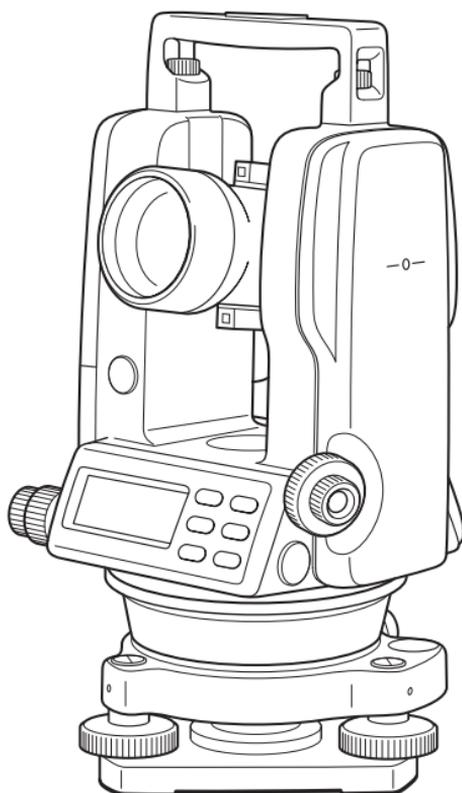


SOKKIA

DT240
DT540
DT740
DT940
DT540L
DT740L
DT940L
Digital Theodolite



CLASS 2 Laser Product

OPERATOR'S MANUAL

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

SOKKIA

DT240
DT540
DT740
DT940
DT540L
DT740L
DT940L
Digital Theodolite

CLASS 2 Laser Product

OPERATOR'S MANUAL

Thank you for selecting the DT240/540/740/940/540L/740L/940L.

- Please read this operator's manual carefully before using this instrument.
- Verify that all equipment is included.
☞ "STANDARD EQUIPMENT"
- The specifications and general appearance of the instrument are subject to change without prior notice and without obligation by Sokkia Topcon Co., Ltd. and may differ from those appearing in this manual.
- The content of this manual may be altered at any time.
- 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.
- {HOLD}** etc. : Indicates operation keys.

Notes regarding manual style

- Except where stated, “DT” means DT240/540/740/940/540L/740L/940L in this manual.
- All other company and product names featured in this manual are trademarks or registered trademarks of each respective organization.

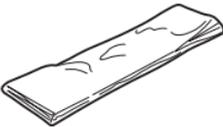
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STANDARD EQUIPMENT

The numerical value in parentheses shows the quantity.

<p>DT main unit (1) (with lens cap)</p>  A detailed line drawing of a surveying total station instrument, showing the telescope, objective lens, eyepiece, and base.	<p>Carrying case (1)</p>  A line drawing of a rectangular carrying case with a handle on top and a latch on the front.
<p>Plumb bob (1)</p>  A line drawing of a plumb bob, consisting of a pointed metal weight attached to a cord.	<p>Tool pouch (1) Cleaning brush, Screwdriver, Rod pins, Plumb bob hook (Hexagonal wrench: Only for models with laser- pointer)</p>  A line drawing showing the contents of a tool pouch: a cleaning brush, a screwdriver, two rod pins, and a plumb bob hook.
<p>AA batteries (4)</p>  A line drawing of four AA batteries arranged in two rows of two.	<p>Vinyl cover (1)</p>  A line drawing of a folded vinyl cover, likely for the instrument's lens or display.
<p>Cleaning cloth (1)</p>  A line drawing of a square cleaning cloth.	<p>Operator's manual (1)</p>  A line drawing of a rectangular operator's manual.

- Please verify that all equipment is included.
- Guarantee card, Laser use card, Caution sticker are supplied for certain markets.

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 instruction 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 minor 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.

General



Warning



Do not perform disassembly or rebuilding. Fire, electric shock, burns or hazardous radiation exposure could result.



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.



Never look at the sun through the telescope. Loss of eyesight could result.

1. PRECAUTIONS FOR SAFE OPERATION

 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 securing screws. Failure to properly secure the handle could result in the unit falling off while being carried, causing injury.

Power Supply

Warning

 Do not short circuit. Heat or ignition could result.

 Do not use voltage other than the specified power supply voltage. Fire or electrical shock could result.

 Do not heat or throw batteries into fire. An explosion could occur, resulting in injury.

 Do not use batteries if wet. Resultant shorting could lead to fire or burns.

 Do not use batteries other than those designated. An explosion could occur, or abnormal heat generated, leading to fire.



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.



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.



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

2. PRECAUTIONS

Before starting work or operation, be sure to check that the instrument is functioning correctly with normal performance.

Do not submerge the instrument in water

- The instrument can not be submerged underwater.
- The instrument is designed based on the International Standard IP66, therefore it is protected from normal rainfall.

Setting the instrument on a tripod

When mounting the instrument on a tripod, use a wooden tripod when possible. The vibrations that may occur when using a metallic tripod can effect the measuring precision.

Installing the tribrach

If the tribrach is installed incorrectly, the measuring precision could be effected. Occasionally check the adjusting screws on the tribrach. Make sure the tribrach clamp is locked and the locking screws are tightened.

Guarding the instrument against shocks

When transporting the instrument, provide some protection to minimize risk of shocks. Heavy shocks may cause the measurement to be faulty.

Carrying the instrument

Always carry the instrument by its handle.

Exposing the instrument to extreme heat

Do not leave the instrument in extreme heat for longer than necessary. It could adversely affect performance.

Sudden changes of temperature

Any sudden change of temperature to the instrument or prism may result in a reduction of measuring distance range, e.g. when taking the instrument out from a heated vehicle. Let instrument acclimate itself to ambient temperature. When a high degree of precision is required for measurement, provide shade against direct sunlight for the instrument and tripod.

Battery level check

Confirm battery level remaining before operating.

Store with the batteries removed when operation is halted for more than a month. Leaving the batteries installed for an extended period of time can result in battery leakage, which may lead to malfunction.

Notice on Transceiver

Do not use a high output transceiver etc. near the instrument.

Maintenance

- For cleaning the instrument after use, remove dust using a cleaning brush, then wipe off with a cloth.
- For cleaning the lens surface, use a cleaning brush to remove the dust, then use the cleaning cloth or a clean lintless cotton cloth. Moisten it with alcohol (or mixture with ether) to wipe gently in a rotational motion from the center out.
- Never use thinner or benzine to clean the case. Use a clean cloth moistened with neutral detergent.
- Check each part of the tripod after extended use. Parts (screws or clamps) may work themselves free.

2. PRECAUTIONS

User

- This product is for professional use only!
The user is required to be a qualified surveyor or have a good knowledge of surveying, in order to understand the user and safety instructions, before operating, inspecting or adjusting.
- Wear the required protectors (safety shoes, helmet, etc.) when operating.

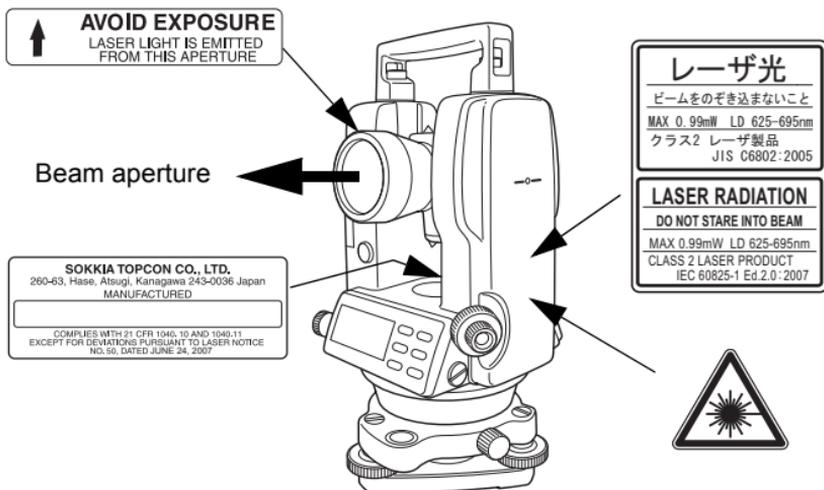
Exceptions from Responsibility

- The user of this product is expected to follow all operating instructions and make periodic checks (hardware only) of the product's performance.
- The manufacturer, or its representatives, assumes no responsibility for results of a faulty or intentional usage or misuse including any direct, indirect, consequential damage, and loss of profits.
- The manufacturer, or its representatives, assumes no responsibility for consequential damage, and loss of profits by any disaster, (an earthquake, storms, floods etc.). A fire, accident, or an act of a third party and/or a usage any other usual conditions.
- The manufacturer, or its representatives, assumes no responsibility for any damage, and loss of profits due to a change of data, loss of data, an interruption of business etc., caused by using the product or an unusable product.
- The manufacturer, or its representatives, assumes no responsibility for any damage, and loss of profits caused by usage except for explained in the user manual.
- The manufacturer, or its representatives, assumes no responsibility for damage caused by wrong movement, or action due to connecting with other products.

3. LASER SAFETY INFORMATION

The DT540L/740L/940L is classified as the following class of Laser Product according to IEC Standard Publication 60825-1 Ed. 2.0: 2007 and United States Government Code of Federal Regulation FDA CDRH 21CFR Part1040.10 and 1040.11 (Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No.50, dated June 24, 2007.)

- Laser-pointer (visible) in objective lens: Class 2 Laser Product



Depending on the country where the instrument is sold, some of these labels may not be found on the instrument.

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. If an eye injury is caused by exposure to the laser beam, seek immediate medical attention from a licensed ophthalmologist.
- Do not look directly into the laser beam source. Doing so could cause permanent eye damage.

