Nikon

Pulse Laser Station NPL-302 Series
Instruction Manual

NPL-332
NPL-352
NPL-362

H163E 05.10.TF.9

Contact Information

Nikon-Trimble Co. Limited

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The contents of this manual are subject to change without notice. Although every effort has been made to ensure the accuracy of this manual, please contact your dealer if you find anything in it that is incorrect or unclear.

Release Notice

This is the October 2005 release of the *Pulse Laser Station NPL-302 Series Instruction Manual*, part number H163E. It applies to release 05.10.TF.9 of the Pulse Laser Station NPL-302 series.

Notices

USA

FCC 15B Class B satisfied.

This equipment has been tested and found to comply with the limits for a Class B personal computer and peripherals, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

– Consult the dealer or an experienced radio/TV technician for help.

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

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

European Union

EU EMC Directive satisfied.

Canada

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.

Taiwan

Battery Recycling Requirements

The product contains a removable battery. Taiwanese regulations require that waste batteries are recycled.

「廢電池請回收」

Notice to Our European Union Customers

For product recycling instructions and more information, please go to: www.trimble.com/environment/summ ary.html

Recycling in Europe

To recycle Trimble WEEE,
call: +31 497 53 2430,
and ask for the "WEEE associate,"
or mail a request for recycling instructions to:

Trimble Europe BV
c/o Menlo Worldwide Logistics
Meerheide 45
5521 DZ Eersel, NL

Safety

In this chapter:

- ■ Introduction
- ■ Laser Safety
- ■ Warnings and Cautions

Introduction

For your safety, read this instruction manual carefully and thoroughly before using the NPL-302 series instrument. Although Nikon products are designed for maximum safety, using them incorrectly or disregarding the instructions can cause personal injury or property damage.

You should also read the instruction manual for the battery charger, and the documentation for any other equipment that you use with a NPL-302 series instrument.

Note – Always keep the manual near the instrument for easy reference.

Laser Safety

The NPL-362/352/332 is a Class 1 laser instrument. The laser beam is hazardous to the eyes and the body. Do not sight the instrument on the face or body of a person.

Specifications for laser emission

Wave length	870 nm
Drive method	Pulse repetitive drive
Output power	< 6.4 W
Pulse width	<5 ns

Conforming standards

E.U.	EN60825-1/Am.2 : 2001 (IEC60825-1/Am.2 : 2001) : class 1
USA	FDA21CFR Part 1040 Sec.1040.10 and 1040.11 (except for deviations pursuant to Laser Notice No.50, dated July 26, 2001) : class 1

クラス1レーザ製品
CLASS 1 LASER PRODUCT

Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated July 26, 2001 MADE IN JAPAN

NIKON-TRIMBLE CO., LTD.
16-2, MINAMIKAMATA 2-CHOME, OTA-KU, TOKYO, JAPAN

Warnings and Cautions

The following conventions are used to indicate safety instructions:

⚠ **Warning –** Warnings alert you to situations that could cause death or serious injury.

⚠ **Caution –** Cautions alert you to situations that could cause injury or property damage.

Always read and follow the instructions carefully.

Warnings

Before using the instrument, read the following warnings and follow the instructions that they provide:

⚠ **Warning –** Never look at the sun through the telescope. If you do, you may damage or lose your eyesight.

⚠ **Warning –** NPL-302 series instruments are not designed to be explosion-proof. Do not use the instrument in coal mines, in areas contaminated with coal dust, or near other flammable substances.

⚠ **Warning –** The NPL-302 series instrument is a Class 1 laser instrument. The laser beam is hazardous to the eyes and the body. Do not sight the instrument on the face or body of a person. If you suspect an injury caused by exposure to the laser beam, seek medical advice immediately.
If the instrument housing is open and the instrument is turned on, the laser emits a beam stronger than the Class 1 safety level.

⚠ **Warning –** Never disassemble, modify, or repair the instrument yourself. If you do, you may receive electric shocks or burns, or the instrument may catch fire. You may also impair the accuracy of the instrument.

⚠ **Warning –** Use only the specified battery charger (part number Q-75U/E) to charge the battery pack (part number BC-65). Using other chargers, such as a charger with part number Q-7U/E or Q-7C, may cause the battery pack to catch fire or rupture. (The BC-65 cannot be charged by the Q-7U/E or Q-7C.)

⚠ **Warning –** Do not cover the battery charger while the battery pack is being recharged. The charger must be able to dissipate heat adequately. Coverings such as blankets or clothing can cause the charger to overheat.

⚠ **Warning –** Avoid recharging the battery pack in humid or dusty places, in direct sunlight, or near heat sources. Do not recharge the battery pack when it is wet. If you do, you may receive electric shocks or burns, or the battery pack may overheat or catch fire.

⚠ **Warning –** Although the battery pack (part number BC-65) has an auto-reset circuit breaker, you should take care not to short circuit the contacts. Short circuits can cause the battery pack to catch fire or burn you.

⚠ **Warning –** Never burn or heat the battery. Doing so may cause the battery to leak or rupture. A leaking or ruptured battery can cause serious injury.

⚠ **Warning –** Before storing the battery pack or battery charger, cover the contact points with insulation tape. If you do not cover the contact points, the battery pack or charger may short circuit, causing fire, burns, or damage to the instrument.

⚠ **Warning –** The battery BC-65 is not waterproof on its own. Do not get the battery wet when it is removed from the instrument. If water seeps into the battery, it may cause a fire or burns.

Cautions

Before using the instrument, read the following cautions and follow the instructions that they provide:

⚠ **Caution –** Do not use controls or adjustments, or carry out any procedures, other than those specified in this document. Otherwise you may be exposed to hazardous radiation.

⚠ **Caution –** The tops of the tripod ferrules are very sharp. When handling or carrying the tripod, take care to avoid injuring yourself on the ferrules.

⚠ **Caution –** Although a Class 1 laser is regarded as safe under normal operating conditions, it is recommended that you cap the objective when the instrument is not in use, to avoid laser emissions. Take care not to look into the laser.

⚠ **Caution –** Before carrying the tripod or the instrument in the carrying case, check the shoulder strap and its clasp. If the strap is damaged or the clasp is not securely fastened, the carrying case may fall, causing personal injury or instrument damage.

⚠ **Caution –** Before setting up the tripod, make sure that no-one's hands or feet are underneath it. When the legs of the tripod are being driven into the ground, they could pierce hands or feet.

⚠ **Caution –** After mounting the instrument on the tripod, securely fasten the thumb screws on the tripod legs. If the thumb screws are not securely fastened, the tripod may collapse, causing personal injury or instrument damage.

⚠ **Caution –** After mounting the instrument on the tripod, securely fasten the clamp screw on the tripod. If the clamp screw is not securely fastened, the instrument may fall off the tripod, causing personal injury or instrument damage.

⚠ **Caution –** Securely fasten the leveling base clamp knob. If the knob is not securely fastened, the leveling base may come loose or fall off when you lift the instrument, causing personal injury or instrument damage.

⚠ **Caution –** Do not stack objects on the plastic carrying case, or use it as a stool. The plastic carrying case is unstable and its surface is slippery. Stacking or sitting on the plastic carrying case may cause personal injury or instrument damage.

⚠ **Caution –** Do not swing or throw the plumb bob. You could injure yourself or other people.

⚠ **Caution –** Before charging the battery pack, read the instruction manual for the quick charger (part number Q-75U/E).

⚠ **Caution –** Make sure the laser is disabled before disposing of the instrument.

Contents

Introduction

In this chapter:

- ■ Welcome
- ■ Parts of the Instrument
- ■ Maintenance

Welcome

Thank you for purchasing this Nikon product.

This instruction manual was written for the users of Pulse Laser Station NPL-302 series instruments. Before you operate a Pulse Laser Station NPL-302 series instrument, read this manual carefully. In particular, pay attention to the warnings and cautions that appear in the Safety section at the front of the manual. Before you begin, you should also read the maintenance instructions. For more information, see Maintenance, page 6.

Instrument accuracy and display

One of the benefits of the Nikon DTM-302, NPL-302, and DTM-502 series products is ease-of-use. The software for these three product series has been designed to make it easy for you to learn to operate one model of instrument and apply that knowledge to the other models with little additional training. A DTM-302 series user can easily operate the non-prism NPL-302 series instruments or the higher accuracy DTM-502 series instruments.

There are some subtle differences in the software between these different product families. Some of these differences stem from additional capabilities or features available in some models. For example, the DTM-502 series offers the Lumi-Guide functionality, which guides the rodman to the correct stake-out position quickly and easily. The NPL-302 series offers reflectorless operation, allowing you to take measurements to points inaccessible with a prism. This manual shows the unique capabilities and features available in the NPL-302 series instrument.

Other differences stem from the accuracy specifications of the different product families. Each instrument model is specified to different performance levels, and the instrument's display resolution then varies depending on the instrument's accuracy. The following table describes the instrument accuracy and the corresponding angle and distance resolution displayed on the instrument's screen.

Model	Angle performance accuracy	Displayed angle resolution	Displayed distance resolution (decimal places)
DTM-332	5"	1"	3
DTM-352	5"	1"	3
DTM-362	3"	1"	3
NPL-332	5"	1"	3
NPL-352	5"	1"	3
NPL-362	3"	1"	3
DTM-522	3"	1"	4
DTM-532	2"	1"	4
DTM-552	1"	0.5"	4

The manuals for all of these total station product families show the measurement screens with the higher resolution data for the highest accuracy DTM-552.

Parts of the Instrument

Figure 1.1 and Figure 1.2 show the main parts of the NPL-302 series instrument.

Carrying handle

Optical sight (Finder)

Telescope focusing ring

Telescope eyepiece

Diopter ring

Reticle plate cover

Plate level

Face-1 display/keyboard

Leveling base clamp knob

Battery mounting button

Battery pack BC-65

Vertical tangent screw

Vertical clamp

Upper plate clamp

Upper plate tangent screw

The laser Safety Label shown below is attached to the underside of the keyboard

Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated July 26, 2001
MADE IN JAPAN

NIKON-TRIMBLE CO., LTD.
16-2, MINAMIKAMATA 2-CHOME, OTA-KU, TOKYO, JAPAN

Figure 1.1   Pulse Laser Station NPL-302 series – Face-1

The Laser Class Label shown below is attached to the telescope

クラス1レーザ製品
CLASS 1 LASER PRODUCT

Objective
(LASER LIGHT IS EMITTED FROM THIS PART.)

Horizontal axis indication mark

Display and face-2 keyboard
(NPL-332 is not equipped with face-2 display/keyboard)

Optical plummet

Data output/ external power input connector
(Input voltage 7.2 – 11 V DC)

Leveling base

Circular level

Leveling screw

Figure 1.2   Pulse Laser Station NPL-302 series – Face-2

Maintenance

Before using the instrument, read and follow the following maintenance instructions:

- Do not leave the instrument in direct sunlight or in a closed vehicle for prolonged periods. Overheating the instrument may reduce its efficiency.

- If the NPL-302 series instrument has been used in wet conditions, immediately wipe off any moisture and dry the instrument completely before returning the instrument to the carrying case. The instrument contains sensitive electronic assemblies which have been well protected against dust and moisture. However, if dust or moisture gets into the instrument, severe damage could result.

- Sudden changes in temperature may cloud the lenses and drastically reduce the measurable distance, or cause an electrical system failure. If there has been a sudden change in temperature, leave the instrument in a closed carrying case in a warm location until the temperature of the instrument returns to room temperature.

- Do not store the NPL-302 series instrument in hot or humid locations. In particular, you must store the battery pack in a dry location at a temperature of less than 30 °C (86 °F). High temperature or excessive humidity can cause mold to grow on the lenses. It can also cause the electronic assemblies to deteriorate, and so lead to instrument failure.

- Store the battery pack with the battery discharged.

- When storing the instrument in areas subject to extremely low temperatures, leave the carrying case open.

- Do not overtighten any of the clamp screws.

- When adjusting the vertical tangent screws, upper plate tangent screws, or leveling screws, stay as close as possible to the center of each screw's range. The center is indicated by a line on the screw. For final adjustment of tangent screws, rotate the screw clockwise.

- If the leveling base will not be used 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 of the instrument (such as the keyboard) or the painted or printed surfaces. Doing so could result in discoloration of the surface, or in peeling of printed characters. Clean these parts only with a soft cloth or a tissue, lightly moistened with water or a mild detergent.

- To clean the optical lenses, lightly wipe them with a soft cloth or a lens tissue that is moistened with alcohol.

- The reticle plate cover has been correctly mounted. Do not release it or subject it to excessive force to make it watertight.

Reticle plate cover
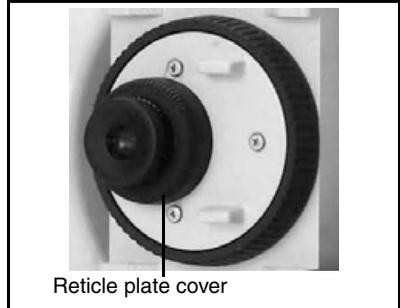
- Before attaching the battery pack, check that the contact surfaces on the battery and instrument are clean. Press the battery pack into place until the battery-mounting button rises up to the battery pack top surface. If the battery pack is not attached securely, the instrument is not watertight.

- Press the cap that covers the data output/external power input connector terminal until it clicks into place. The instrument is not watertight if the cap is not attached securely, or when the data output/external power input connector is used.

- The carrying case is designed to be watertight, but you should not leave it exposed to rain for an extended period. If exposure to rain is unavoidable, make sure that the carrying case is placed with the Nikon nameplate facing upward.

- The BC-65 battery pack contains a Ni-MH battery. When disposing of the battery pack, follow the laws or rules of your municipal waste system.

- The instrument can be damaged by static electricity from the human body discharged through the data output/external power input connector. Before handling the instrument, touch any other conductive material once to remove static electricity.

Preparation

In this chapter:

- ■ Unpacking and Packing the Instrument
- ■ Charging and Discharging the Battery Pack
- ■ Detaching and Re-Attaching the Battery Pack
- ■ Setting Up the Tripod
- ■ Centering
- ■ Leveling
- ■ Sighting
- ■ Setting the Measurement Mode and Preparing the Target
- ■ Preparing the Reflector Sheet
- ■ Setting Up the Prism Reflector
- ■ Face-1/Face-2 Measurements

Unpacking and Packing the Instrument

Note – Handle the NPL-302 series instrument gently to protect it from shocks and excessive vibration.

Unpacking

To unpack the instrument, grip the carrying handle and gently remove the instrument from the carrying case.
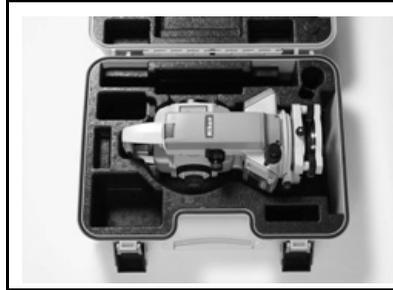
Packing

Note – Store the instrument with the battery pack attached.

To pack the instrument back into the carrying case:

1. Set the telescope in the horizontal face-1 position.
2. Align the ▼ storage mark on the bottom of the face-1 keyboard with ▼ the mark on the leveling base clamp knob.
3. Lightly fasten the clamp knobs.
4. Place the instrument in the carrying case.

Note – When packing the charger (Q-75U/E) in the plastic carrying case, make sure that you store it as shown on the sticker inside the case. Make sure that the battery charger cable is not pinched when you close the case cover.
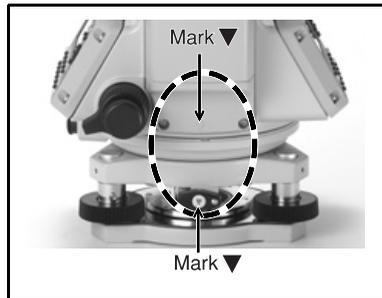
Charging and Discharging the Battery Pack

Before charging the battery pack, read the warnings (also listed in the Safety section at the front of this manual) and the following notes.

⚠ **Warning –** Use only the specified battery charger (part number Q-75U/E) to charge the battery pack (part number BC-65). Using other chargers, such as a charger with part number Q-7U/E or Q7C, may cause the battery pack to catch fire or rupture.

⚠ **Warning –** Do not cover the battery charger while the battery pack is being recharged. The charger must be able to dissipate heat adequately. Coverings such as blankets or clothing can cause the charger to overheat.

⚠ **Warning –** Avoid recharging the battery pack in humid or dusty places, in direct sunlight, or near heat sources. Do not recharge the battery pack when it is wet. If you do, you may receive electric shocks or burns, or the battery pack may overheat or catch fire.

⚠ **Warning –** Although the battery pack (part number BC-65) has an auto-reset circuit breaker, you should take care not to short circuit the contacts. Short circuits can cause the battery pack to catch fire or burn you.

⚠ **Warning –** Never burn or heat the battery. Doing so may cause the battery to leak or rupture. A leaking or ruptured battery can cause serious injury.

⚠ **Warning –** Before storing the battery pack or battery charger, cover the contact points with insulation tape. If you do not cover the contact points, the battery pack or charger may short circuit, causing fire, burns, or damage to the instrument.

⚠ **Warning –** The battery BC-65 is not waterproof on its own. Do not get the battery wet when it is removed from the instrument. If water seeps into the battery, it may cause a fire or burns.

⚠ **Caution –** Before charging the battery pack, read the instruction manual for the quick charger (part number Q-75U/E).

Important notes

• Charge the battery pack indoors where the ambient temperature is between 0 °C and 40 °C (between 32 °F and 104 °F). If you try to charge the battery when the ambient temperature is outside this range, the protective circuit will work and prevent it from being charged normally.

- To prevent malfunction, keep the charging plug clean.
- If the CHARGE indicator blinks repeatedly after charging starts, there is a problem with the battery pack. Do not use or charge the battery pack any further, and contact your dealer.
- If the ambient temperature drops below 0 °C (32 °F) while the battery pack is charging, the charger stops charging the battery pack. When the ambient temperature rises above 0 °C (32 °F), charging resumes. Charging will be completed after restarting.
- If the CHARGE indicator remains lit for more than four hours, and the ambient temperature during charging was within the specified operational range (0 °C through 40 °C or 32 °F through 104 °F), there is a problem with the battery pack. Do not use or charge the battery pack any further, and contact your dealer.
- During charging or discharging, the battery pack and quick charger will become warm. This is normal.
- After charging the battery pack, do not recharge it until it has been fully discharged. Recharging a fully charged battery pack lowers its performance.
- If the battery pack is used at low temperatures (below –20 °C or –4 °F), its capacity is reduced, and it will allow less operation time than a battery pack used at normal (room) temperature.
- If a battery pack is not used for a long period, it cannot be charged to its full capacity again. To improve the battery pack's capacity, charge and discharge it several times.
- You can use a battery charger with part number Q-70U/E or Q-70C to charge a battery pack with part number BC-65. However, these chargers cannot fully charge this battery pack.

Charging the battery pack

1. Connect the power plug on the charger to an AC power outlet.
2. Connect the charging plug on the charger cable to the charging connector on the battery pack.

   The CHARGE indicator lights up, and charging starts automatically.

   When the battery pack is fully charged, the CHARGE indicator turns off.
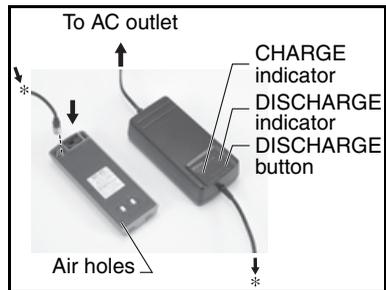
To AC outlet

CHARGE indicator
DISCHARGE indicator
DISCHARGE button

Air holes

Discharging the battery pack

1. Connect the power plug on the charger to an AC power outlet.

2. Connect the charging plug on the charger cable to the charging connector on the battery pack.

3. Press the DISCHARGE button on the battery charger.

   The DISCHARGE indicator lights up, and the charger starts to discharge the battery. When discharging is completed, the DISCHARGE indicator turns off. Then the CHARGE indicator lights up, and charging starts automatically.

To stop discharging the battery pack, press the DISCHARGE button again.

Note – The battery pack can be recharged repeatedly. If you recharge the battery pack while it still has enough power to operate the instrument, however, it will last for a shorter period. This is called the **memory effect**. *If you experience the memory effect, discharge the battery pack as described above and then recharge it. This returns the battery pack to its full capacity. We recommend that you discharge the battery pack in this way at least once every ten charges.*

Detaching and Re-Attaching the Battery Pack

Detaching the BC-65 battery pack

1. If the instrument is turned on, press PWR to turn it off.

2. Depress the battery mounting button while holding the battery pack.

⚠ **Caution –** Avoid touching the contacts on the battery pack.

Attaching the BC-65 battery pack

Before you attach the battery pack, clear any dust or other foreign particles from the battery socket.

1. Fit the two projections at the bottom of the battery pack into the concave sections at the bottom of the socket on the instrument.

2. Hold the instrument steady with one hand and push the battery pack against the instrument.

3. Make sure that the battery mounting button is securely locked.
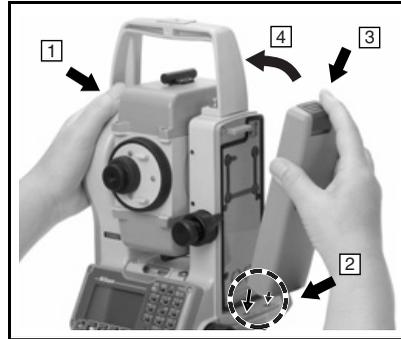
⚠ **Caution –** If the battery pack is not attached securely, this could adversely affect the watertightness of the instrument.

Note – An external battery is available as an optional accessory for s. When the external battery is connected and the BC-65 battery pack is mounted on the instrument, the instrument automatically uses the power source that has the most available power.

Setting Up the Tripod

⚠ **Caution –** The tops of the tripod ferrules are very sharp. When handling or carrying the tripod, take care to avoid injuring yourself on the ferrules.

1. Open the tripod legs enough to for the instrument to be stable.

2. Locate the tripod directly over the station point. To check the tripod's position, look through 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 – If you want to use the plumb bob to center the instrument (see Centering, page 15), you must level the tripod head precisely.

5. Securely fasten the thumb screws on the tripod legs.

6. Place the instrument on the tripod head.

7. Insert the tripod mounting screw into the center hole of the base plate of the instrument.

8. Tighten the tripod mounting screw.

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

Centering

When you center the instrument, you align its central axis precisely over the station point. To center the instrument, you can either use the optical plummet or a plumb bob.

Centering using the optical plummet

Note – If you require high accuracy, check and adjust the optical plummet before you center the instrument. For detailed instructions, see Checking and Adjusting the Optical Plummet, page 171.

To center the instrument using the optical plummet:

1. Set up the instrument on the tripod. For detailed instructions, see Setting Up the Tripod, page 14.

2. While looking through the optical plummet, align the reticle with the station point. To do this, turn the leveling screws until the center mark ◎ of the reticle is directly over the image of the station point.

3. While supporting the tripod head with one hand, loosen the tripod leg clamps and adjust the lengths of the legs until the air bubble is in the center of the circular level.

4. Tighten the tripod leg clamps.

5. Use the plate level to level the instrument. For detailed instructions, see Leveling, page 16.

6. Look through the optical plummet to check that the image of the station point is still in the center of the reticle mark.

7. If the station point is off center, do one of the following:

– If the station point is slightly off center, loosen the tripod mounting screw and then center the instrument on the tripod. Use only direct movement to center the instrument. Do not rotate it.
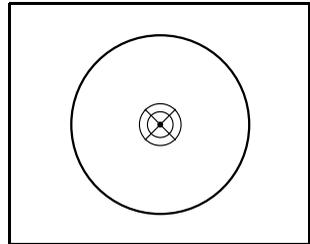
When the instrument is centered, tighten the mounting screw.

– If the displacement of the station point is major, repeat this procedure from Step 2.

Centering using a plumb bob

1. Set up the instrument on the tripod. For detailed instructions, see Setting Up the Tripod, page 14.

2. Hang the plumb line on the hook of the tripod mounting screw.

3. Adjust the length of the plumb line so that the tip of the plumb bob is at the height of the station point.

4. Loosen the tripod mounting screw slightly.

5. Using both hands to support the outer side of the leveling base, carefully slide the instrument about on the tripod head until the tip of the plumb bob is positioned over the exact center of the station point.

   Note – To confirm that the instrument is precisely aligned, check its position from two directions at right angles to each other.

Leveling

When you level the instrument, you make the vertical axis of the instrument exactly vertical. To level the instrument, use the plate level.

To level the instrument:

1. Loosen the upper plate clamp.

2. Rotate the alidade until the plate level is parallel with any two of the leveling screws (B and C).

3. Use leveling screws B and C to move the bubble into the center of the level.

4. Rotate the alidade approximately 90°.
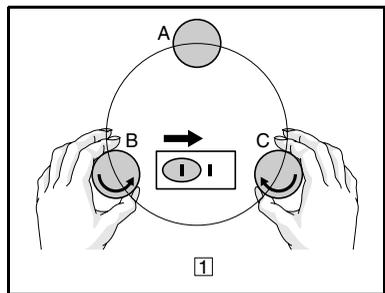
5. Use leveling screw A to move the bubble into the center of the level.

6. Repeat Step 1 through Step 5 to center the bubble in both positions.

7. Rotate the alidade 180°.

8. If the bubble in the plate level remains centered, the instrument is level. If the bubble moves off center, adjust the plate level. For detailed instructions, see Checking and Adjusting the Plate Level, page 170.
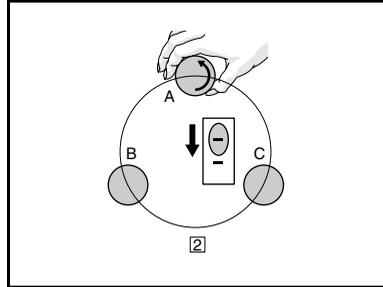
Sighting

When you sight the instrument, you aim the telescope at the target, bring the target image into focus, and align the image with the center crosshairs of the reticle.

To sight the instrument:

1. Adjust the diopter:

  a. Aim the telescope at a blank area, such as the sky or a piece of paper.
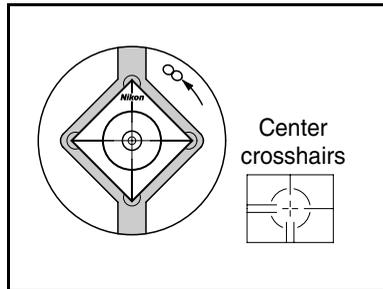
⚠ **Warning –** Never look at the sun through the telescope. If you do, you may damage or lose your eyesight.

  b. Looking through the eyepiece, rotate the diopter ring until the reticle crosshairs are in sharp focus.

2. Eliminate parallax:

  a. Aim the telescope at the target image.

  b. Rotate the focusing ring until the target image is in sharp focus on the reticle crosshairs.

  c. Move your eye vertically and laterally to check whether the target image moves relative to the reticle crosshairs.
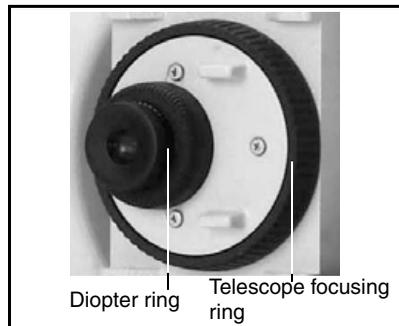
  If the target image does not move, there is no parallax.

   d. If the target image does move, rotate the telescope focusing ring. Then repeat from Step c.

3. Rotate the tangent screw:

   – The final turn of the tangent screw should be in a *clockwise* directions, to align the target accurately on the center crosshairs.

Setting the Measurement Mode and Preparing the Target

The NPL-362/352/332 has two measurement modes: Prism mode (Prism) and Reflectorless mode (N-Prism). These modes can be changed at any time by holding down the [MSR1] or [MSR2] key for one second. For more information, see, page 60.

```
<MSR2>
  Target: Prism
   Const:    0 mm
    Mode: Precise
     AVE: 3
Rec mode: Confirm
```
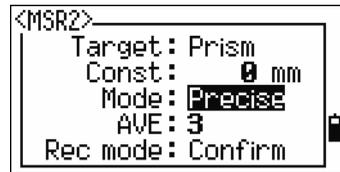
Table 2.1 describes how to set the measurement mode depending on the target you want to measure.

Table 2.1   Measurement modes

Target	Target setting
Prism, reflector sheet	Prism (Prism mode)
Other (reflective materials)	N-Prism (Reflectorless mode)

In some cases, you can measure another target that is not appropriate to the set measurement mode.

Measurement with a prism

Figure 2.1   *Do not* use a prism with scratches, a dirty surface, or a chipped center. Prisms with thin edges are recommended.

thin edges   chipped center   thick edges
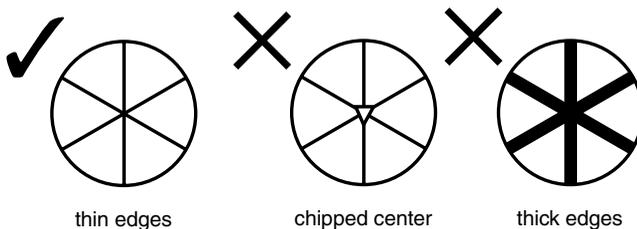
As the NPL-362/352/332 is extremely sensitive, multiple reflections on the prism surface can sometimes cause a significant loss in accuracy.

To maintain the accuracy of your measurements:

- When using a reflector sheet, take measurements longer than 5 meters.
- When using a mini or standard prism, take measurements longer than 10 meters.
- When measuring a short distance, incline the prism slightly so that the EDM can ignore unnecessary reflections on the prism surface, as shown in Figure 2.2

Figure 2.2   Angling the prism
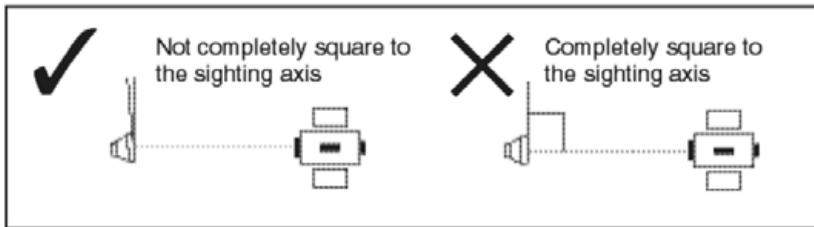
Hold the prism securely in place and do not move while taking measurements.
In Prism mode, in order to avoid false measurements on objects other than the prism or reflector-sheet, targets that are less reflective than the prism or reflector sheet are not measured. Even if you start a measurement, measured values are not displayed. To measure less reflective objects, use the N-prism (reflectorless) mode.

Measurement in Reflectorless mode

The intensity of the reflection from the target determines the distance the NPL-362/352/332 can measure in this mode. The color and condition of the target surface also affect the measurable distance, even if the targeted objects are the same. Some less-reflective targets may not be measured.

Table 2.2 describes some examples of targets and approximate measureable distances.

Table 2.2   Targets and measurement distances

Target	You can measure approximately...
Traffic signs, reflectors	500 meters (1640 feet)
Paper (white), veneer (new)	200 meters (660 feet)
wall (brightly painted), brick	50 to 100 meters (160 to 330 feet)

Measurable distances may be shorter or measurement intervals may be longer in the following cases:

- the angle of the laser against the target is small
- the surface of the target is wet

In direct sunlight, the measurable distance may be shorter. In this case, try to throw a shadow on the target.

Targets with completely flat surfaces, such as mirrors, cannot be measured unless the beam and the target are perpendicular to each other.

Sighting a prism in Reflectorless mode may cause an excessive signal error. In this case, change the [MSR1] or [MSR2] key Target setting to Prism.

In the Reflectorless mode, the beam passing area is shown by a circle in crosshairs on the telescope reticle.

If the target is smaller than the circle and there is something highly reflective in the background, the measured data may be affected by these adverse conditions.

Beam passing area

When an obstacle momentarily passes through the beam between the instrument and the target (for example, passing cars on the road), the false data (short distance) is deleted automatically. However, if the amount of reflection is almost the same and the difference in distances between the correct and the false data is less than two meters, it may cause an error in measurements.
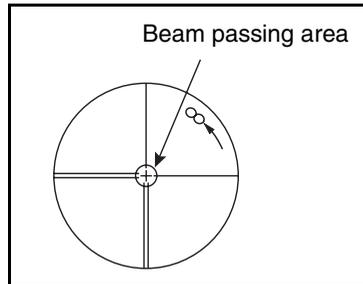
Make sure there are no obstacles between the instrument and the target when taking measurents.

When you need to take measurements across a road or a place where vehicles or other objects are frequently moving, take several measurements to a target for the best result.

Preparing the Reflector Sheet

The reflector sheet can be used for measurements in Prism mode. Assemble the reflector sheet as shown in Figure 2.3.
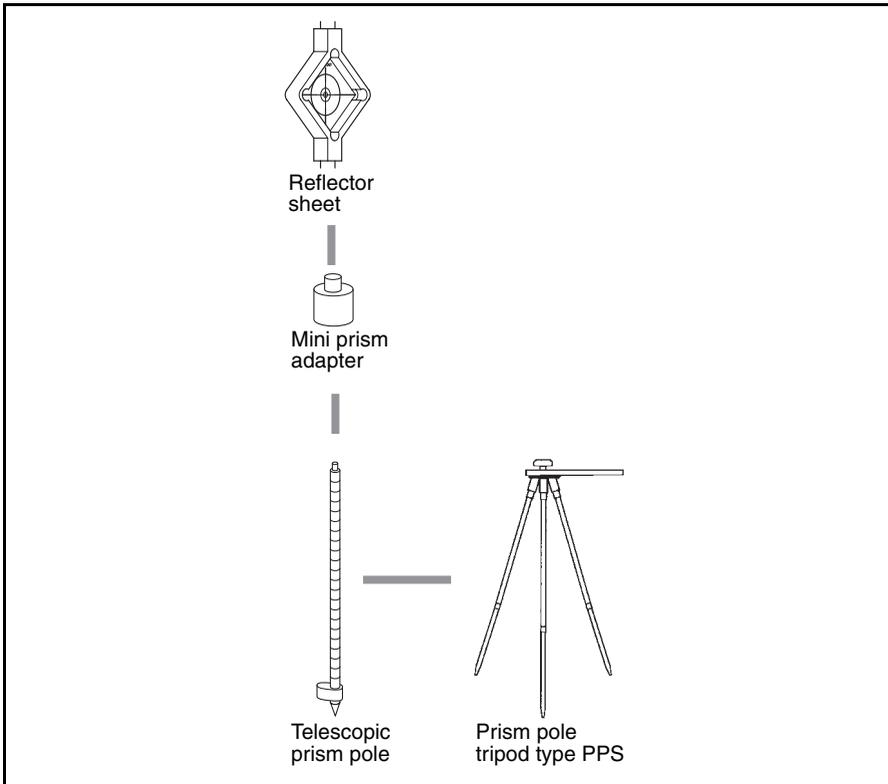
Figure 2.3   Reflector sheet assembly.

Setting Up the Prism Reflector

The prism reflector is also for measurements in Prism mode.

1. Assemble the prism reflector as shown in Figure 2.4.
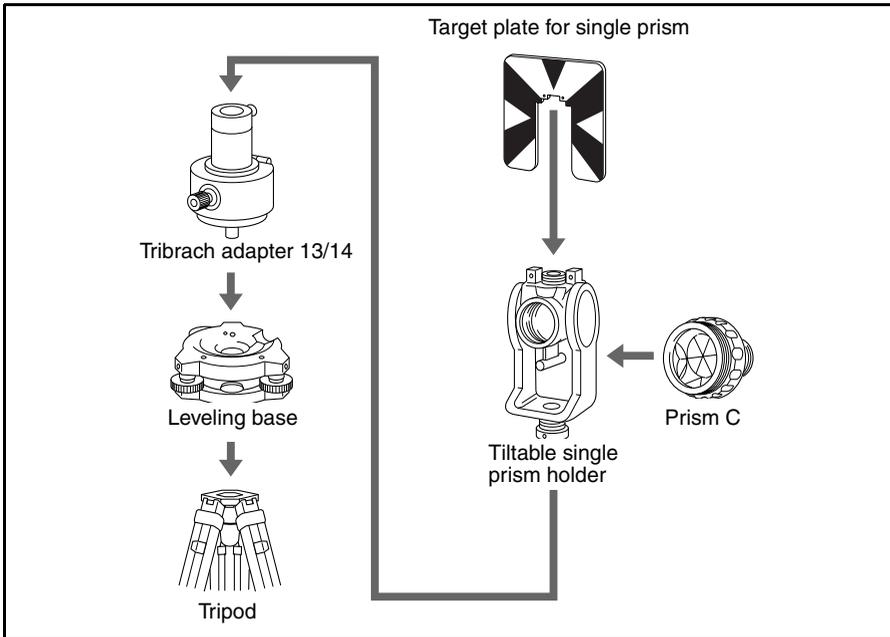
Figure 2.4   Assembling the prism reflector

2. Adjust the height of the tribrach adaptor (see page 23).

3. If necessary, change the direction of the prism (see page 23).

4. Set the prism constant (see page 23).

5. Set the position of the target plate (see page 24).

Detailed instructions for Step 2 through Step 5 are provided on the following pages.

Adjusting the height of the tribrach adapter

The tribrach adapter has two height settings. To use the prism reflector with a NPL-302 series instrument, use the lower height setting.

To adjust the height of the tribrach adapter:

1. Remove the height adjustment screw from the tribrach adapter.

2. Slide the tribrach adapter up or down the prism holder mount until the height adjustment screw holes on the prism holder mount and on the tribrach adapter are aligned.

3. Replace and tighten the adjustment screw.
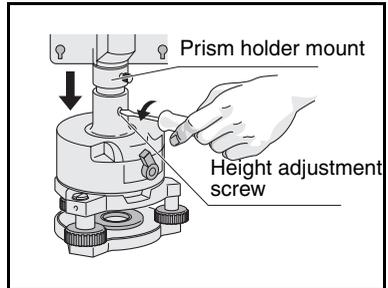
Changing the direction of the prism

The prism mounted on the tribrach adapter can be rotated to face in any direction.

To change the direction of the prism:

1. Release the rotation clamp. To do this, turn the clamp lever counterclockwise.

2. Turn the upper plate of the tribrach adapter until the prism is facing in the required direction.

3. Fasten the rotation clamp. To do this, turn the clamp lever clockwise.
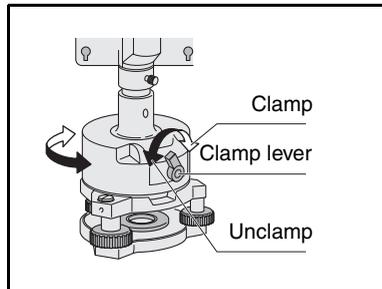
Setting the prism constant

1. Attach the prism to the single prism holder.

2. Set the prism constant. To do this, hold down [MSR1] or [MSR2] for one second. For more information, see Measurement settings, page 60.
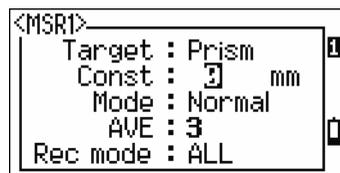
Note – The prism constant of a Nikon prism is always 0.

If your prism constant is not 0mm, then directly enter the prism constant value in the *Const* field. For example, if your prism constant is 30mm, enter **30mm** in the *Const* field on the instrument.

Tip – When using a prism at a short distance, set the prism at a slight angle to the sighting axis, rather than completely square.

Setting the position of the target plate

Make sure that the target plate is aligned with the tribrach adapter and the prism.

To set the position of the target plate:

1. Use the two set screws supplied to attach the target plate to the single prism holder.

2. Move the target plate within the screw holes until the apex of the wedge pattern is aligned with the vertical axis of the prism and the tribrach adapter.

Center on axis
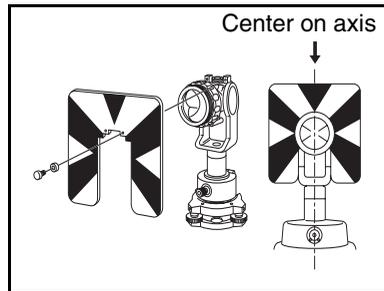
Face-1/Face-2 Measurements

You can take a measurement from either face of the instrument. To change the face, rotate the instrument 180° on its base, and rotate the telescope 180° within the standard.

By averaging the Face-1 and Face-2 measurement values, you can cancel out most constant mechanical errors. Some errors, such as vertical axis error, cannot be cancelled out by averaging Face-1 and Face-2 measurements.

Caution – When rotating the telescope, take care not to catch your finger in the gap between the instrument's standard and the telescope.

