

HYDRA

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1 INTRODUCTION

This document describes the HYDRA system (*Hyper Definition Radar*), and particularly refers to the concepts the user should learn before initiating the utilization of this device. Therefore we recommend reading the entire document before starting the system.

1.1 Purpose

Reading this document will provide all the necessary knowledge to install and maintain the HYDRA system. It particularly presents a step by step procedure to install the system, information for a safe use of the system and instructions for its general maintenance.

1.2 Application field

This document applies to the installation of the HYDRA system in all its configurations:

- **Hydra G HP** for monitoring of Quarries, Open pit mines, Landslides and Cut-slopes;
- **Hydra G LP** for Building monitoring;
- **Hydra U** for monitoring of Tunnels and Underground mines.

1.3 Authorization for use – national restriction

The use of HYDRA system is subject to authorization by the Competent Ministry of the country where the system will be used.



BE	BG	CZ	DK	DE
EE	IE	EL	ES	FR
HR	IT	CY	LV	LT
LU	HU	MT	NL	AT
PL	PT	RO	SI	SK
FI	SE	UK		

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

<https://www.efis.dk/views2/search-general.jsp>

1.4 CE Marking



This equipment is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/UE.

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.

2 ABOUT THE MANUAL

2.1 Manual layout

This manual is composed of several parts. After an Introduction, the first part describes the device and its components, with the explanation of the main features.

The second part shows the procedure to install the device and how to configure it correctly (Assembly Procedure).

Eventually, the maintenance plan and additional information are illustrated.

2.2 Symbols



2.3 Glossary and acronyms

2.3.1 Acronyms

DEM	Digital Elevation Model
HYDRA	HYper Definition RAdar
RADAR	Radio Detection And Ranging
FMCW	Frequency Modulated Continuous Wave
PSU	Power Supply Unit
PoE	Power-over-Ethernet
HP	High Power
LP	Low Power
IR	Infra Red
PTU	Pan-Tilt Unit
USB	Universal Serial Bus
AC	Alternate Current

2.4 Reference

The applicable versions of the following documents are the one officially released at the time of the emission of the present document.

- [BD1] MNG/2017/010 – IBIS Guardian 3.5 – User Manual
- [BD2] MNG/2017/015 – Hydra Controller - User Manual
- [BD3] MNG/2017/014 – Surf Scan 1.2 – User Manual

3 SAFETY DIRECTIONS

3.1 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.

3.2 Definition of Use

The intended use is the monitoring, with early warning capabilities, of movement on:

- Tunnel Walls.
- Buildings.
- Open Pit Mines.
- Landslides.
- Dams.
- Cut Slopes.

3.3 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 IDS GeoRadar s.r.l.
- Inadequate safeguards at the working site.

3.4 Limits of Use



DANGER: Local safety authorities and safety experts must be contacted before working in hazardous areas, or close to electrical installations or similar situations by the person in charge of the product.

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

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 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;

SAFETY DIRECTIONS

- to inform IDS GeoRadar s.r.l. immediately if the product and the application becomes unsafe;
- to ensure that the national laws, regulations and conditions for the operation of electromagnetics transmitters are respected.

3.6 Hazards of Use

DANGER: Because of the risk of electrocution, it is dangerous to use poles 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: Watch out for erroneous measurement results if the product has been dropped or has been misused, modified, stored for long periods or transported.

Precautions:

Periodically carry out test measurements, particularly after the product has been subjected to abnormal use and before and after of important measurements.

WARNING: Moving parts. The movement of the Acquisition Unit can cause loss of stability.

Precautions:

It is suggested to screw the tripod to the ground. An emergency stop button is installed on the Power Supply Unit to immediately stop the movement in case of hazard (Fig. 1).

SAFETY DIRECTIONS

WARNING: Moving parts. Be aware of the risk of collision with the Acquisition Unit during its movement.



Precautions:

Do not stand inside the Area of Operation (Fig. 2) during the functioning of the system. An emergency stop button is installed on the Power Supply Unit to immediately stop the movement in case of hazard (Fig. 1).



Fig. 1 – Emergency stop button

WARNING: Infrared laser radiation (class 1M): the laser radiation is safe to look with the unaided eye but must not be viewed using binoculars or other optical devices at a distance of less than 15 m.

Precautions:

Do not use optical devices inside the Area of Operation (Fig. 2) during the functioning of the system.



DANGER: HYDRA emits non-ionizing radiations that can cause interference with implanted electrical or ferromagnetic devices (such as a pacemaker).

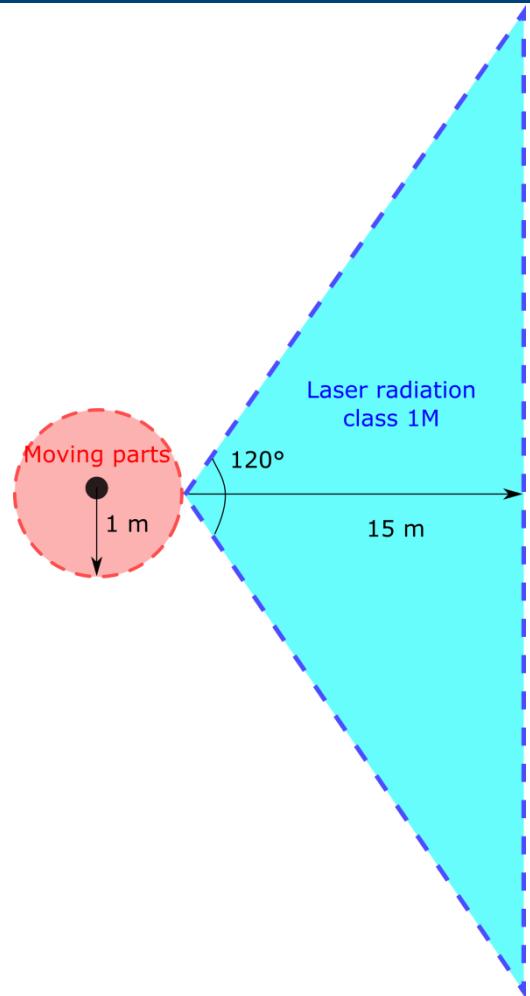


Fig. 2 – Area of Operation

WARNING: If the product is used with accessories, for example the Spotlight, you may increase the risk of being struck by lightning.

Precautions:

Do not use the product in a thunderstorm.

WARNING: 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 and accident prevention and road traffic.

WARNING: 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.



WARNING: Only IDS GeoRadar authorized technical service are entitled to repair these product.



WARNING: 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.



DANGER: The use of the system in explosive environments such as gassy mines is strictly forbidden. The non-ionizing radiations can interfere with devices such as detonators and cause explosions.



WARNING: 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 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.



WARNING: During the maintenance of the system always switch off the system and disconnect it from the power source.



WARNING: Always perform the maintenance and regulation of the system with steady Acquisition Unit. Performing these operations with the system moving can cause hazards.

Precautions:**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 environmental friendly disposal contribute towards avoiding any unnecessary effects on the environment and to health and favour the reuse or recycling of the materials that make up the equipment. Unauthorised disposal of this product as unsorted waste by its possessor will lead to an administrative penalty foreseen by national regulations.

WARNING: 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.

4 GENERAL DESCRIPTION

The HYDRA system is designed to provide real time displacement information with an accuracy of a tenth of a millimeter. The HYDRA system is particularly suitable for a range of applications depending on the configuration:

- **Hydra G HP** for Slope Monitoring: it is capable to detect and measure both slow and fast movements in various different environments, like for example Quarries, Open pit mines, Landslides and Cut-slopes;
- **Hydra G LP** for Building Monitoring: with its all-in-one software package, Surf Scan, it permits fast movement detection of a Building, for example during the foundation consolidation process;
- **Hydra U** for Tunnel Monitoring: it aims to monitor rock fall precursory event and provide warning in advance to evacuate people and machinery at risk.

All the Hydra configurations operate at the same frequency.

The performance of the HYDRA system depends on the operative measurement conditions (above all, related to the reflectivity of the area under investigation); however, the best performance characteristics can be defined as follows, depending on the configuration and type of antennas.

4.1 System Configurations

Hydra G HP with ANT 101:

- Maximum operational distance: 800 m;
- Image resolution in distance: 0.2 m;

- Angular resolution: 14 mrad;
- Accuracy in measuring displacements in the viewing direction: 0.1 mm;
- Radiation Cone (without considering the Pan-Tilt Movement): 16° H × 13° V;
- Angular coverage (thanks to the Pan-Tilt Movement): 120°.

Hydra G HP with ANT 102:

- Maximum operational distance: 500 m;
- Image resolution in distance: 0.2 m;
- Angular resolution: 8 mrad;
- Accuracy in measuring displacements in the viewing direction: 0.1 mm;
- Radiation Cone (without considering the Pan-Tilt Movement): 26° H × 25° V;
- Angular coverage (thanks to the Pan-Tilt Movement): 120°.

