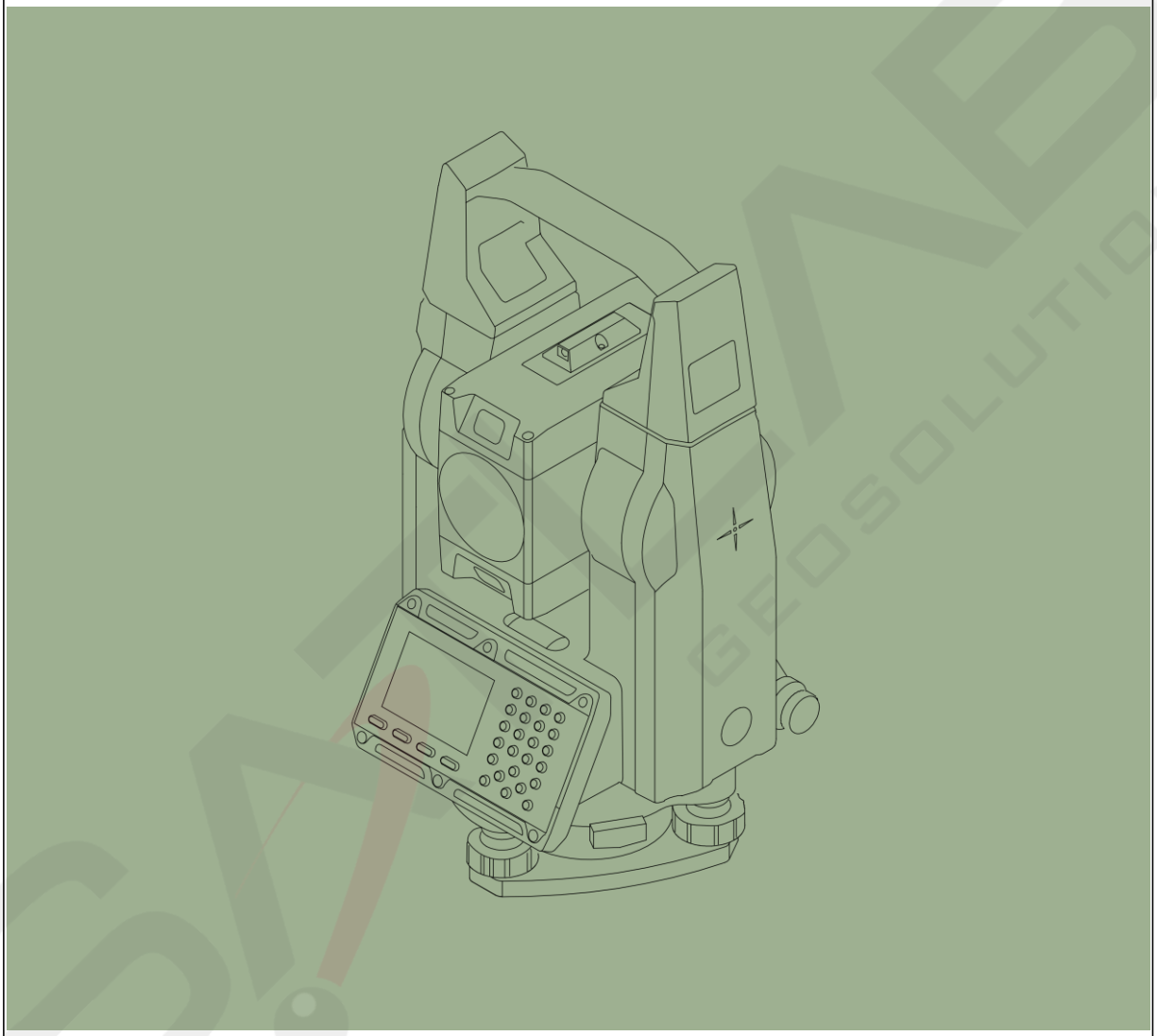


SLT10（S）Series Instruction Manual

Preface

Thanks a lot for purchasing our SLT10 series total station!

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

Product affirm:
In order to get the best service from our company, please feedback your instruments' version including number, 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: the company's SLT10 Series Total Station is equipped with a wealth of measurement applications including data storage, parameter settings and other functions for all kinds of professional measurements.

1.Absolute coded dial

Equipped with absolute code disc, the instrument can be directly measured after switched 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.Non-prism distance measuring

With non-prism distance measuring, this series total station can be directly to all kinds of material, different colors of objects (such as the structure of the walls, poles, wires, cliff wall, mountain, clay, wood, etc.) for long, fast, high precision measurement. This function is especially for the measurements of targets that cannot be accessed.

4.Special measurement program

Our total station is equipped with some special measurement program to meet the needs of professional measuring, such as Remote Height (REM) Measurement, Offset Measurement, MLM (MLM Measurement), Resection, Area measurement calculation, Roadway design and staking out.

5.Changeable eyepiece

As the eyepiece is changeable, it is convenient to be equipped with diagonal eyepiece, which makes it easy to observe the zenith direction high-rise buildings

6.Optional laser plummet

Easy to direct the station point and free station

Notice

1. Do not look directly into the sun with the objective lens. Recommended to use solar filter to reduce the impact.
2. Do not leave the instrument at extreme temperatures (too high or too low) or use it when thermal shock.
3. The instrument should be loaded in box placed in dry and ventilated place and prevented from shock, dust and moisture when it is not in use.
4. In order to get good accuracy, you should leave the instrument in the box if the instrument temperature has 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.
5. If the instrument is not used for a long time, the battery should be unloaded and stored separately and charged once a month to prolong battery life.
6. The instrument should 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.
7. It is better to use high quality wooden foot stool to make sure the stability of measurement and improve its accuracy ,when setting up the instrument.
8. Only use absorbent cotton or lens paper to wipe the instrument gently If exposed optical device need to be cleaned.
9. 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.
10. Inspect instrument carefully and comprehensively to ensure its indicators, function, power supply, initial setting and correction parameters meet the requirements before operating.
11. If the function is abnormal, non-professional maintenance persons are not allowed to dismantle the device without authorization in case of any unnecessary damage.
12. The emitted light of the no-prism total station SLT10 is laser, do not direct to eyes.

Security Guide

Please pay attention to the following security matters when using the instrument with non-prism.

Warnings：

Total station is equipped with rangefinders with laser level 3R/IIIa.

The Total Station is classified as Class 3R Laser Product and abides by the class of Laser Product according to IEC Standard Publication 60825-1:2001.

For Class 3R/IIIa Laser Product, its emitted laser with wavelength between 400nm and 700nm can be at most 5 times of that of Class 2/II.

Warnings：

Never stare at laser beam constantly, it could cause permanent eye damage.

Precautions：

Do not see directly into laser beams nor point laser to persons.

The reflected beam is the necessary for the instrument measurement signal.

Warnings：

When the laser beam is irradiated reflected by prisms, plane mirrors, surface of metal and windows, it can be dangerous to look straight into the reflected beams.

Precautions：

Do not 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 prism with total station telescope only.

Warning ：

It’s dangerous to use Class 3R Laser instrument improperly.

Precautions：

In order to avoid causing damage, the proper precautions should be taken for you and control well the distance (in accordance with the standard “IEC60825-1:2001”) that may occur hazards.

The following is the main part of the explanation of the IEC Standard Publication:

Class 3R Laser Products are used in outdoors and on building site (with non-prism measurements).

A: The personnel who are specially trained, qualified and authenticated are allowed to install, adjust and operate these laser instruments.

B: Set up corresponding laser warning signs in the use of area range.

C: Prevent anyone from looking directly into laser beams or watching the laser beams with optical device.

D: In order to prevent laser damage to people, the laser beams should be blocked at the end of the working route. In the limited area (★Hazardous distances) where the laser beams through ,the laser beams should be terminated when there are some activities.

E: the route which laser beans through must be set higher or lower than the sight of people.

F: When the instrument not in use, please make it safekeeping and storied. Unauthorized person should not use it.

G: To prevent exposure to laser beam accidentally, such as mirrors, metal surfaces, windows, be careful as the flat surface of the mirror and concave mirror.

The hazardous distance refers to the maximum distance which is from beginning of the laser beams to the laser beam weaken until it does not harm people. The built-in rangefinder products equipped with Class 3R/IIIa laser whose hazardous distance is 1000 meters (3300feet), and in the distance, the strength weakens to a Class 1 laser (sightseeing beam eyes couldn't hurt).

Content

1. Use of instrument

The total station is such an instrument that measures the azimuth and distances to destination and can calculate the destination point coordinates automatically. It plays an important role in the economic construction and national defense construction. General Survey, exploration and mining of minerals, the construction of railways, roads, bridges, irrigation, urban planning and construction is driven by electronic total station measurements. In the building of national defense, such as battlefield preparations, harbor, forts, airfields, bases and military construction projects, and so on, must be based on a detailed and accurate geodetic. In recent years, electronic total station is a large precision engineering, shipbuilding and aviation industries and other aspects of effective tools for precise positioning and installation.

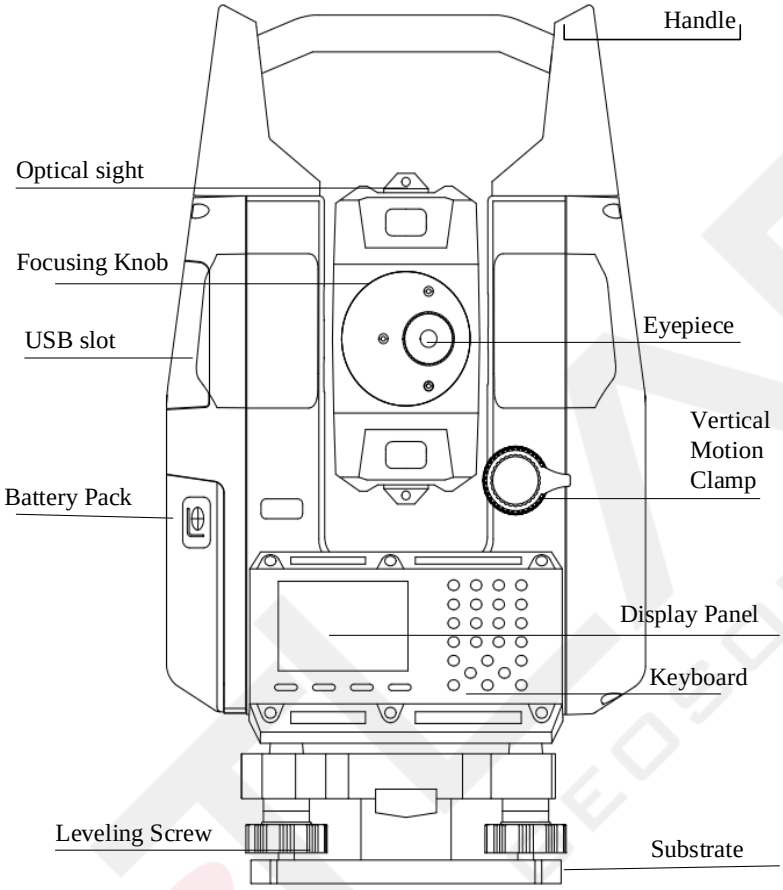
The SLT10 total station is equipped with absolute code dial system, integrated-circuit-control-board ranging item and microcomputer for measurements of angle and distance and for calculation, display, depositing and etc. It can exhibit horizontal and vertical angle, slope and horizontal distance and altitude difference simultaneously. Furthermore, it can be set to measure under different mode (e.g. Angle mode, Distance mode).It is even designed for you specializing in construction projects with non-prism ranging. The non-prism ranging can be comprehensively used in measuring three-dimensional coordinates, position determination, remote elevation measurement (REM), verticality, pipeline positioning, cross-section measurement etc. It also meets requirements for trigonometrical control survey, topographic survey, cadastre and real estate survey.

This series of instruments, SLT10 to support prism-free ranging model.

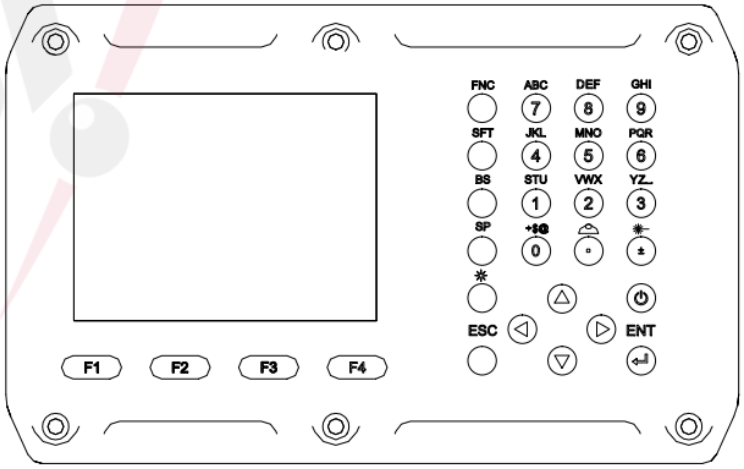
This series of instruments can link to handheld controller, and communication format support Topcom GTS-6 format. Bluetooth or serial port communication can be selected according to the specific configuration of the instrument.

2. Name and function of each part

2.1 Name of each part



2.2 Keys Functions and information display



Keys	Function
⏻	Power on / Power off

☼	Turn on or turn off the interface and key backlight
ESC	Return to the previous interface
ENT	Confirm the input and wrap it
FNC	1. Soft key function menu page turning 2. The input target height function can be selected in the functions of stakeout, opposite side, and suspension.
SFT	Switch between alphabetic and numeric input
BS	(Backspace)Delete one last character on the left of the inserter in the edited column
SP	1.Delete all typed in the edited column 2.Trigger the function of modifying ranging parameters
▲	1. Move cursor up 2. Look up previous data in data lists and lookups
▼	1. Move cursor down 2. Look up next data in data lists and lookups
◄	Move the cursor left or select another option
►	Move the cursor right or select another option
STU GHI 1 ~ 9	Alphabet input
1 ~ 9	Input number or select one of menu
.	1. Input decimal point in the digital input function 2. Input special characters：\ # in the character input function 3. Enter the automatic compensation page in non-input functions
+/ -	1. Input + or - in the numeric input 2. Input * / + in the character input 3. Enter laser pointing and laser centering page in non-input functions
F1~F4	Select the corresponding softkey on the display

3. Preparations before measurements

3.1 Unpacking and storing instruments

- Unpacking

  Lay down the box gently with the top side facing up. Open the lock and take out the instrument.

- Storage

  Cover the telescope cover. Make sure that the vertical clamping screw and the level bubble face upwards. Lay down the instrument into the box (with objective lens of the telescope facing downwards.). Tighten the vertical clamping screw gently and cover the box, then Lock the box.

3.2 Set up the instrument

- Reference for operation:

  Install the instrument onto the tripod gently, then level and center the instrument to ensure the accuracy of the measurement result.

3.2.1 Using plummets to center and level (align)

1）Set up the tripod

a) Position tripod legs so that the plummet is aimed to the ground mark point. Turn the focusing ring of the optical plummet to focus;

b) Make sure that the center of the tripod top is right above the station;

c) Stamp the tripod on the ground with your feet.

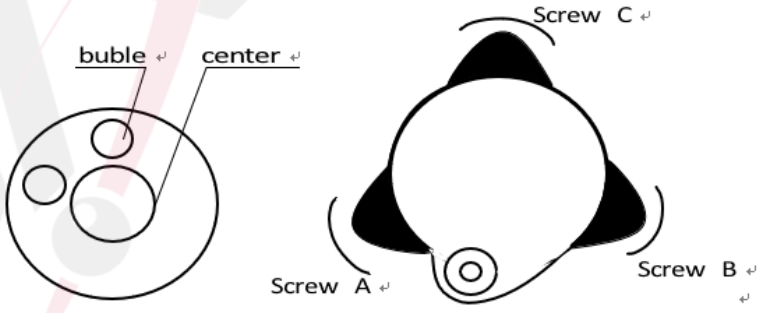
2）Install the instrument onto the tripod

Mount the instrument on the tripod head. Support it with one hand, and tighten the centering screw on the bottom of the unit to make sure it is secured to the tripod.

3）Using the circular level to level the instrument coarsely

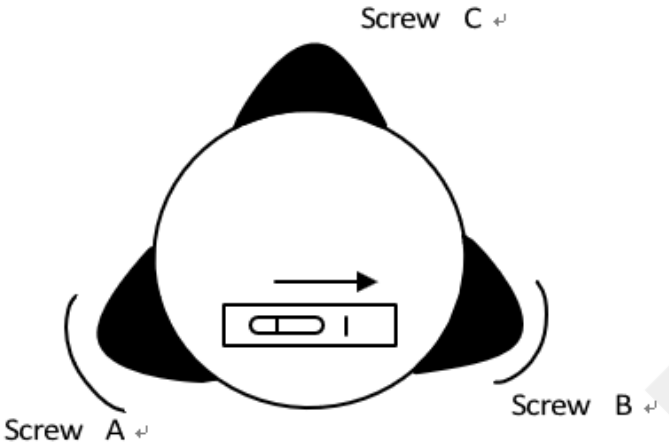
a) Twist and adjust the two leveling screw A and B on the bottom of the instrument until the bubbles of the circular level moves to the line perpendicular to the center line the screw A and B;

b) Twist and adjust leveling screw C to move the bubble to the center of the circular level.

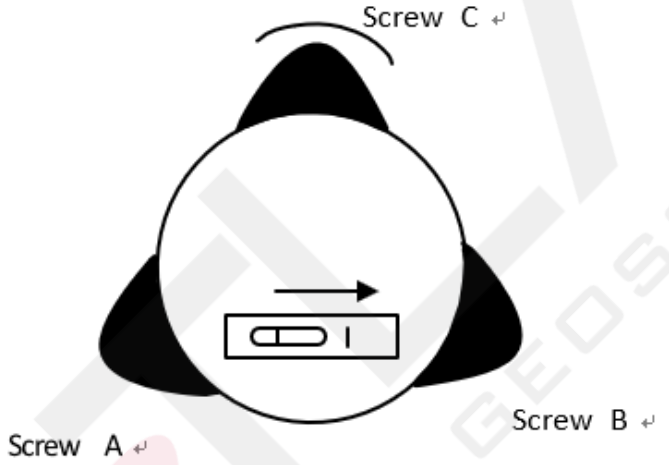


4）Using the plate level to level the instrument precisely

a) Loosen the horizontal locking screw and turn the instrument around until the plate level is perpendicular to a line shaped with screws A and B. Adjust the screws A and B to make the bubble in the center of the level;



b) Turn the instrument approximately 90°and adjust screw C until the bubble in the center of the level;



c) Turn around the instrument 90°again. Repeat above steps until the bubble remains in the center of the plate level even though the instrument is rotated to any position.

3.2.2 Using centering device to center (optical or laser)

1）Set up a tripod

a) Open the tripod. Make sure that the three feet of the tripod are approximately equal in distance from the center and that the top is leveled. Screw up the three locking screw;
b) Make sure that the center of the tripod top is right above the station;
c) Stamp one foot on the ground with your feet.

2）Install the instrument and pointing

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. Adjust three feet screws of total station and keep the optical centering tool (or laser centering) aiming at the station accurately.

3）Using circular level to level the instrument coarsely;

（same as The section above that discusses centering and leveling with plumb bob）

4）Using tubular level to level the instrument precisely;

（same as The section above that discusses centering and leveling with plumb bob）

5）Precise centering and leveling;

According to the observation of center device, loose the connection screw slightly and shift the instrument horizontally (mention that do not turn around the instrument) until the instrument aims at the station precisely.

Repeat the steps above until the instrument aims at the station precisely.

3.3 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

 ——Full battery, operation is 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：

The working time of battery will be effected by many factors, such as ambient temperature, recharging time, recharging and discharging times. For safety, we suggest you recharge the battery full or prepare several full batteries before operation.

The battery symbol only indicates power capability for current measurement mode. The power consumption in distance measurement mode is more than in angle mode, if the instrument enters into distance measurement mode from angle mode, the power maybe auto-off because of lower battery.

Notice in charging：

• Though the charger is designed with overcharge protection circuit, one must unplug the charger after finished charging.

• Suitable temperature range for charging is between -45℃ and +45℃. Charging process may be abnormal if being over the temperature range.

• A battery can be recharged for 300-500 times.

• A monthly recharging is required if the instrument is not used for a long time.

3.4 Reflecting prism

When measuring distance with prism mode, a reflecting prism must be set at the target site. You

can connect the prism to the base, and then connect the base onto the tripod .you can also set the prism onto the centering rod. There are single-prism group and three prism group available on the market, so you can select them according to your requirements.

3.5 Loading and unloading of the pedestal

● Unloading

Unload the base by loosening the locking screw on the base with a screw driver and anti-clockwise turn the screw around 180°.

● Loading

Put the three fixed feet of the instrument into the corresponding holes to make the instrument on the base. Turn the clamping screw clockwise 180° to lock the instrument. Then tighten the screw with a screw driver.

3.6 Adjusting eyepiece lens of the telescope and aiming the target.

- How to aim at targets(only for reference)

Aim at the bright sky with the telescope and adjust the eyepiece to focus until a sharp image of the cross wire forms;

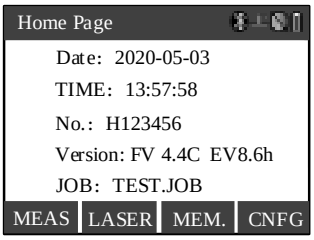
Aim at the target with the cross center in the coarse sighting device on the top of the lens. Your eyes should keep a proper distance (about 200mm) away from the sighting device;

Obtain a sharp image of the target on the reticule with the focusing screw. If optical parallax appears when angle of view changed, the focus or the diopter of the eyepiece may be unadjusted. For precision concerns, please adjust the eyepiece focus to eliminate the optical parallax carefully.

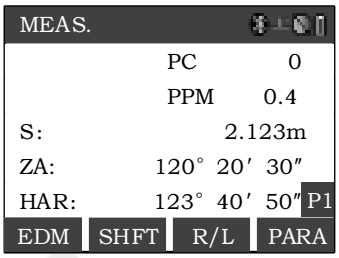
4.Initial setup and basic operations

4.1 Turn on / off

Press and hold the power key for about one second, then release the key to boot into the initial interface, as follow:

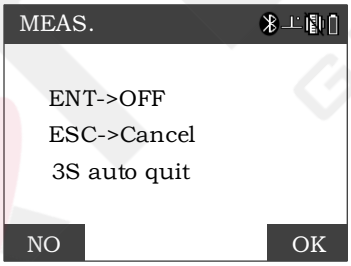


After a stay for about one second to enter the Basic Measurement interface.



In the basic measurement interface, press [ESC] key to return to the initial interface and enter the memory operation functions and configuration interfaces.

Press the power button to go to the pop-up confirmation box, as follow.



Press[ENT]to power off the instrument and press[ESC]to exit the prompt box. The prompt box will disappear if no operation for three seconds.

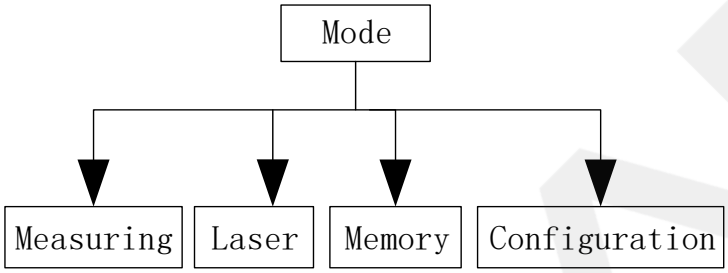
4.2 The mode structure and display symbol of the system

- Display symbols

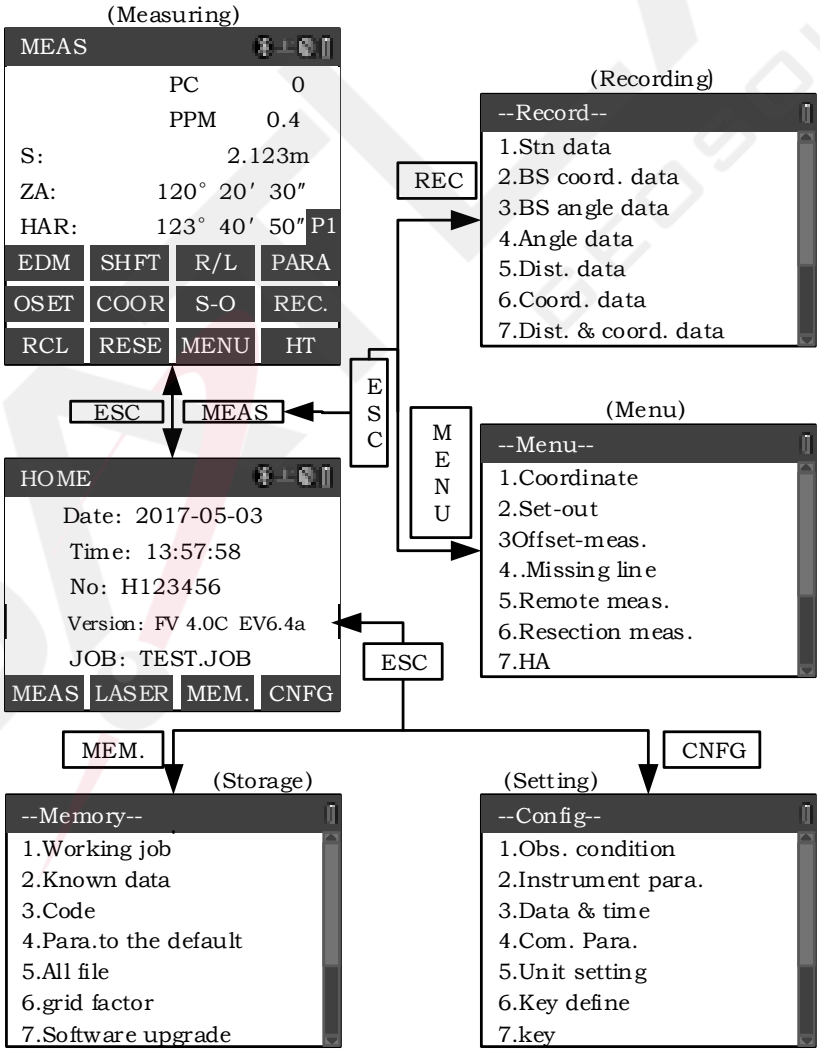
symbols	Meaning
PC	Prism Constant
PPM	Parts Per Million
ZA	Zenith Angle (zenith 0°)
VA	Vertical Angle（horizontal 0° / ±90°）
%	Slope
S	Slope Distance

H	Horizontal Distance
V	Vertical Distance
HAR	Horizontal Angle Right
HAL	Horizontal Angle Right
$\perp^{+}$	Lean effective compensation

- Mode Structure Overview



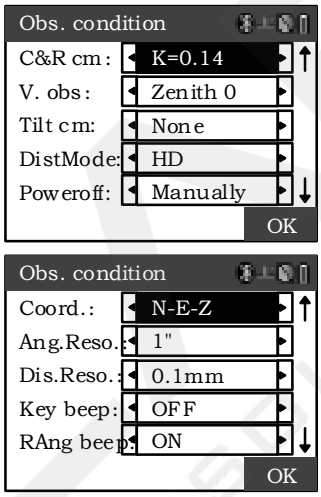
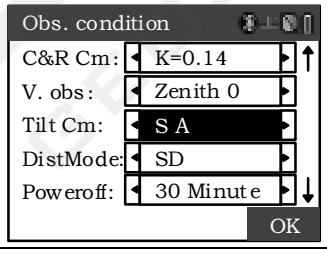
- Mode structure detailing



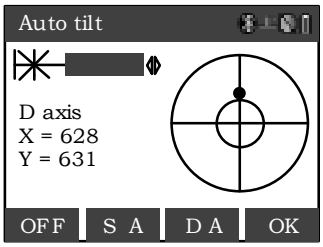
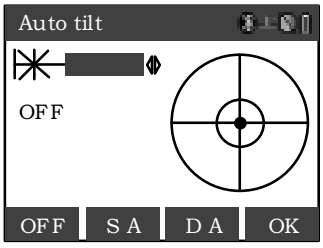
4.3 Set up the tilt correction

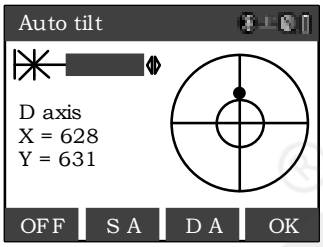
When the tilt sensor is activated, the number of corrections that need to be automatically applied to the vertical and horizontal angles (dual axis) due to the instrument not being strictly level is displayed (press the [·] key). To ensure the accuracy of the angle measurement, try to use the dual axis tilt sensor, whose display can also be used for better levelling of the instrument. If the angle display shows "Tilt Over", the instrument is out of range of the automatic compensation and must be levelled manually.

▸Step set up the tilt correction switch

Operating Steps	Key	Display
(1) Power on →[ESC]→[CNFG]→1.obs. condition	POWER [ESC][CNFG] [1]	
(2) move the cursor to "Tilt cm", choose "SA" or "DA" or "None"	▲ ▼ ◄ ►	

▸Step leveling instrument

Operation process	Key	Display
(1) In all measurement interface, press [•] to enter electronic blister display	[•]	
(2) Manually level the instrument with the tribrach screws. According to the method described in 3.2 to make black circles centered at right. Single-axis: Only compensate vertical angle. Double-axis: Onlycompensate horizontal angle		

press[OFF]to turn off compensation.		
(3) Click F2 (single axis) to display the x-axis compensation value, and click F3 (double axis) to display the x and y-axis compensation value.	［F2、F3］	

When the instrument is in an unstable state or in windy weather, the vertical angle display will be unstable, in which condition the compensator shutdown is appropriate. This can prevent the compensator beyond the operating scope and the instrument prompts the error information to interrupt the measurement. Close the compensator function in the［•］key function.

