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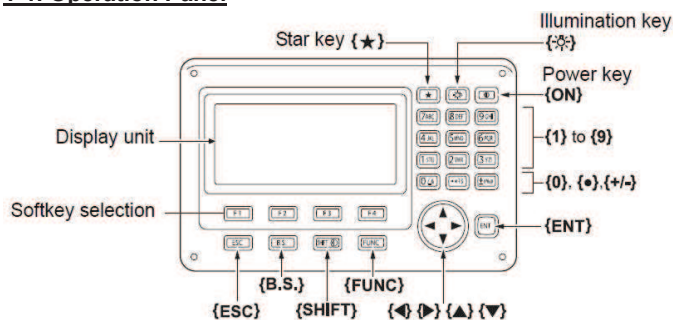
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## 1. BASIC OPERATION

### 1-1. Operation Panel



Basic key operation		
	Power Key	Power ON/OFF by press & hold about 1 second.
	Illumination Key	Lighting up the display unit & key.
	Laser-pointer Guide light	Switching the Laser-pointer/Guide light ON/OFF by press & hold.
	SHIFT	Switching target type (Prism/Sheet/Reflector less). Target type can be switched only on the screen where the target symbol (ex. ) is displayed.
	Star key {★}	Setting commonly used for measuring. Refer to "1-2. Star Key Mode".

## 1. BASIC OPERATION

Softkey operation		
	{[F1] ~ [F4]}	Select the function matching the softkeys.
	{FUNC}	Toggle between OBS mode screen pages.
Inputting letters/figures		
	{SHIFT}	Switch between numeric & alphabetic characters.
	{0} ~ {9}	During numeric input, input number of the key. During alphabetic input, input the characters displayed above the key in the order they are listed.
	{.} / {±}	Input a decimal point/plus or minus sign during numeric input. During alphabetic input, input the characters displayed above the key in the order they are listed.
	{◀} / {▶}	Right & left cursor/Select other option.
	{ESC}	Cancel the input data.
	{B.S.}	Delete a character on the left.
	{ENT}	Select/accept input word/value.

## 1. BASIC OPERATION

### Selecting options

▲▼	{▲}/ {▼}	Up & down cursor.
◀▶	{◀}/ {▶}	Right & left cursor/Select other option.
ENT	{ENT}	Accept the option.

### Other operation

ESC	{ESC}	Return to the previous screen.
-----	-------	--------------------------------

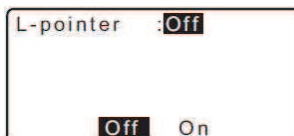
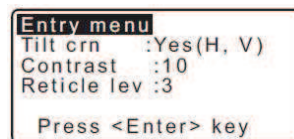
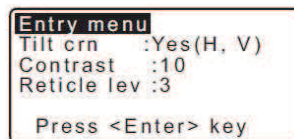
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## 1. BASIC OPERATION

### 1-2. Star Key Mode

Pressing the Star key {★} displays the Star Key menu.

In the Star Key Mode, you can start the measurement program from the Entry menu & change the setting commonly used for measuring.



### Contents

[Tilt crn]	Turning ON/OFF tilt angle correction. <u>Yes(H,V)</u> / <u>Yes(V)</u> / <u>No</u>
[Contrast]	Adjusting the display unit's contrast. Steps <u>0 ~ 15</u> .
[Reticle lev]	Adjusting reticle illumination level. Steps <u>0 ~ 5</u> .
[Reflector]	Switching target type. <u>Prism</u> / <u>Sheet</u> / <u>N-Prism</u> .
[Illum.hold]	Turning ON/OFF laser pointer or Guide light. <u>Laser</u> / <u>Guide</u> .

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## 1. BASIC OPERATION

[L-pointer]	Turning ON/OFF laser pointer. <u>On</u> / <u>Off</u> . This option can be selected when you select "Laser" in the "Illum.hold".
[Guide ligh]	Turning ON/OFF guide light. <u>On</u> / <u>Off</u> . This option can be selected when you select "Guide" in the "Illum.hold".
[Guide pattern]	Select guide light pattern. <u>1</u> / <u>2</u> . This option can be selected when you select "Guide" in the "Illum.hold".

\*The Star Key Mode can be called only from the OBS mode.

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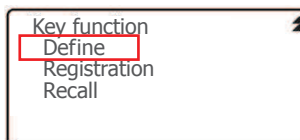
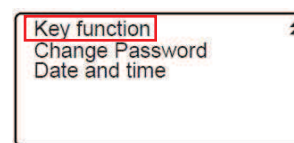
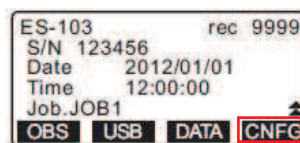
## 1. BASIC OPERATION

### 1-3. Allocating Functions

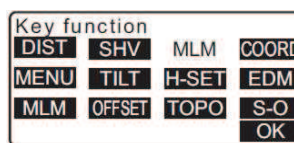
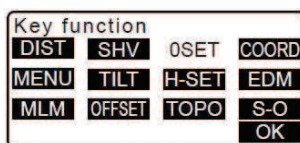
Enable to allocate the softkeys in OBS mode to suit the measurement conditions.

#### -PROCEDURE-

1) Select [CNFG] - [Key function] - [Define].



2) Align the cursor with the softkeys whose allocation you want to change using {◀}/ {▶}. The cursor of the selected softkey flashes.



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## 1. BASIC OPERATION

- 3) Change the softkey function using {▲} / {▼}. Set the softkey function & its location by pressing {◀} / {▶}. The set softkey stops flashing & the cursor flashes on the next softkey.
- 4) Repeat steps 2 to 3 only as many times as necessary.
- 5) Press [OK] to record the allocations & restore "Key function".

The following functions can be allocated to the softkeys.

Functions	
[MEAS]	Distance measurement.
[SHV]	Switch between angle display & distance display.
[0SET]	Set horizontal angle to 0.
[COORD]	Coordinates measurement.
[REP]	Repetition measurement.
[MLM]	Missing line measurement.
[S-O]	Staking-out measurement.
[OFFSET]	Offset measurement.
[TOPO]	To TOPO menu.
[EDM]	Setting EDM.
[H-SET]	Set required horizontal angle.
[TILT]	Display tilt angle.
[MENU]	To Menu mode.
[REM]	REM measurement.
[RESEC]	Resection measurement.
[R/L]	Select horizontal angle right/left.
[ZA / %]	Switch between zenith angle/slope in %.