3. LASER SAFETY INFORMATION

- Do not stare at the laser beam. Doing so could cause permanent eye damage.
- Never look at the laser beam through a telescope, binoculars or other optical instruments. Doing so could cause permanent eye damage.

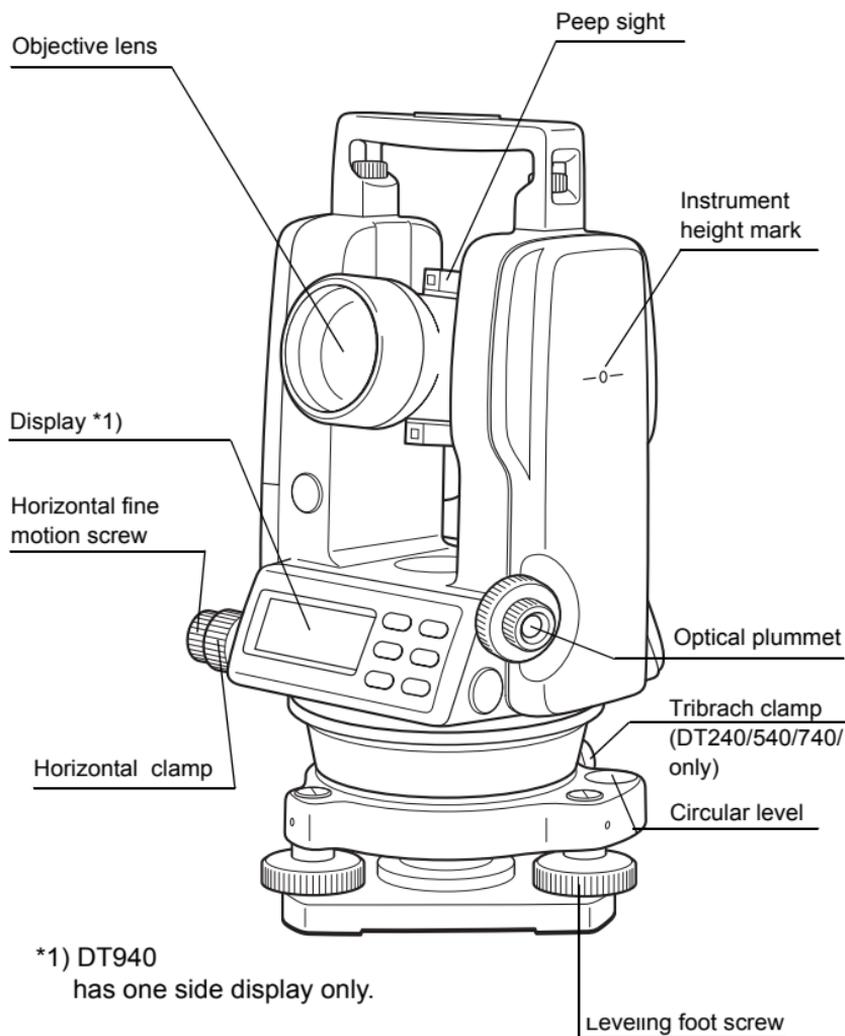
Caution

- 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 and replace the lens cap.
- 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.

