Nikon

Total Station DTM-500 series

DTM-550
DTM-530
DTM-520

Instruction Manual

Thank you for purchasing the Nikon products. This instruction manual was written for the users of the Electronic Total Station DTM-500 series. 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-500 series.

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-500 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-80. Charging by the other types of chargers than specified may cause fire or rupture. (BC-80 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.
- 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-80 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.

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 battery, resulting in injury or instrument damage.
- Roughly moving the instrument by grasping the carrying handle battery without first placing the battery mounting buttons in the LOCK position may cause the main unit to come loose and fall, resulting in injury or instrument damage. Make sure that the battery pack is clamped securely in place and the mounting buttons are set in the LOCK position.
- Do not use the carrying case as a stool. Plastic carrying case is slippery and unstable. You may fall down and injure yourself.
- 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.

MAINTENANCE Read This Section Before Use!

- Avoid prolonged exposure to the sun or the heat of a closed vehicle. Efficiency could be adversely affected.
- If the DTM-500 has been used in wet conditions, immediately wipe off any moisture and dry it completely before replacing it in its carrying case. The DTM-500 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 DTM-500 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.

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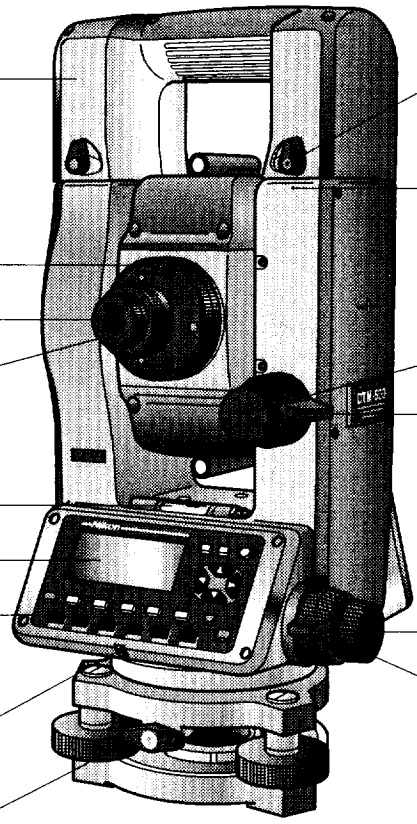
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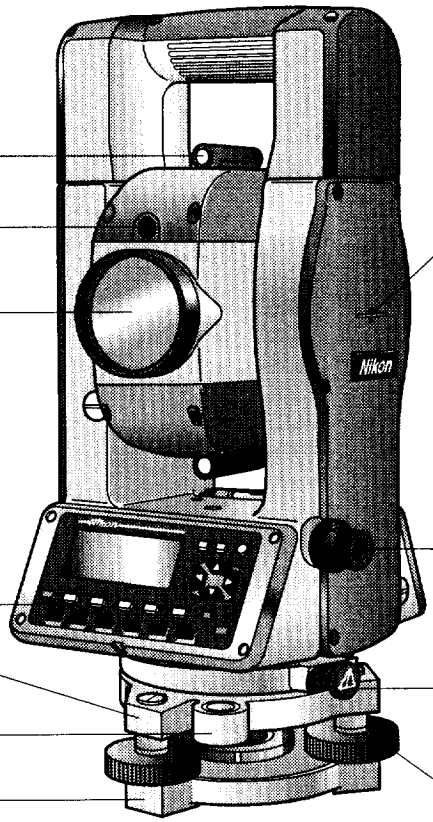
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1 NOMENCLATURE




Optical sight (Finder)
Lumi-guide transmitter
Objective
Face-right keyboard
Leveling base
Circular level
Base plate
Holizontal axis indication mark
Optical plummet
Data output/External power input connector
⚠ Input voltage DC 7.2 – 11V
Leveling screw
Nikon

NOMENCLATURE

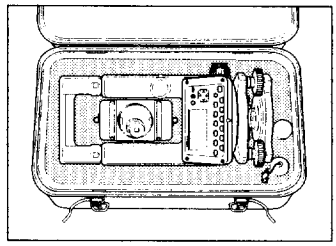
2 PREPARATION

2.1 Unpacking and Packing the DTM-500

- Handle gently the DTM-500 to guard against shocks or excessive vibration.

Unpacking

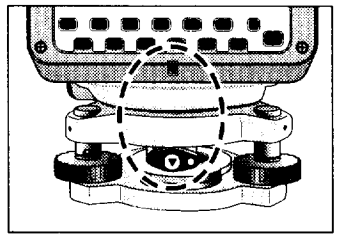
Hold the carrying-handle and take the instrument out of the case. The instrument is placed in its carrying case as shown in the figure.



Packing

- Encase the instrument with the battery pack attached.

Set the telescope in the horizontal "face-left" position and align the storage mark (●) on the bottom of the face-left keyboard 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-80 Battery Pack

⚠ WARNING

- Use only the specified charger Q-75U/E for charging the battery pack BC-80. Charging by the other types of chargers than specified may cause fire or rupture. (BC-80 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.
- 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-80 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.

⚠ CAUTION

- Be sure to read the instructions of Quick Charger Q-75U/E before starting charging operation.
- Roughly moving the instrument by grasping the carrying handle battery without first placing the battery mounting buttons in the LOCK position may cause the main unit to come loose and fall, resulting in injury or instrument damage. Make sure that the battery pack is clamped securely in place and the mounting buttons are set in the LOCK position.

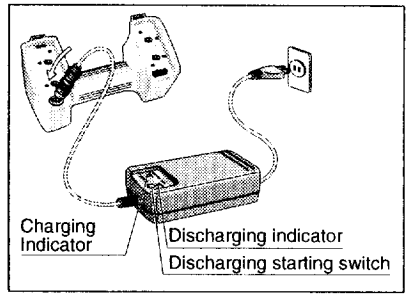
- Recharge the battery pack indoors within an ambient temperature range 0°C to +40°C. Charging outside this temperature range will trigger a protective circuit which prevents normal recharging.
- Keep the charging plug clean to prevent misoperation.
- If the charging indicator blinks whenever charging 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 3 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 3 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 2 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 recarged. In such a case, charge and discharge the battery pack several times to restore its full recharging potential.
- BC-80 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

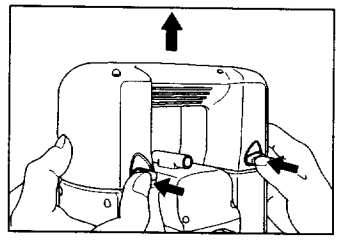
The battery pack is designed for repetitive recharging and use. However, if the battery pack is recharged while it still has enough power to operate the surveying instrument, the battery power will last for shorter periods. (Memory effect) In such a case, discharging the battery pack first can refresh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

Detaching the BC-80

- Be sure to turn off the [PWR] key before attaching or detaching the BC-80.
- Avoid touching the battery pack BC-80 contacts.

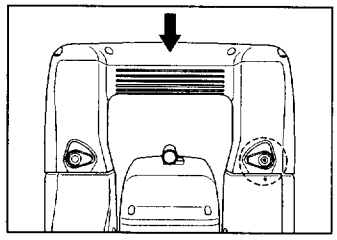
(1) Release the LOCK by turning the battery mounting buttons in the opposite direction of the arrow mark until they stop in the horizontal position.

(2) Raise the battery pack while depressing the battery mounting buttons to remove the battery pack from the main body.



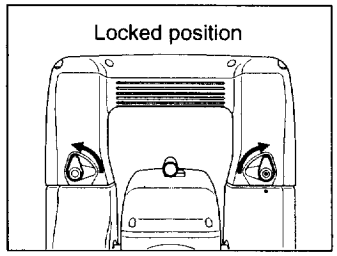
Attaching the BC-80

(1) Make sure that the battery mounting buttons are turned in the horizontal position (UNLOCKED position).



(2) Align the mark (●) on the battery mounting button with the mark (●) on the main body. Fit the battery pack with the connecting pins on the top of the main body while depressing the battery mounting buttons. Release your fingers from the buttons where the battery pack settles in position.

(3) Turn the mounting buttons in the direction of the arrow mark to the limit (in the vertical position) after both buttons are completely released from the depressed position. Doing this enables the LOCK to avoid the main body falling.
There is a slight opening between the BC-80 and the main body though the BC-80 has been correctly mounted and locked. This is due to the design to keep the precision of the instrument.



⚠ CAUTION

■ Roughly moving the instrument by grasping the carrying handle battery without first placing the battery mounting buttons in the LOCK position may cause the main unit to come loose and fall, resulting in injury or instrument damage. Make sure that the battery pack is clamped securely in place and the mounting buttons are set in the LOCK position.

- An external battery (optional accessory) is available for use with the DTM-500 series. When the external battery is connected and the battery pack BC-80 is mounted on the DTM500, the DTM-500's electrical source will automatically be switched to the one with the higher battery power.

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 DTM-500 on the tripod head. Insert the tripod mounting screw into the center hole of the DTM-500's 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.

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 DTM-500 on the tripod head. Insert the tripod mounting screw into the center hole of the DTM-500's base plate and tighten.

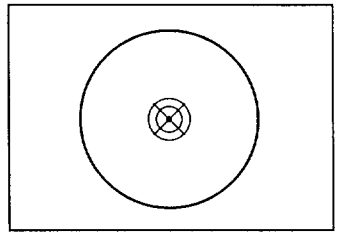
• Do not carry the instrument while it is attached to a tripod.

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).

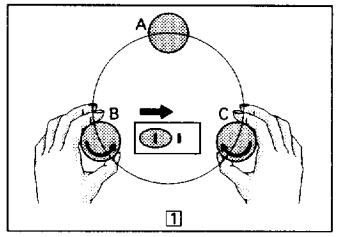
(2) Using these two screws, move the bubble to the center of the level.

(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.

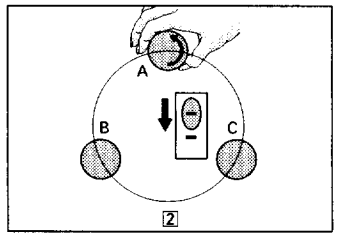
(4) Repeat Steps (1) through (3) to center the bubble in both positions shown by the Figures.

(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.



1



2

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

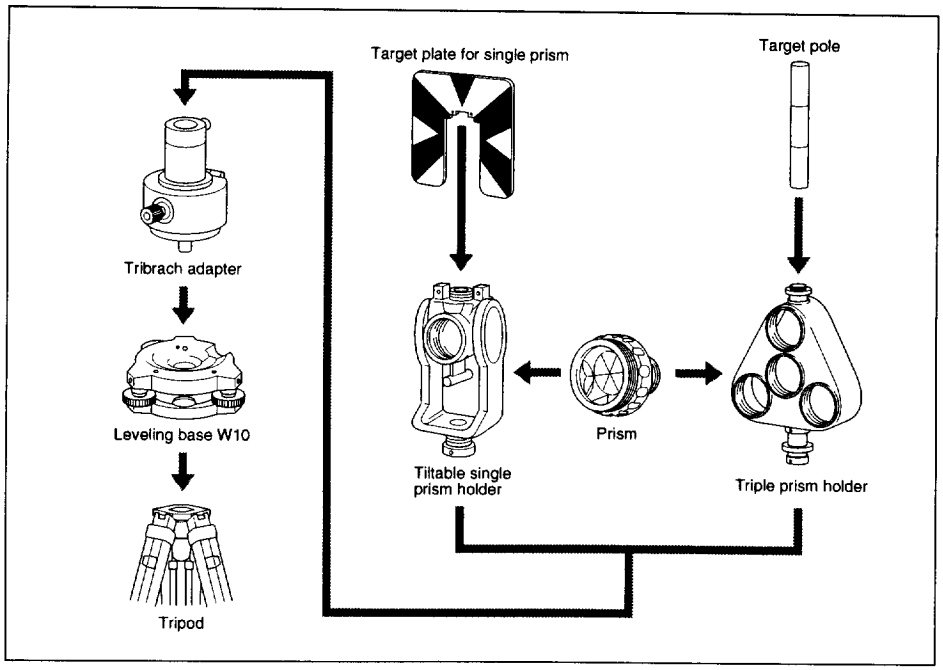
- Never view the sun through the telescope. Doing so may cause the loss of your eyesight.

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

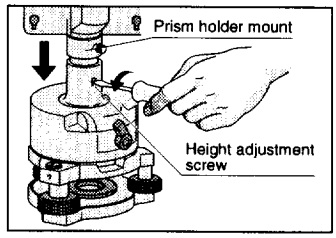
Assemble the prism reflector referring to the Figure below.



Height Adjustment of Tribrach Adapter

Tribrach adapter can be adjusted to two heights by sliding up and down the prism holder mount.

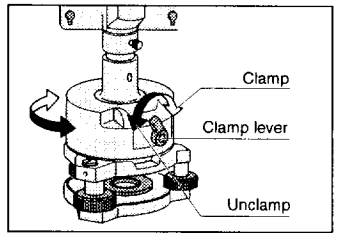
To change the height, first remove the height adjustment screw from the tribrach adapter. Slide the prism holder mount to align the height adjustment screw holes and screw in the adjustment screw again.



- When using the DTM-500 series Total Station, 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.



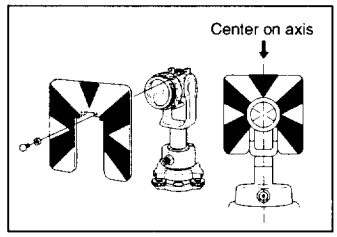
Prism Constant

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.



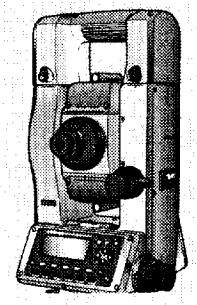
2.8 Face-left/Face-right Measurement

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

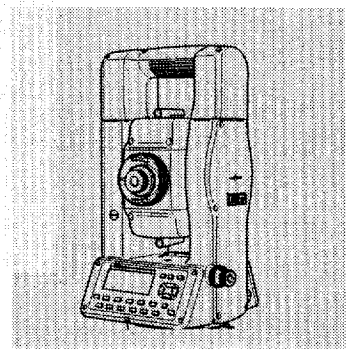
Face-right Measurement: Measurements made with the vertical circle positioned to the right of the telescope eyepiece

- 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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3) Lumi-guide 3-17

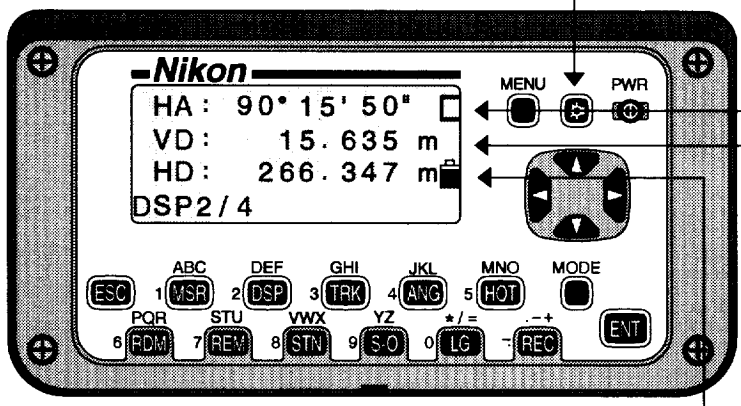
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3-1 Display and Key Functions

Illumination Key

Turn ON/OFF the Back-light of the display.
Holding down for one sec will show a screen to adjust: 1.Backlight, 2. Reticle, 3. Lumi-guide, 4. Sound



Battery Voltage Level Indication

Indicates the battery level in five steps. (See p. 3-6)

Input Mode (or Lumi-guide) Indication

Indicates the input mode while PT or CD is input. When shooting points, Lumi-guide state is shown. (See p.3-18)

Signal Level indication

Indicates the reflected light intensity in five steps and two status info. (See p. 3-6)

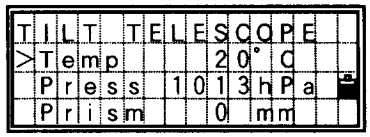
Key	*Major function*
PWR	Turns the power on and off.(See p.3-4)
	Turns ON/OFF the Backlight. When holding down for more than one second, it shows a setting screen for: 1:Backlight, 2:Reticle light, 3:LG, 4:Sound ON/OFF. (See p.3-17)
MENU	Displays Function MENU: 1:JOB, 2:COGO, 3:Sett, 4:Data, 5:Comm., 6:Time, 7:Calib. (See p.3-52)
MODE	Provides extra operations depending on the current activated functions. When: 1: input PT or CD (change input mode), 2: on the Basic Measurement Screen (activate Qcode mode), 3: from List-type indication (Add/DEL etc.) (See p.3-12)
.-+ REC	Records measurement data. (See p.3-49) In the numeric input mode, enters a decimal point. In the alpha-numeric input mode, enters (.), +, -.
ESC	Aborts the current process and returns to the previous screen except on the basic screen (the measurement mode indication is DSP). In the numeric or alpha-numeric mode, clears the input data.
1 ABC MSR	Carries out measurement based on the measure mode settings for MSR key and displays the result. (See p.3-8) In the numeric input mode, enters 1. In the alpha-numeric input mode, enters A, B, C, 1.
2 DEF DSP	When there are two or mode display screens, switches between them. (See p.3-11) In the numeric input mode, enters 2. In the alpha-numeric input mode enters D, E, F, 2.
3 GHI TRK	Carries out measurement and displays the result. (See p.3-8) In the numeric input mode, enters 3. In the alpha-numeric input mode, enters G, H, I, 3.
4 JKL ANG	Displays the angle menu. (See p.3-23) In the numeric input mode, enters 4. In the alpha-numeric input mode, enters J, K, L, 4.
5 MNO HOT	Displays in the numeric input mode enters 5. (See p.3-14) In the alpha-numeric input mode enters M, N, O, 5.

POR 6 RDM	Measures the sighting point difference. (See p.3-27) In the numeric input mode enters 6. In the alpha-numeric input mode, enters P, Q, R, 6.
STU 7 REM	Measures the elevation difference between the sighting (target) point and an arbitrary point on the vertical line extending from the target point. (See p.3-29) In the numeric input mode enters 7. In the alpha-numeric input mode, enters S, T, U, 7.
VWX 8 STN	Sets the station point (known point or arbitrary point). (See p.3-30) In the numeric input mode enters 8. In the alpha-numeric input mode, enters V, W, X, 8.
YZ 9 S-O	Indicates and displays a stake-out point. (See p.3-42) In the numeric input mode enters 9. In the alpha-numeric input mode, enters Y, Z, (space), 9.
*/= 0 LG	Turn on the and off the lumi-guide. (See p.3-18) In the numeric input mode, enters 0. In the alpha-numeric input mode, enters *, /, =, 0.
ENT	Proceeds to the next process except on the basic measurement screen. (BMS) In the numeric or alpha-numeric input mode, determines the input data. Also, dumps the measurement data through COM port when it is pressed on the basic measurement screen.

3-2 Power On and Off

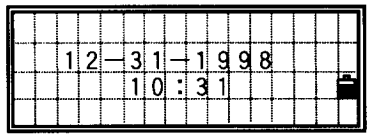
Turn On the instrument PWR

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



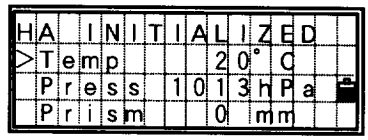
- Temperature, Pressure and Prism constant from the current settings are displayed.
- You can input Temp/Press/Prism by ten keys on this screen. Press the [ENT] to activate the numeric input mode.

Set up the instrument in the face-left position and tilt the telescope.
The current Date and Time are displayed.
It will automatically resume the last job and return to where you have powered off the instrument last time.



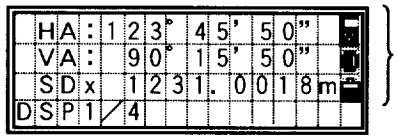
> If you choose the [Rst] when turning off the instrument, it restarts the software from the Basic Measurement screen (BMS) without having any JOB opened.

Rotating the alidade before tilting the telescope resets the horizontal zero position.



When the telescope is tilted before rotating the instrument, the horizontal angle is not reset. Instead, it keeps the original zero position.

