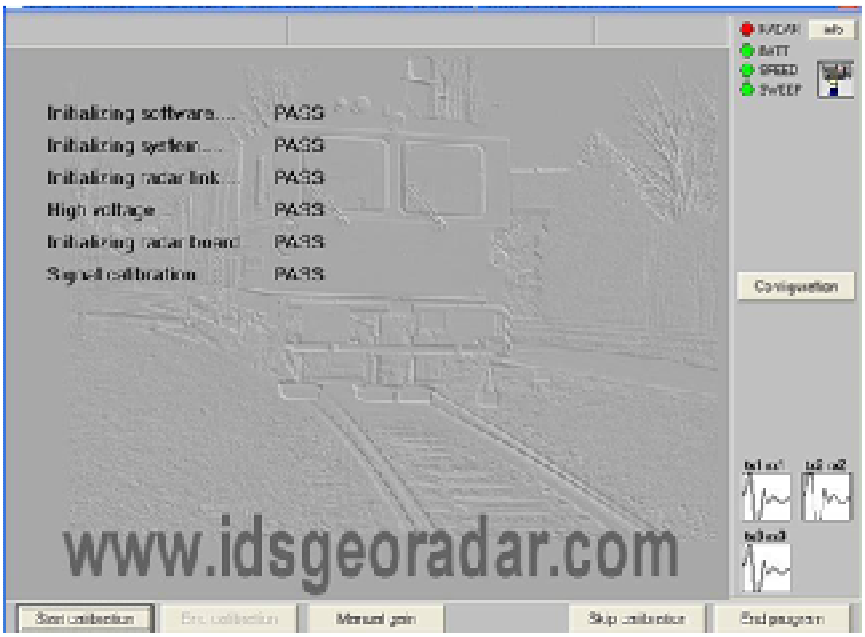
IDS
INGEGNERIA DEI SISTEMI S.p.A.

Rev. 1.2

Protocol: MN/2009/030

Safe Rail System User Guide



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Rev. 1.0	March 2009	First edition
Rev. 1.1	July 2009	Add of Mechanical kit
Rev 1.2	August 2009	FCC information added

SW Versions covered by this document
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DISCLAIMER

IDS WILL NOT BE HELD RESPONSIBLE FOR THE CONSEQUENCES OF AN IMPROPER USE OF THE EQUIPMENT AND/OR THE SOFTWARE.

THIS SOFTWARE MAY INCLUDE AUTOMATED DATA PROCESSING AND ANALYSIS TOOLS.

WHILE EVERY EFFORT IS MADE TO ENSURE THE ACCURACY OF THE INFORMATION PROVIDED BY THOSE TOOLS, THEY MUST NOT BE INTENDED AS A SUBSTITUTE FOR INTELLIGENT ANALYSIS; RATHER, THEY HAVE TO BE INTENDED AS AN ADVISOR AND THE USER MUST NOT COMPLETELY RELY ON THE RESULTS PROVIDED BY THEM TO GIVE THE COMPLETE ANSWER.

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SAFETY INFORMATION

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

1999/05/EEC Radio Directive

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

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

IMPORTANT NOTE FOR THE US CUSTOMERS

FCC ID: UFW-SRS-FW400

This device complies with part 15 of the FCC Rules:

Operation is subject to the following conditions:

1. This device may not cause harmful interference, and

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

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

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

Coordination Requirements

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

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

Frequency Coordination Branch., OET

Federal Communications Commission

445 12th Street, SW

Washington, D.C. 20554

ATTN: UWB Coordination

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

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

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

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

In this manual, instructions that specifically apply to the version of the system dedicated to the US market, are identified by the following label

FCC Federal Communications Commission

CLEANING INFORMATION

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

The Detector Duo should be cleaned periodically using a damp cloth.

Do not use solvents or abrasive detergents.

Do not apply liquid directly to the electrical contacts of the various connectors. If a specific spray is used to clean the PC TFT monitor, make sure it is not flammable; ion any case, do not spray it directly on the screen, instead, spray it onto the cleaning cloth.

BATTERIES REMOVAL INFORMATION

Laptop Batteries:

Manufacturer: PANASONIC

Type: Li-ion Ni

Characteristics: 10.65V 5.7Ah

Removal instructions:

1. turn off the laptop;
2. open the drawer with the symbol of the batteries;
3. extract the battery pack pulling the tab.

Radar batteries:

Manufacturer: FIAMM FG21202 / SAFT MP176065

Type: rechargeable lead acid / rechargeable lithium-ion

Characteristics: 12V & 12Ah / 15V & 6.8Ah

Removal instructions:

1. disconnect the battery from the instrument:
    a. pull the connector wings;
    b. separate the connectors;
2. remove the battery from the cover (optional) opening the strap.

RECICLYING

The crossed out wheeled bin symbol shown on the equipment indicates that the product must be recycled separately from other waste at the end of its useful life.

Separate waste disposal of this product at the end of its useful life will be organised and managed by IDS. When you decide to dispose of the equipment, contact IDS and follow the system that IDS has set up to permit the separate collection of the apparatus at its life end.

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

WARRANTY CERTIFICATE CONDITIONS

1) IDS Ingegneria dei Sistemi S.p.A, hereinafter referred to as IDS, warrants hardware/software products for a period of 12 months from the delivery date to the original customer;

2) The delivery date is certified by the "Warranty Registration Form";

3) IDS's hardware products will be free from defects in materials workmanship under normal use and service;

4) IDS's obligation is limited to repairing or replacing parts or equipment which are returned to IDS, without alteration or further damage, and which in IDS s judgment, were defective or became defective during normal use;

5) IDS' software will have to be installed on a PC according to the requirement of the IDS hardware (see IDS User's Guide the Software Data Acquisition);

6) IDS' s software products designed by IDS for use for IDS hardware products are warranted not to fail to execute their programming instructions due to defects during the warranty period, provided they are properly installed on IDS hardware products. IDS does not warrant if the IDS software will be used and operated in hardware and software combinations not selected by IDS;

7) IDS does not assumes any liability for any direct, indirect, special, incidental or consequential damages or injuries caused by proper or improper operation of its equipment whether defective or not defective;

8) This software may include automated data processing and analysis tools. While every effort is made to ensure the accuracy of the information provided by those tools, they must not be intended as a substitute for intelligent analysis; rather, they have to be intended as an advisor and the user must not completely rely on the results provided by them to give the complete answer. IDS assumes no liability for any direct, indirect special, incidental or consequential damages or injuries caused by such reliance on the accuracy, reliability, or timeliness of the information provided by those tools. Any person or entity who relies on information obtained from the automated data processing/analysis tools only, does so at his or her own risk;

9) IDS's warranty does not extend and shall not apply to:

   a) Products which have been repaired or altered by other than IDS personnel;

   b) Products which have been subjected to misuse, neglect, accident or improper installation;

   c) Products in which have been installed Hardware/Software accessories not supplied by IDS and/or without any approval by IDS;

   d) Products which have been connected to equipment different from the ones supplied by IDS (except the PC data Logger which must conform to IDS specifications;

   e) Products which have been damaged by natural disaster or calamities.

10) Before returning any equipment to IDS , you have to contact the IDS Customer Care Office that will authorize you to return the material to be repaired;

11) Once the parts/equipment to be repaired arrive to IDS, IDS may inspect the defective products to verify they are eligible for repair or replacement. All packing must be saved for inspection purpose in order to assist IDS to understand the cause of the defects. IDS, will not be obliged to repair, or replace for products returned as defective but damaged from abuse, misuse, neglicence , accident loss or damage in transit;

12) The final clients, is responsible for ensuring the defective products returned to be properly packaged;

13) The above warranty are sole and exclusive, and no other warranty, whether written or oral, is expressed or implied.

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FIGURES INDEX

1. OVERVIEW

1.1 How to use this manual

This SRS_PLUS software user manual is subdivided as follows:

- Chap. 1: Overview.
- Chap. 2: Hardware configuration of the SRS_PLUS and of the SRS-FW400 systems
- Chap. 3: SRS_PLUS/SRS-FW400 acquisition software operating procedures.
- Chap. 4: Setup of the SRS_PLUS/SRS-FW400 acquisition software
- Chap. 5: Error messages and warnings
- Chap. 6: On Line Assistance

2. THE SRS SYSTEM HARDWARE CONFIGURATION

The SRS system consists of the following parts:

- ***SRS_PLUS or SRS-FW400 Control Unit***
- ***Notebook Computer***
- ***Lan Cable***
- ***Battery Cable***
- ***Battery Pack***
- ***Power supply cable***
- ***Position sensor***
- ***From one to four 400MHz antennas***

2.1 The SRS_PLUS Control Unit

The ***SRS_PLUS Control Unit*** is the control unit responsible for directing the antennas and digitalising the acquired radar data and it has the following ports:

- ***Lan Port*** for a network connection to the Notebook Computer
- ***Battery Port*** to connect the battery
- ***Wheel Port*** to connect the position sensor wheel
- ***Ant. 1 - Ant. 2 – Ant. 3 – Ant. 4*** for the connections to the radar antennas
- ***Start up button and indicator light***
- ***Voltmeter***
- ***Notebook connection port***

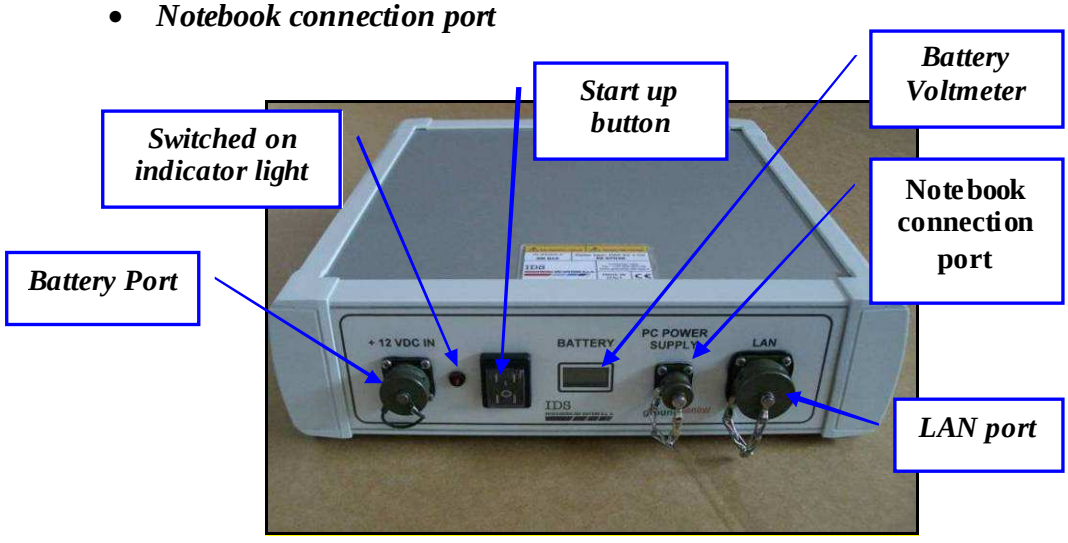


Fig. 2-1 – View of Control Unit, start up side

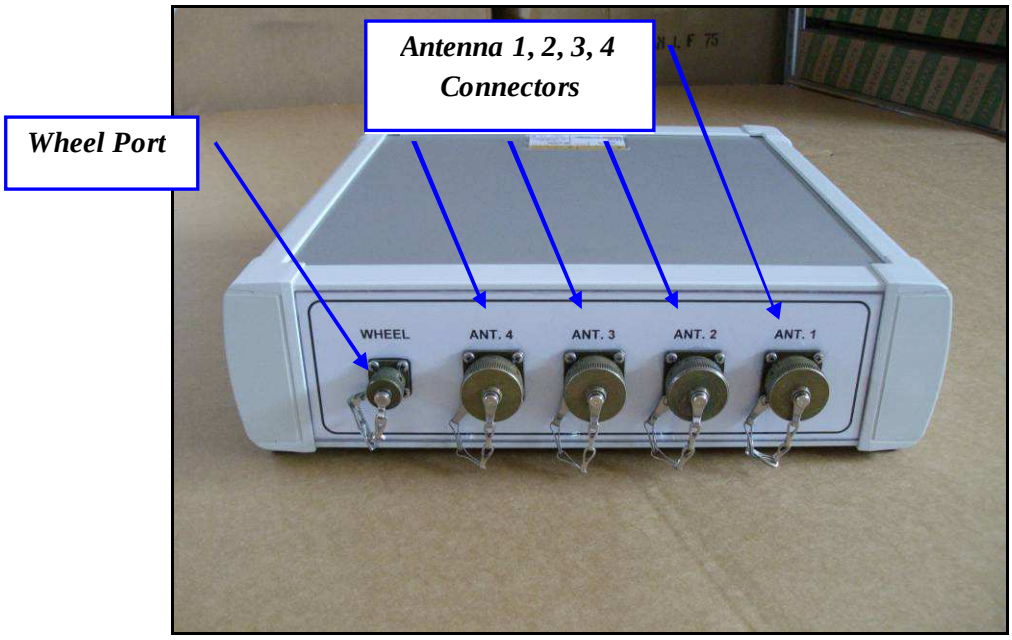


Fig. 2-2 – View of Control Unit, antenna connectors side

2.2 The SRS-FW400 Control Unit

The ***SRS-FW400 Control Unit*** has the following ports

- ***Lan Port*** for a network connection to the Notebook Computer
- ***Battery Port*** to connect the battery
- ***Wheel Port*** to connect the position sensor wheel
- ***Ant.1/CHAIN - Ant.2*** for radar antenna connection
- ***Power switch with pilot light***
- ***Wireless antenna connector***

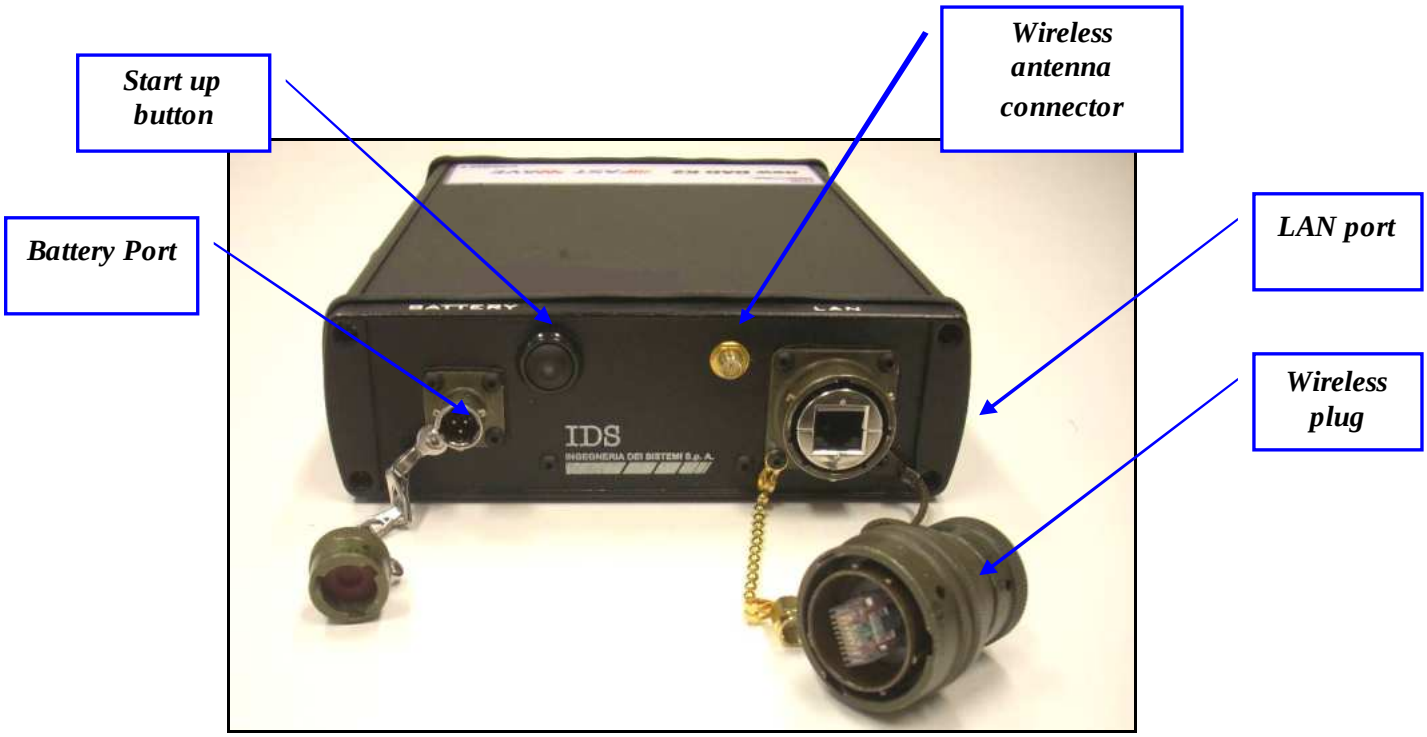


Fig. 2-3 – SRS-FW400 Control unit front panel with Battery Port, Lan Port and wireless connector

Fig. 2-4- SRS-FW400 Control unit rear panel with connections to position sensor and antennas

The SRS-FW400 uses the Ant.1 connector only (19 pins connector) to connect the SRS antennas with a cascade connection.

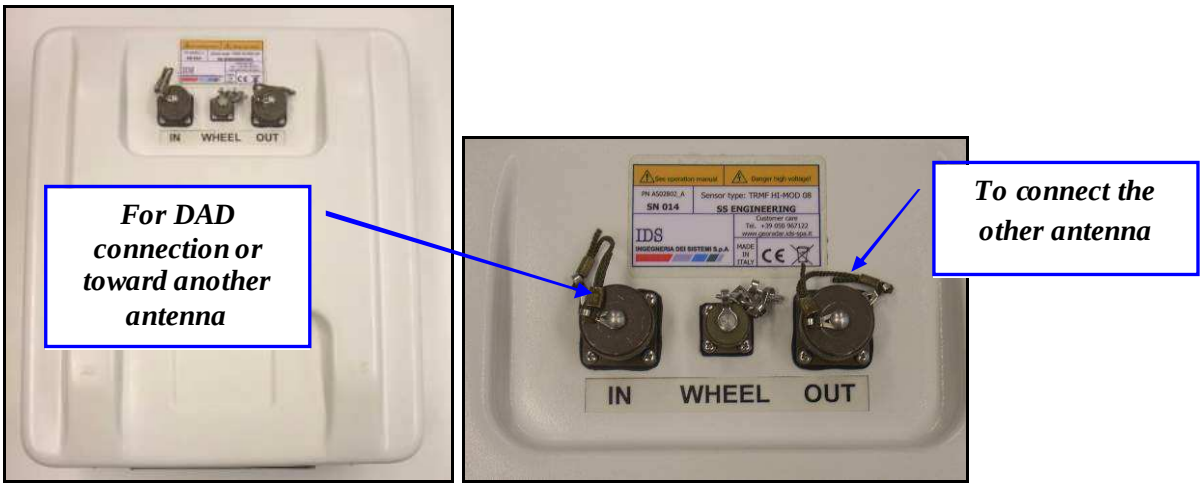


Fig. 2-5 – SRS antenna with a 19 pole connector and possibility of a cascade connection

The Ant.2 connector (11 pins) is not used by the SRS-FW400 system.

2.3 The Notebook Computer

The **SRS_PLUS** acquisition SW is installed on a ***Notebook Computer.*** This SW is dedicated to the specific phases of setting up, acquiring and saving radar data.

Fig. 2-6 – Panasonic Toughbook CF-30

IDS recommends the use of the Panasonic model CF-30 ***Notebook Computer,*** (see Fig. 2-6) which has the following characteristics:

- Intel Duo Processor L2400
- Processor speed: 1.66 GHz.
- Ethernet 100 Mbit/sec card.
- Minimum 512 Mbyte RAM
- Monitor resolution (colour) 1024X768 (13.3").
- Operative system: Windows XP Professional.
- HDD > 80 Gbyte, shock-mounted.
- No communication software of the type Firewall, WiFi or Antivirus protection may be installed on the computer; these types of SW enter into conflict with the SRS_PLUS acquisition SW
- Touch screen.
- Water-proof (>= IP54).

