

Leica DSX



User Manual
Version 1.0
English

- when it has to be **right**

Leica
Geosystems

Introduction

Purchase

Congratulations on the purchase of the Leica DSX.



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.

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.

Product identification

This manual applies to the DSX instruments.

Differences between the versions are marked and described.

Trademarks

- Windows is a registered trademark of Microsoft Corporation in the United States and other countries
- Google is a registered trademark of Google Inc.

All other trademarks are the property of their respective owners.

Available documentation

Name	Description/Format	
DSX User Manual	To operate the instrument to a basic level all instructions required, are included in the User Manual. Provides an overview of the instrument together with technical data and safety directions.	- ✓
DSX Quick Guide	Short introduction for setting up the DSX.	✓ ✓

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

- the Leica USB stick
- <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 up-to-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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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.

1.2

Definition of Use

Intended use

- Data communication with external appliances
- Carrying out measurement tasks using various GNSS measuring techniques
- Remote control of product
- Validating user-input utilities based on the processed data
- Locating utilities and estimating the depth
- Detecting both metallic and non-metallic underground utilities

Reasonably foreseeable 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 obvious damages or defects.
- Use with accessories from other manufacturers without the prior explicit approval of Leica Geosystems.
- 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.



The following advice is only valid for battery charger, power adapter and car adapter.

Environment

Suitable for use in dry environments only and not under adverse 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

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 $1 \mu\text{W}/\text{cm}^2$ ($0.01 \text{ W}/\text{m}^2$). 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.



To ensure that the radio modem is not operated without the permission of the local authorities on frequencies and/or output power levels other than those specifically reserved and intended for use without a specific permit, the internal and external radio modems have been designed to operate on frequency ranges and output power ranges. The exact use of the frequency ranges differs from one region and/or country to another.

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.

WARNING

Folding the handle

Risk of crushing hands and fingers.



Precautions:

- Keep hands and fingers clear from crossing parts when folding handle to avoid crushing.

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 Leica Geosystems authorised service centres are entitled to repair these products.

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 Leica Geosystems authorised service centres are entitled to repair these products.

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:

- ▶ 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.

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. Do not drop or immerse batteries 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 objects.

WARNING

Short circuit of battery

Risk of fire, electric shock and damage.

Precautions:

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

WARNING

Battery pack of the signal transmitter may get hot after prolonged use.

Risk of burning injuries.

Precautions:

- ▶ Avoid touching the hot battery pack.
- ▶ Allow the battery pack to cool down before removing it.

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.

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

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.

CAUTION

Before any cleaning procedure, ensure that the instrument is switched off and the battery has been removed.

CAUTION

Unused connectors must be protected using the attached dust cap.

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.

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.

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, 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.

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, 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.

WARNING

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.

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 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.

1.7

FCC Statement, Applicable in U.S.



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

FCC ID: RFD-CTDSX

This device complies with part 15 of the FCC Rules.

Operation is subject to the following conditions:

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

CAUTION

Changes or modifications

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

- ▶ Do not change or modify this unit without approval by the party responsible for compliance!

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.

⚠ CAUTION

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

Labelling DSX



1.8

Requirements of RSS-220 for Ground Antennas (EN/FR), Applicable in Canada

IMPORTANT NOTE FOR THE CANADIAN CUSTOMERS

Canada Compliance Statement

IC Certification Number: **3177A-CTDSX**

This device complies with the requirements of IC Standard RSS-220.

This Ground Penetrating Radar Device shall be operated only when in contact with or within 1 m of the ground.

This Ground Penetrating Radar Device shall be operated only by law enforcement agencies, scientific research institutes, commercial mining companies, construction companies, and emergency rescue or firefighting organizations.

NOTE IMPORTANTE POUR LES UTILISATEURS CANADIENS

Canada Compliance Statement

Numéro de certification : **3177A-CTDSX**

Cet appareil est conforme aux exigences de la norme RSS IC-220.

Cet équipement géoradar doit être utilisé que lorsqu'il est en contact ou à moins de 1 mètre du sol.

Cet équipement géoradar doit être utilisé que par des organismes d'application de la loi, des instituts de recherche scientifique, des sociétés minières commerciales, des entreprises de construction et de secours d'urgence ou les organisations de lutte contre les incendies.