Hydra G LP:

- Maximum operational distance: 300 m;
- Image resolution in distance: 0.2 m;
- Angular resolution: 14 mrad;
- Accuracy in measuring displacements in the viewing direction: 0.1 mm;
- Radiation Cone (without considering the Pan-Tilt Movement): 16° H × 13° V;

GENERAL DESCRIPTION

- Angular coverage (thanks to the Pan-Tilt Movement): 120°.

HYDRA-U:

- Maximum operational distance: 200 m;
- Image resolution in distance: 0.2 m;
- Angular resolution: 8 mrad;
- Accuracy in measuring displacements in the viewing direction: 0.1 mm;
- Radiation Cone (without considering the Pan-Tilt Movement): 26° H × 25° V;
- Angular coverage (thanks to the Pan-Tilt Movement): 120°.

- Permits the autonomous DEM reconstruction of the monitored area, without the need of an external model of the terrain (only for HYDRA U model);
- Permits the positioning of each monitored point directly on an image from the Camera (only for HYDRA G LP model)
- It doesn't require the continuous presence of an operator and can be remotely controlled through Ethernet connection;
- It can be deployed in less than 30 minutes and it can be transported by a single person.

4.2 System Features

Some of the features of the HYDRA system are:

- Permits the operator to perform remote monitoring of the area (remote sensing), without needing to access the critical area;
- Supplies a continuous displacement map of the entire area. The HYDRA system simultaneously measures all the displacements of the entire area illuminated by the antenna beam;
- Directly measure the displacements of the territory of interest in real time;
- It can be used also in dark conditions providing a visual feedback thanks to its infrared camera (except HYDRA G LP model);

4.3 System Composition

The main components are:

- Radar Sensor: this generates, transmits and receives the electromagnetic signal. The Radar Sensor is installed on the Pan-Tilt;
- Positioning Unit, made of a Pan-Tilt Unit (PTU) and a metallic arm to hold the Radar Sensor. The movement of the Radar Sensor on the PTU permits the utilization of an Arc-SAR technique, that obtains a two dimensional image of the scenario;
- Tripod unit, for the installation of PTU;
- Power Supply Unit (PSU): supplies power to the system through the batteries. Mains supply is used to load the batteries. Embedded in the PSU there is the control computer, equipped with the system management software. This is used to configure the acquisition parameters, manage measurements and transmit data to the control room;
- Camera: provides a panoramic view or shots of the monitored area; in case of HYDRA U and HYDRA G HP model it also have IR capabilities to work during the night or in darkness.
- IR Laser (only for HYDRA U model): installed on the PTU, act as a laser scanner to reconstruct the surface of the monitored area, on which are projected the radar data.
- Cables: Hydra is supplied with 3 cables, a Main Cable connecting the Power Supply Unit to the Pan-Tilt Unit, a Camera Ethernet Cable, and a Power Cable connecting the PSU to the main power line.
- Optional components: The HYDRA system can be integrated with two optional components, a Siren Alarm and a Spotlight.

A detailed description of each component is reported in Chapter 5.



Fig. 3 – Composition of the HYDRA system

5 SYSTEM BREAKDOWN

The Hydra system is composed by:

- Hydra Radar Sensor (see Par. 5.1);
- Antennas (see Par. 5.2);
- Pan-Tilt Unit (see Par.5.3);
- Tripod (see Par. 5.4);
- Power Supply Unit (see Par. 5.5);
- Tablet (see par. 5.6);
- Camera (see Par. 5.7);
- Laser, only for Hydra U model (see Par.5.8);
- Cables (see Par. 5.9);
- Siren Alarm, optional (see Par. 5.10);
- Spotlight, optional (see Par. 5.11).

5.1 HYDRA Radar Sensor

The Radar Sensor (Fig. 4) is the unit containing all the parts for the generation, transmission, reception and acquisition of the radar signal.

The HYDRA Radar Sensor has the following interfaces:

- n. 14 threaded holes for the installation of the antenna cover (Fig. 5);
- n. 2 waveguides for installation of the antennas (Fig. 5);
- n. 1 connector 19 pins to Pan-Tilt cable (Fig. 6);

- n.1 connector 4 pins for Laser cable (Fig. 6);
- n.1 connector 3 pins for Trigger cable (Fig. 6);
- n.3 fixing points for Positioning Unit (Fig. 7);
- n.1 Radome protective cover (Fig. 4).



Fig. 4 – HYDRA Radar Sensor (front view)

SYSTEM BREAKDOWN

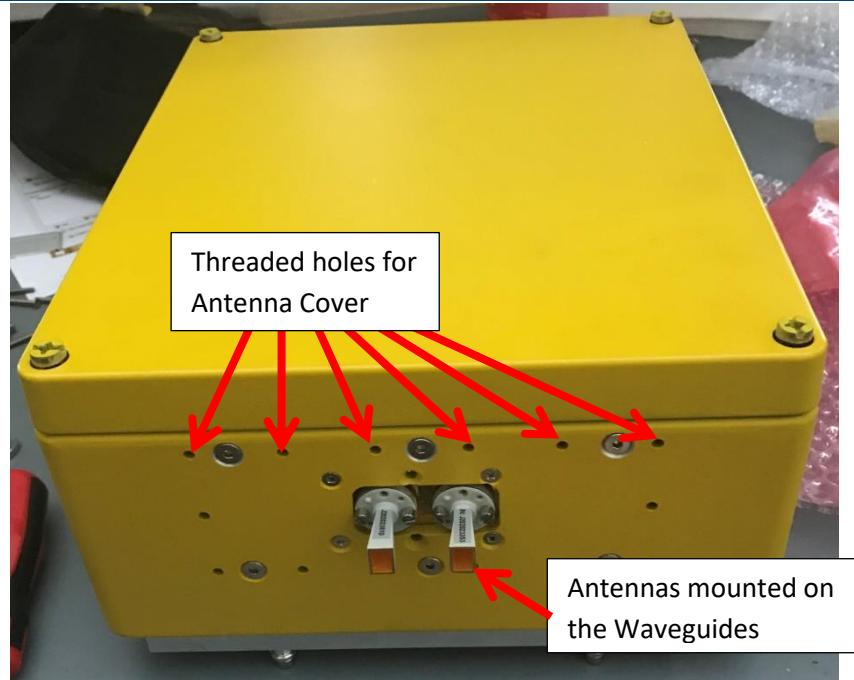


Fig. 5 – HYDRA Radar Sensor (front view without cover)



Fig. 6 – HYDRA Radar Sensor (back view)

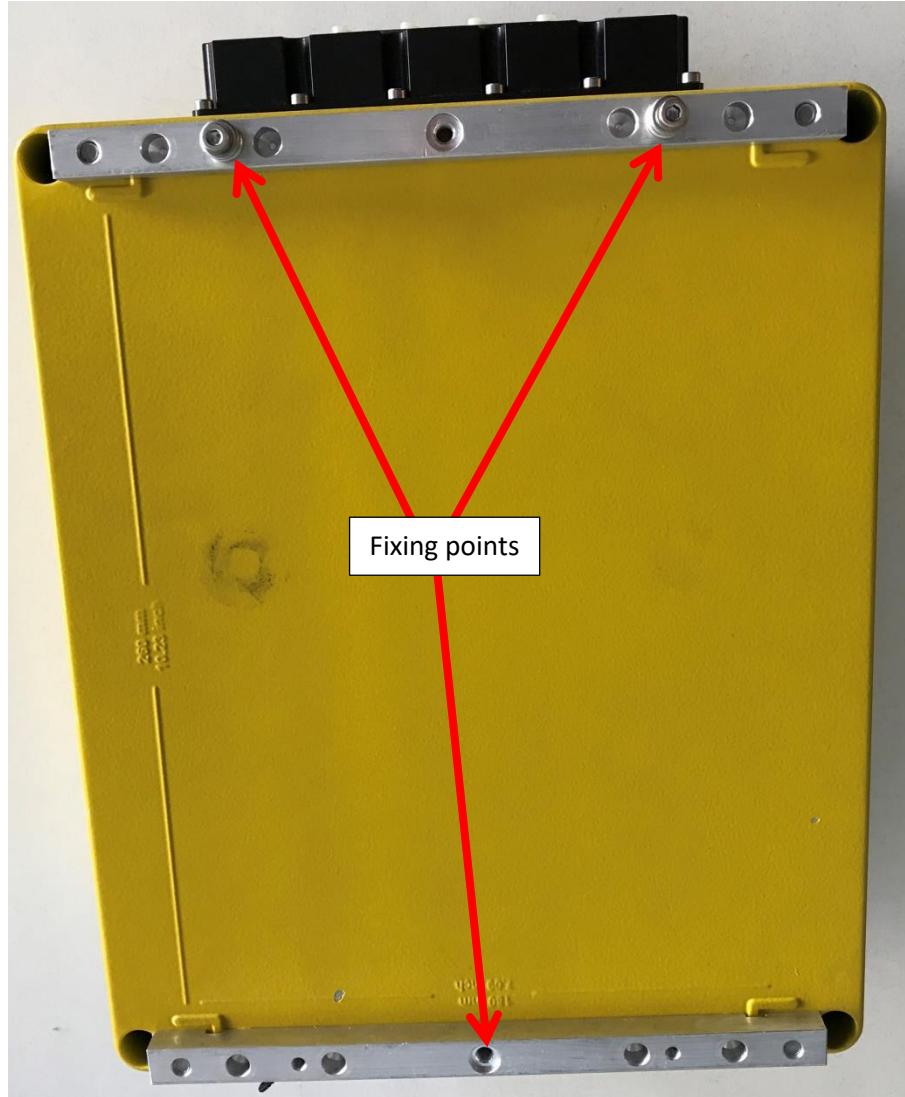


Fig. 7 – HYDRA Radar Sensor (bottom view)