! NOTE	IDS takes no responsibility for any functional conflicts that may occur between their own software and any other software installed by the user onto the Notebook Computer. IDS doesn't guarantee that equipment performance will be maintained using configurations different to those recommended.

2.4 Connecting the Control Unit - Notebook Computer

The following describes how to cable the Control Unit to the Notebook Computer

- Use the **Lan Cable** (Fig. 2-7) to connect the ***Control Unit*** and the ***Notebook Computer*** as shown in (Fig. 2-8)

Fig. 2-7 – Lan Cable

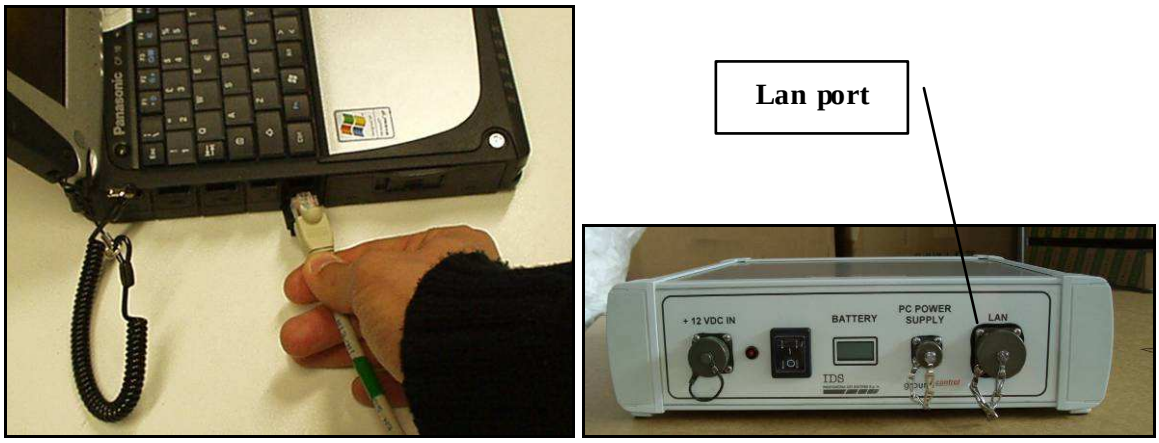


Fig. 2-8 – Lan Cable connection between the Notebook Computer and the Control Unit (SRS_PLUS)

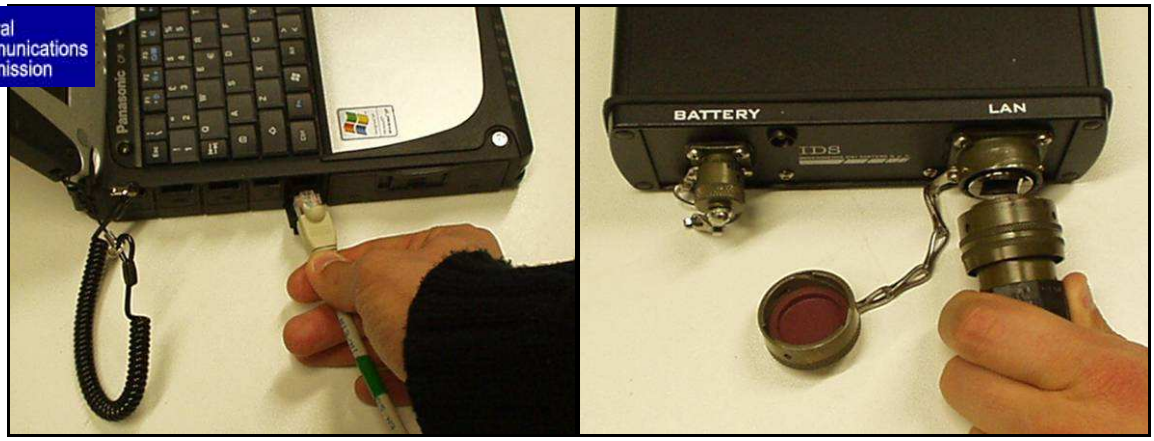


Fig. 2-9 – Lan Cable connection between the Notebook Computer and the Control Unit (SRS-FW400 only)

- Connect the ***Control Unit*** to the ***Battery*** using the **Battery Cable** (Fig. 2-10) as shown in (Fig. 2-11). Then connect the black and the red clamps respectively to the negative and to the positive electrode of a Car Battery (12V). The Voltmeter will automatically measure the battery voltage.

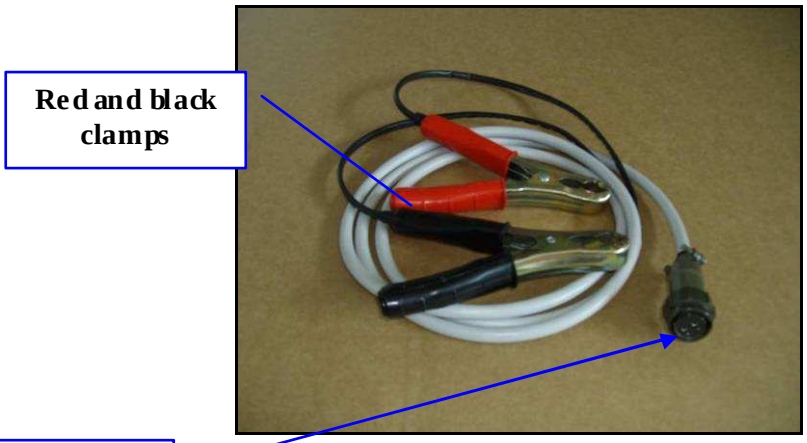


Fig. 2-10 – Battery Cable

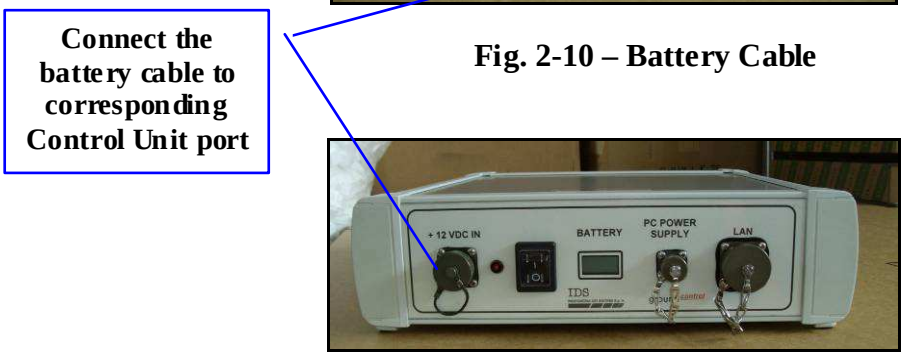


Fig. 2-11 – Connecting the Control Unit to the battery (SRS_PLUS)

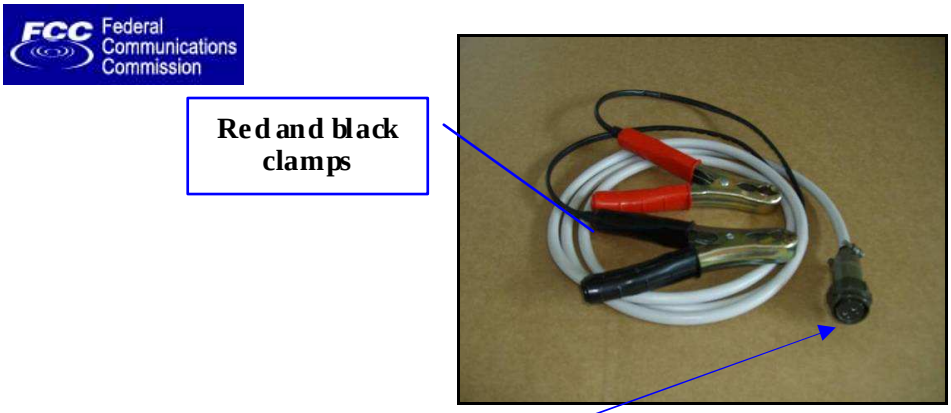


Fig. 2-12 – Battery Cable

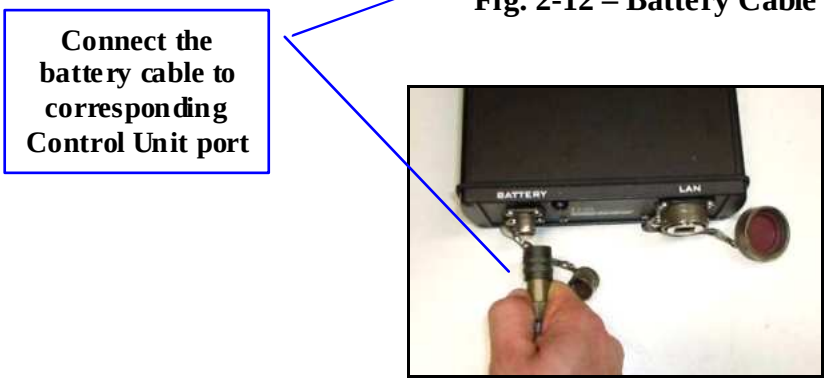


Fig. 2-13 – Connecting the Control Unit to the battery (SRS-FW400 only)

- **SRS_PLUS only:** Then connect the power supply cable to the PC POWER SUPPLY port on the Control Unit and to the Notebook PC (see Fig. 2-14).

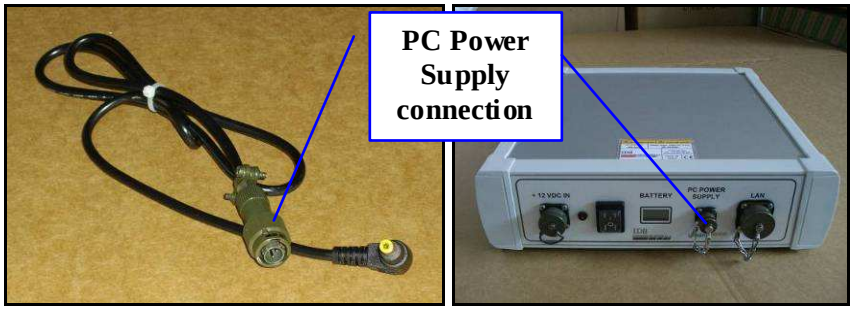


Fig. 2-14 – Power supply cable and connection to the Control Unit

2.5 Position radar sensor

As position sensor we provide a Deuta-Werke DRS05 Doppler system (see Fig. 2-15). The Doppler system must be connected through its cable to the Doppler interface box (Doppler port). Then you have to connect the wheel cable from the Doppler interface box (wheel port) to the DAD CONTROL UNIT wheel port.

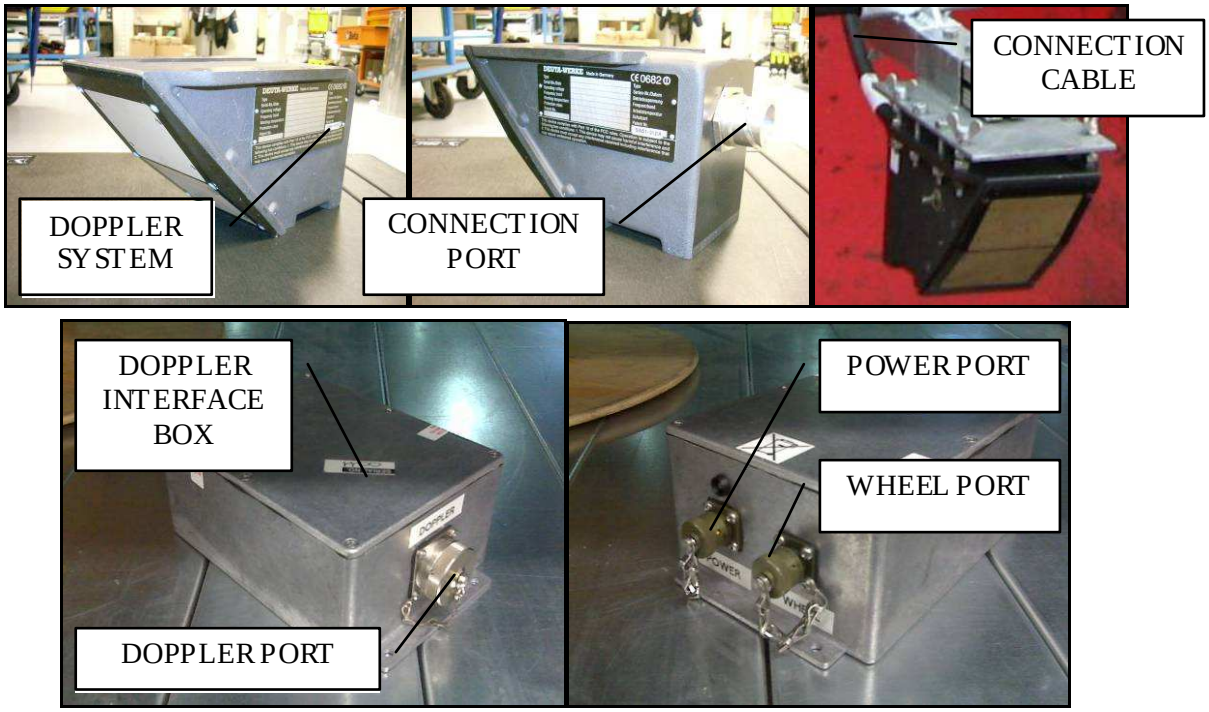


Fig. 2-15 – Position sensor

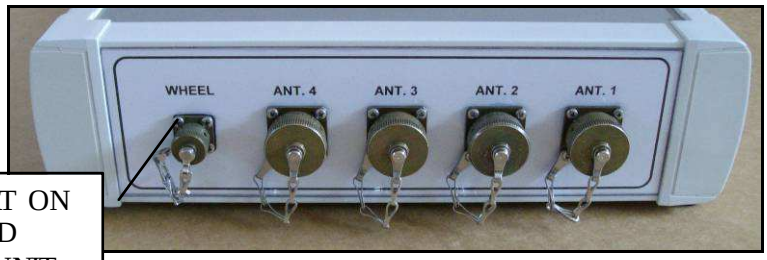


Fig. 2-16 – Wheel port on the SRS_PLUS control unit

Fig. 2-17 – Wheel port on the SRS-FW400 control unit

2.6 Antennas

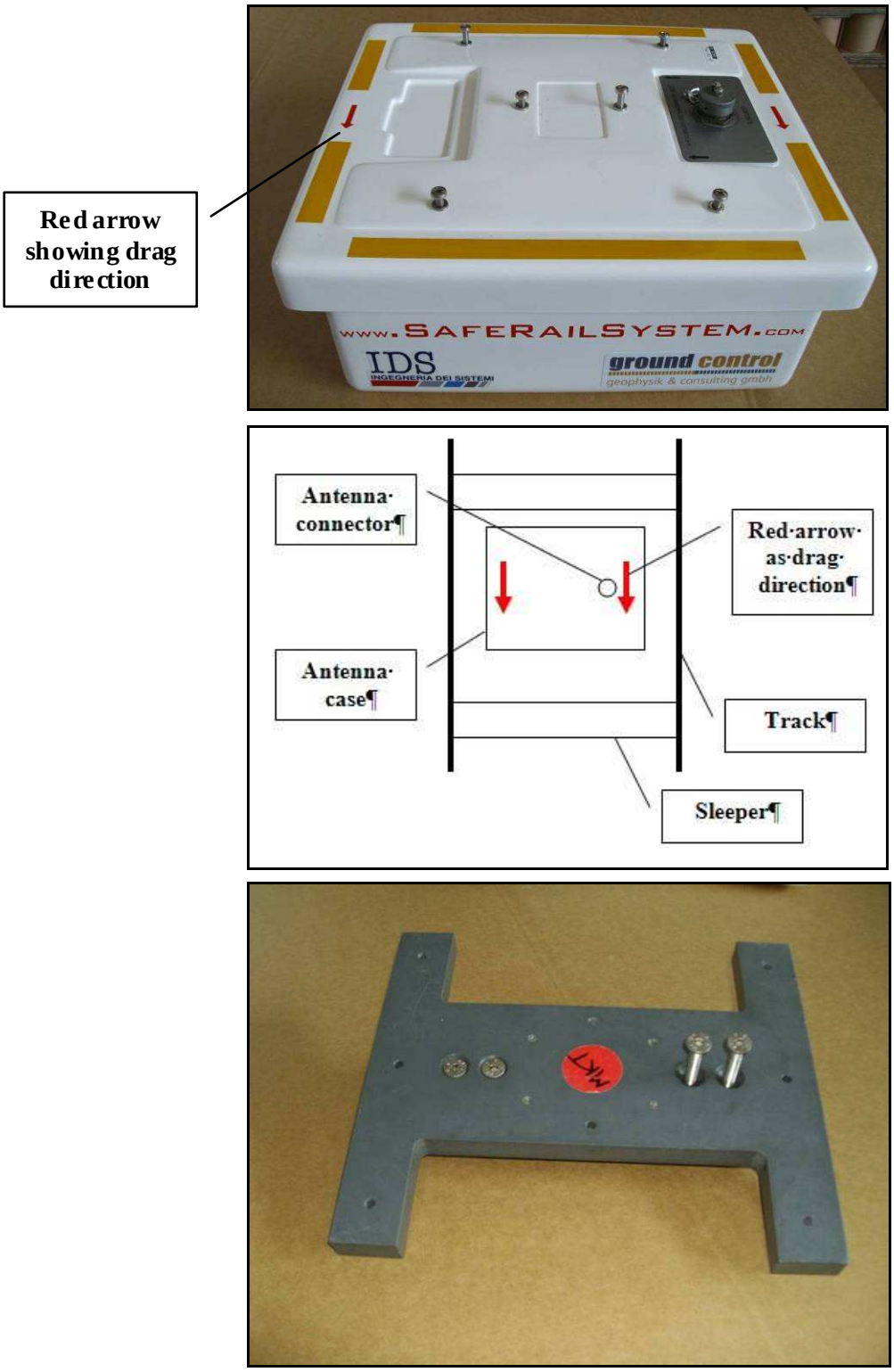


Fig. 2-18 – 400MHz SRS_PLUS Antenna (top), sketch of drag direction (middle) and PVC "H" plate (bottom)

Fig. 2-19 –Antenna for the SRS-FW400 system (red arrows show dragging direction)

The system includes from 1 to a maximum of 4 antennas and all antennas have a frequency of 400MHz.

Each antenna is marked with a different colour on the case to simplify antenna connection. So when connecting each antenna, make sure the corresponding coloured cable is connected to the control unit on ports ANT. 1, ANT. 2, ANT. 3, ANT. 4, depending on the number of antennas to be used (see an antenna in Fig. 2-18).

Each antenna must be mounted with the red arrows parallel to the drag direction (or parallel to the tracks).

The dedicated "H" plate can be fixed to the top of the case so the case can be mounted onto any customized mechanical kit.

2.7 Mechanical kit

IDS provides to offer a special mechanical kit, in order to mount in a correct and efficient way the antennas in front of the locomotive.

