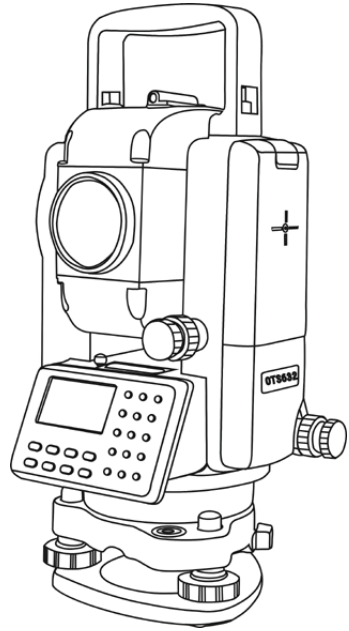
OTS630 SERIES
RTS630(H) SERIES TOTAL STATION

Instruction Manual (Ver2.0e)



Suzhou FOIF Co.,Ltd.

Foreword

Thanks for you purchasing the FOIF TS630 series total station. In order to use the instrument well, please read this instruction manual carefully and keep it cautiously for consulting in the further.

Product confirmation:

Please fill the model and the serial number of your instrument in corresponding blank. Feedback to local distributor or our sales department.

NOTE :

- Please read this instruction manual carefully before use it.
- Avoiding insolates the instrument, and don't collimate the sun directly for protecting eyes and instrument.
- When using it please insure the connection between tripod and instrument is firm. If raining, you can hood it with rainproof cover.
- Please loose the clamp system when the instrument in the case, and keep the case dry.
- When transporting, keep the instrument in the case and try your best to lighten librations.
- After working in wet or raining condition, please wipe water on surface and keep it in air, when it is dry completely, you can put it in the case.
- Don't clean the instrument surface with alcohol, aether or other irritant chemical things; and use the equipped paper to clean the optical parts.
- If you do not use the instrument for a long time, you should take the battery pack down and recharge once every month.
- If you do not use the instrument for a long time, take the instrument out of the case and keep it in the dry condition.
- If the temperature changing is sharp (for example: move it out from one hot vehicle), the measured data will be influenced, so it can be used when it adapts the surrounding condition.
- Before use it, you should check the voltage for whether it is enough.
- Do not remove the battery at working time, otherwise some settings or measured data may be lost.

Safety Cautions:

- **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 FOIF or an authorized dealer, only!

- **Cause eye injury or blindness.**

  Do not look at the sun through a telescope.

- **Laser beams can be dangerous, and can cause eye injury if used incorrectly.**

  Never attempt to repair the instrument yourself.

- **Cause eye injury or blindness.**

  Do not stare into laser beam.

- **High temperature may cause fire.**

  Do not cover the charger while it is charging.

- **Risk of fire or electric shock.**

  Do not use damaged power cable, plug and socket.

- **Risk of fire or electric shock.**

  Do not use a wet battery or charger.

- **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.

- **Risk of fire or electric shock.**

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

- **Risk of fire.**

  Do not use any other power cable 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 connect or disconnect equipment with wet hands, you are at risk of electric shocks if you do!

•Risk of injury by overturn the carrying case.

Do not stand or sit on the carrying cases.

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

•Risk of injury by falling down the instrument or case.

Do not use a carrying case with a damaged which belts, grips or latches.

•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.

•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.

●Risk of injury by falling down a tripod and an instrument.

Always check that the screws of tripod are tightened.

• It could cause measurement error when there is leave or other object between instrument and target.

User

1. 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 manual and safety instructions, before operating, inspecting or adjusting.

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

Exceptions from Responsibility

1) The user of these products is expected to follow all operating instructions and make periodic checks of the product's performance.

2) The manufacturer, assumes no responsibility for results of a faulty or intentional usage or misuse including any direct, indirect, consequential damage, and loss of profits.

3) The manufacturer assumes no responsibility for consequential damage, and loss of profits by any disaster, (an earthquake, storms, floods etc.).

4) The manufacturer assumes no responsibility for any damage, and loss of profits due to a change of data, loss of data, an interruption of business etc., caused by using the product or an unusable product.

5) The manufacturer assumes no responsibility for any damage, and loss of profits caused by usage except for explained in the user manual.

6) The manufacturer assumes no responsibility for damage caused by wrong transport, or action due to connecting with other products.

Safety Standards for OTS630 EDM Laser (OTS630 series)

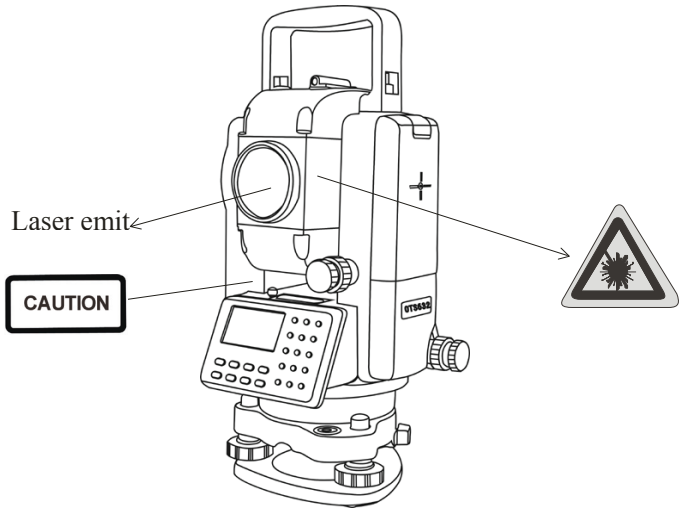
OTS630 series adopt the class of Laser Product according to IEC Standard Publication 60825-1 Amd. 2:2001. According this standard, EDM device is classified as Class 3R Laser Product when reflectless measurement is selected, when the prism and reflective sheet is selected as target, the output is equivalent 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 1 LASER RADIATIONS WHEN OPEN
DO NOT STARE INTO THE BEAM

Note for Safety

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



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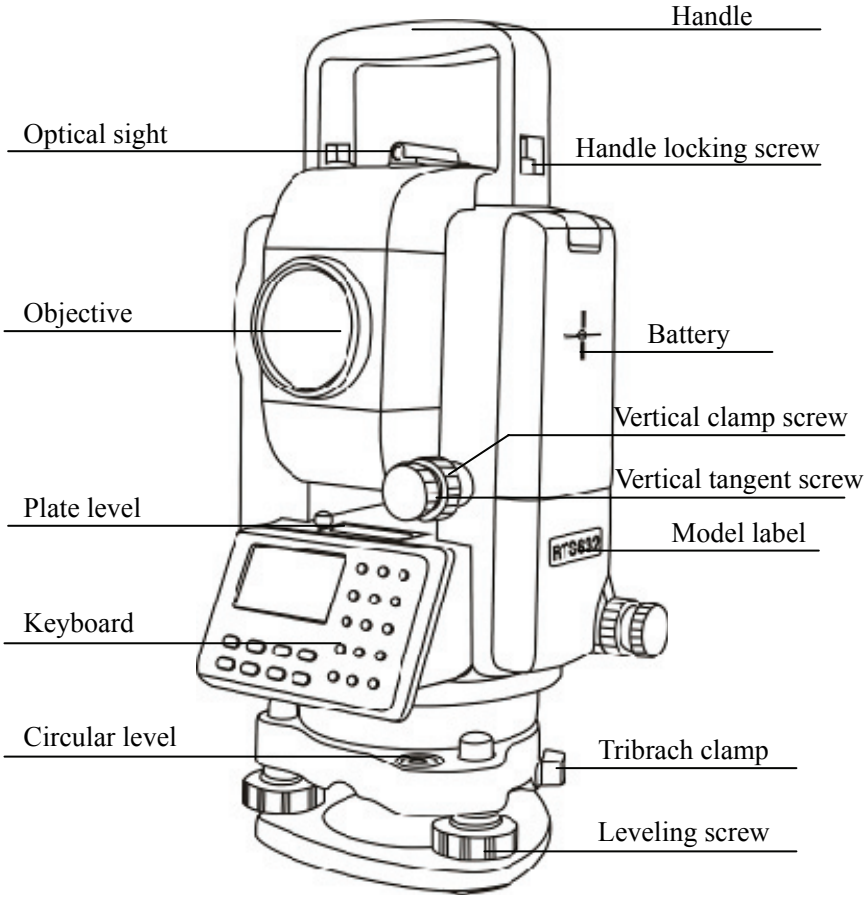
Applications

FOIF TS630 series Total Station applied absolute encoder system to digital angle measurements, it adopt phases measurement system to measure distance. It can measure distance not only with prism but also with reflective sheet, so much as it can work without cooperate objective. It can achieve measurement, calculating, display and storage etc. by means of microcomputer-technology. It can display measuring results of horizontal, vertical angle and distance at the same time.

These series Total Station is designed for engineering items, especially for every construction area. It can be used in coordinate measurement or location measurement for construction, remote elevation measurement, plumb line surveying, ductwork surveying and sectional surveying etc. It also can be used in triangulation control survey, cadastral surveying, topographic surveying and house property surveying.

1. Nomenclature and functions

1.1 Nomenclature



1.2 Display

The display uses a dot matrix LCD/OLED (factory optional) which has 4 lines and 16 characters per line. In general, the upper three lines display measured data, and the bottom line displays the soft key function which changes with the measuring mode.

There are two type modes: measurement mode and menu mode.

◆Measurement mode of TS630 series:

```
VZ:   81°   54′   21″
HR: 157°   33′   58″
0SET HOLD HSET   P1
```

Angle measurement mode

Zenith distance: 81° 54′ 21″

H-angle:157° 33′ 58″

```
VZ:   81°   54′   21″
HR: 157°   33′   58″
SD:      130.216m   f
DIST MODE   S/A   P1
```

Distance measurement mode 1

Zenith distance: 81° 54′ 21″

H-angle: 157° 33′ 58″

Slope distance: 130.216 m

```
HR: 157°   33′   58″
HD:        128.919m
VD:        18.334m
DIST MODE   S/A   P1
```

Distance measurement mode 2

H-angle: 157° 33′ 58″

H-distance: 128.919m

V-distance: 18.334 m

```
N:        5.868m
E:        -3.308m
Z:        0.226m
DIST MODE   S/A   P1
```

Coordinate measurement mode

N: 5.868 m

E: -3.308 m

Z: 0.226 m

◆ Example of menu mode:

```
MENU                1/3
F1:DATA COLLECT
F2:LAYOUT
F3:MEMORY  MGR.  P
```

```
PARAMETERS 1 1/2
F1:MIN ANG READING
F2:AUTO OFF
F3:TILT            P ↓
```

MENU(page 1,total 3)

Press F1 enter “data collect”

Press F2 enter “layout”

Press F3 enter “memory MGR.”

PARAMETERS

Press F1 enter “min.angle reading”

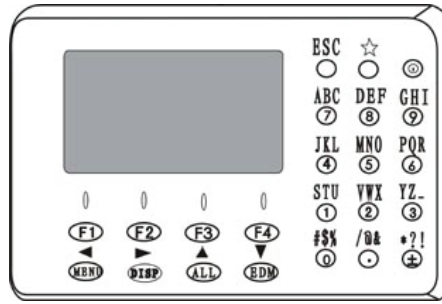
Press F2 enter “auto off”

Press F3 enter “tilt” for sensor

◆ Display mark

VZ	Zenith distance
VH	Height angle
V%	grade
HR/HL	H-angle right/H-angle left
SD/HD/VD	S-distance/H-distance/Height difference
N	N coordinate
E	E coordinate
Z	Z coordinate
PT#	Point number
ST/BS/SS	Measured station/Backsight/Collected point
Ins.Hi(I.HT)	Instrument height
Ref.Hr(R.HT)	Prism Height
PT#	Registered number of PCODE
PCODE	Point code
P1/P2/P3	Page 1/Page 2/Page 3

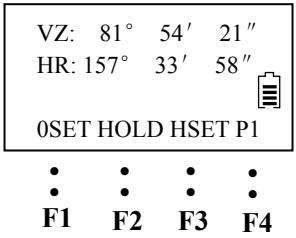
1.3 Operating Key



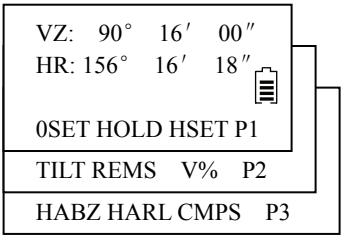
Keys	1st Function	2nd Function
F1-F4	Functions keys correspond message displayed	Functions keys correspond message displayed
0~9	Enter number	Enter letter or other character
ESC	Escape from menu	
★	Open fast setting menu	
①	Power on/off	
MENU	Enter menu	Cursor move left, return to previous page
DISP	Switches the angle, SD,HD and coordinate measurement mode	Cursor move left, return to next page
ALL	Start measuring and record by 1-key	Cursor move down, display previous point in memory
EDM	Distance measurement setting menu	Cursor move up, display next point in memory

1.4 Function key (Soft Key)

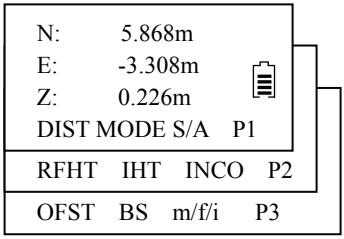
The Soft Key function is displayed at the bottom line of display.
The function is changed with measurement mode.



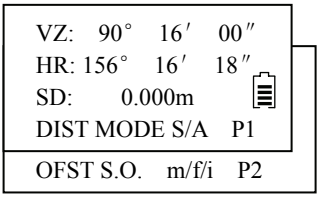
Function key



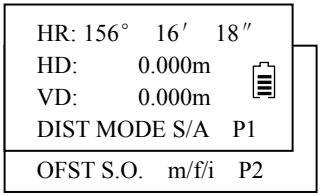
Angle measurement mode



Coordinate measurement mode



Slope distance measurement



Horizontal distance measurement

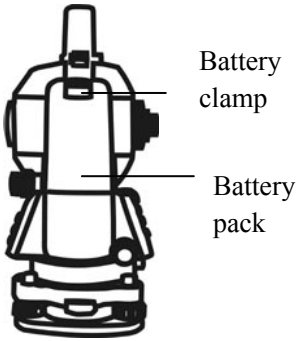
Descriptions

Mode		Display mark	Soft key	Function
Angle measurement	P1	0SET	F1	Horizontal angle is set to 0
		HOLD	F2	Hold the horizontal angle
		HSET	F3	Setting horizontal angle by input values
	P2	TILT	F1	Setting tilt compensator on/off
		REMS	F2	Enter repeat angle measurement program
		V%	F3	Switch grade/zenith distance VZ
	P3	HABZ	F1	Buzzer set for every horizontal angle 90°
		HARL	F2	Switch horizontal angle mode (HR/HL)
		CMPS	F3	Set a vertical angle mode(VH/VZ)
S-distance meas.	P1	DIST	F1	Start distance measurement
		MODE	F2	Select the measurement model as fine or track
		S/A	F3	EDM setting
	P2	OFST	F1	Select Offset measurement program
		S.O.	F2	Select stake out measurement program
		m/f/i	F3	Change the display of distance unit
Coordinate meas.	P1	DIST	F1	Start distance measurement
		MODE	F2	Select the measurement model as fine or track
		S/A	F3	EDM setting
	P2	RFHT	F1	Set prism height
		IHT	F2	Set instrument height
		INCO	F3	Sets occupied station coordinate
	P3	OFST	F1	Enter offset measurement program
		BS	F2	Sets back sight point coordinate
		m/f/i	F3	Change the distance unit

2. Battery

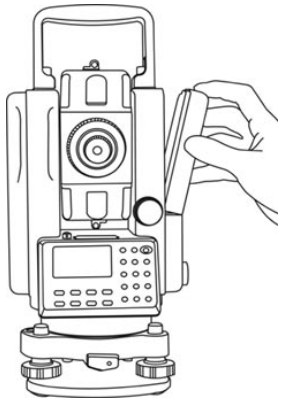
2.1 Mounting the battery

(1) Insert the battery by aligning the battery pack's tenon with the notch in the instrument, press the battery clamp and push the top of the battery pack until you hear a click.



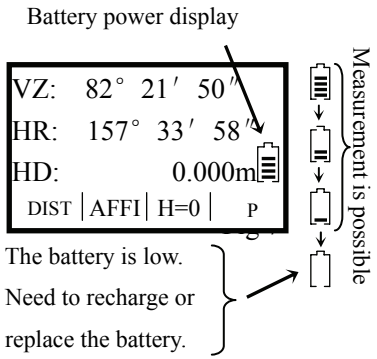
(2)Removing the battery

Press the battery clamp and remove the battery pack by pulling it toward you.



(3)Battery Indicator

Battery power display indicates the power condition. You should recharge or replace the battery when you hear the continue buzz. Please turn off in the normal way in order to save the data. Please find the battery operating time on Specifications.



2.2 Recharge

1. Plug the charger on 100-240VAC (50-60Hz) power supply, the red lamp lighting.
2. When recharge is complete, the light become green. Normally, it will take about 3-4 hours.

Caution: For indoor use only.

Note:

1. The new battery (or not be used for long time) need to recharge and discharge for several times, the battery could become the good performance for using. Please recharge more than 10 hours.
2. Please prolong charge 1-2 hours after green lamp lighting to reach the best performance.
3. Lamp situation: red lamp lighting--charging; green lamp lighting--charge complete; red lamp flash--waiting, not connecting or battery defective.
4. If the red lamp flashes when plug the charger, please remove the charger and wait a minute to plug it again.

3. Preparation for measurement

3. 1 Setting up the instrument

(1) Setting up the tripod

First, extend the extension legs to suitable lengths and tighten the screws on the midsections

(2) Attaching the instrument on the tripod head

Place the instrument carefully on the tripod head and slide the instrument by loosening the tripod screw.

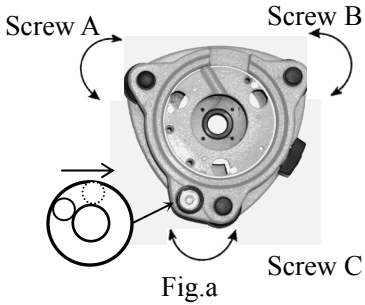


Fig.a

3.2 Leveling the instrument

(1) Leveling with the circular level

by adjusting leveling screws A and B, position the bubble in the center of vial (Fig a).

Adjust the leveling screw C, position the bubble in the center of circle (Fig b).

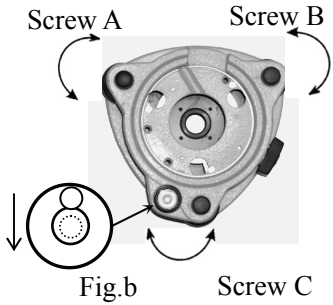


Fig.b

(2) Leveling precisely by plate level

Loosen horizontal motion clamp, place the plate level in parallel with the line joining leveling screws A and B. Adjust the leveling screws A and B, position the bubble in the center of the plate level (Fig c).

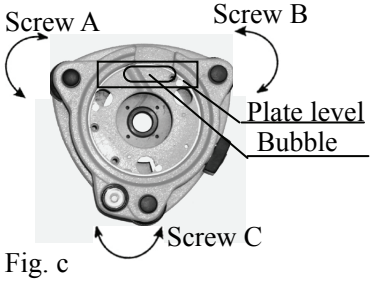


Fig. c

Loosen horizontal motion clamp, rotate the plate level through 90°around the vertical axis. Adjust leveling screw C, position the bubble in the center of plate level (Fig d).

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

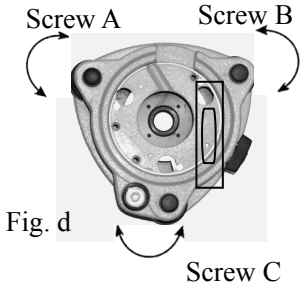
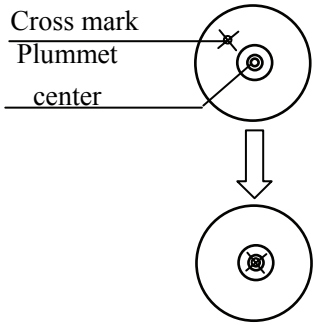


Fig. d

3.3 Centering

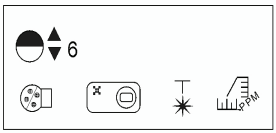
3.3.1 Centering with optical plummet



Leveling the instrument by plate level first. Rotate the focusing ring of the optical plummet and adjust the focus to the ground mark point. Then loosen the center screw of the tripod, look through the optical plummet, and move the base plate on the tripod head until the center mark coincides with the ground mark point. At last tighten the center screw.

Repeat above steps to leveling the instrument again, until the center of reticle coincides with the mark point when rotating alidade of instrument.

3.3.2 Centering with laser plummet（Factory Optional）



Laser Point Adjust
Level: 4

\+ — —— ENT

(1) Press ★ key to open fast setting menu, and press F3 to open plummet laser intensity adjusting menu, press F1 to increase laser intensity, or press F2 to decrease laser intensity, at last press F4(ENT) to confirm.

(2)Turn the focusing knob until the laser spot on the same horizontal plane with mark point on the ground.

(3) Loosen the center screw of the tripod, and move the base plate on the tripod head until the laser spot coincides with the ground mark point. Tighten the center screw.

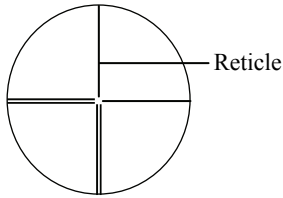
(4) Repeat leveling and (3) steps until the instrument keeps leveling and the laser spot coincides with the mark point when rotating alidade of instrument to any direction.

(5) After centering, please press [ESC] key.

3.4 Focusing

(1) Diopter adjustment

Point telescope to sky or a uniformly light surface (Do not point to the sun). Turn eyepiece until cross hairs are sharp and black.



(2) Target image focusing

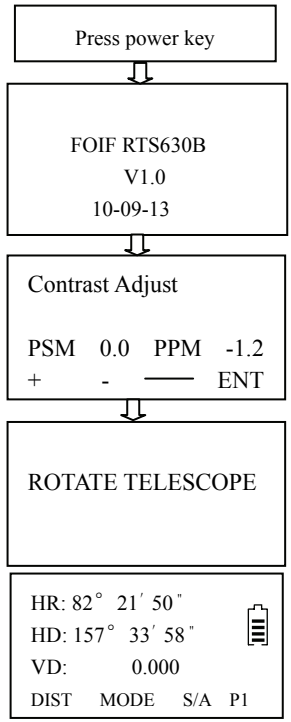
Look through telescope eyepiece and turn focusing ring until target is seen. There should be no apparent movement between cross hairs and target as observer moves his eye slightly. If there is parallax, please remove it by adjusting the focusing ring slightly.

