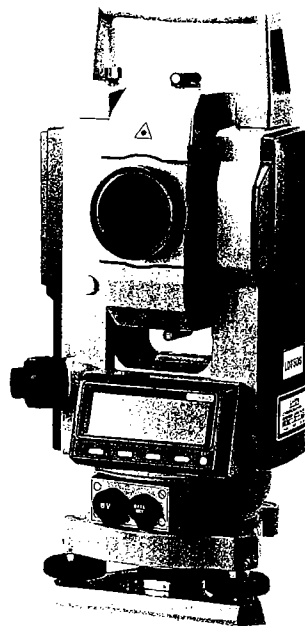


SOKKIA

**LDT50
LDT50S**



**Class 3a Laser Product
Class IIIa Laser Product**

OPERATOR'S MANUAL

**LDT50
LDT50S**

Laser Digital Theodolite

**Class 3a Laser Product
Class IIIa Laser Product**

OPERATOR'S MANUAL

- Thank you for selecting the LDT50/LDT50S Laser Digital Theodolite.
- Before using the instrument, please read this operator's manual carefully.
- Verify that all equipment is included by referring to "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.

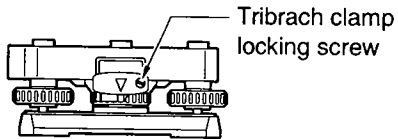
Before Using the Instrument

- **For rechargeable battery**

The battery has not been charged at the factory. Please charge the battery fully before using by referring to "16. POWER SUPPLIES."

- **For Tribrach**

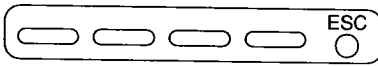
When the LDT50/50S is shipped, the tribrach clamp is fixed with a screw. Loosen it and leave it loose. If the LDT is again shipped, fix the tribrach clamp with this screw to secure the tribrach to the instrument.



Power on and off

►PROCEDURE

Power on

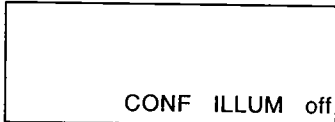


- Press any one of the 5 keys.

►PROCEDURE

Power off

<ESC>



- Press and hold the <ESC> key in any mode to display the screen on the left. To switch the power off, while holding <ESC>, press <off>.

Hold <ESC> and press <off>

- To cancel power off and return to Basic mode, take your finger off the <ESC> key.

Release finger from <ESC> key:
Power off cancelled.

Table of Contents

ALWAYS FOLLOW PRECAUTIONS FOR SAFE OPERATION	vi
LASER SAFETY INFORMATION	x
EXPLANATION OF SOFTKEYS	xii
HOW TO USE THIS MANUAL	xiii

Introduction

1. PRECAUTIONS	1
2. PARTS OF THE INSTRUMENT	2
3. DISPLAY SYMBOLS	4
4. KEY FUNCTIONS	5
5. MODE DIAGRAM	7

Preparation for measurement

6. MOUNTING THE BATTERY	8
7. SETTING UP THE INSTRUMENT	9
7.1 Centering	9
7.2 Levelling	11
8. POWER ON AND PREPARATION FOR MEASUREMENT	15
8.1 Power on and off	15
8.2 Indexing the vertical and horizontal circles	18
8.3 Focusing and target sighting	19
8.4 Display and reticle illumination	21
8.5 Setting the instrument options	22

Table of Contents

Measurement

9. EMITTING THE LASER BEAM AND ADJUSTING BEAM ANGLE	26
10. ANGLE MEASUREMENT	28
10.1 Measure the horizontal angle between 2 points	29
10.2 Set Horizontal circle to a required value	30
10.3 Horizontal angle display selection	31
10.4 Horizontal angle repetition	32
10.5 Slope in %	34
10.6 Slope in $\%/\infty$	35
11. OPTICAL DISTANCE MEASUREMENT: STADIA SURVEY	36

Troubleshooting

12. ERROR MESSAGES	37
13. CHECKS AND ADJUSTMENTS	38
13.1 Plate level	38
13.2 Circular level	40
13.3 Tilt sensor	41
13.4 Reticle	45
13.5 Optical plummet	50

Measurement options selection

14. CHANGING INSTRUMENT PARAMETERS	52
15. CHANGING LOCATION OF FUNCTIONS FOR KEYS	58
15.1 Key function allocating	59
15.2 Registered location recalling	63
16. POWER SUPPLIES	65

Table of Contents

Appendices

Appendix 1: Manually indexing the vertical circle by face left, face right measurements	68
Appendix 2: Standard accessories	69
Appendix 3: Optional accessories	70
STANDARD EQUIPMENT	72
MAINTENANCE	73
SPECIFICATIONS	74
REGULATION	77

ALWAYS FOLLOW 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 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.

