10.6.1 Exporting Points

Access

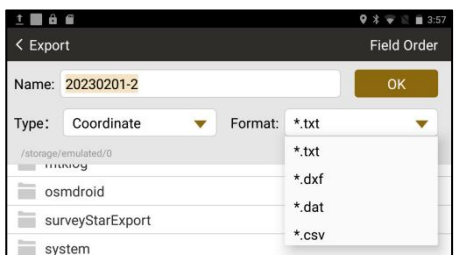
1) Press **[ ] \{Data}** Page **\[ ]\[Export]**.

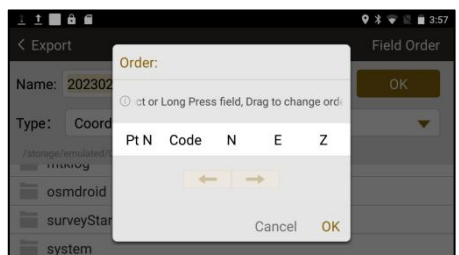
Step by Step

2) Press **[Export]** to export the ticked data.

3) Enter the file name, select the type and format.

4) Select the saving location, press **[OK]**





Item	Description
Name	File name to be saved in internal memory.
Type	Coordinate, raw or side & angle.
Format	Select the format of data
[ESC]	Escape to the root directory.
[Back]	Back to the last page.

[Field Order]	Change the order of exported data.
[OK]	Save and export.

Next Step Copy to external devices (Chapter 10.6.3)

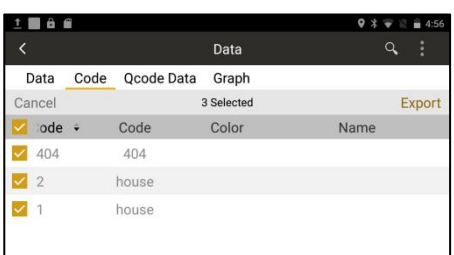
10.6.2 Exporting Codes

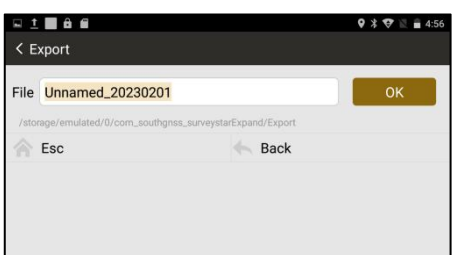
Access

1) Press **[ ] \{Code}** Page **[ ]\[Export Code]**.

Step by Step

2) Press **[Export]** to export the ticked data.
3) Enter the file name.
4) Select the saving location.
5) Press **[OK].**





Next Step Copy to external devices (Chapter 10.6.3)

10.6.3 Copy to External Devices

Description	The files in the internal memory can be transferred to another device by Micro SD card, USB OTG or Bluetooth.	
Access Step by Step	1. Micro SD 2. USB OTG	1) Insert a micro SD card or USB OTG. 2) Select **[File Manager].** The data will be saved in **[InternalStorage]\[com_southgnss_surveystarExpand]\[Export]** in default. 3) Press the file until it is colored and selected. 4) Press **[**  **]** to copy the file. 5) Back to the location of external device. 6) Press **[** **]** to paste it.
	3. Bluetooth	1) Select **[File Manager].** 2) Press the file until it is colored and selected. 3) Press **[** **]\[Bluetooth]** to select and connect your Bluetooth device. 4) Confirm the Bluetooth Connection Request, 5) Press **[Yes]\[OK]** to receive the data from total station.

11. COGO

Program	Description
Reduction	To convert the local coordinates to real coordinates.
Traverse Adjustment	To adjust the traverse.
Calc.XYZ	To calculate the position of new points using the azimuth, bearing and distance from a known point.
Inverse	To calculate the angle and distance differences between two known points.
Area & Girth	To calculate the area and girth linked by points.
Included Angle	To calculated the included angle from three points.
Dist. Conversion	To convert the unit of distances.
Angle Conversion	To convert the unit of angles.
Average	To computes the average for coordinate.
Equidistant Point	To calculate the equidistant points between two known points.
Triangle Calc.	To calculate a triangle by angles or sides.
Calculator	Calculator.

11.1 REDUCTION

Overview

Reduction is used to convert the local coordinates to the real coordinates.

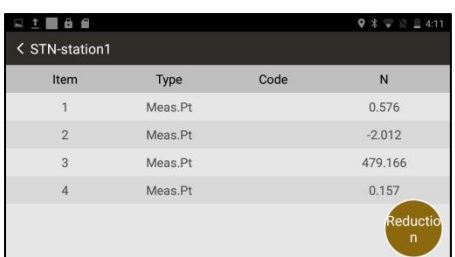
1) Free station. Refers to Chapter 7.7.
2) Station setup without CP. Refers to Chapter 7.8.

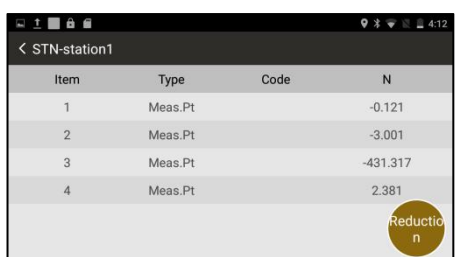
11.1.1 Reduction for Free Station

Access

1) Choose station ID. Press **[Reduction]**.
2) Press **[Call]** or **[Input]** to select backsight.
3) The local coordinates will convert to the real coordinates.