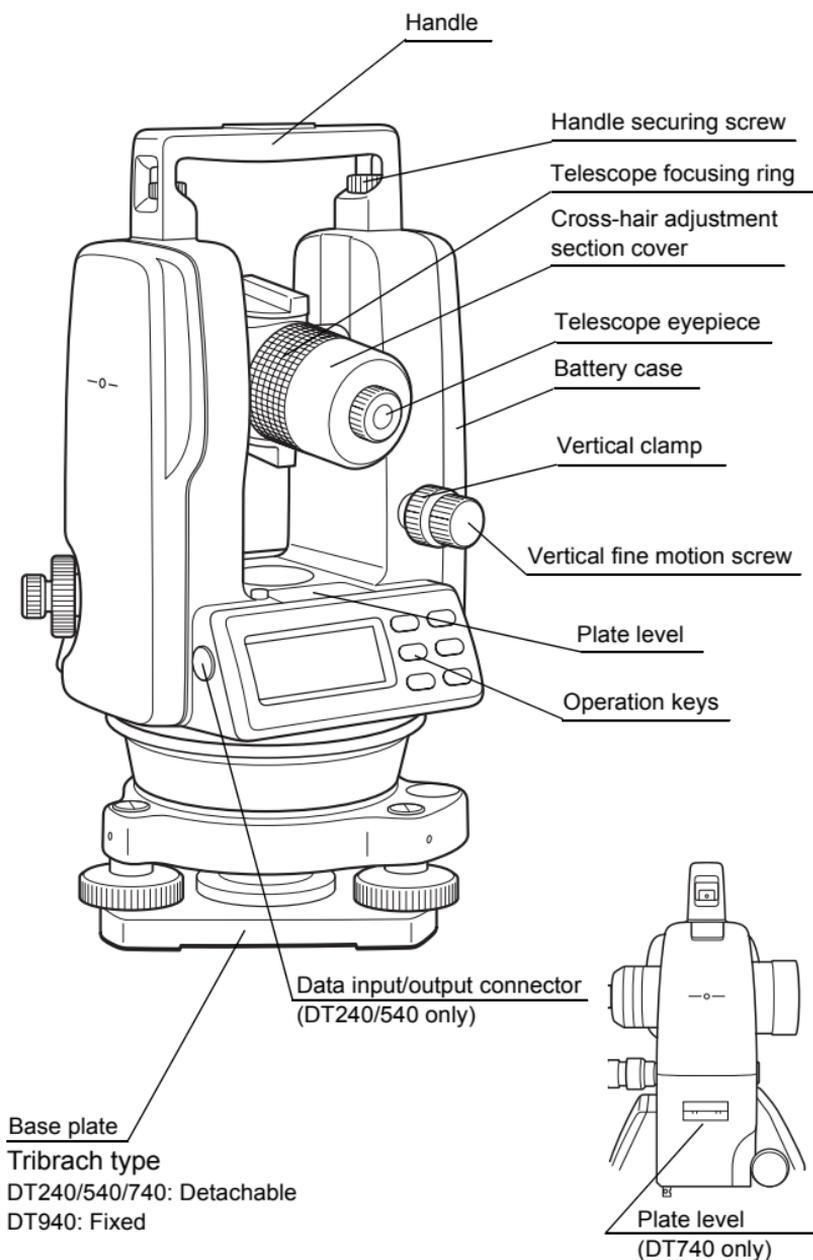
4. PRODUCT OUTLINE

4.1 Parts of the Instrument

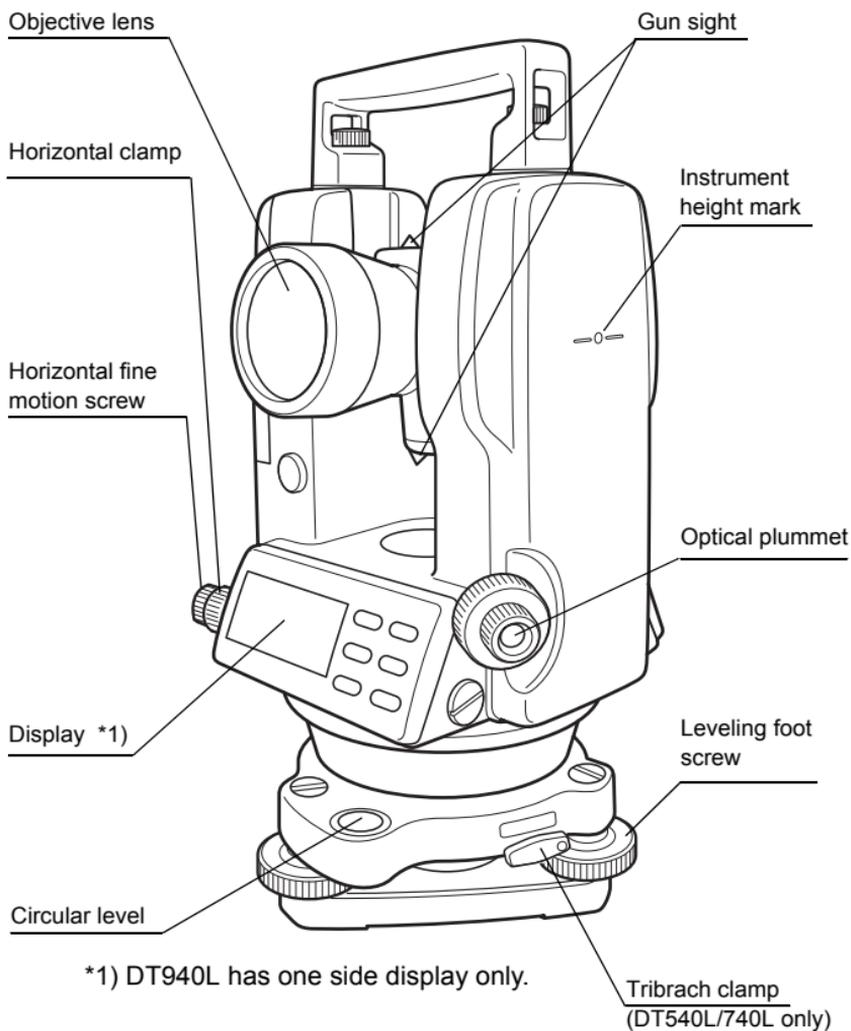
■ DT240/540/740/940



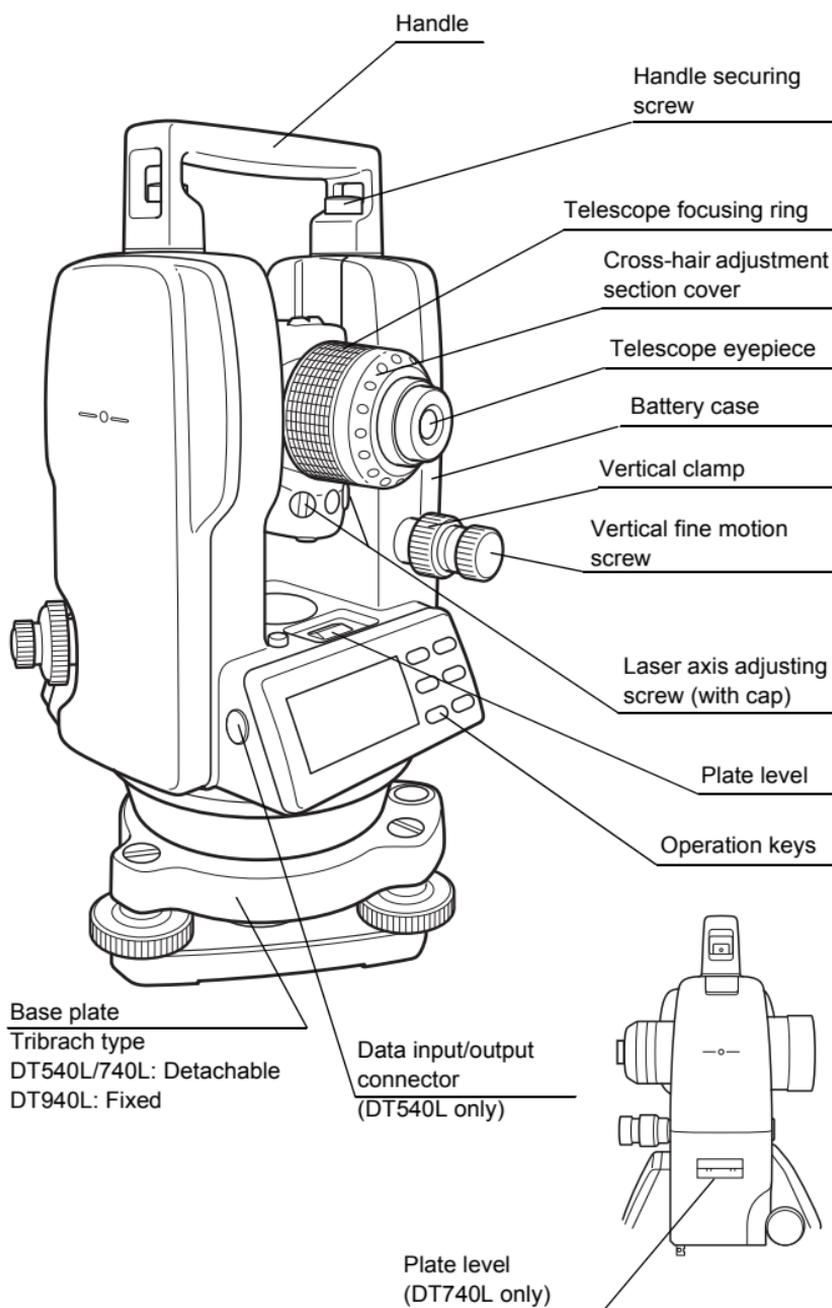
4. PRODUCT OUTLINE



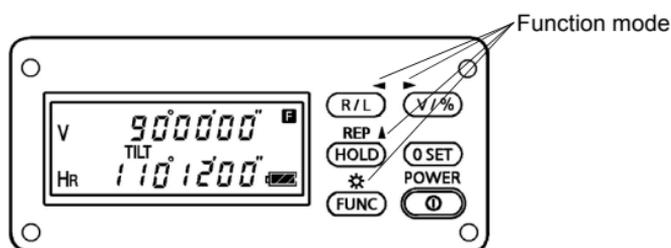
■ DT540L/740L/940L



4. PRODUCT OUTLINE



4.3 Basic Key Operation



Key	Function	Key	Function (Function mode)
{ ⓘ }	Power switch	{ REP }	Repetition angle measurement
{ R/L }	Selection for horizontal angle right/left measurement	{ ☼ }	Illumination of display and reticle ON/OFF (Reticle illumination: DT240/540L/740L only)
{ V/% }	Vertical angle display Selection for vertical angle/percent display	{ ◀ }	Moving the blinking digit to the left
{ HOLD }	Holding the horizontal angle	{ ▶ }	Moving the blinking the digit to the right
{ 0 SET }	Horizontal angle 0° set	{ ▲ }	Increment the blinking numeral
{ FUNC }	Upper function selection		

■ Adjustment mode and Selecting mode

Mode	Key
Adjustment mode of vertical angle 0 datum	Turn the power ON while pressing {0 SET} .
Selecting mode 1	Turn the power ON while pressing {R/L} .
Selecting mode 2	Turn the power ON while pressing {V/%} .

5. PREPARATION FOR MEASUREMENT

5.1 Setting Instrument Up for Measurement

Setting up the Tripod

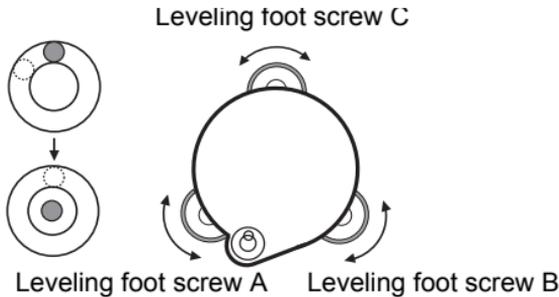
First, extend the extension legs to suitable lengths and tighten the screws on their midsections.

Attaching the Instrument on the Tripod Head

Place the instrument carefully on the tripod head and slide the instrument by loosening the centering screw. If the plumb bob is positioned right over the center of the point, slightly tighten the centering screw.

Roughly Leveling the Instrument Using the Circular Level

- 1 Turn leveling foot screws A and B to move the bubble in the circular level. The bubble is now located on a line perpendicular to a line running through the centers of the two leveling foot screws being adjusted.
- 2 Turn leveling foot screw C to bring the bubble to the center of the circular level.



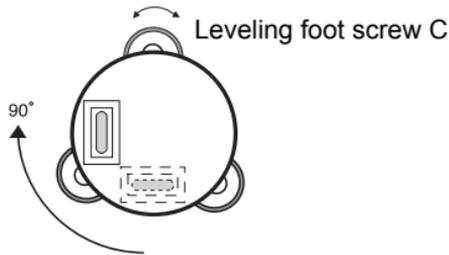
Centering Using the Plate Level

- 1 Rotate the instrument horizontally using the Horizontal fine motion screw and place the plate level parallel with the line connecting leveling foot screws A and B, and then bring the bubble to the center of the plate level by turning leveling foot screws A and B.

5. PREPARATION FOR MEASUREMENT



- 2** Rotate the instrument 90° (100 gon) around its vertical axis and turn the remaining leveling foot screw or C to center the bubble once more.



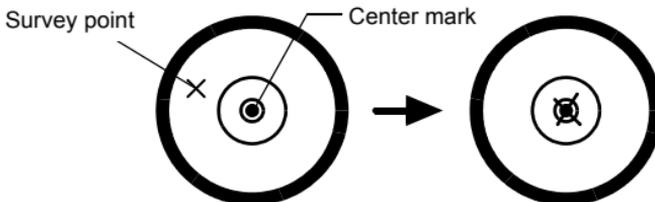
- 3** Repeat procedures 1 and 2 for each 90° (100 gon) rotation of the instrument and check whether the bubble is correctly centered at all four points.

Centering Using the Optical Plummet

Adjust the eyepiece of the optical plummet to your eyesight. Slide the instrument by loosening the centering screw, place the point on the center mark, and then tighten the centering screw. Slide the instrument carefully so as to prevent unintentional rotation that may shift the bubble.

Centering with a Shifting Tribrach

Slide the instrument by loosening the shifting clamp. Place the point on the center mark, and then tighten the shifting clamp.

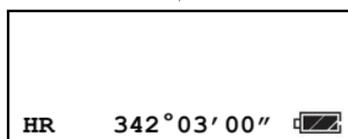


Completely Leveling the Instrument

Level the instrument precisely in a similar way to 4. Rotate the instrument and check that the bubble is in the center of the plate level regardless of telescope direction, then tighten the centering screw hard.

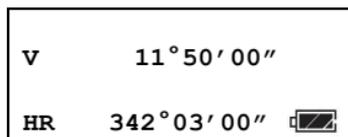
5.2 Power Switch Key ON

- 1 Confirm the instrument is leveled.
- 2 Turn the power switch ON.
Every segment turns on for about 1 second.



Battery Power
Remaining
Display

- 3 Press {V/%}. The vertical angle is displayed.

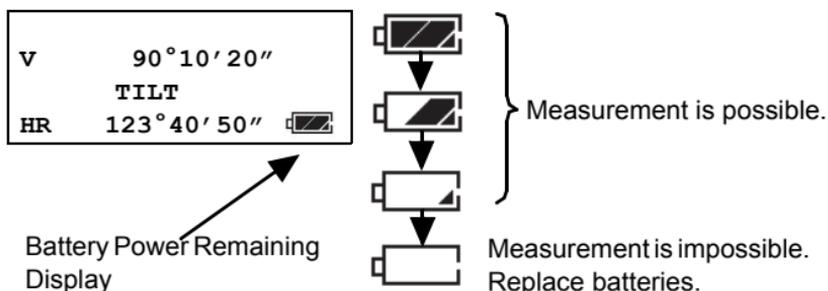


Confirm the battery power remaining on the display. Insert new batteries when battery level is low.

