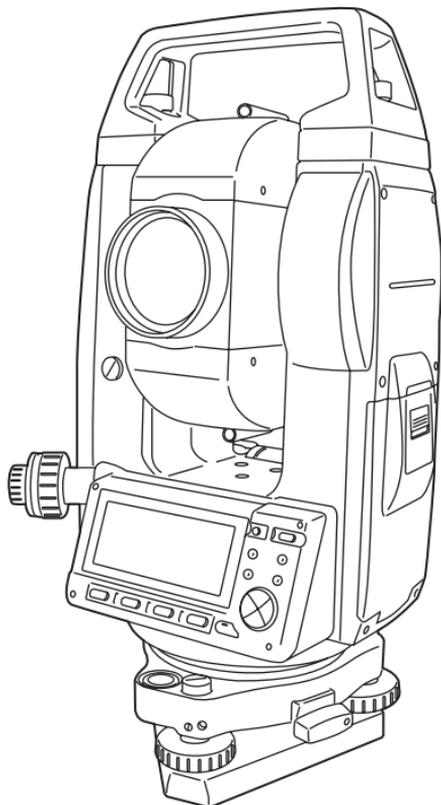


SOKKIA

LDT520 LDT520S

Laser Digital Theodolite



Class 3R Laser Product

OPERATOR'S MANUAL



Li-ion

CONTAINS Li-ion BATTERY.
MUST BE RECYCLED OR DISPOSED OF PROPERLY.

JSIMA

:This is the mark of the Japan Surveying
Instruments Manufacturers Association.

SOKKIA

LDT520
LDT520S
Laser digital Theodolite

Class 3R Laser Product

OPERATOR'S MANUAL

- Thank you for selecting the LDT520/LDT520S Laser Digital Theodolite.
- Before using the instrument, please read this operator's manual carefully.
- Verify that all equipment is included.
☞ "15.1 Standard Equipment"
- The specifications and general appearance of the instrument may be altered at any time and may differ from those appearing in brochures and this manual.
- Some of the diagrams shown in this manual may be simplified for easier understanding.

HOW TO READ THIS MANUAL

Symbols

The following conventions are used in this manual.

-  : Indicates precautions and important items which should be read before operations.
-  : Indicates the chapter title to refer to for additional information.
-  : Indicates supplementary explanation.
-  : Indicates an explanation for a particular term or operation.
- [LASER]** etc. : Indicates softkeys on the display.
- {ESC}** etc. : Indicates operation keys on the LDT.
- <Meas> etc. : Indicates screen titles.

Notes regarding manual style

- Except where stated, "LDT520" means LDT520 and LDT520S in this manual.
- Screens and illustrations appearing in this manual are of LDT520.
- Location of softkeys in screens used in procedures is based on the factory setting. It is possible to change the allocation of softkeys in Meas Mode.
-  What are softkeys: "4.1 Parts of the Instrument", Softkeys allocation: "12.2 Allocating Key Functions"
- Learn basic key operations in "5. BASIC OPERATION" before you read each measurement procedure.
- For selecting options and inputting figures, see "5.1 Basic Key Operation".
- All company and product names featured in this manual are trademarks or registered trademarks of each respective organization.

READ THIS
FIRST

INTRODUCTION

PREPARATION
FOR
MEASURE-
MENT

MEASURE-
MENT

ADDITIONAL
DETAILS

TROUBLE-
SHOOTING

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INFORMATION ABOUT LDT

1. PRECAUTIONS FOR SAFE OPERATION

For the safe use of the product and prevention of injury to operators and other persons as well as prevention of property damage, items which should be observed are indicated by an exclamation point within a triangle used with WARNING and CAUTION statements in this operator's manual.

The definitions of the indications are listed below. Be sure you understand them before reading the manual's main text.

Definition of Indication



WARNING

Ignoring this indication and making an operation error could possibly result in death or serious injury to the operator.



CAUTION

Ignoring this indication and making an operation error could possibly result in personal injury or property damage.



This symbol indicates items for which caution (hazard warnings inclusive) is urged. Specific details are printed in or near the symbol.



This symbol indicates items which are prohibited. Specific details are printed in or near the symbol.



This symbol indicates items which must always be performed. Specific details are printed in or near the symbol.

1. PRECAUTIONS FOR SAFE OPERATION

General

Warning

-  Do not use the unit in areas exposed to high amounts of dust or ash, in areas where there is inadequate ventilation, or near combustible materials. An explosion could occur.
-  Do not perform disassembly or rebuilding. Fire, electric shock, burns, or hazardous radiation exposure could result.
-  Never look at the sun through the telescope. Loss of eyesight could result.
-  Do not look at reflected sunlight from a prism or other reflecting object through the telescope. Loss of eyesight could result.
-  When securing the instrument in the carrying case make sure that all catches, including the side catches, are closed. Failure to do so could result in the instrument falling out while being carried, causing injury.

Caution

-  Do not use the carrying case as a footstool. The case is slippery and unstable so a person could slip and fall off it.
-  Do not place the instrument in a case with a damaged catch, belt or handle. The case or instrument could be dropped and cause injury.
-  Do not wield or throw the plumb bob. A person could be injured if struck.
-  Secure handle to main unit with locking screws. Failure to properly secure the handle could result in the unit falling off while being carried, causing injury.
-  Tighten the adjustment tribrach clamp securely. Failure to properly secure the clamp could result in the tribrach falling off while being carried, causing injury.

Power Supply

Warning

-  Do not short circuit. Heat or ignition could result.
-  Do not place articles such as clothing on the battery charger while charging batteries. Sparks could be induced, leading to fire.
-  Do not use voltage other than the specified power supply voltage. Fire or electrical shock could result.

1. PRECAUTIONS FOR SAFE OPERATION

-  Do not use damaged power cords, plugs or loose outlets. Fire or electric shock could result.
-  Do not use power cords other than those designated. Fire could result.
-  Use only the specified battery charger to recharge batteries. Other chargers may be of different voltage rating or polarity, causing sparking which could lead to fire or burns.
-  Do not heat or throw batteries into fire. An explosion could occur, resulting in injury.
-  Do not use the battery, charger or AC (power) cable for any other equipment or purpose. Fire or burns caused by ignition could result.
-  To prevent shorting of the battery in storage, apply insulating tape or equivalent to the terminals. Otherwise shorting could occur resulting in fire or burns.
-  Do not use batteries or the battery charger if wet. Resultant shorting could lead to fire or burns.
-  Do not connect or disconnect power supply plugs with wet hands. Electric shock could result.

Caution

-  Do not touch liquid leaking from batteries. Harmful chemicals could cause burns or blisters.

Tripod

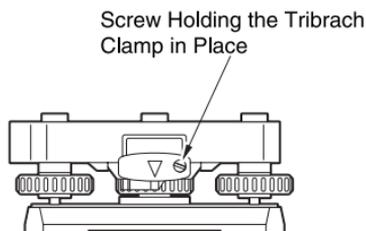
Caution

-  When mounting the instrument to the tripod, tighten the centering screw securely. Failure to tighten the screw properly could result in the instrument falling off the tripod, causing injury.
-  Tighten securely the leg fixing screws of the tripod on which the instrument is mounted. Failure to tighten the screws could result in the tripod collapsing, causing injury.
-  Do not carry the tripod with the tripod shoes pointed at other persons. A person could be injured if struck by the tripod shoes.
-  Keep hands and feet away from the tripod shoes when fixing the tripod in the ground. A hand or foot stab wound could result.
-  Tighten the leg fixing screws securely before carrying the tripod. Failure to tighten the screws could lead to the tripod legs extending, causing injury.

2. PRECAUTIONS

Tribrach Clamp

- When the instrument is shipped, the tribrach clamp is held firmly in place with a locking screw to prevent the instrument from shifting on the levelling base. Before using the instrument the first time, loosen this screw with a screwdriver. And before transporting it, tighten the locking screw to fasten the tribrach clamp in place so that it will not shift on the levelling base.



Precautions concerning water and dust resistance

LDT conforms to IP66 specifications for waterproofing and dust resistance when the battery cover is closed and connector caps are attached correctly.

- Be sure to close the battery cover and correctly attach the connector caps to protect the LDT from moisture and dust particles.
- Make sure that moisture or dust particles do not come in contact with the inside of the battery cover, terminal or connectors. Contact with these parts may cause damage to the instrument.
- Make sure that the inside of the carrying case and the instrument are dry before closing the case. If moisture is trapped inside the case, it may cause the instrument to rust.

Other precautions

- If the LDT is moved from a warm place to an extremely cold place, internal parts may contract, making the keys difficult to operate. This is caused by cold air trapped inside the hermetically sealed casing. If the keys do not depress, open the battery cover to resume normal functionality. To prevent the keys from becoming stiff, remove the connector caps before moving the LDT to a cold place.
- Never place the LDT directly on the ground. Sand or dust may cause damage to the screw holes or the centering screw on the base plate.
- Do not aim the telescope at the sun. Internal damage to the instrument may result.
- Protect the LDT from heavy shocks or vibration.
- When the operator leaves the instrument attached to the tripod, the vinyl cover should be placed on the instrument.
- Never carry the LDT on the tripod to another site.
- Turn the power off before removing the battery.

- When placing the LDT in its case, first remove its battery and place it in the case in accordance with the layout plan.
- Consult your local dealer before using the instrument under special conditions such as long periods of continuous use or high levels of humidity. In general, special conditions are treated as being outside the scope of the product warranty.

Maintenance

- Always clean the instrument before returning it to the case. The lens requires special care. First, dust it off with the lens brush to remove tiny particles. Then, after providing a little condensation by breathing on the lens, wipe it with a soft clean cloth or lens tissue.
- If the display is dirty, carefully wipe it with a soft, dry cloth. To clean other parts of the instrument or the carrying case, lightly moisten a soft cloth in a mild detergent solution. Wring out excess water until the cloth is slightly damp, then carefully wipe the surface of the unit. Do not use any organic solvents or alkaline cleaning solutions.
- Store the LDT in a dry room where the temperature remains fairly constant.
- Check the tripod for loose fit and loose screws.
- If any trouble is found on the rotatable portion, screws or optical parts (e.g. lens), contact your local dealer.
- When the instrument is not used for a long time, check it at least once every 3 months.

