Leica iCB50/iCB70



User Manual Version 2.0 English



Introduction

Purchase

Congratulations on the purchase of the Leica iCB50/iCB70.



This manual contains important safety directions as well as instructions for setting up the product and operating it. Refer to "1 Safety Directions" for further information.

Read carefully through the User Manual before you switch on the product.



The content of this document is subject to change without prior notice. Ensure that the product is used in accordance with the latest version of this document.

Updated versions are available for download at the following Internet address:

https://myworld.leica-geosystems.com > myDownloads.

Product identification

The model and serial number of your product are indicated on the type plate. Always refer to this information when you need to contact your agency or Leica Geosystems authorised service centre.

Trademarks

- Windows is a registered trademark of Microsoft Corporation in the United States and other countries
- Bluetooth® is a registered trademark of Bluetooth SIG, Inc.

All other trademarks are the property of their respective owners.

Validity of this manual

This manual applies to all iCB50/iCB70 instruments. Where there are differences between the various models they are clearly described.

Available documentation

Name	Description/Format		PDF
iCB50/70 Quick Guid	Provides an overview of the product together with technical data and safety directions. Intended as a quick reference guide.	✓	✓
iCB50/70 User Manu	All instructions required in order to operate the product to a basic level are contained in the User Manual. Provides an overview of the product together with technical data and safety directions.	-	√
iCON build How-To Guide	Overall comprehensive guide to the product and application functions. Included are detailed descriptions of special software/hardware settings and software/hardware functions intended for technical specialists.	-	√

Refer to the following resources for all iCB50/70 documentation/software:

- the supplied data storage device
- https://myworld.leica-geosystems.com

Leica Geosystems address book

On the last page of this manual, you can find the address of Leica Geosystems headquarters. For a list of regional contacts, please visit http://leica-geosystems.com/contact-us/sales_support.



myWorld@Leica Geosystems (https://myworld.leica-geosystems.com) offers a wide range of services, information and training material.

With direct access to myWorld, you are able to access all relevant services whenever it is convenient for you.

Service	Description
myProducts	Add all products that you and your company own and explore your world of Leica Geosystems: View detailed information on your products and update your products with the latest software and keep upto-date with the latest documentation.
myService	View the current service status and full service history of your products in Leica Geosystems service centres. Access detailed information on the services performed and download your latest calibration certificates and service reports.
mySupport	Create new support requests for your products that will be answered by your local Leica Geosystems Support Team. View the complete history of your support requests and view detailed information on each request in case you want to refer to previous support requests.
myTraining	Enhance your product knowledge with Leica Geosystems Campus - Information, Knowledge, Training. Study the latest online training material on your products and register for seminars or courses in your country.
myTrustedServices	Add your subscriptions and manage users for Leica Geosystems Trusted Services, the secure software services, that assist you to optimise your workflow and increase your efficiency.

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Table of Contents

Safety Directions

1.1 General

Description

1

The following directions enable the person responsible for the product, and the person who actually uses the equipment, to anticipate and avoid operational hazards.

The person responsible for the product must ensure that all users understand these directions and adhere to them.

About warning messages

Warning messages are an essential part of the safety concept of the instrument. They appear wherever hazards or hazardous situations can occur.

Warning messages...

- make the user alert about direct and indirect hazards concerning the use of the product.
- · contain general rules of behaviour.

For the users' safety, all safety instructions and safety messages shall be strictly observed and followed! Therefore, the manual must always be available to all persons performing any tasks described here.

DANGER, WARNING, CAUTION and **NOTICE** are standardised signal words for identifying levels of hazards and risks related to personal injury and property damage. For your safety, it is important to read and fully understand the following table with the different signal words and their definitions! Supplementary safety information symbols may be placed within a warning message as well as supplementary text.

Туре	Description
▲ DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
≜ WARNING	Indicates a potentially hazardous situation or an unintended use which, if not avoided, could result in death or serious injury.
∆ CAUTION	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in appreciable material, financial and environmental damage.
	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

1.2

Definition of Use

Intended use

- Measuring horizontal and vertical angles
- Measuring distances
- Recording measurements
- Visualising the aiming direction and vertical axis
- Data communication with external appliances
- Computing with software

Reasonably forseeable misuse

- Use of the product without instruction.
- Use outside of the intended use and limits.
- Disabling safety systems.
- Removal of hazard notices.
- Opening the product using tools, for example screwdriver, unless this is permitted for certain functions.
- Modification or conversion of the product.
- Use after misappropriation.
- Use of products with recognisable damage or defects.
- Use with accessories from other manufacturers without the prior explicit approval of Leica Geosystems.
- Deliberate dazzling of third parties.
- Controlling of machines, moving objects or similar monitoring application without additional control and safety installations.
- Aiming directly into the sun.
- Inadequate safeguards at the working site.

1.3

Limits of Use

Environment

Suitable for use in an atmosphere appropriate for permanent human habitation: not suitable for use in aggressive or explosive environments.

WARNING

Working in hazardous areas, or close to electrical installations or similar situations

Life Risk.

Precautions:

Local safety authorities and safety experts must be contacted by the person responsible for the product before working in such conditions.

1.4

Responsibilities

Manufacturer of the product

Leica Geosystems AG, CH-9435 Heerbrugg, hereinafter referred to as Leica Geosystems, is responsible for supplying the product, including the User Manual and original accessories, in a safe condition.

Person responsible for the product

The person responsible for the product has the following duties:

- To understand the safety instructions on the product and the instructions in the User Manual.
- To ensure that it is used in accordance with the instructions.
- To be familiar with local regulations relating to safety and accident prevention.
- To inform Leica Geosystems immediately if the product and the application becomes unsafe.
- To ensure that the national laws, regulations and conditions for the operation of the product are respected.

1.5 Hazards of Use

NOTICE

Dropping, misusing, modifying, storing the product for long periods or transporting the product

Watch out for erroneous measurement results.

Precautions:

Periodically carry out test measurements and perform the field adjustments indicated in the User Manual, particularly after the product has been subjected to abnormal use as well as before and after important measurements.

▲ DANGER

Risk of electrocution

Because of the risk of electrocution, it is dangerous to use poles, levelling staffs and extensions in the vicinity of electrical installations such as power cables or electrical railways.

Precautions:

Keep at a safe distance from electrical installations. If it is essential to work in this environment, first contact the safety authorities responsible for the electrical installations and follow their instructions.



WARNING

Lightning strike

If the product is used with accessories, for example masts, staffs, poles, you may increase the risk of being struck by lightning.

Precautions:

Do not use the product in a thunderstorm.

NWARNING

Distraction/loss of attention

During dynamic applications, for example stakeout procedures, there is a danger of accidents occurring if the user does not pay attention to the environmental conditions around, for example obstacles, excavations or traffic.

Precautions:

The person responsible for the product must make all users fully aware of the existing dangers.

MARNING

Inadequate securing of the working site

This can lead to dangerous situations, for example in traffic, on building sites and at industrial installations.

Precautions:

- ► Always ensure that the working site is adequately secured.
- Adhere to the regulations governing safety, accident prevention and road traffic.

ACAUTION

Pointing product toward the sun

Be careful when pointing the product toward the sun, because the telescope functions as a magnifying glass and can injure your eyes and/or cause damage inside the product.

Precautions:

Do not point the product directly at the sun.

ACAUTION

Not properly secured accessories

If the accessories used with the product are not properly secured and the product is subjected to mechanical shock, for example blows or falling, the product may be damaged or people can sustain injury.

- When setting up the product, make sure that the accessories are correctly adapted, fitted, secured, and locked in position.
- Avoid subjecting the product to mechanical stress.

AWARNING

Inappropriate mechanical influences to batteries

During the transport, shipping or disposal of batteries it is possible for inappropriate mechanical influences to constitute a fire hazard.

Precautions:

- Before shipping the product or disposing it, discharge the batteries by the product until they are flat.
- When transporting or shipping batteries, the person in charge of the product must ensure that the applicable national and international rules and regulations are observed.
- Before transportation or shipping, contact your local passenger or freight transport company.

AWARNING

Exposure of batteries to high mechanical stress, high ambient temperatures or immersion into fluids

This can cause leakage, fire or explosion of the batteries.

Precautions:

Protect the batteries from mechanical influences and high ambient temperatures. Do not drop or immerse batteries into fluids.