In details IDS provides:

- 6 supports in stainless steel with "L" shape
- 3 aluminium long bars for antennas

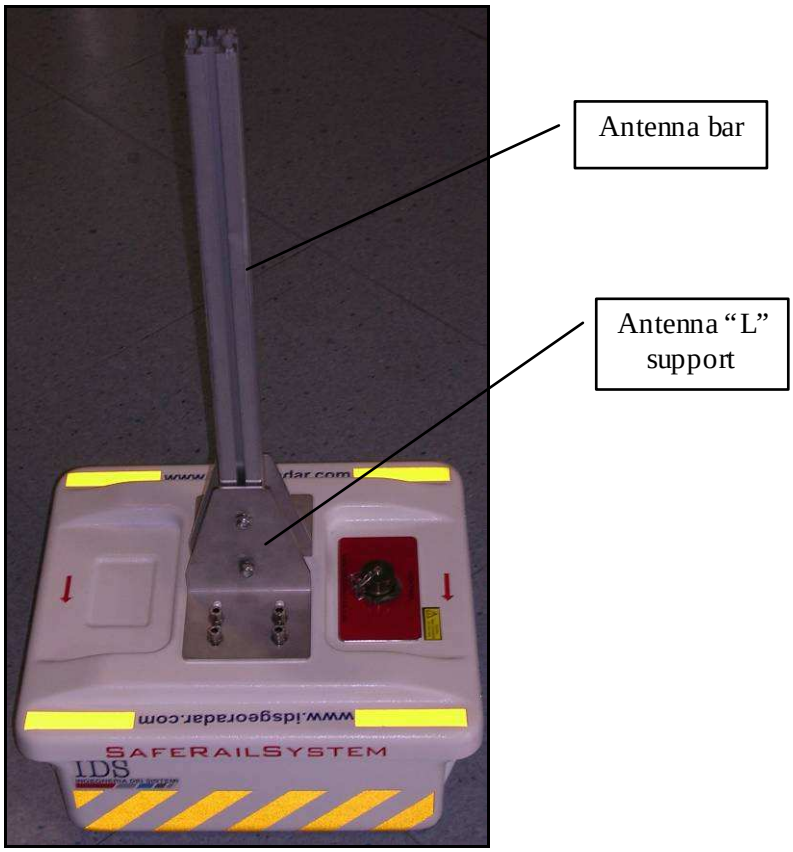


Fig. 2-20 – Antenna "L" supports and bar

- 4 brackets in zinc-plated steel (3 for antennas and 1 for Doppler)
- 1 aluminium small bar for Doppler
- 1 plate of interface in zinc-plated steel for Doppler

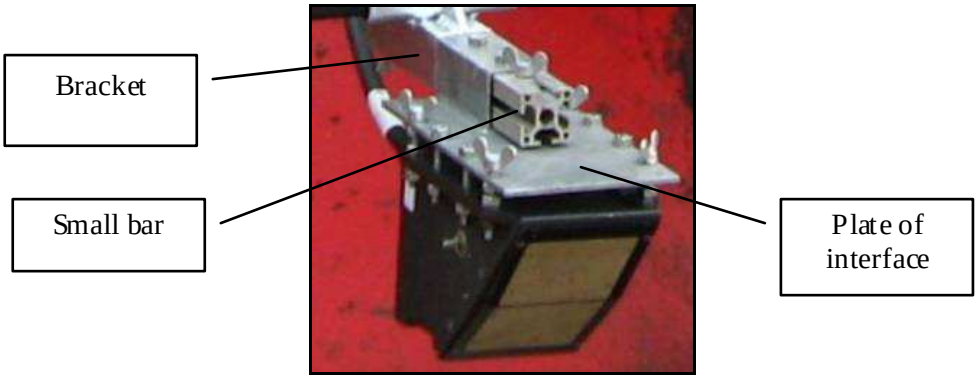


Fig. 2-21 – Doppler supports

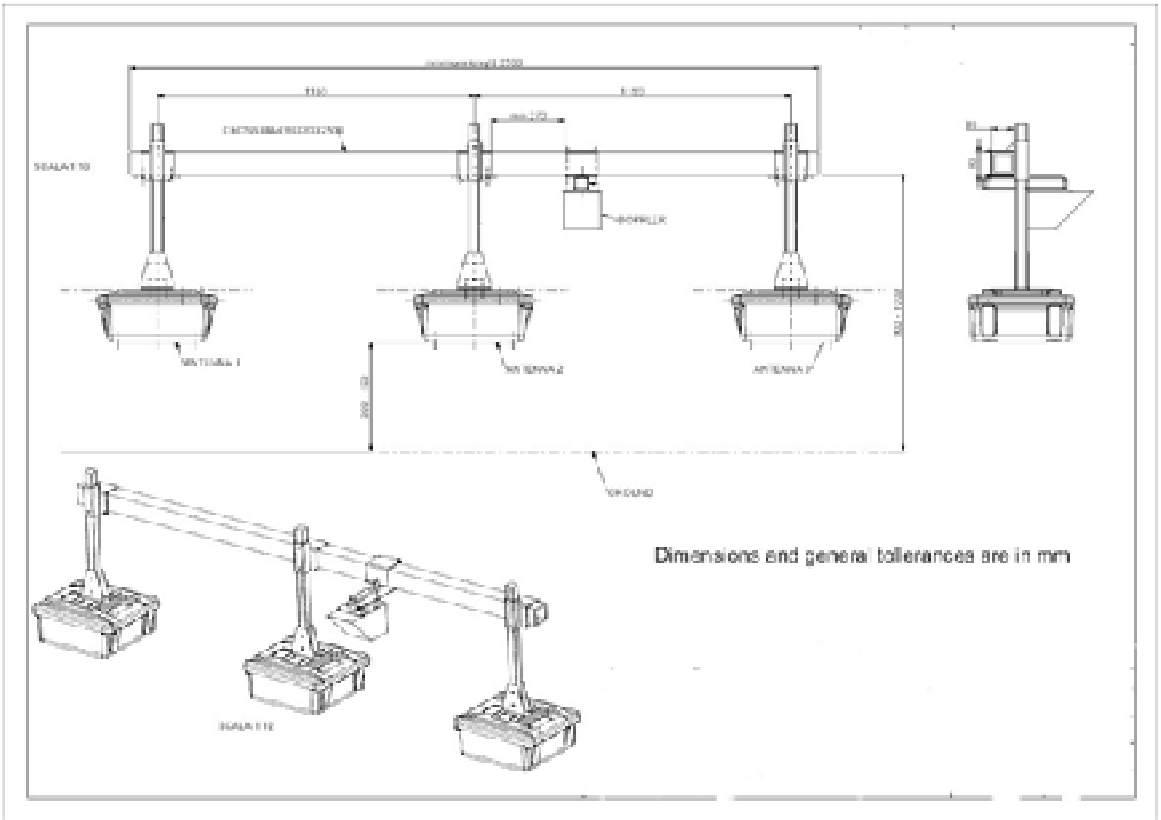


Fig. 2-22 – Sketch of SRS layout

3. SOFTWARE CONFIGURATION OF THE SRS SYSTEM

This chapter describes the SW procedures you have to follow to correctly perform a radar data acquisition.

3.1 Software Installation and configuration

Install the SW SRS_PLUS Kit as follows:

STEP1 execute the **SRS_PLUS.msi** file in the electronic support that comes along with the instruments (Flash memory or CD).

Fig. 3-1 – SW SRS_PLUS installation Kit

STEP2 continue SW SRS_PLUS installation pushing NEXT.

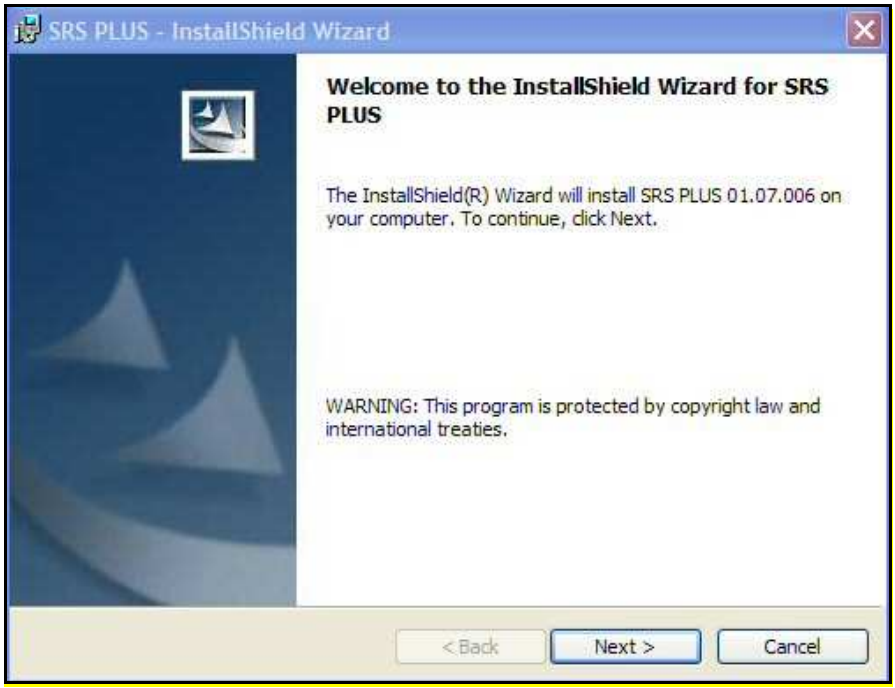


Fig. 3-2 – Installation Kit, Next button

STEP3 select TYPICAL and press NEXT to continue.

Fig. 3-3 – Installation Kit, Typical button

STEP4 Press INSTALL to continue SW SRS_PLUS installation.

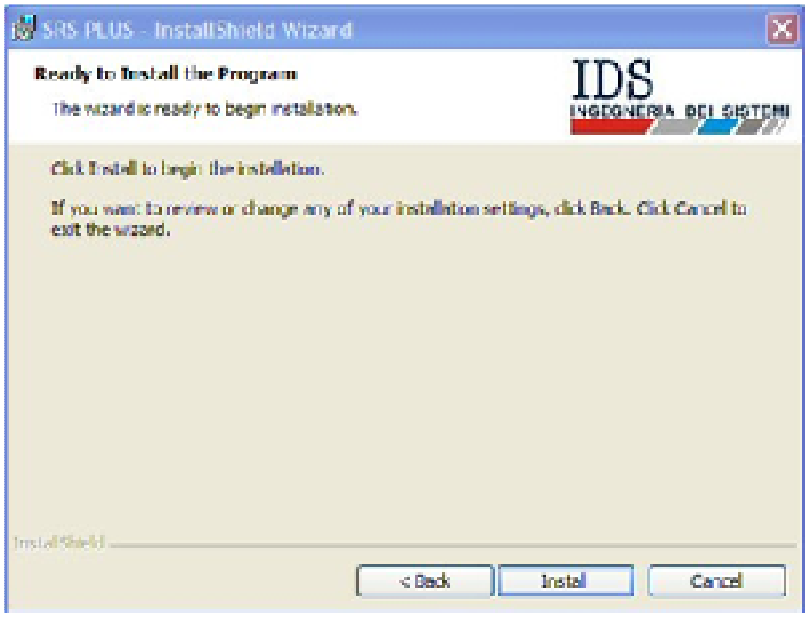


Fig. 3-4 - Installation Kit, Install button

STEP5 the installation procedure will terminate pressing FINISH, and the SW SRS_PLUS icon will appear on the portable computer desktop.

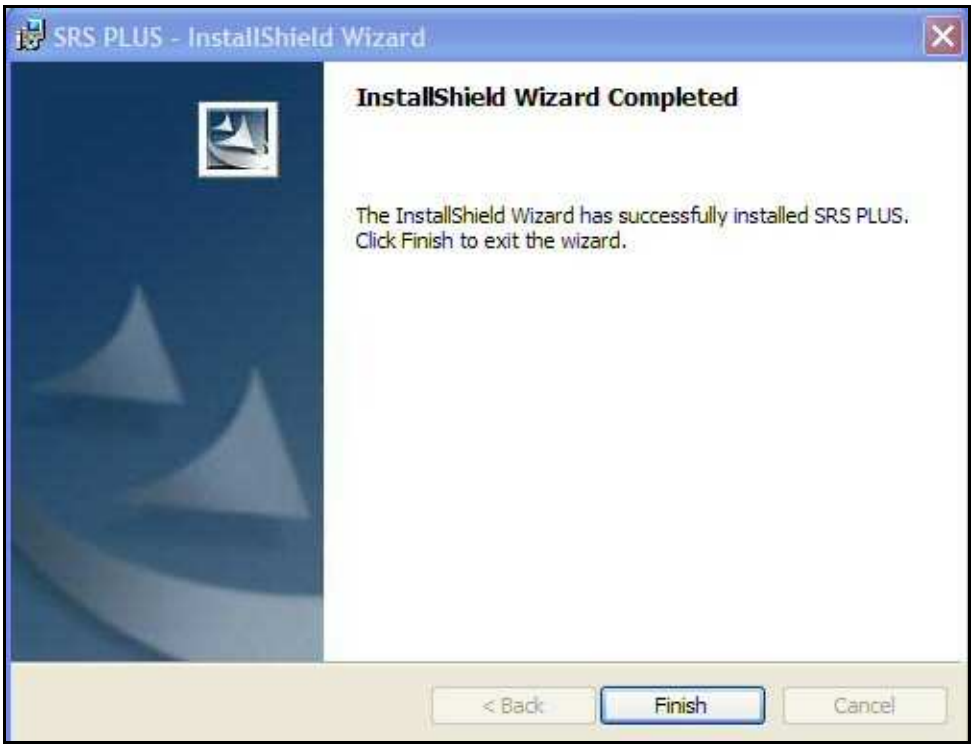


Fig. 3-5 – Installation Kit, Finish button

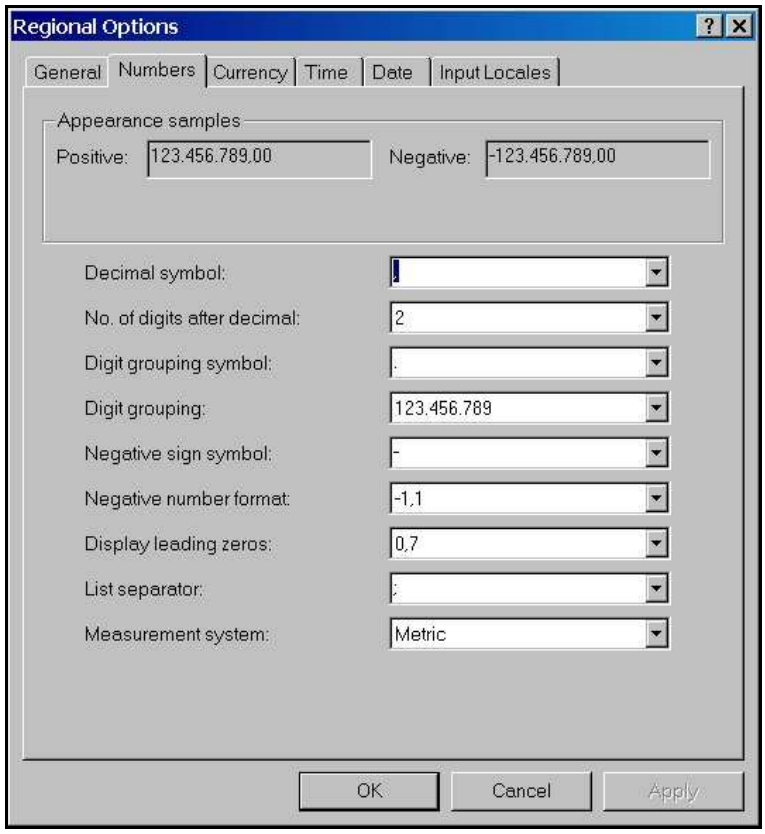
! NOTE	The functions of the **SRS_PLUS** acquisition SW are only guaranteed on computers operating with Windows 2000 or Windows XP Professional.

! NOTE	Check that the **SRS_PLUS** directory is copied into the **C:** drive and is not write protected, otherwise the **SRS_PLUS** SW will not function correctly.

! NOTE	Check that the **SRS_PLUS** directory is copied into the **C:** drive and is not write protected, otherwise the **SRS_PLUS** SW will not function correctly.

In order to keep the same network settings we suggest to create a user account properly dedicated for GPR software.

During installation, software SRS_PLUS will install automatically international settings. To guarantee the correct functioning of the SRS_PLUS SW, set the following configuration in the Numbers field of the Regional Options menu.



Then the user has to set manually the ***Notebook Computer*** TCP/IP address, following the procedure described below.

- Select the *my network places* icon from the ***Notebook Computer*** desktop with the right mouse button;
- Select the *Properties* button.
- Select the *Local Area Connection (LAN)* file with the right mouse button.
- Select the *Properties* command.
- Select *Internet Protocol (TCP/IP)* from the list of components (in the general menu) with the left mouse button (see Fig. 3-6).
- Select the *Properties* command

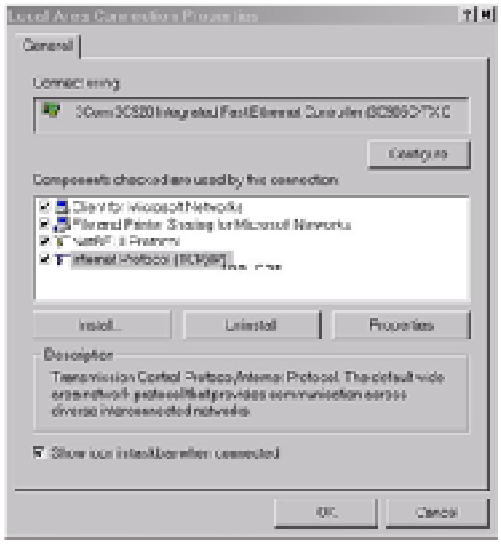


Fig. 3-6 – Selecting the Internet Protocol (TCP/IP)

- The window shown in Fig. 3-7 appears, in which you have to select *Use the following IP address.*
- Write the following number in the *IP* address field: 192 . 168 . 200 . 199. It is necessary that the last number of the series is different by 200 (in Fig. 3-7 it is 150).
- Write the following number in the *Subnet mask* field: 255 . 255 . 255 . 0.
- Press OK to confirm the changes
- Restart the ***Notebook Computer*** if requested to do so to activate the modifications made to the internet protocol.

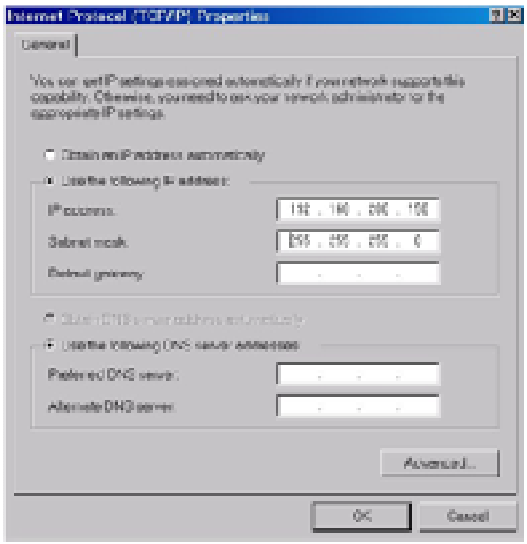


Fig. 3-7 – Modifying the IP code

4. SRS ACQUISITION SOFTWARE

The SRS_PLUS acquisition software is used to manage the phases of radar acquisition and to review the data acquired directly on site.

The operative phases of the SRS_PLUS acquisition software occur in the following sequence:

1. ***Start up the SRS_PLUS software***
2. ***Choose the configuration***
3. ***Set up the calibration***
4. ***Choose the survey***
5. ***Set the acquisition parameters***
6. ***Acquire the radar data***
7. ***Review the data***

4.1 Starting the SRS_PLUS acquisition software

Once the Notebook Computer has been switched on, and the start up button on the Control Unit has been pressed (a blue indicator light will be continuously lit), open the **SRS_PLUS** acquisition software by clicking on the desktop icon shown in Fig. 4-1.

Fig. 4-1 – Acquisition Software icon

Fig. 4-2 shows the SRS_PLUS acquisition software start up window.

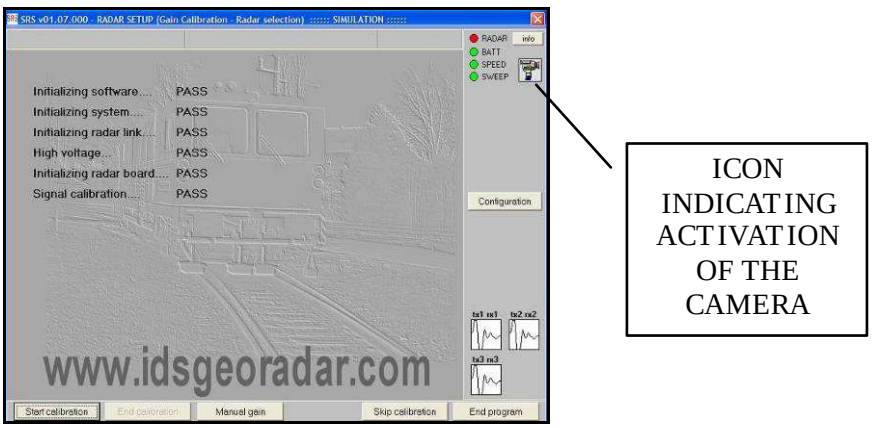


Fig. 4-2 – SRS_PLUS acquisition software startup window

4.2 Choosing the configuration

The steps to be followed for choosing the required radar configuration for the acquisition are given below.

