

# IBIS-ArcSAR

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# 1 INTRODUCTION

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### 1 INTRODUCTION

This document describes the IBIS-ArcSAR system, and particularly refers to the concepts the user should learn before initiating the utilization of this device. Therefore we recommend to read the entire document before starting the system.

If technical assistance is required, please use the contact numbers provided on the Appendix of this manual.

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#### 1.1 Purpose

Reading this document will provide all the necessary knowledge to install and maintain the IBIS-ArcSAR 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 IBIS system in ArcSAR configuration and its use in the field for monitoring of quasi static phenomena.

## 2 ABOUT THE MANUAL

### 2.1 Manual layout

This manual consists of the following chapters:

Chapter 3 – General Description

Chapter 4 – IBIS-ArcSAR Hardware Breakdown

Chapter 5 – First ArcSAR Setup

Chapter 6 – First ArcSAR Start Up

Chapter 7 – Dismantling an ArcSAR system

APPENDIX A – Disclaimer

APPENDIX B - Warranty

APPENDIX C – Packing Contents

APPENDIX D – Additional Notes

APPENDIX E - Contacts

APPENDIX F - Maintenance

### 2.2 Symbols



Warning information



Note information



Tip information

### 2.3 Glossary and acronyms

#### 2.3.1 Acronyms

|      |  |
|------|--|
| AC   | Access Point                                 |
| DEM  | Digital Elevation Model                      |
| FMCW | Frequency linearly Modulated Continuous Wave |
| GPS  | Global Positioning System                    |
| IBIS | Image By Interferometric Survey              |
| LED  | Light Emitting Diode                         |
| LoS  | Line of Sight                                |
| LS   | Linear Scanner                               |
| PoE  | Power over Ethernet                          |
| PSU  | Power Supply Unit                            |
| SAR  | Synthetic Aperture Radar                     |
| SNR  | Signal to Noise Ratio                        |
| SU   | Subscriber Unit                              |
| USB  | Universal Serial Bus                         |

### 2.4 Reference

#### 2.4.1 Bibliography

|       |  |
|-------|--|
| [BD1] | MNG/2016/0009 – IBIS Controller v.04.02 – User Manual            |
| [BD2] | MNG/2016/0001 – IBIS Guardian v. 03.02 – User Manual             |
| [BD3] | MN/2014/062 (IDS) – Eagle-Vision Camera - Installation Guide     |
| [BD4] | MNG/2016/0017 - IBIS-ROVER System – Maintenance and Repair Guide |

#### 2.4.2 1.6.2 Definitions

Pixel: *area of resolution used in the IBIS-ArcSAR system.*

Radial displacement: *displacement of the range bin or the pixel along the direction joining the Range bin or pixel to the IBIS system i.e. along the LoS.*

### 3 GENERAL DESCRIPTION

The IBIS-ArcSAR system is designed to remotely measure slow displacements at an accuracy great as a tenth of a millimeter. The IBIS-ArcSAR system is particularly suitable for terrain and structural monitoring applications, it aims to detect quasi-static displacements over long time periods.

The performance of the IBIS-ArcSAR system depends on the type of configuration used and 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:

For Ku band system:

- maximum operational distance: 5 km;
- field of view: 360°;
- acquisition time: 40 seconds;
- image resolution in distance: 0.75 m (EU/FCC limits);
- angular resolution: 5 mrad (5 m at 1 km);
- accuracy in measuring displacements in the viewing direction: 0.1 mm (for points with a good reflectivity – SNR > 50 dB – and depending on the impact of atmospheric variation on the measure).

The IBIS-ArcSAR system offers the following advantages over the currently available monitoring systems (GPS, total stations, extensometers):

IBIS-ArcSAR permits the operator to perform remote monitoring of the area (remote sensing), without needing to access the area to install sensors or optical targets;

IBIS-ArcSAR supplies a continuous displacement map of the entire area. It measures simultaneously all the displacements of the entire area illuminated by the antenna beam, which can cover over hundreds of thousands of square meters;

IBIS-ArcSAR directly measures the displacements of the territory of interest near real time;

IBIS-ArcSAR can be used both day and night, and in almost all weather conditions;

IBIS-ArcSAR doesn't require the continuous presence of an operator and can be controlled by wireless connection.

This possibility of performing long distance monitoring, without needing to install sensors signifies that investigations can be performed even when:

- the area of interest is not accessible;
- the area of interest is particularly large and would therefore require many in situ sensors.

In addition, when the monitoring activity is required to assure personnel safety in emergency situations, the possibility of performing remote monitoring may be essential to protect lives.

Fig. 1 and Fig. 2 show a view of the four side of IBIS-ArcSAR system. The basic components are:

- ArcSAR Acquisition Unit: made of Positioner, Radar Sensor, Antennas, Pointing Camera, Panoramic Camera and GPS;
  - Positioner: it is device that allows the movement in azimuth and tilt of sensor and the panoramic camera. The movements are controlled by the Controller SW. The

positioner is able to rotate within 360°. The radar view can therefore be 360° wide.

- Radar Sensor: it generates, transmits and receives the electromagnetic signal. The Radar Sensor is installed at the edge of the positioner arm. The movement of the Radar Sensor around the positioner permits the utilization of the ArcSAR technique, which obtains a 3D image of the scenario;
- Antennas: proper antennas are required to make the Radar Sensor properly transmitting and receiving RF signals;
- Pointing Camera: mounted right over the Radar Sensor, it helps to easily define the area of interest. A video streaming is in fact integrated in the Controller Software to get a real time feedback of the Radar current pointing direction during the session setup.
- Panoramic Camera: installed below the radar trolley, it provides 360° high-resolution geocoded images of the scenario;
- GPS: to automatically retrieve the information needed for the geocoding (Radar position and bearing);
- ArcSAR Supply Unit: this module is in charge of giving power supply and control to the Acquisition Unit and to other optional devices such as WIFI antenna and weather station; It is composed of:
  - Laptop PC: it is equipped with the system management software (IBIS Controller Software). This is used to setup the acquisition parameters, store the data and transmit them to the control room;
  - Battery pack: this is the main source for supplying the Acquisition System and all the other devices;

- Generator: it is the main source of power used to recharge the battery pack when connection to the grid is not available. It can be configured to automatically start when required;
- ArcSAR Trailer: it permits the mobilization of the IBIS-ArcSAR and gives extreme stability to the Acquisition Unit during the monitoring session thanks to hydraulic jacks.
- Integrated Solar Panels: for recharging the battery pack therefore reducing the generator running time;

The optional components are:

- Wind turbine: for recharging the battery pack therefore reducing the generator running time;
- Weather Station: it provides information about the atmospheric conditions;
- Wi-Fi Bridge: it permits data transmission from IBIS-ArcSAR to the Control Room;
- Low temperature kit: it allows the IBIS-ArcSAR operation in extremely cold environments;

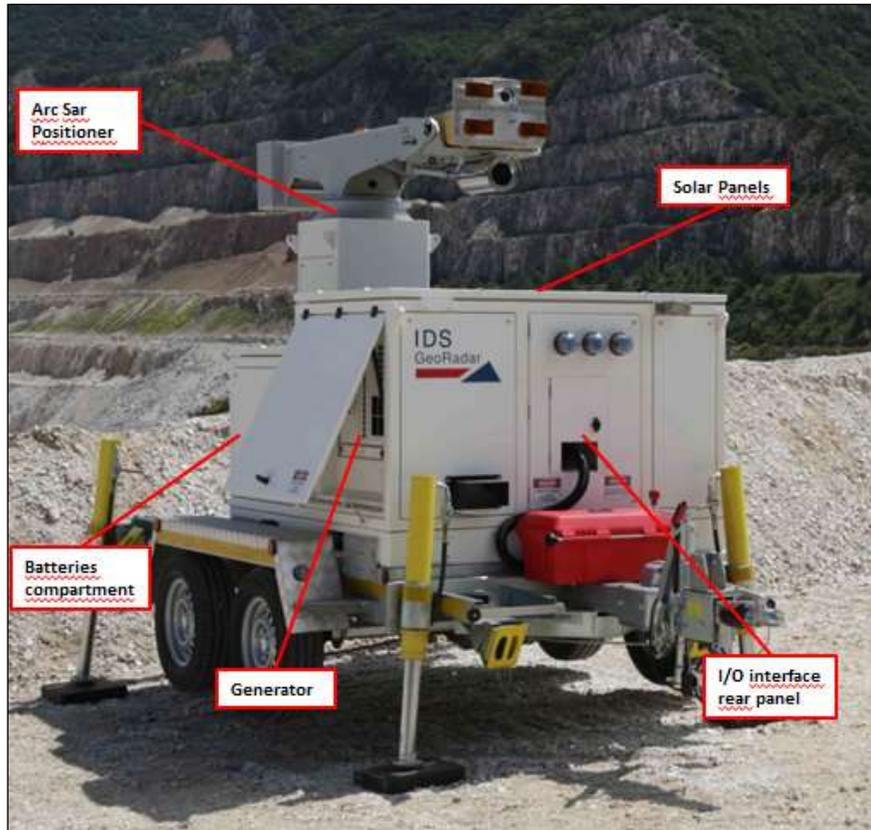


Fig. 1 – IBIS-ArcSAR system (rear and right side)

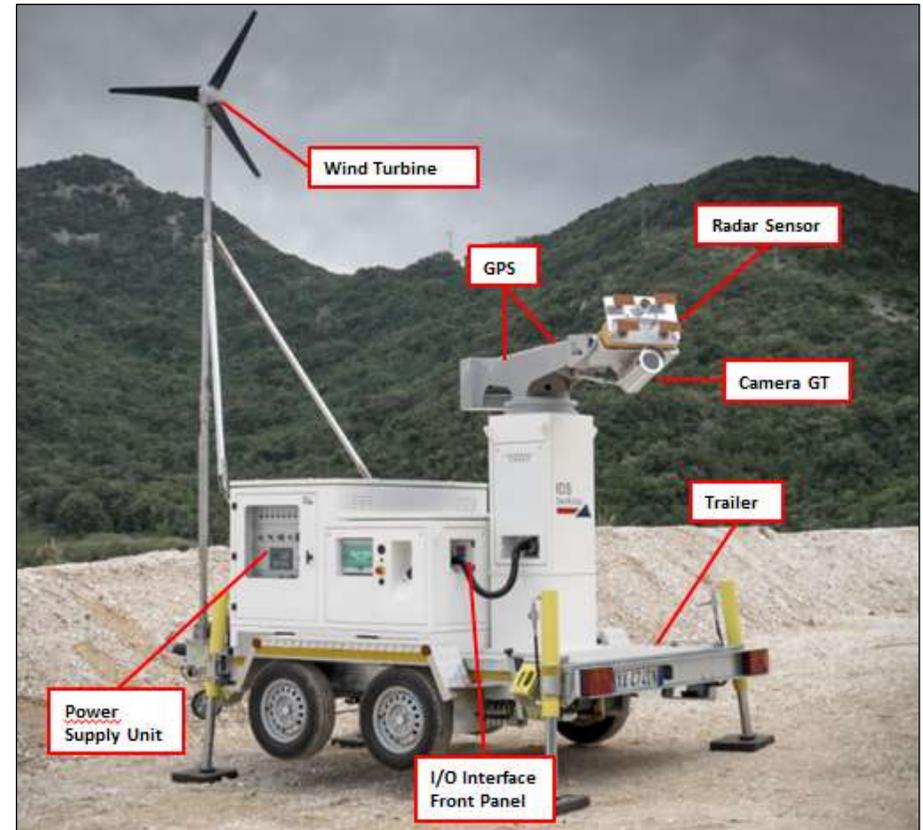


Fig. 2 – IBIS-ArcSAR system (front and left side)

## 4 IBIS-ArcSAR HARDWARE BREAKDOWN

This section of the manual provides a detailed description of the components making up IBIS-ArcSAR system:

The system configuration depends on the selected purchase options, the system may not include some of the items specified below.

### 4.1 ArcSAR Trailer

The ArcSAR Trailer (Fig. 3) is the basis where the IBIS-ArcSAR Base is set. It is provided with a hook to tow the trailer with a vehicle. At every corner there is a hydraulic support legs (or jacks) whose task is ensuring the stability of the trailer during IBIS-ArcSAR operation. Trailer is equipped with mechanical brakes plus a hand brake for parking. Next to the wheels four yellow chock levels are provided to increase the working security when the trailer is parked.

The supplying of the trailer supports is provided by a cable to connect to the main I/O interface panel, placed on the rear side of ArcSAR Supply Unit. A battery cut-off is provided to isolate the supplying of hydraulic supports (Fig. 28).



Fig. 3 - View of the ArcSAR Trailer

The trailer is provided with a car connector to supply the rear positioning lights of the trailer.

### 4.2 ArcSAR Acquisition Unit

This system is made of Positioner, Radar Sensor, Antennas, Pointing Camera, Camera GT and GPS

#### 4.2.1 IBIS Radar Sensor

The IBIS Radar Sensor is a unit containing all the parts for the generation, transmission, reception and acquisition of the radar signal. The Radar Sensor is shown in Fig. 4 and can be seen as a yellow box.

