NORTH
Surveying and Positioning Systems

NXR SERIES TOTAL STATION

OPERATING MANUAL

Content

North Group LTD.

North Group LTD.

Thank you for purchasing NORTH NXR Series Total Station. For the best performance of the instruments, please carefully read these instructions and keep them in a convenient location for future reference.

General handing Precautions

Before starting work or operation, be sure to check that the instrument is working correctly with normal performance.

Do not immerse the instrument into the water

The instrument must not be submerged underwater.

The instrument is designed based on the International Standard IP54; therefore it is protected from the normal rainfall.

Setting the instrument on a tripod

When mounting the instrument on a tripod, use a wooden tripod when possible. The vibrations that may occur when using a metallic tripod can affect the measuring precision.

Installing the tribrach

If the tribrach is installed incorrectly, the measuring precision could be affected.

Occasionally check the adjusting screws on the tribrach. Make sure the base fixing lever is locked and the base fixing screws are tightened.

Guarding the instrument against shocks

When transporting the instrument, provide some protection to minimize risk of shocks.

Heavy shocks may cause the measurement to be faulty.

Carrying the instrument

Always carry the instrument by its handgrip.

Do not expose the instrument to extreme heat

Do not leave the instrument in extreme heat for longer than necessary. It could adversely affect its performance.

Sudden changes of temperature

North Group LTD.

Any sudden change of temperature to the instrument or prism may result in a reduction of measuring distance range, i.e. when taking the instrument out from a heated vehicle. Let instrument acclimate itself to ambient temperature.

Battery level check

Confirm battery level remaining before operating.

Taking the battery out

It is recommended not to take the battery or external battery out while the power is on. All the data stored is possible gone at that time. So please do your assembling or taking the battery out after the power is off.

Do not hold the lower part of display unit

When you take out the instrument from a carrying case, or keep into the case, please hold the hand grip and base of the instrument. Please do not hold the lower part of the display unit.

External power source

Use only recommended batteries or external power source. Use of batteries or an external power source not recommended by us may result in equipment failure.

(For further information see the chapter '2.2 About the Battery.').

Display for Safe Use

In order to encourage the safe use of products and prevent any danger to the operator and others or damage to properties, important warnings are put on the products and inserted in the instruction manuals. These are indicated by an exclamation point within a triangle used with WARNING and CAUTION statements in this manual.

We suggest that everyone understand the meaning of the following displays and icons before reading the "Safety Cautions" and manual's main text.

⚠ **WARNING:** Ignoring or disregard of this display may lead to the danger or death or serious injury.

North Group LTD.

⚠ **CAUTION:** Ignoring or disregard of this display may lead to personal injury or physical damage.

Injury refers to hurt, burn, electric shock, etc.

Physical damage refers to extensive damage to buildings or equipment and furniture.

Safety Cautions

⚠ **WARNING**

There is a risk of fire, electric shock or physical harm if you attempt to disassemble or repair the instrument yourself

This is only to be carried out by North Group Support or an authorized dealer.

Cause eye injury or blindness

Do not use the equipment to collimate the sun directly. The eye injury or blind could result.

Continuously looking straight at the laser beam is harmful.

High temperature may cause fire

Do not cover the charger while it is charging.

Do not close the instrument to burning gas or liquid, and do not use the instrument in coal mine. Blast could be result.

Risk of fire or electric shock

Do not use damaged power cable, plug and socket.

Do not use a wet battery or charger.

Do not use any power voltage except the one given on manufacturer's instructions.

Do not use an AC cable incompatible with the power supply voltage in use.

May ignite explosively

Never use an instrument near flammable gas, liquid matter, and do not use in a coal mine.

Battery can cause explosion or injury

Do not dispose in fire or heat.

Do not use any other type of charger other than the one specified.

The short circuit of a battery can cause a fire

Do not short circuit battery when storing it.

⚠ **CAUTION**

Do not stare at the object which reflects the laser beam. When the laser is switched on (under EDM mode), do not look at it on the optical path or near the prism. It is only allowed to observe the prism with the telescope of total station.

Do not connect or disconnect equipment with wet hands, you will be at risk of electric shocks if you do.

Do not stand or sit on the carrying cases, and do not turn over the carrying case arbitrarily, the instrument could be damaged.

Please note that the tips of tripod can be hazardous, be aware of this when setting up or carrying the tripod.

There is risk of injury by falling down the instrument or case.

Do not use a carrying case with damaged belts, grips or latches, instrument damage could result.

Do not allow skin or clothing to come into contact with acid from the batteries, if this does occur, then wash off with copious amounts of water and seek medical advice.

A plumb bob can cause an injury to a person if used incorrectly.

It could be dangerous if the instrument falls over, please ensure you attach a handle to the instrument securely.

Ensure that you mount the Tribrach correctly; failing to do so may result in injury if the tribrach were to fall over.

It could be dangerous if the instrument falls over, please check that you fix the instrument to the tripod correctly.

There are risks of injury by falling down a tripod and an instrument.

Always check that the screws of tripod are tightened.

The battery should be disposed of safely.

The appliance is not intended for use by young children or infirm persons without supervision.

Young children should be supervised to ensure that they do not play with the appliance.

Safety Standards for Laser

This series adopt the class of Laser Product according to IEC Standard Publication 60825-1 Amd. 2:2001. According this standard, EDM device is classified as Class 3R Laser Product when reflectorless measurement is selected, when the prism and reflective sheet is selected as target, the output is equivalent to the safer class 1. Follow the safety instructions on the labels to ensure safe use.

CAUTION: CLASS 3R LASER RADIATION WHEN OPEN

AVOID DIRECT EYE EXPOSURE.

CAUTION: CLASS 2 LASER RADIATION WHEN OPEN

DO NOT STARE INTO THE BEAM

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.

When the laser beam emits on prism, mirror, metal surface, window, etc., it is dangerous to look straight at the reflex.

User

This product is for professional use only!

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

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

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, or its representatives, assumes no responsibility for results of a faulty or intentional usage or misuse including any direct, indirect, consequential damage, and loss of profits.

1) The manufacturer, or its representatives, assumes no responsibility for consequential damage, and loss of profits by any disaster, (an earthquake, storms, floods etc.). Fire, accident or an act of a third party and/or a usage any other usual conditions.
2) The manufacturer, or its representatives, 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.
3) The manufacturer, or its representatives, assumes no responsibility for any damage, and loss of profits caused by usage except for explained in the user manual.
4) The manufacturer, or its representatives, assumes no responsibility for damage caused by wrong movement, or action due to connecting with other products.

1. Nomenclature and functions

1.1 Nomenclature

Handle

Handle screw

Telescope focusing knob

Eye Piece

Instrument Center Mark

Battery

Keyboard

Horizontal clamp

Horizontal tangent screw

Leveling screw

Base

North Group LTD.

Collimator

Objective lens

Vertical clamp

Vertical tangent
screw

Plate vial

Display

Data port

1.2 Functions of keys

Key	Name	Function
F1~F4	Soft Keys	Functions corresponding to information displayed
0~9	Number Keys	1. Input number when numeric input 2. Input characters when alphabetic input 3. Select items of the menu
.	Decimal point	Input decimal point
±	Sign	Input plus /minus sign
★	Star Key	Enter into setting mode directly
POWER	Power	Power ON/OFF
ENT	Enter	Confirm End dialog and save setting to file
ESC	Escape	Escape to the previous menu or mode; end dialog and not save
ANG	Angle Measuring	1. Enter to angle measurement mode 2. Up arrow. move the cursor upward or select upper items.
DIST	Distance Measurement	1. Enter into distance and angle measurement mode(under basic measurement mode) 2. Down arrow
CORD	Coordinate measurement	1. Enter into coordinate and angle measurement mode(under basic measurement mode) 2. Left arrow
MENU	Menu	1. Enter into menu mode(under basic measurement mode) 2. Right arrow

North Group LTD.

12

1.3 Display

The LCD could display 7 lines with 24 characters per line. In measurement mode, it displays some common information in above 5 lines and displays soft functions in the last line.

Contrast and Illumination

The contrast and illumination of display window are adjusted. See "1.5 Star key mode" to change contrast level.

Display marks

Symbol Displayed	Meaning
Vo	Vertical angle reading from horizontal line clockwise
Vh	Vertical angle reading from horizontal line anticlockwise
Vz	Vertical angle reading from zenith
V%	Vertical Angle (slope percentage)
HR	Horizontal Angle (right)
HL	Horizontal Angel (left)
HD	Horizontal Distance
SD	Slope Distance
N	North Coordinate
E	East coordinate
Z	Height
*	EDM (Electronic distance meter) is under operation
m	Meter as the unit
ft	Foot as the unit
fi	Foot and inch as the unit

1.4 Functional Keys

ANGLE MEASUREMENT MODE

```
Vz:      90°10'20"
HR:     122°09'30"


Save    Set0    SetA    P1/2
 Hold    L/R    Vmode   P2/2
```

North Group LTD.

Page	Soft key	Display	Function
Page 1	F1	Save	Start angle measurement, and save the results in respective job. (Measurement files and coordinates files are selected in DATA COLLECT menu.)
	F2	Set0	Set horizontal angle to 0 degree.
	F3	SetA	Input horizontal angle by keyboard
	F4	P1/2	Display the soft key functions in Page 2.
Page 2	F1	Hold	Lock the reading of horizontal angle
	F2	L/R	Shift between right/left angle of horizontal angle.
	F3	Vmode	Shift between vertical angle measurement mode
	F4	P2/2	Display the soft key functions on Page 3.

DISTANCE MEASUREMENT MODE (2 interface menus)

```
V:          90°10'20"
HR:         122°09'30"
SD*[FS]    <<
HD
VD
 Save    Meas    Mode   P1/2
 Offset  Setout  m/f/i  P2/2
```

Page	Soft key	Display	Function
Page 1	F1	Save	Start distance measurement, and save the results in respective job. (Measurement files and coordinates files are selected in DATA COLLECT menu.)
	F2	Meas	Start distance measurement
	F3	Mode	Shift the distance measurement mode (Single, Rept 5, Cont, Track)
	F4	P1/2	Display the soft key functions in Page 2.
Page 2	F1	Offset	Offset measurement mode
	F2	Setout	Distance stake out mode
	F3	m/f/i	Shift between vertical angle/slope percentage
	F4	P2/2	Display the soft key functions on Page 1.

COORDINATES MEASUREMENT MODE (3 interfaces menus)

```
V:        90°10'20"
HR:       122°09'30"
N:
E:
Z:
 Save    Meas    Mode    P1/3
 Height   BSS     STA    P2/3
   Offset  Setout  SetN   P3/3
```

Page	Soft key	Display	Function
Page 1	F1	Save	Start distance measurement, and save the results in respective job. (Measurement files and coordinates files are selected in DATA COLLECT menu.)
	F2	Meas	Start Coordinates measurement
	F3	Mode	Shift the distance measurement mode (Singe, Rept 5, Cont, Track)
	F4	P1/3	Display the soft key functions in Page 2.
Page 2	F1	Height	Change instrument height or target height
	F2	BSS	Set backsight point
	F3	STA	Change station coordinates
	F4	P2/3	Display the soft key functions on Page 3
Page 3	F1	Offset	Offset measurement mode
	F2	Setout	Coordinate stake out mode
	F3	SetN	Change number of measurement
	F4	P3/3	Display the soft key functions on Page 1

1.5 Star Key Mode (★)

Press ★, the screen will show:

```
Reflector     NP        ▶
Contrast      4         ↕

        [*]Choose file
 Light    Tilt    Laser  Factor
```

Through Star key (★), you can set the below items:

1. Reflector: Press [MENU] [▶] to set the reflector type. Press [MENU] every time to shift the reflector type among PRISM > NP (No prism) > RB (Sheet).

2. Contrast: Press [▲], or [▼] you can adjust the contrast of the LCD.

3. Backlight:

Press [F1]: Turn on the background light.

Press [F1] again: Turn off the background light.

4. Tilt Compensation:

```
                              🔋
Ref ┌──────────────┬──────┐
Con │              │      │
    │  Tilt X=50"  │  ●   │
    │              │      │
────┴──────────────┴──────┘
 Light   Tilt   Laser   Factor
```
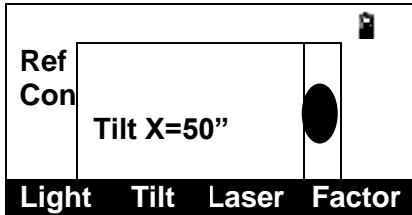
Press [F2] to enter to settings of tilt compensation.

Press [F2] again to switch tilt sensor ON/OFF.

[ESC] will quit tilt sensor status display.

5. Laser:

Press [F3] to activate the visible laser beam.

Press [F3] again the laser beam will disappear.

6. Factor:

Press [F4] to select "Factor", pop up "atmosphere parameter setting" dialog box, after you input temperature and atmospheric pressure, the PPM value will be calculated automatically you can set the prism constant and check the reflecting signal by pressing [F3]; the EDM will return current EDM signal. [ESC] will quit signal show.

```
┌──────────────────────────────┐
│ Temper   25.0          °C     │
│ Press:   1013.5        Hpa    │
│ Prism C  0             mm     │
│ PPM:     5             ppm    │
│ Signal                        │
├──────────────────────────────┤
│  B.S     Clear  Signal  Enter │
└──────────────────────────────┘
```

6.1 SETTING ATMOSPHERIC CORRECTION

When measuring distance mode, the result may be affected by atmospheric condition.

To overcome the affection of the atmospheric condition, it is necessary to use make correction through atmospheric correction constant during distance measurement.

Temperature: the temperature of the surrounding air.

Pressure: the atmospheric pressure surrounding the instrument.

PPM: the atmospheric correction calculated and estimated.

- Standard atmospheric condition of total station NXR series (i.e. the atmospheric condition when the atmospheric correction value is 0):

Pressure： 1013hPa

Temperature： 20°C

- Calculation of atmospheric correction:

$\Delta S = 278.44 - 0.294922\ P\ /\ (1 + 0.003661T)\ (ppm)$

In the formula:

ΔS: correction coefficient (unit: ppm)

P: pressure (unit: hPa)

When the unit of atmospheric pressure is mmHg, follow this formula: 1hPa = 0.75mmHg

T: temperature (unit: °C)

6.2 Setting the atmospheric Correction Value Directly

Measure the temperature and press, then calculate the atmospheric correction value (PPM) through the atmospheric correction graph or the formula.

Operation Steps	Key	Display
1) Enter to Star key Mode, press (F4)(Factor).	[★] [F4]	**Temper** 25.0 °C **Press:** 1013.5 Hpa **Prism C** 0 mm **PPM:** 5 ppm **Signal** **B.S** **Clear Signal Enter**

2) Press [F4](ENT) to move down to PPM item.	[F4]	**Temper** 25.0 °C **Press:** 1013.5 Hpa **Prism C** 0 mm **PPM:** 5 ppm **Signal** **B.S Clear Signal Enter**
3) Input the atmospheric correction value, and press (ENT) to return to Star key mode.	Input de value [ENT]	**Temper** 25.0 °C **Press:** 1013.5 Hpa **Prism C** 0 mm **PPM:** 4 ppm **Signal** **B.S Clear Signal Enter** **Reflector** NP ► **Contrast** 4 ↕ **[*]Choose file** **Light Tilt Laser Factor**
Inputting range: -99.9mm to +99.9mm Step length: 0.1mm		

6.3 Calculating the Atmospheric Correction based on Temperature and Pressure

Measure the temperature and pressure of the surrounding air previously. E.g. temperature: +20°C, pressure: 1017.5

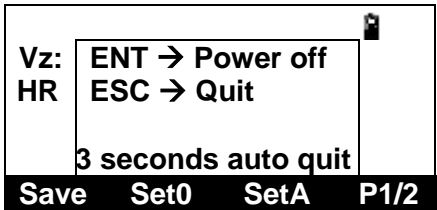| Operation Steps	Key	Display
1) Enter to Star key Mode, press (F4)(Factor).	[★] [F4]	**Temper** 25.0 °C **Press:** 1013.5 Hpa **Prism C** 0 mm **PPM:** 5 ppm **Signal** **B.S Clear Signal Enter**

2) Input the temperature and pressure values, the system will calculate the PPM value automatically according to the values you input.	[F4]	**Temper** 20.0 °C **Press:** 1017.5 Hpa **Prism C** 0 mm **PPM:** 3.5 ppm **Signal** **B.S Clear Signal Enter**
3) Press (ENT) to return to Star key mode.	[ENT]	**Reflector** **NP** ► **Contrast** **4** ↕ **[*]Choose file** **Light Tilt Laser Factor**
Inputting range of temperature: -30° ~ +60°C (step length: 0.1°C) or -22~+140°F (step length: 0.1°F). Inputting range of pressure: 560 ~ 1066hPa (step length: 0.1hPa) or 420 ~ 800mmHg (step length: 0.1 mmHg) or 16.5 ~ 31.5inHg (step length: 0.1 inHg). If the PPM calculated according to temperature and press input is beyond ±999.9ppm, the system will return to Step 2 automatically and you should input the value again.		

2. INITIAL SETTINGS

2.1 Power ON/OFF

```
                          🔋
Vz:     90°10'20"
HR:     122°09'30"


Save    Set0    SetA    P1/2
```
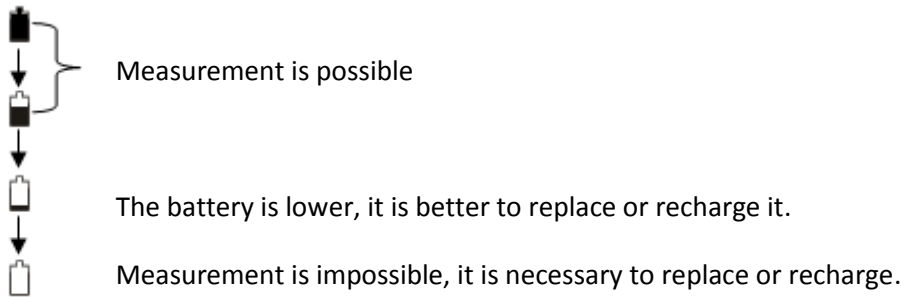
Confirm the instrument is leveling, press the red key ⏻ [POWER], release ⏻ [POWER], the instrument will turn on and it will display the angle measurement mode screen.

```
                          🔋
Vz:  ENT → Power off
HR   ESC → Quit

     3 seconds auto quit
Save    Set0    SetA    P1/2
```

Press the key⏻ [POWER], the instrument will pop up "power off" dialog box, [ENT] key will shut down.

2.2 About Battery

2.2.1 Battery Power Symbol

Measurement is possible

The battery is lower, it is better to replace or recharge it.

Measurement is impossible, it is necessary to replace or recharge.

NOTE:

- The working time of battery will be effected by many factors, such as ambient temperature, recharging time, recharging and discharging times. On the data safe side, we suggest the users recharge the battery full or prepare several full batteries before operation.

- The battery symbol only indicates power capability for current measurement mode. The power consumption in distance measurement mode is more than in angle mode, if the

20

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 to check every battery power before field work.

Cautions for Removing the Battery:

When removing the battery, please switch off the instrument in case the instrument may be damaged.

Charging the Battery

- Charge the battery with the appropriative charger (NC-20A).

- Before charging, link the charger with the electrical outlet first. Unload the battery from the instrument and connect the charger plug with the charging outlet of the battery. When the indicator light of the charger is orange, it means the battery is being charged. When the light is green, it means the batteries is charged and full; please pull out the plug.

Cautions for Charging

- The charger has built-in circuitry for protection from overcharging. However, do not leave the charger plugged into the power outlet after recharging is completed.

- Be sure to recharge the battery at a temperature of 0° ~ ±45°C, recharging may be abnormal beyond the specified temperature range.

- When the indicator lamp does not light after connecting the battery and charger, either the battery or the charger may be damaged. Please connect professionals for repairing.

Cautions for Storage:

- Rechargeable battery can be repeatedly recharged 300 to 500 times. Complete discharge of the battery may shorten its service life.

- In order to get the maximum battery life, be sure to recharge it at least once a month.

2.2.2   Replace the Battery

1. Remove the battery.

2. Press the button downward as shown left.

3. Remove the battery by pulling it toward you.

2.2.3   Recharge the battery

Mount the battery

Insert the battery to the instrument

Press the top of the battery until you hear a click.

As above figures show, connect the charger and the battery, then plug the charger into the outlet of 110V-220V AC power supply, recharging will begin.

NOTE:

- 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 turn green.
- Once the red light flashes constantly after the charger is plugged into the outlet of 110V-220V AC power supply please remove the battery and reconnected it after 3 or 5 min.

2.3 How to input Number and Alphabet

All Number and alphabet inputting must be carried out in a dialog box. For example, input point name PR001 and STN -123.456 in "Setup station" dialog box.

