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Foreword

WinMG2007

WinMG2007 is designed for field work，it can only run on WinCE operating system. WinMG2007 is easy to operate, powerful, user-friendly, and practical.

Copyright

This manual will introduce you how to use WinMG2007.we suggest you read it carefully.

All copyrights of the manual are reserved by our company. In the scope of copyright protection, reproduction, adaptation will be prohibited without the written consent of company.

Registered trademarks

AutoCAD, WinCE is registered trademarks. All those trademarks are the property of their respective owners.

Technical Service

From the day you buy WinMG2007，you have the right to ask for our after service.
Mail-box: softspt@vip.sina.com.

Hardware

High efficiency ARM or MIPS CPU
16MB memory
320×240 Touchscreen
Serial and USB port
Pen

Software

WinMG2007 is only suitable for the WIN total station with Microsoft Windows CE.net

Unpacking:

	Name	Quantity

1	WinMG2007 manual	1
2	Total Station Communication Cable	1

Caution

When you use the command of Save, Save As, Coord Export, File Export in WinMG2007， do save all the new files in the default file location SouthDisk.

1 Install WinMG2007

We sent along a CD and instruction manual with every total station. You can find WinMG2007, Microsoft ActiveSync, and driver for Win Total Station in the CD.

1.1 Install Microsoft ActiveSync and Driver

1.1.1 **Caution**

- After the installation of Microsoft ActiveSync，you must restart the computer. We suggest that you close all programs and save your work.
- Connect the computer with Win Total Station, and then you will get a message asking for the installation of drivers. Please download them from the CD attached with total station.

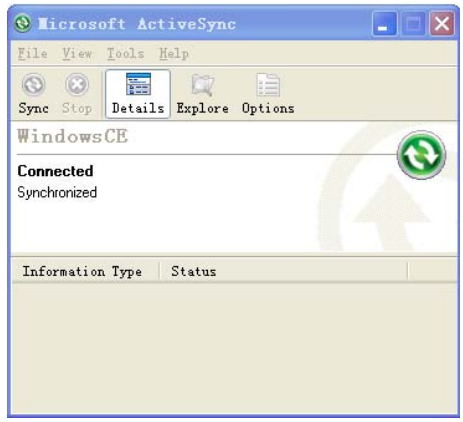
1.1.2 Install Microsoft ActiveSync

Put the disk into CD-ROM drivers and run “Microsoft ActiveSync”
The setup wizard will guide you through the process of installation.

After the installation, please restart the computer.

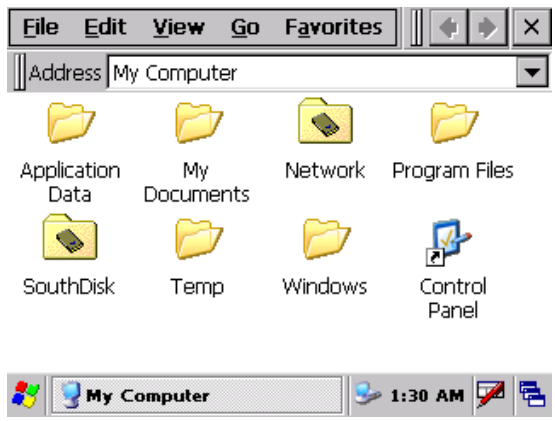
- Connect the computer and the total Station with Communication Cable.

Then turn on the total station, once the connection is successful, you will get the following figure as shown



1.1.3 Browse

Click the browse button, then you can see all the data of this connected total station and, you can also delete, copy, and move the files.



1.1.4 Installation for Driver of Win Total Station

If you do not have the driver for the Win total station on your computer the connection will stop and prompt for it, then follow the setup wizard to finish the installation.

After the installation, reconnect the computer and the total station.

1.2 Installation of WinMG2007

After the successful connection between the computer and the total station，you can setup or upgrade the WinMG2007.Click the “setup.exe” under the folder of WinMG2007 on your disk, you get the following figure.

WinMG2007

Click “Install” as shown in the following figure.

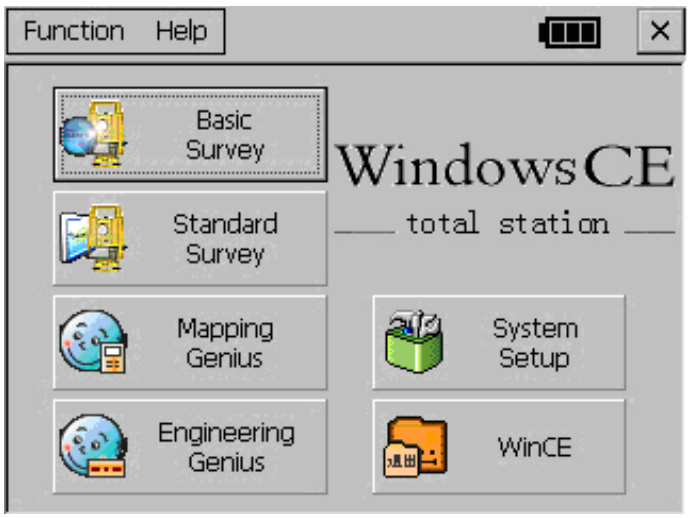
WinMG2007

The setup will cost you 2-5 min， then click ok, and finish the installation.

2. INTRODUCTION OF WINMG2007

2.1 Interface

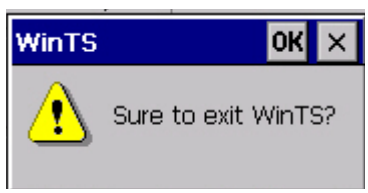
Press the POWER button on the keyboard, the interface of Win total station will be showed as follows



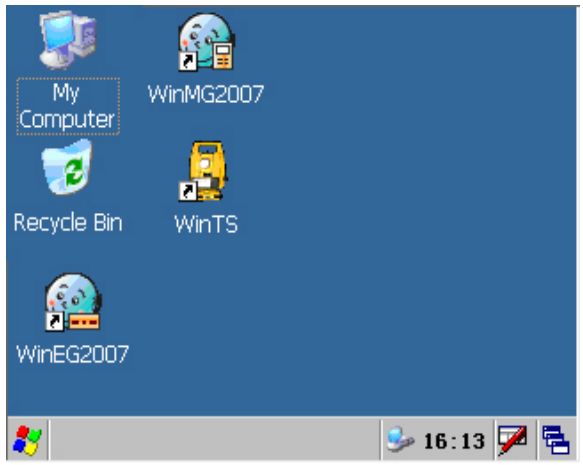
WIN Total Station Interface

Click

, you get a message asking for confirmation of quit.

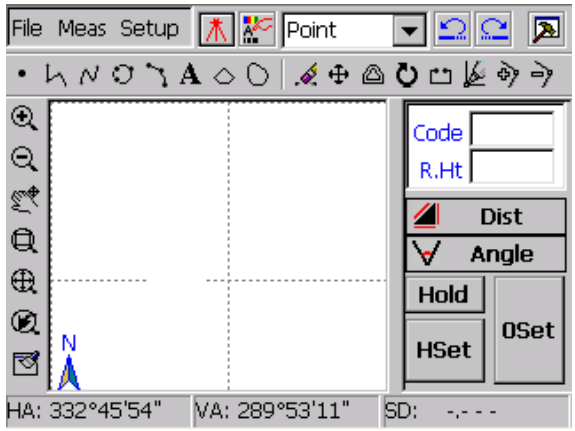


If click OK, you enter the interface of WinCE operating system



System Interface

Run WinMG2007, the following figure as shown.



WinMG2007 Interface

In the interface of WinMG2007

From left to right in the first row, we have three pull-down menus: File, Meas, Setup; Two icons: E-Panel and Attribute; Pull-down menu: Symbol selection, three icons: Revoke, redo and Measuring panel.

The second line are tools for mapping, they are: Point, Poly line, Curve, Circle, Arc, Annotation Text, Closed Polyline, Closed Curve, Delete, Move, Offset Copy, Rotate, Break, Move the Node, Add Node and Delete Node.

The left of the screen is a toolbar of the view manipulation, they are: zoom out, zoom in, Pan, Windowing, Zoom all, Previous and Refresh.

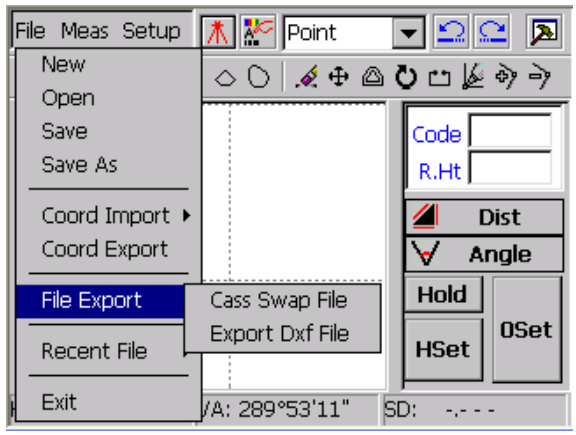
The right of the screen is measuring panel.

The bottom of the screen is data display bar.

2.2 Menu

2.2.1 File

Click File， you get the following figure as shown.



File

The options of file list are as follows

New: Create a new graphic file，it will be automatically saved in the folder of "~$Winmg$.%%%"before you save it.

Open: Open an existing graphic file（*.SPD）.

Save: Save the information of the graphic file.(*.SPD).

Save as: Save the current graphic file another one.

Coord Import: Input the coordinate point into the current graphic file. There are two different ways of import: Manual Entry and Auto Import.

Coord Export: Create CASS file (*.data).

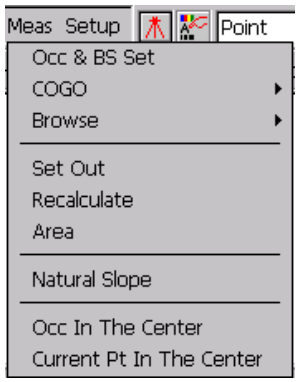
File Export: Create CASS swap file (*.cas)or Create AutoCAD's DXF file（*.dxf）.

Recent File: Show the recent file and its' location.

Exit: quit the WinMG2007.

2.2.2 Meas

Click the Meas in the menu， we get the following figure:

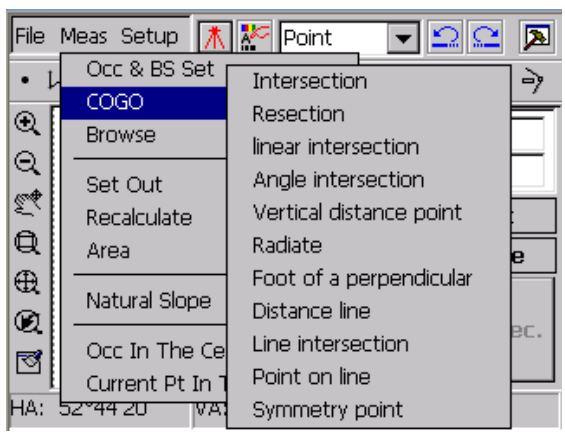


Meas

The options of file list are as follows:

Occ & Bs Set: We need a backsight to start the process of surveying, there are two ways BS Orientation and Azimuth Orientation.

COGO: Under this menu. there are many ways to calculate unknown parameters, such as Intersection， Resection, etc.



COGO

We will discuss the detail of all the functions under COGO in the last chapter. Here is just a brief introduction.

Browse: You can browse the Coord data and raw data here.

Set Out: We use this function to do polar coordinate set out

Inverse: According to the raw data, we recalculate the current graphic file.

Area: Calculate the area of any figure composed by points (at least three, non-collinear), or polygonal line.

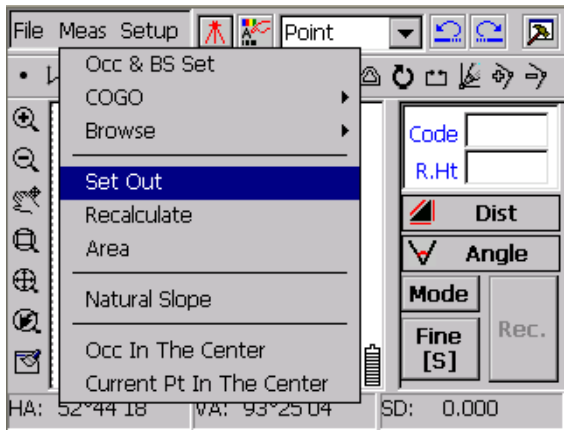
Natural Slope: There are Natural slope Reinforce Nature Slope Nature Cliff Irregular Stair. After drawing up the top line and bottom line, choose this item， then follow the tips on the top right window to finish the natural slope.

Occ in the center: Move the Occupied point to the center of the screen, and show the whole figure in current scale.

Current Pt in the center: Move the latest point to the center of the screen, and show the whole figure in current scale.

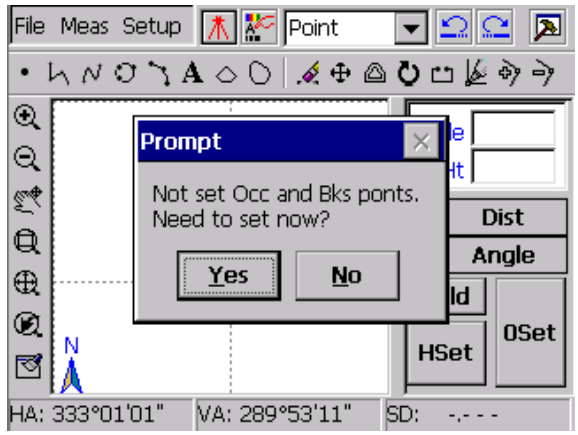
2.2.2.1 Set Out

Click Meas→Set Out enter the interface of Set Out.

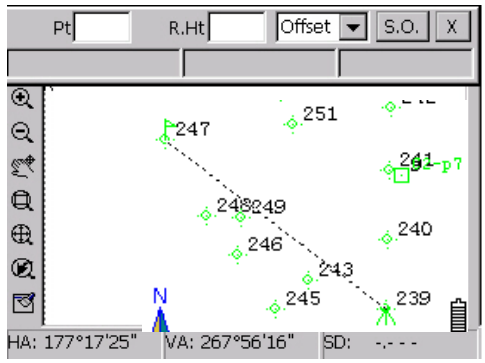


Set Out

If you haven't set the backsight, you will get a message asking for it, as shown in the following figure.



Tips for backsight



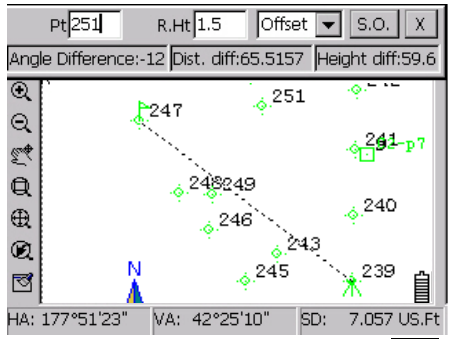
Set out mode

In setout mode，there are two different ways: One is Offset, the other is command. See the following figure.

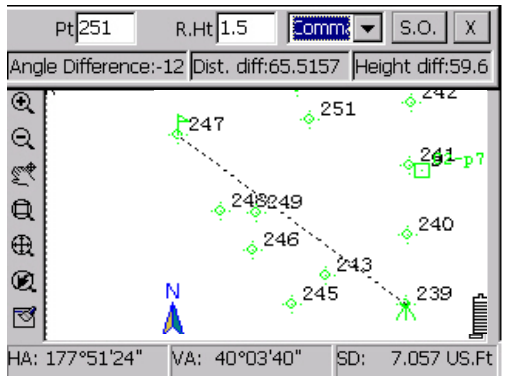
You can input the Pt by clicking them with the pen, or input the number with keyboard. Then click S.O. to begin the setout process.

Caution: When the stakeout point is not existed, you will get a prompt saying that “Point does not exist! Need to input manually?”

Offset: After we input the stakeout Pt, click the S.O. button， you will get the value of angle and distance, The application will count out the offset between the stakeout Pt and the measured Pt. Move the prism according to the offset until it become the minimum value. The figures are as follows



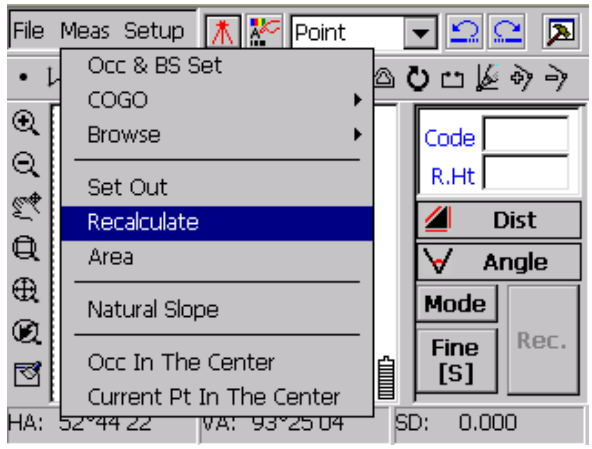
Command: After we input the stakeout Pt, click the S.O. button， you will get the value of angle and distance, The application will count out the offset between the stakeout Pt and the measured Pt， and show you how to move the prism ,such as Right ,Forward or Upward. See the following figure.



2.2.2.2 Recalculate

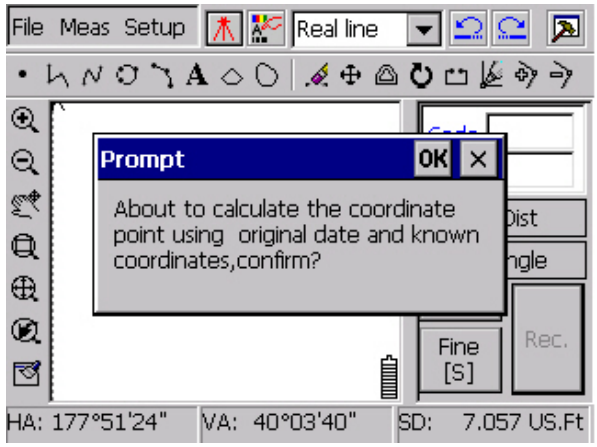
We recalculate all the points according to the modified raw data. Please do use this function especially when you changed the raw data.

Click Meas→Recalculate the following figure:



Menu for recalculation

Then we get a message asking for the confirmation of recalculating.

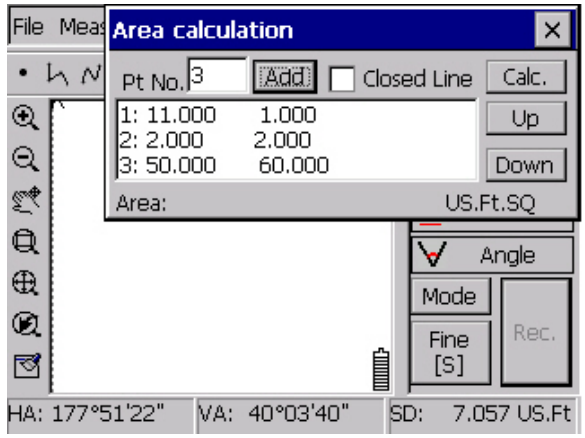


Recalculate

2.2.2.3 Area

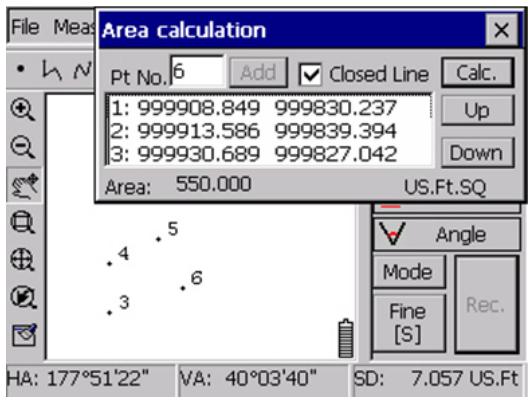
You can calculate the area of any closed polygonal line, and figure composed by points (at least three, non-collinear).

Calculation of three non-collinear points: In the area calculation dialog box, choose points from the screen or input the point No. with keyboard， after inputting, you can use the up/down button on the right to change the sequence of the points. If the point is already existed, the window will show you the point No. if not, you will see "-".see the following figure.



Area Calculation 1

Calculation of closed polygonal line: choose the Closed Line Check box, the area calculation window will show you the coord. of the nodes. Click Calc. closed polygonal line, see the following figure.

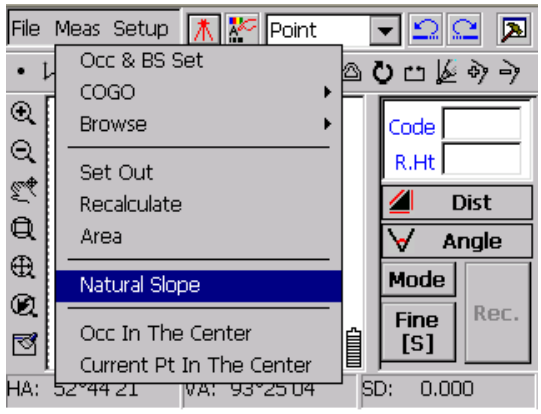


Area Calculation 2

Caution: Choose the nodes in correct order, and then you get the true value of the figure.

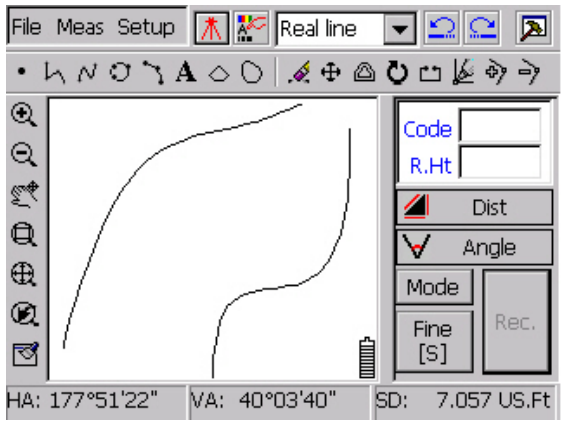
2.2.2.4 Natural Slope.

This command can help you create natural slope. Choose Meas→Natural slope see the figure as follows.



