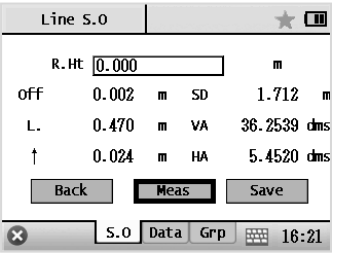
L.: Length from start point.

↑ / ↓ **:** Move vertically to find the stake-out points, until it becomes 0.

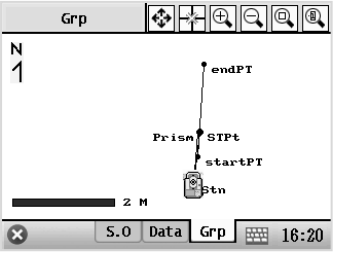
[Back]: Back to previous step.

[Meas]: Measure the target until the offset becomes 0.

[Save]: The coordinate of stake out point can be saved.



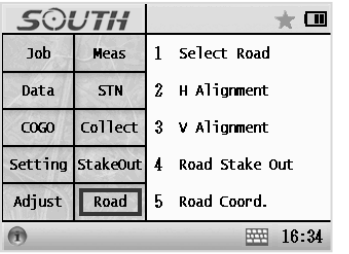
▶ Stake out the points



12. ROAD

This program enables users to easily define a line, curve or transition curve as a reference to measure or stake out.

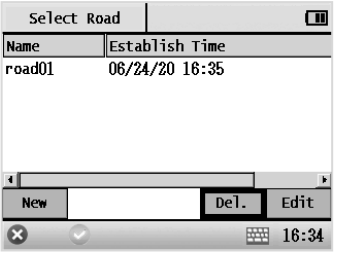
Before starting the roads, please set job, station and backsight at first.



12.1 Select Road

Select or create a new road under the current job. Each road consist of two elements: horizontal alignment and vertical alignment.

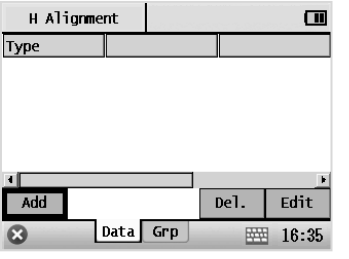
The selected road will be displayed in blue.



12.2 H Alignment

Define the horizontal alignment by start point, line, curve and transition curve.

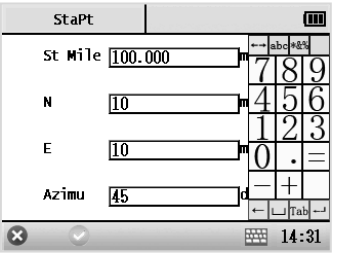
[Add]: Add an element.
[Del.]: Delete the selected element.
[Edit]: Edit the selected element.
{Grp}: Check the road by graphic



▶ Data list.

1) Start Point

The elements of start point included the start mile (**St Mile**), initial coordinate (**N/E**) and azimuth (**Azimu.**).

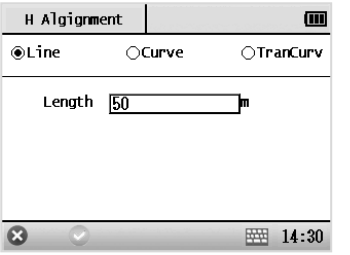


▶ Start Point

2) Line

The element of straight line only included the length.

Note: The value of length should be positive.



▶ Straight Line

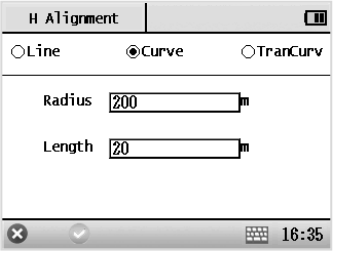
3) Curve

The elements of curve included the radius and length.

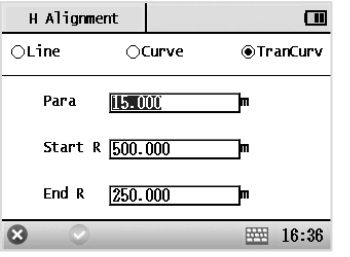
Note:

The value of radius depending on the direction. When the curve turns right, the value should be positive; otherwise, it should be negative.