5.2 Antennas

The HYDRA system is provided with a couple of HYDRA-ANT 101 and/or a couple of HYDRA-ANT102 antennas (depending on the configuration) operating in vertical polarization and characterized by a maximum gain of 21 dBi (for ANT 102) or 17.3 dBi (for ANT 102). The amplitude characteristics of the antenna main lobe at -3 dB and -10 dB are provided in Tab. 2 and Tab. 2.

HYDRA-ANT101	HORIZONTAL PLANE	VERTICAL PLANE
-3 dB	16°	13°
-10 dB	32°	26°

Tab. 1 – Main lobes width of HYDRA-ANT101 antennas at -3 dB and -10 dB

HYDRA-ANT102	HORIZONTAL PLANE	VERTICAL PLANE
-3 dB	26°	25°
-10 dB	60°	55°

Tab. 2 – Main lobes width of HYDRA-ANT102 antennas at -3 dB and -10 dB



Fig. 8 – HYDRA-ANT 101



Fig. 9 – HYDRA-ANT 102

The Radar Sensor is fitted with two waveguides, each with four threaded holes, for the installation of the pair of antennas (Fig. 5).

HYDRA antennas are protected by a Radome protective cover (Fig. 7).

5.3 Positioning Unit

The Positioning Unit (Fig. 10) consists of:

- The Pan-Tilt main body, made in aluminum and plastic, with dimensions 32x20x21 cm and weight <10 kg, capable of moving the Radar Sensor in azimuth and elevation;
- A Triggering Magnetic Sensor to synchronize the Pan-Tilt rotation and the radar acquisition;
- The Arc SAR arm 50 cm long holding the payload items;
- An Elevation Pointing System that is the support of HYDRA Radar Sensor and permits the main beam of the antenna to be orientated in elevation towards the area to be observed.

SYSTEM BREAKDOWN

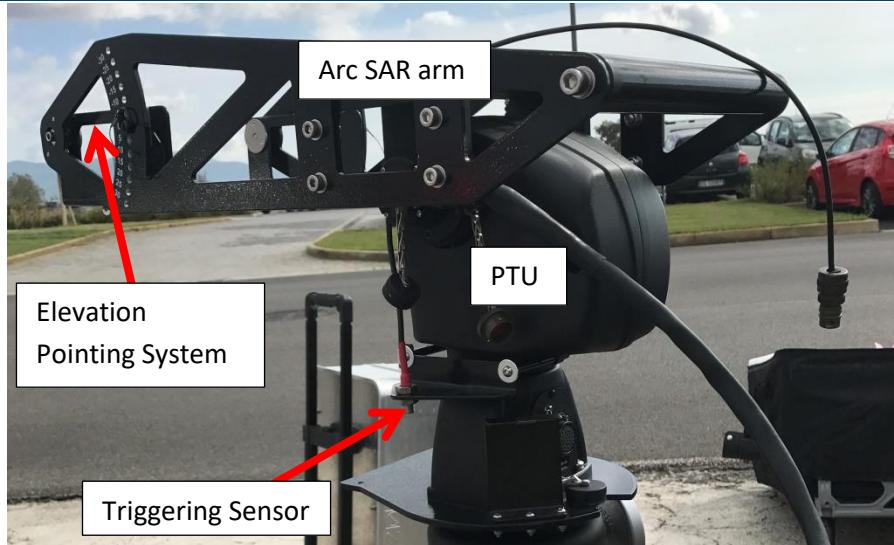


Fig. 10 – Pan-Tilt Unit



Fig. 11 – Elevation Pointing System

The elevation pointing system is fixed on the Arc SAR arm through 2 cam levers and 2 knobs. The cam levers are the rotation fulcrums of the pointing system, while the knobs permit to select different Radar Sensor bearings, between -30° and $+30^\circ$ (see Fig. 11). In Hydra-G LP configuration the Elevation Pointing System must always be positioned at 0° ; in Hydra-G HP and Hydra U configuration the position must be the same of the Camera tilting angle (see Par.5.7).

2 screw holes under the elevation pointing system permits the installation of IR Laser under the Elevation Pointing System (see Fig. 12).



Fig. 12 – Screw Holes for Laser installation

On the Elevation Pointing System there are 3 fixing point to hold the sensor in place, two of them are composed by a pull-tab, the third uses a knob (see Fig. 7).

The PTU must be connected to the Power Supply Unit (PSU) with the Main Cable, attached to the 32-pins connector (Fig. 13):



Fig. 13 – 32-pins connector for the Main Cable

Depending on the system configuration, the function of the Positioning Unit is different:

- For Hydra-U, the PTU is used to move the Laser in azimuth and elevation to perform surface reconstruction and the Radar Sensor in azimuth for the actual monitoring. During surface reconstruction the PTU moves performing a serpentine, alternating clockwise and counterclockwise scans in azimuth, increasing the elevation angle at each scan. During the actual scan, instead, the PTU moves in azimuth at a fixed elevation from -60° (the magnetic trigger angle, see Fig. 14) to +60° clockwise, and then returns to the magnetic trigger angle (counterclockwise).

SYSTEM BREAKDOWN

- For Hydra-G HP, the PTU is used to move the Radar Sensor in azimuth for the actual monitoring. During the scan the PTU moves in azimuth at a fixed elevation from -60° to +60° clockwise, and then returns to -60° (counterclockwise).
- For Hydra-G LP, the PTU is used to move the Radar Sensor in azimuth and elevation to perform the surface reconstruction. After the surface reconstruction the PTU is used to move the Radar Sensor in elevation, to match the Camera tilting angle, then in azimuth (from -60° to +60°) to perform the actual scan.

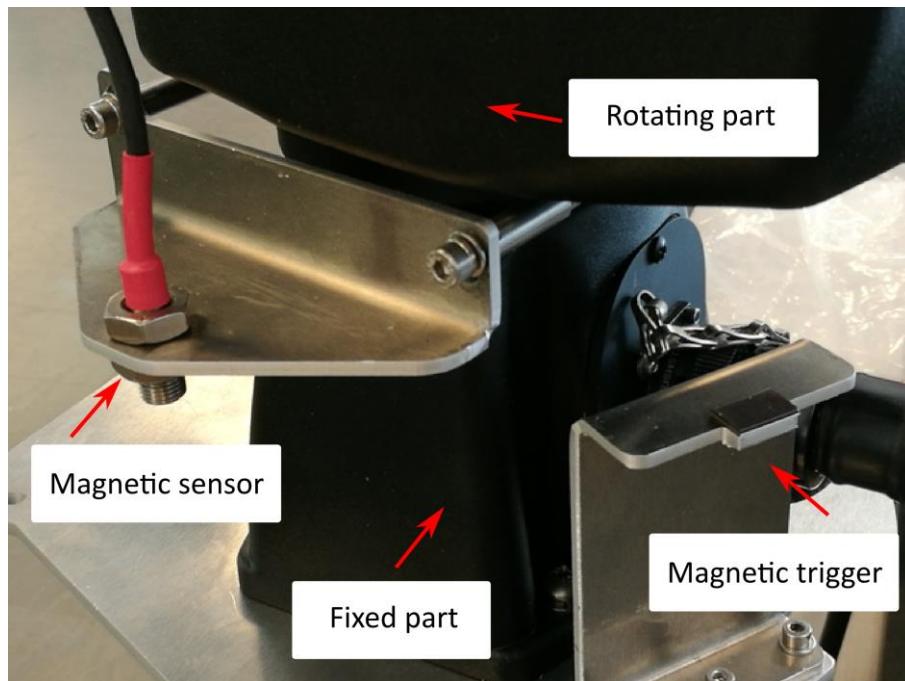


Fig. 14 – Magnetic triggering sensor

WARNING: Pinch point. Beware of the risk of finger pinch between the magnetic sensor and the magnetic trigger during rotation of the system (Fig. 14).