Reduction for Free Station





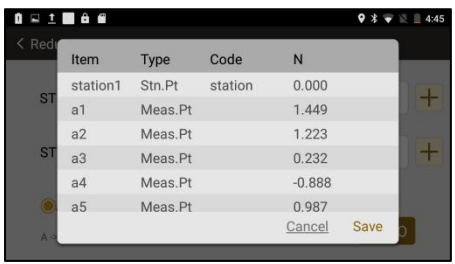
The coordinates will be changed after reduction.

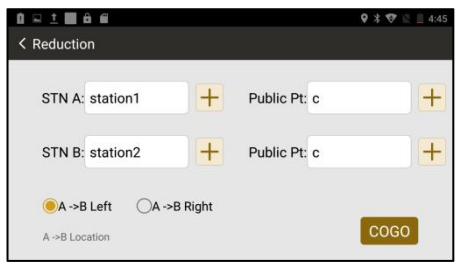
11.1.2 Reduction for Station Setup without CP

Access

1) Input station ID and a public point.
2) Press **[COGO]\[Save]** to convert the coordinates.

Station Setup without Control Point



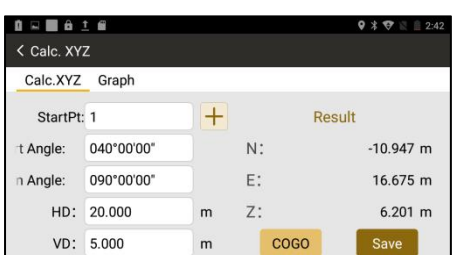


Item	Descriptions
STN A	Select the point ID of the first station.
STN B	Select the point ID of the second station.
Public Pt	Select the point ID of the public point.
A → B Left	The public point C is on the left side of A → B
A → B Right	The public point C is on the right side of A → B
COGO	Calculate

11.2 TRAVERSE ADJUSTMENT

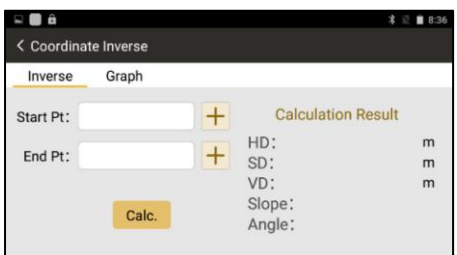
Refers to Chapter 8.10.5 Traverse Adjustment.

11.3 CALC. XYZ

Description	Calculate XYZ, as known as Traverse in COGO. To calculate the position of new points using the azimuth, bearing and distance from a known point.
Access	1) Select Main Menu: **[COGO]\[Calc.XYZ]** 2) Press **[+]**, select point ID. Enter the azimuth, bearing and distance. 3) Press **[COGO]\[Save].**
Calc.XYZ	

Item	Descriptions
Start Pt	Point ID of a known point.
Azimuth	Azimuth of the known point.
Bearing	Bearing from the known point
HD	Horizontal distance (offset)
VD	Vertical distance (offset)
N/E/Z	Coordinate of the calculated point

11.4 INVERSE

Description	To calculate the angle and distance differences between two known points.
Access	1) Select Main Menu: **[COGO]\[Inverse].** 2) Press **[+]**, select point ID. Press **[COGO].**
Inverse	

Item	Descriptions
HD/SD/VD	Horizontal, slope and vertical distance between 2 points.
Slope	Slope differences between 2 points.
Angle	Angle differences between 2 points.

11.5 AREA & GIRTH

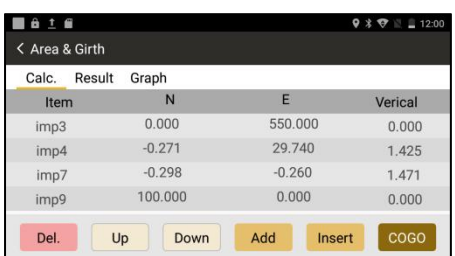
Description

The application program Area is used to compute areas and girth of points connected by straights. The calculated area is projected onto the horizontal plane.

Access

1) Select Main Menu: **[COGO]\[Area & Girth]**
2) Press **[Add]**, the points can be measured, selected from memory or entered by manual.
3) Press **[COGO].**

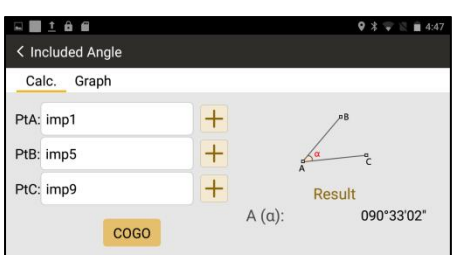
Area & Girth



Keys	Descriptions
Del.	Delete the selected point.

Up/Down	Move the selected data up or down.
Add	Add a new point.
Insert	Insert a new point before the selected point.
COGO	Calculation.

11.6 INCLUDED ANGLE

Description	To calculated the included angle from three points.
Access	1) Select Main Menu: **[COGO]\[Included Angle]** 2) Press **[+]** to add the points. Press **[COGO]** to calculate∠BAC.
Included Angle	

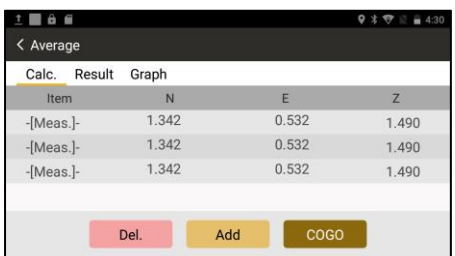
11.7 DISTANCE CONVERSION

Description	To convert the distance unit.
Access	1) Select Main Menu: **[COGO]\[Dist.Conversion]** 2) Press **[▼]** to select the unit, enter the value of distance to convert the units among km, m, cm, mile, yard, feet, inch. 3) Press **[Conversion].**

