

TOTAL STATION

R-400^{SERIES}

INSTRUCTION MANUAL

POWERTOPOLITE
FOR R-400 SERIES

R-422N
R-423N
R-425N
R-435N
R-415N



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PENTAX

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<p>Before using this product, be sure that you have thoroughly read and understood this instruction manual to ensure proper operation. After reading this manual, be sure to keep in a convenient place for easy reference.</p>

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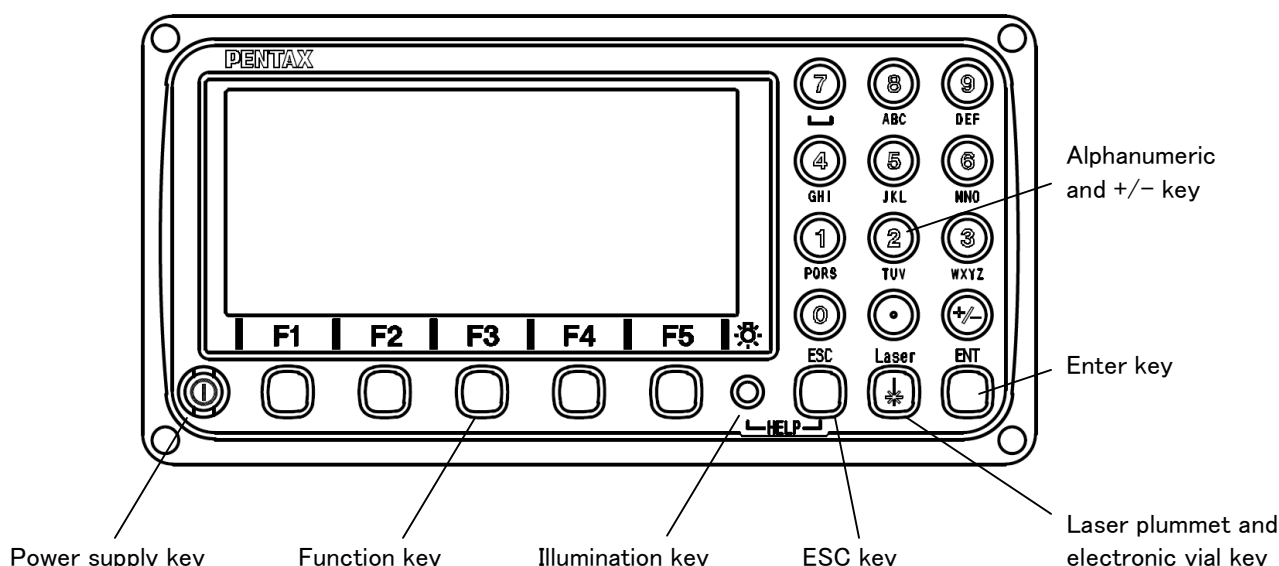
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DISPLAY AND KEYBOARD

- Basic display and keyboard of R-400 series are described below, and the function keys of PowerTopoLite are described in “2. ACCESSING POWERTOPOLITE”.



OPERATION KEY

Key	Description
[POWER]	ON/OFF of power supply.
[ESC]	Returns to previous screen or cancels an operation.
[ILLU]	Turns the illumination of the LCD display and telescope reticle on and off.
[ENT]	Accepts the selected (highlighted) choice or the displayed screen value.
[LASER]	Displays the laser plummet, electronic vial function, and the LD point screen when you push the laser plummet/electronic vial key.
[Alphanumeric]	At the numerical value screen, the numerical value and the sign “.” displayed are input. The English characters printed right under numeric of each key are input.
[HELP]	Pressing [ILLU]+[ESC] key causes a help menu to appear in A MODE or B MODE or causes a help message to appear.

FUNCTION KEY

[⏮]	F1	Moves the cursor to the left.
[⏭]	F2	Moves the cursor to the right.
[⏶]	F3	Moves the cursor up.
[⏷]	F4	Moves the cursor down.
[△]	F1	Goes back five items on the screen.
[▽]	F2	Goes forward five items on the screen.
[RETICLE]	F3	Changing the reticle illumination when pressing illumination key.
[LCD]	F4	Changing the LCD contrast when pressing illumination key.
[ILLU]	F5	Changing the LCD illumination when pressing illumination key.
[CLEAR]	F5	Clear the figure.
[SELECT]	F5	Open the selection window.

- The Function keys of each PowerTopoLite function are described in “2. ACCESSING POWERTOPOLITE” and at each function.

Display combination of MODE A or MODE B

Function	MODE A	MODE B
F1	MEAS	S.FUNC
F2	TARGET	ANG SET
F3	0 SET	HOLD
F4	DISP	CORR
F5	MODE	MODE

- Mode A or Mode B is switched by pressing [F5] [MODE].

ALPHANUMERIC INPUT

The point name etc. is input by the alphanumeric keys as following.

Key	Letter under key	Letter & figure order to input
[0]		[@] [.] [_] [-] [:] [/] [0]
[1]	PQRS	[P] [Q] [R] [S] [p] [q] [r] [s] [1]
[2]	TUV	[T] [U] [V] [t] [u] [v] [2]
[3]	WXYZ	[W] [X] [Y] [Z] [w] [x] [y] [z] [3]
[4]	GHI	[G] [H] [I] [g] [h] [i] [4]
[5]	JKL	[J] [K] [L] [j] [k] [l] [5]
[6]	MNO	[M] [N] [O] [m] [n] [o] [6]
[7]		[] [?] [!] [_] [] [^] [] [&] [7]
[8]	ABC	[A] [B] [C] [a] [b] [c] [8]
[9]	DEF	[D] [E] [F] [d] [e] [f] [9]
[.]		[.] [,] [:] [:] [#] [()]
[+/-]		[+] [-] [*] [/] [%] [=] [<] [>]

1. INTRODUCTION

1.1 Introduction

Thank you for your first looks at PowerTopoLite by reading this manual.

The PowerTopoLite is a user friendly data collection and calculation program for the PENTAX total station R-400 series.

PowerTopoLite is developed based on PowerTopo, which is known as a versatile on-board software for PENTAX ATS total station series. The optimum combination of PowerTopoLite and R-400 hardware makes PowerTopoLite an easy and useful fieldwork tool.

The icon based main menu offers you the following possibilities.

- FILE MANAGER
- MEASURE
- VIEW AND EDIT
- FREE STATIONING
- STAKE OUT
- CALCULATIONS
- VIRTUAL PLANE MEASUREMENT
- REMOTE DISTANCE MEASUREMENT
- TRAVERSE
- ROAD DESIGN
- TRANSFER
- PREFERENCE

1.2 Before using the PowerTopoLite manual

- **Memories in the instrument**

The R-400 series incorporates not only the PowerTopoLite surveying programs as the Special function but also File manager and Data transfer programs.

The internal memory of the instrument can store a maximum of 60000 points data (R-425N, R-435N, R-415N, R-425NM can store a maximum of 50000 points data)

- **Relations between the Memory and each Function**

Function	Read from the stored data	Write to the stored data
Measure	SP, BSP	SP, BSP, FP (SD)
Stake Out	SP, BSP, SOP	SP, BSP, SOP, OP
Point to Line	SP, BSP, KP1, KP2	SP, BSP, KP1, KP2, OP
Free Stationing	Each KP	Each KP, SP (CD)
Traverse	SP, BSP	SP, FP (SD)
VPM	SP, BSP, Each KP	SP, BSP, Each KP, CP (CD)

Station point:	SP	Foresight point:	FP	Backsight point:	BSP	Stakeout point:	SOP
Known point:	KP	End point:	EP	Observation point:	OP	Conversion data:	CD
Conversion point:	CP	Crossing point:	CRP	Surveyed data:	SD		

- **IH and PH**

IH stands for “Instrument Height” and PH stands for “Prism Height”.

-
- The PowerTopoLite manual mainly describes the R-400 special functions, and the basic operations are described in the (basic) R-400 manual. Therefore, refer to the R-400 basic manual regarding the R-400 general instrument operations.
The PowerTopoLite screens vary with the selections of the “Preference”.
The factory default settings of the Preference are shown there. It is also possible to select “Process type” that takes over the functionality of “PowerTopoLite” or “Structure type” that takes over the functionality of our past product in ”Action Method Selection”.
 - The R-400 series instrument has a Job name of “PENTAX” and “COGOPoint” as its default setting. Each data is stored in the “PENTAX” unless another new Job name is created. When another Job name is created, each data is stored in the new Job name.
 - The input range of the X, Y and Z Coordinate is “-99999999.998” - “99999999.998”.
 - The input range of the Instrument and Prism height is “-9999.998” - “9999.998”.
 - The PC, PointCodeList, is added to the PN, Coordinates X, Y, Z and IH (PH or IH) and you can input your desired attributes for the point. If you have PointCodeList in the job named “PointCodeList”, you can easily select one of the PointCode from the list or edit one of them after pressing [ENT]. Please note, that Point Code, which is saved in the other job can not be referred to as a list.
 - There are two Coordinates types: Rectangular and Polar.
The RO,VO,DO,TO offset and the remote measurement are possible when you select the Rectangular Coordinates.
The RO,DO offset is possible when you select the Polar Coordinates.
 - When you measure in EDM SETTINGS of COARSE TRACKING, the R-400 displays a distance value to two decimal places. However, distance data of polar coordinates are displayed by EDIT function to three decimal places, and sent, to four decimal places. So, “0” or “00” is added to the distance data after the third decimal point in COARSE TRACKING mode.

For example

Displayed value:	123.45
Displayed by EDIT:	123.450
Sent polar data:	123.4500

-
- Rectangular coordinates is displayed, stored, and sent to three decimal places even if in COARSE TRACKING or FINE MEASURE mode.
 - You can change the distance measurement mode during measuring operation by pressing the EDM key at the MEASURE and VPM functions.
 - The same Point Name of the plural polar points can be saved.
-

2. ACCESSING POWERTOPOLITE

2.1 How to access PowerTopoLite

To access the R-400 Special Functions of the PowerTopoLite, perform the following procedures.

Press the [POWER] (ON/OFF) key to view the R-400 start-up screen.

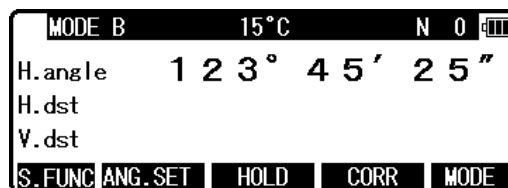
It turns to ELECTRONIC VIAL screen after a while.



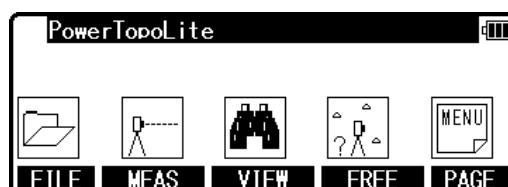
Press the [ESC], [Laser] or [ENT] to view MODE A screen.



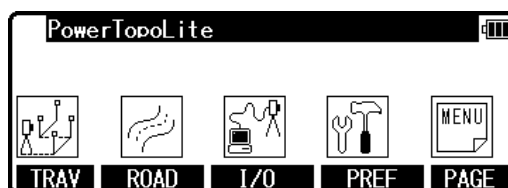
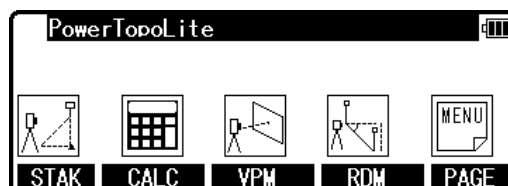
Press the [F5][MODE] to view MODE B screen.



Press [F1][S. FUNC] to view Functions of PowerTopoLite screen.



Press [F5][PAGE] to view another Function combination of PowerTopoLite screen.



2.2 Allocation of each PowerTopoLite Function key

PowerTopoLite functions

KEY	Function	Description
F1	FILE	File Manager
F2	MEAS	Measure
F3	VIEW	View and Edit
F4	FREE	Free stationing

Next four Functions are viewed by pressing [F5][PAGE].

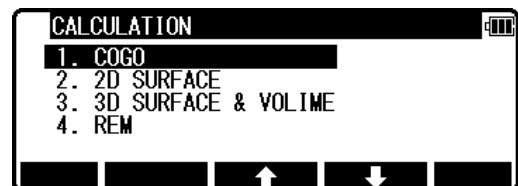
KEY	Function	Description
F1	STAK	Stake out
F2	CALC	Calculation
F3	VPM	Virtual Plane Measurement
F4	RDM	Remote Distance Measurement

Last four Functions are viewed by pressing [F5][PAGE].

KEY	Function	Description
F1	TRAV	Traverse
F2	ROAD	Road design
F3	I/O	Input and Output
F4	PREF	Preference

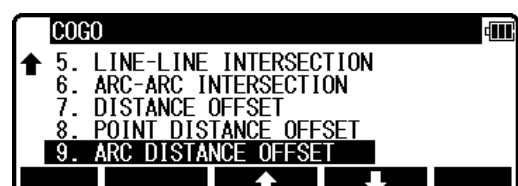
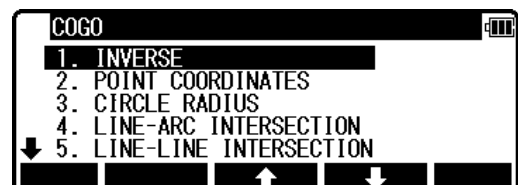
INVERSE, POINT COORDINATES, LINE-LINE INTERSECTION functions

CALCULATION screen is viewed by pressing [F2][CALC]. The CALCULATION consists of COGO, 2D SURFACE and 3D SURFACE & VOLUME functions.



COGO screen is viewed by selecting 1. COGO and pressing [ENT].

The COGO consists of INVERSE, POINT COORDINATES, CIRCLE RADIUS, LINE-ARC INTERSECTION, LINE-LINE INTERSECTION, ARC-ARC INTERSECTION, DISTANCE OFFSET, POINT DISTANCE OFFSET, ARC DISTANCE OFFSET, and functions.

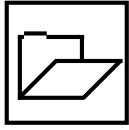


2.3 Typical Function keys of PowerTopoLite

Following function keys are typical of PowerTopoLite and each function key is described for each function in this Manual.

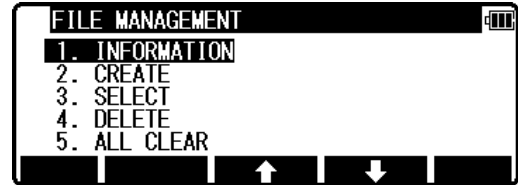
KEY	Description
PAGE	Views another function combination.
SELECT	Selects the Character and moves to next input at PN input etc.
ACCEPT	Enters the displayed values without new Coordinates value input etc.
INPUT	Inputs your desired Horizontal angle.
BSP	Views the BSP SETUP screen to input its Coordinates.
SAVE	Saves input data.
ME/SAVE	Measures and then saves input data.
EDIT	Changes the Point name or Prism height.
REMOTE	Views your aiming point Coordinates.
OFFSET	Views the Target Coordinates adding the offset values.
STATION	Returns to the STATION POINT SETUP screen.
H. ANGLE	Returns to the STATION POINT H.ANGLE SETUP screen.
LIST	Views the POINT SELECTION FROM THE LIST screen.
OTHER	Views the JOB LIST SEARCH screen.
ZOOM ALL	Returns to original size.
ZOOM IN	Magnifies the graphics size.
ZOOM OUT	Reduces the graphics size.
DRAW	Views the GRAPHICAL VIEW screen.
DISP	Views point or point & graphic or point & point name or all.
DELETE	Views the POINT DELETION screen.
FIND PN	Views the PN search screen by inputting the Point name.
ADD	Allow you to add more points for free stationing.
CALC	Starts the calculation of free stationing.
NEXT	Views the next known point Coordinates setup screen.
DATA	Views the TARGET POINT screen.
TARGET	Selects the Target type.
EDM	Selects the EDM settings.
ALL	Selects all points of the current job.
ORDER	The order of selected points.

3.FILE MANAGER



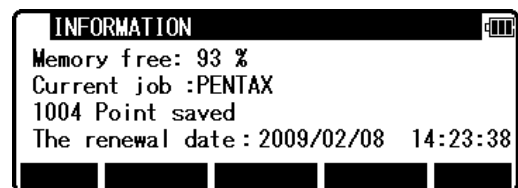
The Data storage memory status, creating a new Job name and the Selection and Deletion of a Job name is executed by this function.

From the PowerTopoLite screen, press [F1][FILE] to view the FILE MANAGEMENT screen.



3.1 Information of the remaining memory availability

Press [ENT] to view INFORMATION screen.

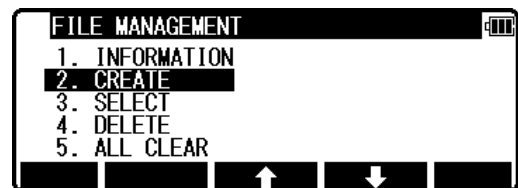


The remaining memory availability and a JOB name PENTAX are viewed on the screen. The Job name “PENTAX” and “COGOPoint” are a default setting.

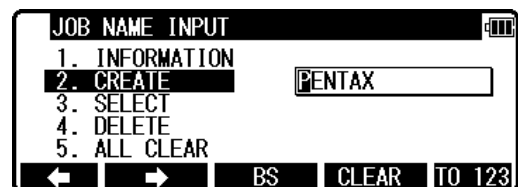
NOTE: Data being used in COGO will be updated in “COGOPoint” file from time to time.
For more details, refer to “8.1 COGO”

3.2 Creation of a new Job

Select 2. CREATE by down arrow key.



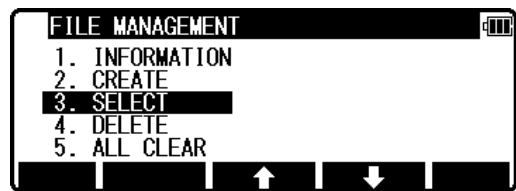
Press [ENT] to view the JOB NAME INPUT screen.



- The Job name input method can be selected by the “Input method selection” of the “Preference”. This is the “10 KEY SYSTEM” input selection.
- If a new Job is created, the new data is stored in this new Job.

3.3 Selection of a Job name

Select 3. SELECT by pressing the down arrow key.



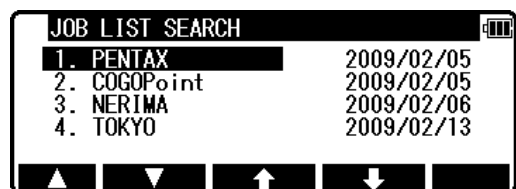
Press [ENT] to view JOB SELECTION screen.



3.3.1 Selection of a Job

Select 1. JOB LIST SEARCH and press [ENT] to view its screen.

JOB LIST is a list of all stored Jobs.



Select your desired Job name and press [ENT] to select.

3.3.2 Selection by a Job name input

Select 2. JOB NAME SEARCH by pressing the down arrow key.

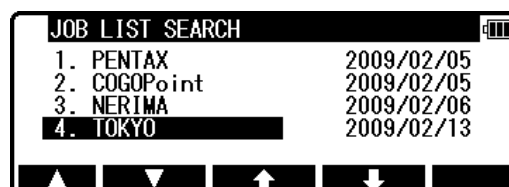
The JOB NAME SEARCH is the search by inputting your desired job name.



Press [ENT] to view the JOB NAME INPUT screen.



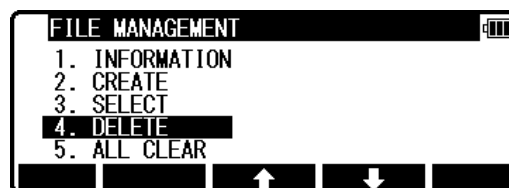
Input your desired JOB NAME and press [ENT] to view the JOB LIST SEARCH screen.



Press [ENT] to select this.

3.4 Deletion of a Job name

Select 4. DELETE by pressing the down arrow key.



Press [ENT] to view JOB DELETION screen.

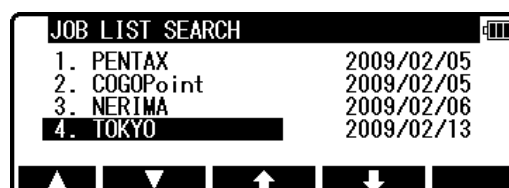


3.4.1 Deletion from a Job list

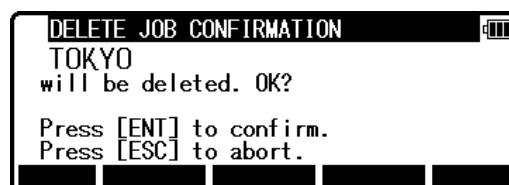
Select 1. JOB LIST SEARCH and Press [ENT] to view its screen.



If TOKYO is selected, deletion confirmation screen is viewed.



Press [ENT] to delete or [ESC] to abort.

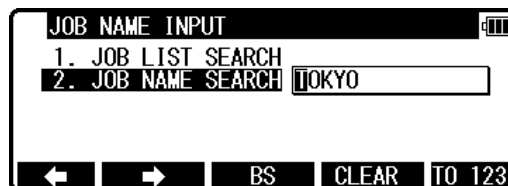


3.4.2 Deletion from a Job name search

Select 2. JOB NAME SEARCH by pressing the down arrow key.

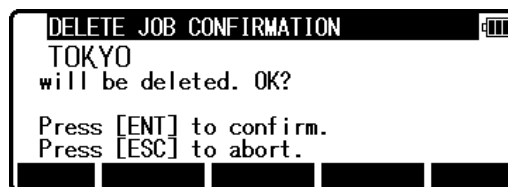


Press [ENT] to view the JOB NAME INPUT screen.



Input your desired JOB NAME to delete and press [ENT] to view the DELETE JOB CONFIRMATION screen.

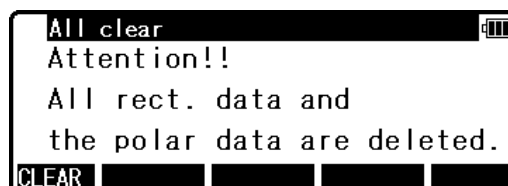
Press [ENT] to delete or [ESC] to abort.



The R-400 series has a Job name of the “PENTAX” as its default setting. Therefore, each data is stored in “PENTAX” unless another new Job name is created. When another Job name is created, each data is stored in the new Job name.

3.5 All Clear

Select 5. All Clear by pressing the down arrow key. Press [ENT] to view its screen.

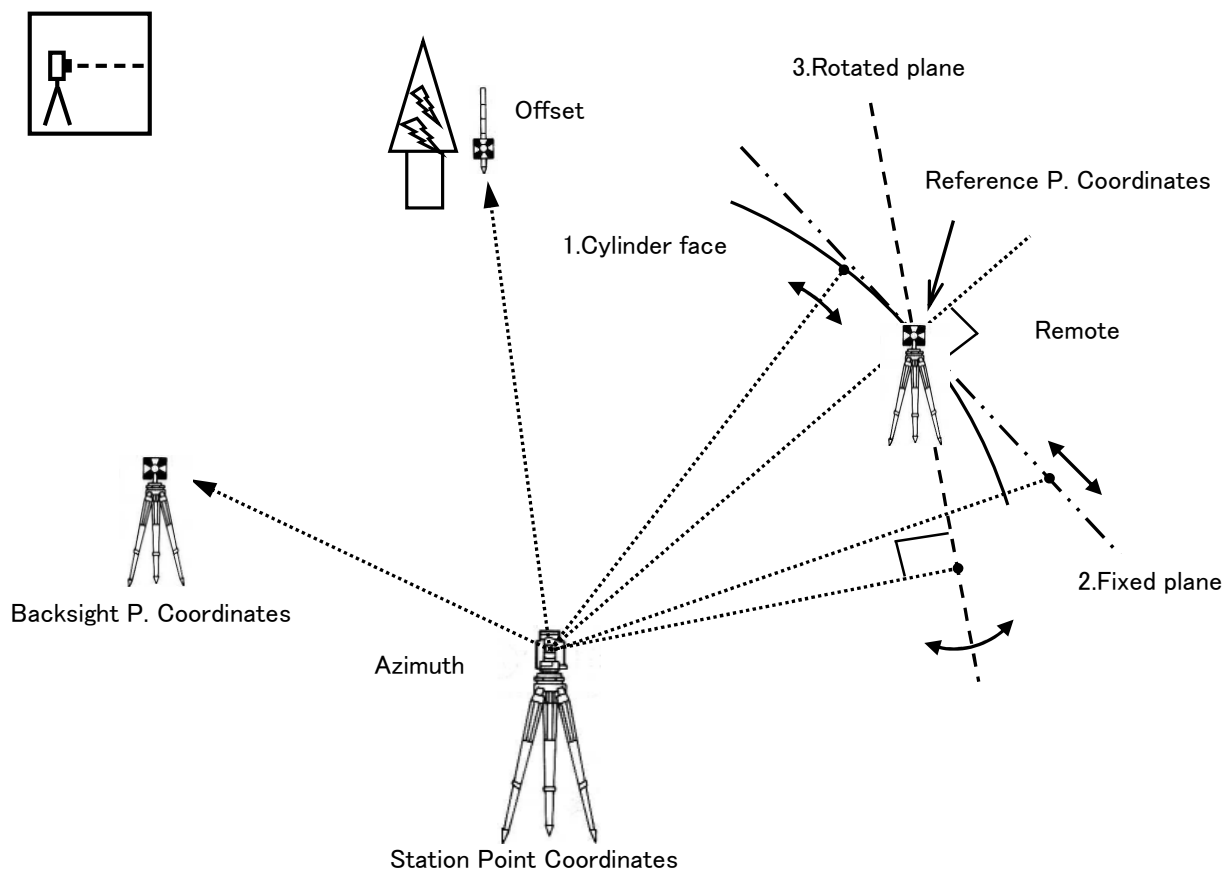


Warning: When [CLEAR] is pushed, all JobFiles are deleted.

NOTE: - Creating several new JOB files and writing-in or rewriting data on the same JOB files repeatedly may cause the time of writing-in and rewriting of the data to be slower.
- Saving data when the memory capacity is almost full, and then deleting some JOB files in order to secure open memory capacity, may cause the time of writing-in and rewriting the data to be slower.
- In case the time of writing-in or rewriting the data becomes slower, send the necessary data to PC for backup, then enter 'All Clear' in FILE MANAGER.

The above procedure will format the inside memory automatically and improve the time or writing-in and rewriting the data. Beware that all JOB files will be deleted.

4. MEASURE



An operator can measure the Foresight point Coordinates from the “Station point Coordinates and Backsight Coordinates” or the “Station point Coordinates and Azimuth”, and can store the Point Name and measured Coordinates in the memory. When the Coordinates of the Station point and Backsight point are already stored in the memory, the new Coordinates input can be omitted by calling or searching from the point name LIST. The Point Name is within 15 characters and the Coordinates are within 8 in integer and 3 in decimal number. There are two Coordinates types: Rectangular and Polar Coordinates in this [MEASURE].

The Offset at the Target point measurement is possible and the Remote measurement, by aiming at any point, is possible as well when you select the Rectangular Coordinates.

An operator can perform the [MEASURE] function only when the Telescope is at the “Face left position”.

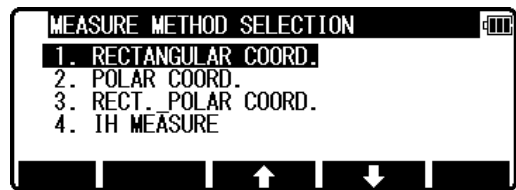
Select the Target type before performing the [MEASURE].

After measuring rectangular coordinates by [MEASURE] function of PowerTopoLite, it is possible to display Angle and Distance by switching the [F3][ANG&DIST] key. When Remote mode is selected, Angle and Distance are also calculated according to the Coordinates of the aiming point on real time.

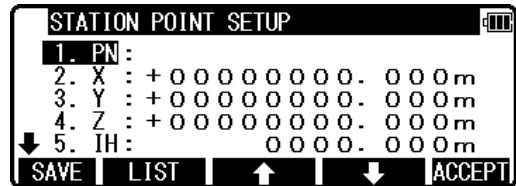
When offset mode is selected, Angle and Distance are also calculated according to the Coordinates where offset value is added.

4.1 Station setup [By Rectangular Coordinates]

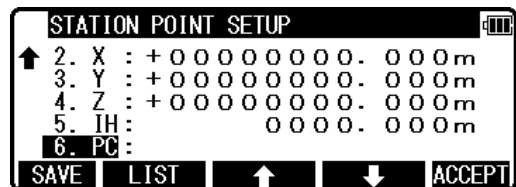
Press [F2][MEAS] of the PowerTopoLite to view the MEASURE METHOD SELECTION screen.



Select 1.RECTANGULAR COORD. and press [ENT] to view the STATION POINT SETUP screen.



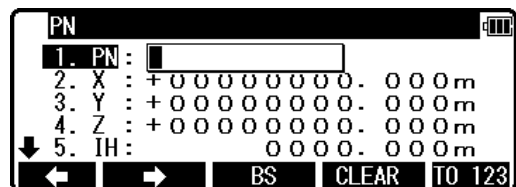
The [↑] / [↓] mark is used to scroll up / down. “6. PC” is viewed by scrolling down.



4.1.1 Point name input

Select 1. PN to display the PN input screen.

[ENT] is used for both accepting the selected choice and opening the input screen of the Coordinates values, etc.

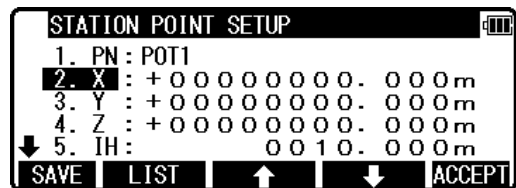


Input your desired point name by pressing keys, and after all Characters are input, press [ENT].

Four character selection methods are available. (Refer to the “14.3 Input method selection”)

4.1.2 Coordinates, X, Y, Z, IH, and PC input

It goes to 2. X coordinate automatically.



STATION POINT SETUP

1. PN: POT1

2. X: +00000000.000m

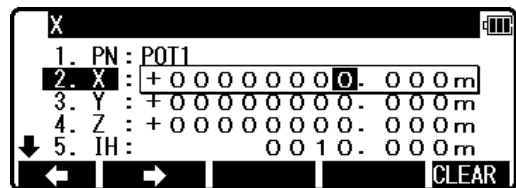
3. Y: +00000000.000m

4. Z: +00000000.000m

5. IH: 0010.000m

SAVE LIST ↑ ↓ ACCEPT

Press [ENT] to view the X coordinate input screen.
Input X, Y and Z coordinates, Instrument height and PC as follows.
Input your desired X coordinate value by pressing keys.



X

1. PN: POT1

2. X: +00000000.000m

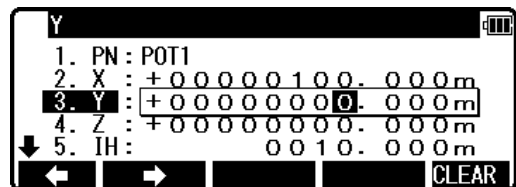
3. Y: +00000000.000m

4. Z: +00000000.000m

5. IH: 0010.000m

← → CLEAR

Y coordinate:
Press [ENT] to view the Y coordinate input screen.
Input your desired Y coordinate value
by pressing keys.



Y

1. PN: POT1

2. X: +000000100.000m

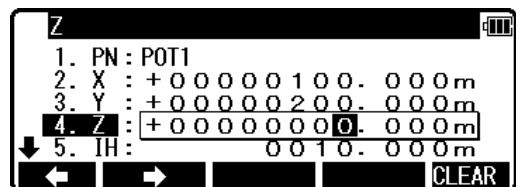
3. Y: +00000000.000m

4. Z: +00000000.000m

5. IH: 0010.000m

← → CLEAR

Z coordinate:
Press [ENT] to view the Z coordinate input screen.
Input your desired Z coordinate value
by pressing keys.



Z

1. PN: POT1

2. X: +000000100.000m

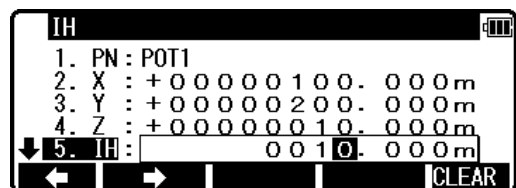
3. Y: +000000200.000m

4. Z: +00000000.000m

5. IH: 0010.000m

← → CLEAR

IH value:
Press [ENT] to view the IH, Instrument height,
screen. Input your desired IH value by
pressing keys.



IH

1. PN: POT1

2. X: +000000100.000m

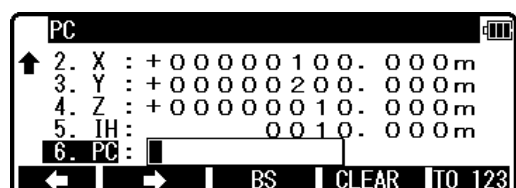
3. Y: +000000200.000m

4. Z: +000000010.000m

5. IH: 0010.000m

← → CLEAR

PC, Point Code:
Press [ENT] to view and input the PC, Point code,
screen.



PC

2. X: +000000100.000m

3. Y: +000000200.000m

4. Z: +000000010.000m

5. IH: 0010.000m

6. PC:

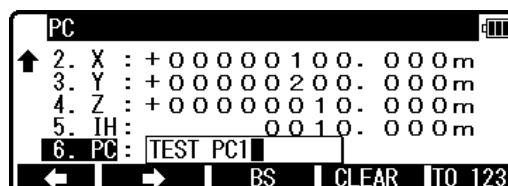
← → BS CLEAR TO 123

If PointCode exists, you can easily select it from the list.

For using PointCodeList, please refer to “5.4.1 Point Code”.



After pressing [ENT], you can edit Point Code data.



Input your desired PC name by pressing keys, and press [ENT] to view next screen.

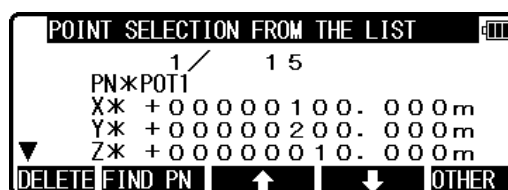
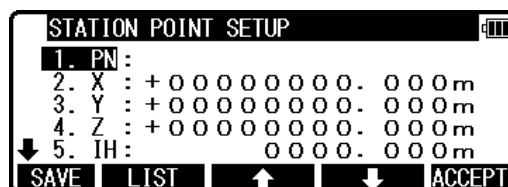
If “PROCESS TYPE” is selected in “Action method selection”, after input/confirm PC data the input POT1 data will automatically be stored in the memory. Then the panel “STATION POINT H.ANGLE SETUP” will be displayed.

But, if “STRUCTURE TYPE” is selected in “Action method selection”, it is necessary to press [ACCEPT] to proceed to next panel.

4.1.3 Point selection from the list

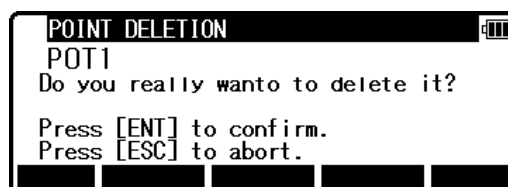
Inputting coordinate information can be done manually and also by calling known points.

Press [F2][LIST] on STATION POINT SETUP screen to display POINT SELECTION FROM THE LIST screen



- [DELETE] Key
To delete the points being displayed

Press [F1][DELETE] to display POINT DELETION screen.



Press [ENT] to delete the selected point from job file.
Press [ESC] to return STATION POINT SETUP.

- [OTHER] Key
To select the job file to be listed

Press [5][OTHER] to display JOB LIST SEARCH screen, then select the job file.

JOB LIST SEARCH	
1. PENTAX	2009/02/05
2. COGOPoint	2009/02/05
3. NERIMA	2009/02/06
4. TOKYO	2009/02/13

- [FIND PN] Key
To search PN from key word

Press [2][FIND PN] to display PN input screen, then input key word.

PN	
1 / 15	
PN*	P1
X*	+000000100.000m
Y*	+000000200.000m
Z*	+00000010.000m

NOTE: Searching point by adding “*” to the initial of the key word enables you to list point data with PN including a string after “*”

For instance, if you need to search point including “P1” in PN, input “*P1” in the key word, then press [ENT].

PN	
1 / 15	
PN*	*P1
X*	+000000100.000m
Y*	+000000200.000m
Z*	+00000010.000m

Select the point from the list

JOB LIST SEARCH	
1. P1	
2. P123	
3. SOP1	

Press [ENT] to display the point that matches the key word.

POINT SELECTION FROM THE LIST	
4 / 15	
PN*	P1
X*	+000000300.000m
Y*	+000000600.000m
Z*	+00000010.000m

- [⇧] / [⇩] Key
To switch the point to be displayed

When the point you want is displayed, press [ENT] to finalize input.

STATION POINT SETUP	
1. PN:	P1
2. X :	+000000300.000m
3. Y :	+000000600.000m
4. Z :	+00000010.000m
5. IH:	0001.200m

4.2 Station Orientation

Press the [F5][ACCEPT] to view the STATION POINT H.ANGLE SETUP screen.

Please note, that the rotation of the “H.angle” depends on the rotation setting of “Coordinate axis definition”.

Input the H.angle by pressing [F2][INPUT], [F3][0SET] and [F4][HOLD] or Reference point Coordinates by pressing [F5][BSP].

- [INPUT] Key
Enter any horizontal angle.
Press [ENT] to view the BSP SETUP screen.

- [BSP] Key
The Back Sight Point information is obtained.
Press [ENT] to finalize input.

Press [ENT] or [F5][ACCEPT] to view the AIM AT THE REFERENCE POINT screen.

Press [F5][ENT] to finalize BSP.
Press [F1][ESC] to redo input.
If you want to make measure to check the point to be aimed, press [F3][MEAS] to display MEASURE screen.

Press [F1][MEAS] to make the distance measurement. DESIGN DISPLAY screen appears when the distance measurement is done. Compare design value with measured value.

DESIGN	141.136	m
DISTANCE	141.112	m
COMPARE	0.024	m

When “PREFERENCE” of “12. BOTH FACES MEAS” is on, measure the distance at the normal and reverse position. The measured value to be displayed is the average of measured values measured in normal and reverse position.

