



USER GUIDE

Trimble® TS525 Construction Total Station



USER GUIDE

Trimble[®] TS525 Construction Total Station

Version 1.20
Revision A
March 2008



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Release Notice

This is the March 2008 release (Revision A) of the *Trimble TS525 Construction Total Station User Guide*. It applies to version 1.20 of the TS525 Construction Total Station.

Manufacturer

Nikon-Trimble Co., Ltd.
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16-2, Minamikamata 2-chome, Ota-ku
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Product Limited Warranty Information

For applicable product Limited Warranty information, please refer to the Limited Warranty Card included with this Trimble product, or consult your local Trimble authorized dealer.

Notices

Class B Statement – Notice to Users. This equipment has been tested and found to comply with the limits for a Class B digital device, 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 communication. 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 the 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.

Changes and modifications not expressly approved by the manufacturer or registrant of this equipment can void your authority to operate this equipment under Federal Communications Commission rules.



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.

Canada

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

Europe

This product has been tested and found to comply with the requirements for a Class B device pursuant to European Council Directive 2004/108/EC on EMC, thereby satisfying the requirements for CE Marking and sale within the European Economic Area (EEA). These requirements are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential or commercial environment.



Representative in Europe

Trimble GmbH
Am Prime Parc 11
65479 Raunheim, Germany

Australia and New Zealand

This product conforms with the regulatory requirements of the Australian Communications Authority (ACA) EMC framework, thus satisfying the requirements for C-Tick Marking and sale within Australia and New Zealand.



Taiwan Battery Recycling Requirements

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



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Notice to Our European Union Customers

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

For your safety read the safety and warnings section and this manual carefully and thoroughly before using the Trimble® TS525 construction total station.

Although these 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 installation manual for the battery charger, and the documentation for any other equipment that you use with a Trimble TS525 construction total station.

Note – Always keep this user guide near the instrument for easy reference.

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.

Note – For warnings relating specifically to laser safety, see [Laser safety, page 5](#).



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



WARNING – The TS525 construction total station is 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 – 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 that is attached to the instrument to charge the BC-65 battery pack. Using other chargers 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 BC-65 battery pack 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 BC-65 battery pack 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 – Use of controls, adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.



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 – 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. The shoulder strap is available as an optional extra.



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 tribrach clamp knob. If the knob is not securely fastened, the tribrach 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 – The system in the instrument may stop functioning in order to avoid any errors in measurements when the instrument detects strong electromagnetic wave(s). If this happens, turn off the instrument and remove the source of the electromagnetic wave(s). Then turn on the instrument to resume the work.

Laser safety

The TS525 is a Class 3R laser instrument, in accordance with IEC60825-1, Am2 (2001): *Safety of Laser Products*.

Use of the Laser Class 3R equipment can be dangerous.

To counteract hazards, it is essential for all users to pay careful attention to the safety precautions and control measures specified in the standard IEC60825-1, (2001-08), particularly EN60825-1:1994, A11:1996, and A2:2001, as this refers to the hazard distance that is defined in this User Guide.

Note – The **hazard distance** is the distance from the laser at which beam irradiance or radiant exposure equals the maximum permissible value to which personnel may be exposed without being exposed to health risks.



WARNING – Only qualified and trained persons should be assigned to install, adjust, and operate the laser equipment.



WARNING – Areas in which these lasers are used should be posted with an appropriate laser warning sign.



WARNING – Precautions should be taken to ensure that persons do not look directly, with or without an optical instrument, into the beam.



WARNING – The laser beam should be terminated at the end of its useful beam path and should in all cases be terminated if the hazardous beam path extends beyond the limit (**hazard distance***) of the area in which the presence and activities of personnel are monitored for reasons of protection from laser radiation..



WARNING – Wherever practicable, the laser beam path should be located well above eye level.



WARNING – When the laser product is not used, it should be stored in a location where unauthorized personnel cannot gain access.



WARNING – Do not turn the Class 3R laser beam to mirror-like specular surfaces; for example, prisms, metal surfaces, or windows, even unintentionally. Special precautions should be taken to ensure eliminating such situations.



WARNING – The TS525 construction total station is a Class 3R 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.



WARNING – When used with the Reflectorless mode, the TS525 construction total station is a Laser Class 3R instrument.
When used with the Prism mode, the TS525 construction total station is a Laser Class 1 instrument.
Do **not** sight the Prism by the Reflectorless mode.

Specifications for laser emission

Wave length	630-680 nm
Laser pointer: CW	$P_o \leq 4.75\text{mW}$
Measurement in reflectorless mode	Pulse
	$P_p \leq 8.75\text{ mW}$
	$P_o \leq 4.75\text{mW}$
	1.2 nsec/400 MHz - 1.6 nsec/320 MHz

Conforming standards

EU	EN60825-1/Am.2:2001 (IEC60825-1/Am.2:2001), class 3R
USA	FDA21CFR Part 1040 Sec.1040.10 and 1040.11
	Except for deviations pursuant to Laser Notice No.50, dated June 24, 2007

Labels



Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007	NIKON-TRIMBLE CO., LTD. Technoport Mitsuseimeiji Bldg. 16-2 Minamikamata 2-chome Ota-ku, Tokyo 144-0035 Japan
MADE IN JAPAN	

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Introduction

In this chapter:

- [System diagram](#)
- [Care and maintenance](#)
- [Related information](#)

This user guide shows the unique capabilities and features available in the Trimble TS525 construction total station.

The TS525 construction total station is a reflectorless EDM instrument. Reflectorless operation enables you to take measurements to points that are inaccessible with a prism.

The software for the TS525 construction total station makes it easy for you to learn to operate one model of instrument and, with little additional training, to apply that knowledge to other models.

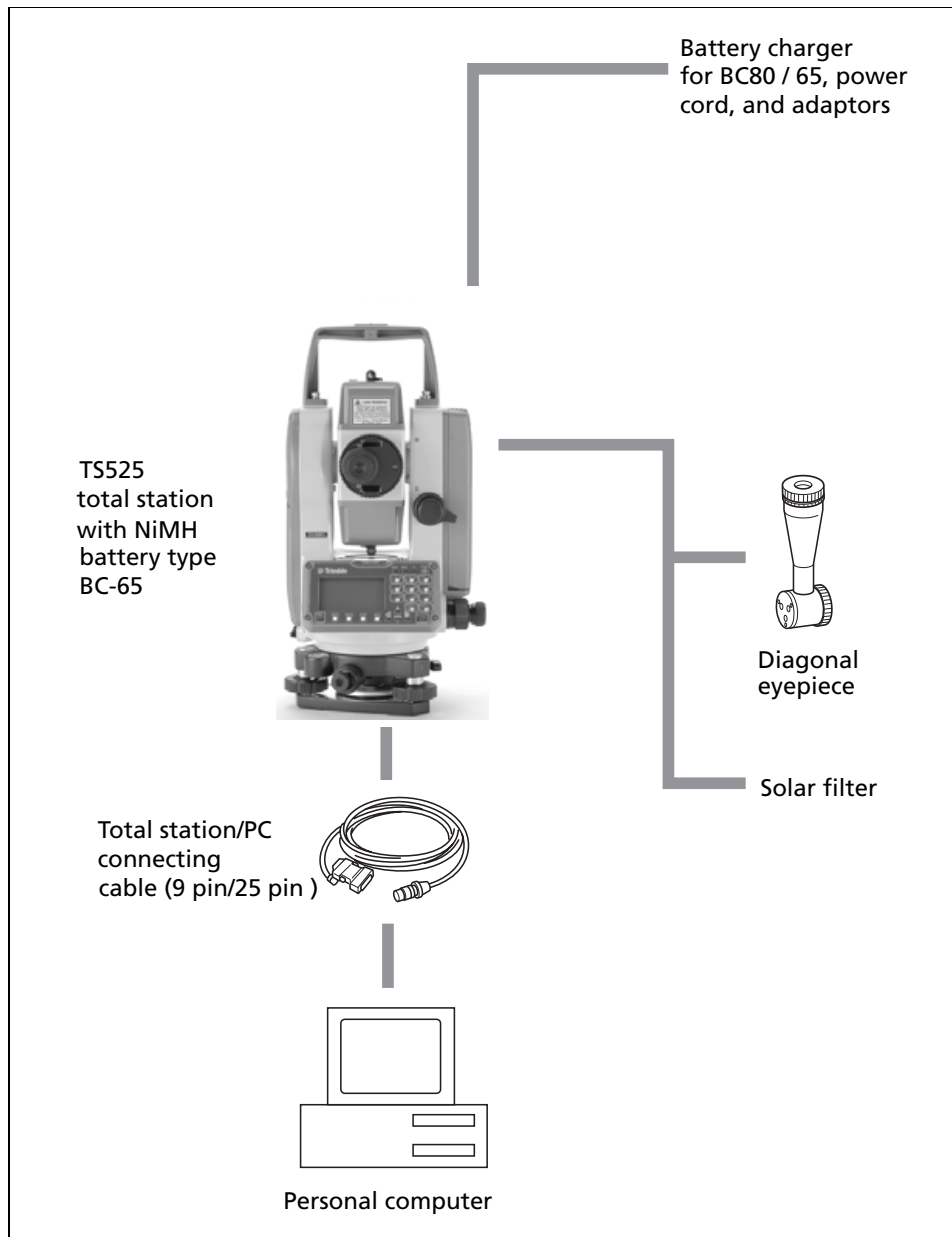
Before using the instrument, read this user guide carefully. In particular, pay attention to the warnings and cautions that appear in the Safety section, see [Safety, page 3](#).

Your comments and suggestions about the TS525 construction total station are welcome. Please contact us at the address given in the front of this manual.

In addition, your feedback about the supporting documentation helps us to improve it with each revision. E-mail your comments to sales@trimble.com.

System diagram

The system diagram shows the hardware that is used with the TS525 construction total station.



Care and maintenance



CAUTION – The BC-65 battery pack contains an NI-MH battery. When disposing of the battery pack, follow the environmental guidelines as determined by law and/or local regulations.

The TS525 construction total station is a precision instrument that you should store, use, and clean in an appropriate way.

Storage

- Do not store the total station 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.
- When storing the instrument in areas subject to extremely low temperatures, leave the carrying case open.
- If you do not intend to use the tribach for an extended period, lock down the tribach clamp knob and tighten its safety screw.

Environmental conditions

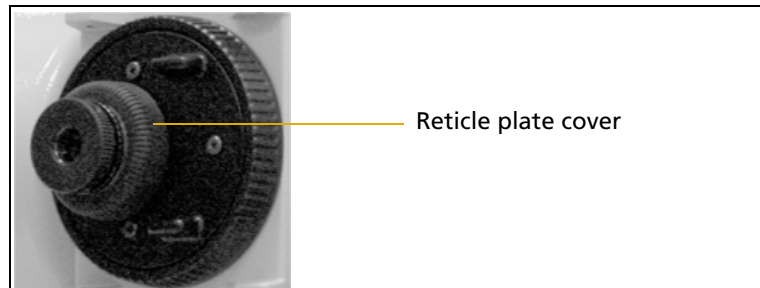
- Do not leave the instrument in direct sunlight or in a closed vehicle for prolonged periods. Overheating the instrument may reduce its efficiency.
- Sudden changes in temperature may cloud the lenses and drastically reduce the measurable distance, or cause an electrical system failure. If there has 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.
- If the total station has been used in wet conditions, immediately wipe off any moisture and dry the instrument completely before returning it to the carrying case. The TS525 construction total station contains sensitive electronic assemblies which have been well protected against dust and moisture. However, if dust or moisture gets into it, severe damage could result.
- 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 Trimble nameplate facing upward.

Cleaning

- Do not use organic solvents such as ether or print 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 tissue that is 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.

Adjusting and tightening

- 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.
- The reticle plate cover has been correctly mounted. Do not release it or subject it to excessive force, for example in an attempt to make it watertight.



- Before attaching the battery pack, make sure that the contact surfaces on the battery and TS525 construction total station are clean. Press the battery pack into place. When the battery-mounting button rises up to the battery pack top surface, the battery pack is in place and the instrument is watertight.
- Press the cap that covers the data output/external power input connector terminal until the cap clicks into place. The instrument is only watertight if the cap is attached securely.
- The TS525 construction total station is not watertight when the data output/external power input connector is used.
- Static electricity from the human body, discharged through the data output/external power input connector, can damage the instrument. Before handling the instrument, touch any other conductive material once in order to remove static electricity.

Related information

- Contact your local Trimble dealer for more information about the support agreement contracts for software and firmware, and an extended warranty program for hardware.
- Consider a training course to help you use your total station to its fullest potential. For more information, go to the Trimble website at www.trimble.com. Alternatively, send an email to trimble_support@trimble.com.

Setting up the Instrument

In this chapter:

- Unpacking and repacking the instrument
- Charging the battery pack
- Setting up the tripod
- Centering the instrument
- Leveling the instrument
- Focusing the telescope
- Setting the measurement mode and preparing the target
- Viewing and changing the measurement settings

This chapter explains how to prepare the TS525 construction total station before you use it in the field.

Unpacking and repacking the instrument

Note – Handle the TS525 construction total station carefully to protect it from shocks and excessive vibration.

Unpacking the instrument

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



Repacking the instrument

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 upper plate with the ∇ mark on the tribrach clamp knob.



3. Lightly fasten the clamp knobs.
4. Place the instrument in the carrying case.

Charging the battery pack

Before charging the battery pack, read the following warnings, cautions, and notes.



WARNING – Use only the specified battery charger that is attached to the instrument to charge the BC-65 battery pack. Using other chargers, such as the 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 BC-65 battery pack 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.



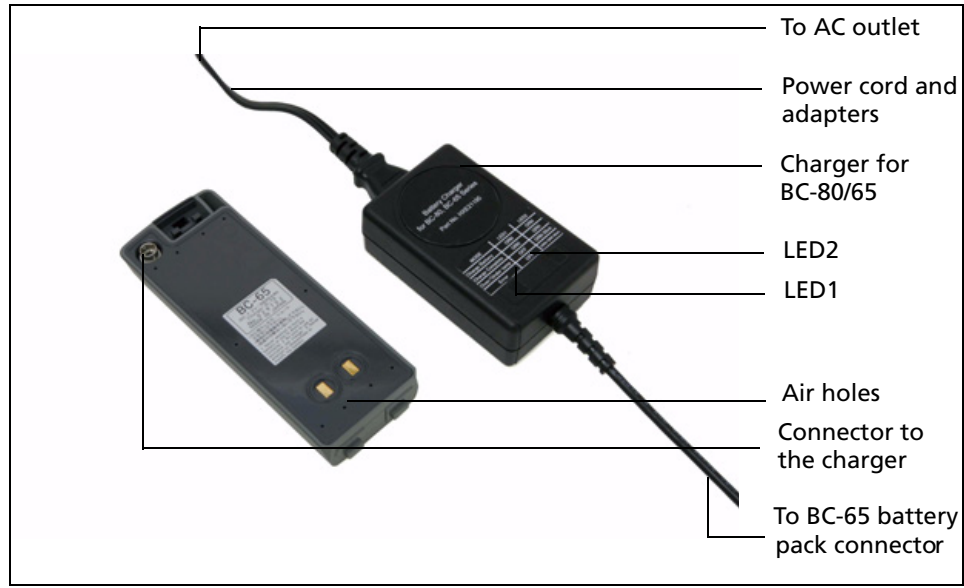
WARNING – The BC-65 battery pack is not waterproof on its own. Do not get the battery wet when it is removed from the instrument. If water seeps into the battery, it may cause a fire or burns.



CAUTION – Before charging the battery pack, read the installation instruction for the battery charger.

To charge 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 indicators (LED1 and LED2) turn orange, and charging starts automatically.

When the battery pack is fully charged, the charger indicator LED2 turns green.

Notes –

Charge the battery pack indoors where the ambient temperature is between 10 °C and 40 °C (between 50 °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.

After charging the battery pack, do not recharge it until it has been fully discharged. Recharging a fully charged battery pack lowers its performance.

To prevent malfunction, keep the charging plug clean.

If the charger indicator (LED2) blinks orange and green after charging starts, there is a problem with the battery pack. Do not use or charge the battery pack any further. Please contact your dealer.

If the ambient temperature drops below 10 °C (50 °F) while the battery pack is charging, charging stops. When the ambient temperature rises above 10 °C (50 °F), charging is resumed.

If the charger indicator (LED2) remains lit and orange for more than three hours, and the ambient temperature during charging was within the specified operational range (10 °C through 40 °C or 50 °F through 104 °F), there is a problem with the battery pack. Do not use or charge the battery pack any further. Please contact your dealer.

During charging, the battery pack and charger will become warm. This is normal.

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 can never be charged to its full capacity again.

Detaching the BC-65 battery pack from the instrument



CAUTION – To avoid problems with the electricity supply, do not touch the contacts on the 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.
3. Remove the battery pack from the instrument.

Reattaching the BC-65 battery pack to the instrument



CAUTION – You must attach the battery pack securely. A loosely attached battery pack makes the instrument less watertight.

1. Clear any dust or other foreign particles from the battery socket.
2. Fit the two projections at the bottom of the battery pack into the concave sections at the bottom of the socket on the instrument.
3. Hold the instrument steady with one hand and push the battery pack against the instrument.
4. Make sure that the battery mounting button is securely locked.

Note – An external battery is available as an optional accessory for the TS525 construction total station. 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.

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


1. Open the tripod legs far enough for the instrument to be stable.
2. Locate the tripod directly over the station point. To check the position of the tripod, 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.
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.

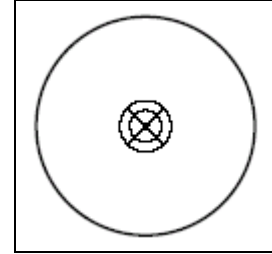
Centering the instrument

When you center the instrument, you align its central axis precisely over the station point. To center the instrument, use the optical plummet or a plumb bob. The plumb bob is sold separately.

Centering with the optical plummet

Note – For high accuracy, check and adjust the optical plummet before you center the instrument.

1. After setting up the instrument on the tripod, look through the optical plummet and 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.
2. 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.
3. Tighten the tripod leg clamps.
4. Use the plate level to level the instrument. See also [Leveling the instrument, page 28](#). Look through the optical plummet to make sure that the image of the station point is still in the center of the reticle mark.
5. 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 there is major displacement of the station point, repeat this procedure starting with Step 2.

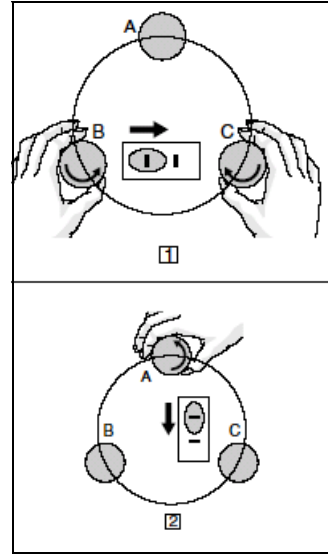


Leveling the instrument

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

To level the instrument, use the plate level.

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.



Focusing the telescope

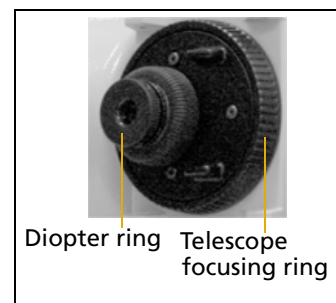
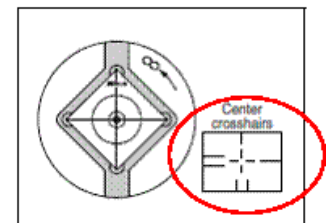


WARNING – Never look at the sun through the telescope. If you do, you may damage or lose your eyesight.