11.8 ANGLE CONVERSION

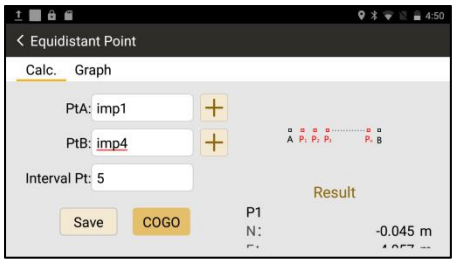
Description	To convert the angle unit.
Access	1) Select Main Menu: **[COGO]\[Angle Conversion]** 2) Press **[▼]** to select the unit, enter the value of distance to convert the units among radian, degree and DMS. 3) Press **[Conversion].**

11.9 AVERAGE

Description	To computes the average for coordinate.
Access	1) Select Main Menu: **[COGO]\[Average]** 2) Press **[Add]\[COGO].**
Average	

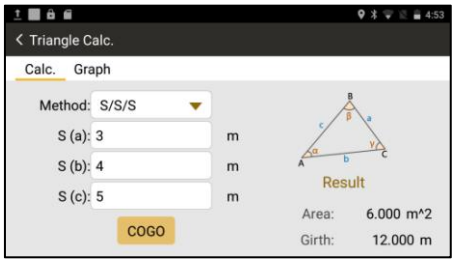
11.10 EQUIDISTANT POINT

Description	To calculate the equidistant points between two known points.
Access	1) Select Main Menu: **[COGO]\[Equidistant Point].** 2) Press **[+]** to add a start point and an end point. Enter the intervals.

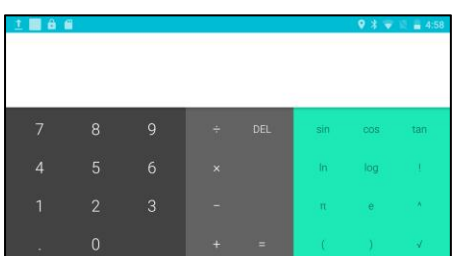
	3) Press [**COGO**]\[**Save**]
Equidistant Point	

11.11 TRIANGLE CALCULATION

Description	To calculate a triangle by angles or sides.
Access	1) Select Main Menu: **[COGO]\[Triangle Calc.].** 2) Select the method (S/S/S, S/A/S, S/A/A, A/S/A, P/P/P), and press **[COGO]**. - S: Sides, A: Angles, P: Points

Triangle Calculation	

11.12 CALCULATOR

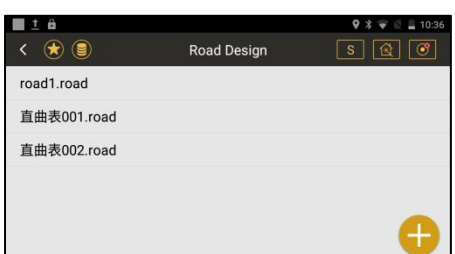
Description	Calculator.
Access	Select Main Menu: **[COGO]\[Calculator].**
Calculator	

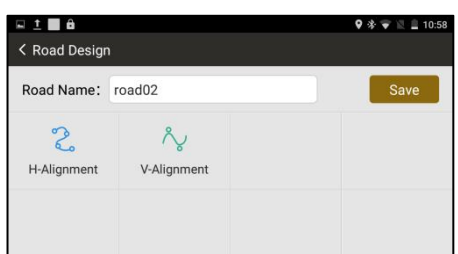
12. ROAD

12.1 ROAD DESIGN

12.1.1 Overview

Description	Design or import the design of roads by intersections.
Access	To Create: Select **[Program]****[Road]****[+]** **[New]**\Enter Name. To Import: Select **[Program]****[Road]****[+]****[Import]** to import files. Available in: *.rd-EG Star, *.ip-EG Star, *.xlsx-Road Elements Form, *.rod-EG Star, *.pm and *.jd. To Edit: Select **[Program]****[Road]**\Click the road in list**[Open]**. To Delete: Select **[Program]****[Road]**\Click the road in list**[Delete]**.
Next Step	When manually typing a road in your total station, the horizontal and vertical





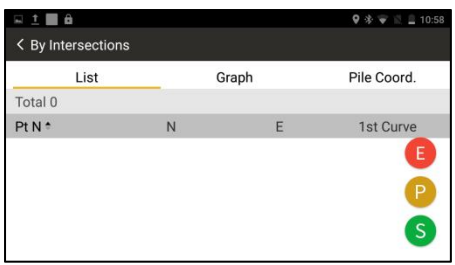
alignment are used for road design. Select **[H-Alignment]** and **[V-Alignment].**

12.1.2 Design a Road - Horizontal Alignment

Description

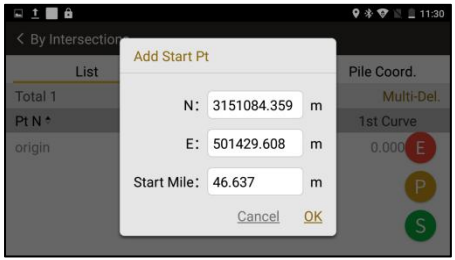
The horizontal alignment is designed by intersection points, there are Start Point, Intersection Points and End Point.