 "5.3 Battery Level Indicator" (p. 19)

5.3 Battery Level Indicator

The battery power indicator shows remaining battery power.

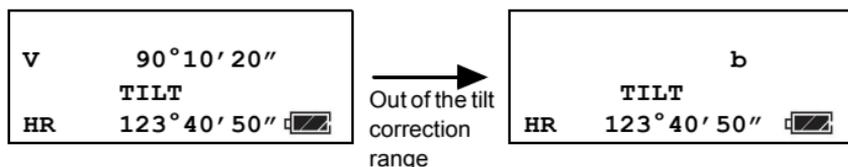


- The battery operating time will vary depending on the environmental conditions, such as ambient temperature etc. Prepare spare batteries in advance to minimize disruption to measurement.
-  "10. HANDLING POWER SOURCE" (p. 37)

5.4 Vertical Angle Tilt Correction

(DT240/540/540L only)

When the tilt sensor is activated, automatic correction of vertical angle tilt is displayed. To ensure precise angle measurement, tilt sensors must be turned on. If the "b" display appears the instrument is out of automatic compensation range and must be leveled manually.



When the instrument is used in an unstable situation, constant indexing of vertical angle may be impossible. In this event, the function of tilt correction can be cancelled.

To cancel tilt correction, refer to "9. SELECTING MODE" (p. 31).

5.5 Data Input/Output Connector

(DT240/540/540L only)

This RS232C connector is used for connecting the DT240/540/540L with a computer, which enables the computer to receive measurement data from the DT240/540/540L.

Contact your local dealer regarding interface cables and output formats used when connecting to a computer.

6. MEASUREMENT

6.1 Measuring Horizontal Angle Right and Vertical Angle

- 1 Sight the first target "A".

V	90°10'20"
HR	120°30'40"

- 2 Press **{0 SET}** twice to set the horizontal angle of target "A" to 0°00'00".

V	90°10'20"
HR	0°00'00"

- Horizontal angle can be set to 0 with one press of **{0 SET}**.
 "9. SELECTING MODE" (p. 31)

- 3 Sight the second target "B".
The required H/V angle to target B will be displayed.

V	90°10'20"
HR	160°40'20"

6.2 Switching Horizontal Angle Right/Left

- 1 Sight the first target "A".

V	90°10'20"
HR	120°30'40"

6. MEASUREMENT

2 Press {R/L}.

The mode switches from Horizontal angle right (HR) to Horizontal angle left (HL).

V	90°10'20"
H L	239°29'20"

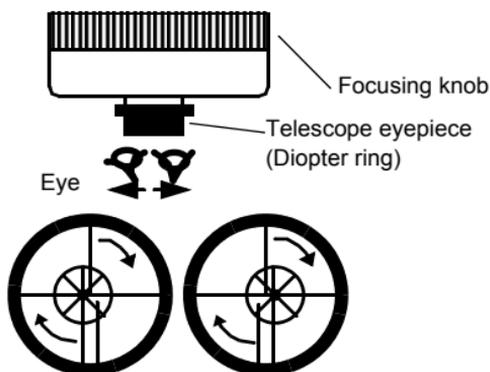
- HR/HL mode switches every time {R/L} is pressed.

3 Measure as HR mode.

Note Sighting

- 1 Point the telescope toward the light. Turn the diopter ring and adjust the diopter so that the cross hairs are in focus.

(Turn the diopter ring toward you first and then backward to focus.)



- 2 Aim the the peak of the triangle mark of the peep sight at the target. Allow a certain space between the peep sight and yourself for sighting.

- 3 Focus on the target with the focusing ring.

* If parallax is created between the cross hairs and the target when viewing vertically or horizontally through the telescope, focusing is incorrect or diopter adjustment is insufficient.

This adversely affects precision in measurement or survey. Eliminate the parallax by focusing carefully and using diopter adjustment.

6.3 Measuring from the Required Horizontal Angle

- 1 Display the required horizontal angle using the horizontal fine motion screw and horizontal clamp.

V	90°10'20"
HR	130°40'20"

- 2 Press **{HOLD}**.
Horizontal angle display blinks and the horizontal angle will be held.

V	90°10'20"
HR	130°40'20"

blinks

- To return to the angle status before the data is held, press any key except **{HOLD}**.

- 3 Sight the target to set.
- 4 Press **{HOLD}**. Angle measurement will start from the held angle.

V	90°10'20"
HR	130°40'20"

6.4 Vertical Angle % display

V	66°23'10"
HR	120°30'40"

1 Press {V/%}.

V	43.719%
HR	120°30'40"

- The mode switches every time {V/%} is pressed.
[-----] is displayed when a point is sighted at 45° or more from the horizontal.

6.5 Repetition Angle Measurement

1 Press {FUNC}.

V	90°10'20" ^F
HR	120°30'40"

2 Press {REP}.

Ht	0°00'00"
0	
H	

3 Sight the target "A", and press {0SET} twice.

Ht	0°00'00"
0	
H	

- 4 Sight the target "B", and press **{HOLD}**.

Ht	45°10'00"
¹ AVG	
H	45°10'00"

- 5 Sight the target "A" again and press **{R/L}**.

- 6 Sight the target "B" again, and press **{HOLD}**.

Ht	90°20'00"	Total angle
² AVG		
H	45°10'00"	Average angle

The number of measurements
2 measurements

- 7 Repeat procedures 5 and 6 for the desired number of repetitions.

Ht	180°40'00"
⁴ AVG	
H	45°10'00"

Example: 4 measurements

- 8 To finish repetition measurement, press **{FUNC}** then press **{HOLD}**.

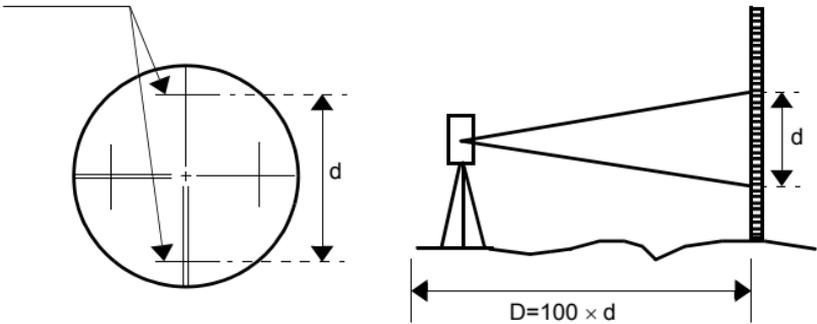


- Horizontal angle can be accumulated up to 2000°00'00" – minimum reading (horizontal angle right).
In case of 5" reading, horizontal angle can be accumulated up to +1999°59'55".
- When the discrepancy value of each measurement is more than $\pm 30''$, error code "E04" is displayed. Press **{OSET}**, and start measurement again.
- Up to 19 measurements can be made.
The first digit "1" will be omitted from the measurement number for the 10th measurement onwards.

6.6 Stadia Surveying

This instrument can be used for stadia surveying. Measurement by stadia is a convenient method for measuring distances with the stadia hairs of the instrument, in combination with a graduated rod, such as a leveling rod or stadia rod, which is preferable for long distances. The distance from the center of the instrument to the rod is found by sighting through the instrument on the rod and multiplying the stadia interval by 100. The stadia interval is the distance between the top stadia hair reading and the bottom stadia hair reading.

Stadia hairs



- 1 Set the rod on the point to be surveyed.
- 2 Sight through the telescope of the leveled instrument and determine the distance or interval, "d", between the top stadia hair reading and bottom stadia hair reading of the rod.
- 3 The horizontal distance "D" from the center of the instrument to the rod is equal to 100 times the stadia interval, "d".

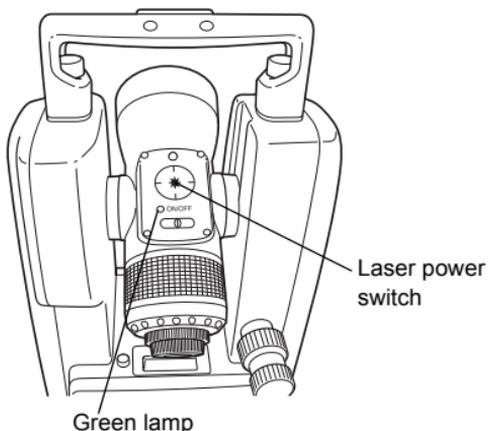
$$D=100 \times d$$

7. HOW TO OPERATE THE LASER

(DT540L/740L/940L only)

7.1 Laser Power Switch Key ON

- 1 Sight a target.
- 2 Press the laser power switch.
The laser beam will emit and the green lamp will illuminate.



Note

DT540L/740L/940L are so designed as to provide the telescope and laser beam with simultaneous focussing to give the minimum spot.

8. OTHER FUNCTIONS

8.1 Buzzer for Horizontal Angle 90° Increments

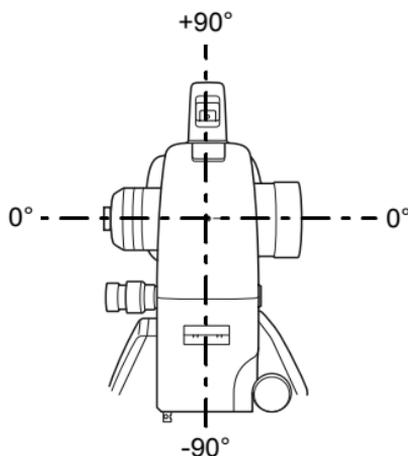
When the horizontal angle falls below $\pm 1^\circ$ of 0° , 90° , 180° or 270° , the buzzer sounds. Buzzer stops only when the horizontal angle is adjusted to $0^\circ 00' 00''$, $90^\circ 00' 00''$, $180^\circ 00' 00''$ or $270^\circ 00' 00''$.