The value of length cannot be negative, it should smaller than the value of radius.



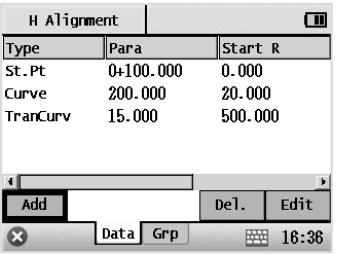
▶ Curve

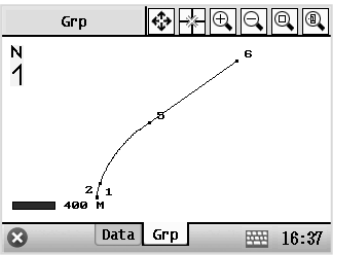


▶ Transition Curve

4) Transition Curve

The elements of transition curve included parameter (**Para.**), start radius (**Start R**) and ending radius (**End R**).



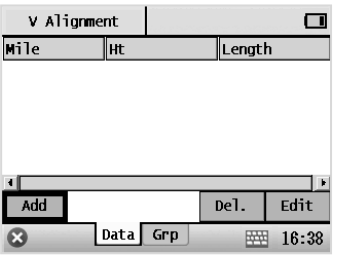


Note: The value of parameter depends on the forward direction of curve. When the curve turns right, the value should be positive; Otherwise, it should be negative.

If the radius is ∞, please keep 0 in the blank.

12.3 V Alignment

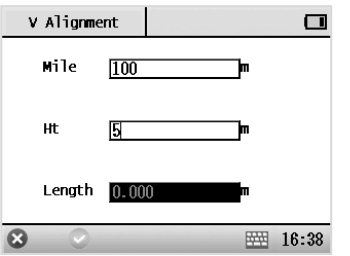
A vertical alignment consists of a series of intersections, including the mile, elevation and length.



[Add]: Add an element.

[Delete]: Delete the selected element.

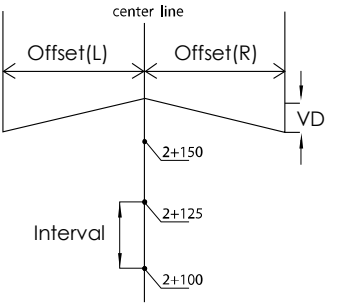
[Edit]: Edit the selected element.



Note: The length of start point and end point must be zero.

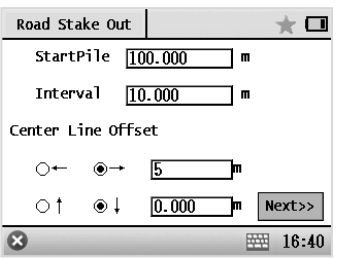
12.4 Road Stake Out

Interval: Interval between the stake-out points.
Offset: The left and right offset from the center line.

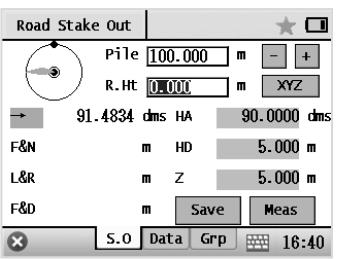


Start Pile: Start pile for road stake-out.
Interval: The interval between the stake-out points.

←/→: The left or right distance offset based on the center line.
↑/↓: The elevation offset between the stake-out point and center line.



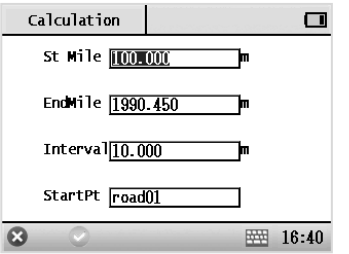
Pile: The pile number of current stake-out point.
[-] : Back to the last pile according to the pre-set interval
[+] : Skip to the next pile according to the pre-set interval
[XYZ]: View the coordinate of current stake-out point.