"14. CHECKS AND ADJUSTMENTS"

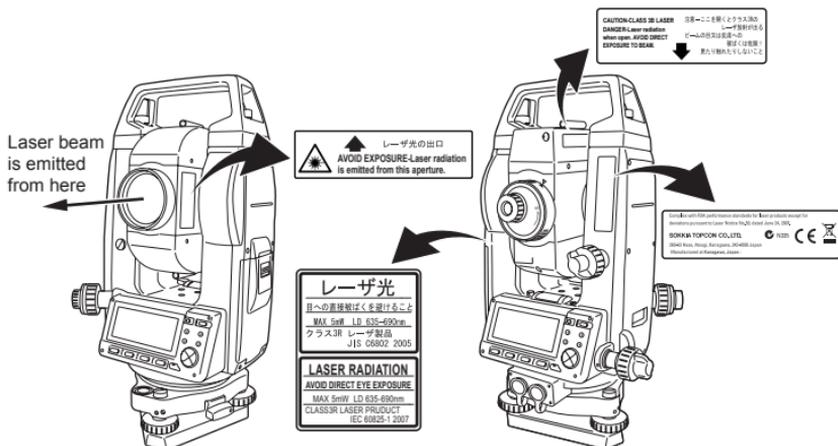
- When removing the LDT from the carrying case, never pull it out by force. The empty carrying case should be closed to protect it from moisture.
- Check the LDT for proper adjustment periodically to maintain the instrument accuracy.

3. LASER SAFETY INFORMATION

The LDT is classified as a class 3R Laser Product according to IEC Standard Publication 60825-1 Amd. 2:2001 and United States Government Code of Federal Regulation FDA CDRH 21 CFR Part 1040.10 and 1040.11 (Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.)

Warning

- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- Follow the safety instructions on the labels attached to the instrument as well as in this manual to ensure safe use of this laser product.



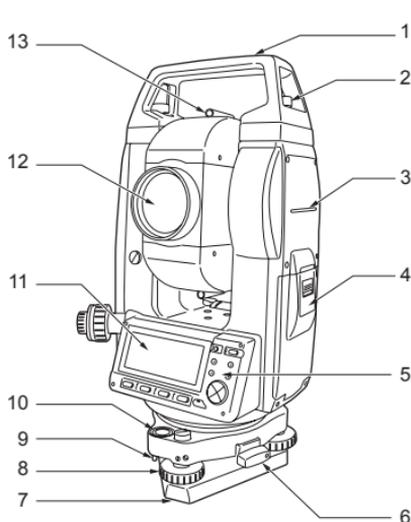
- Never point the laser beam at another person. If the laser beam strikes skin or an eye, it could cause serious injury.
- Do not look directly into the laser beam source. Doing so could cause permanent eye damage.
- Do not stare at the laser beam. Doing so could cause permanent eye damage.
- If an eye injury is caused by exposure to the laser beam, seek immediate medical attention from a licensed ophthalmologist.
- Never look at the laser beam through a telescope, binoculars or other optical instruments. Doing so could cause permanent eye damage.

Caution

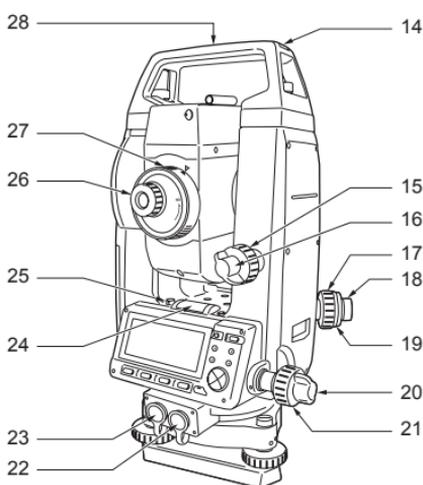
- Perform checks at start of work and periodic checks and adjustments with the laser beam emitted under normal conditions.
- When the instrument is not being used, turn off the power.
- When disposing of the instrument, destroy the battery connector so that the laser beam cannot be emitted.
- Operate the instrument with due caution to avoid injuries that may be caused by the laser beam unintentionally striking a person in the eye. Avoid setting the instrument at heights at which the path of the laser beam may strike pedestrians or drivers at head height.
- Never point the laser beam at mirrors, windows or surfaces that are highly reflective. The reflected laser beam could cause serious injury.
- Only those who have been received training as per the following items shall use this product.
 - Read the Operator's manual for usage procedures for this product.
 - Hazardous protection procedures (read this chapter).
 - Requisite protective gear (read this chapter).
 - Accident reporting procedures (stipulate procedures beforehand for transporting the injured and contacting physicians in case there are laser induced injuries).
- Persons working within the range of the laser beam are advised to wear eye protection which corresponds to the laser wavelength of the instrument being used.
- Areas in which the lasers are used should be posted with laser warning notices.

4. LDT FUNCTIONS

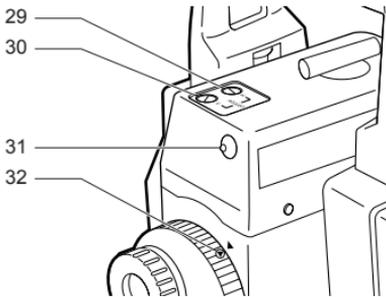
4.1 Parts of the Instrument



- 1 Handle
- 2 Handle securing screw
- 3 Instrument height mark
- 4 Battery cover
- 5 Operation panel
- 6 Tribrach clamp
(LDT520S: Shifting clamp)
- 7 Base plate
- 8 Levelling foot screw
- 9 Circular level adjusting screws
- 10 Circular level
- 11 Display
- 12 Objective lens
- 13 Peep sight



- 14 Tubular compass slot
- 15 Vertical fine motion screw
- 16 Vertical clamp
- 17 Optical plummet focussing ring
- 18 Optical plummet eyepiece
- 19 Optical plummet reticle cover
- 20 Horizontal clamp
- 21 Horizontal fine motion screw
- 22 Data input/output connector
- 23 External power source connector
- 24 Plate level
- 25 Plate level adjusting screw
- 26 Telescope eyepiece
- 27 Telescope focussing ring
- 28 Instrument center mark



- 29 Laser beam horizontal adjusting screw
- 30 Laser beam vertical adjusting screw
- 31 Laser indicator lamp
- 32 Focusing mark



Peep sight

Use peep sight to aim the LDT in the direction of the measurement point. Turn the instrument until the triangle in the peep sight is aligned with the target.

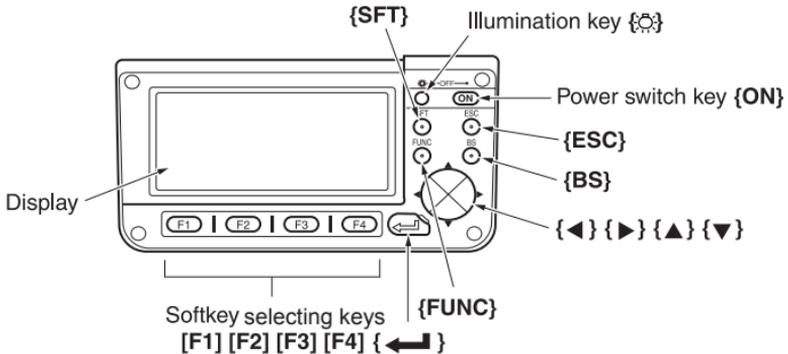


Instrument height mark

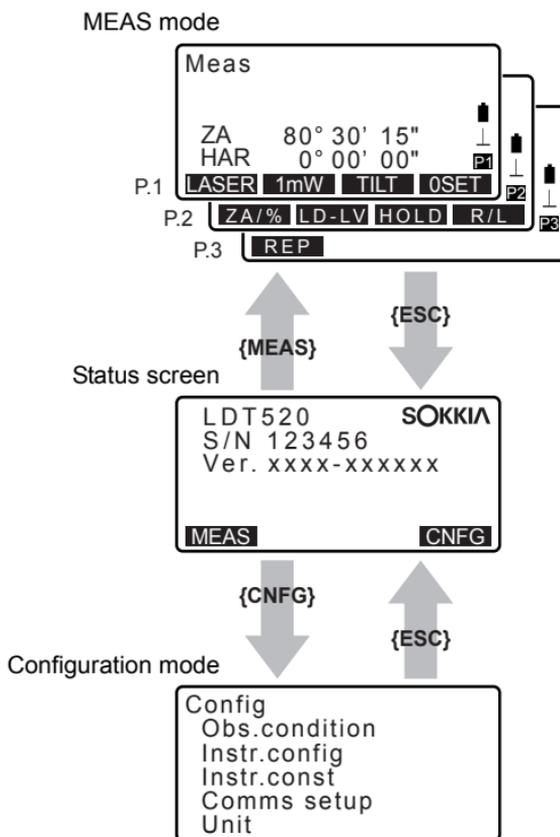
The height of the LDT is 236mm (from tribrach dish to this mark). "Instrument height" is input when setting instrument station data and is the height from the measuring point (where LDT is mounted) to this mark.

Operation panel

☞ "5.1 Basic Key Operation"



4.2 Mode Diagram



5. BASIC OPERATION

5.1 Basic Key Operation

Learn basic key operations here before you read each measurement procedure.

● Power ON / OFF

{ON}: Power On

{ON} (while pressing) + {☉}: Power Off

● Switching reticle illumination/display backlight ON/OFF

{☉}: Turn reticle illumination/display backlight ON/OFF

● Softkey operation

Softkeys are displayed on the bottom line of the screen.

{F1} to {F4}: Select the function matching the softkeys

{FUNC} : Toggle between MEAS Mode screen pages (when more than 4 softkeys are allocated)

● Selecting options

{▲}/{▼} : Up and down cursor

{▶}/{◀} : Right and left cursor/Select other option

{←} : Accept the option

Example: Select a slope display method

1. Press [Obs.condition] in Config Mode.

2. Move to "Slope dsp" using {▲}/{▼}.

3. Display the option you want to select using {▶}/{◀}.
Switches between "%" and "%o"

Tilt crn	:No
coll.crn	:Yes
V manual	:No
V.obs	:Zenith
Ang.reso.	:5"
Slope dsp	:%

4. Press {←} or {▼} to move to the next option.

The selection is set and you can set the next item.

● Switching modes

[CNFG] : From Status mode to Config Mode (Configuration Mode)

[MEAS] : From Status mode to Meas Mode (Measurement Mode)

{ESC} : Return to the Status mode from each Mode

{☰} "4.2 Mode Diagram"

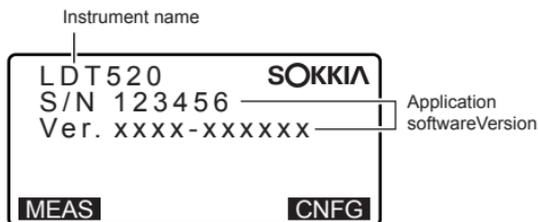
5. BASIC OPERATION

● Other operation

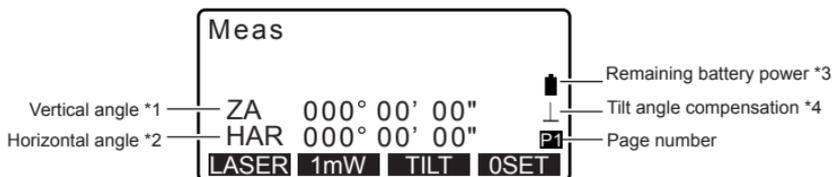
{ESC} : Return to the previous screen.

