

Electronic Total Stations

Model DTM-350

Model DTM-330

Instruction Manual

Thank you for purchasing the Nikon products. This instruction manual was written for the users of the Electronic Total Station DTM-350/330. To ensure correct usage read this manual carefully before operating the instrument.

Also read the Instruction Manual provided with the Battery Charger and any other equipments used together with the DTM-350/330.

Warning and Caution Symbols in This Manual

Though Nikon products are designed to provide you utmost safety during use, incorrect usage or disregard of the instructions can cause personal injury or property damage. For your safety, read the instruction manual carefully and thoroughly before usage. Do not discard this manual but keep it near the product for easy reference.

Inside this instruction manual, safety instructions are indicated with the symbols shown below. Be sure to follow the instructions marked with these symbols for your safety.



WARNING _____

Disregarding instructions marked with this symbol may lead to death or serious injury.



CAUTION _____

Disregarding instructions marked with this symbol may lead to injury or property damage.

WARNING AND CAUTION Read This Section Before Use!



WARNING

- Never see the sun through the telescope. Doing so may cause the loss of your eyesight.
- The DTM-350/330 does not feature explosion-protected construction. Do not use in coal mines, in areas contaminated with coal dust, or near other flammable substances.
- Never disassemble, modify or repair the instrument. Doing so may cause fire, electric shock or burn.
- Use only the specified charger Q-75U/E for charging the battery pack BC-65. Charging by the other types of chargers than specified may cause fire or rupture. (BC-65 can not be charged by using the charger Q-7U/E or Q7C.)
- While recharging the battery pack, do not cover the charger with any blanket or clothing which can cause overheating. Make sure the charger is able to dissipate heat adequately. Especially, do not block its air holes while recharging. If so, the gas will remain in the battery pack and may cause rupture.
- Avoid recharging in humid or dusty places, in direct sunlight, and near heaters. Do not recharge when wet. Doing so may cause electric shock, overheating or fire.
- Although the battery pack BC-65 is equipped with an auto-reset circuit breaker, care should be taken not to short the contacts. Shorting may cause fire or burn.
- Never burn or heat the battery. Doing so may cause rupture or injury.
- When storing the battery pack or charger, guard against a short circuit by putting the insulating tape on the contact point or by doing some other methods. Failure to do so may result in a short circuit, causing a fire, burn or instrument damage.
- The battery BC-65 is not designed to be waterproof by itself. Do not wet the battery with removed from the instrument. Doing so may cause fire or burn.

WARNING AND CAUTION Read This Section Before Use!



CAUTION

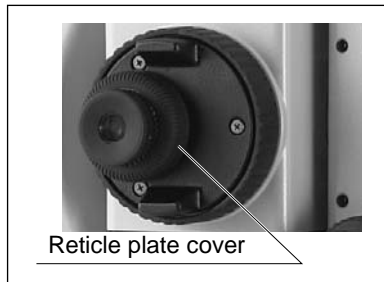
- The top of the tripod ferrule is very sharp and may injure your body. Be careful in handling or carrying the tripod.
- Check the shoulder strap and its clasp before carrying the tripod or the instrument encased in the carrying case. Damaged strap or imperfect clasping may cause an accident of falling.
- Before setting up the tripod, check below to make sure no one's hands or feet are in the way. Failure to do so may result in injury if hands or feet should be pierced by the legs of the tripod.
- Fasten firmly the thumb screws of the tripod legs after mounting the instrument on the tripod. If not, the tripod may collapse, resulting in injury or instrument damage.
- Be sure to fasten the clamp screw on the tripod securely after installing the instrument on the tripod. Failure to do this may cause the instrument to fall, resulting in injury or instrument damage.
- Fasten securely the leveling base clamp knob. If the knob is not securely fastened, the leveling base may fall when you grasp the carrying handle, resulting in injury or instrument damage.
- Do not stack up the plastic carrying case and do not use it as a stool. Plastic carrying case is slippery and unstable. Doing things like this may cause an accident and result in personal injury or instrument damage.
- Do not swing or throw the plumb bob. It may hit and injure the other person.
- Be sure to read the instructions of Quick Charger Q-75U/E before starting charging operation.

- Avoid prolonged exposure to the sun or the heat of a closed vehicle. Efficiency could be adversely affected.
- If the instrument has been used in wet conditions, incline the instrument so as to remove the water drops out of the concave parts on the instrument. Wipe off any moisture on the instrument and dry it completely before replacing it in its carrying case. The instrument contains many sensitive electronic assemblies which have been well protected against dust and moisture. However, should dust or moisture be introduced into the instrument, severe damage could result.
- Sudden changes in temperature may cloud the lenses and drastically reduce the measurable distance, or initiate an electrical system failure. Should this occur, leave the instrument in a warm location with the case closed until the temperature of the instrument returns to room temperature.
- Avoid storing the instrument in hot humid locations. Especially, the battery pack should be stored in a dry location at a temperature of less than 30°C. Higher temperature and excessive humidity may result in growth of mold on the lenses and deterioration of the electronic assemblies, leading to instrument failure.
- Store the battery pack with the battery discharged.
- When storing the instrument in areas subject to extremely low temperature, leave the carrying case open.
- Do not overtighten any of the clamp screws.
- When adjusting the vertical and upper plate tangent screws or the leveling screws, stay as close as possible to the center of the screw's range, as indicated by a line on the screw. Use a clockwise rotation of the tangent screws for final adjustment.
- If the leveling base is to be left unused for an extended period, lock-down the leveling base clamp knob and tighten its safety screw.

MAINTENANCE

Read This Section Before Use!

- Do not use organic solvents (such as ether or paint thinner) to clean the non-metallic parts such as the keyboard, and the painted or printed surfaces. Doing so could result in discoloration or in the peeling of printed characters. Clean only with a soft cloth or tissue lightly moistened with water or mild detergent.
- Optical lenses may be cleaned by lightly wiping them with a soft cloth or lens tissue moistened with alcohol.
- Do not release the reticle plate cover, and do not subject it to undue force, as this cover has been appropriately mounted. Doing so could adversely affect the watertight structure of the unit.



- Before attaching the battery pack, first make sure that the surface where the battery pack attaches is clear of foreign matter, and then press the battery pack into place until the battery mounting button rises up to the battery pack top surface. If the battery pack is not attached securely, it could adversely affect the watertight structure of the unit.
- Press the cap for data output/external power input connector until it clicks into place. If this cap is not attached securely, it could adversely affect the watertight structure of the unit.
- Do not leave the carrying case exposed to rain for an extended period of time, though it is designed to be watertight. If you expose the carrying case to rain because of unavoidable circumstances, place it with its "Nikon" nameplate upward.
- The BC-65 battery pack holds Ni-MH inside. Be sure to follow the laws or rules of your municipal waste system when disposing of it.

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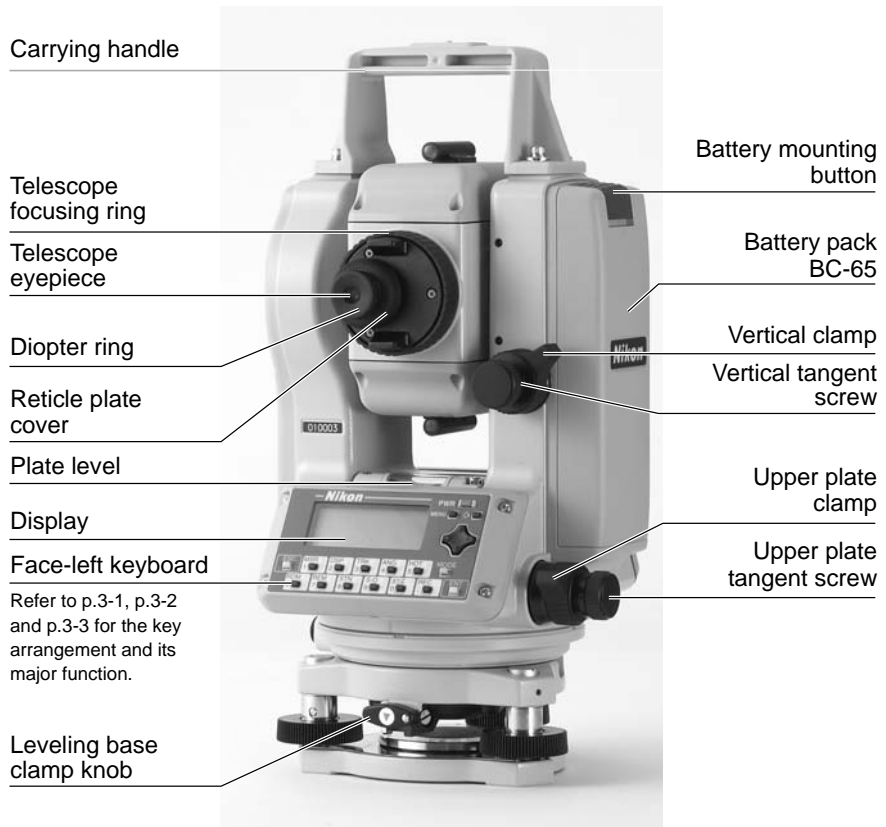
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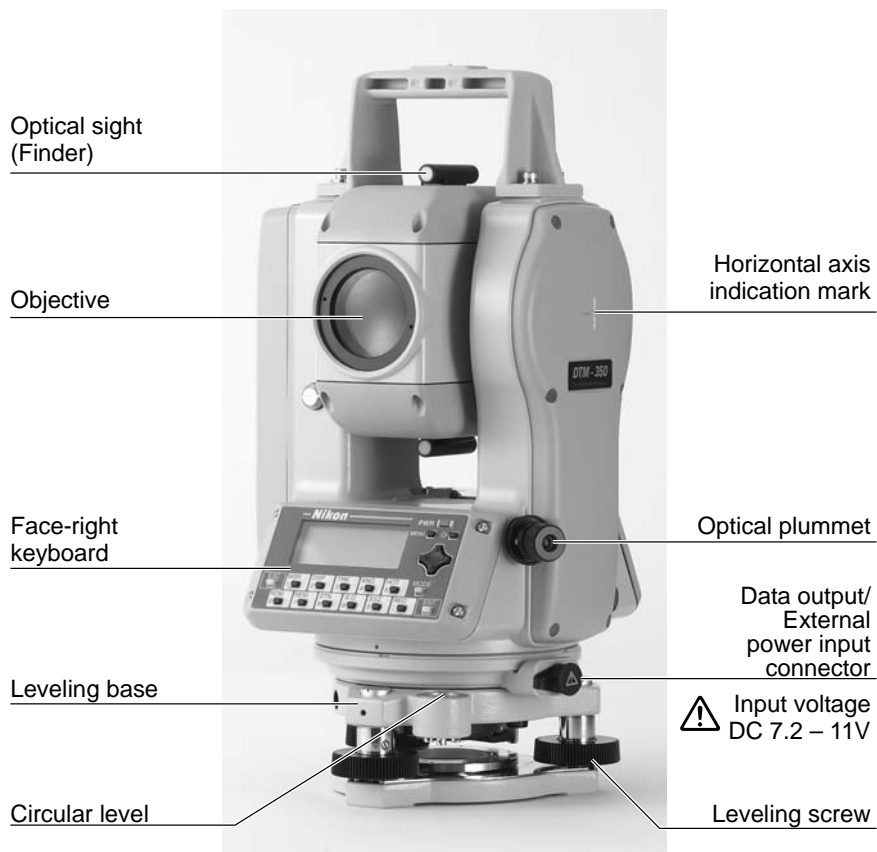
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1. NOMENCLATURE





2. PREPARATION

2-1 Unpacking and Packing the Instrument



- Handle gently the instrument to guard against shocks or excessive vibration.
- Encase the instrument with the battery pack attached.

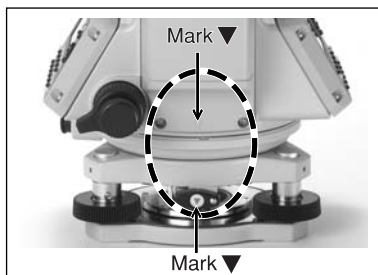
Unpacking

Hold the carrying-handle and take the instrument out of the case. The instrument is placed in its carrying case as shown in the figure.



Packing

Direct the telescope downward and align the storage mark (.) on the upper plate and the mark (.) on the leveling base clamp knob. Fasten lightly the clamp knobs and then replace the instrument in its case.



2-2 Recharging and Connecting the BC-65 Battery Pack

2

PREPARATION



WARNING

- Use only the specified charger Q-75U/E for charging the battery pack BC-65. Charging by the other types of chargers than specified may cause fire or rupture. (BC-65 can not be charged by using the charger Q-7U/E or Q-7C.)
- While recharging the battery pack, do not cover the charger with any blanket or clothing which can cause overheating. Make sure the charger is able to dissipate heat adequately. Especially, do not block its air holes while recharging. If so, the gas will remain in the battery pack and may cause rupture.
- Avoid recharging in humid or dusty places, in direct sunlight, and near heaters. Do not recharge when wet. Doing so may cause electric shock, overheating or fire.
- Although the battery pack BC-65 is equipped with an auto-reset circuit breaker, care should be taken not to short the contacts. Shorting may cause fire or burn.
- Never burn or heat the battery. Doing so may cause rupture or injury.
- When storing the battery pack or charger, guard against a short circuit by putting the insulating tape on the contact point or by doing some other methods. Failure to do so may result in a short circuit, causing a fire, burn or instrument damage.
- The battery BC-65 is not designed to be waterproof by itself. Do not wet the battery with removed from the instrument. Doing so may cause fire or burn.



CAUTION

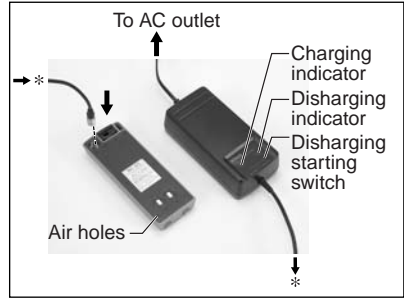
- Be sure to read the instructions of Quick Charger Q-75U/E before starting charging operation.



- Recharge the battery pack indoors within an ambient temperature range 0°C to +40°C. Charging outside this temperature range will trigger a protective circuit which prevents normal recharging.
- Keep the charging plug clean to prevent misoperation.
- If the charging indicator blinks whenever charging starts, there is an error in the battery pack. Stop using the battery pack and contact your dealer or a Nikon representative.
- If the battery pack is recharged within the specified ambient temperature range and the charging indicator stays lit for 4 hours or longer, something is wrong. Contact your dealer or a Nikon representative. (If an ambient temperature lowers than 0°C while recharging the battery, the charger's temperature sensor will stop the charging operation. In such a case, it is normal for the charging indicator to stay lit for 4 hours or longer. If the ambient temperature increases to above 0°C, the quick charge operation will restart and the charging will be completed within 3 hours.)
- After recharging the battery pack, do not recharge it again before using or discharging it. This is to prevent the battery pack's performance from degrading.
- During the quick charging or discharging operation, the battery pack and quick charger will become warm. This is normal.
- Temperatures of less than approx. -20°C will reduce the battery capacity. This will result in a shortened working life compared to operation at a normal temperature.
- The battery pack left disused for a long period might not be fully recharged. In such a case, charge and discharge the battery pack several times to restore its full recharging potential.
- BC-65 can be charged by using the charger Q-70U/E or Q-70C, but not be fully charged.

Recharging Procedure

- (1) Insert the power plug of charger into an AC outlet.
- (2) Connect the charging plug to the battery pack's charging connector.
- (3) Quick charging will then start automatically. Check that the charging indicator lights.
- (4) When charging is completed, the charging indicator goes out.



Discharging Procedure

- (1) Insert the power plug into an AC outlet.
- (2) Connect the charging plug to the battery pack's charging connector.
- (3) Press the discharge starting switch to start discharging. Check that the discharging indicator will light.
- (4) When discharging is completed, the discharging indicator goes out and quick charging starts automatically. During charging, the charging indicator lights.



- To stop discharging before completion, press the discharge starting switch again. The discharging will stop and quick charging will start automatically. During quick charging the charging indicator lights.
- Discharging the battery pack once every 10 recharging cycles is effective.



Discharging Operation

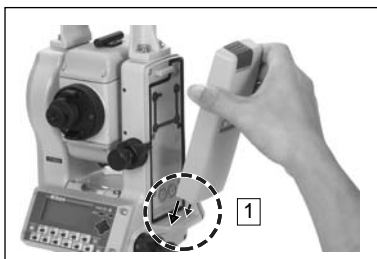
The battery pack is designed for repetitive recharging and use. However, if the battery pack is recharged while it still has enough power to operate the surveying instrument, the battery power will last for shorter periods. (Memory effect) In such a case, discharging the battery pack first can refresh its capacity for normal performance.

Attaching the BC-65

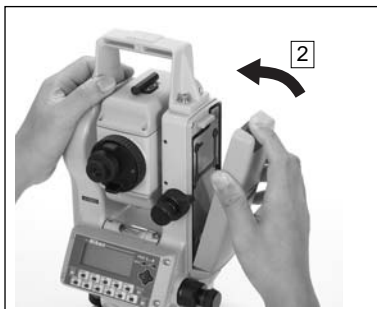


- Be sure to turn off the [PWR] key before attaching or detaching the BC-65.
- Avoid touching the battery pack BC-65 contacts.
- Before attaching the battery pack, first make sure that the surface where the battery pack attaches is clear of foreign matter, and then press the battery pack into place until the battery mounting button rises up to the battery pack top surface. If the battery pack is not attached securely, it could adversely affect the watertight structure of the unit.

- (1) Align the two projections at the bottom of the battery pack with the concave parts of the instrument main body.



- (2) Attach the battery pack by pushing in while holding the instrument.
- (3) Make sure that the battery mounting button is released.



Detaching the BC-65

- (1) Depress the battery mounting button while holding the battery pack.



- An external battery (optional accessory) is available for use with the DTM-350/330. When the external battery is connected and the battery pack BC-65 is mounted on the instrument, its electrical source will automatically be switched to the one with the higher battery power.
- Read also the instruction manual supplied with the external battery.

2-3 Setting up the Tripod



CAUTION

- The top of the tripod ferrule is very sharp and may injure your body. Be careful in handling or carrying the tripod.

- (1) Open the tripod legs sufficiently enough for the instrument to be stable.
- (2) Assure that the station point is located directly beneath the center hole in the tripod head.
- (3) Firmly press the tripod ferrules into the ground.
- (4) Level the top surface of the tripod head.



- Precise level is necessary when the plumb bob is used for the next section “centering”.

- (5) Fasten firmly the thumb screws on the tripod legs.
- (6) Place the instrument on the tripod head. Insert the tripod mounting screw into the center hole of the instrument base plate and tighten.



- Do not carry the instrument while it is attached to a tripod.

2-4 Centering

“Centering” refers to the precise alignment of the instrument’s central axis over the station point. This can be accomplished in two ways, through the use of a plumb bob, or the optical plummet.

Using Plumb Bob

- (1) Place the instrument on the tripod head. Insert the tripod mounting screw into the center hole of the instrument’s base plate and tighten.
- (2) Hang the plumb line on the hook of the tripod mounting screw and adjust the length of the plumb line to the position the tip of the plumb bob at the height approximately level with the station point.
- (3) Slightly loosen the tripod mounting screw. Supporting the outer side of the leveling base with both hands, carefully slide the instrument about on the tripod head until the tip of the plumb bob is perfectly positioned over the center of the station point.





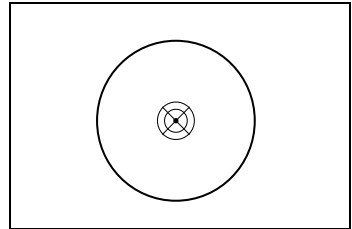
- Confirm precise alignment by viewing from two directions at right angles to each other.

Using Optical Plummet



- Carry out the “CHECKING AND ADJUSTMENT of Optical Plummet” (p.4-2) when the centering operation is performed at a position higher than the station point.
- For high accuracy, carry out the “CHECKING AND ADJUSTMENT of Optical Plummet” (p.4-2) before the centering operation.

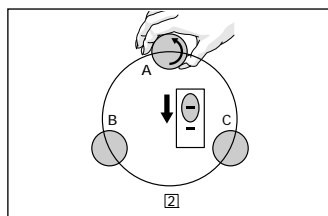
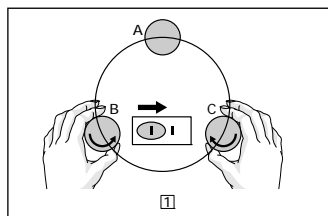
- (1) Place the instrument on the tripod head. Insert the tripod mounting screw into the center hole of the instrument’s base plate and tighten.
- (2) Looking through the optical plummet, align the station point image with the center mark  of the reticle by turning the leveling screws.
- (3) While supporting the tripod head with one hand, loosen the tripod leg clamps and adjust the lengths of the legs to center the air bubble in the circular level. Then tighten the tripod leg clamps.
- (4) Using the plate level proceed to the leveling procedures described in the next section “Leveling”.
- (5) Looking through the optical plummet, reconfirm that the station point image is still centered in the reticle mark .
- (6) If the slight displacement is detected, loosen the tripod mounting screw and correct the instrument’s positioning with direct movement (not rotational). If the displacement is major, repeat Steps from (2).



2-5 Leveling

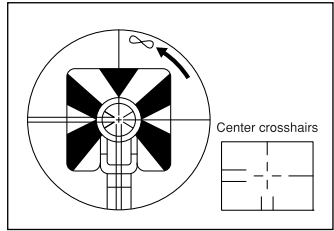
“Leveling” refers to the precise vertical alignment of the instrument’s vertical axis. The procedure for leveling by means of the plate level is described below.

- (1) Loosen the upper plate clamp. Rotate the alidade to position the plate level to a point parallel with any two of the leveling screws B and C (See Figure).
- (2) Using these two screws, move the bubble to the center of the level.
- (3) Rotate the alidade approximately 90° and again move the bubble to the center of the level by turning the leveling screw A, as shown in Figure.
- (4) Repeat Steps (1) through (3) to center the bubble in both positions shown by the Figures.
- (5) Furthermore, rotate the alidade 180° . If the bubble in the plate level remains centered, leveling is complete.
- (6) If the bubble moves off center, refer to p.4-1 “CHECKING AND ADJUSTMENT of Plate Level” and adjust the plate level.



2-6 Sighting

“Sighting” refers to the aiming of the telescope at the target, bringing the target image into focus, and aligning it with the center crosshairs of the reticle.



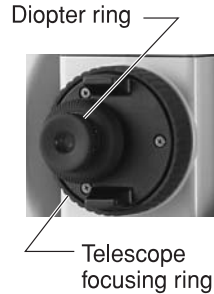
WARNING

- Never view the sun through the telescope. Doing so may cause the loss of your eyesight.

Notes on sighting are as follows:

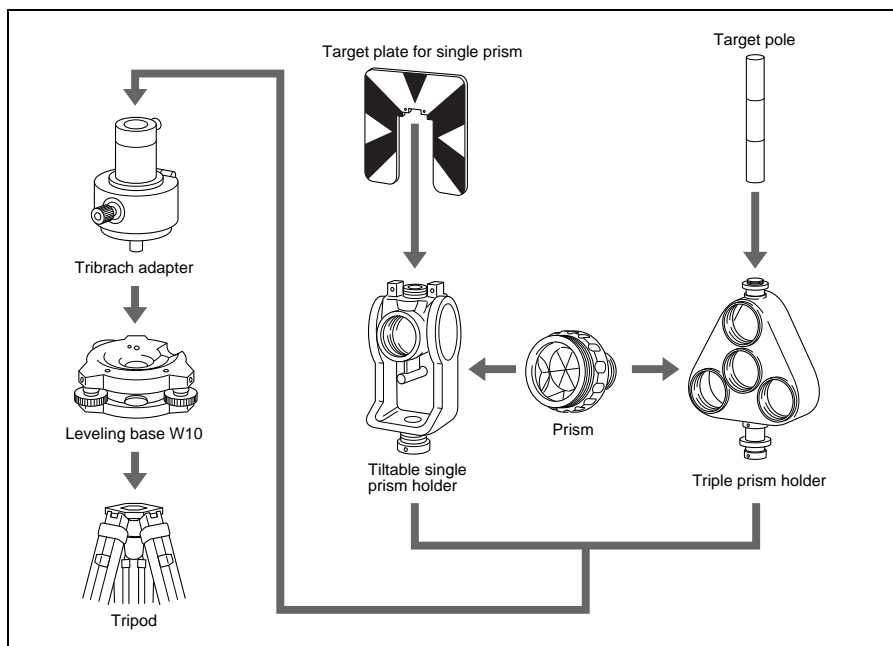


- **Diopter Adjustment**
Direct the telescope towards a blank area, such as the sky or a piece of paper. Looking through the eyepiece, rotate the diopter ring to bring the reticle crosshairs into sharp focus.
- **Elimination of Parallax**
Rotate the focusing ring to bring the target image into focus on the reticle crosshairs. Move your eye vertically and laterally to see if the target image moves in relation to the reticle crosshairs. If the target image does not move, there is no parallax. If it moves, rotate the telescope focusing ring to eliminate the parallax.



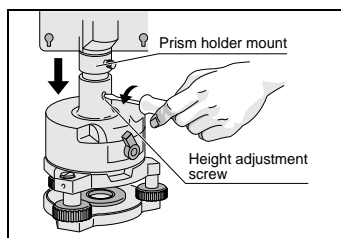
2-7 Assembling the Prism Reflector

Assemble the prism reflector referring to the Figure below.



Height Adjustment of Tribrach Adapter

Tribrach adapter can be adjusted to two heights by sliding up and down the prism holder mount. To change the height, first remove the height adjustment screw from the tribrach adapter. Slide the prism holder mount to align the height adjustment screw holes and screw in the adjustment screw again.

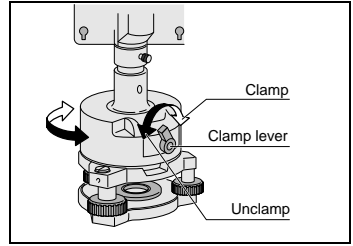


- When using the DTM-350/330, set the prism holder mount to the lower position.

Direction Adjustment of the Prism

The prism mounted on the tribrach adapter can be faced in any direction on the horizontal surface.

To change the direction, release the rotation clamp by turning the clamp lever counterclockwise. Turn the upper plate of the tribrach adapter so that the prism faces the desired direction. Turn the clamp lever clockwise.



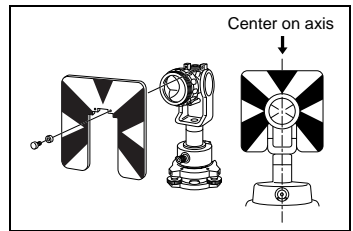
Prism Constant

Attach the prism to the single prism holder or triple prism holder. The prism constant of Nikon prism is 0, regardless of the prism holder type.

- The triple prism holder can also be used as a single prism holder if one prism is screwed in the center thread of the triple prism holder.