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## 1. BASIC OPERATION

[HOLD]	Hold horizontal angle/release horizontal angle.
[CALL]	Display final measurement data.
[S-LEV]	Return signal.
[AREA]	Surface area measurement.
[F/M]	Switch between meters/feet.
[HT]	Set the instrument station height & target height.
[S-O LINE]	Staking-out line measurement.
[S-O ARC]	Staking-out arc measurement.
[P-PROJ]	Point projection measurement.
[PTL]	Point to line.
[INTSCT]	Intersections measurement.
[TRAV]	Traverse adjustment.
[ROAD]	Route surveying.
[X SECT]	Cross section survey.
[TOPOII]	Topography observation.
[L-PLUM]	Brightness configurations for laser plummet.
[HVDOUT-T]	Output distance/angle measurement results to an external instrument.
[HVDOUT-S]	Output angle measurement results to an external instrument.
[NEZOUT-T]	Output the coordinate results to an external instrument.
[NEZOUT-S]	Output the coordinate results to an external instrument.
[---]	No functions set.

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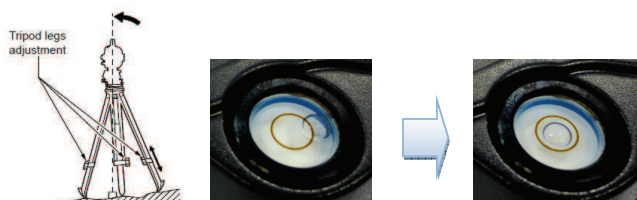
## 1. BASIC OPERATION

### 1-4. Bubble Centering

#### -PROCEDURE-

- 1) Center the bubble in the circular level by either shortening the tripod leg closest to the offcenter direction of the bubble or by lengthening the tripod leg of the bubble. Adjust one more tripod leg to center the bubble.

Turn the leveling foot screws while checking the circular level until the bubble is centered in the center circle.

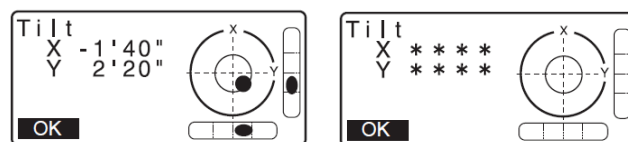


- 2) Press {ON} to power on. Then the circular level is displayed on the screen.

\*"Bubble" is not display when the tilt of the instrument exceeds the detection range of the tilt sensor. Level the instrument while checking the air bubbles in the circular level until "bubble" is displayed on the screen.

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## 1. BASIC OPERATION

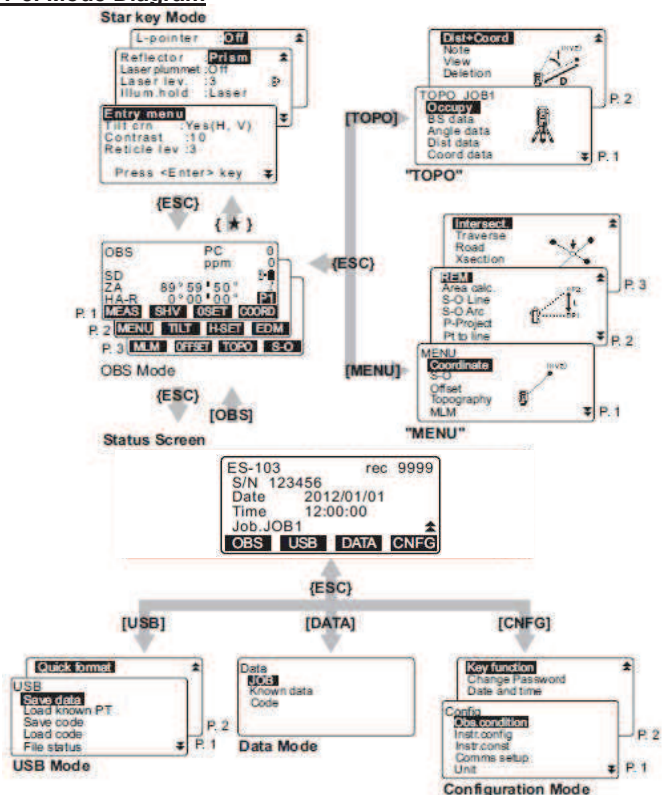


- 3) Center "Bubble" in the circular level.
- 4) Set the tilt angle of X & Y direction to 0° using foot screws.
- 5) When leveling is completed, press [OK] changes to the OBS mode.

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## 1. BASIC OPERATION

### 1-5. Mode Diagram



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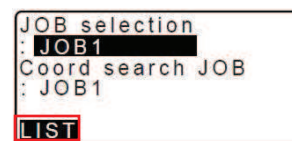
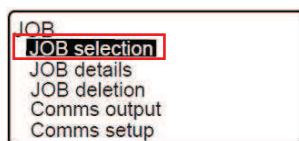
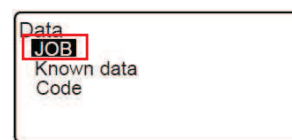
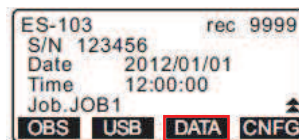
## 2. MEASUREMENT

### 2-1. Job Setting

- A total of 10 JOBS have been prepared.
- The names of the JOBS have been preset as JOB1 to JOB10. You can change them to any names.
- Scale factor can be set for each JOB. Only scale factor of the current JOB can be edited.

#### -PROCEDURE Job selection & Scale factor setting-

- 1) Select [Data] – [JOB] – [JOB selection] – [LIST]



To set same JOB name both <JOB selection> & <Coord search JOB> will come highly recommended.

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## 2. MEASUREMENT

JOB selection	
JOB01	46
JOB02	254
JOB03	0
JOB04	0
JOB05	0

• The numbers to the right represent the number of data items in each JOB.

• "\*" means that the JOB has not been output to an external device yet.

- 2) Align the cursor with the desired JOB as the current JOB & press {ENT} key. The JOB is determined.

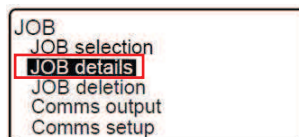
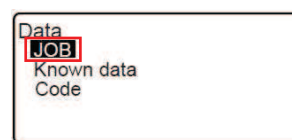
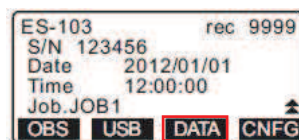
- 3) Press {ENT} key to restore <JOB selection>.

ES-103 rec 9999
S/N 123456
Date 2012/01/01
Time 12:00:00
Job JOB1
OBS USB DATA CNFG

## 2. MEASUREMENT

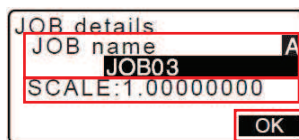
#### -PROCEDURE Inputting a Job name-

- 1) Select [Data] – [JOB] – [JOB details]



- 2) JOB name display current JOB name.

After Inputting desired JOB name & scale factor value, press [OK].



- Maximum length of JOB name: 12 (alphanumeric).