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 cross-hairs 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.
 - b. Looking through the eyepiece, rotate the diopter ring until the reticle cross-hairs 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 cross-hairs.
 - c. Move your eye vertically and laterally to check whether the target image moves relative to the reticle cross-hairs.
 - If the target image does not move, there is no parallax.
 - If the target image does move, rotate the telescope focusing ring and repeat [Step 2c](#).
3. Rotate the tangent screw. The final turn of the tangent screw should be in a clockwise direction, to align the target accurately on the center cross-hairs.

Setting the measurement mode and preparing the target



WARNING – The TS525 construction total station is a Class 3R 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.



WARNING – When used with the Reflectorless mode, the TS525 construction total station is a Laser Class 3R instrument. When used with the Prism mode, the TS525 construction total station is a Laser Class 1 instrument. Do **not** sight the Prism by the Reflectorless mode.



WARNING – Observe all other warnings and cautions. See also [Safety, page 3](#).

The TS525 construction total station has two measurements modes: Prism mode (Prism) and Reflectorless mode (Reflectorless). To change the mode at any time from any observation screen, hold down **[MSR1]** or **[MSR2]**.

Set the measurement mode depending on the target you want to measure, as shown here.

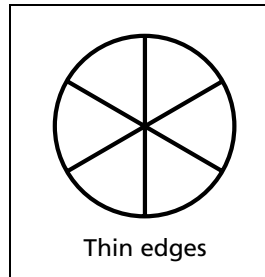
Target	Target settings	Indicator on status bar
Prism, reflector sheet	Prism mode	No sign
Other, reflective materials	Reflectorless mode	

Measurement with a prism

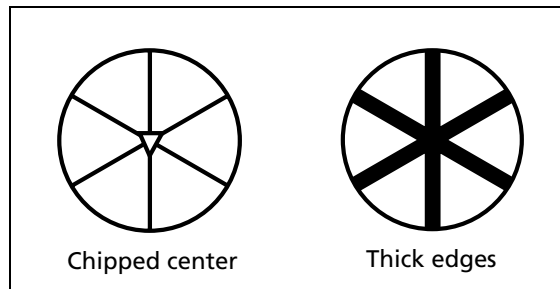
As the TS525 construction total station is extremely sensitive, multiple reflections on the prism surface can sometimes cause a significant loss in accuracy.

To maintain the accuracy of your measurements:

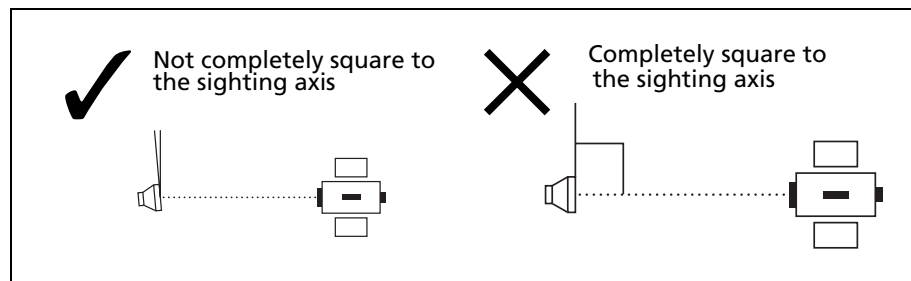
- Use a prism with thin edges.



Do not use a prism with scratches, a dirty surface, a chipped center, or thick edges.



When measuring a short distance, incline the prism slightly so that the EDM can ignore unnecessary reflections on the prism surface, as shown below.



- Hold the prism securely in place and do not move while taking measurements.

In Prism mode, 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 (N-Prism) mode

The TS525 construction total station enables reflectorless measurements up to 200 m (656 feet).

Measurable distances may be shorter or measurement intervals may be longer if either of the following conditions apply:

- 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.

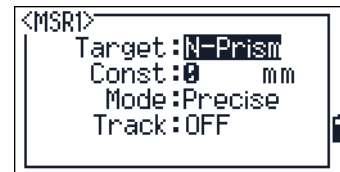
Targets with completely flat surfaces, such as mirrors, cannot be measured unless the beam and the target are perpendicular to each other.

Make sure there are no obstacles between the instrument and the target when taking measurements. 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.

Viewing and changing the measurement settings

Hold down **[MSR1]** or **[MSR2]** for one second.

- To move the cursor between the fields, press **[^]** or **[v]**.
- To change the value in the selected field, press **[<]** or **[>]**.



The available values are:

Field	Values
Target	Prism mode N-Prism mode
Constant (prism constant)	-999 mm through 999 mm
Mode	Precise Normal
Track	Track (continuous MSR) ON Track (continuous MSR) OFF

Target field

If the measurement is started with the *Target* field set to Prism mode, there is a dash in front of the prism constant, for example **-18 mm**.

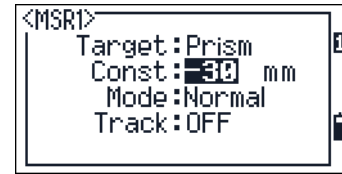
If the measurement is started with the *Target* field set to N-Prism (Reflectorless) mode, there is square bracket in front of the prism constant, for example **]18 mm**.

The displayed symbol will continuously move from left to right over the prism constant in the display.

Prism constant

The factory default of the prism constant value of the TS525 construction total station is -30 mm.

Change the prism constant to match the constant value of the prism you are using.



Once you have set up the instrument, you can turn on the TS525 construction total station, change the instrument settings, and start a job. See also [Getting Started](#), page 33.

Getting Started

In this chapter:

- Parts of the instrument
- Instrument keyboard and display
- Turning on the instrument
- Turning off the instrument
- Language selection
- Regional configuration
- List available jobs or data
- Entering data
- Creating or opening a job
- Measuring distances

After you have set up the instrument, see [page 21](#), you can start using the TS525 construction total station.

This chapter describes the basic features of the instrument, how to turn it on, change the instrument settings, and start a job.

Parts of the instrument

Figure 3.1 and Figure 3.2 show the main parts of the TS525 construction total station.



Figure 3.1 Back view of the TS525 construction total station










Figure 3.2 Front view of the TS525 construction total station







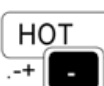

Instrument keyboard and display



Instrument keyboard

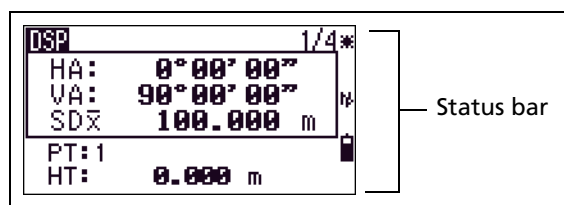
Use the buttons on the instrument keyboard to carry out the following functions:

Button	Function	Details
	Turns the instrument on or off.	page 34
	Illumination button. Turns the backlight on or off. Provides access to the 2-switch window if held down for one second.	page 39
	Displays the MENU screen.	page 85
	Changes the button input mode between alphanumeric and numeric if pressed when you are in a PT or CD field.	page 41
	Records measured data, moves on to the next screen, or confirms and accepts the entered data in input mode.	page 82
	Returns to the previous screen. In numeric or alphanumeric mode, deletes input.	
	Starts distance measurement, using the measure mode settings for the MSR1 button. Displays measurement mode settings, if held down for one second.	page 52

Button	Function	Details
	Starts distance measurement, using the measure mode settings for the (MSR2) button. Displays measurement mode settings, if held down for one second.	page 52
	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 40
	Displays the Angle menu.	page 56
	Displays the Layout function menu. In numeric mode, enters 7. In alphanumeric mode, enters A, B, C, or 7.	page 56
	Displays the Station Setup menu. In numeric mode, enters 8. In alphanumeric mode, enters D, E, F, or 8.	page 56
	Displays the Programs menu. In numeric mode, enters 9. In alphanumeric mode, enters G, H, I, or 9.	page 67
	Displays the (HOT) menu, which includes Height of Target and Temp-Press settings. In numeric mode, enters – (minus). In alphanumeric mode, enters. (period), – (minus), or + (plus).	page 41
	Displays the Bubble indicator. In numeric mode, enters 0. In alphanumeric mode, enters *, /, =, or 0.	page 42


Status bar

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



Laser pointer indicator




The icon appears as you turn on the laser pointer or when you measure using the Reflectorless mode. When the icon appears on the screen, the emitting power is laser class 3R:

 Laser pointer ON.

If there is no icon, the laser pointer is off.






Input mode indicator

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

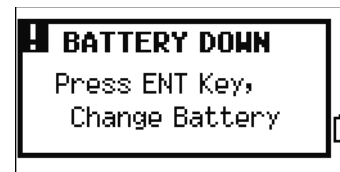
-  Input mode is numeric. Press a button on the number pad to enter the number printed on the button.
-  Input mode is alphabetic. Press a button on the number pad to enter the first letter printed beside the button. Press the button repeatedly to cycle through all the letters assigned to that button.
For example, to enter the letter O in alphabetic mode, press  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, a message appears.



EDM measurement status

When you are taking measurements, the EDM measurement status shows the mode that is being used.

When you display observation data, the EDM measurement status shows the mode that was used when the data was collected.:

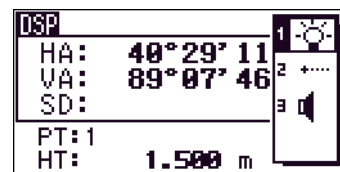
-  Reflectorless mode

If there is no icon, Prism mode is being used.

Adjusting lighting and sound levels and the laser pointer

Use the 3-switch window to turn the backlight lighting, sound settings, and the laser pointer for the instrument on or off.



To access the 3-switch window from any screen, hold down the Illumination button 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 [v]. Then press [ENT] to cycle through the settings for that switch.

Switch 1: Turning on/off the LCD backlight



-  LCD backlight is on
-  LCD backlight is off

Switch 2: Turning on/off the laser pointer

-  Laser pointer is on
-  Laser pointer is off

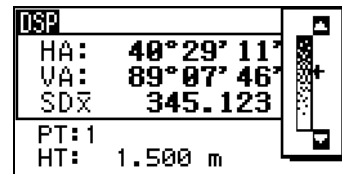
The icon appears while turning on the laser pointer or taking a measurement by the Reflectorless mode. When the icon is on the screen, the emitting power is Laser Class 3R.

Switch 3: Turning on/off the sound

-  Sound is on
-  Sound is off

Contrast adjustment window

When the 3-switch window appears, press [←] or [→] to access the contrast adjustment window. Then press [^] or [v] to change the contrast level. The arrow indicates the current contrast level. To return to the 3-switch window, press [←] or [→].



When you have finished changing display light and sound settings, press [ESC] to close the 3-switch window or contrast adjustment window.

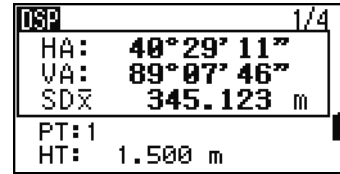
DSP button

Use the **DSP** button to change the current display screen or to change display settings.

Switching between display screens

When several display screens are available:

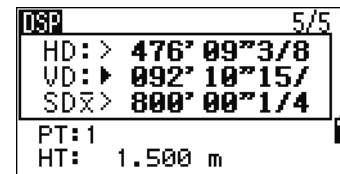
- the **DSP** indicator appears at the top left of the screen
- the screen indicator (for example, 1/4) appears at the top right



To move to the next available screen, press **DSP**.

For example, if you are currently in the second display screen, press **DSP** to move to the third display screen. The screen indicator changes from 2/4 to 3/4.

When the secondary distance unit is set, an additional screen is available. It shows the HD, VD, and SD values. See also [Other settings, page 94](#).



The smallest unit of display for distances measured in feet-and-inches is 1/16 in. Smaller units are impractical in the field.

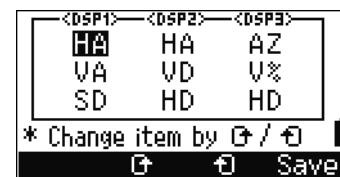
When the actual value is greater than 9999'11"15/16, the > symbol appears. If the actual distance is less than -9999'11"15/16, the ▶ (solid triangle) symbol appears. This does not affect calculations. The precise value is used internally in all cases.

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 buttons **↑**, **↓**, **←**, and **→** to highlight the item that you want to change:
3. Press the **↔** or **↔** softkey 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.

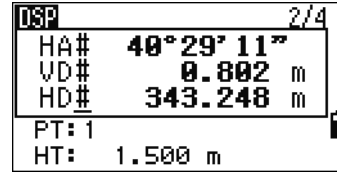
The items displayed in the DSP1, DSP2, DSP3, and DSP4 screens are also used in the corresponding Layout screens (LO2, LO3, LO4, and LO5).

You can also customize the displayed items in Layout.

Header characters

The following header characters appear in DSP screens:

- Colon (:) indicates that tilt correction is applied to the value.
- Hash symbol (#) indicates that tilt correction is off.
- Underscore (_) under the tilt correction character indicates that Sea Level Correction or Scale factor is applied.



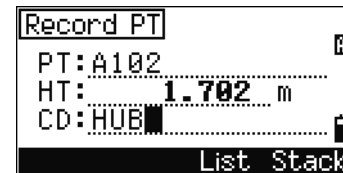
MODE button

The **MODE** button is on the top row of the TS525 keypad. Use it to change the keyboard mode for the current screen.

Changing the 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).

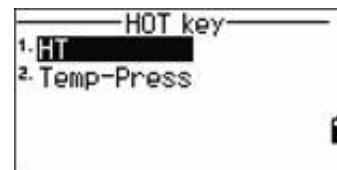
The input mode indicator in the status bar changes to show the current input mode.



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.

HOT key

The HOT key menu is available from any observation screen. To display the HOT key menu, press **HOT**.



Changing the height of the target

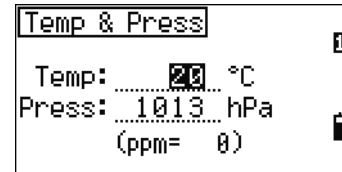
1. Press **HOT** to display the HOT menu.
2. Do one of the following:
 - Press **1**.
 - Select HT.
3. Press **ENT**.
4. Enter the target height or select the height from the HT stack.



Note – To display the HT stack, press the **Stack** softkey. The HT stack stores the last 20 HT values entered.

Setting the current temperature and pressure

1. Press **[HOT]** to display the HOT menu.
2. Do one of the following:
 - Press **[2]**.
 - Select **TEMP-PRESS**.
3. Press **[ENT]**.
4. Enter the ambient temperature and pressure. The ppm value is updated automatically.



Bubble indicator

The bubble indicator appears if the instrument goes out of level while the compensator is turned on.

To display the bubble indicator in an observation screen at any other time, press **[Envelope]**.

The TS525 construction total station has a vertical axis compensator. To turn the leveling compensator on or off, press **[Left Arrow]** or **[Right Arrow]**.

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. See also [Header characters, page 41](#).



Turning on the instrument

1. Press the **[PWR]** button. The start-up screen appears. It shows the current temperature, pressure, date, and time.

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, press **[MENU]** and then select **Settings / Other**. See also [Other settings, page 94](#).
2. To change the temperature or pressure value, press **[Up Arrow]** or **[Down Arrow]** to move the cursor to the field that you want to change. Then press **[ENT]**.



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

Once you start to use an initialized HA, you must rotate the alidade to initialize the HA every time you turn on the TS525 construction total station. If you do this, you can maintain a fixed HA orientation even if the TS525 has moved while turned off.



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

Note – 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

1. Press **PWR** and **ENT**.
2. Do one of the following:

Press...	To...
ENT again	turn off the instrument
the Reset softkey	reboot the software and re-start the instrument
the Sleep softkey	access the Basic Measurement Screen (BMS) without an open job.
the ESC	put the instrument into power-saving mode
	cancel the power-off process and return to the previous screen

Sleep mode

To put the instrument into sleep mode, do one of the following:

- In the Press **ENT** → OFF screen, press the **Sleep** softkey.
- Enable the Power Save setting. See also [Power saving, page 94](#).

The instrument wakes up if any of the following events occur:

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

Language selection

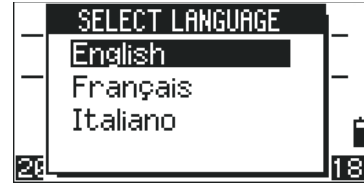
The TS525 construction total station supports multiple languages installed on the instrument. To select one of the languages available, do the following:

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



The *Select Language* screen appears. The screen shows which languages are available on the instrument. The current language selection is highlighted.

2. Press **[↑]** or **[↓]** 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.



Regional configuration

To provide easier configuration for common regional settings, you can quickly configure the TS525 construction 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.

1. Follow the steps in [Language selection, page 44](#).

Once 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:

Category	Setting	Europe	International	United States
Angle	VA zero	Zenith	Zenith	Zenith
	Resolution	5"	5"	5"
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

Category	Setting	Europe	International	United States
Coordinates	Order	ENZ	ENZ	NEZ
	Label	ENZ	ENZ	NEZ
Power Save	Main Unit	Off	Off	Off
	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
Units	Angle	GON	DEG	DEG
	Distance	meters	meters	US-ft
	Temp	°C	°C	°F
	Press	mm Hg	mm Hg	In Hg
Rec	Rec Data	ON	ON	ON
	CD Field	ON	ON	ON
	Add Const	1000	1000	1000
Others	XYZ disp	Fast	Fast	Fast
	2nd Unit	None	None	None
	CD Input	<ABC>	<ABC>	<ABC>

The default regional configuration pre-set is “Europe” settings. See also [Settings \(basic job settings\)](#), page 90.

List available jobs or data

The TS525 construction total station lists available jobs or data when you do any of the following:

- view or edit data (Press **MENU** then select **Data**)
- open the Job Manager (Press **MENU** then select **Job**)
- search for points or codes

The current cursor position is shown in inverted colors (it appears as white text on a black background).

Press **↑** to move the cursor one line up, or press **↓** to move the cursor one line 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**.



Entering data

You can enter the following into the TS525 construction total station:

- A point name or number, see [page 46](#)
- A code, see [page 49](#)

Entering a point name or number

You can use numeric or alphanumeric names up to 20 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 identical to the last point name.

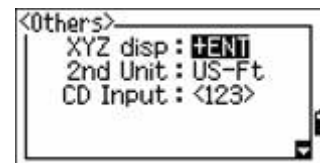
When the cursor is in a PT (point) field, there are several ways to specify a point, or to enter coordinates. You can:

- Enter an existing point, see [page 46](#)
- Enter a new point, see [page 47](#)
- Press **[ENT]** without a point name, see [page 47](#)
- Specify a wildcard, see [page 47](#)
- Record an instant measurement, see [page 47](#)
- Enter a point from a point stack, see [page 48](#)
- Enter a point from the point list, see [page 48](#)

Entering an existing point

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

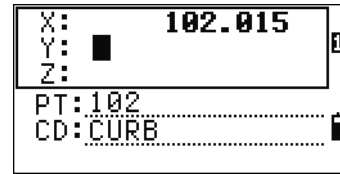
To adjust the duration of the coordinate window display, press **[MENU]** then select *Settings* / *Others*. To leave the window open until you press **[ENT]**, set the *XYZ disp* field to +ENT. See also [page 94](#).



Entering a new point

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

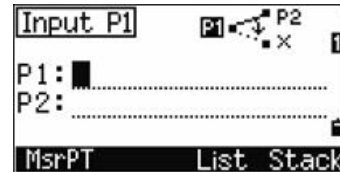
To store the point in the current job, press **ENT** on the last line (the CD field).



