The Operation and Maintenance Manual for the PA-XS, PA0, PA5 and RASS

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1.0 General Information

Contents

1.1 Transporting the PA-XS and PA0 Sodars

These systems must be transported horizontally as shown on the below figures.

This is fully mandatory if the antennas are wet.

PA-XS Sodar

PA0 Sodar

1.2 Safety Issues

There are two types of hazards associated with operating and maintaining SODARs; a high noise hazard and an electrical shock hazard. The SODARs do not, however, present any unusual hazards. As long as all personnel working with the SODARs observe the following two rules, no problems should occur.

Rule One

Always turn the SODAR off before performing maintenance activities.

Rule Two

Follow normally accepted safety practices when performing maintenance activities on the SODAR.

The U.S. Government's Occupational Safety and Health Administration (OSHA) has specified the following permissible noise level exposures.

Duration Per Day In Hours	Sound Level dBA, Slow Response
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25	115

According to OSHA, any exposure in excess of the above permissible limits could result in some hearing loss.

We recommended to stay at one meter of distance for PA-XS and PA0 and 3 meters distance for PA5 during operation. In any case never lean over a sodar antenna. Maintenance personnel should turn off the power to the Sodar antenna before performing any maintenance activity or if runing an antenna test ear protection is required.

The noise generated by our PA-XS Sodar and our PA0 Sodar is respectively 50 dBA and 55 dBA at 100 meter distance. It is 75 dBA for the PA5 for the same distance.

This is the worst case because this is a measure which has been realised along the intersection of the ground with vertical plane including two symetrical tilted beams.

The noise varies from distance d1 to distance d2 according to the following formula :

$$\text{Noise variation in dB from d1 to d2} = 20 \log \left(\frac{d1}{d2} \right)$$

1.2 Safety Issues Con't

Electrical Shock Hazard to Personnel

The SODAR requires 120/220 VAC or 12 VDC electrical power. Although lethal, the AC voltages mentioned are contained inside sealed cables and enclosures. Do not open the chassis of any SODAR component; and turn off all power to the SODAR system before performing any maintenance activities.

2.0 Installation

Contents

2.1 How to Select a Site

The Site

Select a site that is:

- As far as possible from any object capable of generating a whistling noise, such as trees, telephone or electric lines, fences and meteorological towers.
- As far as possible from any object capable of reflecting an echo, such as a building, a tower, or hills.
- As far as possible from any large electric or magnetic fields, such as high power electric transformers.
- As far as possible from a fixed noise source such as an air conditionner.

2.2 How to Lay Out the Site.

The Sodar operates with 5 beams, one pointing vertically for the vertical wind speed measurement and 4 tilted beams: 2 by 2 in two vertical planes which are perpendicular to the antenna sides. These tilted beams are 22.5 degrees from the vertical and are symmetrical 2 by 2 (the tilts are in opposite direction in one vertical plane).
By experience we recommend not to impact on the “secondary lobes” which are pointing with small angles from the horizontal. Preferably no obstacle should be seen above an elevation greater that 20 degrees from the horizontal.
The antenna should be oriented such that any large obstacle should be seen along the diagonal of the antenna (as the 4 titled beams are perpendicular to the square acoustic cuff sides).

2.3 How to Prepare for Installation

Components

Identify and deliver to the site the following components:

- Complete PA-XS or PA0 antenna with acoustic cuff and outdoors electronics / computer case (in one box)
- Support stand, for PA5 only (in one box)
- For PA5 : 4 antenna panels, one of which is equipped underneath with the outdoors electronics / computer case (in one box)
- Heating cables with thermostat box for PA5 (in one box)
- Acoustic cuff for PA5 only in one box

If the configuration includes RASS, add to the above list:

- Amplifier case (one box)
- LNA (low noise pre-amplifier) case (one box)

- Parabolic reflector with 4 leg assemblies, 2 sets
- Power cable
- LO cable
- RF source to amp cable assembly w/ antenna feed
- LNA to interface cable assembly w/ antenna feed
- All in one Box

2.3 How to Prepare for Installation Con’t

- **Always ground the shelter if any**
- **Always anchor the antenna (or antennas if the RASS is present)**
- **Protect all connectors against dust, water, mud, or impact damage while installing the SODAR system.**
- **Do not carry an antenna panel by the transducers.**
- **Do not overlap or loop any cables.**

2.4 How to Assemble the PA5 Antenna

1. Assemble the four vertical panels with the four legs (one corner detail):

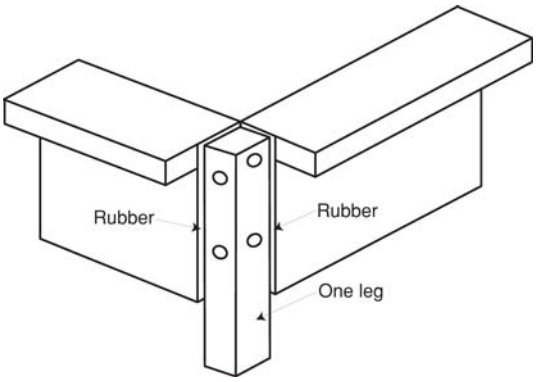


Figure II-A. Supporting structure corner detail for PA5.

The result should be as show in Figure II-B:

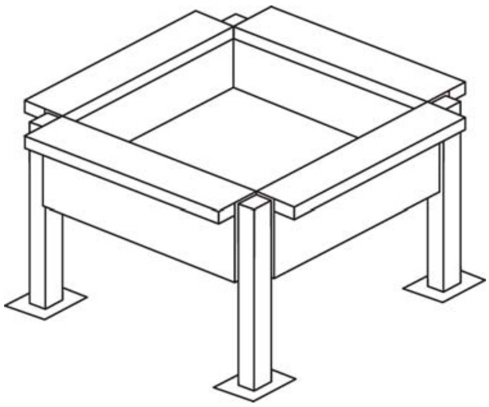


Figure II-B. Supporting structure for PA5

2.4 How to Assemble the PA5 Antenna Con't

2. Install the two «L» brackets in the middle (top view):

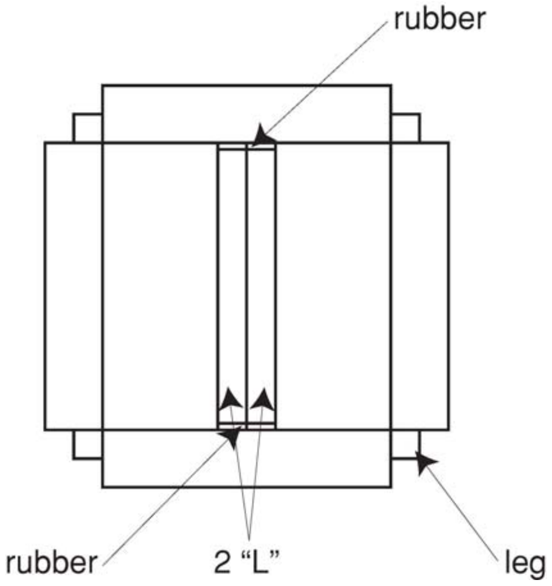


Figure II-C. Installing the middle «L» brackets in the PA5 structure.