Basic Measurement Screen (BMS)



Status bar

1) Battery

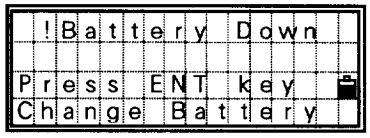
: Level 4 (Full)

: Level 3

: Level 2

: Level 1

: Battery LOW



: Battery Change

2) Signal

: Analog power OFF

: No-Signal (slow-blink) or Signal LOW (quick-blink)

: Dizzy condition (blink)

: Level 1 (minimum)

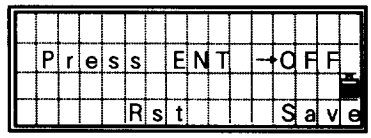
: Level 2

: Level 3

: Level 4 (Max)

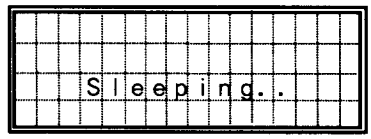
Turn Off the instrument PWR → ENT

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



[2:Rst]=re-boots the program.
[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.3-67) or when the [2:Save] is selected on the above screen.
In this mode, LCD backlight, Lumi-guide, and Reticle light will be turned off.



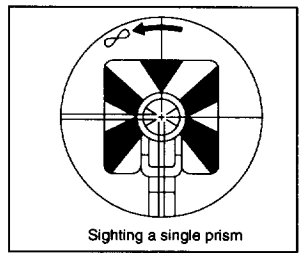
Any key input, receiving a remote control command or rotating alidade can wake up the instrument.

Measuring Distances 1 MSR / 3 TRK

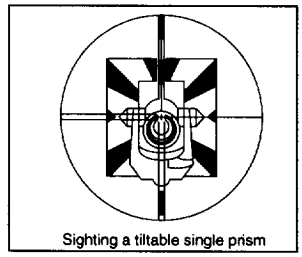
1) Sighting a prism reflector

⚠ WARNING

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


Sighting a single prism

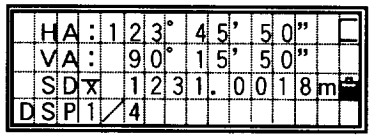
Sight the telescope crosshairs on the center of the prism reflector. When the reflected light is detected, the signal level is indicated.


Sighting a tiltable single prism

For assembling the prism reflector, refer to p.2-13.

2) Measuring distances

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



To abort the measurement, press the [MSR] or [TRK] again or the [ESC] key during the measurement.

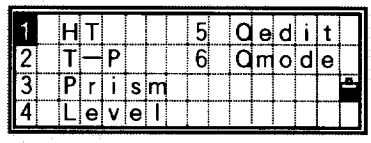
When the Average count is set to 0, measurements are taken continuously until the [MSR]/[TRK] or [ESC] key is pressed. Each time the measurement is taken, the distance is updated.

When the Average count is set to 1 – 99, the averaged distance is displayed at last. The header "SD:" changes to "SDx" for the averaged value.

If the signal level is insufficient for measurement, the signal icon will blink. (See page 3-6)



・To change the height of Target, Temperature and Pressure, or Prism constant, press the [HOT] key from any observation screens. (See page 3-14)

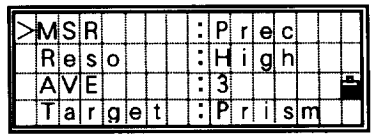


・T-P correction, Sea level correction, C&R adjustment and Map projection are included in Job settings. When you create a job, you can define them for each job. (See page 3-53)

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

3) Measurement mode settings

Holding down the [MSR] or [TRK] key shows a measurement mode settings.



Move the cursor by up/down arrow key and press right/left arrow key to change the setting.

MSR/TRK mode can be set to Precise (Prec) **or** Normal.
Distance Resolution (Reso) can be High **or** Low.
Average count can be set from 0(Continuous) to 99.
Target can be set to Prism **or** Reflective Sheet (Sheet).

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

> In order to apply better adjustment in measurement, "Target" setting is introduced. It eliminates multi-path reflection efficiently.

Switching between Screens

DEF
2 DSP

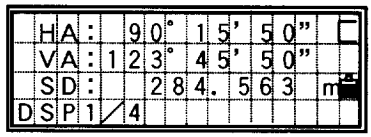
Press the [DSP] key to change the contents of the screen on the Basic Measurement Screen (BMS).

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

Change of the screen can be done during the measurement as well.

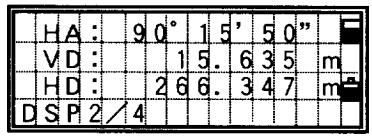
On the BMS, pressing the [REC] key from any of these screens can store the SS record.
Depending on the "Store data" setting, it records only RAW data or Coordinate data or Both. (See p.3-65)

1/4 screen



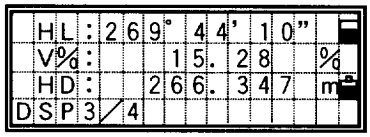
▼

2/4 screen



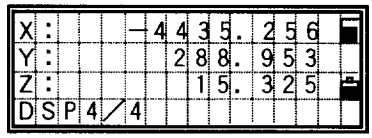
▼

3/4 screen



▼

4/4 screen



Screens can be switched on the BMS, RDM, Stakeout, and Data View functions.

Mode key

MODE

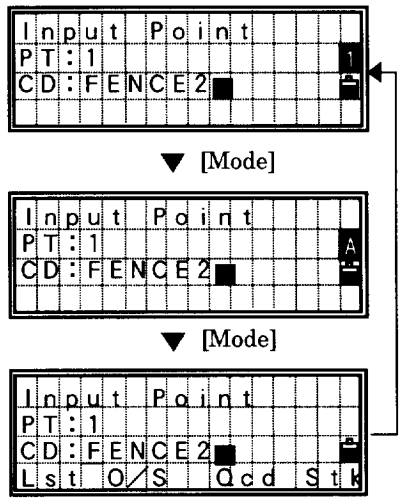
The [Mode] key provise you some useful options responding to the screen currently displayed. There are two ways to enhance the usability by the [Mode] key.

1) While Inputting PT/CD

Pressing the [Mode] key while the cursor is in the PT field, it 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

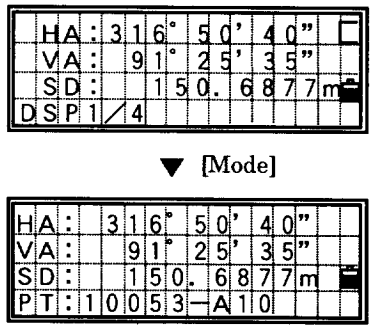
H :Alpha-numeric



·Offset recording and Qcode assigning function are also available in the recording screen from the BMS. (See p.3-54, 3-55)

2) On the BMS

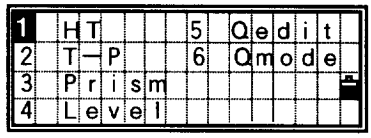
When you press the [Mode] key on the BMS, it activates the Quick code mode measurement. (See p.3-53)



HOT key

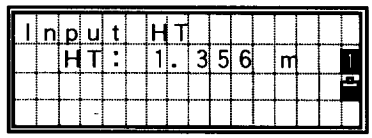
MNO
5 [HOT]

The [HOT] key is available from any observation screen. It shows the screen right.
Press the [ESC] key to return to the previous screen.



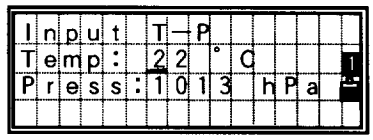
1) Height of Target

You can define the height of target when recording point or by pressing the [HOT] and [1] key.



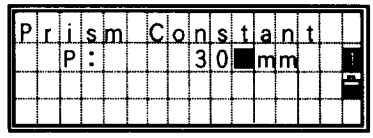
2) Temperature & Pressure

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



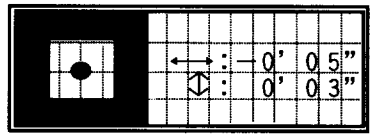
3) Prism Constant

You can set the prism constant in – or + mm. Type the prism constant (–999 to 999 mm).



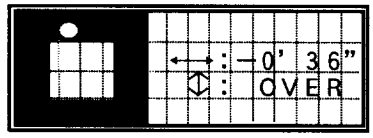
4) Level

The leveling indication is displayed automatically during Station setup, Stakeout and the observation on the BMS if the instrument goes out of level while the compensators are turned on.



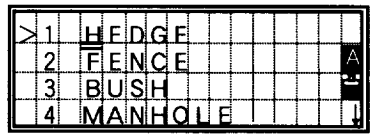
You can turn the leveling compensators on or off by pressing the Right/Left arrow keys.

It shows "OVER" when it is larger than ±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.

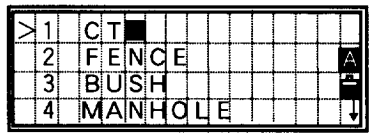


5) Qedit

The list of the feature codes that currently assigned to the Qcode mode are displayed.

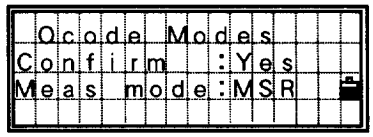


Select the key number by pressing the Up/Down arrow key and type the code in.
Press the [ENT] or Up/Down arrow key to accept the change. Press the [ESC] key to return to the observation screen.



6) Qmode

This function defines the setting for the Qcode mode.

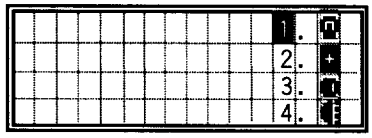


Confirm: "Yes" is a setting to display the recording point screen to confirm PT/HT/CD after each measurement. "No" skips the recording point screen and directly stores the point after a measurement.

Meas mode: a set of setting for taking a measurement in Qcode mode. You can use the setting defined for [MSR] or [TRK] key. (See p.3-10)

When the average count in MSR/TRK key is set to "0", it takes a measurement only once when it is in Qcode mode.

LCD Backlight, Reticle and Sound On/Off



Press the [☼] key to turn ON/OFF the LCD backlight.
Holding down the [☼] key over one second activates the Backlight, Reticle, Lumi-guide and Sound adjustment switch.

To change the setting, press the Right/Left arrow keys.
The Up/Down arrow keys can move the cursor as well as the numeric keys.
Press the [ESC] key to terminate this setting screen.

1) Backlight

: Backlight OFF
: Backlight ON

2) Reticle

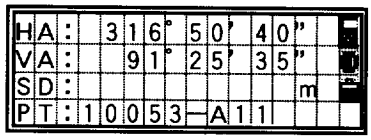
: Reticle light OFF
: Reticle light ON (minimum)
: Reticle light ON (medium)
: Reticle light ON (maximum)

3) Lumi-guide (see p.3-18)

4) Sound

: Sound OFF
: Sound ON

Lumi-guide On/Off 0 [*/= LG]



Press the [LG] key to turn ON/OFF the Lumi-guide.

On any measurement screens, the Lumi-guide icon is shown at the second line of the "Status bar", if it turns ON.

Lumi-guide

: LG-off

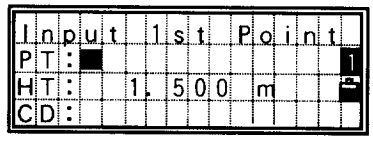
: LG-on (blinking)

Input Point Name/Number

You can use point numbers or names up to 12 digits in this system. 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 the coordinate records, you cannot use the same point name/number which exists in the current Job. (See p.8-2)

1) Pressing the [ENT] without PT

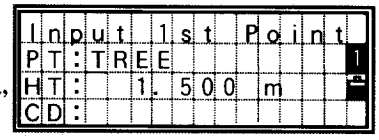


In COGO function, a coordinate input screen will be displayed even if you leave the PT blank. This coordinate will not be saved in the database but you can use it in the calculation temporarily.

When you search a point in Station setup or Stakeout without PT, the system searches the point based on the input CD or R (in Stakeout). (See p.3-49)

Otherwise, you must enter the PT to record the point.

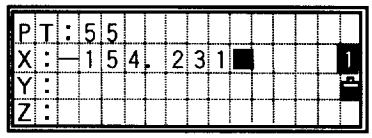
The cursor is placed on the first character of the string when the input mode is activated. It is "All Replace" mode.



Pressing the right arrow key changes the input mode into "Overwrite", leaving the cursor on the first character..

2) Inputting a new PT

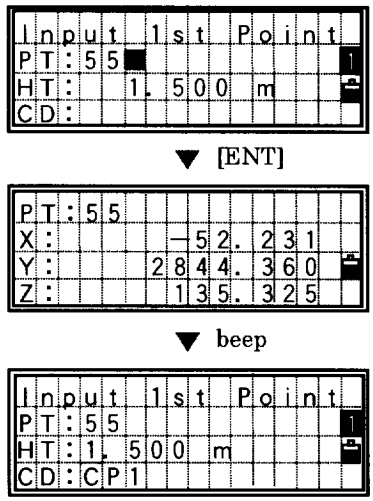
When you input a new point name/ number, it shows a coordinate input screen right. You can input any combination of the coordinate among "NE(EN)" , "NEZ(ENZ)", or "only Z".



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

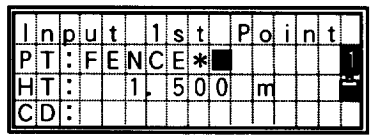
3) Inputting a known PT

When a known point name/number is input, its coordinate is displayed for a while. It automatically proceeds to the next step after a short beep.

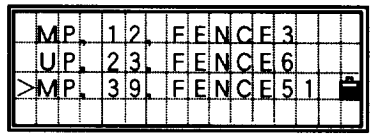


4) When a wildcard (*) is specified

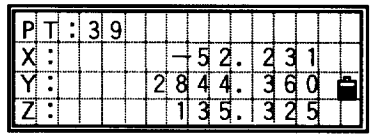
A list of available points are displayed when you use an asterisk to input PT or CD.



▼ [ENT]



▼ [ENT]



Press the Up/Down arrow key and then press the [ENT] to pick up a point you want to use.

If more than four points are applicable to the input conditions, there will be a ↓ sign on the lower right corner. You can use the Right/Left arrow key to page-up/page-down the list as well. (See p.3-24)

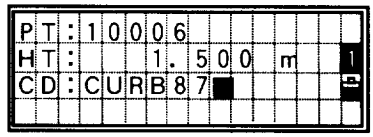
When you select a point from the list, its coordinate is displayed for a while and it automatically proceeds to the next step after a short beep.

How to input Code

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

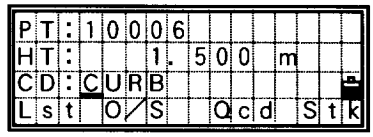
1) Manual Input

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



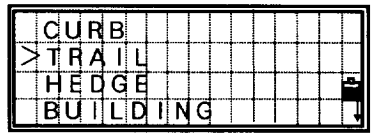
2) Stack Input

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



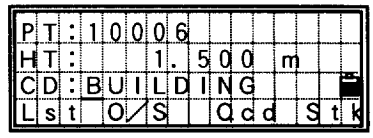
▼ [Stk]

To select the previously used code, press the [Stk], then use the down arrow key to move the cursor downwards through the stack list.
The up arrow key moves up through the stack. Press the [ESC] key to get out of the Stack List without choosing any codes.



▼

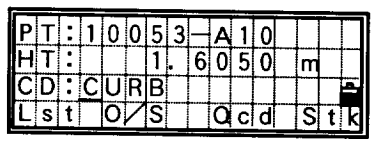
Press the [ENT] key to input the code into the CD field.



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

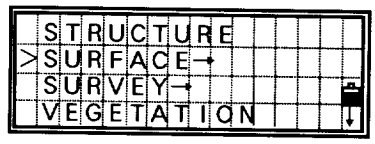
3) Code List

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:Edit List. (See p.3-85)

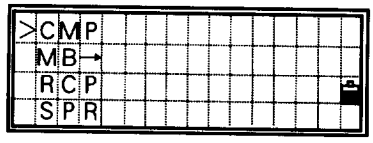


▼ [Lst]

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

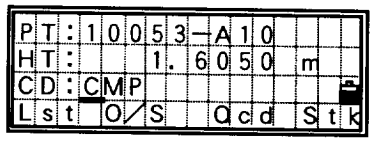


▼ [ENT]



▼

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.
If you would like to append the code from the List, move the cursor by the right arrow key before you press the [Lst] key.



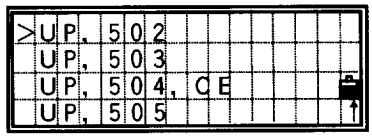
4) Qcode

This is a quick and frequent function to shooting and recording many points with feature codes in the field. You can use up to 10 Quick-codes at a time. Before activate Qcode mode or while you are in it, you can newly assign a code to any of numeric key or change the code. (See p.3-15, 3-54)

Display in the List form

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.



" ↑ " or " ↓ " on the lower right corner means that there are more pages before or after this page.
When you see this sign, you can use the Right/Left arrow key to page up or down the list.

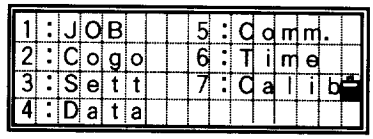
Press the Up/Down arrow key moves cursor one by one. To pick up one record from the list, press the [ENT] key after you move the cursor to the desired record.

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

About Job

DTM-500 organizes your survey data into a database, known as a Job. In addition, you can assign any Job as a "Control Job", to store common survey data that may be used by several jobs.

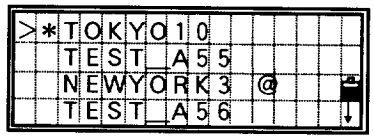
When you need to record data, you must create or open a Job prior to set up the station.



▼ [1]

This is a Job List which you can see in the Job Manager (MENU/1:Job).
In the List, there are two symbols.

- * ····· Current open Job
- @ ····· Control Job



Up to 5000 points can be stored to the database. You can create maximum five Jobs.

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.3-60)

3-4 Applications

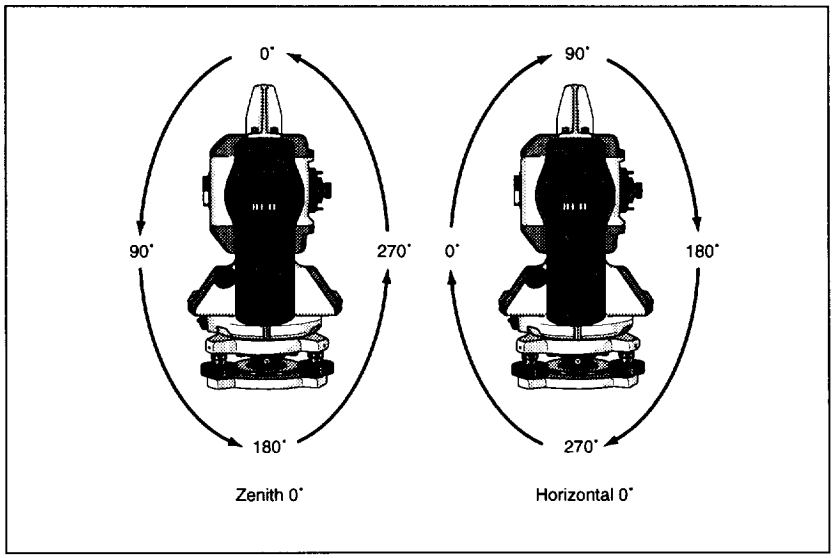
Measuring Angles

JKL
4 ANG

Perform the face-left and face-right measurements to obtain the 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.

The following functions can be selected in the Angle settings (See p.3-65).

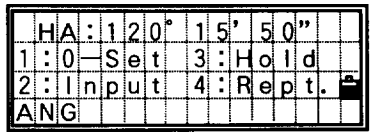
a) Vertical orientation: Zenith 0°/Horizontal 0° angle



b) Minimum increment: 0.5"/1", 0.1mG/0.2mG, 0.005MIL/0.02MIL

c) Tilt sensor compensation: Dual axis/Single axis/OFF

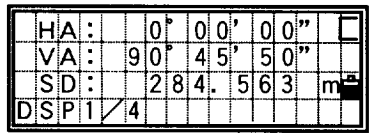
Press the [ANG] key to display the angle menu screen. Select a desired item pressing the numeric key.



