User Manual

Opera XR

IDS Geo

ORIGINAL INSTRUCTION IN ENGLISH LANGUAGE

IDS GeoRadar

LEGAL NOTICE

Use of the Manual

This Manual is intended to be used solely by authorized user of IDS GeoRadar Systems. It is specific for internal business purpose only. If you are not an authorized user, you are NOT allowed to read this Manual and you must return it to IDS GeoRadar as soon as possible. Access to and use of this Manual is also provided subject to the acceptance of the Disclaimer set out below.

Disclaimer

About the Manual

This Manual has been drafted by IDS GeoRadar with the due care in order to ensure the accuracy and completeness. However, please note that no warranty is provided about the fact that the Manual will be free from error or omission and about the accuracy and/or fitness to the purpose of any information contained herein.

Any representation and/or statement contained herein has been written in good faith and on the basis that, due to negligence, lack of care or otherwise, IDS GeoRadar is not liable for any loss, including direct, indirect or consequential losses, in contract or in tort for any misstatement or omission contained herein which has occurred or may occur with reference to any representation and/or statement contained in the Manual.

User shall also acknowledge that some information contained in the Manual may not be up to date. IDS GeoRadar may amend the information contained in the Manual from time to time and IDS GeoRadar shall not be deemed liable in the event that damages arise with reference to changed circumstances or other information which may affect the accuracy of any information contained in this version of the Manual.

About the Product

All products designed, produced and distributed by IDS GeoRadar, its Subsidiaries, Affiliated and authorized Distributors (Products) shall not be used, in the design, development, production or use of chemical, biological, nuclear ballistic weapons. Buyer/ User will defend, indemnify and hold IDS GeoRadar harmless against any liability (including attorney's fees) for non-compliance with the terms of this paragraph.

If IDS GeoRadar requires that Buyer/User shall carry out a training with reference to some Product categories, no operation or use of the Products shall be started before its designated Operator/s has got the User Certificate, as defined by IDS GeoRadar specific procedure which the Buyer confirms to know and accept.

For Products which include specific "Operational" software with automatic data processing and analysis "Tools", e.g. RockSpot, IBIS Products; Hydra Products, User shall be aware that the results provided by these "Tools" may be not error free. User that completely relies on the outcomes provided by these Tools only, does it at his own risk.

In no event IDS GeoRadar shall be liable for special, direct, indirect, incidental, exemplary, punitive or consequential damages including, but not limited to, loss of profits or revenue, caused by the missed or incomplete observance of the instructions and prescriptions for the use of the Products, either separately or in combination with other products.

This paragraph provides only a non-exhaustive summary of the full Product disclaimer. Please see the full Product disclaimer included into the relevant section of this Manual for detailed information.

Confidentiality

This Manual may be subject to legal and other privilege. IDS GeoRadar specifically reserves its rights in relation to this Manual. None of these rights or any other rights subsisting in the Manual are waived if you have received this Manual in error or without permission. No parts of this Manual may be copied, translated or reduced to any electronic medium, or machine-readable form, nor photographed or recorded in any way, without the prior written consent of IDS GeoRadar.

INDEX

1 INTRODUCTION

This document describes ***Opera XR*** system, that is a dual frequency GPR system by IDS GeoRadar.

This document refers to the concepts the User must learn before initiating the utilization of this device. Therefore, it is mandatory to carefully read the entire document before starting and operating the system.

1.1 Estimated Reading Time

The estimated reading time of the entire document is 90 minutes.

1.2 Purpose

The purpose of this document is to drive the Reader to a list of actions to install and use the ***Opera XR*** system, in a thorough, correct, and safe way.
The structure of the manual is organized in a collection of "how-to" as well as descriptive chapters. Each chapter contains illustrations and basic descriptions of the main operations to be carried out for system installation and use on field.

1.3 Application field

The main application of ***Opera XR*** is the collection of GPR data over areas of variable extension, and for applications including, but not limited to, utility mapping, environmental, archaeology, geology, geotechnic. Also, any type of buried objects or structures may be the aim of the system if these are buried within ***Opera XR*** depth of reach.

1.4 Intended readership

The intended Reader(s) of this manual is the technician(s) in charge of using the system that has undergone the IDS GeoRadar training for ***Opera XR***. Training to Users, may also be delivered by either IDS GeoRadar local Selling Units or Distributor Partners.

1.5 Authorization of use

The use of ***Opera XR*** 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:

France: https://www.anfr.fr/en/broadcasting-authorisation/reseaux-professionnels/les-frequences-utilisees-a-titre-temporaire/les-systemes-dimagerie-radar-de-type-gpr-wpr/

Germany: https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Technik/InverkehrbringenvonProdukten/Schnittstellenbeschreibungen/OrtungsfunkOR/SSBOR_NN022.pdf?__blob=publicationFile&v=4

Portugal: https://www.anacom.pt/render.jsp?categoryId=389647

Romania: https://www.ancom.ro/radio-spectrum_2749

Spain: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2011-19146

Sweden: https://www.pts.se/sv/bransch/radio/radiotillstand/ansokningshandlingar/

Liechtenstein and Switzerland: https://www.bakom.admin.ch/bakom/en/homepage/frequencies-and-antennas/frequency-use-with-or-without-licences/radiocommunication-licences-in-general.html

For more details with reference to the restriction, please refer to the following website: ECO Frequency Information System (cept.org)

	CH	DE
	ES	FR
	LI	PT
	RO	SE

1.5.1 CE Compliance

This equipment complies with the essential requirements and other relevant provisions of:

- Directive 2014/53/UE
- Directive 2011/65/UE + 2015/863/UE RoHS
- Regulation (EC) No 1907/2006 REACH

The full Declaration of its Conformity can be found either on the CD or a separate document included with this product.
This is a Class A product. In a domestic environment it may cause radio interference. If so, the user may need to take adequate measures.

1.5.2 UKCA Compliance

This equipment complies with the essential requirements of the Radio Equipment Regulations 2017 (S.I. 2017/1206). The full Declaration of its Conformity can be found either on the CD or a separate document included with this product.

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

1.5.3 FCC Compliance

This device complies with part 15F 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.

2 HOW TO READ THE MANUAL

2.1 Manual Layout

As mentioned, this User Manual is structured in a “How to” manner. In each of the relevant chapters, User shall find the basics to carry out the ***Opera XR*** installation and use.

It is strongly recommended to go through this manual thoroughly, and to read it carefully. However, as the document is divided into a first part that is descriptive of the whole system, but also into procedures that are self-consistent and that can be read sparsely, it is not mandatory to read this document chapter after chapter, in case of need.

Please, note that images and pictures shown in the manual aims at supporting the Users in understanding the operation described. However, pictures and images portraited herein may, from time to time, slightly differ from the actual Hardware and Software they describe.

2.2 SYMBOLS

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, and
- contain general rules of behaviour.

For the user’s 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 herein.

DANGER, **WARNING**, **CAUTION** and **NOTICE** has got standardized signal words for identifying levels of hazards and risks related to personal injury and property damage.

For safety purposes, it is important to read and fully understand the table below 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.

Note text/to keep in mind

Tip information

2.3 Glossary & Acronyms

The following acronyms are used in this manual:

- **Opera XR**: IDS GeoRadar GPR System
- **Controller**: PC / Tablet used by the user for data acquisition. The data acquisition SW (client) is performed on the controller.
- **GNSS**: Global Navigation Satellite System.
- **GPR**: Ground Penetrating Radar or Georadar or Ground Probing Radar.
- **HMI**: Human Machine Interface.
- **HW**: Hardware.
- **NMEA format**: National Marine Electronics Association format.
- **RTK**: Real Time Kinematic.
- **SNR**: Signal to Noise Ratio.
- **SW:** Software.
- **UBLOX**: GNSS device within the GPR system.
- **uMap-Logger**: IDS GeoRadar software for GPR data acquisition.
- **SAP (follow by 6-digit):** ID code to identify the part number.