NWARNING

Short circuit of battery terminals

If battery terminals are short circuited e.g. by coming in contact with jewellery, keys, metallised paper or other metals, the battery can overheat and cause injury or fire, for example by storing or transporting in pockets.

Precautions:

Make sure that the battery terminals do not come into contact with metallic objects.

MARNING

Improper disposal

If the product is improperly disposed of, the following can happen:

- If polymer parts are burnt, poisonous gases are produced which may impair health.
- If batteries are damaged or are heated strongly, they can explode and cause poisoning, burning, corrosion or environmental contamination.
- By disposing of the product irresponsibly you may enable unauthorised persons to use it in contravention of the regulations, exposing themselves and third parties to the risk of severe injury and rendering the environment liable to contamination.
- Improper disposal of silicone oil may cause environmental contamination.
- The product does include parts of Beryllium inside. Any modification of some internal parts can release Beryllium dust or fragments, creating a health hazard.

Precautions:

 \blacktriangleright



The product must not be disposed with household waste. Dispose of the product appropriately in accordance with the national regulations in force in your country. Always prevent access to the product by unauthorised personnel.

Product-specific treatment and waste management information can be received from your Leica Geosystems distributor.

MARNING

Improperly repaired equipment

Risk of injuries to users and equipment destruction due to lack of repair knowledge.

Precautions:

 Only authorised Leica Geosystems Service Centres are entitled to repair these products.

1.6 Laser Classification

1.6.1 General

General

The following chapters provide instructions and training information about laser safety according to international standard IEC 60825-1 (2014-05) and technical report IEC TR 60825-14 (2004-02). The information enables the person responsible for the product and the person who actually uses the equipment, to anticipate and avoid operational hazards.



According to IEC TR 60825-14 (2004-02), products classified as laser class 1, class 2 and class 3R do not require:

- laser safety officer involvement,
- · protective clothes and eyewear,
- special warning signs in the laser working area

if used and operated as defined in this User Manual due to the low eve hazard level.



National laws and local regulations could impose more stringent instructions for the safe use of lasers than IEC 60825-1 (2014-05) and IEC TR 60825-14 (2004-02).

1.6.2

Distancer, Measurements with Reflectors

Applicability

Depending on instrument model.

General

The EDM module built into the product produces a visible laser beam which emerges from the telescope objective.

The laser product described in this section is classified as laser class 1 in accordance with:

• IEC 60825-1 (2014-05): "Safety of laser products"

These products are safe under reasonably foreseeable conditions of operation and are not harmful to the eyes provided that the products are used and maintained in accordance with this User Manual.

Description	Value
Wavelength	658 nm
Pulse duration	800 ps
Pulse repetition frequency	100 MHz
Maximum average radiant power	0.34 mW
Beam divergance	1.5 mrad x 3 mrad



a Laser beam

1.6.3

Distancer, Measurements without Reflectors

Applicability

Depending on instrument model.

General

The EDM module built into the product produces a visible laser beam which emerges from the telescope objective.

The laser product described in this section is classified as laser class 3R in accordance with:

IEC 60825-1 (2014-05): "Safety of laser products"

Direct intrabeam viewing may be hazardous (low eye hazard level), in particular for deliberate ocular exposure. The beam may cause dazzle, flash-blindness

and after-images, particularly under low ambient light conditions. The risk of injury for laser class 3R products is limited because of:

- a) unintentional exposure would rarely reflect worst case conditions of (e.g.) beam alignment with the pupil, worst case accommodation,
- inherent safety margin in the maximum permissible exposure to laser radiation (MPE)
- c) natural aversion behaviour for exposure to bright light for the case of visible radiation.

Description	Value (R500)
Wavelength	658 nm
Maximum average radiant power	4.8 mW
Pulse duration	800 ps
Pulse repetition frequency (PRF)	100 MHz
Beam divergence	0.2 mrad × 0.3 mrad
NOHD (Nominal Ocular Hazard Distance) @ 0.25 s	44 m / 144 ft

ACAUTION

Class 3R laser products

From a safety perspective, class 3R laser products should be treated as potentially hazardous.

Precautions:

- Prevent direct eye exposure to the beam.
- Do not direct the beam at other people.

⚠ CAUTION

Reflected beams aimed at reflecting surfaces

Potential hazards are not only related to direct beams but also to reflected beams aimed at reflecting surfaces such as prisms, windows, mirrors, metallic surfaces, etc.

- Do not aim at areas that are essentially reflective, such as a mirror, or which could emit unwanted reflections.
- Do not look through or beside the optical sight at prisms or reflecting objects when the laser is switched on, in laser pointer or distance measurement mode. Aiming at prisms is only permitted when looking through the telescope.

Labelling



1.6.4

Red Laser Pointer

Applicability

Depending on instrument model.

General

The laser pointer built into the product produces a visible red laser beam which emerges from the telescope objective.

The laser product described in this section is classified as laser class 3R in accordance with:

• IEC 60825-1 (2014-05): "Safety of laser products"

Direct intrabeam viewing may be hazardous (low eye hazard level), in particular for deliberate ocular exposure. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions. The risk of injury for laser class 3R products is limited because of:

- a) unintentional exposure would rarely reflect worst case conditions of (e.g.) beam alignment with the pupil, worst case accommodation,
- inherent safety margin in the maximum permissible exposure to laser radiation (MPE)
- c) natural aversion behaviour for exposure to bright light for the case of visible radiation.

Description	Value (R500)
Wavelength	658 nm
Maximum average radiant power	4.8 mW
Pulse duration	800 ps
Pulse repetition frequency (PRF)	100 MHz
Beam divergence	0.2 mrad × 0.3 mrad
NOHD (Nominal Ocular Hazard Distance) @ 0.25 s	44 m / 144 ft

!CAUTION

Class 3R laser products

From a safety perspective, class 3R laser products should be treated as potentially hazardous.

Precautions:

- Prevent direct eye exposure to the beam.
- Do not direct the beam at other people.

ACAUTION

Reflected beams aimed at reflecting surfaces

Potential hazards are not only related to direct beams but also to reflected beams aimed at reflecting surfaces such as prisms, windows, mirrors, metallic surfaces, etc.

Precautions:

- Do not aim at areas that are essentially reflective, such as a mirror, or which could emit unwanted reflections.
- ▶ Do not look through or beside the optical sight at prisms or reflecting objects when the laser is switched on, in laser pointer or distance measurement mode. Aiming at prisms is only permitted when looking through the telescope.

Labelling





1.6.5

Laser Plummet

General

The laser plummet built into the product produces a visible red laser beam which emerges from the bottom of the product.

The laser product described in this section is classified as laser class 2 in accordance with:

• IEC 60825-1 (2014-05): "Safety of laser products"

These products are safe for momentary exposures but can be hazardous for deliberate staring into the beam. The beam may cause dazzle, flash-blindness and after-images, particularly under low ambient light conditions.

Description	Value
Wavelength	640 nm
Maximum average radiant power	0.95 mW
Pulse duration	0.1 ms - cw
Pulse repetition frequency (PRF)	1 kHz
Beam divergance	<1.5 mrad

ACAUTION

Class 2 laser product

From a safety perspective, class 2 laser products are not inherently safe for the eyes.

- Avoid staring into the beam or viewing it through optical instruments.
- Avoid pointing the beam at other people or at animals.

Labelling



- a Laser beam
- b Exit for laser beam

1.7 Electromagnetic Compatibility (EMC)

Description

The term Electromagnetic Compatibility is taken to mean the capability of the product to function smoothly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic disturbances to other equipment.

WARNING

Electromagnetic radiation

Electromagnetic radiation can cause disturbances in other equipment.

Precautions:

Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment may be disturbed.

ACAUTION

Use of the product with accessories from other manufacturers. For example field computers, personal computers or other electronic equipment, non-standard cables or external batteries

This may cause disturbances in other equipment.

- Use only the equipment and accessories recommended by Leica Geosystems.
- When combined with the product, they meet the strict requirements stipulated by the guidelines and standards.
- When using computers, two-way radios or other electronic equipment, pay attention to the information about electromagnetic compatibility provided by the manufacturer.

∴ CAUTION

Intense electromagnetic radiation. For example, near radio transmitters, transponders, two-way radios or diesel generators

Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that function of the product may be disturbed in such an electromagnetic environment.