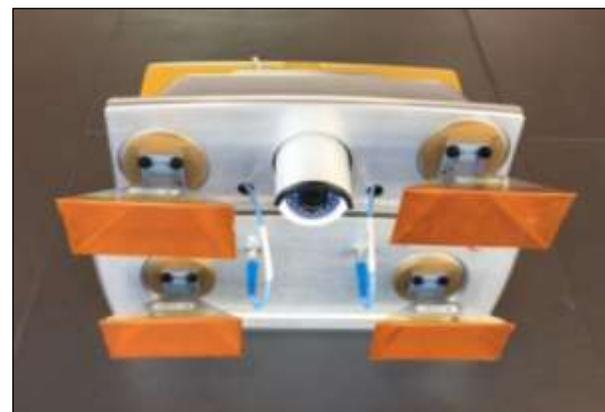


Fig. 4 – IBIS Radar Sensor front view

The Radar Sensor has the following interfaces (see Fig. 5 and Fig. 6):

- Ethernet type and Supply sockets on the case back-side;
- #4 threaded holes and a central pivot on the case bottom-side to fix the sensor to Positioner trolley;



Fig. 5 – Back view of the Radar Sensor



Fig. 6 – Bottom view of the Radar Sensor



Fig. 7 – ArcSAR Pointing Camera

#### 4.2.2 Radar Sensor Pointing Camera

The Pointing Camera is used to easily define the borders of the area to cover with IBIS monitoring. This action is performed during the Controller session wizard, where the user has to set manually the limits of the scenario. The Pointing Camera provides a real-time streaming to the user therefore giving a precise feedback on the actual radar pointing direction. Pointing Camera is installed on the top cover of the Radar Sensor (Fig. 7) and it is automatically supplied by the Positioner. Pointing Camera connections consist of an Ethernet wire and a power wire (12Vdc).

#### 4.2.3 Antennas (Ku band)

The Ku band IBIS-ArcSAR system is provided with four IBIS-ANT7 antennas installed at slightly different elevations operating in vertical polarization. The combination of four antennas installed at different elevations simulates the vertical movement of the sensor, thus allowing the DEM creation.

#### 4.2.4 Positioner

The Positioner (Fig. 8) is equipped of 2 motorizations: the tilt, which is used to facilitate radar pointing and the azimuth, which is used to perform ArcSAR scans (radial).



Fig. 8 – Positioner top part

- Tilt: Radar sensor tilt can range between +/-25° with an accuracy of 0.1°;
- Azimuth: the main horizontal beam can rotate from -180° to +180° with an accuracy of 0.01°;

Once tilt angle has been defined, ArcSAR scans with different angles can be performed to extend or reduce the Radar Sensor field of view.

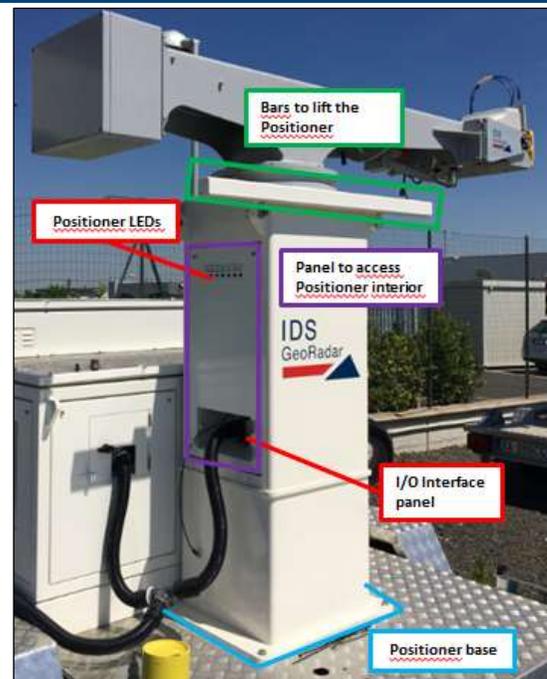


Fig. 9 – Positioner base

On the left side of the Positioner column, there are 6 LEDs (Fig. 9 – Positioner base).

|           |                |   |       |   |
|-----------|----------------|---|-------|---|
| TRANSPORT | Transport mode |   | solid | Green when the system can be moved. Red when the system cannot be moved |
|-----------|----------------|---|-------|---|

Tab. 1 summarizes the meaning the LEDs.

| Label  | Part                          | LED color   |       | Meaning              |
|--------|-------------------------------|---|-------|----------------------|
| SENSOR | Radar Sensor                  |  | solid | Related part powered |
| POS    | Pointing motors               |  | solid | Related part powered |
| CAMERA | Panoramic and Pointing camera |  | solid | Related part powered |
| GPS    | GPS                           |  | solid | Related part powered |
| HEATER | Low temperature kit           |  | solid | Related part powered |

|           |                |   |       |   |
|-----------|----------------|---|-------|---|
| TRANSPORT | Transport mode |  | solid | Green when the system can be moved. Red when the system cannot be moved |
|-----------|----------------|---|-------|---|

Tab. 1 – Positioner LEDs meanings

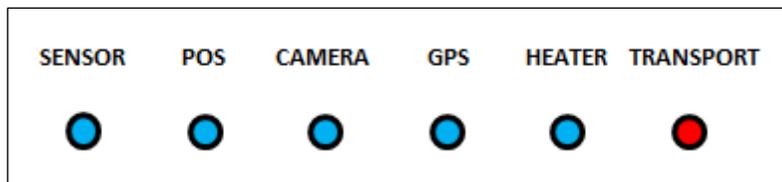


Fig. 10 – Positioner LEDs

At the Positioner base there is an I/O Interface panel that included the following sockets (Fig. 11):



Fig. 11 – I/O interface Positioner panel

- **SOCKET POSITIONER:** this socket allows the power supply and control of the acquisition unit (sensor, positioner, cameras and GPS)

Just below the rotating arm, two metal bars are provided to facilitate the lifting and moving of the Positioner during ArcSAR first configuration.

The Positioner base has holes placed at every corner to allow the fixing of the whole frame to the Trailer deck.

#### 4.2.5 Panoramic Camera

Fixed below the radar trolley the camera (Fig. 14) rotates accordingly to the positioner movement, providing 360° geocoded images of the scenario.

The camera combines long range surveillance capabilities with the possibility to acquire 16 Mpixel pictures that are single panoramic views of the entire scenario, arranged in layers of different image resolution. The integration between the Panoramic Camera and the IBIS-ArcSAR provides several additional features:

- correlate the picture scenario with a given Guardian radar map, thus enabling the visual recognition of moving areas;

These features are made possible thanks to the use of:

- high resolution panoramic views of the scenario, obtained by stitching several images in a single one. Views can be acquired on a

## 4 IBIS-ArcSAR HARDWARE BREAKDOWN

user request or automatically taken by the system following a user-defined time schedule;

- photo Georeference and link to digital terrain models. The camera acquisition geometry is needed to enable the geocoding.



Fig. 14 – Camera fixed below the sensor trolley

### 4.2.6 GPS

During the Controller session setup allows to obtain the system position and northing.

## 4.3 ArcSAR Supply Unit

This module is in charge of giving power supply and control to the Acquisition Unit and to other optional devices as Wi-Fi radios and weather station (both mounted on a dedicated pole) (Fig. 34 and ).

The ArcSAR Supply Unit allows the supplying and the control of all the devices included in the ArcSAR Positioner. In addition, it allows the communication between the field Laptop and the Control Room.

ArcSAR Supply Unit includes the Power Supply Unit with the ArcSAR battery pack, the Laptop PC, the Generator set and the Solar Panels.

Weather Station, Wi-Fi and Generator Solar Panel can be installed on a pole, whose casing is on the rear side of the ArcSAR Supply Unit.

On the bottom part of the Supply Unit side a holes grid is present to allow the installation of the Supply Unit on the trailer deck.

### 4.3.1 Electrical modules

The PSU supplies electric power to the system. Its function is:

- distribute power and signals to the ArcSAR Positioner, Radar Sensor and other peripherals included in the system;
- receive power from the Generator, Solar Panels or from AC Mains supply and charge the batteries required to guarantee a continuous power supply, even if a blackout occurs;



Fig. 12 – Power Supply Unit position on the left side of the IBIS-ArcSAR

The PSU is composed by drawers which are called modules, placed on the left side of the ArcSAR Supply Unit. A front door gives access to them (Fig. 12). Description of the front side of each module follows here below.



**Fig. 13 – Modules on the front side of PSU**

- Control module (Fig. 14): it contains electrical switches which permit to supply (from left to right) Radar Sensor, Positioner, acquisition Laptop PC, Panoramic Camera, Genset Module, GPS, AUX1 socket, AUX2 socket;



**Fig. 14 – Front side of the Control module**

- Power module (Fig. 15): it contains the following components (from left to right):
  - AC Input switch: it permits to supply the system by AC voltage from mains or Generator. The LED is lit up in blue when the voltage is present.
  - DC Input switch: it permits to supply the system by DC current provided by external source. The LED is lit up in blue when the voltage is present.
  - Battery: this indicator shows the charge level of the batteries. The LED is lit up in orange when the batteries are charging;
  - Enable switch: it permits to supply all the modules of the PSU;
  - ON/OFF Switch: it interrupts the power supplying of the system, including the charging of the batteries;



Every time the system is shut down and then supplied again, it is always necessary to press the enable switch in order to switch on the system



The DC Input switch has to be turned on when for example an external battery pack is connected to the system. After connecting the external battery pack and turning on the DC Input switch, the entire system automatically turns off and it is necessary to press again the Enable switch to restore the system



Fig. 15 – Front side of the Power module

- Genset module (Fig. 16) is provided along with the integrated generator: it contains the Generator control unit AMF25 which can start or stop the generator and manage alarm and warning signals from the generator sensors (e.g. lack of oil, empty tank, etc.). On the right hand side (see Fig. 16) there is a horn which activates when AMF25 alarm/warning is present; AMF25 is already set and ready to communicate with the PSC board into the Control module;



Fig. 16 – Front side of the Genset module

- Green module (Fig. 17) is associated to solar panels and wind turbine. It contains following parts:
  - WIND: it includes the button to brake the wind turbine and the LEDs to check the charging status and working mode
  - SOLAR: it includes the switch to turn on the solar panels input and the LED to check the charging status;
  - BATTERY: this switch allows the power flowing from the green sources to the ArcSAR batteries;



Fig. 17 – Front side of the Green module

The Module On blue LED on the upper left of every modules indicates when they are powered and active. The Power, Control and Green modules turn on when the Enable switch on Power Module is switched on. The Genset Module turn on when the Genset switch on Control Module is switched on.

#### 4.3.2 I/O panels

The I/O interfaces are set in two panels, located on the front and rear sides of the ArcSAR Supply Unit, as shown in Fig. 18Figure 1.



Fig. 18Figure 1 – Positions of the I/O interfaces panels on IBIS-ArcSAR



**Fig. 19 – Interface panel on the rear side of the IBIS-ArcSAR Supply Unit**

The I/O interfaces panel shown on front of Fig. 18Figure 1 includes (from upper left to lower right in Fig. 19):

- MAINS INPUT (100-240 Vac 50-60 Hz – 7 A) AC Mains connection;
- AC OUTPUT (230 Vac 50 Hz 10 A): 230 Vac outlet for supplying auxiliary equipment (only when the onboard generator is on);
- WIND: socket for Wind Turbine;
- DC INPUT: connection for external battery pack;
- WEATHER STATION: socket for IBIS Weather Station;

- PREHEATING: socket for preheating system (low temperature kit)
- SOLAR (12 Vdc – 2 A): a plug for a solar panel which could be used to charge the Genset battery;
- LAN 1: Ethernet port connected to router LAN port;
- WAN: Ethernet port connected to router WAN port;
- LAN 2: Ethernet port connected to router LAN port;
- AUX1 (12, 24, 48 Vdc – 4 A) outlet;
- TRAILER SUPPLY (12 Vdc – 10 A) cable socket;
- AUX2 (12, 24, 48 Vdc – 2 A) outlet;



**Fig. 20 – Interface panel on the front side of the ArcSAR Supply Unit**

The I/O interfaces panel placed on the front side includes (from left to right in Fig. 20):

- SOCKET POSITIONER: this socket allows the power supply and control of the acquisition unit (sensor, positioner, cameras and GPS)
- EV CAMERA section: not applicable to the ArcSAR system

## 4 IBIS-ArcSAR HARDWARE BREAKDOWN

The IBIS-ArcSAR is provided of four batteries which supply the system. These batteries are set in an internal compartment placed on the right side of the ArcSAR Supply Unit (Fig. 21).



Fig. 21 – Batteries compartment on the right side of IBIS-ArcSAR Supply Unit

### 4.3.3 Laptop PC

The Laptop PC workspace is placed under the drawers of the Power Supply Unit, in the left side of IBIS-ArcSAR (Fig. 22). The workspace is the lower sliding drawer, as shown in Fig. 23.



Fig. 22 – Laptop drawer

The provided Laptop PC is a Panasonic Toughbook CF31 and it is supplied with the IBIS Controller control and data acquisition software pre-installed.

The Laptop is used to control the Radar Sensor, the Positioner and the other ArcSAR devices, manage the supplying of the System and allows the communication between the field and the IBIS Guardian processing software.



Fig. 23 – Panasonic Toughbook CF31



No communication software such as Firewall, Wi-Fi or antivirus must be installed to avoid any conflict with the IBIS Controller software



IDS GeoRadar takes no responsibility for bad functioning if there is a functional conflict between its software and any software installed on the Laptop PC 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

#### 4.3.4 Generator

The integrated diesel generator (also known as Genset) is used as a back-up source of energy. It is automatically managed with the software, so that when batteries are low (and no energy is coming from the solar panels) it is turned on to provide power.



Fig. 24 – Generator on the ArcSAR left side



Fig. 25 – Generator on the ArcSAR right side

The control unit, placed on Genset Module of the PSU, can start or stop the Genset and manage alarm and warning messages from the Genset sensors (e.g. lack of oil, empty tank, etc.).

The Generator is installed and accessible from the right side of the IBIS-ArcSAR. The Generator area can be divided in:

- the left side includes the filling point for the fuel tank, the System emergency stop red button with the related horn and the fuel level indicator (Fig. 26); it also includes Circuit Breaker switchboard, with the Generator general switch and a 220 Vac output switch (Fig. 99);
- the right side is marked by a lifting door; the generator is located behind the main door.