3 SAFETY DIRECTIONS

3.1 Description

The following directions enable the person responsible for the product, and the person who 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.

3.2 Intended use

The intended use of ***Opera XR*** is the detection of underground features in diverse environmental conditions, and within the depth of reach of the system itself, including but not limited to:

- Utility mapping
- Geotechnical
- Environmental
- Glaciers
- Rivers
- Archaeology
- Forensic
- Buried structures, in general.

NOTE: **The product is intended for professional use only; not for consumers use.**

3.3 Reasonably Foreseeable Misuse

- Infringing traffic regulation.
- Use of the product without instruction.
- Use outside of the intended use and limits.
- 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 IDS GeoRadar s.r.l.
- Inadequate safeguards at the working site.

3.4 Limits of Use

Environment: Suitable for use in an atmosphere appropriate for permanent human habitation. Not suitable for use in explosive environments.

WARNING: **POTENTIALLY HAZARDOUS AREAS**
working in hazardous areas, such as potentially explosive areas, or close to electrical installations, or similar situations, could result in death or serious injury.
PRECAUTION: Local safety authorities and safety experts must be contacted, by the person in charge of the product, prior commencing any survey in potentially hazardous areas for the due risk assessment.

3.5 Responsibilities

Manufacturer of the product - IDS GeoRadar s.r.l. 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 (the User) has the following duties:

- To understand the safety instructions on the product and the instructions in the user manual, and the Quick Guides, provided separately.
- To ensure that it is used in accordance with the instructions.

- To be familiar with traffic laws and local regulations relating to safety and accident prevention.
- To inform IDS GeoRadar s.r.l. immediately if the product and the application becomes unsafe.
- To ensure that the traffic laws, the national laws, regulations, and conditions for the operation of electromagnetics transmitters are respected.

NOTICE: Watch out for erroneous measurement results if the product has been dropped, misused, modified, or stored for long periods.

Precautions:
Periodically carry out test measurements.

3.6 Hazard of Use

WARNING: **CRUSHING HANDS, FINGERS AND TOES**
While installing and using the system, the risk of fingers pinching out may occur.
PRECAUTION: To mount and use the system, the user must always wear protective gloves and safety boots.

WARNING: **RISK OF ACCIDENTS**
During surveys there is a danger of accidents occurring if the user does not pay attention to the surrounding site conditions, such as obstacles, excavations, or traffic.

PRECAUTIONS: During operations, the user of the product must be fully aware of the existing site conditions, and potential dangers.

WARNING: **ELECTROCUTION**
Because of the risk of electrocution, it is dangerous to use poles and extensions near 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 safety instructions.

NOTICE: 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.

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: **LIGHTING STRICKING**
If the product is used with accessories (for example GNSS pole support), the user may increase the risk of being struck by lightning.

PRECAUTIONS: Do not use the product during thunderstorm.

NOTICE: If the product is improperly disposed, 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 unauthorized 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.

RECYCLING

The crossed out wheeled bin symbol shown on the equipment indicates that the product must be recycled separately from other waste at the end of its useful life.
Separate waste disposal of this product at the end of its useful life will be organised and managed by IDS GeoRadar. When you decide to dispose of the equipment, contact IDS GeoRadar and follow the system that IDS GeoRadar 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 contributes 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: SECURING OF THE WORKING SITE
Inadequate securing of the working site 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: EXPOSURE OF BATTERIES TO HIGH MECHANICAL STRESS, HIGH AMBIENT TEMPERATURE OR IMMERSION INTO FLUIDS
High mechanical stress, high ambient temperatures or immersion into fluids can cause leakage, fire, or explosions of the batteries.

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

WARNING: MECHANICAL INFLUENCES ON 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 of it, discharge the batteries by running 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, please contact your local passenger or freight transport company.

NOTICE: Only IDS GeoRadar authorized technical service are entitled to repair this product.

WARNING: Short circuit of battery terminals
Risk of fire, electric shock, and damage.

PRECAUTIONS: Keep away any metallic or wet objects from the battery terminals inside battery housing.

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: Battery may get hot after prolonged use.
Risk of burning injuries.

PRECAUTIONS: Avoid touching the hot battery. Allow the battery to cool down before removing it.

4 GENERAL DESCRIPTION

The ***Opera XR*** GPR system by IDS GeoRadar srl, is designed to detect and locate underground features for a wide range of possible applications including, but not limited to utility mapping, geology, geotechnical, environmental, glaciers, rivers, archaeology, forensic, buried structures in general. It provides georeferenced underground maps if a supported positioning system is used and correctly paired to ***Opera XR***.

4.1 Delivery Content

The IDS GeoRadar ***Opera XR*** Utility Detection system (SAP 1023280) includes the following packages:

1. ***Opera XR*** (SAP 1023280),
2. ***Opera XR GNSS Support Kit*** (Optional, SAP 1020729)
3. ***Opera XR Off-Road Wheels Kit*** (Optional, SAP 1020726)
4. ***Opera XR Shipping Box*** (Optional, SAP 1026386)

4.1.1 Opera XR (SAP1023280)

The basic kit of ***Opera XR*** includes the following items:

a. The **Opera XR Cart**,

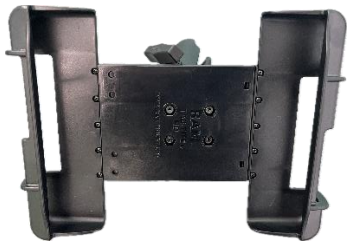
b. (qty. 2) **Quick release** lock pin 72-12,

c. (qty.4) Airless **Wheel 310**,

d. (qty. 1) **LAN** cable 1.5m-5ft. (SAP 970309),

e. (qty. 1) **Clamp** for tablet holder,

g. (qty. 1) **Tablet holder**,



h. (qty. 1) **Antenna** Opera XR with sledge,

i. (qty. 4) Antenna lifting **belts,**

j. (qty. 1) Battery GEB 364 (SAP 954519) and battery charger GKL311 single charger prof 3000 (SAP 799185),

4.1.2 Opera XR GNSS support Kit (SAP 1020729)

The ***GNSS support kit*** includes:

a. GNSS pole,

b. GNSS pole support (including 2 screws, 2 washers, and 2 nuts),

c. GAD50, TPS adaptor.

4.1.3 Opera XR Off-Road Wheels kit (SAP 1020726)

The ***Off-road wheels A380*** are characterized by a diameter wider then **A310** standard wheels, larger “shoulders”, and they can be easily interchanged with A310 wheels. They are used for rough surface terrain.

4.1.4 Opera XR Shipping Box (SAP 1026386)

The shipping box is an optional item allowing the User to store, and safely ship, the ***Opera XR*** system (GNNS pole support would not fit inside).

5 HOW TO SET UP OPERA XR AND ACCESSORIES

This section of the User's Manual provides a schematic description of how to assemble ***Opera XR*** and its accessories.

