TOTAL STATION

LTS-200 SERIES

LTS-202N
LTS-205N

INSTRUCTION MANUAL

On-Board Application

LinertecExpress

LINERTEC

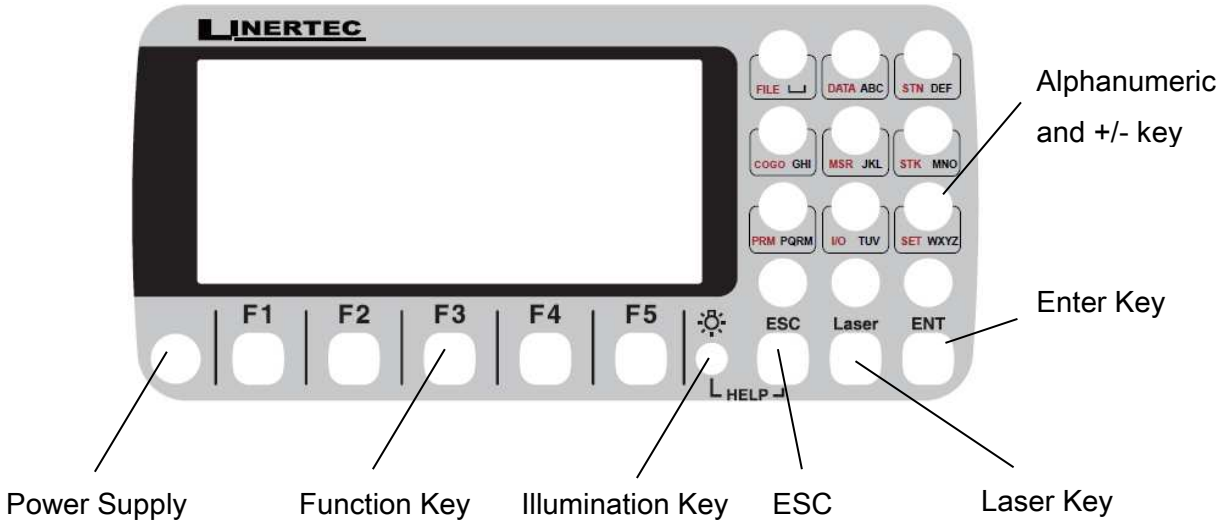
Before using this product, be sure that you have thoroughly read and understood this instruction manual to ensure proper operation. After reading this manual, be sure to keep in a convenient place for easy reference.

Exemption clause

1) TI Asahi Co., Ltd. (TIA) shall not be liable for damage caused by Acts of God, fire, alteration or servicing by unauthorized parties, accident, negligence, misuse, abnormal operating conditions.
2) TIPS shall not be liable for changes or disappearance of data, loss of company profit or interruption of company operation incurred by the use of this product or malfunction of it.
3) TIPS shall not be liable for damage caused by usage not explained in the instruction manual.
4) TIPS shall not be liable for damage to this product caused by other equipment connected to this product.

DISPLAY AND KEYBOARD

- Basic display and keyboard of LTS-200 series are described below, and the function keys of LinertecExpress are described in “2. ACCESSING LINERTECEXPRESS”.



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 and the LD point screen when you push the Laser 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 [lLLU]+[ESC] key causes a help menu to appear in BASE MEASURE 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**	Changes the reticle illumination when pressing illumination key.
[LCD]	**F4**	Changes the LCD contrast when pressing illumination key.
[ILLU]	**F5**	Changes the LCD illumination when pressing illumination key.
[CLEAR]	**F5**	Clears the figure.
[SELECT]	**F5**	Opens the selection window.

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

Display combination of MODE A or MODE B

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

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

ALPHANUMERIC INPUT

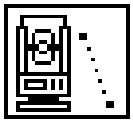
The point name etc. is input by the alphanumeric keys as following.

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

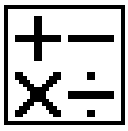
Thank you for your first look at LinertecExpress by reading this manual.
The LinertecExpress is a user friendly data collection and calculation program for the LINERTEC LTS-200 Series Total Stations.
LinertecExpress is developed based on PowerTopo, which is known as a versatile on-board software. The optimum combination of LinertecExpress and LTS-200 hardware makes LinertecExpress an easy and useful fieldwork tool.
The icon based main menu offers you the following possibilities.



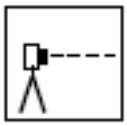
1. PRO: Program（RDM，REM，VPM）

2. I/O: Communication（Text read/write，USB，DATA Transfer）

3. PREF: Preference（Setup）

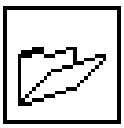


4. CALC: Calculations (COGO, 2D Surface, Road Design)

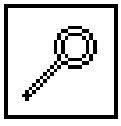


5. MEAS: Measurement

6. STAK: Stake out



7. FILE: File manager



8. DATA: Data

9. STATION: Free Station (Backward Intersection)

1.2 Before using the LinertecExpress manual

- **Memories in the instrument**

The LTS-200 series incorporates not only the LinertecExpress 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 60,000 points of data.

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

Function data	**Read from the stored data**	**Write to the stored**
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	Stake Out point:	SOP
Known point:	KP	End point:	EP	Observation point:	OP	Conversion data:	CD
Conversion point:	CP	Crossing point:	CRP	Surveyed data:	SD		

- IH stands for “Instrument Height” and PH stands for “Prism Height”.
- The LinertecExpress manual mainly describes the LTS-200 special functions, and the basic operations are described in the (basic) LTS-200 manual. Therefore, refer to the LTS-200 basic manual regarding the LTS-200 general instrument operations.
  The LinertecExpress 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 “LinertecExpress” or “Structure type” that takes over the functionality of our past product in ”Action Method Selection”.
- The LTS-200 series instrument has a Job name of “LINERTEC” and “COGOPoint” as its default setting. Each data is stored under “LINERTEC” 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 “-9999.999” - “9999.999”.
- 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 LTS-200 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 are 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 LINERTECEXPRESS

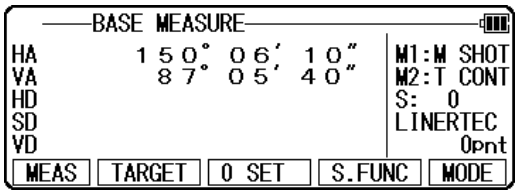
2.1 How to access LinertecExpress

To access the LTS-200 Special Functions of the LinertecExpress, perform the following procedures.

Press the [POWER] (ON/OFF) key. The Electronic Vial screeen will comes up.

Press Enter Key or Laser Key to proceed to the LTS-200 start-up screen.

Then, change to BASE MEASURE screen.



Press [F4] [S.FUNC] to view Functions of LinertecExpress screen.

2.2 Allocation of each LinertecExpress Function key

2.2.1 Mode A
1. Press F1 to Measure distance, Display distance value
2. Press F2 to shift target type such as prsim, reflectorless and sheet
3. Press F3 to reset the horizontal angle value
4. Press F4 to enter LINERTEC function screen

2.2.2 Mode B
1. Press F5 to shift Mode B from Mode A, and press F5 again to return to Mode A
2. Press F1 to shift display type of angle and distance
3. Press F2 to enter the value, direction, slope of horizontal angel,
4. Press F3 twice to lock the horizontal value, and press F3 again to release.
5. Press F4 to correct prism constant, sheet constant, PPM.

2.2.3 The Function of Plummet, Laser and Conpensation
1. Press Laser key to display electronic bubble
2. Press F1 to display tilt value
3. Press F2 to open laser direction, and press F2 again to turn off laser direction.
4. Press F3 to open laser plummet screen. You can adjust the brightness of plummet from 1 to 10. The higer the value, the brighter the laser plummet.

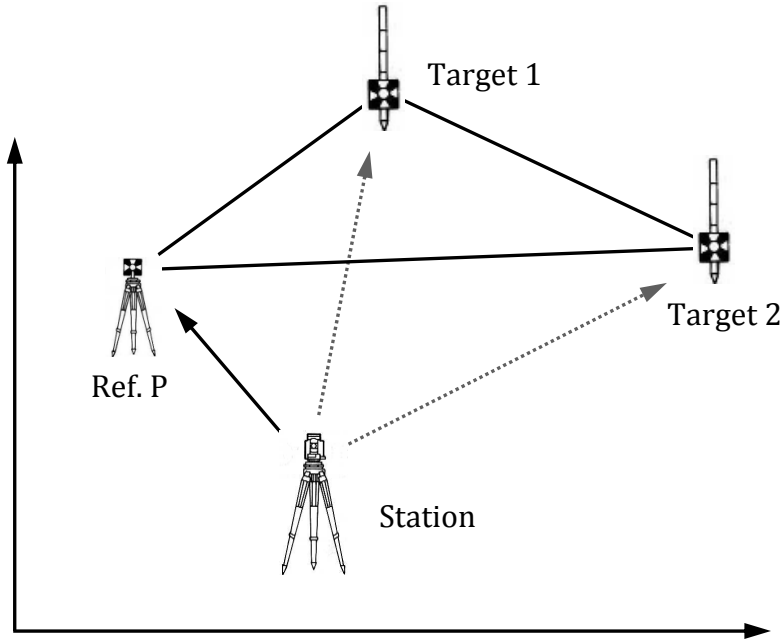
2.3 Typical Function keys of LinertecExpress

Following function keys are typical of LinertecExpress 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 the original size.
ZOOM IN	Magnifies the graphics size.
ZOOM OUT	Reduces the graphics size.
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	Allows 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.

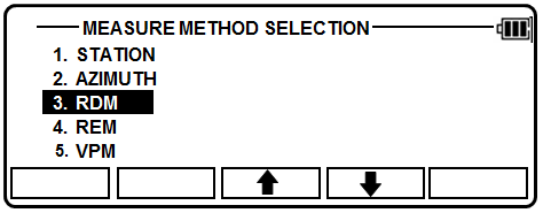
3. PROGRAM

3.1 RDM (Remote Distance Measurement)



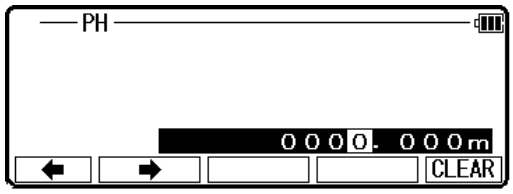
With RDM, the Horizontal, Vertical and Slope distance and % of Slope between the Reference point and the Target point are measured. Any Target point can be changed to the new Reference point.

Press the [ENT][RDM] of the LinertecExpress screen to view the “REF. point”



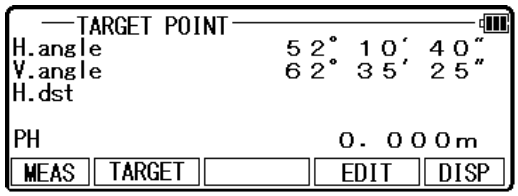
3.1.1 PH INPUT

Press [F4] [EDIT] to input the PH,
Reference Point Height.

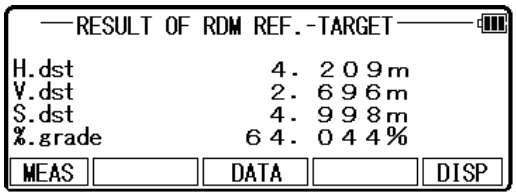


3.1.2 Reference Point-Target Distance

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

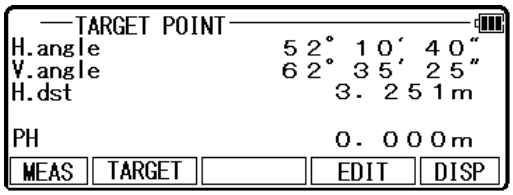


Aim at the Target 1 and press [F1] [MEAS] to measure a distance. The distance between Reference point and Target point 1 is displayed.



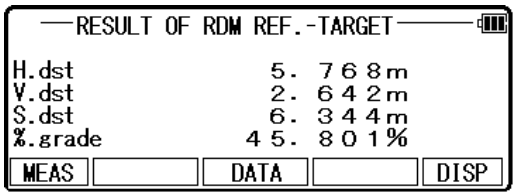
V.dst. and % grade are displayed by minus mark when the Target point height is at a lower position.

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

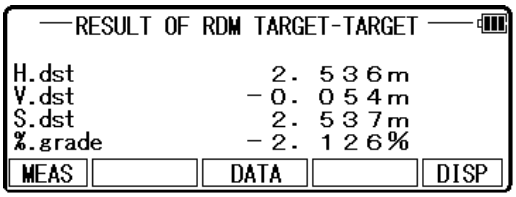


3.1.3 Target-Target Distance

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

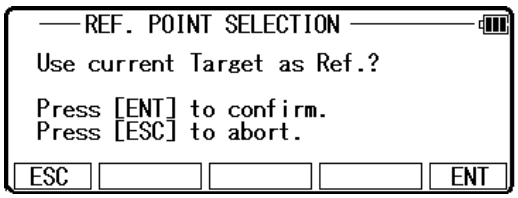


Press [F5] [DISP] to display the distance between Target1 - Target 2.

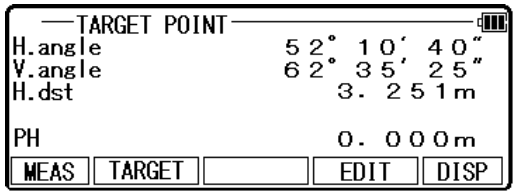


3.1.4 New Reference Point Selection

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



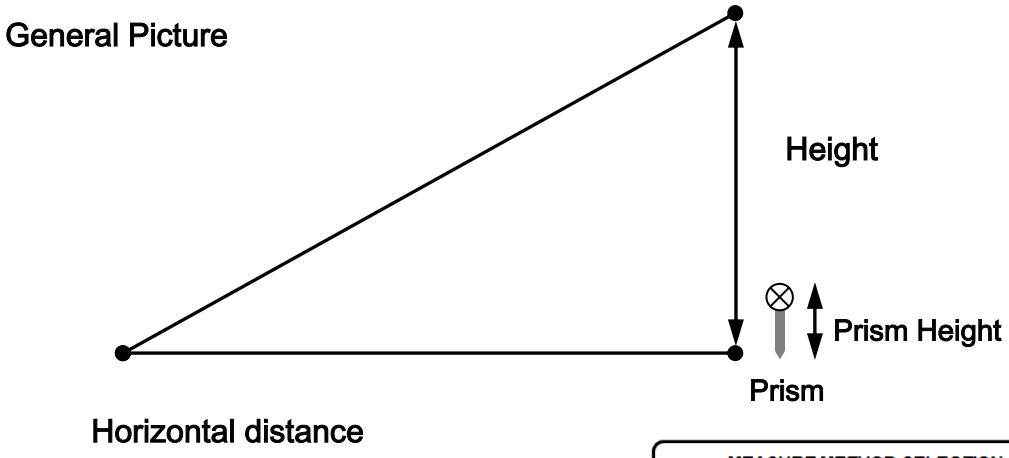
Press the [F5] [ENT] to view the TARGET POINT screen. Reference point is changed.
Input the new PH and repeat the same procedure as the above.



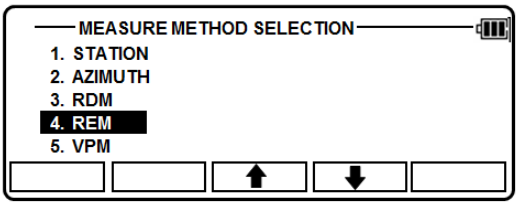
3.2 REM (Remote Elevation Measurement)

3.2.1 General Pictures of Measurement

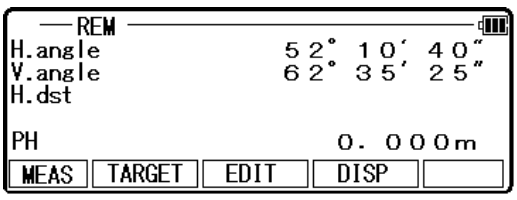
With REM measurement, a prism (Reference point) is set approximately directly below the place to be measured, and by measuring the prism, the height to the target object can be measured. This makes it easy to determine the heights of electric power lines, bridge suspension cables, and other large items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

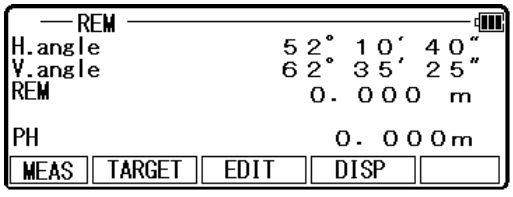


From the LinertecExpress screen, Select [F2] [REM] and press [ENT] to view MEASURE screen.

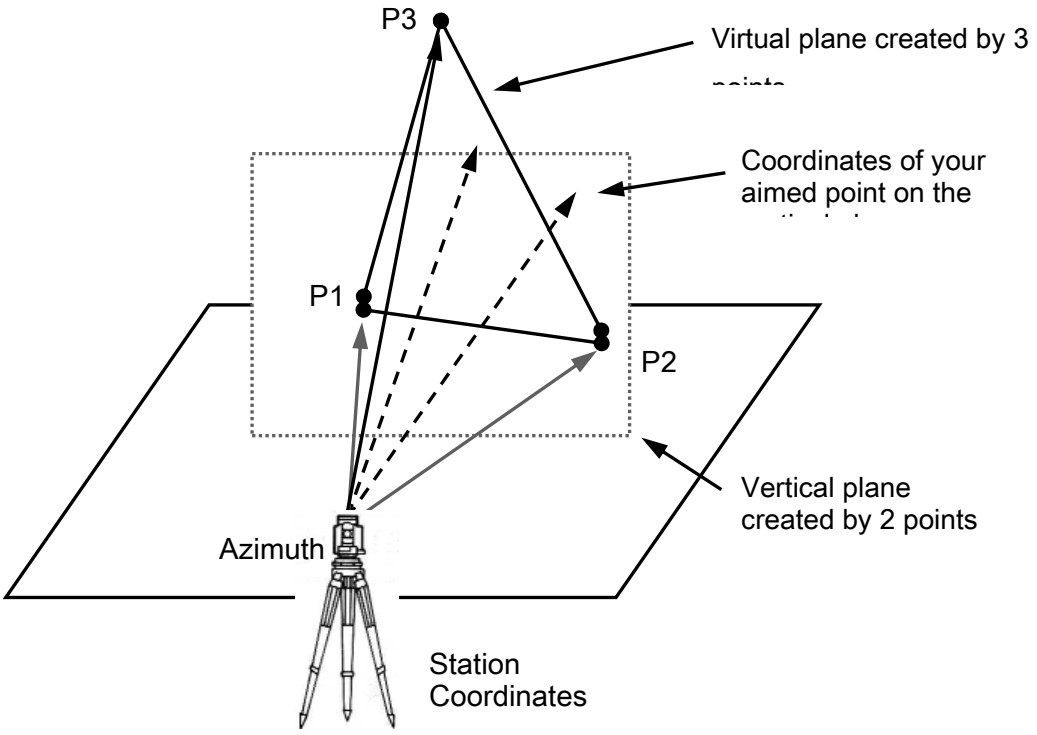


Please press [ENT] after measuring distance.





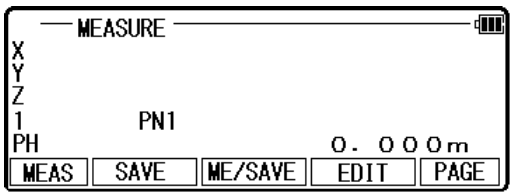
3.3. VPM (Vertual Plane Measurement)



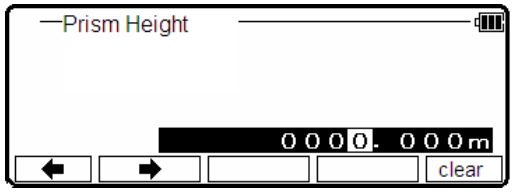
The Virtual plane includes the Vertical plane.

With VPM, the Coordinates on the vertical plane and virtual plane can be obtained by entering the “Station Coordinates and Azimuth” and by measuring P1, P2 and P3.
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.

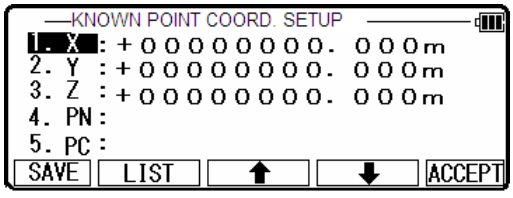
Press [ENT] of the LinertecExpress screen to view the “Measure” screen .



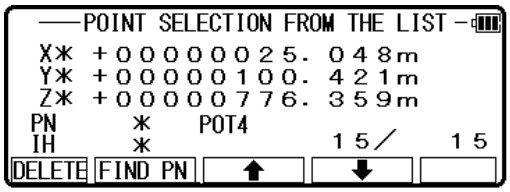
Press[F4] [Edit] to input the Prism Height of the reference point.



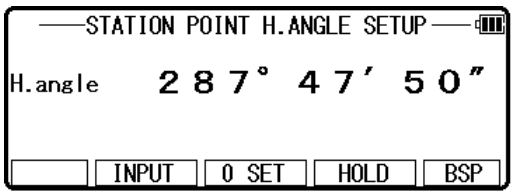
Press [ENT] to enter“KNOWN POINT COORD. SETUP”screen.



[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.

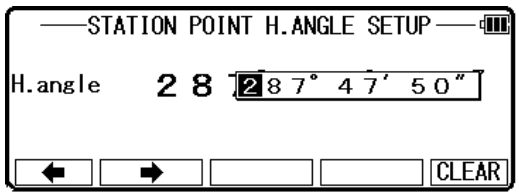


Press [ENT] to open the input window of PN, X, Y, Z and IH value.
Input each Character or value and press [F5] [ACCEPT] to view the STATION POINT H. ANGLE SETUP screen.

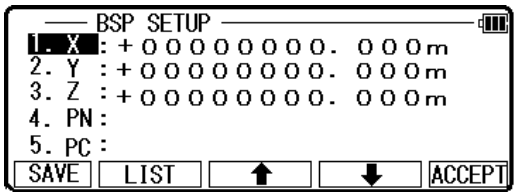


Input the H. angle by pressing [F2] [INPUT], [F3] [0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5] [BSP].
Press [ENT] to open the input window when using [F5] [BSP].

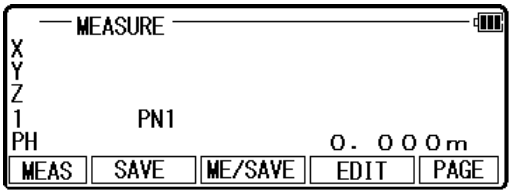
Pressing [F2] [INPUT] Input any horizontal angle.



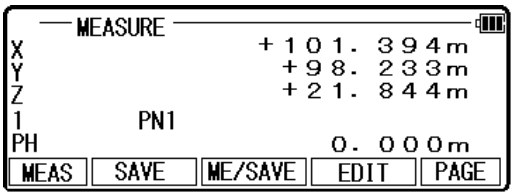
Pressing [F5] [BSP] The information for Back Sight Point is obtained. Press [ENT] to finalize the input.



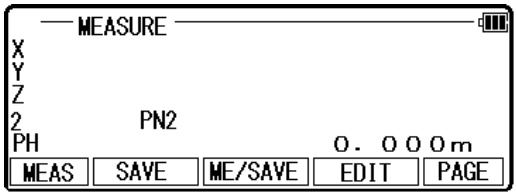
Aim at the reference point, then press [ENT].



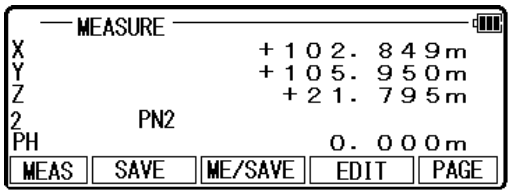
Aim at point 1 and press [F1] [MEAS].
Measured Coordinates are displayed.



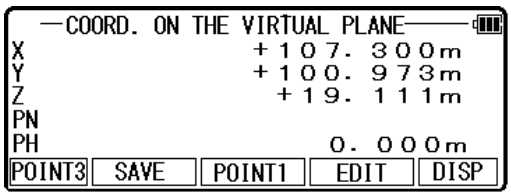
Press [ENT] to view the next MEASURE screen.



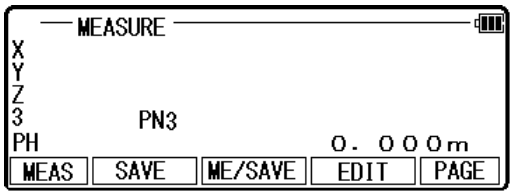
In the same manner, aim at point 2 and press [F1] [MEAS].
Measured Coordinates are displayed.



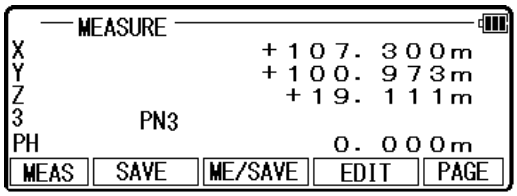
Press [ENT] to view the COORD.
ON THE VIRTUAL PLANE screen.
Aim at your desired point and press [ENT].
The Coordinates which you aim at are displayed.



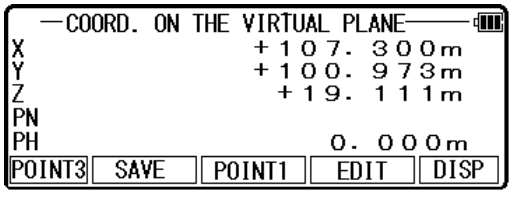
Press [MEAS] to view the next MEASURE screen.



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



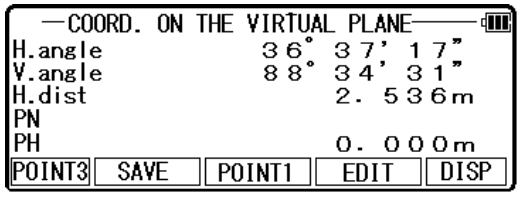
Press [ENT] to view the COORD. ON THE VIRTUAL PLANE screen.
Aim at your desired point and press [ENT].
The Coordinates, which you aim at, are displayed.



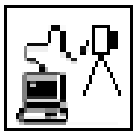
Pressing [F4] [EDIT] can edit the Point Name and Prism Height.

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

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



4. COMMUNICATION



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 of output is "m" 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 unit of input is "m" .
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 = ΣA – (B × 40H) 20H
ΣA = Each character of a block that contains the sum of the ASCII code
B = ΣA÷40H (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

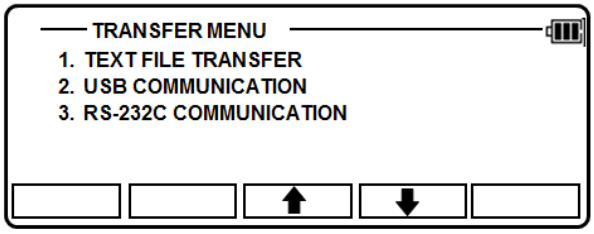
31	,	No.	,	P. Name		P. Code	,	X Coord.	,	Y Coord.	,	Z Coord.	L/F code

[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.

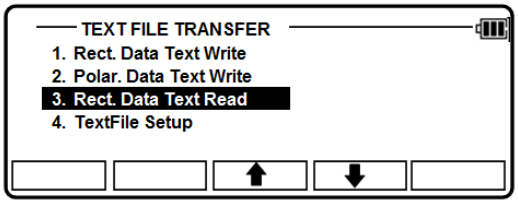
Press the [2] [COMMUNICATION] of the LinertecExpress to view the TRANSFER MENU screen.



4.1 Text File read / write

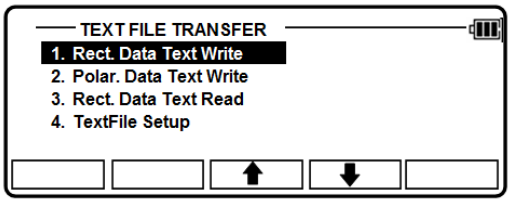
Text file read/write allows you to input and output format and text data specified recording media. Before taking this procedure, make sure of TextFile Setup (refer to "4.1.3. Text file Setup").

Press the [ENT] of the TRANSFER MENU screen to view the TEXT FILE R/W screen.

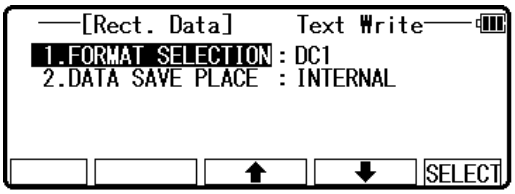


4.1.1 Writing to Text File

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].



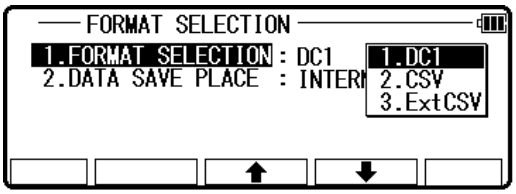
Press [F5] [SELECT] to select format and data save place, then press [ENT].



[FORMAT SELECTION]
Rectangular Data

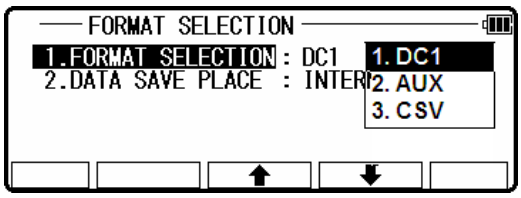
- DC1 (Extension DC1)
- CSV (Extension CSV)
- ExtCSV (Extension CSV)

※ Be careful that extension of CSV and ExtCSV will be the same.

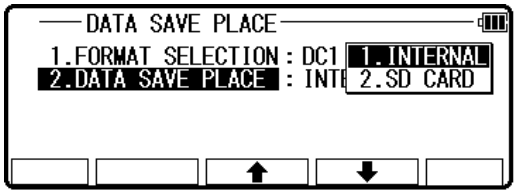


Polar Data

- DC1 (Extension DC1)
- AUX (Extension AUX)
- CSV (Extension CSV)

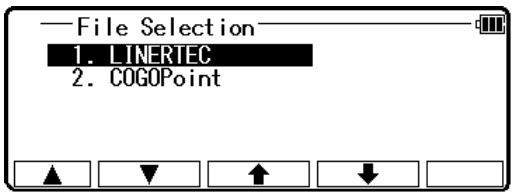


[DATA SAVE PLACE]
INTERNAL
Save data in the memory of the instrument.
Output file can be loaded to PC by connecting a USB (Refer to 4.2 Communication with USB)

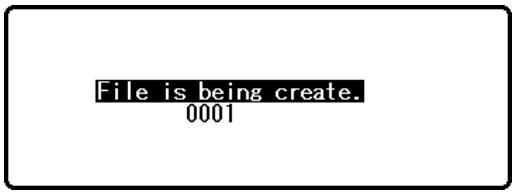


SD CARD
Save data in the SD card.
Output file can be loaded to PC by connecting a USB.
[DATA SAVE PLACE」is set in the SD card, you can use the SD card directly without connection USB.

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.

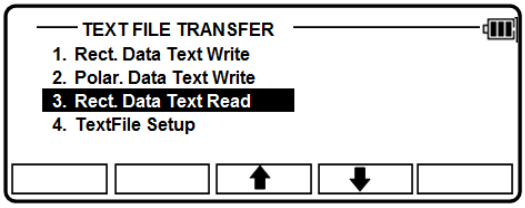


[File Name]
Rectangular Data [Job Name]_C.[Extension]
Polar Data [Job Name]_P.[Extension]

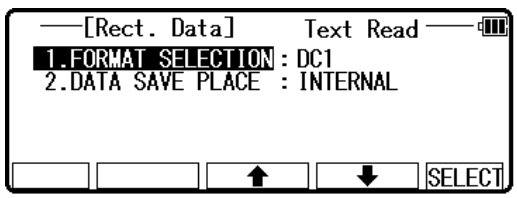
NOTE: If free memory space becomes less than 1MB, you can not create the file, and an error message [Space capacity is short] is displayed. Try again after increasing free memory space.

4.1.2 Reading from Text File

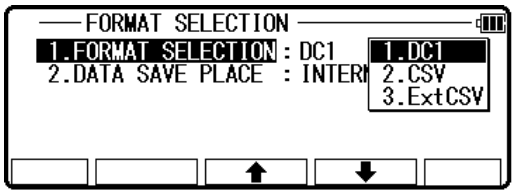
This command allows you to transfer the text file containing measurement point data in the internal memory of the instrument or SD card to the data that can be used with the instrument.



Select 3.Rect. Data Text Read, then press [ENT]

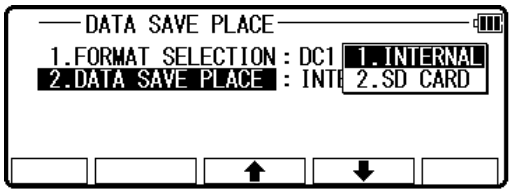


Select the format of the file you desire to read and data save place, then press [ENT]



[FORMAT SELECTION]

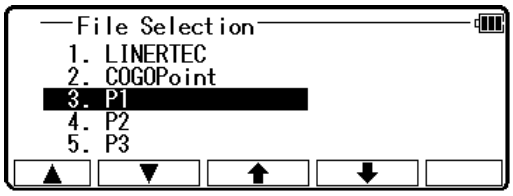
- DC1 (Extension DC1)
- CSV (Extension CSV)
- ExtCSV (Extension CSV)



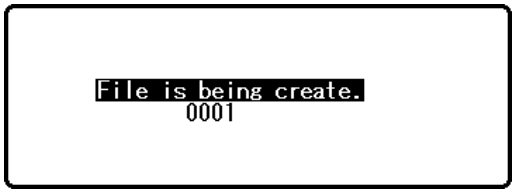
[DATA SAVE PLACE]
INTERNAL
Read the file in the internal memory of the instrument.

SD CARD
Read the file in the SD

Select the file you desire to read, then press [ENT]



In this case, a 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 "10. 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: Warrning

- 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 ["3,000 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. 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 a 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 LTS-200 series .

This test has been done with only the LINERTEC LTS-200 series Total Station, but no other LINERTEC Total Stations. When using with other LINERTEC 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 LTS-200 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 LINERTEC LTS-200 series

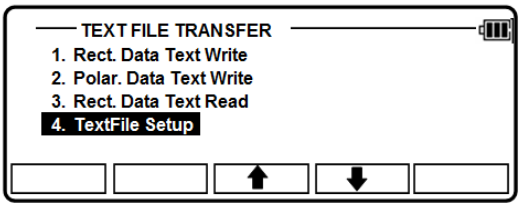
SD Card

Maker	Model	Capacity
Toshiba	**SD-C01GTR**	**1GB**
SanDisk	**SDSDB-1024-J95**	**1GB**
Panasonic	**RP-SDM01GL1A**	**1GB**

- Regardless of the information mentioned here, take note that not all SDHC cards can be used with the LTS-200 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.