CANADIAN REPRESENTATIVE

Company Name : Leica Geosystems Ltd

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2.1**General****Area of application**

The DSX system is designed to detect and locate both metallic and non-metallic underground utilities. It provides georeferenced utility maps in survey-grade accuracy when a supported positioning system is used.

2.2**System Components****DSX System**

The DSX system consists of the following components:



- a GNSS antenna or Total Positioning System (TPS)
- b Tablet with DXplore software
- c DSX utility detection radar

2.3**Delivery Contents**

The delivered components depend on the package ordered.

Starter/Surveyor kit

The starter DSX kit includes the following components:

- DSX utility detection radar
- Battery charger with switchable plug heads
- AC/DC adapter
- TC1000 tablet cradle
- Two ram balls with a double socket arm
- Tightening screws
- Grid assistance square
- Leica USB key of DXplore software and the User Manual

The surveyor kit will include the starter kit plus one additional component:

- Pole support with two brackets and two clamps



Other components of the DSX system need to be purchased separately.

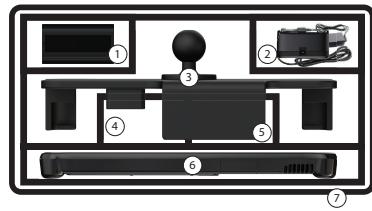
DSX



Description of the main components

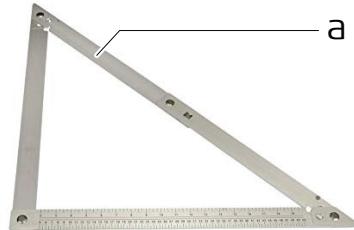
Component	Description
Single-frequency antenna	The 600 MHz antenna detects underground utilities up to a depth of 2 m, depending on the soil conditions.
Control unit	The control unit communicates with the positioning systems, the tablet and the encoders to ensure the entire system is working together correctly.
Encoders	The encoders are used for measuring the distance travelled from the starting point of a scan. The measured distance is constantly transferred to the control unit. The encoders are positioned inside the rear wheels of the DSX to ensure correct measurements even in rough terrain, when sometimes only one wheel is touching the ground.
Handle	The handle of the DSX can be adjusted both in height and inclination. For easy transport of the DSX, the handle can be folded up. The LAN cable for connecting to the tablet is by the right handle
Wheels	DSX is using solid rubber tires which do not require pumping.
Support tablet	The support is designed to hold a Getac CT1000 tablet. The inclination of the support can be adjusted to the optimal viewing angle.
Pole support (surveyor kit only)	The pole support includes two clamps and two brackets. Both clamps will be attached to the pole and the brackets mounted to the handle and housing.

Components inside the accessories bag



- a DSX battery
- b Charger and plug adapter
- c Cradle
- d CT1000 charger
- e Pole support
- f CT1000 tablet
- g Accessories bag (symbolised)

Components outside the accessories bag



0019635_001



a Grid assistance square



Charging

The permissible temperature range for charging is between 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.

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.

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.

Charging the battery



The DSX battery is removable from the battery compartment and is chargeable.



You cannot turn on the DSX while the battery compartment is empty.

1.

- Place the battery in the charger and use the appropriate plug head before charging.



2. While charging, the LED of the battery charger lights up orange. When the battery is nearly charged, the LED turns yellow. When the battery is fully charged, the LED turns green.

2.7

Requirements for Using a GNSS Antenna with the DSX

Requirements

The DSX can be used with a GNSS antenna to position the radar-scanning data in an absolute coordinates system and to receive real-time positional corrections while the DSX cart is moving and collecting data.

The antenna should fulfill the following requirements:

- Multi-frequency (L1 + L2+ L5)
- Positioning update greater than 5 Hz
- Bluetooth
- RTK (Real-Time Kinematic) reference station functionality
- RTK network
- Unlimited RTK range
- DGPS/RTCM



Refer to the equipment list for compatible models.