3. Install the four antenna panels (handle them using the rectangular holes on each panel):

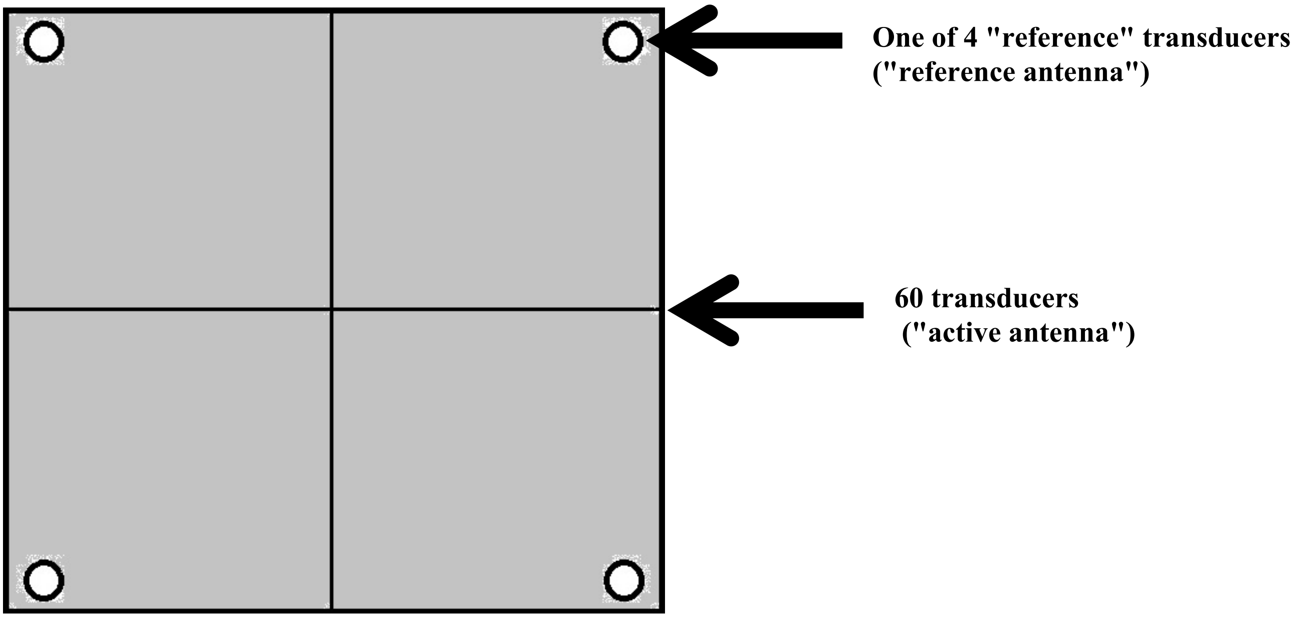


Figure II-D Antenna panels layout (top view) for PA5.

2.5 How to Place the PA5 Heating Cable(s)

PA-XS and PA0

The heating cable has already been installed at the factory.

PA5

1. Attach the thermostat box to the top of one support stand leg with the plugs pointing down.

2. Use Figure II-E. Thread the heating wire underneath the horns. Make single-point contacts only when threading one heating wire over another.

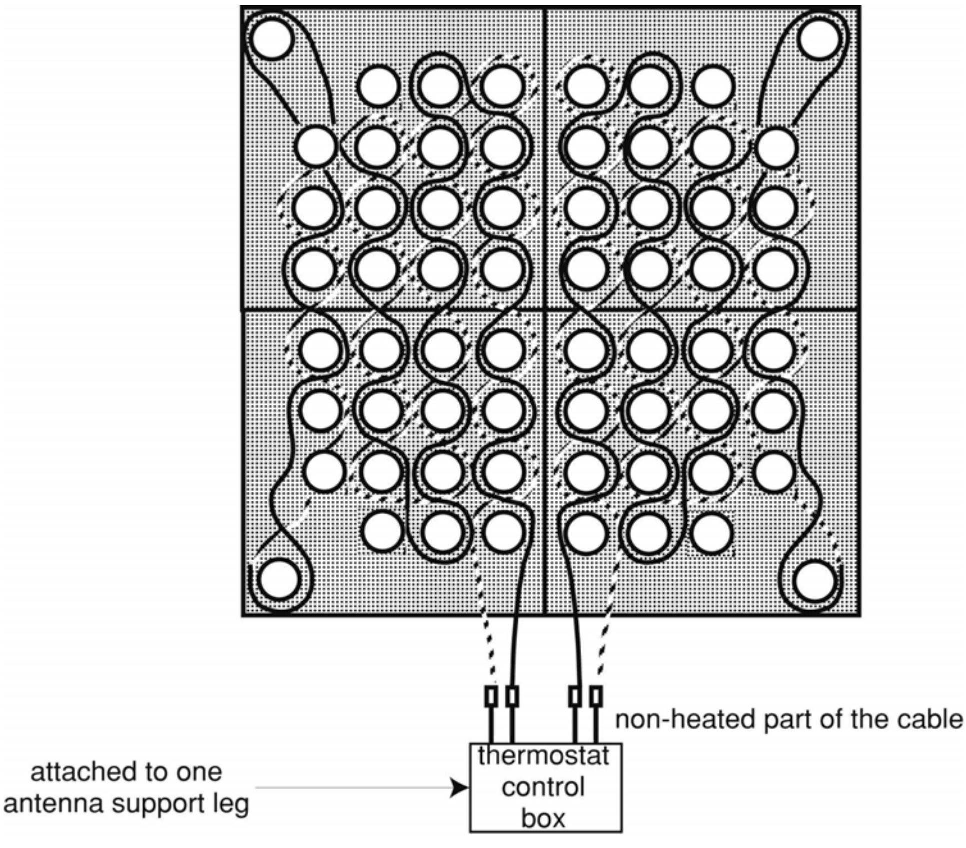


Figure II-E. Thread the heating wires between the transducers, underneath the horns. The thermostat control box must be oriented toward the center of the antenna.