1. Press [F3], the soft key prompt will switch "Alph.".

2. Press [6], 'P' will present in input box and the caret shift to next position.

3. Pause about 0.4second,because the next alphabet 'R' is relational with [6].click [6], 'PP' will present in input box, click [6] again 'PR' will present in input box.

4. Press [F3], switch into Number input mode.

5. Press [0], 'PR0' will present in input box.

6. Press [0] again, 'PR00' will present in input box.

7. Press [1], 'PR001' will present in input box.

8. Press [ENT], end dialog.

3. PREPARATION FOR MEASUREMENT

3.1 Unpacking and store of instrument

- Unpacking of the instrument

Place the case lightly with the cover upward, and unlock the case, take out the instrument.

- Storage of instrument

Cover the telescope cap, place the instrument into the case with the vertical clamp screw and circular vial upwards (Objective lens towards tribrach), and slightly tighten the vertical clamp screw and lock the case.

3.2 Setting up the instrument

Mount the battery in the instrument before performing this operation because the instrument will tilt slightly if the battery is mounted after leveling.

I. 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.

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

II. 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.
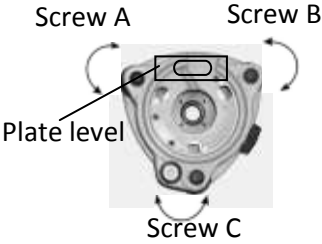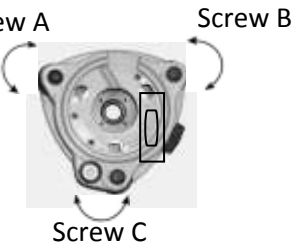
3.3 Centering position and leveling up

1. Position tripod legs so that the plummet is aimed to the ground mark point. Turn on the laser plummet.

2. Turn three foot screws of the tribrach till the center of reticule exactly coincides with the surveying point at any position.

3. Move the tripod legs to centre the circular level. The instrument is now roughly leveled-up.

4. Center the bubble in the circular level.

Screw A　Screw B Plate level Screw C	Loosen the horizontal motion clamp, and turn the instrument till the plate level is perpendicular to line shaped with screws A and B. Adjust the screws A and B to make the bubble in the center of the level.
Screw A　Screw B Screw C	Turn the instrument approximately 90°. Adjust screw C, till the bubble will be 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.	

5. Center the surveying point again.

Loosen the centering screw slightly. Looking the laser plummet point on the floor, slide the instrument over the tripod head until the surveying point is exactly centered in the reticule. Re-tighten the centering screw securely.

6. Check again to make sure the bubble in the plate level is centered.

If it is not, repeat procedure 4.

3.4 Setting of tilt correction on vertical angle

When activating the tilt sensor, it will show the correction value of vertical angles because the instrument is not perfectly leveled. To ensure the measurement accuracy, the tilt sensor should be activated, which will facilitate you to level the instrument better. When "Tilt Over" shows, it needs to be leveled manually.
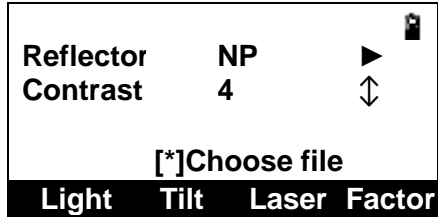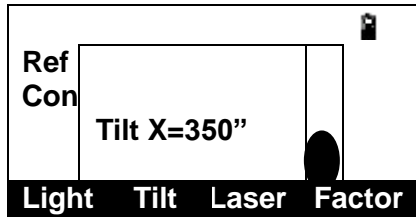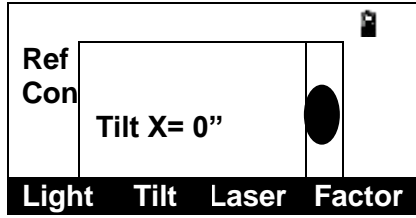
Single axis compensation: Correct the index error of vertical angle. When it exceeds the correction limit of vertical angle, the system will show notice.

Disable tilt sensor: Close the tilt compensator.

If the instrument operates under an unstable status or windy days, the vertical angle displays unstably. In such circumstances, the tilt sensor should be disabled, so that it will avoid the

instrument from displaying error messages as well as abortion of measurement caused by the tilt sensor exceeding the correction limit.

E.g.: Setting Tilt Correction

Operation Steps	Key	Display
1) Enter to Star key Mode.	[★]	**Reflector** NP ▶ **Contrast** 4 ↕ **[*]Choose file** **Light Tilt Laser Factor**
2) Press [F2] to enter to tilt correction settings.	[F2]	**Ref** **Con** **Tilt X=350"** **Light Tilt Laser Factor**
3) When the tilt of instrument exceeds the correction range, it needs leveling manually. Follow the steps described above to center the black dot as shown on the right		**Ref** **Con** **Tilt X= 0"** **Light Tilt Laser Factor**
4) Press ESC to return to Star key mode	ESC	
If the tilt sensor is disabled, press [F2] (TILT) to activate the correction function.		

3.5 Reflecting prism

When measuring distance, a reflector prism needs to be placed at the target place. Reflector systems come with single prism and triple prisms, which can be mounted with tribrach onto a tripod or mounted onto a prism pole. Reflector systems can be self-configured by users according to job.

4. ANGLE MEASUREMENT MODE

4.1 Measuring horizontal angle between two points

1st target   2n target
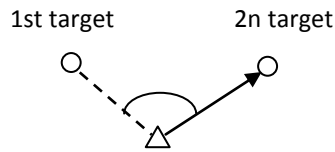
Make sure it is in angle measurement mode.

Operation Steps	Key	Display
1) Collimate the first target A.	Collimate A	Vz: 90°10'20" HR: 122°09'30" Save Set0 SetA P1/2
2) Press [F2] (Set0) and (ENT) to define the horizontal angle of target A to 0°00'00".	[F2] (ENT)	Vz: HR ENT → Set 0 ESC → Quit Save Set0 SetA P1/2 Vz: 90°10'20" HR: 0°00'00" Save Set0 SetA P1/2
3) Collimate the second target B, it displays the Horizontal angle of target B.	Collimate B	Vz: 92°34'20" HR: 22°45'12" Save Set0 SetA P1/2

Method to shoot the target (for reference)
- Sight the telescope to the bright sky. Turn the eyepiece until you can see the cross hair clearly.
- Collimate the target by observing through the tip of the cross hair on the collimator.

27
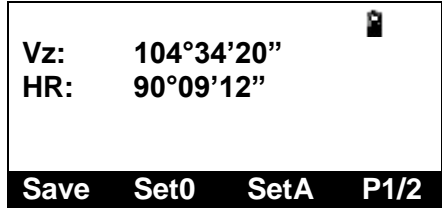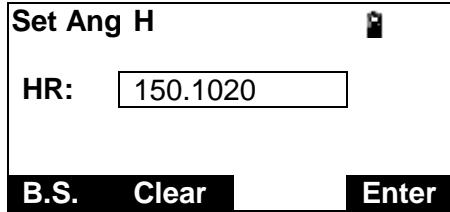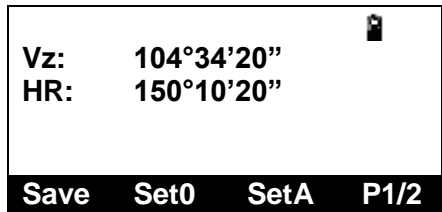
Keep some distance between your eyes and the collimator.
- Rotate the telescope focusing knob until the object can be seen clearly.
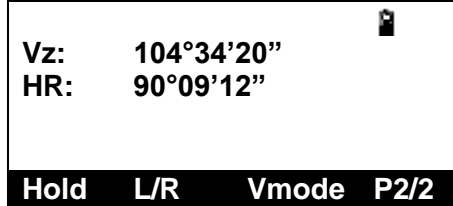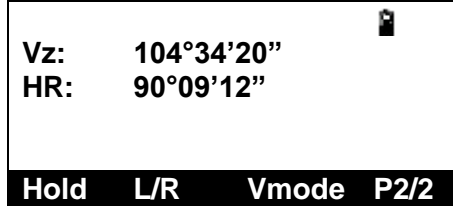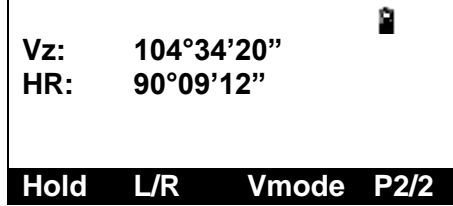
If there are deviations when moving your eye up, down, left or right, it proves that the focus or the diopter of the eyepiece is not adjusted well, which will affect the observation accuracy. You should focus and adjust the eyepiece sleeve carefully to eliminate such errors.

4.2 Set the Horizontal Angle to a Required Value

4.2.1 Setting by Inputting through the Keyboard
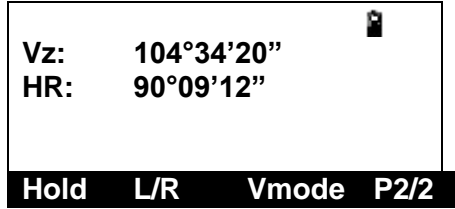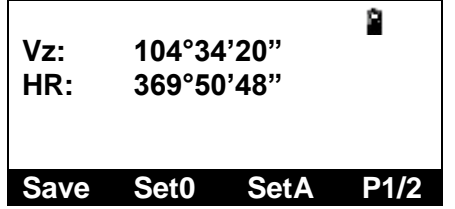
Operation Steps	Key	Display
1) Collimate the target point and press [F3](SetA)	Collimate point [F3]	Vz: 104°34'20" HR: 90°09'12" Save Set0 SetA P1/2
2) Input the desired horizontal angle by the keyboard and press [F4] (Enter) to save the value E.g. 150°10'20".	Input ang [F4]	Set Ang H HR: 150.1020 B.S. Clear Enter
3) H angle is defined		Vz: 104°34'20" HR: 150°10'20" Save Set0 SetA P1/2

The range and format of the input value:
  gon: 0 ~ 399.9999
  degree: 0 ~ 359.5959
  mil: 0 ~ 6399.999		

4.2.2 Setting by [Hold]

Operation Steps	Key	Display
1) Rotate the lens to the horizontal angle which is to be defined by horizontal tangent screw.	Display the angle	Vz: 104°34'20" HR: 90°09'12" Save　Set0　SetA　P1/2
2) Press [F4] to turn to Page 2.	[F4]	Vz: 104°34'20" HR: 90°09'12" Hold　L/R　Vmode　P2/2
3) Press [F1] (Hold).	[F1]	Vz: 104°34'20" HR: 90°09'12" Hold　L/R　Vmode　P2/2
4) Collimate the target point.	Collimate the target	
5) Press [F1](Hold) to release the value to this angle	[F1]	Vz: 104°34'20" HR: 90°09'12" Hold　L/R　Vmode　P2/2

4.3 Shift the horizontal angle (Right/Left)

Make sure it is under angle measurement mode.

Operation Steps	Key	Display
1) Press [F4] to turn to Page 2.	[F4]	Vz: 104°34'20" HR: 90°09'12" **Hold L/R Vmode P2/2**
2) Press [F2] (L/R) to shift the mode from horizontal right angle (HR) to horizontal left angle (HL).	[F2]	Vz: 104°34'20" HR: 369°50'48" **Save Set0 SetA P1/2**
Every pressing on [F2] (L/R) is to shift between HR/HL.		

5. DISTANCE MEASUREMENT

Please set the following items before distance measurement：

- Prism constant
- PPM
- Grid Scale
- Select reflector
- EDM mode setting by the application

User should avoid measuring distance to targets with high reflectivity (e.g. traffic light) neither in IR distance measurement mode nor in laser reflectorless distance mode, otherwise the measured distance will be incorrect or inaccurate.

When pressing "Meas", the total station will measure the distance from the instruments to the target.

During distance measurement, if there're passers-by, cars, animals or shaking branches block the light path, some light beams may be reflected back to the instrument, which will lead a fake result of measurement.

Under the mode of reflectorless and reflecting sheet, user should avoid the light path being blocked by other objects.

Reflectorless Distance Measurement

- Make sure the laser beam is not reflected by any reflecting objects nearby.
- When starting distance measurement, EDM will measure the distance to the target on the light path. If there're passing objects (like cars, rain, snow or frog), EDM will measure the distance to the nearest object
- When measuring a longer distance, the laser beam may deviate from the collimation line, which will affect the accuracy. This is because the emitting point of laser beam may not be the same as the point which is collimated by the crosshair.
- Do not measurement the same target with two instruments.

To implement precise distance measurement to the prism, user should adopt standard mode (Prism mode).

Laser Distance Measurement with Reflecting Sheet

Reflecting sheet can be also used in laser distance measurement. To ensure a high accuracy, please make sure the laser beam is perpendicular to the reflecting sheet.

Ensure the Right Addictive Constant of Different Prisms

Before distance measurement, atmospheric correction and prism constant are needed to be set. Please refer to "2. INITIAL SETTINGS" to know more about how to set atmospheric correction and prism constant.
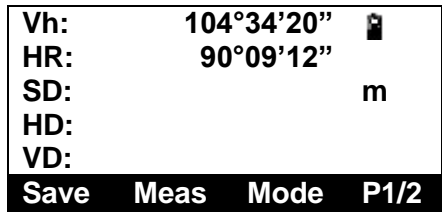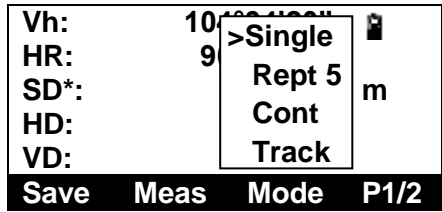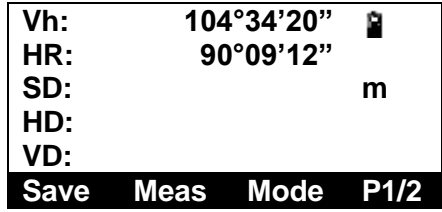
5.1 Distance Measurement

Operation Steps	Key	Display
1) Press [DIST] to enter to interface of distance measurement. Start distance survey.	[Dist]	**Vh:** 104°34'20" **HR:** 90°09'12" **SD:** m **HD:** **VD:** **Save Meas Mode P1/2**
2) It displays the distances measured.		**Vh:** 104°34'20" **HR:** 90°09'12" **SD*:** 2411.552 m **HD:** 345.234 **VD:** 23.231 **Save Meas Mode P1/2**
3) Press [F1] (Save) to start measurement, and record the data. After measurement, Input the point name and code and press (ENTER) to confirm the name displayed return to distance measurement mode. After the measurement of one point is finished, the name of next point will be automatically +1.	[F1] Input the point name and code ENT	**Vh:** 104°34'20" **HR:** 90°09'12" **SD*:** 2411.552 m **HD:** 345.234 **VD:** 23.231 **Save Meas Mode P1/2** **Information** **Pt.name:** SUN1 **Code:** PT **T.H.:** 2.100 m **Fast Slow File Export**

- When under electronic distance measurement (EDM), the symbol "*" will show on the

screen
- Units of distance: "m" (meter), "ft" (feet), "fi" (feet-inch).
- If the measurement result is affected by atmospheric agitation, the instrument will repeat the survey operation automatically.

5.2 Setting Measurement Mode

Total Station North NXR series provides measurement modes as following: Single/Rept 5/ Cont/ Tracking. Under "Rept 5" mode, the instrument will measure 5 times, and calculate the average value.

| Operation Steps	Key	Display
1) Press [DIST] to enter to interface of distance measurement. Start distance measurement.	[Dist]	Vh: 104°34'20" HR: 90°09'12" SD: m HD: VD: Save Meas Mode P1/2
2) Press [F3] (Mode) to shift measurement modes. 3) Use [▲] or [▼] to shift measurement modes among Single /Rept 5 / Cont/ Track.	[F3] [▲] or [▼]	Vh: 10... HR: 9... >Single SD*: Rept 5 m HD: Cont VD: Track Save Meas Mode P1/2
4) Press ENTER to confirm and return to Distance measurement mode	ENTER	Vh: 104°34'20" HR: 90°09'12" SD: m HD: VD: Save Meas Mode P1/2

5.3 Select Distance unit by soft keys (m/ft/ft-in)

You are able to change the distance unit by soft keys.
This setting will not be maintained after power-off. Refer to "9. PARAMETER SETTINGS" to implement the initial settings (this setting will be maintained even after power-off). Make sure it is under distance measurement mode.

Operation Steps	Key	Display
1) Press [DIST] to enter to interface of distance measurement. Start distance measurement.	[Dist]	Vh: 104°34'20" HR: 90°09'12" SD: m HD: VD: **Save Meas Mode P1/2**
2) Press [F4] to turn to page 2.	[F4]	Vh: 104°34'20" HR: 90°09'12" SD*: m HD: VD: **Offset Setout m/f/i P2/2**
4) Press [F3] (m/f/i) to change the unit. Every pressing [F3] (m/f/i) can change the unit mode.	[F3]	Vh: 104°34'20" HR: 90°09'12" SD: 2411.552 ft HD: 345.234 VD: 23.231 **Save Meas Mode P1/2**

5.4 SetOut

This function can display the difference between the distance measured and the distance of setout.
Distance measured – Distance of stake-out = difference displayed

During stake-out, user can choose any mode (angular, distance and cords to stake out).

Operation Steps	Key	Display
1) Press [F4] under Distance Measurement mode to enter to Page 2	[F4]	Vh: 104°34'20" HR: 90°09'12" SD: m HD: VD: **Offset Setout m/f/i P2/2**

North Group LTD.

2) Press [F2] (Setout) to display the distance setout page.	[F2]	**Setout (dist)** **HD:** 5.5 **m** **B.S. Clear Mode Enter**
3) Input distance to stake out (e.g. 5.5 m). After inputting press [F4](Enter)	Input Value and press [F4]	**Vh:** 104°34'20" **HR:** 90°09'12" **SD:** m **dHD:** **VD:** **Save Meas Mode P1/2**
4) Collimate the target (prism) and press [F2] (Meas). It displays the difference between the distance measured and the distance to stake out	Collimate prism [F2]	**Vh:** 104°34'20" **HR:** 90°09'12" **SD:** 1.166 **m** **dHD:** -2.251 **VD:** 0.031 **Save Meas Mode P1/2**
5) Move the prism until the difference (dHD) close to 0.000		**Vh:** 104°34'20" **HR:** 90°09'12" **SD:** 5.567 **m** **dHD:** 0.000 **VD:** 0.624 **Save Meas Mode P1/2**

5.5 Offset Measurement

Offset measurement are performed in order to find a point where a target cannot be installed directly or to find the distance and angle to a point which cannot be sighted.

It is possible to find the distance and angle to a point you wish to measure (target point) by installing the target at a location (offset point) a little distance from the target point and measuring the distance and angle from the surveying point to the offset point.

The target point could be found in the following four ways.

- Distance Offset Measurement
- Angle Offset Measurement

North Group LTD.

- Plane Offset Measurement
- Column Offset Measurement

5.5.1 Distance Offset Measurement Mode

Sometimes we need to measure a coordinate of a point such as A1 whose position cannot place a prism. Assume that we know the horizontal distance from prism to A1. The Distance offset measurement can be used.