4.3 Function of MEASURE screen

Aim at the reference point and press [ENT] to view the MEASURE screen.

MEASURE		15°C	N 0	
PN	PN1			
PH	1. 200m			
X				
Y				
Z				
MEAS		SAVE	ME/SAVE	EDIT PAGE

Press the [F1][MEAS] to measure the Distance and display the Coordinates.

MEASURE		15°C	N 0	
PN	PN1			
PH	1. 200m			
X	- 6. 000m			
Y	+ 10. 000m			
Z	+ 201. 300m			
MEAS		SAVE	ME/SAVE	EDIT PAGE

Press [F2][SAVE] to save the measured data.

Press [F3][ME/SAVE] to measure and save the measured data.

The survey data is not saved if no PN is input.

Press [F4][EDIT] to edit the PN,Point Name,PH,Prism Height and PC,Point Code.

Input your desired Point name, Prism height and Point code.

Press [F5][ACCEPT] if the current PN, PH and PC are acceptable.

If PointCode exists, you can easily select them from the list or edit one of them after pressing the [ENT]. For using Point Code List, please refer to “5.4.1 Point Code”.

MEASURE		
1. PN:	P0T5	
2. PH:	0000. 000m	
3. PC:		
		↑ ↓ ACCEPT

Press [F5][PAGE] to view another menu.

MEASURE		15°C	N 0	
PN	PN1			
PH	1. 200m			
X				
Y				
Z				
REMOTE		OFFSET	STATION	H.ANGLE PAGE

MEASURE		15°C	N 0	
PN	PN1			
PH	1. 200m			
X				
Y				
Z				
EDM		TARGET	ANG&DIST	STAKEOUT PAGE

EDM settings can be selected by pressing [F1][EDM].

For example, change 1.PRIM. MEAS KEY (MEAS) to TRACK SHOT or TRACK CONT if you want to use tracking measurement with primary MEAS key (MEAS).

EDM SETTINGS		
1. PRIM. MEAS KEY	: MEAS. SHOT	
2. SEC. MEAS KEY	: TRACK CONT	
3. EDM MIN DISP/QUICK	: 1mm/OFF	
4. SHOT COUNT	: 1 TIME	
5. SHOT INPUT	: 01TIMES	
		▲ ▼ ↑ ↓ ACCEPT

The target type can be selected by pressing [F2][TARGET].

Coordinates display and Angle & Distance display

- 1) Press [F5][PAGE] twice to view [F3][ANG & DIST].
- 2) Press [F3][ANG & DIST] to view [F3][COORD.] and Angle and Distance values.
- 3) Press [F3][COORD.] to view [F3][ANG&DIST] and Coordinates.

MEASURE		15°C	N 0		
PN	PN1				
PH		1. 200m			
X		- 6. 000m			
Y		+ 10. 000m			
Z		+ 201. 300m			
EDM		TARGET	ANG&DIST	STAKEOUT	PAGE

ANG. & DIST.		15°C	N 0		
PN	PN1				
PH		1. 200m			
H.angle		52° 10' 40"			
V.angle		62° 35' 25"			
H.dst		3. 480 m			
		COORD.	DISP		

Stakeout can be selected by pressing [F4][STAKEOUT].

4.4 Remote, Offset, Station, and H. angle function

4.4.1 Remote

Press [F5][PAGE] to view another MEASURE menu.

Press [F1][REMOTE] once and then quickly press this key again to measure your desired point Coordinates by moving the telescope.

MEASURE		15°C	N 0		
PN	POT3				
PH		0. 000m			
X					
Y					
Z					
REMOTE		OFFSET	STATION	H. ANGLE	PAGE

The displayed Coordinates automatically change according to your aiming point.

The Remote is a function of, so to speak, “Real-time offset”. If a reference point or offset point is measured, the Coordinates of your aiming point are calculated based on the reference plane.

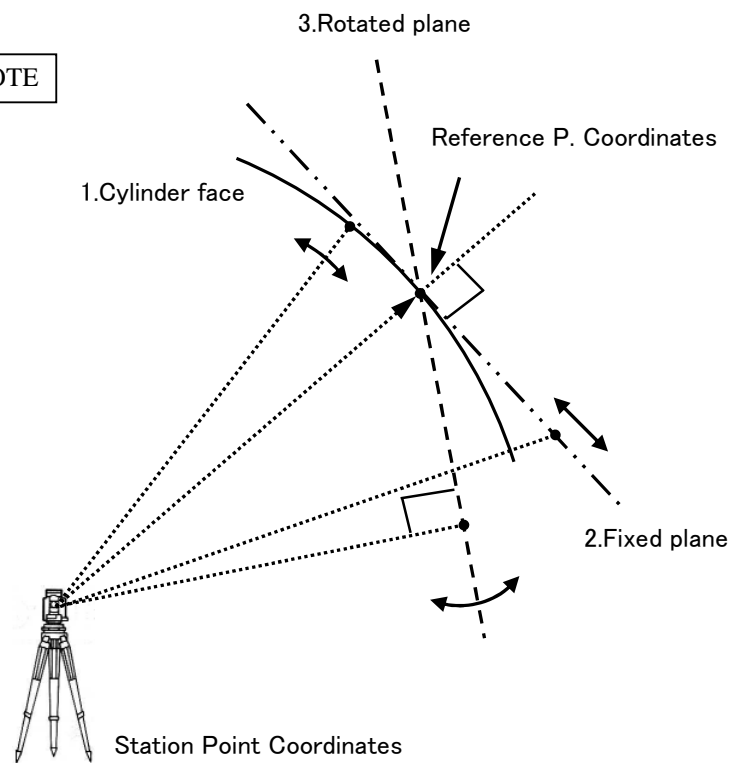
There are three calculation methods: Cylindrical face, Fixed plane and Rotated plane.

They are selected by “14. Preference”. Refer to “14.5 Remote method selection”.

The calculations are performed on the virtual planes.

To quit the Remote measurement, press [F1][REMOTE] twice again.

REMOTE



4.4.2 Offset

Press the [F2][OFFSET] to view the OFFSETS screen.

Offset enables you to work with Offsets.
The following offsets are available.

OFFSETS	
1. RO:	+ 0 0 0 0 . 0 0 0 m
2. VO:	+ 0 0 0 0 . 0 0 0 m
3. DO:	+ 0 0 0 0 . 0 0 0 m
4. TO:	+ 0 0 0 0 . 0 0 0 m

▲ ▼ ▲ ▼ ACCEPT

Press [ENT] to view the offset input window.
Input the RO offset value by pressing keys.
VO, DO and TO values are input in the same manner.

RO	
1. RO:	+ 0 0 0 0 . 0 0 0 m
2. VO:	+ 0 0 0 0 . 0 0 0 m
3. DO:	+ 0 0 0 0 . 0 0 0 m
4. TO:	+ 0 0 0 0 . 0 0 0 m

← → CLEAR

After input "TO" value, press [ENT] to view the MEASURE screen.

(Or press [ESC] then press [ACCEPT].)

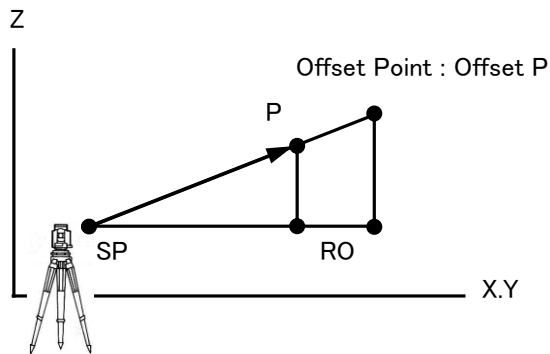
The offset values are added to X,Y and Z values.

OFFSETS		15°C	N 0
PN	P0T3	1. 2 0 0 m	
PH		(OFFSET + X) m	
X		(OFFSET + Y) m	
Y		(OFFSET + Z) m	
Z			
REMOTE	OFFSET	STATION	H.ANGLE PAGE

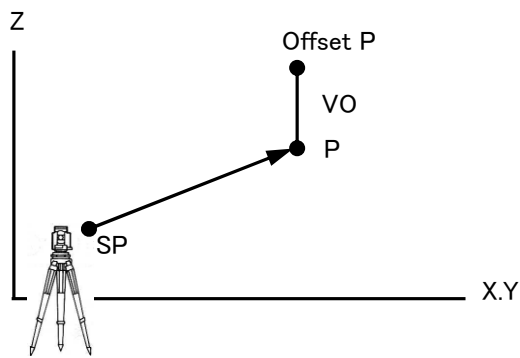
The input value of offset is cleared when you save the surveying point and step forward to the next surveying point.

RO: Radial Offset

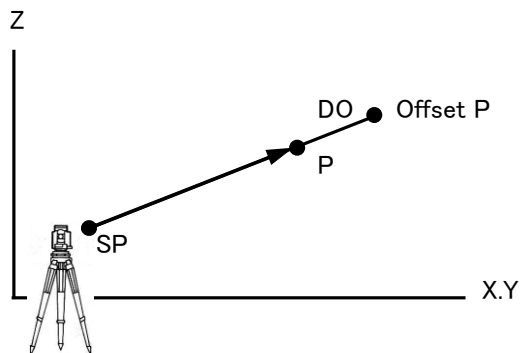
(RO: On the horizontal plane. Offset P: Along the line of measurement, thus along the slope)



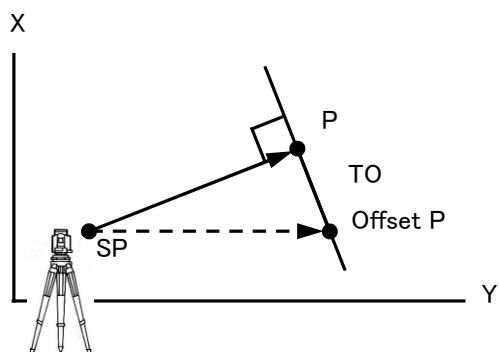
VO: Vertical Offset (Along the third axis)



DO: Distance Offset (Along the line of measurement, thus along the slope)



TO: Tangential offset (TO: On the horizontal plane, perpendicular to the horizontal line between Station and Point. Offset P: Along the slope)



4.4.3 Station

Press [F3][STATION] to return to STATION POINT SETUP screen.

STATION POINT SETUP

1. PN :
2. X : +00000000.000m
3. Y : +00000000.000m
4. Z : +00000000.000m
5. IH : 0000.000m

SAVE LIST ↑ ↓ ACCEPT

4.4.4 H. angle

Press [F4][H.ANGLE] to return to STATION POINT H. ANGLE SETUP screen.

Press [ENT] to view the MEASURE screen.

STATION POINT H.ANGLE SETUP

H.angle 287° 47' 50"

BPRSET INPUT 0 SET HOLD BSP

- [BPRSET] key
Deviation of Back Sight Point can be seen.
Press [F1][BPRSET] key to display BSP CONFIRM screen.

BSP CONFIRM

Designed Data. 45° 00' 00"
Calculated Data. 45° 01' 09"
Deviation. -0° 01' 09"

ESC RESET ENT

“Designed Data” represents the horizontal angle of the current Back Sight Point.
“Calculated Data” represents the horizontal angle of the direction that R-400 is facing.
“Deviation” represents deviation of “Calculated Data”.

If you accidentally move the instrument during the measurement, the amount of error can be checked on this screen.

If the instrument is significantly moved, press [F4] [RESET] to reset Back Sight point at the current position.

If the amount of error is small, press[F5][ENT] to return to MEASURE screen.

4.5 Station setup [By Polar Coordinates]

The same Point Name of the plural polar points can be saved.

Press [F2][MEAS] of the PowerTopoLite screen to view the MEASURE METHOD SELECTION screen.

MEASURE METHOD SELECTION

1. RECTANGULAR COORD.
2. POLAR COORD.
3. RECT. POLAR COORD.
4. IH MEASURE

↑ ↓

Select 2. POLAR COORD. and press [ENT] to view the STATION POINT SETUP screen.

STATION POINT SETUP

1. PN :
2. IH : 0001.200m
3. PC :
4. TEMP : +15°C
5. PRESS : 1013hPa

SAVE ↑ ↓ ACCEPT

The [↑] / [↓] mark is used to scroll up / down.

4.5.1 Point name input

Select 1.PN to display PN input screen.

Input PN value.

Press [ENT].

4.5.2 IH, TEMP, PRESS, ppm and PC input

Input IH value.

Press [ENT].

Input the PC.

Press [ENT] to view and input the PC, Point code, screen.

If PointCode exists, you can easily select it from the list or edit one of them after pressing [ENT].

For using Point Code List, please refer to “5.4.1 Point Code”.

If “PROCESS TYPE” is selected in “Action method selection”, the input point data will be stored in the memory with [SAVE]. Then the panel “STATION POINT H.ANGLE SETUP” will be displayed without pressing [ACCEPT].

But, if “STRUCTURE TYPE” is selected in “Action method selection”, it is necessary to press [ACCEPT] to proceed to next panel.

Input the TEMP value.

Press [ENT].

Input the PRESS value.

Press [ENT].

Input ppm value.
Press [ENT].

ppm

1. PN	:	
2. IH	:	0001.200m
3. PC	:	
4. ppm	:	+000 ppm

← → CLEAR

TEMP, PRESS and ppm input depend on the “Initial setting 1”
(ATM INPUT, ppm INPUT, NIL).

4.6 Station Orientation

Press the [F5][ACCEPT] to view the STATION
POINT H. ANGLE SETUP screen.
Input your desired H.angle.

STATION POINT H.ANGLE SETUP

H.angle 287° 47' 50"

INPUT 0 SET HOLD INVERS

- [INPUT] key
Input your desired H.angle.
Please note, that the rotation of the “H.angle”
depends on the rotation setting of
“Coordinate axis definition”.
- [INVERS] key
If you want to calculate direction angle, Press
[F5][INVERS] to jump to INVERSE function.
Input SP as station point, EP as back sight point.

H.angle

H.angle 28 287° 47' 50"

← → CLEAR

INVERSE

1. SP

2. EP

↑ ↓

Result angle is set here automatically by pressing
[ENT] at RESULT OF INVERSE screen.

RESULT OF INVERSE

H.dst	0.0000m
V.dst	0.0000m
S.dst	0.0000m
H.angle	0° 00' 00"

ESC ENT

Press [ENT] after aiming back sight point.
Aim at the reference point and press [ENT] to view
the MEASURE screen.

MEASURE 15°C N 0

PNT3

PH	1.200m
H.angle	0° 00' 00"
V.angle	100° 38' 40"
S.dst	

MEAS SAVE ME/SAVE EDIT PAGE

4.7 Function of MEASURE screen

Aim at the reference point and press [ENT] to view the MEASURE screen.

MEASURE		15°C	N 0	
PN	POT3			
PH	1. 200m			
H.angle	0° 00' 00"			
V.angle	100° 38' 40"			
S.dst				
MEAS		SAVE	ME/SAVE	EDIT PAGE

Press the [F1][MEAS] to measure and display the Distance.

MEASURE		15°C	N 0	
PN	POT3			
PH	1. 200m			
H.angle	0° 00' 00"			
V.angle	100° 38' 40"			
S.dst	21. 205m			
MEAS		SAVE	ME/SAVE	EDIT PAGE

Press [F2][SAVE] to save the measured data.

Press [F3][ME/SAVE] to measure and save the measured data.

No survey data is saved when no PN is input.

Press [F4][EDIT] to edit the PN, Point Name, PH, Prism Height and PC, Point Code.

Press [ENT] to view each input window by pressing up or down arrow key, and input your desired point name or prism height or point code.

Press [F5][ACCEPT] if the current PN, PH and PC are acceptable.

MEASURE		
1. PN:	POT3	
2. PH:	0001. 200m	
3. PC:		
		↑ ↓ ACCEPT

PC, Point Code:

Press [ENT] to view and input the PC, Point code, screen.

If PointCode exists, you can easily select them from the list or edit one of them after pressing the [ENT].For using Point Code List, please refer to“5.4.1 Point Code”.

Press [F5][PAGE] to view another menu.

MEASURE		15°C	N 0	
PN	POT3			
PH	1. 200m			
H.angle	0° 00' 00"			
V.angle	100° 38' 40"			
S.dst				
OFFSET		STATION	DISP	PAGE

MEASURE		15°C	N 0	
PN	POT3			
PH	1. 200m			
H.angle	0° 00' 00"			
V.angle	100° 38' 40"			
S.dst				
EDM		TARGET		PAGE

Station point setup can be changed by pressing [F3][STATION].

STATION POINT SETUP		
1. PN	:	POT3
2. IH	:	0001. 200m
3. PC	:	
4. TEMP	:	+15°C
5. PRESS	:	1013 hPa
SAVE		↑ ↓ ACCEPT

EDM settings can be selected by pressing [F1][EDM].

For example, change 1.PRIM. MEAS KEY (MEAS) to TRACK SHOT or TRACK CONT if you want to use tracking measurement with primary MEAS key (MEAS).

EDM SETTINGS	
1. PRIM. MEAS KEY	: MEAS. SHOT
2. SEC. MEAS KEY	: TRACK CONT
3. EDM MIN DISP/QUICK	: 1mm/OFF
4. SHOT COUNT	: 1 TIME
5. SHOT INPUT	: 01TIMES

Navigation: ▲ | ▼ | ▲ | ▼ | ACCEPT

The target type can be selected by pressing [F2][TARGET].

4.8 Offset

Press the [F2][OFFSET] to view the OFFSET screen. Offset enables you to work with Offset. The following offset are available.

OFFSETS	
1. RO	: + 0 0 0 0 . 0 0 0 m
2. DO	: + 0 0 0 0 . 0 0 0 m

Navigation: ▲ | ▼ | ▲ | ▼ | ACCEPT

Press [ENT] to view the offset input window. Input the RO offset value by pressing each keys. DO values are input in the same manner.

RO	
1. RO	: + 0 0 0 0 . 0 0 0 m
2. DO	: + 0 0 0 0 . 0 0 0 m

Navigation: ← | → | CLEAR

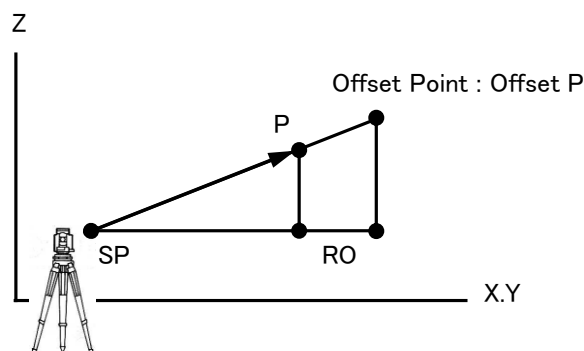
Press [ENT] and then [ACCEPT] to view the MEASURE screen. The S.dst (slope distance) is adjusted by input offset value.

The input value of offset is cleared when you save the surveying point and step forward to the next surveying point.

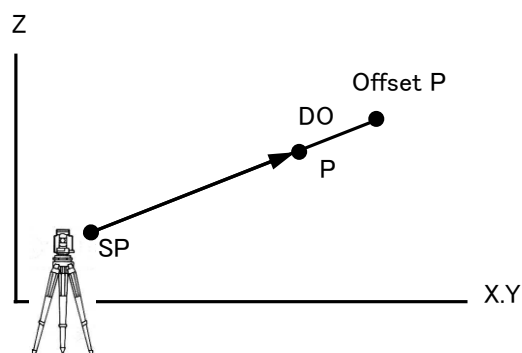
MEASURE		15°C	N 0
PN	POT3		
PH	1: 2 0 0 m		
H.angle	0° 00' 00"		
V.angle	1 0 0° 38' 40"		
S.dst	(OFFSET + DIST) m		

Navigation: OFFSET | STATION | DISP | PAGE

RO: Radial Offset (RO: On the horizontal plane. Offset P: Along the line of measurement, thus along the slope)



DO: Distance Offset (Along the line of measurement, thus along the slope)

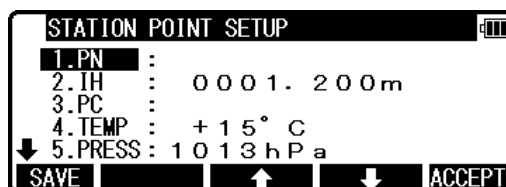
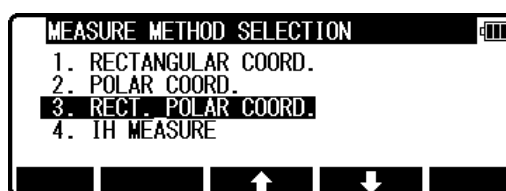


4.9 Station setup [By Rectangular & Polar Coordinates]

Rectangular Data and Polar Data can be stored at the same time in this function

Press [F2][MEAS] of the PowerTopoLite to view the MEASURE METHOD SELECTION screen.

Select 3. RECT._POLAR COORD. and press [ENT] to view the STATION POINT SETUP screen.

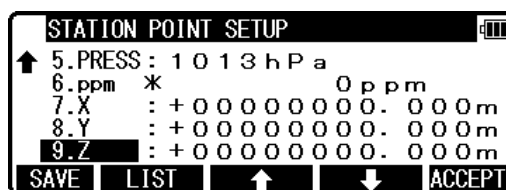


The [↑] / [↓] mark is used to scroll up / down.

Input the necessary parameter.

For more details on input procedure, refer to “4.1

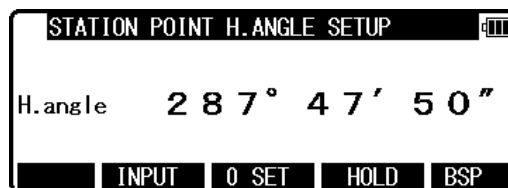
Station setup [By Rectangular Coordinates] and “4.5 Station setup [By Polar Coordinates]



4.10 Station Orientation

Press the [F5][ACCEPT] to view the STATION POINT H.ANGLE SETUP screen.

Please, note that the rotation of the “H.angle” depends on the rotation setting of “Coordinate axis definition”.



Input the H.angle by pressing [F2][INPUT], [F3][0SET] and [F4] [HOLD] or Reference point Coordinates by pressing [F5][BSP] (Refer to “4.2 Station Orientation”).

4.11 Function of MEASRE screen

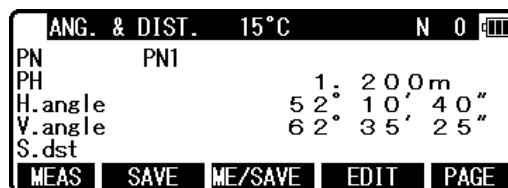
Press [ENT] to display MEASRE screen

Two screens; “MEASURE” and “ ANG. & DIST” are displayed and the screen to be display first can be set on “PREFERENCE “ of “11. MEAS. DISPLAY”

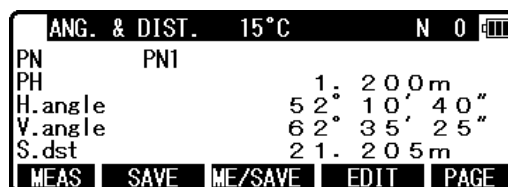
When it is on default, ANG.& DIST screen is displayed

For more details, refer to “14.11 Meas.Display”

Coordinates display and Angle & Distance display.
Aim at the reference point and press [ENT] to view the MEASURE screen.



Press the [F1][MEAS] to measure the Distance and display the Coordinates.



Press [F2][SAVE] to save the measured data.

Press [F3][ME/SAVE] to measure and save the measured data.

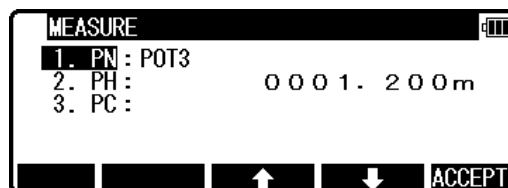
No survey data is saved when no PN is input.

Rectangular Data and Polar Data are saved with the same point name in the same job file.

Press [F4][EDIT] to edit the PN, Point Name, PH, Prism Height and PC, Point Code.

Press [ENT] to view each input window by pressing up or down arrow key, and input your desired point name or prism height or point code. Press

[F5][ACCEPT] if the current PN, PH and PC are acceptable.

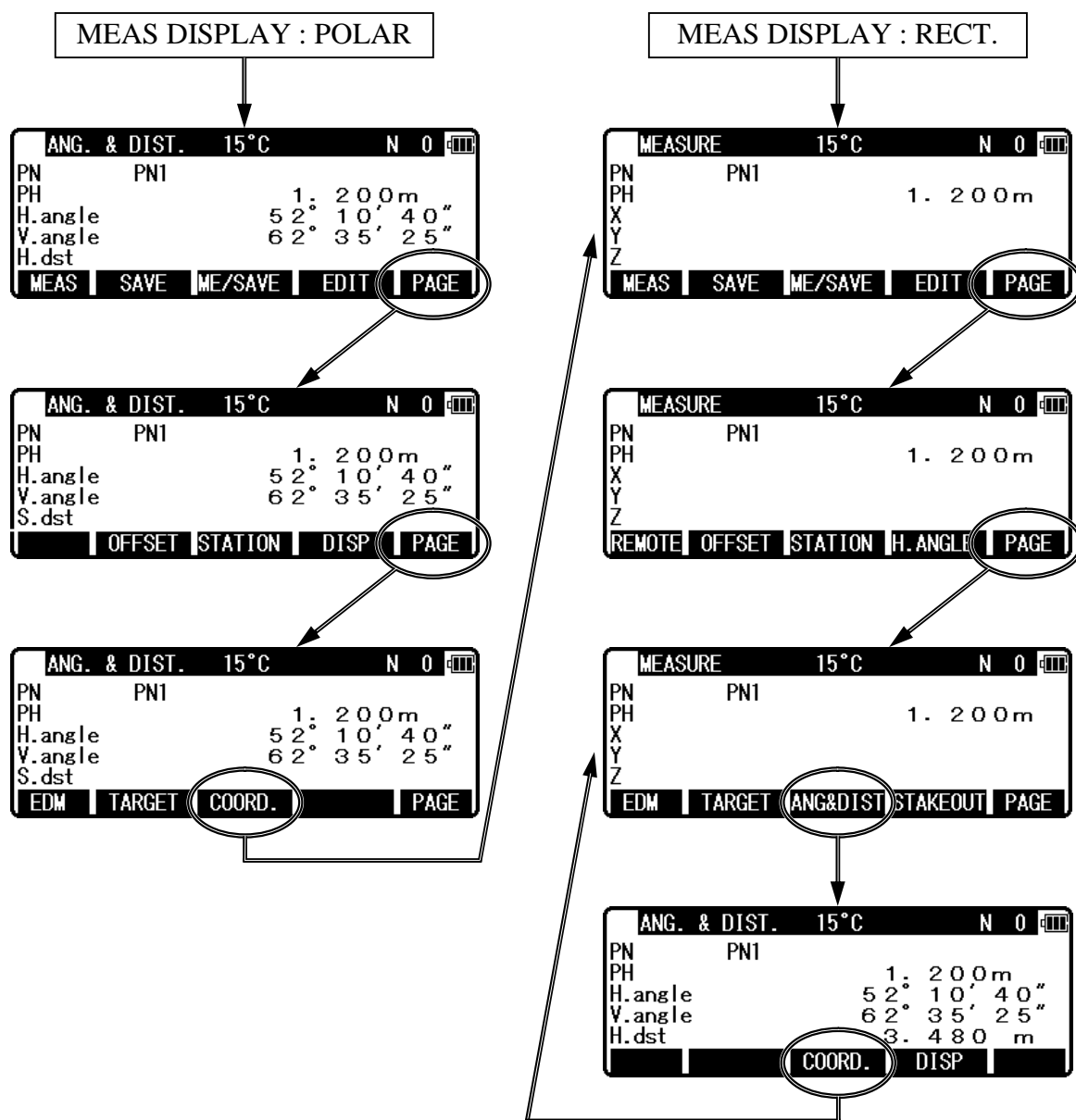


PC, Point Code:

Press [ENT] to view and input the PC, Point code, screen.

If PointCode exists, you can easily select them from the list or edit one of them after pressing the [ENT]. For using Point Code List, please refer to "5.4.1 Point Code".

Pressing [F5][PAGE] switches the screen as follows;



Press [F2][OFFSET] to display OFFSET screen.
For more details on input procedure, refer to
“4.8 Offset”

NOTE: When pressing [F2][OFFSET] on
MEASURE screen, besides RO, DO, VO and TO
can be input.

OFFSETS	
1. RO	: +0000.000m
2. DO	: +0000.000m

▲ | ▼ | ▲ | ▼ | ACCEPT

Station point setup can be changed by pressing
[F3][STATION].

STATION POINT SETUP	
1. PN	:
2. IH	: 0001.200m
3. PC	:
4. TEMP	: +15°C
5. PRESS	: 1013hPa

SAVE | ▲ | ▼ | ACCEPT

EDM settings can be selected by pressing
[F1][EDM].
For example, change 1.PRIM. MEAS KEY (MEAS)
to TRACK SHOT or TRACK CONT if you want to
use tracking measurement with PRIM MEAS KEY
(MEAS).

EDM SETTINGS	
1. PRIM. MEAS KEY	: MEAS. SHOT
2. SEC. MEAS KEY	: TRACK CONT
3. EDM MIN DISP/QUICK	: 1mm/OFF
4. SHOT COUNT	: 1 TIME
5. SHOT INPUT	: 01TIMES

▲ | ▼ | ▲ | ▼ | ACCEPT

The target type can be selected by pressing [F2][TARGET].

Coordinates display and Angle & Distance display

- 1) Press [F5][PAGE] twice.
- 2) Press [F3][ANG & DIST] to view [F3][COORD.] and Angle and Distance values.
- 3) Press [F3][COORD.] to view [F3][ANG&DIST] and Coordinates.

Function of ANG.&DIST screen

Pressing [F4][DISP] changes the distance data to be
displayed

ANG. & DIST. 15°C		N 0
PN	PN1	
PH		1. 200m
H.angle		52° 10' 40"
V.angle		62° 35' 25"
S.dst		21.205m

MEAS | SAVE | ME/SAVE | EDIT | PAGE

ANG. & DIST. 15°C		N 0
PN	PN1	
PH		1. 200m
H.angle		52° 10' 40"
V.angle		62° 35' 25"
H.dst		9.762m

MEAS | SAVE | ME/SAVE | EDIT | PAGE

ANG. & DIST. 15°C		N 0
PN	PN1	
PH		1. 200m
H.angle		52° 10' 40"
V.angle		62° 35' 25"
V.dst		18.824m

MEAS | SAVE | ME/SAVE | EDIT | PAGE

Function of MEASURE screen:

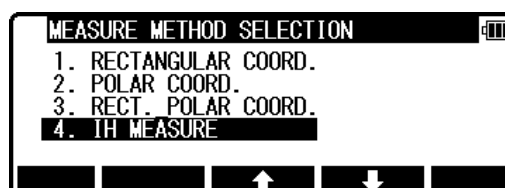
Press [F1][REMOTE] to carry out Remote measurement(Refer to “4.4.1 Remote”)

Press [F4][H.ANGLE] to display STATION POINT H. ANGLE SETUP(Refer to “4.2 Station Orientation”)

Stakeout can be selected by pressing [F4][STAKEOUT].

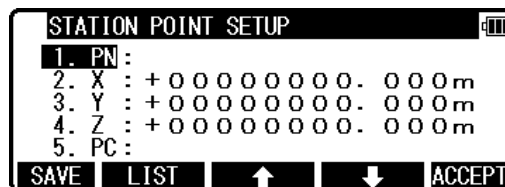
4.12 IH measurement

This function is to measure IH based on known point
The IH value measured here will be set as an initial value of HI to be used on each function



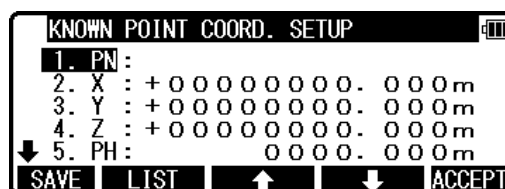
Press [F2][MEAS] of the PowerTopoLite to view the MEASURE METHOD SELECTION screen.

Select 4.IH MEASURE and press [ENT] to view the STATION POINT SETUP screen.



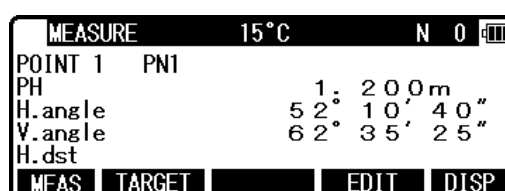
Press [ENT] to open the PN, X, Y, and Z input window and input each.

Then, press [ENT] or [F5][ACCEPT] to view the KNOWN POINT COORD. SETUP screen.



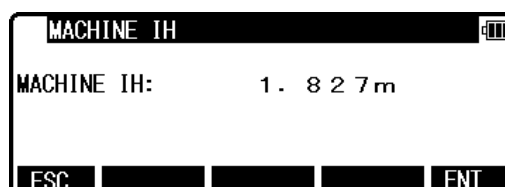
Press [ENT] to open the PN, X, Y, Z and PH input window and input each.

Then, press [ENT] or [F5][ACCEPT] to view the MEASURE screen.

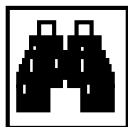


After pressing [F1][MEAS] to make the distance measurement, press [ENT] to display MACHINE IH screen.

The value output on this screen is the current IH value. It will be saved as the updated IH value by pressing [ENT]



5. VIEW AND EDIT



Stored data are displayed graphically, and the editing of the stored data is possible by this Function.

The Z Coordinate (the height) of the point is ignored in the graphical display of the point data.

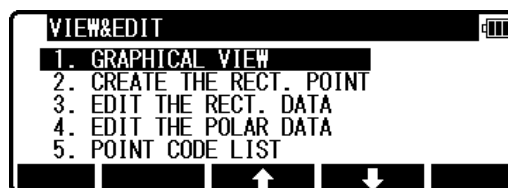
Four menu items are available:

- GRAPHICAL VIEW : Draw recorded points.
- CREATE THE RECT. POINT : Input Rect. Data manually.
- EDIT THE RECT. DATA : Edit recorded Rect. Data.
- EDIT THE POLAR DATA : Edit recorded Polar Data
- POINT CODE LIST : Create and edit PointCodeList

For more details of PointCodeList, refer to “5.4.1 Point Code”.

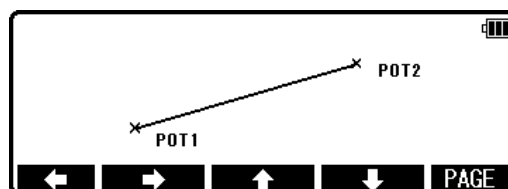
5.1 Graphical View

From the PowerTopoLite screen, press [F3][VIEW] to view its screen.



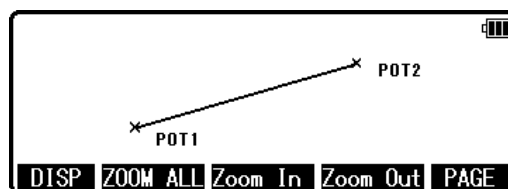
Press [ENT] to view the GRAPHICAL VIEW screen.

Points, Point names and their Graphics are displayed. The graphic is moved by pressing the arrow keys.



The Graphics are not displayed when points are not stored. Two or more points are needed.

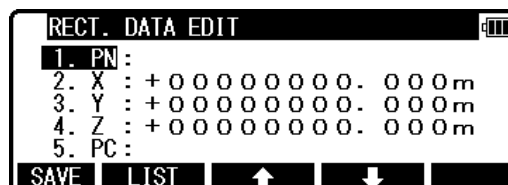
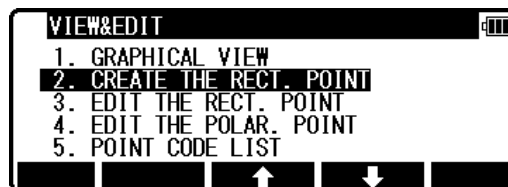
Press the [F5][PAGE] to view another menu.



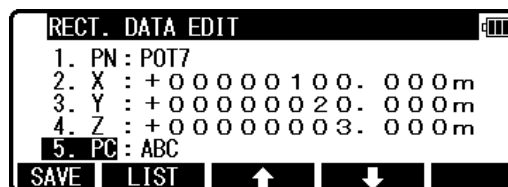
- [DISP]: Each Graphic is displayed as following order by pressing this key.
Full → Points → Points + Line → Points + Points names
- [ZOOM ALL]: Return to the ordinary Graphics size
- [Zoom IN]: Enlarge the Graphics size.
- [Zoom OUT]: Reduce the Graphics size.

5.2 Create the Rectangular Point

Select 2. CREATE THE RECT. POINT and press [ENT] to view the RECT. DATA EDIT screen.



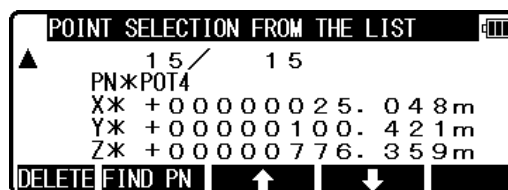
Input the PN, X, Y, Z and PC.
Press [ENT] to save them.



Press [F2][LIST] to view the saved points.

The first line of the screen shows now displayed point and the total number of points.

Press [F1][DELETE] to delete your desired point.
Press [F2][FIND PN] to find your desired point by the PN input.

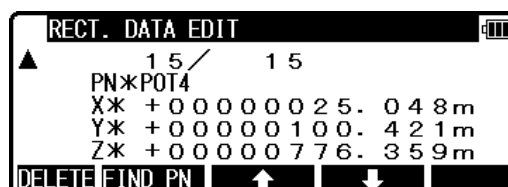
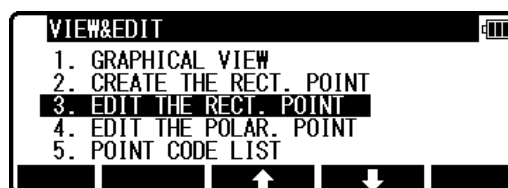


NOTE: For more details on research function, refer to “4.1.2 Coordinates, X,Y,Z,IH and PC input”

5.3 Edit the Data

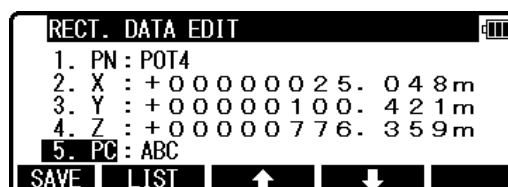
[RECT. DATA]

Select 3.EDIT THE RECT.DATA and press [ENT] to view the RECT.DATA EDIT screen.