The thermostat box is also connected to an external temperature sensor which has its own thermostat inside the box.
This one has two functions:

- it acts as a safety item in case the first thermostat (which measures the ambient

2.5 How to Place the PA5 Heating Cable(s) Con't

temperature inside the box) would become defective

- it also acts as a safety item if the temperature at the antenna level would become too high (this can happen if a user covers the antenna without turning off the heating!)

Fix the temperature sensor at any place on one of the heating cables using the special tape which is provided (attached in a small plastic bag to the temperature sensor).

2.6 How to Assemble the PA5 Acoustic Cuff

PA5

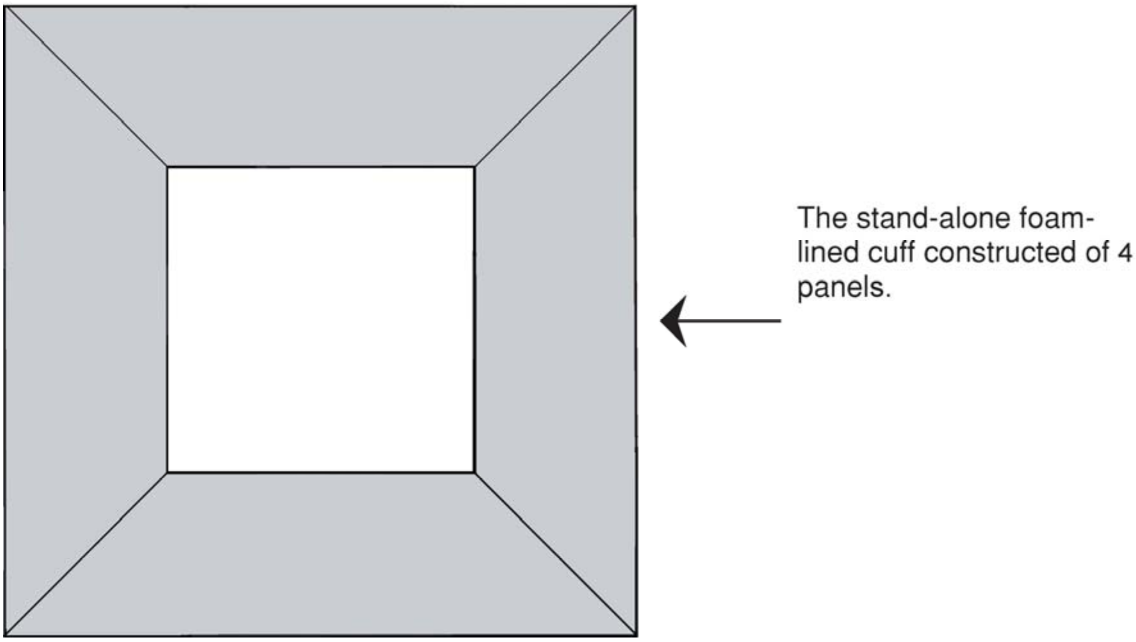


Figure II-F. Configuration for cuffing the PA5

2.7 How to Connect the Cables

For the PA5 install the black flat ribbon cable which interconnects the 4 antenna panels and connect it to the electronics / computer case which is already installed underneath one panel.

Walk the antenna heater power cable from the shelter to the antenna.

Connect the antenna heater power cable to the thermostat box. The thermostat box is factory installed underneath the PA-XS and the PA0 antenna while it comes separate with the PA5 and must be fixed to one of the 4 antenna supporting legs with the box towards the antenna inside.

2.8 How to Anchor the Antenna

Level the support stand, and then secure the antenna to the concrete pad (preferably 4 small individual pads) using four 3/8" concrete anchors per leg. Using a drill with a 3/8" (1/4" for PA0) masonry bit, drill holes through the feet of the support stand, and then insert the concrete anchors.

Alternate methods for anchoring a SODAR antenna directly to the ground include using rebar crimped on one end hammered through the holes in the feet of the support stand. Never use guy wires as they might create a "ringing" effect.

Do not install a flat platform underneath the antenna if on a slope. The platform ground combination with the air volume in between might act as a drum and cause "ringing".

Positioning the small concrete patio blocks supporting the Sodar(s) and RASS legs (avoid a large concrete base because of spurious reflections). Alternatively for short periods experiments fix through the legs bases holes large nails into the ground. Pour four concrete pads as indicated in the diagram below. Make sure the pads are level. Recheck and shim as necessary when placing the support stand on the pads. If unable to pour pads small patio blocks may be used.

2.8 How to Anchor the Antenna Con’t

The following diagrams show the legs positions for PA5 Sodar and for the RASS:

