STONEX

STONEX R35/R35LR

Total Station

User Manual

(June 2020)-Ver.1-Rev.4- Firmware Version V3.0.1.0 150220

www.stonex.it

Contents

1. Precautions for safety

1.1. Note

Don’t collimate the sun directly

Avoid insolating the instrument, and don’t collimate the sun directly for protecting eyes and instrument.

Avoid the vibrations on the instrument

When transporting, keep the instrument in the case and try your best to lighten vibrations.

Carry the instrument

When carrying, the instrument handle must be hold tight.

Check the battery power

Before using it, you should check the power whether it is enough.

Battery maintenance

If the instrument is not used for a long time, the battery should be taken out from the instrument and stored in separate place. Meantime, the battery should be charged every month.

Take out the battery

It is not suggested to take out the battery when the instrument is on, otherwise, the stored data may be lost, so it is better to replace the battery after power off the instrument.

Set up the instrument on the tripod

When using it please insure the connection between tripod and instrument is firm. It is better to work with wooden tripod for the measurement accuracy.

Assemble the tribrach on the instrument

The setting of tribrach would influence the accuracy. The tribrach should be check frequently, the screw which connects the tribrach and alidade must be locked tightly. And the central fixing screw should be tight.

High temperature condition

Don’t put the instrument in high temperature condition for a long time, it is bad for the instrument performance.

Temperature changing sharply

The sharp temperature changing on the instrument or prism will shorten the distance measurement range, for example, after taking the instrument out from a warm car to a cold condition, wait for some time, it can be used when it adapts the surrounding condition.

The noise from the instrument

When the instrument working, it is normal if you hear the noise from instrument motor, it will not affect the instrument work.

Stored data responsibility

STONEX should not be held liable for the lost data because of wrong operation.

The noise from the instrument

When the instrument is working, it is normal if you hear the noise from instrument motor, it will not affect the instrument work.

1.2. Definition of indication

For the safe of your product and prevention of injury to operators and other persons as well as prevention of property damage, items which should be observed are indicated by an exclamation point within a triangle used with WARNING and CAUTION statements in this manual.

The definitions of the indication are listed below. Be sure you understand them before reading the manual's main text.

WARNING:	Ignoring this indication and making an operation error could possibly result in death or serious injury to the operator.
CAUTION:	Ignoring this indication and making an operation error could possibly result in death or serious injury to the operator.

WARNING:

- Only STONEX authorized distributors can disassemble or rebuilt the instrument.
- Do not collimate the sun directly. The eye injury or blind could result.
- Cover the charger maybe result fire when charging.
- If use defection power cable, socket or plug, there is danger of fire, or electronic shock.
- Using wet battery or charger maybe result fire, or electronic shock.
- Do not close the instrument to burning gas or liquid, and do not use the instrument in coal mine. Blast could be result.
- Do not put the battery in the fire or high temperature condition. Explosion, damage could result.
- If use the battery which is not specified by STONEX, there is a danger of fire, electric shock or burn.
- If use the power cable which is not specified by STONEX, there is a danger of fire.
- If short circuit of the battery, there is a danger of fire.
- When this product encounters disturbance of severe Electrostatic Discharge, perhaps it will have some degradation of performance like switching on/off automatically and so on.

CAUTION:

- If touch the instrument with wet hand, there is danger of electric shock.
- Stand or seat on the carrying case, or turn over the carrying case arbitrarily, the instrument maybe damaged.
- Be careful of the tripod tiptoe when setup or move it.
- Drop the instrument or the carrying case, or use defective belt, agraffe or hinge, instrument damage could result.
- Do not touch liquid leaking from the instrument or battery. Harmful chemicals could cause burn or blisters.
- Please assemble the tribrach carefully, if the tribrach is not stable, series damage could result.
- Drop the instrument or tripod, series damage could result. Before use it, check the central screw is tight.

1.3. Safety standards for laser

R35 series adopts the safe and visible laser on the basis of "Specification Standard of radiant products" (FDA CDRH.21CFR Part 1040.10 and 1040.11) and "Safety of laser products – parts 1: Equipment classification, requirements and user's guide" (IEC 60825-1:2001).

According to above standards, R35 Series is class ⅢA/3R laser products. When the prism or reflective sheet is selected in Config mode as target, the output is equivalent to the safer class 1.

Once the instrument is damaged, do not disassemble it. You'd better contact STONEX or local dealer.

NOTE FOR SAFETY:

WARNING
• Never point the laser beam at other's eyes, it could cause serious injury. • Never look directly into the laser beam source, it could cause permanent eye damage. • Never stare at the laser beam, it could cause permanent eye damage. • Never look at the laser beam through a telescope or other optical devices, it could cause permanent eye damage.

1.4. About user

1) This product is for professional user only!

   The user is required to be a qualified surveyor or have a good knowledge of surveying, in order to understand the user manual and safety instructions, before operating, inspecting or adjusting.

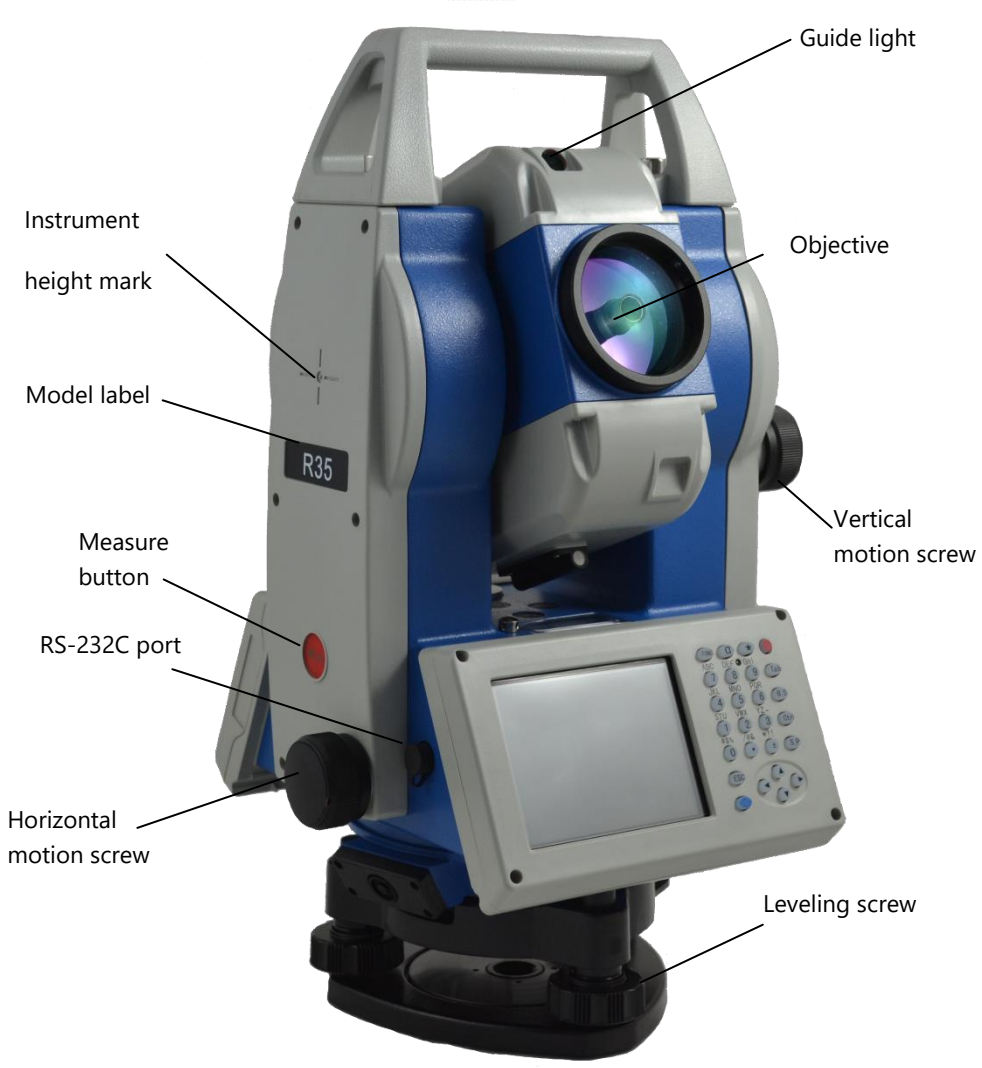
2) Wear the required protectors (safety shoes, helmet, etc.) when operating.

1.5. Exceptions from responsibility

- The user of this product is expected to follow all operating instructions and make periodic checks of the product's performance.
- The manufacturer assumes no responsibility for results of a faulty or intentional usage or misuse including any direct, indirect, consequential damage, and loss of profits.
- The manufacturer assumes no responsibility for consequential damage, and loss of profits by any disaster, (an earthquake, storms, floods etc.).
- The manufacturer assumes no responsibility for any damage, and loss of profits due to a change of data, loss of data, an interruption of business etc., caused by using the product or an unusable product.
- The manufacturer assumes no responsibility for any damage, and loss of profits caused by usage except for explained in the user manual.
- The manufacturer assumes no responsibility for damage caused by wrong transport, or action due to connecting with other products.

2. Nomenclature

2.1. Parts of the instrument


Guide light
Instrument
height mark
Objective
Model label
R35
Vertical
motion screw
Measure
button
RS-232C port
Horizontal
motion screw
Leveling screw

2.2. Keyboard

R35 series is equipped with two color touch screens and alphanumeric keypad, operation by both touching screen and pressing keyboard is possible.

Do not touch the screen with ball-pen, pencil or other sharp thing to avoid damage on instrument.

Keys	**Name**	**Functions**
0~9/ A~!	Alphanumeric keypad	Enter text and numerical values.
α	Shift key for character entry	The current entry method can shift among number, smaller letter and capital letter.
★	Star key	Normal configurations can be set here
Tab	Tab key	Move the cursor right or next position
B.S	Back Space key	Move the cursor left and delete one character
Ctrl	Ctrl key	Same with the Ctrl key of PC
S.P	Space key	Enter the space
ENT	Enter key	Confirm an entry or selection
ESC	Escape key	Quit a screen or edit mode without saving changes. Return to next higher level
FUNC	Function key	Perform variable functions defined by program screen
◄▲▼►	Navigation key	Control the focus bar within the screen and the entry bar within a field
⏻	Power key	Turn on/off the instrument

3. Preparation before measurement

3.1. Power on/off

To power on the instrument, press the [⏻] key. The screen will go to the "Welcome Interface" which is shown right.

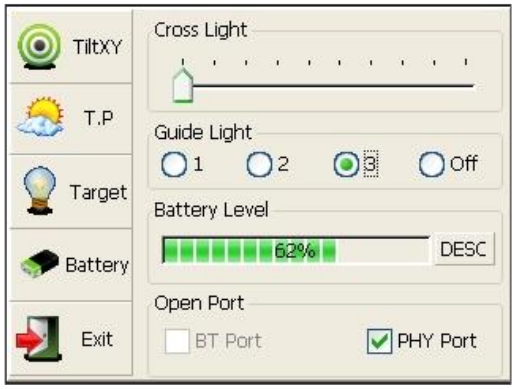
To power off the instrument, at any interface, press [ESC] key to return the "Welcome interface" screen. Then click on "Exit", a message will ask you if turn off: confirm selecting "Yes".

3.2. About battery

3.2.1. Battery power indicator

At any screen interface, press [★] key to open fast setting menu.

Select Battery, battery level will be seen following Battery Level.



NOTE:

- The battery's working time will be affected by many factors, such as ambient temperature, recharging time, recharging and discharging times. So, we suggest the users to fully recharge the battery 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.
- The symbol only indicates the supply power but not the instantaneous power change. And if the measurement mode changes, the symbol will not show the power's decrease or increase immediately.
- It is suggested that user should check every battery power before field work

3.2.2. Replace the battery

1) Remove the battery

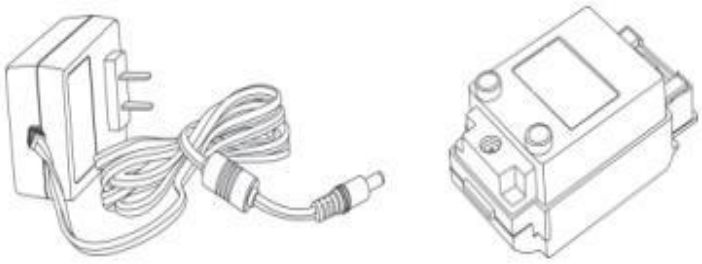
- Press the button downward as shown left;
- Remove the battery by pulling it toward you.

2) Mount the battery

- Insert the battery to the instrument;
- Press the top of the battery until you hear a Click.

3.2.3. Recharge the battery

1) Connect the charger connector to the battery.
2) Plug the charger on 100V/240V power supply. The red lamp becomes lighting, which indicates recharging. If interval-time is longer, the connector isn't fixed well.
3) That the green lamp flashes mean recharging is complete.

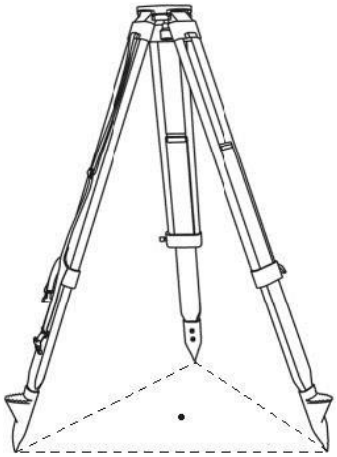


NOTE:

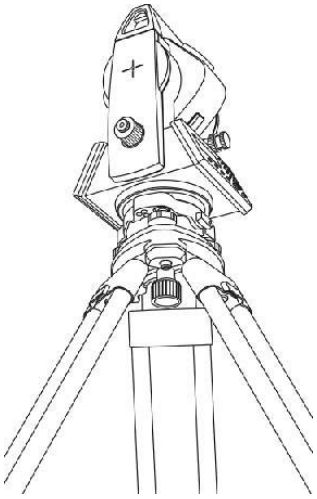
- New battery (or battery does not used for several months) should be recharged for several times. Please recharge it more than 10 hours, and then the battery can attain best status.
- The indicator light on the charger will illuminate three separate colors for varies mode conditions:
  - Solid Red Light — indicates that the charger is working;
  - Solid Green Light — indicates that the charge has finished;
  - Flashing Red Light — indicates no battery on charging; poor connection or some problems exist.
- It is recommended to continue charging for 1 or 2 hours after the light turns green.
- Once the red-light flashes constantly after the charger is plugged into the outlet of 100V-240V AC power

supply, please remove the battery and reconnected it after 3 or 5 min.

3.3. Setting up the instrument



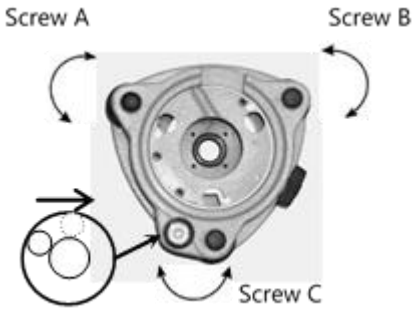
Set up the tripod first: extend the extension legs to suitable lengths and tighten the screws on the midsections. Make sure the legs are spaced at equal intervals and the head is approximately level. Set the tripod so that the head is positioned over the surveying point. Make sure the tripod shoes are firmly fixed in the ground.



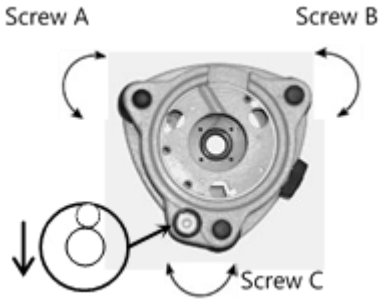
Mount the instrument on the tripod head. Supporting it with one hand, tighten the centering screw on the bottom of the unit to make sure it is secured to the tripod.

3.4. Centering and levelling-up

Basic levelling-up with the circular level

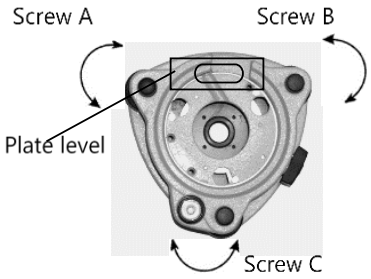


Move the foot screws A and B in opposite direction till the circular bubble is perpendicular to a line shaped with screw A and B. The direction of rotation in left thumb indicates the movement of the circular bubble.

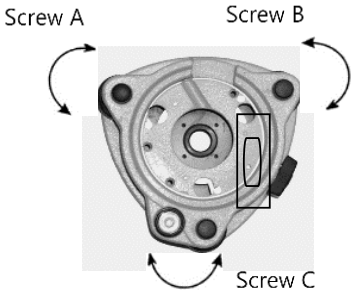


Move the bubble to the center of the circle by turning screw C.

Accurate levelling-up with the plate level



Loosen the horizontal motion clamp and turn the instrument till the plate level is parallel 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.

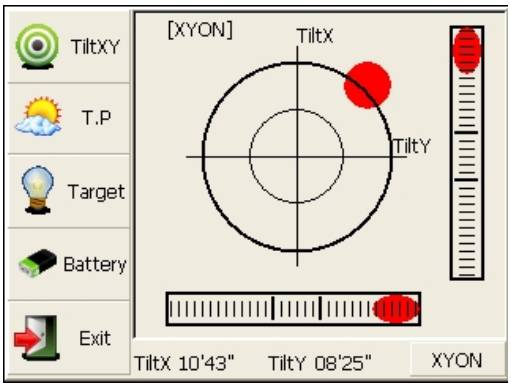


Turn the instrument approximately 90°. Adjust screw C, till the bubble in the center of the level.

Repeat above steps until the bubble remains in the center of the plate level while the instrument is rotated to any position.