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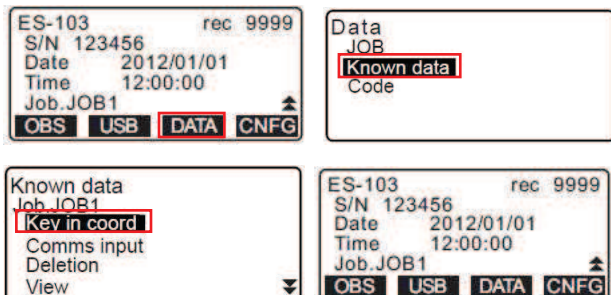
## 2. MEASUREMENT

### 2-2. Registering Coordinate Data by Key Entry

- Enable to register 10000 items of coordinate data, including the data inside the JOBS.
- There are two registration methods: key entry & entry from an external device. For the method of entering from an external device, refer to "3.Data Transfer".

#### -PROCEDURE registering coordinate data by key entry-

- 1) Select [Data] – [Known data] – [Key in coord]



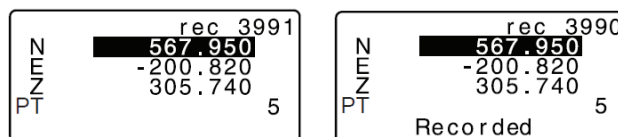
\*Current JOB name is displayed.

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## 2. MEASUREMENT

- 2) After entering the data (N, E, Z, PT), press {ENT} key.

The coordinate data is recorded in the current JOB.



- 3) Continue to enter other known point coordinate data.

Press {ESC} key to finish the registration of coordinate data.

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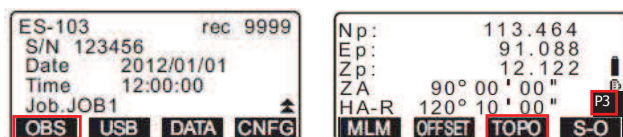
## 2. MEASUREMENT

### 2-3. Topo

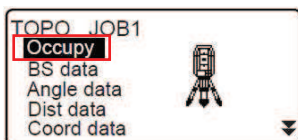
#### 2-3-1. OCC Setting

##### -PROCEDURE-

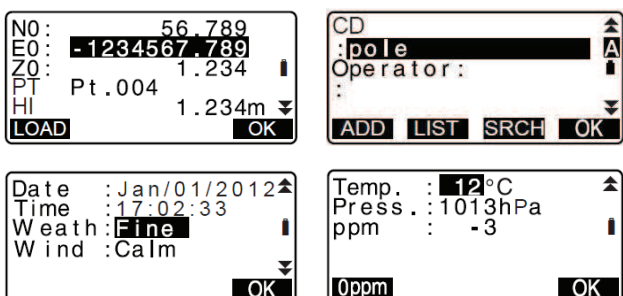
- 1) Select [TOPO] in the third page of [OBS] mode.



- 2) Current JOB name is displayed. Then select [Occupy].



- 3) Set the following data items for 4 pages.



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## 2. MEASUREMENT

### Explanation of data items

[N0] *	Instrument station coordinates --- North.
[E0] *	Instrument station coordinates --- East.
[Z0] *	Instrument station coordinates --- Zenith.
[PT]	Point name. <u>Max. 14(alphanumeric).</u>
[HI]	Instrument height.
[CD] **	Code. <u>Max. 16(alphanumeric).</u>
[Operator]	Operator name.
[Date]	Display only.
[Time]	Display only.
[Weath]	Weather. <u>Fine / Cloudy / Light rain / Rain / Snow.</u>
[Wind]	Wing. <u>Calm / Gentle / Light / Strong / Very strong.</u>
[Temp.]	Temperature. <u>-30 ~ 60(°C) / -22 ~ 140(F).</u>
[Pres.]	Air pressure. <u>500 ~ 1400(hPa) / 375 ~ 1050(mmHg).</u>
[ppm]	Atmospheric correction factor. <u>-499 ~ 499.</u>

\*Select [LOAD] to recall & use the registered coordinates.

\*\*When inputting code, [ADD], [LIST] & [SRCH] are displayed.

- [ADD]: to save input codes in memory.
- [LIST]: to display saved codes in reverse chronological order.
- [SRCH]: to search for a saved code.

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## 2. MEASUREMENT

### 2-3. Topo

#### 2-3-2. BS Setting

##### -PROCEDURE by Angle-

1) Select [TOPO] in the third page of [OBS] mode.

ES-103 S/N 123456 Date 2012/01/01 Time 12:00:00 Job JOB1 OBS USB DATA CNFG	Np: 113.464 Ep: 91.088 Zp: 12.122 ZA 90° 00' 00" HA-R 120° 10' 00" MLM OFFSET TOPO S-O
---	---

2) Select [BS data] – [Angle].

TOPO JOB1 Occupy BS data Angle data Dist data Coord data	TOPO / Backsight Angle Coord
---	------------------------------------

3) Input Azimuth angle. Sight the backsight & press [REC].

TOPO / Backsight Take BS ZA 90° 12' 34" HA-R 130° 12' 34" HA-R REC
---

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## 2. MEASUREMENT

4) After setting the following 3 items, press [OK] to record backsight data.

HR (Target height) / CD (Code) / PT (Point name)

ZA 90° 12' 34" HA-R 0° 00' 00" HR 0.000m CD ADD LIST SRCH OK	PT 1 OK
--	------------

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## 2. MEASUREMENT

##### -PROCEDURE by Coordinate-

1) Select [TOPO] in the third page of [OBS] mode.

ES-103 S/N 123456 Date 2012/01/01 Time 12:00:00 Job JOB1 OBS USB DATA CNFG	Np: 113.464 Ep: 91.088 Zp: 12.122 ZA 90° 00' 00" HA-R 120° 10' 00" MLM OFFSET TOPO S-O
---	---

2) Select [BS data] – [Coord].

TOPO JOB1 Occupy BS data Angle data Dist data Coord data	TOPO / Backsight Angle Coord
---	------------------------------------

3) After Inputting the backsight station coordinates, press [OK].

- When you wish to read in & set coordinate data from memory, press [LOAD].

TOPO / Backsight NBS: 1.000 EBS: 1.000 ZBS: <Null> LOAD OK
--

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## 2. MEASUREMENT

4) Angle measurement values are displayed in real time. Calculated Azimuth angle is also displayed. Sight the backsight & press [REC].

TOPO / Backsight Take BS ZA 90° 12' 34" HA-R 123° 12' 34" Azimuth 45° 00' 00" REC
--

5) After setting the following 3 items, press [OK] to record backsight data.

HR (Target height) / CD (Code) / PT (Point name)

ZA 90° 12' 34" HA-R 0° 00' 00" HR 0.000m CD ADD LIST SRCH OK	PT 1 OK
--	------------

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## 2. MEASUREMENT

### 2-3. Topo

#### 2-3-3. Resection

Observe existing points with known coordinate data to calculate the coordinate value for the instrument station.

#### -PROCEDURE Coordinate resection measurement-

1) Select [COORD] in the first page of [OBS] mode.