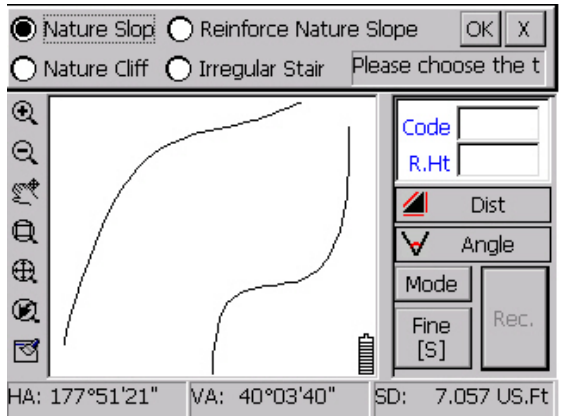
Menu for Natural Slope

First you should draw two lines for top line and bottom line，see the following figure.



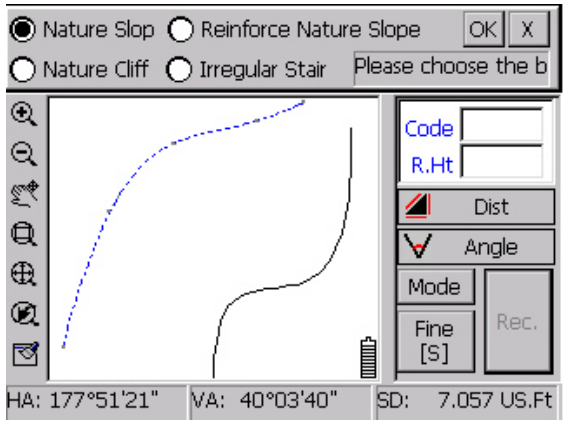
Original Lines for Natural Slope

Choose the natural slope command, you get the following figure, there are four choices: **Natural slope**, **Reinforce Nature Slope**, **Nature Cliff**, **Irregular Stair**.



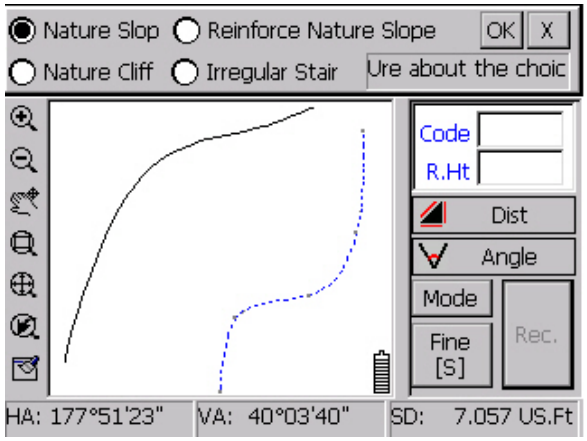
Natural Slope

The Dialog box shows “please choose the topline of slope”, choose it, then you will see “please choose the bottomline of slope” see the following figure “selection of bottom line”:



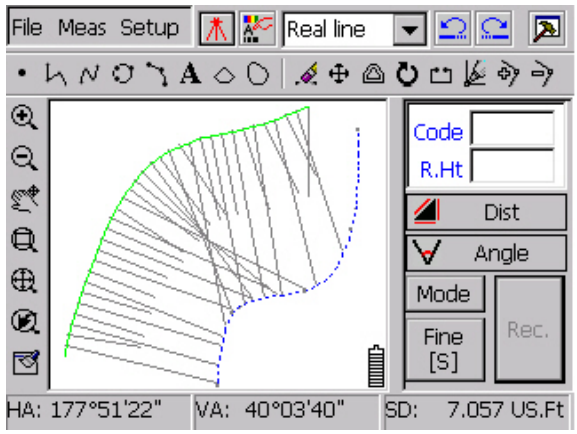
Selection of Top Line

Select the bottom line, then the window will ask for your confirmation, if so, click OK.



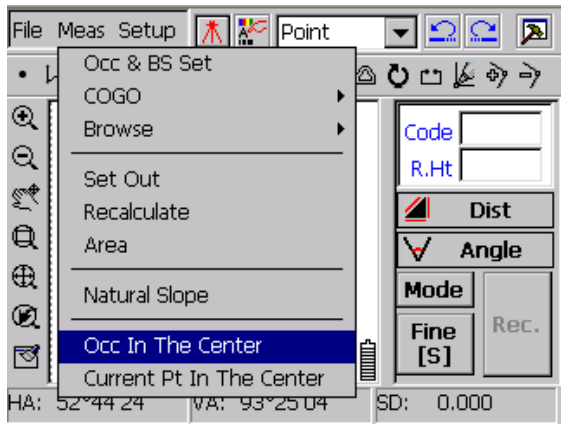
Selection of Bottom Line

Here is the natural slope you get, see the following figure.



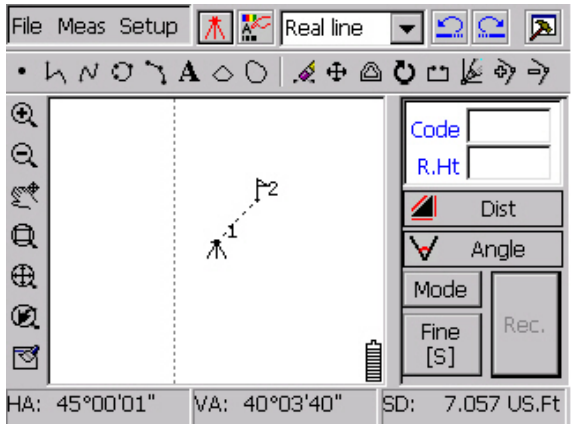
Nature Slope

2.2.2.5 Occ in the Center



Occ in the center

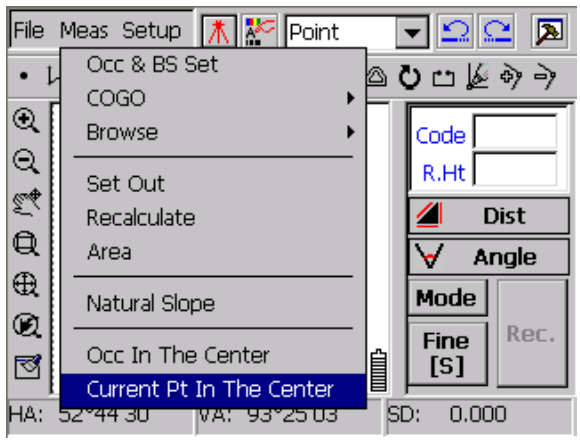
As shown in Figure “Occ in the center”， click the menu: Meas→Occ In The Center. This function moves the Occupied point in the center, as shown in the figure: “No.1 in The Center”



No.1 in the Center

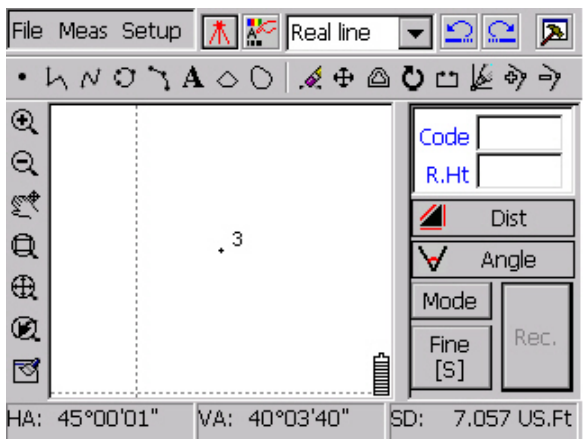
2.2.2.6 Current point in the center

This function moves the latest surveying point to the center of the screen. Click the Meas→Current Pt In The Center, as shown in the figure:



Menu for Current Pt in the Center

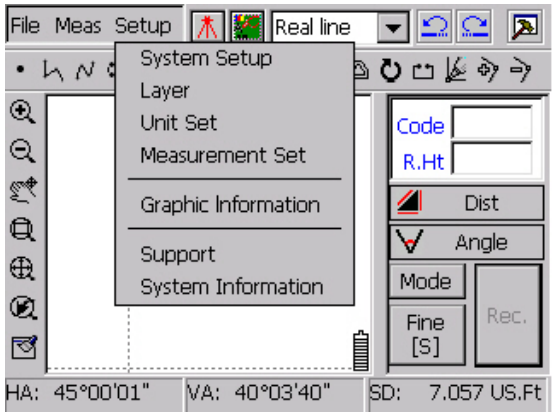
Now the latest point is No.3, and it is centered in the screen, as shown in the figure:



Centering the No.3

2.3. Setup

Click the Setup; we get a message box as follows:



Setup

The functions of this menu are as follows:

System Setup: Here you can set the Screen Capture, Coord Info, 4 Points Objective, Sheet Line System, Power, Quick Draw Mode, Distance Unit, North Arrow.

Layer: There are 12 layers, you can open or close them and choose its colour, after you cancel a layer, refresh the screen, and then all the data in this canceled layer will be hidden.

Unit Set: Set up the unit of angle distance pressure and temp.

Measurement Set: Set the Tilt, Atmospheric reflection coefficient, Vertical angel mode.

Graphic Information: show you all kinds of data and its detail.

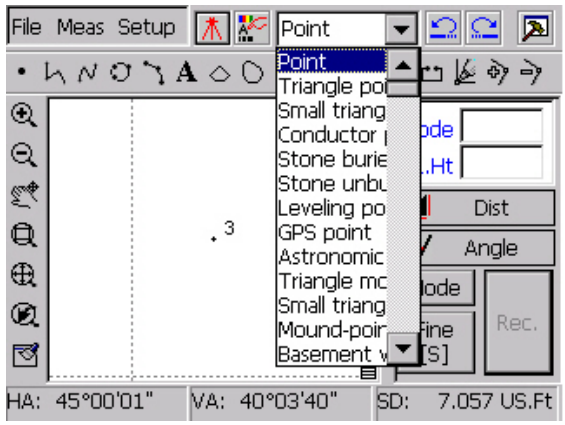
Support: http://www.southinstrument.com

System Information: Copyright and version.

2.4 Attribute of ground objective

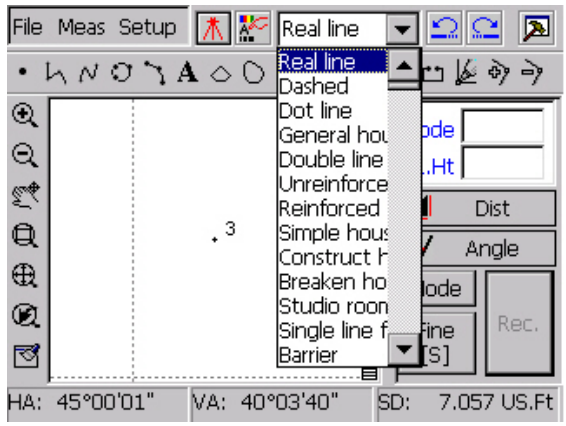
Attribute means a Collection of all the ground objectives, especially those in common use.

Here is a dropdown list of attribute of ground objective, as shown in the following figure:



Attribute dropdown list 1

Click the line-type draw tool， the dropdown combo boxes will show you all the symbols of ground objective. See the following figure.



Attribute dropdown list 2

2.5 Tool Bar

Tool bar shows you the common functions of surveying and mapping. Here is the brief introduction of them:

E-Panel.

Attribute edit.

Refresh.

Measuring panel, hide or show the window.

Icons	Description	Icons	Description
	Zoom in		Zoom out
	Pan		Windowing
	Zoom all		Previous
	Backspace		Revoke
	Point		Polyline
	Curve		Circle
	Arc		Annotation Text
	Closed Polyline		Closed Curve
	Delete		Move
	Offset Copy		Rotate
	Break		Move the Node
	Add Node		Delete Node

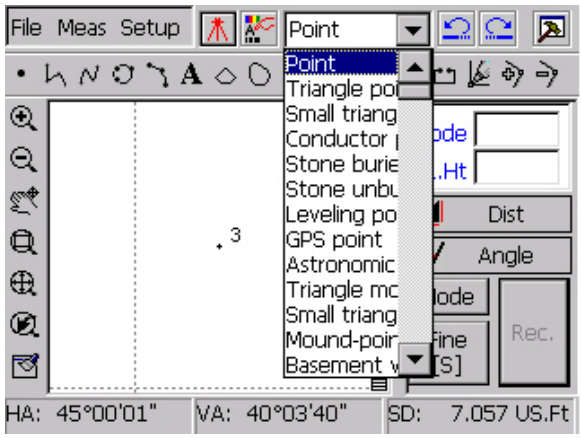
2.5.1 Tool Bar for Mapping

There are eight tools in total, they are Point, Polyline, Curve, Circle, Arc, Annotation text, Closed Curve, Closed Polyline， see the following figure:

Tool bar for Mapping

2.5.1.1 Common Steps for Mapping

First, choose the tools (such as polyline or arc) for mapping, then choose the ground objective symbols you want in the attribute. At last, you can draw figure on the screen. If you want to draw a point, click then choose the ground objective symbols you want in the attribute， see the following figure.

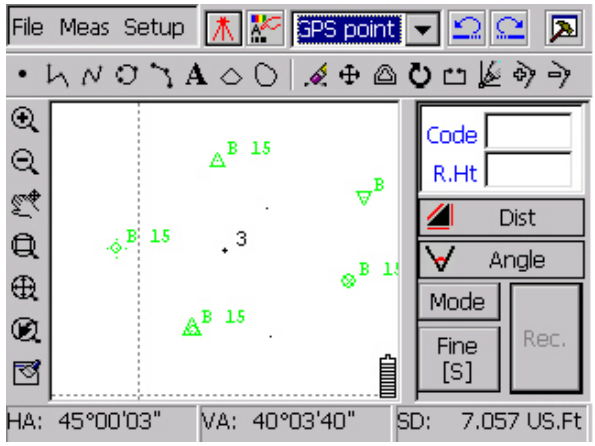


Select the ground objective

When you click the tool bar again, you will draw another ground objective.

2.5.1.2 Point

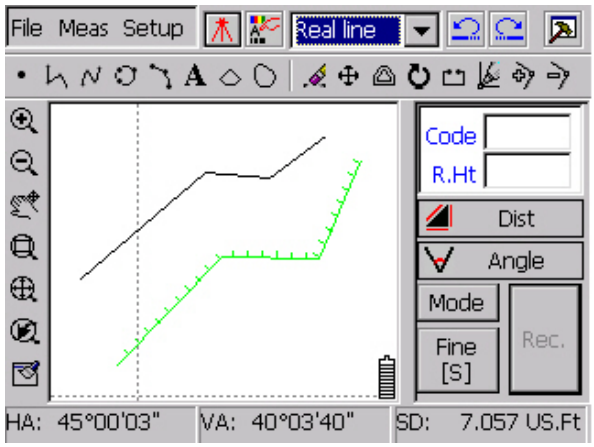
You can draw Point-like ground objectives or control point with this tool. See the following figure:



Point-like ground objectives.

2.5.1.3 Polyline

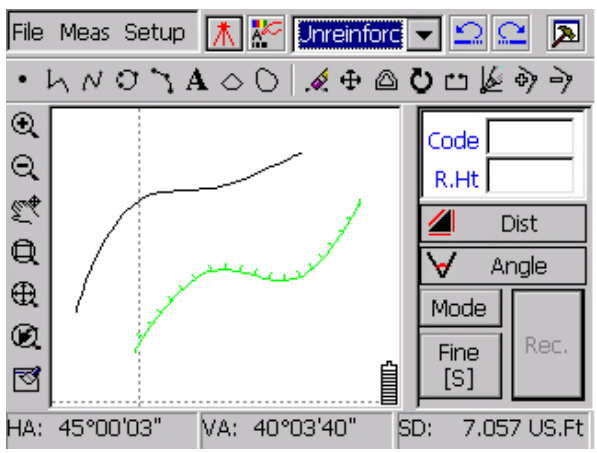
As the following figure shown, polyline can connect the points on the screen as a line.



Polyline

2.5.1.4 Curve

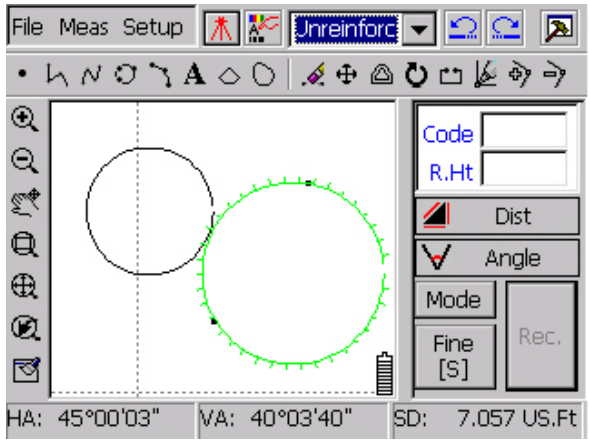
Curve can connect the points on the screen into a much more smooth line, compared with the polyline. see the following figure.



Curve

2.5.1.5 Circle

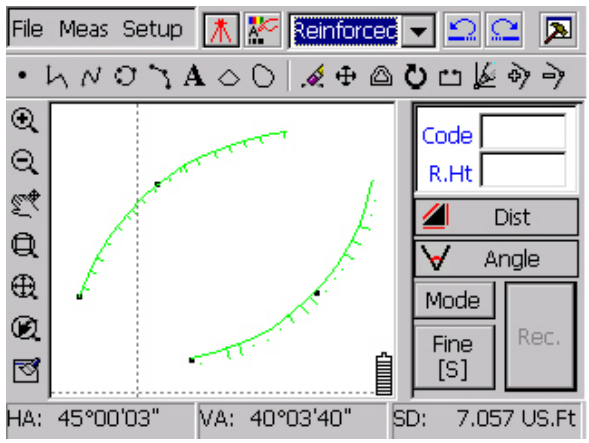
Choose this tool and draw three points, then you will get a circle. And its' forward direction is Clockwise. See the following figure:



Circles

2.5.1.6 Arc

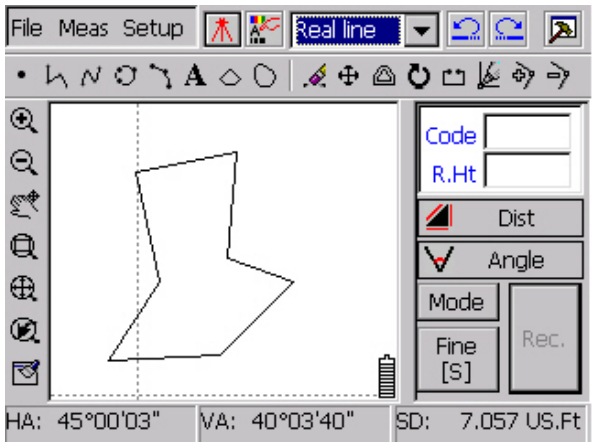
Draw an arc according to the three points you choose. The arc begins with the first point, though the second one, and ended up with the third one.



Arc

2.5.1.7 Closed Polyline

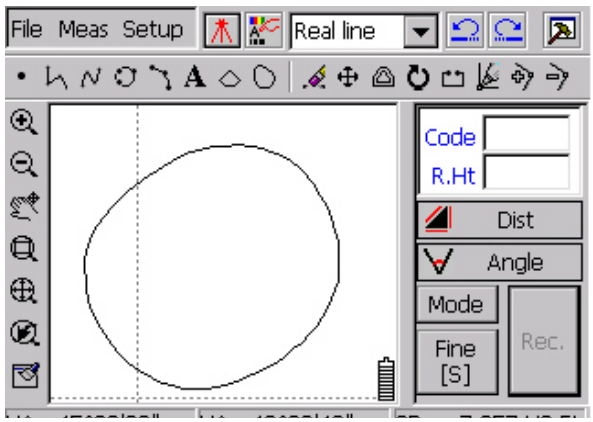
The difference between closed polyline and the polyline is when the points are more than three. The line draw with closed polyline will be automatically closed from the end point to the start point. See the figure as follows:



Closed polyline

2.5.1.8 Closed Curve

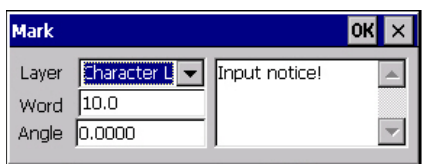
Closed curve can help you draw a smooth closed curve, see the figure as follows.



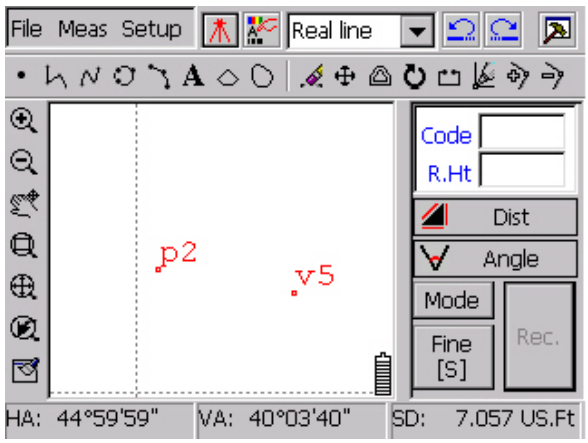
Closed Curve

2.5.1.9 Annotation Text

When you select the annotation text, you will get a dialog box asking for inputting the annotation, as shown in the following figure "Inputting of annotation text" You can also set the size and the angle of the text, then click the OK button，you will see the text as follow" Input notice!”



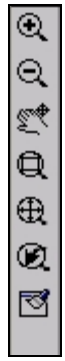
Inputting of annotation text



Annotation Text

2.5.2 View Manipulation

The left of the screen is a toolbar of the view manipulation, they are: Zoom out, Zoom in, Pan, Windowing, Zoom all, Previous and Refresh. See the following figure.