5.4 Tripod

A tripod is provided for the installation of the PTU, with an interface that allows easy fastening (Fig. 15).



Fig. 15 – Tripod

5.5 Power Supply Unit

The Power Supply Unit (or PSU) supplies electric power to the system. Its function is to:

- distribute power and signals to the PTU, Radar Sensor and other peripherals included in the system;
- receive power from mains supply and charge the pair of batteries required to guarantee a continuous power supply for 2 hours after a blackout event;

The PSU is a box with dimensions of 600 x 400 x 385 mm and a weight of 25 kg, with 2 handles plus an additional pull out handle, two wheels and fasteners fitted with plug locks (Fig. 16).



Fig. 16 – Power Supply Unit

The PSU has 7 interfaces (Fig. 17), from left to right they are:

- Tablet Power;
- Spotlight;
- Siren Alarm;
- Power Input (supports 100-240 V AC or 12-24 V DC);
- WiFi antenna;
- PTU Main Cable;
- Local Network;
- Camera Ethernet cable.



WARNING: Camera socket is supplied with 802.3af POE (Power-Over-Ethernet). Do not connect any other peripherals to that socket.



Fig. 17 – Power Supply Unit connectors

The PSU has an emergency stop button accessible on its external surface (Fig. 1) that, if pressed, immediately stops the movement of the PTU. Once pressed, the button switches off the supply of the PTU. The button needs to be pushed again to switch on the PTU again and restart the acquisition.

Opening the PSU gives access to 3 buttons:

- ON button (Fig. 18);
- OFF button (Fig. 18);
- Alarm Mute button (Fig. 19).

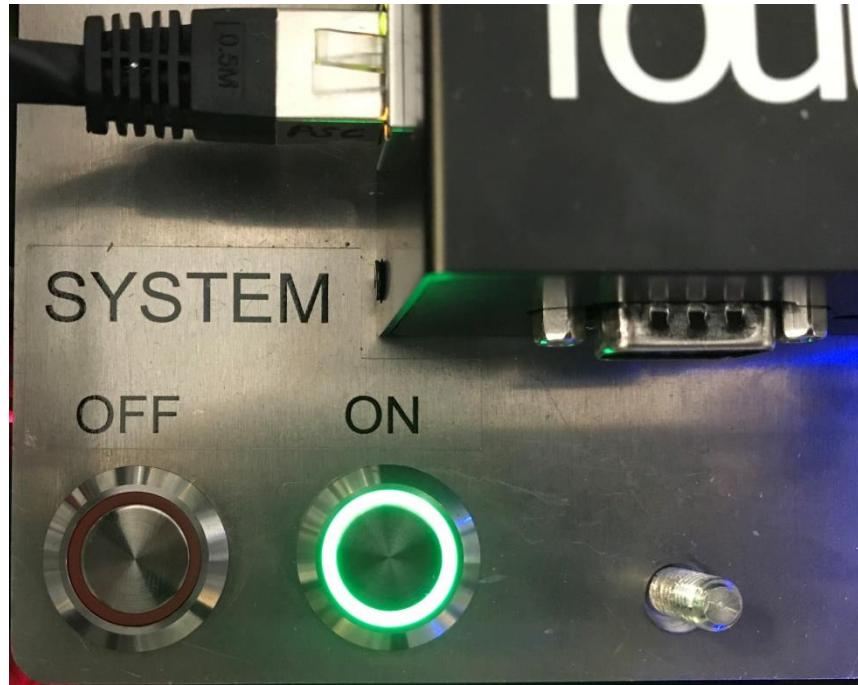


Fig. 18 – ON and OFF button



Fig. 19 – Alarm Mute button

The PSU has inside also the HYDRA computer (Fig. 20): an industrial PC that is supplied with different software, depending on the configuration:

The software used for Hydra G HP and Hydra U is Hydra Controller (for data acquisition) and Hydra Guardian (for processing and early warning); the software used for Hydra G LP is Surf Scanner (for both data acquisition and processing).



Fig. 20 – HYDRA computer



Fig. 21 – Getac Tablet

5.6 Tablet

The HYDRA system uses a Getac Tablet, remotely connected to the industrial PC embedded in the PSU (HYDRA computer), to control the Radar Sensor.

The Tablet comes with a user account already configured with the following credentials:

- Username: hydrauser
- Password: hydra1234



WARNING: No communication software such as Firewall, Wi-Fi or antivirus must be installed to avoid any conflict with the Hydra software.



IDS GeoRadar takes no responsibility for bad functioning if there is a functional conflict between its software and any software installed on the HYDRA computer by the user. IDS GeoRadar does not guarantee that the performance of its equipment will be maintained using a different configuration from the recommended one

5.7 Camera

Depending on the configuration, one of two possible Camera models is provided:

- 4 MP WDR Dome Network Camera with IR, only for Hydra-U or Hydra-G HP (Fig. 22);
- 2 MP Network Mini PTZ Dome Camera, only for Hydra-G LP (Fig. 23);



Fig. 22 – 4 MP WDR Dome Network Camera with IR



Fig. 23 – 2 MP Network Mini PTZ Dome Camera

The 4 MP WDR Dome Network Camera with IR is a dome camera with integrated IR illuminator and auto switch between day and night vision.

The 2 MP Network Mini PTZ Dome Camera is a dome camera capable of self-movement controlled by the software Surf Scan.

Both types of camera are installed on the fixed part of the Positioning Unit, on the plate of connection between PTU and tripod.

For the 4 MP WDR Dome Network Camera with IR there is also an elevation pointing system that permits the orientation towards the area to be observed. An inclinometer is stuck on the elevation pointing system to indicate camera bearing.

SYSTEM BREAKDOWN

The Camera, integrated into a Hydra installation, provides several additional features:

- For Hydra-G LP it is used to display the radar map on the camera image (Fig. 24);
- For Hydra-U and Hydra-G HP it is used to correlate the picture scenario with a given Guardian radar map, thus enabling the visual recognition of moving areas (Fig. 25);
- For Hydra-U and Hydra-G HP it can stream a real time video of the areas of interest.

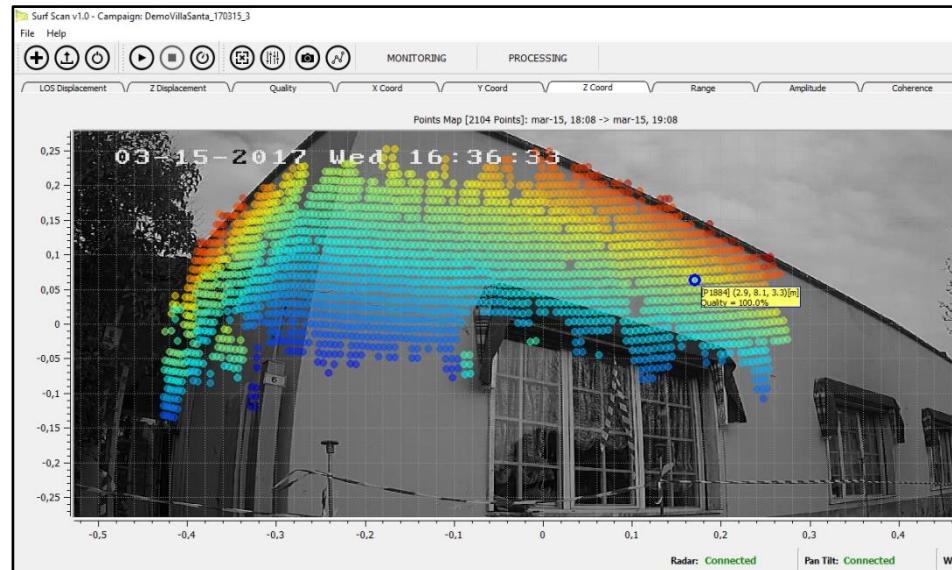


Fig. 24 – Radar map on Camera display for Hydra-G LP



Fig. 25 – Radar map and Camera display for Hydra-G HP and Hydra-U

Both models of the Camera are connected to the PSU though an Ethernet cable.

5.8 Laser

The Laser (Fig. 26), used only in the Hydra-U model, is mounted on the elevation pointing system, below the Radar Sensor and, when moved by the PTU, act as a laser scanner, enabling the surface reconstruction of the monitored scenario.

The laser has good measuring performance on a rocky surface up to 50 m far.

The Laser is connected directly to the Radar Sensor.



Fig. 26 – Laser



WARNING: The laser is rated Class 1M. Do not look at the laser with magnifying optics such as microscopes and telescopes.

