Leica DS4000

User Manual
Version 1.0
English

- when it has to be **right**

Leica Geosystems

PART OF HEXAGON

Introduction

Purchase

Congratulations on the purchase of the Leica DS4000.

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-portal.leica-geosystems.com/ > myDownloads

Product identification

The model and serial number of your product are indicated on the type label.

Always refer to this information when contacting your agency or Leica Geosystems authorised service centre.

Validity of this manual

This manual applies to the Leica DS4000.

Trademarks

- Windows® is a registered trademark of Microsoft Corporation in the United States and other countries
- The terms HDMI, HDMI High-Definition Multimedia Interface, HDMI trade dress and the HDMI Logos are trademarks or registered trademarks of HDMI Licensing Administrator, Inc.

All other trademarks are the property of their respective owners.

Available documentation

Name	Description/Format		
DS4000 Quick Guide	Provides an overview of the product together with technical data and safety directions. Intended as a quick reference guide.	✓	✓
DS4000 User Manual	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.	–	✓

Refer to the following resources for all DS4000 documentation/software:

- https://myworld-portal.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.

https://myworld-portal.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.

The availability of services depends on the instrument model.

Service	Description
My Products	Register 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 up-to-date with the latest documentation.
My Service	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.
My Support	Create new support requests for your products that will be answered by your local Leica Geosystems support team. View your complete support history and view detailed information on all your support requests.
Knowledge	Enter key words and start searching in our knowledge base. You can find FAQs (Frequently asked questions) as well as Knowledge articles for Leica Geosystems products.
Downloads	Downloads of software, manuals, tools, training material and news for Leica Geosystems products. Download the latest documentation and software to keep yourself and your products up-to-date. You can access downloads of software, manuals, tools, and training material.
Online Learning	Welcome to the home of Leica Geosystems online learning! There are numerous online courses – available to all customers with products that have valid CCPs (Customer Care Packages).
My SmartNet	Add and view your HxGN SmartNet subscriptions and user information. HxGN SmartNet delivers high-precision and high-availability GNSS network correction services in real-time and around the globe. The HxGN SmartNet Global family offers Network RTK with RTK bridging and Precise Point Positioning (PPP) services. These services work exclusively with Leica Geosystems GS smart antennas and receivers, providing the highest accuracy. Combined, they ensure HxGN SmartNet coverage everywhere.

Service	Description
My Trusted Services	Leica Geosystems Trusted Services offer you increased productivity while at the same time providing maximum security. New software services and state-of-the-art IT infrastructure offer a vast potential to optimise your workflow and increase your efficiency and productivity, both now and in the future.
My Security	Leica Geosystems Security delivers you total peace-of-mind in knowing that if your instrument is ever stolen, a locking mechanism is available to ensure that the instrument is disabled and can no longer be used.

Table of Contents

1 Safety Directions

1.1 General

Description

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.

Type	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.

Additional symbols

Warning against flammable substances.

Warning against explosive material.

Product must not be opened or modified or tampered with.

Indicates the temperature limits at which the product may be stored, transported or used.

1.2 Definition of Use

Intended use

- Detecting and localising underground utilities, such as cables or pipes.
- Measuring the depth of underground utilities.
- Recording Ground-Penetrating Radar (GPR) raw data and pairing with GNSS and TPS positioning systems.

Reasonably foreseeable misuse

- Disabling of safety systems
- Inadequate safeguards at the working site
- Modification or conversion of the product
- Removal of hazard notices
- Opening the product using tools, for example a screwdriver, unless this is permitted for certain functions
- Use after misappropriation
- Use of the product without instructions
- Use of products with recognisable damage or defects
- Use outside of the intended use and limits
- Use with accessories from other manufacturers without the prior explicit approval of Leica Geosystems

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 the product is used in accordance with the instructions
- To be familiar with local regulations relating to safety and accident prevention
- To stop operating the system and inform Leica Geosystems immediately if the product and the application become unsafe
- To ensure that the national laws, regulations and conditions for the operation of the products are respected
- To ensure that an appropriate training was completed successfully

⚠CAUTION

Safe and correct use of system

For the safe and correct use of the system, it is essential that:

- ▸ The system is only operated by personnel that have successfully completed the appropriate training. It is therefore strongly recommended that all personnel complete any training advised by Leica Geosystems before use.
- ▸ Leica Geosystems is not liable for any damages caused by untrained personnel and/or system misuse.

⚠CAUTION

Customer support

Evaluation of system installation

- ▸ The user is responsible for the evaluation of the system installation, location and the adaptation to the applicable vehicle. It is the users responsibility to decide on an installation plan to reduce potential hazards.
- ▸ Leica Geosystems is not liable for any damages caused by incorrect installation and/or system misuse.

1.5 Hazards of Use

Exposure to Radio Frequency (RF) Signals

The product is normally operated at least 1 m away from the user. At a distance of at least 1 m or greater, the typical power density level is below 1 $\mu W/cm^2$ (0.01 W/m^2). This value is far below the level specified by the current regulations.

☞ When operated in the normal manner of intended use, this product does not pose health or safety risks regarding radio frequency signals.

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.

⚠WARNING

Electric shock though working on or near live electrical utilities

This can lead to dangerous situations which may result in damage or personal injury.

Precautions:

- Do not exceed equipment's recommended ratings and instructions of use.
- Inspect equipment's cables and accessories for damage, do not use if faulty.
- Do not work on electrically live power utilities unless you are properly qualified.
- Use personal protective equipment rated for the utilities voltage and current.
- Familiarise yourself with National and Work regulations governing safety and accident prevention.

For the AC/DC power supply and the battery charger:

⚠WARNING

Electric shock due to use under wet and severe conditions

If unit becomes wet, it may cause you to receive an electric shock.

Precautions:

- If the product becomes humid, it must not be used!
- Use the product only in dry environments, for example in buildings or vehicles.

- Protect the product against humidity.

For the AC/DC power supply and the battery charger:

⚠WARNING

Unauthorised opening of the product

Either of the following actions may cause you to receive an electric shock:

- Touching live components
- Using the product after incorrect attempts were made to carry out repairs.

Precautions:

- ▸ Do not open the product!
- ▸ Only authorised Leica Geosystems Service Centres are entitled to repair these products.

For the AC/DC power supply and the battery charger:

⚠WARNING

Electric shock due to missing ground connection

If unit is not connected to ground, death or serious injury can occur.

Precautions:

- ▸ The power cable and power outlet must be grounded!

⚠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.

⚠CAUTION

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.

Precautions:

- ▸ 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.

⚠WARNING

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.

⚠WARNING

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.