4.4 Background lighting

• Background lighting can be used in dim environments.
Press［☼］to turn on the interface backlight, following process “Turn off→ Level 1 brightness →Level 2 brightness →Level 3 brightness → Turn off”.

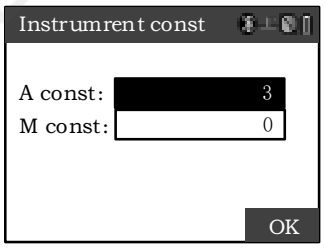
4.5 Set up the instrument parameters

In the setting mode, the parameters should be set in accordance with the observation conditions.

Detail operating refer to “19.1 change observation condition of instrument”.

4.6 Set up the instrument constants

Instrument constants including "additive constant" and "multiplying constant", it has been calibrated in the factory. You can obtain a constant value according to "inspection and calibration of instrument constant" method.

Operation process	Key	Display
(1)power on→[ESC]→[CNFG]→2.instrument para.→3.inst. constant Press[OK]to confirm the input.	POWER [ESC] [CNFG] [2] [3]	

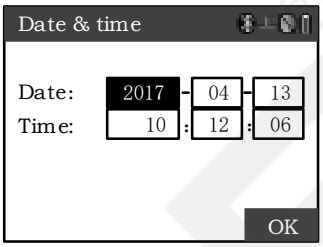
4.7 Backlight settings

The brightness of the instrument's backlight can be adjusted under "Instrument Parameters" as follows:

Operating Steps	Key	Display
(1) power on→ [ESC]→[CNFG]→2.instrument para. (enter PIN code)→4.Backlight setting ［↑］(F2) ［↓］(F3) Adjust the brightness and level of the backlight, press［OK］to return to the menu	POWER [ESC] [CNFG] [2] [4] [F2] [F3] [F4]	

4.8 Set up date and time

• The date/time of the instrument can be set under the "instrument parameter Settings". The method is shown below：

Operating Steps	Key	Display
(1)power on→[ESC]→[CNFG]→3.date &time, After entering one item press[ENT]to next item. press[OK]to save date and time and return.	POWER [ESC] [CNFG] [3]	

4.9 Choose working file

Instrument operation not only requires a large amount of data but also generates large volumes of data. All these data are stored in the instrument's file system in the form of documents. It is a good habit that choosing the required files ahead for the measuring work.

Instrument used by the file type to distinguish extensions, including:

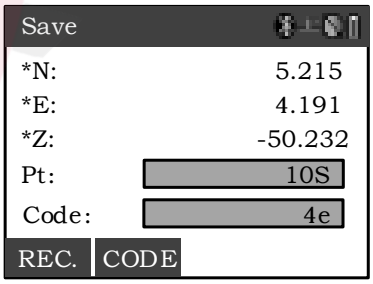
- .JOB file is working file, save date and invoke coordinate.
- PCODE.LIB file is coding file, save and invoke code.
- COORD.PTS file is known coordinate, save known coordinate date and invoke coordinate.
- .LSH file is horizontal alignment file, use in the road lofting.
- .LSV file is vertical alignment file, use in the road lofting.

These files are not necessary in all applications, you can select different application functions as appropriate.

Choose working file refer to chapter 17.1 .

4.10 Input number and alphabet

User can input numbers and alphabets and also the mix of numbers and alphabets.



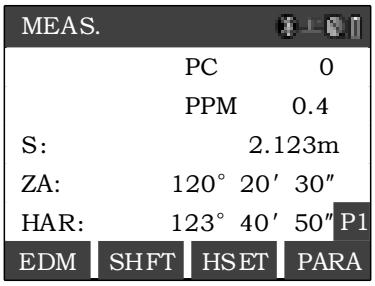
Example：

- The numerical only frame can’t change to alphabetic entry.
- You can input number and letter in the edit frame of point inputting, press［SHFT］to switch from number and alphabet. (Press quickly according to the order of signs below, because alphabet is constituted by three keys , cycle between alphabets).

4.11 Introduction

- Tilt compensation automatic

It means that you have set up single axis or dual-axis compensation when there is a “$\perp^{t}$” sign in the display window. As show in the figure：



◆ Eliminate parallax

When the observer eyes moving slightly in front of the eyepiece, relative displacement between target and the reticule is called the parallax. Parallax causes error, therefore, it should be based on the reticle focusing will eliminate parallax before the observation.

◆ Cut off the power automatic

To save power, the instrument can cut off power after shut-down 30 minutes. The cut off function can open or close when set the observation condition, refer to "20.instrument parameters setting."

◆ Dirty spot recognition of the code disk.

On the interface of angle in real time to refresh, turn the instrument, and when angle displaying "###°##′##″ or "###.####" , it means the code disk is dirty and needed to be cleaned.

You can complete your survey by using this instrument after you have a good command of setting, figuration and basic operate.

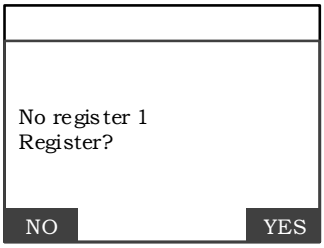
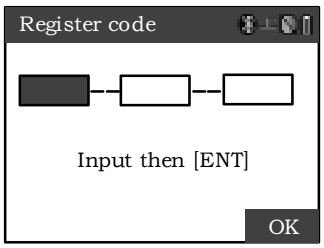
4.12 Instrument registration code

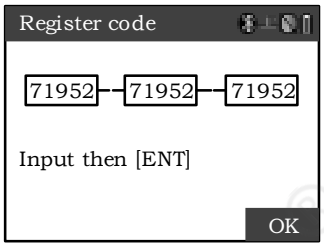
Before the instrument is unregistered, every time it is switched on, a prompt will be displayed as shown below, after "unregistered", the current number of times the instrument has been switched on is shown.

Before the instrument is registered, all functions can be used normally. Between 51-99 times, the registration prompt is also displayed. After 100 times, the application functions cannot be accessed, and after normal registration, all functions can be used.

The registration code can be obtained via the company website or by contacting the service staff.

▸ step

Operating Steps	Key	Display
(1) In the power state, press long [power] to power on and pop up the query message box.	［power］	
(2) In the registration prompt interface, press the [ENT] key to enter the input registration code interface.	［ENT］	

(3) Enter the registration code (ask the supplier), e.g.“71952 71952 71952”.	［num］	
(4) After entering the correct registration code, press the [OK] key to indicate that it has been registered, and the operation of the storage point can be performed.	［OK］	

4.13 Instrument data storage size prompt information notes

When the memory size of the instrument is less than 100k, the prompt "the disk is less than 100K, please organize the data or delete the data" after starting the machine.

Note: When deleting the disk data, please first export your own measurement data to the U disk, so as to cause unnecessary trouble.

5. Angle measurement

Check the following one more time before measurement：

1）Leveling accurately

2）Charging adequately

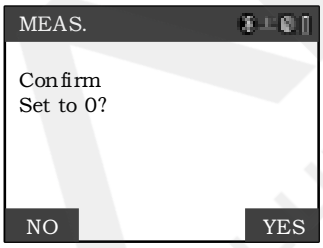
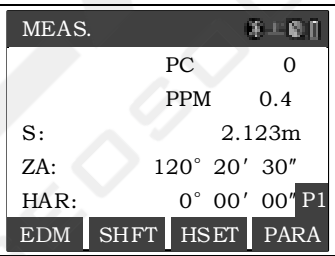
3）The horizontal circle and vertical circle indexing have been completed

4）The parameters are set in conformity with measurement condition

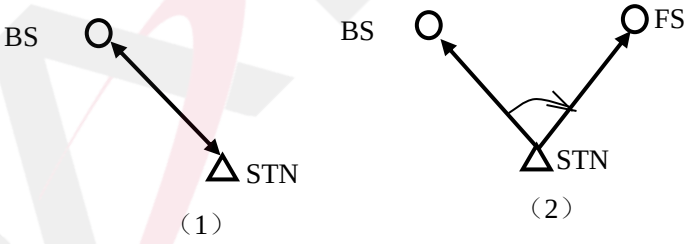
5.1 Measuring the Horizontal Angel Between Two Points.

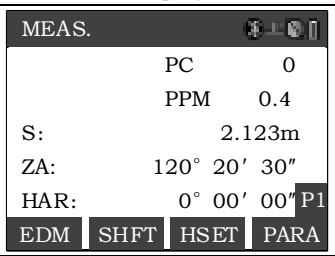
• To measure the included angel between two points, the horizontal angle can be set to 0 at any direction.

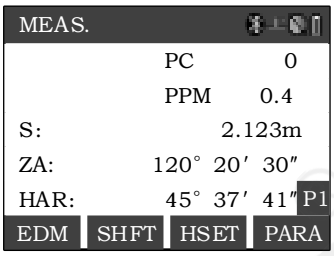
▸Step

Operating Steps	Key	Display
（1）on the first page of the MEAS mode interface, press［FNC］to enter the second page （ display P2 ） and press［0SET］，pop-up ask message box.	［FNC］ + ［0SET］	
(2) Press the [ENT] key, and the correct horizontal direction value is set to 0° 00′ 00″.	Zero setting	

EXAMPLE：Measuring the horizontal angel between two points



Operating Steps	Key	Display
(1) Using the horizontal clamp and the horizontal fine motion screw, sight the first target. On the second page of the “MEAS mode interface” Press[0SET].	[0SET] + [ENT]	

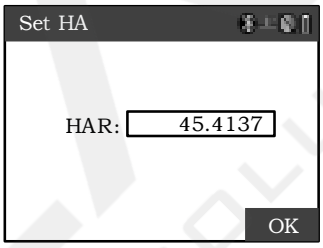
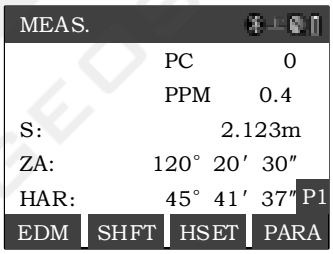
(2) Sight the second target, the displayed horizontal angel(HAR) is the included angle between the two points.	Sight the 2nd target	

5.2 Setting the Horizontal Angle to a Required Value (Horizontal Angle Hold)

5.2.1 Set up the horizontal angel to a required value using［HSET］

• You can set the horizontal angle in the sighted direction to any required value.

▸Step

Operating process	Key	Display
（1）On the first page of the “MEAS Mode interface” , press［HSET］,the “Set HA” interface appears. When turning the horizontal angle to right, [HRA] is displayed. When turning it to left, [HAL] is displayed.	［HSET］	
2）Enter the value you want to set, press “OK”. The “MEAS.” interface appears and the value which is set as the horizontal angel is displayed.	Enter angle value + ［ENT］	

☆Enter rules

- ◆ Press［. ］to set the input of angle symbol in degree, minute, second
- ◆ When you want to enter 45°36′35″, input 45.3635
- ◆ Modify entered value

  ［BS］：Delete a number/ character on the left cursor

  ［SP］：Delete the input date
- ◆ Stop input progress :［ESC］

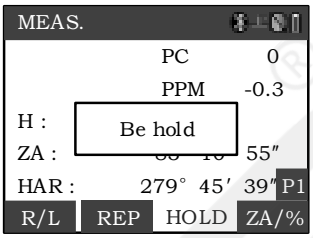
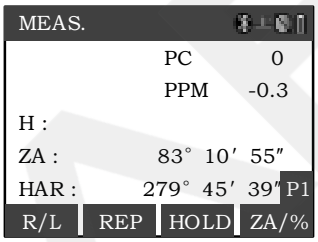
5.2.2 Set up a required value using［HOLD］

- ◆ It is possible to use the horizontal angle hold function to set the horizontal angle of the sight direction to the required angle.
- ◆ To do this, you first define the horizontal angle lock function [HOLD] to the key as described in the Key Function Assignment.

The required orientation values are displayed in the measurement mode.

▸ Step

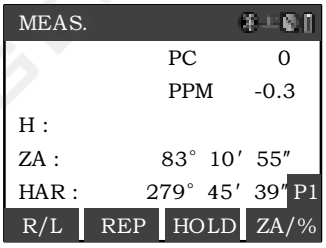
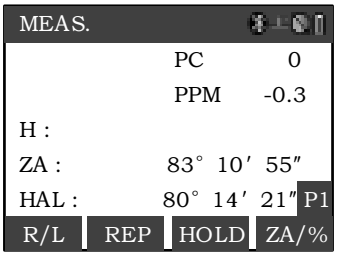
Operating process	Key	Display

（1）Use “Key define”, display［HOLD］function in the survey mode.		
（2）Use the horizontal clamp and the fine motion screw to display the desired angle of the horizontal angle . Press［HOLD］once, the horizontal angel is in the hold status.	［HOLD]	
（3）Sight the target and press［HOLD］once. Horizontal angle [HOLD] is canceled and the desired angle is set for the target.	Lock angle	

5.3 Horizontal Angle Display Option (left /right)

- It is possible to switch between horizontal angel clockwise display (Right) and horizontal angel counterclockwise display (left).
- For this operation, allocate the function keys to display［R/L］,according to the method of “Key define”

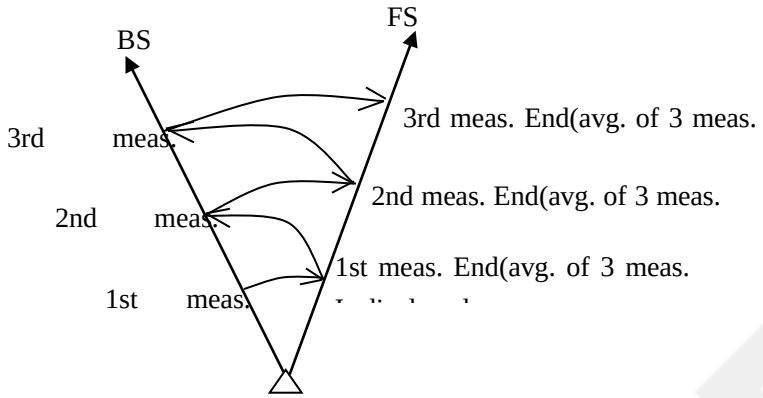
▸Step

Operating process	Key	Display
（1）Allocate the function keys to display [R/L]function, horizontal angle display becomes clockwise (HAR).		
Press [R/L]，horizontal angle display switch from clockwise (HAR) to counter clockwise (HAL). HAL=360°- HAR Press [R/L] once more to return clockwise.	[R/L]	

5.4 Horizontal Angle Repetition

To get the greater precision of the horizontal angle, perform repetition measurement.

- For this operation, allocate the function keys to display［REP.］according to the method of “Key define” and invoke.



▸Step

Operating process	Key	Display
（1）On the “MEAS Mode interface”, press [REP.]. The “Repetition BS Sighting interface” is displayed. Horizontal angle set to 0°.	[REP.] + aim at backsight	REP Hah: 0° 00′ 00″ Reps: 0 Ave: 0° 00′ 00″ HAh: 0° 00′ 00″ Take BS CE OK
（2）Sight the BS point and press [OK], the “Repetition FS Sighting interface” is displayed.	[OK]	REP Hah: 0° 00′ 00″ Reps: 0 Ave: 0° 00′ 00″ HAh: 0° 00′ 00″ Take FS CE OK
（3）Sight the FS and press [OK] once more, “Repetition BS Sighting interface” is displayed a second time.	Aim at foresight + [OK]	REP Hah: 0° 00′ 00″ Reps: 1 Ave: HAh: 0° 00′ 00″ Take BS CE OK
（4）Sight the BS again and press [OK], the “Repetition FS Sighting interface” is displayed s second time.	Sight the BS+ [OK]	REP Hah: 0° 00′ 00″ Reps: 1 Ave: HAh: 0° 00′ 00″ Take FS CE OK
(5)Sight the FS again and press[OK]. The average value of the horizontal angle is displayed on the third line. Repeat 4,5 Steps if continue. When completed, press [ESC].	Aim at foresight + [OK]	REP Hah: 100° 00′ 00″ Reps: 2 Ave: 50° 00′ 00″ HAh: 0° 00′ 00″ Take BS CE OK

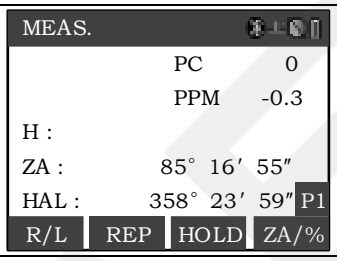
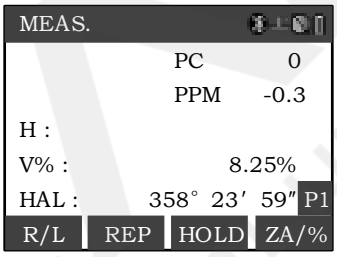
• Maximum repeat times：10

• Maximum angle accumulated value：359°59′59.5″

5.5 Slope in %

- It is possible to display the gradient as a %.
- For this operation, allocate the function keys to display［ZA/%］according to the method of "Key define"

▸Step

Operating process	Key	Display
（1）In the MEAS mode, allocate the function keys to display［ZA/%］.		
（2）Press［ZA/%］, The vertical angel is displayed as a gradient(V%).Press［ZA/%］ again to return the original vertical angle display.	ZA/%	

☆Display Range: ±100%

☆When the vertical angle format set "HA 0" or "HA 0±90", "VA" is displayed instead of "ZA".

6. Distance Measurement

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 the laser beam is not reflected by any highly reflective objects close to the optical path.
•When distance measurement is activated, the EDM measures the distance to objects in the optical path. If there is a temporary obstacle in the optical path (e.g. a passing car, or heavy rain, snow or fog), the distance measured by the EDM is the distance to the nearest obstacle
•When measuring over longer distances, the laser beam deviating from the line of sight can affect the accuracy of the measurement. This is because the reflection point of the diverging laser beam may not coincide with the point where the crosshair is illuminated. It is therefore recommended that the user makes precise adjustments to ensure that the laser beam is aligned with the line of sight. (See section "20.10 No Prism ranging")
•Do not aim both instruments at the same target and measure simultaneously

- **Red laser match reflector for distance measurement**

Laser can also be used to distance the reflective sheet. Similarly, to ensure the measurement accuracy, the laser beam is required to be perpendicular to the reflective plate, and it must be accurately adjusted.(See "20.10 No prism ranging" section)

Ensure the correct additional constants for the different reflective prisms.

6.1 Setting for Distance Measurement.

◆ Set parameters before distance measuring:
- Atmospheric correction
- Prism Constant correction
- EDM modes

Atmospheric correction

During the distance measurement, the distance value is affected by the atmospheric conditions at the time of the measurement. In order to reduce the impact of atmospheric conditions, the distance measurement must be corrected using meteorological correction parameters.

Temperature: Air temperature around the instrument.

Air pressure: the atmospheric pressure around the instrument.

PPM value: the calculated and predicted meteorological correction

● standard meteorological conditions of this series (i. e., when the meteorological value of the instrument is changed to 0):

Air pressure: 1013hPa

Temperature: 20ºC

● atmospheric correction:

ΔS =277.8250.29434 P / (1 + 0.003661T) (ppm), in the formula:

ΔS : correction factor (in unit ppm)

P: Air pressure (in hPa)

T: Temperature (unit ºC)

Distance measurement mode

◆ The following are the measurement time and the smallest distance display for each measurement in different measurement method when a prim is used.

• Fine Measurement

Accuracy：±（2+2PPM×D）mm (D for distance)

Measure time：<3seconds

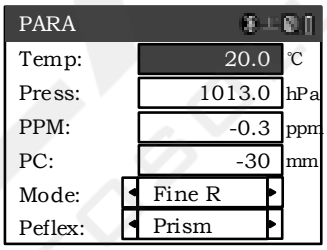
Minimum display：1mm

• Tracking measurement

Measure time：<1second

Minimum display：10mm

◆ Setting for distance measurement

Operation	Display
In MEAS mode, press[SP],the "parameters set interface" is displayed. Set follow items: 1.temperature 2.air pressure 3.atmospheric correction value PPM 4.prism constant correction value 5.distance measurement mode 6.target type After setting , press[ENT].	

◆ Set method and contents：

Item	Set method
Temp	①Entering temperature, atmosphere value, instrument will calculate the atmosphere correction automatic and display the PPM column ② Entering atmosphere correction PPM directly
Press	
PPM	
PC	Enter the prism's constant correction value
Mode	Select it with symbol ◂or ▸: Fine "R", Fine "T" , Fine "S" , 3-Fine
Reflex	Set the target type: prism, reflector less,sheet

NOTICE：

Temperature range：-30~+60℃ or -40~+140℉

Air pressure range：500~1400hPa

Atmospheric correction PPM input range：-499~+499

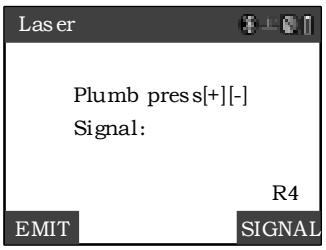
Prism constant range：-99~+99mm

Reflector type: This series of full station can set the optional reflector prism, prism and reflector, the user can set up according to the job needs.

6.2 Laser Pointer and Laser Plummet

In the initial interface, press the［laser］the "Laser" interface is displayed . Press the [+] /[-] key

to switch the laser pointer on/off.



- The laser plummet will be switched on as soon as the “Laser” interface is displayed. Press the [+] or [-] keys to adjust the brightness of the laser plummet. Exit the interface, laser plummet shut down automatically.
- Click [Signal], then display back light signal, press any key to close.

6.3 Distance and Angle Measurement

• An angle can be measured at the same time as the distance measured.

• When recording measurement data, see “Recording Distance Data” chapter.

• Check the following once more before measuring a distance：

1）The instrument is set up correctly over the surveying point.

2）Battery is fully charged.

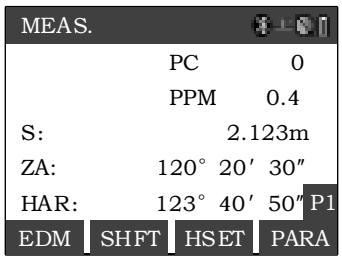
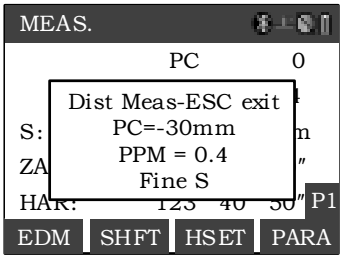
3）The horizontal circle and vertical circle indexing have been completed.

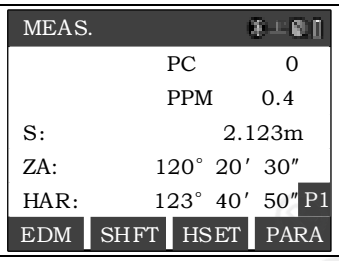
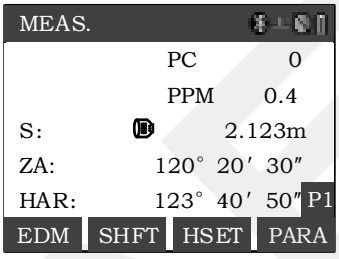
4）The parameters are set up correctly with measurement conditions.

5）Atmospheric correction, prism constant correction and EDM modes has been set up.

6）The center of the prism is correctly sighted and the intensity of the return signal is sufficiently high.

▸Step S/H/V selection and distance measurement

Operating process	Key	Display
In the MEAS mode, press [SHFT] to select the desired distance mode. Each time [SHFT] pressed ,the distance measurement changes. S：slope distance H：horizontal distance V：height difference	[SHFT]	
（2）Press [EDM] to start distance measurement, information about distance measurement（ distance measuring mode, prism constant correction value, atmospheric correction value）will display on the interface by a flashing display.	[SD]	

（3）When distance measurement completed, a short been sounds. and the measured distance data "S", vertical angle "ZA" and horizontal angle "HAR" are displayed.		
（4）When repeat measurement is performed , press [ESC]to stop the distance measuring and display the measured result.	[ESC]	

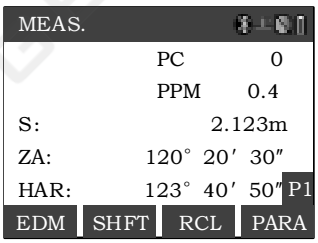
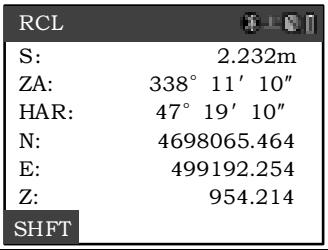
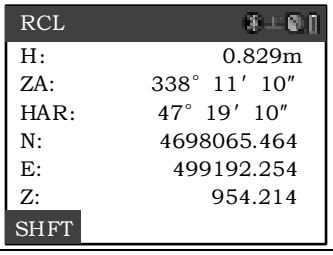
• If the Fine "S" or 3-Fine measurement mode is selected, measurement stops automatically after desired times measurement completed.

6.4 Review of the Measured Data

• The distance and angle measurement data will be stored in the memory until the power is off. These distance measured value, vertical angle, horizontal angle, the coordinate values can be displayed on the interface, it is possible to convert the distance measurement values into the horizontal distance, elevation difference, and slope distance by press［SHFT］.

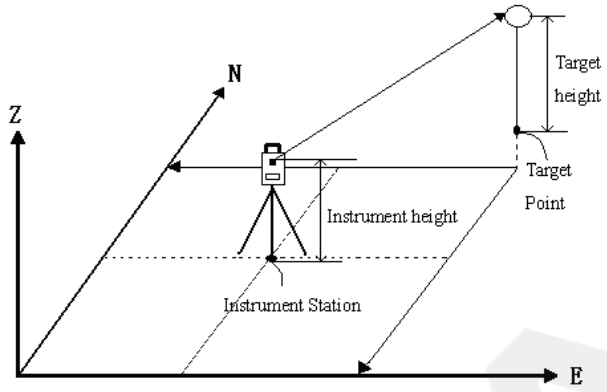
• For this operation, you should first define key by［RCL］according to the method of "Key define".

▸Step

Operating process	Key	Display
(1) In MEAS mode, allocate the function keys to display[RCL], and press [RCL]to access ranging data.	[RCL]	
(2) The recent measured data is stored and display on the interface.		
(3) press[SHFT], switch between slope distance, horizontal distance, height difference , press[ESC]to back to the survey mode.	[SHFT]	

7. Coordinate Measurement

• It is possible to get the 3D coordinate of the target based on the station point coordinate, instrument height, and target height which are entered in advance.



•It is possible to set the azimuth angle of the BS station by entering the coordinates of the station point and the BS and then sighting the BS to be measured.

• The following preparation are needed before measuring：

Station point coordinates setting

Azimuth angle setting

• The coordinate format settings, please refer to “4.5 Set the instrument parameter option”.

7.1 Set station

• Before the coordinate measurement, enter the instrument station coordinates, the instrument height(I.H) and target height(T.H).

• Measure the I.H and T.H with a tape measure.

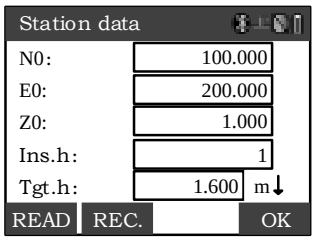
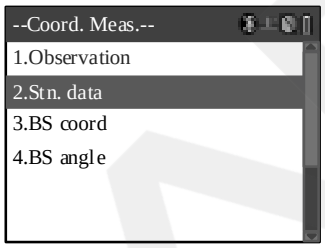
• Coordinate data can be registered in advance.

• Station data can be recorded in the JOB which has been selected. For the JOB selection method, refer to "17.1.1 Select the current working file".

• Coordinate measurement can also be performed in the menu on page 3 of the measurement mode, press [Menu] to enter the menu mode, and then select "1. Coordinate measurement".

▸Step

Operating process	Key	Display
（1）in the second page of the MEAS mode interface , press［COOR］and display coordinate measurement menu.	［COOR］	--Coord.meas-- 1.Observation 2.Stn. data 3.BS coord 4.BS angle
（2）choose “2.Stn.data” and press ［ENT］（or press number 2），enter the instrument station data.	“2.Stn. data” + ［ENT］	Station data N0: 100.000 E0: 200.000 Z0: 1.000 Ins.h: 1.600 m Tgt.h: 1.000 m READ REC OK

（3）Set the following items：N0. E0. Z0 （ instrument station coordinate ） . instrument height . target height. once you set an item, press［ENT］. Press ［REC.］record instrument station data.	Input station data + ［ENT］	
（4）press［OK］to end the instrument station data setting.	［OK］	

Notice：

Coordinate input range： -99999999.999 ~ +99999999.999

The instrument heigh input range：0~+999.999

The target height input range：-999.999~+999.999

☆ To interrupt input, press［ESC］

☆ Read coordinate data: press［READ］（refer to the follow“read coordinate date in advance”

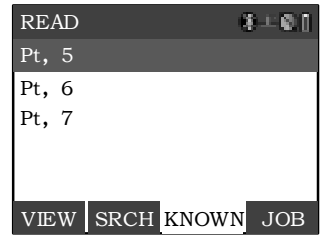
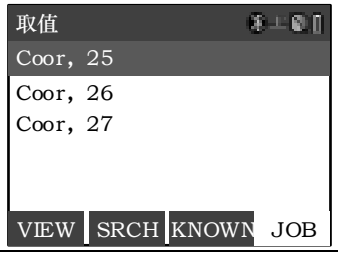
☆ Saving station data: press［REC.］（refer to “record station data”）

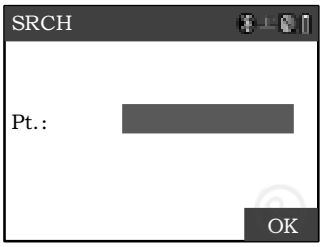
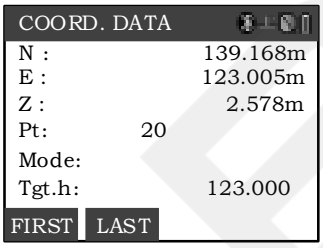
◆ Reading in Registered Coordinate Data

• If you want to read in and set coordinate data form memory, press the［READ］and read the required coordinate data.