5.1 How to set up Opera XR

To assemble ***Opera XR*** in its basic configuration, the User should follow the steps below:

1. After taking off ***Opera XR*** from the card box (or the hard shipping box), remove the (2) pins fastening the rudder on top of the "U-frame",

2. Unfold the rudder upward, by holding the handle,

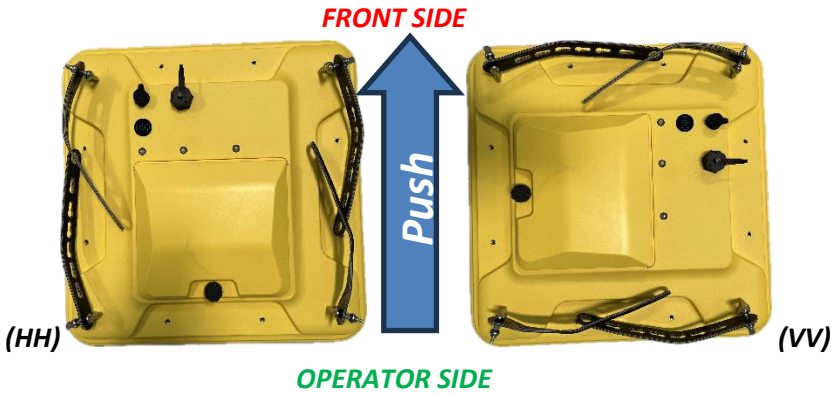
3. Lean the horizontal bar of the rudder against the "U-frame" to support the rudder itself,

4. Enter the (2) pins inside the (2) holes on the side of the rudder, next to the horizontal bar, to fasten the rudder against the “U-Frame”,

5. Place the ***Opera XR*** antenna on the floor, before the cart, and choose the polarization (i.e.: orientation of the antenna):
   a. **Polarization HH (left image)** LAN and wheel connector towards the front of the system (or towards the Operator),

   OR

   b. **Polarization VV (right image)** LAN and wheel connector towards the left (or right) side of the Operator,

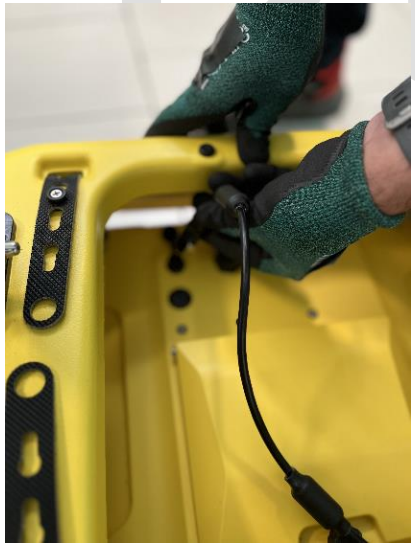


6. Place the ***Opera XR cart*** on top of the antenna (**HH-oriented** in the image below),

7. Enter the (4) antenna belts inside the (4) holes at each corner of the cart,

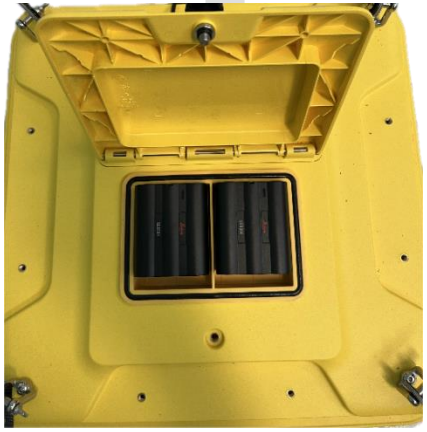
8. Fix the antenna belts to the 4 pins on top of the cart (6 slots are present on each belt). The height of the bottom of the antenna from the ground depends on the slot used to fix the antenna to the cart.

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 (2) batteries.



NOTE: **Opera XR can operate with one battery only, with reduced field operability time. Battery hot swap is possible.**

12. Attach the clamp for the tablet holder and the tablet holder, on top of the rudder.

NOTE: the clamp for tablet holder can be either fixed to the handlebar or to the squared section below handlebar. It is recommended to mount it as per image below (on squared-section horizontal bar).

13. Place the tablet on the tablet holder and plug the LAN cable to the LAN port.

Opera XR after completing the setup is shown in Fig. 1). No field PC is shown in the image below.

Fig. 1 Opera XR (Basic set up, without Tablet)

5.2 How to set up GNSS support kit

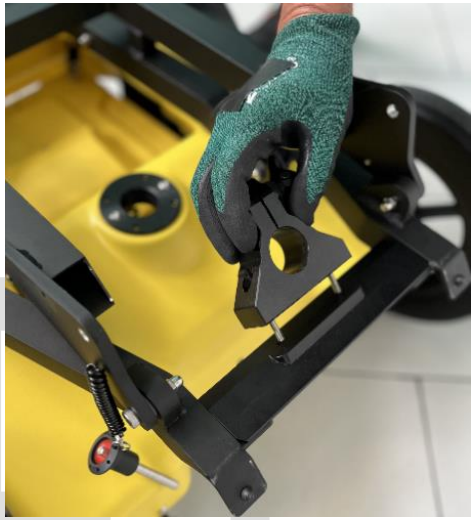
After ***Opera XR*** has been mounted as per instruction illustrated in par. 5.1, the (optional) GNSS pole support can be mounted. Doing so allows the Operator to collect ***Opera XR*** data by pairing an external positioning system like GNSS or Total Station.

To do this, the Operator should implement the steps below:

1. Release the rudder from the U-frame by removing the (2) pins on the side,

2. Fold back the rudder on top of the U-frame, horizontal to the top of the cart,

3. Place the GNSS support in the center of the horizontal bar of the rudder by fitting the (2) screws inside the (2) holes on it,



4. Fix the (2) screws against the (2) bolts and washers provided with the kit (use Allen key #4 on screw side and socket wrench on the bolt side),

5. Place the rudder and the U-frame in the original position (vertical) and enter the (2) pins on the side of the rudder,

6. Fit the GNSS pole inside the support just mounted on the rudder.

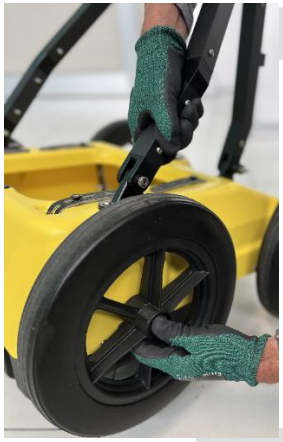
Opera XR with GNSS kit after completing the setup is shown in Fig. 2. No field PC is shown in the image below.

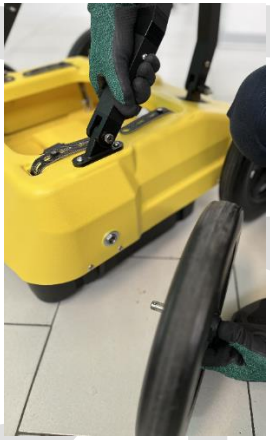
Fig. 2 Opera XR with GNSS kit

5.3 How to set up Off Road wheels kit

Opera XR basic kit, includes one set of (4) wheels named A310 (the diameter is 310 mm). It is possible to use larger diameter wheels that also include larger "shoulders" (namely A380, whose diameter is 380mm). The off-road kit makes the use of the system on dirt road with rough surface easier.
To mount the off-road kit, the Operator should implement the steps below:

1. Remove the ***A310 wheel*** by pressing the button at the center of the wheel and gently pulling outwards,





2. Replace the ***A310 wheel*** just removed with the ***A380***, by the same operation as before (pushing instead of pulling, now). Repeat the same operation for the 4 wheels.

Opera XR with GNSS kit and Off-road kit is illustrated in Fig. 3. No field PC is shown in the image below.

Fig. 3 Opera XR with GNSS kit and Off-road kit

5.4 How to store Opera XR into the shipping box

Opera XR and accessories are shipped inside purpose-built card boxes. However, a hard case (flight case) is also available as optional, Fig. 4. The hard case allows for safer transport of the whole system, but the GNSS pole support.