ES-103 S/N 123456 Date 2012/01/01 Time 12:00:00 Job JOB1	rec 9999
OBS	USB DATA CNFG

OBS	PC 0
SD	ppm 0
ZA	89° 59' 50"
HA-R	0° 00' 00"
MEAS	SHV 0SET
	COORD

2) Select [Occ.Orien.] - [RESEC] - [NEZ].

Coord. Occ.Orien. Observation EDM	N0: 0.000 E0: 0.000 Z0: <Null> PT PNT-001 HI 1.200m LOAD BS AZ BS NEZ RESEC
--	--

Resection. NEZ Elevation
--------------------------------

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## 2. MEASUREMENT

3) Sight the first know point & press [MEAS].

Resection	1st PT
SD	
ZA	80° 30' 10"
HA-R	120° 10' 00"
ANGLE	MEAS

4) The measurement results are displayed on the screen.

After inputting target height, press [YES].

Resection	1st PT
SD	525.450m
ZA	80° 30' 10"
HA-R	120° 10' 00"
HR	1.400m
NO	YES

5) Press [LOAD] to recall registered coordinates for the first know point.

And press [NEXT] to move to the second point.

• You can also input the coordinates directly.

	1st PT
Np:	20.000
Ep:	30.000
Zp:	40.000
HR	10.000m
LOAD	REC NEXT

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## 2. MEASUREMENT

6) Repeat procedures 3) to 5) in the same way from the second point.

7) When the minimum quantity of observation data required for the calculation is present, press [CALC] to automatically start calculations.

	3rd PT
Np:	20.000
Ep:	30.000
Zp:	40.000
HR	10.000m
LOAD	REC NEXT CALC

8) Press [RESULT] to check the result.

N	100.001
E	100.000
Z	9.999
σN	0.0014m
σE	0.0007m
RESULT	OK

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## 2. MEASUREMENT

- [ADD]: when there is a known point that has not been measured or when a new known point is added.
- [OMIT]: If there are problems with the results of a point, align the cursor with that point & press it. "\*" is displayed on the left of the point.
- [RE\_CALC]: to perform calculation again without the point designated by pressing [OMIT].
- [RE\_MEAS]: to measure the point designated by pressing [OMIT].
- [ESC] key: return to the previous screen.

	σN	σE
1st	-0.001	0.001
*2nd	0.005	0.010
3rd	-0.001	0.001
4th	-0.003	-0.002
OMIT	RE_CALC	RE_MEAS
		ADD

9) Press [ESC] key to return to the step 8) screen & press [OK] to finish resection measurement.

N	100.001
E	100.000
Z	9.999
σN	0.0014m
σE	0.0007m
RESULT	OK

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## 2. MEASUREMENT

- 10) Press [YES] when you want to set the azimuth angle of the first known point as the backsight point. Press [OK] sets the direction angle & instrument station data.

Resection Set azimuth NO YES	NO: 100.001 EO: 100.009 ZO: 9.999 PT PNT-001 HI 1.200m LOAD REC OK
------------------------------------	---

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## 2. MEASUREMENT

### 2-3. Topo

#### 2-3-4. Angle Measurement

##### -PROCEDURE-

- 1) Select [TOPO] in the third page of [OBS] mode.

ES-103 rec 9999 S/N 123456 Date 2012/01/01 Time 12:00:00 Job JOB1 OBS USB DATA CNFG	Np: 113.464 Ep: 91.088 Zp: 12.122 ZA 90° 00' 00" HA-R 120° 10' 00" MLM OFFSET TOPO S-O
--	---

- 2) Select [Angle data] & sight the point to be recorded.

Angle measurement values are displayed in real time.

TOPO JOB1 Occupy BS data Angle data Dist data Coord data	ZA 60° 15' 40" HA-R 110° 30' 45" HR 0.000m CD REC TILT H-SET OSET
---	---

- 3) Set the following items.

HR (Target height) / CD (Code) / PT (Point name)

Then press [REC] or {Trigger} key to record the data.

ZA 60° 15' 40" HA-R 110° 30' 45" HR 1.234m CD 1010 ADD LIST SRCH	PT Pt. 002 REC TILT H-SET OSET
--	-----------------------------------

- 4) Press {ESC} key to quit angle measurement.

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## 2. MEASUREMENT

### 2-3. Topo

#### 2-3-5. Distance Measurement

##### -PROCEDURE-

- 1) Select [TOPO] in the third page of [OBS] mode.

ES-103 rec 9999 S/N 123456 Date 2012/01/01 Time 12:00:00 Job JOB1 OBS USB DATA CNFG	Np: 113.464 Ep: 91.088 Zp: 12.122 ZA 90° 00' 00" HA-R 120° 10' 00" MLM OFFSET TOPO S-O
--	---

- 2) Select [Dist data] to display the measurement results.

TOPO JOB1 Occupy BS data Angle data Dist data Coord data	SD 123.456m ZA 80° 30' 15" HA-R 120° 10' 00" HR 1.234m CD REC OFFSET AUTO MEAS
---	---

- 3) Set the following items.

HR (Target height) / CD (Code) / PT (Point name)

Check the input data, and then press [REC] to record the data.

SD 123.456m ZA 80° 30' 15" HA-R 120° 10' 00" HR 1.234m CD REC OFFSET AUTO MEAS	PT REC OFFSET AUTO MEAS
---	----------------------------

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## 2. MEASUREMENT

- 4) To continue measurement, sight the next point, press [MEAS].

Press [AUTO] or {Trigger} key to perform distance measurement & data record automatically.

SD 123.456m ZA 80° 30' 15" HA-R 120° 10' 00" HR 1.234m CD OFFSET AUTO MEAS	SD 123.456m ZA 80° 30' 15" HA-R 120° 10' 00" Recorded
---	--

- 5) Press {ESC} key to quit distance measurement.

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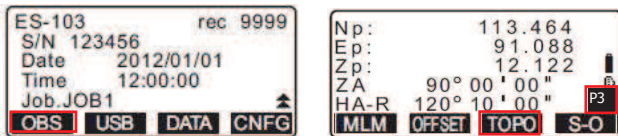
## 2. MEASUREMENT

### 2-3. Topo

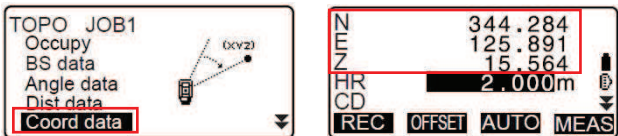
#### 2-3-6. Coordinate Measurement

##### -PROCEDURE-

1) Select [TOPO] in the third page of [OBS] mode.



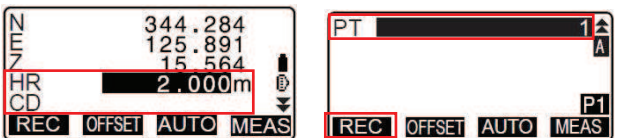
2) Select [Coord data] to display the measurement results.



3) Set the following items.