Operation Steps	Key	Display
1) Press [F4] under Distance Measurement mode to enter to Page 2.	[F4]	**Vh:** 104°34'20" 🔋 **HR:** 90°09'12" **SD:** m **HD:** **VD:** **Offset Setout m/f/i P2/2**
2) Press [F1] (Offset) to see the offset menu.	[F1]	**--Offset—** 🔋 **1. Angle Offset** ▲ **2. Dist Offset** **3. Plane Offset** **4. Column Offset**

3) Press [2] (Dist Offset) to enter to distance offset measurement.	[2]	**Offset(dist)-length** **Left(-)/Right(+) Length:** _____ m **Front(-)/Behind (+) Length:** _____ **B.S. Clear Mode Enter**
4) Input offset distance of left or right, and Front or behind. Then press (ENT).	Input L/R, Front or behind offset distance. [ENT]	**Offset(dist)-length** **Left(-)/Right(+) Length:** 1.600 m **Front(-)/Behind (+) Length:** 2.000 **B.S. Clear Mode Enter**
5) Collimate P1 and press [F1] (MEAS) to start measurement.	Collimate P1 [F1]	**Offset(dist)-prism** HR: 90°09'12" SD: m HD: VD: **Meas T.H. Mode**
6) When distance measurement to the prism is finished, it displays the measured result as the picture on the right. Press [F4] (Enter) to accept the result.	F4	**Offset(dist)-Prism** HR: 282°09'12" SD: 2.061 m HD: 2.045 VD: 0.253 **Meas Mode Enter**
7) The result of target point is shown as the picture on the left. If you wish to display coordinate then you must press [**CORD**], or if you wish display distance then you must press [**DIST**].	[CORD] [DIST]	**Offset(dist)-Target** HR: 282°09'12" N: 3.296 m E: -2.839 Z: -0.147 **Next Mode** **Offset(dist)-Target** HR: 282°09'12" SD: 4.360 m HD: 4.352 VD: 0.254 **Next Mode**

8) When you press F1:[**Next**], you will be informed to save the result, if necessary you can press [**ENT**] to save the result		Offset(dist)-Target 🔋 HR Save record? SD ENT-Save m HD ESC-Not Save VD: 0.254 **Next** **Mode**
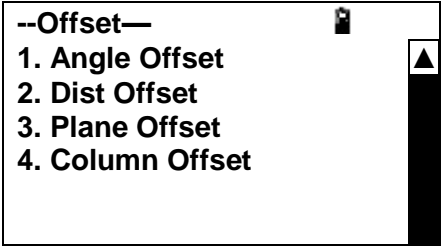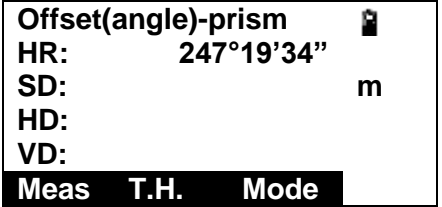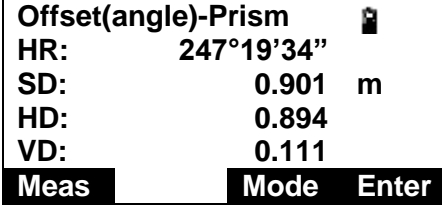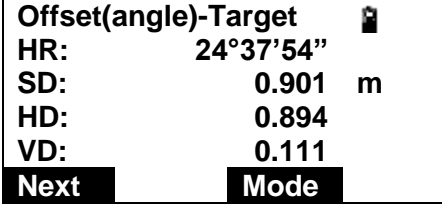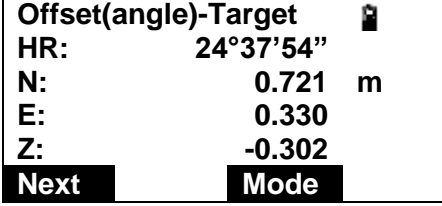
5.5.2 Angle Offset Measurement Mode

Sometimes we need to measure a coordinate of a point such as A1 whose position cannot place a prism, for example the center of a tree, this mode is helpful. It only needs to set the prism on the point which has the same horizontal distance to the instrument as that of the prism to the instrument. Then define the instrument height/target height to start offset measurement, you can get the coordinates of the center of the object.

Note: if you need the coordinate of A0 you should set the height of prism to zero. If you need the coordinate of A1 you should set the height of prism to the real height.

Prism (P)

HD (r)

HD (f)   AO

A1

Center of instrument(CI)

HD (r) =HD (f)

HD (r) : Horizontal distance from CI to P

HD (f) : Horizontal distance from CI to A0

Operation Steps	Key	Display
1) Press [F4] under Distance Measurement mode to enter to Page 2	[F4]	Vh: 104°34'20" 🔋 HR: 90°09'12" SD: m HD: VD: **Offset Setout m/f/i P2/2**

2) Press [F1] (Offset) to see the offset menu.	[F1]	**--Offset—** **1. Angle Offset** **2. Dist Offset** **3. Plane Offset** **4. Column Offset**
3) Press [1] (Angle Offset) to enter to Angle offset measurement mode.	[1]	**Offset(angle)-prism** **HR:**　　　**247°19'34"** **SD:**　　　　　　**m** **HD:** **VD:** **Meas　T.H.　　Mode**
4) Collimate the prism P1 and press [F1] (MEAS) to start measurement. It will measure the distance between the instrument and the prism	Collimate P1 [F1]	**Offset(angle)-Prism** **HR:**　　　**247°19'34"** **SD:**　　　　**0.901　m** **HD:**　　　　**0.894** **VD:**　　　　**0.111** **Meas　　　　Mode　Enter**
5) Collimate A0 by horizontal clamp and tangent screws. It displays the SD, HD, and VD from the instrument to A0.	Collimate A0	**Offset(angle)-Target** **HR:**　　　**24°37'54"** **SD:**　　　　**0.901　m** **HD:**　　　　**0.894** **VD:**　　　　**0.111** **Next　　　　Mode**
6) To display the coordinates of A0 or A1, press (CORD)	(COORD)	**Offset(angle)-Target** **HR:**　　　**24°37'54"** **N:**　　　　**0.721　m** **E:**　　　　**0.330** **Z:**　　　　**-0.302** **Next　　　　Mode**
Press [F1] (NEXT) to return to Procedure 4. Press [ESC] to return to distance measurement mode.		

5.5.3   Plane Offset Measurement Mode

Sometimes we wish to obtain the coordinate of some points where we cannot measure directly. Fortunately, we can measure the distances of another points, and all these points are in a plane. In this time the plane offset measurement can be used. The figure is shown as follow.

P1,P2,P3 are the points where distance can obtain,the height should be setting to 0.P0 is the point that need measuring.

Operation Steps	Key	Display
1) Press [F4] under Distance Measurement mode to enter to Page 2.	[F4]	Vh: 104°34'20" 🔋 HR: 90°09'12" SD: m HD: VD: **Offset Setout m/f/i P2/2**
2) Press [F1] (Offset) to see the offset menu.	[F1]	**--Offset—** 🔋 **1. Angle Offset** ▲ **2. Dist Offset** **3. Plane Offset** **4. Column Offset**

3) Press [3] (Plane Offset) to enter to Plane Offset measurement mode.	[3]	**Offset(plane)-Pt.1** **HR:** 247°19'34" **SD:** m **HD:** **VD:** **Meas T.H. Mode**
4) Collimate the prism P1 and press [F1] (MEAS) to start measurement.	Collimate P1 [F1]	**Offset(Plane)-Pt.1** **HR:** 209°20'53" **SD:** 0.901 m **HD:** 0.894 **VD:** 0.111 **Meas T.H. Mode Enter**
5) Press ENT to keep forward to the measurement of the second point.	ENT	**Offset(plane)-Pt.2** **HR:** 280°22'33" **SD:** m **HD:** **VD:** **Meas T.H. Mode**
6) Collimate the prism P2 and press [F1] (MEAS) to start measurement.	[F1]	**Offset(plane)-Pt.2** **HR:** 280°22'33" **SD:** 0.721 m **HD:** 0.330 **VD:** 0.323 **Meas T.H. Mode Enter**
7) Press ENT to keep forward to the measurement of the third point	ENT	**Offset(plane)-Pt.3** **HR:** 280°22'33" **SD:** m **HD:** **VD:** **Meas T.H. Mode**
8) Collimate the prism P3 and press [F1] (MEAS) to start measurement.	Collimate prism [F1]	**Offset(plane)-Pt.3** **HR:** 280°22'33" **SD:** 0.231 m **HD:** 2.540 **VD:** 0.890 **Meas T.H. Mode Enter**

9) It will calculate and display the distance and coordinates of the intersection of collimation line and this plane.		**Offset(plane)-Target** 🔋 HR: 280°22'33" N: 0.231 m E: 2.540 Z: 0.890 **Next T.H. Mode**
10) Collimate the edge of the plane	Collimate P0	**Offset(plane)-Target** 🔋 HR: 280°22'33" N: 2.231 m E: -0.540 Z: 0.690 **Next T.H. Mode**
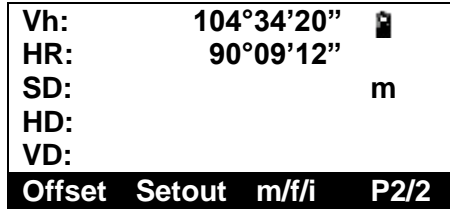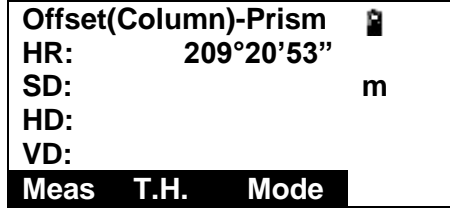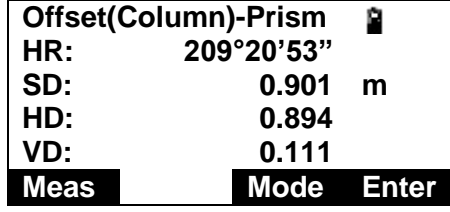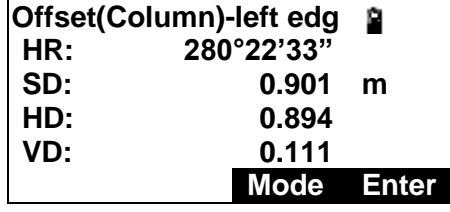
5.5.4   Column Offset Measurement Mode

Sometimes we wish to obtain the coordinate of column center where we cannot find. Fortunately, we can measure the distances of another points on the column, in this time the column offset measurement can be used. The figure is shown as follow:
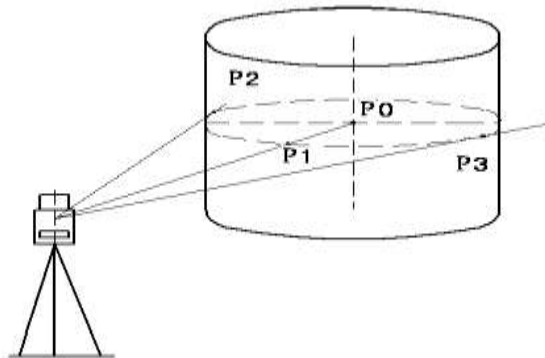

First, measure the distance to the point (P1) of the column surface directly. Then by measuring the azimuth angles of P2 and P3 on the column, you can calculate the distance, azimuth and coordinates of the column center.
Azimuth of the column center is the average value of point of column surface (P2) and azimuth (P3).

Operation Steps	Key	Display
1) Press [F4] under Distance Measurement mode to enter to Page 2	[F4]	**Vh:** 104°34'20" **HR:** 90°09'12" **SD:** m **HD:** **VD:** **Offset Setout m/f/i P2/2**
2) Press [F1] (Offset) to see the offset menu.	[F1]	**--Offset—** **1. Angle Offset** **2. Dist Offset** **3. Plane Offset** **4. Column Offset**
3) Press [4] (Column Offset) to enter to Column Offset measurement mode.	[4]	**Offset(Column)-Prism** **HR:** 209°20'53" **SD:** m **HD:** **VD:** **Meas T.H. Mode**
4) Collimate the center of the column (P1) and press [F](Meas) to start EDM then you can obtain the data of a point on the column which is shown as the picture on the right	Collimate P1 [F1]	**Offset(Column)-Prism** **HR:** 209°20'53" **SD:** 0.901 m **HD:** 0.894 **VD:** 0.111 **Meas Mode Enter**
5) Press ENT to confirm. After measurement, the system will remind you to implement angle measurement of the left point.	ENT	**Offset(Column)-left edg** **HR:** 280°22'33" **SD:** 0.901 m **HD:** 0.894 **VD:** 0.111 **Mode Enter**

6) Collimate the left point of the column surface (P2) and [F4] (Enter) to finish measurement Then it will display the message to measure the angle of the right point (P3).	Collimate the left point (F4)	**Offset(Column)-right** HR:　　　280°22'33" SD:　　　　　0.921　m HD:　　　　　0.330 VD:　　　　　0.323 　　　　　　Mode　Enter
7) Collimate the right of the column surface (P3) and press [F4] (SET). Then the distance between the instrument and the column center (P0) will be calculated.	[F4]	**Offset(Column)-Center** HR:　　　280°22'33" N:　　　　　2.782　m E:　　　　　0.679 Z:　　　　　1.781 Next　　　　Mode
Press [F1] (NEXT) to return to Procedure 4. Press [ESC] to return to distance measurement mode		

6. COORDINATES MEASUREMENT

It is possible to find the 3D coordinates of a target by coordinate measurement. Please input the station coordinate, instrument height, target height, backsight coordinate (or azimuth angle) and azimuth before coordinate measurement.

When measuring the coordinates after inputting the instrument height and target height, you can measure the unknown coordinates directly.

- To define the coordinates of occupied point, refer to "6.1 SETTING COORDINATES OF OCCUPIED POINT".
- To define the instrument height and target height, refer to "6.2 SETTING INSTRUMENT HEIGHT" and "6.3 SETTING TARGET HEIGHT".
- To measure the coordinates, you should define the backsight point and measure the azimuth of backsight point first.

The coordinates of unknown point can be calculated by the formula below:

Coordinates of occupied point: (N0, E0, Z0)

The central coordinates of the target corresponding to the center of the instrument: (N, E, Z) Instrument height: INS. HT

the center of the prism (n, e, z)

coordinates of the center of the Ins.

SD

z (VD)

(N1,E1,Z1) unknown

Ins. HT.

the coordinates of the center of the Ins. = N0,E0,Z0 + Ins. HT.

HD
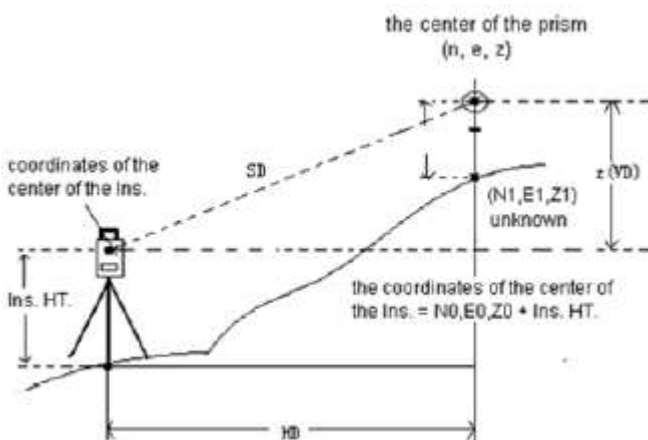
Coordinates of unknown point:
(N1, E1, Z1)

Target height: R. HT

VD: Z(VD)

N1=N0+n

E1=E0+e

Z1=Z0+INS. HT+Z-R. HT

Coordinates of instrument center:
(N0, E0, Z0+INS. HT)

Caution during coordinates measurement: to define the coordinates of occupied point, instrument height, target height and backsight azimuth first.
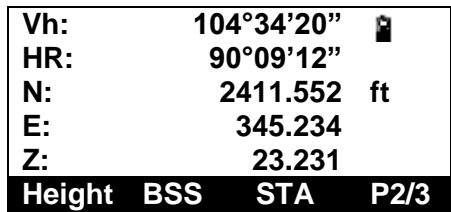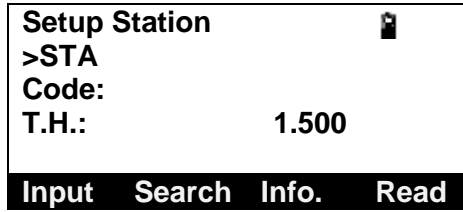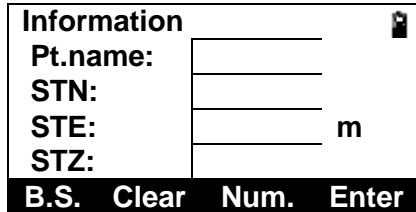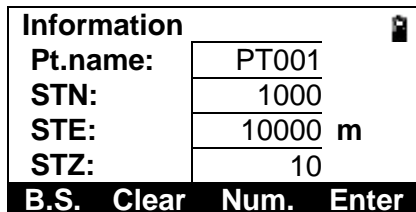
Operation Steps	Key	Display
1) Define the azimuth of known point A.	Define Azimuth	**Vh:** 104°34'20" **HR:** 90°09'12" m **Save** **Set0** **SetA** **P1/2**
2) Collimate target B, and press [CORD].	Collimate the prism [CORD]	**Vz:** 104°34'20" **HR:** 90°09'12" **N:** Sing m **E:** **Z:** **Save** **Meas** **Mode** **P1/2**
4) Start measurement by pressing [F2] (Meas).	[F2]	**Vh:** 104°34'20" **HR:** 90°09'12" **N:** 2411.552 ft **E:** 345.234 **Z:** 23.231 **Save** **Meas** **Mode** **P1/2**
5) Press [F1] (Save) to start coordinates measurement and record the result.	[F1]	**Vh:** 104°34'20" **HR:** 90°09'12" **N:** Sing 2411.552 ft **E:** 345.234 **Z:** 23.231 **Save** **Meas** **Mode** **P1/2**
6) You will see as shown on the right window If you want to change the name, press [F2](Clear) and input the point name.	[F2] Input Point name	**Information** **Pt.name:** N001 **Code:** PT **T.H.:** 2.100 m **[*]Save WORK&COOR. file** **B.S.** **Clear** **Alph** **Enter**

7) Press [ENTER] to confirm and Save point.	[ENTER]	Vh: 104°34'20" HR: 90°09'12" N: **Saved** 1.552 ft E: 345.234 Z: 23.231 **Save Meas Mode P1/2**

After measurement of one point, the system will add 1 to the point name. Repeat the procedures 5~7 to restart a new measurement.

6.1 Setting coordinates of the Occupied Point

By setting the coordinates of the instrument (occupied point) with respect to the origin of coordinates, the instrument can transform and display the coordinates of unknown point (target point) under this coordinates system.

Operation Steps	Key	Display
1) Under coordinate measurement mode, press [F4] (P1↓) to turn to P2.	[F4]	Vh: 104°34'20" HR: 90°09'12" N: 2411.552 ft E: 345.234 Z: 23.231 **Height BSS STA P2/3**
2) Press [F3] (STA)	[F3]	Setup Station >STA Code: T.H.: 1.500 **Input Search Info. Read**
3) Press [F1](Input) to enter coordinates of the occupied point.	[F1]	Information Pt.name: STN: STE: m STZ: **B.S. Clear Num. Enter**
4) Input point name and coordinate N and press [F4] (Enter) to enter the next value. Input the coordinate E and Z with the same method.	Input point name and coordinates	Information Pt.name: PT001 STN: 1000 STE: 10000 m STZ: 10 **B.S. Clear Num. Enter**

5) After inputting, press [ENT] to confirm and return to setup station interface.	[ENT]	**Setup Station** 🔋 **STA** **PT001** **>Code:** **T.H.:** **1.500** **[*]file list** **Input** **Search** **Info.** **Read**
6) If you want to use Codes input the desired code. If you don't want to use codes go to step 7)	Input code	**Setup Station** 🔋 **STA** **PT001** **>Code:** **SDG** **T.H.:** **1.500** **Input** **Info.** **Read**
7) Press ENT and you will see as the picture on the right. Press ENT to save and finish. Or press ESC to cancel.	ENT ENT or ESC	**Setup Station** 🔋 **STA** **Save record?** **>Co ENT-Save** **T.H. ESC-Not Save** **Input** **Info.** **Read**

Inputting Range：-99999999.9999 ≤N, E, Z ≤ +99999999.9999 m
               -99999999.9999 ≤ N, E, Z ≤ +99999999.9999 ft
               -99999999.11.7 ≤ N, E, Z ≤ +99999999.11.7 ft + inch		

6.2 Setting Instrument Height and Target Height
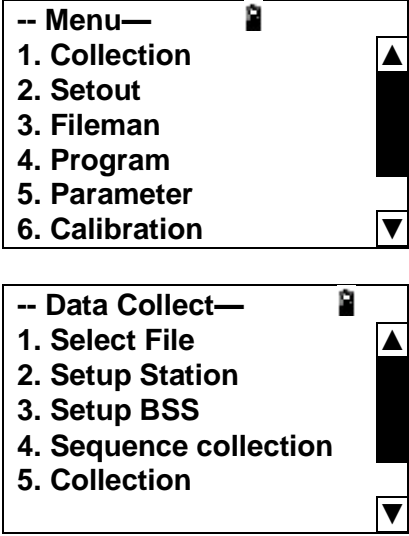
Operation Steps	Key	Display
1) Under coordinate measurement mode, press [F4] (P1↓) to turn to P2.	[F4]	Vh: 104°34'20" HR: 90°09'12" N: 2411.552 ft E: 345.234 Z: 23.231 **Height BSS STA P2/3**
2) Press [F1] (Height) to display the instrument height and the target height.	[F1]	Input I.H. &T.H. I.H.: 1.500 T.H.: 1.900 m **B.S. Clear Save Enter**
3) Input the instrument height and press [F4] (ENT) to input the Target height.	Input Instrument Height [F4]	Input I.H. &T.H. I.H.: 1.500 T.H.: 1.900 m **B.S. Clear Save Enter**
4) Input the target height and press [ENT] to confirm and Save	Input the target height [ENT]	Input I.H. &T.H. I.H.: 1.500 T.H.:	m **B.S. Clear Save Enter**
Inputting Range： -9999.9999≤ INS. HT ≤+9999.9999 m -9999.9999≤ INS.HT ≤+9999.9999 ft -9999.11.7≤ INS.HT ≤+9999.11.7 ft + inch		
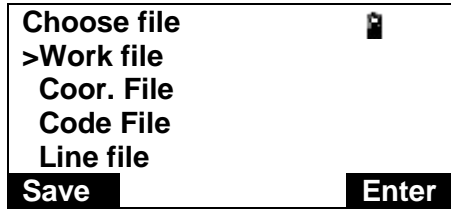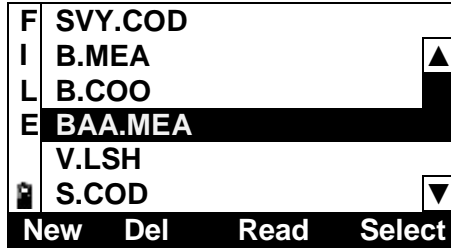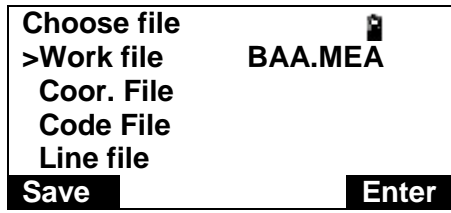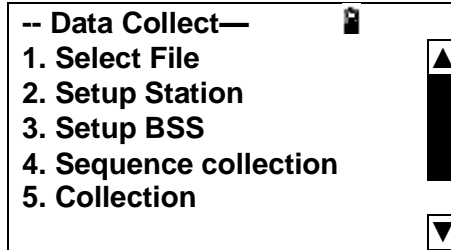
7. DATA COLLECTION

This is the basic procedure to data collection

1. Select a Data Collection File

2. Select "REC. coordinate file", and save the coordinate data converted from original data.

3. Select Coordinate Data File so that you can use Occupied Point coordinate data and Backsight coordinate data. (If coordinate data of known point is not necessary for use, pass this step)

4. Set Occupied Point, including Instrument Height, Point Number and Coordinate.

5. Set Backsight Point, Direction and Azimuth.

6. Start collecting and saving data.

7.1 Selecting a file for data collection

Operation Steps	Key	Display
1) Press [MENU] to enter into MENU, and then press [1] (Collection).	[MENU] [1]	-- Menu— 1. Collection ▲ 2. Setout 3. Fileman 4. Program 5. Parameter 6. Calibration ▼ -- Data Collect— 1. Select File ▲ 2. Setup Station 3. Setup BSS 4. Sequence collection 5. Collection ▼

North Group LTD.

