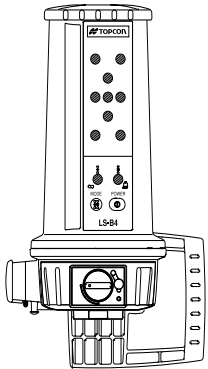
TOPCON



INSTRUCTION MANUAL
LASER SENSOR

LS-B4

Japan Surveying Instruments JSIMA Manufacturers' Association

FOREWORD

Thank you for purchasing the TOPCON LS-B4 Laser Sensor.
For superior product performance, please read these instructions carefully and keep them in a convenient place for future reference.

GENERAL HANDLING PRECAUTIONS

Before starting work or operation, be sure to check that the system is functioning properly.

Guarding the instrument against shocks.

When transporting the instrument, provide some protection to minimize risk of shocks. Heavy shocks may cause faulty measurement. When carrying this instrument, hold the hand grip.

Protecting the instrument from sudden temperature changes.

Any sudden change in temperature of the instrument may result in a reduction of the measuring range. When taking the instrument out from a heated vehicle, let it acclimate itself to the ambient temperature.

Checking battery power.

Before operating, check remaining battery life.

Protecting the instrument from water damage.

When washing the instrument, avoid spraying it with a high pressure stream of water from a water hose. The inside of the instrument will be damaged by the water.
This instrument is designed based on the International Standard IPX 6, but it is not protected from a high pressure water stream or submergence.

Cleaning

Always clean the detector. The dust may cause faulty measurement.

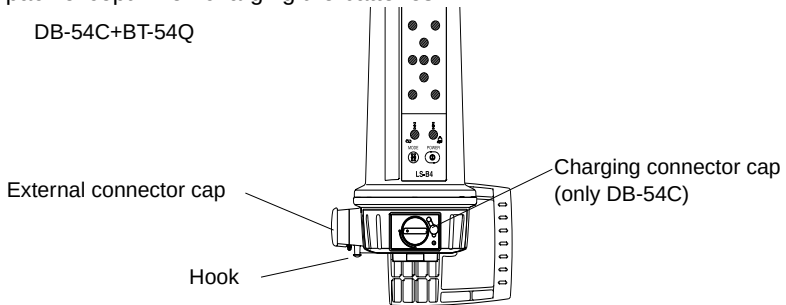
Affection of the radio waves

When using the instrument in the following place, the strong radio wave may cause faulty operation.

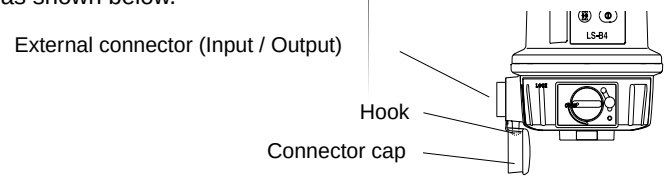
- Near the instrument occurring strong radio waves. (e.g.Transceiver)
- Near the radio wave towers such as television or radio.

Using Connector Caps

When the external connector is not being used, make sure the protective is placed over it as shown below. Keep the cap over the charging connector on the DB-54C rechargeable battery pack except when charging the batteries.



When using the external connector (input /output), be sure to store the connector cap on the hook as shown below.



SAFETY NOTICES

In order to encourage the safe use of products and prevent any danger to the operator and others or damage to property, important warnings are put on the products and inserted in the instruction manual.

We suggest that everyone understand the meaning of the following symbols and notices before reading the Safety Cautions and text.

Display	Meaning
⚠**WARNING**	**Ignoring or disregard of this display may lead to the danger of death or serious injury.**
⚠**CAUTION**	**Ignoring or disregard of this display may lead to personal injury or physical damage.**

•Injury refers to hurt, burn, electric shock, etc.
•Physical damage refers to extensive damage to equipment and structure or furnishings.

SAFETY CAUTIONS

⚠ WARNING
• **There is a risk of fire, electric shock or physical harm if you attempt to disassemble or repair the instrument yourself.** This is only to be carried out by TOPCON or an authorized dealer, only !
• **Risk of fire or electric shock.** Do not use a wet battery or charger.
• **Risk of fire or electric shock.** Do not use damaged power cable, plug and socket.
• **Battery can cause explosion or injury.** Do not dispose in fire or heat.
• **May ignite explosively.** Never use an instrument near flammable gas, liquid matter, and do not use in a coal mine.
• **The short circuit of a battery can cause a fire.** Do not short circuit battery when storing it.