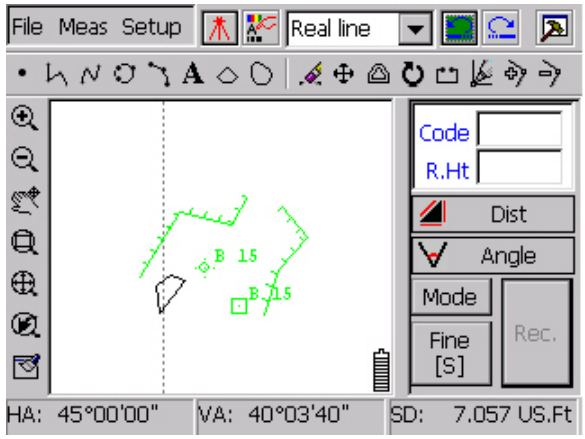


View Manipulation

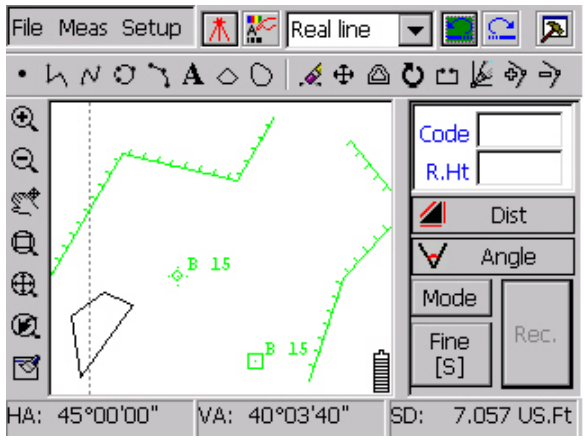
There are other two graphic manipulation buttons, see the figure as follows:

2.5.2.1 Zoom in

The zoom-in button can magnify the figure, see the original graph and the 1.5 times larger one.



Original graph



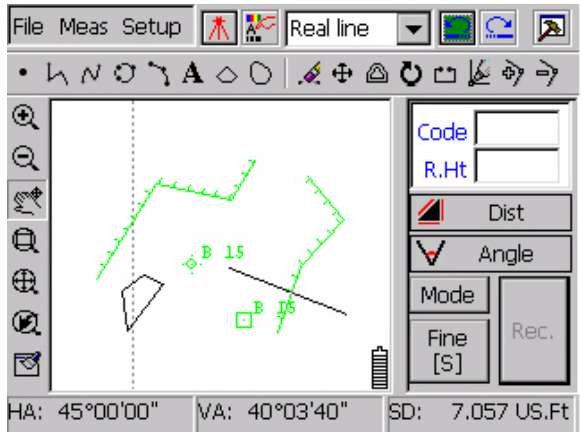
1.5 Times larger one

2.5.2.2 Zoom out

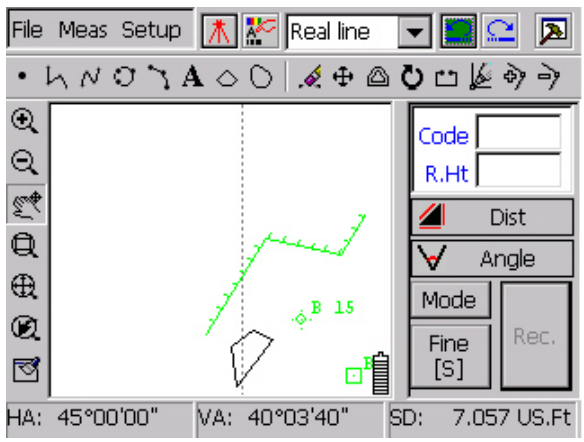
The zoom-out button can scale down the graphic into its 2⁄3.

2.5.2.3 Pan

The button can move the graph，but not change the size. First, select the graph to move then drag it to the location you want. See the following two figures.



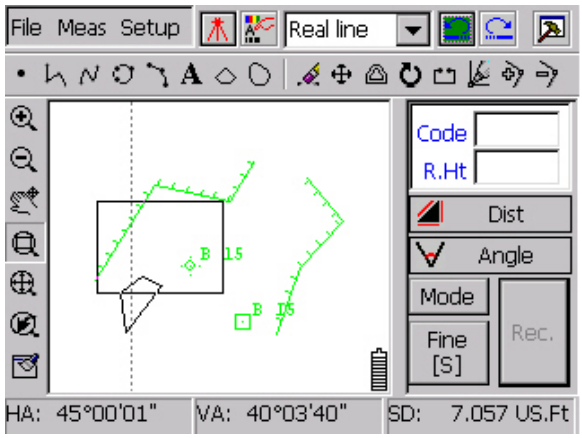
Dragging the graphic



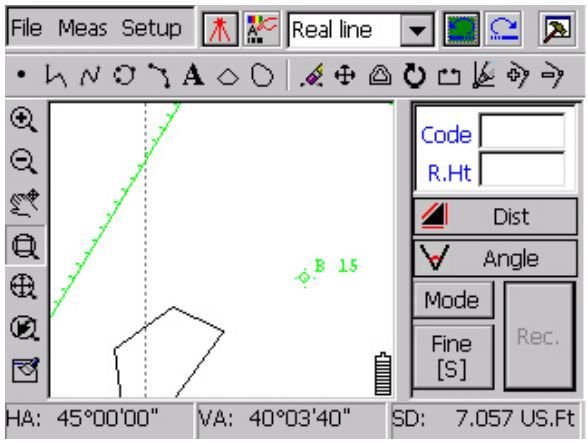
Result

2.5.2.4 Windowing

The windowing button is a special case of magnification. We drag a rectangle, and then the figure in it will be magnified to the whole screen. See the following two figures.



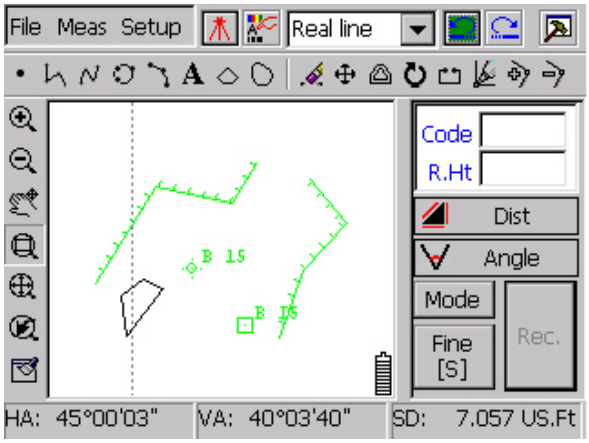
Windowing



Result

2.5.2.5 Zoom all

The button makes the whole graph shown in the screen. See the following figure.



Zoom all

2.5.3 Tool Bar for graphic edit.

2.5.3.1 Backspace

The backspace button helps you cancel the latest command，it can be used several times.

2.5.3.2 Revoke

The anti-backspace button is a reverse process of anti-Backspace; it can also be used many times.

2.5.3.3 Graphic Edit

WinMG2007 have the powerful graphic edit functions like Auto-CAD and cases.

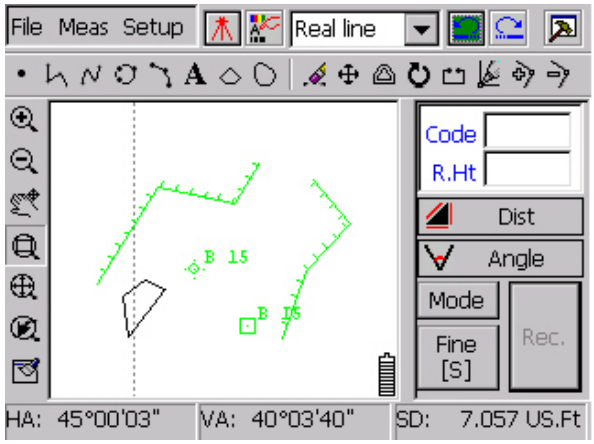
2.5.3.4 Delete

The delete button can delete any ground objective you select but without the points, if you want to delete the annotation text please doesn't click the text, click the right-down corner of the text.

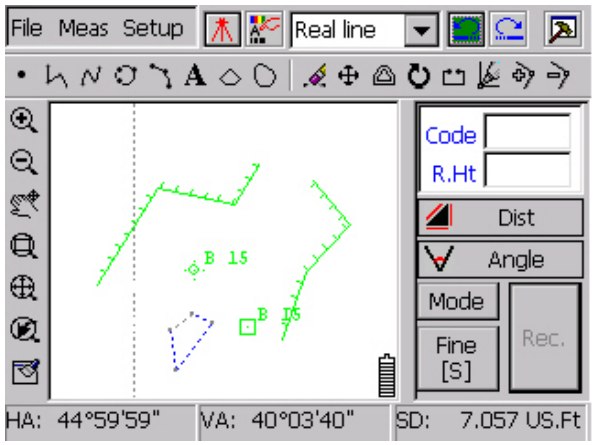
2.5.3.5 Move

The move button can move the ground objective's location, after you click the

, choose the ground objective you want. Dragging it with pen on the screen, then lose the pen, the ground objective will stay there. See the following figure.



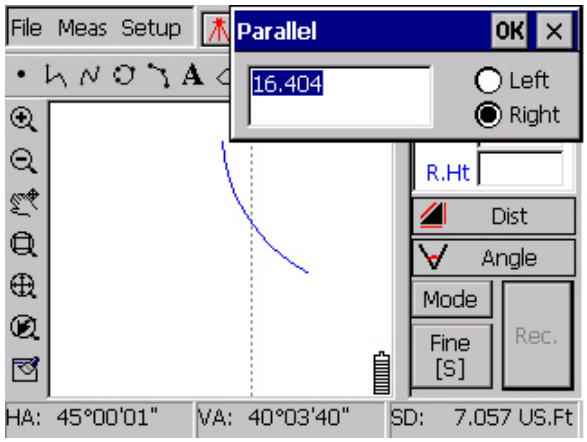
Before moving



After moving

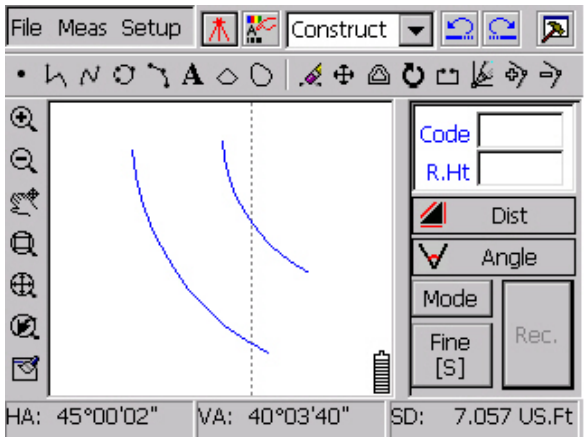
2.5.3.6 Offset Copy

The offset copy button can copy the ground objective to the parallel place, see the following dialog box, you can set the distance between the original figure and the new location.



Offset copy

Input the offset distance and direction, the unit of distance is the same to the current coord. Then press OK, see the following figure: “The result for offset copy”



The result for offset copy

2.5.3.7 Rotate

The rotate button can make the ground objective rotate according to a choosed point; the common steps are like this:

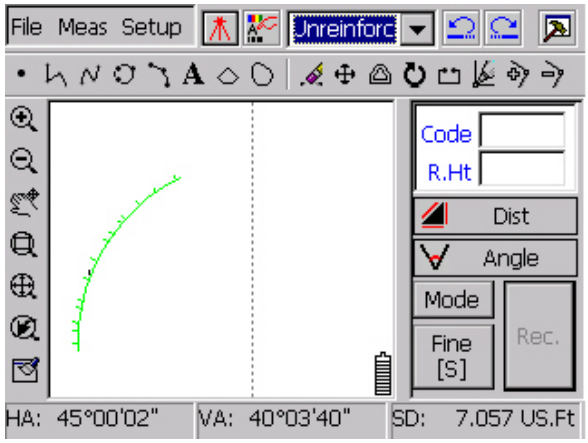
1, Choose the button .

2, Choose the ground objective, see the the following figure “Select the ground objectives for rotating”

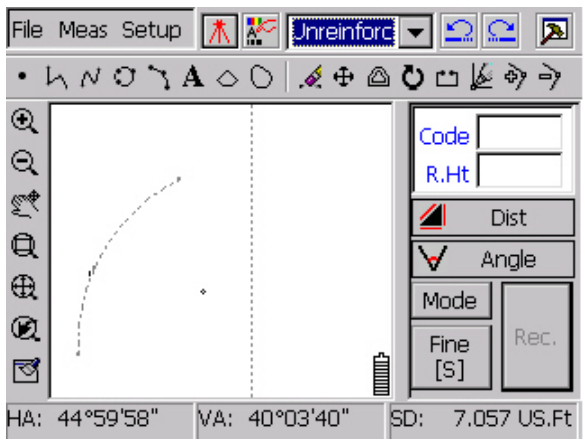
3, Click the center point you want rotate with. See the following figure “center point”.

4, Dragging the pen, the ground objective you choose will rotate according to your

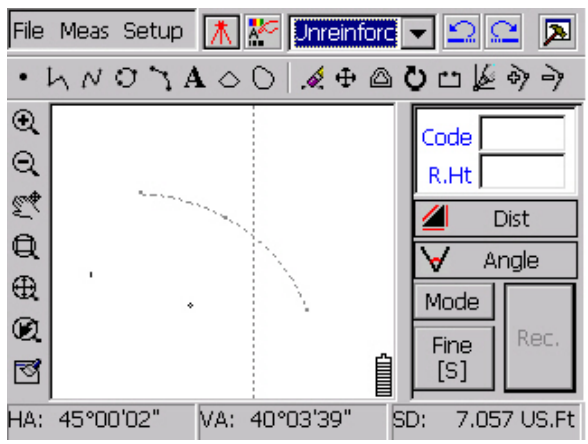
moving pen. See the following figures: “ground objectives rotating” and “result for rotating”.



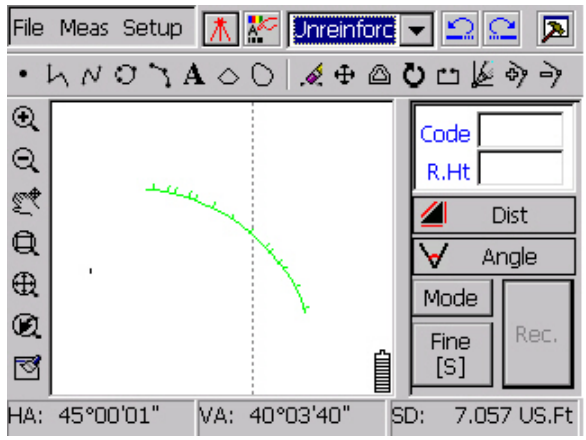
Select the ground objectives for rotating



Center point



Ground objectives Rotating

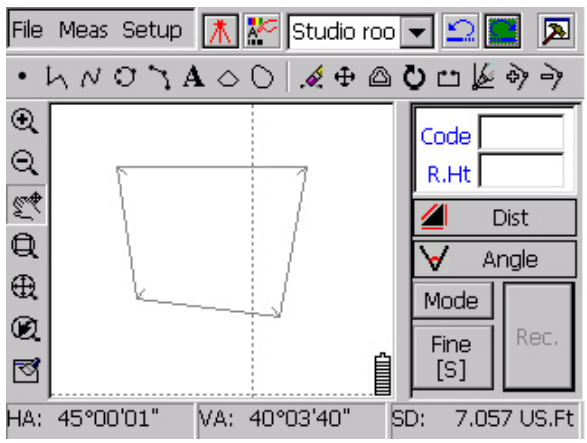


Result for Rotating

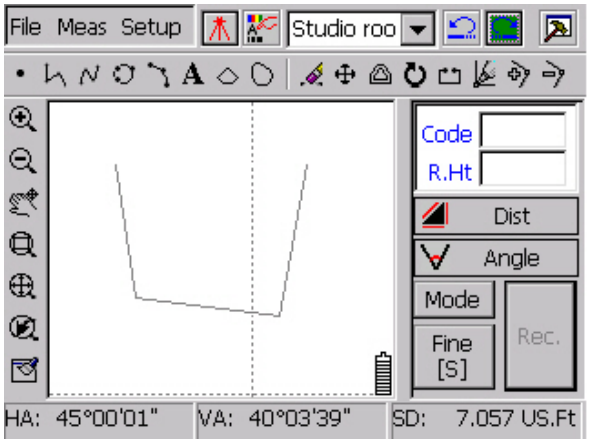
2.5.3.8 Break

The break button is suitable for line, circle, arc, etc. This tool can delete the line between two points, and break an arc into two arcs, a circle into an arc, and a closed line into an open polyline. The common steps are as follows

1. Choose the ground objective; see the following figure “Selection”.
2. Choose the point need to break.
3. The result is as the following figure: “Broken ”



Selection

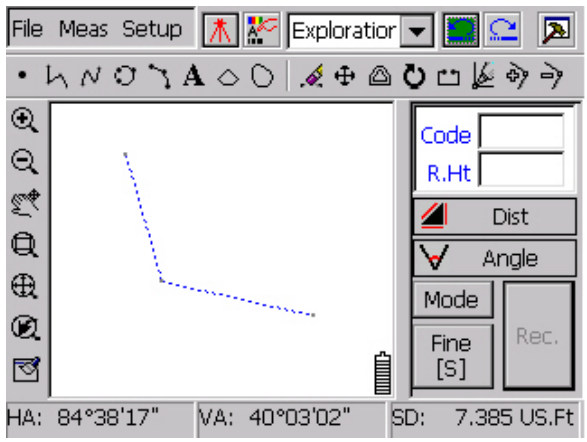


Broken

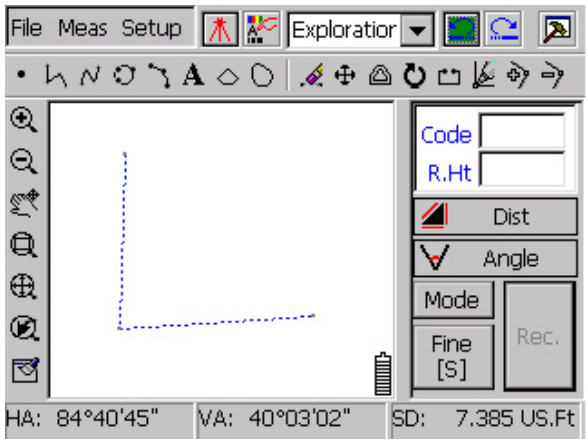
2.5.3.9 Move the Node

The node button can easily move the node on the screen.

1. Choose the button .
2. Choose the ground objective. See the following figure: “Selection of ground objective”.
3. Choose the node on the ground objective and drag it. See the following figure “Node moving”.



Selection of Ground Objective

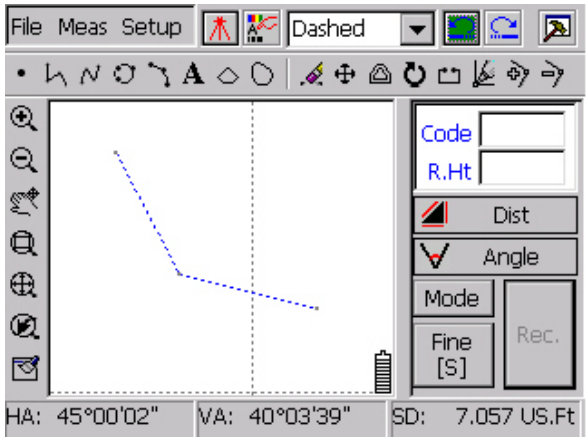


Node Moving

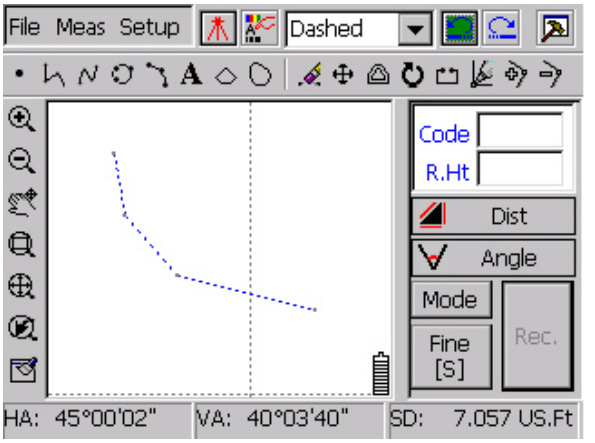
2.5.3.10 Add Node

The add node button is suitable for polyline; it can help you change the shape of the graph.

1. Choose the add node button.
2. Choose the polyline ground objectives.
3. Choose the point you want to add node.
4. See the following two figures.



Before add node



Node added

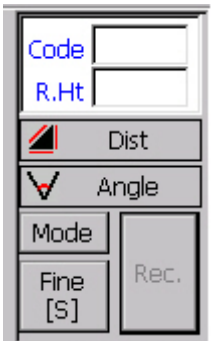
2.5.3.11Delete Node

The delete node button is an anti-process of add node.

Caution: we suggest you shut down the catch when adding node.

2.6 Measuring panel

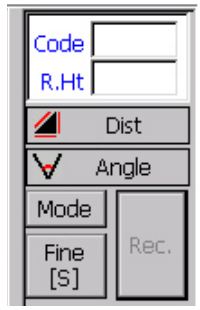
Click the button on the top right corner, it can show or hide the surveying panel on the right.



Angle Mode

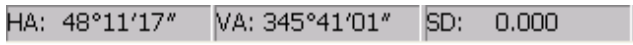
Click the button you can enter the distance mode

Click the button you can enter the angle mode

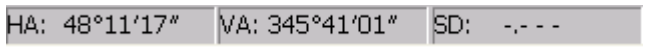


Distance Mode

On the bottom of the screen, there are the value for angle and distance. See the figure as follows



Distance mode



Angle mode

HA: Horizontal Angle.

VA: Zenith Angle

SD: Distance, in the angle mode, here will show you: "-.- - -"

2.6.1 Angle

In the angle mode，you can see the following figure with three buttons, if your system is now in distance mode, please click the"

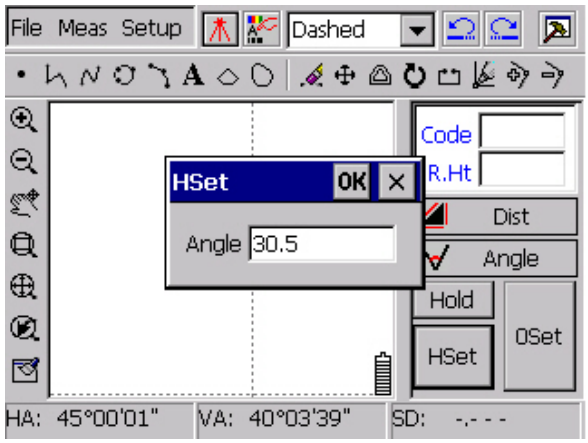
".