5.2 Display Functions

Status screen



Meas Mode screen



* 1 Vertical angle

☞ Switching vertical angle display status: "12.1 Changing Instrument Options ● Settings in Config Mode"

ZA : Zenith angle (Z=0)

VA : Vertical angle (H=0/H=±90)

Slope in %/Slope in ‰

Press [ZA/%] to switch between zenith angle/slope in %.

☞ "11.4 Slope"

* 2 Horizontal angle

Press [R/L] to switch the display status.

HAR: Horizontal angle right

HAL: Horizontal angle left

* 3 Remaining battery power (BDC46B, Temperature=25°C)

■ : level 3 Full power.

▢ : level 2 Plenty of power remains.

▣ : level 1 Half or less power remains.

□ : level 0 Little power remains. Charge the battery.

 (This symbol is displayed every 3 seconds): No power remains.
Stop the measurement and charge the battery.

 "6.1 Battery Charging"

* 4 Tilt angle compensation

When this symbol is displayed, the vertical and horizontal angles are automatically compensated for small tilt errors using 2-axis tilt sensor.

 Tilt compensation setting: "12.1 Changing Instrument Options ● Settings in Config Mode"

6. USING THE BATTERY

6.1 Battery Charging

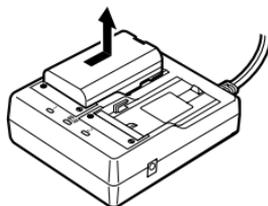
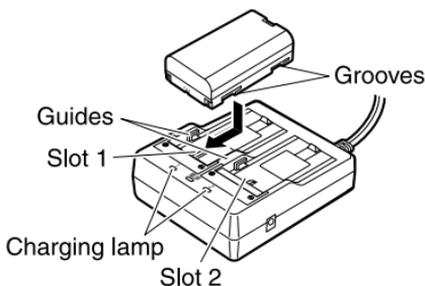
The battery has not been charged at the factory.



- Do not short circuit. Heat or ignition could result.
- Batteries cannot be charged, even when the charging lamp is flashing, when the temperature is outside the charging temperature range.
- Do not leave the battery in places exposed to high temperatures (more than 35°C). Doing so may reduce the life of the battery.
- Charge the battery once a month to maintain its quality when not in use for long periods.
- Do not charge the battery just after charging is completed. Battery performance may decline.
- Do not use to charge batteries other than those specified.
- If you allow the battery level to get too low, the battery may not be rechargeable or operating time may decline. Keep the battery always charged.
- The charger will become rather hot during use. This is normal.

► PROCEDURE

1. Connect the power cable to the CDC68 charger and plug the charger into the wall outlet.
2. Mount the battery (BDC46B) in the charger (CDC68) matching the groove on the battery with the guides on the charger. When charging starts, the lamp starts blinking.
3. Charging takes less than 2.5 hours.
The lamp lights when charging is finished.
4. Remove the battery and unplug the charger.



Note

- Slots 1 and 2: The charger starts charging the battery mounted first. If you place two batteries in the charger, the battery in slot 1 is charged first, and then the battery in slot 2. (step 2)
- Charging lamp: The charging lamp is off when the charger is outside the charging temperature range or when the battery is mounted incorrectly. If the lamp is still off after the charger falls within its charging temperature range and the battery is mounted again, contact your local dealer. (steps 2 and 3)
- Charging time: Charging can take more than 2.5 hours when temperatures are either especially high or low.

6.2 Installing/Removing the Battery

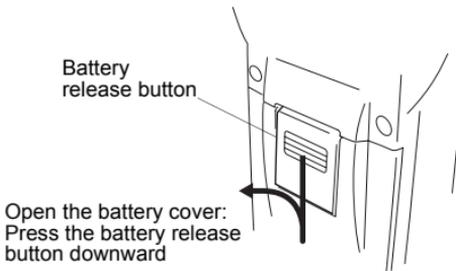
Mount the charged battery.



- When removing the battery, turn the power off.
- When installing/removing the battery, make sure that moisture or dust particles do not come in contact with the inside of the instrument.

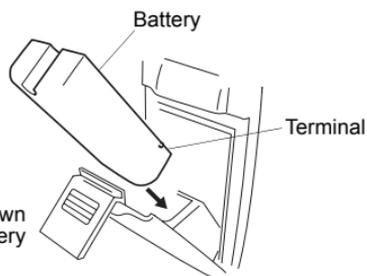
► PROCEDURE

1.



6. USING THE BATTERY

2.



Insert and press down on the top of the battery until a click is heard.

3.



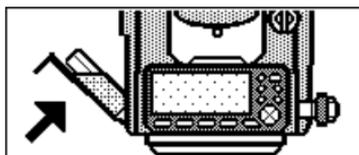
Close the battery cover :
Insert the lip on the top of the battery release button into the groove on the LDT and press until a click is heard.

Note

- Battery cover

If the battery cover is open during power on, LDT notifies you by displaying the screen below and beeping.

When the battery cover is closed, the previous screen is restored.



7. SETTING UP THE INSTRUMENT

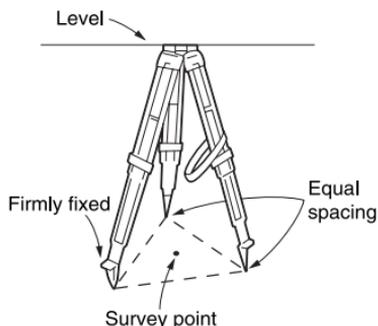


- Mount the battery in the instrument before performing this operation because the instrument will tilt slightly if the battery is mounted after levelling.

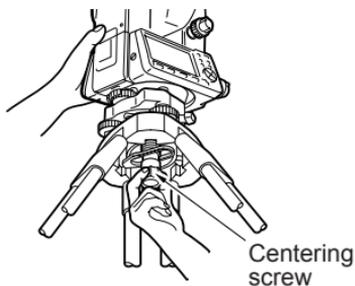
7.1 Centering

► PROCEDURE

1. Make sure the legs are spaced at equal intervals and the head is approximately level.
Set the tripod so that the head is positioned over the surveying point.
Make sure the tripod shoes are firmly fixed in the ground.

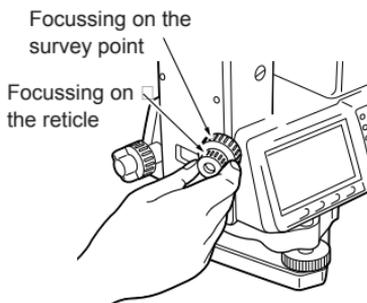


2. Place the instrument on the tripod head.
Supporting it with one hand, tighten the centering screw on the bottom of the unit to make sure it is secured to the tripod.



Turn the levelling foot screws while checking the circular level until the bubble is centered in the center circle.

3. Looking through the optical plummet eyepiece, turn the optical plummet eyepiece to focus on the reticle.
Turn the optical plummet focusing ring to focus on the surveying point.



7. SETTING UP THE INSTRUMENT

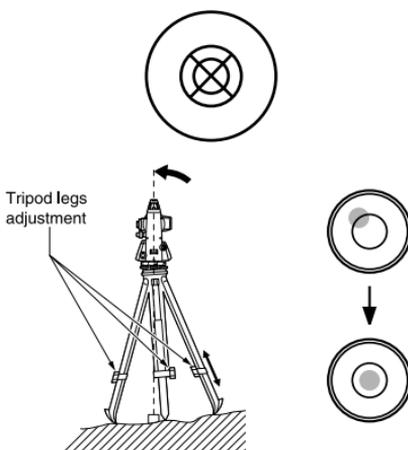
7.2 Levelling

Instrument can be levelled using the screen.

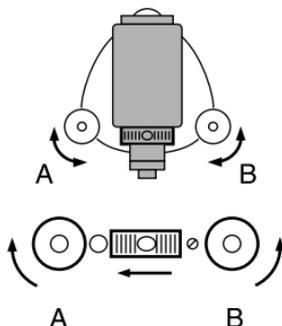
☞ “PROCEDURE Levelling on the screen”

► PROCEDURE

1. Adjust the levelling foot screws to center the surveying point in the optical plummet reticle.
2. Center the bubble in the circular level by either shortening the tripod leg closest to the offcenter direction of the bubble or by lengthening the tripod leg farthest from the offcenter direction of the bubble. Adjust one more tripod leg to center the bubble.

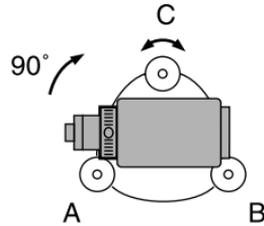


3. Loosen the horizontal clamp to turn the upper part of the instrument until the plate level is parallel to a line between levelling foot screws A and B. Center the air bubble using levelling foot screws A and B. The bubble moves towards a clockwise rotated levelling foot screw.

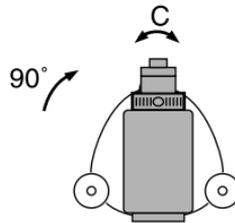


7. SETTING UP THE INSTRUMENT

- Turn the upper part of the instrument through 90° . The plate level is now perpendicular to a line between levelling foot screws A and B. Center the air bubble using levelling foot screw C.



- Turn the upper part of the instrument a further 90° and check to see if the bubble is still in the center of the plate level. If the bubble is off-center, perform the following:
 - Turn levelling foot screws A and B equally in opposite directions to remove half of the bubble displacement.
 - Turn the upper part a further 90° , and use levelling foot screw C to remove half of the displacement in this direction.



Or adjust the plate level.

 "14.1 Plate Level"

- Turn the instrument and check to see if the air bubble is in the same position in all directions. If it is not, repeat the levelling procedure.

7. SETTING UP THE INSTRUMENT

7. (LDT520):

Loosen the centering screw slightly.

Looking through the optical plummet eyepiece, slide the instrument over the tripod head until the surveying point is exactly centered in the reticle.

Retighten the centering screw securely.

(LDT520S):

Turn the tribrach shifting clamp counterclockwise.

Shifting tribrach can be adjusted up to $\pm 8\text{mm}$.

Looking through the optical plummet eyepiece, adjust the instrument position on the tribrach to center the surveying point.

Tighten the shifting clamp to fix the instrument in the center position.

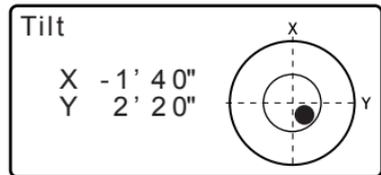
8. Check again to make sure the bubble in the plate level is centered.

If not, repeat the procedure starting from step 3.