⚠WARNING

Unauthorised opening of the product

Either of the following actions may cause you to receive an electric shock:

- Touching live components
- Using the product after incorrect attempts were made to carry out repairs

Precautions:

- ▸ Do not open the product!
- ▸ Only authorised Leica Geosystems Service Centres are entitled to repair these products.

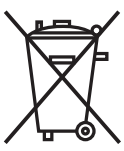
⚠WARNING

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.

Precautions:

- ▸ 

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.

Separate waste disposal of this product at the end of its useful life will be organised and managed by Leica Geosystems. When you decide to dispose of

the equipment, contact Leica Geosystems and follow the system that Leica Geosystems has set up to permit the separate collection of the apparatus at its life end.

Adequate separate collection for its subsequent recycling, treatment and environmentally friendly disposal contribute towards avoiding any unnecessary effects on the environment and to health and favour the reuse or recycling of the materials that make up the equipment. Unauthorised disposal of this product as unsorted waste by its possessor will lead to an administrative penalty foreseen by national regulations.

⚠WARNING

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.

1.5.1 For Lead Acid Batteries

⚠WARNING

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.
- Consider the product's IP class restrictions in chapter 7 Technical Data.
- Do not drop or immerse the product into fluids.

⚠WARNING

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/conductive objects.

⚠WARNING

Short circuit of battery terminals

Risk of fire, electric shock and damage.

Precautions:

- Do not open the battery housing.
- Keep away any metallic or wet objects from the battery terminals.

⚠WARNING

Damaged battery housing

There is a risk of fire. In case skin or eyes have come into direct contact with electrolytes leaking from the battery, rinse them thoroughly with clear water. Immediately contact a doctor.

Precautions:

- Stop using the battery.
- Turn off any charging in action.
- If any electrolytes should leak from a damaged battery, avoid skin contact and direct inhalation of gases.

⚠WARNING

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:

- 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.

⚠WARNING

Improper battery handling

Risk of fire, explosion or burn.

Precautions:

- Only replace battery with supported type.
- Prevent heating the battery above 70 °C.
- Never throw battery into fire.
- Do not disassemble, crush, or modify the battery.

⚠WARNING

Explosion hazard during charging

A highly explosive oxyhydrogen gas mixture occurs when charging batteries. Risk of injuries and environmental damage.

Precautions:

- Only charge the battery in well-ventilated areas.
- Only connect the battery to the battery charger when the charger is turned off.
- 

  Fires, sparks, naked lights and smoking are prohibited: Avoid causing sparks when dealing with cables and electrical equipment, and beware of electrostatic discharges. Avoid short-circuits.

⚠WARNING

Highly corrosive acid

Battery acid is highly corrosive. Risk of caustic burns. Risk of environmental damage.

Precautions:

- 

  During usage, charging and disposal:
  Wear protective gloves and eye protection. Do not tilt battery, acid can escape from the degassing openings or vents.

⚠WARNING

Charging battery outside temperature limits

Charging the battery at temperatures below 0 °C/+32 °F or above +40 °C/ +104 °F is not allowed since it may damage the battery.

Precautions:

- Respect the temperature limits when charging the battery.

⚠WARNING

Operating battery outside temperature limits

Operating the battery at temperatures below −20 °C/−4 °F or above +50 °C/ +122 °F is not allowed since it may damage the battery.

Precautions:

- Respect the temperature limits when operating the battery.

⚠CAUTION

Exposure to rain or water

Direct rain or water may damage and/or reduce lifetime of the battery.

Precautions:

- During outdoor use keep the battery in a rain protected place.

⚠CAUTION

Long-term storage

Long-term storage may reduce lifetime or damage the battery.

Precautions:

- During long-term storage, maintain battery life by periodic recharge.

1.6 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.

⚠CAUTION

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.
- The product is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

⚠CAUTION

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.

Precautions:

- Use only the equipment and accessories recommended by Leica Geosystems.
- When combined with the product, other accessories must 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 the function of the product may be disturbed in such an electromagnetic environment.

Precautions:

- Check the plausibility of results obtained under these conditions.

⚠CAUTION

Electromagnetic radiation due to improper connection of cables

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

Precautions:

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

⚠WARNING

Use of product with radio or digital cellular phone devices

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

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 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 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.

1.7 Conformity to National Regulations

Labelling DS4000

Frequency bands

Type	Inspection range [MHz]
UWB	80–1500

Radio Exposure Statement

In order to comply with RF Exposure requirements, this device must be used/installed to provide at least 20 cm separation from the human body at all times.

CH, DE, ES, FR, LI, PT, RO, SE

The use of Stream T system may be subject to a license and/or an authorization by the Competent Ministry of the country where the system will be used.

An individual license and restrictions are in place to date in the following European countries:

CH, LI	https://www.bakom.admin.ch/bakom/en/homepage/frequencies-and-antennas/frequency-use-with-or-without-licences/radiocommunication-licences-in-general.html
DE	https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Technik/InverkehrbringenvonProdukten/Schnittstellenbeschreibungen/OrtungsfunkOR/SSBOR_NN022.pdf?__blob=publicationFile&v=4
ES	https://www.boe.es/diario_boe/txt.php?id=BOE-A-2011-19146
FR	https://www.anfr.fr/en/broadcasting-authorisation/reseaux-professionnels/les-frequences-utilisees-a-titre-temporaire/les-systemes-dimagerie-radar-de-type-gpr-wpr/
PT	https://www.anacom.pt/render.jsp?categoryId=389647
RO	https://www.ancom.ro/radio-spectrum_2749
SV	https://www.pts.se/sv/bransch/radio/radiotillstand/ansokning-shandlingar/

For more details with reference to the restriction, please refer to the following website:

https://efis.cept.org/sitecontent.jsp?sitecontent=srd_regulations

EU

Hereby, Leica Geosystems AG declares that the radio equipment type DS4000 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.

Receiver test according to EN 302 066 v. 2.1.0

The unit has been tested according to the provision of the EN 302 066 v. 2.1.0. Specifically, for the receiver test (that tests the influence of an interferer signal to the device), the following performance criterion has been used (see ETSI TS 103 361 v.1.1.1) .

Performance criterion: The difference D between the R_x signal noise (increased by an interferer) and the maximum input signal for the R_x in the linear region of operation.

Level of performance: $D_{min} > 30$ dB

⚠CAUTION

This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

UKCA

Hereby, Leica Geosystems AG declares that the radio equipment type DS4000 is following the provisions of the applicable relevant statutory requirement S.I. 2017 No. 1206 Radio Equipment Regulations 2017.