Your desired points are deleted and found as described above.

After selecting desired point with arrow key, press [ENT] to view the RECT. DATA EDIT screen to edit.



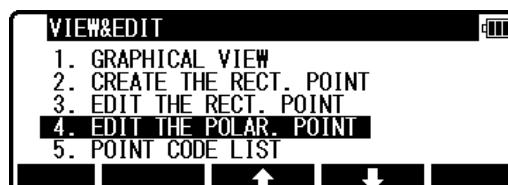
RECT. DATA EDIT

1. PN :	POT4
2. X :	+00000025. 048m
3. Y :	+00000100. 421m
4. Z :	+00000776. 359m
5. PC :	ABC

SAVE | LIST | ↑ | ↓

[POLAR DATA]

Select 4. EDIT THE POLAR DATA and press [ENT] to view the POLAR. DATA EDIT screen.



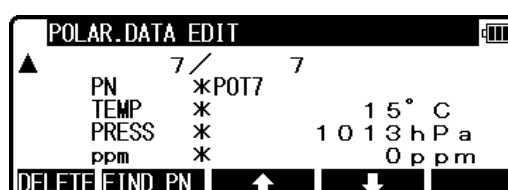
VIEW&EDIT

1. GRAPHICAL VIEW
2. CREATE THE RECT. POINT
3. EDIT THE RECT. POINT
4. EDIT THE POLAR. POINT
5. POINT CODE LIST

↑ | ↓

Your desired points are deleted and found as described above.

After selecting desired point with arrow key, press [ENT] to view the POLAR DATA EDIT screen to edit.



POLAR. DATA EDIT

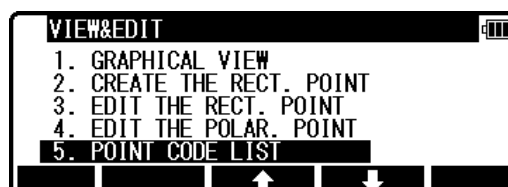
PN	7 / 7	*POT7
TEMP	*	15° C
PRESS	*	1013 hPa
ppm	*	0 ppm

DELETE | FIND PN | ↑ | ↓

You can edit data and save it.

5.4 Point Code List

Select 5. POINT CODE LIST and press [ENT] to view the POINT CODE LIST screen.



VIEW&EDIT

1. GRAPHICAL VIEW
2. CREATE THE RECT. POINT
3. EDIT THE RECT. POINT
4. EDIT THE POLAR. POINT
5. POINT CODE LIST

↑ | ↓



POINT CODE LIST

1. PointCode Create
2. PointCode Edit

↑ | ↓

5.4.1 Point Code

The PC, PointCodeList can be used for adding your desired attributes to Rect. and Polar data. If point codes are stored under the job named "PointCodeList", you can easily select one of the Point Code from the list or edit one of them after pressing [ENT]. Please, note that Point Code, which is saved in the other job can not be referred to as a list. PointCodeList

Making “PointCodeList”:

PointCodeList can be created by using function of “5.4.1 Point Code List”

Use this function to create, edit and add PointCodeList.

Importing “PointCodeList” file:

PointCodeList can be used after importing it from external devices (ex. PC).

After importing, it is stored in the internal memory of the instrument. To store user defined ”PointCodeList”, please carry out following procedure.

Preparing “PointCodeList” file:

Make a “PointCodeList.csv” file with reference to a sample “PointCodeList.csv” file that is contained in the “R-400 Supplement Disk” for the format.

Please, note that the newly entered PointCode on the instrument is not added to the PointCodeList that is stored in the memory. In this case, edit “PointCodeList.csv” separately.

Contents of “PointCodeList.csv”:

```
1,,PointCodeList,
31,,1,ABC,,
31,,2,DEF,,
31,,3,GHI,,
31,,4,JKL,,
31,,5,MNO,,
31,,6,PQR,,
31,,7,STU,,
31,,8,VW,,
31,,9,XYZ,,
```

Format of the “PointCodeList” file

	Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7
Description	Record Type	No.	Name	Description			
Ex. Line 1	1,	,	PointCodeList,	,			
	Job record	Job No. (N/A)	Job Name (Fixed for “PointCodeList”.)				
Ex. Line 2	31,	,	1,	ABC,	,	,	,
	Coord. data record	Point No. (N/A)	Point Name (Should not be duplicated and Max. 15 Characters.)	Point Code (Max. 15 Characters.)			

Import Procedure

Press [F3][I/O] on PowerTopoLite screen to display TRANSFER MENU.

[In case of using file conversion]

First, set “PointCodeList.csv” in the instrument by means of USB or SD card.

Then, specify ExtCSV to format and carry out file conversion.

More details on file conversion, refer to “13.1.2 Reading from Text File”.

[In case of using COM port]

In case of using COM port, communication setting is necessary.

Press [F3][COM] to display TRANSFER.

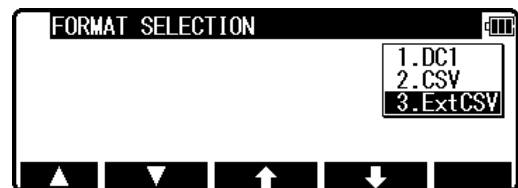
To check the communication setting, select “4. COMMUNICATION SETUP” in the “TRANSFER” screen and press [ENT] to view “COMM.SETTING SELECTION” screen.



Then select “1. RECEIVE RECT.DATA” and set “1. BAUD RATE” to “1200”, “6. XON/XOFF” to “OFF” for using “DL-01”, “ON” for using “HYPER TERMINAL”. “7. PROTOCOL” to “OFF” “8. RECORD DELIMITER” to “CR+LF” and press [ACCEPT]. (Cf. “13.3.3.1 Receiving data setting”)

After the communication setting, specify ExtCSV for format, then start transfer.

For more details on the procedure, refer to “13.3.1 Input from the PC”



5.4.2 PointCode Create

Press [ENT] to view the PointCode Create screen.



Press [ENT] to view and input the PC, Point code, screen.



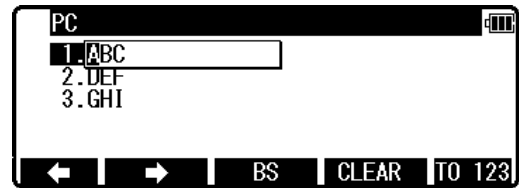
After input, press [F1][SAVE] to save the values.

5.4.3 PointCode Edit

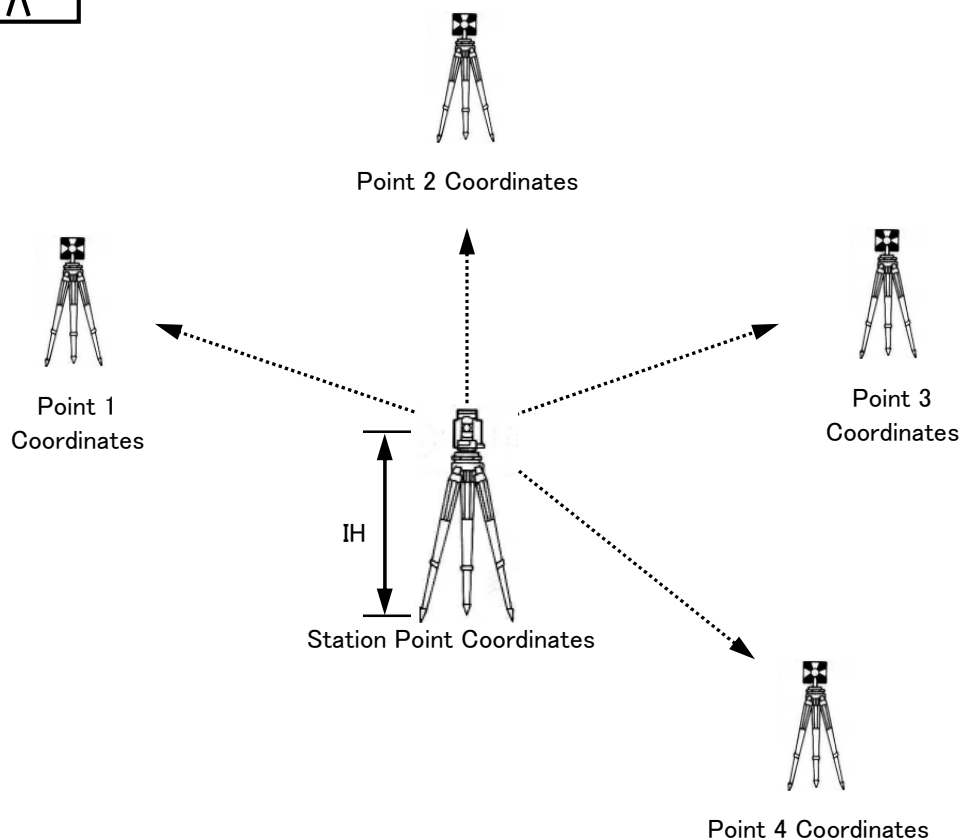
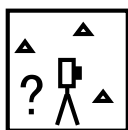
Select 2. PointCode Edit and press [ENT] to view the PointCodeList screen.



Select the PointCode you wish to edit and Press [ENT] to display PC screen , then edit the PointCode.



6. FREE STATIONING



The Station point Coordinates are calculated from the different known points.

To gain the Coordinates, at least two H. angles and one distance or three H. angles are required.

If not so, the error message of “Not enough data to Calculate! 2 angles and 1 distance, 3 angles are required” appears.

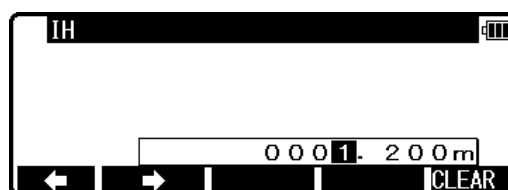
First, input the height of the IH, Instrument height.

6.1 Stationing by more than 3 known points

4 known points stationing (For example)

Press [F4][FREE] of the PowerTopoLite screen to view the IH input screen.

Input the IH value.



Aim at Point 1.

Press [ENT] to view the KNOWN POINT COORD.SETUP screen.

KNOWN POINT COORD. SETUP	
1. PN:	
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. Z :	+000000000.000m
5. PH:	0000.000m
SAVE	LIST

Press [ENT] to open the PN,X,Y,Z and PH input window and input each.

Then, press [ENT] or [F5][ACCEPT] to view the MEASURE screen.

MEASURE		15°C	N 0
POINT 1	PN1		
PH		1. 200m	
H.angle		52° 10' 40"	
V.angle		62° 35' 25"	
H.dst		3. 480 m	
MEAS	TARGET	EDIT	DISP

Press [ENT] to view the ADD/CALC. SELECTION MENU screen.

(Measuring is not needed. Just press [ENT].)

ADD/CALC. SELECTION MENU	
Do you want to add more point?	
Press [ADD] to add more point.	
Press [CAL] to calculate.	
ADD	CALC

Press the [F1][ADD] to view the KNOWN POINT COORD. SETUP screen.

Aim at Point 2, 3 and 4.

In the same manner, input the values of Point 2, 3 and 4.

KNOWN POINT COORD. SETUP	
1. PN:	POT2
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. Z :	+000000000.000m
5. PH:	0001.200m
SAVE	LIST

KNOWN POINT COORD. SETUP	
1. PN:	POT3
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. Z :	+000000000.000m
5. PH:	0001.200m
SAVE	LIST

KNOWN POINT COORD. SETUP	
1. PN:	POT4
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. Z :	+000000000.000m
5. PH:	0001.200m
SAVE	LIST

[F3][P2 MEAS] button appears on 3rd point of ADD/CALC.SELECTION MENU screen.

ADD/CALC. SELECTION MENU	
Do you want to add more point?	
Press [ADD] to add more point.	
Press [CAL] to calculate.	
ADD	P2 MEAS
CALC	

For precise measurement, carry out [F3][P2 MEAS] to calculate at least two multiplicative.

After pressing [F3][P2 MEAS], measure the distance of 2nd point.

With this function you can obtain the most probable value of the angle of three points: after measuring the distance of 3rd point, measure the 2nd point again.

After the measurement, press [ENT] to go to RESULT COORD. OF STATIONING screen.

The most probable value is calculated based on the station point coordinate

MEASURE		15°C	N 0
POINT 2	PN2		
PH		1. 200m	
H.angle		102° 10' 20"	
V.angle		32° 45' 65"	
H.dst			
MEAS	TARGET	EDIT	DISP

After entering values of PN4, press [ENT] twice to view the MEASURE and ADD/CALC SELECTION MENU.

ADD/CALC. SELECTION MENU	
Do you want to add more point?	
Press [ADD] to add more point.	
Press [CAL] to calculate.	
ADD	CALC

Press the [F5][CALC] to view the RESULT COORD. OF STATIONING screen.

The Station Coordinates is displayed. Result coordinates of free stationing can be saved for Station setup after pressing [F5][ACCEPT]. Horizontal angle of the result coordinates will be affected to the Station point for measuring.

RESULT COORD. OF STATIONING	
PN	PN5
HA	33° 51' 40"
X	-6.000m
Y	+10.000m
Z	+201.300m
NEXT	COMPARE ACCEPT

Press [F1][NEXT] to view KNOWN POINT COORD. SETUP screen.

KNOWN POINT COORD. SETUP	
1. PN:	
2. X :	+00000000.000m
3. Y :	+00000000.000m
4. Z :	+00000000.000m
5. PH:	0000.000m
SAVE	LIST
↑	↓
ACCEPT	

DEVIATIONS OF THE POINT: Four points or more are needed to view this. Press [ENT] to view the DEVIATIONS OF THE POINT screen. The deviations of X,Y and Z coordinate of each point are displayed. For each point, you can decide if you want to accept or reject the point.

PN: Current point number
dX: Deviation on the X value
dY: Deviation on the Y value
dZ: Deviation on the Z value

DEVIATIONS OF THE POINT	
PN	
d HA	0° 00' 00"
d X	+0.000m
d Y	+0.000m
d Z	+0.000m
REJECT	ACCEPT

6.2 Stationing by two known points

(One point must be measured at least to gain the Station Coordinates.)

Press [F4][FREE] of the PowerTopoLite screen to view the IH input screen.

Input the IH value.

Aim at the Point 1.

Press [ENT] to open the PN,X,Y,Z,PH and PC input window and input each value.

Then, press [ENT] to view the MEASURE screen.

Press [ENT] to view the ADD/CALC. SELECTION MENU screen.

Press [F1][ADD] to view the KNOWN POINT COORD. SETUP screen.

In the same manner, aim at the Point 2.

Press [ENT] to open the PN,X,Y,Z,PH and PC input window and input each value.

Then, press [ENT] or [F5][ACCEPT] to view the MEASURE screen.

Press the [F1][MEAS] to measure the distance.
Press [ENT] to view the ADD/CALC. SELECTION MENU screen.

ADD/CALC. SELECTION MENU			
Do you want to add more point?			
Press [ADD] to add more point.			
Press [CAL] to calculate.			
ADD			CALC

Press [ENT] to view the RESULT COORD. OF STATIONING.

The Station Coordinates is displayed. Result coordinates of free stationing can be saved for Station setup after pressing [F5][ACCEPT]. Horizontal angle of the result coordinates will be affected to the Station point for measuring.

RESULT COORD. OF STATIONING			
PN	PN5		
HA	33° 51' 40"		
X	-6.	000	m
Y	+10.	000	m
Z	+201.	300	m
NEXT		COMPARE	ACCEPT

Press [F4][COMPARE] to view the RESULT COORD. OF STATIONING screen.

RESULT COORD. OF STATIONING			
<-->PN5			
Design HD	0.	404	m
Calc. HD	0.	378	m
Deviation	0.	064	m
			NEXT

NOTE:

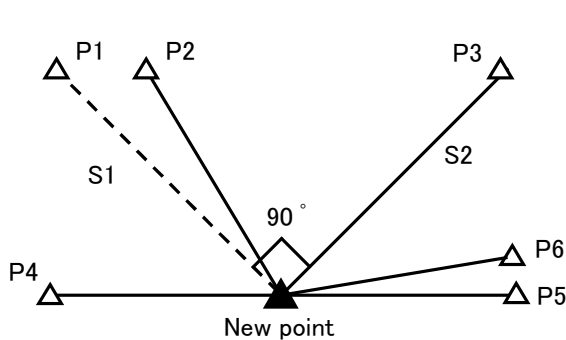


Fig. 1

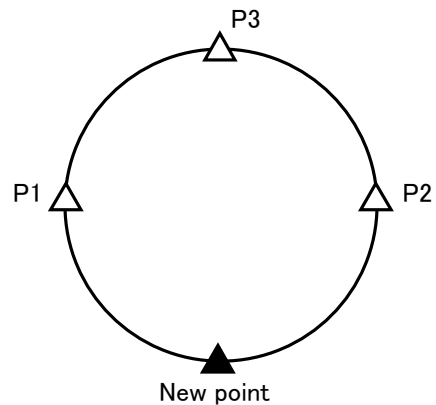


Fig. 2

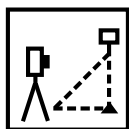
As illustrated in Fig. 1, it is optimal to choose the known points P1 and P3. The instrument should be set up in such a manner so that the angle between P1 and P3 becomes 90°. The distances S1 and S2 should be similar.

The accuracy of a calculation result depends on the following:

- 1) The inner angle between known points is extremely small.
See P1 and P2 on above Fig. 1.
- 2) The inner angle between known points is extremely large.
See P4 and P6 on above Fig. 1.
- 3) The distance from a new point to a known point is extremely short or extremely long.
- 4) A new point (station point) and three or more known points are arranged on the same circumference. See above Fig. 2.

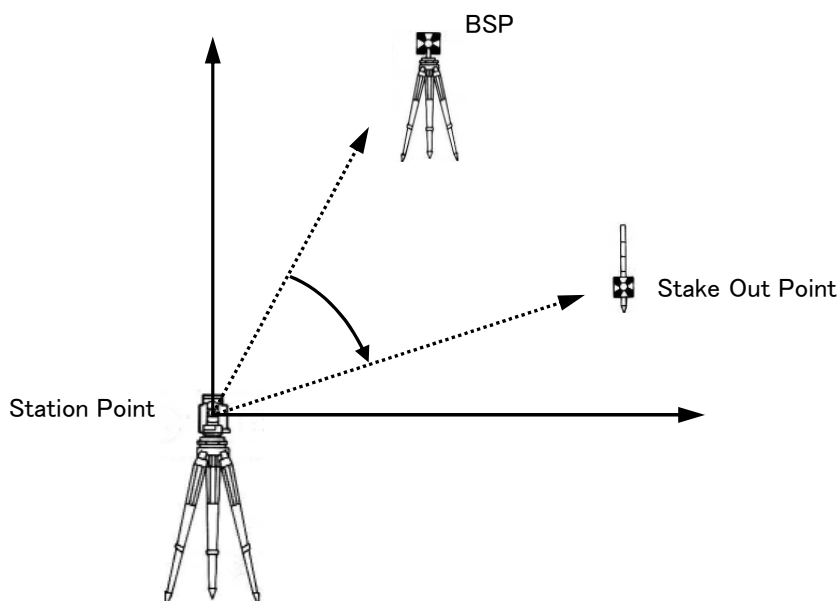
When searching for a new point by free stationing and surveying by installing an instrument in the point, accuracy may not be stabilized compared with the case where an instrument is installed on a known point. In field work which needs a high-precision survey, we cannot recommend this method.

7. STAKE OUT



From the known Station point and Direction angle, the Coordinates for the Stakeout are obtained.

7.1 Stake Out



Press [F1][STAK] to view the STAKEOUT METHOD SELECTION screen.

STAKEOUT METHOD SELECTION	
1.	STAKE OUT
2.	POINT TO LINE
3.	POINT TO ARC

↑ ↓

Select 1.STAKE OUT and press [ENT] to view the STATION POINT SETUP screen.

STATION POINT SETUP	
1.	PN:
2.	X : +00000000.000m
3.	Y : +00000000.000m
4.	Z : +00000000.000m
5.	IH: 0000.000m

SAVE LIST ↑ ↓ ACCEPT

Open the PN, X, Y, Z, IH and PC input window and input each. Save the data by pressing [F1][SAVE].

Press [ENT] to view STATION POINT H.ANGLE SETUP screen.

STATION POINT H.ANGLE SETUP	
H.angle	287° 47' 50"

INPUT 0 SET HOLD BSP

Input the H. angle by pressing [F2][INPUT], [F3][OSET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5][BSP].

Pressing [F2][INPUT]
Input any horizontal angle.

Pressing [F5][BSP]
The information for Back sight point is obtained.
Press [ENT] to finalize the input.

Press [ENT] to view the STAKEOUT COORD. SETUP screen.

Open the PN, X, Y, Z, PH and PC input window and input each.

Save the data by pressing [F1][SAVE].
Press [ENT] or [F5][ACCEPT] to view the STAKEOUT screen.

Aim at the Stake out point and press the [F1][MEAS] to begin the Stake Out.
Deviation of each value is displayed.
Form of the screen to display deviation of the Stake Out can be changed by the selections of the “14.6 Compare method selection” in “14.PREFERENCE” setting.

To display all information at once,
select "ALL IN ONE INFO."

STAKEOUT		15°C	N 0	[BATT]	
PN A					
PH					
D H.	angle	1. 000m			
D V.	angle	65° 32' 14"			
D H.	dist	43' 43' 37"			
D X					
D Y					
D Z					
MEAS		TARGET	DISP	NEXT	PAGE

Press [F3][DISP] to view another screen.

STAKEOUT REPORT		[BATT]			
PN A					
DESIGN					
X		+ 500. 000m			
Y		+ 50. 000m			
Z		+ 2. 000m			
NEXT					ENT

Press [F1][NEXT] to view another screen.

STAKEOUT REPORT		[BATT]			
PN A					
STAKE					
X		+ 0. 000m			
Y		+ 0. 000m			
Z		+ 0. 000m			
NEXT					ENT

STAKEOUT REPORT		[BATT]			
PN A					
DEVIATION					
X		+ 0. 000m			
Y		+ 0. 000m			
Z		+ 0. 000m			
NEXT					ENT

To display information with larger
character, select "LARGE CHARACTER".

STAKEOUT		15°C	N 0	[BATT]	
PN A					
PH					
		0. 000m			
D H.	angle	339° 26' 38"			
D V.	angle	+ 427. 200m			
D H.	dist	+ 2. 000m			
		SCROLL			

Press [F3][SCROLL] to view another screen.

STAKEOUT		15°C	N 0	[BATT]	
PN A					
PH					
		0. 000m			
D H.	angle	65° 32' 14"			
D V.	angle	43° 43' 37"			
D H.	dist.				
MEAS		TARGET	SCROLL	NEXT	PAGE

STAKEOUT		15°C	N 0	[BATT]	
PN A					
PH					
		0. 000m			
X					
Y					
Z					
		SAVE	SCROLL		

STAKEOUT		15°C	N 0	[BATT]	
PN A					
PH					
		0. 000m			
D X					
D Y					
D Z					
MEAS		TARGET	SCROLL	NEXT	PAGE

STAKEOUT		15°C	N 0	[BATT]	
PN A					
PH					
D H.	angle	1. 000m			
D V.	angle	65° 32' 14"			
D H.	dist	43' 43' 37"			
D X					
D Y					
D Z					
MEAS		TARGET	DISP	NEXT	PAGE

STAKEOUT		15°C	N 0	[BATT]	
PN A					
PH					
		0. 000m			
D H.	angle	65° 32' 14"			
D V.	angle	43° 43' 37"			
D H.	dist.				
MEAS		TARGET	SCROLL	NEXT	PAGE

Press [F5][PAGE] to view another screen.

STAKEOUT		15°C	N 0	[BATT]	
PN A					
PH					
D H.	angle	1. 000m			
D V.	angle	65° 32' 14"			
D H.	dist	43' 43' 37"			
D X					
D Y					
D Z					
RECT.M		STATION	H.ANGLE	DRAW	PAGE

STAKEOUT		15°C	N 0	[BATT]	
PN A					
PH					
		0. 000m			
D H.	angle	65° 32' 14"			
D V.	angle	43° 43' 37"			
D H.	dist.				
RECT.M		STATION	H.ANGLE	DRAW	PAGE

R... 5.924
B... 1.143
U... 0.887

← → ↑ ↓ PAGE

R.: 5.924
B.: 1.143
U.: 0.887


DISP ZOOM ALL ZOOM IN ZOOM OUT PAGE

R: 5.924
 S: 1.143
 U: 0.887

DEVIATION

DISPI ZOOM ALL ZOOM IN ZOOM OUT PAGE

R. = 5.924
B. = 1.143
U. = 0.887



DISP ZOOM ALL ZOOM IN ZOOM OUT PAGE

R.: 5.924
B.: 1.143
U.: 0.887

x_p

x_s

x_0

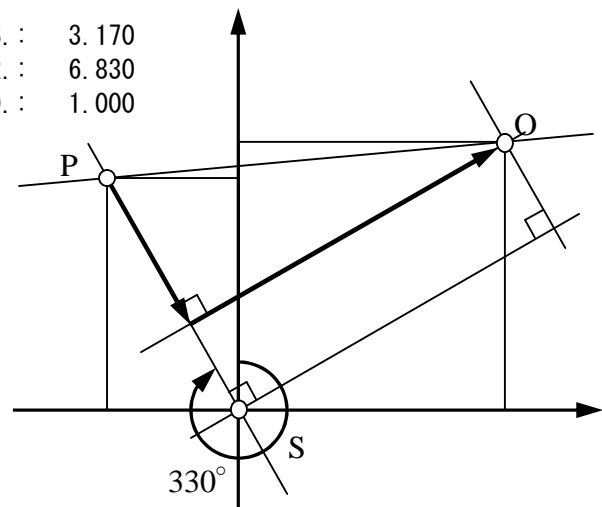
DISP ZOOM ALL ZOOM IN ZOOM OUT PAGE

F(Forward) / B(Back)	Forward/Backward
L(Left) / R(Right)	Left/Right
U(UP) / D(Down)	Up/Down

Press [ENT] or [ESC] to return STAKEOUT screen.

B. : 3.170
R. : 6.830
D. : 1.000

Station	X	0.000 m
Point	Y	0.000 m
S	Z	0.000 m
Measurement	H.angle	330° 00' 00"
Point	H.dst	5.000 m
P	V.dst	1.000 m
Design	X	5.000 m
Point	Y	5.000 m
O	Z	0.000 m



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Press the [F4][NEXT] to carry out staking out for the next point.

STAKEOUT COORD. SETUP	
1. PN:	A
2. X :	-000000001.000m
3. Y :	+000000005.000m
4. Z :	+000000002.000m
5. PH:	0000.000m
SAVE LIST ↑ ↓ ACCEPT	

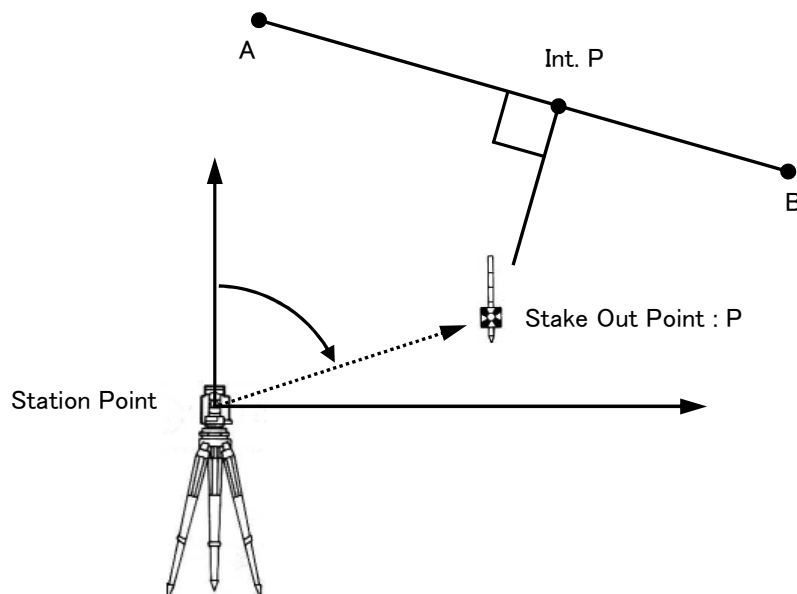
Press the [F1][RECT.M] to view the MEASURE screen.

MEASURE 15°C N 0	
PN	SOPN100
PH	0.000m
D X	
D Y	
D Z	
MEAS SAVE ME/SAVE EDIT PAGE	

Refer to the “4.4 Remote, Offset, Station, and H.angle” function.
Press the [F5][PAGE] to view the other MEASURE menu.

MEASURE 15°C N 0	
PN	SOPN100
PH	0.000m
D X	
D Y	
D Z	
REMOTE OFFSET STATION H.ANGLE PAGE	

7.2 Point to Line



You have to select the point A and B. The distance between the two points A and B has to be at least 1 m. The two points A and B define a line and during Stake out, PTL shows the deviations from the Stake out point, P, to the line A-B.
(At above STAKEOUT screen)

Select 2. POINT TO LINE and press [ENT] to view STATION POINT SETUP screen.

Open the PN,X,Y,Z,IH and PC input window and input each.

STAKEOUT METHOD SELECTION	
1. STAKE OUT	
2. POINT TO LINE	
3. POINT TO ARC	

STATION POINT SETUP	
1. PN:	
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. Z :	+000000000.000m
5. IH:	0000.000m

Press [ENT] to view the STATION POINT H. ANGLE SETUP screen.

Input the H. angle by pressing [F2][INPUT], [F3][0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5][BSP].

STATION POINT H.ANGLE SETUP	
H.angle	287° 47' 50"

Aim at the reference point and press [ENT] to view POINT A COORD.SETUP screen.

Open the PN, X, Y, Z, PH and PC input window and input each of the Point A and press [ENT].

POINT A COORD. SETUP	
1. PN: POT2	
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. Z :	+000000000.000m
5. PH:	0000.000m

Open the PN, X, Y, Z, PH and PC input window and input each of the Point B.

POINT B COORD. SETUP	
1. PN: POT3	
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. Z :	+000000000.000m
5. PH:	0000.000m

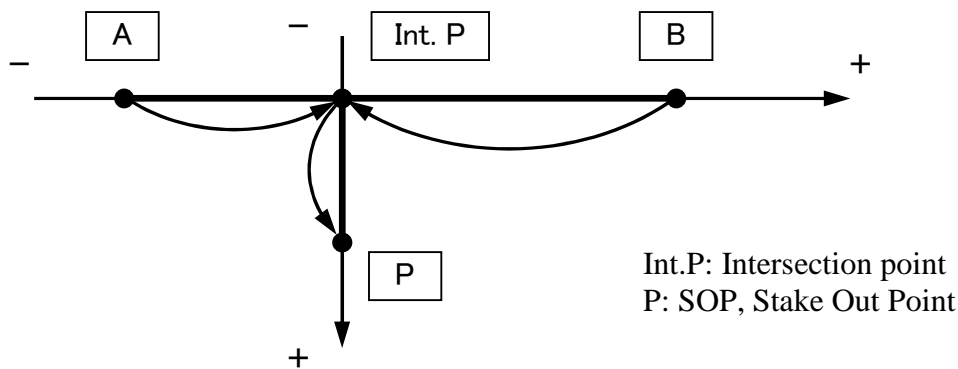
Press [ENT] to view the POINT TO LINE screen.

POINT TO LINE 15°C N 0	
A->B	+80.623m
SOP->A-B	
Int.P->A	
Int.P->B	
Dev.HIGH	

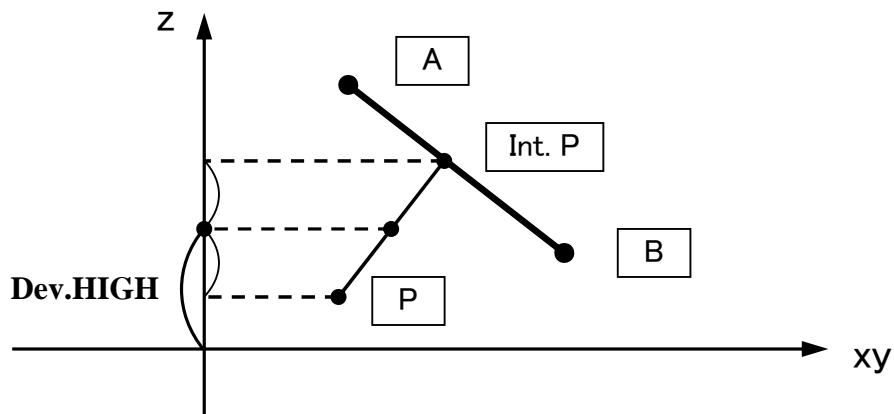
Press [F1][MEAS] to measure. Each distance is displayed.

POINT TO LINE 15°C N 0	
A->B	+80.623m
SOP->A-B	+77.594m
Int.P->A	+315.596m
Int.P->B	+234.974m
Dev.HIGH	-1.916m

- A \rightarrow B Distance between Point A and B. This is always positive.
- P \rightarrow A - B Distance between Int. P and P.
 If P is on the right side for A-B, the value is positive and
 if P is on the left side for A-B, the value is negative
 In case of the below drawing, P is on the right side for A-B ,
 P \rightarrow A-B is positive
- Int. P \rightarrow A Distance between Int. P and A. This is positive or negative.
 If A-Int.P and A-B is on the same direction, Int.P \rightarrow A is positive.
 In case of the below drawing, since A-B and A-Int.P is on the same direction,
 Int.P \rightarrow A is positive
- Int. P \rightarrow B Distance between Int. P and B. This is positive or negative.
 If B-Int.P and A-B is on the same direction, Int.P \rightarrow B is positive.
 In case of the below drawing, A-B is opposite direction to B-Int.P,
 Int.P \rightarrow B is negative.



Dev.HIGH Int.P and P is the deviation of the z coordinate.

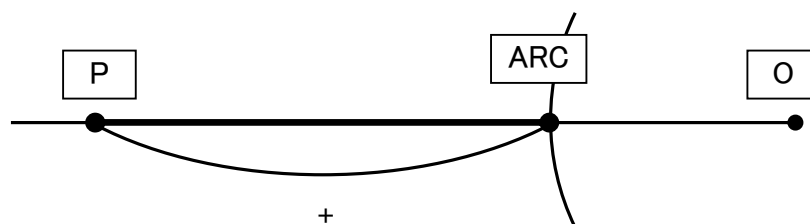


7.3 Point to Arc

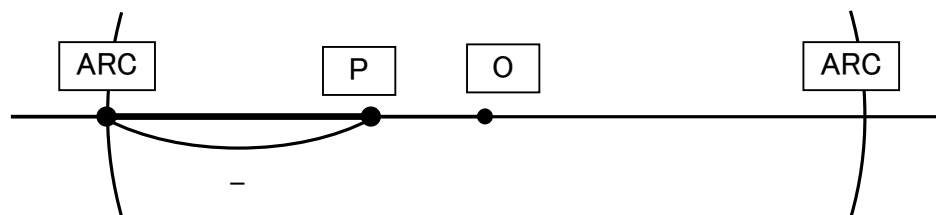
Set station point(SP), target point(P) and an arbitrary circle, then obtain the distance from point P to the arbitrary circle.

SOP->ARC the distance from target point(P) to the circle

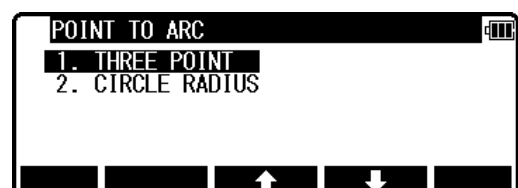
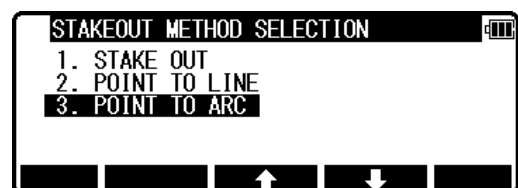
When radius is 0, the figures of the distance between SOP and ARC is shown as a positive figure. When point P is outside the circle, the figures of the distance between SOP and ARC is shown as a positive(+) figure.



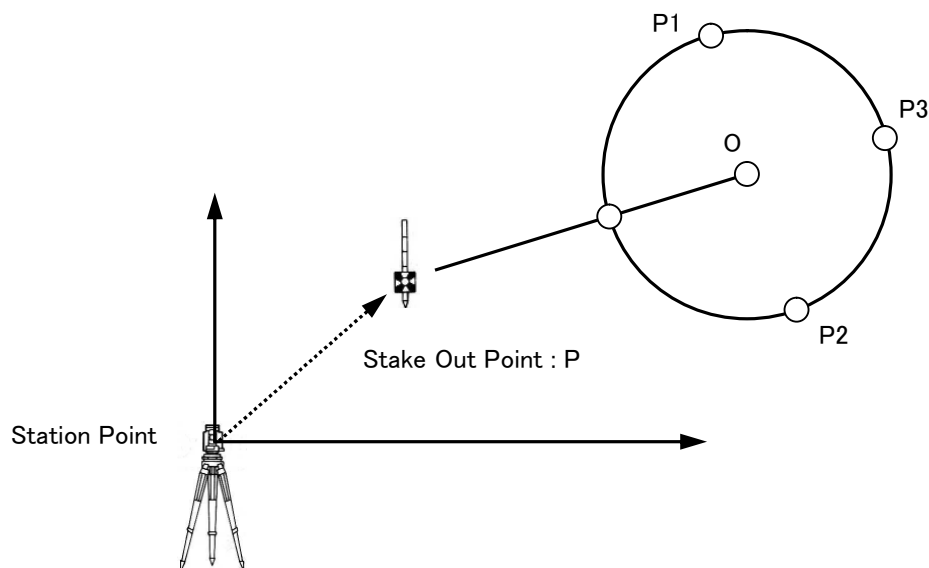
When point P is inside the circle, the figures of the distance between SOP and ARC is shown as a negative(-) figure



Select 3. POINT TO LINE and press [ENT] to view POINT TO ARC screen.