Precautions:

Check the plausibility of results obtained under these conditions.

ACAUTION

Electromagnetic radiation due to improper connection of cables

If the product is operated with connecting cables attached at only one of their two ends, for example external supply cables, interface cables, the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other products may be impaired.

Precautions:

While the product is in use, connecting cables, for example product to external battery, product to computer, must be connected at both ends.

Radios or digital cellular phones

MARNING

Use of product with radio or digital cellular phone devices

Electromagnetic fields can cause disturbances in other equipment, in installations, in medical devices, for example pacemakers or hearing aids and in aircrafts. Electromagnetic fields can also affect humans and animals.

- Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment can be disturbed or that humans or animals can be affected.
- ▶ Do not operate the product with radio or digital cellular phone devices in the vicinity of filling stations or chemical installations, or in other areas where an explosion hazard exists.
- ▶ Do not operate the product with radio or digital cellular phone devices near to medical equipment.
- Do not operate the product with radio or digital cellular phone devices in aircrafts.
- Do not operate the product with radio or digital cellular phone devices for long periods with the product immediately next to your body.

⚠ CAUTION

Exceeding the RF radiation exposure limits for general population Health risk

Precautions:

- The antennas used for this transmitter must be installed such that a minimum separation distance of at least 23 cm is always maintained between the radiator (antenna) and all persons.
- The antennas used for this transmitter must not be co-located or operated with any other antenna or transmitter.

1.8 FCC Statement, Applicable in U.S.



The greyed paragraph below is only applicable for products without radio.

MARNING

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

ACAUTION

Changes or modifications not expressly approved by Leica Geosystems for compliance could void the user's authority to operate the equipment.

Labelling iCB50/iCB70 Laser Class 3R



Labelling iCB70 Laser Class 2



Labelling GEB331



Labelling GEB361



WARNING

This Class (B) digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe (B) est conforme à la norme NMB-003 du Canada.

Canada Compliance Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- 1. This device may not cause interference.
- 2. This device must accept any interference, including interference that may cause undesired operation of the device.

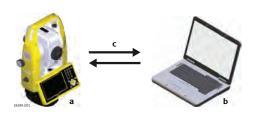
Canada Déclaration de Conformité

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- 1. L'appareil ne doit pas produire de brouillage;
- 2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

System Components

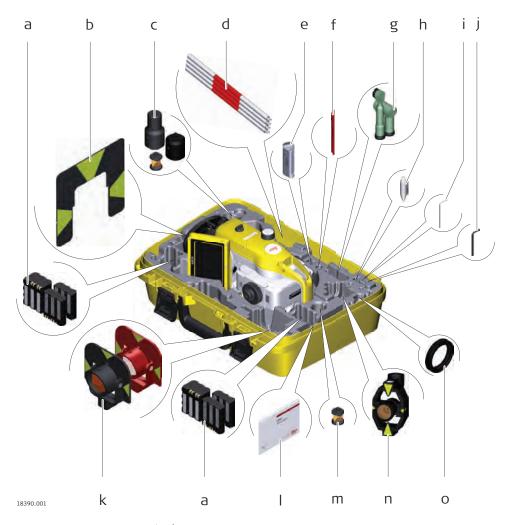
Main components



- iCB50/iCB70 instrument with iCON build firmware
- b Computer with Leica Infinity software
- c Data transfer

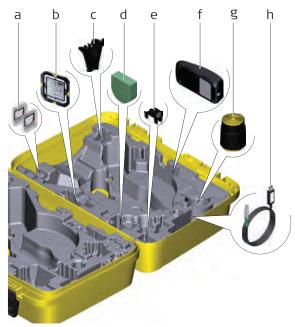
Component	Description
iCB50/iCB70	An instrument for measuring, calculating and capturing data. Ideally suited for tasks from simple surveys to complex applications. Equipped with a iCON build firmware package to complete these tasks.
	The various lines have a range of accuracy classes and support different features. All lines can be connected with Leica Infinity to view, exchange and manage data.
iCON build firmware	The firmware package installed on the instrument. Consists of a standard base operating system with optional additional features.
Leica Infinity software	An office software consisting of a suite of standard and extended programs for the viewing, exchanging, managing and post processing of data.
Data transfer	Data can be transferred between a iCB50/iCB70 and a computer via USB cable, USB-stick, SD card and data transfer cable.

Container contents part 1 of 2



- a GEB331 or GEB361 battery
- b GZT4 target plate
- c GRZ101 mini prism, GAD103 and GAD105 adapter
- d GLS115 mini prism pole
- e Leica industrial grade USB memory stick
- f Stylus
- g GFZ3 and GOK6 diagonal eyepiece
- h Tip for mini prism
- i Adjustment tool
- j Allen key
- k GPR111 and GPR121 round prism
- I Manuals
- m GRZ101 360° mini prism
- n CPR111 Builder prism (true-zero offset)
- o Counterweight for diagonal eyepiece

Container contents part 2 of 2



18395_001

- a SD card
- b GPR105 flat prism
- c GHT196 holder for height metre
- d GHM007 height metre
- e GLI115 clip-on bubble
- f GKL311 charger
- g Protective cover / Lens hood / Cleaning cloth
- h USB MiniUSB cable

2.3 Instrument Components

Instrument components part 1 of 2



- a Compartment for SD card, USB memory stick and USB cable ports
- b Optical sight
- c Detachable carrying handle with mounting screw
- d Objective with integrated Electronic Distance Measurement (EDM). Exit for EDM laser beam
- e Vertical drive
- f Stylus
- g Trigger key
- h Serial interface RS232, located behind keyboard on rotation part
- i Horizontal drive
- j Second keyboard with display*
- * Optional

Instrument components part 2 of 2

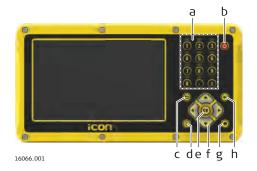


- LTE antenna (iCB70)*
- Focusing telescope image
 m Eyepiece; focusing graticule
 n Battery cover
- Foot screw 0
- Stylus
- Keyboard with display q
- * Optional

User Interface 3

3.1 Keyboard

iCB50/70 keyboard



- Alphanumeric keys а
- ON/OFF Ь
- Back or Cancel
- d Measure
- OK е
- f Arrow keys
- g h Home
- Backspace

Keys

Key		Function
Alphanumeric keys	STU	To type letters and numbers.
ON/OFF	©	If the instrument is already off: Turns on the instrument when held for 2 s. If the instrument is already on: Displays the "Logout/ Shutdown" screen when held for 2 s.
Back or Can- cel	5	To leave the current screen without storing any changes. To close an info message.
Backspace	(Deletes the last character in an entry field.
Measure	(This functionality is available if a measurement application is active on the field software. The functionality of the key can vary depending on the configuration of the measure bar (Measure or Meas+Rec).
		Starts the measurement in the currently selected measurement mode .
Home		Switches to the iCON Main Menu.
Arrow keys		Allow moving the focus on the screen or paging through a list.
ОК	OK	Selects the highlighted line and leads to the next logical menu / dialog. Starts the edit mode for editable fields. Opens a selectable list.

3.2

Operating Principles

Keyboard and touch screen

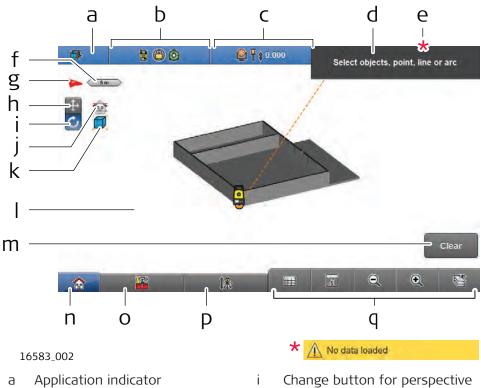
The user interface is operated on the touch screen. In some applications, the keyboard can be used instead. Refer to iCON build for information.

Home menu elements



- c Application container
- f Settings container

Map screen elements



- Status sensor Ь
- Status target C
- Information bar d
- Warning bar (only displayed if there is an issue)
- Scale bar f
- North and 3D indicator
- Change button for panning h mode

- mode (3D)
- Elevation Filter indicator
- Isolation mode indicator
- Main map area
- Measure bar m
- Home n
- Toolbox 0
- Setup Р
- q Map handler

Configuration of the trigger key

1. Select System from the Home Menu. Tap Hard Button.



Following screen is displayed:



Button A is not configurable. This button turns the laser pointer on and off.