Accurate levelling-up with electronic level on screen

It is convenient for R35 Series to level up with electronic level, especially when it is difficult to observe the circular level and plate level.



Firstly, press the [★] key to turn on the electronic bubble as shown in left figure.

Secondly, level it by turning three-foot screws and ensure the bubble is in the plate level. Make sure the red spot is in the center.

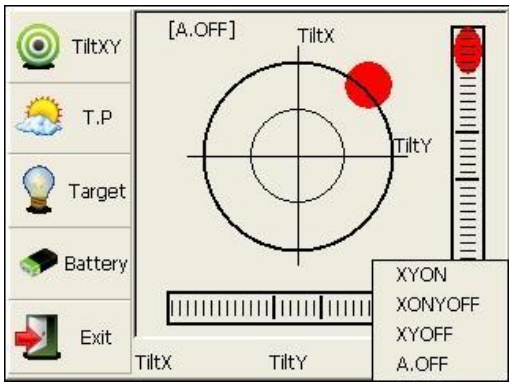
NOTE: As shown, you can realize transformation of compensation options by pressing the lower right button.

【XYON】to compensate horizontal angle and vertical angle at the same time

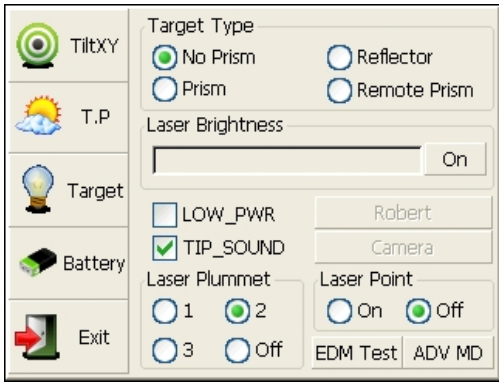
【XONYOFF】to compensate only X axis

【XYOFF】to do not compensate X axis and Y axis

【A.OFF】to do not compensate X axis and Y axis and turn off the popup function of electronic bubble.



Centering with laser plummet



Press the [★] key and click the "target" button to enter the display shown in the figure on the left. You can turn on laser plummet and set it as three levels of brightness. Thus, that laser emits downwards can be seen.

Loosen the center screw of tripod and move the base plate on tripod head until the laser spot coincides with ground mark point. Then tighten the center screw.

Repeat leveling and two steps until the instrument keeps leveling and the laser spot coincides with ground mark point when rotating alidade of instrument in any direction.

After centering, please turn off laser plummet to save power.

3.5. Assembling and disassembling for three-jaws tribrach

It is convenient to assemble or disassemble the instrument from tribrach by loosen or tighten the tribrach clamp.

Disassemble

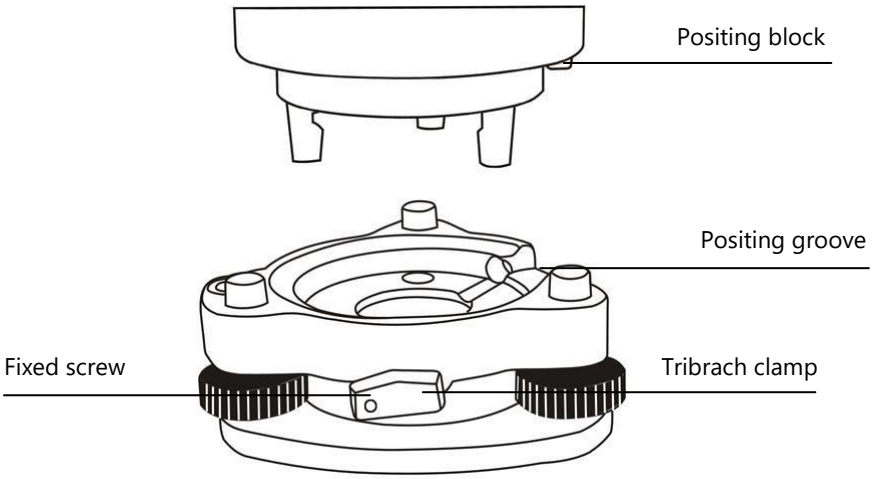
Rotate the tribrach clamp anticlockwise until the lever is loosen.

One hand holds up the tribrach, another hand holds the carry handle of the instrument and lift out the instrument from the tribrach.

Assemble

Put the instrument into the tribrach lightly, let the communication port against in the indentation of the tribrach.

Rotate the tribrach clamp clockwise until the lever is tighten.



NOTE: Fix the tribrach clamp: if the instrument doesn't need assembly or disassembly from tribrach frequently, it is necessary to fix the tribrach clamp by fixed screw to avoid the disassembly by accident.

Screw out the fixed screw by driver to fix the clamp.

4. Basic functions

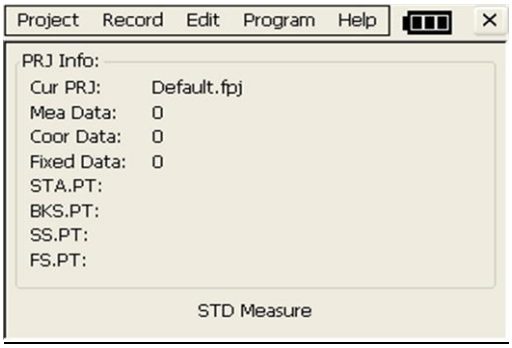
4.1. Comprehensive understanding

After initiating the instrument, the screen will go to present "Welcome Interface". STONEX AIOSurvey consists of several functions:

- "**BSC Measure**" (Basic Measurement) is used for surveying and calculating, including some modes, that is, angle measurement, distance measurement, coordinate measurement and parameter setting during conventional surveying. Distance measurement mode underpins Remote Elevation Measurement and Line-height Measurement. Coordinate measurement mode is made up of Traverse Surveying, Angle Offset Measurement, Distance Offset Measurement, Plane Offset Measurement, and Column Offset Measurement.

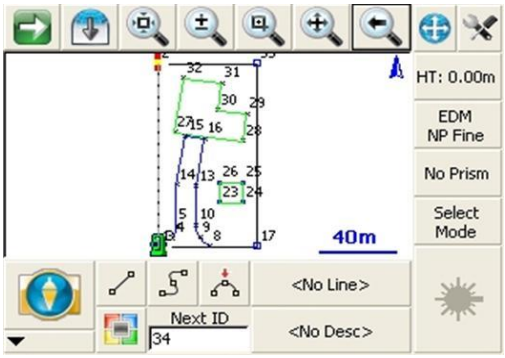
  Besides, basic measurement is also appropriate for checking performance functionality and index of angle measurement and distance measurement for total station.

- "**STD Measure**" (Standard Measurement) is used to resolve and calculate applied measurements during conventional surveying. It contains "project management", "import/export", "instrument station setup and orientation", "foresight measurement", "backsight measurement", "side-looking measurement", "cross-sectional measurement", "setting out of point, bunch and alignment", "road design", "traverse adjustment", "coordinate geometry", "batter board label", "steel ruler connection survey", "data query and editing" and so on.



  NOTE: This part is optional, it is normal to display as right figure.

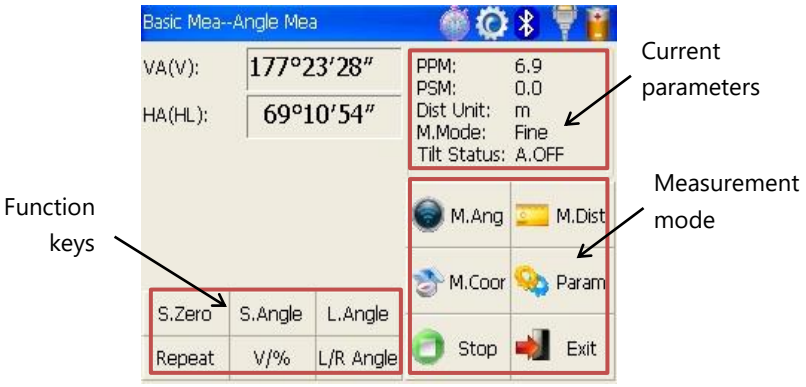
- "**FieldGenius**" (Engineering Surveying). Third-party software provides professional surveying and cartography function. It's main interface of "FieldGenius" in the right figure. In fact, the application program interface of STONEX instrument system supports more third-party software.



- "**INST Setup**" (Instrument Setup) Instrument setup function is mainly applied for instrument settings, instrument calibration and generation and management of instrument constant. It is made up of a series of functions such as "compensator linear correction", "compensator zero correction", "horizontal axis error correction", "index correction", "instrument settings", "distance constant settings", "communication port settings", "configuration management", etc.
- "**About**" (Relevant Information) Offers information of manufacturer and software version.
- "**Exit**"

4.2. BSC Measure screen introduction

In the "Welcome Interface" select "BSC measure" icon to enter in the basic measurement mode.



The screen is subdivided in 3 parts:

- Current parameters:
  - **PPM** (the atmospheric parameter)
  - **PSM** (prism constant)
  - **Dist**. **Unit** (distance unit)
  - **M. Mode** (measuring mode)
  - **Tilt status** (compensator status)
- Measurement mode:
  - **M. Ang** enters into the angle measurement mode;
  - **M. Dist** enters into the distance measurement mode;
  - **M. Coor** enters into the coordinate measurement mode;
  - **Param**. sets up parameters;
  - **Stop**: stops distance measurement;

- **Exit** exits basic measurement program.

- Function keys: they vary from one measurement mode to another. There are some function keys under every measurement mode being listed in the following table.

Measurement mode	Key	Function
	S.Zero	Set current horizontal angle as zero
	S.Angle	Set current horizontal angle
	L.Angle	Lock horizontal angle
	Repeat	Retest horizontal angle
	V/%	Switch between vertical angle and percent grade
	L/R Angle	Horizontal angle switch between left and right
	Mode	Set Fine, N Fine, Loop Fine, Track measurement mode
	m/ft	Switch among meter, UsFeet, IntFeet in terms of distance unit
	Setout	Set out measurement mode
	REM	Start REM function
	MLM	Start MLM function
	LHM	Start LHM function
	Mode	Set Fine, N Fine, Loop Fine, Track measurement mode
	OCC PT	Set the coordinate of instrument station
	S.BS	Set the coordinate of a backsight point
	Setup	Set instrument height and target height
	Line	Start traverse surveying
	Offset	Start offset measurement (ANG. Offset, DIST Offset, PLANE Offset, CYL. Offset) function
	Coor Order	Set displayed coordinate order as NEZ or ENZ

	Save Coor	Save coordinate of instrument station or not
	Ang.Unit	Set Ang.Unit as DMS, GON, MIL
	Dist Unit	Set Dist Unit as m, UsFeet, IntFeet

4.3. Shortcut key

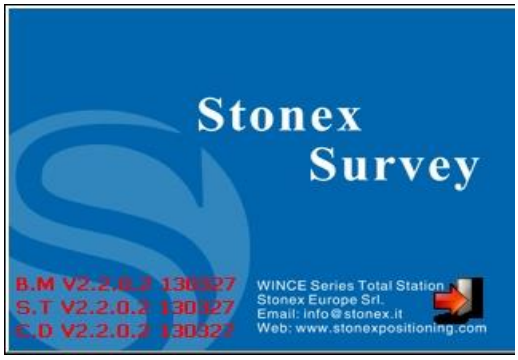
Some shortcut keys are in R35 series

Key combination	Description
⏻	Power on/off
★	Enter into setting mode directly/Turn on the electronic bubble
α	Shift among number, small letter and capital letter
FUNC+B.S+⏻	Enter this combination at the same time before starting up to backup all settings
FUNC+Ctrl+⏻	Enter this combination at the same time before starting up to restore all settings
FUNC+S.P+⏻	Enter this combination at the same time before starting up to erase all settings
FUNC+B.S	Turn on/off backlight of key panel in face left position
FUNC+Tab	Turn on/off backlight of key panel in face right position
CTRL+ESC	Enter boot menu
CTRL+Tab	Start touch screen calibration
FUNC+Ctrl	Turn on/off soft keyboards
FUNC+▲	Increase backlight brightness of LCD
FUNC+▼	Decrease backlight brightness of LCD
FUNC+◄	Turn on/off LCD display in face left position
FUNC+►	Turn on/off LCD display in face right position

4.4. System information

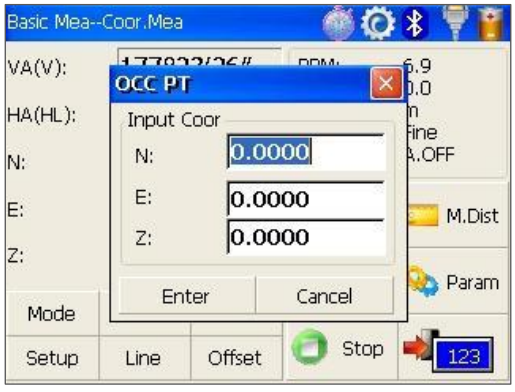
From the “Welcome Interface” select the “About” function.

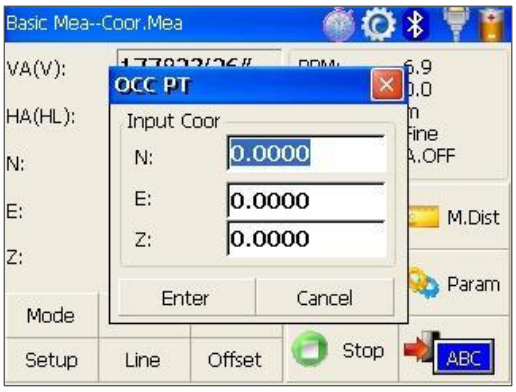
It offers information of manufacturer and software versions.

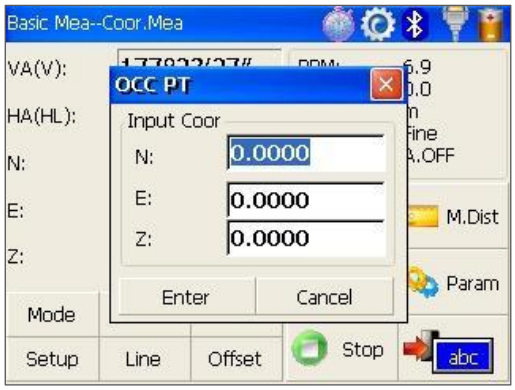


4.5. How to input number and alphabet

Press [α] key: current character entry method will be changed. On the lower right corner, the inputting method will display for a moment. Numbers, capital and small letters are available.







When the editable space is highlighted with blue (as for the N row in the above figures), everything is cancelled inputting a character. It is possible to highlight all the content, double clicking on the cell.

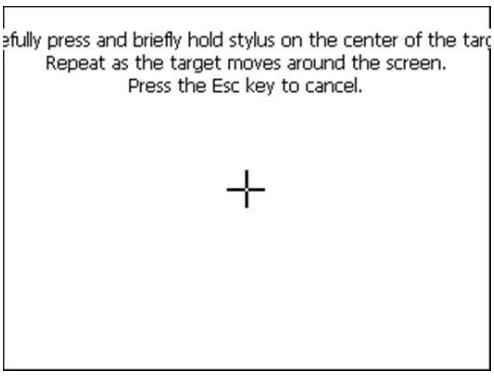
Use [B.S] if you want to delete one character or [S.P] to add a white space.

5. Instrument settings

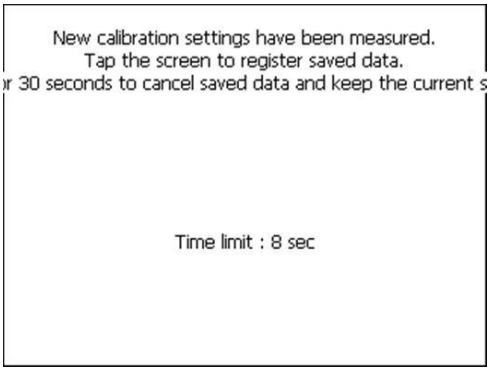
5.1. Touch screen calibration

When you operate on the screen, if your device isn't responding to your taps, you may need to recalibrate your screen. In any picture, press the combination keys [Ctrl]+[Tab] so as to enter into touch screen calibration. The calibration process is shown in the figure below.

Carefully press and briefly hold stylus on the center of the target. Repeat as the target moves around the screen.



After all the targets are clicked, the screen will display as left, tap the screen to register saved data. The screen goes back to Stylus Properties menu.



5.2. INST Setup

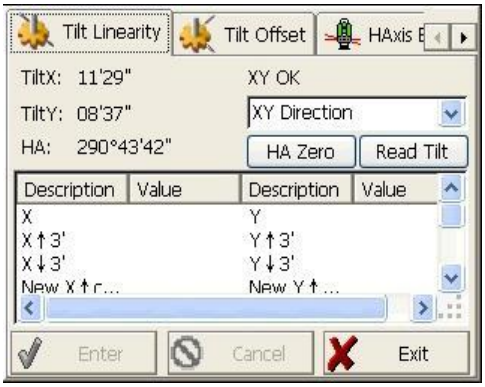
Instrument settings software is applied for settings and calibration of instrument, generation and management of instrument constant. It is made up of a series of functions such as “compensator linear correction”, “compensator zero correction”, “horizontal axis error correction”, “index correction”, “instrument settings”, “distance constant settings”, “communication port settings”, “configuration management”, etc.