A Face-1 measurement is made with the vertical circle positioned to the left of the telescope eyepiece. A Face-2 measurement is made with the vertical circle positioned to the right of the telescope eyepiece. See Figure 2.5.
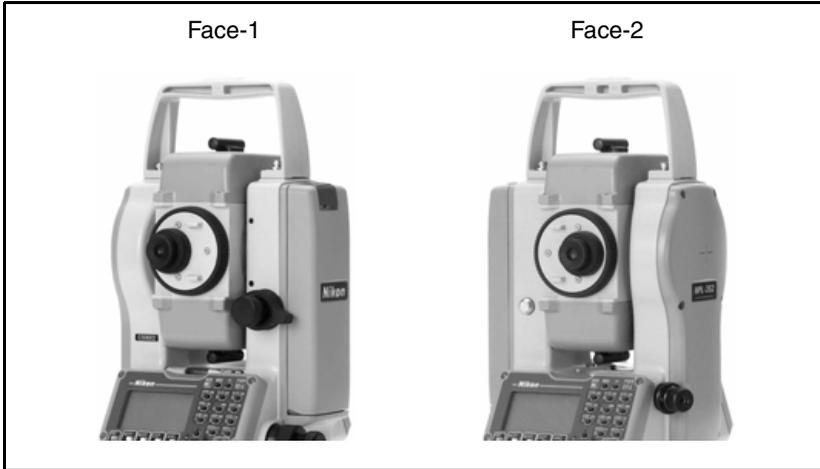
Figure 2.5   Face-1 and Face-2

Getting Started

In this chapter:

- ■ Turning the Instrument On and Off
- ■ Selecting a Language
- ■ Changing Regional Configuration Pre-sets
- ■ Display and Key Functions
- ■ List Display
- ■ Inputting Data
- ■ Jobs
- ■ Measuring Distances

Turning the Instrument On and Off

Turning on the instrument

1. To turn on the instrument, press [PWR]. The start-up screen appears. It shows the current temperature, pressure, date, and time.

```
  TILT TELESCOPE

 >Temp  20°C
  Press 1013hPa   ▐
2001/10/21   13:54:18
```

2. To change the temperature or pressure value, use [∧] or [∨] to move the cursor to the field that you want to change. Then press [ENT].

```
  TILT TELESCOPE   ▮

 >Temp  █0°C
  Press 1013hPa   ▐
2001/10/21   13:54:18
```

3. If you want to initialize the horizontal angle, rotate the alidade.

4. Tilt the telescope until it passes the horizontal position on Face-1.

```
  HA INITIALIZED

 >Temp  20°C
  Press 1013hPa   ▐
2001/10/21   13:54:18
```

If you have entered your name or your company's name in the Owner's detail field, the text from this field appears on the start-up screen. To set the Owner's detail field, go to MENU > Settings > Other. For more information, see page 140.

```
NIKON-TRIMBLE CO.LTD ▨
  TILT TELESCOPE

 >Temp  84°F
  Press 29.9 inHg  ▐
2003/08/27   11:20:55
```
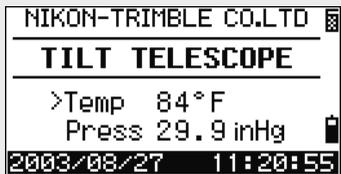
Once you start to use an initialized HA, you must rotate the alidade to initialize the HA every time you turn on the instrument. If you do this, you can maintain a fixed HA orientation even if the instrument has moved while it is turned off.

If you tilt the telescope before you rotate the alidade, the horizontal angle is not initialized, and the instrument uses the previous HA reading.

Turning off the instrument

To turn the instrument off, press [PWR] and [ENT].
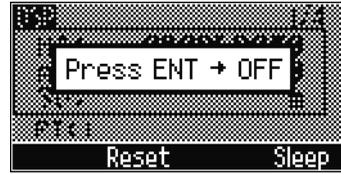
Then do one of the following:

Press ...	To ...
[ENT] again	turn off the instrument
the Reset softkey	reboot the program and re-start the instrument
the Sleep softkey	put the instrument into power-saving mode
[ESC]	cancel the power-off process and return to the previous screen

If you press the Reset softkey, the software is rebooted and the Basic Measurement Screen (BMS) appears without an open job.

Sleep mode

If you press the Sleep softkey in the Press [ENT] → OFF screen, or enable the Power Save setting (see Power saving, page 138), the instrument goes into sleep mode.

When the instrument is in sleep mode, it wakes up if any of the following occurs:

- You press a key
- The instrument receives a remote control command
- You rotate the alidade
- You tilt the telescope

Selecting a Language

The Nikon total station supports one Language Pack at a time. The Language Pack is a set of up to three different languages installed on the instrument from which the user can select. Several Language Packs are available for the Nikon total stations.

• Language Pack #1: English, French, Spanish

• Language Pack #2: English, German, Italian

• Language Pack #3: English, Chinese, Russian

1. To select a different language, power on the instrument and press [ESC] and [3] at the Tilt Telescope screen.

   The *Select Language* screen appears. Up to three languages are available in the installed Language Pack. The screen shows which languages are currently available on the instrument.

   The current language selection is highlighted.

2. Press [ʌ] or [v] to highlight the required language and then press [ENT.]

3. The instrument reboots and displays the start-up *Tilt Telescope* screen in the selected language.

Language Pack #1 is the default Language Pack installed at the factory. Other Language Packs can be installed at an authorized Nikon total station service provider.

Changing Regional Configuration Pre-sets

To provide easier configuration for common regional settings, you can quickly configure the Nikon total station to a pre-set combination of default regional settings. The Regional Configuration screen appears only after the language configuration is complete, the instrument has rebooted, and the telescope has been tilted. To change the regional configuration pre-sets:

1. Follow the steps in Selecting a Language, page 30.

   After the instrument reboots and the telescope is tilted, the *Regional Configuration* screen appears.

2. Press Ⓐ or Ⓥ to highlight the required regional settings and then press ⎡ENT⎤.

3. If you do not want to change the current settings, press ⎡ESC⎤ and quit. The instrument will continue to use the last settings that were configured.

The settings affected by the Regional Configuration screen are:

Table 3.1   Regional Configuration Pre-sets

Category	Setting	Europe	International	United States
Angle				
	VA zero	Zenith	Zenith	Zenith
	Resolution	1"	1"	1"
	HA	Azimuth	Azimuth	Azimuth
Distance				
	Scale	1.000000	1.000000	1.000000
	T-P corr.	On	On	On
	Sea Level	Off	Off	Off
	C&R corr.	0.132	0.132	0.132
Coordinates				
	Order	ENZ	ENZ	NEZ
	Label	ENZ	ENZ	NEZ

Table 3.1   Regional Configuration Pre-sets

Category	Setting	Europe	International	United States
	AZ zero	North	North	North
Power Save				
	Main Unit	Off	Off	Off
	EDM Unit	3 minutes	3 minutes	3 minutes
	Sleep	5 minutes	5 minutes	5 minutes
Communication				
	Ext. Comm	Nikon	Nikon	Nikon
	Baud	4800	4800	4800
	Length	8	8	8
	Parity	None	None	None
	Stop bit	1	1	1
Stakeout				
	Add PT	1000	1000	1000
Units				
	Angle	GON	GON	DEG
	Distance	meters	meters	US-ft
	Temp	° C	° C	° F
	Press	mm Hg	mm Hg	In Hg
Rec				
	Store DB	RAW&XYZ	RAW&XYZ	RAW&XYZ
	Data Rec	Internal	Internal	Internal
Others				
	XYZ disp	Fast	Fast	Fast
	2nd Unit	None	None	None
	Sig Beep	On	On	On
	Split ST	No	No	No

Table 3.1   Regional Configuration Pre-sets

Category	Setting	Europe	International	United States
	CD Input	<ABC>	<ABC>	<ABC>
	Owner's Detail	Blank	Blank	Blank

The default regional configuration pre-set is "United States" settings. For more information, see Settings, page 135.

Display and Key Functions

Figure 3.1 shows the keys on the NPL-302 series instrument keyboard and the LCD display.

Figure 3.1   NPL-302 keyboard and display

Table 3.2 summarizes the functions of the NPL-302 keys.

Table 3.2   Key functions

Key	Function	Details
PWR	Turns the instrument on or off.	page 28
(illumination key)	Illumination key. Turns the backlight on or off. Provides access to the 2-switch window if held down for one second.	page 38
MENU	Displays the MENU screen.	page 115
MODE	Changes the key input mode between alphanumeric and numeric if pressed when you are in a PT or CD field. Activates Qcode mode if pressed when you are In the Basic Measurement Screen (BMS).	page 41
REC/ENT	Records measured data, moves on to the next screen, or confirms and accepts the entered data in input mode. You have the option to record the measurement as a CP record instead of an SS record, if you hold this key down for one second in the Basic Measurement Screen (BMS). The instrument outputs the current measurement data (PT, HA, VA, and SD) on the COM port if you press this key in the BMS or in a Stakeout observation screen. (The Data Rec settings must be set to COM.)	page 103
ESC	Returns to the previous screen. In numeric or alphanumeric mode, deletes input.	
MSR1	Starts distance measurement, using the measure mode settings for the [MSR1] key. Displays measurement mode settings, if held down for one second.	page 58

Table 3.2   Key functions (continued)

Key	Function	Details
MSR2	Starts distance measurement, using the measure mode settings for the [MSR2] key. Displays measurement mode settings, if held down for one second.	page 58
DSP	Moves to the next available display screen. Changes the fields that appear on the DSP1, DSP2, and DSP3 screens, if held down for one second.	page 61
ANG	Displays the Angle menu.	page 64
STN ABC 7	Displays the Station Setup menu. In numeric mode, enters 7. In alphanumeric mode, enters A, B, C, or 7.	page 66
S-O DEF 8	Displays the Stakeout menu. Shows stakeout settings, if held down for one second. In numeric mode, enters 8. In alphanumeric mode, enters D, E, F, or 8.	page 81
O/S GHI 9	Displays the Offset Point Measurement menu. In numeric mode, enters 9. In alphanumeric mode, enters G, H, I, or 9.	page 105
PRG JKL 4	Displays the Programs menu, which contains additional measuring programs. In numeric mode, enters 4. In alphanumeric mode, enters J, K, L, or 4.	page 90
MNO 5	In numeric mode, enters 5. In alphanumeric mode, enters M, N, O, or 5.	
DAT PQR 6	Displays RAW, XYZ, or STN data, depending on your setting. In numeric mode, enters 6. In alphanumeric mode, enters P, Q, R, or 6.	page 47

Table 3.2   Key functions (continued)

Key	Function	Details
USR STU 1	Executes the function that is assigned to the [USR1] key. In numeric mode, enters 1. In alphanumeric mode, enters S, T, U, or 1.	page 46
USR VWX 2	Executes the function that is assigned to the [USR2] key. In numeric mode, enters 2. In alphanumeric mode, enters V, W, X, or 2.	
COD YZ 3	Opens a window where you can enter a code. The default code value is the last code entered. In numeric mode, enters 3. In alphanumeric mode, enters Y, Z, a space, or 3.	page 42
HOT .-+ -	Displays the (HOT) menu, which includes Height of Target, Temp-Press, Target, Note recording, and Default PT settings. In numeric mode, enters – (minus). In alphanumeric mode, enters . (period), – (minus), or + (plus).	page 43
*/= 0	Displays the Bubble indicator. In numeric mode, enters 0. In alphanumeric mode, enters *, /, =, or 0.	page 45

Status bar

The status bar appears on the right side of every screen. It contains icons that indicate the status of various system functions.
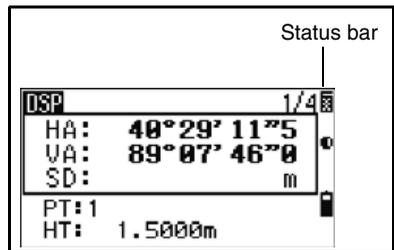
Signal indicator

The signal indicator shows the reflected light intensity:

⯐   Level 4 (maximum)

⯐   Level 3

Level 2

Level 1 (minimum)

If this icon is blinking, there is excessive signal for N-prism.

If this icon is blinking rapidly, the signal is low.
If this icon is blinking slowly, there is no signal.

If there is no icon, analog power for EDM is off.

Input mode indicator

The Input mode indicator only appears when you are entering points or coordinates. It shows the data input mode:

Input mode is numeric. Press a key on the number pad to enter the number printed on the key.

Input mode is alphabetic. Press a key on the number pad to enter the first letter printed beside the key. Press the key repeatedly to cycle through all the letters assigned to that key.

For example, to enter the letter O in alphabetic mode, press ⑤ three times.

Battery indicator

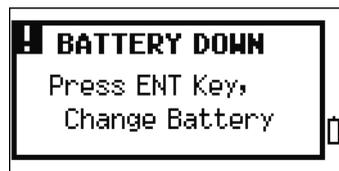The battery indicator shows the battery voltage level:

Level 4 (Full)

Level 3

Level 2

Level 1

Battery low

If the battery level is critically low, the following message appears:

Adjusting lighting and sound levels

LCD backlight

To turn the LCD backlight on or off, press the illumination key ☼▪ . To adjust the backlight level, use the 2-switch window described below.

2-switch window

Use the 2-switch window to adjust lighting and sound settings for the instrument.

To open the 2-switch window from any screen, hold down the Illumination key for one second.

To cycle through the settings for a switch, press the number beside that switch. For example, to turn the backlight on or off, press ①.

Alternatively, to highlight the switch that you want to set, press ⌃ or ⌄. Then press ENT to cycle through the settings for that switch.
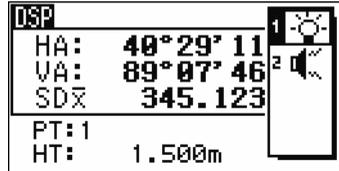
Switch 1 (backlight)

☼ LCD backlight is on.

☉ LCD backlight is off.

Switch 2 (Sound)

◀ᵏ Sound is on.

◀ Sound is off.

Contrast adjustment window

When the 2-switch window is open, press ⟨ or ⟩ to display the contrast adjustment window. Then press ⌃ or ⌄ to change the contrast level. The arrow indicates the current contrast level. To return to the 2-switch window, press ⟨ or ⟩.

When you have finished changing display light and sound settings, press ESC to close the 2-switch or contrast adjustment window.

DSP **key**

Use the key to change the current display screen or to change display settings.

Switching between display screens

When several display screens are available, the
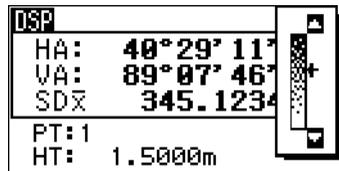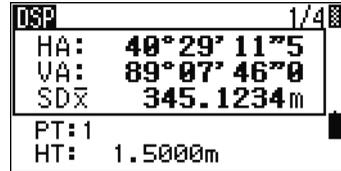DSP indicator appears at the top left of the screen,
and the screen indicator (for example, 1/4)
appears at the top right.

```
DSP                    1/4
  HA:    40°29'11"5
  VA:    89°07'46"0
  SDx̄      345.1234m
  PT:1
  HT:   1.5000m
```

To move to the next available screen, press DSP.

```
DSP                    2/4
  HA:    40°29'11"5
  VD:       0.8021m
  HD:     343.2488m
  PT:1
  HT:   1.5000m
```
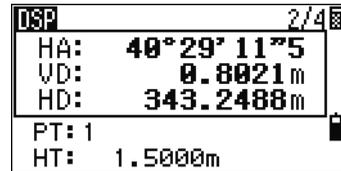
For example, if the DSP2 screen is currently
displayed, press DSP to move to the DSP3 screen.
The screen indicator changes from 2/4 to 3/4.

```
DSP                    3/4
  AZ:    85°44'01"5
  V%:       12.835%
  HD:     343.2488m
  PT:1
  HT:   1.5000m
```
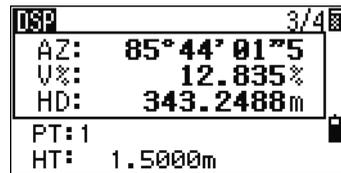
When the secondary distance unit is set, an
additional screen is available. It shows the HD,
VD, and SD values. For information on setting the
secondary distance unit, see page 140.

The smallest unit of display for distances
measured in feet-and-inches is 1/16 in. Smaller
units are impractical in the field. When the actual
value is greater than 99999'11"15/16, the ">"

```
DSP                    5/5
  HD:> 476'09"3/8
  VD:▶ 092'10"15/
  SDx̄> 800'00"1/4
  PT:1
  HT:   1.500 m
```

symbol is shown. If the actual distance is less than -9999'11"15/16, the "▶" (solid
triangle) symbol is shown. This does not affect calculations. The precise value is
used internally in all cases.
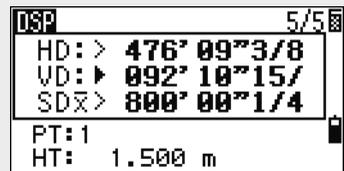
Customizing items in the Basic Measurement Screen (BMS)

To customize the items that are displayed on the DSP1, DSP2, and DSP3 screens:

1. Hold down ⌷DSP⌷ for one second.

2. Use the arrow keys ⌷^⌷, ⌷v⌷, ⌷<⌷, and ⌷>⌷ to highlight the item that you want to change.

3. Use the ⬆ and ⬇ softkeys to scroll through the list of items that can be displayed for this item.

   The items that you can choose from are HA, AZ, HL, VA, V%, SD, VD, HD, Z, and (none).

4. To save your changes, press the Save softkey. Alternatively, highlight the last item for DSP3 and press ⌷ENT⌷. The DSP screens show the items you have selected.
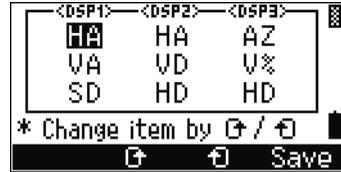
Except for the (none) item, you cannot display the same item on more than one line of the same screen.

The items displayed in the DSP1, DSP2, DSP3, and DSP4 screens are also used in the corresponding Stakeout screens (SO2, SO3, SO4, and SO5).

You can also customize the displayed items in Stakeout.

Header characters

The following header characters can be used in DSP screens:

A colon (:) indicates that tilt correction is applied to the value.

A hash symbol (#) indicates that tilt correction is off.

An underscore (_) under the tilt correction character indicates that Sea Level Correction or Scale factor is applied.

MODE **key**

Use the MODE key to change the keyboard mode for the current screen.

Changing input mode while entering points or codes

When the cursor is in a point (PT) or code (CD) field, press MODE to change the input mode between alphanumeric (A) and numeric (1).
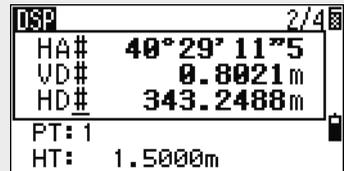
```
Record PT                    A
 PT:A102
 HT:      1.7026 m
 CD:HUB
                    List  Stack
```
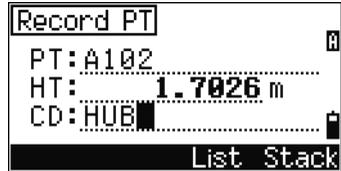
The input mode indicator in the status bar changes to show the current input mode.

```
Record PT                    1
 PT:A102
 HT:      1.7026 m
 CD:HUB
                    List  Stack
```
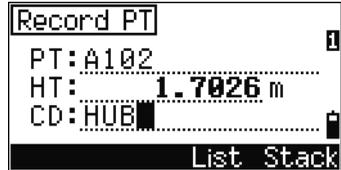
When the cursor is in a height (HT) field, only numeric input mode is available. Pressing MODE has no effect when the cursor is in a HT field.

Quick code measurement mode

1. To activate Quick code measurement mode, press MODE in the BMS.

```
DSP                      1/4
 HA:     40°29'11"5
 VA:     89°07'46"0
 SDx̄      345.1234 m
 PT:1
 HT:   1.5000m
```
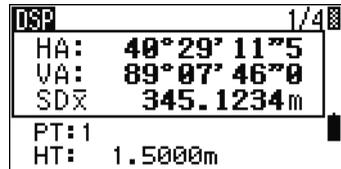
The PT field shows the default point name.

2. Press any numeric key (0 through 9) to start measuring and recording points.

A list of the numeric keys and their assigned feature codes appears on the right side of the screen.

```
    Qcode          1:MANHOL
 HA: 40°29'11"5     2:CURB_S
 VA: 92°11'46"0     3:CURB_E
 SD:          m     4:BWALL
 PT:1              5:TREE
 HT:   1.5000 m
           Edit  DSP  Sett
```
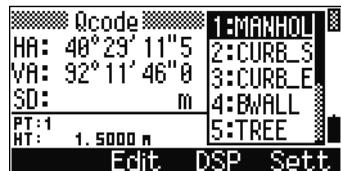
For example, when you press 6, the code assigned to 6 is selected, and the instrument starts a measurement.

```
    Qcode          2:CURB_S
 HA: 40°29'11"5     3:CURB_E
 VA: 92°11'46"0     4:BWALL
 SD: - <0mm>   m     5:TREE
 PT:1              6:SIGN3
 HT:   1.5000 m
           Edit  DSP  Sett
```
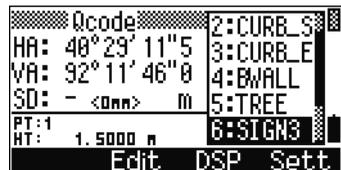
3. If you have set the record mode to Confirm (see Measurement settings, page 60), the Record PT screen appears after each measurement.

Do one of the following:

– To record the point, press [ENT].

– To return to the BMS, press [ESC].

To assign a new feature code to a numeric key, press [^] or [v] to highlight the code that you want to change. Then press the Edit softkey.

You can use the DSP softkey to change the values shown in the measurement box, in the same way as you use the [DSP] key in the Basic Measurement Screen (BMS).

4. To return to the BMS from the Qcode screen, press [MODE] or [ESC].

[COD] **key**

In the BMS, press [COD] to change the default feature code that will appear in the CD field when you record a point.

Setting the default code

When you press [COD] in the BMS, a window for entering the feature code appears.

You can use the List and Stack softkeys to enter the code.

Qcode observations

To enter the Quick code observation routine, press the Qcode softkey.

In this function, you can use the ten numeric keys to both select a feature code and shoot a point.

To change the measurement mode for the Quick code observation, press the Sett softkey.

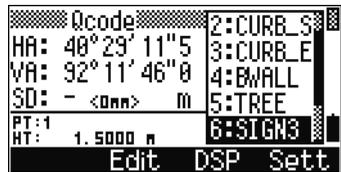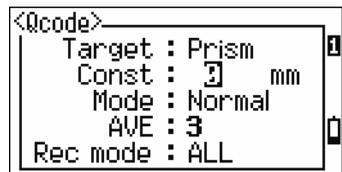In Quick code measurement, the Rec mode can only be set to Confirm or ALL.

[HOT] **key**

The HOT key menu is available on any observation screen. To display the HOT key menu, press [HOT].

```
-------HOT key-------
1. HT
2. Temp-Press
3. Target
4. Note
5. Default PT
```
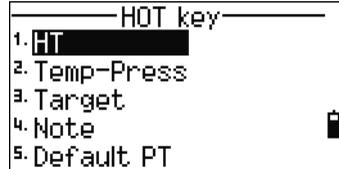
Changing the height of the target

To change the height of the target, press [HOT] to display the HOT menu. Then either press [1] or select HT and press [ENT].

Enter the height of the target, or press the Stack softkey to display the HT stack. The HT stack stores the last 20 HT values entered.

```
|Input HT|                    1
    HT: 1.5260       m

                         Stack
```
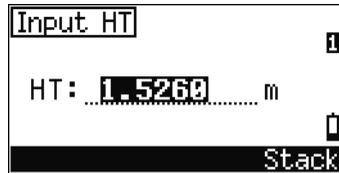
Setting the temperature and pressure

To set the current temperature and pressure, press [HOT] to display the HOT menu. Then either press [2] or select Temp-Press and press [ENT]. Enter the ambient temperature and pressure. The ppm value is updated automatically.

```
|Temp & Press|                1
    Temp:    20  °C
  Press:   1013  hPa
         (ppm=   0)
```
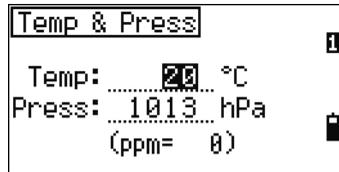
Selecting the target set

A target set specifies settings for the target type, the prism constant, and height of target. When you change the selected target set, all three settings are changed. You can use this function to quickly switch between two types of target, such as a reflector sheet and a prism. You can prepare up to five target sets.

```
1. Prism      0      -
2. Sheet      0      -
3. Prism     30   4.2081
4. Prism   -955 125.0300
5. Sheet      0      -
        Edit        Set
```
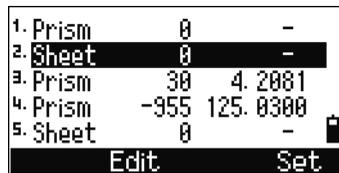
Press [HOT] to display the HOT menu. Then either press [3], or select Target and press [ENT]. A list of the five target sets appears. To select a target set, either press the corresponding numeric key ([1] through [5]), or use [^] or [v] to highlight the target set in the list and press [ENT].

To change the settings defined in a target set, highlight the target set in the list. Then press the Edit softkey.

Type	Prism/N-Prism
Const	–999 to 999 mm
HT	–9.990 to 99.990 m

```
<TGT1>
     Type: Prism
     Const: _____0 mm
  HT: ...................... m
```

HT can be left blank in the target set. If you leave it blank, the current HT value is always applied to the measurement.

When a target set is selected, the Type and Const values are copied to both MSR1 and MSR2 settings, and to the measurements in Qcode. If you have specified a value for HT, this value is also copied to the current HT.

Entering a field note

To enter a field note, press HOT to display the HOT menu. Then either press 4, or select Note and press ENT.

This function can be used at any time on any observation screen.

```
Input Note                A

FINISHED..............
                      Stack
```

Each note can be up to 50 characters.

The note is stored as a CO record in the raw data.

```
Input Note                A

FINISHED█............
                      Stack
```
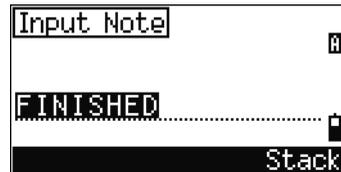
To display a list of previously used notes, press the Stack softkey. The stack stores the last 20 notes.

Use ^ or v to highlight a note in the list. Then press ENT to select the note.

```
IN TOLERANCE
OUT OF TOLERANCE
GO NEXT SITE
CONTINUE TOMORROW
```
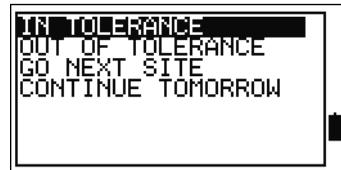
Setting the default point name

To change the default point name, press [HOT] to display the HOT menu. Then press [5], or select Default PT and press [ENT].

This function is available from any observation screen.

Modify the default point name for the next record.

Press [ENT] to confirm the new default point name. The new point name is appears as the default PT name on the input screen.

Bubble indicator

The bubble indicator is automatically displayed if the instrument goes out of level while the compensators are turned on.

To display the bubble indicator in an observation screen, press ▭.

The NPL-362/352 has two-axis level compensation. To turn the leveling compensators on or off, press [<] or [>]. When the leveling compensators are turned off, the text OFF appears on the screen.
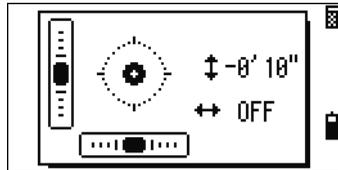
If the instrument is more than ±3'30" out of level, the text OVER appears on the screen.

To return to the observation screen, press [ESC] or [ENT] .
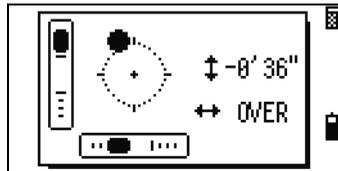
The NPL-332 has vertical axis adjustment only. To turn the leveling compensators on or off, press [<] or [>].
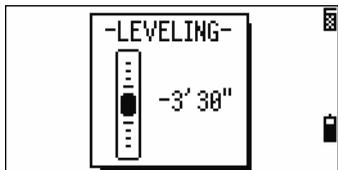
The current setting of leveling compensators is indicated by header characters (:, #, :, and #) after field labels (such as HA, VA, SD, and HD) in observation screens. For more information, see Header characters, page 40.

[USR] **keys**

If you use a function frequently in the field, you can assign it to the [USR1] or [USR2] key. Whenever you press a [USR] key, the function that is assigned to that key is activated directly.

The following functions can be assigned to the [USR] keys:

- Input HT
- BS Check
- Base XYZ
- Default PT
- Select Target
- Input Temp-Press
- Input Note
- The following menus, or a single function from one of these menus:
  - Cogo
  - O/S
  - PRG

By default, Input HT is assigned to [USR1], and no function is assigned to [USR2].

Hold down the [USR] key for one second to display the list of functions that can be assigned to the key. The currently assigned function is indicated by an asterisk (*) beside the function name.

To change the function that assigned to the key, press [^] or [v] to highlight the function. Then press [ENT].
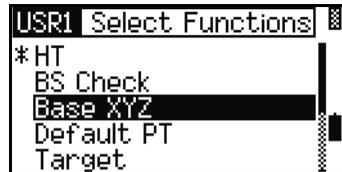
If an item on the list has an arrow (–>) beside it, this item is a menu. If you highlight a menu item and then press [ENT], a sub-menu appears.
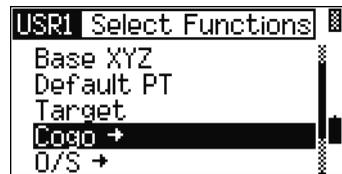
The first item on the sub-menu ends with the text [MENU]. If you select this item, the whole menu is assigned to the [USR] key.

To assign a specific function from the sub-menu, press ⌃ or ⌄ to highlight the function. Then press [ENT].

Once you have assigned a function to a [USR] key, it is called directly whenever you press that [USR] key in the BMS.
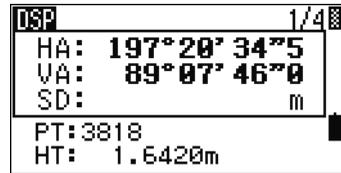
To change the type of data that is assigned to the [USR] keys in MENU > 1sec-Keys > [USR]. For more information, see [USR] key settings, page 165.

[DAT] **key**

Use the [DAT] key to quickly access data in the current job from observation screens.

When you press [DAT] in the BMS or in observation screens in functions such as Stakeout, 2Pt RefLine, and Arc RefLine, the assigned data in the current job appears.

Hold down [DAT] for one second in the BMS or an observation screen to display the Select Format screen. Use this screen to change the type of data that is assigned to [DAT]. Press [1] or select DAT [MENU] to display the Data menu whenever you press [DAT].
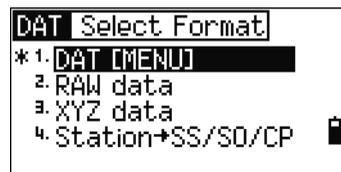
When you select an option from this screen, the change is applied immediately, and the selected data type appears.

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

To change the type of data that is assigned to [DAT], go to MENU > 1sec-Keys > [DAT]. For more information, see [DAT] key settings, page 166.
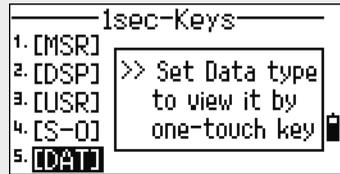
List Display

Available jobs or data appear in a list display when you do any of the following:

- view or edit data (MENU > Data)
- open the code list, point list, or Job Manager (MENU > Job)
- search for points or codes

In the list, the current cursor position is shown in reverse video (it appears as white text on a black background).

Press [^] or [v] move the cursor one line up or down.

If the Page Up icon ◫ appears, there are more pages before the current page. Press [<] to move up one page.
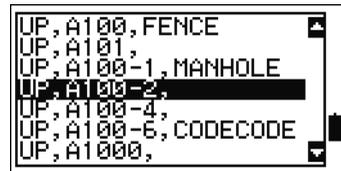
If the Page Down icon ◪ appears, there are more pages after the current page. Press [>] to move down one page.

To select an item from the list, move the cursor onto the item and press [ENT].

Inputting Data

Entering a point name or number

You can use numeric or alphanumeric names up to 16 characters long to identify points.

The default name for a new point is the last point name entered, with the last digit incremented. For example, if the last point name was A100, the default name for the next point is A101.

If the last character of the previous point name is alphabetic, the default point name is the last point name.

When the cursor is in a PT (point) field, there are several ways to specify a point, or input coordinates.

Entering an existing point

When you enter a known point name or number, the coordinates of that point are displayed briefly. A short beep sounds before the next screen appears or the next field is selected.

```
Input Station                 A
 ST:A100█
 HI:        0.0000 m
 CD:
                      List  Stack
```
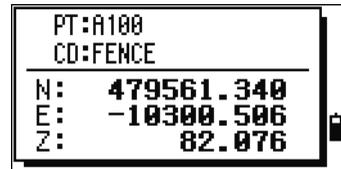
```
 PT:A100
 CD:FENCE
 ─────────────────────
 N:    479561.340
 E:    -10300.506
 Z:        82.076
```

To adjust the duration of the coordinate window display, go to MENU > Settings > Others. To leave the window open until you press [ENT], set the XYZ disp field to +ENT. For more information, see page 140.
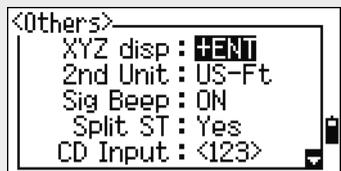
```
<Others>
   XYZ disp: +ENT
   2nd Unit: US-Ft
   Sig Beep: ON
    Split ST: Yes
   CD Input: <123>
```

Entering a new point

When you input a new point name or number, a coordinate input screen appears. Enter the point's coordinates in NE, NEZ, or elevation-only (Z) format.

```
X:        102.0155
Y: ■
Z:
PT:102
CD:CURB
```

Press [ENT] on the last line (the CD field) to store the point in the current job.

```
X:        102.0155
Y:        184.1729
Z:         70.4480
PT:102
CD:CURB
              List  Stack
```

Pressing [ENT] without a point name

To use a point without recording the coordinates, press [ENT] in a PT field, without entering a point name.

```
Input P1        P1 ⋖  P2
                       ×
P1:■
P2:
MsrPT          List  Stack
```

The input coordinates are used in the calculation. They are not saved in the database.

```
X: ■
Y:
Z:

 * This PT will not
   be recorded
```

Specifying a wildcard (*)

If you include an asterisk (*) when you enter a point or code name, a list of points that match the entered text appears.

```
Input P1        P1 ⋖  P2
                       ×
P1:■
P2:
MsrPT          List  Stack
```

Use [^] or [v] to move the cursor to the point that you want to use. Then press [ENT].

If the Page Up ◘ or Page Down ◘ icons are displayed, use [<] or [>] to page up or page down the list.

```
UP,A100,FENCE
UP,A100-0,
UP,A100-1,MANHOLE
UP,A100-2,
UP,A100-4,
UP,A100-6,CODECODE
UP,A1000,
```

When you select a point from the list, its coordinates are displayed and a beep sounds.

```
PT:A100
CD:FENCE
N:    479561.340
E:    -10300.506
Z:        82.076
```
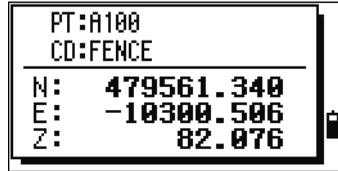
Recording an instant measurement

You can also input a point by recording an instant measurement. To do this, press the MSR softkey.

```
Input Line P1          1
P1:█.....................
P2:.......................
                       □
MsrPT        List Stack
```
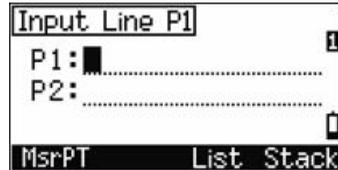
An observation screen appears.

Press [MSR1] or [MSR2] to start a measurement. To change the height of the target, press the HT softkey.

```
HA: 147°29'11"5
VA:  90°27'48"0
SD:              m
HT:    1.5555  m
* Sight PT & Press [MSR]
              HT
```
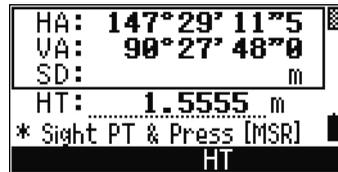
To go to the point recording screen when you have finished the measurement, press [ENT].

Enter the point or code name. Press [ENT].

```
X:    102.0155
Y:    184.1729
Z:     70.4480
PT:102
CD:CURB
              List Stack
```
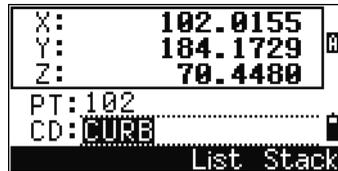
When you move the cursor to a field, the current or default value appears in inverted text (this is the default "Replace All" input mode).

```
Input Station          1
ST:A-1
HI: 0.0000    m
CD:                    □
```
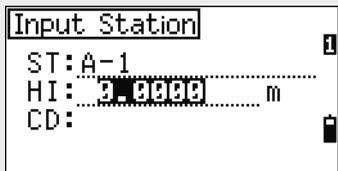
Press [>] to change the input mode to Overwrite mode and highlight the first character. Press [<] to move the cursor the end of the string.

```
Input Station          1
ST:A-1
HI: 0.0000█   m
CD:                    □
```
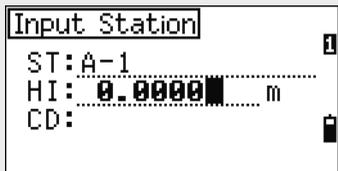
Entering a point from the stack

The point stack is a list of recently used points. To display the stack, press the Stack softkey when the cursor is in the PT field.

Use ^ or v to move the cursor to the point that you want to use. Then press ENT.
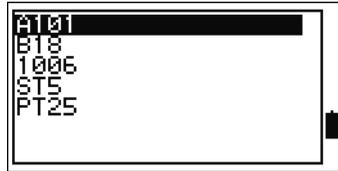
When you return to the point input screen, the selected point name is entered in the PT field, incremented by one. For example, if you selected the A101 point, A102 appears in the PT field.
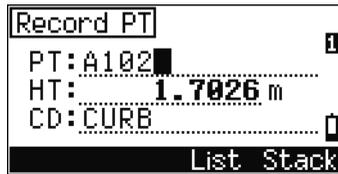
The stack shows the last 20 point names used, in chronological order from last used to first used.

Entering a point from the point list

To display a list of existing points, press the List softkey when the cursor is in the PT field.

Use ^ or v to move the cursor to the point that you want to use. Then press ENT.
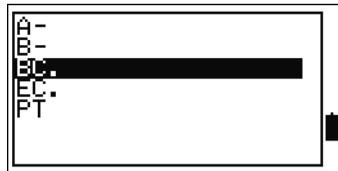
When you return to the point input screen, the selected point name is entered in the PT field. You can add digits or alphabetic characters if required.

Entering a code

The CD (Code) field always defaults to the last code used. You can change the selected code on the input point screen, or you can press COD in the BMS. For more information, see [COD] key, page 42.

You can use numeric or alphanumeric names up to 16 characters long to identify codes.

Entering a code directly

To enter a code directly, press [MODE] to change the input mode to alphanumeric or numeric mode. Then use the keypad to enter the code.

```
┌─────────────────┐
│ Record PT       █│
│  PT:A102         │
│  HT:    1.7026 m │
│  CD:HUB█        ▐│
│          List Stack│
└─────────────────┘
```
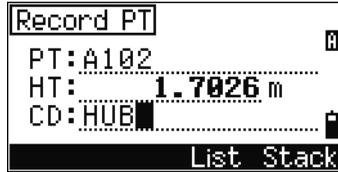
Entering a code from the stack

The code stack is a list of recently used codes. The stack may contain up to 20 codes.

To display the stack, press the Stack softkey when the cursor is in the CD field.

```
┌─────────────────┐
│ Record PT       █│
│  PT:A102         │
│  HT:    1.7026 m │
│  CD:BC2         ▯│
│          List Stack│
└─────────────────┘
```

Use [^] or [v] to move the cursor to the code that you want to use. Then press [ENT].

The selected code is copied to the CD field.

```
┌─────────────────┐
│ BC2             █│
│ HUB              │
│ BWALL            │
│ POB              │
│ ROOF            ▐│
│ POLE             │
│ BM               │
└─────────────────┘
```

When the instrument is rebooted, the code stack is cleared.

Entering a code from the code list

To display a list of existing codes, press the List softkey when the cursor is in the CD field.

To edit the code list, go to MENU > Data > Code List. For more information, see Editing an item in the point list or code list, page 156.

```
┌─────────────────┐
│ Record PT       █│
│  PT:A102         │
│  HT:    1.7026 m │
│  CD:BC2         ▯│
│          List Stack│
└─────────────────┘
```

Use [^] or [v] to highlight the feature code that you want to use. Then press [ENT].

```
┌─────────────────┐
│ GENERAL+        █│
│ RAILROADS+       │
│ ROADS+           │
│ STRUCTURES+      │
│ SURFACE+        ▐│
│ SURVEY+          │
│ UTILITIES+       │
└─────────────────┘
```
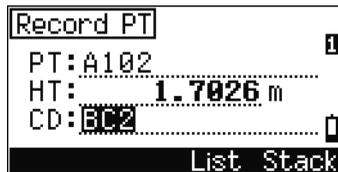
A layer has an arrow at the end of the code label. If you highlight a layer in the list and then press [ENT], the codes and layers in that layer are displayed.

When you return to the input screen, the selected code is entered in the CD field.

Items are shown in alphabetic order.

You can also use the first character search to quickly find a code. For more information, see Advanced feature: Searching for a code by using the first character, page 54.

Advanced feature: Searching for a code by using the first character

To find a code quickly when the code list appears, use the first-character search.

For example, to see feature codes that begin with T, use the keypad to enter the letter T. To do this, press [1] twice.
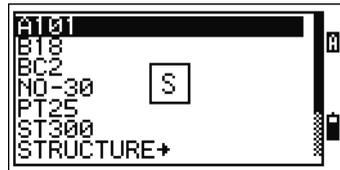
After each press of the key, the input mode field displays the selected letter. For example, if you press [1], S appears. If you quickly press [1] again, T appears. If you do not press the [1] key again, the letter T is selected.
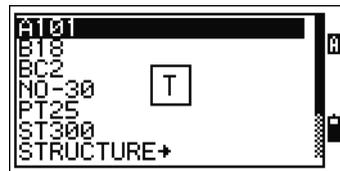
Once you have selected a letter, the cursor moves to the feature code beginning with that letter.

If there is no code beginning with that letter, the cursor moves to the next available letter.
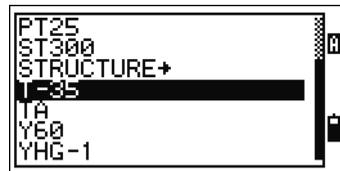
Qcodes

Quick codes (Qcodes) let you shoot and record many points with feature codes in the field. You can register up to ten Quick codes. To register Qcodes, press the Edit softkey. For more information, see Quick code measurement mode, page 41.

```
▒▒▒▒Qcode▒▒▒▒ 2:CURB_S
HA: 40°29'11"5  3:CURB_E
VA: 92°11'46"0  4:BWALL
SDⴋ 286.1190 m  5:TREE
PT:B-126
HT:  1.6045 m   6:SIGN37
        Edit  DSP  Sett
```
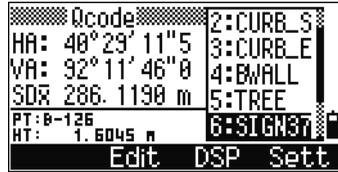
Press MODE to switch Qcodes on or off.
Press the Edit softkey to change the Qcode. You can edit the entire code, or just the number at the end of the code.
You can still use DSP to change the background displays.