Angle set

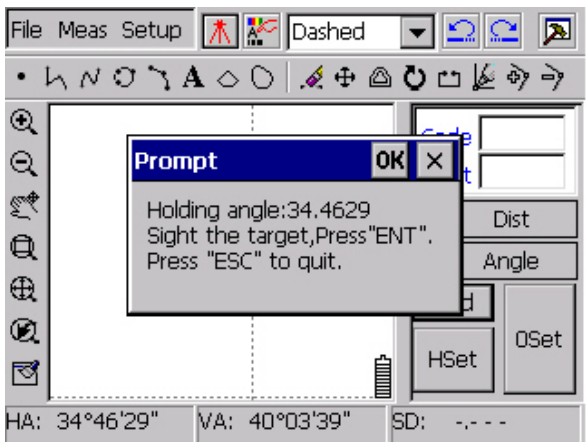
0Set: Set the angle to 0 degree.

Hset: Set the current angle to any reasonable value.

Hold: lock the current angle. See the following two figures.



Hset



Hold

Caution: if the angle mode is in Gon or Mil. please pay attention to its rule.

2.6.2 Distance

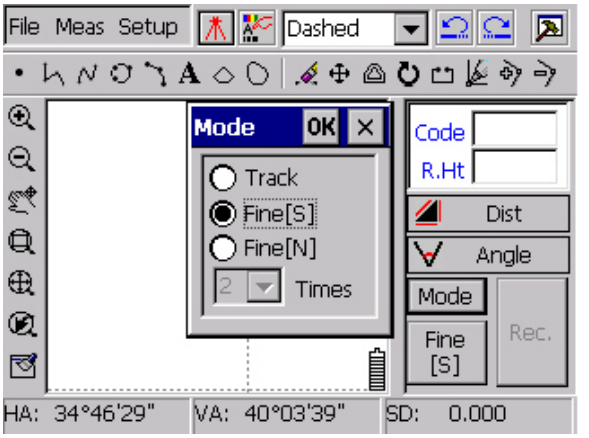
In the distance mode，you can see the following figure and click"Mode"button，it displays the distance mode，you can change different distance mode here，in order to satisfy the different precision，here are three kinds of distance mode for user，the precision from high to low is: Fine[N], Fine[S], Track

Fine[N]: the range of N is:2～5 times，default value is 2 times. If choose the Fine[N] mode， after input the value for N, the system calculates the average value of N. But it costs a lot of time.

Fine[S]: it calculates the result after one Fine measure. It costs only 1/N time of Fine[N] mode.

Track: this is the quickest distance measure mode of the three, but the lowest precision. It costs only a little time. Under Track mode, it changes to Pause if you click the measure bottom again.

Distance mode as following figure:



Distance mode figure

2.7 E-Panel

2.7.1 Occupied point set

Before measuring， we must set the occupied point, otherwise we get the wrong coordinate data. Entry the known point before setup.

Two methods for occupied point set: BS Orientation and Azimuth Orientation.

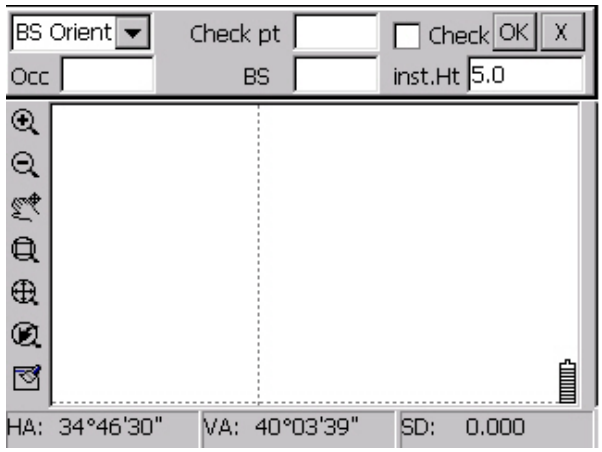
2.7.1.1 BS orientation:

Click menu: Meas→Occ&BS Setup，as following figure. Choose BS Orientation，cursor in the edit box at first， there are two ways to input the occupied point: first is inputting the point number by number panel at right side of total station, if the point is not existed， it prompts “Positioning coords not existed! Input manually” after you click OK bottom. Second is touching the point in the screen by stylus pen. So before we touch the point, we should first move and zoom the point to the center. The same way as the backsight point.

Angle default value is HA，which in the bottom of the screen. Instrument height default value is 1.5 m， measure the instrument height by steel measuring tape, and put the value in the Inst. Ht.

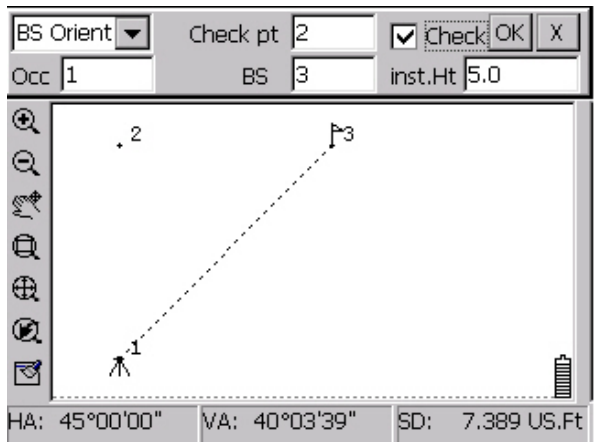
After inputting, rotate the telescope to aim at the bottom of backsight point. Click √ button to finish. It displays graphic symbols in the occupied point and dashed

between occupied point and backsight point. Click as following figure “BS Orientation”.

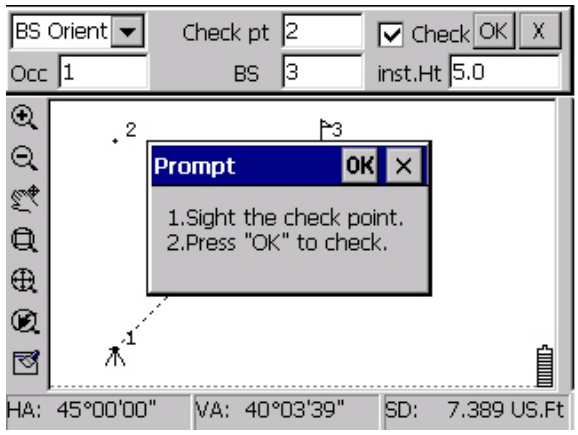


BS Orientation

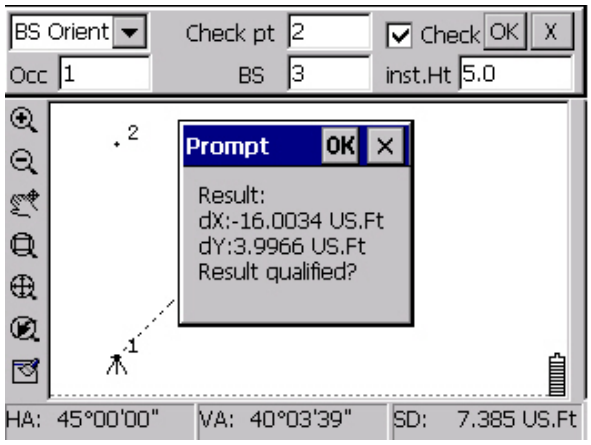
If we have checked point (known point), we can check the occupied point and backsight point. As following figure “Check occupied point”, click check and then OK after input the occupied point, the backsight point and the check point, it prompts : 1.Sight the check point. 2. Press “OK” button to check.” As following figure “Prompt”. Click OK button it prompts the result of check. As following figure “Result”. If the result is unqualified, click X button, system back to BS Orientation interface, user can rotate the telescope to aim at the point and do check again until the result qualified, then click OK button to finish.



Check occupied point



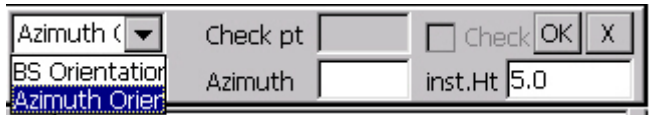
Prompt



Result

2.7.1.2 Azimuth Orientation:

Click menu: Meas→Occ&Setup, choose Azimuth Orientation, as following figure "Azimuth Orientation", the difference from BS Orientation is azimuth replace backsight point and no check point. Other steps are same as BS Orientation.

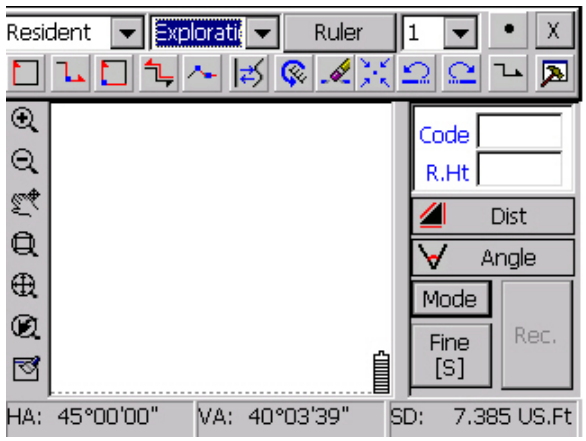


Azimuth Orientation

2.7.2 E-Panel Introduction

E-Panel is used for WinTS field work, this function define a current ground

objective， all the operations are for this current ground objective, current ground objective include line-like ground objectives and Point-like ground objectives. (Differentiation), (Backspace), (Inverting), (Close), (Right angle close), (One right angle close), functions and so on are only for that the selected current ground objective is line-like ground objective. They are shown by dashed.



E-Panel

There are two ways to define point in E-Panel: First, collect data from total station, and calculate the coordinate by occupied point coordinate; Second, pick the point from screen by pen. In order to increase the pick precision, you can turn on “catch” function. When current ground objective is line-like ground objective, no matter collect coordinate from total station and pick from screen, the point is showed as line-like ground objective automatically.

We can use tool bar functions to edit or browse the ground objective in E-Panel.

They are: Zoom in, Zoom out, Pan, Windowing, Zoom all, Previous and Refresh

They are: Delete, Line-type switch, Straight and curve line switch, Backspace, Revoke, occupied point in the center.

2.7.2.1 Select current ground objective

Enter E-Panel function, we can pick ground objective by pen as current ground objective.

Ruler function is used for changing another ground objective as current ground objective. Step: Click Ruler button, then pick ground objective by pen for current ground objective. This function can make different ground objectives to different rulers. Step: choose layer and ground objective, then choose the ruler number and click Ruler bottom，after that click Line，last step draw the ground objective. The same as defining a new ruler.

Line function is used for drawing a new line-like ground objective. It shows a point when you define the first point, after define the second point it shows a line from two points, and this line automatically become current ground objective. We also can define different ground objectives to different rulers by ruler number.

PS: After quitting E-Panel，system cancel all the relations between ruler and ground objective .

2.7.2.2. Edit line-like ground objective

（1）Close “ ”

Close is used for close line-like ground objective, after close, the line-like ground objective is no longer current ground objective, so it is impossible to add point.

（2）Right angle close “ ”

Right angle close is used for measuring corner of house. After defining a new point, it automatically inserts a new point between last two points and defined point, and angle for these four points is right angle.

（3）One right angle close “ ”

The difference from right angle close is, one right angle close replace the new point by first point or last point and connects the last two points with right angle which will be judged as ground object.

（4）Inverting “ ”

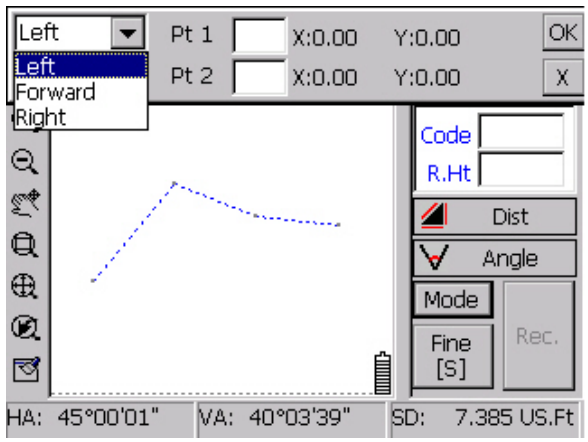
Inverting is used for changing the direction of current ground objective. If the direction is plus, new point will be connected to the last point of line. If the direction

is minus, new point will be connected to the first point of line.

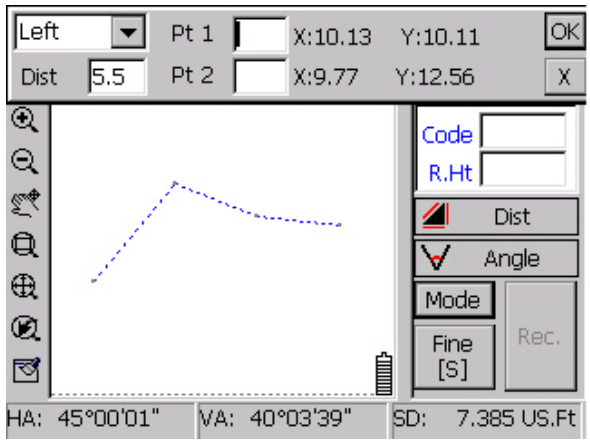
（5）Differentiation “”

Click differentiation button to enter differentiation setup dialog box.

According to the request to make forward direction (left, right or forward) and distance, then input the first and second points to differentiation, this two points can be picked from screen by pen or input the point number by number key. Click √ button, system will calculate the result and show the new point to the line.



Differentiation setup 1



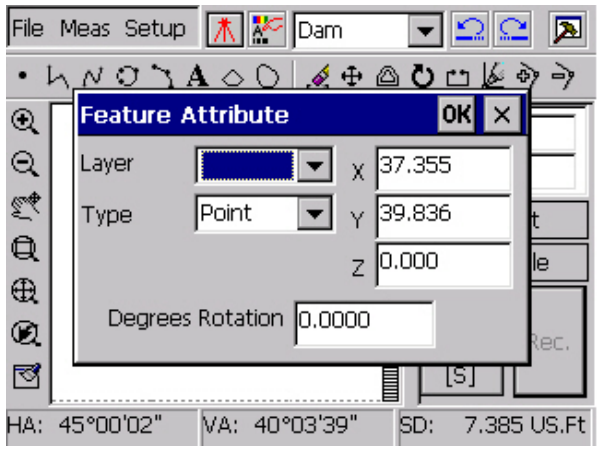
Differentiation setup 2

PS: When picking point with no Pt No. by pen , Pt 1 and Pt 2 do not display the point number, only display the coordinates as figure “Differentiation setup 2”

2.7.2.3 Modify ground objective attribute

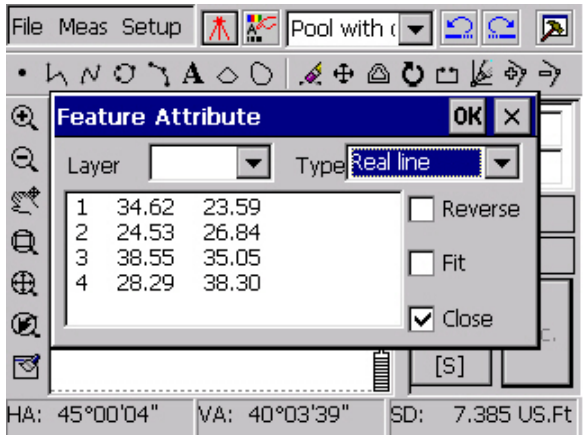
" " button is used for browsing and editing ground objective attribute.

Before editing ground objective attribute, make sure the button of pan and windowing are released, choose the ground objective to edit. Different dialog box for point-like ground objective and line-like ground objective edit.



Point-like ground objective editing dialog box

As figure "Point-like ground objective edit dialog box"， we can change point-like ground objective by layer, type and degrees rotation. Also we can change X, Y, Z by coordinate. After change click OK button to finish edit or click × to cancel.



Area-like ground objective editing dialog box

As figure "Area-like ground objective editing dialog box", we can change ground objective by layer and type， also we can change inverse , fitting and close to change

the display of ground objective

2.8 File introduction

We have 7 types file format which WinMG2007 support in WinTS, they are DrawClass.dll, Layer.ini, SouthPdaClass.dll, point.def, work.def, linetype.def, SouthPdaFunc.dll. point.def, linetype.def, work.def these 3 files include code, name, style and other information for point symbol and line symbol.

Customer can edit symbol file (work.def, point.def and linetype.def) in computer.

The path for target file is“\SouthDisk\WinMG\”， customer can copy new file at this path or cover same name file.

2.8.1 Symbol code

The form of symbol code as follows:

1+ the people's republic of china national standard topographic map symbol number+running number+0 or 1

Caption:

“1” is for start, must input.

“The people's republic of china national standard topographic map symbol number” is the people's republic of china national standard topographic map symbol 95 year modes. For example the number of trigonometrical station is 3.1.1，code is 311.

“Running number” begins from zero.

“0 or 1” must input.

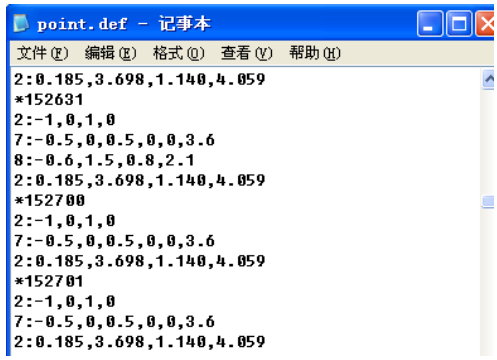
Example: trigonometrical station code:1+311+0+0，so is 131100

Common house code: 1+411+0+1, so is 141101

Code can be defined by customer, only do not repeat.

2.8.2 Point.def file

point.def is point-like ground objective file，each point-like ground objective is formed by one attribute code and some explanation symbol，as follows:



Point.def file

The form is:

First row is “*attribute code”， as “*131100”

Second row is explanation symbol，form is “type of graphic elements: coordinate and caption for connect of graphic elements”，coordinate of graphic elements based on origin point not consider the rotate coordinate and coordinate in front of Y coordinate separate with “:”. Graphic elements type as follows:

Type 1: draw single point, format is ”X coordinate, Y coordinate”.

Type 2: draw single line, format is “pt 1 X, Y, pt2 X, Y”.

Type 3: draw triangle, format is “pt 1 X,Y, pt 2 X,Y, pt 3 X,Y”.

Type 4: draw rectangle, format is “lower left corner pt X, Y, upper right corner pt X, Y”.

Type 5: draw circle, format is “the centre of a circle Pt X, Y, radius”.

Type 6: draw circular arc, format is “the centre of a circle pt X, Y, radius, start radian, end radian”.

Type 7: draw filled triangles; format is “pt 1 X, Y, pt 2 X, Y, pt 3 X, Y”.

Type 8: draw filled rectangle, format is “lower left corner pt X, Y, upper right corner pt X, Y”.

Type 9: draw filled circle, format is “the centre of a circle pt X, Y, radius”.

Type 10: draw circular arc, format is “the centre of a circle pt X, Y, radius, start radian, end radian”.

File end with“*End”.

Take trigonometrical station for example

*131100

1:0, 0

3:-1.2,-0.9, 1.0,-0.9, 0, 1.1

First row is trigonometrical station attribute code 131100

Second row is draw a reference single point（0,0）

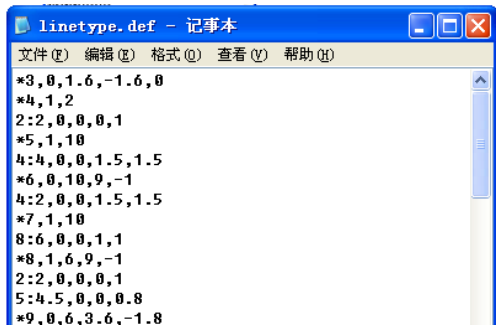
Third row is draw reference points （-1.2,-0.9），（0,-0.9）,(0,1.1) for triangle.

Customer can modify the point symbol and even add new point symbol.

We must register in (work.def) before add new point.

2.8.3 **Linetype.def file**

linetype.def file is for line-like ground objective, each line-like ground objective is formed by one attribute code and some explanation symbol and end with “*End”, linetype named begin with number “4”, as follows:



Linetype.def file

The meaning for each row as follows:

First row:*linetype name, base line type, period length, caption for one period linetype.

Second row: caption for complex linetype symbol

Linetype name begin with “4”.

Linetype :0——None base line，1——real line for base line，2——dashed line for base line， 3——point line for base line.

Period length: length for one period linetype, unit is point.

One period of linetype include three situation: Plus for connect line， minus for unconnected line,0 for a point. As complex linetype, record graphic elements information from the second row, and the caption is almost as same as point symbol, the different is period length.

Take “Broken Great Wall” for example， as linetype name is 4:

*6, 0, 10, 9,-1

4:2, 0, 0, 1.5, 1.5

First row is linetype name 6， no baseline， 10 unit for period length，9 unit for connect line,1 unit for unconnected line.

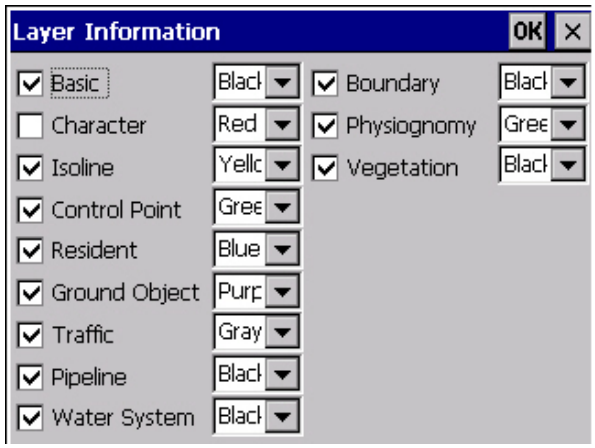
Second row is draw reference rectangle point for each period（0,0）,（1.5,1.5），and this rectangle's period begin with 2 unit.

Customer can modify the line symbol and even add new line symbol.

We must register in (work.def) before add new line.

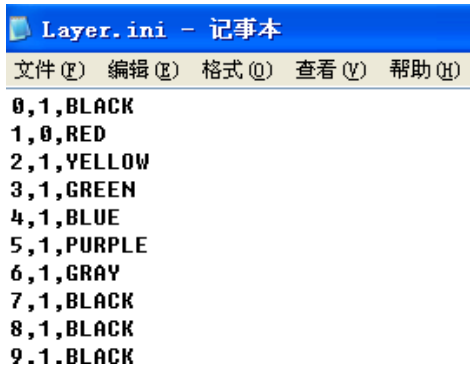
2.8.4 Layer.ini file

Layer.ini is used for layer. Under WinMG2007 main interface，click setup，there are 12 layers in layer setup. They are basic, character, isoline, control point, resident, ground object, traffic, pipeline, water system, boundary, physiognomy, vegetation. As follows.