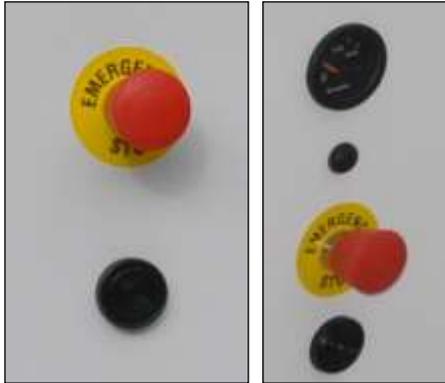
#### 4.3.5 Electrical safety devices

IBIS-ArcSAR is provided of several electrical safety devices. In detail:

- a red emergency stop button placed next to the generator fuel level indicator;
- a red emergency stop button placed on the battery panel side;



Every time the emergency stop button is released, the enable switch has to be pressed to restore the system.



**Fig. 26 – Red emergency stop buttons**

- two isolation points (red lever switches) placed on the front side of the IBIS-ArcSAR: the left one allows the electrical isolation of PSU batteries, the right one allows the electrical isolation of GENSET battery (Fig. 27). The panel that contains these two switches can be locked if necessary;



**Fig. 27 – PSU and GENSET isolation points**

- an isolation point (a battery cut-off switch commanded with a key) which allows the electrical isolation of the trailer lifting supports only (Fig. 28).



**Fig. 28 – Battery cut-off switch**

#### 4.4 Pole

The rear side of the ArcSAR is provided with a metallic pole. On the pole can be installed optional components, as Weather Station or Wi-Fi Link or the Genset solar panel. This pole can reach a height of about 3 meters from

its base (the total height depends on the trailer specs). The pole can be tilted to facilitate the installation of every single component on it. Pole can be rotated to point the Wi-Fi antenna towards the desired location.

#### 4.5 Additional items

Additional items are part of the IBIS-ArcSAR, shipped together with the devices explained in the paragraphs below.

- IBIS Radar Sensor Case
- AC Mains cable (Fig. 148);
- Supply Output cable to provide 220 Vac while generator is running (Fig. 29);



Fig. 29 – 220 Vac output cable

- 2 Ethernet cable (Fig. 30);



Fig. 30 – Ethernet cable

- 1 48 V Power-over-Ethernet Wi-Fi Link cable (Fig. 39);
- 1 24 V Power-over-Ethernet cable (Fig. 39);
- 1 Aux 12 V cable (Fig. 31);
- 1 Aux 24 V cable (Fig. 31);



Fig. 31 – Aux 12 V - 24 V cables

- External cable for Generator battery;

An additional cable is provided to supply the system with Mains AC power. The power cable has a plug whose shape is suitable for the destination country electric system.

### 4.6 Solar Panels

The Solar Panels permit to exploit the solar irradiation and the reduction of the need of the generator, therefore reducing its maintenance and fuel consumption. The panels are placed on the top covers of IBIS-ArcSAR and mounted on their frame.



Fig. 32 – Solar Panels

The solar panels are managed by Green Module placed on the PSU.

### 4.7 Wind Turbine (optional)

The Wind Turbine generates power from wind and helps to reduce of the need of the generator, therefore reducing its maintenance and fuel consumption. The Wind Turbine is installed on a pole mounted on the Trailer shaft



Fig. 33 – Wind Turbine

The Wind Turbine is managed by Green Module placed on the PSU.

### 4.8 Weather Station (optional)

Weather Station provides info about meteorological data. The weather sensors are temperature, pressure, humidity, wind speed and direction, rain precipitation, Data Logger with internal temperature, pressure and humidity (integrated in the ArcSAR PSU).



Fig. 34 – View of the Weather Station



Fig. 35– Components of the Weather Station

Please refer to the provided Weather Station manual for further details.

#### 4.9 Wi-Fi Link (optional)

The Wi-Fi link allows the data transmission between the IBIS-ArcSAR installation site, where IBIS Controller is installed on CF31, and the Control Room, where IBIS Guardian workstation is present.

The basic layout of Wi-Fi Link is when the mine facilities have free line of sight to the IBIS-ArcSAR or when their distance is less than 2 km (Fig. 36).

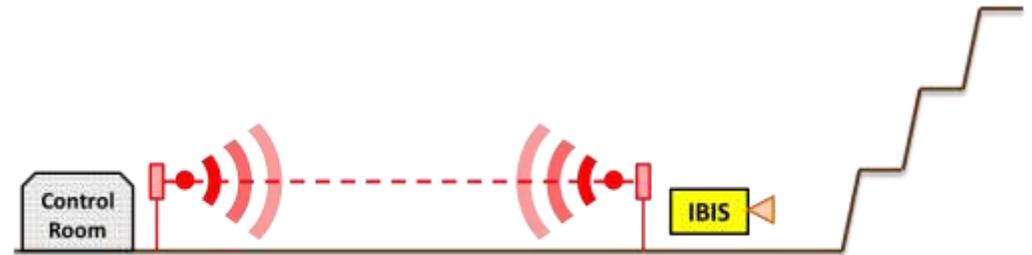


Fig. 36 – Wi-Fi Link with no Repeater

In this case the Wi-Fi Link is composed of a couple of Wi-Fi radios, supplied by Power-over-Ethernet. One radio is located on the IBIS-ArcSAR, the other radio is installed at the Control Room, and it's connected to the IBIS Guardian workstation.



Fig. 37 – Content of a Wi-Fi radio box

## 4 IBIS-ArcSAR HARDWARE BREAKDOWN

When the mine facilities have no free line of sight to the IBIS-ArcSAR or when their distance is more than 2 km (Fig. 38), a Repeater is needed.

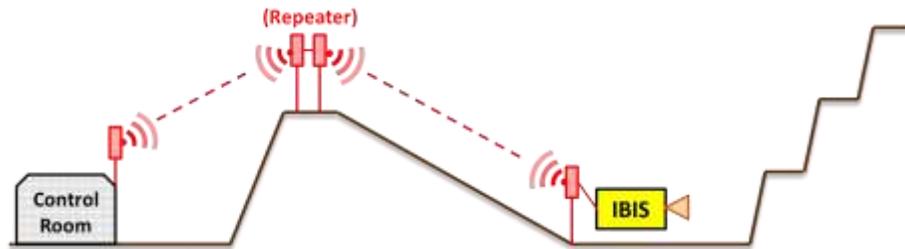


Fig. 38 – Wi-Fi Link with repeater

The Repeater is composed of an additional couple of radios and it has a specific power supply with solar panels and batteries. The two Repeater Wi-Fi Radios are connected together with an Ethernet cable.

The Repeater is supplied with 2 back up batteries giving an autonomy of about 5 days. The Repeater power supply can be supplied by a couple of photovoltaic panels or by the Mains Supply. An alternative option is to detach the batteries and charge them using the battery charger (e.g. if not enough solar power is provided for several days).

Together with the IBIS-ArcSAR Wi-Fi, two Power-over-Ethernet (PoE) cables are provided:

- a 24 Vdc PoE cable to supply IBIS Wi-Fi (Fig. 39 left – yellow plug).
- a 48 Vdc PoE cable (Fig. 40 right – red plug) to different supply needs;



Fig. 39 – Wi-Fi PoE cables

### 4.10 Low temperature kit (optional)

The Heater allows the IBIS-ArcSAR working in cold environment. Webasto® Heater can be controlled by a thermostat control knob which is installed in the Laptop PC drawer (Fig. 40).



Fig. 40 – Webasto® Heater temperature control

It is recommended to turn the control knob within the first two marks.

Once the Heater internal engine is started, it is able to warm up all the internal compartment of the IBIS-ArcSAR.

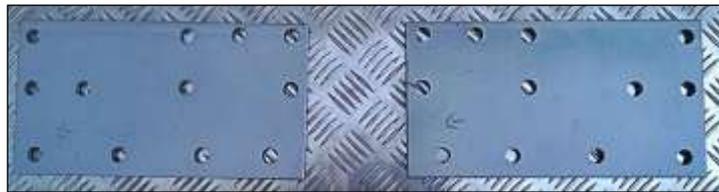
## 5 FIRST ArcSAR SETUP



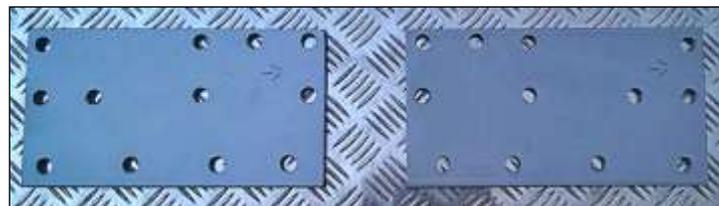
Don't use electric screwdriver while working with IBIS ArcSAR hardware parts.

### 5.1 Unpacking the wooden boxes

1. Open the wooden shipped boxes which contains ArcSAR Trailer, ArcSAR Positioner and ArcSAR Supply Unit;
2. Take the box placed under the Trailer: it contains some items to install the Positioner and the Supply Unit on the Trailer. This box contains:
  - 4 fixing pierced plates for the Supply Unit installation;



(right side)



(left side)

Fig. 41 – Fixing pierced plates

- 16 screws (M10 x 35 mm hexagonal Head) to fix plate to the Trailer;



Fig. 42 - M10 x 35 mm hexagonal head screw with M10 washer

- 32 screws (M10 x 35 mm hexagonal head) to fix plate to the Supply Unit;
- 48 M10 washers;
- 4 screws (M12 x 50 mm hexagonal head) provided with 2 washers and self-blocking nuts;



Fig. 43 - M12 x 50 mm hexagonal head screw with self-blocking nut and washer

3. Descend the Trailer from the box and brake it using the hand-brake and the chops.

### 5.2 Supply Unit on the trailer deck

## 5 FIRST ArcSAR SETUP

1. Remove the mudguards from the Trailer (use two 13 mm wrenches). Every mudguard has 4 fixing screws (two screws for each side);



Fig. 44 – Mudguards fixing screws

2. after the mudguards removal, the 16 Trailer holes (4 holes for each side) become well visible;



Fig. 45 – Holes on the Trailer

3. install the Supply Unit on the Trailer for first. In this way the right balance of the trailer is ensured. If you look close to the forks guides, you can see a pierced frame close to every guide: every frame has a grid of holes to install the trailer fixing plates;

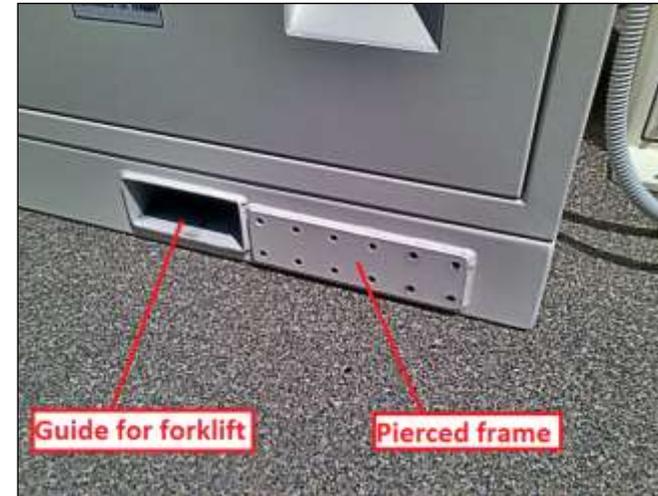


Fig. 46 – Detail of Supply Unit bottom

4. lift the Supply Unit with the forklift, inserting the forks into the specific guides placed at the bottom side. It is recommended to lift the Supply Unit from the heaviest side of the Supply Unit (generator and battery side)



**Fig. 47 – Lifting the Supply Unit with the forklift**

5. align the corners of the Supply Unit to the limits of the Trailer. In detail, on the shaft side, align the edge of the Supply Unit with the edge of the last upper bar of the trailer. The position of the holes of the Trailer and the Supply Unit can help to calculate the right alignment;



**Fig. 48 – Supply Unit aligned with the Trailer**

6. take the fixing plates: every plate has its right position. The carved arrow indicates how the plates have to be placed: the arrow has to face the trailer shaft (Fig. 49). helps to understand the position of the plates on the Trailer;

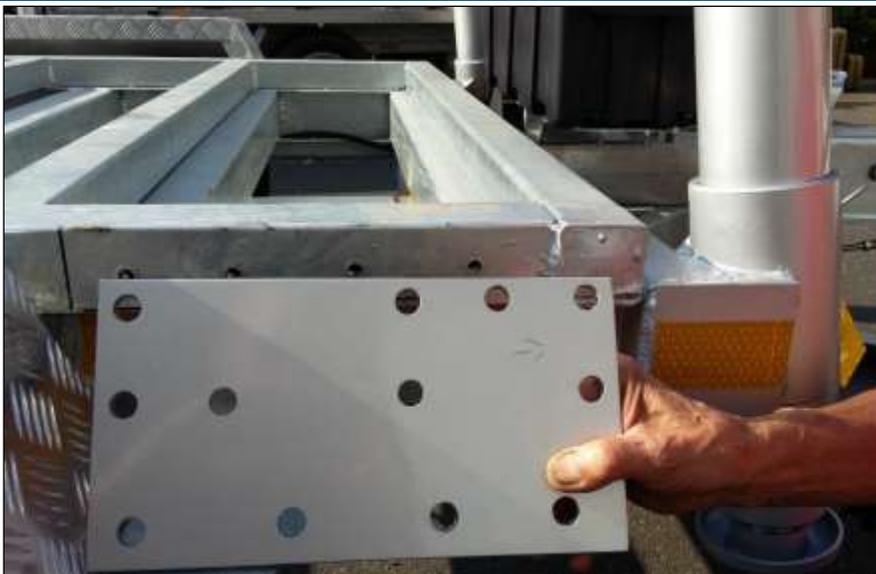


Fig. 49 – Fixing plates with the arrow facing the trailer shaft

7. fasten the screws (M10 x 35 mm hexagonal Head) in order to fix the plates to the Trailer (4 lower holes): a 17 wrench is needed;
8. fasten the screws (M10 x 35 mm hexagonal Head) in order to fix the plates to the Supply Unit (8 upper holes): a 17 mm wrench is needed;
9. check the fastening of the screws in order to ensure the perfect immobility of the Supply Unit;
10. install again the mudguards of the Trailer (Fig. 50).