Entering values in feet and inches

When either US Survey Feet (US-Ft) or International Feet (I-Ft) is selected as the distance unit, you can enter and display distances, HIs, HTs, and coordinate values either in decimal feet, or in feet and inches For more information, see Unit, page 139, and Others settings, page 140.

To enter values in feet and inches in an input screen, enter the elements, separated by periods (.), in the following format:

<Feet> [.] <Inches> [.] <Numerator> [.] <Denominator> ENT
      (0–11)   (0–15)   (0–99)

The default denominator is 16. If the denominator is 16, you do not have to enter it, and it is not displayed on the screen.

```
Record PT              A
PT:280
HT:2.08.5.
CD:O/S 5.300           ▯
              List  Stack
```
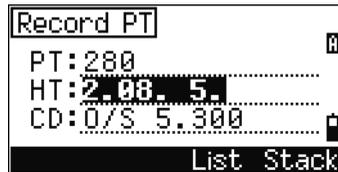
For example, if you enter
2 [.] 0 8 [.] 5 [.] ENT, it appears as 2'08" 5⁄ (2 feet, 8 and 5/16ths inches).

```
Record PT              A
PT:280
HT:    2'08" 5⁄
CD:O/S 5.300           ▯
              List  Stack
```
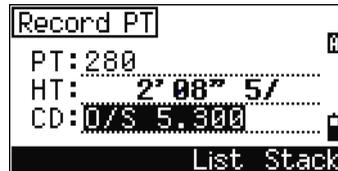
The following examples show how various values are entered:

To enter ...	Type ...
65' 5 3/8"	6 5 . 5 . 3 . 8 ENT
65'	6 5 ENT
65' 5"	6 5 . 5 ENT
65' 5 3/8"	6 5 . 5 . 6 ENT
5 3/8"	0 . 5 . 3 . 8 ENT or 0 . 5 . 6 ENT

The numerator and denominator that you enter are automatically converted to the closest value from the following list: 0, 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 1/16, 3/16, 5/16, 7/16, 9/16, 11/16, 13/16, 15/16.
If the denominator is 16, it is not shown on the screen.

Jobs

To record data on the instrument, you must create or open a job.

⚠ **Caution –** Before you use the instrument for the first time, check the job settings.

Creating a new job

1. Press MENU to open the MENU screen.

2. Press 1 to open the Job Manager.

3. Press the Creat softkey to open the Create Job screen.

4. Enter the job name.
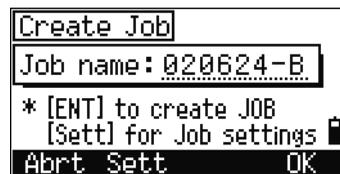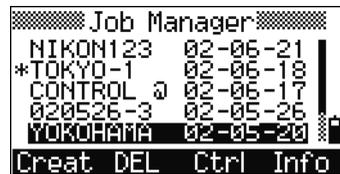
5. Press the `Sett` softkey to check the job settings. You cannot change a job's settings once you have created the job.

6. Press [ENT] in the last field of the Job Sett screen to create the new job.

```
<Job Sett 1/3>
  Scale : 1.000000     1
 T-P corr. : ON
 Sea Level : OFF
 C&R corr. : 0.132
```

If either of the messages MAX 32JOBs or Data Full appears, delete at least one existing job to free space. You cannot free space by deleting records in an existing job.

Creating a control job

A control job, or common file, stores coordinate data that is used by several field jobs. You can create a control job in the office.

1. Press [MENU] to open the MENU screen.

2. Press [1] or select `Job` to open the Job Manager.

3. Move the cursor to the job that you want to use as the control job.

4. Press the `Ctrl` softkey.

5. Press the `Yes` softkey.

```
░░░░▒▒Job Manager▒▒░░░░
 NIKON123  02-06-21
*TOKYO-1   02-06-18
 CONTROL @ 02-06-17
 020526-3  02-05-26
 YOKOHAMA  02-05-20
Creat DEL  Ctrl Info
```

```
Control Job <ON>
Job name: NIKON123
  * Set this Job as
    the Control Job?
 No              Yes
```
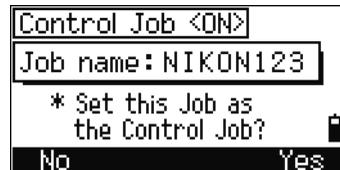
When you enter a point name or number, the system searches in the current job first. If the point is not found in the current job, the search is automatically extended to the control job. If the point is found in the control job, the selected point is copied to the current job as a UP record.

Jobs created before version 1.10

The current database version is 1.10. Jobs prefixed with ? were created in earlier versions of the database, and cannot be used in version 1.10.

If a job is from an earlier version, you cannot open it, set it as the control job, or display its job information. However, you can use the DEL softkey to delete it.

Jobs created in version 1.02 or earlier are not compatible with version 1.10 or later. Download all jobs before you update the software that is running on the instrument.

Measuring Distances

Sighting a prism reflector

⚠ **Warning –** Never look at the sun through the telescope. If you do, you may damage or lose your eyesight.

For information on how to assemble the prism reflector, see Setting Up the Prism Reflector, page 22.

Sight the telescope to see crosshairs at the center of the prism reflector.

Sighting a single prism
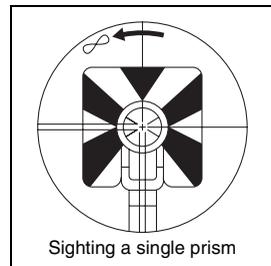
When a reflected lightwave is detected, the signal level is indicated.

Sighting a tiltable single prism
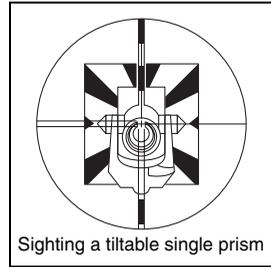
Measuring distances

To take a distance measurement, press [MSR1] or [MSR2] in the Basic Measurement Screen (BMS) or in any observation screen.
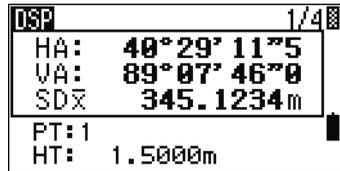
While the instrument is taking a measurement, the prism constant appears in a small font.
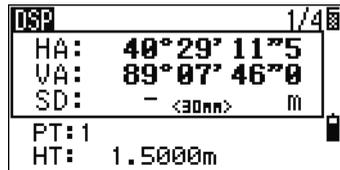
If the average count is set to 0, measurements are taken continuously until you press [MSR1], [MSR2], or [ESC]. Each time a measurement is taken, the distance is updated.

If the average count is set to a value from 1 to 99, the averaged distance appears after the last shot. The field name SD changes to SD$\overline{x}$ to indicate the averaged data.
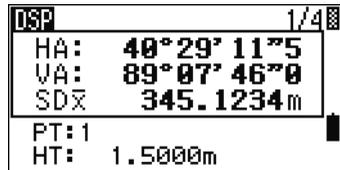
If the signal level is insufficient to take a measurement, the signal icon flashes on and off. For more information, see Status bar, page 36.

To change the height of target (HT), temperature, or pressure, press [HOT]. For more information, see [HOT] key, page 43.

```
————HOT key————
1. HT
2. Temp-Press
3. Target
4. Note
5. Default PT
```
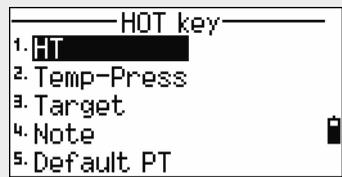
Settings that relate to corrections (T-P corr, Sea Level, C&R corr., and Map projection) are included in the job settings. These settings are job-specific. If you need to change any of these settings, you must create a new job. For more information, see Job settings, page 117, and Settings, page 135.

```
<Job Sett 1/3>
  Scale : 1.000000
T-P corr. : ON
Sea Level : OFF
C&R corr. : 0.132
```
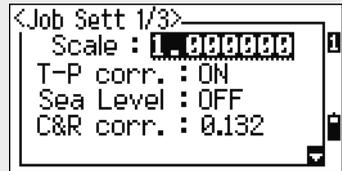
Measurement settings

To view the measurement settings, hold down [MSR1] or [MSR2] for one second.

Use [∧] or [∨] to move the cursor between the fields. Use [<] or [>] to change the value in the selected field.

```
<MSR2>
  Target: Prism
   Const:    0 mm
    Mode: Precise
     AVE: 3
Rec mode: Confirm
```
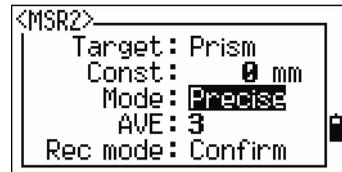
Field	Values
Target	Prism N-prism
Const (prism constant)	–999 mm through 999 mm
Mode	Precise Normal
AVE (Average count)	0 (Continuous) through 99
Rec mode	One of the following: MSR only Confirm ALL

Target field

If the measurement is started with the Target field set to **Prism**, there is a dash "–" in front of the prism constant.

If the measurement is started with the Target field set to **N-prism**, there is a right square bracket "]" in front of the prism constant.

```
DSP                    1/4
 HA:    40°29' 11"5
 VA:    89°07' 46"0
 SD:     -  <30mm>      m
 PT:1
 HT:   1.5000m
```

The symbol then constantly runs from left to right over the prism constant in the display.

When an N-prism measurement is taken, the icon appears in the status bar (above the battery icon).

```
DSP                    1/4
 HA:    40°29' 11"
 VA:    89°07' 46"
 SD:     ]  <0mm>       m
 PT:1
 HT:   1.500 m
```
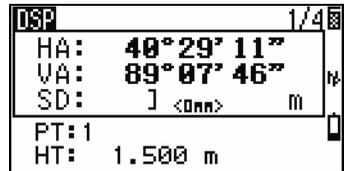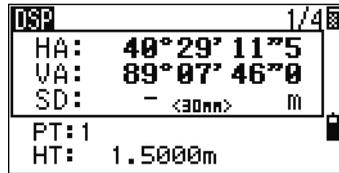
Incorrect Target settings may result in measurements outside the precision and intervals specified for the instrument.

A measurement made immediately after changing the target setting may take a longer time than usual.

The Target setting is used to apply better cyclic-error adjustment in distance measurement. It efficiently eliminates multipath reflection.

Rec mode field

The Rec mode setting controls how the [MSR1] and [MSR2] keys operate in the BMS.

The **MSR only** setting is the default measurement mode. After a measurement, the instrument stops in the BMS and waits for you to press [ENT] before recording the point.

The **Confirm** setting displays the Record PT screen before data is recorded.

The **ALL** setting is a quick shooting and recording mode. The instrument automatically records the point using the default PT/CD. The instrument then returns to the BMS for the next measurement.

Applications

In this chapter:

■ HA Reset and Angle Operations

■ Station Setup

■ Stakeout

■ Program Key

■ Recording Measurement Data

■ Measuring Offsets

HA Reset and Angle Operations

To open the Angle menu, press [ANG] in the BMS. To select a command from this menu, either press the corresponding number key, or press [<] or [>] to highlight the command and then press [ENT]

```
┌─────────Angle─────────┐
│ HA:  34°00'20"0       │
│ ¹·0-Set   ⁴·F1/F2     │
│ ²·Input   ⁵·Hold      │
│ ³·Rept.               │
└───────────────────────┘
```
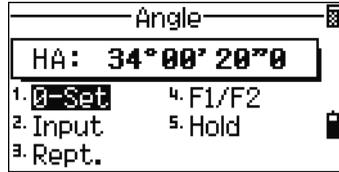
F1/F2 is not supported by the NPL-332.

Setting the horizontal angle to 0

To reset the horizontal angle to 0, press [1] or select 0-Set in the Angle menu. The display returns to the Basic Measurement Screen (BMS).

Entering the horizontal angle

To display the HA Input screen, press [2] or select Input in the Angle menu. Use the numeric keys to enter the horizontal angle. Then press [ENT].

```
┌─HA Input──────────────┐
│ HA:125.243▊           │
│                       │
│ * Input Horizontal Angle │
│   and Press [ENT]     │
└───────────────────────┘
```

To enter 123°45'50", type [1][2][3][.][4][5][5][0].
The displayed value is rounded to the minimum angle increment.

Recording a foresight point after repeat angle measurement

1. To activate repeat angle measurement, press [3] or select Rept. in the Angle menu.

   HR=0 appears.

```
┌REPT──────────N= 0──┐
│  HRΣ    0°00'00"0   │
│  HRX̄    0°00'00"0   │
│      -HA HOLD-      │
│ * Sight the BS  BS FS│
│   Press [ENT]      │
└────────────────────┘
```

2. Sight the backsight and press [ENT].
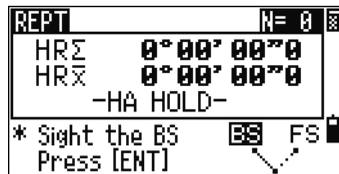
3. Sight the foresight and press [ENT].

   The horizontal angle is accumulated and the value is held again.

4. To end repeat angle measurement, press [ESC].

```
┌REPT──────────N= 1──┐
│  HRΣ   35°00'07"0   │
│  VA:   87°52'12"5   │
│  HD:              m │
│ * Sight the FS  BS FS│
│   Press [ENT]/[MSR] │
└────────────────────┘
```
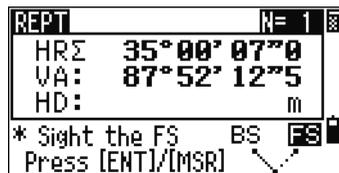
5. When you have accumulated enough horizontal angle between the backsight and the foresight, press [MSR1] or [MSR2] to take a measurement to the foresight.

```
REPT                N= 1
  HRΣ    35°00'07"0
  HRx̄    35°00'07"0
        -HA HOLD-
* Sight the BS    BS  FS
  Press [ENT]
```
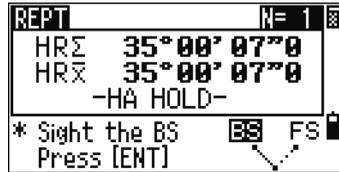
The averaged horizontal angle appears. This value is fixed until the process is finished or cancelled.

HRx̄ = HRΣ ÷ N

HA = BSAz + HRx̄ (normalized)

HRx̄ is not updated even if the instrument is moved.

```
REPT                N= 5
  HRx̄    35°00'06"0
  HA:    64°01'10"5
  HD:      180.2346m
* Press [ENT] to store
  Foresight as a CP record
```

6. Press [ENT] to store the foresight as a CP record. Check the PT, HT, and CD values. Then press [ENT] to record.

```
Record PT
  PT:A100
  HT:       1.7026 m
  CD:EDGE1
              List  Stack
```
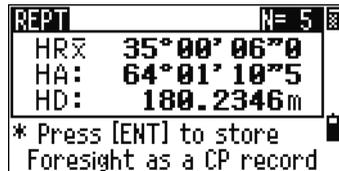
In repeat angle measurement, the HA is replaced by HRΣ. The number of repeat angles appears at the top of the screen (for example, N= 5).
Horizontal angles can be measured up to 1999°59'59".
This function stores both raw and XYZ data as CP records, regardless of the Store DB setting.

Face-1/Face-2 measurement

Use Face-1/Face-2 (F1/F2) measurements to obtain maximum accuracy for measuring angles. Using F1/F2 measurements effectively cancels out mechanical constant error, except for some special errors such as the vertical axis error. For more information, see Face-1/Face-2 Measurements, page 24.

To take F1/F2 data without taking a distance measurement, press [4] or select F1/F2 in the Angle menu.

```
———Angle———
  HA:  34°00'20"0
¹·0-Set      ⁴·F1/F2
²·Input      ⁵·Hold
³·Rept.
```

If you have already taken a distance measurement to the target, you can initiate F1/F2 averaging by flipping the telescope to the other face.

```
DSP                    1/4
 HA:  40°29'11"5
┌─────────────────────┐
│    Turn to F2       │
└─────────────────────┘
 PT:1
 HT:   1.5000m
```
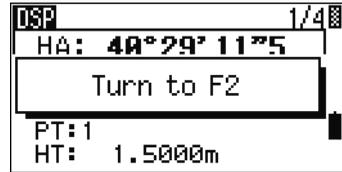
For the HA to be adjusted from a F1/F2 measurement, the Backsight must also have been measured in F1/F2 during the station setup.

```
 ⚠  STN Setup has
     to be in F1/F2
    * Press any key
```

Horizontal angle hold

To hold the horizontal angle to the current value, press 5 or select Hold in the Angle menu.

To set the horizontal angle to the displayed value, press ENT or the Set softkey.

To cancel the process and return to the Basic Measurement Screen (BMS), press ESC or the Abrt softkey.

```
HA Hold
 HA:   34°00'20"0

* HA is held & fixed until
  the [ENT] is pressed.
Abrt              Set
```
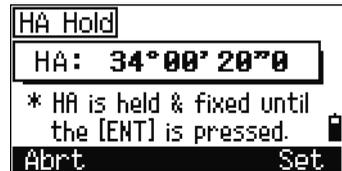
Station Setup

To open the Stn Setup menu, press STN in the BMS.

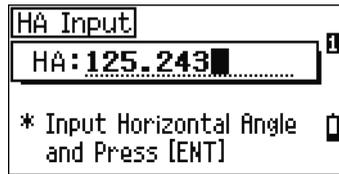To select a command from this menu, press the corresponding number key. Alternatively, press < or > to highlight the command and then press ENT. Press ^ or v to move up or down one page.

The last function used is highlighted.

```
─Stn Setup─────────
              1. Known
              2. Resection
              3. Quick
  (X,Y,Z)     4. Remote BM
              5. BS Check
```

```
─Stn Setup─────────
  P1  P2    6. Base XYZ
            7. Known Line
```
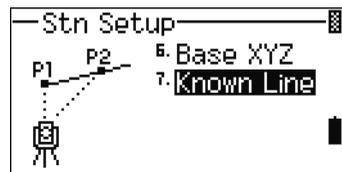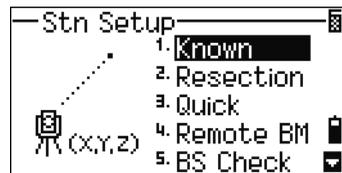
Setting up a station with known coordinates or azimuth

1. Press $\boxed{1}$ or select Known in the Stn Setup menu.

2. Enter a point name or number in the ST field.

    – If the input point number or name is an existing point, its coordinates are displayed and the cursor moves to the HI (Height of instrument) field.

    – If the point is new, a coordinate input screen appears. Enter the coordinates for the point. Press $\boxed{ENT}$ after each field. When you press $\boxed{ENT}$ in the CD field, the new point is stored.

    – If the specified point has a code, the code appears in the CD field.

3. Enter the instrument height in the HI field and then press $\boxed{ENT}$.

    The Backsight screen appears.

4. Select an input method for defining the backsight point.

    – To sight the backsight by entering coordinates, see below.

    – To sight the backsight by entering the azimuth and angle, see page 70.

Sighting the backsight by entering coordinates
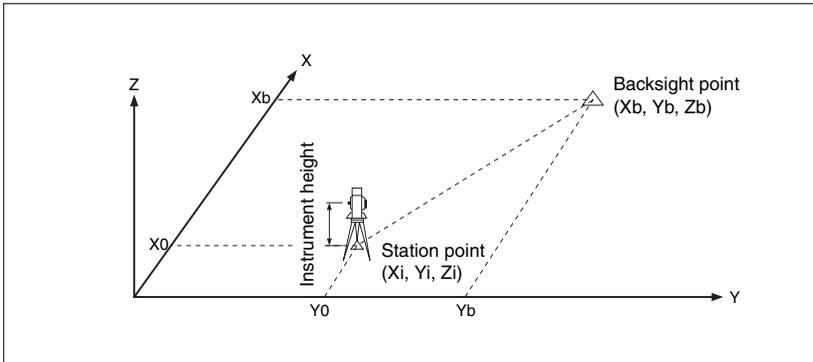
1. To enter coordinates for the backsight point (BS), press ① or select Coord in the Backsight screen.

2. Enter the point name. If the point exists in the job, its coordinates are shown.

3. If you intend to take a distance measurement to the BS, enter the height of target in the HT field.

4. Sight the BS on Face-1 (F1). Press [ENT] to complete the setup.

   – To record a full shot (with HA, VA, and SD values) to the BS, press [MSR1] or [MSR2].

   AZ   Azimuth calculated by coordinates

   – If you are measuring to a known coordinate BS, press [DSP] to display a QA screen. The QA screen shows the dHD and dVD values, which indicate the difference between the measured distance and the distance calculated from the known coordinates.
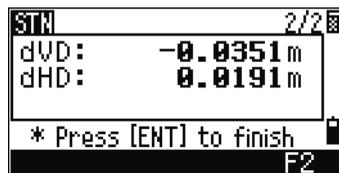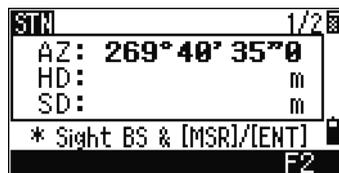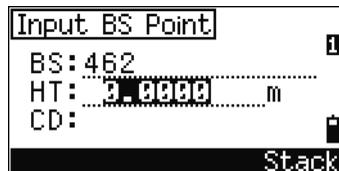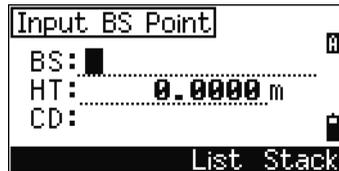
5. To record the station, press [ENT].

6. To finish the station setup after taking a distance measurement, press [ENT]. ST and F1 records are stored to the current job.

```
┌STN───────────────2/2█
│dVD:      -0.0351 m │
│                    │
│     - REC STN -    │
│                    │
│ * Press [ENT] to finish │
└────────────────────┘
```
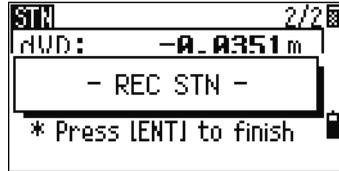
Advanced feature: Measuring F1 and F2

F1/F2 measurements are not available with the NPL-332

To take an angle shot and proceed to the next measurement on Face-2, press the F2 softkey.

```
┌STN───────────────1/2█
│ AZ: 269°40'35"0 │
│                    │
│     Turn to F2     │
│                    │
│ * Sight BS & [MSR]/[ENT] │
└────────────────────┘
```
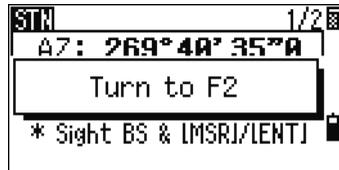
To go directly to the Face-2 measurement after taking a distance measurement to the BS on Face-1, flip the telescope. The instrument automatically detects F1/F2.

```
┌STN───────────────1/2█
│ AZ: 269°40'35"0 │
│ HD:             m │
│ SD:             m │
│ * Sight BS on F2 and │
│   Press [MSR] or [ENT] │
└────────────────────┘
```
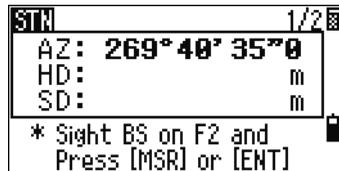
Press [ENT] on Face-2. The delta screen appears.

To record a CP record which stores the averaged HA, VA, and SD from the F1/F2 data, press the CP softkey. To record only the ST and F1/F2 records, without a CP record, press the OK softkey.

```
┌STN───────────────█
│dHA:     0°00'20"5 │
│dVA:     0°00'48"0 │
│dSD:       0.0061 m │
│ * Press [ENT] to record │
│ Abrt        CP    OK │
└────────────────────┘
```
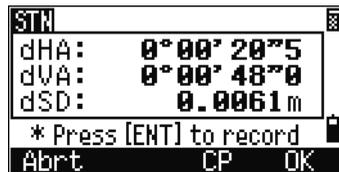
Sighting the backsight by entering the azimuth angle
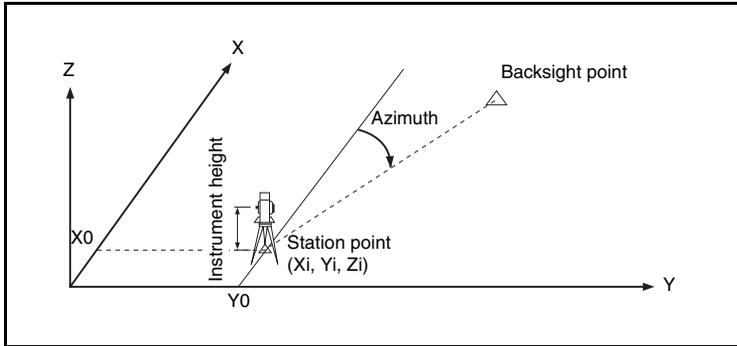
1. To enter the azimuth angle to the backsight point, press ② or select Angle in the Backsight screen.
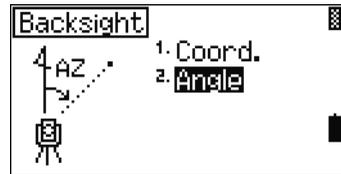
2. If there is no point name for the BS, press ENT on the BS field.
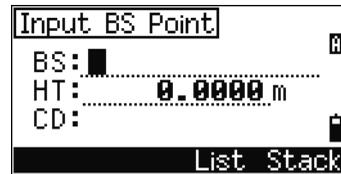
3. In the AZ field, enter the azimuth angle to the BS point.
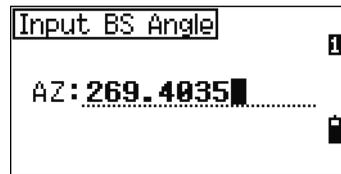
   If you press ENT without entering a value in the AZ field, the azimuth is automatically set to 0°00'00".

4. Sight the BS point and press ENT. ST and F1 records are stored in the job.

   You can also use the F2 softkey for F1/F2 measurements. See Advanced feature: Measuring F1 and F2, page 69.
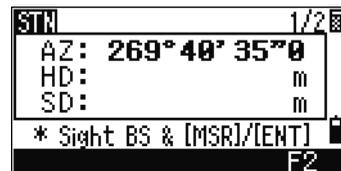
The F2 softkey is not available on the NPL-332.

Setting up a station using multiple point resection

A resection sets up the station using angle/distance measurements to known points.
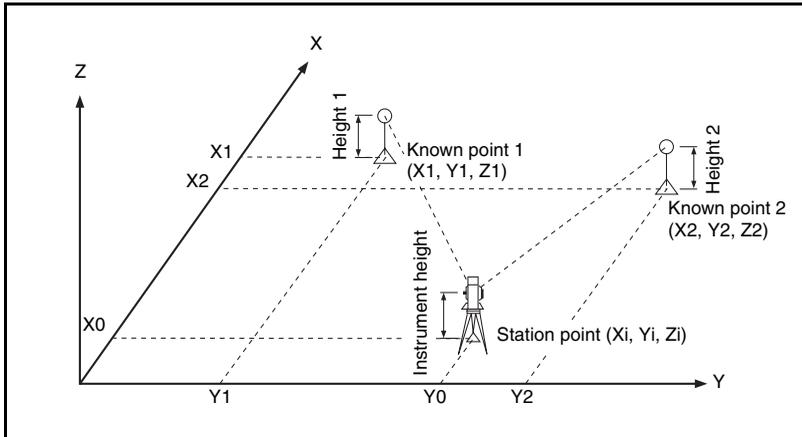
You can use a maximum of 10 points in a resection. Measurements can be distance and angle, or angle only. Calculation starts automatically when enough measurements are taken.

You can delete poor observations and recalculate if necessary. You can also select the BS point.

If the angle between known point 1 and known point 2 (measured from the station point) is extremely acute or extremely oblique, the resulting solution will be less reliable geometrically. For geometric reliability, select known point locations (or station point locations) that are widely spaced.

1. To start the resection, press ② or select Resection in the Stn Setup menu.

```
─Stn Setup──────────
       ∴      ¹·Known
    ╱    ∵    ²·Resection
   📷   ∴    ³·Quick
   ⚸           ⁴·Remote BM
               ⁵·BS Check
```
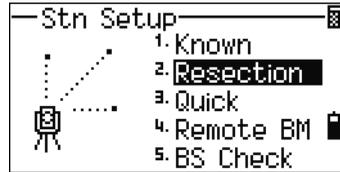
2. Enter the point name for the first observation point (PT1).

```
┌Input PT1┐           A
 PT:█
 HT:      0.0000 m
 CD:
             List  Stack
```

3. Enter the target height and press ENT.

```
┌Input PT1┐           1
 PT:503
 HT: 0.0000    m
 CD:POT
                    Stack
```
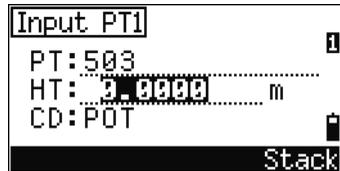
4. Sight PT1 and press MSR1 or MSR2.

To use the F2 softkey for F1/F2 measurements, see Advanced feature: Measuring F1 and F2, page 69.

```
STN
 HA:    90°30'26"5
 HD:             m
 SD:             m
 * Sight PT1 & [MSR]/[ENT]
                       F2
```
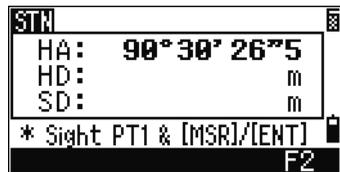
The F2 softkey is not available on the NPL-332.

5. To proceed to the next point, press ENT.

```
STN
 HA:    96°30'15"0
 HD:    78.6230 m
 SDx̄    79.0015 m
 * Press [ENT] to next PT
                       F2
```

6. Enter the second point (PT2) and its height of target.

```
┌Input PT2┐           1
 PT:█
 HT:      1.5600 m
 CD:
             List  Stack
```

7. Measure to PT2 and press [ENT].

When the instrument has enough data, it calculates the station (STN) coordinates.

```
STN
  HA:  148°55'34"0
  HD:              m
  SD:              m
* Sight PT2 & [MSR]/[ENT]
                      F2
```
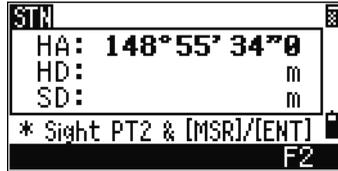
– If more than the minimum required data is available, a standard deviation screen appears.

– To take measurements to strengthen geometry of the resection, press the Add softkey. For information about the View softkey, see Advanced feature: Viewing and deleting a measurement in resection, page 74.

```
STN               1/2
  ơN:        0.0193
  ơE:        0.0084
  ơZ:        0.0227
* Press [REC] to finish
  Add   View   DSP   REC
```
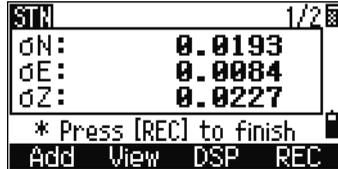
8. When the results are satisfactory, record the station. To do this, press [ENT] or the REC softkey.

```
STN               2/2
  N:       200.4651
  E:       100.0126
  Z:        64.4160
* Press [Add] for next PT
  Add   View   DSP   REC
```
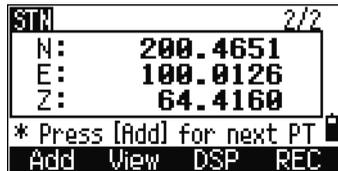
9. Enter the height of instrument, if required. Press [ENT]. The ST field defaults to the last recorded PT + 1.

10. To change the station name, move to the ST field and edit or replace the text.

```
ST:9005
HI: 1.2345   m
CD:
BS:9000
 * Input Height of Inst.
```
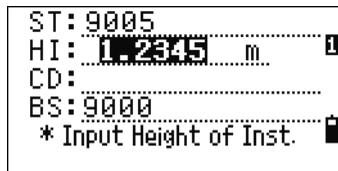
If you have set Split ST to Yes, the ST field defaults to the last recorded ST value + 1. For more information, see Others settings, page 140.

BS defaults to the first observed point.

11. To change the BS, press the Change softkey.

```
ST:9005
HI:    1.2345 m
CD:MANHOLE-7
BS:9000
 * Select Backsight PT
                  Change
```
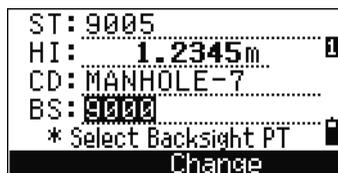
12. Select the BS point that you want to use and press [ENT].

```
Select BS point
9000,
200,MANHOLE
30-A,N-POLE
201,
```
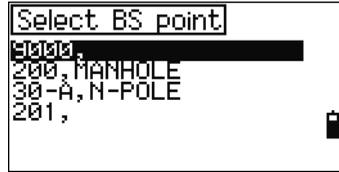
13. To finish the resection setup, move the cursor to the BS field and press [ENT].

```
ST:9005
HT:    1.2345m
    - REC STN -
  * Select Backsight PT
```
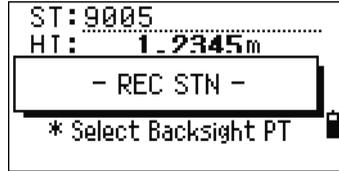
The minimum data required for a resection is either three angle shots, or one angle shot and one distance shot. If you use a distance shot, the distance between the target points must be greater than the measured distance.
Stn-Z is calculated from distance-measured data. If no distances are measured, then Stn-Z is calculated using angle-only measurements to points with 3D coordinates.

Advanced feature: Viewing and deleting a measurement in resection

To check the measurements to each known point, press the View softkey on the calculated STN (sigma or coordinate) screen.

```
▒▒▒▒ View Shots ▒▒▒▒
K-65,ROAD
200,MANHOLE
30-A,N-POLE
201,
202,
 Add   DEL
```

dHA Distributed HA errors in each direction

dVD VD errors between measured distance and calculated distance

dHD HD errors between measured distance and calculated distance

```
dHA:   -4°19'02"5
dVD:      0.0267m
dHD:      0.0819m
 PT:K-65
 HT:    1.8520m
 Add   DEL   DSP
```
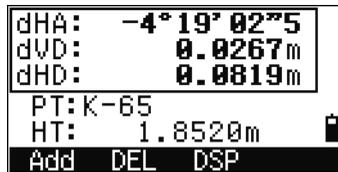
To delete a measurement (because of large sigma values, for example), highlight the measurement data or display the detail screen for the measurement. Then press the DEL softkey. The STN coordinates are automatically recalculated.

To continue resection observations, press the Add softkey. The input screen for the next PT appears.

```
┌Input PT5─────────────────┐A
│ PT:█......................│
│ HT:........0.0000 m       │
│ CD:                      ▐│
│                  List Stack│
└──────────────────────────┘
```

Setting up the station quickly without coordinates

The station point (ST) in this function defaults to a new point number. For the new point, MP (0, 0, 0) is stored as the coordinates. When the ST is manually changed to a known point name, the station is set up on the coordinates of the known point.

1. To enter Quick Station setup, press ③ or select Quick in the Stn Setup menu.

```
┌─Stn Setup──────────┐
│        .  ¹·Known  │
│      ./    ²·Resection│
│    ./      ³·Quick ▐│
│ ▣         ⁴·Remote BM▐│
│ 冊(0,0,0)  ⁵·BS Check│
└────────────────────┘
```

   ST   Station point (defaults to the last recorded PT + 1, or ST + 1, depending on the Split ST setting)
   HI   Height of instrument
   BS   Backsight point (blank)
   AZ   Backsight azimuth (defaults to zero)

```
┌Quick Station─────────┐1
│ ST:9005              │
│ HI:    1.2345 m      │
│ BS:█                 │
│ AZ:  0°00'00"0      ▐│
└──────────────────────┘
```

2. No default PT is assigned to the BS. Leave this field blank, or enter a BS point name.

3. The backsight azimuth (AZ) defaults to zero, but you can change this.

```
┌Quick Station─────────┐1
│ ST:▓9005▓            │
│ HI:    0.0000 m      │
│ BS:                  │
│ AZ:  0°00'00"0      ▐│
│               List Stack│
└──────────────────────┘
```

4. To complete the station setup, sight the BS and press [ENT].

   When you press [ENT] in the AZ field, both HA and AZ are reset to the value you have entered.

> Even if both ST and BS are known points, this function does not calculate the backsight angle (AZ) automatically. To calculate the AZ between two known points (ST and BS), use Station Setup > Known. For more information, see Setting up a station with known coordinates or azimuth, page 67.

Determining station elevation

1. Press ④ or select Remote BM in the Stn Setup menu.

```
─Stn Setup────────────▤
          1. Known
    ↑⌂     2. Resection
   ⤢  ⚏   3. Quick
  ⛫....↓   4. Remote BM ▮
          5. BS Check
```

2. Enter the BM point and press [ENT]. When the point is found, it appears briefly. The cursor then moves to the HT field.

3. Enter the HT and press [ENT].

```
┌Input BM─────────────┐
│                    ▯ │
│ PT:▮                 │
│ HT:      1.5600 m    │
│ CD:                 ▯│
│              List Stack│
```

4. Sight the BM point and press [MSR1] or [MSR2].

```
RBM                  ▤
  HA: 269°40'35"0
  VD:              m
  HD:              m
 * Sight BM point and
      Press [MSR]   ▮
```

5. To take an F1/F2 measurement, press the F2 softkey or flip the telescope to Face-2 after a distance measurement.

```
RBM                  ▤
  HA: 269°40'35"0
  VD:      0.6011 m
  HD:    108.5247 m
 * Press [ENT] or [F2] ▮
                    F2
```
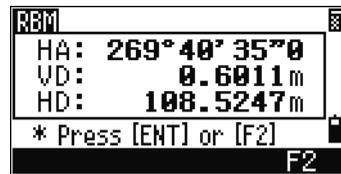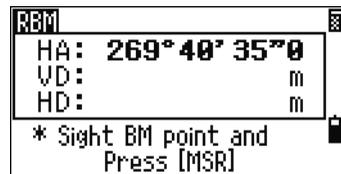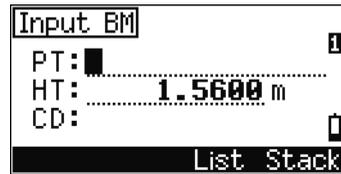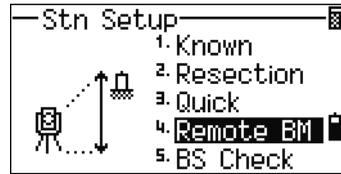
The F2 softkey is not available on the NPL-332.

The updated station coordinates are displayed. You can change the HI in this screen.

6. To record the updated STN, press [ENT].

```
 X:     -88.7215
 Y:     -20.1467  ▯
 Z:      84.5800
ST:T-37
HI: 0.0000      m  ▯
```
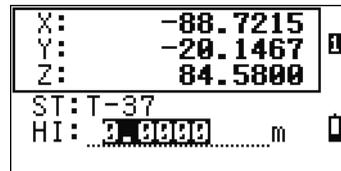
When the HI is changed, the Z coordinate is updated before the station is recorded. You must complete a station setup before you use the Remote Benchmark function.

Checking and resetting the backsight direction

You must complete a station setup before you use the BS check function.
This function always refers to the backsight point from the last ST record stored in the current open job.

1. To enter the backsight (BS) check function, press ⑤ or select BS Check in the Stn Setup menu.

```
┌─Stn Setup──────────
│        BS  ¹·Known
│  ┌┐         ²·Resection
│  ┤ ˙·.      ³·Quick
│  ▣         ⁴·Remote BM ▮
│  ⊼⊼        ⁵·BS Check
```
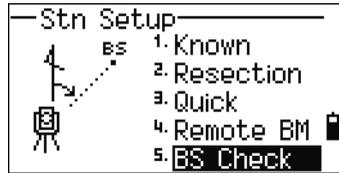
    HA   Current HA reading

    BS   The HA to the BS in the last station setup. Enter station coordinates for observations without recording data

```
┌─BS CHECK──────────▨─
│ HA:    0°00'02"5
│ BS:    0°00'00"0
│ * Check the Backsight
│                    ▮
│Abrt            Reset
```

2. Do one of the following:

    – To reset the horizontal angle to the HA set in the last station setup sight the BS and press the Reset softkey or press ⟨ENT⟩.

    – To cancel the process and return to the BMS, press the Abrt softkey or press ⟨ESC⟩.
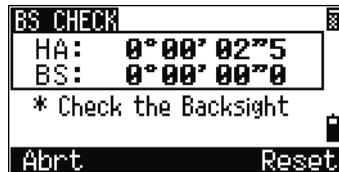
Base XYZ function:

Base XYZ does not store a ST record, so the BS Check cannot check the backsight when you enter a station using Base XYZ.

To store raw data, use one of the other functions in the Stn Setup menu. This function does not store an ST record in the job.

You can use this function without an open job. If there is an open job when you use this function, a CO record is stored to indicate that the instrument's base coordinates have changed.

1. To enter the Base XYZ function, press ⑥ or select Base XYZ in the Stn Setup menu.

   The current instrument XYZ values are shown as the default.

2. Enter the new instrument XYZ values and press [ENT].
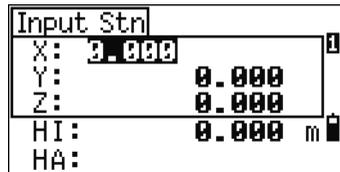
3. Do one of the following:

   – To reset the horizontal angle, enter a value in the HA field and press [ENT].

   – If you do not need to reset the HA, leave the HA field blank and press [ENT].

   The display returns to the BMS.