Layer setup

In Layer.ini file，number begin with 0 to 11 ，each number means a layer，as number 0 is basic layer， number 1 is character layer and so on. The second number of each line is 1 or 0 ， 1 is open for this layer，0 is close， the last English word is colour for this layer. Layer.ini as follow figure



Layer.ini file

2.8.5 File “work.def”

After adding new point symbls, user should define the layer, symbol type, description, etc. of those new symbols. If new line symbols are added, user needs to

add code, layer, type, description, etc. of the symbols. In this case, it is required to register in the symbol definition file (work.def). “work.def” can be opened in txt file “work.def” is a text file. Each row defines a ground object symbol, with the formats as below.

Attribute code, layer, symbol type, parameter, description.

Layer codes:

code	layer	code	layer
0	Basic	6	Traffic
1	Character	7	Pipeline
2	Isoline	8	Water System
3	Control Point	9	Boundary
4	Resident	10	Physiognomy
5	Ground Object	11	Vegetation

Each symbol type means:

1—— Punctate ground object that is not able to rotate, such as street lamp. The attribute code would be the code name. Parameter is not necessary.

2—— Punctate ground object that is able to rotate, such as gate pier, which is fixed by two points. Parameter is not necessary.

3—— Control point and elevation point.

4—— Mismatched linear ground object, such as national boundaries. Such ground object merely can be polygonal line. It can’t be curve or circle.

5—— Linear ground object, including line segment, complex line, circle, arc. It is determined when it is drawn. Parameter represents the linetype of this linear ground object. Bilinear ground object such as bounding wall is of this type.

6—— Complicated ground object that is positioned by two points, such as shopwindow. It is not allowed to be fitted.

7—— Complicated ground object that is positioned by three points，such as bridge. In the process that it is positioned by three points, input two endpoints of one side and one random point on the other side. These 2 sides are considered paralleled. Such ground object is not allowed to be fitted.

8—— Complicated ground object that is shaped as circle, such as kiln in pile shape. Parameter is not necessary.

9—— Complicated ground object that is undertaken special treatment in the nodal point, such as power wire. Parameter is net necessary. And it is not allowed to

be fitted.

10—— Ground object that is filled.

11—— Bilinear ground object, such as barrier wall；

12—— Natural slope.

User can register the ground object symbol from type 1 to 5. Type 1 to 3 represent punctuate ground objects. The way to add punctuate ground object: first, customize the segment of the new punctate ground object in the punctate ground object file (point.def). Then add the attribute code, respective layer, symbol type (from 1 to 3), parameter, description of the new punctate ground object to the symbol definition file (work.def). For example, symbol of “triangulation point”:

131100,3,3,3, triangulation point

It means in file “point.def”, the attribute code of the triangulation point is 131100. It is a control point layer, with symbol type 3.

Type 4 and 5 are linear ground objects. The way to add linear ground object: first, add a linetype description in linear ground object file (linetype.def). Then add the ground object attribute code, respective layer, symbol type (type 4 or 5), parameter, description of this linetype to the symbol definition file. For example, linear ground object “broken outboard of the Great Wall”:

144121, 4, 5, 6, broken outboard of the Great Wall

It means the attribute code of “broken outboard of the Great Wall” is 144121. It is a resident layer.

2.8.6 SPD file

For the graphics file of WinMG2007, which is a binary format, each SPD file corresponds to a complete graphics, including raw data, coordinates data, and all ground object entities.

2.8.7 DAT file

Coordinates data file is the most fundamental data file in CASS, with the extension name “DAT”. No matter exporting the coordinates data from the Win Total Station, or exporting the data from the PDA to the computer, or recording the data with electronic panel in field, it will create a coordinates data file, with the formats as below:

Pt 1 name，Pt 1 code, Pt 1 Y (E) coordinate, Pt 1 X (N) coordinate, Pt 1 elevation

…

Pt N name, Pt N code, Pt N Y (E) coordinate, Pt N X (N) coordinate, Pt N elevation

…

Description:

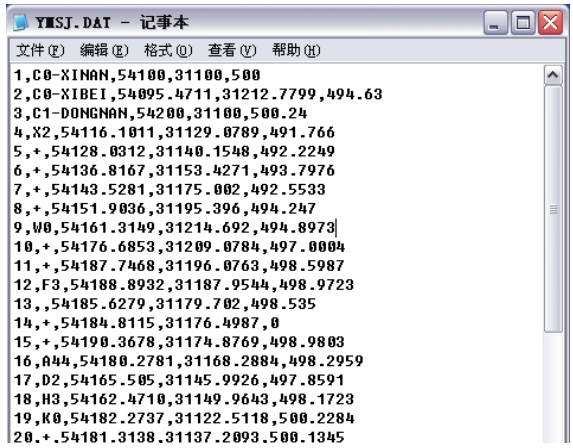
①Each row represents one point in a file;

②The units of Y, X, and elevation are meter;

③The code cannot include a comma. Even though the code is absent, the comma afterwards cannot be neglected.

④All the commas should be input in half width form.

In WinMG2007, no matter importing coordinates data automatically or exporting coordinates data, the format will be in the format below.



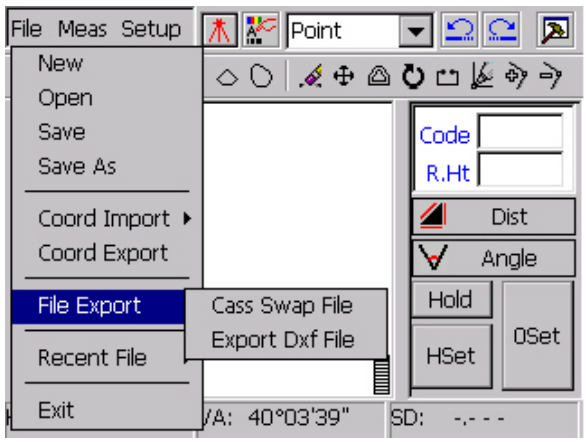
DAT file

3 PREPARE FOR MEASURING

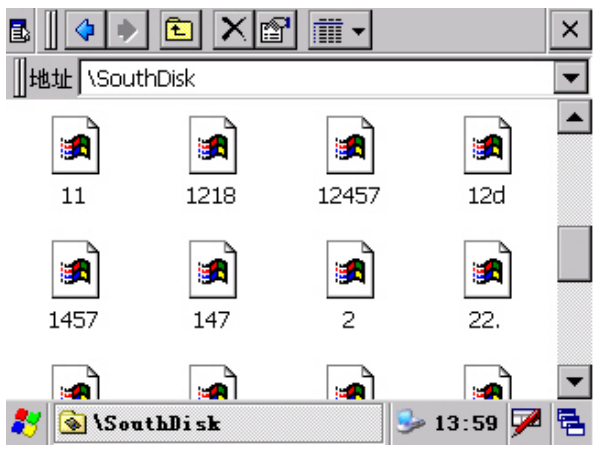
3.1 File Management

Double click the icon of WinMG2007 on the desktop to enter into WinMG2007 main menu. Click File, then New, to create a new job. This job is unnamed. In order to save the job in real time, we'd better click Save before collecting the data, then the system will request you to input the job name and save path.

The file management menu is under File, as shown below.



File menu



File saved

The default save path is “SouthDisk”, as shown

Caution: User’s personal file and measuring data should be saved in SouthDisk folder. In case it is saved in other path, it will be lost after taking out the battery.

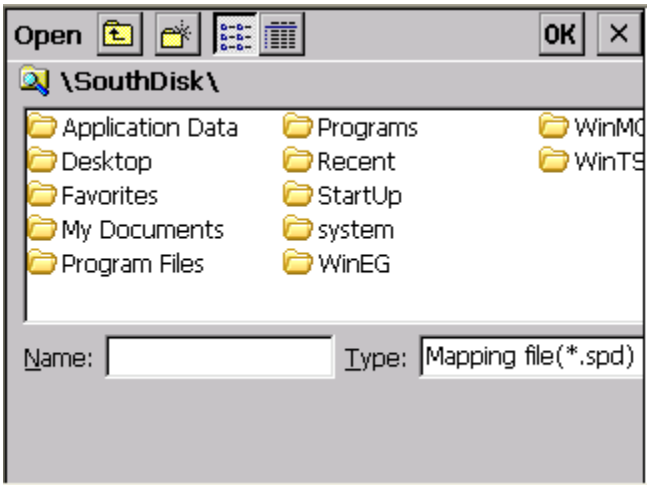
3.1.1New

Click File, then New to close the current graphics, and create a new graphics that excludes any entities and coordinates. Be there any changes after last saving, the system will request you to save the current graphics, as shown below:

Notice to save

3.1.2 Open

Click File, then Open, the dialog box “Open” will pop up as below. This function can open any image file selected and close the current graphics. (If the modification on the current graphics hasn’t been saved, the system will ask you whether to save.)

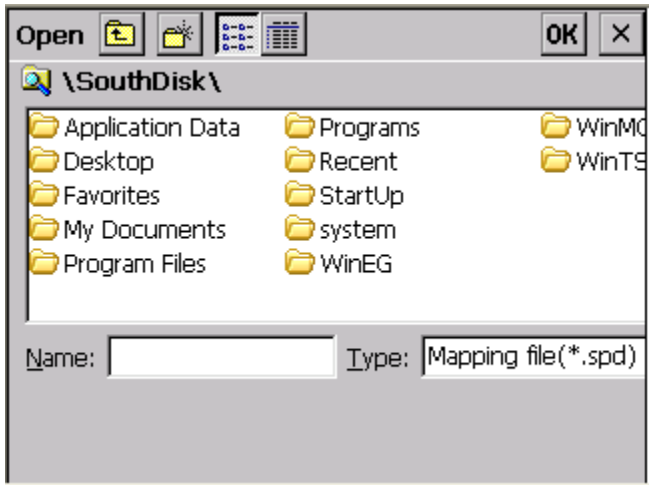


Open a file

Notice to save

3.1.3 Save

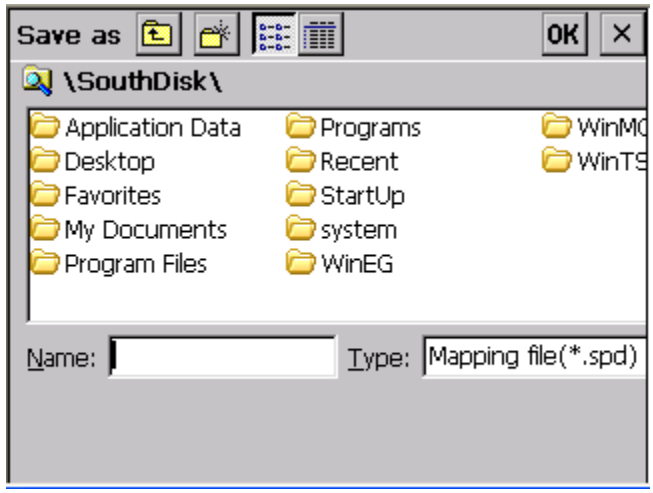
Click File, then Save, the system will save the current graphics. If it is the first time to save, the system will request you to choose a save path, and input the respective file name. Click OK to save, as shown below.



Save

3.1.4 Save as

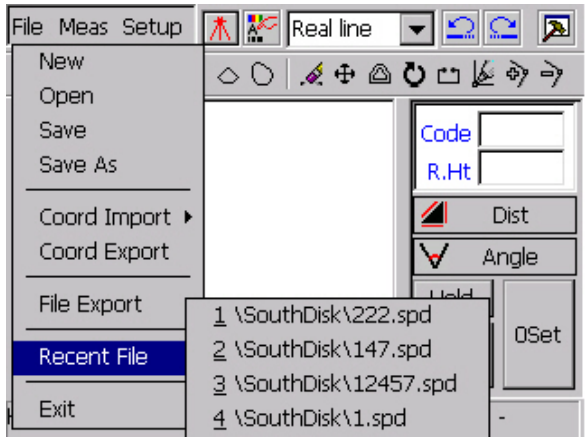
Click File, then Save as, a dialog box “Save as” pops up. Select the path to save the file and input the respective file name. Click OK to finish saving, as shown below.



Save as

3.1.5 Recent File

This function displays the path of the files that is manipulated or saved recently, as shown below.



Recent File

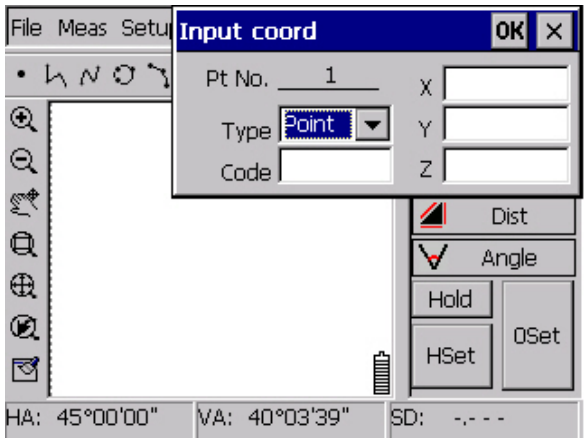
Caution: If the file is moved or deleted, an error massage will appear. .

3.1.6 Exit

This function is to quit this program. If the current graphics is not saved or it is modified, the system will notice you to save the graphics.

3.2 Coord Import

Before measuring, user should input the control point of the area that is to be measured. There are two ways to input: Manual Entry and Auto Import. Here's the instruction to input the coordinates by Manual Entry.



Import

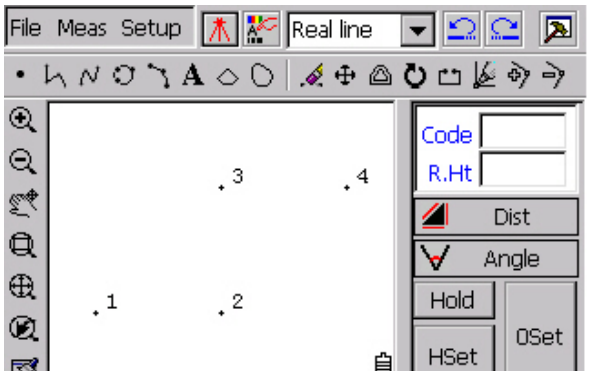
Click File→Coord Import→Manual Entry， as shown above.

Input the attribute of this point in type column; Code column allows user to input customized code. We can input 4 points according to the following form.

Pt No.	Name	X	Y	Z
1	A1	100	200	22
2	A2	200	200	22
3	A3	300	80	21
4	A4	250	40	20

Caution: Point number is accumulated automatically. It is not allowed to modify it manually.

Click × after inputting the fourth point. Then click to display all the 4 points on the screen, as below.

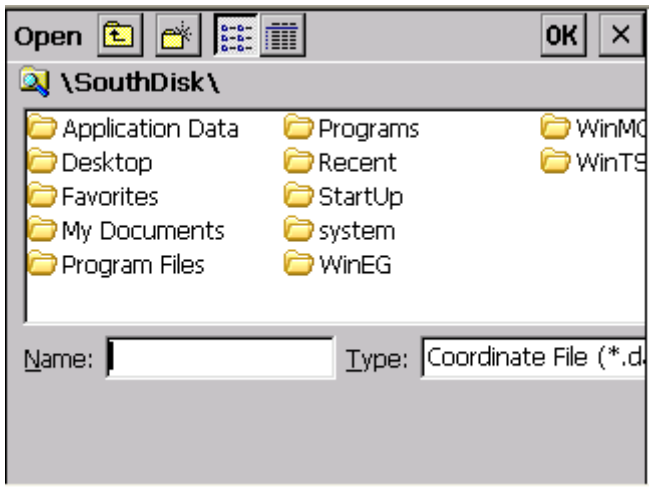


Control Point Graph 1

Another way to import the coordinates is Auto Import. When the area to be measured is very large, coupled with many points, employing Auto Import will bring great convenience to the surveying job.

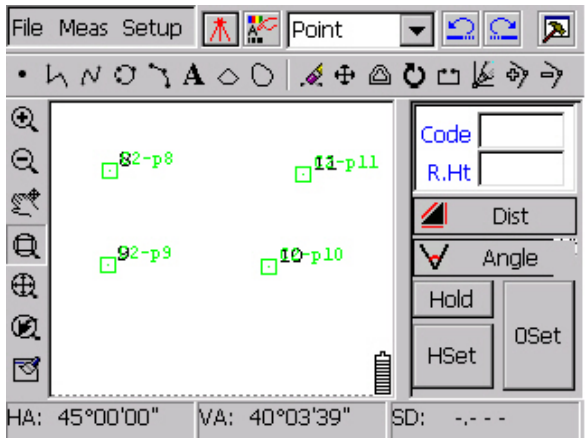
First, user should input the control points of the area to be measured in a txt file according to the *.dat form which has been introduced in last chapter, and save it. Suppose the file name we save is “kzd.dat”. Upload “kzd.dat” to the folder “SouthDisk\” in the total station. Enter into WinMG2007, create a project, name the file and save it.

Click File→Coord Import→Auto Import, as below.



Auto Import

Click “kzd.dat” and click OK, the control point will be imported to the project file, as below.



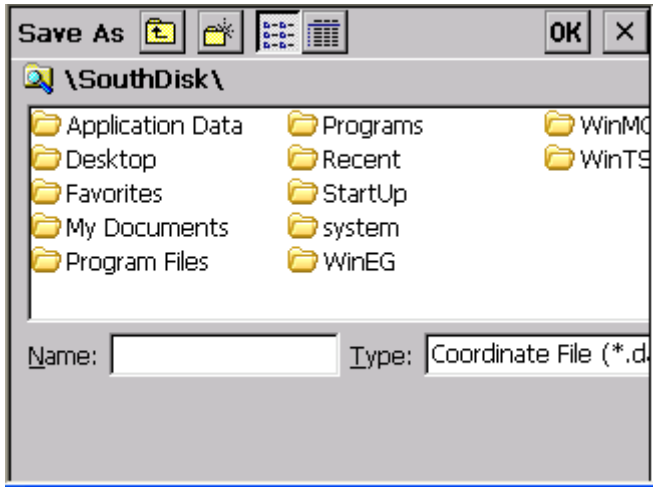
Control Point Graph 2

After importing the control points, user should complement the orientation of the measuring station, and stat to survey in field.

3.3 Coord Export

Export coordinates data in formats of (*.dat) or (*.dxf).

Click File→Coord Export, as below.



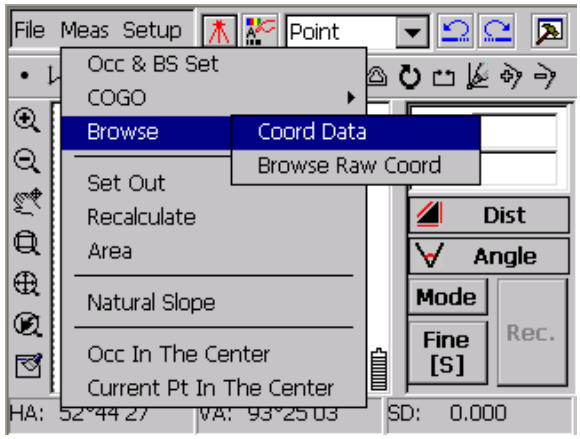
Data Import

Select the folder where you are to save the file, and name it “STUDY”. Press ENT button on the keyboard, or click OK on the screen, all the data in this project file will be saved in the format of “*.dat” in the file “STUDY.dat”. .

Caution: “*.dxf is for Auto CAD and “*.dat” is for CASS (product by SOUTH).

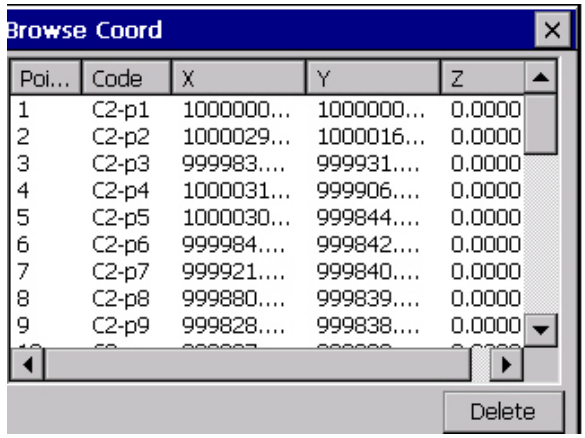
3.4 Brose and Edit

Click Meas→Browse, as below.



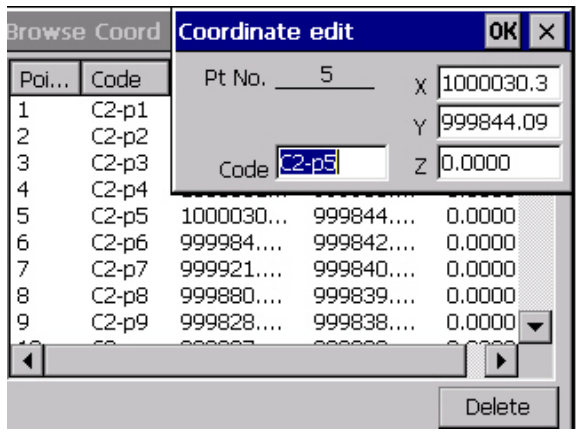
Browse

You can browse Coord Data and Browse Raw Coord in this function.



Coord Data

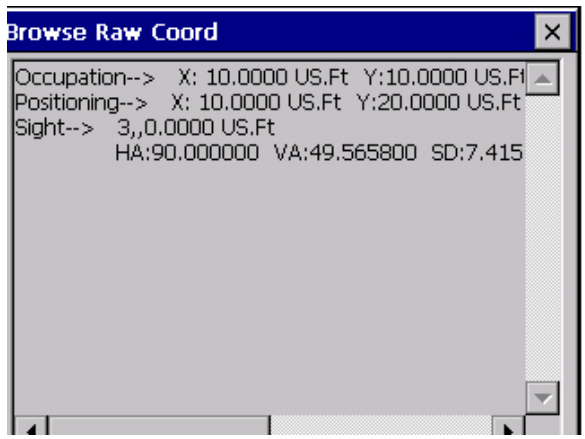
Coord Data displays Point No., Code, X, Y, Z and Elevation in order. Double click a certain line will pop up a “Coordinate edit” dialog box, as below.