Position of Target Plate for Single Prism

Attach the target plate to the single prism holder using the supplied two set screws. Within the range of screw hole, adjust the position of the target plate so that the apex of the wedge pattern of the target plate will come into line with the centers of the tribrach adapter and the prism.



2-8 Face-left/Face-right Measurement

Face-left Measurement: Measurements made with the vertical circle positioned to the left of the telescope eyepiece

Face-right Measurement: Measurements made with the vertical circle positioned to the right of the telescope eyepiece



- Be careful not to catch your finger in the opening between the instrument's standard and the telescope when rotating the telescope.



- Mechanical constant error (except in some special cases such as vertical axis error) can be effectively cancelled out by averaging the measurement values obtained in face-left and face-right measurements. Therefore, both measurement methods should be used whenever possible.



Face-left measurement











Face-right measurement




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8) Note.....	3-121

3. OPERATION

3-1 Display and Key Functions

Illumination Key

Turns ON/OFF the display Back-light.
Holding down for one second will show a screen to adjust: 1.Backlight, 2.Sound



Battery Voltage Level Indication









Indicates the battery level in five steps. (See p.3-4)










Input Mode Indication

Indicates the input key mode (**A** or **1**) during input PT or CD input. (See p.3-29)

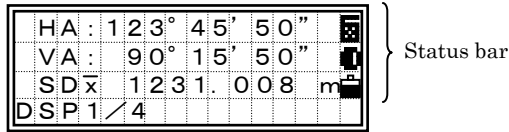
Signal Level indication

Indicates the reflected light intensity in five steps, with two additional signal status indicators. (See p.3-4)

Key	Summary	for detail
	Turns the Power ON and OFF.	p.3-14
	Turns the Backlight ON and OFF. When held down for over one second, it shows a setting screen for: 1:Backlight, 2:Sound ON/OFF.	p.3-28
	Displays MENU items: 1:JOB, 2:COGO, 3:Sett, 4:Data, 5:Comm., 6:Time, 7:Calib., 8:Note. Also, a sub-function menu such as DEL/Edit/Add can be shown by this key in JOB and Data.	p.3-78
	Changes the key input mode between alpha-numeric (A), numeric (1) and Lst/Stk for inputting PT or CD. Also, the Qcode mode can be activated by this key on the Basic Measurement Screen (BMS).	p.3-23
	Records measurement data. Holding this key for a second from the BMS, enables to record data as CP record instead of SS. In the numeric input mode (1), enters a decimal point or minus sign. In the alpha-numeric input mode (A), enters (.), +, -.	p.3-64
	Returns to the previous screen. In the numeric or alpha-numeric input mode, clears the input data.	/
	Starts measurement based on the measure mode settings for the MSR key and displays the result. Holding down this key for a second displays its measure mode settings (Target, Prism Const., Mode and AVE). In the numeric input mode (1), enters 1. In the alpha-numeric input mode (A), enters A, B, C, 1.	p.3-17
	When there are two or more display screens, switches between them. To change the combination of the display items on DSP1/4, 2/4 and 3/4 (same as S-O3/8, 4/8 and 5/8), holding down this key for a second. In the numeric input mode (1), enters 2. In the alpha-numeric input mode (A), enters D, E, F, 2.	p.3-20

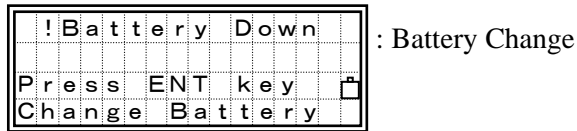
	<p>Initiates a TRK measurement and displays the result. Holding down this key for a second displays its measure mode settings (Target, Prism Const., Mode and AVE). In the numeric input mode (1), enters 3. In the alpha-numeric input mode (A), enters G, H, I, 3.</p>	p.3-17
	<p>Displays the angle menu. In the numeric input mode (1), enters 4. In the alpha-numeric input mode (A), enters J, K, L, 4.</p>	p.3-30
	<p>Displays the HOT menu. While in Qcode observation mode, it has to be held down for one second to activate the HOT menu. In the numeric input mode (1), enters 5. In the alpha-numeric input mode (A), enters M, N, O, 5.</p>	p.3-25
	<p>Measures differences between remote target points. In the numeric input mode (1), enters 6. In the alpha-numeric input mode (A), enters P, Q, R, 6.</p>	p.3-34
	<p>Measures the elevation difference between a prism target point and an arbitrary point on a vertical line extending from the target point. In the numeric input mode (1), enters 7. In the alpha-numeric input mode (A), enters S, T, U, 7.</p>	p.3-36
	<p>Sets the station point (known point or arbitrary point). In the numeric input mode (1), enters 8. In the alpha-numeric input mode (A), enters V, W, X, 8.</p>	p.3-37
	<p>Stakeout coordinates or pre-calculated angles/distances. Holding this key for a second in Stakeout displays a S-O related settings screen. In the numeric input mode (1), enters 9. In the alpha-numeric input mode (A), enters Y, Z, space, 9.</p>	p.3-49
	<p>Enables observations without recording ST. HI, HT, Stn coordinate, and BS azimuth can be input. In the numeric input mode (1), enters 0. In the alpha-numeric input mode (A), enters *, /, =, 0.</p>	p.3-29
	<p>Proceeds to next screen. In the numeric or alpha-numeric input mode, accepts the input data. Also, on the BMS, outputs the current measurement data (Pt/HA/VA/SD) via COM port when “Ext.Comms=Nikon” is set.</p>	

Basic Measurement Screen (BMS)



1) Battery

- : Level 4 (Full)
- : Level 3
- : Level 2
- : Level 1
- : Battery LOW



2) Signal

- : Analog power OFF
- : No-Signal (slow-blink) or Signal LOW (quick-blink)
- : flicker condition (blink)
- : Level 1 (minimum)
- : Level 2
- : Level 3
- : Level 4 (Max)

3-2 Pre-Start

Input Point Name/Number

You can use point numbers or names up to 12 digits in length. When the system gives you a default PT, basically, the Last recorded PT + 1 is used, except the case where the last digit is alphabet.

For coordinate records, you cannot use a point name/number that already exists in the current Job except when you record sideshots or stakeout shots. (See p.8-2)

1) Pressing [ENT] without a PT

In COGO, a coordinate input screen will be displayed if you leave the PT field blank. This coordinate will be used temporarily in the calculation and will not be saved in the database.

Input	1st	Point
PT:		1
HT:	1.5000m	
CD:		

When you search a point in Stakeout or Data View/Edit without PT, the system searches the point based on the input CD or other given conditions. Otherwise, you must enter a PT to record the point.



- The cursor is placed on the first character of the string when the input mode is activated. It is “All Replace” mode.

Input	1st	Point
PT:	1205	1
HT:	1.5000m	
CD:		

- Pressing the right arrow key changes the input mode into “Overwrite”, leaving the cursor on the first character. Pressing the left arrow key moves the cursor to the end of the current input.

2) Inputting a new PT

When you input a new point name/number, it shows a coordinate input screen right. You can input a 2D “NE(EN)”, 3D “NEZ(ENZ)”, or elevation only “Z” coordinate.

PT:	55																			
X:	-	1	5	4.	2	3	1													
Y:																				
Z:																				

Press the [ENT] key on the last line (Z:field) to store the point in the current Job.

3) Inputting a known PT

When a known point name/number is input, its searched coordinate is displayed briefly and a beep is sounded before proceeding to the next step.

Input 1st Point																				
PT:	55																			
HT:					1.	5	0	0	0	m										
CD:																				

▼ [ENT]

PT:	55																			
X:					-	5	2.	2	3	1	0									
Y:					2	8	4	4.	3	6	0	5								
Z:					1	3	5.	3	2	5	2									

▼ beep

Input 1st Point																				
PT:	55																			
HT:	1.	5	0	0	0					m										
CD:	CP	1																		

4) When a wildcard (*) is specified

A list of available points are displayed when you use an asterisk to input PT or CD.

Input	1st	Point	
PT :			A
HT :	1.	5000m	PT
CD :	FENCE*		

▼ [ENT]

MP, 12, FENCE3	
UP, 23, FENCE6	
>MP, 39, FENCE51	PT

▼ [ENT]

PT : 39			
X :	-52.	2310	
Y :	2844.	3600	PT
Z :	135.	3250	

Use the up/down arrow keys and [ENT] to select the point you want to use.

If more than four points match the input conditions, there will be a ↓ sign in the lower right corner. You can also use the Right/Left arrow key to page-up/page-down the list. (See p.3-12)

When you select a point from the list, its coordinate is displayed briefly and a beep is sounded before proceeding to the next step.

How to input a Code

Basically, CD: field is defaulted to the code previously used.
You can change it on the recording point screen.

1) Manual Input

Press the [Mode] key to change the input mode into alpha-numeric (A) or numeric (1) mode.

PT :	10006								
HT :		1.	5000m						
CD :	CURB87								

2) Stack Input

Press the [Stk] key to display a list of Code stack. The stack may contain up to 20 codes.

PT :	10006								
HT :		1.	5000m						
CD :	CURB								
Lst	O/S	Qcd	Stk						

▼ [Stk]

To select the previously used code, press the [Stk], then use the down arrow key to move the cursor downwards through the stack list.

	CURB								
>	TRAIL								
	HEDGE								
	BUILDING								

▼

The up arrow key moves up through the stack. Press the [ESC] key to get out of the Stack List without choosing any codes.

Press the [ENT] key to input the code into the CD field.

PT :	10006								
HT :		1.	5000m						
CD :	BUILDING								
Lst	O/S	Qcd	Stk						



- Each code can be input up to 12 characters.
- When you re-boot the program, Stack area will be cleared.

3) Code List

Press the [Lst] key to display a feature code List. It shows the first four codes from the first layer.

To edit the Code List, you can go into MENU/4:Data/3:Code List.
(See p.3-109)

PT:	10053	-A10		
HT:		1.6050m		
CD:	CURB			
Lst	O/S	Qcd	Stk	

▼ [Lst]

There is a “→” at the end of each Layer name. “Layer” has more Codes underneath. For example, when you press the [ENT] key on “SURFACE→”, it shows another layer under the “SURFACE”

	STRUCTURE			
>	SURFACE→			
	SURVEY→			
	VEGETATION			

▼ [ENT]

When a feature code is selected, it is added to the CD: field. If a code already exists and the cursor is on its first character, it will be replaced by the new code.

>	CMP			
	MB→			
	RCP			
	SPR			



All items in the List are shown in alphabetical order. The “first character search” is also available to find a desired code quickly. You can just input the first character of the feature code directly by using ten-key. While the List is shown, the ten-key is actually set to alpha-numeric input mode. (See next page)

The First character Search in List

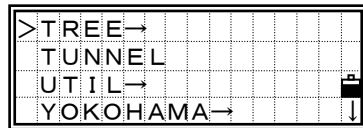
For instance, when you want to see the feature code begins with “T”, you can just hit [7] key twice, while it shows a List.



When you hit the [7] key once, it shows “S” in input mode field to indicate the selected character. It changes to “T” when you press it again within a certain duration.



When the input is fixed, the cursor moves to the feature code beginning with the character you input. If the exact item doesn't exist, the cursor moves to the next available choice, i.e., next one in alphabetical order.

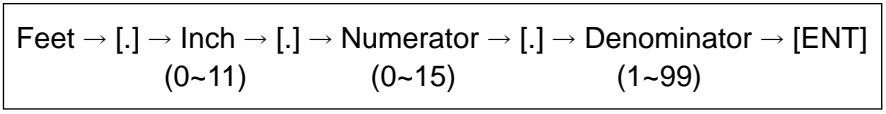


4) Qcode

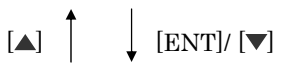
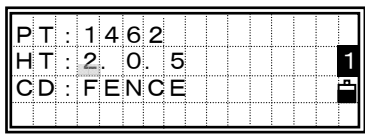
This is a quick and frequent function to shoot and record many points with feature codes in the field. You can use up to 10 Quick-codes at a time. Before activating Qcode mode or while you are in it, you can newly assign a code to any numeric key or edit the code currently assigned to a key. (See p.3-27, 3-65)

How to Input the Feet-Inches on the Instruments

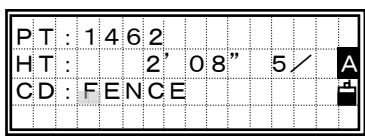
When either US Survey Feet (US-Ft) or International Feet (I-Ft) is selected as the distance unit, there is an option for values to be input and displayed in decimal feet, or in feet and inches (See p.3-93). All distances, HI's, HT's and coordinate values will be entered and displayed in feet and inches. The input screen allows you to enter "feet and inches" element by element separated by periods.



If the denominator is 16, you don't have to key in 16. When you press the [ENT] after inputting the numerator, the system understands that the denominator is 16.



Denominator "16 (for 16th inches)" is not displayed on the screen. 2'08"5/ indicates 2 feet, 8 and 5/16th inches. Refer to the following examples:



- 65' 5 3/8" is entered 65.5.3.8
- 65' is entered 65
- 65' 5" is entered 65.5
- 65' 5 3/8" can be entered 65.5.6
- 5 3/8" is entered 0.5.3.8 or 0.5.6

Input value (numerator/denominator portion) is automatically converted to the closest value from the following.

0, 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 1/16, 3/16, 5/16, 7/16, 9/16, 11/16, 13/16, 15/16

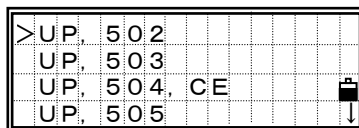
(The denominator 16 is not shown on the screen.)

List Displays

You will see the same type of “list” display in View/Edit data (MENU/4:Data), Code List function, Qcode Edit (HOT/5:Qedit), and Job manager (MENU/1:JOB).

There are some common rules to operate this “list”.

“>” on the first line shows the current cursor place.



The screenshot shows a list display with four lines of text. The first line has a greater-than sign (>) at the beginning, followed by 'UP, 502'. The second line is 'UP, 503'. The third line is 'UP, 504, CE'. The fourth line is 'UP, 505'. A small icon of a folder with a downward arrow is visible in the bottom right corner of the list area.

>UP, 502									
UP, 503									
UP, 504, CE									
UP, 505									

“↓” on the lower right corner means that there are more pages after this page.

When you see this sign, you can use the Right/Left arrow key to page up or down the list.

Press the Up/Down arrow key moves cursor one by one. To pick up one record from the list, press the [ENT] key after you move the cursor to the desired record.

In some cases, the [Mode] key is also available on this “list” screen to activate a sub-function menu.

About Jobs

When you record data on the instrument, you must create or open a Job. Up to 8100 records can be stored to one Job database. You can have a maximum of eight Jobs at one time. (See p.3-78 for detail)

Please ***check the settings first*** when you use the instrument for the first time.

Settings → Create Job

- 1) Enter [MENU] and [3:Sett].
- 2) Check the settings at least [1:Angle], [2:Dist], [3:Coord.], and [5:Unit].
There are some job settings in them. You cannot change any of the job settings after creating a job.
- 3) After checking those settings, press [ESC] to return to MENU screen.
- 4) Press [1:Job], [MENU], and [1:Create].
You can confirm the current job setting via [2:Set] key in “Create JOB?” screen.

Control Job

- 1) Create a job in the office and store some coordinate data that may be used by several field works.
- 2) Press [MENU] and [1:Job]. Move the cursor onto the job you want to use as a common file (control job).
- 3) Press [MENU] again and choose [3:Control].



The system will search the coordinate points in the Control Job when the input point cannot be found in the current Job. If the point is found in the Control Job, it will be copied into the current Job. (See p.3-82)

3-3 Getting Started

Turn On the Instrument

Press the [PWR] key to turn on the instrument. The start-up screen shown right appears.

TILT	TELESCOPE	
>Temp	20° C	
Press	1013 hPa	P
2000-07-17	11:35	

The current Temperature and Pressure are displayed.

The displayed value can be modified on the spot after pressing the [ENT] key. Use the up/down arrow keys to select the desired item.


TILT	TELESCOPE	
>Temp	20° C	1
Press	1013 hPa	P
2000-07-17	11:35	

Tilt the telescope past the horizontal position in the face-left position. It will automatically resume the last job and return to the screen where the instrument was previously powered off.



If you choose the [Rst] option when turning off the instrument, it restarts the software from the Basic Measurement Screen (BMS) without having any JOB opened.

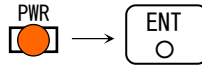
Rotating the alidade before tilting the telescope initializes the HA.

HA INITIALIZED											
>Temp		20°		C							
Press		1013		hPa							
2000-07-17		11:35									

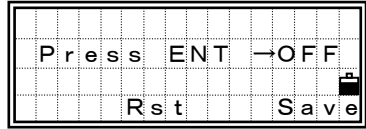


- When the telescope is tilted before rotating the instrument, the horizontal angle is not initialized. Instead, it simply recalls the last HA reading before Power OFF.
- The previous orientation can only be recalled if the HA was initialized before the original HA was set. When you prefer to recall orientation using this method, it is recommended that you get accustomed to rotating the alidade whenever you turn ON the instrument.

Turn Off the Instrument



Press [PWR] and [ENT] to turn off the instrument.



[2:Rst]=re-boots the program and starts over.

[4:Save]=puts the instrument into sleep mode.

[ESC]=cancels the power-off process and returns to the previous screen.

“Sleep mode” is automatically activated based on the Power Save setting (see p.3-91) or when the [2:Save] is selected on the above screen.



In this mode, LCD backlight is to be turned off.

Any key input, receiving a remote control command or rotating the instrument will wake up the instrument.

Measuring Distances

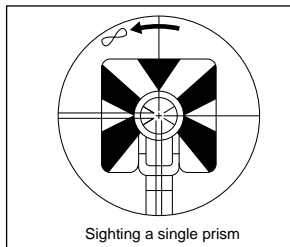


1) Sighting a prism reflector

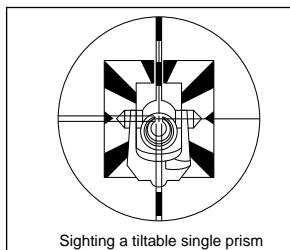


WARNING

Never view the sun through the telescope.
Doing so may cause loss of eyesight.



Sighting a single prism



Sighting a tiltable single prism



For assembling the prism reflector, refer to p.2-11.

2) Measuring distances

Press the [MSR] or [TRK] key on the BMS or any other observation screens to take a measurement.

HA :	90°	15'	50"	F
VA :	123°	45'	50"	
SD \bar{x}	1241.	008	m	
DSP	1/4			

When the Average count is set to 0, measurements are taken continuously until [MSR]/[TRK] or [ESC] is pressed. Each time a measurement is taken, the distance is updated.

For the Average count is set to 1–99, the averaged distance is displayed after the last shot. The header “SD:” changes to “SD \bar{x} ” for this value.

If the signal level is insufficient for measurement, the signal icon will blink. (See page 3-4)



- To change the Height of Target, Temperature and Pressure, or settings for measurement, press the [HOT] key from any observation screen. (See page 3-25)


1 :	HT	5 :	Qedit
2 :	T-P	6 :	Qmode
3 :	Meas.		
4 :	Level		

- T-P correction, Sea level correction, C&R adjustment and Map projection are included in Job settings. They can be defined when creating a job. (See page 3-79)

- When the [MENU] key is pressed on the BMS or any other observation screens, it stops the measurement and displays the MENU screen.

3) Measurement mode settings

Holding down the [MSR] or [TRK] key for one second shows the measurement settings for each key.

>	T a r g e t	:	P r i s m	
	C o n s t	:	3 0 m m	
	M o d e	:	P r e c	
	A V E	:	2	

Move the cursor by the up/down arrow keys and use the right/left arrow keys to change the setting.

Target = Prism/Sheet

Prism constant (Const) = -999~999mm

Mode = Prec/Normal

AVE = 0 (Continuous) ~ 99

“ — — — ”(for Prism) or “))) ”(for Sheet) is displayed during the measurement depending on the Target setting.



In order to apply better cyclic error adjustment in distance measurement, the 'Target' setting is introduced. It efficiently eliminates multi-path reflection.

3
MSR/TRK

Switching between Screens



1) Changing display

Press the [DSP] key to change the contents of the screen on the Basic Measurement Screen (BMS).

Upon each press of the [DSP] key, the screen scrolls among DSP1/4 to 4/4.

Change of the screen can be done before, during or after a measurement.

On the BMS, pressing the [REC] key from any of these screens will store a SS record.

Depending on the “Store data” setting, it will record RAW data (HA,VA,SD), coordinate data (X,Y,Z) or Both. (See p.3-93)

1/4 screen

HA :	90°	15'	50"	
VA :	123°	45'	50"	
SD :	284.	563	m	
DSP 1/4				



2/4 screen

HA :	90°	15'	50"	
VD :		15.	635	m
HD :	266.	347	m	
DSP 2/4				



3/4 screen

HL :	269°	44'	10"	
V% :		15.	28	%
HD :	266.	347	m	
DSP 3/4				



4/4 screen

X :		-4435.	256	
Y :		288.	953	
Z :		15.	325	
DSP 4/4				



When the Secondary Unit is set to any distance unit, it shows HD/ VD/ SD in the specified unit as the fifth screen. (See p.3-93 for Secondary Unit setting)

<for "Ft-inch">

H :	700'	07"	1/4	
V :	-6'	02"	0	
S :	999'	11"	15/8	
DSP 5/5				



Screens can be changed using the DSP key in the BMS, RDM, Stakeout, and Data View functions.

2) Customizing items on the BMS

Holding down the [DSP] key for one second to customize the screen on the BMS.

DSP1/4, DSP2/4, and DSP3/4 can be edited to show the desired items. (*)

HA:	90°	15'	50"	
VA:	123°	45'	50"	
SD:	284.	563	m	
DSP1/4				

▼ [DSP] for 1 sec.

Select the desired item by pressing the right/left arrow keys.

Press the [ENT] on "Line 3" to put the changes into effect.

Select Items				
>	Line 1:	HA		
	Line 2:	VA		
	Line 3:	SD		



- Available items : HA/HL/VA/V%/SD/VD/HD/N/E/Z/(none)
- None of the items can be displayed in two lines except for (none) .
- The items showed in DSP1/4, 2/4, 3/4 and 4/4 are also used in Stakeout (S-O3/8, 4/8, 5/8 and 6/8).
- Changing the combination of display items can be done in Stakeout as well.

- = Header characters =
- The ":" character indicates that Tilt correction is applied.
 - The "#" character indicates that Tilt adjustment is set to OFF.
 - The "_" character under the Tilt correction character indicates that Sea Level Correction is applied.



When the Sea Level Correction is set to "ON", the ":" or "#" character following the "HD", "N" and "E" headers are changed to "_" or "#".

HA:	9	0°	15'	50"	<input type="checkbox"/>
VD:			15.	635	m <input type="checkbox"/>
HD:			266.	347	m <input type="checkbox"/>
DSP 2/4					

X#			-4	435.	256	<input type="checkbox"/>
Y#			288.	953		<input type="checkbox"/>
Z#			15.	325		<input type="checkbox"/>
DSP 4/5						

Mode key



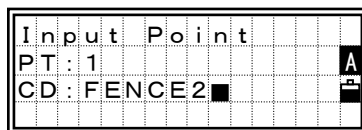
The [Mode] key changes the the keyboard mode depending on the current screen.

3

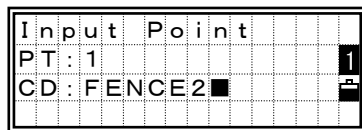
1) While Inputting PT/CD

Pressing the [Mode] key while the cursor is in the PT field changes the input mode between Alpha-numeric (A) and Numeric (1). When the cursor is in the CD field, three input modes are available, i.e., (A), (1), and (Lst, Stk).

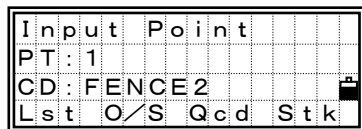
- 1** :Numeric
- A** :Alpha-numeric



▼ [Mode]



▼ [Mode]



Offset recording (O/S) and Qcode assigning function (Qcd) are available in the recording screen of the BMS. (See p.3-65 through 3-66)

MODE

2) Quick Code Mode (from BMS)

When you press the [Mode] key on the BMS, it activates the Quick code measurement mode. (See p.3-65)

HA :	3	1	6°	5	0'	4	0"	E
VA :	9	1°	2	5'	3	5"		
SD :		1	5	0.	6	8	7	m ²
DISP	1	/	4					

▼ [Mode]

A default point name is displayed on the last line. Press any numeric key to start measurement and record points.

HA :	3	1	6°	5	0'	4	0"	E		
VA :	9	1°	2	5'	3	5"				
SD :		1	5	0.	6	8	7	m ²		
QPt	=	1	0	0	5	3	-	A	1	0

▼ Any [1] to [0]

When a measurement is started, "QPt" field is changed to "Qcd" to show the feature code assigned to each key.

Press the [Mode] or [ESC] key to return to the BMS.

HA :	3	1	6°	5	0'	4	0"	E
VA :	9	1°	2	5'	3	5"		
SD :		1	5	0.	6	8	7	m ²
Qcd	=	C	U	R	B			



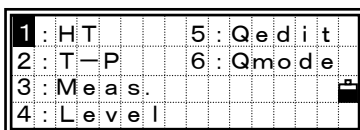
- To assign a feature code to each key → HOT/5:Qedit (See 3-26)
- To change the Qcode recording mode → HOT/6:Qmode (See 3-27)

HOT key



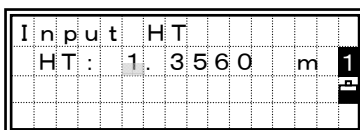
The [HOT] key is available from any observation screen. It shows the screen on the right.

Press the [ESC] key to return to the previous screen.



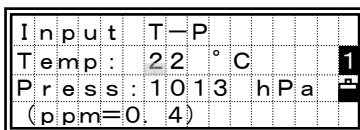
1) Height of Target

You can define the height of target by pressing the [HOT] and [1] keys.



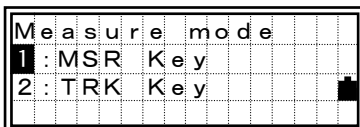
2) Temperature & Pressure

Set the current temperature and pressure using this command. Press the [HOT] and [2] keys from the BMS or other observation screens and type the ambient temperature and pressure.



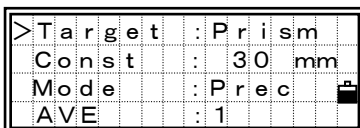
3) MSR/TRK Key Settings

Press the [HOT] and [3] keys to show the [MSR] or [TRK] key settings. (Same screen displayed by holding down [MSR]/[TRK] for one second; See p.3-19)



↓ [1]/[2]

Move the cursor by the up/down arrow keys and use the right/left arrow keys to change the setting.



Target = Prism/Sheet

Prism constant (Const) = -999~999mm

Mode = Prec/Normal

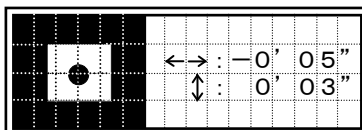
AVE = 0(Continuous) ~ 99

4) Level

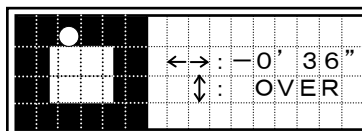
The leveling indication is displayed automatically on any measuring screen if the instrument goes out of level while the compensators are turned on. It can also be displayed by pressing the [HOT] and [4] keys.