⚠ CAUTION
• **Do not allow skin or clothing to come into contact with acid from the batteries, if this does occur then wash off with large amounts of water and seek medical advice.**
• **Do not use a damaged instrument case. It could accidentally open causing damage to the instrument or injury to people.**

USER

Wear the required protectors (safety shoes, helmet, etc.) when operating.

EXCEPTIONS FROM RESPONSIBILITY

1)The user of this product is expected to follow all operating instructions and make periodic checks of the product's performance.
2)The manufacturer, or its representatives, assumes no responsibility for results of a faulty or intentional use or misuse including any direct, indirect, consequential damage, and/or loss of profits.
3)The manufacturer, or its representatives, assumes no responsibility for consequential damage and loss of profits by any disaster, (earthquake, storm, flood etc.), a fire, accident, or an act of a third party and/or use outside the instrument's intended conditions.
4)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.
5)The manufacturer, or its representatives, assumes no responsibility for any damage, and loss of profits caused by use except for as explained in the user manual.
6)The manufacturer, or its representatives, assumes no responsibility for damage caused by wrong movement or action due to connecting with other products.

CONTENTS

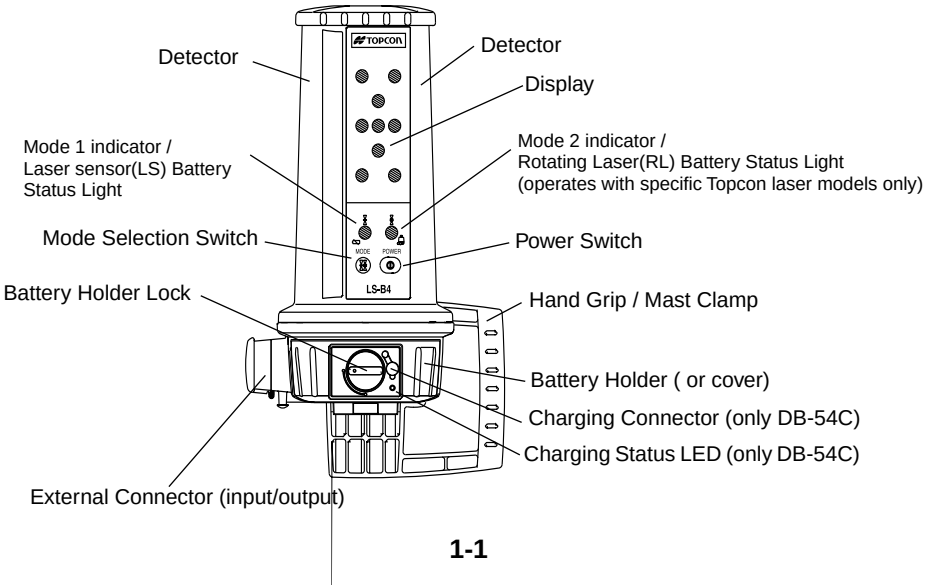
STANDARD SYSTEM COMPONENTS

Components \ Types	Chargable battery type (A model)	Dry battery type (B model)	Laser Tracker package (C model)
Instrument (LS-B4)	1pc.	1pc.	1pc.
DB-54C Battery holder (For rechargable and dry battery.)	1pc.	-	-
DB-54 Battery holder (Only for dry battery)	-	1pc.	-
Battery cover	-	-	1pc.
BT-54Q Ni-MH rechargeable battery	1pc.	-	-
D size dry battery	-	2pc.	-
AD-9B/7C AC-DC convertor / battery charger	1pc.	-	-
Hard case	1pc.	1pc.	-
Soft case	-	-	1pc.
Instruction manual	1vol.	1vol.	1vol.
Warranty card	1vol.	1vol.	1vol.

Make sure that all of the above items are with the instrument when purchased.
If you purchased the LS-B4 Laser Tracker package (C model) all package components are stored in the incleded soft carrying case.