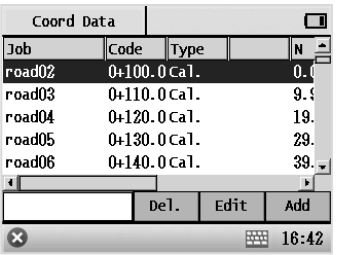


Move the prism to find out the stake-out points based on the guidance, then save the coordinates.

12.5 Road Coord.

After setting the horizontal and vertical alignment, the coordinates can be calculated and saved. You can find those points in data list, then stake out the calculated points separately.





St Mile: The start mile of calculation.
End Mile: The end mile of calculation.

Interval: The interval of the points
Start Pt: The start point of calculation. The point name will be saved as R01, R02, R03, etc.

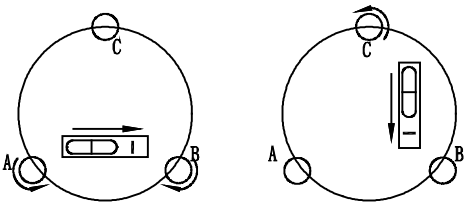
13. INSPECTION & ADJUSTMENT

The instrument has passed the procedure of inspection and adjustment before shipping to your side. However, after long periods of transportation or the changeable environment, some influences may occur to the internal structure. Before the instrument is used for the first time, please check and adjust the functions we introduced in this session to ensure the precision of the job.

13.1 Plate Vial

Inspection

Rotate the instrument after set-up (Refers to Chapter 2.2) to see whether the bubble is in center, if not, please adjust the vial bubble.



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 screws, which is parallel to the plate vial. Adjust the remaining half by adjusting pin.
2. Rotate the instrument in 180° to check whether the bubble is in the center. If not, repeat Step 1.
3. Rotate the instrument in 90°, adjust the third screw. Repeat the steps until the bubble remains in the center in any direction.

13.2 Circular Vial

Inspection

It is not necessary to adjust the circular vial, except the bubble is not in the center after the adjustment of plate vial.

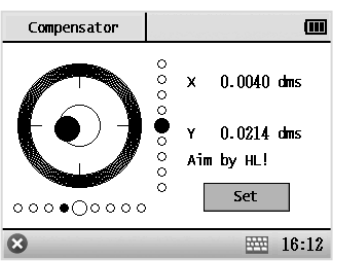
Adjustment

If the bubble of the circular vial is not in the center, adjust the bubble to the center by using the adjusting pin or hexagon wrench.

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. When the bubble stays in the center, keep the tightness of the three screws uniformly.

13.3 Compensator

Inspection



1. Leveling instrument accurately.
2. Turn on the setting page of e-bubble
3. Read the value of X & Y as X1 & Y1; Check the position of bubble.
4. Rotate 180° to read the value of X & Y as X2 & Y2.
5. Calculate the value of deviation as below:

Average Deviation of X=(X1+X2)/2

Average Deviation of Y=(Y1+Y2)/2

If the average deviation is less than ±20″, the compensator works well; Otherwise, please adjust the compensator.

Adjustment

Please refers to Chapter 7.1 Compensator for adjustment.

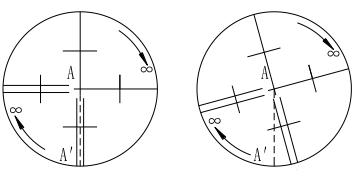
Repeat the steps for double check. If the deviation still overrange, please contact your local dealer for further help.

13.4 Inclination of Reticle

Inspection

1. Sight object A after leveling the equipment, lock the horizontal and vertical tangent unit and confirm the target A is in the center of reticle.
2. Move object A to the edge of the field of view, point A' by rotating the vertical tangent screw.
3. Adjustment is not necessary if object A moves along the vertical line of the reticle and point A' still in the vertical line.

Otherwise, as picture shown, A' is deviate to the center of the vertical cross-hair, it is necessary to adjust.

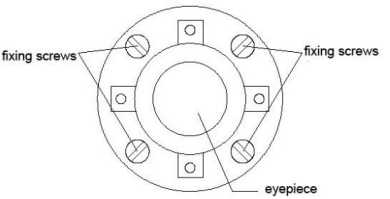


Adjustment

1. Remove the eyepiece cover to expose the four reticle adjusting screws, as picture shown.
2. Loosen the four reticle adjusting screws uniformly by the adjusting pin. Rotate the reticle around the sight line and align the vertical line of the reticle with point A'.