7.3.1 Three point



Input three points to make a circle, obtain the distance from the Stake Out Point to the circumference.

Select 1.THREE POINT and press [ENT] to view the STATION POINT SETUP screen.

Open the PN, X, Y, Z, IH and PC input window and input each. Save the data by pressing [F1][SAVE].

STATION POINT SETUP	
1. PN :	
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. Z :	+000000000.000m
5. IH :	0000.000m
<div> <div>SAVE</div> <div>LIST</div> <div>↑</div> <div>↓</div> <div>ACCEPT</div> </div>	

Press [ENT] to view STATION POINT H.ANGLE SETUP screen.

Input the H. angle by pressing [F2][INPUT], [F3][0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5][BSP].

STATION POINT H.ANGLE SETUP	
H.angle	287° 47' 50"
<div> <div>INPUT</div> <div>0 SET</div> <div>HOLD</div> <div>BSP</div> </div>	

After you finish with sighting the reference point, press [ENT] to go to the next screen.

Input three coordinates points on each screen of P1, P2 and P3 to make a circle.

The procedure of inputting the points is the same as that of STATION POINT SETUP .

P1

1. PN:

2. X : +000000000.000m

3. Y : +000000000.000m

4. Z : +000000000.000m

5. PH: 0000.000m

SAVE LIST ↑ ↓ ACCEPT

P2

1. PN:

2. X : +000000000.000m

3. Y : +000000000.000m

4. Z : +000000000.000m

5. PH: 0000.000m

SAVE LIST ↑ ↓ ACCEPT

P3

1. PN:

2. X : +000000000.000m

3. Y : +000000000.000m

4. Z : +000000000.000m

5. PH: 0000.000m

SAVE LIST ↑ ↓ ACCEPT

After you finish with the input, press [F1][SAVE] or [F5][ACCEPT] to display the measurement screen.

POINT TO ARC 15°C N 0

SOP->ARC

MEAS TARGET NEXT PAGE

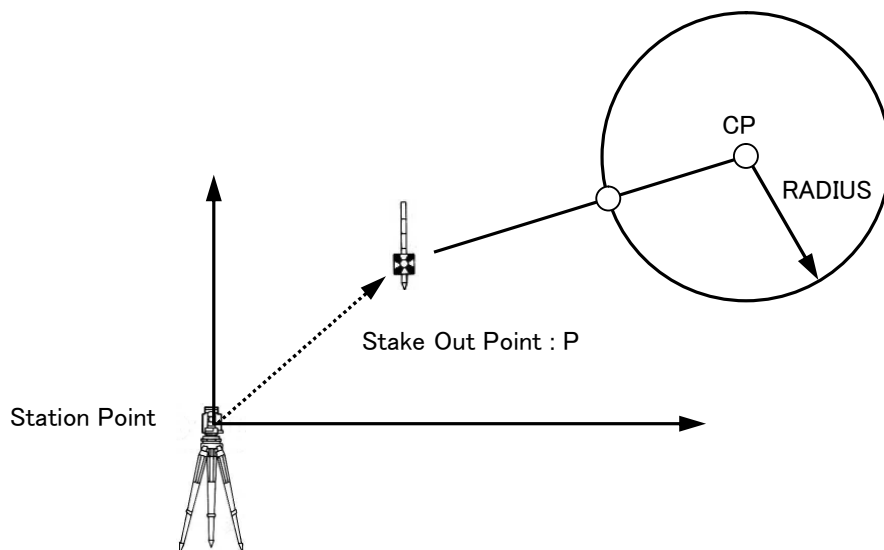
Sight the target, Press [F1][MEAS] to measure the distance. From the measurement results, the distance from the target to the circumference is displayed.

POINT TO ARC 15°C N 0

SOP->ARC + 7.014m

MEAS TARGET NEXT PAGE

7.3.2 Circle radius



Input center coordinate of the circle and radius to make a circle, then obtain the distance from the Stake Out Point to the circumference.

Select 1.THREE POINT and press [ENT] to view the STATION POINT SETUP screen.

Open the PN, X, Y, Z, IH and PC input window and input each. Save the data by pressing [F1][SAVE].

POINT TO ARC	
1.	THREE POINT
2.	CIRCLE RADIUS

STATION POINT SETUP	
1.	PN:
2.	X : +000000000.000m
3.	Y : +000000000.000m
4.	Z : +000000000.000m
5.	IH: 0000.000m
<div> <div>SAVE</div> <div>LIST</div> <div>↑</div> <div>↓</div> <div>ACCEPT</div> </div>	

Press [ENT] to view STATION POINT H.ANGLE SETUP screen.

Input the H. angle by pressing [F2][INPUT], [F3][0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5][BSP].

STATION POINT H.ANGLE SETUP	
H.angle	287° 47' 50"
<div> <div>INPUT</div> <div>0 SET</div> <div>HOLD</div> <div>BSP</div> </div>	

After you finish sighting the reference point, press [ENT] to go to next screen.

CP

1. PN :

2. X : +00000000.000m

3. Y : +00000000.000m

4. Z : +00000000.000m

↓ 5. PH : 0000.000m

SAVE LIST ↑ ↓ ACCEPT

Input coordinates of the center point and radius to make a circle.

RADIUS

0000.000m

← → CLEAR

After you finish with input, press [ENT] to display the measurement screen.

POINT TO ARC 15°C N 0

SOP->ARC

MEAS TARGET NEXT PAGE

Sight the target, Press [F1][MEAS] to measure the distance. From the measurement results, the distance from the target to the circumference will be displayed.

POINT TO ARC 15°C N 0

SOP->ARC + 7.014m

MEAS TARGET NEXT PAGE

8. CALCULATIONS



The following calculations are available:

- COGO
- 2D SURFACE
- 3D SURFACE & VOLUME
- REM

8.1 Cogo

The following COGO functions are available:

- Inverse
- Point Coordinates
- Circle Radius
- Line-Arc intersection
- Line-Line intersection
- Arc-Arc intersection
- Distance offset
- Point distance offset
- Arc distance offset

"COGOPoint" File

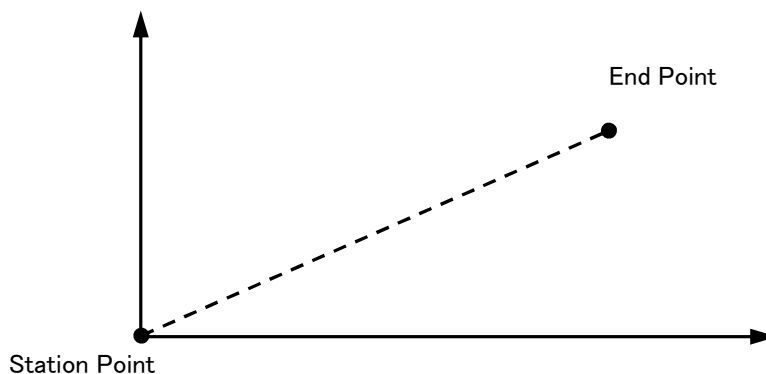
The R-400 series automatically creates "COGOPoint" file. In the file the following coordinates to be used in GOGO function are recorded.

SP	Station Point
EP	End Point
CO	Coordinates
P1	Point 1
P2	Point 2
P3	Point 3
CP	Center Point
S1	Start point 1
E1	End point 1
S2	Start point 2
E2	End point 2
C1	Center point 1
C2	Center point 2
OP	Observation Point

The values recorded in "COGOPoint" are used as an initial value each time these values are input. These values are updated when the function which uses these values is carried out.

For instance, if you carry out Inverse, then carry out Distance offset later, the values of SP and EP which are input at Inverse will be initial values of SE and EP of Distance offset which is carried out later. If you wish to input the initial value in advance, edit it by using "VIEW&EDIT of EDIT THE RECT. DATA.(Refer to "5.3 Edit the Data").

8.1.1 Inverse

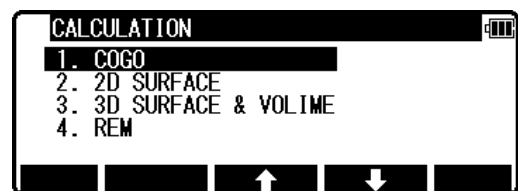


From the given two point Coordinates, the Direction angle and distance are calculated.

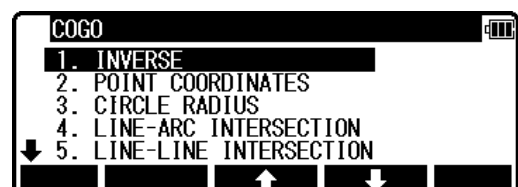
Input: Coordinates of two points

Output: Horizontal distance, Vertical distance between the points and Direction of the line defined by the two points

From the PowerTopoLite screen, press [F2][CALC] to view CALCULATION screen.



Select 1.COGO and press [ENT] to view the COGO screen.



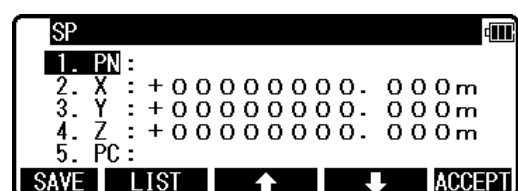
Select the 1. INVERSE and press [ENT] to view INVERSE screen.



A. Start point input

(Input the PN, Coordinates and PC of the Start point.)

Select 1. SP and press [ENT] to view SP screen.



- [LIST] key

All stored points can be displayed as follows by pressing [F2][LIST].

Press [F2][LIST] to view POINT SELECTION FROM THE LIST screen.

POINT SELECTION FROM THE LIST

▲ 1 5 / 1 5

PN*POT4

X* +000000025. 048m

Y* +00000100. 421m

Z* +00000776. 359m

DELETE FIND PN ↑ ↓

Press [ENT] to open the SP input screen.

SP

1. PN: POT1

2. X: +000000000. 000m

3. Y: +000000000. 000m

4. Z: +000000000. 000m

5. PC: ABC

SAVE LIST ↑ ↓ ACCEPT

Input your desired point name by pressing keys, and press [ENT] to open the X coordinate input screen.

X

1. PN: POT1

2. X: +000000000. 000m

3. Y: +000000000. 000m

4. Z: +000000000. 000m

5. PC: ABC

← → CLEAR

Input your desired value by pressing each keys and press [ENT] to go Y coordinate.

SP

1. PN: POT1

2. X: +000000000. 000m

3. Y: +000000000. 000m

4. Z: +000000000. 000m

5. PC: ABC

SAVE LIST ↑ ↓ ACCEPT

Press [ENT] to open the Y coordinate input screen and input.

Y

1. PN: POT1

2. X: +00000100. 000m

3. Y: +000000000. 000m

4. Z: +000000000. 000m

5. PC: ABC

← → CLEAR

Press [ENT] to open the Z coordinate input screen and input.

Z

1. PN: POT1

2. X: +00000100. 000m

3. Y: +00000200. 000m

4. Z: +000000000. 000m

5. PC: ABC

← → CLEAR

Press [ENT] to open the PC input screen and input.

PC

1. PN: POT1

2. X: +000000000. 000m

3. Y: +000000000. 000m

4. Z: +000000000. 000m


5. PC: ABC

← → BS CLEAR TO 123

B. End point coordinates input

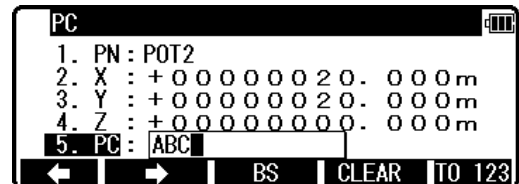
(Input the PN , Coordinates and PC of the End point.)

After PC input, EP screen is viewed.



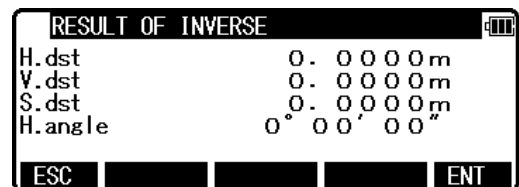
```
EP
1. PN:
2. X : +000000000.000m
3. Y : +000000000.000m
4. Z : +000000000.000m
5. PC:
SAVE | LIST | ↑ | ↓ | ACCEPT
```

Input the PN, X, Y, Z Coordinates and PC name of the End point.



```
PC
1. PN: POT2
2. X : +000000020.000m
3. Y : +000000020.000m
4. Z : +000000000.000m
5. PC: ABC
← | → | BS | CLEAR | TO 123
```

Press [ENT] to view the RESULT OF INVERSE screen.



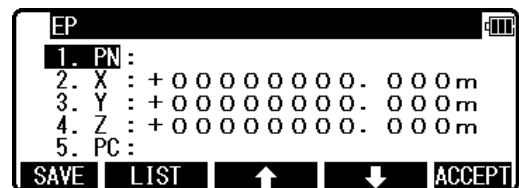
```
RESULT OF INVERSE
H.dst      0.0000m
V.dst      0.0000m
S.dst      0.0000m
H.angle    0° 00' 00"
ESC | | | ENT
```

C. Another End point Coordinates input

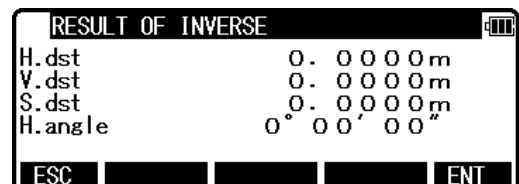
Input the PN, X, Y, Z Coordinates and PC name of another End point, and another inverse result can be performed.



```
INVERSE
1. SP
2. EP
↑ | ↓
```

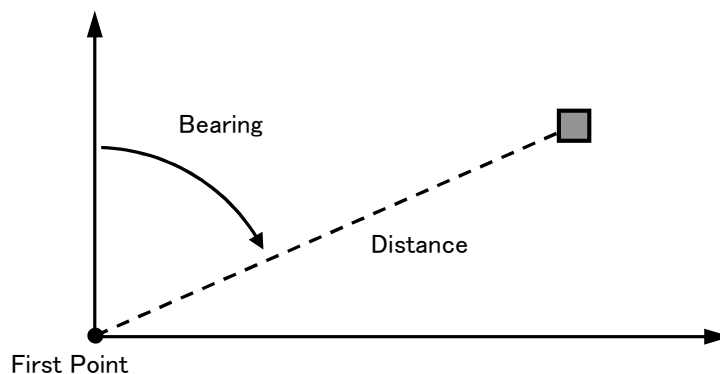


```
EP
1. PN:
2. X : +000000000.000m
3. Y : +000000000.000m
4. Z : +000000000.000m
5. PC:
SAVE | LIST | ↑ | ↓ | ACCEPT
```



```
RESULT OF INVERSE
H.dst      0.0000m
V.dst      0.0000m
S.dst      0.0000m
H.angle    0° 00' 00"
ESC | | | ENT
```

8.1.2 Point Coordinates

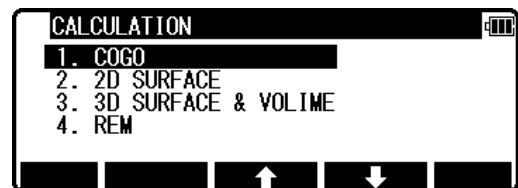


A point Coordinates is calculated from a known point Coordinates and the Distance and Horizontal angle of the second point.

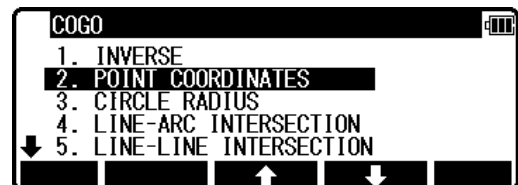
Input: Coordinates of a known point, Distance and Horizontal angle of the second point

Output: Coordinates of the second point

From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



Select 1.COGO and press [ENT] to view the COGO screen.

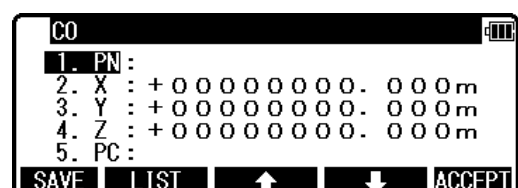


8.1.2.1 Point Coordinates, Distance and H. angle

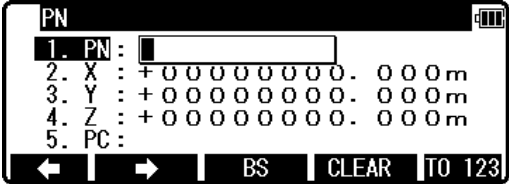
Select the 2. POINT COORDINATES and press [ENT] to view POINT COORINATES screen.



Select 1. CO and press [ENT] to view CO screen.



Press [ENT] to open the PN input screen.



PN

1. PN:

2. X : +000000000. 000m

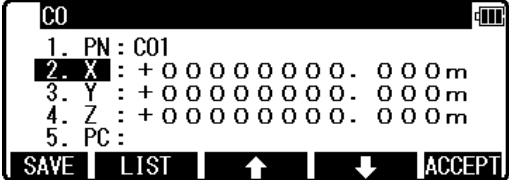
3. Y : +000000000. 000m

4. Z : +000000000. 000m

5. PC:

← → BS CLEAR TO 123

Input your desired point name by pressing keys and press [ENT] to view X screen.



CO

1. PN: C01

2. X : +000000000. 000m

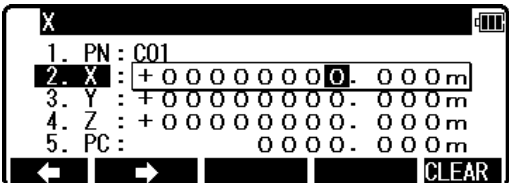
3. Y : +000000000. 000m

4. Z : +000000000. 000m

5. PC:

SAVE LIST ↑ ↓ ACCEPT

Press [ENT] to open the X coordinate input screen.



X

1. PN: C01

2. X : +000000000. 000m

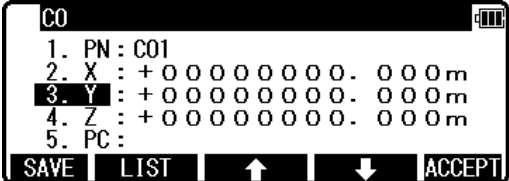
3. Y : +000000000. 000m

4. Z : +000000000. 000m

5. PC: 0000. 000m

← → CLEAR

Input your desired value by pressing keys and press [ENT] to go Y coordinate.



CO

1. PN: C01

2. X : +000000000. 000m

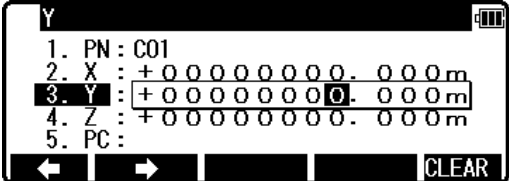
3. Y : +000000000. 000m

4. Z : +000000000. 000m

5. PC:

SAVE LIST ↑ ↓ ACCEPT

Press [ENT] to open the Y coordinate input screen.



Y

1. PN: C01

2. X : +000000000. 000m

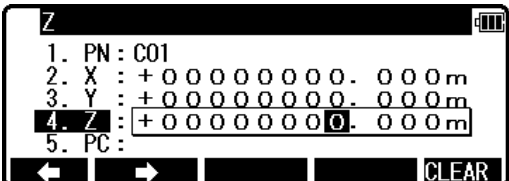
3. Y : +000000000. 000m

4. Z : +000000000. 000m

5. PC:

← → CLEAR

In the same manner, input your desired value by pressing keys and press [ENT] to open the Z coordinate input screen.



Z

1. PN: C01

2. X : +000000000. 000m

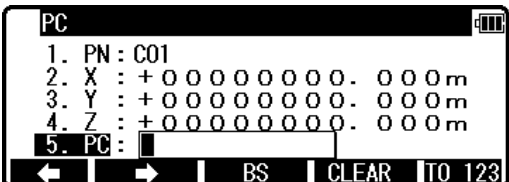
3. Y : +000000000. 000m

4. Z : +000000000. 000m

5. PC:

← → CLEAR

Input your desired value by pressing keys and press [ENT] to open the PC, Point Code, input screen.



PC

1. PN: C01

2. X : +000000000. 000m

3. Y : +000000000. 000m

4. Z : +000000000. 000m

5. PC:

← → BS CLEAR TO 123

Input your desired PC by pressing keys, and press [ENT] to view DI screen.

Input your desired value and press [ENT] to open the H. ANGLE input window.

Input your desired value to view the RESULT OF COORD. CALCULATE screen.
The second point Coordinates are displayed by plus or minus from the known Coordinates.

Press [ENT] to view the following screen.

The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5][ACCEPT] to save them.

8.1.2.2 Distance and H. angle

In the same manner, the values of Distance and H. angle are input as follows and the second point Coordinates are displayed.

Select 2. DI and press [ENT] to view DI screen.

Input your desired value and press [ENT] to open the H. ANGLE input window.

Input your desired value to view the RESULT OF COORD. CALCULATE screen.
The second point Coordinates are displayed by plus or minus from the known Coordinates.

Press [ENT] to view the following screen.

The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5][ACCEPT] to save them.

8.1.2.3 H. angle input

In the same manner, only the value of H. angle is input as follows, and the second point Coordinates are displayed.

Select 3. BE and press [ENT] to view H. ANGLE screen.

Input H. angle and press [ENT] to view the RESULT OF COORD. CALCULATE screen.

The second point Coordinates are displayed by plus or minus from the known Coordinates.

Press [ENT] to view the following screen.

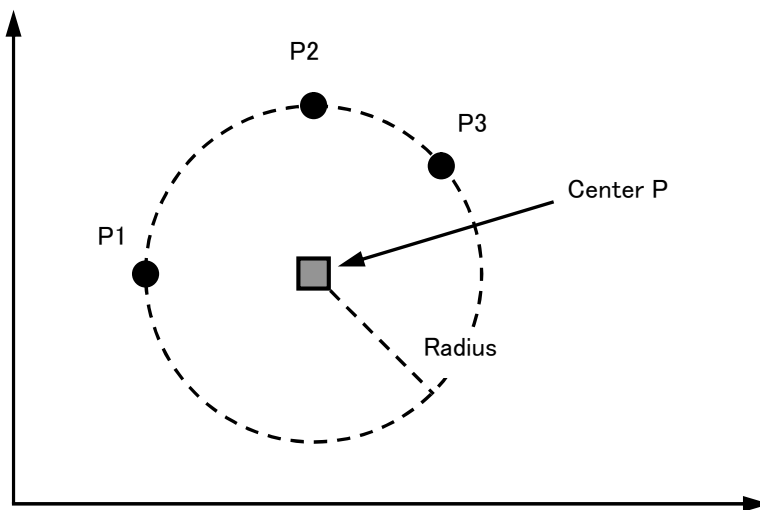
RESULT OF COORD. CALCULATE	
1. PN:	C02
2. X :	+00000000.000m
3. Y :	+00000000.000m
4. Z :	+00000000.000m
5. PC:	ABC

▲ ▼ ▲ ▼ ACCEPT

The PN, X, Y, Z and PC are viewed and can be edited.

If all items are OK, press [F1][SAVE] or [F5][ACCEPT] to save them.

8.1.3 Circle Radius



The center point and radius of the circle drawn by three points are calculated by this function. You can store calculated center point.

Input: 3 points

Output: Center point of the arc
Radius of the arc

From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.

CALCULATION	
1. COGO	
2. 2D SURFACE	
3. 3D SURFACE & VOLTIME	
4. REM	

▲ ▼ ▲ ▼

Select 1.COGO and press [ENT] to view the COGO screen.

COGO	
1. INVERSE	
2. POINT COORDINATES	
3. CIRCLE RADIUS	
4. LINE-ARC INTERSECTION	
5. LINE-LINE INTERSECTION	

▼ ▲ ▼ ▲

Select the 3. CIRCLE RADIUS and press [ENT] to view CIRCLE RADIUS screen.

```

CIRCLE RADIUS
1. P1
2. P2
3. P3
  
```

Select 1. P1 and press [ENT] to view P1 screen.

```

P1
1. PN:
2. X : +000000000.000m
3. Y : +000000000.000m
4. Z : +000000000.000m
5. PC:
SAVE LIST  ACCEPT
  
```

Input PN (Point Name), X, Y, Z, and PC (Point Code) of P1 point or import from the memory of rectangular coordinate as P1 by [F2][LIST].

If you finish the input of P1 value, press [F5][ACCEPT]. Then you go to P2 input screen.

```

P2
1. PN:
2. X : +000000000.000m
3. Y : +000000000.000m
4. Z : +000000000.000m
5. PC:
SAVE LIST  ACCEPT
  
```

Input P2 data like input of P1.
If you finish the input of P2, press [F5][ACCEPT].
Then you go to P3 input screen.

```

P3
1. PN:
2. X : +000000000.000m
3. Y : +000000000.000m
4. Z : +000000000.000m
5. PC:
SAVE LIST  ACCEPT
  
```

If you finish the input of P3, press [F5][ACCEPT].
Then you go to RESULT OF CIRCLE RADIUS screen.

You can see the coordinates of center point of the arc and the radius of the arc.

```

RESULT OF CIRCLE RADIUS
X          + 50.000m
Y          + 50.000m
Z          + 0.000m
RADIUS     + 70.711m
ESC
  
```

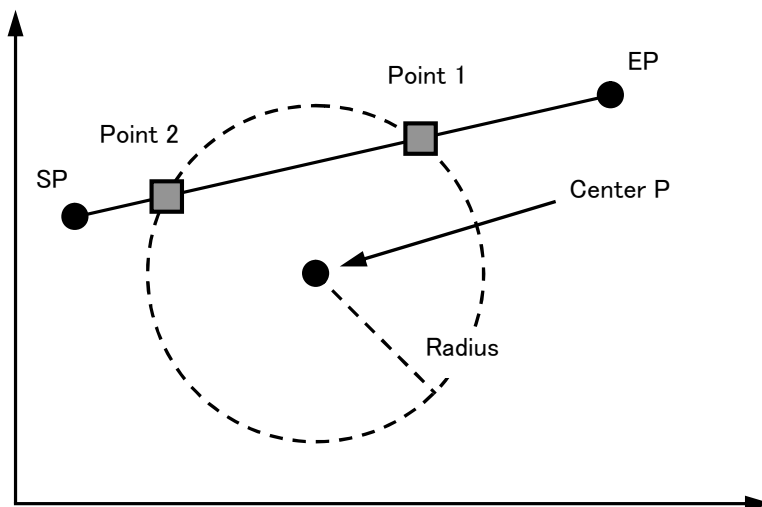
Press [F5][ENT] to save the coordinates of center point.

```

RESULT OF CIRCLE RADIUS
1. PN: P4
2. X : +000000000.000m
3. Y : +000000000.000m
4. Z : +000000000.000m
5. PC: ABC
  
```

The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5][ACCEPT] to save them.

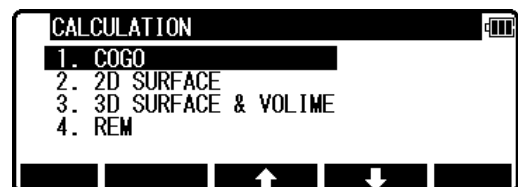
8.1.4 Line-Arc intersection



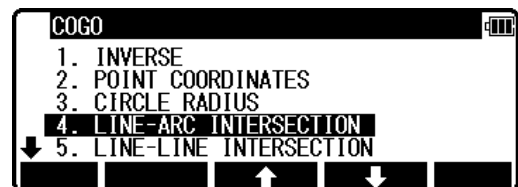
Two intersection points of one line and circle are calculated by this function.
The line is drawn by SP and EP. The circle is drawn by center point and radius.
You can store two possible intersection points.

Input: Line: start point and end point
Arc: center point and radius
Output: Two possible intersection points

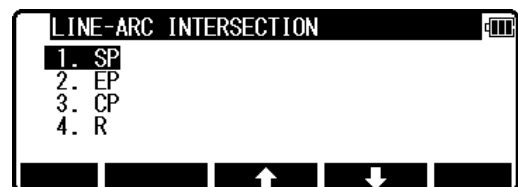
From the PowerTopoLite screen, press [F2][CALC]
to view the CALCULATION screen.



Select 1.COGO and press [ENT] to view the COGO screen.



Select the 4.LINE-ARC INTERSECTION and press [ENT] to view LINE-ARC INTERSECTION screen.



Select 1. SP and press [ENT] to view SP screen.

Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2][LIST].

If you finish the input of SP value, press [F5][ACCEPT]. Then you go to EP input screen.

Input EP value like an input of SP.
If you finish an input of EP, press [F5][ACCEPT].
Then you go to CP input screen.

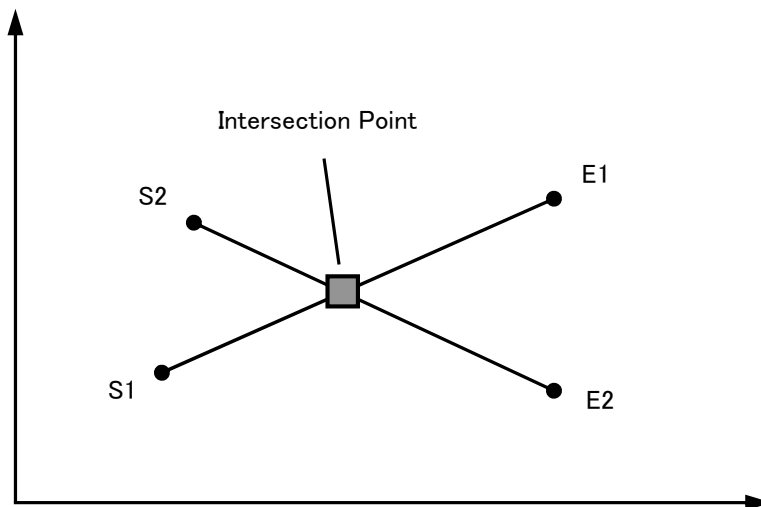
If you finish the input of CP value, press [F5][ACCEPT].
Then you go to RADIUS input screen.

If you finish the input of RADIUS, press [ENT].
Then you go to RESULT OF LINE-ARC INTERSECTION screen.
You can see the coordinates of one of intersection point. You can switch to one more intersection point by pressing [F3][ONE MORE].

Press [F5][ENT] to save an intersection point.

The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5][ACCEPT] to save them.

8.1.5 Line-Line intersection



The intersection point of two lines drawn by given four points is calculated by this Function.

Input: First line: Start point and End point

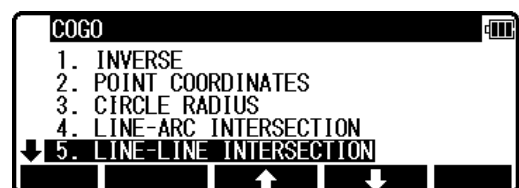
Second line: Start point and End point

Output: Intersection point between the two lines

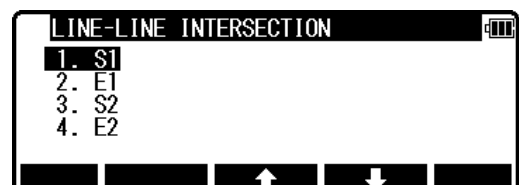
From the PowerTopoLite screen, press the [F2][CALC] to view the CALCULATION screen.



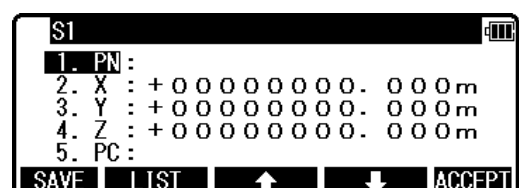
Press 1.COGO to view the COGO screen.



Select the 5. LINE-LINE INTERSECTION and press [ENT] to view its screen



Select 1.S1 and press [ENT] to view S1 screen.



Input PN (Point Name), X, Y, Z, and PC (Point Code) of S1 point or import from the memory of rectangular coordinate as S1 by [F2][LIST].

If you finish the input of S1 value, press [F5][ACCEPT]. Then you go to E1 input screen.

Input E1 value like an input of S1.
If you finish an input of E1, press [F5][ACCEPT].
Then you go to S2 input screen.

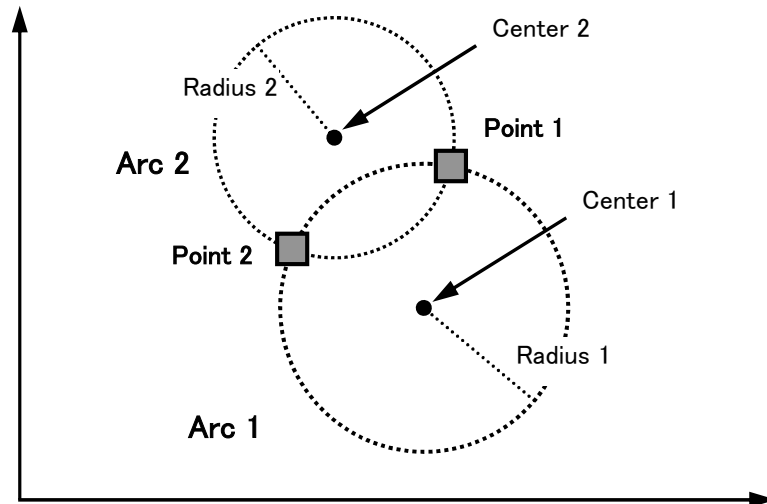
If you finish the input of S2 value, press [F5][ACCEPT]. Then you go to E2 input screen.

If you finish the input of E2, press [ENT]. Then you go to RESULT OF LINE-LINE INTERSECTION screen.
You can see the coordinates of one of intersection point. You can switch to one more intersection point by pressing [F3][ONE MORE].

Press [F5][ENT] to save an intersection point.

The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F1][SAVE] or [F5][ACCEPT] to save them.

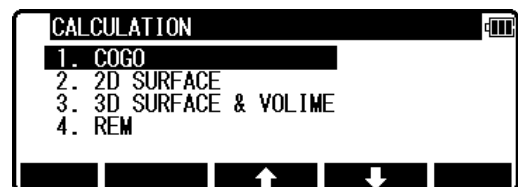
8.1.6 Arc-Arc intersection



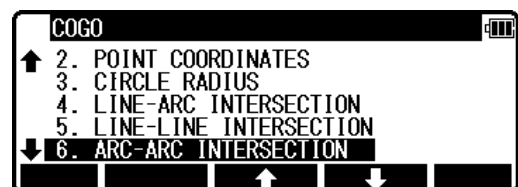
Two intersection points of two arcs drawn by each center point and radius are calculated. You can store two possible intersection points.

Input: Arc 1: center point and radius
Arc 2: center point and radius
Output: Two possible intersection points

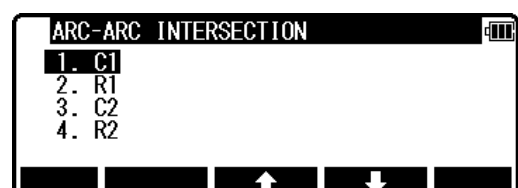
From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



Select 1.COGO and press [ENT] to view the COGO screen.



Select the 6. ARC-ARC INTERSECTION and press [ENT] to view ARC-ARC INTERSECTION screen.



Select 1. C1 and press [ENT] to view C1 screen.

C1 (Center 1) point is center point of Arc 1.

Input PN (Point Name), X, Y, Z, and PC (Point Code) of C1 point or import from the memory of rectangular coordinate as C1 by [F2][LIST].

If you finish the input of C1 value, press [F5][ACCEPT]. Then you go to R1 input screen.

Input the radius of Arc1 as R1 value. If you finish the input of R1, press [F5][ACCEPT]. Then you go to C2 input screen.

C2 (Center 2) point is center point of Arc 2.

Input PN (Point Name), X, Y, Z, and PC (Point Code) of C2 point or import from the memory of rectangular coordinate as C2 by [F2][LIST].

If you finish the input of C2 value, press [F5][ACCEPT]. Then you go to R2 input screen.

Input the radius of Arc 2 as R2 value. If you finish the input of R2, press [ENT]. Then you go to RESULT OF ARC-ARC INTERSECTION screen.

You can see the coordinates of one of intersection point. You can switch to one more intersection point by pressing [F3][ONE MORE].

RESULT OF COORD. CALCULATE

1. PN : P4

2. X : -00000082. 288m

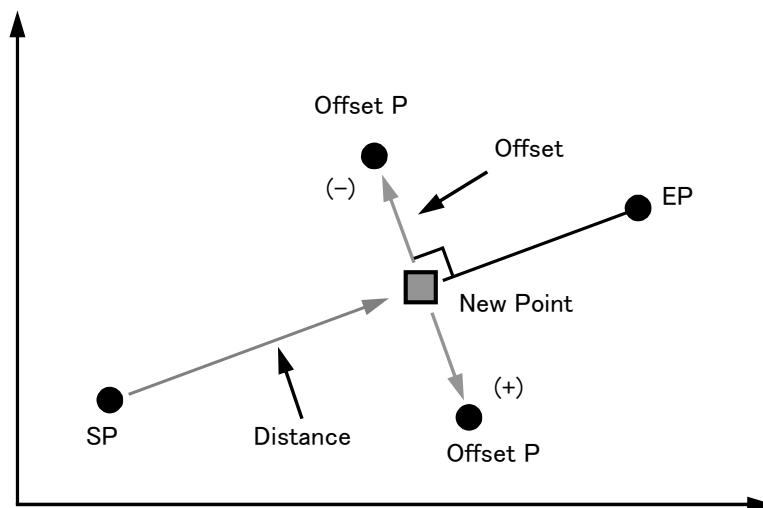
3. Y : +00000182. 288m

4. Z : +00000000. 000m

5. PC : ABC

▲ ▼ ▲ ▼ ACCEPT

8.1.7 Distance offset



Input: line: start point (SP) and end point (EP)
offset point (OP)

Output: new point
offset of new point from the line
(moving in the direction from start point to end point, right is positive,
left is negative)
distance of new point from start point

CALCULATION

1. COGO

2. 2D SURFACE

3. 3D SURFACE & VOLIME

4. REM

Select 1. COGO and press [ENT] to view the COGO screen.