• Both known coordinate data saved in memory and the coordinate data in the selected JOB can be read in.

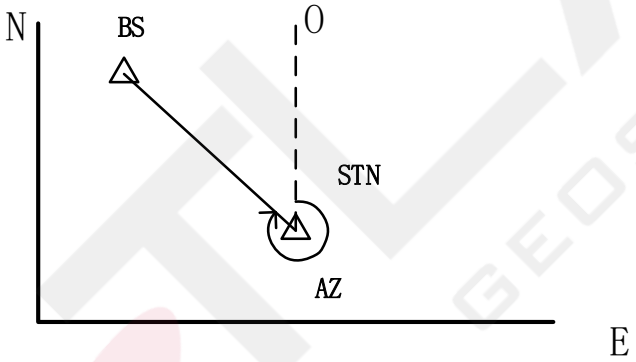
▸Step

Operating process	Key	Display
(1) Press［READ］, The “Coordinate data points list interface ” is displayed ［KNOWN］:Coordinate data saved in the known data memory. ［JOB］:Coordinate data saved in selected JOB.	［READ］ ［JOB］	 

(2) Press［▲］or［▼］ to select the required item. Use the point number to search for coordinate data , press ［SRCH］.	［SRCH］	
(3) Press ［VIEW］ to read point, and display the coordinate date on the interface. Press ［ESC］ to back to the “Coordinate data points list interface ”	［LAST］	
(4) Press［ENT］ to back to station set interface.	［ENT］	

7.2 Azimuth Angle Settings

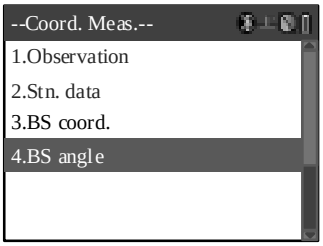
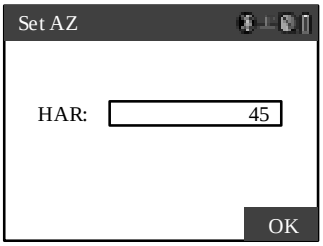
• After the instrument station coordinate and the BS coordinate have been set, sight the BS and perform a key operation to automatically set the azimuth angle of the BS station.



7.2.1 BS angle

It is possible to set the backsight by entering the azimuth directly.

▸Step

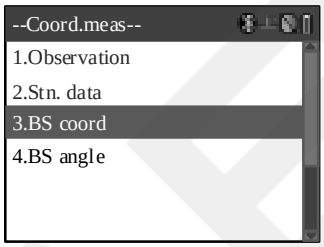
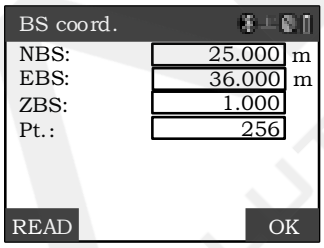
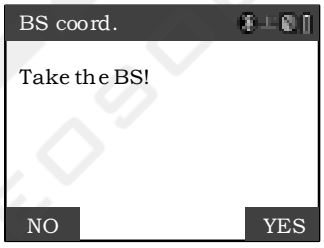
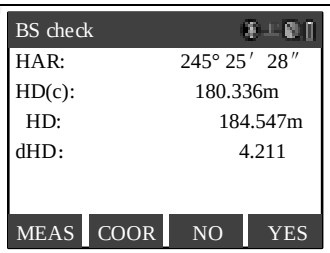
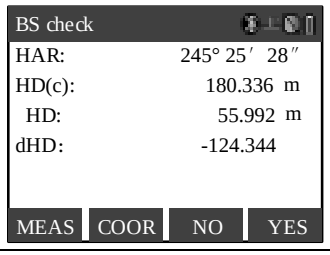
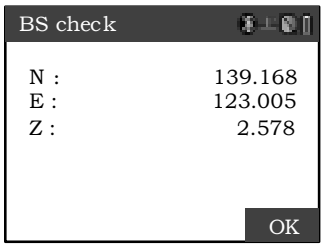
Operating process	Key	Display
(1)press ［▲］［▼］ to move the cursor on“4.BS angle” then press［ENT］（or press number 4 directly）.	“4.BS angle” + ［ENT］	
(2) Enter desired angle and sight the backsight , then press［OK］.	Input azimuth angle + ［OK］	
(3) Back to coordinate survey menu		

interface after completing AZ Set.		

7.2.2 Backsight by coordinate

As soon as enter the backsight coordinate data, the system will calculate the azimuth according to the instrument station coordinates and backsight coordinates.

▸Step

Operating process	key	Display
（1）In the menu display , choose "3. BS coord".	"3.BS coord" + ［ENT］	
（2）Enter backsight coordinate data, when set each item ,press ［ENT］. press［READ］to read in memory.	Input backsight coordinate + ［ENT］	
（3）The system calculate the azimuth by station point and backsight point , press［OK］and sight the backsight target.	［OK］	
（4）sighting the backsight target, press［ENT］. Press ［MEAS］to check the backsight. If you want to ignore check, press［NO］.	［ENT］	
（5）press［MEAS］ to measure to backsight, the result is displayed on the interface.	［MEAS］	
（6）press［COOR］, you can view the backsight coordinate,［ENT］or［ESC］to return	［COOR］	

Note: read coordinate data from memory: read backsight point coordinate data: place the cursor on NBS, EBS or ZBS and press [value].

7.3 Coordinate measurement

• After station data and backsight azimuth set, the coordinate values of the target can be got by the distance and angle measurement.

The coordinate values of the target are calculated and displayed as following：

Station coordinate：（N0，E0，Z0）

instrumental height：I.H

Prism height：

Height difference：z

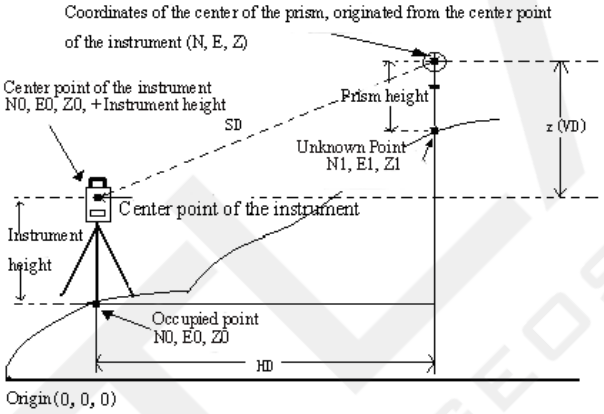
The difference from center of the instrument to the center of the prism：（n,e,z）

Unknown point coordinate：（N1. E1. Z1）

N1=N0 + n

E1=E0 + e

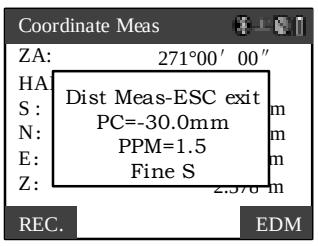
Z1=Z0 + I.H + z - Prism height

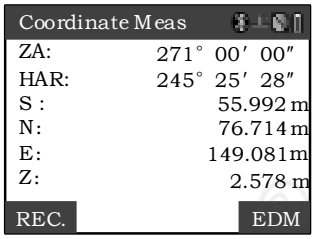
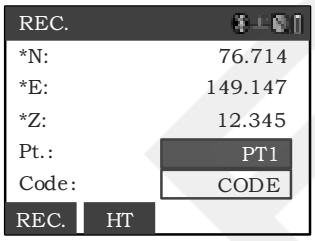
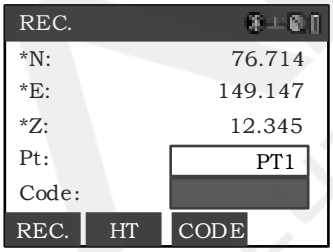
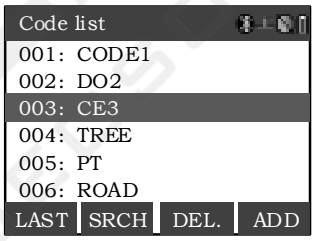
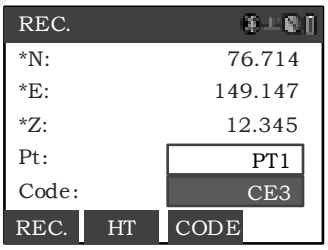
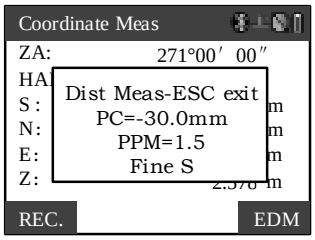


• Please check the following once more before measuring：

1. Instrument is correctly set up over the surveying point .
2. Battery is fully charged
3. The horizontal circle and the vertical circle indexing have been completed.
4. The parameters are set in conformity with measurement conditions.
5. Atmospheric correction, prism constant correction and ranging mode is set up correctly
6. the center of the target is sighted correctly and intensity of the returned signal is sufficiently high.
7. station data and backsight azimuth set have been done.

▸Step

Operating process	Key	Display
（1）Sight the center of target, choose “1.Observation” in the survey coordinate menu interface and press［ENT］（or press number 1 directly）.	“1.Observation” + ［ENT］	

（2）Complete the measurement ,the coordinate data of the target, vertical angle and horizontal angle between targets is displayed.		
(3)To record the coordinate data in the JOB, press［REC.］. The coordinate data recording interface is displayed. Set the following items: 1. PT.：target point name 2. Code： code or note information. Press▼or［ENT］after setting each item. •When the curser is in the code line, press［CODE］and display code list, press▲or ▼to select the desired one, press［ENT］ and return data.	［REC.］ ［CODE］ ［REC.］	   
(4)Sight the next target and press［EDM］to start the measurement. Press［ESC］to end up the coordinate measurement and return to coordinate measurement menu interface.	［EDM］	

☆ Remember the following when record:

① the maximum length of the point number is 14 characters

② the maximum length of the code is 14 characters

☆Code enter in advance, refer to introduction “ 17.3.1 Input code”

8. Staking out measurement

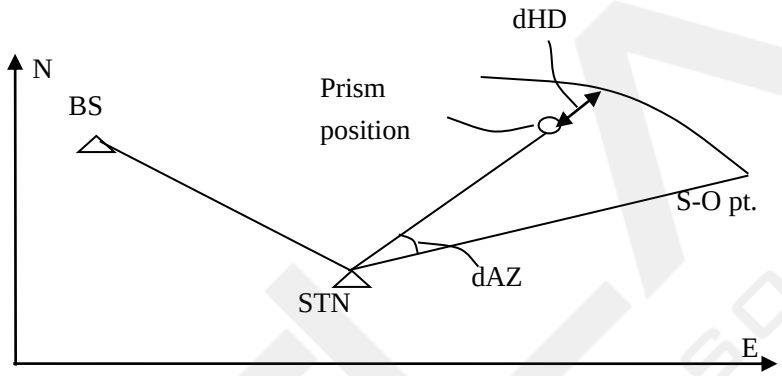
• The staking out measurement is used to set out the required point. The difference between the previously input data to the instrument (the setting-out data) and the measured value can be displayed by measuring the horizontal angle, distance or coordinates of the sighted point.

Displayed value = Difference between measured value and setting-out data.

8.1 Coordinate Stake out measurement

• This measurement is used to set out the point of a certain coordinate away from the reference point.

• After setting the coordinates to be set out, the instrument calculates the setting out horizontal angle and horizontal distance and stores the value in memory. According to the horizontal angle and horizontal distance, the required point location can be set out.

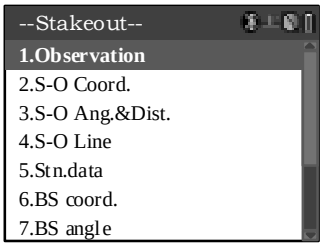
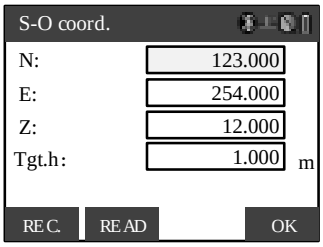


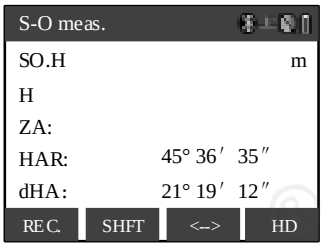
• It is possible to perform coordinates setting out measurement when on the Menu Mode and "2. S-O" is selected.

• It is possible to output the coordinate data previously registered and set it as the setting-out coordinates.

• To find the Z coordinate, attach the target to a pole, etc., with the same target height.

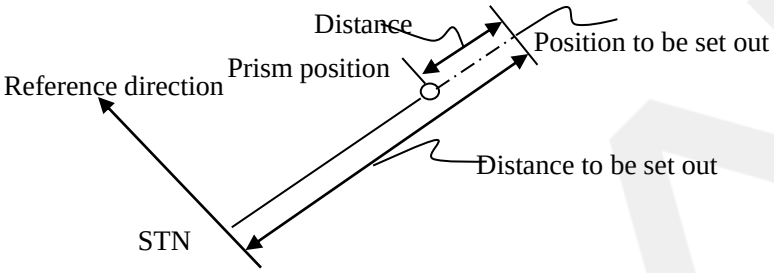
▸Step

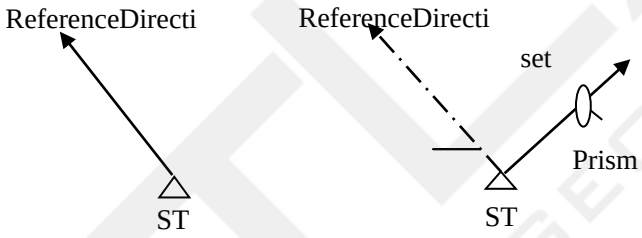
Operating process	Key	Display
（1）Press［S-O］in the MEAS mode page 2, “Stake out Menu interface ”is displayed	［S-O］	
（2）choose “2. S-O coord.” and press［ENT］, or press the . Enter the coordinate. ［REC.］: record coordinate currently ［READ］: read coordinate value from memory	“2. S-O coord.” + ［ENT］	

（2）press［OK］Enter the S-O meas. refer to chapter 8.3.	［OK］	

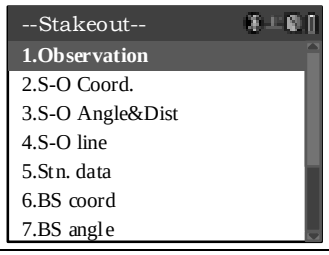
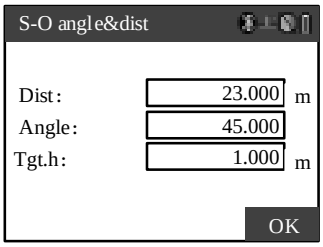
8.2 Angle and Distance Stake out

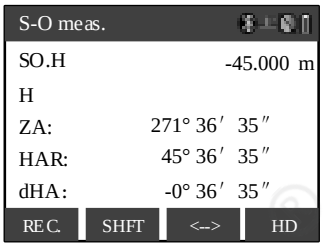
• The point can be found based on the horizontal angle from the reference direction and the distance from the instrument station.





▸Step

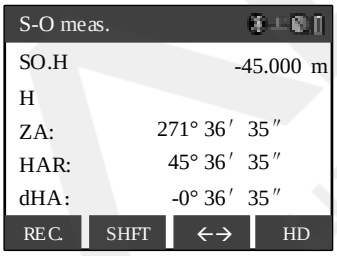
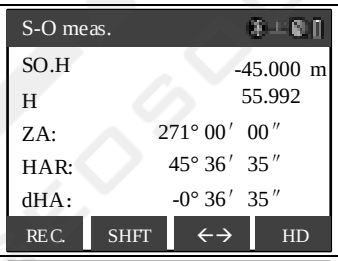
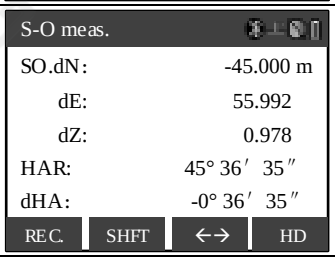
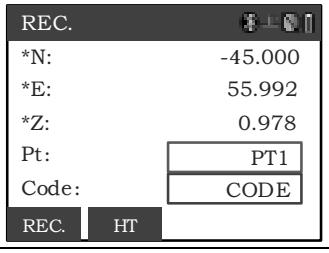
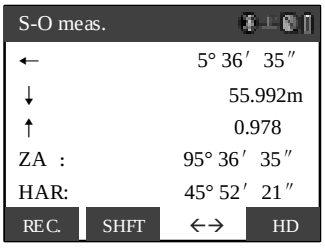
Operating process	Key	Display
(1) Press［S-O］in the MEAS mode page 2, “Stake out Menu interface ”is displayed	［S-O］	
(2) Select”3.S-O Ang.& Dist.” and press［ENT］, Enter the following items： ● Distance from the instrument station to the position to be set out. ● Included angle between the Reference direction and the position to be set out.	“3. S-O Ang.& Dist.” + ［ENT］	

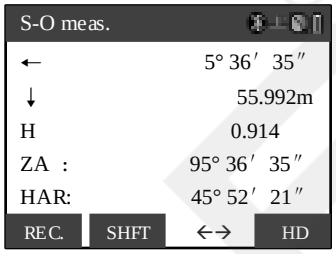
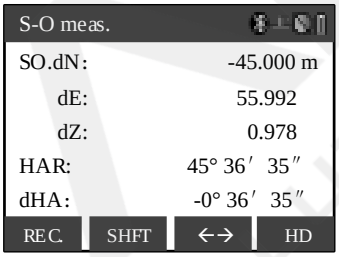
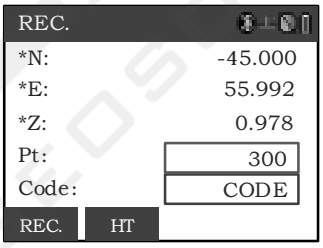
(3) Press［OK］,The " S-O meas. " interface refer to chapter 8.3.	［OK］	

8.3 Set out

The principle of set out measurement is rotate the instrument until the angle is about 0°0′0″, set the target on the sight-line and sight it from the telescope.

▸Step

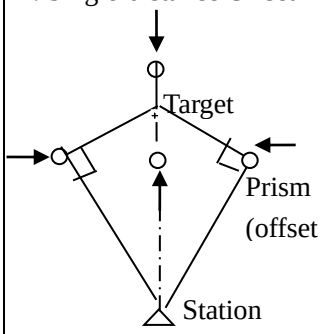
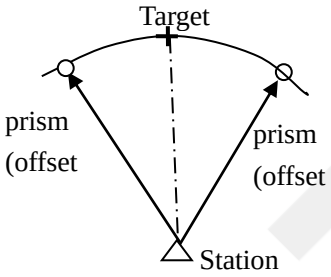
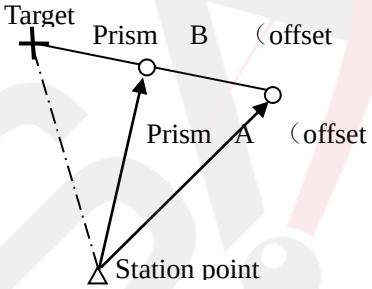
Operating process	Key	Display
（1）After performing the S-O meas Take angle&distance stakeout as an example here.	［OK］	
（2）Press［HD］,perform measurement of the target. SO.H：horizontal distance difference H：horizontal distance from instrument to the target dHA：angle difference	［HD］	
（3）Press ［SHFT］, switch to coordinate display interface, press［COOR］to measure the target again.	［SHFT］	
（4）Press［REC.］, Record the current coordinate data.	［REC.］	
（5）Press［←→］to switch the guide interface **First line：** the angle should be rotate. **Second line：** the movement direction of the target is indicated by the arrows pointing upwards and downwards.	［←→］	

(↓：Move the target towards yourself ↑：Move the target away from yourself） **Third line**：prism move distance of moving up or down.		
（6）Press［SHFT］to switch the measurement mode.	［SHFT］	
（7）Press［←→］again to switch back to the differential display interface. Click F1［STORE］to store the current measurement data.	［←→］	
（8） Press F1［STORE］for the next point of data measurement.	［STORE］	

9. Offset measurement

• Offset measurements are performed in order to find a point where a target cannot be installed directly or to find the distance and angle to a point which cannot be sighted. It is possible to find the distance and angle to a point you wish to measure (target point) by installing the target at a location (offset point) a little distance from the target point and measuring the distance and angle from the surveying point to the offset point.

• The target point can be found in the following three ways：

graphical representation	method
1. Single-distance Offset measurement 	•When the offset point is positioned to the left or right of the target point, make sure the angle formed by lines connecting the offset point to the target point and to the instrument station is approximately 90 °. •When the offset point is positioned in front of or behind the target point, install the offset point on a line linking the instrument station with the target point.
2. angle offset measurement 	• Install the offset point as close as possible to the target point to its left or right, make the distance between the target to the station point is approximate the same as the distance between and the station point.
3. two distance offset measurement 	• Install offset points A and B on a line extending from the target point, measure A and B, then enter the distance between B and the target point to find the target point.

• For this operation, press the “key function configuration” to define key of the methods described in [OSET] function.

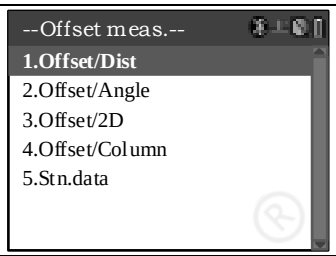
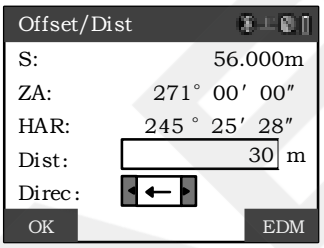
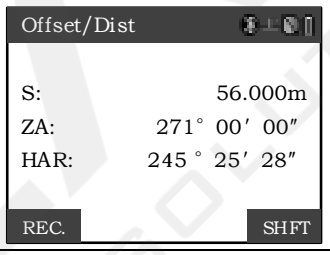
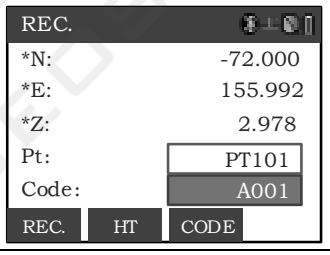
• Offset measurement in menu mode by “3.Offset-meas.”.

• The model used for the Offset measurement is the same as that used before the Offset measurement.

9.1 Single distance off-set measurement

▸Step

Operating process	Key	Display

(1) Enter the single distance offset measurement function from the menu.	［offset］	
(2) Select “1.Offest/Dist” and press [ENT], click on "Observe" to display the m single distance offset measurement data on the interface. Set the following data items. 1. Offset distance: the flat distance from the eccentric point to the target point 2.Direction: the offset of the point, press [◄] or [►] to set	“1.Offest/Dist” + ［ENT］	
(3) Press [OK] to display the offset measurement result interface. The display is different for different measurement modes (the measurement mode used in step 1). You can [toggle] the display if you enter directly from the menu.	［Ok］	
(4) Press [REC.] to record the measurement data.	［REC.］	

Notice：• The direction of the offset point：

→ The target point on the right of the prism

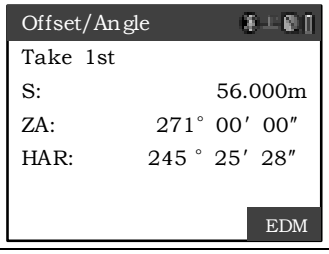
← The target point on the left of the prism

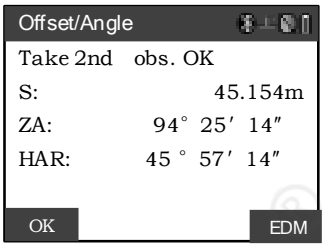
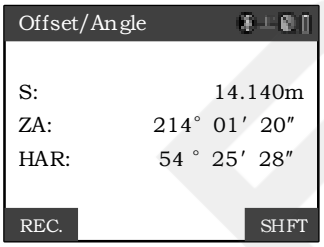
↑ The target point on the ahead of the prism

↓ The target point on the back of the prism

9.2 Angle offset measurement

▸Step

Operating process	Key	Display
（1）In the angle offset function, press［EDM］measure the offset point and display the result on the interface.	［EDM］	

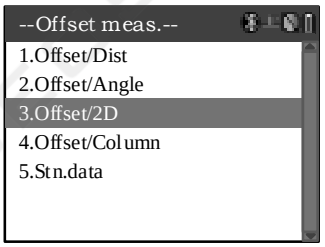
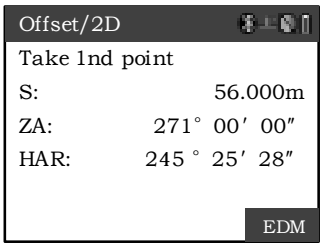
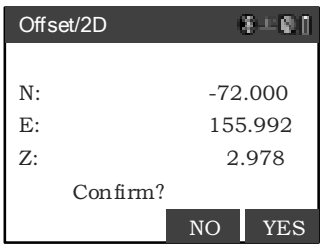
（2）The slope distance, vertical angle, and horizontal angle of the instrument station and the target point are displayed.	［EDM］	
（3）Accurately sight the direction of the target point and press [OK].	［OK］	
（4）Other operation refer to single distance offset measurement.		

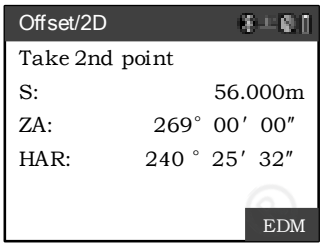
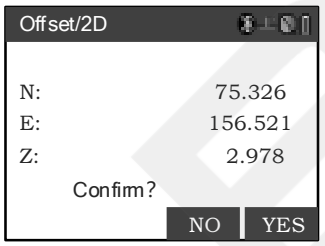
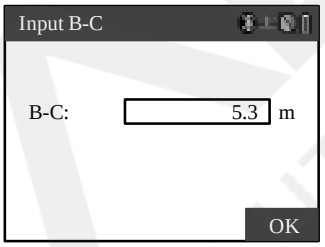
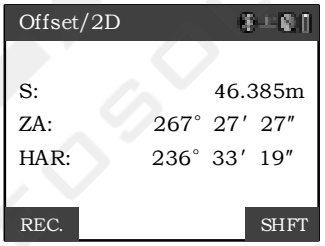
9.3 Double distance offset measurement

☆ Notice：

Install two offset points (1st target and 2nd target) on a straight line from the target point, observe the 1st target and 2nd target, then enter the distance between the 2nd target and the target point to find the target point

▶Step

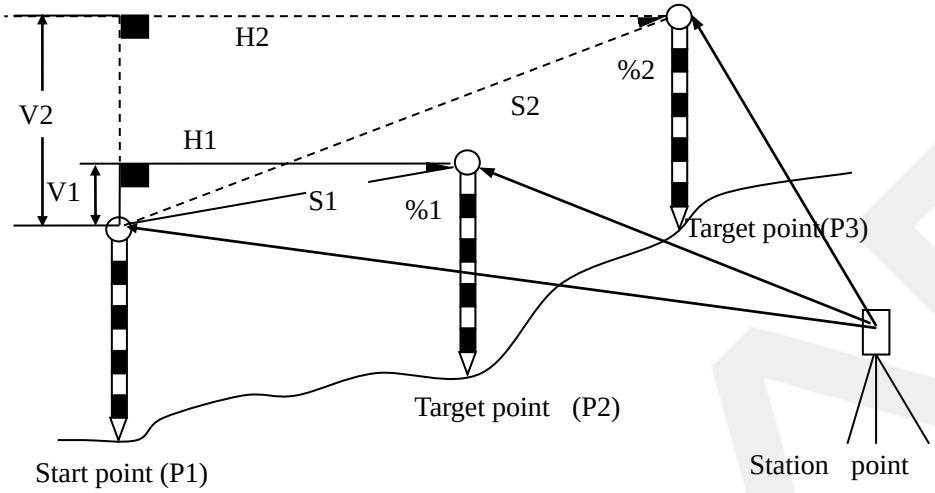
Operating process	Key	Display
（1）In MEAS mode ,press [OFFS],the “Offset meas.”interface is displayed.	[OFFS]	
（2）Select “3. Offset/2D” and press［ENT］. The “Take 1st point”interface is displayed.	“3. Offset/2D” + ［ENT］	
（3）Sight the target A and press ［EDM］to start measurement. The measurement result is displayed after measurement completed.	［EDM］	

（4）Press［OK］，（repeat observation the target press［NO］）.	［OK］	
（5）Sight the target B and press［EDM］to start the measurement, the result is displayed.	［EDM］	
（6）Enter the offset distance, and press［OK］.	［OK］	
（7）The instrument calculate and display the coordinate of target point.	［OK］	
（8）Other operation refer to single distance offset measurement.		