Coordinate edit

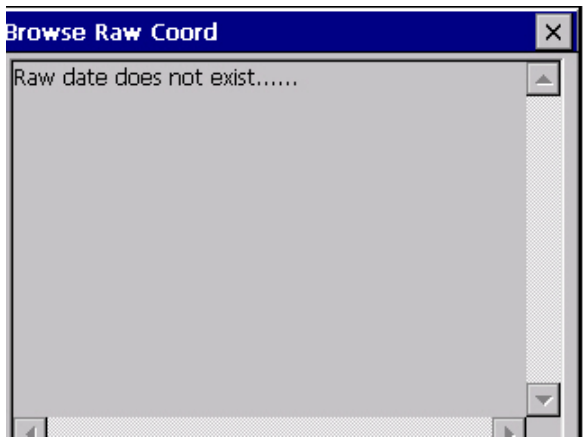
From this dialog box, user is able to edit the code and coordinates values.

Caution: User can adjust the width of the row to see the full information of the coordinates.



Raw data

If there is no raw data，it displays “Raw data does not exist…..”, as below.



Browse Raw Data

Due to the limitation of the LCD, some data cannot be displayed. User can double click the record to pop up the dialog box showing each data, as “Coordinate edit” shows.

In the dialog box for a single data, user can see the complete information as well as edit the wrong data. Click OK to save.

Caution: User can only see the raw data. Modification is not allowed.

3.5 Setup before Measuring

Before measuring with WinMG2007, we must be clear about the common measurement settings. These manipulations are positioned under pull-down menu. Here are the detailed instructions.

3.5.1 System Setup

In the interface of “System Setup”, user can define the screen capture range and capturing method, set the coordinates information displaying and the positioning method of 4-point object, customize the sheet line system and its size, as well as decide whether to display battery remaining condition, north arrow, distance unit, and quick draw mode.

Screen Capture: Set the capture range. 5 pixels is the default value. Capturing methods include capturing endpoint, foot of perpendicular, nearest point, and midpoint of line. For more instructions to how to capture objects, refer to “Screen Capture”.

Coord Info (Way of Displaying Points): There’re 4 methods to display the point: None (no display), Point, Pt No., and Pt Code. Thronging selecting these options, user can control the displaying or hiding of measured point.

Caution: Either the Pt No. or Pt code can be shown at a time.

4 Point Object: Set the way to position the 4 points object, such as bridge, house, stairs, etc.

Sheet Line System: Set the scale and norm of the image.

3.5.1.1 Screen capture

According to the range set in System Set and the extent point on the screen you click at close to, system judge that if operator clicks at the point or ground object. Then, get the coordinates and confirm the ground object user chooses. Capture contains Endpoint, Foot of perpendicular, nearest point, Midpoint of line. You could find them in System Setup in Setup.

Endpoint

Endpoint is suitable for line object and curve object. If operator chooses the Endpoint option, system pick the nearest point or the endpoint of a curve according to the direction of the line, when click at the point near the line object or curve object.

Nearest Point

Suitable for coordinates collection. Once there are coordinates in the graph, system will collect the nearest point. The difference from Endpoint is: Endpoint might get nothing of data, but nearest point will capture the point, only if there have coordinate data exists.

Foot of Perpendicular

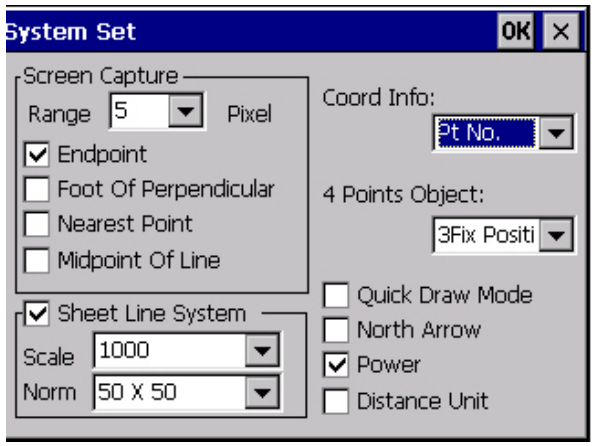
Foot of perpendicular is suitable for line object. Once you collect this option in System set, system will confirm the position of the foot automatically according to the direction of the line, when click at the point near the foot.

Midpoint of Line

Midpoint of line is suitable for line object. .Once you collect this option in System set, system will confirm the position of the midpoint automatically according to the direction of the line, when click at the point near the midpoint.

3.5.1.2Point display

In System set, display of point can be set. Click Setup→System set, as the picture below:



Point display set

In the dropdown list of the point display set, there has “None”, "Point”, "Pt No.”, "Pt Code”, four types to collect, by which content of coordinate point appeared in graph can be set.

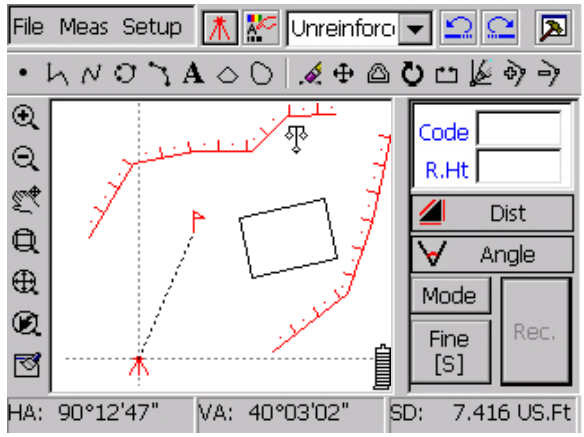
None：All of the contents about the point will not be shown.

Point：Only position of the point will be shown.

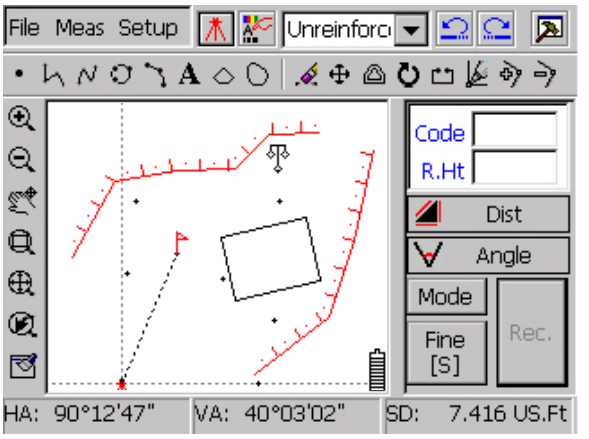
Pt No.：Point No. and position both will be shown

Pt code：Point code and position both will be shown.

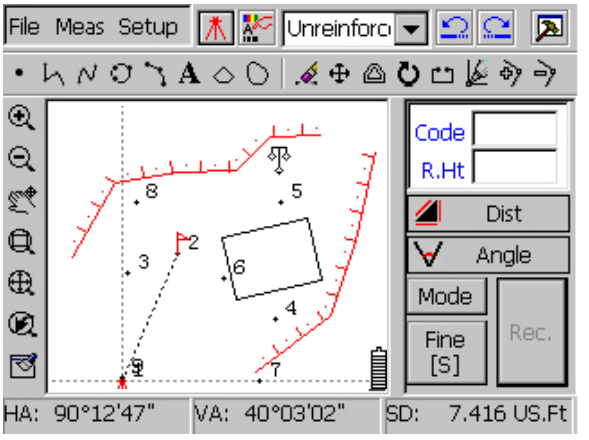
Each type graph shown as below:



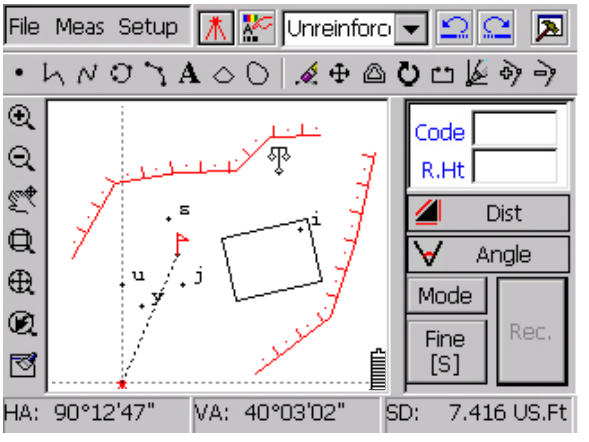
None



Point



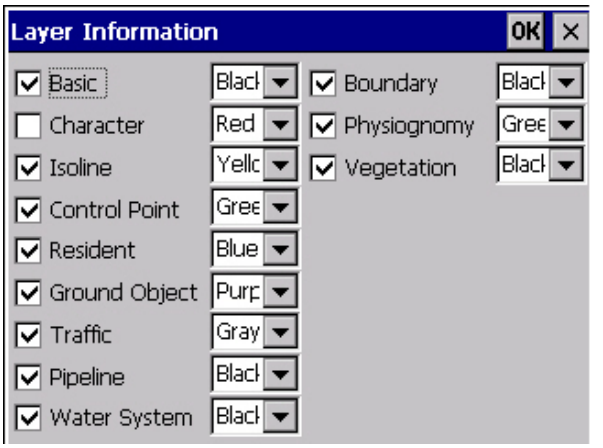
Point No.



Point code

3.5.1.3 Layer set

Click these two icons in turn: Setup→Layer, as below “layer information” options will be showed.



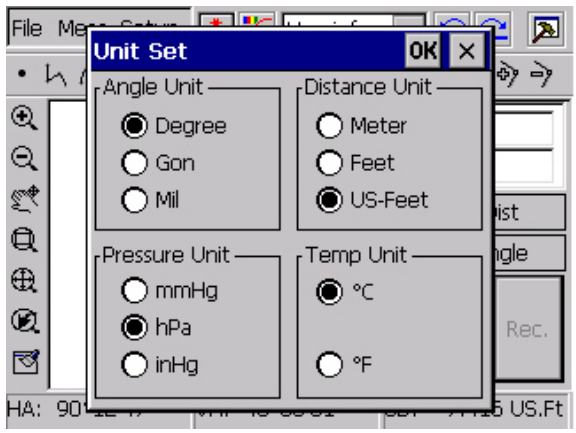
Layer information

There are 12 layer-control switches and 12 layercolour-controls as dropdown list mode. They control the display of each layer. If a layer-control switch is turned off, a corresponding layer can not be shown. However, the object in corresponding layer can still be edited. And the corresponding object will be hidden, if Refresh order is carried out. Colour of corresponding layer can be set through the dropdown list at right side of the corresponding layer-control switch.

3.5.1.4 Unit set

Click these two options in turn Setup→Unit Set, “Unit Set” dialog box will be shown as below. User can set the unit of angle, distance, pressure, temperature here. For example: when angle unit is set as Gon, distance unit set as Feet, corresponding sets would be changed in the whole software.

Note: Once change the unit, system will change all of the data unit to the one have been set.



Unit Set

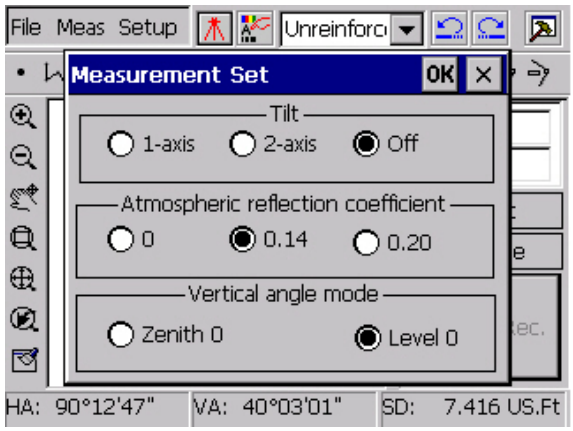
In Unit Set, the options as below can be set:

Menu	Option	content
1.Angle	Degree/Gon/Mil	Collect the angle unit, have Degree(360°), Gon(400 Gon),Mil(6400 Mil) to choose
2.Distance	Meter/Feet/US-Feet	Collect the distance unit, have Meter, Feet, US-Feet to choose.
3.Temperature	°C/°F	Collect the temperature unit, have °C, °F to choose.
4.Pressure	mmHg/ hPa/ inHg	Collect the Pressure unit. Have mmHg, hPa, inHg to choose.

Unit Set

3.5.1.5 Measurement Set

Click these two options in turn: Setup→Measurement set, “Measurement Set” dialog box will be shown as below:

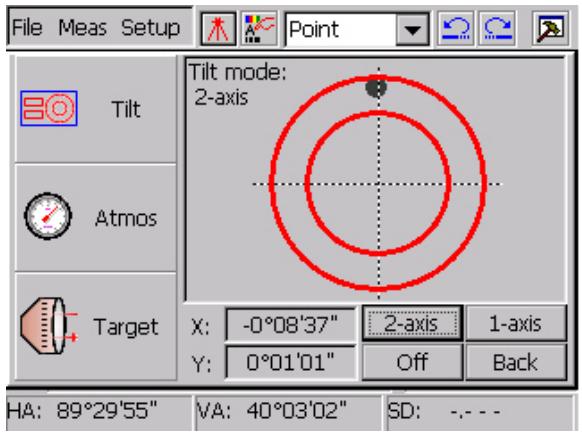


Measurement Set

In Measurement Set, the options as below can be set:

Menu	Options	Content
1.Tilt mode	1-axis/2-axis /off	Collect the Tilt mode. There are 1-axis (vertical angle), 2-axis and off three types to choose.
2.Atmospheric reflection coefficient	0/0.14/0.20	Collect Atmospheric reflection coefficient. There are 0, 0.14, 0.20 three constants to choose.
3.Vertical angle mode	Zenith 0/Level 0	Collect Zenith or Level direction as 0 directions.

When Off is choosed, Tilt will not work while the vial plate over the range; When 1or 2-axis mode is chosen, Tilt will work automatically when the vial plate over the range. And The Tilt dialog box pop up. This dialog box will not disappear until total station is leveled. Shown as below:



Tilt

The rest functions are described in Win total station manual specifically, please read Win total station manual, if you want to know more.

Atmospheric Refraction and Earth Curvature Correction

The instrument will automatically correct the effect of atmosphere refraction and the earth curvature when calculating the horizontal distance and the height differences.

The correction for atmosphere refraction and the earth curvature are done by the formulas as follows:

Corrected Horizontal Distance：

D=S * [cosα+ sinα* S * cosα(K-2) / 2Re]

Corrected Height Differentia：

H= S * [sinα + cosα* S * cosα(1-K) / 2Re]

If the correction of atmosphere refraction and the earth curvature is neglected, the calculation formula of horizontal distance and the height differentia are:

D=S·cosα

H=S·sinα

In formula: K=0.14 ……Atmosphere Refraction Modulus

Re=6370 km ……The Earth Curvature Radius

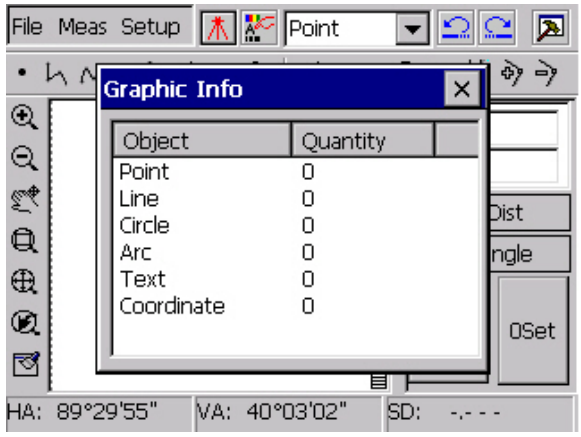
α (orβ) ……..The Vertical Angle Calculated From Horizontal Plane (Vertical Angle)

S ……Oblique Distance

Note: The atmosphere refraction modulus of this instrument has been set as: K=0.14.it also can be set as: K=0.2,or be set shut (0 VALUE).

3.5.1.6 Graphic information

Click these two options in turn: Setup→Graphic information, "Graphic information" dialog box will pop up as below: The number of points, lines, circles, arcs, text, coordinates is shown in this dialog box, see below:



Graphic information

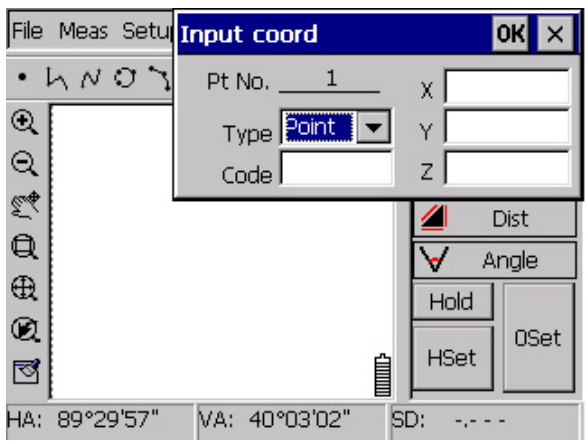
4 MAP WITH WINMG2007

4.1 Create new project

Click WinMG2007 icon on the desktop twice. Then press the New option to create a new project. In this case, The name of project is not defined, in order to save the measurement data, it's better to name the project first (example: AA.spd).

4.2 Coordinate import

Import the coordinates of reference points before measuring. The two ways of import has been introduced last chapter: Manual Entry and Auto import. First, use manual entry way to give a demonstration.



Coordinate import dialog box

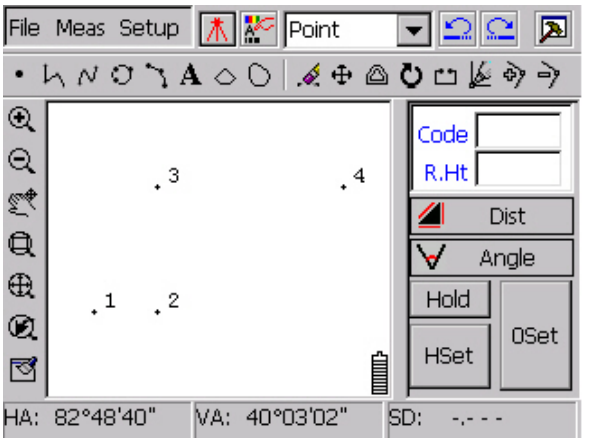
Click File→Coord Import→Manual Entry in turn, Coordinate import dialog box will pop up, shown as the graph.

For example input 4 points data, according to the form below. User defined code in code column, we Input the attribute of the point according to the table below:

Pt No.	Pt	X	Y	Z
1	A1	100	200	22
2	A2	200	200	22
3	A3	300	80	21
4	A4	250	40	20

Note：Data accumulates automatically，and can not be interrupted by hand.

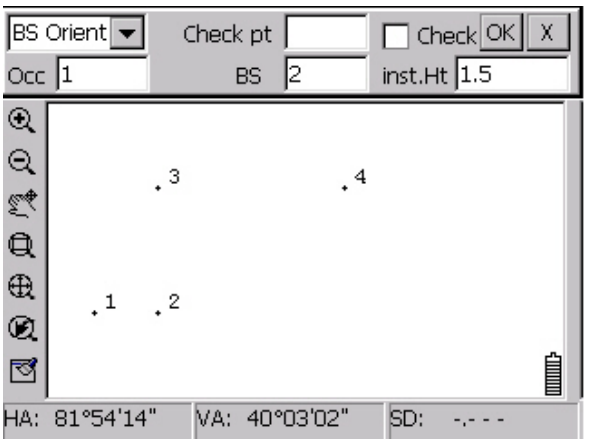
When input is completed, press × to quit. Then click to check if all the points displayed on screen. Shown as below:



Reference points graph

4.3 Occupied and Backsight point Set

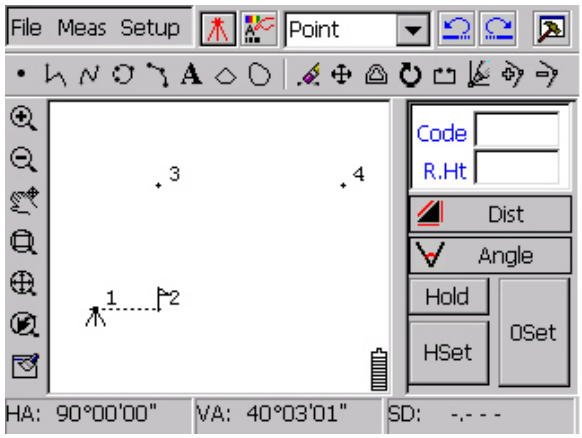
Click below menus in turn: Meas→Occ&BS Set, occupied point and backsight point set dialog box will pop up as below. This function offers two ways to set: BS orientation and Azimuth orientation. We use BS orientation to describe:



Occupied point and backsight point set

As occupied point and backsight point set shown above, input occupied point No., backsight point No., Instrument height. If check for occupied point and backsight point is needed, please also input the point No. of the checking point. Then click √. The input of the occupied point and backsight point can be done by capturing the point on the screen.