Select the 7. DISTANCE OFFSET and press [ENT] to view DISTANCE OFFSET screen.

Select 1. SP and press [ENT] to view SP screen.

Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2][LIST].

If you finish the input of SP value, press [F5][ACCEPT]. Then you go to EP input screen.

Input EP data like input of SP. If you finish the input of EP, press [F5][ACCEPT]. Then you go to OP input screen.

If you finish the input of OP, press [F5][ACCEPT]. Then you go to RESULT OF DISTANCE OFFSET screen.

You can see the coordinates of new point on the line, offset distance of new point to the line and distance of new point to start point.

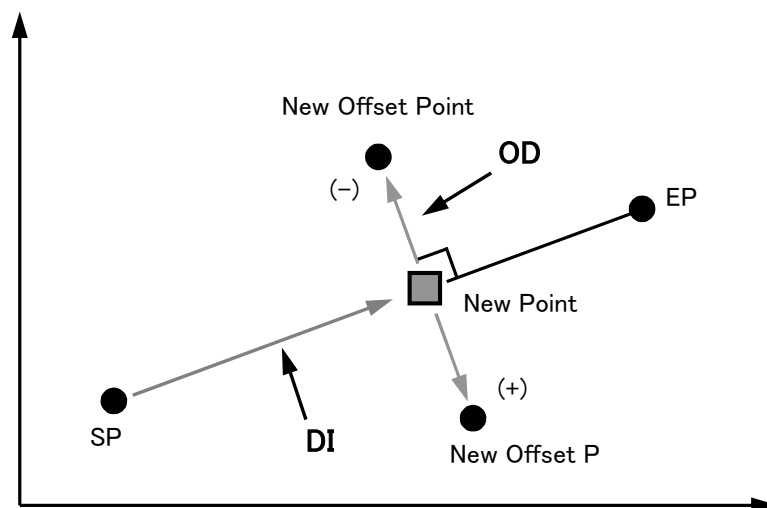
Press [F5][ENT] to save the coordinates of new point.

RESULT OF COORD. CALCULATE	
1. PN :	P4
2. X :	+000000050.000m
3. Y :	+000000050.000m
4. Z :	+000000000.000m
5. PC :	ABC

▲ ▼ ▲ ▼ ACCEPT

The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5][ACCEPT] to save them.

8.1.8 Point distance offset



New offset point is calculated by inputting distance from start point and offset from line.

Input: line: start point and end point
distance from start point (DI)
offset from the line (OD) (moving in the direction from start point to end point, right is positive, left is negative)

Output: new point

From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.

CALCULATION	
1. COGO	
2. 2D SURFACE	
3. 3D SURFACE & VOLTIME	
4. REM	

▲ ▼ ▲ ▼

Select 1. COGO and press [ENT] to view the COGO screen.

COGO	
4. LINE-ARC INTERSECTION	
5. LINE-LINE INTERSECTION	
6. ARC-ARC INTERSECTION	
7. DISTANCE OFFSET	
8. POINT DISTANCE OFFSET	

▲ ▼ ▲ ▼

Select the 8. POINT DISTANCE OFFSET and press [ENT] to view POINT DISTANCE OFFSET screen.

```

POINT DISTANCE OFFSET
1. SP
2. EP
3. DI
4. OD
  
```

Select 1. SP and press [ENT] to view SP screen.

```

SP
1. PN:
2. X : +000000000.000m
3. Y : +000000000.000m
4. Z : +000000000.000m
5. PC:
SAVE LIST  ↑  ↓  ACCEPT
  
```

Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2][LIST].

If you finish the input of SP value, press [F5][ACCEPT]. Then you go to EP input screen.

```

EP
1. PN:
2. X : +000000000.000m
3. Y : +000000000.000m
4. Z : +000000000.000m
5. PC:
SAVE LIST  ↑  ↓  ACCEPT
  
```

Input EP data like input of SP.
If you finish the input of EP, press [F5][ACCEPT].
Then you go to DISTANCE input screen.

```

DISTANCE
0000.000m
←  →  CLEAR
  
```

Input DI (Distance from SP to point on the line).
If you finish the input of DI, press [F5][ACCEPT].
Then you go to OFFSET input screen.

```

OFFSET
0000.000m
←  →  CLEAR
  
```

Input OD (Offset distance from the line to offset point).
If you finish the input of OD, press [F5][ACCEPT].
Then you go to RESULT OF POINT DIST.OFFSET screen.

```

RESULT OF POINT DIST. OFFSET
X      +78.787m
Y      +49.497m
Z      +0.000m
ESC    ENT
  
```

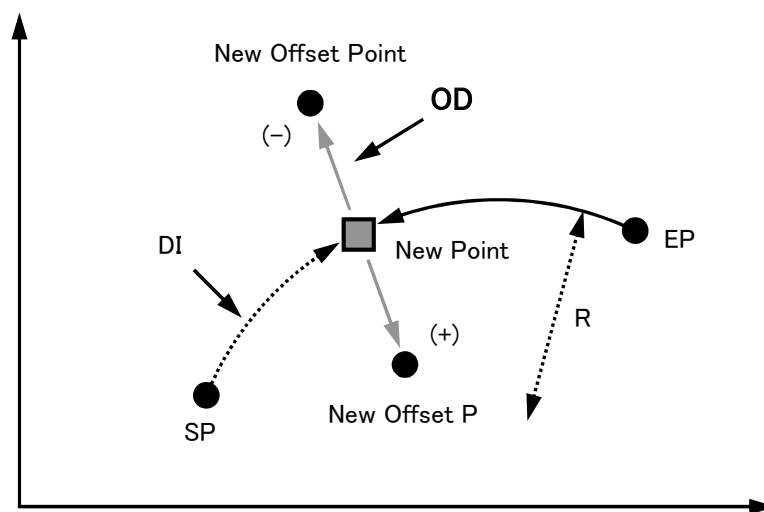
You can see the coordinates of offset point from the line.

Press [F5][ENT] to save the coordinates of offset point.

RESULT OF COORD. CALCULATE	
1. PN:	P3
2. X :	+00000078.787m
3. Y :	+00000049.497m
4. Z :	+00000000.000m
5. PC:	ABC
<div>▲ ▼ ▲ ▼ ACCEPT</div>	

The PN, X, Y, Z and PC are viewed and can be edited. If all items are OK, press [F5][ACCEPT] to save them.

8.1.9 Arc distance offset



Offset point from the arc is calculated.

Input: arc: start point, end point and radius (R)
 distance along arc from start point (DI)
 offset from the arc (OD) (moving in the direction from start point to end point, right is positive, left is negative)

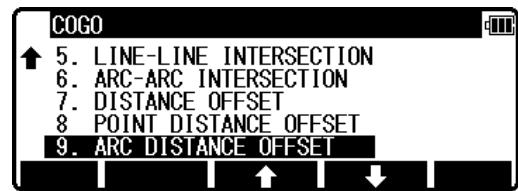
NOTE: From start point to end point must be CLOCKWISE. If you calculate by arc of COUNTER CLOCKWISE, change SP for EP and calculate changed DI manually.

Output: new offset point

From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.

CALCULATION	
1. COGO	
2. 2D SURFACE	
3. 3D SURFACE & VOLIME	
4. REM	
<div>▲ ▼ ▲ ▼ </div>	

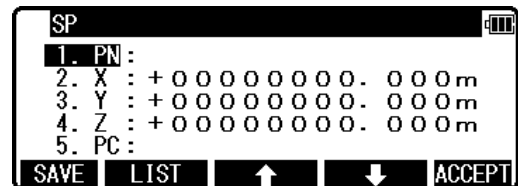
Select 1.COGO and press [ENT] to view the COGO screen.



Select the 9. ARC DISTANCE OFFSET and press [ENT] to view ARC DISTANCE OFFSET screen.

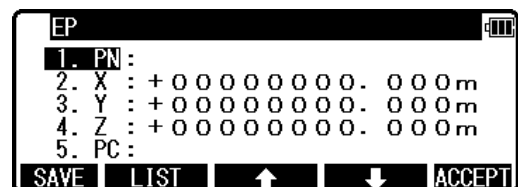


Select 1. SP and press [ENT] to view SP screen.

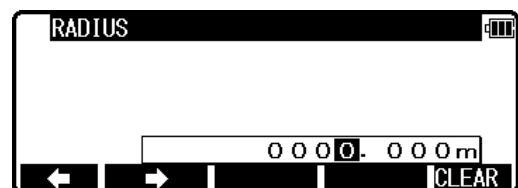


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2][LIST].

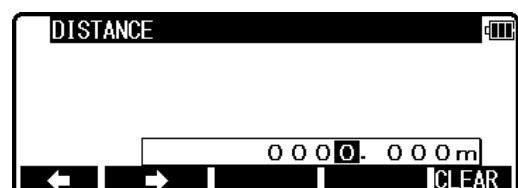
If you finish the input of SP value, press [F5][ACCEPT]. Then you go to EP input screen.



Input EP data like an input of SP.
If you finish input of EP, press [F5][ACCEPT].
Then you go to RADIUS input screen.



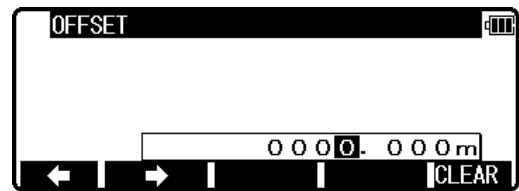
Input RADIUS (Radius of circle).
If you finish the input of RADIUS, press [ENT].
Then you go to DISTANCE input screen.



Input DISTANCE (Distance from SP to point on the arc).

If you finish the input of DISTANCE, press [ENT].

Then you go to OFFSET input screen.

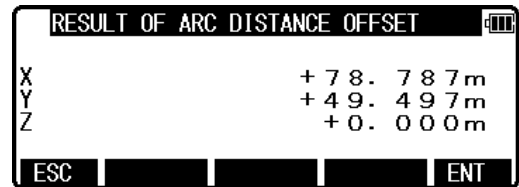


Input OFFSET (Offset distance from the arc to offset point).

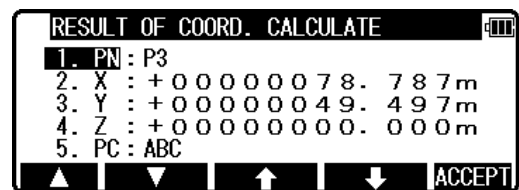
If you finish the input of OFFSET, press [ENT].

Then you go to RESULT OF ARC DISTANCE OFFSET screen.

You can see the coordinates of offset point from the arc.



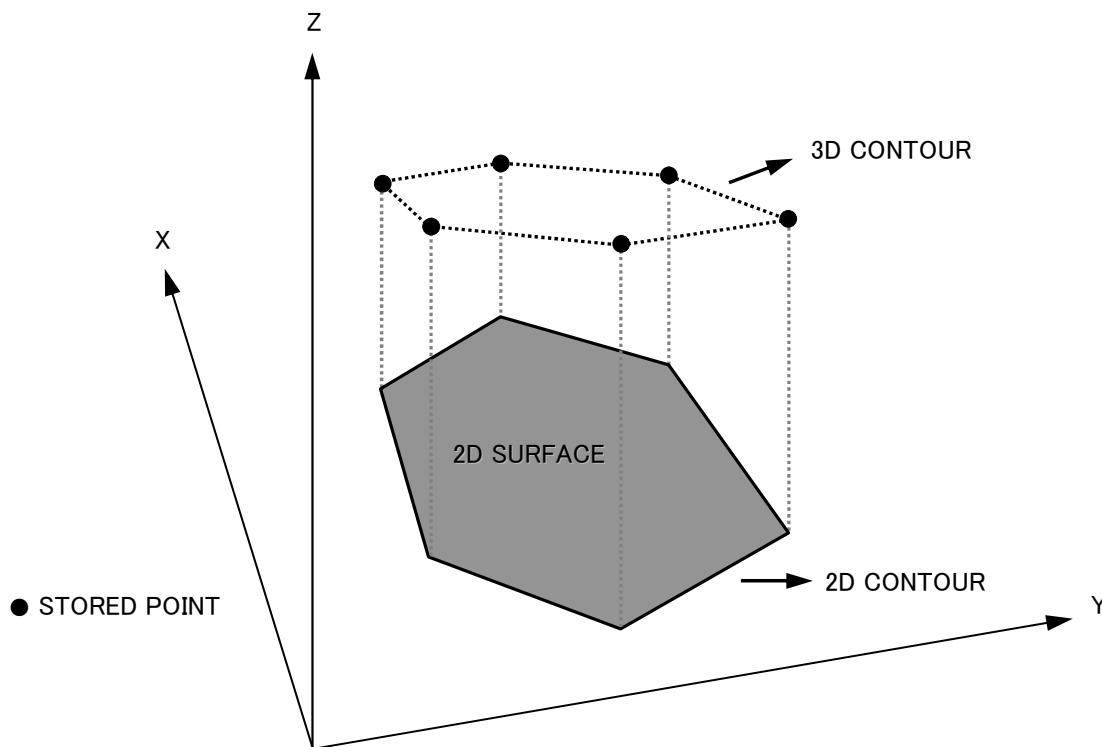
Press [F5][ENT] to save the coordinates of offset point.



The PN, X, Y, Z and PC are viewed and can be edited.

If all items are OK, press [F5][ACCEPT] to save them.

8.2 2D Surface



This function calculates the 2D and 3D contour of a polygon and the 2D surface of the area defined by the polygon.

You define the polygon by selecting points and PowerTopoLite then calculates contour and 2D surface.

NOTE: The polygon is defined by the point you select. Therefore, the order in which you enter the point is important.

If you select points by [ALL] or [FROM][TO], the polygon is defined according to the order of the memory address. If you select points one by one by [ENT], polygon is defined according to the order of your selection.

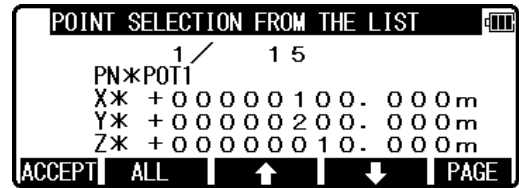
NOTE: You have to select points in such a way that the line segments that define the polygon do not intersect.

NOTE: Selected points should be less than 500 points.

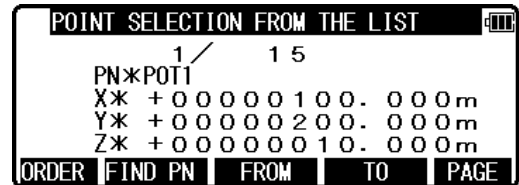
From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



Select 2. 2D SURFACE and press [ENT] to view POINT SELECTION FROM THE LIST screen.



If you press [F5][PAGE], you can see another screen.



You select points, which define the polygon in order at this screen.

How to select points of polygon

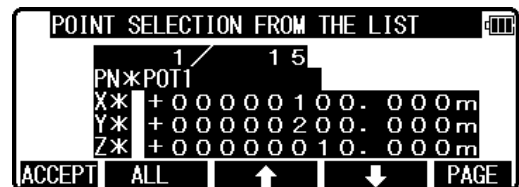
[ENT] key

Move to selection point by [F3] and [F4] arrow keys and press [ENT] to select it one by one and each indication is reversed as follows.

Reverse display shows that it was selected.

If you cancel the selection of the point, press [ENT] again.

You can cancel the selection points one by one after pressing [ALL].



[F2][ALL] key

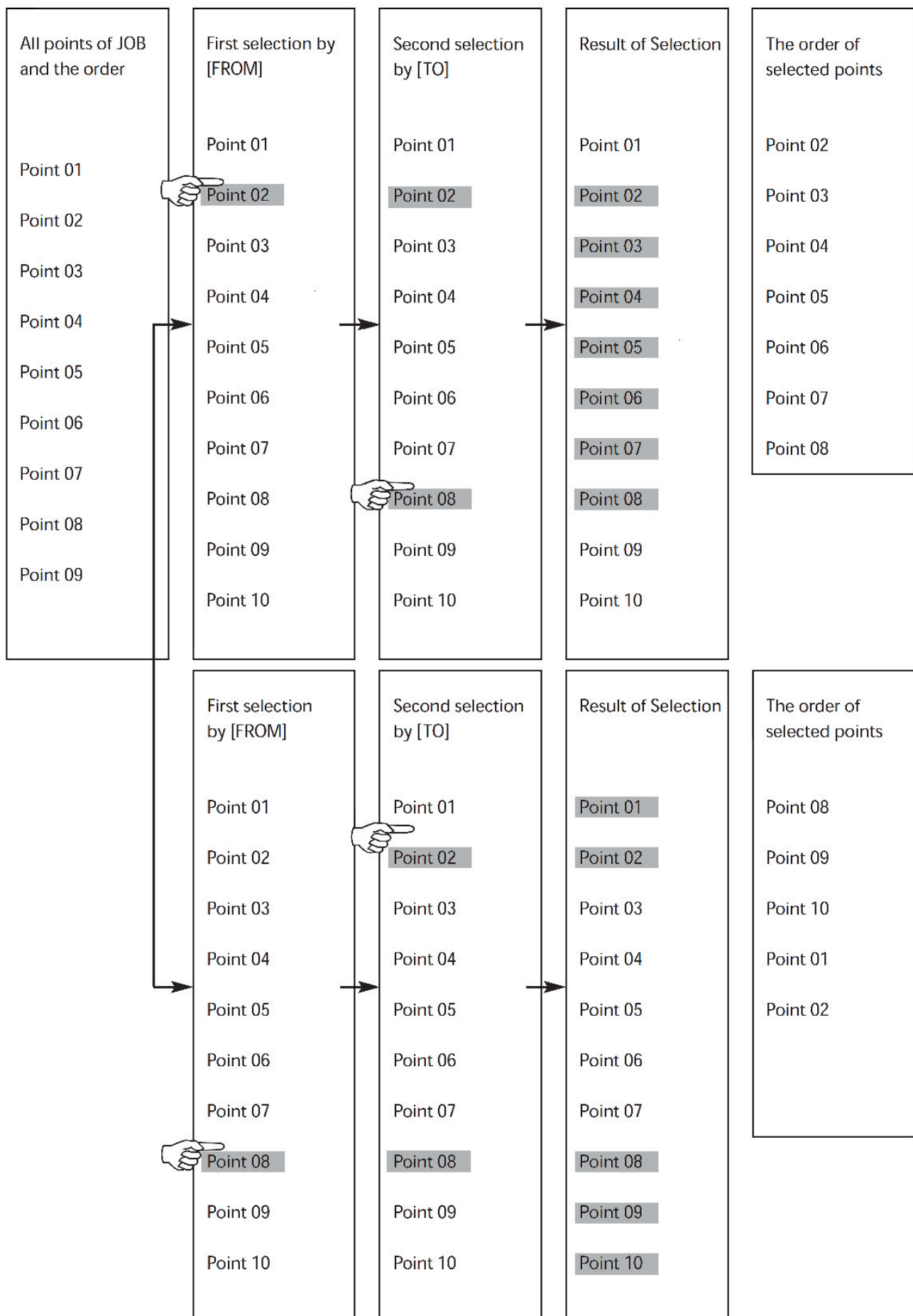
Press [F2][ALL] to select all stored points of current JOB. The order of points is according to the arrangement of the memory.

If you press [F2][ALL] again, the selection of all points is canceled. You can cancel the selection points by [ENT] one by one, after pressing [ALL].

If you press [F2][ALL] after you already selected some points, the selection of all points is reversed.

[F3][FROM] key and [F4][TO] key

You can define the range of polygonal points from all points of current JOB by [F3][FROM] and [F4][TO] as follows.



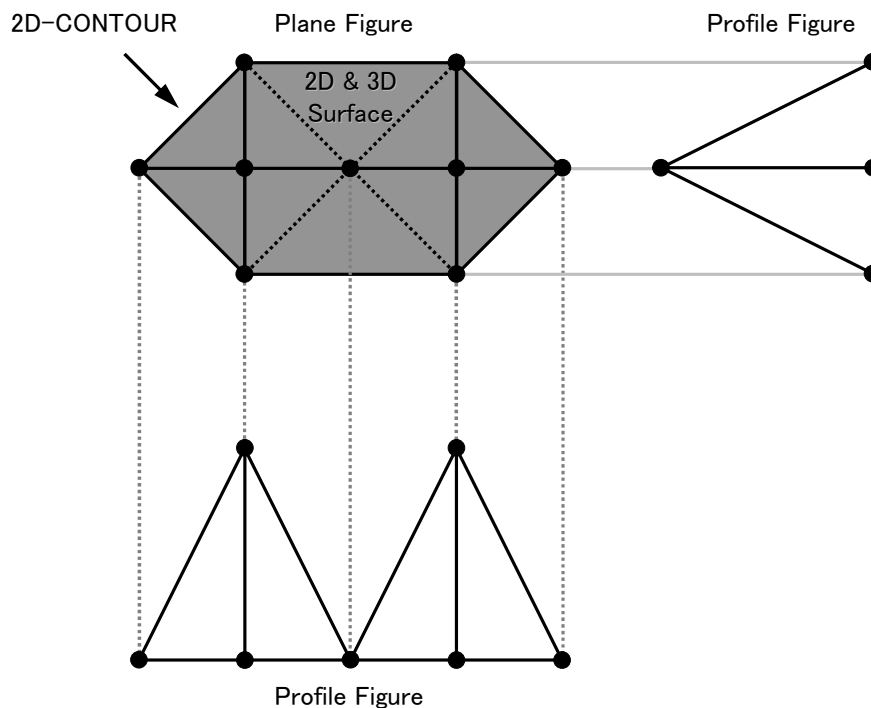
NOTE: [F1][ORDER] key

Press [F1][ORDER] to confirm order of selected points after you finished the selection. If you finish point selection of a polygon, press [F1][ACCEPT] to calculate. The result of calculation is displayed as follows.

RESULT OF 2D SURFACE	
COUNTER	
2D:	9 4 7. 8 7 1 m
3D:	1 1 9 5. 0 8 4 m
2D SURFACE	1 5 0 0 0. 0 0 0 m ²
ESC	ENT

Press [ENT] or [ESC] to return to POINT SELECTION FROM THE LIST screen. You change a selection, and you can calculate it again.

8.3 3D Surface and Volume



This function calculates the center, the 2D and 3D surface and positive, negative and total volume.

First, you select the points that are used for the volume calculation. The order in which you select the points is not important. Please refer 2D SURFACE chapter about selection way. PowerTopoLite generates a mesh (triangulation) of the points automatically and calculates the result based on the mesh.

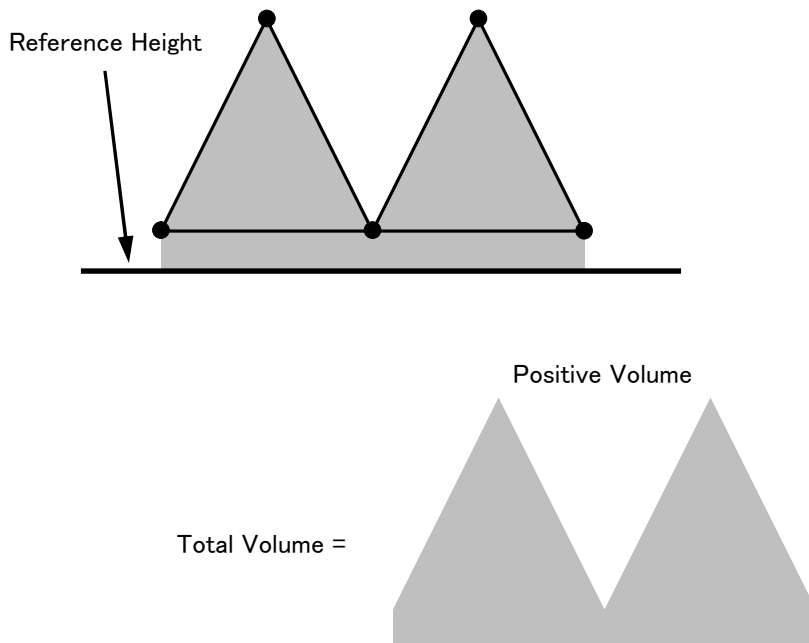
The contour of the points will always be convex. A polygon is generated so that an area may become the biggest. It is like a rope, which is laid around the points, and then tightens.

You have to give the reference height, which is used for volume calculation: the part of the volume that is situated below the reference height is called negative volume and the part above the reference height is called positive volume.

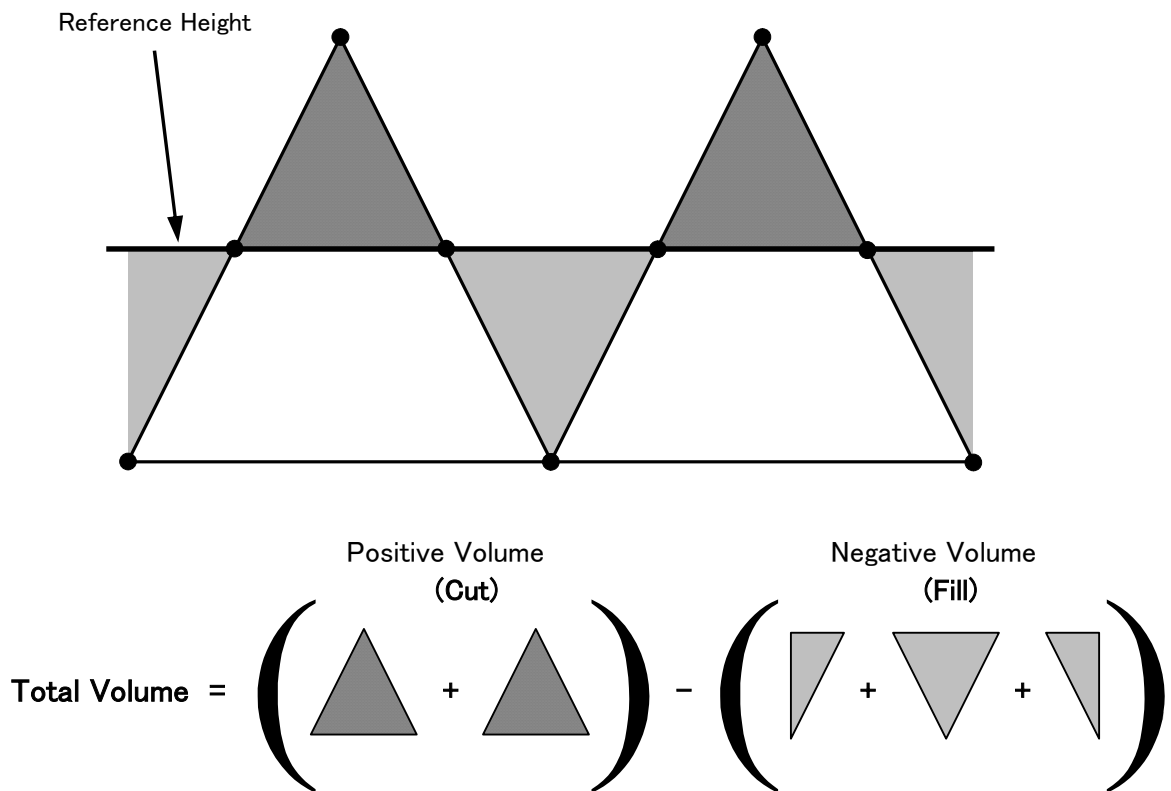
NOTE: Selected points should be less than 50 points.

NOTE: Relations between each volume and reference height are as follows.

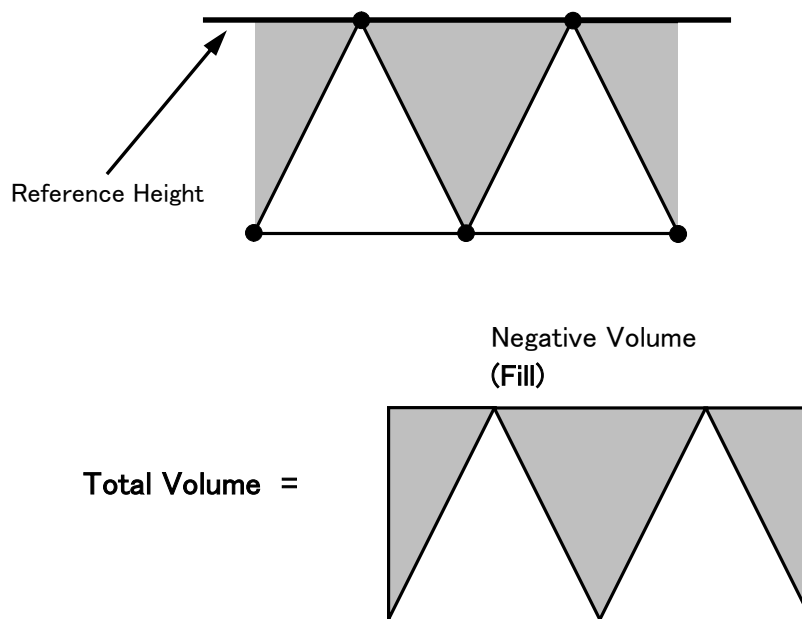
In 3D Volume, the case that input reference height is lower than a solid



In 3D Volume, the case that input reference height is between a solid



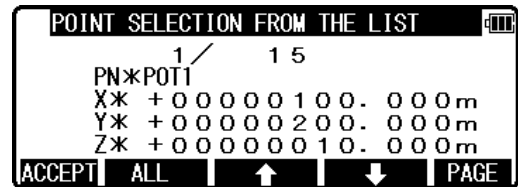
In 3D Volume, the case that input reference height is higher than a solid



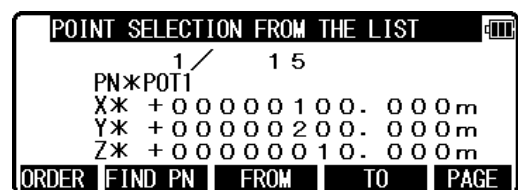
From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



Select 3. 3D SURFACE & VOLUME and press [ENT] to view POINT SELECTION FROM THE LIST screen.

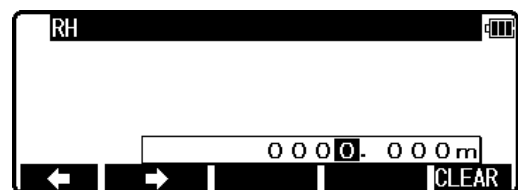


If you press [F5][PAGE], you can see another screen.



You select points, which compose the polygon in order at this screen.

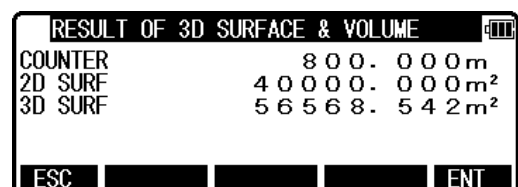
If you finish point selection of a polygon, press [F1][ACCEPT] to go to RH screen (RH stands for the Reference Height).



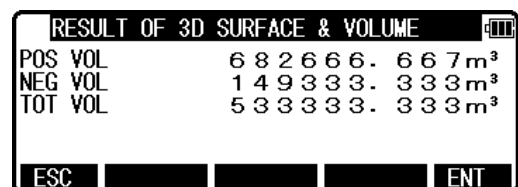
Input reference height.

If you finish it, press [ENT] to calculate.

The result of calculation is displayed as follows.



Press [ENT] to go to next screen as follows.



Press [ESC] to return to POINT SELECTION FROM THE LIST screen.

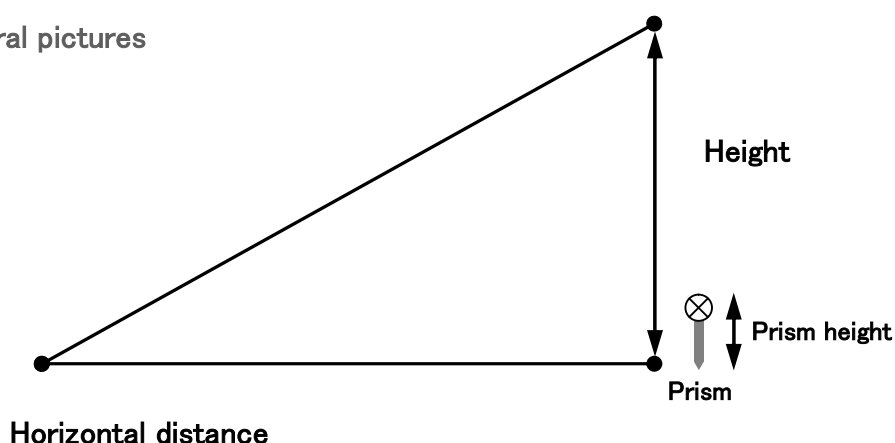
You change a selection, and you can calculate it again.

8.4 REM

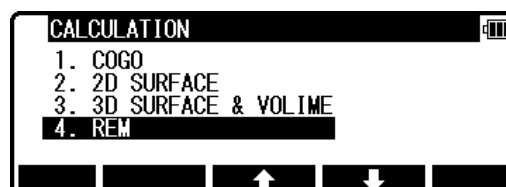
8.4.1 General pictures of measurement

With REM measurement, a prism (Reference point) is set approximately directly below the place to be measured, and by measuring the prism, the height to the target object can be measured. This makes it easy to determine the heights of electric power lines, bridge suspension cables, and other large items used in construction.

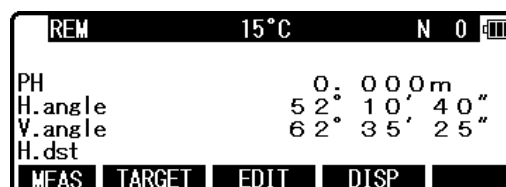
General pictures



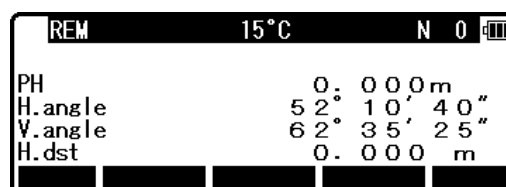
From the PowerTopoLite screen, press [F2][CALC] to view the CALCULATION screen.



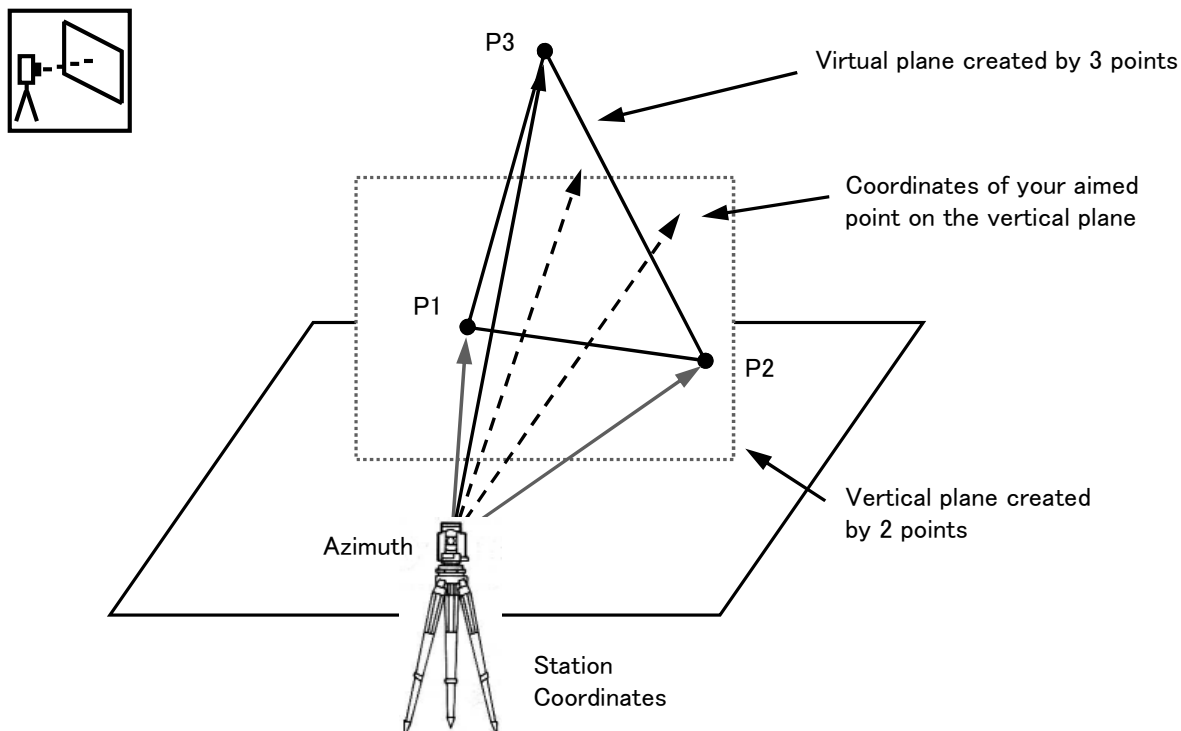
Select 4. REM and press [ENT] to view MEASURE screen.



Please press [ENT] after measuring distance.



9. VPM (Virtual Plane Measurement)



The Virtual plane includes the Vertical plane.

With VPM, the Coordinates on the vertical plane and virtual plane can be obtained by entering the “Station Coordinates and Azimuth” and by measuring point 1, point 2 and point 3. Two points make a vertical plane and three points make a virtual plane. You can measure the Point Coordinates of this virtual plane by aiming at your desired points.

Press the [F3][VPM] of the PowerTopoLite screen to view the STATION POINT SETUP screen of the VPM function.

STATION POINT SETUP	
1. PN:	
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. Z :	+000000000.000m
5. IH:	0000.000m
SAVE LIST ↑ ↓ ACCEPT	

- [LIST] key

All stored points can be displayed as follows by pressing [F2][LIST].

Press the [F2][LIST] to view POINT SELECTION FROM THE LIST screen.

You can enter Coordinates data by applying the List data.

POINT SELECTION FROM THE LIST	
▲	15 / 15
PN*POT4	
X*	+00000025.048m
Y*	+00000100.421m
Z*	+00000776.359m
DELETE FIND PN ↑ ↓	

Press [ENT] to open the input window of PN, X, Y, Z and IH value.