• Input range of offset distance：-999.999~+999.999m

10. Missing Line Measurement

• Missing line measurement is used to measure the slope distance, horizontal distance, and horizontal angle to a target from the start target without moving the instrument.

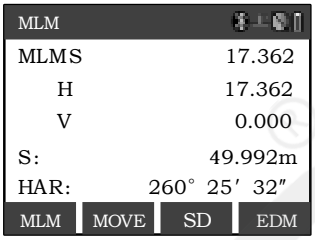
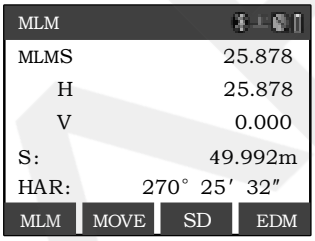


• To find the height difference (V) between 2 points, use a pole etc. to make the target height of all the targets identical.

10.1 Measuring the distance between multiple targets

▸Step measure multi-point distance

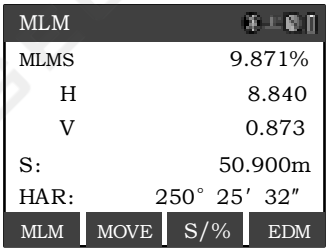
Operating process	Key	Display
（1）Press the “MLM” in the MEAS mode on the third page.	［MLM］	MLM MLM S 0.000 H 0.000 V 0.000 S : HAR: 240° 25′ 32″ MLM MOVE SD EDM
（2）Sight the first target, press［EDM］,the measured values are displayed on the interface.	［EDM］	MLM MLM S 0.000 H 0.000 V 0.000 S : 49.992 m HAR: 240° 25′ 32″ MLM MOVE SD EDM
（3）Sight the second target , press［MLM］, start missing line measurement.	［MLM］	MLM Dist Meas-ESC exit PC=---mm PPM=1.5 Fine S m HAR: 240° 25′ 32″ MLM MOVE SD EDM

（4）When the measurement is completed ,the result is displayed：MLM S：Slope distance of the two target H：horizontal distance between of the two target V：height difference between the two target H：horizontal distance between station and P2 HAR：horizontal angle between station and P2 Repeat observation：［EDM］		
（5）Sight the third target and press［MLM］to start measurement. When the observation is completed, the "MLM "interface is displayed. The values displayed are the slope distance, horizontal distance, and the height difference between starting position and 3rd target.	［MLM］	
（6）Press［ESC］to end and return	［ESC］	

10.2 Slope between two points

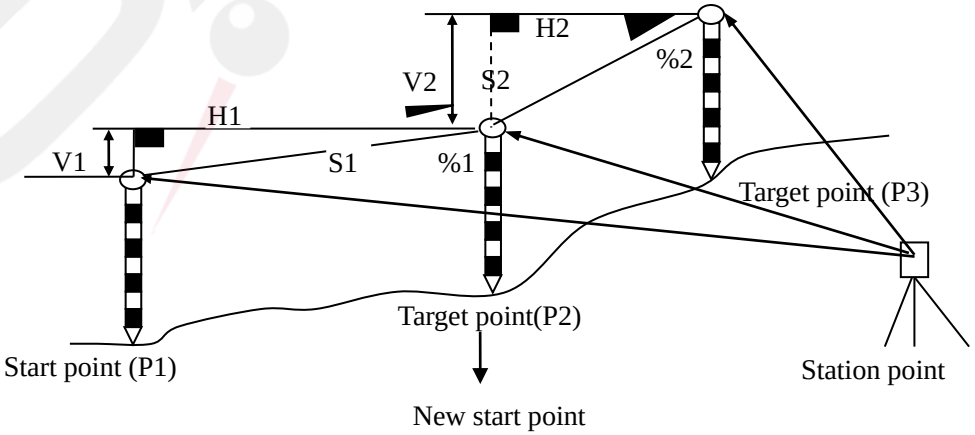
• Slope between start point P1 and second point P2 can be displayed by %.

▸Step

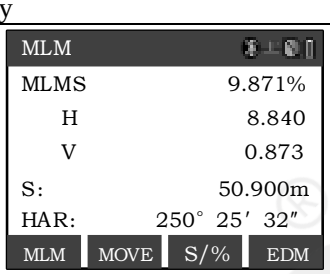
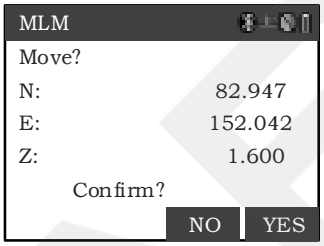
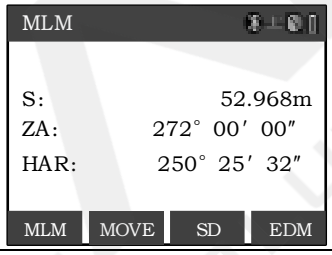
Operating process	Key	Display
Press［SD］with the measured value is displayed, the. At the moment,［SD ］change to［S/%］. Press［S/%］again and restore the original interface.	［SD］	

10.3 Change the start target

• It is possible to change the last measured target to the next start target.

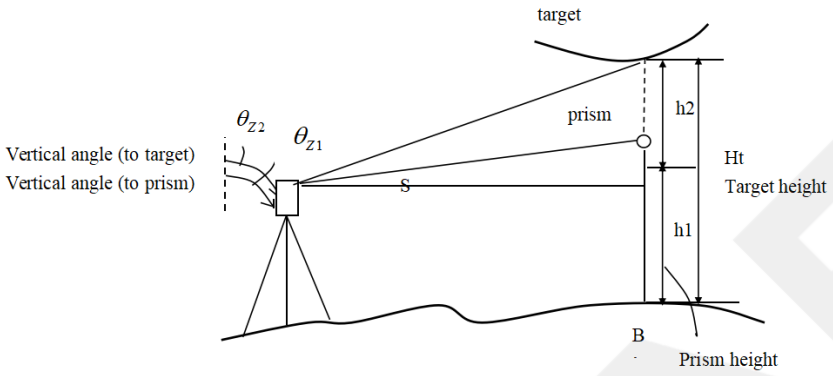


▶Step

Operating process	Key	Display
（1）Observe the starting position and target following the steps in Measuring the distance between multiple targets.		
（2）Press［MOVE］	［MOVE］	
（3）Press［YES］,the “Missing line measurement interface “is displayed, the last target measured becomes the next start target.	［YES］	

11. Remote Height (REM)

●REM is adequate for measuring the target height when the prism cannot be placed at the target point.



• The calculation formula：

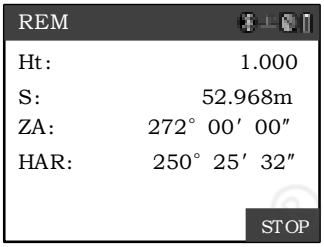
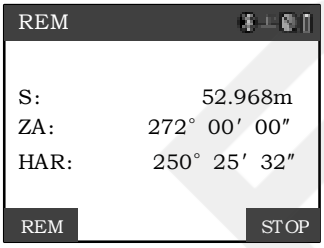
$$Ht = h1 + h2$$
$$h2 = Sin\theta_{Z1} \times Ctg\theta_{Z2} - S\cos\theta_{Z1}$$

• To operate, define key by function［Remote meas.］according to the “key function distribute”

• You can choose “5. remote meas.” to start remote measurement in menu mode.

▸ Step

Operating process	Key	Display
(1) Set the target under or over the object and measure the target height with a tape measure.	［MENU］	--Menu-- 1.Coordinate 2.Set-out 3.Offset-meas 4.Missing Line 5.Remote meas. 6.Resecion meas 7.HA Repetition
(2) Press“5.Remote meas. ”	5.Remote meas.	REM S: ZA: 272° 00′ 00″ HAR: 250° 25′ 32″ REM EDM
(3) Press［EDM］to start measurement.	［EDM］	REM S: ZA HA Dist Meas-ESC exit PC=---mm PPM=1.5 Fine S REM EDM

(4) Sight the target, Press［REM］, the item “Ht.” display the height from the surveying point to the object .	［REM］	
(5) Press［STOP］to stop this operating • ［EDM］: observe the target again • ［REM］: start REM measurement	［STOP］	
(6) Press［ESC］back to the former interface	［ESC］	

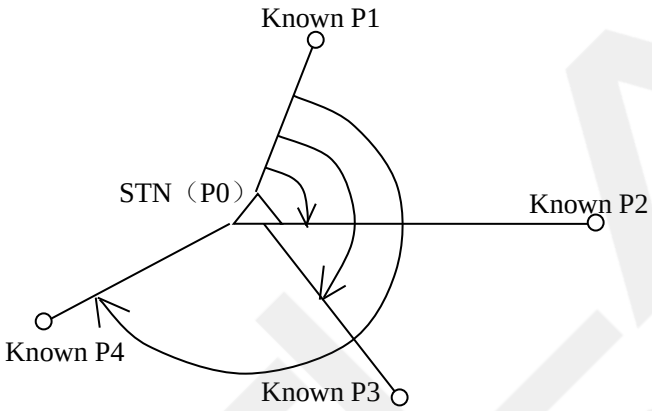
Maximum observation angle：±89°

Maximum observation height：±9999.999m

12. Resection Measurement

●Resection measurement through the measurement of multiple known points to determine the coordinates of the station.

Enter values or observation values	Output
Ni. Ei. Zi：coordinate value of the given point	N0. E0. Z0：coordinate of station
Hi：horizontal angle value	
Vi：vertical angle value	
Di：distance value	



• The instrument can calculate the station point's coordinate by observe 2-4 known points.

1、 When the distance can be measured .2 known points is required.

2、 When there is even one point can not be measured ,3 known points is required.

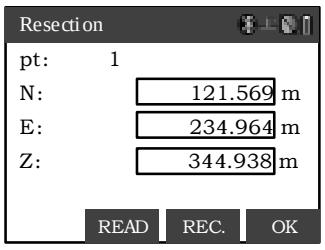
• Resection survey is available by choosing "6,resection"in the menu mode.

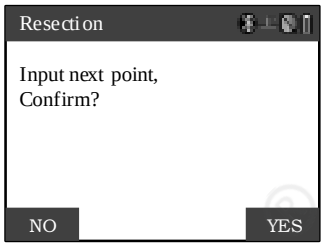
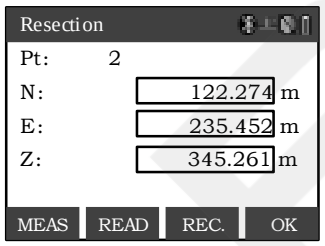
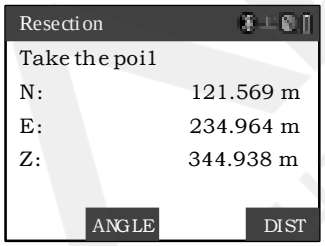
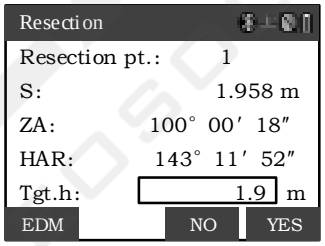
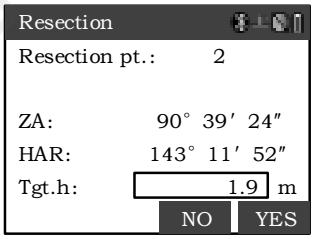
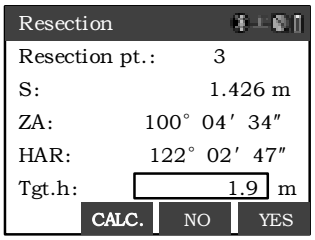
• The known coordinates of the point can be read from the memory in advance.

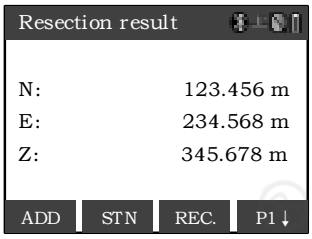
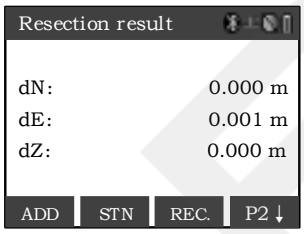
• It is possible to record set known point coordinate data or calculated instrument station data in the JOB which has been selected.

• Target height will recover to its initial value by completing resection measurement.

▸Step

Operating process	Key	Display
（1）In the MENU page, press"6.Resection meas.". Enter the first known point date and press［OK］, pop up as shown in the interface and press［ENT］. •interrupt input ：［ESC］ • read coordinate data：［READ］ • record coordinate data：［REC.］	"6.Resection meas." + ［OK］ + ［ENT］	

		
（2）Press［OK］ and ［ENT］after setting the first point . • Repeat the first Step and enter all the given points	Input coordinate date	
（3）All the given point is entered completed. Sight the first target, press［ANGLE］ for angle measurement only, if distance measurement is needed, press［DIST］	［MEAS］	
（4）When pressed［DIST］, the result value is displayed. Press［YES］to continue , press［NO］to re-survey this point.	［DIST］	
（5）［ANGLE］only offer the angle measurement . Press［YES］to continue surveying, press［NO］to re-survey this point.	［ANGLE］	
（6）Repeat Step 4 and Step 5 to measure the known points. When the number of observation values is enough, ［CALC.］will display on the interface. Press [YES] to automatically start calculations after observations of all known points are completely surveyed. • re-observe the same point: ［NO］ • Observe next point:［YES］ • Calculate station coordinate：［CALC.］	［CALC.］	

（7）When calculate is completed, result will be displayed on the interface NEZ：calculate station coordinate dN/dE/dZ:the standard differential which indicate the precision of the observation Press［P1↓］to switch results	［CALC.］ ［P2］	 
（8）Press［STN］to set the result as the instrument station coordinate and the result will be stored.	［STN］	
（9）Press［REC.］to store the station coordinate and then exit.	［REC.］	

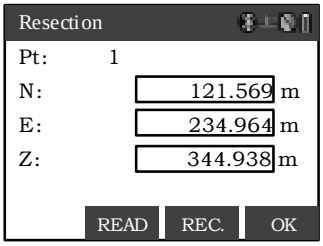
• Abandon calculate result and observe again：［ESC］

• Abandon calculate result and add known points：［Add point］

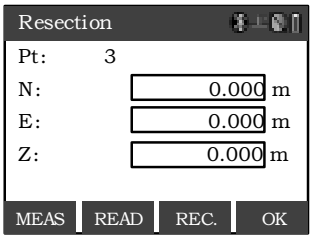
• Take the calculation and record it in the working document without resetting the angle:［REC.］

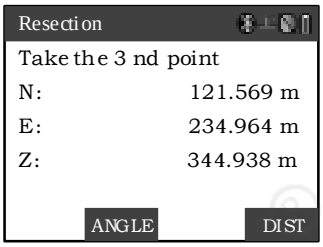
12.1 Re-observation

●It is possible to re-observe a known point from the first point or to re-observe only the final known point.

Operating process	Key	Display
（1）Press［ESC］ to back to the former display, former data is still on the interface.	［ESC］	

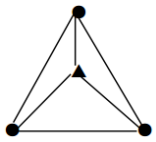
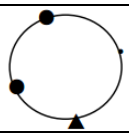
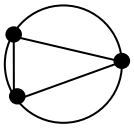
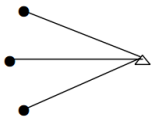
12.2 Add known points

Operating process	Key	Display
(1)Press［ADD］in the result display interface.	［ADD］	

(2) After adding the points, when there is a known point which has not been measured, perform from the known point.	［MEAS］	

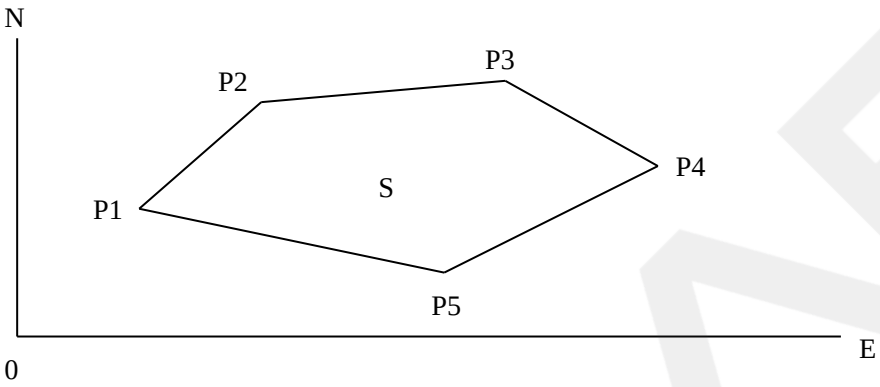
▸Notice of resection

•It is impossible to calculate the coordinate of the unknown point (station point), if the unknown point and the known points are on the edge of a single circle.

	• The arrangement such as shown on the left are liable: ▲: Unknown Point ●: Known Point
	• It is impossible to calculate the correct result.
	• When the known points is on the edge of a same circle, take one of the following measures: set the observation station at the center of the triangle if possible
	• In some cases, it is impossible to calculate the coordinate of the instrument station if the include angle between the known points is too small. It is difficult to imagine that the longer the distance between the instrument station and the known points, the narrower the include angle between known points. Be careful because the points can easily be aligned on the edge of a single circle.

13. Area calculation

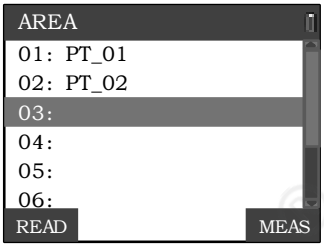
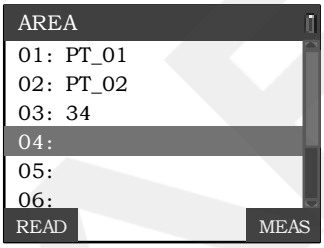
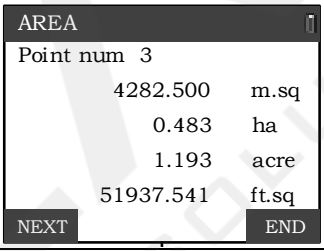
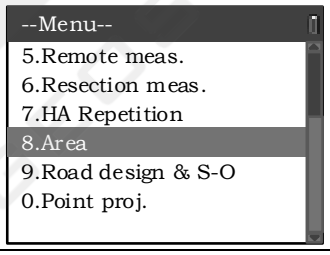
It is possible to calculate the polygon area which are the connection of by some points data, the coordinate data can be measured or read from memory. And the following two methods can be alternately performed.
Coordinate（given value）： P1 (N1, E1)，P2 (N2, E2) ，P3 (N3, E3) …
Area（calculated value）：S



• The number range of coordinate points that constitute polygon：3~20
• The area is calculated from the coordinates of an ordered series of points that make up the closed figure. The sequence points used can be directly observed or pre-entered into the instrument memory.
Notice： • the area calculate result will be incorrect when the points are less than three.
• The consequence of the given points must be clockwise or counterclockwise, otherwise the result of the calculation will be incorrect.

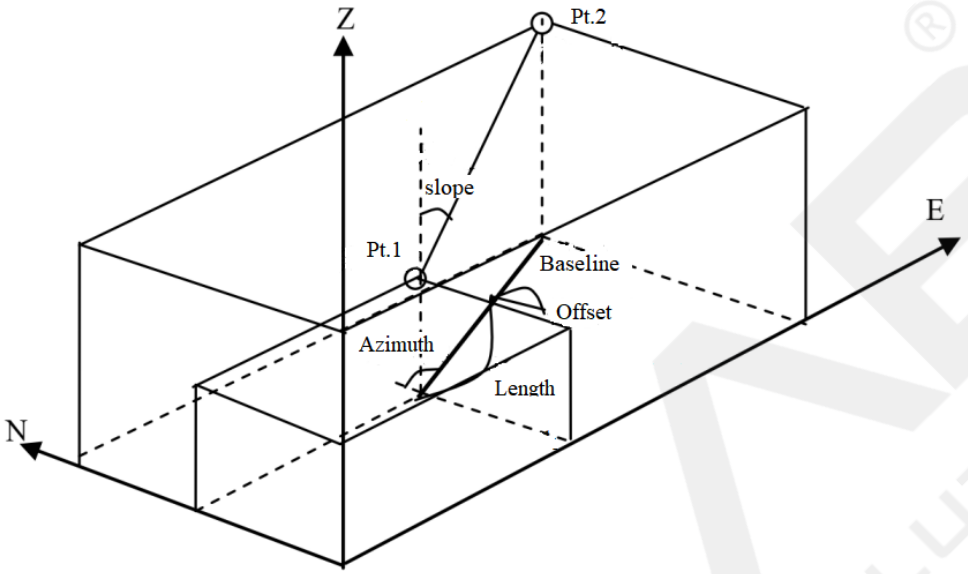
▸Step

Operating process	Key	Display
(1) On the［MENU］display, select the "8.area ". the points which take part in the calculate of the area calculation can be read from the memory or measurement.	［MENU］+ “8. Area”	--Menu-- 5.Remote meas 6.Resection meas 7.HA Repetition 8.Area 9.Road design & S-O 0.point Proj. AREA 01: 02: 03: 04: 05: 06: READ MEAS
(2) Sight the first point of the polygon ,then press［MEAS］, the measurement results will be displayed on the interface.	［MEAS］	Coordinate meas. N: 95.391 m E: 149.216 m Z: 2.490 m S: 50.992 m V: 271° 00′ 00″ HR: 264° 48′ 53″ STOP

(3) When complete the measurement, the result will show as "pt_01".	［STOP］	
(4) Repeat Steps 2 to 3, finish the point measurement in clockwise or counterclockwise		
(5) You can also use coordinate data in memory. Press the［READ］, select the desired points in the memory, the information will be display on the interface.	［READ］	
(6) Complete measurement, press［CALC］,then you can get the result.	［CALC］	
(7) Press［END］, stop area calculation and return to the menu interface. Press[［NEXT］to perform the area calculation program again.	［END］	

14. Straight-line set out

It is used to setting-out the baseline to the point that distance to the baseline is designed. It is also used to measure the distance from the baseline to a measuring point.



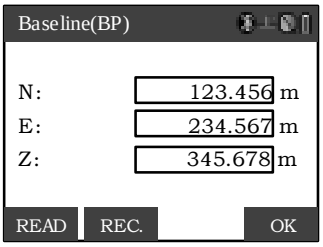
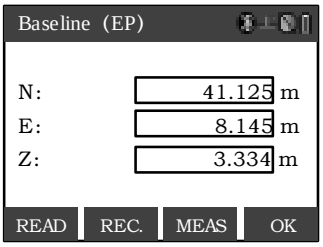
14.1 Define baseline

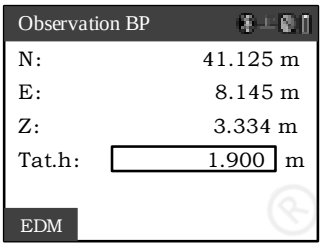
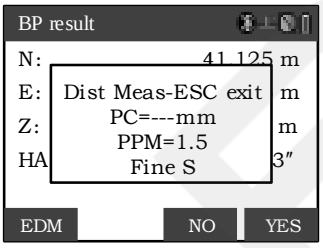
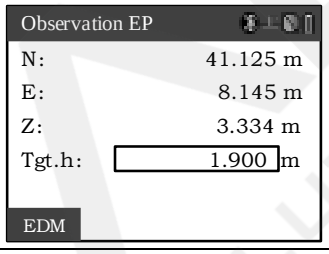
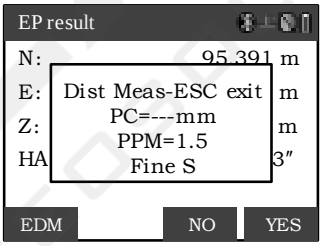
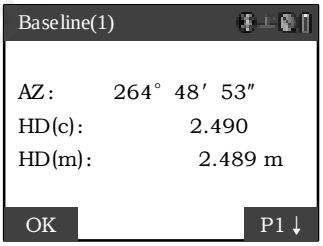
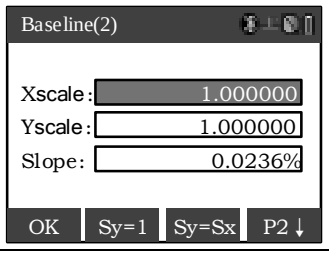
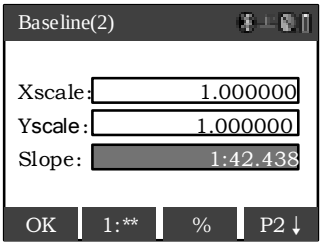
It is required to define the baseline before perform the measurement. The baseline can be defined by entering the two-point coordinates. The ratio values indicate the differences between the coordinates entered and the coordinates of the observation.

$$\text{ratio } valucs = \frac{Hdist'(\text{the distance calculated by the coordinates of obvervation})}{Hdist(\text{the distance calculated by the coordinates inputted})}$$

• The ratio is 1, if the first or the second points is not be observed.
• The definition of the baseline can be used for straight-line set out measurement and point projection.

▸Step

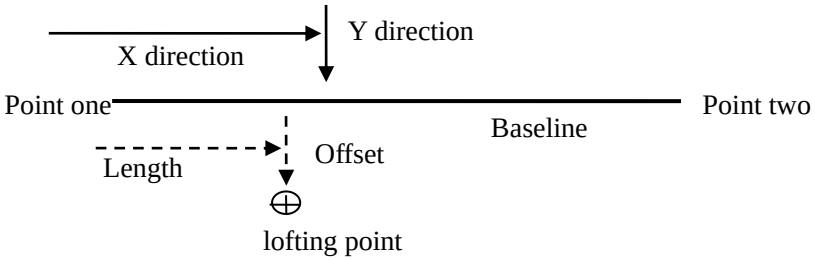
Operating process	Key	Display
(1) In the MEAS mode, arrange［S-O］to the soft keys firstly. Select the "4. S-O line", then select the "1. Def. baseline ".	1. Def. baseline	
(2) Press［READ］,get coordinate data form memory You can also manually enter the known points.	［OK］	

(3) Complete set the points , press［MEAS］to measure baseline point.. If do not to measure baseline start and end point, press［OK］directly to Step (7).	［MEAS］	
(4) Sight the first point of the baseline, and press［EDM］,the results are displayed on the interface.	［EDM］	
(5) Press［YES］, to confirm the results. Press［NO］to measure the start point again	［YES］	
(6)Sight the end(second) point of the baseline, press［EDM］, then the measurement results will be displayed on the interface.	［EDM］	
(7)Press［YES］,confirm the results. The instrument can calculate the distance between the start point to the end point, and we can get the scale factor on the display.	［OK］	 
(8)Press［OK］, complete the definition of the baseline, and return to the menu. Press［F4］to page ,press［Sy=1］,set scale factor Y to 1,When you focus on" slope" ,press［1:**］to convert ratio display mode 1: **= elevation: horizontal distance	［1:**］	

14.2 Straight-line point set out

The instrument can calculate the coordinate of setting out point by the entering length value and the

offset value based on certain baseline, and set the target on the position of the calculated coordinate.
• Define baseline before setting out.

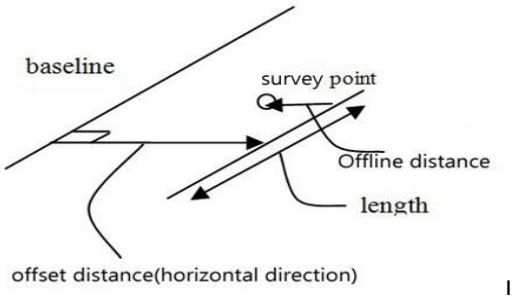


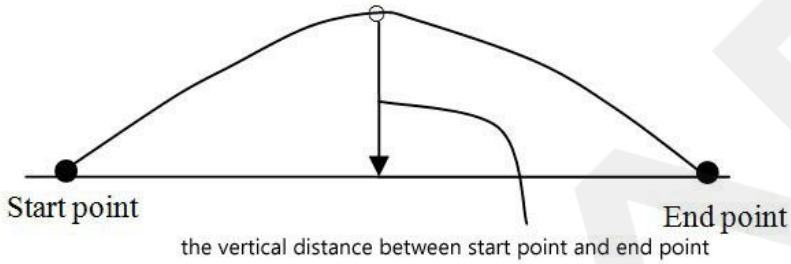
▶Step

Operating process	Key	Display
（1）In the line stakeout menu, choose "2.point stakeout", then press［ENT］	"2.point stakeout"+［ENT］	--Stakeout line-- 1.Def. baseline 2.S-O Point 3.S-O line 4.Stn.data 5.BS coord. 6.BS angle
（2）Enter the following items: length: the distance of baseline start point to the point which stake point projected to baseline. Offset: the vertical distance from stake point to the baseline.	Input length. offset. Height difference	S-O line(point) length: 5.000 m offset: 12.000 m HV: 1.000 m OK
(3) Press［OK］,to calculate and display the coordinate of stake point.(press［F4］to page 2) Record: save the calculated coordinate. Press［HT］to register the target height. Press［S-O］to setting out the point.	［OK］ ［F4］	S-O line(point) N: -1.663 m E: 13.724 m Z: 2.118 m S-O REC. HT P1↓ S-O line(point) Dist: 212.212m Angle: 241° 22′ 33″ Tgt.h: 1.000 m S-O REC. HT P2↓

14.3 Line setting-out

Line setting-out is used to measure the horizontal and vertical distance from the point to baseline.
• Baseline must be defined before staking out line.