<DTM-350 = 2axis compensation>

You can turn the leveling compensators on or off by pressing the Right/Left arrow keys.

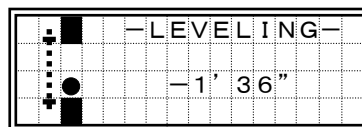


It shows “OVER” when it is larger than $\pm 3'30''$. When the compensation is set to off, it shows “OFF” on the screen right. Press the [ESC] or [ENT] key to return to the observation screen.



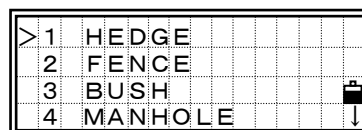
<DTM-330 = 1axis compensation>

DTM-330 has the vertical axis adjustment only. It can be turned ON/OFF by the Right/Left arrow keys.

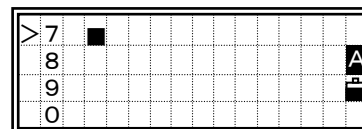


5) Qedit

The list of feature codes currently assigned in Quick code mode are displayed.



Directly input the key number or select the one by the Up/Down arrow keys. Then, press the [ENT] key to start typing characters in.



Press the [ENT] key or Up/Down arrow key to complete input. Press the [ESC] key to return to the observation screen.

6) Qmode

This function defines the setting for Qcode mode.

Q	c	o	d	e	M	o	d	e	s			
>	C	o	n	f	i	r	m	:	Y	e	s	
	M	e	a	s	m	o	d	e	:	M	S	R

Confirm: “Yes” = displays the point input screen to confirm PT/HT/CD before recording each measurement.

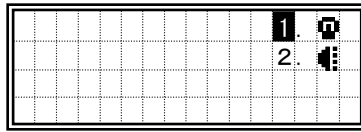
“No” = skips the point input screen and directly stores the point after a measurement.

Meas mode (Measurement mode): Defines whether the measurement settings for MSR or TRK are used when a key is pressed in Qcode mode. You can use the setting defined for [MSR] or [TRK] key. (See p.3-19)



When the average count is set to “0” (Continuous) for the selected MSR/TRK mode, only one measurement is taken in Qcode mode.

LCD Backlight Sound On/Off




The LCD backlight can be turned ON/OFF by pressing the illumination key. Holding down the illumination key for one second activates the Backlight and Sound ON/OFF switches from any observation screen.

Use the Right/Left arrow keys to turn the switch ON/OFF.

The Up/Down arrow keys and the numeric keys can be used to move the cursor between the item 1 and 2.


Press the [ESC] key to terminate this screen.

1) Backlight

 : Backlight OFF

 : Backlight ON

2) Sound

 : Sound OFF

 : Sound ON

Simple Station input (XYZ-key)



The [XYZ] key is a simple and conventional way of setup.

- 1) Input the station coordinate
- 2) Set the horizontal angle by [ANG] key

※No ST record is stored to the DB in this function.

Therefore, when you try to record data to an open job after using this key, your SS/CP records follow a comment record (CO, STN is changed by [XYZ] key) instead of ST.

Input Height of Target, Height of Instrument, XYZ coordinate of the Station.

HT:	1.	356			m	
HI:		1.	646		m	
X:		3864.	990			
Y:		-1872.	507			

The Horizontal angle input is optional. If you reset the angle by [ANG] key or you don't have to change the angle, you can just press [ENT].

X:		3864.	990			
Y:		-1872.	507			
Z:		42.	185			
HA:						

This function can be used without an open job. It is useful when you need to continue surveying despite the "Data Full" environment, for example, you can use this [XYZ] + [ANG] setup as an emergency means on site.

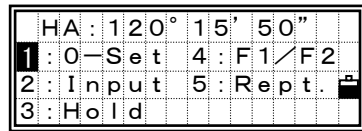
3-4 Applications

HA Reset and Measurements



Perform face-left and face-right measurements to obtain maximum accuracy for measuring angles. (Refer to p.2-15) By doing so, mechanical constant error (except in some special cases such as the vertical axis error) can be effectively cancelled out.

Press the [ANG] key to display the angle menu screen. Select the desired item pressing the numeric key.



• F1/F2 is not supported in DTM-330.

1)0-Set

Setting the horizontal angle to 0

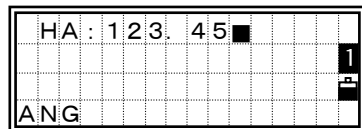
Press the [1] key to reset the horizontal angle to 0. The display returns to the basic measurement screen after resetting the horizontal angle.

2)Input

Inputting the horizontal angle

Press the [2] key, and the numeric input screen is displayed.

Input the horizontal angle using numeric keys and press the [ENT] key.



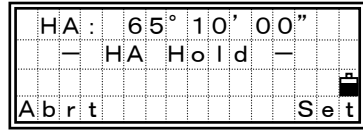
Ex.) To enter $123^{\circ}45'50''$, key input should be 123.4550.

• The displayed value is rounded to the minimum increment of angle.

3) Hold

Horizontal Angle Hold

Press the [3] key to hold the horizontal angle to the current value.



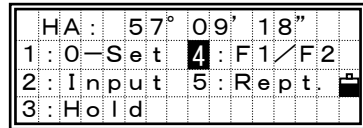
Press the [4:Set] or [ENT] key to set the horizontal angle as it is displayed. After setting the angle, it returns to the basic measurement screen.

Press the [1:Ab rt] or [ESC] key to cancel holding and setting the horizontal angle.

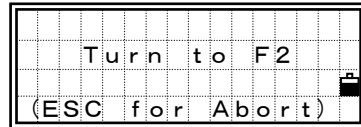
4) F1/F2 (Not included in DTM-330)

Face1/Face2 measurement

Without taking a distance measurement, you can take F1/F2 data by pressing [ANG]→[4:F1/F2].



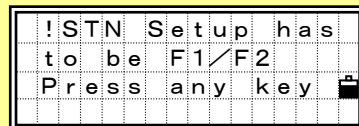
[4]/[ENT]



If you take a measurement to the target, you can initiate F1/F2 measurement by just flipping the telescope to different side.



To store the F1/F2 records and its average data, the observation to the Backsight has to be F1/F2.



5)Rept.

Recording a foresight point after repeat angle measurement

Press the [4] key to display “0” as a horizontal angle and activate repeat angle measurement mode.

HRΣ		0°	00'	00"	
	-	HR	Hold	-	
ANG	N=	0			

Press the [ENT] key to accumulate the horizontal angle, and press the [ENT] key again to hold the current horizontal angle. To cancel repeat angle measurement mode, press the [ESC] key.

HRΣ	250°	00'	50"		
VA:	91°	24'	50"		
ANG	N=	05			

Press the [REC] key to average the horizontal angle. The horizontal angle display is fixed until the process is finished or cancelled.

HR \bar{x}	50°	00'	10"	F	
HA:	300°	01'	00"		
Press MSR or TRK					
ANG	N=	05			

$$HR\bar{x} = HR\Sigma \div N$$

$$HA = BSAz + HR\bar{x} \text{ (normalized)}$$

By pressing the [MSR] or [TRK] key, the VA and SD \bar{x} are displayed after the measurement to the foresight point. HR \bar{x} will not be updated even if the instrument is moved.

HA:	300°	01'	00"		
VA:	91°	24'	50"		
SD \bar{x}	33.	860	m		
ANG					

Press the [REC] or [ENT] key again, and the default point number and code for the foresight point are displayed. Press the [ENT] key to record.

PT:	18				
HT:		1.	600	m	
CD:	EDGE1				
Lst				Stk	

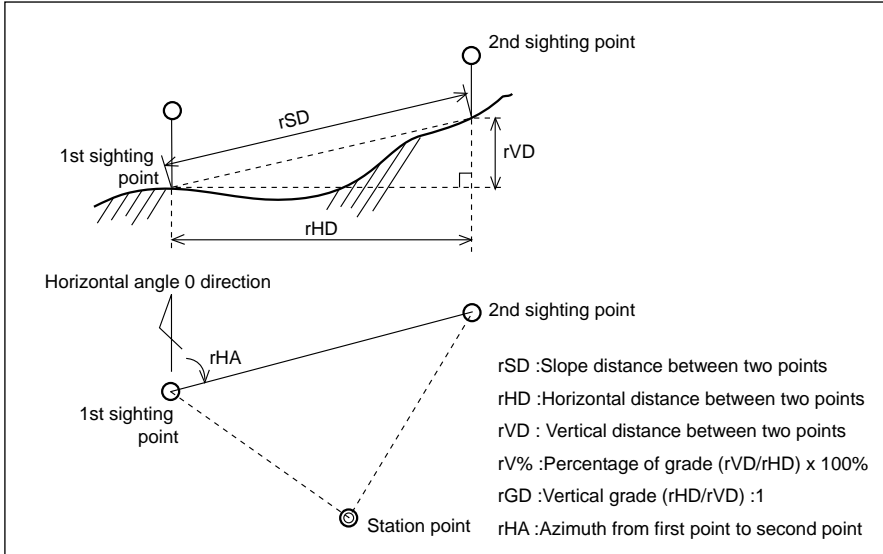


- In this mode, the display “:” following “HA” is replaced with “Σ” and the number of repeat angles is displayed after “N=”.
- Horizontal angles can be measured up to 1999°59’59”.
- This function will store both RAW and XYZ data (as CP record) after the foresight point is measured regardless of the “Store DB” setting.
- While in the repeat angle measurement mode, distance measurements cannot be taken or recorded.
- Once the $HR\bar{x}$ is calculated after some repetition shots, the horizontal angle display will not change until the process is finished or aborted.

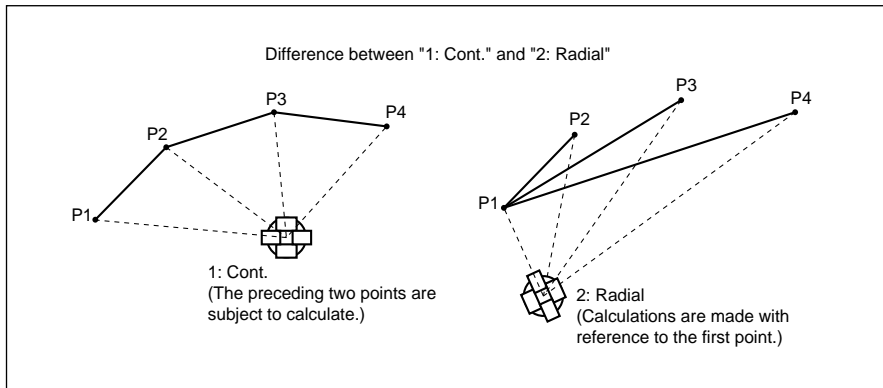
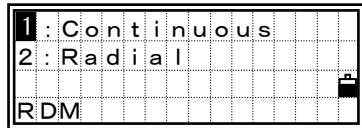
Remote Distance Measurement



Measures the horizontal distance, vertical distance and slope distance between two points.



Press the [RDM] key to display the menu screen shown right. Select a desired item pressing the numeric key.



1: Cont

Measuring between the current point and the immediately preceding point

2: Radial

Measuring between the current point and the first point measured

The screen shown right appears by selecting 1 or 2 in the RDM menu. Sight the 1st point and press the [MSR] or [TRK] key.

rSD:						m	■
rVD:						m	■
rHD:						m	■
RDM1/2							

The distance from the station point to the 1st point is displayed.

rSD:		15.6735	m	■
rVD:		2.5810	m	■
rHD:		15.4271	m	■
RDM1/2				

Sight the 2nd point and press the [MSR] or [TRK] key. The distances between the 1st and 2nd point are displayed.

rSD:		55.3651	m	■
rVD:		5.4212	m	■
rHD:		50.2687	m	■
RDM1/2				

rSD : Slope distance between two points.

rVD : Vertical distance between two points

rHD : Horizontal distance between two points

Press the [DSP] key to change data displays.

rHA:	350°	26'	50"	■
rV%:		10.74%		
rGD:		15.160	: 1	■
RDM2/2				

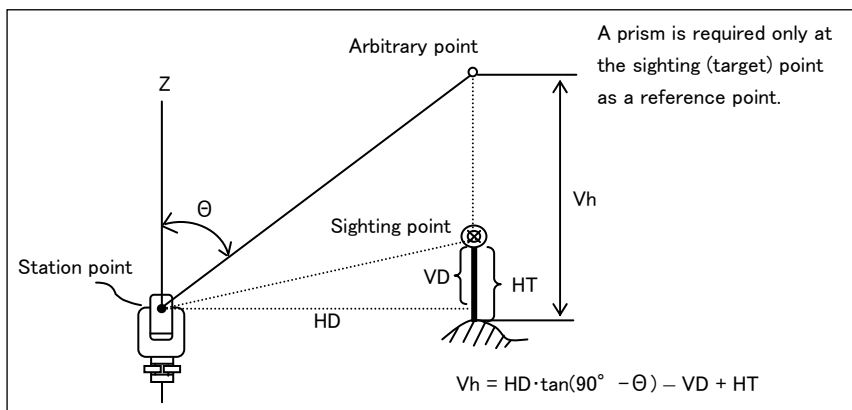
rHA : Azimuth from 1st point to 2nd point

rV% : Percentage of grade (rVD/rHD) x 100%

rGD : Vertical grade (rHD/rVD) : 1

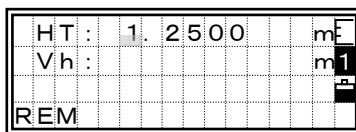
Remote Elevation Measurement

REM $\frac{S}{T}$
7 0 U

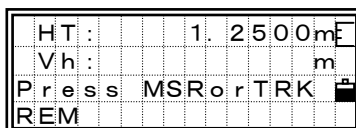


3

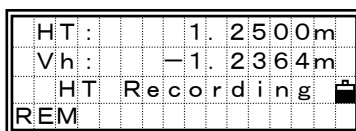
Press the [REM] key to display the screen shown right. HT can be input from here.



Sight the target point and press the [MSR] or [TRK] key.



Loosen the vertical clamp, and turn the telescope to aim at an arbitrary point. The elevation difference between the target ground point and the arbitrary point will be displayed.



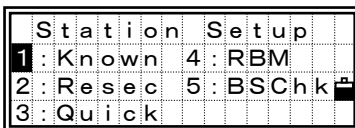
You can update the Height of target by REM measurement. Sight the bottom of the prism pole and press the [REC] key after shooting to the prism.

REM

Instrument Station Setup



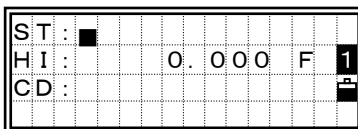
Press the [STN] key to display the menu screen.



1: Known

Station setup with known coordinates or azimuth

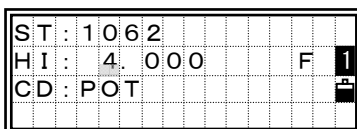
Press the [1] key to display the screen shown right. Input the station point number/name and press the [ENT] key.



If the input point number/name has already been recorded, its coordinates are displayed and it automatically proceeds to the next step.

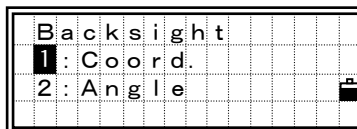
If the point is new, the screen waits for the input of coordinate. After inputting the coordinates and pressing [ENT] on each line, the newly input point will be stored by [ENT] key on Z field.

Input the Height of Instrument and press [ENT]. If the coordinate of the station point is input manually on the previous screen, CD: can also be input here.



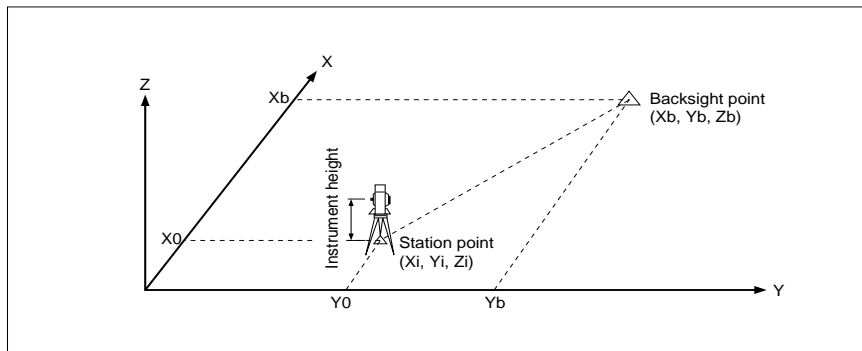
The screen then changes to the menu display for methods of setting the backsight azimuth angle.

Select the menu option by pressing the numeric key.

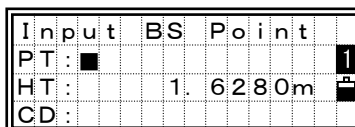



1: Known → 1:Coord

Sighting the BS (backsight) point by inputting coordinates



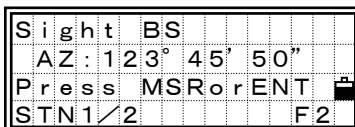
Press the [1] key to display the screen for inputting the BS point name and Height of target. Type the point name first. When the Pt exists in the Job, its coordinates will be shown.



 Code can be input only when a new PT: is entered.

Sight the Backsight on FACE1 and take a measurement.

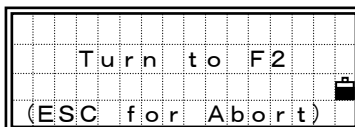
Press the [ENT] key to finish the station setup by an angle measurement to the BS.




AZ: Azimuth calculated from coordinates

↓ [4]

The [4:F2] key is to take an angle shot and proceeds to another measurement on FACE2.



 [F2] key is not available in DTM-330.

When you take a distance measurement to the BS on FACE1, you can go to the FACE2 measurement by just flipping the telescope.

Sight	BS	on	F2	
AZ:	123°	45'	50"	
HD:	87.	9577m		
STN1	/2			

↓ [ENT]/[REC]

After taking measurements on both faces, the delta screen will be displayed.
[3:CP] will records the averaged HA/VA/SD from F1/F2 data.

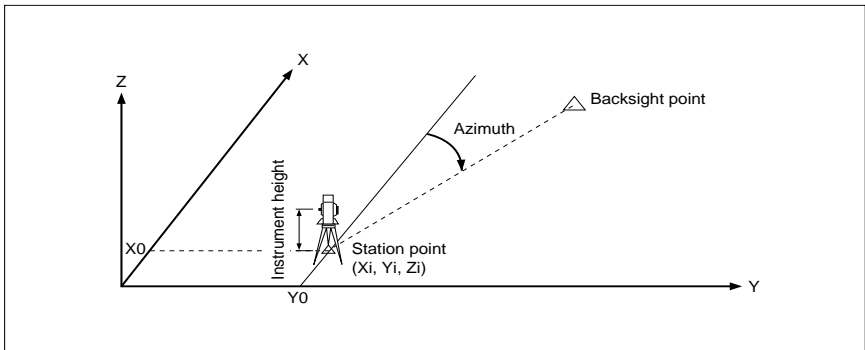
dHA:	0°	00'	21"	
dVA:	0°	00'	43"	
dSD:	0.	0063m		
Abrt		CP	OK	

Press the [3] or [4]/[ENT] key to record the station and return to the BMS.

		REC	STN	
Job:	PROJ582			

1:Known→2:Angle

Sighting the BS (backsight) point by inputting azimuth



The BS point input screen.

If you don't use any point name for the BS, just press the [ENT] key at a blank PT.

Input	BS	Point	
PT:			
HT:	1.	6280m	
CD:			

The screen for inputting the azimuth to the BS point is displayed. Just pressing the [ENT] key inputs 0°00'00".

Input	BS	Angle	
AZ:	■		1
			■



Ex.) To enter 123°45'50", key input should be 123.4550.

Sight the BS point and press the [ENT] key. It records the station and returns to the BMS.

Sight	BS		
AZ:	0°	00'	00"
Press	MSR	or	ENT
STN1/2			F2

F1/F2 observations to the BS is also available by [4:F2] key or just flipping the telescope to Face2 after taking a distance measurement on Face1.

AZ: Input azimuth to the BS

The [DSP] key changes the indication between STN1/2 and STN2/2.

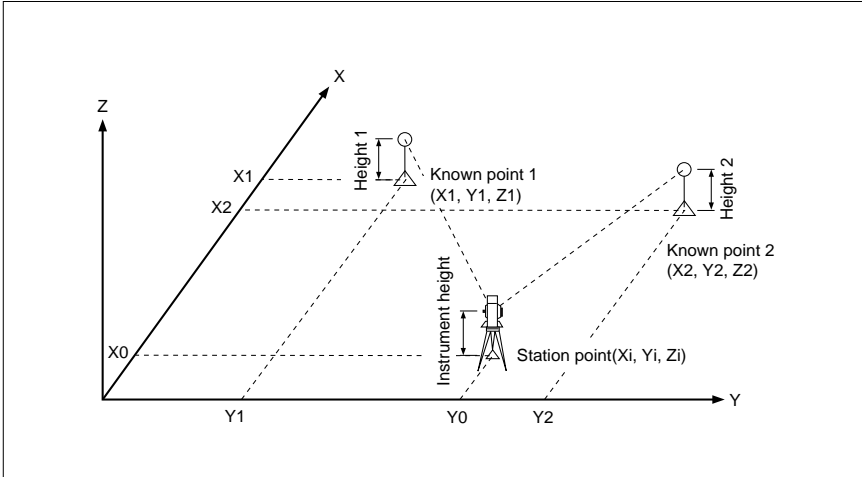
On either screen, press the [ENT] key to record the Station.

Sight	BS		
VA:	0°	00'	00"
SDx	217.	4916m	■
STN2/2			F2

2: Multiple Resection

Setup station by angle/distance measurements to known PT

- Maximum 10 points can be used in Resection.
- Calculation starts automatically when enough measurements are taken.
- Deleting any poor observation data can be done.
- Selecting BS point is available.



If the angle between known point 1 and known point 2 (as measured from the station point) is extremely acute or extremely obtuse, the resulting solution will be less geometrically reliable. It is best to select known point locations (or station point locations) which will yield strong geometry.

Press the [2] key on the “Station Setup” screen to display the screen for inputting the number/name of known point 1.

When you input a known PT, it shows the coordinate and proceeds to the target height input.

Input		1st Point	
PT :	█		1
HT :		1.5000m	█
CD :			

Input the target height and press the [ENT] key. When the coordinate is input manually on the previous screen, CD: can be input on the screen. (Lst/Stk input are not available on this screen.)

Input	1st	Point	
PT:	55		1
HT:	1.5000	m	
CD:	CP1		

Sight known point 1 and press the [MSR], [TRK], [4:F2] or [ENT] key. The [4:F2] and [ENT] take an angle measurement.

Sight	PT1	on	F1
HA:	150°	30'	27"
Press	MSR	or	ENT
STN	1/2		F2

↓ [MSR]

By pressing [4] or just flipping the telescope to Face2, you can take F1/F2 measurements.

Sight	PT1	on	F1
HA:	150°	30'	27"
HD:	106.4289	m	
STN	1/2		F2

Press the [ENT] key to proceed to the next point input.

Input the second PT and the height of target and take a measurement to the second point.

Input	2nd	Point	
PT:	■		1
HT:	1.5000	m	
CD:			



[F2] key is not available in DTM-330.

Once the data enough to calculate the Station coordinates are obtained, its standard deviation screen will be displayed.

Press [ESC] to return to the last measurement screen.

σ N:				0.0193
σ E:				0.0084
σ Z:				0.0270
A d d	D S P	V i e w	R E C	

[2:DSP] ↑ ↓ [2:DSP]

N:				280.4193
E:				-7.0814
Z:				16.0270
A d d	D S P	V i e w	R E C	

Press [1] to add more direction to enhance the accuracy of your resection.

When you are satisfied with the result, press [4] or [ENT] to record the station through ST input & Select BS screen.

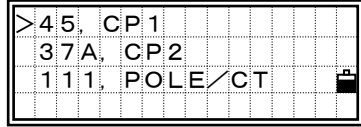
For [3:View] functionality, please turn to the next page for details.



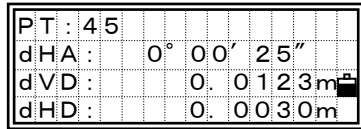
- In 2-Pt Resection, one point is distance measured while the other is angle measured, the sigma values will not be available.
- When the known PT has a Z-coordinate, the Stn-Z will be given for your reference even without a distance measurement. If you take a distance measurement to any point, the Stn-Z will be calculated by that measurement, not from any angle measurements.

View&Delete each data in Resection

By pressing [3:View] key on the calculated STN data screen, you can check your observation to each direction.



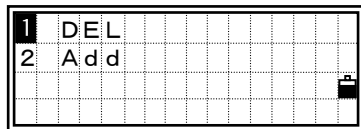
[ESC] ↑ ↓ [ENT]



- dHA : distributed errors in HA to each direction
- dVD : errors in VD between measured distance and calculated data based on its known coordinates
- dHD : errors in HD between measured distance and calculated data based on its known coordinates

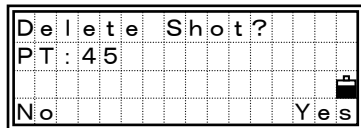
Place the cursor on a bad data or show its detail data, you can press [MENU] and [1] to delete it.

[2:Add] will provide you another PT input screen to continue the resection observations.



[ESC] ↑ ↓ [ENT]/[1]

When you select an unnecessary point and choose [MENU]→[1:DEL], a confirmation screen will be shown. After deleting it, recalculation will be started the STN coordinate with remaining data.



Input the height of instrument and press the [ENT] key.
 “ST” is defaulted to the “Last recorded PT + 1”. You can change it if necessary.

ST:	250								
HI:	0.	0000			m				
CD:									

3

After inputting the ST, HI and CD for station record, you will be selecting the Back-sight. Choose the BS by up/down arrow key and press [ENT] to complete the Station setup.

S	e	l	e	c	t	B	S	P	T
>	5	,	C	P	1				
2	3	,	P	O	L	E			
1	8	E							

↓ [ENT]

			-	R	E	C	S	T	N	-	
J	o	b	:	P	R	O	J	5	9	6	3

STN

3: Quick Station (Quick)

Setup the station quickly without given coordinates

Press the [4] key on the setup menu to display the screen for inputting a quick station point.

ST :	1507					
HI :	0.0000			m		1
BS :						2
AZ :		0.0000		g		

ST : Station point (defaulted to the Last recorded PT +1)

HI : Height of Instrument

BS : Backsight point

AZ : Backsight azimuth (defaulted to zero)

The Station point (ST) in this function is defaulted to a new point number. For the new point, MP (0, 0, 0) is stored as the coordinate of the station. When the ST is changed to a known point, the setup is done on the coordinate of the point specified.

The backsight point(BS) has no default. You can leave it blank or input any point name/number.

ST :	1507					
HI :		1.8150		m		1
BS :						2
AZ :		0.0000		g		

The backsight angle(HA) can be changed, if necessary.

