

Nikon

Field Station DTM-801 series

DTM-851/DTM-831/DTM-821

Instruction Manual

Thank you for purchasing the Nikon products. This instruction manual was written for the users of the Field Station DTM-801 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-801 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-801 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 Q-7C.)
- While recharging the battery pack, do not cover the charger with any blanket or clothing which can cause overheating. Make sure the charger is able to dissipate heat adequately. Especially do not block its air hole while recharging. If so, the gas will remain in the battery pack and may cause rupture.
- Avoid recharging in humid or dusty places, in direct sunlight, and near heaters. Do not recharge when wet. Doing so may cause electric shock, overheating or fire.
- Although the battery pack BC-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

- 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 clasp 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-801 has been used in wet conditions, immediately wipe off any moisture and dry it completely before replacing it in its carrying case. The DTM-801 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-801 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 is 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.
- 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.



CONTENTS

Warning and Caution Symbols in This Manual	1
Read This Section Before Use!	2
WARNING AND CAUTION	2
MAINTENANCE.....	5
1. NOMENCLATURE	10
2. PREPARATION	12
2-1. Unpacking and Packing the DTM-801.....	12
2-2. Recharging and Connecting the BC-80	13
2-3. Memory Card	20
2-4. Setting up the Tripod	22
2-5. Centering.....	24
2-6. Leveling.....	26
2-7. Sighting.....	27
2-8. Assembling the Prism Reflector.....	28
2-9. Face-left/Face-right Measurement	31
3. OPERATION	32
3-1. PreStart.....	34
Start-up screen.....	34
Basic measurement screen (BMS).....	36
3-2. Job Manager	65
3-3. Station Setup	71
3-4. Stakeout.....	99
3-5. Remote Measurements (RM).....	106
3-6. 2-Pt Reference Line (2REF).....	109
3-7. Cogo	113
3-8. View Data.....	121
3-9. Settings.....	133
The Main Settings Menu.....	133
Change of Setting.....	134

3-10. Communication.....	144
Uploading to the Instrument	144
Downloading from the Instrument	151
3-11. System.....	155
3-12. Emergency Menu	160
Appendix.....	169
Setting Up Feature Code, Parameter and Note Files.....	169
Download Format.....	173
Mathematical Formulae.....	185
4. CHECKING AND ADJUSTMENT	204
4-1. Plate Level.....	204
4-2. Circular Level.....	205
4-3. Optical Plummet	206
4-4. Instrument Constant	208
5. SPECIFICATIONS	210
5-1. Main Body.....	210
5-2. Standard Components.....	216
5-3. External Device Connection Connector.....	216
6. SYSTEM DIAGRAM	218

1

2

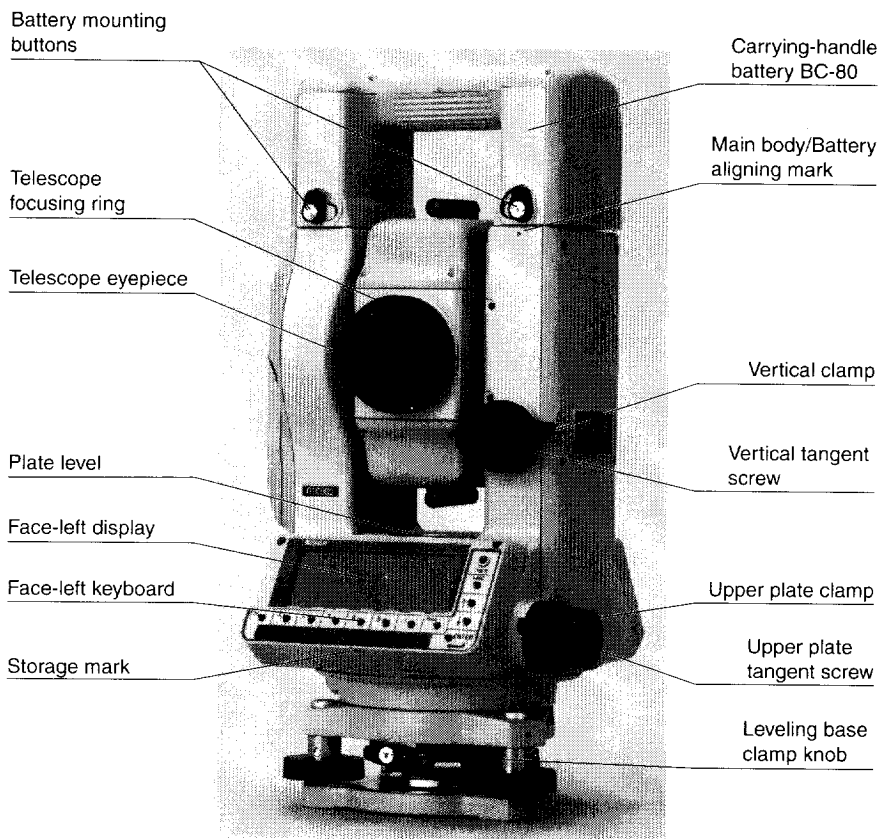
3

4

5

6

1. NOMENCLATURE



Optical sight
(Finder)

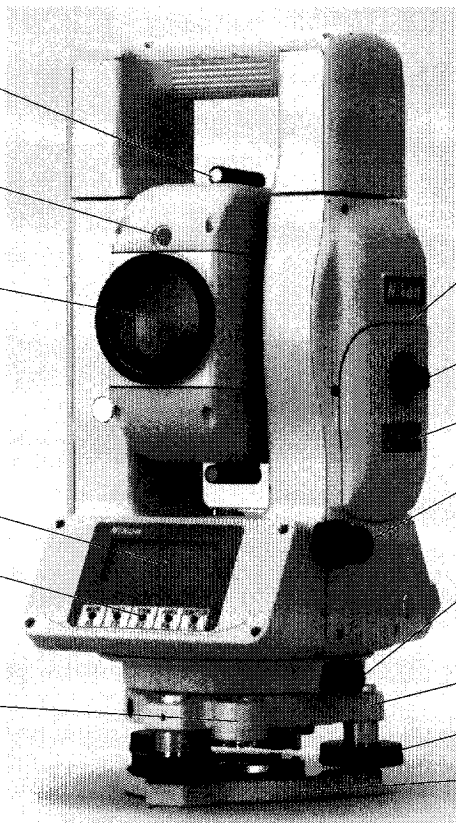
Lumi-guide
transmitter

Objective

Face-right display

Face-right keyboard

Circular level



Horizontal axis
indication mark

Card slot
cover dial

Card slot

Optical plummet

Data output/
External power
input connector

⚠ Input voltage
DC 7.2-11V

Leveling base

Leveling screw

Base plate

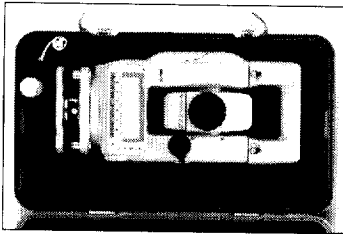
2. PREPARATION

2-1. Unpacking and Packing the DTM-801

- NOTE**
- Handle gently the DTM-801 to guard against shocks or excessive vibration.

Unpacking

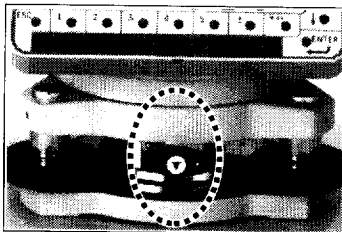
Hold the carrying-handle battery and take the instrument out of the case. The instrument is placed in its carrying case as shown in the figure.



Packing

- NOTE**
- Encase the instrument with the battery pack attached.

Set the telescope in the horizontal “face-left” position and align the storage mark (●) on the lower side 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

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. Especially do not block its air hole while recharging. If so, the gas will remain in the battery pack and may cause rupture.
- Avoid recharging in humid or dusty places, in direct sunlight, and near heaters. Do not recharge when wet. Doing so may cause electric shock, overheating or fire.
- Although the battery pack BC-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.

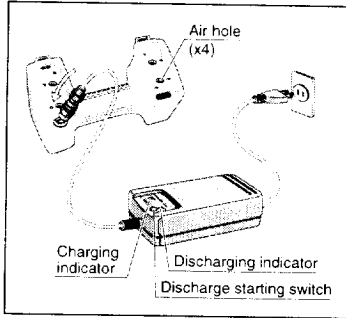
 **CAUTION**

- 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.

- NOTE**
- Recharge the battery pack indoors within an ambient temperature range 0°C to +40°C. Charging outside this temperature range will trigger a protective circuit which prevents normal recharging.
 - Keep the charging plug clean to prevent misoperation.
 - If the charging indicator blinks whenever charging starts, there is an error in the battery pack. Stop using the battery pack and contact your dealer or a Nikon representative.
 - If the battery pack is recharged within the specified ambient temperature range and the charging indicator stays lit for 4 hours or longer, something is wrong. Contact your dealer or a Nikon representative. (If an ambient temperature lowers than 0°C while recharging the battery, the charger's temperature sensor will stop the charging operation. In such a case, it is normal for the charging indicator to stay lit for 4 hours or longer. If the ambient temperature increases to above 0°C, the quick charge operation will restart and the charging will be completed within 3 hours.)

- After recharging the battery pack, do not recharge it again before using or discharging it. This is to prevent the battery pack's performance from degrading.
- During the quick charging or discharging operation, the battery pack and quick charger will become warm. This is normal.
- Temperatures of less than approx. -20°C will reduce the battery capacity. This will result in a shortened working life compared to operation at a normal temperature.
- The battery pack left disused for a long period might not be fully recharged. In such a case, charge and discharge the battery pack several times to restore its full recharging potential.
- BC-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 a 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 a 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.

- NOTE**
- 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.

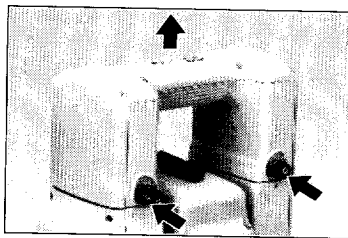
MEMO Discharging Operation

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

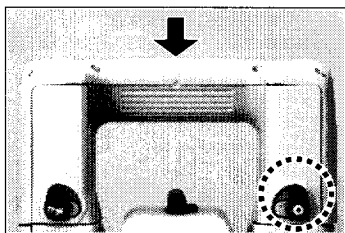
- NOTE**
- Be sure to turn off the [PWR] key before attaching or detaching the BC-80.
 - Avoid touching the battery pack BC-80 contacts.

- (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.



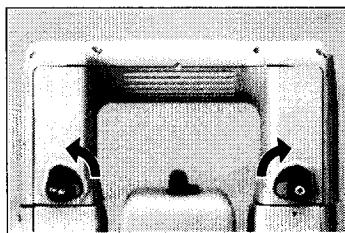
Attaching the BC-80

- (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.

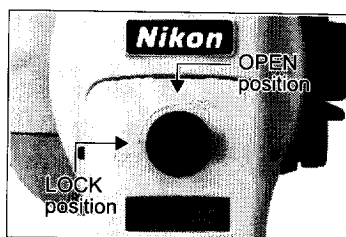
- NOTE**
- An external battery (optional accessory) is available for use with the DTM-801 series. When the external battery is connected and the battery pack BC-80 is mounted on the DTM-801, the DTM-801's electrical source will automatically be switched to the one with the higher battery power.

2-3. Memory Card

Inserting / Removing the Memory Card

- NOTE**
- Be sure to turn off the power before inserting or removing the memory card.

- (1) Turn the card slot cover dial 90° clockwise until it stops to the limit (OPEN position). Open the cover.

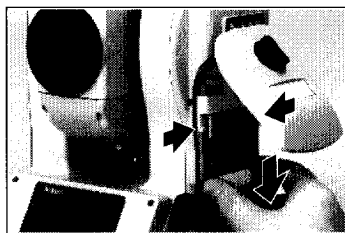


- NOTE**
- Do not turn the dial forcibly past the OPEN position, as it may break.
 - When opening the cover, pull gently in order to avoid breaking the hinge.

- (2) Insert the card into the slot so the front side of the card faces outward.
- (3) Check that the dial is still in the OPEN (vertical) position, then close the cover and turn the dial counterclockwise all the way until it stops in the LOCK position.

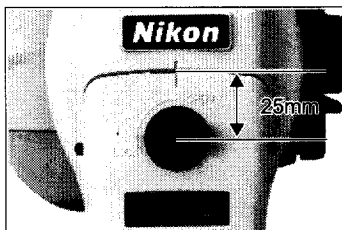
- NOTE**
- Do not force to close the cover though the dial is in the LOCK (horizontal) position, as it may break.

- (4) When removing the card from the slot, open the cover following the way of above step (1).
- (5) Push the levers in the arrow direction shown in the figure, then pull down the card to remove.



NOTE • Be careful not to drop the card, as it may break.

MEMO • There is an offset distance of 25mm between the center of the dial and the horizontal axis indication mark. Utilize this for measuring the center of the instrument height.



2-4. 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.
- 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.

- (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.

NOTE • 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-801 on the tripod head. Insert the clamp screw on the tripod into the center hole of the DTM-801's base plate and tighten.

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

2-5. 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

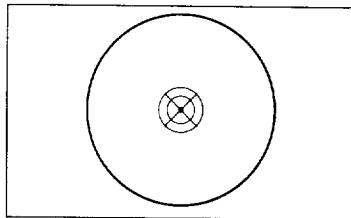
- (1) Place the instrument on the tripod head. Insert the tripod mounting screw into the center hole of the instrument’s base plate and tighten.
- (2) Hang the plumb line on the hook of the tripod mounting screw and adjust the length of the plumb line to the position the tip of the plumb bob at the height 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.


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

Using Optical Plummet

- NOTE**
- Carry out the “CHECKING AND ADJUSTMENT of Optical Plummet” (p.206) 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.206) 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.

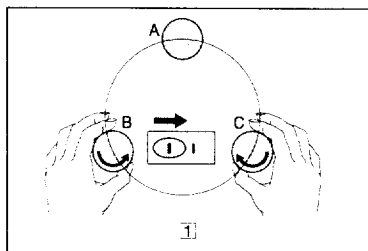


- (3) While supporting the tripod head with one hand, loosen the tripod leg clamps and adjust the lengths of the legs to center the air bubble in the circular level. Then tighten the tripod leg clamps.
- (4) Using the plate level proceed to the leveling procedures described in the next section “Leveling”.
- (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).

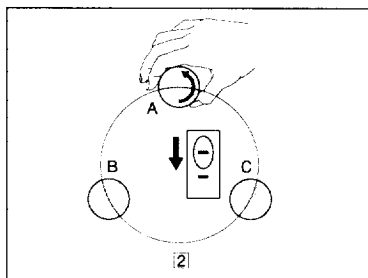
2-6. Leveling

“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).



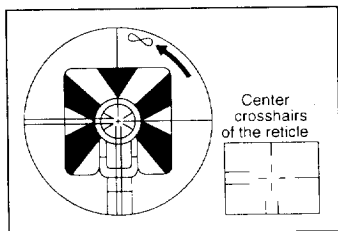
- (2) Using these two screws, move the bubble to the center of the level.
- (3) Rotate the alidade approximately 90° and again move the bubble to the center of the level by turning the leveling screw A, as shown in Figure.



- (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.204 “CHECKING AND ADJUSTMENT of Plate Level” and adjust the plate level.

2-7. 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

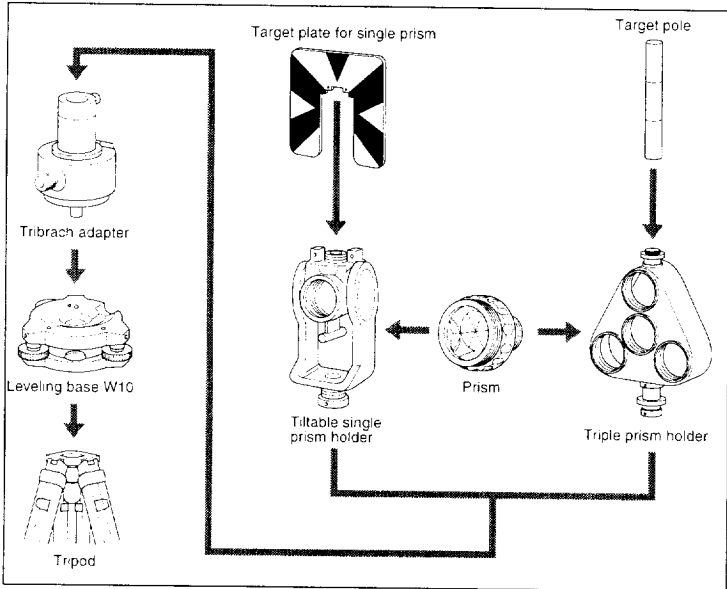
- Never see the sun through the telescope. Doing so may cause the loss of your eyesight.

Notes on sighting are as follows:

- NOTE**
- **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.

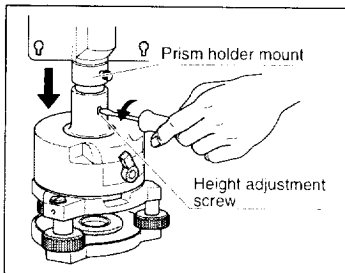
2-8. Assembling the Prism Reflector

Assemble the prism reflector referring to the Figure below.



Height Adjustment of Tribrach Adapter

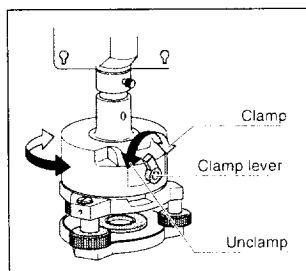
Tribrach adapter can be adjusted to two heights by sliding up and down the prism holder mount. To change the height, once remove the height adjustment screw from the tribrach adapter. Slide the prism holder mount to align the height adjustment screw holes and screw in the adjustment screw again.



- NOTE**
- When using the DTM-801 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.



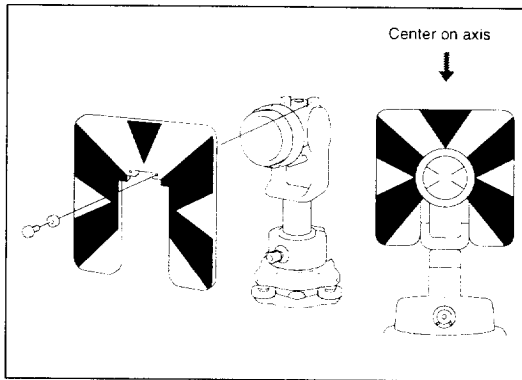
Prism Constant

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.

-
- MEMO**
- The triple prism holder is used also 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.



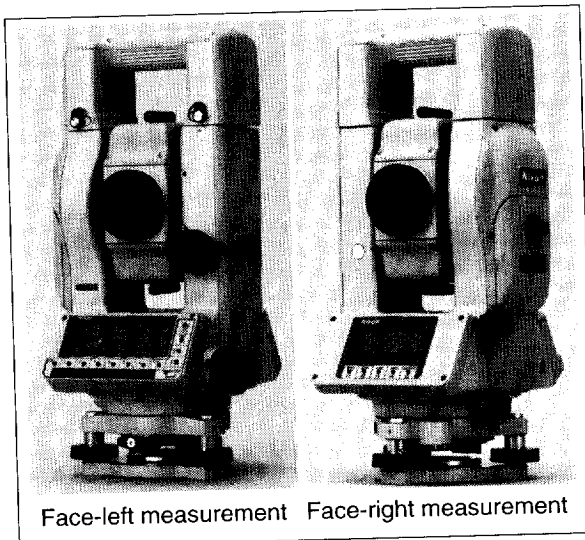
2-9. Face-left/Face-right Measurement

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

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

MEMO • 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.



2-9. Face-left/Face-right Measurement

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

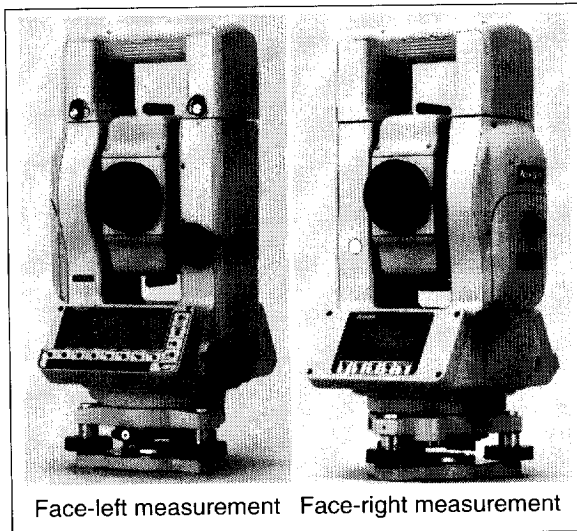
Face-right Measurement: Measurements made with the vertical circle positioned to the right of the telescope eyepiece

NOTE

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

MEMO

- 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

3. OPERATION

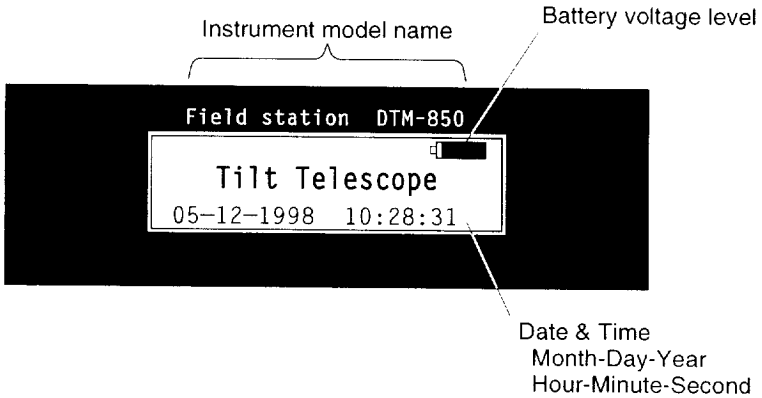
Contents of Operation

3-1. PreStart	34
Start-up screen	34
Basic measurement screen (BMS)	36
MSR/TRK	38
When recording a point	40
Input Feature Codes and Code Parameters	43
DSP	51
ANG	53
F1/F2	56
ALL	58
Note	59
MENU	61
Check Level	62
3-2. Job Manager	65
Create New Job	66
Job settings	67
Open Different Job	70
Delete Job	70
3-3. Station Setup	71
Known Station	71
2-Pt Resection Station	79
3-Pt Angle Resection	85
Quick Station	90
Remote BM	93
BS Check	98
3-4. Stakeout	99
Stakeout by Angle & Distance	99
Stakeout by Coordinate	102
3-5. Remote Measurements (RM)	106
RDM	106
REM	108
3-6. 2-Pt Reference Line (2REF)	109
3-7. Cogo	113
Pt-Pt Inverse	113
HA-HD Input	115
Area and Perimeter	117
Manual Input Coordinate	119
3-8. View Data	121
Show point details	122
DSP key	124
DEL key	125
Add point	127
Search record	129
XYZ key	132
3-9. Settings	133
The Main Settings Menu	133
Change of Setting	134

Temp-Press	135
Angle	136
Distance	137
Target Mode	138
Power Save	139
Files	140
Communications	141
Date & Time	141
Others	142
Show Settings	143
3-10. Communication	144
Uploading to the Instrument	144
Uploading From an ASCII File on the Data Card	145
Uploading From your PC through COM1	147
Error Messages in Upload	148
Acceptable ASCII data format	150
Downloading from the Instrument	151
Downloading to an ASCII file on the Data Card	152
Downloading to your PC through COM1	153
Error Messages in Download	154
3-11. System	155
Format Card	155
Calibration	157
3-12. Emergency Menu	160
Internal Data Output	161
Select Battery	165
Program Install	165
System Initialize	168
Appendix	169
Setting Up Feature Code, Parameter and Note Files	169
Creating Feature Code, Parameter and Note Files in ASCII Format	169
Sample Code List	171
Setup the Code Lists	172
Download Format	173
Nikon Download Format	173
SDR Download Formats (2x and 33)	178
Mathematical Formulae	185
Units	185
Notation	187
VA, HA and Tilt Calibration	188
Corrections	189
Coordinate Calculation	192
Known Station	192
Resection	193
Remote Benchmark	197
Remote Measurement	198
F1/F2	199
Area & Perimeter	199
Stakeout	200
2-Pt Reference Line	202

3-1. PreStart

Start-up screen

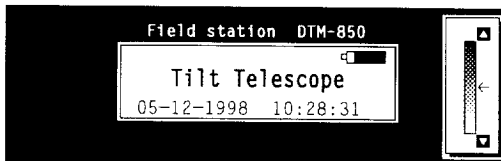


<Display density adjustment in Face-left position>

- When the up or down arrow key is pressed on the start-up screen, the display density level can be adjusted.

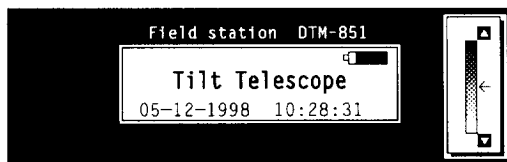
[↑] = Darken the display.

[↓] = Brighten the display.



<Horizontal Angle initializing>

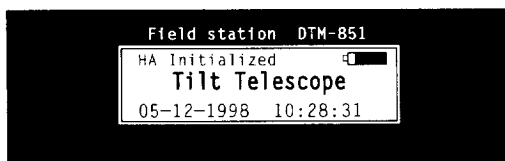
- To initialize the horizontal angle, all you have to do is to rotate the instrument before tilting the telescope.
- If you tilt the telescope without rotating the alidade, it recalls the HA value which is kept when the instrument is turned off last time.



- NOTE**
- You can initialize the Horizontal Angle by rotating the instrument before tilting the telescope while the "Tilt Telescope" message is on the screen at power ON. Otherwise, it recovers the HA when the instrument is turned off.

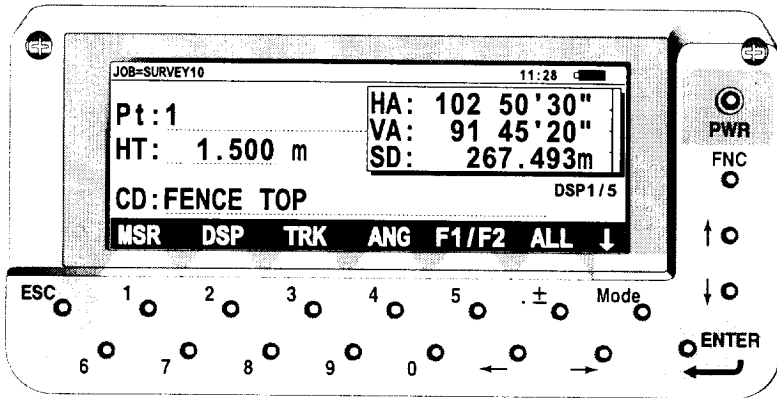
<Vertical Angle initializing>

- After tilting the telescope, it shows the screen left. The zero position of the vertical angle is set by rotating the telescope.
- Usually, you will be in resume mode so it will directly return to the last screen where you turned off the instrument.



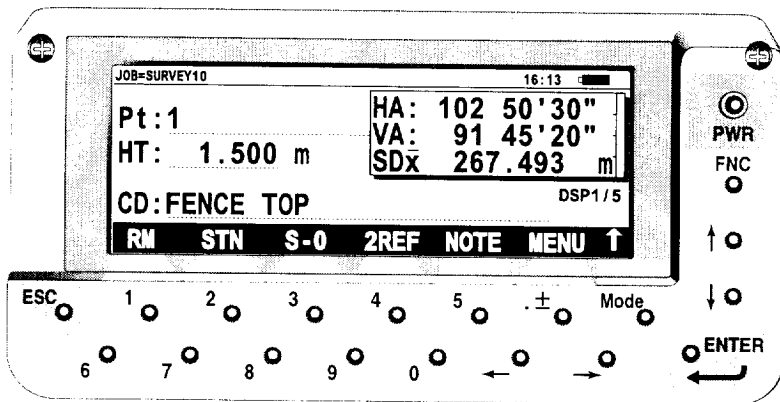
Basic measurement screen (BMS)

- After Power-ON and the “Tilt Telescope” screen, the Basic Measurement Screen (BMS) is displayed.