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.

The input coordinates are used in the calculation but they are not saved in the database. The message This PT will not be recorded appears.



Specifying a wildcard (*)

If you include an asterisk (for example, A100*) when you enter a point or code name, a list of points that match the entered text appears.

Use **▲** or **▼** to move the cursor to the point that you want to use. Then press **ENT**.

If the Page Up **▲** icon appears, you can use it to move up one page on the list. You can also use **▲**.

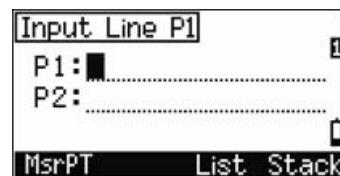
If the Page Down **▼** icon appears, you can use it to move down one page. You can also use **▼**.



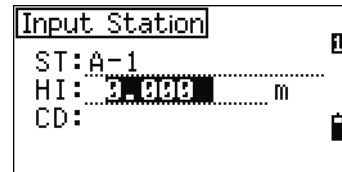
When you select a point from the list, its coordinates are displayed and a beep sounds.

Entering a point by recording an instant measurement

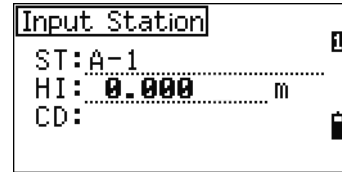
1. Press the **MSR** softkey:
An observation screen appears.
2. To start a measurement, press **MSR1** or **MSR2**.
3. To change the height of the target, select the **HT** softkey.
4. When you have finished the measurement, press **ENT** to go to the point recording screen.
5. Enter the point or code name and then press **ENT**.



When you move the cursor to a field, the current or default value appears in inverted colors. (It appears as white text on a black background). This is the default Replace All input mode.



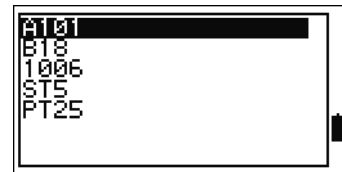
To change the input mode to Overwrite and highlight the first character, press \rightarrow . To move the cursor to the end of the string, press \leftarrow .



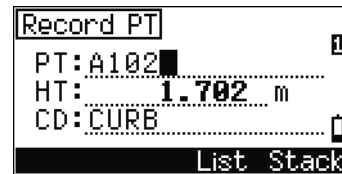
Entering a point from the point stack

The point stack is a list of the last 20 point names used, in chronological order from last used to first used. To enter a point from the point stack:

1. Select the Stack softkey when the cursor is in the PT field. The stack appears.
2. Press \uparrow or \downarrow to move the cursor to the point that you want to use.
3. Press ENT .

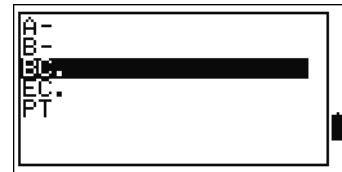


When you return to the point input screen, the selected point name is entered in the PT field, incremented by one. For example, if you selected the A101 point, A102 appears in the PT field.

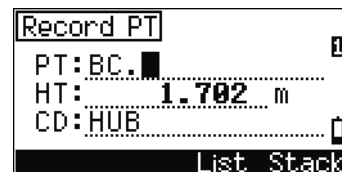


Entering a point from the point list

1. Select the List softkey when the cursor is in the PT field. A list of existing points appears.
2. Press \uparrow or \downarrow to move the cursor to the point that you want to use.
3. Press ENT .



When you return to the point input screen, the selected point name is entered in the PT field. Add numeric or alphabetic characters if required.



Entering a code

The CD (Code) field defaults to the last code used. You can select a different code in the input point screen.

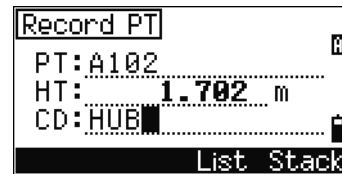
Codenames can be numeric or alphanumeric, and up to 16 characters long.

There are several ways to enter a code:

- Enter a code directly, see [page 49](#)
- Enter a code from the code stack, see [page 49](#)
- Enter a code from the code list, see [page 49](#)

Entering a code directly

1. To change the input mode to alphanumeric or numeric, press **(MODE)**.
2. Use the keypad to enter the code.

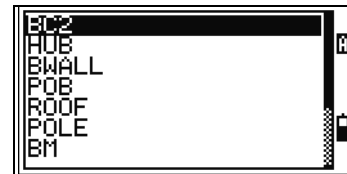
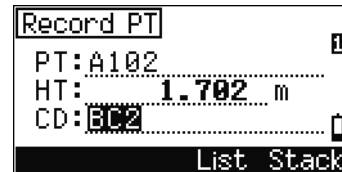


Entering a code from the code stack

The code stack is a list of up to 20 recently used codes. When you reboot the TS525 construction total station, the code stack is cleared.

To enter a code from the code stack:

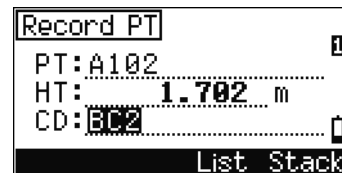
1. Select the **Stack** softkey when the cursor is in the CD field. The stack appears.
2. To move the cursor to the code that you want to use, press **(^)** or **(v)**.
3. Press **(ENT)**.



The selected code is copied to the CD field.

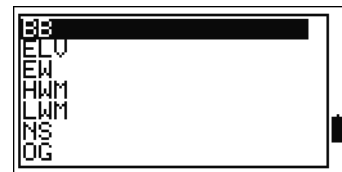
Entering a code from the code list

1. Select the **List** softkey when the cursor is in the CD field. A list of existing codes appear.
2. Press **(^)** or **(v)** to highlight the feature code that you want to use.
3. Press **(ENT)**.



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.

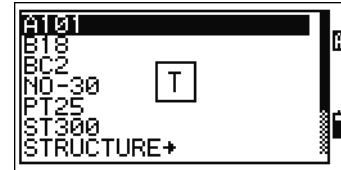
When you return to the input screen, the selected code is entered in the CD field.



Advanced feature: Searching for a code using the first character

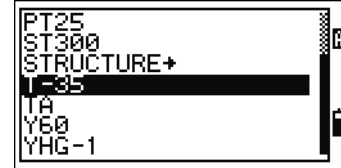
Items are shown in alphabetic order. To find a code quickly when the code list appears, use the first-character search. For example, to see feature codes that begin with T, use the keypad to enter the letter T (press **T** twice).

After each button press, the input mode field displays the selected letter. For example, if you press **T**, **S** appears. If you quickly press **T** again, **T** appears. If you do not press the **T** button again, the letter T is selected.



Once you select 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.



Entering values in feet and inches

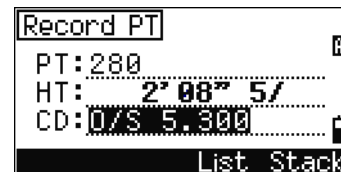
If US Survey Feet (US-Ft) or International Feet (I-Ft) is selected as the distance unit, you can enter and display distances, HIs, HTs, and coordinate values in decimal feet or in feet and inches. See also [Unit, page 93](#), and [Other settings, page 94](#).

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.

For example, if you enter **2** **.** **08** **.** **5** **.** **ENT**, it appears as 2' 08" 5/ (2 feet, 8 and 5/16ths inches).



The following examples show how to enter various values:

To enter...	Key in...
65' 5 3/8"	6 . 5 . 3 . 8 ENT
65'	6 . ENT
65' 5"	6 . 5 ENT
65' 5 3/8"	6 . 5 . 3 . 8 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.

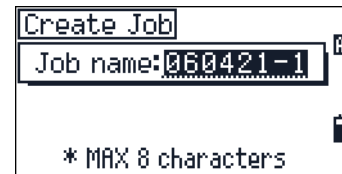
Creating or opening a job

To record data on the TS525 construction total station, you must create or open a job.

Note – Before using the TS525 construction total station for the first time, check that you are using the required job settings.

Creating a new job

1. Press **[MENU]**. The MENU screen appears.
2. Press **[1]**. The Job Manager appears.
3. Select the **Cr eat** softkey. The Create Job screen appears.
4. Enter the job name.
5. To check the job settings, select the **Set t** softkey. You cannot change the settings for a job once you have created the job.
6. Press **[ENT]** in the last field of the Job Sett screen. The new job is created.

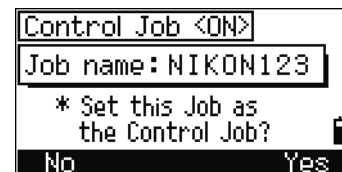


Note – You can only have a maximum of 32 jobs.

Creating a control job

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

1. Press **[MENU]**. The MENU screen appears.
2. Press **[1]** or select **Job**. The Job Manager appears.
3. Move the cursor to the job to use as the control job.
4. Select the **Ctrl** softkey.
5. Select the **Yes** softkey.



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.

Measuring distances



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



WARNING – Areas in which these lasers are used should be posted with an appropriate laser warning sign.



WARNING – Precautions should be taken to ensure that persons do not look directly, with or without an optical instrument, into the beam.



WARNING – The laser beam should be terminated at the end of its useful beam path and should in all cases be terminated if the hazardous beam path extends beyond the limit (*hazard distance* *) of the area in which the presence and activities of personnel are monitored for reasons of protection from laser radiation.



WARNING – Laser beam path should be located well above or below eye level wherever practicable.

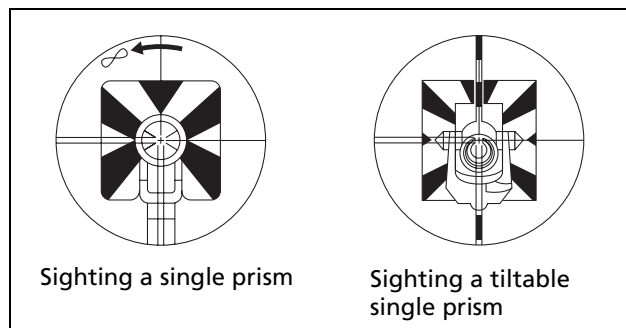


WARNING – Do **not** turn the class 3R laser beam to mirror like specular surfaces; for instance, prisms, metal surfaces or windows, even unintentionally. Special precautions should be taken to ensure eliminating such situations.

Note – The *hazard distance* is the distance from the laser at which beam irradiance or radiant exposure equals the maximum permissible value to which personnel may be exposed without being exposed to health risk.

Sighting a prism reflector

Sight the telescope until you see cross-hairs at the center of the prism reflector.

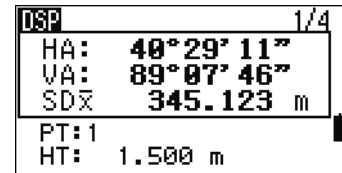


Taking a distance measurement

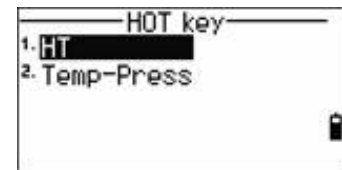
To take a distance measurement, press **[MSR1]** or **[MSR2]** in the Basic Measurement Screen (BMS) or in any observation screen.

While the instrument is taking a measurement, the prism constant appears in a smaller font.

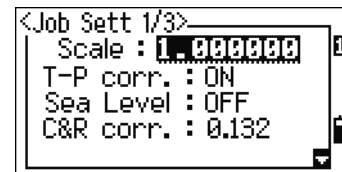
If tracking is set to ON, measurements are taken continuously until you press **[MSR1]**, **[MSR2]**, or **[ESC]**. Each time a measurement is taken, the distance is updated.



To change the height of target (HT), temperature, or pressure, press **[HOT]**. See also **[HOT]** button, [page 41](#).

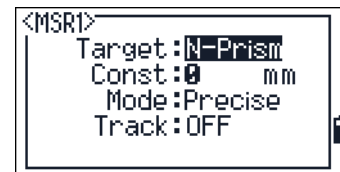


Settings that relate to corrections (T-P corr., Sea Level, C&R corr., and Map projection) are included in the job settings and are job-specific. To change any of these settings, you must create a new job. See also [Job settings, page 87](#), and [Settings \(basic job settings\), page 90](#).



Viewing and changing the measurement settings

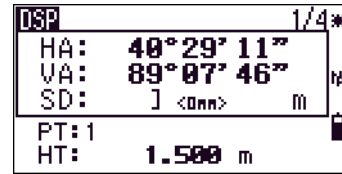
1. Hold down **[MSR1]** or **[MSR2]** for one second.
2. To move the cursor between the fields, press **[↑]** or **[↓]**.
3. To change the value in the selected field, press **[←]** or **[→]**.



Field	Values
Target	Prism N-Prism
Const (prism constant)	-999 mm through 999 mm
Mode	Precise Normal
Track	Track (continuous MSR) ON Track (continuous MSR) OFF

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.



The symbol then continuously moves from left to right over the prism constant in the display.

The Target setting is used by the TS525 construction total station to apply better cyclic-error adjustment in distance measurement. The target setting efficiently eliminates multipath reflection.

Applications

In this chapter:

- HA reset and angle operations
- Station setup
- Layout menu
- Programs menu
- Recording measurement data
- Switching between display screens

This chapter describes the menu and display screens, and TS525 construction total station applications.

Use the following keystrokes when working in the display screens and when you use the applications:

To switch between display screens

Press **[DSP]**. See also [page 83](#).

To change HT

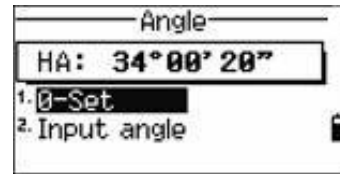
Press **[HOT]**

To record points

Press **[ENT]**

HA reset and angle operations

To access the *Angle* menu, press **[ANG]** in the Basic Measurement Screen (BMS). To select a command from the *Angle* menu, press the corresponding number key. Alternatively, press **[↑]** or **[↓]** to highlight the command and then press **[ENT]**.

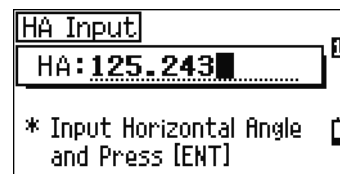


Setting the horizontal angle to 0

Press **[1]** or select **0-Set** in the Angle menu. The display returns to the BMS.

Entering the horizontal angle

1. Press **[2]** or select **Input** in the Angle menu. The HA Input screen appears.
2. Use the numeric keys to enter the horizontal angle.
3. Press **[ENT]**.



To enter 123°45'50", key in **[1][2][3][.][4][5][5][0]**.

The displayed value is rounded to the minimum angle increment.

Station setup

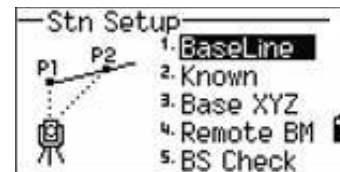
To access the Stn Setup menu, press **[STN]** in the BMS.

To select a command from the Stn Setup menu, press the corresponding number key. Alternatively, press **[↑]** or **[↓]** to highlight the command and then press **[ENT]**.

The last function used is highlighted.

The station setup options are:

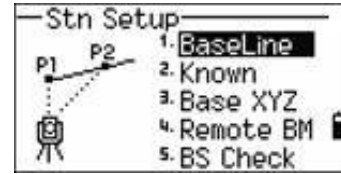
- [Baseline, page 57](#)
- [Known, page 58](#)
- [Base XYZ, page 60](#)
- [Remote BM, page 60](#)
- [BS Check, page 61](#)



Baseline

Select this option for a two-point resection along a known line.

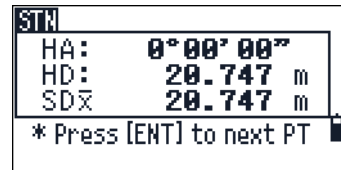
1. Press **1** or select BaseLine from the Stn Setup menu.



2. Enter a known point as P1.

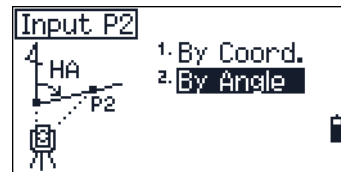
If you enter a new point name, a coordinate input screen appears.

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

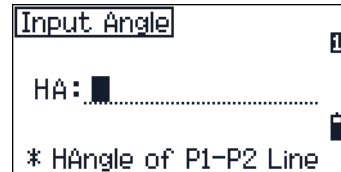


3. Choose how you want to define a known line:

- 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.**



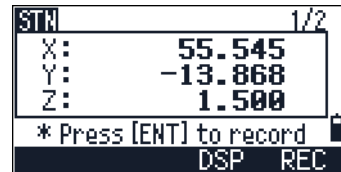
- a. If you select **By Angle**, the azimuth input screen appears: Enter the angle value and press **ENT**.



A measurement screen appears.

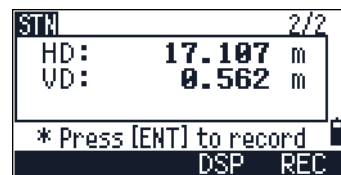
- b. Sight P2 and press **MSR1** or **MSR2** to take a measurement. Press **ENT**.

After the measurement to P2 is completed, press **ENT**. The coordinates of the station are calculated.



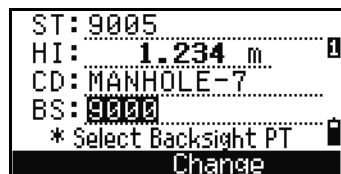
4. To record the station, press **ENT** or the **REC** softkey.

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



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.

6. 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.

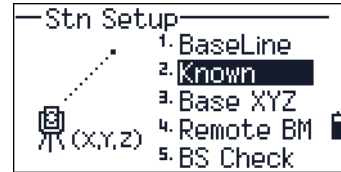


7. Backsight (BS) defaults to the first point (P1). To change the selected point, highlight the BS field and then select the CHANGE softkey.
8. To finish the setup and record the station, press ENT in the BS field.

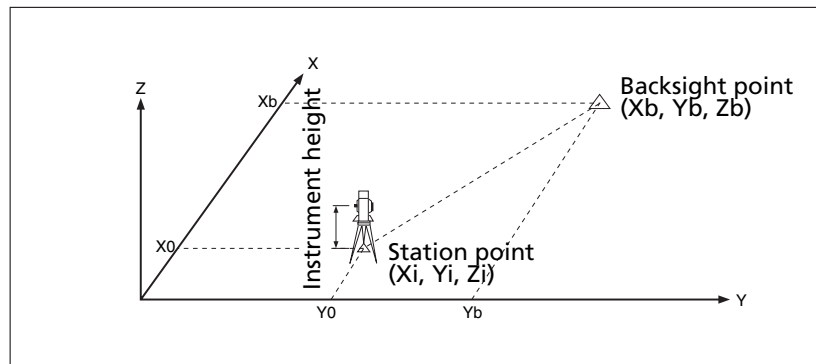
Known

Select this option to set up a station with known coordinates or azimuth.

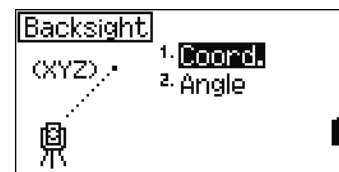
1. Press 2 or select **Known** in the Stn Setup menu.
2. Enter a point name or number in the ST field.
 - If the input point number or name is an existing point, its coordinates are displayed and the cursor moves to the HI (Height of instrument) field.
 - If the point is new, a coordinate input screen appears. Enter the coordinates for the point. Press ENT after each field. When you press 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 ENT .
4. In the Backsight screen that appears, select an input method for defining the backsight point:
 - To sight the backsight by entering coordinates, see the following section.
 - To sight the backsight by entering the azimuth and angle, see [page 59](#).



