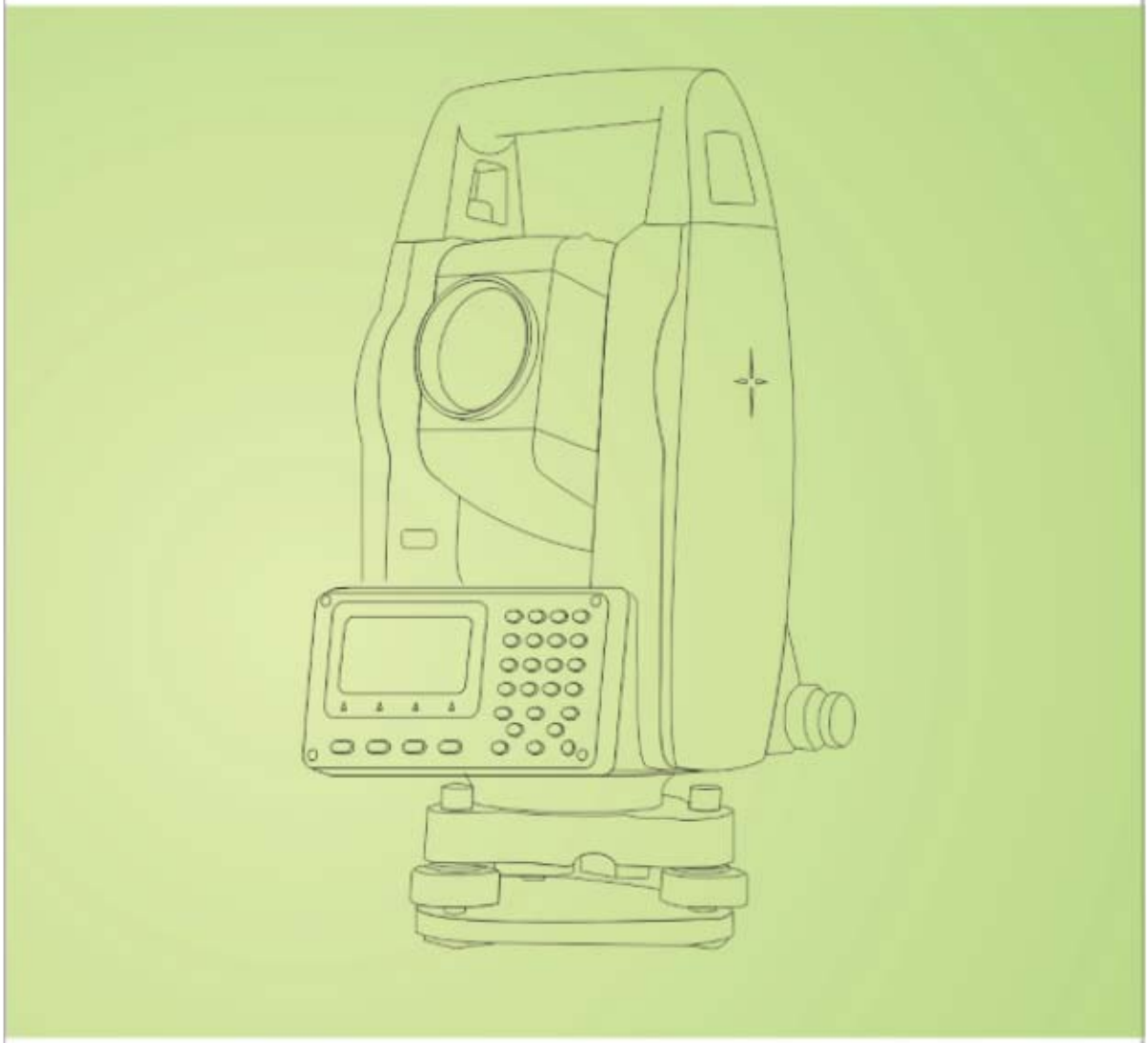
GEOMAX



ZOOM 10 Total Station Manual

Preface

Thanks a lot for purchasing our total station!

This manual is your good helper, please read it carefully before using the instrumentand keep it safely.

Product affirms:
In order to get the best service from our company, please feedback your instruments' versionincludingnumber, purchasing date and your suggestions to us after the purchasing of the product.

We will attach great importance to any piece of advice from you,
We will be very concerned about any detail of our products,
We will make great efforts to provide better quality.

Notice: Our Company has the right to upgrade and improve the technical parameters of instruments, which may not be announced in advance .The pictures in the manual are only for reference and kind prevail.

- **Features:**

Rich Feature: Our Total Station is equipped with a wealth of measurement applications including data storage, parameter settings and other functions for a

1. Absolute coded dial

With absolute digital dial, instrumentscan be measureddirectlywhen it powers on. The measured azimuth angle result will not be lost even when the instrument shut off.

2. powerful memory management

Large-capacity EMS memory,easy to manage the file system, serving to add, delete and transfer data

3. No prism ranging

The series Total Station ZOOM 10 with laser ranging No-Prism is capable of surveying forlong distance, fast and precise measurements with various materials and different colors of objects (such as building walls, poles, wires, cliff wall, mountain, mud , stakes, etc.). For those which are hard or impossible to be reached, the application of Prism features can be a good measurement tasks.

4. special measurement procedure

The series total station is equipped with the basic surveying function as well as special measurement procedures, undertaking REM, offset measuring, stakeout, Resection, area measurement and calculation, road design etc. to meet the needs of professional measurement.

5. eyepiece changeable

The instruments' eyepiece can be changed, and equipped with a diagonal eyepiece,serving to observe zenith and high buildings

6. An optional laster plumb

The site features is easy to instruct and set up stations

NOTE:

Avoid look directly into the sun with the eyepiece when measuring. Recommended to use solar filter to reduce the impact

1. Avoid extreme temperature when storing equipment and sudden changes in temperature when using the instrument.
2. The instrument should be loaded in boxplaced in dry and ventilated place and prevented from shock, dust and moisture when it is not in use.
3. In order to get good accuracy, you should leave the instrument in the box if the instrument temperaturehas large difference between working and storing you may unpack the box and employ the instrument until the instrument reaches the temperature at the working field.
4. If the instrument is not used for a long time, the battery should be unloaded and stored separately and charged once a monthto prolong battery life.
5. The instrumentshould be installed in box when it is transported. Extrusion, collision and violent vibration need to be carefully avoided during the transport process. The soft mat May be placed around the box on the long-distance transportation.
6. It is better to use high quality wooden foot stool to make surethe stability of measurement and improve its accuracy, whensetting up the instrument.
7. Only use absorbent cotton or lens paper towipe the instrument gentlyIf exposed optical device need to be cleaned.
8. Use flannelette or hairbrush to clean the instrument after using. Do not electrify and start up after the device got wet in a rain.Using clean soft cloth to wipe it dry and put it at ventilated place for a period of time to make the instrument fully dry before using or packing.
9. Inspect instrument carefully and comprehensively to ensure its indicators,function,power supply,initial setting and correction parameters meet the requirements before operating.
10. If the function is abnormal, non-professional maintenance persons are not allowed to dismantle the device without authorization in case of any unnecessary damage.
11. Theemitted light of the no-prism total station ZOOM 10 is laser, do not direct to eyes.
12. The elements of the instructional safeguard shall be as follows:
    – element 1a: not available
    – element 2: “CAUTION” or equivalent word or text
    – element 3: “Risk of explosion if the battery is replaced by an incorrect type” or equivalent text
    – element 4: optional

- **Security Guide**

Pay attention to the following safety matters when you use the laser ranging free of prism.

Warning:

Total station fit out laser level 3R/IIIa which is recognized by the loge, which is above: the verticallocking screw saying: “3A laser product ”.This product belongs to Class 3R levellaser .According to the following standards IEC 60825-1: 2001Class 3R/IIIa laser product can reachfive times of emission limits of the Class 2/ II in the wavelength between 400nm-700nm.

Warning :

Continuous stareinto the laser beam is harmful.

Prevention:

Do not stare at laser beam or point to others. The reflected beams is the effective signal of the instrument. It’s safety to observe by eyepice.

Warning:

When the laser beam is irradiated reflected by prisms, plane mirrors, surface of metal and windows,it’s dangerous to look straightinto the reflected beams.

Prevention :

Don’t stare at the reflected beams. When the laser is switched on (distance mode), do not obstruct optical path or stand near the prism.Target at a prismwith total station telescope only.

Warning :

It’s dangerous to use the Class 3R laser deviceinproperly.

Prevention:

Toavoid injury, each user must carry safety prevention measures and operate the instrument within the safety scope according to standard IEC60825-1: 2001).

The following is the explanation of the main part of the standard:

Class 3R level raserproducts are used outdoors and in construction (surveying with No-Prism).

A: Only trained and certified personnels are allowed to install, adjust and operate the laser equipment.

B: set up appropriate laser warning sign within the operating field

C: To prevent anyone from looking into the laser beam use an optical instrument to observe.

D: in order to prevent laser damage to persons, the laser beams should be blocked at the end of the working route, and also should be cut off when people work in the restricted area (harmfuldistance)where laser beams crossing are harmful.

E: the route of the laser beam must set to be higher or lower than the human eye.

F: properly store and safekeep the laser products when they it is not used, unauthenticated personals are not allowed using it.

G: Do not point laser beams at surfaces such as plane mirror, metal surface, window, especially the surface of plane mirror and concave mirror.

Harmful Distance is the maximum distance from the starting point of the laser beams to where people are right safe.The built-in harmful idstance of the Class 3R/IIIa laser is 1000m(3300ft) and the laser intensity will reduce to that of Class 1 products (which does not harm eyes) if people is out of this range.

Caution: The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules and Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (

2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio/TV technician for help.

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-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.

FCC& IC Radiation Exposure Statement:

This equipment complies with FCC and Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Déclaration d'IC sur l'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux radiations définies par le Canada pour des environnements non contrôlés. Cet équipement doit être installé et utilisé à une distance minimum de 20 cm entre l'antenne et votre corps.
Cet émetteur ne doit pas être installé au même endroit ni utilisé avec une autre antenne ou un autre émetteur.

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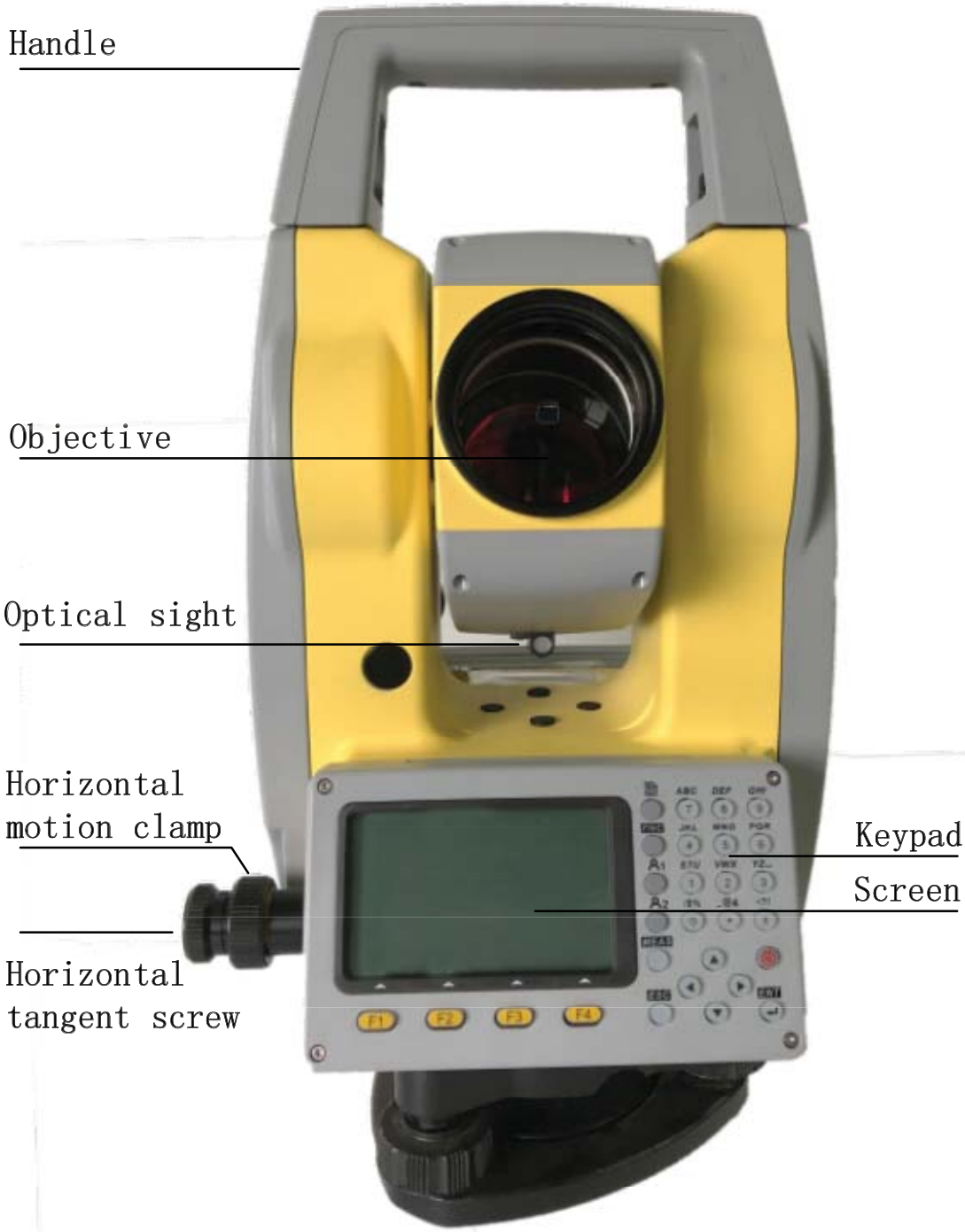
1. Name and function of eachpart

1. Name



Handle screw
Focusing knob
Horizontal axis center
Eyepiece
Vertical motion clamp
LOGO
Vertical Tangent screw
RS-232C port
Levelling screw
Substrate

2. Keys Functions and information display

Key	Function
	Power ON/ Power OFF.
MEAS	Trigger key, depends on setting, maybe disting& save, disting or none.
ESC	Cancel or exit.
ENT	Confirm or commit editing.
	Switch pages
FNC	Hot key to enter function menu in measuring interface.
1	User defined function key 1.
2	User defined function key 2
▲	Move cursor up or goto previous.
▼	Move cursor down or goto next.
◀	Move cursor left or goto left.
▶	Move cursor right or goto right.
STU GHI 1 ~ 9	Entering letters A-Z.
0 ~ 9	Entering number or choose menu item.
F1 ~ F4	Soft keys to choose screen bottom function.

2. Preparation before measurement

1. Unpack and store instrument

- Unpack

Put down the box gently and turn up the cover then turn on the lock, open the cover and take out the instrument.

- Deposit

Cover up the telescope mirror and make the vertical motion of alidade upwards then put the instrument horizontally (keep the objective upwards) into box. Then screw vertical motion gently. Cover up the box cover andlock the box. Loose horizontal and vertical axis as much as possible to reduce he shock damage to instrument.

2. Setting up the instrument

If the battery is mounted after the instrument is set up, the instrument will tilt slightly. So, first mount the battery, then set the instrument up.

- Operating reference

1. Centering and levelling

1) Setting up the tripod

①Extend the tripod legs toprovide a comfortable posture.

②Setting up the tripod over the marked point on the ground, and center it.

2) Install the instrument on a tripod

①Place the instrument on the tripod head.

②Fix the instrument on the tripod.

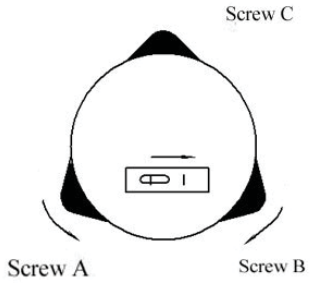
3) Leveling instrument roughly by circular level

①Turn on the instrument and switch the laser plummet and the electronic level function on.

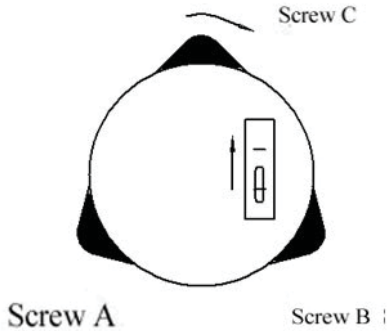
②Move the tripod legs and use the tirbrach screws to center the instrument over the ground point. Adjust the tripod legs to level the circular level.

4) Leveling instrument accurately by tubelevel

①Loosen the horizontal clamp, and turn the instrument until the plate level is parallel to the line between leveling foot screws A and B. Use leveling foot screws A and B to center the bubble.



② Rotate instrument 90°by vertical axis, then use foot screw C to center the bubble.



③Repeatsteps above until the bubble is at the same place in all directions.

2. Centering by centering tool (optional or laser)

1) Set up a tripod

Extend a tripod to the appropriate height make sure the legs are spaced at equal intervals and the head is approximately level .Set the tripod so that the head is positioned over the surveying point. Brace tripod on the ground and keep one leg fixed.

2) Set up instrument and spotting

Put instruments on a tripod carefully, and tighten the center connection screw. Adjust the optical centering tool to make reticule clear (open instrument and laser centering if it's a laser centering tool).Handle another two unfixed legs, and adjust their position through the observation of the optical plummet. Make the three legs of the tripod fixed on the ground when the optical plummet is aligned to the station approximately .Adjustthree feet screws of total station and keep the optical centering tool (or laser centering) aiming at the station accurately.

3) Leveling instrument roughly by circular level

(Same as The section abovethat discusses centering and leveling with plumb bob)

4) Leveling instrument accurately by tubelevel

(Same as The section abovethat discusses centering and leveling with plumb bob)

5) Centering and leveling accurately

Loosen center connection screw slightly and move instrument horizontally(Don't rotate instrument) through observation to optical plummet, making the instrument

aim at station accurately. Tighten the center connection screw and leveling instrument accurately again.

This operation should be repeated till the plumb aims at station accurately.

3. About the battery

- **Mounting the battery**

☆Fully charge the battery before measurement.

☆Cut off the power before removing the battery.

▶ Step mounting the battery

1. Insert the battery to the instrument.
2. Press the top of the battery until you hear a click sound.

▶ Step Remove battery

1. Press the button downward.
2. Remove the battery by pulling it toward you.

●Battery information

——Power is adequate, operating available.

——The battery can be used for 4 hours when this symbol first appears. If you cannot master the consumed time, you should prepare a spare battery or charge the battery before using.

——End of the operation as soon as possible and replace the battery and charge if running out of power.

——It takes several minutes for the instrument to shut down when this symbol first appears. The battery has few power now and should be replaced an recharged.

Notice:

① The operating time of battery depends on environmental conditions such as ambient temperature, time and times of charging and so on the battery is suggested to be prepared or charged ahead before operation to keep it safety.

② The battery symbol only indicates power capability undercurrent measurement mode. The remained capacity of the battery shown under current mode does not guarantee its capacity under other modes .Because consumption of power in distance measurement mode is more than that in angle measurement mode ,the instrument may end ranging sometimes due to insufficient capacity of battery (when switching between modes).

Notice in charging:

- Though overcharging protection is installed in the instrument, please plug off the battery immediately after finishing charging.
- Charging range from 0°~±45℃. Abnormal responds of instrument occurs over this range.
- Rechargeable for300—500 times, it may shorten Service time of the battery

completely.

- Charge the battery once a month no matter if it is used to prolong its longevity.

4. Reflecting prism

When using a prism mode for measuring distance, reflection prism should be placed where the target is. A reflecting prism group includes one or three prisms that can connect prism group placed at the base of the tripod with the dock connector or by placing them in the stem directly. Prism group may need to be configured by users based on target.

5. Load or unload the base

- Load

Put the three fixed feet in the corresponding bases, make the instrument in a triangular base, clockwise lock the button by 180° to lock the base, and then fix screw with a screwdriver to screw it out at a fixed lock knob.

- Unload

If necessary, the triangle base can be removed from the instrument (including the same base of reflection prism base connector) by loosening the lock knob base fixed screw with a screwdriver, and anticlockwise locking button about 180°, then separate the instrument from base.

6. Adjust telescope objective and aiming target

Aiming method (reference)

① Rotate the telescope and point it to the bright sky and focus reticule clearly (by rotating eyepiece in own direction and focusing reticule slowly).

② Aim at the target with the crosswire in optical sight , and keep an appropriate distance when aiming (about 200mm).

③ Use telescope focus screw to make target clear.

It means that focus or eyepiece diopter is not adjusted adjusted when there is a parallax with eye moving up and down, thus focus carefully and adjust eyepiece to reduce parallax.

7. Input Mode

Total station keybord includes alpha/digit keys.User can input letters and numbers directly.

- **Input box:**

Each digit key defines 3 letters and 1 number. Depends on the properties of input box, input process varies.

Number input box:

In number input box, user can only input numbers, include “1-9”,“.”, “-+”. Number will appear in box when user presses the key.

Text input box:

In text input box, user can input numbers and letters. Repeat pressing same key to get proper letter, such as A->B->C->7.

When right-bottom of screen display icon AB, user can input number/letter; when display icon 01, user can only input number. User canpress soft-key [F4] to switch input mode between Number and Text when input box beenactive.

- **Letters:**

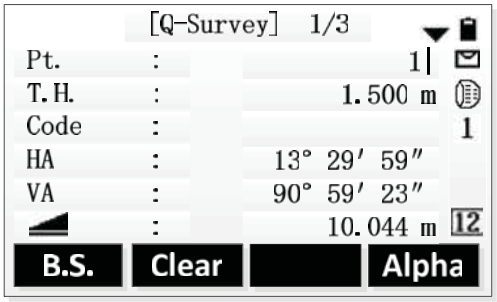
  Letters that total station can input includes “A-Z/$%_@&*?!+-.”.

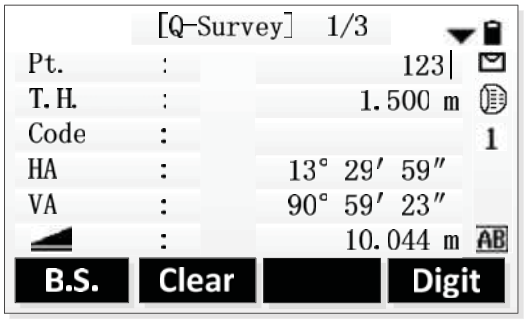
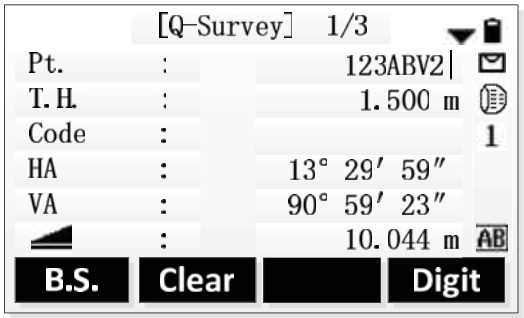
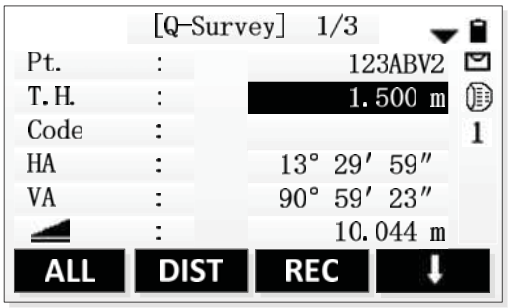
- ➢ Arrow key ←,→ move inputing cursor.
- ➢ PressingENTentersediting; pressingENT confirms input after editing.
- ➢ When editing distance, angle, temperature and pressure values that containunit format, input box’s text will convert into text without unit format. Such as angle 29° 32′ 56″ transforms into 29.3256; Distance115.321m transforms into 115.321. When finish editing, the text will automatic convert back.

7.1 Input characters

Each digit key defines 3 letters and 1 number. In text input mode, each time pressing the key, one character appears at cursor position. Number appears when pressing 4 times.

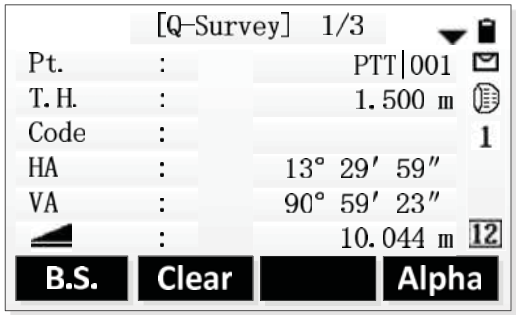
Example: input 123ABV2

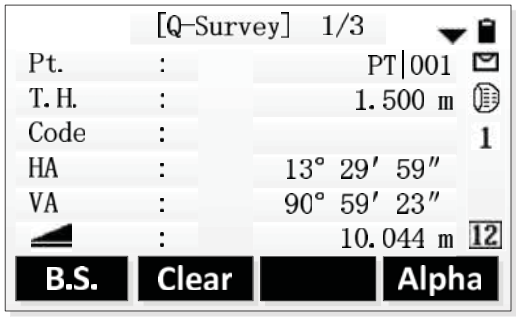
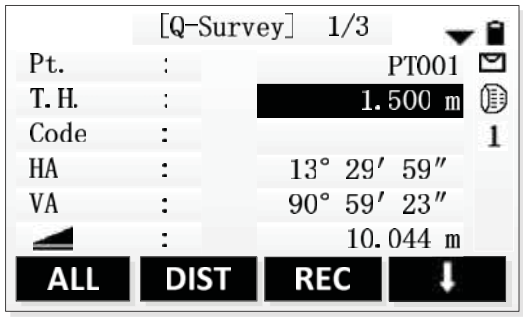
Steps	Key	Display
① Pressing key to start inputing. Right-bottom screen displaying icon 12 means in number input mode.		