- [MSR] = take a normal measurement (See page 38)
- [DSP] = changes screen between 5 screens. (See page 51)
- | | |
|------------|------------|
| 1:HA/VA/SD | 4:HL/V%/HD |
| 2:HA/VD/HD | 5:N/E/Z |
| 3:HA/VA/HD | |
- [TRK] = takes a TRK measurement (See page 38)
- [ANG] = goes to angle functions (See page 53)
- [F1/F2] = activates Face2 (See page 56)
- [ALL] = takes an ALL measurement and records data (See page 58)
- [↓:Mode] = shows the second set of softkeys (See page 37)

-
- MEMO**
- From any observation screen including BMS, Stakeout and Station setup functions, the [6] key is a shortcut key to change the settings for MSR/TRK/ALL. (See page 137)
 - In the same manner as the [6] key, The Prism Constant and Target mode can also be activated by the [7] key. (See page 138)
-

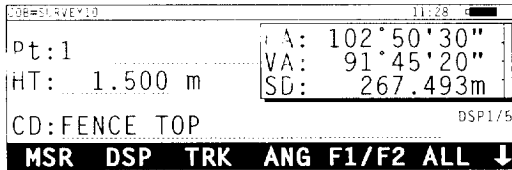


- [RM] = goes to Remote measurement functions. (See page 106)
- [STN] = goes to Station setup functions. (See page 71)
- [S-O] = goes to Stakeout function (See page 99)
- [2REF] = goes to 2-Pt Reference Line functions (See page 109)
- [NOTE] = opens Note input window (See page 59)
- [MENU] = opens Sub-function MENU window (See page 61)
- [↑:Mode] = shows the first set of softkeys (See page 36)

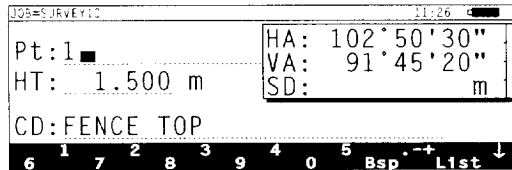
- "Pt:" can be numeric (9 digits) or alpha-numeric (16 chars), controlled by a setting. (See page 69)
- "CD:" is a field to input a feature code. The code can be alpha-numeric and up to 24 characters.

■ MSR/TRK

- Pt field is defaulted to the “Last recorded Pt + 1”
- HT and Code fields are filled with the value used previously.
- [ALL] will take a measurement and record the point with one key stroke. (See page 58)

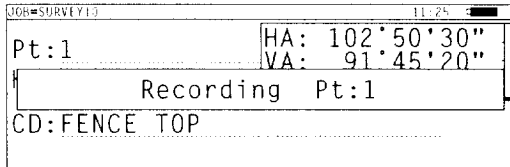


- The up and down arrow keys start input mode with the cursor in the CD field, then move the cursor between the Pt, HT and CD fields in a circular fashion. Pressing [ENT] in the CD field will finish input mode and return the softkeys from alpha-numeric to the MSR keys.



MEMO • When “2D/3D Coordinates” is set to “2D”, HT field is not displayed on the screen. (See page 142 for “2D/3D” settings)

- After recording a point, the “Pt:” will be incremented by one.

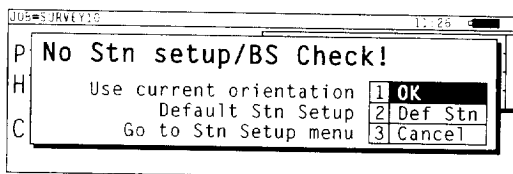


- SS records (Pt/HT/HA/VA/SD/Time/Code) will be stored in the RAW file and Coordinate records will be stored in the XYZ file, when “Store data” setting is “XYZ & RAW”. (See page 140 for “Store data” settings)

For the internal memory, only records similar to those in the RAW file are stored. A long feature code may be truncated in the internal memory.

■ When recording a point

- If the station setup is not done when recording a point, it shows a question box.

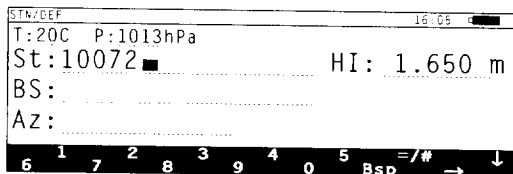


[1:OK] = adds the following CO record to the end of the RAW data file. "CO, Using Current Instrument Orientation."

[2:Def Stn] = jumps into the Def Stn setup screen.

[3:Cancel] = returns to the Stn setup menu.

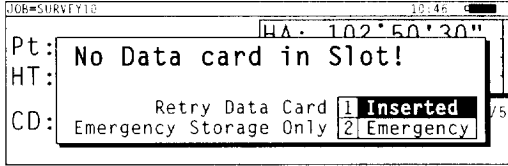
- When [2:Def Stn] is selected, it shows the Default Stn screen with the default St displayed. The default St is the "Last recorded+1".



- The following question box is displayed when you attempt to record a point without a job being opened.



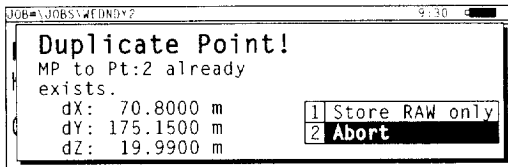
- If the data card is not inserted in the slot when recording a point, it shows a question box.



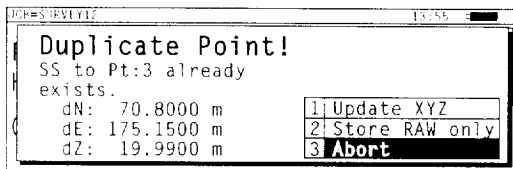
- [1:Inserted] = suspends process until a card is inserted to the slot.
- [2:Def Stn] = continues working without having a data card. Data is recorded to the Internal Backup memory.

-
- MEMO**
- When you select [2:Emergency] mode, you can setup stations, collect and stakeout points in the field but you are requested to export data from the internal backup data storage to see those records. (See page 161)
 - While you are in Emergency mode, recalling and viewing points are not available on the instrument.
-

- When a Measured record is to be stored while a manual input or calculated/uploaded Coordinate record exists under the same point name/number, only the RAW data can be stored as a check shot. XYZ data cannot be updated.



- When the XYZ data from measurement record (SS/SO/CP) already exists, there is another choice to update XYZ as well.



■ Input Feature Codes and Code Parameters

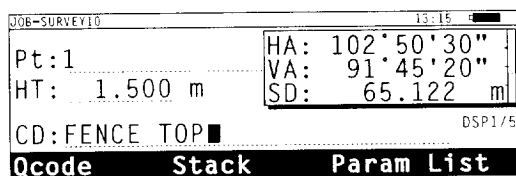
You can quickly input frequently used feature codes using the Stack and Quick Codes functions. Press the [Mode] key to get the expanded softkey while the cursor is in the CD field.

Selection lists are also available for feature codes and code parameters.

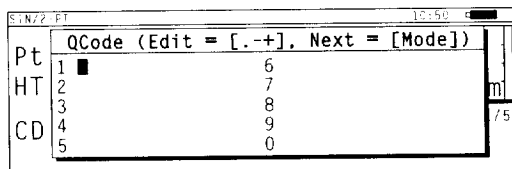
When a feature code is selected, it is added to the CD field. If a code already exists it will be overwritten by the new code. Code Parameters are added to the end of the existing code information up to 24 characters.

1) Quick Code

- On the BMS, press [↑] or [↓] key to place the cursor on the CD: field and press [Mode] key twice to display the expanded softkey below.

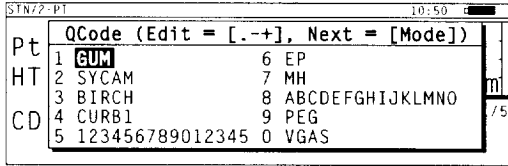


- Press the [Qcode] key to activate the Quick-code function.

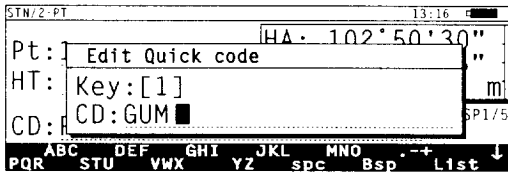


Edit Qcode

- To edit or newly assign a Quick Code, press [.] key after moving the cursor to the item you want to change.
- Or, while no code is assigned, you can just press a numeric key and press [ENT] to open a window for assigning a Quick Code.

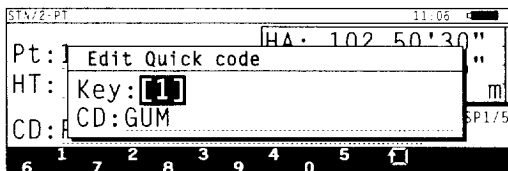


↓ [.]



MEMO • Pressing [Mode] key shows the next available set of Qcode (toggle key). Maximum five(5) sets (up to 50 Qcodes) can be defined and stored.

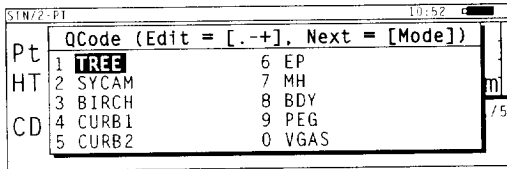
- Quick Code which is longer than 15 characters is displayed in its first 15 characters on the List window. However, you can edit whole contents in “Edit Quick code” window.
- [List] can be activated to input code from the code list as well.



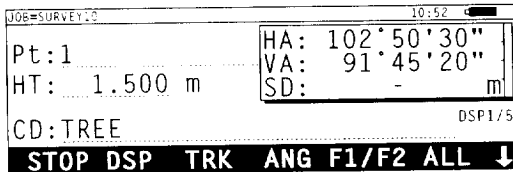
- If you want to change the “Key:” in “Edit Quick code” window, press an up arrow key to place the cursor on “Key:” field and use the circular icon or a numeric key to change the Key number.

Shooting Points from Qcode window

- Press [ENT] or numeric key which contains a desired code when the “QCode” List window is opened. A measurement is started after closing the window.
- If the key-number you choose is blank (no code is assigned yet), it doesn’t start a measurement. It simply moves the cursor to the selected key so you can press [±] key to input code.

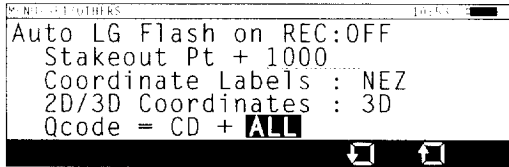


↓ [ENTER]



- After recording a point via QCode, it returns to the QCode window automatically. You can continue QCode measurement until you get out from the QCode window by pressing [ESC].

- The measurement mode is either of MSR or ALL key, depending on the setting below.
- After taking a measurement by Qcode, it records the point (Qcode=CD + ALL) or just waits for the [ENT] key to record it (Qcode=CD + MSR). It depends on the MENU/4:Settings/7:Others/QCode setting below.



- You can prepare your own List file of Quick Code as a text file. The file name is fixed to "QCODE.TXT". See below for format of the file.

Format of QCODE.TXT file

- One line is recognized as one code.
- Maximum 50 codes (5 pages) can be used. It shows 10 codes from the top of the list in one display. The second set starts at the 11th item.

TREE	→ for key [1]
SYCAM	→ for key [2]
BIRCH	→ for key [3]
CURB1	→ for key [4]
CURB2	→ for key [5]

By this list, the key [6] to [0] are left blank.

2) Using Stacked Codes

- Each time you enter a code, the code you recorded with a point is automatically “stacked” and stored for future use. The stack may contain up to 20 codes. Pre-Installed software puts the last used code at the bottom of the stack and displays it on the screen as a default.
- To select the previous code, press the [Stack] key. It shows the previously used code one by one directly on the “CD” field.

JOB=SURVEY10		16:54
Pt: 1	HA: 102°50'30"	
HT: 1.500 m	VA: 91°45'20"	
	SDX: 65.122 m	
CD: BM		
Qcode	Stack	Param List

↓ [Stack]

JOB=SURVEY10		17:01
Pt: 1	HA: 102°50'30"	
HT: 1.500 m	VA: 91°45'20"	
	SDX: 65.122 m	
CD: TREE		
Qcode	Stack	Param List

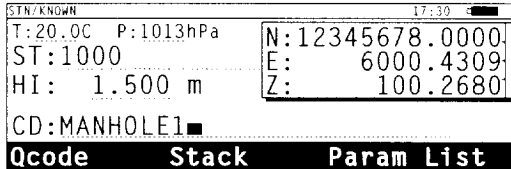
- When the [Stack] key is pressed while it shows the oldest code in stack, the indication will go back to the latest one. For instance, when “BM”, “TREE”, and “CURB” are in the Stack, it changes code in the CD: field like “BM” → “TREE” → “CURB” → “BM”, if the [Stack] is pressed three times.

MEMO

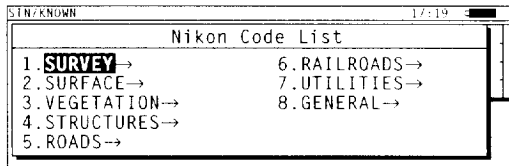
- If you want to install a specific set of Stacks before you go to the field, you can copy the file as “STACK.TXT” to the root directory in the datacard. When the instrument is rebooted and its time stamp is newer than the one in the instrument, the Stack will be replaced by the one in the datacard.
- The file format of “STACK.TXT” is the same as the one for “QCODE.TXT” file. (See page 46)

3) Using Code List file

- Press [List] to enter the Code list function.

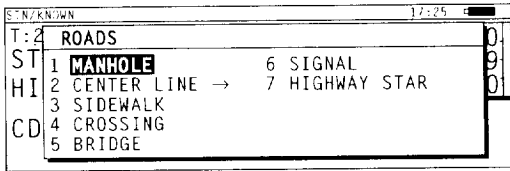


↓ [List]



- When [List] is selected, the first layer of the code list is displayed. In this example, there are eight titles. A right arrow (→) indicates that the item has some codes under each title.

- When you pressed [5] key or four times of down arrow key and [ENT], it shows the second layer under “ROADS”.



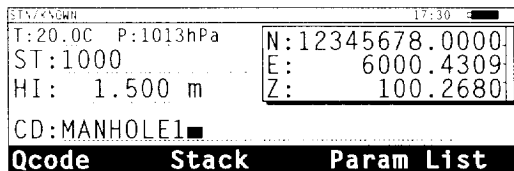
- A code is input to the CD: field when you select a code from the list. In the above example, press [ENT] to input “MANHOLE” to the CD: field. Or, you can input “SIGNAL” by pressing [6] key.

MEMO • You can make your own Feature Code List on your PC. The List is a text file and its format is explained in Appendix. It has the same format as Code Parameter List. (See page 169 through 172)

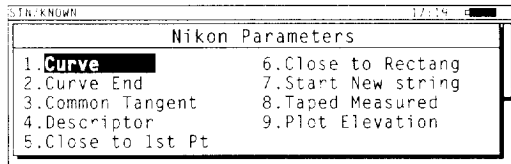
4) Using Code Parameter file

A feature code parameter is a device that can reduce the number of shots in the field and gives you the freedom to take shots in the most efficient manner. For instance, you can control the shape of the lines between points by attaching appropriate parameters when you store those points.

Feature code parameters are added to feature codes and have a one or two character identifier.



↓ [Param]



- Press [ENT] on any desired item or select it by corresponding numeric key. The feature code parameter is appended to the end of the existing feature code.

MEMO • You can make your own Code Parameter List on your PC. The List is a text file and its format is explained in Appendix. It has the same format as Feature Code List. (See page 169)

■ DSP

- During Basic Measurement five sets of measured data can be displayed in the “Measure Box” by pressing the [DSP] key. You can press [DSP] before, during or after a distance measurement is taken. Elevation values (VD & Z) will be dynamically updated in the vertical plane after a distance is measured and the telescope is moved.
- From any of these screens, “Pt/HT/HA/VA/SD/Time/Code” will be stored to the RAW file and “Pt/X/Y/Z/Code” to the XYZ file by pressing [ENT] or [ALL] on basic measurement screen.

JOB= SURVEY10		9:46	
Pt: 200	HT: 1.700 m	HA: 56°40'10"	VA: 90°25'30"
		SD \bar{x} : 267.490 m	
CD: POB CT		DSP1/5	
MSR DSP TRK ANG F1/F2 ALL ↓			

- When any sub-function is called from “HA/VD/HD”, “HA/VA/HD”, “HL/V%/HD” or “N/E/Z” screen, it returns to the same screen after performing the sub-menu function.

JOB= SURVEY10		9:46	
Pt: 200	HT: 1.700 m	HA: 56°40'10"	VD \bar{x} : -8.190 m
		HD \bar{x} : 267.365 m	
CD: POB CT		DSP2/5	
MSR DSP TRK ANG F1/F2 ALL ↓			

- From any of these screens, you can take a measurement and record the point.

JOB= SURVEY10		9:46	
Pt: 200	HA: 56°40'10"	VA: 90°25'30"	
HT: 1.700 m	HDX: 267.365 m		
CD: POB CT	DSP3/5		
MSR DSP TRK ANG F1/F2 ALL ↓			

JOB= SURVEY10		9:47	
Pt: 200	HL: 303°19'50"	V%: -3.065 %	
HT: 1.700 m	HDX: 267.365 m		
CD: POB CT	DSP4/5		
MSR DSP TRK ANG F1/F2 ALL ↓			

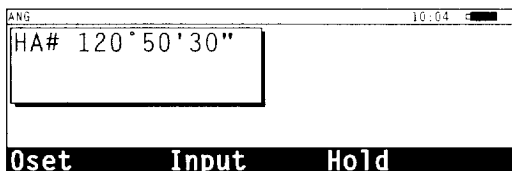
JOB= SURVEY10		9:47	
Pt: 200	N: 40.576	E: 360.677	
HT: 1.700 m	Z: -8.290		
CD: POB CT	DSP5/5		
MSR DSP TRK ANG F1/F2 ALL ↓			

- [DSP] key is also available on Face2.

HA: 236°40'00"	[DSP] →	HA: 236°40'00"
VA: 270°25'15"		VDX: -8.180 m
SDx 267.496 m		SDX 267.360 m
DSP 1/5		DSP 2/5

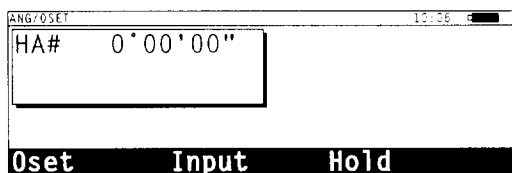
■ ANG

- ANG function has three sub-functions. They are HA zero set, Input HA and Hold HA.
- Press [ANG] on the BMS to get into ANG menu below.



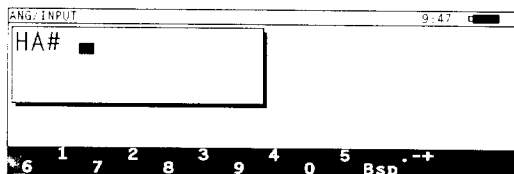
1) HA zero set

- When 1.[Oset] is pressed, the HA is reset to zero and the software returns to the BMS.

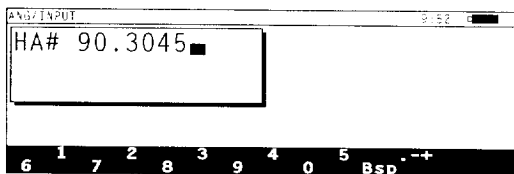


2) HA input

- When 3.[Input] is pressed, the HA is cleared and the cursor is displayed for input.



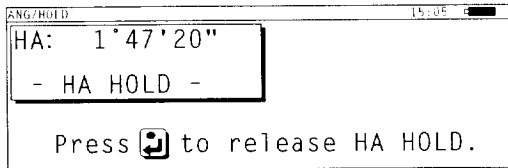
- For instance, to input 90°30'45", type 90.3045 by numeric softkey and press the [ENT] key.



- To cancel the current input and retrieve the previous HA, press the [ESC] key before pressing [ENT]. Press [ESC] again to return to BMS.

3) HA Hold

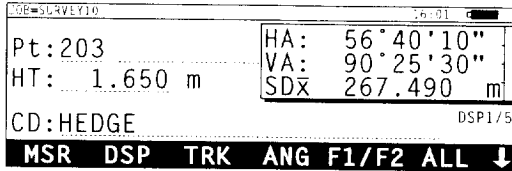
- When 5.[Hold] is pressed, the HA Hold function is activated.



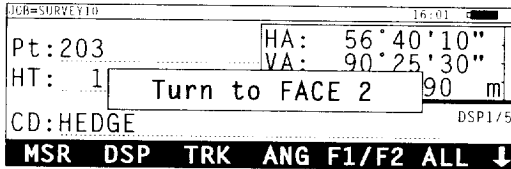
- HA is fixed to the value displayed when [Hold] is pressed.
- Rotate the instrument to the desired direction and press [ENT] to release the HA holding.

■ F1/F2

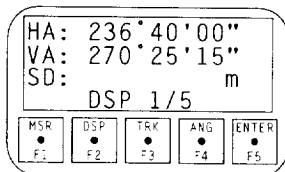
- On the basic measurement screen (BMS), press the [F1/F2] key to take a Face2 shot to the current target.



↓ [F1/F2]

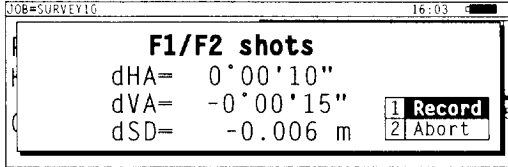


- Flip the telescope to take a Face2 shot.
- Press [ESC] to cancel Face2 shot. It closes the message window.
- While the telescope is on Face2, all keys but ESC, FNC and PWR on Face1 will be ignored.
- A message "Return to Face1" appears after a measurement is taken.



- [MSR] = takes a measurement by MSR mode.
- [DSP] = changes the screen among 5 DSP screens.
- [TRK] = takes a measurement by TRK mode.
- [ANG] = takes an angle shot.
- [ENT] = (takes an angle shot)

- The delta informations between F1 and F2 shots are shown, when the telescope is returned to Face1.

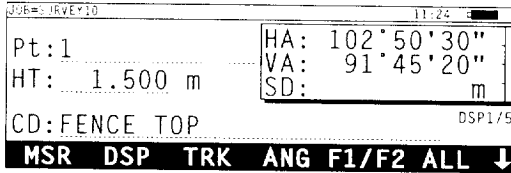


- [1:Record] = calculates SS by averaging F1/F2 and record SS(XYZ) to the XYZ file. If the “Store data” is set to “XYZ & RAW”, then F1/F2/SS(Raw) are stored to the RAW data file as well.
- [2:Abort] = discards F1/F2 data and returns to the BMS on Face1.

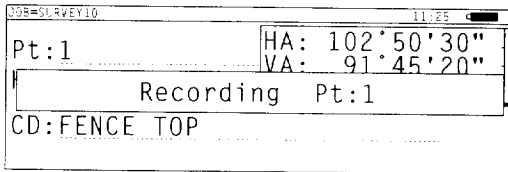
MEMO • When either F1 or F2 is taken as an angle shot, the delta SD field will be left blank. In this case, the coordinate cannot be calculated by this observation. To record the coordinate, you need to take a distance measurement in both faces.

■ ALL

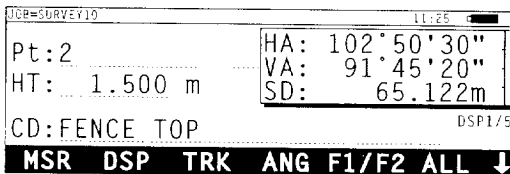
- The 'ALL' softkey allows you to "shoot the point and record it" by one keystroke. Displayed "Pt:", "HT:", and "CD:" are stored with the measured angles, distance and time.



- Pressing [ALL] starts the distance measurement according to the distance setting (See page 137). When the measurement is completed, it directly proceeds to record the point.



- After recording the point, the next available point number/name is shown in the "Pt:" field.



■ Note

- Press 5.[Note] key on the second set of softkey for the BMS to input a comment record.

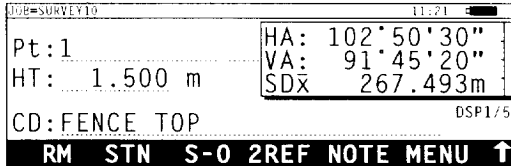
```
JOB= SURVEY1C 10:08
Pt: 55 HA# 102°50'30"
HT: 1.640 m VA# 91°45'20"
CD: FENCE SD: 267.493m
DSP1/5
RM STN S-0 2REF NOTE MENU ↑
```

- Up to 40 characters can be input in one Note record.
- [Mode] key changes the softkey between numeric and alpha-numeric.
- Press [ENT] to store the Note record.

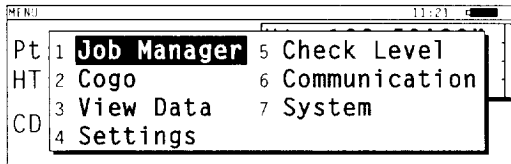
```
JOB= SURVEY1C 12:55
Pt: 55 HA# 102°50'30"
Input Note Record
HT=1.526M
CD: FENCE
ABC DEF GHI JKL MNO
PQR STU VWX YZ spc Bsp -+ L1st ↓
```


■ MENU

- Press [MENU] to show a menu window.



↓ [MENU]



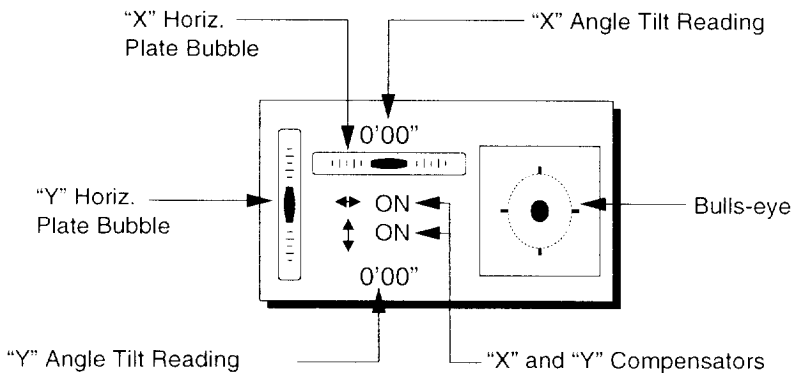
- 1:Job Manager: Job create/delete/open
- 2:Cogo: Survey point calculations
- 3:View data: Show/Add/Delete record
- 4:Settings: Settings for instrument and observation
- 5:Check Level: Display the electronic leveling bubble
- 6:Communication: Upload/Download functions
- 7:System: Format data card/Instrument Calibration

FNC: Hardware switch: Available from any screen in any situation. (1:Backlight, 2:Reticle Light, 3:LumiGuide, 4:LCD Heater, 5:Sound Level and 6:LCD Contrast Adjustment)

■ Check Level

This screen allows you to accurately level the instrument using the software and turn the leveling compensators on or off. Once the instrument is leveled, and assuming that the compensators are reading (turned on and adjusted within their working tiltrange), the measured angles will be compensated for instrument tilt.

MEMO • The leveling window pops up automatically during any measurements if the instrument goes out of level while the compensators are turned on. Also, you can display the leveling window from Check Level function by pressing MENU/5:Check Level.



Leveling the Instrument

Three on-screen devices are available to help you to level the instrument. You still use the instrument's leveling screws to adjust the level of the instrument.

Bull's-Eye and X and Y Horizontal Plate Bubbles-Center the bull's-eye and bubbles.

X and Y Tilt Angle Readings-The software displays each reading within the range $\pm 3'30''$ if the compensator is turned "ON". When the instrument goes out of level more than $3'30''$, it shows "OVER" instead of the angle reading.

When a measurement is taken, the X tilt angle compensates the horizontal angle and the Y tilt angle compensates the vertical angle.

Horizontal and Vertical Compensators

You can turn the horizontal and vertical compensators on or off. Use the \uparrow and \rightarrow to change the status of the compensators in the order ON/ON, OFF/ON, and OFF/OFF. (\downarrow and \leftarrow reverses the order.)

WARNING

- If you turn the compensators off they will remain off until you turn them on again. The current state of the compensators is maintained even if you turn the instrument's power off, then on again.

In this case, you need to display the leveling window by MENU/5:Check Level.

The BMS shows the status of the Tilt Sensors by showing "VA:" when the Y tilt sensor is ON, and "VA#" when it is OFF. Similarly, "HA:" is displayed when the X tilt sensor is ON, and "HA#" when it is OFF.

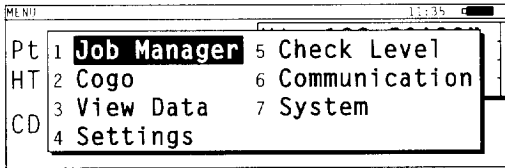
Close Leveling Window

- Press [ENTER] or [Esc] to close the window.

MEMO • The software will allow you to close the window when the instrument is out of level, regardless of whether the compensators are on or off.