Definition of Symbols



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.

General

WARNING

-  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.
-  Do not perform disassembly or rebuilding. Fire, electric shock or burns could result.
-  Do not use the main 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.

CAUTION

-  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 tribrach clamp securely. Failure to properly secure the clamp could result in the tribrach falling off while being carried, causing injury.
-  Do not wield or throw the plumb bob. A person could be injured if struck.
-  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 use the carrying case as a footstool. The case is slippery and unstable, so a person could slip and fall off of it.

Power Supply

⚠WARNING


- ⊘** Do not use voltage other than the specified power supply voltage. Fire or electrical shock could result.
- !** Use only the specified battery charger to recharge the batteries. Other chargers may be of different voltage rating or polarity, causing sparking which could lead to fire or burns.
- ⊘** Do not place articles such as clothing on the battery power charger while charging batteries. Sparks could be induced, leading to fire.
- ⊘** Do not use damaged power cords, plugs or loose outlets. Fire or electric shock could result.
- ⊘** Do not use batteries or the battery charger if wet. Resultant shorting could lead to fire or burns.
- ⊘** Do not use power cords other than those designated. Fire or electric shock could result.
- !** To prevent shorting of the battery in storage, apply insulating tape or the equivalent to the battery terminals. Otherwise shorting could occur, resulting in fire or burns.
- ⊘** Do not heat or throw batteries into fire. An explosion could occur, resulting in injury.


⚠CAUTION


- ⊘** Do not connect or disconnect power supply plugs with wet hands. Electric shock could result.
- ⊘** 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.

-  Securely tighten 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.

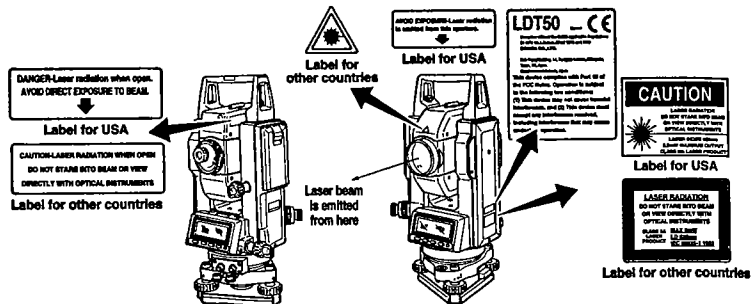
-  Do not carry the tripod with the tripod shoes pointed at other persons.
A person could be injured if struck by the tripod shoes.

-  Keep hands and feet away from the tripod shoes when fixing the tripod in the ground.
A hand or foot stab wound could occur.

-  Tighten the leg fixing screws securely before carrying the tripod.
Failure to tighten the screws could lead to the tripod legs extending, causing injury.

LASER SAFETY INFORMATION

The LDT is classified as a class 3A Laser Product according to IEC Standard Publication 825-1, and as a class IIIa Laser Product according to the United States Government Code of Federal Regulation CFR21. Follow the safety instructions on the labels attached to the instrument as well as in this manual to ensure safe use of the laser product.