3.5 Switch on

1. Confirm the instrument is leveled and centered.
2. Press power key to switch on.
3. It will show the software version and date first, then to show LCD Contrast adjusting screen. It also shows current prism constant value (PSM) and atmospheric correction value (PPM). You could press F1 or F2 to adjust the contrast. Then press F4 to confirm and enter basic measurement mode.

Check the battery power indicator, recharge battery when battery level is low or indicates “battery empty”.

4. Rotate telescope to initialize the vertical circle.
5. The instrument will display basic measurement screen.

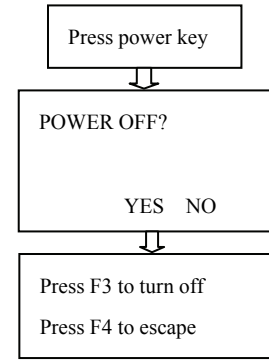


Flow chart for switch on

3.6 Switch off

(1)Press power key.

(2)Press F3 to switch off; Press F4 back to the latest mode.



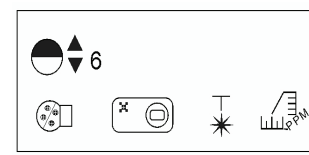
Flow chart for switch off

3.7 The function of ★ key fast setting menu

● RTS630H series

(1)Display contrast adjusting （ 6）

Press ★ key, the display contrast will be higher if you press ALL（▲）key; and it will be lower if you press EDM（▼） key.



(2) Illumination on/off（ ）

Press [F1] key to turn on/off reticle illumination and display backlight.

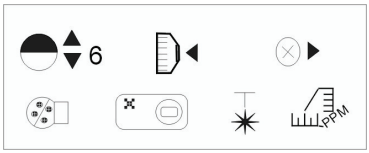
(3)Tilt On/Off （ ）

Press ★ key and displaying the ★menu. Press [F2] to display the tilt medo, the tilt will be on if you press [F1] key and it will be off if you press [F3] key.

(4)Laser plummet intensity adjusting （ ✳ ）

Press ★ key and displaying the ★menu. Press[F3] to display laser point adjust mode. Press [F1] or [F2] to level up or level down, press [F4] to confirm.

● OTS630 series



Icons	Functions	Operating keys
6	Display contrast adjusting	▼ or ▲
	Target setting Prism/Sheet/Noprism	◀
	Laser pointer On/Off	▶
	Illumination on/off	F1
	Tilt sensor On/Off	F2
	Laser plummet intensity adjusting	F3
PPM	EDM settings	F4

3.8 How to input number and letter

For TS630 series, the number and letter can input with keyboard directly.

Example: Create one file for data collect program

Operating procedure	Operation	Display
①Enter the menu by press the [MENU] key. ②Press [F1] key to enter file selecting screen, press the [F1](INPT) key to rename file name. And press [F1](ALPH) key to switch inputting mode from number to letter. ③Input letter one by one ※1） Input “S” Input “U” Input “N” Input “-” ④Press [F1](ALPH) key to switch inputting mode from letter to number. Input “01” ⑤Press the [F4] key to confirm	[MENU] [F1] [F1] [F1] [1] [1][1][1] [5][5] [3][3][3] [F1] [0][1]	MENU 1/3 F1: DATA COLLECT F2: LAYOUT F3:MEMORY MGR. P SELECT A M.FILE FN: INPT LIST ENT SELECT A M.FILE FN: ALPH SPC CLR ENT SELECT A M.FILE FN=SUN_01 /M0015 NUM SPC CLR ENT After input a number, the cursor will move backward automatically

※1）If one letter need to be input twice or more, after input the front letter, press the ▶ key to move cursor, then input the following letter again.

Press F2 (SPC) key to enter a space.

Press F3[CLR]key, all the input characters will be deleted.

3.9 Vertical Angle Tilt Correction

When the tilt sensors are activated, automatic correction of vertical angle for mislevelment is displayed.

To ensure a precise angle measurement, tilt sensors should be turned on. The display can also be used to precise level the instrument. If the display(X Tilt over) appears the instrument is out of automatic compensation range and must be leveled manually.

The vertical angle display is unstable when instrument is on an unstable stage or a windy day. You can turn off the auto tilt correction function in this case.

Example: Setting Tilt OFF

Operating procedure	Operation	Display
①Under Angle measurement mode, press[F4] to enter P2.	[F4]	VZ: 82° 21′ 50″ HR: 157° 33′ 58″ TILT REMS V% P2
②Press [F1] key. In case ON is already selected, the display shows tilt correction value.※1）	[F1]	TILT [ON] X: -0° 1′ 12″ ON —— OFF ——
③Press[F3](OFF) key. ④Press[ESC]key.	[F3] [ESC]	TILT [OFF] ON —— OFF ——

※1） The setting mode performed here will not be memorized after powering OFF. To set TILT correction in the initialized setting (it is memorized after powering OFF), see Section 6.4.3“Vertical and Horizontal Angle Tilt correction (Tilt ON/OFF)

4. Angle Measurement

4.1 Measuring Horizontal Angle (Right) and Vertical Angle

Make sure the mode is in Angle measurement

Operating procedure	Operation	Display
①Collimate the 1st target (A).	Collimate A	VZ: 89° 25′ 55″ HR: 157° 33′ 58″ 0SET HOLD HSET P1
②Set horizontal angle of target A at 0°00′ 00, press the [F1](0SET) key and press the [F3] (YES) key.	[F1] [F3]	H-ANG SET0 >SET? --- --- YES NO VZ: 89° 25′ 55″ HR: 0° 00′ 00″ 0SET HOLD HSET P1
③Collimate the 2nd target (B).The horizontal angle between B and A and vertical angle of B be displayed.	Collimate B	VZ: 124° 34′ 20″ HR: 56° 21′ 01″ 0SET HOLD HSET P1

Reference: How to Collimate

①Point the telescope toward the light back ground. Turn the diopter ring and adjust the diopter so that the cross hairs are clearly observed.

②Aim the target at the cross hair of the sighting collimator. Allow a certain space between the sighting collimator and yourself for collimating.

③Focus the target with the focusing knob.

※If parallax is created between the cross hairs and the target when your eyes move vertically or horizontally, focusing is incorrect or diopter adjustment is poor. This affects precision in measurement.

Eliminate the parallax by carefully focusing and using diopter adjustment.

4.2 Switching Horizontal Angle Right/ Left

Make sure the mode is Angle measurement.

Operating procedure	Operation	Display
①Press the [F4] key twice to get the function on page3. ②Press [F2] (HARL) key. The mode Horizontal angle Right (HR) Switches to (HL) mode. ③Measure at HL mode as HR mode.	[F4] [F4] [F2]	VZ: 89° 25′ 55″ HR: 168° 36′ 18″ HABZ HARL CMPS P3 VZ: 89° 25′ 55″ HL: 191° 23′ 42″ HABZ HARL CMPS P3
●Every time pressing the [F2] (HARL) key, HR/HL mode switches alternately.		

4.3 Set a Horizontal Angle

1) Setting by Holding the Horizontal Angle

Make sure the mode is angle measurement

Operating procedure	Operation	Display
①Set the required horizontal angle, using Horizontal tangent screw	Display angle	VZ: 89° 25′ 55″ HR: 191° 23′ 42″ 0SET HOLD HSET P1
②Press[F2](HOLD) key.	[F2]	H-ANG HOLD HR: 191° 23′ 42″ >SET? --- --- YES NO
③Collimate the target.※1) ④Press [F3] (YES) key to finish holding the horizontal angle. The display turns back to angle measurement mode.	[F3]	VZ: 89° 25′ 55″ HR: 191° 23′ 42″ 0SET HOLD HSET P1
※1) To return to the previous mode, press the [F4] (NO) key.		

2) Setting a horizontal angle by the number key

Make sure the mode is Angle measurement

Operating procedure	Operation	Display
①Collimate the target.	Collimate	VZ: 89° 25′ 55″ HR: 168° 36′ 18″ " 0SET HOLD HSET P1
②Press[F3](HSET)key.	[F3]	
③Input the required horizontal angle by using keys.※1 For example:80°30′50″	[F1] [80.3050]	H-ANG SET HR= 80.3050 —— —— CLR ENT
④Press [F4] to set the horizontal angle.	[F4]	VZ: 89° 25′ 55″ HR: 80° 30′ 50″ 0SET HOLD HSET P1

※1）If input is mistake, press [MENU] (▶)or [F3](CLR) to cancel the input.

If the input fault, you have to repeat step from ③.

4.4 Vertical Angle Grade Mode Switch

Make sure the mode is Angle measurement

Operating procedure	Operation	Display
①Press[F4] key to get the function on page 2. ②Press [F3](V%) key.※1)	[F4] [F3]	VZ: 67° 38′ 15″ HR: 168° 36′ 19″ 0SET HOLD HSET P1 TILT REMS V% P2 V: 41.13% HL: 168° 36′ 19″ TILT REMS V% P2
※1) Every time pressing the [F3] (V%) key, the display mode switches.		

4.5 Zenith distance/ vertical angle mode switch

Make sure the mode is Angle measurement

Operating procedure	Operation	Display
①Press [F4] (P1) key to get the function on page3. ②Press [F3] (CMPS) key. ※1)	[F4] [F3]	Vz: 67° 38′ 15″ HR: 168° 36′ 19″ 0SET HOLD HSET P1 HABZ HARL CMPS P3 VH: 22° 21′ 42″ HL: 168° 36′ 19″ HABZ HARL CMPS P3
※1) Every time press the [F3] key, the display mode switches. ●At VH mode, vertical angle is 0 when telescope is in horizontal direction.		

4.6 Set Buzzer Sounding for Horizontal Angle 90°

When the horizontal angle falls in the range of ±1°of 0°,90°,180°or 270°, the buzzer sounds. Buzzer stops only when the horizontal angle is adjusted to 0°00′00″, 90°00′00″, 180°00′00″ or 270°00′00″.

This setting is not memorized after powering off.

Make sure the mode is Angle measurement

Operating procedure	Operation	Display
①Press the [F4] key twice to get the function on page 3.	[F4][F4]	Vz: 89° 25′ 55″ HR: 168° 36′ 19″ 0SET HOLD HEST P1 TILT REMS V% P2 HABZ HARL CMPS P3
②Press [F1] key. The previously status is shown on the right up corner.	[F1]	HA Buzzer [OFF] ON OFF --- ENT
③Press [F1] (ON) key or [F2] (OFF) key to select the buzzer ON/OFF.	[F1] or [F2]	HA Buzzer [ON] ON OFF --- ENT
④Press [F4] key to set.	[F4]	VZ: 89° 25′ 55 " HR: 168° 36′ 18 " HABZ HARL CMPS P3

5. Distance Measurement

5.1 Distance Measurement (Slope distance mode)

Make sure the mode is angle measurement.

Operating procedure	Operation	Display
①Press [DISP] key. ②Collimate the center of prism. ③Press[F1]key to start measure distance.※1) ④The measured distance are shown.※2)~※5)	[DISP] [F1]	VZ: 89° 25′ 55″ HR: 168° 36′ 19″ SD: DIST MODE S/A P1 VZ: 89° 25′ 55 " HR: 168° 36′ 18 " SD * m DIST MODE S/A P1 VZ: 89° 25′ 55 " HR: 168° 36′ 18 " SD: 88.888 m DIST MODE S/A P1

※1) When EDM is working, the“- <”mark appears in the display.
※2) The measured distance appears with buzzer sounds.
※3) The displayed measured distance values depend on the different measurement mode. When the mode is Single measurement, the value is the current measured distance; When the mode is Continuous measurement, the latest display is the average value; When the mode is tracking measurement, the measured distance precision is 0.01m.
※4) Press [DISP] key to change distance measurement mode to (HR,HD,VD) modes.
※5)If the target is covered, distance can’t be measured. Please make sure there is nothing between the target and instrument telescope.

5.2 Distance Measurement (HD/VD mode)

Make sure the mode is angle measurement

Operating procedure	Operation	Display
①Press [DISP] key twice to into the HD/VD slope distance mode. ②Collimate the center of prism. ③Press [F1] key. ※1) The measured distances are shown.※2)~※4)	[DISP] twice [F1]	HR: 168° 36′ 18 " HD: 0.000m VD: 0.000m DIST MODE S/A P1 HR: 168° 36′ 18 " HD: 88.886m VD: 0.002 m DIST MODE S/A P1

※1) When EDM is working, the“- <”mark appears in the display.

※2) The measured distance appears with buzzer sounds.

※3) The measured distance display values depend on the different measurement mode. When the mode is Single measurement, the value is the current measured distance; When the mode is Continuous measurement, the latest display is the average value of all; When the mode is tracking measurement, the measured distance precision is 0.01m.

※4) Press [DISP] key to change distance measurement mode to (VZ, HR, SD) modes.

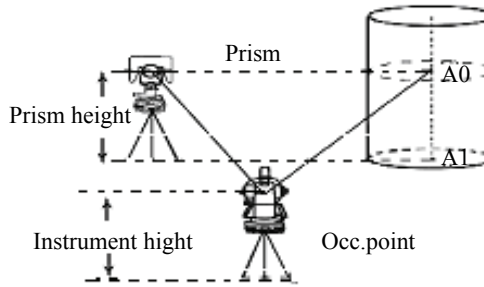
5.3 Distance Offset Measurement

For TS630. Offset measurement has four measuring methods.

1. Angle offset measurement
2. Distance offset measurement
3. Plane offset measurement
4. Column offset measure

5.3.1 Angle offset measurement

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



When measuring coordinates of ground point A1: Set the instrument height and prism height.

When measuring coordinates of point A0, set the instrument height only. (Set the prism height to 0).

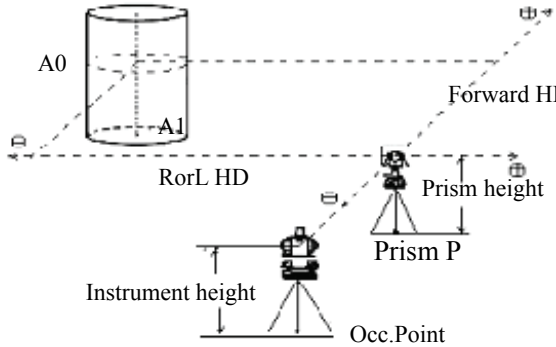
Make sure the mode is Distance measurement.

Operating procedure	Operation	Display
①Press the [F4] to page 2.	[F4]	VZ: 89° 25′ 55″ HR: 168° 36′ 19″ SD: DIST MODE S/A P1 OFST S.O m/f/i P2

②Press the [F1] (OFST) key.	[F1]	OFFSET 1/2 F1: ANG. OFFSET F2: DIST. OFFSET F3: PLANE OFFSET
③Press the [F1](angle offset).	[F1]	ANGLE OFFSET HR: 0° 00′ 00″ HD m MEAS --- --- ---
④Collimate the prism.	Collimate prism	
⑤Press the [F1] (MEAS) key.	[F1]	ANGLE OFFSET HR: 0° 00′ 00″ HD: 12.345m MEAS--- --- ---
⑥Rotate the instrument to collimate the point A0.	Collimate A0	
⑦Each time press [DISP] key to display HD, VD, SD, N, E, Z in sequence.	[DISP]	OFFSET MEAS HR: 20° 00′ 00″ VD: 1.345m NEXT--- --- ---
⑧Press the [F1] (NEXT) key to measure the next point.	[NEXT]	OFFSET MEAS HR: 20° 00′ 00″ N: 501.345m NEXT--- --- ---
1) Press F1:[NEXT] back to step ④ 2) Press [ESC] back to distance measurement mode		

5.3.2 Distance Offset Measurement

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



When measuring coordinates of ground point A1: set the instrument height and prism height. When measuring A0: set instrument height only.

Make sure the mode is Distance measurement

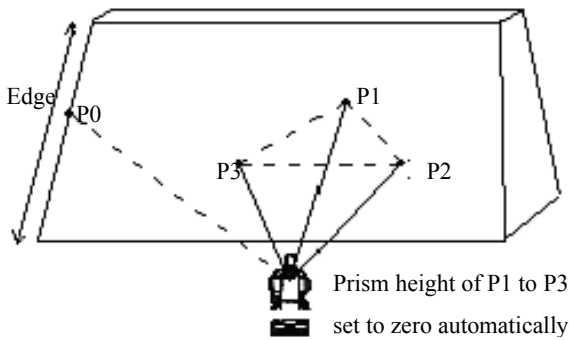
Operating procedure	Operation	Display
①Press the [F4] to page 2.	[F4]	VZ: 89° 25′ 55″ HR: 168° 36′ 19″ SD: DIST MODE S/A P1 OFST S.O m/f/i P2
②Press the [F1] (OFST) key.	[F1]	OFFSET 1/2 F1: ANG. OFFSET F2: DIST. OFFSET F3: PLANE OFFSET

③Press the [F2] key (DIST OFFSET).	[F2]	DISTANCE OFFSET INPUT RorL HD oHD=1.000 --- --- CLR ENT
④Enter Right or Left distance offset value; press [F4] to confirm.	[F4]	DISTANCE OFFSET INPUT FORWARD HD oHD=1.000 --- --- CLR ENT
⑤Enter forward distance offset value; press [F4] to confirm.	[F4]	
⑥Rotate instrument to collimate offset point (Prism P).	Collimate Offset point	DISTANCE OFFSET HR: 168° 36′ 19″ HD: 10.000m NEXT --- --- ---
⑦Press [F1] key, measuring starts.	[F1]	DISTANCE OFFSET HR: 168° 36′ 19″ SD: 11.789m MEAS --- --- ---
⑧Measured data of point A is shown.		
⑨Each time press [DISP] key to display HD, VD, SD, N, E, Z in sequence.	[DISP]	DISTANCE OFFSET HR: 168° 36′ 19″ SD: 11.789m MEAS --- --- ---
⑩Press the [F1] (NEXT) key to measure the next point.	[F1]	N: 12.345m E: 23.345m Z: 1.345m MEAS --- --- ---
1) Press F1:[NEXT] back to step ⑥ 2) Press [ESC] back to step ④		

5.3.3 Plane Offset Measurement

Measuring will be taken for the place where direct measuring can not be done, for example distance or coordinate measuring for a edge of a plane.

Three random points (P1, P2, P3) on a plane will be measured at first in the plane offset measurement to determine the measured plane, collimate the measuring point (P0), the instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane.



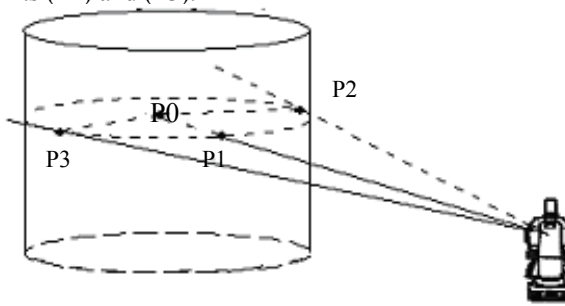
Operating procedure	Operation	Display
①Press the [F4] to page 2.	[F4]	VZ: 89° 25′ 55″ HR: 168° 36′ 19″ SD: DIST MODE S/A P1 OFST S.O m/f/i P2
②Press the [F1] (OFST) key.	[F1]	OFFSET 1/2 F1: ANG. OFFSET F2: DIST. OFFSET F3: PLANE OFFSET

Operating procedure	Operation	Display
③Press the [F3] key (plane offset).	[F3]	PLANE N001# SD: m MEAS --- --- ---
④Collimate point P1, and press the [F1] (MEAS) key to measure. After measuring, the display will show the second point measurement.	Collimate P1 [F1]	LANE N002# SD: m MEAS --- --- ---
⑤Collimate point P2, and press the [F1] (MEAS) key to measure.	Collimate P2 [F1]	PLANE N003# SD: m MEAS --- --- ---
⑥Collimate point P3, and press the [F1] (MEAS) key to measure.	Collimate P3 [F1]	HR : 80° 30′ 40″ HD : 54.321m VD : 10.000m EXIT
⑦Collimate the point P0 on plane edge, the calculated data will be shown.	Collimate P0	HR : 75° 30′ 40″ HD : 54.600m VD : -0.487m EXIT
⑧press [DISP] key to display VR, HR, SD, N, E, Z of P0	[DISP]	VR: 90° 30′ 40″ HR : 75° 30′ 40″ SD : 56.602m EXIT
⑨Press [ESC] back to distance measurement mode	[ESC]	N: 11.237m E: 9.260m Z: 1.234m EXIT

5.3.4 Column Offset Measurement

It is possible to measure circumscription point (P1) of column directly, the distance to the center of the column (P0), coordinate and direction angle can be calculated by measuring circumscription points (P2) and (P3)

The direction angle of the column center is average of circumscription points (P2) and (P3).



Make sure the mode is Distance measurement

Operating procedure	Operation	Display
① Press the [F4] to page 2.	[F4]	VZ: 89° 25′ 55″ HR: 168° 36′ 19″ SD: DIST MODE S/A P1 OFST S.O m/f/i P2
② Press the [F1] (OFST) key.	[F1]	OFFSET 1/2 F1: ANG. OFFSET F2: DIST. OFFSET F3: PLANE OFFSET
③ Press ▼key to display next page	▼	OFFSET 2/2 F1: COLUMN OFFSET

Press the [F1] (column offset) key.		COLUMN OFFSET Center HD: m MEAS --- --- ---
④Collimate the center of column P1, and press the [F1] (MEAS) key to measure N times.	Collimate P1 [F1]	COLUMN OFFSET Center HD* 1.234m < Measuring>
⑤Collimate the left side of the column (P2) and press the [F4] (SET) key.	Collimate P2 [F4]	COLUMN OFFSET Left HR: 12° 34′ 56″ --- --- --- SET
⑥Collimate the right side of the column (P3) and press the [F4] (SET) key.	Collimate P3 [F4]	COLUMN OFFSET Right HR: 12° 34′ 56″ --- --- --- SET
⑦The distance between the instrument and center of the column (P0) will be calculated and shown.		COLUMN OFFSET HR: 12° 34′ 56″ HD: 1.234m NEXT --- --- ---
⑧Each time press [DISP] key to display HD, VD, SD, N, E, Z in sequence.	[DISP]	COLUMN OFFSET HR: 12° 34′ 56″ VD: 0.000m NEXT --- --- ---
⑨Press the [F1] (NEXT) key to measure the next point.	[F1]	

5.4 Stake out (S.O)

The difference between the measured distance and the input stake out distance is displayed.