Sighting the backsight by entering coordinates

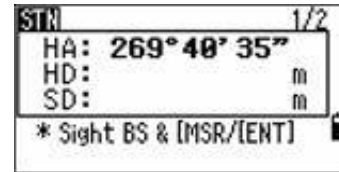


1. To enter coordinates for the backsight point (BS), press 1 or select **Coord** from the Backsight screen.
2. Enter the point name. If the point exists in the job, its coordinates are shown.

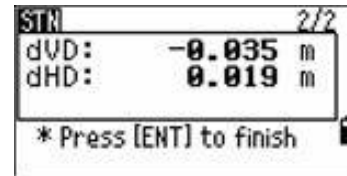


- If you intend to take a distance measurement to the BS, enter the height of target in the HT field.
- Sight the BS, and then press **[ENT]** to complete the setup

HA Azimuth calculated by coordinates

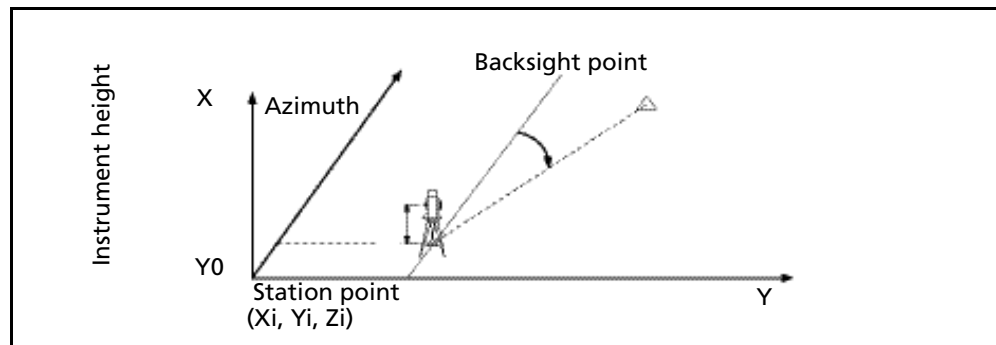


If measuring to a known coordinate BS, press **[DSP]** to display a QA screen. The QA screen shows the dHD and dVD values, which indicate the difference between the measured distance and the distance calculated from the known coordinates.

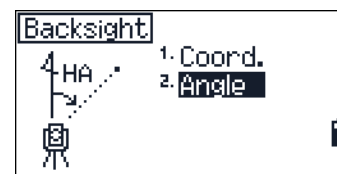


- To record the station, press **[ENT]**.
- To finish the station setup after taking a distance measurement, press **[ENT]**.

Sighting the backsight by entering the azimuth angle

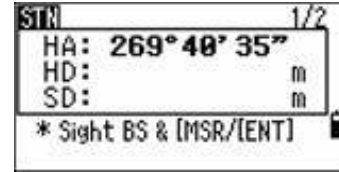


- To enter the azimuth angle to the backsight point, press **[2]** or select **Angle** from the Backsight screen.
- If there is no point name for the BS, press **[ENT]** on the BS field.
- In the HA field, enter the azimuth angle to the BS point.



If you press **[ENT]** without entering a value in the HA field, the azimuth is automatically set to 0°00'00\".

- Sight the BS point and press **[ENT]**.



Base XYZ

Select this option to change the instrument XYZ values.

Base XYZ does not store an ST record in the job, so the BS Check cannot check the backsight if you enter a station using the Base XYZ option.

You can use this function without an open job.

- Press **[3]** or select **Base XYZ** from the Stn Setup menu.

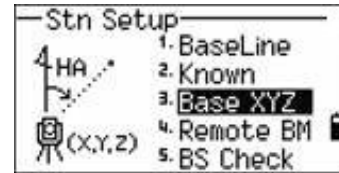
The current instrument XYZ values are shown as the default.

- Enter the new instrument XYZ values and then press **[ENT]**.

- Do one of the following:

- To reset the horizontal angle, enter a value in the HA field and then press **[ENT]**.
- If you do not need to reset the horizontal angle, leave the HA field blank and then press **[ENT]**.

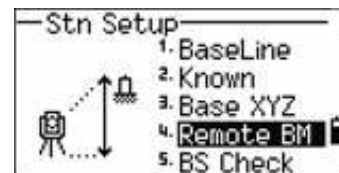
The Stn Setup menu appears.



Remote BM

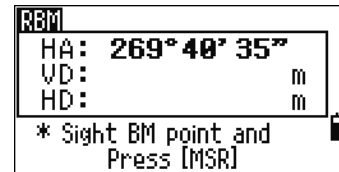
Select this option to determine the station elevation.

- Press **[4]** or select **Remote BM** from the Stn Setup menu.



- Enter the BM point and press **[ENT]**. The point appears briefly. The cursor then moves to the HT field.
- Enter the HT and then press **[ENT]**.

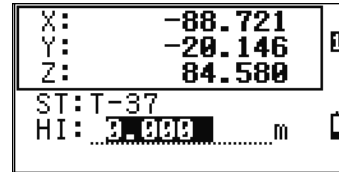
4. Sight the Bench Mark point and then press **[MSR1]** or **[MSR2]**.



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

5. To record the updated STN, press **[ENT]**.

When the HI setting 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.

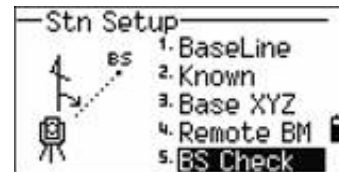
BS Check

Select these options to check and reset the backsight direction.

Note – Complete a station setup before using the BS check function.

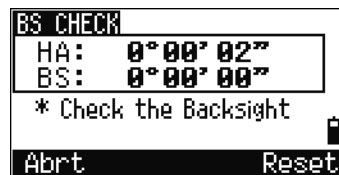
This function always refers to the backsight point from the last station (ST) record stored in the current open job.

1. Press **[5]** or select **BS Check** in the Stn Setup menu.



The HA field refers to the current HA reading, and the BS field refers to the BS in the last station setup. Enter station coordinates for observations without recording data.

2. Do one of the following:
- To reset the horizontal angle to the HA set in the last station setup, sight the BS and then select the **Reset** softkey or press **[ENT]**.
 - To cancel the process and return to the BMS, select the **Abt** softkey or press **[ESC]**.



Layout menu

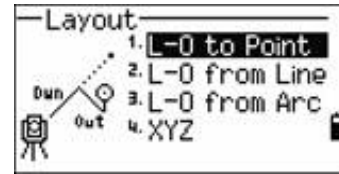
To access the Layout menu, press **[L-O]** in the BMS.

To select a command from the Layout menu, press the corresponding number key. Alternatively, press **[↑]** or **[↓]** to highlight the command and then press **[ENT]**.

The last function used is highlighted.

There are four layout options:

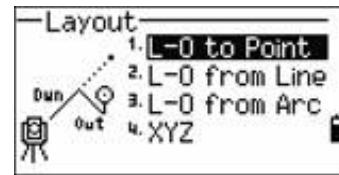
- [L-O to Point, page 62](#)
- [L-O from Line, page 63](#)
- [L-O from Arc, page 64](#)
- [XYZ, page 65](#)



L-O to Point

Use this method to lay out a point based on the down, out, and dZ location to a specified line.

1. Press **[1]** or select **L-O to Point** from the Layout menu.

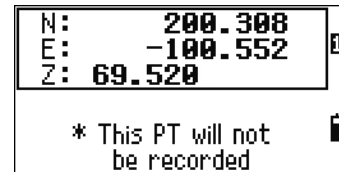


2. Enter the first point (P1) along the line.

Alternatively, select the **MSR** softkey to measure a point.

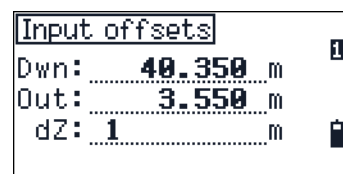
If you press **[ENT]** without entering a PT name, you can enter temporary coordinates. Temporary coordinates are not recorded in the job.

3. Enter the second point (P2) along the line.
4. Enter offsets to the line.



To enter the value 0.0000, press **[ENT]** in a blank field.

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



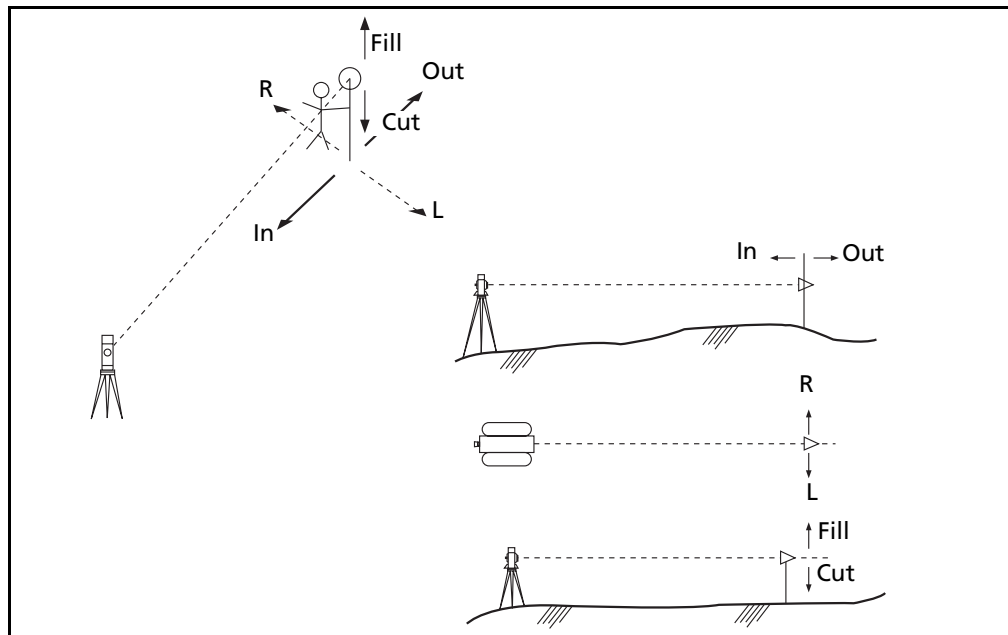
5. Rotate the instrument until the dHA is close to 0°00'00".
6. Sight the target, and then press **[MSR1]** or **[MSR2]**.

When a distance measurement is taken, the difference between the measured point and the design point appears.

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

Note – Press **[DSP]** to switch between display screens. See also [page 83](#).

The following figure shows the terminology used to guide you to the required point.



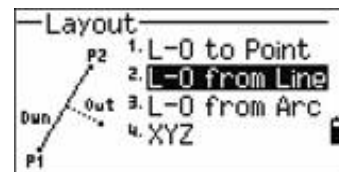
POINT		1/7
dHA+	2°46'10"	
R +	0.396 m	
OUT+	1.297 m	
FIL+	1.000 m	
* Press [ENT] to finish		

L-O from Line

Select this option to measure distance and offset values along a specified line.

- Press **[2]** or select **L-O** from **Line** from the **Layout** menu.
- Enter the first point for the reference line.

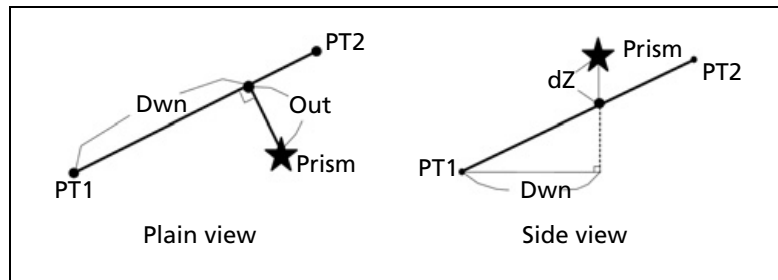
Alternatively, select the **MSR** softkey to measure a point.



If you press **[ESC]** in the Record PT screen, the measured point is used but not recorded in the job.

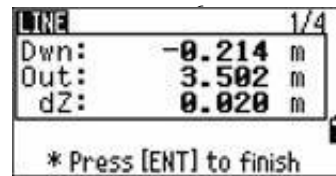
- Enter the second point for the reference line.
- Enter an asterisk (for example, A*) in the PT field to perform a wildcard search. A list of matching points appears. Highlight a point in the list and then press **[ENT]**.

The following figure shows how to determine or input a location relative to a line used for Layout.



- Sight the prism or reflective sheet and press **[MSR1]** or **[MSR2]**.

- Dwn Horizontal distance from P1 to the measured point along the P1-P2 line
- Out Horizontal offset from the P1-P2 line to the measured point
- dZ Vertical offset from the P1-P2 line to the measured point



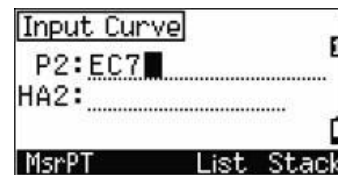
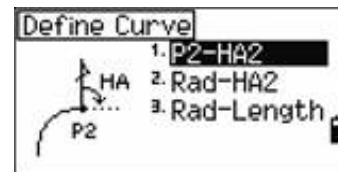
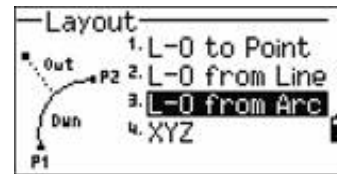
Note – Press **[DSP]** to switch between display screens. See also [page 83](#).

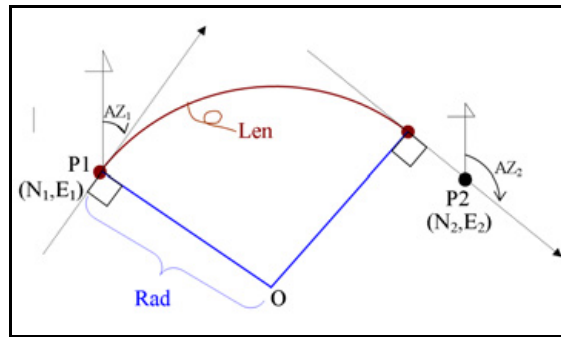
L-O from Arc

Select this option to measure distance and offset values on the arc-curve.

- Press **[3]** or select **L-O** from **Arc** from the **Layout** menu.
- Enter the start of the curve point (P1) and the azimuth of its tangent line (HA1).
Alternatively, to enter P1 by direct measurement, select the **MSR** softkey.
- Choose a method to define the curve.

P2 can be any point on the tangent line that is to exit the curve.
- In the radius (Rad) field, enter a positive value for a clockwise curve. Enter a negative value for a counter-clockwise curve.





Once you entered all factors, the TS525 construction total station calculates the curve. If the curve length (Len) is too large for a circle of the given radius, the curve is shortened.

Note – Press **[DSP]** to switch between display screens. See also [page 83](#).

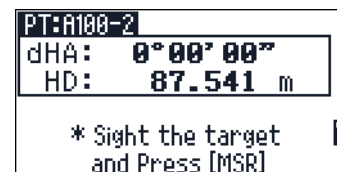
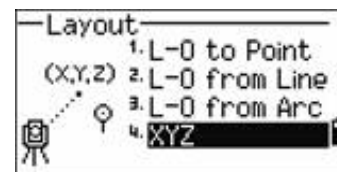
XYZ

Select this option to specify the layout point by coordinates.

1. Press **[4]** or select **XYZ** in the Layout menu.
2. Do one of the following:
 - Enter the point name that you want to establish and then press **[ENT]**.
 - Specify the point by code or radius from the TS525 construction total station. If several points are found, they are displayed in a list. Press **[^]** or **[v]** to move up and down the list. Use **[<]** to move up one page, or **[>]** to move down one page.
3. Highlight a point in the list and then press **[ENT]**.
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]**.

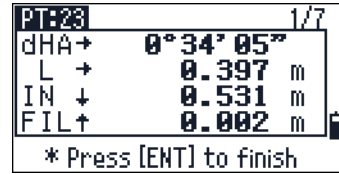
dHA Difference in horizontal angle to
the target point

HD Distance to the target point



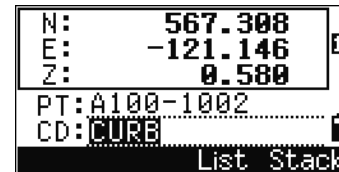
- Ask the rod person to adjust the target position. When the target is on the intended position, the displayed errors become 0.000 m (0.000 ft).

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



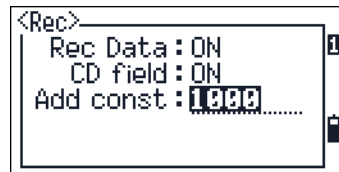
Once a measurement is taken, the Cut/Fill value and Z coordinate are updated as the VA is changed.

- To record the point, press [ENT]. The PT field defaults to the specified PT + 1000.

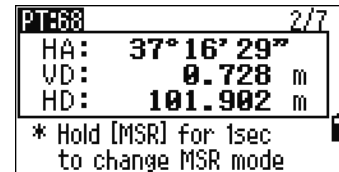


Press [MENU] and then select Settings / Rec.

Use the Add Constant field to specify an integer. The integer is added to the point number that is being laid out to generate a new number for recording the layout point. The default value is 1000. For example, when you stake out PT3 with an Add Constant of 1000, the default value in the SO field (layout record) is 1003.



The display then returns to the observation screen. 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.

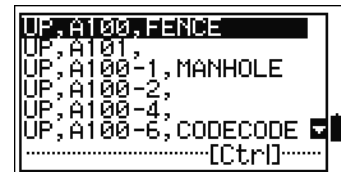
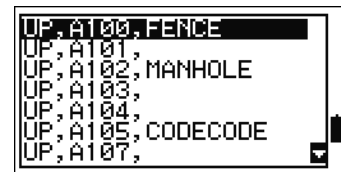
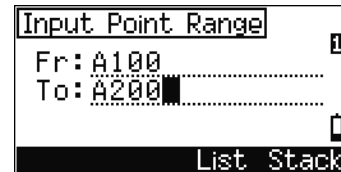
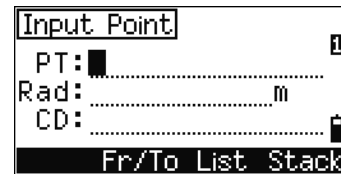


- If you selected a point from the list, the display returns to the list, unless all points have been selected. Press [ESC] to return to the point input screen.



Advanced feature: Specifying a layout list by inputting points by range

1. Select the **Fr/To** softkey when the PT field is selected.
2. Enter the start point (Fr) and the end point (To). The range between Fr and To must be less than 1001 points.
 - If existing points are found between Fr and To, a point list appears.
To highlight a point in the list, press **▲** or **▼**.
To go to the layout observation screen, press **ENT**.
 - If you have assigned a control job, and additional points are found in the control job, the **Ctrl 1** softkey appears under the list.



Programs menu

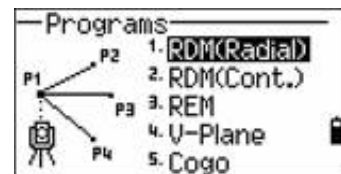
To access the Programs menu, press **PRG** in the BMS.

To select a command from the Programs menu, press the corresponding number key. Alternatively, press **▲** or **▼** to highlight the command and then press **ENT**.

The last function used is highlighted.