For the best result achieved, we recommend using a Variable "fix_GS18_T" not defined. and Leica Variable "fix_iCON_gps_70_T" not defined. antenna with tilt compensation activated

Procedure for setting up the DSX

The setup procedure of the DSX consists of the following steps:

- Unfolding and adjusting the handle (refer to "3.1 Unfolding and Adjusting the Handle")
- Inserting the battery (refer to "3.3 Inserting the Battery")
- Attaching and connecting the CT1000 tablet (refer to "3.2 Attaching and Connecting the Laptop or Tablet")
- Mounting the pole support (optional; refer to "3.4 Mounting the Pole Support (Surveyor Kit Only)")
- Calibrating the encoders (refer to "3.6 Calibrating the Encoders")

3.1

Unfolding and Adjusting the Handle

Unfold and adjust the handle

1



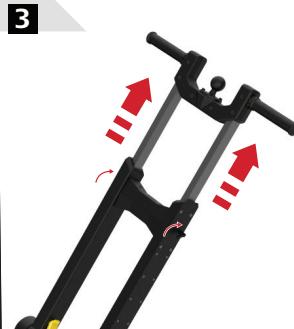
1. Unlock the hinges on the inner side of the handles and expand the handles.

2



2. When the handles reach the hard-stop, lock the hinges.

3



3. Unlock another hinges on the outer side of the housing and raise the handles.

Lock the hinges when the handles are raised to an optimal inclination.

Loosen the screws on both sides to adjust the handle height.

Tighten the screws once the handle height adjustment is done.

3.2

Attaching and Connecting the Laptop or Tablet

Attach and connect the tablet



The support is designed to hold a CT1000 tablet.



☞ The support includes the tablet cradle to hold the tablet, two RAM balls (one attached to the cart handles and the other to the cradle). Also it includes a double socket arm which holds together the RAM balls.



1. Mount the two RAM balls to attach the tablet to the handle:
 - One to the handle top
 - The other to the tablet cradle
2. Use the double socket arm to hold the two RAM balls:
Adjust the tablet cradle until optimal inclination and then tighten the screw on the double socket arm.

3.



Plug in the DSX LAN cable to the tablet.

3.3

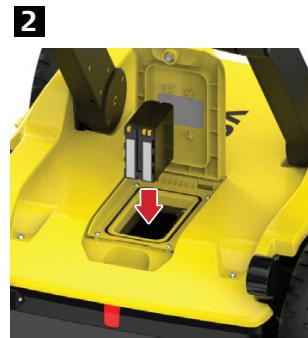
Inserting the Battery

Insert the battery

1



2



3



1. To open the battery compartment, loosen the screw on the battery compartment.
2. Insert the battery facing downwards. The rough surface of the battery points towards the up-down direction.
3. Close the battery compartment and tighten the screw.

3.4

Mounting the Pole Support (Surveyor Kit Only)

Mount the pole support (surveyor kit only)



0019589_001



1. Mount the two brackets:
 - One to the left handle
 - The other to the upper chassis.
2. Attach the two clamps to the pole.
3. Make sure the clamps align, so they can both fit into the brackets. Tighten the screws of the clamps, so they are stable on the pole.
4. Place the lower clamp in the housing bracket, and then fit the upper clamp in the handle bracket.
5. Tighten the screw of the handle bracket.

3.5

Switching the DSX ON/OFF

Switch the DSX device ON/OFF



0019637_001

1. Press the ON/OFF key on the DSX.

3.6

Calibrating the Encoders

Calibration procedure

- ☞ Calibrate the encoders when using the DSX for the first time and when the distance measured by the encoders deviates from the actual distance.
- 1. Measure out a distance of at least 10 m. The defined distance is used as a reference for the calibration procedure.
- 2. Ensure that the tablet is connected to the control unit.
- 2. Turn on the control unit of the DSX. Turn on the tablet and start the DXplore software.
- 3. Start the calibration procedure with the DXplore software. (Refer to (→ TARGET NOT FOUND) within (→ TARGET NOT FOUND)).
- 4. Move the DSX along the defined distance.
- 5. Complete the calibration procedure with the DXplore software and check the calibration result. If necessary, repeat the calibration.
- ☞ After the prominent part on the outer wheel is worn out, it is required to perform an encoder calibration. For a separate encoder calibration, lift one wheel during the calibration procedure, then repeat the procedure with the other wheel. Compare the results with the defined distance to ensure that both encoders work properly.
- ☞ In the DXplore software, a reminder will pop up once the DSX has been operated for XX meters.

4.1**Software Installation****Requirements for installing the DXplore software**

When purchasing a DSX package that includes a tablet, the **DXplore** software is already installed on the tablet.

However, you can also operate the DSX with any laptop/tablet. When installing the **DXplore** software on another laptop/tablet, respect the following requirements.