- For iCB70 devices with laser class 2, the laser pointer function is not available. Button A can be configured just like Button B.
- 2. Tap **Button B** to configure the button.
- 3. Tap a measure bar function to assign it to the button.
 - Meas+Rec
 - Measure
 - Store
 - Start Line/Stop Line
 - Laser Pointer ON/OFF
 - None

Tap ✓ to save changes.



To run the assigned function with the trigger key, the function must also be configured and displayed in the measure bar. Refer to the iCON build How-To Guide.

Operation

4.1

Instrument Setup

Description

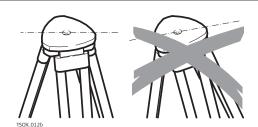
This topic describes an instrument setup over a marked ground point using the laser plummet. It is always possible to set up the instrument without the need for a marked ground point.



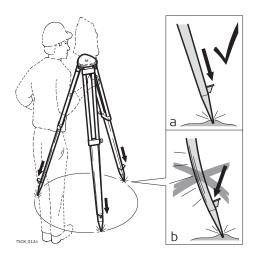
Important features

- It is always recommended to shield the instrument from direct sunlight and avoid uneven temperatures around the instrument.
- The laser plummet described in this topic is built into the vertical axis of the instrument. It projects a red spot onto the ground, making it appreciably easier to centre the instrument.
- The laser plummet cannot be used with a tribrach equipped with an optical plummet.

Tripod



When setting up the tripod pay attention to ensuring a horizontal position of the tripod plate. Slight corrections of inclination can be made with the foot screws of the tribrach. Larger corrections must be done with the tripod legs.

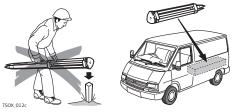


Loosen the clamping screws on the tripod legs, pull out to the required length and tighten the clamps.

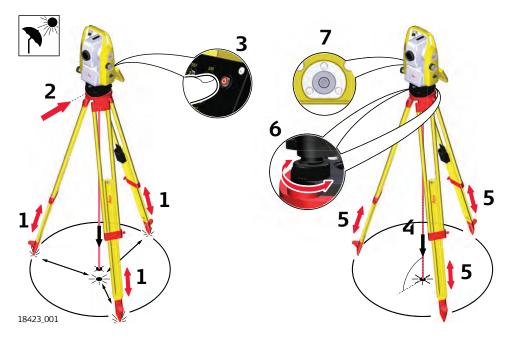
- a In order to guarantee a firm foothold sufficiently press the tripod legs into the ground.
- b When pressing the legs into the ground note that the force must be applied along the legs.



- Check all screws and bolts for correct fit.
- During transport, always use the cover supplied.
- Use the tripod only for surveying tasks.



Instrument setup step-by-step



- 1. Extend the tripod legs to allow for a comfortable working posture. Position the tripod above the marked ground point, centring it as good as possible. Ensure that the tripod plate is roughly horizontal.
- 2. Fasten the tribrach and instrument onto the tripod.
- Shield the instrument from direct sunlight and avoid uneven temperatures around the instrument.
- 3. Turn on the instrument.

To activate the laser plummet, display the Compensator screen:

- Select **Devices** from the Home Menu.
- Tap the arrow button to the right of the device name.
- Tap Compensator.
- 4. Use the tribrach footscrews (a) to centre the plummet above the ground point (b).
- 5. Adjust the tripod legs to level the circular level (c).
- 6. By using the electronic level, turn the tribrach footscrews (a) to level the instrument precisely.
- 7. Centre the instrument precisely over the ground point (b) by shifting the tribrach on the tripod plate.
- 8. Repeat steps 6. and 7. until the required accuracy is achieved.

Level up with the electronic level stepby-step

The electronic level can be used to precisely level up the instrument using the footscrews of the tribrach.

- 1. Turn the instrument until it is parallel to two footscrews.
- 2. Centre the circular level approximately by turning the footscrews of the tribrach.

3. Turn on the instrument, and, if tilt correction is set to **On**, the laser plummet will be activated automatically, and the level screen appears.

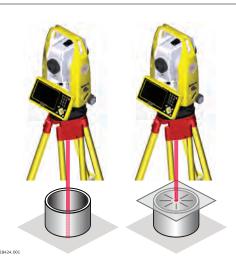
The bubble of the electronic level and the arrows for the rotating direction of the footscrews only appear if the instrument tilt is inside a certain levelling range.

4. Centre the electronic level of the first axis by turning the two footscrews. Arrows show the direction of rotation required. The first axis is levelled, when the bubble is exactly between the squared brackets [] of the single axis bubble tube.

When levelled correctly, checkmarks are displayed.

- Centre the electronic level for the second axis by turning the last footscrew. An arrow shows the direction of rotation required.
 When all three bubbles are centred, the instrument has been perfectly levelled up.
- 6. Accept the setting.

Position over pipes or holes



Under some circumstances the laser dot is not visible, for example over pipes. In this case, using a transparent plate enables the laser dot to be seen and then easily aligned to the centre of the pipe.

4.2.1

Operating Principles

First-time use/ charging batteries

- The battery must be charged before using it for the first time because it is delivered with an energy content as low as possible.
- The permissible temperature range for charging is from 0 °C to +40 °C/+32 °F to +104 °F. For optimal charging, we recommend charging the batteries at a low ambient temperature of +10 °C to +20 °C/+50 °F to +68 °F if possible.
- It is normal for the battery to become warm during charging. Using the chargers recommended by Leica Geosystems, it is not possible to charge the battery once the temperature is too high.
- For new batteries or batteries that have been stored for a long time (> three months), it is effectual to make only one charge/discharge cycle.
- For Li-lon batteries, a single discharging and charging cycle is sufficient.
 We recommend carrying out the process when the battery capacity indicated on the charger or on a Leica Geosystems product deviates significantly from the actual battery capacity available.

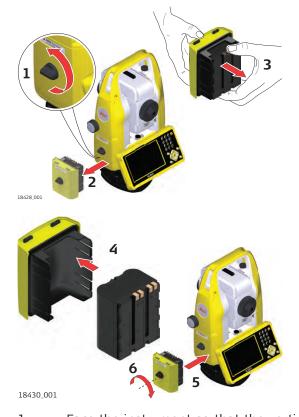
Operation/discharging

- The batteries can be operated from -20 °C to +55 °C/-4 °F to +131 °F.
- Low operating temperatures reduce the capacity that can be drawn; high operating temperatures reduce the service life of the battery.

4.2.2

Battery for the iCB Instrument

Change the battery step-by-step



- Face the instrument so that the vertical drive screw is on the left.
 The battery compartment is below the vertical drive. Turn the knob to the vertical position, opening the lid of the battery compartment.
- 2. Pull out the battery housing.

- 3. Pull the battery out of the battery housing.
- 4. At the top of the battery is a notch which corresponds to the inner surface of the battery housing. This notch helps you to place the battery correctly.

Place the battery into the battery housing, ensuring that the contacts are facing outward. Click the battery into position.

- 5. Place the battery housing into the battery compartment. Push the battery housing in until it fits completely into the battery compartment.
- 6. Turn the knob to lock the battery compartment. Ensure that the knob is returned to its original horizontal position.

4.3 Data Storage

Description

An internal memory is included in all instruments. The iCON build firmware stores all data in projects and jobs in a database in the internal memory.

Data can be transferred from the internal memory to a computer or other device via:

- a LEMO cable connected to the serial interface RS232 port
- an SD card
- an USB stick inserted into the USB host port,
- an USB cable connected to the USB device port, or
- a Bluetooth connection.
- WLAN
- an LTE antenna (iCB70)



While other SD cards/USB sticks can be used, Leica Geosystems recommends to only use Leica SD cards/USB sticks and is not responsible for data loss or any other error that can occur while using a non-Leica SD card/USB stick.



Unplugging connecting cables or removing the SD card or USB stick during the measurement can cause loss of data. Only remove the SD card or USB stick or unplug connecting cables when the iCB instrument is switched off.



SD cards can directly be used in an OMNI drive as supplied by Leica Geosystems. Other PC card drives can require an adaptor.