Fig. 4 Hard case for Opera XR

The internal cases include precast foam to host the A310 wheels, and ***Opera XR*** with A380 wheels (Fig. 5).

Fig. 5 Internal of the Opera XR hard case

The correct way to store the system inside includes the following steps:

1. Place the ***Opera XR antenna*** first and then the Cart on top of it,
2. Enter the (2) pins on top rudder to block this against the U-frame,

WARNING:
Lifting ***Opera XR*** and antenna together to fit inside the hard case may cause injury to the Operator and damage to the system.
PRECAUTION:
lift and place inside the hardcase the Opera XR antenna first and then the ***Opera XR*** cart, separately.

3. Place the A310 wheel on the foam of the cover and fix them all using the Velcro.

Opera XR correctly placed inside the shipping box, is illustrated in Fig. 6.

Fig. 6 Opera XR inside the hard shipping box

6 HOW TO WORK ON SITE WITH OPERA XR

Opera XR is a Georadar system that can be deployed on site including several positioning systems (i.e.: **Quick Scan**, **Grid**, **GNSS**, **Robotic Total Station**). Its structure is designed with the aim to cover the largest possible applications and field conditions.

6.1 How to set up Opera XR in HH or VV Polarization

Opera XR can be deployed in 2 different orientations of the antenna, namely in **HH Polarization** (***Horizontal***, internal dipoles perpendicular with respect to the push/pull direction) or **VV Polarization** (***Vertical***, internal dipoles parallel with respect to the push/pull direction).

1. ***HH Polarization acquisition mode***:

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

FRONT SIDE

Antenna TOP View

OR

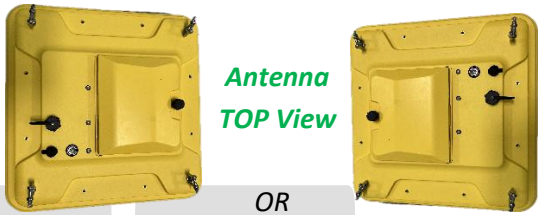
Opera XR TOP View

OPERATOR SIDE

2. ***VV Polarization acquisition mode***:

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

FRONT SIDE



Antenna TOP View

OR

Opera XR TOP View

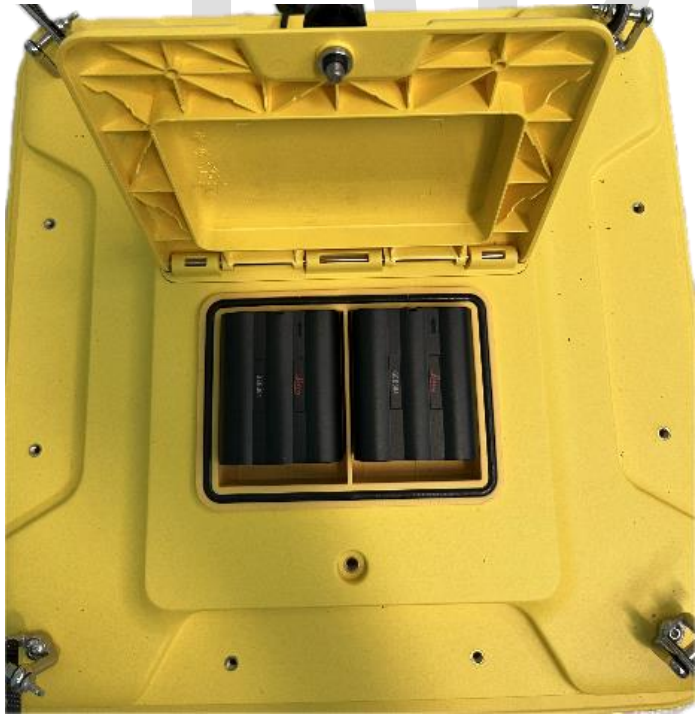
OPERATOR SIDE

6.2 How to connect the field PC and the Opera XR antenna

The connection between the field PC (where uMap-Logger, the data acquisition SW, is installed) and the ***Opera XR*** is fulfilled via LAN Cable.
The steps to start up the system before commencing any data acquisition on site are:

a. Open the battery compartment on top of the antenna case and insert the (2) batteries.

NOTE: **Opera XR can operate with one battery only, with reduced field operability time. Battery hot swap is possible.**



b. Then close the battery compartment.

c. Connect the field PC and the ***Opera XR*** antenna via the LAN cable provided with the system: on one side to the antenna LAN connector, on the opposite side to the LAN port of the PC.

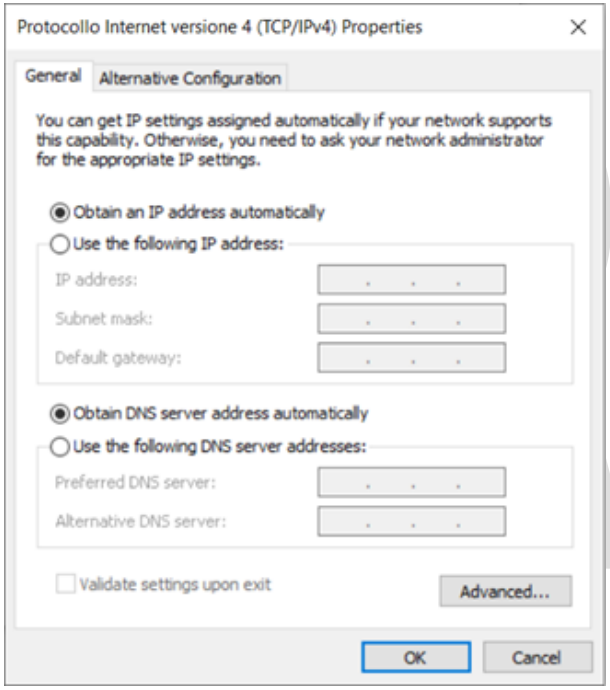
d. Press the O/I button beside the battery compartment to start up the antenna. This button shall turn blue. Antenna Led status is:

i. **System LED** BLU: Antenna powered but not connected to PC

ii. **Battery 1 LED** Green: Fully charged

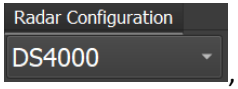
iii. **Battery 2 LED** Green: Fully charged

e. Turn on the field PC where the *uMap-Logger* software is installed (note: refer to the specific *uMap-Logger* user's manual for details on installation. Also, firewall and antivirus must be OFF). The IP address of the Ethernet port of the PC must be set to DHCP (Dynamic mode and NOT Static IP address).