② Press key 1, key 2, key 3. Then press key F4, active text input mode.Icon AB should appear in right bottom screen.	[1],[2],[3],[F4]	
③ Press key 7, display letter 'A', wait about half second, press key 7 twice, display letter 'B', then press key 2, display letter 'V', wait about half a second, press key 2 four times, display number '2'. Then finished text '123ABV2' input.	[A],[B],[V],[2]	
④ Press key ENT to finish editing, cursor will move down to next input box.	[ENT]	

7.2 Delete characters

Delete or clear input characters.

Steps	Key	Display
① Press key ← to move cursor to right side of the character that to be deleted.	←	

② Press key F1(Delete).	[F1]	
③ Press key ENT to confirm input. Press Key ESC to undo changes.	[ENT] [ESC]	

8. Point Search

Point search is a function used by applications to find measured or fixed points in the jobs.。

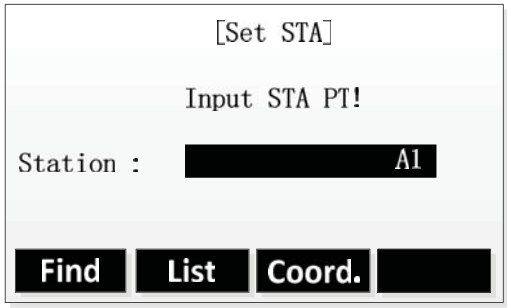
Point search is limited to a particular job.

If several points meet the search criteria, then the results are ordered according to the date.

8.1 Direct search

By entering an actual point number (for example 'A1'), and pressing key SEARCH, all points within the selected job and with the corresponding point number are found.

Here is an example for searching fix point in function 'Set STA'.

Steps	Key	Display
① Choosing 'Survey' in application menu, then choose function 'Set STA'. Entering point number, for example 'A1', pressing ENT to finish input, then pressing F1 to search.	[F1]	

② In searching result window, using arrow key ↑ ↓ to move cursor to select point number. Press key F4 or ENT to conirm selecting.	↑ ↓ [F4] [ENT]	[Find Pt.] 1/5 A1 Station A1 Station A1 Meas. PT A1 Meas. PT A1 Fix Pt. View Coord. Job OK

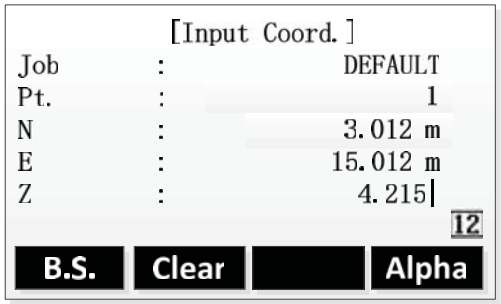
Soft keys introduction:

[View] Show the coordinate of selected point.

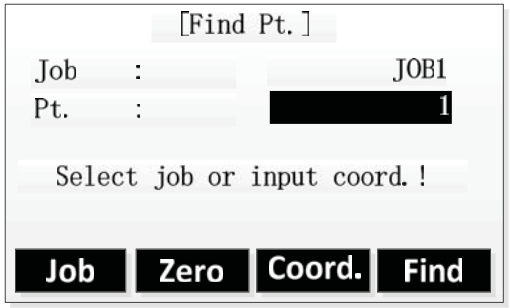
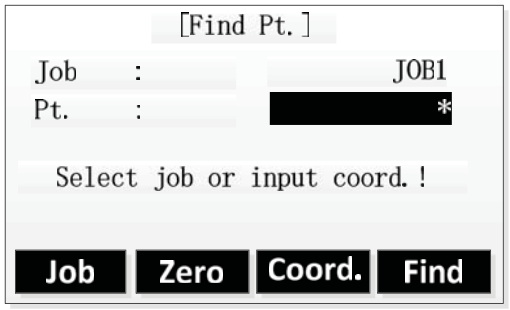
③ Using arrow key ↑ ↓ to move cursor and select point number. Press key F1 to show the coordinate details of selected point.	[F1]	[View Coord.] Job : DEFAULT Pt. : A1 N : 0.000 m E : 0.000 m Z : 0.000 m Date : 2015.05.15 OK
④ Press ESC or F4 back to previous screen.	[ESC] [F4]	[Find Pt.] 1/5 A1 Station A1 Station A1 Meas. PT A1 Meas. PT A1 Fix Pt. View Coord. Job OK

[Coord.] Input point manually.

③ If required point not exists in the job, user can manually input it by pressing key F2.	[F2]	[Input Coord.] Job : DEFAULT Pt. : 1 N : 0.000 m E : 0.000 m Z : 0.000 m Back OK

④ Input point number and N, E, Z values, by pressing ENT to move cursor to next input box.	[ENT]	
⑤ After all values finishing input, pressing key F4 to save the point to the job.	[F4]	

[Job]Choose another job's points.

③ If required point not exists in the job, user can choose another job's points.	[F3]	
④ Entering job list by pressing key F1, choose the particular job and press ENT or F4 to commitchoosing.	[F1] [F4] [ENT]	
⑤ Entering searching point number. If using input point, press key F2 (Zero) or F3 (Coord.)※[1]	[ENT]	

⑥ Press key F4 to search the point in the selected job.	[F4]	[Find Pt.] 1/1 B1 Fix Pt. View Coord. Job OK
※[1][F2](Zero): Set N, E, Z to 0. [F3](Coord.): Input point manually.		

[OK] Commit selected point.

8.2 Wildcard search

The wildcard search is indicated by a "*". The asterisk is a place holder for any following sequence of characters. Wildcards should be used if the point number is not fully known, or to search for a batch of points.

Examples:

* All points are found.

A All points with exactly the point number "A" are found.

A* All points containing "A" are found, for example, A1, A2, 1A.

Steps: (For example "*")

Steps	Key	Display
① Choosing 'Survey' in application menu, then choose function 'Set STA'. Entering "*", pressing ENT to finish input, then pressing F1 to search.	[F1]	[Set STA] Input STA PT! Station : * Find List Coord.
② In searching result window, using arrow key ↑ ↓ to move cursor to select point number. Press key F4 or ENT to conirm selecting.	↑ ↓ [F4] [ENT]	[Find Pt.] 1/5 A1 Station A2 Station A3 Meas. PT B4 Meas. PT C0 Fix Pt. View Coord. Job OK

3. Q-Survey

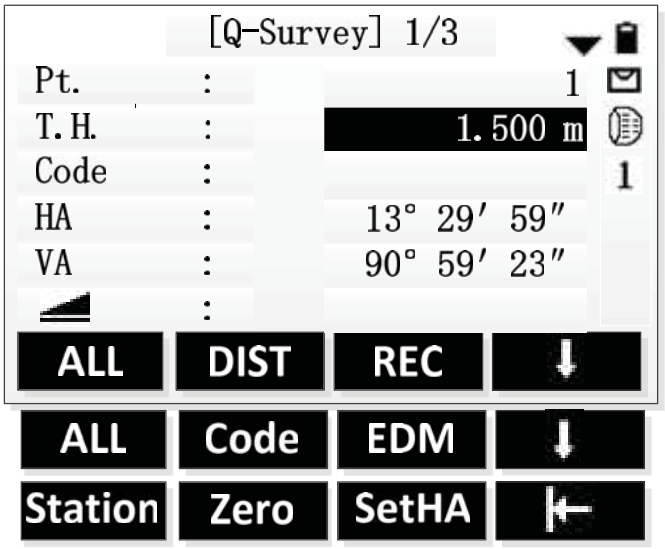
1. Notes in the distance measurement

After the placement of instrumentand turned on the power, total station is ready, can start measuring.

In measurement display, user can call the function of set key, the functionkeys and hotkey.

The show is an example. Localized version may be slightly different.

The example of Q-Survey show:



F1-F4 Start the corresponding functions

Notes:

Measurements to strongly reflecting targets such as to traffic lights in Reflector EDM mode without prism should be avoided. The measured distances may be wrong or inaccurate.

When a distance measurement is triggered, the EDM measures to the object which is in the beam path at that moment.

If e.g. people, cars, animals, swaying branches, etc. cross the laser beam while a measurement is being taken, a fraction of the laser beam is reflected and may lead to incorrect distance values.

Avoid interrupting the measuring beam while taking reflectorless measurements or measurements using reflective foils.

- No Prism Ranging
- Ensure that laster beam is not feflected by any object with high reflectivity and close to the light path.

- When start the distance measurement, EDM will measure distance for the object in the light path.If there are temporary obstacles in the light path (such as by car, or the heavy rain, snow, or filled with fog), the distance measured by EDM is the distance to the nearest obstacle.
- When a long distance measurement, laser beam deviation of collimation line will affect the accuracy of measurement.This is because the divergence of the laser beam reflection point may not be with the crosshair sighting points coincide. It is recommended that the user accurately adjust to ensure that is consistent with laser beam collimation.（Please refer to “20.10 NO Prism Ranging” in the Chapter 9）
- Don't use two instruments to measure the same target at the same time .

➢ Red light cooperates with reflective pieces to measure distance

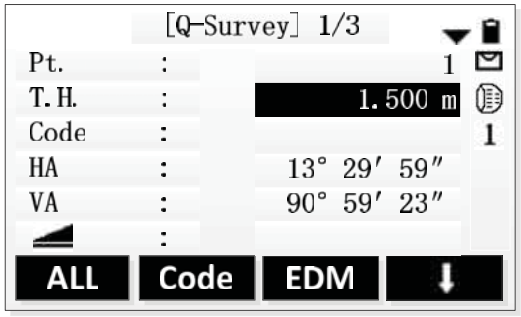
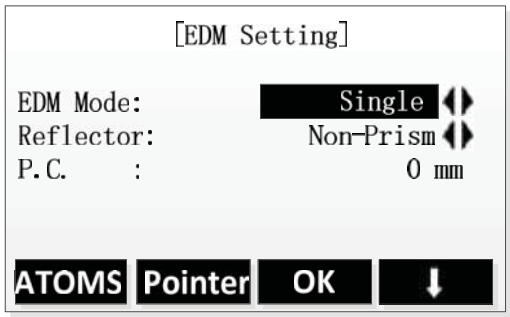
Laster can also be used to measure distance for eflectivepieces.To guarantee the accuracy of measurement, the laser beam is perpendicular to the reflector plate, and through accurate adjustment.（Please refer to “3.10 NO Prism Ranging” in the Chapter 9）

Ensure proper additive constant of different reflection prism.

2. EDM Setting

2.1 Set the mode of EDM

Select the mode of distance measurement,there are 6 modes : Single,Repeat,Tracking,3 Times,4 Times,5 Times.

Steps	Key	Display
① Press [F4](↓)and show the second soft key in the Q-Surveying. Press [F3] to enter the interface of EDM Setting.	[F4] [F3]	
② When the cursor is in EDM mode option,Press the direction key of ←→ to select the mode of measurement.Each time you press ← or →, the mode of measurement is switched.	← →	
③ After finishing setting, press [F3](OK) to return the function of Q-Surveying.If you want to cancel the settings, press [ESC] to ignore the changes.	[F3]	

Set the reflector type

Our series total station can be set up for the red laser (RL) range and invisible infrared light (IR) range and the total station has three reflectors to be selected, which are prism, non-prism (NP) and reflect board (Sheet). You can set by job,but the prism used should be matched with prism constants.

- **About the parameters of various reflectors in distance measurement, please**

refer to “Technical Parameters”.

Steps	Key	Display
① After entering to the interface of EDM Setting,using the direction of ↓ to move the cursor to the setting item of Reflector.	↓	[EDM Setting] EDM Mode: Single Reflector: Prism P.C. : -30.0 mm ATOMS Pointer OK ↓
② Press ← → to select the types of reflector. Each time you press ← or →, the type of reflector is switched.	← →	[EDM Setting] EDM Mode: Single Reflector: Non-Prism P.C. : 0 mm ATOMS Pointer OK ↓
③ After finished setting, press [F3] (OK) to return the function of Q-Surveying.If you want to cancel the settings, press [ESC] to ignore the changes.	[F3]	[Q-Survey] 1/3 Pt. : 1 T.H. : 1.500 m Code : 1 HA : 13° 29′ 59″ VA : 90° 59′ 23″ ALL Code EDM ↓

Set up the Reflecting Prism Constant.

As a prism is selected as a reflector, a prism constant should be set before any measurement. If the constant is entered and set, it is saved and will not be erased after switching off the instrument.

Example: Prism Constant is -30mm

Steps	Key	Display
① After entering to the interface of EDM Setting,using the direction of ↓ to move the cursor to the setting item of P.C.	↓	[EDM Setting] EDM Mode: Single Reflector: Prism P.C. : 30.0 mm ATOMS Pointer OK ↓
② Enter the prism constant value and press the key of [ENT]. ※1※2※3	[ENT]	[EDM Setting] EDM Mode: Single Reflector: Prism P.C. : -30.0 mm R4 ATOMS Pointer OK ↓
③ After finished setting, press [F3](OK) to return the function of Q-Surveying.If you want to cancel the settings, press [ESC] to ignore the changes.	[F3]	[Q-Survey] 1/3 Pt. : 1 T.H. : 1.500 m Code : 1 HA : 13° 29′ 59″ VA : 90° 59′ 23″ ALL Code EDM ↓

※1: Prism constant you enter is effective only when the reflector mode isPrism.
※2: The range of Prism constant value: -99mm～+99mm.
※3: Range mark: In the bottom right corner of the page as shown above, this mark is the distance Range identifier, where R4 represents 400m, L6 stands for 600m, and so on. That is the maximum distance from the prism-free mode range in good weather conditions (visibility is not less than 30km).

2.2 Atomosphere setting

Refraction:

When measuring horizontal distance and elevation, our instrument corrects the atmospheric refraction and the earth curvature automatically.

The instrument supports of atmospheric refraction coefficient have three option, they are 0.00, 0.14, and 0.20.

Note: The refraction of instrument has been set for K=0.00 when left factory .It also can be set to other values

Steps	Key	Display
① After entering to the interface of EDM Setting, press [F1] (Atoms) to enter the interface of Atomspheric Data.	[F1]	[EDM Setting] EDM Mode: Single Reflector: Prism P.C. : 30.0 mm ATOMS Pointer OK ↓
② Interface displays the current setting, using the direction of ↓ to move the cursor to the setting item of Refraction. Press ←→ to select the value of refraction.Each time you press ← or →, the value of refraction is switched.	↓ + ←→	[Atomspheric Data] Temp. : 20.0 ℃ Press : 1013 hPa PPM : 0.0 PPM Refraction 0.00 PPM=0 OK
③ After finished setting, press [F4] (OK) to save settins and back to previous menu. If you want to cancel the settings,press [ESC] to ignore the changes	[F4]	[EDM Setting] EDM Mode: Single Reflector: Prism P.C. : 30.0 mm ATOMS Pointer OK ↓

Atmospheric Correction:

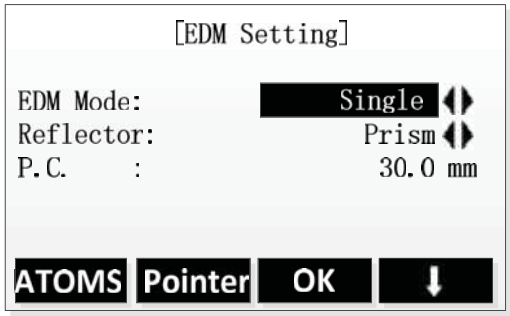
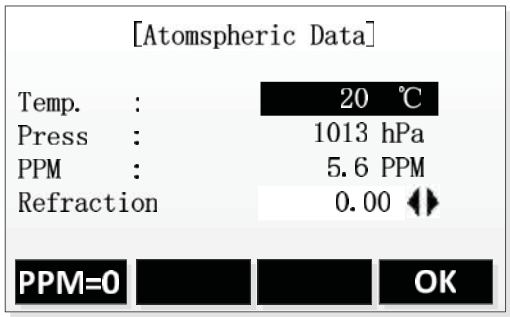
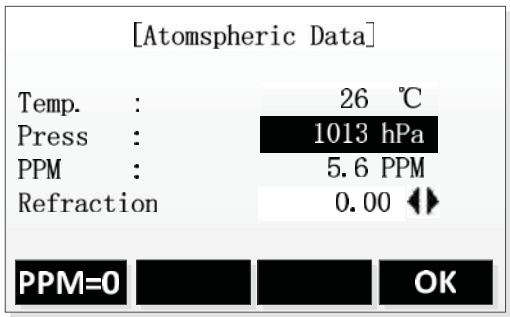
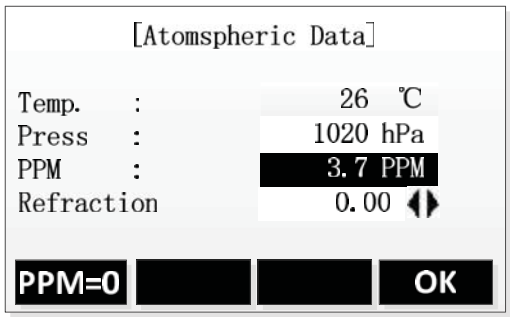
When measuring distance, the measured value will be influenced by the atmosphere.

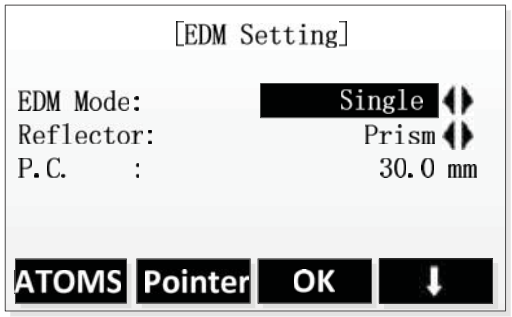
In order to reduce the influence, a atmospheric correction parameter is needed.

Correction value associated with the pressure and temperature in air.Calculated as follows:

If the air pressure unit is mmHg, Make a conversion according to the formula: 1hPa=0.75mm Hg

- Standard meteorological conditions (atmospheric correction value =0):
  press: 1013hPa
  temperature: 20℃
- If the atmospheric correction is not required, please set PPM to zero.

Steps	Key	Display
① After entering to the interface of EDM Setting. Press [F1] (Atoms) to enter the interface of Atomspheric Data.	[F1]	
② Interface displays the current settings.	↓	
③ Input the value of temperature. example: Enter 26 ℃ and press the key of [ENT]. The cursor moves to the setting item of Press.	[ENT]	
④ Input the value of atmospheric pressure. example: Enter 1020 hPa and press the key of[ENT].Program calculates the value of PPM and the cursor moves to the setting	[ENT]	

item of PPM.※[1]※[2]※[3]※[4]		
⑤ After finishing setting, press [F4](OK) to save settins and back to previous menu.Then press the key of [F3](OK) to save the setting of EDM and back to the function of measurement.	[F4] [F3]	
※1: The range of enter: Temp.(-30℃～60℃), Press.(500hPa～1400hPa). ※ 2: The instrument calculates the value of PPM according to the values of temperature and pressure you enter. ※3: Press [F1](PPM=0) can set the value of PPM to 0. ※4: If instrument supports temperature pressure sensor, you can press [F2] to receive the values of air pressure, temperature and calculate the correction valueautomatically.		

2.3 Grid factor setting

When calculating the coordinates, the horizontal distance measured must multiply by the scale factor.

Computation formula

1.Altitude factor=R/(R+ELEV)

R: The average radius of earth

ELEV: mean sea level altitude

2.Scale factor

Scale factor: Scale factor of the station

3.Grid factor

Grid factor=altitude factor×scale factor

Distance calculation

1. Grid distance

HDg=HD×grid factor

HDg: Grid distance

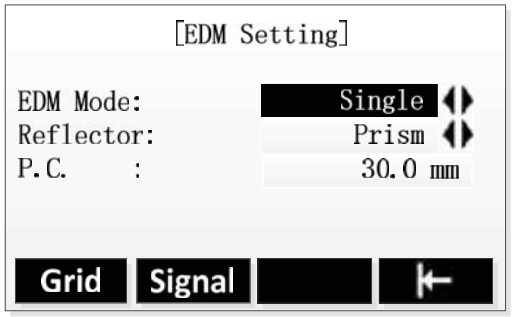
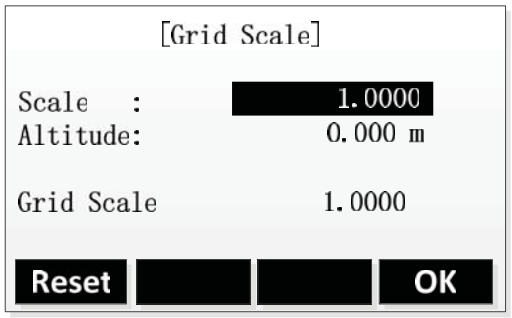
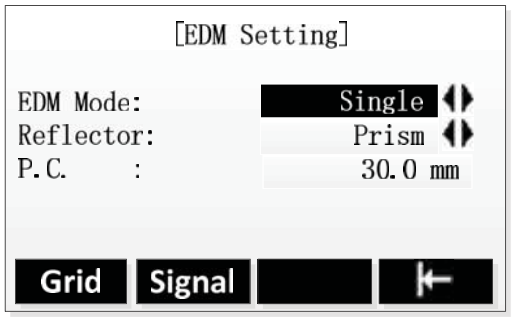
HD: Ground distance

2. Ground distance

HD=HDg/(Grid factor)

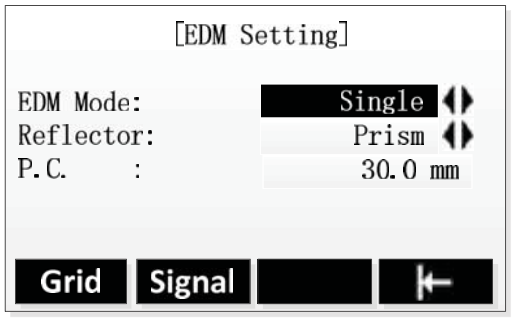
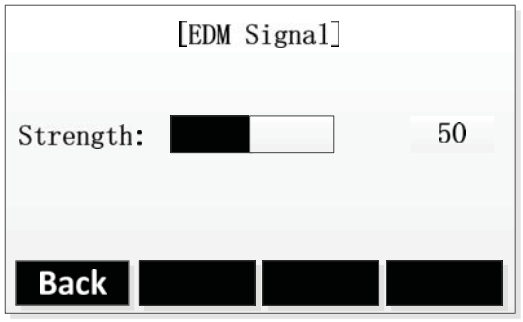
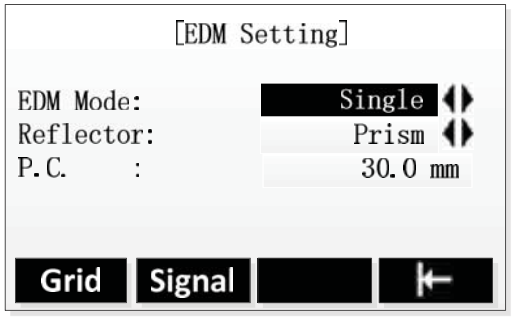
Note:

1. The enter range of the scale factor: 0.99~1.01,the default value is 1.0.
2. The enter range of the average height above sea level: -9999.9999~9999.9999. The average altitude retained after the decimal point one, the default value is 0.

Steps	Key	Display
① After entering to the interface of EDM Setting,press the key of [F4] to enter the second page of soft key, then press te key of [F1](Grid) to set the Grid Scale.	[F4] [F1]	
② Interface displays the current setting.Enter the values of Scale and Altitude then press the key of [ENT].Program calculates the Grid Scale and displays it in the interface.If you want to set all enter area to 0,you can set the key of [F1] (Reset).	[ENT]	
③ After finished setting, press [F4](OK) to save settins and back to previous menu.Then press the key of [F3](OK) to save the setting of EDM and back to the function of measurement.	[F4]	

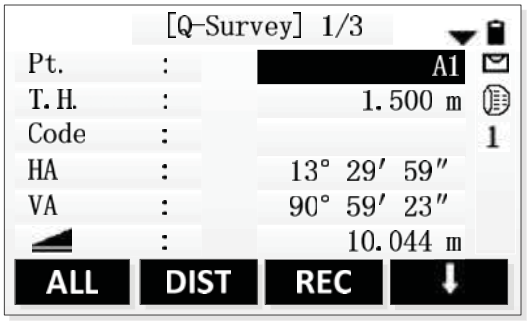
2.4 EDM signal

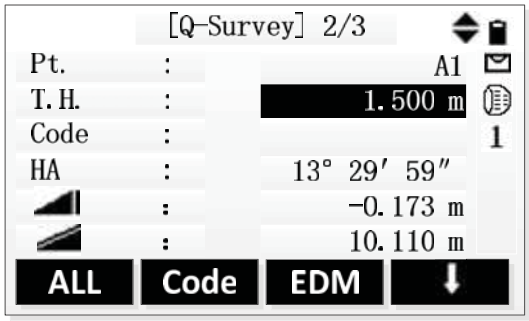
The function of signal is to display the intensity of signal received by total station.If the target is hard to be found or can't see, using the function can achieve the best sighting accuracy.