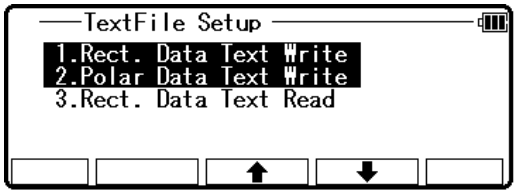
4.1.3 Text File setup

When coordinate data is output/input to and from text file, input parameters.

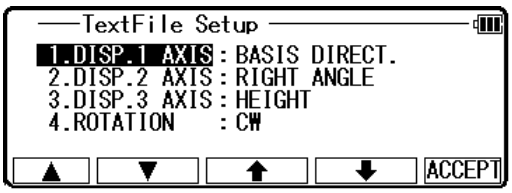


4.1.3.1 Writing data setting

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].

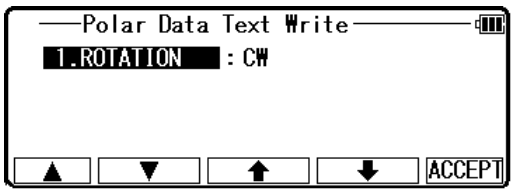


Press [F5] [ACCEPT] to enter when all selections are finished.

- **DISP.# AXIS: BASIS DIRECT, RIGHT ANGLE, or HEIGHT is selected when data is transferred between the TS and PC. (cfr. "5.5.2 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.



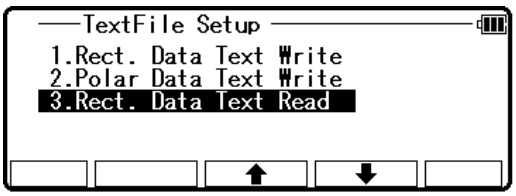
Press [ENT] to open the selection window. Select each setting and press [ENT].

Press [ACCEPT] to enter when all selections are finished.

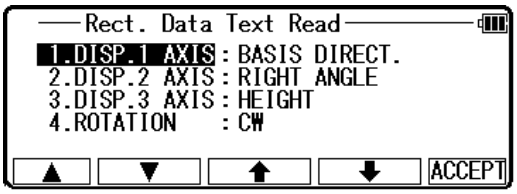
- **Factory default setting of 3. SEND POLAR DATA**
  1. ROTATION: CW

4.1.3.2 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.

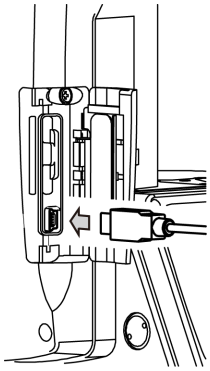
- **DISP.# AXIS: BASIS DIRECT., RIGHT ANGLE, or HEIGHT is selected when data is transferred between the TS and PC. (cf.“5.5.2 Coordinate axis definition”)**
  They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. 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

4.2 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;

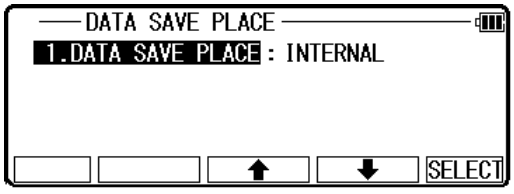
[Connecting USB cable]
(1) Open the SD&USB slot cover.
(2) Insert the USB connector into the USB port in the right direction.
(3) After the USB cable is removed, close the SD&USB slot cover completely.



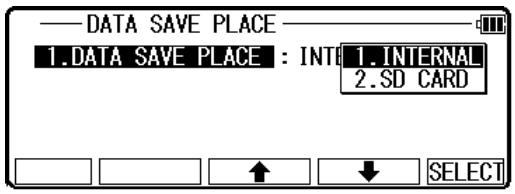
CAUTION

- Be sure to open/close the SD&USB slot cover and insert/remove
  the USB cable indoors.

Choose 2. Communication with USB of the TRANSFER MENU screen and press [ENT] 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 the 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.

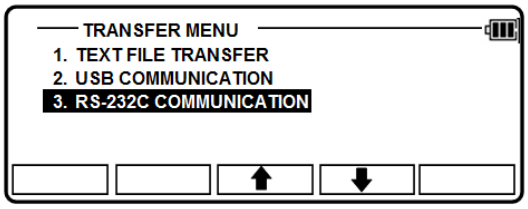
  NOTE: DAT file has a hidden file. If you take the following procedure in Windows, DAT file is not displayed.
  - Go to Windows Explorer
  - Click Folder Options in Tools
  - Click tab of View
  - In Advanced settings, check [Hidden file and No showing hidden file]
  - Click OK

- 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.

4.3 DATA TRANSFER

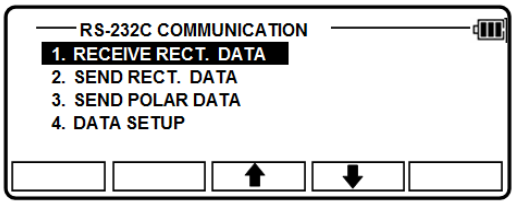
This instrument can use the communication by RS-232C.

Select 3. RS-232C COMMUNICATION of the TRANSFER MENU screen and press the [ENT] to view the TRANSFER screen.

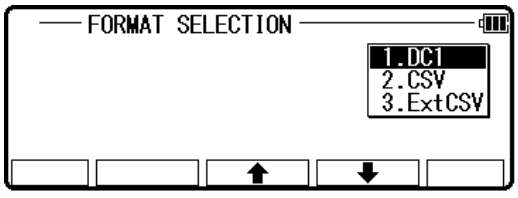


4.3.1 Receiving Coordinate Data

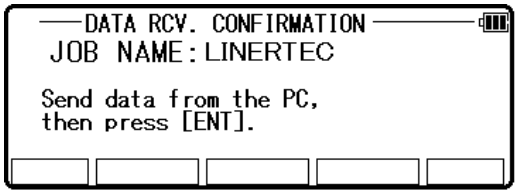
The Rect. data is sent from the PC and stored in the internal memory of the instrument.



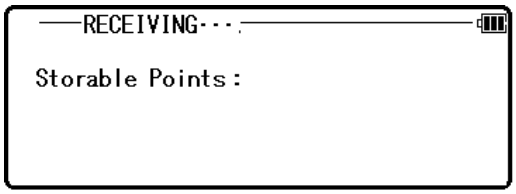
Select the 1. RECEIVE RECT. DATA and press [ENT] to view FORMAT SELECTION screen.



Select the DC1 format and press [ENT] to view DATA RCV. CONFIRMATION screen.
(Same procedure is performed for CSV format.)



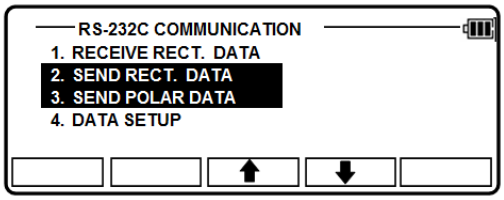
Set the PC to be ready to send and press [ENT] to receive the data from the PC.



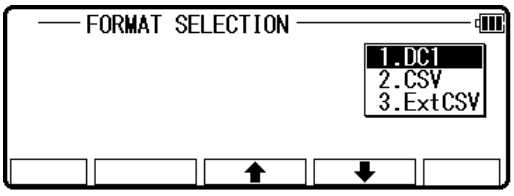
4.3.2 Sending Data

The data stored in the internal memory is sent to the PC.

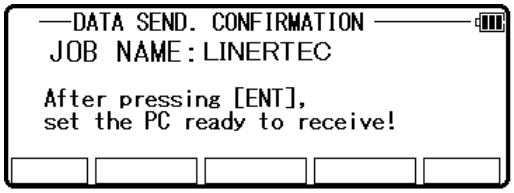
Including: 2. SEND RECT. DATA ; 3. SEND POLAR DATA



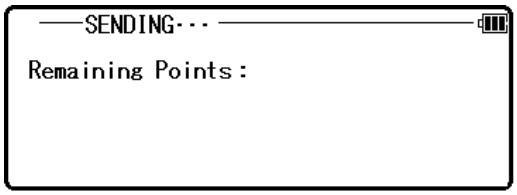
[RECT. DATA]
Select the 2.SEND RECT.DATA and press [ENT] to view the FORMAT SELECTION screen.



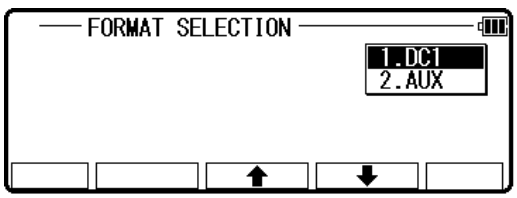
Select DC1 format and press [ENT] to view the DATA SEND. CONFIRMATION screen.
(Same procedure is performed for CSV format.)



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.



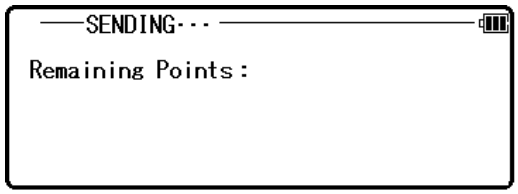
Press [ENT], and set the PC to be ready to receive.



[POLAR DATA]
Select the 3. SEND POLAR DATA and press [ENT] to view the FORMAT SELECTION screen.

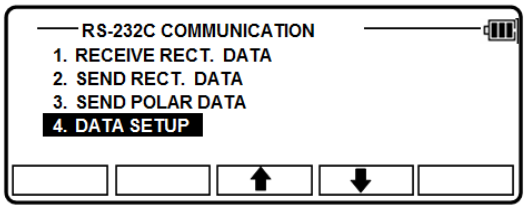
Select DC1 format and press [ENT] to view the DATA SEND. CONFIRMATION screen. (Same procedure is performed for AUX format.)

Press [ENT], and set the PC to be ready to receive.



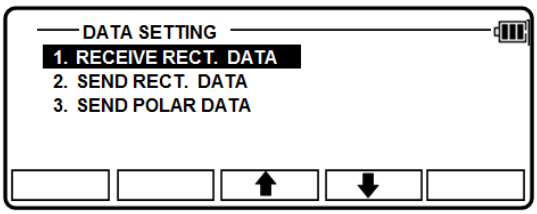
4.3.3 Communication setup

The communication parameter is set when stored data is received or sent between the instrument and the PC etc.

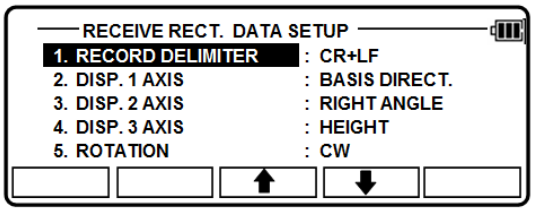


4.3.3.1 Receiving data setting

Select the 4. DATA SETUP and press [ENT] to view the DATA SETTING.



[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. (cfr. "5.5.2 Coordinate axis definition")**

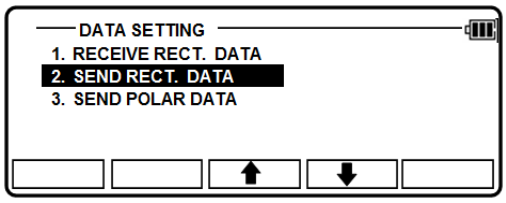
They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. However, it is necessary to match the definition of the "Coord. Axis" between settings in "Communication setup" and settings in "Coordinate axis definition" when same coordinate systems are used.

- **Factory default setting of RECEIVING**

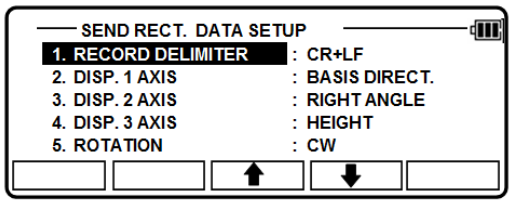
  1. RECORD DELIMETER: CR+LF
  2. DISP.1 AXIS: BASIS DIRECT.
  3. DISP.2 AXIS: RIGHT ANGLE
  4. DISP.3 AXIS: HEIGHT
  5. ROTATION: CW

4.3.3.2 Sending data setting

Select the 4. DATA SETUP and press [ENT] to view the DATA SETTING.



[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].



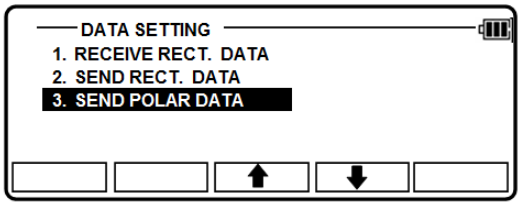
Press [ACCEPT] when all selections are made.

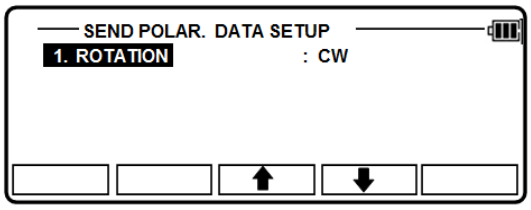
- **DISP.# AXIS: BASIS DIRECT, RIGHT ANGLE, or HEIGHT is selected when data is transferred between the TS and PC. (cfr. "11.2 Coordinate axis definition")**
  They are used for matching coordinate system between definition in the instrument and definition in the external device when they are different. 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. RECORD DELIMETER: CR+LF
  2. DISP.1 AXIS: BASIS DIRECT.
  3. DISP.2 AXIS: RIGHT ANGLE
  4. DISP.3 AXIS: HEIGHT
  5. 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. ROTATION: CW

4.3.3 About DataLink DL-01 Software

DataLink DL-01 Software allows you to send collected data by LTS-200 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 for 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 LTS-200.

b-3 Limitation for each format.

Please, use “CSV” or “DC1(DC-1Z)” format to transfer data to/from LTS-200.

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 LTS-200.
Recommended settings for “COMM SETTING SELECTION” on LTS-200 special function is as follows.

LTS-200 → 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
Subsequent items: As you like.

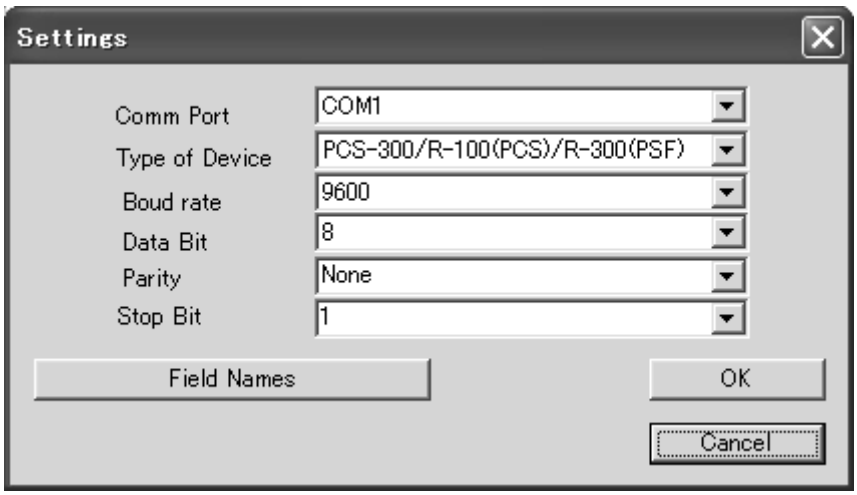
LTS-200 → PC(DL-01) to “SEND POLAR DATA”
1. BAUD RATE: 1200-9600
2. DATA LENGTH: 8
3. PARITY BITS: NIL
4. STOP BITS: 1
5. SIGNAL CONTROL: OFF
6. XON/XOFF: OFF
7. ROTATION: As you like.

PC(DL-01) → LTS-200 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
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)” , and other setting should be as follows.



Please note that these settings should be common with LTS-200's. And if the selection of “Type of Device” is not correct it may result in missing some data.

LTS-200 → PC(DL-01)
Bits per second: 1200 (1200-9600 for sending “POLAR DATA”)
Databits: 8
Parity: None
Stop bits: 1

PC(DL-01) → LTS-200
Bits per second: 1200
Databits: 8
Parity: None
Stop bits: 1

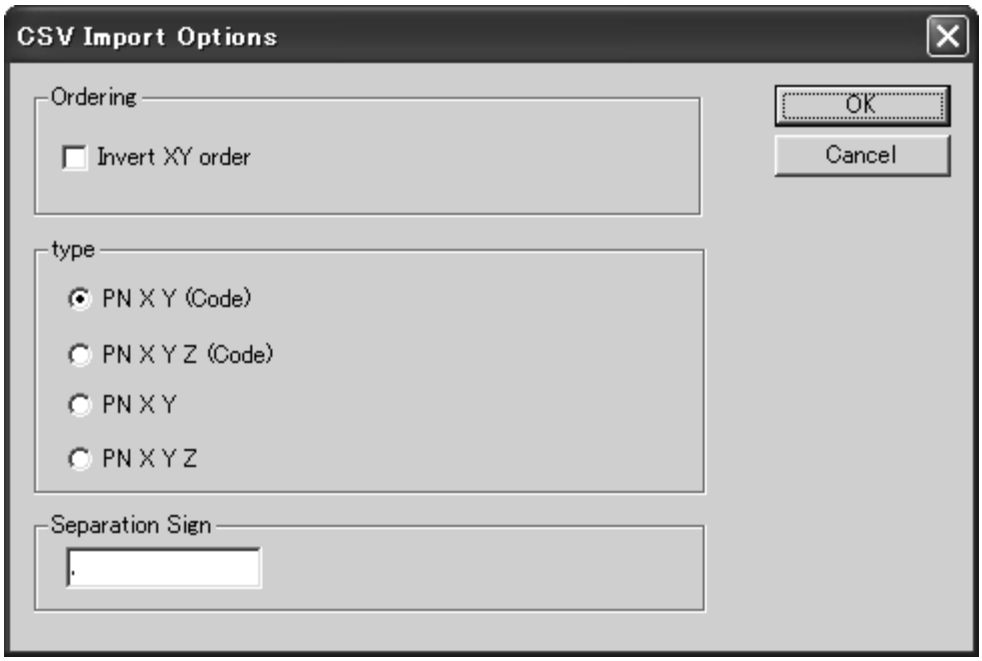
c) Note for the Memory capacity.

Data transfer failure from DL-01 to LTS-200 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 [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 MODE A is displayed.

d) Note on converting CSV file.

When you attempt to convert CSV file from LTS-200 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

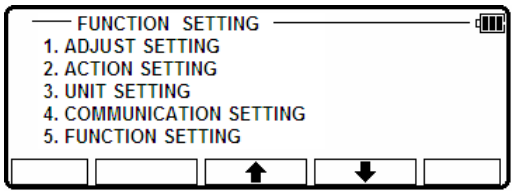
e) For more information to work with DL-01, please refer to the “help” file after the installation.

5. PREFERENCE (SETUP)

Followings are possible functions and the factory default settings:

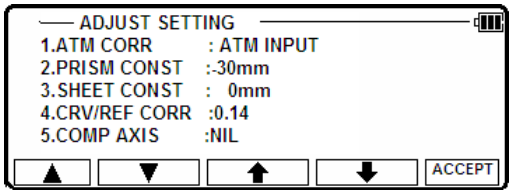
A language other than English can be selected.

Press [ENT] [SETUP] of the LinertecExpress screen to view the FUNCTION SETTING screen.

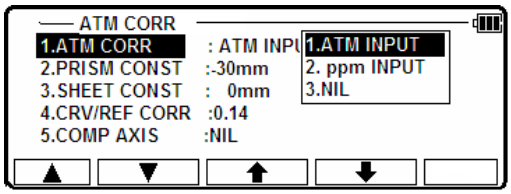


5.1 ADJUST SETTING

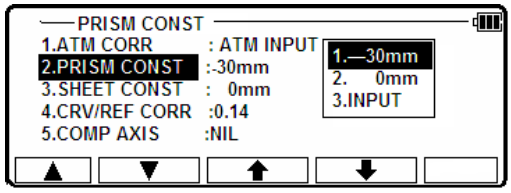
Select 1. ADJUST SETTING of the FUNCTION SETTING screen to view the following screen.
Press [ENT] to open the selection window.
Select each setting and press [F5] [ACCEPT] to enter.



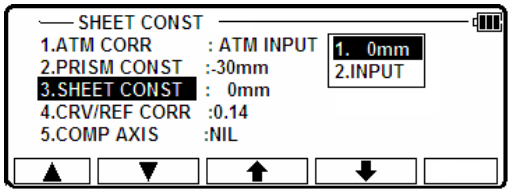
[1.ATM CORR]
Select the 1.ATM CORR and press [ENT] to view the following screen. Press the down arrow key to choose and press [ENT] to enter.



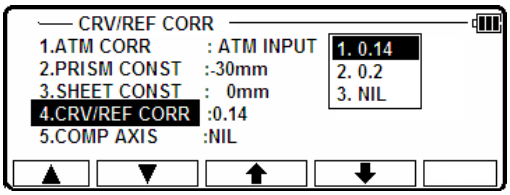
[2.PRISM CONST]
Select the 2.PRISM CONST and press [ENT] to view the following screen. Press the down arrow key to choose and press [ENT] to enter.



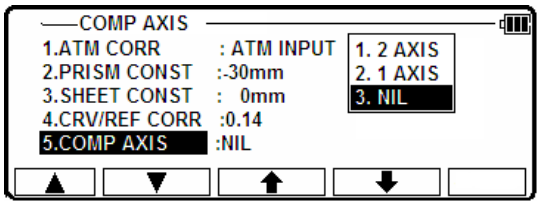
[3.SHEET CONST]
Select the 3.SHEET CONST and press [ENT] to view the following screen. Press the down arrow key to choose and press [ENT] to enter.



[4.CRV/REF CORR]
Select the 4.CRV/REF CORR and press [ENT] to view the following screen. Press the down arrow key to choose and press [ENT] to enter.

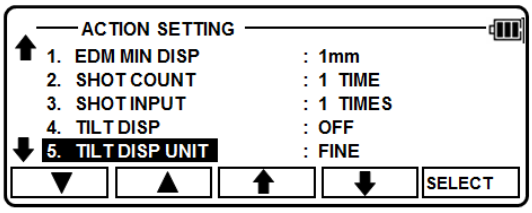


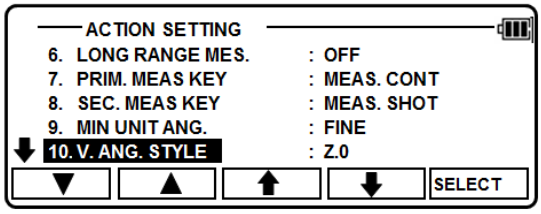
[4. COMP AXIS]
Select the 4. COMP AXIS and press [ENT] to view the following screen. Press the down arrow key to choose and press [ENT] to enter.

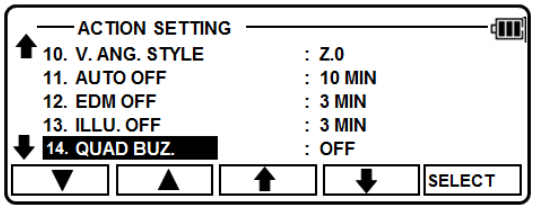


5.2 ACTION SETTING

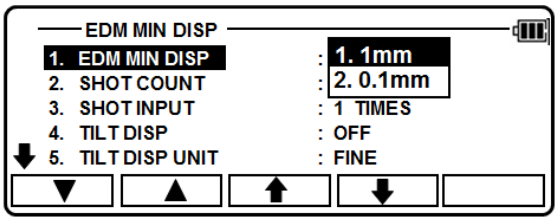
Select the 2. ACTION SETTING of the FUNCTION SETTING screen and press [ENT] to view the following screen. Press [ENT] to open the selection window. Select each setting and press [F5][ACCEPT] to enter.



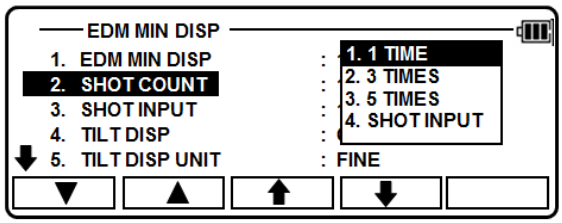




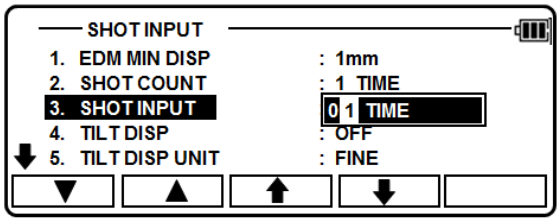
[1.EDM MIN DISP]
Select the 1.EDM MIN DISP and press [ENT] to view the following screen. Press the down arrow key to choose and press [ENT] to enter.



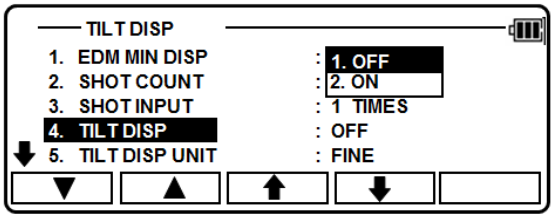
[2. SHOT COUNT]
Select the 2. SHOT COUNT and press [ENT] to view the following screen.
Press the down arrow key to choose and press [ENT] to enter.



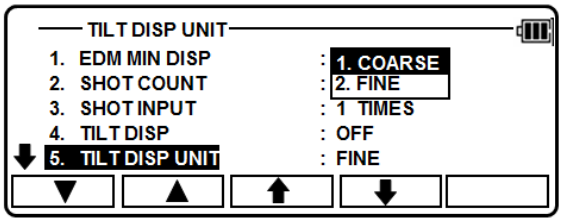
[3. SHOT INPUT]
Select the 3. SHOT INPUT and press [ENT] to view the following screen.
Press the down arrow key to choose and press [ENT] to enter.



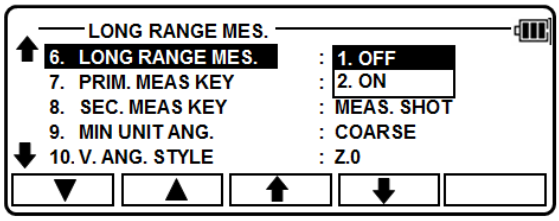
[4. TILT DISP]
Select the 5.TILT DISP and press [ENT]
to view the following screen.
Press the down arrow key to choose and press
[ENT] to enter.



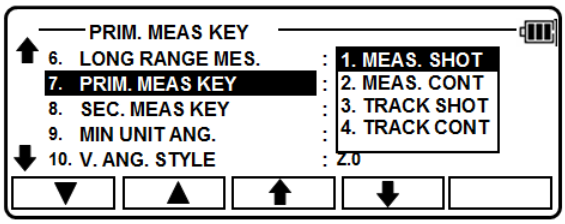
[5. TILT DISP UNIT]
Select the 6.TILT DISP UNIT and press [ENT]
to view the following screen.
Press the down arrow key to choose and press
[ENT] to enter.



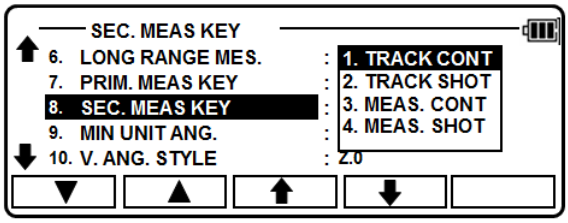
[6. LONG RANGE MES.]
Select the 7.LONG RANGE MES. and press
[ENT]
to view the following screen.
Press the down arrow key to choose and press
[ENT] to enter.



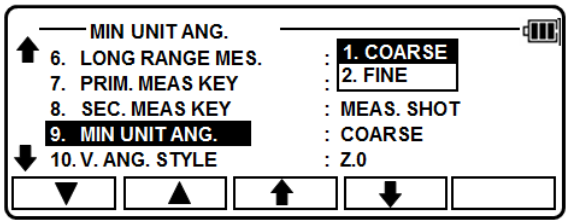
[7. PRIM. MEAS KEY]
Select the 8.PRIM. MEAS KEY and press [ENT]
to view the following screen.
Press the down arrow key to choose and press
[ENT] to enter.



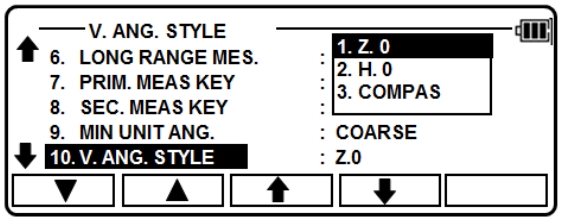
[8. SEC. MEAS KEY]
Select the 9.SEC. MEAS KEY and press [ENT]
to view the following screen.
Press the down arrow key to choose and press
[ENT] to enter.



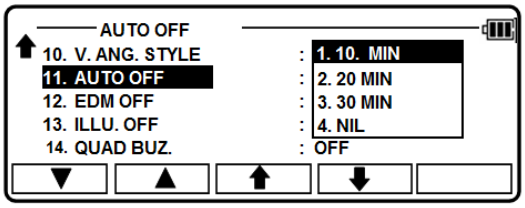
[9. MIN UNIT ANG.]
Select the 10.MIN UNIT ANG. and press [ENT]
to view the following screen.
Press the down arrow key to choose and press
[ENT] to enter.



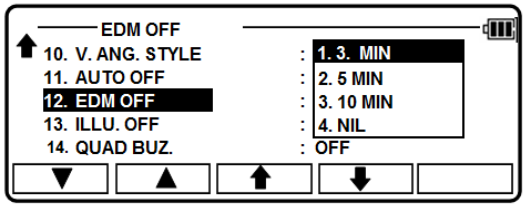
[10. V.ANG. STYLE]
Select the 11.V.ANG. STYLE and press [ENT]
to view the following screen.
Press the down arrow key to choose and press
[ENT] to enter.



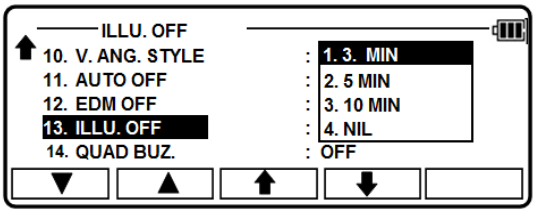
[11. AUTO OFF]
Select the 12.AUTO OFF and press [ENT] to view the following screen.
Press the down arrow key to choose and press [ENT] to enter.



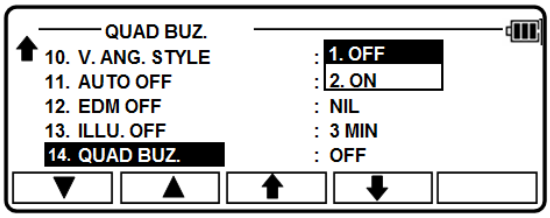
[12. EDM OFF]
Select the 13. EDM OFF and press [ENT] to view the following screen.
Press the down arrow key to choose and press [ENT] to enter.



[13. ILLU. OFF]
Select the 14.ILLU. OFF and press [ENT] to view the following screen.
Press the down arrow key to choose and press [ENT] to enter.

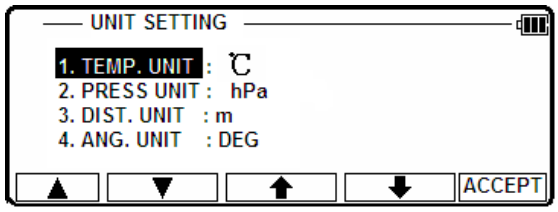


[14. QUAD BUZ.]
Select the 16. QUAD BUZ. and press [ENT] to view the following screen.
Press the down arrow key to choose and press [ENT] to enter.

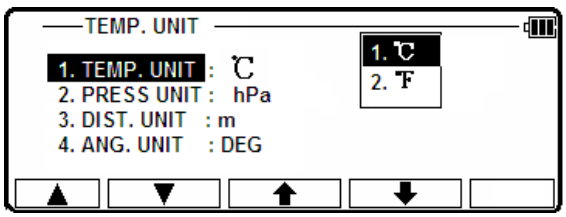


5.3 UNIT SETTING

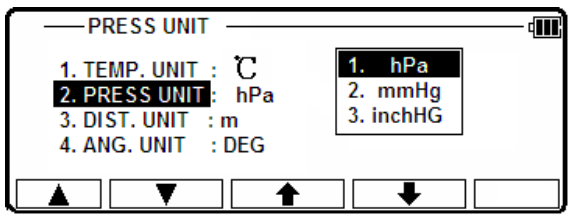
Select the 3. UNIT SETTING of the FUNCTION SETTING screen and press [ENT] to view the following screen. Press [ENT] to open the selection window. Select each setting and press [F5] [ACCEPT] to enter.



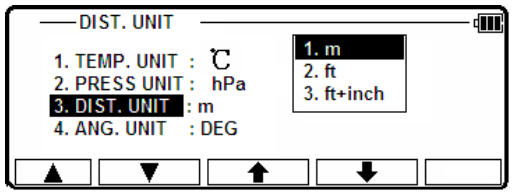
[1. TEMP. UNIT]
Select the 1.TEMP. UNIT and press [ENT] to view the following screen.
Press the down arrow key to choose and press [ENT] to enter.



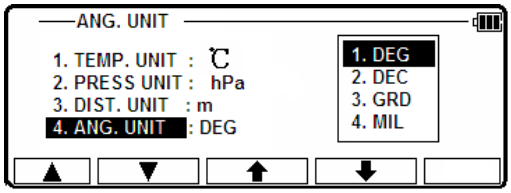
[2. PRESS UNIT]
Select the 2.PRESS UNIT and press [ENT] to view the following screen.
Press the down arrow key to choose and press [ENT] to enter.



[3. DIST. UNIT]
Select the 3.DIST. UNIT and press [ENT] to view the following screen.
Press the down arrow key to choose and press [ENT] to enter.

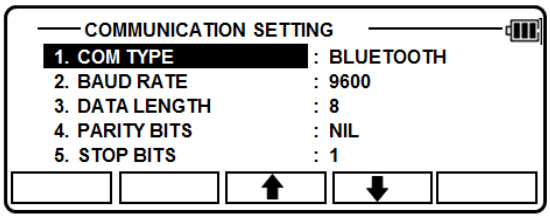


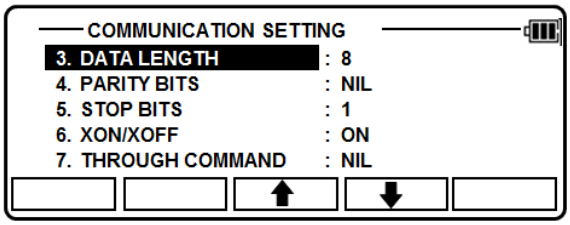
[4. ANG. UNIT]
Select the 4.ANG. UNIT and press [ENT] to view the following screen.
Press the down arrow key to choose and press [ENT] to enter.