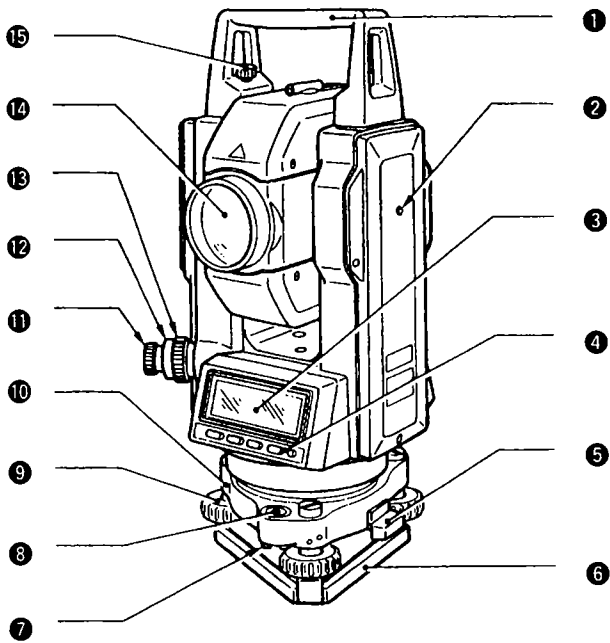
CAUTION

- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- 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 (to NOHD) extends beyond the controlled area.
- The laser beam path should be located well above or below eye level wherever practicable.
- Areas in which the laser is used should be posted with a standard laser warning sign.
- Precautions should be taken to ensure that persons do not look directly into the beam (prolonged intrabeam viewing is hazardous). Direct viewing of the beam through optical instruments (theodolite, etc.) may be hazardous and should not be permitted unless specifically approved by a laser safety officer.

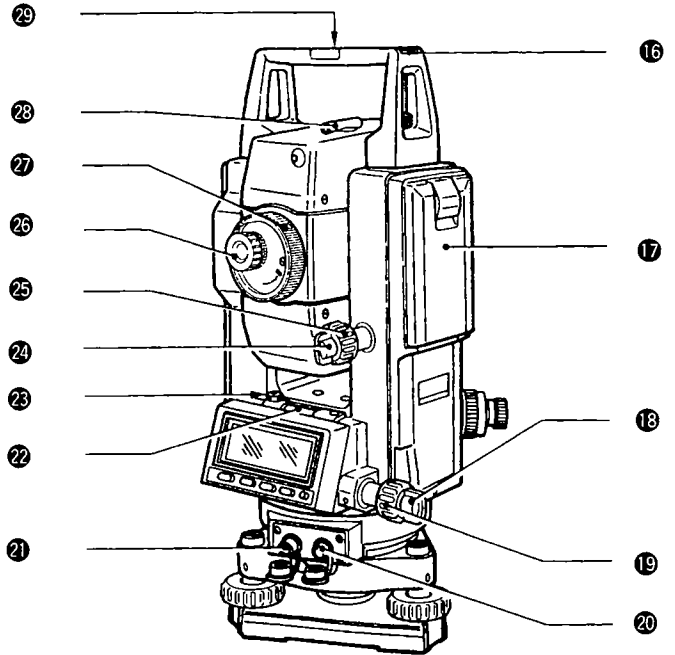
1. PRECAUTIONS

- Never place the LDT directly on the ground.
Avoid damaging the tripod head and centering screw with sand or dust.
- Do not aim the telescope at the sun.
Avoid damaging the LED by using a solar filter when the telescope is pointed at the sun.
- Protect the LDT with an umbrella against direct sunlight, rain and humidity.
- Handle the LDT with care. Avoid heavy shocks or vibration.
- When the operator leaves the LDT, the vinyl cover should be placed on the instrument.
- Always switch the power off before removing the standard battery.
- Remove the standard battery from the LDT before putting it in the carrying case.
When the LDT is placed in the carrying case, follow the layout plan.

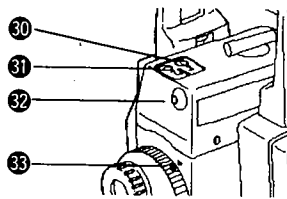
2. PARTS OF THE INSTRUMENT



- | | |
|--------------------------|---|
| ① Handle | ⑦ Circular level adjusting screws |
| ② Instrument height mark | ⑧ Circular level |
| ③ Display | ⑨ Levelling foot screw |
| ④ Keyboard | ⑩ Tribrach |
| ⑤ Tribrach clamp | ⑪ Optical plummet eyepiece |
| ⑥ Base plate | ⑫ Optical plummet reticle adjusting cover |
| | ⑬ Optical plummet focussing ring |
| | ⑭ Objective lens |
| | ⑮ Handle securing screw |