Licensing requirements in UK can be found here: https://www.ofcom.org.uk/manage-your-licence/radiocommunication-licences/licensed-short-range

USA

FCC ID: UFW-AE4H

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

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

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, it may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user is required to correct the interference at his own expense.

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

Operation of this device is restricted to law enforcement, fire and rescue officials, scientific research institutes, commercial mining companies, and construction companies. Operation by any other party is a violation of 47 U.S.C. § 301 and could subject the operator to serious legal penalties.

Coordination Requirements:

(a) UWB imaging systems require coordination through the FCC before the equipment may be used. The operator shall comply with any constraints on equipment usage resulting from this coordination.

(b) The users of UWB imaging devices shall supply detailed operational areas to the FCC Office of Engineering and Technology who shall coordinate this information with the Federal Government through the National Telecommunications and Information Administration. The information provided by the UWB operator shall include the name, address and other pertinent contact information of the user, the desired geographical area of operation, and the FCC ID number and other nomenclature of the UWB device. This material shall be submitted to the following address:

Frequency Coordination Branch., OET
Federal Communications Commission
445 12th Street, SW
Washington, D.C. 20554
ATTN: UWB Coordination

(c) The manufacturers, or their authorized sales agents, must inform purchasers and users of their systems of the requirement to undertake detailed coordination of operational areas with the FCC prior to the equipment being operated.

(d) Users of authorized, coordinated UWB systems may transfer them to other qualified users and to different locations upon coordination of change of ownership or location to the FCC and coordination with existing authorized operations.

(e) The NTIA/FCC coordination report shall include any needed constraints that apply to day-to-day operations. Such constraints could specify prohibited areas of operations or areas located near authorized radio stations for which additional coordination is required before operation of the UWB equipment. If additional local coordination is required, a local coordination contact will be provided.

(f) The coordination of routine UWB operations shall not take longer than 15 business days from the receipt of the coordination request by NTIA. Special temporary operations may be handled with an expedited turn-around time when circumstances warrant. The operation of UWB systems in emergency situations involving the safety of life or property may occur without coordination provided a notification procedure, similar to that contained in CFR47 Section 2.405(a)-(e), is followed by the UWB equipment user.

NOTICE

Use of this device as a wall imaging system is prohibited by FCC regulations.

☞ **This form is only for Domestic United States users.**

The Federal Communications Commission (FCC) requires that all users of GPR who purchased antennas after July 15th, 2002 register their equipment and areas of operation. It is required that you fill out this form and fax or mail to the FCC.

Failure to do this is a violation of Federal law.

1. Date:
2. Company name:
3. Address:
4. Contact Information [contact name and phone number]:
5. Area of operation [state(s)]:
6. Equipment Identification:

Brand:	Leica Geosystems AG
Model:	DS4000
FCC ID:	UFW-AE4H

7. Receipt date of equipment:

Fax this form to the FCC at: 202-418-1944 or mail to:

Frequency Coordination Branch., OET
Federal Communications Commission
445 12th Street, SW
Washington, D.C. 20554
ATTN: UWB Coordination

☞ Do not send this information to Leica Geosystems AG.

Canada

CAN ICES-003(Class A)/NMB-003(Class A)
IC: 8991A-AE4H

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 du dispositif

CANADIAN REPRESENTATIVE

Company Name :	Leica Geosystems Ltd
CN Number :	3177B
Contact Name :	Mario Hidalgo
Address :	3761 Victoria Park Avenue, Unit 1 Scarborough Ontario
Telephone No :	+1 520 348 7580
Email :	mario.hidalgo@hexagon.com

UAE

23-07-79569/E23-07-081739/NB 0002

Others

The conformity for countries with other national regulations has to be approved prior to use and operation.

1.8 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**.

☞ There are guidelines on **How to carry** and **How to ship** products with Lithium batteries. Before any transportation of a Leica product, we ask you to consult the guidelines on the web page (IATA Lithium Batteries) 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.

2 Description of the System

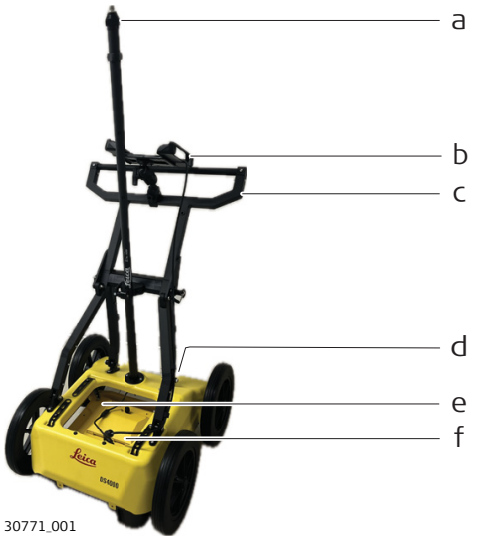
2.1 General

Area of application

The DS4000 system is intended for localising and mapping underground utilities and can therefore be used for civil engineering and utility surveying applications.

2.2 System Components

Overview



a GNSS antenna pole support
GNSS is not included.
b Laptop holder
PC Laptop is not included.
c Handle and rudder
d DS4000 main body
Including frame, one wheel encoder, four A310 wheels
e Antenna top
f Battery compartment
Battery charger comes in a separate box.

2.3 Delivery Contents

☞ The delivered components depend on the package ordered.

DS4000 starter kit

The basic kit of DS4000 starter includes the following items:


DS4000 cart


DS4000 antenna with sledge


Four A310 wheels (airless)


Four antenna lifting belts


Tablet holder


One clamp for tablet holder


One LAN cable


Two quick release lock pins 72-12

One GEB364 battery

GKL311 battery charger

DS4000 surveyor kit

Additionally to the DS4000 starter kit items, the DS4000 surveyor kit includes:

GNSS pole

GNSS pole support
Included:

- 2 screws
- 2 washers
- 2 nuts

GAD50, TPS adaptor

Four A380 off-road wheels used for rough surface terrain
Exchangable with A310 wheels
Difference to A310 standard wheels:

- Wider diameter
- Larger "shoulders"

Shipping Box

The shipping box is an optional item allowing you to store, and safely ship, the DS4000.

☞ The GNSS pole support does not fit inside.