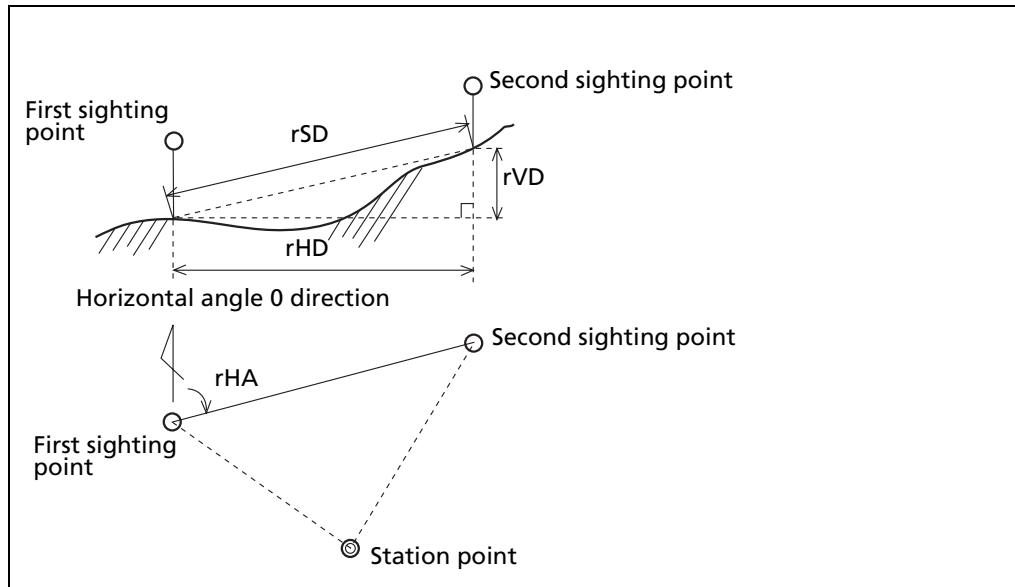
The Programs menu has the following options:

- [RDM \(Radial\), page 69](#)
- [RDM \(Cont\), page 69](#)
- [REM, page 70](#)
- [V-Plane, page 70](#)
- [Cogo, page 71](#)



Remote distance measurement (RDM) - overview

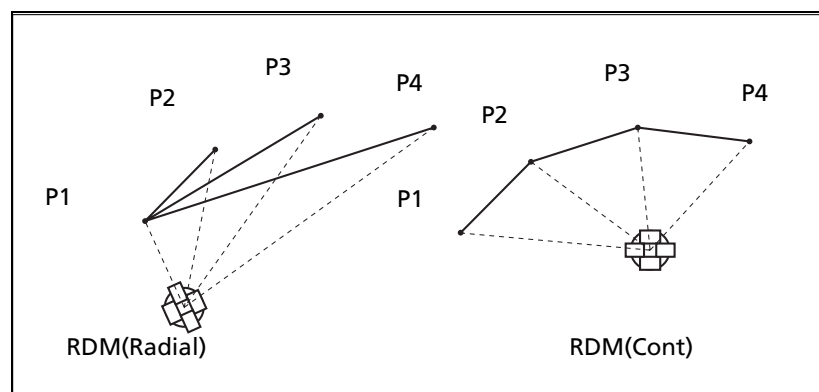
RDM or “Remote distance measurement” measures the horizontal distance, vertical distance, and slope distance between two points.



rSD	Slope distance between two points
rVD	Vertical distance between two points
rHD	Horizontal distance between two points
rV%	Percentage of grade $(rVD/rHD) \times 100\%$
rGD	Vertical grade $(rHD/rVD):1$
rAZ	Azimuth from first point to second point

Difference between RDM (Radial) and RDM (Cont) measurement methods

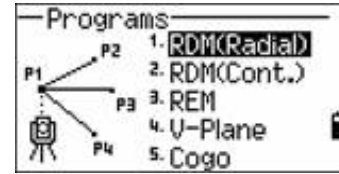
RDM (Radial) calculations are made with reference to the first point. RDM (Cont) calculations are made with reference to the two preceding points.



RDM (Radial)

Choose this option to measure between the current point and the first point measured.

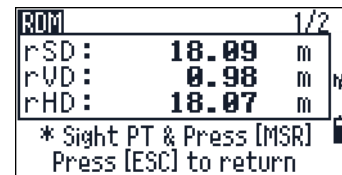
1. Press **1** or select RDM(Radial) in the Programs menu.
2. Sight the first point and press **[MSR1]** or **[MSR2]**.



The distance from the station point to the first point appears.

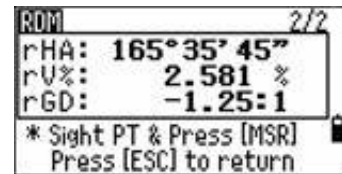
3. Sight the second point and press **[MSR1]** or **[MSR2]**. The distances between the first and second point are displayed.

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]**.

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

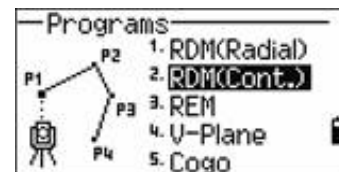


5. Press **[ESC]** to exit.

RDM (Cont)

Choose this option to measure between the current point and the immediately preceding point.

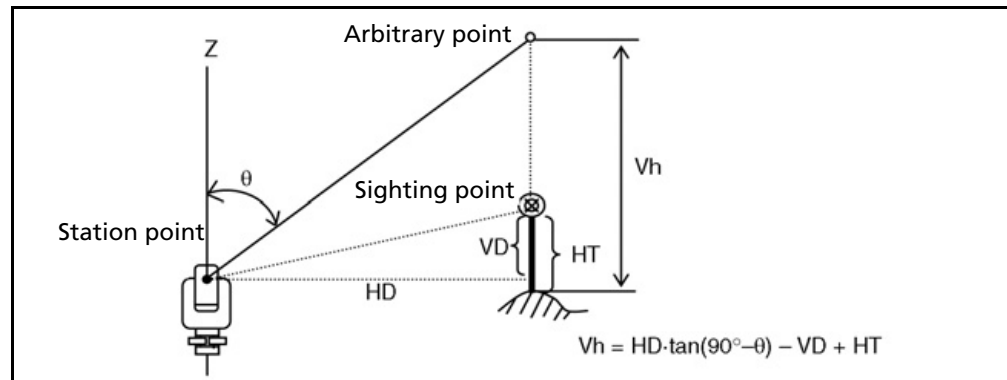
1. Press **2** or select RDM(Cont.) from the Programs menu.
2. Follow the procedure as for a radial RDM measurement. See also [RDM \(Radial\)](#), page 69.



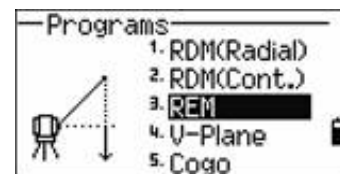
REM

Choose this option to measure a remote elevation.

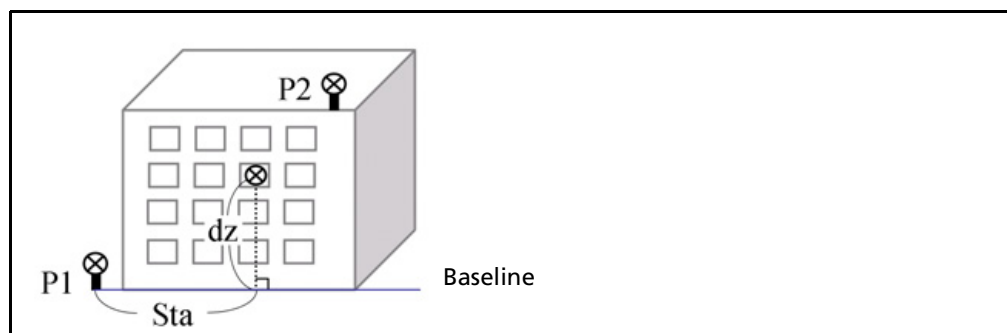
Note – A prism is required only at the sighting (target) point.



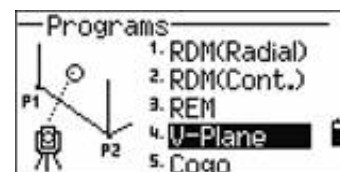
1. Press **[3]** or select **REM** in the Programs menu.
2. Enter the height of the target.
3. Sight the target point and press **[MSR1]** or **[MSR2]**.
4. Loosen the vertical clamp and then turn the telescope to aim at an arbitrary point.
The difference in elevation (V_h) appears.
5. Press **[ESC]** to exit.

**V-Plane**

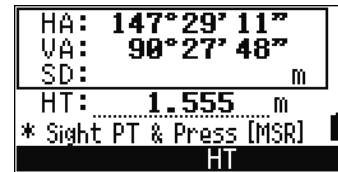
Choose this option to measure distance and offset values in the vertical plane, using the 2-Pt Reference Plane function.



1. Press **[4]** or select **U-Plane** in the Programs menu.
2. Enter the first point in the vertical plane:

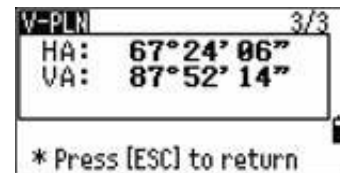


- a. To enter the first point by direct measurement, select the MSR softkey. A temporary observation screen appears.
 - b. Press [MSR1] or [MSR2]. The Record PT screen appears.
 - c. Enter a value in the PT and CD fields, and then press [ENT].
3. Enter the second point in the vertical plane. To do this, repeat [Step 2](#).



Once the plane is defined, the calculated Dwn and dZ values are updated as you move the telescope. No distance measurement is required.

Dwn Horizontal distance from P1 to the target point along the baseline
 dZ Vertical distance from P1 to the target point



Note – Press [DSP] to switch between display screens. See also [page 83](#).

4. Press [ESC] to exit this function.

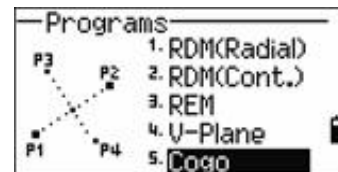
Cogo

Choose the Cogo option to perform coordinate geometry (Cogo) calculations.

To open the Cogo menu, press [5] on the Programs menu.

There are five items in the Cogo menu:

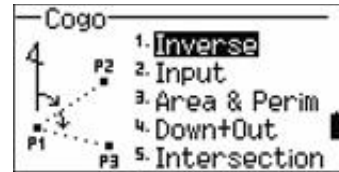
- [Inverse, page 72](#)
- [Input, page 74](#)
- [Area & Perm, page 76](#)
- [Down+Out, page 77](#)
- [Intersection, page 78](#)



Inverse

Choose this option from the Cogo menu to calculate angle and distance between two coordinates.

Press **[1]** or select **Inverse** in the Cogo menu. The Inverse menu appears.

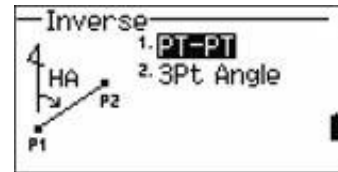


PT-PT inverse

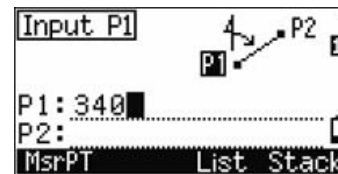
PT-PT calculates the distance and the angle between two input points.

To calculate a PT-PT inverse:

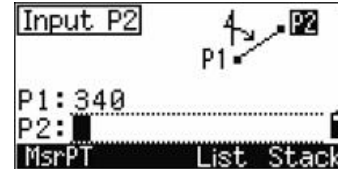
1. Press **[1]** or select **PT-PT** in the Inverse menu.
2. Enter the first point number or name, and then press **[ENT]**.



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.

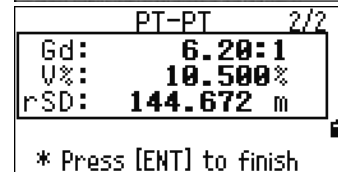
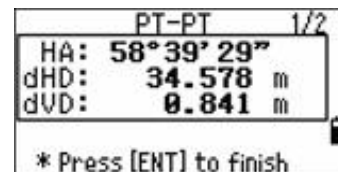


3. Type the second point number/name, and then press **[ENT]**. If necessary select the **MsrPT** softkey to shoot the point on the spot so that you can use it in the calculation.

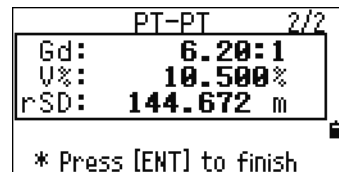


The azimuth, horizontal distance, and vertical distance from the first point to the second point are displayed.

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

If you choose 3Pt Angle, the TS525 construction total station calculates the angle between two lines defined by three points.

To calculate a 3Pt angle:

1. Press **[2]** or select **3Pt Angle** from the Inverse menu.

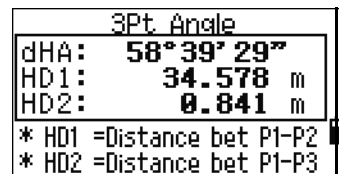
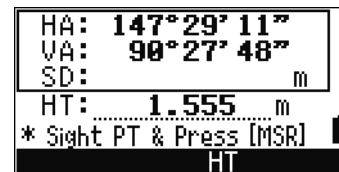
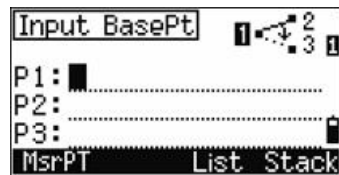
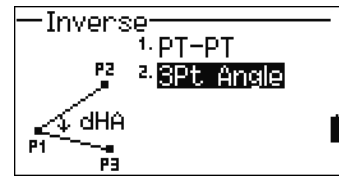
P1 is the base point. Two lines are to be defined by P2 and P3, both from P1.
2. Enter the P1 point name. Alternatively, use the **MSR** softkey to take a measurement to the point.
3. Enter the second point (P2) to define the baseline, P1-P2. The angle (dHA) is measured from the baseline.
4. Enter the third point (P3) to define the second line, P1-P3.

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]**.

When you have entered three points, the instrument calculates the angle and distances.

5. Do one of the following:
 - To return to the Inverse menu, press **[ENT]**.
 - To return to the Input BasePt screen, press **[ESC]**.



Input

Choose this option from the Cogo menu to calculate and manually input coordinates.

To enter the Input menu, press **[2]** or select **Input** from the Cogo menu. There are three functions in this menu for recording new coordinate points.

Azimuth+HD input

To calculate a coordinate by an angle and distance input from the base point (P1), press **[1]** or select **HA+HD** from the Input menu.

Enter the base point, P1. Type the point name and press **[ENT]**.

Enter the azimuth, horizontal distance, and vertical distance. Then press **[ENT]**.

For example, to enter $123^{\circ}45'45''$, type 123.4545 and then press **[ENT]**.

If you do not enter a value in the dVD field, the value 0.0000 is used.

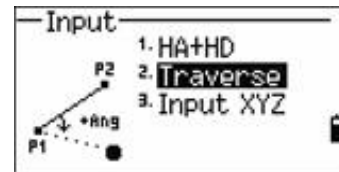
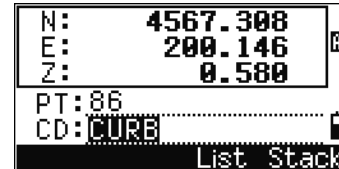
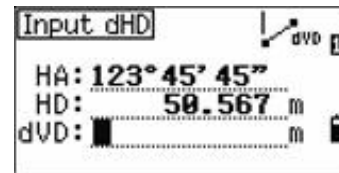
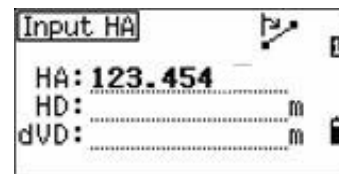
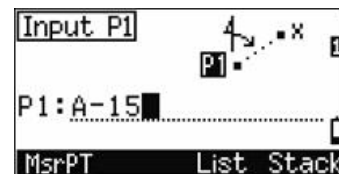
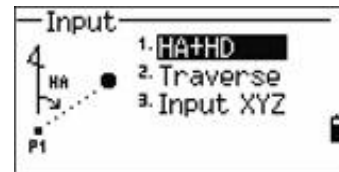
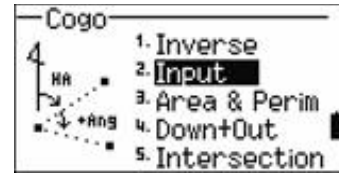
A recording point screen with the calculated coordinates appears. The PT field defaults to the last recorded point + 1.

Press **[ENT]** to store the point.

Traverse

To calculate a new point based on two defined points and the angle, horizontal and vertical distances from the line defined by those two points, use the Traverse (2Pt Angle) function.

Press **[2]** or select **Traverse** in the Input menu.



To enter P1 and P2, enter point names or take measurements to targets.

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.

When you press **[ENT]** in the dVD field, a new point is calculated. The name in the PT field defaults to the last recorded point, + 1.

To record the new point and return to the point input screen, press **[ENT]**.

P1 (the base point) defaults to the previously recorded point value. P2 defaults to the previous P1 value.



Tip – 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** from 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.

Area & Perm

Choose this option from the Cogo menu to calculate area and perimeter.

Press **[3]** or select **Area & Perim** in the Cogo menu.

To take a measurement, enter the first point and press **[ENT]**, or select the **Msr** softkey.

In the upper right corner of the screen, a counter indicates how many points you have entered.

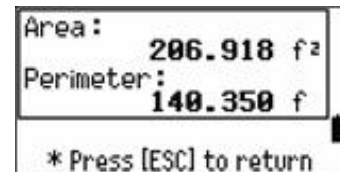
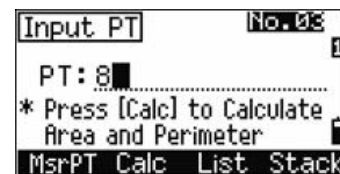
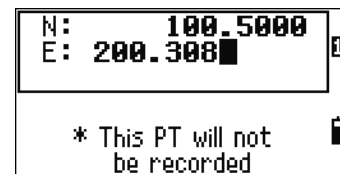
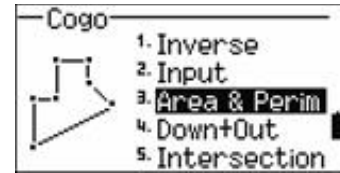
To input point numbers consecutively, use the **Fr/To** softkey. See also [Advanced feature: Entering a range of points, page 76](#).

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.

Continue to enter points until you have defined all the points in the lot. Then, press **[v]** to calculate the area and perimeter.

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.

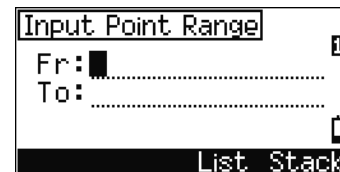
Press **[ENT]** to exit from the function, or press **[ESC]** to return to the previous screens one by one.



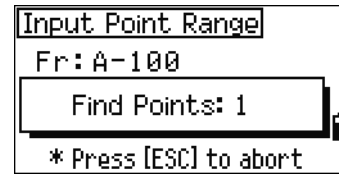
Advanced feature: Entering a range of points

To quickly enter a sequential range of points, use the range input function. To access this function, select the **Fr/To** softkey in the No. 01 or No. 02 input screens.

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.



To start searching for matching points, press **[ENT]** in the To field. The counter shows the number of matching points found.



When the search is complete, you are returned to the Input PT screen.

Select the **Calc** softkey to calculate the area and perimeter, or enter point names in the PT field.



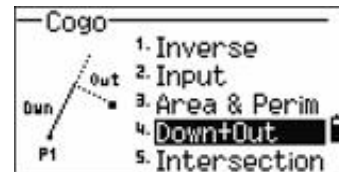
Press **[ESC]** to return to the Input PT screen where the preceding point name appears.