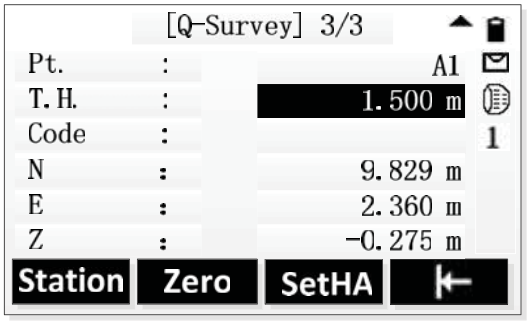
Steps	Key	Display
① After entering to the interface of EDM Setting,press the key of [F4] to enter the second page of soft key, then press te key of [F2](Signal) to enter the function of Signal intensity.	[F4] + [F2]	
② Using the bar chart and value of number to show the intensity of signal received by total station in the screen. As shown in the picture on the right.		
③ Press [F1] or [ESC] to back to the menu of EDM setting.	[F1] or [ESC]	

3. Start measurement

Q-Survey has 3 pages menu, including all measuring functions commonly used, such as angle measurement, distance measurement and coordinate measurement.
As shown
below:



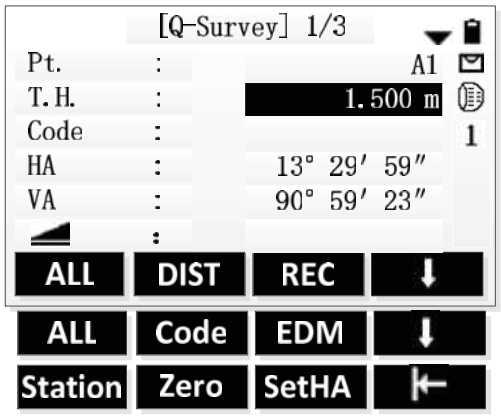




3.1 Set HA

You can set the horizontal angle as 0 or set it as wanted angle.

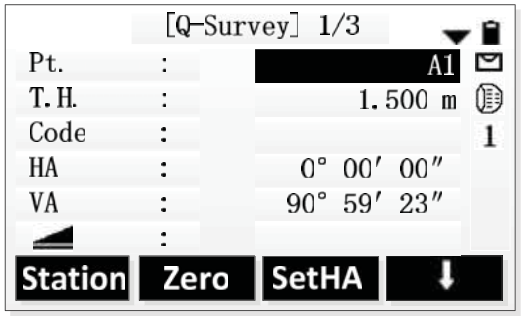
Set horizontal angle to 0.

Steps	Key	Display
① Aim at the target which used to orient.Press [F4] twice to enter third pages soft key.	[F4] + [F4]	

② Press [F2](Zero), the screen give a prompt to set HA as 0 or not.	[F2]	Set HA=0? No Yes
③ Press [F4](Yes), the screen backs to Q-Survey and HA is set as 0. If you want to cancel the operation,please press [F1](No).	[F4] or [F1]	[Q-Survey] 1/3 Pt. : A1 T.H. : 1.500 m Code : 1 HA : 0° 00′ 00″ VA : 90° 59′ 23″ Station Zero SetHA ↓

Set HA.

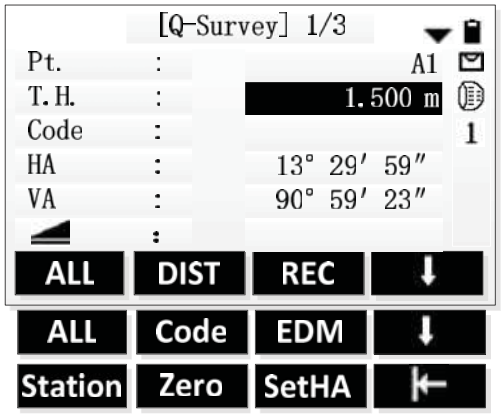
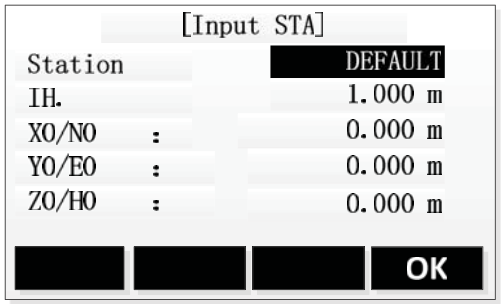
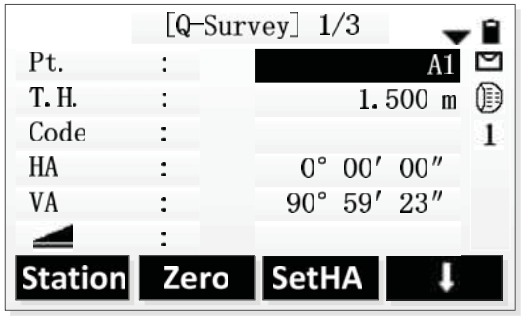
Steps	Key	Display
① Aim at the target which used to orient.Press [F4] twice to enter third pages soft key.	[F4] + [F4]	[Q-Survey] 1/3 Pt. : A1 T.H. : 1.500 m Code : 1 HA : 13° 29′ 59″ VA : 90° 59′ 23″ ALL DIST REC ↓ ALL Code EDM ↓ Station Zero SetHA ⇤
② Press [F3](SetHA) to enter the interface of SetHA.Screen displays the current value of HA. A: If want the current value of HA as the orientation angle, press [F4](OK) or press	[F3] [F4]	[SetHA] HA : 359° 39′ 01″ Zero OK A: [OK]

[ESC] to go back. B If want other value of angle as the orientation angle,you need to enter the wanted value of angle and press [ENT], then press [F4](OK). Example: enter 121.2030 (121° 20′ 30″). C: If want to set HA to 0,press [F1](Zero) and the value in the edit text of HA becomes 0 ° 00 ′ 00 ″ .Then press the key of [F4] (OK).	[F4] [F1] + [F4]	 B: Input angle C: [Zero]
③ Back to the function of Q-Survey, the value of HA just set displays in the interface. Here take an example of setting HA to zero.	[F4] [F1]	

3.2 Set Station and instrument height

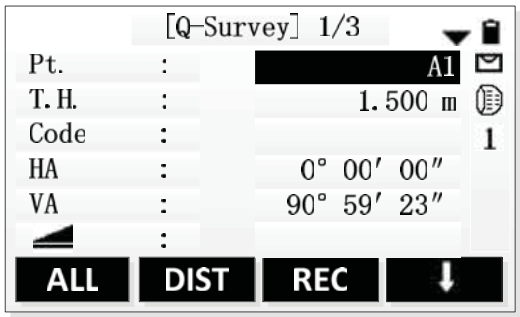
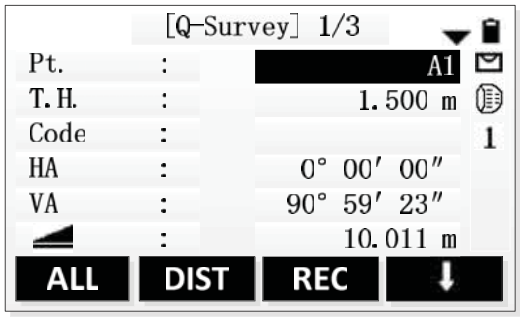
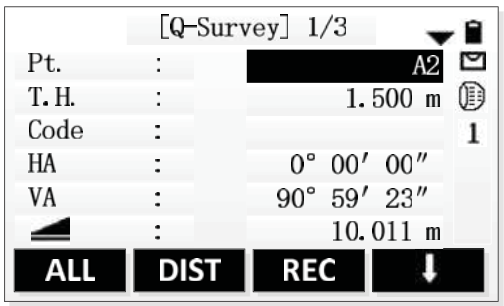
After set the coordinate of station (the site of instrument) relatives to the origin, the instrument can calculate the coordinate of the location to your position (the site of prism).

You can set station and the instrument height conveniently in the Q-Survey.

Steps	Key	Display
① Aim at the target which used to orient.Press [F4] twice to enter third pages soft key.	[F4] + [F4] + [F2]	
② Press [F1] (Station) to enter the interface of Enter STA. Enter the name of station, the instrument height and coordinates. After entering each item, move the cursor to the next edit text.	[F1]	
③ After finished entering, press [F4] (OK) to save the data of station and back to the function of Q-Survey.	[F4]	

3.3 Measurement

After all settings have been finished, you can start to measure. There are 3 pages to display the result of measurement, including all measurement data and you can press [PAGE] to view.

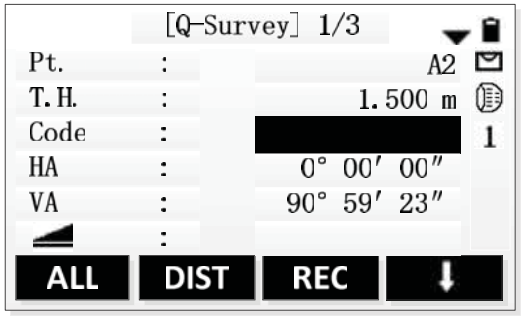
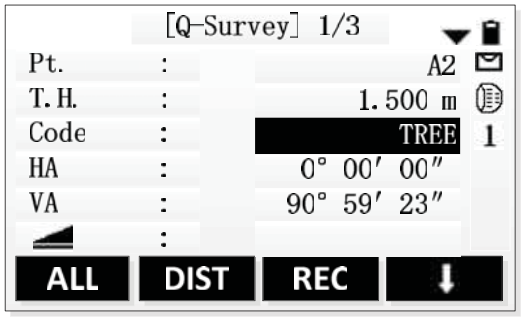
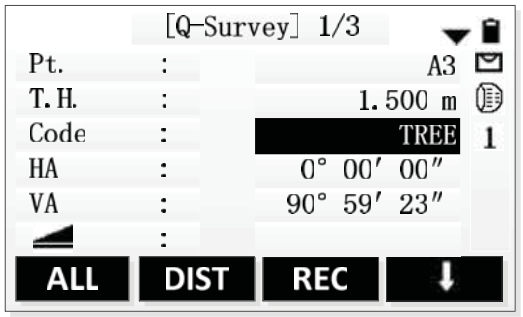
Steps	Key	Display
① Input the name of point and instrument height.Move the cursor to the next edit text after entering each item. You can enter Code when necessary.	[ENT] + [ENT]	
② Aim at the center of prism, press [F1](ALL) or [F2](DIST)+[F3](REC) to start to measure and record the measurement data. The measurement data including angle data, distance data and coordinatedata.You can press [PAGE] to view.	[F1] or [F2] + [F3]	
③ After finishing measuring a point, program makes the number of point add 1 automatically, aim at the center of prism and repeat the above steps to start next point measurement.		

3.4 Code

The code contains the information about the recording points, in the process of post-processing, with the help of encoding function , you can process conveniently according to the specific group.The function of "File Manager" also contains the information of code.

Simple Oeration of Code

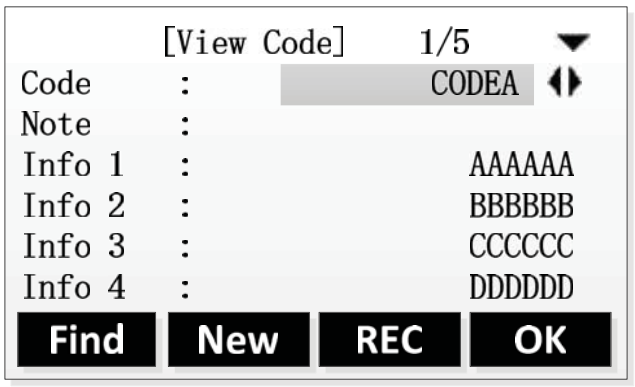
1. Move the cursor to the line of Code.
2. Enter the name of Code.
3. Press the key of [ALL] to start the distance measurement and record the data of code and measurement at the same time. If the name of code already exists in the code library, it will extract the information of code in the code library to record at the same time.

Steps	Key	Display
① Move the cursor to the line of Code.	↓	
② Enter code and press [ENT] to make sure. The entered code here will not be added to the code library.	Input code + [ENT]	
③ Press [F1] to start to measure, record the code and the daa of measurement to job at the same time. ※[1]		
※[1] :The order to save code and measurement data is set in the "Setting" function. The set items of code record are Before REC and After REC.		

Before REC: Record code data before recording the actual measurement data. After REC: Record code data following after the actual measurement data.

Soft key of Code

After starting the function of soft key (Code), Screen displays the following:



GSI-the introduction of code properties:

Code: The name of code

Note: The additional note

Info1: The editable information of other contents

Info8: Other information

The introduction of soft key:

[Find]: Use the name of code or wildcard to find the needed code.

[New]: New a piece of editable information of code and use it.

[REC]: Record the current code data to the job and the code data not with any measurement point binding at this time.

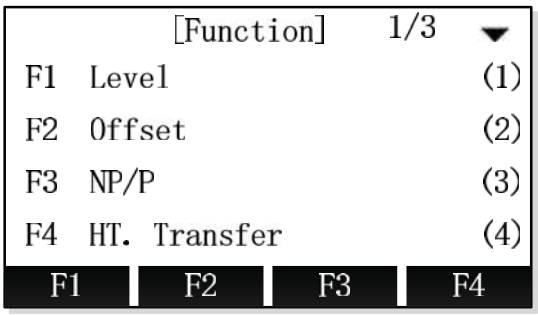
[OK]: Select the current code and use it.

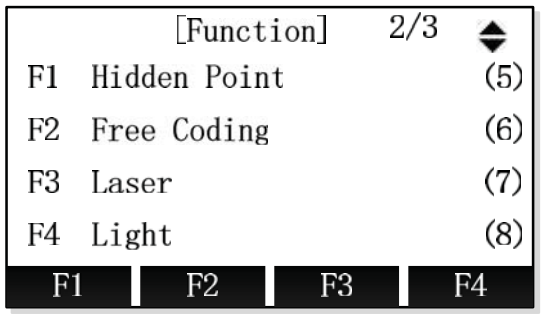
Using the soft key of [Code] can select the code in the code library directly, it will back to the interface of Q-survey after selecting, the code in the edit text of Code is the selected code.

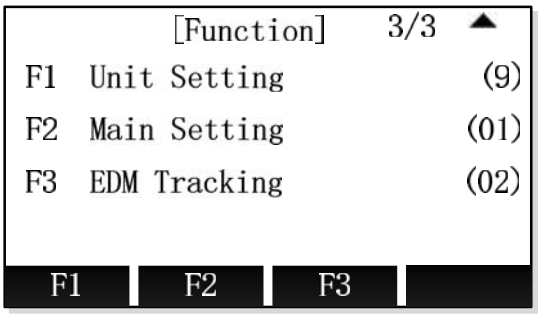
4. Funtions

Bring the total station's common functions and settings together, they can be used in the process of measurement conveniently. In the function of Q-Survey which in the Main menu or other interface of measuremen in the program,you can press [FNC] to enter the menu of Function

The menu of Function has 4 pages, you can press 【PAGE】 to view.
The specific introduction as follows:



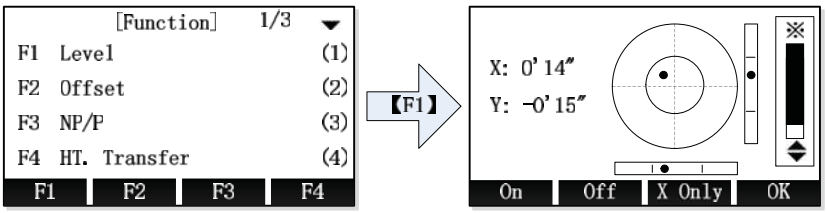




You can open Function menu to select the function you want to use, you can also define the function which on the Function menu to the key of [USER1] or [USER2], then press the key of [USER1] or [USER2] to use these functions.

1. Level

When the compensator is on, Compensator can compensate to the tilt caused by the instrument is not level. Manually level the instrument with the tribrach screws to make the compensation value of compensator tend to 0, by doing these can make the instrument tend to level. When the instrument is level, the laser plummet is in the direction vertical, the place of laser points is the place of instrument

station. 

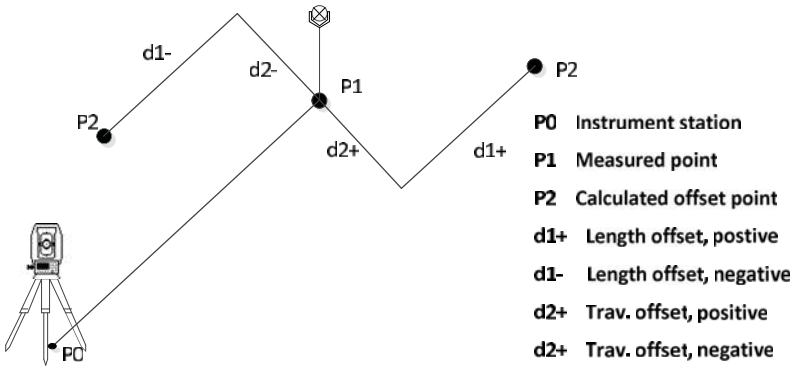
- Press [On] to open the compensator and press [Off] to close the compensator.
- Press [X Only] to open the compensator of X direction.
- Press [▲][▼] to adjust the laser plummet brightness.
- Press [OK] to closs the laser plummet and exit.

2. Offset

The Offset is used to measure the points which are not intervisible or intervisible but can not set up prism in the Station.

Offset contains Dist.Offset and two subprograms, the two subprograms are Cylinder Offset and Angle Offset.

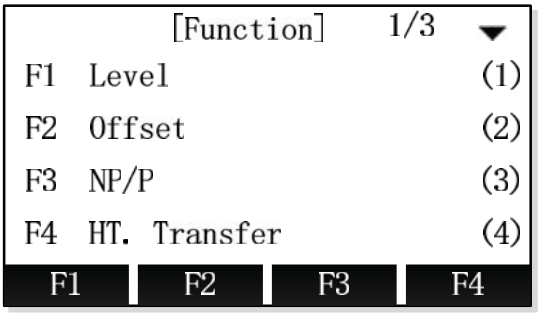
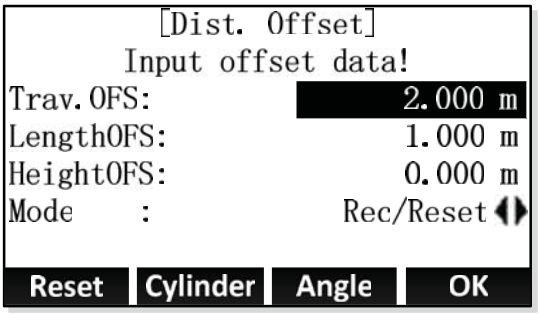
2.1 Distance Offset



Using the external tools to measure the Offset values of the target point p2 and measurement point p1 along the line of station point and measurement point, the Offset values are Trav.OFS, LengthOFS and HeighOFS. Combining the information of measuring point (p1) can calculate the distance of station point (p0) to target point (p2), can also calculate the angel and coordinate.

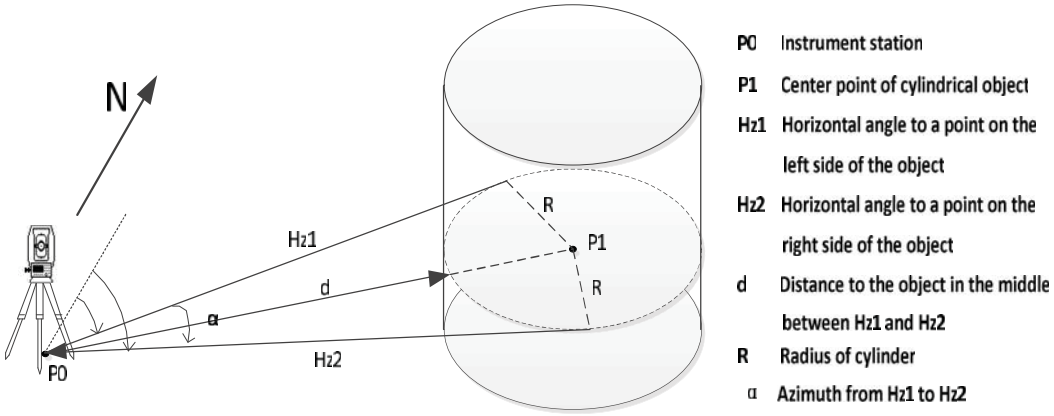
When the measurement point is set on the left of target point or the right of target point, you should make the angle that between line of measurement point and target point and the line of measurement and station point about equals 90° . When the offset point is set on the front of target point or on the back of target point, you should make it on the line of station point and target point.

Steps	Key	Display

① In the program of Q-Survey, press [FNC] to open the menu of Function, next pressing [F2] to enter the program of Offset.	[F2]	
② Input the values of Trav.OFS, LengthOFS and HeightOFS, then select the mode of offset and press [F4] to save.※[1]	[F4]	

※[1]:
Rec/Reset: Make sure the inputed values of Offset and reset all the values of Offset to 0 after once measurement.
Permanent: The values of Offset are always working in the calculation of measurement point.

2.2 Cylinder Offset



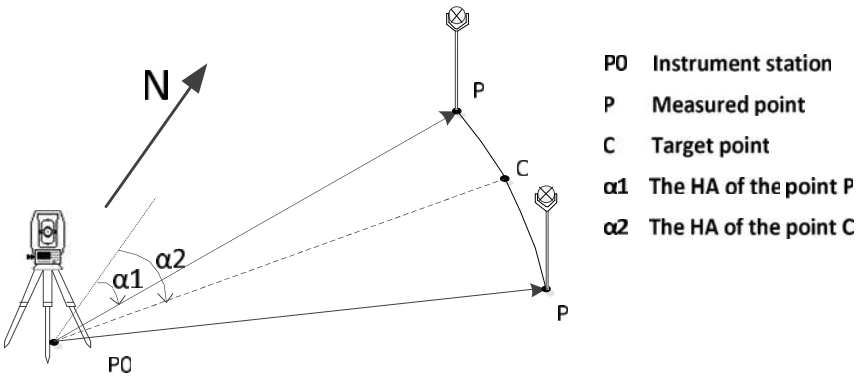
As for the not intervisible cylinders, you can measure the angles of station point with cylinder in Hz Left and Hz Right and the shortest distance of station point to cylinder firstly. Then calculate the coordinate of cylinder center and radius of cylinder through the geometric relationships. The shortest distance between station point and cylinder is in the bisector of angle of station point with cylinder in Hz Left and Hz Right. Turning the instrument to make the collimation axis in the bisector of angle that station point with cylinder in Hz Left and Hz Right, thus can measure the distance

between cylinder and station.

Steps	Key	Display
① In the program of Q-Survey, press [FNC] to enter the menu of Function, then pressing [F2] to enter the program of Offset.	[F2]	[Function] 1/3 F1 Level (1) F2 Offset (2) F3 NP/P (3) F4 HT. Transfer (4) F1 F2 F3 F4
② Press [F2] to enter the subprogram of Cylinder Offset.	[F2]	[Dist. Offset] Input offset data! Trav.OFS: 2.000 m LengthOFS: 1.000 m HeightOFS: 0.000 m Mode : Rec/Reset Reset Cylinder Angle OK
③ Aim at the left edge of cylinder, press [F1] to make sure the angel of Hz Left, turn the instrument to aim at the right edge of cylinder and press [F2] to make sure the angle of Hz Right.	[F1]+[F2]	[Cylinder Offset] Hz Left : 125° 36' 25" Hz Right : 88° 45' 46" : 0.000 m 1 △Hz : 1° 45' 46" Prism OFS: 0.000 m Hz Left Hz Right ALL ↓ DIST REC EDM ←
④ Turn the instrument to make △Hz=0, if use the prism,please input the thickness of prism in the edit text of PrismOFS, if don't use the prism, the default value is 0 in the edit of PrismOFS, then press [F3] to measure the shortest distance of the instrument to cylinder and enter the interface of Cylinder Offset-Result.	[F3] or [F4] + [F1]+[F2]	[Cylinder Offset] Hz Left : 125° 36' 25" Hz Right : 88° 45' 46" : 12.124 m 1 △Hz : 0° 0' 0" Prism OFS: 0.000 m Hz Left Hz Right ALL ↓ DIST REC EDM ←

⑤ Display the result of cylinder offset.		[Cylinder Offset-Result] Pt. : 1 Note : N : 12.215 m E : 25.325 m Z : 0.000 m Radius : 8.125 m Done New

2.3 Angel Offset



Angle Offset is used to measure the points which are intervisible but hava no reflector and can't set up the prism. The basic principle is making the target point and measurement point in the concentric circles whose center is station point, then measuren the position information of station point and measurement point and the angle offset of station to target point, thus can calculate the coordinate of target point.

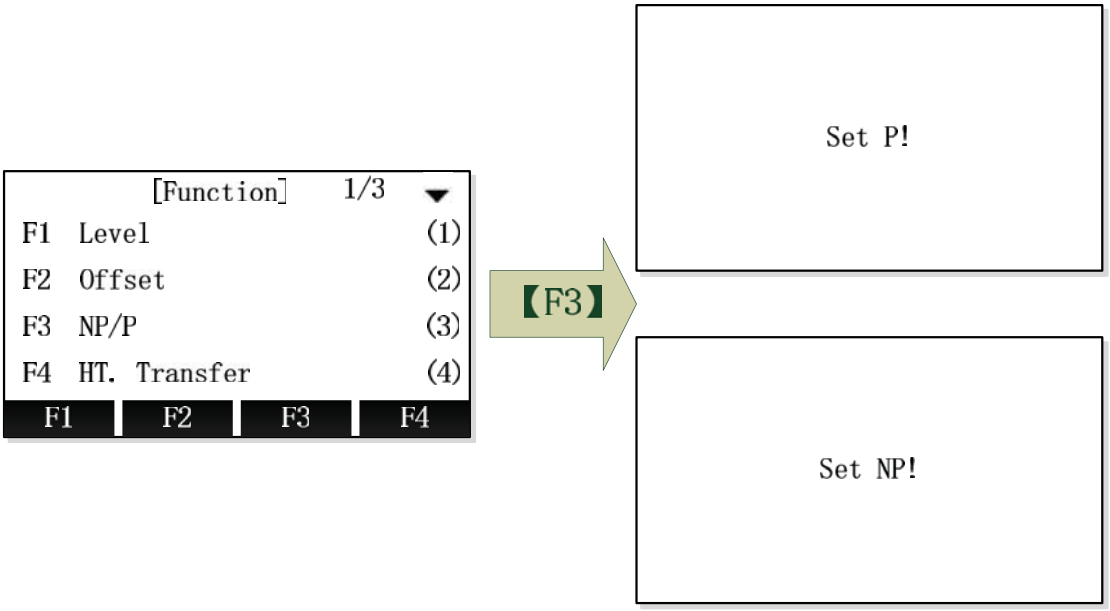
Set the measurement point P in the place where is as far as possible to close the left or right of target point C, and make the distance between measurement point P and station point A and the distance between station point A and target point C are approximately equal.