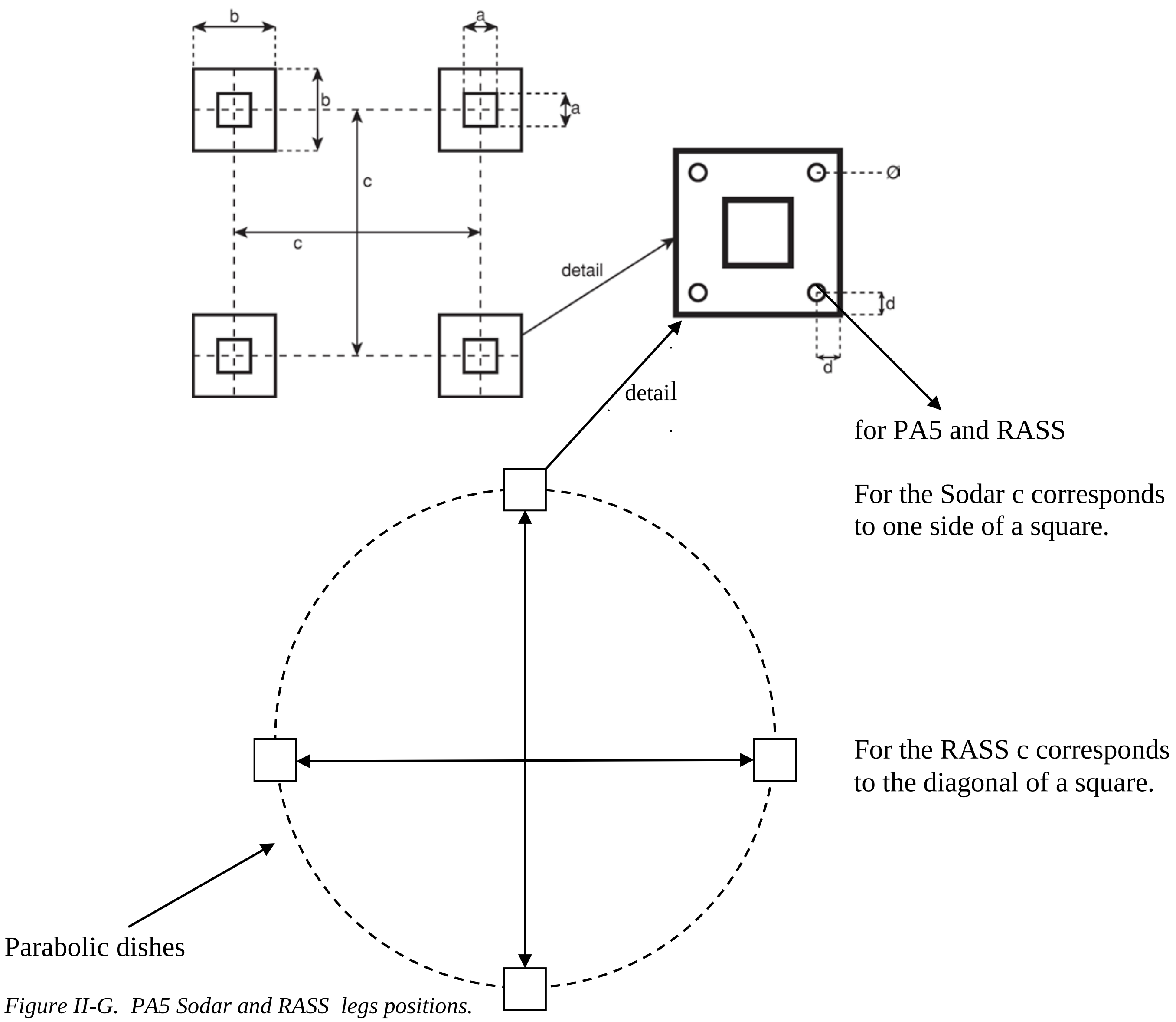


Figure II-G. PA5 Sodar and RASS legs positions.

with

	PA5	RASS
a	50	50
b	150	150
c	1770	1885
d	25	25
Ø	13	13

(dimensions in mm)

2.9 How to Assemble RASS

1. Assemble one RASS antenna by placing the parabolic reflector right-side up on the ground. Align a reinforcement plate and a mounting bracket with a set of three holes in the rim of the parabolic reflector, and secure with hardware. See Figure II-I. Repeat this step for the three other sets of holes in the reflector rim.

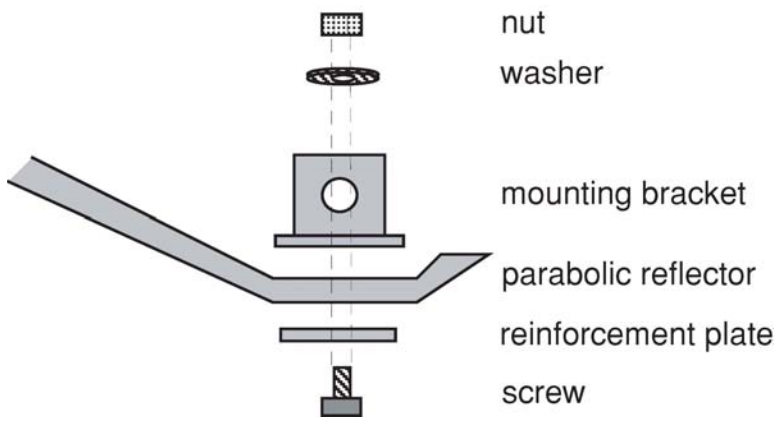


Figure II-H. Attaching the mounting bracket to the parabolic reflector.

2. Turn the parabolic reflector right-side down. Fit the leg onto the mounting bracket, and secure it with hardware. Repeat this step for the three other legs.

3. Repeat steps 1 and 2 for the other antenna.

4. Turn both antenna right-side up on their legs. Install the feeders bases. See Figure II-J. Install the white plastic tubes on top of the feeder bases. Slide the Type N connector end of each feed through the tube. See Figure II-K.