Note – 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. See also [Setting the control job, page 89](#).

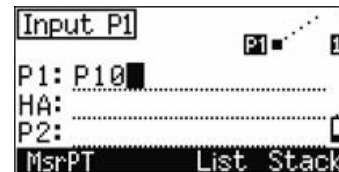
Down+Out

Choose this option from the Cogo menu to calculate coordinates from Down and Out.

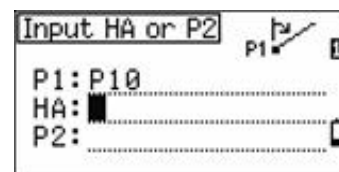
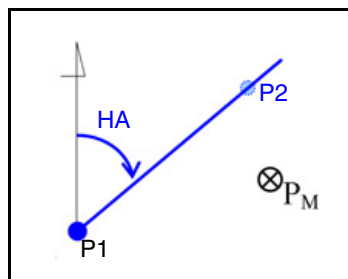
Press **[4]** or select **Down & Out** in the Cogo menu.



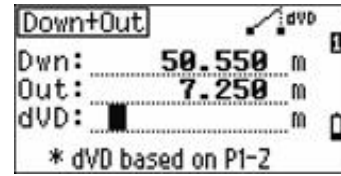
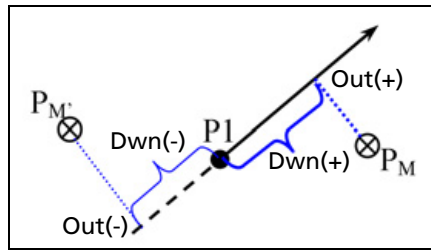
Enter the base point (P1).



Specify the azimuth bearing. To do this, enter a value in the HA or P2 field. P2 is a second point on the line.



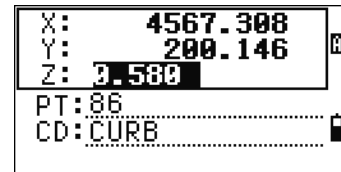
Enter the horizontal distance along the baseline (Dwn), the horizontal distance perpendicular to the line (Out), and the vertical distance (dVD).



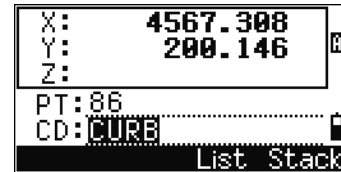
A negative value in the Dwn field means the opposite direction along the defined bearing line.

A negative value in the Out field is for the left-hand side of the bearing line.

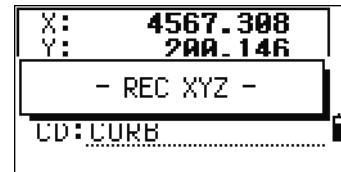
To calculate the coordinates of the point (PM), press **[ENT]** in the dVD field. You can change the Z coordinate here.



To record the point, press **[ENT]** in the CD field.



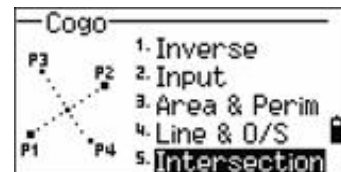
The coordinates are stored as a CC record.



Intersection

Choose this option from the Cogo menu to calculate coordinates using intersection functions.

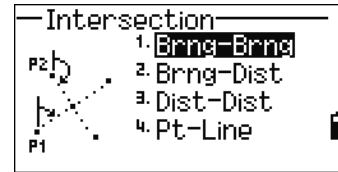
Press **[5]** or select **Intersection** in the Cogo menu. The Intersection menu appears. It has four functions for calculating coordinates.



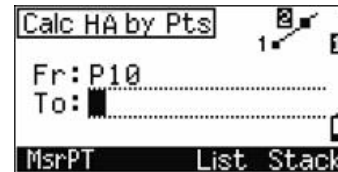
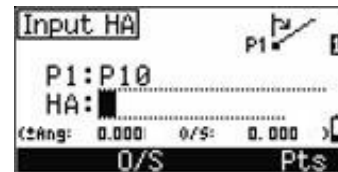
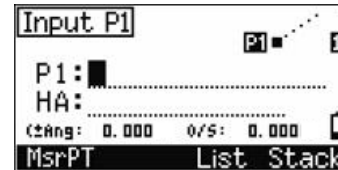
Calculating a bearing-bearing intersection

A bearing-bearing intersection is the intersection point of two lines. To calculate a bearing-bearing intersection:

1. Press **[1]** or select **Brng-Brng** in the Intersection menu.
2. Enter the first point name and press **[ENT]**. Alternatively, to measure directly to the point, select the **MSR** softkey.

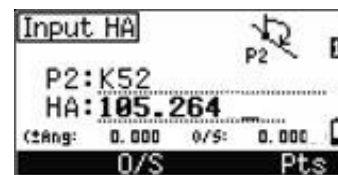


3. Define the first line by azimuth.
4. To define the line by two points, select the **Pts** softkey. The **Fr** field defaults to the **P1** point, but you can change the selected point. In the **To** field, enter or measure to the second point.

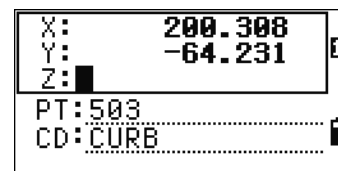


See also [Advanced feature: Entering angle and distance offsets](#), page 82.

5. Do one of the following:
 - To return to the previous screen, press **[ENT]**. The calculated value appears in the **HA** field.
 - To go to the next screen, press **[ENT]**.
6. Define the second line by two points or by **P2** and **HA**.



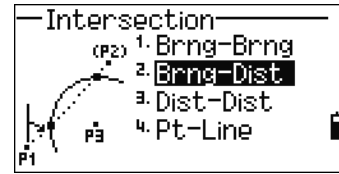
7. To calculate the coordinates of the intersection point, press **[ENT]** in the **HA** field. The calculated coordinates are displayed. You can input a **Z** coordinate if necessary.
8. Enter a value in the **PT** field and in the **CD** field.
9. To record the point, press **[ENT]**.



Calculating a bearing-distance intersection

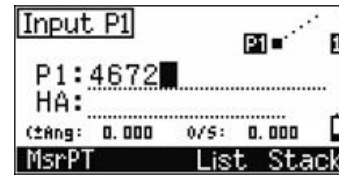
1. Press **[2]** or select **Brng-Dist** in the Intersection menu.

Brng-Dist calculates the intersection point formed by one line and one distance (radius).



2. Enter a point on the line.

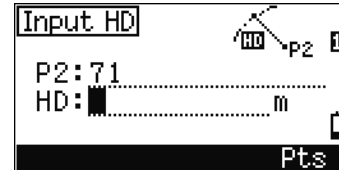
The line can be defined by two points or by a point and an azimuth.



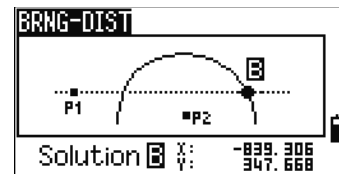
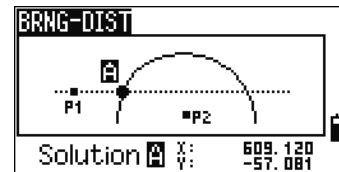
3. Enter the second point (P2) as the center of the circle.



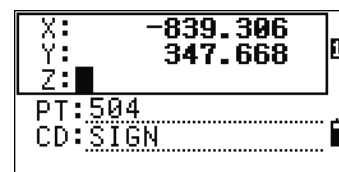
4. Enter the distance from P2:
 - To define the distance (HD) by two points, select the **Pt- \approx** softkey.
 - To calculate the coordinates of the intersection point, press **[ENT]** in the HD field.



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.

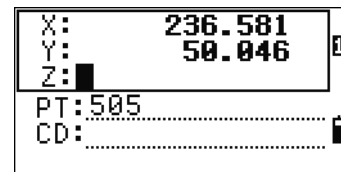
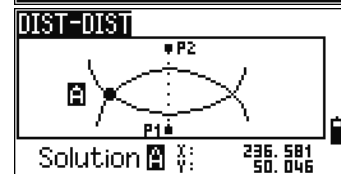
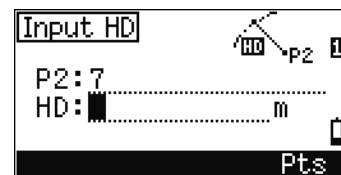
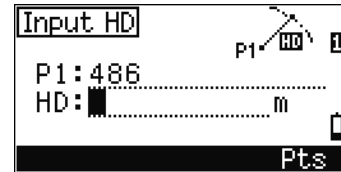
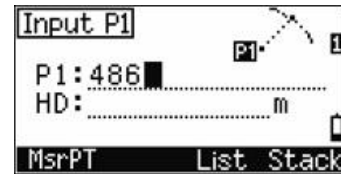


7. Enter a Z coordinate if necessary.
8. To move to the PT and CD fields, press **[ENT]**.



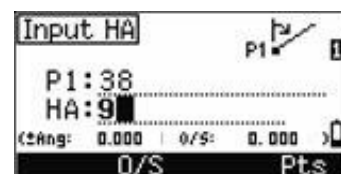
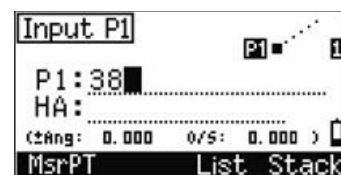
Calculating a distance-distance intersection

1. Press **[3]** or select **Dist-Dist** in the Intersection menu.
2. Enter the first point name and press **[ENT]**, or select the **Msr** softkey to measure directly to the point.
3. Enter the distance from P1 and press **[ENT]**.
4. To define the distance (HD) by two points, select the **Pts** softkey.
5. Enter P2 and the distance from P2 (HD).
6. To calculate the coordinates of the intersection point, press **[ENT]** in the HD field.
7. Press **[←]** or **[→]** to display the second solution.
8. To record the point, press **[ENT]** when the required solution appears.
9. Enter a Z coordinate if necessary.
10. Press **[ENT]** to move to the PT and CD fields.

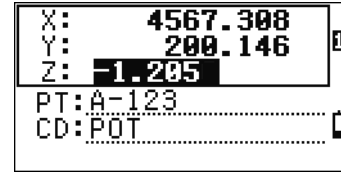
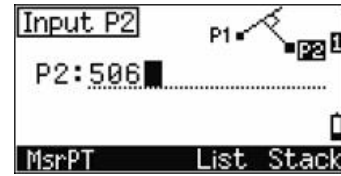


Calculating a point-line intersection

1. Press **[4]** or select **Pt-Line** in the Intersection menu.
2. Enter the first point name and press **[ENT]**, or select the **Msr** softkey to measure directly to the point.
3. Enter the azimuth, or select the **Pts** softkey to enter another point name on the line.

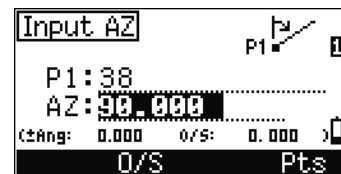


4. Enter the perpendicular point to the line, or select the MSR softkey to take a measurement to the point.
5. To calculate the coordinates of the intersection point, press **[ENT]**.
If P1 and P2 are 3D points, the Z coordinate of the perpendicular point is calculated relative to the P1-P2 slope.
6. Enter PT and CD then press **[ENT]** to record the point.

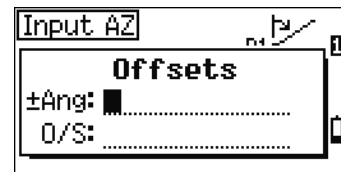
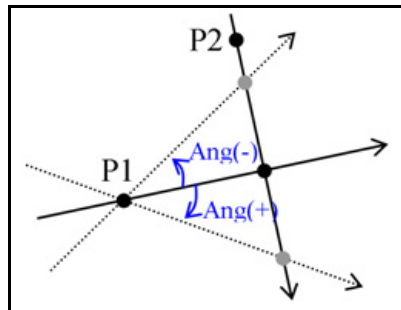


Advanced feature: Entering angle and distance offsets

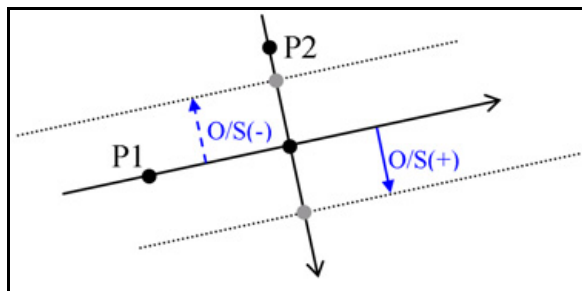
To display the offset input screen, select the O/S softkey.



In the Ang field, enter a positive value to rotate the line clockwise. Enter a negative value to rotate the line counter clockwise.



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.



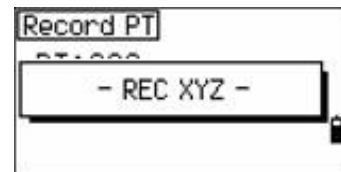
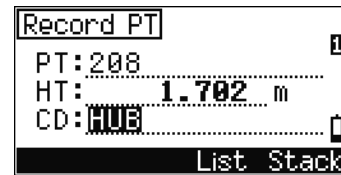
Recording measurement data

To record points from any observation screen, press **[ENT]**.

PT defaults to the last recorded PT, + 1.

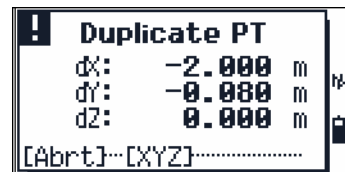
You can enter the PT name from the point list or the point stack. See [Entering a point from the point list, page 48](#), and [Entering a point from the point stack, page 48](#).

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



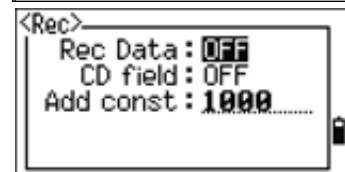
If HA or VA is moved after you take a measurement, but before you press **[ENT]**, the recalculated coordinates will be stored.

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. See [Recording data, page 127](#).



If you do not need to record data, press **[MENU]** and set **Settings / Rec** to OFF.

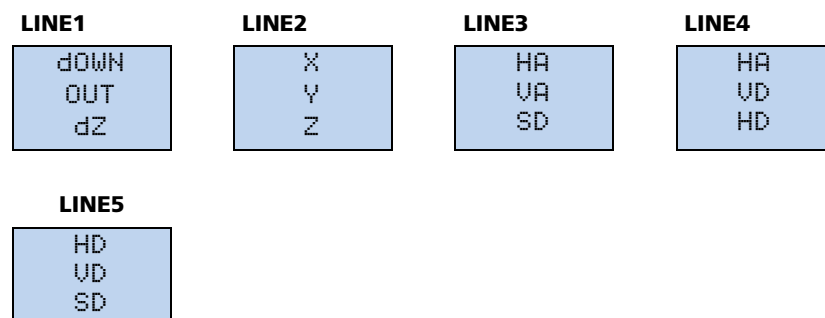
The default setting is OFF.



Switching between display screens

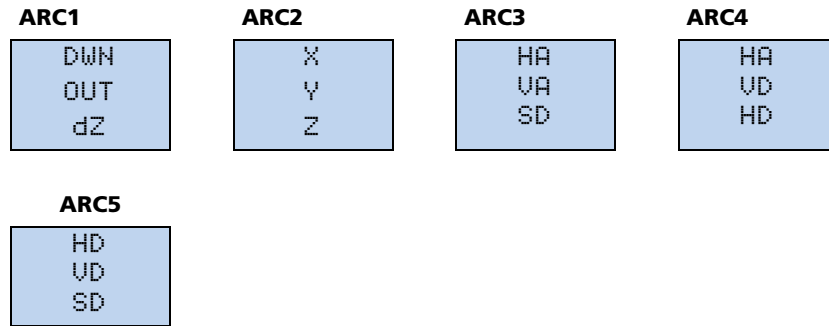
Press **[DSP]** to switch between display screens. See the **[DSP]** button, [page 40](#). Each time you press **[DSP]**, the next screen appears. When you press **[DSP]** in the final screen, the first screen appears.

The following line display screens are available.



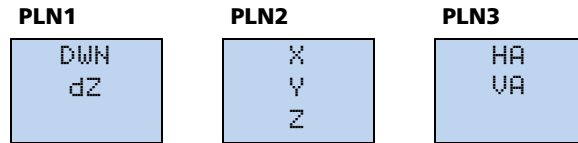
The LINE5 screen is available only if the secondary distance unit is set. See also [Other settings, page 94](#).

The following arc display screens are available.



The ARC5 screen is available only if the secondary distance unit is set. See also [Other settings, page 94](#).

The following plane display screens are available.



Menu Screen

In this chapter:

- Job
- Settings (basic job settings)
- Data
- Communication
- 1sec-Key
- Calibration
- Time

Use the MENU screen to access functions and settings.

To display the MENU screen, press the **MENU** key.

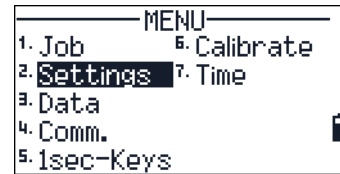
Job

Use the Job option to open, create, delete, and manage jobs.

To open the Job Manager, press **[1]** or select **Job** from the MENU screen.

If jobs are stored on the TS525 construction total station, the job list appears. It shows all the stored jobs with the newest job at the top of the list. See [Opening an existing job, page 86](#).

If no jobs are stored, the Create Job screen appears. See [Creating a new job, page 86](#).



Opening an existing job

The job list shows all the jobs stored on the instrument, in descending date order.

The following symbols provide extra information about jobs:



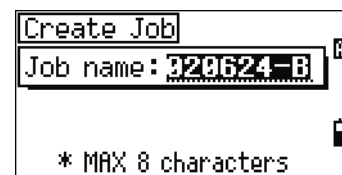
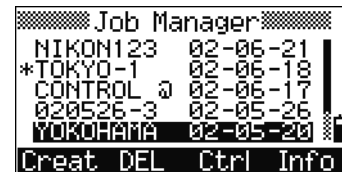
Symbol	Meaning
*	Current job
@	Control job
!	Some of the job settings are different from the current job

Press **[^]** to move up or **[v]** to move down the job list. Press **[ENT]** to open the highlighted job.

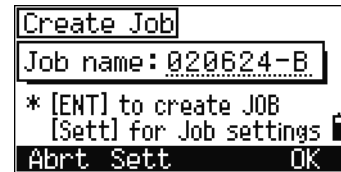
When you open a job, all job settings are automatically changed to match those used in the open job.

Creating a new job

- Select the **Cr eat** softkey in the job list.
- Enter a job name of up to eight characters. Select **[ENT]**.
- Do one of the following:



- To check the job settings, select the **Sett** softkey.
- To create a new job using the current job settings, press **[ENT]** or select the **OK** softkey.



Job settings

Job settings are separate from other temporary settings.

Job settings are established 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.

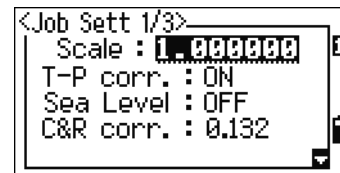
To move between fields, press **[^]** or **[v]**. Alternatively, to move to the next field, press **[ENT]**.

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.