Steps	Key	Display
① In the program of Q-Survey, press [FNC] to enter the menu of Function, then pressing [F2] to enter the program of Offset.	[F2]	[Function] 1/3 F1 Level (1) F2 Offset (2) F3 NP/P (3) F4 HT. Transfer (4) F1 F2 F3 F4

② Press [F3] to enter the subprogram of Angel Offset.	[F3]	[Dist. Offset] Input offset data! Trav.OFS: 2.000 m LengthOFS: 1.000 m HeightOFS: 0.000 m Mode : Rec/Reset Reset Cylinder Angle OK
③ Aim at the measurement point and press [F1] to measure distance.	[F1]	[Angle Offst] Pt. : 1 T.H. : 1.55 m HA : 89° 51' 16" 1 VA : 12° 35' 45" : 12.235 m DIST OK
④ Aim at the target point and press [F4] to make sure the direction of target point, next enter the program that displaying the result of angle measurement.	[F4]	[Angle Offset] Pt. : 1 T.H. : 1.55 m HA : 123° 36' 32" 1 VA : 12° 35' 45" : 12.235 m DIST OK
⑤ Display the result of angle Offset.		[Angle Offset] 1/2 Pt. : 1 Note : N : 5.154 m E : 4.465 m Z : 2.348 m Done New [Angle Offset] 2/2 Pt. : 1 Note : 1.55 m HA : 123° 36' 32" △Hz : 12° 35' 45" : 12.235 m Done New

3. NP/P Toggle

Switch the mode of reflector quickly. (P is the mode of Prism and NP is the mode of Non-Prism)

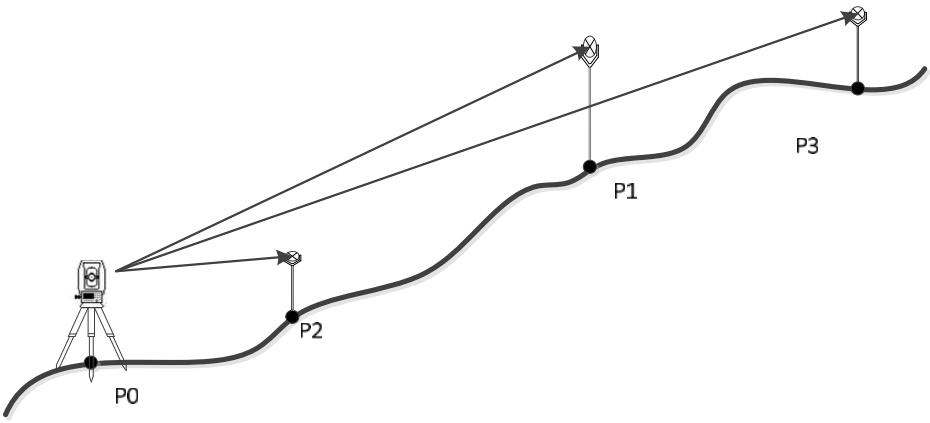


Open the first page of Function Menu and press [F3] to switch the mode of reflector.

4. Height Transfer

The functions of HT. Transfer as follows: Using the measurement data of target point, the fixpoints, fix measurement points and so on to calculate the height of current station point and set the height of station again. You can receive the coordinate of target point by calling the points in the file or through the keyboard to input, you can observe 5 fixpoints' height at most and to calculate.

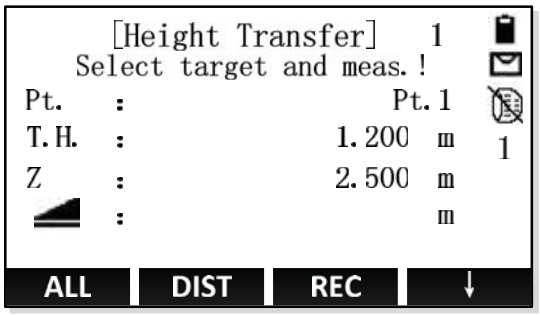
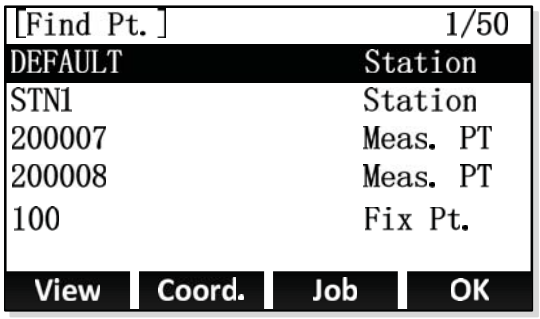
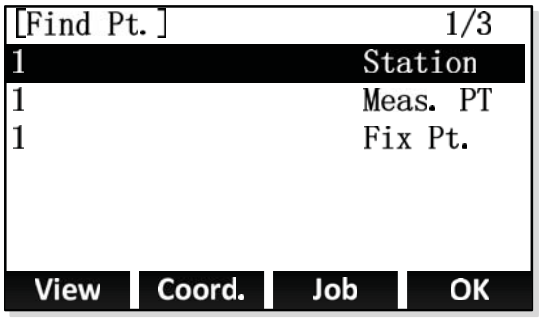
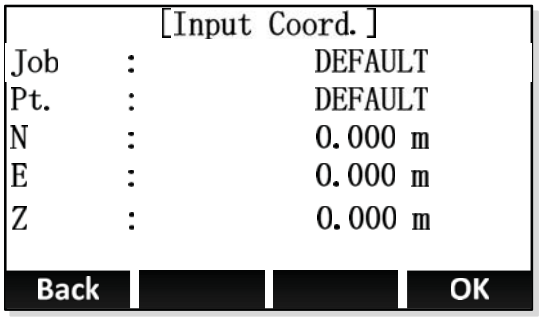
The principle of Height Transfer:



P0 Station point

P1~P3 Target fixpoints height

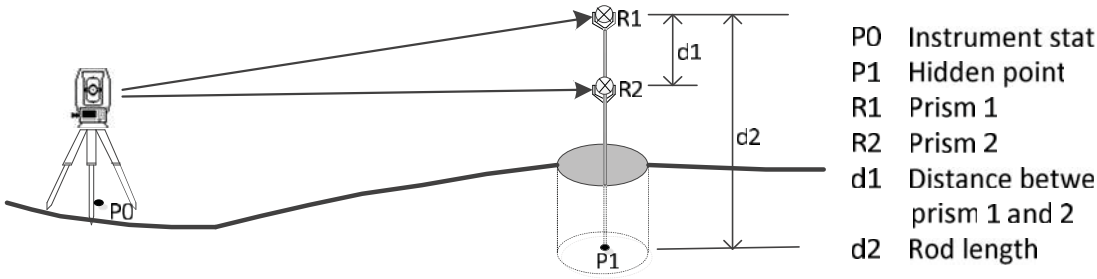
Steps	Key	Display
① Press [F4] or [4] in the first page of [Function] to enter the function of Height Transfer measurement.	[F4] or [4]	[Function] 1/3 F1 Level (1) F2 Offset (2) F3 NP/P (3) F4 HT. Transfer (4) F1 F2 F3 F4 [Height Transfer] 1 Select target and meas. ! Pt : T.H. : 1.200 m Z : m : m ALL DIST REC ↓
② Press [F4] twice and display the third page of soft keys, press [F2](IH)to enter the function of setting instrument height, inputing the current instrument height and press [F4] to back to the function of Height Transfer interface.	[F4] + [F4] + [F2] + [F4]	[Height Transfer] 1 Select target and meas. ! Pt. : T.H. : 1.200 m Z : m : m ALL DIST REC ↓ Find List Coord. ↓ EDM IH. View ← [Height Transfer] Station : STN IH. : 1.300 m X0/N0 : 100.000 m Y0/E0 : 100.000 m Z0/H0 : 10.000 m Back OK

③ Selcet the fixpoint and input the height of Prism. The numbers of measured fixpoints are displayed in the top right corner. There are 3 methods to selecting fixpoint. A: Press [F4] to enter the second page of soft key and press [F2](List) .In the dialog of [Find Pt.], by pressing [▲] or [▼] to select the fixpoints to call.	[F4] + [F2] + [F4]	 A: [List] 
B: Input the name of point and press [F1] (View) to view the point whether exists in the file or not. If exists, you can call it, otherwise, you need to input or measure the coordinate of the point.	[F1] (View) + [F4] (OK)	B: Search point 
C: Press [F3] (Coord.) and input a point name which not exists in the file.	[F3] (Coord) + [F4]	C: Input point 

④ After finishing setting up the fixpoint, the height of fixpoint is displayed in the screen and press [F1](ALL)or [F2](DIST)+[F3](REC) to start to measure and calculate, the height of station is calculated.	[F1] or [F2] + [F3]	[Height Transfer] 1 Select target and meas.! Pt : Pt.1 T.H. : 1.200 m Z : 2.500 m : m ALL DIST REC ↓
⑤ In the interface of [Height Transfer Result], pressing [PAGE] to switch the display of result information. Press [F1](Add PT) to add a new point and to start a new measurement. Press [F3](Back) to back to measure the current point again. Press [F4](OK)to enter the interface of [Set STA HO].	[PAGE]	[Height Transfer Result] 1/2 Station : STN ZO/HO : 0.781 m Correc. : 0.000 m PT NUM. : 1 Add PT Back OK [Height Transfer Result] 2/2 Station : STN XO/NO : 0.081 m YO/EO : 0.081 m ZO/HO : 0.081 m PT NUM : 1 Errors : 0.000 m Add PT Back OK
⑥ Pressing [F1] to back to the interface of [Height Transfer Result]. Press [F2] to set the height of staton to the old value Press [F4] to set the height of station to the new value which calculated after Height Transfer. Press [F3] to set the height of station to the average of the old value and new vlaue		[Set STA HO] Station : STN Old HO : 0.000 m New HO : 0.781 m ΔHO : 0.781 m Back OLD AVG NEW

5. Hidden Point

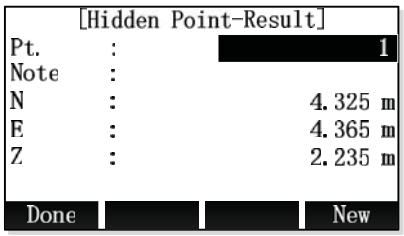
The function of Hidden Point is using a specia hidden point measuring rod to measure the points which are not intervisible.



The length of measuring rod is known, by measuring the position information of prism 1 and prism 2 in the measuring rod and using mathematical methods to calculate the coordinate of hidden point on the other side of the measuring rod.

Steps	Key	Display
① In the program of Q-Survey, press [FNC] to enter the menu of Function, then pressing [PAGE] to open the second page of Function and then pressing [F1] to enter the function of hidden point measurement.	[F1]	[Function] 2/3 F1 Hidden Point (5) F2 Free Coding (6) F3 Laser (7) F4 Light (8) F1 F2 F3 F4
② In the interface of measuring the first prism point, pressing [F4] to enter the interface of Rod Length.	[F4]	[Hidden Point] Meas. target 1! Pt. : 1 HA : 89° 51' 16" 1 VA : 12° 35' 45" : 12.235 m ALL DIST REC ROD/ED

③ Inputting the correct value of Rod length and pressing [F4] to back to measure the first prism point.	[F4]	[Rod Length] Rod length : 3.000 m R1-R2 : 1.000 m Error Limits: 0.001 m OK
④ The instrument aims at the prism on the top and pressing [F1] to finish measuring the first prism and enter the interface of measuring the second prism.	[F1] or [F2] + [F3]	[Hidden Point] Meas. target 1! Pt. : 1 HA : 89° 51' 16" 1 VA : 12° 35' 45" : 12.235 m ALL DIST REC ROD/ED
⑤ Aim at the second prism and press [F1] to finish the second prism's measurement. Start to calculate the information of hidden point now. If the error is beyond the set value, enter the step ⑥ of giving a prompt of error, otherwise, enter step ⑦ to display the result of hidden point measurement.	[F1] or [F2] + [F3]	[Hidden Point] Meas. target 2! Pt. : 2 HA : 89° 51' 16" 1 VA : 12° 35' 45" : 12.235 m ALL DIST REC ROD/ED
⑥ A prompt of error. Press [F1] to enter the step ⑦ to display the result of hidden point measurement, press [F4] to back to the step ②。	[F1] or [F4]	[Hidden Point] Overrange Error Limits: 0.050 m Error : 0.065 m Accept New

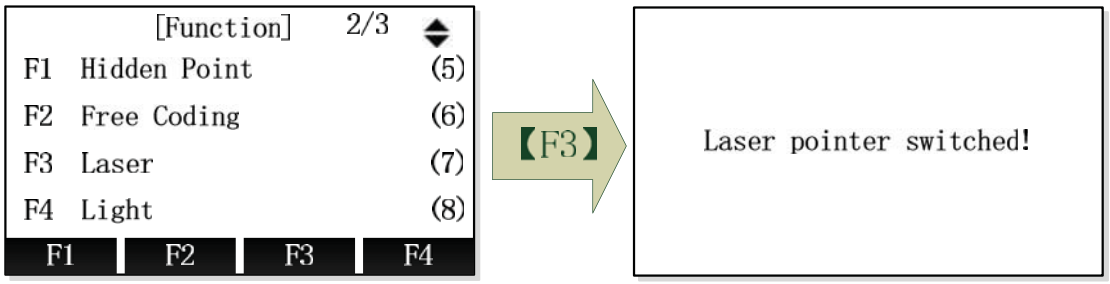
⑦ Display the result of hidden point measurement.		

6. Free Coding

Please refer to "3. Q-Survey" → "3. Start Measurement" → "3.4 Code"

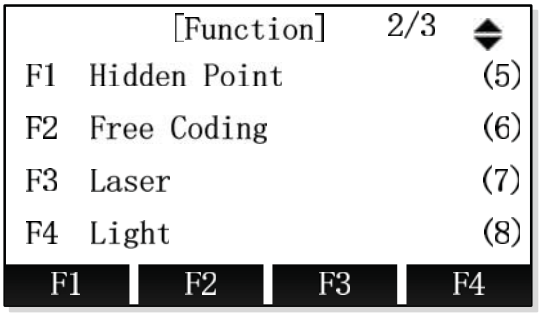
7. Laser Pointer

Open or close the laser fastly.



8. Light

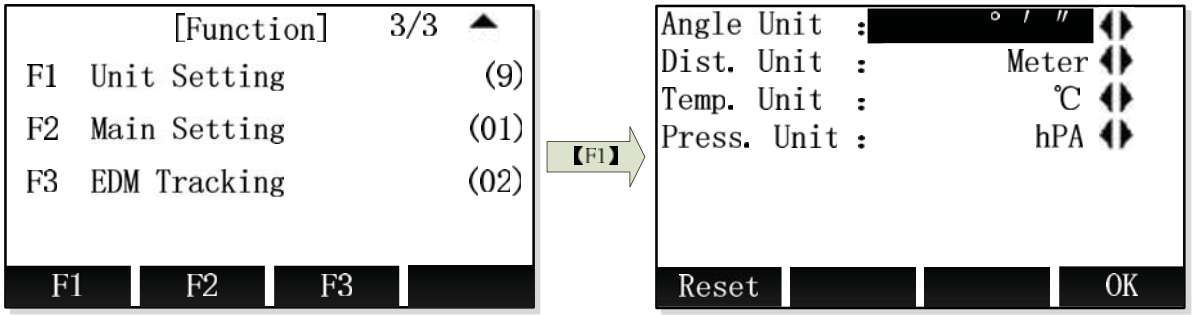
Turn on or off the light of instrument screen fastly.



Open the second page of Function Menu and press [F4] to turn on or off the Light.

9. Unit Setting

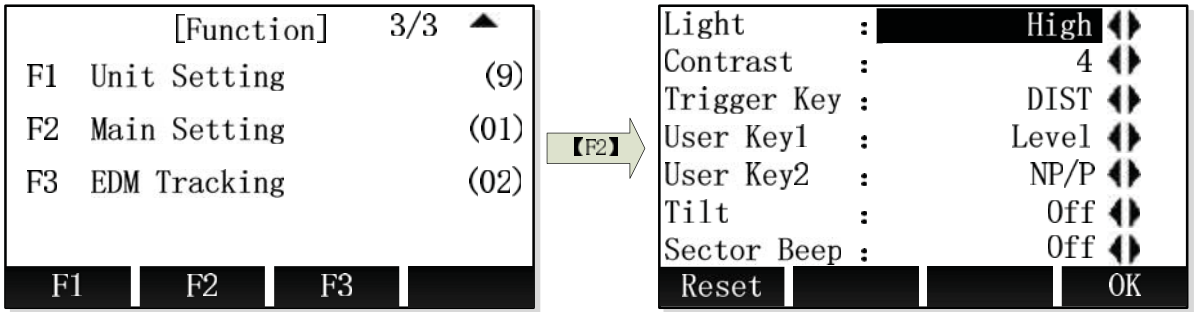
Set the common Unit fastly.



Open the third page of Function Menu and press [F1] to enter the interface of unit setting. After finishing setting the units in the interface of Unit Setting, press [F4](OK) to save the settings,press [F1](Reset)to restore all units to factory default.

10. Main Setting

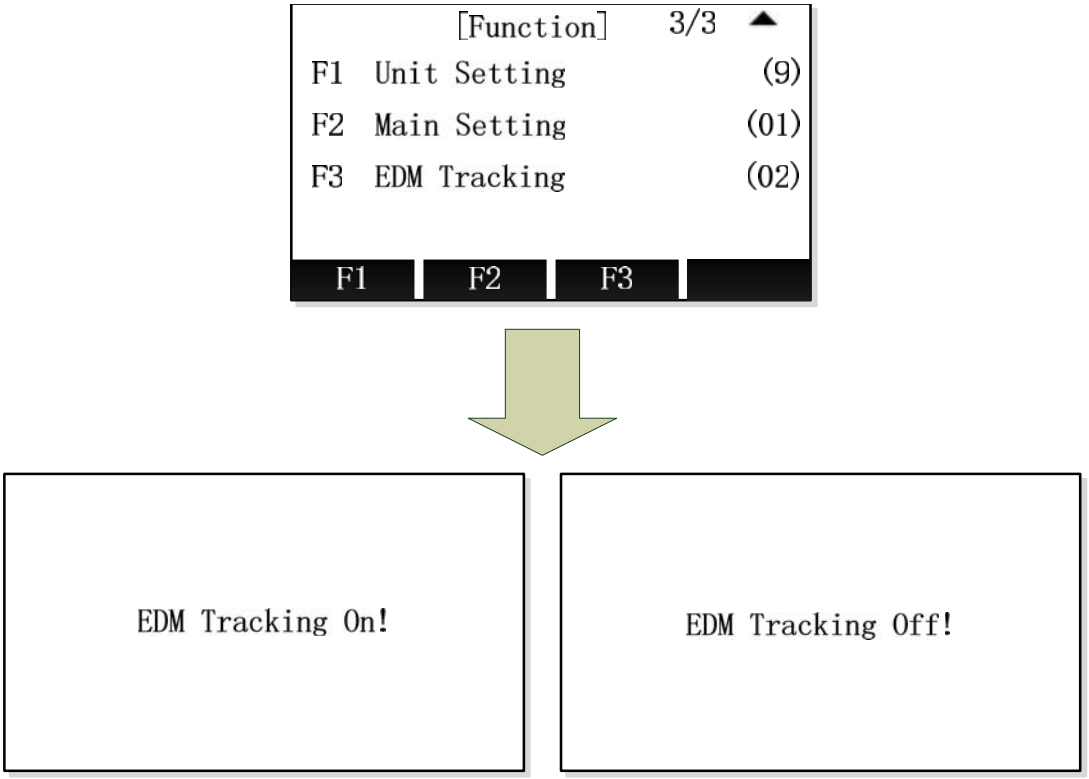
Open the settings about instrument's hardware, the specific items as follows:



As for the setting of specific items , please refer to "General Setting".

11. EDM Tracking

Open or close the mode of EDM Tracking fastly.

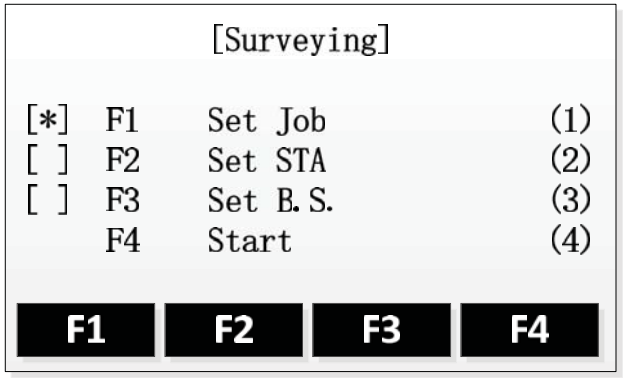


Open the thied page of Function Menu, press [F3] to open or close the mode of EDM tracking.

5. Applications

Prepare setting before measuring:

Before startingthe application, there are some preparations needed to set up. The Pre-Settingsscreenwill beshown after the user selects an application. User can select and set the content of the Pre-Settings menu successively.



[*]: Setting has been done.

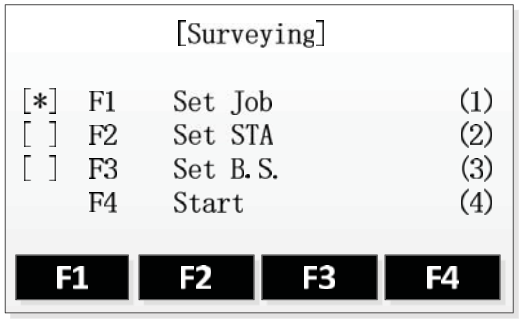
[ ]: Setting has not been done.

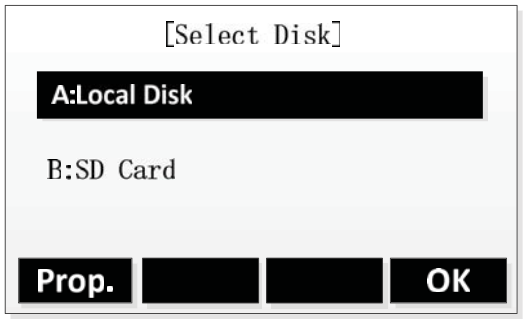
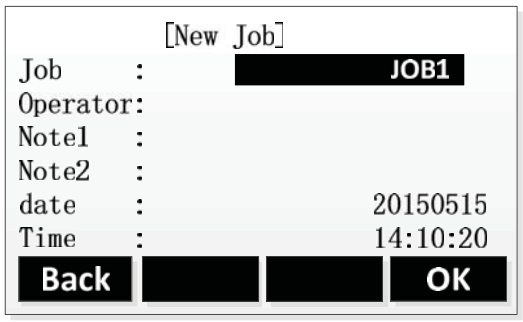
The details of every setting are as follows.

1. Setting the Job

The measured data and fix data are saved in the jobs which are shown as childdirectories. The job contains different types of data, such as fix points, measured points, station points, codes, etc. The datas in the job can be read, edited and deleted.

1.1 Create a new Job

Steps	Key	Display
① Press [F1] in the Pre-Settings screen. Then enter the Set Job function.	[F1]	

② Press [F2](New) and then enter the Create a New Job screen. Press [F4](OK), the displayed job will be set as current job and then back to Pre-Settings screen.	[F1]	
③ If the instrument is fitted with SDCard, there willfirstly showthe diskselection screen. In this screen, user can select the disk through Up or Down key. Then press [F4](OK) to confirm. A: Local Disk B: SD Card		
④ Continue to show New Job screen. Input the new job's name, operator, etc. Press [ENT] to finish one input item and thecursor moves to the next input itemautomaticallyat the same time. ※[1]	Input job's data + [ENT]	
⑤ Press [F4](OK) to complete setting a new job after finishing all the inputs. This job will be set as the current job. Then back to the Pre-Settings screen.The completed setting item is marked with [*].	[F4]	

		[Surveying] [*] F1 Set Job (1) [ ] F2 Set STA (2) [ ] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4
※[1]: The instrumentsystem will create and add date and time automatically.		

1.2 Select anExisting Job from Memory

If there is any job existing in the memory, user can select this job and set it as the current job.

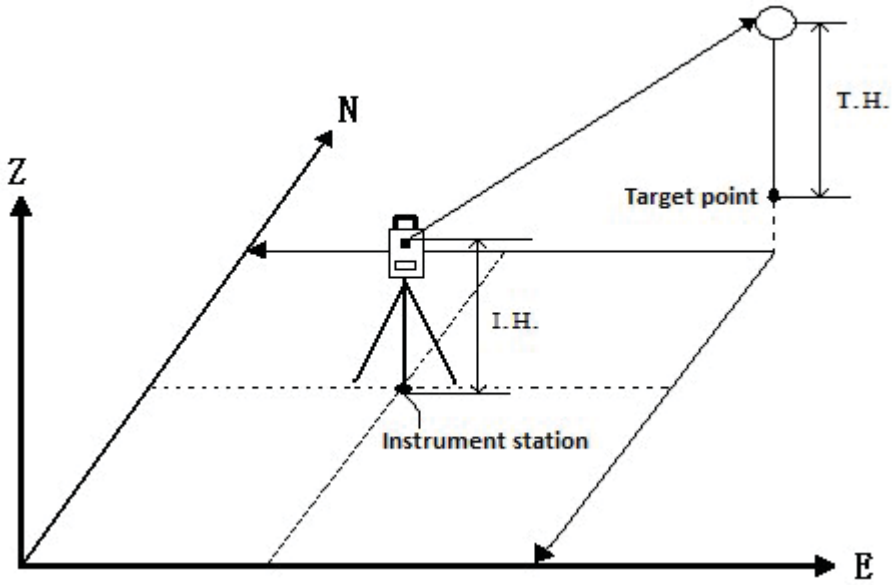
Steps	Key	Display
① Press [F1] in the Pre-Settings screen. Then enter the Set Job function.	[F1]	[Surveying] [*] F1 Set Job (1) [ ] F2 Set STA (2) [ ] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4
② Press [F1] (List) to enter Job list screen.	[F1]	[Set Job] Job : DEFAULT Operator: Date : 20150515 Time : 14:10:20 List New OK
③ All the existing jobs, including that stored on SD Card and will be shown as a list. The current job is marked with a *. Select the target job through Up and Down key and then press [F4](OK) to confirm the selection. The selected job is set as current		[Job list] JOB1 JOB2 JOB3 JOB4 [SD] Delete New View OK

job.		
⑤ Back to Pre-Setting screen.The completed setting item is marked with *.	[F4]	[Surveying] [*] F1 Set Job (1) [ ] F2 Set STA (2) [ ] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4
Note:Don't pull out the SDCard when it is in operating state, otherwise it will cause the SDCard'sdata loss or damage.		