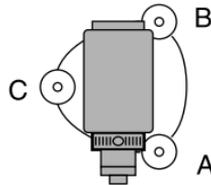
►PROCEDURE Levelling on the screen

1. Press **{ON}** to power on
2. Press **[TILT]** in the second page of Meas Mode to display the circular level on the screen.
 "●" indicates bubble in circular level. The range of the inside circle is $\pm 4'$ and the range of the outside circle is $\pm 6'$.
 Tilt angle values X and Y are also displayed on the screen.

3. Center "●" in the circular level
 "7.2 Levelling", steps 1 to 2



4. Turn the instrument until the telescope is parallel to a line between levelling foot screws A and B, then tighten the horizontal clamp.
5. Set the tilt angle to 0° using foot screws A and B for the X direction and levelling screw C for the Y direction.
6. Press **{ESC}** to return to Meas Mode.



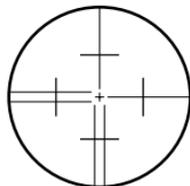
8. FOCUSING AND TARGET SIGHTING



- When sighting the target, strong light shining directly into the objective lens may cause the instrument to malfunction. Protect the objective lens from direct light by attaching the lens hood.

►PROCEDURE

1. Look through the telescope eyepiece at a bright and featureless background. Turn the eyepiece clockwise, then counterclockwise little by little until just before the reticle image becomes focussed. Using these procedures, frequent reticle refocussing is not necessary since your eye is focussed at infinity.

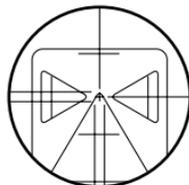


2. Loosen the vertical and horizontal clamps, then use the peep sight to bring the target into the field of view. Tighten both clamps.

Align center of target with tip of peep sight triangle



3. Turn the telescope focussing ring to focus on the target. Turn the vertical and horizontal fine motion screws to align the target with the reticle. The last adjustment of each fine motion screw should be in the clockwise direction.



Target plate

4. Readjust the focus with the focussing ring until there is no parallax between the target image and the reticle.



Eliminating parallax

This is the relative displacement of the target image with respect to the reticle when the observer's head is moved slightly before the eyepiece. Parallax will introduce reading errors and must be removed before observations are taken. Parallax can be removed by refocussing the reticle.



- Sight using the central crosshairs of the reticle when observing in both faces.

9. POWER ON

 Setting "V manual": "12.1 Changing Instrument Options • Settings in Config Mode"

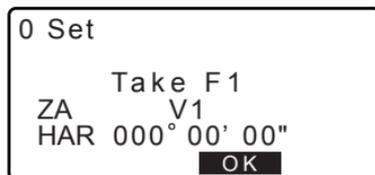
►PROCEDURE

1. Press {ON}.

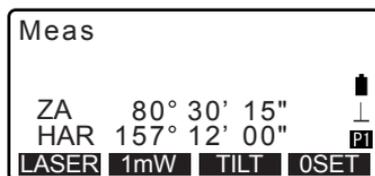
When the power is switched on, a self-check is run to make sure the instrument is operating normally.

- When "V manual" is set to "Yes", the display appears as at right.

 Manually indexing the vertical circle by face left, face right measurements:
"17. EXPLANATION"



After that, Meas Mode screen appears.



"Out of range" may be displayed when "Tilt crn" in "Obs. condition" is set to "Yes". If "Out of range" is displayed, the instrument tilt sensor is indicating that the instrument is out of level. Level the instrument once again and the horizontal and vertical angles will be displayed.

Note

- When "Resume" in "Instr. config" is set to "On", the screen previous to power off is displayed.
 -  "12.1 Changing Instrument Options • Settings in Config Mode"
- "Tilt crn" in "Obs. condition" should be set to "No" or "Yes (V)" if the display is unsteady due to vibration or strong wind.
 -  "12.1 Changing Instrument Options • Settings in Config Mode"

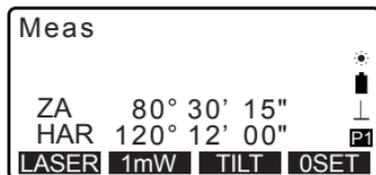
10. EMITTING THE LASER BEAM AND ADJUSTING BEAM ANGLE

This section explains how to output the laser beam and adjust the beam angle.

10.1 Laser beam output

► PROCEDURE

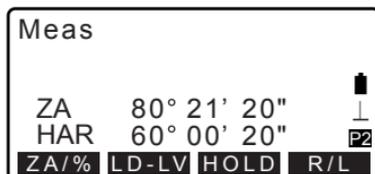
1. Focus on the target.
2. Press **[LASER]** in the first page of Meas mode. The laser is emitted.
 - The laser indicator lamp lights and "☉" is displayed while the laser is being emitted.
 - When focussing is complete the diameter of the laser beam spot is at its minimum level.
 - Press **[1mW]** to output a 1mW laser regardless of the laser level setting.
 - ☞ Laser level: "10.2 Laser level adjustment"
3. Press the same button used to emit the laser to stop laser output.



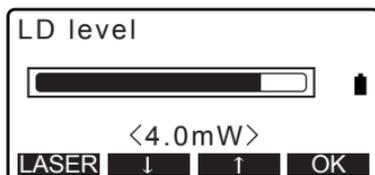
10.2 Laser level adjustment

► PROCEDURE

1. Press **[LD-LV]** in the second page of Meas mode.



2. Use **[↓]**/**[↑]** to set the laser level within the range 1mW to 4.5mW
Press **[LASER]** to output the laser at the level set above.



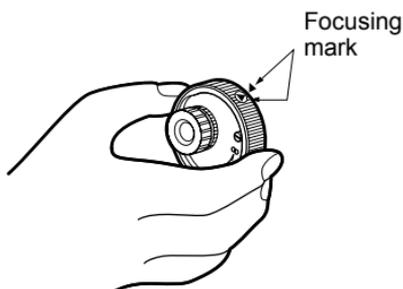
3. Press **[OK]** to set the laser level.

10.3 Horizontal beam output

There is very little variation in the diameter of the laser beam spot from the LDT to a target 200m away.

► PROCEDURE

1. Focus on the target and output the laser beam.
2. Turn the telescope focusing ring fully clockwise and then gradually counterclockwise until the focusing marks on the body of the unit and focusing ring are aligned.



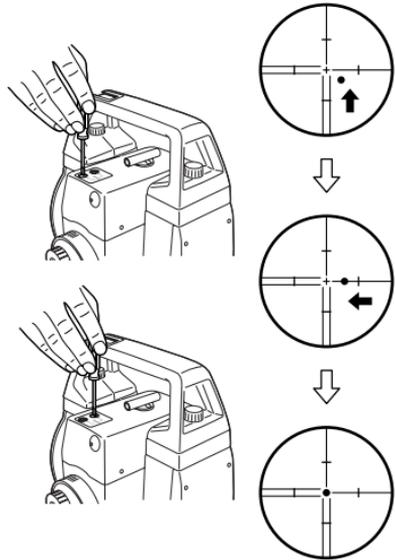
10.4

Laser beam angle adjustment

When the laser beam spot does not coincide with the reticle center, adjust as follows by turning the laser beam adjusting screws.

►PROCEDURE

1. Vertical position adjustment:
By turning the vertical adjusting screw clockwise (counterclockwise), the beam spot moves up (down).
2. Horizontal position adjustment:
By turning the horizontal adjusting screw clockwise (counterclockwise), the beam spot moves left (right).



11. MEASUREMENT

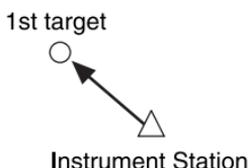
This section explains the procedures for basic angle measurement.

11.1 Measuring the Horizontal Angle between Two Points (Horizontal Angle 0°)

Use the "0SET" function to measure the included angle between two points. The horizontal angle can be set to 0 at any direction.

► PROCEDURE

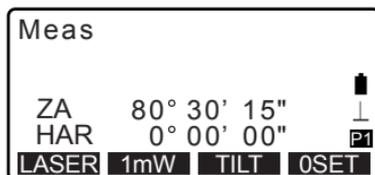
1. Sight the first target as at right.



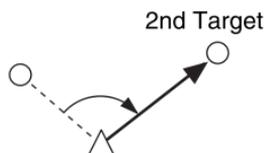
2. In the first page of the Meas mode screen, press [0SET].

[0SET] will flash, so press [0SET] again.

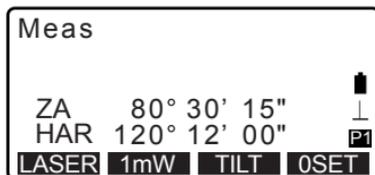
The horizontal angle at the first target becomes 0°.



3. Sight the second target.



The displayed horizontal angle (HAR) is the included angle between two points.

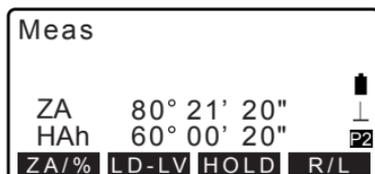
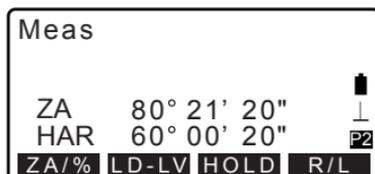


11.2 Set Horizontal Circle to a Required Value (Horizontal angle hold)

Use the "HOLD" function to set the horizontal angle to a required value.

► PROCEDURE

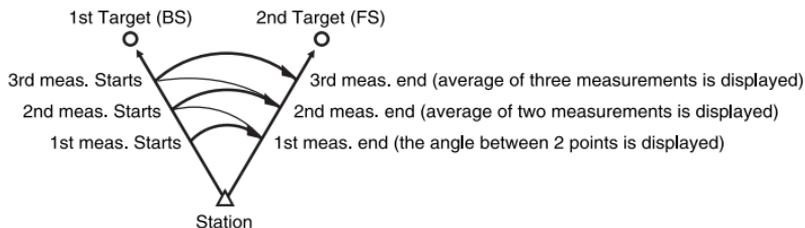
1. Rotate the instrument until the desired angle is displayed.
2. Press **[HOLD]** in the second page of Meas mode once. **[HOLD]** flashes. Press again to hold the horizontal angle for the first point at the displayed value.
3. Sight the target and start measurement.
 - Press **[HOLD]** once more to cancel the hold setting. The horizontal angle from the set value is displayed.