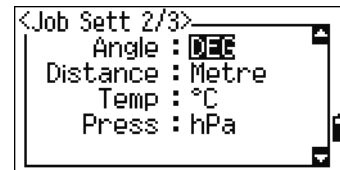
Screen 1

Scale Factor	0.999600 to 1.000400
T-P correction	ON / OFF
Sea Level	ON / OFF
C&R correction	OFF / 0.132 / 0.200



Screen 2

Angle unit	DEG / GON / MIL
Distance unit	Metre / US-Ft / I-Ft
Temp unit	°C / °F
Press unit	hPa / mmHg / inHg

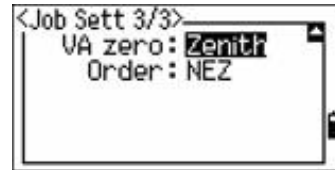


Screen 3

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.



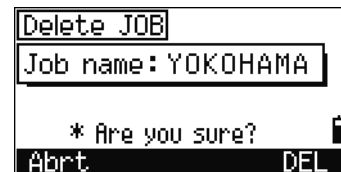
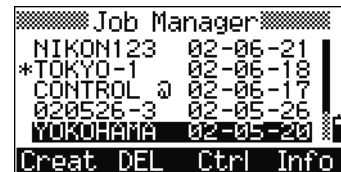
VA zero Zenith / Horizon
 Order NEZ / ENZ



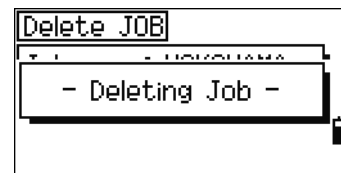
Deleting a job

Note – There is no undelete function in 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 to delete.
2. Select the **DEL** softkey. A confirmation screen appears.
3. Do one of the following:
 - To delete the selected job, press **ENT** or select the **DEL** softkey.
 - To cancel the deletion and return to the previous screen, press **ESC** or select the **Abt** softkey.



After you delete a job, the job list appears.



Setting the control job

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:

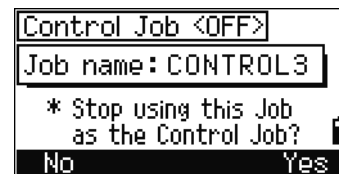
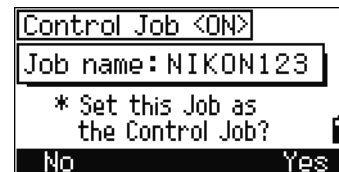
1. Highlight the job that you want to use as the control job.
2. Select the **Ctrl 1** softkey.

A confirmation screen appears.

3. Do one of the following:
 - To set the selected job as the control job, press **ENT** or select the **Yes** softkey.
 - To cancel the process, press **ESC** or select the **No** softkey.

If a control job is already assigned, the newly assigned control job replaces it as the control job.

To clear the selected control job, highlight the current control job in the job list and select the **Ctrl 1** softkey. Then press **ENT** or select the **Yes** softkey.



Displaying job information

To display job information, highlight the job name and then select 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 button.

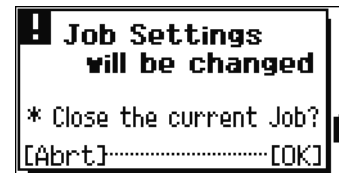
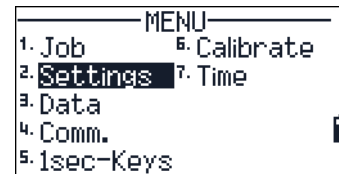


Settings (basic job settings)

Use the Settings menu to configure the basic job settings.

Press **[2]** or select **Settings** on the MENU screen.

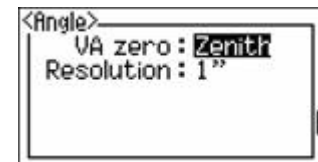
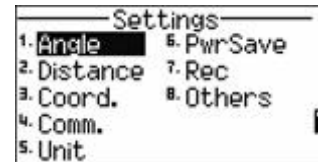
Some job settings, as identified in the following sections, cannot be changed once a job is created. If you attempt to change any of these settings while a job is open, a confirmation screen appears, asking you to create a new job with the new settings, or to work with the new settings without recording any data. See [Settings, page 128](#).



Angle

To change the angles, press **[1]** or select **Angle** in the Settings menu.

VA zero	Zenith / Horizon
Resolution	1" / 5" / 10" 0.2 / 1 / 2 mgon 0.005 / 0.02 / 0.05 mil



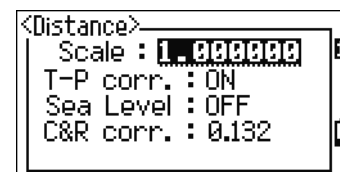
The VA zero job setting cannot be changed once a job is created.

Distance

These settings cannot be changed once a job is created.

To change the distance, 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



Temperature and pressure corrections

$$K = 278.23 - \left[\frac{0.29527}{1 + \left[\frac{T}{273.16} \right]} \times P \right]$$

$$SD^1 = \left[1 + \frac{K}{1000000} \right] \times SD$$

SD	Slope dist. (before adj.)
SD'	Slope dist. (after adj.)
K	Compensation coefficient
P	Pressure (hPa)
T	Temperature (°C)

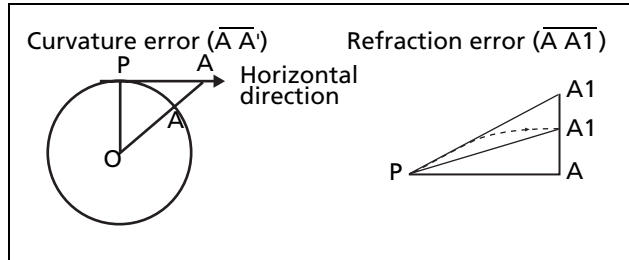
Sea-level corrections

$$HD' = \frac{HD \times R_e}{R_e + Z_{STN}}$$

HD	Horizontal dist. (before adj.)
HD'	Horizontal dist. (after adj.)
Z _{STN}	Instrument-Z
R _e	6370 km

Curvature and refraction corrections

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**.



$$HD' = HD - \frac{SD^2 \sin(2VA)}{2R_e} \left(1 - \frac{k}{2}\right)$$

$$VD' = VD - \frac{HD^2}{2R_e} (1 - k)$$

- 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)

Coordinate

Press **3** or select **Coord.** in the Settings menu. The Coordinate menu appears.

Order NEZ / ENZ
Label XYZ / YXZ / NEZ(ENZ)



The Order and AZ job settings cannot be changed once a job is created.

Communications

Press **4** or select **Comm.** in the Settings menu. The Communication menu appears.

Ext.Comm NIKON / SET
Baud (bps) 1200 / 2400 / 4800 / 9600 / 19200 /
 38400
Length 7 / 8
Parity EVEN / ODD / NONE
Stop bit 1 / 2



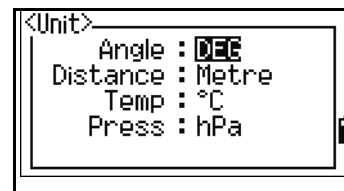
See also [Chapter B, Transferring Coordinate Data](#).

Unit

Note – The Angle, Distance, Temp, and Press job settings cannot be changed once a job is created.

Press **5** or select **Unit** in the Settings menu. The Unit menu appears.

Angle DEG (Degree)
 GON (GON)
 MIL (Mil6400)
Distance Meter
 US-Ft
 I-F
Temp °C (Celsius)
 °F (Fahrenheit)
Pressure hPa
 mmHg
 inHg



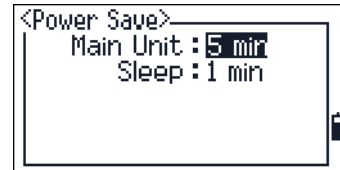
If you select US-Ft or I-Ft, an additional settings screen appears. Use this screen to specify whether to display values in Decimal-Ft or Ft-Inch.



Power saving

To open the Power Save menu, press **[4]** or select **Power Save** in the Settings menu.

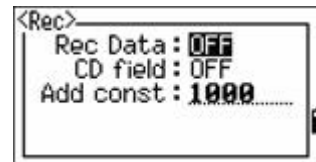
Main unit	OFF / 5 min / 10 min / 30 min
Sleep	OFF / 1 min / 3 min / 5 min



Recording

Press **[7]** or select **Rec** in the Settings menu. The Rec Menu appears.

Rec Data	ON / OFF
CD field	ON / OFF
Add const	Integer between 1 and 999,999



- If you need to record coordinate data from your observations, set the Rec Data field to ON.
- If you would like to record a feature code when you record coordinate data, set the CD field to ON. The CD field appears in the Recording PT screen.
- This field sets the default point number for the observed coordinate data when you select Layout / XYZ.

Other settings

Press **[8]** or select **Other** in the Settings menu. The Others menu appears.

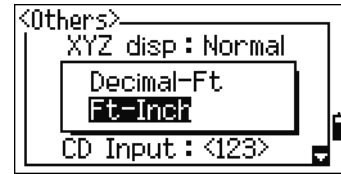
XYZ disp	Fast / Normal / Slow / +ENT
2nd Unit	None / Meter / US-Ft / I-Ft
CD Input	123 / ABC
Owner's Detail	Up to 20 characters



XYZ disp defines the speed to move to the next screen after showing XYZ of the input point.

When the secondary unit is set to a unit, an extra display screen is available in the BMS, layout observation screens, and L-O from 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.



The CD Input field sets the default input mode when a CD field appears.

The Owner's Detail field allows you to enter your name or the name of your company. If you enter a value in this field, it appears when you start the TS525 construction total station.



To provide easier configuration for common regional settings, you can quickly configure the TS525 construction total station to a pre-set combination of default regional settings. See also [Regional configuration, page 44](#).

The TS525 construction total station total station supports multiple languages installed on the instrument. For more information on changing the language settings, see [page 44](#).

Data

Use the Data menu to view or edit records. To access it, press **[3]** on the MENU screen.

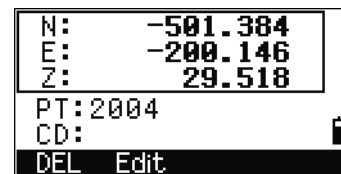


Viewing coordinate data

Coordinate data appears in a list, with the newest record at the bottom of the screen. Use **[↑]** or **[↓]** to scroll through the records. Use **[←]** or **[→]** to move up or down one page.



Press **[ENT]** to see more detailed information about the selected record.



The header (XYZ, YXZ, NEZ, or ENZ) depends on the Coord. Label setting, which is accessed by pressing **[MENU]** and then selecting **Settings / Coord**. See also [Coordinate, page 93](#).

UP, MP, CC, SS, and SO records

All coordinate records contain PT, CD, X, Y, and Z fields.

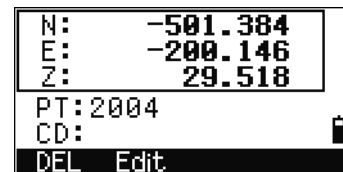
- UP records are uploaded point coordinates.
- MP records are manually input point coordinates.
- CC records are points calculated in Cogo.
- SS records are sideshot records stored in the BMS.
- SO records are stored in layout functions.

Deleting coordinate records

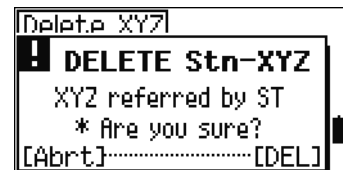
1. In the XYZ screen, use \uparrow or \downarrow to highlight the record that you want to delete. Then select the DEL softkey.
2. A confirmation screen appears.
 - a. To delete the selected record, press ENT or select the YES softkey.
 - b. To cancel the deletion of data, press ESC or select the NO softkey.



Alternatively, delete coordinate data by selecting the DEL softkey in the detailed display screen for the record.



If the record that you want to delete is referred by any station record, a confirmation message appears.



Editing coordinate records

You can edit point, CD, and coordinate values in coordinate records. However, you cannot edit the coordinate record for the current station.

1. Do one of the following:
 - In the XYZ screen, use \uparrow or \downarrow to highlight the record to edit. Then select the Edit softkey.
 - In the detailed data screen, select the Edit softkey.
2. Use \uparrow or \downarrow to highlight a field. Then modify the value in the selected field.
3. When you have finished editing, press ENT in the CD field.



A confirmation screen appears.

4. Do one of the following:
 - To accept the changes and return to the data view screen, press **[ENT]** or select the **✓** softkey.
 - To go back to the edit screen, press **[ESC]** or select the **⏪** softkey.

Searching coordinate records

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

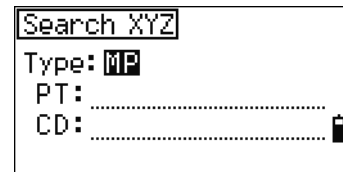
In the XYZ screen, select the **SRCH** softkey to access the XYZ data search function.



To search for a record by point name, enter the point 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.

To search for a record 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.



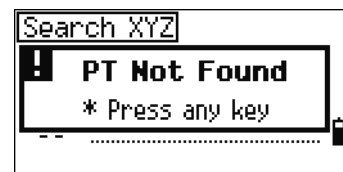
- If more than one point matches the search criteria, the matching points are displayed in a list.

Use **[↑]** or **[↓]** to highlight the required point. Press **[ENT]** to select it.

Detailed data for the selected record appears. Select 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 button to return to the data screen.



Entering coordinates

In the XYZ screen, select the **INPUT** softkey. A new input point screen appears.

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.

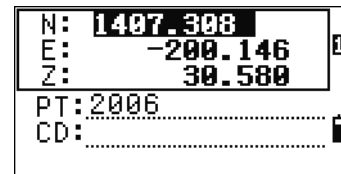


Use the numeric keys to enter the coordinates. Press **[ENT]** or **[v]** in each field to move to the next field.

When you press **[ENT]** in the CD field, the point is stored as an MP record.

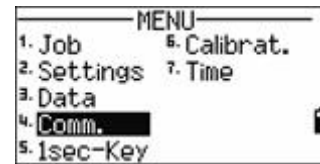
After you have recording a point, the next point input screen is shown with the updated default PT.

You can record NE, NEZ, or Z-only data.



Communication

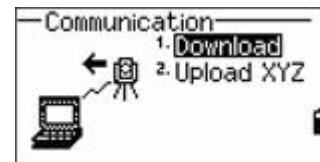
Use the Communication menu to download or upload data. To access it, press **[4]** or select **Comm.** on the MENU screen.



Downloading coordinate data

To change the download settings, press **[1]** or select **Download** in the Communication menu.

Format	NIKON (Fixed)
Data	Coordinate (all) Coordinate (layout records only)

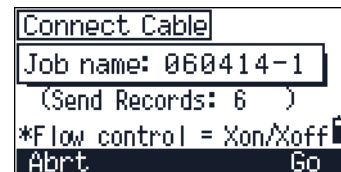


To display the total number of records that will be downloaded, press **[ENT]** in the Data field.

As each record in the current job is output from the TS525 construction total station, the current line number is updated.

Once transferring is completed, you can choose whether to delete the current job:

- To delete the current job, press **[4]**.
- To return to the Basic Measurement Screen (BMS) without deleting the current job, press **[ESC]** or select the **Abt** softkey.



Uploading coordinate data

To upload coordinate data from a computer, press **[2]** or select **Upload XYZ** in the Communication menu.

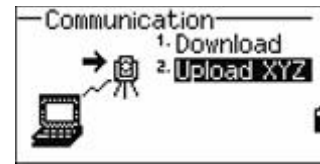
The default data format appears.

To change the order of data fields, select the **Edit** softkey. See also [Advanced feature: Editing the data order for upload, page 99](#).

Otherwise, press **[ENT]**.

Select the **Job** softkey to go to the Job Manager screen. See also [Job, page 86](#).

To change the communication settings, select the **Comm** softkey. The serial port settings must match the settings used by the terminal software on the computer.



Use an RS-232C cable to connect the TS525 construction total station to the computer. In the terminal program, set flow control to Xon/Xoff.

The Free space field shows the number of points that can still be stored on the TS525 construction total station.

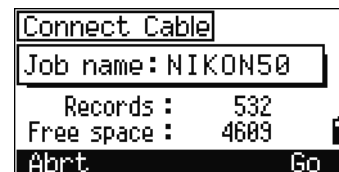
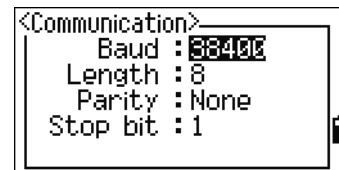
Press **[ENT]** to put the TS525 construction total station in receive mode. On the computer, choose the Send Text File command in the terminal program to start sending data.

As each point is received by the instrument, the value in the Records field is incremented.

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.

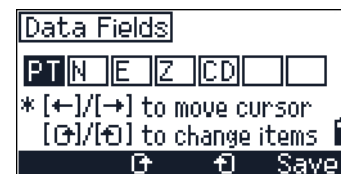
During upload, the system will truncate any code that is longer than 16 characters.

If the existing point is a UP, CC, or MP record, and it is not referred to by any station or backsight, it is automatically overwritten by the uploaded point. No error message appears.



Advanced feature: Editing the data order for upload

1. Select the **Edit** softkey. The Data Fields screen appears.
2. To move between the fields, press **[←]** or **[→]**.
3. To change the selected item in a field, use the **[G]** and **[H]** softkeys. The options are PT, N, E, Z, CD, or blank.



- To save your changes and return to the previous screen, select the **Save** softkey.

For example, if your original data is as follows:

1, 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

For more information about coordinate data, see [Transferring coordinate data to the total station](#), page 120.

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 an item in your original file, set the corresponding field to blank.

1sec-Key

Use the 1sec-Key menu to configure the settings for the one-second buttons, **[MSR1]**, **[MSR2]**, and **[DSP]**.

To access it, press **[5]** or select **1sec-Keys** in the MENU screen.



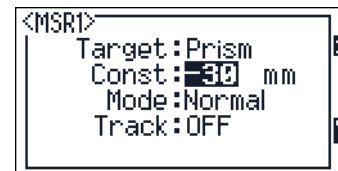
[MSR] button settings

There are two **[MSR]** buttons:

- To change the settings for the **[MSR1]** button, press **[1]** or select MSR1.
- To change the settings for the **[MSR2]** button, press **[2]** or select MSR2.

Each **[MSR]** button has four settings.

In the Const and Track field, use the numeric keys to enter values. In the other fields, use **[<]** or **[>]** to change the settings.



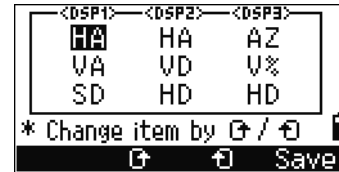
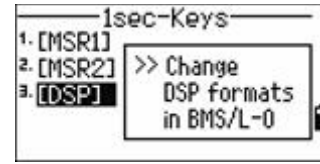
Tip – To quickly access the settings screen, hold down **[MSR1]** or **[MSR2]** for one second.

DSP button settings

To change the display items in the BMS and in Layout observation screens, press **[2]** or select **[DSP]** in the Isec-Keys menu.

To move the cursor, use **[←]**, **[→]**, **[↑]** or **[↓]**. To change the display item, press either the **[G]** softkey or the **[A]** softkey.

To save the changes, press **[ENT]** from the last line of <DSP> or select the **Save** softkey.



Tip – To quickly access the DSP settings screen, hold down **[DSP]** for one second.

Calibration

Use the Calibration screen to calibrate the instrument if required. To access the Calibration screen, press **[6]** or select **Calibrat** from the MENU screen.

See also [Adjusting the calibration, page 105](#).



Time

Use the Date & Time screen to set the current date and time.