- All measureddatas are stored in the current job.
- If start the application without setting the job, press ALL key or press REC key in the Q-Surveying screen, the instrument system will create a job which named DEFAULT automatically.

2. Setting the Station

Every target coordinate's calculation is related to the position of the station. The station coordinate can be input manually or selected from the instrument memory.



2.1 Select the coordinate from memory [Find]

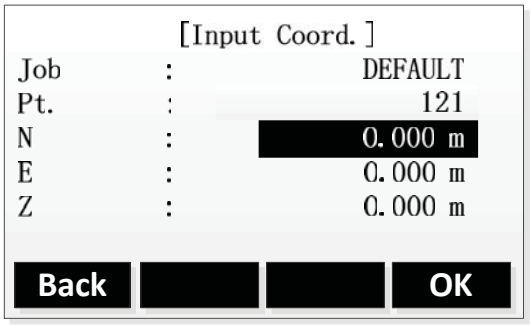
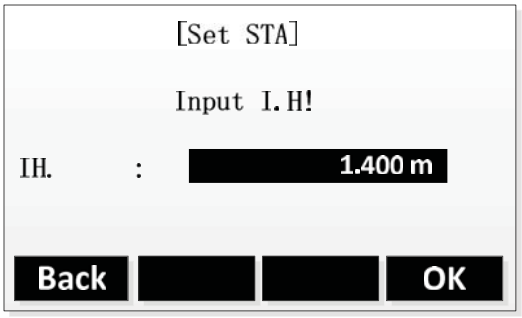
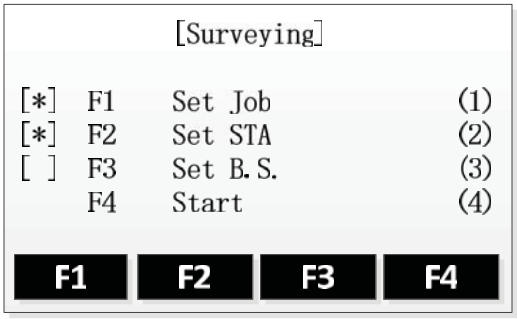
Steps:

1、 Select the coordinate from memory.

2、 Input instrument height.

3、 [OK] Set station.

Steps	Key	Display
① Press [F2] in the Pre-Settings screen. Then enter the Set STA function.	[F2]	[Surveying] [*] F1 Set Job (1) [ ] F2 Set STA (2) [ ] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4
② Input the name of the station point which exists in the job and then press [ENT]. ※1	Input point name + [ENT]	[Set STA] Input STA PT! Station : A1 Find List Coord.
③ Press [F1](Find): **A:** If the input name exists in the current job, there will show the screenas shown on the right figure. The multiple points with the same name will be sorted by type. **B:** If the input name doesn't exist in the current job, the program prompts the message "Pt. not found". Then enter the [Find Pt.] screen. There can also select point from other jobs and set it as the station point. Input the point name and press [F4](Find). If		A: [Find Pt.] 1/5 1 Station A1 Station A1 Meas. PT A1 Meas. PT A1 Target PT View Coord. Job OK B: [Find Pt.] Job : DEFAULT Pt. : 121 Select job or input coord.! Job Zero Coord. Find

the point is found, press [OK] in the [Find Pt.] list screen to set it as station. Program enter input instrument height screen. If the point doesn't exist, press [F3](Coord.) to input the coordinates of N, E and Z. Set this point as station. **[Zero]:** Set this point's all coordinates as 0 and set the point as station. **[Coord.]:** Enter [Input Coord.] screen. Input the coordinates and save them to the current job.		
④ Enter input instrument height screen. Input the instrument height and press [ENT] to confirm. Then press [F4](OK) to save and set the station informations. Press [ESC] then back to previous screen. Continue to set the coordinates of station.	Input instrument height + [ENT] + [F4]	
⑤ Back to Pre-Settings screen. The setting items that have been made are marked with *.		
※[1]: The details of [Find Pt.] can be found in the chapter "Find Point". You can also input the wildcard "*" to search all the points.		

2.2 Select the Fix Point in the Memory [List]

User can select the fix point in the memory's jobs to set station without inputting the point name.

Steps	Key	Display

② Press [F2](List) in the [Set STA] screen.	[F2]	[Set STA] Input STA PT! Station : A1 Find List Coord.
③ Show the point list all the fix points and measured points of the current job.		[Find Pt.] 1/5 DEFAULT Station STN1 Station 200007 Meas. PT 200008 Meas. PT 100 Target PT View Coord. Job OK
④ Select the needed point through Up and Down key. [View]: Show the informations of this point. [Coord.]: Input the coordinate datas manually. [Job]: Select datas from another job.	↑ ↓	[View]: [View Coord.] Job : DEFAULT Pt. : 121 N : 0.000 m E : 0.000 m Z : 0.000 m Date: 20150515 OK [Coord.]: [Input Coord.] Job : DEFAULT Pt. : 121 N : 0.000 m E : 0.000 m Z : 0.000 m Back OK [Job]:

		[Find Pt.] Job : DEFAULT Pt. : 121 Select job or input coord.! Job Zero Coord. Find
⑤ After selecting needed point, press [F4](OK) and enter input instrument height screen. Complete all settings and then back to Pre-Settings screen.	[F4] input instrument height + [ENT] [F4]	[Set STA] Input I.H! IH. : 1.400 m Back OK

2.3 Input the coordinates manually.

Steps:

1. Press [Coord.], enter input coordinate screen.
2. Input the point name and coordinates.
3. [OK] Save the station coordinates. And then input the instrument height.

Steps	Key	Display
② Press [F3](Coord.) in the [Set STA] screen.	[F3]	[Set STA] Input STA PT! Station : A1 Find List Coord.
③ Input the point name and the point's coordinates. After inputting one item, the curser will move to next input item.	Input point name and coordinate + [ENT]	[Input Coord.] Job : DEFAULT Pt. A1 N : 3.102 m E : 15.012 m Z : 4.215 12 B.S. Clear Alpha

④ Press [F4](OK) to save the coordinates of this point.	[F4]	[Input Coord.] Job : DEFAULT Pt. : 121 N : 3.102 m E : 15.012 m Z : 4.215 m Back OK
⑤ Program prompts"Saved!" Then enter input instrument height screen. Input the instrument height and press [ENT] to confirm. Then press [F4](OK) to finish the setting.	Input instrument height + [ENT] [F4]	[Set STA] Input I.H! IH. : 1.400 m Back OK
⑥ Back to Pre-Settings screen. The setting items that have been made are marked with *.		[Surveying] [*] F1 Set Job (1) [*] F2 Set STA (2) [ ] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4

3. Setting the Orientation

The orientation can be input manually or determined from points that are either measured orselected from the memory.

3.1 Manual input orientation

Steps:

1. Press [F1] and enter manual input screen.
2. Input the azimuth, prism height and point name.
3. Press [F1](ALL) to start measuring and set theorientation.
4. Press [REC] to record theangle and orientation.

Steps	Key	Display
① Press [F3] in the Pre-Settings screen. Then enter the Set STA function.	[F3]	[Surveying] [*] F1 Set Job (1) [*] F2 Set STA (2) [ ] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4
② Press [F1] and select the [Angle Setting] to input orientation manually.	[F1]	[Set B.S.] F1 Angle Setting (1) F2 Coordinates (2) F1 F2
③ Aim B.S. point and then input the azimuth, prism height and backsight point name. Press [ENT] after finishing every input.	Input horizontal angle + [ENT]	[Angle Setting] Azimuth : 50 ° 00′ 00″ T.H. : 1.500 m BS PT : DEFAULT1 Aim BS. Then ALL/REC! ALL REC Zero EDM
④ Press [F1](ALL) to start measuring and set the orientation. [REC]: Press this key to finish setting orientation without measurement. [Zero]: Set the azimuth as 0.	[F1]	BS SET!

⑤ Back to Pre-Settings screen. The setting items that have been made are marked with *.		[Surveying] [*] F1 Set Job (1) [*] F2 Set STA (2) [*] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4

3.2 Set orientation with coordinates

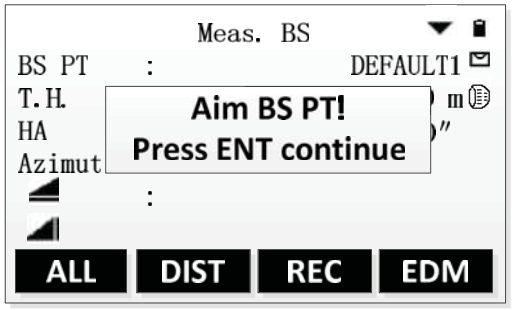
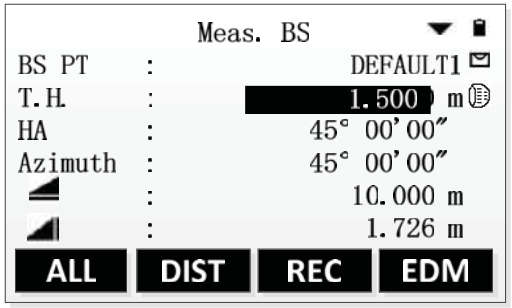
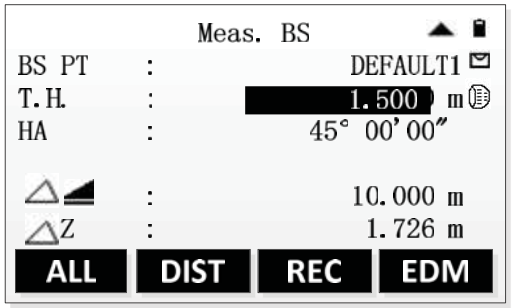
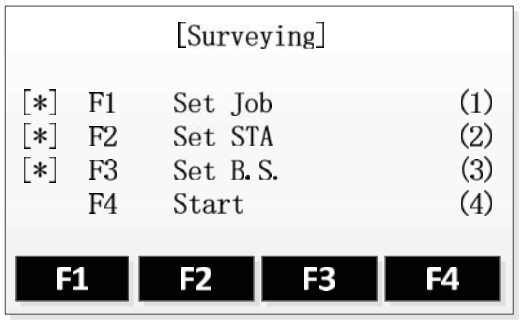
The determination of the direction value can also be carried out using a point with a known coordinate.

Steps:

1. Press [F2] to go to set orientation with coordinates
2. Input the name of orientation point and find the point.
3. Input the prism height and determine it.
4. Use this point to set orientation.

➢ The orientation point can be select from memory or inputted manually.

Steps	Key	Display
① Press [F2] to select Coordinate to Set orientation with coordinates.	[F2]	[Set B.S.] F1 Angle Setting (1) F2 Coordinates (2) F1 F2
② Find, select or input the backsight point coordinates and then go to the Meas. BS screen.	Find, select or input the backsigh t point	[Set BS] Input BS PT! BS PT : DEFAULT1 Find List Coord.

③ Aim backsight point and then press [ENT]. Press [F1](ALL) or press [F2](DIST) and [F3](REC) to start measuring and finish setting orientation. User can also press [F3](REC) to finish setting orientation without measurement. Press the [PAGE] key to switch the display of measured values screen and backsight inspection values screen. [EDM]: Go to set EDM settings.	[ENT] [F1] or [F2] 、[F3]	  
④ Back to Pre-Settings screen. The setting items that have been made are marked with *.		

4. Starting the Applications

The preset applications covers a wide range of measurement tasks.That makes the daily field measurementeasier and faster. The all applications can be selected to use are as follows:

- Surveying

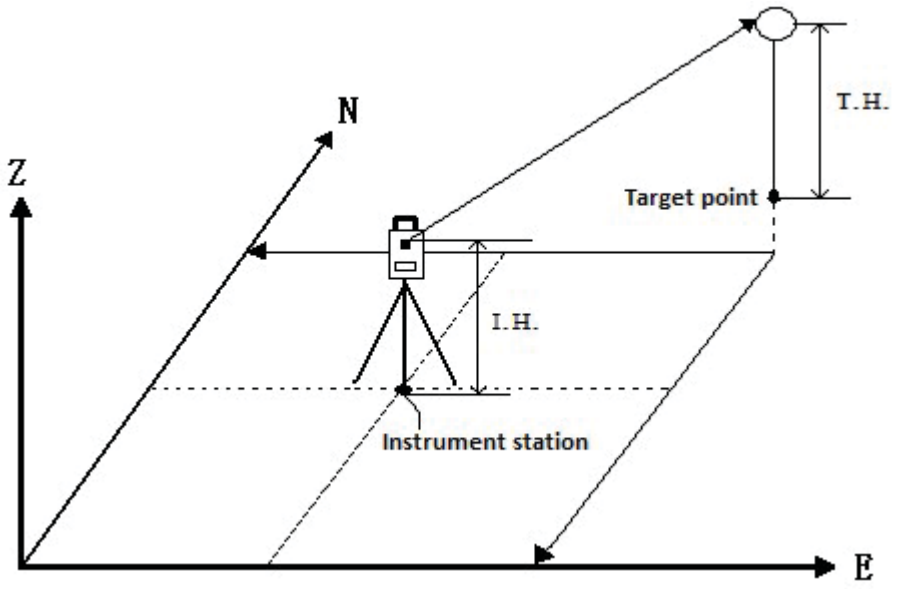
- Stakeout
- Free Station
- Tie Distance
- Area
- Remote Height
- COGO
- Road

Steps:

1. Go to the MAIN MENU.
2. Move the focus to [Program] or press the Numeric key 2 to select and go to the PROGRAM MENU.
3. Press [PAGE] to browse the application menu. Press [F1]-[F4] to select and start an application.

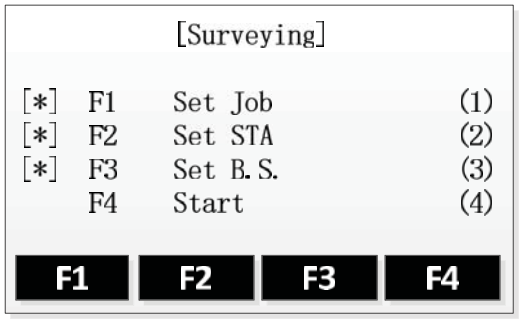
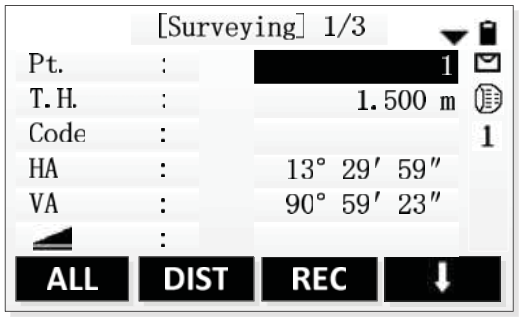
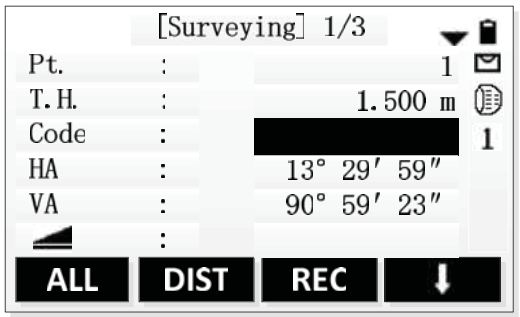
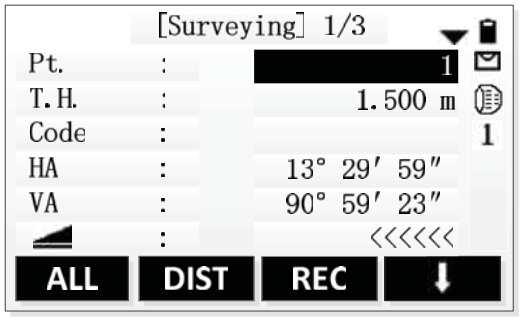
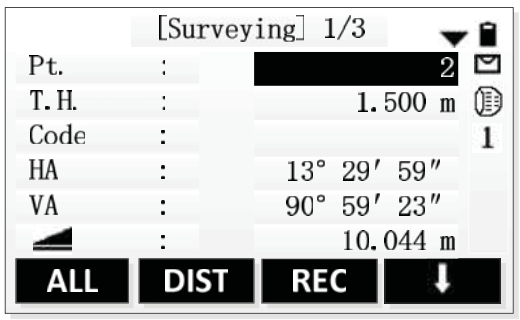
5. Surveying

Compared with the Q-Suveying, Surveying has different guides in setting station and set orientation.



Operation: Must first finish seting the station and orientation.

Steps	Key	Display

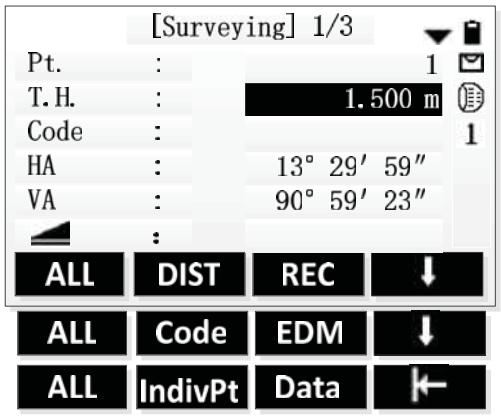
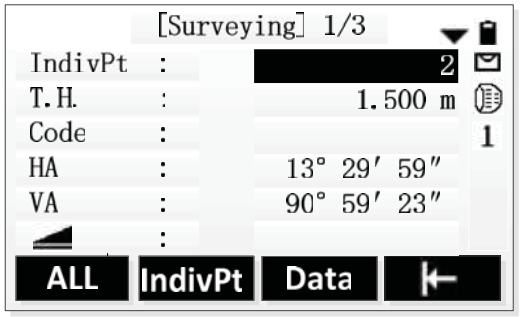
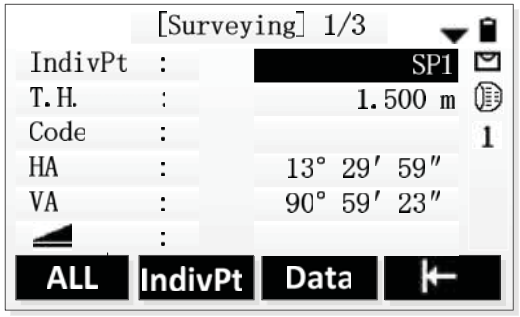
① After finishing setting the job, setting the station and setting the orientation, press [F4] to start the application in the Pre-Setting menu.	[F4]	
② Input the point name, and then press [ENT] to move to next input item to input prism height.	Input point name + [ENT]	
③ Input the prism height and then press [ENT] to move the cursor to next input item. If needed, input the code.	Input prism height + [ENT]	
④ Press [F1](ALL) or press [F2](DIST) and [F3](REC) to start measuring and record the measured data. This data contains angle, distance and coordinates. Press [PAGE] to switch the display mode of the data.	[F1] or [F2]+[F3]	
⑤ After finishing measuring one point, the point name automatic plus one. Press [F1](ALL) or press [F2](DIST) and [F3](REC) to continue measuring next		

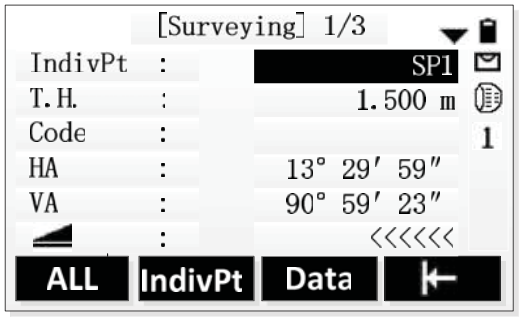
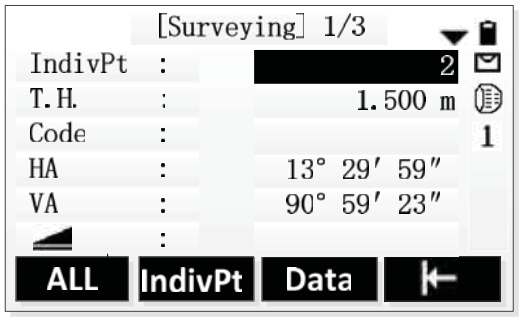
point. At this time, the screen remains the last measured data which can be looked over by pressing [PAGE].		

5.1 Individual Point

[IndivPt]:

In the data acquisition, point can be recorded individually. Press this key to switch the screens of Individual Point Measurement and Consecutive Point Measurement.

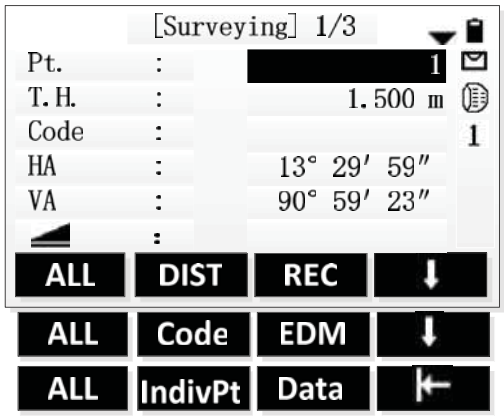
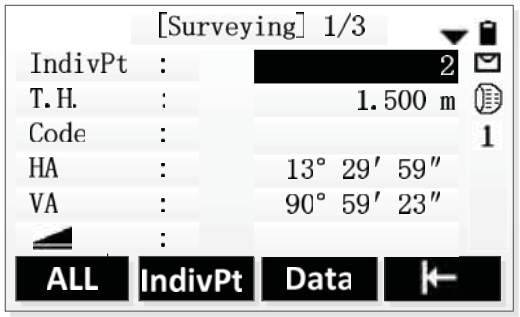
Steps	Key	Display
① Press [F4](↓) twice to display the last page of soft keys.	[F4]	
② Press [F2](IndivPt) to start measuring individual point function.	[F2]	
③ Input the individual point's name and prism height and press [ENT] to move the cursor to next input item.. If needed, input the code.	Input point name, prism height and code + [ENT]	

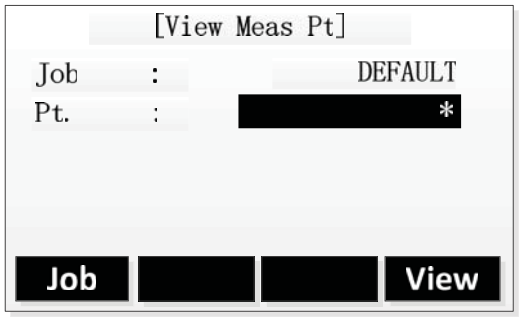
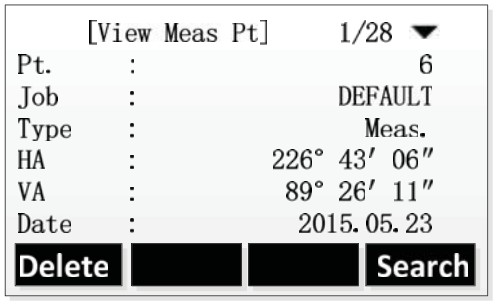
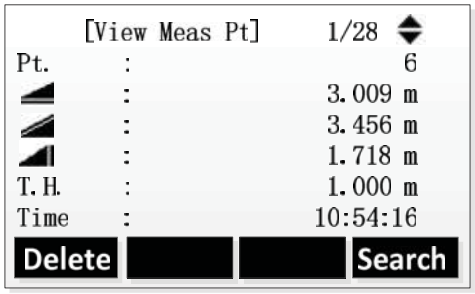
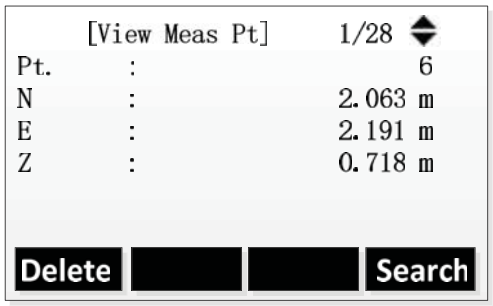
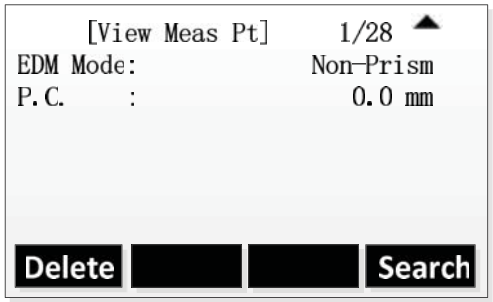
④ Press [F1](ALL) or press [F2](DIST) and [F3](REC) to start measuring and record the measured data.	[F1] or [F2]+[F3]	
⑤ Finish measuring, application turn off the function of measuring individual point and then continue to display the consecutive point name.		

5.2 Data

[Data]:

Look over the measured datas which are saved in current job.