Input each Character or value and press [F5][ACCEPT] to view the STATION POINT H. ANGLE SETUP screen.

STATION POINT H. ANGLE SETUP	
H. angle	2 8 7° 4 7' 5 0"
<input type="button" value="INPUT"/> <input type="button" value="0 SET"/> <input type="button" value="HOLD"/> <input type="button" value="BSP"/>	

Input the H. angle by pressing [F2][INPUT], [F3][0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5][BSP].

Press [ENT] to open the input window when using [F5][BSP].

Pressing [F2][INPUT]

Input any horizontal angle.

H. angle	
H. angle	2 8 2 8 7° 4 7' 5 0"
<input type="button" value="←"/> <input type="button" value="→"/> <input type="button" value="CLEAR"/>	

Pressing [F5][BSP]

The information for Back sight point is obtained.

Press [ENT] to finalize the input.

BSP SETUP	
1. PN:	
2. X :	+ 0 0 0 0 0 0 0 0 . 0 0 0 m
3. Y :	+ 0 0 0 0 0 0 0 0 . 0 0 0 m
4. Z :	+ 0 0 0 0 0 0 0 0 . 0 0 0 m
5. PC:	
<input type="button" value="SAVE"/> <input type="button" value="LIST"/> <input type="button" value="↑"/> <input type="button" value="↓"/> <input type="button" value="ACCEPT"/>	

Aim at the reference point, and press [ENT] to view the MEASURE screen.

MEASURE		15°C	N 0
1	PN2		
PH		0. 0 0 0 m	
X			
Y			
Z			
<input type="button" value="MEAS"/> <input type="button" value="SAVE"/> <input type="button" value="ME/SAVE"/> <input type="button" value="EDIT"/> <input type="button" value="PAGE"/>			

Aim at point 1 and press [F1][MEAS].

Measured Coordinates are displayed.

MEASURE		15°C	N 0
1	PN2		
PH		0. 0 0 0 m	
X		+ 1 0 1. 3 9 4 m	
Y		+ 9 8. 2 3 3 m	
Z		+ 2 1. 8 4 4 m	
<input type="button" value="MEAS"/> <input type="button" value="SAVE"/> <input type="button" value="ME/SAVE"/> <input type="button" value="EDIT"/> <input type="button" value="PAGE"/>			

Press [ENT] to view the same MEASURE screen.

MEASURE		15°C	N 0
2	PN2		
PH		0. 0 0 0 m	
X			
Y			
Z			
<input type="button" value="MEAS"/> <input type="button" value="SAVE"/> <input type="button" value="ME/SAVE"/> <input type="button" value="EDIT"/> <input type="button" value="PAGE"/>			

In the same manner, aim at point 2 and press [F1][MEAS].

Measured Coordinates are displayed.

MEASURE		15°C	N 0
2	PN2		
PH		0. 0 0 0 m	
X		+ 1 0 2. 8 4 9 m	
Y		+ 1 0 5. 9 5 0 m	
Z		+ 2 1. 7 9 5 m	
<input type="button" value="MEAS"/> <input type="button" value="SAVE"/> <input type="button" value="ME/SAVE"/> <input type="button" value="EDIT"/> <input type="button" value="PAGE"/>			

Press [ENT] to view the COORD. ON THE VIRTUAL PLANE screen.
ON THE VIRTUAL PLANE screen.
Aim at your desired point and press [ENT].
The Coordinates which you aim at are displayed.

COORD. ON THE VIRTUAL PLANE			
PN	PN2		
PH		0. 000m	
X		+ 101. 754m	
Y		+ 100. 145m	
Z		+ 20. 479m	
POINT3 SAVE POINT1 EDIT			

Press the [F1][POINT3] to view the MEASURE screen.

MEASURE 15°C N 0			
3	PN2		
PH		0. 000m	
X			
Y			
Z			
MEAS SAVE ME/SAVE EDIT PAGE			

Aim at point 3 and press [F1][MEAS].
Measured Coordinates are displayed.

MEASURE 15°C N 0			
3	PN2		
PH		0. 000m	
X		+ 107. 300m	
Y		+ 100. 973m	
Z		+ 19. 111m	
MEAS SAVE ME/SAVE EDIT PAGE			

Press [ENT] to view the COORD. ON THE VIRTUAL PLANE screen.
ON THE VIRTUAL PLANE screen.
Aim at your desired point and press [ENT].
The Coordinates, which you aim at, are displayed.

COORD. ON THE VIRTUAL PLANE			
PN	PN2		
PH		0. 000m	
X		+ 107. 300m	
Y		+ 100. 973m	
Z		+ 19. 111m	
POINT3 SAVE POINT1 EDIT DISP			

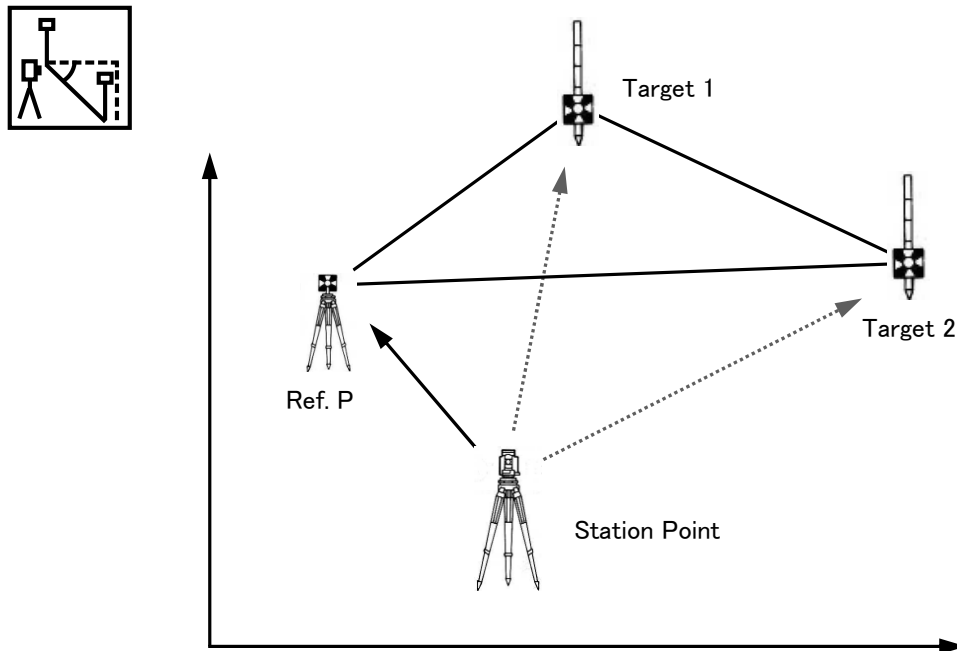
Pressing [F4][EDIT] can edit the point name and prism height.

Pressing [F5][DISP] can switch displayed value from Rectangular data to Polar data.

COORD. ON THE VIRTUAL PLANE			
PN	PN2		
PH		0. 000m	
H.angle	36°	37' 17"	
V.angle	88°	34' 31"	
H.dist		2. 536m	
POINT3 SAVE POINT1 EDIT DISP			

Press [F2][SAVE] to save the measured data.
When no PN is input, no survey data is saved.

10. RDM (Remote Distance Measurement)



With RDM, the Horizontal, Vertical and Slope distance and % of Slope between the Reference point and the Target point are measured. The distance between Target 1 and Target 2 are also measured. Any Target point can be changed to the new Reference point.

Press the [F4][RDM] of the PowerTopoLite screen to view the REF. POINT screen of the RDM function.

REF. POINT		15°C	N 0	BATT
PH	0. 000m			
H.angle	52° 10' 40"			
V.angle	62° 35' 25"			
H.dst				
MEAS		TARGET		EDIT DISP

10.1 PH input

Press [F3][EDIT] to input the PH, Reference point height.

PH		BATT
0000. 000m		
←	→	CLEAR

10.2 Reference point - Target distance

Aim at the Reference point and press [F1][MEAS] to measure the Reference point.
It turns to TARGET POINT screen automatically.

TARGET POINT		15°C	N 0	BATT
PH	0. 000m			
H.angle	52° 10' 40"			
V.angle	62° 35' 25"			
H.dst				
MEAS		TARGET		EDIT DISP

Aim at the Target 1 and press [F1][MEAS] to measure a distance. The distance between Reference point and Target point 1 is displayed.

RESULT OF RDM REF.-TARGET	
H.dst	4. 209m
V.dst	2. 696m
S.dst	4. 998m
%grade	64. 044%
MEAS	DATA DISP

V.dst. and % grade are displayed by minus mark when the Target point height is at a lower position.

Press the [F3][DATA] to view the TARGET POINT screen.

TARGET POINT 15°C N 0	
PH	0. 000m
H.angle	52° 10' 40"
V.angle	62° 35' 25"
H.dst	3. 251m
MEAS	TARGET EDIT DISP

10.3 Target - Target distance

Aim at the Target 2 and press [F1][MEAS] to measure a distance.
The distance between Reference point and Target point 2 is displayed.

RESULT OF RDM REF.-TARGET	
H.dst	5. 768m
V.dst	2. 642m
S.dst	6. 344m
%grade	45. 801%
MEAS	DATA DISP

Press [F5][DISP] to display the Target - Target distance.

RESULT OF RDM TARGET-TARGET	
H.dst	2. 536m
V.dst	-0. 054m
S.dst	2. 537m
%grade	-2. 126%
MEAS	DATA DISP

10.4 New Reference point selection

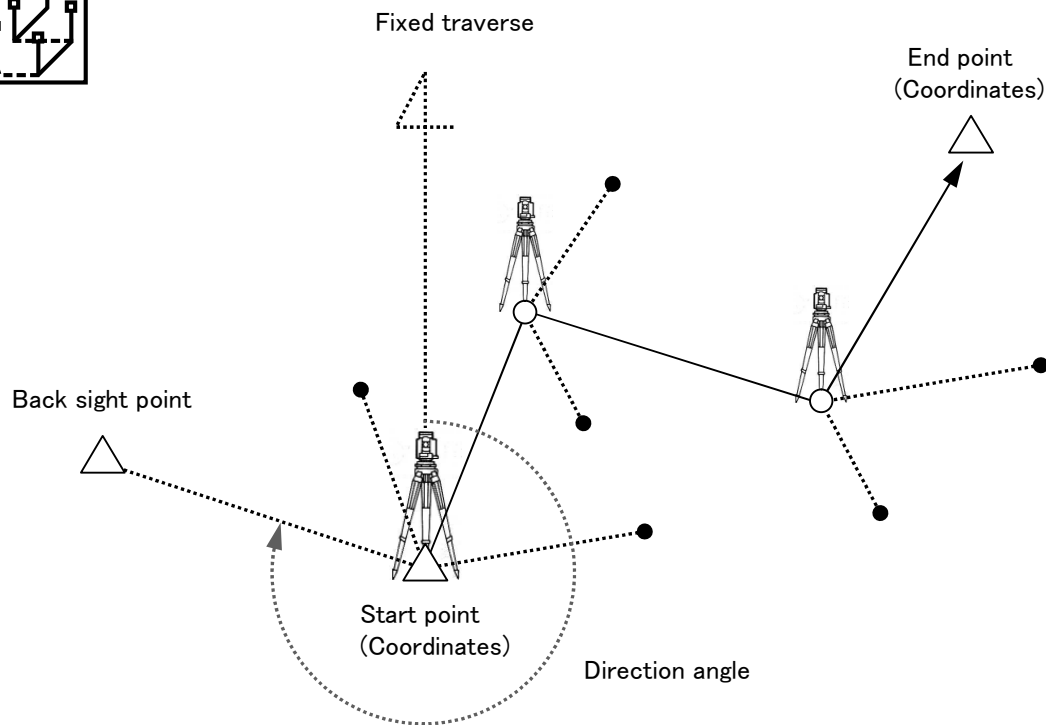
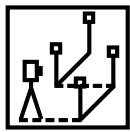
Press [ENT] to view the REF. POINT SELECTION screen.
New Ref. point can be selected.

REF. POINT SELECTION	
Use current Target as Ref.?	
Press [ENT] to confirm.	
Press [ESC] to abort.	
ESC	ENT

Press the [F5][ENT] to view the TARGET POINT screen. Reference point is changed.
Input the new PH and repeat the same procedure as the above.

TARGET POINT 15°C N 0	
PH	0. 000m
H.angle	52° 10' 40"
V.angle	62° 35' 25"
H.dst	
MEAS	TARGET EDIT DISP

11. TRAVERSE



- △ Known point
- Corner point
- Sideshot point

This function is for fixed, closed and open traverse calculations.

You can measure not only the corner points but also the sideshot points at the same time.

When the traverse is closed, the closing errors of coordinates are calculated and the corner points can be adjusted. In addition, the sideshot points from the corner point based on the adjusted each corner point's coordinates are calculated.

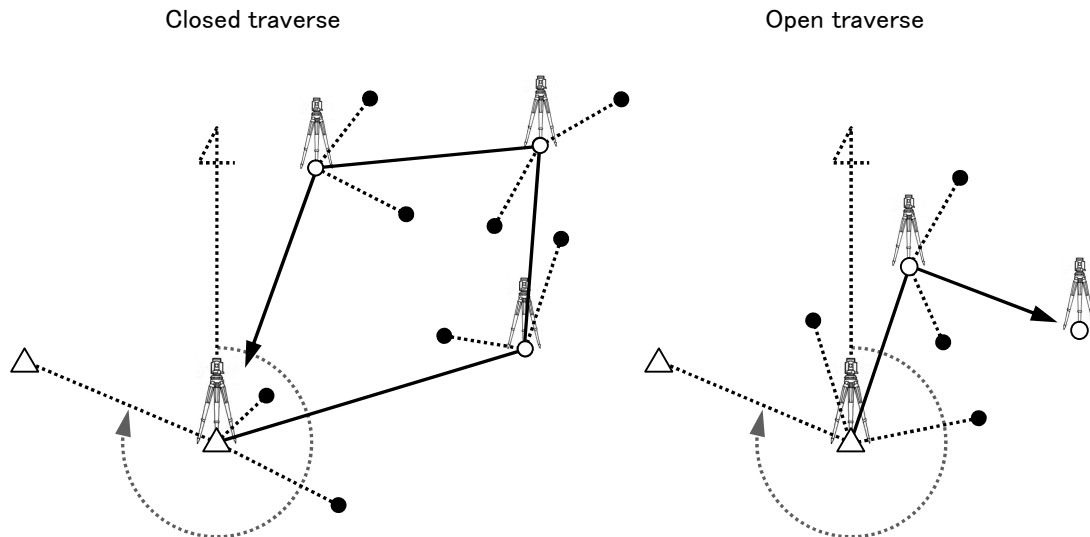
One point of the traverse data uses the memory size of two or three coordinates data.

Therefore, please check the remaining memory.

The calculation type is the Compass Rule.

The traverse function can store the polar coordinates data and the rectangular coordinates data.

And it can send the polar data by DC1 or AUX format and rectangular data by DC1 or CSV format respectively.



The following assumptions are made:

The current station is the foresight point of the previous station which you select as a next station. The back sight point of current station is the previous station.

The following limitations are made:

More than one traverse route can't be measured at the same time. Don't store other data while you are measuring the traverse route. When one traverse route is finished, perform the traverse calculation before you store other data. Don't turn the power supply off until the measurement at one start point or at one corner point is completed.

Don't escape from the MEASURE screen.

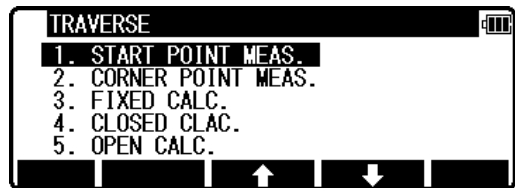
You can't use a duplicate PN in one Job. And you can't overwrite the PN in the traverse. The same traverse route can't be calculated again. Polar coordinates data of back sight and station points can't be seen in the EDIT THE POLAR DATA function. But it is sent properly in SEND POLAR DATA function.

Traverse

From the PowerTopoLite, Press the [F1][TRAV] of the PowerTopoLite to view the TRAVERSE screen.

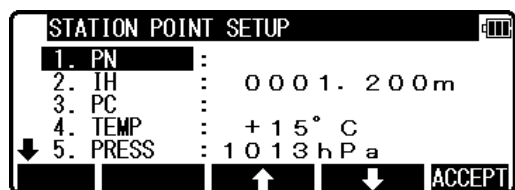
11.1 Start point measuring

Select 1. START POINT first to start new traverse.

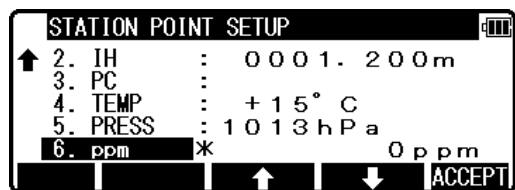


NOTE: More than one traverse route can't be measured at the same time.
Please start the new traverse route after another traverse route is finished.

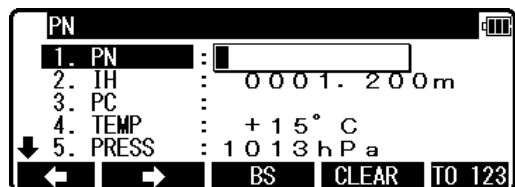
Press [ENT] to view the STATION POINT SETUP screen.



The [↑] / [↓] mark is used to scroll up / down.

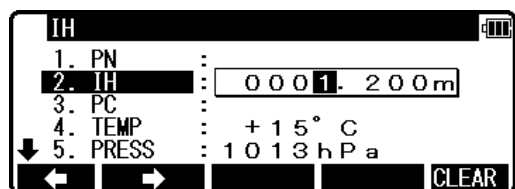


Point name, PN, input.
Press [ENT] to view the PN screen.

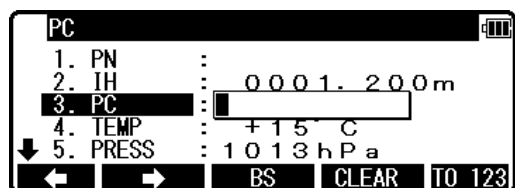


IH, TEMP, PRESS, ppm and PC input.

Input IH value.



Press [ENT] and input the PC.



Input the TEMP value.

Press [ENT].

Input the PRESS value.

Press [ENT].

Input the ppm value.

TEMP, PRESS and ppm input depend on the Initial setting 1 (ATM INPUT, ppm INPUT, NIL). And they are alternative.

Press [F5][ACCEPT] to save the input data.

Then it proceeds to STATION POINT H. ANGLE SETUP screen automatically.

Station Orientation

Input the back sight point's direction angle from the start point.

NOTE: The direction angle set at this screen is used in the traverse calculation which will be executed later.

And the rotation of the “H.angle” depends on the rotation setting of “14 .2 Coordinate axis definition”.

- [INVERS] key

If you want to calculate the direction angle, press [F5][INVERS] to jump INVERSE function.

Input SP as a start point and EP as a back sight point.

Result angle is set here automatically by pressing the [ENT] at the RESULT OF INVERSE screen. Press [ENT] after aiming at the reference point.

Aim at the reference point and press [ENT] to view the MEASURE screen.

MEASURE		15°C	N 0	
PN	POT3			
PH	1. 200m			
H.angle	0° 00' 00"			
V.angle	100° 38' 40"			
S.dst	3. 480m			
MEAS		SAVE	ME/SAVE	EDIT PAGE

Measuring

Aim at the Target point and press [F1][MEAS] to measure the distance.

MEASURE		15°C	N 0	
PN	POT3			
PH	1. 200m			
H.angle	0° 00' 00"			
V.angle	100° 38' 40"			
S.dst	3. 480m			
MEAS		SAVE	ME/SAVE	EDIT PAGE

Press [F3][ME/SAVE] to measure and save the measured data as sideshot point.

Press [F2][SAVE] to save the measured data as sideshot point.

When no PN is input, no survey data is saved.

Press the [F4][EDIT] to edit the PN, Point Name, PH, Prism Height and PC, Point Code.
Press [ENT] to view each input window by pressing the up or down arrow key, and input your desired point name or prism height or point code. Press [F5][ACCEPT], if the current PN, PH and PC are acceptable.

MEASURE				
1. PN:	POT4			
2. PH:	0001. 200m			
3. PC:	ABC			
▲		▼	▲	▼ ACCEPT

Press the [ENT] to save the measured data as corner point. If [ENT] is pushed more than twice at the one station, the last [ENT] point becomes next corner point.

NOTE: Please use [SAVE] [ME/SAVE] and [ENT] properly by sideshot and corner point.
Press [F5][PAGE] to view another menu.

MEASURE		15°C	N 0	
PN	POT3			
PH	1. 200m			
H.angle	0° 00' 00"			
V.angle	100° 38' 40"			
S.dst	3. 480m			
EDM		TARGET		PAGE

11.2 Corner point measuring

Select 2.CORNER POINT to start measuring at corner point.

TRAVERSE			
1. START POINT MEAS.			
2. CORNER POINT MEAS.			
3. FIXED CALC.			
4. CLOSED CLAC.			
5. OPEN CALC.			
		▲	▼

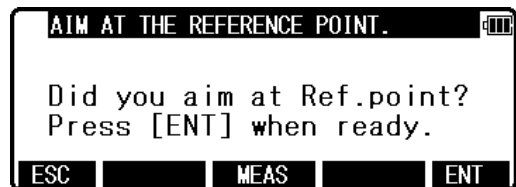
And press [ENT] to view the STATION POINT SETUP screen.

STATION POINT SETUP			
1. PN*	POT4		
2. PH:	0001. 200m		
3. PC*	ABC		
		▲	▼ ACCEPT

Press the [ENT] to view the AIM AT THE REFERENCE POINT screen.

Aim at the previous station, then press [ENT].
The direction angle is set automatically.
It proceeds to MEASURE screen automatically.

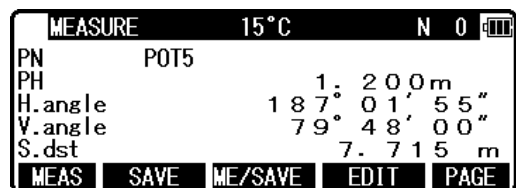
Press [F3][MEAS] to confirm the points to be aimed
For more details, refer to “4.2 Station Orientation”.



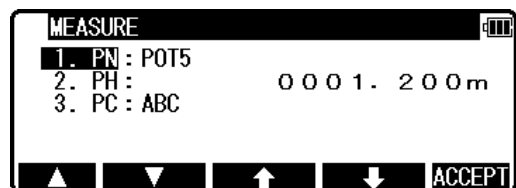
Measuring

Aim at the Target point and press [F1][MEAS] to measure the distance.

Press [F3][ME/SAVE] to measure and save the measured data as sideshot point.
Press [F2][SAVE] to save the measured data as sideshot point.
When no PN is input, no survey data is saved.



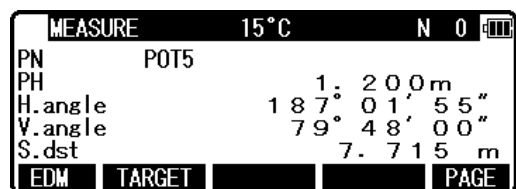
Press the [F4][EDIT] to edit the PN, Point Name, PH, Prism Height and PC, Point Code.
Press [ENT] to view each input window by pressing the up or down arrow key, and input your desired point name or prism height or point code. Press the [F5][ACCEPT], if the current PN, PH and PC are acceptable.



Press the [ENT] to save the measured data as corner point.
If [ENT] is pushed more than twice at the one station, the last [ENT] point becomes next corner point.

NOTE: Please use [SAVE] [ME/SAVE] and [ENT] properly by sideshot and corner point.

Press [F5][PAGE] to view another menu.



To finish the traverse measurement

Fixed traverse

Please measure the known point and press [ENT] at the last corner point.

Closed traverse

Please measure the start point and press [ENT] at the last corner point.

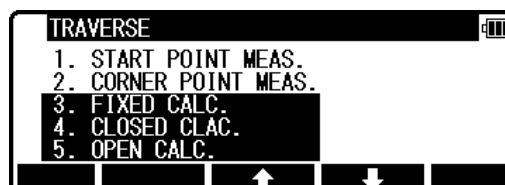
NOTE: Don't use the same point name (PN) for start point when you measure the start point from the last corner point. For example, change "T1" to "T1-1" etc.

Open traverse

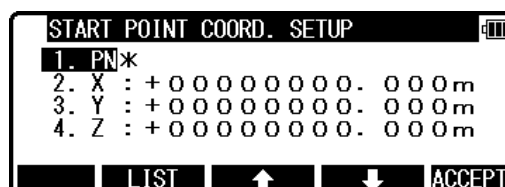
You do not need to measure the corner point by pressing [ENT] for calculation at the last corner point. The closing errors are not calculated.

11.3 Calculation

Select "3.FIXED CALC." or "4. CLOSED CALC." or "5.OPEN CALC." to calculate the traverse route.



Press [ENT] to view the START POINT COORD. SETUP screen.

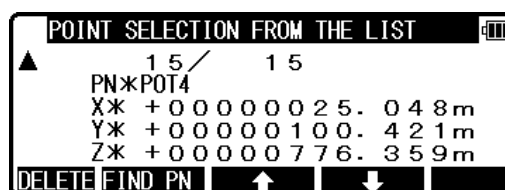


Start point coordinates setup.
(Input the PN, Coordinates and PC of the Start point.)

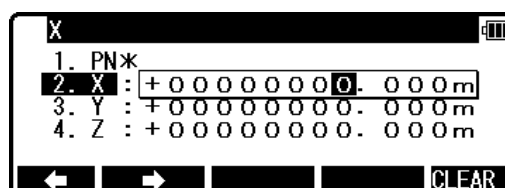
[LIST] key

All the stored points can be displayed as follows by pressing [F2][LIST].

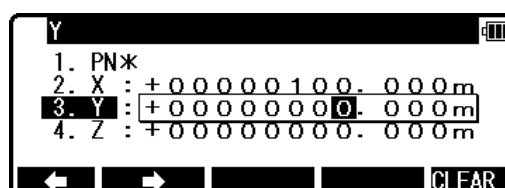
Press [F2][LIST] to view the POINT SELECTION FROM THE LIST screen.



Press [ENT] to open the X coordinate input screen.
Input your desired value by pressing each keys and press [ENT] to go Y coordinate.



Press [ENT] to open the Y coordinate input screen and input.



Press [ENT] to open the Z coordinate input screen and input.

Only in the case of fixed traverse, end point coordinates setup screen is displayed.
(Input the PN, Coordinates and PC of the End point.)

After Z coordinate input, END POINT COORD. SETUP screen is viewed.

Input the PN, X, Y, Z Coordinates and PC name of the End point.

Press [ENT] to view the RESULT COORD. OF TRAVERSE screen.

e/S

Display of Calculation Results ※The contents of “e/S” varies by the points to be displayed.

Points being displayed	Contents of “e/S”
Traverse point of Station Point (The point where the instrument is set)	Length between last station P. & current P. / Length between start P. & current P.
Traverse point of not Station Point (The point where the instrument is not set)	Length between last station P. & current P.
Start Point	Closing errors / Total length
End Point	Length between last station P. & current P. / Length between start P. & current P.

※In case of OPEN CALC, Closing errors is not available.

[F1] and [F2] only indicate corner points in order.

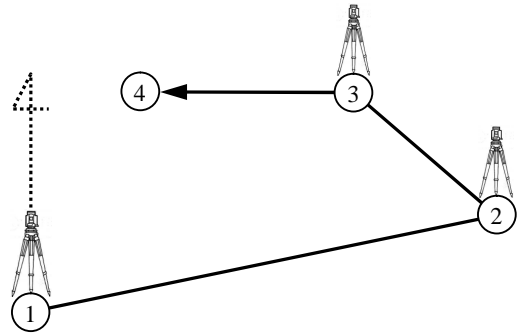
[F3] and [F4] indicate all points in order.

Press [F5][ACCEPT] to save the all corner, sideshot points, and known points.

FIXED TRAVERSE

Set the instrument in the order of 1, 2, 3 and 4, then make the measurement.

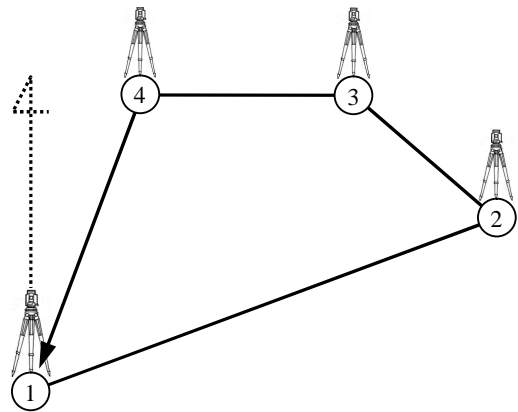
- 1: [Start point]
- 2 and 3: [Traverse points of Station P]
- 4: [End point]



CLOSED TRAVERSE

Set the instrument in the order of 1, 2, 3 and 4, then make the measurement.

- 1: [Start point]
- 2, 3, 4: [Traverse points of Station P.]
- 1, which is measured last, is [End point]



Example:

For point 1

“Closing errors/Total length is the horizontal distance error at point 1 between measured value and theoretical value.

“Total length” is the distance measured in the order of 1-2-3-4-1

For point 3

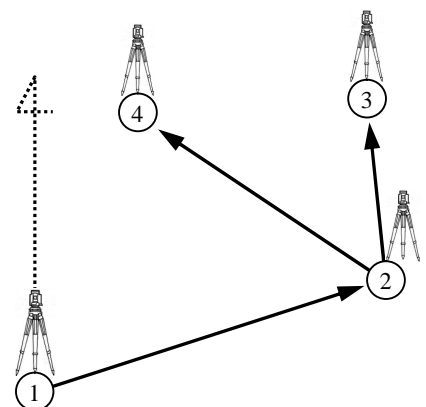
“Length between last station P. & current P. ” is the distance between 2 and 3

“Length between start P. & current P. ” is the distance measured in the order of 1-2-3

OPEN TRAVERSE

Set the instrument in the order of 1 and 2, then make the measurement.

- 1: [Start point]
- 2: [Traverse point of Station P.]
- 3 and 4: [Traverse points of not Station P.]

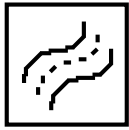


Example :

For point 4

“Length between last station P. & current P.” is the distance between 2 and 4.

12. ROAD DESIGN



You can use this function to calculate basic design clothoid, raised type clothoid, and central peg and width peg of simple curve, and record the coordinates by inputting and specifying each coordinate of BP, IP and EP and the elements of the curve.



WARNING

- Road calculation excludes Z coordinate values from the calculation.
- Road calculation allows you to calculate up to 3,000 points in combination with number peg, plus peg and width peg.
- The maximum number of points that can be processed per route is 3,000 points. When making a design for a complex route having many consecutive IP points, you may not be able to obtain your desired smooth linear shape if you calculate with an extreme and rough pitch. Also if there is a mistake of inputting coordinates or elements, it may generate the coordinates quite differently from your desired linear shape. To prevent yourself from these, we recommend you to send the generated coordinates to PC and confirm the linear shape on the monitor or printer screen before using.

[Measurement point name to be selected and specified]

Regarding measurement point name of each coordinate, input alphanumeric character up to three character following the character of BP, IP and EP. When more than three characters following BP, IP and EP or completely different alphanumeric characters by deleting the initial character are input, it automatically generates the point name of an existing value. This will also happen when you specify a coordinate by researching from the memory.

[Generation of measurement point name]

Numerical part: 3 digits and up to 001~999.

Integer part of plus peg: up to 01~99.

Width peg: Left width peg [L] is added at the end of the measurement point name.

Right width peg[R] is added at the end of the measurement point name.

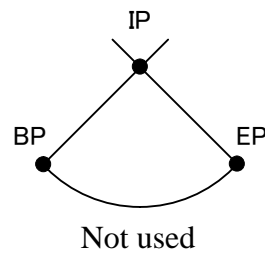
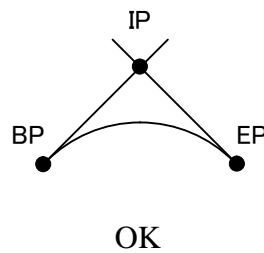
NOTE: measurement point name is not processed for the additional distance.

[Generation of principal peg to be recorded by calculation and measurement point name of

- In case of Simple curve;
BC#, EC#, SP#
(「#」 of measurement point name of principal peg has actually become IP number.)
- In case of basic design clothoid;
KA#-1、KE#-1、KE#-2、KA#-2、SP#
- In case of raised type clothoid;
KA#-1、KE#-12、KA#-2

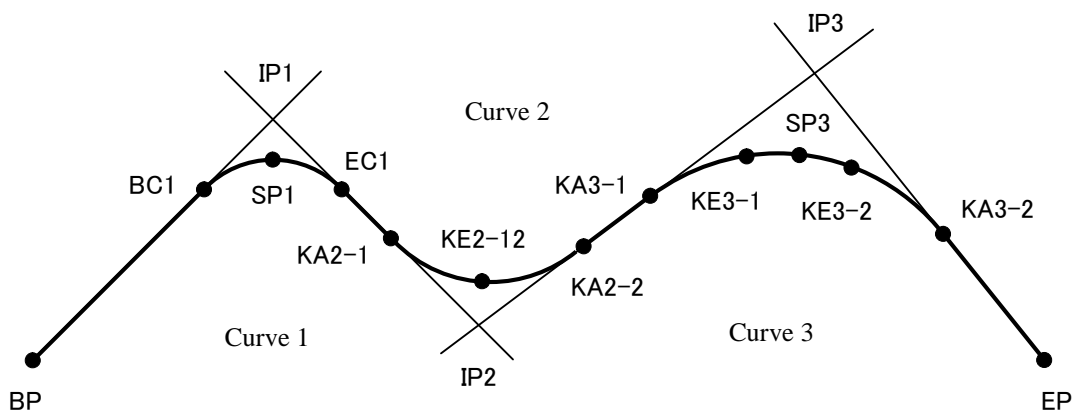
[The curve to be used in road design]

The curve mentioned in the right drawing can not be used , which is called reverse IP or IP curve, although it can be used with basic design clothoid, raised type clothoid and simple curve (see left drawing).



[Terms and curves to be used in Road Calculation]

BP	Beginning point of route	IP	Intersection point of main tangent
EP	End point of route	IA	Intersection point of main contact
BC	Beginning of curve	CL	Curve length
EC	End of curve	SP	Secant point
KA	Beginning of clothoid curve		
KE	End of clothoid curve		



12.1 BP, IP, EP input

Press [F2][ROAD] in PowerTopoLite to open BP DATA SETUP.

BP DATA SETUP	
1. PN:	BP
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. PC:	0000.000m
SAVE LIST ↑ ↓ ACCEPT	

Press [ENT] to open the PN,X,Y,Z and PC input window and input each.

Then, press [ENT] or [F5][ACCEPT] to view the IP DATA SETUP screen.

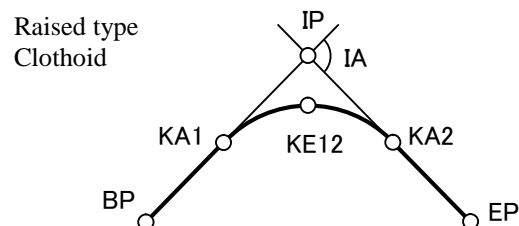
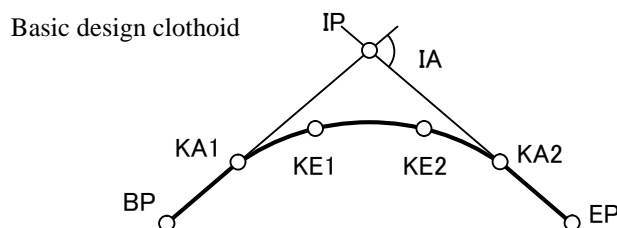
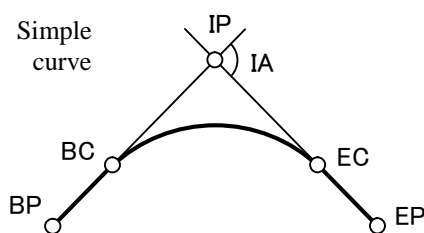
IP DATA SETUP	
1. PN:	IP1
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. A1:	0000.000m
5. A2:	0000.000m
SAVE LIST ↑ ↓ ACCEPT	

NOTE:

Based on the input parameters in the following table, basic design clothoid, raised type clothoid and simple curve are calculated.

Type	Input items
Basic design clothoid	Radius R Parameter A1, A2
Raised type clothoid	Parameter A1,A2
Simple curve	Radius R

You can input radius R, parameter A1,A2 in the range of 1m or more and less than 10,000m . If you input only parameter A1, or only parameter A2, a message 「clothoid<--->arc cannot cal.」 is displayed. This doesn't support road design composed from clothoid-simple curve or simple curve-clothoid.



In the same manner, input the values of IP.
Then, press [ENT] or [F5][ACCEPT] to view the ADD IP POINT screen.

IP can be stored up to 10 points.
Press [F5] [OK] to input IP, if not necessary, press [F1][NO] .

In case of OK

In case of No good

12.2 Road parameter and pitch input

After input of BP, IP and EP is done, input the remaining parameters.

NOTE:

- Initial value of number peg pitch interval : 20m. Initial value of pitch curve section interval: . Input range between number peg pitch and pitch curve section: between 1m or more, and less than 100m.
- Regarding number peg pitch interval and pitch curve interval, if pitch curve section is not 1: integer of number peg pitch (number peg pitch is integer times of pitch curve section), an error message [No.P.isn't multiple of C.P.] is displayed. In this case input again value of number peg pitch and pitch curve section in the range of 1m or more, and less than 100m.
- In case value of pitch curve section is [0], central peg is calculated based on number peg pitch in the pitch curve section.
- If value of number peg pitch and pitch curve section is set for 0, only principal peg is calculated. If interval of number peg is longer than curve length, a message [too large data, cal.stop] is displayed. Input less value of number peg pitch.
- Input range of width is between 0m or more, and less than 100m.
- If you input incorrect value in the input item, a message, [CAN'T CALCULATE THE ROAD] is displayed. Input parameter, BP, IP and EP again.