Enter “instrument settings” program by clicking “INST Setup” icon on the desktop. Input the following password to display configuration settings screen:

12345678

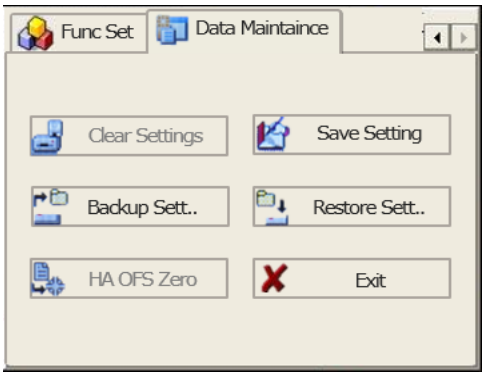
NOTE: This password is open for all users, current configuration settings can be checked here, but not be adjusted. If you want to adjust these settings, please contact local distributer or STONEX company.

On the upper right part of the screen tap ◄/► keys: different setting screen can be shifted.

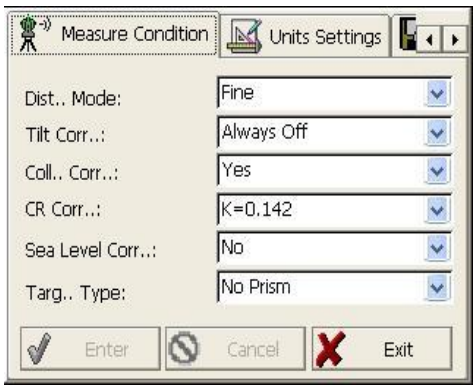


After selecting the option, in each page, press [Enter] to keep the setting or press [Cancel].

Before leaving this program click [Save Setting] in the “Data Maintenance” screen, otherwise changes are not saved.



5.2.1. Measure condition setting



In this page, the following options can be set:

The distance measurement mode possesses five sorts of modes (Fine, Coarse, Repeat Fine, Average Fine, Tracking) which choice interfere with the accurancy of the measures. Worth noting that along with selected measuring mode the selections of prism types are different.

Fine	The measuring is continuous and the number of measures is set by default.
Coarse	The distance is measured once. This measuring mode has the higest measuring speed but reduced accurancy.
Repeat fine	The distance is measured once and, for some EDM, a frequency is added to have an higher accurancy.
Average Fine	The measuring is continuous and the number of measures is choosen by the operator (see 6.2. Distance measurement).
Tracking	The distance is measured continuely untill [STOP] is pressed.

Tilt correction: allows to activate the compensator in one or two directions:

- **HV** the compensator is on in both the direction (XYON);
- **V** the compensator is on in the X direction only (XONYOFF);
- **NO** the compensator is off in both the direction (XYOFF);
- **Always off** the compensator is always off in both the direction (A.OFF).

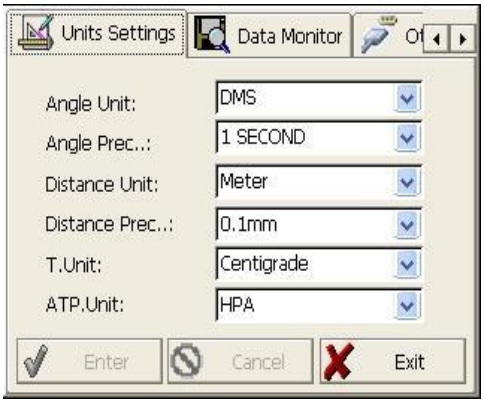
Collimator correction: Yes or No.

CR correction: this coefficient takes into account the fact that measures can be affected to the refraction and the earth curvature (see Appendix II: Correction for refraction and earth curvature). Values can be chosen between 0.142, 0.20 and No.

Sea Level correction: Yes or No.

Target Type: with this option, it is possible to define the target type. Four types are available: Prism, No prism, Reflector, Remote prism.

5.2.2. Units settings



Angle unit: set the angle unit between DMS, GON, MIL.

Angle Precision: the displayed minimum angle format can be selected in the following way:

- 1 second;
- 0.1 second;
- 0.5 second.

Distance Unit: set the distance unit between Meter, US Feet, Feet.

Distance precision: the displayed minimum angle format can be selected in the following way:

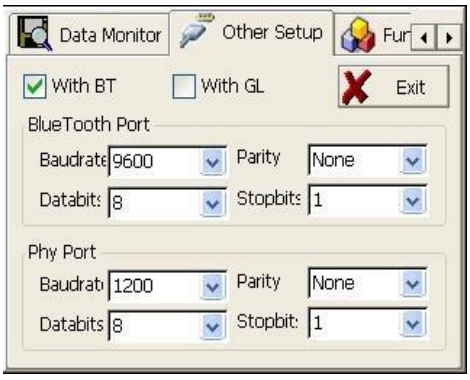
- 1mm;
- 0.1 mm.

T. unit: set the temperature unit between Centigrade and Fahrenheit degree: °C / °F.

ATP. Unit: Set the pressure unit between HPA / mmHg / inchHg / mbar / PSI.

5.2.3. Communication ports settings

Click "Other Setup", you can activate Bluetooth (BT) and guidelight (GL), and set parameters of "Bluetooth Port" and "Phy Port".



Baudrate: it is the data transfer speed. Choose between 1200/2400/4800/9600/19200/38400 /57600/115200.

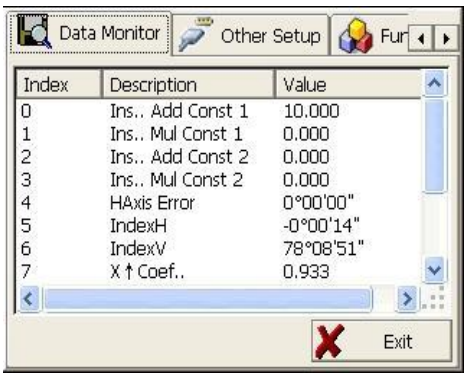
Databits: you can choose the data bits with which transfer data. Choose between 7 or 8.

Parity: choose between "None" or "Odd".

Stopbits: choose between 1bit/2bit.

5.2.4. Instrument parameters review

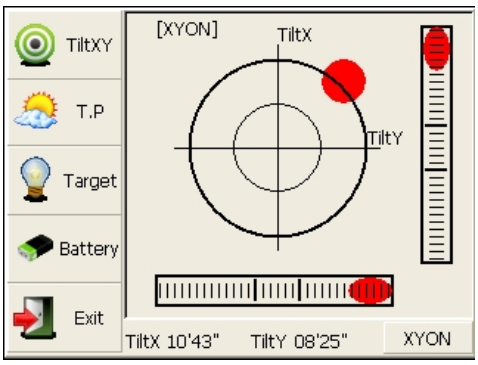
Click on “Data Monitor” window to review the setting parameters.



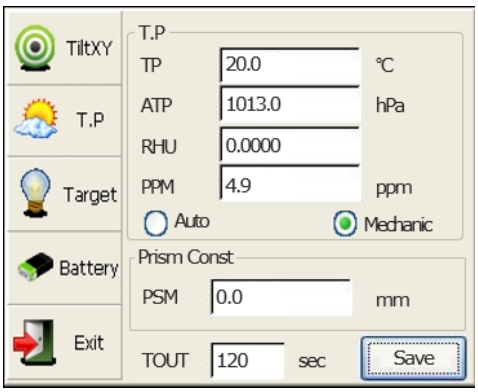
5.3. Star settings

Press the [★] button. Electronic bubble function on this panel is used for dynamic display of electronic bubble during leveling up. Furthermore, functions like settings of meteorological condition, observed object, illumination, prism constant and communication port are provided. On the electronic bubble screen, five function keys are displayed in the left column, which is listed as follows:

TiltXY: (it is opened as default): it shows the bubble and gives the possibility to select the compensator options (see 3.4. Centering and levelling-up).

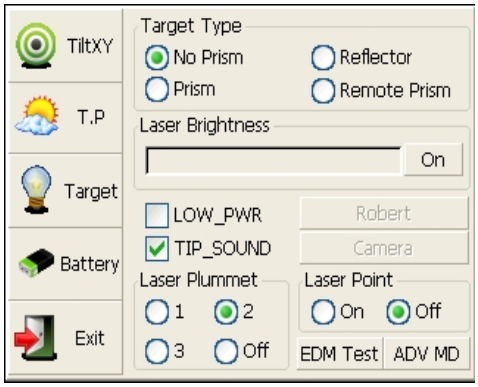


T.P.: observation and setting of temperature and atmospheric pressure



- **TP**: edit the temperature
- **ATM**: edit the air pressure
- **RHU**: edit the relative humidity
- **PPM**: edit the atmospheric correction value
- **Auto/Mechanic**: choose the former to use default values, the latter to type values.
- **PSM**: edit the prism constant
- **TOUT:** edit the maximum timeout time when you start distance measuring and firstly get the distance result.

Target: target condition of surveying

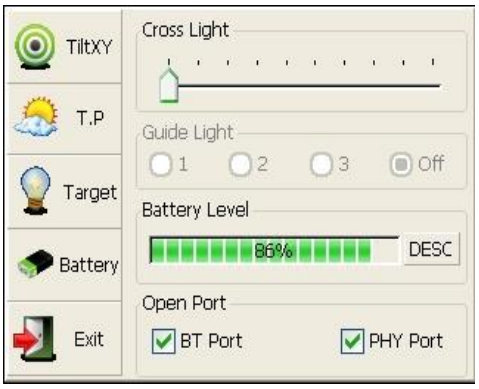


- **Target type**: select the target type between one of the following options: Prism, No prism, Reflector, Remote prism;
- **Laser Brightness** it evaluates the laser brightness in percentage;
- **LOW_PWR**: ticking it, you reduce the screen illumination;
- **TIP_SOUND**: ticking it, the sound is on while measuring;
- **Laser plummet**: you can choose between three levels of laser plummet brightness or to switch it off;
- **Laser point**: choose if switch it off or on;

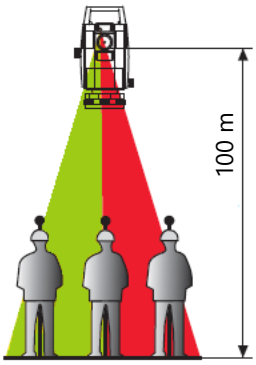
- EDM Test: it evaluates the EDM signal intensity (reflection intensity) NOTE: it is optional for R35 series total stations.

- ADV MD: allows to edit advanced functions of EDM.

Battery: dynamic display of battery level



- **Cross Light**: level the telescope illumination on reticle;
- **Guide Light**: it could be helpful to the surveyor to adjust the station and prism positions and to set the prism, mainly during the stake out. The guide light could be seen within 100 meters, even if the distance may be affected by atmospheric conditions and others.



Under the face left situation, the person at the prism has to move to left direction when he only sees the green light or the light becoming bigger; while to the right direction, if he only sees the red light or light becoming bigger. In the contrary way when the telescope is in face right. Choose the light intensity or select "Off" to turn off guide light

- **Battery level**: see the battery level. The [DESC] button on the right allows to see some battery parameters.

- **Open Port**: tick the port you want to use: "BT Port" is the Bluetooth connection; "PHY Port" is the physical port service of system.

Exit: exit the electronic bubble screen.

5.4. Setup parameters

In the welcome interface, select “BSC Measure“ to enter into the basic measure interface.

Select the [Param] icon.

Here you can set:

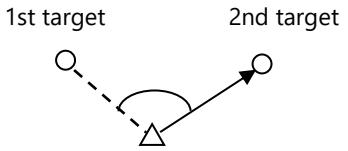
- The coordinate order as NEZ or ENZ;
- The instrument coordinate saving (Save or S.Zero (not save));
- The angle Unit as DMS, GON, MIL;
- The Distance Unit as m, UsFeet, IntFeet.

6. Measurement

6.1. Angle measurement

Select the [M. Angle] icon to operate under angle measurement mode. The vertical and horizontal angles are displayed.

6.1.1. Measure a horizontal angle between two points



Collimate the first target.

Set horizontal angle as zero for the first target, clicking the [S.Zero] button, and choose "Yes" in the popup dialog box.

Collimate the second target, and the horizontal angle and vertical angle will display on the screen of instrument.

6.1.2. Horizontal angle switch between right and left

Make sure the operation is under angle measurement mode.

Switch horizontal angle between left and right by clicking [L/R Angle] key.

Left angle or right angle will be switched in turn every time you click the [L/R Angle] key.

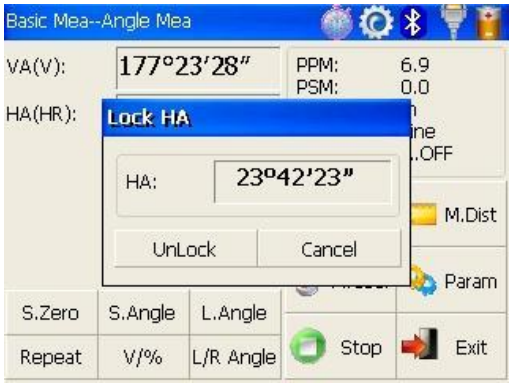
6.1.3. Setting horizontal angle to a required position

Make sure the operation is under angle measurement mode.

Sight the needed direction.

Click [L.Angle] key to activate the function of locking horizontal angle.

Collimate target point used for orientation.



Click [UnLock] key to deactivate the function of locking horizontal angle. Then the screen will return to normal angle measurement mode, and meantime horizontal angle will be set as locked angle.

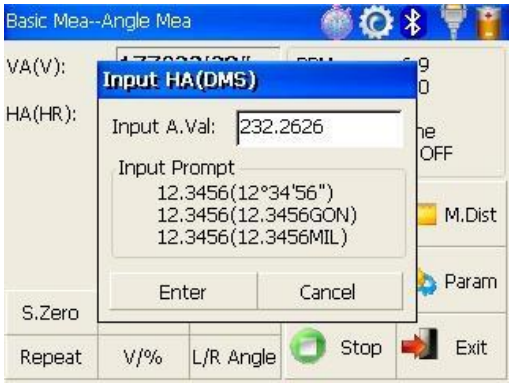
6.1.4. Setting horizontal angle to a required value

Make sure the operation is under angle measurement mode.

Sight the needed direction.

Click [S.Angle] key, and a dialog box will be ejected, as is showed in the right figure.

Input horizontal angle you need (such as: 232°26'26"). Data entry should be referred to the format shown in the dialog box.



Click [Enter] key, and angle measurement after orientation will go on.

6.1.5. Set vertical angle in percentage values

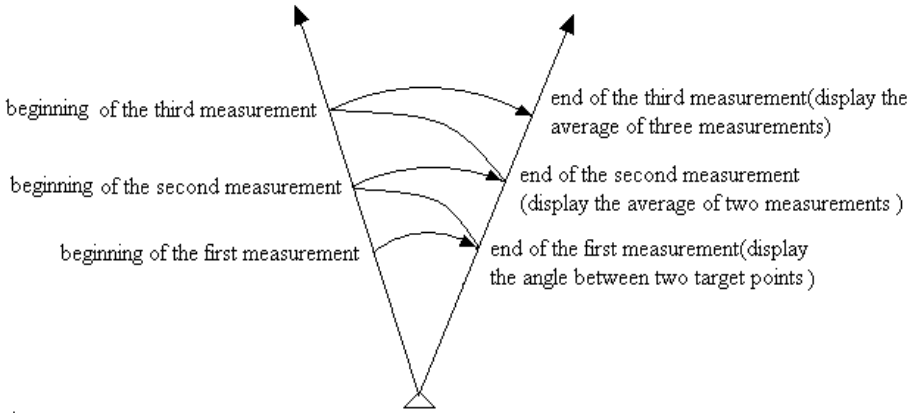
Make sure the operation is under angle measurement mode.

Click [V/%] key. The angles are shown in percentage values. It is possible to measure angles smaller or equal to ±45°, otherwise "Overlay" appears on the display. 0 is set when the objective is turned in the horizontal direction: ±45°=±100%, Horizontal=0°.

Vertical angle and percent grade will be switched in turn every time you click "V/%" key.

6.1.6. Carrying out angle retesting

This program is applied for adding up angle retesting values, displaying the sum and the average of all observed values, and meantime recording the number of observations.



Click [Repeat] key to activate angle retesting function.

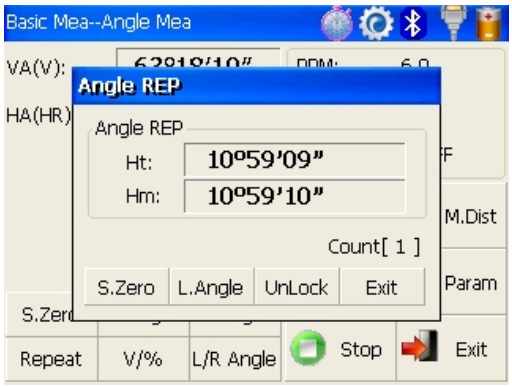
Collimate the first target A and click [S.Zero] key, and set horizontal angle as zero.

Collimate the second target B and click [L.Angle] key.

"Count" stands out the number of angle measures (1 in this step).

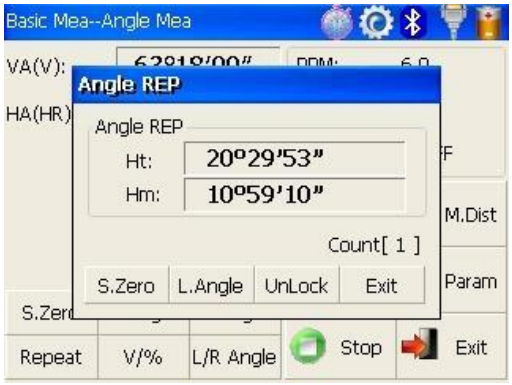
Collimate the first target A again using horizontal clamp and tangent part.

Click [Unlock] key.



Collimate the second target B again using horizontal clamp and tangent part.