3. Tighten the adjusting screws slightly. Repeat the previous steps to see whether the position is correct.

4. Assemble the eyepiece cover back.



13.5 Perpendicularity between Sight of View & Horizontal Axis (2C)

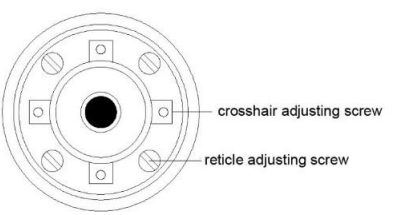
Inspection

1. Set object A at a far distance at the same height as the instrument, leveling the instrument and turn on the power (e.g. HL=10°13'10").

2. Sight object A in horizontal left and read value of HA. (e.g. HR= 190°13'40").

3. Loosen the vertical and horizontal tangent unit and rotate the telescope. Sight object A in horizontal right and read the HA.

4. 2C =HL-HR±180°=-30"≥±20", overrange. So it is necessary to adjust 2C.



Adjustment

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

reading which has been eliminated C:

$$R+C=190°13'40"-15"=190°13'25"$$

2. Take off the cover of the reticle between the eyepiece and focusing screw. Adjust the left and right 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.

Note: After adjustment, please check the photoelectricity coaxially.

13.6 Vertical Index (I Angle) & V0 Adjustment

Inspection

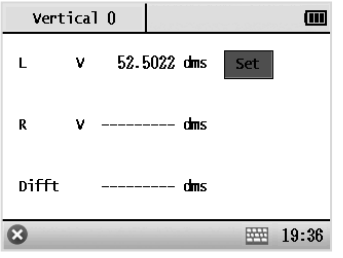
1.After leveling the instrument, aim at a target A in HL. Record the value as L.

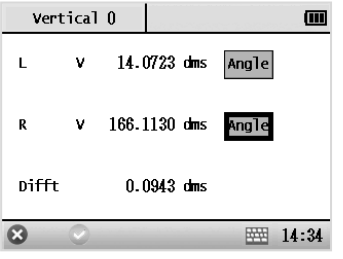
2.Rotate the EDM and aim at the target A in HR. Record the value as R.

3.If the vertical 0 is zenith 0, I =(L + R - 360°)/2. If the vertical 0 in horizontal 0, I= (L + R - 180°)/2 or (L + R - 540°)/2.

4. If $|i| \geqslant 10"$, it's necessary to adjust the Vertical 0.

Note: The value of vertical angle is not adjusted, for reference use only.





Adjustment

Please refers to Chapter 7.2 V0 Adjustment.

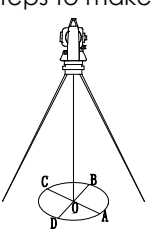
13.7 Optical Plummet

Inspection

1. Set the instrument on the tripod and place a piece of white paper with a cross lines on it below the equipment.
2. Adjust the focus of optical plummet. Move the paper until the intersection point of the crossline on the paper comes to the center of optical plummet.
3. Adjust the leveling screws and keep the center mark of the optical plummet coincides with the intersection point of the crossline precisely.
4. Rotate the instrument and check whether the position of center mark coincides with the intersection point of the crossline in every 90°.
5. If the center mark always coincides with intersection point, it is not necessary to adjust.

Adjustment

1. Take off the protective cover between the plummet eyepiece and focusing knob.
2. Rotate the instrument and mark the point of the center of optical plummet which falls on the paper in every 90°. Point A, B, C, and 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 steps to make the instrument meets the requirements.



13.8 Laser Plummet

Inspection

1. Activate the laser plummet, from star key - Plummet
2. Repeat the inspection steps as Chapter 13.7
3. If the laser point keep coincide with the intersection point, it is not necessary to adjust.

Adjustment

If the laser plummet was broken, please contact your local dealer to change a new one.