Displayed value=Measured distances-Stake out distance

In stake out operation, you can select either horizontal distance (HD), relative elevation(VD)or slope distance (SD).

Make sure the mode is Distance measurement

Operating procedure	Operation	Display
①Press [F4] (P1) key from distance measuring mode to get the function on page 2.	[F4]	VZ: 89° 25′ 55″ HR: 168° 36′ 19″ SD: DIST MODE S/A P1
②Press [F2] (S.O) key.	[F2]	OFST S.O m/f/i P2
③Press[F1](HD) key.※1)	[F1]	SET OUT HD: 0.000m HD VD SD ---
④Enter the distance for stake out and press [F4] key.	[F4]	SET OUT HD: 10.000m ---- ---- CLR ENT
Collimate the prism.	[F4] [F1]	HR: 168° 36′ 18 " dHD: -12.410m VD: 0.000m OFST S.O. m/f/i P2
⑤Press [F4] key to return HD mode page 1, press [F1] starts measuring. +value means move prism toward the instrument. -value means move prism backward the instrument.		HR: 168° 36′ 18 " dHD: -12.410m VD: 0.000m DIST REC --- P1

※1) At step ④, if we set the stake out distance as 0, the program will return to normal distance measurement mode.

5.5 Set distance measurement mode

There are two modes can be selected: F1: FINE, F2: TRK

For F1: FINE mode, press [DIST] key to measure distance according to the set times, the first measuring time is about 3s, minimum reading is 1mm.

For F2: TRK mode, press [DIST] key to measure distance continuously until press [ESC] key, the first measuring time is about 2s, minimum reading is 10mm.

Make sure the mode is Distance measurement

Operating procedure	Operation	Display
①Press[F2](MODE) key. Current setting will display at the bottom corner. “T” means current setting is tracking mode. “F” means current setting is fine mode. “C” means current setting is coarse mode. ② Press [F1](FINE), the current setting will change to fine mode, and back to normal measurement screen.	[F2] [F1] [ESC]	VZ: 89° 25′ 55″ HR: 168° 36′ 19″ SD: DIST MODE S/A P1 VZ: 89° 25′ 55″ HR: 168° 36′ 19″ SD: FINE TRK RAP T VZ: 89° 25′ 55″ HR: 168° 36′ 19″ SD: DIST MODE S/A P1

5.6 Set distance unit

Make sure the mode is Distance measurement

Operating procedure	Operation	Display
① Press[F4](P1) key from distance measuring mode to get the function on page 2.	[F4]	VZ: 89° 25′ 55″ HR: 168° 36′ 19″ SD: m DIST MODE S/A P1 OFST S.O m/f/i P2
② Every time press [F3](m/f/i), the current unit will change among m, ft, inch in sequence.	[F3]	VZ: 89° 25′ 55″ HR: 168° 36′ 19″ SD: f OSET S.O. m/f/I P2

5.7 Setting of the Atmospheric Correction

These series Total Station setting the atmospheric correction value by input directly the temperature and pressure value.

Operating procedure	Operation	Display
① Press [★]key.	[★]	6
② Press [F4]( ) key.	[F4]	EDM SET F1: PSM-30.0 PPM -1.9 Signal: [ ] PSM PPM T-P TIMS
③ Press [F3] key.	[F3]	PPM:000 TEMP = 18.0_ ° C PRES : 1020.0 hPa --- --- CLR ENT
④Input the prism constant correction value. ⑤Press[F4]key to save the setting.	[F4]	PPM:000 TEMP = 25_ ° C PRES : 1020.0 hPa --- --- CLR ENT

The atmospheric correction is little effect on distance measurement. But if the input Temp. value and pressure value is big different from the measuring value, the distance different should be more than 0.001m.

Input range: -40. 0℃< Temperature< +60.0℃

-40. 0℉< Temperature< +140.0℉

Input range: +500.0hpa<Pressure< +1500.0hpa

+500.0mbar<Pressure< +1500.0mbar +375.0mmHg<Pressure< +1125.0mmHg +14.8inhg<Pressure< +44.3inhg +7.3psi<Pressure< +21.8hpa

5.8 Returned signal Checking

Check to make sure that sufficient reflected light is returned by the reflective prism sighted by the telescope.

Operating procedure	Operation	Display
① Press [★]key. ② Press [F4] key. ③ The intensity of current returned signal is shown on the third line.. ④ Press[ESC]key to return the previous mode.	[★] [F4] [ESC]	6 EDM SET F1: PSM-30.0 PPM -1.9 Signal: [ ] PSM PPM T-P TIMS

5.9 Setting distance measurement times (Factory setting is “3”)

Operating procedure	Operation	Display
③ Press [★]key.	[★]	6
④ Press [F4] key.	[F4]	EDM SET F1: PSM-30.0 PPM -1.9 Signal: [ ] PSM PPM T-P TIMS
⑤ Press [F4] key.	[F4]	DIST TIMES SET TIMES=3_ --- --- CLR ENT
④ Input the distance measurement times. ⑤ Press[F4]key to save the setting.	[F4]	DIST TIMES SET TIMES=5_ --- --- CLR ENT

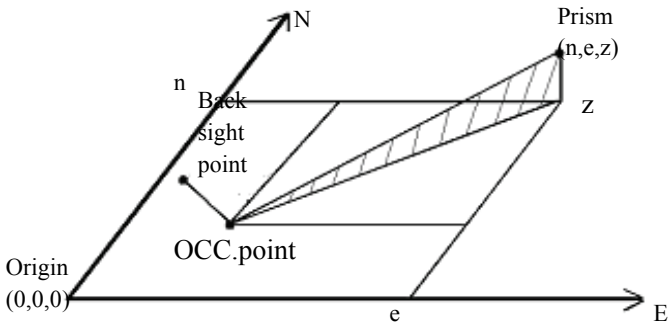
NOTE: It is not possible to set the times as “0”. The appropriate time is “3”, which is better for saving power and high accuracy.

6. Coordinate Measurement

Set the coordinates of the instrument (occupied point) and backsight point, the instrument can measure and displays the unknown point (prism point) coordinates

Press [ ] key to switch to coordinate measurement mode.

.



6.1 Setting Coordinate of Occupied point

1) Coordinate data input by keyboard directly

Operating procedure	Operation	Display
①Press [DISP] key several times until entering coordinate measurement mode.	[DISP] [F4]	N : 0.000m E : 0.000m Z : 0.000m DIST MODE S/A P1 RFHT IHT INCO P2
②Press [F4] key to display the function page2.	[F3]	N = 0.000_ m E : 0.000m Z : 0.000m --- --- CLR ENT
③Press [F3] (INCO) key. ※1）	Enter NEZ data	N : 123.456m E : -987.015m Z : 0.803 m --- --- CLR ENT
④Enter the coordinate. ※2）		
⑤After NEZ coordinate is entered, press [F4] to confirm, the instrument returns coordinate measurement menu on page 2.	[F4]	

※1）“=”means the current entering item, the item can be entered right now. After enter and press [F4] key, the“=” moves to the next line. If this item need not to enter, press [F4] key to move “=” directly.

※2）Input range: -99999999.9990m< N,E,Z< +99999999.9990m

Input range: -99999999.9990ft< N,E,Z< +99999999.9990ft

Input range: -99999999.11.7ft+in< N,E,Z< +99999999.11.7ft+in

6.2 Setting of instrument height

After power off, the instrument height can be saved.

Operating procedure	Operation	Display
①Press [DISP] key to enter coordinate measurement mode. ②Press [F4] key to display the function page2. ③Press [F2] (IHT) key. ④Enter the instrument height, press F4 to confirm, the instrument returns coordinate measurement menu on page 2. ※1）	[DISP] [F4] [F2] Enter Inst.H [F4]	N : 123.456m E : -987.015m Z : 0.803 m DIST MODE S/A P1 RFHT IHT INCO P2 INSTRUMETN HEIGHT INPUT Ins.Hi=1.174_ m --- --- CLR ENT N : 123.456m E : -987.015m Z : 0.803 m RFHT IHT INCO P2

※1） Input range: -999.9990m< Inst.H< +999.9990m
Input range: -999.9990ft< Inst.H< +999.999f0t
Input range: -999.11.7 ft+in< Inst.H< +999.11.7 ft+in

6.3 Setting of target height

After power off, the target height can be saved.

Operating procedure	Operation	Display
①Press [DISP] key to enter coordinate measurement mode .	[DISP]	N : 123.456m E : -987.015m Z : 0.803 m DIST MODE S/A P1
②Press[F4]key to display the function page2.	[F4]	RFHT IHT INCO P2
③Press[F1](RFHT)key.	[F1]	REF HT INPUT Ref.Hr=2.500_ m --- --- CLR ENT
④Enter the target height, press F4 to confirm, the instrument returns coordinate measurement menu on page 2.. ※1）	Enter Targ.H [F4]	N : 123.456m E : -987.015m Z : 0.803 m RFHT IHT INCO P2

※1） Input range: -999.9990m< Ref.H< +999.9990m
Input range: -999.9990ft< Ref.H< +999.9990ft
Input range: -999.11.7 ft+in< Inst.H< +999.11.7 ft+in

6.4 Setting coordinate of backsight point

Direct key input of coordinate data

Operating procedure	Operation	Display
①Displaying the coordinate measurement mode on page3.		N : 123.456m E : -987.015m Z : 0.803 m DIST MODE S/A P1 RFHT IHT INCO P2 OFST BS m/f/i P3
②Press [F2] key to get the function of setting backsight point.	[F2]	N= 0.000_ m E : 0.000m Z: 0.000m --- --- CLR ENT
③Enter the coordinate.		N= 0.000m E : 0.000m Z: 0.000m --- --- CLR ENT
④After NEZ coordinate is entered; press [F4] to confirm.	Input N,E,Z [F4]	
⑤Collimate backsight point prism center, press [F3] (YES) key. The azimuth angle is set, and instrument returns coordinate measurement menu on page 3.	AIM [F3]	BACKSIGHT HR: 12° 34′ 56″ >Sight? YES NO N : 123.456m E : -987.015m Z : 0.803 m OFST BS m/f/i P3

6.5 Measuring point coordinate

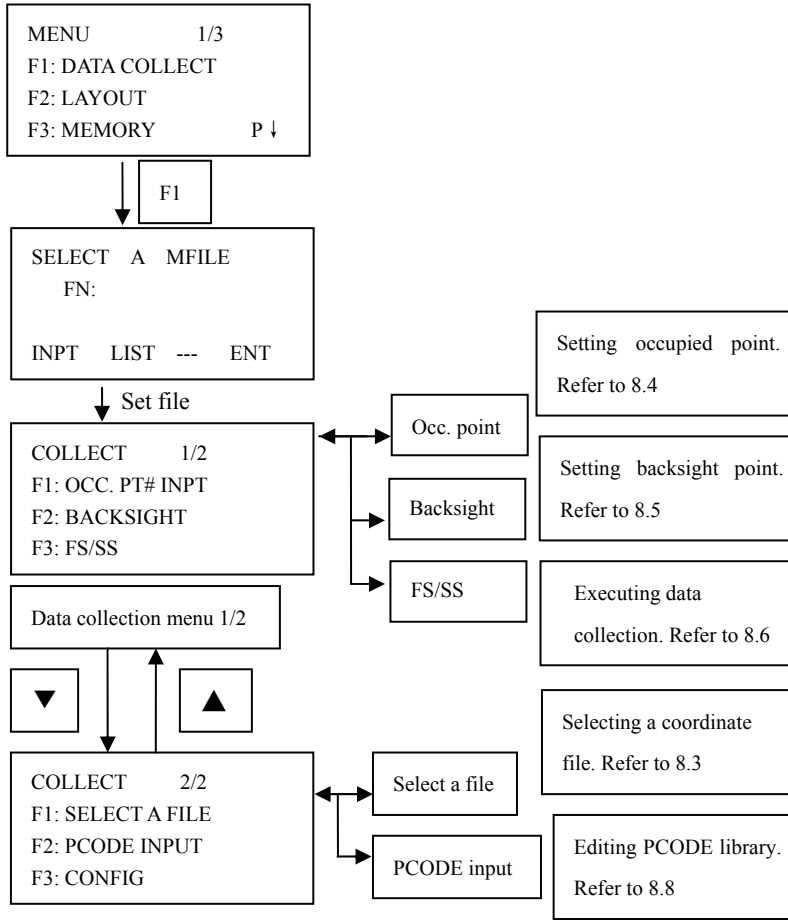
After setting the coordinate of instrument and backsight, instrument height and target height, collimate the point to measure its coordinate.

Operating procedure	Operation	Display
①In coordinate measurement mode function page1. ②Collimate prism, press [F1] key, the instrument begins to measure distance and then give the final result.	Collimate [F1]	N : 123.456m E : 987.654m Z 1.000m DIST MODE S/A P1 N:*[3] -< m E : 1020.821m Z -2.345m DIST MODE S/A P1 N : 135.400m E : 1020.821m Z : -2.345m DIST REC S/A P1

7. Data collection

These series total station is able to store the measured data into the internal memory. The internal memory is shared by the measured data files and the coordinate data files.

7.1 Data collection menu operation



7.2 Selecting a file for data collection

Select a file before beginning data collection. The measured data could be stored into the selected file.

Operating procedure	Operation	Display
①Press [MENU] key enter the menu display.	[MENU]	MENU 1/3 F1:DATA COLLECT F2:LAYOUT F3: MEMORY MGR P↓
②Press [F1] key enter data collection.	[F1]	SELECT A MFILE FN: INPT LIST --- ENT
③Press [F2] key to display the file list. ※1）	[F2]	> *1 /C0003 1SV /C0000 TOP LAST SRCH ENT
④Scroll file list by pressing [▲]or [▼] key and select one file to use.※2）	[▲] [▼]	1 /C0003 >*1SV /C0000 S /C0000 TOP LAST SRCH ENT
⑤Press [F4] key. The file will be set.	[F4]	COLLECT 1/2 F1: OCC. PT# INPT F2: BACKSIGHT F3:FS/SS

※1） If you want to input file name directly, press[F1] key and enter a file name.

※2） When a file has been selected already, “*”mark is indicated on left of current file name.

● It is possible to select a file from DATA COLLECT 2/2, menu in the same way.

7.3 Selecting a coordinate file for data collection

When coordinate data in a coordinate date file are used for occupied point or backsight point, select a coordinate file beforehand.

Operating procedure	Operation	Display
①Enter the page 2 of data collection menu.		COLLECT 2/2 F1 : SELECT A FILE F2 :PCODE INPUT F3 :CONFIG P↓
② Press [F1 key.	[F1]	SELECT A FILE F1 : MEAS.FILE F2: COORD.FILE
③Press [F2] key.	[F2]	SELECT A FILE FN: INPT LIST --- ENT
④ Press[F2] key to display the list of file.	[F2]	> @FOIF_01/0012 FOIF_02/0102 FOIF_03/0008 TOP LAST SRCH ENT
⑤Scroll file list by pressing [▲]or [▼] key and select a file to use.	[▼]	FOIF_01/0012 > @FOIF_02/0102 FOIF_03/0008 TOP LAST SRCH ENT
⑥Press [F4]key. The file will be set.	[F4]	COLLECT 2/2 F1 :SELECT A FILE F2 :PCODE INPUT F3 :CONFIG

7.4 Occupied Point Setting

1) Setting the coordinate data from the internal memory.

Operating procedure	Operation	Display
①Make sure the displaying is Data Collect menu.		COLLECT 1/2 F1 : OCC. PT# INPUT F2 :BACKSIGHT F3 :FS/SS P↓
②Press [F1] (OCC. PT# INPUT) key, displays PT# input menu.	[F1]	PT# > PCODE : Ins.Hi : 1.000 m INPT SRCH REC STN
③Press [F4] key.	[F4]	OCC. PT PT#: INPT LIST NEZ ENT
④Press[F2] key to display the list of PT#.※1）	[F2]	[FOIF] > F001 F002 VIEW SRCH --- ENT
⑤Scroll PT# list by pressing [▲] or [▼] key and select PT#. Press [F4] key. ※2）※3）	[▲]or [▼] [F4]	N 5.620m E 4.210m Z 1.250m >OK? YES NO
⑥Press [F3] to select YES. ⑦Enter Ins. Hi, PCODE, Press [F3] key. ※4）	[F3]	PT# >F001 PCODE : Ins.Hi : 1.000 m INPT SRCH REC STN

※1）If you want to input PT# directly, press [F1]key and enter PT#.

※2）The coordinate data can be viewed by press [F1](VIEW)key.

※3）The coordinate data can be searched by press [F2](SRCH) key.

※4）If the input number is 1-50, it should be ID of PCODE in library.

2) Input the instrument point coordinates by hand

Operating procedure	Operation	Display
①Make sure the displaying is Data Collect menu.		COLLECT 1/2 F1: OCC. PT# INPT F2: BACKSIGHT F3: FS/SS
②Press[F1](OCC. PT# INPUT) key , displays PT# input menu.	[F1]	PT# > PCODE: Ins.Hi : 1.000 m INPT SRCH REC STN
③Press [F4] key.	[F4]	OCC. PT PT#: INPT LIST NEZ ENT
④ Press [F3] (NEZ) to enter coordinate input menu. ⑤Press[F1]key and enter coordinate values. ※ 1）	[F3] [F1] Input coord [F4]	N: 123.456 m E: 987.654 m Z= -1.608_ m --- --- CLR ENT
⑥ Press [F3] (YES) to record the input coordinate to memory.	[F3]	N: 123.456 m E: 987.650 m Z: -1.608 m >REC ? [YES] [NO]
⑦After enter the PT# and then press [F4] to confirm	[F4]	INPUT COORD PT# : 5 INPT LIST --- ENT
		PT# >5 PCODE : Ins.Hi : 1.000 m INPT SRCH REC STN

7.5 Backsight Point

1) Setting the coordinate data from the internal memory

Make sure the mode is Data Collect.

Operating procedure	Operation	Display
① Make sure the displaying is Data Collect menu.		COLLECT 1/2 F1 :OCC.PT# INPUT F2 :BACKSIGHT F3 :FS/SS P↓
②Press [F2] (BACK SIGHT) key.	[F2]	BS# > PCODE: Ref.Hr: 0.000m INPT 0SET MEAS BS
③Press [F4] (BS) key. ※1）	[F4]	BACK SIGHT PT# : INPT LIST NEAZ ENT
④Press[F1] key and enter PT#.※2）	[F1] Input PT#	BACK SIGHT PT# =F002_ ALPH SPC CLR ENT
⑤Press[F4] key, the coordinate will display	[F4]	
⑥Press [F4] (YES) key.	[F4]	N: 22.000m E: 123.210m Z: 100.000m >OK? [NO] [YES]
⑦ Collimate backsight point, press [F4] (YES) key. ※3) The display returns to BS menu, press [ESC] return to Data Collect main menu.	[F3]	BACKSIAHT HL :179° 59′ 07″ >Sight? dHD NO YES
		BS# >F002 PCODE : Ref.Hr: 0.000m INPT BS MEAS 0SET

※1）The coordinate data can be searched by press [F2](LIST)key.
※2) Press [F3] key, bacsight setting mode will be switched among NEAZ/AZ/PT#.
※3) Press [F1](dHD) to measure the horizontal difference between calculated Backsight and true backsight.

2) Setting the direction angle

Make sure the mode is Data Collect.

Operating procedure	Operation	Display
① Make sure the displaying is Data Collect menu.	[F2]	COLLECT 1/2 F1 :OCC.PT# INPUT F2 :BACKSIGHT F3 :FS/SS P↓
② Press [F2](BACK SIGHT) key.	[F3]	BS# > PCODE: Ref.Hr: 0.000m INPT 0SET MEAS BS
③Press[F4](BS) key. ※1）	[F3]	BACK SIGHT PT# : INPT LIST NEAZ ENT
④Press [F3] twice to enter AZ inputting menu.		BACK SIGHT HR: INPT ---- PT# ENT
⑤ Press[F1] key, input the direction angle. 186°56′00″ Press [F4] key.	[F1] [186.5600] [F4]	BACK SIGHT HR=186.5600_ --- --- CLR ENT
⑥ Collimate backsight point, press [F3]key. The display returns to BS menu.	Collimate backsight point [F3]	BACKSIAHT HL :186° 56′ 00″ >Sight? YES NO

7.6 Operational Procedure of “Data Collect”

Make sure the mode is Data Collect.

Operating procedure	Operation	Display
①Press [F3] (FS/SS) key.	[F3]	PT# > PCODE : 0 Ref.Hr : 0.000m INPT SRCH MEAS ALL
②Press [F1] key and input PT#, PCODE, Ref.Hr. Press [F3](MEAS)key. ※1）	[F3]	PT# :F021 PCODE : FOIF Ref.Hr : 1.000m VH HD NEZ OFST
③There are four modes can be selected, press [F2](HD) key, HD/VD data will be measured.※2）※3）	[F2]	HR : 0° 00′ 00″ HD: m VD - <Meauring>
④Press [F3](YES) to record the measured data to memory. ※4)	[F3]	HA : 58° 14′ 22″ HD: 56.461 m VD: 5.625 m >OK [YES] [NO]
④The display changes to previous menu, and it is ready to measuring next point. PT# is automatically incremented. Press [F4] (ALL) key to measure next point in the same measuring mode(HD) with previous point.※5）※6）	[F4]	PT# :F022 ID :FOIF Ref.Hr : 1.000m INPT SRCH MEAS ALL HR : 180° 05′ 18″ HD: m VD - <Measuring>

※1）When the mark > is located PCODE, PCODE can be input directly, or recall by inputting a register number linked with PCODE Library. To show the list of PCODE library, press the [F2] (SRCH)

※2）VH means the measured data is in angle format, the HD/SD means the data is in angle and distance format, NEZ means the data is in coordinate format.

※3）In DATA COLLECT/CONFIG/F1:HD/SD menu, if current setting is SD, here SD is displayed to be set

※4）In DATA COLLECT/CONFIG/F3:DATA CONFIRM menu, if current setting is NO, this asking screen will not display and the measured data will be recorded automatically.