5.9 Cables

The Hydra system is provided with a Cable Kit composed by:

- PTU Main Cable (Fig. 27);
- Camera Ethernet Cable (Fig. 28);
- AC Power Cable (Fig. 29);

- Power Cable Adapter (Fig. 30), this cable is different based on the country.
- Sensor Cable (Fig. 31);
- Local Network Cable (Fig. 32);
- DC Power Cable (Fig. 33);
- Laptop Battery Cable (Fig. 34).

The PTU Main Cable (Fig. 27) is used to connect the Pan-Tilt to the PSU, it provides power to the PTU and it exchange data between the HYDRA computer embedded in the PSU and the PTU.



Fig. 27 – PTU Main Cable

SYSTEM BREAKDOWN

The Camera Ethernet Cable (Fig. 28) is used to connect the Camera to the PSU, it provides power to the Camera and it exchange data between the Camera and the HYDRA computer embedded in the PSU.



Fig. 28 – Camera Ethernet Cable

The AC Power Cable (Fig. 29), is used to connect the PSU to the main power line, it can be used in conjunction with the Power Cable Adapter (Fig. 30).



Fig. 29 – AC Power Cable



Fig. 30 – Power Cable Adapter

The Sensor Cable (Fig. 31) is used to connect the PTU to the Sensor. The curved end needs to be connected to the Sensor (Fig. 6).



Fig. 31 – Sensor Cable

SYSTEM BREAKDOWN

The Local Network Cable (Fig. 32) is an Ethernet cable used to connect the PSU to an external network.



Fig. 32 – Local Network Cable

The DC Power Cable (Fig. 33) is used to connect the PSU to a direct current power source, such as Solar Panels or Fuel Cells.



Fig. 33 – DC Power Cable

SYSTEM BREAKDOWN

The Laptop Battery Cable (Fig. 34) is used to recharge the Laptop through the PSU.



Fig. 34 – Laptop Battery Cable

5.10 Siren Alarm

A Siren Alarm (Fig. 35) can be connected to the PSU to provide Early Warning based on the detected movements in the scanned area. It is only used in Hydra-U and Hydra-G HP configurations, and provides both a visual and auditory alarm.



Fig. 35 – Siren Alarm

5.11 Spotlight

In the event that the jobsite illumination is not enough, a Spotlight (Fig. 36) can be connected to the PSU.



Fig. 36 – Spotlight

6 HOW TO INSTALL AN HYDRA-U SYSTEM

The installation of the HYDRA system requires about 15 minutes of work. The procedure can be broken down into following parts:

1. preliminary operations;
2. installation of the tripod;
3. installation of the positioning unit on the tripod;
4. installation of the HYDRA Radar Sensor on the positioning unit;
5. installation of the Camera;
6. installation of the PSU;

The procedure for the dismantling of the equipment from the measurement site is given in Par. 7.1, after the description of the 6 mentioned steps.

6.1 Preliminary operations

These are the preliminary operations suggested before the actual installation of an HYDRA system:

- choose installation site;
- verify in advance that the contents of the transport cases were properly loaded to avoid any damage during transportation.
- arrange a suitable means of transportation, capable of containing all the needed material.

6.1.1 Choose the Installation Site

The first step in setting up an HYDRA is choosing an installation point. This is a very important process which will greatly affect the quality of data. For

this reason it is advised that you work with IDS GeoRadar personnel to choose the best installation point.

Below some considerations when choosing an installation site:

- Installation site should have a clear view of the area to be monitored. Shadowed areas or other areas that cannot be seen will not be present in the data;
- Installation site should be a place with enough room to permit free movement of the PTU both in pan and tilt, avoiding collisions of the Arc-SAR metallic arm with other obstacles;
- HYDRA should not be placed at a distance less than 2 m from the area of interest for the monitoring, since targets nearer than 2 m will not be visible;
- HYDRA should be placed far enough away from the wall so that it can monitor the desired scenario. The system will monitor a cone shaped area extending from the installation point. Refer to Par.4.1 and 5.2 for the maximum distance and beam width of the various configurations;
- HYDRA measures the line of sight displacement. This means that it measures the displacement that occurs along a line that extends from the radar to the monitored surface. Movements which are perpendicular to the radar's line of sight can't be seen. For this reason avoid monitoring walls which are parallel to the radar's line of sight;
- Avoid area with vegetation (for slope monitoring) and glass surfaces (for building monitoring);
- We can imagine two typical monitoring scenarios for HYDRA scanning: side wall monitoring (Fig. 37) and roof monitoring (Fig. 38).

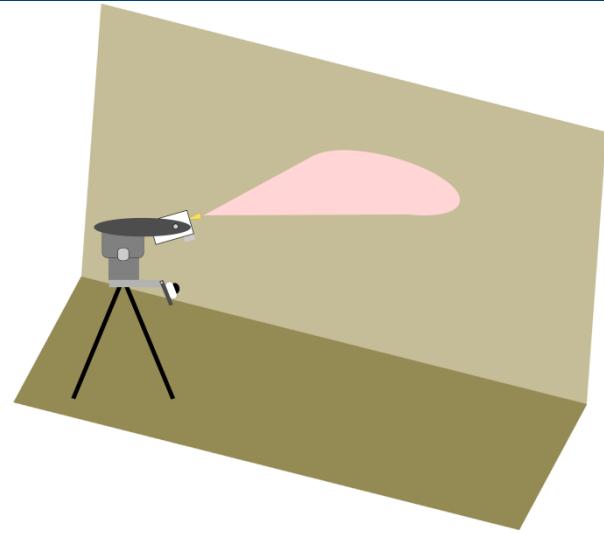


Fig. 37 – Side wall monitoring

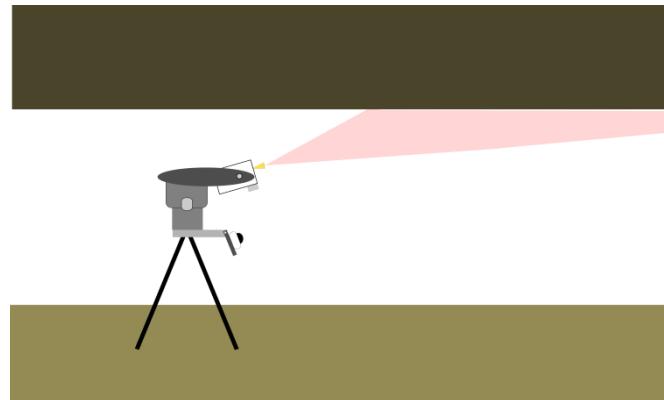


Fig. 38 – Roof monitoring

For side wall monitoring, is suggested an oblique orientation of the PTU with respect to the monitored surface, in order to maximize the enlightened area, as shown in Fig. 39.

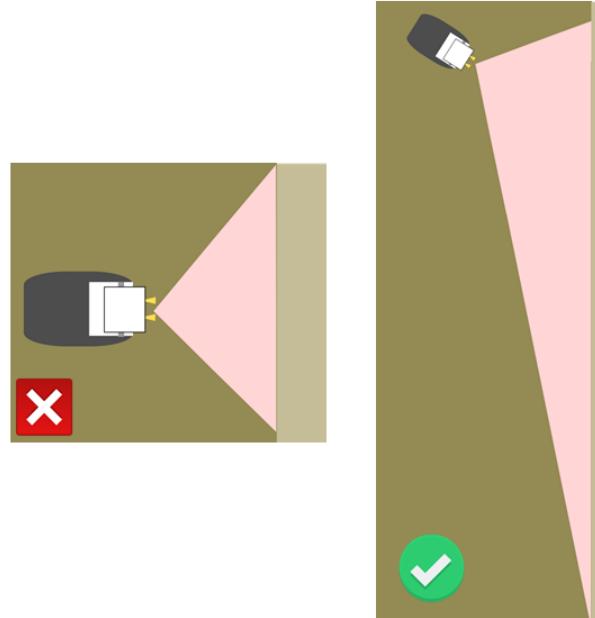


Fig. 39 – Side wall positioning

6.2 HYDRA installation

1. Pull out the Tripod from the transport bag and place it in the installation point (Fig. 40);



Fig. 40 – Place the Tripod in the installation point

2. Level the Tripod using the three legs and checking bubble level for a correct installation (Fig. 41). It is suggested to screw the tripod to the ground using the special holes on the tripod's feet.