4.4

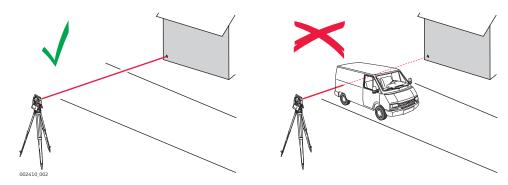
Distance Measurements - Guidelines for Correct Results

Description

An EDM is incorporated into the instrument. In all versions, the distance can be determined by using a visible red laser beam which emerges coaxially from the telescope objective. Depending on the model, there are up to two EDM modes:

- Prism measurements
- Non-Prism measurements

Non-prism measurements



- When a distance measurement is triggered, the EDM measures to the
 object which is in the beam path at that moment. If a temporary obstruction, for example a passing vehicle, heavy rain, fog or snow is between
 the instrument and the point to be measured, the EDM may measure to
 the obstruction.
- Be sure that the laser beam is not reflected by anything close to the line of sight, for example highly reflective objects.
- Avoid interrupting the measuring beam while taking Non-Prism measurements or measurements using reflective foils.
- Do not measure with two instruments to the same target simultaneously.

Prism measurements

- Measurements to strongly reflecting targets such as traffic lights in Prism mode without a prism should be avoided. The measured distances may be wrong or inaccurate.
- When a distance measurement is triggered, the EDM measures to the
 object which is in the beam path at that moment. If for example people,
 cars, animals, or swaying branches cross the laser beam while a measurement is being taken, a fraction of the laser beam is reflected from these
 objects and may lead to incorrect distance values.
- Measurements to prisms are only critical if an object crosses the measuring beam at a distance of 0 to 30 m and the distance to be measured is more than 300 m.
- In practice, because the measuring time is very short, the user can always find a way of avoiding unwanted objects from interfering in the beam path.

Red laser to reflector tape

- The visible red laser beam can also be used to measure to reflective foils.
 To guarantee the accuracy the red laser beam must be perpendicular to the reflector tape and it must be well adjusted.
- Make sure the additive constant belongs to the selected target (reflector).

5 Check & Adjust

5.1 Overview

Description

Leica Geosystems instruments are manufactured, assembled and adjusted to the best possible quality. Quick temperature changes, shock or stress can cause deviations and decrease the instrument accuracy. It is therefore recommended to check and adjust the instrument from time to time. This check and adjust can be done in the field by running through specific measurement procedures. The procedures are guided and must be followed carefully and precisely as described in the following chapters. Some other instrument errors and mechanical parts can be adjusted mechanically.

Electronic adjustment

The following instrument errors can be checked and adjusted electronically:

Instrument error	Description
I, t	Compensator longitudinal and transversal index errors
i	Vertical index error, related to the standing axis
С	Horizontal collimation error, also called line of sight error
а	Tilting axis error

If the compensator and the horizontal corrections are activated in the instrument configuration, every angle measured in the daily work is corrected automatically. Check whether the tilt correction and the horizontal correction are turned on.

The results are displayed as errors but used with the opposite sign as corrections when applied to measurements.

Mechanical adjustment

The following instrument parts can be adjusted mechanically:

- Circular level on instrument and tribrach
- Optical plummet option on tribrach
- Allen screws on tripod

Precise measurements

To get precise measurements in the daily work, it is important:

- To check and adjust the instrument from time to time.
- To take high precision measurements during the check and adjust procedures.
- To measure targets in two faces. Some of the instrument errors are eliminated by averaging the angles from both faces.



During the manufacturing process, the instrument errors are carefully determined and set to zero. As mentioned above, these errors can change and it is highly recommended to redetermine them in the following situations:

- Before the first use
- Before every high precision survey
- After rough or long transportation
- After long working periods
- After long storage periods
- If the temperature difference between current environment and the temperature at the last calibration is more than 20 °C

Summary of errors to be adjusted electronically

Instrument error	Effects Hz	Effects V	Elimination with two face measurement	Automatically corrected with proper adjustment
c - Line of sight error	✓		✓	✓
a - Tilting axis error	✓		✓	✓
l - Compensator index error		✓	✓	✓
t - Compensator index error	✓		✓	✓
i - Vertical index error		✓	✓	✓

5.2 Preparation





Before determining the instrument errors, the instrument has to be levelled using the electronic level.

The tribrach, the tripod and the underground should be stable and secure from vibrations or other disturbances.





The instrument should be protected from direct sunlight to avoid thermal warming.

It is also recommended to avoid strong heat shimmer and air turbulence. The best conditions are early in the morning or with overcast sky.



Before starting to work, the instrument has to become acclimatised to the ambient temperature. Take at least 15 minutes into account or approximately 2 minutes per °C of temperature difference from storage to working environment.

Next step

- Adjusting a combination of instrument errors Refer to "5.3 Combined Adjustment (I, t, i and c)".
- Adjusting the circular level
 Refer to "5.4 Adjusting the Circular Level of the Instrument and Tribrach".
- Adjusting the laser/optical plummet
 Refer to "5.6 Inspecting the Laser Plummet of the Instrument".
- Adjusting the tripod
 Refer to "5.7 Servicing the Tripod".

5.3

Combined Adjustment (I, t, i and c)

Description

The combined adjustment procedure determines the following instrument errors in one process:

Instrument error	Description
I, t	Compensator longitudinal and transversal index errors
i	Vertical index error, related to the standing axis
С	Horizontal collimation error, also called line of sight error

Combined adjustment procedure step-bystep

The following description explains the most common settings:

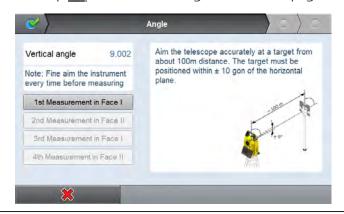
It is recommended to use a clean Leica circular prism as target. Do not use a 360° prism.

1. Select **Sensor** from the Home Menu.



- 2. Select **Sensor Calibration**.
 - To start calibration, tap

 ✓.
 Follow the wizard which guides through the calibration.
- 3. Aim the telescope accurately at a target at about 100 m distant. The target must be positioned within \pm 9°/ \pm 10 gon of the horizontal plane.
 - Start the procedure in face I.
 - Press the measurement keys to measure and to continue to the next step.
 - Tap in the wizard to get to the next page.



The fine aiming has to be performed manually in both faces.



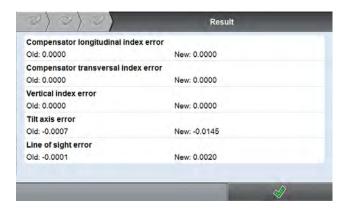
- Aim the telescope accurately at a target at about 100 m distant or less if not possible. The target must be positioned at least 27°/30 gon above or beneath the horizontal plane.
- Start the procedure in face I.
- Press the measurement keys to measure and to continue to the next step.

Tap in the wizard to get to the next page.

The fine aiming has to be performed manually in both faces.

5. Adjustment Accuracy

After pressing the last in the wizard the results are shown and stored to the instrument.



Calibration report

The purpose of the calibration report is a documentation of the results of the field calibration. The report proofs the quality of the equipment for quality insurance.

At the end of the sensor calibration, a report (*.calibration) is created automatically. The report contains all calibration values.

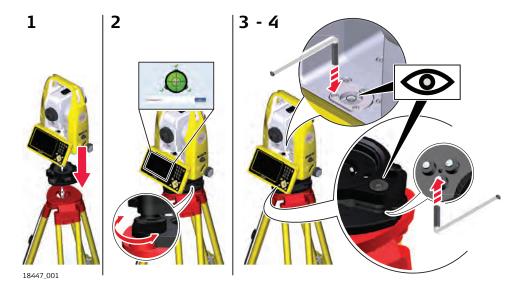
The report is stored on the hard drive of the controller (for instruments with keyboard unit only):



The reports and results of past calibrations can also be exported.

Adjusting the Circular Level of the Instrument and Tribrach

Adjusting the circular level step-by-step



- 1. Place and secure the instrument into the tribrach and onto a tripod.
- 2. Turn on the instrument. Using the tribrach footscrews, level the instrument with the electronic level.
- Electronic level:
 - Select **Devices** from the Home Menu.
 - Tap the arrow button to the right of the device name.
 - To display the electronic level, tap **Compensator**.
- 3. Check the position of the circular level on the instrument and tribrach.
- If both circular levels are centred, no adjustments are necessary.
- 4. If one or both circular levels are not centred, adjust as follows: **Instrument**: If it extends beyond the circle, use the supplied allen key to centre it with the adjustment screws. Turn the instrument by 200 gon (180°). Repeat the adjustment procedure if the circular level does not stay centred.