Press [F5] [ACCEPT] after parameter input is done to display IP POINT CONFIRM screen.

```

IP POINT CONFIRM
DO IP POINT CONFIRM AND
CURVE WIDENING ?
NO      OK
  
```

Press [F1][NO] to display calculation results, or press [F5][OK] to go to IP confirmation and widening input screen.

12.3 IP confirm

Select IP by pressing [F1][△] / [F2][▽] key. Confirm intersection IA, point name, turning direction, distance 1, distance 2 and curve length and other value show in the illustration

```

IP POINT CONFIRM
IP NAME : IP1      TURN TO: RIGHT
IA      : 58°06'33"  A1: +50.000
DST.1   : +72.801   A2: +50.000
DST.2   : +145.602  R : +80.000
CURVE L.: +112.386
▲      ▼      C. WIDEN IP PARAM ENT
  
```

Press [F3][C. WIDEN] to display road widening setting screen.

```

ROAD WIDENING
1. MAX C.WIDEN(L) : 00.000m
2. MAX C.WIDEN(R) : 00.000m
▲      ▼      ▲      ▼      ACCEPT
  
```

Press [F4][IP PARAM] to display IP PARAMETER screen.

```

IP PARAMETER
1.A1 : 0050.000m
2.A2 : 0050.000m
3.R  : 0080.000m
▲      ▼      ▲      ▼      ACCEPT
  
```

NOTE:

Input range of widening is between 0m or more, and less than 100m.
Widening is calculated based on transition curve (Parabola).

In case of simple curve.

Widening is [0] at BC point, the widening will be the maximum at the center of curve and widening of EC point will be [0].

In case of clothoid.

Widening is [0] at KA point, the widening will be the maximum at KE point.

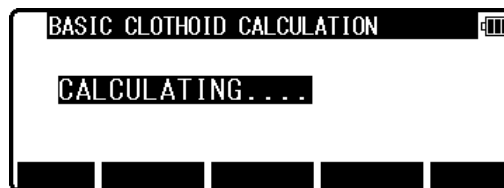
Be aware that there are some limitations as mentioned above when you use it.

NOTE:

If you select raised type clothoid, the radius R, which is calculated inside, will be displayed on IP point confirmation screen. When you change the element of raised type clothoid by pressing [F4] [IP PARAM], [0] must be input to [3.R] on the elements setting change screen. If you don't input [0] and press [ENT] with the displayed value, re-calculate as basic design clothoid. Be sure to input [0] when changing the elements.

12.4 Calculation

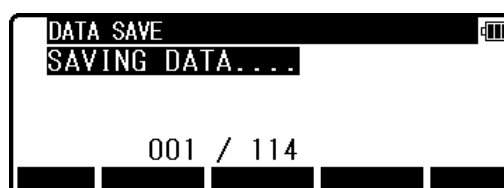
Press [F1] [NO] on 12.2 IP POINT CONFIRM screen or [F5] [ENT] on 12.3 IP POINT CONFIRM to start calculation.



CALCULATION RESULT		
PN	X	Y
BP	+110.000	+120.000
BPR	+108.626	+124.808
BPL	+111.374	+115.192
No001	+114.808	+121.374

Navigation arrows (up, down) and a [RECORD] button are at the bottom.

Press [F5][RECORD] to save the calculation results.



NOTE: In case the calculation results don't appear and an error message [CAN'T CALCULATE THE ROAD] is displayed, check input coordinates and parameter again.

- 1) On relation between BP-IPI and BC (or KA), BC (or KA) exists before BP and geometric relationship isn't consistent. Same thing happens to EP.
- 2) In case KE exist before KA.
- 3) When curve section is consecutive, parameter of the curve element is not consistent with the straight section between IP.
- 4) Straight section between IP is not consistent with the curve section.
- 5) Integral part of coordinate of principal peg exceeds 6 digits.

NOTE: If integral part exceeds 6 digits, an error message [TOO LARGEDATA, CAL STOP] is displayed and calculation is stopped.

NOTE: Numerical part of measurement point name of number peg exceeds [999] and becomes more than 1,000, under-3 digit is used as a measurement point name of number peg.

NOTE: In case created coordinates exceed 1,000 before calculation reaches end point, an error message tells you that it is impossible to make calculation until end point, [OVER 1000 POINTS, CAL CAN'T FINISH] is displayed. Select [ESC] and divide route section. Then recalculate, or press [CONT] to continue the calculation, but in this case you have to understand that coordinate calculation is not done completely.

NOTE: Calculated coordinate is stored in the selected job file. If you carry out recording even though the same measurement point name as that of the calculation result exists in the job, the same measurement point name is recorded in the job file.

NOTE: When you want to stop function on the way, press [ESC] several times to return.

NOTE: Since a lot of data is recorded at the same time, it may take some time to complete all the data. Do not remove the battery during recording as it may damage the instrument.

NOTE: IP point is not stored.

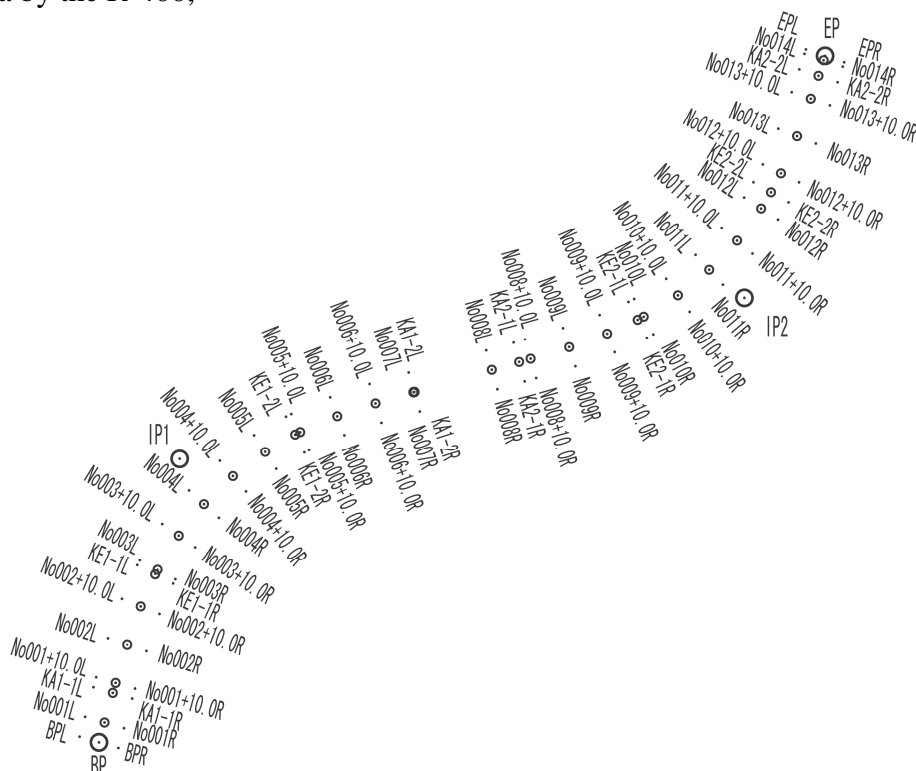
Sample Data

Point Name	X	Y	A1	A2	R
BP	110.000	120.000			
IP1	180.000	140.000	50.000	50.000	80.000
IP2	220.000	280.000	50.000	50.000	80.000
EP	280.000	300.000			

BP Additional distance	15.000
------------------------	--------

Number peg pitch	20.000
Pitch curve section	10.000
Width(Left)	5.000
Width(Right)	5.000

The following plot was made by sending the calculation results to PC after calculating the sample data by the R-400,



13. INPUT / OUTPUT



The communication setting and the Input/Output of data are performed by this function.

We recommend you not to press any key until data transfer is completed while transfer operation.

Notice concerning the unit of data to transfer.

Output data (Rect. data & Polar data).

Coordinates and Distance data.

The unit is output by “m” unit even if the distance unit setting of the instrument to send the data is “m”, “ft” and “ft+inch”.

Angle, Temperature and Pressure data.

The data is output according to the unit setting of the Angle, Temperature and Pressure of the instrument to send the data.

Input data (Rect. data).

Coordinates data.

The Coordinates data received is input in the instrument as data of “m” unit.

Then, it is converted according to the distance unit which is set in the instrument, and displayed on the screen.

Data format

1. DC-1

[In case of Text File read / write]

Record No.	:	Site name	:	L/F code	
Record No.	:	P. Name	:	X Coord.	: Y Coord. : Z Coord. L/F code

[In case of Communication with COM]

Record No.	:	Site name	:	BCC	:	L/F code	
Record No.	:	P. Name	:	X Coord.	: Y Coord. : Z Coord. : BCC	L/F code	

[Record No.]

The Record number is a 5-digit serial number.

(the number consists of a 4-digit serial number plus one digit.

The last digit represents the data type. 1: Site name; 2: Survey P.data)

[P. Name] The Survey P. number is handled as text data, if it is input.

[:] “ : ” is used to separate items.

[Coordinate data] X, Y, and Z coordinate data

A 6-digit integer part and a 3-digit fraction part represent coordinate data.

[BCC]

To detect a data transmission error, BCC is calculated per block and attached to the end of data.

[L/F code] use CR/LF

BCC is calculated by the following calculation method

$$BCC = \Sigma A - (B \times 40H) 20H$$

ΣA = Each character of a block that contains the sum of the ASCII code

$$B = \Sigma A \div 40H \text{ (truncate decimal places)}$$

2. CSV

P.Name	,	X Coord.	,	Y Coord.	,	Z Coord.	,	P.Code	,	L/F code
--------	---	----------	---	----------	---	----------	---	--------	---	----------

[P. Name]

The P. Name is handled as text data, if it is input.

[Coordinate data]

X, Y, Z Coordinate data.

Represented by a 6-digit integer part and a 3-digit fraction part.

[P. Code]

The P. Code is handled as text data, if it is input.

[L/F code]

use CR/LF.

3. ExtCSV

31	,	No.	,	P. Name		P. Code	,	X Coord.	,	Y Coord.	,	Z Coord.	L/F code
----	---	-----	---	---------	--	---------	---	----------	---	----------	---	----------	----------

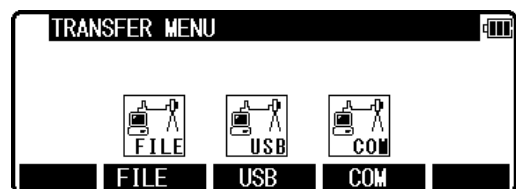
[31] Fixed

NOTE: This format is used when sending PointCodeList. Received files are automatically saved in the “PointCodeList” of Job file.

4. AUX

Format of AUX is used the same as that of DC1.

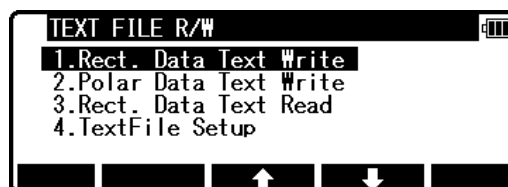
Press the [F3][I/O] of the PowerTopoLite to view the TRANSFER MENU screen.



13.1 Text File read / write

Text file read/write allows you to input and output format and text data specified recording media. Before taking this procedure, make sure of TextFile Setup (refer to 13.1.3. Text file Setup).

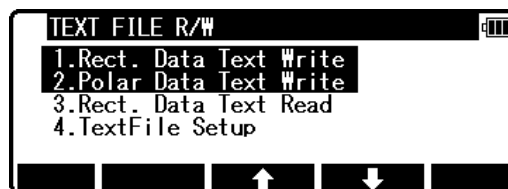
Press the [F2][FILE] of the TRANSFER MENU screen to view the TEXT FILE R/W screen.



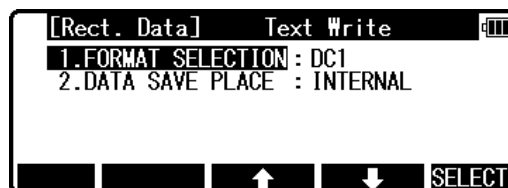
13.1.1 Writing to Text File

This command allows you to transfer the existing measurement point data in the internal memory to specified format per file.

When output Rectangular Data, select 1 and in case of Polar Data, select 2, then press [ENT].



Press [F5][SELECT] to select format and data save place, then press [ENT].

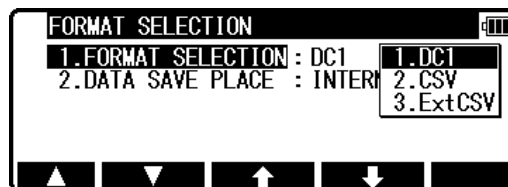


[FORMAT SELECTION]

Rectangular Data

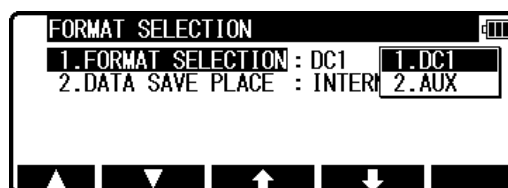
- DC1 (Extension DC1)
- CSV (Extension CSV)
- ExtCSV (Extension CSV)

※ Be careful that extension of CSV and ExtCSV will be the same.



Polar Data

- DC1 (Extension DC1)
- AUX (Extension AUX)



[DATA SAVE PLACE]

INTERNAL

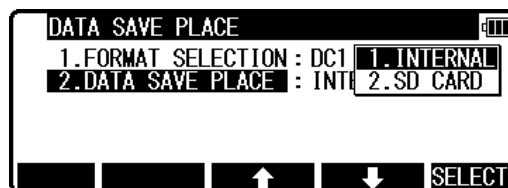
Save data in the memory of the instrument.
Output file can be loaded to PC by connecting a USB (Refer to 13.2 Communication with USB)

SD CARD

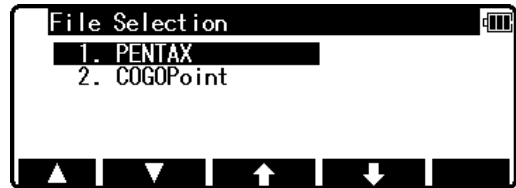
Save data in the SD card.

Output file can be loaded to PC by connecting a USB.

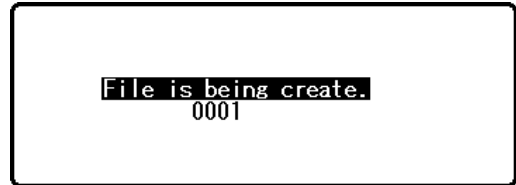
[DATA SAVE PLACE] is set in the SD card, you can use the SD card directly without connection USB.



Select the file you desire to output, then press [ENT].



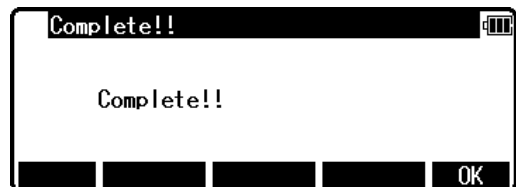
New files are created in the memory of the instrument and SD card, and also transferred data will be recorded in it.



[File Name]

Rectangular Data [Job Name]_C.[Extension]

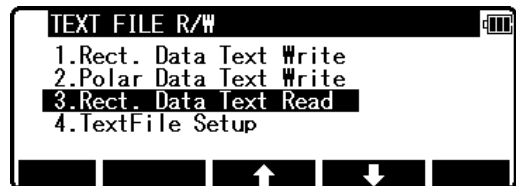
Polar Data [Job Name]_P.[Extension]



NOTE: If free memory space becomes less than 1MB, you can not create the file, and an error message [Space capacity is short] is displayed. Try again after increasing free memory space.

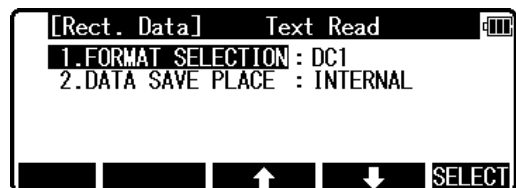
13.1.2 Reading from Text File

This command allows you to transfer the text file containing measurement point data in the internal memory of the instrument or SD card to the data that can be used with the instrument.



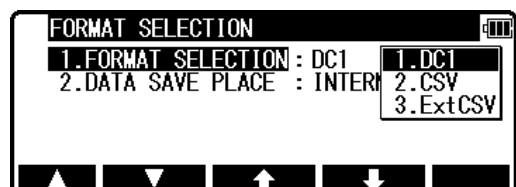
3.Select Rect. Data Text Read, then press [ENT]

Select the format of the file you desire to read and data save place, then press [ENT]



[FORMAT SELECTION]

- DC1 (Extension DC1)
- CSV (Extension CSV)
- ExtCSV (Extension CSV)



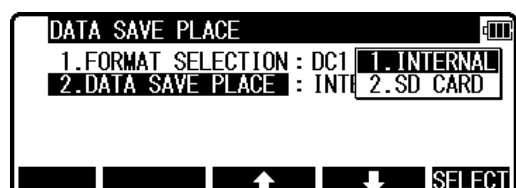
[DATA SAVE PLACE]

INTERNAL

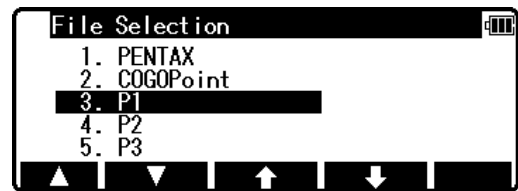
Read the file in the internal memory of the instrument.

SD CARD

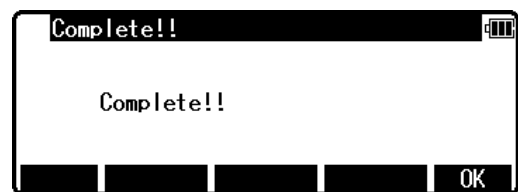
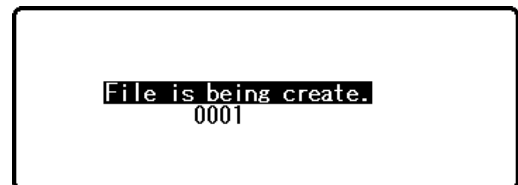
Read the file in the SD



Select the file you desire to read, then press [ENT]



In this case, new job file is created in the internal memory of the instrument and the transferred data is recorded in it.



NOTE: File name is limited to a maximum of 12 characters. If the file name is more than 13 characters, it is **not put in the list of the file that can be read.**

NOTE: Error Message

- Duplication of the file name.
If the same file name exists in the instrument, an error message [The file name isn't correct] is displayed. Change the file name and try again.
- Incorrect format.
If the format is incorrect, an error message [Format is not correct] is displayed. Check the format of the coordinate data and try again to read the text file. (For more details on "Format", refer to "13. INPUT/OUTPUT".)
- Maximum number of job files stored in the internal memory is exceeded.
The maximum number of job files stored in the file is 50. If you try to read a new file while 50 job files already exist, an error message [limited number of files] is displayed. Delete unnecessary job files by pressing [4. DELETE] in [FILE MANAGEMENT]. (For more details, refer to 3.4 Deletion of a Job name.)
- The remaining capacity of the internal memory becomes less than 1 MB.
You cannot create a file when the remaining capacity is not enough and an error message [Space capacity is short] is displayed. Make sure that the remaining capacity is more than 1MB, then try again to read the text file.

NOTE: Warning

- The number of data exceeds 3,000 points.
The maximum number of points stored in the internal memory per job is 3,000 points. If it reaches 3,000 points during reading the text file, an error message ["3000 point over!"] is displayed. In this case, up to the 3,000th point will be read, but after that no more.

- The number of data exceeds the maximum number of job files stored in the internal memory.
If the total number of points in all job files exceeds the maximum number of points stored in the internal memory, an error message [WARNING This job file was exceeded] is displayed.
(6000 points for R-422N and R-423N, 5000 points for R-425N, R-435N and R-415N).
In this case, up to the maximum number can be read, but after that no more.

[Suitability of SD card]

- The SD card that can be used with the instrument is 1GB or less.
- SD card and SD logo is registered trademark.
- The SD cards listed in the following table have been tested by us and it has been confirmed that the SD cards can be used with the R-400 series.



This test has been done with only the Pentax R-400 series Total Station, but no other Pentax Total Stations. When using with other Pentax Total Stations, please contact us to confirm it works properly.

It has also been confirmed that the models mentioned in the following table can be used with the R-400 series Total Station. Other brands or models of SD cards are not confirmed by us. Please note that the test has been done by us and that this does not mean that each SD card manufacturer guarantees that the SD cards can be used with the Pentax R-400 series.

SD (micro SD) Card

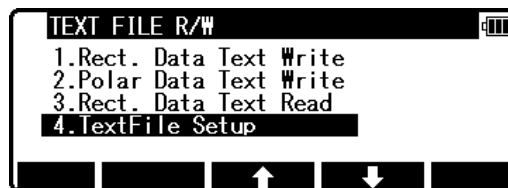
Maker	Model	Capacity
Toshiba	SD-C01GTR	1GB
Toshiba	SD-MD001GA (microSD)	1GB
Panasonic	RP-SDM01GL1A	1GB

Make sure to use the adaptor when using a microSD.

- Regardless of the information mentioned here, take note that not all SDHC cards can be used with the R-400 Total Stations.
- Test item : The following has been done according to our Test Standards.
 - ① When data is being sent (by connecting USB), it is necessary to be able to refer to information on the SD card from PC and to operate the file.
 - ② When writing/reading text, it is necessary to be able to read/write text file.

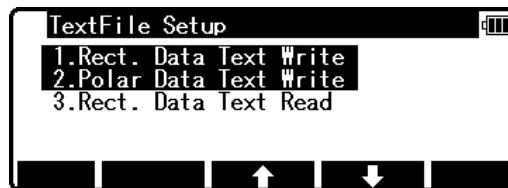
13.1.3 Text File setup

When coordinate data is output/input to and from text file, input parameter.



13.1.3.1 Writing data setting

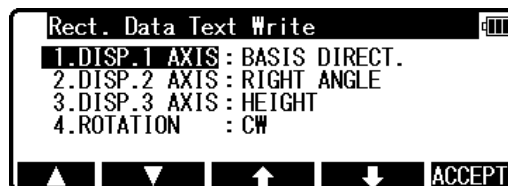
Select the 4. TextFile Setup and press [ENT] to view the TextFile Setup screen.



[1. WRITE RECT. DATA]

Select the 1. Rect. Data Text Write and press [ENT] to view the following screen.

Press [ENT] to open the selection window. Select each setting and press the [ENT].



Press [ACCEPT] to enter when all selections are finished.

- **DISP.# AXIS: BASIS DIRECT, RIGHT ANGLE, or HEIGHT is selected when data is transferred between the TS and PC. (cf.“14.2 Coordinate axis definition”)**

They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. However, it is necessary to match the definition of the “Coord. Axis” between settings in “Rect. Data Text Write” and settings in “Coordinate axis definition” when same coordinate systems are used.

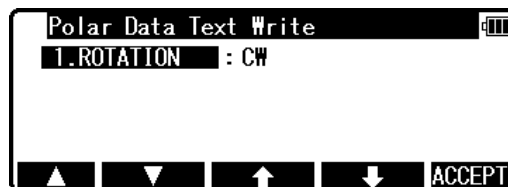
- **Factory default setting of SENDING**

- | | |
|-----------------|--------------|
| 1. DISP.1 AXIS: | BASIS DIRECT |
| 2. DISP.2 AXIS: | RIGHT ANGLE |
| 3. DISP.3 AXIS: | HEIGHT |
| 4. ROTATION: | CW |

[2. WRITE POLAR DATA]

Select the 2. Polar Data Text Write and press [ENT] to view the following screen.

Press [ENT] to open the selection window. Select each setting and press [ENT].



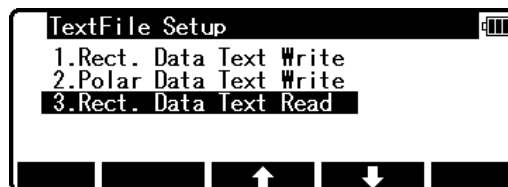
Press [ACCEPT] to enter when all selections are finished.

- **Factory default setting of 3. SEND POLAR DATA**

- | | |
|--------------|----|
| 1. ROTATION: | CW |
|--------------|----|

13.1.3.2 Reading data setting

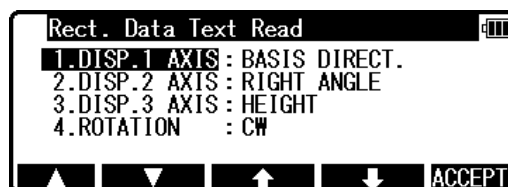
Select the 4. TextFile Setup and press [ENT] to view the TextFile Setup screen.



Select the 3. Rect. Data Text Read and press [ENT] to view the following screen.

Press [ENT] to open the selection window.

Select each setting and press [ENT].



Press [ACCEPT] to enter when all selections are finished.

- **DISP.# AXIS: BASIS DIRECT., RIGHT ANGLE, or HEIGHT is selected when data is transferred between the TS and PC. (cf.“14.2 Coordinate axis definition”)**

They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. However, it is necessary to match the definition of the “Coord. Axis” between settings in “Rect. Data Text Read” and settings in “Coordinate axis definition” when same coordinate systems are used.

- **Factory default setting of RECEIVING**

1. DISP.1 AXIS:	BASIS DIRECT.
2. DISP.2 AXIS:	RIGHT ANGLE
3. DISP.3 AXIS:	HEIGHT
4. ROTATION:	CW

13.2 Communication with USB

By connecting the instrument and PC with USB cable, you can refer to information in the internal memory and SD card. You can use this to transfer the file in the internal memory and SD card to PC or send the file created in the PC to the internal memory or SD card.

Connect the instrument and PC by USB cable as follows;

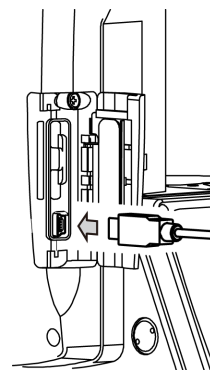
[Connecting USB cable]

- (1) Open the SD&USB slot cover.
- (2) Insert the USB connector into the USB port in the right direction.
- (3) After the USB cable is removed, close the SD&USB slot cover completely.

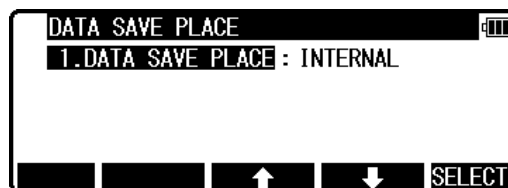


CAUTION

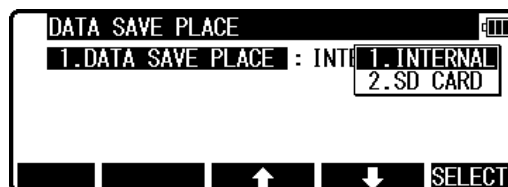
- Be sure to open/close the SD&USB slot cover and insert/remove the USB cable indoor.



Press [F3][USB] of the TRANSFER MENU screen to view the DATA SAVE PLACE screen.



Select data save place, then press [ENT].



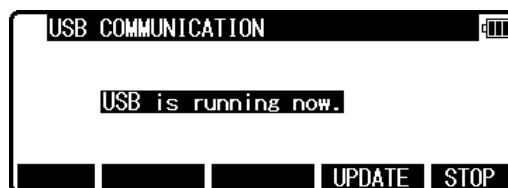
[DATA SAVE PLACE]

INTERNAL

Refer to the internal memory of the instrument.

SD CARD

Refer to SD card.



[Button]

UPDATE

Reset USB communication and update the information being displayed on PC.

STOP

Finish USB communication, then return to TRANSFER MENU screen.

NOTE: If removable disk doesn't activate although the USB is connected, click My Computer then double-click Removable disk.

CAUTION

- DAT file in the internal memory is identical with the information in the job file stored in the instrument. For the files with DAT extension, do not copy, paste and delete the file, and do not change the file name.

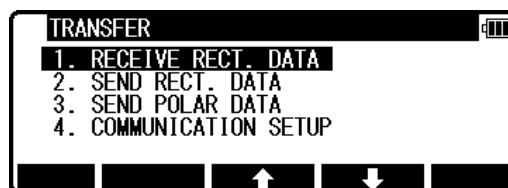
NOTE: DAT file has a hidden file. If you take the following procedure in Windows, DAT file is not displayed.

- ① Go to Windows Explorer
 - ② Click Folder Options in Tools
 - ③ Click tab of View
 - ④ In Advanced settings, check [Hidden file and No showing hidden file]
 - ⑤ Click OK
- When you finish USB communication, make sure to click [Safely Remove Hardware] icon shown in the bottom right of the Desktop. If you don't click this icon, it may cause a loss of data. In case the file, that should be downloaded, is not included, try this procedure again. Before pressing the key to finish, make sure to click [Safely Remove Hardware] icon.

13.3 Communication with COM

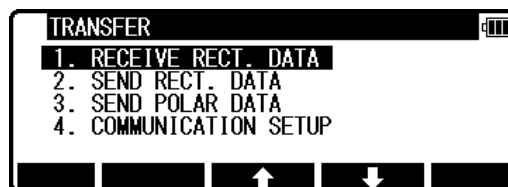
This instrument can use the communication by RS-232C.

Press the [F4][COM] of the TRANSFER MENU screen to view the TRANSFER screen.

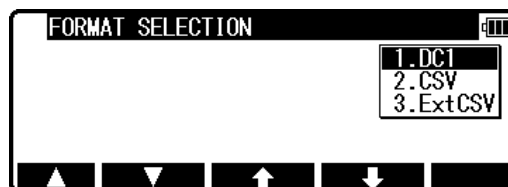


13.3.1 Input from the PC

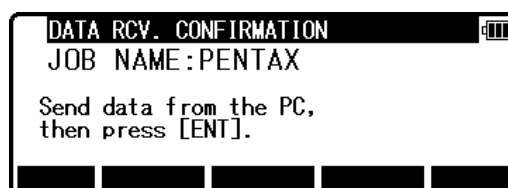
The Rect. data is sent from the PC and stored in the internal memory of the instrument.



Select the 1. RECEIVE RECT. DATA and press [ENT] to view FORMAT SELECTION screen.



Select the DC1 format and press [ENT] to view DATA RCV. CONFIRMATION screen.
(Same procedure is performed for CSV format.)



Set the PC to be ready to send and press [ENT] to receive the data from the PC.

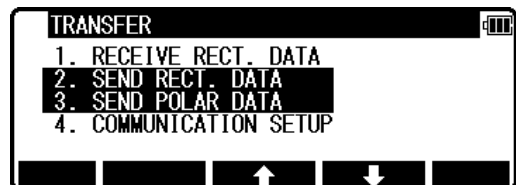


13.3.2 Output to the PC

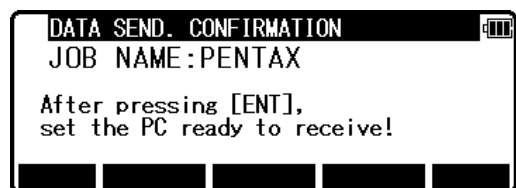
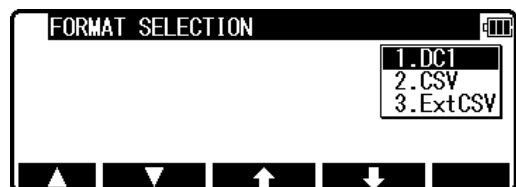
The data stored in the internal memory is sent to the PC .

[RECT. DATA]

Select the 2.SEND RECT.DATA by pressing the down arrow key, and press [ENT] to view the FORMAT SELECTION screen.

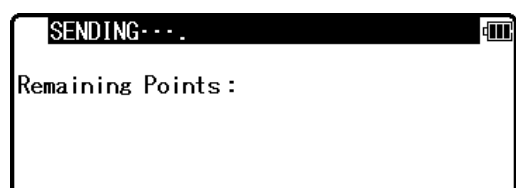


Select DC1 format and press [ENT] to view the DATA SEND. CONFIRMATION screen.
(Same procedure is performed for CSV format.)



NOTE: When Rect.data DC1 is selected and data is transmitted to PC, the DC1 format PointCode data cannot be transferred.
If CSV or ExtCSV is selected, the PointCode data can be transferred to PC.

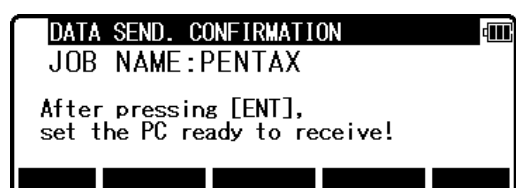
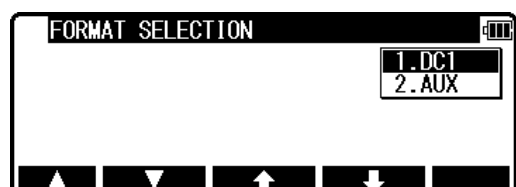
Press [ENT], and set the PC to be ready to receive.



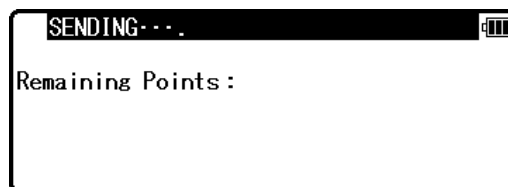
[POLAR DATA]

Select the 3. SEND POLAR DATA by pressing the down arrow key, and press [ENT] to view the FORMAT SELECTION screen.

Select DC1 format and press [ENT] to view the DATA SEND. CONFIRMATION screen.
(Same procedure is performed for AUX format.)



Press [ENT], and set the PC to be ready to receive.



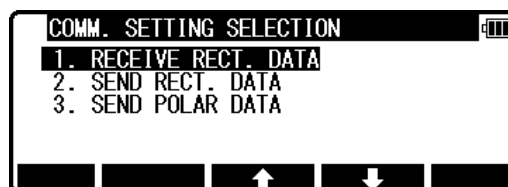
13.3.3 Communication setup

The communication parameter is set when stored data is received or sent between the instrument and the PC etc.



13.3.3.1 Receiving data setting

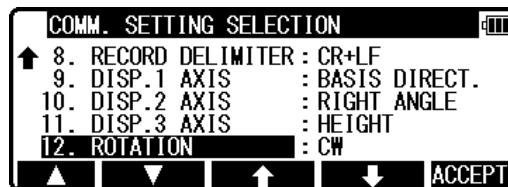
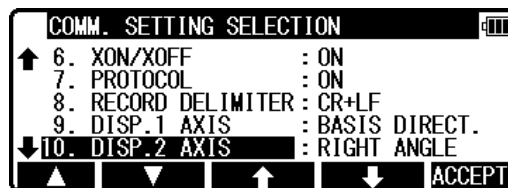
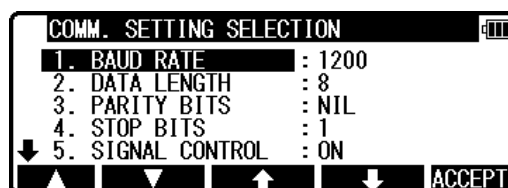
Select the 4. COMMUNICATION SETUP and press [ENT] to view the COMM. SETTING SELECTION.



[1. RECEIVE RECT. DATA]

Select the 1. RECEIVE RECT. DATA and press [ENT] to view the following screen.

Press [ENT] to open the selection window. Select each setting and press [ENT].



Press [ACCEPT] when all selections are made.

- **DISP.# AXIS: BASIS DIRECT., RIGHT ANGLE, or HEIGHT is selected when data is transferred between the TS and PC. (cf.“14.2 Coordinate axis definition”)**

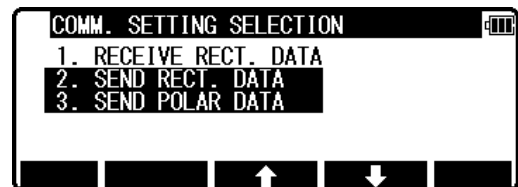
They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. However, it is necessary to match the definition of the “Coord. Axis” between settings in “Communication setup” and settings in “Coordinate axis definition” when same coordinate systems are used.

- **Factory default setting of RECEIVING**

1. BAUD RATE:	1200
2. DATA LENGTH:	8
3. PARITY BITS:	NIL
4. STOP BITS:	1
5. SIGNAL CONTROL:	ON
6. XON/XOFF:	ON
7. PROTOCOL:	ON
8. RECORD DELIMITER:	CR+LF
9. DISP.1 AXIS:	BASIS DIRECT.
10. DISP.2 AXIS:	RIGHT ANGLE
11. DISP.3 AXIS:	HEIGHT
12. ROTATION:	CW

13.3.3.2 Sending data setting

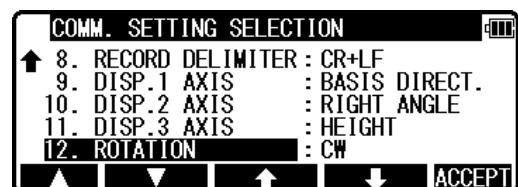
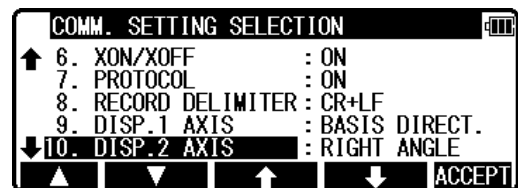
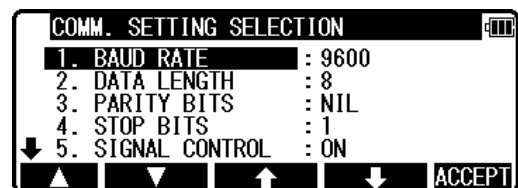
Select the 4. COMMUNICATION SETUP and press [ENT] to view the COMM. SETTING SELECTION.



[2. SEND RECT. DATA]

Select the 2. SEND RECT. DATA and press [ENT] to view the following screen.

Press [ENT] to open the selection window. Select each setting and press the [ENT].



Press [ACCEPT] when all selections are made.