1 NOMENCLATURE AND FUNCTIONS

1.1 NOMENCLATURE

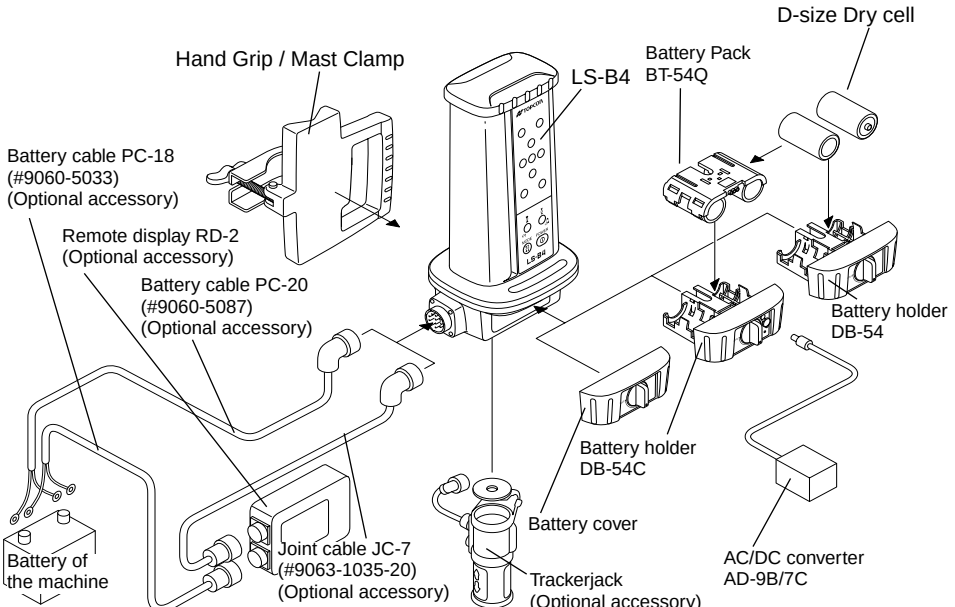


1.2 FUNCTIONS

When this instrument is used with a rotating laser, the display (red, yellow and green LED's) indicate the direction the cutting edge of the machine should be moved in order to obtain the preset on-grade position.

This instrument can also be used in conjunction with the Trackerjack (Laser Tracker package, C model) as the primary rotating laser receiver for any Topcon equipment automation system (System Five, System Four, Touch Series 5, etc).

1.3 Connection diagram



2 PREPARING FOR USE

2.1 Handling the battery

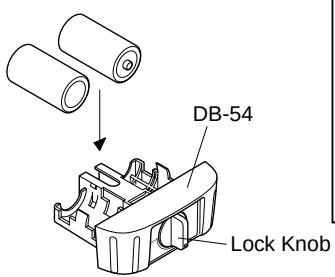
2.1.1 Dry battery

Installing the battery

1 Turn the lock konb on the battery holder (DB-54) to “OPEN” and remove it.

2 Insert the two D-size dry cells, matching them with the positive and negative illustrations.

3 Insert the battery holder into the instrument and turn the lock konb to “LOCK”.



NOTE

- Replace both batteries with new ones at the same time.
- Insert the batteries in the holder according to the illustration.
- Remove the dry cells from the instrument when you will not use it for more than one month.

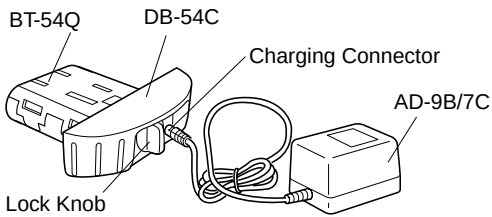
2.1.2 Chargable battery

Installing

1. Remove DB-54C holder by turning the lock knob to “OPEN”.
2. Insert BT-54Q battery pack into the holder.
3. Insert the holder to the instrument and turn the lock knob to “LOCK”.

Charging

1. Plug the AD-9B/7C AC/DC convertor into the charging connector on the holder.
2. Plug the convertor into an electrical outlet.
   (AD-9B:110-120 volt AC, AD-7C:230 volt AC)
3. After charging is completed (approximately nine hours) unplug the AC/DC converter from the battery holder and the electrical outlet.
4. Place cover over the charging connector on the battery holder.



The LED on the battery pack indicates charging status as follows:

Red ON	:Charging
Green ON	:Charging completed.
Green flashing	:BT-54Q isn't installed on DB-54C correctly.
Red flashing	:Indicates rechargeable battery protection feature* is active. See note on next page for proper charging conditions.

*Battery protection feature:
In case of overcharge or high or low ambient temperatures that exceeds charging temperature range, charging will be stopped or changed to protect battery.

- You can charge the battery pack(BT-54Q) while the battery holder(DB-54C) is installed on the instrument(LS-B4).
- Dry batteries (two D-cell alkaline) can be used by removing the battery pack (BT-54Q) and placing them in battery holder (DB-54C) as shown in the illustration on page 2-1.

Note

- Recharging should take place in a room with an ambient temperature range of 10°C to 35°C (50°F to 95°F).
- Exceeding the specified charging time may shorten the life of the battery and should be avoided if possible.
- The battery source will discharge when stored and should be checked before using with instrument.
- Be sure to charge a stored battery source every 3 or 4 months and store in a place at 30 °C (86 °F) and below when it will not used for a long period.
  If you allow the battery to be completely discharged, it will have an effect on the overall performance for proper charging in the future.
- Recharging can take less than 9 hours depending on the discharge condition of the battery when charging begins.