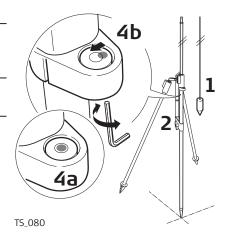
Tribrach: If it extends beyond the circle, use the supplied allen key to centre it with the adjustment screws.

After the adjustments, all adjusting screws must have the same tightening tension and no adjusting screw should be loose.

Adjusting the Circular Level of the Prism Pole

Adjusting the circular level step-by-step

- 1. Suspend a plumb line.
- 2. Use a pole bipod, to align the prism pole parallel to the plumb line.
- 3. Check the position of the circular level on the prism pole.
- 4. a If the circular level is centred, no adjustment is necessary.
 - b If the circular level is not centred, use an allen key to centre it with the adjustment screws.



After the adjustments, all adjusting screws must have the same tightening tension and no adjusting screw should be loose.

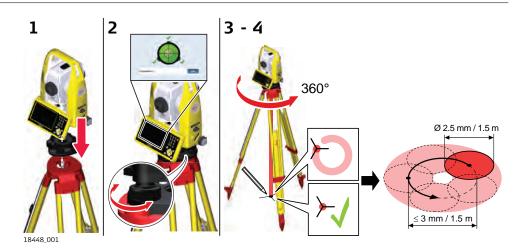
5.6

Inspecting the Laser Plummet of the Instrument



The laser plummet is located in the vertical axis of the instrument. Under normal conditions of use, the laser plummet does not need adjusting. If an adjustment is necessary due to external influences, return the instrument to any Leica Geosystems authorised service workshop.

Inspecting the laser plummet step-by-step



The following table explains the most common settings.

- 1. Place and secure the instrument into the tribrach and onto a tripod.
- 2. Turn on the instrument. Using the tribrach footscrews, level the instrument with the electronic level.

(F)

Electronic level:

- Select **Devices** from the Home Menu.
- Tap the arrow button to the right of the device name.
- To display the electronic level, tap **Compensator**.

3. The laser plummet is switched on when the Compensator screen is displayed.

Inspection of the laser plummet should be carried out on a bright, smooth and horizontal surface, such as a sheet of paper.

Mark the centre of the red laser dot on the ground.

4. Turn the instrument slowly through 360°, carefully observing the movement of the red laser dot.

The maximum diameter of the circular movement described by the centre of the laser dot should not exceed 3mm at a height of 1.5m.

If the centre of the laser dot describes a perceptible circular movement, or moves more than 3 mm away from the point which was first marked, an adjustment may be required. Inform your nearest Leica Geosystems authorised service centre. Depending on brightness and surface, the diameter of the laser dot can vary. At 1.5 m, it is about 2.5 mm.

5.7

Servicing the tripod step-by-step

Servicing the Tripod



The following table explains the most common settings.

- The connections between metal and timber components must always be firm and tight.
- 1. Tighten the leg cap screws moderately, with the supplied Allen key.
- 2. Tighten the articulated joints on the tripod head enough to keep the tripod legs open when lifting the tripod off the ground.
- 3. Tighten the Allen screws of the tripod legs.

6 Care and Transport

6.1 Transport

Transport in the field

When transporting the equipment in the field, always make sure that you

- either carry the product in its original container,
- or carry the tripod with its legs splayed across your shoulder, keeping the attached product upright.

Transport in a road vehicle

Never carry the product loose in a road vehicle, as it can be affected by shock and vibration. Always carry the product in its container and secure it.

For products for which no container is available use the original packaging or its equivalent.

Shipping

When transporting the product by rail, air or sea, always use the complete original Leica Geosystems packaging, container and cardboard box, or its equivalent, to protect against shock and vibration.

Shipping, transport of batteries

When transporting or shipping batteries, the person responsible for the product must ensure that the applicable national and international rules and regulations are observed. Before transportation or shipping, contact your local passenger or freight transport company.

Field adjustment

Exposing the product to high mechanical forces, for example through frequent transport or rough handling, or storing the product for a long time may cause deviations and a decrease in the measurement accuracy. Periodically carry out test measurements and perform the field adjustments indicated in the User Manual before using the product.

6.2 Storage

Product

Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to "7 Technical Data" for information about temperature limits.

Li-Ion batteries

- Refer to "7 Technical Data" for information about storage temperature range.
- Remove batteries from the product and the charger before storing.
- After storage recharge batteries before using.
- Protect batteries from damp and wetness. Wet or damp batteries must be dried before storing or use.
- A storage temperature range of 0 °C to +30 °C / +32 °F to +86 °F in a dry environment is recommended to minimize self-discharging of the battery.
- At the recommended storage temperature range, batteries containing a 40% to 50% charge can be stored for up to one year. After this storage period the batteries must be recharged.

Cleaning and Drying

Product and accessories

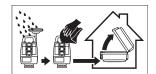
- Blow dust off lenses and prisms.
- Never touch the glass with your fingers.
- Use only a clean, soft, lint-free cloth for cleaning. If necessary, moisten the cloth with water or pure alcohol. Do not use other liquids; these may attack the polymer components.

Fogging of prisms

Prisms that are cooler than the ambient temperature tend to fog. It is not enough simply to wipe them. Keep them for some time inside your jacket or in the vehicle to allow them to adjust to the ambient temperature.

Damp products

Dry the product, the transport container, the foam inserts and the accessories at a temperature not greater than 40 $^{\circ}$ C /104 $^{\circ}$ F and clean them. Remove the battery cover and dry the battery compartment. Do not repack until everything is completely dry. Always close the transport container when using in the field.



Cables and plugs

Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables.

Technical Data 7

7.1 **Angle Measurement**

Accuracy

Available angular accuracies	Standard deviation Hz, V ISO 17123-3	Disp	lay resoli	ution	
["]	[mgon]	["]	[°]	[mgon]	[mil]
1	0.3	0.1	0.0001	0.1	0.01
2	0.6	0.1	0.0001	0.1	0.01
5	1.5	0.1	0.0001	0.1	0.01

Characteristics

Absolute, continuous, diametric. Updates each 0.1 to 0.3 s.

7.2

Distance Measurement with Reflectors

Range

Reflector	Range	Α	Range	В	Range	C
	[m]	[ft]	[m]	[ft]	[m]	[ft]
Standard prism (GPR1)	1800	6000	3000	10000	3500	12000
360° prism (MPR122, GRZ4, GPZ122)	800	2600	1500	5000	2000	7000
Reflector tape 60 mm x 60 mm						
Prism mode	150	500	250	800	250	800
Non-prism mode, R500	300	1000	500	1600	>500	>1600
Builder prism True-zero offset (CPR111)	450	1500	800	2600	1000	3500
Flat prism (GPR105)	150	490	300	975	650	2100
360° Mini prism (GRZ101)	450	1500	800	2600	1000	3500
Shortest measuring	distance:		1.5m			

Atmospheric conditions

A Strong haze, visibility 5 km; or strong sunlight, severe heat shimmer B Light haze, visibility about 20 km; or moderate sunlight, slight heat shimmer C Overcast, no haze, visibility about 40 km; no heat shimmer	Range	Description
C Overcast, no haze, visibility about 40 km; no heat	А	
· · · · · · · · · · · · · · · · · · ·	В	3
	С	

Accuracy

Accuracy refers to measurements to standard prisms.

Distance measuring mode	Standard deviation ISO 17123-4, standard prism	Standard deviation ISO 17123-4, tape	Measurement time, typical [s]
Single Auto	1 mm + 1.5 ppm	3 mm + 2 ppm	2.4
Continuous with lock	3 mm + 1.5 ppm	3 mm + 2 ppm	< 0.15

Beam interruptions, severe heat shimmer and moving objects within the beam path can result in deviations of the specified accuracy.

The display resolution is 0.1 mm.