2) Press [1] (Select File) and press [F4] (Enter) to select a work file.	[1]
	
	[F4]
		Choose file 🔋
		>Work file
		  Coor. File
		  Code File
		  Line file
		Save **Enter**

3) The screen shows Disk list. Choose the Disk which the work file is in Select the desired file using [▲] or [▼] or create a new one *1	[▲] or [▼].	**F SVY.COD** **I B.MEA** ▲ **L B.COO** **E BAA.MEA** **V.LSH** 🔋 **S.COD** ▼ **New** **Del** **Read** **Select**

4) Press ENT to confirm.	ENT	**Choose file** 🔋
		>Work file **BAA.MEA**
		  Coor. File
		  Code File
		  Line file
		Save **Enter**

5) Press [F1](Save) and then the screen returns to DATA COLLECT MENU.	[F1]	**-- Data Collect—** 🔋 **1. Select File** ▲ **2. Setup Station** **3. Setup BSS** **4. Sequence collection** **5. Collection** ▼
*1) Refer to "8.1.1 Create a new file" to create a new job		
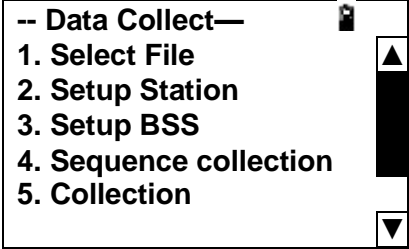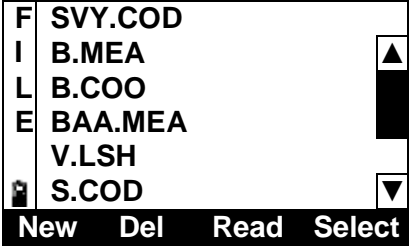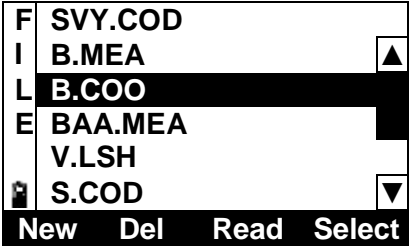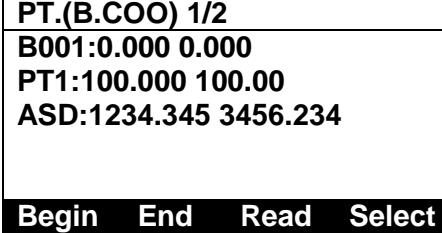
7.2 Setup Station
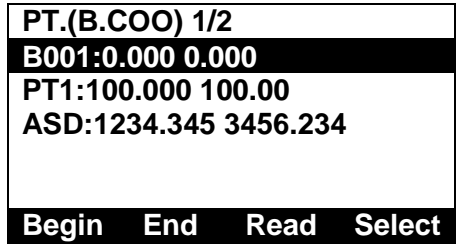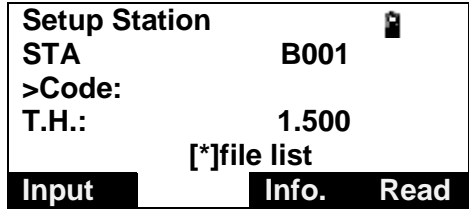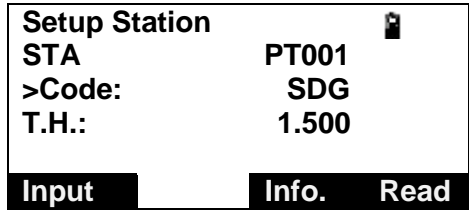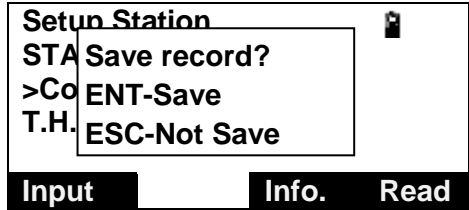
The occupied point and direction angle in the data collect mode are linked with the occupied point and it is possible to set or change the occupied point and direction angle from the data collect mode.
Occupied point can be set by two setting methods as follow：
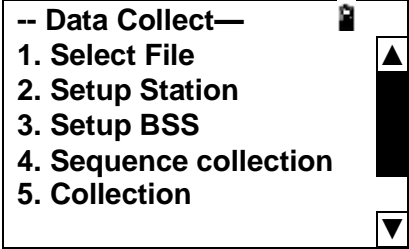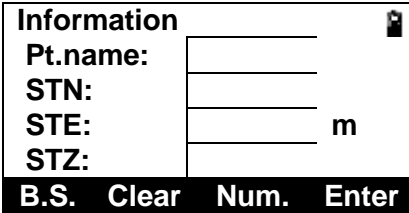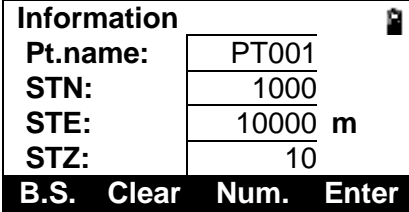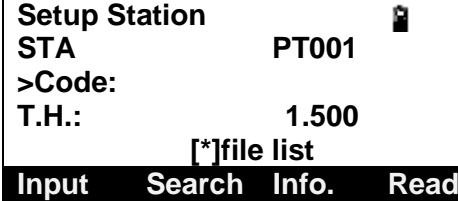
1) Setting from the coordinate data stored in the internal memory
2) Direct key input

7.2.1 Setting the occupied point from data stored in the internal memory

Operation Steps	Key	Display
1) Press Menu and then press [1](Data Collection).	[MENU] [1]	-- Data Collect— 1. Select File ▲ 2. Setup Station 3. Setup BSS 4. Sequence collection 5. Collection ▼
2) In Data Collection Menu, press [2] (Setup Station).	[2]	Setup Station >STA Code: T.H.: 1.500 [*]file list Input Search Info. Read
3) Press [F4] (Read) to read the coordinates stored in the current coordinate file, if you hasn't selected a coordinate job, it will prompt the file select list as shown on the right picture.	[F4]	F SVY.COD I B.MEA ▲ L B.COO E BAA.MEA V.LSH 🔋 S.COD ▼ New Del Read Select
4) Select the desired file using [▲] or [▼] and press [F4] (Select)	[▲] or [▼] [F4]	F SVY.COD I B.MEA ▲ L B.COO E BAA.MEA V.LSH 🔋 S.COD ▼ New Del Read Select
5) You will see as shown on the right		PT.(B.COO) 1/2 B001:0.000 0.000 PT1:100.000 100.00 ASD:1234.345 3456.234 Begin End Read Select

53

6) Select the desired point using [▲] or [▼] and press [F4] Select	[▲] or [▼] [F4]	**PT.(B.COO) 1/2** **B001:0.000 0.000** **PT1:100.000 100.00** **ASD:1234.345 3456.234** **Begin End Read Select**
7) After selecting, press [ENT] to confirm and return to setup station interface	[ENT]	**Setup Station** **STA B001** **>Code:** **T.H.: 1.500** ** [*]file list** **Input Info. Read**
6) If you want to use Codes input the desired code If you don't want to use codes go to step 7)	Input code	**Setup Station** **STA PT001** **>Code: SDG** **T.H.: 1.500** **Input Info. Read**
7) Press ENT and you will see as the picture on the right. Press ENT to save and finish. Or press ESC to cancel	ENT ENT	**Setup Station** **STA Save record?** **>Co ENT-Save** **T.H. ESC-Not Save** **Input Info. Read**

7.2.2 Setting the occupied point by direct key input

Operation Steps	Key	Display
1) Press Menu and then press [1](Data Collection).	[MENU] [1]	-- Data Collect— 1. Select File ▲ 2. Setup Station 3. Setup BSS 4. Sequence collection 5. Collection ▼
2) In Data Collection Menu, press [2] (Setup Station).	[2]	Setup Station >STA Code: T.H.:　　　　　1.500 [*]file list Input　Search　Info.　Read
3) Press [F1](Input) to enter coordinates of the occupied point	[F1]	Information Pt.name: STN: STE:　　　　　　　m STZ: B.S.　Clear　Num.　Enter
4) Input point name and coordinate N and press [F4] (Enter) to enter the next value. Input the coordinate E and Z with the same method	Input name and coordinates	Information Pt.name:　　PT001 STN:　　　　1000 STE:　　　10000 m STZ:　　　　　10 B.S.　Clear　Num.　Enter
5) After inputting, press [ENT] to confirm and return to setup station interface	[ENT]	Setup Station STA　　　　　PT001 >Code: T.H.:　　　　　1.500 [*]file list Input　Search　Info.　Read

6) If you want to use Codes input the desired code If you don't want to use codes go to step 7)	Input code	**Setup Station** **STA** **PT001** **>Code:** **SDG** **T.H.:** **1.500** **Input** **Info. Read**
7) Press ENT and you will see as the picture on the right. Press ENT to save and finish. Or press ESC to cancel	ENT	**Setup Station** **STA Save record?** **>Co ENT-Save** **T.H. ESC-Not Save** **Input** **Info. Read**

Inputting Range： -99999999.9999 ≤N, E, Z ≤ +99999999.9999 m
                   -99999999.9999 ≤ N, E, Z ≤ +99999999.9999 ft
                   -99999999.11.7 ≤ N, E, Z ≤ +99999999.11.7 ft + inch		

7.3 Setting the Azimuth (Backsight Point)

Setup station shall be done before setup BSS
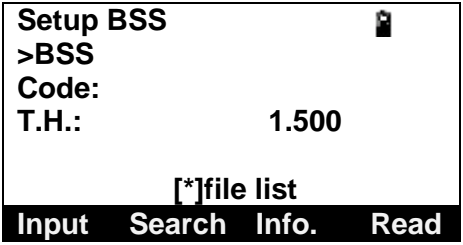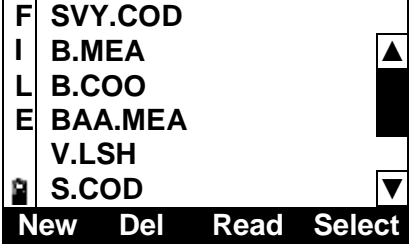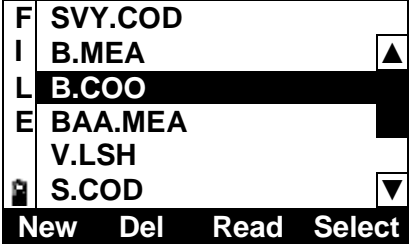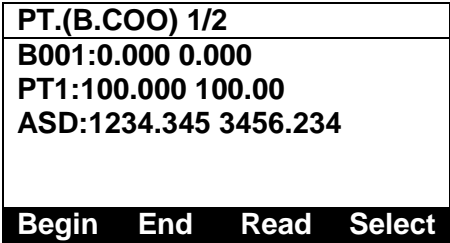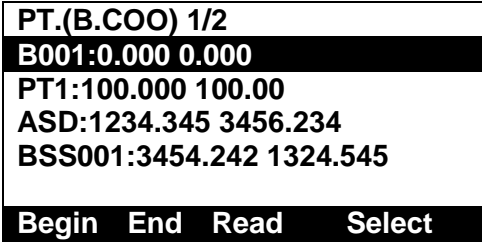
The azimuth of backsight could be inverse calculated by the coordinates of instrument station and backsight station.
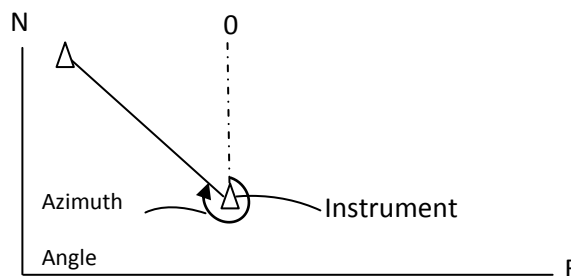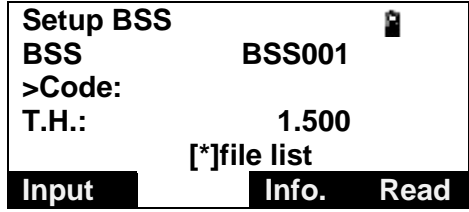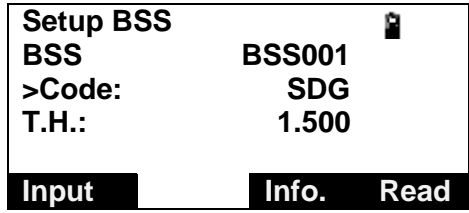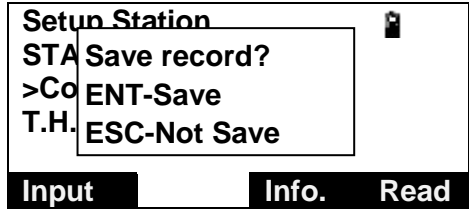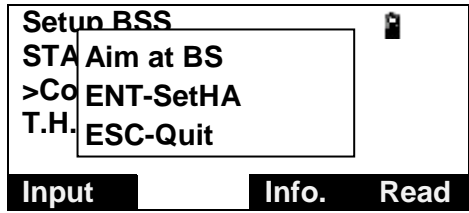
NOTE:
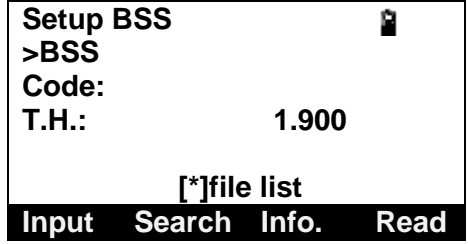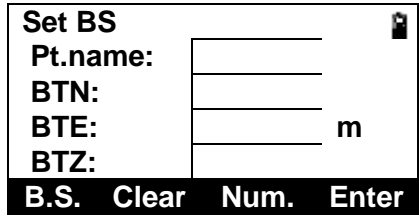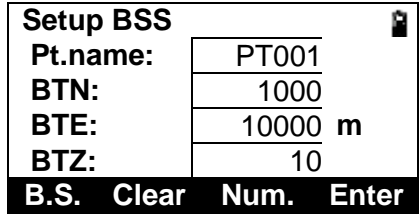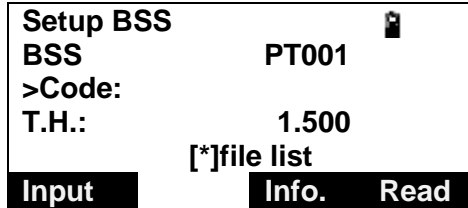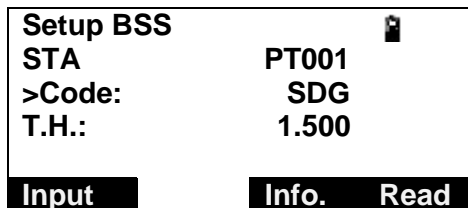
You can input the azimuth angle directly in angle measurement mode.
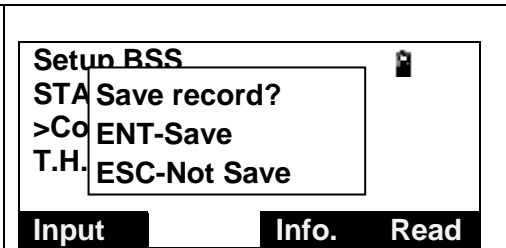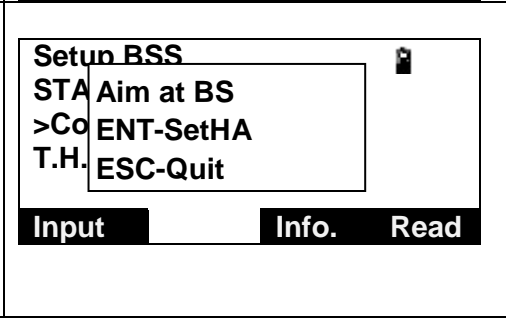
7.3.1 Setting the Backsight point from data stored in the internal memory

Operation Steps	Key	Display
1) In Data Collection Menu, press [3] (Setup BSS).	[3]	**Setup BSS** 🔋 **>BSS** **Code:** **T.H.: 1.500** **[*]file list** **Input Search Info. Read**
2) Press [F4] (Read) to read the coordinates stored in the current coordinate file, if you hasn't selected a coordinate job, it will prompt the file select list. As shown on the right picture*	[F4]	**F SVY.COD** **I B.MEA** ▲ **L B.COO** **E BAA.MEA** ** V.LSH** 🔋 **S.COD** ▼ **New Del Read Select**
3) Select the desired file using [▲] or [▼] and press [F4] Select	[▲] or [▼] [F4]	**F SVY.COD** **I B.MEA** ▲ **L B.COO** **E BAA.MEA** ** V.LSH** 🔋 **S.COD** ▼ **New Del Read Select**
4) You will see as shown on the right		**PT.(B.COO) 1/2** **B001:0.000 0.000** **PT1:100.000 100.00** **ASD:1234.345 3456.234** **Begin End Read Select**
5) Select the desired point using [▲] or [▼] and press [F4] (Select).	[▲] or [▼] [F4]	**PT.(B.COO) 1/2** **B001:0.000 0.000** **PT1:100.000 100.00** **ASD:1234.345 3456.234** **BSS001:3454.242 1324.545** **Begin End Read Select**

57

6) After selecting, press [ENT] to confirm and return to setup station interface.	[ENT]	**Setup BSS** **BSS BSS001** **>Code:** **T.H.: 1.500** **[*]file list** **Input Info. Read**
7) If you want to use Codes input the desired code. If you don't want to use codes go to step 8)	Input code	**Setup BSS** **BSS BSS001** **>Code: SDG** **T.H.: 1.500** **Input Info. Read**
8) Press ENT and you will see as the picture on the right. Press ENT to save and finish. Or press ESC to cancel.	ENT	**Setup Station** STA **Save record?** >Co **ENT-Save** T.H. **ESC-Not Save** **Input Info. Read**
9) Then prompt if you need to setup azimuth using the BSS data or not. If you select [**ENT**] then the instrument will display the horizontal angle as Azimuth evermore. Collimate BSS point and press [ENT].	Collimate BSS point [ENT]	**Setup BSS** STA **Aim at BS** >Co **ENT-SetHA** T.H. **ESC-Quit** **Input Info. Read**
*Known point data is in the current coordinate file. If the coordinate data is in another coordinate file then you have to select the file as current coordinate file. In this time you can do it by pressing (★).		