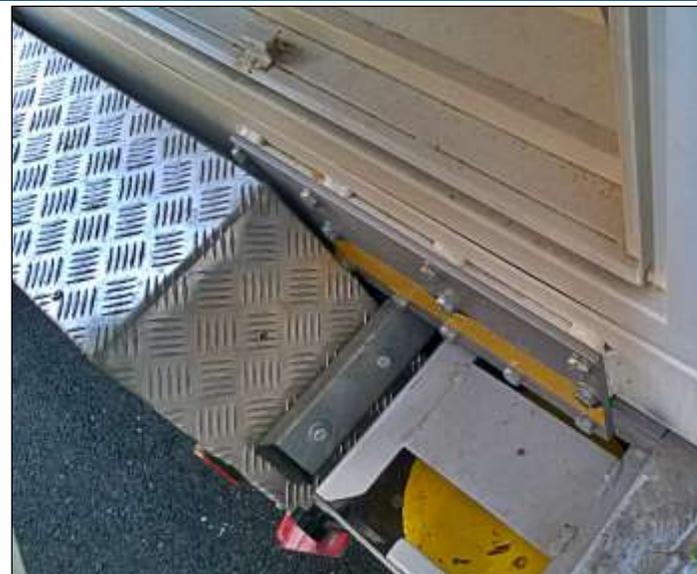


Fig. 50 – Fixing plates properly installed

### 5.3 Acquisition Unit on the trailer deck

1. Lift the Acquisition Unit with the forklift, using the provided metal wings (you have to remove them after the installation). Lift the Acquisition Unit with the back side facing the forklift. Use the forks edges to lift the Acquisition Unit, in order to have enough space to place the Acquisition Unit on its position on the Trailer;



**Fig. 51 – Lifting the Acquisition Unit with the forklift**

2. Look at the base of the Acquisition Unit: there are four holes at the corners: Align these holes with the four holes drilled on the slip aluminium sheet of the Trailer;



**Fig. 52 – Drilled holes on the Trailer for Acquisition Unit installation**

3. fasten the screws (M12 x 50 mm hexagonal head) through the holes in order to fix the Acquisition Unit base to the trailer (two 19 mm

wrenches are needed). Check the fastening of the self-blocking nut in order to ensure the perfect immobility of the Acquisition Unit;



**Fig. 53 – Fix the Acquisition Unit base to the trailer**

4. remove the wings frame from the Acquisition Unit (Fig. 54). A 14 mm Allen Key and a 27 mm wrench are required to unfasten the four screws with related nuts (Fig. 55)



**Fig. 54 – Removing wings from installed Acquisition Unit**



Fig. 55 - Wings removed from the Acquisition Unit

#### 5.4 Pole on the Supply Unit

A metallic pole is provided inside its own wooden box or into the Trailer wooden box. The pole has to be installed on the rear side of the IBIS-ArcSAR. Two guides provide its fastening. The lower guide allows the fixing of the pole base and the possibility to lower it to facilitate the installation of the devices (Fig. 56). The pole is provided with a sliding leg that allows to maintain the pole in horizontal position while the user is installing these devices.



Fig. 56 – Base of the pole installed on its guide

The upper guide ensures a complete fixing of the pole (Fig. 57). To open or close the guide, it is necessary to unscrew the security bolt and move the security plate (two wrenches are needed).

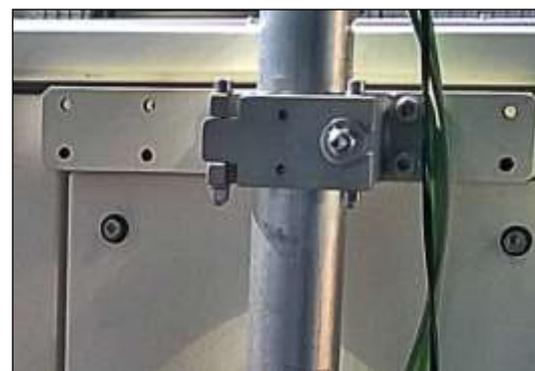


Fig. 57 – Upper pole guide for the ArcSAR

The installation of the Weather Station, Wi-Fi Link and Generator Solar Panel (see Paragraph 5.5) has to be done with their cables already connected (Fig. 58). The pole can be rotated to set the best line of sight of the Wi-Fi;

In order to increase the stability of the pole, the tie-rod metallic wire has to be hook with the karabiners to the ArcSAR Supply Unit. If the tie-rod metallic wire is not well drawn, it is necessary to fasten the tie-rod.



**Fig. 58 – Pole with installed devices**

## 5.5 IBIS Accessories on Pole

### 5.5.1 Weather Station

The following sequence of operations should be performed in order to install the Weather Station. The provided pole can be used as a support. The Weather Station is placed in the big cardboard shipped box.



**Fig. 59 – Installation steps (1/3)**

1. take the anemometer arm and wind cups;
2. push the wind cups into the stainless steel shaft of the anemometer arm;
3. slide the wind cups up the shaft as far as possible;



Fig. 60 – Installation steps (2/3)

4. make sure the wind cups are not loose;
5. tighten the set of screw with the Allen wrench provided. Try to spin the wind cups. They should spin freely;
6. insert the anemometer arm into the base, sliding the cable through the notch in the base as shown in the figure;

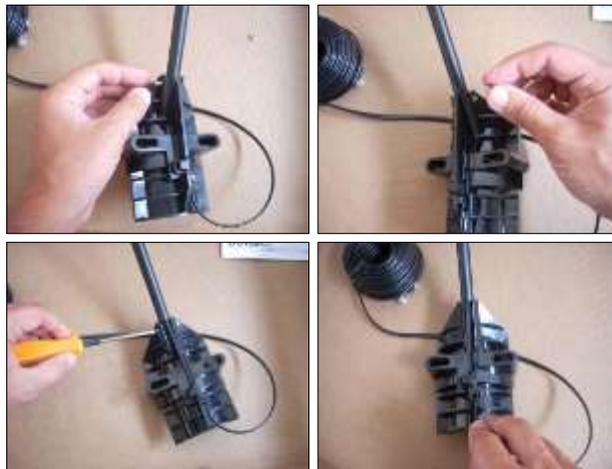


Fig. 61 – Installation steps (3/3)

7. make sure to align the small hole in the arm with the holes in the base;
8. insert the machine screw through the holes in the base and arm;
9. slide the tooth-lock washer and hex nut onto the machine screw. Tighten the hex nut while holding the screw with a Phillips head screwdriver to prevent it from turning;
10. press the sensor cable firmly and completely into the zig-zagging channel in the base, starting from the arm and progressing downward to the bottom of the base. Make sure to press the cable into the channel at the bottom of the groove;
11. fix the Weather Station on the provided pole or something similar. This can be performed using the anchoring elements provided, or simply by using cable ties.

The anemometer arm should be pointing North in order to obtain the right values in terms of wind direction.

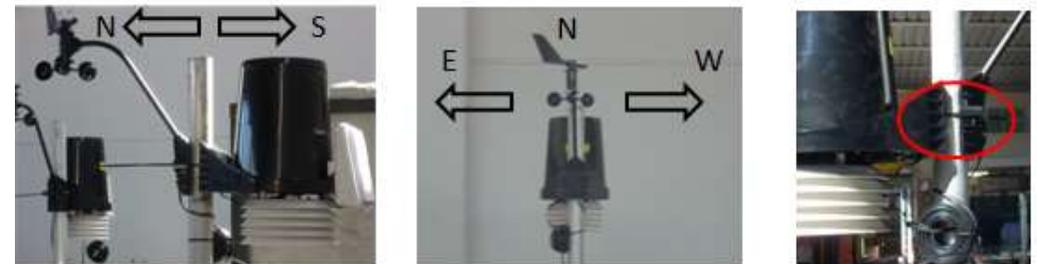


Fig. 62 – The Weather Station can be easily fixed to a pole using cable ties

Using cable ties represent a valuable solution easily adaptable to different poles or situations but in some cases, the anchoring elements provided can be used instead. Hence, you will need to remove first the rain gauge funnel as it is shown in the Fig. 63.



**Fig. 63 – Remove the rain gauge funnel**

The anchoring elements (Fig. 64) allow different configuration: for further explanations please refer to the specific manual of this device.



**Fig. 64 – Weather Station anchoring elements**

The last part of the installation consists in making all the necessary connections between the Weather Station and the Power Supply.



**Fig. 65 – Weather Station cable connections (1/6)**

1. locate the white box in front of the weather station and its white tab at the bottom center of the box cover;
2. lift the tab away from the box while sliding the cover up: the sensor connectors are now visible once the cover is removed;
3. get the protective foam out of the cable access port between the cables and set the foam insert aside;



Fig. 66 – Weather Station cable connections (2/6)

4. insert the anemometer cable end into the cable access port with the connector lever down;
5. firmly insert the end of the anemometer cable into the connector labelled WIND. The lever clicks into place;
6. make sure the cables lies flat on the bottom of the cable access port;
7. take the cable (CABLE: WEATHER) to connect the weather station console to the power supply;



Fig. 67 – Weather Station cable connections (3/6)

8. insert the WEATHER cable end into the cable access port with the connector lever down;
9. firmly insert the end of the cable into the connector labelled CONSOLE. The lever clicks into place;
10. firmly insert the foam between the cables and at the top of the cables access port, making sure the foam entirely seals the access port, leaving no holes;
11. connect the other end of the WEATHER cable to its socket in the I/O interfaces panel placed on the rear side of the IBIS-ArcSAR (red box in Fig. 68);
12. make sure the external ring is well tightened.



Fig. 68 – Weather Station connection on the I/O interface right panel

The Weather Station is supplied when the System Switch on the front Power Module is turned on and when the internal PSC is powered. Weather station power supply can be managed from IBIS Controller software. As reported above, the pole can be tilted to ease the access to the installed Weather Station.

### 5.5.2 Wi-Fi

The Wi-Fi Link can be deployed with two different layout, depending on the case, as already explained in Par. 4.9.

- Basic Layout when there is free line of sight between Control Room and IBIS-ArcSAR, (no physical obstacles along the line of sight);
- Basic Layout + Repeater when there is absence of line of sight between the Control Room and the IBIS-ArcSAR.

The Wi-Fi Link components are placed in the big shipped cardboard box. The radio antennas arrive on-site already set with the proper configuration.

In detail, the radio installed at the Control Room (Guardian side) is set as Access Point. The radio installed at the IBIS-ArcSAR (Controller side) is set as Station. The Repeater couple of radio are set as in the same way. As other IBIS devices, Wi-Fi is set with default IP address: check the IPs address before installing the antennas.



Wi-Fi radio antennas can be managed using their software *AirOS*® installed on the IBIS-ArcSAR CF31 computer. To access it the user has to open your web browser and connect to <https://10.0.0.106> (Access Point) or <http://10.0.0.107> (Station). The *Wireless* page allows antenna type modify (*Wireless Mode*), while the *Network* page allows to change the IP of the device.



PoE Ethernet connectors are supplied with 24/48 Vdc. Connect peripherals only with their specific cable.

#### 5.5.2.1 Basic Wi-Fi layout

##### Control Room side

1. install a pole outside the Control Room, in a position with a cleared view towards the IBIS-ArcSAR and that is at less than 100 m from the workstation or server in the Control Room;
2. install the first radio (configured as Access Point AP) on the pole using the provided tie: the radio has to face the IBIS-ArcSAR;
3. connect the Ethernet cable from the PoE injector to the Guardian workstation and the provided PoE cable from the PoE injector to the Wi-Fi Radio, opening the bottom part of the antenna (Fig. 70);
4. supply the Wi-Fi Radio, connecting the power cable to the PoE injector;

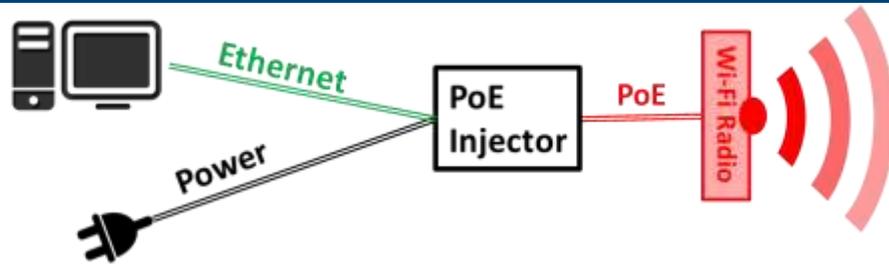


Fig. 69 – Control Room installation

### IBIS-ArcSAR side

1. install the Wi-Fi radio (configured as Station) on the ArcSAR pole so that it faces the Wi-Fi radio installed at the Control Room. Fasten the radio with provided tie;
2. open the bottom part of the Wi-Fi radio and connect the provided PoE 24 Vdc cable with the yellow plug (Fig. 70) to the socket. Connect the other side of the cable to the specific Wi-Fi on the rear I/O interface panel (red box in Fig. 70).