2.4 General Battery Handling

Charging / first-time use

- For new batteries or batteries that have been stored for a long time (> three months), we recommend performing 3 to 5 charge/discharge cycles

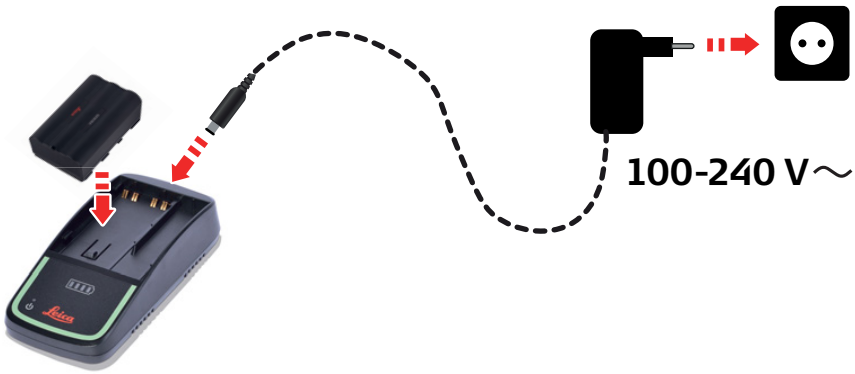
- The battery must be charged before using it the first time, because it is delivered with an energy content as low as possible or might be in sleep mode.
- The permissible temperature range for charging is from 0 °C to +40 °C/ +32 °F to +104 °F. For optimal charging, we recommend charging the batteries 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

Operation/discharging

- The batteries can be operated from −20 °C to +50 °C/−4 °F to +122 °F
- Low operating temperatures reduce the capacity that can be drawn; high operating temperatures reduce the service life of the battery

Charging the battery

1. Connect the battery to the battery charger and the battery charger to a mains socket.



30960_001

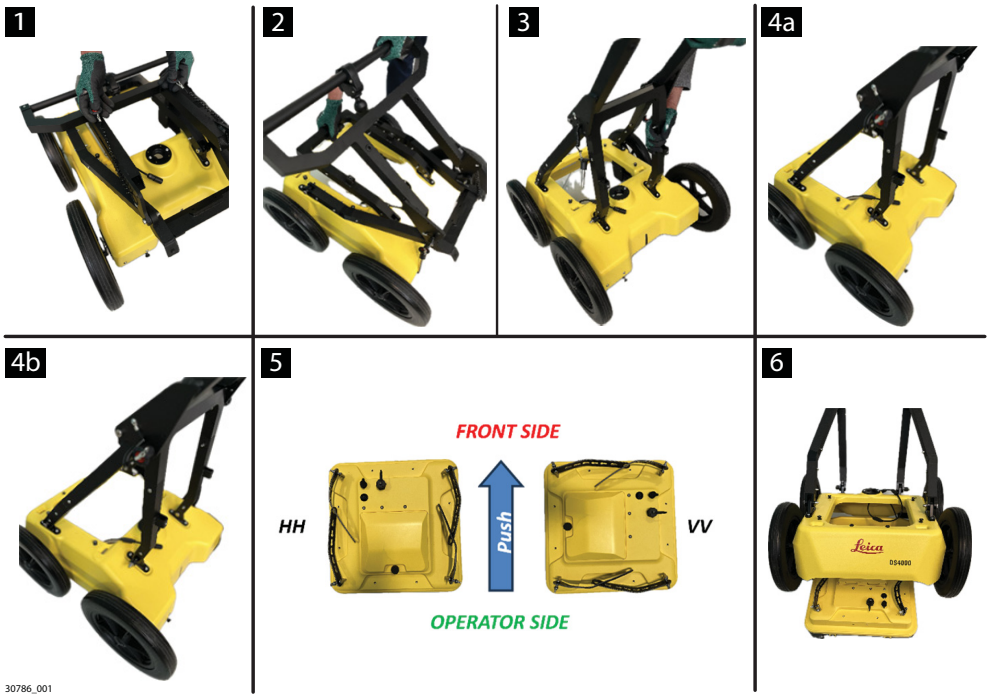
2. While charging, the green LED flashes, increasing from one to four LED until fully charged.

☞ Eight hour (acquisition), with two batteries. Extended, by the hot swap capability.

3 Setup

3.1 How to Set Up DS4000 Starter Kit

Step-by-step



	Take the DS4000 out of the Card box or the Hard shipping box, if purchased.
1.	Remove the pins fastening the rudder on top of the “U-frame”.
2.	Unfold the rudder upward, by holding the handle.

3.	Lean the horizontal bar of the rudder against the “U-frame” to support the rudder itself.
4.	a) Enter the two pins inside the two holes on the side of the rudder, next to the horizontal bar. b) Fasten the rudder against the “U-Frame”.
5.	Place the DS4000 antenna on the floor, before the cart, and choose the polarization (orientation) of the antenna: • **Polarization HH (left image)** LAN and wheel connector towards the front of the system or towards the operator • **Polarization VV (right image)** LAN and wheel connector towards the left (or right) side of the operator
6.	Place the DS4000 cart on top of the antenna (HH-oriented in the image).
7.	Enter the four antenna belts into the four holes at each corner of the cart.
8.	Fix the antenna belts to the four pins on top of the cart. Six slots are available on each belt. The height of the bottom of the antenna from the ground depends on the slot used to fix the antenna to the cart.
9.	Plug the wheel cable into the wheel connector on top of the antenna.
10.	Plug the LAN cable into the LAN connector on top of the antenna.
11.	Open the battery compartment and enter the battery.
12.	Attach the clamp for the tablet holder on the square bar on top of the rudder and attach the tablet holder.
13.	Place the tablet on the tablet holder and plug the LAN cable to the LAN port.
14.	The setup is completed. No field PC is shown.

Step-by-step

1.	Starting from the Starter kit set-up, release the rudder from the U-frame by removing the two pins on the side.
2.	Fold back the rudder on top of the U-frame to a horizontal position to the top of the cart.
3.	Place the GNSS support in the center of the horizontal bar of the rudder by fitting the two screws inside the two holes.
4.	Fix the two screws against the two bolts and washers provided with the kit. Use an Allen key #4 on screw side and a socket wrench on the bolt side.
5.	Place the rudder and the U-frame in the original position (vertical) and enter the two pins on the side of the rudder.
6.	Fit the GNSS pole inside the support mounted on the rudder.
7.	a) Remove the A310 wheels by pressing the button in the center of the wheel. b) Gently pull the wheels outwards.

8. Replace the A310 wheels just removed, by the A380 wheels.
Do the same operation as before but pushing instead of pulling.
Repeat the same operation for the four wheels

9. The setup is completed. No field PC is shown.

3.3 How to Put the DS4000 into the Shipping Box

Step-by-step

1

2

3

30964_001

1. Place the DS4000 antenna into the shipping box.
Carefully place the cart on top of the antenna and into the shipping box.
Install each pin on the top rudder to secure them in the U-frame.