3-2. Job Manager

- This chapter introduces you how to create/open/delete a job.
- Press [MENU] key in the second set of softkeys on the BMS. You can select [1. Job Manager] to enter this function.



- When entering the Job Manager from the menu, it shows a list of files, directories and the current open job.
- When all necessary files exist, it displays them as a Job. Other files (non-JOB-related) will be shown with their full DOS extensions.

The screenshot shows a terminal window titled 'MENU/JOB MANAGER' with a time of 16:04. The window displays a list of jobs with columns for Job Name, Job ID, Date, and Time. The 'RAIL1' job is highlighted.

B:JOBS		Job-B:\JOBS\ASURVEY10	
JOBS	<DIR>		
RAIL1	JOB	4806	01-09-97 07:18
RAIL77	JOB	5170	01-12-97 09:43
SIGHT80	JOB	8254	02-02-97 14:43
SIGHT81	JOB	15392	02-08-97 16:05
TSP_OBJ	ASC	2048	10-09-97 19:50

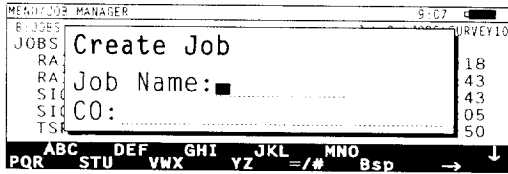
At the bottom of the screen, there are softkey labels: CrJob, DEL, Pg↑, and Pg↓.

- [CrJob] Create Job.
- [DEL] Delete Job/Directory.
- [↑][↓] Scroll up and down, one by one.
- [Pg↑] Show the previous page, if any.
- [Pg↓] Show the next page, if any.

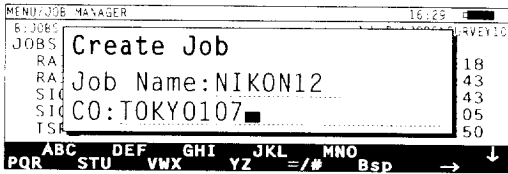
- When [ENT] key is pressed on a Job name, it opens the highlighted job.

■ Create New Job

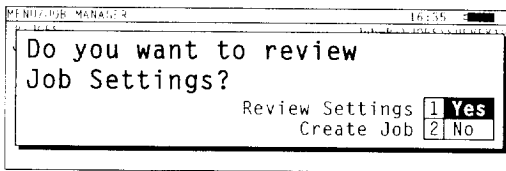
- Pressing the [CrJob] softkey displays a window to enter a new Job name and comment.
 - * Job name is up to 8 characters. (No extension)
 - * Comment is up to 20 characters.



- Pressing the [ESC] key returns to the Basic measurement screen.



- Pressing [ENT] at the CO: field proceeds to the next screen.



- [1:Yes] Goes through the job settings before creating the job.
- [2:No] Creates job immediately using the current job settings.

■ Job settings

[1] Corrections

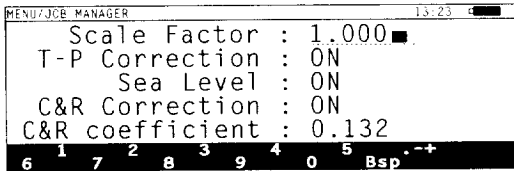
Scale Factor: 1.000 (numeric input)

T-P Correction: ON/OFF

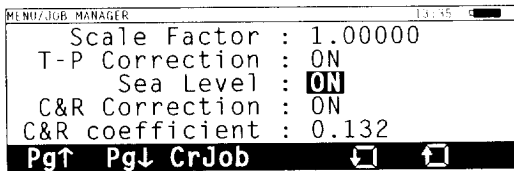
Sea level: ON/OFF

C&R coefficient: 0.132/0.200

- “Scale Factor” can be input by numeric softkeys. You can input the value between 0.9000 and 1.1000 for the Scale Factor.



- Press the down arrow key to change other settings on this screen. For all correction settings, the softkeys change to circular selection icons. You can change the setting by pressing those circular icons on [5] or [.-+] key.



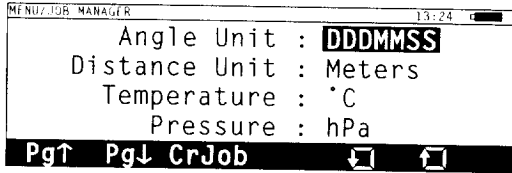
[2] Unit

Angle Unit: DDMMSS/GON/MIL6400

Distance Unit: Meters/Feet-Int'/Feet-US

Temp: °C/°F

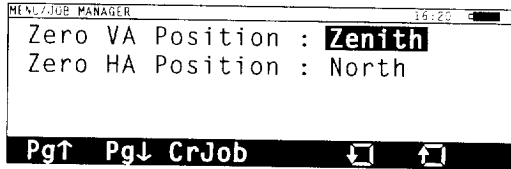
Press: hPa/mmHg/inHg



[3] Angle

Zero VA Position: Zenith/Horizontal

Zero HA Position: North/South

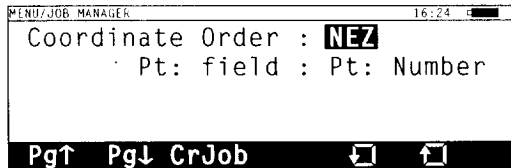


[4] Coordinates

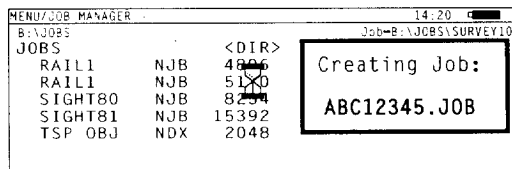
Coordinate Order: NEZ/ENZ

Pt: field: Pt: Number/Pt: Name

- When you choose "Pt: Number" as Pt., you can use 9 digits of point number system. If you select "Pt: Name", you can use 16 characters of point name (number and alphabet) system instead. This definition cannot be changed once the Job is created.



- When you finish going through all settings or you press [3:CrJob] at any screen, it proceeds to create a job. After a job is created, it exits from Job Manager and then you are brought back to the BMS.
- These JOB settings will be written to the RAW data file as well.

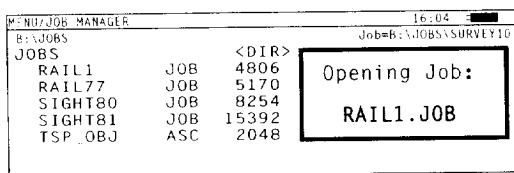


MEMO

- All Job settings are each job specified. You cannot change any of them once the Job is created.
- Once you create a Job going through the Job settings, they are shown as default when you create next Job.

■ Open Different Job

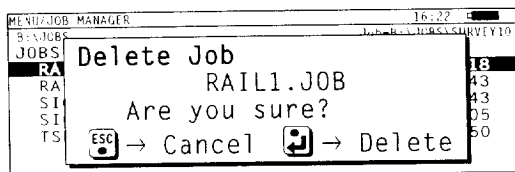
- The path and name of the current job is displayed on the top right corner of the screen.
- Use the following keys: Up and down one line [\uparrow] and [\downarrow]; up and down one page [Pg \uparrow] and [Pg \downarrow].
- Move the highlight to a Job you want to open and press [ENT].



MEMO • Job created by V1.02 of Pre-Installed software cannot be used in later version directly.
 If you download the Job from V1.02 in Nikon Raw data/Coordinate format and upload them to a Job created by later version (after V1.10) via TransIt™ software, all coordinates can be restored and you can continue working on the Job.

■ Delete Job

- Move the highlight to a Job you want to delete and press the [Del] softkey.
- When the [Del] key is pressed, it shows a confirmation window to delete the highlighted job.
- Press [ENT] to delete the specified Job, or [ESC] to return to the Job Manager screen.



3-3. Station Setup

- This chapter describes four ways of setting up the instrument, Known Station, 2-Pt Resection, 3-Pt Angle Resection, and Quick Station, as well as Remote Benchmark which enables you to determine the station elevation, the height of instrument, or the instrument elevation. A Backsight Check function is also included.
- To reach to the Station Setup menu, press the [STN] of [2] key.

JOB=SURVEY10		10:13
Pt:1	HA: 102°50'30"	DSP1/5
HT: 1.500 m	VA: 91°45'20"	
	SD: 267.493m	
CD:FENCE TOP		
RM STN S-0 2REF NOTE MENU ↑		

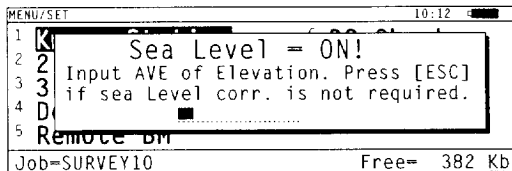
-
- MEMO** • When "2D/3D Coordinates" is set to "2D", HI and HT field are not displayed on the screen. (See page 142 for "2D/3D" settings.)
-

■ Known Station

- Use this function if you are setting up over a known station and backsighting to a known point or azimuth. The known station and backsight points may be found in the current job or be manually input.

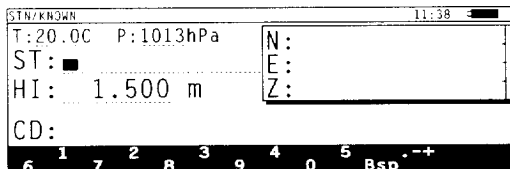
MENU/SET		10:11
1	Known Station	6 BS Check
2	2-Pt Resection	
3	3-Pt Angle Resect.	
4	Quick Station	
5	Remote BM	
Job=SURVEY10		Free= 382 Kb

- When the setting is “2D” + “Sea Level = ON”, an elevation input window is shown by selecting [1:Known Station].
- [ESC] or [ENT] without Elevation sets zero and closes the window.

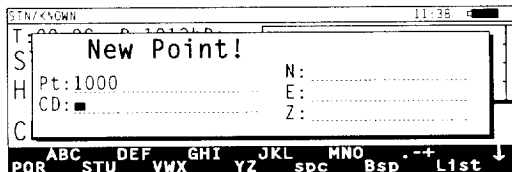


Enter Station Point

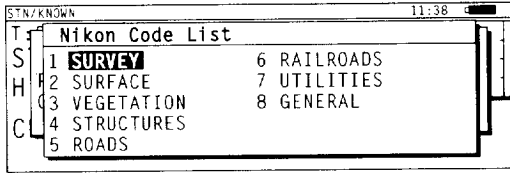
- Input the Stn point. The coordinate will be shown if it exists in the DB. When a new Pt: is input, a Pt: input window will be opened.
- When the down arrow key is pressed the cursor moves ST→HI→T→P→ST.... The direction is reversed when the up arrow key is pressed.



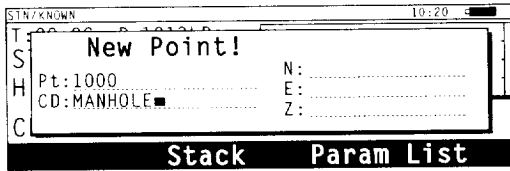
- If a new Pt: is input, it shows a new point input window.
- Input the Code. It can be left blank.



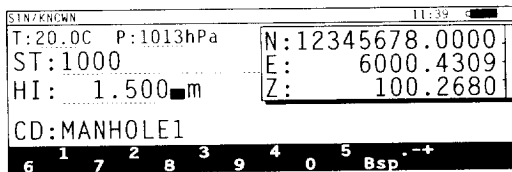
- [List] activates a code selection list specified in the settings.



- Pressing the [Mode] key on CD: changes softkeys.
- Some parameters can be added to the code by the [Param] key.



- [Stack] = displays feature codes in Stack one by one.
- [Param] = activates a parameter selection list specified in the settings.
- [List] = activates a code selection list specified in the settings.
- Pressing [ENT] in the HI field accepts the displayed values and changes to the BS input screen.



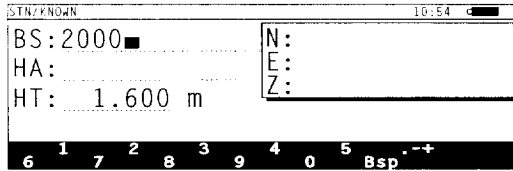
3

OPERATION

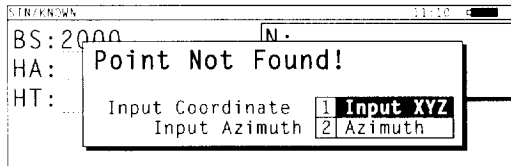
Enter Backsight Point or Azimuth _____

(1) Input BS Pt:

- It is possible to input the BS Az without a BS(Pt):
- Use the down arrow key to move to HA: and input a BS Az.
- The last used HT value is used as a default.

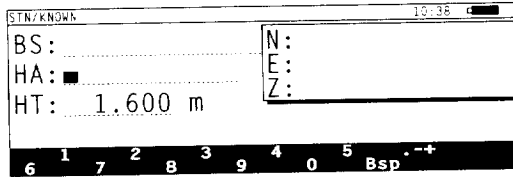


- When an unknown point is input, user can choose to enter Coordinates or Azimuth to that Pt.
- Pressing [2:Azimuth] closes the window and goes to the HA: field allowing Azimuth angle input.



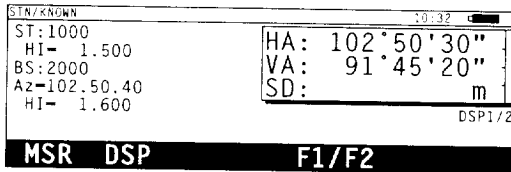
(2) Input BS Azimuth

- When the down arrow key is pressed from the BS: field, a BS AZ can be input without defining a BS Pt.

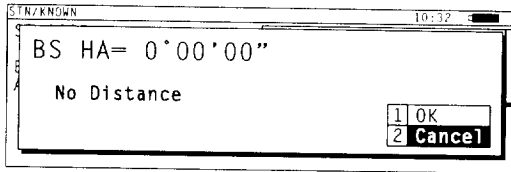


Sight Backsight and Measure

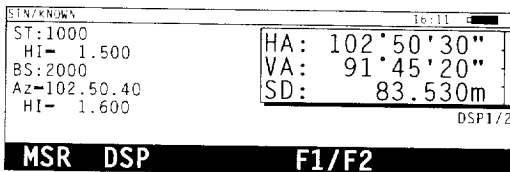
- Sight the BS point and press [MSR] or [ENT].
- When you need to take a measurement only on Face1, you can finish the setup by pressing [ENT] after the measurement is completed.
- There are data display windows for “HA/VA/SD” and “HA/VD/HD”. Use [DSP] to cycle through the measurement display boxes.



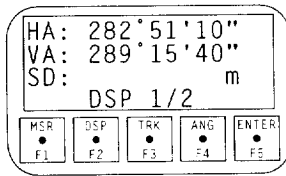
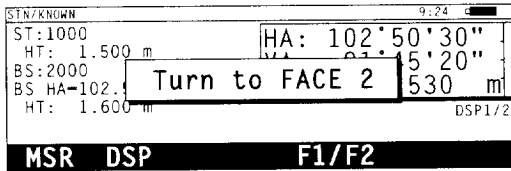
- [ENT] takes an angle measurement to the BS.



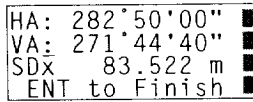
- After a MSR shot is taken, you can re-measure, or just accept the value and complete the Stn-Setup by pressing [ENT].
- You can take a shot on Face2 by pressing [5] key here.



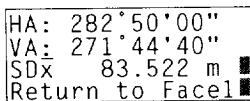
- When the [F1/F2] key is pressed, a message window is displayed and the Face2 is activated.



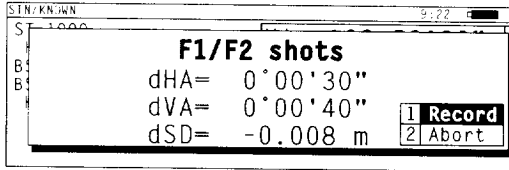
↓ [F1/MSR]



- A message "ENT to Finish" appears after a measurement is taken. Re-measuring to the prism by [MSR]/ [TRK]/[ANG] is also available on this screen.
 - [MSR] = takes another measurement.
 - [DSP] = changes the screen (HA/VA/SD or HA/VD/HD).
 - [TRK] = takes another measurement by TRK mode.
 - [ANG] = takes another angle measurement.
- When you finish observation on Face2, press [ENT] to return to Face1.



- After pressing the [ENT] key on Face2, it shows the delta window on Face1. If the either shot is an angle shot, dSD is left blank.

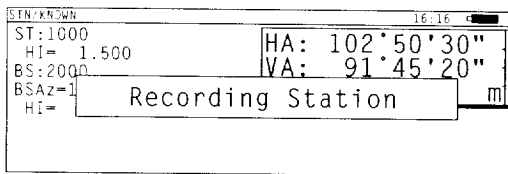


[1:Record] = proceeds to recording Station.

[2:Abort] = returns to the BS measurement screen.

MEMO • The delta values are recalculated by original F1 and the latest F2.

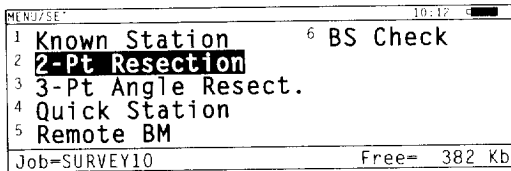
- By pressing [ENT], it records the Station data and BS data.
- It returns to the basic measurement screen after recording STN.



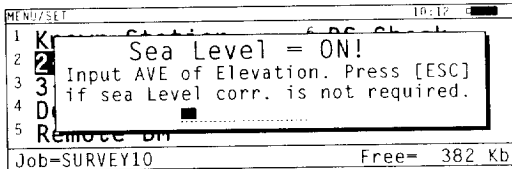
■ **2-Pt Resection Station**

- The resection procedure results in a (RE) coordinate record, a ST record for the station point and F1 records of the measurements taken.

A 2-Pt Resection with one distance and one angle is available when the distance between the two target points P1 & P2 is greater than the distance measured.



- When the setting is "2D" + "Sea Level = ON", an elevation input window is shown by selecting [2:2-Pt].
- [ESC] or [ENT] without Elevation sets zero and closes the window.



3-3. Station Setup

- Input the first known point. If the point is new, it opens a new point input window.

STN/2-PT 10:09

P1: ■	HA: 63°10'20"
HT: 1.500 m	VA: 89°07'10"
	SD: m

DSP1/2

1 2 3 4 5 Bsp -+
6 7 8 9 0

STN/2-PT 11:18

New Point!

Pt: 1011	N:
CD: ■	E:
	Z:

ABC DEF GHI JKL MNO
PQR STU VWX YZ spc Bsp -+ L1st ↓

- Take a measurement to the first point.
- [DSP] key changes contents of the box between "HA/VA/SD" and "HA/VD/HD".
- If you are going to take angle shots to the backsight by Face1 and Face2, you can just press [5:F1/F2] on this screen.

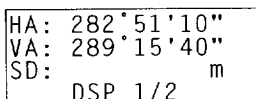
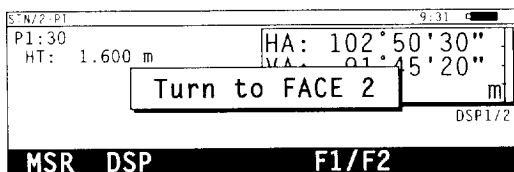
STN/2-PT 11:38

P1:30	HA: 102°50'30"
HT: 1.600 m	VA: 91°45'20"
	SD: m

DSP1/2

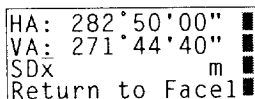
MSR DSP F1/F2

- When the [F1/F2] key is pressed, a message window is displayed and the Face2 is activated.



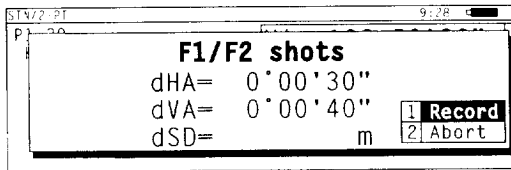
- [MSR] = takes another measurement.
- [DSP] = changes the screen (HA/VA/SD or HA/VD/HD).
- [TRK] = takes another measurement by TRK mode.
- [ANG] = takes another angle measurement.

- If you take an angle shot to the backsight point on Face2, just press [ENT] or [ANG]. The observation is finished by one key and it leads you to the Face1 to see the delta information.

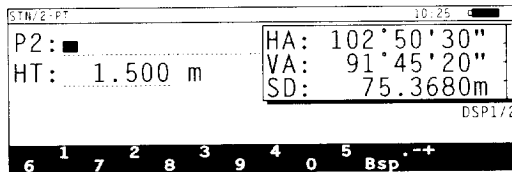


3-3. Station Setup

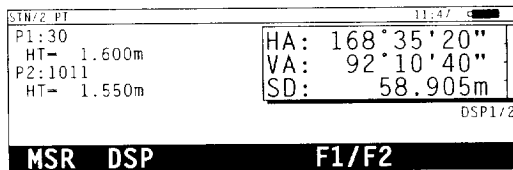
- "dHA/dVA/dSD" between F1 and F2 shots are displayed. When you take a distance measurement on both faces, dSD is shown as well.
- Press [1] or [ENT] to proceed to the second point input.



- Input the second known point.
- When the input point is not found in the current Job, a point input window is opened and you can input the coordinate on the spot.



- After taking a measurement to the second point, press [ENT] to accept the measurement and record it.

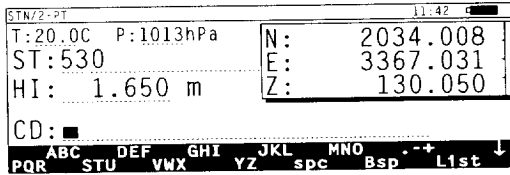


[MSR] = takes another measurement.

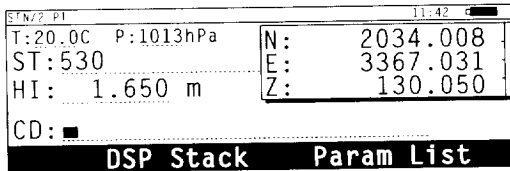
[DSP] = changes the screen (HA/VA/SD or HA/VD/HD).

[F1/F2] = activates Face2. If a distance measurement is not taken, it also takes an angle measurement by [F1/F2].

- After taking two measurements and pressing [ENT], it shows the calculated coordinates of the station point. The cursor waits for CD input.
- ST: is defaulted to “the Last recorded Pt + 1”. When you change HI, you can use the up/down arrow key to move the cursor to the HI: field.



- Pressing [Mode] key on CD: from any field returns to the second known point input screen.

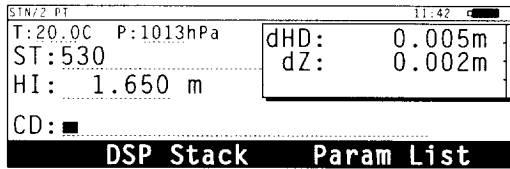


- [DSP] = changes the screen (N/E/Z or dHD/dZ).
- [Stack] = shows Feature codes in Stack one by one.
- [Param] = displays a Code Parameter List.
- [List] = displays a Feature Code List.

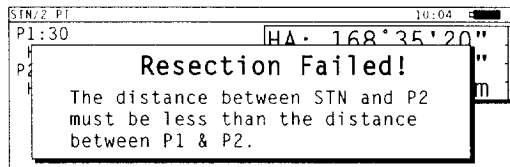
- [ENT] = records this station.
- [ESC] = returns to the input screen for known point 2.

3-3. Station Setup

- The second DSP screen for calculated Station. Delta HD is the difference between the calculated distance from P1 & P2 coordinates, and the distance calculated from two measurements.
- The cursor still waits for a Code input. The [List] key is available to input a Code and the [Param] key is available for additional parameters.
- Input Feature Code or press [ENT] to record Station.

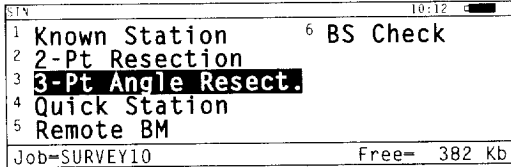


-
- MEMO**
- At least one distance measurement must be taken to calculate the Station coordinate.
 - In one-Angle & one-Distance Resection, if the distance between two known points are shorter than the measured distance, the station coordinate cannot be calculated properly. It shows an error screen. Press any key to return to the P2 input screen.
-

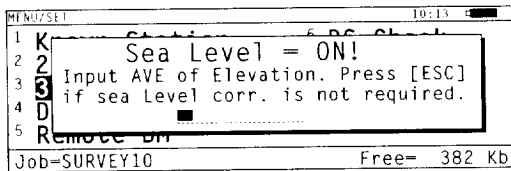


■ **3-Pt Angle Resection**

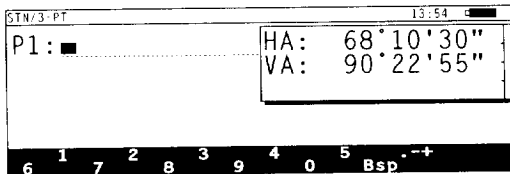
- To achieve the coordinate and ST record for the station in 3-Pt Angle Resection, you must take three angle measurements.



- When the setting is "2D" + "Sea Level = ON", an elevation input window is shown by selecting [3:3-Pt].
- [ESC] or [ENT] without Elevation sets it to zero and closes the window.



- Input the first point.



3

OPERATION

3-3. Station Setup

- When a input point does not exist in DB, it shows a new point input window. You can either input NEZ or NE.

STN/3-P 12:58

P

New Point!

Pt: 30 N: _____

CD: ■ E: _____

Z: _____

ABC DEF GHI JKL MNO
PQR STU VWX YZ spc Bsp List

- Take an angle measurement to P1 by [ENT] or [F1/F2] key.

STN/3-PT 13:14

P1: 30 HA: 102°50'30"

VA: 91°45'20"

Sight Pt and Press ENT or F1/F2

F1/F2

- After taking an angle measurement to P1, a cursor is placed on the P2: field and waits for the second point input.

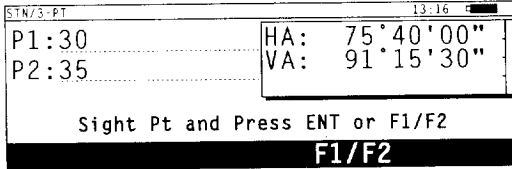
STN/3-PT 15:03

P1: 30 HA: 133°22'15"

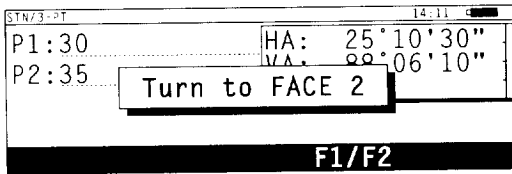
P2: ■ VA: 90°00'05"

1 2 3 4 5
6 7 8 9 0 Bsp +

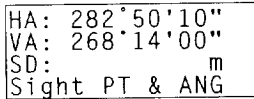
- Sight P2 and press [ENT] or [F1/F2] to measure the angle to P2. Pressing [F1/F2] takes an angle shot on Face1 and leads you to the Face2 measurement.



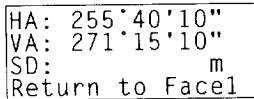
↓ [F1/F2]



- Press [ENT] or [ANG] and you can return to Face1.

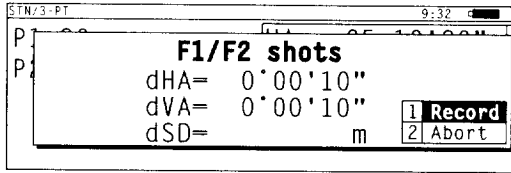


↓ [ANG] or [ENT]

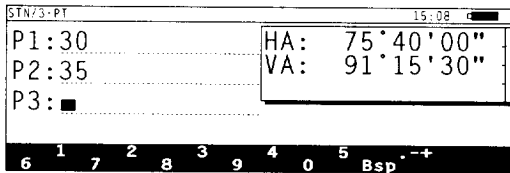


3-3. Station Setup

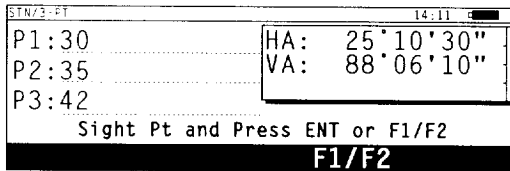
- After the F1/F2 measurement, delta information is shown. Press [ENT] to proceed to next point.