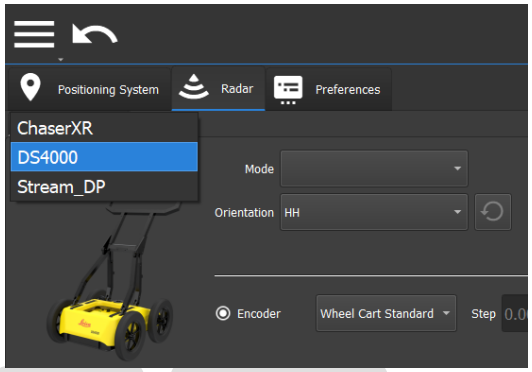


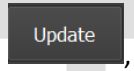
f. Turn on uMap-Logger,

g. Press on the Radar Settings icon  of the SW main page,

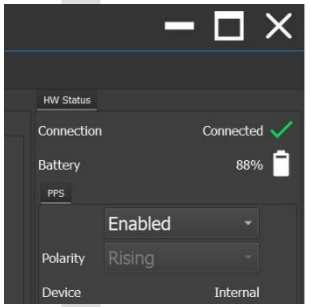
h. Select **DS4000** from the ***Radar Configuration*** drop-down menu 

,



i. press update 

, and the connection between the antenna and the PC is established.



j. Antenna LED status is now:

   i. **System LED** Green: System powered and connected to PC

   ii. **Battery 1 LED** Green: Fully charged

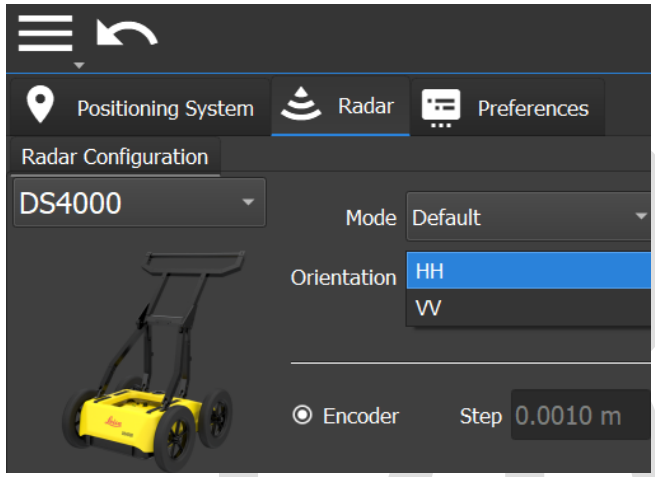
   iii. **Battery 2 LED** Green: Fully charged

Opera XR, is now ready to be used on site for data acquisition.

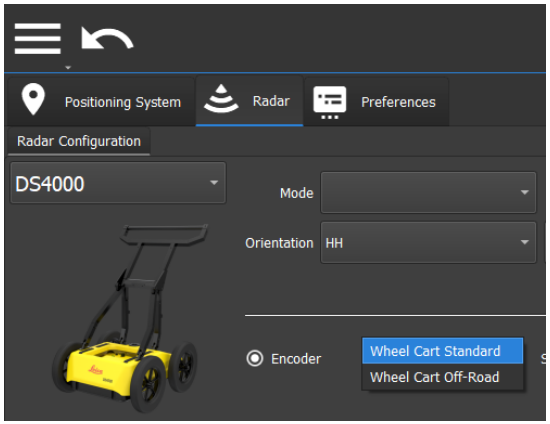
6.3 How to collect Opera XR data in Quick Scan mode

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

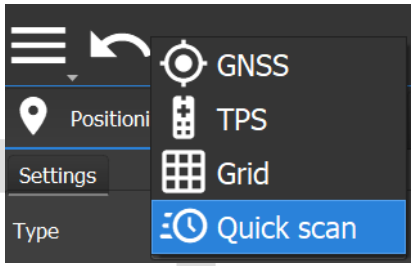
1. Follow all steps described in par. 6.1 and par 6.2,
2. Select the Antenna orientation (HH or VV), from the ***Orientation*** drop down menu,



3. Select ***Encoder type*** (depending if **A310** or **A380** Wheels are mounted),

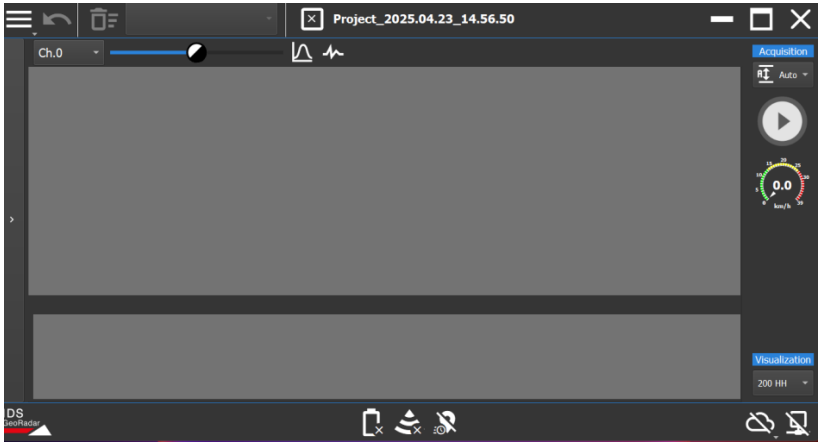


4. Click on the positioning icon  to switch to the ***Positioning*** view tab,
5. From the drop-down menu of ***Positioning*** tab select the **Quick Scan** Mode,



6. Go back to the previous page by pressing the icon  ,
7. Then, press on the ***New Project*** icon to start a new project window.

8. In the ***Project Window***:

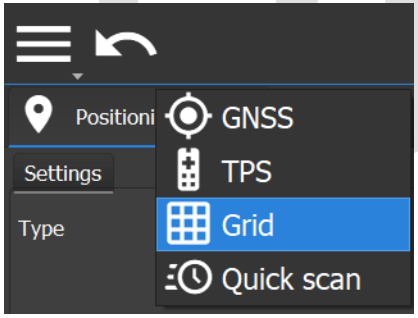


9. press the ***Play*** button to start the acquisition,
10. Press the ***Stop*** Acquisition button to close the swath acquisition,
11. Press the ***close current project*** button to close the active project.
12. Refer to ***uMap-Logger*** Software User's Manual for specific software tools.

6.4 How to collect Opera XR data in GRID mode

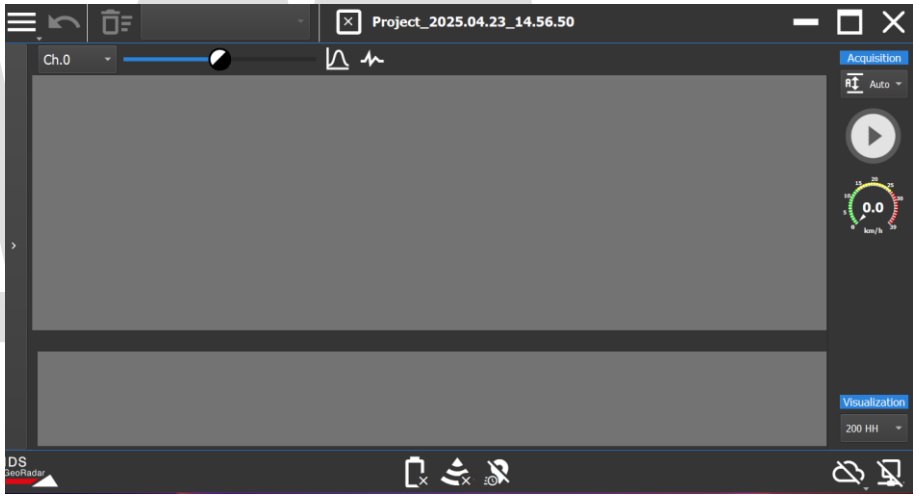
The steps to be taken to start gathering data in **GRID** mode, are:

1. Select Steps 1 to 4 of par 6.3,
2. From the ***Positioning*** tab select the **GRID** Mode from the drop-down menu,



3. Go back to the previous page by pressing the icon ,
4. Then, press on the ***New Project*** icon to start a new project window.