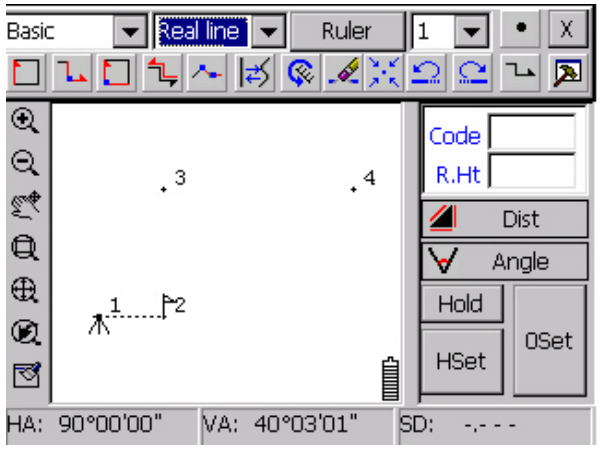
Aim at backsight point with telescope, click √ to complete the set. For now, icon (Occupied point), (Backsight point) can be found on the screen, shown as below:



Display of occupied point and backsight point

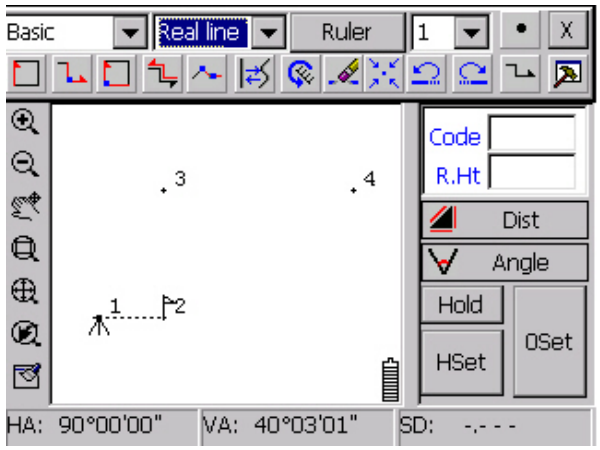
4.4 Operation of E-panel

Click the icon above to get into E-Panel to start measuring. Shown as below:

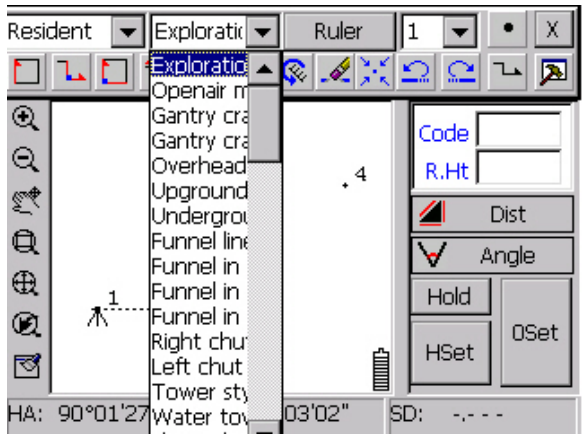


E-Panel

First step: Choose the layer where ground objects exist, then set the attributes of them. Take a step of measuring a house as an example. Collect Resident in layer dropdown list, then collect General Housing in attribute dropdown list, shown as below:

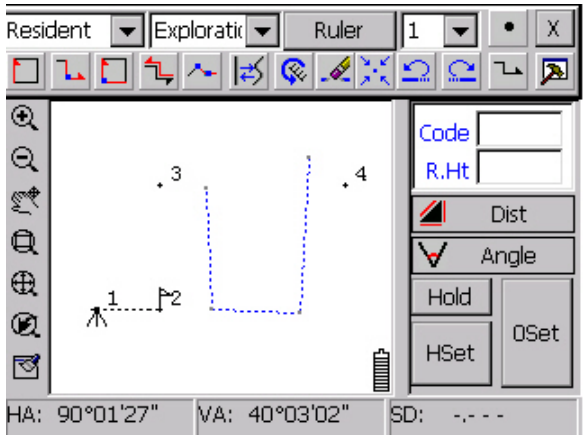


Layer dropdown list



Attribute dropdown list

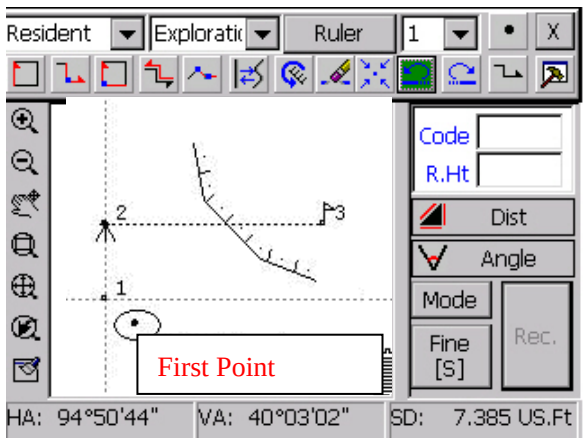
Note: More frequently used item will be put upper in the box



Second step: Choose Ruler type as “1”, click Line, and then click Dist rightside in “Measuring panel” to get into state of Distance measure. Sight the target point click “Mears”, see graph below:

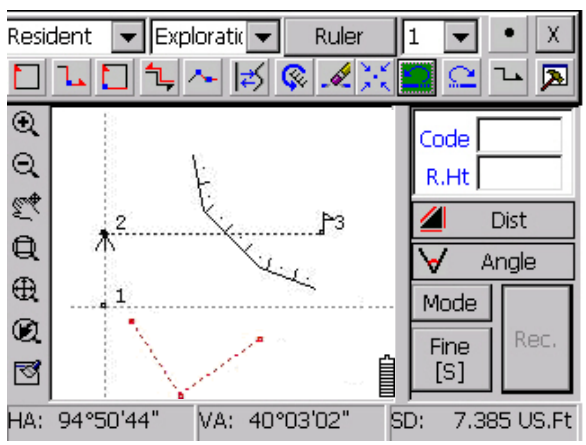
In the bar downside of the screen, at (HA), (VA), (SD) items, data of measurement will be shown simultaneously.

Prism height and code should be input manually. Press Record to save data. Mapping panel will show the position of point at the same time. See below:



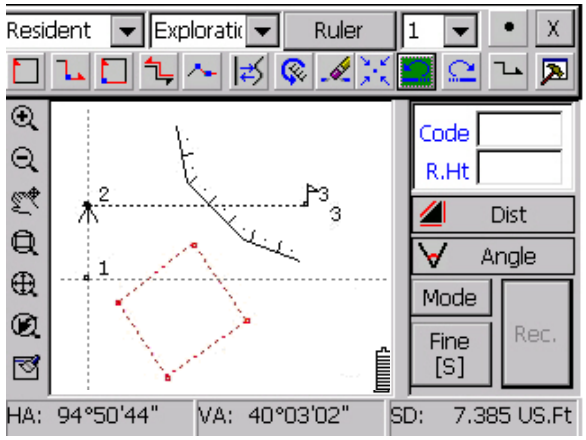
First point of a house

Get the second and third points by the same way, shown as:



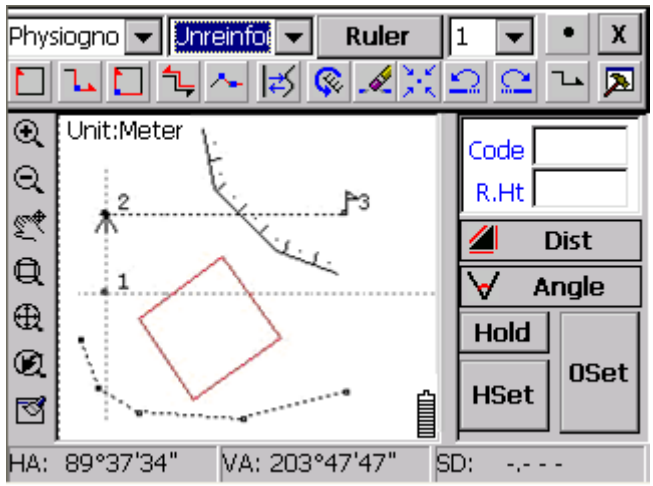
Three points of a house

Click to close them as a house. Shown as below picture:



Closed house

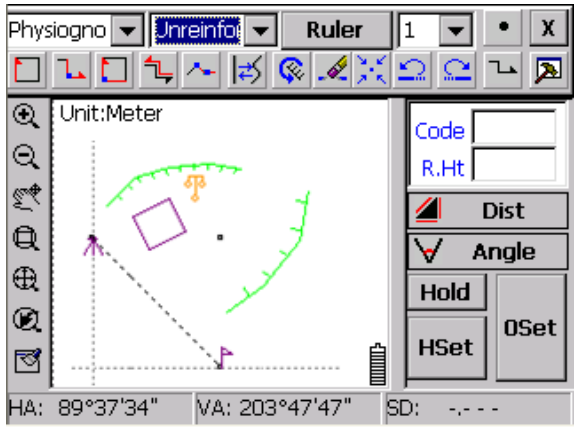
Take “measuring scrap” as an instance. Set Layer dropdown lists as “physiognomy “ and Attribute dropdown lists as “unreinforced scrap”, choose Ruler “1”,click Line, then Meas→Record to start measuring. Repeat “Meas→Record” to get 1, 2, 3, 4, 5 points, shown as below:



Unreinforced scrap

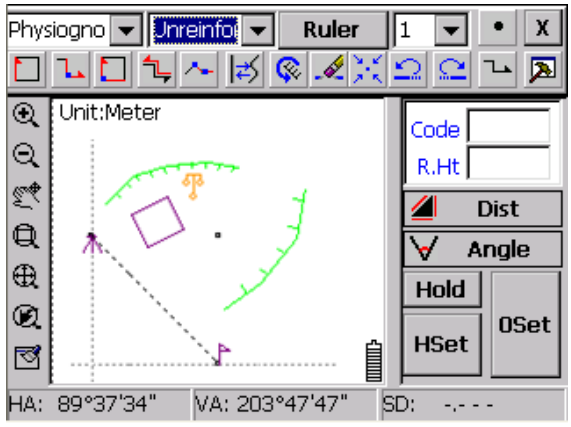
If operator need to measure the street lamp sideward while the scrap is not finished, at this moment, operator could collect ruler “2”(Right now, unreinforced scrap is set as waiting state),then click Point to change to point-object measuring state. Set Layer dropdown lists as “Ground Object" and Attribute dropdown lists as “Streetlamp”. Then start to measure. Streetlamp will show on screen automatically

after clicking Record. Shown as below:



Streetlamp

To continue to measure scrap after finishing streetlamp, only have to select Ruler '1' （By now,unreinforced scrap measured just now is put under selected state ）.So, 6, 7 points of scrap can be measured. By which line object could always be complete. After finishing all points, quit E-Panel, then click '✉'to refresh the screen, measured objects display as "Simple object" below:



Simple object

Simplest point, line, plane objects are contained in this graph. It's the same way to measure other kinds of ground objects.

In the procedure of measuring, several ground objects may need to be measured at the same time. With this function, different objects can be set with different rulers. when operator needs to measure scrap, just switch to ruler'1'， then scrap measuring

is in active state. If operator needs to continue to measure house, only need to switch to ruler‘2’to measure house.

When setting an object to one ruler, select the object’s layer and attribute, then choose the ruler number with pen, click ruler to finish setting.

After finishing mapping, click menus in turn: File→Save, input MyFirstMap in the pop-up dialogue box, click OK .WinMG2007 will keep MyFirstMap.spd in SouthDisk list.

Notice: Data must be set in “SouthDisk” list, otherwise, data would be deleted completely when Win total station is power off.

4.5 Method to improve mapping efficiency

4.5.1 Select mapping type

WinMG2007 has two ways to map: one is mapping when measuring, the other is measuring first, mapping second. User can switch them from one to another optionally.

Mapping when measuring is one kind of function that allows total station to map while getting point coordinates from measuring. It is often used in situation of low measuring frequency and many kinds of ground objects. It has advantage of preventing measured points from being forgotten. This can make procedure more clear, and it’s strongly suggested.

When measure frequency is high, such as measuring with several prisms, and ground objects are not complex, surveyor can measure several points first, and map them in time clearance to spread the points to map.

4.5.2 E-Panel

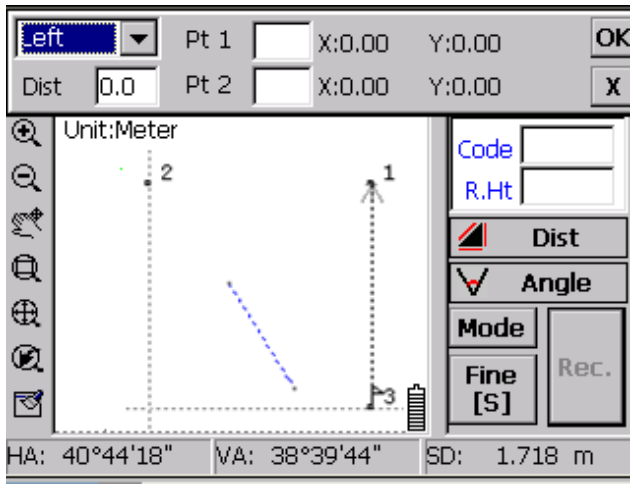
E-Panel can connect the points with line automatically. All of the new points will be connected to the measuring object automatically, and it contains 、 、 、 、 , etc. ways to measure line object. Therefore, it’s easier of collecting points before mapping in the case of too many line objects.

With E-Panel, surveyor can measure point and line objects at the same time. After

click Point and make sure that set the ground object type already, point icon will appear at next new point. Then, next point will continue to be added to line object. For example, it can be used when you want to add a streetlamp without stopping the measure the route.

In order to increase the speed of mapping, sometimes, using two or more prisms is necessary, which will cause the problem of how to switch objects. For example, when one prism is measuring a house, and another one measures a route, these two prisms take turns to measure. In this situation, multi-ruler could handle it easily. Only need to distribute the different objects to different rulers one by one, and switch them when you are surveying.

When line and angle measurement are needed, you could click to do it. Show as below graph:



Input measurement

Input the point No. of first and second points, then choose the direction of next point and input the distance, click OK .With this function, house can be measured easily.

4.5.3 Pick point on screen quickly and accurately

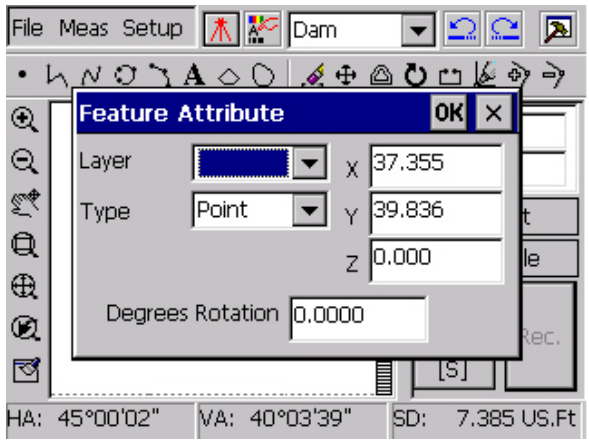
The accuracy of using pen to pick point is very low, so we need screen capture function to make it more accurate. There are four screen capture ways. Arrange them in priority order: Endpoint, Nearest point, Foot of perpendicular, Midpoint of line.

End point capture means capturing endpoint of line object. For example, you need to use this function to position the corner of a house, at which to draw a fence.

Nearest point means capturing the point which is nearest to the touch point. Foot of perpendicular and Midpoint of line are used for line objects.

4.5.4 Change entity attribute

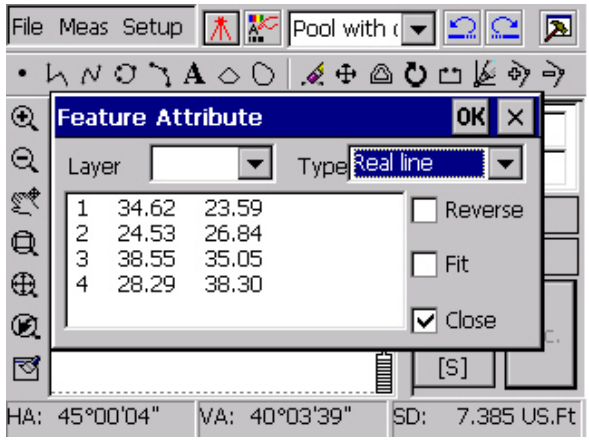
In the main menu of software, there is a " "icon, which is for viewing the attribute of ground object and editing them.



Edit of point ground object

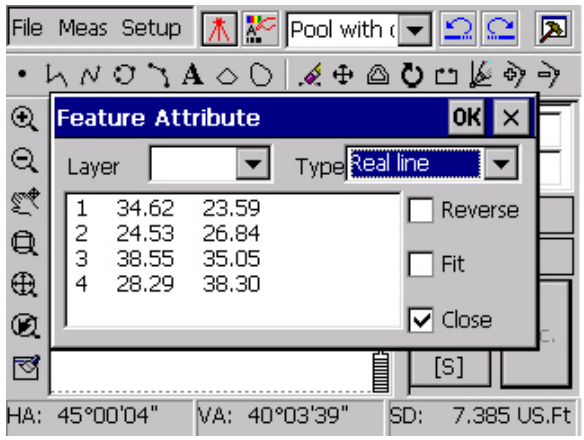
First, click this icon before editing attribute of ground object and make sure that pan button and windowing button are closed. Then click and select the ground object needed to edit. Dialogue boxes of editing point object and line object are different.

As shown in above picture Edit of point ground object, by selecting the layer, type and rotate ratio, we can change the attributes of ground object. By changing coordinates X, Y, Z, we can change the coordinate attribute of ground object. Click OK to finish edit, press × to cancel.



Editing for plane ground object

As picture “Editing for plane ground object” shown above, by modifying the layer and type of ground object, we can change the attribute of graph. By selecting inverse, close, etc. to edit the display attribute of ground object. Another important application is changing the type of ground object entity. For example, when measuring a scrap, in order to speed up, we usually express them with real line and edit the attribute of line as scrap later. See below:



Attribute search

4.5.5 Set graph at suitable position

WinMG2007 has strong viewing function, and many basic functions like Zoom in, Zoom out, Pan, Windowing, Zoom all, etc. Beside, there is a centering occupied point function which can put occupied point in the center of screen easily. Function of Centering the Point could put the last measured point in the center of screen.

If guest only need to view the picture, the box at right side of screen can be hidden for widen area to view.

Every time hitting the dropdown list, the screen will be covered by a large area, which will cause remapping the figure and the viewing speed will be slower when the area contains many objects. In order to avoid this situation, please not to shrink the image too much. Additionally, Point number display have to be noticed, setting as none when you don’t need to display will increase the speed very much.

4.5.6 Select suitable mapping tool

When mapping line object, operator can select Fold line or Curve line function

according to the fitting situation of line. When mapping closed plane object, like plant filling, Operator can select Close fold-line or Close curve to draw the closed line directly.

When mapping parallelogram object, like house, user can set 4 point object in system settings as 3 point, which can calculate the fourth point automatically and close when 3 points are set.

4.5.7 Use each mapping tool flexibly

WinMG2007 contains eleven different kinds of mapping tool. Using these mapping tools well will save much time and make the speed faster. For example, there is one streetlamp and fence to measure. On the other side of the fence, there is a symmetrical streetlamp towards the first one. Now you could only measure one streetlamp coordinate, then use Symmetry point function to get the other one's coordinate easily. For another example, in a case that you can not get one point's coordinate directly, now you could use measuring tape to get the distances from the point to another two known point and select Linear intersection to get that point's coordinate.

4.5.8 Utilize map edit tools reasonably

WinMG2007 has Delete, Move, Offset copy, Rotate, Break, Move the Node, Add Node, Delete Node, etc, for editing. Although it's not as strong as AutoCAD, it's enough to deal with common edit process.

There are Backspace and Revoke function icons, which allow you to get back and go back in unlimited times. That is convenient for user to go back after mistaking some steps. Except deleting function, all functions are set to aim at current objects. After clicking Refresh, the object that pen touch is current object. A critical sign of current object is showed by dashed. For example, if bridge is selected as current object, the four points of which will be connected by four dashed.

If a curve or a line lacks a point between two endpoints, you could use Add point function to add one point, and then use Move the Node function to put the point at the place you wish. In the process, screen capture function can be used to improve accuracy.

4.5.9 Process for Natural slope

Natural slope, reinforced natural slope, natural cliff, irregular stairs, all of them contain topline of slope and bottomline of slope, which exist separately and can be

edited separately. After editing, click Refresh, system will create new natural slope between these topline and bottomline of slope automatically.

5 COGO

In WinMG2007 software, COGO contains forward intersection, resection, linear intersection, angle intersection, vertical distance point, radiation, foot of perpendicular, distance line, lines intersection, point on line, Symmetry point, etc eleven coordinate calculating function.

Each coordinate calculating function has simple picture to instruct. System supplies manually input, capture on screen with pen and select from coordinate list three types of methods to input point number at every place to input point number.

If coordinate has already existed at the point we need to calculate, software will reserve a coordinate data which has same coordinate with the existed point. And the point number will be accumulated to the total point number. Software will show the notice of failure if there is no such intersection.

5.1 Forward intersection

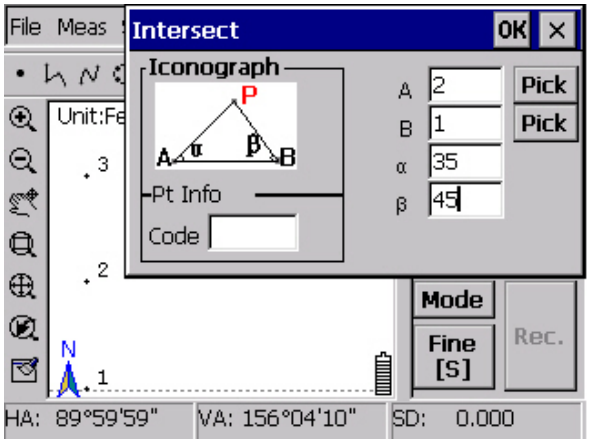
According to forward intersection, we have point 1, point 2, both of which are known points. Set occupation at these two points and get value of ∠1, ∠2, to calculate unknown point P. The mathematical model as below:

$$xP=\frac{x1\times ctg\angle 2+x2\times ctg\angle 1-y1+y2}{ctg\angle 1+ctg\angle 2}$$

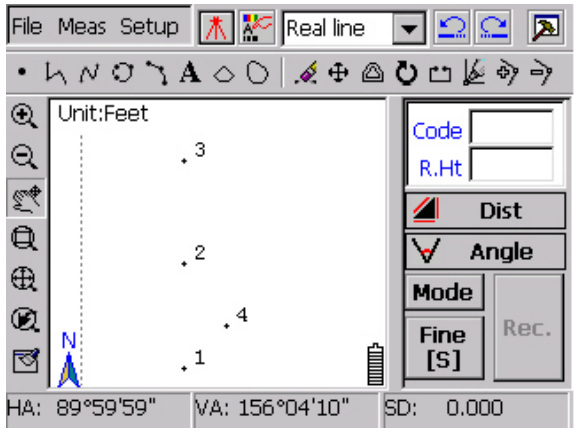
$$yP=\frac{y1\times ctg\angle 2+y2\times ctg\angle 1-x1+x2}{ctg\angle 1+ctg\angle 2}.$$

As picture ‘Forward intersection’ show, point 1 and point 2 are known, input angle value and click OK. Point position will be shown on the screen, new point number will be accumulated to the total existed point number. See No.4 point in picture ‘Forward intersection results’.