※5）Press F4 (ALL) to measure next point, the PT# will increase one automatically, PCODE and the Ref.Hr, and distance measurement mode will not change, according to your need to edit every item before selecting ALL.

※6）While executing the DATA COLLECT mode, you can search the recorded data.

● While executing the DATA COLLECT mode, press [F2](SRCH) key.

```
PT#      :F022
ID       :FOIF
Ref.Hr :       1.000m
INPT   SRCH MEAS   ALL
```

● Select one of three search methods by pressing [F1] to [F3] key

The operation is same as the "SEARCH" in the MEMORY MANAGER mode.

```
MEAS.DATA SEARCH
F1:FIRST DATA
F2:LAST DATA
F3:PT# DATA
```

7.7 Setting PCODE for measured point

7.7.1 Entering PCODE / ID using PCODE Library

While executing the DATA COLLECT mode, you can enter PCODE /ID from PCODE Library.

Operating procedure	Operation	Display
①Move the arrow to the PCODE		PT# :F023 PCODE > Ref.Hr : 0.000m INPT SRCH MEAS ALL
②Press [F1]to enter a register number linked with PCODE library and press the [F4](ENT) key. (Example) Register number, 12 = FOIF	[F1] Input ID of PCODE [F4]	PT# :F023 PCODE =12_ Ref.Hr : 0.000m NUM SPC CLR ENT PT# :F023 PCODE :FOIF Ref.Hr > 0.000m INPT SRCH MEAS ALL

7.7.2 Entering PCODE / ID from the list of PCODE

You can also enter PCODE / ID from the list of PCODE.

Operating procedure	Operation	Display
①Move the arrow to the PCODE, press [F2](SRCH)	[F2]	PT# :F023 PCODE > Ref.Hr : 0.000m INPT SRCH MEAS ALL
②By pressing the following keys, the register number will increase or decrease. [▲]or[▼]:Increasing or decreasing one by one [◀] or [▶]: By ten increasing or Decreasing. *1)		>001:TREE 002:SYG EDIT --- CLR ENT 011:DKIID >012:FOIF 013:IOOF EDIT --- CLR ENT
Press [F4] (ENT) to confirm.	[F4]	PT# :F023 PCODE >FOIF Ref.Hr > 0.000m INPT SRCH MEAS ALL

※1） To edit the PCODE library, press the [F1](EDIT) key.

To delete the PCODE registered with shown an arrow, press the [F3] (CLR) key.

PCODE can be edited in DATA COLLECT menu 2/2 or MEMORY MANAGER menu 2/3.

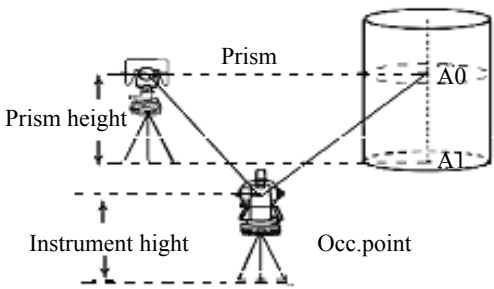
7.8 Data Collect Offset Measurement mode

For these series total station, Offset measurement has four measuring methods:

1. Angle offset measurement
2. Distance offset measurement
3. Plane offset measurement
4. Column offset measurement

7.8.1 Angle offset measurement

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



When measuring coordinates of ground point A1: Set the instrument height and prism height.

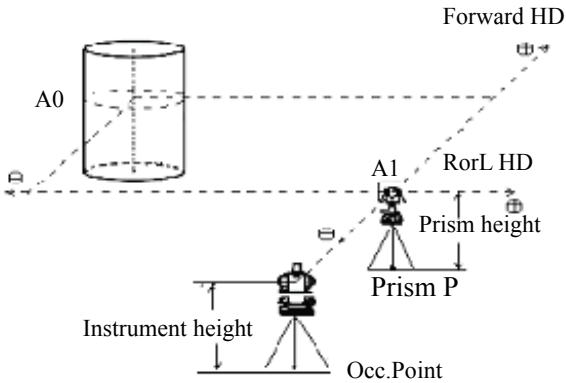
When measuring coordinates of point A0: set the instrument height only.(Set the prism height to 0). Make sure the mode is Data Collect.

Operating procedure	Operation	Display
①Press the [F3] (MEAS) key.	[F3]	PT# > PCODE: Ref.Hr : 0.000m INPT SRCH MEAS ALL VH HD NEZ OFST

②Press the [F4] (OFST) key.	[F4]	OFFSET 1/2 F1: ANG. OFFSET F2: DIST. OFFSET F3: PLANE OFFSET
③Press the [F1] (angle offset).	[F1]	ANGLE OFFSET HR: 120° 30′ 40″ HD: m >Sight? YES NO
④Collimate the prism, press [F3] to measure distance.	Collimate prism [F3]	ANGLE OFFSET HR: 120° 30′ 40″ HD*[3] - > m <Measuring>
⑤Collimate point A0 using the horizontal motion clamp and horizontal tangent screw. ※1） Press [F3] (YES) to confirm, the measured data of A0 will be recorded.	Collimate A0 [F3] [F3]	ANGLE OFFSET HR: 0° 00′ 00″ HD m >OK? [YES] [NO] PT# :F003 PCODE >0 Ref.Hr : 0.000m INPT SRCH MEAS ALL
※1）The factory setting of display is horizontal distance, each time pressing [DISP] key, HD, VD, SD, N, E, Z are shown in sequence, and recorded mode is displayed mode.		

7.8.2 Distance Offset Measurement

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



When measuring coordinates of ground point A1: set the instrument height and prism height. When measuring A0: set instrument height only.

Make sure the mode is Data Collect.

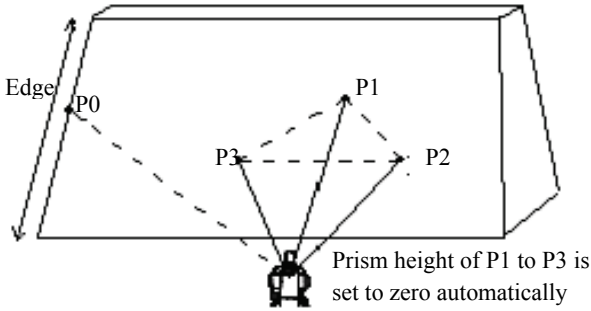
Operating procedure	Operation	Display
①Press the [F3] (MEAS) key	[F3]	PT# :F003 PCODE >0 Ref.Hr : 0.000m INPT SRCH MEAS ALL VH HD NEZ OFST
②Press the [F4] (OFST) key.	[F4]	OFFSET 1/2 F1: ANG. OFFSET F2: DIST. OFFSET F3: PLANE OFFSET

③Press the [F2] key (DIST OFFSET).	[F2]	DISTANCE OFFSET INPUT RorL HD oHD: m --- --- CLR ENT
④Enter Right or Left distance offset value; press [F4] to confirm.	[F4]	DISTANCE OFFSET INPUT RorL HD oHD=1_ --- --- CLR ENT
⑤Enter forward distance offset value; press [F4] to confirm.	[F4]	DISTANCE OFFSET INPUT FORWARD HD oHD=2_ --- --- CLR ENT
⑥Enter the PT#, PCODE, Ref.Hr. Collimate the prism, select measuring mode as distance or coordinate, and then begin measure distance.	Collimate prism SD	PT# >F003 PCODE :M Ref.Hr : 1.000m --- SD COOR --- VZ: 95° 55′ 50″ HR: 117° 17′ 22″ SD: 10.360m >OK? [YES] [NO]
⑧Measured data is shown, press [F3] (YES) the data is recorded and the next measuring point is displayed.	[F3]	PT# :F004 PCODE: Ref.Hr : 0.000m INPT SRCH MEAS ALL

7.8.3 Plane Offset Measurement

Measuring will be taken for the place where direct measuring can not be done, for example distance or coordinate measuring for a edge of a plane.

Three random points (P1, P2, P3) on a plane will be measured at first in the plane offset measurement to determine the measured plane, collimate the measuring point (P0), the instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane.



Operating procedure	Operation	Display
①Press the [F3] (MEAS) key	[F3]	PT# :F004 PCODE >0 Ref.Hr : 0.000m INPT SRCH MEAS ALL VH HD NEZ OFST
②Press the [F4] (OFST) key.	[F4]	OFFSET 1/2 F1: ANG. OFFSET F2: DIST. OFFSET F3: PLANE OFFSET

Operating procedure	Operation	Display
③Press the [F3] key (plane offset).	[F3]	PLANE N001# SD: m MEAS --- --- ---
④Collimate point P1, and press the [F1] (MEAS) key to measure. After measuring, the display will show the second point measurement.	Collimate P1 [F1]	PLANE N002# SD: m MEAS --- --- ---
⑤Collimate point P2, and press the [F1] (MEAS) key to measure.	Collimate P2 [F1]	PLANE N003# SD: m MEAS --- --- ---
⑥Collimate point P3, and press the [F1] (MEAS) key to measure.	Collimate P3 [F1]	PLANE PT# >F004 PCODE: V INPT SRCH --- MEAS
⑦Collimate the point P0 on plane edge.	Collimate P0	HR : 12° 34′ 56″ HD : 1.234m VD : 0.000m > OK? [YES] [NO]
⑧Press the F4 (MEAS) key, the instrument calculates and displays coordinate and distance value of cross point between collimation axis and of the plane.※1）※2）	[F4]	N: 1.234m E: 1.234m Z: 1.234m > OK? [YES] [NO]
⑨Press [DISP] key to show different display mode in sequence. ※3）		
⑩Press the [F3] (YES) key to confirm and record, the display returns to the next point number in Plane Offset menu.		PLANE PT# >F005 PCODE: V INPT SRCH --- MEAS

※1）In case the calculation of plane was not successful by the measured three points, error displays. Start measuring over again from the first point.

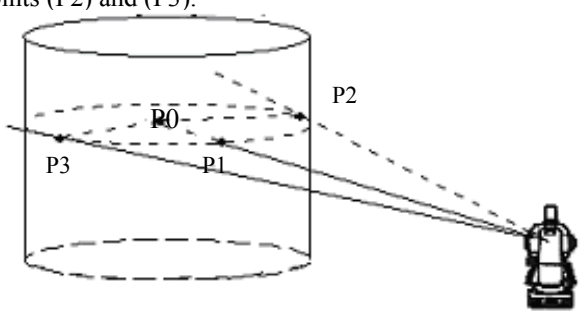
※2）Error will be displayed when the collimated direction does not cross with the determined plane.

※3）Each time pressing [DISP] key, HD, VD, SD, N, E, Z are shown in sequence, and the recorded mode is as displayed mode.

7.8.4 Column Offset Measurement

It is possible to measure circumscription point (P1) of column directly, the distance to the center of the column (P0), coordinate and direction angle can be calculated by measuring circumscription points (P2) and (P3)

The direction angle of the column center is average of circumscription points (P2) and (P3).



Operating procedure	Operation	Display
①Press the [F3] key (MEAS) ②Press the [F4](OFST) key, press [EDM] key to show next page.	[F3] [F4] [EDM]	PT# :F005 PCODE >0 Ref.Hr : 0.000m INPT SRCH MEAS ALL VH HD NEZ OFST

③Press the [F1] (column offset) key.		OFFSET 2/2 F1: COLUMN OFFSET
④Collimate the center of column P1, and press the [F1] (MEAS) key to measure N times.	Collimate P1 [F1]	COLUMN OFFSET Center HD: m MEAS --- --- ---
		COLUMN OFFSET Center HD* 1.234m < Measuring>
⑤Collimate the left side of the column (P2) and press the [F4] (SET) key.	Collimate P2 [F4]	COLUMN OFFSET Left HR: 12° 34′ 56″ --- --- --- SET
⑥Collimate the right side of the column (P3) and press the [F4] (SET) key.	Collimate P3 [F4]	COLUMN OFFSET Right HR: 12° 34′ 56″ --- --- --- SET
⑦The distance between the instrument and center of the column (P0) will be calculated and shown.		COLUMN OFFSET HR: 12° 34′ 56″ HD: 1.234m > OK? [YES] [NO]
⑧Press [DISP]to show different display mode in sequence. ※1） ⑨Press the [F3] (YES) key to confirm and record.	[F3]	COLUMN OFFSET HR: 12° 34′ 56″ VD: 0.000m > OK? [YES] [NO]
※1）Each time pressing [DISP] key, HD, VD, SD, N, E, Z are shown in sequence, and the recorded mode is displayed mode.		

7.9 NEZ Auto Calculation

As measured data is collected, coordinates are calculated and stored for traverse or topo collection. Automatic making out function of coordinate data sets up in CONFIG of data collect. Refer to Section 7.10 “Setting Parameter of Data Collect [CONFIG.]”.

As a default, coordinate data calculated will be saved in a file of the same name as the measurement data file. When the coordinate data file of the same name as the measurement data file does not exist, it wills be generated automatically. It is possible to change a file for saving coordinate data in the DATA COLLECT Menu 2/2 (F1: SELECT A FILE).

To calculate a coordinate data, it is necessary to add a point number in Data Collect execution. When a coordinate data of the same point number exist already, it can be replaced with the new data by confirming display.

● Coordinates will be calculated using the grid factor. To set the grid factor, see Section 8.6“Setting the GRID FACTOR”

7.10 Setting Parameter of Data Collect [CONFIG.]

In this mode, the following settings of data collect mode are possible

● Setting Items:

Menu	Selecting Item	Contents
F1:HD/SD	HD/SD	Select the distance measurement mode Horizontal Distance or Slope distance.
F2:MEAS ORDER	N TIMES/S TIMES/REPEAT	Select to set measurement mode for distance measurement.
F3:DATA CONFIRM	YES/NO	It is possible to confirm the result of measuring data before the data is recorded.
F1:COLLECT ORDER	Edit→Meas/ Meas→Edit	Select the procedure of data collection. [EDIT →MEAS]: Measurement is carried out after entering other data. [MEAS→EDIT]: Measurement is carried out before entering other data.
F2:NEZ AUTO.CALC	ON/OFF	It is possible to calculate coordinate value of data collected and store it into coordinate data file in every data collection.

● How to Set items

Example Setting: DATA CONFIRM: YES

Operating procedure	Operation	Display
①The instrument in Data Collect mode.		COLLECT 1/2 F1: OCC.PT# INPUT F2: BACKSIGHT F3: FS/SS
②Press [▼] to enter collect menu 2/2.	[▼]	COLLECT 2/2 F1:SELECT A FILE F2: PCODE INPUT F3:CONFIG
③Press [F3] to show CONFIG menu.	[F3]	CONFIG F1: HD/SD F2: MEAS ORDER F3: DATA CONFIRM P↓
④Press [F3] (DATA CONFIRM).	[F3]	Data Confirm F1:YES [F2:NO] ENT
⑤Press [F1](YES) key, then press [F4] key to confirm.	[F1] [F4]	Data Confirm [F1:YES] F2:NO ENT

8. Coordinate Layout

Layout mode has two functions which are setting of layout points and setting new points using coordinate data in the internal memory. Also, if the coordinate data is not stored in the internal memory, this can be input from key board. The coordinate data is loaded from PC to the internal memory via RS-232C or USB/SD card.

The coordinate data

The coordinate data is memorized into a file, the memory has three recorded parts, one is for measured data, another is for coordinate data, and the last one is for PCODE data.

For the internal memory, refer to Chapter 10 “Memory Manager Mode”

1) When turning off the power, ensure that you are in the main menu screen or angle measurement mode. This ensures completion of the memory access process and avoids possible damage of the stored data. 2) It is recommended for safety to charge the battery beforehand and prepared fully charged spare batteries.

8.1 Layout procedures

1) Selecting a file for layout.

2) Input Occ. point.

3) Input backsight point or backsight angle.

4) Input or pick-up (from internal memory) the coordinate data for layout point. Start layout.

8.2 Selecting or creating a coordinate data file

You can execute a Layout from selected coordinate date file.

Here one existing coordinate data file can be selected; also you can input a new file name to create one new file for coordinate layout

Operating procedure	Operation	Display
①Press [MENU] key, the instrument will be in MENU mode.	[MENU]	MENU 1/3 F1: DATA COLLECT F2: LAYOUT F3: MEMORY MGR P↓
②Press [F2] key, to enter file selecting menu.	[F2]	SELECT A CFILE FN: INPT LIST SKIP ENT
③Press [F2] key to display the list of coordinate data file. ※1）※2）	[F1]	> *1 /C0002 1SV /C0000 TOP LAST SRCH ENT
④Scoll file list by pressing the [▲]or[▼]key and select a file to use.※3） ⑤Press [F4] key, the file will be selected. Instrument enters Layout Menu.	[▼] [F3]	*1 /C0002 > 1SV /C0000 S /C0000 TOP LAST SRCH ENT Layout 1/2 F1: OCC. PT# INPUT F2: BACKSIGHT F3: LAYOUT P↓

※1）If you want to input file name directly, press[F1]key to enter.

※2）If you input a file name that it is not found in memory, a new coordinate with input name will be created automatically.

※3）When a file has been selected already, mark .“@”is indicated on left of current file name.

● It is possible to select a file from Layout 2/2, menu in the same way.

8.3 Occupied Point Setting

1) Setting the coordinate data from the internal memory.

Example: Confirm the coordinate data file has been selected already

Operating procedure	Operation	Display
①The instrument be in LAYOUT mode.		Layout 1/2 F1: OCC. PT# INPUT F2: BACKSIGHT F3: LAYOUT P↓
②Press [F1] key.	[F1]	OCC. PT PT# : INPT LIST NEZ ENT
③Press [F2] key. ※1）	[F2]	> 2 1 VIEW SRCH --- ENT
④Press [▲] or [▼] key to select PT#. ※2）※3）Press [F4] key to confirm.	[F4]	N 5.620m E 4.210m Z 1.250m >OK? [YES] [NO]
⑤ Press [F3] key to select YES.	[F3]	
⑥Input Ins.Hi. Range:-999.999~ +999.999m Press [F4] key.	[F4]	INSTRUMENT HEIGHT INPUT Ins.Hi =1.000 m --- --- CLR ENT

※1）Direct input PT#: Press [F1] key and input PT#.

※2）The selected coordinate data can be viewed by press[F1](VIEW) key.

※3）The coordinate data can be searched by press[F2](SRCH).

2) Input the instrument point coordinates by hand

Make sure the coordinate data file is selected.

Operating procedure	Operation	Display
①Layout menu.		Layout 1/2 F1: OCC. PT# INPUT F2: BACKSIGHT F3: LAYOUT
②Press [F1] key.	[F1]	OCC. PT PT# INPT LIST NEZ ENT
③Press [F3] (NEZ) key to coordinate inputting mode.	[F3]	N > 0.000m E 0.000m Z 0.000m INPT --- PT ENT
④Press [F1] key and enter N coordinate value; press [F4] to confirm. ※ 1）	[F1] [F4]	N = 123.456_ m E : 0.000 m Z : 0.000 m --- --- CLR ENT
⑤Enter E coordinate, press [F4] to confirm. ※ 2）	[F4]	N: 123.456 m E= 987.65_ m Z : 0.000 m --- --- CLR ENT
⑥Enter Z coordinate, and press [F4].	[F4]	N: 123.456 m E: 987.65 m Z= -1.608_ m --- --- CLR ENT

Operating procedure	Operation	Display
⑦ Press[F3](YES) key to record the inputted data to memory. ※ 1）	[F4]	N: 123.456 m E: 987.65 m Z: -1.608 m >REC ? [YES] [NO]
⑧ Input the PT# for input coordinate, press [F4] key.	Input PT# [F4]	INPUT COORD PT# : INPT LIST --- ENT
⑨ Input the instrument height. Press [F4] key to confirm.	Input Instr.H [F4]	INTRUMENT HEIGHT INPUT Ins.Hi=1.5 _ --- --- CLR ENT
⑩ Back to Layout menu.		Layout 1/2 F1: OCC. PT# INPUT F2: BACKSIGHT F3: LAYOUT

※1) The item following "<" is current inputting item. After the inputting of this item press F4 to confirm, the mark "<"will move downward to another item. Otherwise, press ▼ the cursor "<" will also move to other item.

※2) If the setting of MANUAL NEZ REC is OFF at parameters menu, the PT# inputting screen will not display, and the inputted coordinates isn't recorded to memory, and can not be recalled from memory in the future.

3) Input the point number of occupied point directly

Refer to Chapter 7.2 to select the Coordinate data file

Operating procedure	Operation	Display
①The instrument be in LAYOUT mode.		Layout 1/2 F1: OCC. PT# INPUT F2: BACKSIGHT F3: LAYOUT
②Press [F1] key.	[F1]	OCC. PT PT# : INPT LIST NEZ ENT
③Press [F1] key to enter the point number, and press [F4] to confirm.	[F1] Enter PT# [F4]	OCC. PT PT# =F023_ ALPH SPC CLR ENT
④The coordinate value will display. ⑤ Press [F3] key to select YES.	[F3]	N 5.620m E 4.210m Z 1.250m YES NO
⑥Input Ins.Hi. Range:-99.999~ +99.999m Press [F4] key to confirm, instrument will back to Layout menu automatically.	Input Inst.H [F4]	INTRUMENT HEIGHT INPUT Ins.Hi=1.5 _ --- --- CLR ENT Layout 1/2 F1: OCC. PT# INPUT F2: BACKSIGHT F3: LAYOUT

8.4 Setting Backsight Point

1) Setting the coordinate data file from the internal memory

Make sure the instrument displays layout menu

Operating procedure	Operation	Display
①Press [F2] (BACKSIGHT) key to set backsight point.	[F2]	BACKSIGHT PT# INPT LIST NEAZ ENT
②Press [F2] key to view data file. ※1）※2）	[F2]	> 2 1 VIEW SRCH --- ENT
③Press [▲] or [▼] key to select PT#. Press [F4] key.	[▼] [F4]	
④The coordinate value will display. Press [F4] key to select YES. ※3）	[F4]	N 1.000m E 2.000m Z 1.100m >OK? [NO] [YES]
⑤Collimate backsight, press [F3] key and return back the layout menu. ※4）	Collimate backsight [F3]	BACKSIGHT HR:283° 25′ 33″ >Sight? --- dHD YES NO
		Layout 1/2 F1: OCC. PT# INPUT F2: BACKSIGHT F3: LAYOUT P↓

※1）Press [F1](VIEW) key the coordinate data values can be displayed.

※2）Press [F2](SRCH) key the coordinate data can be searched by entering PT#.

※3）Press [F4](NO) key return to points list menu.