After you input or accept the azimuth for HA, sight the BS and press the [ENT] key to complete the station setup. The HA will be reset to the input value when the [ENT] is pressed at the AZ field.



Even if both of ST and BS are known points, this function does not calculate the backsight angle (AZ) automatically. When you want the AZ to be calculated between two known points (ST and BS), you need to use STN/1:Known. (See p.3-37)

4: Remote Benchmark (RBM)

Determine the station elevation

Input the BM point and press the [ENT] key. When the point is found in the current or specified Control Job, it is displayed.

Input BM Point			
PT :	■		1
HT :		2.1400m	■
CD :			

After inputting the Height of Target, sight the BM and press the [MSR] or [TRK] key.

Sight BM			
Press MSR or TRK			
STN			■

↓ [MSR]

You can take F1/F2 measurements by pressing the [4] key or just flipping the telescope to Face2.

Sight BM			
VD :		1.1184m	■
HD :		86.7521m	■
STN			F2

↓ [ENT]



[F2] key is not available in DTM-330.

The coordinate of the station point is displayed with the updated Z-coordinate. The HI can be changed on this screen.

X :		-154.231	■
Y :		2345.362	1
Z :		135.325	■
HI :	1.8140		m

Z: The elevation of the station, calculated from the BM point measurement.



- When the HI is changed, the Z-coordinate will be updated before recording the station.
- If you have not already completed a station setup, the Remote Benchmark function is not available. An error screen will be shown. (See p.8-1, 3rd screen)

5: BSChk (BSChk)

Check the Backsight direction

Press the [5:BSChk] on the station setup menu to enter the BS check function.

HA :	1	0	3°	5	0'	3	4"	0	
BS :	1	0	3°	5	0'	3	0"	5	
Ab	r	t							Rs
									t

Sight the BS and press the [ENT] or [4] key to reset the horizontal angle to the HA set in the last station setup.

Press the [ESC] or [1] to abort the process and return to the BMS.

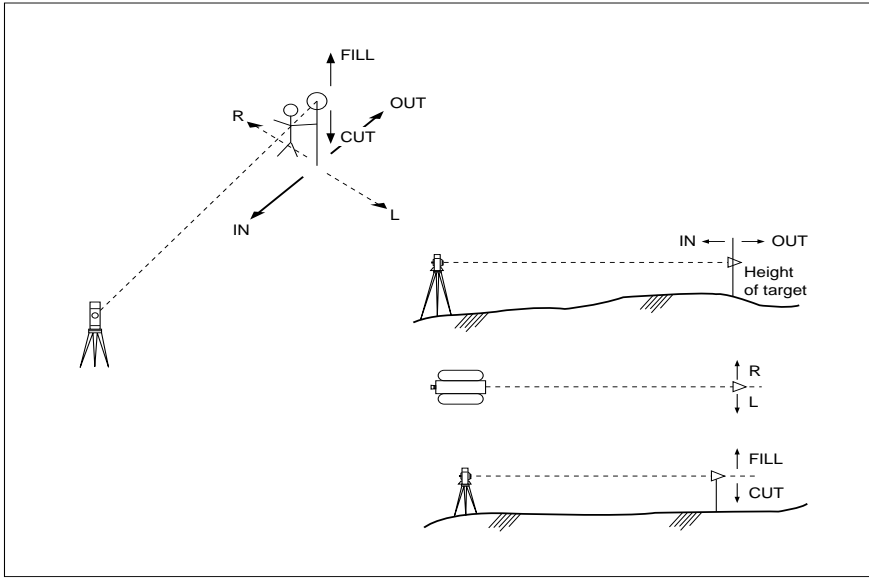
HA: Current HA reading

BS: The HA to the BS at the last station setup.



If you have not finished setting up the station, the Backsight check function is not available. An error screen will be shown.
(See p.8-1, 3rd screen)

Staking out



Press the [S-O] key to display the stakeout menu screen*. Select the desired function using the numeric keys.

Stakeout			
1	: HD-HA	4	: V-Pln
2	: XYZ	5	: S-Pln
3	: 2REF	6	: Arc

1:Ang-Dist (HD-HA)

Specifying the stakeout point position by Angle and Distance

Press the [1] key to display the screen for inputting distance and angle to the target. Input them and press the [ENT] key.

HD:	0	0	0	0	m
dVD:					m
HA:					
S-O					

- HD: Horizontal distance from station point to stake-out point
- dVD: Vertical distance from station point to stake-out point
- HA: Azimuth to stake-out point



When the [ENT] key is pressed without HA input, the current HA is input automatically.

Rotate the instrument until the dHA becomes close to 0°00'00".
Sight the target and press the [MSR] or [TRK] key.

dHA	→	35°	12'	30"	F
HD:		25.	356	m	
Pr	ess:	MSR	or	TRK	
S-O					

When the measurement is completed, the errors between the target position and the stake-out point are displayed.

dHA	→	0°	00'	05"	F
R	←	0.	001	m	
OUT	↑	0.	002	m	
S-O	1/8				

- dHA: Difference in Horizontal angle to the target point
- R/L: Right/Left (Lateral error)
- IN/OUT: In/Out (Longitudinal error)

Once a measurement is taken, the Cut/Fill value and Z-coordinate will be updated as the VA is changed.

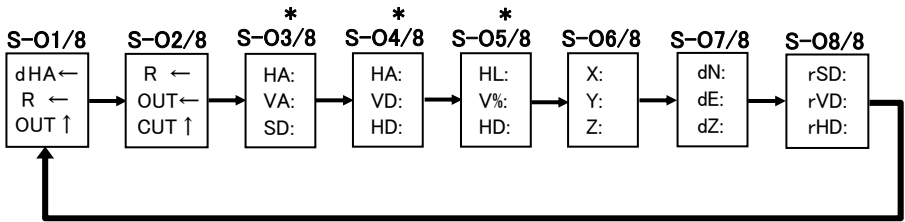


When the [HOT] key is pressed on any of the shooting point displays, it shows the setting screen.
You can change the HT, T-P or Prism constant at any time.


1	:	HT		5	:	Qedit
2	:	T-P		6	:	Qmode
3	:	Meas.				
4	:	Level				

Switching screen by [DSP]

When the Secondary unit is set, one more screen (S-O9/9) is added.



* S-O3/8, S-O4/8 and S-O5/8 can be customized by holding down [DSP] key for one second. (See p.3-21)

 When the Secondary Unit is set to any of distance unit, it shows HD/VD/SD in that unit as the eighth screen. (See p.3-93 for Secondary Unit setting)

<for "Ft-Inch">

H:	132'	07"	1/2
V:	10'	04"	3/8
S:	149'	01"	7/8
S-O9/9			

To record the stake-out point, press the [REC] key. A default point number and the last recorded code are shown. Press the [ENT] key to record the point.

Input	S-O	Point
PT: 15		
CD:		
List		Stk

After recording the point, it returns to the screen where the [REC] key was pressed. You can continue observation or press the [ESC] key to input another HD/dVD/ HA.

	-	REC	RAW	-
Job:	ITALY205			

2:XYZ

Specifying the stakeout point position by Coordinates

Press the [2] key on the Stakeout menu screen to start Stakeout by Coordinates. Input the point number/name you want to stake and press [ENT].

You can also specify the points by Code and/or Radius from the instrument.

```
PT : 50*
CD :
R : 50
```

When several points can meet the specified condition, points are shown in list style. Right/Left arrow keys will be the page Up/Down keys.

```
>UP, 502
UP, 503
UP, 504, CE
UP, 505
```

New point input is also available. Type in a new PT name and its coordinate.

```
PT : 68
X :
Y :
Z :
```

The delta angle and distance to the target are shown. Rotate the instrument until the dHA becomes close to $0^{\circ} 00' 00''$.

Press the [MSR] or [TRK] key to measure to the prism.

```
dHA: 146° 19' 25"
HD: 23.4680m
Press MSR or TRK
PT: 502
```

dHA: Difference in Horizontal angle to the target point

HD: Distance to the target point



When the [HOT] key is pressed on any of the shooting point displays, it shows the setting screen.

You can change the HT, T-P or Prism constant at any time.

```
1 : HT          5 : Qedit
2 : T-P        6 : Qmode
3 : Meas.
4 : Level
```


Advise the rodman to adjust the prism position. When the target is on the intended position, the displayed errors become 0.0000 m/ft.

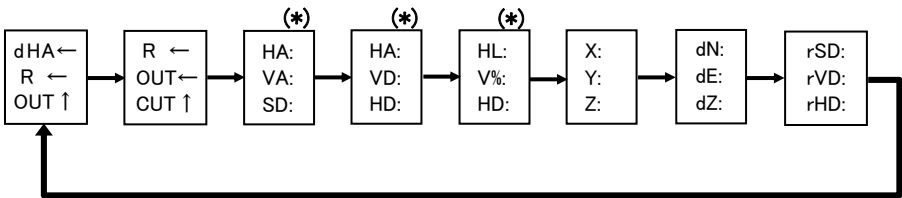
dHA←	0°	00'	05"
R ←	0.	001	m
OUT ↑	0.	006	m
PT :	502		

3

- dHA: Difference in Horizontal angle to the target point
- R/L: Right/Left (Lateral error)
- IN/OUT: In/Out (Longitudinal error)

Switching screen by [DSP]

When the Secondary unit is set, one more screen (HD/VD/SD) is added. Although the indication like S-O1/8 is not displayed, the [DSP] key works exactly the same as in the Angle-Distance stakeout.



(*) Contents in these three screens can be customized by holding down [DSP] key for one second. (See p.3-21)



- “Add Constant” can be changed by pressing [9: S-O] key from any of the observation screens. (See p.3-92)

>Add Pt :	1000
-----------	------

- Once a measurement is taken, the Cut/Fill and Z-coordinate will be updated as the VA is changed.

S-O

Press the [REC] or [ENT] key record the point. A default PT is shown based on the previously recorded point number plus “Add constant” (See p.3-92).

Input	S-O	Point
PT: 1002		
CD:		
Lst		Stk



“Add Constant” is defaulted to 1000 in MENU/3:Sett/ 7:S-O. (See p.3-92) It requires an integer that is added to the point number being staked to obtain a new number for the staked point record. For example, a staked coordinate point 3 with an Add Constant of 1000 is recorded as stakeout point 1003.

After recording the point, it returns to the observation screen. When the [ESC] key is pressed, it returns to the PT/CD/R input screen. The PT is defaulted to the previous point plus one if you input the stakeout point by point.

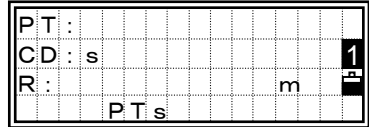
dHA →	0° 00' 10"
L →	0.004 m
IN ↓	0.005 m
PT: 502	

When you selected a point from a List, it returns to the same List until all points in the List have been selected. Press the [ESC] key to return to the point input screen.

MP, 125, FENCE1	
>MP, 128, FENCE2	
MP, 153, FENCE	
MP, 206, FENCE1	↓

Specify a Stakeout List by Range-Input

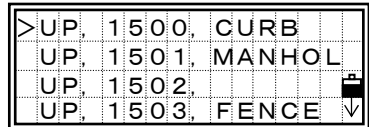
3 Press the [MODE] key twice while the cursor is in the PT field to show the [Pts] softkey.



Input the start point (Fr) and the end point (To). The range has to be less than 1001 points.

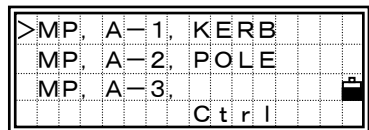


A point list is shown when any existing point is found between 'Fr' and 'To'. Select a point by up/down arrow keys and press [ENT] to go to the stakeout observation screen.



(The rest of the operation in Stakeout is exactly the same with XYZ stakeout.)

When you assign the Control Job and the additional points are found there as well as in the current Job, a softkey (Ctrl) is shown on the List.



3: 2-Pt Reference Line (2REF)

Measuring distance and offset values along a specified line

Press the [3] key on the Stakeout menu screen to start 2-Pt Reference Line.

Input the two point names for the reference line.

Input Line	PT1
P1:	
P2:	



Inputting point by measurement is also available. Press the [Mode] key to get the observation screens.

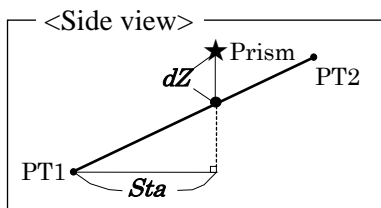
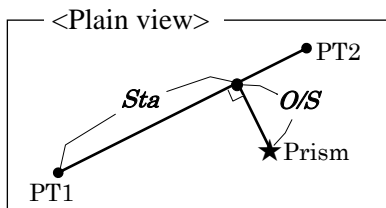
Sight 1st Point
Press MSR or TRK

You can search the point by inputting the asterisk (wild-card) as well.

Input Line	PT2
P1:	18
P2:	20A*

When more than two points are found, the point list is shown. You can select the desired point by pressing up/down arrow and the [ENT] key.

>UP, 20A-1, CURB
SS, 20A-2, CURB
MP, 20A-4, CURB



The observation screen is displayed next. Sight the prism or reflective sheet and press the [MSR] or [TRK] key.

Sta:	15.4564m
O/S:	2.3876m
dZ:	0.5209m
REF 1/4	

Sta: Horizontal distance from P1 to the measure point along the P1-P2 line

O/S: Horizontal offset from the P1-P2 line to the measured point

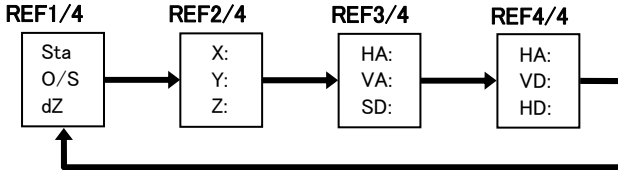
dZ : Vertical offset from the P1-P2 line to the measured point



When the [HOT] key is pressed on any of the shooting point displays, it shows the setting screen.
 You can change the HT, T-P or Prism constant at any time.

Switching screen by [DSP]

When the Secondary unit is set, one more screen (REF5/5) is added.



When the Secondary Unit is set to any distance unit, it shows HD/VD/SD in the specified unit as the fifth screen.
 (See p.3-93)

<for Ft-US unit>

HD:	75.411	F
VD:	-8.106	F
SD:	89.223	F
REF5/5		

Press the [REC] or [ENT] key to store the shooting point and its offset distance information.

Input Point	
PT :	301230481
CD :	TREE4
Lst	Stk

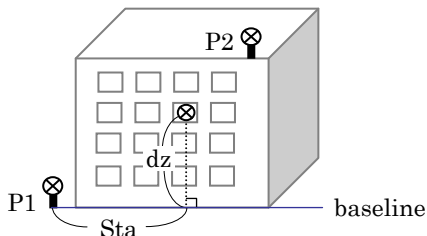
Input the point name and feature code.

= Sample recording data in S-O/3:2REF =

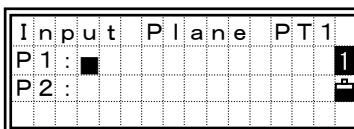
CO, 2pt-Ref Pt:16 & Pt:13 Az:311.2932
 CO, Sta= -12.6876 Offset= 1.3721 dZ= 0.0971
 SS,17,1.0000,6.9202,18.4700,80.3120,15:48:48,2REF-LINE

4: 2-Pt Reference Plane (V-Pln)

Measuring distance and offset values on the vertical plane



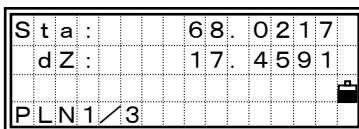
Press the [4] key on the Stakeout menu screen to start 2-Pt Reference Plane. Input two points to define the plane.



Inputting point by measurement is also available. Press the [Mode] key to get the observation screens.

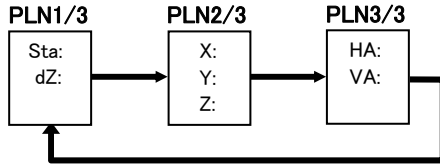
Sight 1st Point
Press MSR or TRK

Once the plane is defined, the calculated Sta/dZ and coordinate will be shown. No distance measurement is required. [DSP], [HOT], [REC] and [ESC] keys are available.



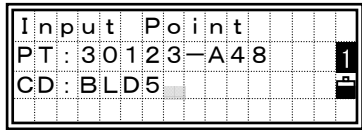
- Sta = Horizontal distance from P1 to the target point along the baseline
- dZ = Vertical distance from P1 to the target point.

Switching screen by [DSP]



3

To record the point, press the [REC] key on any of the PLN1/3 to PLN3/3 screens. Input the feature code



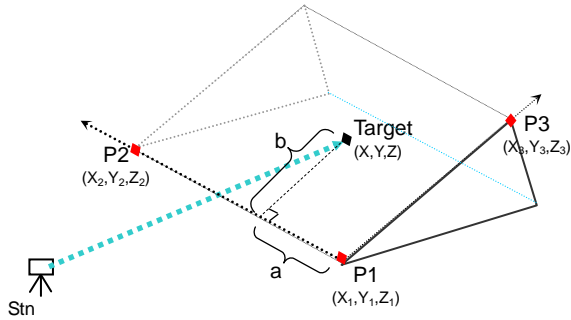
= Sample recording data in S-O/4:V-Pln =

CO,Vertical Ref Plane Pt1:516-A1 Pt2:530
 CO,Sta=68.021 dz=17.459
 SS,30123-A48,1.5480,16.4020,40.4720,89.0730,14:22:47,

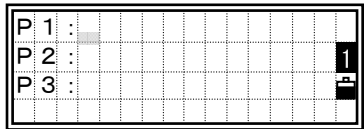
S-O

5: 3-Pt Reference Plane (S-Pln)

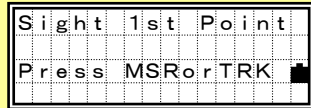
Measuring distance and offset values on the slope



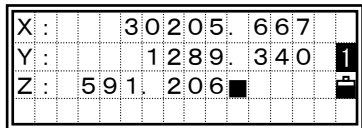
Press the [5] key on the Stakeout menu screen to start 3-Pt Reference Plane. Input three points to define the slope.



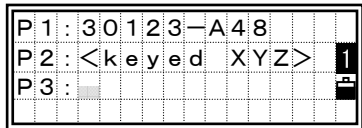
Inputting point by measurement is also available. Press the [Mode] key to get the observation screens.



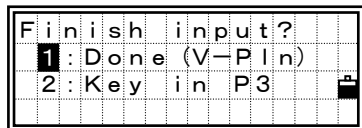
When the [ENT] key is pressed on a blank P1 or P2 field, you can input coordinate without recording it to the database.



Such a temporary input coordinate is displayed as <keyed XYZ> instead of point name.

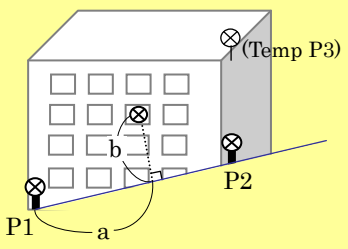


When the [ENT] key is pressed on a blank P3 field, a confirmation screen left is shown.





In case the plane is defined by two points (by selecting [1:Done]), that vertical plane will be the same with the one used in V-Pln function but the indicating factors (Sta/dZ vs a/b) are different. (See p.3-56)

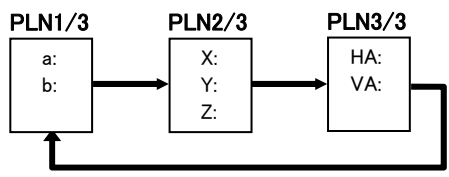


Once the plane is defined, the calculated 'a', 'b' and coordinate will be shown. No distance measurement is required. [DSP], [HOT], [REC] and [ESC] keys are available.

a:	31.	297
b:	14.	795
PLN1/3		

- a = Distance between P1 and the point which is perpendicular to the target point along the P1-P2 line
- b = Length of the perpendicular line from the target point to the P1-P2 line

Switching screen by [DSP]



To record the point, press the [REC] key on any of the PLN1/3 to PLN3/3 screens. Input the feature code and press the [ENT] key.

Input Point	
PT: 501	
CD:	
Lst	Stk

= Sample recording data in S-O/5:S-Pln =

```
CO,3ptPlane P1:1062 P2:2902 P3:1547
CO,a=31.497 b=14.239
SS,30123-A49,1.6110,0.0000,234.3210,86.0955,16:07:18,
```

6: Arc-curve Reference Line (Arc)

Measuring distance and offset values on the arc-curve

Input the Start of the Curve point (P1) and the azimuth of the tangent line (AZ1). P1 can be input through measuring to a point by pressing the [Mode] key while the cursor is on the P1 field.

Start of curve	
P1: 583	[P1]
AZ1: 35.4030	[P1]

[ESC] ↑ ↓ [ENT]

Choose the method to define the arc.

- 1: Input P2 & AZ2
- 2: Input Radius & AZ2
- 3: Input Radius & Arc length

Define curve	
1: PT-AZ	[P1]
2: Radius-AZ	[P1]
3: Radius-Length	[P1]

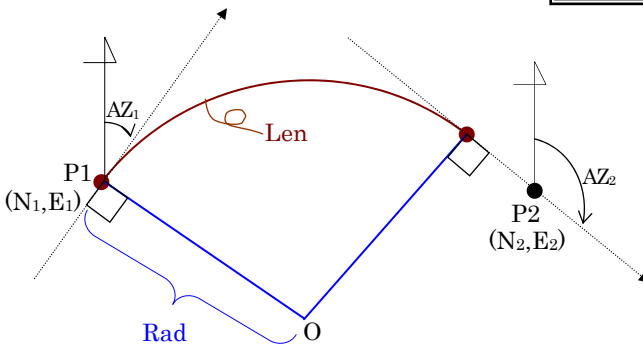
P2 can be any point on the tangent line that is to exit the curve.

Input curve	
P2: []	[P1]
AZ2: []	[P1]

While inputting the radius (Rad), positive value is for clockwise arc and negative is for counterclockwise.

Input curve	
Rad: []	[P1]
AZ2: []	[P1]

Input curve	
Rad: []	[P1]
Len: []	[P1]



After you define the arc, the calculated curve data will be shown for your confirmation.

Rad:	50.0000m
Len:	125.6637m
AZ2:	120° 00' 30"
Ab rt	OK

↓ [4]/[ENT]

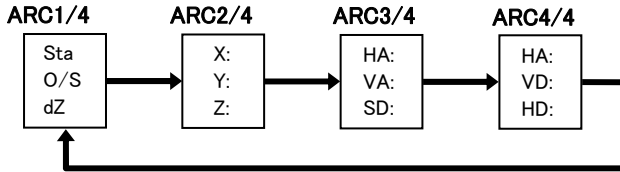
When the input value in “Rad” doesn’t match the one in “Len”, the system uses the input “Rad” value and the “Len” will be replaced by the calculated value.

Next is the observation screens. You can use [MSR], [TRK], [DSP], [HOT] and [REC]/[ENT] key from here.

Sta:	76.9024m
O/S:	141.1250m
dZ:	-0.3429m
ARC1/5	

Switching screen by [DSP]

When the Secondary unit is set, one more screen (ARC5/5) is added.



From any of the ARC display, you can hit the [REC] or [ENT] to record the point with comment records.

Input Point	
PT:	301230482
CD:	TREE4
Lst	Stk

= Sample recording data in S-O/6: Arc-RefLine =

```

CO,Arc P1:583 AZ1=0.0000 P2:102
CO, AZ2=311.2932 Radius=50.0000 Length=125.6637
CO, Sta= -12.6876 Offset= 1.3721 dZ= 0.0971
SS,17,1.0000,6.9202,18.4700,80.3120,15:48:48,2REF-LINE
  
```

Recording Measurement Data



1) Recording data from any observation screen

Press the [REC] key to display the PT/HT/CD input screen right.

PT:	10005				
HT:		1.507	m		
CD:	MANHOLE				
Lst	O/S	Qcd	Stk		

You can quickly input frequently used feature codes using the Code List (Lst) and Code Stack (Stk) functions.

(See p.3-8, 3-9)

Pressing [ENT] on the CD: field records the point.

- REC RAW -						
Job:	NIKON5					

When recording Sideshots, Stakeout records and Control shots from the

ANG/Rept function, there is an option to store “RAW data” only or “XYZ only” or “Both” which can be specified in “Store Data” in MENU/3:Sett /8:Others. (See p.3-93)



- When you move HA/VA before pressing the [REC] key (after taking a measurement), it records the angle when the [REC] key is pressed.
- For the angle shot, SD is always recorded as 0.0000.

Holding down the [REC] key for 1 sec allows you to record the measurement as a CP record.

Select PT Type						
>	CP					
	SS					

2) Qcode

Quick measurement & recording by less key-press

To activate the Qcode mode, press [Mode] on the BMS.

HA:	316°	50'	40"	[F]
VA:	91°	25'	35"	
SD:	150.	687m		
DSP1/4				

▼ [Mode]

The default PT is shown in the bottom line. Pressing any numeric key will initiate a measurement and input a defined code for each key at the same time.

HA:	316°	50'	40"	
VA:	91°	25'	35"	
SD:	150.	687m		
QP t=10053-A10				

▼ [1] to [0]

The feature code which has already assigned to the key will be shown while taking a measurement.

HA:	316°	50'	40"	
VA:	91°	25'	35"	
SD:	-			
Qc d=MANHOLE				

When the Qcode mode in HOT/6:Qmode is set to “Confirm: Yes” (See p.3-27), the recording point screen is shown.

The feature code is defaulted to the one assigned to the key.

PT:	10053	-A10		
HT:	1	600	m	
CD:	CMP			
Lst O/S Qc d St k				

Press the [ENT] key to record the point.

The next PT number is increased by one.

To exit Qcode mode, press the [Mode] or [ESC] key.

HA:	316°	50'	40"	
VA:	91°	25'	35"	
SD:			m	
QP t=10053-A11				

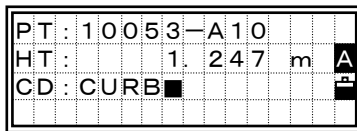


Press the [HOT] key twice to get into HOT /5:Qedit function. (See p.3-26)

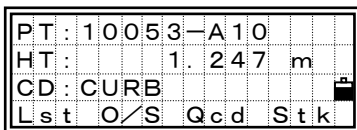
When Qcode mode in HOT/6:Qmode is set to “Confirm: No”, the recording screen is not shown and the point is simply recorded after the measurement completes. (See p.3-27)

Assign a Code for Qcode

To assign a new code to one of the numeric softkeys, press [3:Qcd] on the recording point screen after you edit the code.

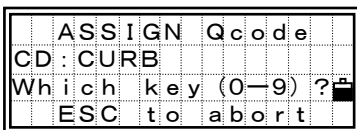


▼ [Mode]



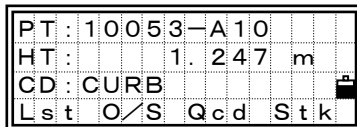
▼ [Qcd]

Press the numeric key you want to assign the current code to.