1)0-Set

Setting the horizontal angle to 0

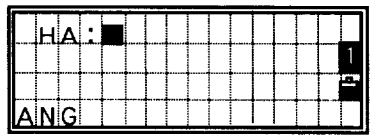
Press the [1] key to reset the horizontal angle to 0. The display returns to the basic measurement screen after resetting the horizontal angle.



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.



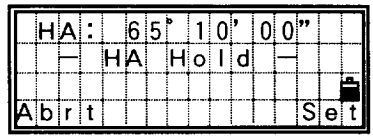
Ex.) To enter 123°45'50", key input should be 123.4550.

・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.

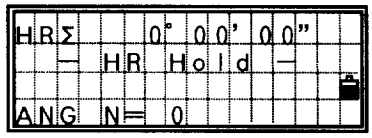


Press the [4:Set] or [ENT] key to set the horizontal angle as it is displayed. After setting the angle, it returns to the basic measurement screen.
Press the [1:Abrt] or [ESC] key to cancel holding and setting the horizontal angle.

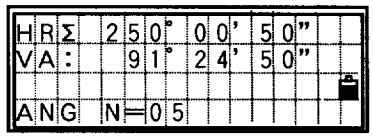
4)Rept.

Recording a foresight point after repeat angle measurement

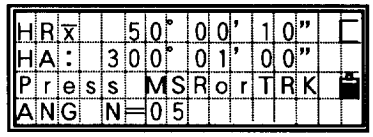
Press the [4] key to display "0" as a horizontal angle and activate the repeat angle measurement mode.



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



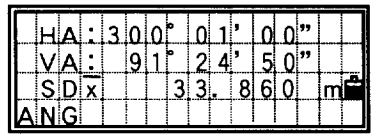
Press the [REC] key to average the horizontal angle. The horizontal angle display is fixed until the process is finished or cancelled.



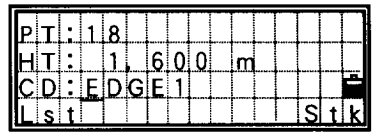
$HR\bar{x} = HR\Sigma \div N$

$HA = BSAz + HR\bar{x}$ (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.



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



- 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".

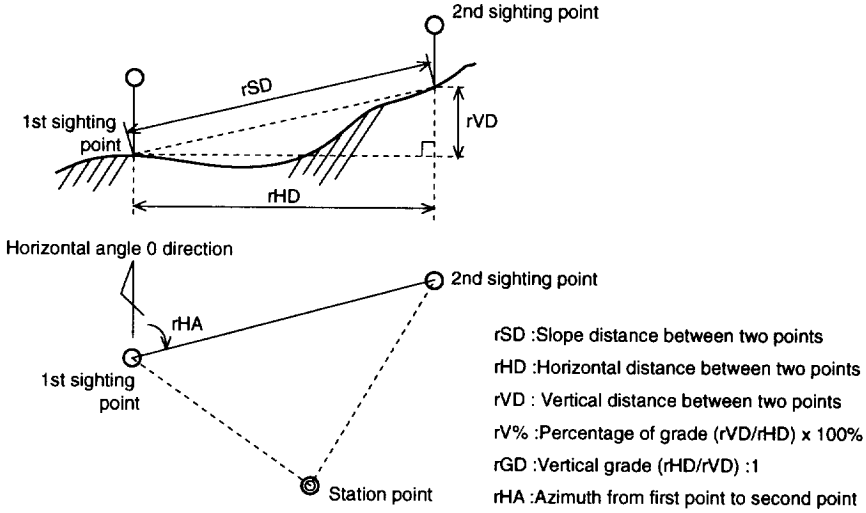
- When the Default station setup is done before entering Rept. function, only RAW data (CP record) is stored after shooting the foresight point.
- When the station Setup is done by Known/2-pt/3-pt, both RAW and XYZ data are recorded after shooting the foresight point.

- While in the repeat angle measurement mode, distance measurements can neither be taken nor be recorded.
- Once the HRx is calculated after some repetition shots, the horizontal angle display will not change until the process is finished or aborted.

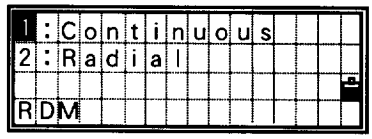
Remote Distance Measurement

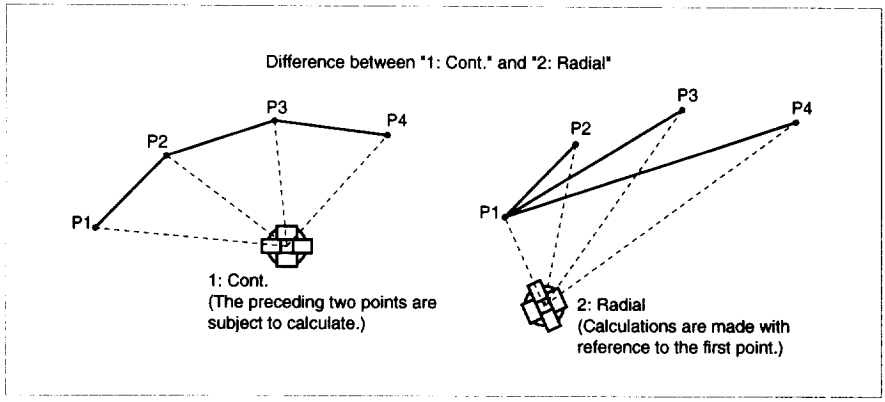
6 POR RDM

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.





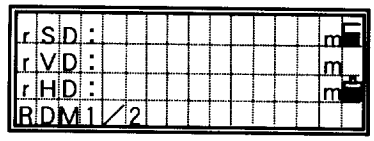
1: Cont

Measuring between the current and preceding points

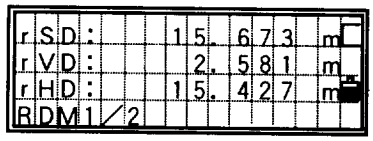
2: Radial

Measuring between the current point and the first point measured

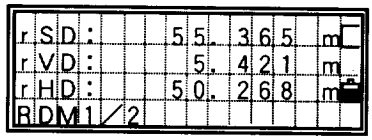
Screen shown right appears by selecting 1 or 2 in the RDM menu. Sight the 1st point and press the [MSR] or [TRK] key.



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

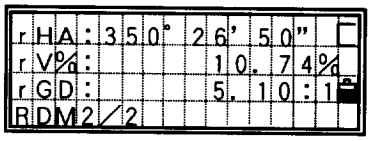


Sight the 2nd point and press the [MSR] or [TRK] key. The distances between the 1st and 2nd point are displayed.



rSD : Slope distance between two points.
rVD : Vertical distance between two points
rHD : Horizontal distance between two points

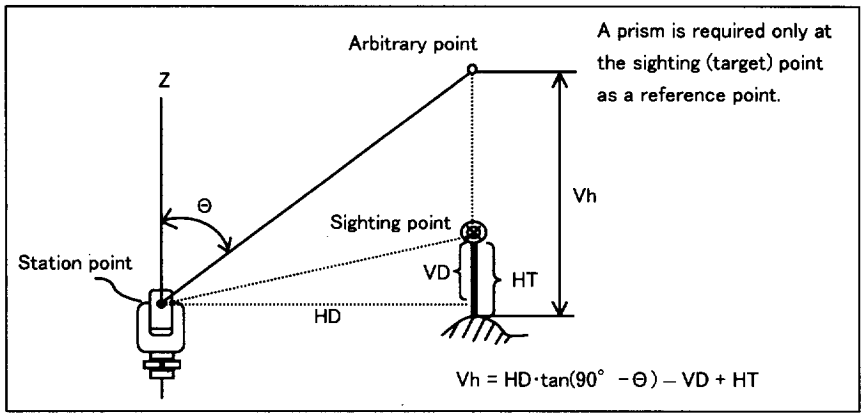
Press the [DSP] key to change the screen.



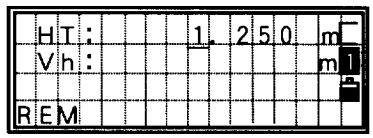
rHA : Azimuth from 1st point to 2nd point
rV% : Percentage of grade (rVD/rHD) x 100%
rGD : Vertical grade (rHD/rVD) : 1

Remote Elevation Measurement

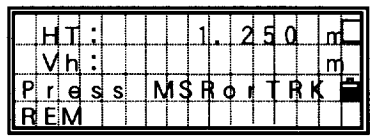
STU 7 REM



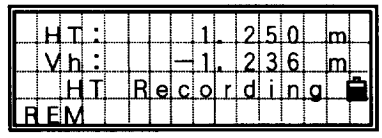
Press the [REM] key to display the screen shown right. HT can be input from here.



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



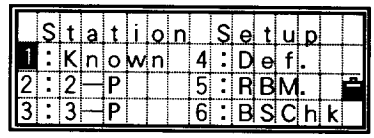
Loosen the vertical clamp, and turn the telescope to aim at an arbitrary point. The elevation difference between the ground point and an arbitrary point will be displayed.



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

Instrument Station Setup 8 VWX STN

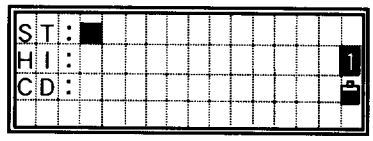
Press the [STN] key to display the menu screen. Select a desired item pressing the numeric key.



1:Known

Station setup with known coordinates or azimuth

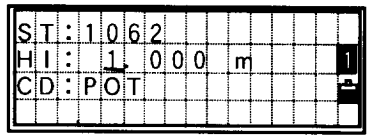
Press the [1] key to display the screen shown right. Input the station point number/name and press the [ENT] key.



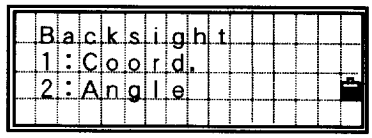
If the input point number/name has already been recorded, its coordinates are displayed and it automatically proceeds to the next step.

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

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

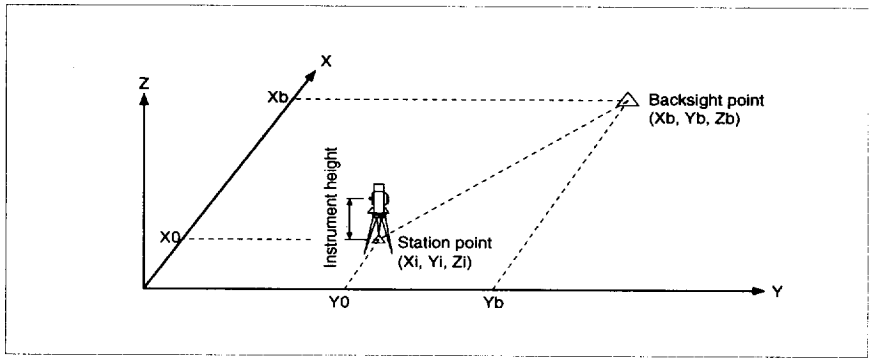


Then the screen changes to the menu display for methods of setting the backsight azimuth angle.
Select the menu option pressing the numeric key.

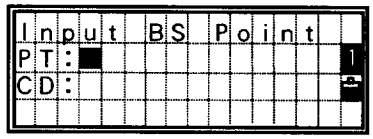


1: Known→1:Coord

Sighting the BS (backsight) point by inputting coordinates

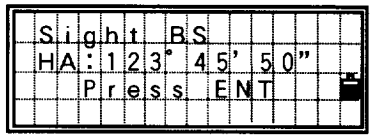


Press the [1] key to display the screen for inputting the BS point name and then its coordinates. Input the point name and its coordinate values and press the [ENT] key.



> Code can be input in CD: field only when the new PT: is entered.

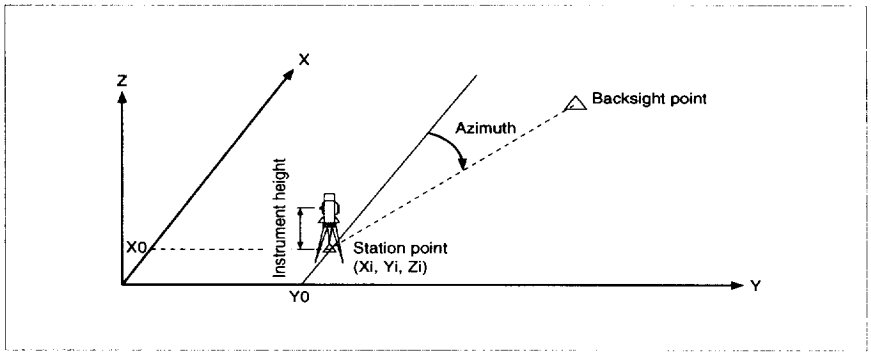
Sight the BS point and press the [ENT] key. It records the station and returns to the BMS.



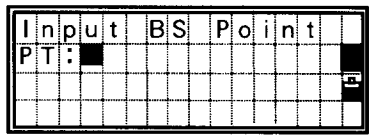
HA: Azimuth calculated from coordinates

1:Kown→2:Angle

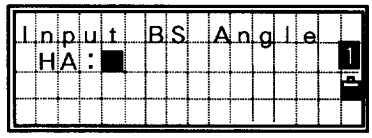
Sighting the BS (backsight) point by inputting azimuth



Press the [2] key to display the screen for inputting the BS point name. Input the point name and press the [ENT] key.
If you don't want to use any point name for BS, just press the [ENT] key without inputting PT.

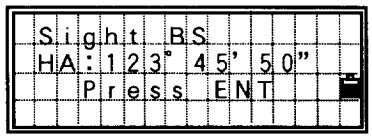


Then the screen for inputting the azimuth of BS point is displayed. Input the azimuth and press the [ENT] key.



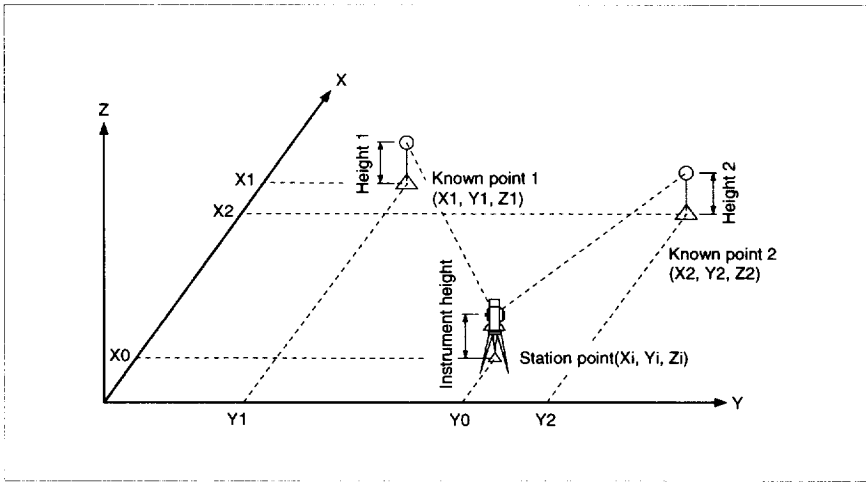
Ex.) To enter 123°45'50", key input should be 123.4550.

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



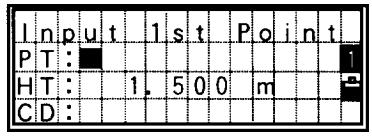
HA: Input azimuth to the BS point

2: 2-Point Resection

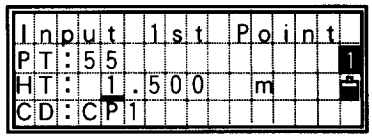


If the angle between known point 1 and known point 2 (as measured from the station point) is extremely acute or extremely oblique, the resulting solution will be less accurate. It is best to select known point locations (or station point locations) which will yield strong geometry.

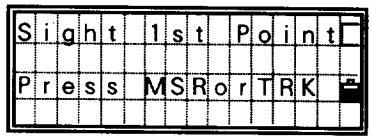
Press the [2] key on the "Station Setup" screen to display the screen for inputting the number/name of known point 1. When you input a known PT, it shows the coordinate and proceeds to the target height input.



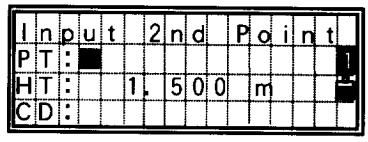
Input the target height and press the [ENT]key. When the coordinate is input manually in the previous screen, CD: can be input on the screen.



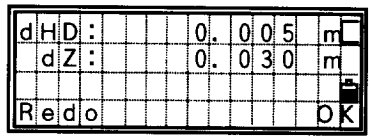
Sight the known point 1 and press the [MSR] or [TRK] key.



After the point 1 has been measured, the display changes to the screen for inputting the known point 2. Input the point number/name, coordinates and height of target. Press the [ENT] key.



After taking a measurement to point 2, the observation error screen is displayed. Press the [4:Redo] or [ESC] key to cancel the resection and return to the previous screen.

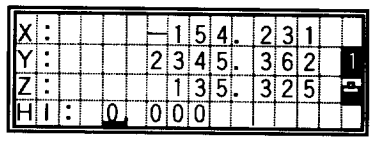


Press the [4:OK] or [ENT] to proceed to input height of instrument screen.

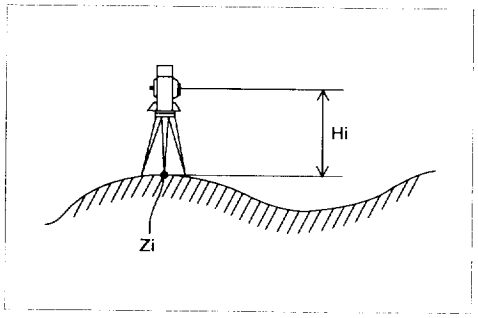
dHD: Difference in horizontal distance between two points. One is calculated from coordinates and the other is from observation data.

dZ: Difference between elevations calculated from the measurement to point 1 and the measurement to point 2.

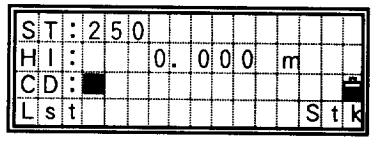
Input the height of instrument and press the [ENT] key to store the data for the station point and return to the basic measurement screen.



Z: The elevation of the station point.



Input the code for station point, if necessary. "ST" is defaulted to "Last recorded PT + 1". You can change ST and/or HI by pressing the up arrow key.

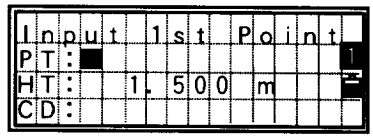


The Last recorded number is updated when any of the point except ST, BS, and SO is stored. When the last digit was alpha, it will not be counted.

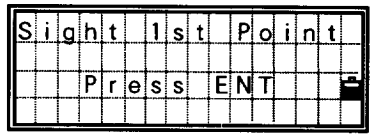
3: 3-Point Resection

Setup the station by angle measurement to three known points

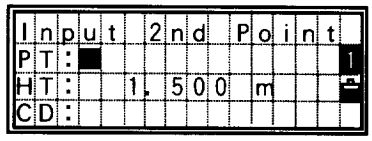
Press the [3] key on the "Station Setup" screen to display the screen for inputting the number/name of known point 1. If the point exists in the instrument memory, its coordinate screen will be shown after entering a code.



Press the [ENT] key to go to the next screen.
Sight the known point 1 and press the [ENT] key.

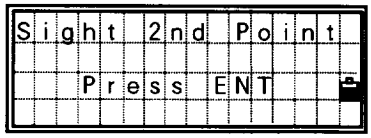


After shooting point 1, the display changes to the screen for inputting known point 2. Input a point number following the same method applied to point 1. Press the [ENT] key.

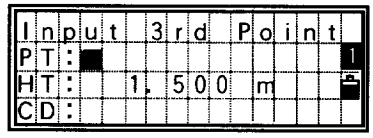


If the same PT is input or the coordinate is the same with the 1st PT, an error message will be displayed. You must choose another PT then.