- **DISP.# AXIS: BASIS DIRECT, RIGHT ANGLE, or HEIGHT is selected when data is transferred between the TS and PC. (cf.“14.2 Coordinate axis definition”)**

They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. However, it is necessary to match the definition of the “Coord. Axis” between settings in “Communication setup” and settings in “Coordinate axis definition” when same coordinate systems are used.

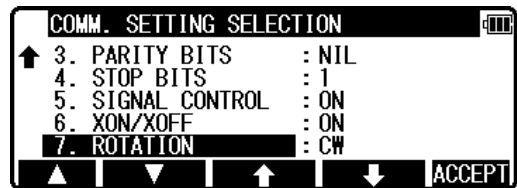
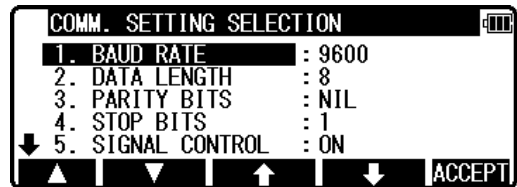
- **Factory default setting of SENDING**

1. BAUD RATE:	9600
2. DATA LENGTH:	8
3. PARITY BITS:	NIL
4. STOP BITS:	1
5. SIGNAL CONTROL:	ON
6. XON/XOFF:	ON
7. PROTOCOL:	ON
8. RECORD DELIMITER:	CR+LF
9. DISP.1 AXIS:	BASIS DIRECT
10. DISP.2 AXIS:	RIGHT ANGLE
11. DISP.3 AXIS:	HEIGHT
12. ROTATION:	CW

[3. SEND POLAR DATA]

Select the 3. SEND POLAR DATA and press [ENT] to view the following screen.

Press [ENT] to open the selection window. Select each setting and press the [ENT].



Press [ACCEPT] when all selections are made.

- **Factory default setting of 3. SEND POLAR DATA**

1. BAUD RATE:	9600
2. DATA LENGTH:	8
3. PARITY BITS:	NIL
4. STOP BITS:	1
5. SIGNAL CONTROL:	ON
6. XON/XOFF:	ON
7. ROTATION:	CW

13.3.4 About DataLink DL-01 Software

DataLink DL-01 Software allows you to send collected data by R-400 to other devices, to receive coordinates data, and to convert the resulting files into a number of common formats.

a) Recommendation for "PN".

It is recommended that "PN" (Point Name) data should consist of less or equal to 4 (one-byte) numeric characters to convert files with DL-01. Because, it may not be converted properly if alphabetic characters or more than 5 (one-byte) numeric characters are used for the "PN".

b) Notes for the data transferring.

Please, be careful about following items for the data transfer with "DL-01".

b-1 Type of data, which can be transferred.

With PTL, "POLAR DATA" can be transferred by "DC1" or "AUX" format. In addition, it is possible DL-01 to receive/convert "POLAR DATA" with "DC1 (DC-1Z)" format.

b-2 Notes for unit.

If you are requested to select unit when you convert data on DL-01, please select unit according to the settings on R-400.

b-3 Limitation for each format.

Please, use "CSV" or "DC1 (DC-1Z)" format to transfer data to/from R-400.

Limitation for the "CSV" format.

With the "CSV" format, "PN" and "PC (Point Code)" data that consists of less or equal to 15 (one-byte) characters can be transferred.

Limitations for the "DC1 (DC-1Z)" format.

With "DC1 (DC-1Z)" format, the length of "PN" data should consist of less or equal to 11 (one-byte) characters. And with the "DC1 (DC-1Z)" format "PC" data cannot be transferred.

b-4 Recommended communication settings on R-400.

Recommended settings for “COMM SETTING SELECTION” on R-400 special function is as follows.

R-400 → PC(DL-01) to “SEND RECT. DATA”

- | | |
|----------------------|---|
| 1. BAUD RATE: | 1200 |
| 2. DATA LENGTH: | 8 |
| 3. PARITY BITS: | NIL |
| 4. STOP BITS: | 1 |
| 5. SIGNAL CONTROL: | OFF |
| 6. XON/XOFF: | OFF |
| 7. PROTOCOL: | OFF for “CSV” format, ON for “DC1 (DC-1Z)” format |
| 8. RECORD DELIMETER: | CR+LF |
| Subsequent items: | As you like. |

R-400 → PC(DL-01) to “SEND POLAR DATA”

- | | |
|--------------------|--------------|
| 1. BAUD RATE: | 1200-9600 |
| 2. DATA LENGTH: | 8 |
| 3. PARITY BITS: | NIL |
| 4. STOP BITS: | 1 |
| 5. SIGNAL CONTROL: | OFF |
| 6. XON/XOFF: | OFF |
| 7. ROTATION: | As you like. |

PC(DL-01) → R-400 to “RECEIVE RECT. DATA”

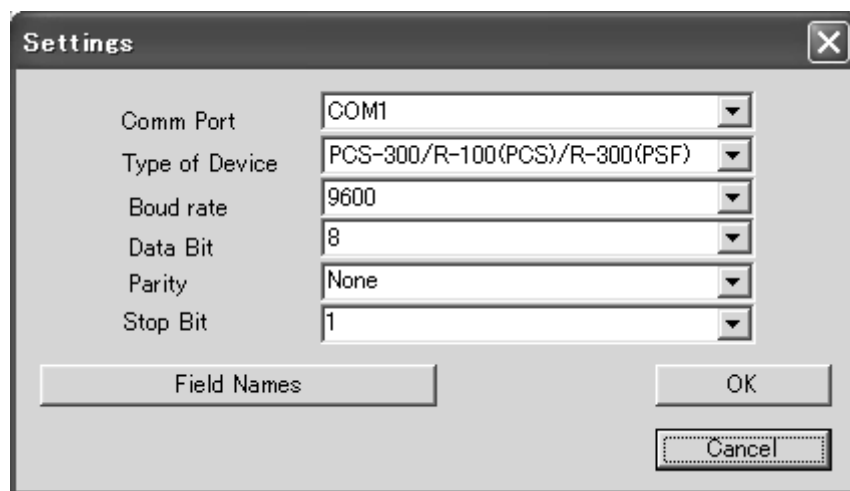
- | | |
|----------------------|---|
| 1. BAUD RATE: | 1200 |
| 2. DATA LENGTH: | 8 |
| 3. PARITY BITS: | NIL |
| 4. STOP BITS: | 1 |
| 5. SIGNAL CONTROL: | OFF |
| 6. XON/XOFF: | OFF |
| 7. PROTOCOL: | OFF for “CSV” format, ON for “DC1 (DC-1Z)” format |
| 8. RECORD DELIMETER: | CR+LF |
| 9. Subsequent items: | As you like. |

Please note that these settings should be common with DL-01's.

b-5 Recommended communication settings on DL-01.

To configure DL-01 Communication setting, please read “Configuring the software” in the Help topics of DL-01. And select values as follows:

For setting “Type of Device” in the “Settings” panel (Menu—“Edit”--”Settings”), select “R-100(PTL) / R-300(PTL)” for “R-300 PowerTopoLite” and other setting should be as follows.



Please note that these settings should be common with R-400's. And if the selection of “Type of Device” is not correct it may result in missing some data.

R-400 → PC(DL-01)

Bits per second: 1200 (1200-9600 for sending “POLAR DATA”)
 Databits: 8
 Parity: None
 Stop bits: 1

PC(DL-01) → R-400

Bits per second: 1200
 Databits: 8
 Parity: None
 Stop bits: 1

c) Note for the Memory capacity.

Data transfer failure from DL-01 to R-400 may cause reduction of memory capacity.

If memory capacity becomes less, please back up required data first, and then initialize coordinates data.

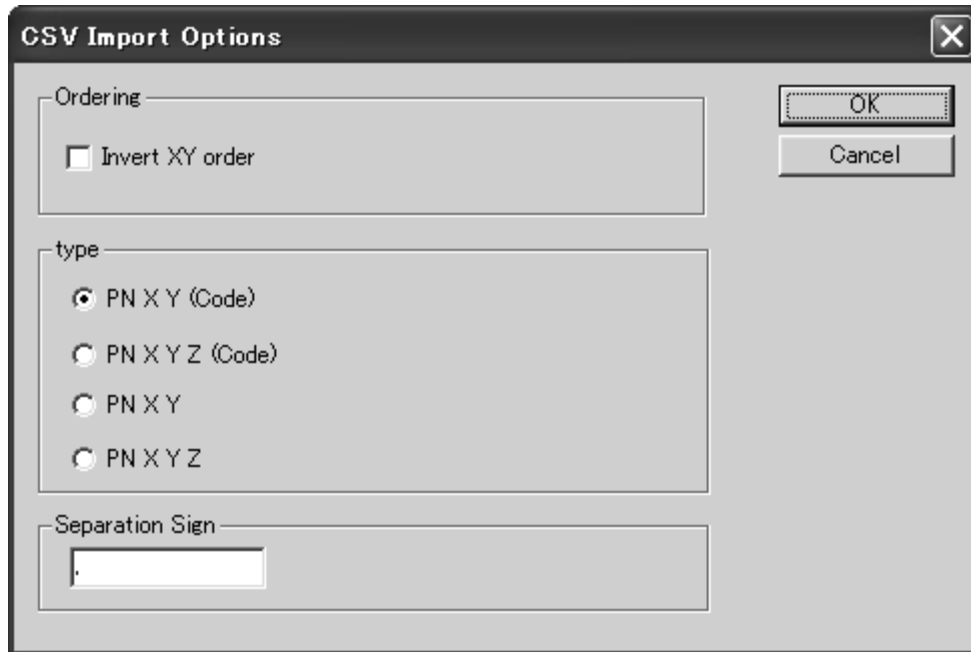
To initialize coordinates data, turn on the instrument while pressing [F2]+[F5]+[ON/OFF], and take your finger off from [ON/OFF] again.

After you see the message “COORD. DATA INITIAL”, press [F5]. Then the message “Please wait” is displayed. When it is completed, the panel of Electronic Vial is displayed.

d) Note on converting CSV file.

When you attempt to convert CSV file from R-400 by DL-01, please note that it may not succeed if CSV data type is not correct.

After [CONVERT] button is clicked on DL-01 then “CSV files from PCS/ R-100 (*.*)” is selected for the type of file, “CSV Import Option” will be appear.



In case the CSV data doesn't have “CODE” field, please select “PN XY” or “PN XYZ” from following four types for the “type” of data on the “CSV Import Option” panel.

- PN XY (Code)
- PN XYZ (Code)
- PN XY
- PN XYZ

e) For more information to work with DL-01, please refer to the “help” file after the installation.

14. PREFERENCE

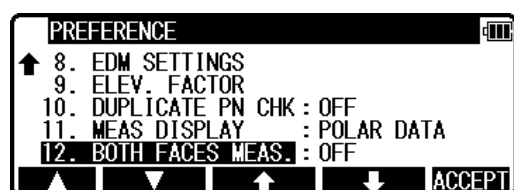
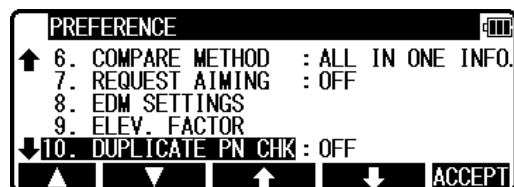
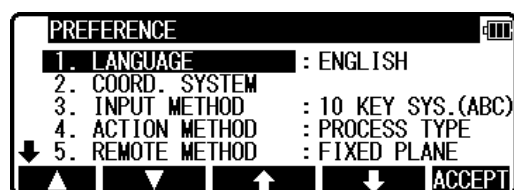


Followings are possible functions and the factory default settings:

A language other than English can be selected.

FUNCTION	DEFAULT SETTINGS
Coordinate system can be selected.	(cf.14.2 Coordinate axis definition)
Character input method can be selected.	“10 KEY SYS.(ABC)”
Action input method can be selected.	“PROCESS TYPE”
The offset (remote) method can be selected.	“FIXED PLANE”
Compare method can be selected.	“ALL IN ONE VIEW”
Aiming on/off can be selected.	“OFF”
EDM (electronic distance meter) settings can be selected.	
PRIM. MEAS KEY	“MEAS. SHOT”
SEC. MEAS KEY	“TRACK CONT”
MEAS. MIN DISP	“COARSE”
SHOT COUNT	“1 TIME”
SHOT INPUT	“01 TIME”
Elevation factor can be defined.	
AVE. ELEV.	+0000.0000m
SCALE FACT	1.00000000
Duplicate point name checking	“OFF”
Order of displaying measurement screen	“POLAR DATA”
Foresight and backsight Setting of BSP measurement	“OFF”

Press [F4][PREF] of the PowerTopoLite screen to view the PREFERENCE screen.



14.1 Language selection

Select 1. LANGUAGE and press [ENT] to view the LANGUAGE selection window.

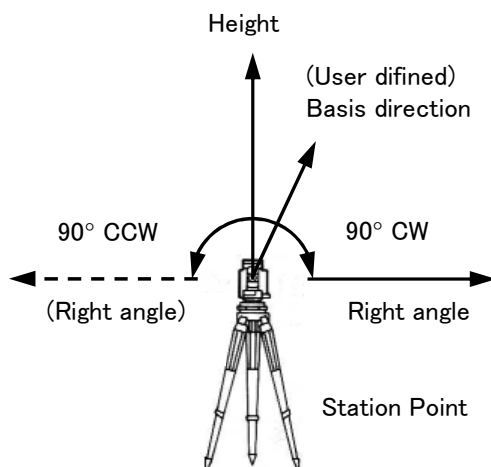
Press [ENT] to select and press [F5][ACCEPT] to enter.

LANGUAGE	
1. LANGUAGE	1. ENGLISH
2. COORD. SYSTEM	2. YOUR LANGUAGE
3. INPUT METHOD	: TO KEY SYS.(ABC)
4. ACTION METHOD	: PROCESS TYPE
5. REMOTE METHOD	: FIXED PLANE

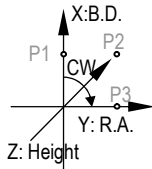
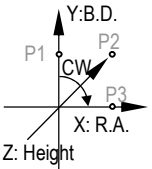
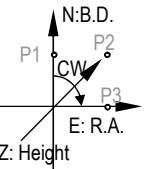
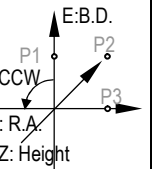
14.2 Coordinate axis definition

Select 2. COORD.AXIS by pressing the down arrow key, and press [ENT] to view the coordinate system definition window. Press [ENT] to select and press [F5][ACCEPT] to enter.

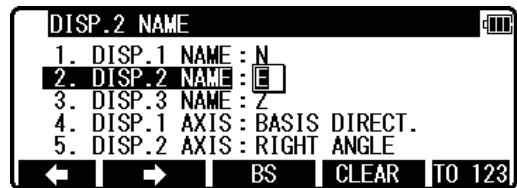
PREFERENCE	
1. LANGUAGE	: ENGLISH
2. COORD. SYSTEM	
3. INPUT METHOD	: 10 KEY SYS.(ABC)
4. ACTION METHOD	: PROCESS TYPE
5. REMOTE METHOD	: FIXED PLANE



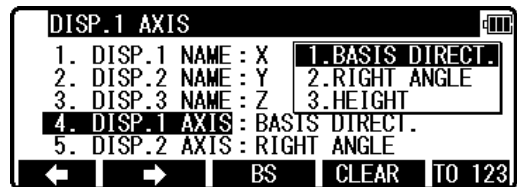
Definition of each selection is as follows.

Item	Description	Selection	Default	ex.1 German XYZ	ex.2	ex.3
1. DISP.1 NAME	Name of the 1st Axis on the screen. (Ex. It is shown 3rd line of the "MEASURE" screen.)	Any name	X	X	N	E
2. DISP.2 NAME	Name of the 2nd Axis on the screen. (Ex. It is shown 4th line of the "MEASURE" screen.)	Any name	Y	Y	E	N
3. DISP.3 NAME	Name of the 3rd Axis on the screen. (Ex. It is shown 5th line of the "MEASURE" screen.)	Any name	Z	Z	Z	Z
4. DISP.1 AXIS	Define the direction of the 1st Axis.	1. BASIS DIRECTION 2. RIGHT ANGLE 3. HEIGHT	1. BASIS DIRECTION	2. RIGHT ANGLE	1. BASIS DIRECTION	1. BASIS DIRECTION
5. DISP.2 AXIS	Define the direction of the 2nd Axis.	1. BASIS DIRECTION 2. RIGHT ANGLE 3. HEIGHT	2. RIGHT ANGLE	1. BASIS DIRECTION	2. RIGHT ANGLE	2. RIGHT ANGLE
6. DISP.3 AXIS	Define the direction of the 3rd Axis.	1. BASIS DIRECTION 2. RIGHT ANGLE 3. HEIGHT	3. HEIGHT	3. HEIGHT	3. HEIGHT	3. HEIGHT
7. ROTATION	Define the rotation from the 1 Axis to the 2 Axis..	1. CW 2. CCW	1. CW	1. CW	1. CW	1. CCW
Example of GRAPHICAL VIEW						

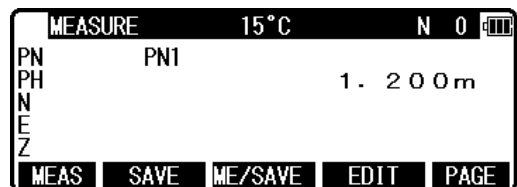
Any name can be defined for all three axes.
For the “DISP.# NAME”, it is possible to define same name. However, please note that the same coordinates value will be displayed.



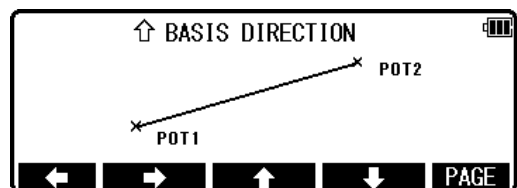
Three types of axes can be selected for each three axes.
For the “DISP.# AXIS”, it is possible to define same type of axis. However, please note that the same coordinates value will be displayed.



Definition of this function will be affected to the value of the coordinates.

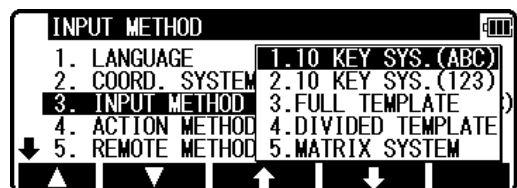


Please note that the up arrow on the screen of the graphical view always shows “BASIS DIRECTION”. In addition, position of points doesn’t change on the “GRAPHICAL VIEW”, but value of coordinates changes according to the setting of “Coordinate axis definition”.



14.3 Input method selection

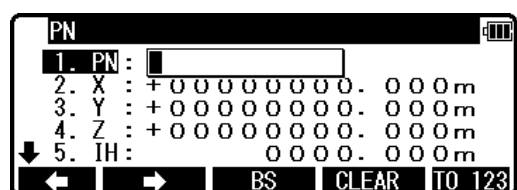
Select 3. INPUT METHOD and press [ENT] to view the Character INPUT METHOD selection window. Press [ENT] to select and press [F5][ACCEPT] to enter.



Explanation of the 10 Key system (123/ABC), Full template, Divided template and Matrix system.

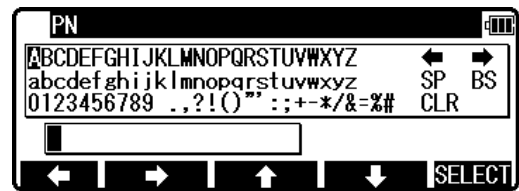
1. 10 KEY SYSTEM(123/ABC)

These are the standard input method using the Alphanumeric and +/- key.

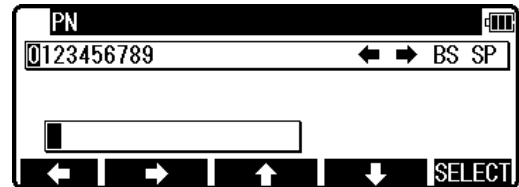


2. Full template

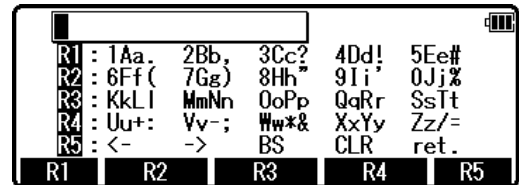
Select each Character by pressing left, right, up and down arrow keys and select each Character by pressing [F5][SELECT] each time.



3. Divided template

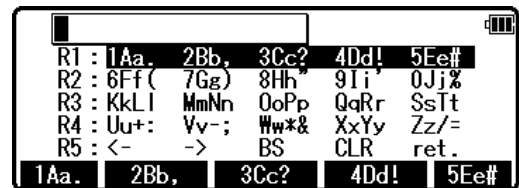


4. MATRIX

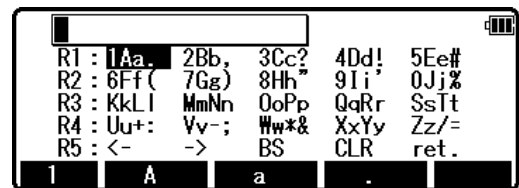


How to input "A" by Matrix.

First press [F1][R1] to view next screen.



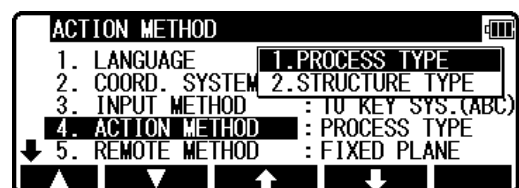
Press [F1][1Aa] to view next screen.



Press [F2][A] to select "A".

14.4 Action method selection

Select 4.ACTION INPUT METHOD and press [ENT] to view the Character ACTION INPUT METHOD selection window. Press [ENT] to select and press [F5][ACCEPT].



Process type

This input method takes over functionality of “PowerTopoLite”. When this option is selected, the next screen will be shown after inputting necessary items.

STATION POINT SETUP	
1. PN:	
2. X :	+000000000.000m
3. Y :	+000000000.000m
4. Z :	+000000000.000m
5. IH:	0000.000m
SAVE LIST ↑ ↓ ACCEPT	

Structure type

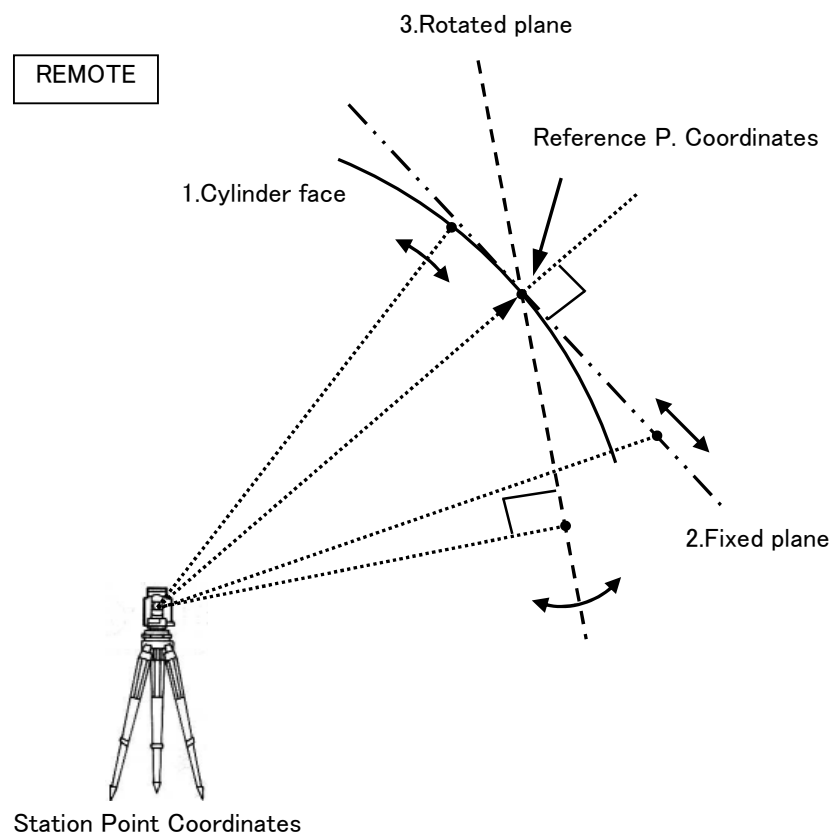
This input method takes over functionality of our past product. When this option is selected, the menu screen will be shown after inputting necessary items.

RECTANGULAR COORD.	
1. STATION	
2. AZIMUTH	
3. MEASURE	

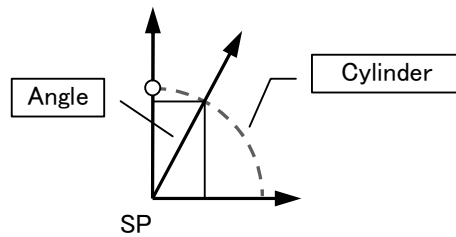
14.5 Remote method selection

Select 5.REMOTE METHOD and press [ENT] to view the REMOTE METHOD selection window. Press [ENT] to select and press [F5][ACCEPT].

REMOTE METHOD	
1. LANGUAGE	1.CYLINDER FACE
2. COORD. SYSTEM	2.FIXED PLANE
3. INPUT METHOD	3.ROTATED PLANE
4. ACTION METHOD	: PROCESS TYPE
5. REMOTE METHOD	: FIXED PLANE
▲ ▼	

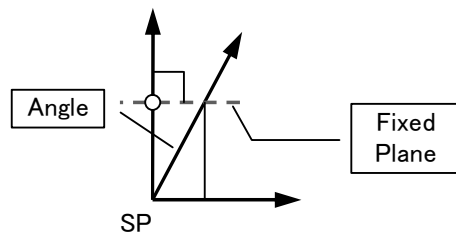


1. Cylinder face



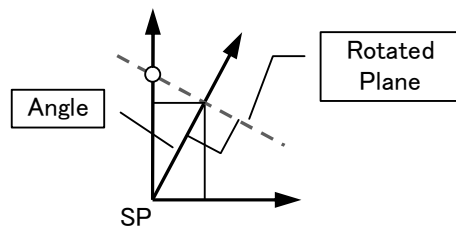
The Remote measurement is performed on the inner surface of the vertical cylinder as shown left.

2. Fixed plane



The Remote measurement is performed on the fixed plane, which is perpendicular to the sight of the reference point as shown left.

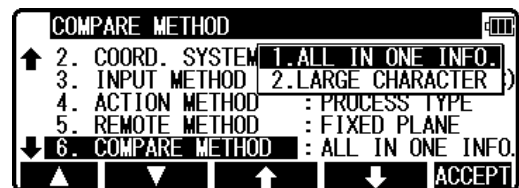
3. Rotated plane



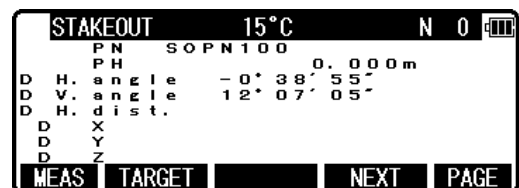
The Remote measurement is performed on the Rotated plane, which is always perpendicular to the present line of sight and induces the reference point as shown left.

14.6 Compare method selection

Select 6.COMPARE METHOD SELECTION and press [ENT] to view the COMPARE METHOD selection window. Press [ENT] to select and press [F5][ACCEPT].



When “ALL IN ONE INFO” is selected, all information will be displayed on the result of stakeout panel.



When “LARGE CHARACTER” is selected, result information is shown with two screens and these screens and the Graphics screen can be switched by pressing [ENT].

```

STAKEOUT      15°C      N 0
PN  SOPN100
PH
D H.angle      - 0° 38' 55"
D V.angle      12° 07' 05"
D H.dist.
MEAS | TARGET | SCROLL | NEXT | PAGE

```

```

STAKEOUT      15°C      N 0
PN  SOPN100
PH              0. 000m
D X
D Y
D Z
MEAS | TARGET | SCROLL | NEXT | PAGE

```

14.7 Request aiming selection

Select 7.REQUEST AIMING and press [ENT] to view the REQUEST AIMING selection window. Press [ENT] to select and press [F5][ACCEPT].

```

REQUEST AIMING
↑ 3. INPUT METHOD      : 10 KEY S 1.ON
  4. ACTION METHOD     : PROCESS  2.OFF
  5. REMOTE METHOD      : FIXED PLANE
  6. COMPARE METHOD     : ALL IN ONE INFO.
↓ 7. REQUEST AIMING   : OFF
  ▲ | ▼ | ▲ | ▼

```

After pressing [ENT] on STATION POINT H.ANGLE SETUP screen, you can choose whether or not the warning message, “Did you aim at Ref. Point? “ is displayed.

```

AIM AT THE REFERENCE POINT.
Did you aim at Ref.point?
Press [ENT] when ready.
ESC |      |      |      | ENT

```

14.8 EDM settings selection

Select 8.EDM SETTINGS and press [ENT] to view the EDM SETTINGS selection window. Press [ENT] to select and press [F5][ACCEPT].

```

PREFERENCE
↑ 4. ACTION METHOD     : PROCESS
  5. REMOTE METHOD      : FIXED PLANE
  6. COMPARE METHOD     : ALL IN ONE INFO.
  7. REQUEST AIMING    : OFF
↓ 8. EDM SETTINGS
  ▲ | ▼ | ▲ | ▼ | ACCEPT

```

```

EDM SETTINGS
1. PRIM. MEAS KEY     : MEAS. SHOT
2. SEC. MEAS KEY      : TRACK CONT
3. EDM MIN DISP/QUICK : 1mm/OFF
4. SHOT COUNT         : 1 TIME
5. SHOT INPUT         : 01TIMES
  ▲ | ▼ | ▲ | ▼ | ACCEPT

```

1. PRIM.MAES KEY	1. MEAS. SHOT
	2. MEAS. CONT
	3. TRACK SHOT
	4. TRACK CONT
2. SEC.MEAS KEY	1. TRACK CONT
	2. TRACK SHOT
	3. MEAS. CONT
	4. MEAS. SHOT
3. MEAS. MINI DISP.	1. COARSE
	2. FINE
4. SHOT COUNT	1. 1 TIME
	2. 3 TIMES
	3. 5 TIMES
	4. INPUT
5. SHOT INPUT	XX TIMES

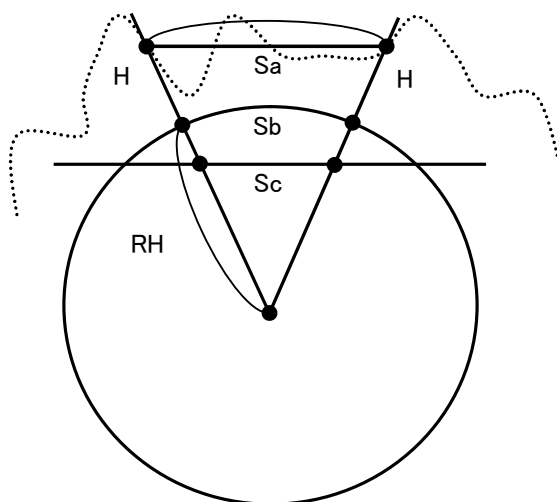
Please refer to the instruction manual of basic function about details of each setting.

14.9 Elevation factor

“Elevation Factor” as used here refers to Average Elevation Correction and Scale Factor carried out as part of the measurement process among the special functions.

It is effective only with MEAS-Rect., FREE, CALC-Traversal, and VPM. These reverse corrections are carried out with STAK (Stakeout, Point To Line). When the instrument is shipped from the factory, the 1.AVE.ELEV. is set to "0" and the 2.SCALE FACT to "1" so that no correction is carried out.

If correction is necessary, input the appropriate values for the AVE.ELEV and SCALE FACT.



Cross section of the earth

Select 9.Elevation factor and press [ENT] to view the ELEVATION FACTOR selection window. Press [ENT] to select and press [F5][ACCEPT].

```

PREFERENCE
↑ 5. REMOTE METHOD : FIXED PLANE
6. COMPARE METHOD : ALL IN ONE INFO.
7. REQUEST AIMING : OFF
8. EDM SETTINGS
↓ 9. ELEV. FACTOR
▲ | ▼ | ▲ | ▼ | ACCEPT
  
```

1. Average Elevation

Average (H) = Averaged on-site elevation
Input range: -9999.9998 -- +9999.9998m

```

AVE.ELEV.
1. AVE.ELEV. : +0000.0000m
2. SCALE FACT : 1.00000000
▲ | ▼ | ▲ | ▼ | ACCEPT
  
```

2. Scale Factor

Scaling = On-site scaling coefficient
Input range: +0.00000001 -- +1.99999998

```

SCALE FACT
1. AVE.ELEV. : +0000.0000m
2. SCALE FACT : 1.00000000
▲ | ▼ | ▲ | ▼ | ACCEPT
  
```

14.10 Duplicate point check

When for this setting ON is selected, you can check whether a Point Name overlaps another Point Name already input.

```

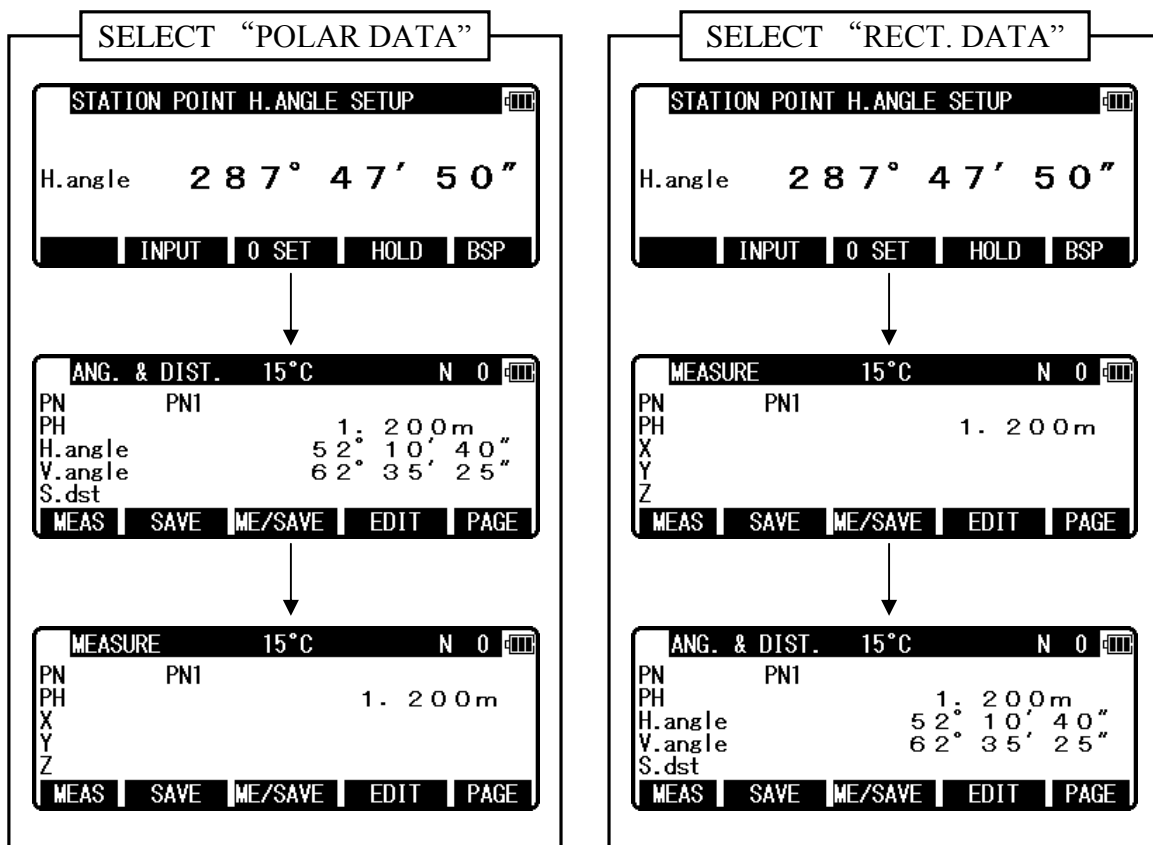
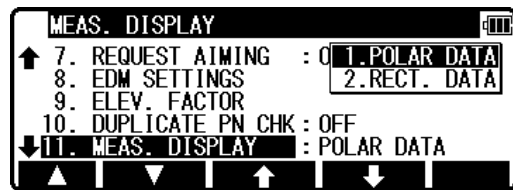
DUPLICATE PN CHK
↑ 6. COMPARE METHOD : ALL IN O 1.ON
7. REQUEST AIMING : OFF 2.OFF
8. EDM SETTINGS
9. ELEV. FACTOR
↓ 10. DUPLICATE PN CHK : OFF
▲ | ▼ | ▲ | ▼ | ACCEPT
  
```

14.11 Meas. display

This setting allows you to set the order of display when a function of “4 MEASUR, RECT_POLAR COORD.RECT is carried out.

When “POLAR DATA” is selected, STATION POINT H.ANGLE SETUP screen appears next to ANG. & DIST. screen.

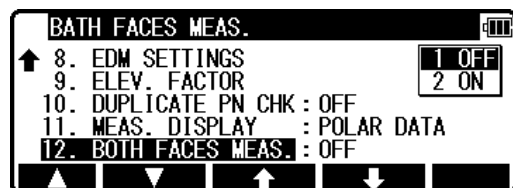
When “RECT. DATA” is selected, MEASURE screen is displayed.



14.12 Both faces meas.

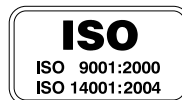
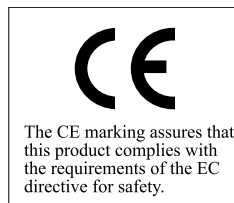
When “ON” is selected and sighting the BSP(Back Sight Point), you are requested to sight at reverse position as well after normal position.

When “OFF” is selected, you can sight only at normal position.



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DANGER

LASER RADIATION - DO NOT STARE INTO
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620-690 nm/4.95mW max.
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*Laserclass IIIa, conform FDA 21 CFR
Ch. 1 § 1040*



CAUTION

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620-690 nm/0.95mW max.
CLASS II LASER PRODUCT
*Laserclass II, conform FDA 21 CFR
Ch. 1 § 1040*



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