Fig. 41 – Tripod leg and bubble level

3. Pull out the PTU from the transport bag;

HOW TO INSTALL AN HYDRA-U SYSTEM

4. Mount the PTU on the Tripod by accommodating the metallic cylinder (bottom of the PTU) in the Tripod's cylindrical housing (Fig. 42);



Fig. 42 – Mounting the PTU on the Tripod

5. Rotate the Positioning Unit on the Tripod until it is possible to access the fixing screw in the Tripod's cylindrical housing;
6. Use the hex key with the red handle, provided with the Tripod, to screw on the Positioning Unit to the Tripod (Fig. 43);



Fig. 43 – Secure the PTU to the Tripod

7. Pull out the Camera (already mounted on its mechanical holding system) from the transport bag;

8. Fix the Camera to the metallic plate of the PTU using the two knobs (Fig. 44);



Fig. 44 – Camera Mounted on the PTU

11. Mount the Radar Sensor on the PTU using the knob and the two fixing levers (Fig. 45);



Fig. 45 – Radar Sensor fixing Levers

9. Use the Camera lateral knobs to point the camera at 0° (only for the model 4 MP WDR Dome Network Camera with IR);
10. Pull out the Radar Sensor from the transport bag;

12. Use the 2 quarter turn screws to point the Radar Sensor at 0° (Fig. 46);



Fig. 46 – Radar Sensor pointing system

13. Connect the PTU Data Cable, the Triggering Sensor Cable, and the Laser Cable, to the back of the Radar Sensor (Fig. 47);



Fig. 47 – Radar Sensor cabling



Check the gap between the magnetic sensor and the magnetic trigger; the gap needs to be 0.1÷3mm for correct functioning

HOW TO INSTALL AN HYDRA-U SYSTEM

14. Place the PSU in a convenient location around 1.5m-2m from the Tripod;
15. Connect the PTU main cable to the Pan-Tilt and to the Power Supply Unit (Fig. 48);



Fig. 48 – Connect the PTU Main Cable

16. Connect Camera Ethernet Cable to the PSU and to the Camera (Fig. 49);



Fig. 49 – Connect the Camera Ethernet Cable

17. Connect the Wi-Fi Antenna to the PSU (Fig. 50);



Fig. 50 – Connect the Wi-Fi Antenna

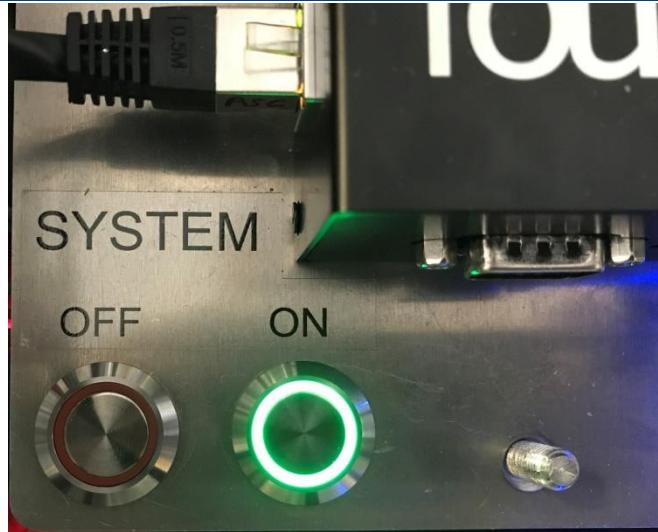


Fig. 51 – Turn ON the system

18. Connect the AC Power Cable to the PSU and to the main power line, eventually using the Power Cable Adapter (Fig. 29 and Fig. 30);
19. Open the PSU and switch on the system pushing and holding for 7 seconds the ON button inside the PSU (Fig. 51);

20. Switch on the tablet;
21. The credentials for the Tablet access are:
 - Username: HydraUser
 - Password: hydra1234
22. Open the “Wireless Network Connection” menu on the Tablet and connect:
 - Network name: Hydra Wifi
 - Password: hydra1234

23. Run the “Remote Desktop Connection” application linked on the Tablet’s desktop;
24. Click on “Show Options” and enter the following credentials:
 - Computer: 10.0.10.3
 - Username: HydraUser
25. The user is now connected with the HYDRA computer inside the PSU.
Run the software “HYDRA Controller” or the software “SurfScan”,
depending on the HYDRA system version. We refer to the User
Manual of the 2 software for further details about the use of the
abovementioned software.

7 DISMANTLING AN HYDRA SYSTEM

When dismantling the measurement site, carefully verify exactly what is to be removed and accurately place the pieces to be stored in the packing cases.



Send the PTU to the “home” position (Pan=0°, Tilt=0°) before the dismantling of the system, in order to fit it in the transport case.

8. Disconnect the PTU Data Cable, the Triggering Sensor Cable, and the Laser Cable, from the back of the Radar Sensor, cover each connector with the relative cap;
9. Remove the Radar Sensor from the PTU, unlocking the two metallic levers and unscrewing the fixing knob;
10. Unscrew the Positioning Unit from the Tripod using the hex key;
11. Remove the Positioning Unit from the Tripod by lifting it up;
12. Close the cases after verifying that all parts have been packed;

7.1 Dismantling the measurement site

The following procedure should be followed in order to remove the HYDRA Radar Sensor from the measurement site:

1. Switch off the tablet;
2. Turn OFF the PSU and close the lid;
3. Disconnect the AC Power cable and the Power Cable Adapter from the main power line;
4. Disconnect the AC Power Cable, the Camera Ethernet Cable, the PTU Main Cable and the Wi-Fi antenna from the PSU, cover each connector with the relative cap;
5. Disconnect the Camera Ethernet Cable from the Camera;
6. Disconnect the PTU Main Cable from the Pan-Tilt, cover the connector with the cap;
7. Remove the Camera from the PTU;

8 MAINTENANCE AND TROUBLESHOOTING

8.1 Maintenance

In the present section information for HYDRA system maintenance are provided. For further details please contact IDS GeoRadar Customer Care.



WARNING: All maintenance operations need to be performed with the system stopped and disconnected from the power source. Different behavior can lead to injuries due to mechanical or electrical hazards.

- Periodically clean the system from dust with particular attention to protective antenna cover, laser lens and rotation joints.
- Periodically verify that the magnetic sensor is well screwed on its frame and that the gap clearance between the sensor and the trigger is correct (0.1÷3 mm), see Fig. 14.
- Keep clean the magnetic trigger surface.
- Periodically check if the PTU has acquired some play, that is if the clearance between different angular positions has increased. You can test it with the stopped PTU trying gently to move it around its steady position. The movement allowed should be minimum.
- Lubricate periodically the cylindrical interface between PTU FLIR and Moog Tripod, use silicone grease or silicone spray lubricant, see Fig. 42.
- After 5 years of use replace the batteries inside the PSU.

8.2 Troubleshooting

This paragraph lists some tips to avoid the most common mistakes in the use of the system. For further details please contact IDS GeoRadar Customer Care.

PROBLEM	SUGGESTION
The PSU does not turn on.	The backup batteries could be low. Remember they ensure continuous operation only for 2 hours.
The PSU is powered on but some components of the system seems to be powered off (e. g. the camera/PTU/radar are off).	If the system is disconnected from the main supply, make sure to keep the on-button pressed for at least 7 seconds in order to start the PSU switching on all the peripherals of the system.
The Wifi network “Hydra Wifi” for the remote connection of the Tablet with HYDRA computer is not listed among the Tablet’s Wireless Network Connection list.	Verify that the Wifi antenna is properly connected to the PSU (see Fig. 50).
The PSU is powered on but the PTU seems to be powered off.	Verify that the emergency button is not pressed.
The PTU moves but the radar does not acquire new data.	Verify that the gap between the magnetic sensor and the trigger is correct (0.1÷3 mm), see Fig. 14.

Tab. 3 – Troubleshooting

9 IDS GEORADAR ON-LINE ASSISTANCE

9.1 Download Area

The GeoRadar section of the IDS GeoRadar website has a download area you can access to get the latest update of software, manuals, guides and other useful tools.

To do this, the first step is to request an account activation in <http://idsgeoradar.com/customer-area/customer-area-registration>.

The request will be handled by the Customer Care of IDS GeoRadar, after which you will receive an email with your credentials for accessing the download area during login at <https://support.idscorporation.com/>.

9.2 Screen Connect Support Center Remote Assistance

The Screen Connect Support Center is a service that allows the activation of a two host session, making your application or your desktop available to another user.

It can be used to perform web conferences and presentations, and is easy to use thanks to a simple and intuitive interface.

Since there are no firewalls or other types of network configurations, it is a fast and secure means of reaching any client host in any part of the world. In fact, you only need to accept to download a small plugin used to permit the service authentication and functioning.

9.2.1 HOW TO USE THE SCREEN CONNECT SERVICE

You will receive an email from IDS GeoRadar Customer Care containing a link to the support session (see Fig. 52).