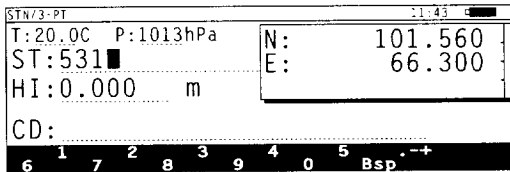
- Input a point for P3.



- Sight P3 and press [ENT] or [F1/F2] key to take an angle measurement.



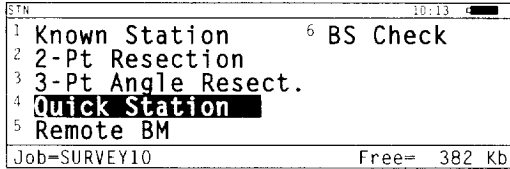
- The coordinate of the station is calculated after angle measurements to three directions have done.
- ST point number is defaulted to the “Last recorded point + 1”
- You can press the up & down arrow key to move the cursor to T: and P: fields, if you need to change Temperature & Pressure.
- Press [ENT] at CD: field to record the station.



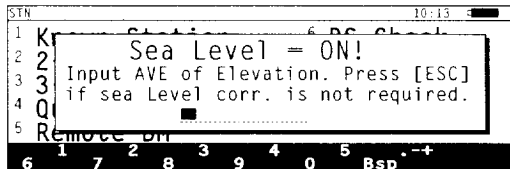
MEMO • If any of three points has elevation, the Station Z-coordinate will be calculated as well. Enter “STN/5:Remote BM” to sight a benchmark point to update the Station Elevation more accurately. (See page 93)

■ Quick Station

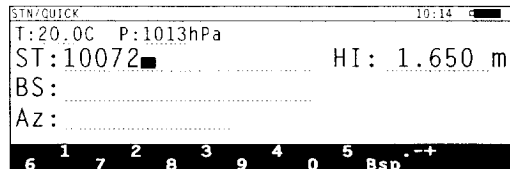
- By this function, you can setup the station without specifying coordinates. There is no connection between BS and Az in the Quick Station. Therefore, azimuth will not be calculated based on the BS input.



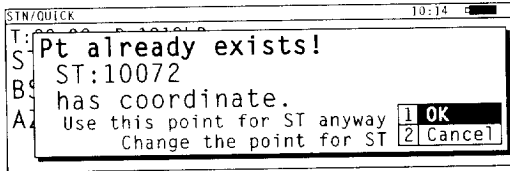
- When the setting is “2D” + “Sea Level = ON”, an elevation input window is shown by selecting [4:Quick Station].
- [ESC] or [ENT] without Elevation sets zero and closes the window.



- The “Last recorded Pt: + 1” is shown in the ST: field as a default.

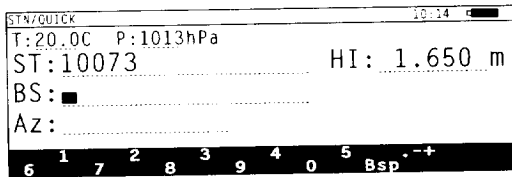


- If the input ST is found in the current JOB, a confirmation window is shown.



- [1:OK] = use an existing MP as a station point.
- [2:Cancel] = returns to the ST input screen.

- Input BS point. BS point name/number can be left blank.
- Even if an existing point is input to BS, the coordinate of the BS will not be taken into consideration to prepare the following Az.



3-3. Station Setup

- Azimuth is defaulted to 0.0000.
- When you change Azimuth while you have BS point name/number, no check will be performed by this function. If you want to input a known point for BS, please use the Known Station function. (See page 71 through 74)

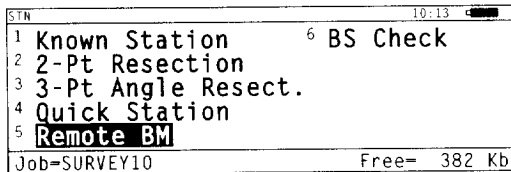
The screenshot shows a handheld device screen with the following text and layout:

- Top status bar: STW/QUICK 10:15 [Battery icon]
- Line 1: T:20.0C P:1013hPa
- Line 2: ST:10073 HI: 1.650 m
- Line 3: BS:
- Line 4: Az:120.1050 [Cursor]
- Bottom keypad: 1 2 3 4 5 6 7 8 9 0 Bsp . - +

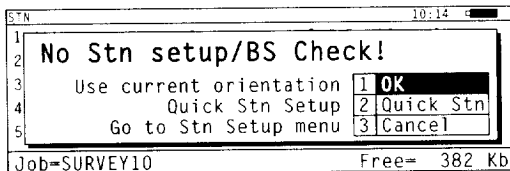
- Press the [ENT] on Az field. It proceeds to record ST.
- For a new point input on ST, a MP record is created by this function. (0,0,0) or (0,0), depending on the settings of 2D/3D.

■ Remote BM

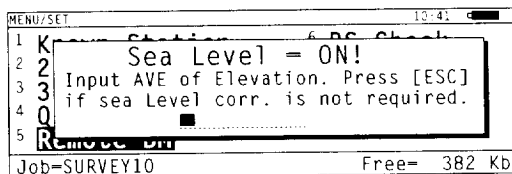
- Remote Benchmark lets you determine the station elevation, the height of instrument, or the instrument elevation. You can use any point with a known elevation even if the Northing and Easting coordinates are unknown.



- Known Stn, 2-Pt Resection, 3-Pt Angle Resection or Default Station must be performed before entering Remote BM. Otherwise, an error window is displayed.



- When the setting is "2D" + "Sea Level = ON", an elevation input window is shown by selecting [5:Remote BM].
- [ESC] or [ENT] without Elevation sets zero and closes the window.



3-3. Station Setup

- Input a BM point name or Code or Z.
- When Z is directly input without Pt: the BM point will not be stored to the Database.

STN/RBM 10:32

Pt: ■	HA: 106°15'40"
Z: m	VA: 91°23'45"
HT: 1.600 m	SD: m
CD:	

6 1 2 8 3 9 4 0 5 Bsp - +

- When a new Pt: is input, a point input window is displayed. User can input only Z coordinate as a Benchmark point on this screen.

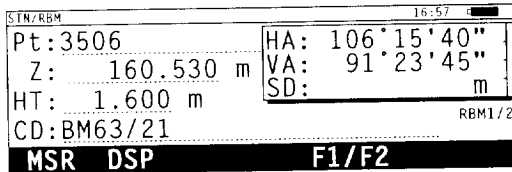
STN/RBM 14:09

New Point!

Pt: 3506	N:
CD: ■	E:
	Z:

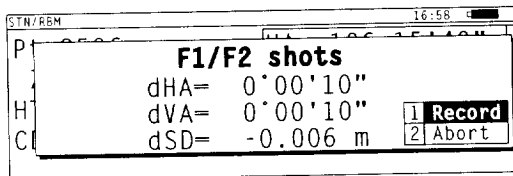
ABC DEF GHI JKL MNO
PQR STU VWX YZ spc Bsp - + List ↓

- When an existing Pt: is input, Z-coordinate and Code is shown.
- The up & down arrows key place the cursor back to the input Pt field.



- [MSR] = takes a distance measurement.
- [DSP] = changes the contents of the measurement box
HA/VA/SD (RBM1/2)
HA/VD/HD (RBM2/2)
- [6] = shows the MSR/ TRK/ALL mode setting screen.
- [7] = shows the Target setting screen.
- [↓]/[↑] = returns to the Pt: input screen.
- [ESC] = terminates this function and goes to the BMS.
- [F1/F2] = activates Face2, showing "Turn to Face 2" message.

- When the [F1/F2] key is pressed, the delta HA/VA/SD window is displayed with [1:Record]/[2:Abort] selection after a F2 measurement.

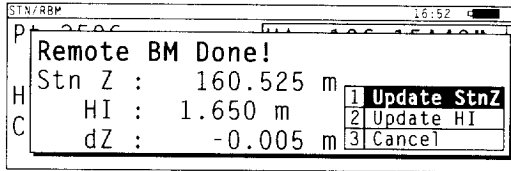


3

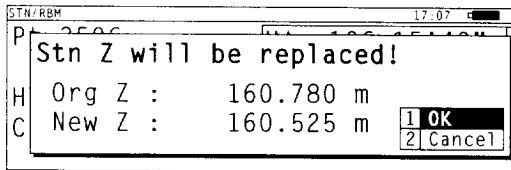
OPERATION

3-3. Station Setup

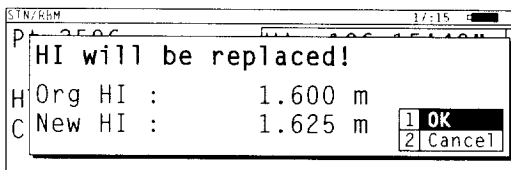
- When the current station has both Z-coordinate and HI, they are shown on the following screen and you can choose the way to adjust the delta-Z.



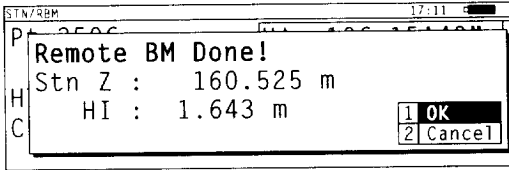
- [1:Update StnZ] = updates the Z-coordinate of the Station point and leaves the HI as it is.
 - [2:Update HI] = replaces the HI and leaves the Stn Z as it is.
 - [3:Cancel] = ignores this result and keeps the current Stn Z and HI.
- If [1:Update StnZ] is selected on the previous screen, a confirmation screen is displayed.
 - Press [ESC] to go back to the previous screen.



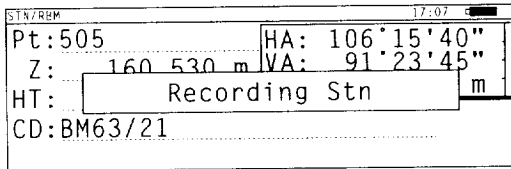
- When [2:Update HI] is selected, it shows a confirmation window for HI.



- When the original station doesn't have an elevation, it calculates the Stn Z and shows a confirmation window.

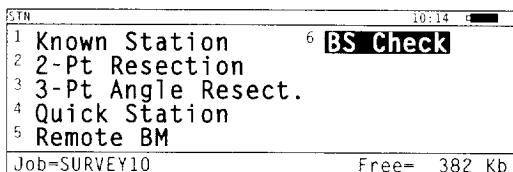


- The referenced XYZ data for the current ST will be updated. The old data is moved to the edited RAW data file (.NR). A comment (CO) record will be written to the RAW file as well.

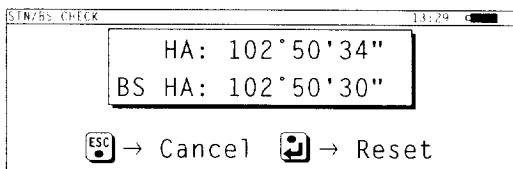


■ BS Check

- The BS Check function allows you to measure and check the angle to the backsight point.



- It shows the current HA in "HA:" field and the HA from the current setup in "BS HA:" field.



- [ENT] = sets HA to Last BS and returns to BMS. A comment record is stored to the RAW data file.
- [ESC] = returns to the basic measurement screen without setting HA to Last BS.

3-4. Stakeout

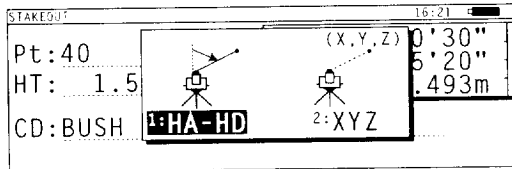
This function shows you how to stakeout individual points. Stakeout function in Pre-Installed software consists of two parts. One is Stakeout by Angle & Distance and the other is by Coordinate input.

You can store both RAW data and Coordinate from each measurement, if you set the "Store data" setting to "XYZ & RAW". (See page 140)

MEMO • When "2D/3D Coordinates" is set to "2D", HT field is not displayed on the screen. (See page 142 for "2D/3D" settings.)

■ Stakeout by Angle & Distance

- Select [1:HA-HD] to stakeout points by angle and distance from the station, after choosing 3. [S-O] key on the BMS.



3-4. Stakeout

- Input HA/dVD/HD from the station point to a target point.
- Press [ENT] at HA field without inputting any value, it enters the current HA reading to the HA field.

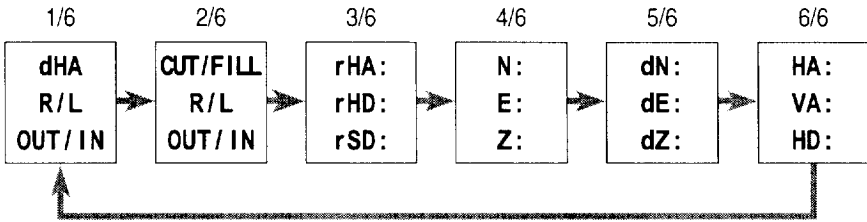
STAKEOUT/HA-HD		16:21	
HA: ■		HA:	90°50'00"
dVD: _____ m		VA:	89°20'30"
HD: _____ m		SD:	_____ m
HT: 1.500 m			
6 1 2 3 4 5 Bsp -+ 7 8 9 0			

- Sight the point and take a measurement.
- Lumi-Guide is also available on this screen by pressing [5:LG].

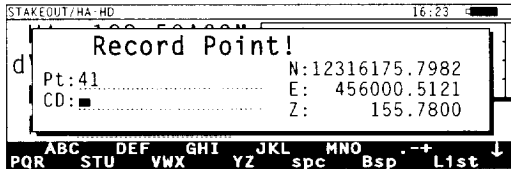
STAKEOUT/HA-HD		16:22	
HA: 123°50'00"		dHA→	-170°50'50"5
dVD: 0.530 m		HD:	85.620 m
HD: 85.620 m			
HT: 1.500 m			
MSR	TRK	LG	

- The up & down arrow key place the cursor back to the input factors.
- After taking a measurement, [DSP] key is shown. It changes the contents of the box between the following six screens.

STAKEOUT/HA-HD		16:22	
HA: 123°50'00"		dHA←	0°00'00"0
dVD: 0.530 m		R ←	0.057 m
HD: 85.620 m		OUT ↑	0.112 m
HT: 1.500 m			
		S-01/6	
MSR	DSP	TRK	LG



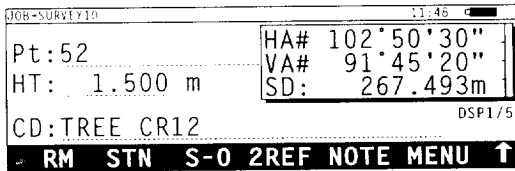
- Pt: is defaulted to the “last recorded Pt + 1”.
- Up to 24 characters can be input from this screen in the CD: field.



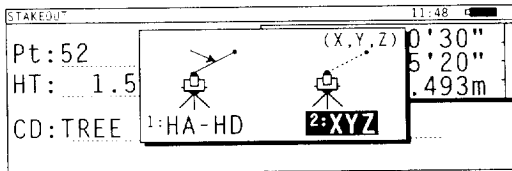
- After recording a point, it returns to HA/dVD/HD input screen with the previous values as defaults and waits for next input.
- [ESC] key returns to the BMS.

■ Stakeout by Coordinate

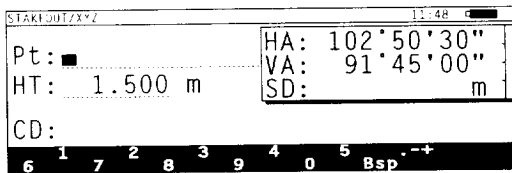
- Press [Mode] key to get the second set of softkey on the Basic Measurement Screen (BMS).



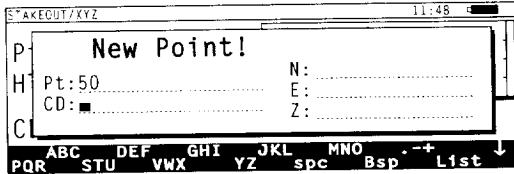
- Select [2:XYZ] to stakeout points by their coordinates, after choosing 3. [S-O] key on the BMS.



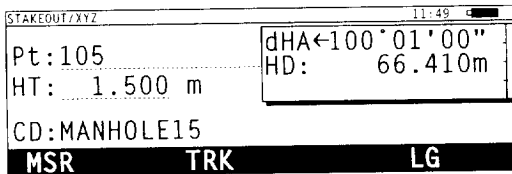
- Input a stakeout point name/number.
- CD: field is shown only when the input point has code.
- Pressing the down arrow key puts the cursor to the HT: field.



- When a new Pt: is input, it shows a point input window.
- While the cursor is in the CD: field, the [List] key is available for inputting a code.



- After a point is input, the measurement box changes to show the difference in HA and HD to the target point.
- The up & down arrow key place the cursor back to the input Pt or HT field.
- By pressing [ENT] on HT field, the softkey changes to <MSR>.



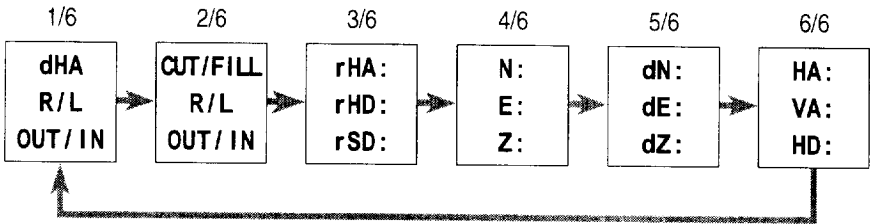
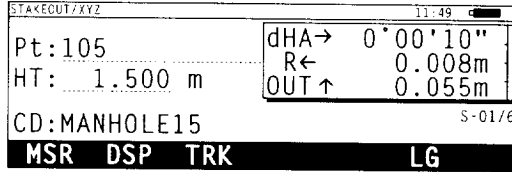
3

OPERATION

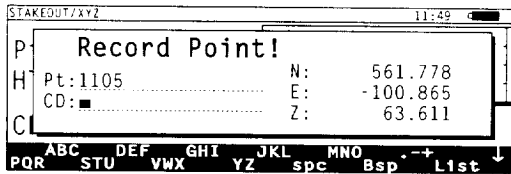
3-4. Stakeout

- After taking a measurement, [DSP] key is added to the softkeys.

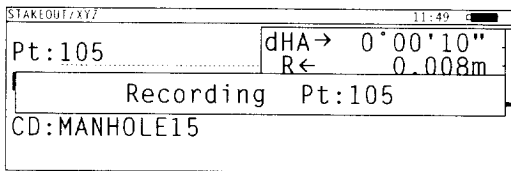
It changes the contents of the measurement box among the following six screens.



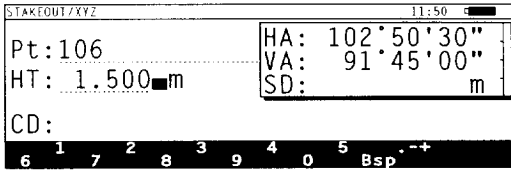
- The default Pt number/name is shown. It depends on the Add-const setting. (See page 142)



- SO(RAW) and SO(XYZ) are recorded when the “Store data” setting is “XYZ & RAW”. (See page 140)
- If the ST has no coordinate, it only records RAW data.



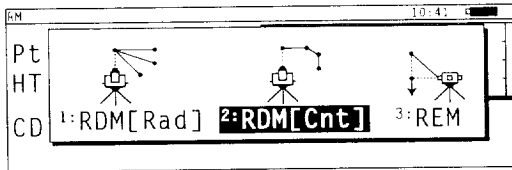
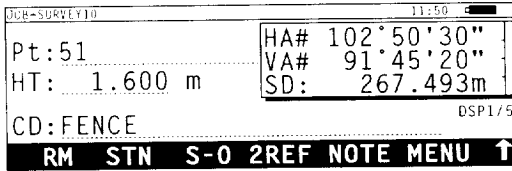
- After recording a point, it returns to the Pt: input screen for next stakeout. A default Pt number/name is displayed as "Last stakeout Pt+1".
- [ESC] key returns to the basic measurement screen.



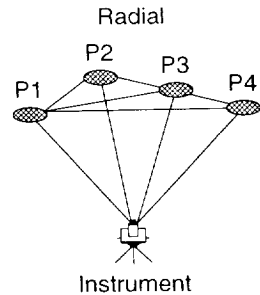
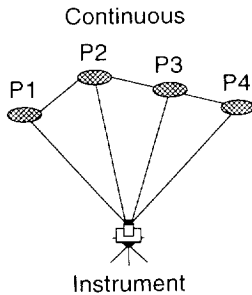
3-5. Remote Measurements (RM)

■ RDM

- Press [Mode] key to get the second set of softkeys on the Basic Measurement screen (BMS).



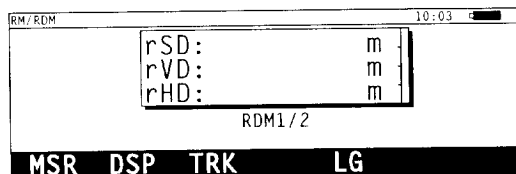
- Select either the Continuous or the Radial method (see illustration and comment below).



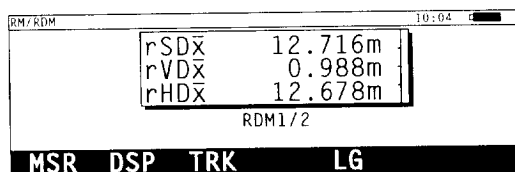
Continuous method: The latest two points are used for calculation.

Radial method: The first point is used as a base point for calculation.

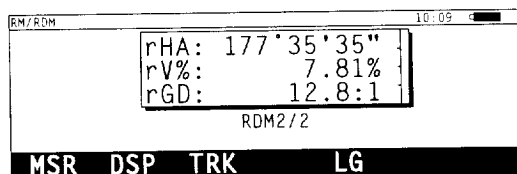
- Take a measurement to the first point.
- If the average is set to “Continuous”, it takes a measurement only once in the accuracy defined.



- It displays distance information to the first point.



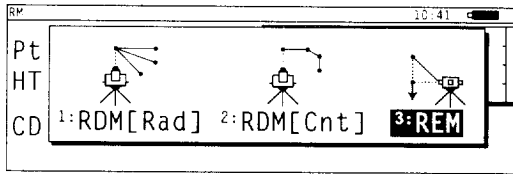
[DSP] = toggles the screen between “rSD/rVD/rHD” and “rHA/rV%/rGD”.



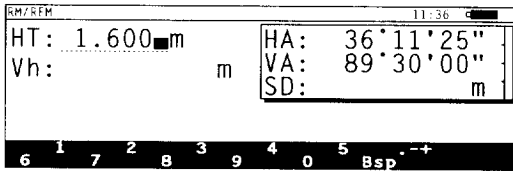
- From [1:Radial], it calculates the distance between the first and current point and shows the result on the screen after the second measurement.
- From [2:Continuous], it calculates the distance between the previous and current point and shows the result on the screen after the second measurement.

■ REM

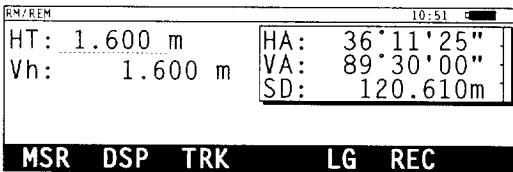
- This function calculates the vertical difference between the ground and an arbitrary point on the vertical line.



- Input new HT or accept the current HT value by pressing [ENT].



- Use [MSR] or [TRK] to take a full measurement to the base or reference point.
- Move the telescope up or down. The height of the arbitrary point is displayed on "Vh:" field.



- [REC] = replaces the HT value with the current HT - Vh. (New HT = old HT - Vh)
- [DSP] = changes contents of the measurement box among "HA/VA/SD", "HA/VD/HD", "HA/VA/HD", "HL/V%/HD", and "N/E/Z".

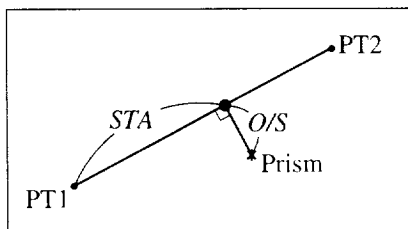
3-6. 2-Pt Reference Line (2REF)

- By using 2-Pt Reference Line, you can measure the offset distances to a point in relation to an imaginary line between two points and the plane that the line sits on.
- Press [4] key in the second set of the softkey for the Basic Measurement screen (BMS).

JOB-SURVEY10		14:51	
Pt: 6	HA# 303°50'35"	VA# 92°00'10"	SD \bar{x} 157.280 m
HT: 1.600 m			
CD: TREE	DSP1/5		
RM STN S-0 2REF NOTE MENU ↑			

MEMO • When "2D/3D Coordinates" is set to "2D", HT field is not displayed on the screen. (See page 142 for "2D/3D" settings.)

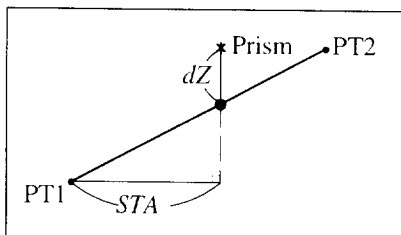
<Plane view>



STA = Horizontal distance along the specified line to the measured point

O/S = Horizontal offset from the specified line to the measured point

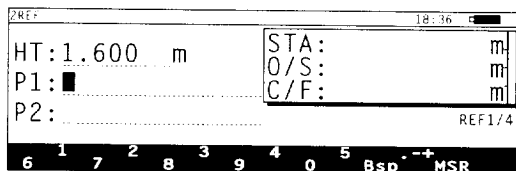
<Side view>



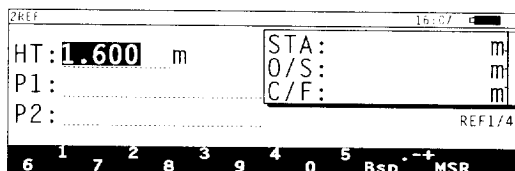
- STA = Horizontal distance along the specified line to the measured point
- dZ = Vertical offset from the specified line to the measured point

Define the Reference Line _____

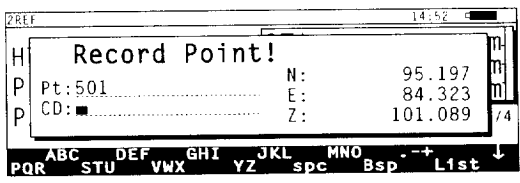
- Type a point name/number or take a shot to P1.
- When there is any valid ST, it shows [MSR] key on the softkey.



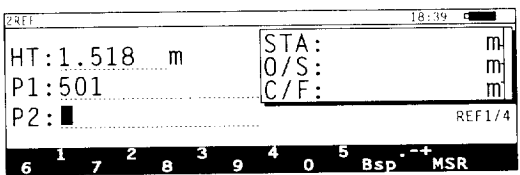
- It is possible to change HT by pressing the up/down arrow key.



- If you take a measurement to P1, the coordinates are calculated and a "Record Point!" window is shown. Pt: is defaulted to the "Last recorded Pt + 1". Input code and press [ENT] to record.

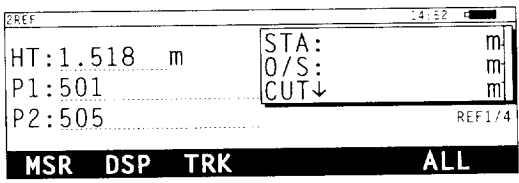


- Input P2 or take a shot to P2.
- After specifying P2, you can set the HT value for the measurement to the offset point. With the cursor in the "HT:" field, enter the value and press [ENT].



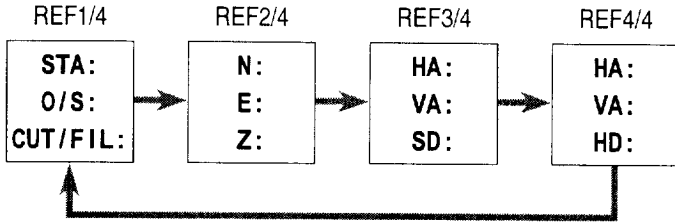
Taking a measurement

- The "Measuring" screen shows the information about the 2-Pt Reference Line, height of target on the left and distance information in the right box.

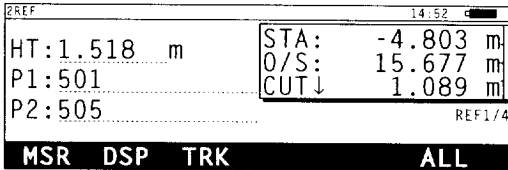


3-6. 2-Pt Reference Line (2REF)

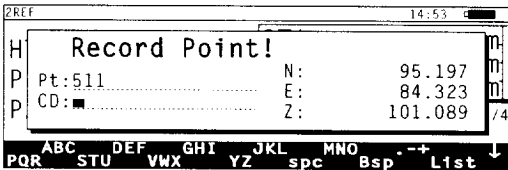
- [DSP] key changes the contents of the box among following four screens:



- The up & down arrow key place the cursor back to the input factors.