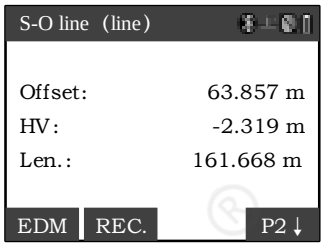
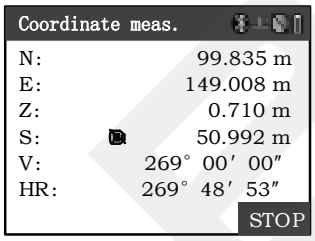




section view

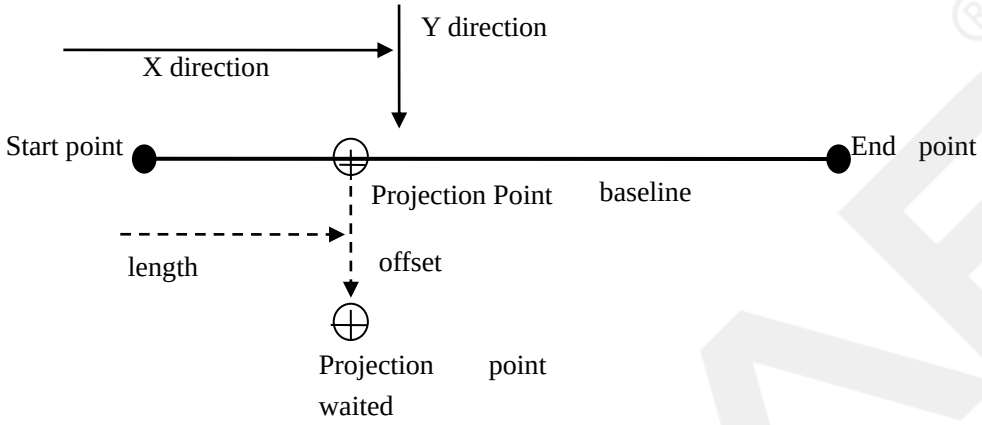
▶Step

Operating process	Key	Display
(1) In the line stakeout menu, choose "3.S-O line ",then press［ENT］.	“3.S-O line” + ［ENT］	--Stakeout line-- 1.Def. baseline 2.S-O point 3.S-O line 4.Stn.data 5.BS coord. 6.BS angle
(2) Enter offset value: Offset: the moved distance in horizontal direction of baseline. Moved to right the value is plus, moved to left the value is minus.	Input length. offset	S-O line(line) Offse: 5.000 m EDM
(3) Sight the first target, then press［EDM］,the interface will show the results.	Focus on target + ［EDM］	Coordinate meas. N: 95.391 m E: 149.216 m Z: 2.490 m S: 50.992 m V: 271° 00′ 00″ HR: 264° 48′ 53″ STOP
(4) The results is displayed on the interface(press［F4］go to page 2）. • Offset: the offset from measure point to required position, right offset is plus, the left offset is minus • HV: the height difference from measure point to baseline. If the value is plus, it means that the point is above the baseline. If it is minus, it means that the point is below the baseline. • Len.: the distance from the point to its	［F4］	S-O line(line) N: -1.663 m E: 13.724 m Z: 2.118 m EDM REC. P1↓

projection on baseline.		
(5) Sight the next target, press［EDM］, press［REC.］to save the result.	Focus on the next target+ ［EDM］	

15. Point projection

Point projection is used to project a point to a known baseline. It is possible to enter the coordinate or get the coordinate from measurement.



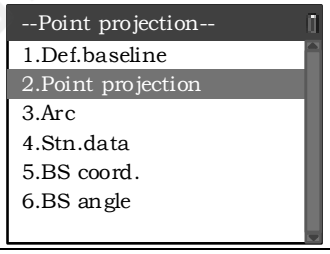
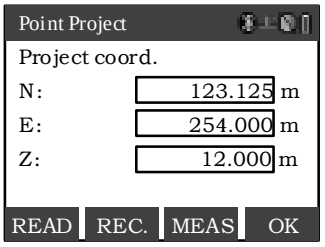
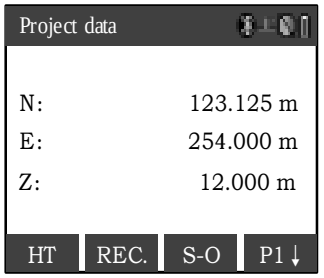
15.1 definition of the baseline

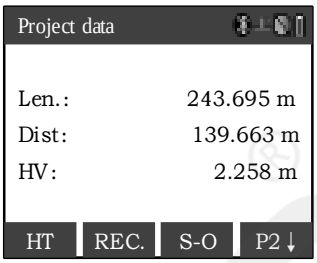
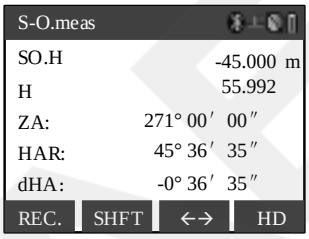
● The definition of the baseline can be used in line setting-out measurement and point projection. See Chapter 14.1 Steps.

15.2 point projection

Define the baseline before point projection.

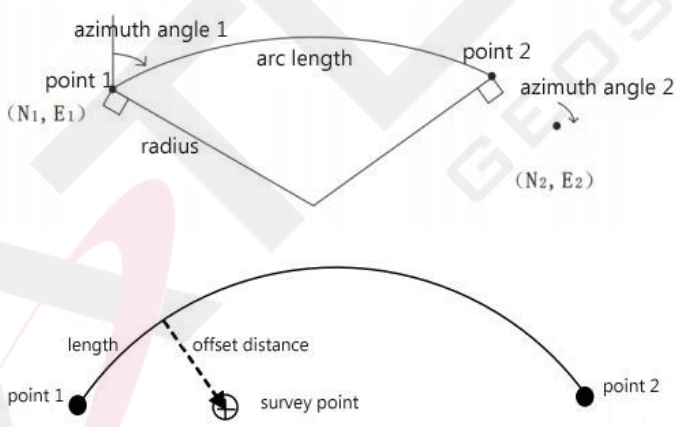
▸Step

Operation process	Key	Display
(1) Define baseline，refer to14.1.		
(2) Choose "2.Point projection "in projection menu, then press［ENT］.	"2. point projection" + ［ENT］	
(3) Enter the point of the projection or press • ［MEAS］to get the projection point coordinate .If you want to save the coordinate ,press［REC.］ • To get the coordinate form memory press［READ］	input the projection point coordinates	
(4) Press［OK］, then the instrument will calculate and display the results:(press［ F4］to page 2) •Len: the start point to project point •Dist: the vertical distance from the project point to the baseline. •HV: the height from the point (ready to	［OK］ ［F4］	

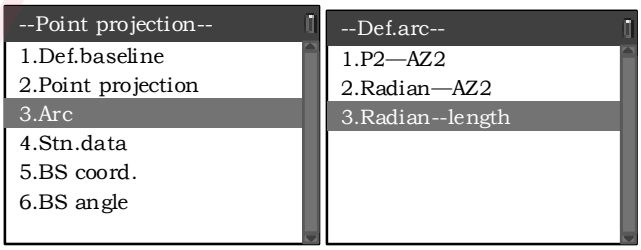
project) to foot point on the baseline. •Press［HT］to enter the target height •Press［REC.］to save		
(5) Press［S-O］ to perform point projection set out.	［S-O］	
(6) Press［ESC］		

15.3 Reference Arc

We can define an arc through three ways, and then measure a target point, so you can get the data relationship between target and the arc. It is equivalent to using the arc as a base line, similar to the point projection.

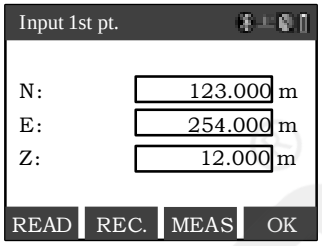
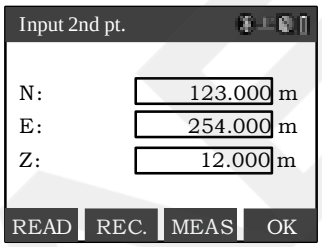
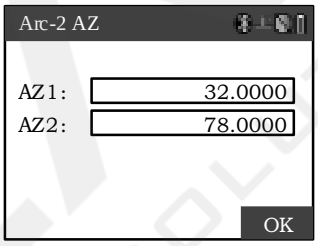
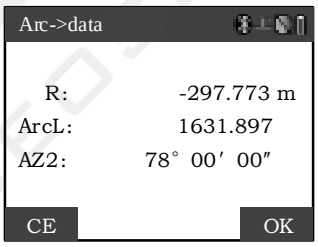


- You can enter this menu through point projection menu
- You can define “arc” to keys, and reach function menu through basic measurement interface
- You can define arcs by three ways



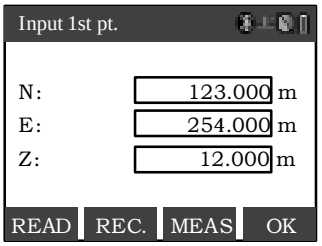
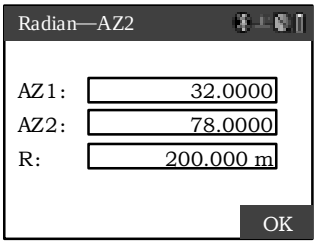
15.3.1 Two endpoint + two azimuth to define the arc

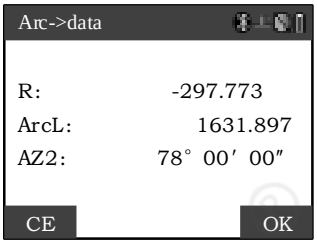
▸Step

Operation process	key	display
◆ Choose “1.P2—AZ2” In the menu, enter the P1 coordinate ［READ］:get the coordinate from memory. ［REC.］:record the current coordinate ［MEAS］:measure point P1 ［OK］: confirm your entry	“1.P2—AZ2”	
◆ Enter the P2 coordinate, the operation is the same with P1	［YES］	
◆ After inputting the tangent line azimuth of the two points, press［OK］.	［YES］	
◆ Calculate to get the arc data ［CE］：back to menu ［OK］：go to target point measurement	［YES］	

15.3.2 Endpoint + R + two azimuth to define arc

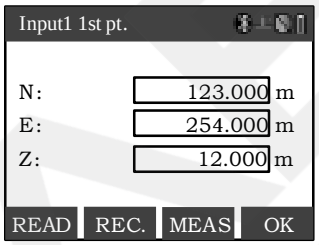
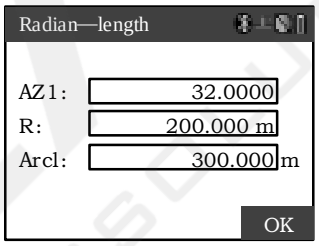
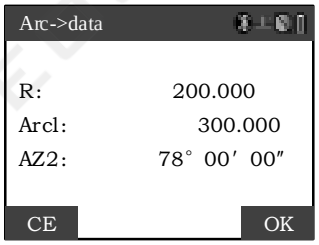
▸Step

Operation process	key	Display
（1）Choose “2. radian--AZ2”, you can enter the P1 coordinate ［READ］：get the coordinate from memory ［REC.］：record the current coordinate ［MEAS］：measure P1 ［OK］：confirm your entry	“2. radian--AZ2”	
（2）After setting the radius and tangent azimuth of two endpoints, press［OK］.	［yes］	

（3）Get the arc data ［CE］：back to menu ［OK］：go into target point measurement, refer to chapter 15.3.4	［yes］	

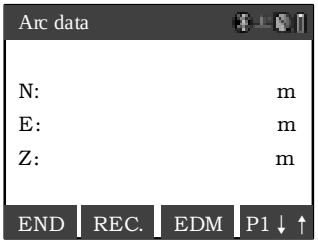
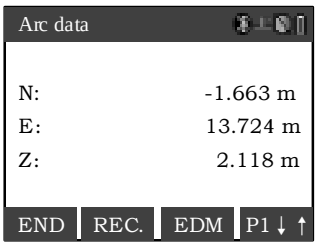
15.3.3 One endpoint + radian + one azimuth + arc length + radius to define arc

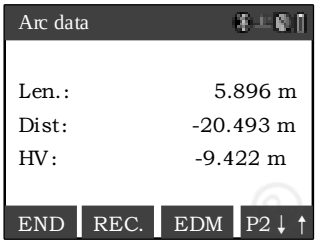
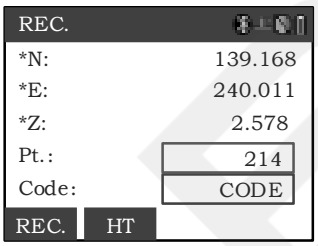
▸Step

Operation process	Key	Display
（1）Choose”3. radian--length” in the menu, you can input the P1 coordinate ［READ］：get the coordinate ［REC.］：record the current coordinate ［MEAS］：measure P1 ［OK］：confirm, go to next Step	3.radian--length”	
（2）Input the tangent line azimuth of an endpoint ,and the arc radius ,press［OK］.	［OK］	
（3）Calculate and get the arc data ［CE］：back to menu ［OK］：go to target point measurement, refer to chapter 15.3.4	［OK］	

15.3.4 Arc reference line target point measurement

▸Step

Operation process	key	display
（1）In the arc data interface, press［OK］,go to target point measure.	［OK］	
（2）Sight the target point，press［EDM］,get the target point coordinate.	［EDM］	

（3）Press［F4］,to page up and down, show you the relationship data between target point and arc.	［F4］	
（4）Press［REC.］,to record the current point coordinate.	［REC.］	
（5）Press［END］， back to menu.		

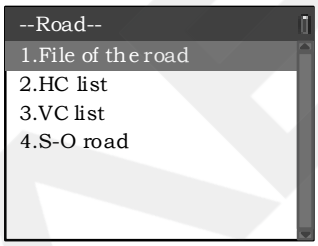
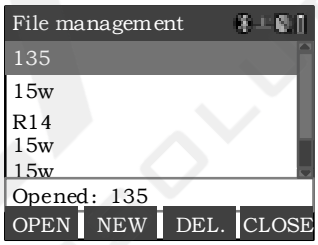
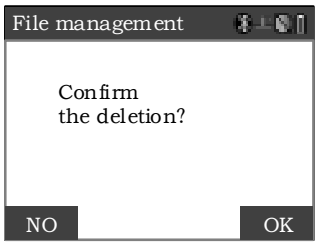
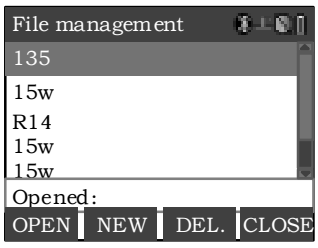
16. Road design and set out

You can set out the designed point by horizontal and vertical curve, stake number and the deviation.

16.1 Road file management

Manage the road file.

▸Step

Operation process	Key	Display
（1）Choose “9.Road design & S-O” in the［MENU］, then press［ENT］.	“9. Road design & S-O” + ［ENT］	
（2）Select “1. File of the road “in “9. Road design and S-O” menu	“1. File of the road “	
（3）Press［NEW］， to create a new road file. Enter a name of the new road file, press［OK］,then you can create Horizontal and vertical alignment file with the same name.	［NEW］	
（4）Press［DEL.］to delete a road file. When completed, the list will be refreshed.	［DEL.］ ［ENT］	
（5）Press［OPEN］,to set the current file as the road working file. Press［CLOSE］to set the current road file empty.	［CLOSE］	

16.2 Define horizontal alignment of roadway（at most 30 datum）

The horizontal curve data can be manually edited, and also be imported from the computer. There

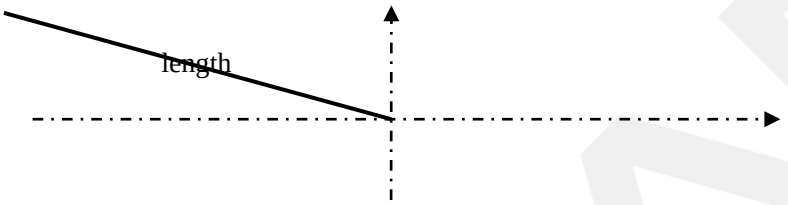
are two ways to define the horizontal alignment: one is "element ", another is "intersection".

16.2.1 Define a horizontal alignment by “element method”

The element method consists of the following elements: the starting point, straight line, circle and easement curve.

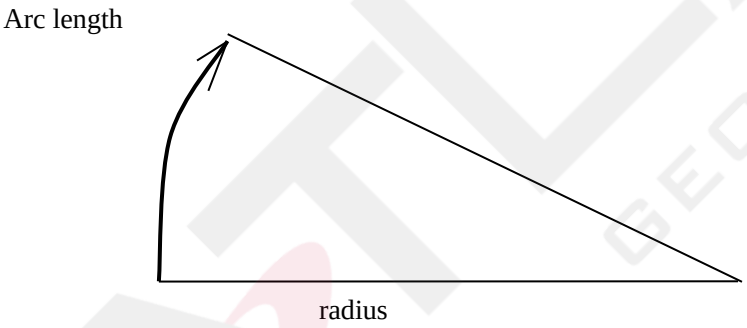
- Straight line

The straight line can be defined when start point and other type of line have been defined.



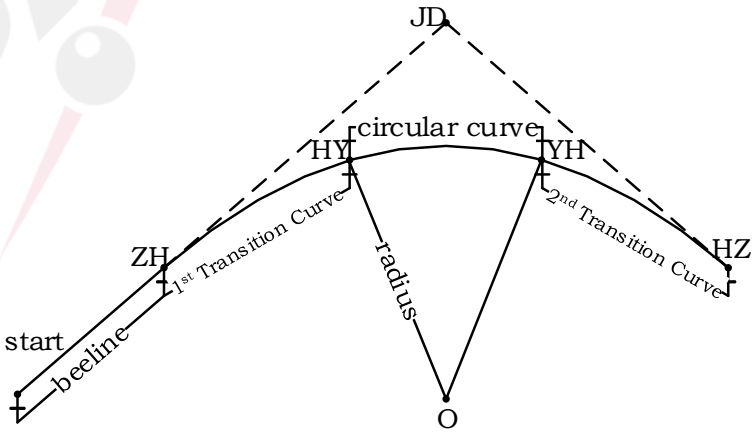
Straight line includes azimuth and distance, and the distance cannot be minus.

- Circle



Circular curve includes radius and arc length. The rules of radius: Along the curve direction, when turning to the right, the radius is positive, negative radius when turning to the left. Arc length cannot be negative.

- Easement curve

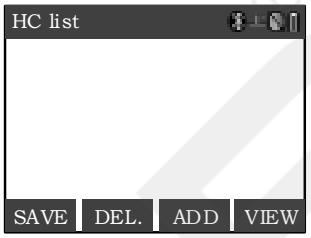
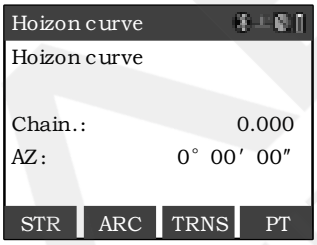
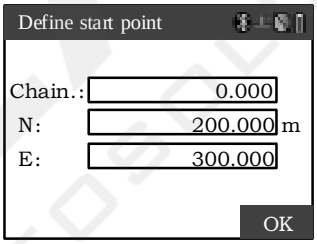
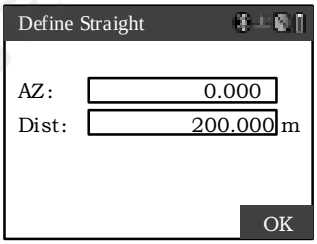
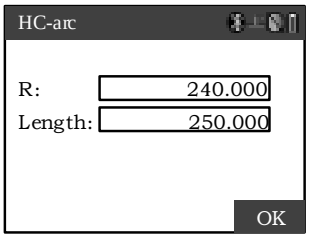
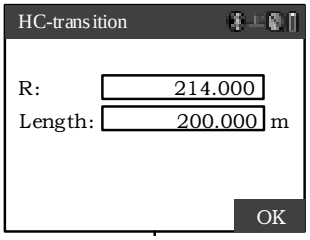


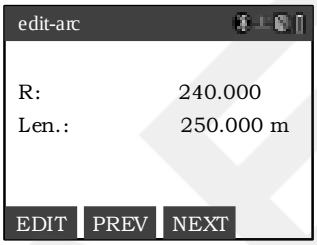
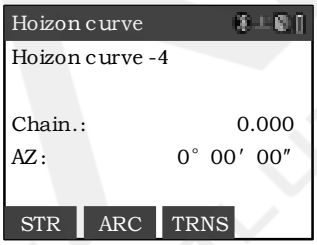
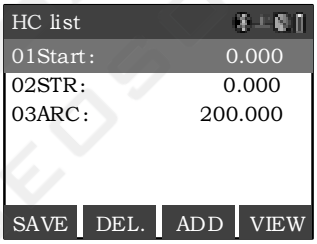
Easement curve data includes the minimum radius and arc length. The radius positive-negative

regularity of easement curve is the same as the radius of circle. Also, the arc length cannot be negative.

Follow is the input Steps of the horizontal alignment element method.

▸Steps

Operating procedure	Key	Display
(1) Choose "2.HC list" from the road menu.	"2. HC list"	
(2) Press［ADD］. If you haven't input starting point, you will come in starting point interface whatever straight line, circular curve or easement curve you choose. Input the start point and press［OK］.	［ADD］ ［OK］	 
(3) Press［STR］come in the straight line data input interface. When completed setting, press［OK］.	［STR］	
(4) Press［ARC］come in the circular curve data input interface. When completed setting ,press［OK］.	［ARC］	
(5) Press ［TRNS］ come in the easement curve data input interface.	［TRNS］	

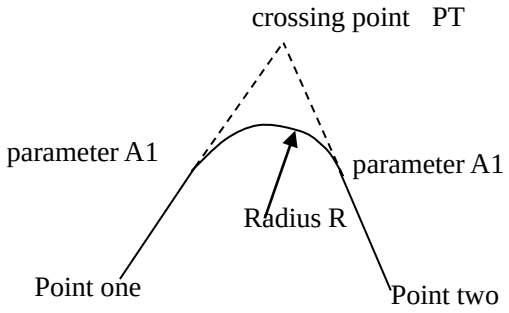
(6) Complete setting all line data, press［ESC］return to horizontal alignment list interface.	［ESC］	
(7) Press ［VIEW］to show the road data of the line you chosen. Here we choose the circular curve as an example. You can view the road date in the list according to［▼］［▲］. Press［EDIT］to edit the road data.	［VIEW］	
(8) Press［ADD］to add new road data.	［ADD］	
(9) Press［DEL.］to delete the chosen line date (start point is forbidden).	［DEL.］	
(10) Press ［SAVE］ to get a prompt box , press［ENT］to save the data in the current opened road file.	［SAVE］	

Note: If you don't save the data, there will be no data or the data existent earlier in the road file when you restart the total station.

16.2.2 Define the horizontal alignment by "intersection method"

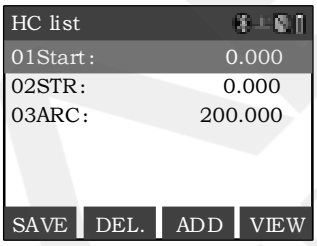
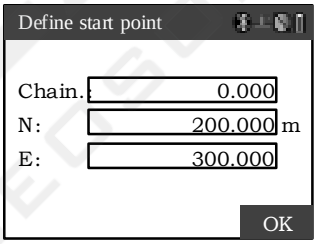
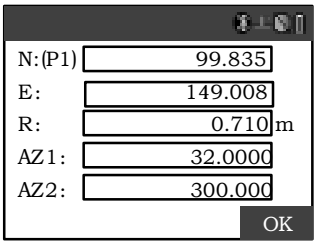
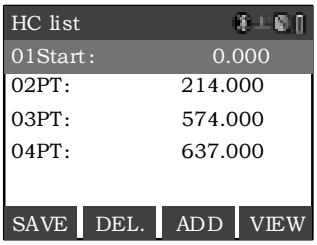
The intersection of point includes coordinate，radius and parameters A1,A2 of the easement curve. The radius and parameters A1, A2 can't be minus. If inputting radius there will be inserted an arc with a specified radius between the current point and the next point. If inputting easement curve and parameters A1, A2 there will be inserted an easement curve with a specified length between the straight line and the arc.

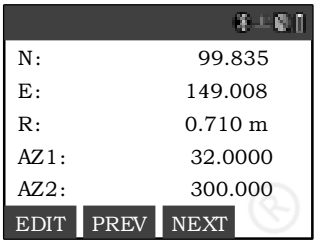
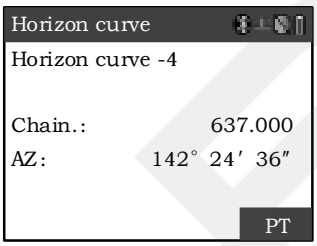
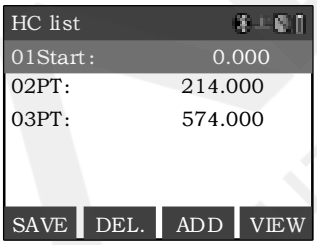
Don't mix the point of intersection with the straight line, arc and easement curve, or the calculation will be wrong.



Follow is the Intersection method definition of horizontal alignment input Steps.

▸Steps

Operating procedure	Key	Display
(1) Choose "2. HC list" from the road menu.	"2. HC list"	
(2) Press［ADD］come in line choose interface . If you haven't input starting point, you will come in starting point interface.	［ADD］ ［OK］	
(3) Input start point, then press［OK］come in the point of intersection input interface. Press［OK］to input the next point of intersection.	［OK］	
(4) After input all points of intersection press［ESC］return to horizontal alignment list interface. It is line + N coordinate of the intersection in the list.	［ESC］	

(5) Press［VIEW］to show the detail data of the current road you chosen. ·You can view the road date in the list according to［◄］or［►］. ·Press［EDIT］to edit the road data, the operation is the same as the input.		
(6) Press［ADD］to continue to add new road data.	［ADD］	
(7) Press［DEL.］to delete the line date chosen(start point is forbidden).	［DEL.］	
(8) Press［SAVE］to get a prompt box , press［ENT］to save the data in the current opened road file.	［SAVE］	

Note：Use the following formula to compute when you input A1,A2 according to L1，L2.

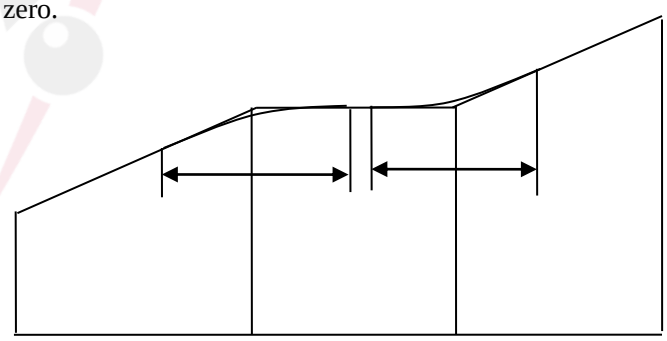
$$A_1 = \sqrt{L_1 \cdot radius}$$

$$A_2 = \sqrt{L_2 \cdot radius}$$

You can edit the alignment just according to the alignment menu.

16.3 Define the vertical alignment(Up to 30 datum)

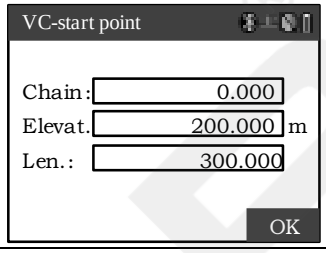
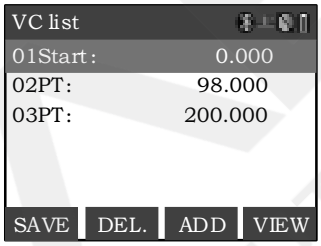
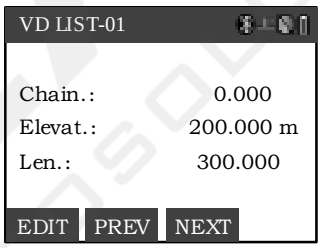
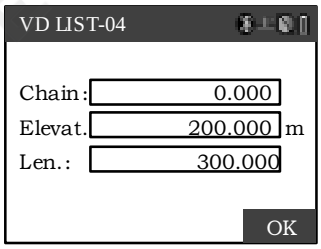
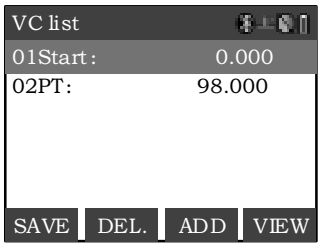
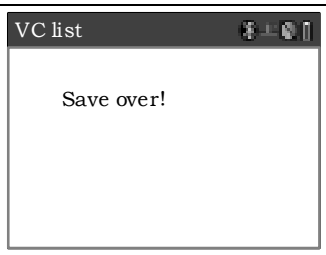
Vertical alignment consists of a set of intersection points. Intersection point including pile number, height and the curve length. The curve length of starting point and end point of vertical alignment must be zero.



Chain	1000	1300	1800	2300
Elevation	50	70	60	90
Lenth	0	300	300	0

Following is the vertical alignment input Steps.