Settings:  "9. SELECTING MODE" (p. 31)

8.2 Compasses (vertical angle)

Vertical angle scale is displayed as shown below.

Settings:  "9. SELECTING MODE" (p. 31)



8.3 Power-saving Automatic Cut-Off

If no key operation is given for more than 10 or 30 minutes, the power turns off automatically.

Settings:  "9. SELECTING MODE" (p. 31)

8.4 Setting Minimum Display

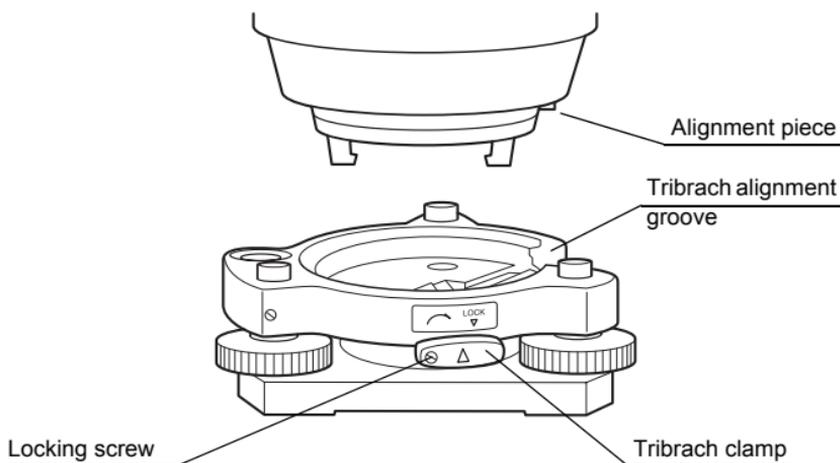
Select minimum display unit for angle measurement from the options shown below.

Settings:  "9. SELECTING MODE" (p. 31)

DT240	1"/5" (0.2 mgon/1 mgon)
DT540/540L	1"/5" (0.5 mgon/1 mgon)
DT740/740L	5"/10" (1 mgon/2 mgon)
DT940/940L	10"/20" (2 mgon/5 mgon)

8.5 Detaching/Attaching the Tribrach

Only for detachable tribrach type



The instrument is easily detached from/attached to the tribrach by releasing/engaging the tribrach clamp.

• Detaching

1. Release the tribrach clamp by revolving it 180° or 200 gon in the counterclockwise direction (which will point the triangle mark upwards).
2. Grip the handle firmly with one hand while holding the tribrach with the other. Then lift the instrument straight upwards and off.

• Attaching

1. Hold the instrument by the handle, with one hand, and carefully lower it on top of the tribrach while, at the same time, aligning the alignment piece with the tribrach alignment groove on the instrument and tribrach respectively.
2. When fully seated, revolve the tribrach locking lever 180° or 200 gon clockwise (which will point the triangle mark downwards again).

• Locking the Tribrach Clamp

The tribrach clamp can be locked, to prevent it being accidentally released, especially if the upper instrument section is not detached very often. Simply tighten the locking screw on the tribrach clamp with the screwdriver provided.

9. SELECTING MODE

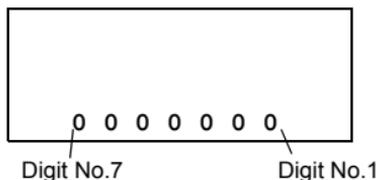
The following modes are available

9.1 Selecting Mode Options

■ Selecting mode 1

To set the instrument to selecting mode 1, turn the power ON while pressing {R/L}.

Selecting mode 1
{R/L} + Power on



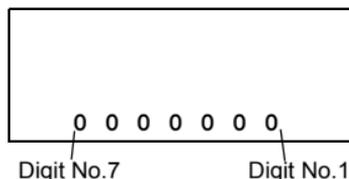
Selecting mode 1				
Digit No.	Items	Contents	Setting value = 0	Setting value = 1
1	Minimum angle unit	Select the minimum angle unit.	5" (DT240/540/ 540L) 10" (DT740/740L) 20" (DT940/940L)	1" 5" 10"
2	V angle Z0/H0	Select the vertical angle reading from zenith or from horizontal.	Horizontal 0	Zenith 0
3	Power-saving automatic cut-off ON/OFF	Set whether or not to power off when no key operation performed for 10 or 30 minutes.	ON	OFF
4	Auto cut off time 10 min./ 30 min.	Set the interval time of power off automatically.	10 min.	30 min.
5	Angle unit DEG/GON	Select degree (DEG) or gon (GON).	DEG	GON
6	90° buzzer ON/OFF	Specify whether the buzzer sounds or not for every horizontal 90°	ON	OFF
7	Angle unit MIL	Select angle unit MIL.	DEG/GON	MIL

9. SELECTING MODE

■ Selecting mode 2

To set the instrument to selecting mode 2, turn the power ON while pressing {V/%}.

Selecting mode 2
{V/%} + Power on



Selecting mode 2				
Digit No.	Items	Contents	Setting value = 0	Setting value = 1
1	Press {0 SET} once/ twice	Select number of times {0SET} is pressed to set horizontal angle to 0.	Twice	Once
2	Compass ON/OFF	Set the compass to ON or OFF (Vertical angle scale).	OFF	ON
3	RS-232 Output *1)	Set data input/output function to ON or OFF.	OFF	ON
4	H Angle Memory	Horizontal angle set can be retained after the power is turned off.	OFF	ON
5	Tilt correction ON/OFF *1)	Set tilt correction to ON or OFF.	OFF	ON
6 7	Unused	---	---	---

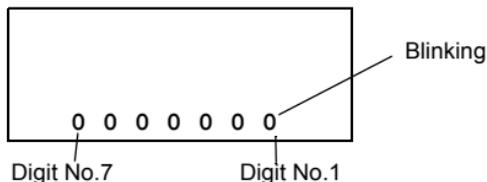
- Do not change the setting value (0) of unused items.
- *1) DT240/540/540L only

9.2 How to Set the Selecting Modes

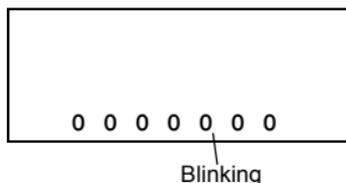
■ Selecting Mode 1

Sample setting: Auto cut off: OFF, 90° buzzer: OFF

- 1 Turn the power ON while pressing {R/L}.
The instrument will be in selecting mode 1, and the digit No.1 will blink.

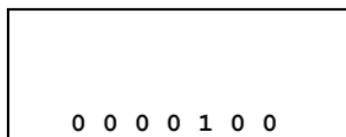


- 2 Press {◀} until digit No.3 blinks.



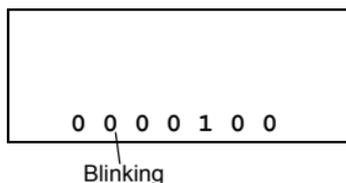
- Pressing {▶} moves the blinking digit to the right.

- 3 Press {▲} to set this digit to "1".



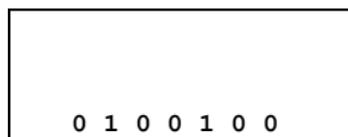
- Pressing {▲} switches the blinking digit value between "0" and "1".

- 4 Press {◀} until digit No.6 (90° buzzer) blinks. .

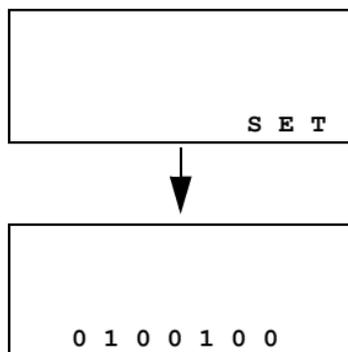


9. SELECTING MODE

5 Press {▲} to set this digit to "1".



6 Press {0 SET} to set.

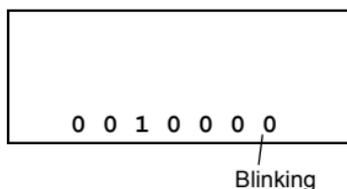


7 Turn the power off.

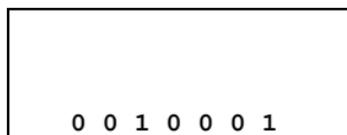
■ Selecting mode 2

Sample setting: {0 SET} operation: Once, Tilt correction: OFF

- 1 Turn the power ON while pressing {V/%}.
The instrument will be in selecting mode 2, and the digit No.1 (0set operation) will blink.

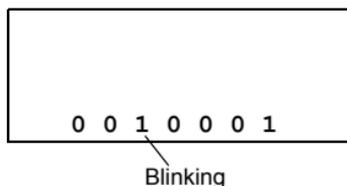


- 2 Press {▲} to set this digit to "1".



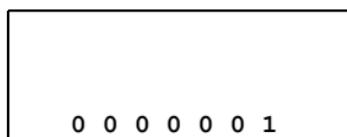
- Pressing {▲} switches the blinking digit value between "0" and "1".

- 3 Press {◀} until digit No.4 (Tilt correction) blinks.