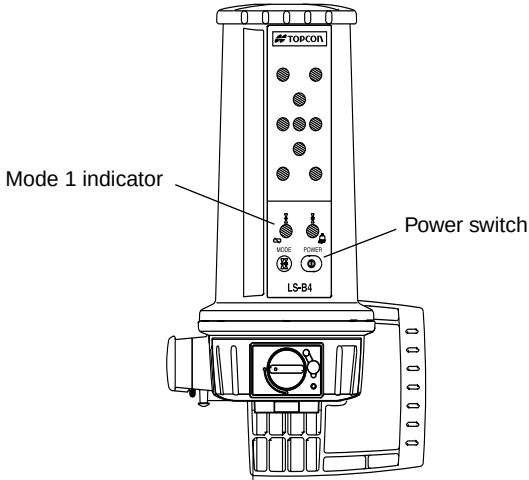
Before connecting any cable to the input/output external connector of this instrument, remove the batteries (dry batteries or chargeable battery pack).
If a cable is connected to the input/output external connector and the power is turned on while the batteries are installed, “Double power supply connection warning” is displayed (refer to “2.3.2 Double power supply connection warning”). Immediately turn off the power and remove the batteries from the battery holder. Replace the empty battery holder. Then, turn on the power again.

Do not use the LS-B4 without the battery cover or battery holder installed.
Without it installed, water may enter the instrument and cause a malfunction.

2.2 Power switch ON and OFF

The power can be turned on by pressing the POWER switch.
The Mode 1 indicator will illuminate.

Pressing the POWER switch again turns off the power.



2.3 Battery Status Light

The LS-B4 has two separate low battery indicator lights, one for the LS-B4 batteries and one for indicating low batteries in the rotating laser *.

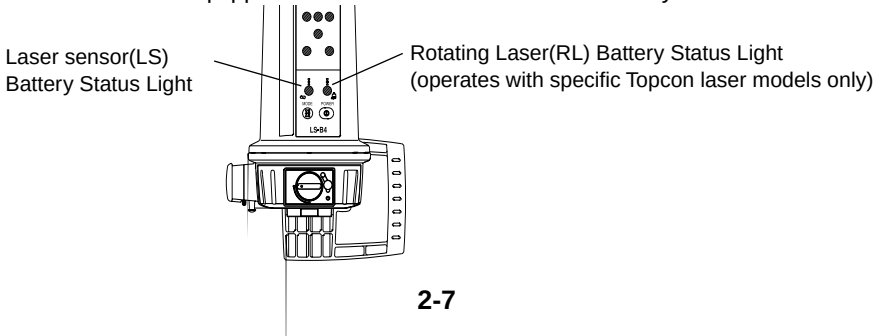
LS-B4 (LS Battery Status Light)

If the LS-B4 battery status light (Mode 1 indicator) blinks, replace the batteries with new ones or charge the battery pack.

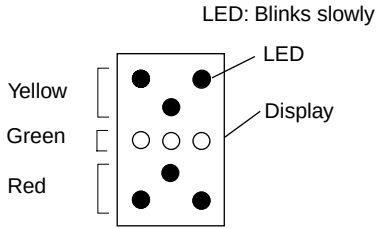
Rotating Laser (RL Battery Status Light)*

If the rotating laser battery status light (Mode 2 indicator) blinks it indicates that the laser batteries are running low. Replace or charge the rotating laser batteries.

*The rotating laser battery status light works only with specific Topcon rotating laser models that are equipped with a sensor-detectable low battery alert function.



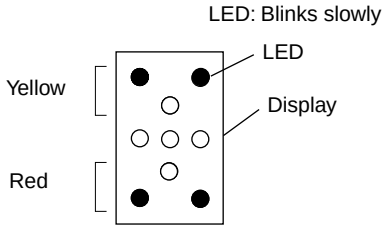
2.3.1 Rotating laser height alert warning*



If the display illuminates as shown above, the rotating laser has been disturbed and a substantial change in its position could have occurred. This change has been detected by the LS-B4. The laser position should be checked to prevent possible erroneous measurements.

*The rotating laser height alert warning works only with specific Topcon rotating laser models that are equipped with a sensor-detectable height alert function.

2.3.2 Double power supply connection warning



This warning is displayed when any cable is connected to the input/output external connector and the power is turned on while the batteries (dry batteries or rechargeable battery pack) are installed.
When this warning is displayed, immediately turn off the power and remove the batteries from the battery holder. Replace the empty battery holder. Turn on power again.

Do not use the LS-B4 without the battery cover or battery holder installed.
Without it installed, water may enter the instrument and cause a malfunction.