HR (Target height) / CD (Code) / PT (Point name)

Check the input data, and then press [REC] to record the data.

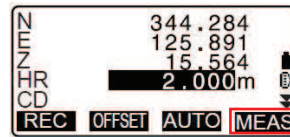


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## 2. MEASUREMENT

4) To continue measurement, sight the next point, press [MEAS].

Press [AUTO] or {Trigger} key to perform coordinate measurement & data record automatically.



5) Press {ESC} key to quit coordinate measurement.

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## 2. MEASUREMENT

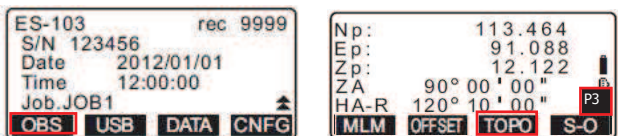
### 2-3. Topo

#### 2-3-7. Distance + Coordinate Measurement

- Both distance measurement data & coordinate data are recorded as the same point name.
- Distance measurement data is recorded first, then coordinate data is recorded.

##### -PROCEDURE-

1) Select [TOPO] in the third page of [OBS] mode.



2) Select [Dist + Coord] to display the measurement results.

Sight the point & press [MEAS] to begin the measurement.



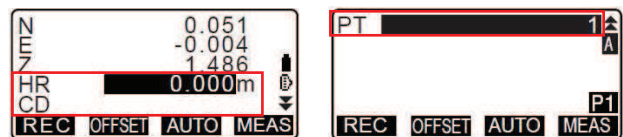
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## 2. MEASUREMENT

3) Set the following items.

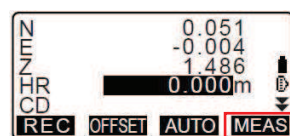
HR (Target height) / CD (Code) / PT (Point name)

Check the input data, and then press [REC] to record the data.



4) To continue measurement, sight the next point, press [MEAS].

Press [AUTO] or {Trigger} key to perform distance + coordinate measurement & data record automatically.



5) Press {ESC} key to quit distance + coordinate measurement.

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## 2. MEASUREMENT

### 2-3. Topo

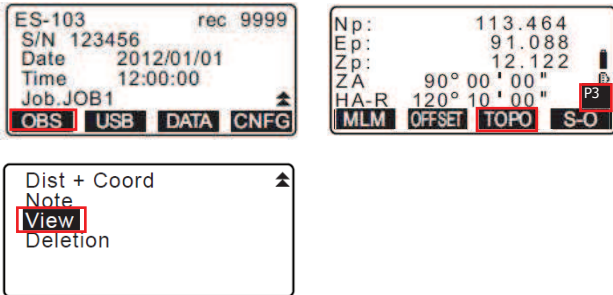
#### 2-3-8. Data View

- Enable to search for the data within the JOB to be displayed by point name.
- Known point data that are entered from an external device are not reviewed.

#### -PROCEDURE-

1) Select [TOPO] in the third page of [OBS] mode.

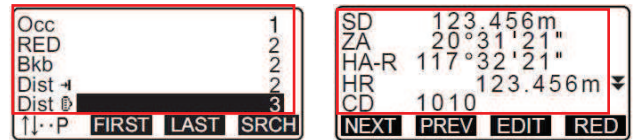
Then select [View] to display the list of recorded points.



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## 2. MEASUREMENT

2) After selecting the point name, press {ENT} key to display the details data.



Contents	Description
[Occ]	Occ data.
[Ang.]	Angle measurement data.
[Crd]	Coordinate measurement data.
[Dist]	Dist & angle measurement data.
[P]	Measured by prism mode.
[R]	Measured by reflector-less mode.
[S]	Measured by sheet mode.

\*Above list include main contents only.

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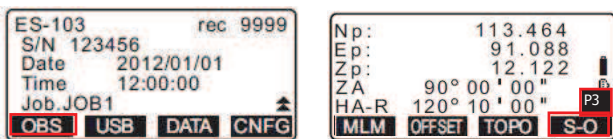
## 2. MEASUREMENT

### 2-4. Stake Out

After setting the coordinates for the point to be stake out, the instrument calculates the staking-out horizontal angle & horizontal distance.

#### -PROCEDURE-

1) Select [S-O] in the third page of [OBS] mode.

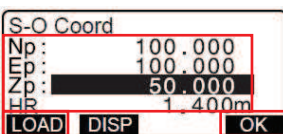


2) Select [Occ.orient] to set the instrument station data & azimuth angle of the backsight point. After that, select [S-O data].



3) After entering the coordinates of the staking-out point, press [OK].

- When [LOAD] is pressed, registered coordinates can be recalled & used as staking-out coordinates.

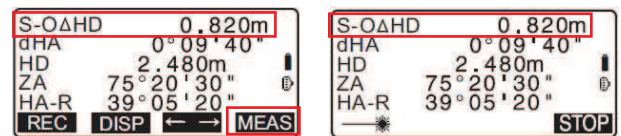


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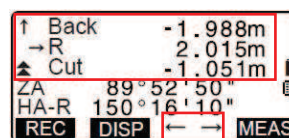
## 2. MEASUREMENT

4) The difference in the angle & distance calculated with the set instrument station & the target point is displayed. Rotate the HA until "dHA" is 0° & place the target on the sight line.

5) Press [MEAS] to begin staking-out measurement. The target & distance of the point to be stake out is displayed (S-O△HD). Move the prism forward & backward until the staking-out distance is 0m.



- By pressing [←→], an arrow pointing to the left or right displays which direction the target should be moved. When the target is within measurement range, all four arrows are displayed.



Arrow	Description
[←]	Move the prism to left.
[→]	Move the prism to right.
[↓]	Move the prism forward.
[↑]	Move the prism away.
[▲]	Move the prism upward.
[▼]	Move the prism downward.

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## 2. MEASUREMENT

6) Press {ESC} key to return to step 3).

↑ ↓ 0.010m  
← → 0° 00' 30"  
HD 2.290m  
ZA 75° 20' 30"  
HA-R 39° 59' 30"  
**REC** DISP ← → MEAS

\*[REC]: records measurement results.

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## 3. DATA TRANSFER

### 3-1. Data Output

#### -PROCEDURE Data outputting with cable-

- 1) Connect instrument & PC.
- 2) Select [DATA] – [JOB] – [Comms output].



ES-103 rec 9999  
S/N 123456  
Date 2012/01/01  
Time 12:00:00  
Job JOB1  
**DATA** CNFG

**JOB**  
Known data  
Code

JOB  
JOB selection  
JOB details  
JOB deletion  
**Comms output**  
Comms setup

- 3) Select [T type] or [S type]. Then press {ENT} key.

Comms output  
**T type**  
S type

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## 3. DATA TRANSFER

- 4) Select the JOB to be output & press {ENT} key, not press [OK] here.  
"Out" appears to the right of the JOB selected. You can select as many JOBS as you want. And then press [OK].