7.3.2 Setting the Backsight point by direct key input

Operation Steps	Key	Display
1) In Data Collection Menu, press [3] (Setup BSS)	[3]	**Setup BSS** ▮ **>BSS** **Code:** **T.H.:** **1.900** **[*]file list** **Input Search Info. Read**
2) Press [F1](Input) to enter coordinates of the occupied point	[F1]	**Set BS** ▮ **Pt.name:** **BTN:** **BTE:** **m** **BTZ:** **B.S. Clear Num. Enter**
3) Input point name and coordinate N and press [F4] (Enter) to enter the next value. Input the coordinate E and Z with the same method	Input coordinates	**Setup BSS** ▮ **Pt.name:** PT001 **BTN:** 1000 **BTE:** 10000 **m** **BTZ:** 10 **B.S. Clear Num. Enter**
4) After inputting, press [ENT] to confirm and return to setup BSS interface	[ENT]	**Setup BSS** ▮ **BSS** **PT001** **>Code:** **T.H.:** **1.500** **[*]file list** **Input Info. Read**
5) If you want to use Codes input the desired code If you don't want to use codes go to step 6)	Input code	**Setup BSS** ▮ **STA** **PT001** **>Code:** **SDG** **T.H.:** **1.500** **Input Info. Read**

6) Press ENT and you will see as the picture on the right. Press ENT to save and finish. Or press ESC to cancel	ENT	**Setup BSS** STA **Save record?** >Co **ENT-Save** T.H. **ESC-Not Save** **Input** **Info. Read**
7) Then prompt if you need to setup azimuth using the BSS data or not. If you select [ENT] then the instrument will display the horizontal angle as Azimuth evermore. Collimate BSS point and press [ENT]	Collimate BSS point [ENT]	**Setup BSS** STA **Aim at BS** >Co **ENT-SetHA** T.H. **ESC-Quit** **Input** **Info. Read**

7.4 Sequence of Collection

You can set the sequence of data collection and edition.

There are two different ways to work.

In Data Collection Menu, press [4] (Sequence of collection)

```
-- Collection—
1. Select file              ▲
2. Setup Station
3. Setup BSS
4. Sequence  >Meas first
5. Collection  Edit First
                            ▼
```
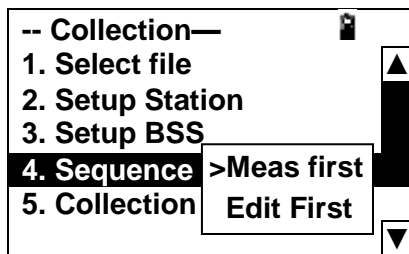
EDIT→ MEAS: Set the PT# name, PCODE and target height firstly and then collect data.

MEAS→ EDIT: Collect data firstly, and then allow the customer to edit the collected PT# name, PCODE, target height

7.5 Measuring and saving the data

Operation Steps	Key	Display
1) In Data Collection Menu, press [3] (Setup BSS).	[3]	Vz: 104°34'20" HR: 90°09'12" N: Sing m E: Z: Save Meas Mode P1/2
2) Collimate target	Collimate the prism	Vz: 104°34'20" HR: 90°09'12" N: Sing m E: Z: Save Meas Mode P1/2
4) Start measurement by pressing [F2] (Meas).	[F2]	Vh: 104°34'20" HR: 90°09'12" N: 2411.552 ft E: 345.234 Z: 23.231 Save Meas Mode P1/2
5) Press [F1] (Save) to start coordinates measurement and record the result.	[F1]	Vh: 104°34'20" HR: 90°09'12" N: Sing 2411.552 ft E: 345.234 Z: 23.231 Save Meas Mode P1/2
6) You will see as shown on the right window If you want to change the name, press [F2](Clear) and input the point name	[F2] Input Point name	Information Pt.name: N001 Code: PT T.H.: 2.100 m [*]Save WORK&COOR. file B.S. Clear Alph. Enter

North Group LTD.

61

7)Press [ENTER]to confirm and Save point	[ENTER]	Vh: 104°34'20" 🔋 HR: 90°09'12" N: **Saved** 1.552 ft E: 345.234 Z: 23.231 **Save Meas Mode P1/2**
After measurement of one point, the system will add 1 to the point name. Repeat the procedures 5~7 to restart a new measurement.		

8. Setout measurement

Setout measurement is used to Setout the required point. The difference between the previously inputted data to the instrument（the Setout data）and the measured value can be displayed by measuring the horizontal angle, distance or coordinates of the sighted point.

The horizontal angle difference and distance difference are calculated and displayed using the following formulas:

Horizontal angle difference

dHA =Horizontal angle of Setout data – measured horizontal angle

Distance difference

Distance   Displayed item

SD: S-O SD=measured slope distance – slope distance of Setout data

HD: S-O HD=measured horizontal distance – horizontal distance of Setout data

VD: S-O VD=measured height difference – height difference of Setout data

There are the following steps：
1．Setting occupied point.
2．Setting backsight point and azimuth angle.
3．Input layout point coordinates, and then starts.

NOTE:

- Setout data can be input in various modes: SD, HD, VD, coordinates and REM measurement.
- EDM settings could be set in this mode.

8.1 Preparation

Setting the Grid Scale

Calculation Formula
1）Elevation factor
Elevation factor=R/(R+ELEV)
R：The average radius of the earth
ELEV：The elevation above the mean sea level

2）Scale factor:

Scale factor in the surveying station

3）Grid factor
Grid factor = Elevation factor×Scale factor
Distance calculation
1）Grid distance
HDg=HD×Grid factor
HDg：Grid distance
HD：Ground distance
2）Ground distance
HD= HDg/ Grid factor
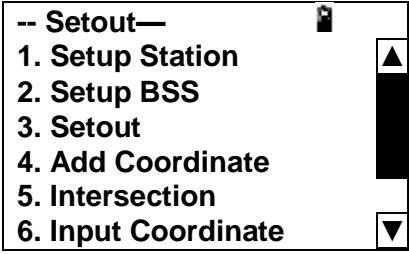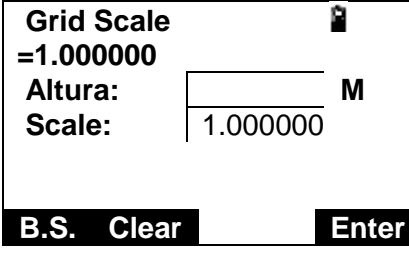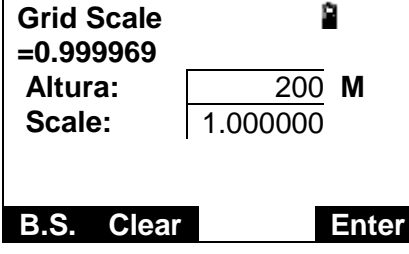
Operation Steps	Key	Display
Press Menu, and then press [2](Setout).		-- Setout— 1. Setup Station 2. Setup BSS 3. Setout 4. Add Coordinate 5. Intersection 6. Input Coordinate
2) In Setout menu, press [7](Grid Scale)	[7]	Grid Scale =1.000000 Altura: M Scale: 1.000000 B.S. Clear Enter
2)input Elevation, press [F4](ENT)	Input Elevation [F4]	Grid Scale =0.999969 Altura: 200 M Scale: 1.000000 B.S. Clear Enter

3)Input Scale Factor in the same way, press [F4](ENT)	Input Scale Factor [F4]	**Grid Scale** **=0.999969** **Altura:** 200 **M** **Scale:** 0.999900 **B.S. Clear** **Enter**

8.2 Coordinates Setout Measurement

After setting coordinates for the point to be Setout, the instrument calculates the Setout HA and HD. By selecting the HA and then the HD Setout functions, the required coordinate location can be Setout.

To get the Z coordinate, attach the target to a pole etc, with the same target height
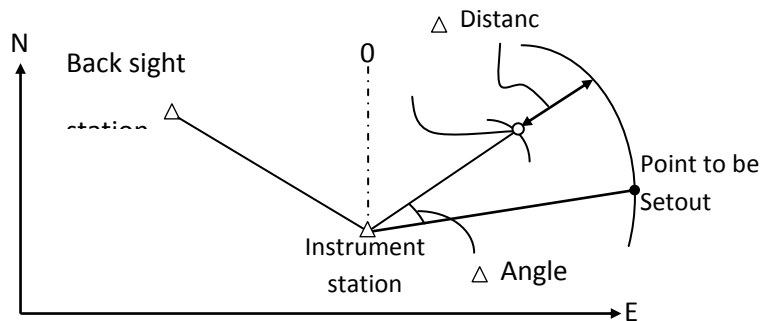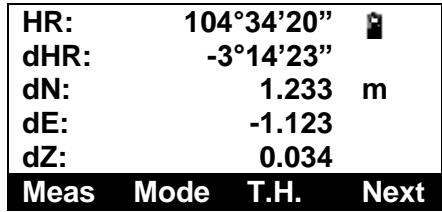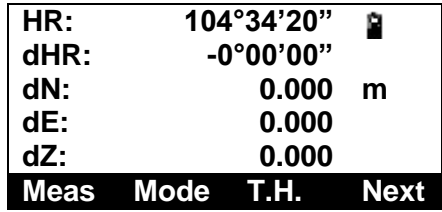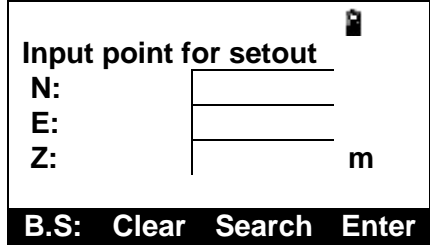
The following methods can be selected to launch a Setout:
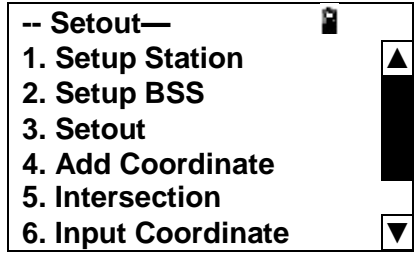
- Direct input of coordinates values
- Obtaining points from internal memory by point number

8.2.1 Direct input of coordinate values

Operation Steps	Key	Display
1) Press Menu, and then press [2] (Setout).	[Menu] [2]	-- Setout— **1. Setup Station** ▲ **2. Setup BSS** **3. Setout** **4. Add Coordinate** **5. Intersection** **6. Input Coordinate** ▼
2) In Setout Menu, press [3](Setout)	[3]	**Input point for setout** N: E: Z: **m** **B.S: Clear Search Enter**
3) Input point coordinates that you need to setout.	Input coordinates	**Input point for setout** N: 100.000 **m** E: 100.000 Z: 10.000 **B.S: Clear Search Enter**
4) Press [ENT], The system calculates out the angle that the lens should be rotated, horizontal distance HD, then you can select one of two setout mode – distance or coordinate		**Calculate-Setout** **HR: 90°10'20"** **HD: 156.205** **Dist Coord**
5) Press [F2] (Coor). Coordinate setout mode *	[F2]	**HR: 104°34'20"** **dHR: -3°14'23"** **dN: m** **dE:** **dZ:** **Meas Mode T.H. Next**

6) Collimate prism and press [F1] (Meas) to start to measure	[F1]	HR: 104°34'20" dHR: -3°14'23" dN: 1.233 m dE: -1.123 dZ: 0.034 **Meas Mode T.H. Next**
7) When the display value dHR, dN, dE and dZ are equal to 0,the layout point is established		HR: 104°34'20" dHR: -0°00'00" dN: 0.000 m dE: 0.000 dZ: 0.000 **Meas Mode T.H. Next**
8) Press [F4] (Next) to set next layout point	[F4]	**Input point for setout** N: E: Z: m **B.S: Clear Search Enter**
*Press [F3] (T.H.) to input target height again.		

8.2.2 Obtaining point from internal memory

Operation Steps	Key	Display
1) Press Menu, and then press [2] (Setout).	[Menu] [2]	-- Setout— 1. Setup Station ▲ 2. Setup BSS 3. Setout 4. Add Coordinate 5. Intersection 6. Input Coordinate ▼

2) In Setout Menu, press [3](Setout)	[3]	**Input point for setout** N: E: Z: **m** **B.S: Clear Search Enter**
3) If the point is in the current coordinate file then you can press [F3] (Search) to call the coordinate.	Input coordinates	**Nome Pt.** **B.S: Alph. Clear**
4) If you can remember the point then you input the pointname, else you can press directly [ENT] and you will see a list of the points stored.	[ENT]	**Pt.(ABC.COO)1/6** **B001: -0.767, -0.993** C002 -1.912, -4.046 C003 -0.353, -4.754 C004 1200 1200.00 **Begin End Read select**
5) The point list will appear.) Select the desired file using [▲] or [▼], then press [F4](Select) to get the coordinate.	[▲] or [▼] [F4]	**Input point for setout** N: -1.912 E: -4.046 Z: 2.43 **m** **B.S: Clear Search Enter**
6) Press [ENT], The system calculates out the angle that the lens should be rotated, horizontal distance HD, then you can select one of two setout mode – distance or coordinate	[ENT]	**Calculate-Setout** HR: 90°10'20" HD: 156.205 **Dist Coord**

7) Press [F2] (Coor). Coordinate setout mode*	[F2]	HR: 104°34'20" dHR: -3°14'23" dN: m dE: dZ: **Meas Mode T.H. Next**
8) Collimate prism and press [F1] (Meas) to start to measure	[F1]	HR: 104°34'20" dHR: -3°14'23" dN: 1.233 m dE: -1.123 dZ: 0.034 **Meas Mode T.H. Next**
9) When the display value dHR, dN, dE and dZ are equal to 0,the layout point is established		HR: 104°34'20" dHR: -0°00'00" dN: 0.000 m dE: 0.000 dZ: 0.000 **Meas Mode T.H. Next**
10) Press [F4] (Next) to set next layout point	[F4]	**Input point for setout** N: E: Z: m **B.S: Clear Search Enter**
*Press [F3] (T.H.) to input target height again.		

8.3 Intersection

Intersection program is used to determine the coordinates of an instrument station (unknown) by measuring several known points. Coordinate data in memory could be read.

Input

Coordinates of known points: X_i, Y_i, Z_i
Measured HA: H_i

North Group LTD.

69

Measured VA: Vi
Measured distance: Di
Output
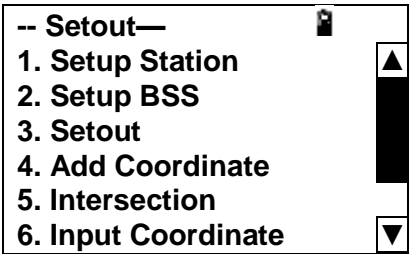
Coordinate of occupied data: Xo, Yo, Zo

Known point P1

Known point P2

Occupied point P0

Known point P4
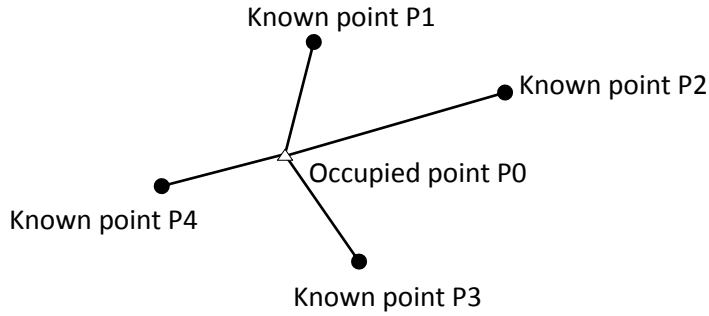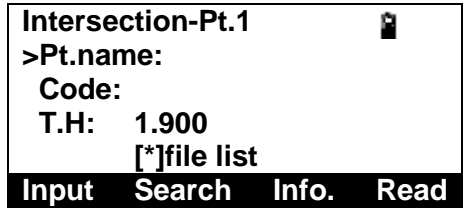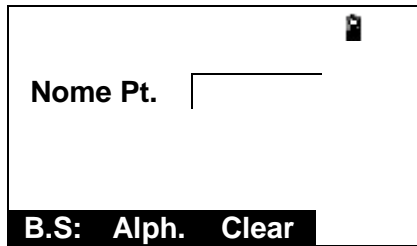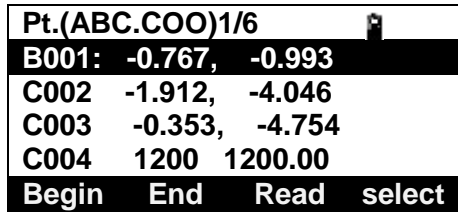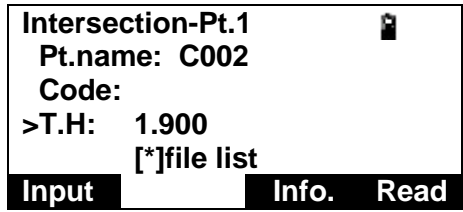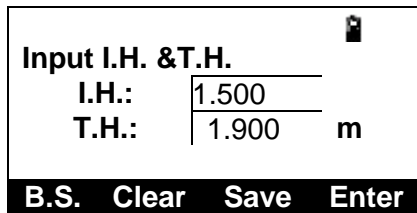
Known point P3

Note:
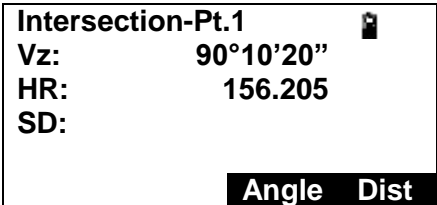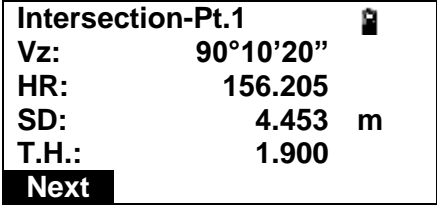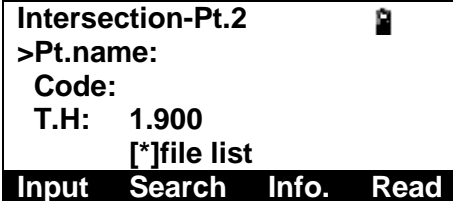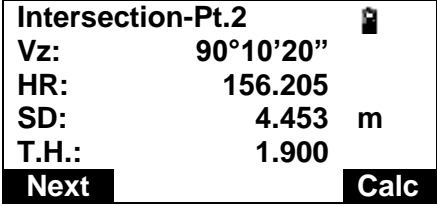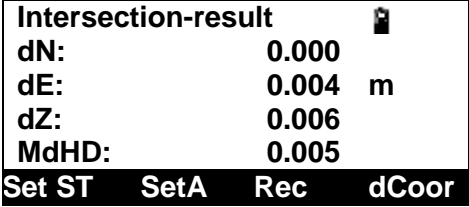
- All N, E, Z value or only Z value of the occupied point is calculated by measuring known points.
- Coordinate intersection measurement overwrites the N, E, Z data of the instrument station.
- Inputted known coordinate data and calculated data could be recorded in the current coordinate file.
- Max number of known points is 5

8.3.1   Coordinate Intersection

Operation Steps	Key	Display
1) Press [MENU], and then press [2] (Setout).	[Menu] [2]	-- Setout— 1. Setup Station 2. Setup BSS 3. Setout 4. Add Coordinate 5. Intersection 6. Input Coordinate

2) In Setout Menu, press [5](Intersection)	[5]	**Intersection-Pt.1** 📱
		>Pt.name:
		  Code:
		  T.H: 1.900
		     [*]file list
		Input Search Info. Read

3) If the point is in the current coordinate file then you can press [F3] (Search) to call the coordinate.	Input coordinates	📱 **Nome Pt.** [ ] **B.S: Alph. Clear**
4) If you can remember the point then you input the point name, else you can press directly [F4](Reas) and you will see a list of the points stored.	[F4]	**Pt.(ABC.COO)1/6** 📱 **B001: -0.767, -0.993** **C002 -1.912, -4.046** **C003 -0.353, -4.754** **C004 1200 1200.00** **Begin End Read select**

5) The point list will appear.) Select the desired file using [▲] or [▼], then press [F4](Select) to get the coordinate.	[▲] or [▼]
	
	[F4]
		Intersection-Pt.1 📱
		  Pt.name: C002
		  Code:
		>T.H: 1.900
		     [*]file list
		Input Info. Read

6) Press [F1] (Input), to change the prism height and the instrument height.
Press [ENT] to confirm.
	[F1]
	
	[ENT]
		📱
		Input I.H. &T.H.
		   I.H.: [1.500]
		   T.H.: [1.900 **m**]
		B.S. Clear Save Enter

7) Press [ENT]. Then you can select one of two setout mode – distance or angle		**Intersection-Pt.1** **Vz:** **90°10'20"** **HR:** **156.205** **SD:** **Angle** **Dist**
8) I.E. Using Distance setout mode. Collimate the prism and press [F4] (Dist).	Collimate prism [F4]	**Intersection-Pt.1** **Vz:** **90°10'20"** **HR:** **156.205** **SD:** **4.453** **m** **T.H.:** **1.900** **Next**

9) EDM will start and obtaining the slope distance. After measuring distance, press [F1](Next) to measure the next point.	[F1]	**Intersection-Pt.2**
		>Pt.name:
		  Code:
		  T.H **1.900**
		      [*]file list
		Input **Search** **Info.** **Read**

10)Repeat procedure 3 ~ 9 at least one more time*
  if you have measured two or more distance the prompt "Calc" will appear
		Intersection-Pt.2
		Vz: **90°10'20"**
		HR: **156.205**
		SD: **4.453** **m**
		T.H.: **1.900**
		  Next **Calc**

11) Press [F4] (Calc) to obtain the coordinates of instrument station. The result of calculated instrument station is shown as the picture on the right. This is the error of the station coordinates	[F4]	**Intersection-result** **dN:** **0.000** **dE:** **0.004** **m** **dZ:** **0.006** **MdHD:** **0.005** **Set ST** **SetA** **Rec** **dCoor**

12) Press [F4](dCoor) the coordinate of instrument station will be shown	[F4]	**Intersection-result** N: 0.000 m E: 0.004 Z: 0.006 **Set ST SetA Rec Coor**
13) Press [F1](SetST) to set this station as actual	[F1]	**Intersection-result** N: 0.000 m E: 0.004 Z: 0.006 **SetA Rec Coor**
14) Press [F2](SetA) to setup the Azimuth of the instrument.	[F2]	**Intersection-result** N: 0.000 m E: 0.004 Z: 0.006 **Rec Coor**
15) Press [F3](Rec) to save coordinates to current measurement file	[F3]	**Intersection-result** N: 0.000 m E: 0.004 Z: 0.006 **Coor**
16)Press ESC to return to Setout menu		
*Press [F3] (T.H.) to input target height again.		