11. MEASUREMENT

11.3 Horizontal Angle Repetition

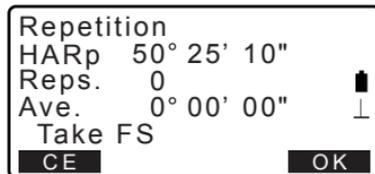
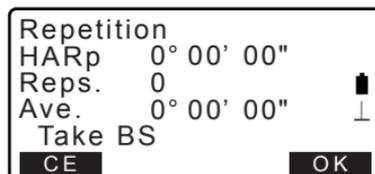
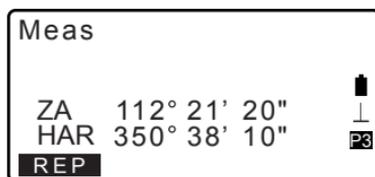
To find the horizontal angle with greater precision, perform repetition measurement.



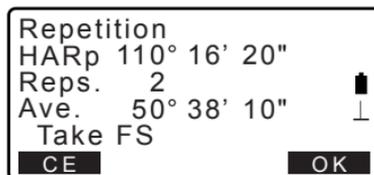
- The maximum number of angle measurements that can be made is 10.
(Display range: $\pm 3599^{\circ} 59' 59''$)

► PROCEDURE

1. Allocate the **[REP]** softkey to the Meas mode screen.
☞ "12.2 Allocating Key Functions"
2. Press **[REP]**.
The horizontal angle becomes 0° .
3. Sighting the first target, press **[OK]**.
4. Sighting the second target, press **[OK]**.
5. Sighting the first target a second time, press **[OK]**.



6. Sighting the second target a second time, press **[OK]**.
The added value of the horizontal angle is displayed on the second line "HARp" and the average value of the horizontal angle is displayed on the fourth line "Ave."



- Return to the previous measurement of the first target and redo it: **[CE]**.
(Effective when the display shows "Take BS")

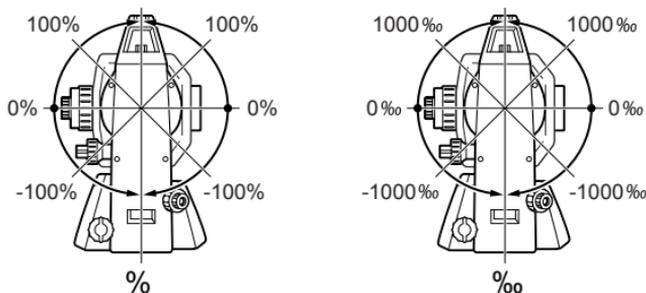
7. When continuing the repetition measurement, repeat steps 5 to 6.
8. When the repetition measurement is completed, press **{ESC}**.



- It is also possible to perform repetition measurement when **[MENU]** on page 2 of the Meas mode screen is pressed to enter <Menu>, then "Repetition" is selected without allocating the function key.

11.4 Slope

The LDT can display slope values in either % or ‰.



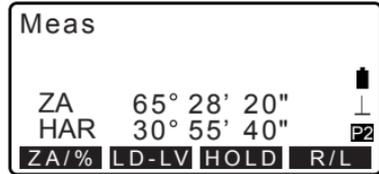
Units for slope display can be set in "Obs. conditions".

- Switching slope display units: "12.1 Changing Instrument Options ● Settings in Config Mode"

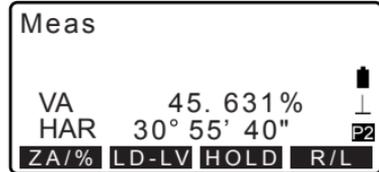
11. MEASUREMENT

► PROCEDURE

1. Press **[ZA/%]** in the second page of Meas mode.



Slope value is displayed.
Press **[ZA/%]** again to return the display to vertical angle.



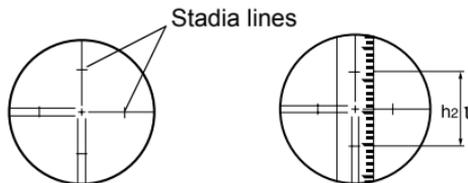
- When slope display units are set to "%", **[ZA/%]** will change to **[ZA/‰]**.
- When V. mode (vertical angle display method) in "Obs. condition" is set to "Horizontal 0°" or "Horizontal ±90°", **[ZA/%]** will change to **[VA/%]**.

11.5 STADIA SURVEY

The telescope reticle is provided with stadia lines (two vertical and two horizontal) which can be used to measure the target distance and height difference as follows.

Stadia line separation = 1/100 of the focal distance.

Stadia ratio = 1:100
Additive constant = 0

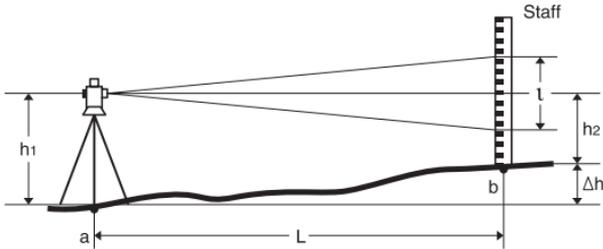


► When the telescope is horizontal:

Read the distance (l) on the staff between the two stadia lines, and the center line value, h_2 .

Horizontal target distance $L = 100 \times l$

Target height difference $D_h = h_1 - h_2$



► **When the telescope is slanted:**

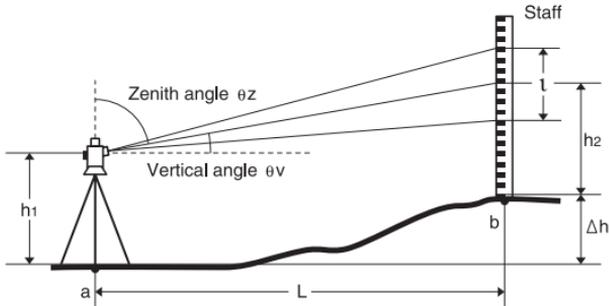
Read the distance (l) on the staff between the two stadia lines, the vertical angle, and the center line value, h_2 .

Horizontal target distance $L = 100 \times l \times \sin 2\theta_z$ or

$$100 \times l \times \cos 2\theta_v$$

Target height difference $\Delta h = 50 \times l \times \sin 2\theta_z + h_1 - h_2$ or

$$50 \times l \times \sin 2\theta_v + h_1 - h_2$$



12. CHANGING THE SETTINGS

This section explains the contents of parameter settings, how to change settings and how to perform initialization.

12.1 Changing Instrument Options

The following explains the EDM settings and setting modes in Meas mode. Each item can be changed to meet your measurement requirements.

- “*”: Factory setting

Config
Obs.condition
Instr.config
Instr.const
Comms setup
Unit

● Settings in Config Mode (items set, options, and input range)

Select “Obs. condition” in Config mode

Tilt crn	:No
coll.crn	:Yes
V manual	:No
V.obs	:Zenith
Ang.reso.	:5"
Slope dsp	:%

Tilt crn (Tilt correction): Yes (H,V), Yes (V), No*

coll. crn (Collimation correction): Yes*, No

V manual: Yes, No*

V.obs (Vertical angle display method): Zenith*, Horiz, Horiz 90° (Horizontal ±90°)

Ang. reso. (Angle resolution): 1"*, 5"

Slope dsp:%, %_o

 Setting V manual to "Yes": “17.1 Manually Indexing the Vertical Circle by Face Left, Face Right Measurement”



Automatic tilt angle compensation mechanism

The vertical and horizontal angles are automatically compensated for small tilt errors using the 2-axis tilt sensor.

- Read the automatically compensated angles when the display has stabilized.

- The horizontal angle error (vertical axis error) fluctuates according to the vertical axis, so when the instrument is not completely leveled, changing the vertical angle by rotating the telescope will cause the displayed horizontal angle value to change.
Compensated horizontal angle = Measured horizontal angle + Tilt in angle /tan (Vertical angle)
- When the telescope is directed close to the zenith or nadir angle, tilt compensation is not applied to the horizontal angle.

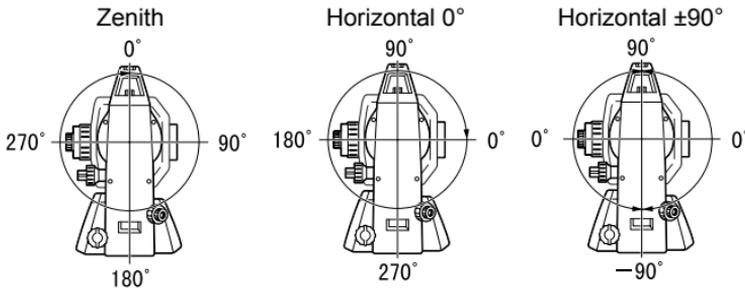


Collimation correction

The LDT has a collimation correction function that automatically corrects horizontal angle errors caused by horizontal axis and leveling axis errors.



V mode (vertical angle display method)



Select "Instr. Config" in Config mode

Power off	:No
Reticle lev	:high
Contrast	:10
Resume	:On
Light off	:key
Tilt beep	:no

Power off: 5min, 10min, 15min, 30min, No*

Reticle lev: high*, low

Contrast: 0 to 15 level (10*)

Resume: On*, Off

Light off: key*, auto

Tilt beep: yes, no*



Power-saving automatic cut-off

To save power, power to the LDT is automatically cut off if it is not operated for the selected time.

12. CHANGING THE SETTINGS



Resume function

When the Resume function is set to "On," and the power is switched off and then on again, the screen appearing before the instrument was switched off is redisplayed. Also, all parameter settings are saved. Memory backup period is about one week, after which the Resume function is cancelled.



Tilt beep

A beep sounds when the tilt of the instrument exceeds the tilt correction range.

Select "Comms setup" in Config mode

Baud rate	:1200bps
Data bits	:8bit
Parity	:Not set
Stop bit	:1bit
Check sum	:No

Baud rate: 1200bps*, 2400bps, 4800bps, 9600bps, 19200bps, 38400bps

Data bits: 8bit*, 7bit

Parity: Not set*, Odd, Even

Stop bit: 1bit*, 2bit

Check sum: Yes, No*

Select "Unit" in Config mode

Angle	:degree
-------	---------

Angle: degree*, gon, mil

12.2 Allocating Key Functions

It is possible to allocate the softkeys in Meas mode to suit the measurement conditions. It is possible to operate the LDT efficiently because unique softkey allocations can be preset to suit various applications and the ways that different operators handle the instrument.

- The current softkey allocations are retained until they are revised again, even when the power is cut off.
- It is possible to register two sets of key function allocations: user setting 1 and user setting 2.
- It is possible to recall the softkey arrays registered for User 1 and User 2 as necessary.



- When softkey allocations are recorded and registered, the previously recorded key settings are cleared. When a softkey array is recalled, the key array is changed to the key array that has been recalled, clearing the previous key array. Be sure to remember this.

● The following are the softkey allocations when the LDT was shipped.

Page 1 [LASER] [1mW] [TILT] [0SET]

Page 2 [ZA/%] [LD-LV] [HOLD] [R/L]

Page 3 [REP]

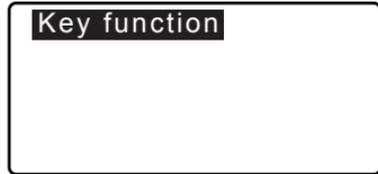
● The following functions can be allocated to the softkeys.