▸Steps

Operating procedure	Key	Display
(1) Choose "3. VC list" from the road menu.	"3. VC list"	
(2) Press［ADD］come in line choose interface. After input data, press［OK］to input the next point.	［ADD］	
(3) After input line data, press［ESC］return to vertical alignment list interface.	［OK］	
(4) Press［VIEW］to show the detail data of the current road you chosen. ·You can view the road date in the list according to［▼］［▲］. ·Press［EDIT］to edit the road data, the operation is the same as the input. .	［VIEW］	
(5) Press［ADD］to continue to add new road data.	［ADD］	
(6) Press［DEL.］to delete the line date chosen(start point is forbidden).	［DEL.］	
(7) Press［SAVE］to get a prompt box , press［ENT］ to save the data in the current opened road file.	［SAVE］	

16.4 Stake out road

You can do alignment lofting of the design points according to design road pile number and deviation.

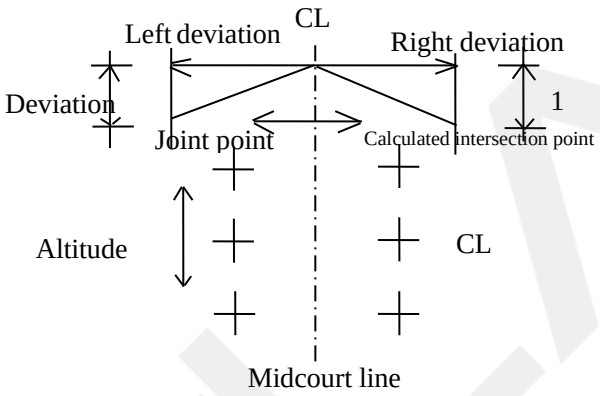
You must define the line first for alignment lofting. The way to define the alignment: Load the data from computer according to the function［receive horizontal alignment data］in［road design & S-O］，or input by hand in［HC list］.

The vertical alignment doesn't have to define, but you have to define it if calculating altitude difference. The definition method is the same as the horizontal alignment.

The definition of the alignment lofting data as shown below.

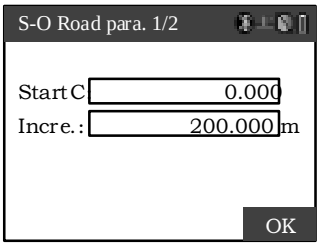
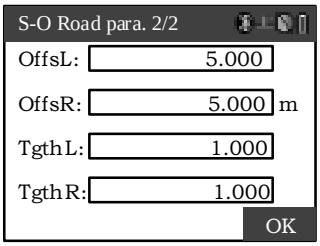
Deviation left: Mean the horizontal distance between left pile and center line, right: Mean the horizontal distance between right pile and center line.

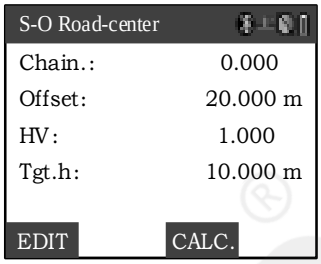
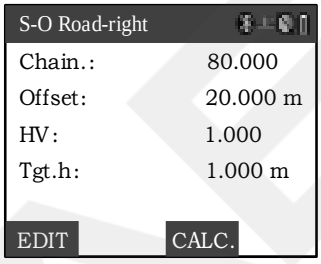
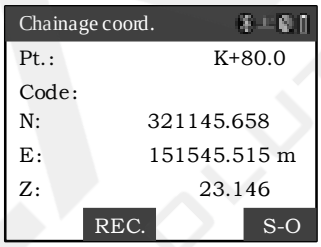
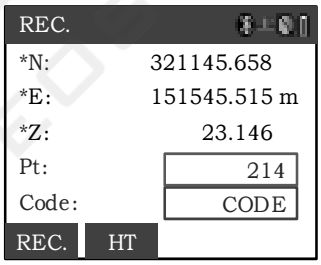
Altitude difference left(right): Mean the horizontal distance between left(right) pile and center line, respectively.



When set up station point and backsight point, we can begin Staking out road.

▸Steps

Operating procedure	Operating	Display
(1) Select "4. S-O road" in the "Road lofting" menu.	"4. S-O road"	
(2) After input data, press [OK] come in calculating parameter interface.	[OK]	

(3) After input parameter , press [OK] come in the interface that you can select pile number, left, right, and center pile. ● Press [◄][►] to left and right pile. ● Press [▼][▲] increase or decrease of pile number. ● Press [EDIT] to edit the calculation parameters of the pile.	[OK]	 
(4) Press [CALC.] and the current pile point coordinate data are calculated. If need to compute other pile point data, then press [ESC] to return to Step 3.	[CALC.]	
(5) Press [REC.] to record the current pile point coordinate data..	[REC.]	
(6) Press [HT] come in the setting-out survey of current pile point. Specific operation sees setting-out survey	[HT]	

Note： If the road data is saved, you can go directly into the road lofting without having to input data when you start up the next time.

Following is the statement of the lofting parameter:

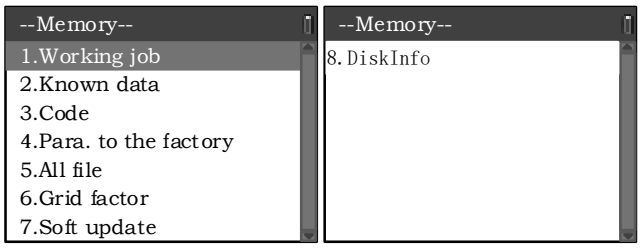
Left deviation (right deviation): Current left pile (right pile).

Left altitude difference (right altitude difference): Current left pile (right pile).

Increase or decrease of pile number: increase or decrease according to the distance between the piles.

17. Data recording

Memory mode interface



• Enter the memory mode, press［MEM.］on the status interface.

• In the memory mode, the operation of the data about work file and memory can be done.

• Select work file;

• Delete work file;

• Register the known data in advance;

• Clear the coordinate data in memory;

•Read the coordinate data from memory;

•Input code;

• Read code;

• Output the data of work file to computer;

• Software upgrade

The machine supports up to 8G U disk read and write, when running the program, don't insert or pull out the U disk. If you pull out the U disk when the instrument checking it, the subsequent operations may cause error!

17.1 JOB file

17.1.1 Select current JOB file

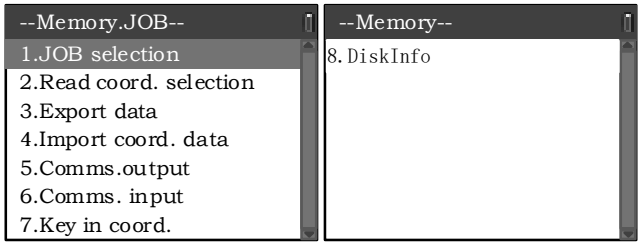
• Before recording the data, select the work file of recording and the file to be read. It is possible to read coordinate data from the file which is selected for read. Following is the data that can be recorded into the work file.

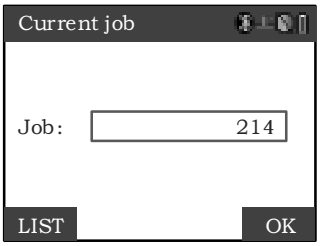
• Observation data

• Instrument station data and backsight data

• Annotation data

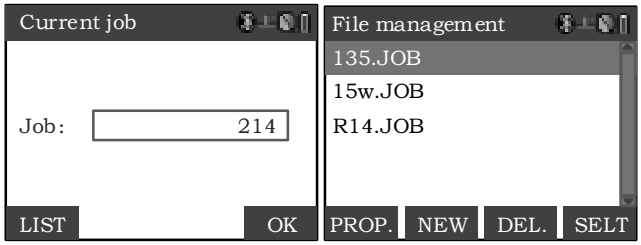
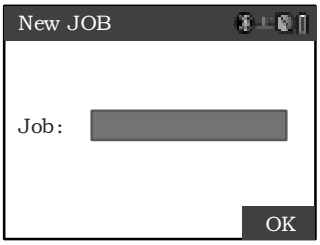
▸Steps

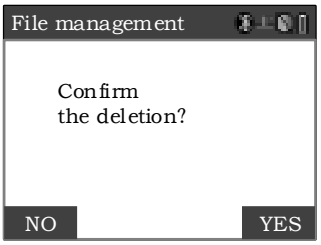
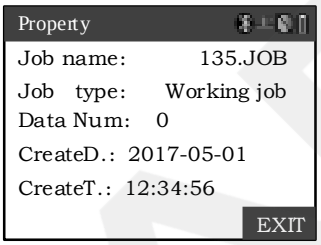
Operating procedure	Operating	Display
(1) In the memory mode, select "1.work file" and then press［ENT］, the "File Management " interface is displayed.	"1.Work file" + ［ENT］	

(2) Select "1.JOB selection" and then press［ENT］, the "JOB name edit interface" is displayed. Input the file name and then press［OK］to set the current working file.	"1.JOB selection" +［ENT］	
(3) Press［LIST］, enter the disk selection interface, display all the working file names, press [▲] or [▼] to move the cursor to the working file name you want to select, and press [Select] to recall the file successfully.	［LIST］	
(4) Press［ESC］to return to work file management list interface.	［ESC］	

17.1.2 Check the memory status and format disk

According to this operation you can display the properties of the currently selected file .

Operating procedure	Key	Display
(1) According to the first and second Steps described in the select current work file, the "Current job selecting" interface is displayed.		
(2) Press [New] to enter the new file interface, enter the file name and press [OK].	［NEW］	

(3) Press [Del.] , a confirmation box will be displayed , asking for confirmation again. Press[YES]to delete. The currently open file does not allow deletion.	［Del.］	
(4) Press [PROP.] to display the properties of the currently selected file.	［PROP.］	

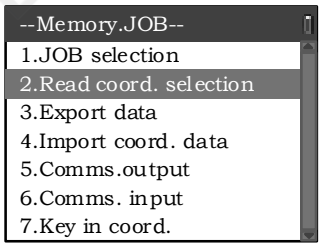
17.1.3 Work file management

Set up a new work file. The file name can be letters A to Z, also it can be Numbers 0-9 or a combination of both, can't contain characters do not conform to the rules and use the existing file name.

17.1.4 Select the file for reading

The file which has been selected to read data from can be used to read coordinates data.

▸Steps

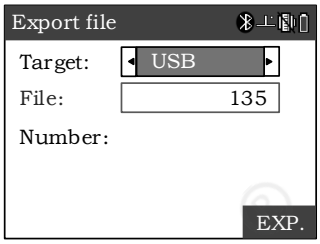
Operating procedure	Operating	Display
（1） Press "2. Read coord. selection " , then press［ENT］in “memory.work file” list. Select the file for reading.	"2.Read coord. selection " + ［ENT］	

17.1.5 Export file data

It need to insert the SD card or USB flash disk to firstly if export the data from the local disk or SD card into the SD card or USB flash disk, all the exported file will automatically convert to TXT format file.

▸Steps

Operating procedure	Key	Display
（1） Press "3. Export data " （2） Select the disk of the work file to be exported, then press［OK］into the work file list.	“3.Export file data” + ［ENT］	

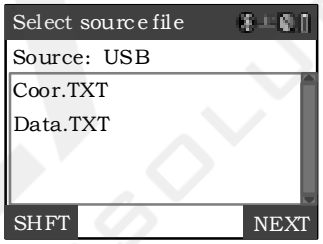
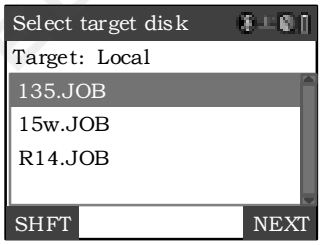
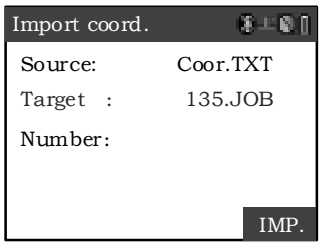
（3）Select the file to be exported, then press［NEXT］. Select the target disk, you can change the file name again, then press［EXP.］to start exporting data.	［Next］	

17.1.6 Import the coordinate data

·Need to insert the SD card or USB flash disk to import the data from the USB flash disk or SD card to a local disk or SD card. You can't do this operation between the local disk files.

·The format of the file imported: PTNO (point number), E, N, Z, CODE (code), each line ends with "enter+ newline", and at the file end must have an empty line of "enter + newline", in other word, press the enter key again behind the last data.

▸Steps

Operating procedure	Key	Display
（1） Press［ENT］after select "4.import coord.data" in the "memory.work file" menu, It will display the file for the coordinate imported.	"4.import coord.data"	
（2） Press［SHFT］you can switch between SD card and USB flash disk. Selected file, press［NEXT］, and it will display the selection of the target disk.（3）After selecting the disk, press［OK］, it will display a list of work files in the disk.	［NEXT］	
（3） After selecting the target file, press［NEXT］, the information about the import operation is displayed , then press［IMP.］, preform importing the coordinate data.	［NEXT］ + ［IMP.］	

17.1.7 Send the file data to a computer

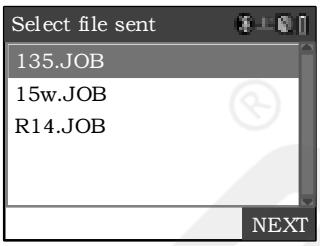
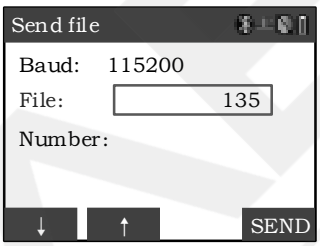
It is need to connect the instrument and PC computer with the serial port line, and match up with the transfer software.

▸Steps

17.1.8 Receive coordinate data

It is need to connect the instrument and PC computer with the serial port line, and match up with the transfer software.

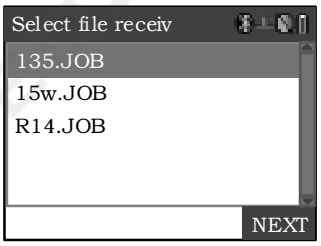
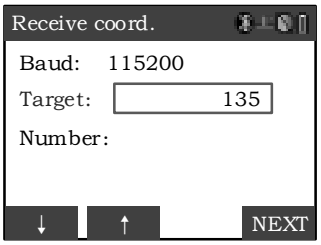
▸Steps

Operating procedure	Key	Display
（1） Select “5. Comms.output ” in“memory.work file”, then Press [NEXT].	“5.Comms.output” +[NEXT]	
（2） Select the file to be sent, then press [NEXT] ,the “send file ” interface is displayed. ·Press[↑] to increase baud rate. ·Press[↓]to decrease baud rate. ·Press [SEND] to start sending data , it will refresh the "send number" in the process of sending until send over.	[NEXT]	

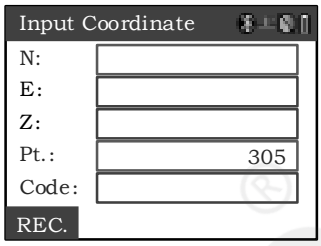
17.1.9 Input coordinate data

Can input the coordinate data to the work file by hand.

▸Steps

Operating procedure	Key	Display
（1） Select “6.Comms input” in“memory.work file”, then Press［NEXT］.	“6.Comms input”+［NEXT］	
（2） Select the file to receive the coordinate data , then press［NEXT］, the“receive coord. Information ” interface is displayed. ·Press［↑］to increase baud rate. ·Press［↓］to decrease baud rate. ·Press［RECV.］to start receiving data , it will refresh the "receive number" in the process of receiving until receive over.	［NEXT］	

Operating procedure	Key	Display

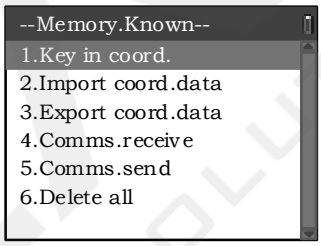
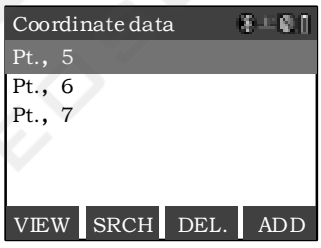
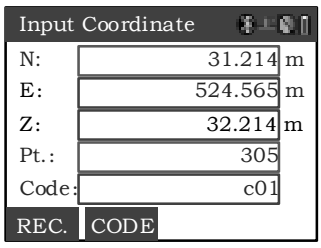
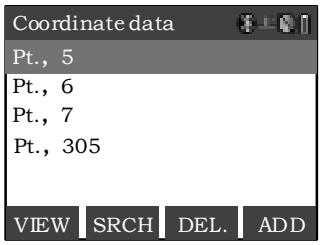
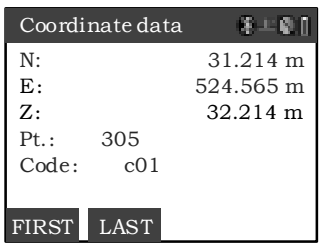
Select “7.Key in coord.” in the“memory. JOB”, then press［ENT］. After inputting the coordinate data , press［REC.］, the coordinates are recorded into the current working file. If you want to view the data, see the data view method in the record mode.	“7.Key in coord.” + ［ENT］	

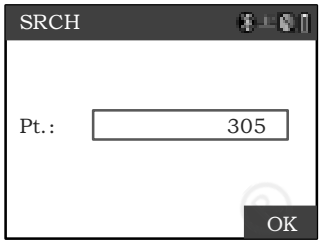
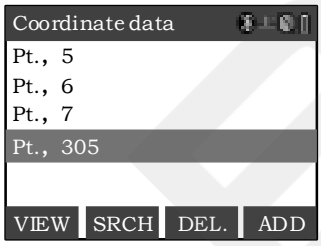
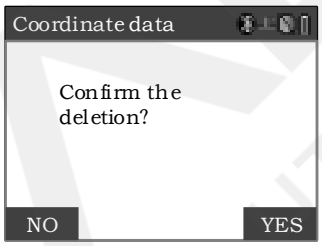
17.2 Known points management

• Known coordinates can be input and stored in the instrument in advance. These data can be used as station point, backsight point, and setout point.
• The known coordinate data input in advance can use the keyboard, also can from external devices.

17.2.1 Known coordinate management

▸Steps

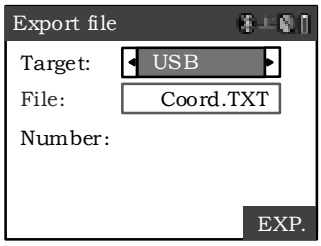
Operating procedure	Key	Display
（1） Select “2.known data” in the memory mode, then press［ENT］into known data menu interface.	“2.known data” + ［ENT］	
（2） Select “1.Key in coord” , then press［ENT］into the name list of coordinate data. Press［ADD］,coordinate edit interface is displayed. Press［ ENT ］or［ ▼ ］every time you input a data item.	“1.Key in coord” + ［ADD］	 
（3） Press［REC.］to store the coordinate in the file of the known coordinate. Press［ESC］return to the known coordinate list interface when the coordinate data input is finished.	［ESC］	
（4） Press［VIEW］to view the points data. ·［FRIST］view the first data. ·［LAST］view the last data. ·［▼］View the next data. ·［▲］View the previous data.	［VIEW］	

（5） Press［SRCH］and Input the point name desired and press［OK］to return the list of point, and the cursor is focused on the point name find.	［SRCH］ ［OK］	 
（6） Press ［DEL.］ and the confirmation prompt dialog box is given, then press［ENT］to delete.	［DEL.］	

17.2.2 Export coordinate data

·Need to insert the SD card or USB flash disk to continue, export the data from the local disk or SD card into the SD card or USB flash disk, all the exported file suffix will automatically convert to TXT format file.

▸Steps

Operating procedure	Key	Display
（1） Select “3. Export coord. data”in “memory.work file” list , then press［ENT］.	“3.Export coord. data”	
（2） Selected the target disk, you can change the file name , then press［EXP.］to start exporting data, you will be prompted when finish exporting.	［EXP.］	

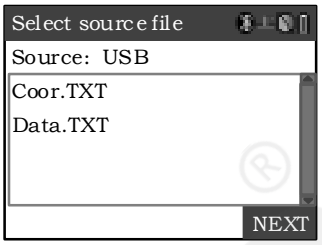
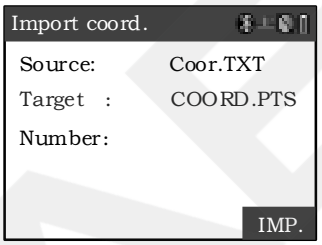
17.2.3 Import file data

• Need to insert the SD card or USB flash disk to import the data in the SD card or USB flash disk into the file in of known point in the local disk.

• The format of the file imported: PTNO (point number),E, N, Z, CODE (code) , each line ends with "enter+ newline”, and the file tail must have a empty line of carriage return + newline, in other word, press the enter key again behind the last data.

▸Steps

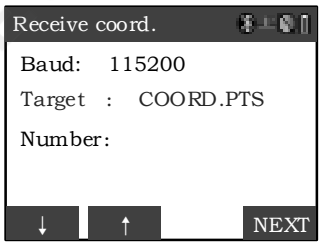
Operating procedure	Key	Display

（1） Press［ENT］after select “2.import coord.data” in the “memory.work file” menu, It will display the source selection of the file with the coordinate imported. Press［SHFT］you can switch between SD card and USB flash disk.	“2.import coord.data” + ［ENT］	
（2） After selecting the target file, press［NEXT］, then press［IMP.］begin to import the coordinate data. Notify when done.	［NEXT］	

17.2.4 Receive coordinate data

• This function needs to use the serial port line, connect the instrument and PC computer, and match up with the “transfer software”.

▸Steps

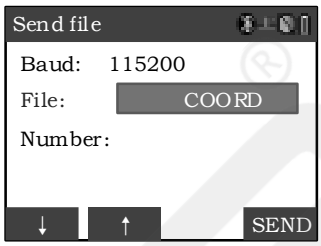
Operating procedure	Key	Display
（1） Select “4.Comms.receive” in“memory.work file”, then Press［ENT］. （2） Select the file to receive the coordinate data , then press［NEXT］ to the receive interface. ·Press［↑］to increase baud rate. ·Press［↓］to decrease baud rate. ·Press［RECV.］to start receiving data until finished , it will refresh the "receive number" in the process of receiving.	“4.Comms.receive”+ ［ENT］	

17.2.5 Import coordinate data

• This function need the serial port line, connect the instrumentation and PC computer, and match up with the “transfer software”.

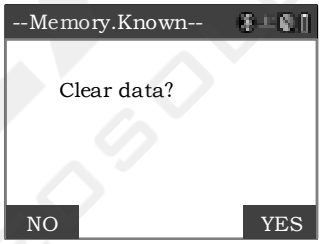
▸Steps

Operating procedure	Key	Display

（1） Select “5.Comms. send” in “memory.work file”, then Press［ENT］. （2） Select the file to receive the coordinate data , then press［NEXT］ into the receive interface. ·Press［↑］to increase baud rate. ·Press［↓］to decrease baud rate. ·Press［SEND］to start sending data until finished , it will refresh the "send number" in the process of sending.	“5.Comms. send” + ［ENT］	

17.2.6 Delete all the coordinate data

•This operation will delete all the known coordinate data in the memory immediately.

Operating procedure	Key	Display
Select “6.Delete all” in the “memory. known data” interface, then press ［ENT］, and the deletion confirmation prompt dialog box is given. Press［ENT］again to delete all data, press［ESC］to cancel.	“6. Delete all” + ［ENT］	

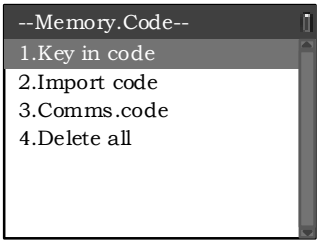
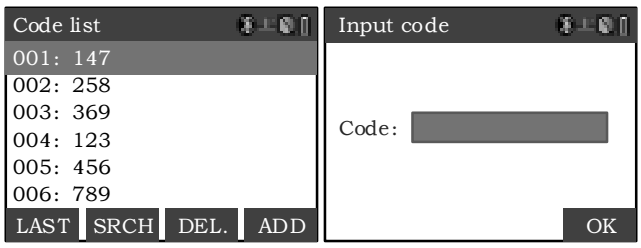
17.3 Code management

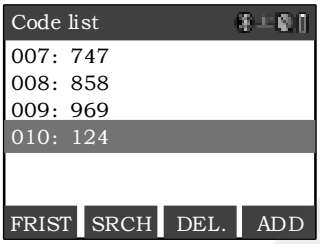
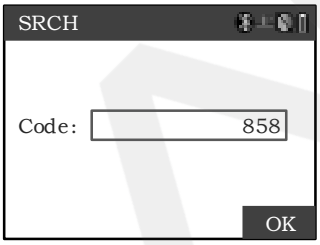
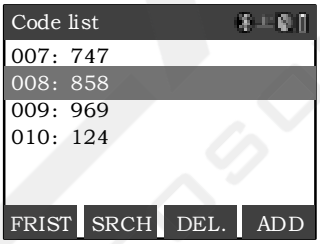
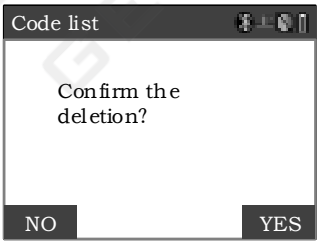
• Code can be deposited in the instrument memory in advance.

• When recording station data or observation data, you can invoke the code in memory.

17.3.1 Input code

▸Steps

Operating	Key	Display
（1） Select “3.Code” in the memory mode, and then press［ENT］into the code menu interface.	“3.Code” + ［ENT］	
（2） Select “1.Key input code” and then press［ENT］into the code menu, press［ADD］into the input code	“1.Key input code” ［ADD］	

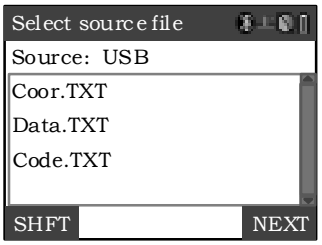
interface.		
（3） Press ［LAST］, and the button change to ［FRIST］,and the focus position to the last. ·Press ［FRIST］, and the button change to ［LAST］,and the focus position to the first.	［LAST］	
（4） Press ［SRCH］ and Input code and then press［SRCH］ to return to points list, the focus position to the code searched.	［SRCH］ ［OK］	 
（5） Press［DEL.］, and the confirmation prompt dialog box is given, then press ［ENT］to delete.	［DEL.］	

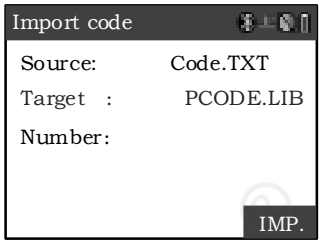
17.3.2 Import the code

• Need to insert the SD card or USB flash disk to continue, import the code from the SD card or USB flash disk into the code file in the local disk.

• The format of the file imported: CODE (code), each line ends with "enter+ newline", and the file tail must have an empty line of carriage return + newline, in other word, press the enter key again behind the last data.

▸Steps

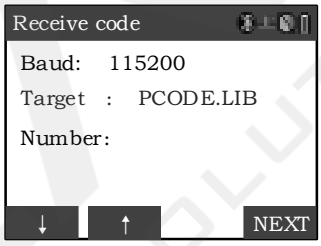
Operating procedure	Key	Display
（1） Select "2.Import code" in the "memory.code", then Press ［ENT］you can enter the source of disk file selection interface.	"2.Import code"	

（2） After selecting the file, press［NEXT］into import interface, then press ［IMP.］ to start importing the code. Notify when done.	［Next］	

17.3.3 Receive code

• This function needs to use the serial port line, connect the instrumentation and PC computer, and match up with the “transfer software”.

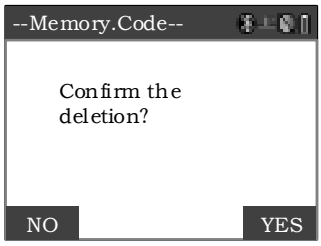
▸Step

Operating procedure	Key	Display
Select “3.Comms. code ” in“memory.code”, then Press［ENT］. ·Press［↑］to increase baud rate. ·Press［↓］to decrease baud rate. ·Press ［RECV.］ to start receiving code data until finished , it will refresh the "receive number" in the process of receiving.	“3.Comms. code ” + ［ENT］	

17.3.4 Delete all code data

• This operation will delete all the code data in the memory immediately.

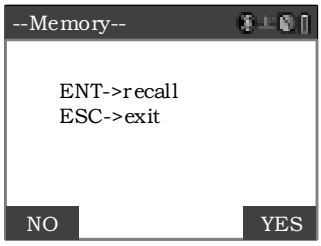
▸Steps

Operating procedure	Key	Display
Select “4.delete all” in the “memory,code”, then press［ENT］, and the interface shows a confirmation dialog box . Press［ENT］again will delete all the code data. Press［ESC］to cancel.	“4.Delete all” + ［ENT ］	

17.4 Restore the factory parameter

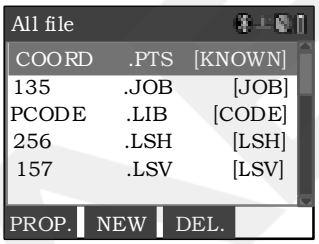
• This operation will make the instrument parameters restore to factory Settings.