Characteristics

Туре	Description
Principle	Phase measurement
Type	Coaxial, visible red laser
Carrier wave	658 nm
Measuring system	System Analyzer Basis 100–150 MHz

7.3

Distance Measurement without Reflectors (Non-Prism mode)

Range

Pinpoint R500 (without reflector)

Kodak Gray Card	Range	D	Range	E	Range	F
	[m]	[ft]	[m]	[ft]	[m]	[ft]
White side 90% reflective	250	820	500	1640	>500	>1640
Grey side 18% reflective	100	330	150	490	>200	>820
Range of measurement:		1.5 m	to 500 n	n		
Display unambiguous:		up to	500 m			

Atmospheric conditions

Range	Description
D	Object in strong sunlight, severe heat shimmer
E	Object in shade, or overcast
F	Underground, night and twilight

Accuracy

Standard measuring	ISO17123-4	Measure time, typical [s]	Measure time, maximum [s]
0m - 500m	2 mm + 2 ppm	3 - 6	15

Beam interruptions, severe heat shimmer and moving objects within the beam path can result in deviations of the specified accuracy.

Tracking measuring*	Standard deviation	Measure time, typical [s]
Tracking	5 mm + 3 ppm	0.25

* Accuracy and measure time depend on atmospheric conditions, target object and observation situation.

Characteristics

Туре	Description
Туре	Coaxial, visible red laser
Carrier wave	658 nm
Measuring system	System Analyzer Basis 100–150 MHz

Laser dot size

Distance [m]	Laser dot size, approximately [mm]
at 30	7 × 10
at 50	8 × 20
at 100	16 × 25

7.4

LOC8 Theft Deterrence and Location Device (optional)

Internal battery

Battery	Voltage	Capacity
Li-lon	800 mAh Recharged by the total station battery when instrument	
	is switched on	conditions

Tracking period

Update rate up to 1 minute

Interfaces

Wi-Fi: 802.11 b/g/n

Environmental specifications

Temperature

Operating temperature [°C]	Storage temperature [°C]
-20 to +60	-20 to +60

7.5

Conformity to National Regulations

7.5.1

iCB50/iCB70

Conformity to national regulations

- FCC Part 15 (applicable in US)
- Hereby, Leica Geosystems AG declares that the radio equipment type iCB50/iCB70 is in compliance with Directive 2014/53/EU and other applicable European Directives.

The full text of the EU declaration of conformity is available at the following Internet address: http://www.leica-geosystems.com/ce.



Class 1 equipment according to European Directive 2014/53/EU (RED) can be placed on the market and be put into service without restrictions in any EEA member state.

 The conformity for countries with other national regulations not covered by the FCC part 15 or European Directive 2014/53/EU has to be approved prior to use and operation.

- Japanese Radio Law and Japanese Telecommunications Business Law Compliance.
 - This device is granted pursuant to the Japanese Radio Law (電波法) and the Japanese Telecommunications Business Law (電気通信事業法).
 - This device should not be modified (otherwise the granted designation number will become invalid).

Frequency band

Туре	Frequency band [MHz]
iCB50/iCB70, Bluetooth	2402 - 2480
iCB70, WLAN	2400 - 2473, channel 1 to 11
iCB70, Cellular phone (EU, CN)	Dual-Band GSM 900 / 1800 & Tri-Band UMTS 900 / 1800 / 2100 & Penta-Band LTE 800 (B20) / 900 (B8) / 1800 (B3) / 2100 B(7) / 2600 (B1)
iCB70, Cellular phone (USA, CDN)	Quad-Band GSM 850 / 900 / 1800 / 1900 & Tri-Band UMTS 850 / AWS 1700/2100 / 1900 & Penta-Band LTE 700 (B13) / 700 (B17) / 850 (B5) / AWS 1700/2100 (B4) / 1900 (B2)
iCB70, Cellular phone (Japan)	Tri-Band UMTS 800 B6 / 800 B19 / 2100 B1 & Tri-Band LTE 800 (B19) / 1800 (B3) / 2100 (B1)

Output power

Туре	Output power [mW]
Bluetooth	<10
WLAN (802.11b)	50
WLAN (802.11gn)	32

Antenna

Туре	Antenna	Gain [dBi]	Connector
Bluetooth/WLAN	Internal Patch antenna	2 max.	-
GSM/UMTS/LTE	Internal antenna	2 max.	-

7.5.2

LOC8 Theft Deterrence and Location Device (optional)

Conformity to national regulations

- FCC Part 15, 22 and 24 (applicable in US)
- Hereby, Leica Geosystems AG declares that the radio equipment type LOC8 is in compliance with Directive 2014/53/EU and other applicable European Directives.

The full text of the EU declaration of conformity is available at the following Internet address: http://www.leica-geosystems.com/ce.



Class 1 equipment according to European Directive 2014/53/EU (RED) can be placed on the market and be put into service without restrictions in any EEA member state.

• The conformity for countries with other national regulations not covered by the FCC part 15, 22 and 24 or European Directive 2014/53/EU has to be approved prior to use and operation.

- Japanese Radio Law and Japanese Telecommunications Business Law Compliance.
 - This device is granted pursuant to the Japanese Radio Law (電波法) and the Japanese Telecommunications Business Law (電気通信事業法).
 - This device should not be modified (otherwise the granted designation number will become invalid).

Specific Absorption Rate (SAR)

The product meets the limits for the maximum permissible exposure of the guide-lines and standards which are force in this respect. The product must be used with the recommended antenna. A separation distance of at least 20 centimetres should be kept between the antenna and the body of the user or nearby person within the intended application.

Frequency band

Туре	Value
GSM	GSM 900: 880 - 960 MHz GSM 1800: 1710 - 1880 MHz
WCDMA	WCDMA 900: 880 - 960 MHz WCDMA 2100: 1920 - 2170 MHz
WLAN	2.4G Wi-Fi 802.11 b/g/n (20 MHz): 2412 - 2472 MHz 802.11 n (40 MHz): 2422 ~ 2462 MHz
GPS	1.57542 GHz

Output power

Туре	Value
GSM	GPRS: Maximal power: 29,13 dBm
WCDMA	Maximal power: 23,58 dBm

Antenna

Туре	Antenna	Gain
GSM	Internal PIFA antenna	GSM 900: 0.23 dBi GSM 1800: 0.23 dBi
WCDMA	Internal antenna	WCDMA 900: 1.34 dB WCDMA 1200: 1.34 dBi
GPS	Internal antenna	0 dBi
WLAN	Internal PIFA antenna	-0.66 dBi

7.5.3

Dangerous Goods Regulations

Dangerous Goods Regulations

Many products of Leica Geosystems are powered by Lithium batteries.

Lithium batteries can be dangerous under certain conditions and can pose a safety hazard. In certain conditions, Lithium batteries can overheat and ignite.



When carrying or shipping your Leica product with Lithium batteries onboard a commercial aircraft, you must do so in accordance with the IATA Dangerous Goods Regulations.

Leica Geosystems has developed **Guidelines** on "How to carry Leica products" and "How to ship Leica products" with Lithium batteries. Before any transportation of a Leica product, we ask you to consult these guidelines on our web page

(http://www.leica-geosystems.com/dgr) to ensure that you are in accordance with the IATA Dangerous Goods Regulations and that the Leica products can be transported correctly.



Damaged or defective batteries are prohibited from being carried or transported onboard any aircraft. Therefore, ensure that the condition of any battery is safe for transportation.