※4）Press[F2](dHD) to measure the difference between calculated backsight and true backsight

2) Direct key input of coordinate data

Make sure the instrument displays layout menu

Operating procedure	Operation	Display
①Press [F2] key to enter backsight point setting screen.	[F2]	BACKSIGHT PT# : INPT LIST NEAZ ENT
②Press [F3] (NEAZ) key.※1）	[F3]	N > 0.000m E : 0.000m Z: 0.000m INPT ---- AZ ENT
③Press [F1] key and enter N, E, Z coordinates in turns. Press [F4] key. ※2）	[F1] [F4] [F4]	N: 123.450m E: 987.640m Z= 564.230_ --- --- CLR ENT
④Press [F3] key to record the input data.	[F3]	N: 123.450m E : 987.640m Z : 564.230 >REC ? [YES][NO]
⑤Press [F1] to input PT#, then press [F4] to confirm.	[F1] Input PT#	INPUT COORD PT#: INPT LIST --- ENT
⑥Collimate backsight, press [F3]key and return back the layout menu. ※3）	[F4] [F3]	BACKSIGHT HR:283° 25′ 33″ >Sight? dHD YES NO

※1） With each pressing of [F3] key, switched among PT#, NEAZ (coordinate) and AZ (backsight angle).

※2) The item following “<” is current inputting item. After the inputting of this item press F4 to confirm, the mark “<” will move downward to another item. Otherwise, press ▼ the cursor “<” will also move to other item.

※3） Press[F2](dHD) to measure the difference between calculated backsight and true backsight.

3) Direct key input of setting angle.

Make sure the instrument displays layout menu

Operating procedure	Operation	Display
①Press [F2] key.	[F2]	BACKSIGHT PT# : INPT LIST NEAZ ENT
②Press[F3](NEAZ) key.※1）	[F3]	N > 0.000m E: 0.000m Z: 0.000m INPT --- AZ ENT
③Press [F3] (AZ) key.	[F3]	BACKSIGHT HR: INPT ---- PT# ENT
④Press [F1] key and enter setting angle. 123°16′18″ Press [F4] key.	[F1] [123.1618]	BACKSIGHT HR =123.1618 --- --- CLR ENT
⑤Collimate backsight, press [F3] key and return back the layout menu.	[F4] Collimate backsight [F3]	BACKSIGHT HR :123° 16′ 18″ >Sight? YES NO

※1） With each pressing of [F3] key, switched among PT#, NE (coordinate) and AZ (backsight angle).

8.5 Executing a Layout

The following methods can be selected for executing a layout.

1) Recalling points from internal memory by point number.

2) Direct key input of coordinate values.

Example setting: recalling point from internal memory

Operating procedure	Operation	Display
①Make sure the displaying is layout menu.		Layout 1/2 F1: OCC. PT# INPUT F2: BACKSIGHT F3: LAYOUT P↓
②Press [F3] (LAYOUT) key.	[F3]	LAYOUT PT# : INPT LIST NEZ ENT
③Press [F2] (LIST) key. ※1）	[F2]	[FOIFMA] > 2 1 VIEW SRCH --- ENT
④Press [▲] or [▼] key to select PT#. Press [F4] key. ※2）※3）	[F4]	N: 2.615m E: 3.186m Z: 1.268m >OK? [YES] [NO]
⑤Press [F3] (YES) key to confirm the coordinate. ※4）	[F3]	
⑥Input target height Ref.Hr. ⑦Press [F4] key.	[F4]	REF HT INPUT Ref.Hr=1.75_ --- --- CLR ENT
HR: calculated horizontal angle of the layout point HD: Calculated horizontal distance from the instrument		CACULATED HR: 44° 38′ 29″ HD: 173.464m ANG DIST --- ---

to the layout point ⑧Collimate the prism, press [F1] (ANG) key. HR: measured(actual) horizontal angle dHR: Horizontal angle to be turned to the layout point=Actual horizontal angle-Calculated horizontal angle. Correct direction when dHR= 0°00′00″	[F1]	PT# : HR : 44° 38′ 29″ dHR: 30° 38′ 29″ DIST --- CORD ---
⑨Press [F1] (DIST) key to measure distance. dHD: Measuring(Actual) horizontal distance dHD: Horizontal distance to be moved to the layout point=Actual horizontal distance-Calculated horizontal distance. dZ: Vertical distance to be moved to the layout point=Actual vertical distance-Calculated vertical distance. Press the [ESC] to stop measure.	[F1] [ESC]	dHR: 346° 08′ 20″ dHD: -7.810 m dZ : - 0.022 m DIST MODE ANG NEXT

When the display value dHR, dHD and dZ are equal to 0, the layout point is established. ※4）※5） ⑪Press [F3] (ANG) key to setting screen, press [F3] (CORD) key again, the coordinate data is shown. Press [F2] mode key to setting the distance measuring mode. ⑬Press [F4] key to set next layout point.	[F3] [F3]	dHR: 000° 00′ 12″ dHD: -0.001 m dZ : - 0.002 m DIST MODE ANG NEXT PT# : HR : 44° 38′ 29″ dHR: 30° 38′ 29″ DIST --- CORD --- N: 56.287 m E: 986.321 m Z: 123.345 m DIST MODE ANG NEXT LAYOUT PT#: INPT LIST NEZ ENT

※1）If you want to input PT# directly, press [F1]key and enter PT#.

※2）The coordinate data can be viewed by press [F1]key.

※3）The coordinate data can be searched by press [F2]key and enter PT#.

※4）As normal, rotating the horizontal circle and make dHR reach 0. Setting the prism as this direction. Make the dHD and dZ reach 0 by distance measured.

※5）Cut&Fill displaying function is available. Refer to Chapter 13 “Selecting Mode”.

NOTE: After layout, collimate the layout point and measure it’s coordinate, and then confirm its accuracy, the measurement mode can be selected.

8.6 Setting the GRID FACTOR

Calculation Formula

1. Elevation Factor = R/(R+ELEV)

   R: The average radius of the earth

   ELEV. : The elevation above mean sea level

2. Scale Factor

   Scale Factor: Scale Factor at the surveying station

3. Grid Factor

   Grid Factor=Elevation Factor×Scale Factor

Distance Calculation

1. Grid Distance

   HDg=HD ×Grid Factor

   HDg: Gird distance

   HD: Ground distance

2. Ground Distance

   HD= HDg/ Grid Factor

After the Grid Factor setting is finished, it is used for layout and other coordinate measurement programs.

Operating procedure	Operation	Display
①Displayed the layout menu 2/2.		Layout 2/2 F1: SELECT A FILE F2: GRID FACTOR
②Press [F2] key.	[F2]	GRID FACTOR =1.000000 > MODIFY? YES NO

Operating procedure	Operation	Display
③Press [F3]key.※1）	[F3]	GRID FACTOR ELEV. =0_ m SCALE : 1.000000 --- --- CLR ENT
④Enter Elevation. ※2） Press [F4] to confirm.	enter Elevation [F4]	GRID FACTOR ELEV. = 1000 m SCALE: 1.000000_ --- --- CLR ENT
⑤Enter Scale Factor. Press [F4]key.※3） ⑥Press [F4] key. Grid Factor is displayed, and then returns to Layout menu automatically. ※4）	enter Scale Factor [F4]	GRID FACTOR =1.000685

※1）Press[F4] key if don't need to changed the Grid Factor.

※2）Elevation enter range:-9999m ~ +9999m.

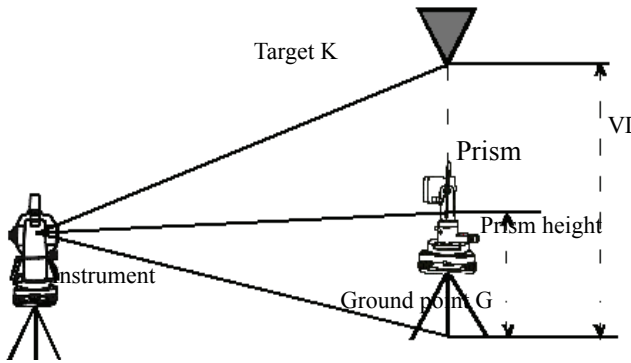
※3）Scale enter range:0.990000 ~ 1.010000.

※4）In Resection program, the Grid Factor need be reset to calculate the error, refer to the procedures from step 2 to step 5 to do that.

9. Application Measurement (Programs)

9.1 Remote Elevation Measurement (REM)

Two mode of with prism and without prism can be selected to measure the vertical height from target to prism or ground point, the prism or ground point should be on the vertical line from the target.



1) With prism height (h) input (Example: h=1.5m)

Operating procedure	Operation	Display
①Press the [MENU] key to menu mode.	[MENU]	MENU 2/3 F1:PROGRAMS F2:PARAMETERS 1 F3:CONTRAST P↓
②Press the [F1] (PROGRAMS) key.	[F1]	PROGRAMS 1/2 F1: REM F2: MLM F3: Z COORD

Operating procedure	Operation	Display
③Press the [F1] (REM) key to REM program.	[F1]	REM F1: INPUT R.HT F2: NO R.HT
④Press the [F1] key to select the first mode: INPUT R.HT.	[F1]	REM-1 <STEP-1> Ref.Hr 0.000m --- --- CLR ENT
⑤Enter prism height, press [F4] key to confirm.	Enter R.HT [F4]	REM-1 <STEP-2> HD: m MEAS --- --- ---
⑥Collimate prism, press [F1] (MEAS) key to measure distance, the horizontal distance (HD) between instrument and prism will be shown.	Collimate P [F1]	REM-1 <STEP-2> HD: * 21.232 m <Measuring>
⑦The vertical distance (VD) from prism to ground will be decided.		REM-1 VD: 1.5 m --- HT HD ---
⑧Move telescope, the VD will upgrade in real-time. Collimate target, vertical distance (VD) from target to ground will be decided. ※1）	Collimate target	REM-1 VD: 1.602 m --- HT HD ---

※ 1）Press [F2](HT) to enter the new prism height. Press [F3] (HD) to measuring the horizontal distance again.

To return to PROGRAMS Menu, press the [ESC] key.

2) Without prism height input

Operating procedure	Operation	Display
①Press the [MENU] key to menu mode.		PROGRAMS 1/2 F1: REM F2: MLM F3: Z COORD
②Press the [F1] (REM) key.	[F1]	REM F1: INPUT R.HT F2: NO R.HT
③Press the [F2] (NO R.HT) key.	[F2]	
④Collimate prism Press the [F1] (MEAS) key, measuring starts, horizontal distance (HD) between instrument and prism will be decided.	Collimate P [F1]	REM-2 <STEP-1> HD: m MEAS --- --- ---
		REM-1 <STEP-1> HD: * 6.888 m <Measuring>
⑤Vertical angle(VZ) will be shown ⑥Press the [F4](SET) key. The prism position will be decided.	[F4]	REM-2 <STEP-2> VZ: 6° 30′ 25 " --- --- --- SET
⑦Collimate ground point G. The position of point G will be decided. *1	Collimate G [F4]	REM-2 VD: 0.000m --- VZ HD ---
⑧Collimate target K. Vertical distance (VD) will be shown. *2	Collimate K	REM-2 VD: 6.580m --- VZ HD ---

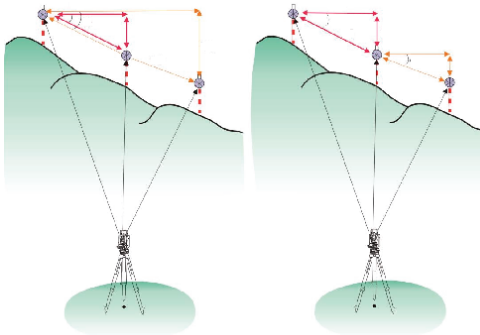
*1) To return to procedure 4, press the [F3](HD) key.
To return to procedure 5, press the [F2](VZ) key.
*2) To return to PROGRAMS Menu, press the [ESC] key.

9.2 Missing Line Measurement (MLM)

9.2.1 Missing Line Measurement

Measurement for horizontal distance (dHD), slope distance (dSD), elevation (dVD) between two targets. MLM has two modes:

1. MLM-1 (A-B, A-C): Measurement is A-B, A-C, A-D.....
2. MLM-2 (A-B, B-C): Measurement is A-B, B-C, C-D.....



MLM-1 MLM-2

[Example]1. MLM-1 (A-B, A-C)

Procedure of MLM-2 (A-B, B-C) mode same as MLM-1 mode

Operating procedure	Operation	Display
①Press the [MENU] key to menu mode. ②Press the [F2] (MLM) key.	[F2]	PROGRAMS 1/2 F1: REM F2: MLM F3: Z COORD
③Press the [F1] or [F2] key to select using	[F2]	MLM F1:USE FILE F2:DON' T USE

coordinate file. [Example:F2 : DON'T USE] ④Press the [F1] or [F2] key to select using GRID FACTOR. [Example:F2 :Not Use]	[F2]	GRID FACTOR F1:Use F2:Not Use
⑤Press the [F1] key to select the first measure mode: MLM-1 A-B, A-C.		MLM F1:MLM-1 A-B ,A-C F2:MLM-2 A-B,B-C
⑥Collimate A, press the [F1](MEAS) key to measure distance,※1）	Collimate A [F1]	MLM-1(A-B, A-C) <STEP-1> HD: m MEAS RHT COOR ---
⑦Horizontal distance will display.		MLM-1(A-B, A-C) <STEP-1> HD:* 6.688m <Measuring>
⑧Collimate B, press the [F1] (MEAS) key to measure distance	Collimate B [F1]	MLM-1(A-B, A-C) <STEP-2> HD: m MEAS RHT COOR SET
		MLM-1(A-B, A-C) <STEP-2> HD: * 2.380m <Measuring>
⑨Horizontal distance (dHD), relative elevation (dVD) and slope distance (dSD) between A and B can be shown.		MLM-1(A-B, A-C) dHD: 5.726m dVD: 1.722m --- --- COOR ---

To show slope distance (dSD), press [DISP] key. Press [F3] (COOR), the coordinate of point B will display.	DISP [F3]	MLM-1(A-B, A-C) dSD: 15.890m HR: 6° 30′ 25 " --- --- COOR --- N> -3.066m E: 32.430m Z: 8.796m INPT --- HD ENT
⑩ To measure the distance between points A and C, Press the [F3] (HD). *1) Collimate point C (Prism C) and press the [F1] (MEAS) key. Horizontal distance (HD) between the instrument and prisms C will be shown. ※2) ⑪ To measure the distance between points A and D, repeat procedure 11. *1)	Collimate C [F1]	MLM-1(A-B, A-C) <STEP-2> HD: m MEAS RHT COOR --- MLM-1(A-B, A-C) <STEP-2> HD: * 16.536 m <Measuring>

※1) Press the [F2] key to input prism height.

※2) Press the [ESC] key to return to previous Menu.

9.2.2 USE FILE and GRID FACTOR

Operating procedure	Operation	Display
①Make sure the display is in [PROGRAMS] mode.		PROGRAMS 1/2 F1: REM F2: MLM F3: Z COORD
②Press the [F2] (MLM) key.	[F2]	MLM F1:USE FILE F2:DON' T USE
③ Press[F1](USE FILE) key	[F1]	SELECT A CFILE FN:1SV INPUT LIST --- ENT
④Select a coordinate file.		GRID FACTOR F1: USE F2: Not Use
⑤Press [F1] (F1:USE) to confirm.	[F4]	GRID FACTOR =1.0000000 >OK? [YES][NO]
⑥ Press [F3] (YES) to confirm the Grid Factor.	[F3]	MLM F1:MLM-1 A-B ,A-C F2:MLM-2 A-B,B-C
⑦Repeat 9.2.1 step ④ - ⑩		

9.2.3 Use coordinate for MLM program

It is possible to input coordinate value directly or calculate from coordinate data file

Operating procedure	Operation	Display
To use coordinate data file, select “USE FILE” in step ③ of chapter 9.2.1.		
①Press the [F3](COOR) key.	[F3]	MLM-1(A-B, A-C) <STEP-1> HD: m MEAS RHT COOR ---
Coordinate direct key input display will be shown.		N> 0.000m E: 0.000m Z: 0.000m INPT --- PT ENT
③Press the [F3](PT#) key to use coordinate data file. Point number input display will be shown.	[F3]	MLM-1 (A-B, A-C) PT#: INPT LIST HD ENT
Input the point number PT# or select coordinate in LIST.	Input coordinate or PT# [F4]	
④Pressing the [F3](HD) key, the display will return to next point setting menu..	[F3]	MLM-1(A-B, A-C) <STEP-2> HD: m MEAS RHT COOR ---

9.3 Setting Z Coordinate of Occupied Point

Input occupied point coordinate data, with known point actual measuring data, Z coordinate of occupied point is calculated and reset again. Known point data and coordinate data can recalled from the coordinate data file.

1) Setting coordinate data file (if you don't recall data from memory, please ignore this operation step)

Operating procedure	Operation	Display
①Display PROGRAMS menu on page 1.		PROGRAM 1/2 F1: REM F2: MLMa F3: Z COORD
②Press the [F3] (Z COORD) key	[F3]	Z COORD. SETTING F1: USE FILE F2: DON'T USE
③Press the [F1] (USE FILE) key.	[F1]	SELECT A FILE FN: INPT LIST --- ENT
④Press the [F2] (LIST) key, the list of coordinate data files are shown.※1）	[F2]	>&1 /C0002 1SV /C0000 TOP LAST SRCH ENT
⑤press [▲] or [▼] keys, the cursor will move up or down one by one, select a file.※2）	[▼]	&1 /C0002 > 1SV /C0000 TOP LAST SRCH ENT

⑥Press the [F4] key to confirm.	[F4]	Z COORD. SETTING F1: OCC. PT INPUT F2: REF. MEAS
※1）Press the [F1](INPT) key to enter file name directly. ※2）Press the [F3](SRCH) key to scan the coordinate data in the selected file		

2) Setting the Coordinate of occupied point

Operating procedure	Operation	Display
①Make sure the displaying is in Z Coordinate mode		Z COORD. SETTING F1: OCC. PT INPUT F2: REF. MEAS
②Press the [F1] key（OCC. PT INPUT）	[F1]	OCC.PT PT#: INPT LIST NEZ ENT
③Press the [F2](LIST) key to display coordinates list.※1）※2）	[F2]	>2 1 VIEW SRCH --- ENT
④Press [▲] or [▼] keys, the cursor will move up or down one by one, select a point. Press the [F4] key to confirm※3）	[F4]	N: 1002.362m E: 566.231m Z: 100.002m >OK? NO YES
⑤The coordinate value will be shown, press the [F3] (YES) key to confirm.	[F3]	INSTRUMENT HEIGHT INPUT Ins.HT=1.000 m --- --- CLR ENT
⑥Input the instrument		

height and press the [F4] to confirm.	Enter I.HT [F4]	Z COORD. SETTING F1: OCC. PT INPUT F2: REF. MEAS
※1) Press the [F1] (INPT) key to input point number directly. ※2) Press the [F3] (NEZ) key to input coordinate data directly. ※3) Press the [F1] (VIEW) key to scan the coordinate data in the selected file.		

3) Z Coordinate Calculation from Known Point Measuring Data

Example: Using coordinate data file

Operating procedure	Operation	Display
①The display return to Z Coordinate program after selected the coordinate for occupied point.		Z COORD. SETTING F1: OCC. PT INPUT F2: REF. MEAS
②Press the [F2] key. (REF. MEAS)	[F2]	N001# PT#: INPT LIST NEZ ENT
③Press [F2] (LIST) key to open the data list, select a point, press [F4] (YES) to confirm.	[F2] Select PT# [F4]	N: 1002.362m E: 566.231m Z: 100.002m >OK? NO YES
④Press [F1](INPT) to input prism height R.HT Press [F4] to confirm.	[F1] Input R.HT [F4]	REF HT INPUT Ref.Hr=1.500_ m --- --- CLR ENT

⑤Collimate prism Press the [F3] (YES) key to start measure distance.	Collimate P [F3]	REF HT INPUT Ref. 1.5m > SIGHT? YES NO > Measuring…….
⑥Press the [F4] (CALC) key, the result will be shown. ※1）Z:Z coordinate dZ: standard error	[F4]	HR: 142° 23′ 59″ HD: 15.8m VD: 10.3m NEW --- --- CALC
⑦Press the [F4] (SET) key, the result will be set as the Z coordinate of occupied point. Backsight point measuring screen will be shown.※2）	[F4]	Z COORD. SETTING Z 12.345m dZ 0.000m --- --- BS SET BACK SIGHT HR: 180° 00′ 00″ > Sight? YES NO
⑧If press the [F3](YES) key, azimuth angle will be set, the display returns to Z coordinate program mode	[F3]	PROGRAM 1/2 F1: REM F2: MLM F3: Z COORD

※1）Press the [F1](NEW) key to measure more points to improve precision, repeat the steps from ② to ⑤ .

※2）Pressing the [F3] key, the display will be changed alternately.

9.4 Area Measurement

This mode calculates the area of a closed figure.

There are two area calculation methods as follows.

1) Area Calculation from Coordinate data file

2) Area Calculation from Measured data

- Area is not calculated correctly if enclosed lines cross each other.
- It is impossible to calculate what a mix of coordinate file data and measured data.
- If the coordinate data file does not exist, the area calculation from measured data is done automatically.
- The numbers of points used to calculate are not limited.

9.4.1 Area Calculation from Coordinate Data File

Operating procedure	Operation	Display
①Enter PROGRAMS menu and press [F4] to enter page2.		PROGRAMS 2/2 F1: AREA F2: POINT TO LINE F3: NEW POINT P↓
②Press the [F1] (AREA) key.	[F1]	AREA F1:KNOWN DATA F2:MEASURE
③Press [F1] (KNOWN DATA) key	[F1]	
④ Press the [F1] (INPUT) key and enter the file name. Initial display will be shown. The top of the file data is set as the first point of area automatically.	[F1] Enter the File name [F4]	SELECT A CFILE FN:FY_ INPT LIST --- ENT

⑤Press the [F4](NEXT) key. ※1）, ※2） The top of the file data (F001) will be set and the second point number will be shown. ⑥ Repeat pressing the [F4] (NEXT) key to set required number of points. When 3 or more points are set, the area surrounded by the points is calculated and the result will be shown. ※3）	[F4]	AREA 0000 m.sq NEXT PT:F001 PT CALL UNIT NEXT AREA 0001 m.sq NEXT PT:F002 PT CALL UNIT NEXT AREA 0003 25.650 m.sq NEXT PT:F004 PT CALL UNIT NEXT

※1） To set specify point, press the [F1](PT) key.
※2） To show the list of the coordinate data in the file, press the [F2](CALL) key.
※3）Evey time press the [F3](UNIT) key to switch area unit.