2. Place the A310 wheels in the foam of the cover and secure them using the velcro.

3. The components correct in shipping box.

4 Planning a Survey

Jobsite Investigation

To carry out a survey with the DS4000 in the most efficient way, gather all available information before each project:

- Make yourself familiar with the jobsite features.
- Obtain technical maps, recommended in DXF format, about existing utilities on the jobsite.
- Supplement the acquired scan data by opening manholes on-site.

☞ Be cautious when performing site investigation and make sure to adhere to local laws for safety.

Jobsite Features

The basic requirement for carrying out a survey is understanding the features of the jobsite. When gathering information about the jobsite, keep in mind the objectives of the survey. Consider the following points when preparing the survey:

- Do you need any specific permissions to carry out the survey on the jobsite, for example, access permission to pedestrian zones or permission to interrupt the traffic flow?
- Are there any difficulties in accessing the jobsite? (Available space, any architectural features forming an obstacle, etc.).
- Is the jobsite in an area with a high level of urban traffic, such as streets, squares or pavements? Are there parked cars that could be in the way during the survey?

Technical Maps of existing utilities

Technical maps of existing utilities are normally created by public utility companies. Such maps give a schematic overview about the type and position of utilities that are constructed and managed by the public utility companies. Even if these maps are generic, they can give a first impression of the existing utilities and provide additional information during the data acquisition and interpretation phase.

☞ To obtain technical maps of the jobsite, contact the cartographic or planning office of the different utility companies. Clearly specify the streets and areas of interest. Request the maps early enough in advance to the survey, to ensure that the maps are available for the data acquisition phase.

The following list contains the most important types of utilities that need to be considered:

- Street lights
- Low, medium and high-voltage electricity cables
- Telephone cables
- Gas pipes
- Water supply pipes
- Sewage pipes

Opening manholes

Once data acquisition is complete, opening the manholes on-site can provide you with further information regarding depth, diameter and direction of the utility. This information serves as reference data during the interpretation phase.

5 How to Work On Site with the DS4000

How to Work On Site with the DS4000

The DS4000 is a Leica Geosystems system that can be deployed on site including several positioning systems (Quick Scan, Grid, GNSS, TPS modes). Its structure is designed with the aim to cover the largest possible applications and field conditions.

5.1 How to Setup the DS4000 in HH or VV Polarisation

How to setup the DS4000 in HH or VV Polarisation

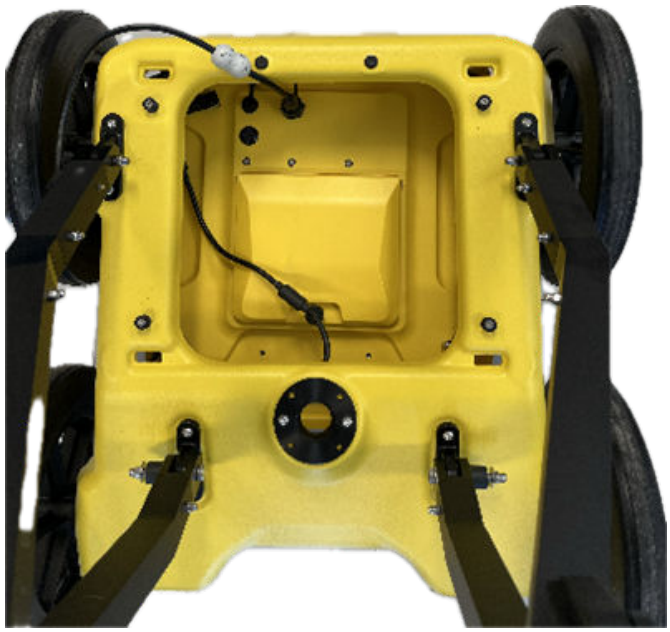
The DS4000 can be deployed in two different orientations of the antenna, namely in horizontal, internal dipoles perpendicular with respect to the push/pull direction (HH Polarisation) or vertical, internal dipoles parallel with respect to the push/pull direction (VV Polarisation).

HH Polarisation acquisition mode:

Front of the antenna (with respect to direction of acquisition) with the battery compartment opposite to the operator (or towards the operator).

Front side

Front side



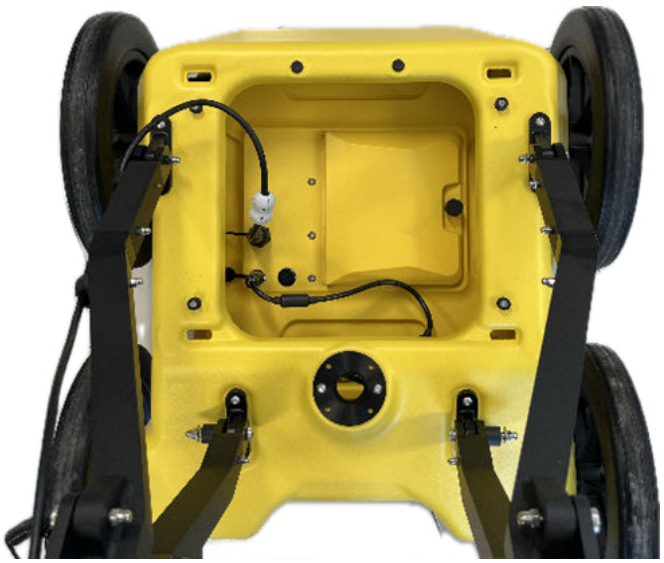
Operator side

VV Polarisation acquisition mode:

Front of the antenna (with respect to direction of acquisition) with the battery compartment right to the operator (or left to the operator).

Front side

Front side



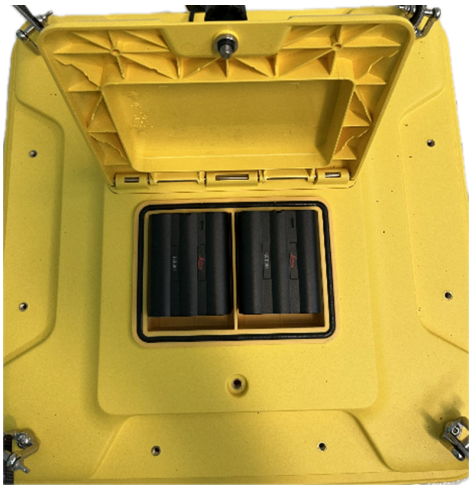
Operator side

☞ DS4000 top view.