1. Press the 

button (Fig. 4-2) to open the **Radar selection** window (Fig. 4-3). This is where you can choose the antenna type and configuration for the acquisition. In the example shown in Fig. 4-3, the user has choosen a configuration file from the list. This file corresponds to an array of 3X400MHz antennas. Naturally the user can choose different types of configuration for the SRS_PLUS system, as shown in Fig. 4-3, selecting a configuration of between 1 and 3 antennas.

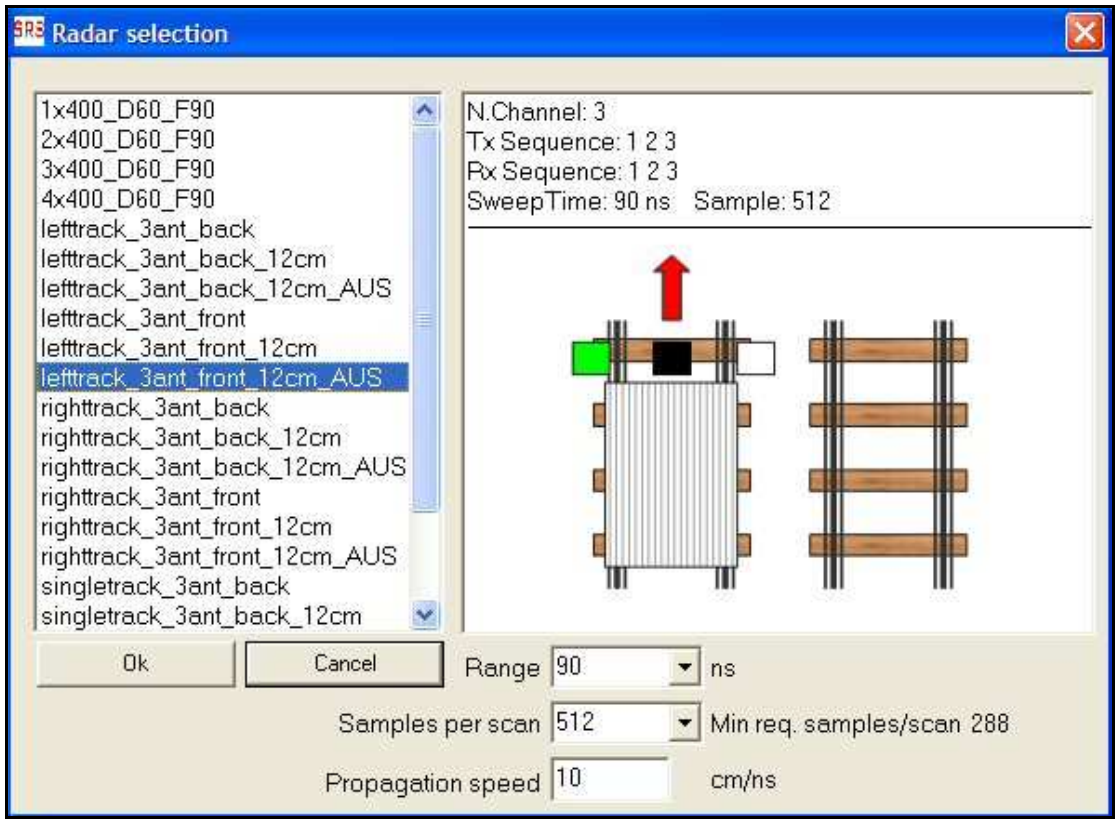


Fig. 4-3 – Radar selection window

2. The range can be changed with respect to the preset value by typing the new value in the **Range** field (Fig. 4-4).

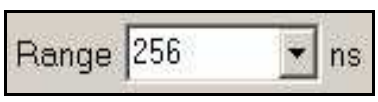


Fig. 4-4 – Range field

3. The number of **Samples per scan** can be varied by choosing one of the preset values available in the **Sample per scan** field (Fig. 4-5). However, this value can't be lower than the one indicated in the **Min req. sample/scan**.

Fig. 4-5 – Samples per scan

4. The electromagnetic wave propagation speed can then be set in the **Propagation speed** field (see Fig. 4-6). We recommend you accept the default value unless you have specific information on the types of ground present in the area to be investigated.

Fig. 4-6 – Propagation speed field

4.3 Setting up the Calibration

This paragraph describes the procedure used to calibrate the parameters used in the real-time processing of radar data.

1. Press the 

button shown in Fig. 4-2 to view the window shown in Fig. 4-7, then perform the automatic calibration procedure by moving the antennas across the surface to be scanned for a distance of at least one meter.

2. Stop the calibration phase by pressing the 

button in the window shown in Fig. 4-7. This permits the system to save the filter parameters required to view the radar maps in real time.

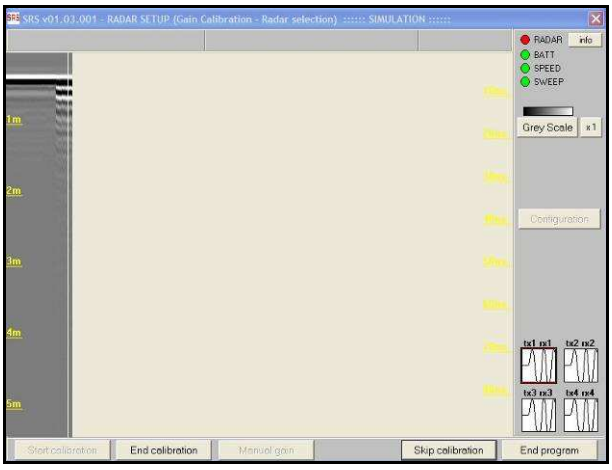


Fig. 4-7 – Gain calibration underway

3. You can check in the sweep display window that each antenna displays a radar signal (see Fig. 4-8); this display window is found in Fig. 4-7.

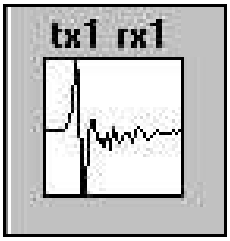


Fig. 4-8 – Controlling the presence of radar signal on the antenna/s

NOTE	A lack of signal in the window shown in Fig. 4-8 should warn you that the system is not operating

4. You can skip this phase by pressing the Skip gain button shown in Fig. 4-7, but this means that you can only review pre-existing radar data, and not acquire new data.
5. Pressing the Manual gain button opens the window shown in Fig. 4-9, from where you can edit, delete or create a new gain calibration file.

Fig. 4-9 –Calibration file selection window

Pressing the **New** button from the window of Fig. 4-9 opens the window shown in Fig. 4-10 from where you can edit the calibration filename. Now press the **OK** button to open the window shown in Fig. 4-11, from where you can set the gain values to apply on the radar map.

Fig. 4-10 – Gain window

The following parameters can be set in the window shown in Fig. 4-11

- the time in nsec in the **Time** column,
- the value of gain to apply on the radar map based on the values set in the **Gain** column.

Then pressing the **Apply** button, you can draw the gain curve based on these values.

As an alternative to the above procedure, you can use the graphics mode, which consists of manually inserting the individual points of the gain curve. To activate this procedure:

- point with the mouse on the red square on the right edge of the window, corresponding to the value 0dB (Fig. 4-12 and Fig. 4-13)

- the square has been successfully selected when it becomes bigger
- now click with the right mouse button, the cursor will become a cross that can move across the entire window
- click with the right mouse button to position a point on the gain curve on the graph; a text box linked to the cursor will indicate the value in **ns** and **dB** of the point you intend to fix.

NOTE	A gain curve can only be reapplied to configurations with the same starting conditions

You can apply the gain curve you desire to each single channel simply by selecting the desired channel number beforehand.

You can choose from the following options shown in Fig. 4-11:

- **Processed Sweep** activating this function, you can visualize how to modify the sweep as a function of the chosen gain curve.
- **Filter cut:** here you can select the cut frequency to apply to the sweep. You can either choose the preset value of 100MHz or set a different value in the dedicated textbox; we do however suggest you select the preset cut frequency value of 100MHz.
- **Contrast:** you can select the contrast value here to be applied to the radar map.
- **Note:** you can write any comments here about the calibration file just created.

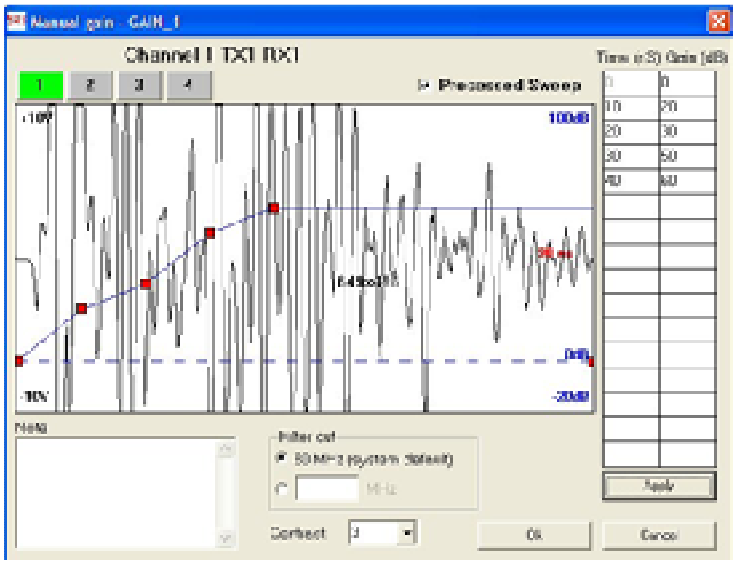


Fig. 4-11 – Gain parameter settings window

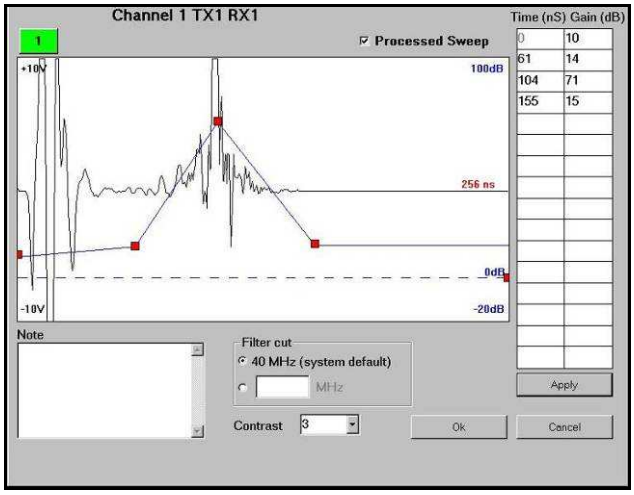


Fig. 4-12 – Graphical construction of the gain curve

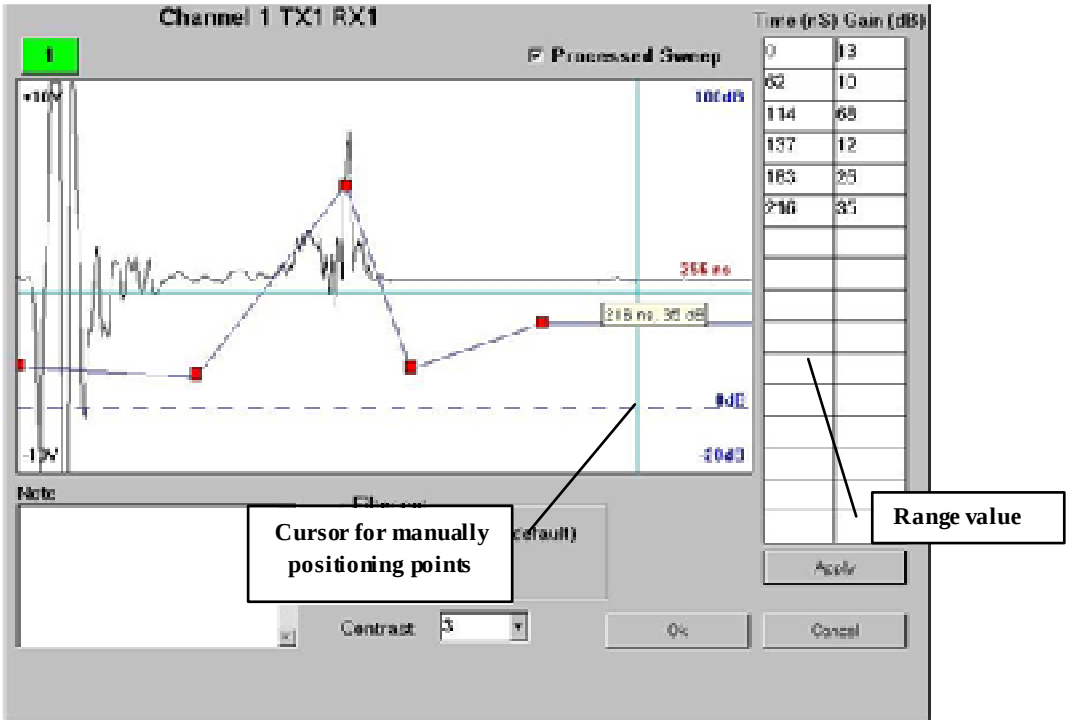


Fig. 4-13 – Manual construction of the gain curve

! NOTE	The gain values set in the window shown in Fig. 4-11 are only applied to the radar map during the visualisation phase, they are not applied to the *.DT raw data file

6. The spy lights representing the radar (**RADAR**), battery (**BATT**), acquisition speed (**SPEED**) and acquired sweeps (**SWEEP**), shown in Fig. 4-7, indicate the functional status of the system (see Fig. 4-14). When the spy lights are coloured
   - ***White:*** this means the system is not active
   - ***Green:*** this means the system is functioning correctly
   - ***Red:*** this means the system is not functioning correctly

The **GPS** spy light shows the connection with a GPS system connected to the ***Notebook Computer.*** Appendix H describes the procedure for connecting the GPS system to the radar.

The battery spy light changes colour from green through yellow to red, representing the decreasing level of charge remaining.

Fig. 4-14 – The system function spy lights

7. There is an **info** button next to the RADAR spy light (Fig. 4-15). Pressing this button automatically opens the window shown in Fig. 4-16, which shows all the parameters set for the current configuration.

Fig. 4-15 – Info button

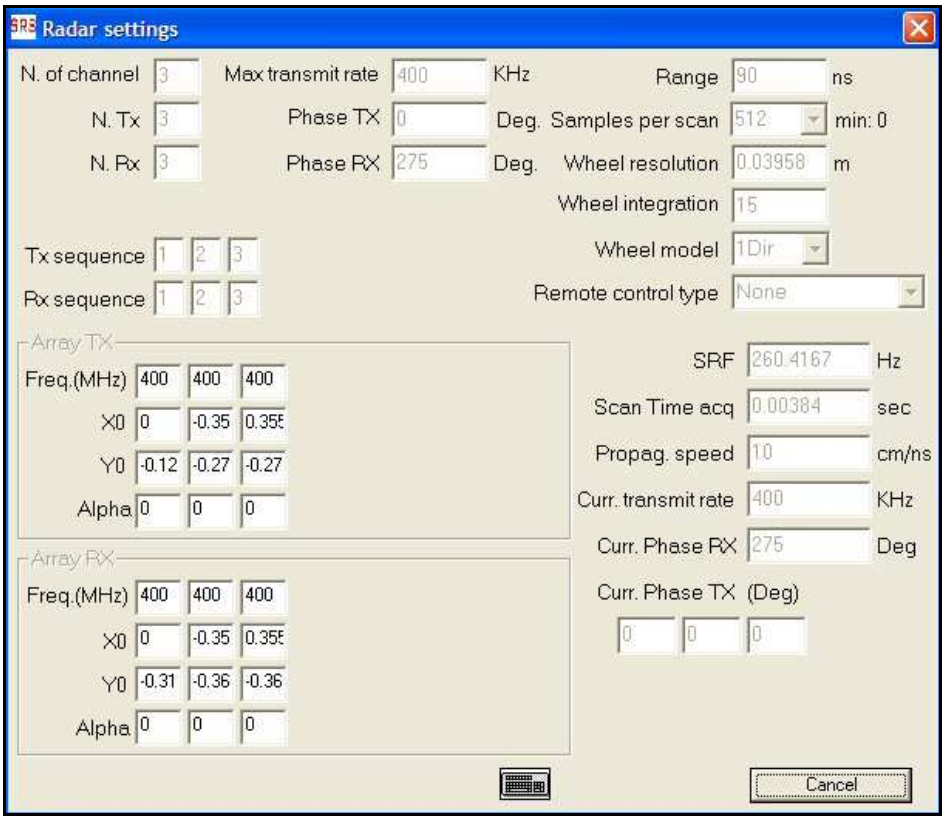


Fig. 4-16 – Info window

8. Pressing the colour scale button shown in the window in Fig. 4-7, you can choose one of the 10 types of colour palettes available for displaying the radar maps (see Fig. 4-17).

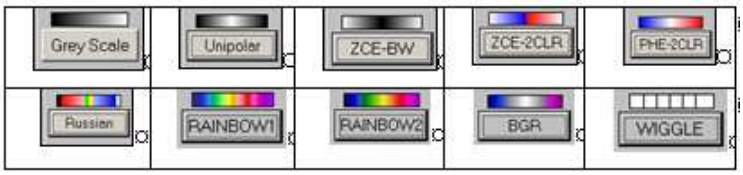


Fig. 4-17 – Colour palettes available

9. You can zoom in on the maps up to a magnification of four times by pressing the 

buttons in the window shown in Fig 4-7.

10. Pressing the 

button in the window shown in Fig. 4-7 closes the software. Before shutting down, the software displays a message window reminding you to switch off the Radar Control Unit (see Fig. 4-18).

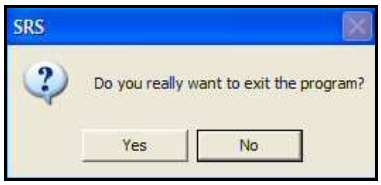


Fig. 4-18 – Program shut-down window

4.3.1 Advanced Settings Menu

The **Advanced Settings** menu **(**Fig. 4-20**)** can be selected by clicking on the SRS_PLUS icon in the top left corner of the main window of the SW (Fig. 4-19), or by mouse clicking twice on the grey bar at the top of the window.

Fig. 4-19 – Activating the Advanced settings menu

This menu allows you to set the following parameters:

- **Wheel setting** here you can set the acquisition mode of the system, which can be either
  - **Wheel driven** field selected, in this mode, the radar acquisition is set using the position sensor.
  - If the wheel is not used, you can set the radar acquisition to be performed under a constant time regime; the value inserted in the **Auto Stacking** field indicates the number of sweeps averaged during the acquisition phase.
  - The User Stacking function on the other hand allows you to control the number of sweeps averaged. The acquisition is still controlled in this configuration by the position sensor (wheel, hip-chain encoder or manual trigger). Once the signal from the position sensor has been received, the system performs an average of the number of sweeps selected by the user and emits an acoustic signal to confirm that the data has been saved.