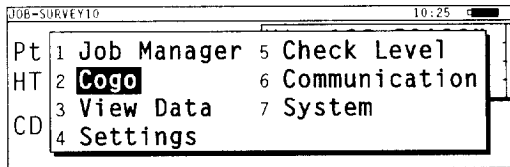


- By pressing [ENT], a coordinate of the measurement point is recorded to XYZ file.
- When “Store data” is set to “XYZ & RAW”, STA, O/S, Cut/Fill values are recorded to RAW file as CO record. A measurement to the prism is also stored as SS record in RAW data file.



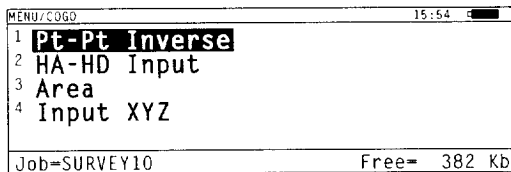
3-7. Cogo

- This chapter describes the coordinate geometry features available within the Pre-Installed software. Cogo provides you with three functions which enable you to calculate new design points while in the field, and inspect and work with your field measurements.
- Select [2:Cogo] from the MENU window.

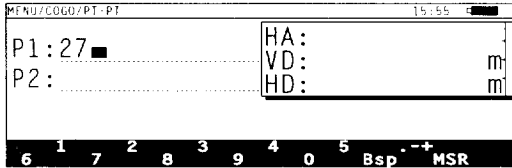


■ Pt-Pt Inverse

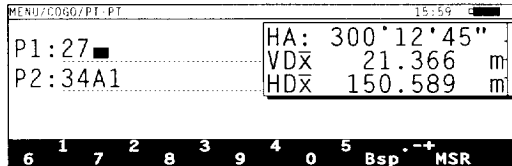
- This function allows you to enter any two points from the open job. Pre-Installed software calculates the inverse (Az, VD and HD) between the two points that you enter.
- Press [1] or [ENT] key to go into the Pt-Pt inverse function.



- Type the first point number/name.
- When the station setup is done, a [MSR] key is also available in softkey. You can take a shot to P1 and record it on the spot.



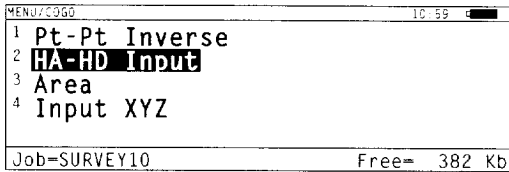
- If the input point number/name does not exist, a “New Point!” window is shown, giving you the option to enter the point’s details manually. This is a common treatment throughout Cogo when a point which does not exist in the current job database is entered.
- After the two points are defined, press the [ENT] to calculate the inverse. When the second point is measured, it shows the result right after recording the point.



- Calculation is performed each Pt: input (P1 or P2), after the first result is shown.
- The VD will be left blank if one of the point (P1/P2) or both does not have Z-coordinate.
- Press [ESC] to return to the BMS.

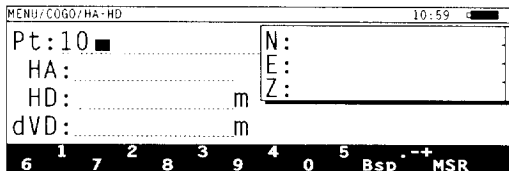
■ HA-HD Input

- This function enables you to identify and record a new point by specifying a bearing and distance from a known point. The calculated point is stored in the current job.
- Press [2] key or down arrow and [ENT] key to go into the HA-HD input function.



Complete the screen with the following information:

- Pt* : Input a base point. If the point is not found in the job, the "New Point!" window is opened. When you completed station setup already, the point can be defined by taking a measurement.
- HA* : Input angle and distance from the base point.
- HD* : Type the horizontal distance value from the base point.
- dVD* : Type the vertical distance value from the base point.



-
- MEMO**
- If a point which does not have N/E coordinate is input, the "Input Coordinate" window is displayed.
 - When you completed station setup already, the point can be defined by taking a measurement. After shooting to a prism, the "Record Point!" window is displayed. Pt: is defaulted to the "Last recorded Pt + 1".
 - If the "2D/3D" setting is set to "2D", then the dVD field is eliminated from this screen.
-

- Press [ENT] on the last field to calculate the coordinates of the new point.
- [Next] key just clears all fields except Pt: field.

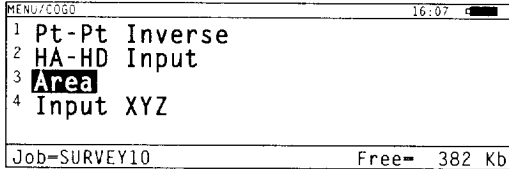
MENU/COGO/HA-HD		10:59	
Pt: 10		N:	1260.560
HA: 120°00'00"		E:	900.333
HD: 100.000 m		Z:	71.615
dVD: 1.505 m			
Next REC			

- "Record Point" window is shown by pressing [REC] or [ENT] key. The default Pt is "Last recorded point + 1". You can edit Pt: and CD: fields before you record the point. Pressing [ENT] on CD: fields records the point and returns to the input factor screen.

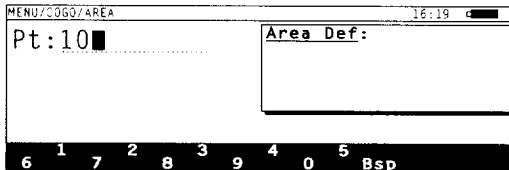
MENU/COGO/HA-HD		11:00	
Record Point!			
Pt: 106		N:	1260.560
CD: []		E:	900.333
		Z:	71.615
ABC DEF GHI JKL MNO - + PQR STU VWX YZ spc Bsp List ↓			

■ **Area and Perimeter**

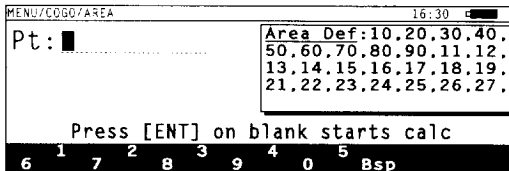
- The Area function enables you to define a lot (loop traverse) by listing points, and then calculates the area and perimeter of the defined lot.



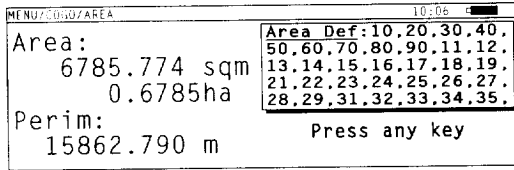
- Input point number/name one by one. Press [ENT] to accept the point.
- Repeat this until you have defined all points in the lot.



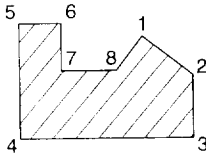
- When more than three points are entered, it enables you to calculate the area and perimeter by pressing [ENT].
- Press [ENT] on the blank field starts the calculation.



- When the distance unit is set to “Meters”, the Area and Perimeter are shown in “m² (sqm)” and hectare. For distance unit of “Feet”, they are in “ft² (sqf)” and acre.
- Up to 100 points can be input.
- Press any key to go back to the Cogo menu screen.

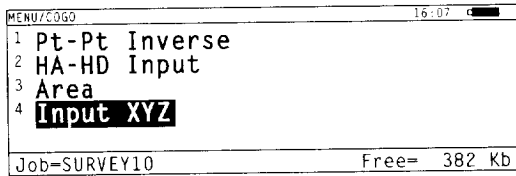


- MEMO**
- By default, the system closes the area using last and first point in the list.
 - To obtain a correct result, make sure you input all necessary points in order of closing the area with one stroke.

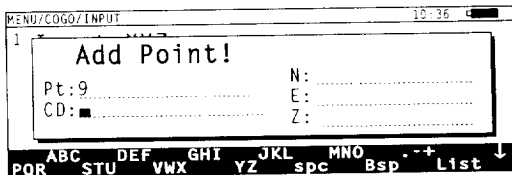


■ **Manual Input Coordinate**

- This function provides you a way to input new points manually to the current job.
- Press [4] or three times of down arrow and [ENT] key to go into the Add point function.



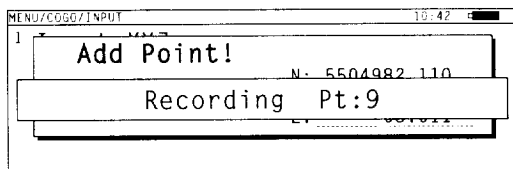
- Input Pt, Code and NEZ.
Pt: is defaulted to “the last recorded Pt + 1” automatically, if the last digit is numeric. If it is alphabet, it will be alphabetically count up until Z. When the last digit is “Z” or the last recorded Pt: is “999999999”, the last recorded Pt: is shown as a default. In this case, when you try to record it without changing Pt:, an error window is displayed.
- Pt: must be entered before the cursor moves to the next field.
- CD: field can be left blank.
- N&E or Z has to be entered before recording the point.



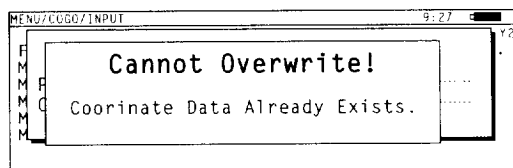
3

OPERATION

- The input point is added to the end of the RAW file and Coordinate file as a MP record.

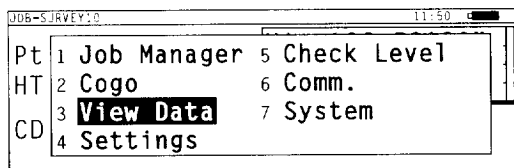


- After recording the input point, it increments the Pt: field by one automatically and places an cursor to the CD: field.
- If a coordinate record already exists when recording a point, it cannot be overwritten by another coordinate record under the same point name/number. To change the contents of the existing coordinate, the old XYZ should be deleted beforehand.

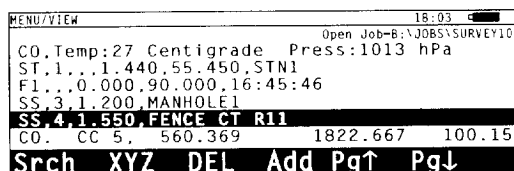


3-8. View Data

- This chapter shows you how to view, search, delete or add your survey data.



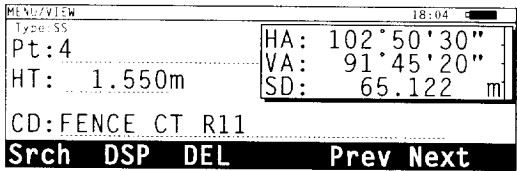
- Press [3:View Data] on MENU screen goes to the VIEW data screen, which shows data from RAW data file.



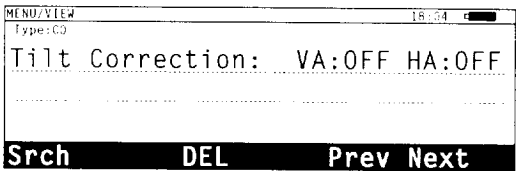
- [Srch] = opens a search condition input screen
- [XYZ] = displays data from coordinate file.
- [DEL] = deletes a line of record.
- [Add] = displays a point input window
- [Pg↑]/[Pg↓] = scrolls screen a page before/after
- [ENT] = displays detail data
- [↑]/[↓] = moves the highlight bar one line up/down

■ Show point details

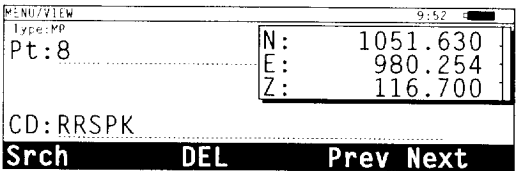
- Press [ENT] key to show a detail screen for the high-lighted point.
- No cursor will be shown on the detail data screen.
- [DSP] key changes the contents of the measurement box among “HA/VA/SD”, “HA/VD/HD”, and “N/E/Z”.



- When the [ENT] key is pressed on CO: record, it shows VIEW-comment screen.



- MP, CC, and RE record have only N/E/Z data, as is shown in the screen below.



- The detail data for F1 record

MENU/VIEW 9:54

Type:F1

Pt:107 HA: 341°23'50"

HT: 1.600m VA: 89°10'30"

SD: 203.110m

Srch DEL Prev Next

- The detail screen for ST record
- [DSP] key changes the contents of measurement box between Backsight point and station coordinates.
- When the BS point name/number is not defined (azimuth input only), the BS: field is left blank.

MENU/VIEW 9:54

Type:ST

Pt:19 BS:109

HI: 1.700m Temp: 24°C

Az:175.3625 Press: 785mmHg

Srch DSP Prev Next

■ DSP key

- Press [DSP] to see the next available measurement box.

MENU/VIEW		9:55
Type: SS		
Pt: 15601	HA: 350°00'00"	
HT: 1.550m	VA: 81°20'00"	
	SD: 10.028m	
CD: FENCE CT R11		
Srch DSP DEL		Prev Next

- If the [Prev] or [Next] key is pressed on this screen, it shows the chronologically previous or next point of the same contents in the measurement box.

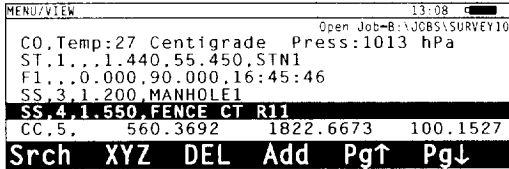
MENU/VIEW		9:55
Type: SS		
Pt: 15601	HA: 350°00'00"	
HT: 1.550m	VD: 1.511m	
	HD: 9.913m	
CD: FENCE CT R11		
Srch DSP DEL		Prev Next

- If only the angle measurement is taken to the point, the N/E/Z screen will not be shown. In such a case, [DSP] only swaps screens between HA/VA/SD and HA/VD/HD.

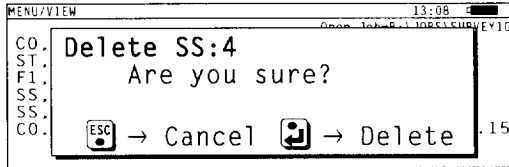
MENU/VIEW		9:57
Type: SS		
Pt: 15601	N: 3109.222	
HT: 1.550m	E: -1003.637	
	Z: 151.559	
CD: FENCE CT R11		
Srch DSP DEL		Prev Next

■ **DEL key**

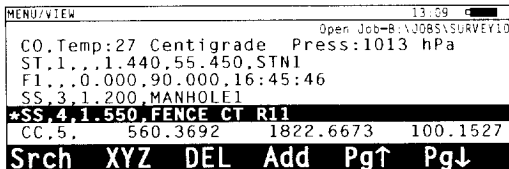
- Place the cursor on the record to be deleted and press [3] key.



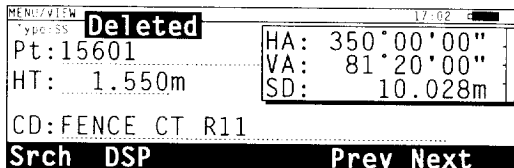
↓ [DEL]



- The deleted data is shown with an asterisk mark(*) in RAW data view screen.
- Deleted data cannot be edit at all.
- When a record is deleted in XYZ data view screen (See page 132), the deleted record is removed from the list. Different from RAW data, the deleted coordinate record in XYZ data view will not be shown.

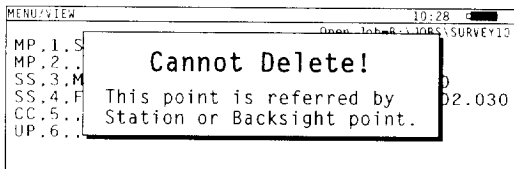


- If [ENT] key is pressed on the deleted record in data list screen, it shows a detailed data screen for deleted record below.



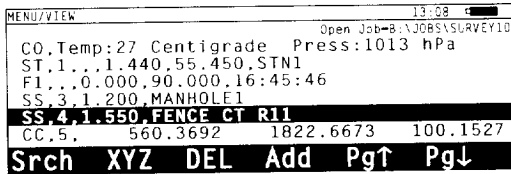
-
- MEMO**
- Any records in RAW data can be deleted except ST record.
 - When deleting a RAW record, corresponding XYZ is kept remaining. Only a RAW record is deleted.
-

- When [DEL] key is pressed while the high-light bar is on the point referenced by Station or Backsight point, an error screen is shown.

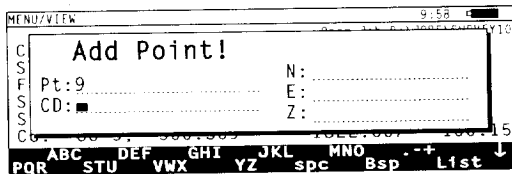


■ Add point

- You can add a point (coordinate) by pressing [4:Add] key in View Data function.

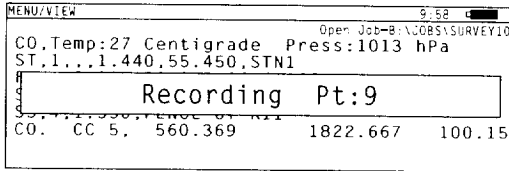


- Input Pt, Code and NEZ.
- Pt: is defaulted to “the last recorded Pt + 1” automatically, if the last digit is numeric. If it is alphabet, it will be alphabetically count up until Z. When the last digit is “Z” or the last recorded Pt: is “999999999”, the last recorded Pt: is shown as a default. In this case, when you try to record it without changing Pt:, an error window is displayed. (See page 128 MEMO [I], [II])
- Pressing up & down arrow key moves the cursor among each field.
- [List] is available for feature code input.



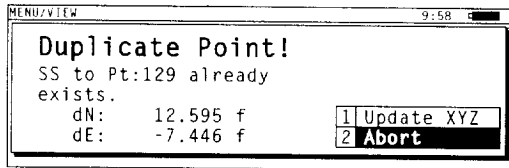
- Pt: must be entered before the cursor moves to the next field.
- CD: field can be left blank.
- N&E or Z has to be entered before recording the point.

- The input point is added to the end of the RAW file and Coordinate file as a MP record.
- After recording the input point, it increments the Pt: field by one automatically and places an cursor to the CD: field to wait for next point input.

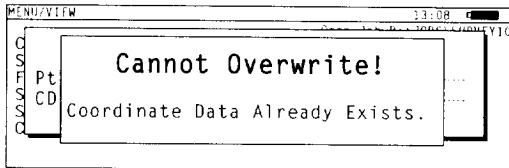


MEMO • When an existing Pt: number/name is entered to record new coordinate point, a confirmation window or an error is displayed.

[I] If the existing Pt: is SS/SO/CP record:

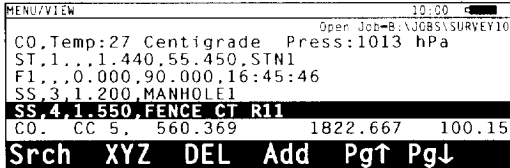


[II] If the existing Pt: is MP/CC/RE/UP record:

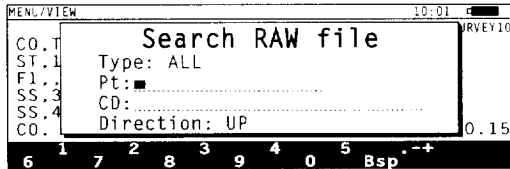


■ **Search record**

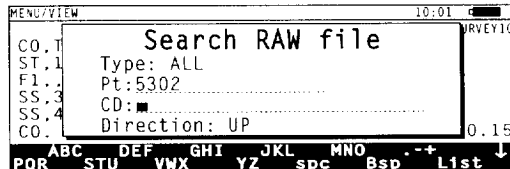
- To find a point, press [Srch] softkey on this screen. Search can be done by Pt (point name/number) and /or CD (feature code).



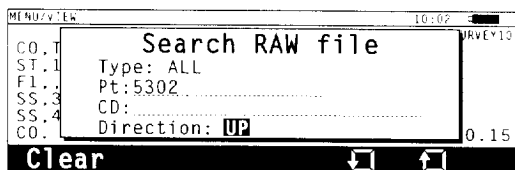
- First, the cursor is on Pt field and the softkey is automatically changes to numeric. The Alpha softkey will be shown by pressing [Mode] key, only when the setting is Pt = Name. (See page 69)



- When the cursor is on CD field, the softkey is automatically changes to Alpha and it waits for the code input. Code list is available by [List] key.

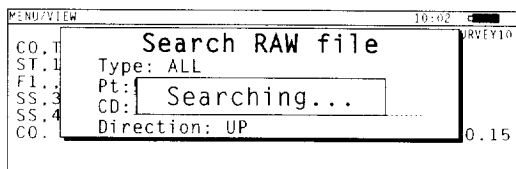


- When a circular selection icon is pressed on "Type:" field, the point type can be changed. It can be selected among "ALL", "ST", "F1", "SS", "CP", "SO", "CO", "MP", "CC", "RE".
- When a circular selection icon is pressed while the cursor is in "Direction:" field, the search direction can be changed to UP, DOWN, or ALL. A search direction of ALL performs a search from the last record up.



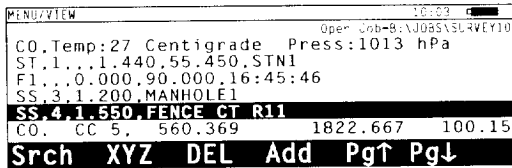
[Clear] = clears all input in the Search window. It sets defaults to Type=ALL and Direction=UP.

- When you press [ENT] at the last field (Direction:), a search for the specified point is started.
- The time taken to search depends upon the number of search parameters entered and the number of records in the RAW or XYZ data file.

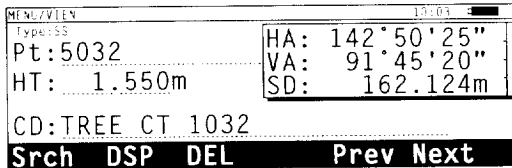


-
- MEMO**
- Direction: ALL is always start search from the last record of the DB.
 - Direction: UP/DOWN is a setting to start search from the current highlight-bar position.
 - When the Pt is not input, the search is done by the combination of the conditions such as Code and Type.
-

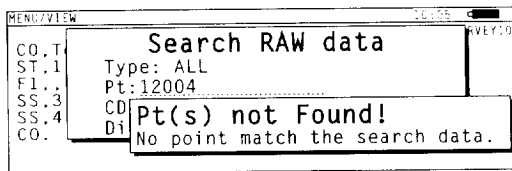
- When the specified point is found, it puts a highlight bar on the point, if the search is taken place on the point list screen below.



- If the [Srch] key is pressed on the point detail screen, the result will be the same type of screen below.

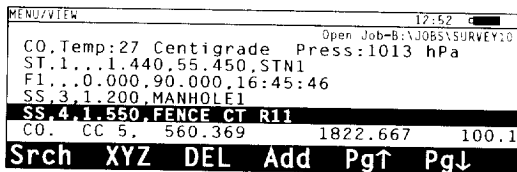


- When there is no matching data to the input search factors, it gives an error. Press any key to return to the Search data input window.

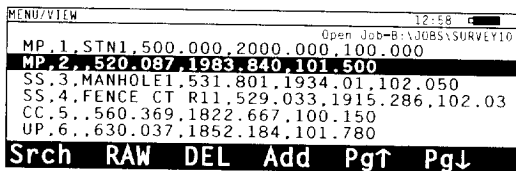


■ XYZ key

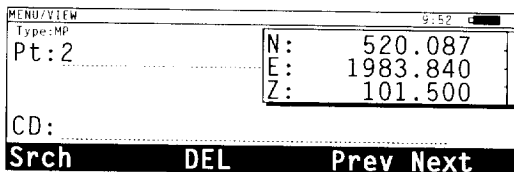
- You can look at only coordinate records by pressing [XYZ] key. When it shows data in the coordinate file, softkey indication on [2] key changes to [RAW].



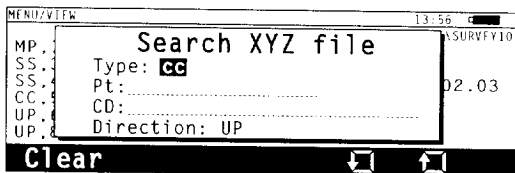
↓ [XYZ]



- When the [ENT] is pressed on any record, a detailed data screen is opened.



- MEMO**
- For the [Srchr] key in XYZ data view, "ALL", "MP", "UP", "RE", "CC", "UC", "SS", "SO", and "CP" can be set in Type column.



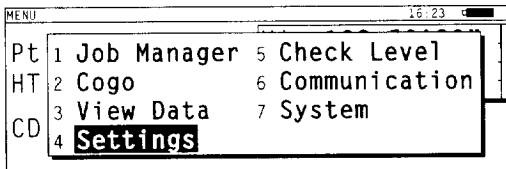
- [DEL] and [Add] softkeys work just the same as they are in View data screen for RAW data. (See page 125 through 131)

3-9. Settings

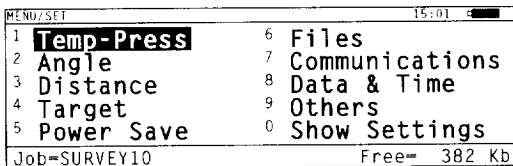
This chapter describes a diverse range of instrument and software settings which effect how measurements are taken, corrected, and presented to you.

The Main Settings Menu

- By pressing the [4:Settings] key or the [ENT] key after moving a cursor there, it shows the Settings menu screen.

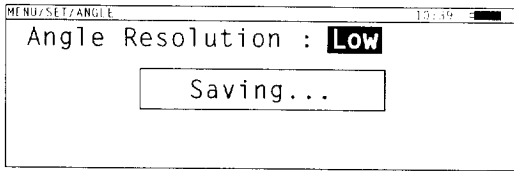


- Settings menu screen

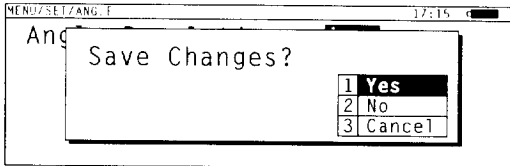


Change of Setting

- In most settings, you can use the circular selection icon on key [5] and [.-] to change the inverted item. Sometimes you will type in the required settings. A numeric input field will be displayed with dotted underline.
- When the [ENT] key is pressed from the last field on a setting screen after any changes are made, a “Saving” message is displayed while it saves those changes you made. After saving them, it goes back to the Settings menu screen.



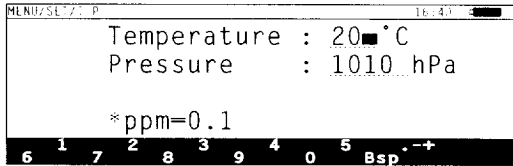
- When the [ESC] key is pressed after some change is made on any settings screen, a confirmation window is shown.



- [1:Yes] = saves the changes and returns to the Settings menu screen.
- [2:No] = does not save the changes and returns to the Settings menu screen.
- [3:Cancel] = does not save the changes and returns to the previous settings screen.

■ Temp-Press

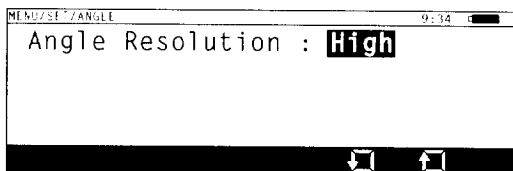
- You can set the current temperature using this function or you can change the temperature when you set up a station. In both cases, the temperature you set is fixed until you change it again.



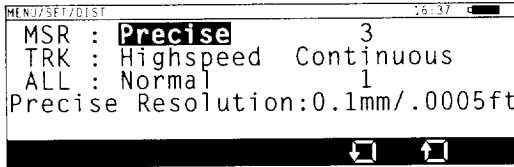
- Type the ambient temperature (-42°C to + 57°C).
- Type the ambient pressure (527 hPa to 1338 hPa).
- “ppm” is calculated and shown based on the current setting. When T-P is changed, it is recalculated after saving new values.
- After every Station Setup, T&P values are recorded in the RAW file as a comment.

■ Angle

- “Angle Resolution” sets the angle display resolution of the instrument. High or Low.