Two-point resection along a known line

1. To enter the Known Line function, press 7 or select Known Line in the Stn Setup menu.

```
─Stn Setup──────────
           P2   6. Base XYZ
      P1        7. Known Line
```

2. Enter a known point as P1.

If you enter a new point name, a coordinate input screen appears.

```
Input P1                  A
 P1:█
 HT:    0.000  m
 CD:
                   List  Stack
```

Sight P1 and press MSR1 or MSR2 to take a measurement. Press ENT.

```
STN
 HA:   96°30′15″
 HD:   78.623  m
 SDx̄   79.001  m
* Press [ENT] to next PT
                        F2
```
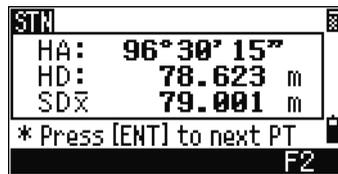
3. Choose how you want to define a known line:
  - To define the line by entering P2 coordinates, press 1 or select By Coord.
  - To define the line by entering the azimuth, press 2 or select By Angle.

```
Input P2
    AZ      1. By Coord.
      P2    2. By Angle
```
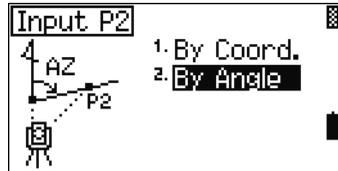
4. If you select By Angle, the azimuth input screen appears. Enter the angle value and press ENT.

```
Input Angle               1
 AZ:269.4035█
 * Azimuth of P1-P2 Line
```
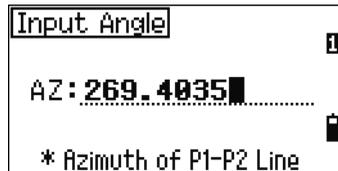
A measurement screen appears.

5. Sight P2 and press MSR1 or MSR2 to take a measurement. Press ENT.

```
STN
 HA:  148°55′34″
 HD:           m
 SD:           m
* Sight PT2 & Press [MSR]
                        F2
```
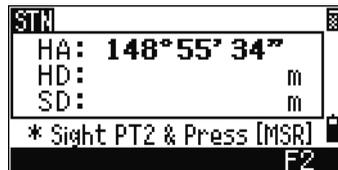
After the measurement to P2 is completed, the coordinates of the station are calculated.

6. To record the station, press [ENT] or the REC softkey.

```
STN                    1/2
 X:       200.465
 Y:       100.012
 Z:        64.416
 * Press [ENT] to finish
                DSP    REC
```

7. To check your measurement, press the DSP softkey. If you defined the line by entering its azimuth, HD and VD between P1 and P2 are displayed.

```
STN                    2/2
 HD:      182.035  m
 VD:        0.648  m

 * Press [ENT] to finish
                DSP    REC
```

If you defined the line by entering the P2 coordinates, the difference of HD (dHD) and VD (dZ) between your measurement data and input coordinate data are displayed.

8. Enter the station name, the height of instrument (HI), and a feature code (CD) if required. The station name defaults to the last recorded PT + 1, or last recorded ST + 1, depending on the Split ST setting.

```
ST:9005
HI:      1.2345m        1
CD:
BS:9000
     * Input ST name
              List  Stack
```

9. Backsight (BS) defaults to the first point (P1). To change it, highlight the BS field and then press the Change softkey.

```
ST:9005
HI:      1.2345m        1
CD:MANHOLE-7
BS:9000
   * Select Backsight PT
            Change
```

10. To finish the setup and record the station, press [ENT] in the BS field.

```
ST:9005
HI:     1.2345m

     - REC STN -

   * Select Backsight PT
```
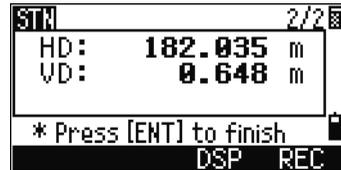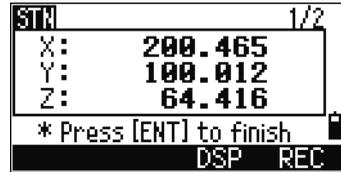
Sample records
CO, Temperature:20C Pressure:1013hPa Prism:0 …
ST,9005, ,265, ,1.2350,150.40300,150.40300
F1,265,1.6040,79.0010,90.30150,89.35260,
F1,200,1.4590,50.2300,269.4035,93.50110,
CO, P1-P2 HD=122.0350 VD=0.5600

Stakeout
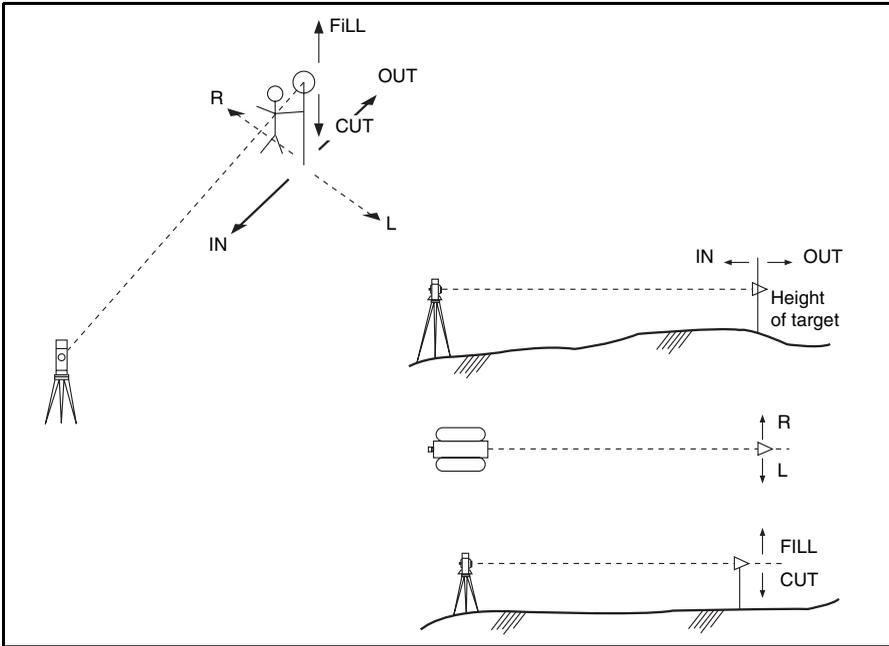
To display the Stakeout menu, press [S-O].
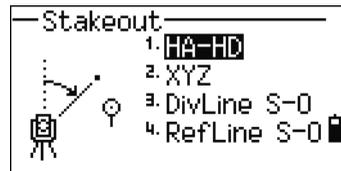
Specifying the stakeout point by angle and distance

1. To display the input screen for the distance and angle to the target, press [1] or select HA-HD in the Stakeout menu.

2. Enter the values and press [ENT].

    HD   Horizontal distance from station point to stakeout point

    dVD   Vertical distance from station point to stakeout point

    HA   Horizontal angle to stakeout point
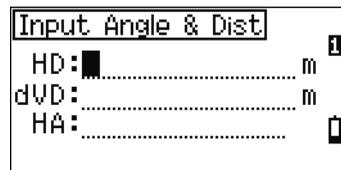
If you press [ENT] without entering HA, the current HA is used.

3. Rotate the instrument until the dHA is close to 0°00'00".

4. Sight the target and press [MSR1] or [MSR2].

```
S-0                        
dHA+ 205°35'41"0
 HD:      87.5412m

   * Sight the target
     and Press [MSR]
```
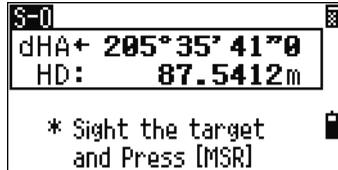
When the measurement is completed, the differences between the target position and the stakeout point are displayed.

```
S-0                   1/7
dHA+       0°00'08"5
  R  +     0.0846m
OUT↑       1.0057m
CUT↓       0.0615m
* Press [ENT] to record
```

dHA   Difference in horizontal angle to the target point

R/L   Right/Left (Lateral error)

IN/OUT   In/Out (Longitudinal error)
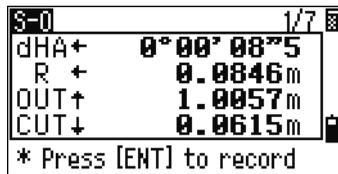
CUT/FIL   Cut/Fill

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

If you press [HOT] in any observation screen, the HOT key menu appears. You can use this menu at any time to change HT and T-P.

```
─────HOT key─────
1. HT
2. Temp-Press
3. Target
4. Note
5. Default PT
```

Using ⌷DSP⌷ to switch between display screens

Press ⌷DSP⌷ to switch between the Stakeout display screens. The following screens are available:

S-O1	S-O2	S-O3	S-O4
dHA← R← OUT↑ CUT↑	HA VA SD	HA VD HD	HL V% HD

S-O5	S-O6	S-O7	S-O8
X Y Z	dX dY dZ	rSD rVD rHD	HD VD SD

The S-O8 screen is only available if the secondary distance unit is set. For more information, see Others settings, page 140.

Every time you press ⌷DSP⌷, the next screen appears. If you press ⌷DSP⌷ in the last screen (S-O7, or S-O8 if the secondary distance unit is set), the S-O1 screen appears.

To customize the S-O2, S-O3, and S-O4 screens, hold down ⌷DSP⌷ for one second. For more information, see Customizing items in the Basic Measurement Screen (BMS), page 40.

To record the stakeout point, press ⌷ENT⌷. PT defaults to the last recorded PT+1.

Press ⌷ENT⌗ to record the point.

```
X:      102.0155
Y:      184.1729
Z:       70.4480
PT:102
CD:
              List Stack
```
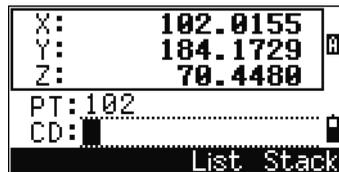
After recording the point, it returns to the observation screen. You can continue observation, or press ⌷ESC⌷ to input another angle and distance for stakeout.

```
X:      102.0155
Y:      184.1729
   - REC XYZ -
CD:
```
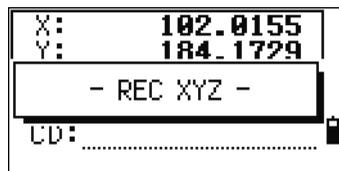
Specifying the stakeout point by coordinates

1. To start a stakeout by coordinates, press ②︎ or select XYZ in the Stakeout menu.

```
─Stakeout─
           1. HA-HD
 (X,Y,Z)   2. XYZ
           3. DivLine S-O
   ⌀       4. RefLine S-O
```
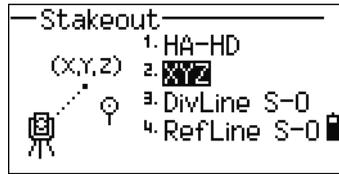
2. Enter the point name that you want to stake and press [ENT].

You can also specify the point by code or radius from the instrument.

```
Input Point              1
 PT:A100*▮
Rad:                  m
 CD:
          Fr/To List Stack
```
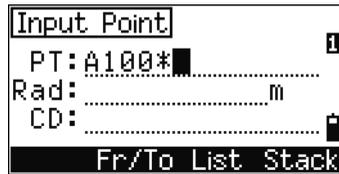
If several points are found, they are displayed in a list. Use Ⓐ or Ⓥ to move up and down the list. Use Ⓒ or Ⓓ to move up or down one page.

3. Highlight a point in the list and press [ENT].

```
UP,A100,FENCE
UP,A101,
UP,A100-1,MANHOLE
UP,A100-2,
UP,A100-4,
UP,A100-6,CODECODE
UP,A1000,
```

The delta angle and the distance to the target are shown.

4. Rotate the instrument until the dHA is close to 0°00'00". Press [MSR1] or [MSR2].

```
PT:A100-2
 dHA:     0°00'00"0
  HD:      87.5412m

 * Sight the target
   and Press [MSR]
```

    dHA   Difference in horizontal angle to the target point

    HD   Distance to the target point
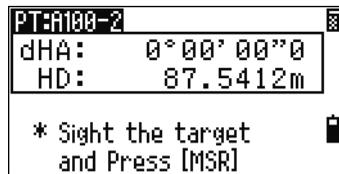
5. Ask the rodman to adjust the target position. When the target is on the intended position, the displayed errors become 0.000 m (or 0.000 ft).

```
PT: A100-2         1/7
dHA◄     0°00'26"5
 R  ◄      0.055  m
IN  ↓      0.920  m
FIL↑       0.036  m
 * Press [ENT] to record
```

    dHA   Difference in horizontal angle to the target point

    R/L   Right/Left (Lateral error)

    IN/OUT   In/Out (Longitudinal error)

    CUT/FIL Cut/Fill
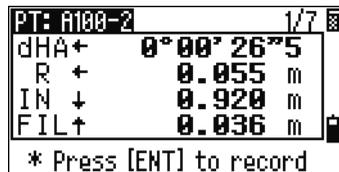
To switch between display screens, press [DSP]. This function works as in the angle-distance stakeout, except that the screen counter (for example, S-O1/8) is not displayed. For more information, see Using [DSP] to switch between display screens, page 83.

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

6. To record the point, press [ENT]. PT defaults to the specified PT + 1000.
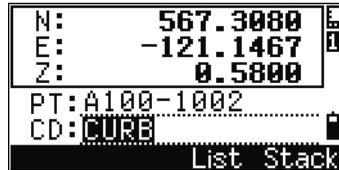
```
N:           567.3080
E:          -121.1467
Z:             0.5800
PT:A100-1002
CD:CURB
                List Stack
```

Use the Add Constant field in MENU > Settings > Stakeout to specify an integer that is added to the point number being staked to generate a new number for recording the staked point. The default value is 1000. For example, when you stake out PT3 with an Add Constant of 1000, the default number for SO record is 1003. For more information, see Stakeout, page 138.

```
<Stakeout>
  Add PT : 1000
```

After recording the point, the display returns to the observation screen. When you press [ESC], the display returns to the PT/CD/R input screen. If you entered the stakeout point using a single point name, the PT defaults to the last PT + 1.
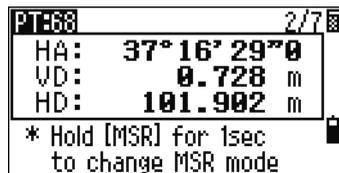
```
PT:68              2/7
  HA:    37°16'29"0
  VD:       0.728 m
  HD:     101.902 m
* Hold [MSR] for 1sec
   to change MSR mode
```

If you selected a point from the list, the display returns to the list, unless all points have been selected. Press [ESC] to return to the point input screen.

```
UP,A100,FENCE
UP,A101,
UP,A100-1,MANHOLE
UP,A100-2,
UP,A100-4,
UP,A100-6,CODECODE
UP,A1000,
```

Advanced feature: Specifying a stakeout list by range input

1. To input points by range, press the Fr/To softkey in the PT field.

```
┌─Input Point─────────────┐
│                       ▪ │
│ PT:█.....................│
│Rad:..................m   │
│ CD:...................▪  │
│            Fr/To List Stack│
└─────────────────────────┘
```
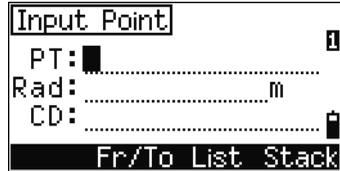
2. Enter the start point (Fr) and the end point (To). The range between Fr and To must be less than 1001 points.

```
┌─Input Point Range───────┐
│                       ▪ │
│ Fr:A100                 │
│ To:A200█..............   │
│                       ▯ │
│                 List Stack│
└─────────────────────────┘
```
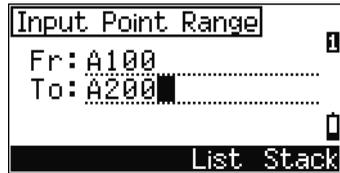
If existing points are found between Fr and To, a point list appears.

To highlight a point, press ⌃ or ⌄. To go to the stakeout observation screen, press ENT.

```
┌─────────────────────────┐
│UP,A100,FENCE            │
│UP,A101,                 │
│UP,A102,MANHOLE          │
│UP,A103,                 │
│UP,A104,                ▮│
│UP,A105,CODECODE         │
│UP,A107,                ▼│
└─────────────────────────┘
```
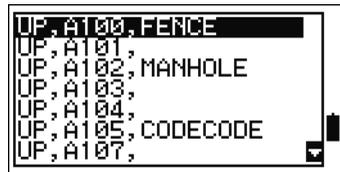
If you have assigned a control job, and additional points are found in the control job, the Ctrl softkey appears under the list.

```
┌─────────────────────────┐
│UP,A100,FENCE            │
│UP,A101,                 │
│UP,A100-1,MANHOLE        │
│UP,A100-2,               │
│UP,A100-4,              ▼│
│UP,A100-6,CODECODE     ▮│
│··················[Ctrl]····│
└─────────────────────────┘
```
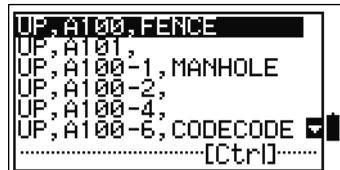
DivLine S-O

This function divides the line between the instrument and the first target by an input span number. It then guides you to stake out the points, one by one.

1. Press ③ or select DivLine S-O in the Stakeout menu.

   ```
   ┌Stakeout──────────┐
   │       1. HA-HD    │
   │  ○    2. XYZ      │
   │  ╱    3. DivLine S-O│
   │ 璺    4. RefLine S-O│
   │ 亣                │
   └──────────────────┘
   ```
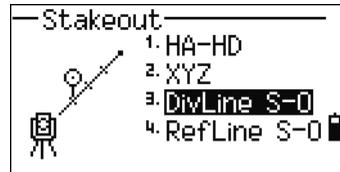
2. Set up the baseline. To do this, sight the target on the line (the end point) and press [MSR1] or [MSR2].

   ```
   ┌LineS-O──────────┐
   │ HA:209°35' 46"5 │
   │ HD:          m  │
   │ 璺          璺  │
   │ 亣─────────     │
   │ * Sight END-Pt and [MSR]│
   └──────────────────┘
   ```
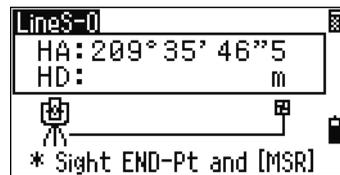
3. Enter the total stake number in the Span total field.

   ```
   ┌LineS-O──────────┐
   │ HA:  209°35' 46"5│
   │ HD:     148.2600m│
   │ 璺│ │ ┊ ┊ ┊ 璺 │
   │ 亣              │
   │  Span total:▆   │
   └──────────────────┘
   ```
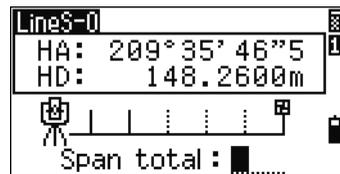
   The observation screen for the first stake (from the instrument) appears.

4. Sight the prism and press [MSR1] or [MSR2].

   ```
   ┌LineS-O   <1/4>──┐
   │ HD:     10.0650m│
   │ L  +     0.1564m│
   │ In ↓     0.3408m│
   │ * [↓] = Go to next nail│
   │   [↑] = Back to prev nail│
   └──────────────────┘
   ```
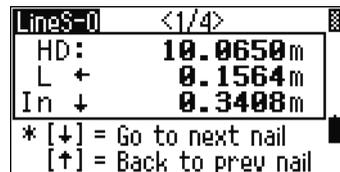
5. Use △ or ▽ to change the guide point. You can calculate and guide up to double the number of the stakes.

   ```
   ┌LineS-O   <2/4>──┐
   │ HD:     20.1300m│
   │ L  +     0.1502m│
   │ Out↑    10.4058m│
   │ * [↓] → Go to next nail│
   │   [↑] → Back to prev nail│
   └──────────────────┘
   ```

6. To record the point as an SO record, press [ENT].

   ```
   ┌──────────────────┐
   │ X:    102.0155   │
   │ Y:    184.1729   │
   │ Z:     70.4480   │
   │ PT:102           │
   │ CD:CURB          │
   │            List Stack│
   └──────────────────┘
   ```
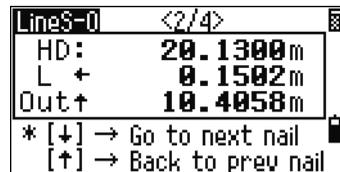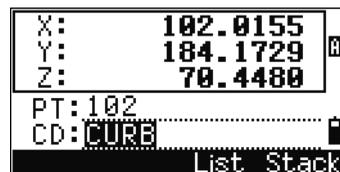
For example, if you measure to the end point at 100 m from the instrument and set the span total to 2, the following four points are calculated and can be staked:

	<1/2>	<2/2>	<3/2>	<4/2>
HD	50 m	100 m	150 m	200 m
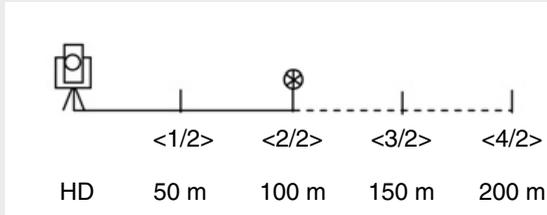
RefLine S-O

This function allows you to stake out a point based on the Sta, O/S, and dZ to a specified line.

1. Press ④ or select
   RefLine S-O in the Stakeout menu.
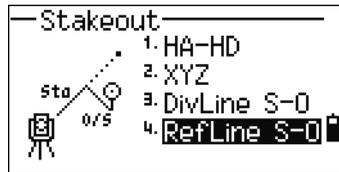
2. Enter the first point (P1) of the line.
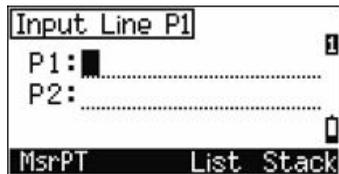
If you press (ENT) without entering a PT name, you can enter temporary coordinates which are not recorded in the job.
Alternatively, press the MSR softkey to measure a point.
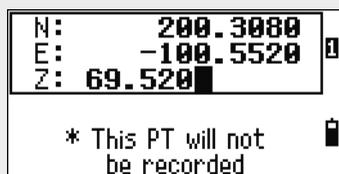
3. Enter the second point (P2) of the line.

```
Input Line P2        ▣
 P1:<Keyed-in XYZ>
 P2:█
                     ▯
MsrPT        List Stack
```

4. Enter offsets to the line.

Press [ENT] in a blank field to enter the value 0.0000.

```
Input offsets        ▣
Sta:      40.3500m
O/S:       3.5500m
 dZ:█             m   ▯
```

- Sta   Distance from P1 along the line
- O/S   Distance perpendicular to the line
- (+)   Right side of the P1—P2 line
- (-)   Left side of the P1—P2 line
- dZ   Difference in height from the line

5. Rotate the instrument until the dHA is close to 0°00'00".

6. Sight the target and press [MSR1] or [MSR2].

```
REF S-O              ▨
dHA+ 205°35'41"0
 HD:      87.5412m

   * Sight the target
     and Press [MSR]
```

When a distance measurement is taken, the difference from the design point appears.

7. To record the point as an SO record, press [ENT].

```
REF S-O          1/7▨
dHA+    0°00'08"5
 R  +    0.0846m
OUT↑     1.0057m
CUT↓     0.0615m
 * Press [ENT] to record
```

Using [DSP] to switch between display screens

You can use [DSP] to switch between display screens. This function works as in the angle-distance stakeout. For more information, see Using [DSP] to switch between display screens, page 83.

Program Key

To display the Programs menu, press [PRG].

Measuring distance and offset values along a specified line

1. Press [1] or select 2Pt RefLine in the Programs menu.

```
┌─Programs──────────
│      P2  1. 2Pt RefLine
│          2. Arc RefLine
│    o/s   3. RDM(Radial)
│ sta      4. RDM(Cont.)
│          5. REM
│ P1
```
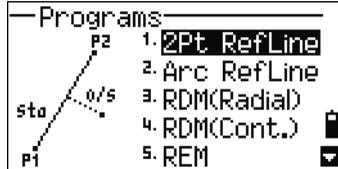
2. Enter the first point for the reference line. Alternatively (to enter the point by measuring), press the MsrPT softkey.

```
┌Input Line P1┐
│ P1:308▉        ⊞
│ P2:........
│
│
│MsrPT    List Stack
```
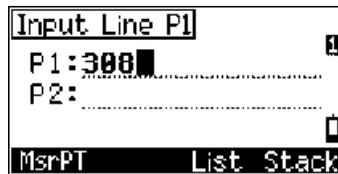
Direct Measurement screen

Press the MsrPT softkey to display a direct measurement screen.
Sight the target and press [MSR1] or [MSR2]. The Record PT screen appears.
If you press [ESC] in the Record PT screen, the measured point is used but not recorded in the job.

```
HA:  147°29' 11"5
VA:   90°27' 48"0
SD:              m
HT:     1.5600 m
* Sight PT & Press [MSR]
              HT
```
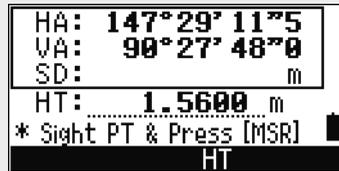
3. Enter the second point for the reference line.

```
┌Input Line P2┐
│ P1:308        ⊞
│ P2:A*▉
│
│
│MsrPT    List Stack
```
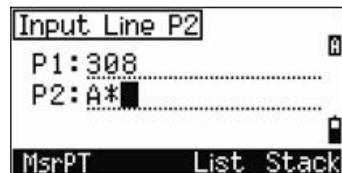
4. Enter an asterisk (*) in the PT field to perform a wildcard search. A list of matching points appears. Highlight a point in the list and then press [ENT].

```
UP,A57,FENCE
UP,A58,
UP,A59,MANHOLE
UP,A60-1,CURB-IN
UP,A60-2,CURB-OUT
UP,A68,DITCH
UP,A70,
```

| Plain view | Side view |
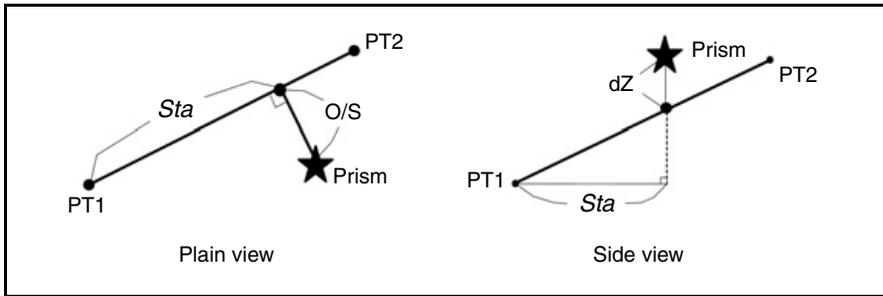
5. Sight the prism or reflective sheet and press [MSR1] or [MSR2].

```
REF                  1/4
Sta:      -0.2146 m
O/S:       3.5021 m
 dZ:       0.0207 m

* Press [ENT] to record
```

Sta	Horizontal distance from P1 to the measure point along the P1-P2 line
O/S	Horizontal offset from the P1-P2 line to the measured point
dZ	Vertical offset from the P1-P2 line to the measured point

Using [DSP] to switch between display screens

Press [DSP] to switch between the Stakeout display screens. The following screens are available:

REF1
```
Sta
O/S
dZ
```

REF2
```
X
Y
Z
```

REF3
```
HA
VA
SD
```

REF4
```
HA
VD
HD
```

REF5
```
HD
VD
SD
```

The REF5 screen is only available if the secondary distance unit is set. For more information, see Others settings, page 140.

Every time you press [DSP], the next screen appears. If you press [DSP] in the last screen (REF4 or REF5), the REF1 screen appears.

To store the point and its offset distance information, press [ENT].

Enter the point name and feature code.

You can also use this screen to change the HT value.

```
┌─────────────┐
│Record PT│  ▯│
│ PT:A102······│
│ HT:    1.7026 m│
│ CD:HUB·········▯│
│         List Stack│
└─────────────┘
```

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

Measuring distance and offset values on the arc-curve

1. Press [2] or select Arc RefLine in the Programs menu.

```
┌─Programs──────┐
│ ▪ o/s   ¹·2Pt RefLine│
│    ╱─P2 ²·Arc RefLine│
│   ╱      ³·RDM(Radial)│
│  sta     ⁴·RDM(Cont.) ▮│
│ P1       ⁵·REM       ▼│
└───────────────┘
```

2. Enter the start of the curve point (P1) and the azimuth of its tangent line (AZ1).

3. To enter P1 by direct measurement, press the MSR softkey.

```
┌─────────────┐
│Start of Curve│ ▯│
│ P1:█·············│
│AZ1:·············│
│               ▯│
│MsrPT    List Stack│
└─────────────┘
```

4. Choose a method to define the arc.

```
┌─────────────┐
│Define Curve│    │
│    ↑    ¹·P2-AZ2│
│  ⎸AZ  ²·Rad-AZ2│
│   ⋱·· ³·Rad-Length ▮│
│  P2          │
└─────────────┘
```

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

```
┌─────────────┐
│Input Curve│   ▯│
│ P2:█·············│
│AZ2:·············│
│               ▯│
│MsrPT    List Stack│
└─────────────┘
```

5. In the radius (Rad) field, enter a positive value for a clockwise curve. Enter a negative value for a counterclockwise curve.

```
┌Input Curve┐            ▯
Rad:█.........................m
AZ2:.................................
 * Rad(-) : anticlockwise  ▯
   Rad(+) : clockwise
```

```
┌ARC┐                      ▨
Rad:    -85.2400 m
Len:    128.1405 m
AZ2: 167°24'06"0
                          ▯
 Abrt                  OK
```
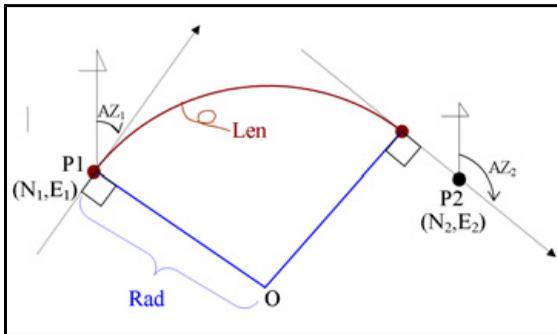

When all factors have been entered, the instrument calculates the curve.

If the curve length (Len) is too large for a circle of the given radius, it is shortened.

```
┌ARC┐                  1/4▨
Sta:    -0.2146 m
O/S:     3.5021 m
 dZ:     0.0207 m
                          ▯
 * Press [ENT] to record
```

To ...	Press ...
switch between display screens	[DSP]
change HT	[HOT]
record points	[ENT]

Using DSP **to switch between display screens**

Press DSP to switch between the Stakeout display screens. The following screens are available:

ARC1	**ARC2**	**ARC3**	**ARC4**
Sta O/S dZ	X Y Z	HA VA SD	HA VD HD

ARC5

HD
VD
SD

The ARC5 screen is only available if the secondary distance unit is set. For more information, see Others settings, page 140.

Every time you press DSP, the next screen appears. If you press DSP in the last screen (ARC4 or ARC5), the ARC1 screen appears.

To record the point, press ENT on any observation screen. The arc is stored in comment records.

```
Record PT                    1
 PT:208
 HT:      1.7026 m
 CD:HUB
                    List  Stack
```
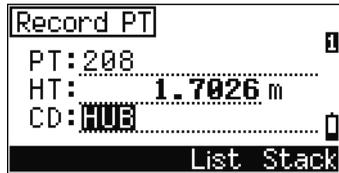
Sample records

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

Remote distance measurement

This function measures the horizontal distance, vertical distance, and slope distance between two points.
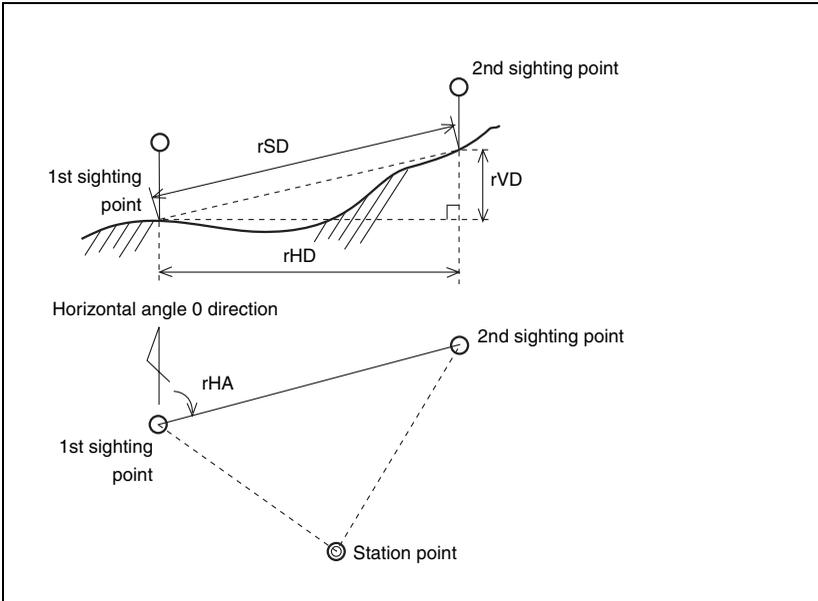
rSD   Slope distance between two points

rHD   Horizontal distance between two points

rVD   Vertical distance between two points

rV%   Percentage of grade (rVD/rHD) × 100%

rGD   Vertical grade (rHD/rVD) :1

rAZ   Azimuth from first point to second point

Measuring between the current and the first point measured

1. To enter the RDM (Radial) function, press ③ or select RDM(Radial) in the Programs menu.

```
┌Programs──────────
│        P2  1·2Pt RefLine
│  P1         2·Arc RefLine
│        P3  3·RDM(Radial)  ▐
│  ▨         4·RDM(Cont.)   ▐
│  ⚎   P4    5·REM          ▼
```

2. Sight the first point and press [MSR1] or [MSR2].

```
┌RDM─────────────1/2▨
│rSD:              m
│rVD:              m
│rHD:              m
│* Sight PT & Press [MSR] ▐
```
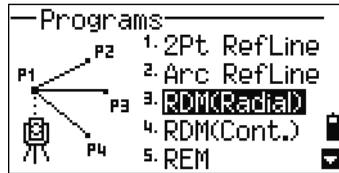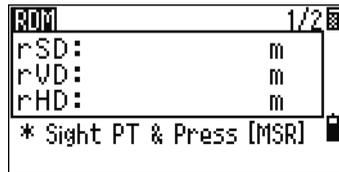
The distance from the station point to the first point appears.

3. Sight the second point and press [MSR1] or [MSR2]. The distances between the first and second point are displayed.
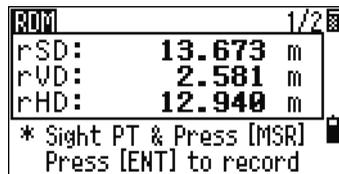
```
┌RDM─────────────1/2▨
│rSD:      13.673  m
│rVD:       2.581  m
│rHD:      12.940  m
│* Sight PT & Press [MSR] ▐
│  Press [ENT] to record
```

   rSD   Slope distance between two points

   rVD   Vertical distance between two points

   rHD   Horizontal distance between two points

4. To change display screens, press [DSP].

   rAZ   Azimuth from first point to second point

   rV%   Percentage of grade (rVD/rHD) × 100%

   rGD   Vertical grade (rHD/rVD): 1

```
┌RDM─────────────2/2▨
│rAZ:  165°35'45"
│rV%:      2.581  %
│rGD:     -1.25:1
│* Sight PT & Press [MSR] ▐
│  Press [ENT] to record
```
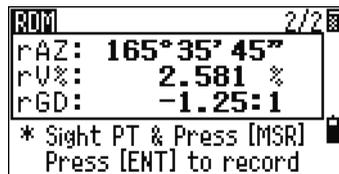
5. To record the distance and angle information as a comment record, press [ENT] in the 1/2 or 2/2 observation screen.

```
┌Record Note─────────
│ Fr:0 ................ ▌
│ To:▌ ................
│                     ▐
│             List  Stack
```
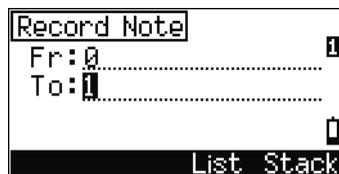
Default point numbers are displayed. You can change these point numbers. To record a note, press [ENT] in the To field.

```
┌Record Note─────────
│ Fr·0
│     ┌──────────────┐
│     │ - REC NOTE - │
│     └──────────────┘ ▐
```
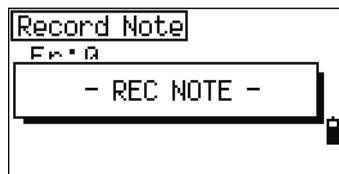
Data that you save in RDM functions is stored in RM records. For more information, see RM records, page 143. When you download data in Nikon RAW format, they are output as comment (CO) records.

Measuring between the current point and the immediately preceding point

1. To enter the RDM (Continuous) function, press ④ or select RDM(Cont.) in the Programs menu.

2. Follow the procedure as for a radial RDM measurement. For more information, see Measuring between the current and the first point measured, page 96.

```
┌─Programs─────────────┐
│              P2  ¹·2Pt RefLine      │
│  P1 ↖          ²·Arc RefLine        │
│       ↘    P3  ³·RDM(Radial)        │
│   ▣        ⁴·RDM(Cont.)  ▮          │
│  ↗ʌ↖   P4   ⁵·REM         ▼        │
└──────────────────────┘
```


Difference between "1:Cont." and "2:Radial"

1:Cont.
(The preceding two points are subject to calculation.)

2:Radial.
(Calculations are made with reference to the first point.)
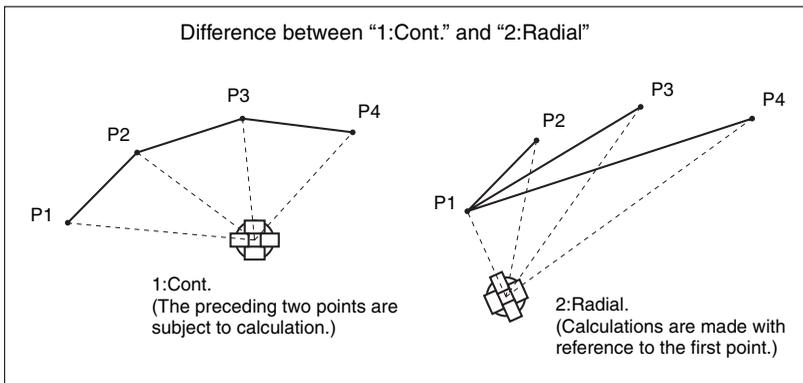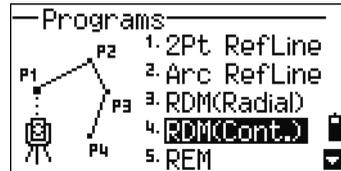
Measuring remote elevation
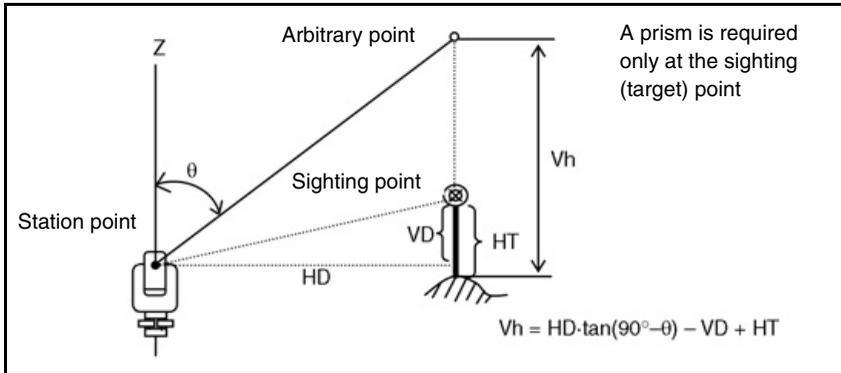
1. To enter the Remote Elevation Measurement function, press ⑤ or select REM in the Programs menu.
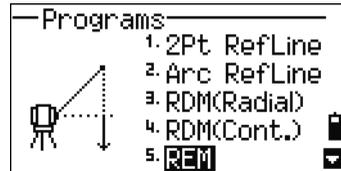
2. Enter the height of target.
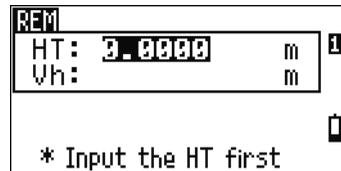
3. Sight the target point and press [MSR1] or [MSR2].
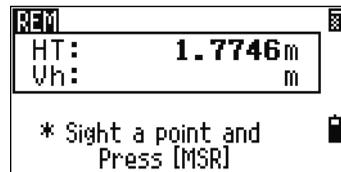
4. Loosen the vertical clamp, and turn the telescope to aim at an arbitrary point.

   The difference in elevation (Vh) appears.
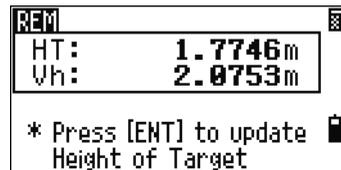
You can use an REM measurement to update the height of target. Take a measurement to the prism, sight the bottom of the prism pole, and press $\boxed{\text{ENT}}$.

Measuring distance and offset values on the vertical plane
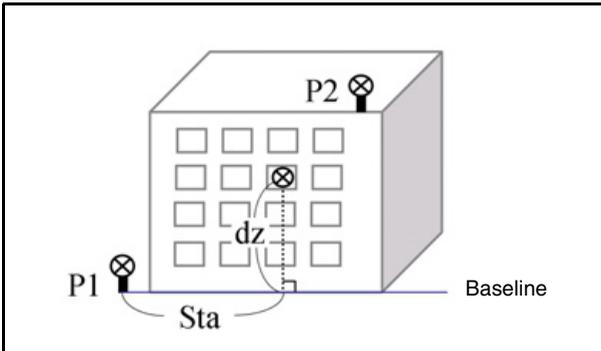
1. To enter the 2-Pt Reference Plane function, press $\boxed{6}$ or select V-Plane in the Programs menu.
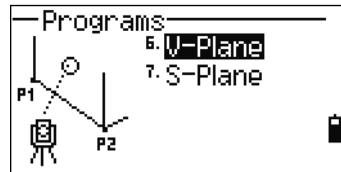
2. Enter two points to define the plane.

   – To enter the point by direct measurement, press the MSR softkey.
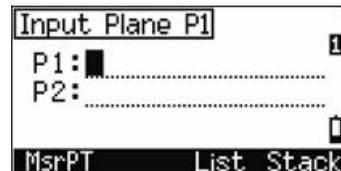
   When you press the MSR softkey, a temporary observation screen appears.
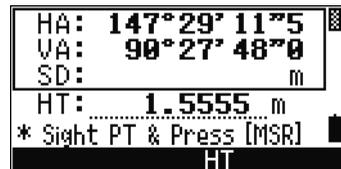
3. Press $\boxed{\text{MSR1}}$ or $\boxed{\text{MSR2}}$. The Record PT screen appears.