5. Customize the Grid trajectory, based on the project specification, and use the tools described in uMap-logger User's manual.
6. In the ***Project Window***:

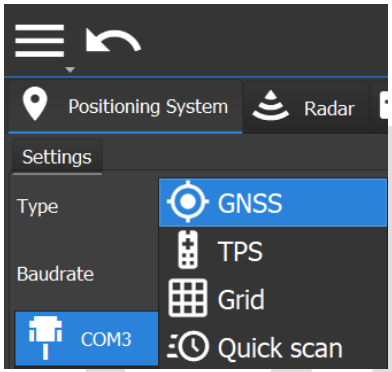


7. press the ***Play*** button to start the acquisition,
8. Press the ***Stop*** Acquisition button to close the swath acquisition,
9. Press the ***close current project*** button to close the active project.
10. Refer to ***uMap-Logger*** Software User's Manual for specific software tools.

6.5 How to collect Opera XR data in GNSS mode

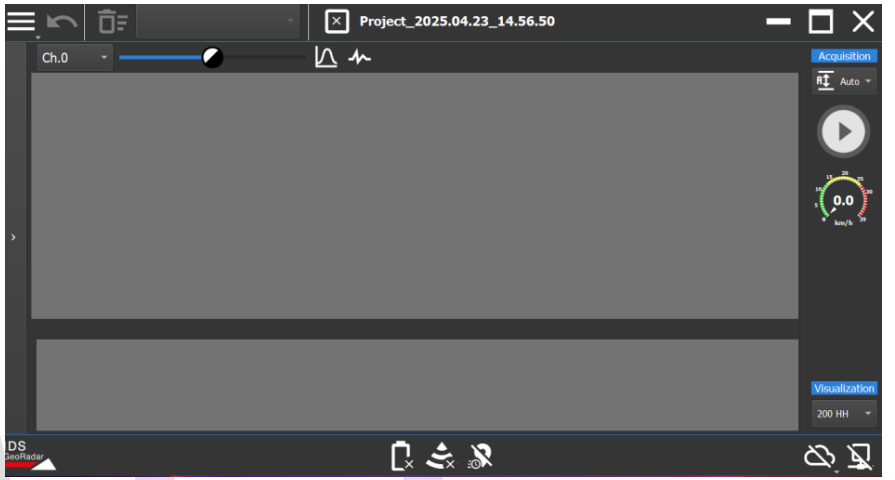
The steps to be taken to start gathering data in **GNSS** mode are:

1. Follow all steps 1 to 4 of par 6.3,
2. From the ***Positioning*** tab select the **GNSS** Mode from drop-down menu,



3. Go back to the previous page by pressing the icon  ,
4. Then, press on the ***New Project*** icon to start a new project window.

5. In the ***Project Window***:

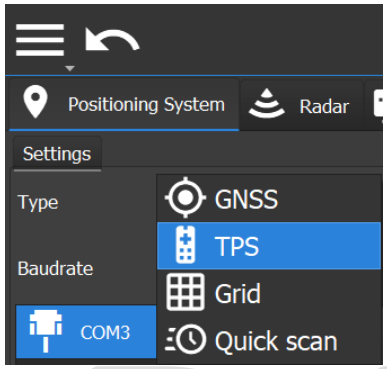


6. press the ***Play***  button to start the acquisition,
7. Press the ***Stop*** Acquisition  button to close the swath acquisition,
8. Press the ***close current project***  button to close the active project.
9. Refer to ***uMap-Logger*** Software User's Manual for specific software tools.

6.6 How to collect Opera XR data in TPS mode

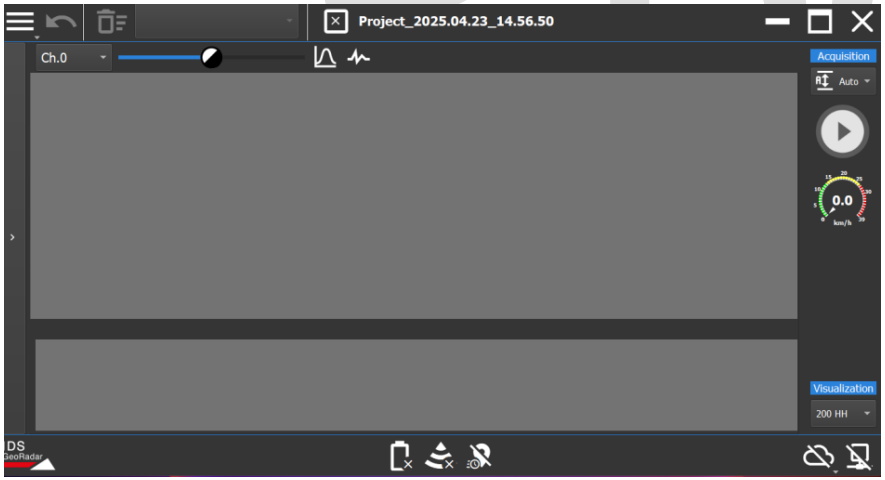
The steps to be taken to start gathering data in **TPS** mode are:

1. Follow all Steps 1 to 4 of par 6.3,
2. From the ***Positioning*** tab select the **TPS** Mode from drop-down menu,



3. Go back to the previous page by pressing the icon  ,
4. Then, press on the ***New Project*** icon to start a new project window.

5. In the ***Project Window***:



6. press the ***Play***  button to start the acquisition,
7. Press the ***Stop*** Acquisition  button to close the swath acquisition,
8. Press the ***close current project***  button to close the active project.
9. Refer to ***uMap-Logger*** Software User's Manual for specific software tools.

7 CARE AND TRANSPORT

7.1 Cleaning Information

Before cleaning any of the external parts of the apparatus, make sure that all cables and wires have been unplugged, including the power supply cable. If a damp cloth is used, make sure it is not wet, to avoid any damage to the electrical components of the equipment. Wait until the equipment is totally dry before reconnecting the cables.

CAUTION: **DAMAGE TO ELECTRICAL COMPONENTS**

If a damp cloth is used while cleaning the system or part of it, make sure that this is not wet, to avoid any damage to the electrical components of the equipment

PRECAUTION: Before cleaning any of the external parts of the apparatus, make sure that all cables and wires have been unplugged, including the power supply cable.

The ***Opera XR*** should be cleaned periodically using a damp cloth.

NOTICE: If the system is severely dirty or clogged by dust, connectors and encoders may not work properly.
Precautions:
After a field work, check the conditions of the system and clean it if necessary.

Do not use solvents or abrasive detergents.

CAUTION: **DAMAGE TO ELECTRICAL COMPONENTS**

Consider only cleaning products appropriate for electronic components.

PRECAUTION: Verify if the cleaning products are compliant with electronic devices.

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

If a specific spray is used to clean the PC monitor, make sure it is not flammable; in any case, do not spray it directly on the screen, instead, spray it onto the cleaning cloth.

CAUTION: **DAMAGE TO ELECTRICAL COMPONENTS**

Flammable spray could damage the electronic devices, as controller laptop.

PRECAUTION: Verify if the cleaning products are compliant with electronic devices.

7.2 Battery Removal Information

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 −20 °C to +50 °C/−4 °F to +122 °F in a dry

environment is recommended to minimize self-discharging of the battery.

• At the recommended storage temperature range, batteries containing a 40% to 50% charge can be stored for up to one year. After this storage period the batteries must be recharged.

As for the Laptop Batteries please, do refer to the PC manufacturer user's manual.

7.3 Periodical Check

The Operator should periodically check the status of the antenna sledge, shells, all cables, any rotating part, and any (potentially) consumable part. The system must not be used in case of any malfunctioning or broken part, as this may cause other parts to be damaged and/or malfunction consequently.

NOTICE: The Sledges should be periodically checked out to verify their status, and should be removed and replaced, when needed. Prior starting any survey, the status of the sledge should be verified for integrity.
Precautions:
If the antenna shell is exposed, even partially, because of the sledge being consumed, the sledge must be replaced immediately.