▼ [6]

The current feature code is assigned to the selected numeric key. It returns to the record point screen. You can press [ENT] to record this point as well.



Assigning codes to numeric keys for Qcode mode can also be done through the HOT/5:Qedit function. The Qedit function is also convenient for checking the currently assigned codes. (See p.3-26)

3) Offset Measurements

3-1) Tape Offset Measurements

After a distance measurement to a point, offset measurement is available when you press the [REC] key.

PT:	10053-A10						
HT:		1.605	m				
CD:	CURB						
Lst	O/S	Qcd	Stk				

Press [2:O/S] and [1] key to enter the tape-offset.

1:	Tape	5:	Cnr				
2:	Angle	6:	+SD				
3:	Pole	7:	Circ l				
4:	+Line						

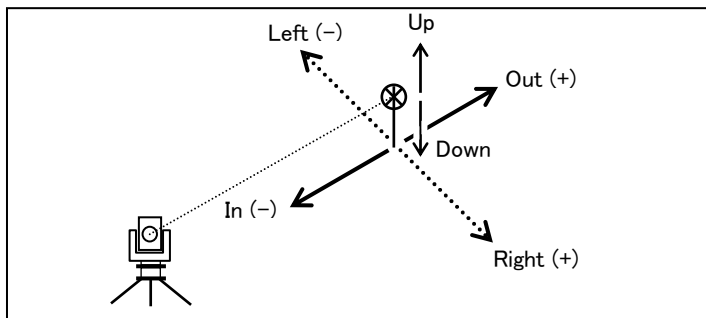
Input offset distance from the measured point. You can choose the direction to take an offset by Up/Down arrow keys.

+/-	Tape	Offset					
R/L:							
O/I:							
U/D:							

[1:R/L] = Right(+)/Left(-)

[2:O/I] = Out(+)/In(-)

[3:U/D] = Up(+)/Down(-)



You can enter any combination of taped offset distances to specify the offset.

+/-	Tape	Offset					
R/L:		0.500	m				
O/I:		-0.700	m				
U/D:		1.200	m				

Press the [ENT] key in the U/D field and the new point with the offset is calculated and recorded to the open Job.

The RAW data will also be recalculated based on the tape-offset value.

	-	REC	RAW	-			
J o b :	TOKYO23						

3-2) Angle-Offset Measurements

After a distance measurement, press the [REC] and [2:O/S] to show the Offset menu screen.

Select [2] key to enter the angle-offset.

1 : Tape	5 : Cnr
2 : Angle	6 : +SD
3 : Pole	7 : Circ l
4 : +Line	

The current reading of HA/VA is shown. You can rotate the alidade and telescope to take a necessary angle offset with the measured distance kept unchanged.

Angle Offset	
HA :	234° 32' 14"
VA :	91° 55' 09"
Ab rt	OK

Press the [ENT] or [4:OK] to record the offset point.

The XYZ data will also be recalculated based on the new angle.

- REC RAW -	
Job : TOKYO12	



The [2:O/S] key is not available for angle shots and F1/F2 shots. In those cases, the O/S softkey will be left blank.

3-3) Two-Prism Pole Offset Measurements

After a distance measurement to the first prism on the pole, press the [REC], [2:O/S] and [3:Pole] to get to the two-prism pole measurement.

1: Tape	5: Cnr
2: Angle	6: +SD
3: Pole	7: Circ l
4: +Line	

Input the distance between the second prism and the target point. Distance between the first and the second prism can be left blank if you don't need any QA information.

Input Distance	
P1-P2:	m
P2-Tgt: 0. 55	m

Sight the second prism and take a measurement.

Sight 2nd Prism	
Press MSR or TRK	

[MSR]

After taking a measurement, it automatically goes to the record PT screen. Press [ENT] to record the point.

Input Point	
PT: 47	
CD: DITCH1	
Lst	Stk

Only when the P1-P2 distance is input, a QA screen is displayed before the "Input Point" screen. The input value and the measured distance can be compared to confirm the accuracy of the observation.

P1-P2 Dist	
Key In: 0. 480 m	
MSRed: 0. 502 m	
Redo	OK

= *Example of recorded RAW data from [O/S]/3: Pole =*

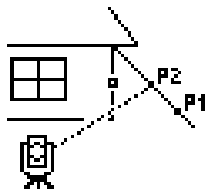
SS,14,0.0000,38.9200,271.0350,89.2630,11:04:15,DITCH
CO,2Prism O/S: P1-P2= 0.5090(0.5060) P2-Tgt= 0.5020
 ↑ ↑
 Input value Measured value

3-4) Line extension by Horizontal Angle Offset

After a distance measurement to the first prism (or target) on the line, press the [REC], [2:O/S] and [4:+Line] to get to the Line Extension (by HA) function.

1: Tape	5: Cnr
2: Angle	6: +SD
3: Pole	7: Circle
4: +Line	

Sight the second prism (or target) and press [MSR] or [TRK].



Sight	PT2
HA:	38° 45' 25"
Press	MSR or TRK
+LN	

After taking a measurement, the horizontal distance is displayed. [DSP] is available to check VA/SD as well. Press [ENT] to go to the next step.

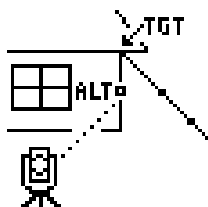
Sight	PT2
HA:	35° 21' 09"
HD:	76.0481m
+LN	

[ENT]

Sight the alternative place which lays on the same vertical line with the actual target point.

Sight	ALT Tgt
HA:	35° 21' 09"
Press	ENT
+LN	

Pressing [ENT] on ALT calculates the coordinate and the raw data of the TGT point.



Input the Code if necessary. The height of target is defaulted to 0.0000 for the offset point. Press [ENT] to record it (TGT).

PT:	48
HT:	0.0000 m
CD:	BLD5
Lst	Qcd Stk

= Example of recorded RAW data from [O/S]/4: +Line =

```
SS, 40, 0.0000, 48.3304, 169.20370, 82.02470, 10:52:37  
CO, PT1, 0.0000, 48.3020,169.19165, 83.58565  
CO, PT2, 0.0000, 48.3155,168.54250, 85.42440  
CO, O/S MSR:40 0.0000 169.20370 87.02340
```

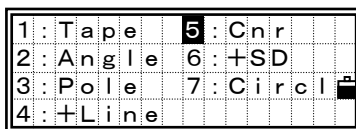
- * The calculated point (TGT) is stored as a SS record on the first line.
- * Measurements to the first and second target (P1 and P2) are stored as PT1 and PT2. The last record is of the angle measurement to the ALT (vertically offset point from the actual target point).

3

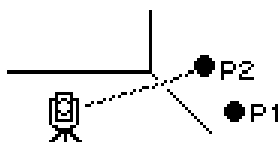
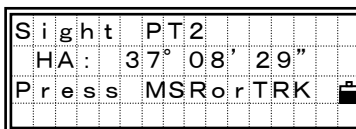
REC/Offset

3-5) Corner Offset Measurements

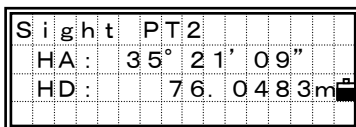
After a distance measurement to the first prism (or target) on the wall, press the [REC], [2:O/S] and [5:Cnr] to get to the Corner function.



Sight the second point on the same wall with the first point measurement and press [MSR] or [TRK].

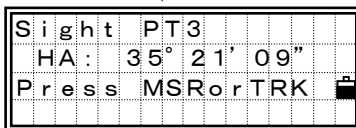


After taking a measurement, press [ENT] to proceed to next screen.



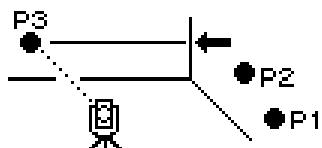
[ENT]

Sight the third point on the different wall from P1 and P2. Press [MSR] or [TRK] again.

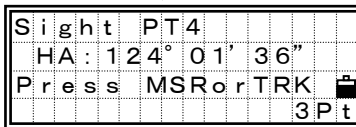


[MSR]

[ENT]

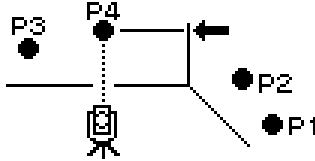


When the corner point should be perpendicular to the first wall (by P1&P2) from the third point (P3), just press [ENT] or [4:3Pt] on the screen right.



When a measurement is taken to the forth point, the corner point can be calculated as the intersection of two walls (P1-P2 and P3-P4). The default elevation is given by P4.

Sight	PT4				
HA:	157° 30' 24"				
HD:	32.856	m			
					REC



Input the Code if necessary. The height of target is defaulted to 0.0000 for the offset point. Press [ENT] to record the corner point.

PT:	58				
HT:	0.0000	m			
OD:	FLOOR2				
L s t		Q c d	S t k		

= **Example of recorded RAW data from [O/S]/5: Cnr =**

SS, 58, 0.0000, 48.3304, 169.19165, 82.02470, 10:52:37, FLOOR2
 CO, PT1, 1.0080, 48.3020, 169.19165, 83.58565
 CO, PT2, 1.0080, 48.3155, 128.54250, 85.42440
 CO, PT3, 1.6528, 74.0362, 57.07330, 80.11485

- * The calculated corner point is stored as a SS record on the first line.
- * The rest of the comment lines show the observed points for the calculation. The format is “point name (fixed), HT, SD, HA, VA” after the header, “CO,”.

3-6) Slope distance extension

After a distance measurement to a point, press the [REC], [2:O/S] and [6:+SD] to input the additional slope distance manually.

1: Tape	5: Cnr		
2: Angle	6: +SD		
3: Pole	7: Circle		
4: +Line			

The measured distance is shown the second line. Input the slope distance you have to add or subtract.

Any value between -99.990 and +99.990 metre (or -328.000 and +328.000 feet) can be input.

Input	Distance		
MSR:	75.3048m		
+SD:	0.0000	m	

= *Example of recorded RAW data from [O/S]/6: +SD* =

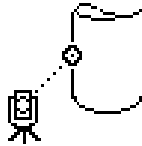
SS, 83, 1.5000, 77.0518, 62.08380, 81.06510, 11:51:48,
CO, O/S MSR: 83 76.5518 62.08380 81.06510

3-7) Circle Offset Measurements

After a distance measurement to the surface of the circle, press the [REC], [2:O/S] and [7:Circle] to get to the Circle offset function.

1: Tape	5: Cnr
2: Angle	6: +SD
3: Pole	7: Circle
4: +Line	

Sight one edge of the circle and press [3:Ed2].

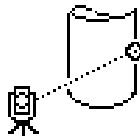


Sight	Edge1
HA:	47° 05' 35"
Press	ENT
	+SD Ed2 REC



- If you use a Prism attached to the surface of the circle for the distance measurement, press [2:+SD] to eliminate the offset error (from the attached point to the measured surface of the prism) before pressing [3:Ed2] or [4:REC].
- When the distance measurement was taken to the center of the circle, you can have a shortcut calculation by one-edge angle observation. In such a case, just press [ENT] or [4:REC].

Sight the other edge of the circle and press [ENT] or [4:REC] to calculate and record the center of the circle.



Sight	Edge2
HA:	29° 53' 01"
Press	ENT
	REC

= Example of recorded RAW data from [O/S]/7: Circl =

```
SS,71,1.5000,37.0518,32.08380,81.06510,11:51:48,  
CO, PT1, 0.0000, 0.0000,47.05350, 83.58560  
CO, PT2, 0.0000, 0.0000, 29.53010, 83.58560  
CO,O/S MSR:71 36.5418 38.28360 81.06510  
CO,Input +SD:0.0020
```

- * The calculated center point is stored as a SS record on the first line.
- * The following one or two comment lines are the observed points for the calculation. The format is “point name (fixed), HT(0.0000), SD(0.0000), HA, VA” after the header, “CO,”.
- * When the [+SD] is used before sighting the Edge1, the input value is shown at the bottom of the records.

3-8) Horizontal distance input after Angle-only shot

Turn the telescope to the direction of the point and press [REC].

HA:	157°	30'	24"	
VA:	93°	45'	18"	
SD:				m
DSP	1/4			

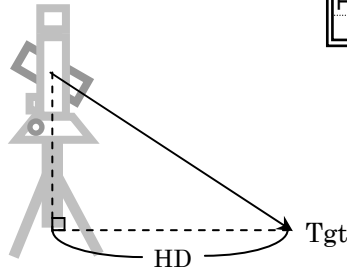
[ESC] ↑ ↓ [REC]

Input the code if necessary. Press [2:HD] to proceed to the horizontal distance input.

PT:	1462			
HT:	0.0000			m
CD:	FENCE79			
Lst	+HD	Qcd	Stk	

Input the taped measured distance from the instrument point to the target point and press [ENT].

Distance from				
Instrument				
HT:	0.0000			m



= **Example of recorded RAW data from [+HD]** =

SS,158,0.0000,77.0518,62.08380,108.06510,11:51:48,
CO, Input HD:76.1243



- This function is convenient when the instrument is very close to the fence or any point that you need to record.

Using Various Functions (menu-key)

Press the [MENU] key to display the MENU screen.



1) Job Manager

Press the [1] key on the MENU screen to get into the Job Manager. It shows a Job list. The newest created Job name will be displayed on the top of the list.

1	: Job	5	: Comms
2	: Cog o	6	: Time
3	: Set t	7	: Cal i b
4	: Data	8	: Note

1-1) Opening an existing Job

Use the up/down arrow keys to place the cursor on the desired Job name and press the [ENT] key to open it.

MENU for option			
>	*TOKYO10		
	NEWYORK3	@	
!	TEST-A56		

- * ----- Current open Job
- @ ----- Control Job
- ! ----- Some of the Job settings are different from the current one on the instrument.

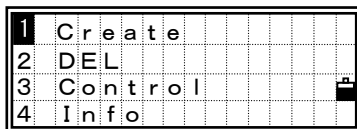
When there are more than three Jobs, “↓” will be indicated in the lower right corner of the list.



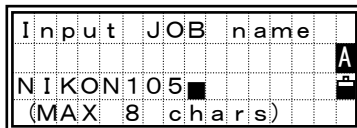
- If no Job is created when entering this function, it shows the new Job input screen directly.
- When a Job is opened, all Job settings are automatically changed to the ones in the Job being opened.

1-2) Creating a New Job

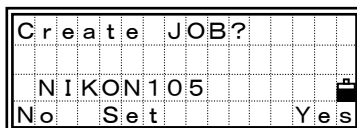
Press the [MENU] key on the Job list screen to display the sub-function menu in Job Manager.



Press the [1] or [ENT] key to show the “Input Job name” screen. Input a Job name within eight characters and press the [ENT] key.



When you want to check the Job settings, press the [2] key on the screen right. Otherwise, you can just press the [ENT] or [4] key to create a new job.

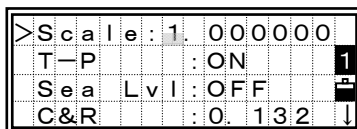


If you don't have to change any settings from the previous Job, just press [ENT] or [4:Yes] to create the new Job on the confirmation screen. The current Job settings will be transferred to the creating Job.

Job settings

The following 11 settings are fixed to each Job and cannot be changed once the Job is created. These settings are separated from other temporary settings. By this way, the data is clearly and purely stored in the database with all necessary corrections applied at the time you store each record.

Scale Factor: 0.999600~1.000400
T-P : ON/OFF
Sea Lvl: ON/OFF
C&R : OFF/0.132/0.200



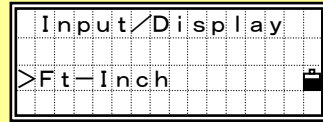
Angle unit: DEG/GON/MIL
 Dist unit: Metre/Ft-US/Ft-Int
 Temp unit: degC/degF
 Press unit: hPa/mmHg/inHg



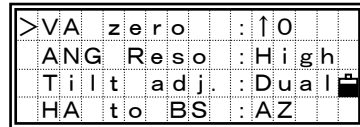
US-Ft or I-Ft



For Feet users, there is an option to display and input values in Feet-Inch. After the “Dist:” field, the option screen is opened only for Feet unit. You can select either “decimal-Ft” or “Ft-Inch” by Right/Left arrow key.



VA zero: ↑0(Zenith) / →0(Horizon)
 Az zero: North/South
 Coord-order: NEZ/ENZ
 HA to BS: AZ/zero



These settings can be changed using the Right/Left arrow keys. You can move the cursor using the Up/Down arrow keys and change any necessary items.

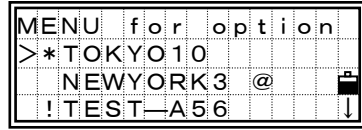
Pressing the [ENT] or Down arrow key on each line will confirm the input and move the cursor to the next line.

Finally, a job will be created using these Job settings after pressing the [ENT] key on the last Job setting line (Coord).

1-3) Deleting Job

On the Job list screen, move the cursor to the Job you want to delete.

Then, press the [MENU] key to display the sub-function menu.



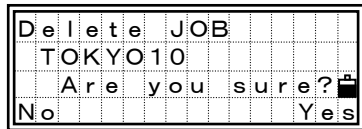
Select [2:DEL] by pressing the [2] key.

You can also choose it using the Down arrow and [ENT] keys.



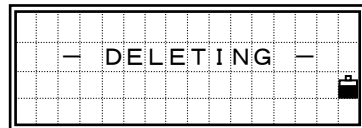
A confirmation screen is shown.

Press the [ENT] or [4] key to delete the Job you chose. Press the [ESC] or [1] key to cancel the process and return to the previous screen.



There is no "UNDELETE" function in the Job manager so before you press the [ENT] key, please make sure that the selected Job is the one you really want to delete.

It returns to the Job list screen after deleting the Job.



1-4) Control Job

A Control Job stores survey data (such as control points) that may be used by several jobs as the source of common data. This facility saves time when surveying a region that already has known points.

Once a Control job is assigned, the system will search the coordinate points in the Control Job when the input point cannot be found in the current Job. If the point is found in the Control Job, it will be copied into the current Job.

A Control Job has the same format as a standard job: it can be opened and modified. You can use it to record any measured data when you open that Job as a normal Job.

Move the cursor to the Job you want to assign as the Control Job.

MENU for option									
*	T	O	K	Y	O	1	0		
	N	E	W	Y	O	R	K	3	@
>	I	T	A	L	Y	5	6		↓

Press the [MENU] key to display the sub-function menu, shown right.
Select [3] by pressing the numeric key or the Down arrow and [ENT] keys.

1	C	r	e	a	t	e			
2	D	E	L						
3	C	o	n	t	r	o	l		
4	I	n	f	o	.				

A confirmation screen is shown.
Press the [ENT] or [4] key to assign the Job as a control job.
Press the [ESC] or [1] key to cancel the process.

Assign												
T	E	S	T	-	A	5	5					
a	s	C	o	n	t	r	o	l	J	o	b	?
N	o								Y	e	s	



- When a Control Job is already assigned, the newly assigned Control Job replaces the previously assigned Control Job.
- To cancel the current control job, move the cursor to the job name and press [MENU] and [3:Control] again. It will undo the control job.

```

Terminate
TEST-A55
as Control Job?
No Yes
  
```

[ESC]/[1:No]=returns to Job list

[ENT]/[4:Yes]=cancels control job

1-5) Displaying Job Information

Place the cursor on the Job which you want to check.

```

MENU for option
*TOKYO10
NEWYORK3 @
> ITALY56
  
```

Press the [MENU] and [4] key to see its information.

```

1 Create
2 DEL
3 Control
4 Info.
  
```

The Job name, the record count in the Job and available record numbers, that can be stored to that Job when you open it, are displayed.

Press any key to return to the Job List screen.

```

Job: NIKON108
Records: 3029
Free: 2090
  
```

2) Cogo

Coordinate Geometry Calculations

Press the [2] key on the MENU screen to display the COGO menu screen.

This function can be used at any time from observation or inputting PT screens.

C o g o			
1	: PT-PT	4	: Line
2	: HA+HD	5	: Input
3	: Area		

2-1) PT-PT Inverse

Calculating Angle and Distance between two Coordinates

Press the [1] key in the COGO menu to display the screen for inputting the first point number/name. Type the PT and press the [ENT] key.

Input	1st	Point	
PT:	■		1
COGO			



When you press [ENT] without having any point name/number in the PT field, it shows a coordinate input screen anyway. This coordinate will NOT be stored in the database. If you want to record the point, you need to specify a new point name/number.

Type the second point number/name and press the [ENT] key.

Input	2nd	Point	
PT:	■		1
COGO			

The azimuth, horizontal distance, and vertical distance from the first point to the second point are displayed.

Press the [ESC] or [ENT] key to return to the COGO menu.

rHA:	123°	24'	10"
dHD:	123.	4569m	
dVD:	13.	1457m	
COGO	1/2		

Press the [DSP] key to change the contents of the result screen.

Gd:			6.20	:	1	
V%:		10.500	%			
rSD:	144.6722	m				
COGO	2/2					

Gd: Grade (HD/VD)
 V%: 100/Gd
 rSD: Slope distance PT1 to PT2

2-2) HA+HD Coordinate Calculating Coordinates from Angle and Distance

Press the [2] key in the COGO menu to display the screen for inputting the base point. Type the PT and press the [ENT] key.

Input Point					
PT:					1
COGO					

Input the azimuth, horizontal distance, and vertical distance from the base point and then press the [ENT] key.

Input Angle Dist					
HA:	123.4520				1
HD:					
dVD:					

The coordinates are calculated and displayed. Press the [4] or [ENT] key to record the point.

X:	-154.2019				
Y:	2345.3627				
Z:	135.3250				
Ab r t					REC

The “Input Point” screen is displayed to record the point. The PT is defaulted to the “Last recorded PT + 1”. Press the [ENT] key to store the point.

Input Point					
PT:	16				
CD:	BUSH				
L s t					S t k

2-3) Area & Perimeter

Calculating Area and Perimeter

Press the [3] key in the COGO menu.
Input the first point of the lot and press the [ENT] key. In the upper right corner of the screen, there is a counter to show how many points you have entered.

Input	Point	01
PT:	1005	1

When a new point name is input, you can input new coordinates and record it.
If you don't have to record the point, just press the [ENT] without PT. It shows XY coordinate input screen.

X:	5508.211	1
Y:	1761.540	1

Repeat inputting points until you have defined all the points in the lot. Then, press the Down arrow key to calculate the area and perimeter.

Input	Point	04
PT:		1
Press ↓ to Calc		

Press any key to return to the COGO menu.

Area:	654.5882m ²	1
Perim:	346.0081m	1



- By default, the system closes the area using the last point and the first point in the list.
- To obtain the correct result, you must input the point in order of closing the area with one stroke .
- Area and Perimeter cannot be recorded.
- Maximum 99 points can be input.

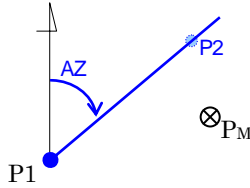
2-4) Line and Offset

Calculating coordinates from Line and Offset

Press the [4] key in the COGO menu to enter the Line & offset function.

Type in the base point (P1) and specify the bearing through P1 by either AZ or P2.

Line Define	
P1: 100	1
AZ:	1
P2:	

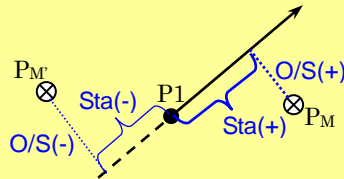


Once the base point and the bearing is established, input the horizontal distance along the line (Sta), the horizontal distance perpendicular to the line (O/S) and the vertical distance (dVD) to P1.

Line & Offset	
Sta:	25.0000m 1
O/S:	-1.7400m 1
dVD:	m



- Negative value in “Sta” means the opposite direction along the defined bearing line.
- Negative “O/S” value is for the left-hand side of the bearing line.



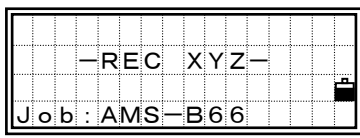
By pressing the [ENT] at “dVD” field, the coordinate of the desired point (P_M) is calculated. Only the Z-coordinate can be changed here.

N:	29000.4562
E:	-1234.7408 1
Z:	89.7650

Press the [ENT] to record the point, after inputting the PT and CD in the following screen.

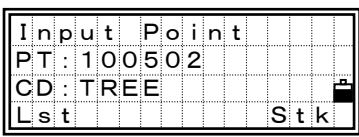
Input Point	
PT: 10005	
CD: MANHOLE	1
Lst	Stk

The coordinate is stored as a CC record. Line definition info. and “Sta”, “O/S” and “dVD” values will be stored as comment records as well.

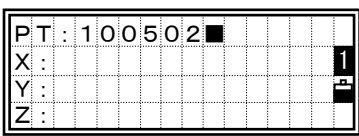


2-5) Input Coordinate
Manually input coordinate

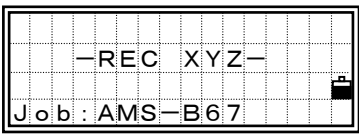
Press the [5] key in the COGO menu to enter the manual input XYZ function. The PT is defaulted to the “Last recorded PT + 1”.




Input the coordinate using the numeric keys. Press the [ENT] or down-arrow key at each line.



The point is stored as a MP record when you press [ENT] on the Z-field. After recording the point, it returns to the PT/CD input screen with the default PT incremented.



 NE, NEZ, or Z only data can be recorded to the database.

3) Sett

Initial settings

Press the [3] key on the MENU screen to display the initial settings menu.

1: Angle	5: Unit	
2: Dist	6: Comm.	
3: Coord.	7: S-O	
4: Power	8: Other	

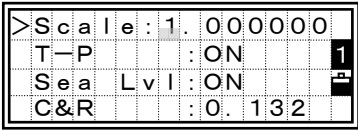
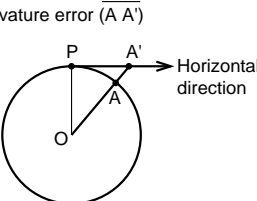
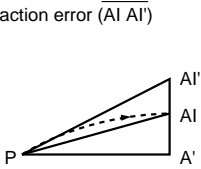
3

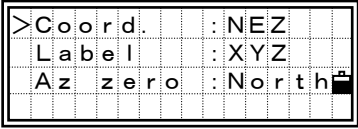

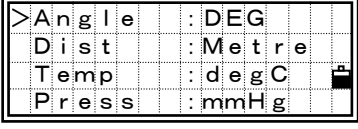
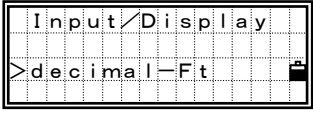


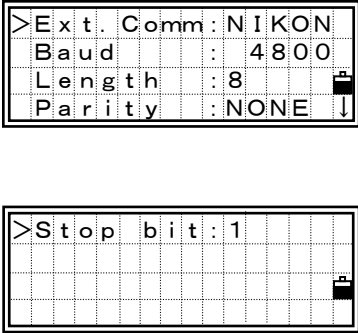
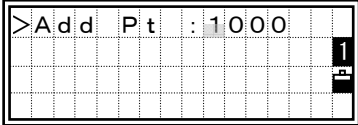
- The items shown in a box (ex. **VA zero direction**) in “Conditions” column are Job Settings that cannot be changed in the existing Job.
- When any of those Job settings is changed, a confirmation screen is shown to ask you to create a new Job with those new settings or just continue working under those settings without recording data.