8.3.2   Precautions when performing intersection

In some cases it is impossible to calculate the coordinates of occupied point if the unknown point and three or more known points are arranged on the edge of a single circle. It is also impossible to calculate if the included angle between the known points is too small. Be careful for the points can easily be aligned on the edge of a single circle.

An arrangement such as shown below is desirable.
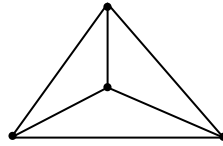
△▲： unknown point
○●： known point

It is sometimes impossible to perform a correct calculation such as shown below.
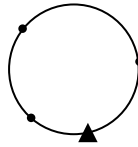
When they are on the edge of a single circle, take one of the following methods:

（1）Move the instruction station as close as possible to the center of the triangle.
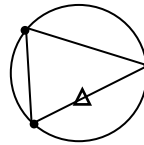
（2）Measure one more known point which is not on the circle.
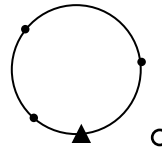
（3）Perform a distance measurement on at least one of the three points.
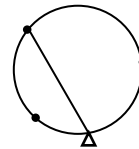
9. FILE MANAGER (Fileman)

The instrument use a file system to manage the data, all data obtained from measuring can save to current measurement file. The extension name of measurement file is *.MEA. All coordinates used by measurement can be picked up from current coordinate file, the extension name of current coordinate file is *.COO. Sometimes you need to note an attribute of a point when you measure, the code file maybe a good helper, the extension name of code file is *.COD. The extension of LINE-TYPE file for roadway is *.LSH and *.LSV, *.LSV is vertical defining file for roadway, it always is loaded after the *.LSH.

You can implement the following applications under File Manager

1) File Man: modify file name/search for data in the file/delete files/create new files/edit files.
2) Data Transfer: sending measurement data/coordinates data or code-base data/receiving coordinates data or code-base data, or horizontal/vertical alignment, setting communication parameters.
3) File Import: transferring the files stored in SD card to local disks or another SD card.
4) File Output: transferring the files stored in local disks or SD card to another SD card.
5) Disk format: Erase all data storage in memory.
6) Disk information: Displays the available memory.

Menu list of Memory Management

```
--Fileman—              ▮
1. Fileman              ▲
2. Import
3. Export
4. Diskformat
5. Disk Information
6. Input Coord.         ▼
```
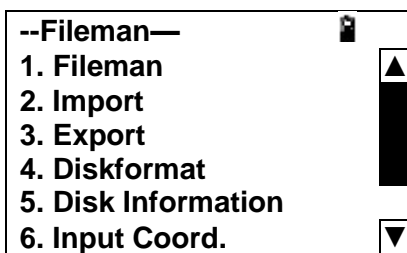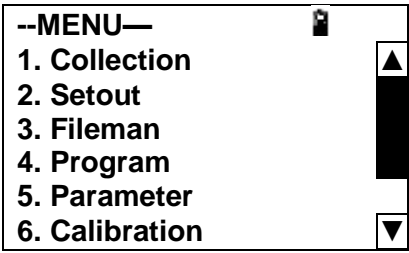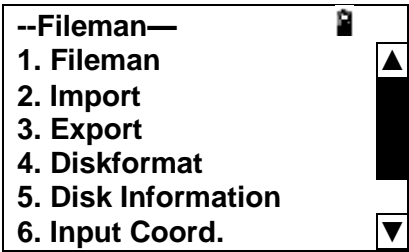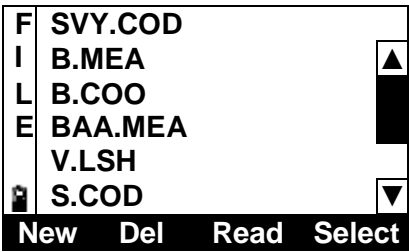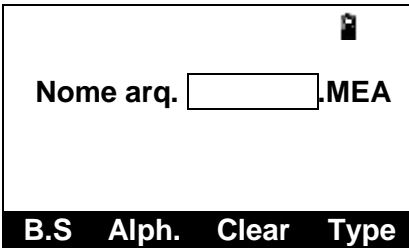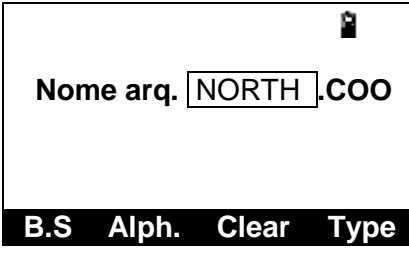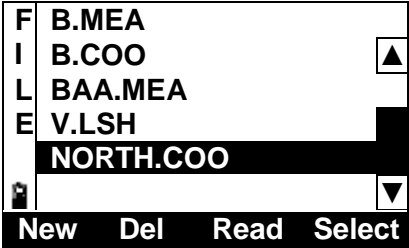
9.1 File manager

With this function you can create new files, erase files, read the measurement data and select and existing job.

9.1.1   Create a new file
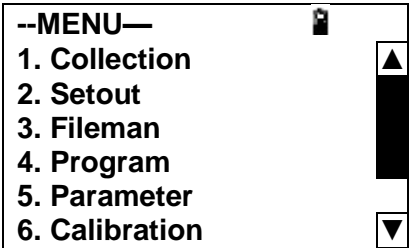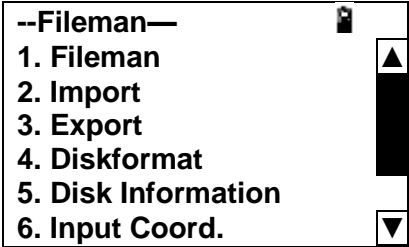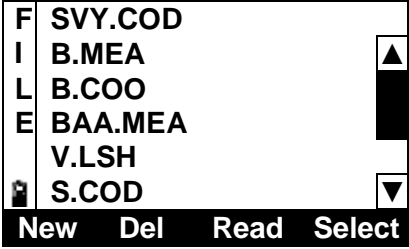
Create a new file in the memory.
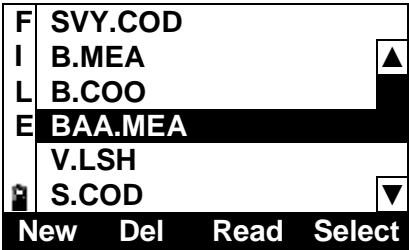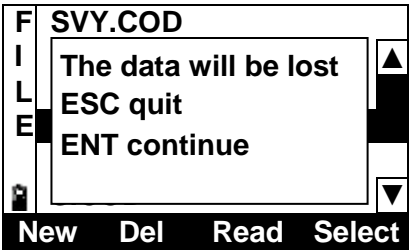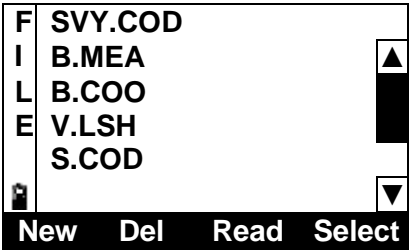
Operation Steps	Key	Display
1) Press (MENU) to enter the main menu.	(MENU)	**--MENU—** **1. Collection** ▲ **2. Setout** **3. Fileman** **4. Program** **5. Parameter** **6. Calibration** ▼
2) Press [3](Fileman) to display the menu of File Manager.	[F3]	**--Fileman—** **1. Fileman** ▲ **2. Import** **3. Export** **4. Diskformat** **5. Disk Information** **6. Input Coord.** ▼
3) Press 1.Fileman to see the list of existing jobs.	[1]	**F SVY.COD** **I B.MEA** ▲ **L B.COO** **E BAA.MEA** **V.LSH** **S.COD** ▼ **New Del Read Select**
4) Press [F1](New) to create a new job	[F1]	**Nome arq. [ ].MEA** **B.S Alph. Clear Type**
5) Enter the file name and select type by pressing [F4] (Type).	[F4]	**Nome arq. [NORTH].COO** **B.S Alph. Clear Type**

6) Press ENT to confirm new job and return to the file list	[ENT]	F B.MEA I B.COO ▲ L BAA.MEA E V.LSH **NORTH.COO** ▼ **New Del Read Select**
7) Press [F4](Select) to select this job as current job.	[F4]	
Existed file name can't be used again. Press [ESC], to return to file list.		
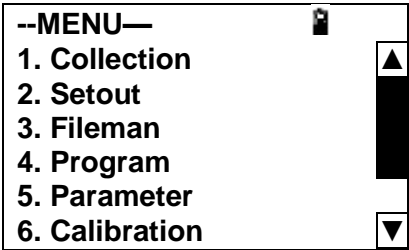
9.1.2   Delete file
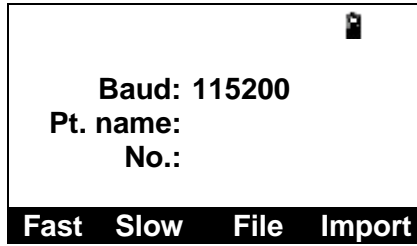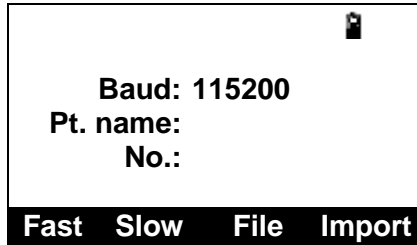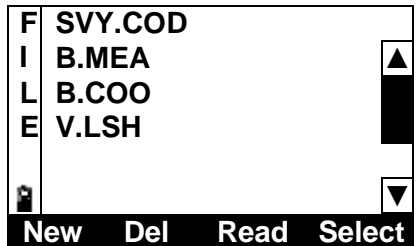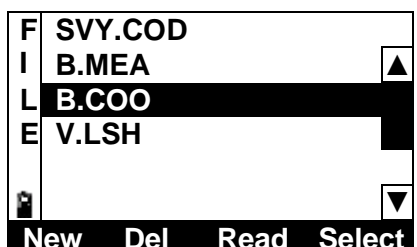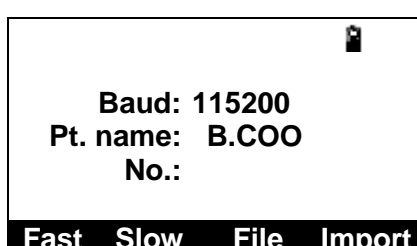
Delete one file in the internal memory and only one file once.

Operation Steps	Key	Display
1) Press (MENU) to enter the main menu.	(MENU)	--MENU— 1. Collection ▲ 2. Setout 3. Fileman 4. Program 5. Parameter 6. Calibration ▼
2) Press [3] (Fileman) to display the menu of File Manager.	[F3]	--Fileman— 1. Fileman ▲ 2. Import 3. Export 4. Diskformat 5. Disk Information 6. Input Coord. ▼
3) Press [1](Fileman) to see the list of existing jobs.	[1]	F SVY.COD I B.MEA ▲ L B.COO E BAA.MEA V.LSH S.COD ▼ **New Del Read Select**
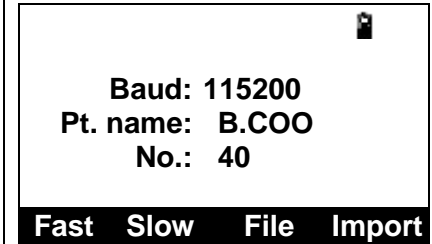
4) Press [▲] or [▼] to select a file to delete, or press [►] [◄] to turn page.	[▲] or [▼]	F SVY.COD
		I B.MEA ▲
		L B.COO
		E **BAA.MEA**
		  V.LSH
		  S.COD ▼
		New Del Read Select

5) Press [F2](DEL).	[F2]	F SVY.COD I **The data will be lost** ▲ L **ESC quit** E **ENT continue** ▼ **New Del Read Select**
6) Press ENT to confirm erase.	ENT	F SVY.COD I B.MEA ▲ L B.COO E V.LSH S.COD ▼ **New Del Read Select**
Deleting operation is dangerous, for safety, you should export the data first.		

9.2 Data Import
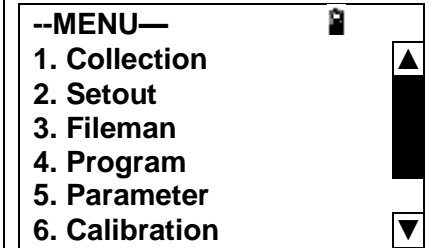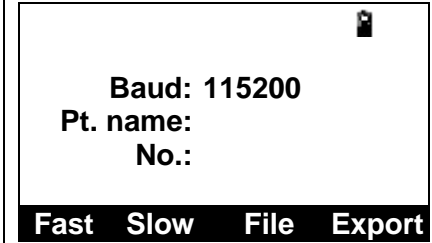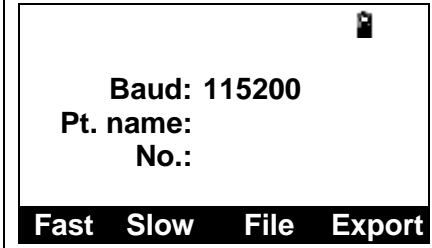
Operation Steps	Key	Display
1) Press (MENU) and to enter the menu. 2) Press 3. Fileman to display the menu of File Manager.	(MENU)	--MENU— 1. Collection ▲ 2. Setout 3. Fileman 4. Program 5. Parameter 6. Calibration ▼

North Group LTD.

78
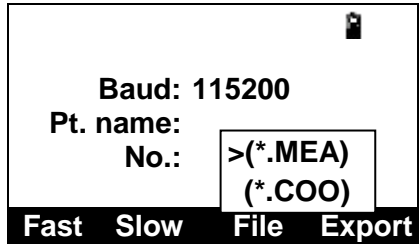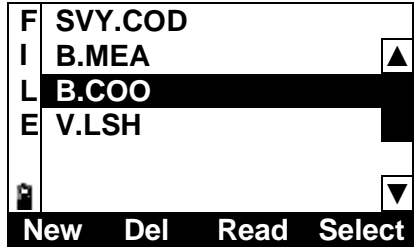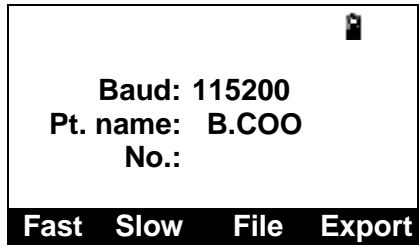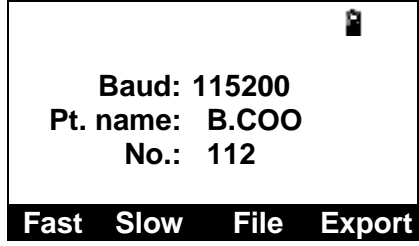
3) Press [2] (Import) and you will see as shown right.	[2]	Baud: 115200 Pt. name: No.: Fast　Slow　File　Import
5) Press [F1] (Fast) or [F2] (Slow) to select the needed parameter. *	[F4]	Baud: 115200 Pt. name: No.: Fast　Slow　File　Import
6) Press [F3](File) to select the file you want to import	[F3]	F SVY.COD I B.MEA ▲ L B.COO E V.LSH ▼ New　Del　Read　Select
7) Select the desired file using [▲] or [▼]. You need a COORD file to import coordinate. You can create a new job. See "8.1.1 Create a new file""	[▲] or [▼]	F SVY.COD I B.MEA ▲ L B.COO E V.LSH ▼ New　Del　Read　Select
8) Confirm job by pressing [F4] (Select).	[F4]	Baud: 115200 Pt. name:　B.COO No.: Fast　Slow　File　Import

North Group LTD.

Operation Steps	Key	Display
9) Press [F4](Import) to import coordinates to the file. 10) send data from computer to total station	[F4]	Baud: 115200 Pt. name: B.COO No.: 40 **Fast Slow File Import**

Press [F4] (EXIT) to return to File Import menu. (＊40): Indicates how many groups of data are being imported.
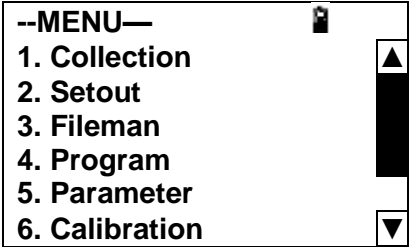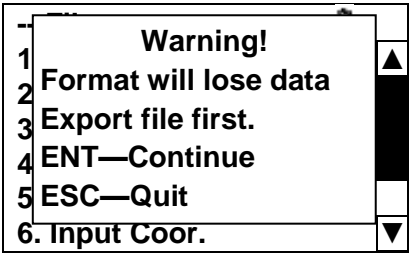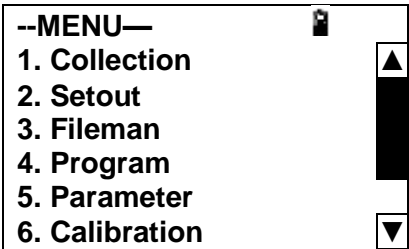
9.3 Export Data

Operation Steps	Key	Display
1) Press (MENU) to enter the main menu. 2) Press 3. File manager	(MENU) [3]	--MENU— 1. Collection ▲ 2. Setout 3. Fileman 4. Program 5. Parameter 6. Calibration ▼
3) Press [3](Export) and you will see as shown right	[3]	Baud: 115200 Pt. name: No.: **Fast Slow File Export**
5) Press [F1] (Fast) or [F2] (Slow) to select needed parameter. *	[F1] or [F2]	Baud: 115200 Pt. name: No.: **Fast Slow File Export**
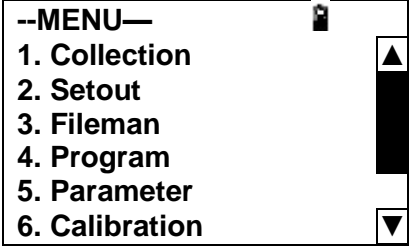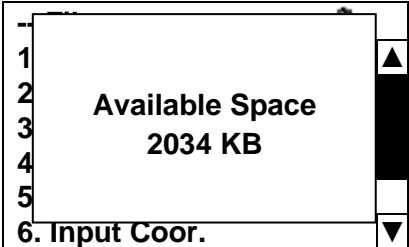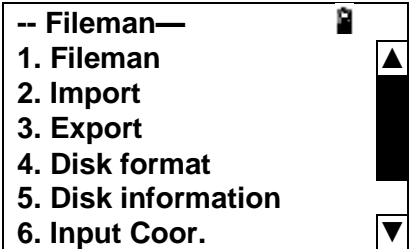
6) Press [F3](File) to select the type of file you want to import	[F3]	Baud: 115200 Pt. name: No.: >(*.MEA) (*.COO) **Fast** **Slow** **File** **Export**
7) Select the desired file using [▲] or [▼].	[▲] or [▼]	F SVY.COD I B.MEA ▲ L B.COO E V.LSH ▼ **New** **Del** **Read** **Select**
8) Confirm job by pressing [F4] (Select) or ENTER		Baud: 115200 Pt. name: B.COO No.: **Fast** **Slow** **File** **Export**
9) Prepare your computer to receive data. 10) Press [F4](Export) to send coordinates to the computer	[F4]	Baud: 115200 Pt. name: B.COO No.: 112 **Fast** **Slow** **File** **Export**
Press [F4] (EXIT) to return to File Import menu. (＊112): Indicates how many groups of data have being sent to the computer.		