7.6 General Technical Data of the Product

Telescope

Туре	Value
Magnification	30 x
Free Objective aperture	40 mm
Focusing	1.55 m/5.08 ft to infinity
Field of view	1°30'/1.66 gon. 2.7 m at 100 m

Compensation

Angular accuracy	Setting a	ccuracy	Setting r	ange
["]	["]	[mgon]	[']	[gon]
1	0.5	0.2	±4	0.07
2	0.5	0.2	±4	0.07
5	1.5	0.5	±4	0.07

Level

Туре	Value
Circular level sensitivity	6'/2 mm
Electronic level resolution	2"

Control unit

Туре	Description
Display	WVGA (800 × 480 pixels), colour, graphics capable LCD, illumination, touch screen
Keyboard	22 keys Illumination
Angle display	360°'", 360° decimal, 400 gon, H:V, V:H, V%
Distance display	m, ft int, ft us, ft int inch, ft us inch
Position	In both faces, face two is optional
Touch screen	Screen protection foil on glass

Instrument ports

Name	Description
RS232	5 pin LEMO-0 for power, communication, data transfer This port is located on the rotation part of the instrument.
SD card port	SD card port for data transfer

Name	Description
USB host port	USB memory stick port for data transfer
USB device port	Cable connections from USB devices for communication and data transfer
Bluetooth	Bluetooth connections for communication and data transfer
WLAN (iCB70)	WLAN connection for Internet access, communication and data transfer
LTE (optional)	Internet access

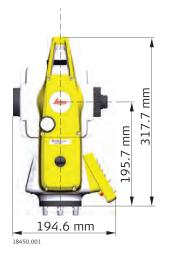
Pin assignments of the 5 Pin LEMO-0 port



- a Pin 1: Power input
- b Pin 2: not used
- c Pin 3: Single ground
- d Pin 4: RxD
 - (RS232, receive data, In)
- e Pin 5: TxD
 - (RS232, transmit data, Out)

Instrument dimensions

iCB50/iCB70





iCB70



Weight

Туре	Value
Instrument	4.3 kg - 4.5 kg (depending on hardware configuration)
Tribrach	760 g
Battery GEB331	110 g
Battery GEB361	340 g

Tilting axis height

Туре	Description
Without tribrach	196 mm
With tribrach (GDF111)	240 mm

Recording

Model	Memory Type	Capacity [MB]	Number of measurements
iCB50	Internal memory	800	90,000
iCB70	Internal memory	800	90,000

Laser plummet

Туре	Description
Туре	Visible red laser class 2
Location	In standing axis of instrument
Accuracy	Deviation from plumb line 1.5 mm at 1.5 m instrument height
Diameter of laser point	2.5 mm at 1.5 m instrument height

Power

Туре	Description
External supply voltage (via serial interface)	Nominal voltage 13.0 V DC Range 12.0 V - 15.0 V

Internal battery

Туре	Battery	Voltage	Capacity	Operating time, typically*
GEB331	Li-lon	11.1 V	2.8 Ah	≤ 15 h
GEB361	Li-lon	11.1 V	5.6 Ah	≤ 30 h

^{*} Based on a single measurement every 30 s at 25°C. Operating time may be shorter if battery is not new.

Environmental specifications

Temperature

Туре	Operating temperature [°C]	Storage temperature [°C]
All instruments	-20 to +50	-40 to +70
Battery	-20 to +50	-40 to +70
USB memory stick	-40 to +85	-50 to +95

Protection against water, dust and sand

Туре	Protection
All	IP66 (IEC 60529)
instruments	

Humidity

Туре	Protection
All instruments	Max 95% non condensing. The effects of condensation are to be effectively counteracted by periodically drying out the instrument.

Automatic corrections

The following automatic corrections are made:

- Line of sight error
- Tilting axis error
- Earth curvature
- Standing axis tilt
- Vertical index error
- Refraction
- Compensator index error
- Circle eccentricity

7.7

Scale Correction

Use of scale correction

By entering a scale correction, reductions proportional to distance can be taken into account.

- Atmospheric correction.
- Reduction to mean sea level.
- Projection distortion.

Atmospheric correction

The slope distance displayed is correct if the scale correction in ppm, mm/km, which has been entered corresponds to the atmospheric conditions prevailing at the time of the measurement.

The atmospheric correction includes:

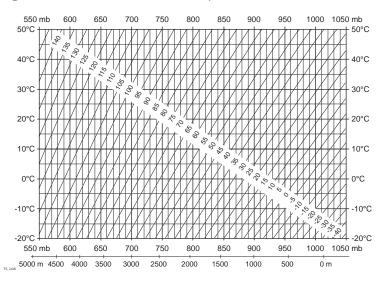
- Adjustments for air pressure
- Air temperature

For highest precision distance measurements, the atmospheric correction should be determined with:

- An accuracy of 1 ppm
- Air temperature to 1 °C
- Air pressure to 3 mbar

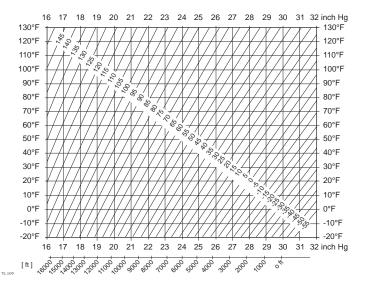
Atmospheric corrections °C

Atmospheric corrections in ppm with temperature [°C], air pressure [mb] and height [m] at 60% relative humidity.



Atmospheric corrections °F

Atmospheric corrections in ppm with temperature [°F], air pressure [inch Hg] and height [ft] at 60% relative humidity.



7.8

Reduction Formulas

Reflector types

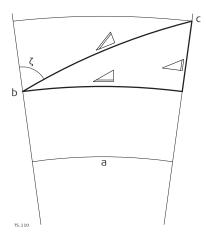
The reduction formulas are valid for measurements to all reflector types:

- To prisms
- To reflector tape
- · Reflectorless measurements

Slope distance - corrections

Corrections are applied on the instrument display and to all exported formats in the same way.

Formulas



- a Mean Sea Level
- b Instrument
- c Reflector
- ✓ Slope distance
- ∠ Horizontal distance
- ∠ Height difference

The instrument calculates the slope distance, horizontal distance, height difference in accordance with the following formulas:

$$\triangle = D_0 \cdot (1 + ppm \cdot 10^{-6}) + AC$$

∠ Displayed slope distance [m]

D₀ Uncorrected distance [m]

ppm Atmospheric scale correction [mm/km]

AC Additive constant of the reflector [m]

$$\underset{\mathsf{TS},112}{\underline{\hspace{1cm}}} = \mathsf{Y} - \mathsf{A} \cdot \mathsf{X} \cdot \mathsf{Y}$$

$$\Delta = X + B \cdot Y^2$$

∠ Horizontal distance [m]

∠ Height difference [m]

ζ Vertical circle reading

A $(1 - k / 2) / R = 1.47 * 10^{-7} [m^{-1}]$

B $(1 - k) / (2 * R) = 6.83 * 10^{-8} [m^{-1}]$

k 0.13 (mean refraction coefficient)

R $6.378 * 10^6$ m (radius of the earth)

Earth curvature (1/R) and mean refraction coefficient (k) are automatically taken into account when calculating the horizontal distance and height difference. The calculated horizontal distance relates to the station height and not to the reflector height.

Software Licence Agreement

Software Licence Agreement

8

This product contains software that is preinstalled on the product, or that is supplied to you on a data carrier medium, or that can be downloaded by you online according to prior authorisation from Leica Geosystems. Such software is protected by copyright and other laws and its use is defined and regulated by the Leica Geosystems Software Licence Agreement, which covers aspects such as, but not limited to, Scope of the Licence, Warranty, Intellectual Property Rights, Limitation of Liability, Exclusion of other Assurances, Governing Law and Place of Jurisdiction. Please make sure, that at any time you fully comply with the terms and conditions of the Leica Geosystems Software Licence Agreement.

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Appendix A

Directory Structure

Description

On the USB memory stick, files are stored in certain directories. The following diagram is the default directory structure.

Directory structure

I-- CODES

Import formats

 Possible import formats are *.cod, *.xml (LandXML, HeXML) and *.csv

Export formats

 Possible export format is *.xml (LandXML, HeXML).

|-- DATA

Import formats

- Background Image: Possible import format is *.dxf, *.jpg, and *.tiff.
- Control: Possible import formats are *.txt, *.csv, *.geo, *.gsi, and *.xml (LandXML, HeXML).
- Coordinate System: Possible import formats are *.lok, TRFSET.dat, *.xml (LandXML, HeXML), and Trimble.dc.
- Reference Data: Possible import formats are *.txt, *.csv, *.dxf, *.geo, *.gsi, *.xml (LandXML, HeXML), *.ifc, *.kof, and *.TRM.
- Road data: Possible import formats are *.L3D, *.lin, *.lmd, and *.xml (LandXML, HeXML).

Export formats

- Data: Possible export formats are *.csv, *.dxf, *.geo, *.gsi, *.xml (LandXML, HeXML), *.kof, *.llc, *.plm, and *.txt.
- Reports: Possible export formats are *.csv, *.html, *.pdf, and *.txt, depending on the report to export.
- Projects are exported as a copy to the memory device selected, Internal Memory or Removable Disk.
- Stakeout Lists: Possible export formats are
 *.txt, *.csv, *.gsi, *.geo, *.kof and *.dxf.

- |-- SYSTEM
- |-- PROJECTS
- |-- REPORTS

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