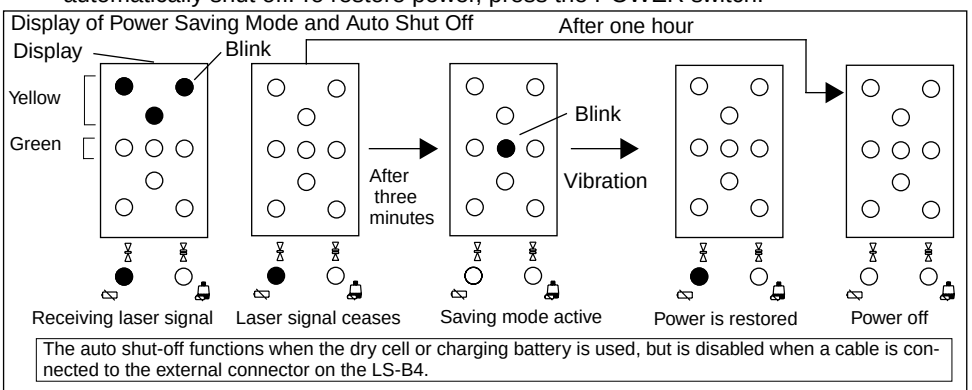
2.4 Power Saving Mode and Auto Shut-Off

Power Saving Mode

If the LS-B4 does not receive a laser signal within a three minute period, it automatically enters Power Saving Mode, which is indicated by a blinking center LED.
To return to full power, vibrate the LS-B4 by moving the equipment where it is mounted.

Auto Shut-Off

If the LS-B4 does not receive a laser signal within an one hour time period, power is automatically shut off. To restore power, press the POWER switch.



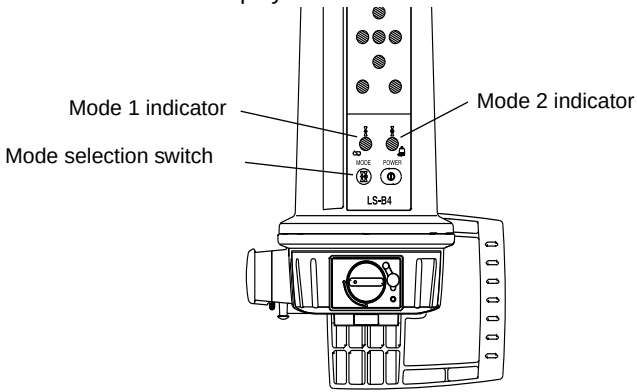
The auto shut-off functions when the dry cell or charging battery is used, but is disabled when a cable is connected to the external connector on the LS-B4.

2.5 Changing On-Grade Tolerance (Mode Selection)

Two on-grade tolerance (height of the on-grade indication) are available.
Select Mode 1 (±6mm) and Mode 2 (±20mm) according to the work specifications.

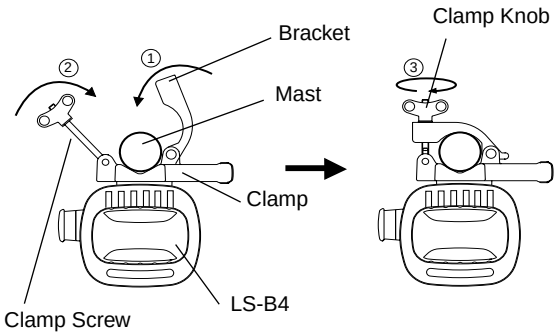
Changing mode

Press the mode selection switch. Mode 1 and Mode 2 are alternately selected and indicated on the display.



2.6 Installing on the equipment

Use the clamp on the rear of LS-B4 to mount it to a mast installed on the equipment.

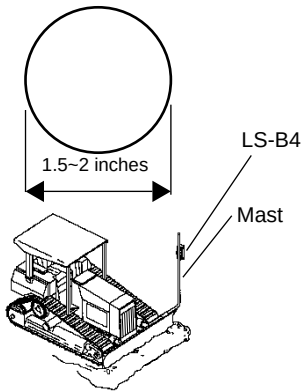


Mounting onto mast

1. Place the clamp on the mast and close the bracket.
2. Slide the clamp screw into the bracket and orient the LS-B4 so the display can be seen easily.
3. Tighten the clamp knob securely.