Steps	Key	Display
① Press [F4](↓) twice to display the last page of soft keys.	[F4]	
② Press [F3](Data) to start view measured point function.	[F3]	

③ After inputting the target point's name or wildcard (*), press [ENT] and then press [F4](View) to look over the datas. If there is no match point, the program prompts"**Pt. not found!"** [Job]: Select the job where the measureddatais to be viewed.	Input point name/ wildcard + [ENT] + [F4]	
④ Go to View Measured Point screen. Press [PAGE] to turn the page and look over all data field of this point. Press direction key ← and → to browse the last or next measured point. [Delete]: Delete this point data. [Search]: Back to the Find Point screen.	[PAGE] ← →	   

6. Stakeout

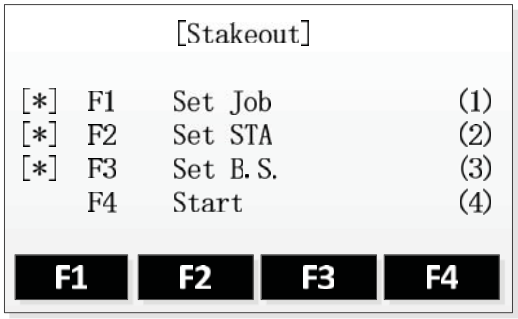
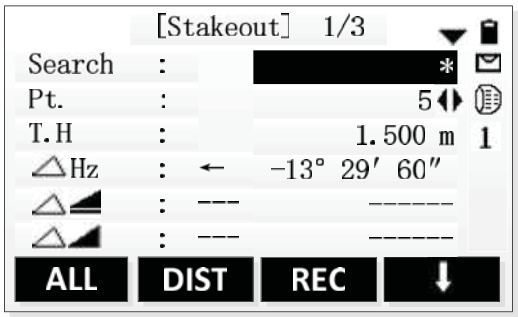
The Stakeout Application can calculate lofting elementsbase on lofting point's coordinate or manually input angle or horizontal distance. The application can continuously display differences, between current position and desired stake out position.

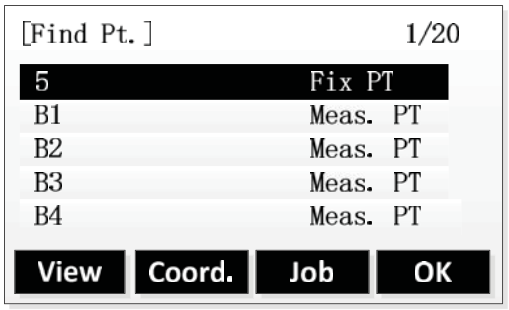
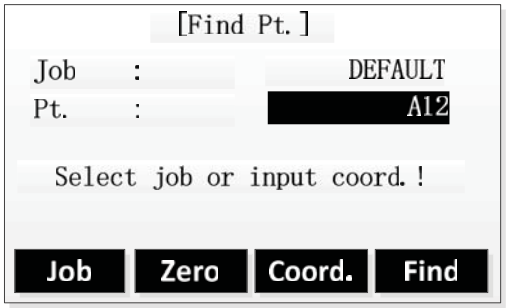
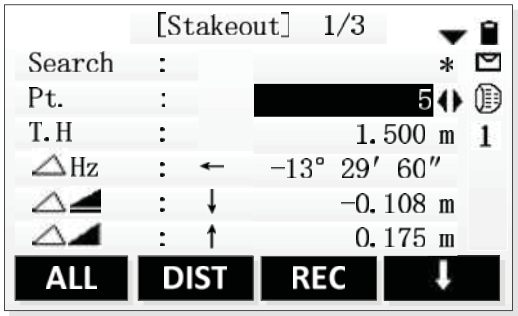
Steps of Stakeout :

1. Set the job.
2. Set the station
3. Set the orientation
4. Extractecoordinates from memory. The coordinates may be a measured point or a manually entered fix point.
5. Start staking out. There are three ways to choose: Polar Stakeout mode, Orthogonal to StationStakeout mode, Cartesian Stakeoutmode.

6.1 Set Stakeout Point

- **Extractecoordinates from job**

Steps	Key	Display
① After finishing setting the job, setting the station and setting the orientation, press [F4] to startstaking out in the Pre-Setting menu. ※1	[F4]	
② Input the name of stakeout point in the Search item. Press [ENT] to start Find Point function. (Or input wildcard "*"to start the wildcard search.)	Inputstakeout point's name + [ENT]	

③ A: The program searchs the point name in the job and show the result dialog. The match points will be listed, press [F4](OK) to identify selected point and back to Stakeout screen. (If the input is wildcard "*", the program will show all the points of the current job.)※[2] B: If there is no match point in the job, the program prompts“**Pt. not found!”.**And then go in **Find Point In Job** screen. User can input a point or select a point from another job and then back to Stakeout screen.		 
④ After finishing setting stakeout point, start staking out.		

※[1]: The settings of job, station and orientation have been elaborated in detailIn the previous chapters, here is no longer repeat. Refer tochapters“Setting The Job、Setting The Station、Setting The Orientation”.

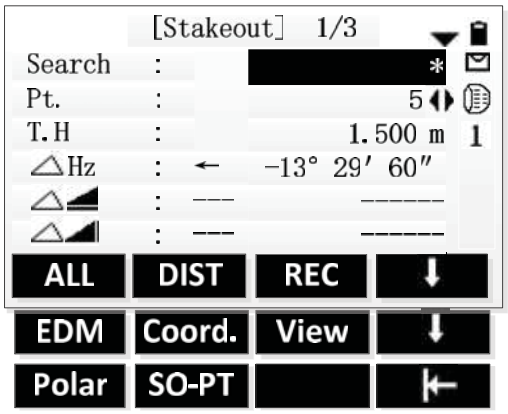
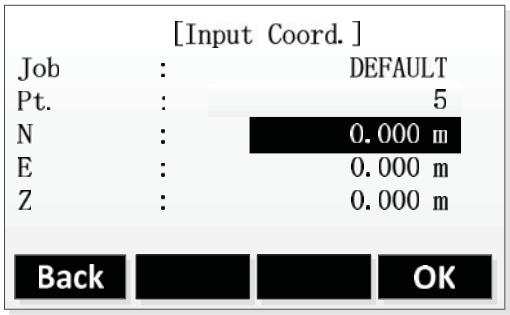
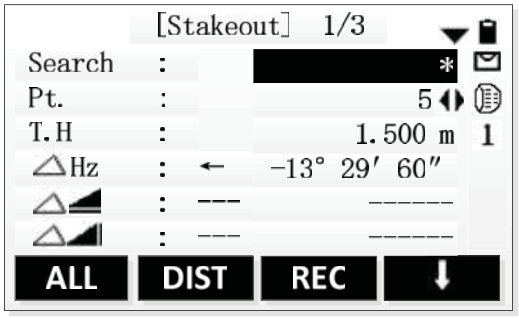
※[2]: Unlike the other place's points list, the stakeout points are ordered by time.In the stakeout points list, the newest point is at the back and the fix point is in the front ofmeasured point. But in the other points list, the newest point is at the back and the measured point is in the front offix point.

- **Manual input stakeout point**

  Press key [Coord.] or [SO-PT] to manual input stakeout point coordinates and then continue staking out.

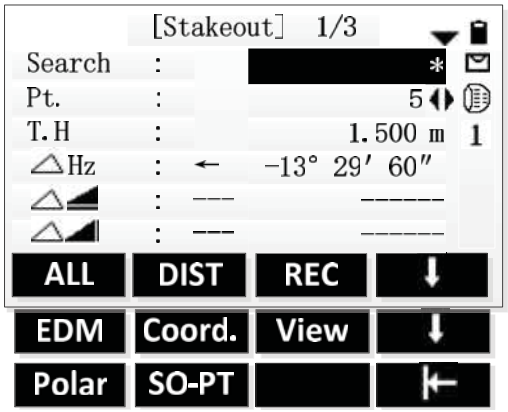
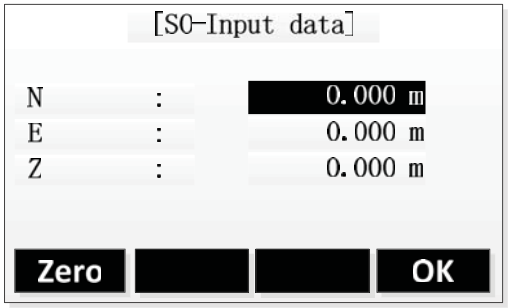
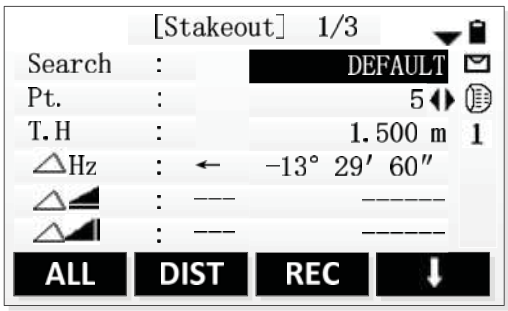
  [Coord.]:

  Press [Coord.] and then input a target point's coordinates. Saved this point into job and continue staking out.

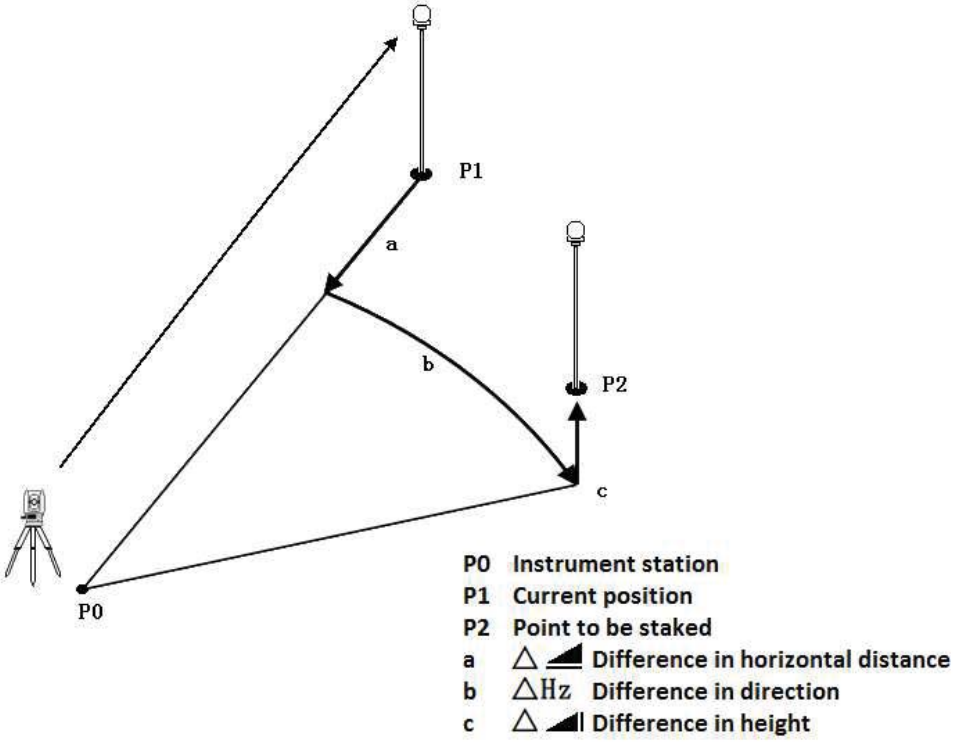
Steps	Key	Display
① Press [F4] (↓) to view the second page of soft keys.	[F4]	
② Press [F2](Coord.) to go to Input Coord. Screen. Input point name and coordinate of the stakeout point. After input one item, the curser will move to next input item.	[F2] + Input point name and coordinates + [ENT]	
③ After finishing inputs, press [F4](OK) to save the data. And then back to Stakeout screen. Start to stakeout the input point.		

[SO-PT]:

Press [SO-PT] to input a stakeout point without point name and being saved into job.

Steps	Key	Display
① Press [F4] (↓) to view the third page of soft keys.	[F4]	
② Press [F2](SO-PT) to go to SO-Input data screen. Input the coordinates of stakeout point. After input one item, the curser will move to next input item.	[F2] + Input point name and coordinates + [ENT]	
③ After finishing inputs, press [F4](OK) to save the data. And then back to Stakeout screen. Start to stakeout the input point. The program will name this point **DEFAULT** automatically. ※[1]		
※[1]: [SO-PT]: The input point won't be saved into job.		

6.2 Polar Stakeout Mode

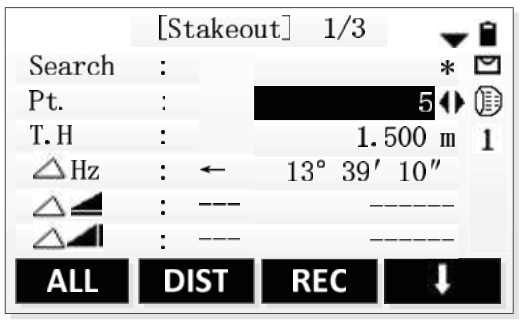


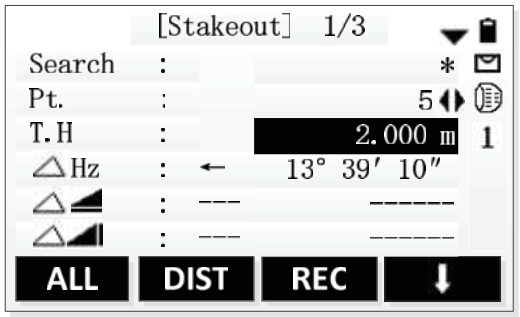
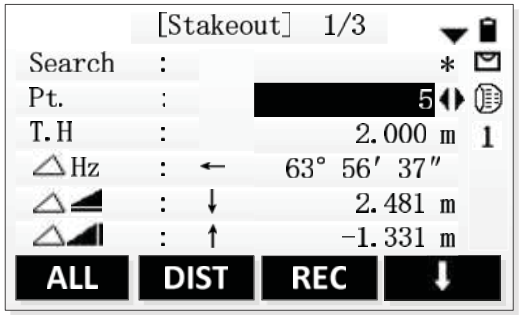
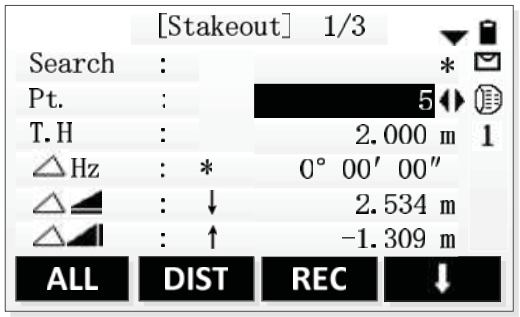
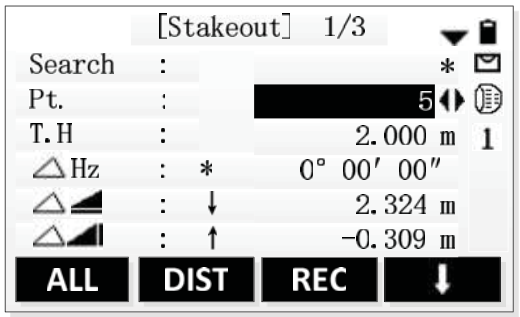
The meanings of the differencesin thePolar Stakeout mode:

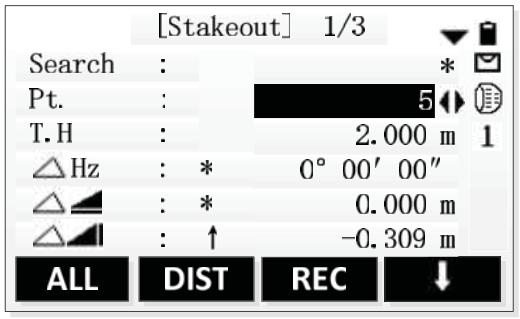
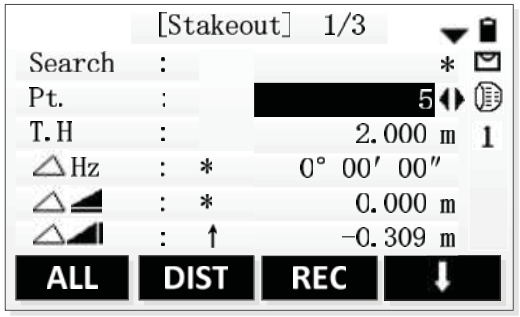
△Hz Difference in direction:If the measured point is located in the right side of stakeout point, the value is positive.

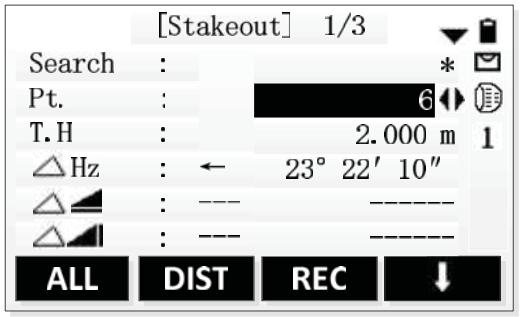
△ Difference in horizontal distance: If the measured point is farther than stakeout point, the value is positive.

△ Difference in height: If the measured point is higher than stakeout point, the value is positive.

Steps	Key	Display
① Set all the points that are readied to stake out. Select one stakeout point through search the point name in the job.		

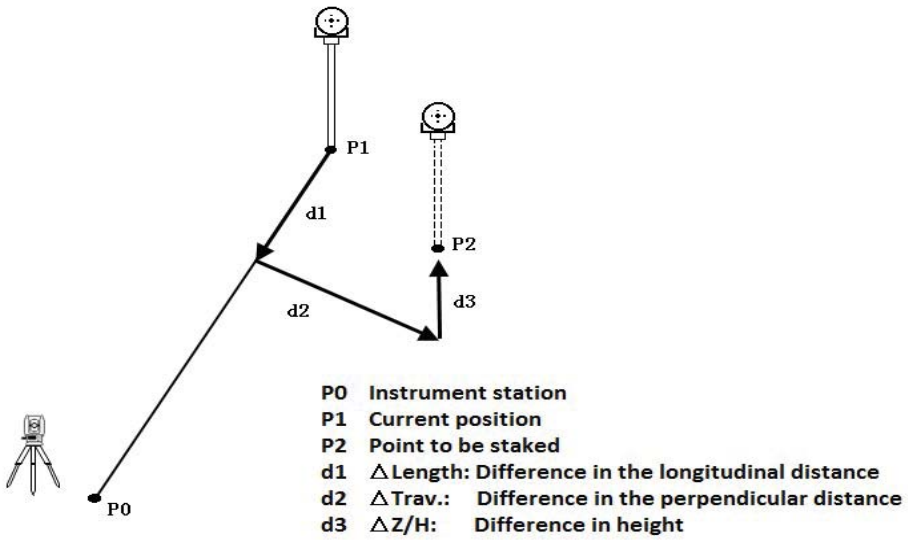
② Press [PAGE] to go to page 1/3(Default page). Press direction key and move the cursor to input prism height item. Input the prism height and then press [ENT] to confirm.	[PAGE] + ↓ + Input prism height + [ENT]	
③ Aim at the prism. Press [F2](DIST) to start measuring and calculate the differences between measured point and stakeout point.	[F2]	
④ Turn the instrument telescope to make the △Hz equal 0° 00′ 00″ and command the staff to move the prism at the same time. Arrows Meaning: ←: Look forward from station and move the prism to the left. → : Look forward from statioand move the prism to the right.		
⑤ While the △Hz equals 0° 00′ 00″, press [F2](DIST) to start measuring and calculate the differences between measured point and stakeout point. The arrow's direction is the direction of the prism need to	[F2]	

move.		
⑥ Move the prism according to the direction of the arrow to make the value of △ ◢ equal 0m. Arrows Meaning: ↓ : Move the prism close to the station. ↑ : Move the prism far away the station. In the process of staking out, if using the Repeat Measurement or Tracking Measurement, the calculation of the differences between measured point and stakeout point can be displayedin real time and convenient.		
⑦ It means the current prism position is effective stakeout point while both the△Hz and △◢ are 0. △◢ Display as dig or fill data. ↓ : The value expresses the depth of needed to dig. ↑ : The value expresses the height of needed to fill.		

⑧ Now itfinishes staking out a point.Repeat the previous steps to stake out next point.		

6.3 Orthogonal to StationStakeout Mode

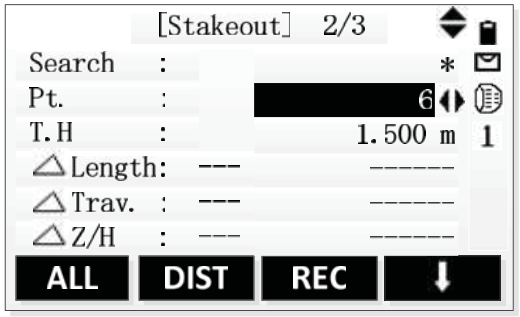
Use longitudinal difference and perpendicular difference to indicatethe position differences of stakeout point and current prism position.

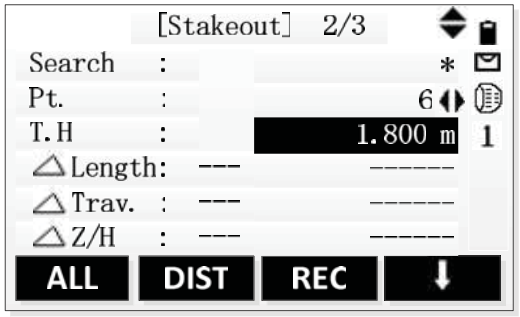
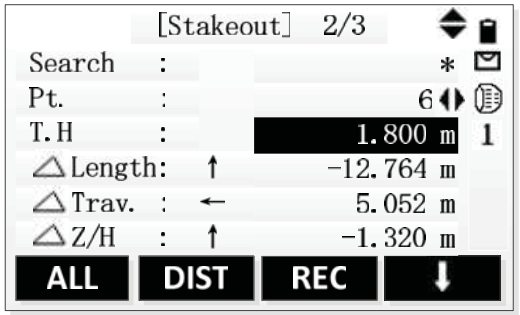
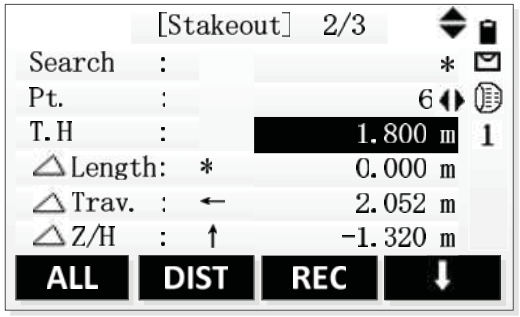


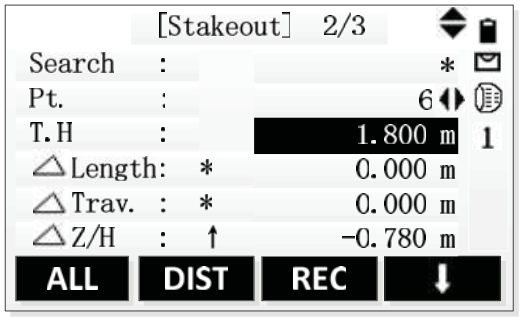
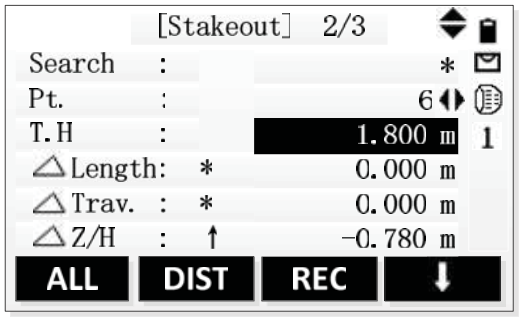
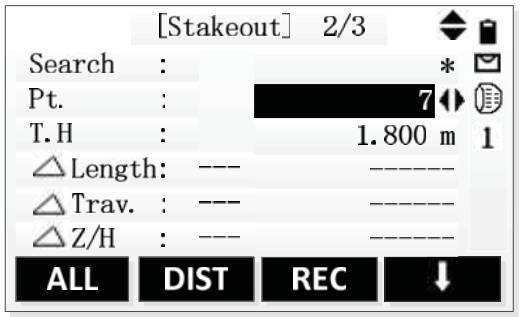
The meanings of the differencesin theOrthogonal to StationStakeout Mode:

△Length Difference in longitudinal distance: If the measured point is farther than stakeout point, the value is positive.

△Trav. Difference in perpendicular distance: If the measured point is located in the right side of stakeout point, the value is positive.

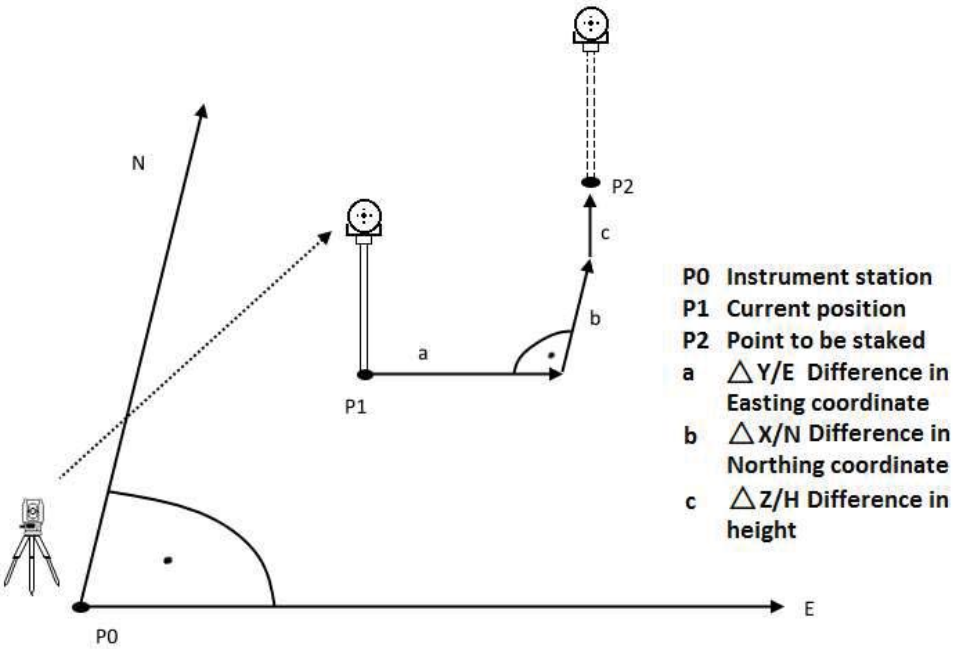
Steps	Key	Display
① Press [PAGE] to show Orthogonal to StationStakeout Mode in page 2/3. Set the stakeout point. The stakeout point can be found in the job through inputting point name in the search item.	[PAGE]	

② Press direction key and move the cursor to input prism height item. Input the prism height and then press [ENT] to confirm.	↓ + Input prism height + [ENT]	
③ Aim at the prism. Press [F2](DIST) to start measuring and calculate the differences between measured point and stakeout point. The arrow's direction is the direction of the prism need to move.	[F2]	
④ Move the prism according to the direction of the arrow to make the value of △Length equal 0m. Arrows Meaning: ↓ : Move the prism close to the station. ↑ : Move the prism far away the station. In the process of staking out, if using the Repeat Measurement or Tracking Measurement, the calculation of the differences between measured point and stakeout point can be displayedin real time and convenient.		