Minimum requirements:

- Processor: i3 1.7 GHz
- RAM: 1 GB
- Graphic adapter compatible with Open GL 2 or a higher version
- Operating system: Windows 7
- Ethernet port

Requirements for an optimal performance:

- Processor: i5 1.7 GHz
- RAM: 2 GB
- Graphic adapter compatible with Open GL 2 or a higher version
- Operating system: Windows 7
- Hard disk: 40 GB, shock-proof
- Serial port (RS232), only necessary, when using a GPS antenna
- USB port
- Ethernet port

4.2**Main Menu****Available functions****4.3****Acquisition of Scan Data****4.3.1****The Acquisition Screen****4.4****Review of Scan Data****4.4.1****The Review Acquisition Screen****4.5****Export of Scan Data****4.6****Settings**

Jobsite Investigation

To carry out a survey with the DSX in the most efficient way, gather all available information:

- Make yourself familiar with the jobsite features.
- Obtain technical maps about existing utilities on the jobsite.
- Supplement the acquired scan data by opening manholes onsite.

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 the data acquisition is complete, the opening of 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 and allows you to estimate the propagation velocity in order to calculate the depth of a utility as precisely as possible.

6.1

Preparing an Acquisition

Steps to be taken

 Before departing to the jobsite, ensure that the laptop/tablet and the DSX battery are fully charged.

- At the jobsite, set up the DSX and mount the accessories, if available. Refer to "3 Setup".
- Depending on the purpose of the survey and the available accessories, carry out one of the procedures described in the following paragraphs:
 - Marking out targets on site
 - Mapping utilities without using GPS
 - Mapping utilities using GPS

6.2

Marking Out Targets on-Site

Procedure for marking out targets

Follow these steps when the mapping of detected utilities is not necessary.

 Ensure that the spray support is mounted.
 Ensure that the laptop/tablet is connected to the control unit.

- Press the power button to turn on the control unit of the DSX.
- Turn on the laptop/tablet and start the DXplore.
- Click the **Variable "Button_NewProj" not defined.** button.
The software starts calibrating the radar. As soon as the radar calibration is complete, the Acquisition screen is displayed.
- Check the radar and battery status. (Refer to [\(→ TARGET NOT FOUND\)](#) within "4.3.1 The Acquisition Screen").

 For a better visualisation of the radargrams, turn off the **Map** section. (Refer to [\(→ TARGET NOT FOUND\)](#) within "4.3.1 The Acquisition Screen").

- Select the scan direction depending on whether the DSX is being pushed or pulled. (Refer to [\(→ TARGET NOT FOUND\)](#) within "4.3.1 The Acquisition Screen").
 Position the DSX at the starting point of the line to be scanned.
- Start the acquisition with the respective acquisition command.
 (Refer to [\(→ TARGET NOT FOUND\)](#) within "4.3.1 The Acquisition Screen").
 Start moving the DSX along the scan line.
- When a target is detected, stop and move the DSX back until the vertical yellow line of the radargram is on top of the target.
- Insert a marker and estimate the correct depth. (Refer to [\(→ TARGET NOT FOUND\)](#)).
- Mark the target on the ground using the spray paint. (Refer to [\(→ TARGET NOT FOUND\)](#) within "4.3.1 The Acquisition Screen").
- When reaching the end of the scan line, stop the acquisition with the respective acquisition command. (Refer to [\(→ TARGET NOT FOUND\)](#) within "4.3.1 The Acquisition Screen").

11. Position the DSX at the starting point of the next line to be scanned. Repeat the steps 6 to 10 until the jobsite is covered.

6.3

Mapping Utilities without Using GPS

Procedure for mapping utilities without GPS

If a GPS antenna is not available, follow these steps to map the detected utilities based on a measurement grid.