9.4.2 Area Calculation from measured data

Operating procedure	Operation	Display
①Enter PROGRAMS menu and press [F4] to enter page2.		PROGRAMS 2/2 F1: AREA F2: POINT TO LINE F3: NEW POINT P↓
②Press the [F1](AREA) key.	[F1]	AREA F1:KNOWN DATA F2:MEASURE

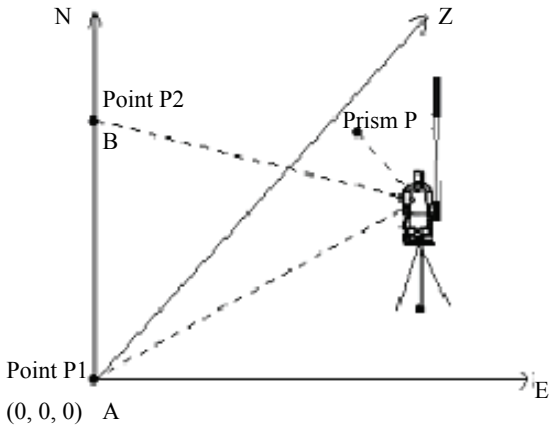
③ Press [F2] (MEASURE) key.	[F1]	AREA F1:USE GRID FACTOR F2:NOT USE
④ Press the [F1] or [F2] key to select using GRID FACTOR. [Example:F2 : DON'T USE]	[F2]	AREA 0000 m.sq MEAS --- UNIT ---
⑤ Collimate a prism and press the [F1] (MEAS) key. Measuring starts.	[F4]	N: 154.894m E: 45.685m Z: 10.588m <Measuring>
⑥ Collimate next point and press the [F1] (MEAS) key.	[F1]	AREA 0001 m.sq MEAS --- UNIT ---
⑦ When 3 or more points are measured, the area surrounded by the points is calculated and the result will be shown. ※1）		AREA 0003 56.741 m.sq MEAS --- UNIT ---

※1） Evey time press the [F3](UNIT) key to switch area unit.

9.5 Point to Line

This mode is used to obtain the relative coordinate data from the coordinate system: origin point A (0, 0, 0) and the line AB as N axis.

Place the 2 prisms at the points A and B on the line, and place the instrument at unknown point C. After measuring the 2 Prisms, the coordinate data and the direction angle of the instrument will be calculated and restored.



Operating procedure	Operation	Display
①Make sure the displaying is in Program menu on page2. ②Press the [F2] (POINT TO LINE) key. ③Enter instrument height Press the [F4] key to confirm.	[F2] Enter INS.HT [F4]	PROGRAM 2/2 F1: AREA F2: POINT TO LINE F3: NEW POINT INSTRUMENT HEIGHT INPUT Ins.Hi= 1.750_ m --- --- CLR ENT

④Enter the reflector height of Point A, [F4] (ENT) to confirm.	Enter Ref.Hr [F4]	REF HT INPUT Ref..Hr 0.000m --- --- CLR ENT
⑤Collimate Point A(P1), press the [F3] to measure.	[F3]	POINT TO LINE MEAS. P1 HD: m >SIGHT? YES NO POINT TO LINE MEAS. P1 HD:* 15.632 m <Measuring>
⑥Enter reflector height of point B. Press the [F4] key to confirm .	Enter R.HT [F4]	REF HT INPUT Ref.Hr=2.500_ m --- --- CLR ENT
⑦Collimate Point B (P2), press the [F3] to measure.	Collimate A [F3]	POINT TO LINE MEAS. P2 HD: m >SIGHT? YES NO
⑧The measured results will be shown. The coordinate data and direction angle of the instrument are calculated and restored. The result (the distance between A and B) will be displayed.		POINT TO LINE MEAS. P1 HD* 78.840 m < Measuring> < Complete> DIST. (P1-P2) 1/2 dHD: 8.080m dVD: 0.080m NEZ S.CO --- NP

⑨ Each time press the [F4] (NP) key, the result will be shown as HD, VD and SD in sequence. Press the [F2] (S.CO) key, the new coordinate of occupied point will be shown. The result will be shown. ⑩Press the [F1] (NEZ) key to measure other points. ⑪ Collimate a prism and press the [F4] (MEAS) to start measure.	[F4] [F1] [F4]	DIST. (P1-P2) 1/2 dSD: 8.100m NEZ S.CO --- NP N: 0.000m E: 0.000m Z: 0.000m EXIT --- HT MEAS > Measuring... N: 8.000m E: 1.000m Z: 0.080m EXIT --- HT MEAS

9.6 Setting a new point

New point is required for example when a layout point cannot be sighted from existing control point.

9.6.1 Side short method

Set up the instrument at a known point, and measure the coordinate of the new points by the side short method.

Operating procedure	Operation	Display
①Make sure the displaying is in Program menu on page2.		PROGRAM 2/2 F1: AREA F2: POINT TO LINE F3: NEW POINT
② Press[F3](NEW POINT) key.	[F3]	NEW POINT F1: SIDE SHORT F2: RESECTION
③Press [F1](SIDE SHORT) key.	[F1]	SELECT A FILE FN: INPT LIST --- ENT
④ Press [F2](LIST) key to display the list of coordinate date file.※1）	[F2]	>&1 /C0002 1SV / C0000 TOP LAST SRCH ENT
⑤Scroll file list by pressing [▲] key or [▼]key and select a file to use.※2）	[▲] or [▼]	&1 / C0002 >1SV / C0140 S /C0000 TOP LAST SRCH ENT

⑥ Press the[F4](ENT) key. The file will be set.	[F4]	SIDE SHOT PT#=F125_ NUM SPC CLR ENT
⑦ Press the[F1] key , and enter the new point name PT#. Press the [F4] key.	[F1] Enter PT# [F4]	REF HT INPUT Ref.Hr 0.000 m --- --- CLR ENT
⑧Enter R.HT in the same way.	Enter Ref.Hr [F4]	REFLECTOR HEIGHT INPUT Ref. 1.000 m >Sight? YES NO
⑨Collimate the new point, and press the [F3](YES) key to start measure distance.	[F3]	HR: 12° 34′ 56″ HD* < m VD: m >Measuring... < Complete >
⑩Press [F3](YES) key. The coordinate value is stored into COORD.DATA.file The input menu for next new point is displayed. PT# is automatically incremented	[F3]	N: 56.287m E: 986.321 m Z: 123.345 m >REC? [YES] [NO] SIDE SHOT PT#: F126 INPT SCRH --- ENT

※1） Press [F1](INPT) key and enter a file name.

※2） The coordinate data can be searched by press[F3]（SRCH）key.

9.6.2 Resection method

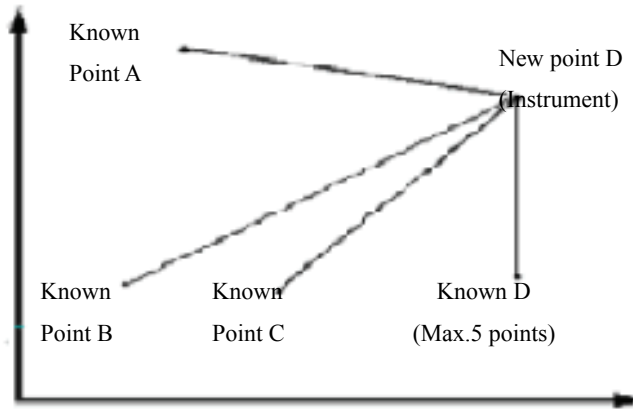
Set up the instrument at a new point, and calculate the coordinate of the new point using the coordinate data of up to five known points and the measurements make to these points.

By following observation, resection is possible:

*Resection by distance measurement: 2 or more known points must be measured.

* Resection by angle measurement only: 3 or more points must be measured

NOTE: the new point can not be on the circum circle formed by the known points; otherwise the coordinate of new point is not correct.



Operating procedure	Operation	Display
①Make sure the displaying is in Program menu on page2. ② Press [F3](NEW POINT) key. ③Press [F2] (RESECTION)	[F3]	PROGRAM 2/2 F1:AREA F2: POINT TO LINE F3: NEW POINT NEW POINT F1: SIDE SHORT F2: RESECTION

key.	[F2]	SKLECT A CFILE FN=FOIFMA_ ALPH SPC CLR ENT
④ Select a coordinate file for known points. ⑤Enter the new point number. Press[F4] key.※1	PT# [F4] [F4]	NEW POINT PT#:45 INPT SRCH SKIP ENT
⑥Enter the instrument height. Press [F4] key.	INS.HT [F4]	INSTRUMENT HEIGHT INPUT Ins.Hi=1.500_ m --- --- CLR ENT
⑦Press[F1(INPT)]key and enter the known point 1. ※2	[F1] PT#	N001# PT# INPT LIST NEZ ENT
⑧Press F3(YES) to confirm the coordinate for point 1.	[F3]	N: 99.925m E: 56.369m Z: 9.563m REC? [YES] [NO]
⑨Enter reflector height. Press [F4] key.	R. HT [F4]	REF HT INPUT Ref.Hr=1.500_ m --- --- CLR ENT
⑩Collimate the first known point 1, and press[F3] or [F4]key to select measuring mode. Measuring starts. ⑪The second known point B is waiting to confirm, entering display will be shown.		REF HT INPUT Ref.Hr=1.500_ m >SIGHT? ANG DIST

⑿ Same as procedure ⑤-⑩ proceed to the second known point 2. When two points have been measured, the RESIDUAL ERROR will be calculated.※3）		N002# PT# INPT LIST NEZ ENT
⒀Select GRID FACTOR for calculation of RESIDUAL ERROR by pressing [F1] or [F2] key. ※3） Example: [F1]	[F1]	SET GRID FACTOR F1:USE LAST DATA F2:CALC MEASDATA
⒁Press the [F1](NEXT) key to measure other points. Maximum five points can be measured.	[F1]	RESIDUAL ERROR dHD= 0.002m dZ = 0.003m NEXT --- G.F. CALC
⒂ Same as procedure ⑤-⑩ proceed to the known point 3.		HR: 1° 23′ 45″ HD: 1.234 m VD: 0.001 m NEXT --- --- CALC
⒃The measured value is displayed. Press the[F4](CALC) key. Standard error will be shown.	[F4]	Standard Dev =2.01sec. --- NP --- NEZ
⒄Press the [F2](NP) key. Standard errors of each coordinate will be shown. The display will be changed alternately by pressing [F2] key.	[F2]	SD(n) = 1.234m SD(e) = 0.001m SD(z) = 0.000m -- NP --- NEZ
⒅ Press the [F4](NEZ) key. Coordinate data of the new point will be shown.	[F4]	N: 1.234m E: 0.001m Z: 0.000m REC? [YES] [NO]

⑲Press the[F3](YES) key. The new point data will be stored into the coordinate data file and set as the current occupied point. ⑳ Press [F3](YES) to set the new point as occupied point, the last measured known point as backsight. The display returns to New Point menu. ※4）	[F3] [F3]	Resection Set Azimuth --- --- YES NO NEW POINT F1: SIDE SHORT F2: RESECTION

※1） When there is no need to memorize the new point data, press the [F3](SKIP) key.

※2） To enter the known point coordinate data by direct key inputting, press the [F3](NEZ)key.

※3） RESIDUAL ERROR

dHD(Horizontal distance between two known points)=Measured value-Calculated value dZ=(Z coordinate of the new point calculated from known point A)-(Z coordinate of the new point calculated from known point B)

※4） When [F3] key pressed in step 5, in this case, the new point data is not stored into the coordinate data file, only the value of occupied coordinate data changes to that of the calculated NEW POINT.

10. Memory Manager Mode

The following items for internal memory are available in this mode.

1) FILE STATUS: Checking the number of files or data in memory.

2) SEAECH: Searching and view point of memory.

3) FILE MAINTAN: Deleting files /Editing file name

4) COORD.INPUT: Inputting coordinate data to memory by keyboard.

5) DELETE COORD: Deleting coordinate data from memory.

6) PCODE INPUT: Inputting PCODE data into memory by keyboard.

7) COMM.PARAM.

SEND DATA: Sending measured data or coordinate data from instrument internal memory to other equipments.

RECEIVE DATA: Uploading measured data or coordinate data to total station internal memory.

COMM PARAMENT: Communication parameters setting

8) INITIALIZE: Initializing internal memory, all the file and data will be cleared.

9) U Function: Enter the connecting interface between TS630 and PC by USB port

10.1 Enter Memory Manager Mode

Operating procedure	Operation	Display
①Press the [MENU] key to enter menu mode. ②Press the [F3](MEMORY MGR.) key to enter memory manager mode. Press the [▲] or [▼] to turn page.	[MENU] [F3]	MENU 1/2 F1: DATA COLLECT F2: LAYOUT F3:MEMORY MGR MEMORY MGR. 1/3 F1: FILE STATUS F2: SEARCH F3: FILE MAINTAN P↓

10.2 Display Internal Memory Status

Operating procedure	Operation	Display
①Make sure the displaying in Memory Manager mode on page1. ②Press the [F1] (FILE STATUS) key, the total number of stored Measured data files and Coordinate data files are shown. ③Press the [F4] (P) key to display the page 2, the total number of stored measured data and coordinate data are shown ※1)	[F1] [F4]	MEMORY MGR. 1/3 F1: FILE STATUS F2: SEARCH F3: FILE MAINTAN FILE STATUS 1/2 MEAS. FILE : 4 COORD. FILE : 7 [.....] P↓ FILE STATUS 2/2 MEAS. DATA : 000460 COORD. DATA : 000450 [.....] P↓
※1) Press the [F4] key to change the displaying status between files or data.		

10.3 Searching data

MEAS.DATA: Measured data.

COORD.DATA: known coordinate data for layout or station setting

PCODE Library: The data which was registered with a number from 0 to 49.

10.3.1 Measured data searching

Operating procedure	Operation	Display
①Make sure the displaying mode in Memory Manager on page 1.		MEMORY MGR. 1/3 F1: FILE STATUS F2: SEARCH F3: FILE MAINTAN

②Press the [F2] (SEARCH) key.	[F2]	SEARCH F1: MEAS. DATA F2: COORD. DATA F3: PCODE LIB
③Press the [F1] (MEAS. DATA) key.	[F1]	SELECT A FILE FN:1 INPT LIST --- ENT
④Press the [F1] key to input file name. Press the [F4] key to confirm.	[F1] Input file name [F4]	MEAS. DATA SEARCH F1: FIRST DATA F2: LAST DATA F3: PT# DATA
⑤Press the [F3](PT# DATA) key.※1）	[F3] Input PT#	PT# DATA SEARCH PT#=_ NUM SPC CLR ENT
⑥Input PT#, press the [F4] to confirm, the point data will display in details.	[F4]	PT#]1 1/3 N] 3713804.5836m E] 389849.825m Z] 959.514m ↓
⑦Press the [F4] key to turn page, other information of this point are shown.※2）※3）	[F4]	PT#]1 3/3 PCODE] Ref.Hr] 1.680m EDIT ↓

※1）Press the [F1] key ,the first point data will be shown, press the [F2] key, the last point data will be shown.

※2）Press the [▲] or [▼] key to display previous or next point data.

※3）Press F1(EDIT) to edit the PT#, PCODE, or target height of this point.

10.3.2 Coordinate Data Searching

Operating procedure	Operation	Display
①Make sure the displaying is in Memory Manager mode on page 1.		MEMORY MGR. 1/3 F1: FILE STATUS F2: SEARCH F3: FILE MAINTAN
②Press the [F2] key.	[F2]	SEARCH F1: MEAS. DATA F2: COORD. DATA F3: PCODE LIB
③Press the [F2] (COORDDATA) key.	[F2]	SELECT A FILE FN: INPT LIST --- ENT
④Press the [F1] key to input file name. Press the [F4] key to confirm.	[F1] Input file name [F4]	COORDDATA SEARCH F1: FIRST DATA F2: LAST DATA F3: PT# DATA
⑤Press the [F3] (PT# DATA) key. ※1）	[F3]	PT# DATA SEARCH PT#=8_ INPT SPC CLR ENT
⑥Press the [F1] key to input PT#, press the [F4] to confirm, this point data will display	[F1] Input PT# [F4]	PT#]8 1/2 N] 3725350.730m E] 602484.036m Z] 945.646m ↓
⑦Press the [F4] key, other information of this point are shown.※2）		

※1）Press the [F1] key, the first point data will be shown, press the [F2] key, the last point data will be shown.

※2） Press the [▲] or [▼] key to display previous point data or next point data.

10.3.3 PCODE Library Searching

Example searching: Number searching

Operating procedure	Operation	Display
①Make sure the displaying is in Memory Manager mode on page 1.		MEMORY MGR. 1/3 F1: FILE STATUS F2: SEARCH F3: FILE MAINTAN
②Press the [F2] key.	[F2]	SEARCH F1: MEAS. DATA F2: COORD. DATA F3: PCODE LIB
③Press the [F3] (PCODE LIB) key.	[F3]	PCODEDATA SEARCH F1: FIRST DATA F2: LAST DATA F3: NO. SEARCH
④Press the [F3](PT# DATA) key.※1）	[F3]	NO. SEARCH NO.=10_ --- --- CLR ENT
⑤Enter number. Press the [F4] key to confirm.※2）※3）	[F1] Input number [F4]	> 009 : SYG 010 : FOIF 011 : GPS EDIT --- CLR ---

※1）Press the [F1] key ,the first point data will be shown, press the [F2] key, the last point data will be shown.

※2）Press the [▲] or [▼] key to display the previous or next PCODE, press the [F1] key to edit it, and press the [F3] key to delete this PCODE.

※3）Press [F1](Edit) to edit this PCODE.
Press [F3] (CLR) to delete this PCODE.

10.4 File Maintenance

In this menu, the following items are available: Renaming file name, Searching data in a file and Deleting files, special symbols will be shown.

```
>@FOIF_001     /C0008
 *FOIF_002     /C0022
  FOIF_003     /M0108
REN    SRCH   DEL   ---
```

(1) File discrimination mark (*, @).

The mark (* or @) placed ahead file name indicates the file status.

For measured data file:

"*"means selected file for recording the measured data

For coordinate data file:

"*" means selected file for LAYOUT mode.

"@" means selected coordinate file for DATA COLLECT mode.

(2) Data type discrimination character (M, C)

Data type discrimination character (M, C) placed before four figures indicate the type of data.

"M" means measured data

"C" means known coordinate data

(3) Four numbers following "M" or "C" means the recorded point quantity in the file.

(4) This is a PCODE library in the memory. And it can record 50 PCODE in the library; the ID number of PCODE can be set from 01 to 50 freely.

10.4.1 Rename a file

Operating procedure	Operation	Display
①Make sure the displaying is in Memory Manager mode on page 1.		MEMORY MGR. 1/3 F1: FILE STATUS F2: SEARCH F3: FILE MAINTAN ↓
②Press the [F3] (FILE MAINTAL) key, the files in memory will be shown.	[F3]	>*1 /M0013 1SV /M0056 REN SRCH DEL ---
③Press the [F1] key to input the new file name, and press the F4 to confirm.	[F1] Input [F4]	> =FOIF_ /M0013 1SV /M0056 REN SRCH DEL ---

10.4.2 Deleting a File

Operating procedure	Operation	Display
①In the files displaying mode as 10.4.1-②, Selecting a file by pressing [▼] key or [▲] key, press the [F3](DEL) key to delete.	[F3]	>FOIF /M0013 1SV /M0056 >DEL? [NO] [YES]
②Confirm the deleting, and press the [F4] (YES) key.	[F4]	>1SV /M0056 REN SRCH DEL ---

10.4.3 Searching Data in a File

Operating procedure	Operation	Display
①In the files displaying mode as above procedure 10.4.1-② ②Selecting a file by pressing [▼] key or [▲] key, press the [F2](SRCH) key ③Select searching method by pressing the [F1] to [F3] key.※1）	[F2]	>1 /M0003 1SV /M0000 REN SRCH DEL --- > 1SV /M0000 REN SRCH DEL --- SEARCH [1SV] F1: FIRST DATA F2: LAST DATA F3: PT# DATA
※1） The first line displays file's name.		

10.5 Coordinate Data Direct Key input

Coordinate data for the layout point or control point can be input directly from keyboard. This data can be stored into a file in internal memory.

Operating procedure	Operation	Display
①Make sure the displaying is in Memory Manager mode on page 2. ②Press the [F1] key (COORD INPUT).	[F1] [F1]	MEMORY MGR. 2/3 F1: COORD INPUT F2: DELETE COORD F3: PCODE INPUT SELECT A FILE FN:1SV INPT LIST --- ENT

③Press the [F1] key to input File name you want to input. Press the [F4] to confirm. ④Press the [F1] [INPT] key to input PT#. Press the [F4] to confirm. ⑤Input N coordinate data, press [F4] to confirm and move to E coordinate inputting status. After input Z, enter PCODE inputting menu, ⑥ Input PCODE, press F4, “complete” will display. Then next input display is shown. Point number (PT#) can increase automatically. ⑦ Press the [ESC] to return.	Input file name [F4] [F1] Input PT# [F4] [F1] Input Coord data [F4]	SELECT A CFILE FN=FOIF_ ALPH SPC CLR ENT COORD DATA INPUT PT#=1_ INPT LIST --- ENT N=0.000 _ m E 0.000m Z 0.000m --- --- CLR ENT COORD DATA INPUT CODE: INPT LIST ---- ENT COORD DATA INPUT PT#:2 INPT LIST --- ENT

10.6 Delete a Coordinate Data from a File

Operating procedure	Operation	Display
①Make sure the displaying is in Memory Manager mode on page 1.		MEMORY MGR. 1/3 F1: FILE STATUS F2: SEARCH F3: FILE MAINTAN P↓
②Press the [F4] key to display page 2.	[EDM]	MEMORY MGR. 2/3 F1: COORD INOUT F2: DELETE COORD F3: PCODE INPUT
③Press the [F2] key.（DELETE COORD）	[F2]	
④Press the [F1] (INPT) key and enter File Name. Press the [F4] key to confirm.	[F1] INPT FILE [F4]	SELECT A FILE FN:=FOIF_ INPT LIST --- ENT
⑤Press the [F1] key and enter Point Number (PT#), press [F4] key to confirm.	[F1] INPUT PT# [F4]	DELETE COORD PT#:=15_ INPT LIST --- ENT
⑥The instrument will ask you to confirm, press [F3] to delete the selected point, or press [F4] the selected point can not be deleted.	[F3]	N: 100.000 m E: 100.000 m Z: 100.000 m >DEL? [YES] [NO]

10.7 Editing PCODE Library

PCODE data can be entered into PCODE Library in this menu. A PCODE is linked with a number of 1 to 50. PCODE can be also edited in DATA COLLECT mode.