5.4 COMMUNICATION SETTING

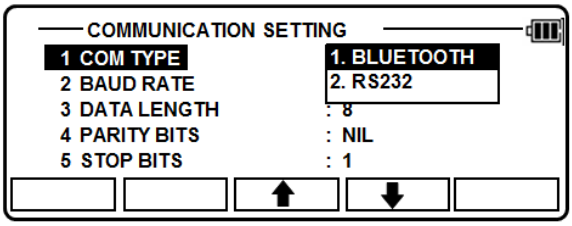
Select the 4. COMMUNICATION SETTING of the FUNCTION SETTING screen and press [ENT] to view the following screen. Press [ENT] to open the selection window. Select each setting and press [F5] [ACCEPT] to enter.



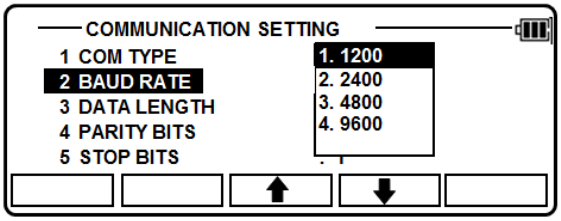


[1. COMMUNICATION TYPE]

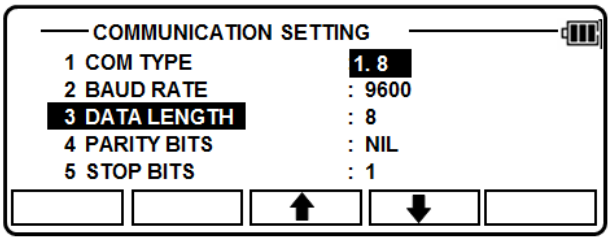
Select “Communication Type”and press F5 to enter into the “communication type”screen. Using updown arrows to select, then press [accept] to confirm the item.



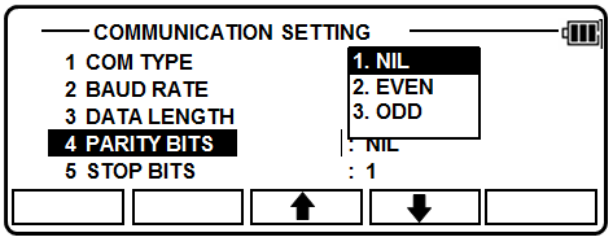
[2. BAUD RATE]
Select “Data Baud Rate” and press F5 to enter into “Data Baud Rate”GUI, using updown arrows to select, then press [accept] to confirm the item.



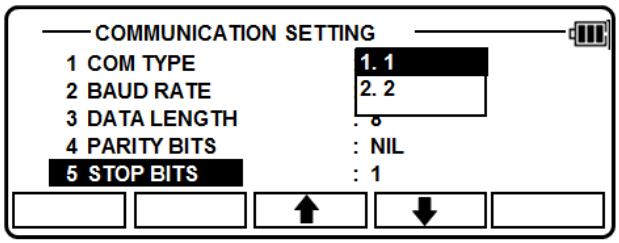
[3. DATA LENGTH]
Select “Data Length” and press F5 to enter into “Data Length”GUI, using updown arrows to select, then press [accept] to confirm the item.



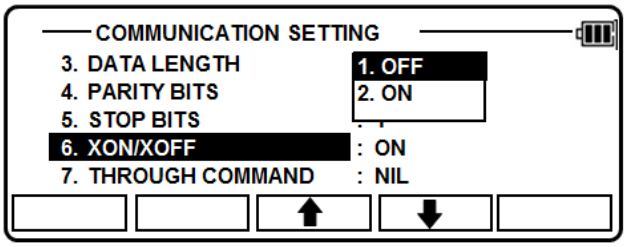
[4. PARITY BITS]
Select “Data Parity” and press F5 to enter into “Data Parity”GUI, using updown arrows to select, then press [accept] to confirm the item.



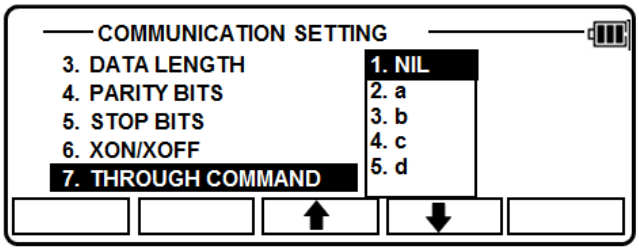
[5. STOP BITS]
Select “Stop Bits” and press F5 to enter into “Stop Bits”GUI, using updown arrows to select, then press [accept] to confirm the item.



[6. XON/XOFF]
Select “XON/XOFF” and press F5 to enter into “XON/XOFF”GUI, using updown arrows to select, then press [accept] to confirm the item.



[7. THROUGH COMMAND]
Select “protocols” and press F5 to enter into “protocols”GUI, using updown arrows to select, then press [accept] to confirm the item.

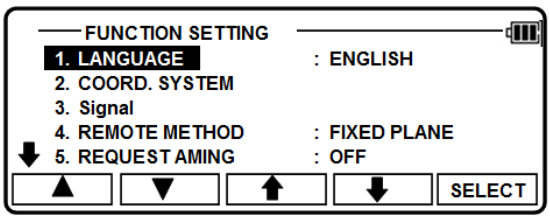


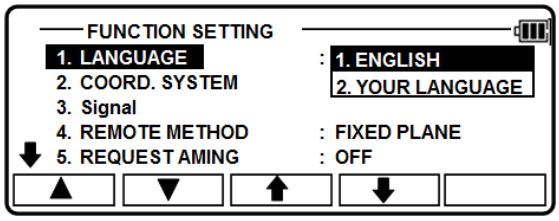
More details please refer to “4.3.3 COMMUNICATION SETTING”.

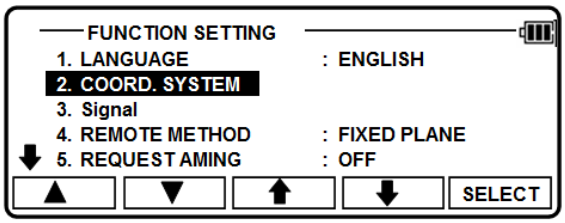
5.5 FUNCTION SETTING

FUNCTION	DEFAULT SETTINGS
Coordinate system can be selected.	(cfr. 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"
EDM MIN DISP/QUICK	"1mm/OFF"
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"
Recording format to record polar data	"HA VA SD"

Press [3. PREF] of the Linertec screen and press the down arrow key to view the FUNCTION SETTING screen.

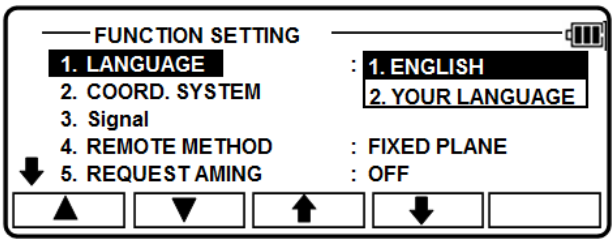






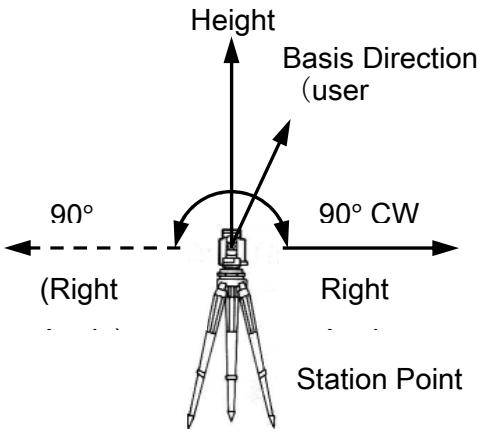
5.5.1 Language Selection

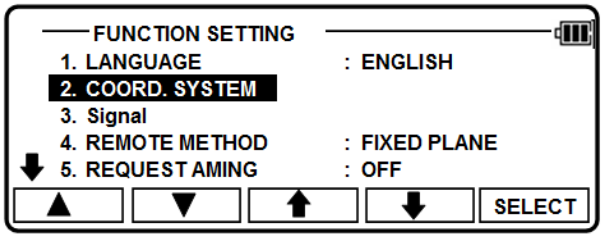
Select 1. LANGUAGE and press [ENT] to view the LANGUAGE selection window.
Press the down arrow key to select and press [ENT]
to comfirm the selected one.



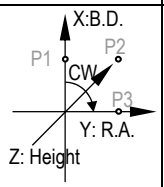
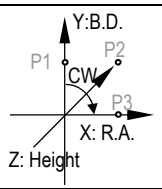
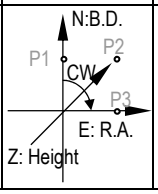
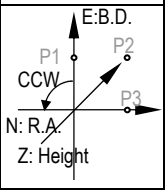
5.5.2 Coordinate axis definition

Select 2. COORD. SYSTEM and press [ENT] to view the coordinate system definition window. Press [ENT] to select and press [F5] [ACCEPT] to enter.

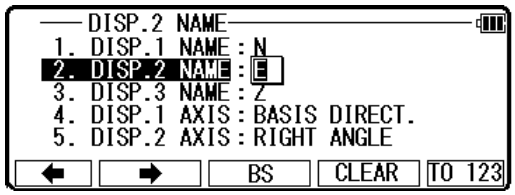




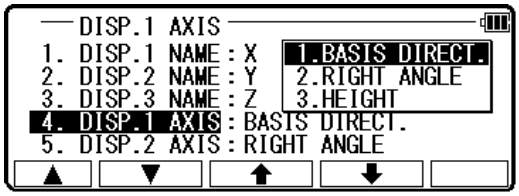
Definition of each selection is as follows.

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. RIGHT ANGLE 2. HEIGHT 3. BASIS DIRECTION	2. RIGHT ANGLE	1. BASIS DIRECTION	2. RIGHT ANGLE	2. RIGHT ANGLE
6. DISP.3 AXIS	Define the direction of the 3rd Axis.	1. HEIGHT 2. BASIS DIRECTION 3. RIGHT ANGLE	3. HEIGHT	3. HEIGHT	3. HEIGHT	3. HEIGHT
7. ROTATION	Define the rotation from the 1st Axis to the 2nd Axis..	1. CW 2. CCW	1. CW	1. CW	1. CW	1. CCW
Example of GRAPHICAL VIEW						

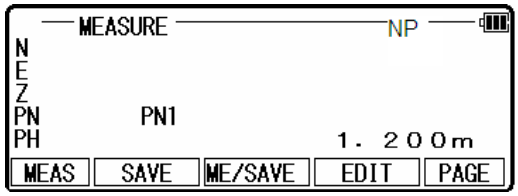
Any name can be defined for all three axes.
For the “DISP.# NAME”, it is possible to define same name. However, please note that the same coordinates’ value will be displayed.



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.



5.5.3 Return Light Signal

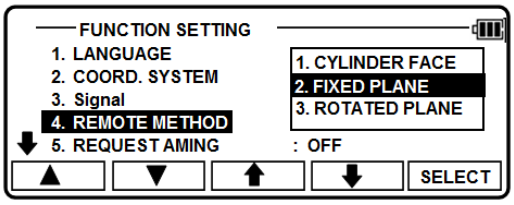
Select 3. Signal and press [SELECT] to enter Return Lingt Signal window.

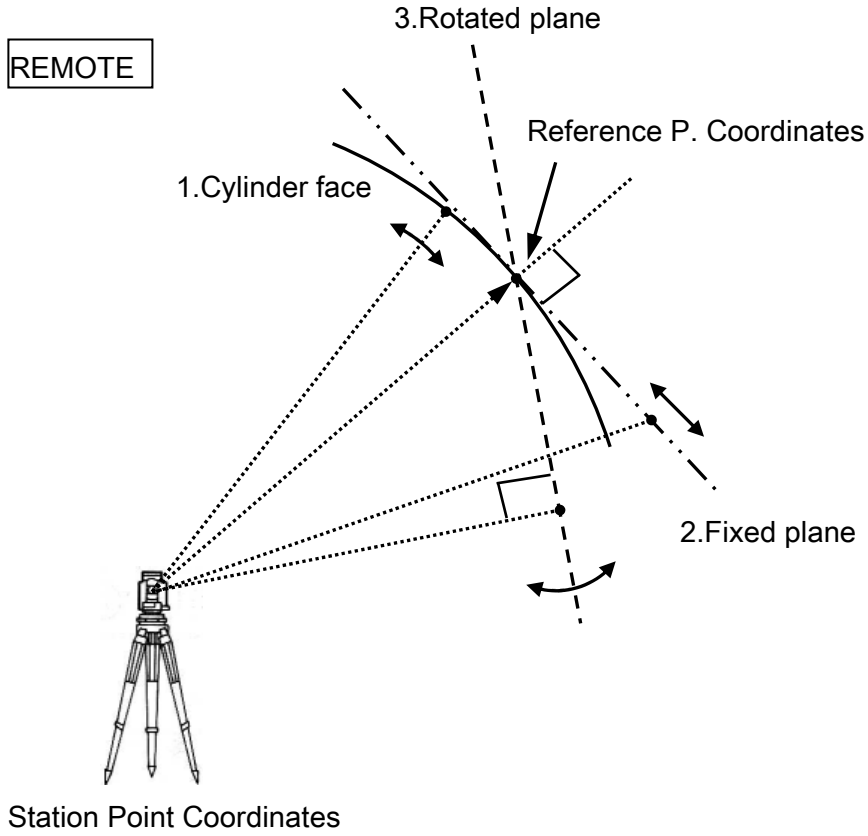
Press [ENT] to emit laser and the screen shows the strength of the retuning light from reflective objects.

Press [ESC] to exit operation.

5.5.4 Remote method selection

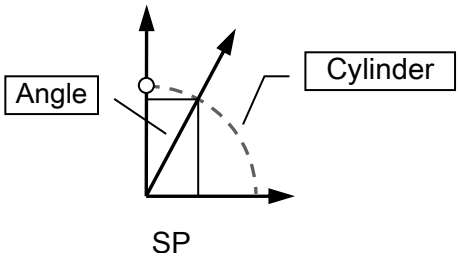
Select 5.REMOTE METHOD and press [ENT] to view the following screen. Press the down rrow key to choose and press [ENT] to enter.





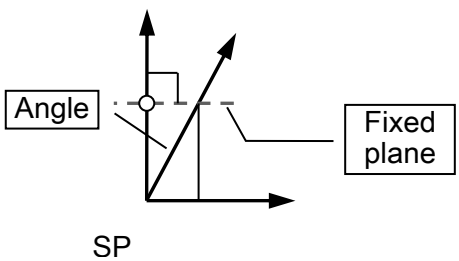
1. Cylinder face

The Remote measurement is performed on the inner surface of the vertical cylinder as shown left.

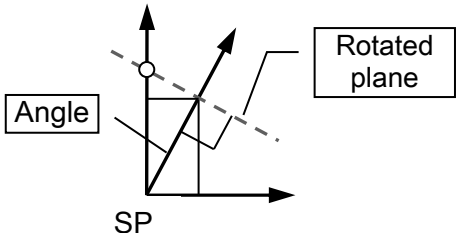


2. Fixed plane

The Remote measurement is performed on the fixed plane, which is perpendicular to the sight of the reference point as shown left.



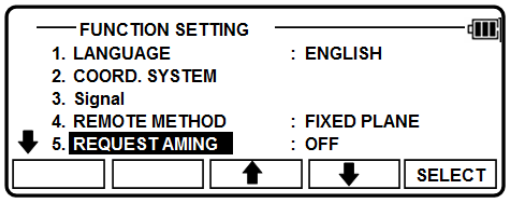
3. Rotated plane



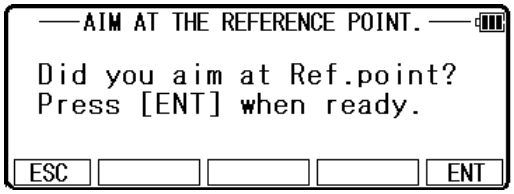
The Remote measurement is performed on the Rotated plane, which is always perpendicular to the present line of sight and induces the reference point as shown left.

5.5.5 Request aiming selection

Select 7. REQUEST AIMING and press [ENT] to view the following screen. Press the down arrow key to choose and press [ENT] to enter.

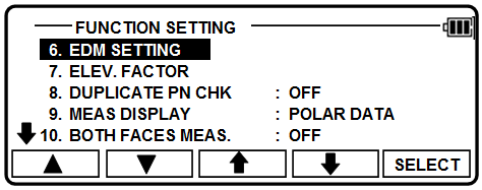


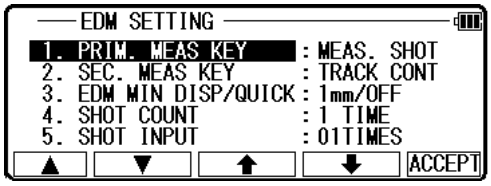
After pressing [ENT] on STATION POINT H.ANGLE SETUP screen, you can choose whether or not the warning message, “Did you aim at Ref. Point?” is displayed.



5.5.6 EDM settings selection

Select 8.EDM SETTINGS and press [ENT] to view the following screen. Press the down arrow key to choose and press [ENT] to enter.



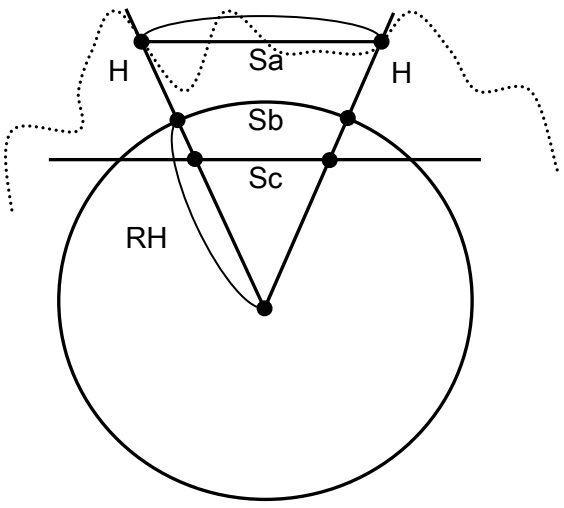


1. PRIM.MAES KEY	1. MEAS. SHOT
	2. MEAS. CONT
	3. TRACK SHOT
	4. TRACK CONT
2. SEC.MEAS KEY	1. TRACK CONT
	2. TRACK SHOT
	3. MEAS. CONT
	4. MEAS. SHOT
3. EDM MIN DISP/QUICK	1. 1mm/OFF
	2. 1mm/ON
	3. 0.1mm
4. SHOT COUNT	1. 1 TIME
	2. 3 TIMES
	3. 5 TIMES
	4. INPUT
5. SHOT INPUT	XX TIMES

Please refer to the instruction manual of basic function about details of each setting.

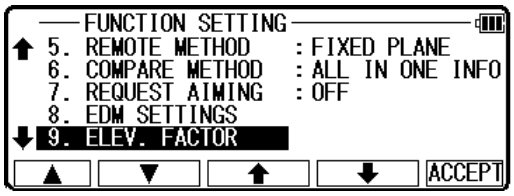
5.5.7 Elevation factor

"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-Traverse, and VPM. These reverse corrections are carried out with STAK (Stake Out, 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

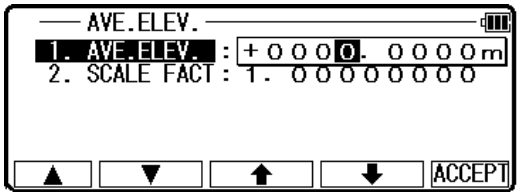
Select 9. Elevation factor and press [ENT] to view the ELEVATION FACTOR selection window. Press [ENT] to select and press [F5] [ACCEPT].



1. Average Elevation

Average (H) = Averaged on-site elevation

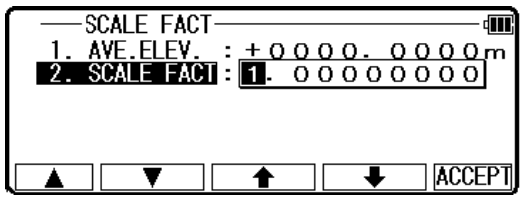
Input range: -9999.9998 -- +9999.9998m



2. Scale Factor

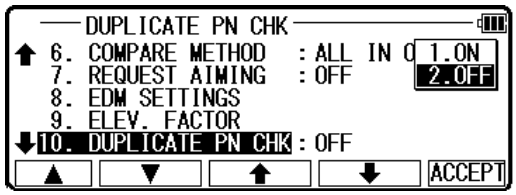
Scaling = On-site scaling coefficient

Input range: +0.00000001 -- +1.99999998



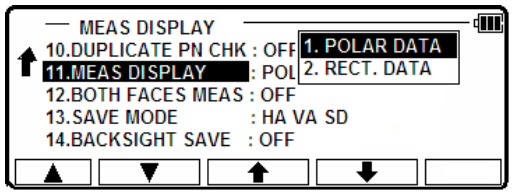
5.5.8 Duplicate point check

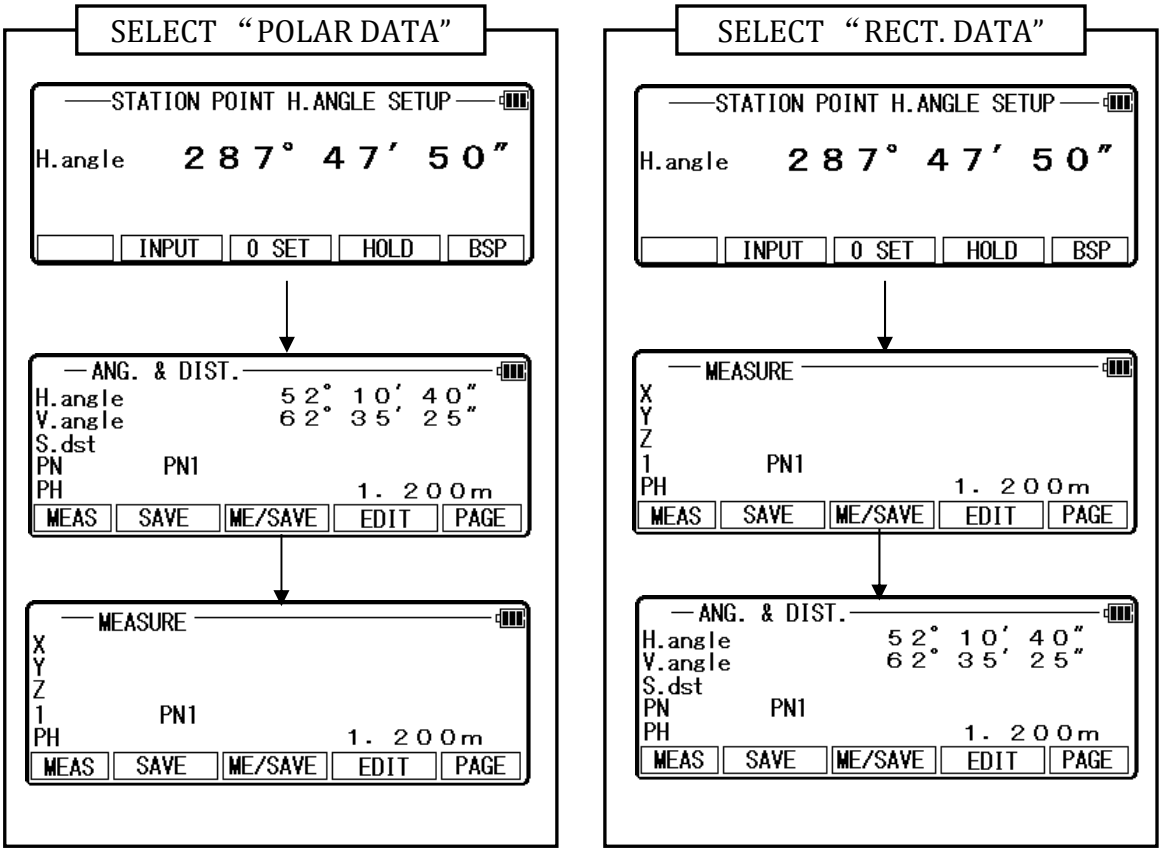
When for this setting ON is selected, you can check whether a Point Name overlaps another Point Name already input.



5.5.9 Meas. Display

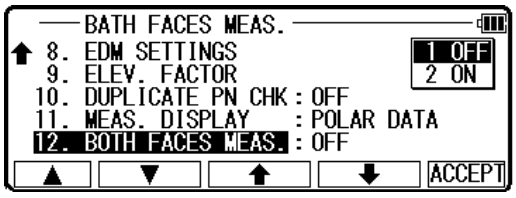
This setting allows you to set the order of display when a function of "11. MEAS. DISP" is carried out. When "POLAR DATA" is selected, STATION POINT H.ANGLE SETUP screen appears next to ANG. & DIST. screen. When "RECT. DATA" is selected, MEASURE screen is displayed.





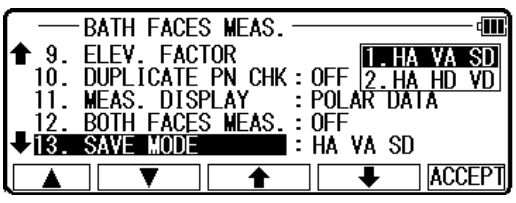
5.5.10 Both faces meas.

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.

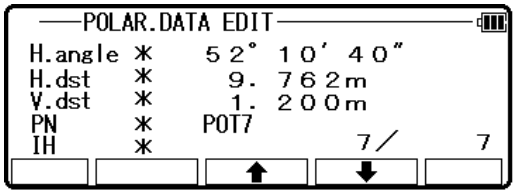


5.5.11 Save Mode

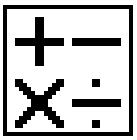
If you switch to SAVE MODE, you can change the display when Polar data is displayed.



When "HA HD VD" are selected at VIEW&EDIT of POLAR DATA of EDIT, the display will be changed as shown in the right figure.



6. CALCULATIONS



The following calculations are available:

- COGO
- 2D SURFACE
- Road Design

6.1 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

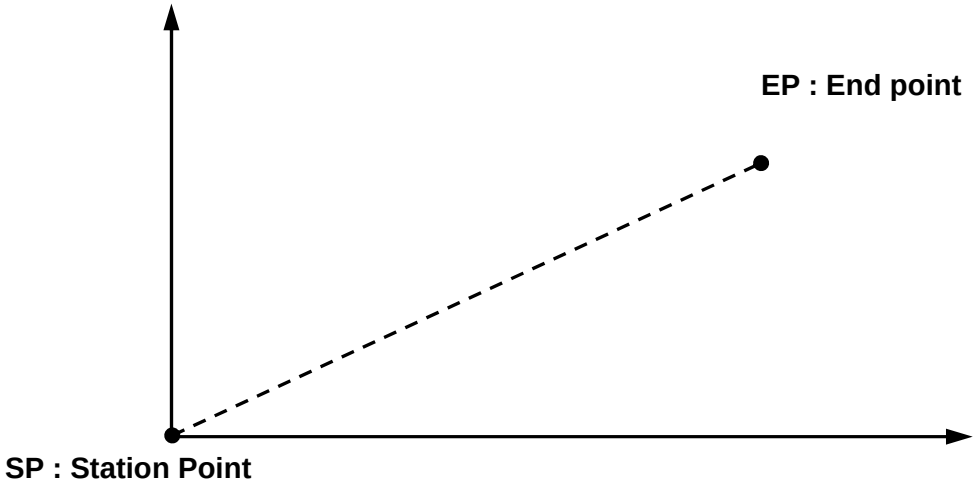
The LTS-200 series automatically creates “COGOPoint” file. In the file, the following 14 coordinates to be used in COGO function, are recorded.

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").

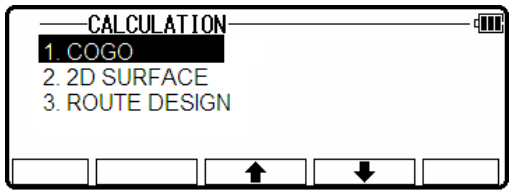
6.1.1 Inverse



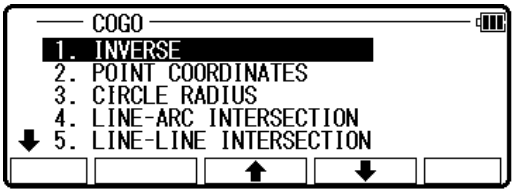
From the given two point Coordinates, the Direction angle and distance are calculated.

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

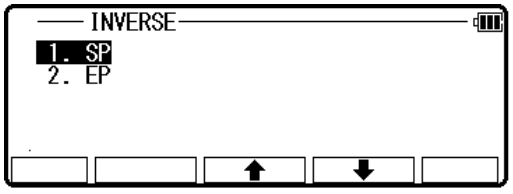
From the LinertecExpress screen, press 4 to view CALCULATION screen.



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



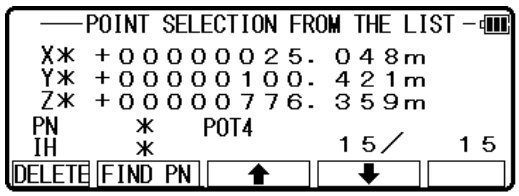
Select the 1. INVERSE and press [ENT] to view INVERSE screen.



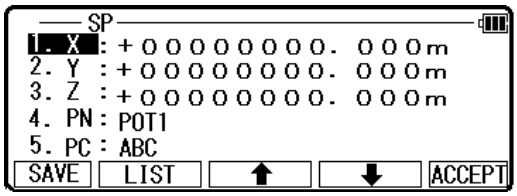
A. **Start Point Input**（Input the PN, Coordinates and PC of the Start point.）

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

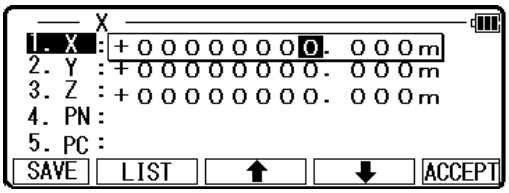
- [LIST] key
  All stored points can be displayed as follows by pressing [F2] [LIST].
  Press [F2] [LIST] to view POINT SELECTION FROM THE LIST screen.



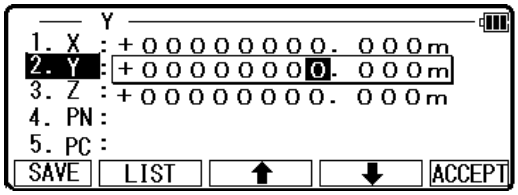
Press [ENT] to open the SP input screen.



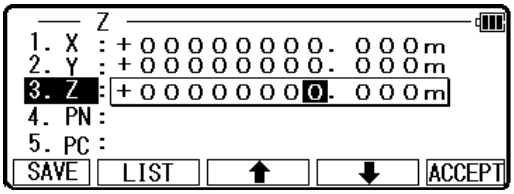
Input your desired Point Name by pressing keys, and press [ENT] to open the X coordinate input screen.



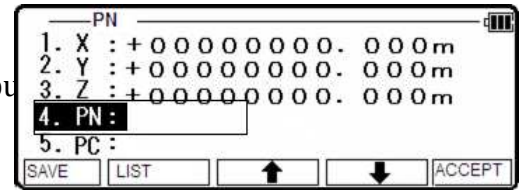
Input your desired Point Name by pressing keys, and press [ENT] to open the Y coordinate input screen.



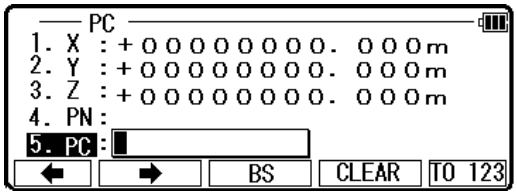
Input your desired Point Name by pressing keys, and press [ENT] to open the Z coordinate input screen.



Press [ENT] to open the PN input screen and inpu



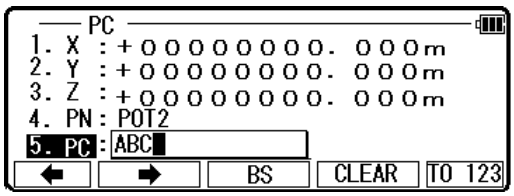
Press [ENT] to open the PC input screen and input.



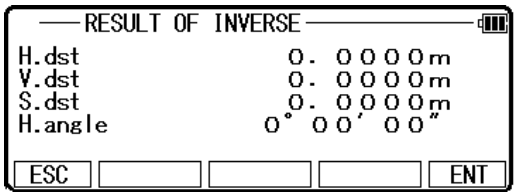
B. End point coordinates input

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

After PC input, press [ENT] or F5[ACCEPT] to viwe the EP screen.
Input the PN, X, Y, Z Coordinates and PC name of the End point.

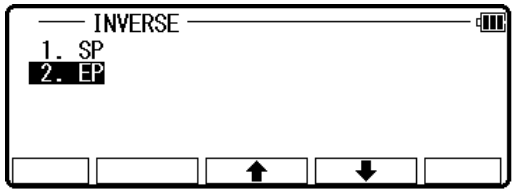


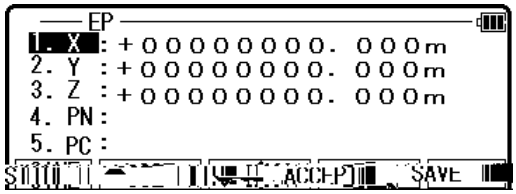
Press [ENT] to view the RESULT OF INVERSE screen.

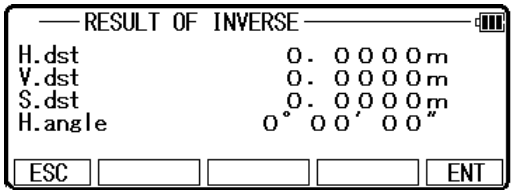


C. Another End point Coordinates input

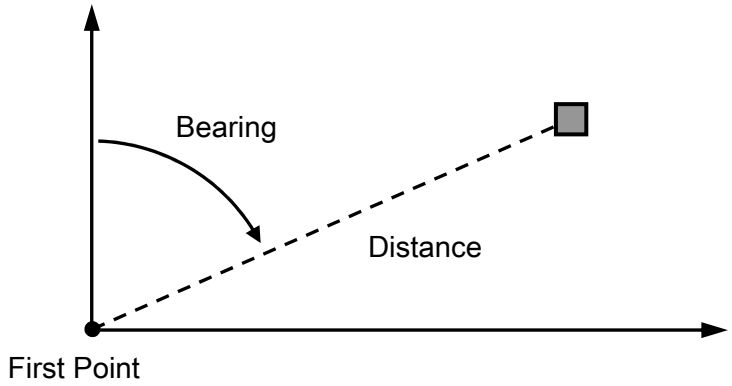
Input the PN, X, Y, Z Coordinates and PC name of another End point, and another inverse result can be performed.