-  If available, mount the spray support.
Ensure that the laptop/tablet is connected to the control unit.
- 1. Press the power button to turn on the control unit of the DSX.
- 2. Turn on the laptop/tablet and start the DXplore.
- 3. Click the **Variable "Button_NewAssProj" not defined.** button.
The Assisted Project Setup screen is displayed.
- 4. If available, load a map from a saved cartographic file or from the internet. (Refer to (\rightarrow TARGET NOT FOUND) within "4.3.1 The Acquisition Screen").
- 5. Set up the measurement grid. (Refer to (\rightarrow TARGET NOT FOUND) within (\rightarrow TARGET NOT FOUND)).
- 6. When the setup of the measurement grid is finished, click the **Variable "Button_StartSurvey" not defined.** button to start the acquisition.
The software starts calibrating the radar. As soon as the radar calibration is complete, the Acquisition screen is displayed.
- 7. Check the radar and battery status. (Refer to (\rightarrow TARGET NOT FOUND) within "4.3.1 The Acquisition Screen").
- 8. Select the scan direction depending on whether the DSX is being pushed or pulled. (Refer to (\rightarrow TARGET NOT FOUND) within "4.3.1 The Acquisition Screen").
- 9. Position the DSX on the line of the measurement grid suggested by the software.
-  To skip the line suggested by the software, select a new line.
-  To edit the starting point position and the scan direction, open the **Starting Point Editor**. (Refer to (\rightarrow TARGET NOT FOUND) within (\rightarrow TARGET NOT FOUND)).
- 10. Start the acquisition with the respective acquisition command. (Refer to (\rightarrow TARGET NOT FOUND) within "4.3.1 The Acquisition Screen").
Start moving the DSX along the scan line.
- 11. When a target is detected, stop and move the DSX back until the vertical yellow line of the radargram is on top of the target.
- 12. Insert a marker and estimate the correct depth. (Refer to (\rightarrow TARGET NOT FOUND)).
- 13. If the spray support is mounted, mark the target on the ground using the spray paint. (Refer to (\rightarrow TARGET NOT FOUND) within "4.3.1 The Acquisition Screen").
- 14. When reaching the end of the scan line, stop the acquisition with the respective acquisition command. (Refer to (\rightarrow TARGET NOT FOUND) within "4.3.1 The Acquisition Screen").

15. Repeat the steps 9 to 14 until the measurement grid is covered.
16. Before returning to the main menu, save a report of the survey with the **Survey Report** dialogue. (Refer to ([→ TARGET NOT FOUND](#))).

 If necessary, you can review the acquired scan data. (Refer to "4.4 Review of Scan Data").

 If necessary, you can export the scan data to be edited in AutoCad. (Refer to "4.5 Export of Scan Data").

6.4

Mapping Utilities Using GPS

Procedure for mapping utilities with GPS

If a GPS antenna is available, follow these steps to create a georeferenced map of the detected utilities.

 If available, mount the spray support.

Mount the GPS support on the DSX and attach the pole with the GPS antenna.

Ensure that the laptop/tablet is connected to the control unit and to the antenna.

1. Press the power button to turn on the control unit of the DSX.
2. Turn on the laptop/tablet and start the DXplore.
3. Select **Settings>Survey Settings>Positioning Settings** to connect and configure the GPS. (Refer to ([→ TARGET NOT FOUND](#))).
4. Click the **Variable "Button_NewProj" not defined.** button.
The software starts calibrating the radar. As soon as the radar calibration is complete, the Acquisition screen is displayed.
5. Check the radar, GPS and battery status. (Refer to ([→ TARGET NOT FOUND](#)) within "4.3.1 The Acquisition Screen").
6. If available, load a map from a saved cartographic file or from the internet. (Refer to ([→ TARGET NOT FOUND](#)) within "4.3.1 The Acquisition Screen").
7. Select the scan direction depending on whether the DSX is being pushed or pulled. (Refer to ([→ TARGET NOT FOUND](#)) within "4.3.1 The Acquisition Screen").
Position the DSX at the starting point of the line to be scanned.
8. Start the acquisition with the respective acquisition command. (Refer to ([→ TARGET NOT FOUND](#)) within "4.3.1 The Acquisition Screen").
Start moving the DSX along the scan line.
9. When a target is detected, stop and move the DSX back until the vertical yellow line of the radargram is on top of the target.
10. Insert a marker and estimate the correct depth. (Refer to ([→ TARGET NOT FOUND](#))).
11. If the spray support is mounted, mark the target on the ground using the spray paint. (Refer to ([→ TARGET NOT FOUND](#)) within "4.3.1 The Acquisition Screen").
12. When reaching the end of the scan line, stop the acquisition with the respective acquisition command. (Refer to ([→ TARGET NOT FOUND](#)) within "4.3.1 The Acquisition Screen").