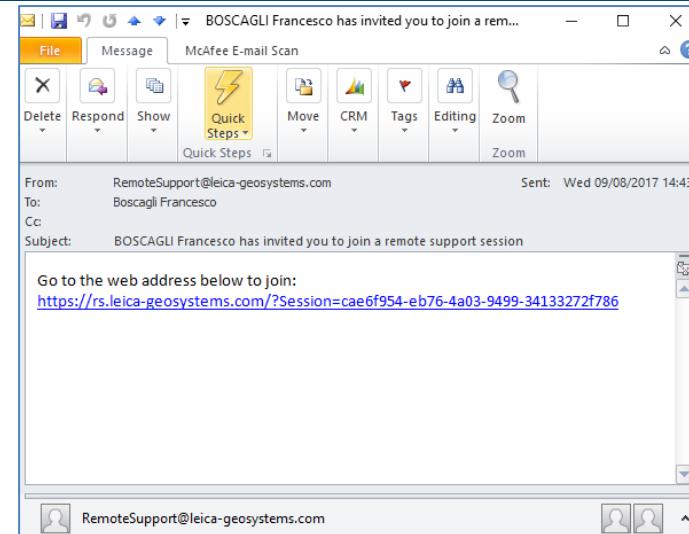


Fig. 52 – IDS GeoRadar email sent to the client

Clicking on the link in the email, the following window appears. Click on the arrow to join the session (see Fig. 53).

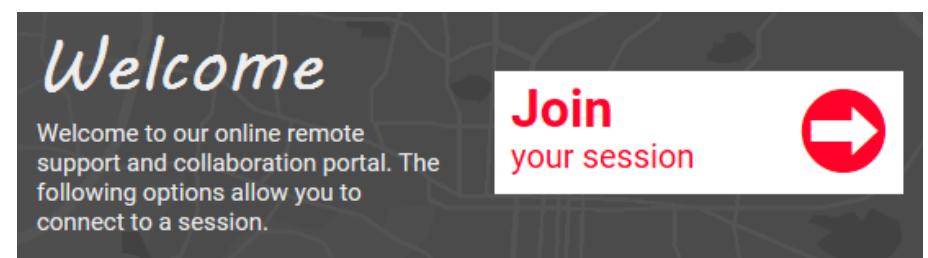


Fig. 53 – Client data insertion form

Click on Run to download the Screen Connect application (see Fig. 53).

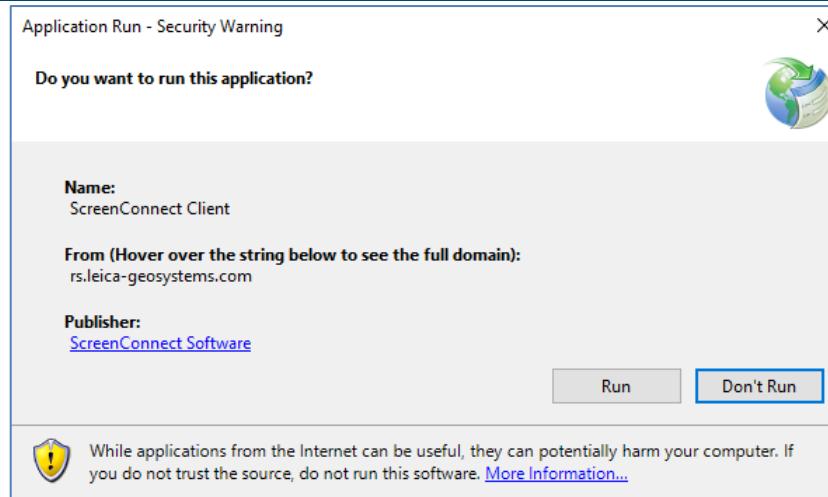


Fig. 54 – Run Screen Connect application

At this point, IDS GeoRadar Customer Care can perform a range of operations on your desktop:

- Send and receive files;
- Directly control your PC;
- Chat to ask some physical operation to be performed (for example connect a cable, turn off/on a system, move some parts).

When the IDS GeoRadar technician try to connect to your pc you will receive a Popup requesting the authorization, click on Allow (see Fig. 55).

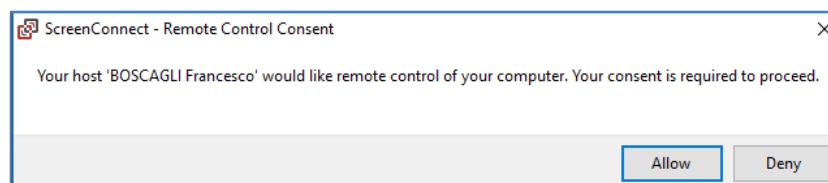


Fig. 55 – Authorization request

10 APPENDIX A – SYSTEM PACKAGING

The system is delivered with the following packaging:

- Power Supply Unit (Fig. 56);
- Trolley Bag #1 (Fig. 57);
- Trolley Bag #2 (Fig. 57);
- Optional Components Bag (Fig. 58).



Fig. 56 – Power Supply Unit



Fig. 57 – Trolley Bag

APPENDIX B – SYSTEM PACKAGING



Fig. 58 – Optional Components Bag

The Power Supply Unit is a stand-alone object (see Par. 5.5).

The Trolley Bag #1 contains:

- Positioning Unit (see Par. 5.3);
- Camera (see Par. 5.7);
- Tablet (see Par. 5.6).

The Trolley Bag #2 contains:

- Tripod (see Par. 5.4);
- Cables (see Par. 5.9);

- Radar Sensor with Antennas (see Par. 5.1 and 5.2).

The Optional Components Bag is only present if one of the optional items are purchased, it contains:

- Siren Alarm, optional (see Par. 5.10);
- Spotlight, optional (see Par. 5.11).

APPENDIX B - TECHNICAL SPECIFICATIONS OF HYDRA

Pan-Tilt	
Dimesion	32 X 20 X 21 cm
Arm Length	50 cm
Weight	18 kg
Enclosure Class	IP 65
Temperature Range	-10 °C ÷ + 55 °C

Power Supply	
Dimesion	60 X 45 X 45 cm
Weight	25 kg
Enclosure Class	IP 65
Temperature Range	-10 °C ÷ + 55 °C
Input voltage range	100 ÷ 240 V AC
Power Consumption (whole system)	100 W

Tripod	
Dimesion	100 X 100 X 120 cm
Weight	8 kg

Radar Sensor	
Dimesion	30 X 30 X 11 cm
Weight	5 kg
Enclosure Class	IP 65
Temperature Range	-10 °C ÷ + 55 °C

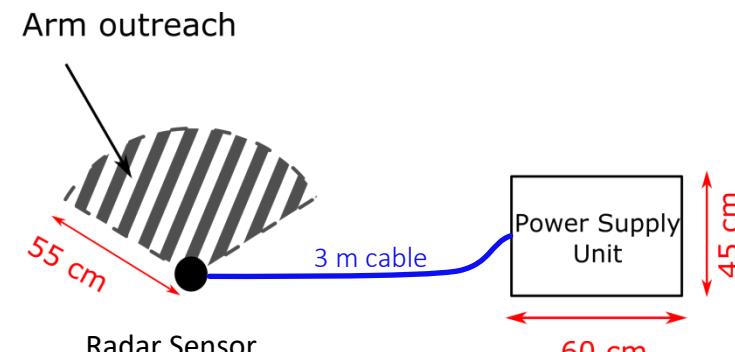


Fig. 59 – Total system footprint

APPENDIX C - DISCLAIMER

DISCLAIMER

Generals.

The present Disclaimer applies to all products (the “Products”) designed, produced and distributed by IDS GeoRadar s.r.l its Subsidiaries, Affiliated and authorized Distributors. IDS GeoRadar 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.

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.

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

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

The Buyer, for setting-up and using the purchased Products, shall consult the official documentation provided by IDS GeoRadar for the Products (“Reference Documentation”) and carefully ascertain the compliance with national laws and requirements, which may limit or even forbid their use.

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 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 unauthorized use of the Products in Public Areas/Roads.

For IBIS Products Family, Buyer/User 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 harmless against any liability (including attorney’s fees) for non-compliance with the terms of this article.

That no operation or use of the IBIS products shall be started before its designated Operator/s has got the IBIS 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”, i.e. the IBIS Products, User shall be aware that the results provided by these “Tools” may be not 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 use of the Products, either separately or in combination with other products or relied upon the results provided by the above “Tools”.

Disclaimer for the “Use” of the Products.

The User shall follow the instructions provided by IDS GeoRadar 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.

In no event IDS GeoRadar shall be liable for special, direct, indirect, incidental,

APPENDIX C –DISCLAIMER

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, in particular for the following main aspects:

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

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.

Opening of the Equipment (for HW Products) without express written authorization of IDS GeoRadar.

Unauthorized changes and additions to the Products.

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

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

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

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

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

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

Disclaimer for the “IBIS Family” Products.

IBIS Products include specific “Operational” software with automatic data processing and analysis which may give outcomes/results for helping User in the monitoring of “the stability conditions” of a specific event.