Horizontal Alignment



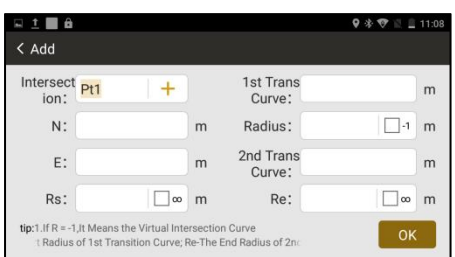
Keys	Descriptions
[S]	Start point. Including N, E and Start Mile.
[P]	Intersection point. Including Point ID, N, E, Rs (Start radius for the 1st transition curve), 1st Transition Curve, Radius, 2nd transition curve, Re (End radius for the 2nd transition curve).
[E]	End point. Including N and E.

[S] Start Point



Item	Descriptions
N	N (X) coordinates
E	E (Y) coordinates
Start Mile	Start mile of the road

[P] Intersection Points



Item	Descriptions
Intersection	Point ID of intersection points
N	N(X) coordinates
E	E(E) coordinates
Rs	Start radius of 1st transition curve.
1st Trans Curve	Length of the 1st transition curve.
Radius	Radius of the arc.
2nd Trans Curve	Length of the 2nd transition curve.
Re	End radius of the 2nd transition curve.

In normal, road includes three elements in horizontal alignment. They are transition curve, arc and straight line.

How to enter the elements (e.g. transition curve, arc and straight line) by intersections?

1) **Transition Curve**:

If the transition curve is connected after a straight line, Rs= ∞;

If the transition curve is connected before a straight line, Re= ∞

2) Arc:

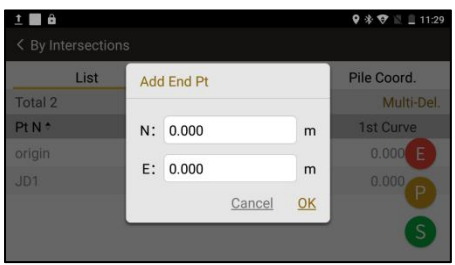
Rs = ∞, Re = ∞, 1st Trans Curve = 0, 2nd Trans Curve = 0.

Only Point ID, N, E, Radius are valid for entry.

3) Straight Line:

Only Point ID, N and E are valid. It will calculate the azimuth automatically.

[E] End Point



Item	Descriptions
N	N (X) coordinates of end point
E	E (Y) coordinates of end point

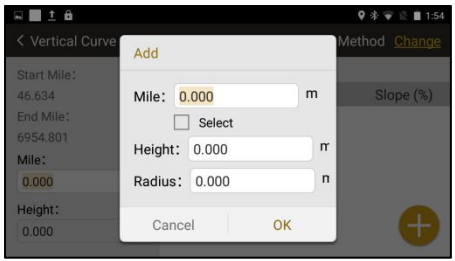
12.1.3 Design a Road - Vertical Alignment

Description Creating, editing and deleting the vertical alignment.

Access

Select **[V-Alignment]****[+]**\Enter the mile and height**[OK]**

Arc Method

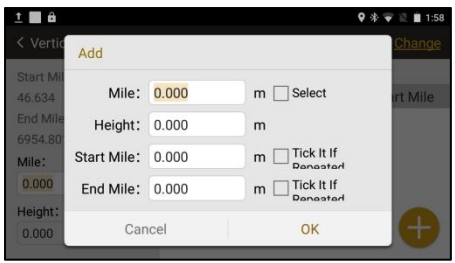


Item	Descriptions
Mile	Mile of the current segment.
Height	Height of the current segment.
Radius	Radius of the current segment. If it is the first mile, leave it as 0.

Parabolic Method

Press **[Change]** to change the method between arc and parabolic arc methods.

Parabolic Arc Method allows a smooth transition between the existing curve shifting to the next part.



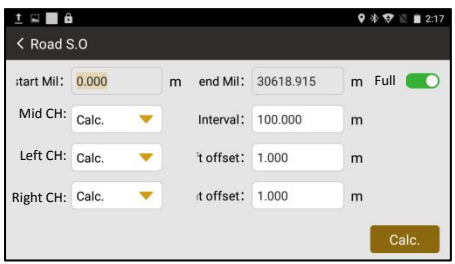
Item	Descriptions
Mile	Mile of the current segment.
Height	Height (elevation) of current segment.
Start Mile	Last mile in the parabolic.
End Mile	Next mile in the parabolic.

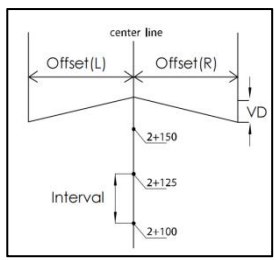
Next Step Road Stake Out.

12.2 ROAD STAKE OUT

Description	Stake out the middle line, left and right pile on the designed road.
Access	Select Main Menu **[Program]\[Road S.O]**\Select a road.

Stake Out



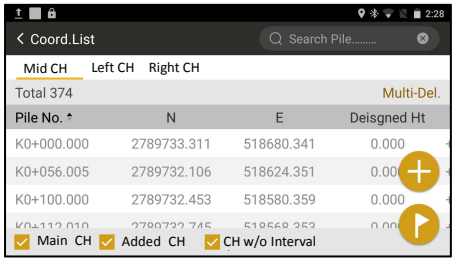


Item	Descriptions
Full	When it is activated, the points to be staked will be calculated from the full road (from start mile to the end). When it is not activated, the points to be staked can be selected by manual. For example, from 1000m to 2000m.
Start Mile	The starting mile for stake out.
End Mile	The ending mile for stake out.