NOTICE: All the cables and connectors should be verified at each use of the system
Precautions:
In case of any damage of cables or connectors, immediately inform IDS GeoRadar to follow up on removal and replacement.

NOTICE: All the connectors on the antenna and the accessories, must be plugged at any time either by the corresponding cable plug, or by the connector cap, when not in use. This is to prevent dust or water ingress, that may damage the connector itself and its functionality.
Precautions:
Verify the connectors status before running a survey.

7.4 Proper system use

Always use the system as indicated in this manual, by following instructions.

When not in use, the system should always be transported and/or shipped by using the case with which the system is delivered. Transporting and/or shipping the system outside this packaging or by using other shipping boxes may cause the system, or part of it, to be damaged.

CAUTION: MECHANICAL DAMAGE OF THE SYSTEM

Transporting and/or shipping the system outside its original packaging or by using other shipping boxes may cause the system, or part of it, to be damaged.

PRECAUTION: The system should always be transported and/or shipped by using the hard case with which the system is delivered.

8 IDS GEORADAR SUPPORT

8.1 myWorld

IDS GeoRadar is part of **Hexagon Geosystems** division, having ***Leica Geosystems*** as parent company. ***myWorld*** platform of ***Leica Geosystems*** offers a wide range of services, information, and training material. With direct access to *myWorld*, the User can access all relevant services. The availability of services depends on the instrument model.

SERVICE	DESCRIPTION
myProducts	Add all IDS GeoRadar 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 IDS GeoRadar service centres including detailed information on the services performed on your system.
mySupport	Create new support requests for your products that will be answered by your local 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.
myLearning	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).
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.
mySmartNet	HxGN SmartNet is the GNSS correction service built on the world's largest reference station network, enabling GNSS-capable devices to quickly determine precise positions in the range of one-to-two-centimetre accuracy. The service is provided 24/7 by a highly available infrastructure and professional support team with more than 10 years of experience reliably delivering the service.
myDownloads	Downloads of software, manuals, tools, training material and news for IDS GeoRadar products.

8.2 How to manage return for Service

On occasions, your GPR may need to be returned to the factory for repairs. These events, depending on circumstances, may be handled under maintenance or warranty conditions.

IDS GeoRadar, implements an internal ticket system to handle the repair of its Products worldwide. In this respect, for the global IDS Customer Support to be able to troubleshoot in case of need, it is necessary to identify the GPR system first hence, it is mandatory providing information including Serial number and Product Number of the system or part of it that need repair.

This information may be found on a label placed on top of the system (e.g.: inside the battery housing, on top of the antenna, on the side of the rudder, on top of the SCU, etc...). An example of this label is illustrated in Fig. 7.

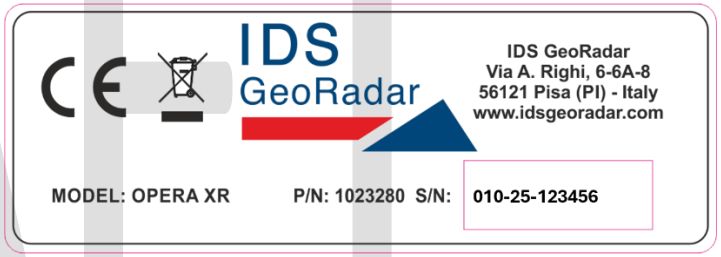


Fig. 7 Example of an IDS GPR system label

In any event, the workflow to follow up on a support request is:

1. Contact, by using the local Support mailing list, your local representative of IDS Customer Support, or enter a support case into the *mySupport* page of *myWorld*, Indicating the following:
    a. Type of System or part of it (defined by Product Number or Article number, that is PN 1023280 in Fig. 7)
    b. Serial Number (SN 010-25-123456, in Fig. 7)
    c. Type of issue
2. The local Representative of IDS Georadar Customer Support or the Central IDS Georadar Customer Support shall follow up on the case

by a first level, remote troubleshooting to assess the system and the possible issue.

3. If a further, direct assessment of the system is necessary, the system shall be returned for analysis. Based on this, a repair under warranty or maintenance conditions, may be carried out. Depending on cases and the type of possible repair, return may be towards the local Representative of IDS or to the IDS GeoRadar main factory.
4. Prior return of the goods, wait for the IDS Georadar logistic office to provide a reference number for the return case and shipping instructions.
5. As the system reaches IDS Georadar repair premises, this is analyzed to find the root cause of the issue, and repaired ONLY after signed approval of the quotation, in case where the warranty does not apply. The status of the repair may be checked onto the *mySupport* page of *myWorld*.
6. At the end of the repair, the system is shipped back to the shipping address indicated at the beginning of the procedure, and this is conducted based on contractual agreements.

NOTICE: The above, is meant solely as a broad indication of the workflow for the return of a system for repair.

Precautions:

Please, refer to the Contractual Terms and Conditions for more detailed information.

APPENDIX A DISCLAIMER

1. General

i. The present Disclaimer applies to all products designed, produced and distributed by IDS GeoRadar S.r.l., its Subsidiaries, Affiliated and authorized Distributors (the "Products"). IDS GeoRadar S.r.l. reserves full ownership and intellectual property rights of any "Information" contained in this Disclaimer including Trade Marks and Graphics. No part of this Disclaimer may be used or reproduced in any forms without the prior written agreement of IDS GeoRadar S.r.l.

ii. In the event that any provision of this Disclaimer may be invalid, unlawful or incapable of being enforced by a rule of law, all other provisions shall, nonetheless, remain in full force and effect. Failure to either enforce or exercise any right, privilege, or legal remedy at any time, any provision contained in this Disclaimer, shall not be deemed a waiver of such provisions or right, remedy, or privilege.

iii. This Disclaimer shall be interpreted, governed, construed and enforced in accordance with the laws of Italy. User/Buyer hereby consents to the exclusive jurisdiction of Pisa.

2. Initial Precautions for Setting-up and Use of the Products.

i. The User/Buyer, for setting-up and using the Products, shall consult the official documentation provided by IDS GeoRadar S.r.l. for the Products ("Reference Documentation") and carefully ascertain the compliance with national laws and requirements, which may limit or even forbid their use.

ii. For Products which shall operate by circulation in Public Areas/Roads, with or without moving traffic, Buyer/User shall verify the approval of local authority and/or site's owner according to their specific procedures. IDS GeoRadar S.r.l. shall not be liable for any direct, indirect, special, incidental or consequential damages or injuries, including without limitation, lost revenues or lost profits, resulting by un-authorized use of the Products in Public Areas/Roads.

iii. Buyer/User further warrants:

- that these Products are not being used, in the design, development, production or use of chemical, biological, nuclear ballistic weapons. Buyer/ User will defend, indemnify and hold IDS GeoRadar S.r.l. harmless against any liability (including attorney's fees) for non-compliance with the terms of this article.
- That, if IDS GeoRadar S.r.l. requires that Buyer/User shall carry out a training with reference to some Product categories, no operation or use of the Products shall be started before its designated Operator/s has got the User Certificate, as defined by IDS GeoRadar S.r.l. specific procedure which the Buyer confirms to know and accept.

iv. For Products which include specific "Operational" software with automatic data processing and analysis "Tools", e.g. the IBIS Products and Hydra Products, User shall be aware that the results provided by these "Tools" may be not error free. User that completely relies on the outcomes provided by these Tools only, does it at his own risk.

v. In no event IDS GeoRadar S.r.l. shall be liable for special, direct, indirect, incidental, exemplary, punitive or consequential damages including, but not limited to, loss of profits or revenue, caused by the use of the Products, either separately or in combination with other products or relied upon the results provided by the above "Tools".