- | | |
|--|--|
| 16 Tubular compass slot | 21 External power source connector / Connector cap |
| 17 Battery | 22 Plate level |
| 18 Horizontal clamp | 23 Plate level adjusting screw |
| 19 Horizontal fine motion screw | 24 Vertical clamp |
| 20 Data output connector / Connector cap | 25 Vertical fine motion screw |
| | 26 Telescope eyepiece |
| | 27 Telescope focusing ring |
| | 28 Peep sight |
| | 29 Instrument center mark |
| | 30 Laser beam horizontal adjusting screw |
| | 31 Laser beam vertical adjusting screw |
| | 32 Laser indicator lamp |
| | 33 Focusing mark |



3. DISPLAY SYMBOLS

- ZA : Zenith angle (Z=0)
- VA : Vertical angle (H=0) /
Vertical angle (H=0±90°)
: Slope in % or ‰
- HAR : Horizontal angle right
- HAL : Horizontal angle left
- HAh : Horizontal angle hold
- HARp: Horizontal angle repetition
- X : Tilt angle in sighting direction
- Y : Tilt angle in horizontal axis
direction
- ⤴ : Tilt angle compensation on

<Remaining battery power>
(BDC25A, Temperature=25°C)

- 3 : 90 to 100%
- 2 : 50 to 90%
- 1 : 10 to 50%
- 0 : 0 to 10%

4. KEY FUNCTIONS

- The key functions are listed below. To use the functions marked with “*”, allocate them to the softkeys by referring to “15. CHANGING LOCATION OF FUNCTIONS FOR KEYS.”

General

<ESC>: Go to Basic mode

While holding <ESC>, press <CONF>: Configuration/Tilt correction/Key select

While holding <ESC>, press <ILLUM>

: Display and reticle illumination ON/OFF

While holding <ESC>, press <off>: Switch the power off

<→PX> : Go to next page

<--->* : No function

<ILLUM> : Display and reticle illumination ON/OFF

<Enter> : Memorize the selected data

<Exit> : Exit from each mode

<CE> : Return to previous display

<EDIT> : Edit the data

<Input> : Change the displayed data

<off> : Switch the power off

<↑> : Move to previous option / Count up (*1)

<↓> : Move to next option / Count down (*1)

<→> : Move to right option / Go to the next column (*1)

<1> : Select the number 1

<2> : Select the number 2

<3> : Select the number 3

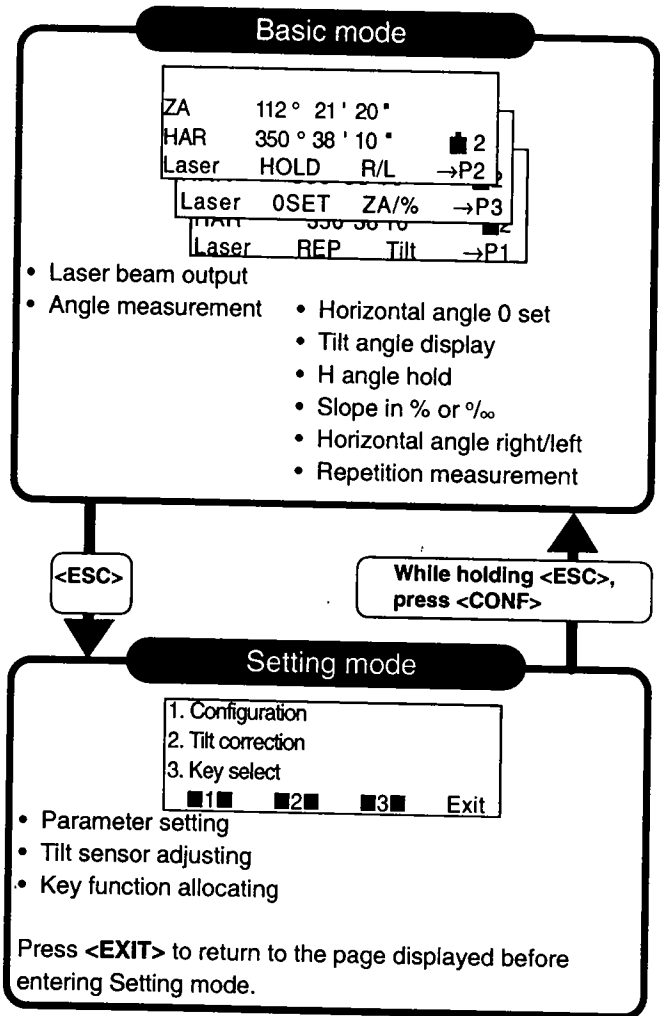
(*1): When <↑>, <↓> or <→> is held down, scrolling of the selected function is performed.