Notice: The intersection points locate in the leftside of the direction forward.



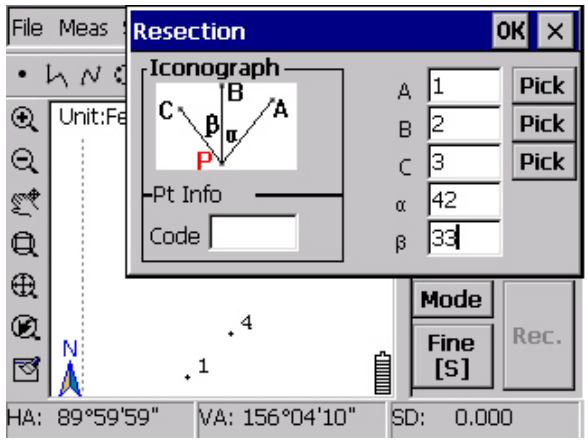
Forward intersection



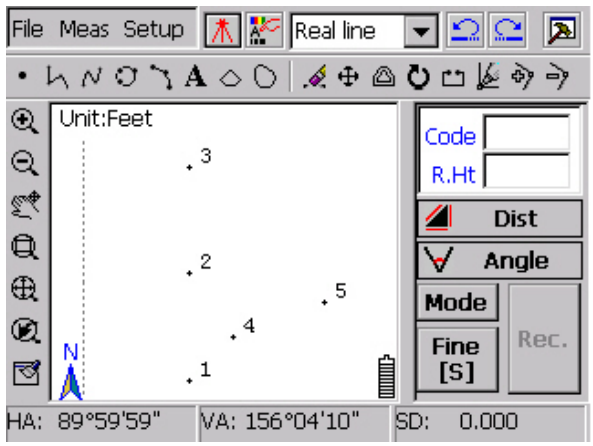
Forward intersection results

5.2 Resection

According to resection, we need three known points 1, 2, 3, two known angles α、β, click OK, intersection position will be shown on screen, new point number will be accumulated to the total existed point number. See point 5 in picture 'Resection results'.



Resection



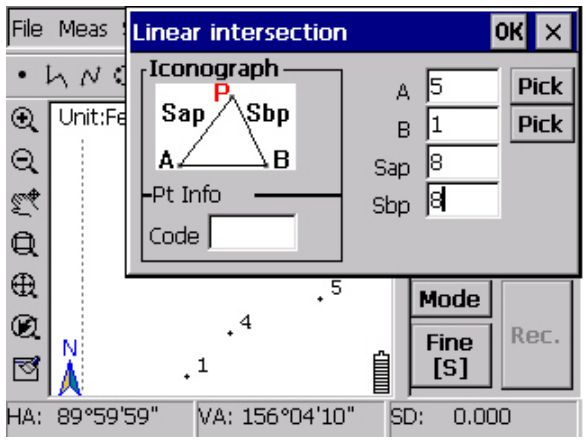
Resection results

5.3 Linear intersection

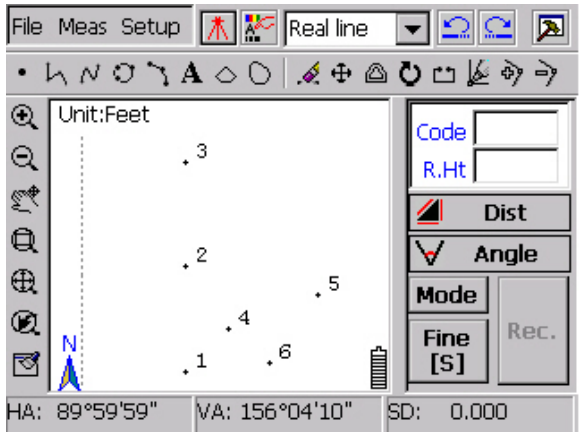
According to linear intersection, we need to set occupation at point P, get two distances from point P to point 1 and to point 5, to calculate coordinate of point P.

As picture 'Linear intersection' show, point 1 and point 5 are known points, input the distances from two known points to intersection point P. Click OK, Dialogue will show P number as 6.Point P position will be shown on screen and new point number will be accumulated to the total existed point number. See point 6 in picture 'Linear intersection results'.

Notice: The intersection points locate in the leftside of the direction forward.



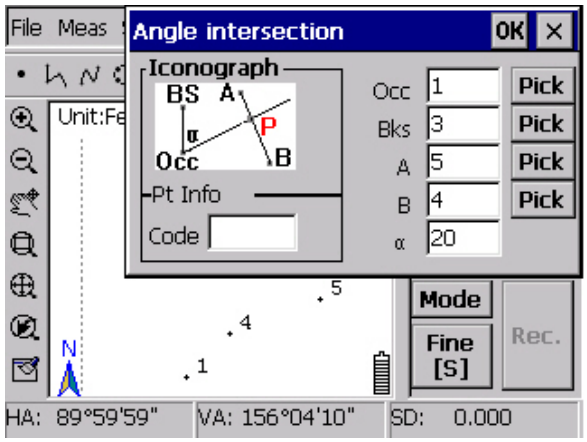
Linear intersection



Linear intersection results

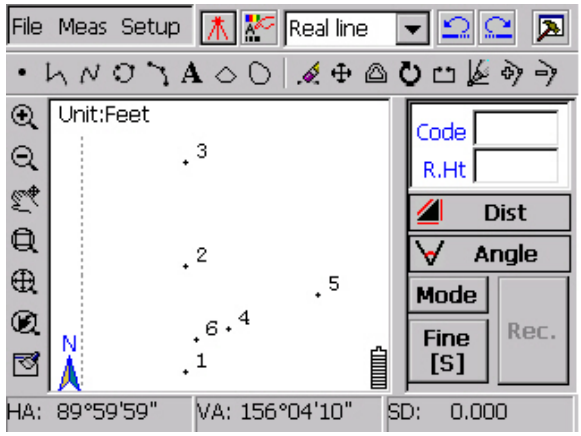
5.4 Angle intersection

In practical measuring, some problems like finding no place to put prism will appear. If unknown point and the two known points are on the same line, you can use this function to get point P.



Angle intersection

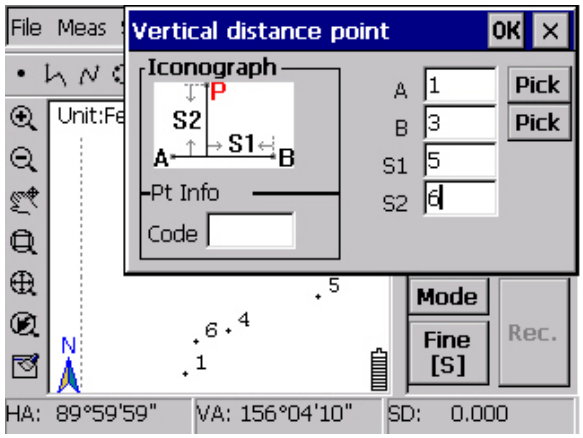
As picture 'Angle intersection' show, points 1, 3 are known, Point 1 is occupation point, and point 3 is backsight point. Input turn angle 'α' and click OK to calculate point P. Dialogue box will show intersection number as 6.Point position will be shown on screen. New point number will be accumulated to the total existed point number. See 6 point in picture 'Angle intersection results'.



Angle intersection

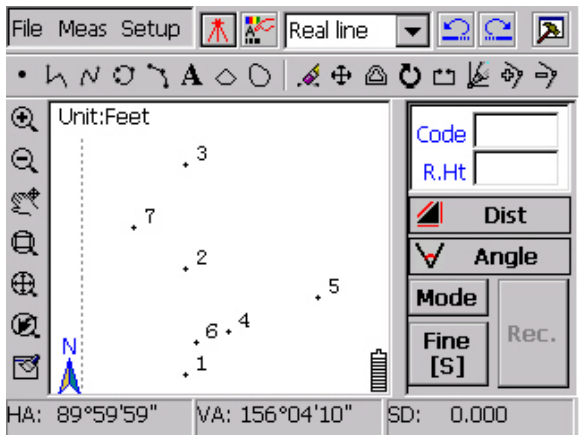
5.5 Vertical distance point

Point A, point B are known, distance from B to foot drop is S1,the distance from unknown point P to the line with end points of A and B is S2, to get point P coordinate.



Vertical distance point

As picture 'Vertical distance point' show, point 1 and pint 3 are known, input distance S1, S2, click OK and get coordinate of point P. Point P's number is 7. Position of it will be shown on screen. New point number will be accumulated to the total existed point number. See point 7 in picture 'Vertical distance point results'.



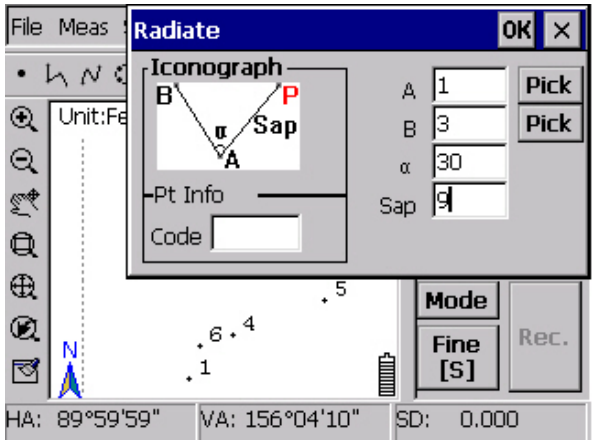
Vertical distance point results

Notice: When the sequence of point 1 and point 3 is counterclockwise rotation, let S1 be positive value, otherwise the value will be negative. When foot drop is located between two known points or on the extending line for the opposite direction of the straight line, S2 should be positive value. When it's located just on the extending line for opposite direction of the straight line, S2 should be negative value.

5.6 Radiation

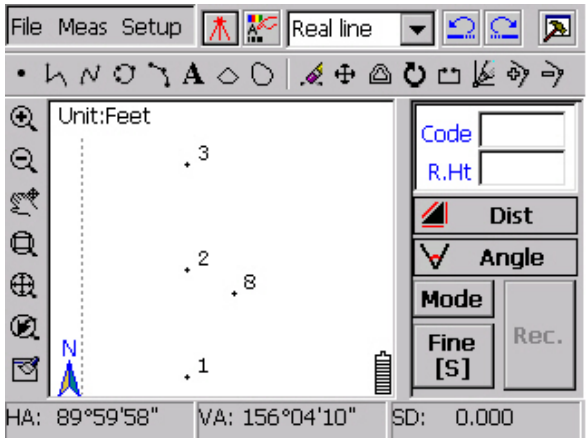
Point A and B are reference points, set occupation at A and set B as start

direction, get horizontal angle ‘α’ and distance ‘S’ by measuring, to calculate point P coordinate. Show as picture ‘Radiate’.



Radiate

Set occupation at point 1, set point 3 as start direction, input the distance from point 1 to point P and horizontal angle ‘α’, click OK, and then get coordinate of point P. The point number of P is 8, position will be shown on screen. New point number will be accumulated to the total existed point number. See point 8 in picture ‘Radiate results’.



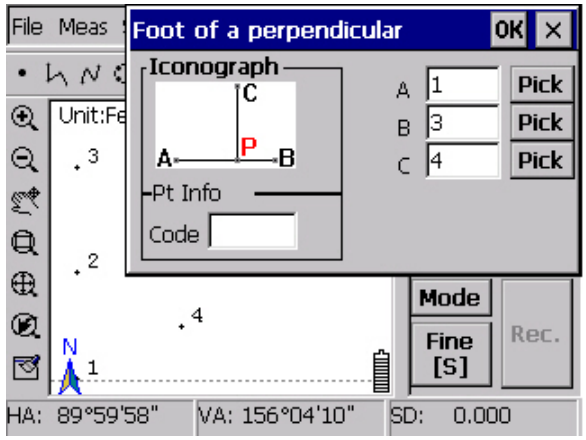
Radiate results

5.7 Foot of perpendicular

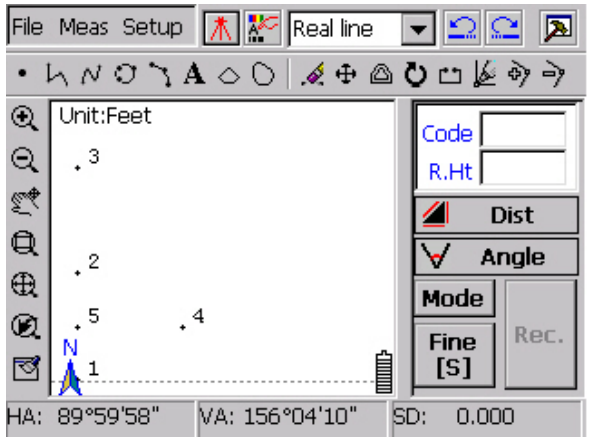
Points A, B, C are known points; make C as reference point, to calculate point P which is foot of perpendicular for line AB and point C.

As picture ‘Foot of perpendicular’ shown, straight line pass through point 1 and point 3, point 4 is reference point, click OK ,then get point P. Position is shown on

screen. New point number will be accumulated to the total existed point number. See point 5 in picture ‘Foot of perpendicular results’.



Foot of perpendicular

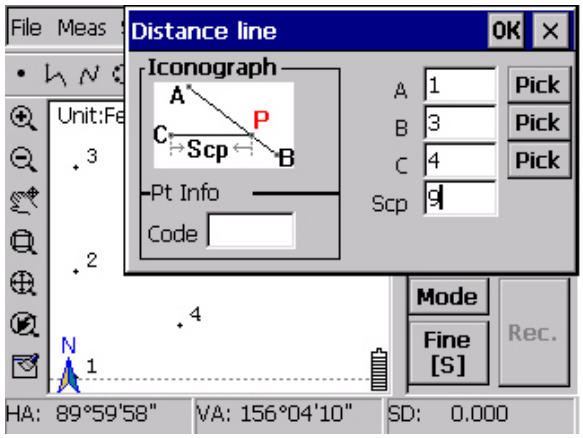


Foot of perpendicular results

5.8 Distance line

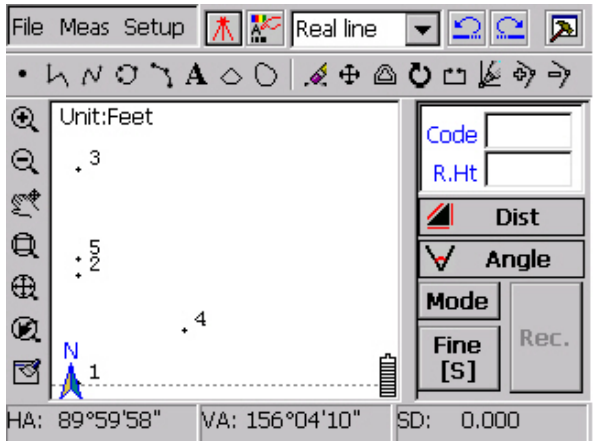
Point A,B,C are all known points, AB is a straight line, S is a distance needed to join calculation, to get the point which is on AB line and the distance from which to point C is S.

As ‘Distance line’ show, a straight connects point 1 and 3. Input distance from unknown point to point 4, click OK to get point P. Position will be shown on screen. New point number will be accumulated to the total existed point number. See point 5 in picture ‘Distance line results’.



Distance line

Notice: According to the limitation of known conditions, this method would produce two intersections, our software will judge by choosing the one which is farthest from first point. When operator needs to get another point, you can change the sequence of point 1 and 3.



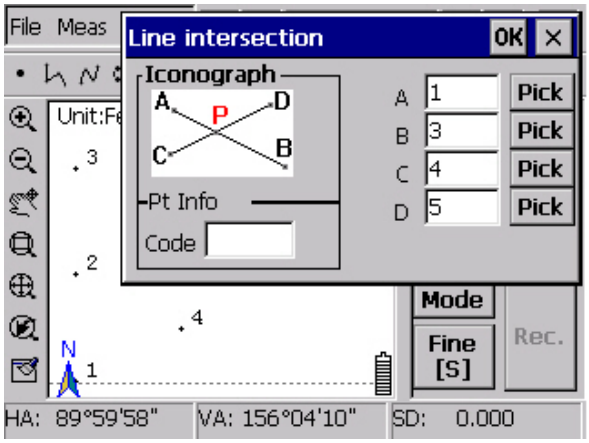
Distance line results

5.9 Lines intersection

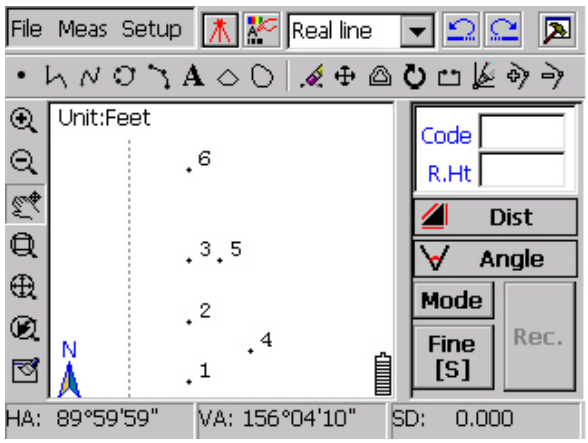
There is one line connecting point A and point B, and another one passing through point C and point D, to calculate the intersection point P of these two lines.

As 'Lines intersection' show, one line passes through point 1 and 3,another passes through point 4 and 5.Click OK ,intersection P will be calculated. Point's position will be shown on screen immediately. New point number will be accumulated to the total existed point number. Calculation result will be saved

automatically as point 6.



Lines intersection

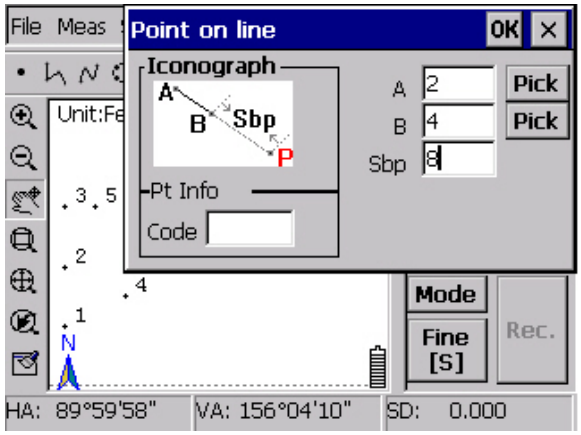


Lines intersection results

Notice: when user inputs these four points by sequence, software will judge that whether the two lines are parallel, if they are, system would notice that “calculating failed, please check input data again.”

5.10 Point on line

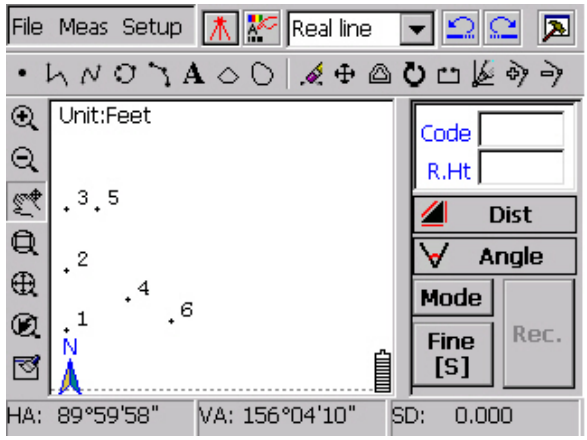
Point A and B are known points, a straight line passes through point A and B, P is inside point or outside point on line, S is distance from B to P, to calculate coordinate of inside point, outside point P.



Point on line

As picture 'Point on line' show, a straight line passed through point 2 and 4,after inputting the distance from unknown point to point 8,click OK ,point P will be calculated and shown on screen immediately. New point number will be accumulated to the total existed point number. See point 6 in picture 'Point on line results'.

Notice: If the input distance is positive value, the unknown point is on positive extending line of straight line; if the distance is negative value, the unknown point is on opposite extending line of straight line.



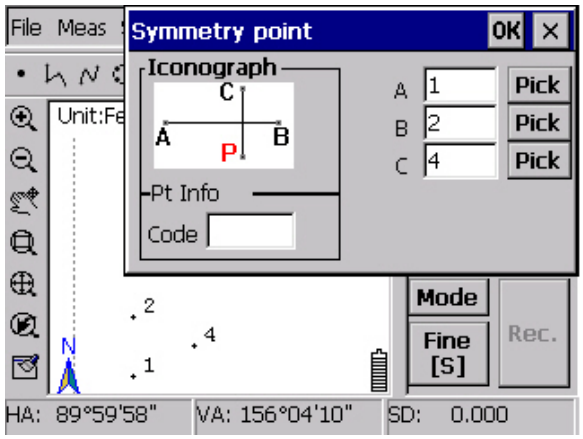
Point on line results

5.11 Symmetry point

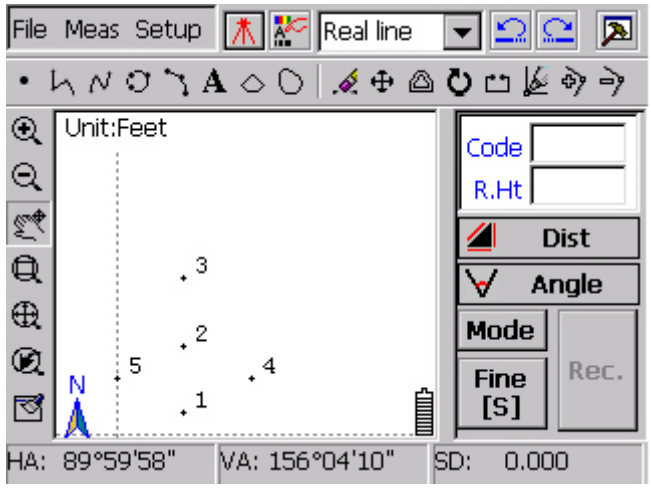
Point A, B, C are all known points. Line AB passes through point A, B, then calculate Symmetry point of point C relative to line AB.

As picture 'Symmetry point' show, one straight line passes through point 1 and point 2.Point 4 is reference point. After clicking OK, Symmetry point P of point 4 could be calculated. Point position will be shown on screen. New point number will

be accumulated to the total existed point number. Show as point 5 in picture ‘Symmetry point results’.



Symmetry point



Symmetry point results