4. Enter a value in the PT and CD fields. Press [ENT].

```
N:        567.3080
E:       -121.1467
Z:          0.5800
PT:56
CD:CURB
               List  Stack
```
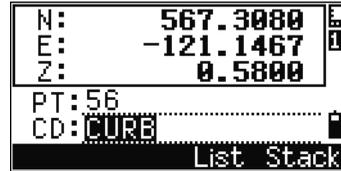
5. Enter the second point on the vertical plane. Press [ENT].

```
Input Plane P2
  P1:56
  P2:█

MsrPT          List  Stack
```
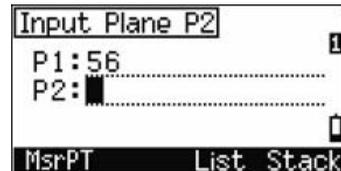
Once the plane is defined, the calculated Sta and dZ values are updated as you move the telescope. No distance measurement is required.

```
V-PLN              1/3
Sta:       55.2618m
 dZ:       -3.0477m

* Sta: Distance from P1
      along the P1-P2 Line
```

    Sta   Horizontal distance from P1 to the target point along the baseline

    dZ   Vertical distance from P1 to the target point
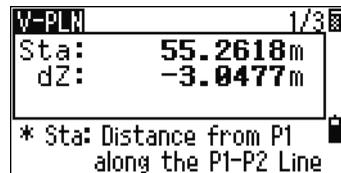
Using [DSP] to switch between display screens

Press [DSP] to switch between the plane display screens. The following screens are available:

PLN1	**PLN2**	**PLN3**
Sta dZ	X Y Z	HA VA
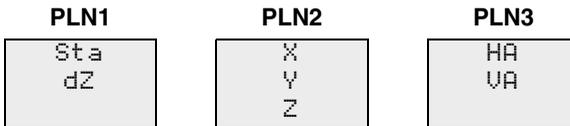
Every time you press [DSP], the next screen appears. If you press [DSP] in the last screen (PLN3), the PLN1 screen appears.

To record the point, press [ENT] on any screen (V-PLN1/3 to V-PLN3/3).

Enter PT and CD. Then press [ENT].

```
HA:    40°29'11"5
VA:    89°07'46"0
SD:       79.4028m
PT:70
CD:KERB
               List  Stack
```
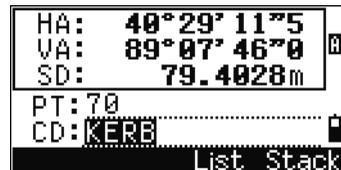
Sample records
CO,Vertical Ref Plane Pt1:516-A1 Pt2:530
CO,Sta=68.021 dz=17.459
SS,30123-A48,1.5480,16.4020,40.4720,89.0730,14:22:47,

Measuring distance and offset values on the slope
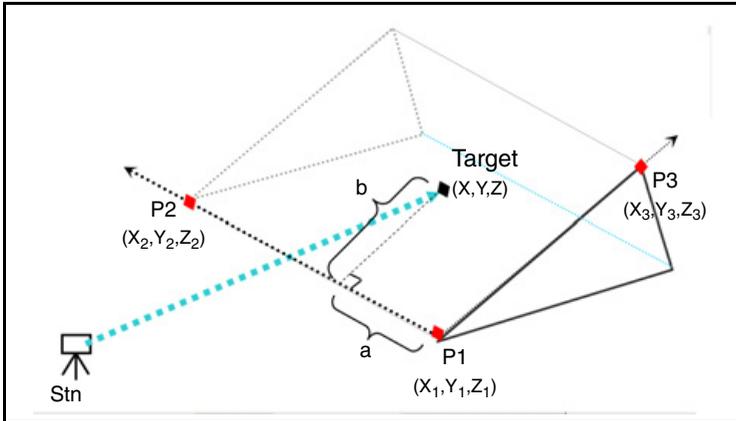
1. To enter the 3-Pt Reference Plane function, press $\boxed{7}$ or select S-Plane in the Programs menu.
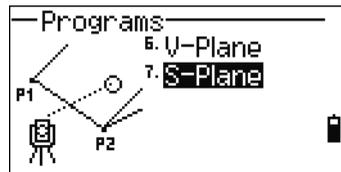
2. Enter three points to define the slope plane. To enter the point by direct measurement, press the MSR softkey.
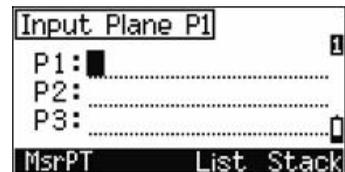
If you press $\boxed{\text{ENT}}$ in a blank field, an input screen for temporary coordinates appears. These coordinates will not be stored.
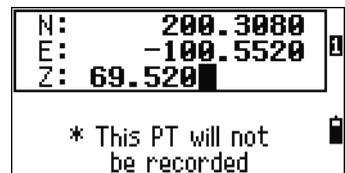
When you have entered the temporary coordinates, <Keyed-in XYZ> appears instead of the PT name.
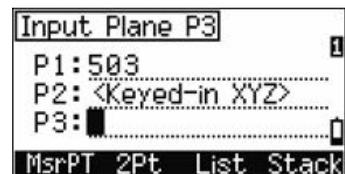
If the plane is defined by two points (by selecting 2Pt), the vertical plane is the same as the plane used in the V-Pln function, but the indicating factors are Sta and dZ, not a and b. For more information, see Measuring distance and offset values on the vertical plane, page 99.
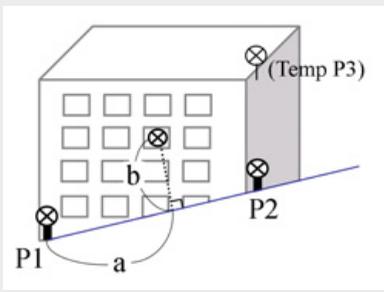
Once the plane is defined, the calculated a and b values are updated as you move the telescope. No distance measurement is required.

a   Distance between P1 and the point that is perpendicular to the target point along the P1-P2 line

b   Length of the perpendicular line from the target point to the P1-P2 line
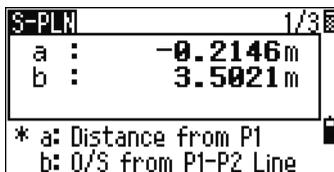
Using [DSP] to switch between display screens

Press [DSP] to switch between the plane display screens. The following screens are available:

PLN1	**PLN2**	**PLN3**
a	X	HA
b	Y	VA
	Z	
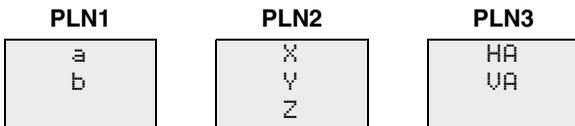
Every time you press [DSP], the next screen appears. If you press [DSP] in the last screen (PLN3), the PLN1 screen appears.

To record the point, press [ENT] on any screen (S-PLN1/3 to S-PLN3/3).

Enter PT and CD. Then press [ENT].
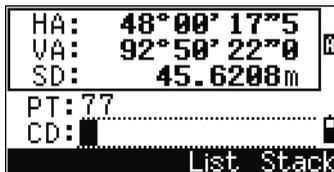
Sample records
CO,3ptPlane P1:1062 P2:2902 P3:1547
CO,a=31.497 b=14.239
SS,30123-A49,1.6110,0.0000,234.3210,86.0955,16:07:18,

Recording Measurement Data

Recording data from any observation screen

To record points on observation screens, press
[ENT].

PT defaults to the last recorded PT + 1.

You can enter the PT name from the point list or
the point stack. For more information, see
Entering a point from the point list, page 52, and
Entering a point from the stack, page 52.

You can also use the code list or the code stack. For more information, see Entering
a code from the code list, page 53, and Entering a code from the stack, page 53.

To record the point, press [ENT] on the last field.

When recording sideshots, stakeout records and
control shots from the Rept function, you can
choose to store raw data only, XYZ data only, or
both. For more information, see Recording,
page 139.
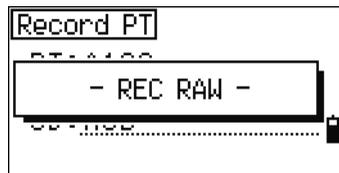
If HA or VA is moved after you take a measurement but before you press [ENT], the
angle recorded is the angle shown when [ENT] is pressed.
In an angle-only record, SD is always recorded as 0.0000.
If the point name that you want to record already
exists in the job, an error message appears.
Depending on the type of existing record, you can
overwrite the old record with the new data. For
more information, see Recording Data, page 210.

Hold down [ENT] for one second to record the
measurement as a CP record.

Outputting data to the COM port

If you press ENT while the COM icon appears in
an observation screen, a line of data is output to
the COM port.
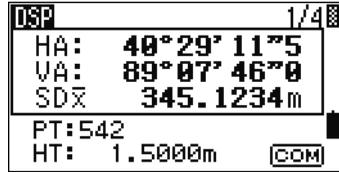
Note – If COM *appears, data is **not** stored to the job when you press* ENT.

The format of the output data is defined by the
setting of the Ext.Comm field in MENU >
Settings > Comm. For more information, see
Communications, page 138.
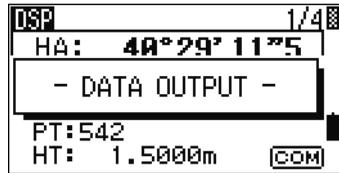
To output data on the COM port when you press
ENT, set the Data Rec field in MENU >
Settings > Rec to COM. For more
information, see Recording, page 139.

Sample output records through COM port

When the Ext.Comm field is set to NIKON:
TR PN: PT8 SD:000066626 HA:003856010 VA:008048500 HT:0000061757
(TR PN: point name SD HA VA HT; when ACK is returned, PN is incremented.)

When the Ext.Comm field is set to SET:
0006662 0804806 0394324 97
(SD VA HA Chk-SUM)

Measuring Offsets

Measuring taped offsets

1. To enter the taped offset function, press ① or select Tape in the Offset menu.

```
┌Offset──────────────
    Up      1. Tape
    │  out  2. Angle
L┄┄◯┄┄R     3. 2Prism Pole
  In│        4. +Line by HA
    Down    5. Input HD
```

  If you have not taken a distance measurement before entering this function, a temporary measurement screen appears.

```
HA:   147°29'11"5
VA:    90°27'48"0
SD:              m
HT:    1.5555  m
* Sight PT & Press [MSR]
          HT
```

2. Sight the target and press MSR1 or MSR2.

3. Enter offset distances from the measured point. Use ⌃ or ⌄ to move to the appropriate offset field.

```
┌Taped offsets┐
R/L: ▮............. m
O/I: .............. m
U/D: .............. m
 * (+)=Right, (-)=Left
```
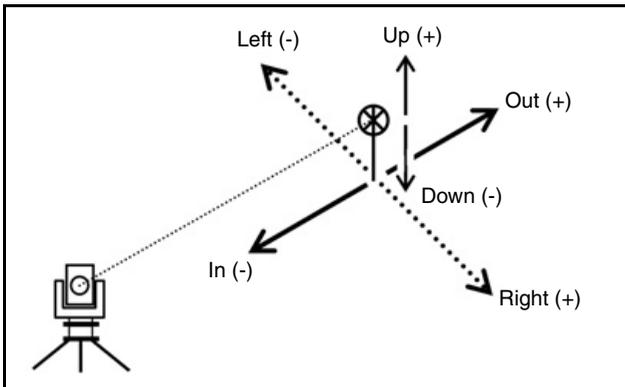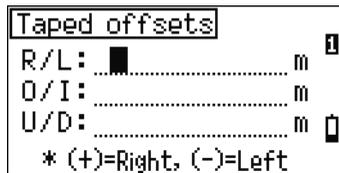
You can enter any combination of taped offset distances to specify the point.

4. To go to the recording PT screen, press ENT in the last field.

```
Taped offsets          1
R/L:        0.5020 m
O/I:      -30.0000 m
U/D: 1.500           m
 * (+)=Up, (-)=Down
```
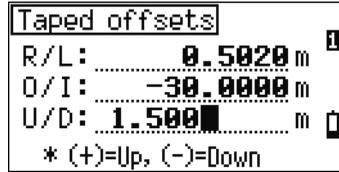
The calculated coordinates are shown.

5. Enter a PT (and CD) value.

6. Press ENT to record the point.

Raw data is also recalculated, based on the taped offset value.

```
X:        102.0155    A
Y:        184.1729
Z:         70.4480
PT:102
CD:CURB
              List Stack
```
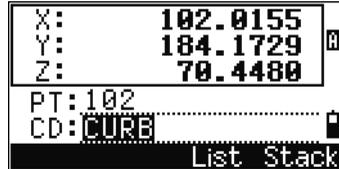
Measuring angle offsets

1. To enter the angle offset function, press 2 or select Angle in the Offset menu.
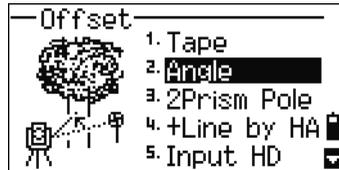
```
 Offset
          1. Tape
          2. Angle
          3. 2Prism Pole
          4. +Line by HA
          5. Input HD
```

If you have not taken a distance measurement before entering this function, a temporary measurement screen appears.

2. Sight the target and press MSR1 or MSR2.

```
HA:  147°29'11"5
VA:   90°27'48"0
SD:             m
HT:     1.5555  m
 * Sight PT & Press [MSR]
            HT
```
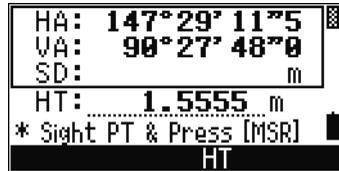
3. To take the angle offset, rotate the alidade and telescope. The measured distance (HD) remains unchanged.

4. To record the offset point, press ENT or the OK softkey.

The XYZ data is also recalculated, based on the new angle.

```
O/S              1/4
HA:  140°29'11"5
VA:   89°07'46"0
SDx   128.6073m
 * Take the Angle O/S
Abrt           OK
```
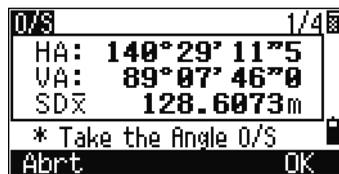
You can record an angle offset in the Basic Measurement Screen (BMS). After taking a distance measurement, rotate the alidade and/or telescope. Then press ENT to record the measured distance with the updated angle value. If you use this method, the dimension of the angle offset is not stored as a CO record. To store the CO record, use the O/S function.

Two-prism pole

1. To enter the two-prism pole function, press ③ or select 2Prism Pole in the Offset menu.

```
─Offset─────
          1. Tape
    P1     2. Angle
    P2  ○  3. 2Prism Pole
        ╲  4. +Line by HA
    ↙ ╱    5. Input HD
```
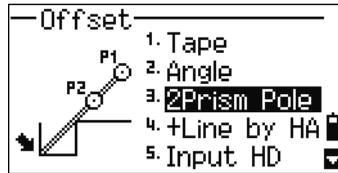
2. Sight the first prism and press MSR1 or MSR2.

```
O/S        <PT1>      1/4
  HA:    40°29'11"5
  VA:    89°07'46"0
  SD̄x      45.6780m
    * Sight the 1st Pt
      and Press [MSR].
```
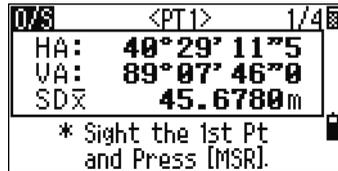
3. Sight the second prism and press MSR1 or MSR2.

```
O/S        <PT2>      1/4
  HA:    75°07'10"0
  VA:    87°09'46"0
  SD:              m
    * Sight the 2nd Pt
      and Press [MSR].
```
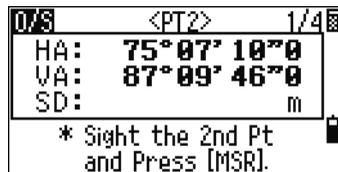
4. Enter the distance between the second prism and the target point. Alternatively, if you do not need QA information, you can leave the distance between the first and the second prism blank.

```
Input Target
  P1-P2:   0.5000 m
P2-Tgt: 0.250     m

* P1-P2 can be left blank.
```

5. If you do enter a P1-P2 distance, the QA screen appears. Compare the entered value and the measured distance to check the accuracy of the observation.

6. To record the point, press ENT or the OK softkey.

```
P1-P2 Dist
  Input:   0.5000 m
Measure:   0.4982 m

Redo               OK
```
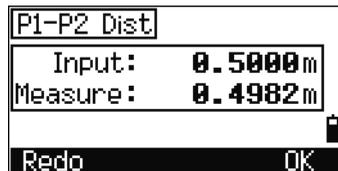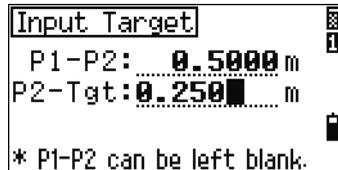
Sample records

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

In this sample data, 0.5090 is the measured value. 0.5060 is the entered value.

Extending a line by horizontal angle offset

1. To enter the line extension (by HA) function, press $\boxed{4}$ or select +Line by HA in the Offset menu.

```
─Offset──────
         1. Tape
      P2  2. Angle
      P1  3. 2Prism Pole
         4. +Line by HA
         5. Input HD
```
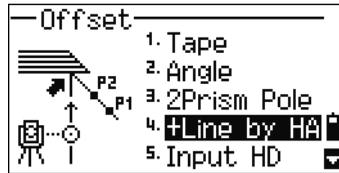
2. Sight the first prism (or target) and press $\boxed{\text{MSR1}}$ or $\boxed{\text{MSR2}}$.

   The display moves to the next screen.

```
O/S      <PT1>      1/4
HA:   40°29'11"5
VA:   89°07'46"0
SD⊼     45.6780m
   * Sight the 1st Pt
     and Press [MSR].
```
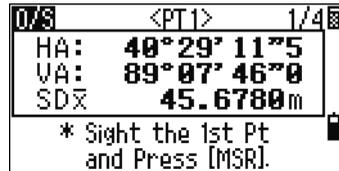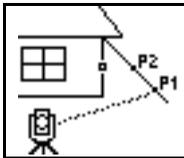
3. Sight the second prism (or target) and press $\boxed{\text{MSR1}}$ or $\boxed{\text{MSR2}}$.

```
O/S      <PT2>      1/4
HA:   75°07'10"0
VA:   87°09'46"0
SD:         m
   * Sight the 2nd Pt
     and Press [MSR].
```
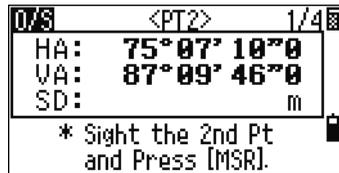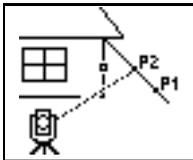
4. Sight the alternative place on the same vertical line as the required target point.

```
O/S      <ALT>      1/4
HA:   52°46'09"0
VA:   87°09'46"0
SD:         m
   * Take a HA offset
     and Press [ENT]
```
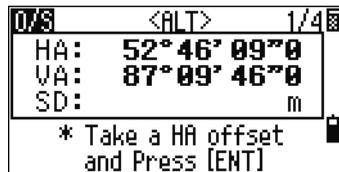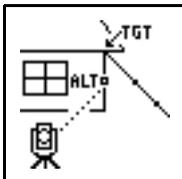
5. To calculate the coordinates and the raw data of the target point, press $\boxed{\text{ENT}}$.

6. To record the point, enter a PT (and CD) value and press ⎡ENT⎤. The height of target is fixed to 0.0000 for the offset point.

```
HA:    40°29'11"5
VA:    89°07'46"0  M
SD:       79.4028m
PT:70
CD:KERB
                List Stack
```
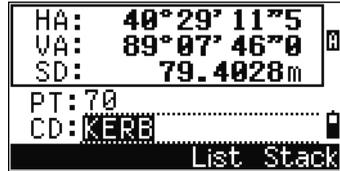
Sample records

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

The calculated point (TGT) is stored as a SS record.

Measurements to the first and second target (P1 and P2) are stored as comment records (PT1 and PT2). The last record records the angle measurement to the ALT (vertically offset point from the actual target point).

Entering a horizontal distance after an angle-only shot

This function is useful when the instrument is very close to the point and it is
difficult to take a measurement using the EDM.

1. To enter the Input HD function, press ⑤ or
   select Input HD in the Offset menu.

```
─Offset───────
        1. Tape
        2. Angle
        3. 2Prism Pole
        4. +Line by HA
   HD   5. Input HD
```
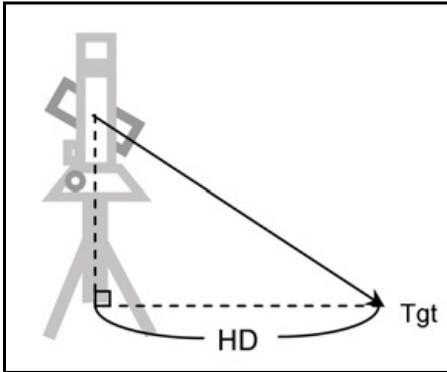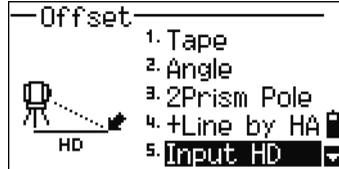

2. Turn the telescope in the direction of the point
   that you want to store.
3. Enter the HD. Usually this is the taped
   distance from the instrument point.

```
Input HD
  HA:   40°29'11"5
  VA:   80°54'10"5

  HD:3.604         m
* Sight Pt & Press [ENT]
```

4. Enter a PT (and CD) value and press [ENT].

   The target point is calculated and recorded as
   an SS record.

```
Record PT
  PT:72
  HT:    0.0000 m
  CD:HUB
                List  Stack
```
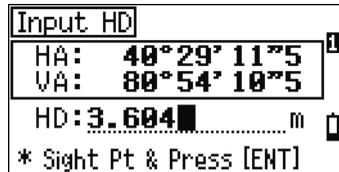
Sample records
SS,158,0.0000,77.0518,62.08380,108.06510,11:51:48,
CO, Input HD:76.1243

Calculating a corner point

1. To enter the corner point function, press ⑥ or select `Corner` in the Offset menu.

2. Take a distance measurement to the first prism (or target) on the wall. Press [MSR1] or [MSR2].

3. Sight a second point on the same wall with the first point measurement. Press [MSR1] or [MSR2].
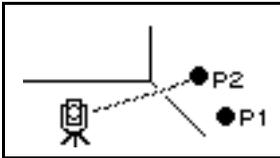
4. Sight the first point on the second wall. Press [MSR1] or [MSR2].
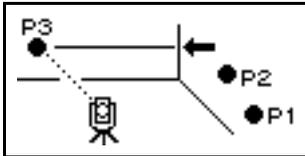
5. If the two walls are at right angles, press the `Calc` softkey to calculate the corner point by three points.

6. If you take a measurement to a fourth point, the corner point can be calculated as the intersection of two walls (P1-P2 and P3-P4). The default elevation is given by P4.
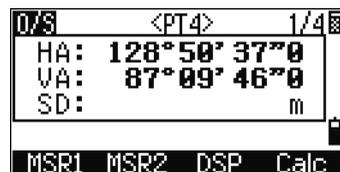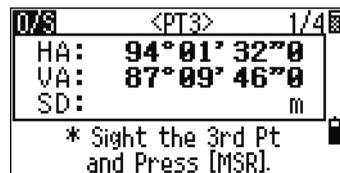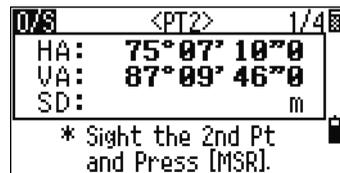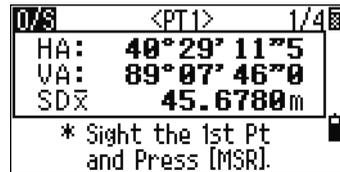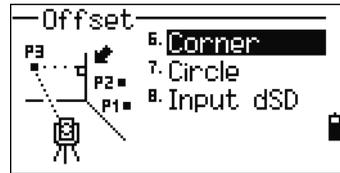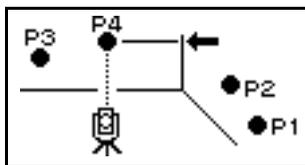
7. Enter a PT (and CD) value. The height of target (HT) defaults to the value used in the last measurement.

8. To record the corner point, press [ENT].

```
┌─────────────┐
│Record PT    ▐1│
│ PT:A102      │
│ HT:   1.7026 m│
│ CD:HUB       ▯│
│       List  Stack│
└─────────────┘
```
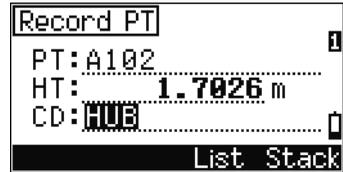
Sample records
SS, 58, 0.0000, 48.3304, 169.19165, 82.02470, 10:52:37, FLOOR2
CO, PT1, 1.0080, 48.3020,169.19165, 83.58565
CO, PT2, 1.0080, 48.3155,128.54250, 85.42440
CO, O/S MSR:40 0.0000 0.0000 169.20370 87.02340

The calculated corner point is stored as an SS record.
The next three or four comment records are measured points. For example:
CO, Point name (fixed to PT1, PT2 etc.), HT, SD, HA, VA.

Measuring circle offsets

1. To enter the circle center calculation function, press [7] or select Circle in the Offset menu.

```
┌─Offset──────┐
│        6.Corner│
│        7.Circle│
│        8.Input dSD│
│              ▮│
└─────────────┘
```
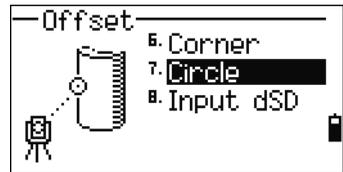
If you have not taken a measurement to the circle before entering this function, a temporary measurement screen appears.

```
┌─────────────┐
│HA:  147°29' 11"5│
│VA:   90°27' 48"0│
│SD:          m│
│HT:    1.5555 m│
│* Sight PT & Press [MSR]│
│          HT  │
└─────────────┘
```

2. Sight any point on the surface of the circle and press [MSR1] or [MSR2].

```
┌─────────────┐
│HA:147°29' 11"5│
│VA: 90°27' 48"0│
│SDx̄    75.3048m│
│HT:    1.5555 m│
│* Input +SD or Press[ENT]│
│          +SD │
└─────────────┘
```
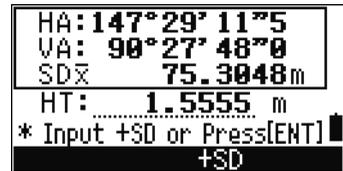
If you use a prism attached to the surface of the circle for the distance measurement, press the +SD softkey to eliminate the offset error (from the attached point to the measured surface of the prism) before you press [ENT].

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

```
HA: 129°07' 46"0
VA:  80°29' 11"5

        *Sight an Edge
          & Press [ENT]
    Calc          Edge2
```
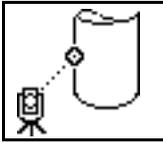
If you have taken a distance measurement to the center of the circle, press the Calc softkey to calculate the offset using one edge angle observation.

4. Sight the other edge of the circle and press [ENT].

The instrument calculates and records the center of the circle.

```
HA:156°22' 34"5
VA:  80°29' 11"5

        *Sight the other
          & Press [ENT]
```
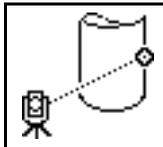
It also calculates the coordinates of the center point and the radius of the circle.

5. To record the point, press [ENT] or the OK softkey.

```
X:       67.1285
Y:      -20.1467
Z:       40.5800
Rad =     0.3560 m

Redo              OK
```
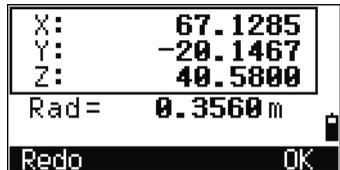
Sample records

SS,71,1.5000,37.0518,32.08380,81.06510,11:51:48,
CO, PT1, 0.0000, 0.0000,47.05350, 83.58560
CO, PT2, 0.0000, 0.0000, 29.53010, 83.58560
CO,O/S MSR:71 1.5555 36.5418 38.28360 81.06510
CO,Radius of circle 0.356
CO,Input +SD:0.0020

The calculated point (center of the circle) is stored as an SS record.
The following one or two comment records are angle-measured points. For example:
CO, Point name (fixed to PT1/ PT2), HT(0.0000), SD(0.0000), HA, VA.
If you press the +SD softkey before you sight Edge1, the input value is recorded at the end.

Extending the slope distance

1. To enter the function for extending the slope distance, press $\boxed{8}$ or select Input dSD in the Offset menu.
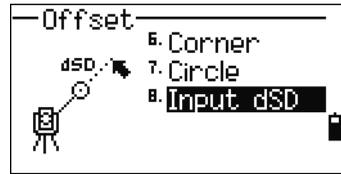
If you have not taken a distance measurement before entering this function, a temporary measurement screen appears.
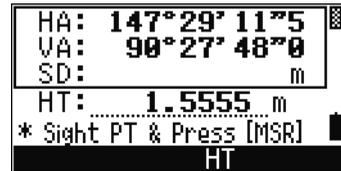
2. Enter the slope distance that you need to add or subtract. You can enter any value from –99.990 through +99.990 m (–328.000 through +328.000 ft).

3. To record the point, press $\boxed{ENT}$.
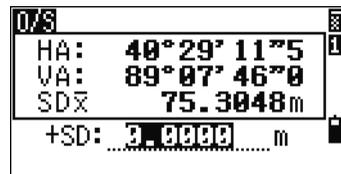
Sample records
SS,83,1.5000,77.0518,62.08380,81.06510,11:51:48,
CO,O/S MSR:83 1.5555 76.5518 62.08380 81.06510

Menu Key

In this chapter:

- ■ Introduction
- ■ Job Manager
- ■ Cogo
- ■ Settings
- ■ Data
- ■ Communication
- ■ 1sec-Keys
- ■ Calibration
- ■ Time

Introduction

Use the MENU screen to access important functions and settings.

To display the MENU screen, press the [MENU] key.

```
————————MENU————————
¹·Job          ⁶·1sec-Key
²·Cogo         ⁷·Calibrat.
³·Settings     ⁸·Time
⁴·Data
⁵·Comm.
```

Job Manager

Use the job manager to open, create, delete, and manage jobs. To open the Job Manager, press [1] or select Job on the MENU screen.

```
————————MENU————————
¹·Job          ⁶·1sec-Key
²·Cogo         ⁷·Calibrat.
³·Settings     ⁸·Time
⁴·Data
⁵·Comm.
```

If there are jobs stored on the instrument, the job list appears, showing all the stored jobs. The newest job appears at the top of the list.

If there are no jobs stored, the Create Job screen appears. See Creating a new job, page 117.

Opening an existing job

The job list shows all the jobs stored on the instrument, in descending date order.

The following symbols may be used to provide extra information about jobs:

```
▨▨▨▨ Job Manager ▨▨▨▨
!NTR2003    03-07-01
*STADIUM1   03-06-31
!CTRL-4  @ 03-06-31
 COLORADO   03-06-28
?OKYO       02-10-27
Creat DEL  Ctrl  Info
```

Symbol	Meaning
*	Current job.
@	Control job.
!	Some of the job settings are different from the current job.
?	Job was created in an older DB. Older files cannot be opened in version 1.10 or later of the software.

Press [^] or [v] to move up or down the job list. Press [ENT] to open the highlighted job.

When you open a job, all job settings are automatically changed to match those used in the open job.

Creating a new job

1. Press the Creat softkey in the job list.

```
▒▒▒▒Job Manager▒▒▒▒
 NIKON123   02-06-21
*TOKYO-1    02-06-18
 CONTROL @  02-06-17
 020526-3   02-05-26
 YOKOHAMA   02-05-20
Creat DEL   Ctrl Info
```

2. Enter a job name of up to eight characters. Press [ENT].

3. Do one of the following:

```
Create Job
Job name:020624-B


 * MAX 8 characters
```

– To check the job settings, press the Sett softkey.

– To create a new job using the current job settings, press [ENT] or the OK softkey.

```
Create Job
Job name:020624-B
* [ENT] to create JOB
 [Sett] for Job settings
Abrt Sett        OK
```
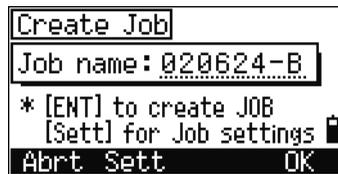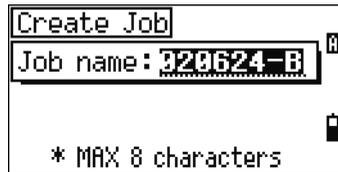
Job settings

The following settings are set when a job is created, and cannot be changed. This ensures that the data in a job is correctly stored in the database, and that all necessary corrections are applied when you store each record.

Scale Factor	0.999600 to 1.000400
T-P correction	ON/OFF
Sea Level	ON/OFF
C&R correction	OFF/0.132/0.200

```
<Job Sett 1/3>
 Scale : 1.000000
T-P corr. : ON
Sea Level : OFF
C&R corr. : 0.132
```
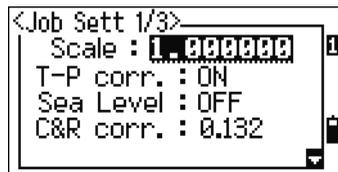
Angle unit	DEG/GON/MIL
Distance unit	Metre/US-Ft/I-Ft
Temp unit	°C/°F
Press unit	hPa/mmHg/inHg
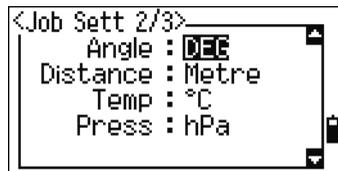
```
<Job Sett 2/3>
   Angle : DEG
Distance : Metre
    Temp : °C
   Press : hPa
```

If you select US-Ft or I-Ft, an additional settings screen appears. Use this screen to specify whether to display values in Decimal-Ft or Ft-Inch.

```
<Job Sett 2/3>
      Angle : DEG
  [ Decimal-Ft
     Ft-Inch
```

VA zero	Zenith/Horizon/Compass
AZ zero	North/South
Order	NEZ/ENZ
HA	Azimuth/0 to BS

```
<Job Sett 3/3>
   VA zero: Zenith
   AZ zero: North
     Order: NEZ
        HA: Azimuth
```
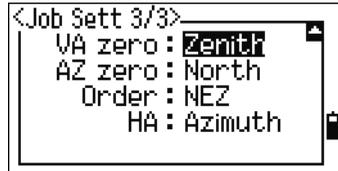
To move between fields, press ⌃ or ⌄.

Alternatively, to move to the next field, press [ENT].

To change the setting in the selected field, press ⌜ or ⌟.

To confirm the job settings and create the job, press [ENT] in the last field (HA).

These settings are separate from other temporary settings.

Deleting a job

⚠ **Caution –** There is no undelete function in the Job Manager. Before you press [ENT] or select DEL, make sure that the selected job is the one that you want to delete.

1. In the job list, highlight the job that you want to delete.

```
░░░░Job Manager░░░░
 NIKON123   02-06-21
*TOKYO-1    02-06-18
 CONTROL @  02-06-17
 020526-3   02-05-26
 YOKOHAMA   02-05-20
Creat  DEL  Ctrl  Info
```

2. Press the DEL softkey. A confirmation screen appears.

3. Do one of the following:

– To delete the selected job, press [ENT] or the DEL softkey.

```
Delete JOB
Job name: YOKOHAMA


  * Are you sure?
Abrt              DEL
```
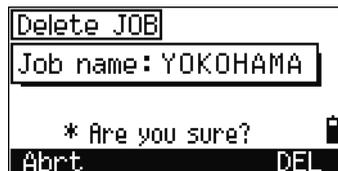
– To cancel the deletion and return to the previous screen, press [ESC] or the
Abrt softkey.

After you delete a job, the display returns to
the job list.

```
┌─────────────────┐
│Delete JOB│       │
│ I_   _  UOKOUAMA │
│  ┌─────────────┐ │
│  │ - Deleting Job - │
│  └─────────────┘ │
│                ▮│
└─────────────────┘
```

Setting the control job

If you search for a point when a control job is specified, and the system cannot find
the point in the current job, the control job is also searched. If the point is found in
the control job, it is copied to the current job as a UP record.

A control job has the same format as a standard job. You can open and modify it like
any other job, and you can use it to record any measured data.

To set the control job:

1. Highlight the job that you want to use.

2. Press the Ctrl softkey.

```
▒▒▒▒Job Manager▒▒▒▒
NIKON123  02-06-21
*TOKYO-1   02-06-18
 CONTROL @ 02-06-17
 020526-3  02-05-26
 YOKOHAMA  02-05-20 ▮
Creat DEL  Ctrl Info
```

A confirmation screen appears.

3. Do one of the following:

– To set the selected job as the control job,
press [ENT] or the Yes softkey.

– To cancel the process, press [ESC] or the No
softkey.

```
┌──────────────────┐
│Control Job <ON>  │
│┌────────────────┐│
││Job name:NIKON123││
│└────────────────┘│
│  * Set this Job as│
│    the Control Job?│ ▮
│No             Yes │
└──────────────────┘
```
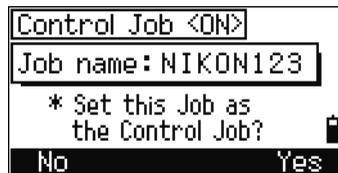
If a control job is already assigned, the newly
assigned control job replaces it as the control job.
To clear the control job selected, highlight the
current control job in the job list and press the
Ctrl softkey. Then press [ENT] or the Yes
softkey to confirm.

```
┌──────────────────┐
│Control Job <OFF> │
│┌────────────────┐│
││Job name:CONTROL3││
│└────────────────┘│
│  * Stop using this Job│
│    as the Control Job?│▮
│No             Yes │
└──────────────────┘
```
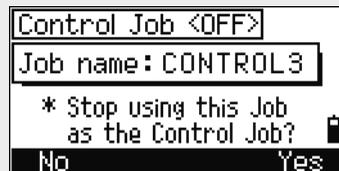
Displaying job Information

To display job information, highlight the job name and then press the Info softkey.

The Information screen shows the number of records in the job, the free space, and the date when the job was created. Free space indicates how many points can be stored in the job.

To return to the job list, press any key.

Cogo

Use the Cogo menu to perform coordinate geometry (COGO) calculations. You can access this menu at any time from any observation or PT input screen.

To open the Cogo menu, press 2 or select Cogo on the MENU screen.
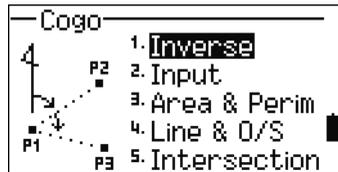
Calculating angle and distance between two coordinates

To open the Inverse menu, press 1 or select Inverse in the Cogo menu.

PT-PT inverse

PT-PT calculates the distance and the angle between two input points.

To calculate a PT-PT inverse:

1. Press 1 or select PT-PT in the Inverse menu.
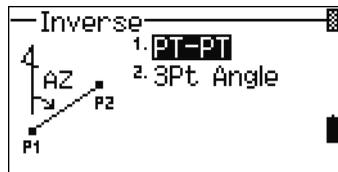
2. Enter the first point number or name. Press ENT.
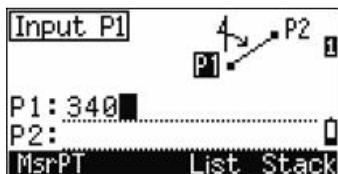
If you press [ENT] without entering a point name, a coordinate input screen appears, and you can enter coordinates. These coordinates are *not* stored to the database. If you want to store the point, specify a new point name.

3. Type the second point number/name and press [ENT]. The MSR softkey allows you to shoot the point on the spot to use it in the calculation.
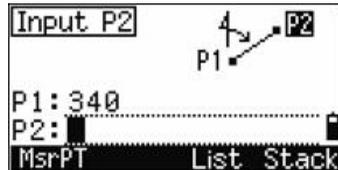
The azimuth, horizontal distance, and vertical distance from the first point to the second point are displayed.

4. Do one of the following:

– To return to the PT input screen, press [ESC].
– To return to the COGO menu, press [ENT].
– To change the contents of the result screen, press [DSP].
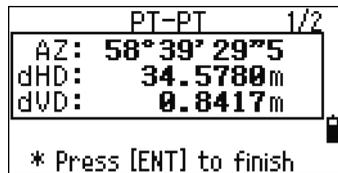
Gd	Grade (HD/VD)
V%	100/Gd
rSD	Slope distance PT1 to PT2
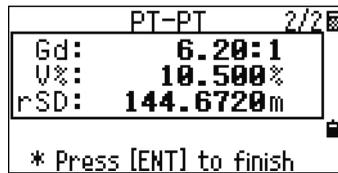
3Pt angle

The 3Pt Angle function calculates the angle between two lines defined by three points.

To calculate a 3Pt angle:

1. Press [2] or select 3Pt Angle in the Inverse menu.
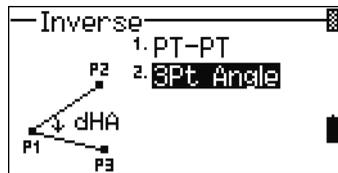
P1 is the base point. Two lines are to be defined by P2 and P3, both from P1.

2. Enter the point name, or use the MSR softkey to take a measurement to the point.
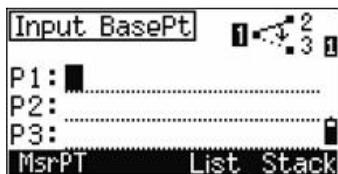
3. Enter the second point (P2) to define the baseline (P1-P2). The angle (dHA) is measured from the baseline.

```
Input direction  1
P1:1000
P2:
P3:
MsrPT          List Stack
```
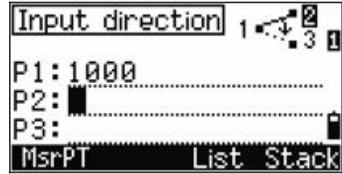
4. Enter the third point (P3) to define the second line (P1-P3).

```
Input direction  1
P1:1000
P2:1001
P3:
MsrPT          List Stack
```

When you press the MSR softkey, a temporary measuring screen appears. Sight the target and press [MSR1] or [MSR2] to take a measurement.