For Angle measurement

- <Laser>** : Laser beam ON/OFF
- <0SET>** : Set Horizontal angle to 0 / Index V circle
- <HOLD>** : Hold H angle / Release H angle
- <Tilt>** : Display the tilt angle
- <REP>** : Transfer to Repetition mode
 - <BS>** : Finish No.1 point sighting
 - <FS>** : Finish No.2 point sighting
 - <CE>** : Return to previous display/setting
- <ZA/%>** : Zenith angle / Slope in % (percent) (*2)
- <VA/%>** : Vertical angle / Slope in % (percent) (*2)
- <ZA/°>** : Zenith angle / Slope in ° (per mill) (*2)
- <VA/°>** : Vertical angle / Slope in ° (per mill) (*2)
- <R/L>*** : Select Horizontal angle right / left

(*2) : "ZA/%" or "ZA/°" is displayed when parameter "V angle format" is set to "Zenith 0".
"VA/%" or "VA/°" is displayed when parameter "V angle format" is set to "Horizontal 0" or "Horizontal ±90°".

5. MODE DIAGRAM

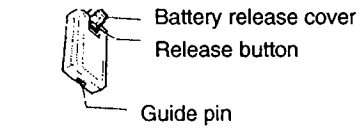


6. MOUNTING THE BATTERY

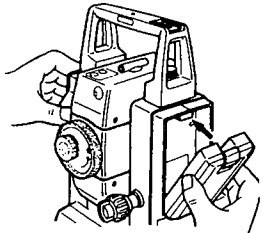
- Charge the battery fully before measurement.

►NOTE Switch off the power before replacing the battery.

►PROCEDURE **Mounting the battery**

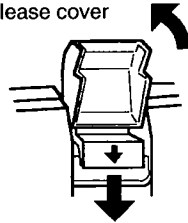


1. Close the battery release cover.
2. Match the battery guide with the hole in the instrument battery recess.
3. Press the top of the battery until a click is heard.



Removing the battery

Open the battery release cover



Press the release button downward

1. Open the battery release cover.
2. Press the release button downward.
3. Remove the battery.

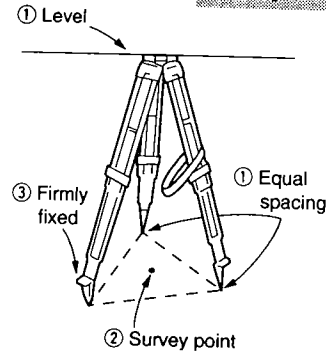
7. SETTING UP THE INSTRUMENT

- 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

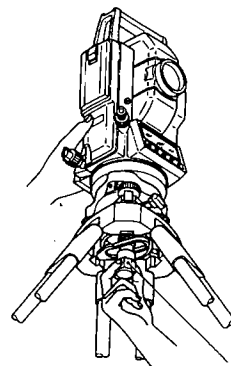
► PROCEDURE

Set up the tripod



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

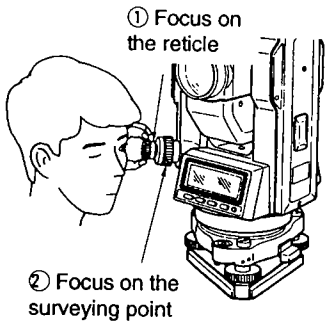
Install the instrument



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

Centering screw

Focus on the surveying point



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

7.2 Levelling

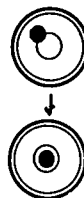
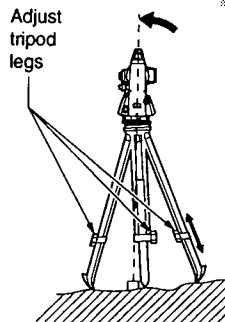
► PROCEDURE

Center the surveying point in the reticle



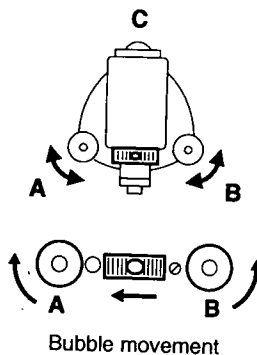
1. Adjust the levelling foot screws to center the surveying point in the optical plummet reticle.