[LASER]	: Output laser
[1mW]	: Output laser at fixed level of 1mW
[TILT]	: Display tilt angle
[0SET]	: Set horizontal angle to 0
[ZA / %]	: Switch between zenith angle/slope in %
[LD-LV]	: Adjust laser level
[HOLD]	: Hold horizontal angle/release horizontal angle
[R/L]	: Select horizontal angle right/left
[REP]	: Repetition measurement
[---]	: No functions set

12. CHANGING THE SETTINGS

►PROCEDURE Allocating functions

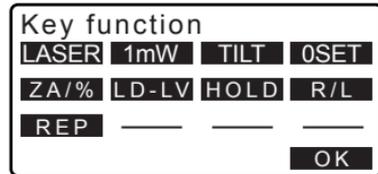
1. Select "Key function" in Config Mode.



Select "Define." Currently allocated softkeys are displayed in <Key function>.



2. Align the cursor with the softkeys whose allocation you want to change using {▶}/{◀}. The cursor of the selected softkey flashes.



3. Change the softkey function using {▲}/{▼}. Set the softkey function and its location by pressing {▶}/{◀}. The set softkey stops flashing and the cursor flashes on the next softkey.
4. Repeat steps 2 to 3 only as many times as necessary.
5. Press [OK] to record the allocations and restore <Key function>. The functions with their new allocations are displayed in Meas mode.

►PROCEDURE Registering an allocation

1. Allocate functions to the softkeys.
 "PROCEDURE Allocating functions"
2. Select "Key function" in Config mode.
3. Select "Registration".
 Select either "User 1" or "User 2" as the softkey array to be registered.
4. Press . The softkey array is registered as user 1 or user 2 and <Key function> is restored.

```
Key function
Define
Registration
Recall
```

```
Key function
User's 1
User's 2

Registered to 1
```

►PROCEDURE Recalling an allocation

1. Select "Key function" in Config Mode.
2. Select "Recall." Select the key array for either User 1, User 2, or Default (setting when the LDT was shipped), and press . <Key function> is restored. This displays the functions in the recalled array in Meas mode.

```
Key function
Define
Registration
Recall
```

```
Key function
User's 1
User's 2
Default
```

12.3 Restoring Default Settings

The following explains how to restore default settings by initializing set items.

► PROCEDURE

1. Turn the power off.
2. While pressing **{F4}** and **{BS}**, press **{ON}**.
3. The LDT is turned on, "Default set" appears on the screen and all items are restored to their initial settings.

13. WARNING AND ERROR MESSAGES

The following is a list of the error messages displayed by the LDT and the meaning of each message. If the same error message is repeated or if any message not shown below appears, the instrument has malfunctioned. Contact your local dealer.

Checksum error

A sending/repetition error has occurred between the LDT and external equipment.
Send/receive the data again.

Flash write error!

Flash mount error!

It is impossible to read in data.
Contact your local dealer.

Out of range

The tilt of the instrument exceeds the tilt angle compensation range during measurement.
Level the instrument again.
 "7.2 Levelling"

Out of value

During slope %/‰ display, the display range (less than $\pm 1000\%$ /less than $\pm 10000\%$) has been exceeded.
Install the instrument station far from the target.

RAM cleared

(Displayed when the LDT is switched on) The resume function does not work because more than one week (memory back-up period) has passed since the LDT was last switched off.
After more than one week, even though "Resume" is still set to "On," the resume function has been canceled.

Temp Rnge OUT

LDT is outside useable temperature range and accurate measurement cannot be performed. Repeat measurement within the appropriate temperature range. If the LDT is used under direct sunlight, use an umbrella to protect it against the heat of the sun.

14. CHECKS AND ADJUSTMENTS

A LDT is a precision instrument that requires fine adjustments. It must be inspected and adjusted before use so that it always performs accurate measurements.

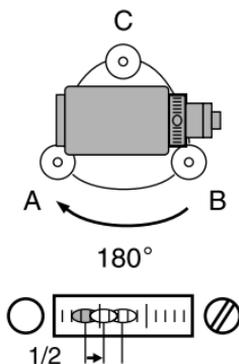
- Always perform checking and adjustment in the proper sequence beginning from “14.1 Plate Level” to “14.6 Optical plummet”.
- In addition, the instrument should be inspected with special care after it has been stored a long time, transported, or when it may have been damaged by a strong shock.
- Make sure the instrument is securely set up and stable before performing checks and adjustments.

14.1 Plate Level

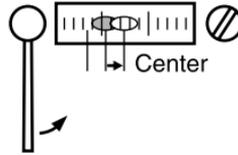
The bubble tube is made of glass, so it is sensitive to temperature changes or to shock. Check and adjust it as outlined below.

► PROCEDURE Checking and adjusting

1. Level the instrument and check the position of the bubble of the plate level.
☞ “7.2 Levelling”, steps 3 to 5.
2. Turn the upper part through 180° and check the bubble position. If the bubble is still centered, no adjustment is necessary. If the bubble is off-center, adjust as follows.
3. Correct half of the bubble displacement using levelling foot screw C.



- Correct the remaining half of the displacement by using the adjustment pin to rotate the plate level adjustment screw. When the plate level adjustment screw is turned in the counterclockwise direction, the bubble moves in the same direction.
- Rotate the top of the instrument and continue adjustments until the bubble remains centered for any position of the upper part. If the bubble does not move to the center even when the adjustment has been repeated, ask your local dealer to adjust it.



14.2 Circular Level

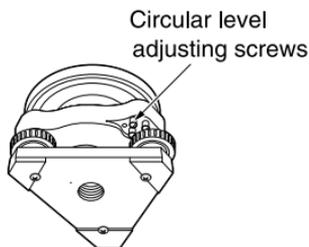
Check and adjust it as outlined below.

►PROCEDURE Checking and adjusting

- Perform the plate level inspection and adjustment or carefully use the plate level to level the instrument.
☞ "14.1 Plate Level"
- Check the position of the bubble of the circular level.
☞ "7.2 Levelling", steps 1 to 2.
If the bubble is not off-center, no adjustment is necessary.
If the bubble is off-center, perform the following adjustment.

14. CHECKS AND ADJUSTMENTS

3. First confirm the off-center direction.
Use the adjusting pin to loosen the circular level adjustment screw on the side opposite to the direction the bubble is displaced to move the bubble to the center.



4. Adjust the adjusting screws until the tightening tension of the three screws is the same to align the bubble in the middle of the circle.



- Be careful that the tightening tension is identical for all the adjusting screws.
- Also, do not over-tighten the adjusting screws as this may damage the circular level.

14.3 Tilt Sensor

If the tilt angle shown on the display shifts from tilt angle 0° (zero point), the instrument is not correctly levelled. This will adversely affect angle measurement. Perform the following procedure to cancel the tilt zero point error.

► PROCEDURE Check

1. Carefully level the instrument. If necessary, repeat the procedures to check and adjust the bubble levels.
2. Set the horizontal angle to 0° .
Press **[0set]** twice in the first page of the Meas mode screen to set the horizontal angle to 0° .

3. Display <Tilt offset>

Select "Instr. const" in the Config. mode screen to display the current correction constant in the X (horizontal) direction and Y (vertical) direction.

```
Config
Obs.condition
Insrt.config
Instr.const
Comms setup
Unit
```

```
Instr.const
Tilt: X 400 Y 400
Collimation
```

Select "Tilt X Y" press {←} to display the tilt angle in the X (sighting) direction and Y (horizontal axis) direction.

```
Tilt offset
X -0° 01' 20"
Y -0° 00' 05"
HAR -0° 00' 00"
Take F1
```

OK

4. Wait a few seconds for the display to stabilize, then read the automatically compensated angles X1 and Y1.

5. Rotate the top of the instrument through 180°.

Loosen the horizontal clamp and turn the instrument 180° while referring to the displayed horizontal angle, then retighten the clamp.

6. Wait a few seconds for the display to stabilize, then read the automatically compensated angles X2 and Y2.

```
Tilt offset
X -0° 01' 20"
Y -0° 00' 05"
HAR 180° 00' 00"
Take F2
```

OK

14. CHECKS AND ADJUSTMENTS

7. In this state, calculate the following offset values (tilt zero point error).

$$X_{\text{offset}} = (X1+X2)/2$$

$$Y_{\text{offset}} = (Y1+Y2)/2$$

If one of the offset values (X_{offset} , Y_{offset}) exceeds $\pm 20''$, adjust the value using the following procedure.

When the offset value falls within the range $\pm 20''$, adjustment is not necessary.

Press **{ESC}** to return to <Instr. const>.

►PROCEDURE Adjustment

8. Store values $X2$ and $Y2$
Press **[OK]** to set the horizontal angle to 0° . "Take F2" is displayed.
9. Rotate the top of the instrument through 180° until the displayed horizontal angle is $180^\circ \pm 1$ and **[OK]** is displayed.
10. Wait a few seconds for the display to stabilize, then store the automatically compensated angles $X1$ and $Y1$.
Press **[YES]** to store tilt angles $X1$ and $Y1$. The new correction constant is displayed.

Tilt offset			
Current	X	403	Y 399
New	X	405	Y 401

NO **YES**

11. Confirm that the values are in the adjustment range.
If both correction constant are within the range 400 ± 120 , select **[YES]** to renew the correction angle. <Instr. const> is restored. Continue to step 12.
If the values exceed the adjustment range, select **[NO]** to cancel the adjustment and restore <Instr. const>. Contact your local dealer to perform the adjustment.

►PROCEDURE Recheck

12. Press {←} at <Instr. const>.
13. Wait a few seconds for the display to stabilize, then read the automatically compensated angles X3 and Y3.
14. Rotate the top of the instrument through 180° .
15. Wait a few seconds for the display to stabilize, then read the automatically compensated angles X4 and Y4.
16. In this state, the following offset values (tilt zero point error) are calculated.
 $X_{\text{offset}} = (X3+X4)/2$
 $Y_{\text{offset}} = (Y3+Y4)/2$
When both offset values fall within the range $\pm 20''$, adjustment is completed.
Press {ESC} to return to <Instr. const>.

14. CHECKS AND ADJUSTMENTS

If one of the offset values (Xoffset, Yoffset) exceeds $\pm 20''$, repeat the check and adjustment procedures from the beginning. If the difference continues to exceed $\pm 20''$ after repeating the check 2 or 3 times, have your local dealer perform the adjustment.

14.4 Collimation

With this option you can measure collimation error in your instrument so that the LDT can correct subsequent single face observations. To measure the error, make angular observations using both faces.