After the measurement, a recording point screen appears. To store the measured point, enter the PT, HT, and CD values and press [ENT]. To use the point without recording it, press [ESC].

```
HA:   147°29'11"5
VA:    90°27'48"0
SD:              m
HT:    1.5555  m
* Sight PT & Press [MSR]
           HT
```
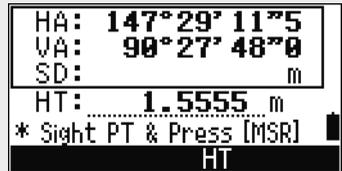
When you have entered three points, the instrument calculates the angle and distances.

```
       3Pt Angle
dHA:   58°39'29"5
HD1:    34.5780m
HD2:     0.8417m
* HD1 =Distance bet P1-P2
* HD2 =Distance bet P1-P3
```

5. Do one of the following:

 – To return to the Inverse menu, press [ENT].

 – To return to the Input BasePt screen, press [ESC].
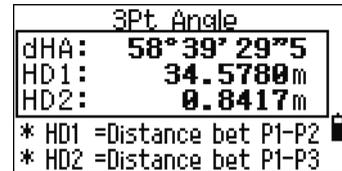
Calculating and manually inputting coordinates

To enter the Input menu, press ② or select Input in the Cogo menu. There are three functions in this menu for recording new coordinate points.

```
─Cogo─────────
            1· Inverse
            2· Input
            3· Area & Perim
            4· Line & O/S
            5· Intersection
```

Azimuth+HD input

To calculate a coordinate by an angle and distance input from the base point (P1), press ① or select AZ+HD in the Input menu.

```
─Input─────────
            1· AZ+HD
            2· Traverse
            3· Input XYZ
```

Enter the base point (P1). Type the point name and press [ENT].

```
Input P1
P1:A-15
MsrPT              List Stack
```

Enter the azimuth, horizontal distance, and vertical distance. Then press [ENT].

```
Input AZ
  AZ: 123.4545
  HD:                    m
 dVD:                    m
```

To enter 123°45'45", type 123.4545 and press [ENT].

If you do not enter a value in the dVD field, the value 0.0000 is used.

```
Input dVD
  AZ: 123°45' 45"0
  HD:    50.5678m
 dVD: ▇                  m
```

A recording point screen with the calculated coordinates appears. PT defaults to the last recorded PT + 1.

Press [ENT] to store the point.

```
 N:     4567.3080
 E:      200.1467
 Z:        0.5800
PT:86
CD: CURB
                  List Stack
```
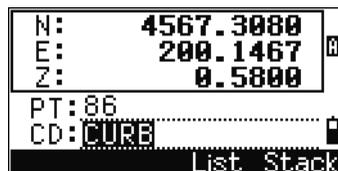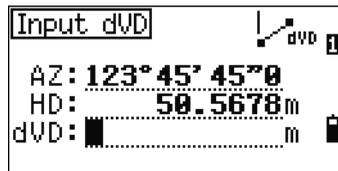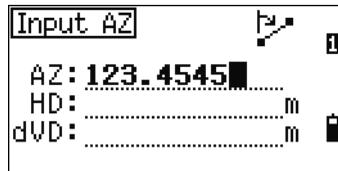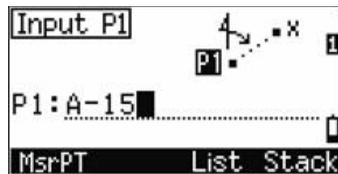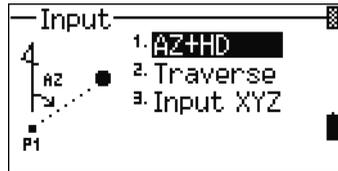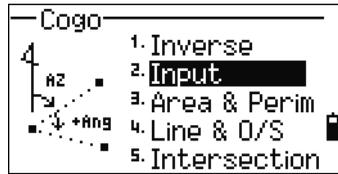
Traverse

To open the Traverse (2Pt Angle) function, press
[2] or select Traverse in the Input menu.

Traverse function calculates a new point based on
the two defined points and angle, horizontal and
vertical distances from the line defined by those
two points.

```
-Input-                       8
        1. AZ+HD
   P2   2. Traverse
        3. Input XYZ
    +Ang
P1      •
```

To enter P1 and P2, enter point names or take
measurements to targets.

```
Input P1    P1      P2
                  x    1
P1:57B
P2:
MsrPT        List Stack
```

Enter the plus-minus angle, horizontal distance,
and vertical distance from the baseline defined by
P1-P2.

If you do not enter a value in the dVD field, the
value 0.0000 is used.

```
Input dVD      dVD   1
+Ang:   64°08'51"0
  HD:     50.5678 m
dVD:              m
```

When you press [ENT] in the dVD field, a new
point is calculated. The PT name defaults to the
last recorded PT + 1.

To record the new point and return to the point
input screen, press [ENT].

```
X:      102.0155   A
Y:      184.1729
Z:       70.4480
PT:102
CD:CURB
         List Stack
```

P1 (base PT) defaults to the previously recorded
PT. P2 defaults to the previous P1.

```
Input P2    P1      P2
                  x    1
P1:102
P2:57B
  * Press [ESC] to finish
MsrPT        List Stack
```
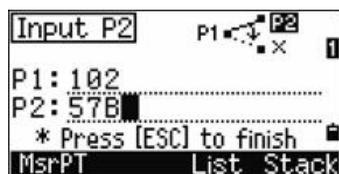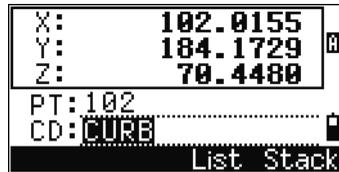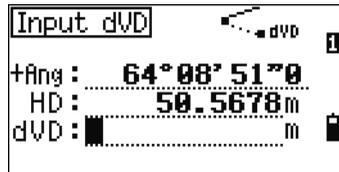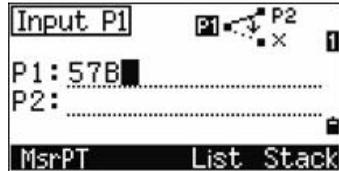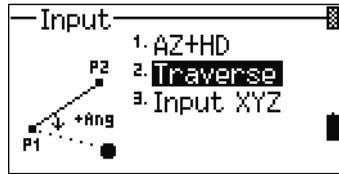
To continuously calculate a new point, enter +Ang, HD, and dVD from the previous
bearing line. This is a convenient way to enter Traverse points.

Entering coordinates

To manually enter the XYZ coordinates, press ③
or select Input XYZ in the Input menu.

The PT name defaults to the last recorded PT + 1.
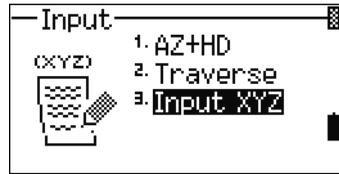
Enter the coordinates using the numeric keys. To
move to the next field, press [ENT] or [v] in a field

To store the point as an MP record and return to
the point input screen, press [ENT] in the Z field.
The default PT is incremented to the next value.
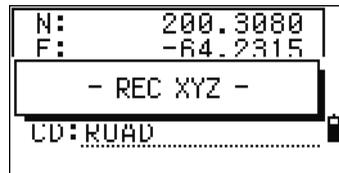
You can record NE, NEZ, or Z-only data to the database.

Calculating area and perimeter

To calculate an area or perimeter, press ③ or select
Area & Perim in the Cogo menu.

To take a measurement, enter the first point and
press [ENT], or press the MSR softkey.
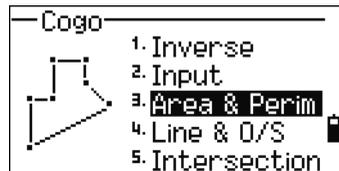
In the upper right corner of the screen, a counter
indicates how many points you have entered.

To input point numbers consecutively, use the
Fr/To softkey. For more information, see
Advanced feature: Entering a range of points,
page 127.

If you enter a new point name, you can enter new coordinates and record the point. If you do not want to record the point, press [ENT] without entering a value in the PT field. An XY coordinate input screen appears.

```
N:        100.5000
E:  200.308█          1


      * This PT will not
          be recorded
```

Continue to enter points until you have defined all the points in the lot. Then, press [v] to calculate the area and perimeter.

```
Input PT          No.03
                       1
  PT: 8█
* Press [Calc] to Calculate
  Area and Perimeter
MsrPT  Calc  List  Stack
```

The first and last points that you enter are joined to close the area.
You must enter the points in the order in which they define the lot.
You can enter up to 99 points.

Press [ENT] to store the calculated values as a comment record, or press [ESC] to return to the Cogo menu.

```
Area:
          206.9187f²
Perimeter:
          140.3502f

* Press [ENT] to record
```

If you chose to store the area, enter a name to identify the area and then press [ENT].

```
Input Area name       A


SITE35-A█

                   Stack
```

When you download data in Nikon RAW format, area (AR) records are output as comment (CO) records.

Advanced feature: Entering a range of points

To quickly enter a sequential range of points, use
the range input function. To access this function,
press the Fr⁄To softkey in the No. 01 or No. 02
input screens.

```
┌──────────────────────────┐
│ Input PT         No.01   │
│                      ▯    │
│ PT:█.....................  │
│                           │
│                      ▮    │
│ MsrPT Fr/To List  Stack  │
└──────────────────────────┘
```

Enter the start point name in the Fr field and the
end point name in the To field. You can include
letters and hyphens in the point names, but the last
character must be numeric.

```
┌──────────────────────────┐
│ Input Point Range    ▯   │
│ Fr:█.....................  │
│ To: .....................  │
│                           │
│                      ▯    │
│              List  Stack  │
└──────────────────────────┘
```

Press [ENT] in To field to start searching for
matching points. The counter shows the number
of matching points found.

```
┌──────────────────────────┐
│ Input Point Range        │
│ Fr:A-100                 │
│ ┌──────────────────┐  ▮  │
│ │  Find Points: 1  │     │
│ └──────────────────┘     │
│  * Press [ESC] to abort  │
└──────────────────────────┘
```

When the search is complete, you are returned to
the Input PT screen.

Press the Calc softkey to calculate the area and
perimeter, or enter point names in the PT field.

Press [ESC] to return to the Input PT screen with
the preceding point name.

```
┌──────────────────────────┐
│ Input PT         No.0?   │
│                      ▯    │
│ PT:█.....................  │
│ * Press [Calc] to calculate│
│     Area and Perimeter ▮ │
│ MsrPT Calc  List  Stack  │
└──────────────────────────┘
```
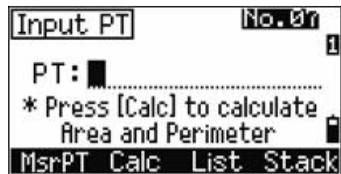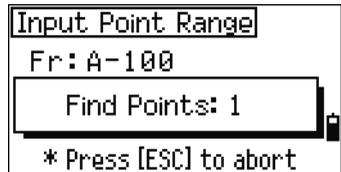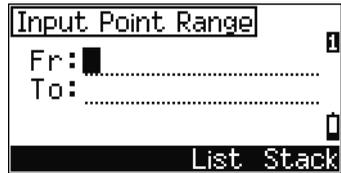
Calculating coordinates from line and offset

To enter the Line & offset function, press [4] or select Line & O⁄S in the Cogo
menu.

Enter the base point (P1).

```
┌──────────────────────────┐
│ Input P1                 │
│                 ▣▪·´  ▯  │
│ P1:P10█..................  │
│ AZ: .....................  │
│ P2: .................. ▯  │
│ MsrPT        List  Stack  │
└──────────────────────────┘
```
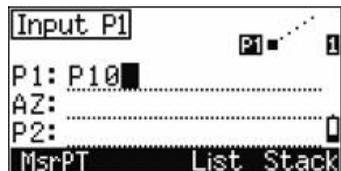
Specify the azimuth bearing. To do this, enter a value in the AZ or P2 field. P2 is a second point on the line.
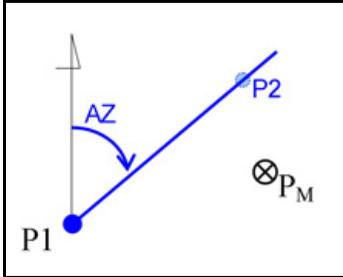

```
Input AZ or P2    P1
P1: P10
AZ:
P2:
```

Enter the horizontal distance along the baseline (Sta), the horizontal distance perpendicular to the line (O/S), and the vertical distance (dVD).

```
Line & Offset          dVD
Sta:        50.5500 m
O/S:         7.2500 m
dVD:                 m
  * dVD based on P1-Z
```

A negative value in the Sta field means the opposite direction along the defined bearing line.
A negative value in the O/S field is for the left-hand side of the bearing line.
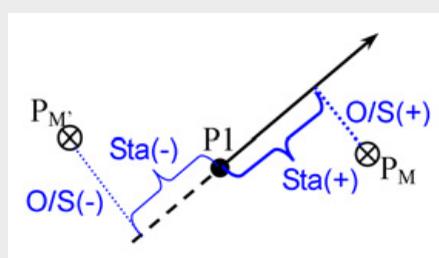
To calculate the coordinates of the point (PM), press [ENT] in the dVD field. You can change the Z coordinate here.

```
X:        4567.3080
Y:         200.1467
Z:  0.5800
PT: 86
CD: CURB
```

To record the point, press [ENT] in the CD field.

```
X:        4567.3080
Y:         200.1467
Z:
PT:86
CD:CURB
            List  Stack
```
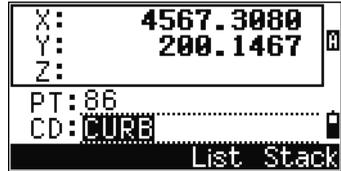
The coordinates are stored as a CC record. Line
definition information and Sta, O/S, and dVD
values are stored in comment (CO) records.

```
X:        4567.3080
Y:         200.1467
    - REC XYZ -
CD:CURB
```
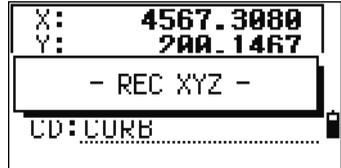
Calculating coordinates using intersection functions

To enter the Intersection menu, press [3] or select Intersection in the Cogo
menu. There are four functions in this menu for calculating coordinates.

Calculating a bearing-bearing intersection

A bearing-bearing intersection is the intersection point of two lines.

1. To calculate a bearing-bearing intersection,
   press [1] or select Brng-Brng in the
   Intersection menu.

```
─Intersection─
        1. Brng-Brng
P2      2. Brng-Dist
        3. Dist-Dist
        4. Pt-Line
P1
```
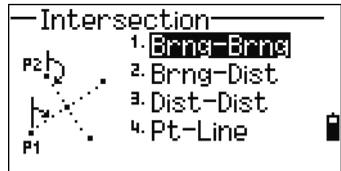
2. Enter the first point name and press [ENT].
   Alternatively, to measure directly to the point,
   press the MSR softkey.

```
Input P1              P1
P1:
AZ:
(±Ang:  0.00000 0/S:  0.0000)
MsrPT             List  Stack
```
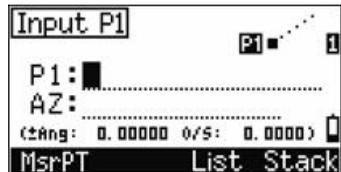
3. Define the first line by azimuth.

```
Input AZ              P1
P1:P10
AZ:
(±Ang:  0.00000 0/S:  0.0000 )
        0/S           Pts
```
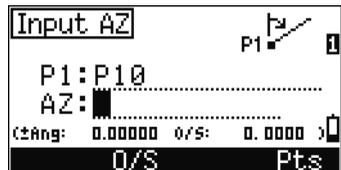
4. To define the line by two points, press the Pts softkey. The Fr field defaults to the P1 point, but you can change the selected point. In the To field, enter or measure to the second point.

For more information about the O/S softkey, see Advanced feature: Entering angle and distance offsets, page 134.
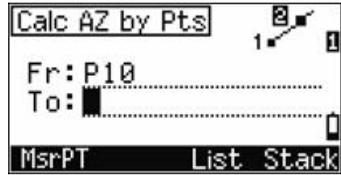
5. Do one of the following:

– To return to the previous screen, press [ENT]. The calculated value appears in the AZ field.

– To go to the next screen, press [ENT].

6. Define the second line by two points or by P2 and AZ.
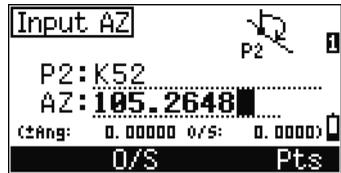
7. To calculate the coordinates of the intersection point, press [ENT] in the AZ field.

The calculated coordinates are displayed. You can input a Z coordinate if necessary.
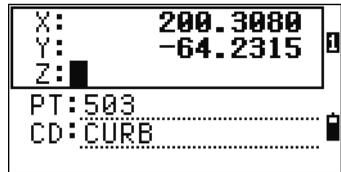
8. Enter a value in the PT field and in the CD field.

9. To record the point, press [ENT].

Sample records
CO,Int BB P1:P10 AZ:330.54175-90.00000
CO, P2:408 AZ:100.0000+0.0000
CC,A123,,4567.3080,200.1467,-1.2056,POT

Calculating a bearing-distance intersection

1. Press ② or select Brng-Dist in the Intersection menu.

Brng-Dist calculates the intersection point formed by one line and one distance (radius).
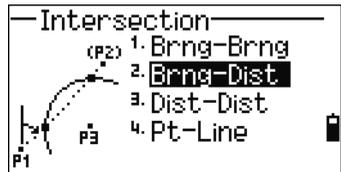
2. Enter a point on the line.

The line can be defined by two points or by a point and an azimuth.

```
Input P1            P1■   I
P1:4672■
AZ:
(±Ang: 0.00000 O/S: 0.0000)
MsrPT          List Stack
```

3. Enter the second point (P2) as the center of the circle.

```
Input P2             ·P2 I
P2:■
HD:              m
MsrPT          List Stack
```

4. Enter the distance from P2.

  – To define the distance (HD) by two points, press the Pts softkey.

```
Input HD        HD ·P2 I
P2:71
HD:■             m
                       Pts
```

  – To calculate the coordinates of the intersection point, press [ENT] in the HD field.

```
BRNG-DIST
        A
   P1       ■P2
Solution A X: 609.1207
         Y: -57.0810
```

5. If there are two results, the first solution appears graphically relative to the P1-P2 line. To display the second solution, press [<] or [>].

6. To record the point, press [ENT] when the required solution appears.

```
BRNG-DIST
                B
   P1    ■P2
Solution B X: -839.3065
         Y: 347.6682
```

7. Enter a Z coordinate if necessary.

8. To move to the PT and CD fields, press [ENT].

```
X:    -839.3065
Y:     347.6682
Z:■
PT:504
CD:SIGN
```

Sample records
CO,Int BD P1:4672 AZ:330.54175+0.00000
CO, P2:71 HD:100.0000
CC,504,,-839.3065,347.6682,,SIGN

Calculating a distance-distance intersection

1. Press ③ or select Dist-Dist in the Intersection menu.

2. Enter the first point name and press ⌊ENT⌋, or press the MSR softkey to measure directly to the point.

```
Input P1                    🔲 🔲
P1:486█ ............................
HD: ....................... m
                                🔲
MsrPT              List  Stack
```
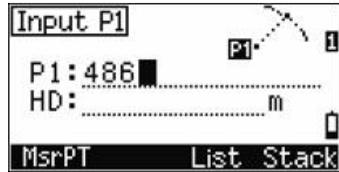
3. Enter the distance from P1 and press ⌊ENT⌋.

4. To define the distance (HD) by two points, press the Pts softkey.

```
Input HD               P1 🔲  🔲
P1:486 ............................
HD:█ ....................... m
                                🔲
                              Pts
```
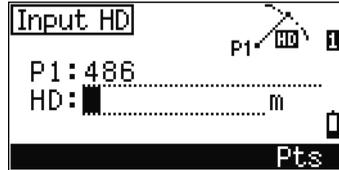
5. Enter P2 and the distance from P2 (HD).

6. To calculate the coordinates of the intersection point, press ⌊ENT⌋ in the HD field.

```
Input HD              🔲 P2  🔲
P2:7 ..............................
HD:█ ....................... m
                                🔲
                              Pts
```
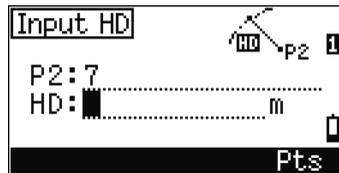
7. Press ⌊<⌋ or ⌊>⌋ to display the second solution.

8. To record the point, press ⌊ENT⌋ when the required solution appears.

```
DIST-DIST
                  ▾P2
         🅰  ●
              P1▴
Solution 🅰 X:        236.5817
          Y:          50.0461
```
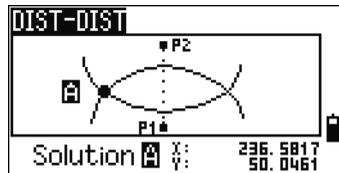
9. Enter a Z coordinate if necessary. Press ⌊ENT⌋ to move to the PT and CD fields.

```
X:           236.5817
Y:            50.0461  🔲
Z:█
PT:505 ...........................
CD: ..............................
```
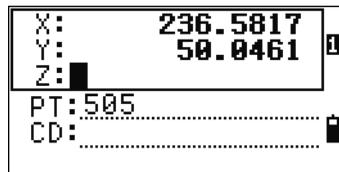
Sample records
CO,Int DD P1:486 HD:330.6020
CO, P2:7 HD:100.0000
CC,505,,236.5817,50.0461,0.0000,

Calculating a point-line intersection

1. Press ④ or select Pt-Line in the Intersection menu.

2. Enter the first point name and press ENT, or press the MSR softkey to measure directly to the point.
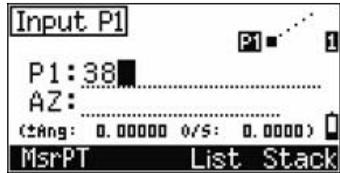
3. Enter the azimuth, or press the Pts softkey to enter another point name on the line.
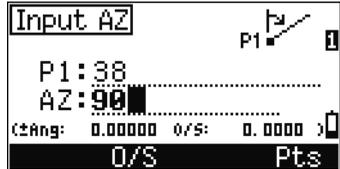
4. Enter the perpendicular point to the line, or press the MSR softkey to take a measurement to the point.

5. To calculate the coordinates of the intersection point, press ENT.

   If P1 and P2 are 3D points, the Z coordinate of the perpendicular point is calculated relative to the P1-P2 slope.

6. Enter PT and CD then press ENT to record the point.
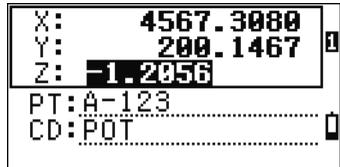
Sample records
CO,Int PtLine P1:38 AZ:90.00000+0.00000
CO, P2:506
CC,A-123,,4567.3080,200.1467,-1.2056,POT

Advanced feature: Entering angle and distance offsets

To display the offset input screen, press the O/S
softkey.

```
┌─────────────────────────┐
│ Input AZ      ┌┘        │
│              P1·┘   █   │
│  P1:38                  │
│  AZ:90.0000             │
│ (±Ang:  0.00000  O/S:   0.0000 )│
│        O/S          Pts │
└─────────────────────────┘
```
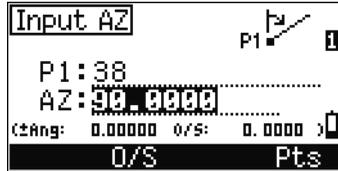
In the Ang field, enter a positive value to rotate
the line clockwise. Enter a negative value to rotate
the line counterclockwise.

```
┌─────────────────────────┐
│ Input AZ      ┌┘        │
│              P1·┘   █   │
│        Offsets          │
│ ±Ang: █                 │
│  O/S:              [ ]   │
└─────────────────────────┘
```
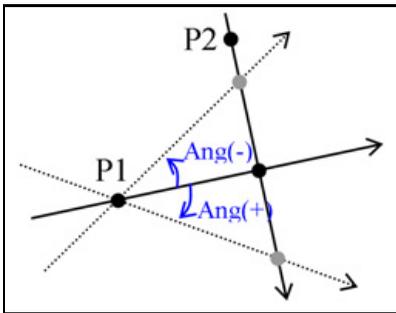

In the O/S field, enter a positive value to specify an offset to the right. Enter a
negative value to specify an offset to the left.
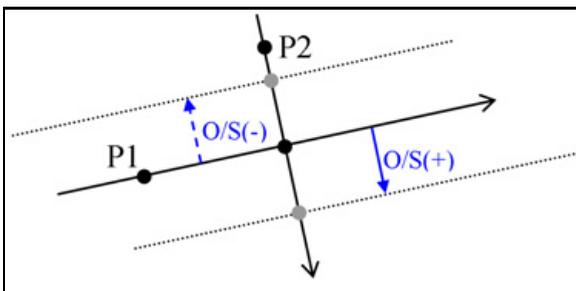
Settings

To display the Settings menu, press ② or select
Settings on the MENU screen.

Use this menu to configure the initial job settings.

```
─────Settings─────
¹·Angle    ⁶·Stakeout
²·Distance ⁷·Unit
³·Coord.   ⁸·Rec
⁴·PwrSave  ⁹·Others
⁵·Comm.
```
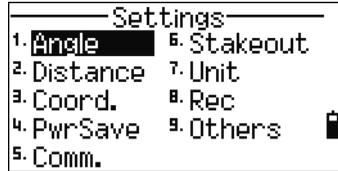
Some job settings, specified in the following
sections, cannot be changed once a job is
created. If any of these settings are changed while
a job is open, a confirmation screen appears,
asking you to create a new job with the new
settings, or to work with those settings without
recording any data. For more information, see
Settings, page 212.

```
❗ Job Settings
   will be changed

* Close the current Job?
[Abrt]⋯⋯⋯⋯⋯[OK]
```
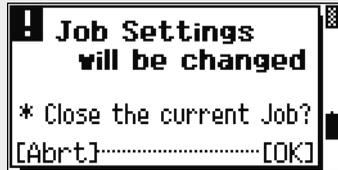
Angle

To open the Angle menu, press ① or select
Angle in the Settings menu.

   VA zero   Zenith/Horizon/Compass

```
<Angle>─────
    VA zero: Zenith
  Resolution: 5"
         HA: Azimuth
```
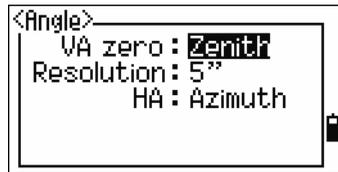
The VA zero job setting cannot be changed once a job is created.

   Resolution   1"/5"/10" or 0.2 mgon/1 mgon/2 mgon
   HA   0 to BS/Azimuth

The HA job setting cannot be changed once a job is created.
When this field is set to Azimuth, the horizontal angle (HA) that appears and
recorded is in Azimuth value. When this field is set to 0 to BS, HA is in HA zero to
BS value.

Distance

To open the Distance menu, press ② or select
Distance in the Settings menu.

Scale	Numeric value between 0.999600 and 1.000400
T-P corr.	ON/OFF
Sea Level	ON/OFF
C&R corr.	OFF/0.132/0.200
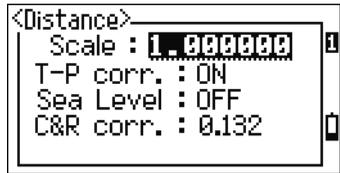
The Scale, T-P corr., Sea Level, and C&R corr. job settings cannot be changed once a job is created.

Temperature and Pressure corrections

SD	Slope dist. (before adj.)
SD'	Slope dist. (after adj.)
K	Compensation coefficient
P	Pressure (hPa)
T	Temperature ($^\circ$C)

$$K = 275 - \frac{106 \times P \times \left(\dfrac{10000.0}{13.5951 \times 980.665} \right)}{237 + T}$$

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

Sea Level correction

HD	Horizontal dist. (before adj.)
HD'	Horizontal dist. (after adj.)
Z_{STN}	Instrument-Z
R_e	6370 km

$$HD' = \frac{HD \times R_e}{R_e + Z_{STN}}$$

Curvature and Refraction correction

Because the surface of the earth is curved, the vertical difference (VD and Z) at the measurement point, as referenced to the horizontal plane, inevitably includes some error. This error is called *curvature error*. Also, because the density of the air surrounding the earth decreases with altitude, light is refracted at different rates at different altitudes. The error caused by this change in refraction is called *refraction error*.
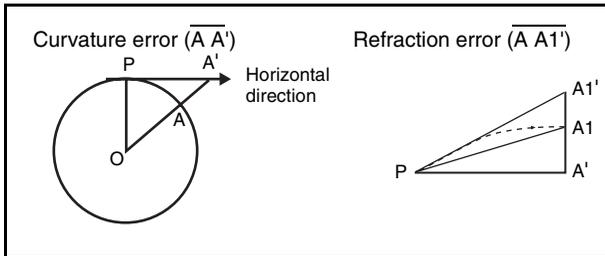
HD	Horizontal dist. (before adj.)
HD'	Horizontal dist. (after adj.)
VD	Vertical dist. (before adj.)
VD'	Vertical dist. (after adj.)
SD	Slope dist
VA	Vertical angle
R_e	6370 km
k	C&R constant (0.132 or 0.200)

$$HD' = HD - \frac{SD^2 \sin(2VA)}{2R_e}\left(1 - \frac{k}{2}\right)$$

$$VD' = VD + \frac{HD^2}{2R_e}(1 - k)$$

Coordinate

To open the Coordinate menu, press ③ or select Coord. in the Settings menu.

Order	NEZ/ENZ
Label	XYZ/YXZ/NEZ(ENZ)
AZ	North/South

<Coordinate>
  Order : NEZ
  Label : XYZ
AZ zero : North
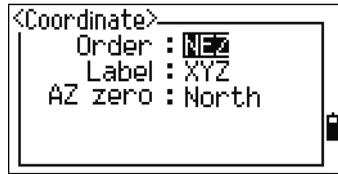
The Order and AZ job settings cannot be changed once a job is created.

Power saving

To open the Power Save menu, press ④ or select PwrSave in the Settings menu.

Main Unit	OFF/5min/10min/30min
EDM Unit	OFF/At Once/0.1min/ 0.5min/3min/10min
Sleep	OFF/1min/3min/5min

<Power Save>
Main Unit: 5 min
EDM Unit: At once
    Sleep: 1 min
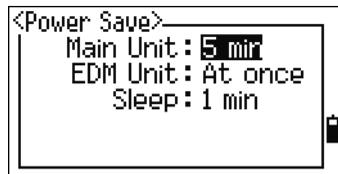
Communications

To open the Communication menu, press ⑤ or select Comm. in the Settings menu.

Ext.Comm	NIKON/SET
Baud	1200/2400/4800/9600/ 19200/38400bps
Length	7/8
Parity	EVEN/ODD/NONE
Stop bit	1/2

<Communication>
 Ext.Comm : NIKON
     Baud : 38400
   Length : 8
   Parity : None
 Stop bit : 1

Stakeout

Press ⑥ or select Stakeout in the Settings menu to open the Stakeout menu.

Add PT	Integer between 1 and 999,999

<Stakeout>
  Add PT : 1000
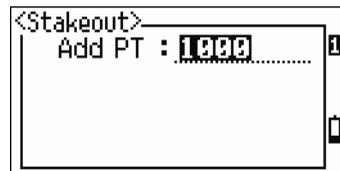
This field sets the default point number to record observed data in stakeout.

Unit

To open the Unit menu, press ⑦ or select Unit in the Settings menu.

Angle	DEG (Degree)
	GON (GON)
	MIL (Mil6400)
Distance	Meter/US-Ft/I-F
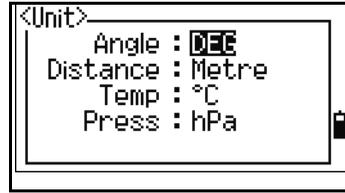
If you select US-Ft or I-Ft, an additional settings screen appears. Use this screen to specify whether to display values in Decimal-Ft or Ft-Inch.

Temp	°C (Celsius)
	°F (Fahrenheit)
Press	hPa/mmHg/inHg

The Angle, Distance, Temp, and Press job settings cannot be changed once a job is created.

Recording

To open the Rec menu, press ⑧ or select Angle in the Settings menu.

Store DB RAW/XYZ/RAW+XYZ

This setting determines whether raw and/or coordinate data is stored when you record SS, CP, or SO records in the Basic Measurement Screen (BMS) or Stakeout screen.

Data Rec Internal/COM

Set this field to COM to output data on the COM port when you press ENT in the BMS or a Stakeout screen. The data is not stored to the job file. For more information, see Outputting data to the COM port, page 104.

Others settings

To open the Others menu, press ⑨ or select
Other in the Settings menu.

```
<Others>
  XYZ disp: Fast
  2nd Unit: US-Ft
  Sig Beep: ON
   Split ST: Yes
  CD Input: <123>
```
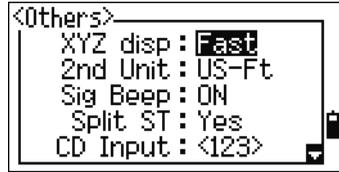
> XYZ disp Fast/Norm/Slow/+ENT
>
> Defines speed to move to the next
> screen after showing XYZ of the
> input PT
>
> 2nd Unit None/Meter/US-Ft/I-Ft
>
> When the Secondary unit is set to a unit, an extra display screen is
> available in the BMS, stakeout observation screens, and 2-pt
> reference line screens. The extra screen shows the HD, VD, and SD
> in the secondary unit.

If you select US-Ft or I-Ft, an additional settings
screen appears. Use this screen to specify
whether to display values in Decimal-Ft or Ft-
Inch.

```
<Others>
  XYZ disp: Normal
   ┌─────────────┐
   │ Decimal-Ft  │
   │ Ft-Inch     │
   └─────────────┘
  CD Input: <123>
```
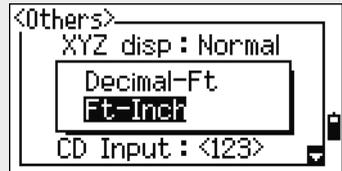
> Sig Beep ON/OFF
>
> Split ST No/Yes
>
> Select Yes to separate the point numbers of station points from other
> record type point numbers.

If you set the Split ST field to Yes, an additional
setting screen appears. Use this screen to specify
the starting ST number.

```
<Others>
  XYZ disp: Normal
   ┌─────────────┐
   │ Start PT:   │
   │ 9000        │
   └─────────────┘
  CD Input: <123>
```
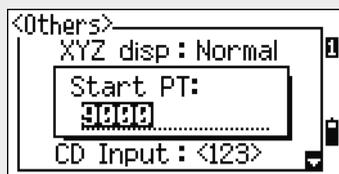
> CD Input ABC/123
>
> Sets the default input mode when a CD field appears.

Owner's Detail	Up to 20 characters
	Enter your name or the name of your company. If you enter a value in this field, it appears at start-up.

```
┌<Others>──────────┐ ▲A
│ Owner's Detail :  │
│ NIKON-TRIMBLE     │
│                   │
│                   │ ▮
└───────────────────┘
```

💡 **Tip –** To provide easier configuration for common regional settings, you can quickly configure the Nikon total station to a pre-set combination of default regional settings. For more information, see Changing Regional Configuration Pre-sets, page 31.

💡 **Tip –** The Nikon total station supports up to 3 languages on the instrument. For more information on changing the language settings, see page 30.

Data

Use the Data menu to view or edit records. To display the Data menu, press ④ on the MENU screen.

```
┌─────── Data ───────┐
│ 1. RAW data         │
│ 2. XYZ data         │
│ 3. ST→SS/SO/CP      │
│ 4. PT name List     │ ▮
│ 5. Code List        │
└────────────────────┘
```

Viewing records

You can view data at any time, even in an observation screen or while entering points.

Viewing raw data

To show the raw data records in a list, press ① on the Data menu screen.

When you first view the raw data, the last four raw records in the current job are displayed. Use ⌃ or ⌄ to scroll through the records.

```
┌▒▒▒▒▒▒▒RAW▒▒▒▒▒▒▒┐
│ SS,303,          ▲│
│ SS,304,FENCE      │
│ SS,305,           │
│ CP,8000,CT/BS     │
│ SS,306,KERB      ▮│
├───────────────────┤
│ DEL  Edit  Srch   │
└───────────────────┘
```

To see detailed information for the selected
records, press [ENT].

To return to the record list, press [ESC].

```
HA:148°36'10"5
VA: 76°25'08"0
SD:    29.5180F
PT:306
HT:     4.1024F
 DEL   Edit   DSP
```

SS, CP, F1, F2 records

Raw SS, CP, F1, and F2 records contain PT, HT, CD, HA, VA, and SD fields.

SS records are sideshots (topo shots). All shots from the Basic Measurement Screen
(BMS) are stored as SS records.

CP records are shots taken in the Angle or Repeat menus, or in the BMS. For more
information, see Recording a foresight point after repeat angle measurement,
page 64, and Recording data from any observation screen, page 103.

F1 and F2 records are Face-1 and Face-2 measurements.

When the Store DB setting is set to RAW+XYZ, press [DSP] to switch between the
first screen (showing HA, VA, SD, PT, and HT) and the second screen (showing X,
Y, Z, PT, and CD).

Coordinates are not available in F1 or F2 records.

When you take more than one measurement to the same point and choose to
overwrite the XYZ data, the old raw record becomes raw data only. As a result, only
one SS(RAW) record keeps its corresponding SS(XYZ) record. Other SS(RAW)
records to the same point no longer have coordinates available.

ST records

ST (station) records contain ST, HI, BS, and AZ fields.

Press [DSP] to switch between the first screen (showing ST, HI, BS, and AZ) and the
second screen (showing X, Y, Z, PT, and CD).

When you assign a new ST point name in MENU > Stn Setup > Quick, the
coordinates of the station is recorded as (0, 0, 0).

SO records

SO records are stakeout shots. These are shots recorded in stakeout functions.

When the Store DB setting is set to RAW+XYZ, press [DSP] to switch between the
first screen (showing HA, VA, SD, PT, and HT), the second screen (showing X, Y,
Z, PT, and CD), and the third screen (showing dX, dY, dZ, PT, and CD).

The dX, dY, and dZ fields store the difference between the stakeout shot's actual position and its planned position. These fields are downloaded as comment records in Nikon RAW format.

CO records

A CO record is a comment added to the job from the system.

For example, when you change the Stn-Z using the Remote Benchmark function, or you reset the horizontal angle using the BSCheck function, the system writes a comment record.

```
CO,Remote BM Cal
c.Z=.70,473 -Stn
Point Updated

 DEL
```

When you input a Stn-XYZ by Base-XYZ function, the recorded station appears as a comment record.

```
CO,Base XYZ
HI=    1.700 m
X=    12345.000
Y=       50.123
Z=      164.208
 DEL
```

SY records

When you complete a station setup, a SY record is stored. This record contains the Temperature, Pressure, and Prism Constant values.

```
CO,
 Temp:     58°F
Press: 29.9inHg
Prism:     0mm

 DEL
```

RM records

When you record measurements in RDM (Cont) or RDM (Rad), they are labeled as RM records.

Each RM record consists of two screens.

```
RDM,          1/2
 From)K-3
  To)605
 rHD:    76.9400 m
 rVD:     2.5810 m
 DEL       DSP
```

Press [DSP] to switch between the first screen (showing From, To, rHD, and rVD) and the second screen (showing rAZ, rSD, rV%, and rGD).

When you download data in Nikon RAW format, RM records are output as comment (CO) records.
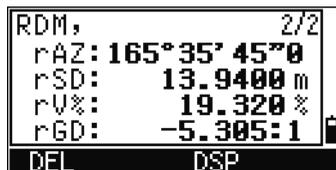
```
RDM,          2/2
 rAZ:165°35'45"0
 rSD:    13.9400 m
 rV%:     19.320 %
 rGD:    -5.305:1
 DEL       DSP
```

AR records

An AR record stores an area and perimeter calculation.

When you download data in Nikon RAW format, AR records are output as comment (CO) records.

```
Name: SITE35-A

 Area :        158.660 m²
 Perim :       339.209 m

 DEL
```

View coordinate data

When you press [2] or select XYZ data in the Data menu, coordinate data appears in a list, with the newest record at the bottom of the screen. Use [^] or [v] to scroll through the records. Use [<] or [>] to move up or down one page.

```
▒▒▒▒▒▒▒▒▒ XYZ ▒▒▒▒▒▒▒▒▒
MP,54,KERB         ▲
UP,2001,
UP,2002,
UP,2003,MANHOLE
UP,2004,
 DEL   Edit  Srch Input
```

Press [ENT] to see more detailed information about the selected record.

```
 N:       -501.3846
 E:       -200.1467
 Z:         29.5180
PT:2004
CD:
 DEL   Edit
```
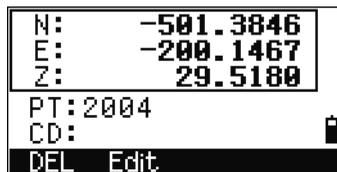
The header (XYZ,YXZ,NEZ, or ENZ) depends on the Coord. Label setting in MENU > Settings > Coord. For more information, see Coordinate, page 138.

UP, MP, CC, and RE records

All coordinate records contain PT, CD, X, Y, and Z fields.

UP records are uploaded point coordinates. MP records are manually input point coordinates. CC records are points calculated in Cogo, and RE records are points calculated in Resection.

When the Store data setting is set to RAW+XYZ or to XYZ, shots in the BMS (SS records), in various O/S functions (SS records), in 2Pt-RefLine and Arc-RefLine in PRG (SS records) and in some Stakeout functions (SO records) store coordinate records as well. The format of the data is the same as other coordinate records.

View records by station

To view records by station, press ③ or select
ST->SS/SO/CP in the Data menu.

```
————Data————
¹·RAW data
²·XYZ data
³·ST▸SS/SO/CP
⁴·PT name List
⁵·Code List
```

A list of all stations appears.