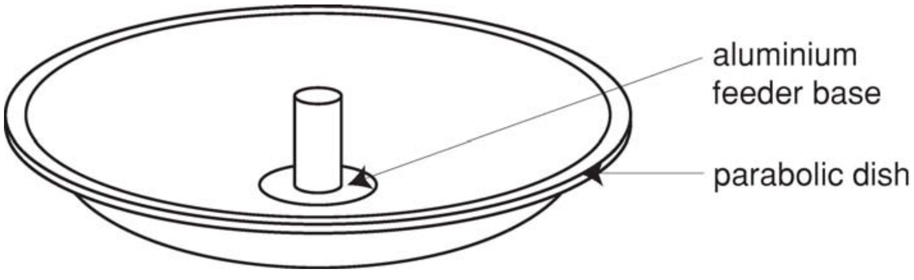


Figure II-I. Assembling the (RASS) feeders bases

2.9 How to Assemble RASS Con't

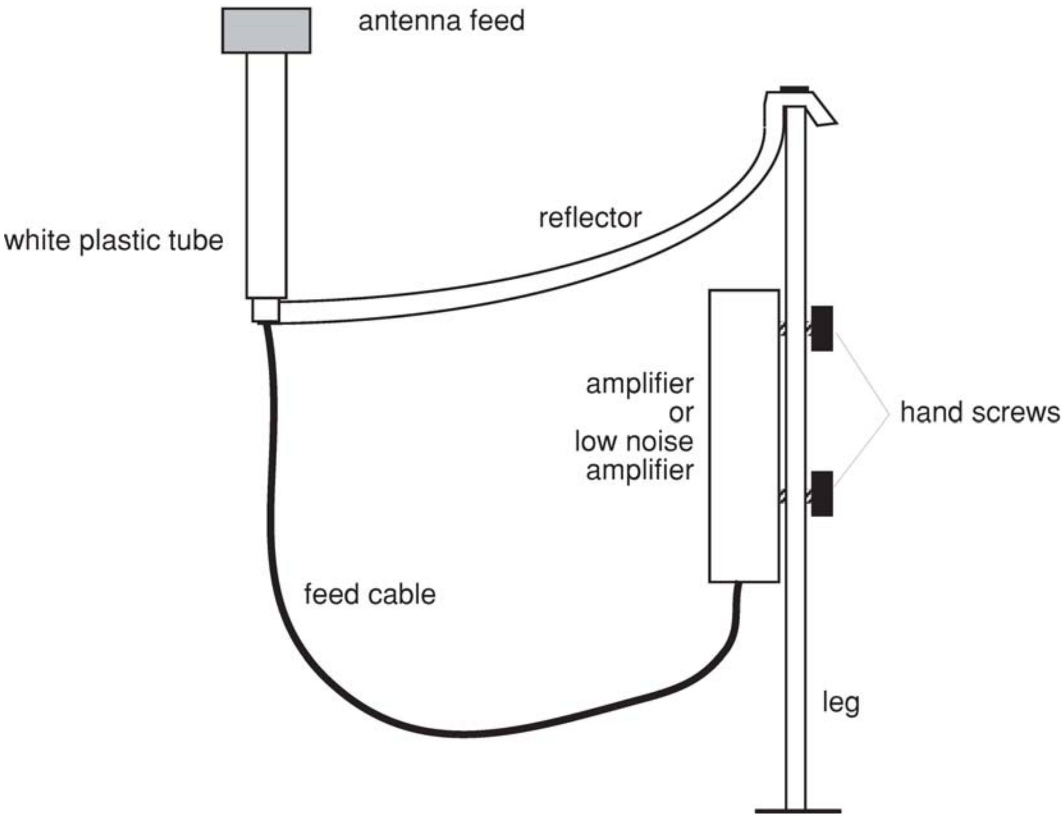


Figure II-J. Assembling the antenna feeds and amplifiers for RASS.

5. Install the vertical plates on each of the parabolic dishes. See Figure II-G. Position the assembly next to the sodar antenna, and rotate the parabolic dishes so that the vertical plates face each other. Using a bubble level and concrete pavers or wood blocks, level the antennas.

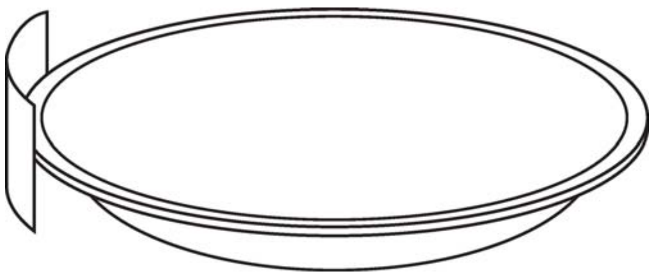


Figure II-K. Installing the anti-crosstalking vertical plates.

2.9 How to Assemble RASS Con’t

6. Attach the low noise amplifier (no heat sink) to the inside of the leg with the hand screws. Connect the antenna feed cable to the low noise amplifier. This defines the receive antenna. Do the same with the other antenna and the power amplifier (with heat sink). This defines the transmit antenna.

7. Using the Local Oscillator (LO) cable with BNC connectors, connect the receive antenna to the transmit antenna.

8. Connect the RASS power cable with 4-pin DIN connectors to the transmit antenna, and walk the power cable to the shelter. Connect the RASS signal cable with 3-pin DIN connectors to the receive antenna, and walk the RASS signal cable to the shelter. Keep the signal cable as for as possible from the power cable all along the way.

3.0 Operation

Contents:

3.1 How to Turn the SODAR On

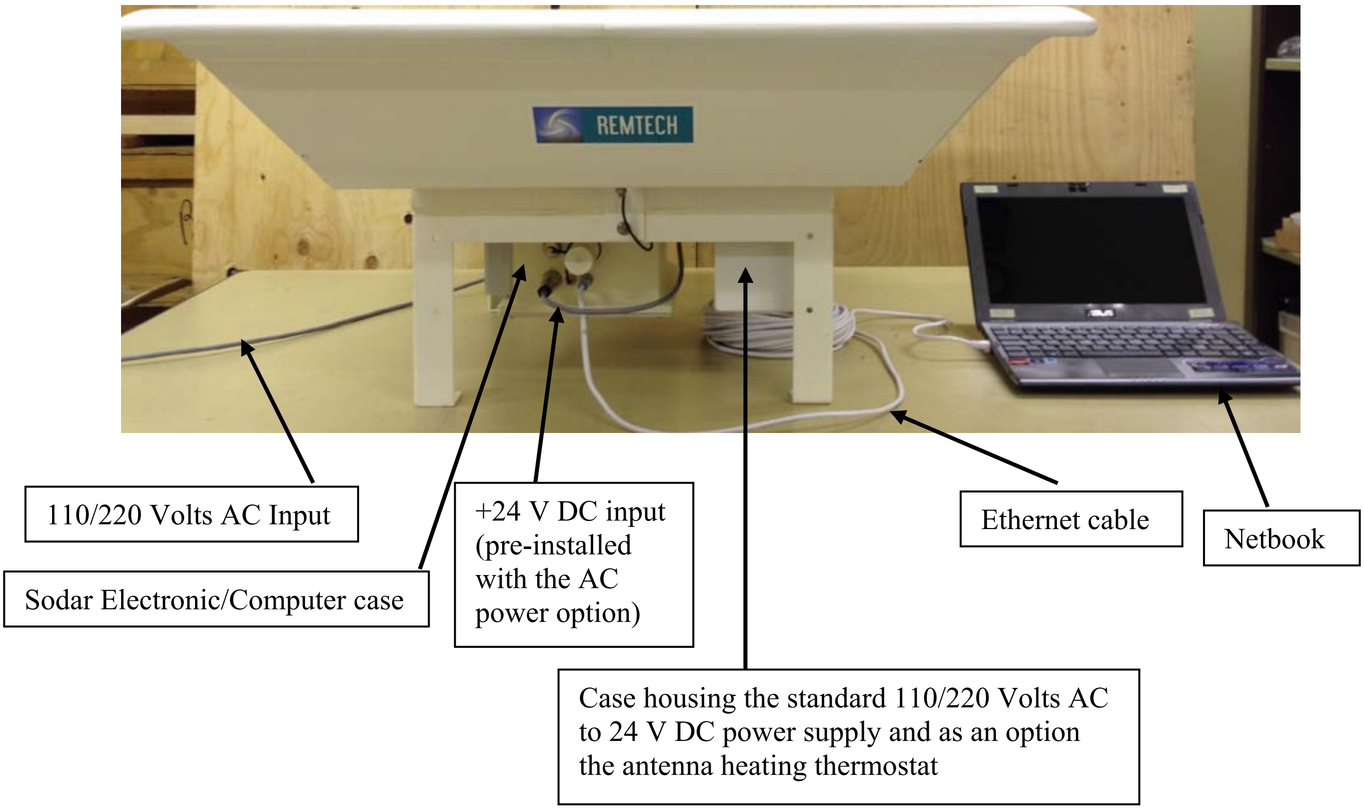
Since 2011 all our systems are delivered with a waterproof processing unit attached underneath the antenna. This means that you do not need any shelter or housing to run the unit. In addition a netbook is provided to control the Sodar (set up of the operating parameters, download of the data, time/date set up, updates...).
This netbook can communicate locally with the unit by ethernet or by WiFi. It does not need to stay on site for the Sodar to run and collect data. You can control and retrieve data remotely using our GPRS or Satellite Terminal options. The processing unit is powered with 24 V DC. This is provided by an AC/DC power supply box which is pre-installed underneath the antenna in case you have AC power available. If not we provide a DC/DC converter (As shown in the below Figure-1-). As the input can be any voltage between 10 V DC to 36 V DC while the output is a stabilized 24 V DC you can use :