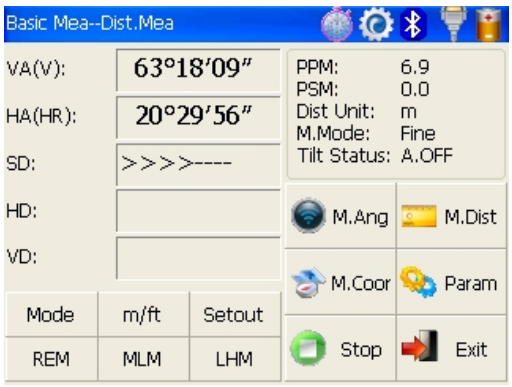
Click [L.Angle] key. And then the screen displays the sum (**Ht**) and the average (**Hm**) of all angles.



Repeat the last two steps according to the requirement and carry out angle retesting.

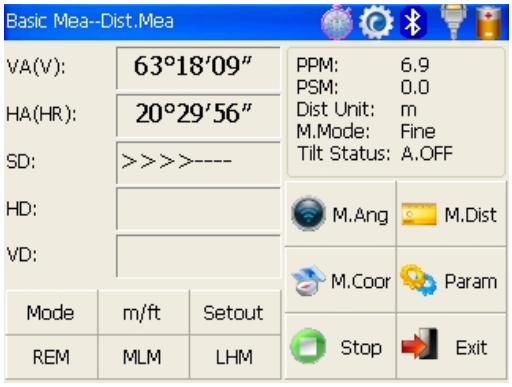
6.2. Distance measurement

Select the [M. Dist] icon to operate under distance measurement mode. The vertical and horizontal angles, the slope (**SD**), horizontal (**HD**) and vertical (**VD**) distances are displayed.



6.2.1. Distance measurement mode

Click [Mode] key to activate setting function of distance measurement mode.



Choose one of the following modes:

- Fine: single fine measuring
- N Fine: n times fine measuring
- Loop Fine: continuous measuring
- Track: tracking measuring

Take "Loop Fine" as example here.

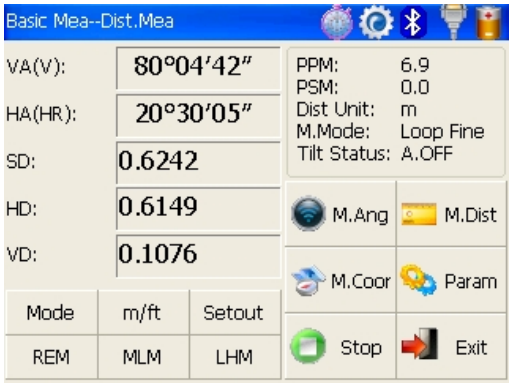
Select [Enter].

In the case you select the "N Fine" mode, input the number of needed observations in the "Count" space.

The selected mode appears on the right upper side of the screen.

Click on [M.Dist] to start measuring the distance. The results of measurement are displayed.

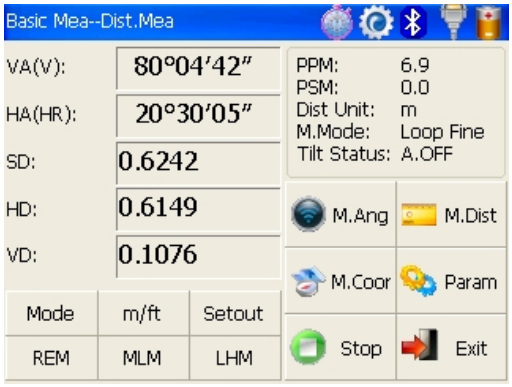
To end measuring press [Stop].



When you preset the measuring times, the instrument will carry out distance measurement and display the average distance according to the setting times. If you preset single observation (Fine mode), the average distance won't be displayed, but the distance comes out from a single measure.

6.2.2. Exchange of distance units

Click [m/ft] key.



Changed distance unit will display in the upper right corner.

Distance unit will be exchanged among meter, American feet and international feet every time you click "m/ft" key.

6.2.3. Distance stake out measurement

This function can display the difference between measured distance and preset distance.

Displayed Value = Observed Value – Standard (Preset) Distance

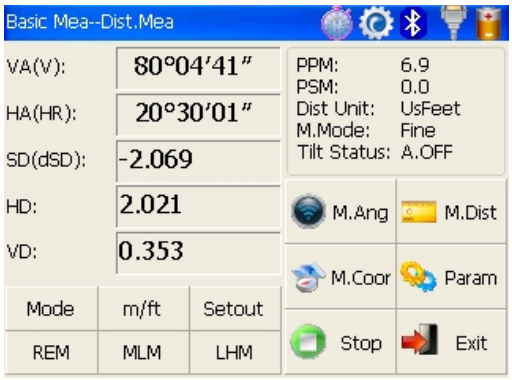
Setting out among all sorts of distance measurement modes (such as slope distance, horizontal distance and elevation difference) can be carried on.

Click [Setout] key under distance measurement mode. A prompt that reminds you to input SD to be set out is displayed in the popup dialog box.

Input data and click [Enter] key to execute SD setting out.

If you want HD setting out, input zero in "SD dialog box", click [Enter], and the system will eject "HD dialog box" automatically. If you want VD setting out, input zero in both "SD dialog box" and "HD dialog box", thus the system will remind you to input elevation difference to be set out.

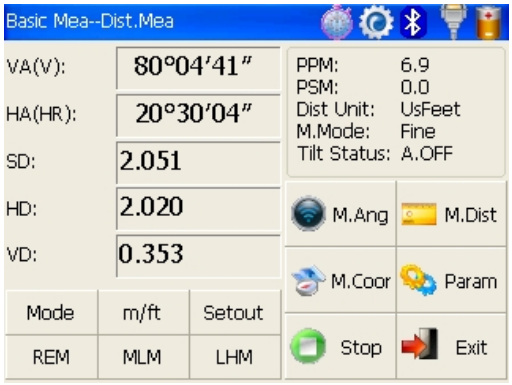
Start setting out.



6.2.4. Remote Elevation Measurement (REM)

The Remote Elevation program calculates the vertical distance (VD) of a remote object relative to ground. When using a prism height, the remote elevation measurement will start from the prism (reference point). If no prism height is used, the remote elevation will start from any reference point in which the vertical angle is established. In both modes, the reference point should be perpendicular to the remote object.

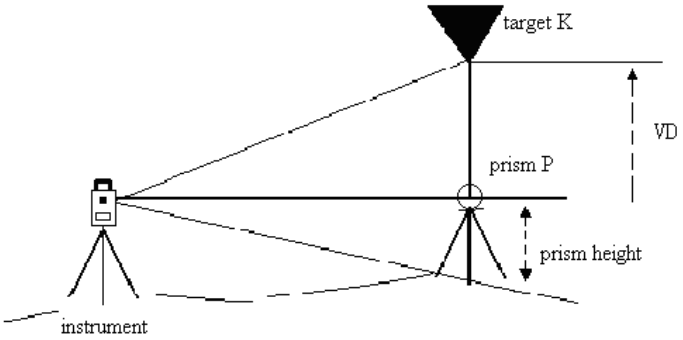
Under distance measurement mode, click [REM] key to activate remote elevation measurement.



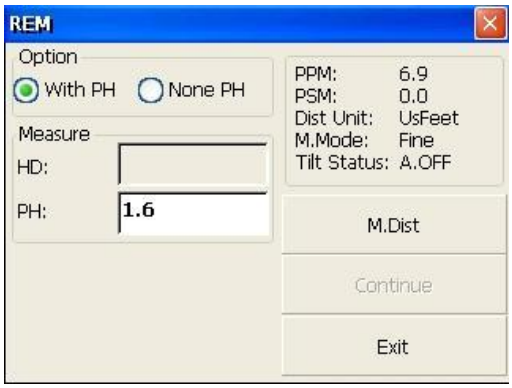
The instrument can accomplish this in two ways:

- With PH: if a prism height is used;
- None PH: if no prism height is used.

With prism height (PH) input



Select “with PH” button with stylus and input the prism height following PH.

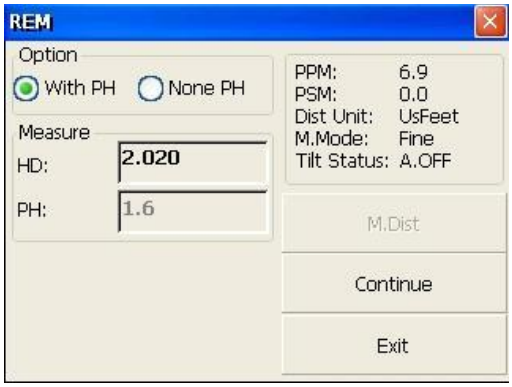


Collimate the center P of prism.

Click [M.Dist] key to start measuring.

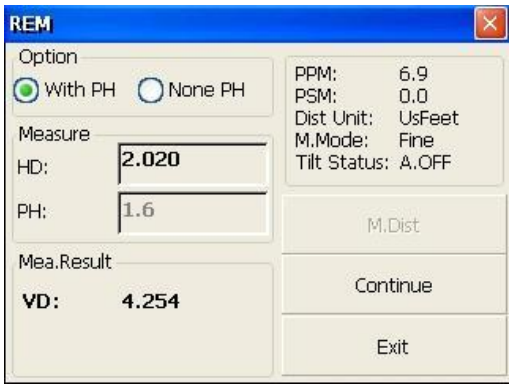
Horizontal distance between instrument and prism will be shown.

Click [Continue] key, and position of prism is locked, that means reference point is confirmed.

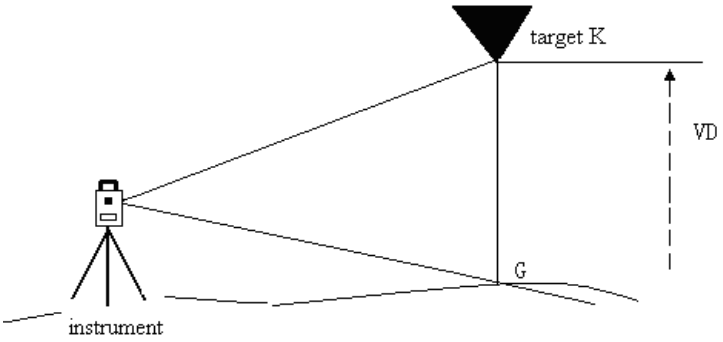


Collimate target K and click [Continue], vertical distance (VD) will be shown.

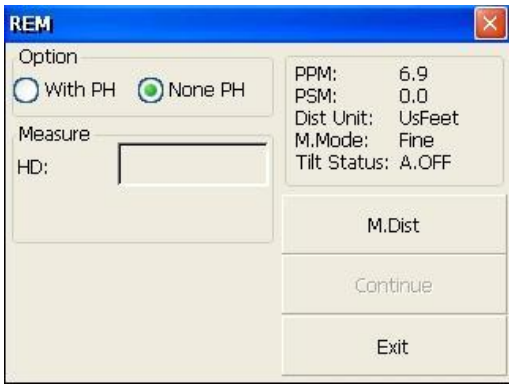
Click [Exit] key to finish REM.



Without prism height input



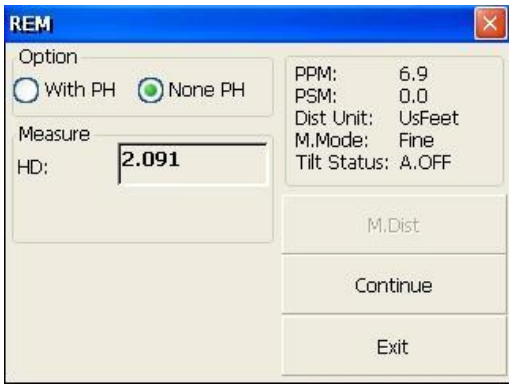
Select “None PH” button with stylus.



Collimate the ground point.

Click [M.Dist] key to start observing.

Horizontal distance between instrument and ground point will be shown.



Click [Continue] key, and position of ground point G is locked that means reference point is confirmed. Vertical distance (VD) has to be 0.

Click [Continue] key.

Collimate remote target K. Vertical distance (VD) will be shown.

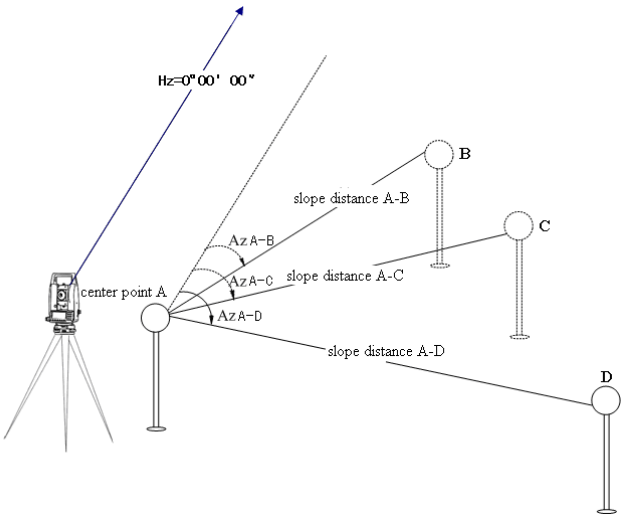
Click [Exit] to finish REM

6.2.5. Missing Line Measurement (MLM)

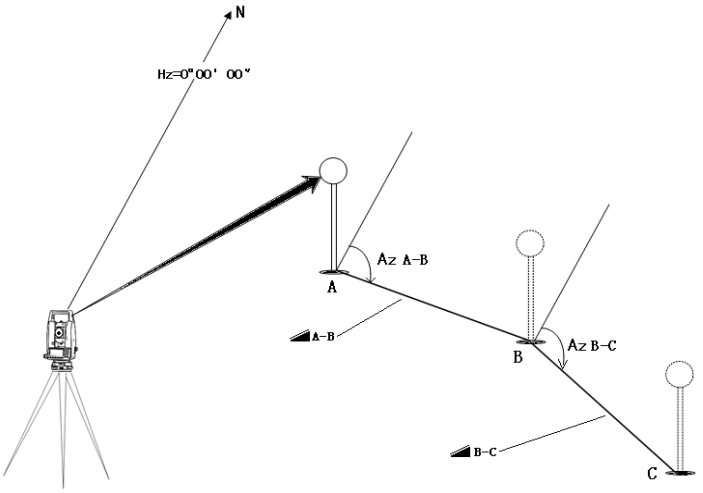
The Missing Line Measurement program calculates the horizontal distance (dHD), slope distance (dSD) and elevation (dVD) between two target prisms.

The instrument can accomplish this in two ways:

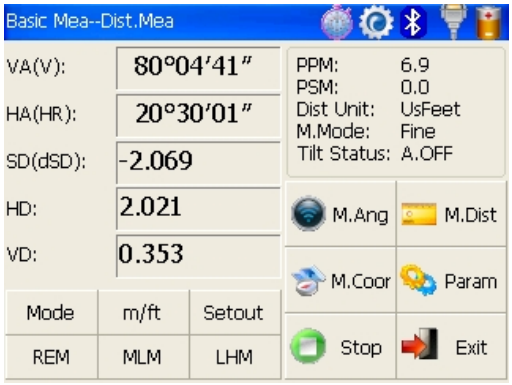
- MLM Method (A-B, A-C): Measurement is A-B, A-C, A-D, …



- MLM Method (A-B, B-C): Measurement is A-B, B-C, C-D, …

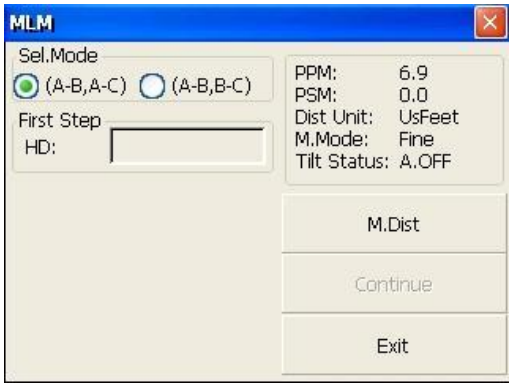


Under distance measurement, click [MLM] key to activate Missing Line Measurement.

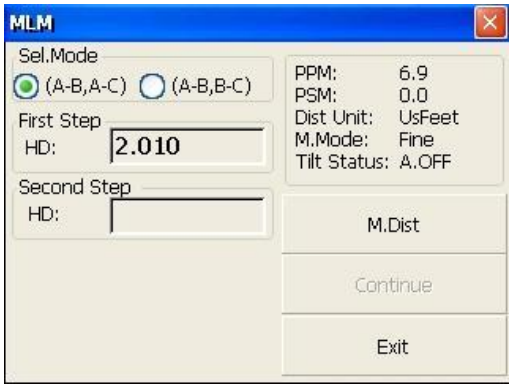


Select method (A-B, A-C) with stylus.

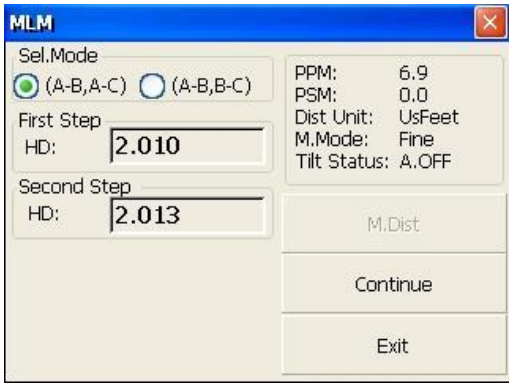
Procedure of (A-B, B-C) method is completely the same as (A-B, A-C) method.



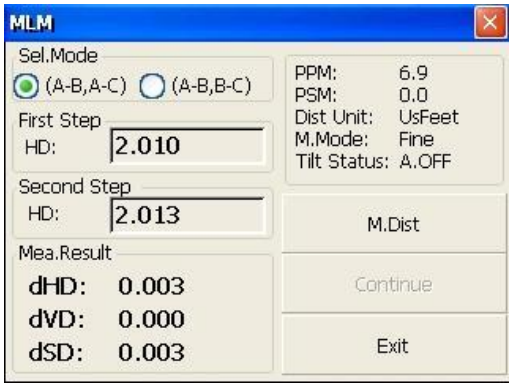
Collimate prism A and click [M.Dist] key. Horizontal distance between instrument and prism A will be shown.