Use ⌃ or ⌄ to highlight the station name that you
want to view. Use ⌃ or ⌄ to move up or down one
page.

```
▨▨▨▨▨Station▨▨▨▨▨
ST,9000          ▲
ST,9001
ST,9002
ST,3500
ST,3501
 DEL   Edit  Srch
```

To view detailed information about the selected
station, press [ENT].

```
 ST:3501
 HI:    1.8433m
 BS:3500
 AZ:   0°00'00"0
* [ENT] to view SS/SO/CP
 DEL   Edit  DSP
```
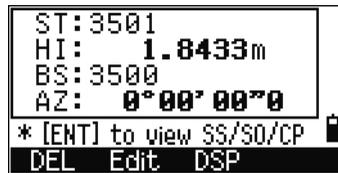
To display all the observation data from the
selected station in chronological order, press [ENT]
again.

```
▨▨▨▨Observation▨▨▨▨
SS,1,            ▲
CP,2,CT
SS,3,
SS,4,
SO,1085,
 DEL   Edit  Srch
```
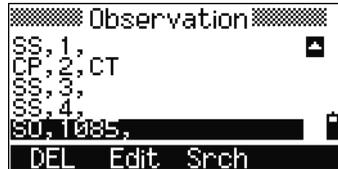
Detailed data is as for raw data. For detailed information about each point type and
format, see Viewing raw data, page 141.

Deleting records

Deleting raw records

In the RAW screen, use ⌃ or ⌄ to highlight the record that you want to delete. Then press the DEL softkey.

```
▓▓▓▓▓▓▓▓▓▓▓▓RAW▓▓▓▓▓▓▓▓▓▓▓▓
SS,303,                    ▲
SS,304,FENCE
SS,305,
CP,8000,CT/BS
SS,306,KERB                █
  DEL   Edit  Srch
```

A confirmation screen appears. To delete the selected record, press [ENT] or the Yes softkey.

```
┌─────────┐
│Delete RAW│
└─────────┘
SS:306

      * Are you sure?       █
 No                     Yes
```

If the Store DB setting is set to Both, the system also deletes the corresponding coordinate data when you delete an SS, SO, or CP record.

You can also delete raw data by pressing the DEL softkey in the detailed display screen for the record.

```
┌─────────────────────────┐
│HA:148°36' 10"5          │
│VA: 76°25' 08"0          │
│SD:    29.5180F          │
└─────────────────────────┘
PT:306
HT:    4.1024F             █
 DEL   Edit   DSP
```
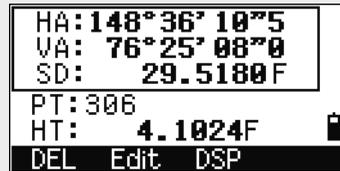
Deleting coordinate records

In the XYZ screen, use ⌃ or ⌄ to highlight the record that you want to delete. Then press the DEL softkey.

```
▓▓▓▓▓▓▓▓▓▓▓▓XYZ▓▓▓▓▓▓▓▓▓▓▓▓
MP,54,KERB                 ▲
UP,2001,
UP,2002,
UP,2003,MANHOLE
UP,2004,                   █
 DEL   Edit  Srch Input
```

A confirmation screen appears.

To delete the selected record, press [ENT] or the Yes softkey.

To cancel the deletion of data, press [ESC] or the No softkey.

```
┌─────────┐
│Delete XYZ│
└─────────┘
UP:2004

      * Are you sure?       █
 No                     Yes
```
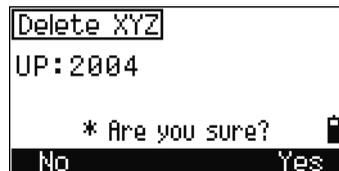
You can also delete coordinate data by pressing the DEL softkey in the detailed display screen for the record.

```
N:      -501.3846
E:      -200.1467
Z:        29.5180
PT:2004
CD:
 DEL   Edit
```

If the record that you want to delete is referred by an ST record, a confirmation message appears.

```
Delete XYZ
  ! DELETE Stn-XYZ
   XYZ referred by ST
      * Are you sure?
[Abrt]··············[DEL]
```
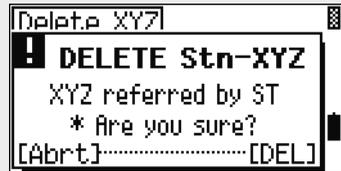
Deleting station records

In the Station screen, use ⌃ or ⌄ to highlight the record that you want to delete. Then press the DEL softkey.

```
▒▒▒▒▒Station▒▒▒▒▒
ST,9000        ▲
ST,9001
ST,9002
ST,3500
ST,3501        ▐
 DEL   Edit  Srch
```

A confirmation screen appears.

Press [ENT] or the Yes softkey to delete the selected record.

```
Delete STN
ST:9001


     * Are you sure?
 No              Yes
```
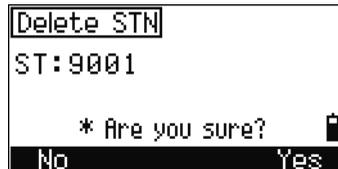
A reconfirmation screen appears. Press the DEL softkey to confirm deletion.

There is no undelete function on the instrument. Before you press the DEL softkey, make sure that you have selected the correct station record. You cannot press [ENT] in this screen.

```
Delete STN
 ! All SS/SO/CP shooted
   from this ST are to
   be deleted in the JOB.
 Abrt            DEL
```
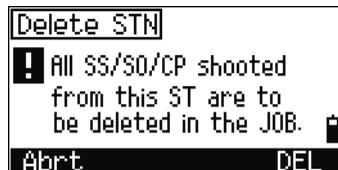
All observations from the station that you selected
are deleted.

```
Delete STN
▀▀ .. .. ...- .. . ..
   - Deleting STN -
  ᵇᵉ ᵈᵉˡᵉᵗᵉᵈ ⁱⁿ ᵗʰᵉ ʲᵒᵇ·
```

When you delete a ST record in the raw data view or the station data view, all the
observation data from the station is also deleted.

Editing records

For any point record, you can edit the point name (PT), feature code (CD), height of
target (HT), height of instrument (HI), backsight point (BS), and backsight azimuth
(AZ).

You cannot edit the CD field for SO, F1, or F2 records.
You cannot edit the HA, VA, or SD values.

Editing raw records

1. Do one of the following:

   – In the RAW screen, highlight the record
   that you want to edit. Then press the Edit
   softkey.

```
░░░░░░░░░░RAW░░░░░░░░░░
SS,303,                  ▲
SS,304,FENCE
SS,305,
CP,8000,CT/BS
SS,306,KERB              ▮
 DEL   Edit  Srch
```

   – In the detailed data screen, press the Edit
   softkey.

```
HA:148°36'10"5
VA: 76°25'08"0
SD:    65.5100 m
PT:304
HT:    1.5000m           ▮
 DEL   Edit  DSP
```

2. Use △ or ▽ to highlight a field. Then modify
   the value in the selected field.

```
PT:304
HT: ▐1.5000▌    m        ▯1
CD:FENCE
  * Modify each item
    and Press [ENT]       ▯
                    Stack
```
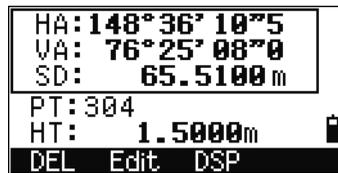
When you change the HT of an SS, SO, or CP measurement record, its Z coordinate is recalculated.

3. When you press [ENT] on the last line of the edit screen, a confirmation screen appears.

```
Edit RAW
SS:304

          * Overwrite?
 No                    Yes
```

4. Do one of the following:

– To accept the changes and return to the data view screen, press [ENT] or the Yes softkey.

– To return to the edit screen, press [ESC] or the No softkey.

```
Edit RAW
- - - - -
   - Updating RAW -

   * Overwrite?
```
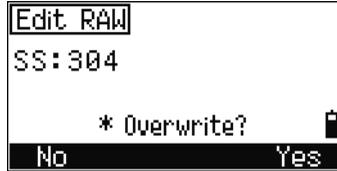
Editing coordinate records

You can edit PT, CD, and coordinate values in coordinate records.

You cannot edit the coordinate record for the current station.

1. Do one of the following:

– In the XYZ screen, use [^] or [v] to highlight the record that you want to edit. Then press the Edit softkey.

```
XYZ
MP,620,
MP,621,
MP,625,
CC,703,MANHOLE
SS,1004,
 DEL   Edit  Srch Input
```

– In the detailed data screen, press the Edit softkey.

```
N:       6000.3260
E:       1050.0000
Z:
PT:625
CD:
 DEL   Edit
```

2. Use ⌃ or ⌄ to highlight a field. Then modify the value in the selected field.

3. To finish editing, press ⌊ENT⌋ in the CD field.
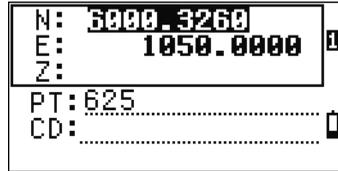
```
N: 5000.3260
E:      1050.0000  ▯
Z:
PT:625 ......................................
CD: ..........................................  ▯
```

A confirmation screen appears.

```
┌Edit XYZ┐
MP:625


      * Overwrite?        ▮
 No                  Yes
```

4. Do one of the following:

– To accept the changes and return to the data view screen, press ⌊ENT⌋ or the Yes softkey.

– To go back to the edit screen, press ⌊ESC⌋ or the No softkey.

```
┌Edit RAW┐
-- ---
  ┌───────────────────┐
  │  - Updating XYZ -   │
  └───────────────────┘
      * Overwrite?        ▮
```
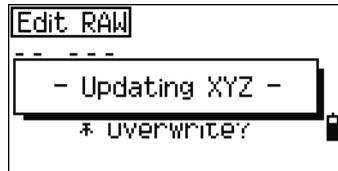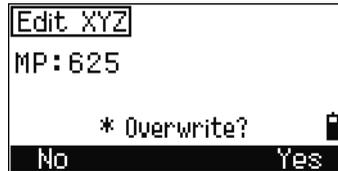
Editing station records

Note – The system will not recalculate measurements if you change the station record. All coordinate and raw data observed from an edited station record must be recalculated in your postprocessing software.

In the RAW screen, use ⌃ or ⌄ to highlight the station record that you want to edit. Then press the Edit softkey.

```
▨▨▨▨▨▨▨▨ RAW ▨▨▨▨▨▨▨▨
CO,Temp:20 Press:101:
ST,3501
F1,,
SS,2,CT/BS
SS,3,KERB            ▾▯
 DEL   Edit  Srch
```

You can edit any field in the ST record, but the instrument does not recalculate any measurements from this station.

Press ⌊ENT⌋ in the AZ field to confirm the change.

```
ST:3501                ▯
HI:      1.8433m
BS:3500
AZ:   0°00'00"0
* Modify each item & [ENT] ▯
              List  Stack
```

If you change the ST or HI values, the coordinates of observation points are not recalculated. A comment record is stored to record the change. The following example shows a comment record for a changed HI value:

> CO,HI changed at ST:9012 Old HI= 1.345m

If you change the BS or AZ values, raw records are not recalculated. A comment record is stored to record the change.

Searching records

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

Searching raw records

In the RAW screen, press the Srch softkey to access the raw data search function.

```
▓▓▓▓▓▓▓▓RAW▓▓▓▓▓▓▓▓    ▲
SS,303,
SS,304,FENCE
SS,305,
CP,8000,CT/BS
SS,306,KERB            ▯
  DEL   Edit   Srch
```

To find a point by name, enter the name in the PT field and press [ENT] twice.

```
┌Search RAW┐           1
│
Type:ALL
  PT:▮.................
  CD:..................▯
                 List  Stack
```

You can use the asterisk (*) as a wildcard. For example, when you enter 30* in the PT field, the search matches the points named 300, 301, 302, 3000A2, and 3010.

```
┌Search RAW┐           A
│
Type:ALL
  PT:.................
  CD:FENCE*▮..........▯
                 List  Stack
```

To search by point type, move to the Type field and use [<] or [>] to change the selected point type. The options are ALL, ST, SS, SO, CP, CO, CO(SY), and CO(RDM).

```
┌Search RAW┐
│
Type:ALL
  PT:.................
  CD:................▯
```
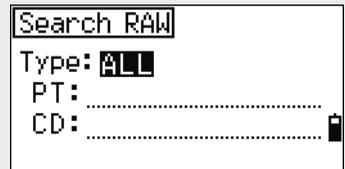
If you selected ST, SO, F1, or F2 in the Type field, you do not have to enter a value in the CD field. Press [ENT] in the PT field to start the search.
If you selected CO, CO(SY), or CO(RDM) in the Type field, you cannot enter a value in the PT or CD fields. Press [ENT] in the Type field to start the search.

If more than one point matches the search criteria, the matching points are displayed in a list.

Use [^] or [v] to highlight the point you want to use. Then press [ENT] to select it.

Detailed data for the selected record appears. Press the DSP softkey to change the fields shown.

Press [ESC] to return to the list.
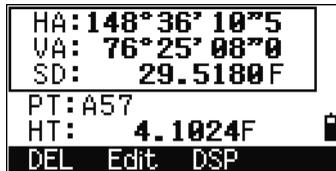
If no point matches the specified criteria, an error screen appears. Press any key to return to the data screen.
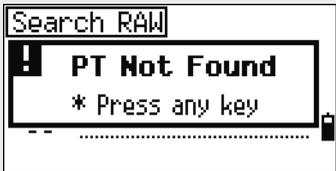
Searching coordinate records

In the XYZ screen, press the Srch softkey to access the XYZ data search function.

To find a coordinate by name, enter the name in the PT field and press [ENT] twice.

You can use the asterisk (*) as a wildcard. For example, when you enter 500* in the PT field, the search matches the points named 500, 500-1, 500-A, and 5000.

```
┌────────────────────────────┐
│ Search XYZ           █      │
│ Type: MP                    │
│  PT:500*█ ................. │
│  CD: ...................... │
│                   List Stack│
└────────────────────────────┘
```

To search by point type, move to the Type field and use ⟨<⟩ or ⟨>⟩ to change the selected point type. The options are ALL, MP, UP, CC, and RE.

```
┌────────────────────────────┐
│ Search XYZ                  │
│ Type: MP                    │
│  PT: ...................... │
│  CD: ...................... │
└────────────────────────────┘
```

If more than one point matches the search criteria, the matching points are displayed in a list.

Use ⟨^⟩ or ⟨v⟩ to highlight the point you want to use. Press ⟨ENT⟩ to select it.

```
┌────────────────────────────┐
│UP,500,FENCE                 │
│UP,500-1,                    │
│UP,500-2,MANHOLE             │
│UP,500-3,                    │
│UP,5000,                     │
│UP,5001,POLE                 │
│UP,5002,                     │
└────────────────────────────┘
```

Detailed data for the selected record appears. Press the DSP softkey to change the fields shown.

Press ⟨ESC⟩ to return to the list.

```
┌────────────────────────────┐
│ X:      2000.2060           │
│ Y:      5000.0064           │
│ Z:                          │
│ PT:500                      │
│ CD:FENCE                    │
│ DEL   Edit                  │
└────────────────────────────┘
```

If no point matches the specified criteria, an error screen appears. Press any key to return to the data screen.

```
┌────────────────────────────┐
│ Search XYZ                  │
│ █  PT Not Found             │
│    * Press any key          │
│ -- ...................... │
└────────────────────────────┘
```

Entering coordinates

In the XYZ screen, press the Input softkey to
display a new input point screen.

The PT field defaults to the last recorded PT + 1,
but you can change the value shown.

Enter the PT and CD and then press [ENT] to enter
coordinates.
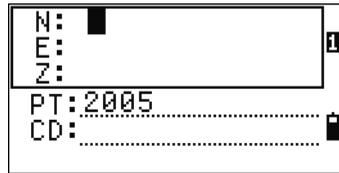
Use the numeric keys to enter the coordinates.
Press [ENT] or [v] in each field to move to the next
field.

When you press [ENT] in the CD field, the point is
stored as an MP record.
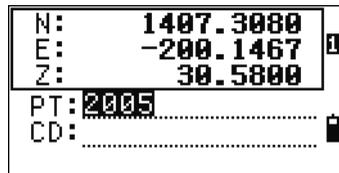
After you have recording a point, the next point
input screen is shown with the updated default PT.
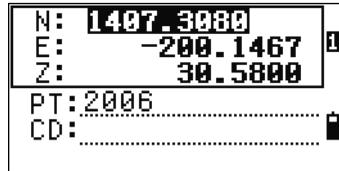
You can record NE, NEZ, or Z-only data to the database.

Point name list and code list

The instrument stores two list files: a list of PT names and a list of CD names. The
structure and functionality of these files is the same.

- The *PT name list* is useful if you have to handle more than one patterns of point
  names in the field. For example, you may need to use points named 1, 2, 3 …, as
  well as points named A1, A2, A3 ….
- The *code list* is a prepared list of feature codes. You can use it to store your own
  codes.

Press ④ or select PT name List in the Data menu to open the point name list.

Press ⑤ or select Code list to open the code list.

```
┌───────Data───────┐
1. RAW data
2. XYZ data
3. ST→SS/SO/CP
4. PT name List
5. Code List
```

The point or code names and layers are shown in alphabetic order. Use the four softkeys to customize the list.

```
BC
EC
EP
IP
KA
NO.
─────────────────
 DEL   Edit   Add  Layer
```

You can store up to 254 points, codes, or layers in each list.

Each list entry can be up to 16 characters long.

You can use the first character search to find a point, code, or layer in the list. In the list screen, enter the first character of the name you want to find to jump to that part of the list. For more information, see Advanced feature: Searching for a code by using the first character, page 54.

Deleting points, codes, or layers

In the point or code list, use ⌃ or ⌄ to highlight the item you want to delete. Then press the DEL softkey.

```
BC
EC
EP
IP
KA
NO.
─────────────────
 DEL   Edit   Add  Layer
```

A confirmation screen appears. Press [ENT] or the Yes softkey to delete the item.

```
┌Delete Item┐
 PT:BC

    * Are you sure?
 No              Yes
```
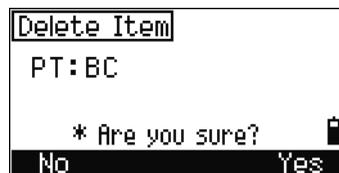
Press [ESC] or the No softkey to cancel the deletion.

```
┌Delete Item┐
┌──────────────┐
│ - Delete Item - │
└──────────────┘
    * Are you sure?
```

To delete a whole layer, highlight the layer name in the list and press the DEL softkey. All codes and layers in the selected layer are deleted.

```
┌Delete Layer┐
|  - Delete Layer -  |
|    * Are you sure?   |
```

Editing an item in the point list or code list

Use ⌃ or ⌄ to highlight the item that you want to edit. Then press the Edit softkey.

```
BC
EC
GENERAL◆
IP
NO
SURVEY◆
 DEL   Edit   Add  Layer
```

An editing screen appears. For points, the Edit Item screen appears. It contains only the PT field. For codes, the Edit Code screen appears, containing the CD field and the REC field.
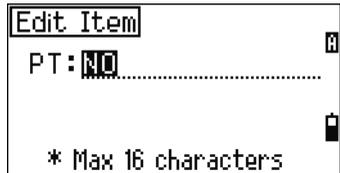
Edit the text shown and then press [ENT].

```
┌Edit Item┐
 PT:NO.........................
      * Max 16 characters
```

A confirmation screen appears. Press [ENT] or the Yes softkey to accept the changes and update the list.

```
┌Edit Item┐
NO
◆NO-
       * Overwrite?
 No                    Yes
```
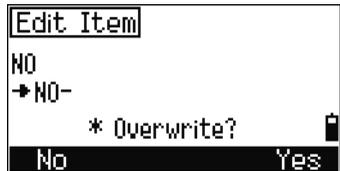
Edit code list

The Edit Code screen has two fields. The CD field contains the text that appears in the list screen. The REC field is optional. It contains the text that is stored in the job. If you leave the REC field blank, the value in the CD field is used.

```
Edit Code                    A
 CD: MANHOLE............
(REC: MANHOLE.........)

* REC= Item for record ;
       can be diff. from CD
```

You can use the REC field to use familiar words or codes on the screen, but store a numeric code in the job. For example, if you set the CD field to MANHOLE and the REC field to 1155, the text MANHOLE appears on the screen, but the code 1155 is stored.

```
Edit Code                    1
 CD: MANHOLE............
(REC: 1155█...........)

* REC= Item for record ;
       can be diff. from CD
```

If you press the Edit softkey when a layer name appears, only the Lyr field appears. To save changes to the layer name, press [ENT] in the Lyr field.

```
Edit Layer                   A
Lyr: SURFACE...........



       * MAX 16 characters
```

Adding a point name

In the point list, press the Add softkey to add a new point name to the current layer.

```
BC
EC                           A
EP
IP
NO.
P-50
 DEL   Edit   Add  Layer
```

Enter a new point name and then press [ENT].

```
Add Item                     A
 PT: KA█.................



       * Max 16 characters
```

The point name is added to the current layer and the list is updated.

Adding a code

In the code list, press the Add softkey to add a new feature code to the current layer.

Enter the feature code in the CD field. Press [MODE] to change between alphabetic and numeric input mode.
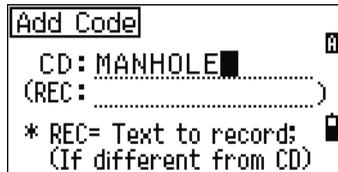
You can use the REC field to define a numeric identifier for each feature code. This is optional: If there is a value in the REC field, this value is stored. If you leave the REC field blank, the CD value is stored.
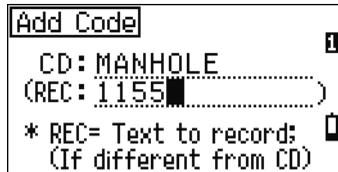
Press [ENT] to add the new code and update the code list.

Adding a layer

1. In the point or code list, press the Layer softkey.

2. Enter the name of the new layer.

3. To change between alphabetic and numeric input mode, press [MODE]. To store the new layer, press [ENT].
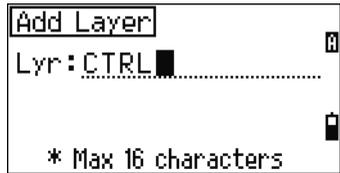
    The new layer is added to the list in alphabetic order.

Communication

Use the Communication menu to download or upload data. To display the Communication menu, press [5] or select Comm. on the MENU screen.

Downloading data

To go to the download settings screen, press $\boxed{1}$ or select Download in the Communication menu.
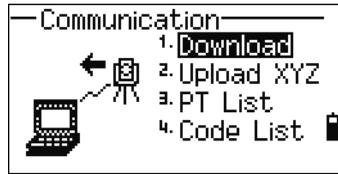
Format	NIKON
	SDR2x
	SDR33
Data	RAW
	Coordinate

To display the total number of records that will be downloaded, press $\boxed{\text{ENT}}$ in the Data field.
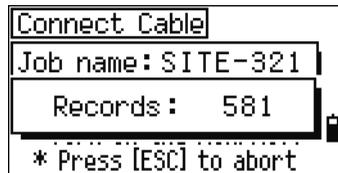
As each record in the current job is output from the instrument (downloaded), the current line number is updated.
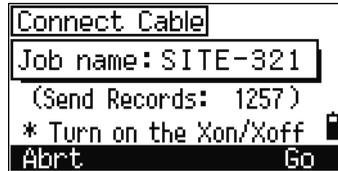
After downloading is completed, you can choose to delete the current job.

To delete the current job, press $\boxed{4}$. To return to the Basic Measurement Screen (BMS), press $\boxed{\text{ESC}}$ or the Abrt softkey.
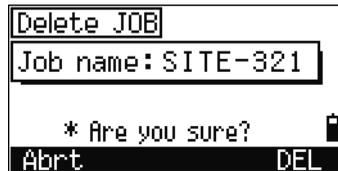
Uploading coordinate data

To upload coordinate data from a computer, press $\boxed{2}$ or select Upload XYZ in the Communication menu.
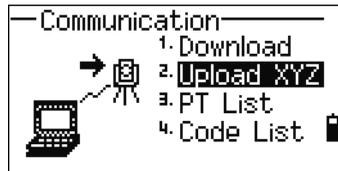
The default data format appears. To change the
order of data fields, press the Edit softkey. For
more information, see Advanced feature: Editing
the data order for upload, page 162.

Otherwise, just press [ENT].

```
┌─────────────┐
│Upload XYZ│
├─────────────────────┐
│Job name:NIKON50  │
└─────────────────────┘
 Format:PT/N/E/Z/CD//
* Turn on the Xon/Xoff ▊
━Job━━Comm━━Edit━━
```
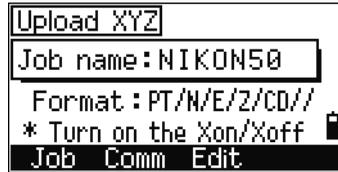
Press the Job softkey to go to the Job Manager screen. For more information, see
Job Manager, page 116.

To change the communication settings, press the
Comm softkey. The serial port settings must match
the settings used by the terminal software on the
computer.

```
┌<Communication>─────
│    Baud :88400
│  Length :8
│   Parity :None
│ Stop bit :1         ▊
└────────────────────
```
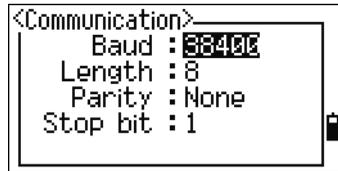
Use an RS-232C cable to connect the instrument
to the computer.

The Free space field shows the number of points
that can be stored.

Press [ENT] to put the instrument in receive mode.
Then use the Send Text File command in the
terminal program on the computer to start sending data.

```
┌──────────────┐
│Connect Cable│
├─────────────────────┐
│Job name:NIKON50  │
└─────────────────────┘
  Records :    532
Free space :    4609  ▊
━Abrt━━━━━━━━━━━Go━
```
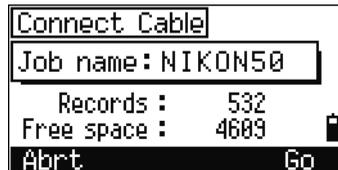
In the terminal program, set flow control to Xon/Xoff.

As each point is received by the instrument, the
value in the Records field is incremented.

```
┌──────────────┐
│Connect Cable│
├─────────────────────┐
│Job name:NIKON50  │
└─────────────────────┘
   Records:    581    ▊

 * Press [ESC] to abort
```
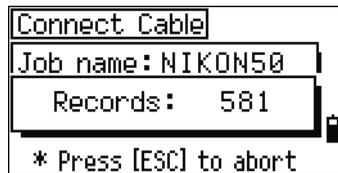
If you press [ESC] during data upload, the upload is canceled and the display returns
to the Communication menu. Records that were received before you pressed [ESC]
are stored in the job.

The system truncates any code that is longer than 16 characters.

Duplicate points

If the existing point is a UP, CC, or MP record, and it is not referred to by any ST or
BS, it is automatically overwritten by the uploaded point. No error message appears.

Advanced feature: Editing the data order for upload

1. To open the Data Fields screen, press the
Edit softkey.

```
Connect Cable
Job name: SITE-321
 (Send Records:  1257)
* Turn on the Xon/Xoff ▊
Abrt                  Go
```
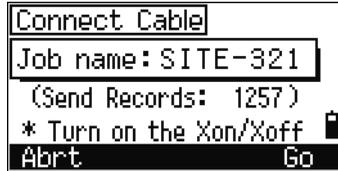
2. To move between the fields, press ◁ or ▷.

3. To change the selected item in a field, use the
⊡ and ⊡ softkeys. The options are PT, N, E,
Z, CD, or blank.

```
Data Fields
PT N E Z CD
* [←]/[→] to move cursor
  [⊡]/[⊡] to change items ▊
        ⊡   ⊡   Save
```

4. To save your changes and return to the
previous screen, press the Save softkey.
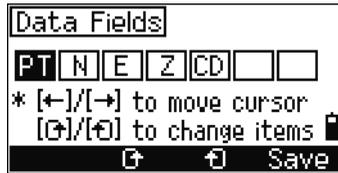
For example, if your original data is as follows:

1, UB, 30.000, 20.000, L1

and you set the data fields to PT N E CD, then the uploaded data is:

PT=1, N=30.000, E=20.000, CD=L1

Uploading coordinates without points

You can upload data without points. If you do not include a point in the format
definition, each line of data is automatically assigned the next available point
number. To help you to select points in the field, make sure that you store an
identifier in the CD field.

The data format cannot include duplicate items. Use PT, N, E, Z and CD once each
in the data format.
To skip some items in your original file, set the corresponding field to blank.

Uploading a point name list or code list

When you upload a code list, it always replaces the existing code list on the
instrument.

To upload a point name list via cable, press ③ or select PT List in the
Communication menu.

To upload a code list, press ④ or select Code
List.
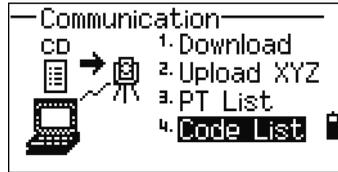
Connect the RS-232C cable.

Start a terminal program on the computer.

To put the instrument into receive mode, press
ENT or the OK softkey.

The counter is updated as each line in the list is
stored.

You can store up to 254 codes or point names.
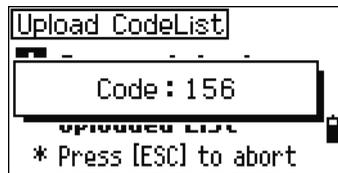
> If a code or point name is longer than 16 characters, it is truncated.

1sec-Keys

Use the 1sec-Keys menu to configure the settings
for the one-second keys, MSR, DSP, USR, S-O,
and DAT. To access this menu, press ⑥ or select
1sec-Keys in the MENU screen.

MSR **key settings**

To change settings for the MSR1 and MSR2 keys,
press ① or select [MSR] in the 1sec-Keys menu.

There are two [MSR] keys:

Measure mode
1. MSR1
2. MSR2
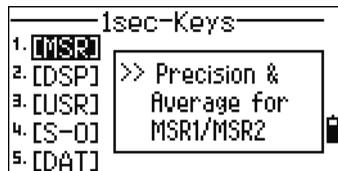
– To change the settings for the [MSR1] key, press [1] or select MSR1.

– To change the settings for the [MSR2] key, press [2] or select MSR2.
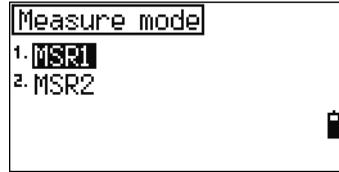
Each [MSR] key has five settings.

In the Const and AVE fields, use the numeric keys to enter values. In the other fields, use [<] or [>] to change the settings.

<MSR1>
    Target : Prism
    Const : 0   mm
    Mode : Normal
    AVE : 3
Rec mode : ALL
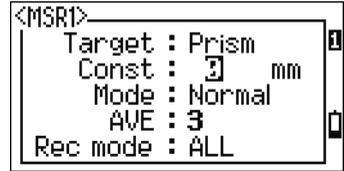
Tip – You can also access the settings screen by holding down [MSR1] or [MSR2] for one second.

[DSP] **key settings**

To change the display items in the BMS and in Stakeout observation screens, press [2] or select [DSP] in the 1sec-Keys menu.

1sec-Keys
1. [MSR]
2. [DSP] >> Change
3. [USR]   DSP formats
4. [S-O]   in BMS/S-O
5. [DAT]
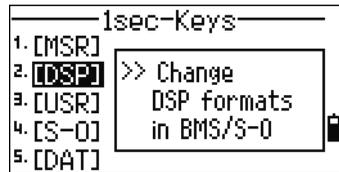
To move the cursor, use [<], [>], [^], or [v]. To change the display item, press either the ↻ softkey or the ↺ softkey.

To save the changes, press [ENT] at the last line of <DSP3> or press the Save softkey.

<DSP1>—<DSP2>—<DSP3>
    HA   HA   AZ
    VA   VD   V%
    SD   HD   HD
* Change item by ↻ / ↺
                ↻   ↺   Save
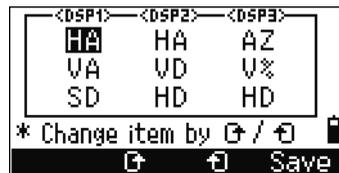
Tip – You can also access the DSP settings screen by holding down [DSP] for one second.

[USR] **key settings**

To change the functions that are assigned to the
[USR1] and [USR2] keys, press [3] or select [USR] in
the 1sec-Keys menu.

```
------1sec-Keys------
1. [MSR]
2. [DSP]  >> Assign a
3. [USR]     Function to
4. [S-O]     each USR key
5. [DAT]
```

There are two [USR] keys. The function that is
assigned to each key appears beside the key name.

```
USR Key
1. USR1 <Area & Perim>
2. USR2 <Target>
```

    – To change the settings for the [USR1] key,
       press [1] or select USR1.

    – To change the settings for the [USR2] key,
       press [2] or select USR2.
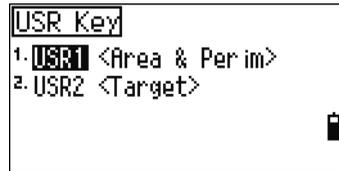
In the Select Functions screen, the asterisk (*)
indicates the function that is currently assigned to
the key.

To highlight a function, use [∧] or [∨]. To assign that
function to the selected [USR] key, press [ENT].

```
USR1 Select Functions
* Cogo  →
  O/S   →
  PRG   →
  Temp-Press
  Note
```
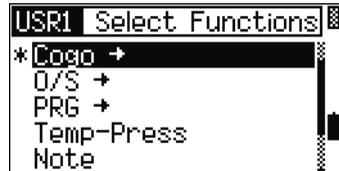
[S-O] **key settings**

To enter the Stakeout settings screen, press [4] or
select [S-O] in the 1sec-Keys menu.

```
------1sec-Keys------
1. [MSR]
2. [DSP]  >> Add const &
3. [USR]     Distance Guide
4. [S-O]     by LG
5. [DAT]
```
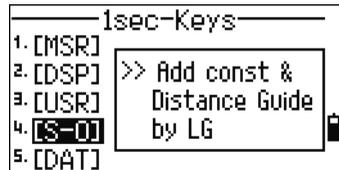
There are two Stakeout settings. For more
information, see Stakeout, page 138.

```
<Stakeout>
   Add PT : 1000
   LG Dist : 0.10 m
```
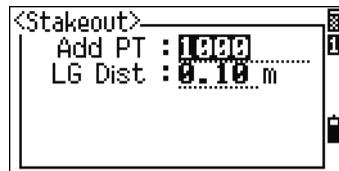
DAT key settings

1. To change the settings for the DAT key, press
   5 or select [DAT] in the 1sec-Keys menu.

   ```
   ------1sec-Keys------
   1. [MSR]
   2. [DSP]  >> Set Data type
   3. [USR]     to view it by
   4. [S-O]     one-touch key
   5. [DAT]
   ```
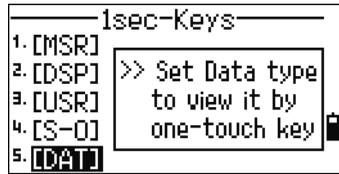
   The asterisk (*) indicates the currently
   selected view format.

2. To move the cursor, use ∧ or ∨.
3. To change the format displayed by DAT, press
   ENT.

   ```
   DAT Select Format
   * 1. DAT [MENU]
     2. RAW data
     3. XYZ data
     4. Station→SS/SO/CP
   ```
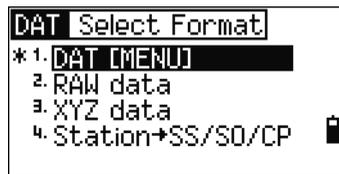
Calibration

Use the Calibration screen to calibrate the
instrument. To open the Calibration screen, press
7 or select Calibrat. on the MENU screen.

For more information, see Adjusting, page 172.

```
------MENU------
1. Job      6. 1sec-Keys
2. Cogo     7. Calibrat.
3. Settings 8. Time
4. Data
5. Comm.
```

Time

Use the Date & Time screen to set the current date
and time.

1. To open the Date & Time screen, press 8 or
   select Time on the MENU screen.

   ```
   ------MENU------
   1. Job      6. 1sec-Keys
   2. Cogo     7. Calibrat.
   3. Settings 8. Time
   4. Data
   5. Comm.
   ```

   The current date and time settings are
   displayed.

2. Enter the date in Year-Month-Day format. For
   example, to change the date to June 18, 2002,
   press
   2 0 0 2 ENT 6 ENT 1 8 ENT.

   ```
   <Date&Time>
    Date: 2002-06-24
    Time: 08:15

   * Year-Month-Day order
   ```
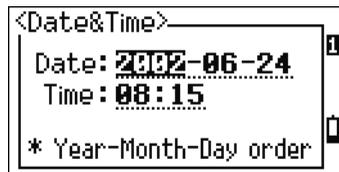
If the highlighted part of the field (for example, the year) is already correct, you can just press ENT to use the current value. For example, if the date is already set to June 24, 2002, and you want to change the date to June 18, 2002, press ENT ENT 1 8 ENT.

3. To move to the Time field, press ENT in the Date field.

4. Enter the time in 24-hour format. For example, to set the time to 4:35 PM, press 1 6 ENT 3 5 ENT.

```
<Date&Time>──────────┐
 Date: 2002-06-24
 Time: 18:15
 * In 24-hour system
```

5. Do one of the following:

– To finish setting the date and time, press ENT in the Minutes field.

– To cancel the input, press ESC.
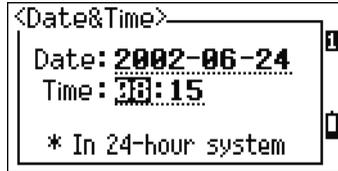
Checking and Adjustment

In this chapter:

- Checking and Adjusting the Plate Level
- Checking and Adjusting the Circular Level
- Checking and Adjusting the Optical Plummet
- Zero Point Errors of Vertical Scale and Horizontal Angle Corrections
- Checking the Instrument Constant

Checking and Adjusting the Plate Level

The axis of the plate level vial must be at right angles to the vertical axis of the instrument.

To check and adjust the plate level:

1. Set up the instrument on the tripod.

2. Follow the leveling procedures described in Leveling, page 16.

3. Rotate the alidade 180°.

4. Check whether the bubble is in the center of the vial.

5. If the bubble is not in the center of the vial, adjust the plate level:

   a. Using the adjusting pin supplied, rotate the plate level's adjustment screw until the bubble has moved half of the distance back to the center.

   b. Using leveling screw A, move the bubble into the center of the vial.

   c. Repeat from Step 4.
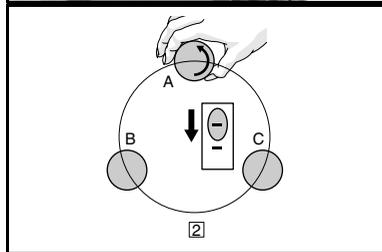
Checking and Adjusting the Circular Level

Once you have checked and adjusted the plate level, check the circular level.

If the bubble is not in the center of the level, use the adjusting pin to rotate the three adjustment screws until the bubble is centered.
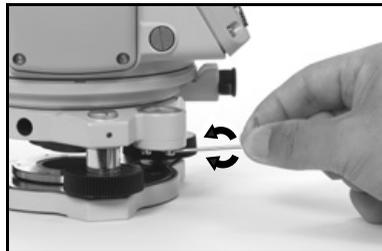
Checking and Adjusting the Optical Plummet

The optical axis of the plummet must be aligned with the vertical axis of the instrument.

To check and adjust the optical plummet:

1. Place the instrument on the tripod. You do not have to level the instrument.

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

While you are looking through the optical plummet, adjust the leveling screws until the image of the X is in the center of the reticle mark ⊙.

3. Rotate the alidade 180°.

If the marked image is in the same position in the center of the reticle mark, no adjustment is required.
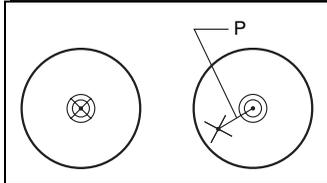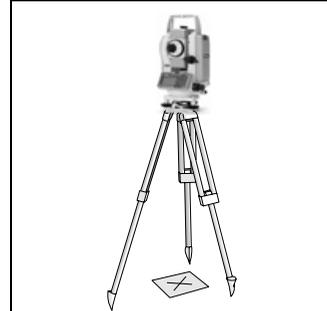
4. If the image is not in the same position, adjust the optical plummet:

a. Use the supplied hexagonal wrench to turn the adjustment screws until the image of the X is in Position P. Position P is the center point of the line connecting the X and the center of the reticle mark ⊙.

b. Repeat from Step 2.

Zero Point Errors of Vertical Scale and Horizontal Angle Corrections

Checking

1. Set up the instrument on the tripod.
2. Follow the leveling procedures described in Leveling, page 16.
3. Flip the telescope to the Face-1 position.
4. Sight a target that is within 45° of the horizontal plane.
5. Read the vertical angle from the VA1 field in the Basic Measurement Screen (BMS).
6. Rotate the instrument 180° and flip the telescope to the Face-2 position.
7. Read the vertical angle from the VA2 field.
8. Add the two vertical angles together, VA1 + VA2.
   – No adjustment is required if the zero reference for vertical angles (VA zero setting) is set to Zenith, and VA1 + VA2 equals 360°.
   – No adjustment is required if the zero reference for vertical angles (VA zero setting) is set to Horizon, and VA1 + VA2 is either 180° or 540°.
   – An adjustment is required if VA1 + VA2 is not one of the values listed above.

*Note – The difference between the vertical angle reading the relevant angle (either 360° for Zenith, or 180° or 540° for Horizon) is called the **altitude constant**.*

Adjusting

To enter the calibration screen, press [MENU] and [7].

```
┌──────MENU──────┐
│¹·Job      ⁶·1sec-Keys│
│²·Cogo     ⁷·Calibrat.│
│³·Settings ⁸·Time  │
│⁴·Data           │
│⁵·Comm.          │
└─────────────────┘
```

1. The NPL-362/352 has two-axis level compensation. Take an F1 measurement to a target on the horizon. Press [ENT].

   The vertical angle is shown in the V0 dir= Horiz setting.