Sight known point 2 and press the [ENT] key.

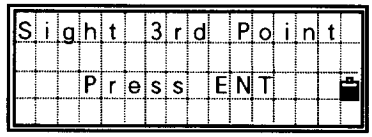


After shooting point 2, the display changes to the screen for inputting known point 3. Input a point number following the same method applied to point 1. Press the [ENT] key.

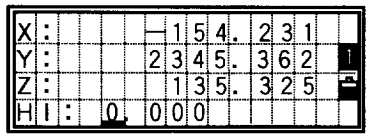


When the PT has the same coordinate with 1st or 2nd point, or all three points are on the same line, an error message will be displayed. You must choose another PT then.

Sight the known point 3 and press the [ENT] key.

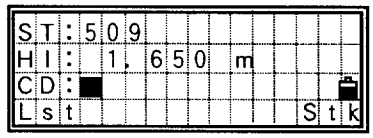


Calculated coordinates of the station point are displayed.
The HI can be input on this screen.



If any of three points has Z-coordinate, it calculates the Station-Z using the current HT value. When all points are 2D coordinates, then the Station-Z will be left blank.

Input the code for station point, if necessary. "ST" is defaulted to "Last recorded PT + 1". You can change ST and/or HI by pressing the up arrow key.



When the HI is changed, the Z-coordinate will be updated before recording the station.

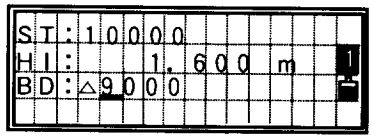
Press the [ENT] key to record the station and return to the BMS.



4: Default Station

Setup the station without coordinates

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



ST : Station point (defaulted to the Last recorded PT +1)
HI : Height of Instrument
BS : Backsight point (defaulted to the previous ST)

The Station point (ST) is defaulted to a new point.

> When the specified ST is a known point, then an error message will be shown. (See p.8-4)

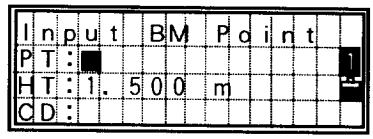
The backsight point of the default station is defaulted to the previous station point. It also can be changed on the screen right.

Sight the BS and press the [ENT] key to accept the BS and complete the station setup.
The current circle reading (HA) is regarded as the backsight azimuth regardless of the BS point name.
No coordinate will be stored to the database from this function.

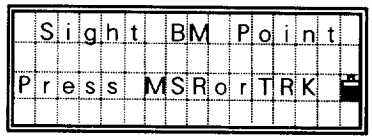
5: Remote Benchmark

Determine the station elevation

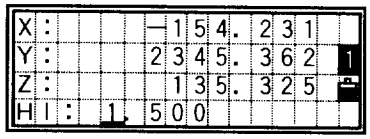
Input the BM point and press the [ENT] key. When the point is found in the database, it shows the coordinates for a while and proceeds to the HT input.



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



Coordinates of the station point are displayed. The HI can be changed on this screen.



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

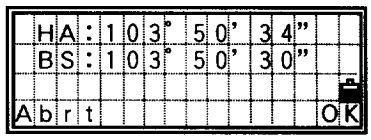
Press the [ESC] key to return to the BM measure screen. Press the [ENT] key to update the station coordinate and return to the BMS.

- When the HI is changed, the Z-coordinate will be updated before recording the station.
- If you have not finished setting up the station, the Remote Benchmark function is not available on STN menu screen.

6: BSCheck

Check the Backsight direction

Press the [6] key on the station setup menu to enter the BS check function.



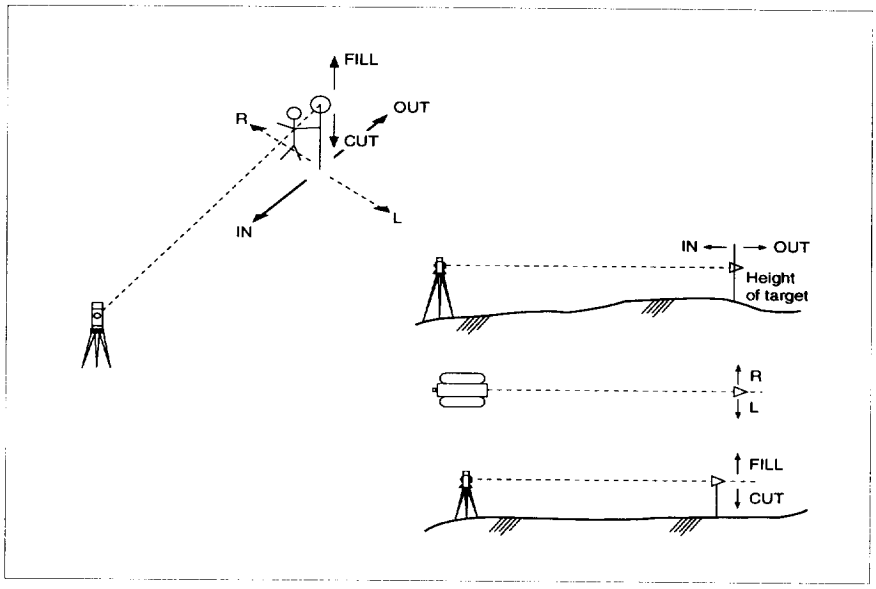
Sight the BS and press the [ENT] or [4] key to reset the horizontal angle to the BS direction.
Press the [ESC] or [1] to abort the process and return to the BMS.

HA: Current HA reading
BS: The HA to the BS when the station is set up.

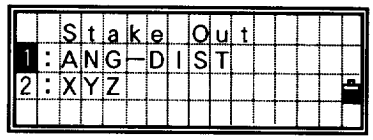
> If you have not finished setting up the station, the Backsight check function is not available on STN menu screen.

Staking out

YZ_
9 S–O



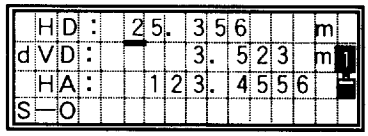
Press the [S-O] key to display the menu screen. Select desired method pressing the numeric key.



1:Ang-Dist

Specifying the stakeout point position by Angle and Distance

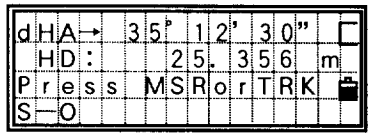
Press the [1] key to display the screen for inputting distances and angle to the target. Input them and press the [ENT] key.



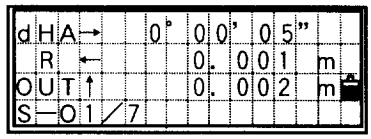
HD: Horizontal distance from station point to stake-out point
dVD: Vertical distance from station point to stake-out point
HA: Azimuth to stake-out point

> Press the [ENT] key on HA field without having any value, the system inputs the current HA automatically.

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



Upon completion of measurement, the errors between the target position and the stake-out point are displayed.

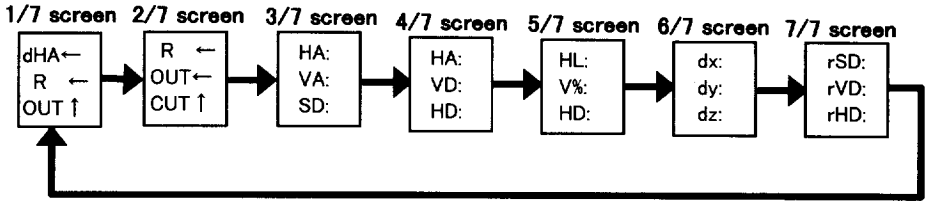


dHA: Difference in Horizontal angle to the target point
R/L: Lateral error
IN/OUT: Longitudinal error

> ·Distance guide by flashing Lumi-guide can be available at any time during the observation. The distance where the flashing speed is changed is set in MENU/3:Sett/ 7:S-O. (See p.3-68)

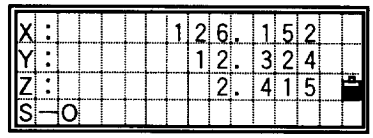
- Once the measurement is taken, the Cut/Fill value and Z-coordinate will be updated as the VA is changed.

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

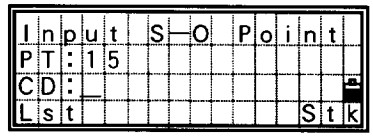


Press the [ESC] key to proceed to the next point without recording the current measurement.

To record the stake-out point, press the [REC] key to display the coordinates of the current position of the target.

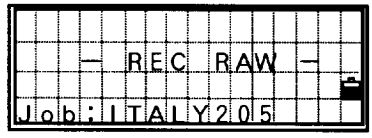


Press the [REC]or [ENT] key to display the screen for inputting the stake-out point number and code.
A default point number will be shown, which is the previous recorded point number plus one.

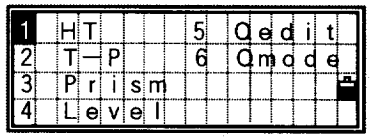


The code defaults to the last recorded code. To input a new code, press the [Mode] key to change the input mode to alpha-numeric or Code List (Lst) or Code Stack (Stk) function.
Press the [ENT] key to record the stake-out point.

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

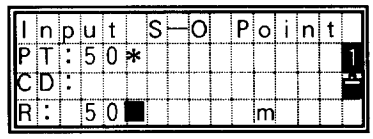


When the [HOT] key is pressed on any of the shooting point screen, it shows the setting screen.
You can change the HT, T-P or Prism constant at any time.



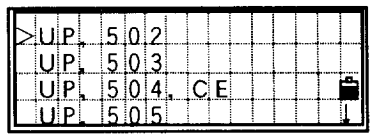
2:XYZ
Specifying the stakeout point position by Coordinates

Press the [2] key on the Stakeout menu screen to start Stakeout by Coordinates. Input the point number/name you refer to on the screen right.
You can also specify the points by Code and/or Radius from the instrument.

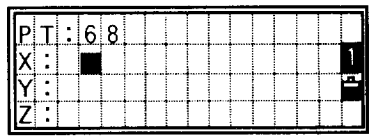


▼

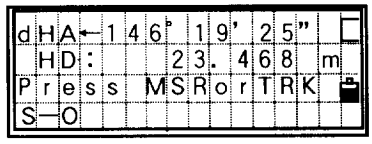
When several points are available to the condition which you input, the list of those points are shown in a list.
Select a point from the list by Up/Down arrow key and press the [ENT] key.



If you input a new point number/name, you can input and record a new point as well.

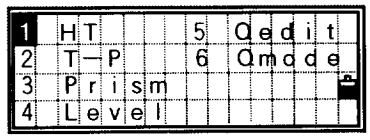


Once you specify the point to be staked, it shows the angle and distance to the target point. Rotate the instrument until the dHA becomes close to 0° 00'00".
Press the [MSR] or [TRK] key to measure to the prism.

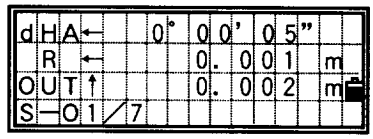


dHA: Difference in Horizontal angle to the target point
HD: Distance to the target point

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

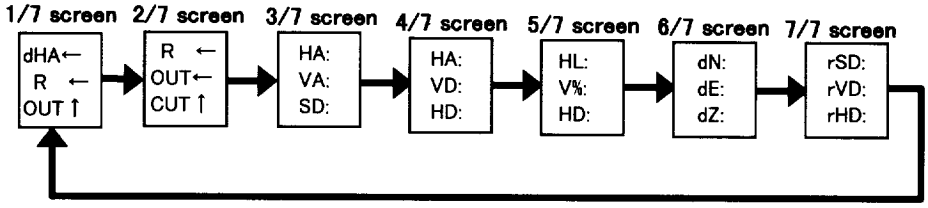


Advise the rodman to adjust the prism position. When the target is on the intended position, the displayed errors become 0.000 m/ft.
Press the [ESC] key to return to the point input screen or the point List.



dHA: Difference in Horizontal angle to the target point
R/L: Lateral error
IN/OUT: Longitudinal error

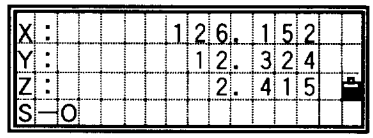
Pressing the [DSP] key switches the screens in the following order.



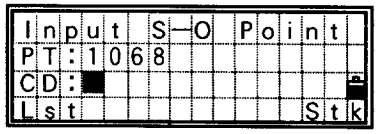
·Distance guide by flashing Lumi-guide can be available at any time during the observation. The distance where the flashing speed is changed is set in MENU/3:Sett/ 7:S-O. (See p.3-68)

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

To record the stake-out point, press the [REC] key to display the coordinates of the current position of the target.



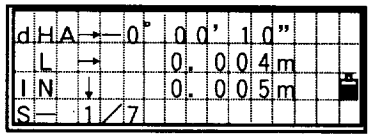
Press the [REC]or [ENT] key to display the screen for inputting the stake-out point number and code.
A default point number will be shown, which is the previous recorded point number plus "Add constant" (See p.3-68).



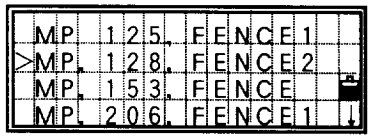
The code defaults to the last recorded code. To input a new code, press the [Mode] key to change the input mode to alpha-numeric or Code List (Lst) or Code Stack (Stk) function.
Press the [ENT] key to record the stake-out point.

"Add Constant" is defaulted to 1000 in MENU/3:Sett/ 7:S-O. (See p.3-68) It requires an integer that is added to the point number being moved to obtain the number for the new point. For example, a moved point 3 when added to an Add Constant of 1000 becomes point 1003.

After recording the point, it returns to the observation screen. The PT is defaulted to the previous point plus one.



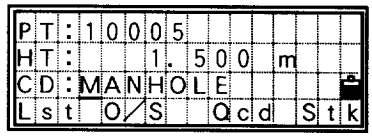
When you select a point from a List, it returns to the same List until all points in the List is picked up.
Press the [ESC] key to return to the point input screen.



Recording Measurement Data [REC]

1) Recording data from any observation screens

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



You can quickly input frequently used feature codes using the Code List (Lst) and Code Stack (Stk) functions.
(See p.3-22, 23)

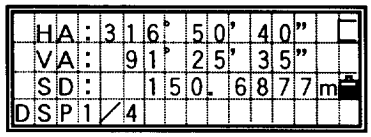
Press the [ENT] key on the CD: field starts recording the point.
When recording Sideshots, Stakeout records and Control shos from ANG/Rept function, there is an option to store "RAW data" only or "Coordinate only" or "Both" which can be specified in "Store Data" on MENU/3:Sett/8:Others. (See p.3-69)



> · When you take an Angle Offset shot, move the HA/VA before pressing the [REC] key, after shooting the point. It records the angle when the [REC] key is pressed.
>
> · To take an angle shot, just press the [REC] key on the BMS. It shows "-REC ANG-" while recording. For the angle shot, SD is always set to 0.0000.

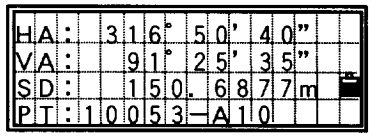
2) Qcode

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



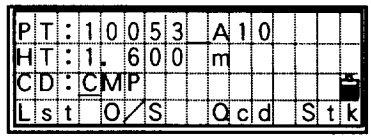
▼ [Mode]

In the Qcode mode, it shows the default PT on the last line. You can start measurement and input code by any numeric keys.

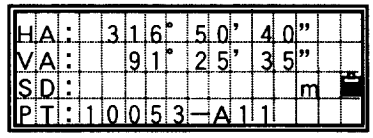


▼ [1] to [0]

When the Qcode mode in HOT/6:Qmode is set to "Confirm: Yes", it shows the recording point screen after taking a measurement via any numeric key. The CD: field is defaulted by the code which is assigned to each numeric key. PT/HT/CD can also be changed on the screen right in a normal process.



Press the [ENT] key to record the point. The next PT is increased by one. To exit the Qcode mode, press the [Mode] key again.

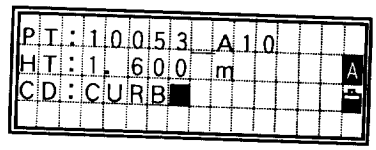




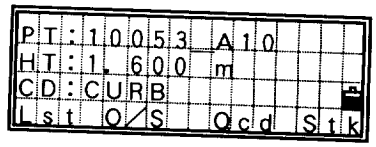
· To check the all codes assigned to each key, you can press the [Mode] key first, and then press the [HOT] key twice to get into HOT /5:Qedit function. (See p.3-15)

Assign a Code for Qcode

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

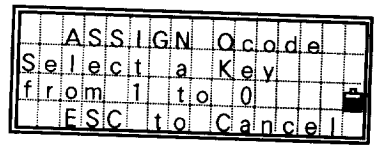


▼ [Mode]



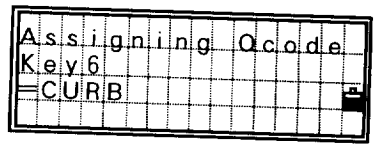
▼ [Qcd]

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



▼ [6]

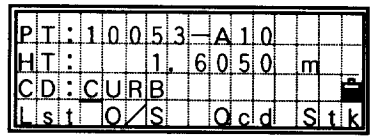
When you select a numeric key, it shows a confirmation screen to assign the code.



Assign a code to any numeric keys for Qcode mode, also can be done through HOT/5:Qedit function. You can see the list of Quick codes in Qedit. (See p.3-15)

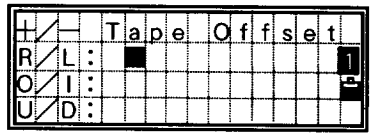
3) Taped Offset Measurements

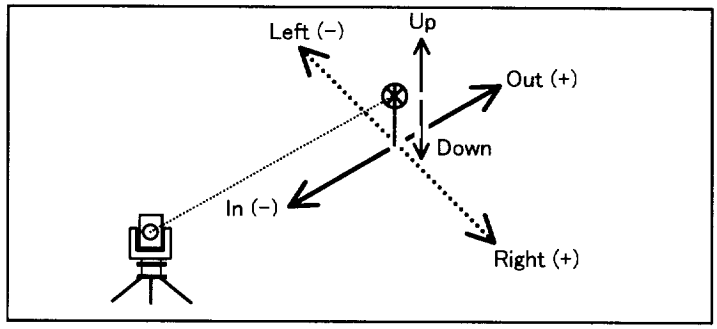
Pressing the [REC] and [2:O/S] key enables you to record taped offset measurements.



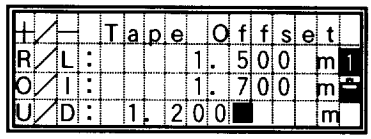
Input offset distance from the measured point. You can choose the direction to take an offset by Up/Down arrow keys.

[1:R/L] = Right(+)/Left(-)
[2:O/I] = Out(+)/In(-)
[3:U/D] = Up(+)/Down(-)

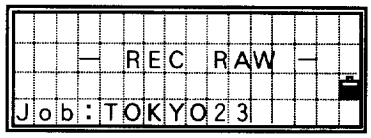




You can enter any combination of taped offset distances to specify the offset.



To calculate the point position and record the offset point, move the cursor to the U/D field and press the [ENT] key. It calculates the new point position and record a SS shot depending on the "Store data" setting.

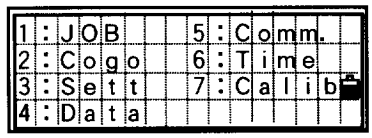


Using Various Functions (menu-key) MENU

Press the [MENU] key to display the MENU screen. Select an item by pressing the numeric key.

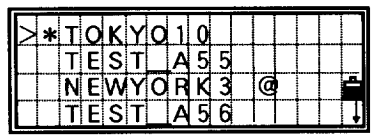
1) Job Manager

Press the [1] key on the MENU screen to get into the Job Manager. It shows a Job list.



1-1) Opening an existing Job

The current job is put an asterisk (*) at the top and a Control Job is indicated by (@) at the end of the Job name.