Collimate prism B, click [M.Dist] key.

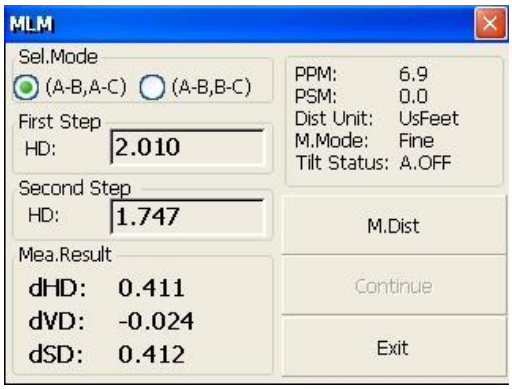


Click [Continue] key, Then horizontal distance (dHD), elevation difference (dVD) and slope distance (dSD) between prism A and prism B will display.



Click "Exit" key to return to main menu, otherwise, in order to calculate the horizontal distance between points A and C, collimate prism C, and click "M.Dist" key again. Thus horizontal distance between instrument and prism C will be shown.

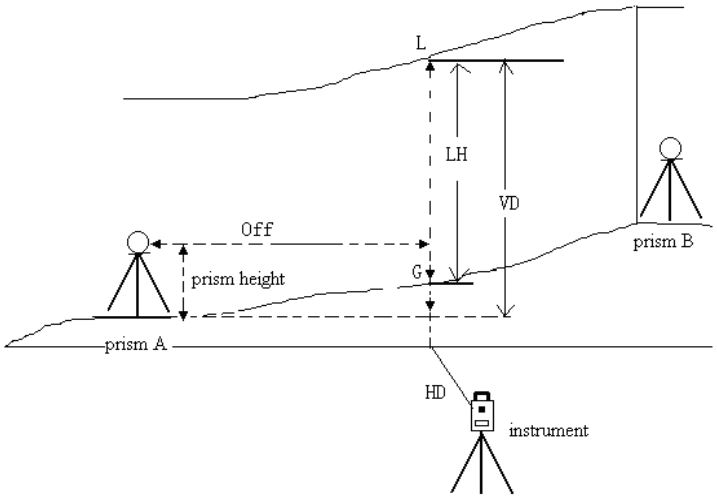
Click "Continue" key,then dHD, dVD and dSD between prism A and prism C will be shown.



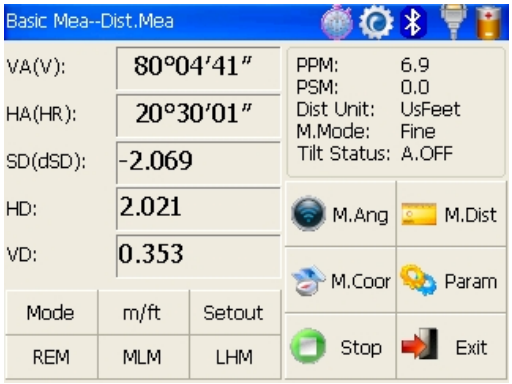
6.2.6. Line-height measurement

This function is applied for measuring and determining a height of line (like electric wire) above ground which is hard to reach.

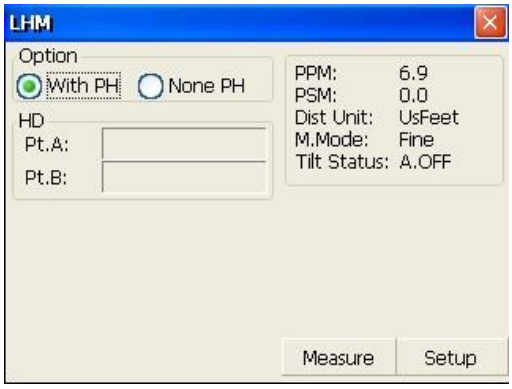
See following image, L is point on the overhead line, G is projective point on the ground, which is also difficult to set target, A and B are baseline which are set up in a certain distance under line. After measuring horizontal distances from instrument to prisms A/B and confirm the base line, VD between A and B, VD between L and G, HD between instrument and L(G), offset distance from A to L(G) will be determined and shown.



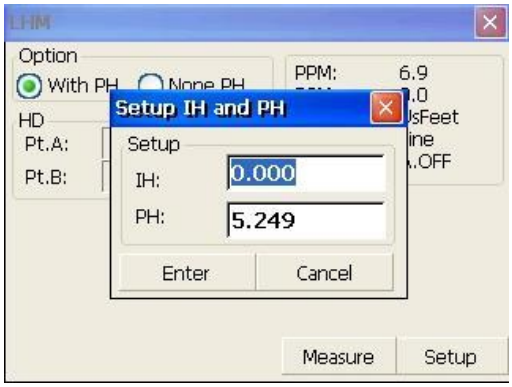
Under distance measurement mode, click [LHM] key to activate line-height measurement program.



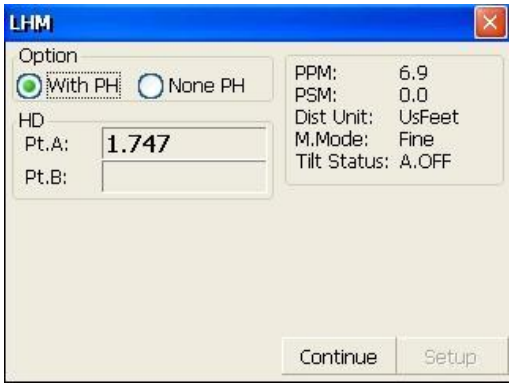
Select "With PH" button with stylus.



Click [Setup] key to input instrument height (**IH**) and prism height (**PH**). After that click [Enter] key.



Collimate prism A, click [Measure] key, and distance measurement begins. After that click [Continue] key.

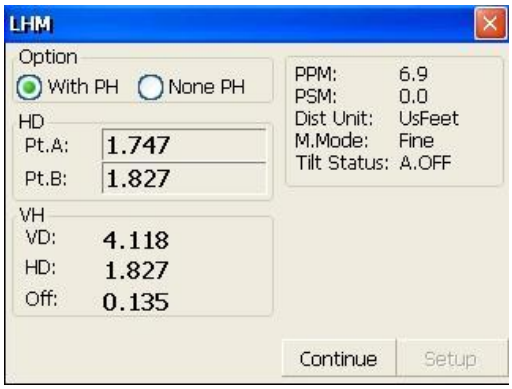


Collimate prism B, click [Measure] key, and distance measurement begins.

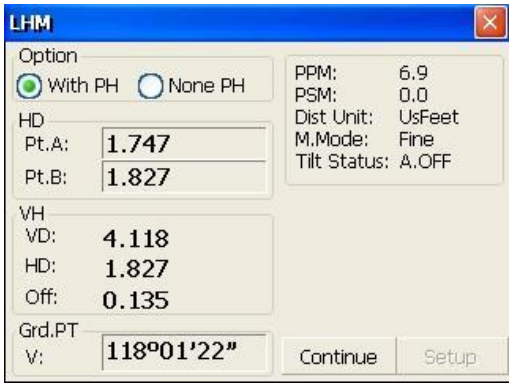
After measurement click [Continue] key.

Collimate point L on overhead line. The screen displays measuring data of collimating L.

- **VD**: Vertical distance between A and L.
- **HD**: Horizontal distance between instrument and L.
- **Off**: Horizontal distance between A and L.



Collimate point on overhead line and click [Continue] key which is used for measuring height between overhead line and ground.



Collimate ground point G by screwing vertical tangent part.

Click [Continue] key again, and then height of overhead line (**LH**) and horizontal distance (**Off**) will display. Click "X" key to end measurement or click [VH] key to return to collimate L point.

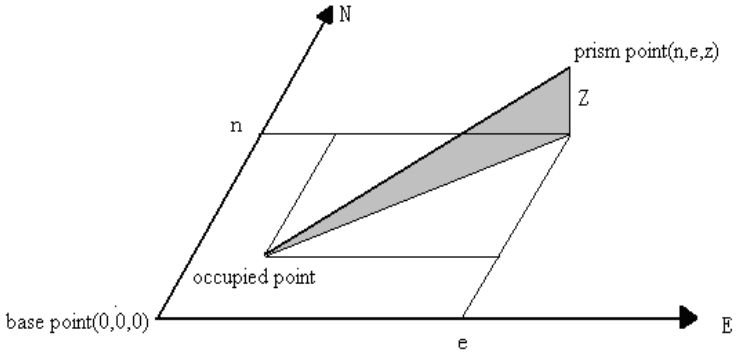
6.3. Coordinate measurement

Select the [M. Coor] icon to operate under distance measurement mode. The vertical and horizontal angles and the E-N-Z coordinates are displayed.

Press [Mode] to select the distance measure mode: options are described in 6.2.1. Distance measurement mode.

6.3.1. Setting coordinate of occupied point

After inputting coordinate of occupied point (instrument location), unknown point coordinate will be measured and displayed with this program.



Click [OCC PT] key.

Input coordinate of occupied point from N to Z and click [Enter] to return to the coordinate measurement interface.

6.3.2. Setting backsight point

Click [S.BS] key to set backsight point.

Input coordinate of backsight point and click [Enter] key.

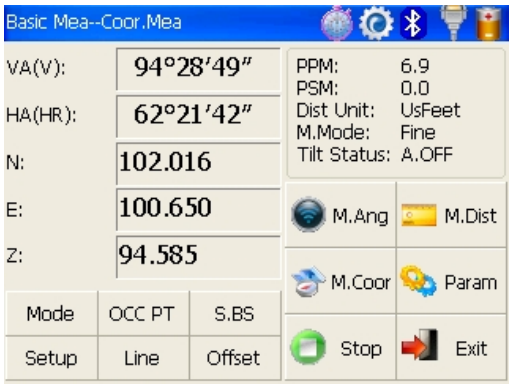
A dialog box is ejected as figure shows.

Collimate backsight point, click [Yes] key. And then the system will define backsight azimuth angle which displays in the upper left corner of coordinate measurement screen.

6.3.3. Setting instrument and prism heights

Coordinate measurement must be based on instrument height and prism height, thus coordinate of unknown point can be calculated easily and directly.

Click [Setup] key.

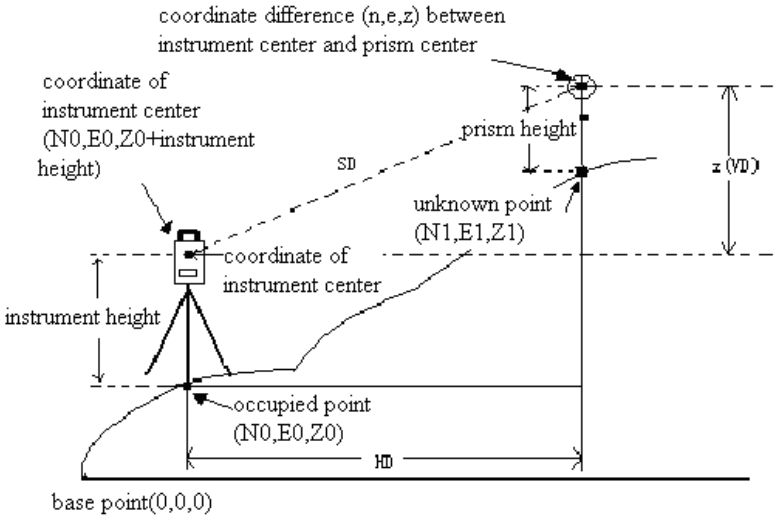


Input instrument height (**IH**) and prism height (**PH**).

Finishing data entry, click "Enter" key to return to coordinate measurement screen.

6.3.4. Operation of coordinate measurement

With coordinate of occupied point, backsight azimuth angle, instrument height and prism height set up, you can directly calculate coordinate of unknown point.

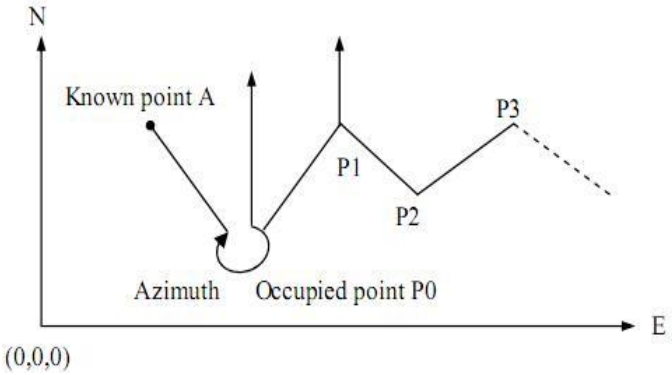


Set coordinate of occupied point (see 6.3.1. Setting coordinate of occupied point) instrument height/prism height (see 6.3.3. Setting instrument and prism heights) and backsight azimuth angle (refer to 6.3.2. Setting backsight point or 6.1.3. Setting horizontal angle to a required value). If don't input coordinate of occupied point, previous coordinate of occupied point is set as default; the same for instrument and prism heights.

Collimate target and click [M.Coor] key to finish operation.

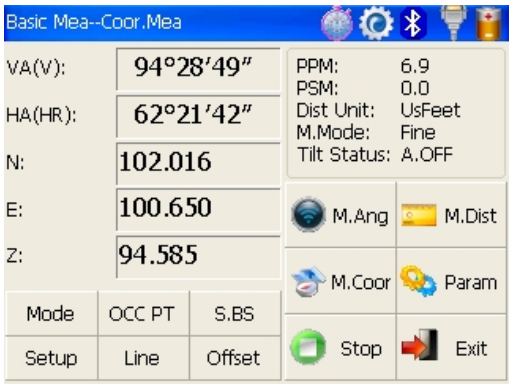
6.3.5. Traverse surveying

Measure the coordinate of foresight point and save it in the list, this point would be taken as the occupied point after transferring to point 2, and the previous occupied point will be taken as the backsight point, the azimuth angle will be calculated and set.

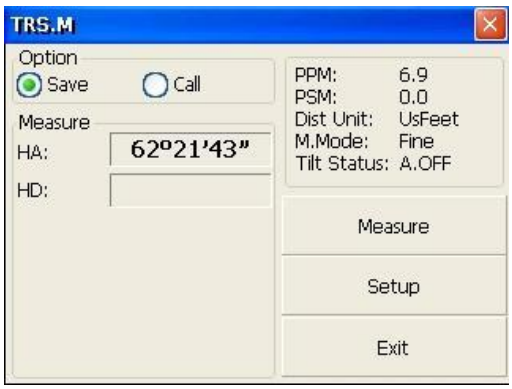


Set coordinate of occupied point P0 and azimuth angle from point P0 to known point A.

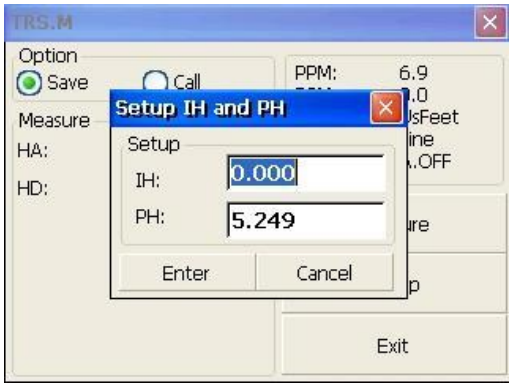
Click [Line] key.



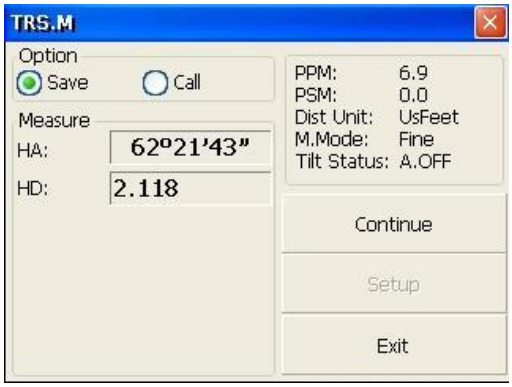
Click [Save] key with stylus.



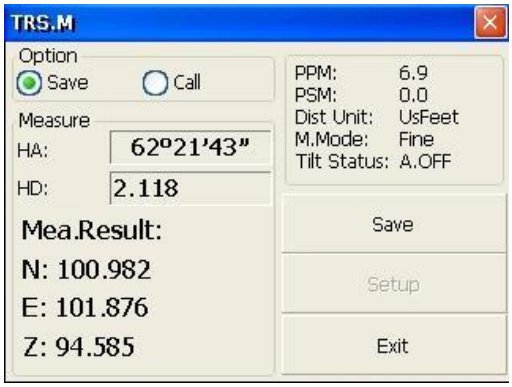
Click [Setup] key to reset instrument and prism heights. And then click [Enter] key.



Collimate prism in target point P1, where instrument will be transferred. Meantime click [Measure] key.

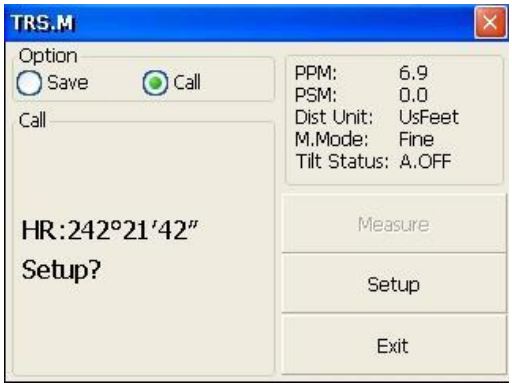


Click [Continue] key and point P1 coordinates are displayed in the lower left corner of screen.