LS-B4 Mast Speciation

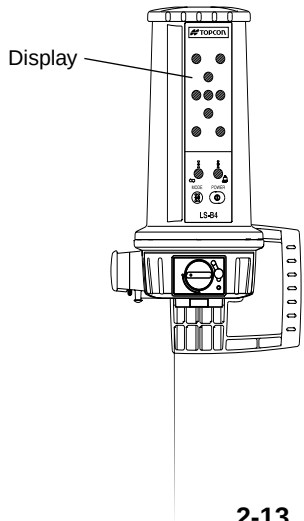
Shape: Round
Size: 1.5”~2” diameter (38~51mm)



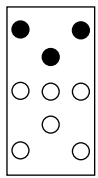
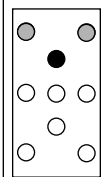
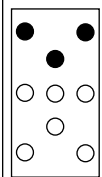
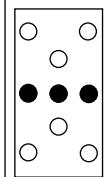
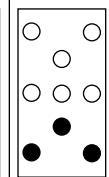
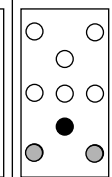
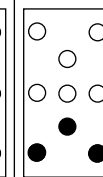
When installing the mast to the equipment (by welding, etc.), refer to the equipment instruction manual or contact the manufacturer. Contact your Topcon dealer for Topcon mast accessories.

2.7 Display Information

The LS-B4 display is a high-intensity colored LED array that provides a visual guide for positioning the cutting edge of the machine to a predetermined on-grade elevation. As the LS-B4 is moved through path of the laser beam, the display will provide seven channels of information as described on the next page.



This illustration depicts the reaction of LS-B4 display as the sensor is moved down through the path of a rotating laser.*

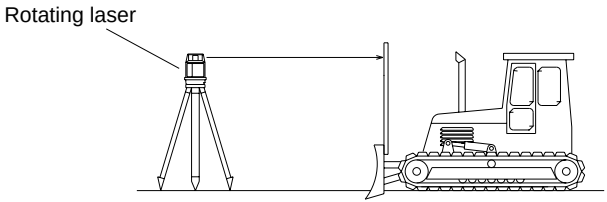
Blade direction to achieve on-grade*	DOWN	DOWN	DOWN	ON-GRADE	UP	UP	UP
LED Color Yellow Green Red							
LED display indication	Blinks slowly (yellow)	Blinks quickly in sequence (yellow)	Blinks quickly (yellow)	Blinks quickly (green)	Blinks quickly (red)	Blinks quickly in sequence (red)	Blinks slowly (red)
Blade position relative to on-grade	Very High Sensor is above laser beam*	High	Slightly High	On-grade** to within: ±6mm (Mode 1) ±20mm (Mode 2)	Slightly Low	Low	Very Low Sensor is below laser beam*

* This illustration is for reference only. Actual blade direction adjustment could vary based on the motion and attitude of machine.

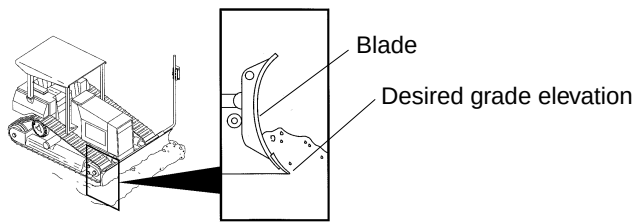
** Tolerance may vary based on rotating laser used, distance from laser instrument or atmospheric conditions.

3 ESTABLISHING ON-GRADE POSITION

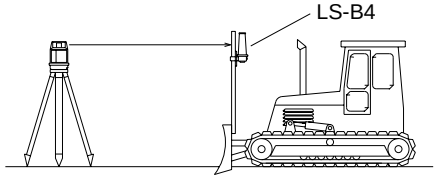
1 Position a rotating laser as shown below and turn on the laser.



2 Raise or lower the machine blade to position the cutting edge at the desired grade elevation.

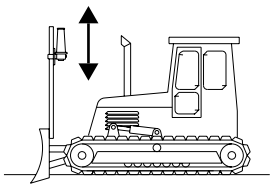


3 Mount the LS-B4 onto the mast near the path of the laser beam.



4 Turn on the LS-B4 and then select the tolerance (mode).

5 Keep the machine blade motionless and raise or lower the LS-B4 until the three center ON-GRADE lights are flashing. This is the ON-GRADE position. Securely clamp the LS-B4 in place. The reference position has been set.



6 While operating, use the LED display to continually monitor the grading, moving the blade or cutting / filling according to the direction of the LS-B4 display.

4 CARE & CLEANING

- Always clean the instrument after use.
- Remove the dust using a brush, then wipe off with a soft cloth.
- Never use thinner or benzine to clean the surface of a receiving window or any plastic parts. Use a clean cloth moistened with neutral detergent.
- Always make sure the instrument is completely dry before storing. Dry any moisture with a soft, clean cloth.