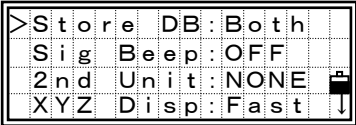

Menu	Item	Conditions
1:Angle		<p>VA zero direction ↑ 0 (Zenith)/→0 (Horizon)</p> <p><Angle Resolution > High/Low</p> <p><Tilt compensation >* Dual/Single/OFF</p> <p>HA to BS AZ(Azimuth)/zero</p>
	<p>*When the “Tilt adj.” setting is set to “OFF” or “Single”, some of the tilt-compensation-free items are displayed after “#” sign instead of “:” indication.</p>	

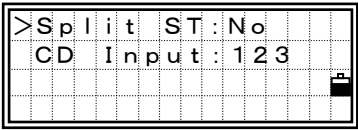
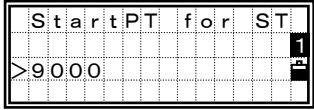
MENU/3: Sett

Menu	Item	Conditions
2:Dist	 <p> >Scale: 1.000000 T-P : ON Sea Level: ON C&R : 0.132 </p>	<p>Scale Factor Numerical input between 0.999600 and 1.000400.</p> <p>Temp&Press Correction ON/OFF</p> <p>Sea Level Adjustment ON/OFF</p> <p>C&R Correction OFF : C&R OFF 0.132 : C&R ON (coef. 0.132) 0.200 : C&R ON (coef. 0.200)</p>
<p>As the surface of the earth is curved, the vertical difference (VD and Z) at the measurement point, as referenced to the horizontal plane, will inevitably include some error. This error is called curvature error. Likewise, as the density of the air surrounding the earth decreases with altitude, light is refracted when it passes through the air. The subsequent error caused by this refraction is called refraction error.</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <p>Curvature error ($\overline{AA'}$)</p>  </div> <div style="text-align: center;"> <p>Refraction error ($\overline{AI AI'}$)</p>  </div> </div>		

Menu	Item	Conditions
3:Coord.		<p><u>Coordinate Order</u> NEZ/ENZ</p> <p><Coordinate Label> XYZ/YXZ/NEZ(ENZ)</p> <p><u>Azimuth zero Direction</u> North/South</p>
4:Power		<p><Main Auto PWR off> OFF/5min/10min/30min</p> <p><EDM Auto PWR off> OFF/At Once/0.1min/ 0.5min/3min/10min</p> <p><Power Save (Sleep mode) > OFF/1min/3min/5min</p>
5:Unit	 <p>*An option in display and input is available only for Feet unit</p> 	<p><u>Angle Unit</u> DEG : Degree GON : GON MIL : Mil6400</p> <p><u>Distance Unit</u> Metre/US-Ft/I-Ft</p> <p><u>Temperature Unit</u> degC : Celsius degF : Fahrenheit</p> <p><u>Pressure Unit</u> hPa/mmHg/inHg</p>

Menu	Item	Conditions
6:Comm		<p><Data Collector/Recorder > NIKON/SET</p> <p><Baud rate > 1200/2400/4800/9600/ 19200/38400bps</p> <p><Data Length > 7/8</p> <p><Parity > EVEN/ODD/NONE</p> <p><Stop bit > 1/2</p>
7:S-O		<p><Add constant in Stakeout > Used to give a default point number to record observed data in Stakeout (1~999,999).</p>

Menu	Item	Conditions
<p>8:Other (1st screen)</p>	 <p>(Continued to the next page)</p>	<p><<i>Store Data</i>> RAW/XYZ/Both</p> <ul style="list-style-type: none"> ·When recording SS/CP/SO records on the BMS or S-O, it records raw and/or coordinate data based on this setting. <p><<i>Beep on Signal</i>> ON/OFF</p> <p><<i>Secondary Unit</i>>* None/Metre/US-Ft/I-Ft</p> <p><<i>XYZ Disp</i>> Fast/Norm/Slow/+ENT</p> <ul style="list-style-type: none"> ·This defines the speed to change to the next screen after showing coordinates of input PT.
	<p>* When the Secondary unit is set to other than “NONE”, one more display for HD/VD/SD in the 2nd Unit will be added to the Basic Measurement Screen, Stakeout and 2-pt Reference Line.</p> <p>* For “US-Ft” and “I-Ft” setting, there is an option to display the value in Ft-Inch.</p>	

Menu	Item	Conditions
8:Other (2 nd screen)		<p><Split ST > No/Yes*</p> <ul style="list-style-type: none"> • Increment of the default PT for all station-related records can be separated from other record types by this setting. <p><CD Input > ABC/123</p> <ul style="list-style-type: none"> • When your feature code system consists of numbers only, it is convenient to use “123” in this setting.
<p>* When ‘Split ST’ is set to “Yes”, the default starting ST number can be input in the additional setting screen appeared.</p> 		

4) Data

Viewing and Editing Records

Press the [4] key on the MENU screen to display the View/Edit menu.

View/Edit	
1	: RAW data
2	: XYZ data
3	: Code List

4-1) Display Records



“Data View” feature is available at all times even from observation or inputting PT screens.

4-1-1) From RAW data

Press the [1] key on the View/Edit menu screen to show the RAW data in List form.

When you first view the RAW data, you will see the last four RAW records in the current Job. You can use the Up/Down arrow keys to scroll through the records.

SS, 14, FENCE
SS, 15, CURB
SS, 16, MANHOLE
>SS, 17, Pt 1

▼ [ENT]

Press the [ENT] key to see more detailed information.

Press the [ESC] key to return to the list screen.

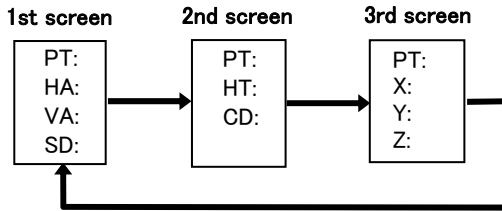
PT : 17
HA : 301° 50' 30"
VA : 89° 12' 25"
SD : 142.8456m

SS/SO/CP/F1/F2 records

These records include the “PT”, “HT”, “CD”, and “HA/VA/SD”.

SS: Topo shots (sideshots). All collection shots on the BMS.
SO: Stakeout shots. Shots taken in the Stakeout function.
CP: Shots taken in the ANG/Rept and the BMS (See p.3-32).
F1/F2: Face1/Face 2 shots.

Pressing the [DSP] key switches the displays in the following order.



- The third screen is only displayed when the raw data record has corresponding coordinates available. For this the "Store Data" setting needs to be set to "Both". Coordinates are never available for F1/F2 records.
- When taking a check shot, if you decide to overwrite an existing coordinate, the raw data record that created the original coordinate becomes 'raw data only' and no longer has coordinates available.

ST records

This record includes the "PT", "HI", "BS", and "BS Az". You can see its coordinate by pressing the [DSP] key as well.



When a new ST point number/name is assigned in STN/4:Quick Stn., the coordinate of the Station will be recorded as (0, 0, 0).

CO records

A comment added to the job from the system.

For example, when you change the Stn-Z by the Remote Benchmark function, or the horizontal angle is adjusted by the BSCheck function, the system records what you have done in the field.

A sample comment record from the Remote Benchmark function.

```
CO, Remote BM Ca  
l c. Z=501.193 -S  
t n Point Update  
d
```

Temperature, Pressure and Prism Constant record (SY record) is also stored when you complete each station setup.

```
CO, Temperature:  
95 Fahrenheit  
Pressure: 29.9  
inHg Prism: 30
```



When no record is stored in the RAW database, it shows an error screen. Press any key to return to the previous screen.

```
No Data  
Press any key
```

4-1-2) Displaying Coordinate data

First, the last four records are displayed when you select [2:XYZ data] in Data menu. You can use the Up/Down arrow keys to scroll through the records.

```
UP, 536,  
UP, 537, CURB  
MP, 1,  
>MP, 2, STN
```

▼ [ENT]

Press the [ENT] key to see more detailed information.

```
PT: 2  
E: 1503024.5590  
N: -8924512.2541  
Z:
```



The header (XYZ, YXZ, NEZ, or ENZ) depends on the Coord. Label setting in MENU/3:Sett/3:Coord. (See p.3-91)

UP/MP/CC/RE records

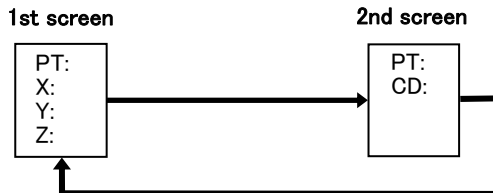
All coordinate records include the “PT”, “CD”, and “X/Y/Z”.

By pressing the [DSP] key, the display toggles between PT/X/Y/Z and PT/CD.

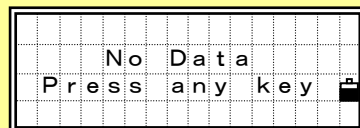
UP: Uploaded point coordinates.
 MP: Manually input point coordinates.
 CC: Calculated coordinates. Points calculated in “COGO”.
 RE: Calculated coordinates. Points calculated in “Resection”.

When the “Store data” setting (See p.3-82) is “Both” or “XYZ”, shots on the BMS (SS), in Stakeout (SO) and in ANG/Rept (CP) store coordinate records as well. The format of the data is the same as other coordinate records.

Pressing the [DSP] key switches the display for UP/MP/CC/RE records in the following order.



When no record is stored in the Coordinate database, it shows an error screen. Press any key to return to the previous screen.

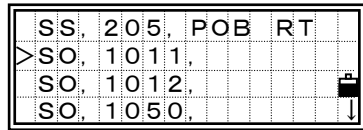


4-2) Delete Record
4-2-1) Deleting RAW data

Select [1:RAW data].



Place the cursor using the Up/Down arrow key to the record you want to delete, then press [MENU].

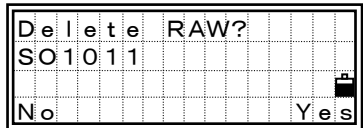


▼ [MENU]

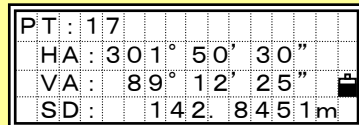
The sub-function menu for RAW data is displayed. Press the [1] or [ENT] key for “Delete”.



A confirmation screen is displayed. Press the [ENT] or [4] key to delete the specified record.



- If the “Store Data” is set to “Both”, the system will also delete the corresponding coordinate data, when the RAW (SS/SO/CP) record is deleted.
- Deleting RAW data can also be activated from the each data screen right. Press the [MENU] key to display the sub-function menu.

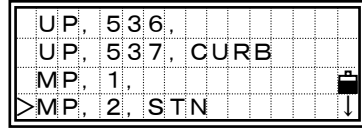


4-2-2) Delete Coordinate data

Select [2:XYZ data].



Place the cursor using the Up/Down arrow keys to the record you want to delete, then press [MENU].

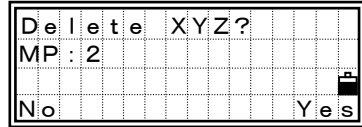


▼ [MENU]

The sub-function menu for XYZ data is displayed. Press the [1] or [ENT] key for “Delete”.



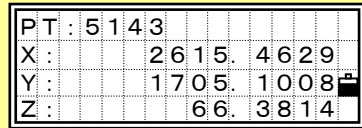
A confirmation screen is displayed. Press the [ENT] or [4] key to delete the specified record.



Press the [ESC] or [1] key to cancel deleting data.



- Deleting coordinate data can also be activated from any detail data screen shown in right. Press the [MENU] key to display the sub-function menu.



- Coordinates points used as Stations or Backsights cannot be deleted. (See p.8-7)

4-3) Edit Record

You can edit records by their point number/name and code. Also the height of target (HT), height of the instrument (HI), backsight point (BS), and backsight azimuth (Az) can be modified.



The Z-coordinate of SS/CP will be recalculated and updated when its HT is changed.

4-3-1) Edit RAW record

Select [1:RAW data].

	View/Edit
1	RAW data
2	XYZ data
3	Code List

Place the cursor using the Up/Down arrow keys to the record you are going to edit, then press [MENU].

ST	100
F1	1.5060
SS	2001, FENCE
>SS	124, MANHOLE↓

▼ [MENU]

The sub-function menu for RAW data is displayed. Press the [2] key for “Edit”.

1	DEL
2	Edit
3	Search

Move the cursor using the Up/Down arrow keys and modify the necessary fields.

PT	124
HT	1.6500m
CD	MANHOLE

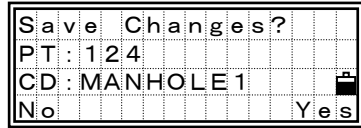


- There is no edit CD field for SO/F1/F2 records.
- HA/VA/SD cannot be changed.
- All items in the ST record can be edited but no recalculation will be performed on the instrument.

< Edit screen for ST record >

ST	100
HI	1.6500m
BS	
AZ	45° 00' 00" 0

When you press the [ENT] key on the last line of the edit screen, it shows a confirmation screen.

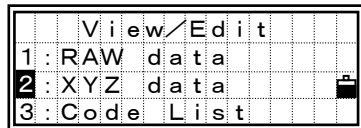


Press the [4] or [ENT] key to accept the modification and return to the Data View screen. Press the [1] or [ESC] key to go back to the edit screen.

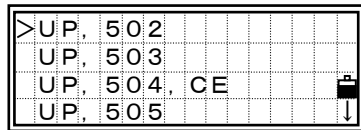


4-3-2) Edit Coordinate record

Select [2:XYZ data] to get into the coordinate list screen.

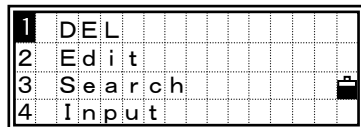


Place the cursor using the Up/Down arrow keys to the record you want to edit, then press [MENU].

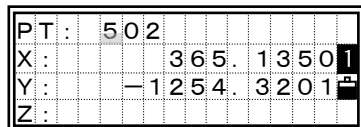


▼ [MENU]

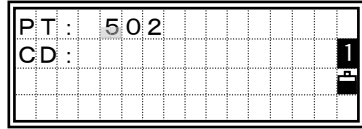
The sub-function menu for XYZ data is displayed. Press the [2] for "Edit".



Move the cursor using the Up/Down arrow keys and modify the necessary fields. You can edit PT and coordinate.



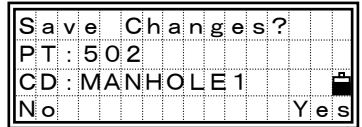
Pressing [ENT] in the Z: field changes to the PT and CD screen. The Point name/number and Code can also be edited.



PT :	5	0	2																	
CD :																				

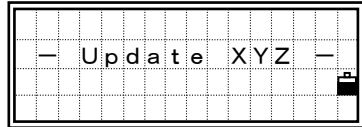
3

When you press the [ENT] key on the last line of the edit screen, it shows a confirmation screen.



Save Changes?																					
PT :	5	0	2																		
CD :	M	A	N	H	O	L	E	1													
No																			Y	e	s

Press the [4] or [ENT] key to accept the modification and returns to the Data View screen. Press the [1] or [ESC] key to go back to the edit screen.



	-	U	p	d	a	t	e		X	Y	Z	-								



Coordinate records used as Stations or Backsights cannot be edited. An error screen will be displayed when you try to edit those records. (See p.8-8)

MENU/4: Data

4-4) Search Record

You can search for records by their type, point number/name, code, or by any combination of these.

4-4-1) Search from RAW record

Select [1:RAW data] to show the list of RAW data before entering “Search” function.

	View/Edit	
1	RAW data	
2	XYZ data	
3	Code List	

Press the [MENU] key to display the sub-function menu for RAW data.

>	ST, 100.	
	F1, . 1. 5000	
	SS, 2001, FENCE	
	SS, 2002, FENCE	

▼ [MENU]

Press the [3] or the Down arrow and [ENT] keys to select “Search”.

1	DEL	
2	Edit	
3	Search	

You can set the record “Type” using the Right/Left arrow keys. It scrolls among ALL/ST/SS/SO/F1/F2/CP/CO/SY.

When you know the PT of the point, you can ignore “Type”. Just leave it as ALL and press the [ENT] key to input “PT”.

Search	RAW	
Type:	<ALL>	
PT:		
CD:		

Type the PT and/or CD. The asterisk (*) can be used as a wildcard.

For example, when you input “30*” in the PT field, Pt:300, 301, 302, 3000A2, 3010...etc. can be found.

Search	RAW	
Type:	SO	
PT:	30*	
CD:		



- When you specified “ST/SO/F1/F2” in “Type” field, the search will be initiated by pressing the [ENT] key on the “PT” field. You don’t have to input “CD” for those types.
- When you specified “CO/SY” in “Type” field, the search will be initiated by pressing the [ENT] key on the “Type” field. For these records, “PT” and “CD” are irrelevant.

When several points are available for the condition which you input, those points are shown in a list form.

Select a point from the list using the Up/Down arrow keys and press [ENT].

>SO,	305,								
SO,	306,								
SO,	307,								
SO,	308,								

Detailed data for the selected record is displayed. Press the [ESC] key to return to the list screen.

On this screen, [DSP] key is also available to change the contents. (See p.3-96)

PT :	308								
HA :	123°	45'	50"						
VA :	90°	15'	20"						
SD :	1234.	5568m							



- A search is successful if the record matches either of PT or CD, when the Type is satisfied.
- When there is no point matches to the specified conditions, an error screen is displayed. Press any key to return to the Data View screen.

!	P	T		N	o	t		F	o	u	n	d
P	r	e	s	s		a	n	y		k	e	y

4-4-2) Search from Coordinate record

Select [2:XYZ data] first to show a list of coordinate data before activating “Search” function.

	View/Edit
1	RAW data
2	XYZ data
3	Code List

Press [MENU] on the XYZ data screen to display the sub-function for XYZ data.

UP	536,
UP	537, CURB
MP	1,
>MP	2, STN

▼ [MENU]

Press the [3] key to enter “Search XYZ” function.

1	DEL
2	Edit
3	Search
4	Input

You can select the “Type” using the Right/Left arrow keys. It scrolls among ALL/MP/UP/CC/RE.

Search	XYZ
Type:	<ALL>
PT:	
CD:	

When you know the PT of the point you want to find, you can ignore “Type”. Just leave it as ALL and press the [ENT] key to input “PT”.

Type the PT and/or CD. The asterisk (*) can be used as a wildcard.

For example, when you input “TREE*” in the CD field without anything in the PT field, any points name/number that have TREE, TREE1, TREE-3C...etc. in CD can be found.

Search	XYZ
Type:	MP
PT:	
CD:	TREE

4-5) Input Coordinate

Select [2:XYZ data] before you enter “Add coordinate” function.

View/Edit	
1: RAW data	
2: XYZ data	
3: Code List	

Press [MENU] on the XYZ data screen to display the sub-function for XYZ data.

UP, 536,	
UP, 537, CURB	
MP, 1,	
>MP, 2, STN	

▼ [MENU]

Press the [4] or the Down arrow and [ENT] keys to show the input point screen next.

1 DEL	
2 Edit	
3 Search	
4 Input	

The PT is defaulted to the “Last recorded PT + 1”. You can change it here too. After you input PT and CD correctly, press [ENT] to input coordinates.

Input Point	
PT: 100502	
CD: TREE	
Lst	Stk

Input the coordinate using the numeric keys. Press the [ENT] or Down arrow key to accept each line.

PT: 100502	
X: ■	
Y:	
Z:	

The point will be stored as a MP record when you press [ENT] in the Z field. After recording the point, it returns to the PT/CD input screen with the updated default PT.

-REC XYZ-	
Job: AMS-B67	



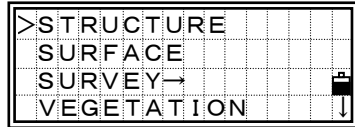
NE, NEZ, or Z only data can be recorded to the database.

4-6) Code List

Select [3:Code List] from the View/Edit menu.



It shows the first four feature codes (or layers) on the first layer of the Code List. The codes (and/or layers) are shown in alphabetical order.

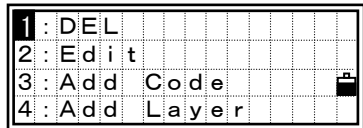


Place the cursor using the Up/Down arrow keys to the code or layer name you want to edit, then press the [MENU] key.



- Maximum 254 codes (and/or Layers) can be stored.
- Each code (or Layer name) is up to 12 characters.
- ‘First character search’ is available to find a feature code (or Layer) you want. When the “List” screen is shown, the keyboard is in alpha input mode and the cursor will move to the feature code starting with the first character you input. (See p.3-10)

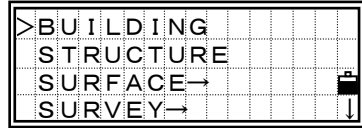
The Code List sub-function menu is displayed. Four functions are available for Code List management.



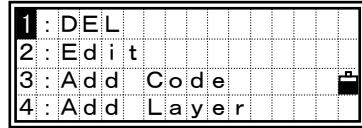
- [1:DEL]= deletes the selected feature code or layer
- [2:Edit]= allows editing and updating of the Code List.
- [3:Add Code]= adds a new feature code to the current layer.
- [4:Add Layer]= adds a new layer beneath the current layer.

4-6-1) Delete Code/Layer

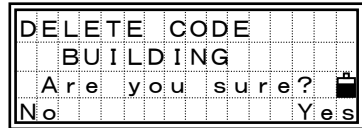
Place the cursor using the Up/Down arrow keys to the code (or layer) you want to delete, then press [MENU].



The sub-function menu for Code List is displayed. Press the [1] or [ENT] key to enter the “Delete Code/Layer” function.



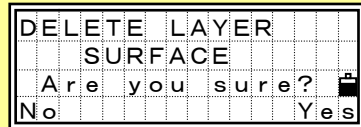
A confirmation screen is displayed. Press the [ENT] or [4] key to delete the specified code.



Press the [ESC] or [1] key to cancel deleting the code.



You can delete a whole layer by selecting [1:DEL] on the sub-function menu when you place the cursor on a layer name. All codes and layers underneath the specified layer will be deleted.

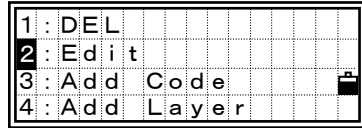


4-6-2) Edit List

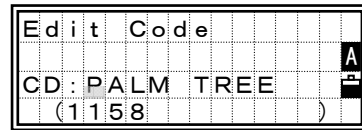
Move the cursor using the Up/Down arrow keys to the code or layer name you want to edit, then press [MENU].



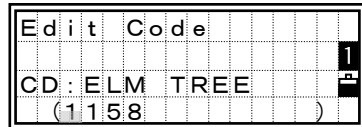
The sub-function menu for Code List is displayed. Press the [2] key for "Edit Code/Layer".



For feature codes there are two input fields. The first CD: field is the word that will be displayed in the List and the optional second field is the code that will be recorded when the List item is selected. This can be used for numeric coding systems, e.g. "TOP" can be selected from a List and "102" can be recorded. (See p.7-3)



Press [ENT] to go to the "record" code field.



- The word shown in parenthesis at the bottom of the screen is the one that will actually be recorded to the Job. Make sure that you edit both fields when you intend to change feature codes.
- If the second field is blank the code in the first input field will be recorded.

When either string is changed, a confirmation screen will be displayed. Press [ENT] or [4:Yes] to accept the change.

Save	change?		
PALM	TREE	(1158	
→ELM	TREE	(1147	→
No			Yes



When a Layer is edited, a single line input screen is shown. Press the [ENT] key after you change the layer name.

Edit	Layer	Name	
CEDAR			→

4-6-3) Add new Code

Press the [3] numeric key or down arrow and [ENT] to select [3:Add Code]. You can add a new feature code to the current layer.

1:	DEL		
2:	Edit		
3:	Add Code		→
4:	Add Layer		

Type the feature code. Pressing the [Mode] key changes the input mode between alphabet and numeric. In the CD: field, you can input the word you want to display in the List.

Input	Code		
CD:	AT/BM		→
()	

The last line is an optional field if you want to record a different code than the one that is displayed in the List. (See p.3-106)

Press [ENT] in the second field to store the new code.

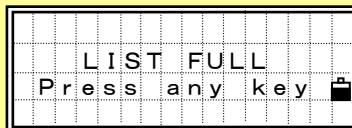
Input	Code		
CD:	AT/BM		→
(5087)	

When a new code is added, the order of the codes in the current layer will be rearranged in alphabetical order and displayed from the first four items.

>AT/BM			
STRUCTURE			
SURFACE			
SURVEY→			↓



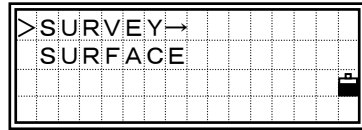
• If the Code List already has 254 code and/or layer names when you try to input more, an error screen is displayed. Press any key to return to the previous screen.



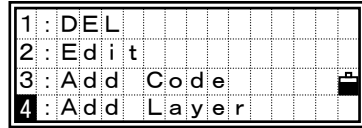
• The input CD in this function is stored as both “String” and “Code”. It will be used both for displaying List and recording data. If you want to see a “String” which is different from what is stored as CD, you can create your own Code List using any standard EDITOR in your PC. (See p.7-3 for format and p.3-119 for uploading List)

4-6-4) Add Layer

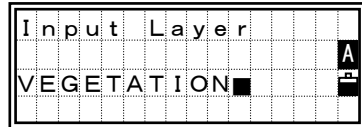
Press the [MENU] key on the desired layer if you want to create another layer underneath it.



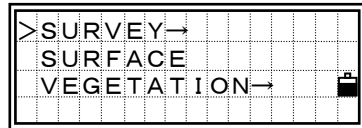
The sub-function menu for Code List is displayed. Press the [4] key for “Add Layer”.



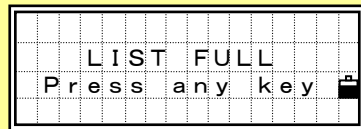
Type the layer name.
Pressing the [Mode] key changes the input mode between alpha-numeric and numeric. Press the [ENT] key to store the new layer name.



When a new code is added, the order of codes in the current layer will be rearranged in alphabetical order and displayed from the first four items.

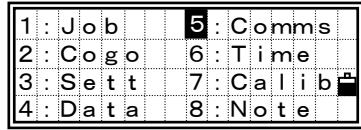


If the Code List already has 254 code and/or layer names when you try to add more layers, an error screen is displayed. Press any key to return to the previous screen.



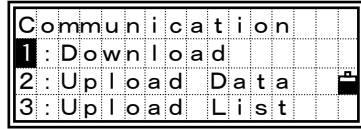
5) Communication
5-1) Download Data

Press the [MENU] and [5] key to display the communication menu.