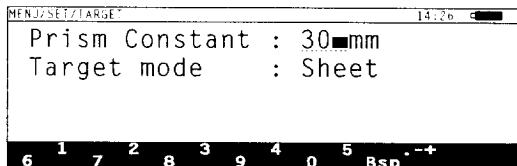
■ Distance



- You can set “TRK”, “MSR”, and “ALL” to any of the three precision mode.
 - Precise..... Completes the measurement in 2.8 second
±0.2 mm or ±0.001 ft.
 - Normal..... Completes the measurement in 0.8 second
±1.0 mm or ±0.002 ft.
 - Highspeed..... Completes the measurement in 0.5 second
±10.0 mm or ±0.02 ft.
- Additionally, you can specify the number of measurements to be averaged for each mode: Continuous, 1, 2, ...99.

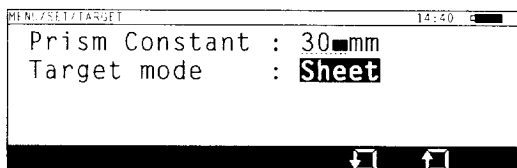
-
- MEMO**
- “ALL” cannot be set to “Continuous”.
 - “Precise Resolution” displays resolution for distances measured by the “Precise” measure mode. It can be set 0.1 mm/.0005 ft (most precise) or 1 mm/.002 ft.
 - The Distance settings can be displayed by the [6] key on the BMS and other measurement screens.
-

■ Target Mode



- Prism Constant: -99 to 99 mm (default = 0 mm)
- Whenever the Prism Constant is changed, a line of comment record will be recorded to the RAW file.

Ex) CO, Temp:28C Press:770hPa Prism:0 16-Oct-1999
08:16:30



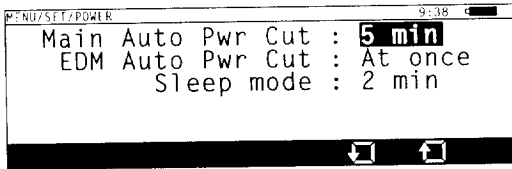
- “Target mode” setting is added for the new EDM and it enables user to select the target as “Prism” or “Sheet”.

MEMO

- The Target setting screen can be displayed by the [7] key on the BMS and other measurement screens.
- The item “Sheet” setting is available only on the DTM-851/831/821.
When you updated Pre-installed software on DTM-850/830/820, the “Target mode” setting is fixed to “Prism”.

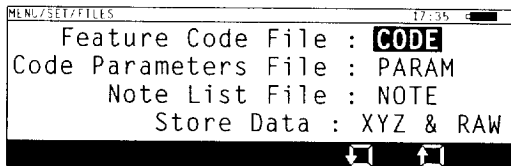
■ **Power Save**

- “Main Auto Power Cut” sets a specific period of inactivity to turn off the instrument automatically. OFF/5/10/15/30/60min.
- “EDM Auto Power Cut” is to save the battery power by switching the EDM to “stand-by” mode. OFF/At once/0.1/0.5/3/10 min.
- “Sleep mode” is a power saving utility which enables to save power without switching off the instrument after a specific period of inactivity. It shows a coffee cup icon during power saving (sleep) mode. OFF/2/5/10 min.



■ Files

- On this screen, you can assign your own List file to Feature Code file, Parameter file, and Note List file. The format for List file is explained in this manual on page 169.
- Those List files should be placed under the sub-directory called “B:\Codes” on your data card.
- You can name your List files by any name. There is no restriction as far as it follows DOS file name.

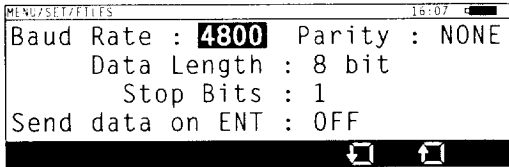


Feature Code File: DEFAULT/other file
Code Parameters File: DEFAULT/other file
Note List File: DEFAULT/other file
Store Data: XYZ & RAW/XYZ Only

-
- MEMO**
- All files in B:\Codes sub-directory are going to be shown by circular selection icon key.
 - Three default files are attached to the Pre-Installed Software and those files are displayed as default files.
 - When the “Store Data” is set to “XYZ only”, it doesn’t add any data to the RAW data file (.NRW).
-

■ Communications

- You can set up Pre-Installed Software to download your survey data. To change the values, you can use the circular selection icon.

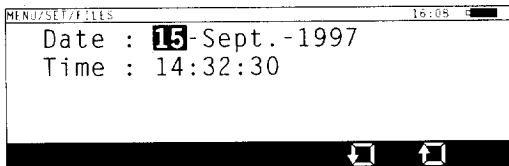


Band Rate: 1200/2400/4800/9600/19200
 Parity: NONE/EVEN/ODD
 Data Length: 8/7
 Stop Bits: 2/1
 Send data on ENT: OFF/ON

- When “Send data on ENT” is set to ON, the current Raw data (HA/VA/SD) is output via the COM port, if the [ENT] key is pressed on the BMS. Usually, it is when recording a point.
- When “Send data on ENT” is set to OFF, SET 1way commands (START, DATA, and STOP) can be handled on any measurement screens.

■ Date & Time

- Date & Time can be adjusted on this screen. To change the values, you can use the circular selection icon on the softkey.

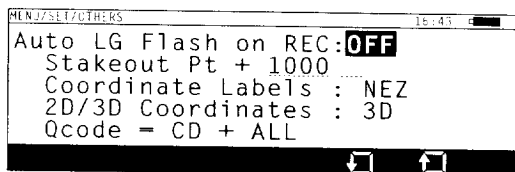


Date: toggle key (circular selection icon) input
 Time: each segment is highlighted individually.
 The hour ranges from 0 to 23, and the minutes/seconds range from 0 to 59. (24 hour only)

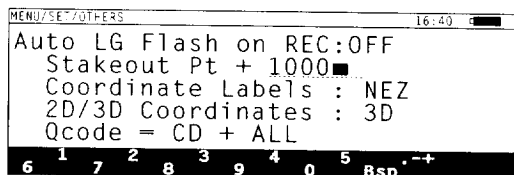
■ Others

Auto LG Flash on REC: OFF/ON
 Stakeout Pt: Pt + 1000
 Coordinate Labels: NEZ/XYZ/YXZ
 2D/3D Coordinates: 2D/3D
 Qcode: MSR/ALL

- If the “Auto LG Flash on REC” setting is ON, it automatically flashes LG for 2 seconds when a point is recorded on the BMS.



- “Pt+1000” is used as a default and the cursor is put on the numeric input field.
 Input range = between 1 to 100000000
- When “Pt” contains alphabets while the setting is “Pt: Name”, it takes the numbers from the end of the Pt: name string, adds the constants, and then returns it to the end of the string to introduce a default Pt: name.
- If the created Pt: Name is more than 16 characters, the upper digits will be truncated to 16 digits.



■ **Show Settings**

A summary view of settings.

- Any Settings cannot be changed from this screen.
- Job settings (cannot be changed in the Settings function) are shown without box. The other settings are changable that are separated into each group based on the Settings menu.
- “List” and “Param” show the specified file name.
- “Dst” = Meters or Ft-Intl or Ft-US
- “Ang” = DEG or Gons or Mills
- “VA 0” = ↑ or ↓
- “Comm” = 96,N,8,1//48,E,7,0, etc

MENU/SET/SHOW SE*		11:14
MSR=Prec.03	Temp=76 F	Dst=Meters
TRK=Norm.00	Press=29.9inHg	Ang=DEG
ALL=Norm.01	Prism=30mm	AZO=North
Prec Res=.1mm	Target=Sheet	VAO=↑
Ang Res=High	T-P=ON	Co-order=ENZ
List=DEFAULT	C&R=OFF	Com=19,N,8,1
Param=NIKONI23	Scale=0.999996	SO+=1000
REC=XYZ/Raw	Sea Level=OFF	Coord=3D

MEMO • “Comm= 19,N,8,1” stands for the setting of:

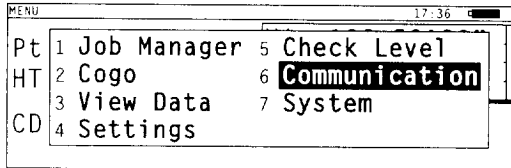
- Baud rate = 19200
- Parity = None
- Data length = 8 bit
- Stop bits = 1

3-10. Communication

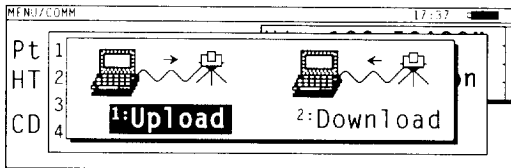
This section shows you how to transfer survey data to and from your computer or data card.

Uploading to the Instrument

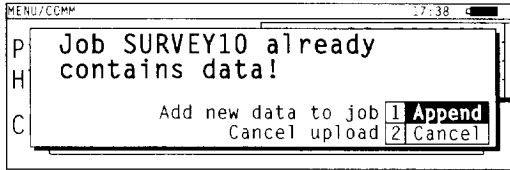
- The uploading procedure transfers data from an ASCII file on the data card or on your computer and puts the coordinates into the open job.
- Select [6:Communication] from the MENU window.



- Press [1:Upload] to enter upload function.



- When the current open job contains data, a confirmation window is shown.

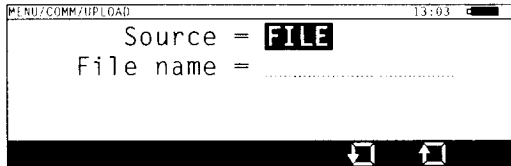


[1:Append] = adds the uploaded data to the end of the coordinate file.

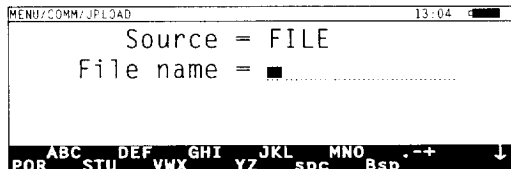
[2:Cancel] = terminates the uploading process and returns to the MENU screen.

■ Uploading From an ASCII File on the Data Card

- After selecting [1:Upload] function, you are lead to specify the Data source from "FILE" or "COM1". Press [ENT] to define the source.

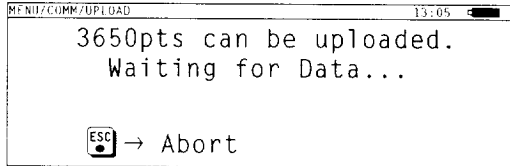


- Input a file name to be uploaded. Maximum 8 characters plus 3 characters (for extension) can be entered as a file name.

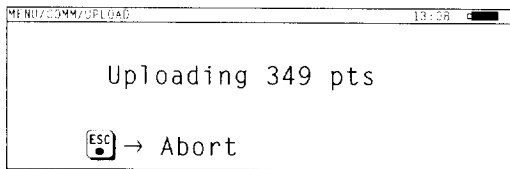


MEMO • A source file for upload should be placed in the root directory.

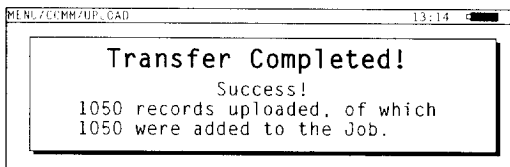
- It shows how many points can be uploaded to the data card.
- The Coordinate order of the data is defined by Job settings.
(See page 69)



- While uploading data, it shows the process by incrementing the counter which indicates how many points has been transferred.
- Press any key to abort uploading.

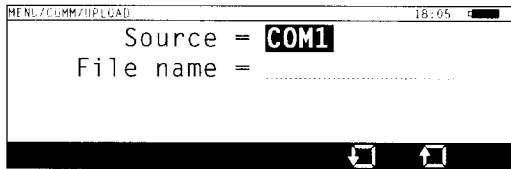


- When the upload is finished or aborted, results of the transmission is displayed.

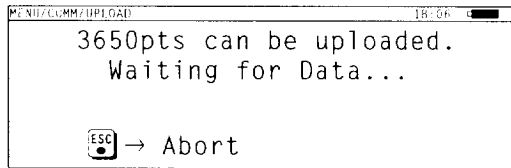


■ **Uploading From your PC through COM1**

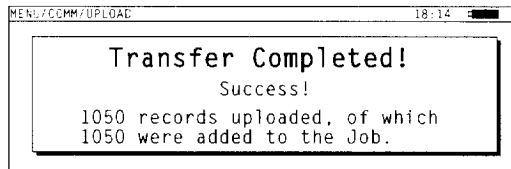
- Select **COM1** at “Source” field and press [ENT].



- Connect the RS232C cable and send data.



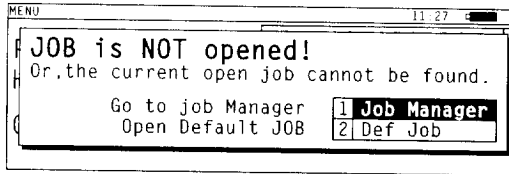
- It shows the number of the points that have been uploaded and stored to the Job.
- Press any key to return to the BMS.



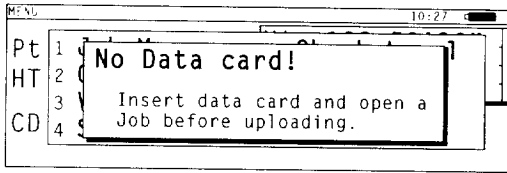
- MEMO**
- If an existing record is overwritten by the new coordinate, it is stored as a UP record in the XYZ-DB. No new record is added to the RAW-DB.
 - When the Point-name records are uploaded to the Point-number Job, data will be recognized as comment records and stored in the RAW-DB. In this case, those comment records will not be counted as “added to the Job” records.

■ Error Messages in Upload

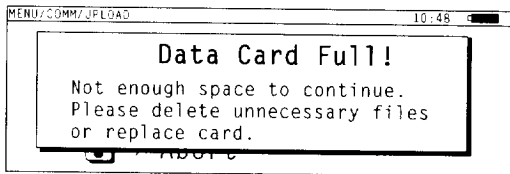
- When no file is opened, you need to go to the Job Manager or to open the Default Job.



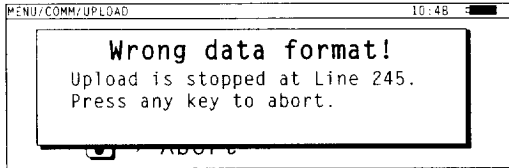
- If a data card is not in the slot when [6:Communication] is selected. It shows an error window and return to MENU screen by pressing any key.



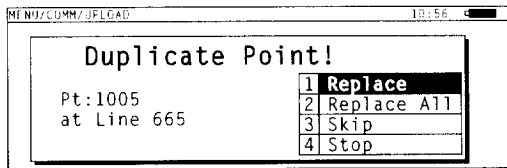
- When the data card becomes full, it shows an error window below, and aborts the upload process by any key. It displays the "Transfer Completed!" with "Aborted!" message before returning to the BMS.



- When the coordinate data is longer than 13 digits for Northing and Easting or than 10 digits for Z, it results in the following error screen. (Also, when the coordinate contains any invalid characters.)



- When the data format is incorrect, it is recognized as a comment record and stored to the Job.
- When there is a duplicate point, the user is prompted with the window shown below.



- [1:Replace] = to continue uploading and replace the duplicate Pt with new.
- [2:Replace All] = to continue and replace all the duplicate points without displaying this window each time
- [3:Skip] = to ignore this duplicate point and move to the next point
- [4:Stop] = to cancel the operation after this point

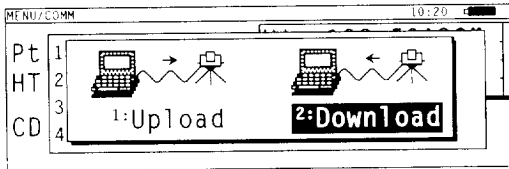
■ Acceptable ASCII data format

- Pt,N,E,Z,Code or Pt,N,E,Z
- Pt N E Z Code or Pt N E Z
- Pt,N,E,,Code or Pt,N,E,Code
- Pt,N,E or Pt N E or Pt,N,E,
- Pt,,,Z,Code or Pt,,,Z or Pt,,,Z,

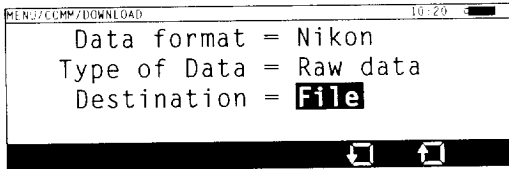
- The order of N and E can be exchangeable.
- Code can be left blank.
- "Pt,N,E,Z,(Code)" and "Pt N E Z Code" are recognized as 3D coordinates.
- "Pt,N,E,Code", "Pt,N,E,Code" and "Pt N E Code" are recognized as 2D coordinates.
- "Pt,,,Z,Code" and "Pt,,,Z" are recognized as Benchmark points. Three commas are required between "Pt" and "Z" for a record to be recognized as a Benchmark point.

Downloading from the Instrument

- The downloading procedure converts formats, and places your measurement data or calculated coordinates into an ASCII file on your computer or data card. The data is always transferred from the current job (open job).
- Press [2:Download] after selecting [6:Communication] on the MENU window.



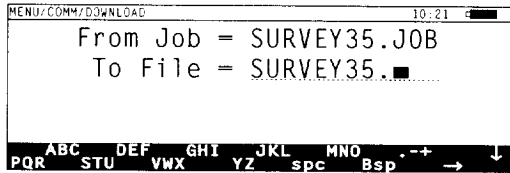
- It is ready to set up the program to download your survey data. You can use the circular selection icon on key [5] and [.-] to change the inverted item.
- Move the cursor to the last field and press [ENT] to next step.



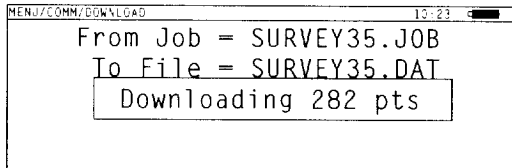
- Data format = Nikon or SDR2x or SDR33
- Type of Data = Raw data or Coordinate
- Destination = COM1 or File

■ Downloading to an ASCII file on the Data Card

- When downloading data to file, it shows the current opened file name to “From Job”.
- The default name for “To File” is displayed without having an extension. You can input your own extension or totally change the file name.

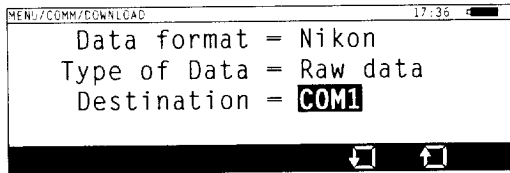


- It shows the process by incrementing the counter which indicates how many points has been output.
- Press [ESC] to abort downloading data at any time.

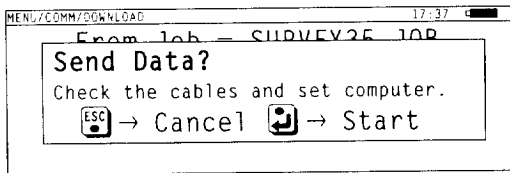


■ **Downloading to your PC through COM1**

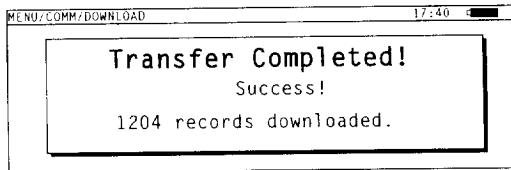
- When **COM1** is selected in “Destination” field, a confirmation screen is shown.



- Check the cables and set your PC to receive the data using the DOS command COPY A COM1:filename or running any terminal software. Then, press [ENT] to download your data.



- Total number of downloaded points is indicated.

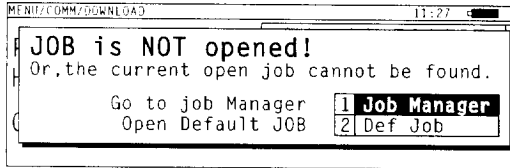


3

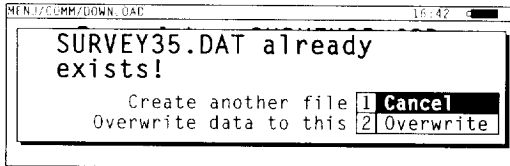
OPERATION

■ Error Messages in Download

- If no file is opened when [6:Communication] is selected, an error window is shown. Select [1:Job Manager] to open a job you are going to download.



- When the input file name as the Destination file already exists in the data card, an error window is shown.



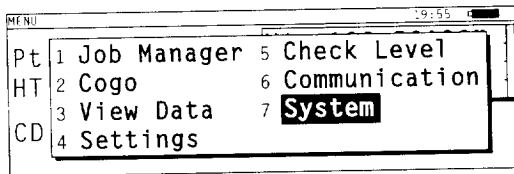
[1:Cancel] = returns to the previous (input filename) screen.

[2:Overwrite] = starts downloading data after deleting the old existing data in the file.

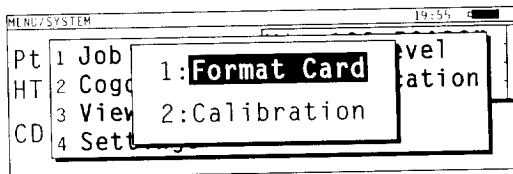
3-11. System

■ Format Card

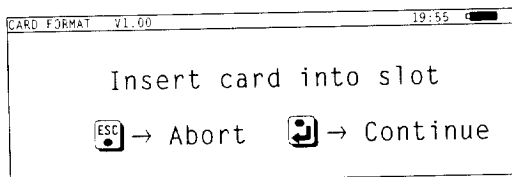
- The data card is formatted by this function so that survey data may be stored on it. You must format a new data card placed in the slot before you use it.
- Press [7:System] on the MENU window.



- Select [1:Format Card] to reach the format function.

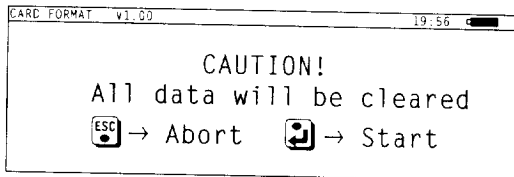


- Check to see if the data card is write-protected, and turn off the write protection.
- Insert the data card to the slot and close the drive door.

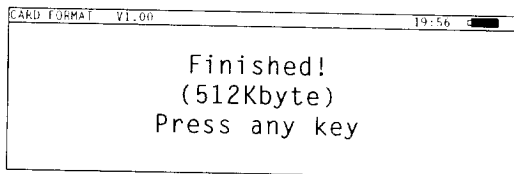


 **WARNING**

- Format deletes ALL existing data on the card !!
- Press [ENT] to format the card. To cancel the operation, press [ESC].

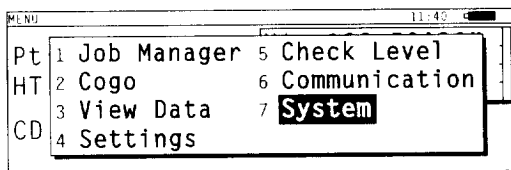


- After formatting the data card, it shows the result on the screen.

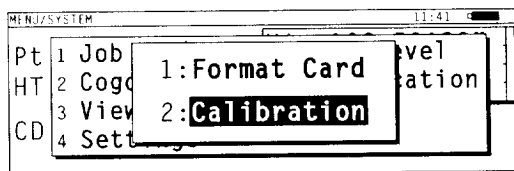


■ Calibration

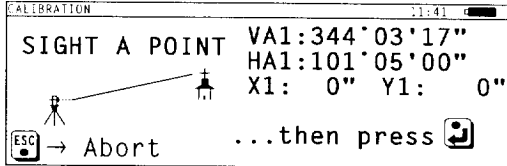
- This section shows you how to accurately determine the vertical, horizontal, and tilt index errors and adjust future angles.
- The Calibration procedure can be performed with the leveling compensators turned ON or OFF.
- By performing this routine, you will be re-calibrating the vertical, horizontal and tilt correction values.
- You should periodically check these index errors to maintain the highest accuracy for angle and tilt measurements.
- Press [7:System] on the MENU window.



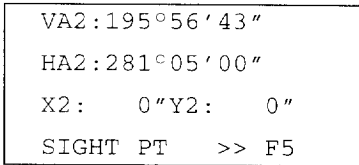
- Select [2:Calibration] to perform the calibration function.



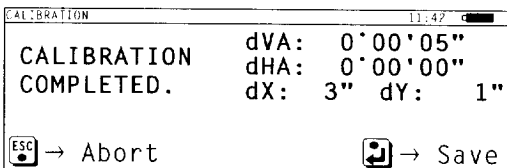
- On Face 1, sight to a clearly defined point.
- Record the vertical angle, the horizontal angle and the tilt offset by pressing [ENT].



- Turn to Face 2 and sight again to the same object. Press [F5:ENTER].



- Return to Face 1 and check the dVA, dHA, dX and dY correction.



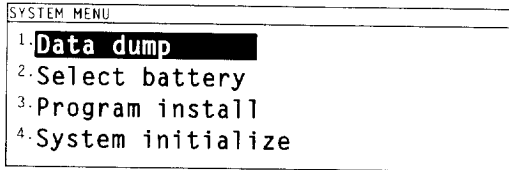
[Save] = automatically corrects all future angle and tilt measurements using this correction value until you change it.

[Abort] = cancels the procedure and the instrument will use the previous correction value.

-
- MEMO** • If the dVA or dHA value is reported as “Calibration Out of Limit”, it is possible that your hardware Reticule needs adjusting to be within tolerance. Please contact your Nikon dealer.
-

3-12. Emergency Menu

The system menu is displayed when you turn on the instrument while [ESC] is holding down.



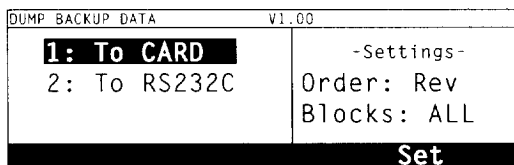
<System Functions>

1. Data dump: Internal data output
2. Select battery: Setting the battery type you are connecting to
3. Program install: Installing the application program via COM port
4. System initialize: Initializing the system, including initializing Main Memory of the instrument

■ Internal Data Output

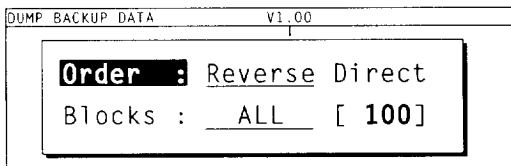
To download the Internal recorded data, select [1:Data dump] on the system menu.

- Select the output device by moving the highlight with the up or down arrow key and pressing [ENT] key.
- Press [Set] on the softkey to get the cursor on the righthand side of the screen, where you can define the order of data block dump and number of blocks to be downloaded.
- Press [ESC] key to abort.

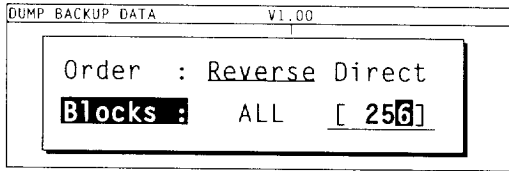


When [Set] key is pressed _____

- The underlined item is the current settings.
- Move the inverted cursor by the up or down arrow key. You can place the underline whichever you want by the right or left arrow key.
- Press [ENT] key to complete the input and proceed to next.
- [ESC] aborts the process and returns to the previous screen

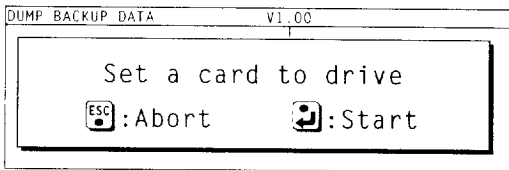


- When the “Blocks” is inversed and the number is underlined, you can set the number of record you want to output.

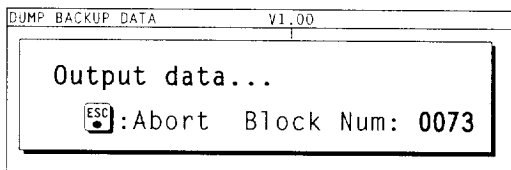


When “1: To CARD” is selected

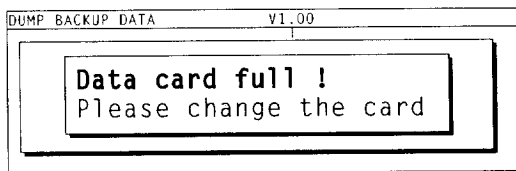
- Insert a data card in the slot.
- Press [ENT] to start downloading data.
- [ESC] key aborts the process and returns to the start-up screen.