One 12 V DC battery
Our cigarette lighter cable
Two batteries in series
One solar power system

Let us review the AC and DC available power in more details :

Figure -1-

3.1 How to Turn the SODAR On Con't



WARNING : ON ALL CONFIGURATION PICTURES, THE NETBOOK IN SHOWN NEAR THE ANTENNA. THIS IS ONLY FOR PRACTICAL REASONS TO BE ABLE TO SHOW ALL THE ELEMENTS IN THE SAME PICTURE WITH A REASONNABLE SIZE. IN REALITY YOU MUST USE THE FULL LENGTH OF THE ETHERNET CABLE TO BE AS FAR AS POSSIBLE FROM THE ANTENNA. WHEN ON SITE AND ESPECIALLY WHEN THE SYSTEM IS EMITTING SOUNDS, PLEASE ALWAYS USE EAR PROTECTION.

3.1 How to Turn the SODAR On Con't

A) AC Power Option

The AC/DC power supply is housed in a waterproof case which is fixed underneath the antenna aside the processing unit (see next picture). The cable connecting the power supply case 24 V DC output and the processing unit 24 V DC input is factory installed. Therefore you simply have to connect the AC power cable to the power supply case. Before doing that make sure that at the other end the cable is disconnected or if connected to a plug strip that the plug strip is switched off.

The Figure-2- below shows the 110/220 Volts AC power cable to use in order to feed the AC/DC power supply and heating system (optional) case.

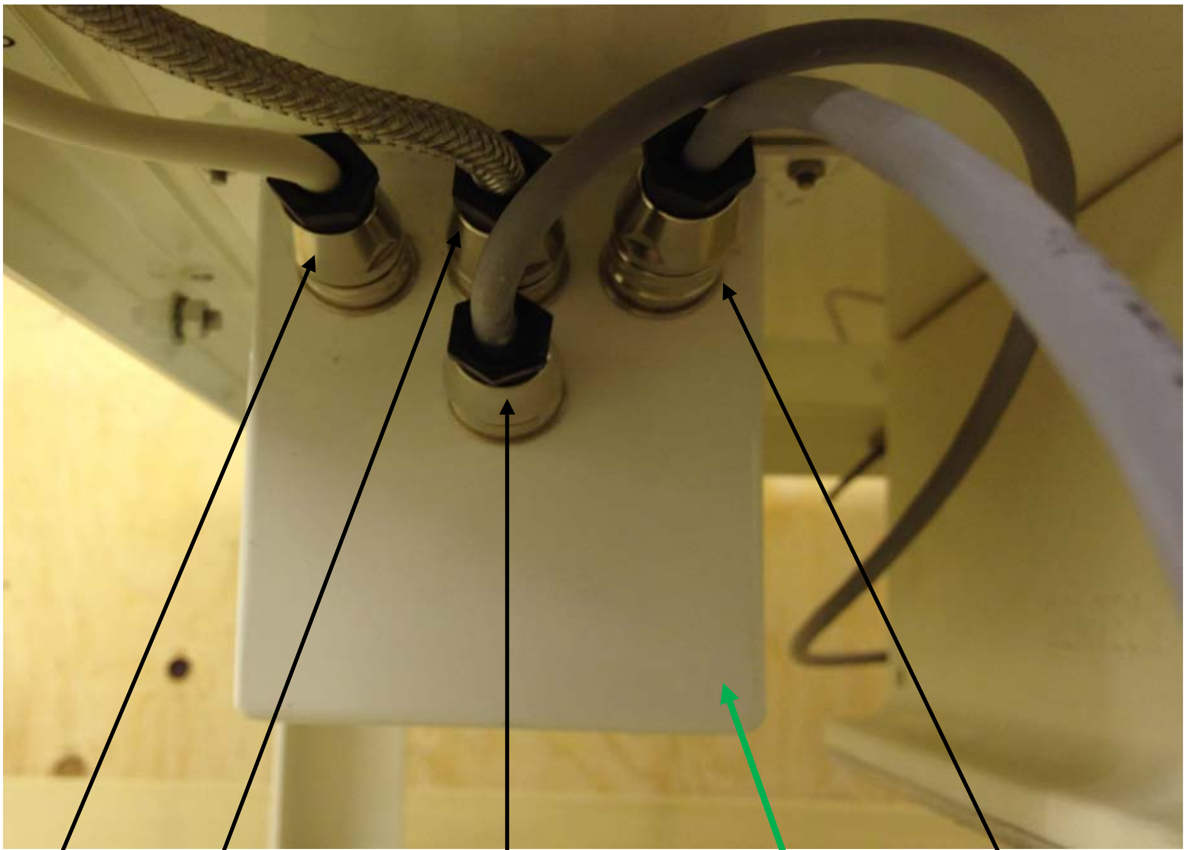
Figure -2-

Figure -3-

The cable shown on Figure-2- has to be connected to the 110/220 Volts AC power Input available on the AC/DC Power Supply (and optional Heating System) Box

3.1 How to Turn the SODAR On Con't

You will find on the below picture the connection to be made on the opposite side of the "AC/DC Power Supply (and optional Heating System) Box" using the upper right plug (the only one available). In case of no heating system installed the corresponding connectors are not present and they are replaced by plastic caps.