► Procedure

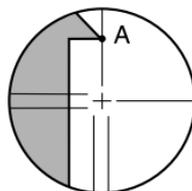
1. Display <Collimation>.
Select "Instr.const" in the Config. mode screen and select "Collimation"
2. Sight the reference point in Face 1 and press **[OK]**.
3. Rotate the instrument 180° . Sight the same point in Face 2 and press **[OK]**.
4. Set the constant.
Press **[YES]** to set the constant.
 - Press **[NO]** to discard the data and return to <Collimation>.

Collimation	
X :	-0° 01' 20"
V off. :	-0° 01' 20"
NO YES	

14.5 Reticle

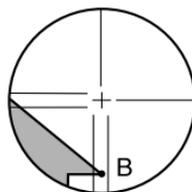
► PROCEDURE Check 1: Perpendicularity of the reticle to the horizontal axis

- Carefully level the instrument.
- Align a clearly visible target (the edge of a roof for example) on point A of the reticle line.



- Use the telescope fine motion screw to align the target to point B on a vertical line.

If the target moves parallel to the vertical line, adjustment is unnecessary. If its movement deviates from the vertical line, have our service representative adjust it.



► PROCEDURE Check 2: Vertical and horizontal reticle line positions



- Perform the check procedure under slightly hazy and weakly scintillating conditions.

- Install a target at a point about 100m in the horizontal direction from the LDT.



- Level the instrument carefully, turn on the instrument's power.

14. CHECKS AND ADJUSTMENTS

3. While the Meas mode screen is displayed and the telescope is in face left, sight the center of the target and read out the horizontal angle A1 and the vertical angle B1.

Example: Horizontal angle A1=18° 34' 00"

Vertical angle B1=90° 30' 20"

4. While the telescope is in face right, sight the center of the target and read out the horizontal angle A2 and the vertical angle B2.

Example: Horizontal angle A2=198° 34' 20"

Vertical angle B2=269° 30' 00"

5. Do the calculations:

A2-A1 and B2+B1

If A2-A1 is within $180^\circ \pm 20''$ and B2 (B1 is within $360^\circ \pm 40''$), adjustment is unnecessary.

Example: A2-A1 (Horizontal angle)

=198° 34' 20" - 18° 34' 00"

=180° 00' 20"

B2+B1 (Vertical angle)

=269° 30' 00" + 90° 30' 20"

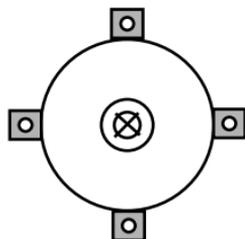
=360° 00' 20"

If the difference is large even after repeating the check 2 or 3 times, have our service representative perform the adjustment.

14.6 Optical plummet

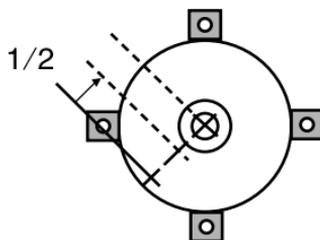
►PROCEDURE Checking

1. Carefully level the LDT and center a surveying point precisely in the reticle of the optical plummet.
2. Turn the upper part through 180° and check the position of the surveying point in the reticle.
If the surveying point is still centered, no adjustment is necessary.
If the surveying point is no longer centered in the optical plummet, perform the following adjustment.



►PROCEDURE Adjustment

3. Correct half the deviation with the levelling foot screw.



4. Remove the optical plummet reticle cover.

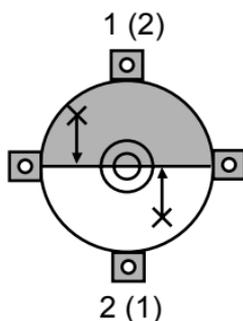
14. CHECKS AND ADJUSTMENTS

5. Use the 4 adjusting screws of the optical plummet to adjust the remaining half of the deviation as shown below.

When the surveying point is on the lower (upper) part of the illustration:

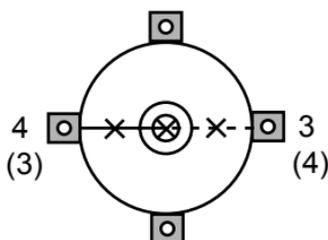
Loosen the upper (lower) adjusting screw slightly, and tighten the upper (lower) adjusting screw the same amount to move the surveying point to a point directly under the center of the optical plummet.

(It will move to the line in the figure on the right.)



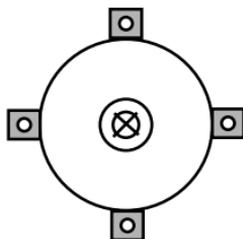
If the surveying point is on the solid line (dotted line):

Loosen the right (left) adjusting screw slightly and, tighten the left (right) adjusting screw by the same amount to move the surveying point to a point in the center of the optical plummet.



- Be extremely careful to adjust all the adjustment screws by the same amount so that none will be over-tightened.

6. Check to make sure that the surveying point remains centered on the reticle even if the upper part of the instrument is rotated. If necessary, perform the adjustment again.

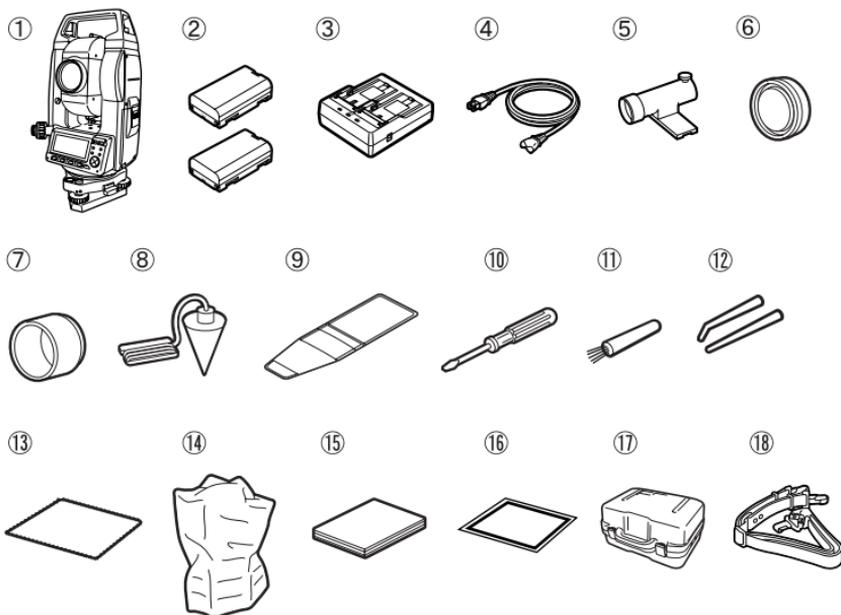


7. Replace the optical plummet reticle cover.

15. STANDARD EQUIPMENT AND OPTIONAL ACCESSORIES

15.1 Standard Equipment

- Please verify that all equipment is included.

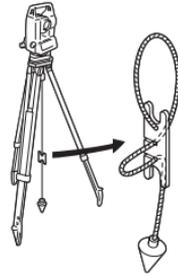


1	LDT main unit	1	10	Screwdriver	1
2	Battery (BDC46B)	2	11	Lens brush	1
3	Battery charger (CDC68)	1	12	Adjusting pin	2
4	Power cable (EDC113A/113B/113C)	1	13	Cleaning cloth	1
5	Tubular compass (CP7)	1	14	Vinyl cover	1
6	Lens cap	1	15	Operator's manual	1
7	Lens hood	1	16	Laser caution sign-board	1
8	Plumb bob	1	17	Carrying case (SC225)	1
9	Tool pouch	1	18	Carrying strap	1

15. STANDARD EQUIPMENT AND OPTIONAL ACCESSORIES

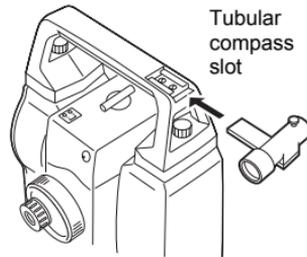
● Plumb bob

The plumb bob can be used to set up and center the instrument on days when there is little wind. To use the plumb bob, unwind its cord, pass it through the cord grip piece as shown in the figure to adjust its length, then suspend it from the hook attached to the centering screw.



● Tubular compass (CP7)

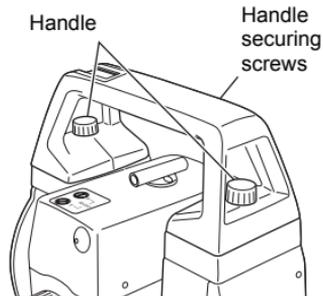
Slide the tubular compass into the tubular compass slot, loosen the clamp screw, then rotate the top part of the instrument until the compass needle bisects the index lines. The telescope's face left sighting direction in this position will indicate magnetic north. After use, tighten the clamp and remove the compass from the slot.



- The tubular compass is susceptible to the influence of nearby magnets or metal. Such influence could cause it to fail to accurately indicate magnetic north. Do not use magnetic north as indicated by this compass for base line surveying.

● Handle

The carrying handle can be removed from the instrument. To remove it, loosen the handle securing screw.



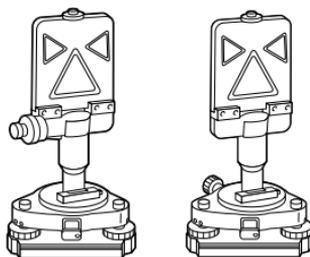
15.2 Optional Accessories

The following are optional accessories which are sold separately from the LDT.

 Power supply optional accessories: "15.3 Power Supply System".

● Target (TG1, TG2)

Targets can be disconnected from tribrachs WA and WOA. TG1 and TG2 instrument height is 233mm. Therefore, a correction of 3mm is necessary when performing indirect levelling. An illumination function is included allowing operation at night or in tunnels (uses 2 C size batteries).



TG1 (tribrach: WA) TG2 (tribrach: WOA)

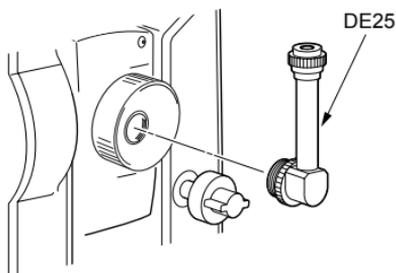
● Diagonal eyepiece (DE25)

The diagonal eyepiece is convenient for observations near the nadir and in narrow spaces.

Magnification: 30X

After removing the handle from the LDT, loosen the attachment screw to remove the telescope eyepiece. Then screw the diagonal lens into place.

 Handle removal method: "15.1 Standard Equipment"



● Battery Unit (BDC55)

BDC55 is used as the power source for the LAP1.

● Laser Plummet (LAP1)

When using the LAP1, a laser is emitted from the bottom of the main unit making it easier to position the instrument over the surveying point. The BDC55 is the power source for the LAP1. The buttons on the

15. STANDARD EQUIPMENT AND OPTIONAL ACCESSORIES

BDC55 can also be used to operate the LAP1. For details, see the LAP1 Operator's manual.