Click [Save] key. Coordinate of P1 can be ascertained and it will return to main menu. At last, power off and transfer instrument to P1 (transfer prism from P1 to P0 meantime).

After instrument is established in P1, enter into traverse surveying of coordinate measurement thought the [Setup] button and select "Call" button with stylus.



Collimate last occupied point P0. Click [Setup] key.

Coordinate of P1 and azimuth angle from P1 to P0 will be ascertained and it returns to main menu at the same time.

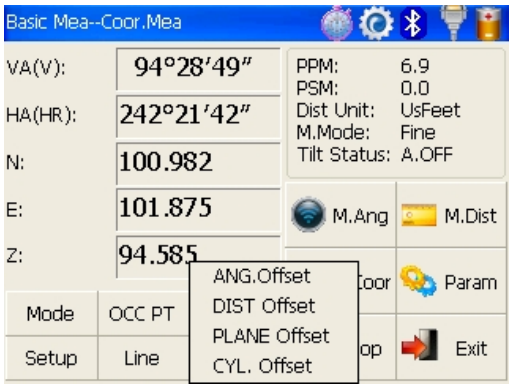
Repeat previous steps, carrying on according to the sequence of guidelines till the end.

6.3.6. Offset measurement mode

Click [Offset] key.

There are four kinds of offset measurement modes:

- ANG. Offset (angle offset measurement)
- DIST Offset (distance offset measurement)
- PLANE Offset measurement
- CYL. Offset (column offset measurement)

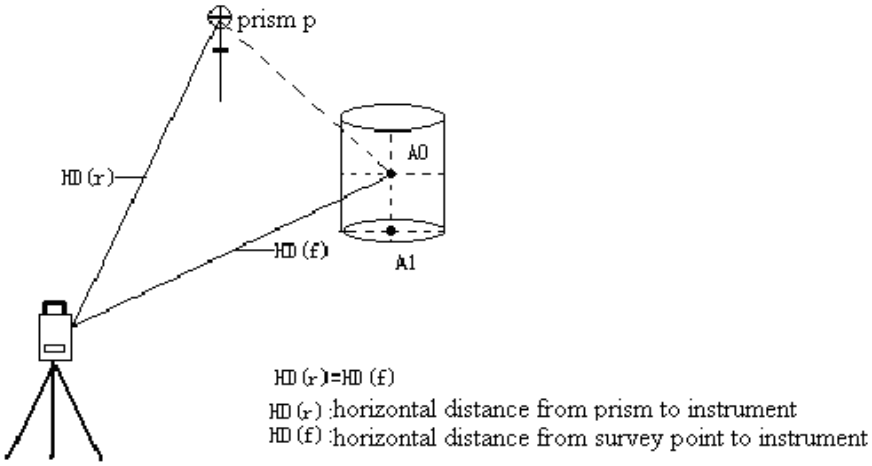


NOTE:

- Set instrument/prism height before offset measurement, see 6.3.3. Setting instrument and prism heights.
- When measuring coordinate of ground point A1 (projection of point A0), instrument and prism heights have to be set; when measuring coordinate of point A0, instrument height has only to be set (prism height is set as 0).
- Set coordinates, referring to 6.3.1. Setting coordinate of occupied point.

Angle offset measurement

This program is used to measure the point where it's difficult to set prism. Place the prism at the same horizontal distance from the instrument as that of point A0 to measure.

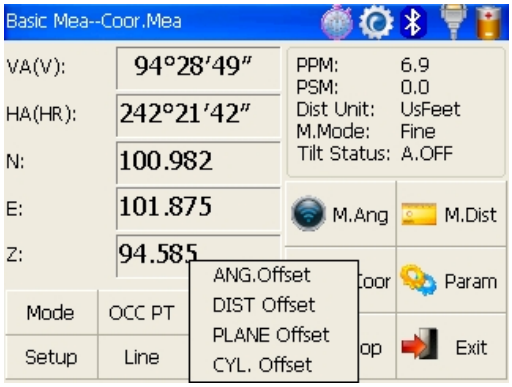


Under angle offset measurement mode, there are two methods to set vertical angle:

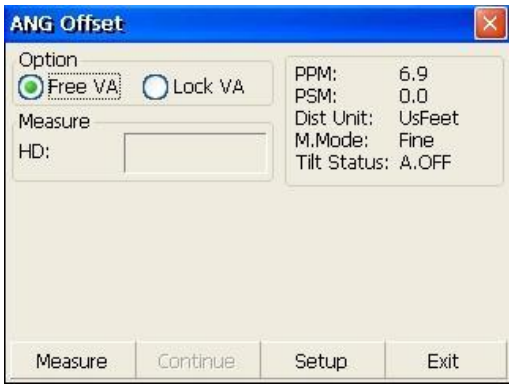
1. Free vertical angle: vertical angle ranges from up-and-down movement of telescope.
2. Lock vertical angle: vertical angle is locked and can't range from up-and-down movement of telescope.

Thus, collimating A0 with the first method, vertical angle ranges from up-and-down movement of telescope, and meantime slope distance (SD) and elevation difference (VD) will change too. But collimating A0 with the second method, vertical angle is locked in the direction where prism is located and can't range from up-and-down movement of telescope.

Click [Offset] key and [ANG.Offset] key in ejecting dialog box.

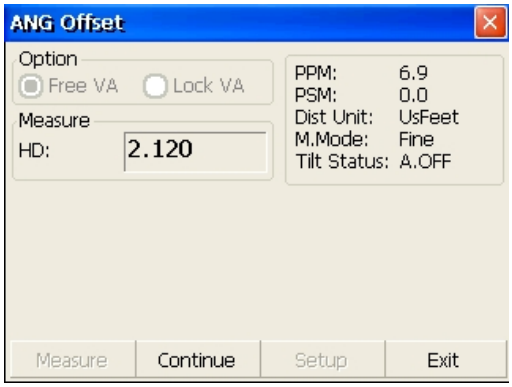


Select "Free VA" (or "Lock VA") with stylus to start angle offset measurement (user makes a choice on the basis of own demand)

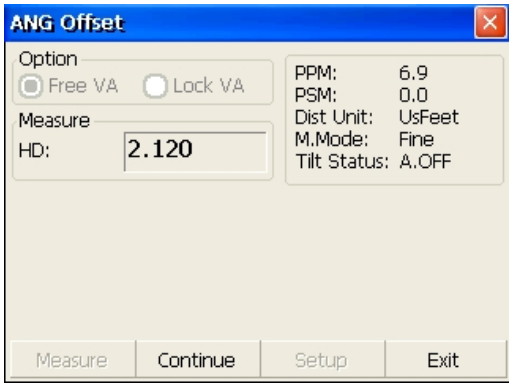


If it hasn't already done, click [Setup] key to set instrument height and prism height.

Collimate prism P and click [Measure] key.



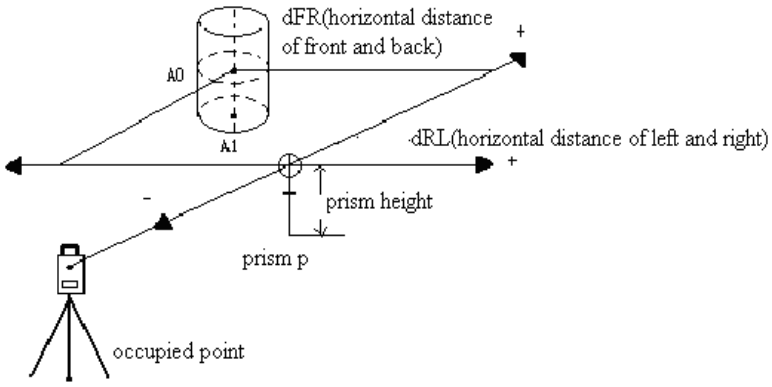
Collimate target A0 with horizontal clamp and tangent part. Click [Continue] key.



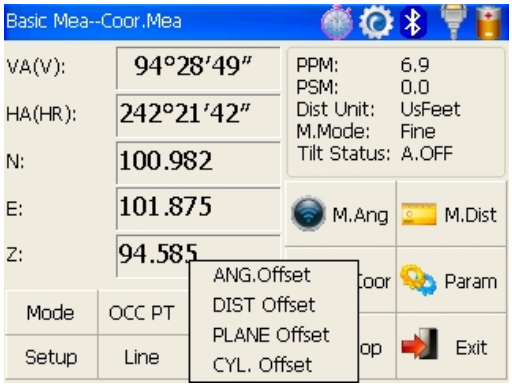
Then slope and horizontal distances and elevation difference from instrument to A0 and coordinate of A0 will be shown.

Distance offset measurement

The measurement of a target point apart from a prism is possible by inputting offset horizontal distance of front and back/left and right.



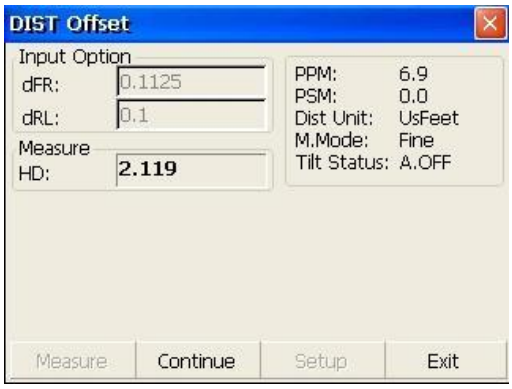
Click [DIST Offset] key in ejecting dialog box.



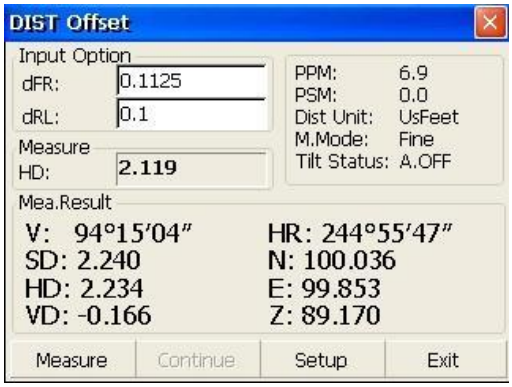
Entry the horizontal distance of front and back (**dFR**) and horizontal distance of left and right (**dRL**).

If it hasn't already done, click [Setup] key to set instrument height and prism height.

Collimate prism and click [Measure] key.

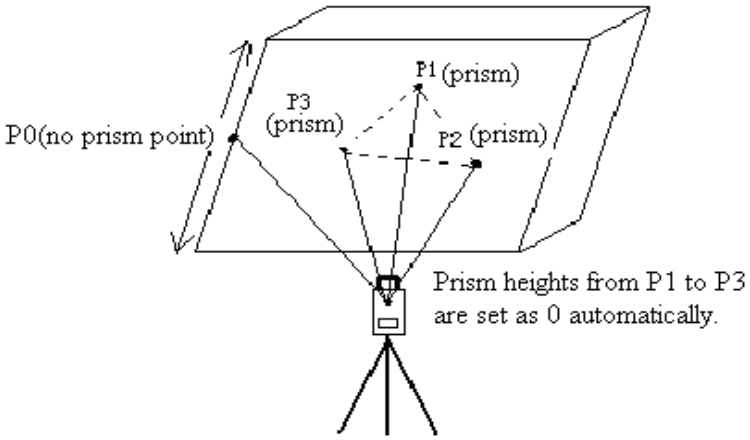


Click [Continue] key and result displays with offset distance correction.

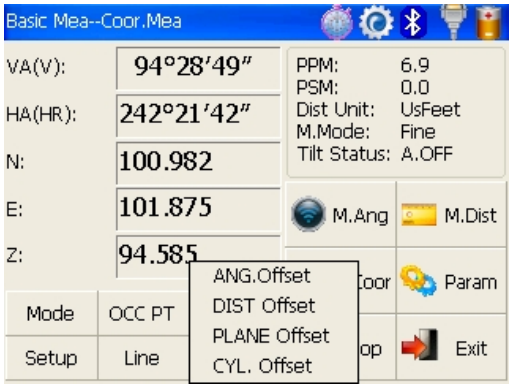


Plane offset measurement

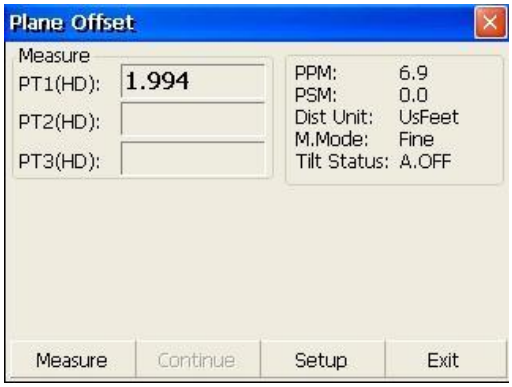
Measuring will be taken for the place where direct measuring can not be done, for example distance or coordinate measuring for an edge of a plane. Three random points (P1, P2, P3) on a plane will be measured at first in the plane offset measurement to determine the measured plane, collimate the measuring point (P0), the instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane.



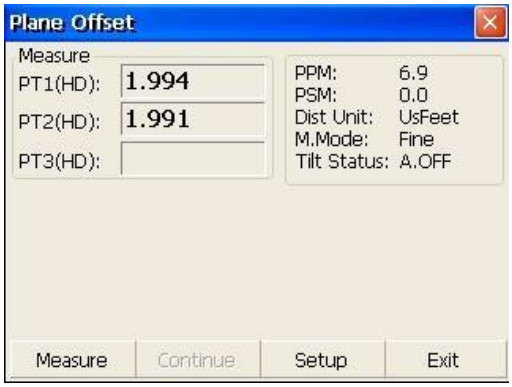
Click [PLANE Offset] key.



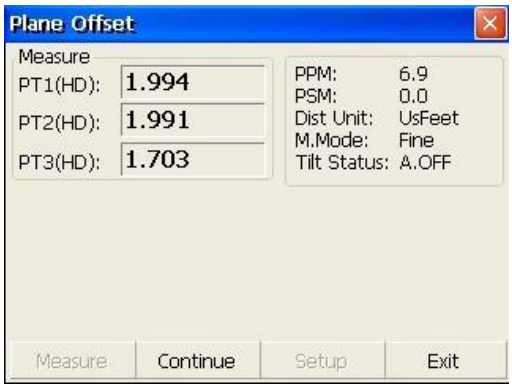
Collimate prism P1, and click [Measure] key.



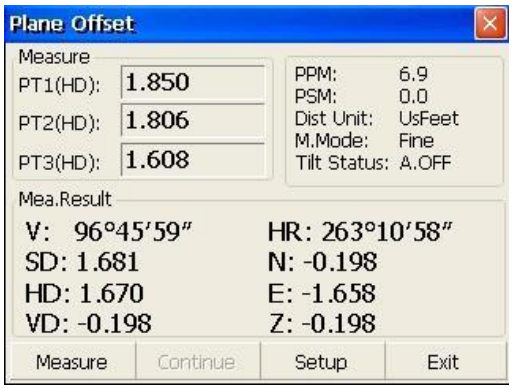
Collimate prism P2, and click [Measure] key.



Collimate prism P3, and click [Measure] key.



Click [Continue] key to calculate relational values between collimation axis and plane.

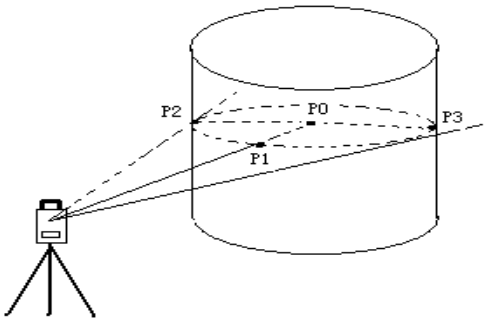


NOTE:

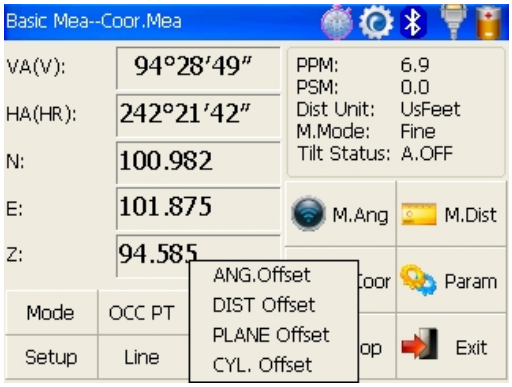
- If the three observing points can't determine a plane, the system will display error message. Thus observe the first point once again.
- When collimation axis doesn't intersect with determined plane, the system will display error message.

Column offset measurement

It is possible to measure circumscription point (P1) of column directly, the distance to the center of column (P0), coordinate and direction angle can be calculated by measured circumscription points P2 and P3. The direction angle of the center of column is 1/2 of total direction angle of circumscription points P2 and P3.

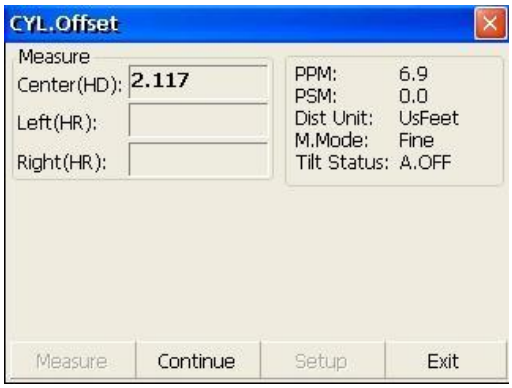


Click [CYL.Offset] key.