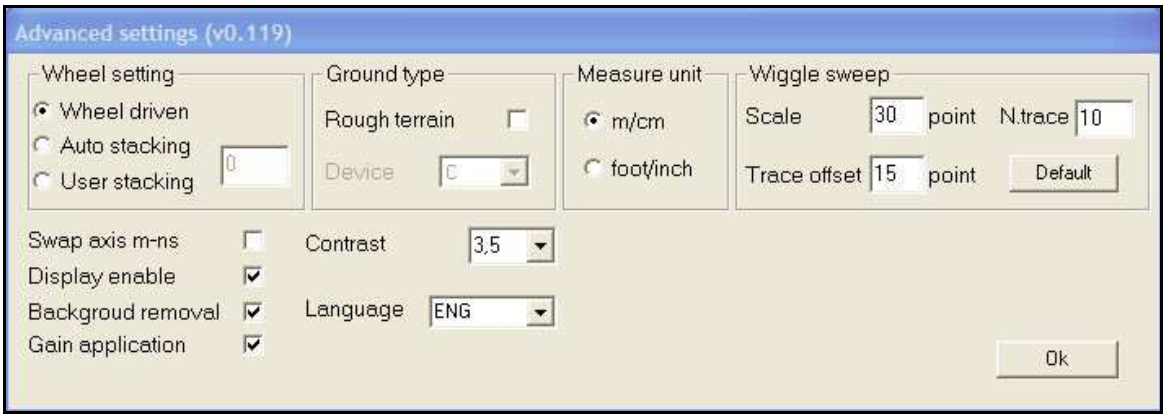


Fig. 4-20 –Advanced Settings window

- The **Ground type** field enables you to activate the **Rough terrain** option if necessary. When this option is activated, the radar data are temporarily saved on the selected **Device** during the acquisition phase. You can even select an external **Device** such as a flash memory to temporarily save the data during the acquisition phases. This option is recommended when the ground conditions are particularly rough, and when you may find that saving the data during the acquisition phase becomes critical due to the high number of vibrations in the system.
- In the **Measure unit** field, you can choose the measurement units to be applied to the radar map visualized in real time. The alternatives are **m/cm** and **foot/inch**
- In the **Wiggle sweep** field, you can select the parameters for visualising the acquired data in real time in Wiggle mode;
    - **Scale** represents the signal amplification (intended as the number of pixels into which the -10V a +10V vector scale is mapped),
    - **N. trace** represents the "x" interval of the viewed traces (i.e. that one sweep is viewed every "x" traces),
    - **Trace offset** is on the other hand the representation interval between adjoining traces (i.e. also in this case the number of pixels)
    - **Default Buttons** saves the preset settings as the default configuration.
- In the **Swap axis** field, you have the choice of modifying the vertical scale of the radar map by setting the value in **m** or **nsec**
- In the **Gain application** field, you can choose to view the radar map acquired in real time with or without gain applied
- In the **Background removal field** you can set the Clear_x application for the acquired radar maps.
- In the **Display enable** you can activate the display mode of the radar section during acquisition phase.

- In the **Contrast** field, you can choose the contrast level to be applied to the radar map viewed in real time.

Activating the **Virtual Keyboard** and **Windows Start** and **Close** commands (Fig. 4-19) opens the virtual keyboard, the windows start menu and closes the SRS_PLUS SW respectively. The **Move** command is not yet active. For details on the **External device setting** command, see Appendix E, page 52.

4.4 Choosing a survey

After the calibration phase, the acquisition procedure continues with the appearance of the following window shown in Fig. 4-21.

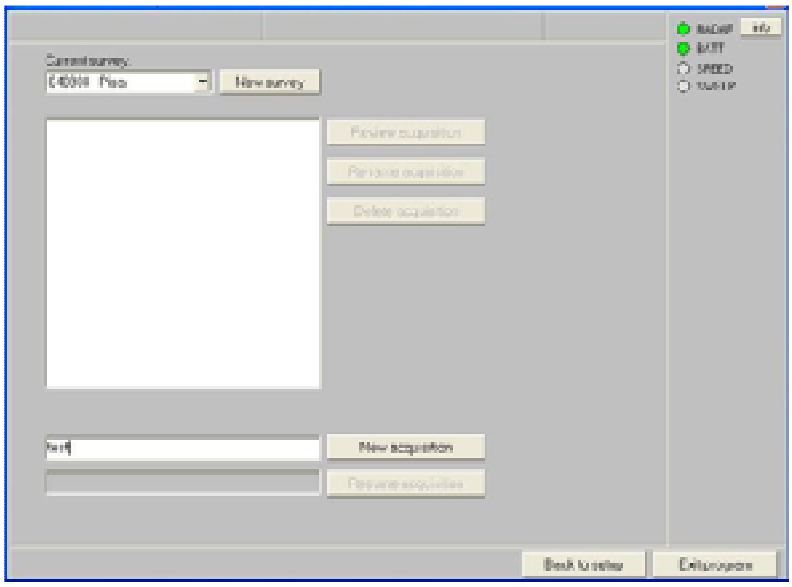
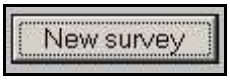
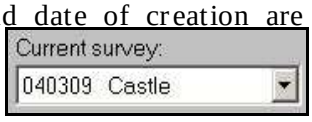


Fig. 4-21 – Acquisition Selection window

1. Pressing the 

button in Fig. 4-21 opens the window shown in Fig. 4-22, in which you have to type the name of the survey in the top text box; any notes relating to the survey can be inserted in the lower text box.

2. Complete the survey selection phase by clicking the 

button in the window shown in Fig. 4-22; this will return you to the window shown in Fig. 4-21. The chosen name and date of creation are automatically inserted into the current survey box 

shown in Fig. 4-21.

Fig. 4-22 – NewSurvey window

NOTE	Once a new survey name has been chosen, a new folder is automatically created with this name and the .**mis** extension in the C:\SRS_PLUS\Mission*.mis directory, as shown below.

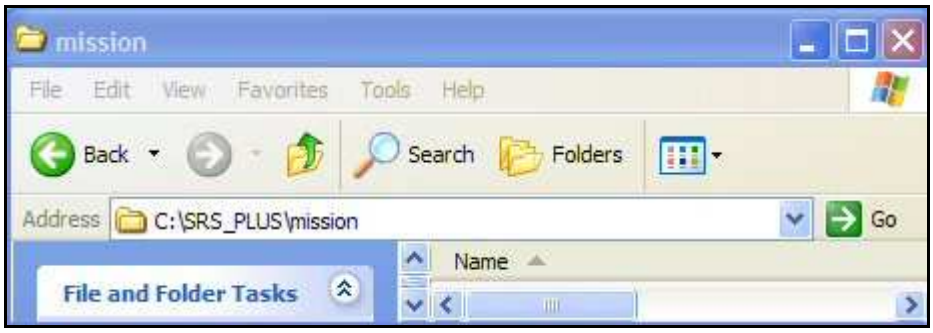


Fig. 4-23 – The *.mis folder directory

4. At this point, type in the name of the new acquisition in the text box shown in Fig. 4-24, which is part of the window shown in Fig. 4-21. The name inserted in the example given in Fig. 4-24 is **Scan-01**.

Fig. 4-24 – NEW ACQUISITION text box

5. You can then move on to the acquisition phase by pressing the **New acquisition** button shown in Fig. 4-24, which is part of the window shown in Fig. 4-25.

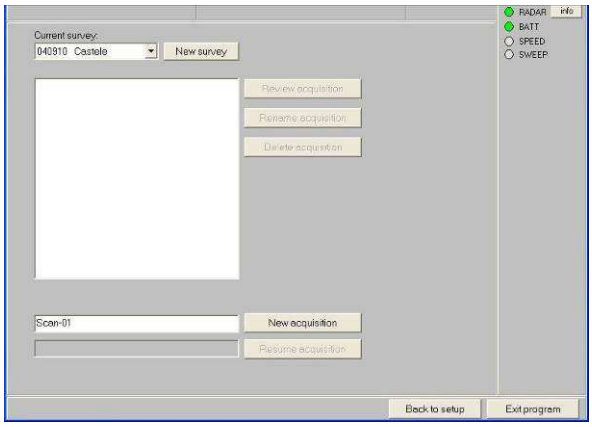


Fig. 4-25 – Setting up a New Acquisition

NOTE	Once you have defined the name of the new acquisition, a new folder is automatically created with this name and the **.zon** extension in the C:\SRS_PLUS\Mission*.mis*.zon directory, as shown in Fig. 4-26: the example shows the C:\SRS_PLUS\Mission\Castle.mis*.zon directory.

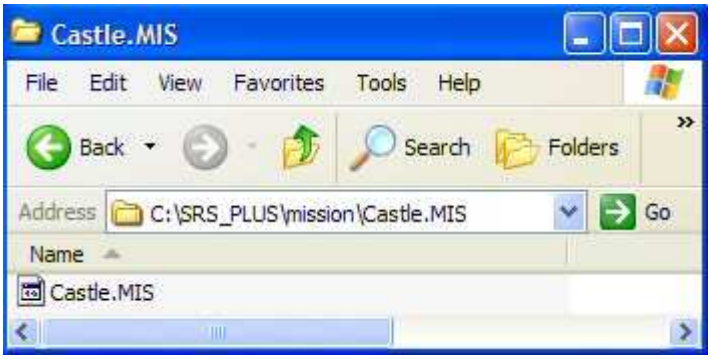


Fig. 4-26 – The Castle.mis folder directory

6. Pressing the Back to setup button returns to the calibration phase window shown in Fig. 4-7.
7. Pressing the End program button in the window shown in Fig. 4-7 closes the software; before shutting down the software, the message window shown in Fig. 4-18 reminds you to disconnect the Control Unit.

4.5 Setting the acquisition parameters

Once the names of the survey and acquisition have been chosen, you can pass straight on to the data acquisition phase.

1. Pressing the 

button on the window shown in Fig. 4-25 automatically produces the **NEW ACQUISITION** window shown in Fig. 4-27.

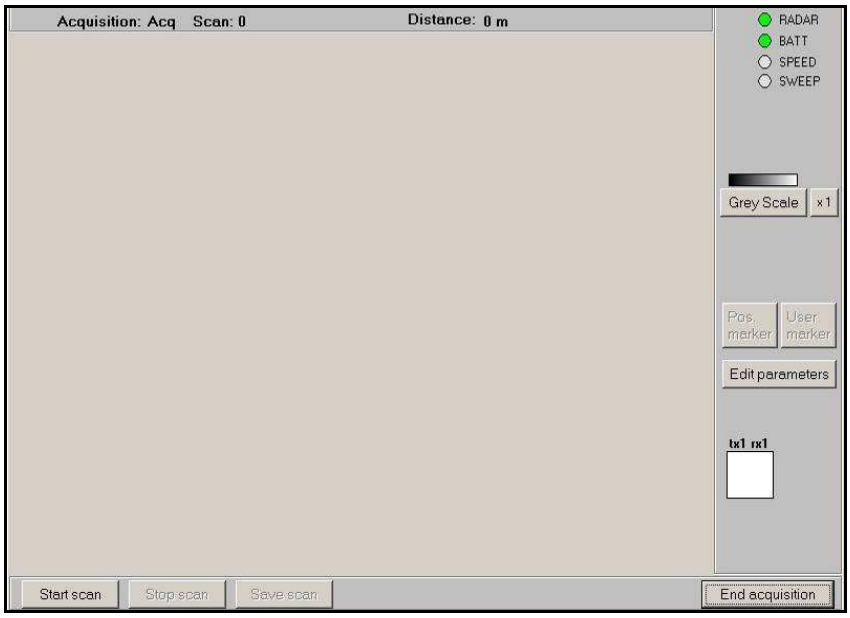


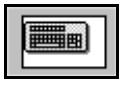
Fig. 4-27 – NEW ACQUISITION Window

2. To set the starting point coordinates, press the 

button from the window shown in Fig. 4-27; this opens the window shown in Fig. 4-28.

3. The following acquisition parameters can be selected from the window shown in Fig. 4-28:

    i. **File prefix:** this consists of two fields which you can fill as you wish. These fields form part of the scan identification (for example you could use the initials of the street name). These two characters, positioned after the first character which is either L or T deriving from the next choice (see the following point), make up the second and third of the 8 characters that identify the name of each single section.

    ii. The  button allows you to open a virtual keyboard you can use to edit the scan coordinate values.

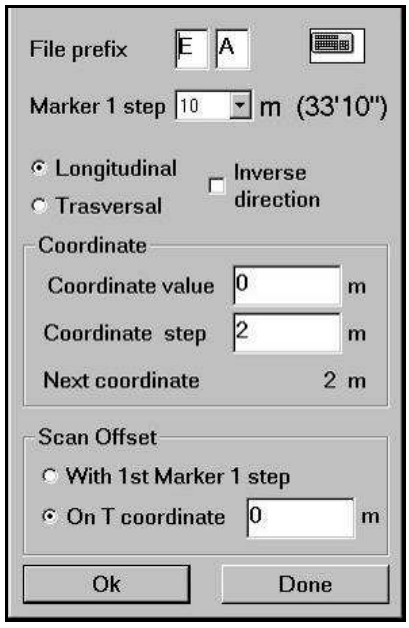


Fig. 4-28 – Acquisition Parameters Window

iii. **Marker 1 step:** this field represents the distance between two reference lines marked on the site. The default value is 10 m. This function allows you to realign the radar sections to compensate for any distance variations with respect to the data acquired with the position sensor wheel. This realignment is performed according to the value set in the **Marker 1 step box**. This setting is typically used for realigning longitudinal scans. If you set the marker with a specific position and then press the button shown in Fig. 4-29, contained in the window shown in Fig. 4-31 at a distance of ± 20% either before or after this assigned point, the **Pos. Marker** will be transformed into a **User Marker** when the file is saved (see Fig. 4-31 and point 3 of Par. 4.6).

Fig. 4-29 – Pos. marker button

iv. **Longitudinal/Transversal – Inverse direction:** this field allows you to select the scanning direction of the radar section about to be acquired. When filling in this field, remember that *Longitudinal* (**L**) means the scans is performed parallel to the zero reference line (T axis), while a scan perpendicular to this line is called a *Transversal scan* (**T**) (see Appendix A). The **Inverse direction** field allows you to perform a T/L scan in the opposite direction, i.e., moving in a

decreasing coordinate direction. In any case, you must return back to the same starting axis used for the forward scan.

v. **Coordinate (m)**: This field allows you to insert the values of the set T or L co-ordinate. Remember to indicate if a coordinate is negative. Check the current T or L coordinate on the site and insert it into the relative field. Remember that, despite the actual dimensions of the antenna trolley, it is represented in the Cartesian reference system by a single point that corresponds to its centerpoint. The position of this point varies depending on the array configuration that has been set. When moving the antenna trolley, make sure the centerpoint is on the scan line, at the defined coordinate.

- **Coord. value**: insert the value of the coordinate to be maintained constant during the scan in this field.
- **Coord. Step**: this field contains the step value that is added automatically to the current value when a scan is finished, leaving the system ready to start the next scan. The preset value = 2 m between scans. For example, if a longitudinal scan has been chosen and it starts from a point with coordinates **T, L** = 0;+2 m, the following values must be set:
  - Longitudinal;
  - 2 in the Coord value field;
  - 2 in the Coord. Step field.

  Once the scan is finished, the coordinate of the L value is automatically positioned on the value 4.

The Antenna array may only be moved in one direction. It may only be pulled or pushed in the direction of increasing scanning coordinates, the only exception being when the **Inverse Direction** field is activated**.**

vi. **Scan Offset (m)**: each radar scan is characterised by an initial L and/or T co-ordinate Therefore, once you have inserted the starting point co-ordinate for the investigation ("*coord. value*" in Fig. 6-9) as a function of the type of scan, the other reference co-ordinate must be defined in the "*Scan Offset (m)*" field. There are two alternatives for this operation:

- Select "**With 1st Marker 1 step**": this selection automates the insertion of the second L or T co-ordinate when the antenna array crosses the zero line starting from a negative co-ordinate. This procedure is normally used when there are many irregularities on the site such as parked cars, indents

in the pavement, etc. In these cases, it can be very time consuming to calculate the distances each time as described above and is more convenient to select the **With 1st Marker 1** box after having just set the initial L or T co-ordinate.

The system automatically recognises the path performed in the negative portion and automatically associates the negative starting co-ordinate to the last L or T co-ordinate.

For example, for the case of the Transversal scans shown in Fig. 4-30, first we select the scan type (in this case Transversal) in the "*Scan Settings*" window (Fig. 4-28). Then we set the current value of the T co-ordinate (2m in this case) in the "*Coordinate (m)*" field; finally, we activate the "*With 1st Marker"* option in the "*Scan Offset (m)*" field. In this way, the acquisition starts in the negative L portion, and when the centerpoint of the antenna trolley passes across the zero line, the Marker 1 button has to be pressed. The trolley is then pushed to the end of the scan. When the stop acquisition button is pressed, the system automatically associates a negative co-ordinate to the initial portion of the file of the scan that has been performed

- "**On L/T coordinate**" selection

  In this case, you have to manually measure the value of the co-ordinate corresponding to the centerpoint of the antenna array with respect to the reference system selected previously, and insert it into the active field.

  For example, if you have to perform a transversal scan starting from the co-ordinate T=2 and L=2, you must set the type of scan to Transversal and then set the actual value of the T co-ordinate (e.g. 2 m) in the "*Coordinate (m)* " field. Next, activate the "*L coordinate*" in the "*Scan Offset (m)*" area, setting it to 2 in this case. The scan can now be performed.

In "*With 1st marker 1 step*" mode, the antenna system must be moved at least 20 cm after having pressed the **Pos. Marker** button shown in Fig. 4-29 before pressing the stop button; otherwise the section cannot be viewed by the elaboration SW.

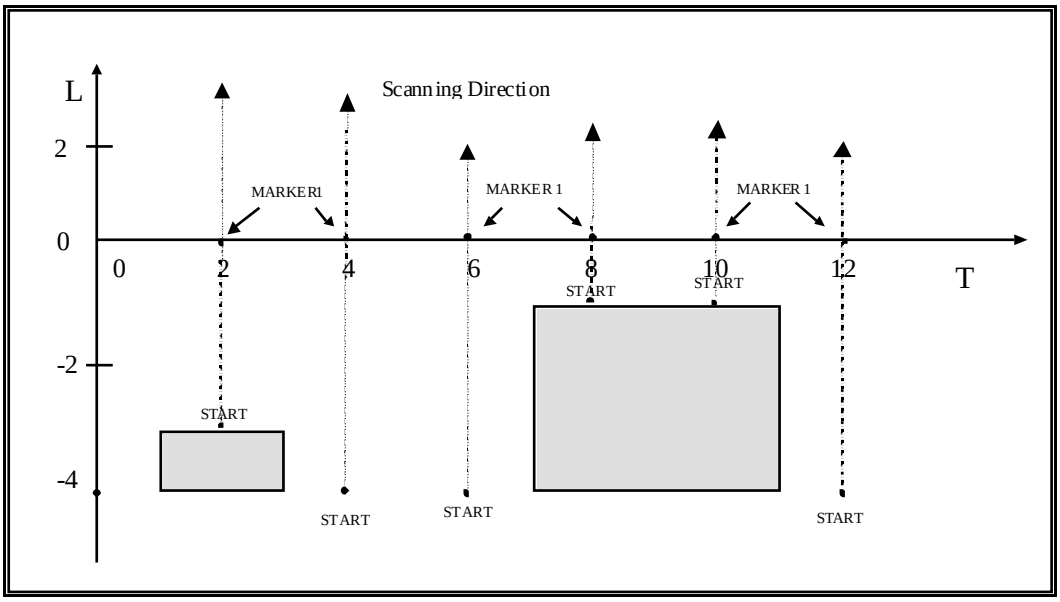


Fig. 4-30 – Diagram showing an example of how to use the function "with 1st Marker 1 step"

4.6 Data acquisition

Once you are sure all the scan parameters have been correctly defined, you are ready to start.

1. Press the 

button in the window shown in Fig. 4-27 and start to move the trolley along the desired path (always in the same direction). The results of the single sections will start to appear in real time on the monitor in a window dedicated to channel 1 (see Fig. 4-31). The active channel is indicated with a red box in the sweep window. When a window is completely filled, the data will be written over from left to right and you will notice that the content of the radar section changes line by line. When the system passes across a possible utility or a radar target of any type, typical hyperbola shaped figures will appear with variable contrast in the depth direction corresponding to the impulses received. The presence of targets can be detected by comparing these figures, window by window, however, it is easier to perform this operation during the processing phase. The distance travelled by the trolley (**Distance:….m**) is shown above the radar map in real time, the depth is expressed in meters (**m**) on the left y axis while the time delay expressed in nanoseconds (**ns**) is given on the right y axis as indicated in Fig. 4-31. To visualize another acquired channel in real time, you can click on the small window of the signal corresponding to the desired channel.