Operating procedure	Operation	Display
①Make sure the displaying is in Memory Manager mode on page 1.		MEMORY MGR. 1/3 F1: FILE STATUS F2: SEARCH F3: FILE MAINTAN
②Press the [▼] key once to display page 2.	[▼]	MEMORY MGR. 2/3 F1: COORD INPUT F2: DELETE COORD F3: PCODE INPUT
③Press the [F3] (PCODE INPUT) key.	[F3]	>001: 12345678 002: SVYJMPADG EDIT --- CLR ---
④By pressing the [▲] or [▼] keys to move the cursor.		001: 12345678 >002: SVYJMPADG 003: 1234567890 EDIT --- CLR ---
⑤Press the [F1] (EDIT) key and input PCODE at current position of cursor, press the [F4] key to confirm.	[F1] [F4]	001: 12345678 >002= SVYJMPADG_ 003: 1234567890 ALPH SPC CLR ENT

10.8 Data Transfer by serial port

Before sending data, please connect instrument and PC correctly with RS-232C cable, and the communication settings of instrument are same as PC's settings.

The data in instrument memory can be downloading to PC, also the data can be uploaded from PC to instrument memory.

10.8.1 Sending data

Example: sending a measured data file.

Operating procedure	Operation	Display
①Make sure the displaying is in Memory Manager mode on page 3.		MEMORY MGR. 3/3 F1: COMM.PARAM. F2: INITIALIZE P↓
②Press[F1](COMM.PARAM) key.	[F1]	Data Com F1:GTS F2:SSS
③ Select data format. F1: GTS: Normal format F2: SSS: With code.	[F1]	
④Press the [F1] (SEND DATA) key.	[F1]	Data Com. F1: SEND DATA F2: RECEIVE DATA F3: COMM PARAMENT
Press [F1] (MEAS.DATA) key.	[F1]	SEND DATA F1: MEAS. DATA F2: COORD.DATA F3: PCODE DATA
⑤Press the [F1] key to input File Name, press the [F4] key to confirm.	[F1] Input File Data [F4]	SELECT A FILE FN=FOIF_ ALPH SPC CLR ENT

⑥After the receiving equipment (PC) is ready, press the [F3] (YES) to confirm, the sent point quantity will display in real-time, press F4 (STOP) to stop data sending.	[F3]	SEND MEAS. DATA >OK? --- --- YES NO SEND MEAS. DATA 88 --- --- --- STOP

10.8.2 Loading data

Example: Loading a coordinate data file to TS630 memory

Operating procedure	Operation	Display
① Following steps ① to ③ of "10.8.1 Sending data".		
②Press the [F2] (RECEIVE DATA).	[F2]	Data Com. F1: SEND DATA F2: RECEIVE DATA F3: COMM PARAMENT
③Press [F1] (COORDDATA) key.	[F1]	LOAD DATA F1: COORDDATA F2: PCODE LIB
④Press the [F1] key to input File Name, press the [F4] key to confirm.	[F1] Input File Data [F4]	COORD FILE NAME FN=FOIF_ ALPH SPC CLR ENT
⑤If the cable connection between TS630 and PC is ready, press F3(YES) to confirm.	[F3]	LOAD COORD. DATA >OK? --- --- YES NO

⑥Operate on the PC software, begin sending data from PC to TS630. Press F4 (STOP) to stop data receiving.		LOAD DATA <Waiting Load !> --- --- --- STOP

10.8.3 Setting parameter of data communications

Items of the Parameter

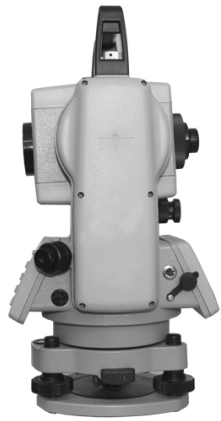
Item	Selecting item	Content
F1: Protocol	[ACK/NAK]/[NO]	Setting Protocol [ACK/NAK] or [NO] communication
F2: Baud rate	1200/2400/4800/ 9600/19200/38400	Setting transfer speed 1200/2400/4800/9600/19200 /38400 baud rate
F3: Char. / Parity	[7/EVEN]/ [7/ODD]/ [8/NON]	Setting data length and parity: [7bit, even], [7bit, odd], or [8bit,none]
F1: Stop Bits	1, 2	Setting Stop 1 bit or 2bits

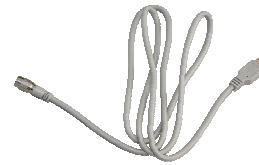
10.9 Connect PC via USB cable

For TS630 USB cable D30-2200 is standard data transfer cable, you can connect TS630 and PC by D30-2200 directly, no driver program need.

Operating procedure	Operation	Display
①Make sure the displaying is in Memory Manager mode on page 3.		MEMORY MGR. 3/3 F1: COMM.PARAM. F2: INITIALIZE F3: U Function P↓
②Press [F3] (U Function) key.	[F3]	U Function Plug the USB Press ESC exit
③Connect instrument and PC via D30-2200 cable, TS630 will display "U FUNCTION Press ESC exit". ※1） It means the TS630 is connected with PC already.	[F2]	U Function Press ESC exit
Press [ESC] to disconnect them, and the instrument back to previous menu.	[ESC]	MEMORY MGR. 3/3 F1: COMM.PARAM. F2: INITIALIZE F3: U Function P↓

※1）After TS630 is connecting with PC, the data folder in memory will open automatically, with FOIFExhange software to view the data.





D30-2200
USB cable

Connect the TS630 and D30-2200 cable via serial port

10.10 Memory initialize

Delete all the files or clear the whole memory.

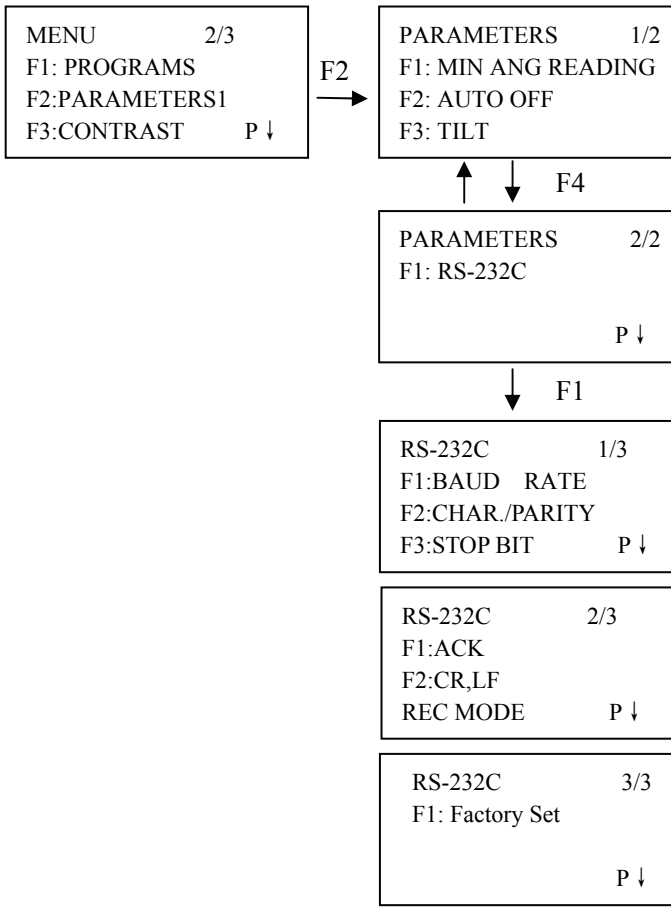
Example: Delete all the measured data files

Operating procedure	Operation	Display
①Make sure the displaying is in Memory Manager mode on page 3.		MEMORY MGR. 3/3 F1: COMM.PARAM. F2: INITIALIZE P ↓
②Press [F2] (INITIALIZE) key.	[F2]	INITIALIZE F1:MEAS FILES F2:COORD FILES F3:PCODE FILES P ↓
③ Select the option you can to clear. MEAS FILES, clear all measured files COORD FILES, clear all coordinate files PCODE FIELS, clear all PCODEs Format, the whole memory will be clear.	[F2]	INITIALIZE Delete Coord Files? ---- --- [YES] [NO]
④Press the [F3] (YES) key, all coordinate data files will be deleted. It returns to previous menu automatically.	[F3]	INITIALIZE F1:MEAS FILES F2:COORD FILES F3:PCODE FILES P ↓
Warning: All the deleted files and data can not be restored.		

11. Instrument Settings

In the parameters menu 1, there are some normal used settings, they are normal used for measurement.

11.1 Items of instrument settings



(* factory setting)

Menu Display	Optional	Content
MIN ANG READING	1″ /0.2mgon*	The min angle reading is 1″ /0.2mgon
	5″ /1mgon	The min angle reading is 5″ /1mgon
	10″ /2mgon	The min angle reading is 10″ /2mgon
AUTO OFF	10M/30M	After 10 or 30 minutes without any operation, power will auto-off
	OFF *	auto-off isn't active
TILT	OFF	The tilt sensor is OFF
	ON *	The tilt sensor is ON
RS-232C	BAUD RATE	1200* 2400 4800 9600 19200 38400
	CHAR. /PARITY	7/EVEN — 7 Data length, even parity
		7/ODD — 7 Data length, odd parity
		8/NONE* — 8 Data length, no parity
	STOP BIT	1 * — One stop bit
		2 — Two stop bit
	ACK	Standard — Communication way: double-action
		Omitted * — Communication way: single-action
	CR,LF	ON — With carriage return
		OFF * — Without carriage return
	REC MODE	REC-A* — Measuring and output measured data
		REC-B — Output displayed data
	Factory Set	Recall factory setting

11.2 Enter setting mode

Operating procedure	Operation	Display
①Make sure the displaying is menu mode on page 2.		PARAMETERS 1/2 F1: MIN ANG READING F2: AUTO OFF F3: TILT
②Press the [F2] (PARAMETERS) key.	[F2]	PARAMETERS 1 1/2 F1: MIN ANG READING F2: AUTO OFF F3: TILT

11.3 Setting procedures

Example: change the minimum reading from 1″ to 5″.

Operating procedure	Operation	Display
①Make sure the displaying is PARAMETERS menu on page 1.		PARAMETERS 1/2 F1:MIN ANG READREADING F2: AUTO OFF F3:TILT P ↓
②Press the [F1] key, the current setting will be shown in the“[ ]”.	[F1]	MinANGLE [F1: 1”] F2: 5” F3: 10” ENT
③Press the [F2](5″) key, press the [F4] to confirm.	[F2] [F4]	MinANGLE F1: 1” [F2: 5”] F3: 10” ENT

12. Selecting Mode

12.1 Items of selecting mode

The following modes are available

Menu	Items	Selecting item	Display
F1: Unit	F1:Temperature	℃/℉	Select the unit of temperature for atmospheric correction
	F2:Pressure	hPa/mmHg/in Hg/psi/ mbar	Select the unit of air pressure for atmospheric correction
	F3:ANGLE	DMS(360°)/ GON(400G)/ MIL(6400M)	Choose degree, gon or mil unit for measuring angle
	F1:Dist	M/Ft/Ftin	Choose measuring unit for distance meter, feet or feet and inch
	F2:Feet	US_feet/ IN_feet	Select the meter/feet conversion factor US SURVEY feet 1m=3.280833333333333ft INTERNATIONAL feet 1m=3.280839895013123ft
F2: Mode	F1:Power On Mode	Angle/Dist	Select to set the measurement mode for angle or distance when the power is turned on
	F2:Fine/Track	Fine/Tracking	Select Fine/Tracking mode in distance measurement mode, when the power is turned on
	F3:HD/SD	HD&VZ/SD	Specify which is displayed first, horizontal and vertical distance or slope distance, when the power is turned on

	F1:Z0/H0	VZ0/HA0	Choose the vertical angle reading from zenith or from level
F2: Mode	F2:NTIMES/ REPEAT	N TIMES/ REPEAT	Select the measurement mode for distance when the power is turned on
	F3:MEAS TIMES	0-99	Set N (number of times) for times of distance measurement. When setting number of times as 1, it is single measurement
	F1:NEZ/ENZ	NEZ/ENZ	Select a coordinate displaying order either NEZ or ENZ
	F2:Offset VA	Free /Hold	Select Vertical angle setting in the Angle Offset measurement mode. FREE: Vertical angle varies by the angle of the telescope. HOLD: Vertical angle is fixed even if the angle of the telescope changes.
	F3:ESC MODE	Collect/SO /Rec/OFF	You can select a function of the [ESC] key. DATA COLLECT/ LAYOUT: It is possible to enter data input mode (in DATA COLLECT) or Layout Menu from normal measuring mode directly. REC: While executing normal or offset measuring, the measuring data can be output. OFF: Returns to normal function

F2: Mode	F1:Coor Check	ON/OFF	Select coordinate displaying ON or OFF when setting a point
	F2:EDMOff Time	0-99	The time when EDM is cut off from distance measurement is completed can be changed. This function is effective for shortening time measuring time when distance measurement is started from distance measurement completing state. Default:3minutes) 0 :After completing distance measurement, EDM is cut off immediately. 1-99: EDM is cut off after 1~99 minutes.
	F3:Read Min	0.2mm/1mm	Select 1mm or 0.2mm for the minimum reading unit in the distance mode (FINE mode)
F3: Other	F1:HA Buzzer	ON/OFF	Specify whether the buzzer sounds or not for every horizontal angle 90°
	F2:Signal Buzzer	ON/OFF	Specify whether the buzzer sounds or not in the set audio mode.
	F3:K select	0.14/0.20/OFF	Set correction for refraction and earth curvature, efficient of refraction as ; K=0.14, K=0.20 or no correction

F3: Other	F1:Coor Rec	ON/OFF	It is possible to retain the coordinate of instrument point, the instrument height and prism height after power off.
	F2:Rec Type	REC-A/ REC-B	Select REC-A or REC-B for data output REC-A: The measurement is made again and this new data is output. REC-B: The data being displayed is output
	F3:CR,LF	ON/OFF	It is possible to output the data with carriage return and line feed.
	F1:NEZ Rec	Standard12/ WithMeas12	Select to record coordinates in standard or 11 digits with raw data
	F2:InputCoor Re	ON/OFF	In the layout mode or data collect mode, it is possible to record coordinates entered directly from the keyboard
	F3:ACK	Standard/Omitted	Set the procedure of the communication with external device. STANDARD: Normal procedure OMITTED: Even though the [ACK] is omitted from the external device, the data is sent again
	F1: GRID FACTOR	Use/Not Use	Select using GRID FACTOR in calculation of measurement data

F3: Other	F2:Cut Or Fill	Standard/Cut &Fill	In the layout mode, CUT & FILL can be displayed instead of dZ
	F3:Back Disp	ON/OFF	It is possible to output the data of echo back type
	F1:Contrast menu	ON/OFF	When the instrument is turned ON, it is possible to display the screen which you can adjust contrast of the display and confirm the prism constant (PSM) and atmospheric correction value (PPM)
	F2:LANGUAGE	ENGLISH/ OTHER	Select the displaying language.
	F3:Key Buzzer	ON/OFF	Setting the key pressing buzzer ON/OFF

12.2 How to set selecting mode

<Example>: Setting unit in °F, NEZ MEMORY:ON

Operating procedure	Operation	Display
① While pressing F2 key, turn Power ON	F2 + Power on	PARAMENT 2 F1:UNIT F2:Mode F3:Other
②Press the [F1] key, the current setting will be shown in the“[ ]”.	[F1]	Unit 1/2 F1: Temperature F2: Pressure F3:Angle P↓
③Press [F2](℉) key, and press[F4](ENTER) key.	[F2] [F4]	Temp. Unit [℃] ℃ ℉ ENT

Operating procedure	Operation	Display
④Press [ESC] key. Returns to PARAMETERS 2 menu.	[ESC]	PARAMENT 2 F1:UNIT F2:Mode F3:Other
⑤ Press [F3] (OTHERS SET) key.	[F3]	Other 1/5 F1:HA Buzzer F2:Signal Buzzer F3:K Select P↓
⑥Press [F4] (P↓) key, to get the function in page 2.	[F4]	Other 2/5 F1:Coor Rec F2:Rec Type F3:CR,LF P↓
⑦Press [F1] key.	[F1]	Coor Rec [OFF] ON OFF [ENT]
⑧Press [F1](ON) key, and press [F4] (ENTER) key. Returns to OTHERS SET menu. ⑨Power off	[F1] [ENT]	Other 2/5 F1:Coor Rec F2:Rec Type F3:CR,LF P↓

13. Check and adjustment

13.1 Checking and adjusting of instrument constant

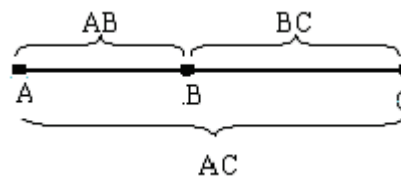
Instrument constant means additive constant for distance measurement.

Normally, the instrument constant doesn't have error. It is recommended you measure and compare with an accurately measured baseline one consistent ground. If such a baseline is not available, establish your own base line over 20m and compare the data measured with the newly purchased instrument.

In case, the instrument setup, the prism, baseline precision, poor collimation, atmospheric correction, correction for refraction and earth curvature determine the inspection precision.

Also, when providing a base line indoor, the following procedure as shown below could be used to check the instrument constant.

(1) Provide point B on a straight line AC, which is almost level and about 100m long. Measure straight lines AB, AC and BC.



(2) Obtain the instrument constant by repeat measurement,

Instrument constant =AB+BC-AC

(3) When there is error between written instrument constant value and calculated value, only need to synthesize the instrument constant and prism constant, and then input the synthesized data in prism constant form, please refer to"7.3.1 Setting of the prism constant".

(4) Once again, measure at a calibrated baseline and compare results.

(5)If using above procedure a difference of over 5mm is found, the instrument constant need reset as the operating procedure on next page.

Operating procedure	Operation	Display
①Press the [F1] key and power [①] key at the same time to enter service menu.	[F1]+ [①]	PASSWORD INPT --- --- ENT
②Press the [F1] key, and input the password 1120, press the [F4] key to confirm.	[F1] [1120] [F4]	ADJUSTMENT MODE F1: V INDEX ADJ. F2: INST. CONST F3: SET DEFAULT!!
③Press the [F2] key.	[F2]	INST. CONST SET CONST: 000mm INPT --- --- ENT
④Press the [F1] key.	[F1]	INST. CONST SET CONST: 0002_ mm --- --- CLR ENT
⑤Press the [F1] key to input new constant, press the [F4] to confirm.	[F1] input constant [F4]	INST. CONST SET CONST:0008 mm SET? --- --- YES NO
⑥Press the [F3] (YES) key. Press any key, the instrument finish setting and power off automatically. ※1)	[F3] Any key	INST. CONST SET CONST:0008 mm SET? Waiting... [NO] Save Ok!
※1) Press the [F4](NO) key to cancel the setting.		

13.2 Checking/adjusting the plate level

(1) Set the instrument on stable device (such as tripod or adjusting table) and fix it.

(2) Level the instrument roughly, place the plate level parallel to a join-line of two leveling screws, say, A and B. Use these two leveling screws only and place the bubble in the center of the plate level.

(3) Rotate the instrument 180°and check bubble movement of the plate level. If the bubble has always been in the center of the plate level, then it is not needed to adjust. If the bubble has been displaced (deviate the center away half of one grid), then adjust it.

Adjustment

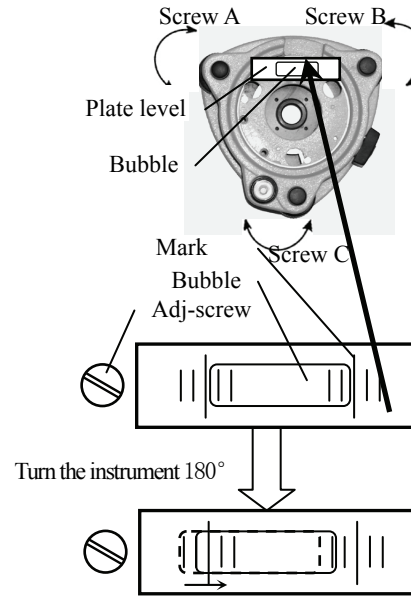
(1) Set the instrument on stable device and fix it.

(2) Level the instrument roughly.

(3) Place the plate level parallel to a join-line of two leveling screws. Use these two leveling screws only and place the bubble in the center of the plate level.

(4) Rotate the instrument 180°. When the bubble stable, adjust the level adjustment screw with the adjusting pin and return the bubble towards the center of the plate level. Correct only one-half of the displacement by this method.

(5) Repeat the procedures of (3) and (4) until anywhere the instrument moves to, the bubble will always be in the center of the plate level.



13.3 Checking/adjusting the circular level Check

(1)Set the instrument on stable device and fix it;

(2)Precisely level the instrument with the plate level;

(3)Look the bubble of the circular level whether is in the center; if the bubble is centered properly, adjustment is not required. Otherwise, adjust it.

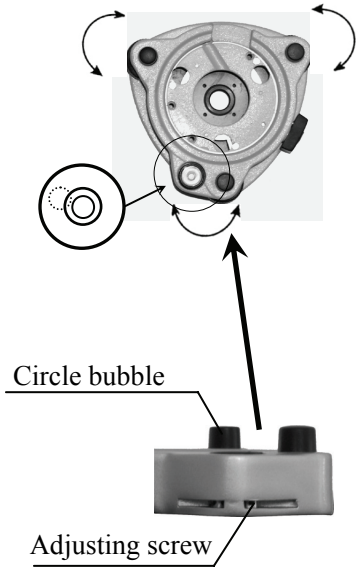
Adjustment

(1)Set the instrument on stable device and fix it;

(2)Precisely level the instrument with the plate level;

(3)Shift the bubble to the center of the circular level, by adjusting two adjustment screws with the adjusting pin.