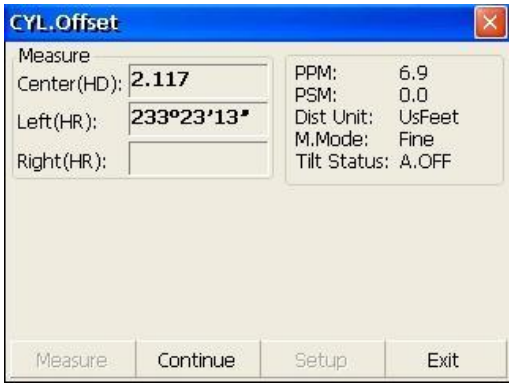


If it hasn't already done, click [Setup] key to set instrument height and prism height.

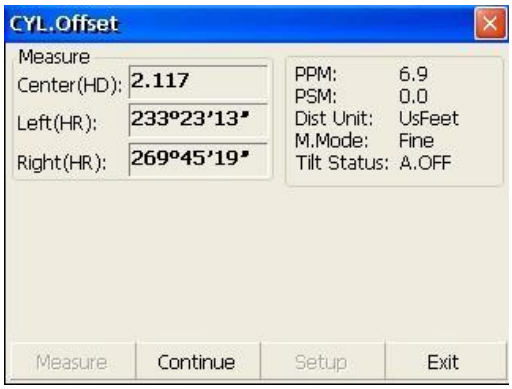
Collimate the center (P1) of column surface, and then click [Measure] key.



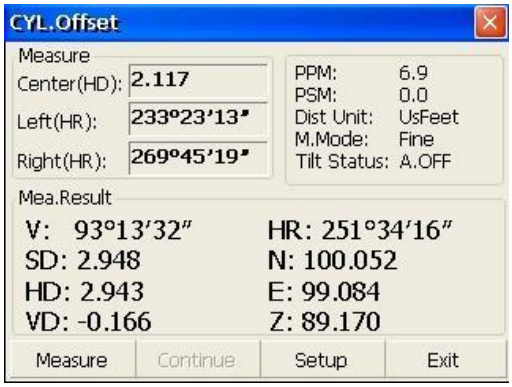
Collimate left point (P2) of column surface, and then click [Continue] key.



Collimate right point (P3) of column surface.



Click [Continue] key, and relational values between instrument and the center of column (P0) can be calculated and shown.



7. Data management

7.1. USB connection

The file in the instrument could be read through:

- ActiveSync software by USB cable;
- External memory stick trough USB host connector. The file in the external memory stick could be read in the instrument interface.

Proceed with the following instructions:

1） At any interface, press [ESC] key to return the “Welcome interface” screen.

2） Select [Exit] icon

3） A dialog box is ejected requiring if turn off: Select [No]

4） Double click “My device” item

5） Open the cover of USB which behind the display panel

6） Input external memory stick into USB host connector

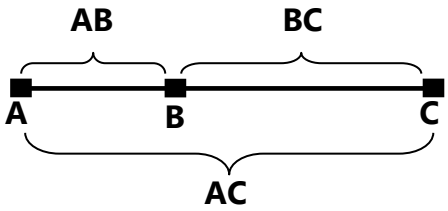
7） The external memory stick is recognized as hard disk automatically.

8. Check and adjustment

8.1. The instrument constant

I. Check

It is suggested to observe and compare the instrument with a testing baseline which is set on stable ground with a accuracy, though error is not generally included in the instrument constant. If the testing line is unavailable, you can select a flat place and set up the instrument and a target in the same height.



1. Select a point B on the approximately horizontal line AC with about 100 meters long. Measure the distances of lines AB, AC and BC.
2. The instrument constant can be calculated;

$$Instrument\ constant\ = AB + BC - AC$$

3. Repeat steps 1 and 2 ten times, and get the average value for instrument constant, if the average value is within ±3mm, adjustment is unnecessary.
4. If the difference is over ±3mm after the preceding operations, it is necessary to reset the instrument constant.

II. Adjustment

If it is necessary to reset the instrument constant, please contact STONEX service representative to perform that.

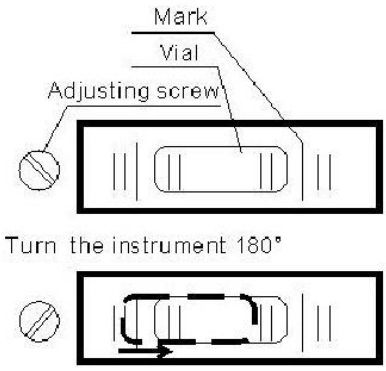
8.2. Plate level

I. Check

1. Mount the instrument on a stable device (as tripod, adjusting device), and fix it.
2. Level the instrument until the plate level is parallel to a line linking leveling foot screws A and B, then adjust the two screws to center the bubble.
3. Turn the instrument 180°/200gon, observe the moving direction of the bubble, if it is still centered, no adjustment is necessary, if not, you have to adjust it.

II. Adjustment

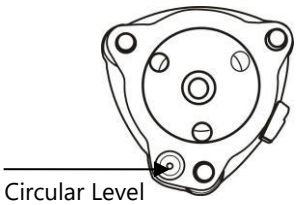
1. Mount the instrument on a stable device and fix it.
2. Level it roughly.
3. Turn the instrument and make the tubular level be parallel to a line linking two leveling foot screws, then adjust the two screws to center the bubble.
4. Turn the instrument 180°/200gon, adjust the Adj-screw with adjustment pin slightly to correct half of the bubble's displacement when it doesn't move,
5. Repeat operations 3, 4 until the bubble remains centered in any position.



8.3. Circular level

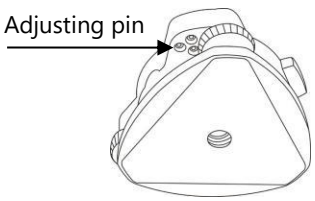
I. Check

1. Mount the instrument on a stable device and fix it.
2. Level it accurately by the plate level.
3. Observe the bubble of the circular level, if it is centered, no adjustment is necessary, if not, you have to adjust it.



II. Adjustment

1. Mount the instrument on a stable device and fix it.
2. Level it accurately by the plate level.
3. Adjust the three adj-screws to center the bubble by a wrench.

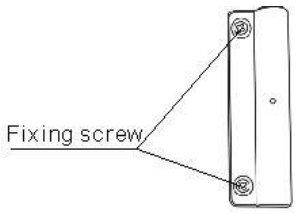


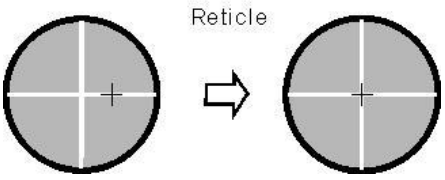
NOTE: Be careful when adjusting the three screws, and the tightening tension is identical for them.

8.4. The optical sight

I. Check

1. Mount the instrument on a tripod and fix it.
2. Set a cross mark target which apart from the instrument about 50m.
3. Take the telescope sight the cross mark.
4. Observe the optical sight collimator whether collimating the cross mark, if collimate the mark, adjustment is not necessary; if not, adjust it.





II. Adjustment

1. Mount the instrument at the tripod and fix it.
2. Set a cross mark target which apart from the instrument about 50m.
3. Take the telescope sight the cross mark.
4. Loosen two fixing screws, adjust the collimator, then fix the two screws again.

8.5. Laser plummet

I. Check

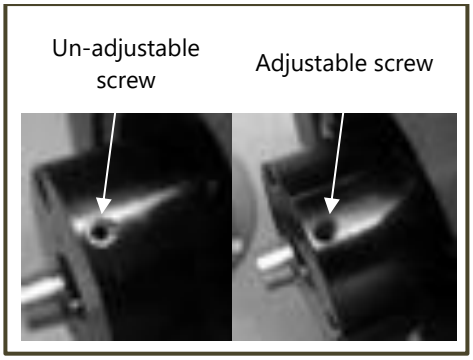
1. Set the instrument on stable device and fix it;
2. Set a cross mark on the ground under the instrument;
3. Turn the three leveling screws until the instrument keeps leveling and the laser spot coincides with the cross mark on the ground;
4. Rotate the instrument 180°(200gon) around and check the laser spot and cross mark, if they are coinciding, adjustment is not required. Otherwise, adjust it.

II. Adjustment

1. Set up the instrument on the checking tool or tripod which is 1.5m apart from ground.
2. Turn on laser plummet, turn tribrach foot screws until laser spot coincide with cross mark. If you use tripod, make a cross mark on the laser spot directly.

3. Rotate instrument 180° around, if the laser spot is over 2mm apart from cross mark, remove the protecting cover firstly, adjust two screws with 1.5mm hexagon wrench to move laser spot to the cross mark, correct only one-half of the displacement in this manner. Adjusting details see figure on the right.

4. Repeat steps 2 and 3 until laser spot coincides with cross mark always when rotate instrument.

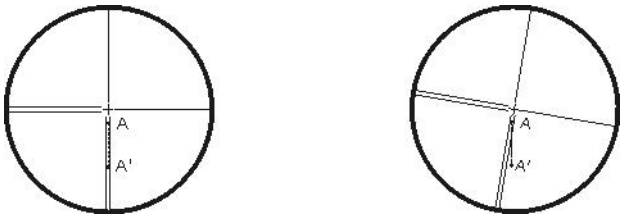


NOTE: there are three screws amounted around laser plummet part, only two screws are used for laser accuracy adjustment.

8.6. Vertical cross-hair on telescope

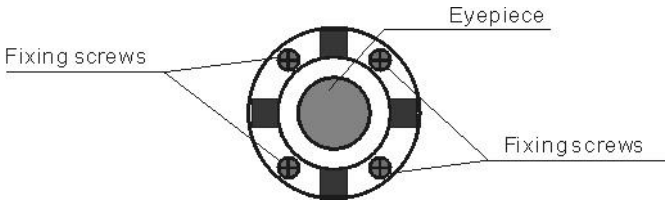
I. Check

1. Set the instrument up the tripod and carefully level it.
2. Set a point A front the instrument 50m apart;
3. Collimate the point A and adjust the vertical tangent screw; If the point appears to move continuously on the hair, adjustment is not required. Otherwise, adjust it.



II. Adjustment

1. Set the instrument and set the point A front the instrument 50m apart.
2. Take off cover of telescope eyepiece, there are 4 screws for the reticle part.
3. Loosen all four fixing screws slightly with the cross screw-driver.
4. Revolve the eyepiece section so that the vertical cross-hair coincides to point A, finally, re-tighten the four screws.
5. Repeat the checking and adjusting until there is no deviation.



NOTE: After the adjustment of cross-hair, please check the collimation error and vertical index error, see 8.10. EDM optical axis and the telescope sighting axis error.

8.7. Tilt sensor

If the tilt angle shown on the display shifts from tilt angle 0° (zero point), the instrument is not correctly leveled. This will adversely affect angle measurement. Perform the following procedures to cancel the tilt zero-point error.

I. Check

Wait a few seconds for this display to stabilize, then read the automatically compensated angles X1 and Y1.

Rotate the instrument 180° /200 gon. Wait a few seconds for the display to stabilize, then read the automatically compensated angles X2 and Y2.

Calculate the following offset values (tilt zero-point error):

$$Xoffset = \left(\frac{X1 + X2}{2}\right)$$

$$Yoffset = \left(\frac{Y1 + Y2}{2}\right)$$

When the offset value falls within the range ±20", adjustment is not necessary. If one of the offset values (Xoffset, Yoffset) exceeds ±20", contact your local dealer.

8.8. Horizontal collimation error C

If the telescope's sight line isn't perpendicular to the horizontal axis, the collimation error will appear. The assembling, transportation and operation will cause this error.

If the collimation error isn't over the permitted range, with the program the instrument can correct this collimation error.

NOTE: After the program correction this deviation error is also on the instrument.

I. Check

1. Set-up the instrument on tripod or adjustment platform and leveling accurately.
2. Aim at the cross-hairs of collimator or the obvious target at a distance. Gets the face left angle reading Hl and the face right angle reading Hr.
3. Calculating the horizontal collimation error C according to:

$$C = \frac{Hl - Hr \pm 180°}{2}$$

if C<8", no adjustment will be necessary. If C>8", contact your local dealer.

8.9. Vertical index error

The deviation between vertical circle zero position and horizontal direction is vertical index (i), it is necessary to concern this error when measure vertical angle. The instrument program applied a formula to correct this error.

WARNING: Before starting this operation, be sure to read this manual carefully, otherwise it may cause data faulty. Because of the close relationship between vertical index and compensator zero position, it is necessary to check and adjust compensator zero position before adjusting vertical circle, the value should be stable when reading.

I. Check:

Please adjust the reticle of telescope and correct the collimation error before this operation.

1. Mount the instrument at the tripod or a stable device and level it accurately, then turn on the instrument.
2. Aim at the cross-hairs of collimator or the obvious target at a distance, VA should be about ±10°. Read the face left angle Vl and face right angle Vr.
3. Calculate the index error according to the formula below:

$$i = \frac{(Vl + Vr - 360°)}{2}$$

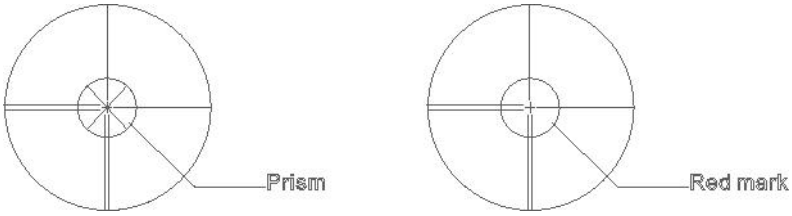
4. If i <10", no adjustment is necessary, otherwise contact your local dealer.

8.10. EDM optical axis and the telescope sighting axis error

It is necessary to check this error after the adjustment of telescope reticle error.

I. EDM optical axis check

1. Install the instrument at the tripod or a stable device and level it accurately, then turn on the instrument's power on.
2. Set a prism about 2m far away from the instrument.
3. Aim at the prism center with telescope reticle
4. Enter EDM signal testing screen, see 5.3. Star settings.
5. Observe through eyepiece, turn the focusing knob until the read mark is clear, if the deviation between mark and cross-hair is not over 1/5 of red mark diameter, adjustment is unnecessary.



II. Telescope sighting axis error check

1. Install the instrument at the tripod or a stable device and level it accurately, then power on the instrument.
2. Set a reflective sheet about 5m-20m far away from the instrument.
3. Aim at the sheet cross-mark with telescope reticle.

4. Enter EDM signal testing screen, see 5.3. Star settings
5. Observe the laser spot, if the laser spot coincides with the cross-mark of reflective sheet, adjustment is unnecessary.

NOTE:

- Laser radiation—Avoid direct eye exposure.
- If the instrument needs adjustment, please contact your local dealer.

9. Technical features

ANGLE MEASUREMENT

Accuracy[1]	2″
Reading system	Absolute encoder
Display resolution (selectable)	0.1″ /0.5″ /1″ 0.00002g/0.0001g/0.0002g 0.0005mil/0.002mil/0.005mil
Angle Units	DEG 360°/GON 400/MIL 6.400

TELESCOPE

Magnification/ Field of view	30x/1°30′
Tube length	156 mm
Minimum focus distance	1.0 m (3.26 ft)
Reticle	10 brightness levels adjustable
Objective aperture	ϕ 45 mm
Laser pointer	Red light, coaxial

TILT SENSOR

Type	Electronic, dual-axis
Compensation range/accuracy	± 3.0′/1″

DISTANCE MEASUREMENT RANGE[2]

Standard mode prism	3.000 m [3]
Long mode prism	5.000 m [4]
Reflective sheet (6cm x 6cm)	800 m [4]
Reflectorless	600 m [4] 1.000 m [4-5]

DISTANCE MEASUREMENT ACCURACY[6]

Standard mode prism	2 mm + 2 ppm
Long mode prism	2 mm + 2.5 ppm
Reflective sheet (6cm x 6cm)	3 mm + 2 ppm
Reflectorless	3 mm + 2 ppm

MEASUREMENT TIME

Standard mode/Prism (Tracking/Fast/Fine)	0.4/0.6/1.0 sec

DISTANCE MEASUREMENT

Distance Unit	m/US ft/INT ft
Display Resolution (selectable)	0.0001m/0.001m 0.001ft/0.01ft

LASER PLUMMET

Laser type	635nm semiconductor laser
Accuracy	1mm/1.5 m
Spot	± 1.5mm/1.5 m

LEVEL VIAL SENSITIVITY

Plate level	30″/2mm
Circular level	8′/2mm

ENVIRONMENTAL CONDITIONS

Operating Temperature	-20° C +50° C
Storage Temperature	-40° C +70° C
Waterproof/Dustproof	IP55

PHYSICAL SPECIFICATION

Dimensions	206 x 203 x 360 mm
Weight including battery and tribrach	6.1 Kg

POWER

Battery Voltage/Capacity	7.4V/3.400mAh Li-ion
Operating time (angle measurement)	9 hours
Operating time (distance meas. every 30 sec)	8 hours
Operating time (angle + distance meas.)	5 hours
Battery charger	110/220V, charging time 4h

OTHER SPECIFICATIONS

CPU	ARM Cortex A8
Display/Keyboard	Two sides, 3.5″ color TFTLCD 320x240 pixel touch screen
OS	Windows CE 7.0
Memory	4Gb internal
Interface	RS-232C/standard USB/ mini USB/Bluetooth
Guide Light	4 levels
Sensor	Temperature/Pressure

ON BOARD FIELD APPLICATION PROGRAMS

On board is it possible install: FieldGenius/SurvCE

Specifications subject to change without notice.