Mid CH	Selectable item. To select whether to calculate the coordinates of chainage on the center line of road.
Interval	Interval (chainage increment) between stake-out points
Left CH	Selectable item. To select whether to calculate the coordinates of left chainage or not.
Left Offset	Left offset, calculated from the center line.
Right CH	Selectable item. To select whether to calculate the coordinates of right chainage or not.
Right Offset	Right offset, calculated from the center line.

Next Step Check the calculated points (including points on the center line, left and right chainage with offset) for stake out.

Stake Out Points



Item	Descriptions
{Mid CH}	Point list for chainage on the center line.
{Left CH}	Point list for left chainage, with left offset.
{Right CH}	Point list for right chainage, with right offset.
Main CH	When it is checked, only main chainage will be shown.
Added CH	When this box is checked, only the chainage which added by manual will be shown.
CH w/ Interval	When this box is checked, only the chainage with intervals (increment) will be shown.
	Add points to be staked by manual.
	Select a point, press it to stake out.

13. SETTING

Items		Options
Unit	Angle Unit	Degree/Gon/Mil/DMS (Degree Minute Second)
	Distant Unit	M/US.Feet/International Feet/US. Feet-Inch
	Temperature Unit	℃/℉
	Pressure Unit	hPA/mmHg/inHg
Angle	Min. Angle Reading	5"/1"/0.1"
	V0	H0/V0/±90/Slope
	HL/HR	Horizontal left/Horizontal right
	Compensator	Off/X-Axis(Single)/XY-Axis(Dual)
Distance	Min. Distance Reading	1mm/0.1mm
	Coefficient (k)	Refraction coefficient. 0.14/0.2/Close.
	Scale Factor	1.0 in default.
	Average Elevation	0.000 in default.
	Temperature	20.000 ℃ in default.
	Pressure	1013.000 hPA in default.
	PPM	The atmospheric ppm is either set or calculated from

		the values in the previous fields.
	Measure Mode	N Times/Continuous/Tracking/Single
	Target	Non-prism/Sheet/Prism
Coordinate	Display Order	NEZ/ENZ
Comm.	Demo Mode	Simulating the data without measurement.
Adjustment	I Angle Set	Refers to Chapter 13.8
	E Bubble Adjust	Adjust the e-bubble. Refers to Chapter 13.3
	2C Set	Adjust the perpendicularity between sight of view and horizontal axis. Refers to Chapter 13.5
	Combine	Combine the adjustment of i-angle, 2C and e-bubble in once. Refers to Chapter 13.9
	H-Axis Error	Adjust the perpendicularity between vertical and horizontal axis. Refers to Chapter 13.6
	Parameter	Set the addictive constant and instrument constant K. Refers to Chapter 13.10
	Error Display	Error display, including i-angle, 2C and H-Axis.
Others	Reticle Backlight	On or Off
	Soft-Keypad	On or Off

	EDM Beep	On or Off
	Measure Beep	On or Off
	Repeat Roll Call	On or Off
	Q-Code	On or Off, designed in Southmap.
Function Key		The measure button and the numeric keys are able to be defined by user. Refers to Chapter 3.7.
Reset to Default		Reset the total station to default settings.
About	Update	Click to check and update the latest software.
	Software Information	Check the software version and copyrights.

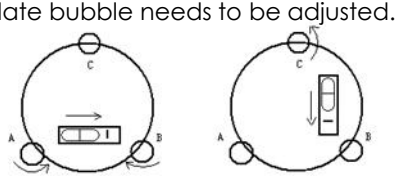
14. INSPECTION & ADJUSTMENT

The instrument has passed the procedure of inspection and adjustment before releasing to the market, which ensures that it meets quality requirement. However, after long periods of transportation or the changeable environment, some influences may occur to the internal structure. Before the first operation, the user should check and adjust the functions to ensure the precision of the job.

14.1 PLATE VIAL

Inspection

Loosen the horizontal tangent screw, rotate the equipment to ensure that the plate vial is parallel to the direction of foot screw AB. Adjust the screw A/B in opposite direction to move the bubble in the center. Rotate the instrument to 180° to see whether the bubble is in center, if not, the plate bubble needs to be adjusted.



Adjustment

1. If the bubble of the plate vial moves away from the center, bring it half way back to the center by adjusting the screws, which is parallel to the plate vial. Correct the remaining half by adjusting pin.
2. Rotate the instrument in 180° to check whether the bubble is in the center. If not, repeat Step 1.
3. Rotate the instrument in 90°, adjust the third screw. Repeat the steps until the bubble remains in the center in any direction.

14.2 CIRCULAR VIAL

Inspection

It is not necessary to adjust the circular vial, except the bubble is not in the center after the adjustment of plate vial.

Adjustment

If the bubble of the circular vial is not in the center, adjust the bubble to the center by using the adjusting pin or hexagon wrench.

First, loosen the screw opposite to the offset side, and then tighten the other adjusting screw on the offset side, bringing the bubble to the center.

When the bubble stays in the center, keep the tightness of the three screws uniformly.

14.3 TILT-SENSOR

Inspection

Leveling the equipment on the collimator. Check the value of tilt-sensor. If the value is larger than 30" when the total station is precisely leveled. Please adjust the tilt-sensor (e-bubble)

Adjustment

Select Main Menu: **[Setting]\ [Adjustment]\ [E-bubble Adjust]**.

Focusing the same target by horizontal right and left, press **[Setting]** to confirm the adjustment.

Note: please adjust the plate vial before the tilt sensor.