Fig. 70 – Wi-Fi sockets in the radio and in the rear I/O interface panel

3. in the Control Module of the PSU, turn on the WIFI switch to supply the Subscriber Unit (Fig. 71);



Fig. 71 – Wi-Fi switch on the front side of Control Module

#### 5.5.2.2 Basic Wi-Fi + Repeater Layout

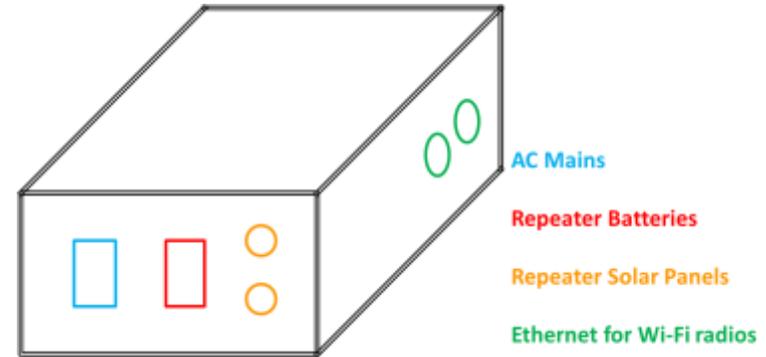
If the repeater is needed, an additional couple of radios has to be installed. Before the installation, it is required to make a survey in order to find the appropriate position to set the Repeater Unit. It must have a cleared view towards the IBIS-ArcSAR and the Control Room. The installation of the Repeater can proceed as follows:

1. install the Repeater frame with its pole on the selected installation point of the Repeater and install the couple of Radios on it. The Radio set as Access Point AP has to face the IBIS-ArcSAR, while the antenna set as Station has to face the Control Room. Fasten radios with provided ties;
2. install the Repeater batteries, connecting them to the Repeater Supply Panel (Fig. 72) using the provided cable with specific pins; put the blue covers on them;



**Fig. 72 – Repeater battery with blue cover installed**

3. install the Repeater Solar Panels on their frame and then, plug their cables to the Repeater Supply Panel;
4. if the AC Mains is available at the Repeater site, supply the batteries plugging the specific cable to the Repeater Supply Panel;



**Fig. 73 – Schematic diagram of the Repeater Supply Panel**

5. connect the radios to the Repeater supply panel with the Ethernet cables: in this way the radios will be supplied by the Repeater batteries and they will be connected together with an internal Ethernet cross cable;
6. install the Repeater Supply Panel on the pole;
7. fill up the stabilizing mass with water.

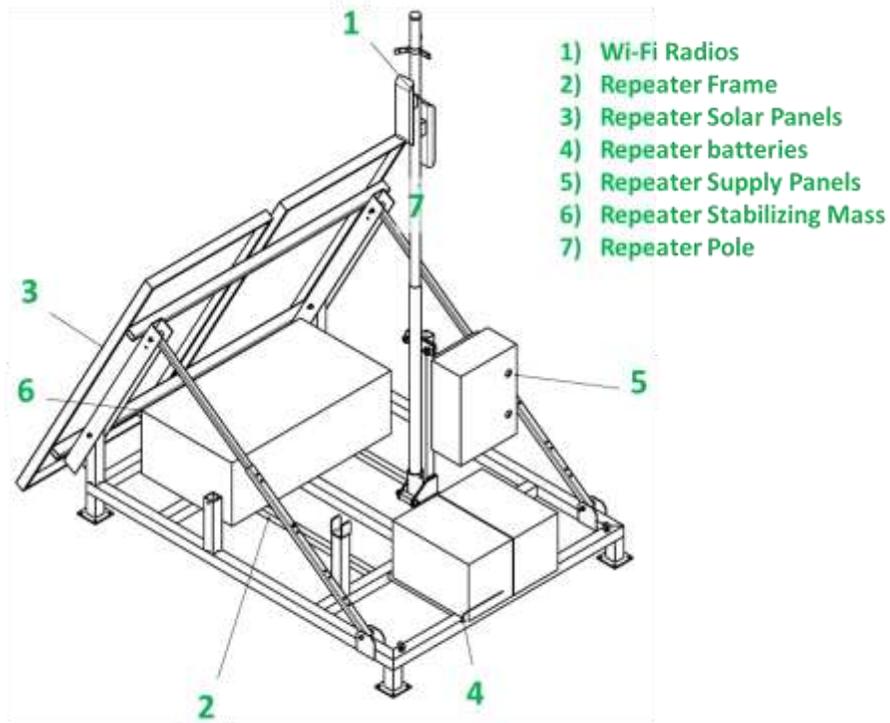


Fig. 74 - Schematic diagram of the Repeater Unit

### 5.5.3 Generator Solar Panel

Take the generator solar panel and install it on the metallic pole, using a wrench to fasten it to the pole (Fig. 75). Connect the related cable to its socket on the left I/O interface panel. The panel is able to charge the internal battery of the generator, thus remember to set the right inclination to optimize the panel efficiency.



Fig. 75 – Genset solar panel installed on the pole

## 5.6 Wind Turbine and Pole Installation and Setup

1. Open the box containing the Wind Turbine installation kit: the included items are the ones shown in Fig. 76;



Fig. 76 – Wind Turbine installation Kit

2. Join together the three blades to the front part of the wind turbine (Fig. 77): fasten each blade to the white circle by using the thread lock nuts.



Fig. 77 - Fixed blades

3. mount the blades block on the main wind turbine body: tight the nut as in Fig. 78.

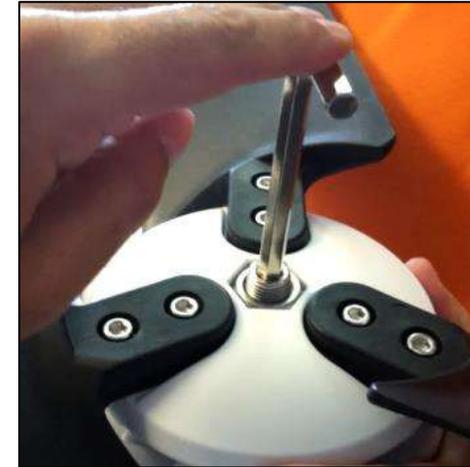


Fig. 78 – Tight the nut to fix the blades block to the Wind Turbine body

4. apply the protective cap to the front side of the blades block, pressing it firmly until it snaps (Fig. 79);



Fig. 79 – Protective Cap installation

5. Connect the Wind cable to its socket in the I/O connector box (Fig. 80).

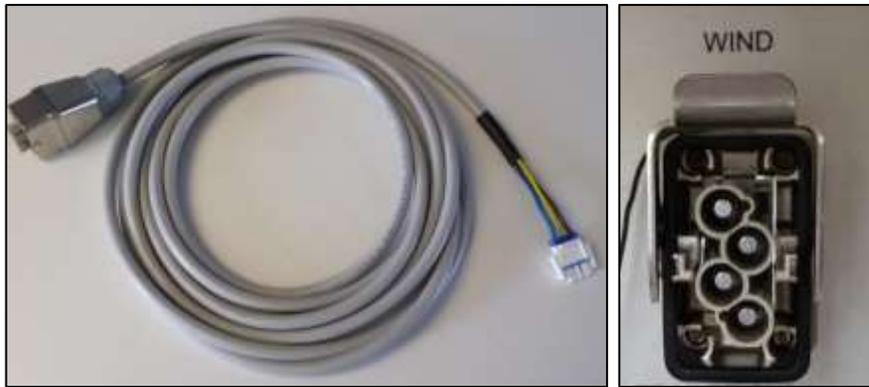


Fig. 80 - WIND cable and its socket in the I/O Connector box

6. Mount the pole metallic base (Fig. 82) on the plate present on the front part of the trailer shaft (Fig. 81). Four screws and nuts are provided to fix the base;



Fig. 81 – Plate installed on the front part of the trailer shaft

7. Notice that pole metallic base is provided with a fraying protection screw and a roll-over protection screw (Fig. 82);



Fig. 82 – Pole metallic base installed on the trailer shaft

8. Remove the roll-over protection screw with an Allen key and spanner (Fig. 83). Once free, turn the base holder almost horizontally;



Fig. 83 - Remove the roll-over protection screw

9. The Wind Turbine pole is divided in two pieces which have to be connected with a metallic joint: let the Wind cable pass inside the three elements (Fig. 84 above), bringing it out from the Wind pole top

part, where the wind turbine body will be installed (see Fig. 87 as reference).



Fig. 84 – Wind cable installed in the pole

10. Join the pole pieces with the metallic joint (Fig. 85), fasten M10 screws to block the two metallic pipes;



Fig. 85 – Metallic pole joint

11. Insert the pole into the holder located at the base of the trailer and extract the support leg of the pole to maintain the pole lifted in horizontal position;
12. With an Allen key and spanner, secure the pole to its base holder fastening the fraying protection screw;

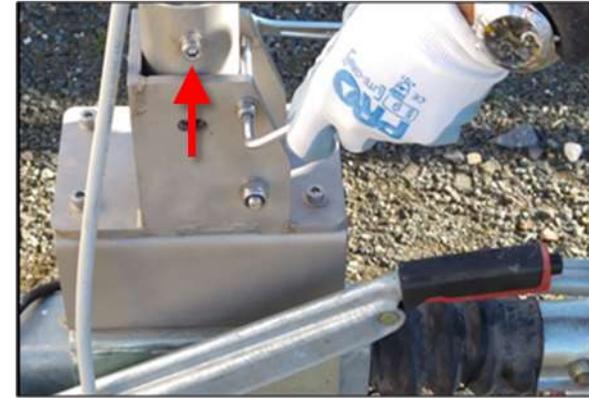


Fig. 86 – Secure the pole to its base holder

13. Plug the white connector coming out from the Wind Turbine with the Wind cable white connector coming out from the pole top (Fig. 87).



Fig. 87 – Wind Turbine connectors setup

14. Fix and tighten the wind turbine to the pole fastening the related screws (Fig. 88);



Fig. 88 – Wind Turbine tightened to the Pole

15. Install the two anchoring bars to the pole (Fig. 89 and Fig. 89) fastening the M10 screws;

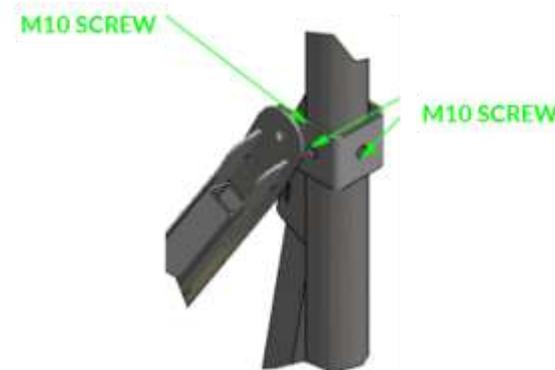


Fig. 89 – Anchoring bars installation on the Wind Pole



**Fig. 90 – Anchoring bars installed on the Wind Pole**

16. Lift the Pole in vertical position;
17. With Allen keys and spanners, tighten all the screws needed to secure the pole to the trailer, take care to keep the screw head on the side of the hand brake.



**Fig. 91 – Pole tightened to the trailer**

18. secure the pole to the Supply Unit Module, using the specific nuts and washers;



Fig. 92 – Secure the Wind Pole to the ArcSAR Supply Unit



Fig. 93 – Wind turbine and pole installed on IBIS ArcSAR

## 5.7 Trailer cable connection

1. open the rear I/O interface panel shown in Fig. 94 and check if the Trailer Supply cable is correctly connected to its plug;



Fig. 94 – I/O Interfaces panel containing the Trailer Supply socket

## 5.8 IBIS Sensor Setup

For the first installation the Radar Sensor, with the 4 Antennas and the Pointing Camera already installed on it, is shipped in a big cardboard. (Fig. 95).



Fig. 95 – Radar Sensor case

To set correctly the Radar Sensor, follow the steps below:

- Fix the Radar Sensor on its support on the end of the positioner arm by adjusting the center guide pivot of the sensor on its housing and by screwing the 4 screws with the help of an allen key. (Fig. 96);

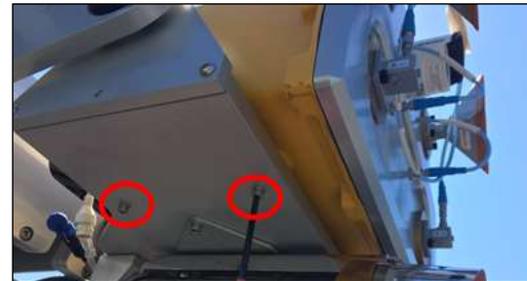


Fig. 96 – Installing the Radar Sensor into its housing

- connect the Ethernet and Power Supply cable from to the Radar Sensor. Screw together socket caps to prevent dust or water heap (Fig. 97);



Fig. 97 – ETHERNET and SUPPLY connections to the Sensor

- connect the Ethernet (white cable) and Supply (blue cable) plugs to the related wires of the Pointing Camera.

## 5.9 Panoramic Camera Setup

Mount the panoramic camera below the radar trolley using the 4 screws and washers as shown in Fig. 98



Fig. 98 – Installing the Panoramic Camera

## 5.10 Supply Unit and Acquisition Unit Connections Setup

Connect the POSITIONER cable from the I/O Interface placed on the front side of the ArcSAR Supply to the socket panel placed at the base of the ArcSAR Acquisition Unit (Fig. 11);

## 5.11 Safety Electrical devices Setup

### 5.11.1 Genset RCD on

Open the Circuit Breaker Panel and turn the GENSET switch on (Fig. 99), in order to allow generator operations;



Fig. 99 – GENSET RCD panel

### 5.11.2 PSM and Genset isolation point on

Open the Isolation Point switchboard, placed on the front side of the ArcSAR Supply Unit, turning on the GENSET and PSU Isolation Point switch (Fig. 100);



Fig. 100 – PSU and GENSET Isolation Points switch turned on



Remind to control the releasing of the emergency stop buttons. If the emergency stop button is pushed, devices will be electrically isolated.

## 5.12 Generator First Setup

### 5.12.1 Oil refill

Before starting this operation, a dry cloth, engine oil and a funnel are required. Then follow the steps below:

- make sure the engine lays on a levelled surface;
- stop the generator and isolate it, turning off the GENSET switch on the PSU front door and the Genset Isolation Point switch;



### **WARNING** **SHOCK HAZARD** **MOVING PARTS HAZARD**

Any maintenance operation on the generator must be carried out with the engine off and the system isolated. It is mandatory to turn OFF the Genset Isolation Point switch before working on the generator.