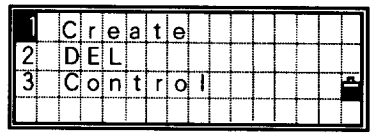


Use the up/down arrow keys to place the cursor on the desired Job name and press the [ENT] key to open it.

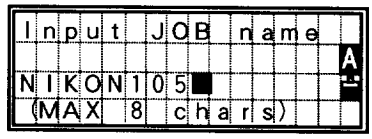
> If no Job has been created when entering this function, it shows a new Job input screen directly.

1-2) Creating New Job

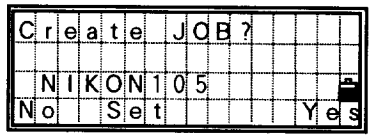
Press the [MENU] key again on the Job list screen to display the sub-function menu in Job Manager.



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.



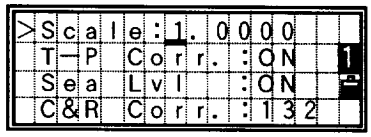
When you want to confirm or change the Job settings, press the [2] key on the screen right.
Otherwise, you can just press the [ENT] or [4] key to create a new job.



Job settings

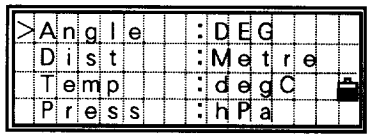
The following 11 settings are fixed to each Job and you cannot change them once you created the Job. They are separated from the normal settings. By this way, the data is clearly and purely stored in the database with all necessary corrections applied at the time you stored each record.

Scale Factor: 0.9996~1.0004
T-P Corr: ON/OFF
Sea Lvl: ON/OFF
C&R Corr: OFF/132/200

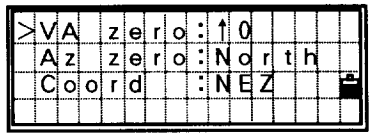


▼

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



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



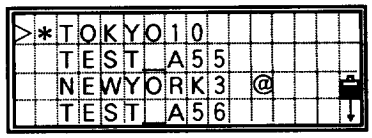
These settings can be changed by the Right/Left arrow key. You can move the cursor by the Up/Down arrow key and change any necessary items.

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

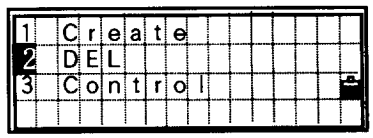
Finally, you can create a job using those Job settings by pressing the [ENT] key at the last Job setting line (Coord).

1-3) Deleting Job

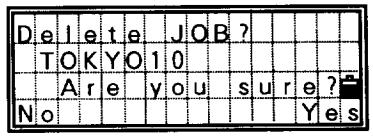
On the Job list screen, move the cursor by the Up/Down arrow key to the Job you want to delete.
Then, press the [MENU] key to display the sub-function menu.



Select [2:DEL] by pressing the [2] key. You can choose it by using the Down arrow key and the [ENT] key as well.

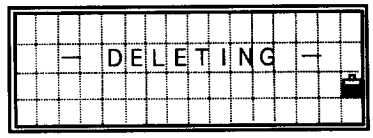


A confirmation screen is shown.
Press the [ENT] or [4] key to delete the Job you chose. Press the [ESC] or [1] key to cancel the process and return to the previous screen.



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.



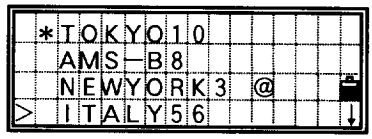
1-4) Control Job

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.

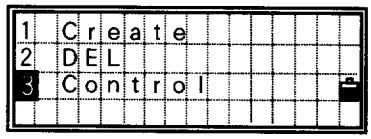
Once a Control job is assigned, the system will search the coordinate points in the Control Job when the input point cannot be found in the current Job. If the point is found in the Control Job, it will be copied into the current Job.

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.

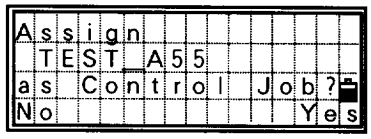
On the Job list screen, move the cursor by the Up/Down arrow key to the Job you want to assign it as a Control Job.



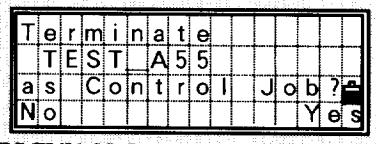
Then, press the [MENU] key to display the sub-function menu.
Select [3:Control] by pressing numeric key or the Down arrow and [ENT] key.



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 and return to the previous screen.



- When a different Job is already assigned as a control job, it replaces the control job as the newly specified one.
- You cannot select the current open Job as a Control Job.
- To cancel the current control job, select the same job again and press the [Mode] and [3]. It shows the screen right.

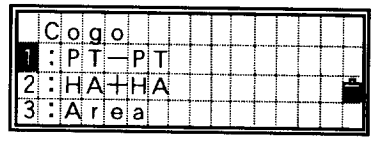


[ESC]/[1:No]=returns to Job list
[ENT]/[4:Yes]=cancels control job

2) Cogo

Coordinate Geometry Calculations

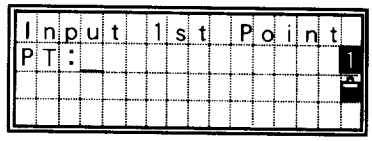
Press the [2] key on the MENU screen to display the COGO menu screen.



2-1) PT-PT

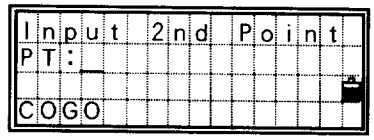
Calculating Angle and Distance between two Coordinates

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.

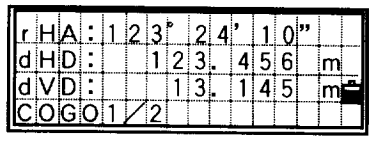


> When you press the [ENT] without having any point name/number in the PT field, it shows a coordinate input screen anyway. This coordinate will NOT be stored in the database. If you want to record the point, you need to specify a new point name/number.

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

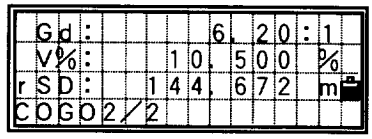


The azimuth, horizontal distance, and vertical distance from the first point to the second point are displayed.
Press any key to return to the COGO menu.



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

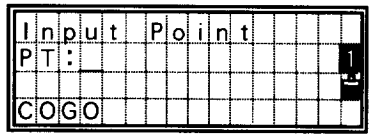
Gd: Grade (HD/VD)
V%: 100/Gd



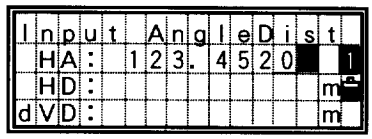
2-2) HA+HD

Calculating Coordinates from Angle and Distance

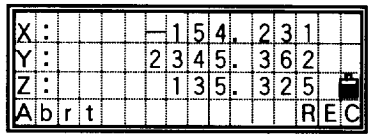
Press the [2] key in the COGO menu to display the screen for inputting the base point. Type the PT and press the [ENT] key.



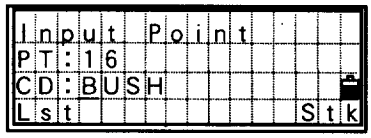
Input the azimuth, horizontal distance, and vertical distance from the base point and then press the [ENT] key.



The coordinates are calculated and displayed.
Press the [4] or [ENT] key to record the point. Press the [1] or [ESC] key aborts the process and returns to the previous screen.



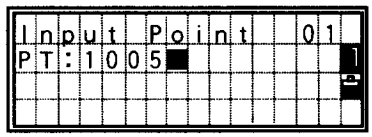
"Input Point" screen is displayed to record the point. The PT is defaulted to the "Last recorded PT + 1".
Press the [ENT] key to store the point.



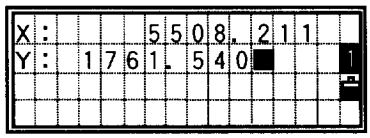
2-3) Area

Calculating Area and Perimeter

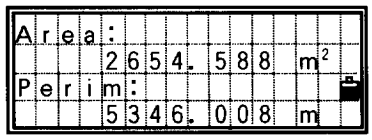
Press the [3] key in the COGO menu to display the screen for inputting the first point number/name. Type the PT for the first point of the lot and press the [ENT] key.



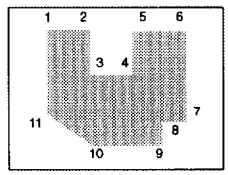
When a new point name/number is input, you can input X and Y coordinates. The upper right corner of the screen, there is an indication about how many points you entered.



Repeat this until you have defined all the points in the lot. Then, press the Down arrow key to calculate the area and perimeter.
Press any key to return to the COGO menu.



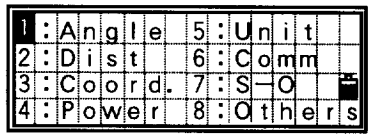
- To obtain a correct result, each point must be input in the order of drawing a parcel of land with one stroke.
- By default, the system closes the area using the last point and the first point in the list.
- Results from this function (Area and Perimeter) cannot be recorded.
- Maximum 99 points can be input.

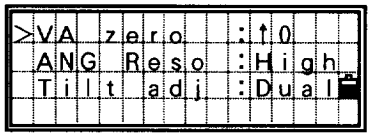


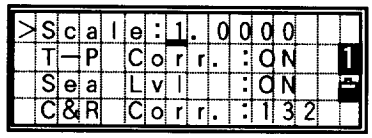
3) Sett

Initial settings

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



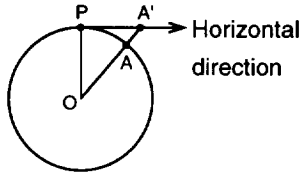
Menu	Item	Conditions
1:Angle		***<VA zero direction>*** ↑ 0 : Zenith → 0 : Horizon ***<Angle Resolution>*** High/Low ***<Tilt conpensation>*** Dual/Single/OFF
	"Out of tilt sensor compensation range" alarm If the vertical axis inclines exceeding the tilt sensor compensation range (±3'30") when "dual or single axis" is specified in the initial setting, the bubble is displayed along with the affected data. (Affected data are VA, VD, HD, V% X, Y, and Z. See p.3-15) This bubble disappears when the vertical axis returns into the compensation range (±3'30"). When "OFF" is specified for tilt sensor compensation, ":" display of the affected data is replaced by the display "#".	

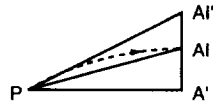
<table>
<tr><th>Menu</th><th>Item</th><th>Conditions</th></tr>
<tr><td>2:Dist</td><td>
</td><td><Scale Factor>
Numerical input between 0.9996 and 1.0004.

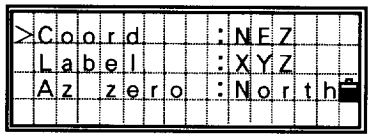
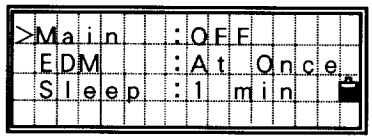
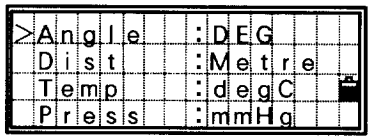
<Temp&Press Correction>
ON/OFF

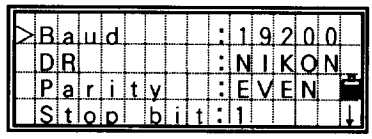
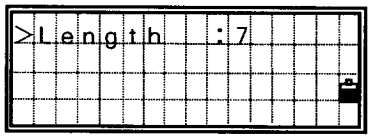
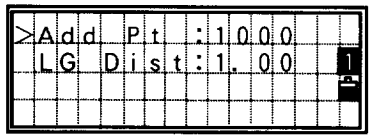
<Sea Level Adjustment>
ON/OFF

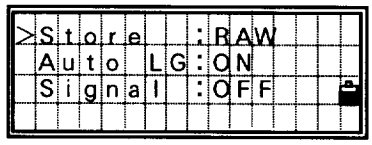
<C&R Correction>
OFF : C&R OFF
132 : C&R ON (coef. 0.132)
200 : C&R ON (coef. 0.200)</td></tr>
<tr><td></td><td colspan="2">As the surface of the earth is curved, the vertical difference (VD and Z) at the measurement point, as referenced to the horizontal plane, will inevitably include some error. This 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.

Curvature error ($\overline{A\,A'}$)


Refraction error ($\overline{Al\,Al'}$)

</td></tr>
</table>

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

Menu	Item	Conditions
6:Comm	 	***<Baud rate>*** 1200/2400/4800/9600/ 19200/38400bps ***<Data Collector/Recorder>*** NIKON/SET ***<Parity>*** EVEN/ODD/NONE ***<Stop bit>*** 1/2 ***<Data Length>*** 7/8
7:S-O		***<Add constant in Stakeout>*** Used to give a default point number to record observed data in Stakeout (1～999,999). ***<LG Distance Guide>*** ·0～9.99m(32.8ft)

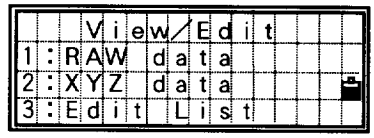
Menu	Item	Conditions
8:Others		***<Store Data>*** **RAW**: Only RAW data is recorded on the BMS, in Stakeout and ANG/Rept. **XYZ**: Only Coordinate data is recorded on the BMS, in Stakeout and ANG/Rept. **Both**: SS/CP/SO records have both RAW and XYZ data from each shot. ***<LG-on on recording Pt>*** ON: When recording a point on the BMS, LG will be turned ON for two seconds. ***<Beep on Signal>*** ON/OFF

When "Store data" is set to "RAW", the duplicate PT-check is not done when recording a point in the BMS and Stakeout.

4) Data

Viewing and Editing Records

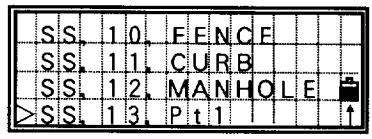
Press the [4] key on the MENU screen to display the View/Edit menu.



4-1) Display records

4-1-1) From RAW data

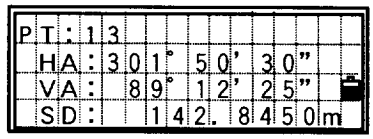
Press the [1] key on the View/Edit menu screen to show the RAW data in List form.



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.

▼ [ENT]

Press the [ENT] key to see more detailed information.
Press the [ESC] key to return to the list screen.

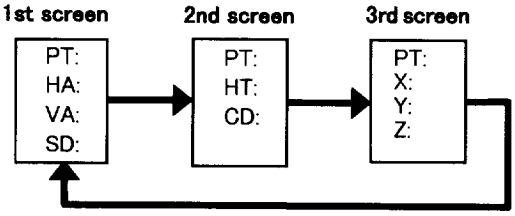


SS/SO/CP/F1/F2 records

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 using the "Stakeout" function.
CP: Shots to control point recorded in ANG/Rept function.
F1/F2: Face 1/Face 2 shots taken in the "Station Setup" .

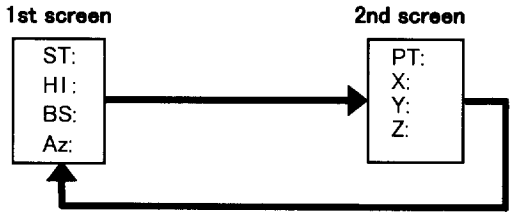
Pressing the [DSP] key switches the screen in the following order.



The 3rd screen is an option and it can be appeared only when the "Store data" setting is set to "Both" and each SS/SO/CP has its coordinate. (It is completely irrelevant in F1/F2 record.)

ST records

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

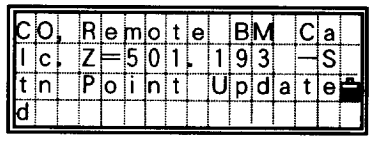


When the station is set up in STN/Def., the coordinate of the Station is left blank.

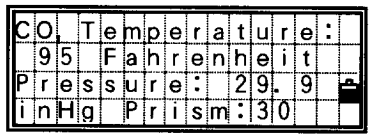
CO records

A comment added to the job from the system.
For example, when you change the Stn-Z by Remote benckmark function or the horizontal angle is adjusted by BSCheck function, the system records what you have done in the field.

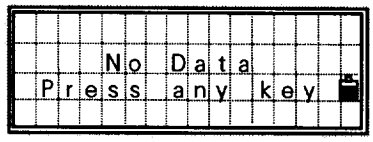
A sample comment record from Remote Benchmark function.



Temp & Press and Prism Constant record is also stored when you complete each station setup.

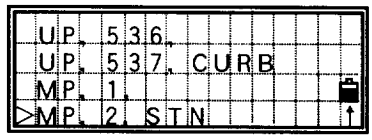


When no record is stored in the RAW database, it shows an error screen. Press any key to return to the previous screen.



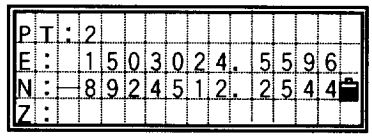
4-1-2) Displaying Coordinate data

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



▼ [ENT]

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



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

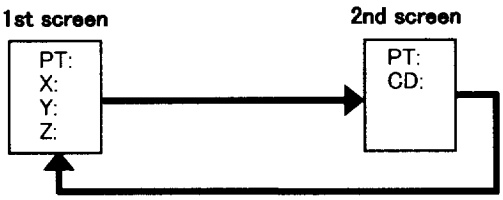
UP/MP/CC/RE records

All coordinate records include the "PT", "CD", and "X/Y/Z". By pressing the [DSP] key, the indication toggles between PT/X/Y/Z and PT/CD.

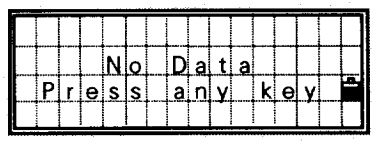
UP: Uploaded point coordinates.
MP: Manually input coordinates of points.
CC: Calculated coordinates. Points calculated using "COGO".
RE: Calculated coordinates. Points calculated using "Resection".

When the "Store data" is set to "Both" or "XYZ", shots on the BMS (SS), in Stakeout (SO) and in ANG/Rept (CP) stores coordinate record. (See p.3-69) The format of the data is the same with other coordinate records.

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

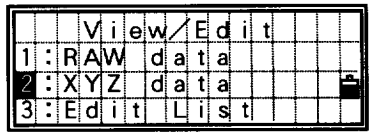


When no record is stored in the Coordinate database, it shows an error screen. Press any key to return to the previous screen.

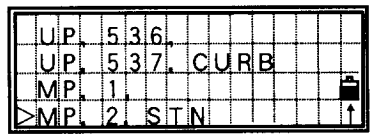


4-2) Input Coordinate

Select [2:XYZ data] by numeric key.

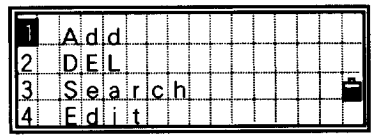


Press the [MENU] on XYZ data screen to display the sub-function menu for the View/Edit data.

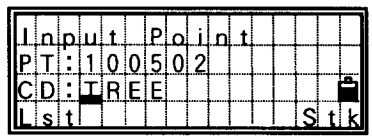


▼ [MENU]

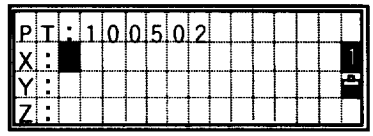
Press the [1] or [ENT] key to start typing a point name/number before inputting coordinates.



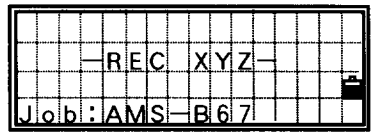
The PT is defaulted to the "Last recorded PT + 1". You can change the PT by pressing the Up arrow key and place the cursor on PT field.
When you input PT and CD correctly, then press the [ENT] key to the next screen.



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



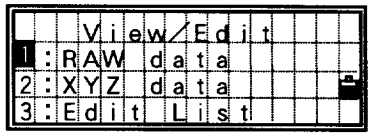
You can store the point as MP record when you press the [ENT] at Z field. After recording the point, it returns to the PT/CD input screen with the updated default PT.