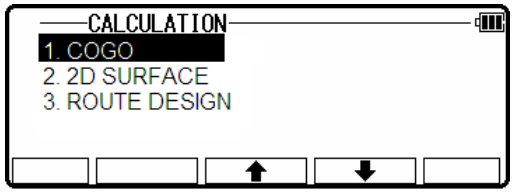
6.1.2 Point Coordinates



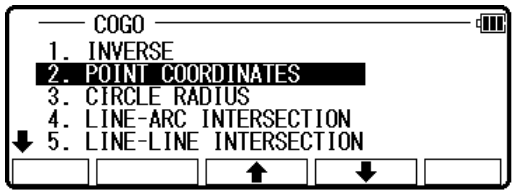
A point Coordinates is calculated from a known point Coordinates and the Distance and Horizontal angle of the Second point.

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

From the LinertecExpress screen, press 4 to view the CALCULATION screen.

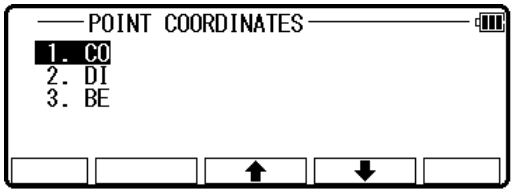


Select 1.COGO and press [ENT] to view the COGO screen.

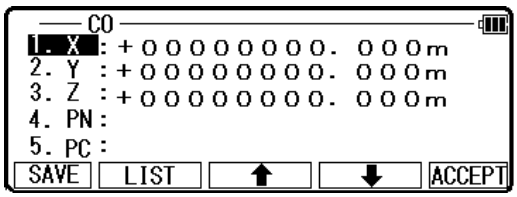


6.1.2.1 Point Coordinates

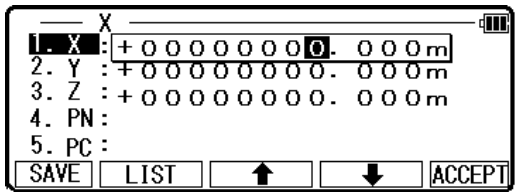
Select the 2. POINT COORDINATES and press [ENT] to view POINT COORINATES screen.



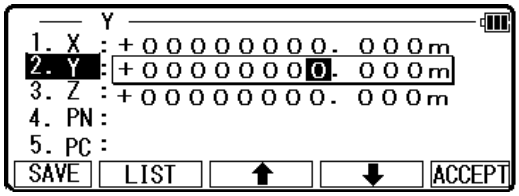
Select 1. CO and press [ENT] to view CO screen.



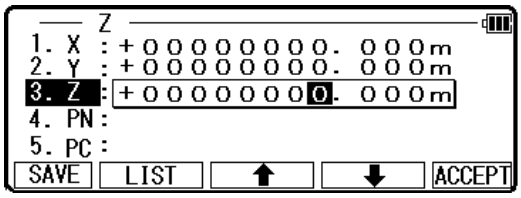
Press [ENT] to open the X coordinate input screen.



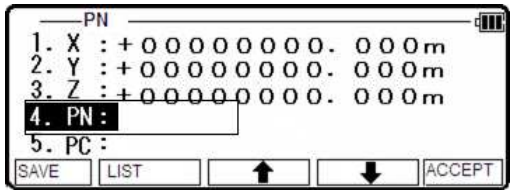
Press [ENT] to open the Y coordinate input screen.



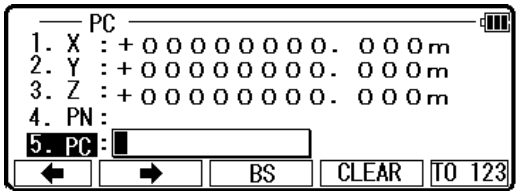
Press [ENT] to open the Z coordinate input screen.



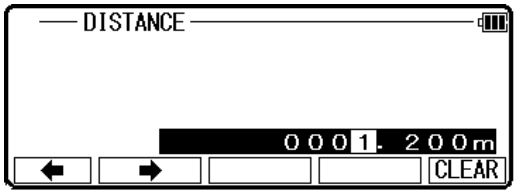
Press [ENT] to open the PN input screen.



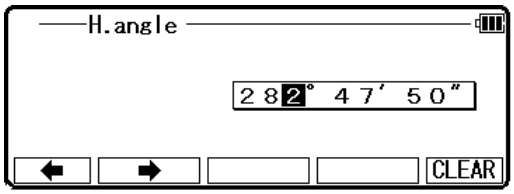
Press [ENT] to open the PC input screen.



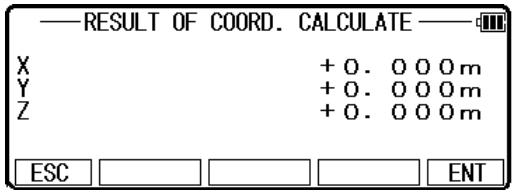
Input your desired PC by pressing keys, and press [ENT] to view DI screen.



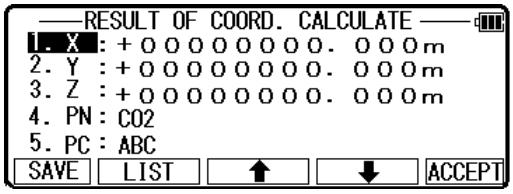
Input your desired value and press [ENT] to open the H. ANGLE input window.



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.



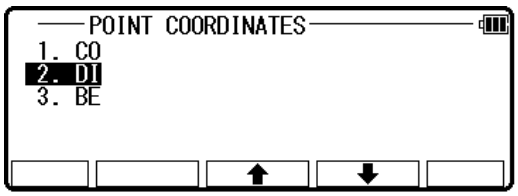
Press [ENT] to view the following screen.



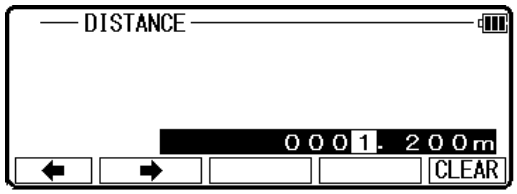
The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5] [ACCEPT] to save them.

6.1.2.2 Distance and H. angle

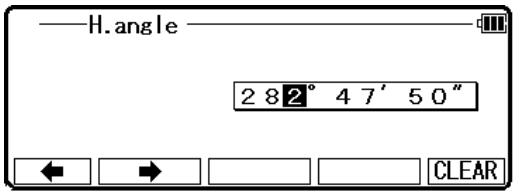
In the same manner, the values of Distance and H. angle are input as follows and the Second point Coordinates are displayed.



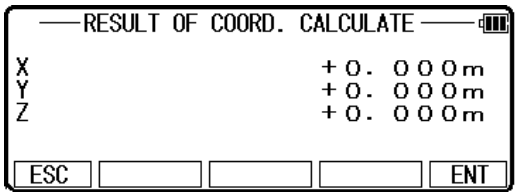
Select 2. DI and press [ENT] to view DI screen.



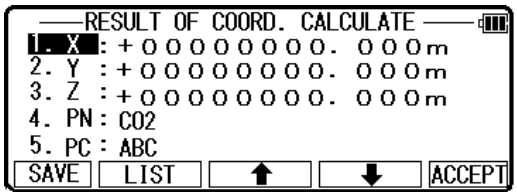
Input your desired value and press [ENT] to open the H. ANGLE input window.



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.



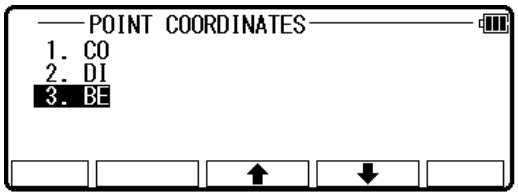
Press [ENT] to view the following screen.



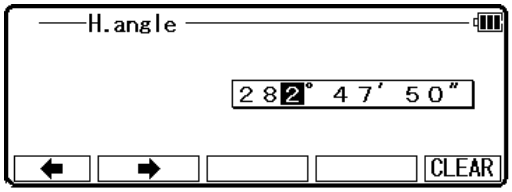
The PN, X, Y, Z and PC are viewed and can be edited.
If all items are OK, press [F5] [ACCEPT] to save them.

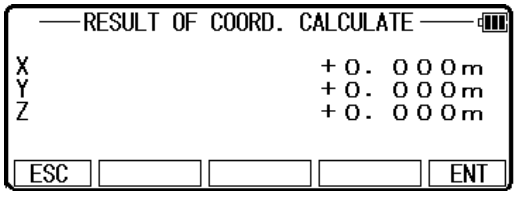
6.1.2.3 H. angle input

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



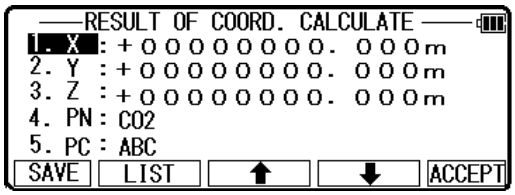
Select 3. BE and press [ENT] to view H. ANGLE screen.
Input H. angle and press [ENT] to view the RESULT OF COORD. CALCULATE screen.





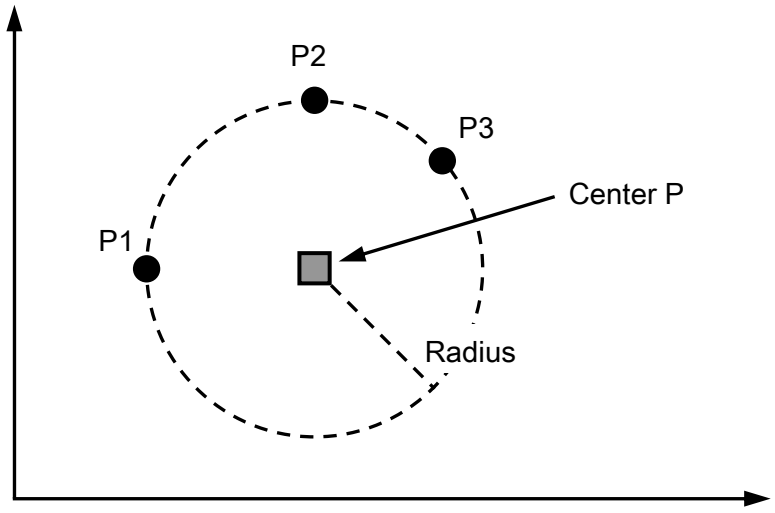
The Second point Coordinates are displayed by plus or minus from the known Coordinates.

Press [ENT] to view the following screen.



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

6.1.3 Circle Radius

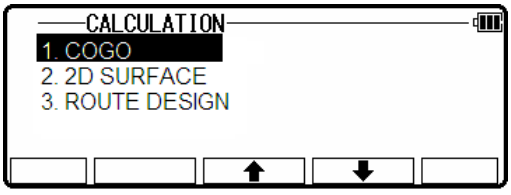


The Center point and radius of the circle drawn by three points are calculated by this function. You can store calculated Center point.

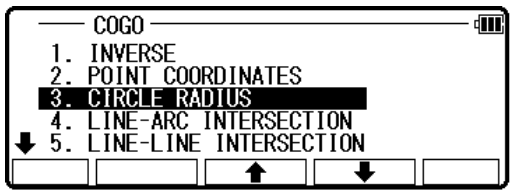
Input: 3 points
Output: Center point of the arc
Radius of the arc

From the LinertecExpress screen, press 4 to view the CALCULATION screen.

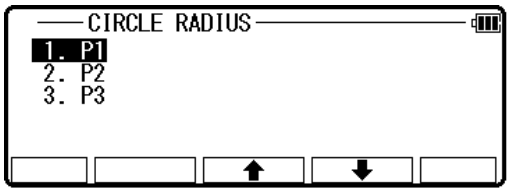
Select 1.COGO and press [ENT] to view the COGO screen.



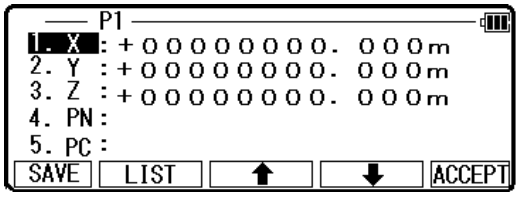
Select the 3. CIRCLE RADIUS and press [ENT] to view CIRCLE RADIUS screen.



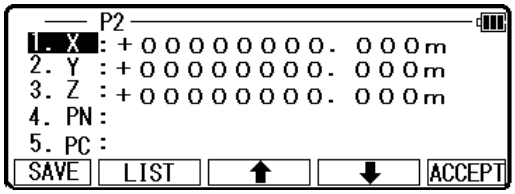
Select 1. P1 and press [ENT] to view P1 screen.



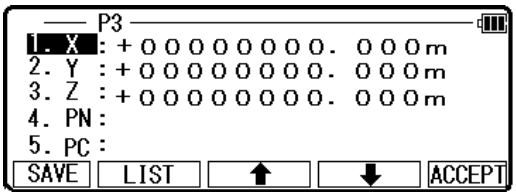
Input PN (Point Name), X, Y, Z, and PC (Point Code) of P1 point or import from the memory of rectangular coordinate as P1 by [F2] [LIST].



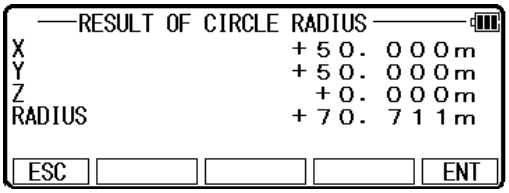
If you finish the input of P1 value, press [F5] [ACCEPT]. Then you go to P2 input screen.



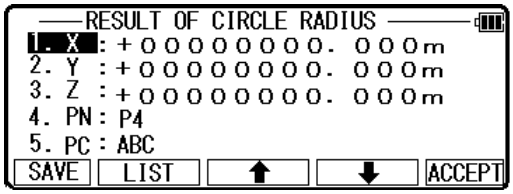
Input P2 data like input of P1.
If you finish the input of P2, press [F5] [ACCEPT]. Then you go to P3 input screen.



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.

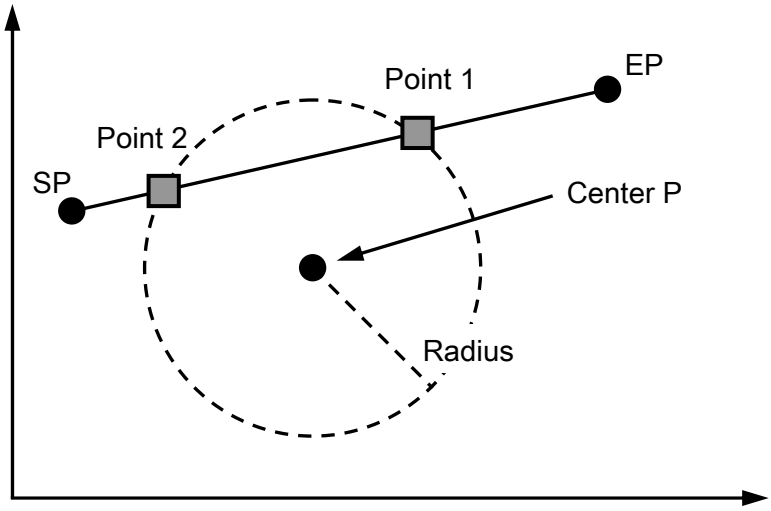


Press [F5] [ENT] to save the coordinates of center point.



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

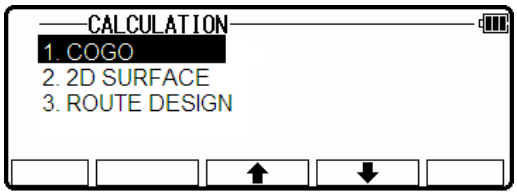
6.1.4 Line-Arc intersection



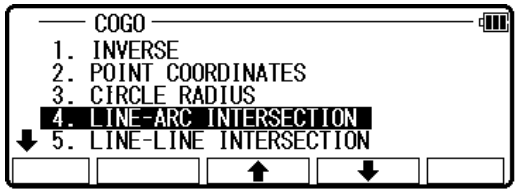
Two intersection points of one line and circle are calculated by this function.
The line is drawn by SP and EP. The circle is drawn by center point and radius.
You can store two possible intersection points.

Input: Line: Start point and End Point
Arc: Center point and Radius
Output: Two possible intersection points

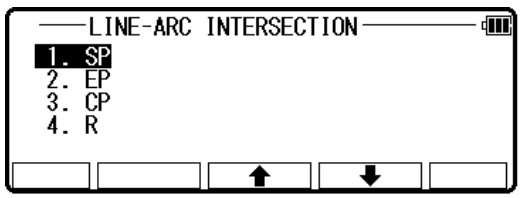
From the LinertecExpress screen, press 4 to view the CALCULATION screen.



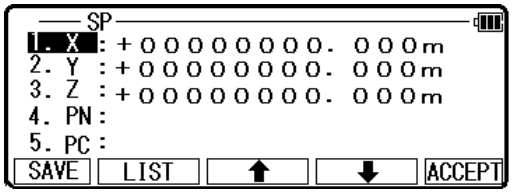
Select 1.COGO and press [ENT] to view the COGO screen.



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

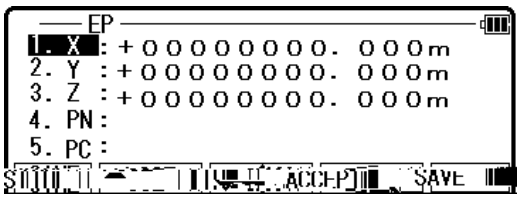


Select 1. SP and press [ENT] to view SP screen.

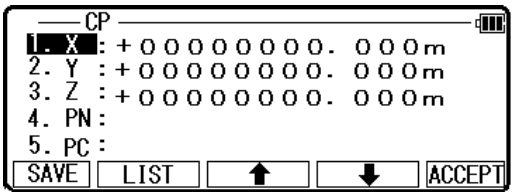


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2] [LIST].

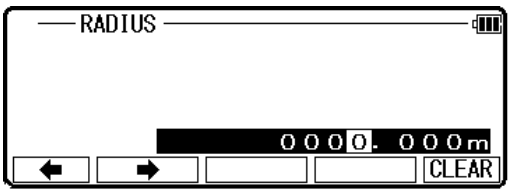
If you finish the input of SP value, press [F5] [ACCEPT].Then you go to EP input screen.



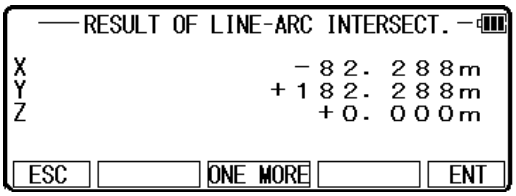
Input EP value like an input of SP.
If you finish an input of EP, press [F5] [ACCEPT].
Then you go to CP input screen.



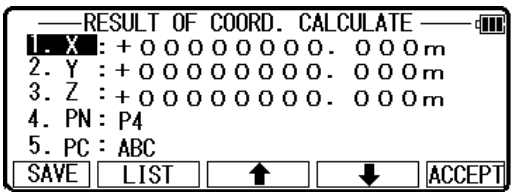
If you finish the input of CP value, press [F5] [ACCEPT].
Then you go to RADIUS input screen.



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].

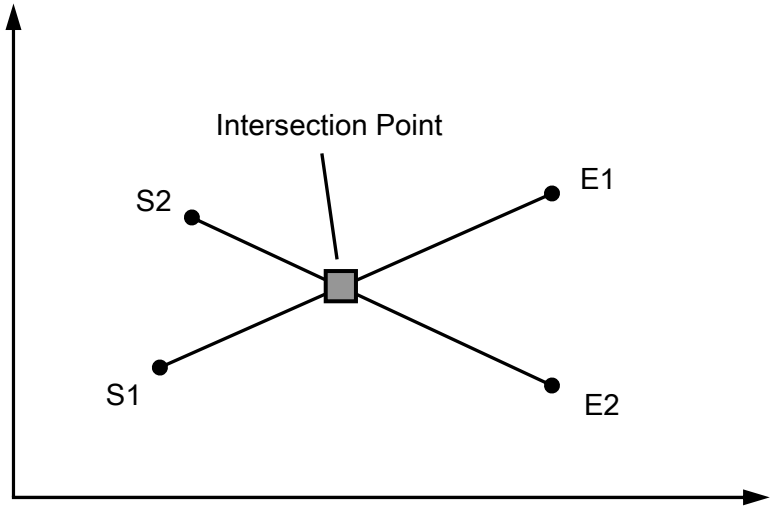


Press [F5] [ENT] to view the RESULT OF LINE-ARC INTERSECT. Screen.



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

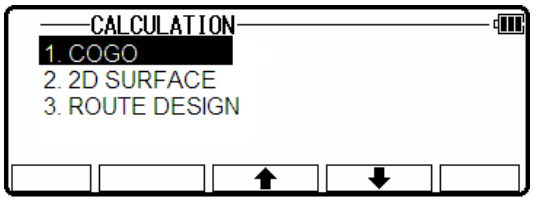
6.1.5 Line-Line intersection



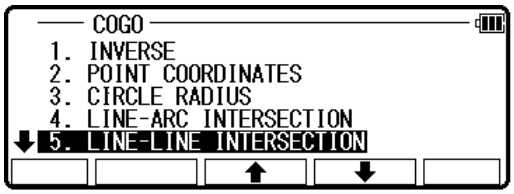
The intersection point of two lines drawn by given four points is calculated by this Function.

Input: First line: S1 (Start point) and E1 (End Point)
Second line: S2 (Start point) and E2 (End Point)
Output: Intersection point between the two lines

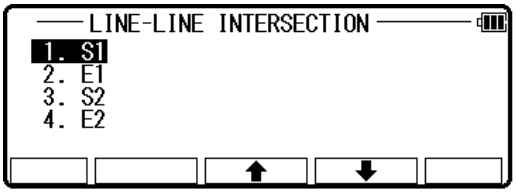
From the LinertecExpress screen, press 4 to view the CALCULATION screen.



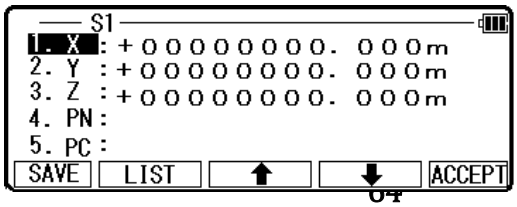
Press 1.COGO to view the COGO screen.



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

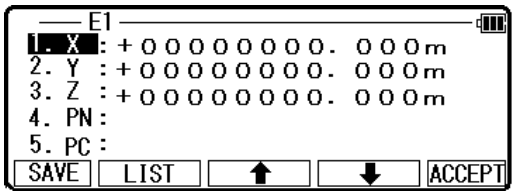


Select 1.S1 and press [ENT] to view S1 screen.
Input PN (Point Name), X, Y, Z, and PC (Point Code) of S1 point or import from the

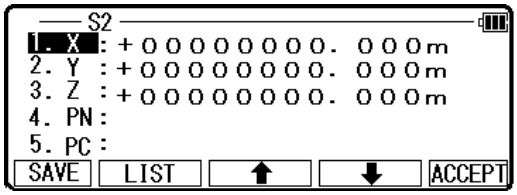


memory of rectangular coordinate as S1 by [F2] [LIST].

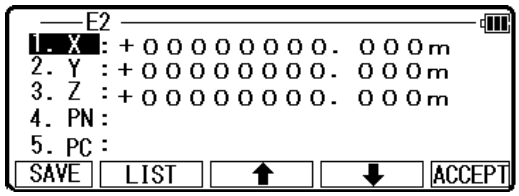
If you finish the input of S1 value, press [F5] [ACCEPT]. Then you go to E1 input screen.



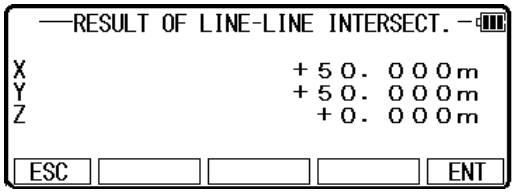
Input E1 value like an input of S1.
If you finish an input of E1, press [F5] [ACCEPT]. Then you go to S2 input screen.



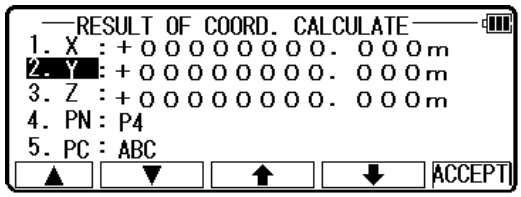
If you finish the input of S2 value, press [F5] [ACCEPT].Then you go to E2 input screen.



If you finish the input of E2, press [ENT]. Then you go to RESULT OF LINE-LINE INTERSECTION screen to confirm the coordinates of the intersection point.

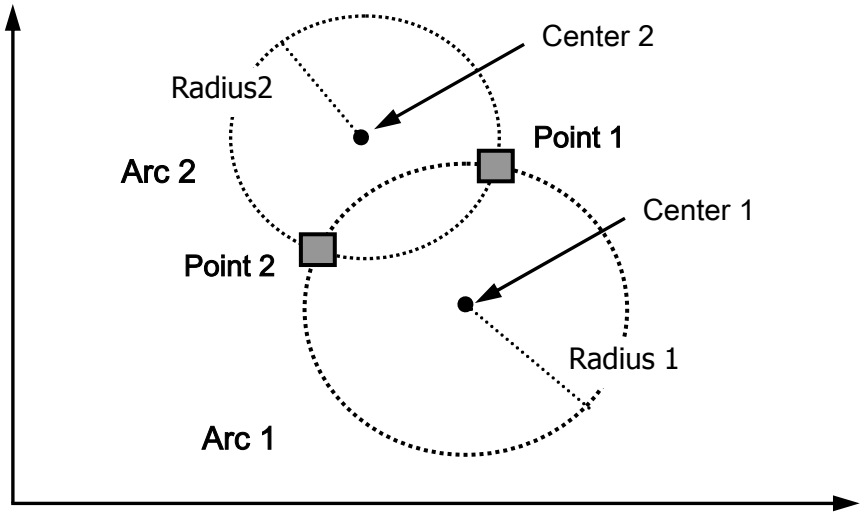


Press [F5] [ACCEPT] to save an intersection point.



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

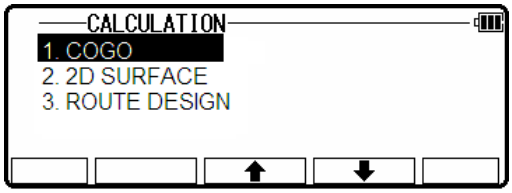
6.1.6 Arc-Arc Intersection



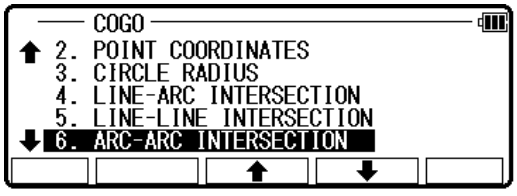
Two intersection points of two arcs drawn by each center point and radius are calculated.
You can store two possible intersection points.

Input: Arc 1: Center point and Radius
Arc 2: Center point and Rradius
Output: Two possible intersection points

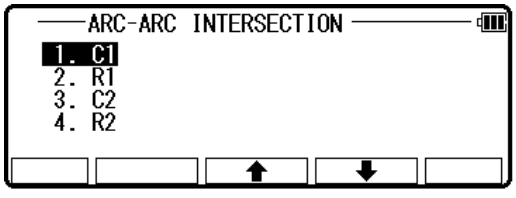
From the LinertecExpress screen, press 4 to view the CALCULATION screen.



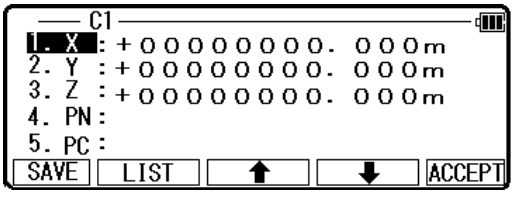
Select 1.COGO and press [ENT] to view the COGO screen.



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

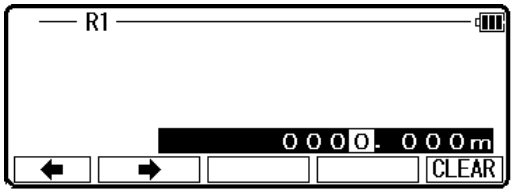


Select 1. C1 and press [ENT] to view C1 screen.

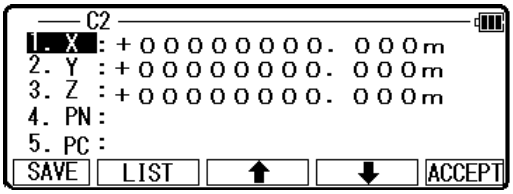


C1 (Center 1) point is Center point of Arc 1.
Input PN (Point Name), X, Y, Z, and PC (Point Code) of C1 point or import from the memory of rectangular coordinate as C1 by [F2] [LIST].

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



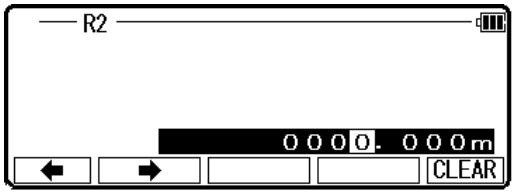
Input the radius of Arc1 as R1 value. If you finish the input of R1, press [ENT].
Then you go to C2 input screen.



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].

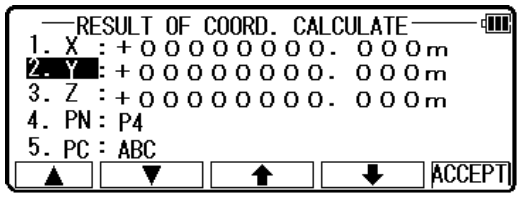
If you finish the input of C2 value, press [F5] [ACCEPT].Then you go to R2 input screen.

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.



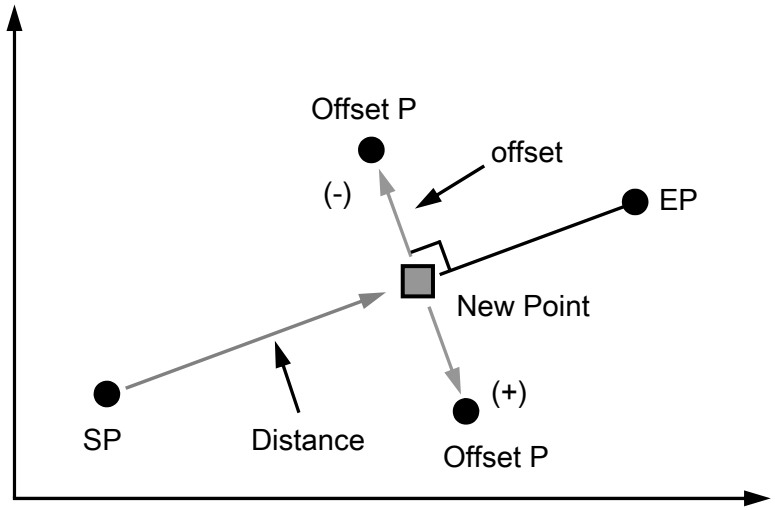
You can see the coordinates of one of intersection point. You can switch to one more intersection point by pressing [F3] [ONE MORE].

Press [F5] [ENT] to save one of 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.

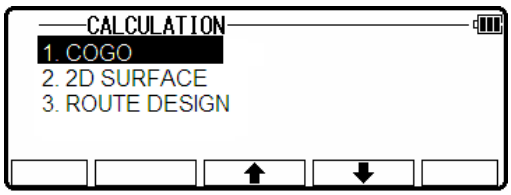
6.1.7 Distance Offset



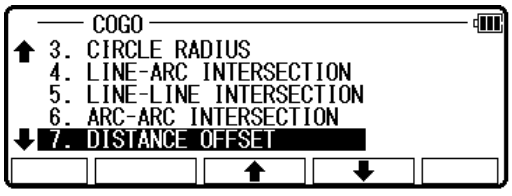
Offset distance of new point to the line and distance of Start point to new point are displayed. Also New Point on the line is calculated by point of start, end, and offset. You can store the New Point.

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

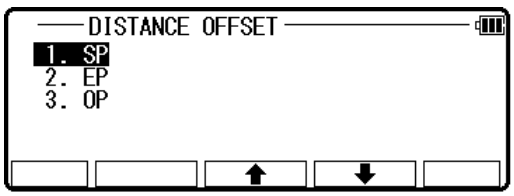
From the LinertecExpress screen, press 4 to view the CALCULATION screen.



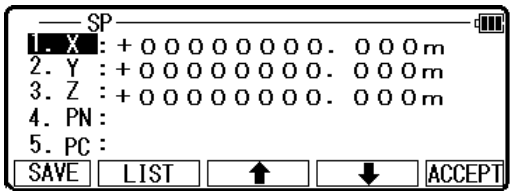
Select 1. COGO and press [ENT] to view the COGO screen.



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

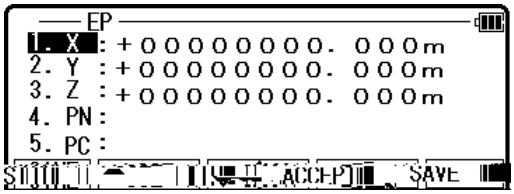


Select 1. SP and press [ENT] to view SP screen.

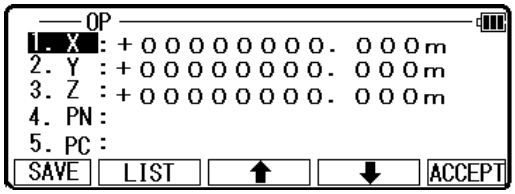


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2] [LIST].

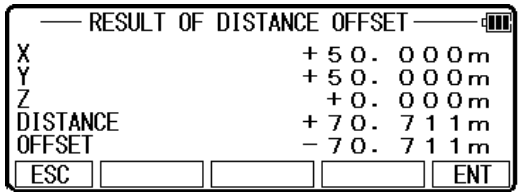
If you finish the input of SP value, press [F5] [ACCEPT].Then you go to EP input screen.



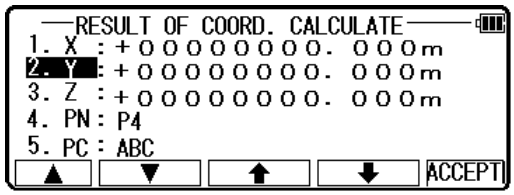
Input EP data like input of SP. If you finish the input of EP, press [F5] [ACCEPT].
Then you go to OP input screen.