2. When you press the Pos. marker button on the window shown in Fig. 4-31, a green line automatically appears on the section at the abscissa.
3. When you come across objects of particular interest such as manholes or macroscopic discontinuities, you can press the User marker button shown in window Fig. 4-31; this will produce a red line at the abscissa.

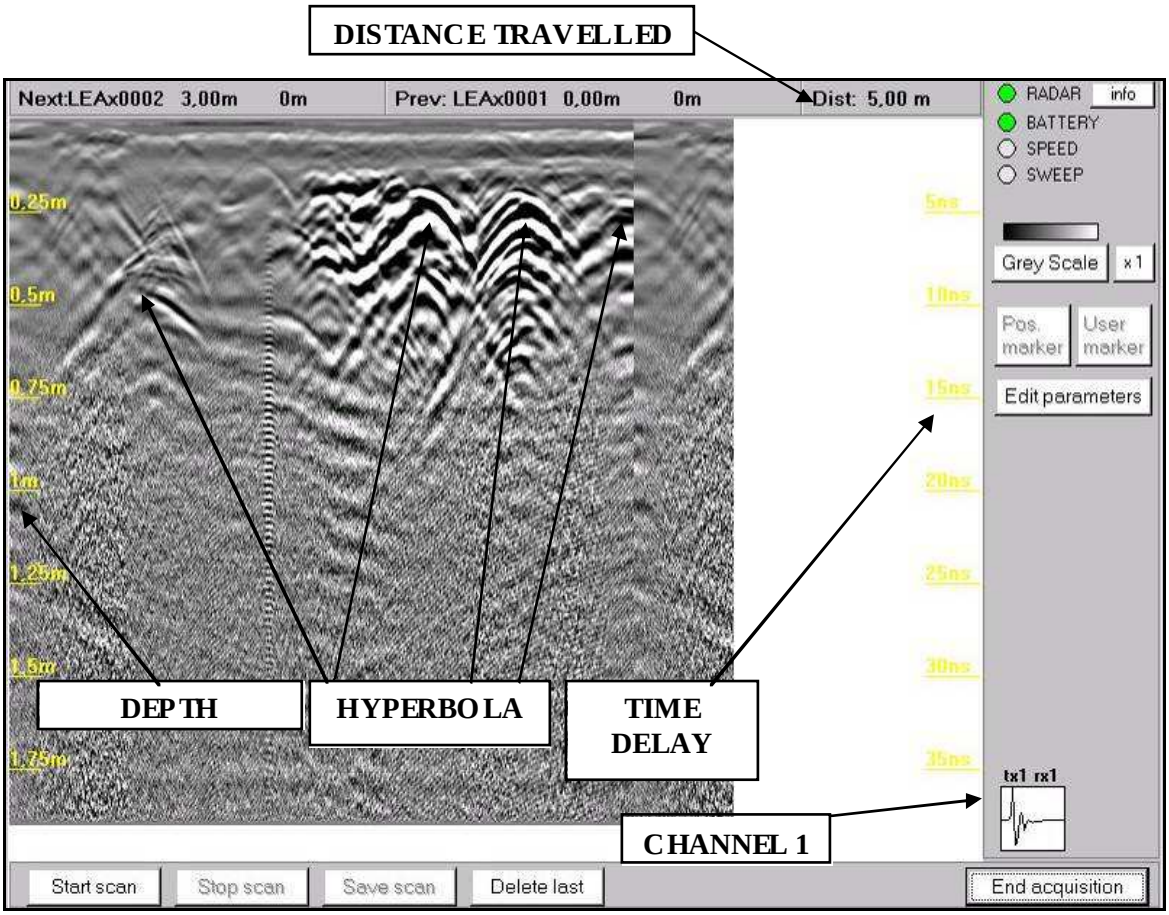


Fig. 4-31 – Radar section during acquisition

4. If you move the trolley too quickly, an alarm sounds to warn you that you are loosing data; if this problem continues, it is best to stop the scan with the Stop scan button shown in Fig. 4-31 and avoid saving the data by pressing the **NO** button in the window shown in Fig. 4-32.

   No modifications need to be made before repeating the scan apart from returning the trolley back to the starting position.

Fig. 4-32 – Data saving window

5. When you want to save the acquired data on the disk, you can choose to press the Stop scan button shown in the window in Fig. 4-31, then create the temporary file by pressing the **YES** button in the window in Fig. 4-32.
6. But you can also choose to temporarily save the data acquired up to that point by pressing the Save scan button shown in Fig. 4-31, and continue to push the trolley in the same direction to the end of the scan, then definitively save it using the above procedure. This save scan procedure is particularly recommended for longer scans that may reach up to a few hundred meters in length.
7. By pressing the Delete last button, you cancel the last radar scan performed. Once the radar map has been completely deleted, the coordinates are updated to those of the preceding scan.
8. Pressing the End acquisition button terminates the acquisition phase, then the software will save definitely all data storage of the same mission by pressing the OK button in the window appearing (see upper Fig. 4-33); then you move on to the window shown in Fig. 4-33 which has all the review functions activated.

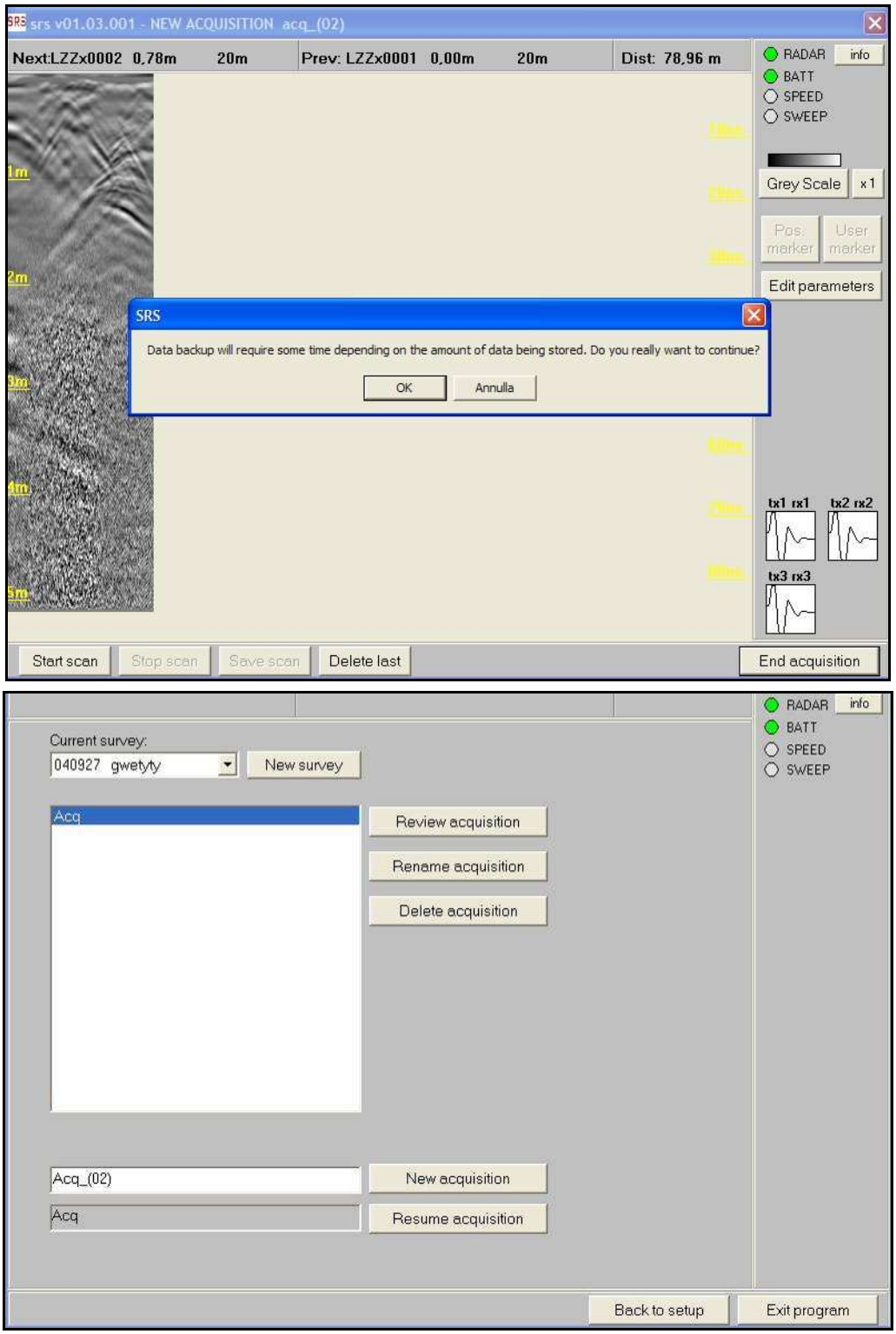


Fig. 4-33 – Acquisition window activated for performing operations in review mode

! NOTE	Remember that data is grouped by scans, i.e. a group of radar sections relating to a single passage of the radar trolley. Any group of radar sections can be visualised from a given scan. You have a list of names of saved scans available. The following nomenclature rules apply for the scans: 1. the scan file names have 8 characters and have the *.dt extension before the data are processed; 2. the filename is derived as follows: • 1st character **L** or **T** depending whether the scan is longitudinal or transversal, • 2nd –3rd character can be chosen by the user, • 4th character ***** = channel number used • 5th –8th characters make up the progressive number of the scan within the survey. The first acquired file has the progressive number 0001, so for example, the name LMA*0012.DT is the name of the twelfth scan, performed in the longitudinal direction and contains unprocessed data. Each channel has its own corresponding data file.

4.7 Operating in review mode

You can perform various operations on the acquired data. Once the acquisition has been selected from the window shown in Fig. 4-33 (in the example shown here in Fig. 4-33, the **Acq** acquisition is chosen) you can:

1. Press the 

button shown in Fig. 4-33 to view the selected acquisition.

   The first radar section of the selected scan will appear (Fig. 4-34). From this section, once the **Edit parameters** button has been pressed, it is then possible to modify the **File prefix** field and the **Longitudinal/Transversal** field shown in Fig. 4-35.

   You can select another scan belonging to the same acquisition directly from the window shown in Fig. 4-34, choosing the one you want from the text box shown in Fig. 4-36 or by pressing the 

and 

buttons to view the next or previous scans respectively.

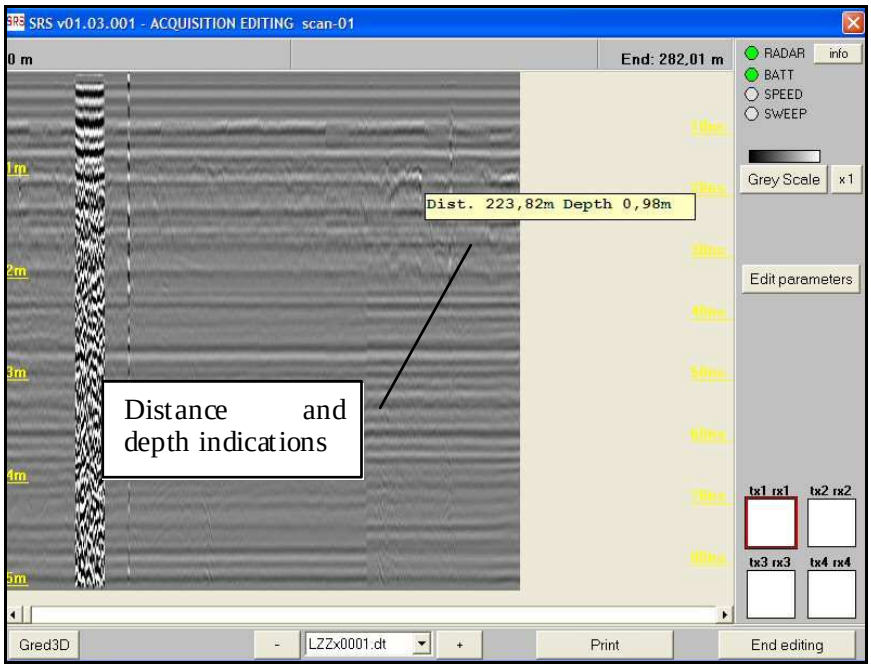
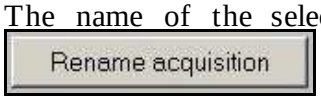


Fig. 4-34 – Acquisition Editing window

Fig. 4-35 – Window for Editing parameters after acquisition transversal

Fig. 4-36 – Scans from the same acquisition

2. The name of the selected acquisition can be changed using the 

button in the window shown in Fig. 4-33. Write the new name of the selected acquisition in the window shown in the window in Fig. 4-37; once the new name has been set, press the **OK** button to confirm.

Fig. 4-37 – Rename Acquisition Window

3. Any previously saved acquisition can be deleted by pressing the 

button in the window shown in Fig. 4-33 using the window shown in Fig. 4-38; the delete operation has to be confirmed by pressing the **YES** button in this window.

Fig. 4-38 – Delete acquisition window

4. Pressing the 

button from the window shown in Fig. 4-33 reloads the last acquisition, enabling you to continue performing other scans in the same acquisition area, following the procedure described in Par.4.6.

5. Pressing the 

button shown in Fig. 4-7 closes down the software. Before closing it down, the system reminds you to disconnect the Radar Control Unit with the message window shown in Fig. 4-18.

5. ERROR MESSAGES AND ALARMS

5.1 Error messages

Error messages found in the program are listed below (*in italics*) followed by their solutions:

- *Network error. Retry or check hardware!*

Check that the network cable is connected properly to the PC and the SRS_PLUS Control Unit. Try restarting the program.

- *Warning. Unable to print on the selected printer*

Check that the printer is switched on and connected to the computer.

- *Unable to review: calibration file has been lost.*
- *Gain calibration has been skipped (or lost). Calibrate gain to proceed..*
- *Unavailable: gain calibration has been skipped (or lost).*
- *Unavailable: gain calibration has changed.*

A calibration has to be performed to be able to acquire data. See Paragraph 4.3 for calibration instructions.

- *Unavailable: directory has been lost.*

The last acquisition cannot be recovered, select a new acquisition.

6. ON LINE ASSISTANCE

6.1 Remote assistance using Webex Support Center

Webex Support Center is a service that allows the activation of a two host session, making an application, or the desktop available to the other user or letting you capture another remote desktop.

It can be used to perform web conferences and presentations.

It is easy to use thanks to its simple and intuitive interface.

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

6.1.1 How to use the Webex service

You will receive an email from IDS Customer Care containing a link to the support session (see Fig. 6-1).

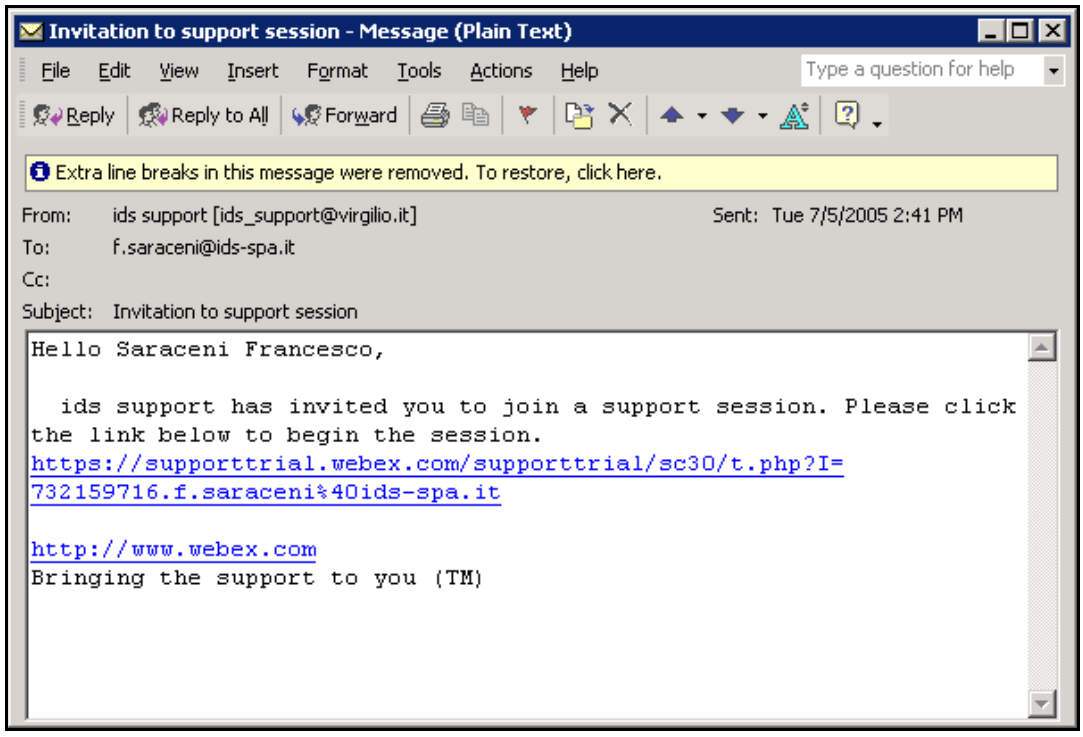


Fig. 6-1 – Mail sent by IDS to the client

Once you have clicked on the link sent by email, the following window will appear. Insert your data into the form (see Fig. 6-2).

Fig. 6-2 – Client data insertion form

Once you have clicked **Submit,** the following page will appear showing a downloading bar. The session starts as soon as the download is complete. (see Fig. 6-3).

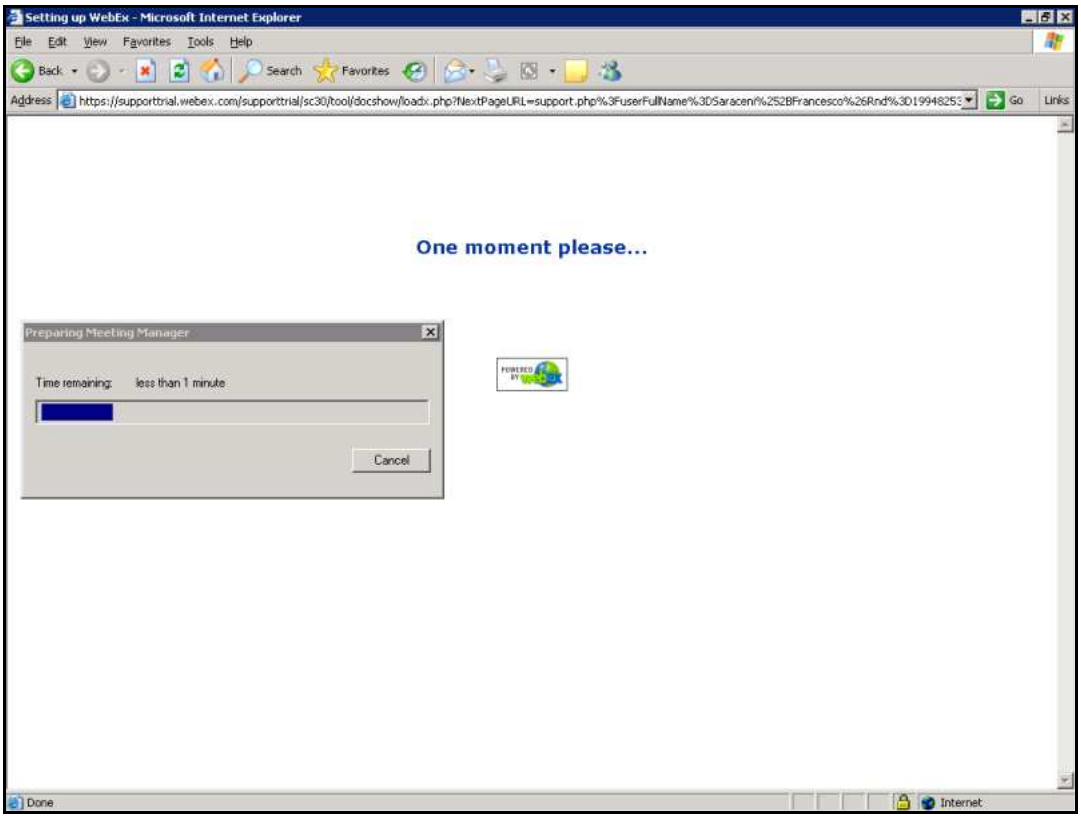


Fig. 6-3 – Webex Set up window

As you can see from the following screen, (Fig. 6-4) you are given a console, just containing the **Chat**, **Video** and **Leave Session** commands.