Center the bubble in the circular level



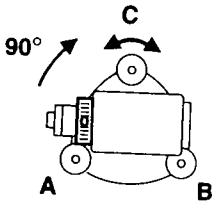
2. Observe the off-center direction of the bubble in the circular level, and shorten the nearest tripod leg, or extend the leg farthest from the direction to center the bubble.
3. One more tripod leg must be adjusted to center the bubble.

Center the bubble in the plate level



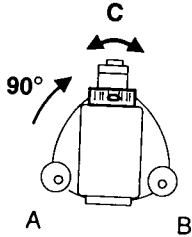
4. Loosen the horizontal clamp to turn the upper part of the instrument until the plate level is parallel to a line between levelling foot screws A and B.
5. Center the air bubble, using levelling foot screws A and B.
 - The bubble moves towards a clockwise rotated levelling foot screw.

Turn 90° and center the bubble



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

Turn another 90° and check bubble position



8. Turn the upper part of the instrument a further 90° and check to see if the bubble is in the center of the plate level.

If the bubble is off-center, perform the following:

- ① Adjust levelling foot screws A and B in equal and opposite directions to remove half of the bubble displacement.
- ② Turn the upper part a further 90°, and use levelling foot screw C to remove half of the displacement in this direction.

Or try the adjustment described in "13.1 Plate level".

Check to see if bubble is in same position in any direction

9. Turn the instrument and check to see if the air bubble is in the same position for any position of the upper part. If it is not, repeat the levelling procedure.

Center the LDT50 over the Surveying point

10. Loosen the centering screw slightly.
11. Looking through the optical plummet eyepiece, slide the instrument over the tripod head until the surveying point is exactly centered in the reticle.
12. Retighten the centering screw securely.
13. Check again to make sure the bubble in the plate level is centered.

Center the LDT50S over the Surveying point

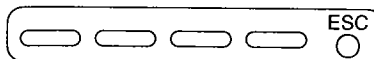
10. Turn the tribrach shifting clamp counterclockwise.
Shifting tribrach can be adjusted up to $\pm 8\text{mm}$.
11. Looking through the optical plummet eyepiece, adjust the instrument position on the tribrach to center the surveying point.
12. Tighten the shifting clamp to fix the instrument in the center position.

8. POWER ON AND PREPARATION FOR MEASUREMENT

- The following preparations are required for measurement.

8.1 Power on and off

►PROCEDURE **Power on and off**



```

ZA  0   SET
HAR 0   SET  ▣2
Laser 0SET  ZA/%  →P2
  
```

```

      Tilt  out  of  range
X- >  ⊥    +
Y-   ⊥    <+  ▣2
      EXIT
  
```

X: Tilt angle in the sighting direction

Y: Tilt angle in the horizontal axis direction

Press any one of the 5 keys

When the power is switched on, a self-check is run to make sure the instrument is operating normally. After that, the display indicates that the instrument is ready for vertical and horizontal circle indexing.

- If this error message is displayed, the instrument tilt sensor is indicating that the instrument is off-level. Relevel the instrument once again until **▣** is displayed. To switch the power off, while holding **<ESC>**, press **<off>**.

►NOTE Automatic tilt angle correction (refer to "14. CHANGING INSTRUMENT PARAMETERS")

The parameter setting when the instrument left the factory was Automatic tilt angle correction OFF. Depending on your measurement needs, you can change the setting between Horizontal and vertical angle correction and Vertical angle correction only.

► **NOTE** Tilt alarm (beep tone) (refer to "14. CHANGING INSTRUMENT PARAMETERS")

The parameter setting when the instrument left the factory was Tilt alarm Off. Depending on your measurement needs, you can change the parameter setting to Tilt alarm ON.

RAM Cleared

- When all data has been cleared from the memory, the display appears as at left. After that the instrument is ready for vertical and horizontal circle indexing.

ZA V 1
HAR 0 SET

- When "V1" is displayed for the vertical angle, please refer to "Appendix1: Manually indexing the vertical circle".