Nevertheless, IDS GeoRadar has the obligation to remind the Users that the performance of IBIS might be influenced by two main factors which may distort its outcomes, thus giving rise to false or missing alarms:

The parameters introduced by the operator/s.

The particular environmental conditions: (even though the radar technology employed by IBIS is deemed among the most reliable for the monitoring of “instable slopes”).

Therefore, when IBIS Products are used in “Critical Monitoring for safety purposes” applications, like real time monitoring of unstable slopes including Opencast or Underground Mining, User must be aware that the “the assessment of the stability conditions of the observed targets” must be tasked to skilled and certified operator/s able to understand data supplied by either IBIS or other equipment employed to such purpose; only operators officially trained and regularly updated by IDS GeoRadar (holding an “IBIS User Certificate” thereof) are allowed to use IBIS products.

IDS GeoRadar assumes no liability for any direct, indirect special, incidental or consequential damages or injuries caused by such reliance or for the use of IBIS Products by operator not holding an “IBIS User Certificate” issued by IDS GeoRadar. Any Buyer or User that completely relies on information obtained from the automated data processing/analysis tools only does so at his own risk and possible damages caused to IBIS products during operations performed by not-certified operators are not covered by the applicable Warranty Terms in force.

APPENDIX D – WARRANTY CONDITIONS

Warranty Conditions

Standard Warranty Conditions

IDS GeoRadar s.r.l, warrants that its products shall be free from defects in material and workmanship, for a period of 12 months from the delivery date duly registered and certified ("Effective Date") in the "Warranty Registration Form" enclosed hereto. IDS GeoRadar shall repair or replace Products or parts thereof found faulty (the "Faulty Parts") which are returned to IDS GeoRadar, and which, at IDS GeoRadar's judgment, were defective or became defective during its normal use. Seller's obligations shall not apply to Faulty Parts that:

Buyer do not properly store, install, use, or maintain;

Buyer modify, or perform tests which are not approved in writing by the Seller;

Buyer have subjected to any kind of misuse, detrimental exposure beyond its intended purpose or damaged in an accident or by natural disaster or calamities.

Are repaired by other than IDS GeoRadar personnel; in which have been installed HW/SW accessories not supplied by IDS GeoRadar; are integrated or connected to equipment different from the ones supplied by IDS GeoRadar (except the PC data Logger conform to IDS GeoRadar specifications);

Whose operational software was not installed as per IDS GeoRadar instruction (see IDS GeoRadar User's Guide for the Data Acquisition Software);

Seller's Products may include specific "Operational" software with automatic data processing and analysis tools (SW) supplied under a License agreement (EULA). While every effort is made to ensure the accuracy of the information/results provided by these tools, they must not be intended as a substitute for people analysis; rather, they have to be intended as an advisor and the user must not completely rely on the results provided by them. Under no circumstances does IDS warrant that the SW will operate uninterrupted or error free. The SW is provided "as is" without warranty of any kind. IDS GeoRadar warrants for a period of sixty (60) days from the Effective date that, under normal use, the SW support media will be free of defects in material and workmanship; in such case the provisions of above point a) apply

Any different warranty, granted by the Buyer to its retailers and clients, even as final consumers, pursuant to the European Union law in force regarding the rights of the consumers, does not engage IDS

GeoRadar in anyway.

The above mentioned warranty excludes any other remedies and it has to be considered the only and exclusive remedy foreseen for the Buyer and its retailers and clients, with reference to IDS GeoRadar Products purchase, being, expressively understood that any kind of limitation and/or discharge of responsibility provided by the present warranty is referred to both (I) the responsibility as against any third parties, pursuant to the legislation regarding the producer responsibility and (II) the warranty provided by the law in force.

Warranty Procedure

To proceed in the application of warranty terms, Buyer shall have to contact IDS GeoRadar Customer Care Office to get the clearance to return the Faulty Parts.

The Faulty Parts once received by IDS GeoRadar will be inspected to verify they are eligible for repair or replacement.

Buyer is responsible for ensuring that the Faulty Parts be returned to IDS GeoRadar with a suitable packing (it is recommended that the original packing be saved for a better understand of the failure cause); IDS GeoRadar will not be obliged to repair or replace Faulty Parts damaged from abuse, misuse, negligence, accident loss or damage in transit.

The Shipping costs for Products returned during the warranty period, are as follows:

From Buyer Site to Seller site → shipping costs, as per Incoterms CIP, are borne by Buyer

From Seller Site to Buyer site → shipping cost, as per Incoterms CIP, are borne by Seller

The warranty period on the repaired or replaced Faulty Parts is 6 (six) months or the unexpired portion of warranty on such Faulty Parts whichever date comes later.

Special Warranty Conditions for IBIS Products

Without prejudice to the Warranty terms defined in the above Clauses A and B, the following special conditions apply to the IBIS products.

IDS GeoRadar offers to the Buyer, optionally, special Support and Maintenance Plans to be performed along the life of the equipment. These plans set forth special Warranty conditions which are detailed in the relevant options purchased.

IBIS Product Family is subject to export/import regulations as per EU export control regime Council Regulation (EC) No. 428/2009 and successive amendments. The category of exportation for IBIS F

APPENDIX D –WARRANTY CONDITIONS

product family is 6A008.d. Buyer warrants that the IBIS Products to be purchased: a) shall not be re-exported, directly or indirectly, outside Buyer's country in violation of any law or regulation or to embargoed or otherwise restricted countries, b) shall not be used, in the design, development, production or use of chemical, biological, nuclear ballistic weapons. It is Buyer's responsibility to know the law pertaining to export/import procedures in the country of destination of the Products. Buyer will defend, indemnify and hold Seller harmless against any liability (including attorney's fees) arising out of Buyer's failure to comply with the terms of this article. Should the Authorities issue an export restriction which leads to the cancellation of a purchase order already accepted by IDS GeoRadar, IDS GeoRadar only liability shall be to return to Buyer any account paid without interests. Buyer shall comply with the laws and procedures in force in the country of destination of the Products.

IBIS can be used in Critical Monitoring for safety purposes applications, like real time monitoring of unstable slopes including Opencast Mining. Buyer shall be aware and agree that the assessment of the stability conditions of the observed target must be tasked to skilled and certified operator/s able to understand data supplied by either IBIS or others. The performance of IBIS can be, in fact, influenced either by the parameters introduced by the operator/s or by particular environmental conditions which may distort its outcomes, thus giving rise to false or missing alarms.

IDS GeoRadar assumes no liability for any direct, indirect special, incidental or consequential damages or injuries caused by such reliance or for the use of IBIS Products by operator who have not achieved a training course certified by IDS GeoRadar. Any person or entity that completely relies on information obtained from the automated data processing/analysis tools only or by operators who have not achieved a training course certified by IDS GeoRadar, does so at his own risk

Limited Liability

Without prejudice to the exclusion of liability stated at the above Clause C.

Seller's sole obligation and liability under this Agreement shall be limited to the repair or replacement of the Product, or the refund of the purchase price at the Seller's sole option. This Article sets forth the sole and exclusive remedies for claims based upon defects or nonconformity of the Products, whether the claim is on contract, warranty, tort (including negligence), strict liability, or otherwise.

The cumulative liability of Seller, including its subcontractors or suppliers, for any and all claims, including but not limited to claims based on Seller's negligence of any degree, strict liability, breach of contract, warranty, reliance on the accuracy, reliability, or timeliness of the information provided by the SW, patents or otherwise, shall not exceed the sums cashed by IDS GeoRadar for the purchased Products, which give rise to the claim, and any such liability shall terminate upon the expiration of the warranty period.

APPENDIX E - RADIO-FREQUENCY EXPOSURE COMPLIANCE

RADIO-FREQUENCY EXPOSURE COMPLIANCE

Please keep a minimum distance of 0.7 m from the product during its operation. Typical power density levels at a distance of 0.7 m or greater is below 1 mW/cm², which is the Maximum Permissible level of Exposure specified by the current regulations.

FCC use limits

Use in all U.S. territories is limited to underground mines, open pit mines, and tunnels. Authorized EIRP may not exceed 48 dBm.

HYDRA devices may not cause interference to and must tolerate interference from Government

Radiolocation, 76-81 GHz Band Radar, Radio Astronomy, Amateur, and Space Research operations.

Thus, this product pose no health and safety risk when operated in the normal manner of intended use.

APPENDIX F - CONTACTS

Contacts

IDS GeoRadar s.r.l.

Via Enrica Calabresi, 20 - Loc. Montacchiello
56121 PISA - ITALIA

Tel: +39.050.3124.501 Fax: +39.050.3124.205

GEO BU Customer Care department:

support.geo@idsgeoradar.com

Tel.: +39.050.3124.356/458

GEO BU Sales & Marketing department:

sales.gpr@idsgeoradar.com

Tel.: +39.050.3124.352/350/373/374