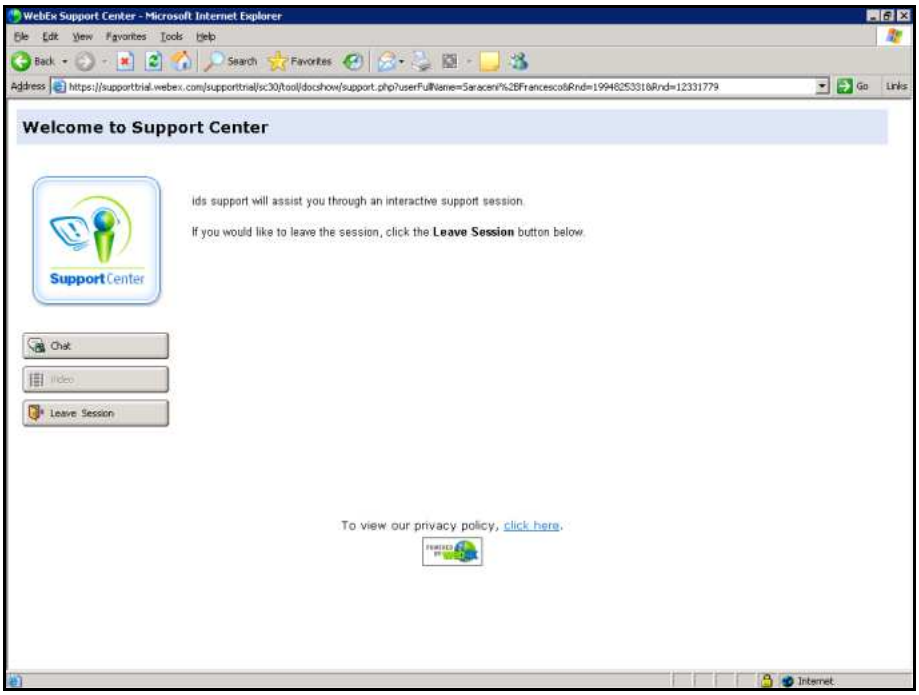


Fig. 6-4 – Welcome to Webex Support Center window

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

- Request control of the desktop using the Request Control command.
- Give you control of the IDS desktop using the Share Control command.
- Request to display the remote desktop using Request View.
- Share the visualisation of the IDS desktop using Share View.

Before each command is activated, you are asked for confirmation through the following window (Fig. 6-5).

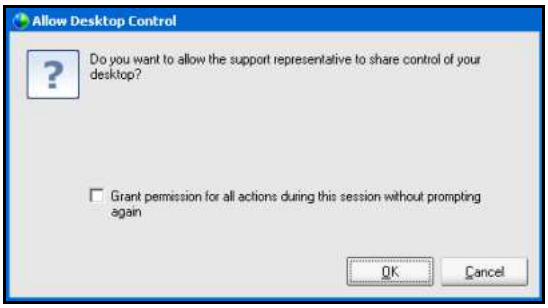


Fig. 6-5 – Command acceptance window

APPENDIX A - MECHANICAL REQUIREMENTS FOR THE INSTALLATION OF SRS SYSTEMS ON BOARD A TRAIN

A.1 - Introduction

This section deals with the installation requirements for the use of a georadar (GPR) system on-board a train.

The system consists of:

- a notebook computer
- a battery
- a GPR control unit
- a GPR multiplexer unit
- up to 4 GPR antennas
- an odometer
- and relevant connection cables.

Items 1-4 will be mounted inside the locomotive and don't need any specific installation; on the contrary, items 5 and 6 shall be mounted in the front of the train and require some mechanical arrangements.

For practical reasons (mainly logistical), some of the devices needed to assure the proper mounting of the system should be provided by SNCF; basically, these consist of a metallic frame used to house the antennas and the brackets for fixing this frame to the front of the locomotive.

A.2 - Mechanical requirements

Mechanical installation of the antennas and the odometer requires brackets to be fixed to the buffers of the train. Therefore, it is important that the train used for the test has buffers.

Moreover, it is also important that there are no obstacles between the buffers as measurements would be affected by them (see Fig. A. 1).

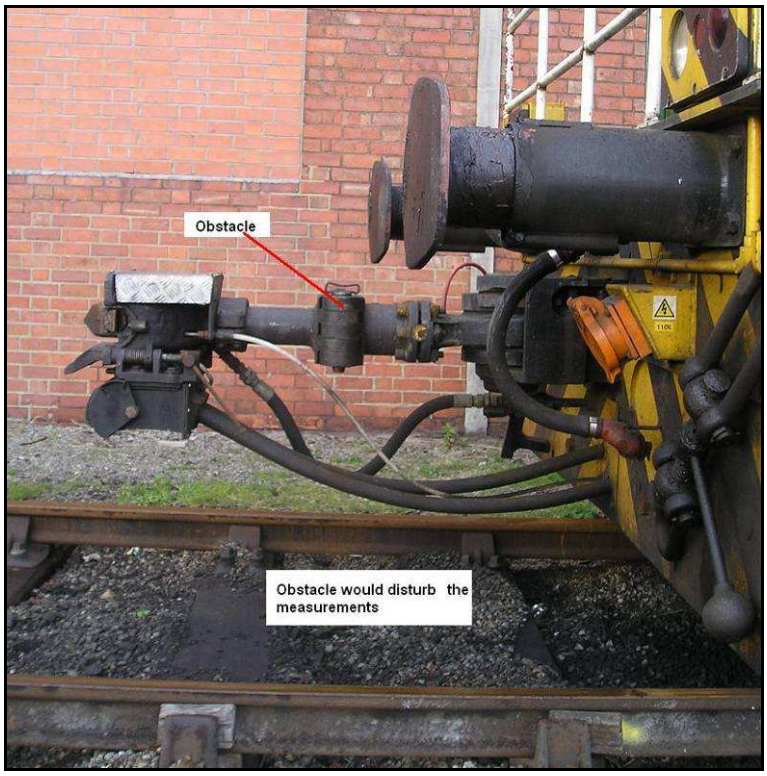


Fig. A. 1 - No obstacle must be present between buffers

A typical installation of the system (3 antenna configuration) is shown in the following picture (Fig. A. 2).

Fig. A. 2 - Example of a typical installation of the system

A.3 - Specifications for the fixing frame

SNCF is kindly required to provide the fixing frame; this frame consists of 2 cross-bars and 2 vertical-bars, as shown in the picture Fig. A. 3). Material to be used for the frame could be either aluminium or iron.

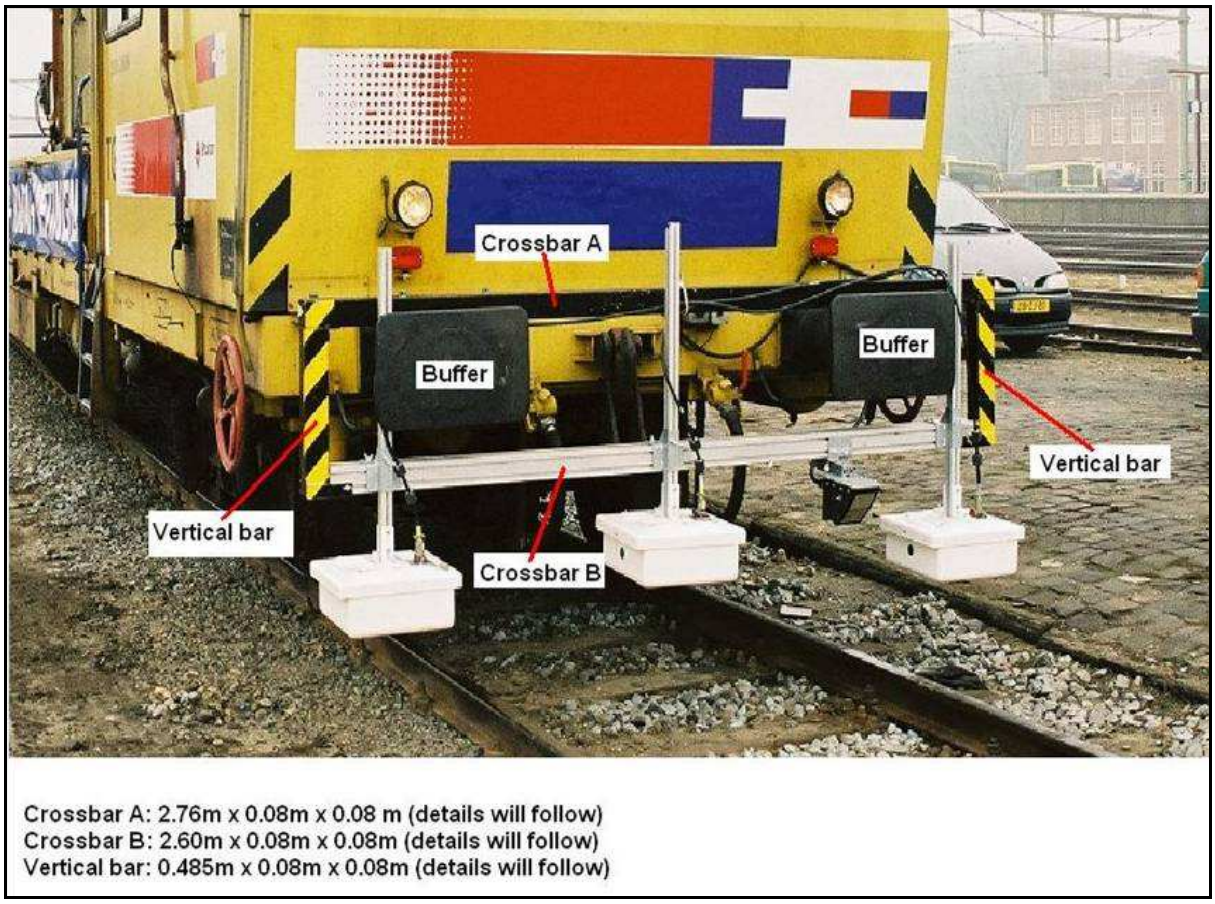


Fig. A. 3 - Overview of the fixing frame

Specifications for the brackets, the cross and the vertical bars are given in the following pictures Fig. A. 4 and Fig. A. 5.

All the bars have a square shape section, 80 mm x 80 mm.

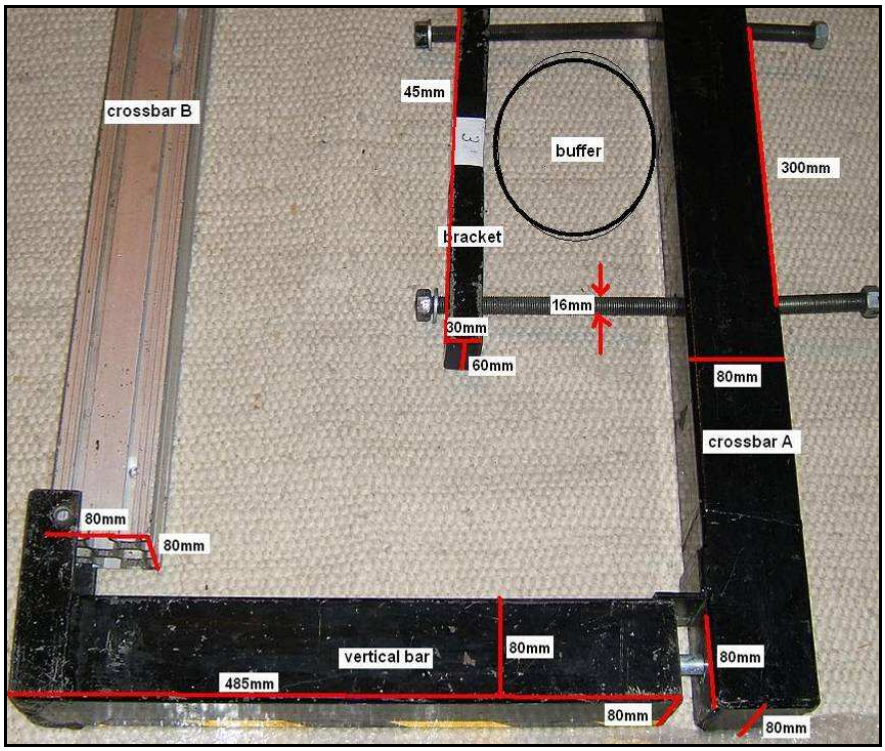


Fig. A. 4 - Specifications for the cross-bars and the brackets

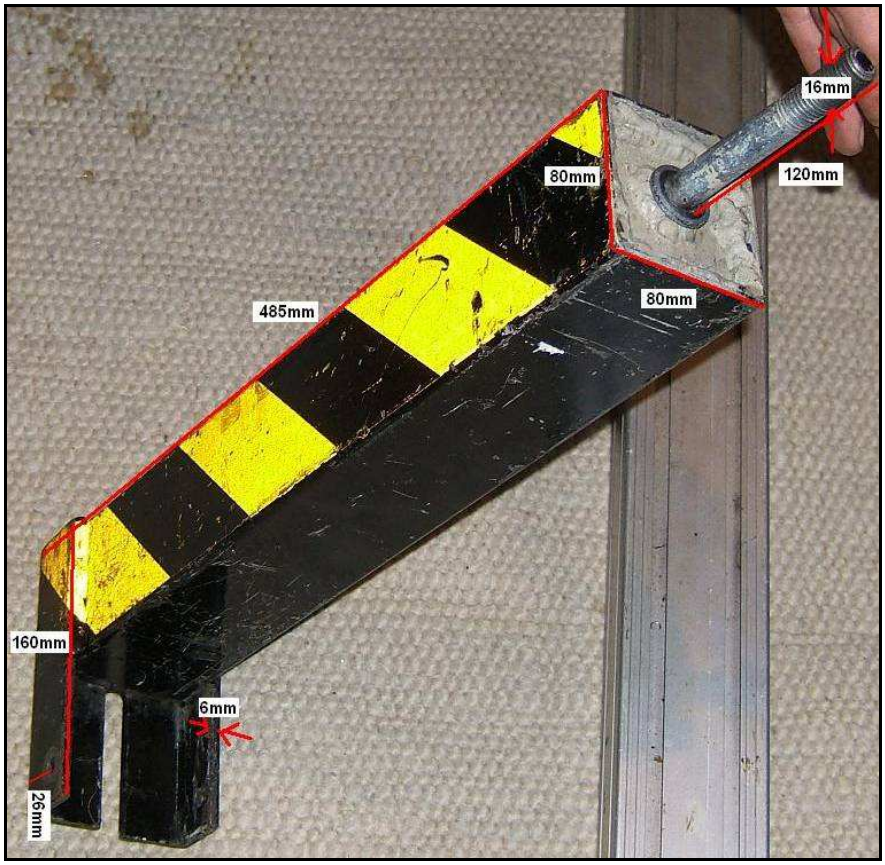


Fig. A. 5 - Specifications for the vertical-bars

APPENDIX B - SRS SYSTEM TECHNICAL SPECIFICATIONS

B.1 - SRS_PLUS System Technical Specifications

The SRS_PLUS system is only compatible with SRS_PLUS 400MHz

Hardware

- SRS_PLUS Control Unit
- Master Unit: IDS recommends the use of the **Panasonic CF30** notebook computeras shown in picture Fig. B. 1.

Software

- **SRS** data acquisition software

B.1.1 SRS_PLUS Control Unit specifications

The technical specifications of the SRS_PLUS Control Unit are given below

- ***Maximum number of acquisition channels:*** 4
- ***Pulse Repetition Frequency:*** 400KHz
- ***Range:*** 0-9999nsec. (recommended 90ns)
- ***Number of Stacks:*** 1–32 768
- ***Max number of scans/second:*** >1000
- ***Number of samples per scan:***128-8192(recommended 384/512)
- ***Trigger options:*** manual or timed
- ***Communication interface with the Master Unit:*** Ethernet
- ***Data transmission speed:*** 100 Mbit/sec
- ***Maximum dimensions of a single radar profile:*** depends on the Hard Disk capacity
- ***GPS:*** supported
- ***Power supply:*** 12 Volt
- ***Power consumption:*** 18 Watt
- ***Water Proof:*** IP65

Fig. B. 1 – SRS_PLUS Control Unit and CF-30 Notebook

B.2 - SRS-FW400 System Technical Specifications

The SRS-FW400 system is only compatible with SRS-FW400 antennas.

Hardware

- DAD FastWave Control Unit
- Master Unit: IDS recommends the use of the **Panasonic CF30** notebook computer as shown in picture Fig. B. 1.

Software

- **SRS** data acquisition software

B.2.1 Control Unit specifications

The technical specifications of the SRS-FW400 Control Unit are given below

- ***Maximum number of acquisition channels:*** 4
- ***Pulse Repetition Frequency:***100KHz
- ***Range:*** 0-9999nsec. (recommended 90ns)
- ***Number of Stacks:*** 1–32 768
- ***Max number of scans/second:*** >1000
- ***Number of samples per scan:***128-8192(recommended 384/512)
- ***Trigger options:*** manual or timed
- ***Communication interface with the Master Unit:*** Ethernet
- ***Data transmission speed:*** 100 Mbit/sec
- ***Maximum dimensions of a single radar profile:*** depends on the Hard Disk capacity
- ***GPS:*** supported
- ***Power supply:*** 12 Volt
- ***Power consumption:*** 18 Watt
- ***Water Proof:*** IP65

APPENDIX C - USING GPS WITH THE SRS SYSTEM

The SRS system can acquire GPS data in NMEA$GGA format. You therefore have to set the GPS receiver so that the data output through the serial port or Ethernet port is in NMEA$GGA format.

The serial or ethernet communication between the GPS and the **Panasonic CF-30** notebook computer must be set up for GPS as follows:

- Baud rate: 9800;
- Byte size: 8;
- Parity: No;
- Stop bits: 1.

GPS data acquisition procedure with the SRS PLUS system:

Step 1 Connect the GPS receiver to the **Panasonic** notebook computer using the serial cable shown in pictures Fig. C. 1.

Fig. C. 1 - Connecting the GPS to the notebook computer

Step 2 Open the **External device settings** after having clicked on the SRS software icon at the top left of the main window (see pictures Fig. C. 2 and Fig. C. 3).