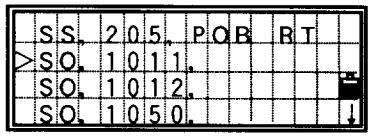
- N/E or NEZ, only Z data can be recorded to the database.
- [Lst] and [Stk] functions are available to input CD as well as Alpha-numeric/Numeric input mode.

4-3) Delete record
4-3-1) Deleting RAW data

Select [1:RAW data] by numeric key.

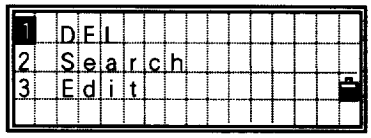


Place the cursor by the Up/Down arrow key to the record you want to delete, then press the [MENU].

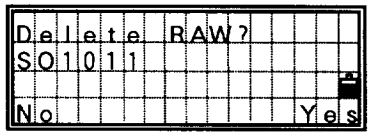


▼ [MENU]

The sub-function menu for RAW data is displayed. Press the [1] or [ENT] key to go into "Delete" function.



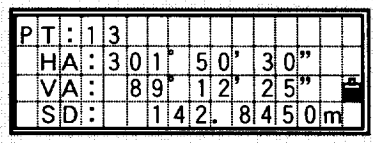
A confirmation screen is displayed.
Press the [ENT] or [4] key to delete the specified record.
Press the [ESC] or [1] key to cancel deleting data.





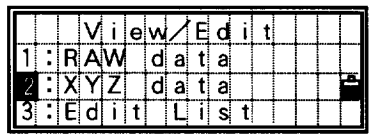
·If the "Store Data" is set to "Both", the system will also delete the corresponding coordinate data, when the RAW (SS/SO/CP) record is deleted.

·Deleting RAW data can also be activated from the each data screen right. Press the [MENU] key to display the sub-function menu.

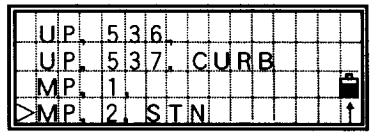


4-3-2) Delete Coordinate data

Select [2:XYZ data] by numeric key.

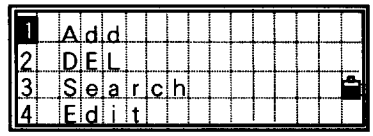


Place the cursor by the Up/Down arrow key to the record you want to delete, then press the [MENU].

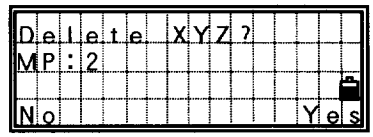


▼ [MENU]

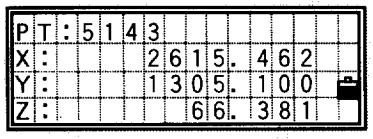
The sub-function menu for XYZ data is displayed. Press the [2] or Down arrow plus [ENT] key to go into "Delete" function.



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 the each data screen right. Press the [MENU] key to display the sub-function menu.



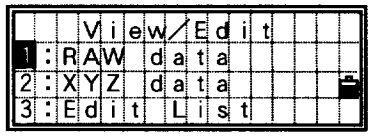
- The coordinate which is referred by the Station or backsight cannot be deleted. (See p.8-7)

4-4)Search Record

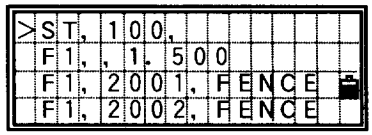
You can search for records by their type, point number/name, code, or by any combination of these.

4-4-1) Search from RAW record

Select [1:RAW data] by numeric key.

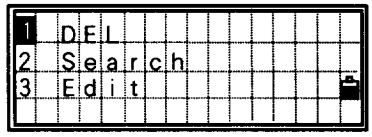


Press the [MENU] key to show the sub-function menu.

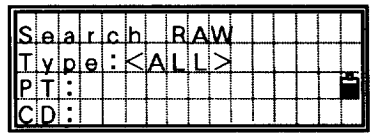


▼ [MENU]

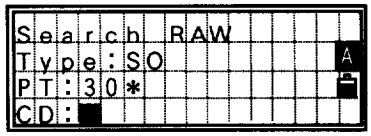
The sub-function menu for RAW data is displayed. Press the [2] or [ENT] key to go into "Search" function.



You can select the "Type" by the Right/ Left arrow key. It toggles among ALL/ ST/SS/SO/F1/F2/CP/CO/SY.
When you know the PT of the point you want to find, you can ignore "Type", leaving it as ALL and just press the [ENT] key to input "PT".



Type the PT and/or CD. The asterisc (*) can be used as a wild card.
For example, when you input "30*" in the PT field, Pt:300, 301, 302, 3000A2, 3010...etc. can be found.

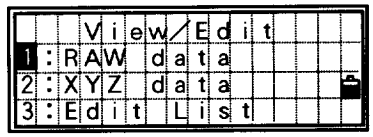


4-4)Search Record

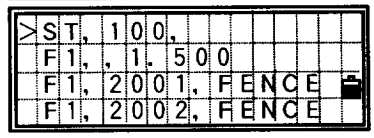
You can search for records by their type, point number/name, code, or by any combination of these.

4-4-1) Search from RAW record

Select [1:RAW data] by numeric key.

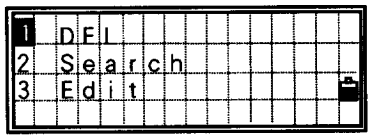


Press the [MENU] key to show the sub-function menu.

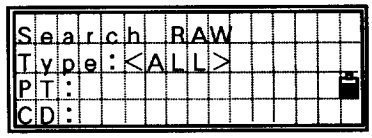


▼ [MENU]

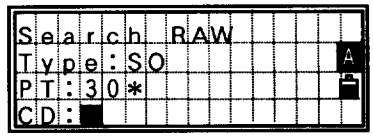
The sub-function menu for RAW data is displayed. Press the [2] or [ENT] key to go into "Search" function.



You can select the "Type" by the Right/ Left arrow key. It toggles among ALL/ ST/SS/SO/F1/F2/CP/CO/SY.
When you know the PT of the point you want to find, you can ignore "Type", leaving it as ALL and just press the [ENT] key to input "PT".

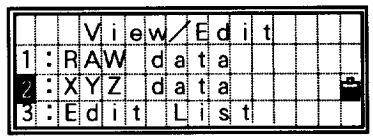


Type the PT and/or CD. The asterisc (*) can be used as a wild card.
For example, when you input "30*" in the PT field, Pt:300, 301, 302, 3000A2, 3010...etc. can be found.

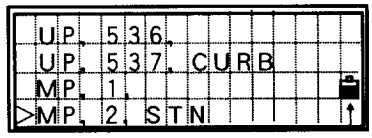


4-4-2) Search from Coordinate record

Select [2:XYZ data] by numeric key.

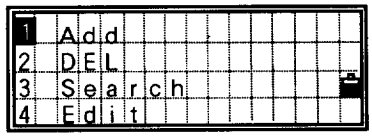


Press the [MENU] on XYZ data screen to display the sub-function menu for the View/Edit data.

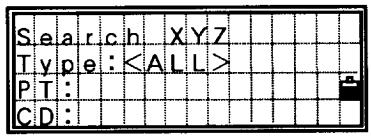


▼ [MENU]

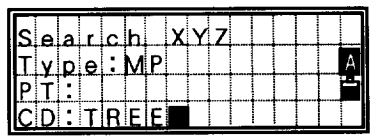
The sub-function menu for XYZ data is displayed. Press the [3] key to enter "Search XYZ" function.



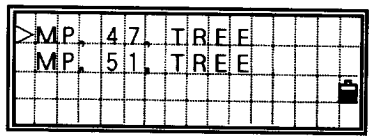
You can select the "Type" by the Right/ Left arrow key. It toggles among ALL/ MP/UP/CC/RE/ALL.
When you know the PT of the point you want to find, you can ignore "Type", leaving it as ALL and just press the [ENT] key to input "PT".



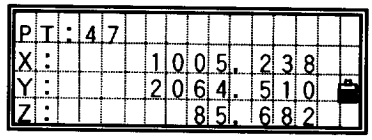
Type the PT and/or CD. The asterisc (*) can be used as a wild card.
For example, when you input "TREE*" in the CD field without input anything in PT field, CD:TREE, TREE1, TREE-3C...etc. with any point name/number can be found.



When several points are available for the condition which you input, a list of those points are shown.
Select a point from the list by Up/Down arrow key and press the [ENT] key.

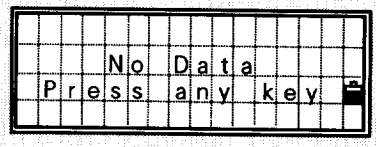


It shows a detailed information screen right. Press the [ESC] key to return to the list screen.
From this screen, the [DSP] key is also available to change the screen. (See p.3-74)



· 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.

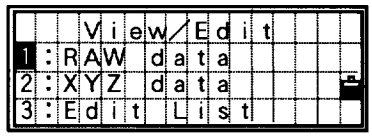


4-5) Edit Record

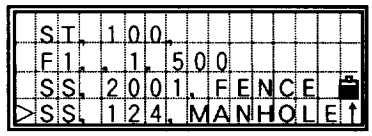
You can edit records by their point number/name and code. Also the height of target (HT), height of the instrument (HI), backsight point (BS), and backsight azimuth (Az) can be modified as well. However, even if you change one of them, the system will NOT recalculate the coordinates.

4-5-1) Edit RAW record

Select [1:RAW data] by numeric key.

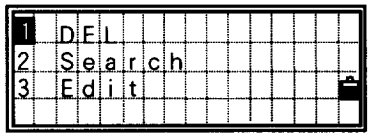


Place the cursor by the Up/Down arrow key to the record you want to edit, then press the [MENU].

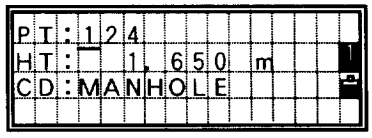


▼ [MENU]

The sub-function menu for RAW data is displayed. Press the [3] key to go into "Edit" function.



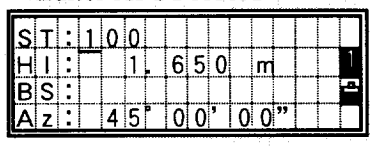
Move the cursor by the Up/Down arrow key and modify the necessary fields. You can edit all data in the screen right.



- There is no edit CD field for SO/F1/F2 record.

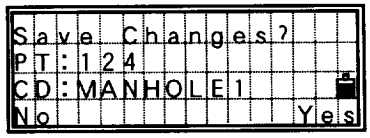
<Editor for ST record>

- All data in the ST record can be edit. However, no recalculation will be performed on the instrument.

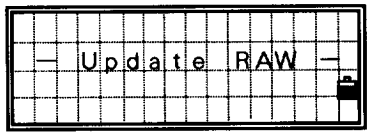


- HA/VA/SD cannot be edited for SS/SO/CP/F1/F2 records.

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

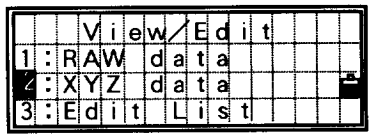


Press the [4] or [ENT] key to accept the modification and returns to the Data View screen. Press the [1] or [ESC] key to go back to the edit screen.

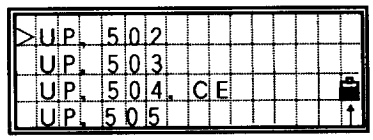


4-5-2) Edit Coordinate record

Select [2:XYZ data] by numeric key.

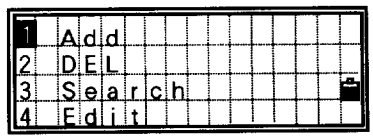


Place the cursor by the Up/Down arrow key to the record you want to edit, then press the [MENU].

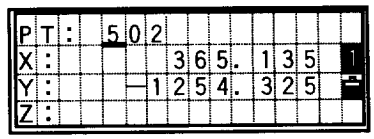


▼ [MENU]

The sub-function menu for XYZ data is displayed. Press the [4] to enter "Edit" function.

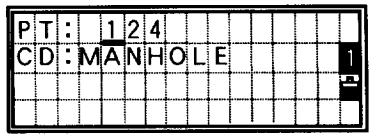


Move the cursor by the Up/Down arrow key and modify the necessary fields. You can edit all data in the screen right.

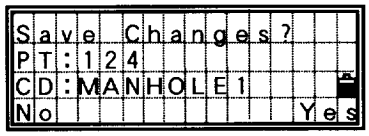


▼ [DSP]

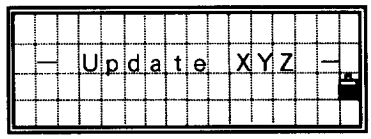
Press the [DSP] key to change the screen. Point name/number and Feature Code are also can be edited.



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 returns to the Data View screen. Press the [1] or [ESC] key to go back to the edit screen.

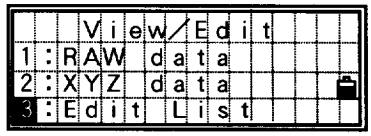




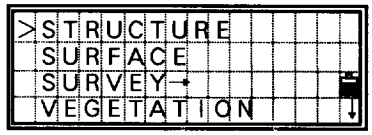
·The coordinate record which is referred by ST can not be edited. An error screen will be come up when you choose those records. (See p.8-7)

4-6) Edit Code List

elect [3:Edit List] by numeric key on the View/Edit menu.

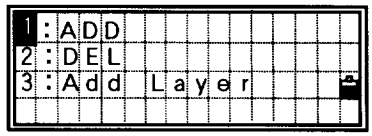


It shows the first four feature codes (or layers) on the 1st layer of the Code List. Place the cursor by the Up/Down arrow key to the code or layer name you want to edit, then press the [MENU] key.



- Maximum 255 codes (and/or layers) can be stored.
- Each code (or layer name) is up to 12 characters.

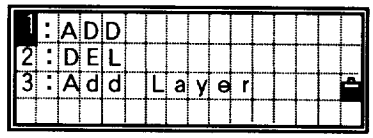
The sub-function menu for Code List is displayed by the [MENU] key.



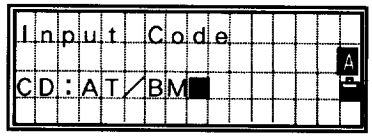
[1:ADD]: adds a new feature code to the current layer.
[2:DEL]: deletes the feature code or layer on which the cursor is
[3:Add Layer]: adds a new layer beneath the current layer.

4-6-1) Add new Code

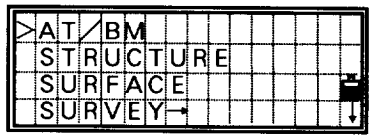
Press the [1] or [ENT] key to add a new feature code to the current layer.



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

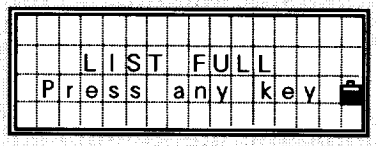


When a new code is added, the order of the codes in the current layer will be rearranged and displayed from the first four items.





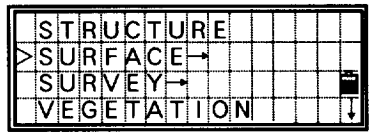
·When the Code List already has 255 code and/or layer names, an error screen is displayed. Press any key to return to the previous screen.



·The input CD in this function is stored as both "String" and "Code". It will be used both for displaying List and recording. If you want to see a "String" which is different from what is stored as CD, you can create your own Code List by any standard EDITOR in yoru PC. (See p.7-3 for format and p.3-91 for uploading List)

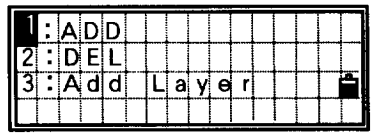
4-6-2) Delete Code/Layer

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

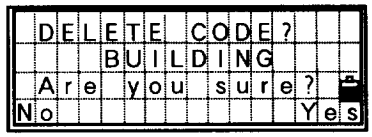


▼ [MENU]

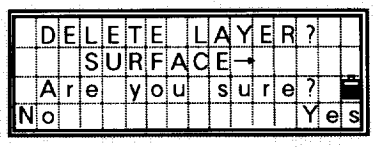
The sub-function menu for Code List is displayed. Press the [2] key to go into "Delete Code/Layer" function.



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.

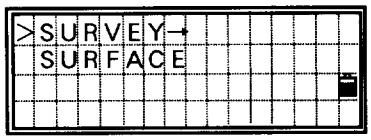


You can delete a whole layer by selecting [2:DEL] on the mode menu after you place the cursor on a layer name. All codes and layers underneath the specified layer will be totally deleted.



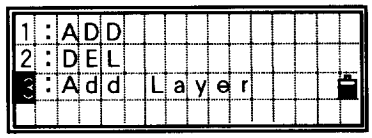
4-6-3) Add Layer

Press the [MENU] key to create a layer on the current layer.

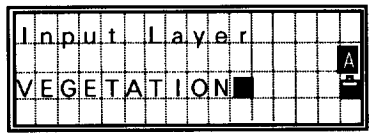


▼ [MENU]

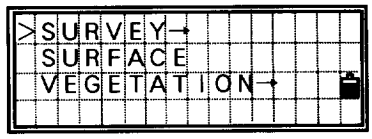
The sub-function menu for Code List is displayed. Press the [3] key to go into "Add Layer" function.



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 the codes in the current layer will be rearranged and displayed from the first four items.

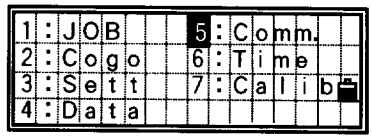


When the Code List already has 255 code and/or layer names, an error screen is displayed. Press any key to return to the previous screen.



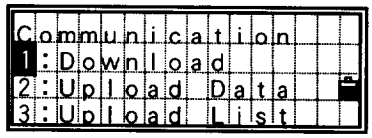
5) Communication
5-1) Download Data

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



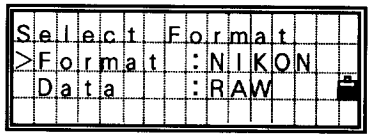
Communication menu:

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

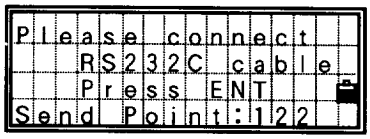


Press the [1] key to get into the download settings screen.

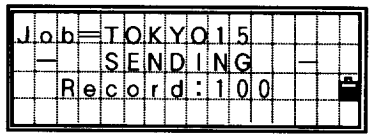
Format: NIKON/SDR2x/SDR33
Data: RAW/Coordinate



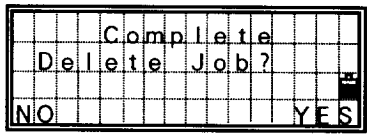
Press the [ENT] key on the "Data" field and it displays the total number of records that are going to be downloaded. Press the [ENT] key again to start download.



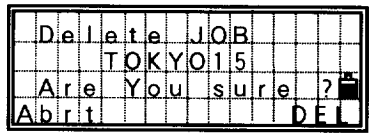
While the records in the current open job are downloaded, the current line number is updated as the record is output from the instrument.



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



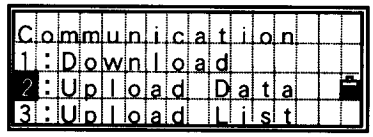
Press the [4] or [ENT] key to delete the current Job. Pressing the [1] or [ESC] key returns you to the BMS.



5-2) Upload Coordinate data

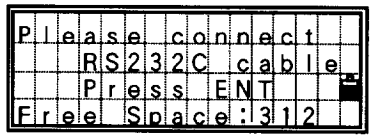
The uploading procedure transfers data from an ASCII file on your computer and puts coordinates into the open job. (See p.7-1 for file format)

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

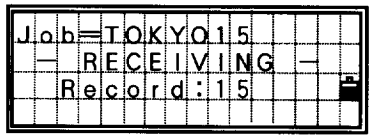


Before starting the upload, it shows the total number of points that can be uploaded in the "Free Space".

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 [ENT] key to start sending data from your computer.