5.2 How to Connect the Field PC and the DS4000 Antenna

How to connect the field PC and the DS4000 antenna

The connection between the field PC (where the UMap-Logger and the data acquisition software, are installed) and the DS4000 antenna is done through the LAN cable. The steps to start up the system before commencing any data acquisition on site are:

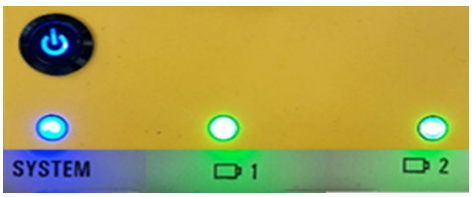


1. Open the battery compartment on the top of the antenna case and insert the battery.

   ☞ The DS4000 can operate with one battery only, but with a reduced field operation time. Battery hot swap is possible.

2. Close the battery compartment.

3. Connect the field PC and the DS4000 antenna through the provided LAN cable. One side to the DS4000 antenna LAN connector, the opposite side to the LAN port of the field PC.

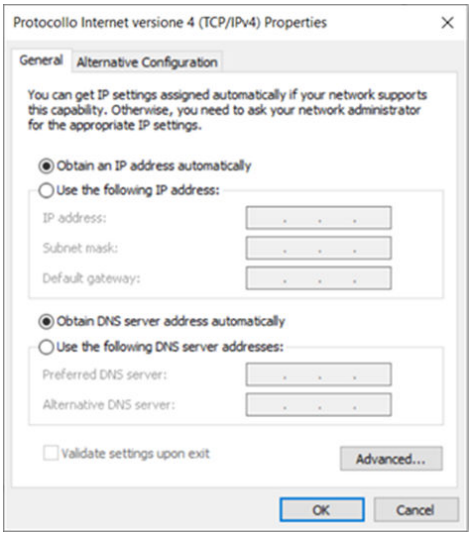


4. Press the O/I button next to the battery compartment to start up the DS4000 antenna.

   ☞ The O/I button turns blue.

   DS4000 antenna LED status is:

   - System LED Blue: DS4000 antenna powered but not connected to field PC.
   - Battery 1 LED Green: Fully charged.
   - Battery 2 LED Green: Fully charged.



5. Turn on the field PC where the UMap-Logger software is installed.

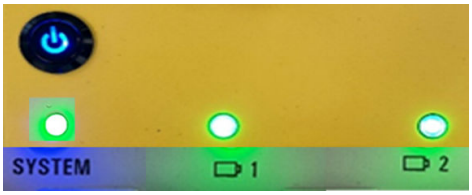
   ☞ Refer to the specific UMap-Logger software user manual for details of installation (firewall and antivirus must be OFF). The IP address of the Ethernet port of the field PC must be set to DHCP (Dynamic mode and NOT Static IP address).

6. Turn on UMap-Logger.

7. Select the **Radar** Settings icon of the software main page.

8. Select **DS4000** from the **Radar Configuration** drop-down menu.

9. Select **Update**, and the connection between the DS4000 antenna and the field PC is established.



10. DS4000 antenna LED status is now:
    - System LED Green: DS4000 antenna powered and connected to field PC.
    - Battery 1 LED Green: Fully charged.
    - Battery 2 LED Green: Fully charged.

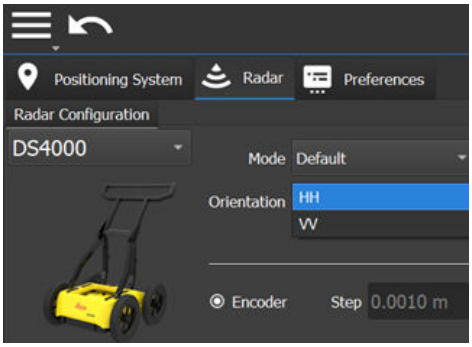
☞ The DS4000, is now ready to be used on site for data acquisition.

5.3 How to Collect DS4000 Data in Quick Scan Mode

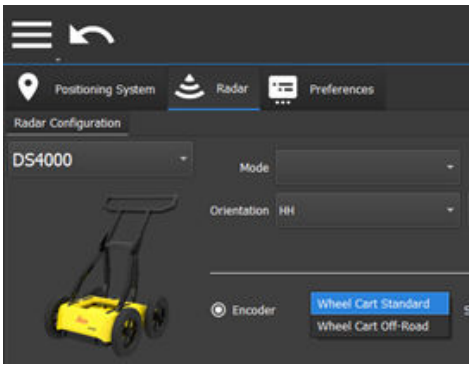
How to collect DS4000 data in Quick Scan mode

The steps to start gathering data in Quick Scan mode are:

1. Follow all steps described in the section 5.1 and 5.2.

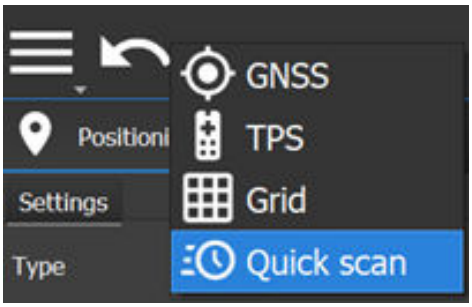


2. Select the antenna orientation (**HH** or **VV**), from the **Orientation** drop-down menu.



3. Select **Encoder** type (depending on if A310 or A310 wheels are installed).

4. Select the **Positioning System** icon, to switch to the **Positioning System** drop-down menu.

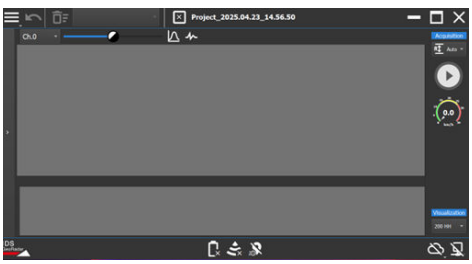


5. From the drop-down menu of the Positioning System tab, select the **Quick Scan** mode.

6. Go back to the previous page, by selecting the icon.

7. Select the **New Project** icon, to start a new Project window.

8. In the Project window:



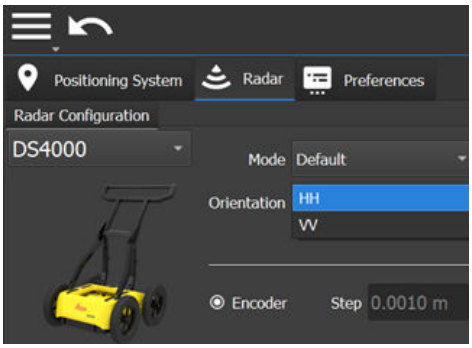
9.	Select **Play**, to start the acquisition.
10.	Select **Stop Acquisition**, to close the swath acquisition.
11.	Select **Close Current Project**, to close the active project.
☞	Refer to the specific uMap-Logger software user manual, for details of any specific software tools.