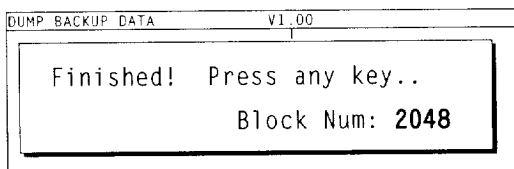
- While data is output, a message left is shown. It also contains the number of records that has already processed when it is started.
- [ESC] key aborts the process and returns to the start-up screen



- If the data card is getting full during the data dump, a message left appears. To continue data output, you need to replace the data card.
- Press [ENT] to download the remaining data to new card.
- [ESC] key aborts the process and returns to the start-up screen

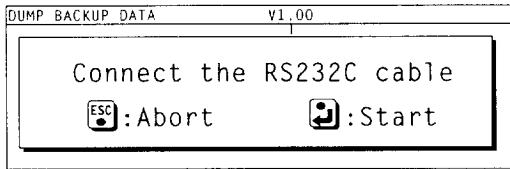


- When the process is completed, it shows the total record number which is transferred. Press any key to return to the start-up screen.

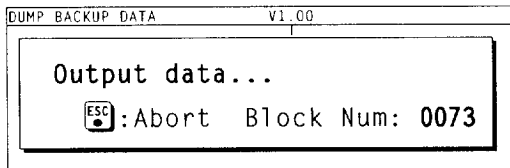


When “2: To RS232” is selected

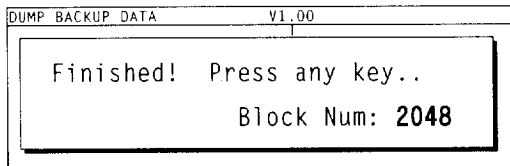
- Connect the communication cable.
- Press [ENT] to start downloading data.
- [ESC] key aborts the process and returns to the start-up screen.



- While data is output, a message left is shown. It also contains the number of records that has already processed when it is started.
- [ESC] key aborts the process and returns to the start-up screen.

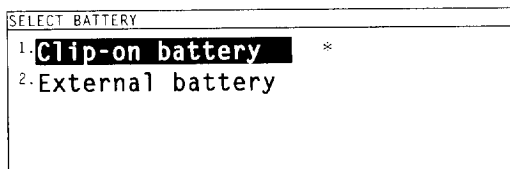


- When the process is completed, it shows the total record number which is transferred. Press any key to return to the start-up screen



■ Select Battery

- This function allows you to see more accurate battery level indication when you use the external battery. When you connect the external battery to the instrument, use a down arrow key to select the correct connection and press [ENT].
- An asterisk is shown on the current connection.

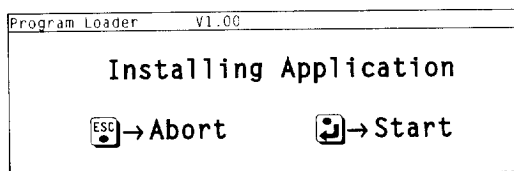


- If you set the battery selection incorrectly, you cannot obtain correct battery level information.

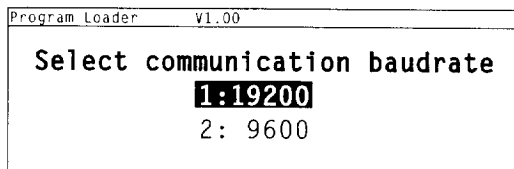
■ Program Install

By this function, you can install an application program from your PC using some communication program via COM port.

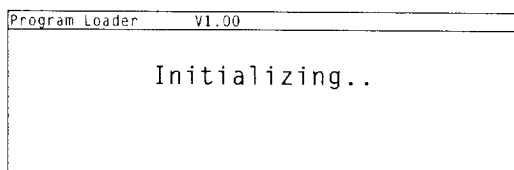
- Connect the instrument and your PC with a cable when start running the install program.



- Set the baudrate by the up or down arrow key. Press [ENT] to proceed.



- Before installing the application program, the system deletes the area where the new program will be installed.



- You can send the application from your PC now.



WARNING

- Before select [ENT] to install the program here, please make sure that you are ready to send a valid program from your PC.
- If you don't send a program even if you select [ENT] to install on the above screen, you will loose your current program on the instrument.

- It indicates the line counts that are finished processing.

```
Program Loader      V1.00
  

                Writing
                Line:1025
```

- By pressing any key to re-start the system.

```
Program Loader      V1.00
  

                Finished!
                BCC:4683
                Press any key
```

- When writing the program is failed by any reason, it will delete the contents in C:\drive and cut off the power afterwards.

```
Program Loader      V1.00
  

                Finished!
                BCC:4683
                Press any key
```


■ System Initialize

[4:System Initialize] is provided just in case you had a hang-up problem with any application program or when you install a new application.

Initializing...

<System Error>

SYSTEM ERROR!
VA OVER SPEED
> Tilt Telescope

When you get this message on the instrument, please tilt the telescope again and wait for a moment until the vertical encoder is reset. It automatically recovers and you can start working without any problem.

SYSTEM ERROR!
“ (Error messages) ”
> Push any key to end

SYSTEM WARNING
“ (warning messages) ”
> Push any key

MEMO • If you find one of above messages by any chance, please contact your Nikon dealer with the information of what message you had.

Appendix

Setting Up Feature Code, Parameter and Note Files

■ Creating Feature Code, Parameter and Note Files in ASCII Format

#2: Curly brackets { } are used as separators to create nested menus e.g. Strings3-1-1 and 3-1-2 are under the submenu 3-1. There are 5 items in the Layer3 menu.

```

Title of the Code list
{
  String1 , Code1
  Layer2
  {
    String2-1, Code2-1
    String2-2, Code2-2
    String2-3, Code2-3
  }
  Layer3
  {
    Layer3-1
    {
      String3-1-1, Code3-1-1
      String3-1-2, Code3-1-2
    }
    String3-2, Code3-2
    String3-3, Code3-3
    String3-4, Code3-4
    String3-5, Code3-5
  }
  String4, Code4
  String5, Code5
  String6, Code6
  String7, Code7
  String8, Code8
  String9, Code9
  String10, Code10
}

```

#1: The first line of the file is the title bar indication for the first layer of the code list.

NOTE

- The title should be within 16 characters.
- String must be defined. Code is optional. When the Code is not included, the Code is assumed to be the same as the String. (Ex: Writing "TREE" equals to "TREE", "TREE")
- Both String and Code should be within 16 characters.
- String/Code should be defined by the characters available in QL2 system.
- The following characters are illegal in String/Code fields.

* , ? , \

- The list file needs to contain at least one String/Code.
- Basically use double-quotation marks on each string, like "ABC". When the string does not include a space or comma, double-quotations can be eliminated. When a double-quotation is needed to be defined within the String or Code, a back-slash is required before.
- Spaces at the beginning and end of the String/Code will be ignored. A space in the middle of the string is valid.
- There is no logical restriction to the number of menu layers, only available memory. The menu will fail to load when the available memory is insufficient.
- Each menu layer can contain up to 10 items (String/Code).
- This ASCII file format is common for the Code list, Parameter list, and Note list.

■ Sample Code List

- By the following Code list file, you can create the code selection windows on the following pages.

```
Nikon Code List
{
  "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"
  }
}
```

■ Setup the Code Lists

Before you can use your Code, Parameter and Note lists you need to copy them into a /CODES directory on the datacard. Then, go to the Settings screen MENU/4:Settings/5:Files and set the desired files for Feature Code, Code Parameter and Note List. (See page 140)

Download Format

There are three data format to be downloaded:

Nikon Download format

SDR Download format (SDR 2X/SDR 33)

When you download data using Pre-Installed Software, you have the choice of selecting "Raw Data" or "Coordinate" type download for each data format.

■ Nikon Download Format

The Nikon Raw data format is compatible with AP700/800 output format and is for communication with other systems and 3rd party software.

1) Raw Data Download

When "Raw data" is selected, all records in the RAW data file and referenced UP records from the Coordinate file are downloaded. The other coordinate records, such as "MP", "RE", or "CC" are already in the RAW file when it is recorded, so they are output as well.

"CC" records are calculated using COGO and "RE" records during a resection session.

All "CP", "SS", "SO", "F1" and "F2" records are downloaded as raw data; that is, coordinates are not calculated for them in raw data file. Station setups are downloaded using the "ST" record format.

Record Formats

Coordinate Records *Record Type, pt, , northing, easting, elevation, code*

where:

Record Type = one of the following types:

- UP (Uploaded Point)
- MP (Manually input Point)
- CC (Calculated Coordinate)
- RE (Resection Point)

pt = Point Number

code = Feature Code

The order of northing, easting or easting, northing is interchangeable according to the current job setting.

Station Records *ST, stnpt, , bspt, , hi, bsazim*

where:

stnpt = Station Point Number

bspt = Backsight Point Number

hi = Height of Instrument

bsazim = Backsight Azimuth

Control Point Records *CP, pt, , ht, sd, ha, va, time, code*

where:

pt = Point Number

ht = Height of Target

sd = Slope Distance

ha = Horizontal Angle (azimuth)

va = Vertical Angle

time = 24 Hour Time Stamp

code = Feature Code

Sideshot
Records

SS, pt, ht, sd, ha, va, time, code

where:

pt = Point Number

ht = Height of Target

sd = Slope Distance

ha = Horizontal Angle (azimuth)

va = Vertical Angle

time = 24 Hour Time Stamp

code = Feature Code

Stakeout
Records

SO, pt, sopt, ht, sd, ha, va, time,

where:

pt = Recorded Point Number

sopt = Original Number of Point Staked

ht = Height of Target

sd = Slope Distance

ha = Horizontal Angle (azimuth)

va = Vertical Angle

time = 24 Hour Time Stamp

F1/F2
Records

F1, pt, ht, sd, ha, va, time

where:

F1 = Face of Shot (F1 or F2)

pt = Point Number

ht = Height of Target

sd = Slope Distance

ha = Horizontal Angle (azimuth)

va = Vertical Angle

time = 24 Hour Time Stamp

- NOTE** • Previous versions of the AP700 raw data format did not include the ht field in F1/F2 records.

Comment/Note CO, text
Records

Sample of Downloaded Raw Data

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-Feb-2000 18:54:10
CO,Software: Pre-Installed version: 1.20
CO,Instrument: Nikon DTM-851
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 18-Feb-2000 08:14:21
MC,1,100.000,200.000,10.000,
MC,2,150.000,250.000,,PSM
CO,Temp:18C Press:760mmHg Prism:30 18-Feb-2000 08:18:39
ST,1,2,1.400,45.0000
F1,2,1.400,0.0000,90.0000,08:20:58
SS,3,1.200,330.706,326.027,20.320,08:22:46,SIGN
SS,4,1.250,379.193,300.847,29.084,08:24:24,TREE
SS,5,1.218,363.344,328.032,30.105,08:25:57,TREE R
SO,1003,3,1.240,331.220,326.783,19.998,08:28:42,

2) Coordinate Data Download

All coordinate download records follow the same format:

Coordinate *pt, northing easting, easting northing,*
Download *elevation, code*
Records

where:

pt = Point Number/Name

code = Feature Code

- NOTE** • Coordinate download records do not have a record type identifier.
The order of coordinates northing,easting or easting,northing depends on the current job settings.

Sample Downloaded Coordinate Data

```
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,TRAIN PLATFORM  
44,126.7042,206.2871,10.8193,RAMP  
45,116.9266,216.9160,11.8028,  
46,126.7046,206.2845,10.8213,CP POINT
```

■ SDR Download Formats (2x and 33)

The DTM-801 series software gives you the option of downloading data in two SDR formats, SDR2x (which is compatible with SDR2, 20, 22 and 24) and SDR33. This section explains the format of the download options.

The important difference between the two formats is that the SDR2x format supports 4 digit point numbers and 10 character coordinates, distances, angles, etc., whereas SDR33 supports 16 character point names and 16 character coordinates, distances, angle, etc. These differences in field lengths are detailed in the “Record Formats” section below.

As with the Nikon format, SDR formatted data can be downloaded as either raw or coordinate data.

NOTE • This document refers to the “Nikon Download Format” section in this Appendix, and should be read in conjunction with that information (see page 173~).

1) Raw Data Download

When you select raw data as the download format, all records from the job database are downloaded.

Record Formats

The record formats are very similar for SDR2x and SDR33, the main difference being the length (number of characters or digits allowed) for some of the fields. The position and length of each field are indicated in this section as follows. (5-8) would indicate that the field begins at the fifth column, extends to the eighth column allowing a maximum of four characters.

NOTE • SDR2xformat will only handle 4-digit point numbers.

9-digit DTM-801 series software point numbers are reduced to their last 4 digits when downloaded in the SDR2x format. For example, a DTM-801 pt No. 101009364 will download as 9364.

Header *00NM ver 0000 datetime ang dist press*
Record *temp coor 1*

where:

ver (5-20) = The SDR Download Version.

SDR2x will read SDR20V03-05.

SDR33 will read SDR33V04-01.

datetime (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, hPa:3.

temp (44) = Temperature Units.

coor (45) = Coordinate Order. NEZ:1, ENZ:2.

1 (46) = Not Used.

Instrument *01K11 instr serNo. Instr serNo.1 zero VA*
Record *0.000*

where:

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 *02KI stnpt northing easting elevation hi*
Record *desc*

where:

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 *03NM ht*
Record

where:

ht (2x:5-14) (33:5-20) = Height of Target.

Backsight *07KI stnpt bspt bsazim ho*
Bearing Details
Record

where:

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 *08KI pt northing easting elevation desc*
Record

where:

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 *09MC stnpt pt sd va ha desc*
Record

where:

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 *09MC stnpt pt sd va ha desc*
Record

where:

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*

where:

note (5-64) = Note/Comment Text.

Sample of Downloaded Raw Data

00NMSDR20V03-05 000011-Apr-2000 11:0422211
10NMTEST JOB
01KI1 Nikon DTM-851020057 Nikon DTM-85102005712 0.000 0.000
0.000
13NM TEST <JOB> Downloaded 11-Apr-2000 11:02:01
13NM Nikon Raw Data Format V2.00
13NM B:\JOBS\TEST
13NM Description:
13NM Client:
13NM Comments: TOKYO BAY157
13NMSftware: Pre-Installed version: 1.20
13NMInstrument: Nikon DTM-851
13NMDist Units: Metres
13NMAngle Units: Degrees
13NMZero azimuth: North
13NMZero VA: Horizon
13NMCoord Order: NEZ
13NM HA Raw data: Azimuth
13NM TEST <JOB> Created 11-Apr-2000 10:55:37
13NM Tilt Correction = OFF
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
03NMO.000
13F10001000323.990 4.1653 359.9833 MAIN PLATFORM
13F10001000427.445 2.4097 328.1958 RAMP
13NM Start of 2PT Resection
13F10000000123.262 176.800 0.000
08KI000224.000 -10.000 35.700 SHELF
13F10000000237.484 124.740 2290.740
08KI000526.257 33.855 28.837 STN-2PT
13NM Temp:62F Press:29.9inHg Prism:30 18-Apr-2000 08:21:55
02KI000526.257 33.855 28.837 2.990
07KI000500012403.511 2403.511
13NM End of Resection from Pt:5

2) Coordinate Data Download

When you select coordinate data download, Pre-Installed Software will download records using the same selection criteria as for the Nikon Format (see page 190). All Coordinate records are downloaded as SDR Coordinate records (Type Code 08).

SDR coordinate format includes all the Type code 13 note records.

Sample of Downloaded Coordinate Data

```

00NMSDR20V03-05      000011-Apr-2000 11:0422211
10NMTEST JOB
01KI1 Nikon DTM-851020057 Nikon DTM-85102005712 0.000 0.000
0.000
13NM TEST <JOB> Downloaded 11-Apr-2000 11:02:01
13NM Nikon Raw Data Format V2.00
13NM B:\JOBS\TEST
13NM Description:
13NM Client:
13NM Comments: TOKYO BAY157
13NMSftware: Pre-Installed version: 1.20
13NMInstrument: Nikon DTM-851
13NMDist Units: Metres
13NMAngle Units: Degrees
13NMZero azimuth: North
13NMZero VA: Horizon
13NMCoord Order: NEZ
13NM HA Raw data: Azimuth
13NM TEST <JOB> Created 11-Apr-2000 10:55:37
13NM Tilt Correction = OFF
08KI0001100.000 200.000 10.000
08KI0002200.000 300.000 20.000
13NMBacksight Check to Pt:2 HA:359.3525 05:21:39
13NMBacksight Pt:2 Reset to HA: 0.0000 05:21:41
08KI0003116.924 216.914 11.843 MAIN PLTFORM
08KI0004126.697 206.260 11.254 RAMP
13NM Start of 2PT Resection
08KI0005100.005 199.996 10.000
13NMFinish of Resection from Pt: 5

```

Mathematical Formulae

This section provides details of the mathematical formulae used by the DTM-801 series software to perform calculations and make adjustments.

■ Units

< Distance Units >

1 international foot = 0.3048 metres

1 US foot = 0.3048006095 metres

Measurement Mode	Minimum Increment (high/low accuracy)
------------------	---------------------------------------

Precise

Metres	0.0001m/0.001m
US Feet	0.0005ft/0.002ft
Int'l Feet	0.0005ft/0.002ft

Normal

Metres	0.001m
US Feet	0.002ft
Int'l Feet	0.002ft

Highspeed

Metres	0.010m
US Feet	0.020ft
Int'l Feet	0.020ft

< Angle Units >

Degrees, Minutes, Seconds

360 degrees in a circle

60 minutes in a degree

Format: DDD.MMSS 359.5959

Gons

400 Gons in a circle

Format: GON.DDDD 399.9998

Mil6400

6400 mil in a circle

Format: MIL.DDD 6399.995

Instrument/Angles	Minimum Increment (High/low accuracy)
Degrees	1"/5"
Gons	0.2mgon/1.0mgon
Mils	0.005MIL/0.02MIL

< Temperature >

Units	Range	Minimum Increment
Celsius	-40°C... +55°C	1°C
Fahrenheit	-40°C... +131°C	1°F

< Pressure >

Units	Range	Minimum Increment
hPa	533hPa... 1332hPa	1hPa
mmHg	400mmHg... 999mmHg	1mmHg
inHg	15.8inHg... 39.3inHg	0.1inHg

■ Notation

Vertical angles are assumed to be measured from the zenith (that is 0° at Zenith and 90° at the horizon) for the formulae.

The following base values are obtained directly from the instrument:

SD = slope distance. HA = horizontal angle.

VA = vertical angle. $HD = SD \cdot \sin (VA)$

$VD = SD \cdot \cos (VA)$ GD = grade.

Hi = height of the instrument station.

Ht = height of the target prism.

Z_{st} = elevation of the station point.

N_{st} = northing of the station point.

E_{st} = easting of the station point.

BS_{AZ} = backsight azimuth.

■ VA, HA and Tilt Calibration

Determined by accurately sighting a point using both the Face 1 (F1) and Face 2 (F2) telescope positions.

< VA Offset >

$$VA_{offset} = \frac{(VA_{F1} + VA_{F2} - 2\pi)}{2}$$

VA displayed on both faces is $VA_{circle} - VA_{offset}$

< HA Offset >

$$HA_{offset} = \frac{(HA_{F2} + HA_{F1} - \pi)}{2}$$

HA displayed on F1 is $HA_{circle} - HA_{offset}$

HA displayed on F2 is $HA_{circle} + HA_{offset}$

< Tilt Offset >

$$TX_{offset} = \frac{(TX_1 + TX_2)}{2}$$

$$TY_{offset} = \frac{(TY_1 + TY_2)}{2}$$

The tilt offset value in the X direction (ΔTX) is given by:

$$TX_{circle} - TX_{offset}$$

The tilt offset value in the Y direction (ΔTY) is given by:

$$TY_{circle} - TY_{offset}$$

■ Corrections

Corrections are applied to various readings which are subsequently used to calculate other values. Whether or not each correction is applied depends on its setting in the Pre-Installed software.

The corrections are applied in the following order:

1. Temperature and Pressure
2. Instrument and Prism Constant
3. Curvature and Refraction
4. Sea Level
5. Map Projection

1. Temperature and Pressure Corrections

T & P corrections are applied to all measured distances if the user selected "ON" in "Settings".

K = Compensation coefficient

P = Pressure in mmHg

T = Temperature in °C

$$K = 275 - \frac{106P}{(273+T)}$$

$$TP_{SD}(SD) = \left(1 + \frac{K}{1000000} \right) SD$$

NOTE • A temperature of 20°C and pressure of 760mmHg (1013hPa) will result in a 0ppm correction

MEMO • EDM calibration processing softwares often require 'C & D' values, which are related to the EDM frequency and temperature/pressure correction.

- The C & D values for the DTM-801 are: 275 & 79.5.
-

2. Instrument and Prism Constant Corrections

C_{Inst} = the instrument constant (set internally by the factory).

C_{Prism} = the prism constant (supplied by user).

$$CO_{SD} (SD) = SD - C_{\text{Inst}} - C_{\text{Prism}}$$

3. Curvature and Refraction

C & R corrections are applied to both HD and VD if the user selected "ON" in "Settings".

$R_e = 6370000\text{m}$

K = curvature and refraction constant (either 0.132 or 0.200, set by user)

$$CR_{HD} (HD) = \left| HD - \frac{SD^2 \sin(2VA)}{2R_e} \left(1 - \frac{K}{2} \right) \right|$$

$$CR_{VD} (VD) = VD + \frac{SD^2 \sin(2VA)^2}{2R_e} (1 - K)$$

4. Sea Level Correction

Sea level correction is applied to the HD if the user selected "ON" in "Settings". (See also the Note under "Map Projection Correction" below.)

$R_e = 6370000\text{m}$

$$SL_{HD} (HD) = \frac{HD \cdot R_e}{R_e + Z_{STX}}$$

5. Map Projection Correction

Map projection correction is applied to the HD if the user selected "ON" in "Settings"

sf = the map projection scale factor (supplied by user).

$$MP_{HD} (HD) = HD \cdot sf$$

- NOTE**
- If turned ON, sea level and map projection corrections are applied to all measured horizontal distances (except those measured inside the Total Station function). Also, all input coordinates or distances are then assumed to be map coordinates or distances.

6. Corrected Forms

As more than one correction may be applied, the Pre-Installed Software applies the corrections in the order shown below:

$$SD' = CO_{SD} (TP_{SD} (SD))$$

$$HD' = MP_{HD} (SL_{HD} (CR_{HD} | SD' \cdot \sin (VA) |))$$

$$VD' = CR_{VP} | SD' \cdot \cos (VA) |$$

These corrected forms are used throughout this Appendix and are distinguished from other measurements by an apostrophe (')

■ Coordinate Calculation

$$N = N_{STX} + HD' \cdot \cos(HA)$$

$$E = E_{STX} + HD' \cdot \sin(HA)$$

$$Z = Z_{STX} + hi - ht + VD'$$

■ Known Station

If the height of the instrument is to be calculated from the backsight, then:

$$hi = bs_z + ht - Z_{STX} - VD'$$

If the station Z is to be calculated from the backsight, then:

$$Z_{STX} = bs_z + ht - hi - VD'$$

The backsight azimuth is calculated by:

$$BS_{AZ} = \tan^{-1} \left(\frac{E_{BS} - E_{STX}}{N_{BS} - N_{STX}} \right)$$

■ Resection

< 2pt Resection-I >

When only one distance measurement is taken, following equations will be used to calculate the station coordinates.

2pt Resection results in Station coordinate $P_i (X_i, Y_i, Z_i)$, when $L_2 > L_1$.

Let:

Known Point: $P_1 (X_1, Y_1, Z_1)$

$P_2 (X_2, Y_2, Z_2)$

Station Point: $P_i (X_i, Y_i, Z_i)$

Dist ($P_i \sim P_1$) = L_1 (measured)

HA ($P_1 \sim P_2$) = a (measured)

Dist ($P_1 \sim P_2$) = L_2

$$L_2 = \sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)^2}$$

Dist ($P_i \sim P_2$) = L_3

$$L_3 = L_1 \cos \alpha + L_2 \sqrt{1 - \left(\frac{L_1 \sin \alpha}{L_2} \right)^2}$$

$$\tan \phi_3 = \frac{L_3 \sin \alpha}{L_1 - L_3 \cos \alpha}$$

$$\tan \phi_2 = \frac{X_2 - X_1}{Y_2 - Y_1}$$

$$\phi_1 = \phi_3 - \phi_2$$

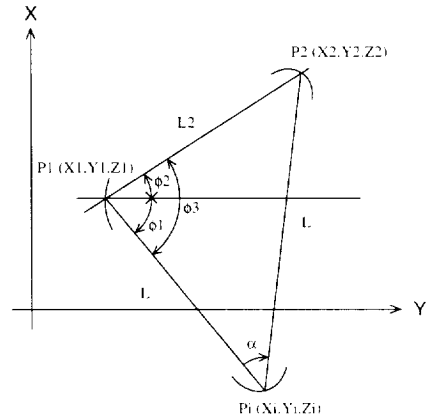
$$= \text{ATAN2} (L_3 \sin \alpha, L_1 - L_3 \cos \alpha) - \text{ATAN2} (X_2 - X_1, Y_2 - Y_1)$$

* The order of parameters in ATAN is from MS-C standard function spec.

Therefore:

$$X_i = X_1 - L_1 \sin \phi_1$$

$$Y_i = Y_1 + L_1 \cos \phi_1$$



< 2pt Resection-II >

When both known points are distance-measured, following process will be applied to calculate the station coordinates.

Known point = P1 (X1,Y1,Z1)

Known point = P2 (X2,Y2,Z2)

Both points are assumed to be measured from (0,0,0) in the fixed axis-XY. In the diagram below, the transformation of the coordinate (shift & rotation) will be done where the known coordinates of P1 (X1,Y1) and P2 (X2,Y2) in the XY-axis are equal to the local (measured) coordinates of P1 (x1,y1) and P2 (x2,y2) in the xy-axis.

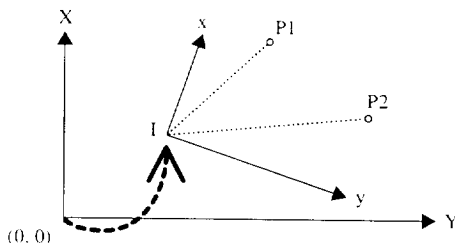
$$X1 = ax1 + by1 + Xi$$

$$Y1 = -bx1 + ay1 + Yi$$

$$X2 = ax2 + by2 + Xi$$

$$Y2 = -bx2 + ay2 + Yi$$

When the variables "a" and "b" are calculated from these equations, the coordinate of the station will be calculated as (Xi,Yi).



$$a = \frac{(X2-X1)(x2-x1)+(Y2-Y1)(y2-y1)}{(x2-x1)^2+(y2-y1)^2}$$

$$b = \frac{(X2-X1)(y2-y1)-(Y2-Y1)(x2-x1)}{(x2-x1)^2+(y2-y1)^2}$$

$$\therefore Xi = X1 - ax1 - by1$$

$$Yi = Y1 + bx1 - ay1$$

For the elevation of the station:

$$z1 = Z1 - VD1 + HT1 \quad HTi = \text{Height of the target for each point}$$

$$z2 = Z2 - VD2 + HT2 \quad VDi = \text{Vertical distance}$$

(C&R correction considered)

$$Zi = (z1 + z2) / 2 - HI \quad HI = \text{Height of Instrument}$$

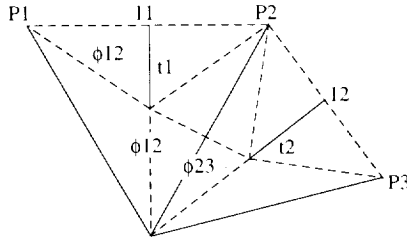
Note: P1 and P2 are assumed to have different coordinates.