⑤ Turn the instrument telescope to find the direction where makes the △ Trav. equal 0m and command the staff to move the prism at the same time. Arrows Meaning: ←: Look forward from station and move the prism to the left. →: Look forward from statio and move the prism to the right.		
⑥ It means the current prism position is effective stakeout point while both the△Length and △Trav.are 0. △Z/H: Display as dig or fill data. ↓ : The value expresses the depth of needed to dig. ↑ : The value expresses the height of needed to fill.		
⑧ Now itfinishes staking out a point.Repeat the previous steps to stake out next point.		

6.4 Cartesian Stakeout Mode

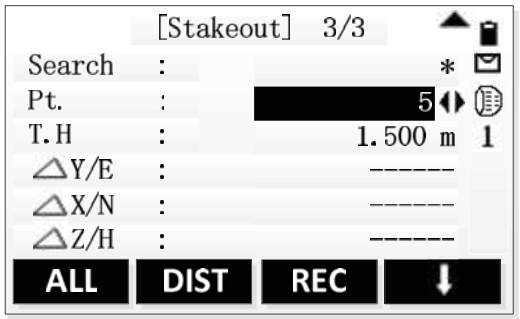
Stake out point based on the Cartesian coordinate system. The deviation values are the coordinate differences.



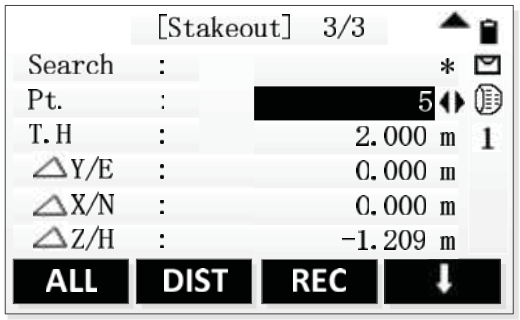
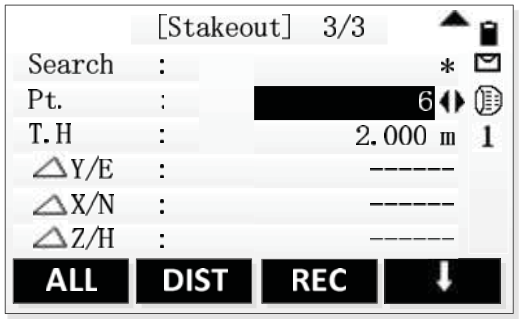
The meanings of the differencesin theCartesian Stakeout Mode:

△Y/E The difference in East coordinate between measured point and stakeout point.

△X/N The difference in North coordinate between measured point and stakeout point.

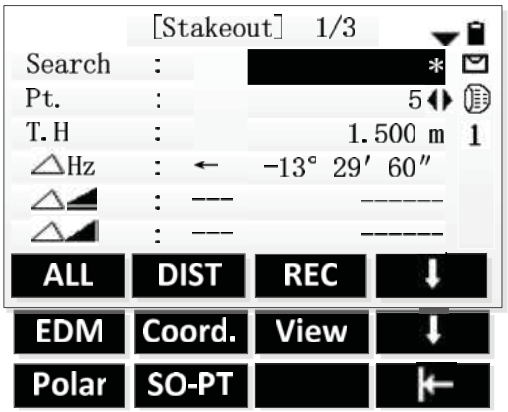
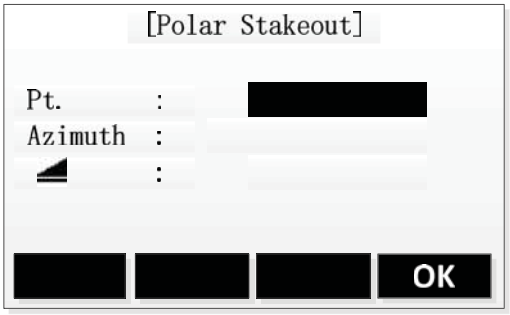
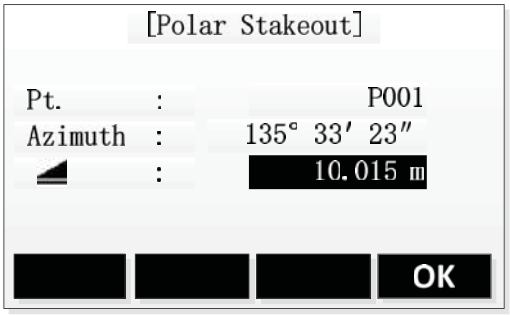
Steps	Key	Display
① Press [PAGE] to show Cartesian Stakeout Mode in page 3/3. Set the stakeout point. The stakeout point can be found in the job through inputting point name in the search item.	[PAGE]	

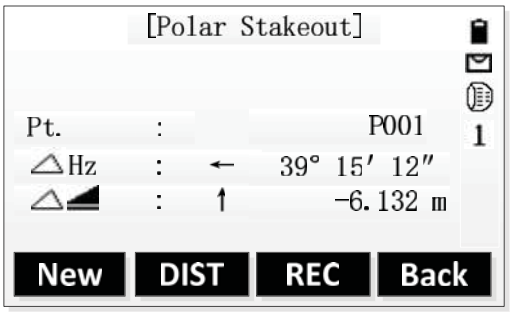
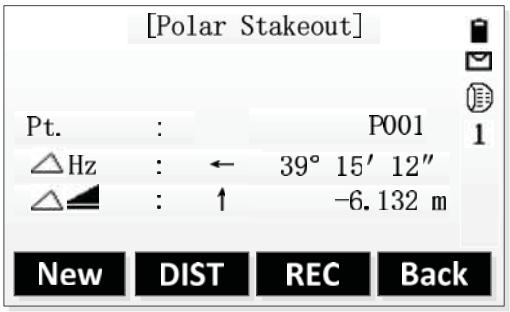
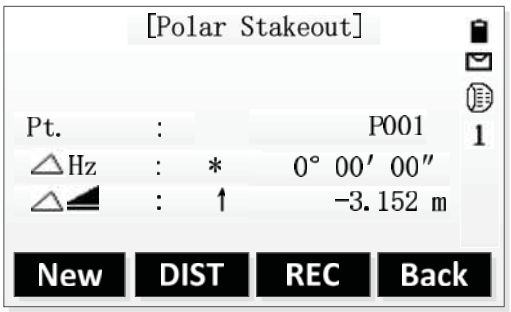
② Press direction key and move the cursor to input prism height item. Input the prism height and then press [ENT] to confirm.	↓ + Input prism height + [ENT]	[Stakeout] 3/3 Search : * Pt. : 5 T.H : 2.000 m 1 △Y/E : ------ △X/N : ------ △Z/H : ------ ALL DIST REC ↓
③ Aim at the prism. Press [F2](DIST) to start measuring and calculate the differences between measured point and stakeout point.	[F2]	[Stakeout] 3/3 Search : * Pt. : 5 T.H : 2.000 m 1 △Y/E : -0.306 m △X/N : 0.404 m △Z/H : -1.299 m ALL DIST REC ↓
④ Move the prism along the East direction to make the value of △Y/E equal 0m. △ Y/E is positive: The stakeout point is in the right side of measured point. Move the prism to right. △ Y/E is negative: The stakeout point is in the left side of measured point. Move the prism to left.		[Stakeout] 3/3 Search : * Pt. : 5 T.H : 2.000 m 1 △Y/E : 0.000 m △X/N : 0.504 m △Z/H : -1.299 m ALL DIST REC ↓
⑤ Move the prism along the North direction to make the value of △X/N equal 0m. △ X/N is positive: The stakeout point is farther than the measured point. Move the prism far away the station. △X/N is negative: It needs to move the prism close to the station.		[Stakeout] 3/3 Search : * Pt. : 5 T.H : 2.000 m 1 △Y/E : 0.000 m △X/N : 0.000 m △Z/H : -1.209 m ALL DIST REC ↓

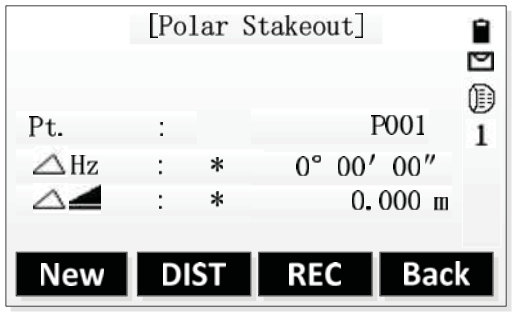
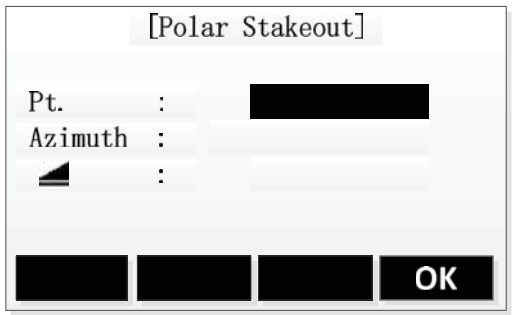
In the process of staking out, if using the Repeat Measurement or Tracking Measurement, the calculation of the differences between measured point and stakeout point can be displayedin real time and convenient.		
⑥ It means the current prism position is effective stakeout point while both the△Y/E and △X/N are 0. △ Z/H: Display as dig or fill data. △ Z/H is positive: The value expresses the depth of needed to dig. △ Z/H is negative: The value expresses the height of needed to fill.		
⑧ Now itfinishes staking out a point.Repeat the previous steps to stake out next point.		

6.5 [Polar]

Press [Polar], then input the polar stakeout elements: Azimuth and Horizontal distance. Start to stake out after finishing inputs of Azimuth and Horizontal distance.

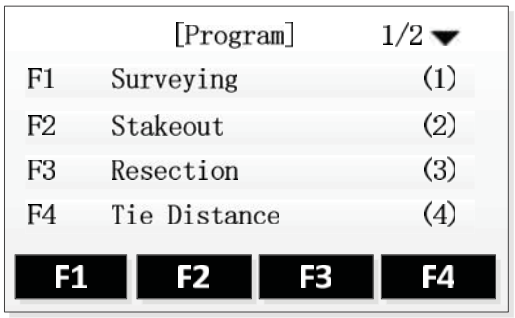
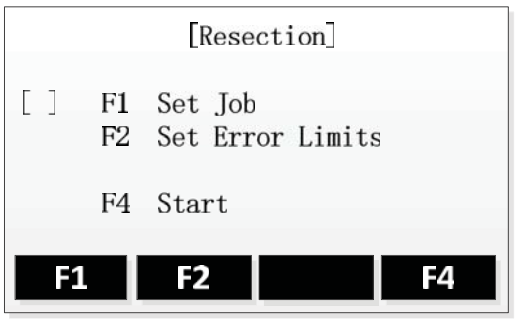
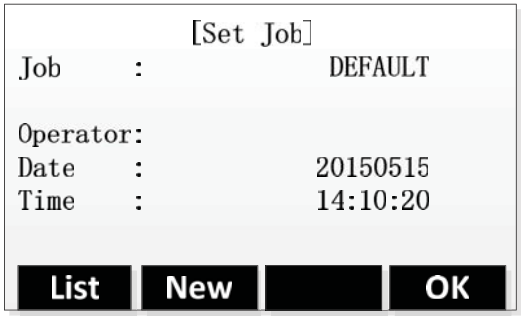
Steps	Key	Display
① Press [F4](↓) twice to view the second page soft keys.	[F4]	
② Press [F1](Polar) to show the dialog as shown in figure.	[F1]	
③ Input the stakeout point's name, azimuth and horizontal distance. Press [ENT] to confirm every input and move the cursor to next input item. Press [F4](OK) to go to Polar Stakeout screen after finishing all inputs. ※[1]	Input point name, azimuth and horizontal distance + [ENT] + [F4]	

④ Aim at the prism. Press [F2](DIST) to start measuring and calculate the differences between measured point and stakeout point.	[F2]	
⑤ Turn the instrument telescope to make the △Hz equal 0°00’00” and command the staff to move the prism at the same time. △ Hz is positive: The stakeout point is in the left side of measured point. Move the prism to left. △ Hz is negative: The stakeout point is in the right side of measured point. Move the prism to right.		
⑥ Set and aim at the prism in the direction of △Hz = 0°00’00”. Press [F2](DIST) to start measuring and calculate the differences between measured point and stakeout point. △◢ is positive: The stakeout point is is closer to the station. Move the prism close to the station. △◢is negative: The stakeout point is is farther to the station. Move the prism far away the station.	[F2]	

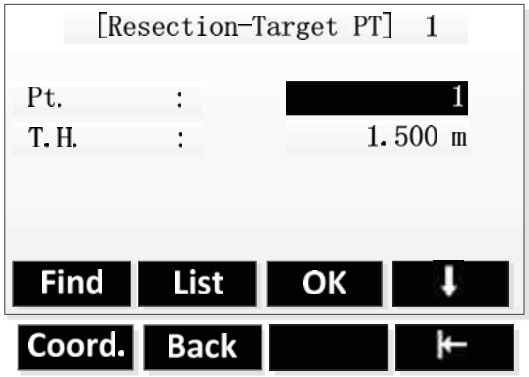
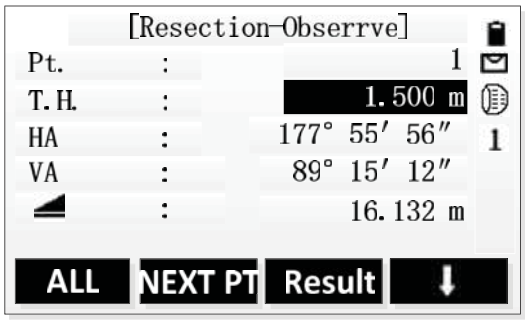
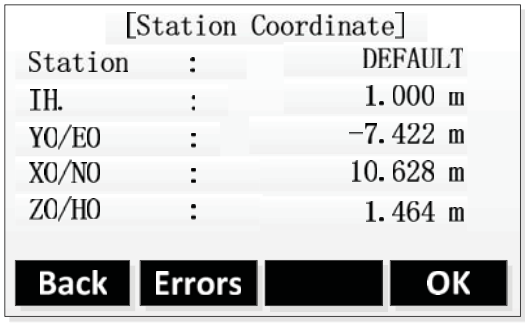
⑦ Move the prism along the arrow direction to make the value of △◢ equal 0m. In the process of staking out, if using the Repeat Measurement or Tracking Measurement, the calculation of the differences between measurement point and stakeout point can be displayedin real time and convenient.		
⑧ Now itfinishes staking out a point.Repeat the previous steps ② ～ ⑦ to stake out next point.		
※[1]: The inputs of polar coordinate data won't be saved to job.		

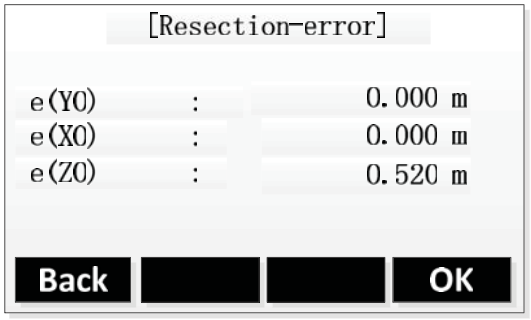
7. Resection

Resection measurement is an application used to determine the coordinate of the instrument station by measuring multiple known points. A minimum of 2 and a maximum of 5 known points can be used to determine the station. It should be used at least 2 known points by distance measurement or at least 3 known points by angle measurement.

Steps	Key	Display
① Select "Program" from the [Main Menu] window, press [F3] or number key [3] to enter the Resection application.	[F3]	
② Press [F1] in the [Resection] window to set the job.	[F1]	
③ In [Set Job] window, press [F1] (List) to select a job in memory or press [F2] (New) to new a job. Then press [F4] (OK) to next step.	[F4]	

④ The window back to the [Resection] window, and press [F2] to set error limits.	[F2]	[Set Error Limits] Input error limits! Status : Off e(Y/E) : 0.000 m e(X/N) : 0.000 m e(Z/H) : 0.000 m OK
⑤ Press [◀] \ [▶] to turn on the error limits status and use the key [▲] \ [▼] to move the focus down to input the every error limit. Then press [F4] (OK) to set and back to the [Resection] window.	Input error limits + [F4]	[Set Error Limits] Input error limits! Status : On e(Y/E) : 0.010 m e(X/N) : 0.010 m e(Z/H) : 0.010 m OK
⑥ Press [F4] in [Resection] window to start resection measurement. It should be input the station name and the instrument high. Then press [F4] (OK) go to next step.	[F4] Input name and IH. + [ENT] [F4]	[Resection-Station] Station : DEFAULT IH. : 1.000 m OK
⑦ Set the first known point and input prism high。 ※ [1]The title bar will display the number of known points in the current setting.		[Resection-Target PT] 1 Pt. : 1 T.H. : 1.500 m Find List OK ↓
⑧ Turn the instrument telescope aimed at first point and press [F1] to finish current measurement. Angle measurement: press [F2] (REC) to record an	[F1]	[Resection-Observe] Pt. : 1 T.H. : 1.500 m HA : 177° 55′ 56″ VA : 89° 15′ 12″ 1 ALL NEXT PT ↓

angle. Distance measurement: [F1] (ALL) or [F1] + [F2] (DIST + REC).		
⑨ When finish a known point measurement, press [F2] (NEXT PT) to start next known point measurement. Repeat steps ⑦ and ⑧.	[F2]	
⑩ If the measured known points are enough, [Result] will display on the screen, then press [F3] (Result) to enter the [Station Coordinate] to view station result. Press [F1] (Back) back to a new known point measurement. Press [F2] (errors) to display standard deviation. Press [F4] (OK) to set the station coordinate and instrument height.		 Press [F3] (Result) to enter the [Station Coordinate] to view result.  Display standard deviation:

		
※[1]: The known points can be called from the memory through the [Find], [List] or manually entered used [Coord.].		

8. Tie Distance

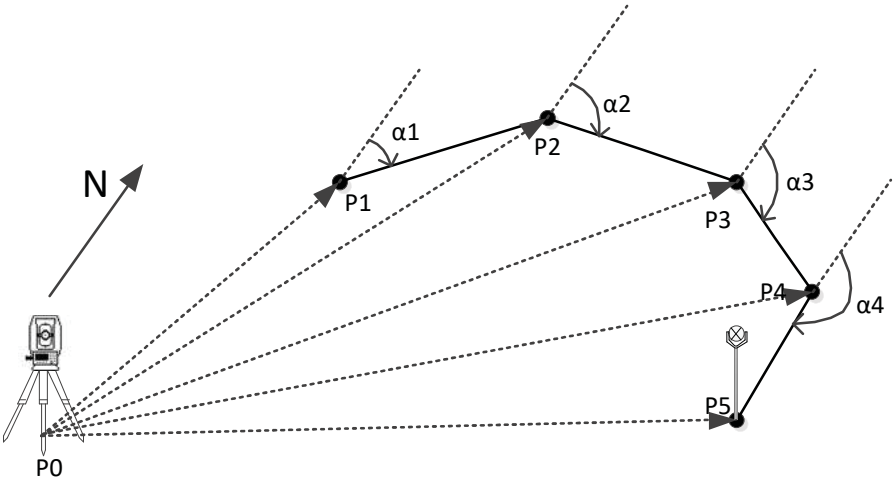
Tie Distance is an application used to compute slope distance, horizontal distance, height difference and azimuth of two target points which are either measured, selected from the memory, or input using the keypad.

The user can choose between two different methods:

- Polygonal: P1-P2, P2-P3, P3-P4
- Radial: P1-P2, P1-P3, P1-P4

Start Tie Distance application through “Main Menu”→”Program”→”Tie Distance”.

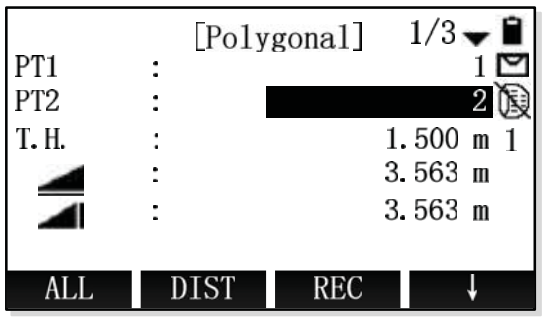
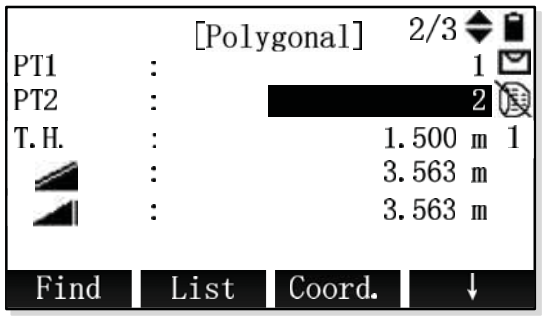
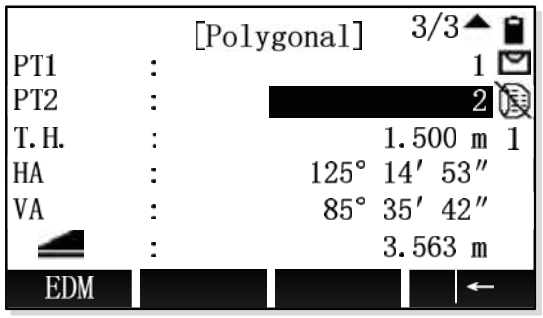
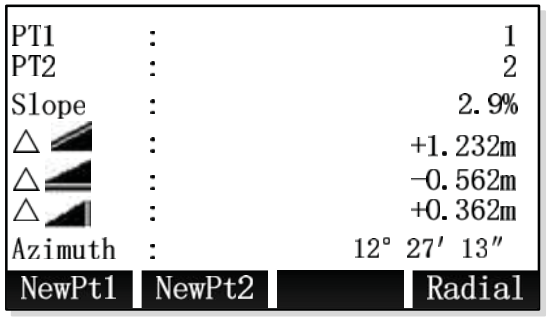
8.1 Polygonal



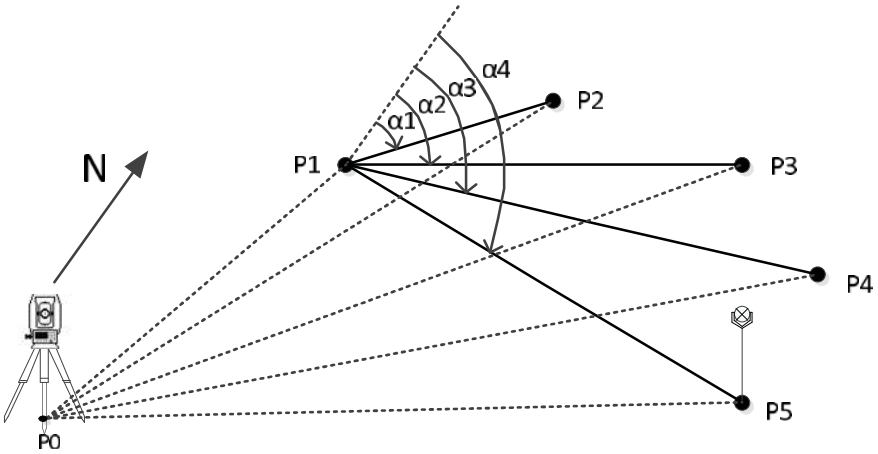
While Polygonal tie distance measuring continuous points, the new tie distance’s first point will usethethe previous one tie distance’s second point(P1-P2 、 P2-P3 、 P3-P4……).

Steps	Key	Display
① Press [F4] in the Program Menu to go to Tie Distance application.	[F4]	[Program] 1/2 F1 Surveying (1) F2 Stakeout (2) F3 Resection (3) F4 Tie Distance (4) F1 F2 F3 F4

② After finishing setting job, station and orientation, press [F4] in the Pre-Setting menu to go to Select Tie Distance Mode screen.	[F4]	[Tie Distance] [*] F1 Set Job (1) [*] F2 Set STA (2) [*] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4
③ Press [F1] to select the Polygonal tie distance.	[F1]	[Tie Distance] F1 Polygonal (1) F2 Radial (2) F1 F2
④ Start to measure the first target point. Aim at the first target point and press [F1](ALL) or [F2](DIST) + [F3](REC) to finishing measurement. ※1	PAGE1 Press [F1] or [F2] + [F3]	[Polygonal] 1/3 PT1 : 1 T.H. : 1.500 m 1 : 3.563 m : 3.563 m ALL DIST REC ↓ [Polygonal] 2/3 PT1 : 1 T.H. : 1.500 m 1 : 3.563 m : 3.563 m Find List Coord. ↓ [Polygonal] 3/3 PT1 : 1 T.H. : 1.500 m 1 HA : 125° 14′ 53″ VA : 85° 35′ 42″ : 3.563 m EDM ←

⑤ Start to measure the second target point. Aim at the second target point and press [F1](ALL) or [F2](DIST) + [F3](REC) to finishing measurement. ※[1]	PAGE1 Press [F1] or [F2] + [F3]	  
⑥ Show the result of polygonal tie distance. [NewPt1]: Start a new polygonal tie distance. [NewPt2]: This polygonal tie distance's second point will be the new polygonal tie distance's first point and then go to ⑤ to measure the new second target point. [Radia]Radial: Go to Radial tie distance.		
※[1]: The target points can be measured, selected from the memory, or input using the keypad.		