- open the generator rotating panel, unlocking the two metal locks (Fig. 101);



Fig. 101 – Opening the Generator internal panel

- unscrew the orange cap/dipstick and clean it with a clean cloth (Fig. 102);

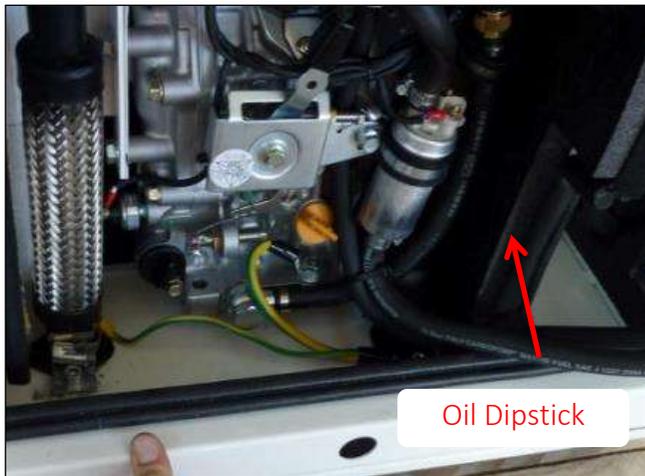


Fig. 102 – Oil dipstick

- fully reinsert the oil cap/dipstick without screwing it in;
- remove the oil cap/dipstick and make sure the oil level is between the MAX and MIN marks on the dipstick;

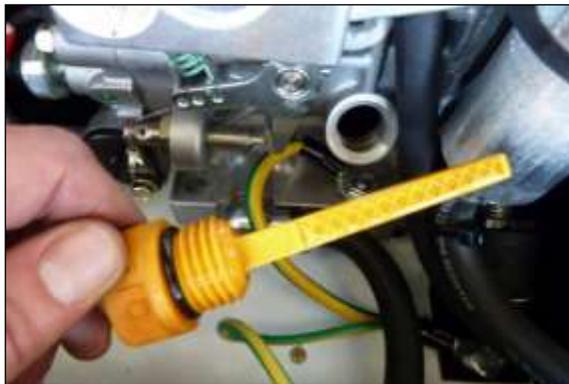


Fig. 103 – Oil dipstick indicator

- if the oil level is too low, add some oil; a funnel should be useful;

- wait one minute and check the oil level;
- add more oil if necessary but don't exceed the MAX level;
- fully reinsert the oil cap/dipstick and tighten it;
- turn on Genset Isolation Point switch and the GENSET switch on the PSU, and test the generator.

#### 1.1.1.1 Oil for ArcSAR Generator

Always use oil with suitable viscosity for the temperature where the engine is being operated. Use the chart reported in Fig. 3.14 when choosing your engine oil. The oil tank has a capacity of 1.1 liters. Besides, use an engine oil that meets or exceeds the following guidelines and classifications:

- API (American Petroleum Institute) services categories CD or higher;
- ACEA (European Automobile Manufacturers Association) services categories E-3, E-4 and E-5;
- JSO (Japanese Automobile Standards Organization) services category DH-1.

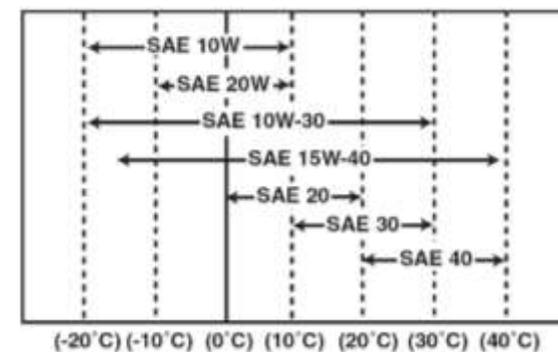


Fig. 104 – Service Grade Viscosity chart



Be environmentally responsible. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.

Follow the guidelines of the government agency for the proper disposal of hazardous materials such as batteries. Consult the local authorities or reclamation sites;

Never dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.



- only use the recommended engine oil. Other engine oils may affect warranty coverage, cause internal engine components to cease and shorten the engine life;
- prevent dirt and debris from contaminating the engine oil. Carefully clean the oil cap /dipstick and the surrounding area before removing the cap;
- never mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil;
- never overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage;
- always keep the oil level between the upper and lower lines in the oil.

### 5.12.2 Fuel refill

- check the fuel level pushing the button of the fuel level indicator (red in Fig. 105 left). If the fuel level in the tank is low (indicator on left), refill the tank through the black filler under the indicator (green in Fig. 105 left);

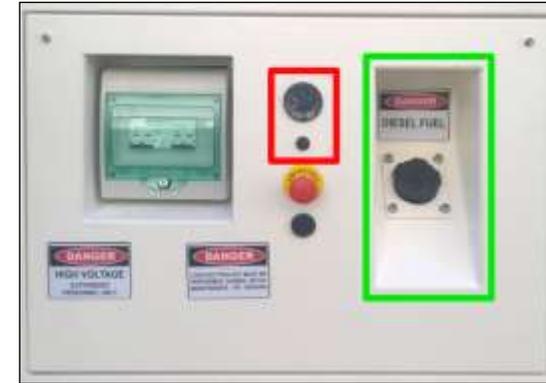


Fig. 105 – Fuel Tank side

### 5.12.3 Drain air in fuel circuit

During first IBIS-ArcSAR installation, it should be necessary to remove the air from the fuel filter inside the generator. To do this, it is necessary to open the generator panel (Fig. 106 left), unlocking the two spring-locks.

Looking on the left, push the black button to activate a pump primer (Fig. 106 right). Wait until hearing a bleeding sound from fuel filter (



Fig. 107).



Fig. 106 – Fuel filter cleaning



Fig. 107 – Fuel filter

Check if the red switch placed under the black button is on / position.

### 5.13 Turning on the system

Turn the red switch on and push the Enable switch (Fig. 108). With this actions, the Power, Control and Green modules will be supplied (the Module On LED has to be lit up).



Fig. 108 – Turning on the system

### 5.14 Green module first setup

Follow the steps below to properly turn on the solar panels and/or the wind turbine.

- Turn on the BATTERY toggle switch (Fig. 109) to allow the power generated by the green sources to flow to the ArcSAR batteries.



Fig. 109 – BATTERY switch on the GREEN module

- Turn on the SOLAR toggle switch (Fig. 110) and check if the LED is lit up;



Fig. 110 – SOLAR switch on the GREEN module

If the Wind Turbine is present:

- Once the SYSTEM switch has been turned on, the MODE LED is lit up and solid, while the STATUS LED is off. In this condition, the wind turbine is electrically braked, this it won't provide any power to the system;
- To release wind turbine brake, push the black button for 10 seconds: while pushing the black button the STATUS LED is blinking;

- Once the brake is released the MODE LED is blinking and the STATUS LED is solid;
- The WIND LED is lit up once the wind turbine generates enough power to charge properly the ArcSAR batteries.

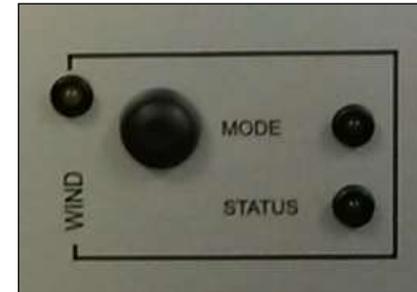


Fig. 111 – WIND controls on the GREEN module

Once the PSU Isolation Point switch is off the Wind Turbine is automatically braked.

In any case it's possible to brake the Wind Turbine blades manually:

- To brake the wind turbine blades, push the black button for 10 seconds: while pushing the black button the STATUS LED is blinking;
- If the blades are braked, the MODE LED is solid, while the STATUS LED is off;

### 5.15 ArcSAR Sensor first set up

On the Control module of the PSU, turn on the SENSOR and CAMERA switches. The corresponding LEDs on the positioner will lit up in blue (Fig. 119)

### 5.16 ArcSAR Positioner first set up

On the Control module of the PSU, turn on the POSITIONER AND GPS switches. The corresponding LEDs on the positioner will lit up in blue (Fig. 119)

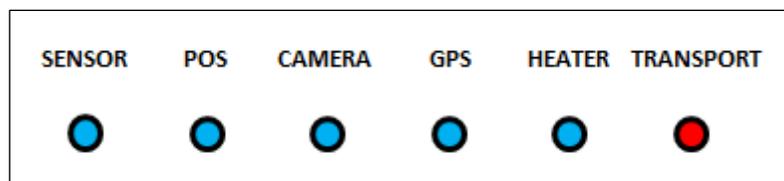


Fig. 112 – Positioner LEDs



The communication between the Positioner and IBIS Controller application is provided using serial connection. The default port is COM7



#### MIND YOUR HEAD

Positioner is automatically controlled by IBIS Controller and it is able to rotate by itself. Pay attention while working under the Positioner to the tuck movement. Every movement of the Positioner is pointed out by an intermittent acoustic sound and a blinking yellow lamp.

### 5.17 ArcSAR Laptop first setup

1. open the Laptop sliding drawer placed under the PSU modules. To extract the Laptop PC drawer unscrew the knob on the right (red) and using the handle (green), pull out the drawer (Fig. 113);



Fig. 113 – Unscrewing PC drawer black knob

2. On the drawer the following connection cables are present: Laptop supply, radar sensor Ethernet, system Ethernet, USB and serial port cable (Fig. 114).



Fig. 114 – Connections on the PC drawer

3. the Laptop PC is provided in its own cardboard box, together with the Laptop Power Supply cable, the Laptop Manual and Recovery Disc;
4. place the Laptop on the drawer: two plastic pivots are present to ensure the fastening of the machine. Insert the two pivots into the

two holes placed at the corner of the bottom side of the laptop. Then connect all the cables;



Fig. 115 – CF31 with cables connected

5. To supply the Laptop turn on the PC switch on the Control Module. The Laptop will turn on automatically;

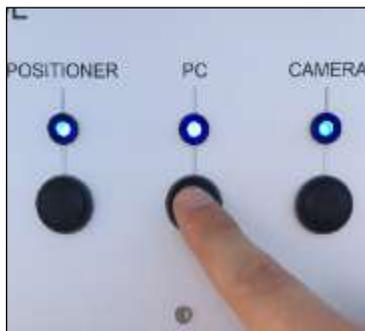


Fig. 116 – PC Switch on Control Module

6. to close the tray, push the drawer inside the compartment and screw the black knob on the right again (Fig. 22). Remember to fasten the

Velcro® belt on the CF31, in order to keep stuck the computer during ArcSAR moving.

## 5.18 ArcSAR IP addresses configuration

In case of integration of the ArcSAR devices into the mine network, the IP addresses have to be configured again.

It is recommended to perform these actions with the assistance of an IBIS Specialist.

The devices that need to set an IP address are:

- Power Supply Controller;
- Pointing Camera;
- Weather Station internal Data Logger board (if present);
- Wi-Fi Radios (if present);
- ArcSAR Laptop.

### 5.18.1 Power Supply Controller IP address

1. Click on *Start* and run *Lantronix* → *DeviceInstaller* as administrator;
2. wait some seconds to let the software visualize all the components connected. On the main big tab, select the device whose IP has to be assigned;

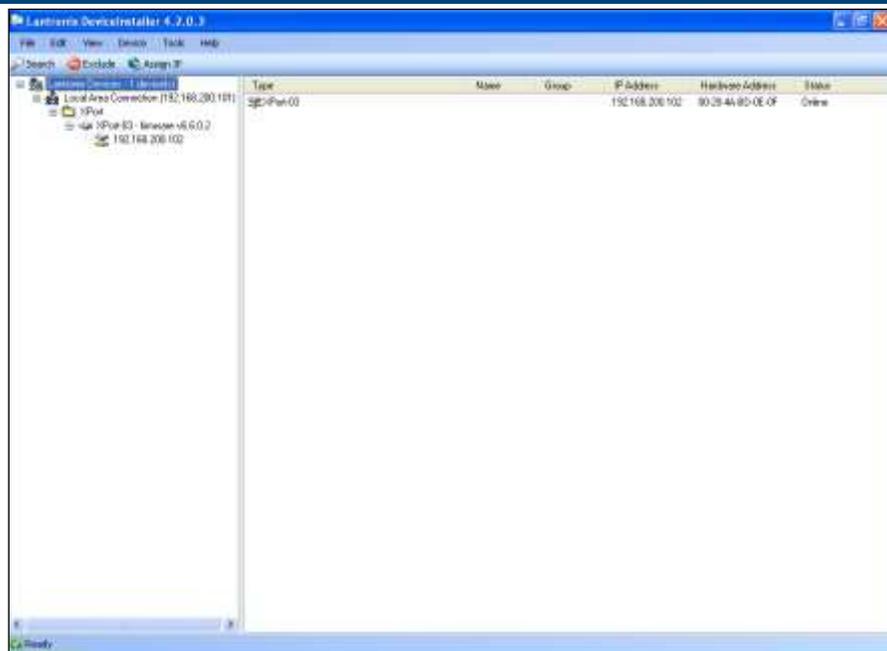


Fig. 117 – Lantronix DeviceInstaller screen

- click on *Assign IP* and a new window will open;