NOTE: When adjust with pin, you should do that with smaller strength, the loose-tight degree of two screws should be similar.



13.4 Checking/adjusting the optical sight

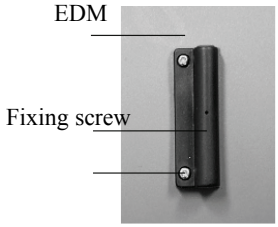
Check

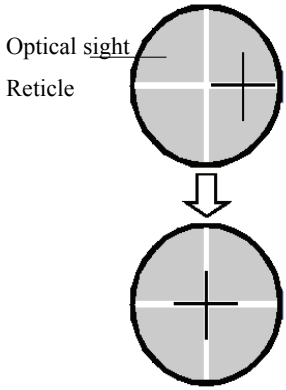
(1) Set the instrument on stable device and fix it;

(2) Set a cross mark front the instrument 50m apart;

(3) Let the telescope collimate the cross mark;

(4) Observe the optional sight collimator whether collimating the cross mark, if collimates the mark, adjusting is not required. Otherwise, adjust it.





Adjustment

(1) Set the instrument on stable device and fix it;

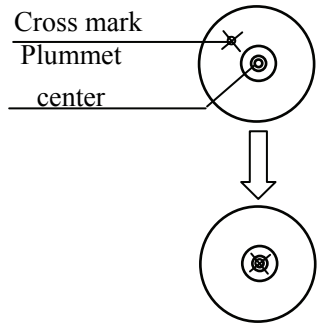
(2) Set a cross mark front the instrument 50m apart;

(3) Let the telescope collimate the cross mark;

(4) Loose two fixed screws of optional sight and adjust them, when the optional sight on proper place fix the two fixed screws.

13.5 Checking/Adjusting the plummet

13.5.1 Checking/Adjusting the optical plummet Check



(1) Set the instrument on stable device and fix it.

(2) Set a cross mark under the instrument.

(3) Use the three leveling screws and coincide the center mark of plummet and cross mark on the ground.

(4) Rotate the instrument 180°around and check the center mark and cross mark, if they are coincide, adjustment is not required. Otherwise, adjust it.

Adjustment

(1) Set the instrument on stable device and fix it.

(2) Set a cross mark under the instrument.

(3) Use the three leveling screws and coincide the center mark of plummet and cross mark on the ground.

(4) Rotate the instrument 180°around and take off the cover of the optical plummet eyepiece, adjust the four adjusting screws with the adjusting pin to shift the center mark to the cross mark, correct only one-half of the displacement in this manner.

(5) Repeat the operation in (3) and (4) until coincide the center mark of the plummet and cross mark on the ground.

13.5.2 Checking/Adjusting the laser plummet (Optional accessory)

Check

(1) Set the instrument on stable device and fixes it;

(2) Set a cross mark on the ground under the instrument;

(3) Turn the three leveling screws until the instrument keeps leveling and the laser spot coincides with the cross mark on the ground;

(4) Rotate the instrument 180°(200g) around and check the laser spot and cross mark，if they are coincide, adjustment is not required. Otherwise, adjust it.

Adjustment

(1) Set the instrument on stable device and fixes it;

(2) Set a cross mark on the ground under the instrument;

(3) Turn the three leveling screws until the instrument keeps leveling and the laser spot coincides with the cross mark on the ground;

(4) Rotate the instrument 180°(200g) around and take off the protecting cover of the laser plummet, adjust the four adjusting screws with the screwdriver to move the laser spot to the cross mark, correct only one-half of the displacement in this manner.

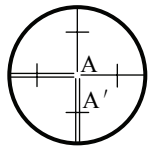
(5) Repeat the operation in (3) and (4) until the instrument keeps leveling and the laser spot coincides with the cross mark when rotating alidade of instrument to any direction.

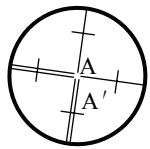
13.6 Checking/Adjusting the vertical cross-hair on telescope

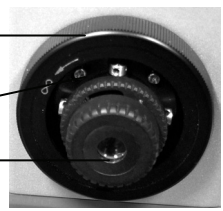
(1) Set the instrument up the tripod and carefully level it.

(2) Set a point A fronts the instrument 50m apart;

(3) Collimate the point A and adjust the vertical tangent screw; if the point appears to move continuously on the hair, adjustment is not required. Otherwise, adjust it.







Adjustment

(1) Set the instrument, and set the point A front the instrument 50m apart.

(2) Take off cover of telescope eyepiece, rotate the vertical tangent screw and loosen all four adjusting screws slightly with the cross screw-drive, then revolve the eyepiece section so that the vertical cross-hair coincide to point A, finally, re-tighten the four screws.

(3) Repeat the operation in check (3) and adjusting (2) until there is no deviation.

13.7 Checking/adjusting horizontal collimation error Check

Check

(1) Set-up the instrument on tripod or adjustment platform and leveling accurately;

(2) Aim at the cross-hairs of collimator or the obvious target at a distance. Get the face left angle reading H1 and the face right angle reading Hr.

(3) Calculating the horizontal collimation error C according to C=（Hl-Hr±180°）/2 if C<8″, no adjustment will be necessary. If C>8″, proceed with the following adjustment.

Adjustment

(1) Rotate the instrument in face right position, turning horizontal tangent screw until Hr′=Hr+C.

(2) Loosen the shield of telescope's reticule adjusting two screws at left and at right until the vertical hairs of telescope's reticule coincides with the cross-hairs of collimator or target.

(3) Repeat the check and adjustment procedure until it is up to standard.

13.8 Checking/adjusting of the vertical index error i.

Finish the adjustment of the across-hair and the error 2C, and then begin this adjustment.

Finish the adjustment of the across-hair and the error 2C, and then begin this adjustment.

Check

(1) Set-up the instrument on tripod or adjustment platform and leveling accurately.

(2) Aim at the cross-hairs of collimator or the obvious target at a distance, which should be about ±10° away from the horizon. Read the face left angle reading VI and the face right angle reading Vr.

(3) Calculating the vertical index error i=（VI+Vr-360°）/2.

(4) If i<10″, adjustment is not required. Otherwise, adjust it.

Adjustment

If the vertical index I is too bigger, using program to adjust.

Operating procedure	Operation	Display
①Press the [F1] key and [①]power key at same time.※1)	[F1]+[①]	PASSWORD: INPT --- --- ENT
②Press the [F1] key to input the password 1120, press [F4] key to confirm.	[F1] [1120] [F4]	ADJUSTMENT MODE F1: V INDEX ADJ. F2: INST. CONST F3: SET DEFAULT!!
③Press the [F1] key.	[F1]	V INDEX ADJ. V 0SET TURN
④Rotate the telescope about one circle to initialize	Initialization	V INDEX ADJ. <STEP-1> FACE 1 VZ: 95° 22′ 04″ ENT
⑤At face-left collimate the reticule of collimator, press the [F4] key to confirm. ※2)※3)	[F4] collimate (Left)	V INDEX ADJ. <STEP-2> FACE 2 VZ: 275° 40′ 04″ ENT
⑥At face-right collimates the reticule of collimator, press the [F4] key to confirm.	[F4] collimate (Right)	V INDEX ADJ. Vl: -5° 22′ 04″ SET? YES NO

⑦Press the [F4] key to confirm.	[F4]	V INDEX ADJ. Vl: -5° 22′ 04″ SET? Waiting…
⑧Press the [F3](YES) key.※4) ⑨Press any key, the instrument finish the setting and power off automatically.	[F3] Any key	V INDEX ADJ. Vl: -5° 22′ 04″ SET? Save OK!

※1) Before adjusting the error, set the instrument on tripod or adjustment platform and fix it with column screw, leveling it accurately and open the compensator.

※2) The collimator or target will not apart away from horizontal line ±10°

※3) Collimate the target at normal position firstly, and then collimate the target at reverse position, users must operate the instrument according to the displaying information.

※4) Press the [F3] key to cancel the setting, and power off automatically.

13.9 Checking the optical axis

Finish the adjustment of the cross-hairs and the error 2C, then check the coincide of the sight-axis and EDM-axis.

Check

(1) Set-up a prism at a distance, which should be about 100m away from the instrument.

(2) Set-up the instrument on tripod or adjustment platform and leveling accurately, then switch on.

(3) Collimate the center of the prism, measure distance in the way which be introduced in chapter 7.

(4) If the receiving is well, the buzzer will sound immediately and the measuring result will display in short time, then the adjustment is not requirement.

Adjustment

If the case is different with introduction in (4), please contact with our local dealer.

This check should be do in fine atmospheric conditions

14. Specifications

RTS series

Telescope	
Length	156mm
Image	Erect
Magnification	30×
Objective lens	Φ45mm
Field of view	1°30′
Minimum focus	1.0m
Reticle illumination	Yes
Angle measurement	
Reading system	Incremental encoder
Angle unit	degree/gon/mil, selectable
Minimum reading	1″/5″/10″, selectable
Detecting mode	Both circles adopt diametrical detection
Accuracy	RTS632 2″
	RTS635 5″
Distance measurement	
Measuring range (Good condition*)	
Single prism	1 to 2000m
Threes prisms	1 to 2500m
Mini-reading	
Fine mode	1mm(0.01ft)
Tracking mode	10mm(0.1ft)
Accuracy	
Prism mode	±(2mm+2ppm×D)
Measuring time	Fine/Rapid/Tracking 1.5s/0.9s/0.5s
	Initial:3s
Distance Unit	m/ft selectable
Temperature unit	℃/℉, selectable

Pressure unit	hPa/mmHg/inchHg, selectable
Temperature input range	-40℃ to +60℃ (1℃ steps)
Pressure input range	500hPa to 1500hPa(1hPa steps)
Prism constant condition	-99.9mm to +99.9mm
Refraction and earth curvature correction	OFF/0.14/0.2, selectable
Reflecting prism constant correction	-99.9mm to +99.9mm

Level sensitivity	
Plate level	30″/2mm
Circular level	8′/2mm
Compensation	Single axis
System	Liquid type
Working range	±3′
Optical plummet	
Image	Erect
Magnification	3×
Focusing range	0.5m～∝
Field of view	4°
Laser plummet (Factory optional)	
Accuracy	±0.8mm/1.5m
Laser class	Class 2(IEC60825-1)
Laser spot size/brightness	Adjustable
Laser wave length	635nm
Focus range	0.5m～∝
Display	
Display unit	LCD
	4 lines ×16 characters
Memory	
Internal memory	128M

Data communication

I/O	RS-232C

Power

Battery	4000mAh Li-ion Rechargeable
Voltage	7.4V DC
Continuous operation time	Approx. 12hours
Chargers	FDJ6-Li (100V to 240V 50/60Hz)
Charging time (at +20℃)	Approx. 4 hours

Others:

CPU	32-bit
EDM technology	Digital signal processing
Dimension	160×155×350mm(W×D×H)
Weight	5.1kg
Water proof	IP66(IEC60529)
Operating temperature	-20℃～＋50℃
Storage temperature	-40℃～＋70℃

***Good condition: no haze, visibility about 30km**

OTS series

Telescope

Length	156mm
Image	Erect
Magnification	30×
Objective lens	Φ45mm
Field of view	1°30′
Minimum focus	1.7
Reticle illumination	Yes

Angle measurement

Reading system	Incremental encoder
Angle unit	degree/gon/mil, selectable
Minimum reading	1″/5″/10″, selectable
Detecting mode	Both circles adopt diametrical detection
Accuracy	OTS632 2″
	OTS635 5″

Distance measurement

Laser wave length	650-690nm
Measuring range(Good condition*)	
Reflectorless	1 to 200m(see details on page 151)
	1 to 300m(optional, see details on page 151)
Laser class	Class 3R(IEC60825-1)
Reflective sheet/RP30	1 to 500m
Reflective sheet/PR60	1 to 800m
Laser class	Class 1(IEC60825-1)
Single prism	1 to 2000m
Laser class	Class 1(IEC60825-1)
Mini-reading	
Fine mode	1mm(0.01ft)
Tracking mode	10mm(0.1ft)

Accuracy	
Prism mode	±(2mm+2ppm×D)
Reflectorless mode	±(3mm+2ppm×D)
Measuring time	Fine/Rapid/Tracking 1.5s/0.9s/0.5s Initial:3s
Distance Unit	m/ft selectable
Temperature unit	℃/℉, selectable
Pressure unit	hPa/mmHg/inchHg, selectable
Temperature input range	-40℃ to +60℃ (1℃ steps)
Pressure input range	500hPa to 1500hPa(1hPa steps)
Prism constant condition	-99.9mm to +99.9mm
Refraction and earth curvature correction	OFF/0.14/0.2, selectable
Reflecting prism constant correction	-99.9mm to +99.9mm
Level sensitivity	
Plate level	30″/2mm
Circular level	8′/2mm
Compensation	Single axis
System	Liquid type
Working range	±3′
Optical plummet	
Accuracy	±0.8mm/1.5m
Image	Erect
Magnification	3×
Focusing range	0.5m～∞
Field of view	4°
Laser plummet (Factory optional)	
Accuracy	±0.8mm/1.5m
Laser class	Class 2(IEC60825-1)
Laser spot size/brightness	Adjustable

Laser wave length	635nm
Focus range	0.5m～∝

Display

Display unit	LCD
	4 lines ×16 characters

Memory

Internal memory	128M

Data communication

I/O	RS-232C

Power

Battery	4000mAh Li-ion Rechargeable
Voltage	7.4 VDC
Continuous operation time	Approx. 12 hours
Chargers	FDJ6-Li (100V to 240V 50/60Hz)
Charging time (at +20℃)	Approx. 4 hours

Others:

CPU	32-bit
EDM technology	Digital signal processing
Dimension	160×155×350mm(W×D×H)
Weight	5.1kg
Water proof	IP66(IEC60529)
Operating temperature	-20℃～＋50℃
Storage temperature	-40℃～＋70℃

***Good condition: no haze, visibility about 30km**

Technical Data for OTS EDM Reflectorless Measurement Range

Option	Kodak Gray Card	Range D	Range E	Range F
		m	m	m
EDM 200m standard	White side, 90% reflective	100	150	200
	Gray side, 18% reflective	50	75	100
EDM 300m Optional	White side, 90% reflective	150	225	300
	Gray side, 18% reflective	75	110	150

Atmospheric Conditions D: Object in strong sunlight, severe heat shimer

E: Object in shade, sky overcast

F: Underground, night and twilight

Measure Time(initial) 3.0s+1.0s/10m when D>50m

15. Packing list

●Carrying case	1each
●Instrument	1each
●Battery	2 each
●Charger	1 each
●Tool kit	1each
●Instruction manual	1each
●Disc	1 each
●Communication cable	1 each
●Reflective sheet (only for OTS series)	2 each

Attachment 1: atmospheric correction formula and chart (for your reference)

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

The correction:

Kpt＝274.417-0.2904*p/(1＋0.0036*t)……..RTS

Kpt＝278.960-0.2904*p/(1＋0.0036*t)……...OTS

Where: p--Pressure value (hPa)

t--Temperature value (℃)

Kpt--Atmospheric correction (ppm)

Example:

t=20℃, p=1013hpa, L0=1000m.

Then: Kpt=0ppm (RTS)

Kpt=4ppm (OTS)

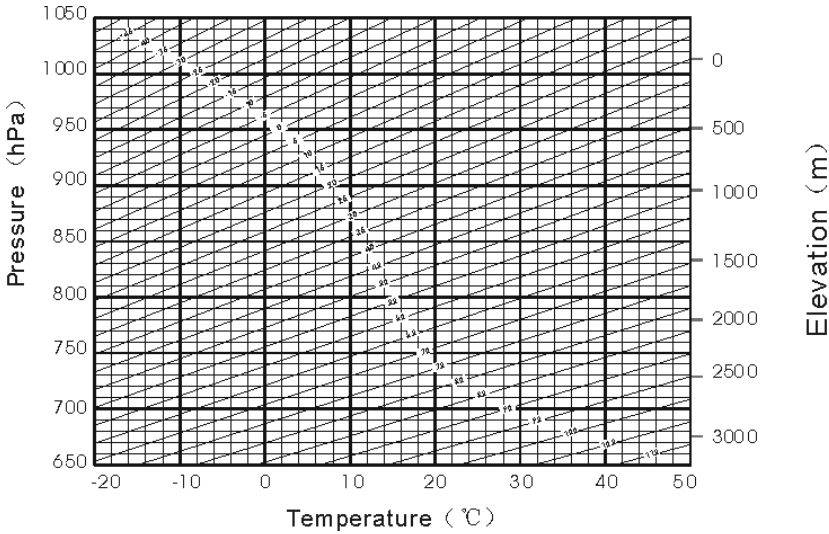
L=L0(1+Kpt)=1000×(1+0×10-6)=1000.000m (RTS)

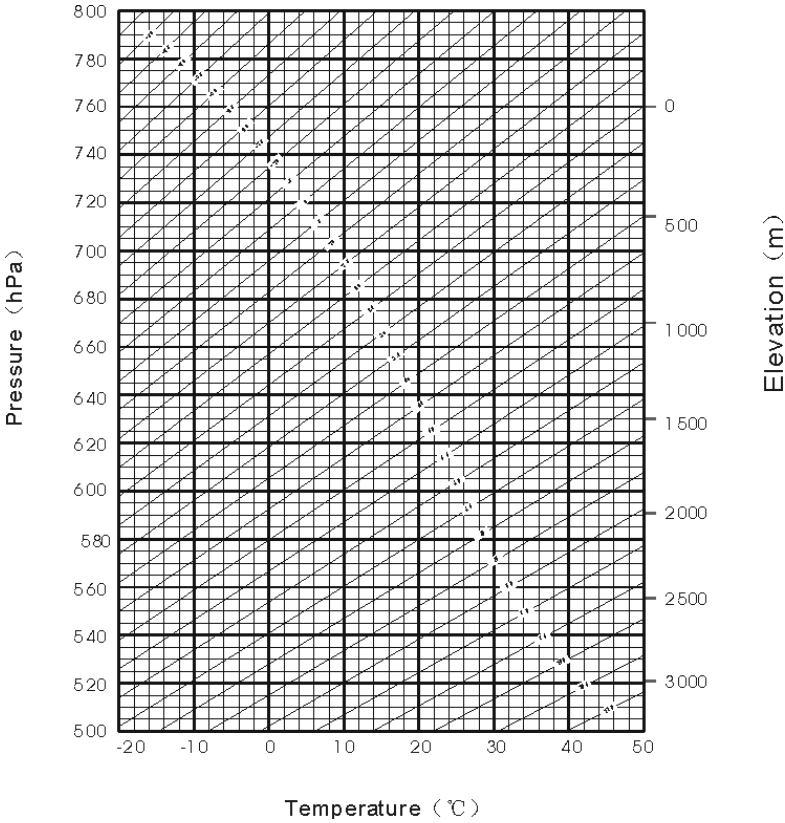
L=L0(1+Kpt)=1000×(1+4×10-6)=1000.004m (OTS)

The atmospheric value is obtained easily with the atmospheric correction chart. Find the measured temperature in horizontal axis, and pressure in vertical axis on the chart.

Read the value from the diagonal line, which is the required atmospheric correction value.

For RTS series





For OTS series

Attachment 2 Correction for refraction and earth curvature

Horizontal distance and vertical distance calculation formula: with correction for refraction and earth curvature taken into account:

Horizontal distance: D=AC（α）or BE（β）

Vertical distance: Z=BC（α）or EA（β）

D=L{cosα-（2θ-γ）sinα}

Z=L{sinα+（θ-γ）cosα}

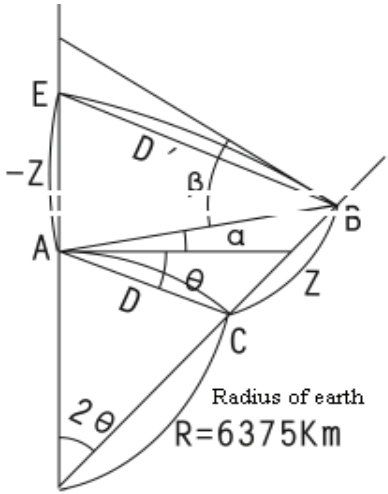
θ=L*cosα/2R .....Earth curvature correcting item

γ=K*Lcosα/2R .....Atmospheric refraction correcting item

K=0.14 or 0.20 .....Coefficient of refraction

R=6372km .....Radius of earth

α（orβ） .....Altitude angle L .....Slope distance



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

HD=L COSα VD=L SINα

Attached file 3: communication instruction and data format

1) Communication parameters setting

BAUD RATE (Baud rate): 2400/4800/9600/19200/38400

PARITY (Parity mode)NONE/ODD/EVEN

DATA BITS (Data length): 7/8

STOP BITS (Stop bit): 0/1/2

PROTOCOL(Protocol): XON/XOFF, NONE

2) Data format

Uploading coordinate data format

│C1│C2│C3│…│Cn│CR│LF│

C1-Cn:

PT#,X,Y,Z,PCODE

NOTE: there is no blank after comma

Example:

101,994.815,1000,987,100.113,STN

CR(ODH) and LF(OAH) at the ending of data block, means the ending mark of data block

Downloading data format:

CONTROL WORD field1.....fieldn

CONTROL WORD, with blank to finish

field1 to fieldn-1 with comma to finish

fieldn with CR(ODH) and LF(OAH) to finish

Control code and attached information:

JOB Job name, description

NAME Surveyor name

INST Description of instrument model

UNITS meter/feet, degree/gon

SCALE Grid factor, scale factor, elevation

ATMOS Temperature, pressure

STN PT#, instrument height, PCODE

XYZ X (N coordinate), Y(E coordinate), Z(elevation)

BKB PT#, azimuth of backsight point, angle of backsight point

BS PT#[. target height]

FS PT# target height, PCODE[, serial code]

SS PT# target height, PCODE[, serial code]

CTL control code[, point code 2[, serial code2](Select one optionally)

HV HA (Horizontal angle), VA(vertical angle)

SD HA (Horizontal angle), VA(Vertical angle), SD(Slope distance)

HD HA (Horizontal angle), HD(Horizontal distance), VD(height difference)

OFFSET Radial offset, tangent offset, vertical offset

PTL_OFF offset on the reference line direction, offset on the line which is cross at right angles with reference line

NOTE Note content

NOTE:

These designs, figures and specifications are subject to change without notice. We shall not be held liable for damages resulting from errors in this instruction manual.

2011.03

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