14.4 RETICLE UNIT

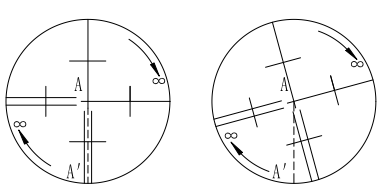
Inspection

1. Sight object A after leveling the equipment, lock the horizontal and vertical tangent unit and make sure that target A is in the center of cross-hair.

2. Move object A to the edge of the field of view, point A' by rotating the vertical tangent screw.

3. Adjustment is not necessary if object A moves along the vertical line of the reticle and point A' still in the vertical line.

Otherwise, as picture shown, A' is deviate to the center of the vertical cross-hair, it is necessary to adjust.



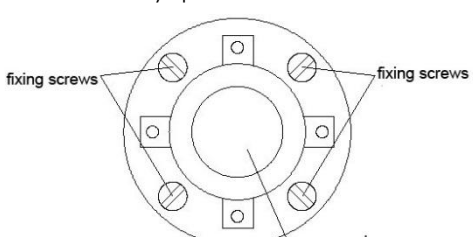
Adjustment

1. Remove the eyepiece cover to expose the four reticle adjusting screws, as picture shown.

2. Loosen the four reticle adjusting screws uniformly by the adjusting pin. Rotate the reticle around the sight line and align the vertical line of the reticle with point A'.

3. Tighten the adjusting screws slightly. Repeat the previous steps to see whether the position is correct.

4. Assemble the eyepiece cover back.



14.5 PERPENDICULARITY BETWEEN SIGHT OF VIEW & HORIZONTAL AXIS (2C)

Inspection

1. Set object A at a far distance at the same height as the instrument, leveling the instrument and turn on the power (eg. HL=10° 13'10").

2. Sight object A in horizontal left and read value of HA. (eg. HR= 190° 13'40").

3. Loosen the vertical and horizontal tangent unit and rotate the telescope. Sight object A in horizontal right and read the HA.

4. 2C =HL-HR±180° =-30"≥±20", overrange. So it is necessary to adjust 2C.

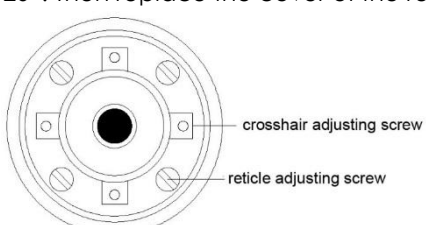
Adjustment

1.Use the horizontal tangent screw to adjust the reading of HA.

HR+C = 190° 13'40" – 15" = 190° 13'25"

2. Take off the cover of the reticle between the eyepiece and focusing screw. Adjust the two adjusting screws, loosening one screw and tightening the other one. Move the reticle to sight object A exactly.

3. Repeat inspection and adjustment until |2C|<20". Then replace the cover of the reticle.



14.6 PERPENDICULARITY BETWEEN VERTICAL & HORIZONTAL AXIS

Inspection

1. Leveling the equipment at the collimator. Aim at the cross-hair in upper tube of collimator by HL.
2. Set the horizontal angle to 0.(**[Measure]\[0 Set/H Set]\[OK]**)
3. Rotate the telescope vertically to the lower tube. Rotate the horizontal tangent screw to the nearest scale, record the angle as A.
4. Repeat the steps by horizontal right. Read the nearest scale of the lower tube, record it as B.
5. The difference between A and B should be less than 0.6".

Adjustment, Method 1

1. Select Main Menu: **[Setting] \ [Adjustment] \ [H-Axis Error**]
2. Press **[Input]** to enter the difference between A and B. Press **[OK]**.

Adjustment, Method 2

1. Leveling the equipment at collimator.
2. Aim at the lower tube of collimator by HL. Press **[OK]** for 10 times.
3. Aim at the lower tube of collimator by HR. Press **[OK]** for 10 times.

14.7 COMPENSATION OF VERTICAL INDEX DIFFERENCE

Inspection

1. After leveling the instrument, make the EDM parallel with the line connecting the center of the instrument to any one of the screws. Lock the horizontal clamp screw.
2. Switch on the equipment, zero the vertical index. Lock the vertical clamp screw and the instrument will display the vertical angle value.
3. Rotate the vertical tangent unit slowly in either direction about 10mm in circumference, and the over-range message appears. It means that the tilt of vertical axis is larger than 4', over the range of compensation. When rotate the vertical tangent unit in opposite direction back to the original place, the instrument will show the vertical angle again, it means that the compensation of vertical index difference works well.

Adjustment

If the compensation function is not working, please send the instrument back to the authorized agency for maintenance.

14.8 VERTICAL 0 (I ANGLE)

The adjustment of vertical index difference (the so-called i-angle).This item must be adjusted after finishing the adjustment of tilt-sensor and cross-hair.

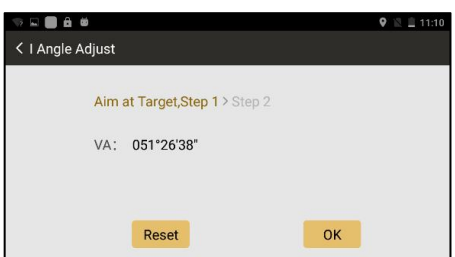
Inspection

1. After leveling the instrument, aim at any target A in HL. Record the value as L.

2. Rotate the EDM and aim at the target A in HR. Record the value as R.

3. If the vertical 0° in zenith, I =(L + R - 360°)/2. If the vertical 0 in horizon, I= (L + R - 180°)/2 or (L + R - 540°)/2.