Heating probe line (prevents from overheating)

Heating cable power supply

These cables are pre-installed if the optional antenna heating has been ordered

+24 Volts DC output to power the electronic/computer case (pre-installed when the sodar is powered by an AC power input)

110/220 Volts AC power Input

Case housing the standard 110/220 V AC to 24 V DC power supply and as an option the antenna heating thermostat

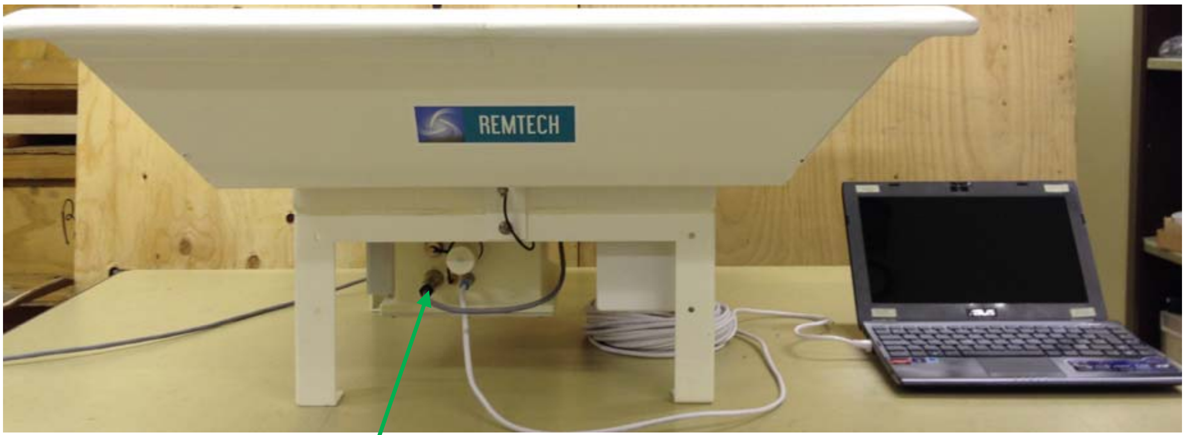
Make sure the netbook is fully charged before going on site.

From now do not stay too close to the antenna without ear protection as the system could start beeping (emitting sounds) any time.
Switch ON the netbook.

3.1 How to Turn the SODAR On Con't

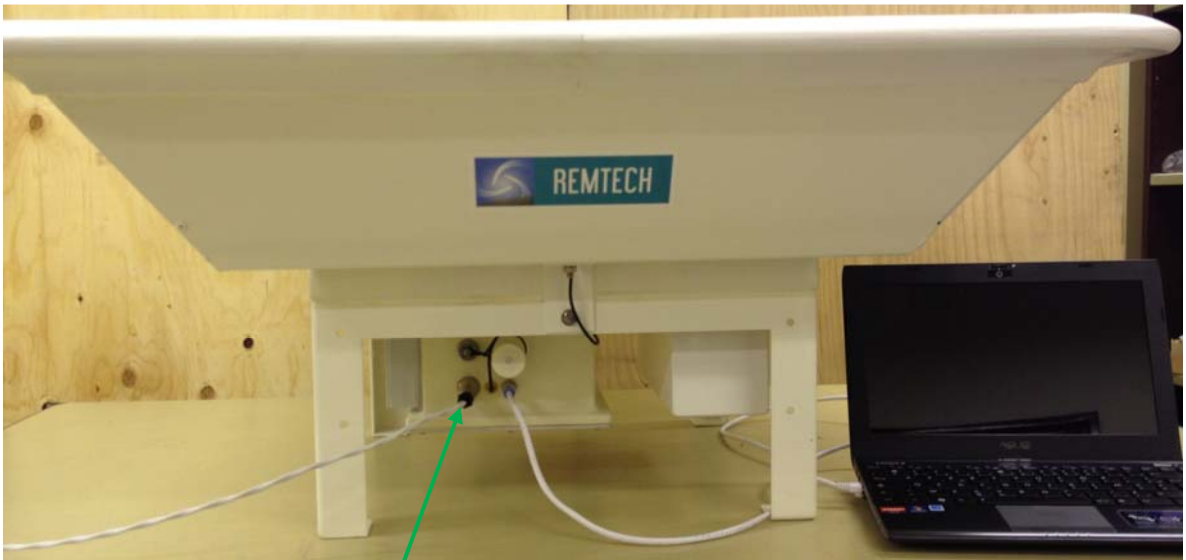
B) DC Power Option

Unplug the grey cable which comes from the AC/DC power supply (and optional heating system) box to the plastic electronic/computer case.



Grey cable to unplug

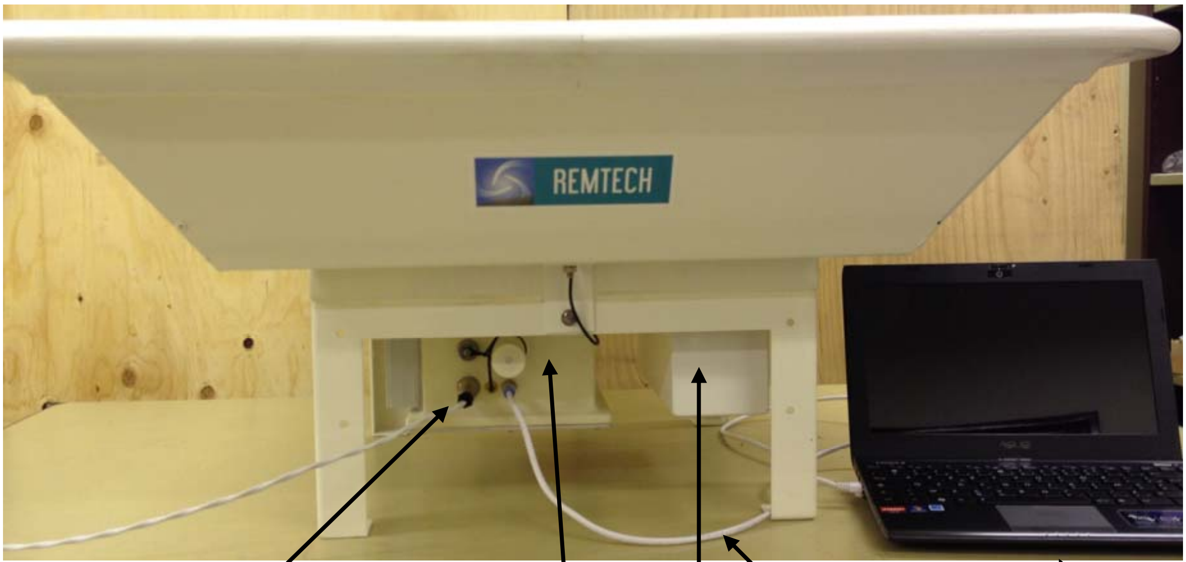
Replace this cable by the white cable coming from the DC/DC converter box.