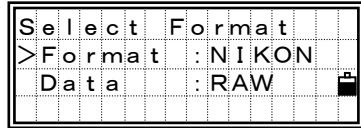
Communication menu:

- 1: Download recorded data
- 2: Upload coordinate data
- 3: Upload a Code List file

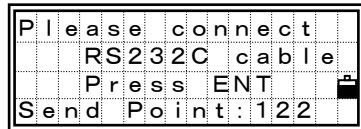


Press the [1] key to get into the download settings screen.

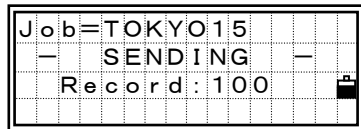
- Format: NIKON/SDR2x/SDR33
- Data: RAW/Coordinate



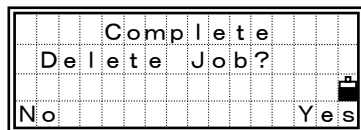
Press the [ENT] key on the “Data” field and it displays the total number of records that will be downloaded.



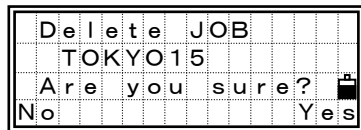
While the records in the current open job are downloaded, the current line number is updated as the record is output from the instrument.



After downloading records is completed, you can choose to delete the current Job to create some room for the another job.



Press the [4] key to delete the current Job. Pressing the [1] or [ESC] returns you to the BMS.



5-2) Upload Coordinate Data

Press [2] key to upload coordinate data via cable.

Communication			
1:	Download		
2:	Upload Data		
3:	Upload List		

The default data format is displayed. If you would like to change the order of data fields, you can press [3:Edit] (See next page for details).

Data Fields			
PT	/	N	/
E	/	Z	/
CD	/	/	/
Comm Edit			

When you don't have to change the order, just press the [ENT].

▼ [2]

You can also change the communication settings by pressing [2:Comm] to match those in your program.

>Baud	:	38400	
Length	:	8	
Parity	:	NONE	
Stop bit	:	1	

“Free Space” is the total number of points that can be stored.

Connect the instrument and your computer by RS-232C cable. Press the [ENT] key on the instrument and start sending data from your computer through a communication program (usually SEND TEXT file).

Please connect			
RS232C cable			
Press ENT			
Free Space:	:	312	



“Flow control” must be set to “Xon/Xoff” on your communication program.

While each point is received by the instrument, the “Record” number is kept updating.

Job=TOKYO15			
- RECEIVING -			
Record: 15			



- When you press the [ESC] key during uploading data, it aborts the process and returns to the MENU screen. Records already processed before the [ESC] key are remaining in the job.
- The system will truncate the code if it is longer than 12 characters.
- When the data recording area becomes full during uploading data, it shows an error message and aborts the process. (See p.8-1)

===== *Advanced Functionalities* =====

Edit data order for Upload

A user-definable upload format screen.
By pressing the left/right arrow keys, the item toggles among PT, N, E, Z, CD and blank.

Field 1:	<PT>	
Field 2:	N	
Field 3:	E	
Field 4:	Z	

Formats that include more than two PT or N/E/Z cannot be accepted.
If you would like to skip some items in your original file, you can set “blank” in the field you are to ignore.

Field 5:		
Field 6:		
Field 7:	<CD>	

Ex.) Your data (original) : 1, UB, 30.000, 20.000, L1
 Defined format : PT/ /N/E/CD
 Uploading data to a job : PT=1, N=30.000, E=20.000, CD=L1

Uploading coordinates without PT

When you don't include PT in your format definition, the available PT number (1 or the largest PT number in the job) will automatically be given to each line of data. In this case, keeping some identifier in CD is recommendable for your efficient fieldwork.



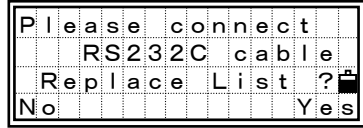
- When uploading a duplicate point that has been already referred to by a Station or Backsight, the "!Duplicate PT" error is shown and that Pt: name/ number is informed. (See p.8-9)
- When the duplicate point is *not* referred to by a Station or Backsight and the point type is UP/CC/MP, then that point will be automatically overwritten by the new uploaded point.
- Even if the duplicate point is *not* referred to by a Station or Backsight, the point will not be replaced when the point type is a SS/SO/CP measurement record.

5-3) Upload List file

Press the [3] key to upload a Code List file via cable.



Connect the instrument and your computer by RS-232C cable. Start the communication program on your computer to send coordinate data (usually SEND TEXT file).

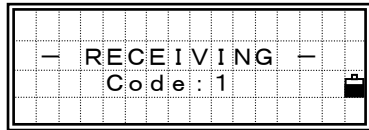


Press the [4] or [ENT] key on the instrument to start uploading a Code List file.



When you upload a Code List, it always replaces the one which is already on the instrument.

While each item in the List is uploaded, the "Code" number is updated as it is stored to the instrument. Maximum 254 codes can be uploaded.



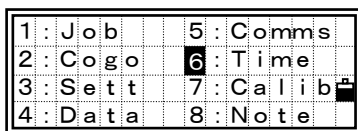
The system will truncate the code if it is longer than 12 characters.



When the memory becomes full during uploading data, it shows an error message and aborts the process. (See p.8-1)

6) Date & Time

Press the [6:Time] key on the MENU screen to display the Date & Time screen.



Date & Time in the current setting are shown.

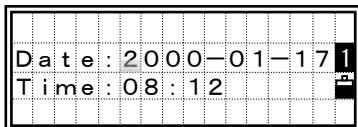
The Date format is Year-Month-Day.

For example, if you want to change the date to January 18, 2000, then press:

2000 [ENT] 1 [ENT] 18 [ENT]

or

just press [ENT], [ENT], and 18 [ENT] on the screen right.

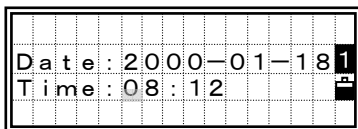


Pressing [ENT] on the “Day” field moves the cursor to the “Time” field.

Input Hour and Minutes in the 24-hour system.

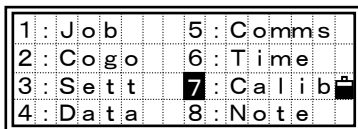
Press the [ENT] at “Minutes” field to finish the input of Date & Time.

Press the [ESC] to cancel the input.



7) Calibration

Press the [MENU] and [7] key to enter the instrument calibration screen. (See p.4-2)



8) Note

Press the [MENU] and [8:Note] key to record some memo to your RAW data. This function can be used at any time from observation or inputting PT screens.

1: Job	5: Comms
2: Cog o	6: Time
3: Sett	7: Calib
4: Data	8: Note

Up to 50 characters can be input per note. The input memo is stored as a CO record in RAW database.

Input Note	A

The Stack function (Stk) is available by [Mode] key. Maximum 20 notes are stored in Stack.

Input Note	
OUT OF TOLERANC	
Stk	

▼ [4:Stk]

>OUT OF TOLERAN	
IN TOLERANCE	
Go Next site	
Cont Tomorrow	

4. CHECKING AND ADJUSTMENT

4-1 Plate Level

(Making the axis of the level vial at right angle to the vertical axis of the instrument)

1) *Checking*

- (1) Set up the instrument on the tripod and follow the leveling procedures described in [2-5. Leveling] p.2-9.
- (2) Rotate the alidade 180°.
- (3) Check to see if the bubble remains in the center of the vial. If a displacement is detected it should be adjusted. Refer to the following adjustment procedure.

2) *Adjustment*

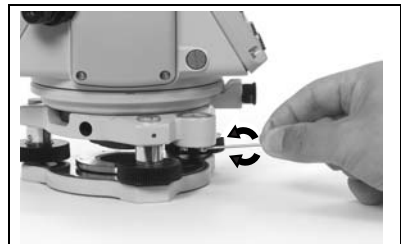
- (1) Using the adjusting pin supplied, rotate the plate level's adjustment screw to move the bubble to eliminate half of the displacement detected.
- (2) Take up the remaining displacement with leveling screw A (refer to the Figure in p.2-9), centering the bubble.
- (3) Recheck, and repeat if necessary.



4-2 Circular Level

1) *Checking*

After confirming the plate level is in adjustment, check for any displacement of the bubble's centering in the circular level. If it is out of adjustment, use the adjusting pin to manipulate the three adjustment screws, centering the bubble.

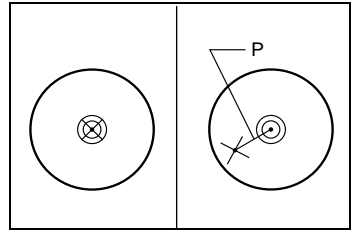
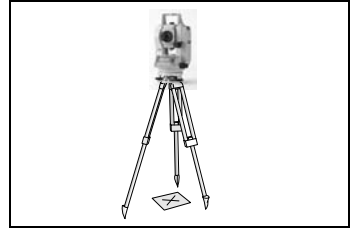


4-3 Optical Plummet

(Aligning the optical axis of the plummet with the vertical axis of the instrument)

1) Checking

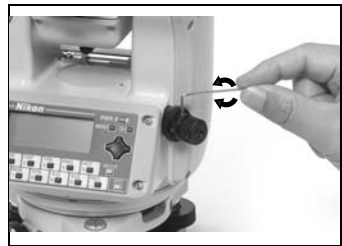
- (1) Place the instrument on the tripod. (No leveling is necessary.)
- (2) Place a thick sheet of paper marked with an X on the ground just below the instrument.
- (3) Looking through the optical plummet, adjust the leveling screws to bring the image of the X to the center of the reticle mark \odot .
- (4) Rotate the alidade approximately 180° .
- (5) If the marked image is seen in the same position in the center of the reticle mark, no adjustment will be required.



If any displacement is detected, such as that shown in Figure, refer to the adjustment procedure below.

2) Adjustment

- (1) Using the supplied hexagonal wrench, turn the adjustment screws to align the X marking with position P, as shown in the Figure. Point P is the center point of the line connecting the X marking and the center of the reticle mark \odot .
- (2) Recheck, following the checking steps (3) to (5).



4-4 Zero Point Errors of Vertical Scale and Horizontal Angle Corrections

1) *Checking*

- (1) Set up the instrument on the tripod and complete the leveling procedure described in [2-5. Leveling] section. (See p.2-9)
- (2) On the BMS, with the telescope in its Face1 position, sight a target that is placed within $\pm 45^\circ$ from the horizontal plane, and read the vertical angle (V1).
- (3) Rotate the instrument and flip the telescope to its Face2 position, and take another vertical angle reading (V2) to the target.
- (4) For the Vertical angle “Zenith” setting, if the “V1+V2” equals 360° , then the adjustment is not necessary. For the Vertical angle “Horizon”, when the “V1 + V2” is 180° or 540° , then the adjustment is not required either.



Difference in vertical angle reading from 360° (for Zenith), 180° or 540° (for Horizon) , is called the Altitude constant. When your instrument is out of tolerance, perform the Calibration program and adjust it before starting your field work.

2) Adjustment

Press the [MENU] and [7] key to enter the calibration screen.

1: Job	5: Comms
2: Cogo	6: Time
3: Sett	7: Calib
4: Data	8: Note

<DTM-350>

Take a F1 measurement to a target on the horizon and press the [ENT] key.

Vertical angle is shown in “V0 dir= Horiz” setting in this function.

X1:	38"	Y1:	51"
V1:	0° 26' 40"		
H1:	79° 00' 50"		
Aim Horiz & ENT			

- V1: Face-left vertical angle (tilt-off value)
- H1: Face-left horizontal angle (tilt-off value)
- X1: Face-left X axis tilt value
- Y1: Face-left Y axis tilt value

Upon finishing the measurement, the message on the bottom line is changed from “DO NOT TOUCH!” to “Turn to FACE2”.

X1:	18"	Y1:	21"
V1:	0° 26' 34"		
H1:	79° 00' 52"		
Turn to FACE2			

Take a F2 measurement to the same target and press the [ENT] key.

X2:	10"	Y2:	-55"
V2:	179° 33' 25"		
H2:	281° 04' 30"		
Aim Horiz & ENT			

- V2: Face-right vertical angle (tilt-off value)
- H2: Face-right horizontal angle (tilt-off value)
- X2: Face-right X axis tilt value
- Y2: Face-right Y axis tilt value

When the observation on F2 is completed four parameters are displayed.

[1:Redo]/[ESC] returns to the first observation screen.

X:	70"	Y:	-10"
ACV:			23"
ACh:			20"
Redo		OK	

[4:OK]/[ENT] sets those parameters on the instrument.



When any of ACV, ACH, X, or Y is out of range (X,Y, ACV > ±3' or ACH > ±30"), "OVER" is shown. Pressing any key to return to the first observation screen.

X:	90"	Y:	-15"
ACV:		OVER	
ACH:		10"	
Press any key			

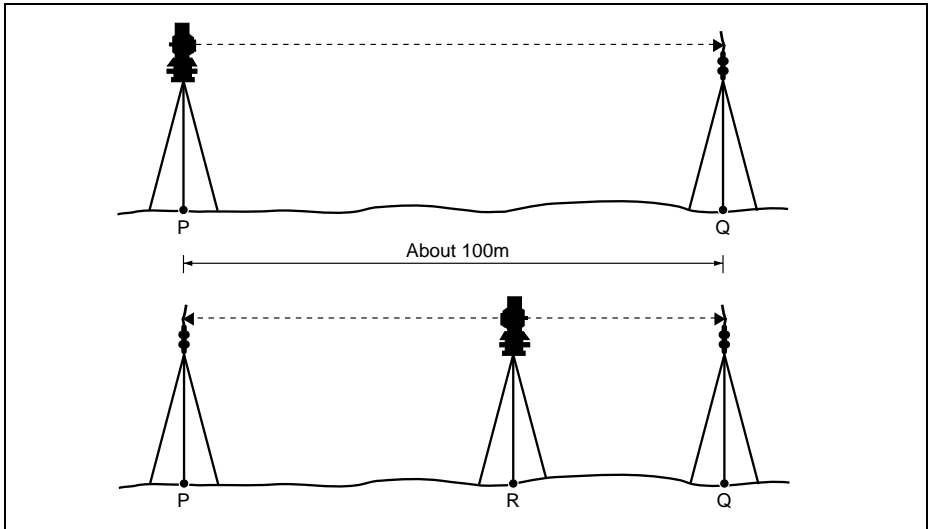
<DTM-330>

The tilt indication is V-tilt only. The header is "Tilt:" instead of "X:" and "Y:". Procedure to execute calibration is the same as DTM-350.

Tilt:		8"	
ACV:		OVER	
ACH:	0° 00'	40"	
Press any key			

4-5 Instrument Constant

The instrument constant is a numerical value used to automatically correct for the displacement between the mechanical and electrical centers when measuring distances. Although this adjustment was made at the time of delivery, it is recommended that the constant be checked several times a year to ensure the highest operational accuracy. Checks can be performed by either comparing a correctly measured base line with the distance as measured by the EDM, or by using the following procedure.



- (1) Perform the check on as flat an area as possible. Set up the DTM-350/330 at Point P, with the reflector prism 100m away at Point Q (taking the prism constant into account).
- (2) Measure the distance between Points P and Q and note it for future reference.
- (3) Set up another tripod between the two, at Point R, and transfer the DTM-350/330 to it. Install a reflector prism back on the tripod at Point P.

- (4) Measure the distances to Points P and Q. Check that their sum falls within the allowable range of error from the distance measured in Step (2). $PR+QR=PQ$
- (5) Move the DTM-350/330 to other points along the line PQ, and repeat Step (4) several times. Calculate the average.
- (6) If the difference between the value of $PR+QR$ and the value PQ is 3mm or longer, contact your nearest Nikon representative.

4 CHECKING AND ADJUSTMENT

5. SPECIFICATIONS

5-1 Main Body

■ Telescope

Tube length:	152mm/5.98in.
Magnification:	28X
Effective diameter of objective:	38mm/1.50in. (EDM: 40mm/1.57in.)
Image:	Erect
Field of view:	1°34' (2.7m at 100m/2.7ft. at 100ft.)
Resolving power:	3.5"
Focusing distance:	1.2m/47.2in. to ∞
Focusing method:	Anallactic focusing

■ Angle measurement

Reading system:	Photoelectric incremental encoder (Diametrical detection for H/V circles)
Circle diameter (reading):	88mm/3.46in. (79mm/3.11in.)
Minimum display increment	
360°:	1"/5"
400G:	0.2mgon/1mgon
MIL6400:	0.005MIL/0.02MIL
DIN18723 accuracy:	5"/1.5mgon

■ Dual-axis tilt sensor (DTM-330: Single axis)

Method:	Liquid-electric detection
Compensation range:	±3'

■ EDM

Distance range with Nikon prisms

Under normal atmospheric conditions (ordinary haze with visibility about 20km/12.5miles)

With single prism:	1,200m/3,900ft.
With triple prism:	1,600m/5,300ft.

Under good atmospheric conditions (no haze with visibility over 40km/25miles)

With single prism:	1,500m/4,900ft.
With triple prism:	2,100m/6,900ft.

- **Precision**

MSR mode: ±(3 + 2ppm x D) mm m.s.e. (-10°C to +40°C)
±(3 + 3ppm x D) mm m.s.e.
(-20°C to -10°C, +40°C to +50°C)

TRK mode: ±(10 + 5ppm x D) mm
(within 500m/1600ft.)

- **Measurement intervals**

MSR mode: 1.6sec. (initial; 2.6sec.)

TRK mode: 1.0sec. (initial; 2.0sec.)

Least count: MSR mode 1mm/0.002ft.
TRK mode 10mm/0.02ft.

Temperature compensation range: -40°C to +55°C/-40°F to +131°F

Barometric pressure (hPa) 533 to 1,332hPa (1hPa step)

compensation range: (mmHg) 400 to 999mmHg (1mmHg step)
(in.Hg) 15.8in Hg to 39.3in Hg
(0.1in Hg step)

Prism offset correction: -999 to +999mm (1mm step)

- **Clamps/tangent screws:** Coaxial tangent/Clamp knobs

Range: ±3.5°

- **Tribrach:** Detachable

- **Level vial sensitivity**

Plate level vial: 30"/2mm

Circular level vial: 10"/2mm

- **Optical plummet**

Image: Erect

Magnification: 3X

Field of view: 5°

Focusing range: 0.5m to ∞/1.6ft to ∞

- **Display/key**

Type: 16 character x 4 line, dot matrix LCD with
backlight illumination with 17 keys

■ **Connections in the base of instrument**

Communications: Type RS-232C
Baud 38400 Max. ASYNC
Input voltage DC 7.2 to 11V



External power supply:

■ **Battery pack BC-65**

Output voltage: DC 7.2V, rechargeable
Continuous operation time: About 16hours
(For angle/distance measurements at 25°C of normal temperature)
(Note that this operation time differs depending on the deterioration of battery.)

■ **Environmental performance**

Operating temperature range: -20°C to +50°C/-4°F to +122°F
Storage temperature range: -25°C to +60°C/-13°F to +140°F

■ **Dimensions**

Main unit: 168 (W) x 173 (D) x 335 (H)mm
Carrying case: 435 x 280 x 218mm

■ **Weight**

Main unit: Approx. 4.7kg/10.36lbs.
Battery BC-65: Approx. 0.4kg/0.88lbs.
Quick charger Q-75U/E: 0.45kg/0.99lbs.
Carrying case: Approx. 2.5kg/5.51lbs.


5-2 Standard Components

DTM-350/330 main body:	1
Battery pack BC-65:	1
Quick charger Q-75U or Q-75E:	1
Tool set:	1
Objective lens cap:	1
Vinyl cover:	1
Instruction manual:	1
Carrying case:	1
Shoulder strap:	1

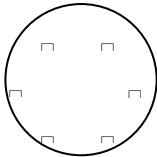
5-3 External Device Connection Connector

This connector is used commonly as a power source connector and a communication connector with an external device.

Confirm the specifications below and observe the cautions on the next page.

	Input voltage:	DC7.2 – 11V
	System:	RS-232C, Asynchronous
	Signal level:	±9V Standard
	Rate:	38400bps Max.
	Compatible male connector:	Hirose HR10A-7P-6P or Hirose HR10-7P-6P

Hirose HR 10A-7R-6S



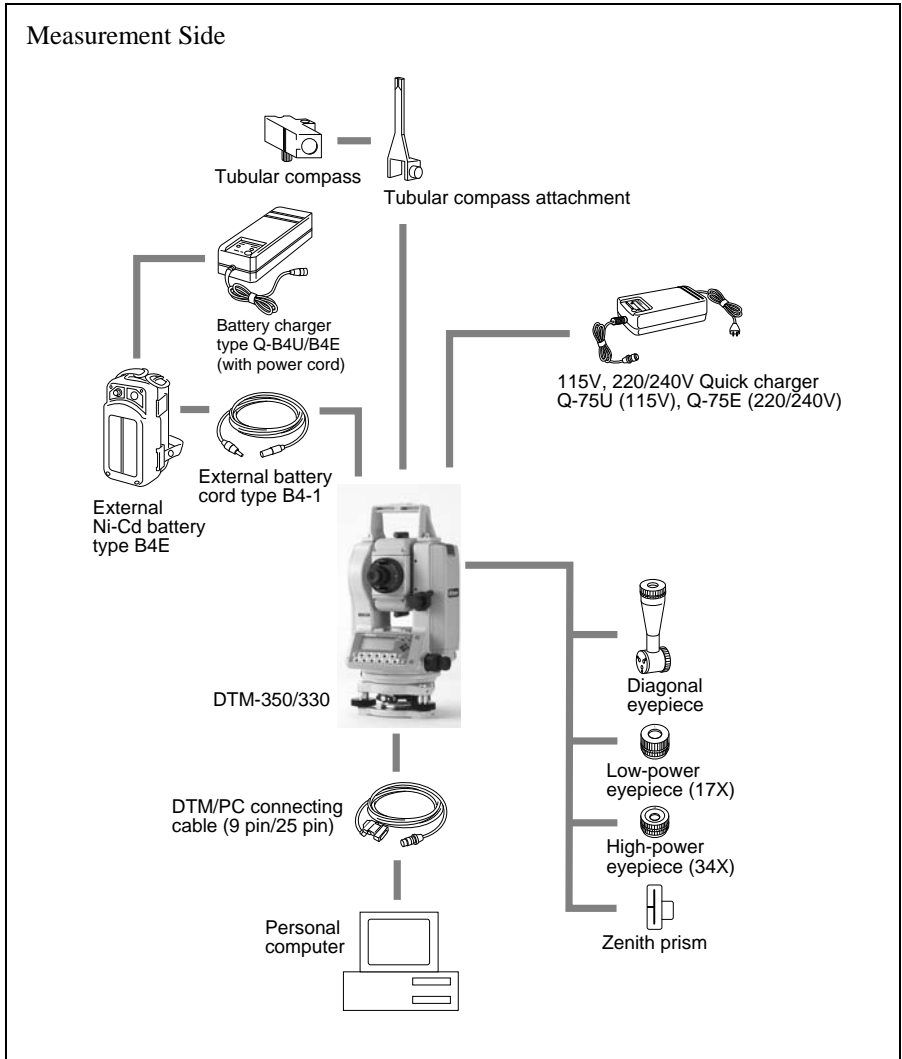
- RxD: Reception data (Input)
- TxD: Send data (Output)
- +
-
- , : No connection



Cautions when using the connector

1. Be sure to connect the specified male connector for this connector.
Prepare the cable and the connector connected with an external device at your side.
2. Be sure to connect according to the pin arrangement shown in the previous page. Wrong connection will cause damage to the instrument.
3. When the connector is used as a power source connector:
 - Supply power such as a battery (which is prepared by you) to pin No.3 (power terminal) and No.5 (ground terminal). This enables the instrument to activate by the external power source though the carrying-handle battery BC-65 has been mounted on it.
 - Used the power within the range specified below.
Rated Input: 7.2 – 11V $\overline{=}$, Max.1A
Using without this range will result in damage to the instrument.
4. When the connector is used as a communication connector:
 - Connect RS-232C signal from PC to pin No.1 (input terminal) and No.2 (output terminal). This enables the instrument to communicate with an external device.
5. Use this connector at your own responsibility except the case shown in the SYSTEM DIAGRAM on p.6-1.
6. Press the cap for data output/external power input connector until it clicks into place. If this cap is not attached securely, it could adversely affect the watertight structure of the unit.

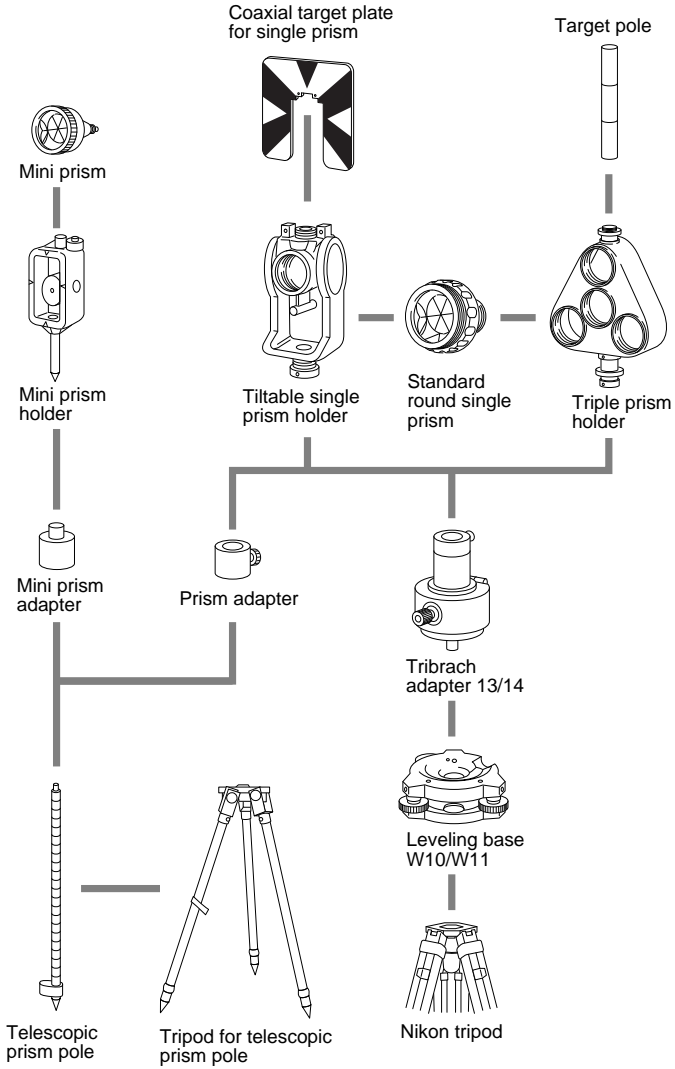
6. SYSTEM DIAGRAM



SYSTEM DIAGRAM

6

Prism Reflector Side



7. COMMUNICATIONS

7-1 Upload Coordinate Data

1) Settings

Transmit Speed and other conditions can be set in MENU/3:Sett/6:Comm. (See p.3-92 for detail.)