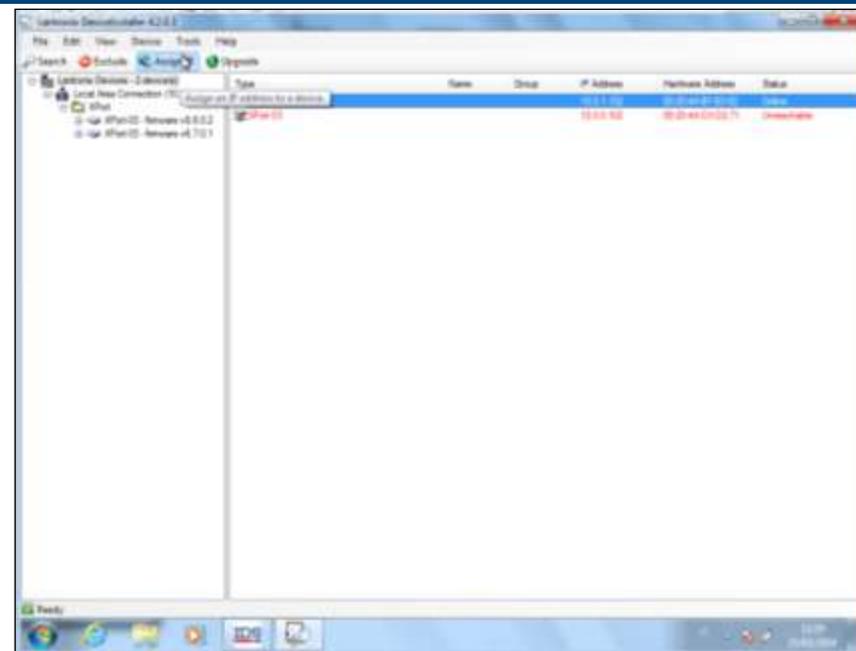


Fig. 118 – Lantronix Assign IP

- in Assignment Method Tab, select *Assign a Specific IP Address* and click on *Next*;

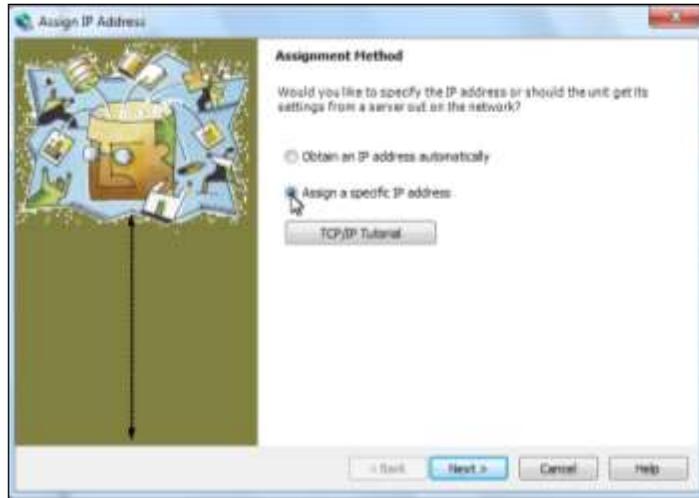


Fig. 119 – Lantronix DeviceInstaller: Assignment Method

5. in IP Settings Tab, complete the three field (*IP Address, Subnet Mask and Default Gateway*) with the specific device addresses and click on *Next*;



Fig. 120 – Lantronix DeviceInstaller: IP Settings

6. in the final Assignment Tab click on button *Assign* to complete the operation. Then close Lantronix;
7. check the right assignment of the device IP directly on Controller software: Settings > Supply > Supply Controller Setup > insert the IP PSC address > Test Connection.



Fig. 121 – Supply Controller Setup

### 5.18.2 Pointing Camera IP address

To change the IP address of the Pointing Camera, open the browser and access the related *Hikvision* application webpage. The default IP address is 10.0.0.105.

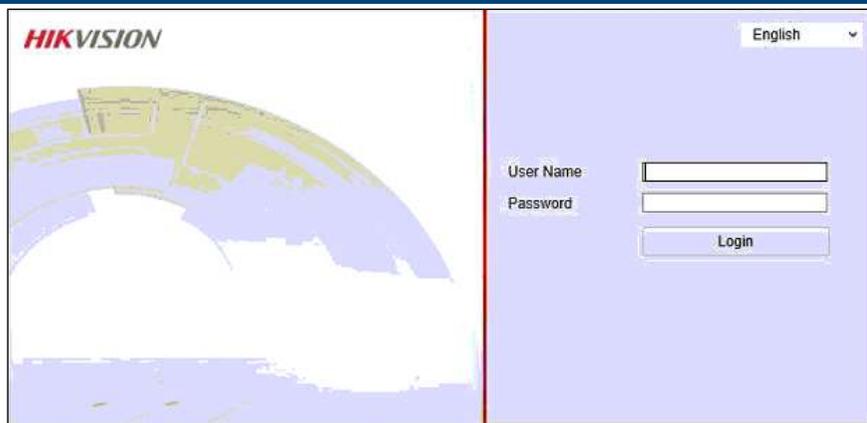


Fig. 122 – Hikvision login page

- insert *admin* as User Name and *ibis12345* as password and click *Login* (Fig. 122);
- select *Configuration* and on the column on the left column select *Network*;
- insert the new IP address, Selection mask and Default gateway (Fig. 123);

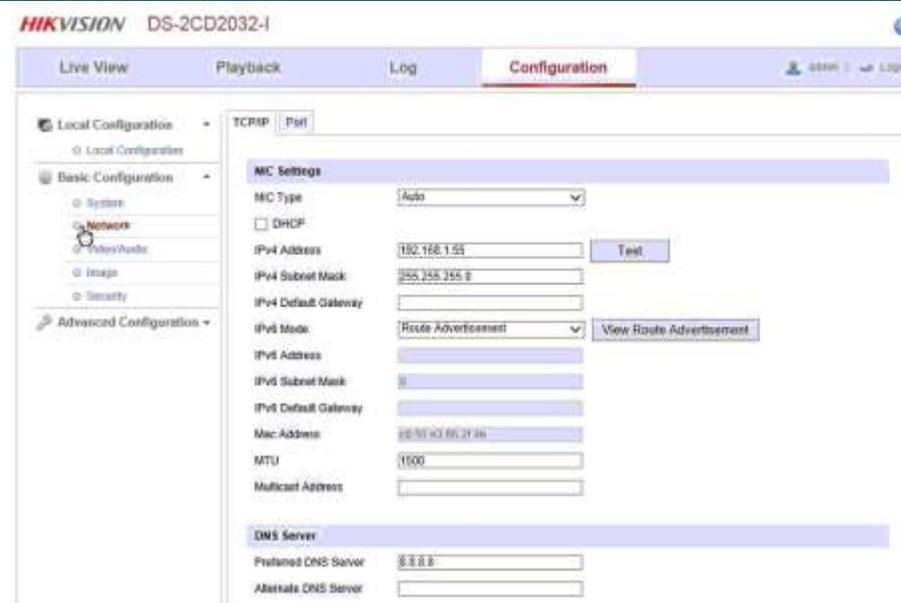


Fig. 123 – Hikvision configuration page

- close Internet Explorer;
- change the IP address of Pointing Camera in IBIS Controller settings. For any further details refer to IBIS Controller User Manual [BD1].

### 5.18.3 Weather Station internal Data Logger board IP address

To change the IP address of the internal Weather Station board, open the browser and access the related application webpage. The default IP address is 10.0.0.104.

In the *WeatherLink* IP Configuration page, tick the field *Use the following IP Address* and assign the desired *IP Address* with the related *Selection Mask* and *Default Gateway*. Do not change anything in the right part of the window. (Fig. 124).



Fig. 124 – WeatherLink IP configuration page

Press *Save IP Settings* to confirm and close Internet Explorer.

Change the IP address of Weather Station in IBIS Controller settings. For any further details refer to IBIS Controller User Manual [BD1].

#### 5.18.4 Wi-Fi Radio IP address

To change the IP address of the Wi-Fi radios, open the browser and access the related *AirOS* application webpage. The default IP address is 10.0.0.106.



Fig. 125 – AirOS login page

- insert *ubnt* as User Name and Password and click *Login* (Fig. 125);

- select *Network* on the upper taskbar to access the network configuration page;



Fig. 126 – AirOS taskbar

- set the *Network Mode* as *Bridge*;
- set the *Configuration Mode* as *Simple*;
- in *Management Network Settings*, tick *Static* in the *Management IP Address*;
- change the IP address, Subnet mask and Default gateway, modifying the related fields (Fig. 127);

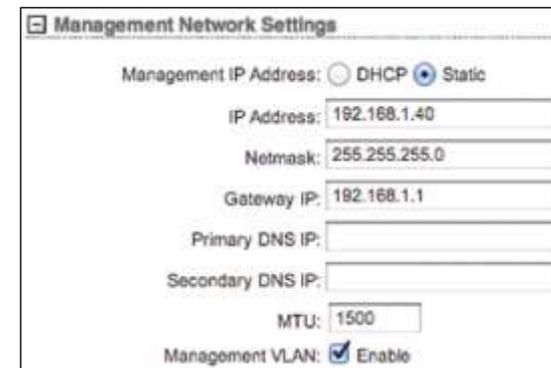


Fig. 127 – AirOS: Management Network Settings

- click on *Change* button, placed at the lower right corner of the screen to save the settings and close the AirOS application.

#### 5.18.5 ArcSAR Laptop IP address

To change the IP address of the CF31 ArcSAR Laptop, follow the steps below:

## 5 FIRST ArcSAR SETUP

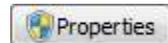
- go on the Windows taskbar;
- right click on the Network icon;
- access *Open Network and Sharing Center*;



- open the *Local Area Connection link*;

Access type: Internet  
Connections: Local Area Connection

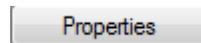
- open *Properties*;



- select *Internet Protocol Version 4*;

Internet Protocol Version 4 (TCP/IPv4)

- click on *Properties*;



- tick *Use the following IP address* and insert the new IP address, Subnet mask and Default gateway. Then click OK

Obtain an IP address automatically  
 Use the following IP address:

IP address:

Subnet mask:

Default gateway:

- reboot the computer

- Digital Terrain Model (DTM) of the scenario to monitor. IBIS Controller accepts following file formats: .dxf, Shapefiles, .xyz or ASCII grid (.txt);
- the EPSG code which is a unique value used to unambiguously identify projected, unprojected, and local spatial coordinate system definitions;
- the IP address of IBIS Guardian software and the type of data transfer (TCP or FTP).

For any further details, please refer to the IBIS Controller User Manual [BD1].

### 5.20 End of the ArcSAR First Setup

To complete the first setup, turn off the PSU and GENSET Isolation Point switches

### 5.19 Controller General Settings

Before starting the setup for a new IBIS-ArcSAR session, it is recommended to take possession of:

## 6 FIRST IBIS-ArcSAR START UP

### 6.1 Park the IBIS-ArcSAR

This part describes the procedure to park and stabilize the Trailer:

- Move the trailer to the site from where the monitoring will be performed (Fig. 128)
- park the trailer, reminding that front side of the ArcSAR (Acquisition Unit) has to face the area to be monitored;



Fig. 128 – Moving the IBIS-ArcSAR

### 6.2 Disconnect the IBIS-ArcSAR from the truck

#### 6.2.1 Set wheel chocks

- slip off yellow chock levels which are placed at the corners in the lower part of the cart. Blocking wheels with them to ensure cart immobility during next steps (Fig. 129);



Fig. 129 – Set wheels chocks

#### 6.2.2 Trailer hand brake

- stabilize the trailer pulling hand brake (Fig. 130);



Fig. 130 – Pulling hand brake

### 6.2.3 Disconnect trailer cable from the truck

- disconnect the cable from the vehicle and connect it to the socket on the cart (Fig. 131);



Fig. 131 – Disconnecting trailer cable

### 6.2.4 Disconnect IBIS-ArcSAR trailer from truck towing bar

- lower the front wheel of the cart, turning handle counter-clockwise, until the wheel touches the ground (Fig. 132). The side lever allows the lifting of the wheel during transport operations;



Fig. 132 – Lowering the front wheel of the cart

- disconnect the cart from the vehicle, lifting the handle vigorously as shown in Fig. 133;



Fig. 133 – Disconnecting cart from the vehicle

- pull off the safety hook with the red wire (Fig. 134);



Fig. 134 – Removing safety hook

## 6.3 Hydraulic Jacks Setup

### 6.3.1 Turning on the jacks battery cut-off switch

- insert the security key in its socket, placed on the cart shaft, and turn it in vertical position (Fig. 135);



Fig. 135 – Hydraulic system battery cut-off switch

### 6.3.2 Plywood bases under jacks

- remove plywood bases from their housings and put them under the four cart hydraulic supports (Fig. 136);



Fig. 136 – Plywood bases setup

### 6.3.3 Open jack switches

- unlock supports opening the four hydraulic valves from horizontal position to vertical position (Fig. 137), in order to activate the moving pistons;



Fig. 137 – Opening jack switches

### 6.3.4 Turning on the Genset Isolation point on the Supply Unit

- open the Isolation Point panel on the front side of the ArcSAR (Fig. 138);



Fig. 138 – Isolation Point panel on Supply Unit front side

- open the Isolation Point switchboard, turning the GENSET Isolation Point switch on (Fig. 139);



Fig. 139 – GENSET Isolation Point switch turned on

### 6.3.5 Lower hydraulic legs

- lower hydraulic legs (right side of the trailer) acting on the four black pistons. Check the right drop of jacks over the plywood bases (Fig. 140);



**Fig. 140 – Jacks pistons**

- check the correct horizontal position of trailer observing spirit levels placed on the left of the pistons. Verify that wheels are raised off the ground (Fig. 141);



**Fig. 141 – Right trailer horizontal levelling**

#### 6.3.6 Secure the jacks movement

- close valves to lock again the four jacks, and turn the security key in horizontal position to secure cart stability (Fig. 142).



**Fig. 142 – Secure the jacks**

## 6.4 Power Supply Unit setup

### 6.4.1 Turn on PSU Isolation point devices

- open the Isolation Point panel on the front side of the ArcSAR (Fig. 143);



**Fig. 143 – Isolation Points panel**

- turn the PSU Isolation Point switch on (Fig. 144);



Fig. 144 – PSU Isolation Point switch turned on

- open the PSU door using the black handle (green). Secure the door fixing it with the lever placed on the left lower corner (Fig. 145);



Fig. 145 – PSU panel

- on the Power Module, turn the red switch to position ON (Fig. 146), the battery indicator will show the battery's level and the LED will turn on;



Fig. 146 – Turning on the PSU ON/OFF switch

- push the ENABLE and AC INPUT switches placed on the Power Module. This operation switch on the Power Module, the Control Module and the Green Module.