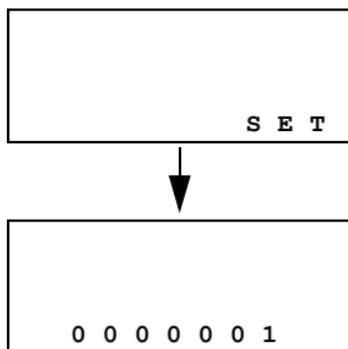
- Pressing {▶} moves the blinking digit to the right.

- 4 Press {▲} to set this digit to "0".



9. SELECTING MODE

5 Press {0 SET} to set.

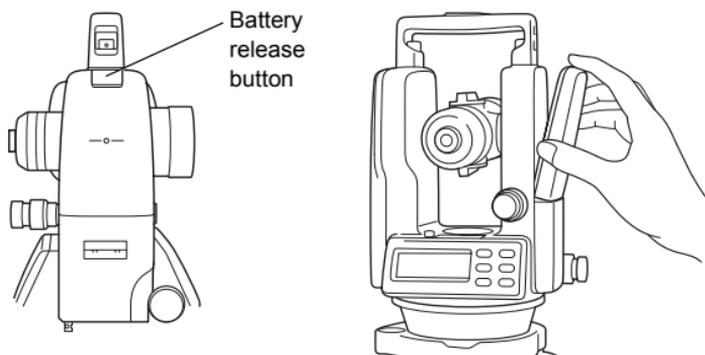


6 Turn the power off.

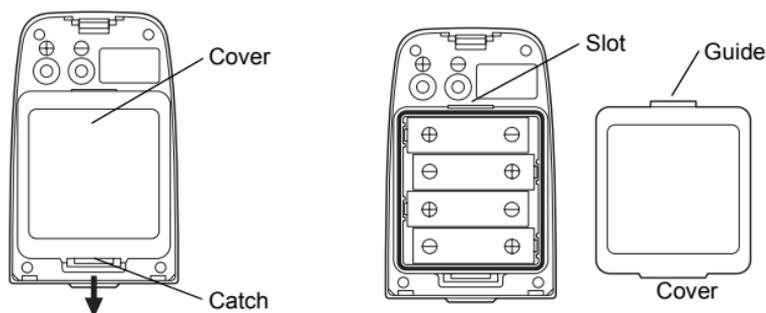
10. HANDLING POWER SOURCE

10.1 Removing

- 1 Push the battery release button downward and detach the battery case.



10.2 Replacing the batteries (BDC69)



- 1 Push the catch downward and remove the cover.
- 2 Remove the old batteries and insert new batteries as shown in the illustration above making sure plus/minus directions are correct.
- 3 Insert the guide into the slot. Close the cover until a click is heard.

Note

- Replace all four batteries at the same time.
- Do not mix old and new batteries.

10.3 For Installing

Place the base of the battery case into the main body, push the battery case toward the instrument until the battery clicks into position.

11. ERROR MESSAGES

Display	Contents	Countermeasure
AnGLE Error	Displayed when the instrument or the telescope rotated too quickly.	This is not a malfunction. However, repair is required when "AnGLE Error" is displayed frequently.
E04	Displayed when the discrepancy value of each measurement is more than $\pm 30''$ while repetition angle measurement is operated.	Press {OSET} and measure again from the beginning.
E70	When "Adjustment of Vertical Angle 0 datum" is performed in wrong procedure. or When "Adjustment of Vertical Angle 0 datum" is sighting a target at $\pm 45^\circ$ or more from the horizontal.	Switch off the power, then on again. Confirm the procedure and adjust again.
E99	Abnormality in internal memory system during "Adjustment of Vertical Angle 0 Datum", or when horizontal angle is being set to zero or hold status.	Switch off the power, then on again. Confirm the procedure and adjust again.

If errors still persist after attempting to clear them, contact your local dealer.

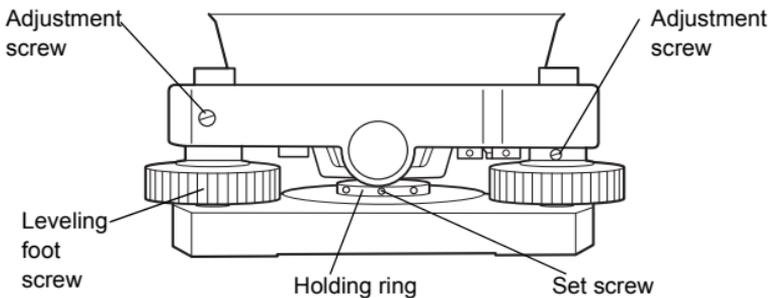
12. CHECKS AND ADJUSTMENTS

■ Precautions when Adjusting

- Adjust the eyepiece of the telescope properly prior to any checking operation which involves sighting through the telescope. Remember to focus properly, with parallax completely eliminated.
- Carry out the adjustments in the order of item numbers, as the adjustments are dependent one upon another. Adjustments carried out in the wrong sequence may nullify previous adjustment.
- Always conclude adjustments by tightening the adjustment screws securely (but do not tighten them more than necessary, as you may strip the threads, twist off the screw or place undue stress on the parts).
Furthermore, always tighten by turning in the direction of tightening tension.
- The set screw must also be tightened sufficiently, upon completion of adjustments.
- Always repeat checking operations after adjustments are made, in order to confirm results.

■ Notes on the Tribrach

- 1** If any leveling foot screw becomes loose and slack or if sighting is unstable due to the looseness of leveling foot screws, adjust by tightening the adjusting screws (in 2 places) installed over each leveling screw with a screwdriver.
- 2** If there is any slack between the leveling foot screws and the base, loosen the set screw of the holding ring and tighten the holding ring with an adjusting pin, until it is properly adjusted. Re-tighten the set screw on completing the adjustment.

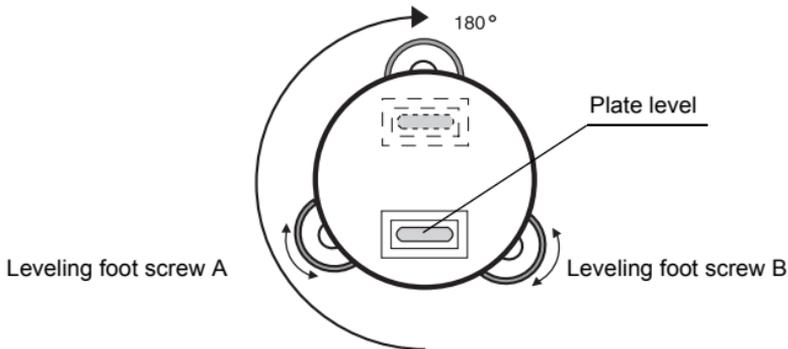


12.1 Checking/Adjusting the Plate Level

Adjustment is required if the axis of the plate level is not perpendicular to the vertical axis.

■ Checks

- 1 Place the plate level parallel to a line running through the centers of two leveling foot screws, say, A and B. Use these two leveling foot screws only and place the bubble in the center of the plate level.
- 2 Rotate the instrument 180° or 200 gon around the vertical axis and check bubble movement of the plate level. If the bubble has been displaced, proceed with the following adjustment.

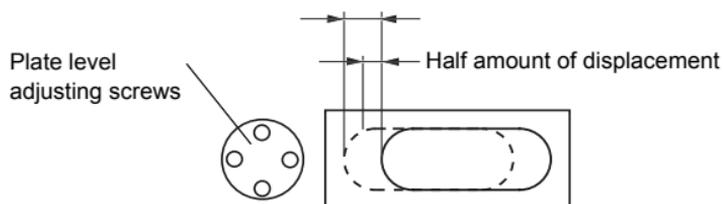


■ Adjustment

- 1 Adjust the plate level adjusting screws, with the adjusting pin provided and return the bubble towards the center of the plate level. Correct only one-half of the displacement by this method.
- 2 Correct the remaining amount of the bubble displacement with the leveling foot screws.

12. CHECKS AND ADJUSTMENTS

- 3** Rotate the instrument 180° or 200 gon around the vertical axis once more and check bubble movement. If the bubble is still displaced, repeat the adjustment.



12.2 Checking/Adjusting the Circular Level

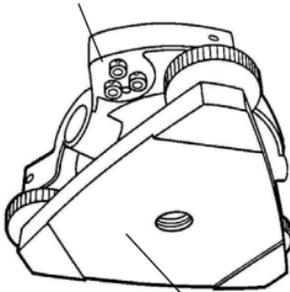
■ Checks

- 1 Carefully level the instrument with the plate level only. If the bubble of the circular level is centered properly, adjustment is not required. Otherwise, proceed with the following adjustment.

■ Adjustment

- 1 Shift the bubble to the center of the circular level by adjusting the three circular level adjusting screws on the bottom surface of the circular level, with the adjusting pin provided.

Circular level adjusting screws



Bottom of the base plate

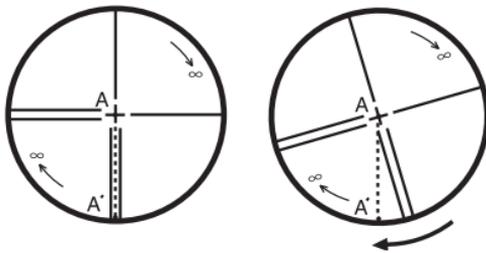


12.3 Adjustment of the Vertical Cross-hair

Adjustment is required if the vertical cross-hair is not perpendicular to the horizontal axis of the telescope (since it must be possible to use any point on the hair for measuring horizontal angles or running lines).