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.

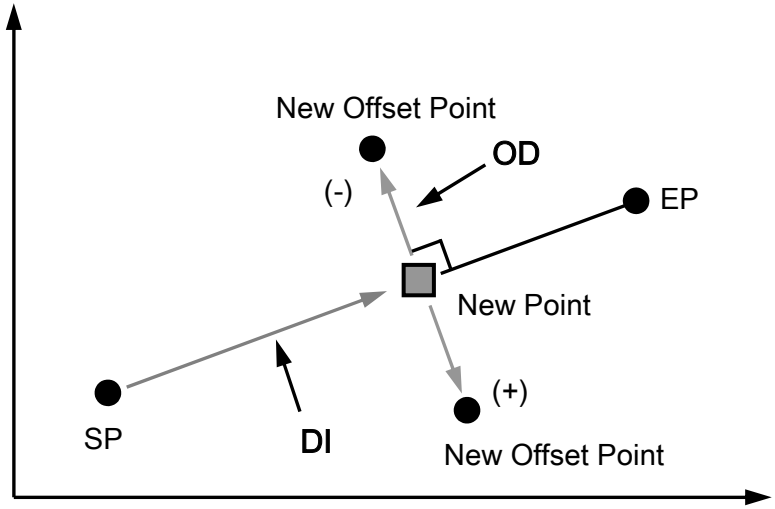


Press [F5] [ENT] to save the coordinates of new point.



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

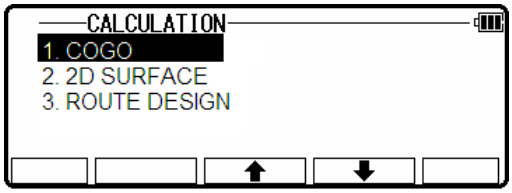
6.1.8 Point Distance Offset



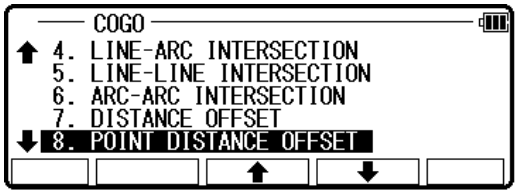
New offset point is calculated by inputting distance from Start point and Offset from line.

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

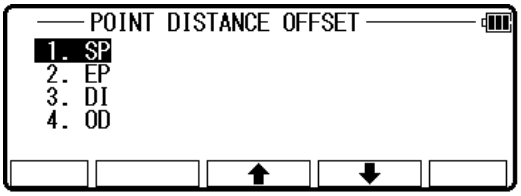
From the LinertecExpress screen, press 4 to view the CALCULATION screen.



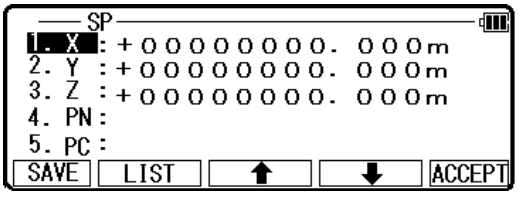
Select 1. COGO and press [ENT] to view the COGO screen.



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

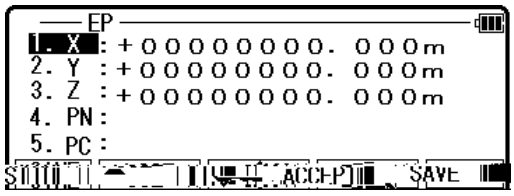


Select 1. SP and press [ENT] to view SP screen.

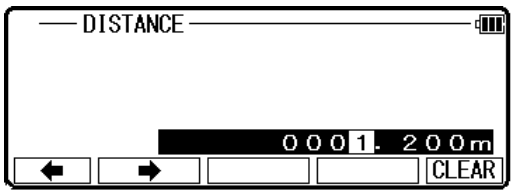


Input PN (Point Name), X, Y, Z, and PC (Point Code) of SP point or import from the memory of rectangular coordinate as SP by [F2] [LIST].

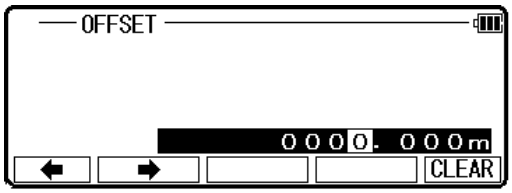
If you finish the input of SP value, press [F5] [ACCEPT].Then you go to EP input screen.



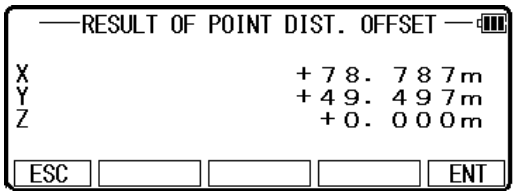
Input EP data like input of SP.
If you finish the input of EP, press [F5] [ACCEPT]. Then you go to DISTANCE input screen.



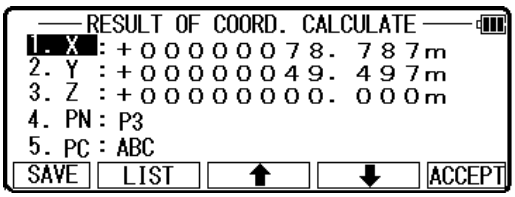
Input DI (Distance from SP to point on the line).
If you finish the input of DI, press [ENT]. Then you go to OFFSET input screen.



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

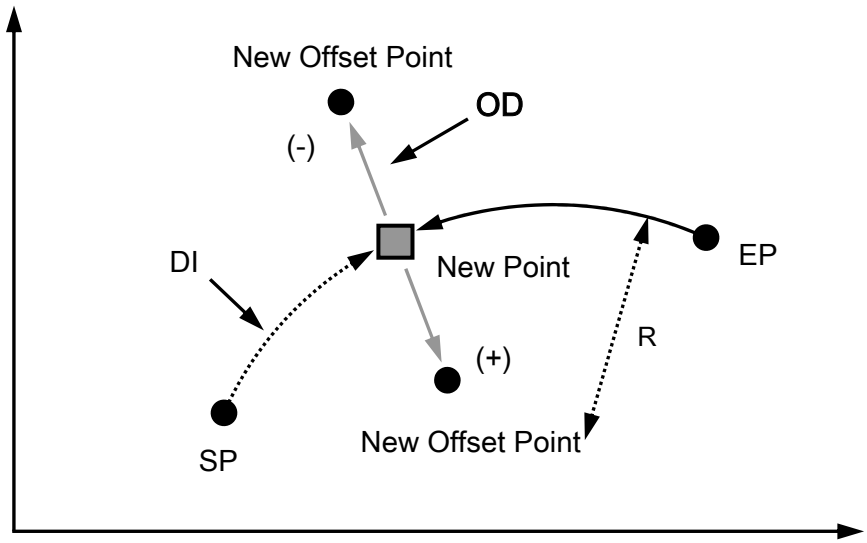


Press [F5] [ACCEPT] to view the RESULT OF COORD. CALCULATE screen.



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

6.1.9 Arc distance offset



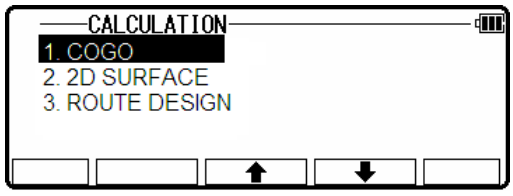
Offset point from the arc is calculated.

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)

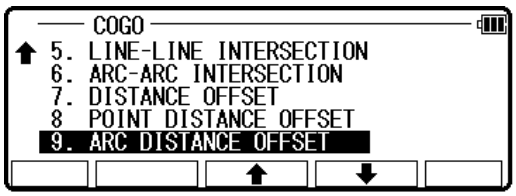
NOTE: From Start point to End Point must be CLOCKWISE. If you calculate by arc of COUNTER CLOCKWISE, change SP for EP and calculate changed DI manually.

Output: new offset point

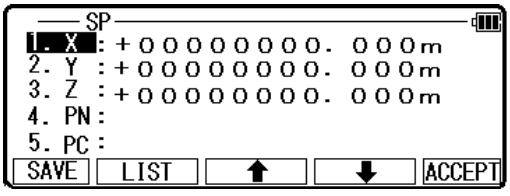
From the LinertecExpress screen, press 4 to view the CALCULATION screen.



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



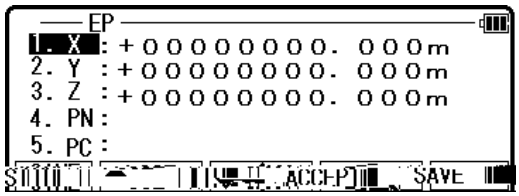
Select the 9. ARC DISTANCE OFFSET and press [ENT] to view ARC DISTANCE OFFSET screen.



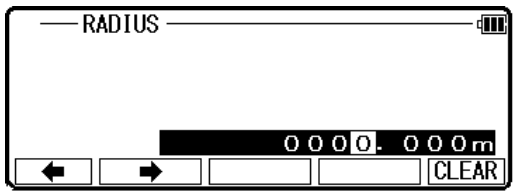
Select 1. SP and press [ENT] to view SP screen.

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].

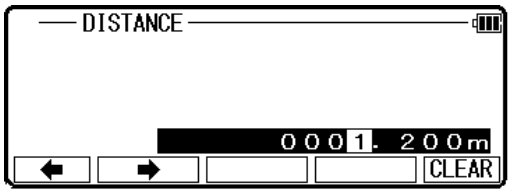
If you finish the input of SP value, press [F5] [ACCEPT]. Then you go to EP input screen.



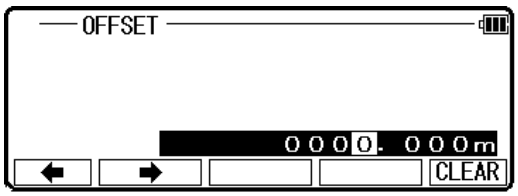
Input EP data like an input of SP.
If you finish input of EP, press [F5] [ACCEPT].
Then you go to RADIUS input screen.



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

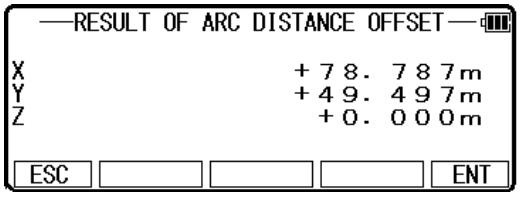


Input DISTANCE (Distance from SP to point on the arc).
If you finish the input of DISTANCE, press [ENT].
Then you go to OFFSET input screen.

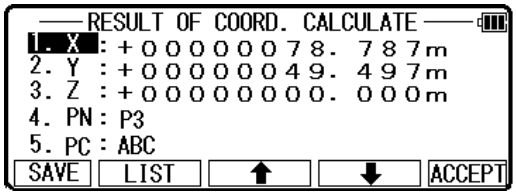


Press [ENT] to view the RESULT OF ARC DISTANCE OFFSET screen. You can see the coordinates of the Offset Point.

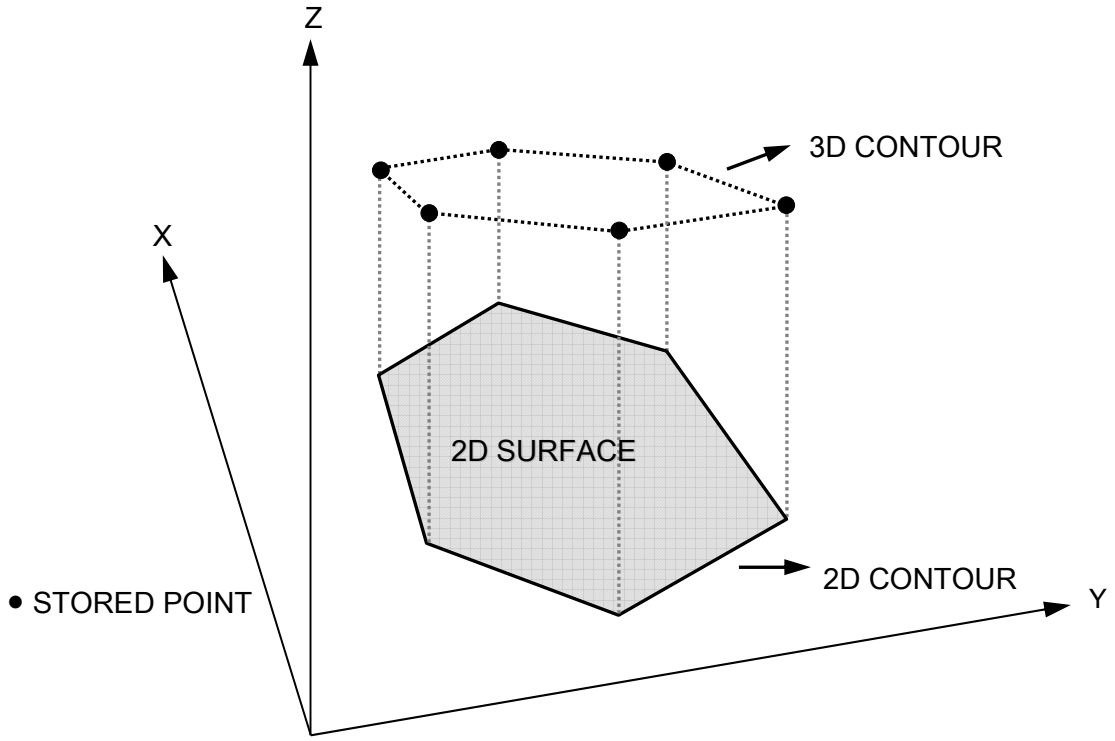
Press [F5] [ACCEPT] to save it。



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



6.2 2D SURFACE



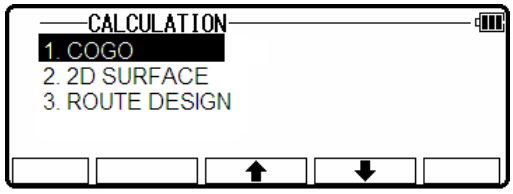
This function calculates the 2D and 3D contour of a polygon and the 2D surface of the area defined by the polygon.
You define the polygon by selecting points and LinertecExpress then calculates contour and 2D surface.

NOTE:
1. The polygon is defined by the points you select. Therefore, the order in which you enter the points 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], the polygon is defined according to the order of your selection.

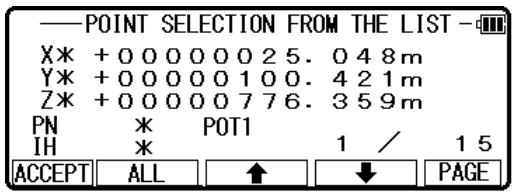
2. You have to select points in such a way that the line segments that define the polygon do not intersect.

3. Selected points should be less than 500 points.

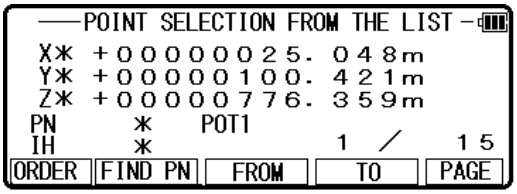
From the LinertecExpress screen, press 4 to view the CALCULATION screen.



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.

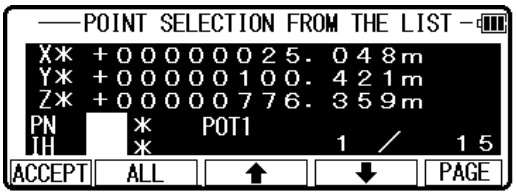


You select the order of points, which define the polygon at this screen.

How to select points of polygon

[ENT] Key：

Move to point selection by [F3] and [F4] arrow keys and press [ENT] to select them one by one, 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 selected points one by one after pressing [ALL].

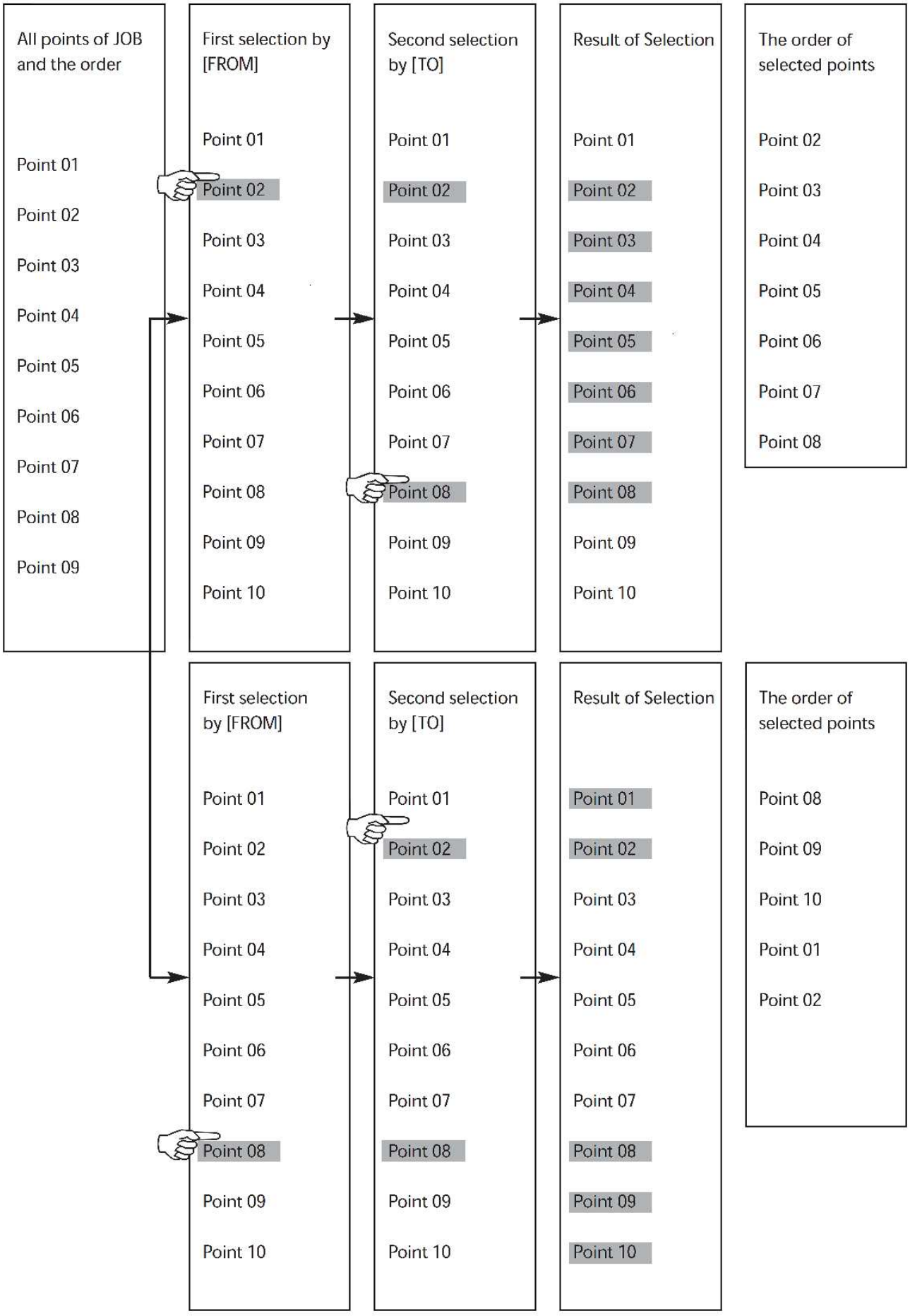


[F2][ALL] Key

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 selected 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.

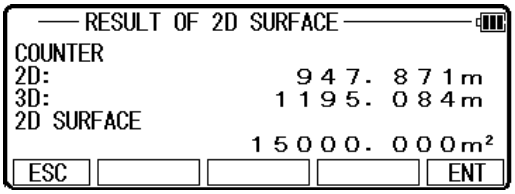
[F3] [FROM] key and [F4] [TO] key

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


All points of JOB and the order
Point 01
Point 02
Point 03
Point 04
Point 05
Point 06
Point 07
Point 08
Point 09
First selection by [FROM]
Point 01
Point 02
Point 03
Point 04
Point 05
Point 06
Point 07
Point 08
Point 09
Point 10
Second selection by [TO]
Point 01
Point 02
Point 03
Point 04
Point 05
Point 06
Point 07
Point 08
Point 09
Point 10
Result of Selection
Point 01
Point 02
Point 03
Point 04
Point 05
Point 06
Point 07
Point 08
Point 09
Point 10
The order of selected points
Point 02
Point 03
Point 04
Point 05
Point 06
Point 07
Point 08
First selection by [FROM]
Point 01
Point 02
Point 03
Point 04
Point 05
Point 06
Point 07
Point 08
Point 09
Point 10
Second selection by [TO]
Point 01
Point 02
Point 03
Point 04
Point 05
Point 06
Point 07
Point 08
Point 09
Point 10
Result of Selection
Point 01
Point 02
Point 03
Point 04
Point 05
Point 06
Point 07
Point 08
Point 09
Point 10
The order of selected points
Point 08
Point 09
Point 10
Point 01
Point 02

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.



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

6.3 ROAD DESIGN

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

WARNING

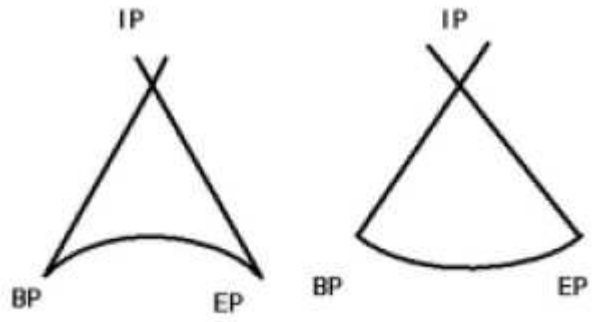
Road csalculation excludes Z coordinate values from the calculation.
Road calculation allows you to calculate up to 1000 points in combination with number peg, plus peg and width peg.
The maxinum number of points that can be processed per route is 1000 points. When making a design for a complex route ghaving many consecutive Ippoints, you may not be able to abtain your desired smooth liner shape if you calculate with an extreme and routh pitch. Also if there is a mistake of inputting coordinates or elements, it may generate the coordinates quite differently from your desired liner shape. To prevent yourself from these, we recommend you to send the generated coordinates to PC and confirm the liner shape on the monitor or printer screen before using.

【Measurement point name to be selected and specified】

Regarding measurement poing name of each coordinate, input alphanumeric character up to three character following the character of BP,IP and EP. When morn than three characters following BP,IP and EP or completely different characters by deleting the initial character and input, it actomatically generates the point name of exsting value.
This will slao happen when you specify a coordinate by researching from the memory

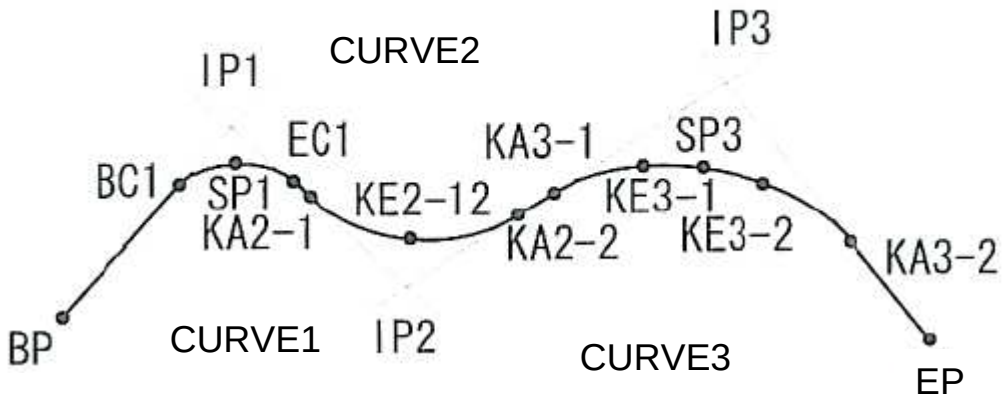
[Generation of measureement point name]
Number part: 3 difits and up to 001—999
Integer part of plus peg:up to 01—99
Width peg: Left width peg is added at the end of measurement point name
Right width peg is added at the end of the measurement point name
NOTE:measurement point name is not processed for the additional distance

[Generation of principal peg to be recorded by calculation and measurement point name]
In case of simple curve:
BC#, EC#, SP#
(# of measurement point name pf 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 rightdrawing can be used, which is called reverse IP or IP curve, Although it can be used with basic design clothoid, raised type clothoid and simple clothoid and simple curve(see left drawing)

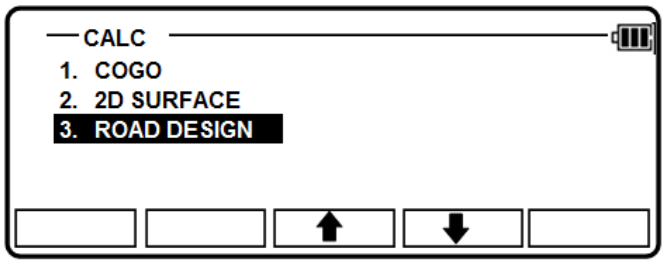
[Terms and curve to be used in Road Design]
BP Begining point of route
IP Intersection point of main tangent
EP End point of route
IA Intersection point of main contact
BC Begining of curve
CL Curve length
KA begining of clothoid curve
KE End of clothoid curve



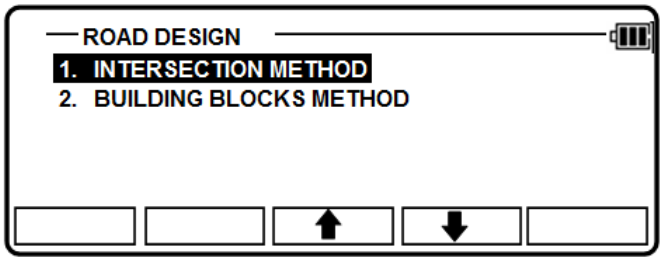
6.3.1 INTERSECTION METHOD

Press 4 calculate at main PowerTopoExpress screen

Seleted 3 Road design and press ENT

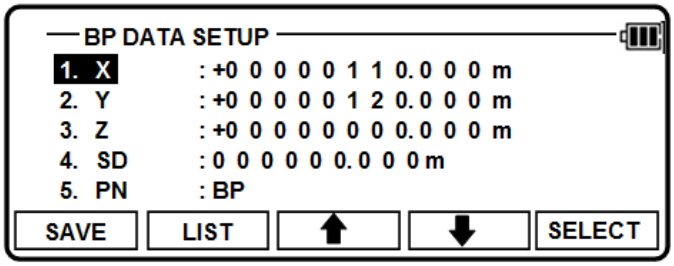


Selected 1 intersection method and pressing ENT
Input BP name with X,Y,Z coordinates or select from the memory.



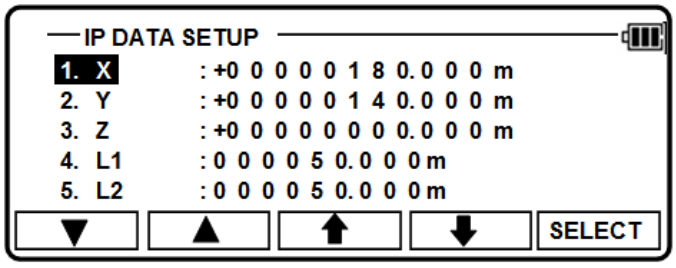
Press ENT to enter BP DATA SETUP screen
Input BP1 name and X,Y,Z coordinates or select from the list.

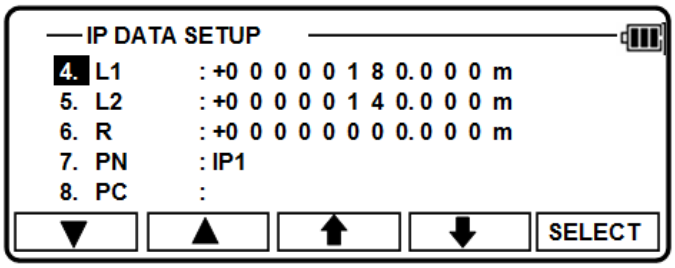
Press SAVE and enter IP DATA SETUP screen.



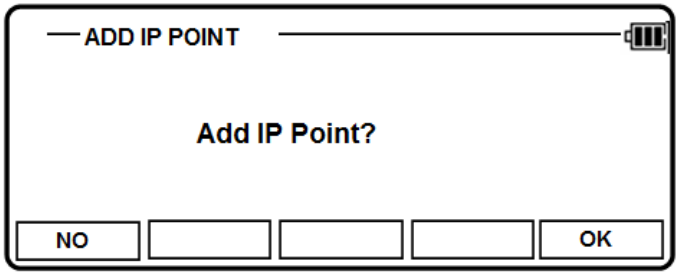
Input IP1 name and X,Y,Z coordinates or select from the list.

Enter L1, L2 and R and press SAVE.

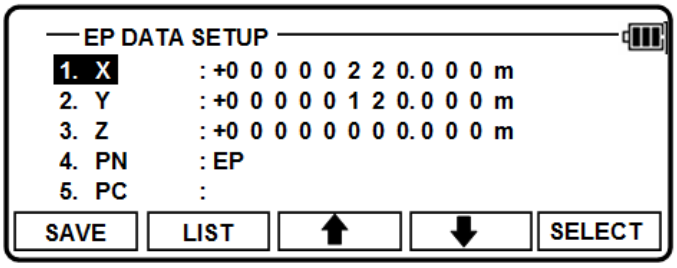




If you need to add another IP point, press OK, If you do not press NO and enter EP DATA SETUP

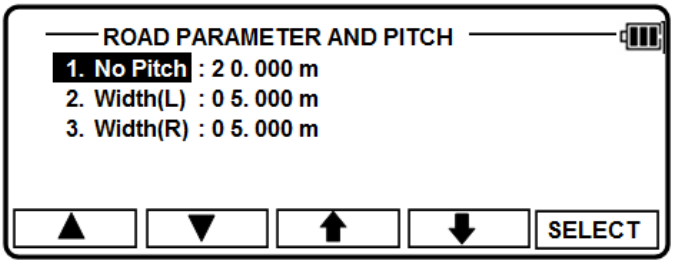


Input EP name and X,Y,Z coordinates or select from the list, and press SAVE.

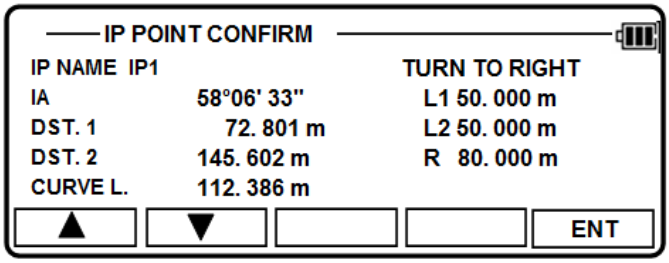


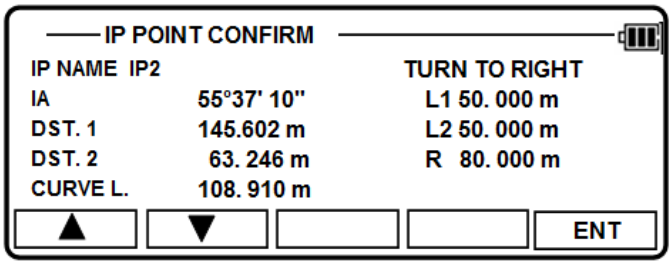
Input EP name and X,Y,Z coordinates or select from the list.
Press ENT to enter into road constant and point distance screen,

Input distance and L/R width.
Press ENT to calculate.
If you press F1 NO, it will return road design mian screen

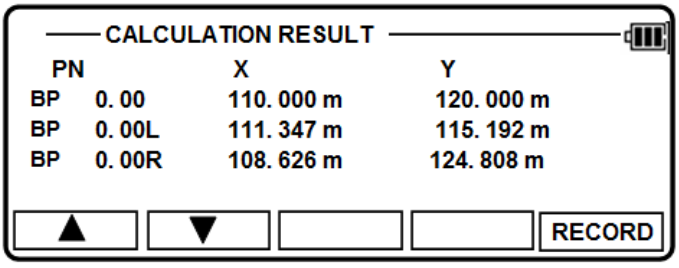


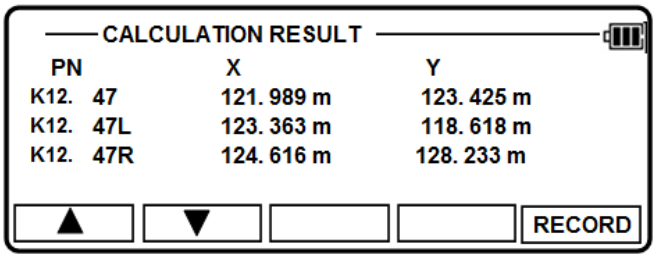
If you press ENT, It will enter into calculate screen.If it have more than one IP, you view them in sequence pressing F1 or F2.



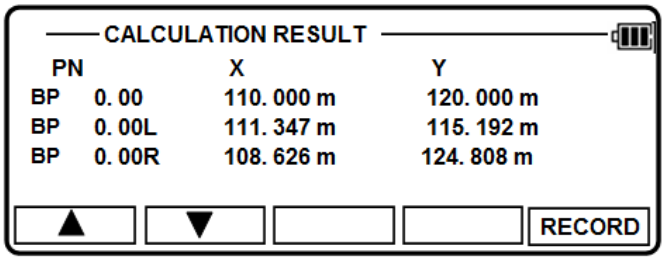


Press F5 to calculate and show the result, and you may view the details by F1 and F2 keys.



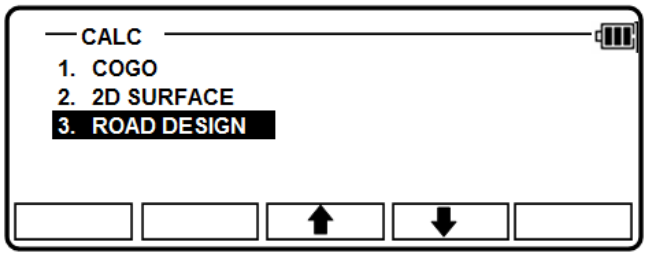


Then press F5 to record the calculated data and return to the main screen.