Fig. 147 – Turning on the ENABLE switch in the Power Module on PSU panel

If the mains AC input is available on site, the AC Mains cable has to be used (Fig. 148 left). The blue end of this cable has to be plugged to the external supply connection and the other end of the cable has to be plugged to the Mains Input connection in I/O interface panel on the rear side of the IBIS-ArcSAR (Fig. 148 right).



Fig. 148 – Connections to supply IBIS-ArcSAR with AC Mains power



Grounding connection is recommended for the IBIS-ArcSAR operation, in order to protect the electrical devices of the equipment.  
Earth pin is below the generator exhaust gas pipe (Fig. 149)



Fig. 149 – Grounding connection

## 6.5 Generator setup

- Open the generator door and fix the panel with the rod placed on the internal side of the door : the panel has to stay partially open while the radar is functioning in order to improve ventilation (Fig. 150 left). If the panel is left closed a sensor avoids the generator starting (Fig. 150) giving an alarm on both AMF25 Unit and Controller software;



Fig. 150 – Generator panel setup

- on the PSU front panel, turned on the GENSET switch placed in the Control Module. In this way Genset Module will be supplied and the AMF25® Control Panel will be switched on (Fig. 151).



Fig. 151 – Turning on AMF25 Control Panel

### 6.6 Wind Turbine Setup

If the Wind Turbine has been installed as optional, repeat the setup steps as described in the Paragraph 5.14.

### 6.7 Panoramic Camera Setup

To supply the Panoramic Camera, it's necessary to open the PSU door and turn on the CAMERA switch (Fig. 152).



Fig. 152 – Turning the CAMERA switch on (PSU Control module)

For the configuration of the Panoramic Camera during a new Controller session wizard, please refer to the IBIS Controller User Manual [BD1].

### 6.8 Laptop Starting

1. open the Laptop sliding drawer placed under the PSU modules;
2. unscrew the knob on the right and pull out the sliding drawer;



Fig. 153 – CF31 laptop with cables connected

3. supply the Laptop turning on the PC switch on the Control Module



Fig. 154 – PC Switch on Control Module

4. the Laptop will be automatically turned on. Wait the loading of the Operating System and the loading of the IBIS Controller software. In any case the software can be run clicking on its desktop icon.

## 6.9 Session starting

Once the instrument with all its peripherals is installed according to instructions, it is ready to be used. The following list describes the operations requires to start up and use IBIS-ArcSAR:

1. make sure that SENSOR and POSITIONER switches are turned on;
2. make sure GPS switch is turned on;
3. turn on the other switches if the related components are present in the system configuration. Remind that if the CAMERA and WIFI switches are turned on, the related plugs are supplied by Power-over-Ethernet.

At this point, a new session can be created on the IBIS Controller application and the instrument can be used following the instructions provided in the IBIS Controller User Manual [BD1].



Fig. 155 – Sliding plates to survey Positioner

### ArcSAR POSITION SURVEYING



The IBIS-ArcSAR is provided with the integrated GPS. The surveying of the ArcSAR position will be performed automatically during a new session wizard. It is mandatory to set the EPSG code in the Controller Settings.



The ArcSAR position can also be evaluated surveying the two little sliding plates placed at the ends of the Positioner (Fig. 155) and then calculating the middle point of the Positioner. This surveying has to be done with the Positioner at 0° azimuth (Scanner parallel to the shorter trailer side).

## 7 DISMANTLING AN IBIS-ArcSAR SYSTEM

### 7.1 Actions on IBIS Controller and on ArcSAR Laptop

- Stop the running Controller session, clicking on the STOP button (refer to the IBIS Controller User Manual [BD1]);
- close the IBIS Controller application;
- the software will ask to move the IBIS-ArcSAR Positioner to the *Transport Mode*. It is mandatory to click Yes. Wait the end of the movement of the ArcSAR Positioner;



During the transportation of the IBIS-ArcSAR, the Positioner has to be set on *Transport mode* ().

## 5 DISMANTLING AN IBIS-ArcSAR SYSTEM

- shut down the Laptop and secure it using the Velcro® strap, in order to ensure its immobility during ArcSAR transportation.

### 7.2 Actions on the ArcSAR Supply Unit

If the Wind Turbine is present it's mandatory to brake its blades:

- If the Wind Turbine is running, the MODE LED is lit up and blinking and the STATUS LED is lit up and solid;
- To brake the wind turbine blades, push the black button for 10 seconds: while pushing the black button verify that the STATUS LED is lit up and blinking;
- If the blades are braked, the MODE LED is lit up and solid, while the STATUS LED is off;

Turn off the red isolation point switch placed on the Power module of the PSU.

Turn off the PSU Isolation Point switch placed on the front side of the Supply Unit.

### 7.3 Actions on the Trailer jacks

- Put the yellow chocks around the trailer wheels (Fig. 129);
- turn on the battery cut-off switch placed on the trailer shaft, turning it with the specific key (Fig. 135);
- unlock supports opening the four hydraulic valves from horizontal position to vertical position (Fig. 137), in order to activate the moving pistons;

- raise hydraulic legs acting on the four black pistons. Check the right lift of jacks over the plywood bases (Fig. 140);
- remove the plywood bases and placed them in the specific housings;
- lock the jacks closing the four hydraulic valves from vertical to horizontal position;
- turn off the GENSET isolation point placed on the front side of the Supply Unit (Fig. 143);
- turn off the battery cut-off switch placed on the trailer shaft, turning it with the specific key.

### 7.4 Get ArcSAR ready to drive

Close and lock all the ArcSAR panels and doors;

- connect the cart to the vehicle, lifting the handle vigorously on the car hook. A click sound will point out the right connection between the car hook and the trailer (Fig. 133);
- raise the front wheel of the cart, turning handle clockwise, until the wheel doesn't touches the ground anymore. The side lever allows the lifting of the wheel during transport operations (Fig. 132);
- connect the cable to the vehicle and connect it to the socket on the car (Fig. 131);
- pull on the safety hook with the red wire (Fig. 134);
- release hand brake;
- at this point, it is possible to move IBIS-ArcSAR safely.

## APPENDIX A DISCLAIMER

### 1. Generals.

- i. 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 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. Buyer hereby consents to the exclusive jurisdiction of Pisa.

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

- i. The Buyer, for setting-up and using the purchased Products, shall consult the official documentation provided by IDS 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 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.
- iii. 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 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 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”, i.e. the IBIS 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, in particular for 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 non in compliance with the required specifications of IDS 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.

#### 4. Disclaimer for the “IBIS Family” Products.

- i. 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.
- ii. Nevertheless, IDS GeoRadar s.r.l. 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:
  - a. the parameters introduced by the operator/s.
  - b. the particular environmental conditions: (even though the radar technology employed by IBIS, is deemed among the most reliable for the monitoring of “instable slopes).
- iii. Therefore, when IBIS Products are used in “Critical Monitoring for safety purposes” applications, like real time monitoring of unstable slopes including Opencast 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 (holding an “IBIS User Certificate” thereof) are allowed to use IBIS products.

IDS GeoRadar S.r.l. 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 S.r.l.. 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 B WARRANTY

### A. Standard Warranty Conditions

1. IDS GeoRadar s.r.l., (hereinafter referred to as IDS or Seller), 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 shall repair or replace Products or parts thereof found faulty (the "Faulty Parts") which are returned to IDS, and which, at IDS's judgment, were defective or became defective during its normal use. Seller's obligations shall not apply to Faulty Parts that:
  - (a) Buyer do not properly store, install, use, or maintain;
  - (b) Buyer modify, or perform tests which are not approved in writing by the Seller;
  - (c) 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.
  - (d) Are repaired by other than IDS personnel; in which have been installed HW/SW accessories not supplied by IDS; are integrated or connected to equipment different from the ones supplied by IDS (except the PC data Logger conform to IDS specifications);
  - (e) Whose operational software was not installed as per IDS instruction (see IDS User's Guide for the Data Acquisition Software);
2. 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 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
3. 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 in anyway.
4. 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 Products purchase, being, expressly 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.

### B. Warranty Procedure

1. To proceed in the application of warranty terms, Buyer shall have to contact IDS Customer Care Office to get the clearance to return the Faulty Parts.
2. The Faulty Parts once received by IDS will be inspected to verify they are eligible for repair or replacement..
3. Buyer is responsible for ensuring that the Faulty Parts be returned to IDS with a suitable packing (it is recommended that the original packing be saved for a better understand of the failure cause); IDS will not be obliged to repair or replace Faulty Parts damaged from abuse, misuse, negligence, accident loss or damage in transit.
4. The Shipping costs for Products returned during the warranty period, are as follows:
  - (f) From Buyer Site to Seller site → shipping costs, as per Incoterms CIP, are borne by Buyer
  - (g) From Seller Site to Buyer site → shipping cost, as per Incoterms CIP, are borne by Seller
5. 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.

### C. 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.

1. IDS 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.
2. 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 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, IDS 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.

3. 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.
4. IDS 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. 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, does so at his own risk

#### **D. Limited Liability**

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

1. 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 for the purchased Products, which give rise to the claim, and any such liability shall terminate upon the expiration of the warranty period.

## APPENDIX C PACKING CONTENTS

### IBIS ArcSAR Acquisition Unit Box:

Wooden packaging - liftable with fork truck - (size: 184 x 113 x 249 (length [cm] x width [cm] x height [cm] )) and total weight, when fully packed, of 495 kg). This box contains following parts:

- The ArcSAR Positioner;

### IBIS Supply Unit Box

Wooden packaging - liftable with fork truck - (size: 166 x 198 x 142 (length [cm] x width [cm] x height [cm] )) and total weight, when fully packed, of 1200 kg). This box contains following parts:

- The ArcSAR Supply Unit.

### IBIS Trailer Unit Box

Wooden container - liftable with fork truck - (size 433 x 227 x 131 (length [cm] x width [cm] x height [cm] )). This box contains following parts:

- The ArcSAR Trailer;
- The CF31 ArcSAR computer;
- The metallic pole to install IBIS ArcSAR accessories;
- The Generator Solar Panel and its metallic frame;
- IBIS ArcSAR standard cables (see Paragraph 4.5);
- IBIS ArcSAR standard spare parts (depending by the Customer purchase);
- The Wi-Fi radios (if they have been purchased as optional items);

- The Weather Station Package (if it has been purchased as optional item);
- The Wind Turbine Installation Kit and its metallic pole (if it has been purchased as optional item);
- The IBIS Radar Sensor case (Fig. C. 1) (size 80 x 50 x 30 cm and total weight - when packed - of 28 kg). This case contains the following list of materials (Tab. C. 1):



Fig. C. 1 – IBIS Radar Sensor case

## APPENDIX C. Packing Contents

| PHOTO  | DESCRIPTION  |
|--|--|
|  A white radar sensor unit with four orange mounting brackets, one on each side, and a central lens.    | 1 IBIS Radar Sensor  |
|  A black power cable with a standard AC plug on one end and a CF31 laptop power connector on the other. | 1 CF31 Laptop Supply cable   |
|  A black power cable with a standard AC plug on one end and a blue connector on the other.              | AC Mains cable (the cable has a different plug depending to the destination country) |

Tab. C. 1 – Contents of the IBIS Radar Sensor case

## APPENDIX D ADDITIONAL NOTES

### Authorization of utilization – national restrictions

#### *European countries*

IBIS products are classified by CEPT as SRD – Short Range Device - i.e. a device that doesn't cause interference to other systems operating in the same frequency band. For details about IBIS products, apply the recommendation ERC/REC 70-03 that defines the SRD equipment (annex 6, frequency band I). Below is the link to the cited document:

<http://www.erodocdb.dk/Docs/doc98/official/pdf/REC7003E.PDF>

#### *For Ku band system*

Almost all the European countries have applied the ERC/70-30 for the Ku band, however in some European countries, the use of IBIS system outside a laboratory can still be subject to authorization by the Competent Ministry of the country, where the system should be used. Please refer to the Appropriate and Competent Ministry of the country to know whether it is still necessary to get an authorization or not.

#### *For X band system*

Almost all the European countries have applied the ERC/REC 70-03 for the X band system. Please refer to the Appropriate and Competent Ministry of the country to know if there are some limitations in the utilization of X band IBIS-FM equipment or not.

#### *USA*

The IBIS sensor is FCC certified, according to the FCC rule part 90, as a radiolocation device (subpart F). In order to use the sensor in the US territory, a license of utilization must be obtained by FCC. The licence application can be submitted to the following website: <http://wireless.fcc.gov/uls/index.htm?job=home>



According to Maximum Permissible Exposure requirements as defined in FCC §1.1307 the Equivalent Isotropic Radiated Power of IBIS Sensor is below the limit of  $1\text{mW}/\text{cm}^2$  at 20cm. Therefore, the minimum distance to be kept with respect to the antennas during the acquisition time, in order to meet MPE requirement, is 20cm.

For more information about licensing procedure contact IDS GeoRadar personnel.

#### *Canada*

The IBIS sensor is IC certified as a licence exempt low power device, according to RSS 210 annex 2. Operating band is 17.1 – 17.2 GHz, with a maximum ERP power of 0.3 W. Respecting the mentioned limitation in terms of band and emitted power, IBIS can be used in Canada, without any license.



The sensor is configured in the factory considering the country of origin of its customer. If monitoring activities are planned outside that country, different settings shall be applied on request, for the duration of the survey. Contact IDS GeoRadar personnel to change the settings and restore them if re-entering the country of origin.

### CE Marking



This equipment is in compliance with the essential requirements and other relevant provisions of Directive RED 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.

APPENDIX E CONTACTS



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## APPENDIX F MAINTENANCE

About the maintenance of IBIS-ArcSAR please refer to the Maintenance and Repair Guide [BD4].