While the coordinate data is uploaded, the current line number is updated as the data is received by the instrument.



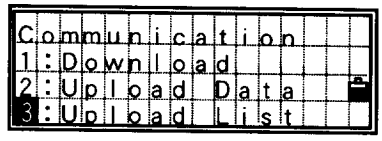
- When you press the [ESC] key during uploading data, it aborts the process and returns to the MENU screen. The data which is already processed until the [ESC] key is pressed, is stored as UP record.

- The system will truncates the code if it is longer than 12 characters, and continue uploading List.

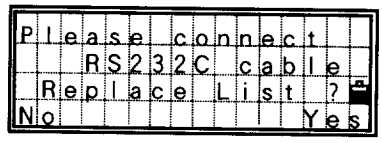
- When the memory becomes full during uploading data, it shows the message and aborts the process. (See p.8-1; DATA FULL)

5-3) Upload List file

Press the [3] key to upload a Code List file via cable.

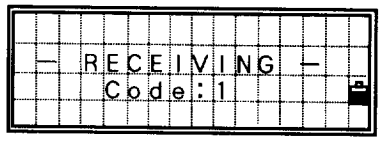


Connect the instrument and your computer by RS-232C cable. Start the communication program on your computer to send coordinate data (usually SEND TEXT file).
Press the [4] or [ENT] key on the instrument to start uploading a Code List file.



> ·When you upload a Code List, it always replaces the one which is already on the instrument.

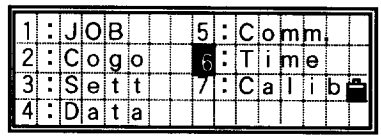
While the List is uploaded, the current line number is updated as it is received by the instrument.
Maximum 255 codes can be uploaded.



> ·The system will truncates the code if it is longer than 12 characters, and continue upload List.
>
> ·When the memory becomes full during uploading data, it shows the message and aborts the process. (See p.8-1)

6) Date & Time

Press the [6:Time] key on the MENU screen to display the input Date & Time screen.

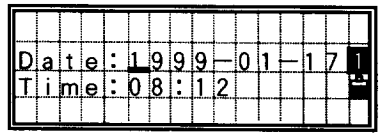


Date & Time in the current setting are shown.
The Date format is Year-Month-Day.
For example, if you want to change the date January 18, 1999, then press:

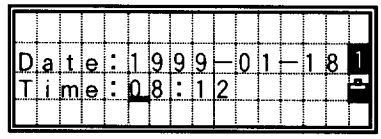
1999 [ENT] 1 [ENT] 18 [ENT]

or

just press [ENT], [ENT], and 18 [ENT] on the screen right.



Pressing the [ENT] key on "Day" field moves the cursor to the "Time" field.
Input Hour and Minutes in 24-hour system.
Press the [ENT] key at "Minutes" field to activate changes in Date & Time.
Press the [ESC] key to cancel the input.



7) Calibration

Press the [MENU] and [7] key to enter the calibration screen. (See p.4-3)

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

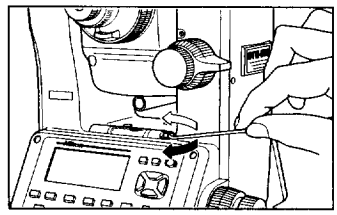
(1) Set up the instrument on the tripod and follow the leveling procedures described in [2-5. Leveling] p.2-11.

(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.



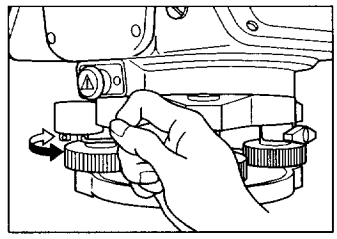
(2) Take up the remaining displacement with leveling screw A (refer to the Figure in p.2-11), centering the bubble.

(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.



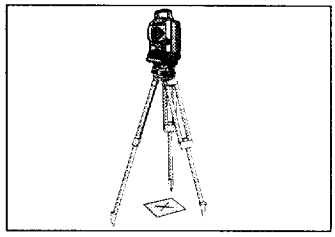
4 3 Optical Plummet

(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.)

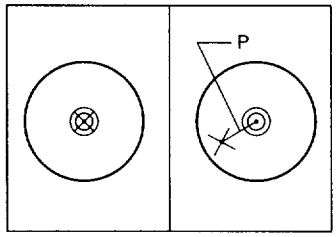
(2) Place a thick sheet of paper marked with an X on the ground just below the instrument.



(3) Looking through the optical plummet, adjust the leveling screws to bring the image of the X to the center of the reticle mark ◎.

(4) Rotate the alidade approximately 180°.

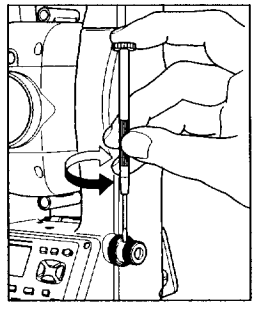
(5) If the marked image is seen in the same position in the center of the reticle mark, no adjustment will be required.



If any displacement is detected, such as that shown in Figure, refer to the adjustment procedure below.

2) Adjustment

(1) Using the supplied minus screwdriver, 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 ◎.



(2) Recheck, following the checking steps (3) to (5).

4.4 Zero Point Errors of Vertical Scale

1) Checking

(1) Set up the instrument on the tripod and complete the leveling procedure described in [2-5. Leveling] section. (See p.2-11)

(2) With the telescope in its face-left position, sight a target P, positioned within ±45° from the horizontal plane, and read the vertical angle (Vr).

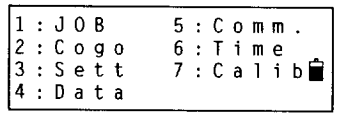
(3) Rotate the instrument to its face-right position, and take another vertical angle reading (Vl) to the target P.

(4) For the Vertical angle "Zenith" setting, if the "Vr+Vl" equals 360°, then the adjustment is not necessary. For the Vertical angle "Horizon", when the "Vr + Vl" is 180° or 540°, then the adjustment is not required either.

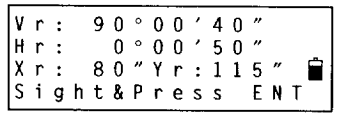
- Difference in vertical angle reading from 360° (for Zenith), 180° or 540° (for Horizon), is called the Altitude constant. When your instrument is out of tolerance, execute the Calibration program and adjust it before starting your field work.

2) Adjustment

Press the [MENU] and [7] key to enter the calibration screen.

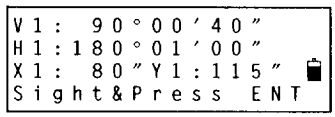


Take a face-left measurement to a prism and press the [ENT] key.



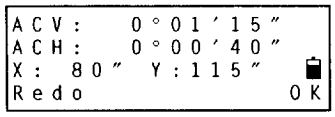
Vr: Face-left vertical angle (tilt-off value)
Hr: Face-left horizontal angle (tilt-off value)
Xr: Face-left X axis tilt value
Yr: Face-left Y axis tilt value

Take a face-right measurement to a prism and press the [ENT] key.
Press the [ESC] key to return to the face-left measurement.



Vl: Face-left vertical angle (tilt-off value)
Hl: Face-left horizontal angle (tilt-off value)
Xl: Face-left X axis tilt value
Yl: Face-left Y axis tilt value

When the observation is completed within the tolerance,



ACV: Vr + Vl – 180°

when ACV>180°, then ACV=V1+V2 – 360°

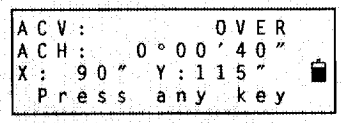
ACH: if (Hl-Hr)>0, then (Hl – Hr – 180°)/2

if (Hl-Hr)<0, then (Hl – Hr + 180°)/2

Xrl: Xr + Xl

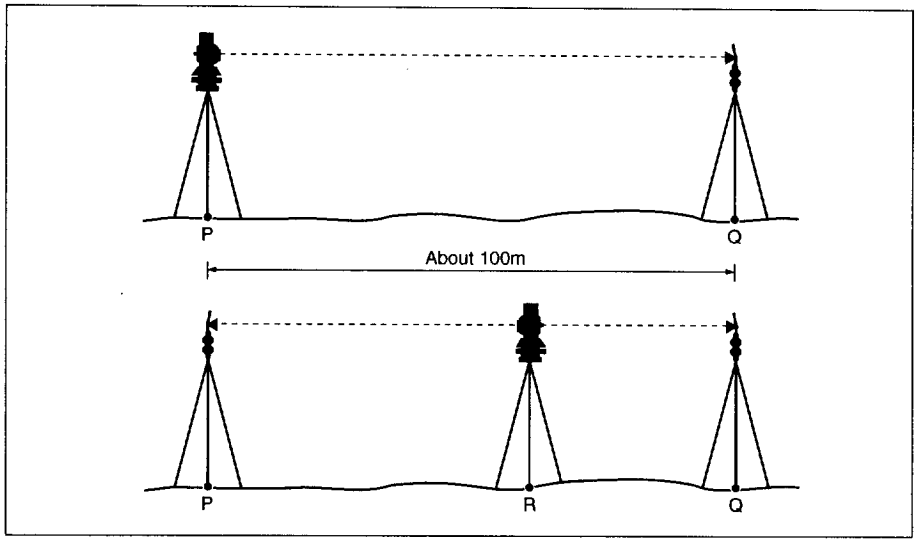
Yrl: Yr + Yl

- When any of ACV, ACH, Xrl, or Yrl is out of the range of ±6 minutes, it shows an error. Pressing any key to return to the Vr/Hr/Xr/Yr observation screen.



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-500 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-500 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-500 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.

5 SPECIFICATIONS

5 1 Main Body

■ Telescope

Tube length:	158mm/6.22in.
Magnification:	33X
Effective diameter of objective:	45mm/1.77in. (EDM: 50mm/1.97in.)
Image:	Erect
Field of view:	1°20' (2.3m at 100m/2.3ft. at 100ft.)
Resolving power:	2.5"
Focusing distance:	1.3m/14.26in. ~ ∞
Focusing method:	Anallactic focusing
Reticle illumination:	3-level variable

■ 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	
DTM-550	
(360°):	0.5"/1"
(400G):	0.1mgon/0.2mgon
(MIL6000/MIL6400):	0.002MIL/0.005MIL
DIN18723 accuracy:	1"/0.2mgon
DTM-530	
(360°):	1"/5"
(400G):	0.2mgon/1mgon
(MIL6000/MIL6400):	0.005MIL/0.02MIL
DIN18723 accuracy:	2"/0.5mgon
DTM-520	
(360°):	1"/5"
(400G):	0.2mgon/1mgon
(MIL6000/MIL6400):	0.005MIL/0.02MIL
DIN18723 accuracy:	3"/1mgon

■ Dual-axis tilt sensor

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)

DTM-550

With single prism:	2,400m/7,900ft.
With triple prism:	3,100m/10,200ft.
With nine prisms:	3,700m/12,100ft.

DTM-530

With single prism:	2,200m/7,200ft.
With triple prism:	2,900m/9,500ft.
With nine prisms:	3,600m/11,800ft.

DTM-520

With single prism:	1,600m/5,300ft.
With triple prism:	2,300m/7,600ft.
With nine prisms:	3,000m/9,800ft.

Under good atmospheric conditions (no haze with visibility over 40km/25miles)

DTM-550

With single prism:	2,700m/8,900ft.
With triple prism:	3,600m/11,800ft.
With nine prisms:	4,400m/14,400ft.

DTM-530

With single prism:	2,500m/8,200ft.
With triple prism:	3,300m/10,800ft.
With nine prisms:	4,200m/13,800ft.

DTM-520

With single prism:	2,000m/6,600ft.
With triple prism:	2,800m/9,200ft.
With nine prisms:	3,500m/11,500ft.

■ **Precision**

MSR mode:	±(2 + 2ppm x D) mm m.s.e.
TRK mode:	±(4 + 2ppm x D) mm (within 500m/1600ft.)

■ **Measurement intervals**

MSR mode:	1.2sec. (initial; 2.5sec.)
TRK mode:	0.5sec. (initial; 1.5sec.)
Least count:	MSR mode 0.1mm/0.001ft. (switchable to 1mm/0.002ft.) TRK mode 1mm/0.002ft. (switchable to 10mm/0.02ft.)
Temperature compensation range:	-40°C ~ +55°C/-40°F ~ +131°F
Barometric pressure compensation range:	(hPa) 533 ~ 1,332hPa (1hPa step) (mmHg) 400 ~ 999mmHg (1mmHg step) (in.Hg) 15.8in. Hg ~ 39.3in. Hg (0.1in.Hg step)
Prism offset correction:	-999 ~ +999mm (1mm step)

■ **Lumi-guide**

Light source:	High luminescence LED
Visible range:	Over 100m/330ft.
Positioning accuracy:	Approx. 6cm/2.4in. at 100m/330ft.
Beam spread:	About 1.5° (2.6m/8.5ft. at 100m/330ft. point)

■ **Clamps/tangent screws:** 2 speed, Coaxial tangent/Clamp knobs

Range: ±4°

■ **Tribrach:** Detachable

■ Level vial sensitivity

DTM-550	
Plate level vial:	20"/2mm
Circular level vial:	10'/2mm
DTM-530	
Plate level vial:	30"/2mm
Circular level vial:	10'/2mm
DTM-520	
Plate level vial:	30"/2mm
Circular level vial:	10'/2mm

■ Optical plummet

Image:	Erect
Magnification:	3X
Field of view:	5°
Focusing range:	0.5m ~ ∞/1.6ft ~ ∞

■ Display/key

Type:	16 character x 4 line, dot matrix LCD with backlight illumination with 21 keys

■ Connections in the base of instrument

Communications:	Type RS-232C Baud 9600 Max. ASYNC
⚠External power supply:	Input voltage DC 7.2 ~ 11V

■ Battery pack BC-80

Output voltage:	DC7.2V, rechargeable
Continuous operation time:	10.5hours (angle/distance measurements)

■ Environmental performance

Operating temperature range:	-20°C ~ +50°C/-4°F ~ +122°F
Storage temperature range:	-25°C ~ +60°C/-13°F ~ +140°F

■ Dimensions

Main unit:	166 (W) x 156 (D) x 365 (H)mm
Carrying case:	488 x 282 x 261mm

■ Weight

Main unit:	Approx. 4.9kg/10.64lbs.
Battery BC-80:	Approx. 0.6kg/1.32lbs.
Quick charger Q-75U/E:	0.45kg/0.97lbs.
Carrying case:	Approx. 4.0kg/8.69lbs.

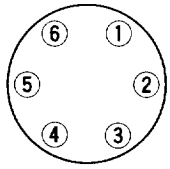
5.2 Standard Components

DTM-500 main body:	1
Battery pack BC-80:	1
Quick charger Q-75U or Q-75E:	1
Tool set:	1
Objective lens cap:	1
Vinyl cover:	1
Plumb bob:	1
Instruction manual:	1
Carrying case:	1
Shoulder strap:	1

5.3 External Device Connection Connector

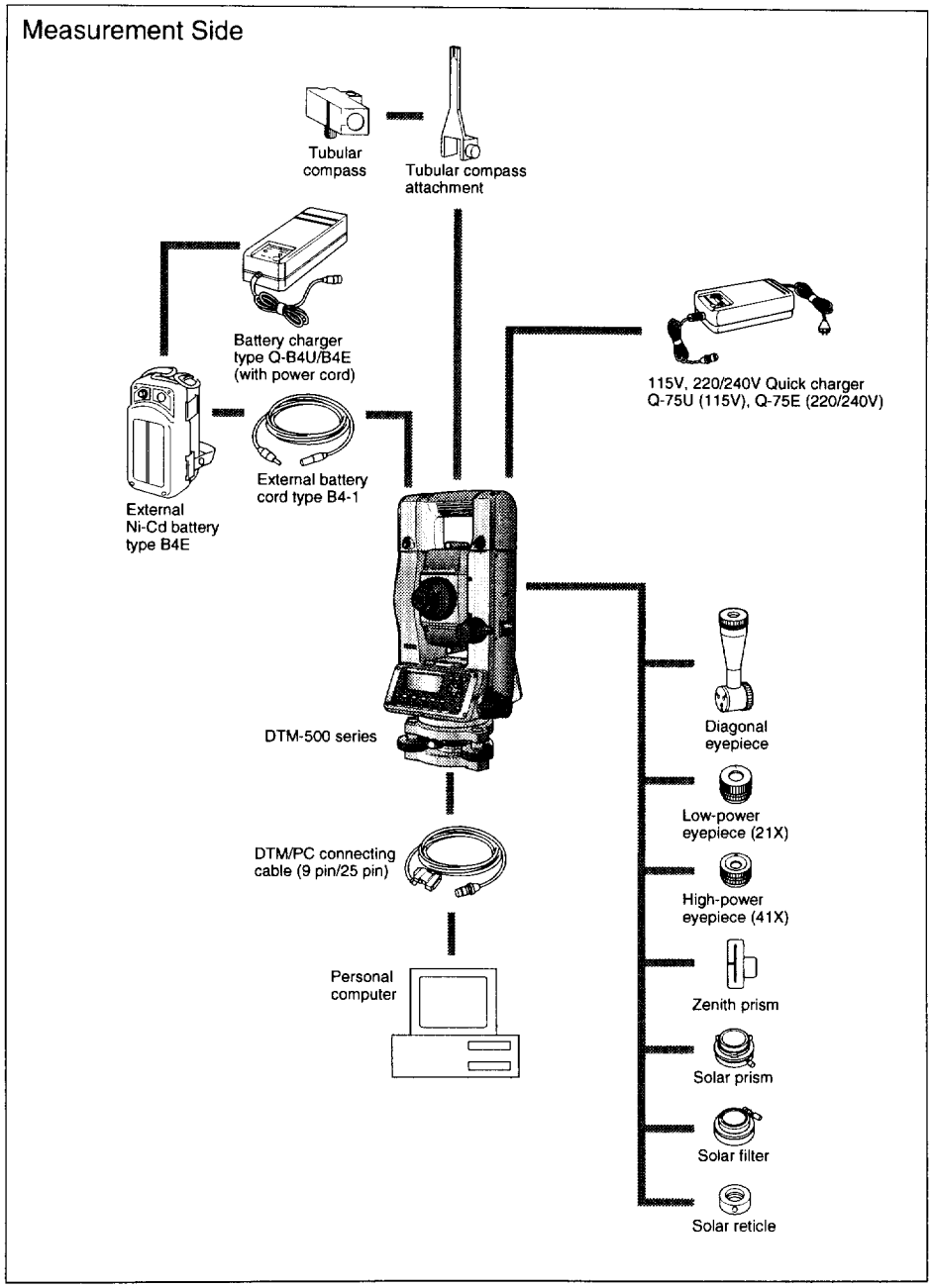
Input voltage:	DC7.2 ~ 11V
System:	RS-232C, Asynchronous
Signal level:	±9V Standard
Rate:	9600bps Max.
Compatible male connector:	Hirose HR10A-7P-6P or Hirose HR10-7P-6P