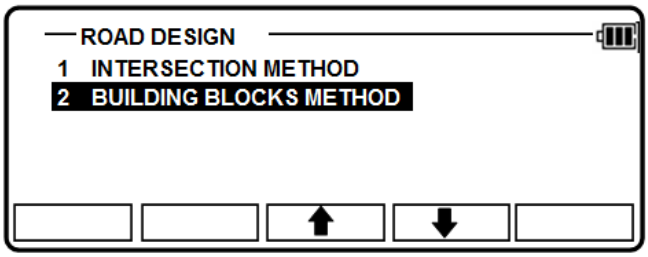


6.3.2 BUILDING BLOCKS METHOD

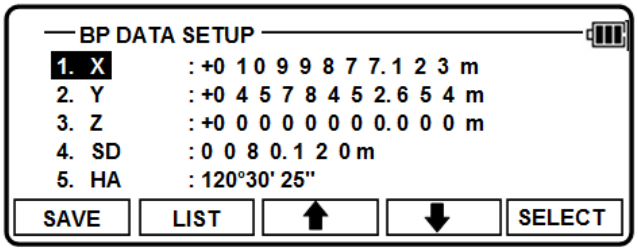
Select 3.ROAD DESIGN and press ENT.



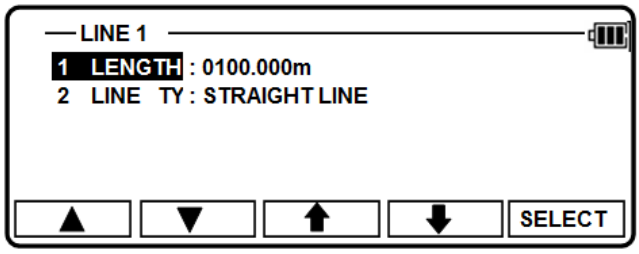
Select 2 BUILDING BLOCKS METHOD and press ENT to enter into SP DATA SETUP screen.



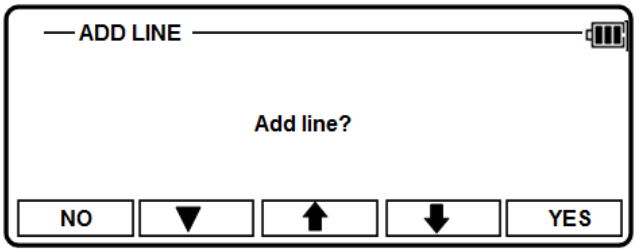
Input BP and press ENT, it will enter into Line 1 input screen.



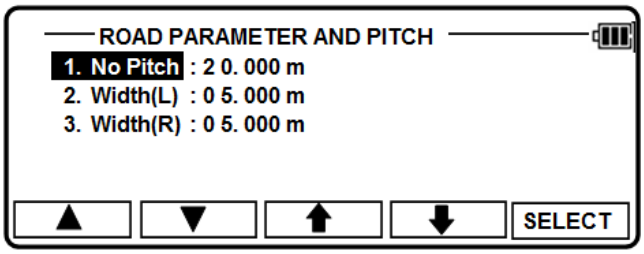
At line 1 screen, we may select straight line, are left, arc roight, clothoid left, and clothoid right five differnet typr lines. After selected, and then press ENT, it will ask you add line?



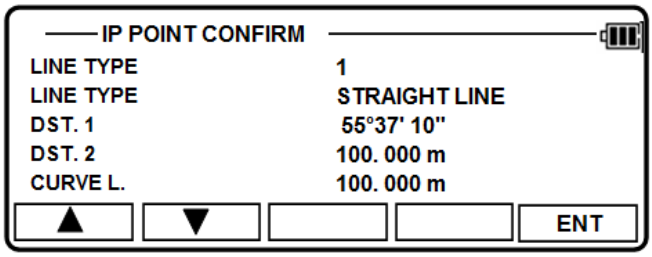
If you press OK, then enter into line 2 screen, if you press No, It will return to ROAD PARAMETER AND PITCH screen.



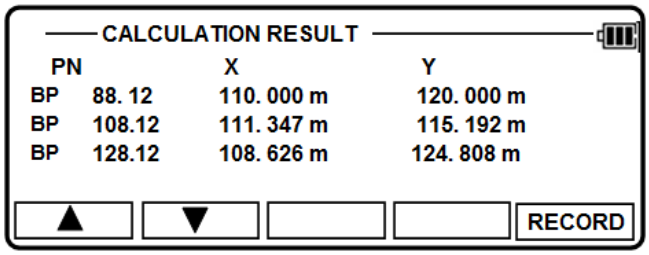
Input the width and pitch, press ENT, it will show line confirm.



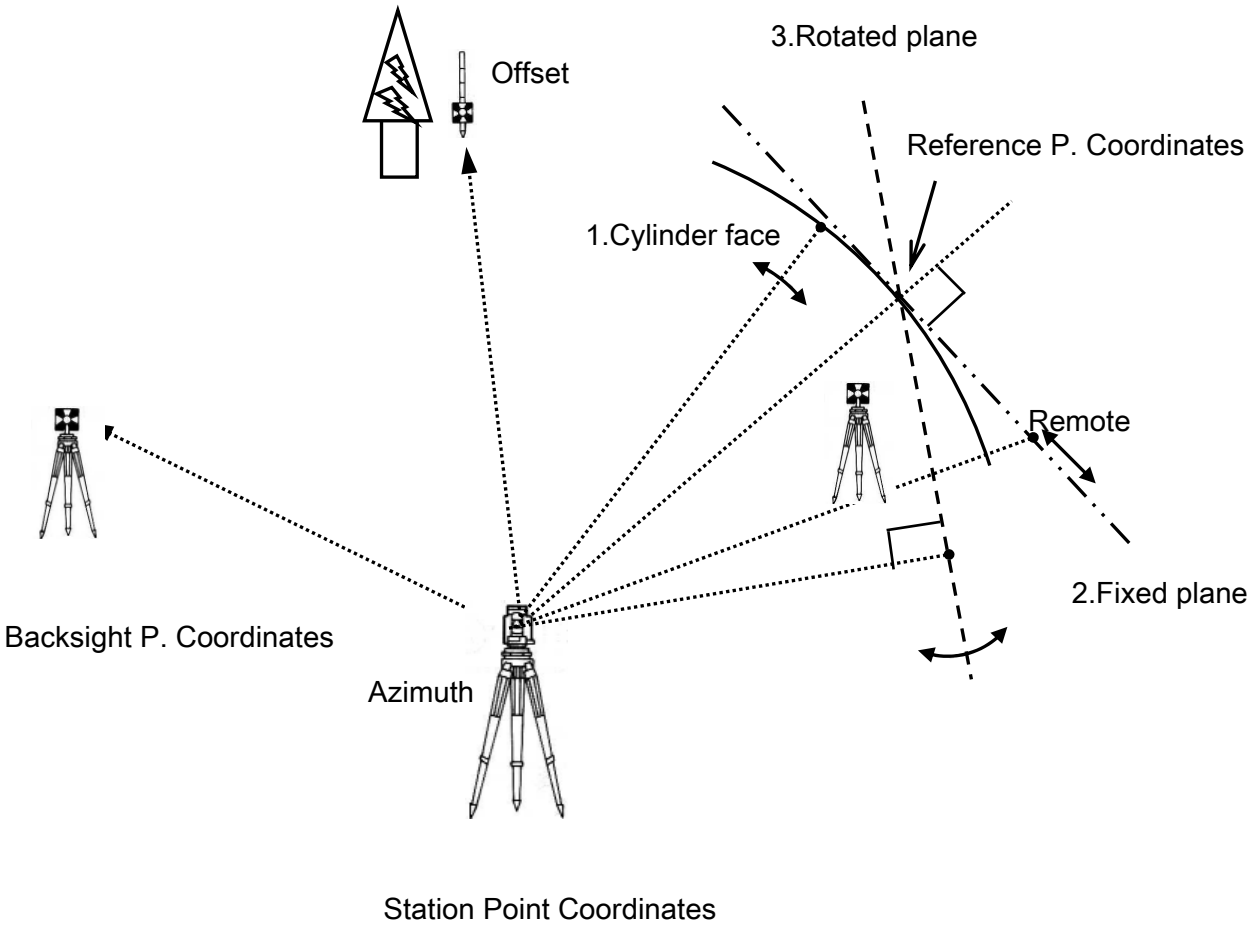
Use up and down key to see the details of each line, press ENT to calculate.



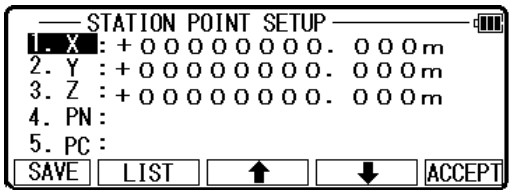
Use to view the results calculated, and Press ENT to record the results.



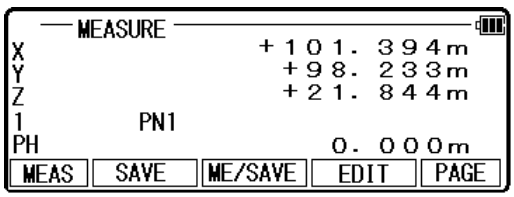
7.MEASURE



7.1 Rectangular Coordinates



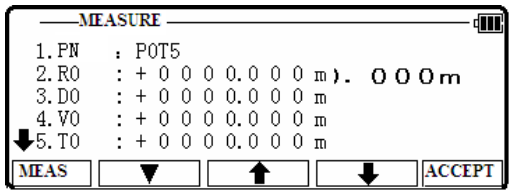
Press 7 [MEAS] of the LINERTEC to view the MEASURE METHOD SELECTION screen. Select 1.RECTANGULAR COORD. and press [ENT] to view the STATION POINT SETUP screen.
Press [F1] [Meas] to measure and display the coordinate.



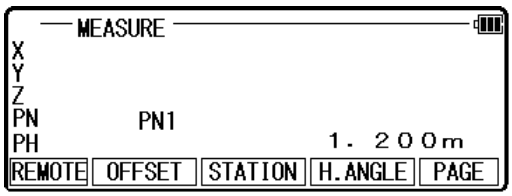
Press[F2] [SAVE] to save it。
Press [F3] [ME/SAVE] to measure and save the measured data.
No survey data is saved when no PN is input.

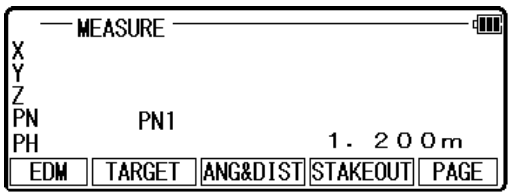
Press [F4] [EDIT] to edit the PN, Point Name, PH, Prism Height and PC, Point Code.
Input your desired Point Name, Prism Height and Point Code.

Press [F5] [ACCEPT] if the current PN, PH and PC are acceptable.
If Point Code exists, you can easily select them from the list or edit one of them after pressing [ENT]. For using Point Code List, please refer to “8.3.1 Point Code”.

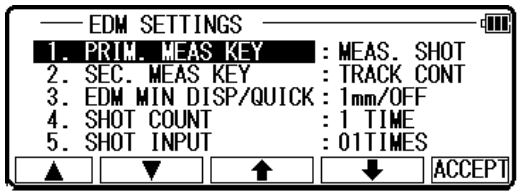


Press [F5] [PAGE] to view another menu.



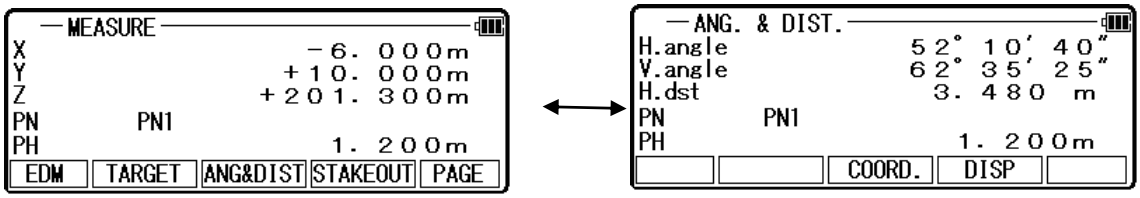


Press [F3] STATION can alter the station information, please refer to 9.1.
EDM settings can be selected by pressing [F1] [EDM].
For example, change 1.PRIM. MEAS KEY (MEAS) to TRACK SHOT or TRACK CONT if you want to use tracking measurement with primary MEAS key (MEAS).



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

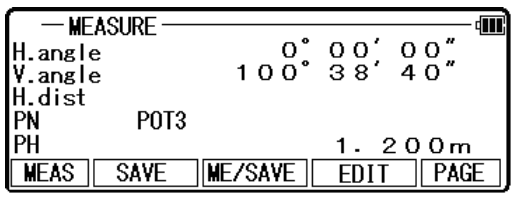
Coordinates display and Angle & Distance display
1) Press [F5] [PAGE] twice to view [F3] [ANG & DIST].
2) Press [F3] [ANG & DIST] to view [F3] [COORD.] and Angle and Distance values.
3) Press [F3] [COORD.] to view [F3] [ANG&DIST] and Coordinates.

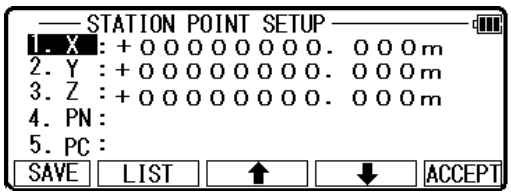


Stake Out can be selected by pressing [F4] [STAKEOUT].

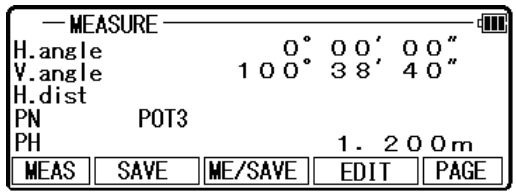
7.2 Polar Coordinates

Press 7 [MEAS] of the LINERTEC to view the MEASURE METHOD SELECTION screen. Select 2. POLAR COORD. and press [ENT] to view the STATION POINT SETUP screen.

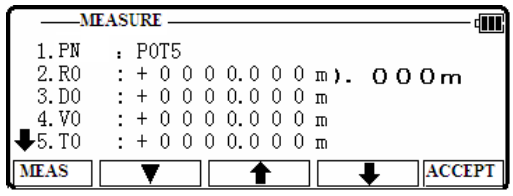




Press [F1] [Meas] to measure and display the coordinate.



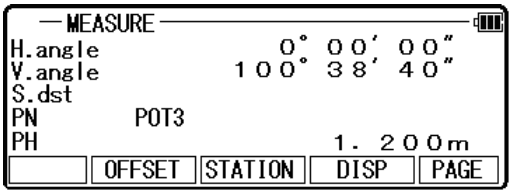
Press [F2] [SAVE] to save the measured data.
Press [F3] [ME/SAVE] to measure and save the measured data.
No survey data is saved when no PN is input.

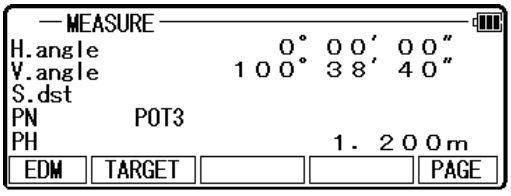


Press [F4] [EDIT] to edit the PN, Point Name, PH, Prism Height and PC, Point Code.
Press [ENT] to view each input window by pressing up or down arrow key, and input your desired point name or prism height or point code.
Press [F5] [ACCEPT] if the current PN, PH and PC are acceptable.

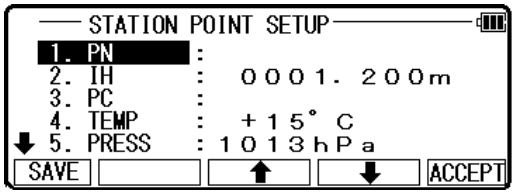
PC, Point Code:
Press [ENT] to view and input the PC, Point Code, screen.
If Point Code exists, you can easily select them from the list or edit one of them after pressing the [ENT]. For using PointCodeList, please refer to“10.3.2 Point Code”.

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





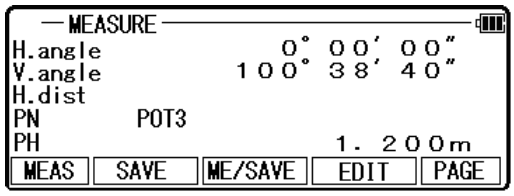
Station point setup can be changed by pressing [F3] [STATION].



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).

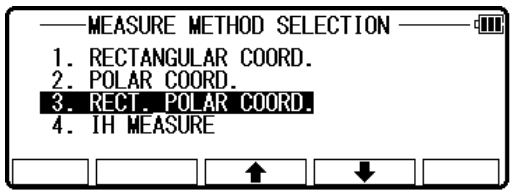
The target type can be selected by pressing [F2] [TARGET].

7.3 Rectangular & Polar Coordinates

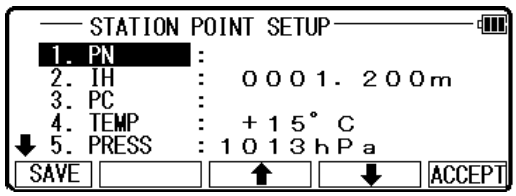


Rectangular Data and Polar Data can be stored at the same time in this function.

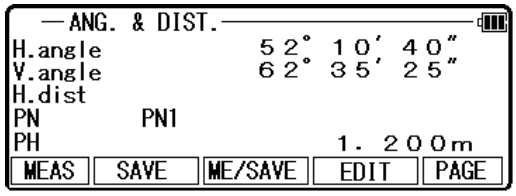
Press 7 [MEAS] of the LINERTEC and press [ENT]to view the MEASURE METHOD SELECTION screen.



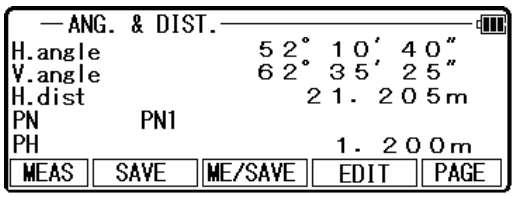
Select 3. RECT._POLAR COORD. and press [ENT] to view the STATION POINT SETUP screen.
"MEASURE" and "ANG.& DIST" will display, you can set one for preference in selecting "5. SETUP" of the FUNCTION SETTING.
More details,please refer to"5.5.11 Meas. DISP".



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

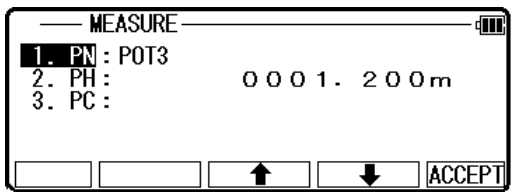


Press [F1] [MEAS] to measure the Distance and display the Coordinates.



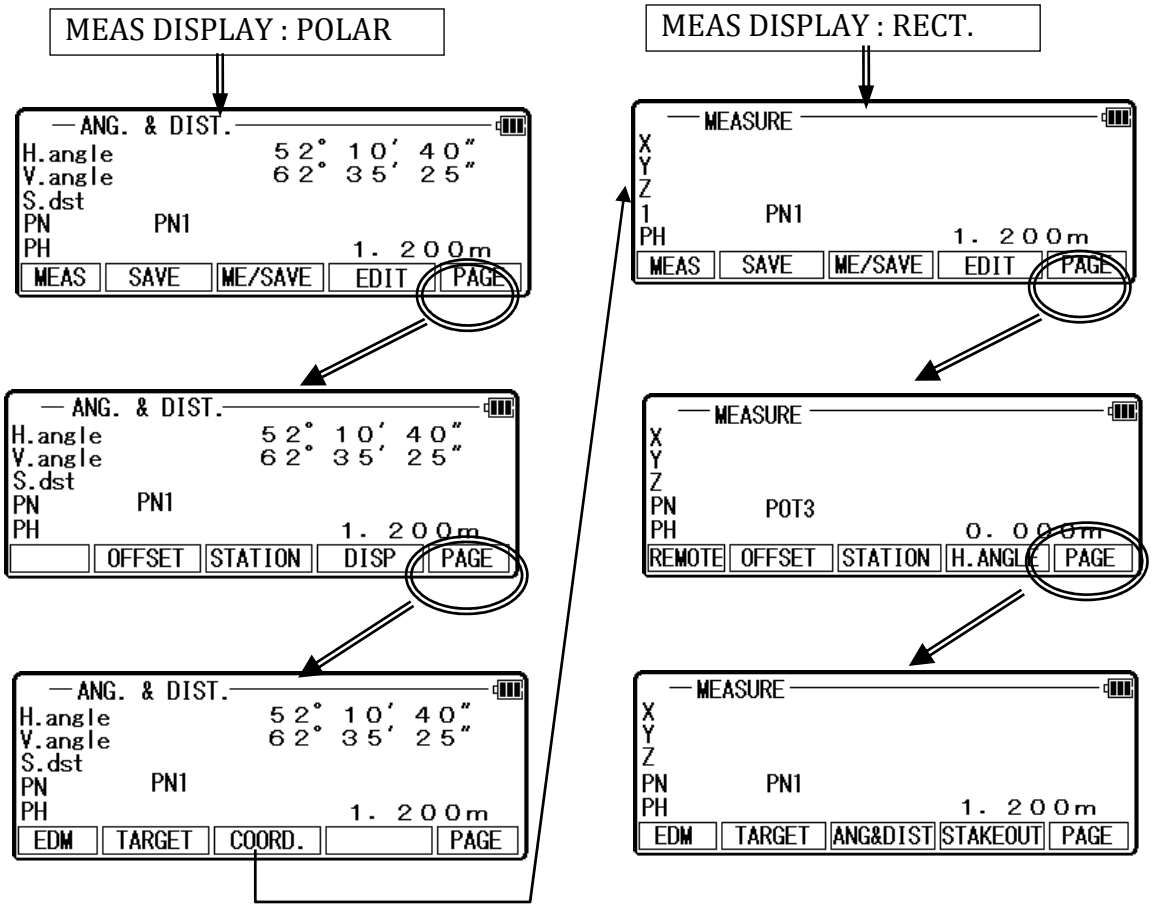
Press [F2] [SAVE] to save the measured data.
Press [F3] [ME/SAVE] to measure and save the measured data.
No survey data is saved when no PN is input.
Rectangular Data and Polar Data are saved with the same Point Name in the same Job File.

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.

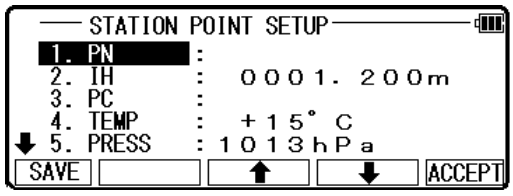


PC, Point Code:
Press [ENT] to view and input the PC, Point code, screen.
If Point Code exists, you can easily select them from the list or edit one of them after pressing [ENT]. For using PointCodeList, please refer to"10.3.2 Point Code".

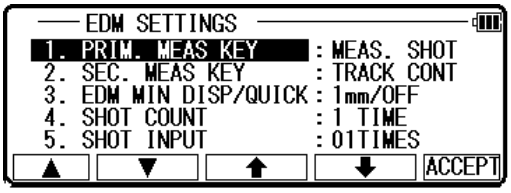
Pressing [F5][PAGE] switches the screen as follows;



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



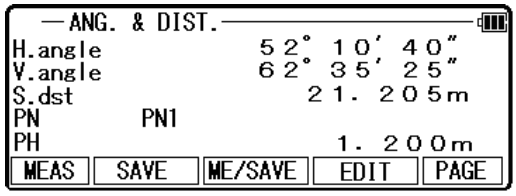
EDM settings can be selected by pressing [F1] [EDM].
For example, change 1.PRIM. MEAS KEY (MEAS) to TRACK SHOT or TRACK CONT if you want to use tracking measurement with PRIM MEAS KEY (MEAS).



The target type can be selected by pressing [F2] [TARGET].
Coordinates display and Angle & Distance display

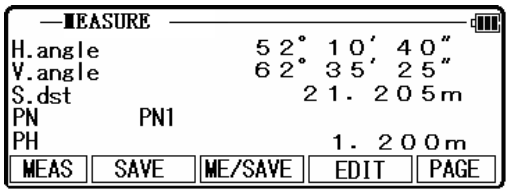
1) Press [F5] [PAGE] twice.
2) Press [F3] [ANG & DIST] to view [F3] [COORD.] and Angle and Distance values.
3) Press [F3] [COORD.] to view [F3] [ANG&DIST] and Coordinates.

Function of ANG. & DIST screen
Pressing [F4] [DISP] changes the distance data to be displayed.



Function of measure screen

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

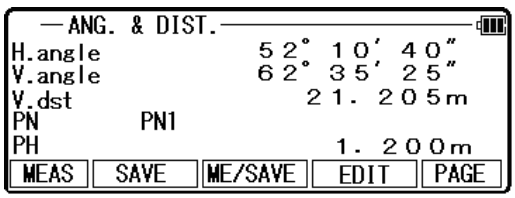


The displayed Coordinates automatically change according to your aiming point.
The Remote is a function of, so to speak, “Real-time offset”. If a reference point or offset point is measured, the Coordinates of your aiming point are calculated based on the reference plane.
There are three calculation methods: Cylindrical face, Fixed plane and Rotated plane. They are selected by “Preference”. Refer to “5.5.5 Remote method selection”.
The calculations are performed on the virtual planes.

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

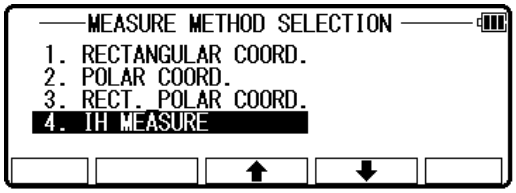
Press [F4] [H.ANGLE] to display STATION POINT H. ANGLE SETUP (Refer to “11.1.3 Station Orientation”)

Stake Out can be selected by pressing [F4][STAKEOUT].

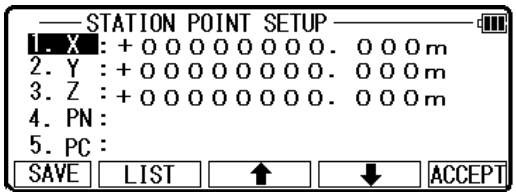


7.4 IH measurement

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

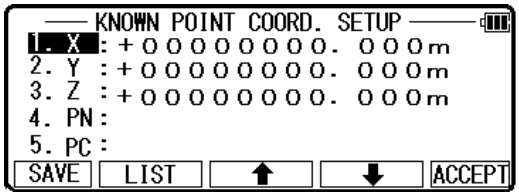


Press 7 [MEAS] of the LINERTEC and press [ENT]to view the MEASURE METHOD SELECTION screen.

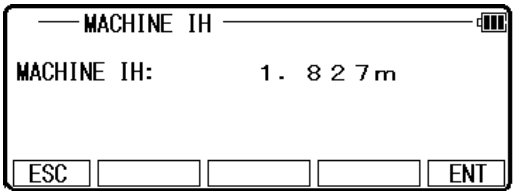


Select 4.IH MEASURE and press [ENT] to view the STATION POINT SETUP screen.

Press [ENT] to open the PN, X, Y, and Z input window and input each.
Then, press [F5] [ACCEPT] to view the KNOWN POINT COORD. SETUP 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]

Caution

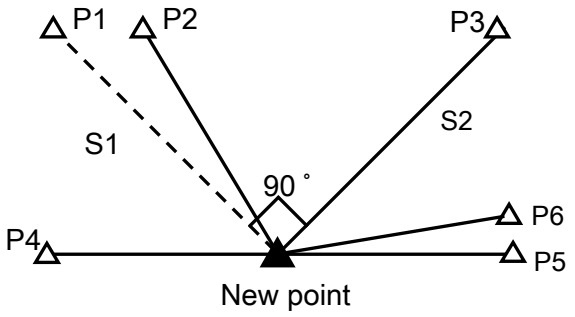


FIG 1

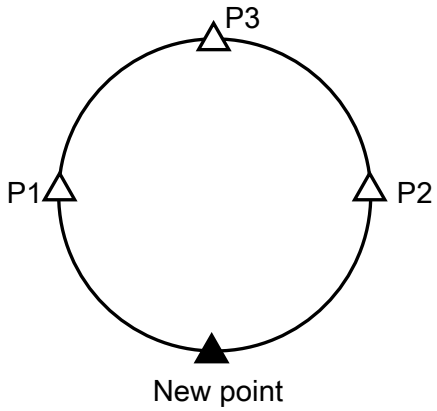


FIG 2

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.

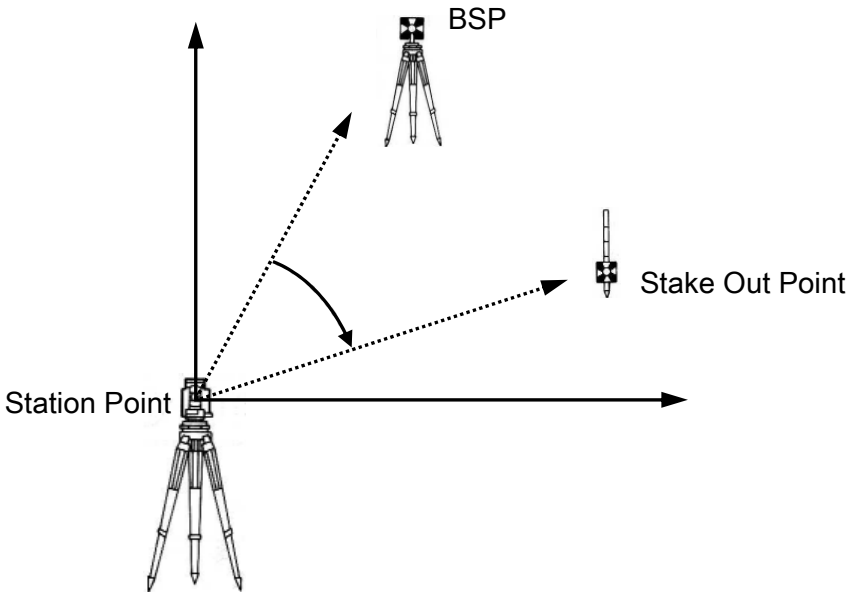
4) A new point (station point) and three or more known points are arranged on the same circumference. See above Fig. 2.

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.

8. STAKE OUT

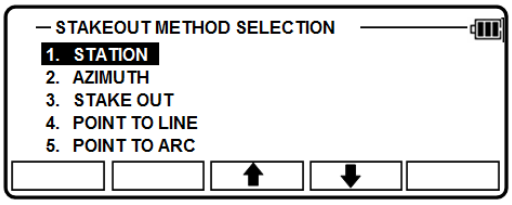
From the known Station Point and Direction Angle, the Coordinates for the Stake Out are obtained.

8.1 Stake Out

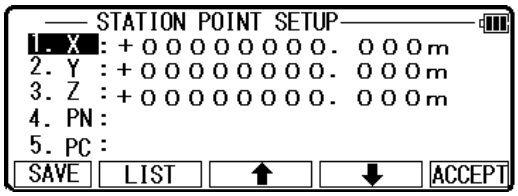


Press [F4] [S. FUNC] of the LinertecExpress screen to view the"LINERTEC Special Func." screen.
Select "6.STAK" and press［ENT］ or [select] to view the "STAKEOUT METHOD SELECTION" screen.

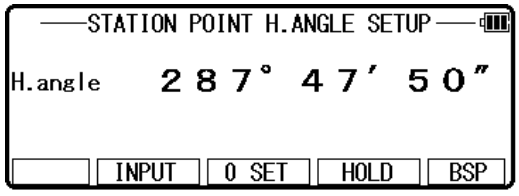
Select 1. STATION and press [ENT] to input the IH, press [ENT] to view the STATION POINT SETUP screen.



Input IH and open the STATION POINT SETUP Screen and input PN, X, Y, Z, and PC or select from the list. Save the data by pressing [F1] [SAVE].

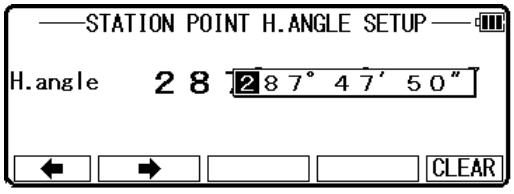


It takes you to view STATION POINT H.ANGLE SETUP screen.

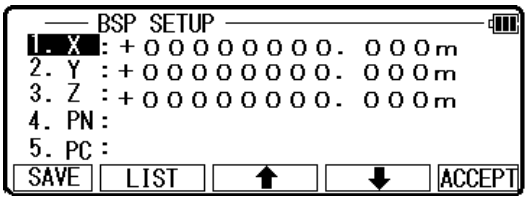


Input the H. angle by pressing [F2] [INPUT], [F3] [0SET] and [F4] [HOLD] or Backsight Coordinates by pressing [F5] [BSP].

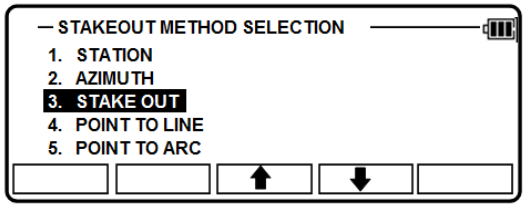
Pressing [F2] [INPUT]
Input any horizontal angle.



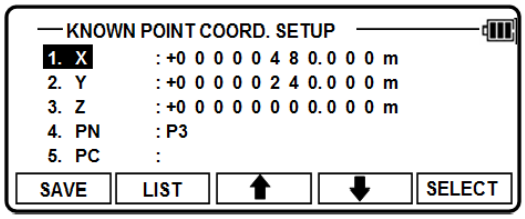
Pressing [F5] [BSP]
The information for Back Sight Point is obtained.
Press [ENT] to finalize the input.
Aim Reference Point , then press [ENT] to enter STAKEOUT COORD.SETUP screen.



Press [ENT] to enter STAKEOUT COORD.SETUP screen.



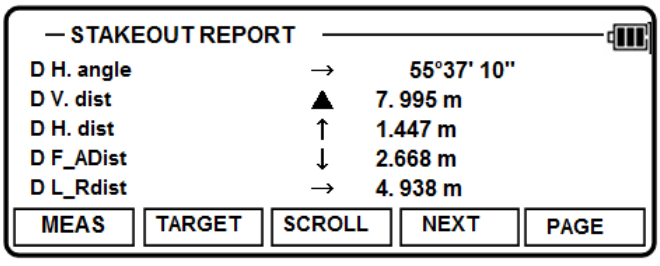
Input PH and open the KNOWN POINT COORD. SETUP Screen. Input PN, X, Y, Z, and PC.



Save the data by pressing [F1] [SAVE].
open the STAKEOUT REPORT screen.

Aim at the target and press the [F1] [MEAS] to begin the Stake Out.
Deviation of each value is displayed.