13. Position the DSX at the starting point of the next line to be scanned. Repeat the steps 8 to 12 until the jobsite is covered.
14. Before returning to the main menu, save a report of the survey with the **Survey Report** dialogue. (Refer to ([→ TARGET NOT FOUND](#))).
 - ☞ If necessary, you can review the acquired scan data. (Refer to "4.4 Review of Scan Data").
 - ☞ If necessary, you can export the scan data to be edited in AutoCad. (Refer to "4.5 Export of Scan Data").

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7.1

Transport

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.

7.2

Storage

Product

Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to "8 Technical Data" for information about temperature limits.

Li-Ion battery

- Refer to ([→ TARGET NOT FOUND](#)) 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 minimise 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.

7.3

Cleaning and Drying

 **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.

Product and Accessories

- Use only a clean, soft, lint-free cloth for cleaning. If necessary, moisten the cloth with water or soapy water. Do not use other liquids; these may attack the product surface.

Cables and plugs

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

Connectors with dust caps

Wet connectors must be dry before attaching the dust cap.

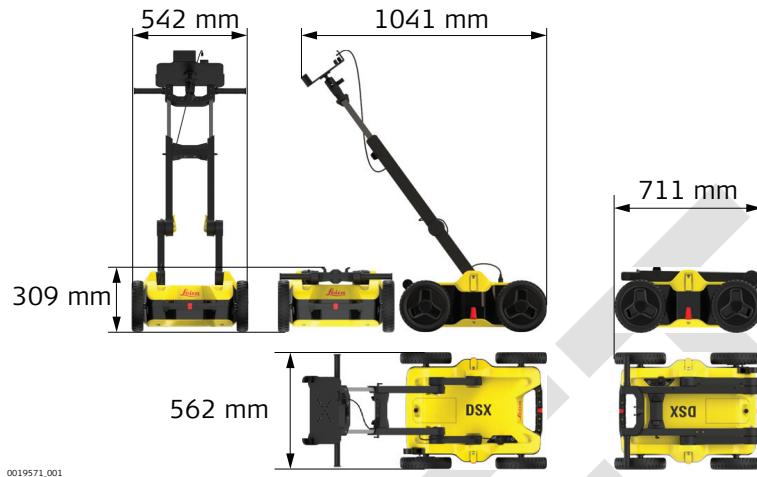
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8.1

General

Dimensions

DSX



Weight

DSX – without battery and tablet 23 kg

Control unit

Power Consumption 13.3 W

Power Supply 12 V DC, 12 Ah
SLAB (Sealed Lead Acid Battery)

Battery for control unit

Type Rechargeable SLAB (Sealed Lead Acid Battery)

Voltage 12 V

Capacity 12 Ah

Single-frequency antenna

Antenna Footprint 40 cm × 50 cm

Number of Hardware Channels 1

Antenna Central Frequencies 600 MHz

Antenna Orientation Broadside antenna array in the direction which is perpendicular to the DSX moving direction

Sampling Frequency 400 kHz

Battery for DSX

Type Li-Ion

Voltage 14.8 V

Capacity GEB242 5.8 Ah

Typical operating time: Measuring time - 8 h

Data Acquisition

Acquisition Speed Normal walking speed, up to 7 km/h

Environmental specifications	Scan Rate per Channel - for 512 Samples per Scan	381 scans per second
	Scan Interval	42 scans per metre
	Positioning	<ul style="list-style-type: none"> Two integrated encoders on the rear wheels GNSS antenna or Total Positioning System (TPS – surveyor kit only)
Temperature		
	Operating temperature [°C]	Storage temperature [°C]
	-10 to +40	-40 to +70
	GEB242: -10 to +55	-40 to +70
Protection against water, dust and sand		
	Protection	
	IP65 (IEC 60529)	
Humidity		
	Protection	
	Max 95% non-condensing The effects of condensation are to be effectively counteracted by periodically drying out the instrument.	

8.2

Conformity to European regulations

Conformity to European Regulations

The equipment conforms to the following requirements set by EC regulations, including subsequent modifications, and to the legislation set by the member states that implement these regulations:

2014/53/EU Radio Directive

Warning: this equipment is destined for use in industrial environments (Class A apparatus). In residential, commercial and light industry environments, this apparatus may generate radio interference: in this case, the user may be required to operate while taking appropriate countermeasures.

The apparatus is sensitive to the presence of external electromagnetic fields, which may reduce its performance.

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

Software Licence Agreement

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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- when it has to be **right**

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