• "\*" means the JOB has not been output to an external device yet.

\*JOB01 Out  
JOB02 254  
JOB03 Out  
JOB04 0  
JOB05 0  
**OK**

- 5) Select output format & press {ENT} key.

#### -T type-

Comms output  
GTS(Obs)  
GTS(Coord)  
SSS(Obs)  
SSS(Coord)

GTS(Obs)	.raw
GTS(Coord)	.xyz
SSS(Obs)	.gt7
SSS(Coord)	.pnt

#### -S type-

Comms output  
**SDR33**  
SDR2X

SDR33(Obs)	.SDR
SDR2x(Obs)	.SDR

If you select following output format, select the output format of distance data.

- T type – GTS(Obs) or SSS(Obs)
- S type – SDR33 or SDR2x

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## 3. DATA TRANSFER

Comms output  
**Obs data**  
Reduced data

- [Obs data]: Outputs the slope distance.
- [Reduced data]: Outputs the horizontal distance data converted from the slope distance. (When the SSS format is selected, the height difference is also output.)

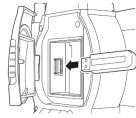
- 6) Press {ENT} key to start outputting data in the current JOB.

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### 3. DATA TRANSFER

#### -PROCEDURE Data outputting with USB-

- 1) Insert the USB memory in the slot.
- 2) Select [USB].



ES-103 rec 9999  
S/N 123456  
Date 2012/01/01  
Time 12:00:00  
Job JOB1  
OBS USB DATA CNFG

- 3) After selecting [T type] or [S type], press {ENT} key.  
Then select [Save data].

USB  
T type  
S type

USB  
Save data  
Load known PT  
Save code  
Load code  
File status

- 4) Select the JOB to be output & press {ENT} key, not press [OK] here.  
"Out" appears to the right of the JOB selected. You can select as many JOBS as you want. And then press [OK].

• "\*" means the JOB has not been output to an external device yet.

\*JOB01 Out  
JOB02 254  
JOB03 Out  
JOB04 0  
JOB05 0  
OK

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### 3. DATA TRANSFER

- 5) Select output format & press {ENT} key.

#### -T type-

Select output format.

Save data  
GTS(Obs)  
GTS(Coord)  
SSS(Obs)  
SSS(Coord)

GTS(Obs)	.raw
GTS(Coord)	.xyz
SSS(Obs)	.gt7
SSS(Coord)	.pnt



Save data  
Obs data  
Reduced data

\*GTS(Obs) & SSS(Obs) need to select the output format of distance data.

#### -S type-

Enter the file name.

Select output format.

JOB01. SDR  
Date : Jan/01/2012  
Time : 08:00  
Format: SDR33  
123.4MB / 3.8GB  
OK

SDR33(Obs)	.SDR
SDR2x(Obs)	.SDR



Send RED data : Yes  
OK

\*[RED]: Horizontal distance data converted from the slope distance.

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### 3. DATA TRANSFER



Enter the file name. Press {ENT} key.

JOB01.raw  
Date : Jan/01/2012  
Time : 08:00  
Format: GTS(Obs)  
123.4MB / 3.8GB  
OK

Remaining memory / Total memory size

- 6) Press [OK] to save the JOBS to the USB memory.

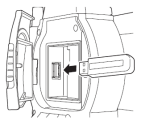
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### 3. DATA TRANSFER

#### 3-2. Data Input

#### -PROCEDURE Data inputting with USB-

- 1) Insert the USB memory in the slot.
- 2) Select [USB].



ES-103 rec 9999  
S/N 123456  
Date 2012/01/01  
Time 12:00:00  
Job JOB1  
OBS USB DATA CNFG

- 3) After selecting [T type] or [S type], press {ENT} key.  
Then select [Load known PT].

USB  
T type  
S type

USB  
Save data  
Load known PT  
Save code  
Load code  
File status

- 4) After checking the displayed current JOB name, press [OK].  
And then select the input format. If select [S type], proceed to step 6).

Load known PT  
Job JOB1  
OK

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### 3. DATA TRANSFER

5) Select the input format.

Load known PT  
GTS(Coord)  
SSS(Coord)  
OK

6) In the list of files, select the file to be read in & press {ENT} key.

ABCDE XYZ  
FGHI PNT  
JKLMNOPQ TXT  
ZZZ SDR

7) Press [YES] to read in the file on the instrument.

ABCDE XYZ  
5354byte  
Jan/01/2012 17:02  
Format :GTS(Coord)  
Confirm ?  
NO YES

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### 4. APPLIED MEASUREMENT

#### 4-1. Missing Line Measurement

Missing line measurement is used to measure the slope distance, horizontal distance, height difference, & gradient to a target from the starting point without moving the instrument.

**-PROCEDURE Measuring by observation-**

1) Select [MLM] in the third page of [OBS] mode. Then select [MLM].

ES-103 rec 9999  
S/N 123456  
Date 2012/01/01  
Time 12:00:00  
Job JOB1  
OBS USB DATA CNFG

Np: 113.464  
Ep: 91.088  
Zp: 12.122  
ZA 90° 00' 00"  
HA-R 120° 10' 00"  
MLM OFFSET TOPO S-O

MLM  
Occ Orien.  
MLM

2) Sight the starting target & press [MEAS].

MLM Set PT1  
SD  
ZA 80° 42' 15"  
HA-R 140° 42' 15"  
MOVE MEAS MLM

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### 4. APPLIED MEASUREMENT

3) Sight the 2<sup>nd</sup> target & press [MLM].

\*Before pressing [MLM], press [REC] to enable to record starting target measurement results.

MLM Set PT2  
SD 0.123m  
ZA 80° 42' 15"  
HA-R 140° 42' 15"  
MOVE REC MEAS MLM

4) The following values are displayed. Then Press [REC].

MLM  
SD 20.757m  
HD 27.345m  
VD 1.012m  
MOVE REC MEAS MLM

[SD]	Slope distance of the starting target & 2 <sup>nd</sup> target.
[HD]	Horizontal distance of the starting target & 2 <sup>nd</sup> target.
[VD]	Height difference of the starting target & 2 <sup>nd</sup> target.

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### 4. APPLIED MEASUREMENT

- Press [Tht.h] on the second page to be able to input target height of the starting target & 2<sup>nd</sup> target.
- Press [S/%] on the second page to be able to display the gradient between two points.

MLM  
SD 20.757m  
HD 27.345m  
VD 1.012m  
COORD S/% Tgt.h

5) After entering HR, CD & PT, press [OK] to record the measured results for the 2<sup>nd</sup> target.

N 10.000  
E 20.000  
Z 30.000  
HR 1.500m  
CD 1010  
OK

6) Press [OK] to record MLM results & return to the results screen.

HD 27.345m  
VD 1.012m  
CD 1010  
PT1 2  
PT2 3  
ADD LIST SRCH OK

MLM  
SD 20.757m  
HD 27.345m  
VD 1.012m  
MOVE REC MEAS MLM

\*When [MOVE] is pressed, the last target measured becomes the new starting target.