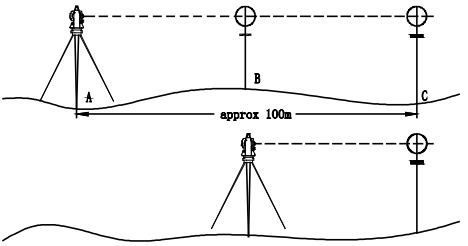
13.9 Instrument Constant (K)

The Instrument constant has been checked and adjusted in the factory, and K=0. Please do not modify the constant without permission.

Inspection

1. Mount and level the instrument on Point A on flat ground. Use the vertical hair to mark Point B and Point C with the distance of 50m on the same line, and collimate the reflector accurately.
2. After setting temperature and pressure value, measure the horizontal distance of AB and AC accurately.
3. Setup the instrument on Point B and center it accurately. Measure the horizontal distance of BC.
4. Then you can get the Instrument Constant: K = AC - (AB + BC). The value of K should be close to 0. If |K|>5mm, the instrument should be strictly inspected on the base alignment, and adjust it according to the

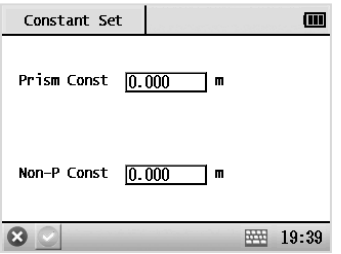
inspection value.



Adjustment

Prism Const: The additive constant of the prism mode.

Non-P Const: The additive constant of non-prism mode.



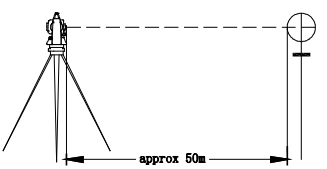
Note: Set the orientation through the vertical reticle to ensure Point A,B, and C on the same line. It must has a fixed and clear centering mark on Point B.

We suggest to use a tripod or a common-used tribrach. It is possible to reduce the inconsistency when changing the upper parts only.

13.10 Coincidence between Sight of View & Emitting Axis

Inspection

1. Set a target 50m away from the instrument.



2. Aim and measure the center of target.

3. Rotate the tangent screw to launch electric collimation and make the light path of EDM unblocked. In the bright zone, find the center of emitting photoelectric axis.

4. Check whether the center of reticle coincide with the center of emitting photoelectric axis. If yes, the instrument is eligible.

Adjustment

If there is any difference between sight of view and emitting axis, please send the instrument to your local dealer for repair and maintenance.

13.11 Levelling Screws on Tribrach

If any one of those leveling screws was loosed, please tighten the adjusting screws on the side of leveling screw appropriately.

14. SPECIFICATIONS

TELESCOPE		
Image		Erect
Tube length		152mm
Effective aperture		45mm (DTM: 47mm)
Magnification		30x
Field of view		1°30'
Resolving power		3"
Minimum focus		1.5m
Reticle illumination		4 brightness level
ANGLE MEASUREMENT		
Accuracy		2"
Measuring method		Absolute encoding
Diameter of disk		79mm
Minimum reading		1"
Detection method		Horizontal: dual; Vertical: dual
Unit		360 degree/ 400 gon/6400 mil
Vertical angle 0°		Horizontal 0/ Vertical 0
DISTANCE MEASUREMENT		
Range	Non-prism	1000m
	Prism	5000m
Accuracy	Non-prism	3+2ppm
	Prism	2+2ppm
	Sheet	3+2ppm
Measure interval		Fine: 1.2s; Tracking: 0.2s

Atmospheric correction		Manual input, auto correction
Prism constant		Manual input, auto correction
Temperature correction		Sensor reading
Distance reading		Max: 99999999.999m; Min: 1mm
COMPENSATOR		
System		Liquid, dual axis
Working range		±6'
Accuracy		1"
PLUMMET		
Laser plummet	Accuracy	±1.5mm @1.5m
	Brightness	5 brightness level
	Wavelength	635nm
	Laser class	Class 2
	Laser power	0.5mW
LPDM module	Range	0.5m-3m
	Min. reading	1mm
	Accuracy	±3mm*
Optical plummet	Image	Erect
	Magnification	3x
	Min. Focusing	0.5m
	Field of view	5"
KEYBOARD AND DISPLAY		
Keyboard		Alphanumeric 30 keys
Display		3.5 inches, color touch
Resolution		320*240 dpi
Position		Face 1, face 2