3. Disclaimer for the "Use" of the Products.

i. The User shall follow the instructions provided by IDS GeoRadar S.r.l. in its official "Reference Documentation" for the Product, in particular the User's Technical Manual which contains all the specific steps and recommendations for a correct setting-up and use of the Product.

ii. In no event IDS GeoRadar S.r.l. shall be liable for special, direct, indirect, incidental, exemplary, punitive or consequential damages including, but not limited to, loss of profits or revenue, caused by the missed or incomplete observance of the instructions and prescriptions for the use of the Products, either separately or in combination with other products, including but not limited to the following main aspects:

a. Use of IDS GeoRadar S.r.l. Products outside its limitation of use, without proper and adequate scientific/technical knowledge or without specific training.

b. Use of results/outcomes of the measurements performed by the Product aimed to safety aspects without using adequate control procedures and assessment by skilled personnel.

c. Opening of the Equipment (for HW Products) without express written authorization of IDS GeoRadar S.r.l.;

d. Unauthorized changes and additions to the Products.

e. Use of the Products connected to suspected non-working equipment or with equipment (mainly PC) having characteristics not in compliance with the required specifications of IDS GeoRadar S.r.l. not expressly authorized by IDS GeoRadar S.r.l.;

f. Poor or faulty operation of the electrical and telecommunication networks not directly managed by IDS GeoRadar S.r.l. or its delegates.

g. Poor or faulty operation Software/Hardware of the third parties connected with IDS GeoRadar S.r.l. Equipment.

h. Poor or faulty operation of the Products due to Software Virus which infected the Products after their delivery.

i. Use of the Products which have encountered suspected manumissions, accidents, electrostatic shocks, flashes, fire, earthquake, flooding or other natural disasters or unexpected events.

j. Use or storage of the Products outside the limits of the “Operational Temperature Range” specified by IDS GeoRadar S.r.l.

APPENDIX B TECHNICAL SPECIFICATIONS

Number of channels	2 (deep channel @200MHz, shallow channel @ 900MHz)
Scan Rate	Up to 66000 scan/s
Scan Interval	4 cm for 200 MHz and 2 cm for 900 MHz 1.6 in for 200 MHz and 0.8 in for 900 MHz
Frequency range	80MHz-1500MHz
Maximum time-range	128ns
Max number of samples	2048
Polarization	HH and VV (depending on acquisition mode)
Power consumption	**Stand-by**: 12 W; **Acquisition**: 16W
Max Operating Time	8h (acquisition), with two batteries. Extended, by hot swap capability
Dimension (Operating mode)	750x625x1000 mm (30x25x40 in)
Dimension (Transport mode)	750x625x420mm (30x25x17 in)
Weight	20Kg (44lbs)
Operating Temperature	-20 °C to +50 °C (-4 °F to 122 °F) IEC 60068 2-1/2
Environmental	IP65
Certification	EC, FCC, IC, UKCA
Vibration	Compliant with IEC 60068-2-64:2012
Shock	Compliant with IEC 60068-2-31:2011
Recommended Laptop	Panasonic FZ-G2
Positioning	Encoder; External GNSS and TPS
SOFTWARE SPECIFICATIONS	
***uMap**-Logger Acquisition Software*	Automatic calibration for an easy and quick start-up Visualization and storage of radar data Real-time visualization of radar tomography (time-slices). Connection with NMEA positioning. Device multi-language. Supports both Metric and Imperial units
***IQMaps** Processing Software*	Advanced 3D processing software with a direct export link to AutoCAD

Tab. 1 – Radar Sensor Technical Specifications

Exposure to Radio Frequency (RF) Signals:

For this the minimum distance between the user and any radiating elements is about 200 mm.

SAR evaluation is not required because the output power value is less than exemption limit at such separation distance.

APPENDIX C CONFORMITY TO EUROPEAN and UK REGULATIONS

We,

IDS Georadar s.r.l.
via A. Righi, 6, 6 A, 8, 56121 PISA, ITALY

declare under our sole responsibility that the product:

Ground Penetrating Radar (GPR)
Model No(s): AE4H

To which this declaration relates, is in conformity with the essential requirements of

2014/53/EU Directive (RED)
Directive 2011/65/UE + 2015/863/UE RoHS
Regulation (EC) No 1907/2006 REACH

The product(s) has been tested according to the following standards or technical specifications:

Essential requirements	Standard
Essential requirements for the protection of the health and safety of people, pets and goods, Article 3.1a)	- Assessment for conformity to Art. 3.1a (Safety) - Assessment for conformity to Art. 3.1a (Health)
Essential requirements on electromagnetic compatibility levels, Article 3.1b)	ETSI EN 301 489-33 V2.2.1 (2019-04) ETSI EN 301 489-1 V2.2.3 (2019-11)
Essential requirements for the effective use of radio spectrum, Article 3.2	ETSI EN 302 066 V2.2.1 (2020-06)
RoHS	EN IEC 63000:2018
Electrical Safety	IEC 62368-1

We,

IDS Georadar s.r.l.
via A. Righi, 6, 6 A, 8, 56121 PISA, ITALY

declare under our sole responsibility that the product:

Ground Penetrating Radar (GPR)
Model No(s): AE4H

To which this declaration relates is in conformity with the relevant legislation of United Kingdom:

UK SI 2017 No. 1206 The Radio Equipment Regulation 2017

The following BSI standards and technical specifications have been applied: standard(s) or other normative document(s):

Essential requirements	Standard
Radio Testing (UK Part 2 Chapter 1(6)(2))	ETSI EN 302 066 V2.2.1 (2020-06)
EMC testing (UK Part 2 Chapter 1(6)(1)(b)	ETSI EN 301 489-33 V2.2.1 (2019-04) ETSI EN 301 489-1 V2.2.3 (2019-11)
Safety testing (UK Part 2 Chapter 1(6)(1)(a))	- Assessment for conformity to UK Part 2 Chapter 1(6)(1)(a) (Safety) - Assessment for conformity to UK Part 2 Chapter 1(6)(1)(a) (Health)
Electrical Safety	IEC 62368-1

APPENDIX D IMPORTANT NOTE FOR US CUSTOMERS

FCC ID: UFW-AE4H

This device complies with part 15 of the FCC Rules:

Operation is subject to the following conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation

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

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.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

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

This device devices may not be employed for the operation of toys. Operation onboard an aircraft, a ship or a satellite is prohibited.

APPENDIX E IMPORTANT NOTES FOR CANADIAN CUSTOMERS

IMPORTANT NOTE FOR THE CANADIAN CUSTOMERS

IC Certification Number: **8991A-AE4H**

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.

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.

NOTE IMPORTANTE POUR LES UTILISATEURS CANADIENS

Numéro de certification : **8991A-AE4H**

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.

Cet appareil contient des émetteurs/récepteurs exempts de licence qui sont conformes aux RSS(s) exempts de licence d'Innovation, Sciences et Développement économique Canada. L'exploitation est soumise aux deux conditions suivantes :

1. Cet appareil ne peut pas causer d'interférence.

2. Cet appareil doit accepter toute interférence, y compris les interférences qui peuvent provoquer un fonctionnement indésirable de l'appareil.

APPENDIX F CONTACTS

The IDS GeoRadar Support team is available to answer any question about:

- general enquiries
- request of advertising material
- technical issues
- As well as listening to your suggestions too.

Please, feel free to contact us at:

IDS GeoRadar S.r.l.

via Augusto Righi, 6/6A/8
Ospedaletto - 56121
Pisa, Italy

(39) 050 8934 122

support.geo@idsgeoradar.com