North Group LTD.

81

9.4 Disk format

Sometimes, many files have been saved in the instrument; it will take a long time to delete these files one by one. Formatting the disk would be a good idea. You must save all measurement data before you format.

Operation Steps	Key	Display
1) Press (MENU) to enter the main menu. 2) Press [3] (File manager)	(MENU) [3]	--MENU— 1. Collection 2. Setout 3. Fileman 4. Program 5. Parameter 6. Calibration
3) Press [4](Disk format) and you will see as shown right.	[4]	**Warning!** **Format will lose data** **Export file first.** **ENT—Continue** **ESC—Quit** 6. Input Coor.
5) Press ENT to delete all the data in the disk.	[ENT]	--MENU— 1. Collection 2. Setout 3. Fileman 4. Program 5. Parameter 6. Calibration

9.5 Checking available memory

Operation Steps	Key	Display
1) Press (MENU) to enter the main menu. 2) Press 3. File manager	(MENU) [3]	--MENU— 1. Collection 2. Setout 3. Fileman 4. Program 5. Parameter 6. Calibration
3) Press [5](Disk information) and you will see as shown right	[4]	Available Space 2034 KB 6. Input Coor.
5) Press ENT or ESC to return to the File manager Menu	ENT	-- Fileman— 1. Fileman 2. Import 3. Export 4. Disk format 5. Disk information 6. Input Coor.

10. MEASUREMENT PROGRAM MODE

Press MENU key, and instrument will entry to menu mode. In this mode, you can set and check.

10.1   Remote Height Measurement (REM)

This program is for measuring the vertical distance (height) between remote target and prism and the height between it and the ground (no-prism height). When prism is used, the prism shall be used as the datum point for REM; while the ground point of the measured vertical angle shall be used as the datum point for measuring when no prism is used. The datum points of both above cases are located on the plumb line of the target point.
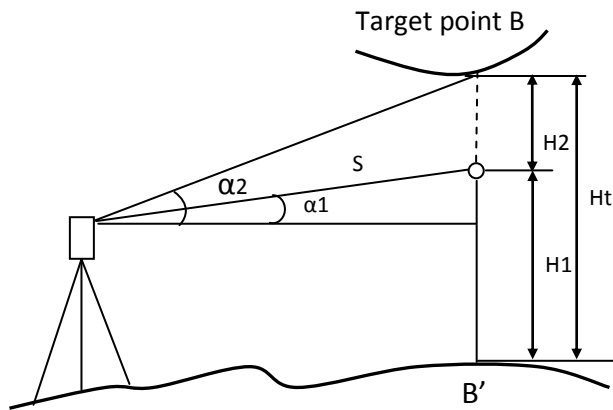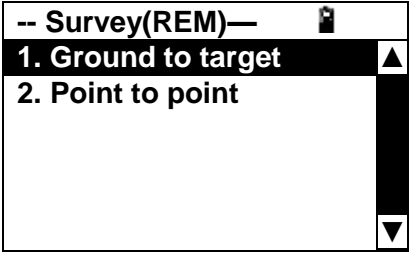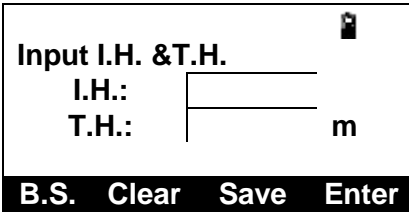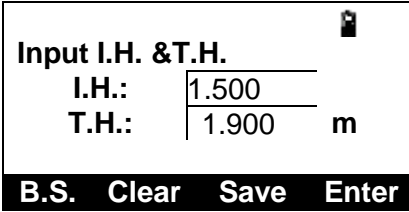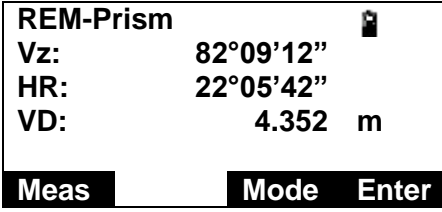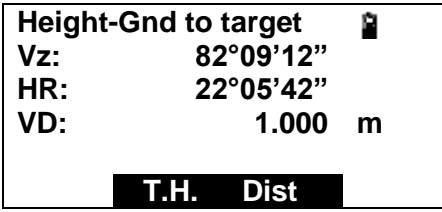
Here is the equation used to calculate the data presented in above figure:

Ht=H1+ S*cosα1*tgα2-S*sinα1
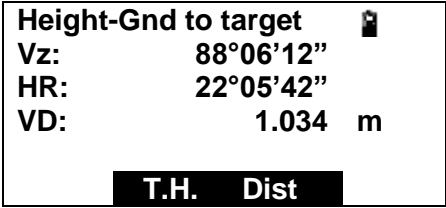
H2= S*cosα1*tgα2-S*sinα1
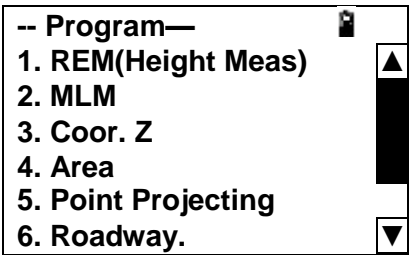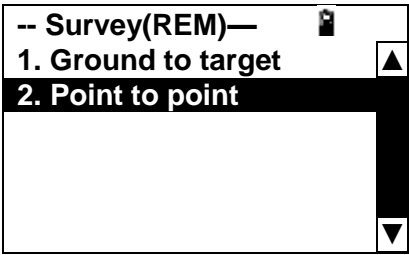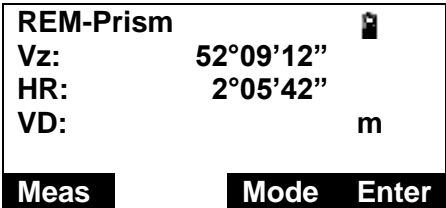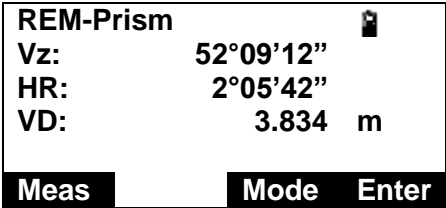
10.1.1 Ground to target

Operation Steps	Key	Display
1) Press [MENU] and then [4](Programs) to enter into PROGRAMS function	[MENU] [4]	-- Program— 1. REM(Height Meas) 2. MLM 3. Coor. Z 4. Area 5. Point Projecting 6. Roadway.

2) Press [1](REM(Height Meas)).	[1]	**-- Survey(REM)—** 🔋 **1. Ground to target** ▲ **2. Point to point** ▼

3) select menu item [1](Ground to target) when you need the height between the target and ground.	[1]	🔋
		Input I.H. &T.H.
		   I.H.: _____
		   T.H.: _____ **m**
		B.S. Clear Save Enter

4) Setting height of instrument and the height of prism.	Set instrument and prism height	🔋
		Input I.H. &T.H.
		   I.H.: 1.500
		   T.H.: 1.900 **m**
		B.S. Clear Save Enter

5) Press [F1]Meas) to start EDM then you can obtain the horizontal distance between the instrument and the target.	[F1]	**REM-Prism** 🔋 **Vz:** 82°09'12" **HR:** 22°05'42" **VD:** 4.352 m **Meas** **Mode Enter**
6) Press [F4](ENTER) to accept the measurement data	[F4]	**Height-Gnd to target** 🔋 **Vz:** 82°09'12" **HR:** 22°05'42" **VD:** 1.000 m **T.H. Dist**
then VD(difference of height) appear ,first display the height of prism		

7) If you rotate the telescope then VD will change, when you aim at the target the VD is the difference of height between the target and ground		**Height-Gnd to target** 🔋 **Vz:** **88°06'12"** **HR:** **22°05'42"** **VD:** **1.034 m** **T.H. Dist**

10.1.2   Point to point

Operation Steps	Key	Display
1) Press [MENU] and then [4](Programs) to enter into PROGRAMS function window.	[MENU] [4]	**-- Program—** 🔋 **1. REM(Height Meas)** ▲ **2. MLM** **3. Coor. Z** **4. Area** **5. Point Projecting** **6. Roadway.** ▼
2) Press [1](REM(Height Meas)).	[1]	**-- Survey(REM)—** 🔋 **1. Ground to target** ▲ **2. Point to point** ▼
3) Select menu item [2](Point to point) when you need the difference of height between any two points.	[2]	**REM-Prism** 🔋 **Vz:** **52°09'12"** **HR:** **2°05'42"** **VD:** **m** **Meas** **Mode Enter**
4) Press [F1] (Meas) to start EDM then you can obtain the horizontal distance between the instrument and the target.	[F1]	**REM-Prism** 🔋 **Vz:** **52°09'12"** **HR:** **2°05'42"** **VD:** **3.834 m** **Meas** **Mode Enter**

North Group LTD.

6) Press [F4](ENTER) to accept the measurement data	[F4]	**Height-Gnd to target** 🔋 **Vz:** **52°09'12"** **HR:** **2°05'42"** **VD:** **0.000 m** **Enter**
Then VD(difference of height) will change when you rotate telescope		
7) If you rotate the telescope then VD will change, when you aim at the target the VD is the difference of height between the target and ground		**Height-Gnd to target** 🔋 **Vz:** **52°06'12"** **HR:** **22°05'42"** **VD:** **1.034 m** **NextV.A Dist**

10.2   Missing line measurement (MLM)

With this mode, the horizontal distance (dHD), slope distance (dSD), and height difference (dVD) between two prisms can be measured.

MLM mode has two functions

(A-B, A-C): measuring A-B, A-C, A-D…

(A-B, B-C): measuring A-B, B-C, C-D…

Start point (P1)
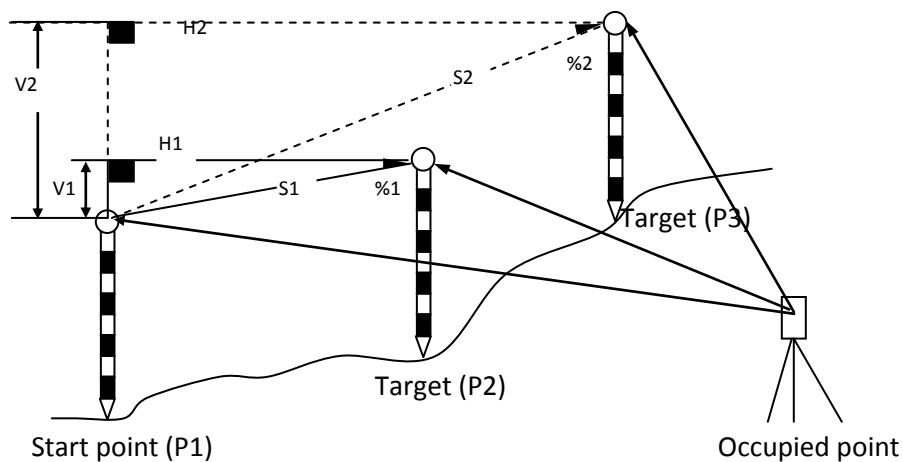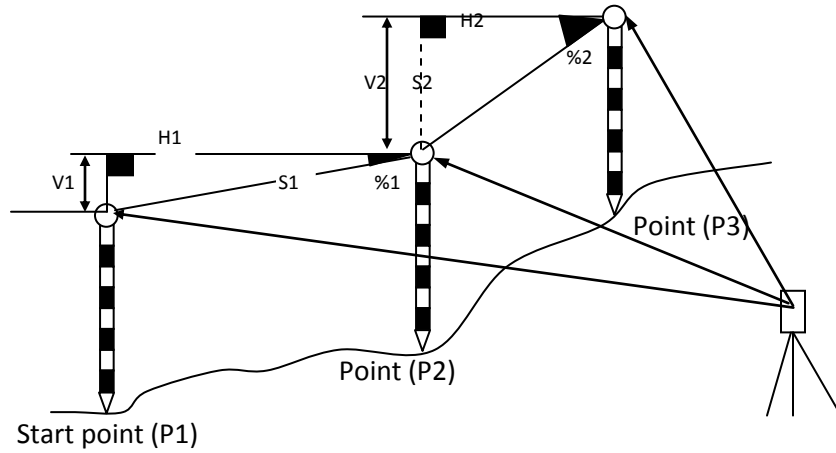
The measuring process of MLM-2 (A-B，B-C) mode is totally the same as MLM-1 mode.
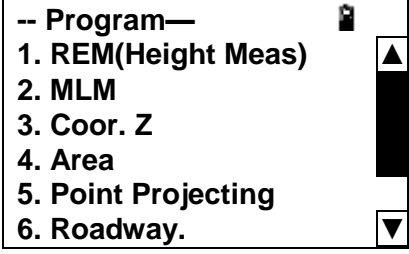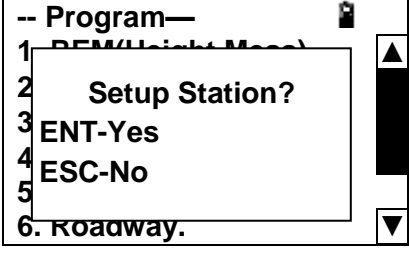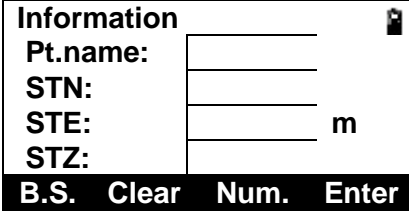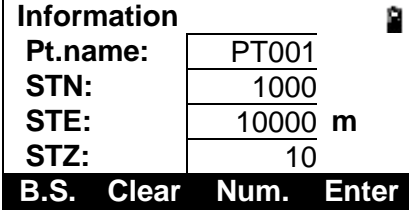
Operation Steps	Key	Display
1) Press [MENU] and then [4](Programs) to enter into PROGRAMS function.	[MENU] [4]	**-- Program—** **1. REM(Height Meas)** **2. MLM** **3. Coor. Z** **4. Area** **5. Point Projecting** **6. Roadway.**
2) If considering the effect of grid scale you should select menu item 1, else you should select menu item 2.	Select as desired [1] or [2]	**Grid Coefficient** **1. With grid scale** **2. Without grid scale**
3) Select one of two models.	Select as desired [1] or [2]	**--- MLM ---** **1. MLM (A-B,A-C)** **2. MLM (A-B)(B-C)**

3) Collimate prism A, and press [F1](MEAS).	Collimate A [F1]	**MLM (A-B,A-C)–step 1** **Vz:** 82°09'12" **HR:** 22°05'42" **HD:** m **Meas T.H. Coord Mode**
5) Press [F1](Meas) to start EDM then you can see the horizontal distance between the instrument and prism A.	[F1]	**MLM (A-B,A-C)–step 1** **Vz:** 82°09'12" **HR:** 22°05'42" **HD:** 4.352 m **Meas T.H. Coord Mode**
6) Press [ENTER] to accept the measurement data. The system will remind you to implement measurement of the second point.	[ENT]	**MLM (A-B,A-C)–step 2** **Vz:** 82°09'12" **HR:** 22°05'42" **HD:** m **Meas T.H. Coord Mode**
5) Press [F1](Meas) to start EDM then you can see the horizontal distance between the instrument and prism B	[F1]	**MLM (A-B,A-C)–step 2** **Vz:** 123°39'22" **HR:** 15°05'22" **HD:** 3.352 m **Meas T.H. Coord Mode**
6) System calculates dSD, dHD and dVD between prism A and prism B according to the positions of points A and B.		**MLM – Result** **dSD:** 1.280 **dHD:** 1.104 **dVD:** -0.644 **HR** 345°39´05" **Next**
7) Press F1(NEXT) to measure distance between A-C		

10.3   Setting Z coordinate of occupied point

Occupied point coordinates data and known point actual measuring data are used to calculate Z coordinate.

North Group LTD.

Coordinate data file can be used as Known point data and coordinate data.
Only Z (elevation) of an instrument station is determined by this measurement

Operation Steps	Key	Display
1) Press [MENU] and then [4](Programs) to enter into PROGRAMS function	[MENU] [4]	**-- Program—** **1. REM(Height Meas)** ▲ **2. MLM** **3. Coor. Z** **4. Area** **5. Point Projecting** **6. Roadway.** ▼
2) Press [3](Coor.Z) to enter.	[3]	**-- Program—** 1 ▲ 2 **Setup Station?** 3 **ENT-Yes** 4 **ESC-No** 5 **6. Roadway.** ▼
3) Press ENT to setup Station.	[ENT]	**Setup Station** **>STA** **Code:** **T.H.:** **1.500** **[*]file list** **Input Search Info. Read**
4) Press [F1](Input) to enter coordinates of the occupied point.	[F1]	**Information** **Pt.name:** **STN:** **STE:** **m** **STZ:** **B.S. Clear Num. Enter**
5) Input point name and coordinate N and press [F4] (Enter) to enter the next value. Input the coordinate E and Z with the same method.	Input coordinates	**Information** **Pt.name:** PT001 **STN:** 1000 **STE:** 10000 **m** **STZ:** 10 **B.S. Clear Num. Enter**

90

10.4   Area

Calculate an area shaped with several points. The coordinate data of the points could be either measured or input by hand.