Hirose HR 10A-7R-6S

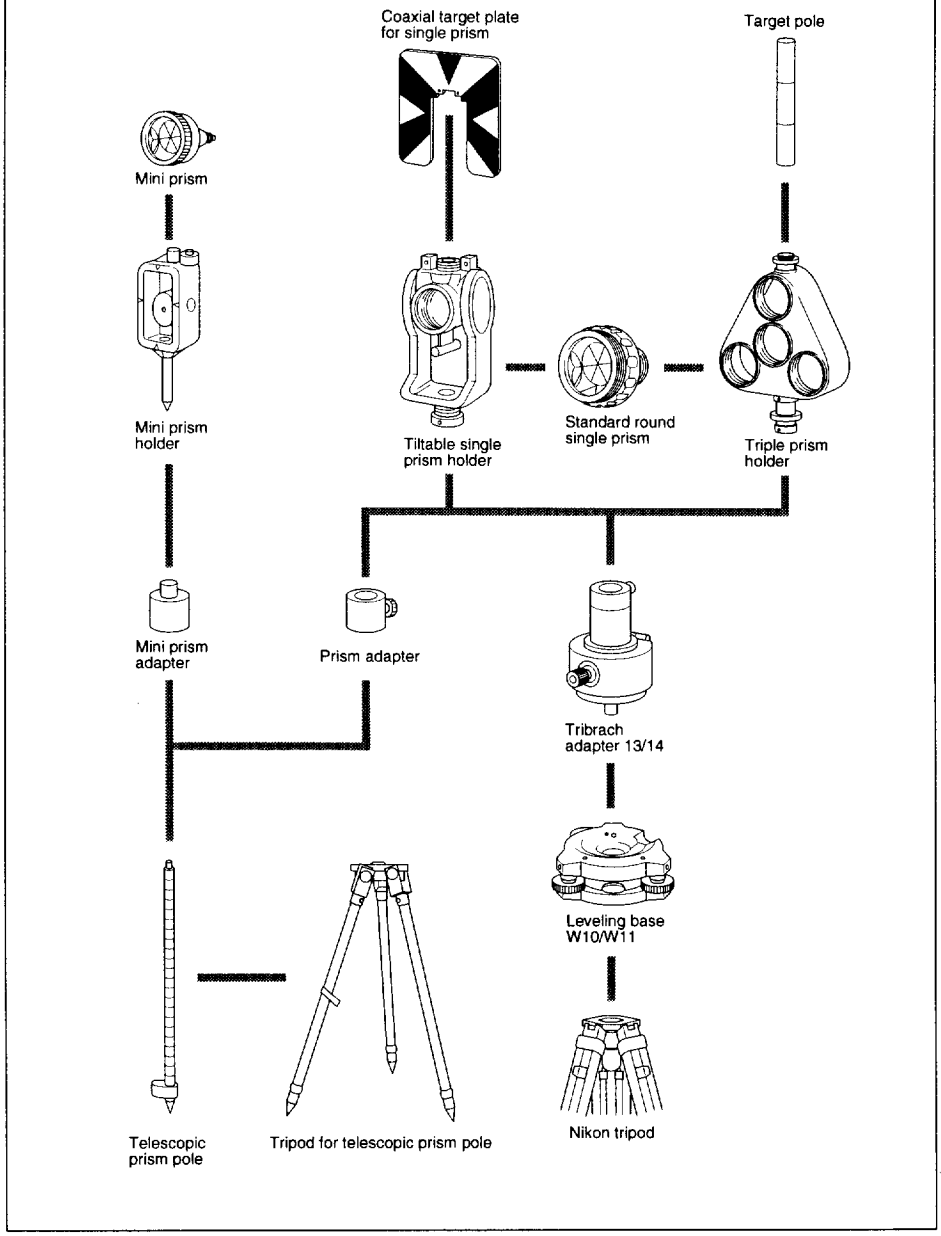


① RxD: Reception data (Input)
② TxD: Send data (Output)
③ +
⑤ –
④, ⑥: No connection

6 SYSTEM DIAGRAM



Prism Reflector Side

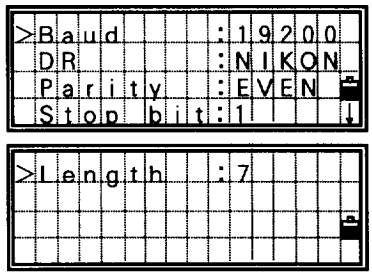


7. COMMUNICATIONS

7-1 Upload Coordinate Data

1) Electrical characteristics

Transmit Speed and other conditions can be set in MENU/3:Sett/6:Comm.
(See p.3-68 for detail.)



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 on the unit of meter (or foot), variable length

CD Feature code: max 12 characters

3) Data Example

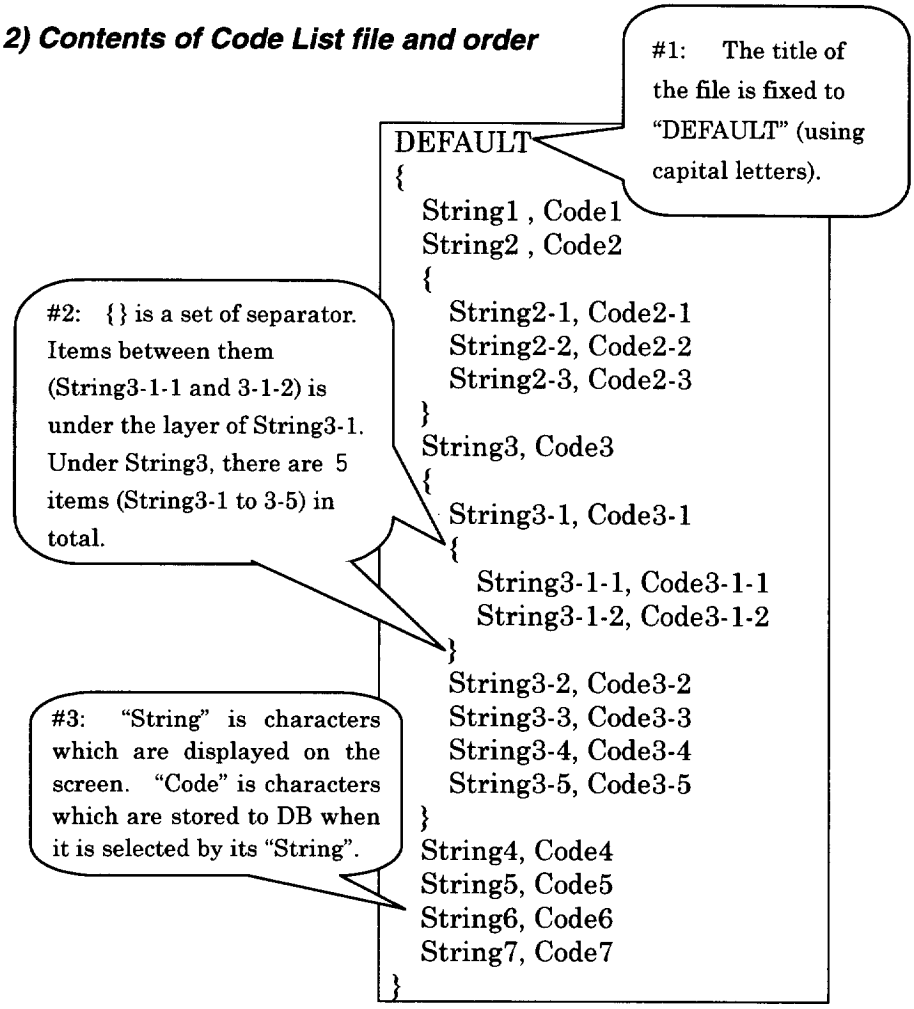
```
20100,6606.165,1639.383,30.762,RKBSS
20104,1165611.6800,116401.4200,00032.8080
20105 5967.677 1102.343 34.353 MANHOLE
20106 4567.889 2340.665 33.444 PT1
20107 5967.677 1102.343 34.353
20109,4657.778,2335.667,,PT2
20111,4657.778,2335.667
20113 4657.778 2335.667
20115,,,34.353,MANHOLE
20117,,,33.444
```

7-2 Uploading Code List

1) Electrical characteristics

Transmit Speed and other conditions can be set in MENU/3:Sett/6:Comm.
(See p.3-68 for detail.)

2) Contents of Code List file and order



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) Electrical characteristics

Transmit Speed and other conditions can be set in MENU/3:Sett/6:Comm.
(See p.3-68 for detail.)

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	,	bsho

stnpt = Station Point Number
(stn id = Station ID)
bspt = Backsight Point Number
(bs id = Backsight ID)
hi = Height of Instrument
bsazim = Backsight Azimuth
bsho = Backsight Horizontal observation

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	diatomite	ang	dist	press	temp	coor	1

ver (5-20) = SDR Download Version*
*SDR2x will read SDR20V03-05. SDR33 will read SDR33V04-01.
0000 (25-40) = Download Data and Time (seconds are not shown).
ang (41) = Angle Units. Degrees:1, Gons:2, Quadrant Bearings:3, Mils:4.
dist (42) = Distance Units, Metres: 1, Feet:2.
press (43) = Pressure Units. MmHg:1, InchHg:2, mbar:3.
temp (44) = Temperature Units.
coor (45) = Coordinate Order. NEZ:1, ENZ:2.
1 (46) = Not Used.

Instrument Record

01KI1	instr	serNo.	Instr	serNo.	1	zero	VA	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	ho

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.
ho (2x:23-32) (33:53-68) = Horz. Observation.

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

09MC	stnpt	pt	sd	va	ha	desc

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 OF DOWNLOADED
CO,Client: NIKON
CO,Comments: MANUAL EXAMPLE
CO,Downloaded 18-JAN-1999 16:35:30
CO,Software: Basic software version: 1.00
CO,Instrument: Nikon DTM550
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-JAN-1999 08:14:21
CO,Prism constant:0
MC,1,,100.000,200.000,10.000,
CO,Temperature: 8 Centigrade Pressure: 770 mmHg
ST,1,,,,1.400,55.4500,55.4500
F1,,,,0.0000,90.0000,8:45:58
SS,3,1.200,330.706,326.027,20.320,8:47:46,SIGN
SS,4,1.250,379.193,300.847,29.084,8:48:24,TREE
SS,5,1.218,363.344,328.032,30.105,8:48:57,TREE R
SO,1003,3,1.240,331.220,326.783,19.998,8:52:42,
```

```
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
```

```
00NMSDR20V03-05     000011-Apr-99 10:39:111211
10NMTEST JOB
01KI1  Nikon DTM550000000  Nikon DTM55000000012 0.000 0.000 0.000
13NMDownloaded 11-Apr-1999 10:39:22
13NMSftware: Basic software version: 1.00
13NMInstrument: Nikon DTM-550
13NMDist Units: Metres
13NMAngle Units: Degrees
13NMZero azimuth: North
13NMZero VA: Horizon
13NMCoord Order: NEZ
13NMClient: ME
13NMDescription: STADIUM PRO-1
13NMTilt Correction:  VA:OFFHA:OFF
13NM P_509 <JOB> Created 10-Apr-1999 07:15:04
13NMPrism constant: 0
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
13NMBacksight Check to Pt:2     HA:359.3525     05:21:39
13NMBacksight Pt:2       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 Resection from Pt: 11
13F10000000427.445    2.4097    0.0000
13F10000000323.991    4.1542    31.8042
13F10000000427.430    1.8583    121.4306
```

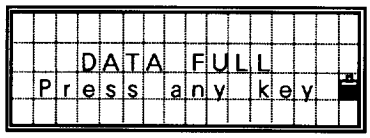
```
13F10000000323.976    3.8625    153.2306
08KI0011100.005   199.996   10.000
02KI0011100.005   199.996   10.000   0.100
07KI0011000344.9980   0.0000
13NMFinish of Resection from Pt: 11
```

SDR2x Coordinate Data Format

```
00NMSDR20V03-05     000011-Apr-99 10:40:111211
10NMTEST JOB
01KI1  Nikon DTM550000000  Nikon DTM55000000012 0.000 0.000 0.000
13NMDownloaded 11-Apr-1999 10:40:06
13NMSftware: Basic software version: 1.00
13NMInstrument: Nikon DTM-550
13NMDist Units: Metres
13NMAngle Units: Deqrees
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 Resection from Pt: 11
08KI0011100.005   199.996   10.000
13NMFinish of Resection from Pt: 11
```

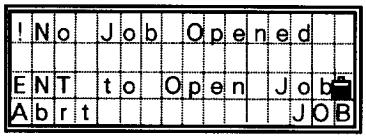
8 ERROR MESSAGES AND ACTIONS

1) When recording data:



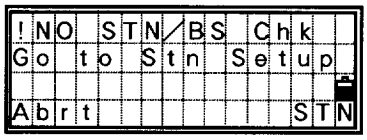
The data storage is full.

Action : Press any key to return to the BMS. Then, you need to delete unnecessary data by entering [Menu]->[4:Data] or to delete a job via [Menu]->[1:JOB].



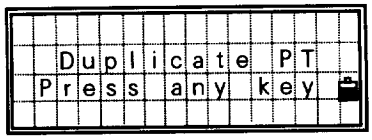
A Job is not opened.

Action : [1:Abrt]/[ESC]=returns to the BMS
[4:JOB]/[ENT] =goes to the Job Manager



There is no Station record in the current job. Or, any Station setup or BS check has not been done yet since the program is re-booted.

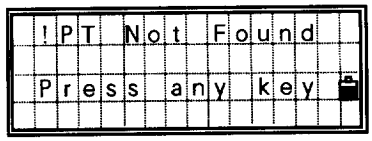
Action : [4:STN]/[ENT] =goes to the Station setup menu
[1:Abrt]/[ESC] =returns to the BMS



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.

2) When searching point:

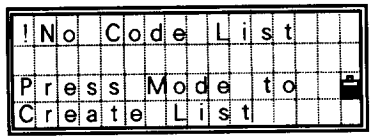


There is no point matches to the condition you entered.

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.

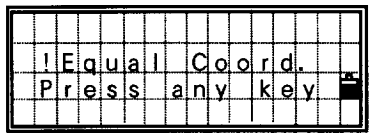
3) In Code List:



There is no code in the Code List when the [Lst] key is pressed.

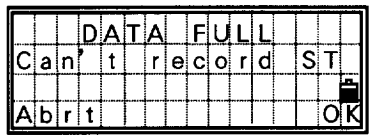
Action : Press the [Mode] key to display the function menu (ADD/DEL). Or, you can upload the Code List by [Menu]->[5:Comm] ->[3:Upload List].

4) In Station Setup:



When the coordinate of the BS is identical to the one in Station or the same point is selected in STN/1:Known.
Or, any of the specified points in 2-pt or 3-pt Resection has the same coordinate or the point name/number.
Or, all three points input in 3-pt Resection on the same line.

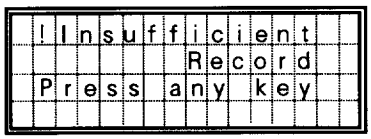
Action : Press any key to return to the BMS.



There is not enough space to record station when you start any of the Station setup functions.

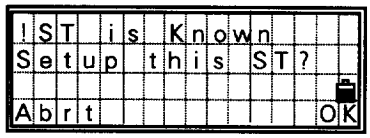
Action : [ESC]/[1:Abrt] =returns to the BMS. Then, you need to delete unnecessary data by entering [Menu]->[4:Data] or to delete a job via [Menu]->[1:JOB].

[ENT]/[4:OK] = You can take a measurement but cannot record the station from the subsequent observations.



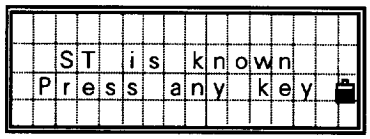
When the selected point for ST doesn't have N/E coordinate. It is also shown when the point specified as BM doesn't have Z coordinate.

Action : Press any key to return to the point input screen.



The known point is input in STN/4:Def.

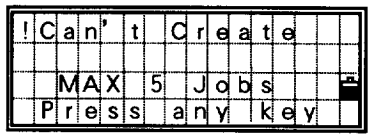
Action :[1:Abrt]/[ESC] = returns to the ST input screen.
[4:OK]/[ENT] = proceeds with the known ST. It will be a known station setup.



When a known point is entered as ST in the default station function (4:Def.), it shows an error screen left.

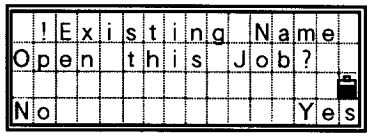
Action : Press any key to return to the point input screen.

4) Job Manager



There are maximum jobs when you try to create a new job.

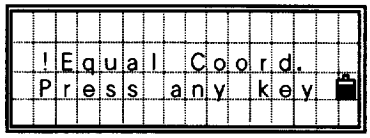
Action :Press any key to return to the job list. You need to move the cursor by up/down arrow key to any unnecessary job and delete it by pressing [Mode]->[2:DEL].



An existing JOB name is input.

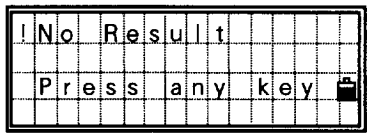
Action : [1:No]/[ESC] =returns to the Job name input screen.
[4:Yes]/[ENT] =opens the existing Job.

5) In Cogo



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.

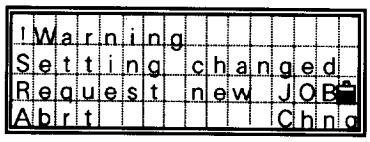
Action : Press any key to return to the 2nd point input screen.



Area calculation is failed.

Action :Press any key to return to the Cogo menu.

6) In Settings



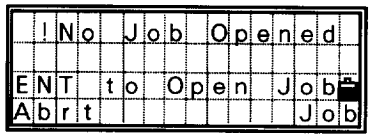
Any of the following JOB settings is changed.

[1:Angle]>VA zero
[2:Dist]>Scale, >T-P Corr., >Sea Lvl
>C&R Corr.
[3:Coord]>Coord, >Az zero
[5:Unit]>Angle, >Dist, >Temp, >Press

Action : [4:Chng]/[ENT] =closes the current Job. The change of the setting is completed.
[1:Abrt]/[ESC] = cancels the change in the Job settings. The current job remains to open.

> When the Job setting is changed by [4:Chng] 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 this setting.

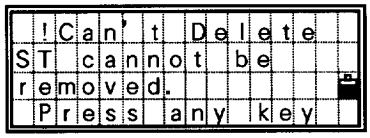
7) Data



A Job is not opened yet.

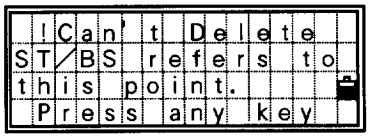
Action : [1:Abrt]/[ESC] =returns to the MENU screen.
[4:Job]/[ENT] =goes to the Job Manager.

> When no Job is created yet, it directly goes into the "Creating new job (input a job name) " screen.



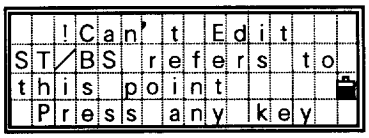
When the ST record is about to delete by [1:RAW data]->[Mode]->[1:Del]:

Action :Press any key to return to the Data view screen.



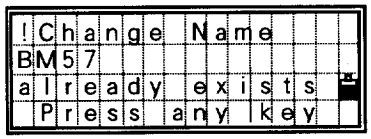
When the coordinate data which is referred by ST/BS is about to delete by [2:XYZ data]->[Mode]-> [2:Del]:

Action :Press any key to return to the Data view screen.



When the coordinate data which is referred by ST/BS record is about to edit by [2:XYZ data]->[Mode]->[4:Edit]:

Action : Press any key to return to the Data view screen.

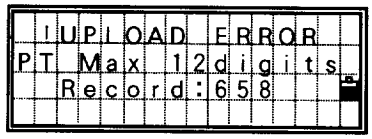


When an existing code/layer name is input by [3:Edit List]->[Mode]->[1:Add] or [3:Edit List]->[Mode]->[1:Add Layer] :

Action : Press any key to return to the code/layer name input screen.

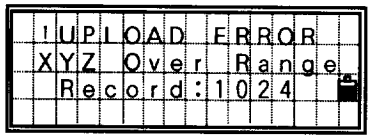
8) Comm.

If an error is detected during upload data, it aborts the process and returns the following messages.



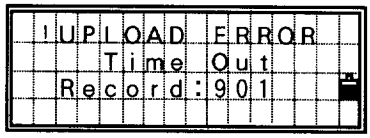
PT name/number is longer than 12 digits.

Action :Press any key to return to the MENU screen.



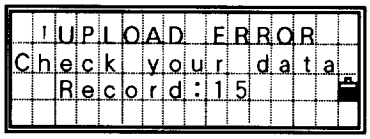
Coordinate is more than 13 digits.

Action : Press any key to return to the MENU screen.



There is no data received after one minute since the last line is received.

Action : Press any key to return to the MENU screen.



Other errors, such as an alpha is included in the coordinates or so.

Action : Press any key to return to the MENU screen.

- The "Record" number is the line number where the error is detected.
- The system will truncates the code if it is longer than 12 characters, and continue uploading.

Conforming Standards:

GS: GS approved product
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 changed 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 representative.



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