▸Steps

Operating procedure	Operating	Display
Select “4.Para. to the factory” in the memory management mode, and then press［ENT］, the confirmation dialog box is given, then press［ENT］ to confirm or press［ESC］to cancel.	“4.Para. to the factory”+ ［ENT ］	

17.5 All files

▸Steps

Operating procedure	Key	Display
Select “5.All files” in the memory management mode, then press［ENT］and choose disk ,then press［OK］to show the file list. PCODE.LIB code fixed file and COORD.PTS known coordinate file. The two files system is set automatically and can’t be deleted. *.JOB work file *.LSH horizontal alignment file *.LSV vertical alignment file PCODE.LIB code fixed file COORD.PTS *.JOB working file *.LSH Horizontal alignment *.LSV Vertical alignment file	“5.All files” + ［ENT］ + ［OK］	

Note: Other operating see the working file

17.6 The grid factor setting

When calculating the coordinates, the horizontal distance measured must multiply by the scale factor. The original data will not change because of the scale factor.

Computation formula

1. $$\text{Altitude factor} = \frac{R}{R + ELEV}$$

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

$$HD = \frac{HDg}{\text{Grid factor}}$$

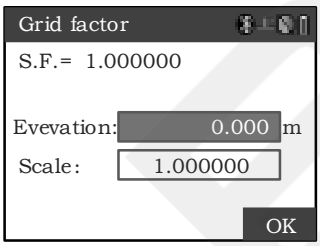
Note:

1. The input range of the scale factor: 0.99~1.01

2. The input range of the average height above sea level: -9999.9999~9999.999 9

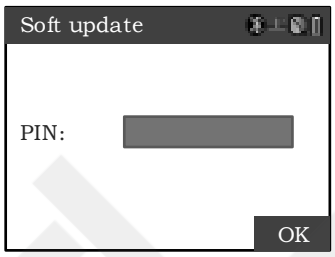
The average altitude retained after the decimal point one, the default value is 0.

▸Steps

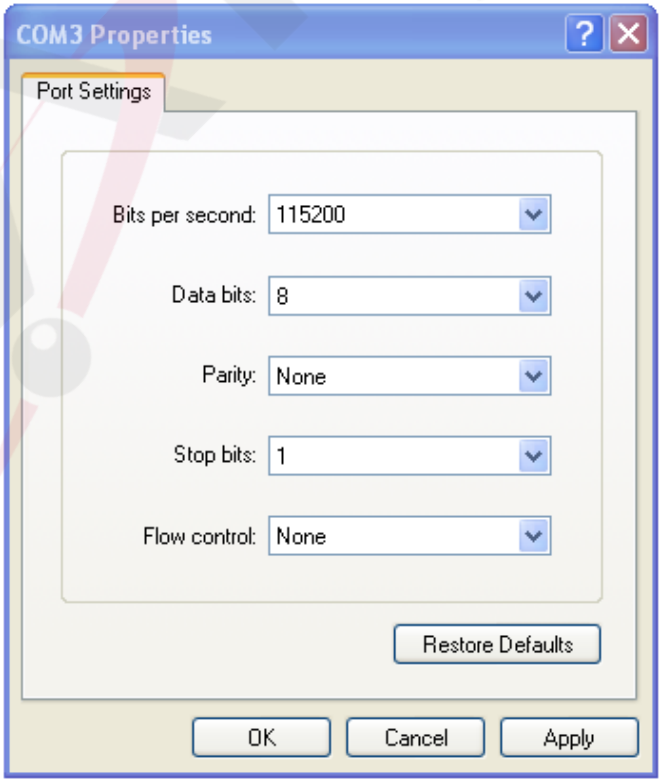
Operating procedure	Key	Display
Select"6.grid factor" in the memory management menu, and then press［ENT］, the interface will display the current setting. Input altitude factor and scale factor, then press［OK］, it will Compute the grid factor again.	"6.Grid factor" + ［ENT ］	

17.7 Software upgrading

This function is prepared for the users to upgrade the instrument software.

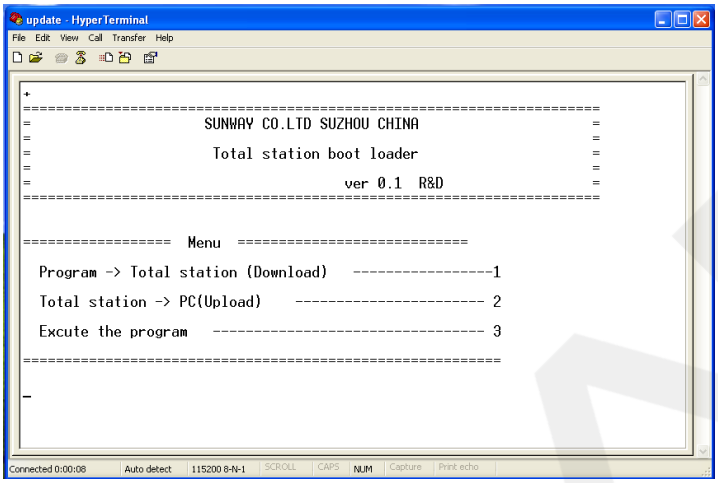


1. Input PIN code(82543), and then press［ENT］,the instrument will be turned off.
2. Connected to the computer through a serial cable, after installing the correct driver premise, open a HyperTerminal software, configure the correct serial port, it will "bits / sec" is set to 115200, "Data Flow Control" is set to "None" and press [OK];

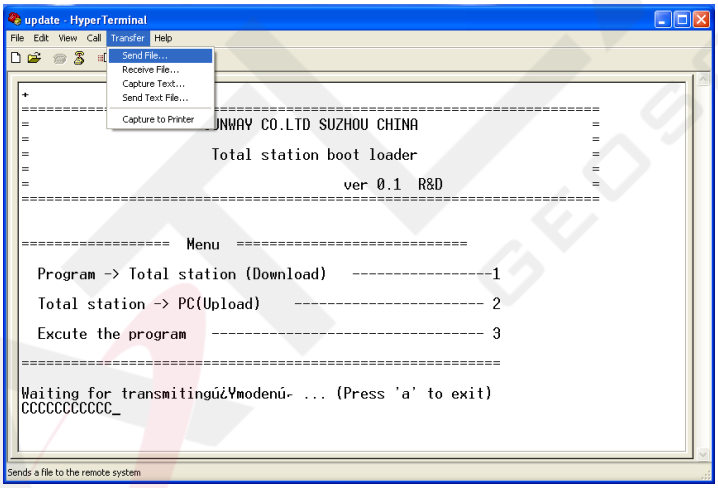


3. Press the power key of the instrument in Hyper Terminal, shown as follows:

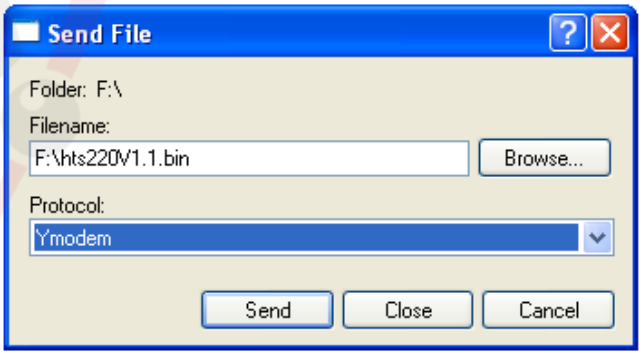
Note: Software upgrade operation must be careful once you select the instrument into the upgrade status; If press "3" in the picture below, you can also resume running the previous program.



4. Press [1] button on the keyboard into waiting to send program state, and then select "send file".



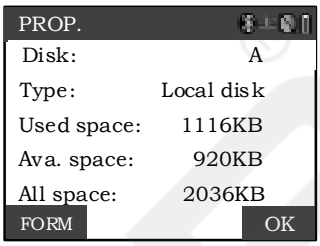
5. Select the new edition total station software, click on "send" button;



6. It will display the sending application process, then close the super terminal, starting up after removing the instrument battery and then putting in again. The current software is the new version updated previously.
7. After all updates are completed, press [3] to end the upgrade and run the Total station program

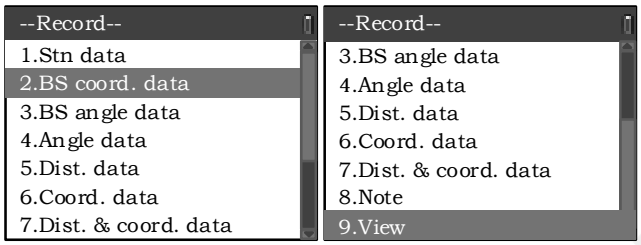
directly, and then close the HyperTerminal.

17.8 Disk information

Operating procedure	Key	Display
(1) Enter the Memoery ,select“8.disk info” and then press［ENT］.	“8.disk info	
(2) Press F1 to select Format Disk. Press [F4] (Yes) to format the disk.	F4［Yes］	
(3) Press [F1] (No) or ESC to exit the formatted disk.	［F1］［ESC］	

18. The date recording in the record mode

Record mode

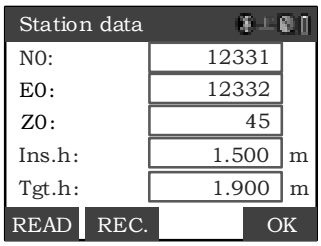
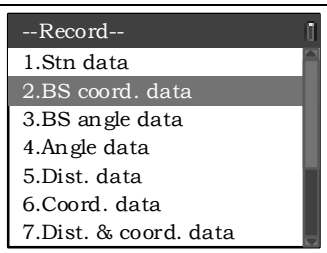


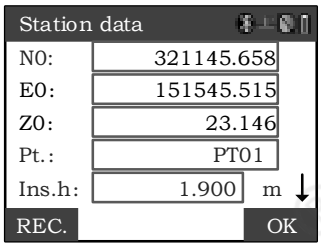
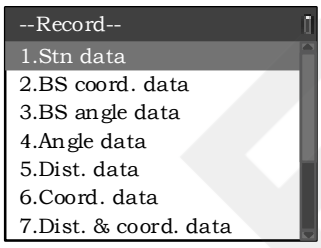
• Enter the record mode, and press［REC.］in the measurement menu.
• the recording can be performed with the data-related operations in the record mode.
• The data of Angle, distance, and coordinate observed can be recorded in the work file.
• Record the data of station point
• Record the data of backsight coordinate
• Record the data of backsight angle
• Record the data of angle measurement
• Record the data of distance measurement
• Record the data of coordinate
• Record the data of distance and coordinate
• Record the data of note
• View the data of work file

18.1 Record the station data

• The station data can record in the work file in the record mode.
• the record data include coordinate of station point, point number, coding, instrument height, the observer, date and time of observation, weather conditions, wind, temperature, pressure, meteorology, correction, prism constant correction and distance measurement mode.

▸Steps

Operating procedure	Key	Display
（1）Enter the record menu, then select“1.Stn data” and press［ENT］. Can press to invoke the coordinate or input directly.	“1.Stn data” + ［ENT ］	
（2）Press ［OK］ to record station coordinate, instrument height, target height into the current system parameter , then return the menu.	［OK］	

（3）Press ［REC.］ enter the input interface of station storage. Can input the following data items: Station coordinate, station name, instrument height, coding, name.	［REC.］	
（4）After Input the station data, press［REC.］to stored the station data in the current working file, then return record menu.	［REC.］	

Note: It will record the current ranging parameters at the time recording the station data.

18.2 Record the backsight coordinate data

There are two kinds of methods to record backsight data:

- Backsight by angle
- Backsight by coordinate

Recording backsight coordinate data see “7.2.2 Backsight by coordinate”.

18.3 Record backsight angle data

Recording backsight angle data see “7.2.1 Backsight by angle”.

Explanation: When recording angle, distance, coordinate data:

① In order to avoid reduplicative recording the same measurement data, after every record completed, the instrument will not display the［record］function before observing the new measurement data .

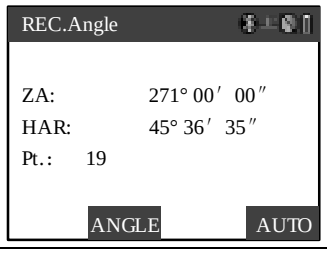
② For the use of automatic functions can be easily and automatically complete from the angle measurement to record the entire process.

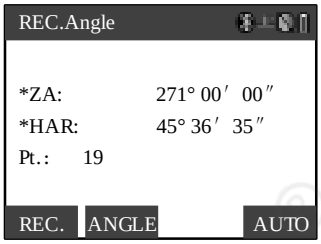
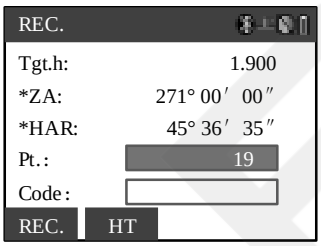
③ When Using the［auto］key, the angle measurement is not necessary in the measurement mode. Press［auto］in the record mode you can complete measuring and recording the results automatically, at the moment , the point name is the origin point number add 1, and the code remains unchanged.

18.4 Record the angle measurement data

• the record data is: Vertical angle, horizontal angle code and the target height.

▸Steps

Operating procedure	Key	Display
(1) Enter the record menu ,select “4. angle data” and then press［ENT］.	“4. Angle data” + ［ENT ］	

(2) Press［ANGLE］ to record the current angle, and the［REC.］ key is effective.	［ANGLE］	
(3) Press［REC.］into record data careen. Press［SAVE.］return to angle measurement after recording the data.	［ENT.］	

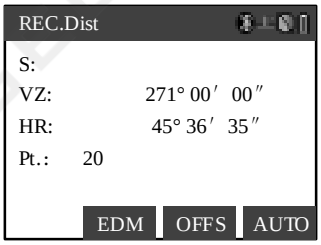
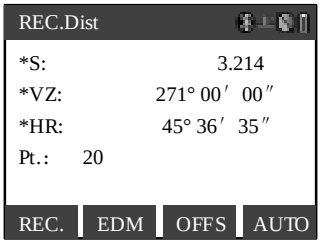
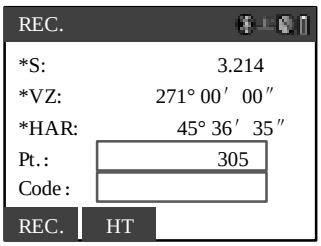
18.5 Record the distance measurement data

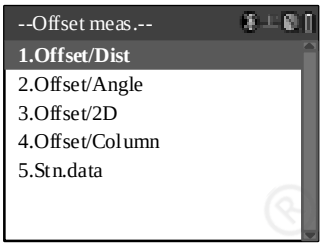
• In the record mode, the observation data of distance measurement, eccentricity measurement can be recorded in the work file.

• The recorded data include slop distance, vertical angle, horizontal angle, point number, code and the target height.

• The eccentricity measurement in the record mode: press［OFFSET］to complete the eccentricity measurement in the record mode.

▸Steps

Operating procedure	Key	Display
(1) Enter the record menu ,select "5. Dist. data" and then press［ENT］.	"5. Dist. data" + ［ENT ］	
(2) Press［EDM］ to observe the current angle and distance, and the［REC.］ key is effective when observing successfully..	［EDM］	
(3) Press［REC.］into record data interface. Press［REC.］return to distance measurement after recording the data.	［ENT.］[Save］	

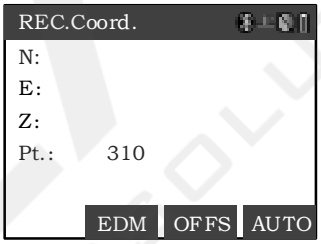
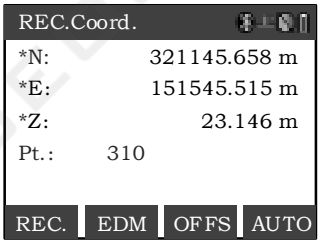
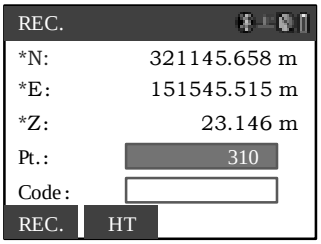
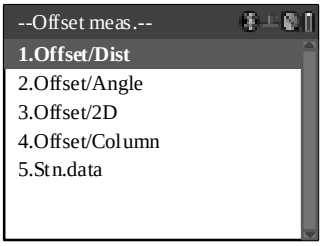
(4) Press［OFFSET］to eccentricity menu, specific operation see the eccentricity function.	［OFFSET］	

18.6 Record the coordinate measurement data

• In the record mode, the observation data of coordinate measurement, eccentricity measurement can be recorded in the work file.

• The recorded data include the coordinate of N, E, Z, point number, target height and the code. • The eccentricity measurement in the record mode: In the record mode press［OFFSET］to complete the eccentricity measurement in the record mode.

▸Steps

Operating procedure	Key	Display
(1) Entering the record menu , select "6. coord. data" and then press［ENT］.	"6.coord. data" + ［ENT ］	
(2) Press［EDM］to measure the current coordinates. Press［REC.］ to enter the record data interface	［EDM］,［REC.］	
(3) Press［Save］to record data and return to distance measurement.	［Save］	
(4) Press［OFFSET］to eccentricity menu, specific operation see the eccentricity function.	［OFFSET］	

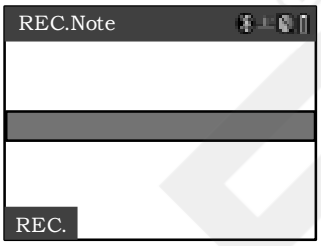
18.7 Record the distance data and coordinate data

This function can complete the distance and coordinate measurement of the observation point at the same time , and store the coordinate data and distance data created in the work file respectively. Operation procedure is the same as the coordinate data record.

18.8 Record the annotation data

• In the record mode, you can input the annotation and record the it in the work file.

▸Steps

Operating procedure	Key	Display
（1）Enter the record menu, select “8. Note” and then press［ENT］. After inputting the annotation data, press［save］to save.	“8. Note” + ［ENT］	

18.9 Access to the data of work file

• In the record mode, you can access to the data in the selected work file.

• Performing this operation, you can also press the "key function configuration" which describes a method to define the access function to the keys, and then invoke.

• When invoking the data of the work file, you can search through the point number, but it does not apply to the annotation data.

• Operation Steps ere similar to "17.2.1 known coordinate management”.

19. The instrument parameter setting and calibration

• This chapter introduces the parameter settings in the setup mode. Once these parameters are set, they will be saved until changing again.

19.1 Change the instrument observation conditions

• The following table gives the instrument parameters to be set and the options.

Table 1：

Setup interface	Parameter	Option (*: factory settings)
Observation conditions setting	Atmospheric correction	No correction*
		K=0.14（Correction，take K=0.14）
		K=0.20（Correction，take K=0.20）
	vertical Angle format	Zenith zero*
		Horizontal zero
		Horizontal ± 90°
		Dual axis
	Distance type	Slope distance
		Horizontal distance
		level difference
	Auto power-off	30 minutes off
		Manual shutdown
	Coordinate format	N—E—Z*
		E—N—Z
	Angle minimum	1″*
		5″
		10″
	Distance minimum	0.1mm
		1mm*
	Buzzer button	On*
		Off
	Right angle buzzer	On*
		Off

Table 2：

Setup interface	Parameter	Option (*: factory settings)
Communication parameter setting	Baud rate	1200b/s,2400b/s
		4800b/s ,9600b/s*
		19200b/s,38400b/s
		57600b/s,115200b/s

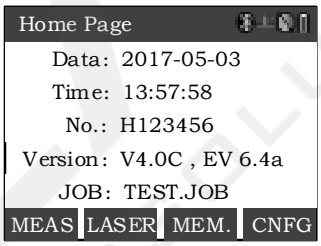
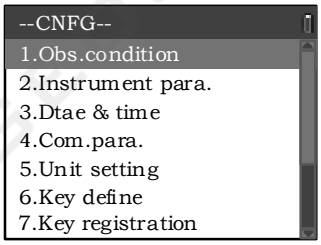
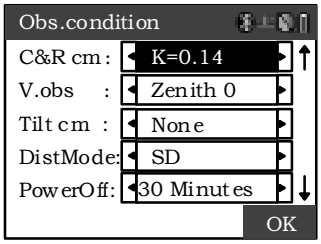
Table 3:

Setup interface	Parameter	Option (*: factory settings)
Units Setup	Temperature	℃（Centigrade）*

		℉(Fahrenheit)
	Atmospheric pressure	hPa（Millipascal)
		mmHg（millimeter of mercury）
		inHg（inch of mercury）
	Angle	Degree (360 degrees system) *
		GON(400 degrees system)（400）
		MIL）
	Distance	m
		Ft(U.S foot)
		Fi(International foot)
		Foot and inch

The following takes setting observation conditions as an example, the same way as the rest.

▸Steps

Operating	Key	Display
(1) Press［ESC］enter the status interface in the survey interface.	［ESC］	
(2) Press ［CNFG］ enter the configuration interface in the status interface.	［CNFG］	
(3) Select “1. Obs. conditions” and then press ［ENT］ into observation conditions setting. Can view and change the observation condition parameter settings in this operation. Use ［▲］or ［▼］(［ENT］) can make the parameter item focus moving up or down. Use ［◄］or［►］ can change the parameter settings in the line with focus. Each time change a parameter item, the cursor must be removed in order to save the changes	“1. Obs. conditions” + ［ENT］	

19.2 Key functional configuration

• Allow users to configurate the key functions for the instrument in different measurements in the measurement mode. The keys defined will be saved forever until changing again.

• The characteristics that users can free to define the key function location will surely greatly convenient the users and increase the working efficiency of the measurement.

• Press［CNFG］enter the configuration interface in the status interface. Select "6. key function configuration" and press［ENT］or directly press［6］into the key function configuration definition menu interface.

• Can do the following operations in the key function configuration:

Key defines

Key registration

Key recall

19.2.1 Key function define and registration

• in the Key define interface, the users can allocate the function again. the new definition of key functions will be displayed in the measurement mode and is kept until being defined again. The instrument internal storage provides users with two check location, they are user defined key 1 and user defined key 2.

Notes：Once defining or checking the new function of the keys, the original keys function or the function checked will be cleared.

The following functions can be assigned to the measurement mode in any page.

1) Slope distance, horizontal distance and level difference: Start distance measurement
2) Switch: Distance type selection (Slope distance, horizontal distance and level difference)
3) Zero setting: the zero setting of horizontal angle
4) Angle setting: Known horizontal Angle setting
5) Left/right Angle: left and right angle selection
6) Repeat observe: the repetitive observation of the horizontal Angle
7) Lock Angle: Horizontal Angle locked or unlocked
8) ZA/%：Gradient type selection
9) Height: Instrument high setting, target height setting
10) Record: Measurement data record
11) Hanging high: Start hanging high measurement
12) Opposite edge：Start opposite edge measurement
13) New: Shows the latest measurement data
14) View: View the data of the current working file
15) Parameters: Distance measurement parameter settings
16) Coordinate: Start the coordinate measurement
17) Stake out: Start to stake out
18) Offset : Start eccentric measurement
19) Menu: Turn to menu mode
20) Resection: Start resection measurement
21) Arc: Arc surveying
22) F/M：Meter and foot
23) Area: Start area surveying
24) Road: Start road surveying

25) Point Projection: Point projection calculate

26) Line Setting Out: Straight line setting out.

• Default key function:

Page 1: Slope distance, switch, set angle, parameters

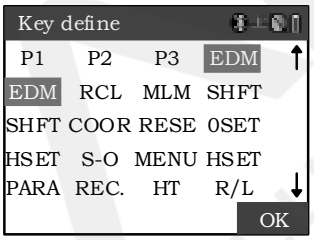
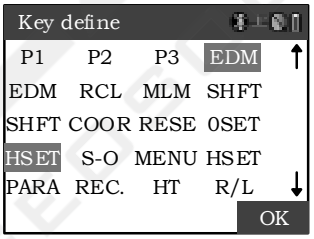
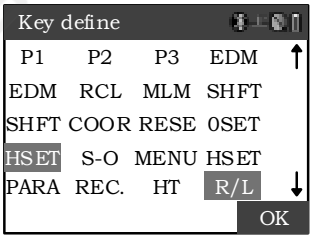
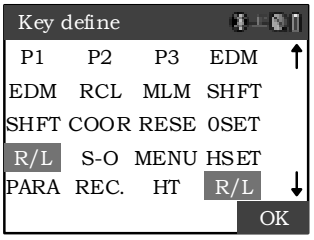
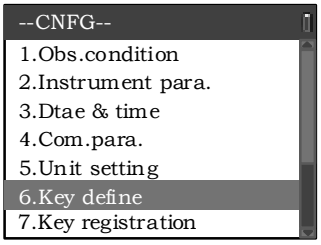
Page 2: Zero setting, coordinate, setting out, record

Page 3: Opposite side, resection, menu, height

19.2.2 Key function assignment

•Customer can define the keys with these 12 functions freely and they can be kept until redefined. Definitions for key functions can be arbitrary.

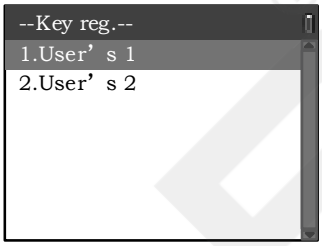
▸Step

Operation Procedure	Key	Display
(1) In setting mode, choose "6. Key define", then press［ENT］	"6. Key define" + ［ENT］	
(2) Use［◄］or［►］to highlight the key. "Pn" means page N.	［◄］or［►］	
(3) use［▲］or［▼］, highlight the function.	［▲］or［▼］	
(4) Press [ENT] to step 3 to specify the functions defined in step 2 on the specified keys.	［ENT］	
(5) repeat from Step 2 to Step 4 to complete the function definition. Then press［OK］to end key function assignment and return to the menu key function definitions.	［OK］	

19.2.3 Key function recall

•The key function user had customized can be stored in a library as user defined 1 and user defined 2.

▸Step

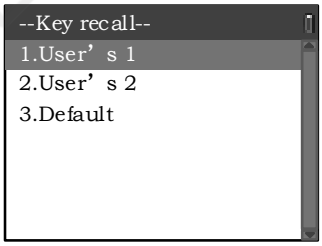
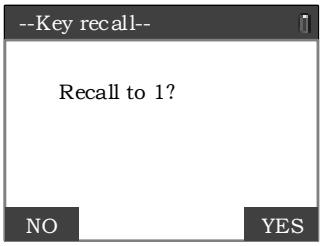
Procedure	Key	Display
(1) In setting mode, choose "7. Key registration ",then press［ENT］.	"7. Key registration" + ［ENT］	
(2) Select "1. User's 1", then press ［ENT］. Then choose［YES］	"1. User's 1" +［ENT］	
(3) Save in user defined 2 with the same way.		

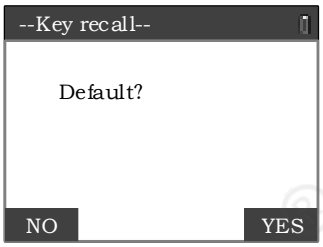
19.2.4 Key function restore

•You can apply user defined settings or default settings when you want.

Note: The current functions will be covered by the restored ones!

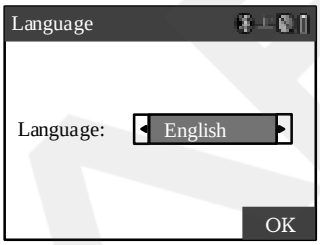
▸Step

Procedure	Key	Display
(1) In setting mode, choose "8. Key recall", then press ［ENT］.	"8. Key recall" + ［ENT］	
(2) Choose "1. User's 1", then press［ENT］,then press OK to apply the user defined 1.	"1. User's 1"+［ENT］	
(3) you can apply user defined 2 in the same way.		

(4) choose “3. Default”, then press［ENT］, then confirm. The key will have the factory default function.	［ENT］	

19.2.5 Language setting

▶Step

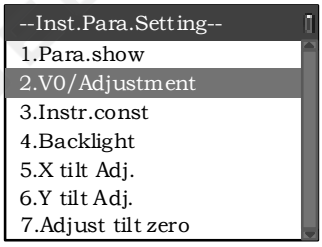
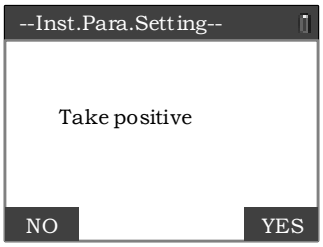
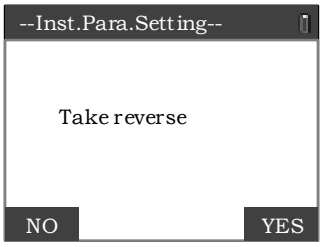
Procedure	Key	Display
In setting mode, choose “9. Language setting”, then press［OK］	“9. Language setting” + ［OK］	

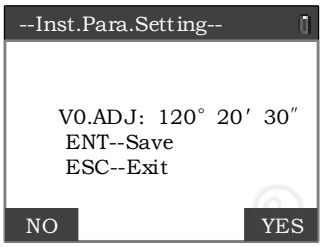
19.3 Instrument parameters settings

After inspection, the instrument should be calibrated again if the parameters are changed.