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## 4. APPLIED MEASUREMENT

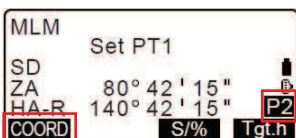
### -PROCEDURE Measuring by input coordinates-

1) Select [MLM] in the third page of [OBS] mode. Then select [MLM].



MLM  
Occ Orien.  
MLM

2) Press [COORD] on the second page.



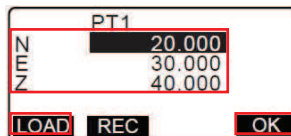
3) Select [PT1] & press {ENT} key.

Input Coord  
PT1  
PT2

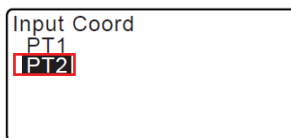
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## 4. APPLIED MEASUREMENT

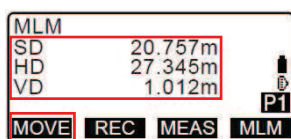
4) Input coordinates directly, or press [LOAD] to read coordinates from memory for the starting target & press [OK].



5) Select [PT2] & press {ENT} key to proceed to 2<sup>nd</sup> target input.



6) Input coordinates directly, or press [LOAD] to read coordinates from memory for the 2<sup>nd</sup> target & press [OK]. The following values are display.



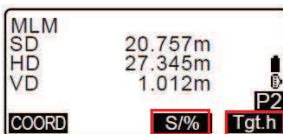
\*When [MOVE] is pressed, the last target measured becomes the new starting target.

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## 4. APPLIED MEASUREMENT

[SD]	Slope distance of the starting target & 2 <sup>nd</sup> target.
[HD]	Horizontal distance of the starting target & 2 <sup>nd</sup> target.
[VD]	Height difference of the starting target & 2 <sup>nd</sup> target.

- Press [Tgt.h] on the second page to be able to input target height of the starting target & 2<sup>nd</sup> target.
- Press [S/%] on the second page to be able to display the gradient between two points.



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## 4. APPLIED MEASUREMENT

### 4-2. Surface Area Calculation

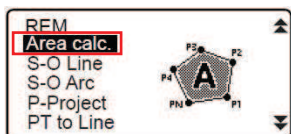
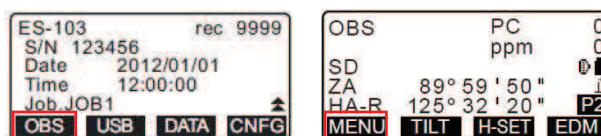
You can calculate the area of land (slope area & horizontal area) enclosed by three or more known points on a line by inputting the coordinates of the points.

- Number of specified coordinate points: 3 or more, 50 or less.
- Surface area is calculated by observing the points on a line enclosing an area in order or reading in the previously registered coordinates in order.

### -PROCEDURE Calculating by observation-

1) Select [MENU] in the second page of [OBS] mode.

Then select [Area calc.].



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## 4. APPLIED MEASUREMENT

2) After entering the instrument station data, select [Area calculation].

Area calculation  
Occ.Orien.  
Area calculation

3) Sight the first point on the line enclosing the area, and press [OBS].

01:  
02:  
03:  
04:  
05:  
LOAD OBS

4) After pressing [MEAS] to begin observation, press [OK] to enter the value of the first point in "01".

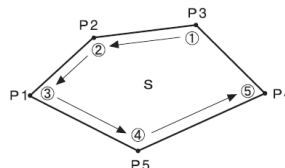
N 12.345  
E 137.186 0  
Z 1.234 0  
ZA 90° 01' 25"  
HA-R 109° 32' 00"  
REC MEAS OK

01: Pt\_01  
02:  
03:  
04:  
05:  
OBS

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## 4. APPLIED MEASUREMENT

5) Repeat the observation until all points have been measured. Points on an enclosed area are observed in a clockwise or counterclockwise direction.



6) Press [CALC] to display the calculated area.

01: Pt\_01  
02: Pt\_02  
03: Pt\_03  
04: Pt\_04  
05: Pt\_05  
CALC OBS

7) Press [REC] to record results & return to <Menu>.

Press [OK] to return to <Menu> without recording results.

PT 5  
SArea 468.064m<sup>2</sup>  
0.0468ha  
HArea 431.055m<sup>2</sup>  
0.0431ha  
REC OK

[PT]	Number of set points
[SArea]	Slope area
[HArea]	Horizontal area

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## 4. APPLIED MEASUREMENT

-PROCEDURE Calculating by reading coordinate point-

1) Select [MENU] in the second page of [OBS] mode.

Then select [Area calc.].

ES-103 rec 9999  
S/N 123456  
Date 2012/01/01  
Time 12:00:00  
Job JOB1  
OBS USB DATA CNFG

OBS PC 0  
ppm 0  
SD 0  
ZA 89° 59' 50"  
HA-R 125° 32' 20"  
MENU TILT H-SET EDM

RFM  
Area calc.  
S-O Line  
S-O Arc  
P-Project  
PT to Line

2) After entering the instrument station data, select [Area calculation].

Area calculation  
Occ.Orien.  
Area calculation

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## 4. APPLIED MEASUREMENT

3) Press [LOAD] to display the list of coordinate data.

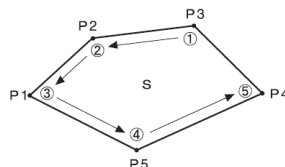
01: Pt\_01  
02:  
03:  
04:  
05:  
LOAD OBS

[PT]	Known point data saved in the current JOB or in the Coordinate Search JOB.
[Crd / Occ]	Coordinate data saved in the current JOB or in the Coordinate Search JOB.

4) Select the first point in the list & press {ENT} key.

Pt. Pt.001  
Pt. Pt.002  
Pt. Pt.004  
Pt. Pt.101  
Pt. Pt.102  
↑↓·P FIRST LAST SRCH

5) Repeat above step until all points have been read in. Points on an enclosed area are read in a clockwise or counterclockwise direction.



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## 4. APPLIED MEASUREMENT

6) Press [CALC] to display the calculated area.

```
01: Pt.002
02: Pt.004
03: Pt.101
04:
05:
LOAD CALC
```

7) Press [REC] to record results & return to <Menu>.

Press [OK] to return to <Menu> without recording results.

```
PT 3
SArea 468.064m²
      0.0468ha
HArea 431.055m²
      0.0431ha
REC OK
```

[PT]	Number of set points
[SArea]	Slope area
[HArea]	Horizontal area

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## 4. APPLIED MEASUREMENT

### 4-3. Intersection

It is possible to find an intersection point between 2 reference points by specifying the length or azimuth angle of either point.

#### -PROCEDURE-


1) Select [MENU] in the second page of [OBS] mode.