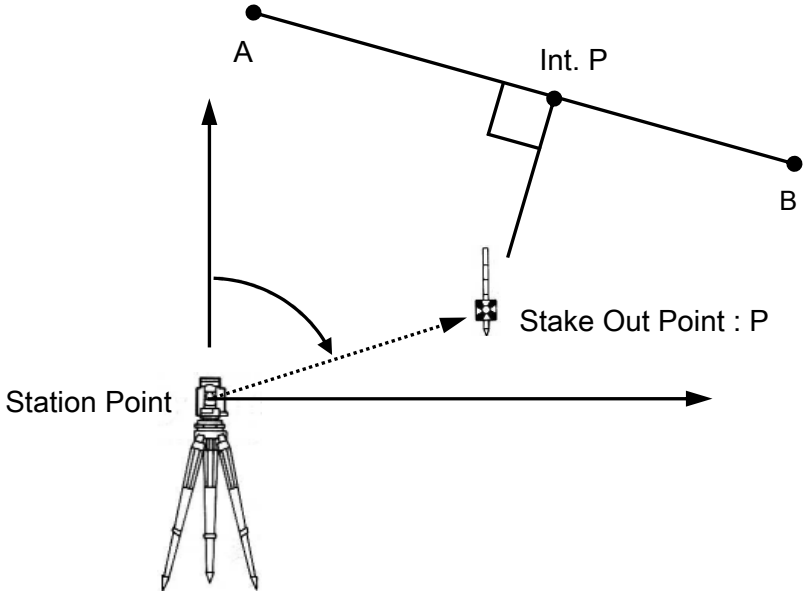
.



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

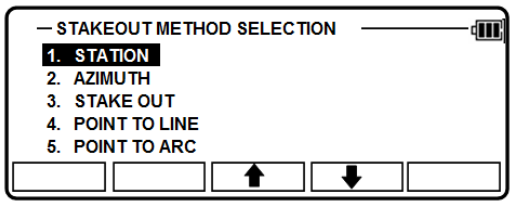
Press [ENT] or [ESC] to return STAKEOUT screen.

8.2 Point to Line

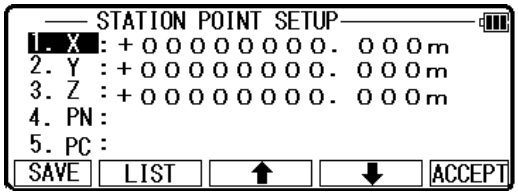


You have to select the point A and B. The distance between the two points A and B has to be at least 1m. The two points A and B define a line and during Stake Out.

Select 1. STATION and press [ENT] to input the IH, press [ENT] to view the STATION POINT SETUP screen.

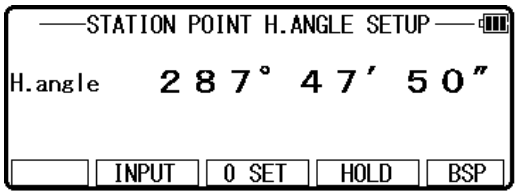


Input IH and open the STATION POINT SETUP Screen and input PN, X, Y, Z, and PC or select from the list. Save the data by pressing [F1] [SAVE].

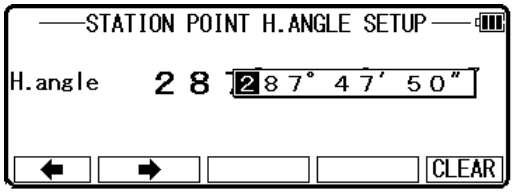


It takes you to view STATION POINT H.ANGLE SETUP screen.

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



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



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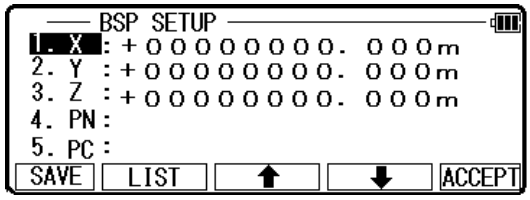
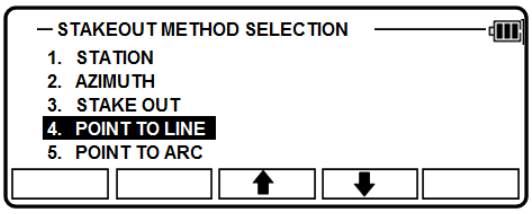
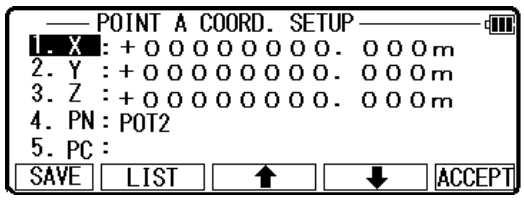
Pressing [F5] [BSP]
The information for Back Sight Point is obtained.
Press [ENT] to finalize the input.
Aim Reference Point , then press [ENT] to enter STAKEOUT COORD.SETUP screen



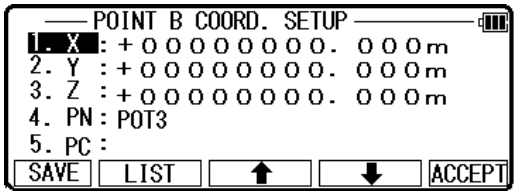
Press ENT to enterPOINT A COORD. SETUP screen.



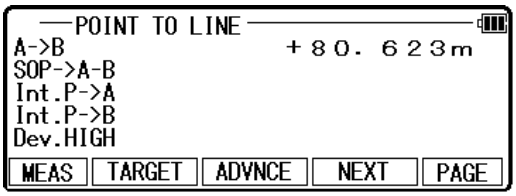
Input PH and open the POINT A COORD. SETUP Screen. Input PN, X, Y, Z, and PC and press ENT.



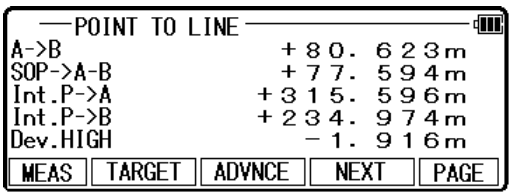
Input PH and open the POINT B COORD. SETUP Screen. Input PN, X, Y, Z, and PC and press ENT.



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



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



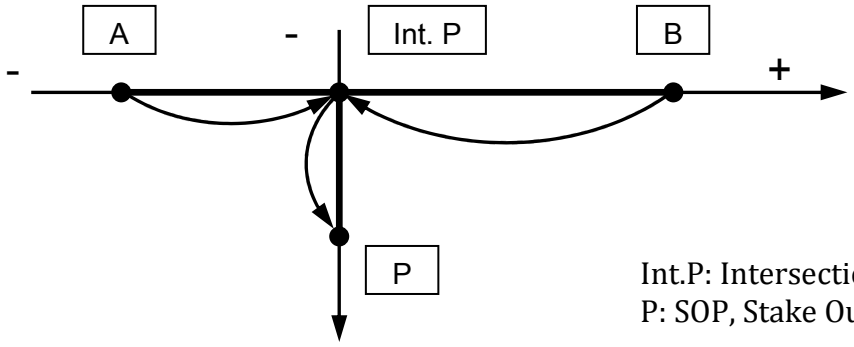
A -> B Distance between Point A and B. This is always positive.

P -> A - B Distance between Int. P and P.
If P is on the right side of A-B, the value is positive
if P is on the left side of A-B, the value is negative.

In case of the below drawing, P is on the right side for A-B ,
P->A-B is negative.

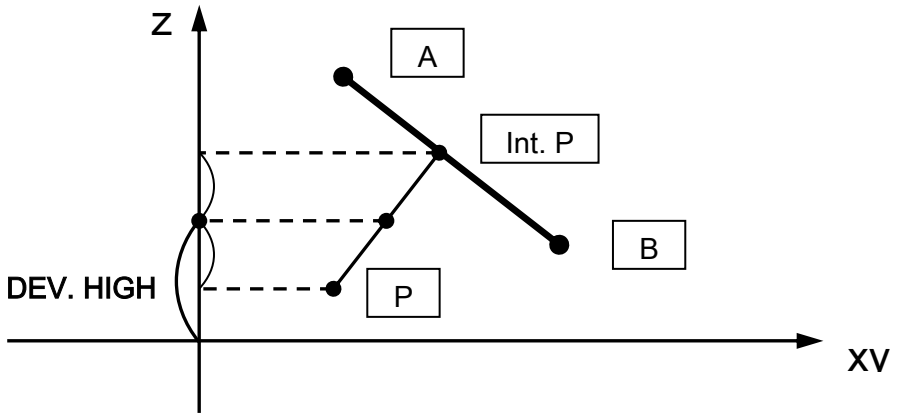
Int. P -> A Distance between Int. P and A. This is positive or negative.
If A-Int.P and A-B is are in the same direction, Int.P->A is positive.
In case of the below drawing, since A-B and A-Int.P are in the same direction, Int.P->A is negative

Int. P -> B Distance between Int. P and B. This is positive or negative.
If B-Int.P and A-B is are in the same direction, Int.P->B is positive.
In case of the below drawing, A-B is opposite direction to B-Int.P,
Int.P->B is negative.

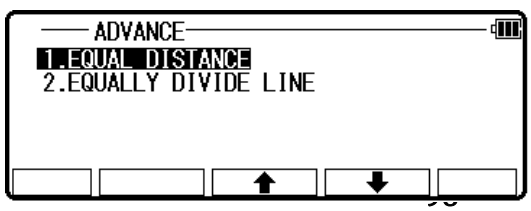


Int.P: Intersection Point
P: SOP, Stake Out Point

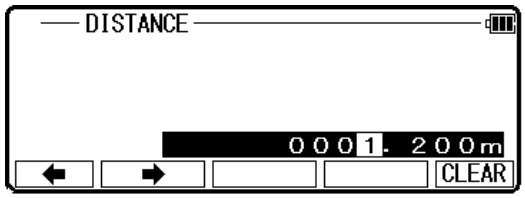
Dev. HIGH Int.P and P is the deviation of the z coordinate.



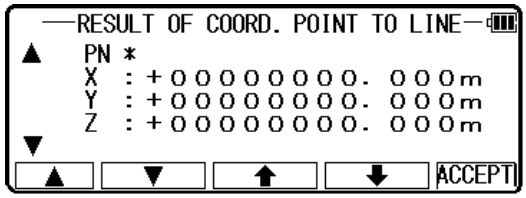
Press [F3] [ADVANCE] to display the ADVANCE screen.



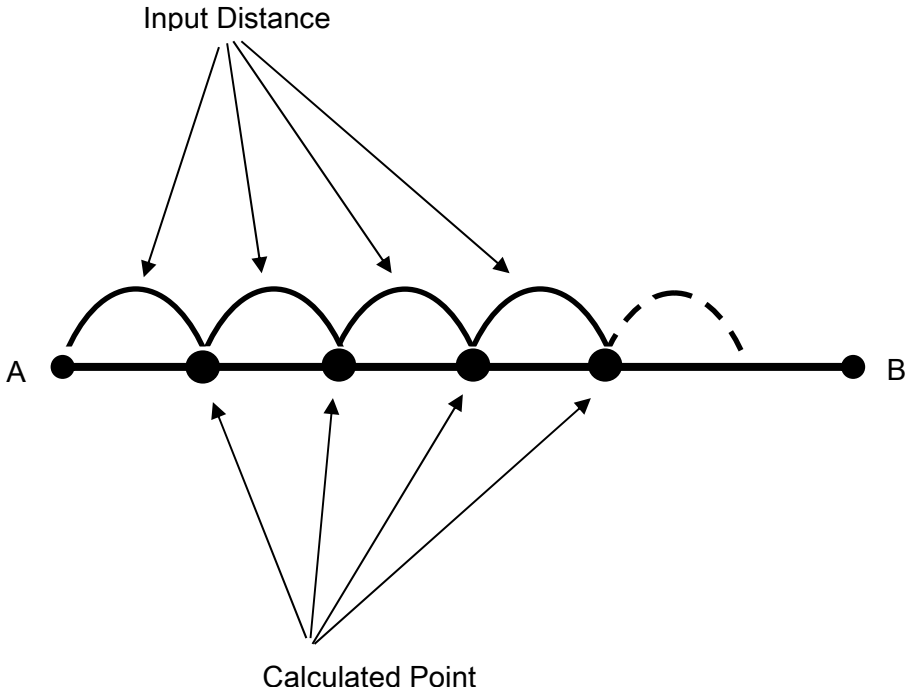
Select [1.EQUAL DISTANCE], enter the following screen.



Input the divided distance.

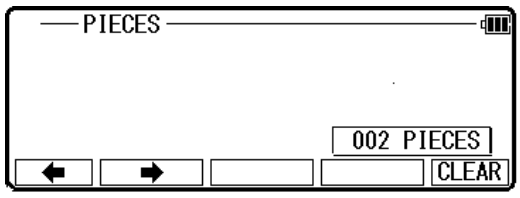


The divided point's coordinate can be calculated, and displayed.
Press the ACCEPT key, the data will be saved, and return to the measure screen.
Coordinates will be calculated from A to B in the order of input distance. Refer to the following drawing.

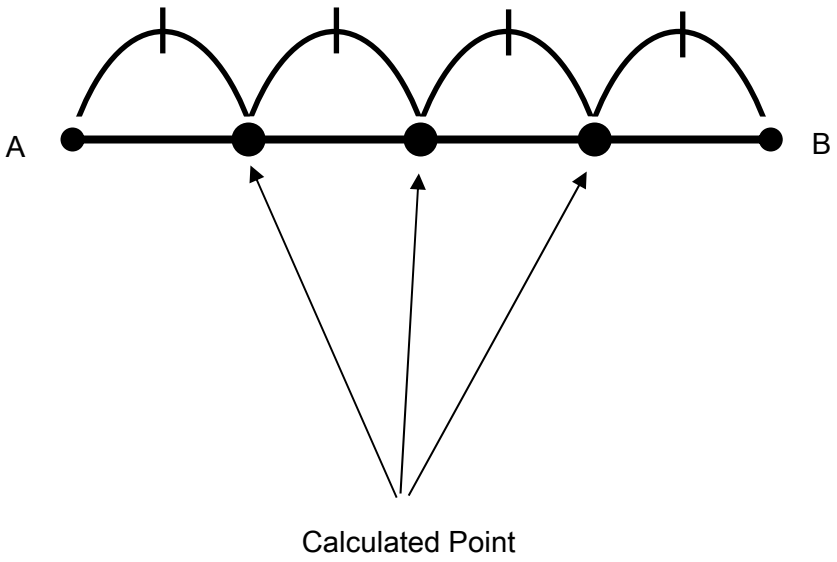


Select [2.EQUALLY DIVIDE LINE], enter the following screen.

Input the divided pieces.



The divided point's coordinate can be calculated, and displayed.
Press the ACCEPT key, the data will be saved, and return to the measure screen.
Coordinates are calculated to be divided by the number you put from A to B
Refer to the following drawing.



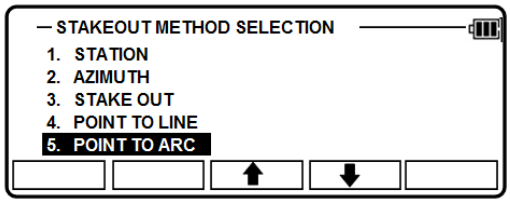
Example: Divide into 4 parts averagely

8.3 Point to Arc

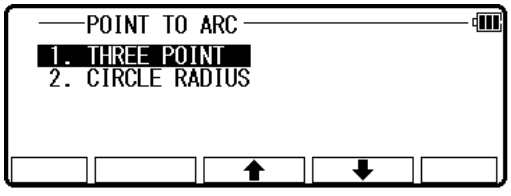
Press [F4] [S .FUNC] of the LinertecExpress screen to view the“LINERTEC Special Func” screen.

Select STATION and press ［ENT］ or [select] to view the “STATION” screen.

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

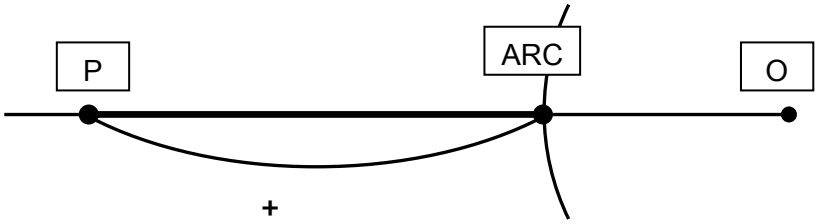


Set Station Point (SP), Target Point (P) and an arbitrary circle, then obtain the distance from point P to the arbitrary circle.

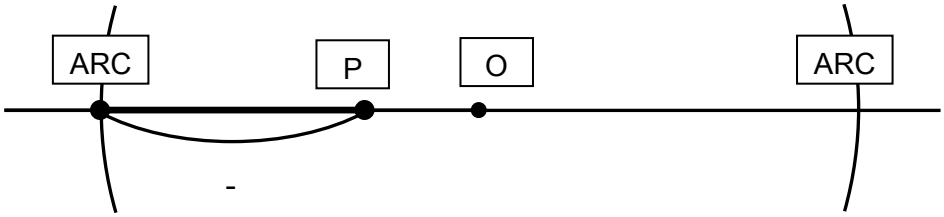


SOP->ARC the distance from Target Point (P) to the circle

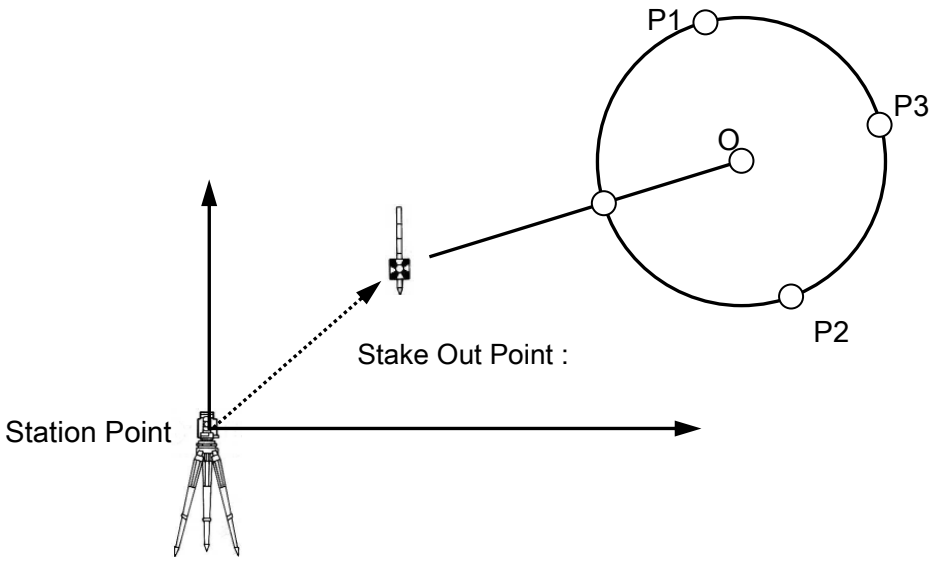
When radius is 0, the figures of the distance between SOP and ARC is shown as a positive (+) figure. When point P is outside the circle, the figures of the distance between SOP and ARC is shown as a positive (+) figure.



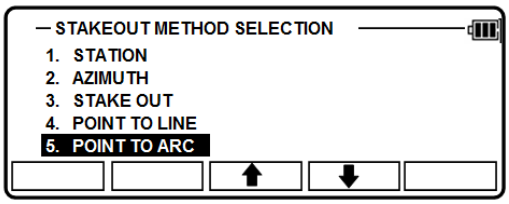
When point P is inside the circle, the figures of the distance between SOP and ARC is shown as a negative (-) figure



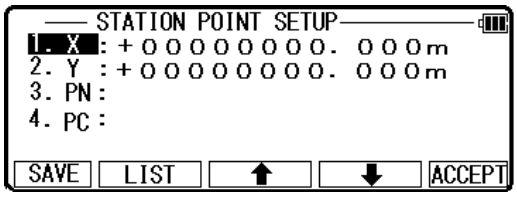
8.3.1 Three point



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

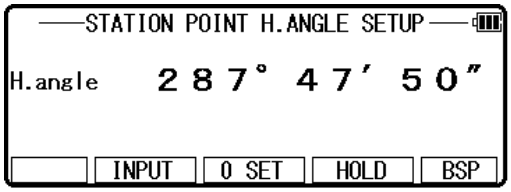


Select 1. THREE POINT and press [ENT] to view the STATION POINT SETUP screen.

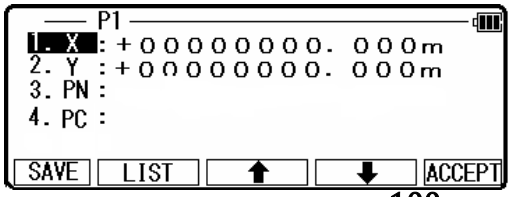


Open the PN, X, Y, Z, IH and PC input window and input each. Save the data by pressing [F1] [SAVE].

Press [ESC] 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].

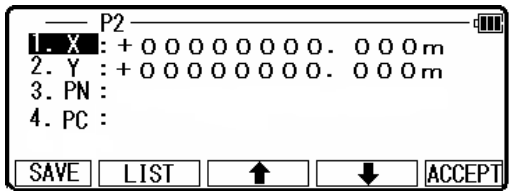


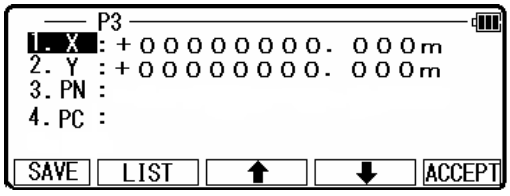
After you finish sighting the reference point, press [ENT] to go to the next screen.



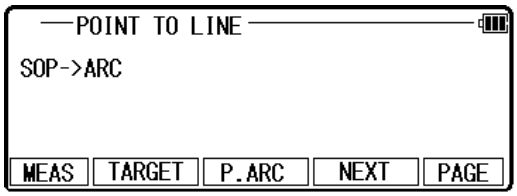
Input three coordinates points on each screen of P1, P2 and P3 to make a circle.

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



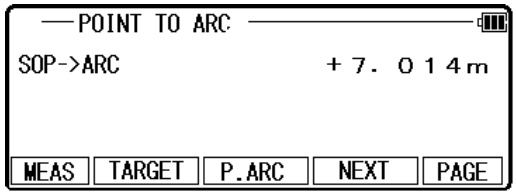


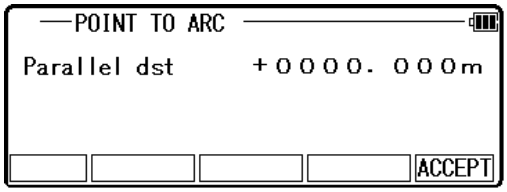
After you are finished with the input, press [F1] [SAVE] or [F5] [ACCEPT] to display the measurement screen.



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

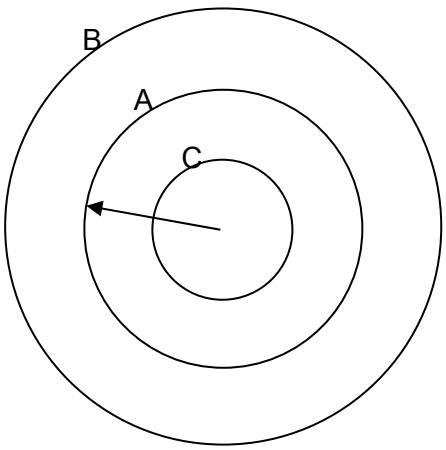
Press [F3] [P. ARC] to enter “Parallel dist” screen.



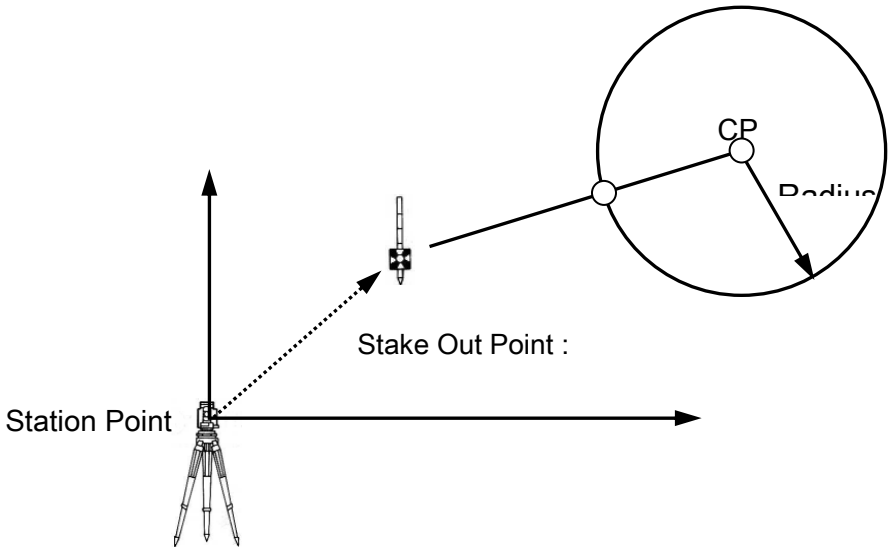


In circle A, an already-known circle, circle B, and circle C are in a Parallel Arc with circle A.
When the input value is "+", Parallel Arc of circle A is circle B.
When the input value is "-", Parallel Arc of circle A is circle C.

Press [ACCEPT] to return to SOP->ARC screen.

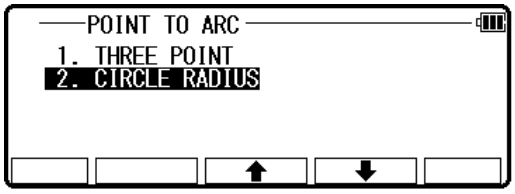


8.3.2 Circle radius

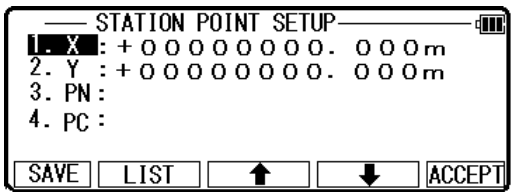


Input center coordinate of the circle and radius to make a circle, then obtain the distance from the Stake Out Point to the circumference.

Select“2.CIRCLE RADIUS”,Press [ENT] to view“STATION POINT SETTING” screen.

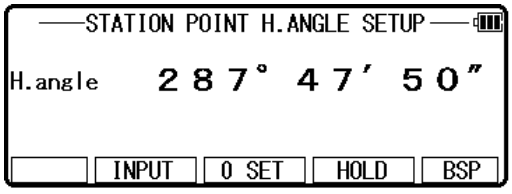


Open the PN, X, Y, Z, IH and PC input window and input each. Save the data by pressing [F1] [SAVE].

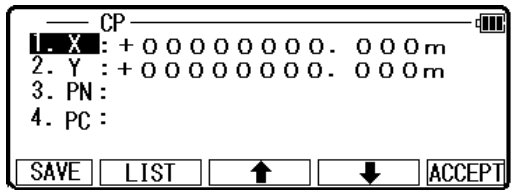


Press [ENT] to view STATION POINT H.ANGLE SETUP screen.

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

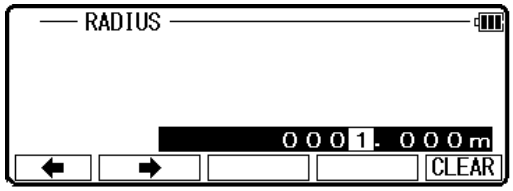


Aim at the reference point.

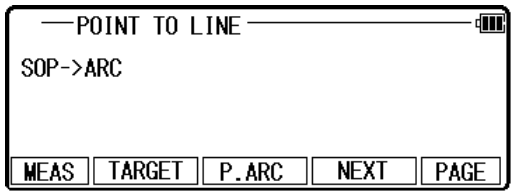


After you finish sighting the reference point, press [ENT] to go to next screen.

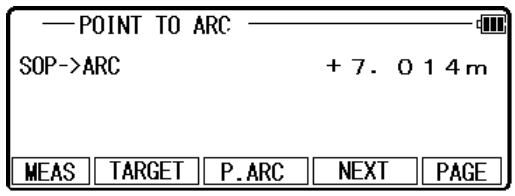
Input coordinates of the center point and radius to make a circle.



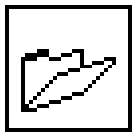
After you are finished with input, press [ENT] to display the measurement screen.



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. Pressing [F3] [P.ARC] enables you to make the same operation of “8.3.1 Three points”.

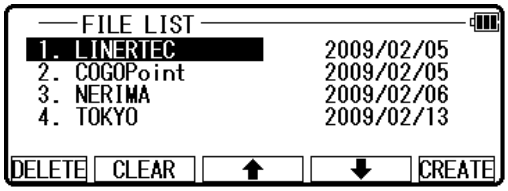


9. FILE MANAGER



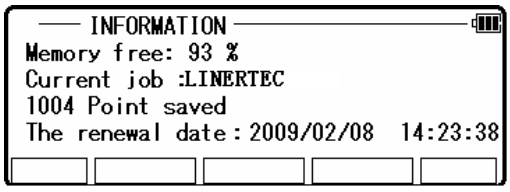
The Data storage memory status, Creating a new Job Name and the Selection
and Deletion of a Job Name is executed by this function.

From the LinertecExpress screen, press [F1] [FILE] to view the FILE LIST screen.



9.1 Information of the remaining memory availability

Press [ENT] to view INFORMATION screen.

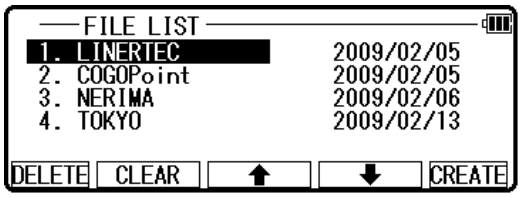


The remaining memory availability and a JOB Name LINERTEC are viewed on the screen. The Job name “LINERTEC” and “COGOPoint” are a default setting.

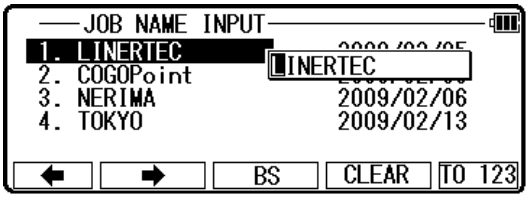
NOTE: Data being used in COGO will be updated in “COGOPoint” file from time to time.
For more details, refer to “8.1 COGO”

9.2 Creation of a new Job

Press [F5] CREATE key to view the JOB NAME INPUT screen.



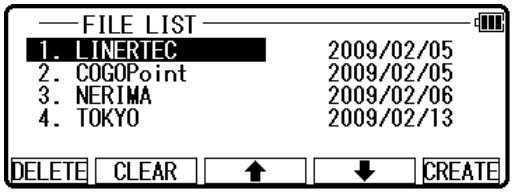
The Job Name input method can be selected by the “Input method selection” of the “Preference”. This is the “10 KEY SYSTEM” input selection.



- If a new Job is created, the new data is stored in this new Job.

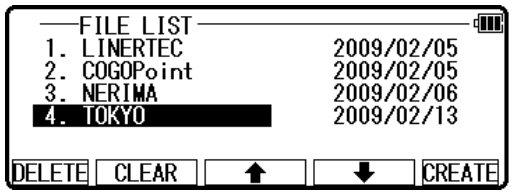
9.3 Selection of a Job Name

Select 3. SELECT by pressing the down arrow key.



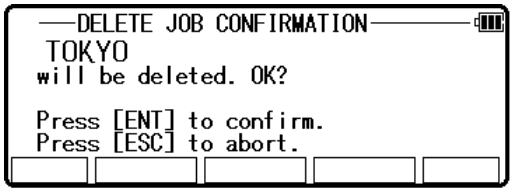
9.4 Deletion of a Job Name

If TOKYO is selected, deletion confirmation screen is viewed. Select [F1] DELETE.



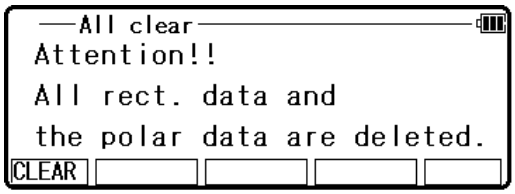
.

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



9.5 All Clear

Select [F1] Clear. All Clear by pressing the down arrow key. Press [ENT] to view its screen.

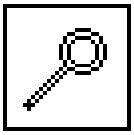


Warning: When [CLEAR] is pushed, all Job Files are deleted.

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 of writing-in and rewriting the data. Beware that all JOB Files will be deleted.

10. VIEW AND EDIT



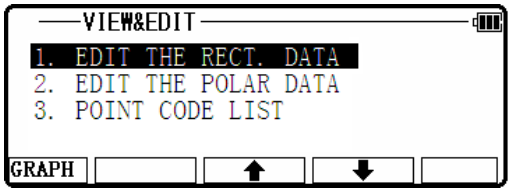
Editing of the stored data is possible by this Function.

Three menu items are available:

- EDIT THE RECT. DATA : Edit recorded Rect. Data.
- EDIT THE POLAR DATA : Edit recorded Polar Data
- POINT CODE LIST : Create and edit PointCodeList

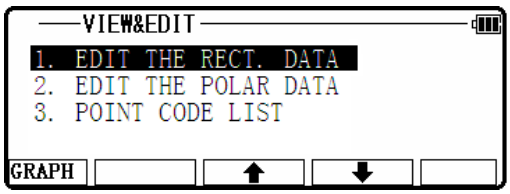
For more details of PointCodeList, refer to “Point Code”

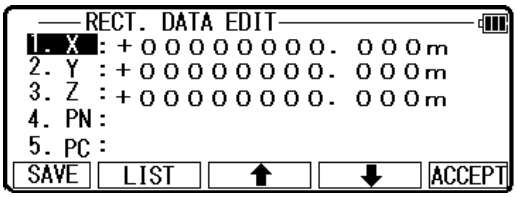
From the LinertecExpress screen, press [F4] to view its screen. Press down and up arrow key to select “10. VIEW & EDIT” or press “10” to enter the screen directly.。

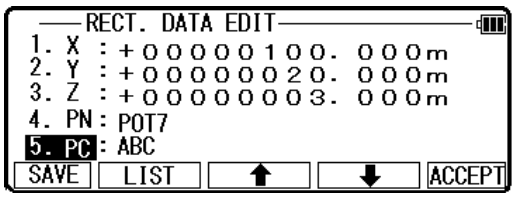


10.1 Create the Rectangular Point

Select 1. EDIT THE RECT. DATA and press [ENT] to view the RECT. DATA EDIT screen.

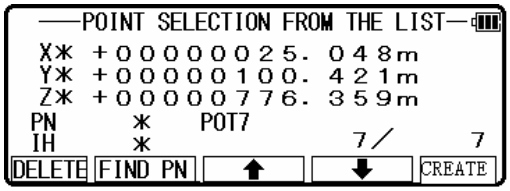






Input the PN, X, Y, Z and PC. Press [ENT] to save them.