5.4 How to Collect DS4000 Data in Grid Mode

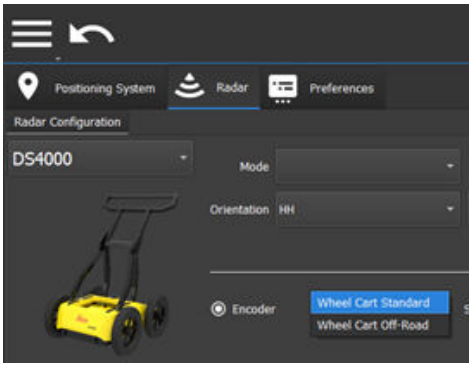
How to collect DS4000 data in Grid mode

The steps to start gathering data in Grid mode are:

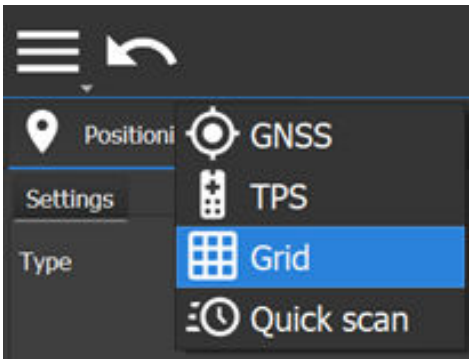
1.	Follow all steps described in the section 5.1 and 5.2.



2.	Select the antenna orientation (**HH** or **VV**), from the **Orientation** drop-down menu.



3.	Select **Encoder** type (depending on if A310 or A380 wheels are installed).
4.	Select the **Positioning System** icon, to switch to the **Positioning System** drop-down menu.



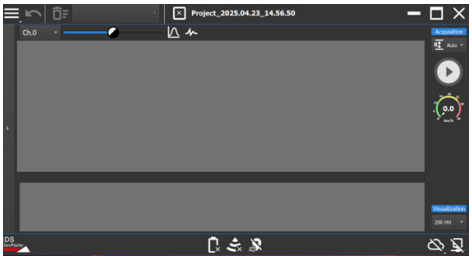
5. From the drop-down menu of the **Positioning System** tab, select the **Grid** mode.

6. Go back to the previous page, by selecting the icon.

7. Select the **New Project** icon, to start a new Project window.

8. Customise the Grid trajectory, based on the project specification and use the tools described in the UMap-Logger software user manual.

9. In the Project window:



10. Select **Play**, to start the acquisition.

11. Select **Stop Acquisition**, to close the swath acquisition.

12. Select **Close Current Project**, to close the active project.

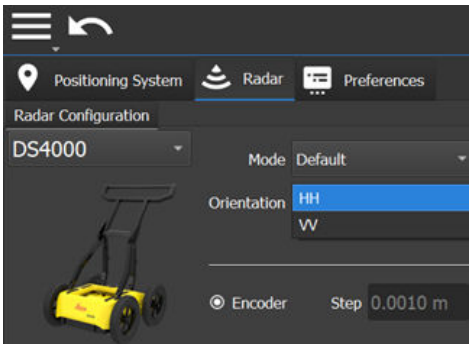
☞ Refer to the specific UMap-Logger software user manual, for details of any specific software tools.

5.5 How to Collect DS4000 Data in GNSS Mode

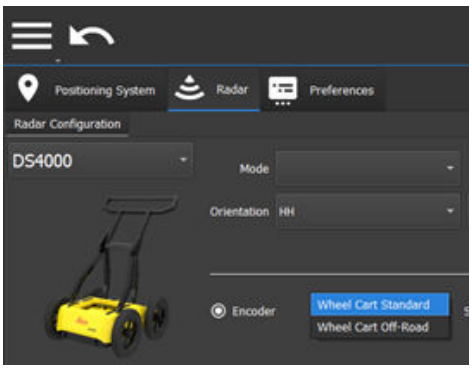
How to collect DS4000 data in GNSS mode

The steps to start gathering data in GNSS mode are:

1. Follow all steps described in the section 5.1 and 5.2.

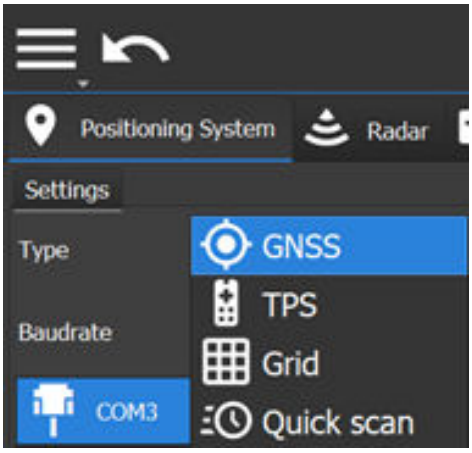


2. Select the antenna orientation (**HH** or **VV**), from the **Orientation** drop-down menu.



3. Select **Encoder** type (depending on if A310 or A380 wheels are installed).

4. Select the **Positioning System** icon, to switch to the **Positioning System** drop-down menu.

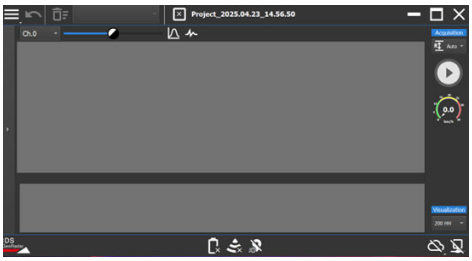


5. From the drop-down menu of the **Positioning System** tab, select the **GNSS** mode.

6. Go back to the previous page, by selecting the icon.

7. Select the **New Project** icon, to start a new Project window.

8. In the Project window:



9. Select **Play**, to start the acquisition.

10. Select **Stop Acquisition**, to close the swath acquisition.

11. Select **Close Current Project**, to close the active project.

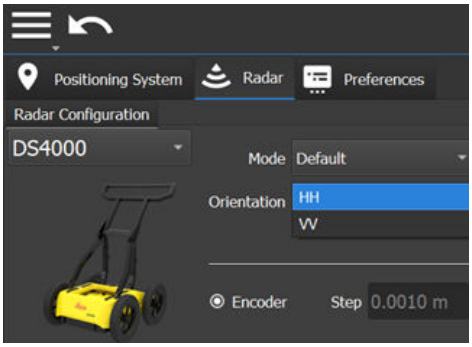
☞ Refer to the specific UMap-Logger software user manual, for details of any specific software tools.