Then select [Intersect.].

```
ES-103 rec 9999
S/N 123456
Date 2012/01/01
Time 12:00:00
Job JOB1
OBS USB DATA CNFG
```

```
OBS PC 0
ppm 0
SD 0
ZA 89° 59' 50"
HA-R 125° 32' 20" P2
MENU TILT H-SET EDM
```

```
Intersect.
Traverse
Road
Xsection
```



2) Enter the 1<sup>st</sup> point data & press [NEXT].

```
Define 1st PT
Np: 113.464
Ep: 91.088
Zp: 12.122
LOAD REC MEAS NEXT
```

- Press [LOAD] to recall & use registered coordinates.
- Press [REC] to record the coordinate value as a known point data.
- Press [MEAS] to observe the selected point.

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## 4. APPLIED MEASUREMENT

3) Enter the 2<sup>nd</sup> point data & press [OK].

```
Define 2nd PT
Np: 112.706
Ep: 104.069
Zp: 11.775
LOAD REC MEAS OK
```

- Press [MEAS] to observe the selected point.

4) Enter azimuth angle (or horizontal distance) of the 1<sup>st</sup> point & 2<sup>nd</sup> point.

```
Azmth1: 45°00'00"
H.dist1: <Null>
Azmth2: 
H.dist2: 50.000m
COORD OK
```

```
1st PT
Np: 0.000
Ep: 0.000
Zp: <Null>
LOAD REC MEAS NEXT
```

- Both the azimuth angle & horizontal distance of the 1<sup>st</sup> (or 2<sup>nd</sup>) point cannot be input.
- When the cursor is on "Azmth1" or "Azmth2", [COORD] is displayed. Press [COORD] to set the azimuth angle for each point by inputting coordinates.
- Press [MEAS] to observe the selected point.

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## 4. APPLIED MEASUREMENT

5) Press [OK]. The coordinate value of the intersection point is calculated.

```
Azmth1: 45°00'00"
H.dist1: <Null>
Azmth2: <Null>
H.dist2: 50.000m
OK
```

```
Intersection1
N 176.458
E 176.458
Z <Null>
OTHER REC S-O
```

- When there are 2 intersections, [OTHER] is displayed.
- Press [S-O] to move to staking-out measurement of the required point.

6) Press {ESC} key to continue the measurement.

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## 5. CONFIGURATION

### 5-1. Config Mode

This section explains the contents of parameter setting.

ES-103 rec 9999  
S/N 123456  
Date 2012/01/01  
Time 12:00:00  
Job JOB1  
OBS USB DATA **CNFG**

Config  
**Obs.condition**  
Instr.config  
Instr.const  
Comms setup  
Unit

Key function  
Change Password  
Date and time

The following explains 5 contents of [Config] Mode.

- 1) Observation Condition
- 2) Instrument Configuration
- 3) Communication Setup
- 4) Unit
- 5) Data and time

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## 5. CONFIGURATION

### 1) Observation Condition

Dist mode : **Sdist**  
H Dist : Ground  
Tilt crn : No  
coll. crn : Yes  
C&R crn : K=0.20  
Sea level crn : Yes

V.obs : **Zenith**  
Coord. : N-E-Z  
Ang.reso : 1"  
Sheet mod : On  
Ofs V ang : Hold  
Stn.ID Incr. : 100

V manual : **No**

Items	Options
Dist mode	Sdist / Hdist / Vdist
H Dist (Horizontal distance display method)	Ground / Grid
Tilt crn (Tilt angle compensation)	Yes (H, V) / Yes (V) / No
coll. crn (Collimation correction)	Yes / No
C&R crn. (Earth curvature and refraction correction)	No / K=0.142 / K=0.20
Sea level crn (Sea level correction)	Yes / No
V.obs (Vertical angle display method)	Zenith / Horiz / Horiz 90° (Horizontal ± 90° )

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## 5. CONFIGURATION

Coord.	N-E-Z / E-N-Z
Ang.reso. (Angle resolution)	1" / 5"
Sheet mod	On / Off
Ofs V ang	Hold / Free
Stn.ID Incr. (station ID increment)	0 ~ 99999 (100)
V manual	Yes / No

### 2) Instrument Configuration

Power off : **30min**  
Reticle lev : 3  
Contrast : 10  
Resume : On  
EDM ALC : Free  
Guide pattern : 1

Items	Options
Power off	5min / 10min / 15min / 30min / No
Reticle lev	0 ~ 5 level
Contrast	0 ~ 15 level
Resume	On / Off
EDM ALC	Hold / Free
Guide pattern	1: The red & green lights flash simultaneously. 2: The red & green lights flash alternately.

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## 5. CONFIGURATION

### 3) Communication Setup

Wireless : **No**  
Baud rate : 9600bps  
Data bits : 8bit  
Parity : None  
Stop bit : 1bit  
Check sum : No

ACK/NAK : **No**  
CR, LF : No  
ACK mode : Standard

Items	Options
Wireless	Yes / No
Baud rate	1200bps / 2400bps / 4800bps / 9600bps / 19200bps / 38400bps
Data bits	8bit / 7bit
Parity	None / Odd / Even
Stop bit	1bit / 2bit
ACK/NAK	Yes / No

The setting is effective when selects "T types".

CR, LF	Yes / No
ACK mode	Standard / Omitted

The setting is effective when selects "S types".

Check sum	Yes / No
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## 5. CONFIGURATION

### 4) Unit

Temp. : °C  
 Press. : hPa  
 Angle : degree  
 Dist : meter

Items	Options
Temp. (Temperature)	°C / F
Press	hPa / mmHg / inchHg
Angle	Degree / gon / mil
Dist	Meter / feet / inch
Feet (only display when "feet" or "inch" selected above)	Int. feet (1m=3.280839895) US feet (1m=3.280833333)

### 5) Date and time

Date and time  
 Date: Jan / 01 / 2012  
 Time: 16:44:38

Items	Options
Date: Entry example	Jul 20, 2013 => 20130720 (YYYYMMDD)
Time: Entry example	2:35:17 p.m. => 143517 (HHMMSS)

## 5. CONFIGURATION

### 5-2. EDM Setting

The following explains the EDM settings.

Press [EDM] in the second page of [OBS] mode.

EDM  
 Mode : Fine "r"  
 Reflector: Prism  
 PC : 0  
 Illum.hold: Laser

EDM  
 Temp. : 15 °C  
 Pres. : 1013hPa  
 ppm : 0

Oppm

Items	Options
Mode (Distance measurement Mode)	Fine "r" / Fine AVG (Setting: 1 ~ 9 times) / Fine "s" / Rapid "r" / Rapid "s" / Tracking
Reflector	Prism / Sheet / N-prism (reflector less)
Illum. hold	Laser (Laser sight) / Guide (Guide light)
Temp. (Temperature)	-30 ~ 60 °C
Air pressure	500 ~ 1400hPa 375 ~ 1050mmHg
Ppm (Atmospheric correction factor)	-499 ~ 499