INTERFACE	
Data interface	RS-232 serial port
	USB, SD card, Mini USB port, Bluetooth
BATTERY	
Type	Lithium, 7.4V
Operating time	8 hours
VIAL	
Plate vial	30"/2mm
Circular vial	8'/2mm
GENERAL	
Storage	98M, 833000 data block
IP	IP54
Size	206*200*353mm
Weight	Approx. 6.0kg

** Under good conditions, Kodak Gray card, 80% reflectance*

15. SAFETY GUIDE

15.1 Internal Distance Meter (Visible Laser)

Warning

The total Station is equipped with an EDM of Laser Class 3A/III a and it is verified by these labels as follows:

There's an indication label "CLASS III LASER PRODUCT" above the vertical clamp screw on Face Left as well as on the Face Right.

The product is classified as Class 3A laser product, according to the standards as follows:
IEC60825-1:2001 "SAFETY OF LASER PRUDUCTS"

The product is classified as Class III a laser product according to the standards as follows:
FDA21CFR ch.1 § 1040:1998 (U.S. department of Health and Human Services, Code of Federal Regulation)
Class 3A/III a laser product: It is harmful to observe the laser beam continuously. Users should avoid staring at the laser directly. It can reach as much as 5 times the emitting limit of Class 2 / II with a wavelength between 400nm and 700nm.

Warning

It is dangerous to continuously look straight at the laser beam.

Prevention

Do not stare at the laser beam, or point the laser beam at others. Reflecting laser beam is also valid.

Warning

When the laser beam emits on prism, mirror, metal surface, window, it might be dangerous to look directly by the reflecting light.

Prevention

Do not stare at the direction which the laser beam might reflects. When the laser is opened, do not look at it near to the optical path or the prism. It is only allowed to observe the prism through the telescope of the total station.

Warning

It is dangerous to make improper use of the Class IIIa laser equipment.

Prevention

To avoid injury, all the users should take safety precautions, and must make sure that everything is under control within the distance that might bring dangers (according to IEC60825-1:2001)

There are explanations of some principle points of related standard as follows:

Class 3R laser product is used in outdoors and construction site (measuring, defining alignment, leveling, etc.). The laser equipment can only be installed, adjusted and operated by those persons who have taken related training course and got the authentication.

a. Set related laser warning marks on site.

b. Prevent anyone from looking straight at the laser beam directly or through optic instrument.

c. To avoid the harm brought by laser, users should block the laser beam at the end of the working route. When the laser beam passes

through the restricted area (harmful distance*), and there are persons taking activities, users must stop the laser beam in time.
d. The optical path of the laser beam should be set higher or lower than the line of sight.
e. When the laser instrument is not in use, users should keep it well. It is not allowed for operation unless the user is authenticated.
f. Prevent the laser beam from accidentally emitting at mirror, mental surface, window, etc. Especially pay attention to the surface of plane mirror or concave mirror.

* Harmful distance suggests that the maximum distance from the start point of the laser beam to the point which the laser beam is weakened to a certain degree that doesn't harm people.
The internal distance measure product which is equipped with a Class3R/III a Laser Product has a harmful distance of 1000m (3300ft). Beyond this distance, the laser strength is weakened to Class I (It is not harmful to look straight at the laser beam.

15.2 Laser Plummet

The internal laser plummet sends out a ray of red visible laser beam from the bottom of the instrument.

This product is classified as Class 2/II laser product.
Class 2 laser product is in accordance with the following standard:
IEC 60825-1:1993 "SAFETY of LASER PRODUCTS"
EN 60825-1:1994+A II:1996 "SAFETY of LASER PRODUCTS".

Class II laser product is in accordance with the following standard:
FDA21CFR ch.1 § 1040:1998 (U.S. Department of Health and Human Services, Code of Federal Regulations).

Class 2/II Laser Product:
Do not stare at the laser beam or point it at others. Users should prevent the laser beam and the strong reflecting light from impinging into eyes so as to avoid incurring harm.