● Interface cable

Connect between the LDT and the host computer for data output.

Computer	Cable	Notes
IBM PC/AT or compatible	DOC26	Length: 2m Pin Numbers and signal levels: RS-232C compatible
	DOC27	D-sub connector: DOC26: 25 pins (female) DOC27: 9 pins (female)
Other computers	DOC1	No connector for attachment to a computer.

15.3 Power Supply System

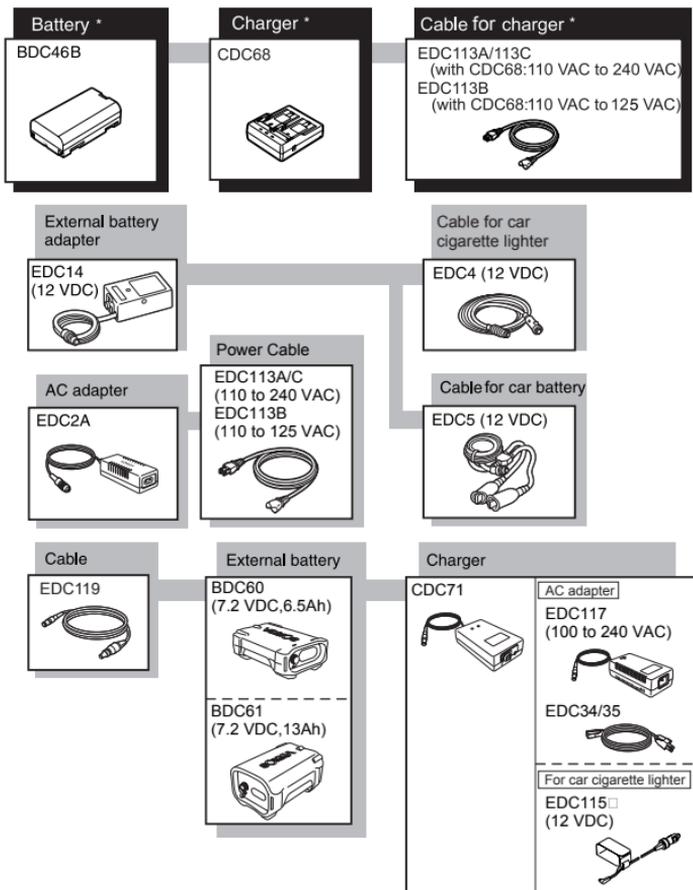
Operate your LDT with the following combinations of power equipment.



- Be sure to carefully read the operating manuals for the battery and charger before operating them.
- Never use any combination other than those indicated below. If you do, the LDT could be damaged.

Those indicated by * are standard accessories.

Others are optional accessories (sold separately) .



15. STANDARD EQUIPMENT AND OPTIONAL ACCESSORIES

● External power supply equipment

- When using EDC14, EDC2A, or BDC60/61, mount the BDC46B in place to maintain the balance of the instrument.
- Make sure that the car cigarette lighter is 12V DC and that its negative terminal is grounded. Use it with the car engine running.
- The EDC14 has a breaker switch. Normally the red mark appears on the breaker. If it cannot be seen, set the breaker so it is visible.
When using the car battery, the breaker will cut off if the poles are not correctly connected.

16. SPECIFICATIONS

Except where stated, the following specifications apply to both LDT520 and LDT520S.

Telescope

Length:	160 mm
Aperture:	42 mm
Magnification:	30X
Image:	Erect
Resolving power:	3"
Field of view:	1° 30' (26m/1,000m)
Minimum focus:	1.3 m
Focussing screw:	1 speed
Reticle illumination:	2 brightness levels
Stadia ratio:	1:100
Additive constant:	0

Angle measurement

Horizontal and Vertical circles type:

	Rotary absolute encoder scanning
Angle units:	Degree/Gon/Mil (selectable)
Minimum display:	1" (0.0002gon/0.005mil)/5" (0.001gon/0.02mil) (selectable)
Accuracy:	5" (ISO 17123-3 :2001)
Measuring time:	Less than 0.5 sec (repeat measurement)
Collimation compensation:	On/Off (selectable)
Measuring mode:	
Horizontal angle:	Right/Left (selectable)
Vertical angle:	Zenith/Horizontal 0°/Horizontal $\pm 90^\circ$ /%/‰ (selectable)

Tilt angle compensation

Type:	Liquid 2-axis tilt sensor
Minimum display:	Agrees with minimum displayed measurement angle
Range of compensation:	$\pm 3'$
Automatic compensator:	ON (V & H/V)/OFF (selectable)

16. SPECIFICATIONS

Laser

Light source:	Laser diode (635nm) Class 3R (IEC 60825-1 Amd. 2:2001/FDA CDRH 21 CFR Part 1040.10 and 1040.11 (Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No.50, dated June 24, 2007))
Output power:	1mW to 4.5mW
Laser focusing:	Simultaneous with telescope focussing. Parallel beam is generated when the focussing ring is adjusted to the mark. (Parallel beam range up to 200m)
Measuring range:	200m and above at 1mW 600m and above at 4.5mW (Ambient light less than 100lx. However, range may vary depending on atmospheric conditions)
Beam spot diameter:	5m: Ø0.5mm 200m: Ø20.7mm 20m: Ø2.1mm 300m: Ø31.0mm 50m: Ø5.2mm 400m: Ø41.3mm 100m: Ø10.3mm 500m: Ø51.6mm 150m: Ø15.5mm 600m: Ø62.0mm (when laser beam focussed: theoretical diameter values for 0-order diffraction beams)
Beam angle adjustment function:	Built-in
Laser ON/OFF switch:	Select with softkey

Power Supply

Power source:	Rechargeable Li-ion battery BDC46B
Nominal voltage:	7.2V
Storage temperature range:	-20 to 35°C
Working duration at 25°C:	
Laser emission (1mW) & angle measurement:	about 13.5 hours
Laser emission (4.5mW) & angle measurement:	about 12.5 hours
Angle measurement only:	about 20 hours
Battery state indicator:	4 levels
Auto power-off:	5 levels (5/10/15/30 min/Not set) (selectable)
<u>Battery (BDC46B)</u>	
Capacity:	2.45Ah
Dimensions	38 (W) x 70 (D) x 20 (H) mm
Weight:	about 103g
Dedicated charger:	CDC68

Dedicated cable:	EDC113A/113B/113C
Charger (CDC68)	
Input voltage:	with EDC113A/113C: 110 to 240 VAC 50/60Hz with EDC113B: 110 to 125 VAC 50/60Hz
Charging time at 25°C:	BDC46B: less than 2.5 hours (Charging can take more than 2.5 hours when temperatures are either especially high or low.)
Charging temperature range:	0 to 40°C
Storage temperature range:	-20 to 65°C
Dimensions:	94 (W) x 102 (D) x 36 (H) mm
Weight:	about 170g

General

Display:	LCD graphic display, 192 dots X 80 dots 1 LCD graphic display on each face with illuminator
Operation panel (keyboard):	15 keys (soft function, operations, power on, light)
Data input/output:	Asynchronous serial, RS232C compatible
Auto power-off:	5 levels (selectable)
Sensitivity of levels:	
Plate level:	40"/2 mm
Circular level:	10"/2 mm
Optical plummet:	
Image:	Erect
Magnification:	3X
Minimum focus:	0.15 m from tribrach bottom
Operating temperature:	-20 to 50°C (no condensation)
Storage temperature range:	-30 to 70°C (no condensation)
Dust and water resistance:	IP66 (IEC 60529: 2001)
Instrument height:	236 mm from tribrach bottom 193 mm from tribrach dish
Size (with handle):	165 (W) X 165 (D) X 355 (H) mm
Weight (with handle and battery):	
LDT520:	5.8 kg (12.8lb)
LST520S:	6.0kg (13.2lb)

17. EXPLANATION

17.1 Manually Indexing the Vertical Circle by Face Left, Face Right Measurement

The 0 index of the vertical circle of your LDT is almost 100% accurate, but when it is necessary to perform particularly high precision angle measurements, you can eliminate any inaccuracy of the 0 index as follows.

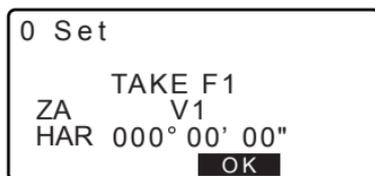


- If the power is cut off, the vertical circle indexing is ineffective. Do it again every time the power is turned on.

► PROCEDURE

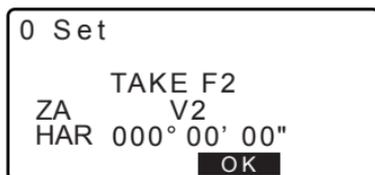
1. Select "Obs. condition" in <Config>. Set "V manual" (vertical circle indexing method) to "Yes".

2. Go to the Meas mode screen. The vertical angle V1 is displayed under "Take F1".



3. Carefully level the instrument.

4. Accurately sight a clear target with a distance of about 30m in the horizontal direction with the telescope in face left. Press [OK]. The vertical angle V2 is displayed under "Take F2."



5. Turn the upper part through 180° and clamp it. Then set the telescope in the face right position and accurately sight the same target.

Press [OK].

The vertical and horizontal angles are displayed.

This concludes the vertical circle indexing procedure.

18. REGULATIONS

Users must ensure that their instrument is compliant with the relevant regulations and legal restrictions in place in the country of use.

For users in the US

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

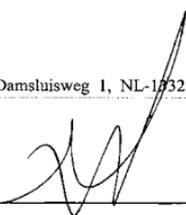
For users in Canada

This Class A digital apparatus meets all requirements of Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Class A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

18. REGULATIONS

For users in the European Economic Area (EEA)

CE Conformity Declaration in accordance with EMC Directive 2004/108/EC of the European Community	
We herewith declare that the undermentioned instrument, in view of its design and type of construction, fully complies with the relevant basic radio interference requirements of the EMC Directive. Should the instrument be modified without agreement, this declaration becomes invalid.	
Instrument Description :	Surveying machine
Model Name :	LDT520 , LDT520S
Relevant EC Directive :	EMC Directive(2004/108/EC)
Applied Harmonized Standard :	EMC EMI EN 61326-1:2006 ClassB EMS EN 61000-4-2 : 1995+A1:1998+A2:2001 EN 61000-4-3 : 2002+A1:2002 EN 61000-4-8 : 1993+A1:2001
Date:	February 19, 2008
Firm:	SOKKIA B.V.
Address:	Industrieterrein De Vaart, Damsluisweg 1, NL-1732 EA Almere
Representative's Signature:	
Name of Representative :	Gerben Wolsink
Representative's position :	European Service Manager

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