>Ext. Comm:	NIKON
Baud	: 4800
Length	: 8
Parity	: NONE

>Stop bit:	1
------------	---

2) Contents of uploading data and order

PT	,	X	,	Y	,	Z	,	Code
----	---	---	---	---	---	---	---	------

PT		X		Y		Z		Code
----	--	---	--	---	--	---	--	------

PT	,	X	,	Y	,	Z
----	---	---	---	---	---	---

PT		X		Y		Z
----	--	---	--	---	--	---

PT	,	X	,	Y	,	,	Code
----	---	---	---	---	---	---	------

PT		X		Y		Code
----	--	---	--	---	--	------

PT	,	X	,	Y	,	,
----	---	---	---	---	---	---

PT	,	X	,	Y	,
----	---	---	---	---	---

PT	,	,	,	Z	,	Code
----	---	---	---	---	---	------

PT	,	,	,	Z
----	---	---	---	---

PT Point number: max 12 digits

X coordinate: Actual

Y coordinate: Actual

Z coordinate: Actual

- Decimal point in the unit of meter (or foot), variable length

CD Feature code: max 12 characters

3) Data Example

20100,6606.165,1639.383,30.762,RKBSS
20104,1165611.6800,116401.4200,00032.8080
20105 5967.677 1102.343 34.353 MANHOLE
20106 4567.889 2340.665 33.444 PT1
20107 5967.677 1102.343 34.353
20109,4657.778,2335.667,,PT2
20111,4657.778,2335.667
20113 4657.778 2335.667
20115,,,34.353,MANHOLE
20117,,,33.444

7-2 Uploading Code List

1) Settings

Transmit Speed and other conditions can be set in MENU/3:Sett/6:Comm.

(See p.3-92 for detail.)

>Ext. Comm:	N I K O N
Baud	: 1 9 2 0 0
Length	: 8
Parity	: N O N E

>Stop bit:	1
------------	---

2) Contents of Code List file and order

#1: The title of the file is fixed to "DEFAULT" (using capital letters).

#2: {} is a set of separator. Items between them (String3-1-1 and 3-1-2) is under the Layer 3-1. Under Layer3, there are 5 items (Layer3-1 to String3-5).

#3: "String" is characters which are displayed on the screen. "Code" is characters which are stored to DB when it is selected by its "String".

```

DEFAULT
{
  String1 , Code1
  Layer2
  {
    String2-1, Code2-1
    String2-2, Code2-2
    String2-3, Code2-3
  }
  Layer3
  {
    Layer 3-1
    {
      String3-1-1, Code3-1-1
      String3-1-2, Code3-1-2
    }
    String3-2, Code3-2
    String3-3, Code3-3
    String3-4, Code3-4
    String3-5, Code3-5
  }
  String4, Code4
  String5, Code5
  String6, Code6
  String7, Code7
}
    
```

3) Data Example

```
DEFAULT
{
  "STRUCTURES"
  {
    "TREE", "S0001"
    "FENCE", "S0002"
    "MAIL BOX", "S0003"
    "FLOWER BED", "S0004"
  }
  "ROADS"
  {
    "MANHOLE", "R0001"
    "CENTER LINE"
    {
      "WHITE", "R002-W"
      "YELLOW", "R002-Y"
    }
    "SIDEWALK", "R0003"
    "CRROSSING", "R0004"
    "BRIDGE", "R0005"
    "SIGNAL", "R0006"
    "HIGHWAY STAR", "R0007"
  }
  "RAILWAY"
  {
    "CRROSSING", "RW001"
    "STATION", "RW002"
    "SIGNAL", "RW003"
    "BRIDGE", "RW004"
    "TUNNEL", "RW005"
  }
}
```


7-3 Downloading Data

1) Settings

Transmit Speed and other conditions can be set in MENU/3:Sett/6:Comm. (See p.3-92 for detail.)

>Ext. Comm:	NIKON
Baud	: 19200
Length	: 8
Parity	: NONE ↓

>Stop bit:	1
------------	---

2) Data format

■ Records in NIKON RAW Data Format V2.00

Coordinate Records

Record Type	,	pt	,	(pt id)	,	northing	,	easting	,	elevation	,	code
-------------	---	----	---	---------	---	----------	---	---------	---	-----------	---	------

Record Type = one of the following types:

- UP (Uploaded Point)
- MP (Manually input Point)
- CC (Calculated Coordinate)
- RE (Resection Point)

pt = Point Number

(pt id = Point ID)

code = Feature Code

Station Records

ST	,	stnpt	,	(stnid)	,	bspt	,	(bs id)	,	hi	,	bsazim	,	bsha
----	---	-------	---	---------	---	------	---	---------	---	----	---	--------	---	------

stnpt = Station Point Number

(stn id = Station ID)

bspt = Backsight Point Number

(bs id = Backsight ID)

hi = Height of Instrument

bsazim = Backsight Azimuth

bsha = Backsight Horizontal Angle

Control Point Records

CP	,	pt	,	(pt id)	,	ht	,	sd	,	ha	,	va	,	time	,	code
----	---	----	---	---------	---	----	---	----	---	----	---	----	---	------	---	------

pt = Point Number

(pt id = Point ID)

ht = Height of Target

sd = Slope Distance

ha = Horizontal Angle

va = Vertical Angle

time = 24 Hour Time Stamp

code = Feature Code

Sideshot Records

SS	,	pt	,	ht	,	sd	,	ha	,	va	,	time	,	code
----	---	----	---	----	---	----	---	----	---	----	---	------	---	------

pt = Point Number

ht = Height of Target

sd = Slope Distance

ha = Horizontal Angle

va = Vertical Angle

time = 24 Hour Time Stamp

code = Feature Code

Stakeout Records

SO	,	pt	,	(sopt)	,	ht	,	sd	,	ha	,	va	,	time	,
----	---	----	---	--------	---	----	---	----	---	----	---	----	---	------	---

pt = Recorded Point Number

(sopt = Original Number of Point Staked)

ht = Height of Target

sd = Slope Distance

ha = Horizontal Angle

va = Vertical Angle

time = 24 Hour Time Stamp

F1/F2 Records

F1	,	pt	,	ht	,	sd	,	ha	,	va	,	time
-----------	---	----	---	----	---	----	---	----	---	----	---	------

- F1 = Face of Shot (F1 or F2)
- pt = Point Number
- ht = Height of Target
- sd = Slope Distance
- ha = Horizontal Angle
- va = Vertical Angle
- time = 24 Hour Time Stamp

Comment/Note Records

CO	,	text
-----------	---	------

■ Record Formats (SDR 2x/33)

Header Record

00NM	ver	0000	datetime	ang	dist	press	temp	coor	1
-------------	-----	------	----------	-----	------	-------	------	------	---

ver (5-20) = SDR Download Version*

*SDR2x will read SDR20V03-05.

SDR33 will read SDR33V04-01.

0000 (21-24) = Not used.

datetime (25-40) = Download Date and Time (seconds are not shown).

ang (41) = Angle Units. Degrees:1, Gons:2, Mils:4.

dist (42) = Distance Units, Metres: 1, Feet:2.

press (43) = Pressure Units. mmHg:1, InchHg:2, hPa:3.

temp (44) = Temperature Units. Celsius:1, Fahrenheit:2

coor (45) = Coordinate Order. NEZ:1, ENZ:2.

1 (46) = Not Used.

Instrument Record

01K11	instr	serNo	Instr	serNo	1	zero VA	0.000	0.000	0.000
--------------	-------	-------	-------	-------	---	---------	-------	-------	-------

instr (6-21) and (28-43) = Instrument Make/Model.

serNo. (22-27) and (44-49) = Instrument Serial Number.

1 (50) = Not Used.

zero VA (51) = Vertical Angle. Zenith:1, Horizon:2.

0.000 (52-61), (62-71) and (72-81) = Not Used.

Station Details Record

02KI	stnpt	northing	easting	elevation	hi	desc
-------------	-------	----------	---------	-----------	----	------

stnpt (2x:5-8) (33:5-20) = Station Point Number.

northing (2x:9-18) (33:21-36)

easting (2x:19-28) (33:37-52)

elevation (2x:29-38) (33:53-68)

hi (2x:39-48) (33:69-84) = Height of Instrument.

desc (2x:49-64) (33:85-100) = Station Description.

Target Details Record

03NM	ht
-------------	----

ht (2x:5-14) (33:5-20) = Height of Target.

Backsight Bearing Details Record

07KI	stnpt	bspt	bsazim	ha
-------------	-------	------	--------	----

stnpt (2x:5-8) (33:5-20) = Station Point Number.

bspt (2x:9-12) (33:21-36) = Backsight Point Number.

bsazim (2x:13-22) (33:37-52) = Backsight Azimuth.

ha (2x:23-32) (33:53-68) = Horizontal Angle.

Coordinates Record

08KI	pt	northing	easting	elevation	desc
-------------	----	----------	---------	-----------	------

pt (2x:5-8) (33:5-20) = Point Number.

northing (2x:9-18) (33:21-36)

easting (2x:29-38) (33:53-68)

elevation (2x:29-38) (33:53-68)

desc (2x:39-54) (33:69-84) = Feature Code.

Observation Record

09MC	stnpt	pt	sd	va	ha	desc
-------------	-------	----	----	----	----	------

stnpt (2x:5-8) (33:5-20) = Station Point.

pt (2x:9-12) (33:21-36) = Observed Point.

sd (2x:13-22) (33:37-52) = Slope Distance.

va (2x:23-32) (33:53-68) = Vertical Angle.

ha (2x:33-42) (33:69-84) = Horizontal Angle

desc (2x:43-58) (33:85-100) = Feature Code.

Job Identifier Record

10NM	jobid	1	incZ	T&Pcorr	C&Rcorr	refcon	sealev
-------------	-------	---	------	---------	---------	--------	--------

jobid (5-20) = Job Name/Title.

NOTE: The following fields are all SDR33 format only.

1 (21) = Point ID Length option.

incZ (22) = 2D or 3D coordinates. 2D:1, 3D:2.

T&Pcorr (23) = Atmospheric Correction. Off:1, On:2.

C&Rcorr (24) = Curvature and Refraction Correction.

Off:1, On:2.

refcon (25) = Refraction Constant. 0.132:1, 0.200:2.

sealev (26) = Sea Level Correction. Off:1, On:2.

Note record

13NM	note
-------------	------

note (5-64) = Note/Comment Text.

3) Data Example

Nikon Raw Data Format

CO,Nikon RAW data format V2.00
CO,B: \EXAMPLE5
CO,Description: SAMPLE DATA OF DOWNLOAD
CO,Client: NIKON
CO,Comments: YOKOHAMA PLANT
CO,Downloaded 18-JUN-1999 17:56:10
CO,Software: Standard software version: 1.10
CO,Instrument: Nikon DTM-350
CO,Dist Units: Metres
CO,Angle Units: DDDMMSS
CO,Zero azimuth: North
CO,Zero VA: Zenith
CO,Coord Order: NEZ
CO,HA Raw data: Azimuth
CO,Tilt Correction: VA:ON HA:ON
CO, EXAMPLE5 <JOB> Created 16-FEB-1999 08:14:21
MC,1,,100.000,200.000,10.000,
CO,Temp:28C Press:760mmHg Prism:30 15-MAR-1999 08:27:34
ST,1,,,,1.400,55.4500,55.4500
F1,,,,0.0000,90.0000,8:27:58
SS,3,1.200,330.706,326.027,20.320,8:34:46,SIGN
SS,4,1.250,379.193,300.847,29.084,8:35:24,TREE
SS,5,1.218,363.344,328.032,30.105,8:38:57,TREE R
SO,1003,,1.240,331.220,326.783,19.998,8:42:17,

Nikon Coordinate Data Format

```
1,100.0000,200.0000,10.0000,  
2,200.0000,300.0000,20.0000,  
3,116.9239,216.9140,11.8425,TRAIN PLATFORM  
4,126.6967,206.2596,11.2539,RAMP  
11,100.0045,199.9958,10.0000,  
13,116.9203,216.9113,11.7157,  
14,126.6955,206.2579,10.9908,  
21,100.0103,199.9958,10.0000,  
31,100.0013,200.0005,10.0000,  
41,100.0224,200.0331,9.9000,  
43,116.9263,216.9165,11.8016,CURB  
44,126.7042,206.2871,10.8193,DITCH  
45,116.9266,216.9160,11.8028,  
46,126.7046,206.2845,10.8213,CP POINT
```


SDR2x RAW Data Format

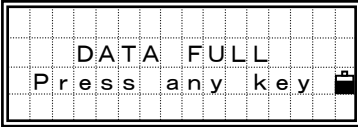
```
00NMSDR20V03-05      000011-Apr-1999 10:39:111211
10NMTEST JOB
01KI1 Nikon DTM35000000 Nikon DTM35000000012 0.000 0.000 0.000
13NMDownloaded 11-Apr-1999 10:39:22
13NMSftware: Standard software version: 1.10
13NMInstrument: Nikon DTM-350
13NMDist Units: Metres
13NMAngle Units: Degrees
13NMZero azimuth: North
13NMZero VA: Horizon
13NMCoord Order: NEZ
13NMClient: ME
13NMDescription: STADIUM PRO-1
13NM P_509 <JOB> Created 10-Apr-1999 07:15:04
08KI0001100.000 200.000 10.000
08KI0002200.000 300.000 20.000
02KI0001100.000 200.000 10.000 0.100
07KI0001000245.0000 0.0000
13F100000002<null> <null> 0.0000
13F200000002<null> <null> 179.9639
13NMBS Check HA:359.3525 Reset to HA: 0.0000 05:21:41
13F10000000323.990 4.1694 0.0000
13F20000000323.990 175.8403 180.0028
03NM0.000
13F10001000323.990 4.1653 359.9833 MAIN PLATFORM
13F10001000427.445 2.4097 328.1958 RAMP
13NMStart of 2-Pt Resection
13F10000000427.445 2.4097 0.0000
13F10000000323.991 4.1542 31.8042
13F10000000427.430 1.8583 121.4306
13F10000000323.976 3.8625 153.2306
08KI0011100.005 199.996 10.000
02KI0011100.005 199.996 10.000 0.100
07KI0011000344.9980 0.0000
```

SDR2x Coordinate Data Format

00NMSDR20V03-05 000011-Apr-1999 10:40:111211
10NMTEST JOB
01KI1 Nikon DTM350000000 Nikon DTM35000000012 0.000 0.000 0.000
13NMDownloaded 11-Apr-1999 10:40:06
13NMSftware: Standard software version: 1.00
13NMInstrument: Nikon DTM-350
13NMDist Units: Metres
13NMAngle Units: Degrees
13NMZero azimuth: North
13NMZero VA: Horizon
13NMProjection correction: OFF
13NMC&R correction: OFF
13NMSea level correction: OFF
13NMCoord Order: NEZ
13NMClient: ME
13NMDescription: STADIUM PRO-1
13NMTilt Correction: VA:OFFHA:OFF
13NM P_0509 <JOB> Created 10-Apr-1999 07:15:04
13NMPrism constant: 0
08KI0001100.000 200.000 10.000
08KI0002200.000 300.000 20.000
13NMBacksight Check to Pt:2 HA:359.3525 07:21:39
13NMBacksight Pt:2 Reset to HA: 0.0000 07:21:41
08KI0003116.924 216.914 11.843 MAIN PLTFORM
08KI0004126.697 206.260 11.254 RAMP
13NMStart of 2-Pt Resection
08KI0011100.005 199.996 10.000

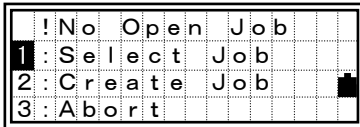
8 ERROR MESSAGES AND ACTIONS

1) When recording data:



The data storage is full.

Action : Press any key to return to the BMS. Then, you need to delete unnecessary data by entering [MENU]→[4:Data] or delete a job via [MENU]→[1:JOB].

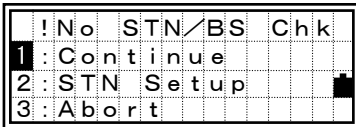


A Job is not opened.

[1: Select Job]=goes to Job list if there is any existing job.

[2: Create Job]=displays a new job creating screen.

[3:Abort]/[ESC]=returns to the previous screen.



There is no Station record in the current job. Or, a Station setup or BS check has not been done since the program was re-booted.

[1: Continue]=continues recording process after the following comment. If a previously recorded ST is in the job, "CO, Use current orientation". After inputting Stn coordinate by [XYZ] key, "CO, STN is changed by [XYZ] key".

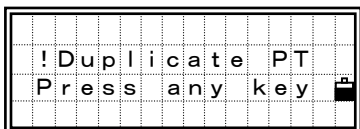
[2: STN Setup]=goes to the STN menu.

[3:Abort]/[ESC]=returns to the previous screen.



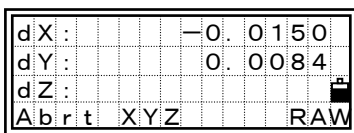
When the coordinate value is more than 13 digits, it shows an error.

Action: Press any key to return to the previous screen.



The input point number/name which is going to be recorded exists in the current Job.

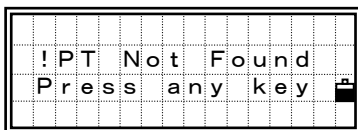
Action : Press any key to return to the point input screen.



When you record a shot to an existing point from the BMS or Stakeout, delta coordinate information is shown.

- [1:Abt]/[ESC]=returns to the PT input screen.
- [2:XYZ]=appends RAW and update XYZ data.
- [4:RAW]=only records RAW data.

2) When searching point:



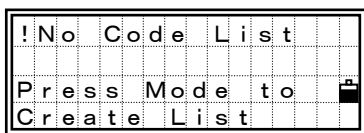
There is no point matching the condition you entered.

Action : Press any key to return to the point input screen.



This can be shown from any functions, such as Station setup or Stakeout when the PT/CD is input.

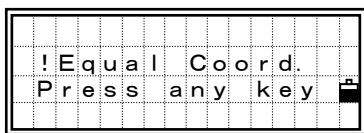
3) In Code List:



There is no code in the Code List when the [Lst] key is pressed.

Action : Press the [MENU] key to display the function menu (ADD/DEL).
Or, you can upload the Code List by [MENU] → [5:Comms] → [3:Upload List].

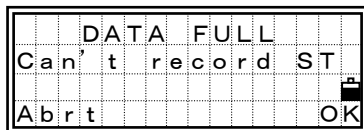
4) In Station Setup:



The coordinate or point name of the BS is identical to the current station in STN/1:Known function.

Or, if any of the specified points in Resection have the same coordinate or point name/number.

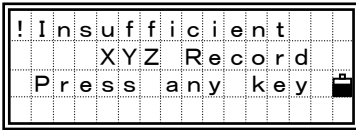
Action : Press any key to return to the BMS.



There is not enough space to record a station when you start any of the Station setup functions.

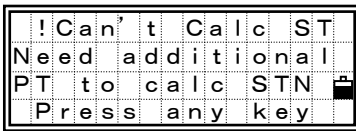
[ESC]/[1:Abrt]=returns to the BMS. You need to delete unnecessary data by entering [MENU] → [4:Data] or to delete a job via [MENU] → [1:JOB].

[ENT]/[4:OK]=You can take a measurement but cannot record a station.



Selected point for ST/BS doesn't have N/E coordinates defined. Or, the point specified as Benchmark doesn't have a Z coordinate.

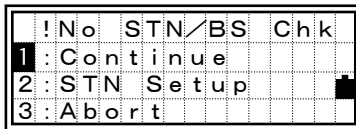
Action : Press any key to return to the point input screen.



In Resection, the calculation is failed after deleting a point in View screen.

Action : Press any key to return to the point input screen. You need to take another shot to have a calculated STN coordinate.

5) In StakeOut

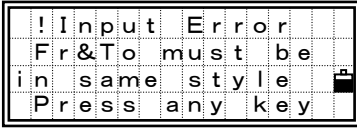


If no Stn Setup or BS check is done when entering the Stakeout function.

- [1:Continue]= goes to Stakeout menu
- [2:STN]= jumps to STN menu
- [3:Abort]/[ESC]=returns to the BMS



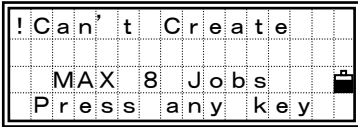
When [1:Continue] is selected, the coordinates from the previous station setup will be used. You should only do this in a testing situation or when you know the previous ST coordinates and current HA orientation are still correct.



When the style of the point name does not match between 'Fr' and 'To'. (Ex. Fr=1, To=A-100 etc.)

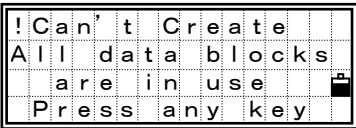
Action : Press any key to return to the range input screen.

6) In Job Manager



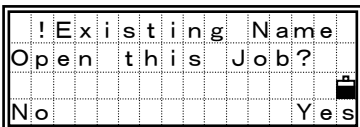
There are already 8 Jobs (maximum) when you try to create a new job.

Action : Press any key to return to the job list. You need to move the cursor using the up/down arrow keys to any unnecessary job and delete it by pressing [MENU]→[2:DEL].



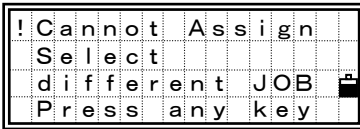
All the data recording area are occupied. Even if you have not created 8 jobs, some jobs use more than two blocks, i.e., some contain 1024 records or more in one job.

Action: Press any key to return to the job list. You need to delete unnecessary records or jobs.



An existing JOB name is input.

Action : [1:No]/[ESC]=returns to the Job name input screen.
[4:Yes]/[ENT]=opens the existing Job.




! Cannot Assign
Select
different JOB
Press any key

The selected job is the current Job. You need to choose different job for the Control file.

Action: Press any key to return to the previous screen.

7) In Cogo



! Equal Coord.
Press any key

When the coordinate of the 2nd point is identical to the 1st point or the same point number/name is input in 1:PT-PT.

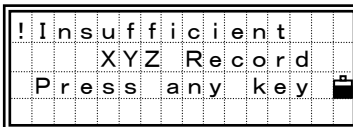
Action : Press any key to return to the 2nd point input screen.



! No Result
Press any key

Area calculation is failed.

Action : Press any key to return to the Cogo menu.

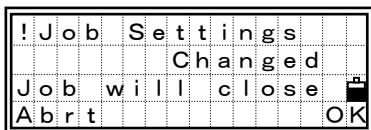


! Insufficient
XYZ Record
Press any key

The input point doesn't have N/E coordinate.

Action : Press any key to return to the point input screen.

8) In Settings



Any of the following JOB settings is changed.

- >1:Angle>>VA zero, HA to BS
- >2:Dist>>Scale, T-P, Sea Lvl, C&R
- >3:Coord>>Coord, Az zero
- >5:Unit>>Angle, Dist, Temp, Press

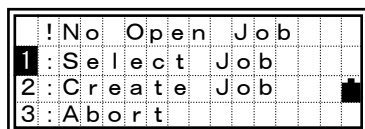
[4:OK]/[ENT]=closes the current Job. The change of the setting is completed.

[1:Abprt]/[ESC]=cancels the change in the Job settings. The current job remains to open.



When the Job setting is changed by [4:OK] or [ENT] on this screen, you can use the new setting afterwards, however, to record the point, you need to create a new JOB with those settings.

9) Data

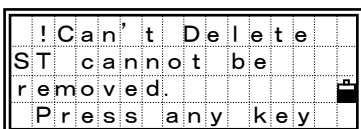


A Job is not opened yet.

[1: Select Job]=goes to Job list if there is any existing job.

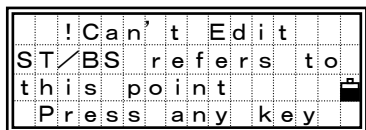
[2: Create Job]=displays a new job creating screen.

[3:Abort]/[ESC]=returns to the previous screen.



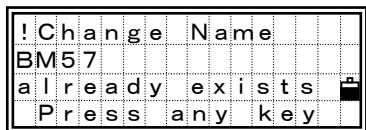
When attempting to delete a ST record by
[1:RAW data]/[2:XYZ data]→[MENU]
→[1:DEL]:

Action :Press any key to return to the Data view screen.



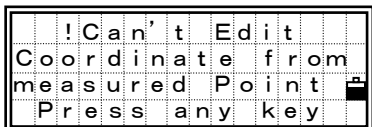
When attempting to edit a coordinate used as a ST or BS by [2:XYZ data] →[MENU]→[2:Edit]:

Action : Press any key to return to the Data view screen.



When an existing code/layer name is input by [3:Code List]→[MENU] →[2:Edit], [3:Add Code], [4:Add Layer] :

Action : Press any key to return to the code/layer name input screen.

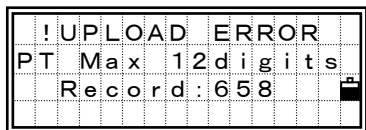


In the XYZ data view, if the [2:Edit] function is selected in a SO/SS/CP record's view screen, it shows an error. SO/SS/CP can be edited/deleted only from RAW data view screen.

Action: Press any key to return to the previous screen.

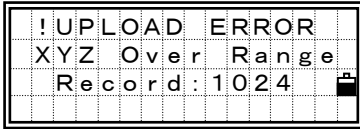
10) Comm.

If an error is detected during upload data, it aborts the process and returns you the following messages.



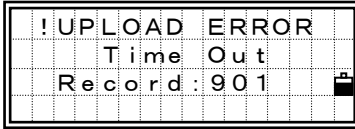
PT name/number is longer than 12 digits.

Action : Press any key to return to the MENU screen.



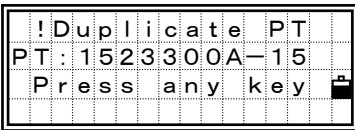
Coordinate is more than 13 digits.

Action : Press any key to return to the MENU screen.



No data has been received for one minute since the last line.

Action : Press any key to return to the MENU screen. Check your cable and/or PC.

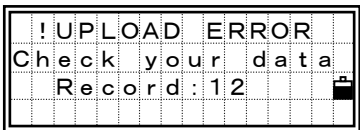


If the duplicate PT founded during upload is referred by a ST or BS, it stops uploading and shows an error.

Action: Press any key to return to the MENU screen. Check your data.



If the original point is UP/CC/MP records (not referred by ST or BS) then the new coordinate will replace them without an error or warning.



Other errors, such as an alpha character included in coordinate fields, etc.

Action: Press any key to return to the MENU screen. You need to check your uploading data.

Conforming Standards:

FCC: FCC 15B CLASS B satisfied
CE: EU EMC Directive satisfied
CE: EU Low Voltage Directive satisfied



NOTE:

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

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

WARNING

This equipment has been certified to comply with the limits for a Class B personal computer and peripherals, pursuant to Subpart B of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits may be attached to this equipment. Operation with non-certified personal computer and/or peripherals is likely to result in interference to radio and TV reception. The connection of a non-shielded equipment interface cable to this equipment will invalidate the FCC Certification of this device and may cause interference levels which exceed the limits established by the FCC for this equipment.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Class B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

- It is prohibited to alter this manual in part or whole without expressed permission.
- The contents of this manual are subject to changed without any notice.
- Although every effort has been made to ensure the accuracy of this manual, if you note any points that are unclear or incorrect, contact your nearest Nikon GEOTECS representative.

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