N
P2   P3
S   P4
P1
P5
E
0
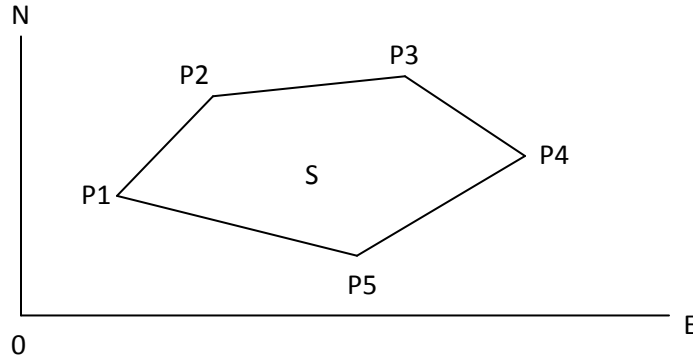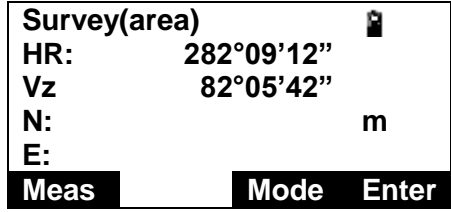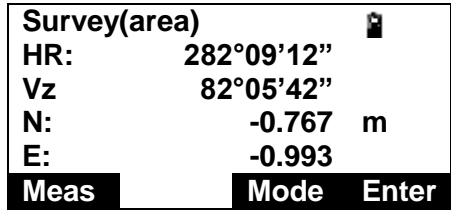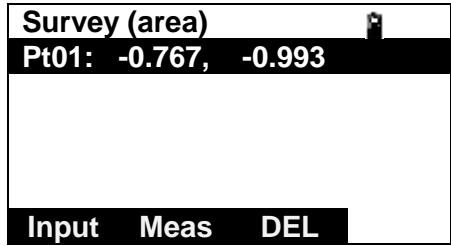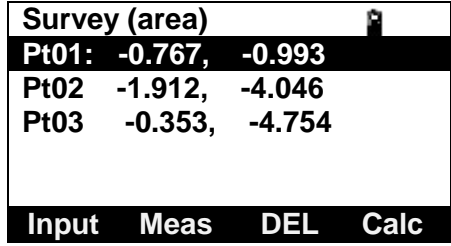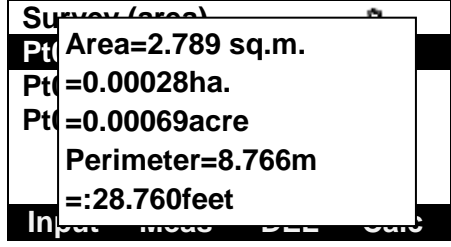
NOTE:
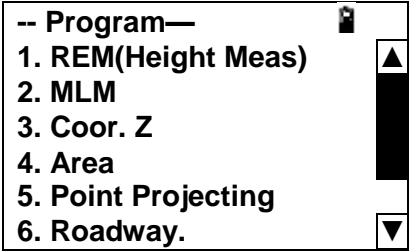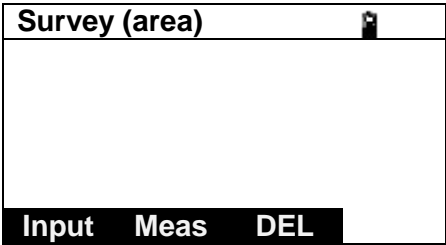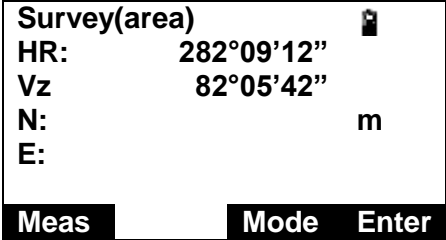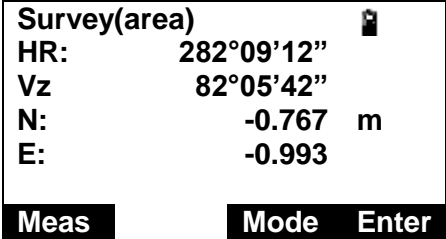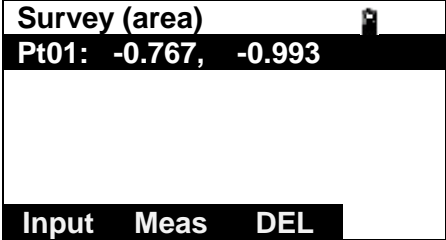
- The number of points: 3 ~ 20.
- Make sure these points must be measured or listed clockwise or anticlockwise, or mistake will result.
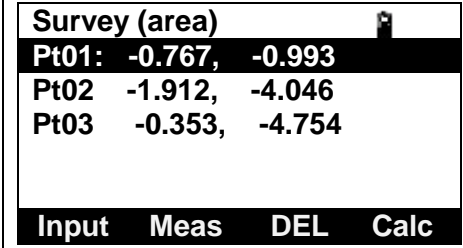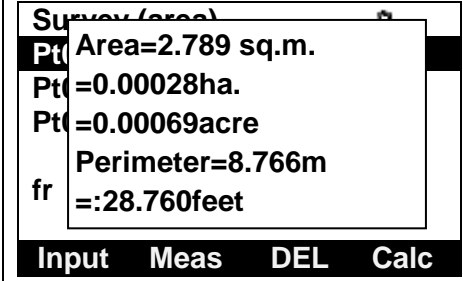
10.4.1 Area calculation from measured data

Operation Steps	Key	Display
1) Press [MENU] and then [4](Programs) to enter into PROGRAMS function.	[MENU] [4]	-- Program— ▯ 1. REM(Height Meas) ▲ 2. MLM 3. Coor. Z 4. Area 5. Point Projecting 6. Roadway. ▼
2) Press [4](Area) to enter area measurement mode.	[4]	Survey (area) ▯ Input Meas DEL

3) Press [F2](Meas)	[F2]	**Survey(area)** HR:　　　282°09'12" Vz　　　　82°05'42" N:　　　　　　　m E: **Meas**　　　**Mode**　**Enter**
4) You will see the coordinates of the target points, press [F4](Enter) to continue.	[F4]	**Survey(area)** HR:　　　282°09'12" Vz　　　　82°05'42" N:　　　　　-0.767　m E:　　　　　-0.993 **Meas**　　　**Mode**　**Enter**
5) The system will return to Survey area mean menu, with the new point saved in the list		**Survey (area)** **Pt01:　-0.767,　-0.993** **Input**　**Meas**　**DEL**
6) Repeat steps 3 ~ 5 until you have at least three points. After the numbers of points is more than 3, the calculation is possible.		**Survey (area)** **Pt01:　-0.767,　-0.993** **Pt02　-1.912,　-4.046** **Pt03　-0.353,　-4.754** **Input**　**Meas**　**DEL**　**Calc**
7) Press [F4] (Calc). The Area and Perimeter of the shape is surrounded by the points in list box.	[F4]	**Survey (area)** Pt **Area=2.789 sq.m.** Pt **=0.00028ha.** Pt **=0.00069acre** **Perimeter=8.766m** **=:28.760feet** **Input**　**Meas**　**DEL**　**Calc**

92

10.4.2 Area calculation from Coordinate data file

Operation Steps	Key	Display
1) Press [MENU] and then [4] (Programs) to enter into PROGRAMS function.	[MENU] [4]	**-- Program—** **1. REM(Height Meas)** ▲ **2. MLM** **3. Coor. Z** **4. Area** **5. Point Projecting** **6. Roadway.** ▼
2) Press [4](Area) to enter area measurement mode	[4]	**Survey (area)** **Input Meas DEL**
3) Press [F1](Input)	[ENT]	**Survey(area)** **HR: 282°09'12"** **Vz 82°05'42"** **N: m** **E:** **Meas Mode Enter**
4) You will see the coordinates of the target points, press [F4](Enter) to continue	[F4]	**Survey(area)** **HR: 282°09'12"** **Vz 82°05'42"** **N: -0.767 m** **E: -0.993** **Meas Mode Enter**
5) The system will return to Survey area mean menu, with the new point saved in the list		**Survey (area)** **Pt01: -0.767, -0.993** **Input Meas DEL**

6) Repeat steps 3 ~ 5 until you have at least three points. After the numbers of points is more than 3, the calculation is possible.	Input coordinates	**Survey (area)** **Pt01: -0.767, -0.993** **Pt02 -1.912, -4.046** **Pt03 -0.353, -4.754** **Input Meas DEL Calc**
7) Press [F4] (Calc). The Area and Perimeter of the shape is surrounded by the points in list box.	[F4]	**Survey (area)** **Pt Area=2.789 sq.m.** **Pt =0.00028ha.** **Pt =0.00069acre** **Perimeter=8.766m** **fr =:28.760feet** **Input Meas DEL Calc**

10.5 Roadway

Roadway application program is composed of designing and roadway setout. When you select roadway function then the menu is appeared as follow:

-- Roadway—
1. Open Road File ▲
2. New H Curve file
3. New V Curve file
4. Resume H curve
5. Resume V curve
6. Road Setout ▼
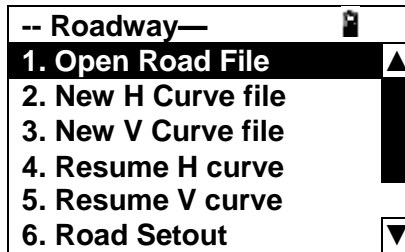
10.5.1 Define the Horizontal Curve of Roadway

Horizontal alignment data can be edited manually or encased from computer. Horizontal alignment consisted of following elements: starting point, straight line, circular curve, spiral and point of intersection
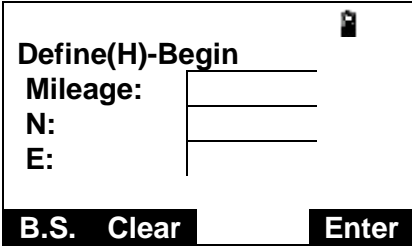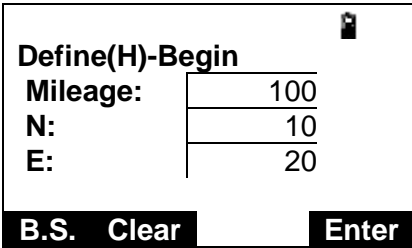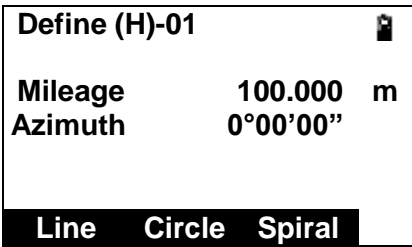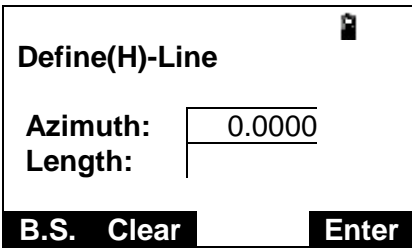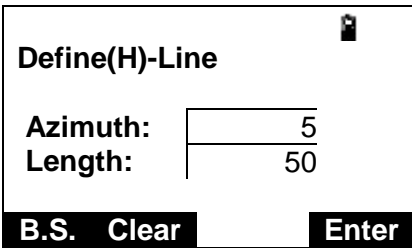
Straight line

When the start point or other line style is well-defined, it allows you to define straight line. A straight line consists of bearing angle (AZ) and distance; the distance value cannot be minus

Line
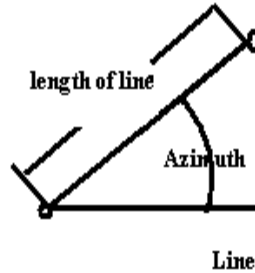
Operation Steps	Key	Display
1) Press [MENU] and then [4] to enter PROGRAMS menu	[MENU] [4]	-- Program— 1. REM(Height Meas) 2. MLM 3. Coor. Z 4. Area 5. Point Projecting 6. Roadway.
2) Press[6](Roads)	[6]	-- Roadway— 1. Open Road File 2. New H Curve file 3. New V Curve file 4. Resume H curve 5. Resume V curve 6. Road Setout
3) Press [2](New H curve file) to define horizontal element	[2]	Define (H)-00 Mileage 0.000 m Azimuth 0°00'00" Line Circle Spiral I.P.

4) Select the method of element to define horizontal roadway. Press [F1](Line) first	[F1]	**Define(H)-Begin** **Mileage:** **N:** **E:** **B.S. Clear** **Enter**
5) Input the Mileage and coordinates of start point	Input Mileage and coordinates	**Define(H)-Begin** **Mileage:** 100 **N:** 10 **E:** 20 **B.S. Clear** **Enter**
6) Press [ENT] to confirm.	[ENT]	**Define (H)-01** **Mileage** **100.000 m** **Azimuth** **0°00'00"** **Line Circle Spiral**
7) Now other alignments can be defined. When the straight line is in the middle of the road, the bearing angle is calculated from the original elements. To change this bearing angle, input a new angle manually. Press [F1](Line)	[F1]	**Define(H)-Line** **Azimuth:** 0.0000 **Length:** **B.S. Clear** **Enter**
8) Input the start azimuth and the length of line	Input azimuth and length of line	**Define(H)-Line** **Azimuth:** 5 **Length:** 50 **B.S. Clear** **Enter**

North Group LTD.
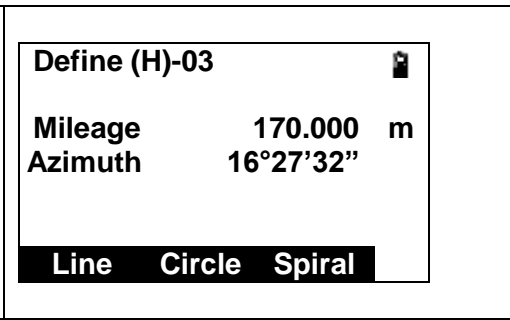
9) System automatically calculates the mileage and azimuth of the fan-out-point		**Define (H)-02** 🔋 **Mileage** **150.000** **m** **Azimuth** **5°00'00"** **Line** **Circle** **Spiral**

Circular Curve
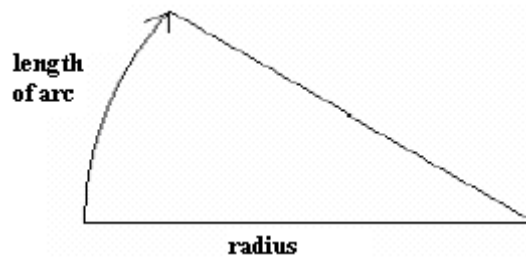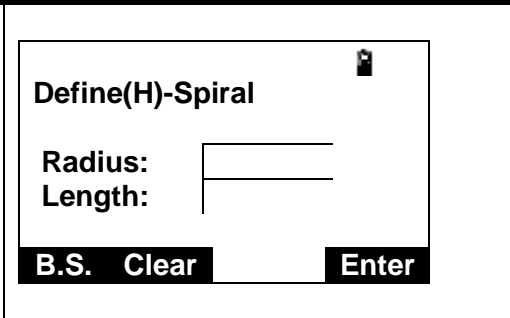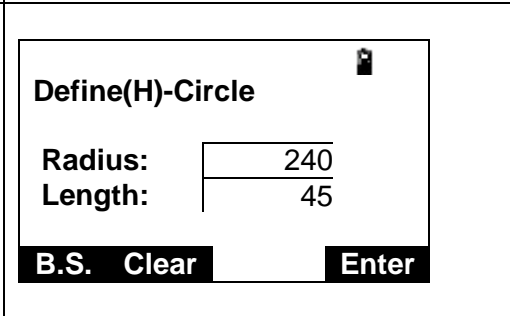
Press [Circle] in the "Main line Input Screen", the circular curve can be defined. Circular curve consists of Arc length and Radius. The rule of radius value: along the forward direction of the curve. When the curve rotates to right, the radius value is positive. When the curve rotates to left, the radius value is minus. The arc length cannot be minus.

Operation Steps	Key	Display
1) Press [F2](Circle), the screen of defining circle will be shown.	[F2]	**Define(H)-Circle** 🔋 **Radius:** _____ **Length:** _____ **B.S.** **Clear** **Enter**
2) Input radius and arc length, then press [ENT] to save.	Input Radius and arc length [ENT]	**Define(H)-Circle** 🔋 **Radius:** 100 **Length:** 20 **B.S.** **Clear** **Enter**

		Define (H)-03 🔋
3) System automatically calculates the mileage and azimuth and return to the input process screen		**Mileage** **170.000 m** **Azimuth** **16°27'32"** **Line Circle Spiral**

Spiral

Press [F3] (Spiral) in the Main Line Input Screen, the transition curve can be defined. Transition curve consists of the minimum radius and arc length. The rule of radius value: along the forward direction of the curve. When the curve rotates to right, the radius value is positive. When the curve rotates to left, the radius value is minus. The arc length cannot be minus

Operation Steps	Key	Display
1) Press [F3](Spiral), in the screen of defining circle will be shown.	[F3]	**Define(H)-Spiral** **Radius:** **Length:** **B.S. Clear** **Enter**
2) Input radius and arc length, then press [ENT] to save.	Input Radius and arc length [ENT]	**Define(H)-Circle** **Radius:** 240 **Length:** 45 **B.S. Clear** **Enter**

3) System automatically calculates the mileage and azimuth and return to the input process screen.		**Define (H)-04** **Mileage** **215.000** **m** **Azimuth** **21°49'50"** **Line** **Circle** **Spiral**

Max number of element is 20. Press [ENT] to pop up the list box of all inputted elements. Press [F1] (Save) to save all elements to current file and quit defining. Press [F2] (View) to browse the detailed information of an element, or to edit it.

List (H element)
01Begin   100.000
02line   100.000
03circle   150.000
04spline   170.000

Save   **View**   **Add**

11. PARAMETER

Through the menu function, you can configure the instrument. Press [MENU], pop up main menu then select [5], the configuration menu is shown as follow:

```
--Parameter—           🔋
1. Units option          ▲
2.Units option (dist)
─────────────
3. HA mode
4. VA mode
5. EDM mode              ▼
```
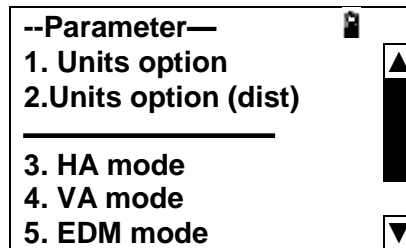
You can configure all instrument options according to your application.

Item	Option		Description
Units Options	Angle	DMS*/GON/mil	
	Distance		Meter*/feet/feet-inch
	Temperature		°C*/°F
	Press		hPa*/mmHG
Units Option (dist)	Inter Feet*		International feet
	US feet		US Survey feet
HA Mode	R mode*		Right Mode
	L mode		Left mode
VA mode	Zenith*		Zenith as 0
	Horizon 0		Horizontal as 0
	>V90(+/-)		Vertical
	Slope		Percentage
EDM mode	Single*		One measurement
	Repeat		Average of 5 measurements
	Continue		Continues measurement
	Tracking		Tracking measurement
Mini read out	1" */ 5" / 10"		
NEZ or ENZ	NEZ		Coordinate sequence
	ENZ*		Select format for data export
Auto shut off mode	Never		
	5 minutes		Select time for auto shut off mode
	10 minutes		
	20 minutes		
Language	English*		
	Spanish		
	Portuguese		
Items marked with * are factory default items			

12. SPECIFICATION:

Power type: 0.690 um red visible laser
Measuring system: base frequency 59.934484MHZ
EDN type: Coaxial
MINI display: 0.1mm
No cooperation type: About 7x14mm / 20mm laser point
Temperature correct: Auto-correct after inputting data
Atmosphere refraction and earth curvature correct: auto-correct after inputting data
Prism constant correct: Input by-hand
Distance unit: meter / feet / inch
No. display: Max: 99999999.99 m   Min: 1 mm
Average measuring times: Able to choose the average of 2 to 9 measuring times

Accuracy:

With prism:

Measuring model	Standard accuracy error	Measuring time
Prism accurate measurement	±（2mm+2ppm*D）	＜1.2s
Prism Track	±（5mm+2ppm*D）	＜0.5s
Reflector	±（5mm+2ppm*D）	＜1.2s

No prism:

Measuring model	Standard accuracy error	Measuring time
No cooperation accurate measurement	±（5mm+2ppm*D）	＜1.2s
No cooperation track	±（10mm+2ppm*D）	＜0.5s

North Group LTD.

OTHER SPECIFICATIONS

Angle measurement model

Absolute coding model
Coded disc Diameter:	79mm
Mini display reading:	1"
Accuracy:	2"or 5" or 6" or 7"

Telescope

Image:	Erect
Telescope length:	154mm
Objective aperture: telescopic:	45 mm/ measuring distance: 50mm
Magnification:	30x
Field of view:	1°20'
Minimum focus:	1.2m
Resolution:	4"

Auto-compensator:

Working range:	±3'
Accuracy:	3''

Leveling bubble:

Plate vial:	30"/2mm
Circular vial:	8' /2mm

Laser point

Power:	5mw
Wavelength:	635nm
Counter point distance:	0-3m

Display part

Type	LCD, seven lines, Picture type

North Group LTD.

Data transfer

Connector: RS-232C

Battery

Power: Rechargeable lithium battery
Voltage: Direct current 6-9v
Continuous working time: 8 hours
Working   Temperature   -25℃～+50℃

Size and weight

Shape: 170 x 190 x 360mm
Weight: 5.2kg

North Group LTD.

13. PROMPT, WARNING AND ERROR MESSAGES

Prompt	Meaning
"Tilt Over"	The tilt compensator is out of range
"Points NO.<=20"	The number of points should be less than 20
"Cannot find"	Cannot find any point
"Pt. first"	Input the name of point first please!
"No information"	There aren't any station, BSS or other coordinates, or user has not input point name
"Filename error"	Illegal character in the filename
"Cannot import"	Type of the file is not match, cannot to import
"Choose file"	please assign a file to import or export
"None record"	There is not record in the file
"Saved"	Records have been saved
"Select coord. file"	Assign a coordinates file
"Overtop"	The value is out of range
"No data"	There is not record in the file
"Type not matching"	The type of file is not match with what you need
"Inexistence file"	File does not exist
"Empty file"	There is not record in the file
"Pickup 21 records"	Read out 21 roadway elements from the file
"Pickup 7 records"	Read out 7 roadways I.Ps from the file

"90° Beep off"	Switch off Beep on rectangle position
"90° Beep on"	Switch on Beep on rectangle position
"Setup station first"	Please setup station before setting BSS
"Open error"	Cannot open file
"T.H. overtop"	The height of the prism is out of range
"I.H. overtop"	The height of the instrument is out of range
"Dist overtop"	The value of distance is out of range
"Press overtop"	The value of air pressure is out of range
"Temp. overtop"	The value of air temperature is out of range
"Cannot calculate"	The shape is messy, so area cannot be calculated
"Extension error Input as follow (COD, COO, MEA, LSH, LSV)"	System can only accept some file such as:*.cod,*.coo,*.mea,*.lsh,*.lsv
"Disk is full"	There is not enough space to save file, delete some unused file
"Max elements should be less than 20!"	There are 20 or less elements that can be accepted by the instrument.
"Mileage overtops!"	The mileage of the start point is out of range
"Error: I.P number less than 3!"	For calculation, the number of the intersection point should be 3 or more
"No data (V)!"	There is not data that define the roadway in vertical aspect

Information/Sales:

info@northgps.com

Technical Support:

support@northgps.com

North Group LTD.

NORTH

Surveying and Positioning Systems

It´s time to go North

WWW.NORTHSURVEYING.COM