► **NOTE** Instrument parameter "V indexing" (refer to chapter 14)
Parameter "V indexing" can change the vertical indexing method. Options are indexed by transiting the telescope or indexing by face left, face right sightings.

ZA 0 SET
HAR 0° 00' 00"

- When the parameter "H indexing" is set to "Manual," "0" is displayed for the horizontal angle.

► **NOTE** Instrument parameter "H indexing" (refer to chapter 14)
Parameter "H indexing" can be used to change the horizontal circle indexing method. Options are indexed by rotating the upper part or indexing and zero setting at power-on.

Battery is low !

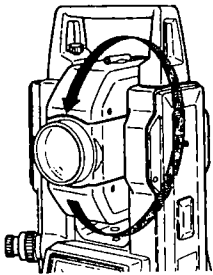
- If the battery is at the "low" level, the message "Battery is low !" will be displayed. Switch the power off and charge the battery.

► **NOTE** Power-saving cut off (refer to chapter 14)
Depending on your measurement needs, you can change the parameter setting so that LDT automatically switches off 30 minutes after the last operation.

8.2 Indexing the vertical and horizontal circles

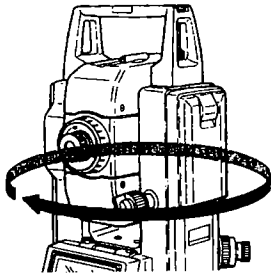
►PROCEDURE

Vertical circle Indexing



1. Loosen the vertical clamp and transit the telescope completely.
(Indexing occurs when the objective lens crosses the horizontal plane in face left.)
An audio tone sounds, and the vertical angle (ZA) is displayed.

Horizontal circle Indexing



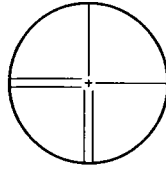
2. Loosen the horizontal clamp and rotate the upper part of the instrument completely.
An audio tone sounds, and the horizontal angle (HAR) is displayed.
- Vertical indexing and horizontal indexing have been completed.

►NOTE Each time the instrument is switched on, the vertical and horizontal indexes must be redetermined.
If the parameter "Resume function" is set to "on," the screen previous to power off is displayed. To change the parameter to "off", refer to chapter 14.

8.3 Focusing and target sighting

►PROCEDURE

Focus on the reticle



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

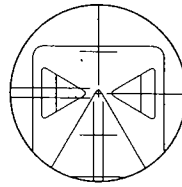
Sight the target

Line the target with the white arrow in the peep sight



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

Focus on the target



<Target center>

4. Turn the telescope focusing ring to focus on the target.
5. 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.

Readjust the focus until there is no parallax

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

► **NOTE** Observe to the same point of the reticle when the telescope face is changed.

8.4 Display and reticle illumination

►PROCEDURE

Display and reticle illumination on/off

ZA	85° 44' 50"	
HAR	53° 56' 40"	■1
CONF	ILLUM	off

- While holding <ESC>, press <ILLUM> to turn the display and reticle illumination on and off.

Holding <ESC>, press <ILLUM>

- NOTE Instrument parameter "Auto power off" (refer to chapter 14) Parameter "Auto power off" can be used to switch ON/OFF the 30-second illumination automatic cut-off facility.
- NOTE Instrument parameter "Backlight timeout" (refer to chapter 14) Parameter "Backlight timeout" can be used to change the brightness of the reticle illumination.
- NOTE To display ILLUM function
The key function allocation allows <ILLUM> to be displayed in any page of any mode. See "15. CHANGING LOCATION OF FUNCTIONS FOR KEYS".

8.5 Setting the Instrument options

- Confirm that these parameters are set according to your measurement needs.
- To confirm or change the parameter options, please refer to "14. CHANGING INSTRUMENT PARAMETERS".

Parameter	Options
Angle unit	1. degree* 2. gon 3. mil
Vertical angle format	1. Zenith angle (Zenith 0)* 2. Vertical angle (Horizontal 0) 3. Vertical angle (Horizontal $\pm 90^\circ$)
Tilt correction	1. Horizontal and Vertical angle Yes* 2. Vertical angle Yes 3. No correction
Angle resolution	1. 1" / 0.2mgon / 0.005mil* 2. 5" / 1mgon / 0.02mil

*: Factory setting