■ Checks

- 1 Set the instrument up on the tripod and carefully level it.
- 2 Sight the cross-hairs on a well defined Point A at a distance of at least 50 meters (160ft.) and clamp horizontal motion.
- 3 Next swing the telescope vertically using the vertical fine motion screw, and check whether the point travels along the length of the vertical cross-hair.
- 4 If the point appears to move continuously on the hair, the vertical cross-hair lies in a plane perpendicular to the horizontal axis (and adjustment is not required).
- 5 However, if the point appears to be displaced from the vertical cross-hair, as the telescope is swung vertically, proceed with the following adjustment.

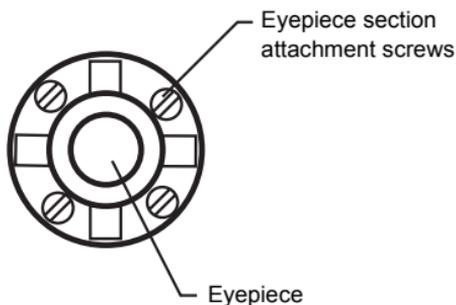


■ Adjustment

- 1 Unscrew the cross-hair adjustment section cover by turning it in the counterclockwise direction, and remove. This will expose four eyepiece section attachment screws.
- 2 Loosen all four attachment screws slightly with the screwdriver provided (while taking note of the number of revolutions). Then turn the eyepiece section so that the vertical cross-hair is aligned with Point A'. Finally, re-tighten the four screws by the amount that they were loosened.

12. CHECKS AND ADJUSTMENTS

- 3 Check once more and if the point travels the entire length of the vertical cross-hair, further adjustment is not required.



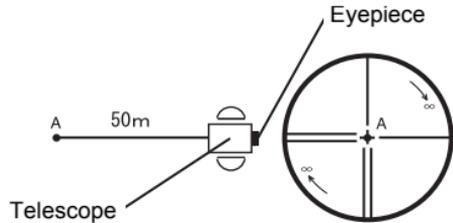
Perform "12.4 Collimation of the Instrument" (p. 46), "12.6 Adjustment of Vertical Angle 0 Datum" (p. 49) after completing the above adjustment.

12.4 Collimation of the Instrument

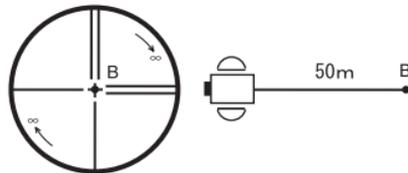
Collimation is required to make the line of sight of the telescope perpendicular to the horizontal axis of the instrument. Otherwise, it will not be possible to extend a straight line by direct means.

■ Checks

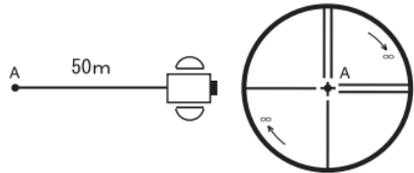
- 1 Set the instrument up with clear sights of about 50 to 60 meters (160 to 200 ft.) on both sides of the instrument.



- 2 Level the instrument properly with the plate level.

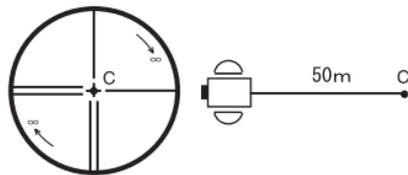


- 3 Sight Point A at approximately 50 meters (160 ft.) distance.



- 4 Loosen the vertical clamp only, and rotate the telescope 180° or 200 gon around the horizontal axis, so that the telescope is pointed in the opposite direction.

- 5 Sight Point B, at equal distance as Point A and tighten the vertical clamp.



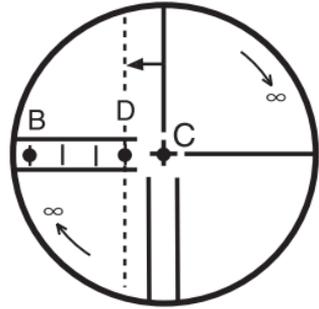
- 6 Release the horizontal clamp and rotate the instrument 180° or 200 gon around the vertical axis. Fix a sight on Point A once more and tighten the horizontal clamp.

- 7 Release the vertical motion clamp only and rotate the telescope 180° or 200 gon around the horizontal axis once more and fix a sight on Point C, which should coincide with previous Point B.

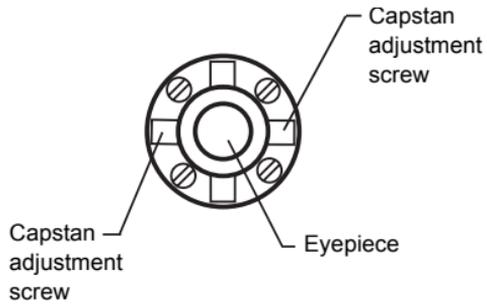
- 8 If Points B and C do not coincide, adjust in the following manner.

■ Adjustment

- 1 Unscrew the cross-hair adjustment section cover.
- 2 Find Point D at a point between Points C and B, which should be equal to 1/4th the distance between Points B and C as measured from Point C. This is because the apparent error between Points B and C is four times the actual error since the telescope has been reversed twice during the checking operation.



- 3 Shift the vertical cross-hair line and align it with Point D, by revolving the left and right capstan adjustment screws with the hexagonal wrench* (or adjusting pin). Upon completing the adjustment, repeat the checking operation once more.



If Points B and C coincide, further adjustment is not required. Otherwise, repeat the adjustment.

* DT240/540/740/940: Hexagonal wrench
DT540L/740L/940L: Adjusting pin

Note

- First, loosen the capstan adjustment screw on the side to which the vertical cross-hair line must be moved. Then tighten the adjustment screw on the opposite side by an equal amount which will leave the tension of the adjustment screws unchanged. Revolve in the counterclockwise direction to loosen and in the clockwise direction to tighten, but revolve as little as possible.
- Perform "12.6 Adjustment of Vertical Angle 0 Datum" (p. 49). after completing above adjustment.

12.5 Checking and Adjusting the Optical Plummet

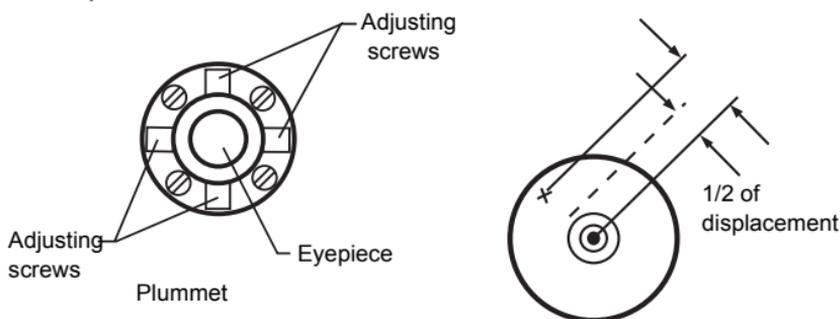
Adjustment is required to make the line of sight of the optical plummet coincide with the vertical axis (otherwise the vertical axis will not be in the true vertical when the instrument is optically plumbed).

■ Checks

- 1 Align the center mark and the point. (☞ "5. PREPARATION FOR MEASUREMENT" (p. 15).)
- 2 Rotate the instrument 180° or 200 gon around the vertical axis and check the center mark.
If the point is properly centered in the center mark, adjustment is not required. Otherwise, adjust in the following manner.

■ Adjustment

- 1 Take off the adjustment section cover of the optical plummet eyepiece. This will expose four adjusting screws which should be adjusted with the adjusting pin provided to shift the center mark to the point. However, correct only one-half of the displacement in this manner.



- 2 Use the leveling foot screws to align the point and center mark.
- 3 Rotate the instrument 180° or 200 gon around the vertical axis once more and check the center mark. If it coincides with the point, then further adjustment is not required. Otherwise, repeat the adjustment.



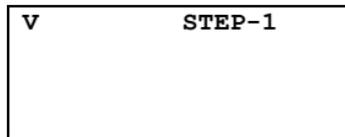
First, loosen the adjusting screw on the side to which the center mark must be moved. Then tighten the adjusting screw on the opposite side by an equal amount which will leave the tension of the adjusting screws unchanged.

Revolve in the counterclockwise direction to loosen and in the clockwise direction to tighten, but revolve as little as possible.

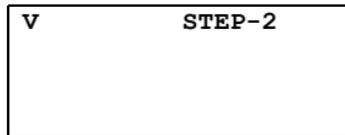
12.6 Adjustment of Vertical Angle 0 Datum

If when measuring the vertical angle of target A in both faces, the total of combined face left and face right measurements is other than 360° (ZENITH-0), half of the difference from 360° is the error amount from corrected 0 setting. Carry out adjustment. As adjustment for vertical angle 0 determines instrument coordinate origin, use special care for adjustment.

- 1 Level the instrument properly with the plate level.
- 2 While pressing {0SET}, turn power switch ON.



- 3 Sight target A from the telescope properly in face left.
- 4 Press {0SET}.

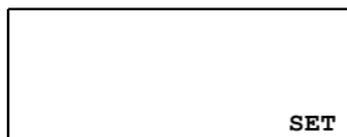


- 5 Sight target A in face right.

12. CHECKS AND ADJUSTMENTS

6 Press {0SET}.

Correction values are calculated and stored.