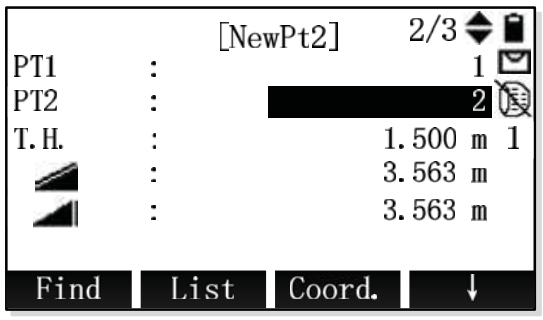
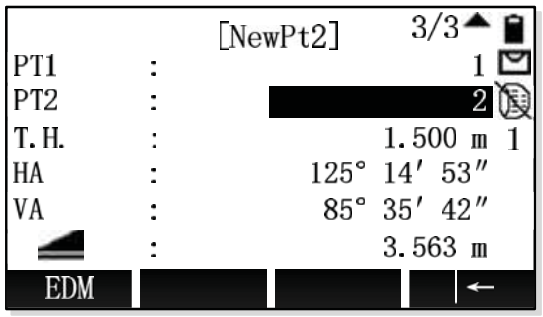
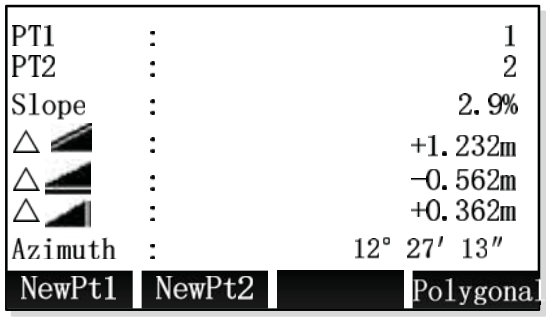
8.2 Radial



While Radial tie distance measuring continuous points, the new tie distance's first point continues usingthethe previous tie distance's first point(P1-P2、P1-P3、P1-P4……).

Steps	Key	Display
①Press [F4] in the Program Menu to go to Tie Distance application.	[F4]	[Program] 1/2 F1 Surveying (1) F2 Stakeout (2) F3 Resection (3) F4 Tie Distance (4) F1 F2 F3 F4
② After finishing setting job, station and orientation, press [F4] in the Pre-Setting menu to go to Select Tie Distance Mode screen.	[F4]	[Tie Distance] [*] F1 Set Job (1) [*] F2 Set STA (2) [*] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4

③ Press [F2] to select the Polygonal tie distance.	[F2]	[Tie Distance] F1 Polygonal (1) F2 Radial (2) F1 F2
④ Start to measure the first target point. Aim at the first target point and press [F1](ALL) or [F2](DIST) + [F3](REC) to finishing measurement. ※1	PAGE1 Press [F1] or [F2] + [F3]	[NewPt1] 1/3 PT1 : 1 T.H. : 1.500 m 1 : 3.563 m : 3.563 m ALL DIST REC ↓ [NewPt1] 2/3 PT1 : 1 T.H. : 1.500 m 1 : 3.563 m : 3.563 m Find List Coord. ↓ [NewPt1] 3/3 PT1 : 1 T.H. : 1.500 m 1 HA : 125° 14′ 53″ VA : 85° 35′ 42″ : 3.563 m EDM ←
⑤ Start to measure the first target point. Aim at the first target point and press [F1](ALL) or [F2](DIST) + [F3](REC) to finishing measurement. ※1	PAGE1 Press [F1] or [F2] + [F3]	[NewPt2] 1/3 PT1 : 1 PT2 : 2 T.H. : 1.500 m 1 : 3.563 m : 3.563 m ALL DIST REC ↓

		 
⑥ Show the result of Radial tie distance. [NewPt1]: Start a new Radial tie distance. [NewPt2]: This Radial tie distance's first point continues to be the new polygonal tie distance's first point and then go to ⑤ to measure the new second target point. [Polygonal]Radial: Go to Polygonal tie distance.		
※[1]: The target points can be measured, selected from the memory, or input using the keypad.		

9. Area

Area is an application used to calculate the polygon areas to a maximum of 20 points which connected by straights. The target points coordinate can be measured, selected from memory or entered via keypad in same direction. And the following three methods can be alternately performed. The calculate area is projected onto the horizontal plane (2D).

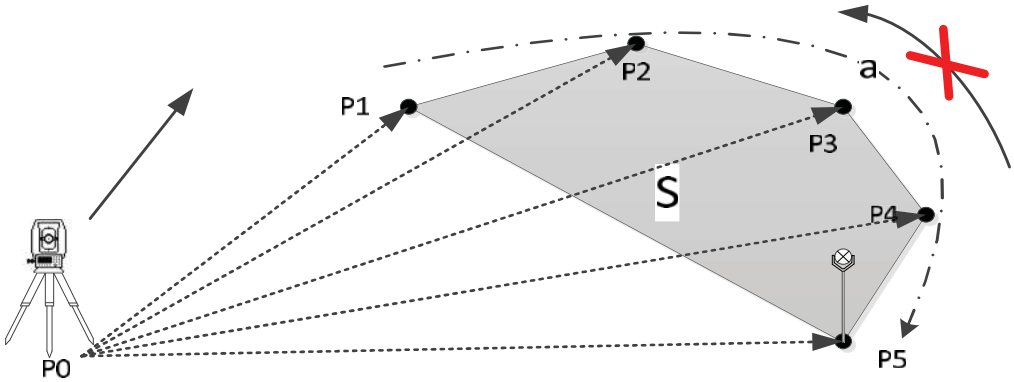


Figure 9.1 Area Diagram

P0 Instrument Point

P1 Start Target Point

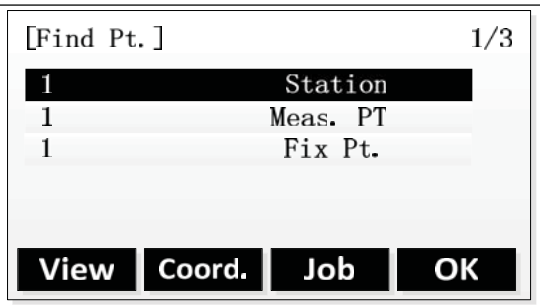
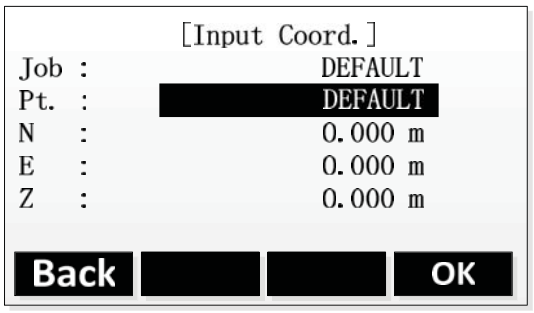
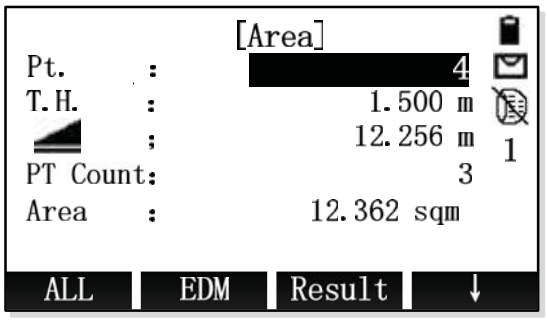
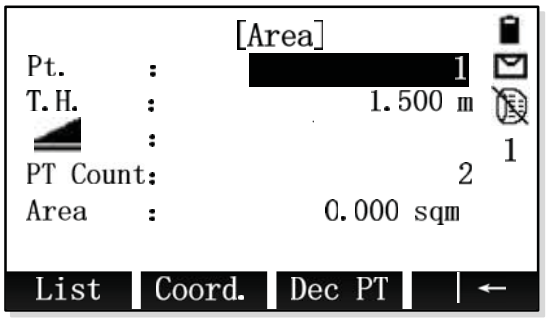
P1~P5 Target Point

a Perimeter, polygonal length from start point to the current measure point.

S Calculated area always closed to the start point P1, projected onto the horizontal plane.

Steps	Key	Display
① Select "Program" from the [Main Menu] window, then press [PAGE] switch to second program list and press [F1] or number key [5] to enter the Area application.	[PAGE] + [F1] or [5]	[Program] 2/2 F1 Area (5) F2 Remote Height (6) F3 COGO (7) F4 Road (8) F1 F2 F3 F4

② After finishing the pre-settings (know more details at the beginning of chapter 5), press [F4] to start Area app.	[F4] or [4]	[Area] [*] F1 Set Job (1) [*] F2 Set STA (2) [*] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4
③ There are four ways to get target point for Area calculation. A: Input the name of target point in"Pt." field and input prism height in "T.H." field in [Area] screen, then aim the prism and press [F1] (ALL) or [F1] (DIST) + [F2] (REC) to measuring and saving the target point for area calculation.	Input point name and prism height + [F1] or [F1] + [F2]	A: Get the target point by measure. [Area] Pt. : 1 T.H. : 1.500 m : 1 PT Count: 0 Area : 0.000 sqm ALL EDM Result ↓ DIST REC Find ↓ List Coord. Dec PT ←|
B: Press [F4] twice then press [F1](List) in [Area] screen, use the key [▲]\[▼] to select the point in the point list for traverse calculation, then press [F4](OK) to be selected.	[F4] + [F4] + [F1](List) + [F4](OK)	B: Select the point by list in the memery. [Find Pt.] 1/50 DEFAULT Station STN1 Station 200007 Meas. PT 200008 Meas. PT 100 Fix Pt. View Coord. Job OK
C: Input the name of known point and press [F3](Find) to find whether the point	Input name + [F3](Find) +	C: Input the name of the point and find whether it is in memory.

is in memory, if exist, then press [F4](OK) to be selected for calculating; if not exist, then need to input or measure the point.	[F4](OK)	
D: Press [F2] (Coord.) to input a point that not exist in memory.	[F2](Coord.) + Input Coord. + [F4](OK)	D: Input the point through keyboard. 
④ Set other target point as described above four ways. The area result will be calculated and showed at "Area" field automatically when there are more than 3 target points be set in application.		
⑤ Press [F4] twice, then press [F3] (Dec PT) to undo selection or measurement of the previous point.	[F4] + [F4] + [F3](Dec PT)	

⑥ If the target points are set, then can press [F3] (Result) to show the [Area Result] window to view the result.	[F3](Result)	[Area Result] PT Count: 3 Area : 12.362 m2 Area : 0.001 ha Area : 144.125 f2 Perimeter: 15.654 m New Area Graph Add PT

※ In [Area Result] window:

Press [F1] (New Area) to restart a new Area application.

Press [F2] (Graph) to show the area graph projected onto the horizontal plane.

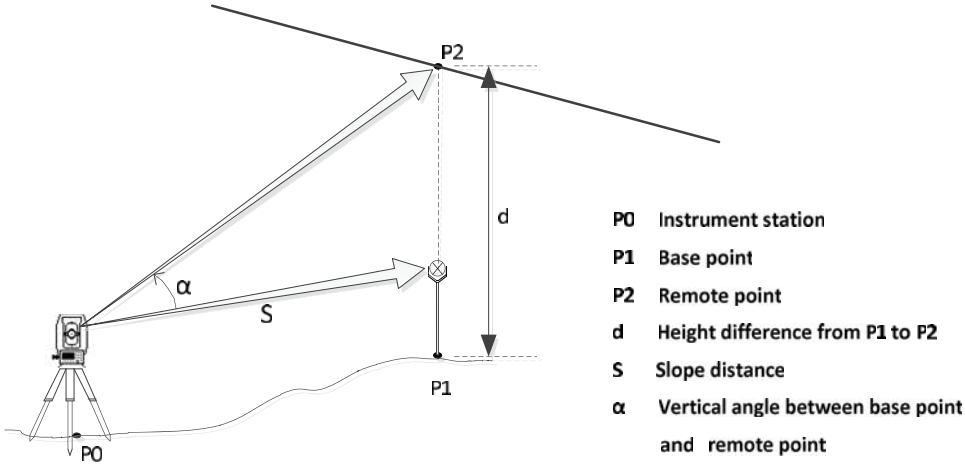
Press [F4] (Add PT) to return the current Area application and continue operation.

Press [ESC] to exit the Area application.

※In all of the above operation, press [ESC] to return to the previous screen.

10. Remote Height

Remote Height is an application used to measure the height to the target (such aselectriccable, bridge, etc.) where can't be set prism.



Prism High Known

If the high of prism is known, the calculation formula of the remote height is:

$$H = S * \cos\alpha_1 * \tan\alpha_2 - S * \sin\alpha_1 + V$$

H Height difference between the base point and the remote point

V Prism High

α_1 Vertical angle to prism

α_2 Vertical angle to target

Steps	Key	Display
① Select "Program" from the [Main Menu] window, then press [PAGE] switch to second program list and press [F2] or number key [6] to enter the Area application.	[PAGE] + [F2] or [6]	[Program] 2/2 F1 Area (5) F2 Remote Height (6) F3 COGO (7) F4 Road (8) F1 F2 F3 F4
② After finishing the pre-settings (know more details at the beginning of chapter 5), press [F4] to enter the [Base Pt.] window to start Remote Height app.	[F4]	[Remote Height] [*] F1 Set Job (1) [*] F2 Set STA (2) [*] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4
③ Move the prism just standing below the remote point, then aim at the prism after input the prism high and press [F1] (ALL) or [F2] + [F3] (DIST + REC) to finish the base point measuring. Then enter the [REM PT] window.	[F1] or [F2] + [F3]	[Base Pt.] Aim and meas. base PT! Base Pt. : 1 1 T.H. : 1.500 m : 4.082 m ALL DIST REC ↓ EDM H.T.? ←
④ Turn the instrument telescope aimed at remote point and press [F4] to finish current remote point measuring. Press [F1] to re-set the base point.	[F4]	[REM PT] Aim and meas. target! Base Pt. : 1 REM PT : 2 1 : 4.082 m △ : 2.430 m Z : 3.849 m Base Pt. OK

10.1 Prism High Unknown

If the high of prism is unknown, the calculation formula of the remote height is:

$$H = S * \cos\alpha_1 * \tan\alpha_2 - S * \sin\alpha_1 * \tan\alpha_3$$

H Height difference between the base point and the remote point

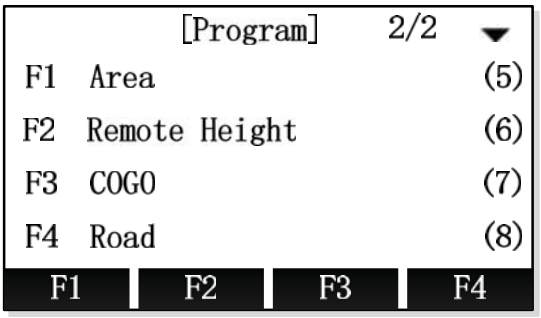
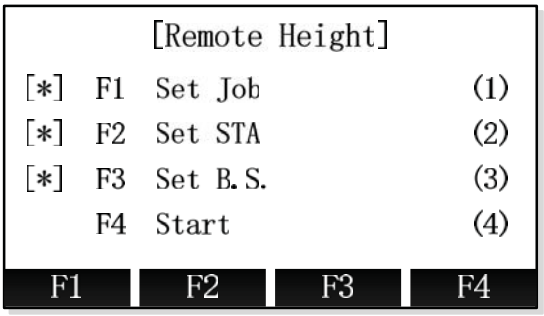
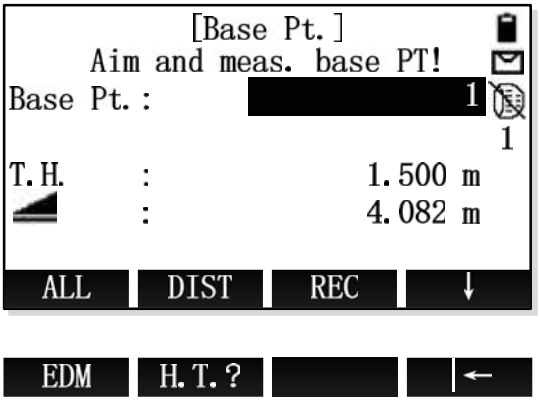
V Prism High

S Slope distance between instrument and prism

α_1 Vertical angle to prism

α_2 Vertical angle to target point (remote point)

α_3 Vertical angle to base point

Steps	Key	Display
① Select "Program" from the [Main Menu] window, then press [PAGE] switch to second program list and press [F2] or number key [6] to enter the Area application.	[PAGE] + [F2] or [6]	
② After finishing the pre-settings (know more details at the beginning of chapter 5), press [F4] to enter the [Base Pt.] window to start Remote Height app.	[F4]	
③ In [Base Pt.] window, press [F4] to second page of function keys, then press [F2] (H.T.?) switch to the situation of prism high unknown to start measuring.	[F4] + [F2]	

④ Move the prism just standing below the remote point, then aim at the bottom of prism rod and press [F1] (ALL) or [F2] + [F3] (DIST + REC) to finish the base point measuring.	[F1] or [F2]+[F3]	[Base Pt.] Aim and meas. base PT! Base Pt. : 1 1 : 4.086 m ALL DIST REC ↓ EDM Back ←
⑤ Turn the instrument telescope aimed at prism and press [F4] to measure the prism high. Then enter the [REM PT] window.	[F4]	[Base Pt.] Aim and meas. target! Base Pt. : 1 1 T.H. : 1.418 m : 4.086 m VA : 305° 37′ 35″ Back OK
⑥ Turn the instrument telescope aimed at remote point and press [F4] to finish current remote point measuring. Press [F1] to re-set the base point.	[F4]	[REM PT] Aim and meas. target! Base Pt. : 1 REM PT : 2 1 : 4.082 m △ : 2.430 m Z : 3.849 m Base Pt. OK

11. COGO

COGO(Coordinate Geometry)is an application used to perform coordinate geometry calculations by the preset conditions such as , coordinates of points, bearings between points and distance between points.

The COGO calculation methods include:

✧ Inverse and Traverse

✧ Intersections

✧ Offset

✧ Extension

11.1 Traverse

Use the traverse subapplication to calculate the plane coordinate of a new pointusing the bearing and distance from a known point. Offset is optional.

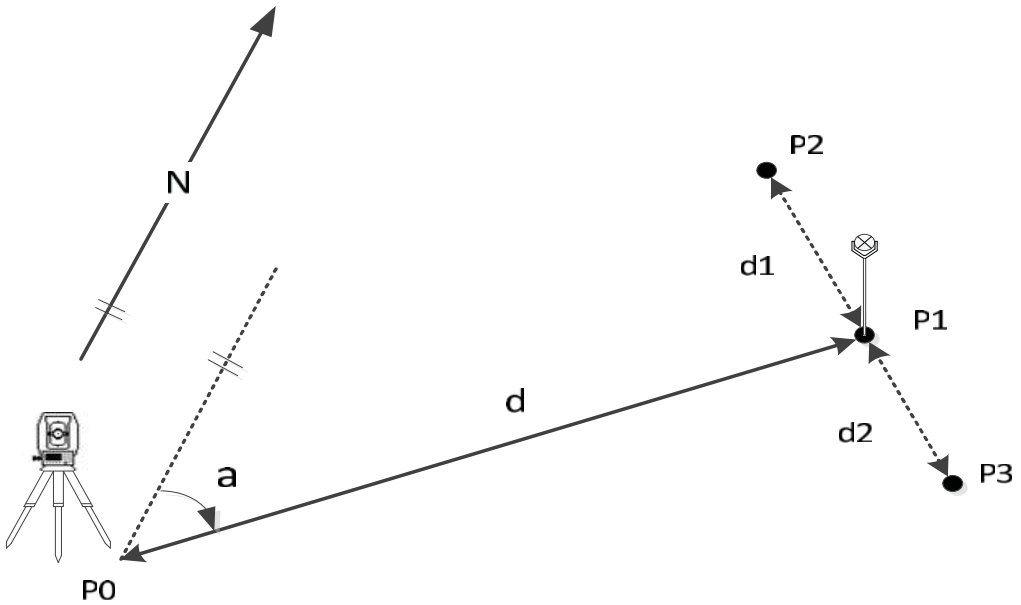


Figure 11.1 Traverse Diagram

Known

P0 known point

a Direction from P1 to P2

d Distance between P1 and P2

d1 Positive offset to the right

d2 Negative offset to the left

Unknown

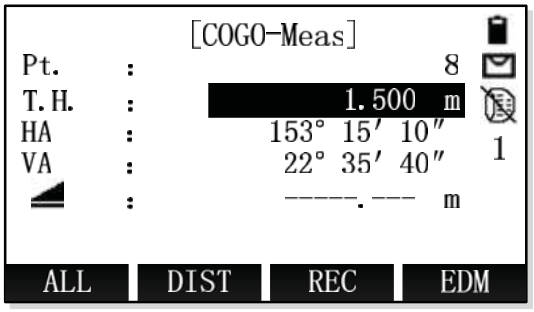
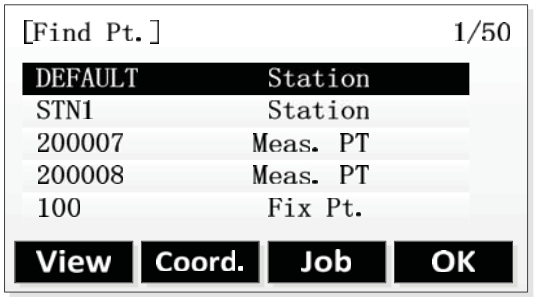
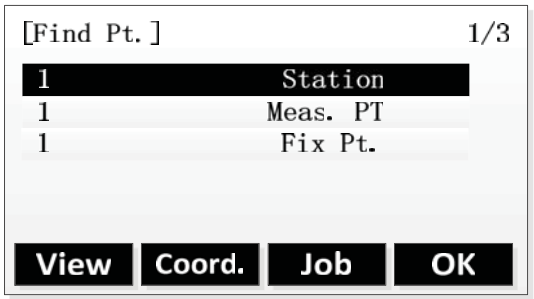
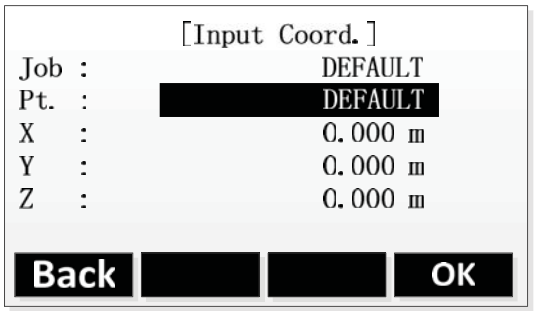
P1 COGO point without offset

P2 COGO point with negative offset

P3 COGO point with positive offset

Steps	Key	Display
① Select "Program" from the [Main Menu] window, then press [PAGE] switch to second program list and press [F1] or number key [7] to enter the COGO application.	[PAGE] + [F2] or [7]	[Program] 2/2 F1 Area (5) F2 Remote Height (6) F3 COGO (7) F4 Road (8) F1 F2 F3 F4

② After finishing the pre-settings (know more details at the beginning of chapter 5), press [F4] to start COGO app.	[F4] or [4]	[COGO] [*] F1 Set Job (1) [*] F2 Set STA (2) [*] F3 Set B.S. (3) F4 Start (4) F1 F2 F3 F4
③ In [COGO Menu] screen, press the [F1] or number key [1] enter the [Traverse & Inverse] screen, press [F2] or [2] enter the traverse subapplication.	[F1] or [1] [F2] or [2]	[COGO Menu] F1 Traverse&Inverse (1) F2 Intersection (2) F3 Offsets (3) F4 Extension (4) F1 F2 F3 F4 [Traverse&Inverse] F1 Inverse (1) F2 Traverse (2) F1 F2
④ There are four ways to get the known point for traverse calculation. A: Input the name of known point in"Pt." field in [Traverse] screen and press [F1](Meas.) entry the [COGO Meas] Input prism height in	Input point name + [F1](Meas.) [F1](ALL) or [F2](DIST) + [F3](REC)	A: Get the known point by COGO-Meas. [Traverse] Pt. : 8 AZ : 15° 34′ 20″ HD : 10.536 m Transverse: 8.361 m Meas. Result Find ↓ List Coord. | ←

the “T.H.” field in [COGO-Meas], then aim the prism and press [F1] (ALL) or [F2] (DIST) + [F3] (REC) to measuring and saving the point for traverse calculation.		COGO-Meas. 
B: Press [F1](List) in [Traverse] screen, use the key [▲]\[▼] to select a Known point in the point list for traverse calculation, then press [F4](OK) to be selected.	[F1](List) + [F4](OK)	B: Select the point by list in the memery. 
C: Input the name of known point and press [F3](Find) to find whether the point is in memory, if exist, then press [F4](OK) to be selected for calculating; if not exist, then need to input or measure the point.	Input name + [F3](Find) + [F4](OK)	C: Input the name of the point and find whether it is in memory. 
D: Press [F2](Coord.) to input a known point that not exist in memory.	[F2](Coord.) + Input Coord. + [F4](OK)	D: Input the point through keyboard.