5. If |i| ≥10", it need to reset the Vertical 0.



Adjustment

1. Aim at target A in same height with the instrument in HL.

2. Aim at the same target A on HR.

3. After setting the angle in both HL and HR, it will display the index difference, press [Reset] to confirm the adjustment.

4. Repeat the inspection steps to check the Index Difference (i angle). If the difference still cannot meet the requirement, please check whether the steps you did are correct. Then reset again.

5. If the Index Difference still fails to meet the requirement after repeated operation, the instrument should be returned to our authorize service center for inspection and repair.

Note: The value of vertical angle is not adjusted and compensated, just for a reference in adjustment.

14.9 COMBINED ADJUSTMENT (I-ANGLE, 2C, E-BUBBLE)

Adjustment

1) Select Main Menu: **[Setting]\[Adjustment]\[Combine].**
2) Aim at a target in Horizontal Left (F1), press **[OK]**.
3) Rotate the equipment to Horizontal Right (F2), aim at the same target and press **[OK]**
4) Check and tick the item to be adjusted.
5) Press **[Setting]** to confirm the adjustment.

14.10 INSTRUMENT CONSTANT K

The Instrument constant has been checked and adjusted in the factory, and K=0. It seldom changes and it is suggested to check once or twice in a year.

Inspection

1. Mount and level the instrument on Point A on flat ground. Use the vertical hair to mark Point B and Point C with the distance of 50m on the same line, aim the reflector accurately.

2. After setting temperature and pressure value, measure the horizontal distance of AB and AC accurately.

3. Setup the instrument on Point B and center it accurately. Measure the horizontal distance of BC accurately.

4. Then you can get the Instrument Constant: K = AC - (AB + BC). The value of K should be close to 0. If |K|>5mm, the instrument should be

strictly inspected on the base alignment, and be adjusted according to the inspection value.

Adjustment

Set the orientation through the vertical hair to make Point A,B, and C on the same line strictly. There must be a fixed and clear centering mark under the Point B.

The coincidence of the center of the prism and the center of the instrument is very essential to the measuring accuracy. Therefore, it's best to use a tripod or a common-used tribrach on the point B. If we replace it with a three-foot adapter and a tribrach, make sure that they are stable and fixed. It is possible to reduce the inconsistency if we just replace the upper part of the prism and the upper part of the instrument.

14.11 COINCIDENCE BETWEEN SIGHT OF VIEW AND EMITTING AXIS

Inspection

1. Set the reflector 50m away from the instrument. Aim at the center of prism precisely.
2. Activate the laser pointer. Check whether the center of reticle coincides to the laser pointer. If no, please adjust the emitting axis.

Adjustment

If there is a huge deviation between the sight of view and emitting axis, please send the instrument to authorized service center for maintenance.

14.12 ADJUSTMENT FOR APR+PRISM SEARCH

The adjustment steps for APR and Prism Search are for Robotic Total Station.

APR

1. Select **[TServer]: [Setting]\[Initial Set]\[Calibration]**

2. Aim at the prism center by manual. Check whether there are parameters in horizontal and vertical. If no, please return the equipment back to the supplier.

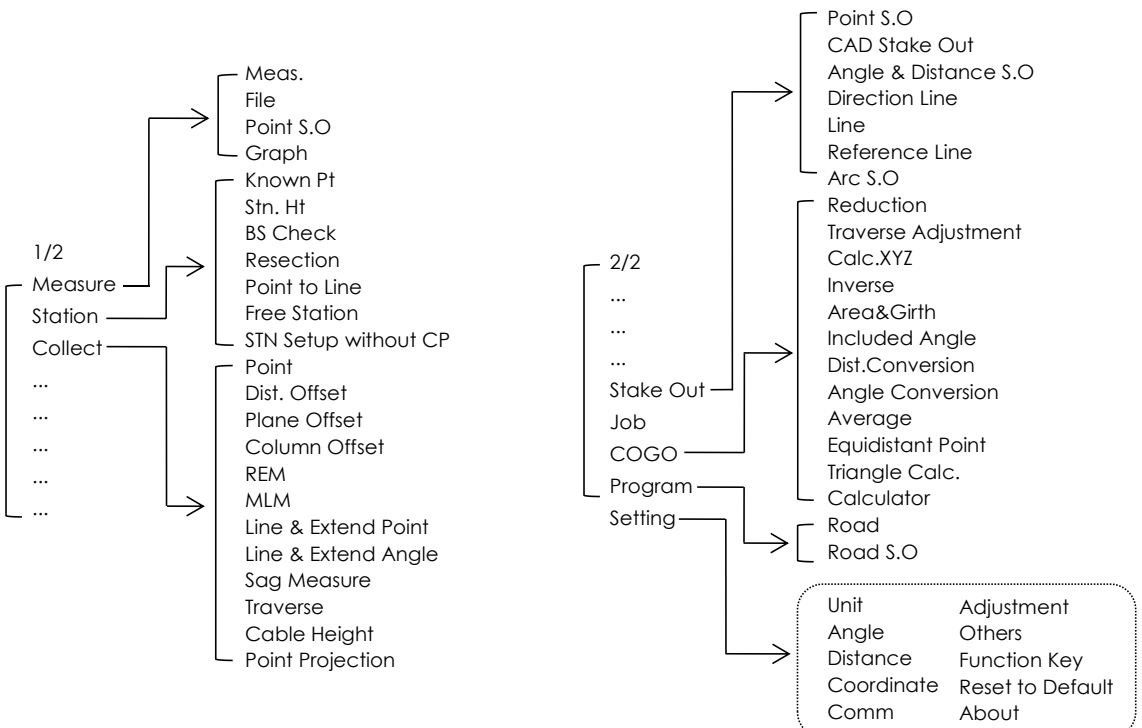
Prism Search

1. If the parameter of APR is normal, activate the Prism Search function.
2. If the motor is no feedback, or if the prism can't be searched in ±18° based on the range of sight of view, please return the equipment back to the supplier.