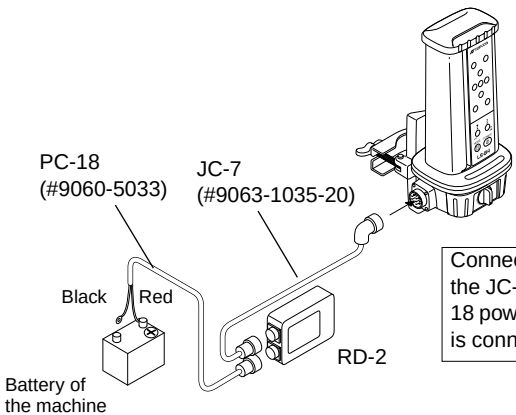
5 OPTIONAL ACCESSORIES

- Remote Display RD-2
- Power Cable PC-20 (#9060-5087)
- Power Cable PC-18 (#9060-5033)
- Joint Cable JC-7 (#9063-1035-20)

5.1 Connection to other instruments

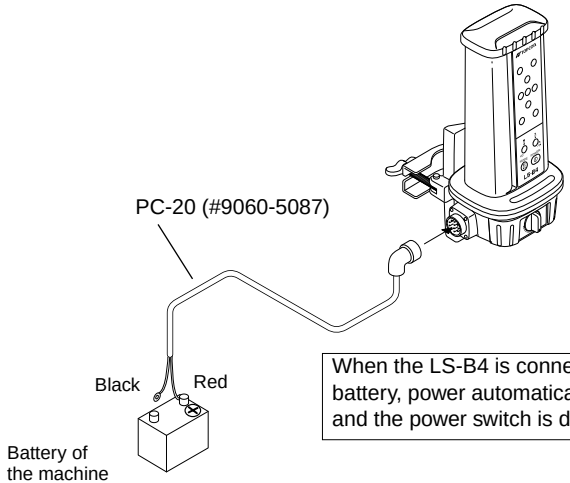
Connect LS-B4 to other instruments and power supply as follows.
When connecting LS-B4 to the battery of a machine, connect the red clip of the power cable (PC-18 or PC-20) to the positive side of the battery and the black clip to the negative side (or ground).

5.1.1 Connecting the RD-2 and LS-B4



Connect the RD-2 remote display to the LS-B4 with the JC-7 junction cable as shown. Connect the PC-18 power cable to the machine battery. When RD-2 is connected, LS-B4 power switch is disabled.

5.1.2 Using the machine battery to power LS-B4

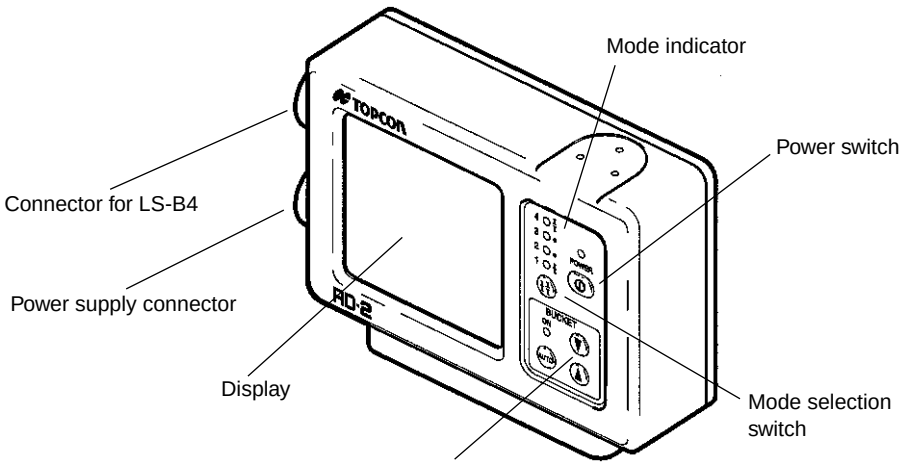


When the LS-B4 is connected to the machine's battery, power automatically supplied to the LS-B4 and the power switch is disabled.

5.2 RD-2 Remote Display

The RD-2 allows the LS-B4 display to monitored in a convenient location, such as in the cab of a dozer.

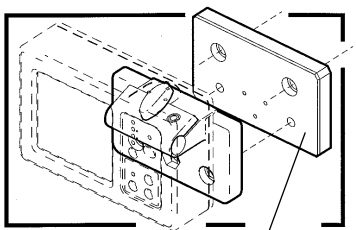
5.2.1 Nomenclature



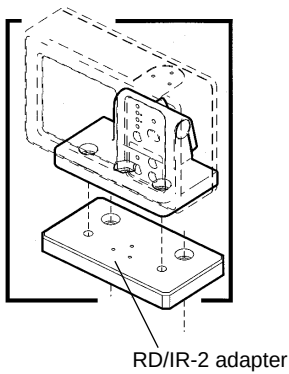
5.2.2 RD-2 Installation

On a vertical or horizontal surface of a machine, install RD-2 using its optional mounting hardware as shown below.