5.6 How to Collect DS4000 Data in TPS Mode

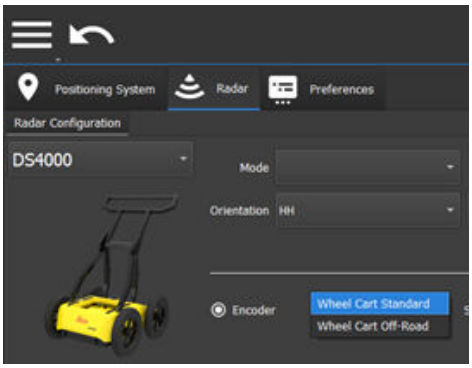
How to collect DS4000 data in TPS mode

The steps to start gathering data in TPS mode are:

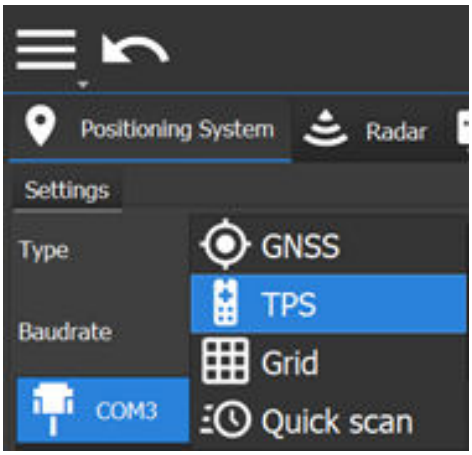
1. Follow all steps described in the section 5.1 and 5.2.



2.	Select the antenna orientation (**HH** or **VV**), from the **Orientation** drop-down menu.

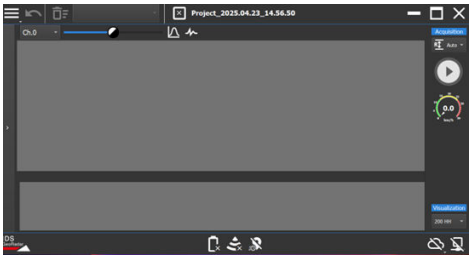


3.	Select **Encoder** type (depending on if A310 or A380 wheels are installed).
4.	Select the **Positioning System** icon, to switch to the **Positioning System** drop-down menu.



5.	From the drop-down menu of the **Positioning System** tab, select the **TPS** mode.
6.	Go back to the previous page, by selecting the icon.
7.	Select the **New Project** icon, to start a new Project window.

8. In the Project window:



9.	Select **Play**, to start the acquisition.
10.	Select **Stop Acquisition**, to close the swath acquisition.
11.	Select **Close Current Project**, to close the active project.
☞	Refer to the specific UMap-Logger software user manual, for details of any specific software tools.

6 Care and Transport

6.1 Transport

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.

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.

Storage

- 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
- The batteries can be stored from −20 °C to +50 °C/−4 °F to +122 °F

Charger and AC/DC power supply

- Keep chargers and AC/DC power supply away from excessive dirt, dust and contaminants
- After unpacking the product, visually inspect the charger for possible damages
- Unplug the product from the outlet before attempting any maintenance or cleaning

⚠WARNING

Risk of electric shock during cleaning and drying

If the product is turned on during cleaning or drying you may receive an electric shock.

Precautions:

- ▸ • Ensure that all cables are disconnected, including the power supply cable.
  - Before cleaning the product, turn off the product and all other devices connected to the product.
  - Ensure that the product is dry before reconnecting cables and turning on the product.

DS4000

Use only a damp cloth for cleaning.

Do not use solvents or abrasive detergents.

☞ Before cleaning any of the external parts of the product, unplug all cables and wires, including the power supply cable.

☞ Wait until the equipment is totally dry before reconnecting cables.

NOTICE

Wet cleaning cloth

Causes damage to electrical components of the equipmenty.

Precautions:

- ▸ Use only a damp cloth.

Product and accessories

- 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.

Battery charger

Use only a clean, soft, lint-free cloth for cleaning.

Cables and plugs

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

Connectors and Encoders

If the system is dirty, connectors and encoders may not work properly.

After field work, check the conditions of connectors and encoders and clean them if necessary.

☞ Do not apply liquid directly to the electrical contacts of the various connectors.

NOTICE

Inappropriate cleaning products

Cause damage to electrical components.

Precautions:

- Use only a damp cloth.
- Verify if the cleaning products are compliant with electronic devices.

Connectors with dust caps

Wet connectors must be dry before attaching the dust cap.

NOTICE

Flammable spray

Cause damage to electrical components.

Precautions:

- Verify if the spray is compliant with electronic devices.

7 Technical Data

7.1 General

Dimensions

Type	Dimension
DS4000 (operating mode)	750 × 625 × 1000 mm (30 × 25 × 40 in)
DS4000 (transport mode)	750 × 625 × 420 mm (30 × 25 × 17 in)

Weight

Type	[kg]
DS4000	20

Control Unit

	Specifications
Power Consumption (standby)	12 W
Power Consumption (acquisition)	16 W

☞ Extended, by hot swap capability.

Dual-frequency antenna

	Specifications
Number of Hardware Channels	2
Antenna Central Frequencies	200 MHz and 900 MHz
Antenna Orientation	HH and VV (depending on acquisition mode)

Battery for control unit

Type	Rechargeable Li-ion Battery
Voltage	10.8 V
Capacity	6.9 Ah

Environmental specifications

Temperature

Type	Operating temperature	Storage temperature
DS4000	−20 °C to +50 °C −4 °F to 122 °F	−20 °C to +50 °C −4 °F to 122 °F
GEB364 battery	Charging: 0 °C to +50 °C +32 °F to +122 °F Discharging: −20 °C to +60 °C −4 °F to 140 °F	−40 °C to +70 °C −40 °F to +158 °F
GKL311 charger	−0 °C to +50 °C +32 °F to +122 °F	−40 °C to +70 °C −40 °F to +158 °F

Protection against water, dust and sand

Type	IP class
DS4000	IP65 (IEC 62368-1)
GEB364 battery	IP54 (IEC 60529)
GKL311 charger	Only operate in dry environments, for example in buildings and vehicles.

Humidity

Type	Protection
DS4000 GEB364 battery GKL311 charger	Max 95% non-condensing. The effects of condensation are to be effectively counteracted by periodically drying out the instrument.

8 Software Licence Agreement/Warranty

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Open Source information

The software on the product may contain copyright-protected software that is licenced under various open source licences.

UMap-Logger software uses the following Open Source library:

- qt-opensource-windows-x86-5.15.5

Copies of the corresponding licences

- are provided together with the product (for example in the About panel of the software)
- can be downloaded on https://idsgeoradar.com/about-us/compliance-standards/open%20source%20data

If foreseen in the corresponding open source licence, you may obtain the corresponding source code and other related data on https://idsgeoradar.com/about-us/compliance-standards/open%20source%20data.

Contact
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- when it has to be right

Leica Geosystems