7 Turn the power switch off.

Note

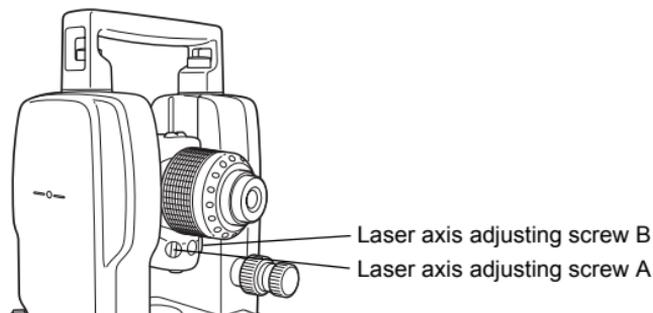
- Any misoperating and error code display appears. Repeat the above procedure from the start.
- Check that the total amount of face left and face right angular travel is 360° when sighting the target A.

12.7 Adjustment of Laser Beam

This adjustment must be done after completing "12.3 Adjustment of the Vertical Cross-hair" (p. 44), "12.4 Collimation of the Instrument" (p. 46).

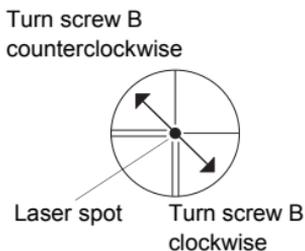
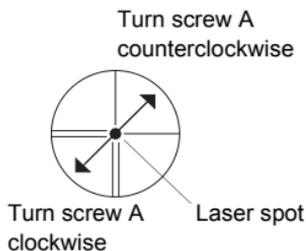
If intersection of the cross-hair does not coincide with the laser spot, turn the laser axis adjusting screws to align the laser spot with intersection of the cross-hair.

- 1 Remove the caps of the laser axis adjusting screws A and B with a coin.



12. CHECKS AND ADJUSTMENTS

- 2** The following shows the moving direction of the laser spot when the laser adjusting screws are turned.

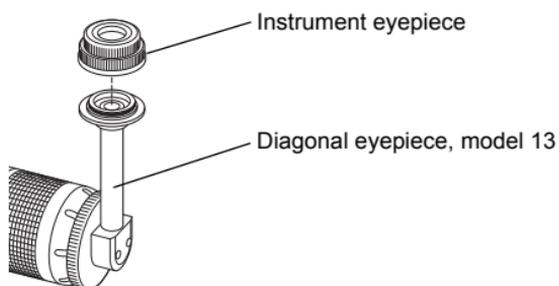


- 3** Attach the caps of the laser axis adjusting screws.

13. OPTIONAL ACCESSORIES

Diagonal Eyepiece, Model 13

The diagonal eyepiece is used in place of the telescope eyepiece for making observations up to the zenith.



Trough Compass model 5

The trough compass is simply mounted on top of the handle.

Aluminum extension leg tripod



Wide frame extension leg tripod (wood)



14. SPECIFICATIONS

(DT240/540/740/940)

		Model			
		DT240	DT540	DT740	DT940
Telescope	Length	149 mm	149 mm	149 mm	149 mm
	Aperture	45 mm	45 mm	45 mm	40 mm
	Magnification	30×	30×	30×	26×
	Image	Erect	Erect	Erect	Erect
	Field of view	1°30'	1°30'	1°30'	1°30'
	Resolving power	2.5"	2.5"	2.5"	3"
	Minimum focus	0.9 m	0.9 m	0.9 m	0.9 m
	Stadia ratio	100	100	100	100
	Additive constant	0	0	0	0
Electronic Angle Measurement	Method	Absolute	Absolute	Absolute	Absolute
	Detecting	Horizontal: 2 sides	Horizontal: 2 sides	Horizontal: 2 sides	Horizontal: 1 sides
		Vertical: 2 sides	Vertical: 1 side	Vertical: 1 side	Vertical: 1 side
	Minimum display	1"/5" (0.2 mgon/1 mgon)	1"/5" (0.5 mgon/1 mgon)	5"/10" (1 mgon/2 mgon)	10"/20" (2 mgon/5 mgon)
	Accuracy *1)	2"	5"	7"	9"
Diameter circle	71 mm	71 mm	71 mm	71 mm	
Display	Unit	2 sides	2 sides	2 sides	1 sides
Illumination	Display	Yes	Yes	Yes	Yes
	Reticle	Yes	Yes	Yes	No
Compensator	Tilt sensor	Automatic vertical compensator	Automatic vertical compensator	No	No
	Compensation range	±3'	±3'	No	No
Optical Plummet	Magnification	3×	3×	3×	3×
	Field of view	3°	3°	3°	3°
	Focal distance	0.5 m to ∞	0.5 m to ∞	0.5 m to ∞	0.5 m to ∞
Sensitivity of levels	Plate level	30"/2 mm	40"/2 mm	40"/2 mm	60"/2 mm
	Circular level	10'/2 mm	10'/2 mm	10'/2 mm	10'/2 mm
Dust and water resistance	Standard	IP 66	IP 66	IP 66	IP 66
Power Supply	Battery	4 AA batteries	4 AA batteries	4 AA batteries	4 AA batteries

14. SPECIFICATIONS

		Model			
		DT240	DT540	DT740	DT940
Working duration (Alkaline manganese dry batteries), (+20°C [+68°F])	Theodolite only	Approx. 100 hours	Approx. 140 hours	Approx. 150 hours	Approx. 170 hours
Tribrach	Type	Detachable	Detachable	Detachable	Fixed
Others	Size D×W×H (mm)	149×188×313 (5.87×7.1×12.3 in)	149×188×313 (5.87×7.1×12.3 in)	149×188×313 (5.87×7.1×12.3 in)	149×188×305 (5.87×7.1×12.0 in)
	Weight (Including batteries)	4.1 kg (9.0 lb)	4.1 kg (9.0 lb)	4.1 kg (9.0 lb)	3.5 kg (7.5 lb)
	Instrument height	176 mm (6.93 in)	176 mm (6.93 in)	176 mm (6.93 in)	-----
	Data input/output connector	Yes	Yes	No	No

*1) Standard deviation based on DIN 18723

(DT540L/740L/940L)

		Model		
		DT540L	DT740L	DT940L
Telescope	Length	152 mm	152 mm	152 mm
	Aperture	45 mm	45 mm	40 mm
	Magnification	30×	30×	26×
	Image	Erect	Erect	Erect
	Field of view	1°30'	1°30'	1°30'
	Resolving power	2.5"	2.5"	3"
	Minimum focus	1 m	1 m	1 m
	Stadia ratio	100	100	100
Additive constant	0	0	0	
Electronic Angle Measurement	Method	Absolute	Absolute	Absolute
	Detecting	Horizontal: 2 sides	Horizontal: 2 sides	Horizontal: 1 sides
		Vertical: 1 side	Vertical: 1 side	Vertical: 1 side
	Minimum display	1"/5" (0.5 mgon/1 mgon)	5"/10" (1 mgon/2 mgon)	10"/20" (2 mgon/5 mgon)
	Accuracy *1)	5"	7"	9"
Diameter circle	71 mm	71 mm	71 mm	
Display	Unit	2 sides	2 sides	1 sides
Illumination	Display	Yes	Yes	Yes
	Reticle	Yes	Yes	No

14. SPECIFICATIONS

		Model		
		DT540L	DT740L	DT940L
Compensator	Tilt sensor	Automatic vertical compensator	No	No
	Compensation range	±3'	No	No
Optical Plummet	Magnification	3×	3×	3×
	Filed of view	3°	3°	3°
	Focal distance	0.5m to ∞	0.5m to ∞	0.5m to ∞
Sensitivity of levels	Plate level	40"/2 mm	40"/2 mm	60"/2 mm
	Circular level	10'/2mm	10'/2mm	10'/2mm
Water protection	Standard	IP 66	IP 66	IP 66
Power Supply	Battery	4 AA batteries	4 AA batteries	4 AA batteries
Working duration (Alkaline manganese dry batteries), (+20°C [+68°F])	Theodolite only	Approx. 140	Approx. 150	Approx. 170
	Laser only	Approx. 80	Approx. 80	Approx. 80
	Theodolite and laser	Approx. 45 (hours)	Approx. 45 (hours)	Approx. 45 (hours)
Tribrach	Type	Detachable	Detachable	Fixing
Others	Size D×W×H (mm)	152×188×313 (5.97×7.1×12.3 in)	152×188×313 (5.9×7.1×12.3 in)	152×188×305 (5.9×7.1×12.0 in)
	Weight (Including batteries)	4.2 kg (9.2 lb)	4.2 kg (9.2 lb)	3.6 kg (7.9 lb)
	Instrument height	176 mm (6.93 in)	176 mm (6.93 in)	-----
	Input/output connector	Yes	No	No
Laser beam	Laser class	Class 2	Class 2	Class 2
	Wave length	633 nm	633 nm	633 nm
	Maximum output	0.6 mW	0.6 mW	0.6 mW
	Laser beam range	50 m	50 m	50 m

*1) Standard deviation based on DIN 18723

Laser beam

Laser class : Class 2

Wave length : 633nm

Maximum output : 0.6mW

Laser beam range : 50m

Condition Weather : Fine

Time : The daylight hours

14. SPECIFICATIONS

Laser beam diameter (When focused) *2)

Telescope Magnification	Distance (m)	5	10	20	30	50
30×	Beam diameter (m)	0.1×0.2	0.2×0.4	0.5×0.7	0.7×1.1	1.2×1.9
26×	Beam diameter (m)	0.1×0.2	0.3×0.4	0.6×0.8	0.8×1.2	1.4×2.0

*2) The laser beam diameters are theoretical values

The visible laser beam diameter will vary with ambient brightness.

15. 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

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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.

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.

15. REGULATIONS

For users in the European Economic Area (EEA)



EMC NOTICE

In industrial locations or in proximity to industrial power installations, this instrument might be affected by electromagnetic noise. Under such conditions, please test the instrument performance before use.

SOKKIA TOPCON CO., LTD.

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