   VA1   Face-1 vertical angle (tilt-off value)

   HA1   Face-1 horizontal angle (tilt-off value)

```
┌─────────────────┐
│X1: 520″ Y1: -125″│
│VA1:   0°03′12″5 │
│HA1:120°50′47″0  │
│* Sight P1 (F1)   │
│& Press [ENT]  ⋯⋯P1│
└─────────────────┘
```
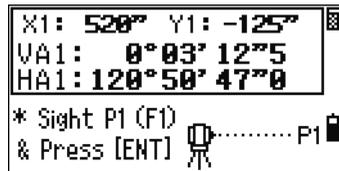
X1   Face-1 X axis tilt value

Y1   Face-1 Y axis tilt value

When you have taken the measurement, the message on the bottom line changes from DO NOT TOUCH! to Turn to F2.

```
X1: 520"  Y1: -125"   ▧
||A1:    0°03'12"5
      Turn to F2
     Sight P1
& Press [ENT]  ▯ ········· P1 ▮
              ж
```
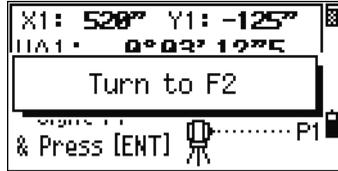
2. Take an F2 measurement to the same target. Press ENT.

```
X2: -120"  Y2:  213"  ▧
VA2: 180°03' 06"5
HA2: 300°50' 39"0
* Sight P1 (F2)
& Press [ENT]  ▯ ········· P1 ▮
              ж
```
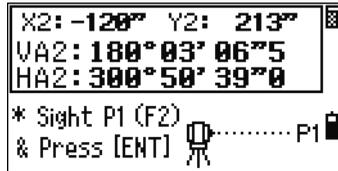
The NPL-332 has vertical axis adjustment only. The header displays Tilt instead of X and Y. Otherwise, the calibration procedure is the same.

```
Tilt: -125"           ▧
VA1:    0°03' 12"
HA1: 120°50' 47"
* Sight P1
& Press [ENT]  ▯ ········· P1 ▮
              ж
```
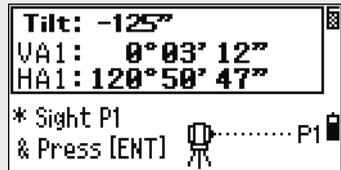
VA2   Face-2 vertical angle (tilt-off value)

HA2   Face-2 horizontal angle (tilt-off value)

X2   Face-2 X axis tilt value

Y2   Face-2 Y axis tilt value

When the observation on F2 is completed, four parameters are displayed.

3. Do one of the following:

– To return to the first observation screen, press ESC or the Redo softkey.

– To set parameters on the instrument, press ENT or the OK softkey.

Checking the 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. The instrument constant is set by the manufacturer before the instrument is shipped. However, to ensure the highest operational accuracy, we recommend that you check the instrument constant several times a year.

To check the instrument constant, you can either compare a correctly measured base line with the distance measured by the EDM, or follow the procedure below.
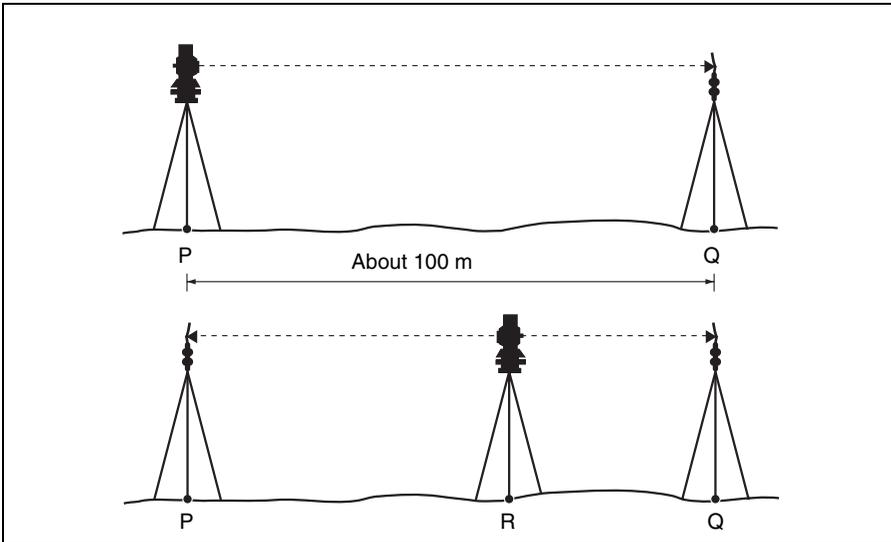
To check the instrument constant:

1. Set up the instrument at Point P, in as flat an area as possible.

2. Set up a reflector prism at Point Q, 100 m away from Point P. Make sure that you take the prism constant into account.

3. Measure the distance between Point P and Point Q (PQ).

4. Install a reflector prism on the tripod at Point P.

5. Set up another tripod at Point R, on the line between Point P and Point Q.

6. Transfer the NPL-302 instrument to the tripod at Point R.

7. Measure the distance from Point R to Point P (RP), and from Point R to Point Q (RQ).

8. Compare the value of PQ to the value RP + RQ. The difference should be within the specified range of error for the instrument (±3 mm + 2 ppm × distance).

9. At 100 m distance, the error range is ±3.2 mm. If the error is out of range, contact your dealer.

10. Move the NPL-302 to other points on the line between Point P and Point Q.

11. Repeat Step 5 through Step 10 several times.

12. Calculate the average of all the values of RP, and the average of all the values of RQ.

13. Compare the value of PQ to averaged RP + averaged RQ. The difference should be within the specified range of error for the instrument (±3 mm + 2 ppm × distance).

At 100 m distance, the error range is ±3.2 mm. If the error is out of range, contact your dealer.

Specifications

In this chapter:

- Main Body
- Standard Components
- External Device Connector

Main Body

Telescope

Tube length	153 mm (6.02 in.)
Magnification	26×
Effective diameter of objective	40 mm (1.57 in.) EDM 50 mm (1.97 in.)
Image	Erect
Field of view	1°30' 2.6 m at 100 m (2.6 ft at 100 ft)
Resolving power	3.0"
Focusing distance	1.6 m to infinity (63 in. to infinity)
Focusing method	Anallactic focusing

EDM

Distances shorter than 1.6 m (5.25 ft) cannot be measured with this EDM.

Measurement range with no haze, visibility over 40 km (25 miles)	
Prism Mode	
Reflector sheet (5 cm x 5 cm)	300 m (984 ft)
Mini prism	3,000 m (9,800 ft)
Standard prism (1P)	5,000 m (16,400 ft)
Reflectorless mode	
Reference target	200 m (656 ft)

- The target should not receive direct sunlight.
- "Reference target" refers to a white, highly reflective material.
- For measurements at short range (approximately 1.6 m to 5 m (5.2 ft to 16.4 ft) to the mini prism, or 1.6 m to 10 m (5.2 ft to 33 ft) to the standard prism), it is recommended that you use a Nikon original prism to maintain accuracy.

Dual-axis tilt sensor (NPL-332 single-axis)

Method	Liquid-electric detection
Compensation range	±3'

Angle measurement

Reading system	Photoelectric incremental encoder
NPL-352	Diametrical reading on HA Single reading on VA
NPL-332	Single reading on HA/VA
Circle diameter (reading)	88 mm (3.46 in.) (79 mm (3.11 in.))
Minimum display increment	
360°	1"/5"/10"
400G	0.2 mgon/1 mgon/2 mgon
MIL6400	0.005 MIL/0.02 MIL/0.05 MIL
DIN18723 accuracy	NPL-362: 3"/1.0 mgon NPL-352/332: 5"/1.5 mgon

Precision

Precise mode	
Prism	± (3 + 2 ppm × D) mm* (−10 °C to +40 °C) ± (3 + 3 ppm × D) mm* (−20 °C to −10 °C), (+40 °C to +50 °C)
Reflectorless	± (5 + 2 ppm × D) mm (−10 °C to +40 °C) ± (5 + 3 ppm × D) mm (−20 °C to −10 °C), (+40 °C to +50 °C)
Normal mode	
Prism	± (10 + 5 ppm × D) mm
Reflectorless	± (10 + 5 ppm × D) mm

* These precisions apply to measurements of 5 m (16 ft) or more to a reflector sheet and 10 m (33 ft) or more to a mini or standard prism. For measurements at shorter distances than these, the precision is ± 5 mm.

Measurement intervals

Measurement intervals may vary with the measuring distance or weather conditions.

Precise mode	
Prism	1.6 sec. (initial 2.6 sec.)
Reflectorless	1.6 sec. (initial 3.5 sec.)
Normal mode	
Prism	0.5 sec. (initial 2.2 sec)
Reflectorless	0.8 sec. (initial 3.2 sec.)
Prism offset correction	–999 mm to +999 mm (1 mm step)

Clamps/tangent screws

Type	Coaxial tangent/clamp knobs
Range	±3.5°

Tribrach

Type	Detachable

Level vial sensitivity

Plate level vial	30''/2 mm
Circular level vial	10'/2 mm

Optical plummet

Image	Erect
Magnification	3×
Field of view	5°
Focusing range	0.5 m (1.6 ft) to infinity

Display and keypad

Display type	Graphical LCD
Resolution	128 × 64
Display illumination	Backlight
Keys	25
Supplied on	NPL-362/352: face-1 and face-2 sides NPL-332: face-1 side

Connections in the base of instrument

Communications	
Type	RS-232C
Maximum baud rate	38400 bps asynchronous
External power supply input voltage	7.2 V through 11 V DC

Battery pack BC-65

Output voltage	7.2 V DC rechargeable
Continuous operation time	
Continuous distance/angle measurement	6.5 hours (Prism mode) 7.0 hours (Reflectorless mode)
Distance/angle measurement every 30 seconds	15 hours (Prism mode) 16 hours (Reflectorless mode)
Continuous angle measurement	27 hours

Tested at 25 °C (normal temperature). Operation times may vary depending on the condition and deterioration of the battery.

Environmental performance

Operating temperature range	–20 °C through +50 °C (–4 °F through +122 °F)
Storage temperature range	–25 °C through +60 °C (–13 °F through +140 °F)

Dimensions

Main unit	168 mm W × 173 mm D × 347 mm H
Carrying case	470 mm W × 350 mm D × 231 mm H

Weight

Main unit	5.4 kg (11.90 lbs), approx.
Battery BC-65	0.4 kg (0.88 lbs), approx.
Carrying case	4.4 kg (9.7 lbs), approx.
Quick charger Q-75U/E	0.45 kg (0.99 lbs)

Standard Components

- NPL-362/352/332 main body
- Battery pack BC-65
- Quick charger Q-75U or Q-75E
- Tool set
- Objective lens cap
- Vinyl cover
- *Pulse Laser Station NPL-302 Series Instruction Manual* (this document)
- Carrying case
- Shoulder strap

External Device Connector

This connector can be used to connect to an external power source or to communicate with an external device.

Before using the external device connector, make sure that the external device meets the specifications below.

Input voltage	7.2 V to 11 V DC
System	RS-232C
Signal level	±9 V standard
Maximum baud rate	38400 bps asynchronous
Compatible male connector	Hirose HR10A-7P-6P or HR10-7P-6P

⚠ **Caution –** Except for the connection shown in Figure 8.1 on page 186, use of this connector is at your own risk.

⚠ **Caution –** Use only the male connectors specified above. Using other connectors will damage the instrument.

The external device connector is a Hirose HR 10A-7R-6S female connector. The pinouts for connecting it to an external device connector are shown below:

Pin	Signal	Description
1	RxD	Receive data (Input)
2	TxD	Send data (Output)
3	+	Power
5	–	Ground
4, 6		No connection
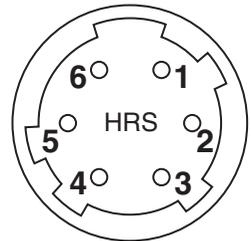
⚠ **Caution –** Use only the pin connections shown above. Using other connections will damage the instrument.

To connect to an external power source, supply power to Pin 3 (power terminal) and Pin 5 (ground terminal) on the instrument. The instrument will use the external power source even if the carrying handle battery BC-65 is attached.

⚠️ **Caution –** Make sure that the power supplied is within the rated input range (7.2 V to 11 V, 1 A maximum). Power supplied outside this range will damage the instrument.

To communicate with an external device, connect the RS-232C signal from the external device to Pin 1 (input terminal) and to Pin 2 (output terminal) on the instrument.

Cap the data output/external power input connector securely while not in use. The instrument is not watertight if the cap is not attached or not attached securely, and when the data output/external power input connector is in use.

The instrument can be damaged by static electricity from the human body discharged through the data output/external power input connector. Before handling the instrument, touch any other conductive material once to remove static electricity.

System Diagrams

In this chapter:

■ System Components

System Components

Tubular
compass

Tubular compass
attachment

Battery charger
type Q-B4U/B4E
(with power cord)

115V, 220/240V Quick charger
Q-75U (115V), Q-75E (220/240V)

External battery
cord tyoe B4-2

External
Ni-Cd battery
type B4E

NPL-302 series

Diagonal
eyepiece

Zenith prism

NPL/PC connecting
cable (9 pin/25 pin)

Personal
computer
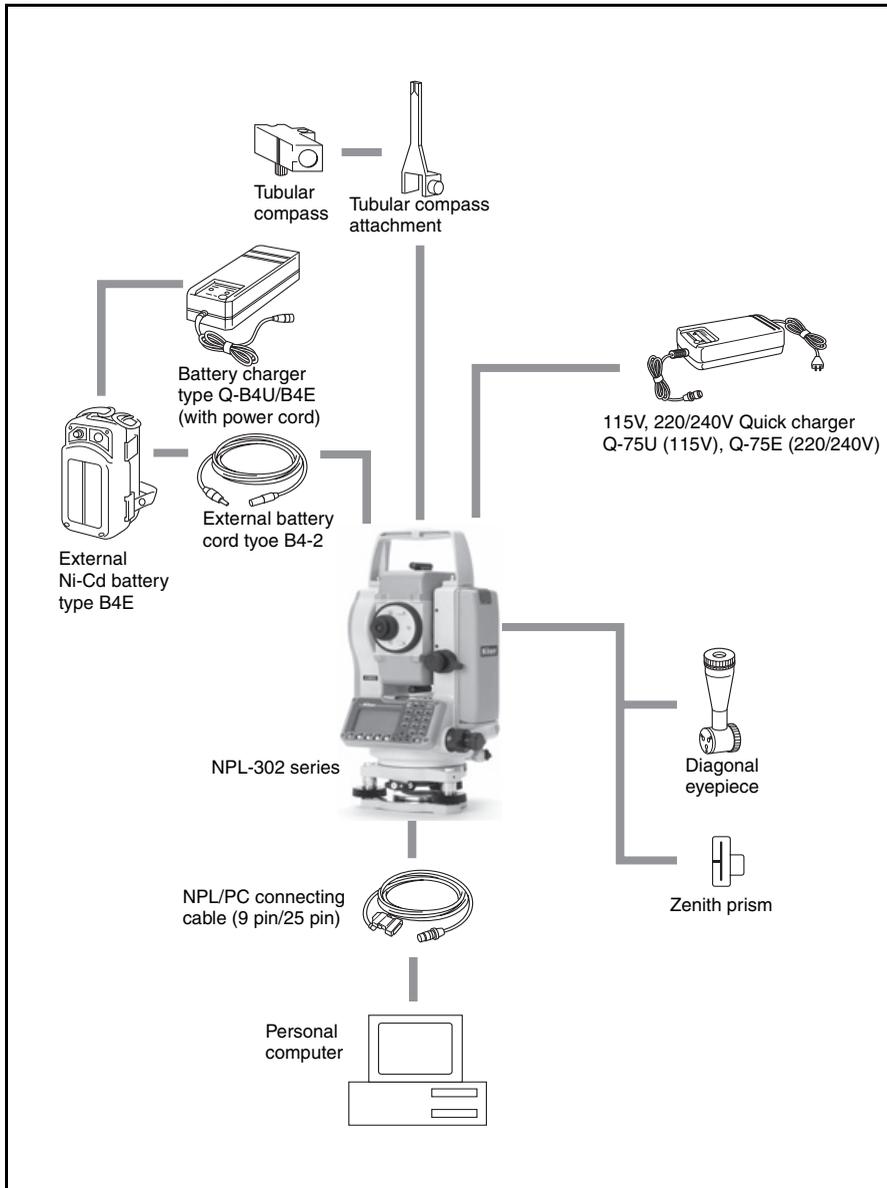
Figure 8.1   Measurement side
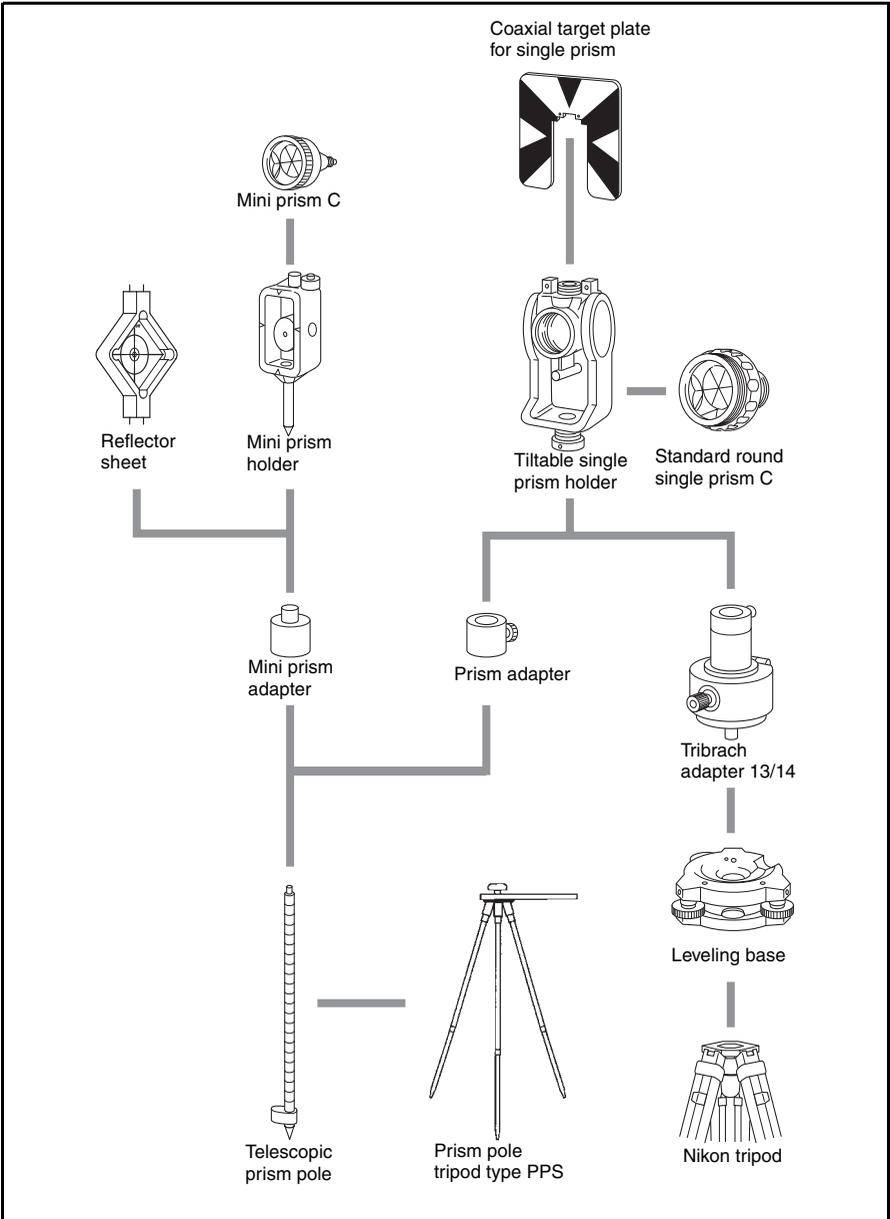
Figure 8.2   Prism reflector side

Communications

In this chapter:

■ Uploading Coordinate Data

■ Uploading Point Lists and Code Lists

■ Downloading Data

Uploading Coordinate Data

Settings

To configure the transmission speed and other settings, go to MENU > Settings > Comm. For more information, see Communications, page 138.

```
<Communication>
 Ext.Comm : NIKON
     Baud : 38400
   Length : 8
   Parity : None
 Stop bit : 1
```

Record format

You can upload coordinate records in the following formats:

PT	,	X	,	Y	,	Z	,	CD

PT		X		Y		Z		CD

PT	,	X	,	Y	,	Z

PT		X		Y		Z

PT	,	X	,	Y	,	,	CD

PT		X		Y		CD

PT	,	X	,	Y	,	,

PT	,	X	,	Y	,

PT	,	,	,	Z	,	CD

PT	,	,	,	Z

The record formats shown above use the following codes:

Code	Description	Length
PT	Point number	Up to 16 digits
X	Actual X coordinate	Variable length
Y	Actual Y coordinate	Variable length
Z	Actual Z coordinate	Variable length
CD	Feature code	Up to 16 characters

Data example

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

Uploading Point Lists and Code Lists

Settings

To configure the transmission speed and other settings, go to MENU > Settings > Comm. For more information, see Communications, page 138.


```
<Communication>
 Ext.Comm : NIKON
     Baud : 38400
   Length : 8
   Parity : None
 Stop bit : 1
```
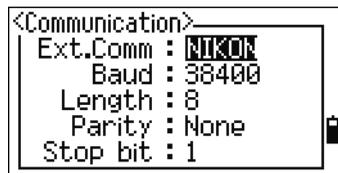
File format

PT lists and code lists use the same record format. Use the filenames POINT.LST for a PT list, and CODE.LST for a code list.

```
DEFAULT
{
    String1 , Code1
    Layer2
    {
        String2-1, Code2-1
        String2-2, Code2-2
    }
    Layer3
    {
        Layer 3-1
        {
            String3-1-1, Code3-1-1
            String3-1-2, Code3-1-2
        }
        String3-2, Code3-2
        String3-3, Code3-3
    }
    String4, Code4
    String5, Code5
    String6, Code6
    String7, Code7
}
```

The first line of the file must contain the text "DEFAULT" in capital letters.

Curly brackets { } group items together under the preceding line.

For example, Layer 3-1 contains String 3-1-1 and String 3-1-2.

Layer 3 contains the five items from Layer 3-1 to String 3-3.

"String" represents characters that are displayed on the screen. "Code" represents characters that are stored in the database.

Figure 9.1   Record format for PT lists and code lists

Data example

```
DEFAULT
{
                "STRUCTURES"
                {
                        "TREE", "S0001"
                        "FENCE", "S0002"
                        "MAIL BOX", "S0003"
                        "FLOWER BED", "S0004"
                }
                "ROADS"
                {
                        "MANHOLE", "R0001"
                        "CENTER LINE"
                        {
                                "WHITE", "R002-W"
                                "YELLOW", "R002-Y"
                        }
                        "SIDEWALK", "R0003"
                        "CROSSING", "R0004"
                        "BRIDGE", "R0005"
                        "SIGNAL", "R0006"
                        "HIGHWAY STAR", "R0007"
                }
                "RAILWAY"
                {
                        "CROSSING", "RW001"
                        "STATION", "RW002"
                        "SIGNAL", "RW003"
                        "BRIDGE", "RW004"
                        "TUNNEL", "RW005"
                }
}
```

Downloading Data

Settings

To configure the transmission speed and other settings, go to MENU > Settings > Comm. For more information, see Communications, page 138.

```
<Communication>
 Ext.Comm : NIKON
     Baud : 38400
   Length : 8
   Parity : None
 Stop bit : 1
```

Nikon raw record formats

Coordinate records

| type | , | pt | , | (pt id) | , | northing | , | easting | , | elevation | , | code |

type	One of the following codes:	
	UP	Uploaded point
	MP	Manually input point
	CC	Calculated coordinate
	RE	Resection point
pt	Point number	
(pt id)	(Point ID)	
northing	Northing of the coordinate	
easting	Easting of the coordinate	
elevation	Elevation of the coordinate	
code	Feature code	

Station records

| **ST** | , | stnpt | , | (stnid) | , | bspt | , | (bs id) | , | hi | , | bsazim | , | bsha |

ST	Station record identifier (fixed text)
stnpt	Station point number
(stn id)	(Station ID)
bspt	Backsight point number
(bs id)	(Backsight ID)
hi	Height of instrument
bsazim	Backsight azimuth
bsha	Backsight horizontal angle

Control point records

| CP | , | pt | , | (pt id) | , | ht | , | sd | , | ha | , | va | , | time | , | code |

CP	Control point record identifier (fixed text)
pt	Point number
(pt id)	(Point ID)
ht	Height of target
sd	Slope distance
ha	Horizontal angle
va	Vertical angle
time	24-hour time stamp
code	Feature code

Sideshot records

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

SS	Sideshot record identifier (fixed text)
pt	Point number
ht	Height of target
sd	Slope distance
ha	Horizontal angle
va	Vertical angle
time	24-hour time stamp
code	Feature code

Stakeout records

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

SO	Stakeout record identifier (fixed text)
pt	Recorded point number
(sopt)	(Original number of point staked)
ht	Height of target
sd	Slope distance
ha	Horizontal angle
va	Vertical angle
time	24-hour time stamp

F1/F2 records

face	,	pt	,	ht	,	sd	,	ha	,	va	,	time

face	One of the following:
	F1 Shot taken using Face-1 (fixed text)
	F2 Shot taken using Face-2 (fixed text)
pt	Point number
ht	Height of target
sd	Slope distance
ha	Horizontal angle
va	Vertical angle
time	24-hour time stamp

Comment/note records

CO	,	text

CO	Comment record identifier (fixed text)
text	Comment text

SDR2x and SDR33 record formats

Header record

00NM	ver	0000	datetime	ang	dist	press	temp	coor	1

1–4	**00NM**	Header record identifier (fixed text)
5–20	ver	SDR download version. One of the following:
		SDR20V03-05 SDR2x
		SDR33V04-01 SDR33
21–24	**0000**	Not used
25–40	datetime	Download date and time (in hours and minutes)
41	ang	Angle units. One of the following:
		1 Degrees
		2 Gons
		4 Mils
42	dist	Distance units. One of the following:
		1 Meters
		2 Feet
43	press	Pressure units. One of the following:
		1 mm Hg
		2 In. Hg
		3 hPa
44	temp	Temperature units. One of the following:
		1 Celsius
		2 Fahrenheit
45	coor	Coordinate order. One of the following:
		1 NEZ
		2 ENZ
46	**1**	Not used

Instrument record

01KI1	instr	serNo	Instr	serNo	1	zero VA	**0.000**	**0.000**	**0.000**

1–5	**01KI1**	Instrument record identifier (fixed text)
6–21, 28–43	instr	Instrument make and model
22–27, 44–49	serNo	Instrument serial number
50	**1**	Not used
51	zero VA	The reference point for vertical angles. One of the following:
		1 Zenith
		2 Horizon
52–61,	**0.000**	Not used
62–71,	**0.000**	Not used
72–81,	**0.000**	Not used

Station details record

02KI	stnpt	northing	easting	elevation	hi	desc

1–4	**02KI**	Station details record identifier (fixed text)
5–8 (2x), 5–20 (33)	stnpt	Station point number
9–18 (2x), 21–36 (33)	northing	Northing of station
19–28 (2x), 37–52 (33)	easting	Easting of station
29–38 (2x), 53–68 (33)	elevation	Elevation of station
39–48 (2x), 69–84 (33)	hi	Height of instrument
49–64 (2x), 85–100 (33)	desc	Station description

Target details record

03NM	ht

| 1–4 | **03NM** | Target details record identifier (fixed text) |
| 5–14 (2x), 5–20 (33) | ht | Height of target |

Backsight bearing details record

07KI	stnpt	bspt	bsazim	ha

1–4	**07KI**	Backsight bearing details record identifier (fixed text)
5–8 (2x), 5–20 (33)	stnpt	Station point number
9–12 (2x), 21–36 (33)	bspt	Backsight point number
13–22 (2x), 37–52 (33)	bsazim	Backsight azimuth
23–32 (2x), 53–68 (33)	ha	Horizontal angle

Coordinates record

08KI	pt	northing	easting	elevation	desc

1–4	**08KI**	Coordinates record identifier (fixed text)
5–8 (2x), 5–20 (33)	pt	Point number
9–18 (2x), 21–36 (33)	northing	Northing of the coordinate
19–28 (2x), 37–52 (33)	easting	Easting of the coordinate
29–38 (2x), 53–68 (33)	elevation	Elevation of the coordinate
39–54 (2x), 69–84 (33)	desc	Feature code

Observation record

09MC	stnpt	pt	sd	va	ha	desc

1–4	**09MC**	Observation record identifier (fixed text)
5–8 (2x), 5–20 (33)	stnpt	Station point number
9–12 (2x), 21–36 (33)	pt	Observed point number
13–22 (2x), 37–52 (33)	sd	Slope distance
23–32 (2x), 53–68 (33)	va	Vertical angle
33–42 (2x), 69–84 (33)	ha	Horizontal angle
43–58 (2x), 85–100 (33)	desc	Feature code

Job identifier record

10NM	jobid	**1**	incZ	T&Pcorr	C&Rcorr	refcon	sealev

1–4	**10NM**	Job identifier record ID (fixed text)
5–8 (2x), 5–20 (33)	jobid	Job name/title

Note – The following fields occur only in SDR33 format.

21	**1**	Point ID length option
22	incZ	2D or 3D coordinates. One of the following:
		1 2D
		2 3D
23	T&Pcorr	Atmospheric correction. One of the following:
		1 Off
		2 On
24	C&Rcorr	Curvature and refraction correction. One of the following:
		1 Off
		2 On
25	refcon	Refraction constant. One of the following:
		1 0.132
		2 0.200
26	sealev	Sea level correction. One of the following:
		1 Off
		2 On

Note record

13NM	note

1–4	**13NM**	Note record ID (fixed text)
5–64	note	Note text

Data examples

Nikon raw data format

CO,Nikon RAW data format V2.00
CO,B: EXAMPLE5
CO,Description: SAMPLE DATA OF DOWNLOAD
CO,Client: NIKON
CO,Comments: YOKOHAMA PLANT
CO,Downloaded 22-JUL-2002 18:56:10
CO,Software: Pre-installed software version: 1.10
CO,Instrument: Nikon NPL-352
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 22-JUL-2002 07:09:21
MC,1,,100.000,200.000,10.000,
CO,Temp:20C Press:760mmHg Prism:0 22-JUL-2002 07:11:34
ST,1,,,,1.400,55.4500,55.4500
F1,,,,0.0000,90.0000,8:27:58
SS,3,1.200,330.706,326.027,20.320,07:13:46,SIGN
SS,4,1.250,379.193,300.847,29.084,07:14:24,TREE
SS,5,1.218,363.344,328.032,30.105,07:14:57,TREE R
SO,1003,,1.240,331.220,326.783,19.998,07:18:17,

Nikon coordinate data format

1,100.0000,200.0000,10.0000,
2,200.0000,300.0000,20.0000,
3,116.9239,216.9140,11.8425,TRAIN PLATFORM
4,126.6967,206.2596,11.2539,RAMP
11,100.0045,199.9958,10,0000,
13,116.9203,216.9113,11.7157,
14,126.6955,206.2579,10.9908,
21,100.0103,199.9958,10.0000,
31,100.0013,200.0005,10.0000,
41,100.0224,200.0331,9.9000,
43,116.9263,216,9165,11.8016,CURB
44,126.7042,206.2871,10.8193,DITCH
45,116.9266,216.9160,11.8028,
46,126.7046,206.2845,10.8213,CP POINT

SDR2x raw data format

```
00NMSDR20V03-05     000023-Jul-2002 18:39:111211
10NMTEST JOB
01KI1  Nikon NPL352000000  Nikon NPL35200000012 0.000 0.000 0.000
13NMDownloaded 23-Jul-2002 18:39:22
13NMSftware: Pre-installed software version: 1.10
13NMInstrument: Nikon NPL-352
13NMDist Units: Metres
13NMAngle Units: Degrees
13NMZero azimuth: North
13NMZero VA: Horizon
13NMCoord Order: NEZ
13NMClient:
13NMDescription:
13NM P_509 <JOB> Created 23-Jul-2002 07:09:21
08KI0001100.000  200.000   10.000
08KI0002200.000  300.000   20.000
02KI0001100.000  200.000   10.000   0.100
07KI0001000245.0000  0.0000
13F100000002<null>  <null>  0.0000
13F200000002<null>  <null>  179.9639
13NMBS Check HA:359.3525  Reset to HA: 0.0000     07:21:41
13F10000000323.990   4.1694  0.0000
13F20000000323.990   175.8403  180.0028
03NM0.000
13F10001000323.990   4.1653   359.9833  MAIN PLATFORM
13F10001000427.445   2.4097   328.1958  RAMP
13NMStart of 2-Pt Resection
13F10000000427.445   2.4097   0.0000
13F10000000323.991   4.1542   31.8042
13F10000000427.430   1.8583   121.4306
13F10000000323.976   3.8625   153.2306
08KI0011100.005  199.996  10.000
02KI0011100.005  199.996  10.000   0.100
07KI0011000344.9980  0.0000
```

SDR2x coordinate data format

```
00NMSDR20V03-05     000023-Jul-2002 18:40:111211
10NMTEST JOB
01KI1  Nikon NPL352000000  Nikon NPL35200000012 0.000 0.000 0.000
13NMDownloaded 23-Jul-2002 18:40:06
13NMSftware: Pre-installed software version: 1.10
13NMInstrument: Nikon NPL-352
13NMDist Units: Metres
13NMAngle Units: Deqrees
13NMZero azimuth: North
13NMZero VA: Horizon
13NMProjection correction: OFF
13NMC&R correction: OFF
13NMSea level correction: OFF
13NMCoord Order: NEZ
13NMClient:
13NMDescription:
13NMTilt Correction:  VA:OFFHA:OFF
13NM P_0509 <JOB> Created 23-Jul-2002 07:09:21
13NMPrism constant: 0
08KI0001100.000   200.000   10.000
08KI0002200.000   300.000   20.000
13NMBacksight Check to Pt:2     HA:359.3525     07:21:39
13NMBacksight Pt:2        Reset to HA:  0.0000     07:21:41
08KI0003116.924   216.914   11.843   MAIN PLTFORM
08KI0004126.697   206.260   11.254   RAMP
13NMStart of 2-Pt Resection
08KI0011100.005   199.996   10.000
```

Error Messages

In this chapter:

- ■ Angle
- ■ Cogo
- ■ Communications
- ■ Data
- ■ External Communication
- ■ Job Manager
- ■ Programs
- ■ Recording Data
- ■ Reflectorless Mode Measurement
- ■ Searching
- ■ Settings
- ■ Stakeout
- ■ Station Setup

Angle

`STN Setup has to be in F1/F2`
You selected `ANG>F1/F2` without an F1/F2 measurement in Station Setup.

Press any key to return to the previous screen. Then go to Station Setup and take F1/F2 measurement to the BS.

Cogo

`NO Result`
The system was unable to calculate an area because points were not entered in the correct order.

Press any key to return to the Cogo menu. Then enter the points in the correct order.

`Same Coordinate`
The point or coordinate that you entered is identical to the previous input point.

Press any key to return to the point input screen. Then use a different point.

`XY-coordinate is required`
The input point does not have XY (NE) coordinates.

Press any key to return to the point input screen. Then enter a point that has X and Y coordinates.

Communications

If an error is detected during uploading of data, the instrument aborts the upload process and displays one of the following messages.

`Check Data`
There are errors in the uploaded data. The uploaded data contains errors, such as an alphabetic character in a coordinate field.

Press any key. Then check the specified line in the data.

`DUPLICATE PT`
The uploaded data contains a duplicate PT.

Press any key. Then check the specified point in the data.

⚠ **Caution –** If the existing point is a UP, CC, or MP record, and is not referred by ST or BS, then it will be overwritten by the uploaded record. No error message appears.

`PT MAX16 chars`
The uploaded data contains a PT with a name or number that is longer than 16 digits.

Press any key. Then check the specified line in the data.

`XYZ OVERRANGE`
The uploaded data contains a coordinate that is longer than 13 digits.

Press any key. Then check the specified line in the data.

Data

`Can't Edit Current ST`
You have tried to edit the current ST.

Note – You cannot edit the current ST. However, old ST records can be edited. No recalculation can be performed on the instrument.

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

`Can't Edit ST/BS refer to this PT`
You have tried to edit a coordinate that the current ST or BS refers to. You cannot change a coordinate if the current ST or BS refers to it.

Press any key to return to the Data view screen.

`Can't Edit XYZ from measurement`
You have tried to change the coordinates of an SO, SS, or CP record. You cannot change the coordinates of an SO, SS, or CP record.

Press any key to return to the previous screen.

DELETE Stn-XYZ
You have tried to delete a coordinate record that the current ST or BS refers to. You must confirm that you want to delete a coordinate record that the current ST or BS refers to.

To ...	Press ...
delete XYZ	the DEL softkey
return to the previous screen without deleting XYZ	[ESC] or the Abrt softkey

External Communication

If an error is detected when receiving a command from an external communication line, the process aborts and the error message appears for a few seconds.

REMOTE ERROR
There is an error in a parameter in the external command. The command line appears on the bottom line.

Contact the company that supplied your data recorder or external communications software and report the command that appears on the bottom line.

Job Manager

Cannot Assign
You have tried to set the current job as the control file.

Press any key to return to the previous screen. Then select a different job.

Can't Create
There is no space available to create a job or record a point.

Press any key to return to the Job Manager. Then use the DEL softkey to delete old jobs.

Existing Job
You have entered an existing job name for a new job.

Press any key and then change the name for the new job.

MAX 32Jobs

You are trying to create a new job when the maximum number of jobs (32) is already stored.

Press any key to return to the Job Manager. Then use the DEL softkey to delete old jobs.

Programs

NO Stn Setup

You did not perform a station setup or BS check before entering the Programs function.

To ...	Press ...
go to the Stn Setup menu	[2] or select Stn Setup
return to the BMS	[ESC]
go to the Programs menu	[1] or select Continue

⚠ **Warning –** Selecting Continue does *not* resume the last ST record. You should only use the Continue option if you are sure that the previous ST coordinates and the current HA orientation are correct. Otherwise, records in the Programs function may not be correct.

XY&Z coordinate are required

Three-dimensional coordinates are required in S-Plane function.

Press any key to return to the point input screen. Then enter a three-dimensional point.

Recording Data

DATA FULL
The data storage is full.

Press any key to return to the Basic Measurement Screen (BMS). Then:

To ...	Go to ...
delete unnecessary data	MENU > Data
delete jobs	MENU > Job

DUPLICATE PT
The input PT you are trying to record already exists in the current job. An existing coordinate record cannot be overwritten by measured data.

Press any key to return to the point input screen. Change PT.

Duplicate PT
The input PT you are trying to record already exists in the current job as an SS, SO, or CP record. An existing SS, SO, or CP record can be overwritten by measured data.

To ...	Press ...
return to the PT input screen	[ESC] or the Abrt softkey
record RAW data and update XYZ data	the XYZ softkey
record RAW data only	the RAW softkey

No Open Job
No job is open.

To ...	Press ...
open the job list, if there are existing jobs	[1] or select Select job
create a new job	[2] or select Create job
return to the previous screen	[ESC]

`NO Stn Setup`
There is no station record in the current job, or a station setup or BS check has not been done since the program was rebooted.

To ...	Press ...
continue recording	① or select `Continue`. If there is already an ST record in the job, the message `CO, Use current orientation` appears.
go to the Stn Setup menu	② or select `STN Setup`
return to the previous screen	(ESC)

`OVER RANGE`
You are trying to record a coordinate with more than 13 digits

Press any key to return to the previous screen. Then check the current ST coordinate.

Reflectorless Mode Measurement

`Signal High!`
Excessive signal is received for the Reflectorless mode measurement.

Press (Esc) and change Reflectorless mode (Target=N-Prism) to Prism mode (Target=Prism) by holding down the (MSR1) or (MSR2) key for one second,

Searching

`PT Not Found`
There is no point that matches the criteria you entered.

Press any key to return to the point input screen.

This message may appear in any function where the PT/CD is input, such as Station Setup or Stakeout.

Settings

`Job Settings will be changed`
You have changed one or more of the following job settings:

- VA zero or HA in the Angle screen (see Angle, page 135)
- Scale, T-P, Sea Lvl, or C&R in the Distance screen (see Distance, page 136)
- Coord or Az Zero in the Coordinates screen (see Coordinate, page 138)
- Angle, Dist, Temp, or Press in the Unit screen (see Unit, page 139)

To ...	Press ...
discard the changes to the job settings	[ESC] or the `Abrt` softkey. The current job remains open.
close the current job and save the changes to the job settings	[ENT] or the `OK` softkey

Note – To record a point using the new settings, create a new job using the new settings.

Stakeout

`Input Error`
The point name style used in the Fr field is not the same as the style used in the To field. For example, the Fr field style is 1, and the To field style is A200.

Press any key to return to the Fr/To input screen. Then re-enter the point name, using the same naming style in both fields.

`NO Stn Setup`
You did not perform a station setup or BS check before entering the Stakeout function.

To...	Press ...
go to the Stn Setup menu	[2] or select `Stn Setup`
return to the Basic Measurement Screen (BMS)	[ESC]
go to the Stakeout menu	[1] or select `Continue`

⚠ **Caution –** Selecting `Continue` does *not* resume the last ST record. You should only use the `Continue` option if you are sure that the previous ST coordinates and the current HA orientation are correct. Otherwise, records in the Stakeout function may not be correct.

Station Setup

`Calc ST Failed Need additional PT`
Calculating ST failed in resection. This message may appear after you have deleted a point the View shots screen.

Press any key to return to the PT input screen. Take another shot to calculate the ST coordinate.

`Same Coordinate`
The input PT or coordinate is identical to the current station in STN/1:Known, or the same coordinate or point name/number is found in Resection.

Press any key to return to the PT input screen. Then use a different PT.

`Space LOW`
There is not enough space to record a station when you start any of the Station Setup functions.

To ...	Press ...
return to the BMS	press ESC or the `Abrt` softkey. Use the `DEL` softkey in Job Manager to delete old jobs.
continue	press ENT or the `OK` softkey. You may not be able to record the whole process.

`XY-coordinate is required`
The input point for ST/BS does not have N/E coordinates.

Press any key to return to the PT input screen. Then use a PT that has N/E coordinates.

`Z-coordinate is required`
The input point for Benchmark does not have a Z coordinate.

Press any key to return to the PT input screen. Then use a PT that has a
Z coordinate.