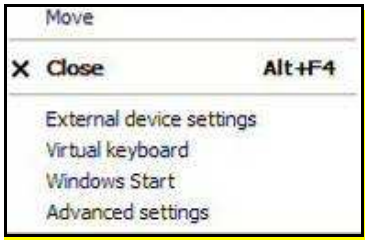


Fig. C. 2 - External device settings command

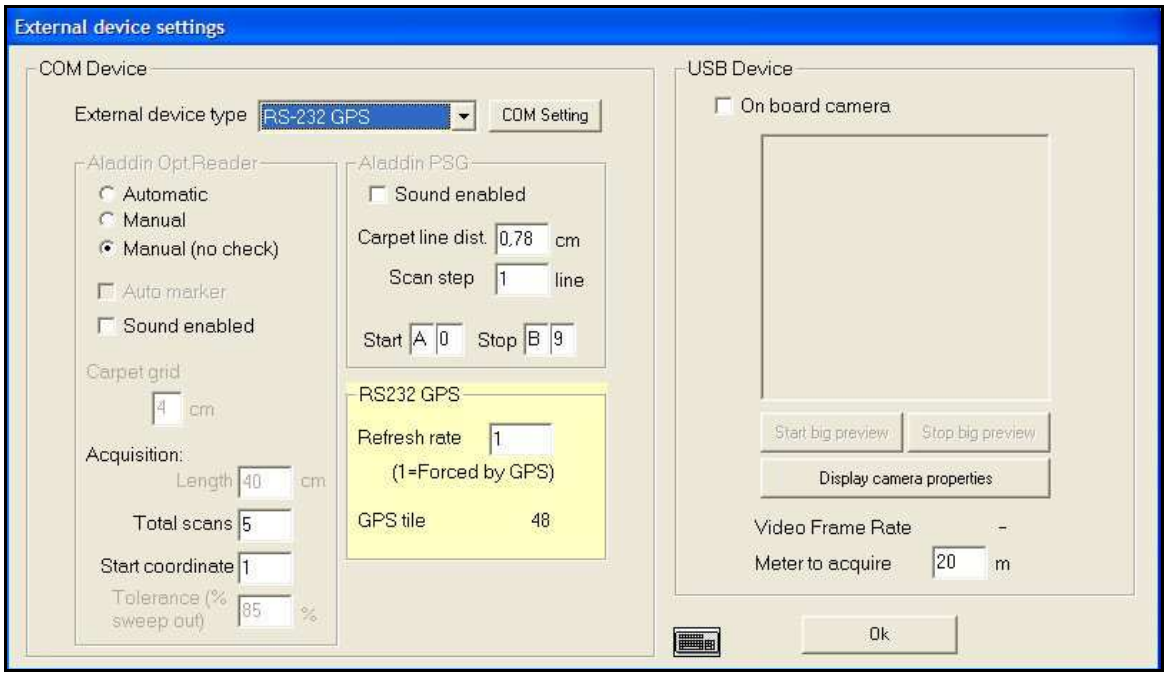


Fig. C. 3 - External device settings window

Step 3 In the **External device settings** window, select the **External device type** (picture Fig. C. 4) field then select the type of GPS connection as *RS-232 GPS (serial port).*

Fig. C. 4 - External device settings field

Step 4 Click the **COM Setting** button; this opens the window shown in picture Fig. C. 5, from where you can set the parameters shown according to the characteristics of the GPS being used.

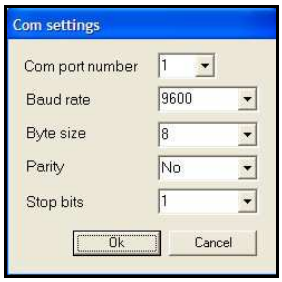


Fig. C. 5 - Com settings window

For example, selecting External device type RS-232 GPS :

- Select 1 in the **Com** menu (or set the number of the COM port number the GPS is connected to) and the other parameters according to the GPS characteristics;
- Use the **Refresh rate** field in Fig. C. 3 to select the number of sweeps interval the GPS data will be acquired with; for example, if you have set the **Acquisition Step** to 2.4cm and the **Refresh rate** field to 20, the system will acquire GPS data every 48cm (2.4cm *20=48cm); if the **Refresh rate** = 1, the SRS_PLUS system will uptake all the information produced by the GPS according to the time parameters set on GPS equipment.

Step 5 Accept the parameters set in the **COM settings** field by clicking the **OK** button, as shown Fig. C. 5.

Step 6 Correct functioning of the GPS and its communication with the SRS_PLUS system is indicated by the GPS spy light in the acquisition window; when the light is green, the GPS is correctly connected and functioning; when the GPS is red, either the connection between the GPS and SRS_PLUS systems has not been correctly made or the GPS is switched off (see picture Fig. C. 6).

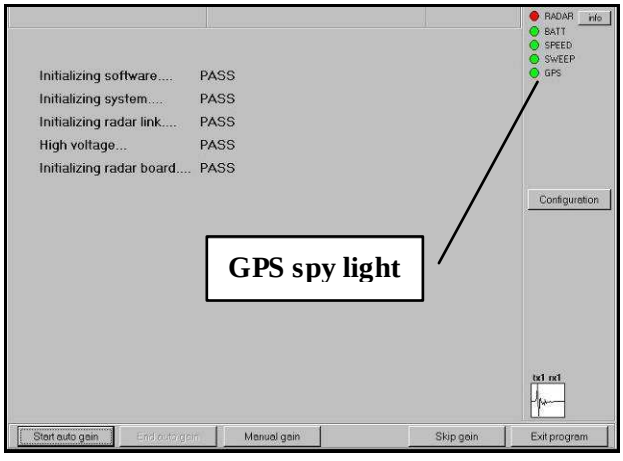


Fig. C. 6 - GPS spy

Remember that the GPS spy light only indicates the correct functioning of the GPS, not the accuracy of the GPS readings; to evaluate precision, use the tools supplied with the GPS system

Step 6 The GPS data in NMEA$GGA format are saved as an ASCII file in the same directory as the radar data; the GPS files have the same numbering as the radar files, but have a *.GPS extension (see the example shown in the picture Fig. C. 7). During the radar data acquisition phase, you can check the GPS acquisition data using white Markers placed at the bottom of the radar map.

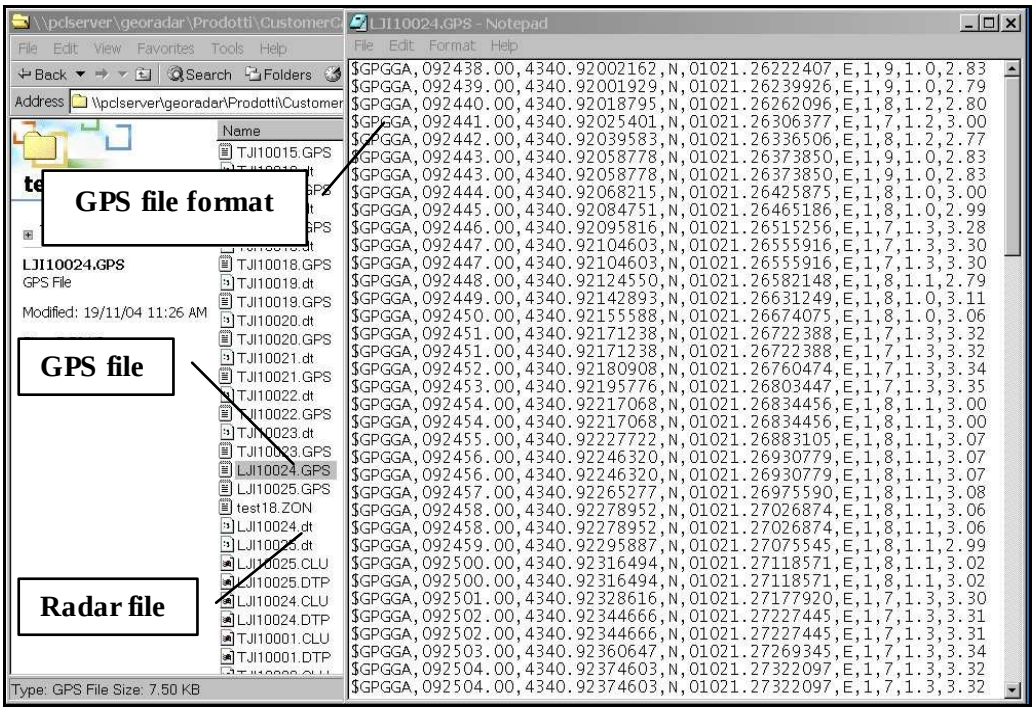


Fig. C. 7 - Example of a GPS file

APPENDIX D - USING CAMERA WITH THE SRS SYSTEM

The SRS system with Lumenera camera option, provided by IDS, has to be used as following:

Step 1 Install the drivers of the camera in the acquisition PC launching the dedicated CD-ROM for Lumenera camera, LM135C model, having a resolution of 800x600 pixels (see Fig. D. 1) pressing in sequence *Next/Continue Anyway* buttons. As you finish with success the installation, reboot the PC. To install correctly the drivers, user has to be connected as System Administrator.

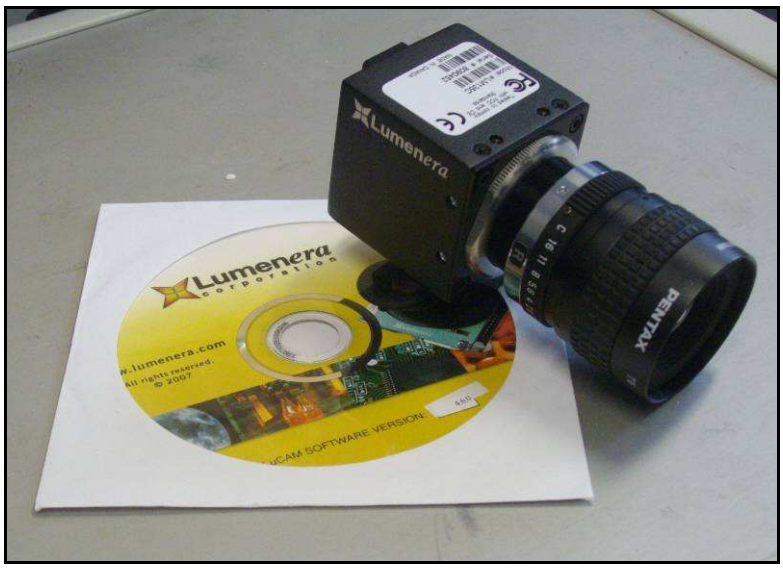


Fig. D. 1 – Videocamera "Lumenera LM135C"

Step 2 Connect the camera to the PC through USB port and activate it. After launching the SW SRS_PLUS, you will see the icon besides the spies in the opening window, as shown in picture on the label of the manual (see icon here below).

Step 3 Select **External device settings** after having clicked on the SRS software icon at the top left of the main window (see Fig. D. 2 and Fig. D. 3).

Fig. D. 2 - External device settings command

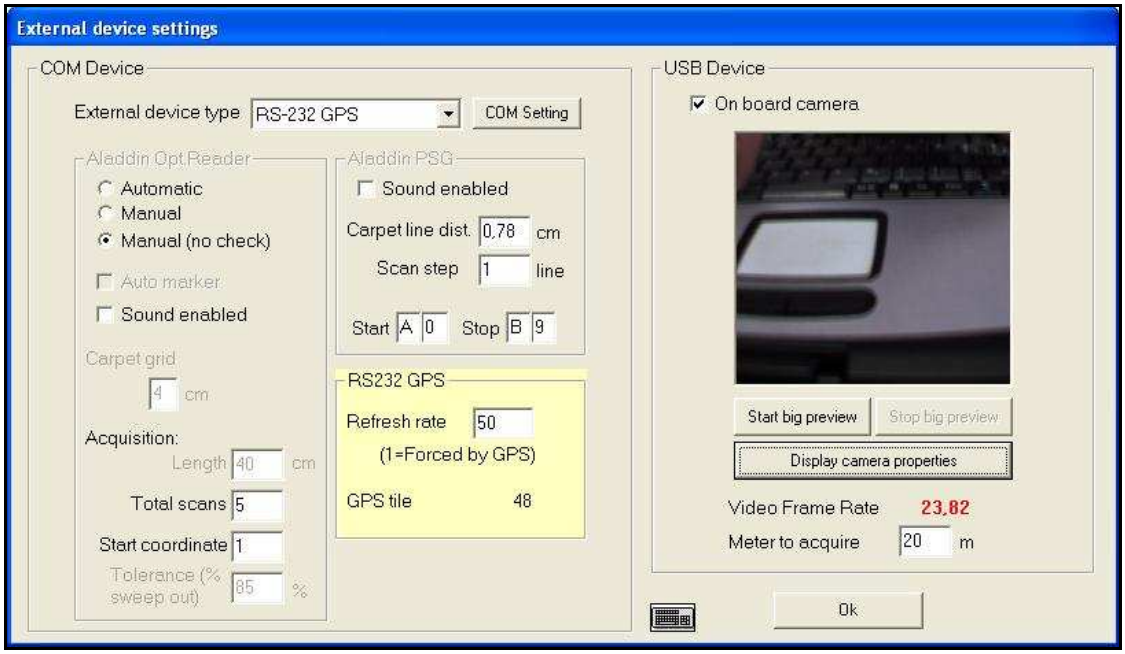


Fig. D. 3 - External device settings window

Step 4 In Fig. D. 3 you can see the field USB Device, where you have to activate the textbox **On board camera**.

Step 5 Here the user has to set the values of the following parameters related to the camera images acquisition:

- **Start/Stop big preview**: here the user can start/stop a zoom of the camera preview.
- **Display camera properties**: clicking this button before starting the acquisition, the user can edit and set all the parameters of the camera in the following window (Fig. D. 4). Here the user can set manually
    - **Exposure:** opening time of the camera shutter (also automatically by clicking *Auto* option);
    - **Gain:** signal's gain of the camera sensor (also automatically by clicking *Auto* option);

- **Red gain:** signal's red colour gain of the camera sensor (also automatically by clicking *Auto* option);
- **Green 1 gain:** signal's green 1 colour gain of the camera sensor (also automatically by clicking *Auto white balance* option);
- **Green 2 gain:** signal's green 2 colour gain of the camera sensor (also automatically by clicking *Auto white balance* option);
- **Blue gain:** signal's blue colour gain of the camera sensor (also automatically by clicking *Auto white balance* option).

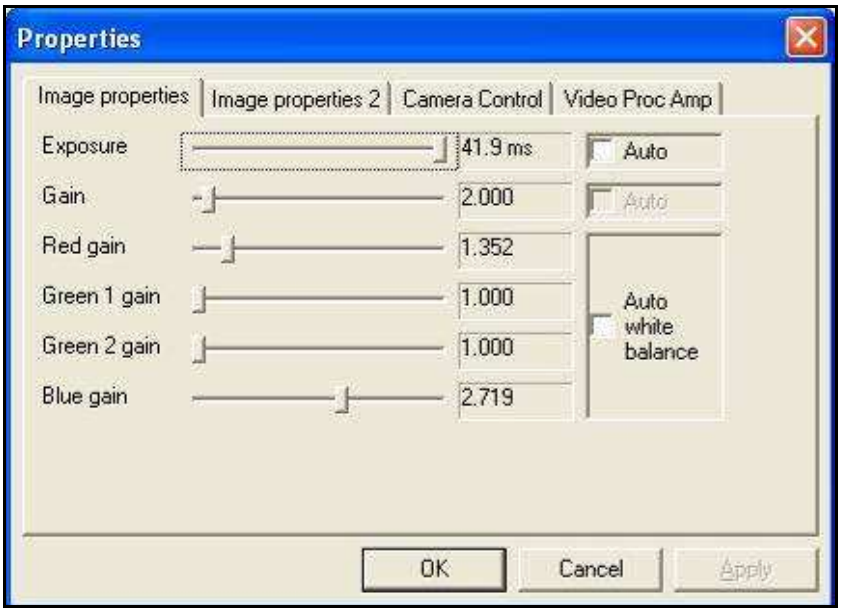


Fig. D. 4 – Camera properties

- **Video Frame Rate**: it's the speed with which the camera sends data to the PC; it's a parameter depending on the PC's capability and it's automatically set during the acquisition.
- **Meter to acquire**: it's the distance (chosen by the user) between each saved image.

Step 6 Then press OK button in Fig. D. 3.

Step 7 As the user will start acquisition, the **Camera View** window (shown in Fig. D. 5) will appear on the screen, besides the radar section in progress with the movement of the Safe Rail System.

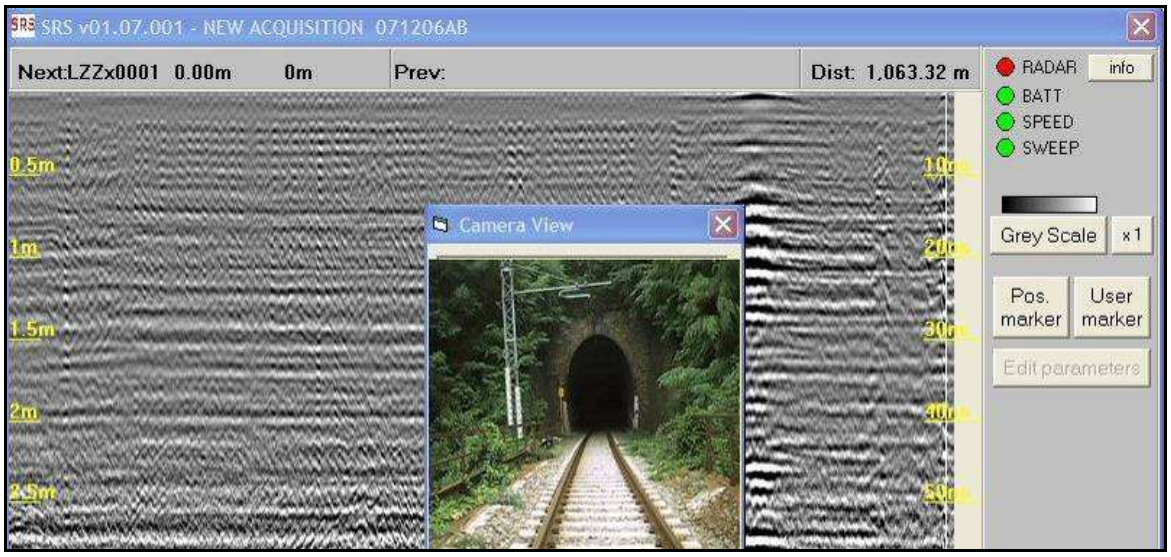


Fig. D. 5 – Camera View window

NOTE	If the user starts acquisition while the camera is activated by software (**On board camera** option is activated), but the camera is physically unplugged, SRS software informs the user with a proper message that the camera is not working, and then **Camera View** window will be closed automatically, without closing the whole software.

Step 8 After you finish the scan and press **End acquisition** button, the software will create automatically a folder named "Camera" in the directory of the mission just acquired (see Fig. D. 6). This folder contains "n" files .jpg for "n" pictures acquired by the videocamera during the scan.

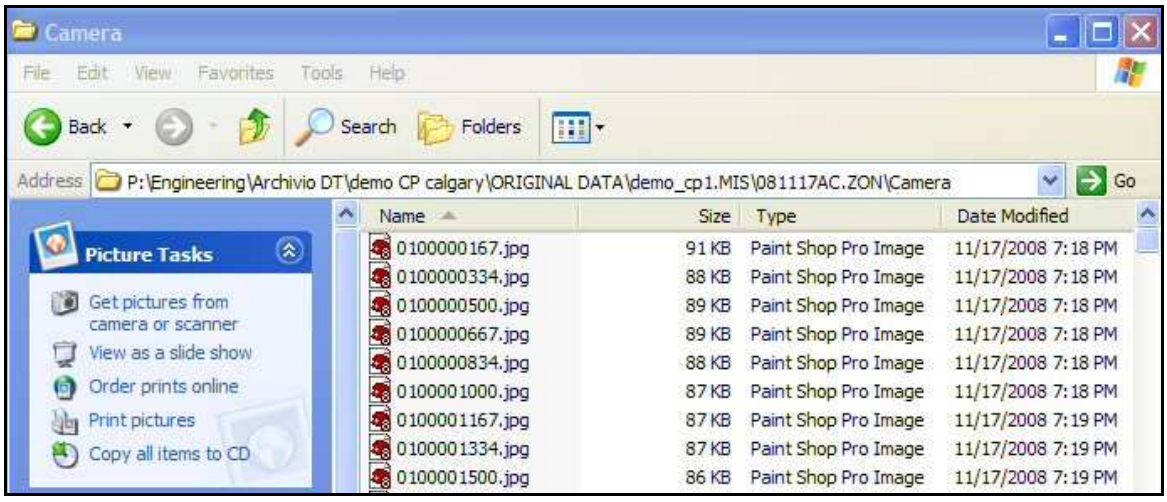


Fig. D. 6 – Folder "Camera"

1. Make sure there is sufficient light into the camera (eg. aperture is open as aperture controls the amount of light entering camera) and exposure time in not set to 0 (you can't take a picture/video if exposure time is set to zero)
2. When upgrading Lumenera software, ensure the follow steps are followed:
   a. Unplug camera from USB
   b. Uninstall the Lucam software
   c. Reboot windows
   d. Download the latest Lucam software: http://www.lumenera.com/support/download.php
   e. Install new Lucam software
   f. Reboot windows
   g. Plug camera back into the same USB port
   h. Try acquiring pictures/video from a bright source (eg bright room)
   i. If there is no video, maybe it's too dark due to wrong software and hardware settings. Check 1. Ensure software setting is correct to allow enough light into the lens
   j. If camera still doesn't work, try upgrading drivers from 'Device manager'