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

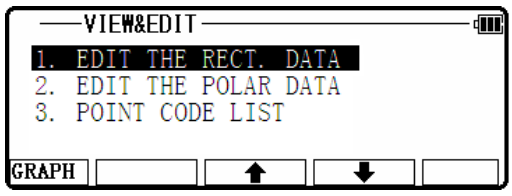


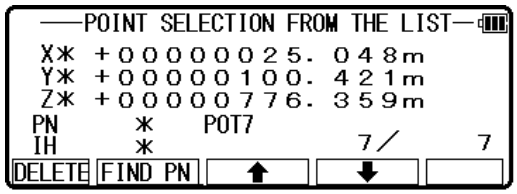
The first line of the screen shows now displayed point and the total number of points.
Press [F1] [DELETE] to delete your desired point.
Press [F2] [FIND PN] to find your desired point by the PN input.
NOTE: For more details on research function, refer to “4.1.2 Coordinates, X, Y, Z, IH and PC input”

10.2 Edit the Data

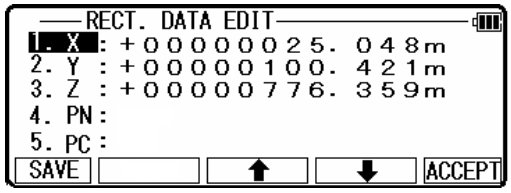
[Edit the Rect. Data]

Select 1. EDIT THE RECT. DATA and press [ENT] to view the RECT. DATA EDIT screen.

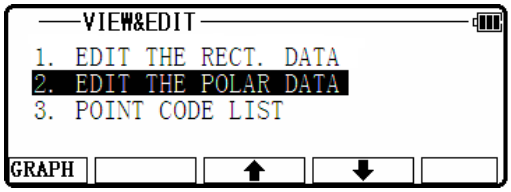




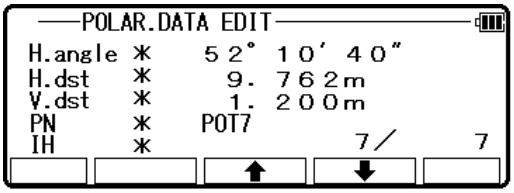
Your desired points are deleted and found as described above.
After selecting desired point with arrow key, press [ENT] to view the RECT. DATA EDIT screen to edit.



[Polar Data]
Select 2. EDIT THE POLAR DATA and press [ENT] to view the POLAR. DATA EDIT screen.

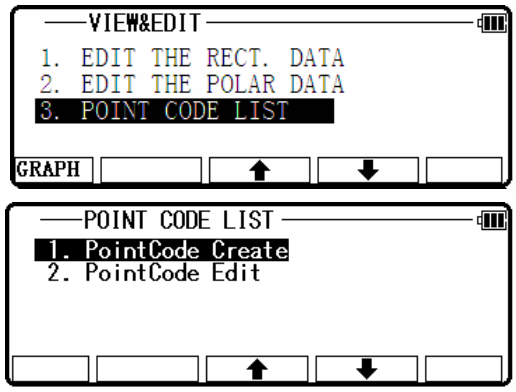


Your desired points are deleted and found as described above.
After selecting desired point with arrow key, press [ENT] to view the POLAR. DATA EDIT
screen to edit.



10.3 Point Code List

Select 3. POINT CODE LIST and press [ENT] to view the POINT CODE LIST screen.



10.3.1 Point Code

The PC, Point Code 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 Codes from the list or edit one of them after pressing [ENT]. Please note, that Point Codes, which are saved in another 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.
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 "LTS-200 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,,,,

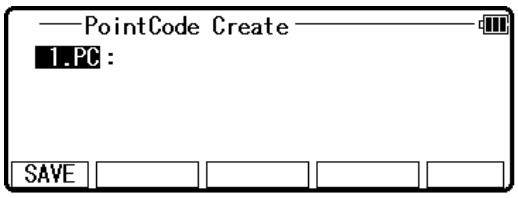
Format of the "PointCodeList" file

	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.)			

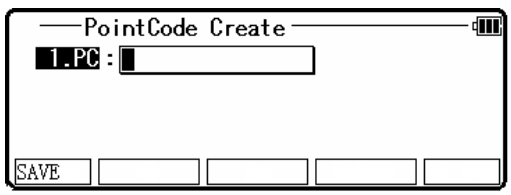
10.3.2 PointCode Create

Press [ENT] to view the PointCode Create screen.

Press [ENT] to view and input the PC.

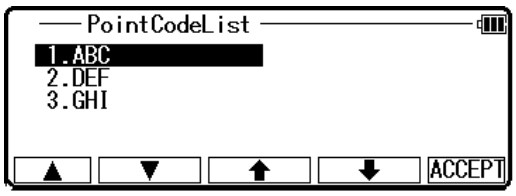


After input, press [F1] [SAVE] to save the values.

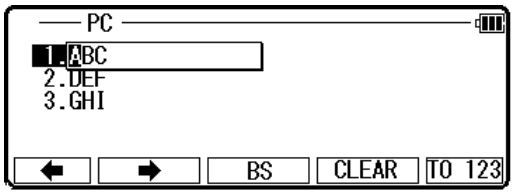


10.3.3 PointCode Edit

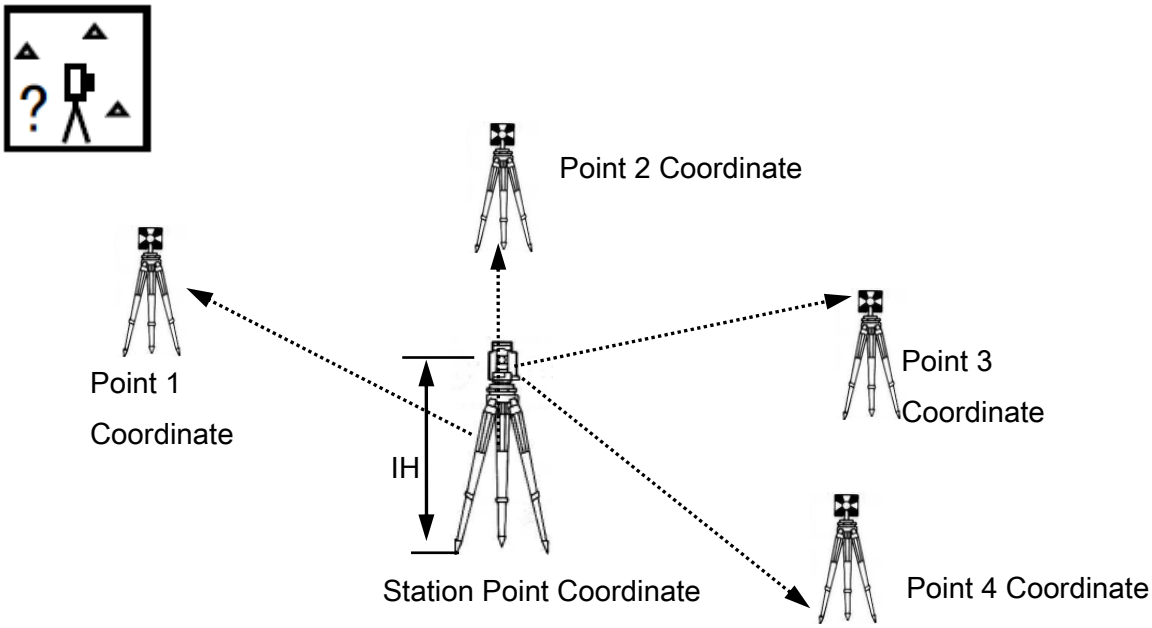
Select 2. PointCode Edit and press [ENT] to view the PointCodeList screen.



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



11. FREE STATIONING

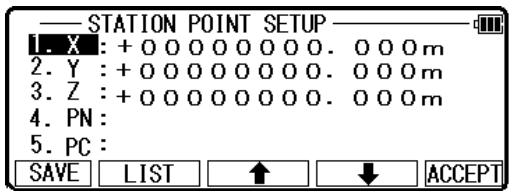


The Station Point Coordinates are calculated from the different known points.
To gain the Coordinates, at least two H. angles and one distance or three H. angles are required.
If not so, the error message of "Not enough data to Calculate! 2 angles and 1 distance, 3 angles are required" appears.
First, input the height of the instrument (IH).

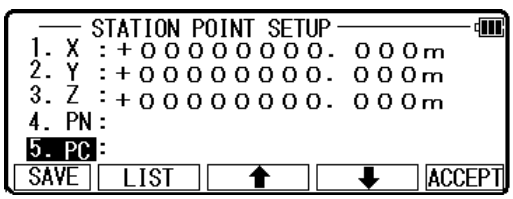
11.1 Station setup [By Rectangular Coordinates]

Press [F4] [FUNCTION] of the LinertecExpress to view the "LINERTEC FUNCTION" screen.Select［STATION］ and press [ENT] or ［SELECT］ to view the STATION screen.

Select 1.RECTANGULAR COORD. and press [ENT] to view the IH screen.

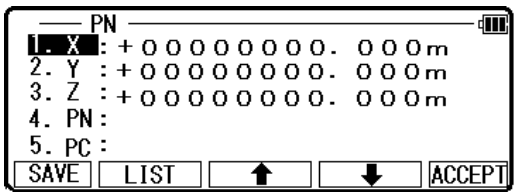


Press［ENT］to view 1.X， 2.Y， 3.Z， 4.PN， 5.PC.

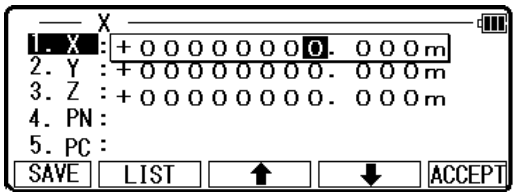


11.1.1 Coordinates, X, Y, Z, IH, and PC input

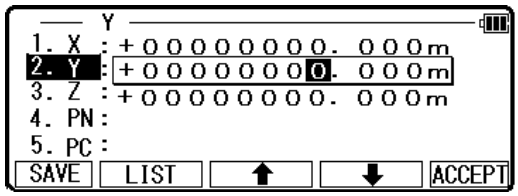
It goes to 1. X coordinate automatically.



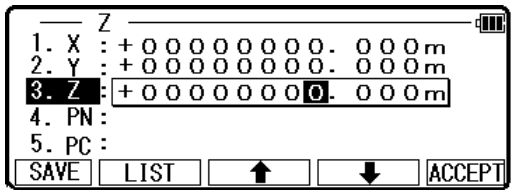
Press [ENT] to view the X coordinate input screen.
Input your desired X coordinate value by pressing keys.



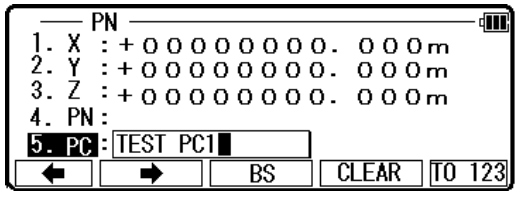
Y coordinate:
Press [ENT] to view the Y coordinate input screen. Input your desired Y coordinate value by pressing keys.



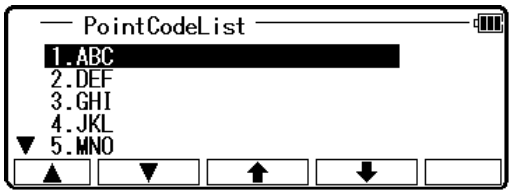
Z coordinate:
Press [ENT] to view the Z coordinate input screen.
Input your desired Z coordinate value by pressing keys.



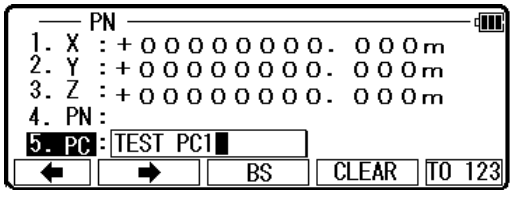
PN, Point Code:
Press [ENT] to view and input thePN, PC screen.



If Point Code exists, you can easily select it from the list.
For using PointCodeList, please refer to “10.3.1 Point Code”.



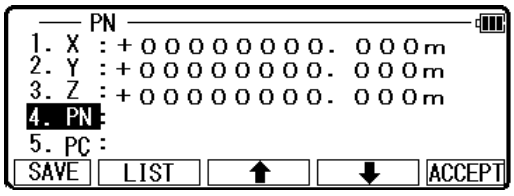
After pressing [ENT], you can edit Point Code data.



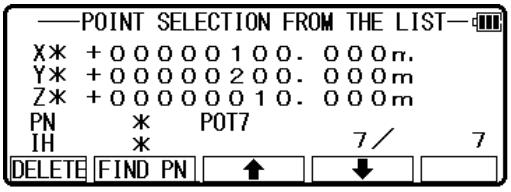
Input your desired PC name by pressing keys, and press [ENT] to view next screen.

11.1.2 Point selection from the list

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

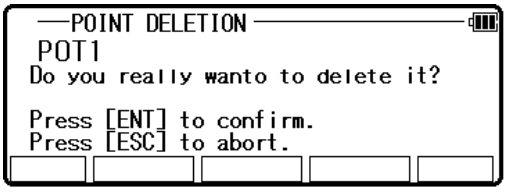


Press [F2] [LIST] on STATION POINT SETUP screen to display POINT SELECTION FROM THE LIST screen.



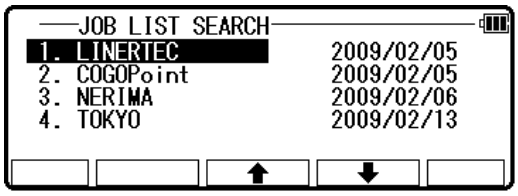
- [DELETE] Key
  To delete the points being displayed

  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.

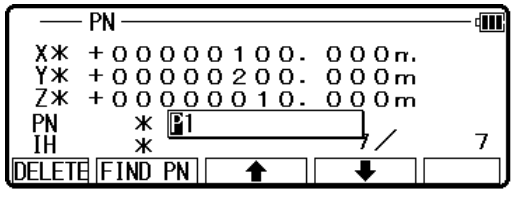
- [OTHER] Key
  To select the Job File to be listed



  Press [F5] [OTHER] to display JOB LIST SEARCH screen, then select the Job File.

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

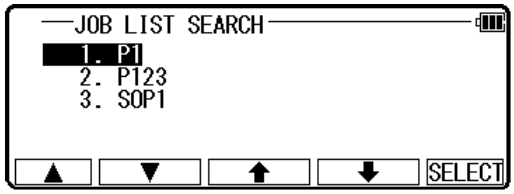
  Press [F2] [FIND PN] to display PN input screen,
  then input key word.



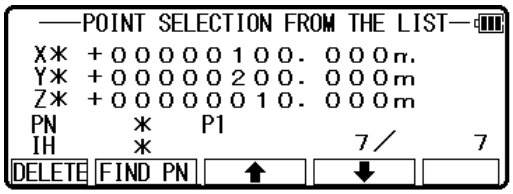
NOTE: Searching a point by adding "* " to the initial of the key word enables you to list point data with PN including a string after "*"

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

Select the point from the list.



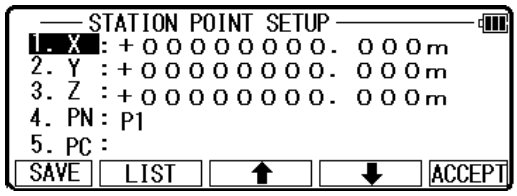
Press [ENT] to display the point that matches the key word.



- [⇧] / [⇩] KEY

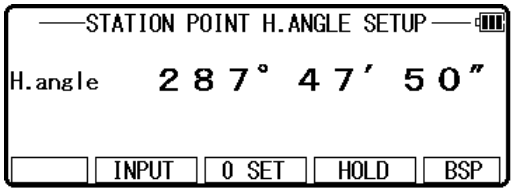
To switch to the point to be displayed.

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



11.1.3 Station Orientation

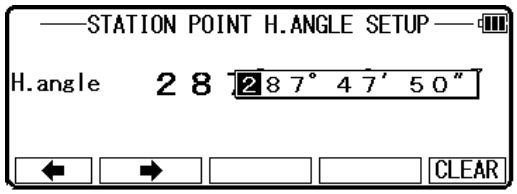
Press the [F5] [ACCEPT] to view the STATION POINT H.ANGLE SETUP screen.



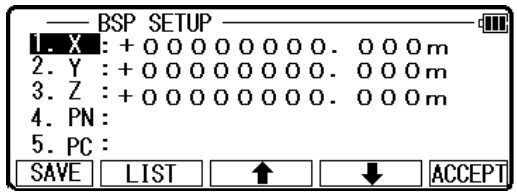
Please note, that the rotation of the “H.angle” depends on the rotation setting of “Coordinate axis definition”.

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

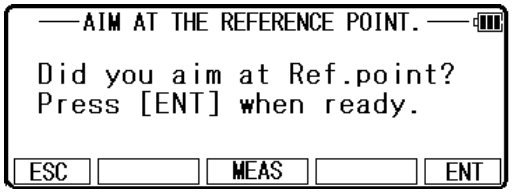
- [INPUT] Key
  Enter any horizontal angle.
  Press [ENT] to view the BSP SETUP screen.



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

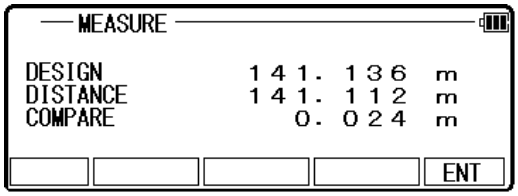


Press [ENT] or [F5] [ACCEPT] to view the AIM AT THE REFERENCE POINT screen.



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 [F3] [MEAS] to make the distance measurement. DESIGN DISPLAY screen appears when the distance measurement is done. Compare design value with measured value.



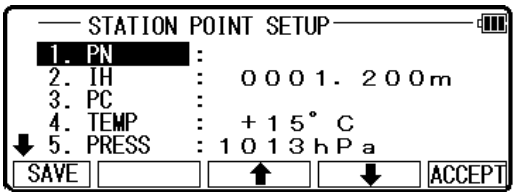
When “PREFERENCE” of “5.12 BOTH FACES MEAS” is on, measure the distance at the normal and reverse position.
The measured value to be displayed is the average of measured values measured in normal and reverse position.

11.2 Station setup [By Polar Coordinates]

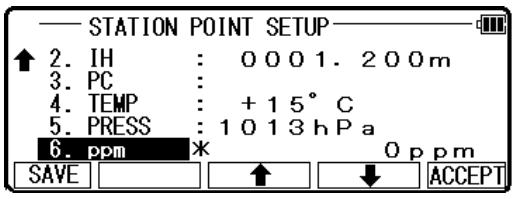
The same Point Name of the plural polar points can be saved.

Press [F4] [FUNCTION] of the LinertecExpress screen to view the “LINERTEC FUNCTION” screen.
Select［STATION］ and press [ENT] or ［SELECT］ to view the STATION screen.

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



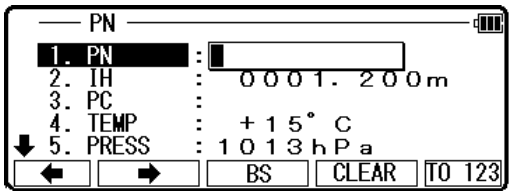
The [⇧] / [⇩] mark is used to scroll up / down.



11.2.1 Point Name input

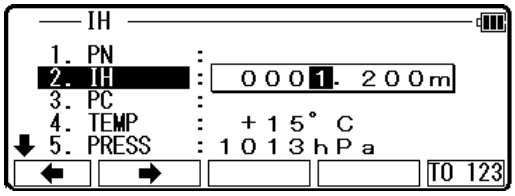
Select 1.PN to display PN input screen.

Input PN value. Press [ENT].

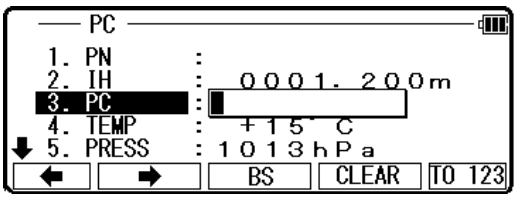


11.2.2 IH, TEMP, PRESS, ppm and PC input

Input IH value.
Press [ENT].



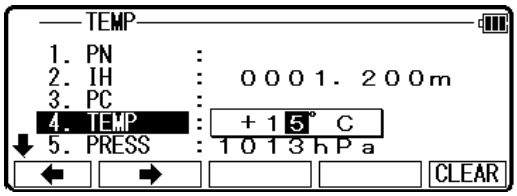
Input the PC.
Press [ENT] to view and input the PC, Point Code, screen.
If Point Code exists, you can easily select it from the list or edit one of them after pressing [ENT].



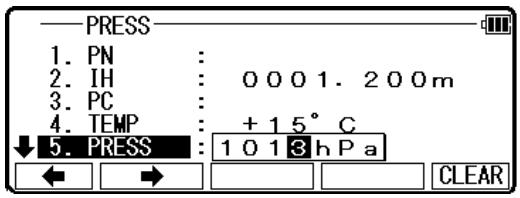
For using Point Code List, please refer to “10.3.1 Point Code”.

Whichever you select PROCESS TYPE or STRUCTURE TYPE,
Pressing [SAVE] or [ACCEPT] proceeds to next screen

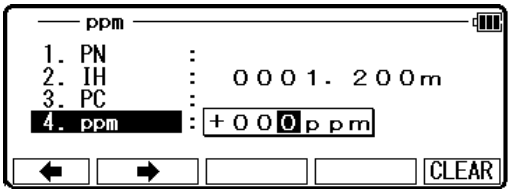
Input the TEMP value.
Press [ENT].



Input the PRESS value.
Press [ENT].



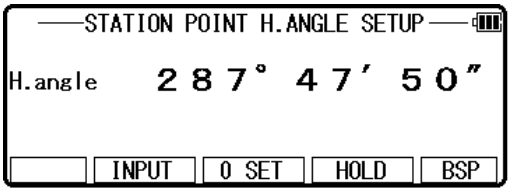
Input ppm value.
Press [ENT].



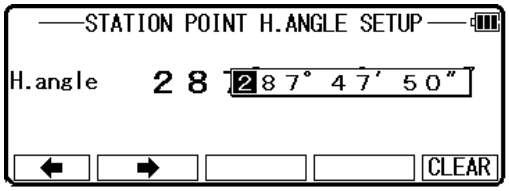
TEMP, PRESS and ppm input depend on the “Initial setting 1”
(ATM INPUT, ppm INPUT, NIL).

11.2.3 Station Orientation

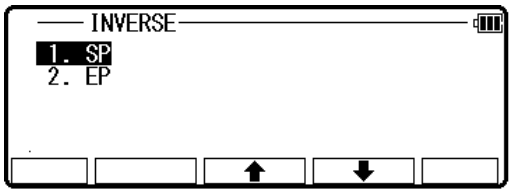
Press the [F5] [ACCEPT] to view the STATION POINT H. ANGLE SETUP screen.
Input your desired H.angle.



- ［F2］[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”.
- ［F3］［0 SET］Key
  Press this Key twice to 0 set the H. Angle.
- ［F4］［HOLD］Key



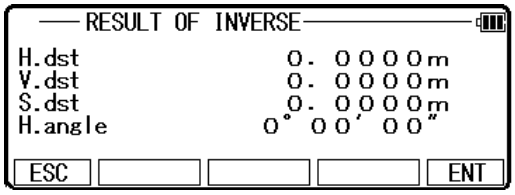
Press this Key twice to hold the current H. Angle.



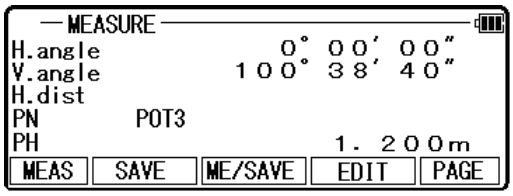
- [INVERS] key

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

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



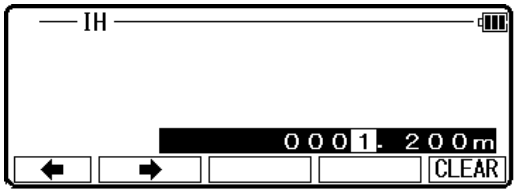
Press [ENT] after aiming back sight point.
Aim at the reference point, then press [ENT].



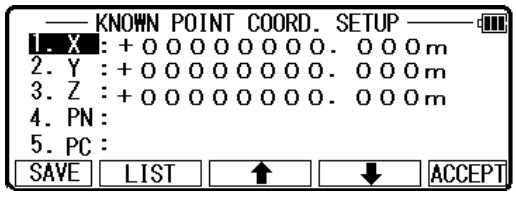
11.3 FREE STATIONING

11.3.1 Stationing by more than 3 known points

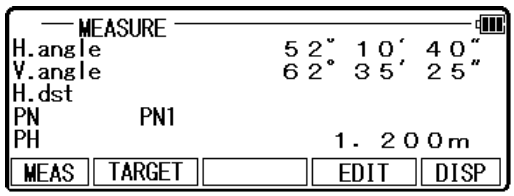
4 known points stationing (For example)
Press 3. FREE STATION of the LinertecExpress screen, and press [ENT] to view the IH input screen. Input the IH value.

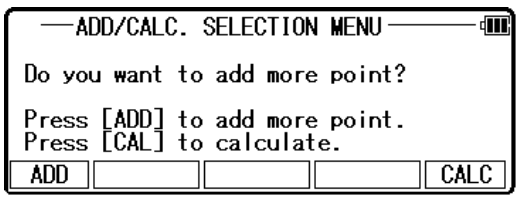


Aim at Point 1.
Press [ENT] to view the KNOWN POINT COORD.SETUP screen.



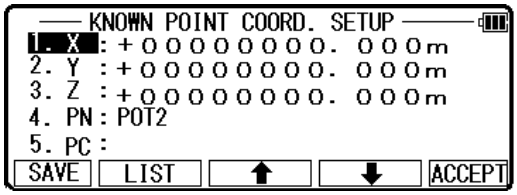
Press [ENT] to open the PN, X, Y, Z and PH input window and input each.
Then, press [F5] [ACCEPT] to view the MEASURE screen.

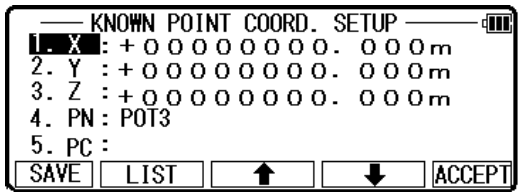


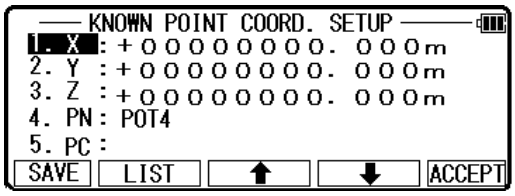


Press [ENT] to view the ADD/CALC. SELECTION MENU screen.
(Measuring is not needed. Just press [ENT].)

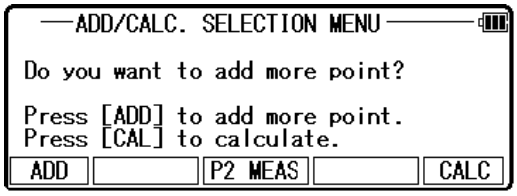
Press the [F1] [ADD] to view the KNOWN POINT COORD. SETUP screen.
Aim at Point 2, 3 and 4.
In the same manner, input the values of Point 2, 3 and 4.



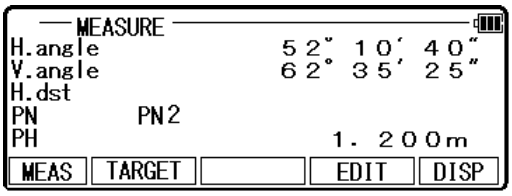




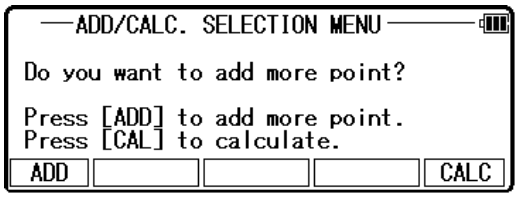
[F3] [P2 MEAS] button appears on 3rd point of ADD/CALC.SELECTION MENU screen.



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.



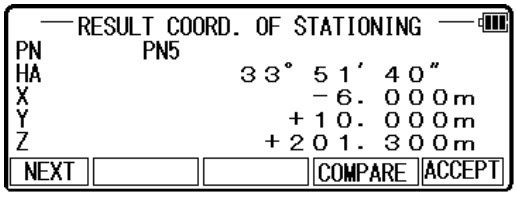
After entering values of PN4, press [ENT] twice to view the MEASURE and ADD/CALC

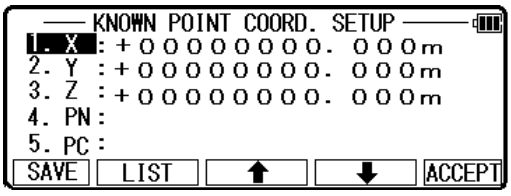


SELECTION MENU.

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

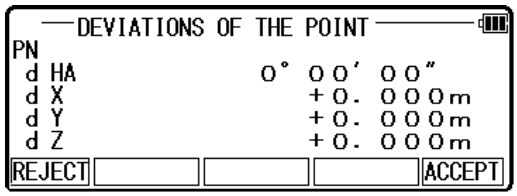
The Station Coordinates are displayed. Result coordinates of free stationing can be saved for Station setup after pressing [F5] [ACCEPT]. Horizontal angle of the result coordinates will be affected to the Station Point for measuring.





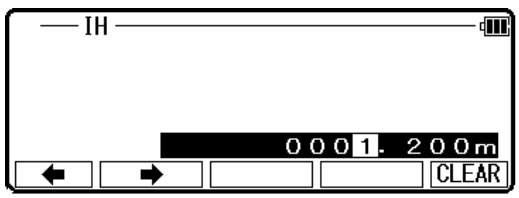
DEVIATIONS OF THE POINT: Four points or more are needed to view this.
Press [ENT] to view the DEVIATIONS OF THE POINT screen. The deviations of X, Y and Z coordinate of each point are displayed. For each point, you can decide if you want to accept or reject the point.

PN: Current Point Number
dX: Deviation on the X value
dY: Deviation on the Y value
dZ: Deviation on the Z value

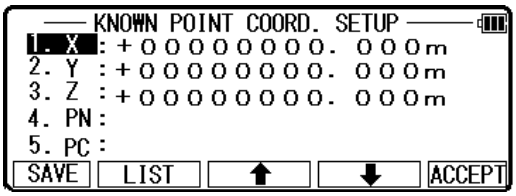


11.3.2 Stationing by two known points

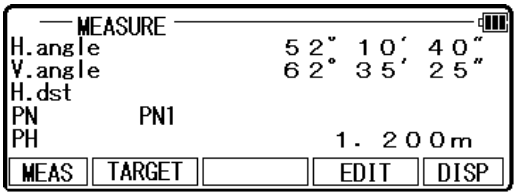
(One point must be measured at least to gain the Station Coordinates.)
Press 3. FREE STATION of the LinertecExpress screen, and press [ENT] to view the IH input screen. Input the IH value.



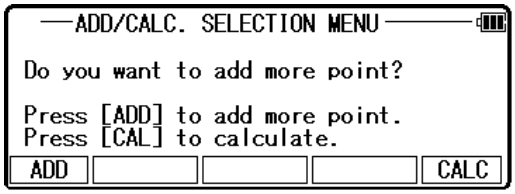
Aim at the Point 1.
Press [ENT] to open the PN, X, Y, Z, PH and PC input window and input each value.



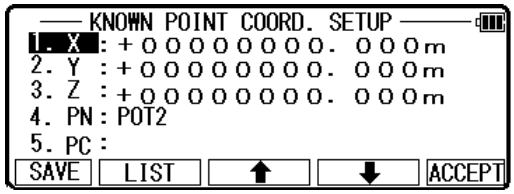
Then, press [F5] [ACCEPT] to view the MEASURE screen.
Press[F1] [MEASURE] to measure.



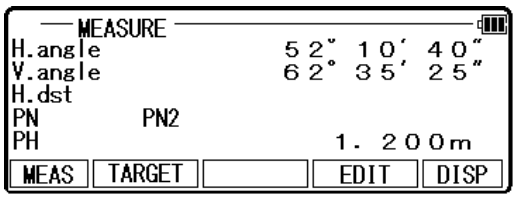
Press [ENT] to view the ADD/CALC. SELECTION MENU screen.



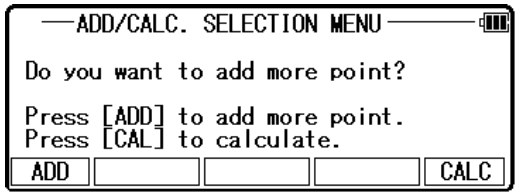
Press [F1] [ADD] to view the KNOWN POINT COORD. SETUP screen.
In the same manner, aim at the Point 2.
Press [ENT] to open the PN, X, Y, Z, PH and PC input window and input each value.



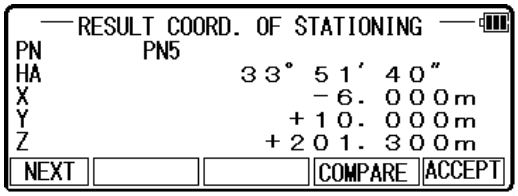
Then, press [ENT] or [F5] [ACCEPT] to view the MEASURE screen.



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



Press [ENT] to view the RESULT COORD. OF STATIONING.
Press [F5] [CALC]to view the RESULT COORD. OF STATIONING.
The Station Coordinates are 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.

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

NOTE:

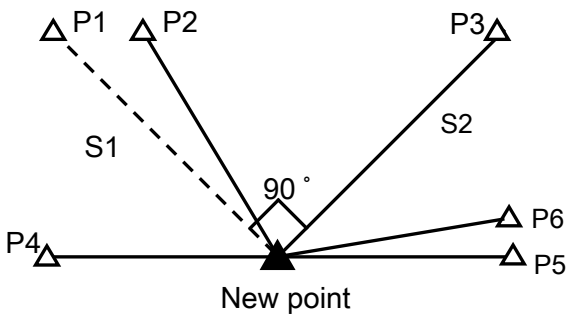


FIG 1

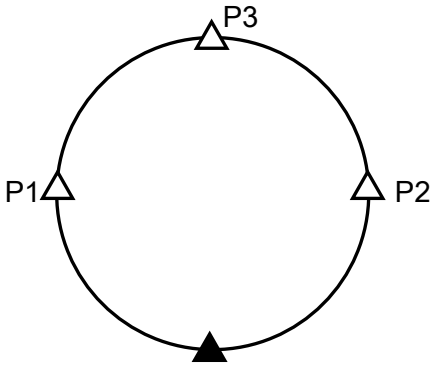


FIG 2

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.

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