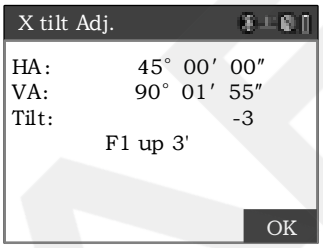
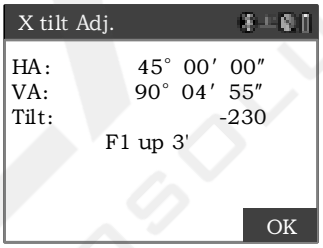
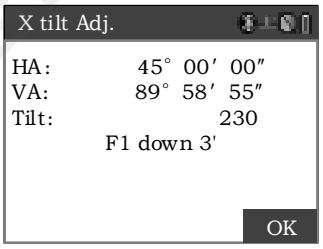
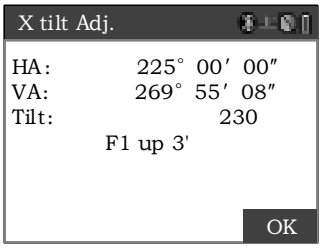
19.3.1 Index Error Setting

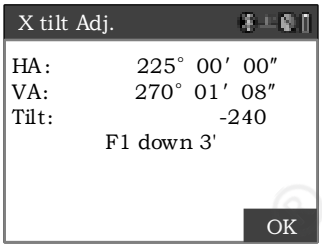
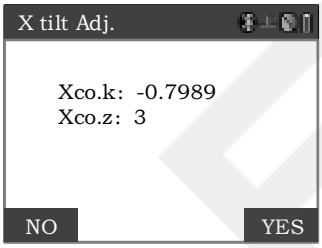
▶Step

Operation process	Key	Display
(1) In setting mode, choose “2. Instrument para.”, then press［ENT］to enter the instrument setting menu. Choose “2. VO/Adjustment” to do calibration.	“2. Instrument para.” + “2. VO/Adjustment”	
(2) Aim at target with face left, then click［ENT］.	［ENT］	 

(3) Aim at target with face right, then click［ENT］, then the calibration result will be displayed. Click［ENT］ to save the parameters.	［ENT］	

19.3.2 X-axis Compensator Calibration

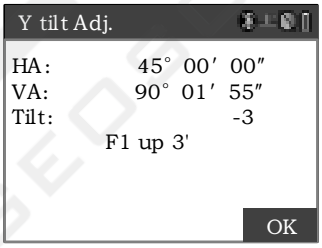
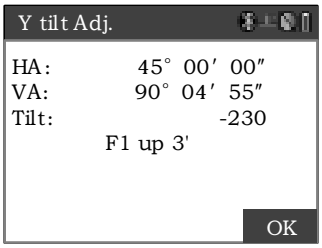
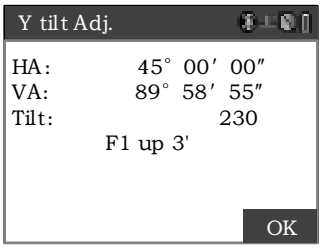
Operation process	Key	Display
(1) In setting mode，“2.Instrument para.” then press［ENT］，go to machine parameter setting menu. Then choose “5. X tilt Adj”.	“5.X title Adj” + ［ENT］	
(2) Level the instrument, focus on the reticle of collimator, record the vertical angle V0.Use fine tuning to set the vertical angle as V0+3′, focus on the reticle center accurately , rotate the instrument 90° counter -clockwise, wait for stable value , press［OK］.	Adjust vertical angle + Adjust angle foot screw	
(3) Use fine tuning to set the vertical angle as V0-3′,focus on the reticle center accurately, Rotate the instrument 90° counterclockwise, wait for stable value, press［OK］.	［OK］ + Adjust vertical angle + Adjust angle foot screw	
(4) Use fine tuning to set the vertical angle as V0,focus on the reticle center accurately		
(5) Reverse the telescope, focus on the reticle of collimator, record the vertical angle V1.Use fine tuning to set the vertical angle as V1-3′,focus on the reticle center accurately, wait for stable value, press［OK］.	［OK］	

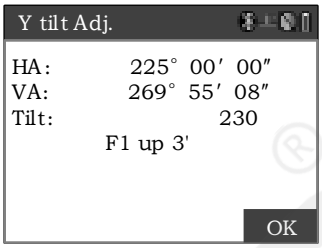
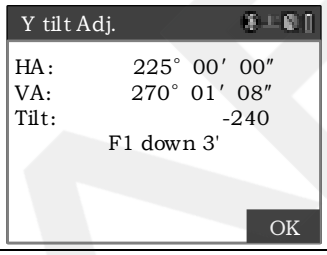
(6) Use fine tuning to set the vertical angle as V1+3′,focus on the reticle center accurately, wait for stable value, press［OK］.	［OK］	
(7) After Finishing, it will display the calibration results, press［ENT］,save and back to menu.	［ENT］	

Note: The normal range of the X coefficient is -0.6~-0.8. If the calibration result exceeds this range and the compensation is wrong, you need to re-calibrate; It will exit the correction process if pressing the ESC key, and save the input parameters.

19.3.3 Y-axis compensator correction

▶ After entering the compensator calibration program, the window interface is shown as follows: Specific steps are as follows:

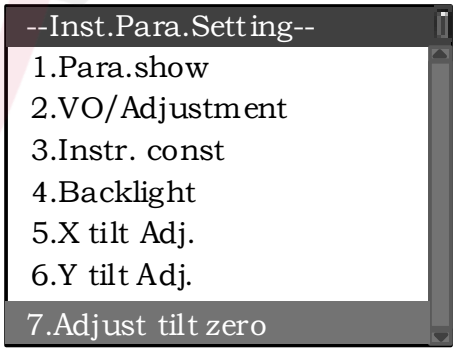
Operation process	Key	Display
(1) In setting mode，“2.Instrument para.” then press［ENT］，go to machine parameter setting menu. Then choose “6. Y title Adj”.	“6. Y title Adj” + ［ENT］	
(2) Level the instrument, focus on the reticle of collimator, record the vertical angle V0.Use fine tuning to set the vertical angle as V0+3′,focus on the reticle center accurately, then turn the instrument counterclockwise 90 °,wait for stable value, press［OK］.	Adjust vertical angle + Adjust the foot screw	
(3) Use fine tuning to set the vertical angle as V0-3′,focus on the reticle center accurately, then turn the instrument counterclockwise 90 °,wait for stable value, press［OK］.	［OK］ + Adjust vertical angle + Adjust angle foot screw	
(4) Use fine tuning to set the vertical angle as V0 ,focus on the reticle center accurately.		

(5) Reverse the telescope, focus on the reticle of collimator, record the vertical angle V1.Use fine tuning to set the vertical angle as V1-3′,focus on the reticle center accurately, then turn the instrument counterclockwise 90 °,wait for stable value, press［OK］.	［OK］	
(6) Use fine tuning to set the vertical angle as V1+3′,focus on the reticle center accurately, then turn the instrument counterclockwise 90 °,wait for stable value, press［OK］.	［OK］	
(7) After Finishing, it will display the calibration results, press［ENT］,save and back to menu.	［YES］	

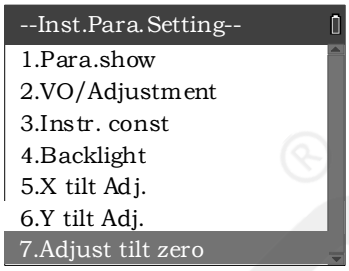
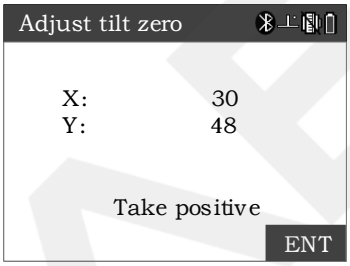
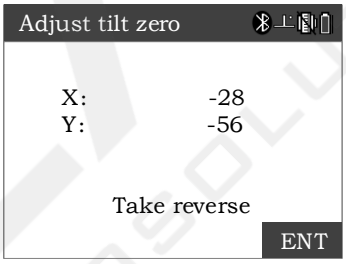
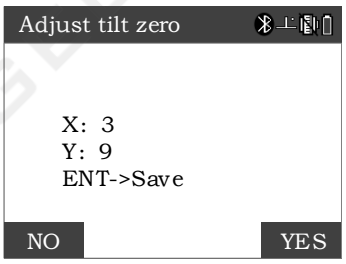
Note: The normal range of the Y coefficient is 0.6~0.8. If the calibration result exceeds this range and the compensation is wrong, it needs to be re-calibrated; during the calibration process, press the ESC key to exit directly and keep the parameters unchanged.

19.3.4 Compensator Zero Correction

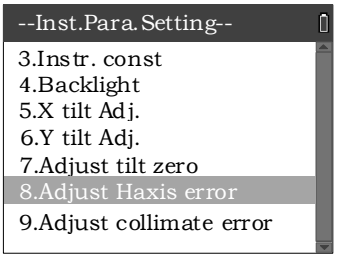
In the setting mode, select "2. Instrument parameter setting" to enter the instrument parameter setting menu interface. The interface is as follows:



Be sure to confirm that the compensator is turned off before zero calibration of the compensator, and the index difference is extremely small. To correct the index difference, please refer to the “Index Error Setting” process.

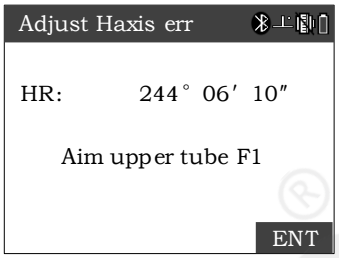
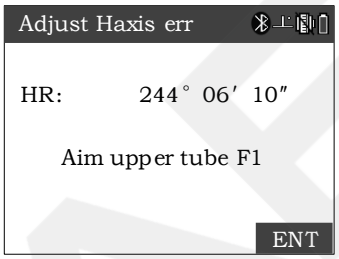
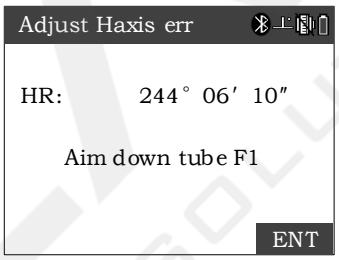
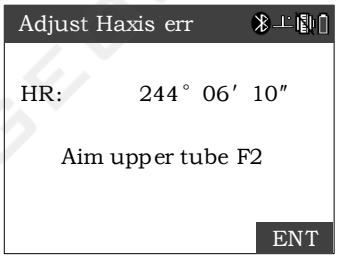
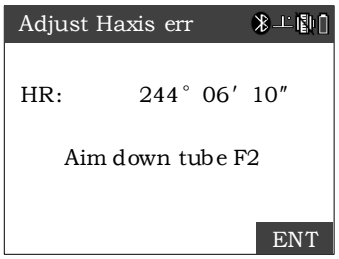
Operation process	Key	display
(1) In setting mode，“2.Instrument para.” then press［ENT］，go to machine parameter setting menu. Then choose “7. Tilt zero adj.”.	“2. 2.Instrument para” + “7. Tilt zero adj.”	
(2) Aim at the target by positive, press the［ENT］key. Go to the next step.	［ENT］	
(3) Reverse the telescope and aim at the target, press the［ENT］key. Go to the next step.	［ENT］	
(4) The calibration results are displayed. Press［ENT］key to confirm and save the parameters.	［ENT］	

19.3.5 Horizontal axis error correction



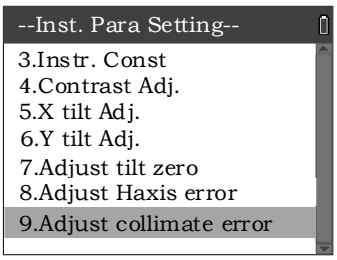
Follow the operation process below：

Operation process	Key	display
(1) Place the instrument on the test table and level the instrument.		

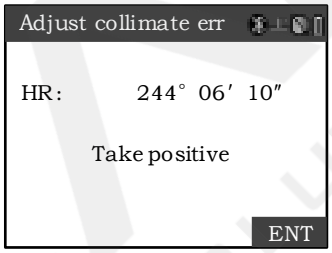
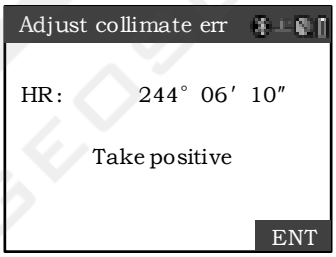
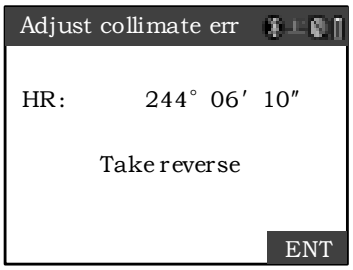
(2) In setting mode , "2. Instrument para." then press［ENT］, go to machine parameter setting menu. Then choose "8. Adjust H axis Err".	"2. Instrument para." + "8. Adjust H axis Err"	
(3) After entering, it will prompt "F1 up", and let positive scope aim at the target, when the reading is stable, press［ENT］or［F4］to confirm.	［ENT］.［F4］	
(4) According to the prompt "F1 down", and let positive scope aim at the target, when the reading is stable, press［ENT］or［F4］to confirm.	［ENT］.［F4］	
(5) Rotate the instrument counterclockwise by 180°. According to the prompt "F2 up", let the reverse scope aim at the target. After the reading is stable, press［ENT］or［F4］to confirm;	［ENT］.［F4］	
(6) According to the prompt "F2 down", let the reverse scope aim at the target. After the reading is stable, press［ENT］or［F4］to confirm;	［ENT］.［F4］	
(7) After finishing all steps, the instrument will save the parameter. During the calibration process, press the［ESC］key to exit the calibration.	［ESC］	

Note: If the calibration result is over 60″, the instrument needs to be calibrated again, otherwise it will cause the measurement results to be wrong.

19.3.6 Collimation correction



Follow the operation process below：

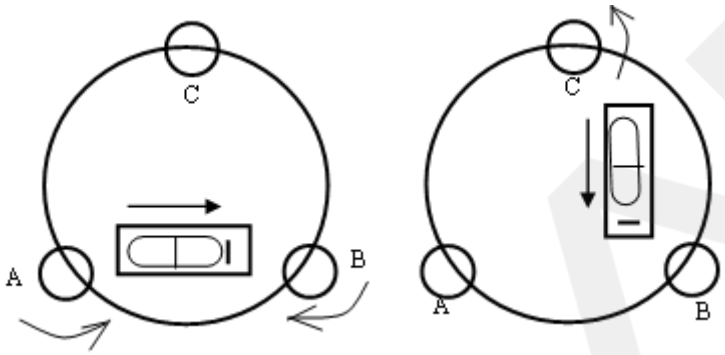
Operation process	Key	Display
(1) Place the instrument on the test table and level the instrument.		
(2) In setting mode , "2. Instrument para." Then press［ENT］, go to machine parameter setting menu. Then choose "9. Ad. Collimate Err".	"2. Instrument para." + "9. Ad. Collimate Err"	
(3) Enter the collimation correction function, and the prompt displays "Take positive", then let the positive scope aim at the target. After the angle value is stable, press［ENT］ or ［F4］ to confirm;	［ENT］.［F4］	
(4) Rotate the instrument by 180°, and the prompt displays "Take reverse", then let the reverse scope aim at the target. After the angle value is stable, press［ENT］ or ［F4］ to confirm; (5) When all process done, the instrument will save all parameters. During the calibration process, press the "ESC" key to exit the calibration.	［ENT］.［F4］	

Note: If the calibration result is over 60″, the instrument needs to be calibrated again, otherwise it will cause the measurement results to be wrong.

20. Check out and calibration

The instrument at the factory has to undergo a rigorous inspection and correction, meeting the quality requirements. However, after long transport or environmental change, its internal structure will be some impact. Therefore, the new purchased instruments should be checked and calibrated before surveying to ensure the precision.

20.1 Tube level



• Checkout

Refer to the chapter "Leveling instrument accurately by tube level "of" Setting up the instrument ".

• Calibration

1. In the calibration, if the leveling bulb diverge from the center, use the foot spiral which parallels the leveling tube to adjust to make the bubble move half of the distance to the center. For the remaining, use the calibration needle to turn the level calibration screw (in the right of the water-level) to adjust the bubble to the center.

2. Turn the instrument for 180 °, check that whether the bubble is in the center. If the bubble is not centered, repeat Step (1) until the bubble to the center.

3. Turn the instrument for 90°, use the third foot screw to adjust the bubble to the center.

·Repeat the Steps of checkout and calibration until the bubble in the center in every direction

20.2 Circular level

• Checkout

After the level tube is calibrated correct, if the circular level bubble also in the center, so there is no need to calibrate.

• Calibration

If the bubbles are not in the center, use the correction needle or six angle wrenches to adjust the correction screw which under the bubble to make the bubble to the center. For calibration, you shall first loosen the calibration screw (1 or 2) which opposite to the direction of the bubble offset, then tighten the other correction screw in the offset direction to make the bubble in the center. When the bubble is in center, make sure the pressure of the three calibration screws is consistent.

20.3 Telescope reticle

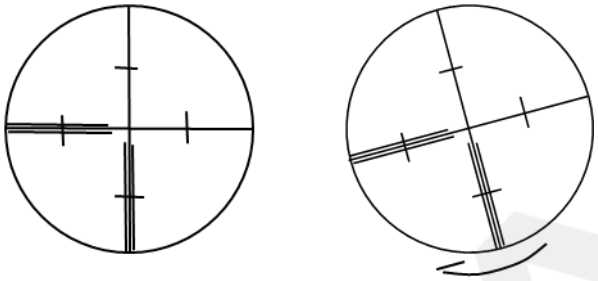
• Checkout

After leveling the instrument find a target A with the telescope, make the center of the crosshair

focused on target A and fixed horizontal and vertical brake handwheel.

1. Rotate telescope vertical micrometer handwheel, move A point to the edge of the field of view (A 'points).

2. If A moves along the vertical line of the crosshair, but A point is still in the vertical line, as the left picture, the crosshair doesn't need to calibrate. If A point deviate from vertical line center, as the right pictured, the crosshair is slant, so need to calibrate the reticle.



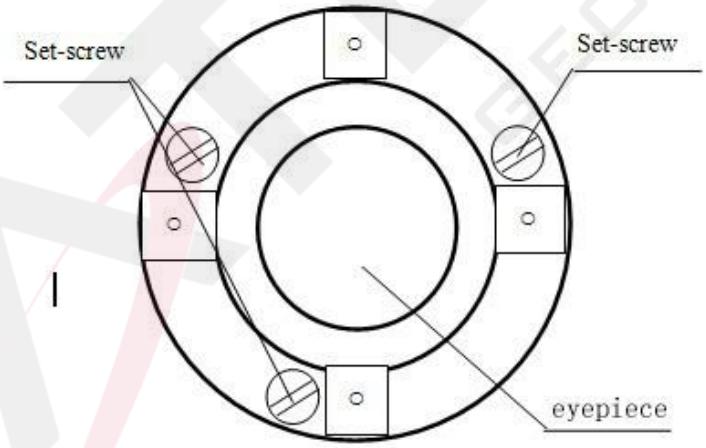
• Calibration

1. first, take down the reticle cover between telescope eyepiece and focusing handwheel, and you can see four fixed screws of the reticle bed (sees attached figure).

2. Unscrew the three fixed screw evenly with screwdriver, rotate the reticle around collimation axis, to make A point on the vertical line of the reticle.

3. Tighten the screw evenly, test the calibration results with the above methods.

4. Put the protective cover back.



20.4 The verticality of collimation axis and horizontal axis （2C）

• Checkout

1. Set a target A in about 100m away, and make sure the vertical angle of the target is within ± 3 °. Precisely level the instrument and switch on it.

2. Make the telescope focused on target A in face left, and read the horizontal angle.

For example: horizontal Angle L = 10°13 '10"

3. loosen the vertical and horizontal brake handwheel, turn the telescope, rotate the alidade to face right and focus on the same target A. Before aiming, please tighten the horizontal and vertical brake handwheel and read the horizontal angle.

For example: level Angle R = 190°13 '40"

4. 2 C = L-(R ±180 °) = -30 "≥±20, need to calibrate.

• Calibration

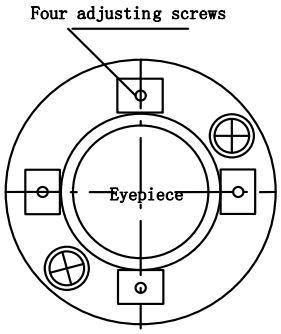
1. Use the horizontal micrometer handwheel to adjust the horizontal angle to the right reading which has eliminated the C.

R + C = 190°13 '40 "-15 "= 190°13' 25".

2. Take down the reticle bed cover between the telescope eyepiece and focusing handwheel, adjust the calibration screw of the crosshair on the left and right. First, loosen the screw on one side, and screw up the screw on the other side, move the reticle and focus on target A.

3. Repeat the test Steps, calibrate it to | 2 C | < 10.

4. Tighten the calibration screws, put the protective cover back.



Notice: Check the photoelectric coaxially after calibrating.

20.5 Vertical plate index zero automatic compensation

• Checkout

1. Set up and level the instrument, make the direction of the telescope consistent with the line between the center of the instrument and any of the foot screw.

2. The vertical plate index change to zero after switching on, tighten the vertical brake handwheel, the instrument display the current telescope vertical Angle.

3. Slowly rotate feet X to 10 mm around in one direction, the display of the vertical Angle will change from changing until disappear to appear "compensation beyond!" correspondingly, it indicates that the dip Angle of the vertical axis is bigger than 3 ', beyond the range of vertical plate compensator design. When rotating the feet spiral recovery in the opposite direction, instruments show vertical Angle again, if you can see the change when testing it again and again in critical positions, it says that vertical plate compensator works normally.

• Calibration

When you find that instrument compensation is useless or abnormal, it should be sent to the factory for checking.

20.6 Vertical collimation error (I Angle) and vertical collimation zero value setting

Check this item after completion of §11.3 and §11.5.

• Checkout

1. Boot after settling and leveling the instrument, focus the telescope on a clear goals A, get the face left reading of vertical Angle L.

2. Turn the telescope to aim A and get the reading R for face right.

3. If the vertical zenith angle is 0 °, then i = (L + R-360 °) / 2, if the vertical Angle level is 0. Then i = (L + R-180 °) / 2 or (L + R-540 °) / 2.

4. If | i |≥10", maybe you need reset the zero value of vertical index.
5. operation refers to chapter 9.6.1 "index error calibration"
Note: 1 repeat the checkout Steps to retest the index error again (i Angle). If the index error still cannot accordance with requirements, it should check the three Steps of calibration index zero setting (in the course of zero setting, the vertical angle showed is not compensated and corrected, it is just for reference) to see whether it is incorrect, whether the focusing of target is correct, reset according to the requirements.
6. If it still can not accordant with the requirements after repeated operation, it should be sent to the factory for checking.

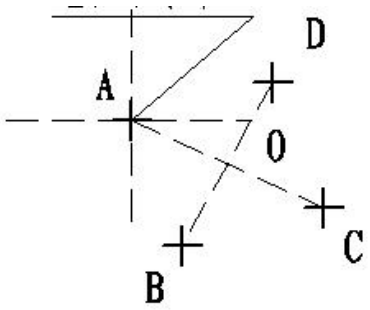
20.7 Plummet

• Checkout

1. Set up the instrument to the tripod, draw a cross on a white paper and put it on the ground below the instrument.
2. Adjust the focal length of the optical plummet (for the optical plummet) or press key★ to switch on laser plummet , move the white paper to make the cross in the center in the field of view (or laser flare).
3. Turn the feet screw, make the center mark of the plummet coincide with the cross center.
4. Rotate alidade, every turn of 90 °, observe the contact ratio of the optical plummet and cross center.
5. When rotate the alidade, the center of the optical plummet always coincides with the cross center, there is no need to calibrate. Otherwise, you should calibrate as the following methods.

• Calibration

1. Take down the screw cover between the optical plummet eyepiece and the focusing handwheel.
2. Fix the white paper with a cross, and mark the points when the instrument rotates 90 °, as the figure shows A, B, C, D points.
3. Connect the diagonal points A. C and B. D with a straight line, the intersection name of the two line is O.
4. Use the calibration needle to adjust the four-calibration screw, to make the center mark of the plummet coincide with point O.
5. Repeat Step 4, check and calibrate until it meets the requirements.



6. With the laser plummet, unbolt the laser cover, using 1 # hex wrench to adjust the three screws, fasten one side and loosen the other side, and adjust the laser flare to point O.
7. Put the cover back in place.

20.8 Instrument additive constant (K)

The instrument constant is inspected when it out, and correct it inside the machine, make K = 0. Instrument constant change rarely, but we suggest that check it this way for one or two times each year. The checkout should be done in the standard baseline, or you can take the following simple method.

• Checkout

1. Choose a flat field A to set up and level the instrument , mark three points A. B. C in the same line ,their interval is 50m, and set up the reflection prism accurately.
2. After setting the temperature and pressure data, accurately measure the horizontal distance of AB. AC .
3. Setting up and centering the instruments accurately, measure the horizontal distance of BC accurately.
4. You can get the instrument ranging constant:

K = AC- (AB + BC)

K should be close to 0, if | K | > 5 mm, it should be sent to standard baseline field for strict checking, then calibrate it based on the checking value.

• Calibration

If it turns out the instrument constant does not close to 0 but changing after strict inspection, you need to calibrate it, set the instrument additive constant according to the comprehensive constant K value. Such as: the K has been measured as -5 according to the method above, and the original instrument constant is -20, so the new value should be set as -20-(5) =-15.

● Use the vertical line of the reticle to orientate, make A, B and C at the same line accurately. There must be a clear mark for point B the ground to focus on.

● Whether the prism center of B coincide with the instrument centers is the guarantee of checking the accuracy, so, you had better use tripod and all-purpose tribrach, for example, if you change the three-hand type prism connector with tribrach, keep the tripod and tribrach stable, just change the prism and the part above tribrach of instrument, and it can reduce the error of misalignment.

20.9 The parallelism of collimation axis and photoelectricity axis

• Checkout

1. Set up the reflecting prism 50 meters long from the instrument.
2. Focus on the reflecting prism center with telescope crosshair accurately.
3. Through the key ★-> parameters-> signal, observe maximum value of the signal, find the center of the launch axis.
4. Check whether the telescope crosshair center coincide with the emission photoelectricity axis center, if they coincide on the whole, we can say it qualified.

• Calibration

If the telescope crosshair center deviate from emission photoelectricity axis center largely, send it to professional repair and calibration department.

20.10 No prism ranging

The red laser beam is coaxial with the telescope, used for no prism ranging, and it is sent by telescope. If the instrument has been calibrated, red laser beams will coincide with the line of sight. External influence such as the vibration, the larger temperature change and other factors may make

laser beam and viewing not overlap.

● Before precise ranging, you should check whether the direction of the laser beam is coaxial. Otherwise, it could lead to inaccuracy.

Warning:

Looking straightly at the laser is dangerous.

Prevention:

Don't look laser beams directly, or focus on others.

• Checkout:

Put the gray side of the reflector towards the instrument, and put it 5 meters and 20 meters away. Start laser direction function. Focus on the reflector center by the telescope crosshair center, then check the position of the red laser point. Generally speaking, the telescope is equipped with special filter, human eyes can’t see laser point through the telescope, you can see the offset between the red laser point and the reflector crosshair center, you can observe this above the telescope or at the side face of reflector. If laser center coincides with the crosshair center, it indicates that the adjustment meets required accuracy. If the offset between the point position and the mark of crosshair is out of limit, will need to send it to professional department for adjustment.

21.Technical parameters

Function		Unit	Configuration
			SLT10
Telescope			
Imaging		—	Erect
Magnification		×	30
Field of view		—	1 °30′
Min. target distance		m	1.5
Effective aperture		mm	40/50(EDM)
Angle measurement(Hz, V)			
Angle measurement accuracy		(″)	2.0
Angle measurement method		—	Absolute encoder
Minimum reading		(″)	1
Distance measurement（IR）			
Range	Single prism	km	5
	Triple prism	km	6
	No-prism[1]	m	1000
Time	Repeated	s	2(first 3)
	Tracking	s	0.5
Minimum Display		mm	0.3
Accuracy	Prism	mm	±(2+2×10^{-6}D)
	No-prism		±(3+2×10^{-6}D)
Tilt compensator			
Compensation method		—	Biaxial type
Compensation range		（′）	±3
Communication port		—	RS232C
U disk interface		—	YES
Bluetooth		—	YES
Temperature and pressure sensors		—	YES
Display			
interface		—	Both sides (320*240, Colorful)
Illumination		—	Support
Laser Plumb			
Laser (optional) Laser Plumb		—	Wavelength 635nm Maximum output power (adjustable): not less than 0.4 mW, not more than

			1.0 mW
level			
Tubular Level		（″ ） /2 mm	30
Round level		（′ ） /2 mm	8
Built-in applications		—	Support
Battery supply			
Type		—	Rechargeable High-energy lithium battery
Voltage		V	7.4
Power		W	＜ 2.2
Battery capacity		mAh	3000
Working duration	Dist + Angle	h	8 （At + 20 ° C, dist once per 30s and keep measuring Angle）

1. It means good meteorological conditions (visibility not less than 30km), Target is KODAK CAT NO.E1527795 (90% reflective surface)

Appendix A File transfer format description (local format)

These following examples to instruct exported file format

STA ST001,1.205,AD
XYZ 100.000,100.000,10.000
BS BS001,1.800
HVD 98.2354,90.2314,10.235
SC A1,1.800,CODE1
NEZ 104.662,99.567,10.214
SD A2,1.800,CODE1
HVD 78.3628,92.4612,4.751
SA A3,1.800,CODE1
HV 63.2349,89.2547

Each record consists of two rows:

The information in the first line of which is parsed as: record type, point name, elevation, code

Such as:

STA refers to station point
BS refers to back sight
SC refers to coordinate data
SD refers to distance measurement data
SA refers to Angle measurement data

The second line information: data types, data records

Such as:

NEZ refers that the following data are coordinates with the order “NEZ”
ENZ refers that the following data are coordinates with the order “ENZ”
HVD refers that the following data are horizontal Angle and vertical Angle and slope distance
HV refers that the following data are horizontal Angle and vertical Angle

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