[1] Standard deviation based on ISO 17123-3
[2] Good condition: no haze, visibility about 40km, no heat shimmer, breeze. Under optimal conditions on Kodak Grey Card (90% reflective)
[3] Class 1
[4] Class 3R
[5] R35LR Model
[6] Standard deviation based on ISO 17123-4

10. Kit components

- R35 Series Total Station
- Carrying case
- Tribrach
- Carrying strap x2
- Battery x2
- Battery charger
- USB communication cable
- Touch pen x2
- Lens cap
- Tools kit
- Cleaning cloth
- User Manual
- Reflective sheet/RP30 x4
- Reflective sheet/RP60
- Laser caution sign board
- Silica gel
- Certification

Appendix I: Atmospheric correction formula and chart

Factory setting: temperature: 20℃, pressure: 1013hPa, 0ppm

The correction:

$$\mathrm{Kpt} = \frac{274.417 - 0.2905 \cdot \mathrm{p}}{(1 + 0.0036 \cdot \mathrm{t})}$$

$$\mathrm{Kpt} = \frac{278.960 - 0.2902 \cdot \mathrm{p}}{(1 + 0.0036 \cdot \mathrm{t})}$$

Where:

p: Pressure value (hPa)

t: Temperature value (℃)

Kpt: Atmospheric correction (ppm)

Example:

t=20℃, p=1013hpa, L0=1000m.

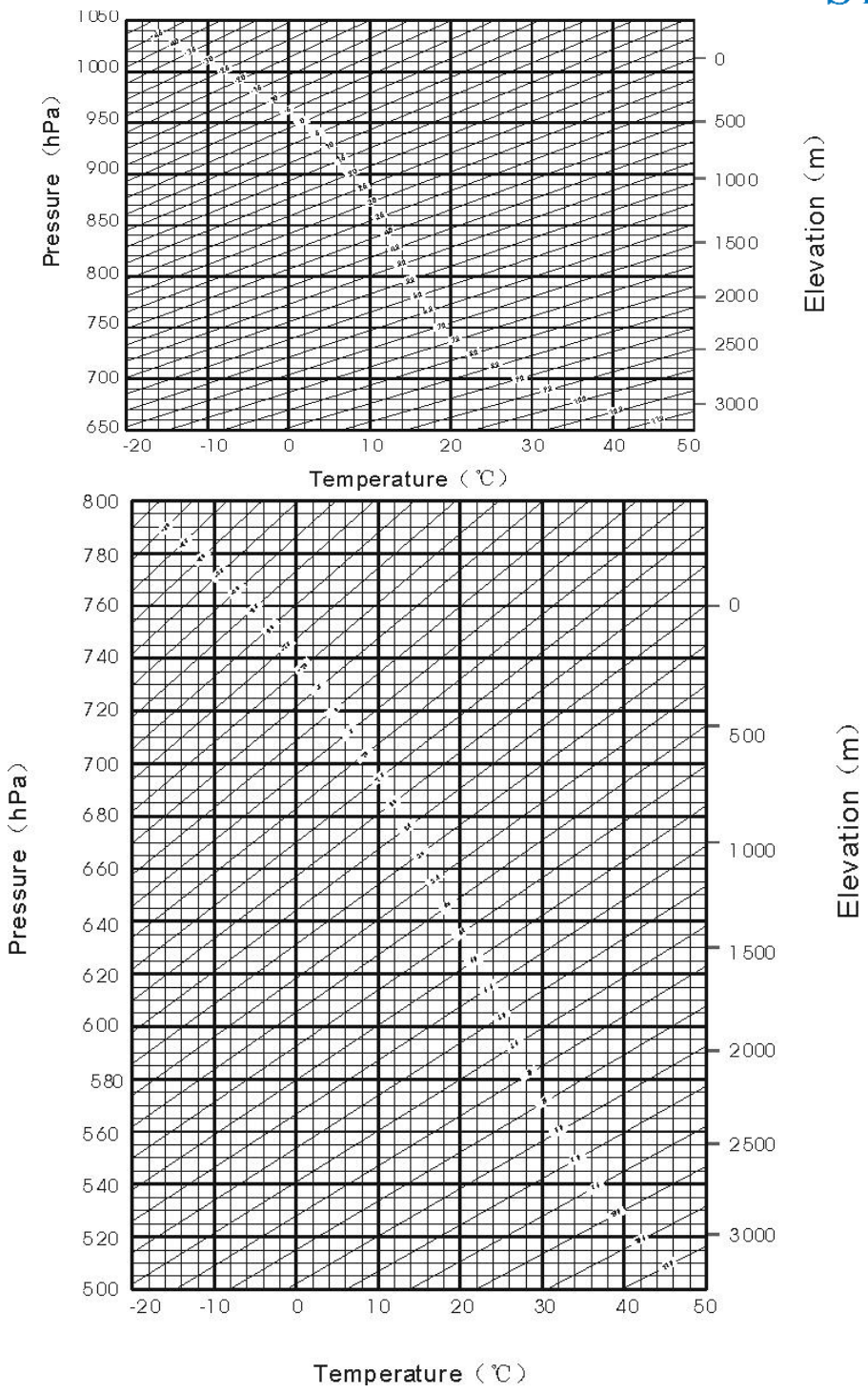
Then: Kpt=0ppm

Kpt=4ppm

L=L0(1+Kpt)=1000×(1+0×10-6)=1000.000m

L=L0(1+Kpt)=1000×(1+4×10-6)=1000.004m

The atmospheric value is obtained easily with the atmospheric correction chart. Find the measured temperature in horizontal axis, and pressure in vertical axis on the chart. Read the value from the diagonal line, which is the required atmospheric correction value.


Pressure（hPa）
1050
1000
950
900
850
800
750
700
650
-20
-10
0
10
20
30
40
50
Temperature（℃）
0
500
1000
1500
2000
2500
3000
Elevation（m）
Pressure（hPa）
800
780
760
740
720
700
680
660
640
620
600
580
560
540
520
500
-20
-10
0
10
20
30
40
50
Temperature（℃）
0
500
1000
1500
2000
2500
3000
Elevation（m）

Appendix II: Correction for refraction and earth curvature

The factory setting for the refraction coefficient K is 0.142.

Considering the correction of refraction and earth curvature for distance measurement, the formula for slope distance, horizontal distance and vertical distance applied in the instrument are as followings:

$SD = D_0 \times (1 + ppm \times 10^{-6}) + mm$

SD——Displayed slope distance (m)

D_0——Real measured distance (m)

ppm——Scale coefficient (mm/km)

mm——Target constant (mm)

$HD = Y - A \times X \times Y$

$VD = X + B \times Y^2$

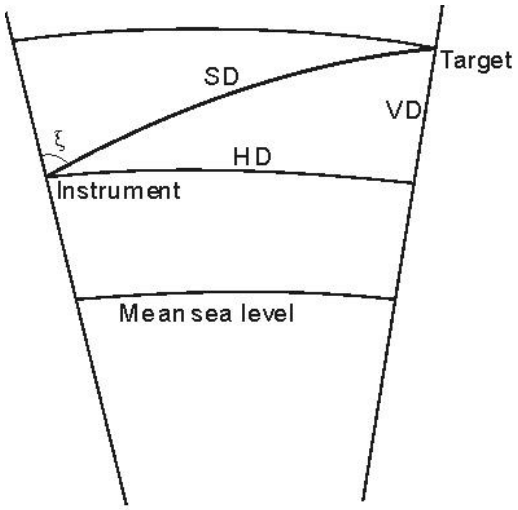
HD——Horizontal distance (mm)

VD——Vertical distance (mm)

$Y = SD \cdot |\sin \xi|$

$X = SD \cdot \cos \xi$

ξ——Zenith angle



Elevation measurement

$$A = \frac{1 - K/2}{R}$$

$$B = \frac{1 - K/2}{2R}$$

K = 0.142 or 0.20

$R = 6.37 \times 10^6$ (m)

The conversion formula for horizontal and vertical distance is as follows when correction for refraction and earth curvature is not applied:

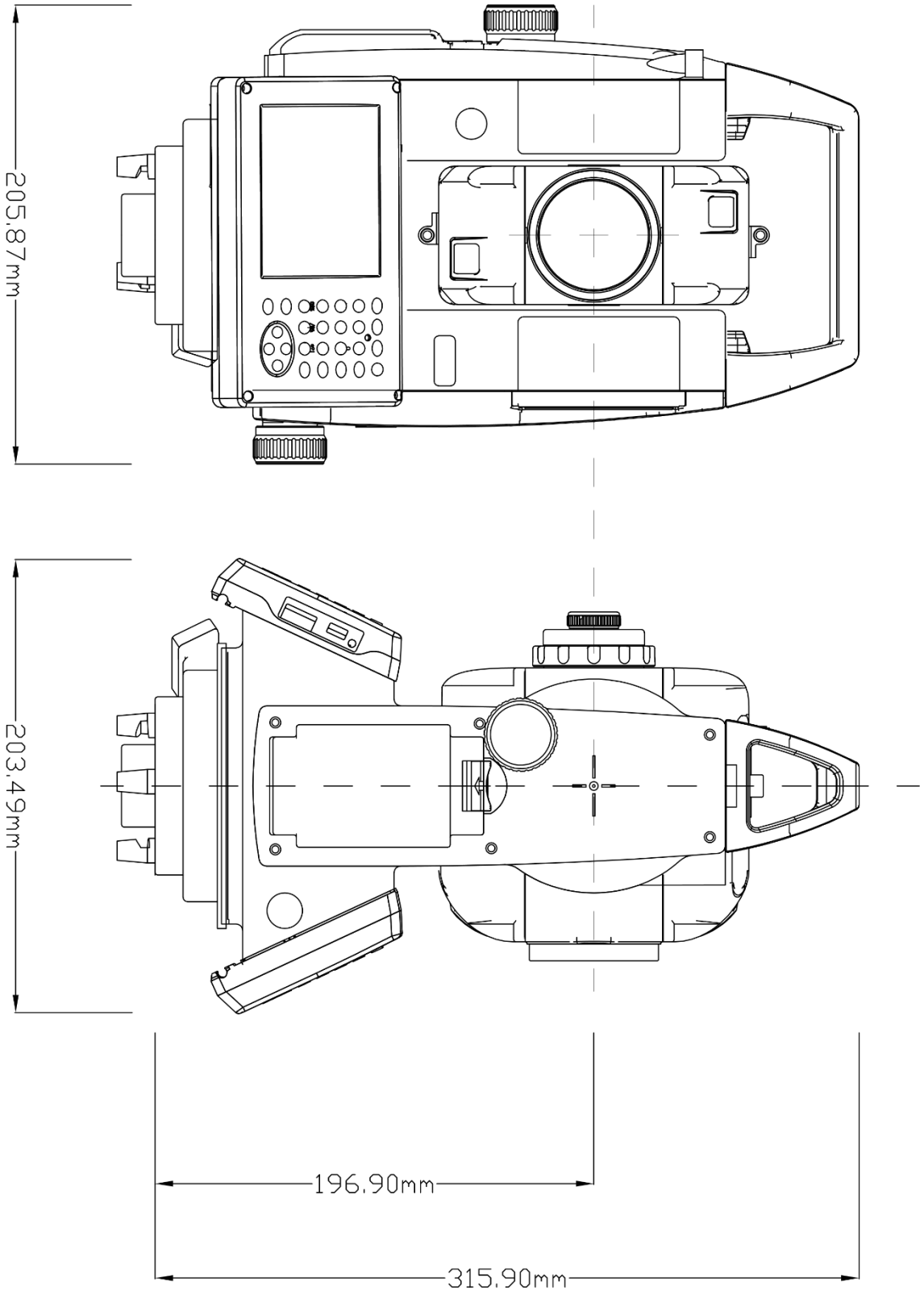
$$HD = SD \cos \xi$$

$$VD = SD \ | \sin \xi \ |$$

NOTE:

- The factory setting for the refraction coefficient K is 0.142.
- Refer to the section 5.2.2. Measure condition settings.

Appendix III: Technical drawing



Limited warranty standard

General warranty for instruments

The terms and conditions of this Limited Warranty constitute the complete and exclusive warranty agreement between The Customer or Dealer and STONEX® for the Product and it supersedes any prior agreement or representation made in any STONEX® sales document or advice that may be provided to Customer by any STONEX® representative in connection with Customer's purchase of the Product. No change to the conditions of this Limited Warranty is valid unless it is made in written form and signed by an authorized STONEX® supervisor.

STONEX® warrants that:

1. Products are free from defects in materials or workmanship for generally 2 years except for accessories or specific parts for which different limited warranty period shall apply.

2. Products have been tested/calibrated in proper working status prior to shipment.

The warranty period starts from date of first sale of the instruments. At its sole discretion, under the warranty period, STONEX® will repair the product or send parts for replacement at its expense. STONEX® Europe agree to repair or replace the defected instrument within thirty (30) days, only if STONEX® recognizes that the defects of the instrument are not caused by human factors or no obvious damage to its surface is visible. STONEX® warrants any new replaced parts or products are warranted to be free from defects in materials and workmanship for thirty (30) days or for the remainder of the Limited Warranty Period of the Product in which they are installed, whichever is longer. Faulty Parts or Products replaced under this Limited Warranty shall become property of STONEX®.

All products that have to be repaired have to be returned to our technical representative office location via any delivery company the customer prefers.

NOTE: STONEX® is not accountable for the unlikely event that the Products gets lost in transit.

Any damage inflicted by the customer or by third party after the products has been delivered to the customer is excluded from the limited warranty as well any damage arising from an improper use, from any action or use not provided for in the enclosed user guides and/or manuals.

Shipping policy

The Customer or the dealer is required to pay for the charges for shipping of fault parts or instruments to STONEX® representative office and STONEX® (will provide) the shipping for return. Dealers needs to follow STONEX® repair/service procedure to achieve a better and prompt service result.

Return policy dead on arrival instruments

All returned products have to be shipped to STONEX® representative office.

The original Purchaser has a period of seven (7) days, starting from date (data) of purchasing to signal the existence of a defect in the instrument for a full refund (less shipping and handling), provided the merchandise is in new, resalable condition and returned in the original, undamaged packaging. Customer has to pay for both the return and the original freight fees, regardless of the original freight paid by the Company. All warranty books, instruction manuals, parts and accessories must be included as well as the original box in which the item was shipped. We recommend placing the original carton inside another box, to avoid any additional damage to the carton itself. In some cases, returns of special items will require a re-stock fee. Acceptance of returned merchandise is final only after inspection by STONEX®.

Above terms and (policy shall apply as for hardware.) Dealers needs to follow STONEX® repair/service procedure to achieve a better and prompt service result.

Firmware/software warranty

Stonex doesn't warrant that operation of Firmware/Software on any instruments will be uninterrupted or error-free, or that functions contained in Firmware/Software will operate to meet your requirements.

Stonex will forward the Software/Firmware Fix to the dealer or customer. Firmware/software Fix means an error correction or other update created to fix a previous firmware version that substantially doesn't conform to the instrument's specification.

Over warranty repair(s) policy

Customer shall pay the standard repair fees for any service (whether part replacement or repairs) and performed by STONEX® Europe under request and explicit authorization of the customer itself. In this case the customer is charged for return shipment's fees as well.

Disclaimer and limitation of remedy

All other express and implied warranties for this product, including the implied warranties of merchantability and fitness for a particular purpose and/or noninfringement of any third party's rights, are hereby disclaimed. STONEX® expressly disclaims all warranties not stated in this limited warranty. any implied warranties that may be imposed by law are limited in duration to the term of this limited warranty. some jurisdictions do not allow the exclusion of implied warranties or limitations on how long an implied warranty lasts, so the above exclusions or limitations may not apply to customer. customer must read and follow all set-up and usage instructions in the applicable user guides and/or manuals enclosed. if customer fails to do so, this product may not function properly and may be damaged. customer may lose data or sustain personal injuries. STONEX®, its affiliates and suppliers do not warrant that operation of this product will be uninterrupted or error free; as do all electronics at times. if this product fails to work as warranted above, customer's sole and exclusive remedy shall be repair or replacement. in no event will STONEX®, its affiliates or suppliers be liable to customer or any third party for any damage in excess of the purchase price of the product. this limitation applies to damages of any kind whatsoever including (1) damage to, or loss or corruption of, customer's records, programs, data or removable storage media, or (2) any direct or indirect damages, lost profits, lost savings or other special, incidental, exemplary or consequential damages, whether for breach of warranty, contract, tort or otherwise, or whether arising out of the use of or inability to use the product and/or the enclosed user guides and/or manuals, even if STONEX®, or an authorized STONEX® representative, authorized service provider or reseller has been advised of the possibility of such damages or of any claim by any other party. some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages for some products, so the exclusions or limitations may not apply to customer. this limited warranty gives customer specific legal rights, and customer may also have other rights which vary from country/state/jurisdiction to country/state/.

Instrument warranty

Two years on Total Station R35 (all variants) excluding battery supply accessories (6 months).

Environmental recycling

The cardboard box, the plastic in the package and the various parts of this product have to be recycled and disposed of in accordance with the current legislation of your Country.

FOR COUNTRIES IN THE EUROPEAN UNION (EU)

The disposal of electric and electronic device as solid urban waste is strictly prohibited: they must be collected separately.

Contact Local Authorities to obtain practical information about correct handling of the waste, location and times of waste collection centers. When you buy a new device of ours, you can give back to our dealer a used similar device.

The dumping of these devices at unequipped or unauthorized places may have hazardous effects on health and environment.

The crossed dustbin symbol means that the device must be taken to authorized collection centers and must be handled separately from solid urban waste.

FOR COUNTRIES OUTSIDE EUROPEAN UNION (EU)

The treatment, recycling, collection and disposal of electric and electronic devices may vary in accordance with the laws in force in the Country in question.

STONEX

STONEX® SRL

Viale dell'industria, 53 | 20037 - Paderno Dugnano (MI) | Italy

Tel : + 390278619201 | Fax :+ 390278610299

www.stonex.it | info@stonex.it