< 3pt Angle Resection >

Let:

Known Points : P1(x1,y1), P2(x2,y2), P3(x3,y3)

HA reading to P1, P2, P3 : ϕ_1, ϕ_2, ϕ_3



$$\phi_{12} = \phi_2 - \phi_1$$

$$\phi_{23} = \phi_3 - \phi_2$$

$$l1 = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

IF ($\phi_{12} \neq 90^\circ$ or 270°) AND ($\phi_{23} \neq 90^\circ$ or 270°):

$$t1 = \frac{l1}{2 \tan \phi_{12}}$$

$$a1 = \frac{x1 + x2}{2} - t1 \cdot \frac{y2 - y1}{l1} = \frac{x1 + x2}{2} - \frac{y2 - y1}{2 \tan \phi_{12}}$$

$$b1 = \frac{y1 + y2}{2} + t1 \cdot \frac{x2 - x1}{l1} = \frac{y1 + y2}{2} + \frac{x2 - x1}{2 \tan \phi_{12}}$$

$$t2 = \frac{l2}{2 \tan \phi_{23}}$$

$$a2 = \frac{x2 + x3}{2} + \frac{y3 - y2}{2 \tan \phi_{23}}$$

$$b2 = \frac{y2 + y3}{2} + \frac{x3 - x2}{2 \tan \phi_{23}}$$

IF ($\phi_{12} = 90^\circ$ or 270°) AND ($\phi_{23} = 90^\circ$ or 270°):

$$r_1 = 0$$

$$a_1 = (x_1 + x_2) / 2 \quad , \quad b_1 = (y_1 + y_2) / 2$$

$$r_2 = 0$$

$$a_2 = (x_2 + x_3) / 2 \quad , \quad b_2 = (y_2 + y_3) / 2$$

$$(x - a_1)^2 + (y - b_1)^2 = r^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

$$(x - a_2)^2 + (y - b_2)^2 = r^2 = (x_2 - a_2)^2 + (y_2 - b_2)^2$$

$$(x - x_2 + x_2 - a_1)^2 + (y - y_2 + y_2 - b_1)^2 = (x_2 - a_1)^2 + (y_2 - b_1)^2$$

$$(x - x_2)^2 + 2(x - x_2)(x_2 - a_1) + (y - y_2)^2 + 2(y - y_2)(y_2 - b_1) = 0$$

$$(x \cdot x_2)^2 + 2(x - x_2)(x_2 - a_2) + (y - y_2)^2 + 2(y - y_2)(y_2 - b_2) = 0$$

$$2(x - x_2)(a_2 - a_1) + 2(y - y_2)(b_2 - b_1) = 0$$

$$x - x_2 = k(b_2 - b_1)$$

$$y - y_2 = -k(a_2 - a_1)$$

$$k^2(b_2 - b_1)^2 + 2k(b_2 - b_1)(x_2 - a_1) + k^2(a_2 - a_1)^2 - 2k(a_2 - a_1)(y_2 - y_1) = 0$$

$$k(a_2 - a_1)^2 + (b_2 - b_1)^2 = 2(a_2 - a_1)(y_2 - b_1) - 2(b_2 - b_1)(x_2 - a_1)$$

Here, it can be assumed to be $k \neq 0$.

$$k = \frac{2\{(a_2 - a_1)(y_2 - b_1) - (b_2 - b_1)(x_2 - a_1)\}}{(a_2 - a_1)^2 + (b_2 - b_1)^2}$$

$$x = x_2 + k(b_2 - b_1)$$

$$y = y_2 - k(a_2 - a_1)$$

Let:

Origin of Elevation = Z1, Elevation = Th1,

Vertical distance between the Instrument and Origin of

Elevation = VD

Station Elevation = Z

$$Z = Z1 + Th1 - VD$$

(VD should be the value considered C&R correction.)

■ Remote Benchmark

Let:

$\overline{VA}_i, \overline{SD}_i$ = Means of the F1 and F2 readings to a benchmark for set i . If a set is only measured on one face, those measurements are used as the mean values for that set.

$$VD_i = \overline{SD}_i \cos(\overline{VA}_i)$$

$$HD_i = \overline{SD}_i \sin(\overline{VA}_i)$$

Stn Z is calculated as:

$$Z_i = Z_{BM} - VD_i + ht_{BM} - hi$$

$$StnZ = \frac{\sum_{i=1}^n \frac{Z_i}{HD_i}}{\sum_{i=1}^n \frac{1}{HD_i}}$$

Stn HI is calculated as:

$$hi_i = Z_{BM} - VD_i + ht_{BM} - StnZ$$

$$StnHI = \frac{\sum_{i=1}^n \frac{hi_i}{HD_i}}{\sum_{i=1}^n \frac{1}{HD_i}}$$

Instrument HI is calculated as:

$$Z_i = Z_{BM} - VD_i + ht_{BM}$$

$$InstZ = \frac{\sum_{i=1}^n \frac{Z_i}{HD_i}}{\sum_{i=1}^n \frac{1}{HD_i}}$$

The maximum Δ values are calculated from the Z_i or hi values.

■ Remote Measurement

< REM-remote elevation measurement >

The REM value is set to 0 at the ground level.

HD and VD = measurements to the prism position.

VA = angle to the REM point.

$$REM = \left(\frac{HD}{\tan(VA)} \right) - VD$$

< RDM Continuous >

$$rHD = \sqrt{(N_i - N_{i-1})^2 + (E_i - E_{i-1})^2}$$

$$rSD = \sqrt{(N_i - N_{i-1})^2 + (E_i - E_{i-1})^2 + (Z_i - Z_{i-1})^2}$$

$$rVD = Z_i - Z_{i-1}$$

< RDM Radial >

$$rHD = \sqrt{(N_i - N_1)^2 + (E_i - E_1)^2}$$

$$rSD = \sqrt{(N_i - N_1)^2 + (E_i - E_1)^2 + (Z_i - Z_1)^2}$$

$$rVD = Z_i - Z_1$$

< Gradient >

$$grade = \frac{HD}{VD} : 1$$

< Percentage Slope >

$$V \% = \frac{VD}{HD} \cdot 100$$

■ F1/F2

$$dHA = (F2 - 180^\circ) - F1$$

$$dVA = (F1 + F2) - 360^\circ$$

$$dSD = SD_2 - SD_1$$

for SS record,

$$SS_{HA} = F1_{HA} + \left(\frac{dHA}{2}\right)$$

$$SS_{VA} = F1_{VA} + \left(\frac{dVA}{2}\right)$$

$$SS_{SD} = F1_{SD} + \left(\frac{dSD}{2}\right)$$

■ Area & Perimeter

$$\text{Perim} = \sum_{i=1}^n HD_{i,i+1}$$

$$\text{Area} = \frac{1}{2} \sum_{i=1}^n [E_i \times (N_{i-1} - N_{i+1})]$$

■ Stakeout

Within stakeout, there are additional values:

N_{ST}, E_{ST}, Z_{ST} = coordinates of the station point.

N_{SO}, E_{SO}, Z_{SO} = design coordinates of the point to be staked out.

N_p, E_p, Z_p = calculated coordinates from the measurement to the prism. The Z is dynamic based on the current VA reading.

HD_{SO} = horizontal distance to the point to be staked out.

$$dHA = HA - \tan^{-1} \left(\frac{E_{SO} - E_{ST}}{N_{SO} - N_{ST}} \right)$$

< In/Out >

Negative values imply the rodman must move out (move the prism away from the instrument) by the specified amount.

$$InOut = \frac{(N_{SO} - N_p)(N_{ST} - N_p) + (E_{SO} - E_p)(E_{ST} - E_p)}{(N_{ST} - N_p)^2 + (E_{ST} - E_p)^2}$$

Negative = Out (move away from the instrument).

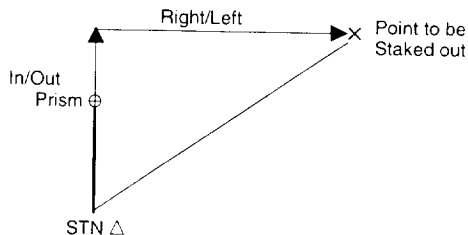
Positive = In (move towards the instrument).

< Right/Left >

$$RightLeft = \frac{(E_{ST} - E_p)(N_{ST} - N_p) - (N_{SO} - N_{ST})(E_{ST} - E_p)}{(N_{ST} - N_p)^2 + (E_{ST} - E_p)^2}$$

Negative = Left (rodman move prism to left when looking at the instrument).

Positive = Right (rodman move prism to right when looking at the instrument).



< Cut/Fill >

Negative values imply the rodman must raise the prism by the specified amount.

$$cut = Z_{SO} - Z_p$$

Negative = Cut (prism is below design).

Positive = Fill (prism is above design).

< Radial Distance >

Horizontal distance from the point to be staked out to the point defined by the last measurement.

$$rHD = \sqrt{(N_{SO} - N_p)^2 + (E_{SO} - E_p)^2}$$

$$rSD = \sqrt{(rHD)^2 + (Z_{SO} - Z_p)^2}$$

* If $(E_{SO} - E_p) \geq 0$:

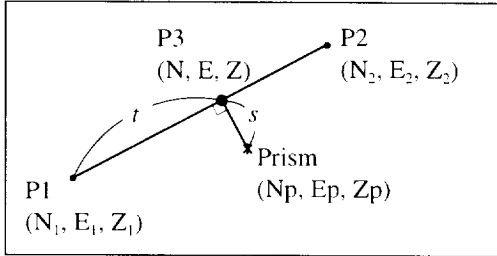
$$rHA = \cos^{-1} \left(\frac{N_{SO} - N_p}{\sqrt{(N_{SO} - N_p)^2 + (E_{SO} - E_p)^2}} \right)$$

* If $(E_{SO} - E_p) < 0$:

$$rHA = 2\pi - \cos^{-1} \left(\frac{N_{SO} - N_p}{\sqrt{(N_{SO} - N_p)^2 + (E_{SO} - E_p)^2}} \right)$$

■ 2-Pt Reference Line

<Plane view>



Known Point: P1 (N_1, E_1, Z_1),
 P2 (N_2, E_2, Z_2),
 Prism (N_p, E_p, Z_p)

First of all, calculate the coordinate of intersection point, P3 (N, E, Z), which is perpendicular to the line P1-P2 from Prism.

A unit vector (a, b) of vector P1-P2 is:

$$a = \frac{N_2 - N_1}{\sqrt{(N_2 - N_1)^2 + (E_2 - E_1)^2}}$$

$$b = \frac{E_2 - E_1}{\sqrt{(N_2 - N_1)^2 + (E_2 - E_1)^2}}$$

Then, Line P1-P2 is described bellow:

$$N = N_1 + t \cdot a$$

$$E = E_1 + t \cdot b$$

A unit vector which is perpendicular to the line P1-P2 is $(-b, a)$.

Line Prism to P3 is:

$$N = N_p - s \cdot b$$

$$E = E_p + s \cdot a$$

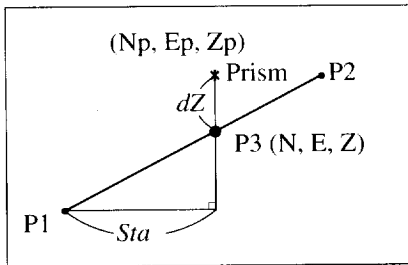
$$\begin{aligned}
 N_1 + t \cdot a &= N_3 - s \cdot b \\
 E_1 + t \cdot b &= E_3 + s \cdot a \\
 \begin{pmatrix} a & b \\ b & -a \end{pmatrix} \begin{pmatrix} t \\ s \end{pmatrix} &= \begin{pmatrix} N_3 - N_1 \\ E_3 - E_1 \end{pmatrix} \\
 \begin{pmatrix} t \\ s \end{pmatrix} &= \begin{pmatrix} a \cdot (N_3 - N_1) + b \cdot (E_3 - E_1) \\ b \cdot (N_3 - N_1) - a \cdot (E_3 - E_1) \end{pmatrix} \\
 t &= a \cdot (N_3 - N_1) + b \cdot (E_3 - E_1) \\
 s &= b \cdot (N_3 - N_1) - a \cdot (E_3 - E_1) \\
 N &= N_1 + t \cdot a \\
 E &= E_1 + t \cdot b
 \end{aligned}$$

Here:

|t| is the length of P1-P3 (Sta). "t > 0" means positive Sta and "t < 0" is negative Sta.

|s| is the length of P3-Prism (O/S). "s > 0" means the Prism is on the left side of the line and "s < 0" is for the right. The sign is inverted before the value is shown as O/S.

<Side view>



On the other hand, the elevation of the intersection point P3 is:

$$Z = Z_1 + (Z_2 - Z_1) \times \frac{Sta}{\sqrt{(N_2 - N_1)^2 + (E_2 - E_1)^2}}$$

Then, the delta value for elevation is:

$$dZ = Z_p - Z$$

4. CHECKING AND ADJUSTMENT

4-1. Plate Level

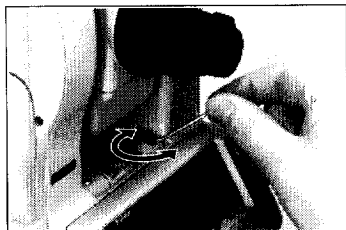
(Making the axis of the level vial at right angle to the vertical axis of the instrument)

Checking

- (1) Set up the instrument on the tripod and follow the leveling procedures described in [2-6. Leveling] p.26.
- (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.

Adjustment

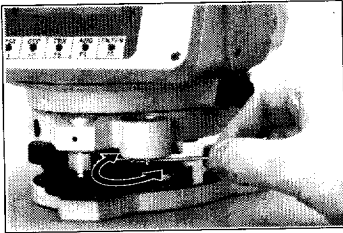
- (1) Using the adjusting pin supplied, rotate the plate level's adjustment screw to move the bubble to eliminate half of the displacement detected.
- (2) Take up the remaining displacement with leveling screw A (refer to the Figure in p.26), centering the bubble.
- (3) Recheck, and repeat if necessary.



4-2. Circular Level

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.

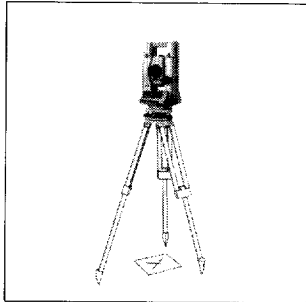


4-3. Optical Plummet

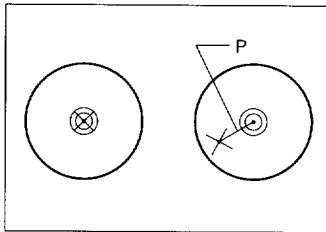
(Aligning the optical axis of the plummet with the vertical axis of the instrument)

Checking

- (1) Place the instrument on the tripod. (No leveling is necessary.)
- (2) Place a thick sheet of paper marked with an X on the ground just below the instrument.



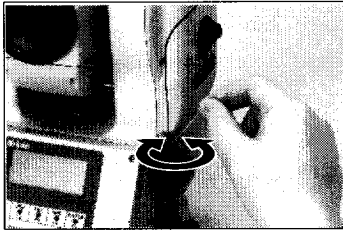
- (3) Looking through the optical plummet, adjust the leveling screws to bring the image of the X to the center of the reticle mark \odot .
- (4) Rotate the alidade approximately 180° .
- (5) If the marked image is seen in the same position in the center of the reticle mark, no adjustment will be required.



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

Adjustment

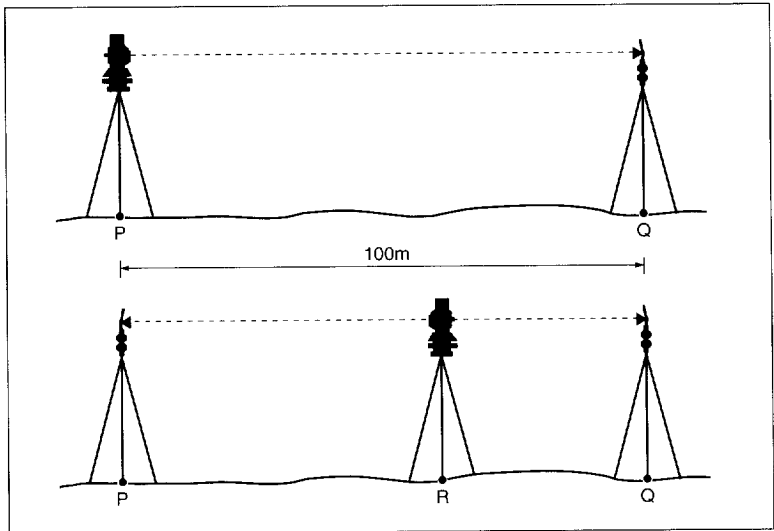
- (1) Using the supplied minus screwdriver, turn the adjustment screw to align the X marking with position P, as shown in the Figure. Point P is the center point of the line connecting the X marking and the center of the reticle mark ◎.



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

4-4. 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-801 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-801 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-801 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:	33 ×
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-851	
(360°):	0.5"/1"
(400G):	0.1mgon/0.2mgon
(MIL6000/MIL6400):	0.005MIL/0.02MIL
DIN18723 accuracy:	1"/0.2mgon
DTM-831	
(360°):	1"/5"
(400G):	0.2mgon/1mgon (0.1mgon/0.2mgon) ¹
(MIL6000/MIL6400):	0.005MIL/0.02MIL
DIN18723 accuracy:	2"/0.5mgon

DTM-821

(360°):	1"/5"
(400G):	0.2mgon/1mgon (0.1mgon/0.2mgon) ^{*1}
(MIL6000/MIL6400):	0.005MIL/0.02MIL
DIN18723 accuracy:	3"/1mgon

*1: Optional setting. Contact your dealer or a Nikon representative.

■ Dual-axis tilt sensor

Method:	Liquid-electric detection
Compensation range:	±3'
Setting accuracy:	±1"/±0.2mgon

■ EDM

Distance range with Nikon prisms

Under normal atmospheric conditions (ordinary haze with visibility about 20km/12.5miles)

DTM-851

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

DTM-831

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

DTM-821

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-851

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

DTM-831

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

DTM-821

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

■ Precision

MSR mode: $\pm (2 + 2\text{ppm} \times D)$ mm
 (At $-20^{\circ}\text{C} \sim +50^{\circ}\text{C}/-4^{\circ}\text{F} \sim 122^{\circ}\text{F}$)

DTM-851: $\pm (2 + 2\text{ppm} \times D)$ mm

DTM-831: $\pm (2 + 2\text{ppm} \times D)$ mm

DTM-821: $\pm (2 + 2\text{ppm} \times D)$ mm

TRK mode: $\pm (4 + 2\text{ppm} \times D)$ 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/0.0005ft.
 (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-851

Plate level vial: 20"/2mm

Circular level vial: 10'/2mm

DTM-831

Plate level vial: 30"/2mm

Circular level vial: 10'/2mm

DTM-821

Plate level vial: 30"/2mm

Circular level vial: 10'/2mm

■ **Optical plummet**

Image: Erect
Magnification: 3 ×
Field of vision: 5°
Focusing range: 0.5m/1.6ft. ~ ∞

■ **Front (Face-left) display/key**

Type: Graphic (256 × 80 pixel) LCD with
backlight illumination 7-level
adjustable with 20 keys
Heater: Automatic sensor control

■ **Rear (Face-right) display/key**

Type: 16 character × 4 line, dot matrix LCD
with backlight illumination with 5 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:	5 hours (angle/distance measurements)

■ External memory card drive: 1

■ 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:	168 (W) × 182 (D) × 365 (H)mm
Carrying case:	488 × 282 × 261mm

■ Weight

Main unit:	Approx. 5.0kg/11.02lbs.
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-801 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

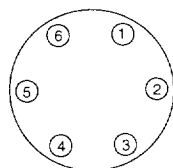
5-3. External Device Connection Connector

This connector is used commonly as a power source connector and a communication connector with an external device.

Confirm the specifications below and observe the cautions on the next page.

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

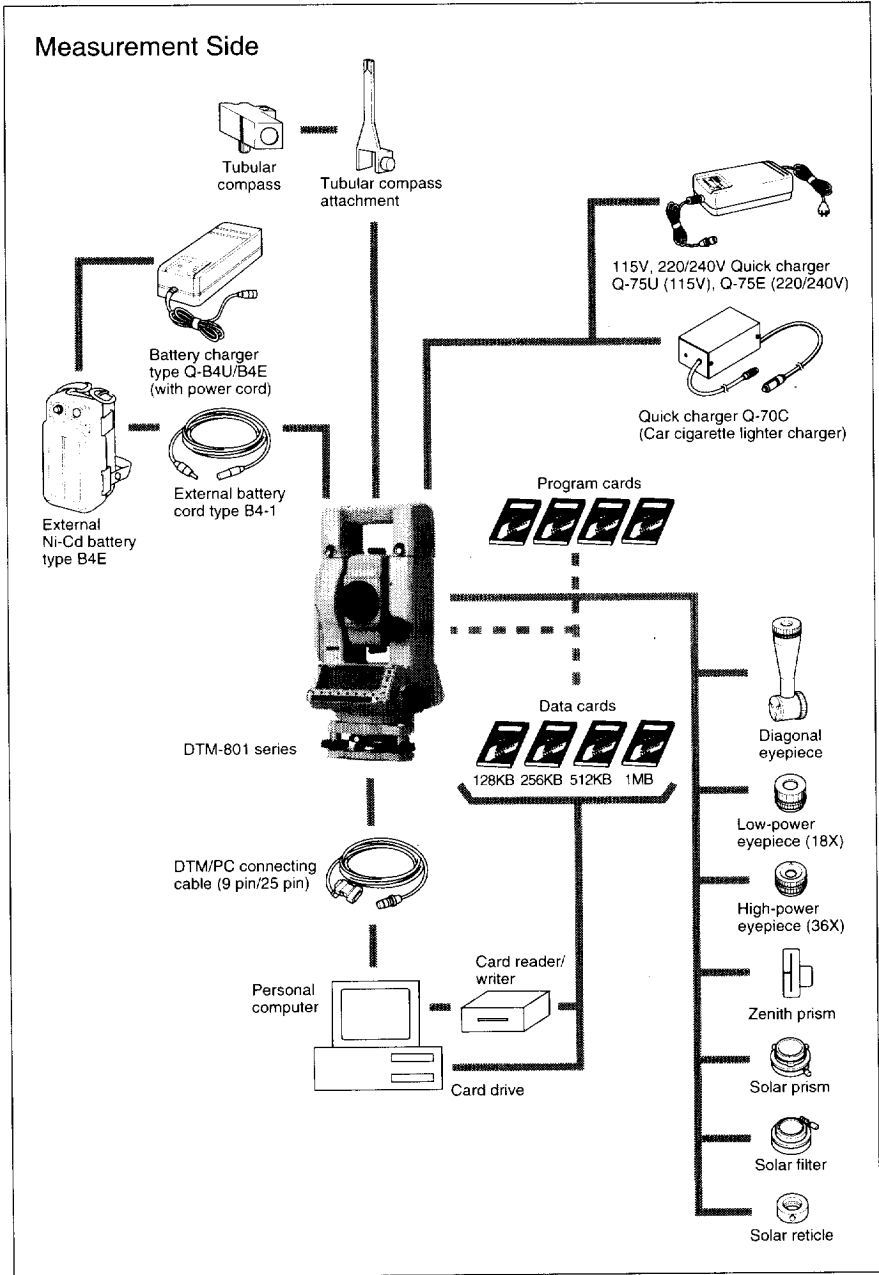
Hirose HR10A-7R-6S



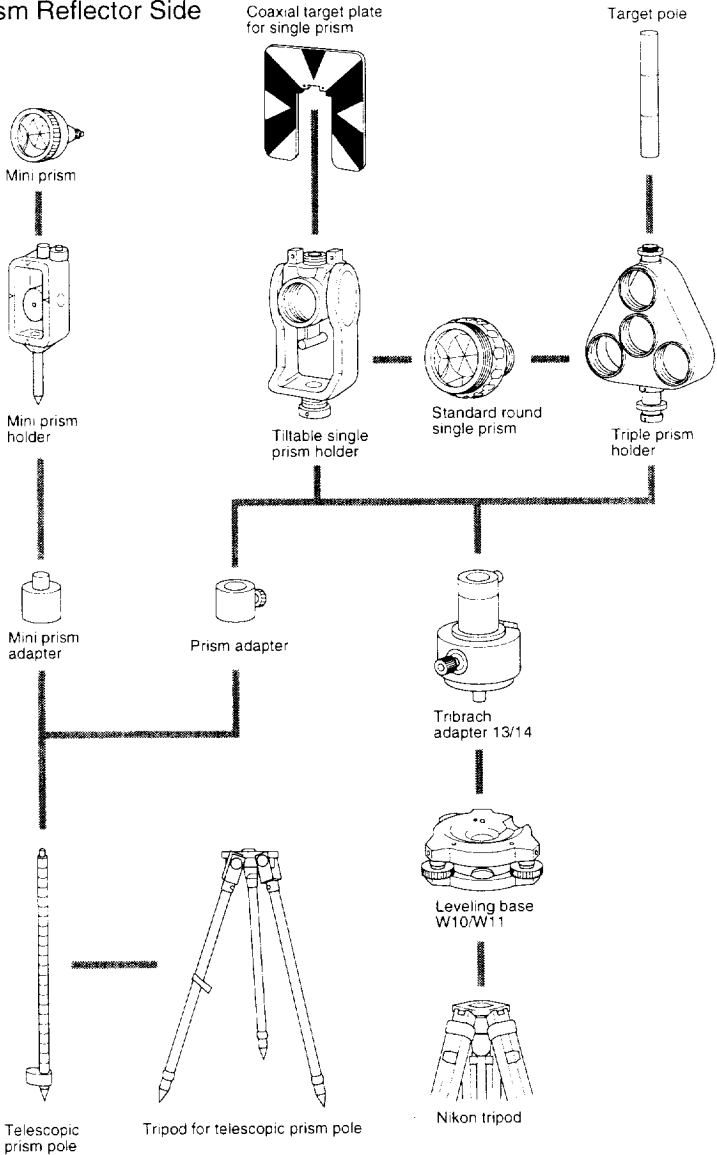
- ① RxD : Reception data (Input)
- ② TxD : Send Data (Output)
- ③ +
- ⑤ -
- ④,⑥ : No connection

- NOTE**
- Cautions when using the connector
 1. Be sure to connect the specified male connector for this connector. Prepare the cable and the connector connected with an external device at your side.
 2. Be sure to connect according to the pin arrangement shown in the previous page. Wrong connection will cause damage to the instrument.
 3. When the connector is used as a power source connector:
 - Supply power such as a battery (which is prepared by you) to pin No. 3 (power terminal) and No. 5 (ground terminal). This enables the instrument to activate by the external power source though the carrying-handle battery BC-80 has been mounted on it.
 - Use the power within the range specified below.
Rated Input: 7.2 - 11V $\overline{=}$, Max. 2A
Using without this range will result in damage to the instrument.
 4. When the connector is used as a communication connector:
 - Connect RS-232C signal from PC to pin No. 1 (input terminal) and No. 2 (output terminal). This enables the instrument to communicate with an external device.
 5. Use this connector at your own responsibility except the case shown in the SYSTEM DIAGRAM on p.218.

6. SYSTEM DIAGRAM



Prism Reflector Side



Conforming Standards:

- FCC: FCC 15B CLASS B satisfied
CE: EU EMC Directive satisfied
CE: EU Low Voltage Directive satisfied



NOTE:

This equipment has been tested and found to comply with the limits for a Class B personal computer and peripherals, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING

This equipment has been certified to comply with the limits for a Class B personal computer and peripherals, pursuant to Subpart B of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits may be attached to this equipment. Operation with non-certified personal computer and/or peripherals is likely to result in interference to radio and TV reception. The connection of a non-shielded equipment interface cable to this equipment will invalidate the FCC Certification of this device and may cause interference levels which exceed the limits established by the FCC for this equipment.

You are cautioned that 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.

IMPORTANT NOTICE

The information contained in this document is subject to change without notice.

Nikon Corporation make no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

Nikon Corporation assume no responsibility for the use or reliability of its software on equipment that is not approved by Nikon Corporation

This document contains proprietary information which is protected by copyright. All right reserved. No part of this document may be photocopied, reproduced or translated to another language without the prior written consent of Nikon Corporation.

COPYRIGHT ACKNOWLEDGMENT

Copyright © 1998 NIKON CORPORATION

- 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.

NIKON GEOTECS CO., LTD.

Technoport Mitsui Seimei Bldg.,

16-2, Minami Kamata 2-chome, Ota-ku, Tokyo 144-0035, Japan

Tel: +81-3-5710-2511

Fax: +81-3-5710-2513

NIKON INC.

Instruments Group, Surveying Dept.

1300 Walt Whitman Road, Melville, NY 11747-3064, U.S.A.

Tel: +1-631-547-4200

Fax: +1-631-547-8669

NIKON EUROPE B.V.

Schipholweg 321, P.O. Box 222, 1170 AE Badhoevedorp, The Netherlands

Tel: +31-20-44-96-222

Fax: +31-20-44-96-298

NIKON FRANCE S.A.

191, rue du Marché Rollay, 94504 Champigny-sur-Marne Cedex France

Tel: +33-1-45 16 45 16

Fax: +33-1-45 16 00 33

NIKON INSTRUMENTS S.P.A.

Via Tevere 54, 50019 Sesto Fiorentino (FI), Italia

Tel: +39-55-3009601

Fax: +39-55-300993