APR+Prism Search:

If the telescope is not coincide with the prism center after APR and Prism Search, please do the calibration. Refers to Chapter 2.7.

APPENDIX A. MENU TREE



APPENDIX B. DATA FORMAT

1. RAW DATA

LINE	EXPLANATION	
JOB	Job name, descriptions	
DATE	Date and time	
NAME	Operator's name	
INST	Serial number	
ORDER	Coordinate order	
VAMODE	Z(V0), H(H0), V(±90)	
L/R	Horizontal left or right	
UNITS	Distance unit, angle unit, temperature unit, pressure unit.	
SCALE	Grid factor, scale factor, elevation	
ATMOS	Temperature, Pressure	
ST	Station Point	Point ID, Code, N, E, Z (or E,N,Z), station height, date&time
BKB	Backsight Point	Backsight ID, code, reflector height, azimuth(123 ° 12'45"=123.1245), date&time
MP	Measured Point	Point ID, code, N, E, Z (or E,N,Z), date and time
UP	Imported Point	Point ID, code, N, E, Z (or E,N,Z), date and time

GPS	GPS Point	Point ID, code, N, E, Z (or E,N,Z), date and time
CC	Calculated Point	Point ID, code, N, E, Z (or E,N,Z), date and time
SS	Side Shot	Point ID, code, reflector height, horizontal angle, vertical angle, SD, HD, VD, N, E, Z (or E,N,Z), date and time
ANG	Angle	Point ID, code, reflector height, horizontal angle, vertical angle, SD, HD, VD, date and time
SO	Stake Out Point	Point ID, code, N, E, Z (or E,N,Z), reflector height, horizontal angle, vertical angle, SD, HD, VD, dx,dy,dz, date and time

2. COORDINATES DATA

LINE	EXPLANATION
JOB	Job name, descriptions
DATE	Date and time
NAME	Operator's name
INST	Serial number
UNITS	M
ORDER	Coordinate order (which can be changed)
Details	Point ID, code, N, E, Z

3. CODE LIST

(Header)[*1]	Q-code	Code	Color[*2]	Name
(Codes)	K01	230421	1	
(Codes)	K02	230421	2	

*1: Header should be exist when importing the codes to your device.

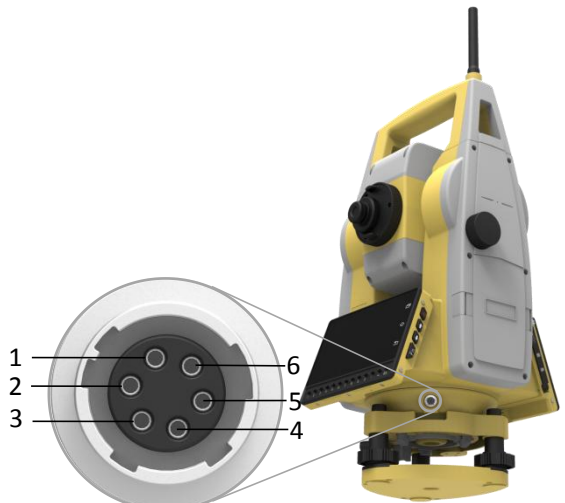
*2: Color refers to the color marks in Southmap or CAD. Marked from 1 to 9.

APPENDIX C. TRAVERSE LEVEL

Level	Traverse Length (km)	Side Length (km)	Mid Error (Ang.) (")	Mid Error (Dist) (mm)	Relative Measuring Error (Dist)	Measure Rounds		Azimuth Closing Error (")	Relative Closing Error
						1"	2"		
3rd level	14	3	1.8	20	1/150000	6	10	$3.6\sqrt{n}$	⩽1/55000
4th level	9	1.5	2.5	18	1/80000	4	6	$5\sqrt{n}$	⩽1/35000
1st Class	4	0.5	5	15	1/30000		2	$10\sqrt{n}$	⩽1/15000
2nd Class	2.4	0.25	8	15	1/14000		1	$16\sqrt{n}$	⩽1/10000
3rd Class	1.2	0.1	12	15	1/7000		1	$24\sqrt{n}$	⩽1/5000

APPENDIX D. COMM PORTS

Ports at NS30



1) RXD
2) TXD
3) VCC
4) NC
5) GND
6) GND

6-Pin LEMO

Pin	Signal Name	Function	Direction
1	RXD	RS232, Receive data	In
2	TXD	RS232, Transmit data	Out

FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Specific Absorption Rate (SAR) information:

This Total station meets the government's requirements for exposure to radio waves. The guidelines are based on standards that were developed by independent scientific organizations through periodic and thorough evaluation of scientific studies. The standards include a substantial safety margin designed to assure the safety of all persons regardless of age or health. FCC RF Exposure Information and Statement the SAR limit of USA (FCC) is 1.6 W/kg averaged over one gram of tissue. Device types: Total station has also been tested against this SAR limit. This device was tested for typical body-worn operations with the back of the phone kept 0mm from the body. To maintain compliance with FCC RF exposure requirements, use accessories that maintain an 0mm separation distance between the user's body and the back of the phone. The use of belt clips, holsters and similar accessories should not contain metallic components in its assembly. The use of accessories that do not satisfy these requirements may not comply with FCC RF exposure requirements, and should be avoided.