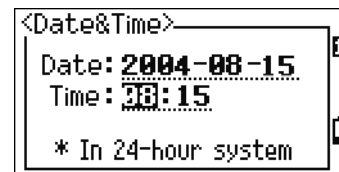
1. Press **[7]** or select **Time** on the MENU screen. The Date & Time screen appears.

The current date and time settings are displayed.

2. Enter the date in Year-Month-Day format. For example, to change the date to August 15, 2006 press **[2][0][0][6][ENT][8][ENT][1][5][ENT]**.

If the highlighted part of the field (for example, the year) is already correct, press **[ENT]** to use the current value. For example, if the date is already set to August 20, 2006, and you want to change the date to August 25, 2006, press **[ENT][ENT][2][5][ENT]**.

3. To move to the Time field, press **[ENT]** from 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]**.
5. Do one of the following:
 - To finish setting the date and time, press **[ENT]** in the Minutes field.
 - To cancel the changes, press **[ESC]**.



Checking and Adjusting

In this chapter:

- Plate level
- Circular level
- Zero point errors of vertical scale and horizontal angle corrections
- The instrument constant
- Checking and adjusting the laser pointer

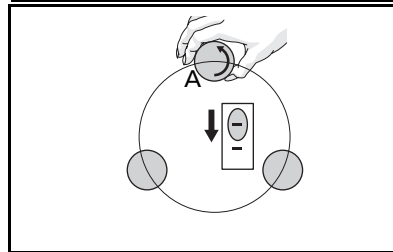
This chapter describes how to check the accuracy of the TS525 construction total station, and if necessary, adjust the required settings.

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:

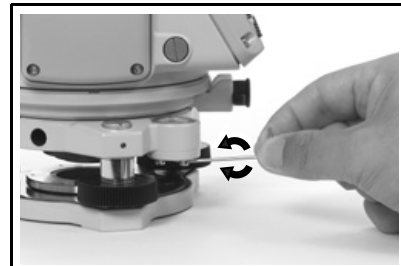
1. Set up the instrument on the tripod.
2. Follow the procedures described in [Leveling the instrument, page 28](#).
3. Rotate the alidade 180°.
4. Check whether the bubble is in the center of the vial.
5. If the bubble is not in the center of the vial, adjust the plate level:
 - a. Using the adjusting 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](#).



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.



Zero point errors of vertical scale and horizontal angle corrections

Checking the calibration

1. Set up the instrument on the tripod.
2. Follow the leveling procedures described in [Leveling the instrument, page 28](#).
3. Flip the telescope to the Face-1 position. The display and tangent screws are facing towards you.
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. The display and tangent screws are turned away from you.
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.

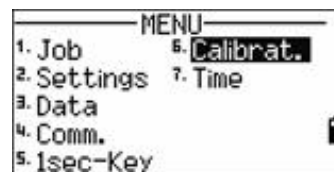
Note – The difference between the vertical angle reading the relevant angle (either 360° for Zenith, or 180° or 540° for Horizon) is called the **altitude constant**.

Adjusting the calibration

1. Press **[MENU]** and **[6]**. The calibration screen appears.
2. Take an F1 measurement to a target on the horizon. Press **[ENT]**.

The calibration fields for F1 are:

X1	Face-1 X-axis tilt value
Y1	Face-1 Y-axis tilt value
VA1	Face-1 vertical angle (tilt-off value)
HA1	Face-1 horizontal angle (tilt-off value)



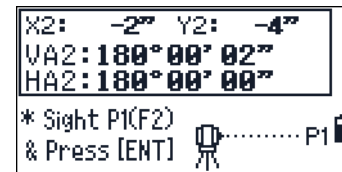
The vertical angle is shown in the V0 dir= Horiz setting.

When you have taken the measurement, the message on the bottom line changes from **DO NOT TOUCH!** to **Turn to F2**.

3. Take an F2 measurement to the same target. Press **[ENT]**.

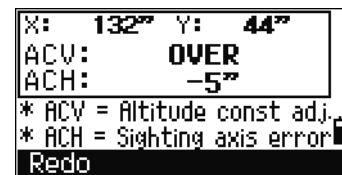
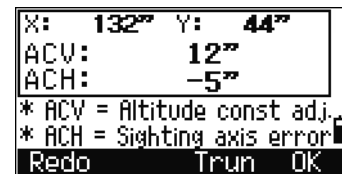
The TS525 construction total station has horizontal and vertical axis adjustment:

X2	Face-2 X-axis tilt value
Y2	Face-2 Y-axis tilt value
VA2	Face-2 vertical angle (tilt-off value)
HA2	Face-2 horizontal angle (tilt-off value)



When the observation on F2 is completed, four parameters are displayed.

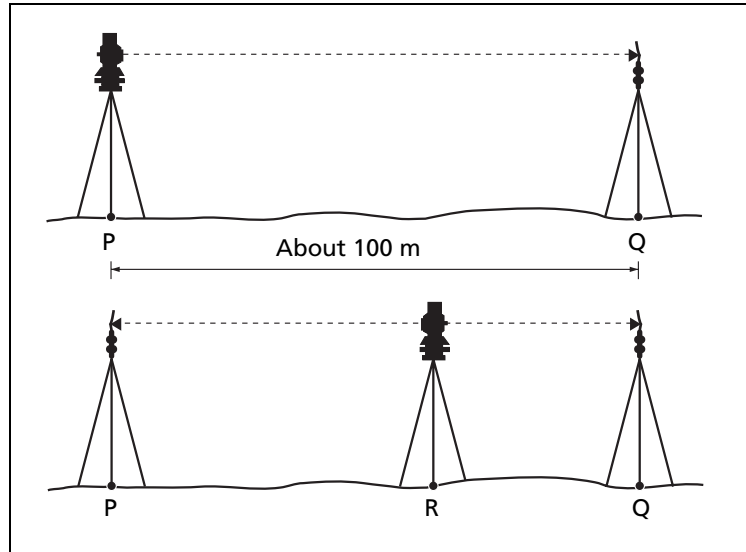
4. Do one of the following:
 - To return to the first observation screen, press **[ESC]** or select the **Redo** softkey.
 - To set parameters on the instrument, press **[ENT]** or select the **OK** softkey.
5. If ACV, ACH, or Tilt is out of range, **OVER** appears. Press any key to return to the first observation screen.



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 at the factory. However, to ensure the highest operational accuracy, we recommend that you check the instrument constant several times a year.

The following figure shows the setup to check the instrument constant.



To check the instrument constant, either compare a correctly measured base line with the distance measured by the EDM, or carry out the following procedure.

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 TS525 construction total station to the tripod at Point R.
7. Measure the distance from Point R to Point P (RP), and the distance from Point R to Point Q (RQ).
8. Calculate the difference between the value of PQ and the value of RP + RQ.
9. Move the TS525 construction total station to other points on the line between Point P and Point Q.
10. Repeat [Step 5](#) through [Step 9](#) several times.
11. Calculate the average of all the differences.
The error range is within 3 mm. ***If the error is out of range, contact your dealer.***

Checking and adjusting the laser pointer

The TS525 construction total station uses a red laser beam to measure and as a laser pointer. The laser pointer is coaxial with the line of sight of the telescope. If the instrument is well adjusted, the red laser pointer coincides with the line of sight. External influences such as shock or large temperature fluctuations can displace the red laser pointer relative to the line of sight.

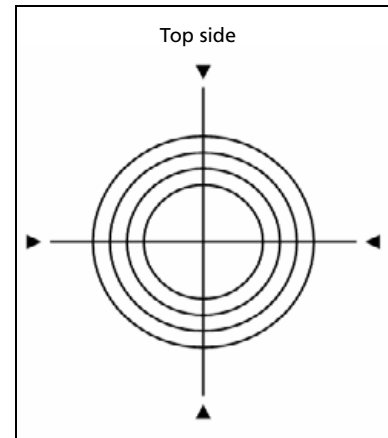
Aligning the laser pointer



WARNING – Viewing the laser spot on the adjustment target through the telescope is safe. Do not try to make the adjustment using a prism. The reflected light from a prism can be dazzling.

To avoid faulty measurements using the laser pointer, use the supplied adjustment target to check the laser alignment regularly and before you attempt precise distance measurements:

1. Set up the adjustment target 20 to 30 meters away, facing the instrument.
2. Activate the laser pointer function to switch on the red laser beam.
3. Aim the instrument to the center of the adjustment target plate and then inspect the position of the red laser spot in relation to the telescope cross-hairs.
4. If the red laser spot lies outside the crosshairs, adjust the direction of the beam until it matches the cross-hairs.



Adjusting the laser beam

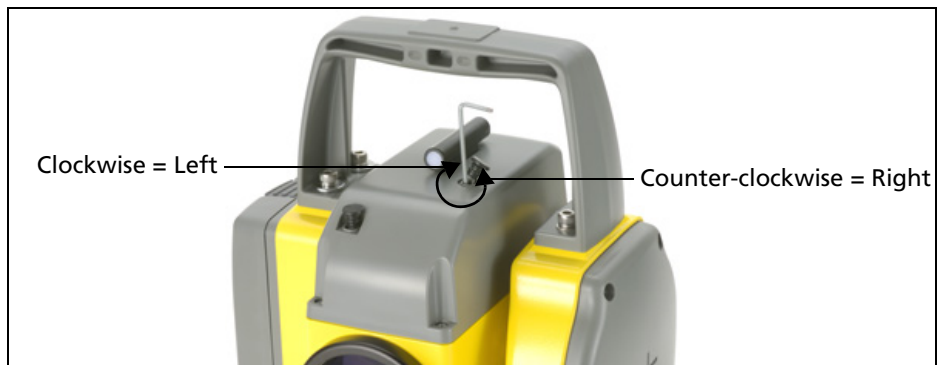
1. Pull out the two plugs from the adjustment ports on top of the telescope cover.



2. To correct the vertical position of the laser spot, insert the Allen wrench into the vertical adjustment port and turn it as shown here. Turn clockwise to move the vertical position down. Turn counter-clockwise to move it up.



3. To correct the horizontal position of the laser spot, insert the Allen wrench into the horizontal adjustment port and turn it as shown here. Turn clockwise to move the horizontal position left. Turn counter-clockwise to move it right.



4. Check the alignment of the laser spot and the cross-hairs. Throughout the adjustment procedure, keep the telescope pointing to the adjustment target. The adjusting screws are of a high tension because they are self-locking. The screws tighten automatically after you adjust them.
5. Refit the plugs in the adjustment holes. Make sure that the plugs are correctly fitted for proper sealing against the cover.



CAUTION – To keep out moisture and dust, make sure that the plugs are correctly fitted in the adjustment ports.

Specifications

In this chapter:

- Measurement range
- Distance measurement precision
- Measurement intervals
- Angle measurement
- Dual-axis tilt sensor
- Clamps/tangent screws
- Tribrach
- Level vial sensitivity
- Display and keypad
- Connections in the base of instrument
- Battery pack BC-65
- Environmental performance
- Dimensions
- Weight
- Standard components
- External device connector

This appendix details the specifications and standard components of the TS525 construction total station. It also describes the connector that is used to connect the instrument to an external power source or to communicate with an external device.

Telescope

Tube length	158 mm (6.20 inch)
Magnification	33×
Effective diameter of objective	45 mm (1.77 inch) EDM 50 mm (1.97 inch)
Image	Erect
Field of view	1°20' 2.3 m at 100 m (2.3 ft at 100 ft)
Resolving power	3.0"
Focussing distance	1.5 m to infinity (59 inch to infinity)

Measurement range

Distances shorter than 1.5 m (4.92 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) 270 m (886 ft)

Standard prism (1P) 3,000 m (9,840 ft)

Reflectorless mode

Reference target 200 m (656 ft)

Notes –

The target should not receive direct sunlight.

“Reference target” refers to a white, highly reflective material (KGC 90%).

Distance measurement precision

Precise mode	
Prism mode	$\pm (3 + 2 \text{ ppm} \times D) \text{ mm}$ -10 °C through +40 °C (+14 °F through +104 °F) $\pm (3 + 3 \text{ ppm} \times D) \text{ mm}$ (-20 °C through -10 °C), (+40 °C through +50 °C) (-4 °F through +14 °F), (+104 °F through +122 °F)
Reflectorless mode	$\pm (3 + 2 \text{ ppm} \times D) \text{ mm}$ -10 °C through +40 °C (+14 °F through +104 °F) $\pm (3 + 3 \text{ ppm} \times D) \text{ mm}$ (-20 °C to -10 °C), (+40 °C through +50 °C) (-4 °F through +14 °F), (+104 °F through +122 °F)
Normal mode	
Prism mode	$\pm (10 + 5 \text{ ppm} \times D) \text{ mm}$
Reflectorless mode	$\pm (10 + 5 \text{ ppm} \times D) \text{ mm}$

Measurement intervals

Measurement intervals may vary with the measuring distance or weather conditions; At the initial measurement, it may take longer.

Precise mode	
Prism mode	1.5 sec.
Reflectorless mode	1.8 sec.
Normal mode	
Prism mode	0.8 sec.
Reflectorless mode	1.0 sec.
Prism offset correction	-999 mm to +999 mm (1 mm step)

Angle measurement

Reading system	Photoelectric incremental encoder
Circle diameter (reading)	Diameter of encoder: 88 mm (3.46 in.) Diameter of etching pattern on encoder: 79 mm (3.11 in.)
Minimum display increment	
DMS	1"/5"/10"
400G	0.2 mgon / 1 mgon / 2 mgon
MIL6400	0.005 mil / 0.02 mil / 0.05 mil
DIN18723 accuracy	5"/ 2.0 mgon

Dual-axis tilt sensor

Method	Liquid-electric detection
Compensation range	±3°

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

Display and keypad

Display type	Graphical LCD
Resolution	128 × 64
Display illumination	Backlight
Keys	25
Supplied on	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	8 hours
Distance/angle measurement every 30 seconds	16 hours
Continuous angle measurement	30 hours

Note – Tested at 25 °C (77 °F) (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)
Water resistance	IP 56

Dimensions

Main unit	Approximately 168 mm W × 173 mm D × 347 mm H (6.6 inch W × 6.8 inch D × 13.7 inch H)
Carrying case	Approximately 470 mm W × 350 mm D × 231 mm H (18.5 inch W × 13.8 inch D × 9.1 inch H)

Weight

Main unit	Approximately 5.0 kg (11.20 lbs) (with tribrach) Approximately 5.4 kg (11.90 lbs) (with tribrach and battery)
Battery BC-65	Approximately 0.4 kg (0.88 lbs)
Carrying case	Approximately 4.4 kg (9.70 lbs)
Charger	Approximately 0.3 kg (0.66 lbs)
Cable for charger	Approximately 0.34 kg (0.75 lbs)

Standard components

- TS525 main body
- Battery pack (BC-65)
- International charger, power cord, and adaptors
- Adjustment pin, Allen wrench
- The *Trimble TS525 Construction Total Station CD*. This contains a PDF version of this user guide.
- Carrying case
- Laser safety kit
- Allen wrench (1.5 mm) for laser pointer adjustment and target for adjustment

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 DC 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



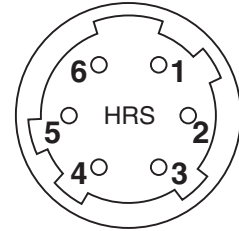
CAUTION – Except when connected as shown in the [System diagram, page 16](#), use of the Hirose HR10A-7P-6P or HR10-7P-6P is at your own risk.



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 the TS525 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 – Only use 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 TS525.

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 TS525.

Cap the data output/external power input connector securely when the TS525 is not in use. The TS525 is not watertight if the cap is detached or not attached securely, or when the data output/external power input connector is in use.

The TS525 can be damaged by static electricity from the human body discharged through the data output/external power input connector. Before handling the TS525, touch any other conductive material once to remove static electricity.

Transferring Coordinate Data

In this chapter:

- Transferring coordinate data to the total station
- Transferring coordinate data from the total station

The TS525 construction total station uses lists of coordinate data. This chapter describes how to transfer data between the total station and the office computer.

Transferring coordinate data to the total station

Settings

To configure the transmission speed and other settings, press **(MENU)** and then select **Settings / Comm.** See also [Communications, page 93](#).



Record format

You can transfer coordinate records to the TS525 construction total station 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 formats use the following codes:

Code	Description	Length
PT	Point number	Up to 20 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
```

Transferring coordinate data from the total station

Settings

To configure the transmission speed and other settings, press **MENU** and then select `Settings / Comm.` See also [Communications, page 93](#).



Data examples

Nikon coordinate data format

```
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
```


Error Messages

In this chapter:

- Cogo
- Communications
- Data
- Job manager
- Layout
- Programs
- Recording data
- Searching
- Settings
- Station setup
- System error

The appendix describes the error messages that may appear when you use the TS525 construction total station.

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 while data is being transferred to the TS525 construction total station, the total station stops the transfer and displays one of the following messages:

Check Data

There are errors in the data that is being transferred to the total station, such as an alphabetic character in a coordinate field.

Press any key. Then check the specified line in the data.

DUPLICATE PT



CAUTION – If the existing point is a UP, CC, or MP record, and the point is not referred to by ST or BS, the existing point will be overwritten by the uploaded record. No error message appears.

The uploaded data contains a duplicate PT.

Press any button. Then check the specified point in the data.

PT MAX20 chars

The uploaded data contains a PT with a name or number that is longer than 20 digits.

Press any button. Then check the specified line in the data.

XYZ OVERRANGE

The uploaded data contains a coordinate that is longer than 13 digits.

Press any button. Then check the specified line in the data.

Data

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 these records.

Press any button 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 this record.

To...	Press...
delete XYZ	the DEL softkey
return to the previous screen without deleting XYZ	ESC or the Abort softkey

Job manager

Cannot Assign

You have tried to set the current job as the control file.

Press any button 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 button to return to the Job Manager. Then select the DEL softkey to delete old jobs.

Existing Job

You have entered an existing job name for a new job.

Press any button 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 button to return to the Job Manager. Then select the DEL softkey to delete old jobs.

Layout

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 button 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 Layout 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.

Programs

NO Stn Setup



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 Programs function may not be correct.

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

Recording data

DATA FULL

The data storage is full.

Press any button to return to the Basic Measurement Screen (BMS). Then:

To...	Press...
delete unnecessary data	MENU and select Data
delete jobs	MENU and select 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 button to return to the point input screen. Change the setting in the PT field.

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 Abort 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 button to return to the previous screen. Then check the setting for the current ST coordinate.

Searching

PT Not Found

There is no point that matches the criteria entered.

Press any button 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 90](#))
- Scale, T-P, Sea Lvl, or C&R in the Distance screen (see [Distance, page 90](#))
- Coord or Az Zero in the Coordinates screen (see [Coordinate, page 93](#))
- Angle, Dist, Temp, or Press in the Unit screen (see [Unit, page 93](#))

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.

Station setup

Same Coordinate

The input PT or coordinate is identical to the current station in STN/2:Known, or the same coordinate or point name/number is found in Resection.

Press any button 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 select the ABRT softkey. Select the DEL softkey in Job Manager to delete old jobs.
continue	press [ENT] or select 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 button 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 button to return to the PT input screen. Then use a PT that has a Z coordinate. See [page 60](#).

System error

=SYSTEM ERROR=

The system has detected an internal error that is related to the lower-level system. Press any key to turn the instrument off. The system will reboot when this error is reported. If you still have more points to shoot in the site, turn the instrument on and repeat the open a job and station setup procedures.

Data stored before this error will be kept safely in the Job file. If the error appears frequently, please contact your dealer or Trimble Support and report the message that appears below the =SYSTEM ERROR= line.



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