Installation on vertical surface



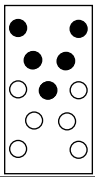
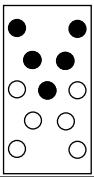
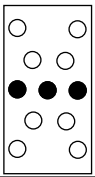
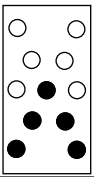
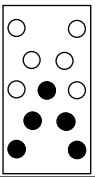
Installation on horizontal surface



The RD/IR-2 adapter is an optional accessory

5.2.3 RD-2 Display

This illustration depicts the reaction of the RD-2 display as the LS-B4 sensor is moved down through the path of a rotating laser.*

Blade direction to achieve on-grade*	DOWN	DOWN	ON-GRADE	UP	UP
LED Display					
LED display indication	Solid	Blinks	Solid	Blinks	Solid
Blade position relative to on-grade	High	Slightly High	On-grade** to within: ±6mm (Mode 1) ±20mm (Mode 2)	Slightly Low	Low

Display steps:
5 steps (RD-2)

7 steps (LS-B4)

* This illustration is for reference only. Actual blade direction adjustment could vary based on the motion and attitude of machine. ** Tolerance may vary based on rotating laser used, distance from laser instrument or atmospheric conditions.

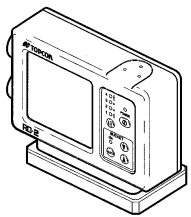
The following indications are not displayed on the RD-2:
Double power supply connection warning; Battery power light; Rotating laser height alert warning.

5.2.4 Using the RD-2

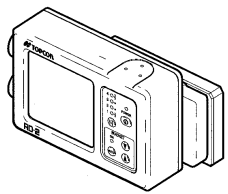
1 Set up a rotating laser, turn it on and position the blade of the machine at the references elevation as described on page 3-1.

2 Mount the LS-B4 on the mast and connect the LS-B4 to the RD-2 with the JC-7 junction cable.

3 Set the RD-2 at a proper position to be seen easily in the machine.



Installation to horizontal surface



Installation to vertical surface

4 Turn on the power of the RD-2. This automatically powers the LS-B4.

5 Press the mode switch on the RD-2 to set the on-grade tolerance.
(Refer to “2.7 Display Information” for information.)

Note:
There are four mode indicators (1~4) on the RD-2 display.
Only two mode indicaters(1~2) are used when the LS-B4 is connected.

6 Move the LS-B4 up and down until the RD-2 display shows “ON GRADE”.
7 Tighten the clamp knob of the LS-B4 securely.
8 Start to work.

6 SPECIFICATIONS

Vertical Sensing Range	:	200mm / 7.875 inches
Horizontal Sensing Radius	:	360 degrees
ON GRADE Tolerance	:	(Using Topcon RL-H1Sa laser)

Modes	On-Grade Tolerance
Mode1	±6mm / 0.02ft
Mode2	±20mm / 0.06ft

*Tolerance may vary depending on laser detecting distance, rotating laser being used or atmospheric conditions.

Detectable laser wave length	:	633nm~780nm
Laser Detecting Range	:	600m / 1960 ft diameter
	:	(Using Topcon RL-H1Sa laser)
Grade Information Channels	:	5 display steps plus out-of-beam high and low

Power Supply	(External battery)	:	DC10V~28V (Battery of the machine)
	(Internal battery)	:	2 D-Type Dry batteries(DC3V) (D-Type Ni-MH battery can be used) Battery pack BT-54Q
Operating Time (+20°C / +68°F)		:	Approximately 60 hours
With alkaline batteries			•The dry batteries included are provided exclusively for operation check and could have a shorter life.
With BT-54Q chargeable battery pack			Approximately 40 hours (BT-54Q)
Ambient Temperature Range		:	+10°C ~ +40°C (+50°F~+104°F)
Operating Temperature Range		:	-20°C~+50°C (-4°F~+122°F)
Protection against water and dust		:	IP66 (Based on the standard IEC60529)
Dimensions(W/D/H)		:	172mm(W) × 133mm(D) × 313mm(H) (6.7”×5.2”×12.3”) (Body only) 186mm(W) × 212mm(D) × 361mm(H) (7.3”×8.3”×14.2”) (With Mechanical Clamp)
Weight(Without Batteries)		:	1.5kg (3.3lbs) (Instrument only)
		:	2.4kg (5.2lbs) (With Mechanical Clamp)

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