White cable from the DC/DC converter box replacing the grey cable

3.1 How to Turn the SODAR On Con’t

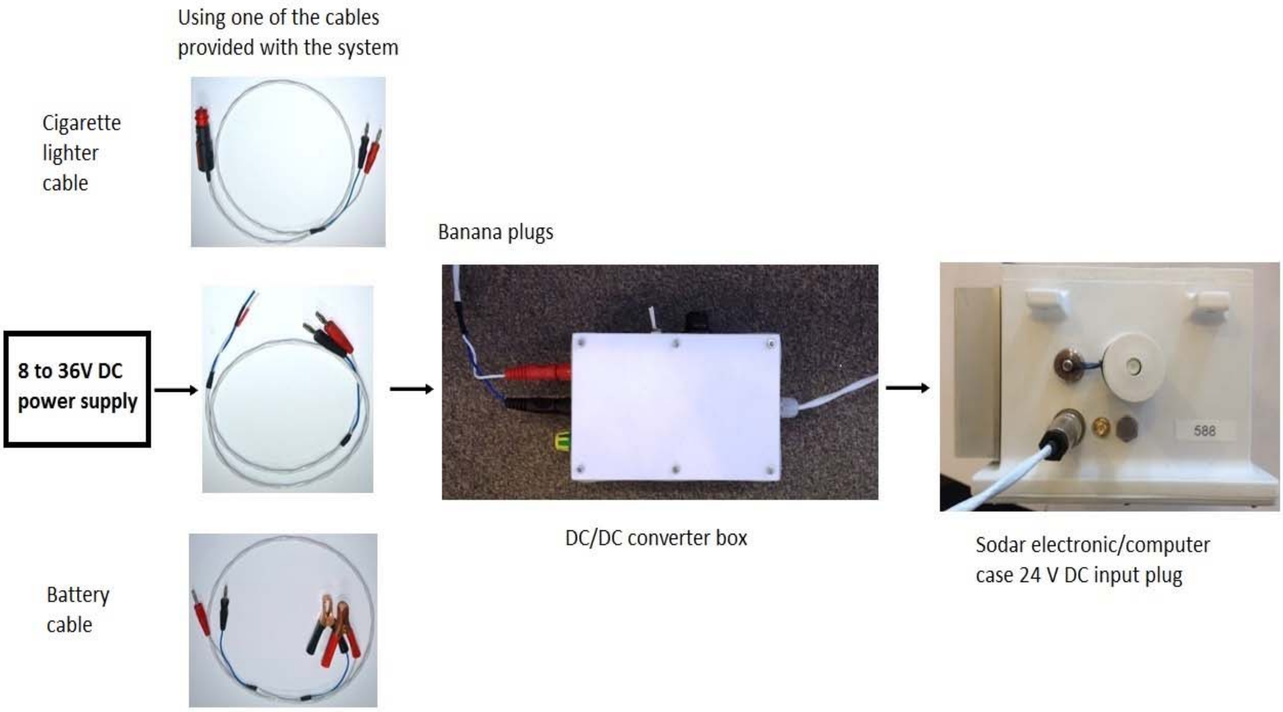
When powering up your Sodar system thanks to a DC source (+12V/+24V), you should have the following configuration :



The “DC INPUT” of the DC/DC converter can be :

- a +12V from a battery
- a +12V from a car cigarette lighter
- a +12V/+24V DC from a power supply provided by the customer (if the power is provided by solar panels we guarantee the Sodar performance only if the solar controller is a **ProStar-30 version PS-30** which is worldwide distributed.
- a +24V DC from the Remtech Solar Power System (in this case the DC/DC converter box is included inside the batteries charge controller enclosure). Please refer to Appendix 1' for installation.

3.1 How to Turn the SODAR On Con’t

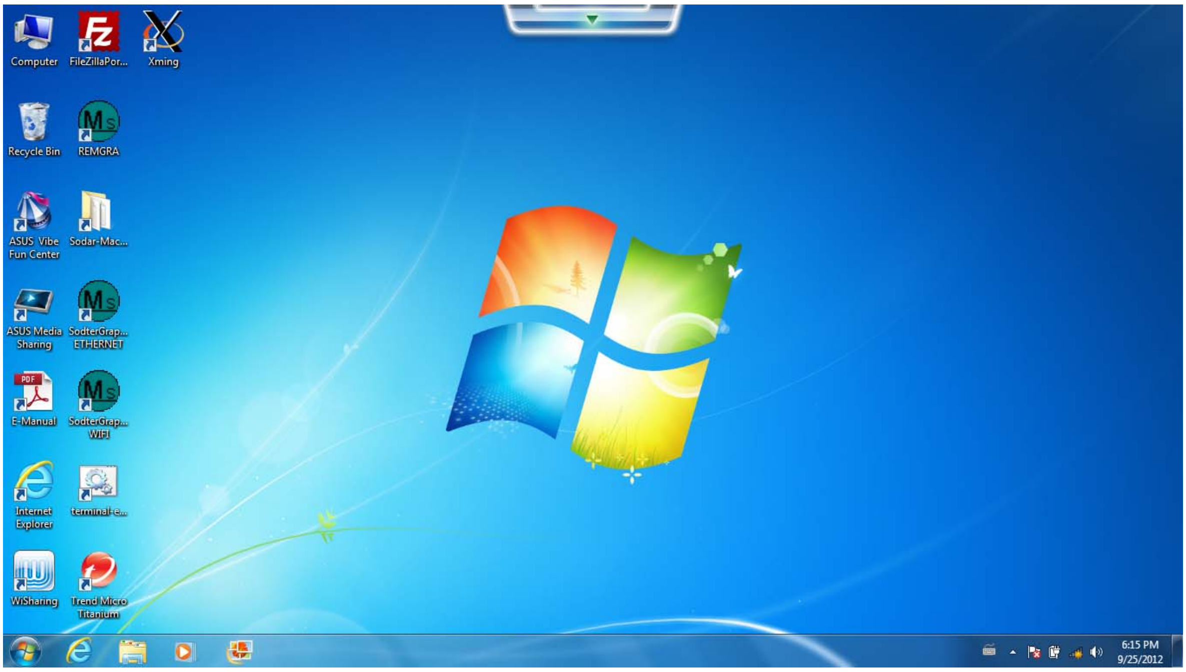


Make the connections as indicated in the above picture.

To start the system power on the “DC/DC converter” using the ON/OFF (1/0) switch.
From now do not stay too close to the antenna without ear protections as the system could start beeping (emitting sounds) at any time.
Switch ON the netbook.

3.2 How to connect to the Sodar

When the boot up process is completed (the SODAR starts to emit sounds) and the netbook is on and ready, you can get connected locally to the Sodar electronic case by ethernet or by WiFi.
After start-up the netbook screen should look like this :



A) Ethernet Connexion

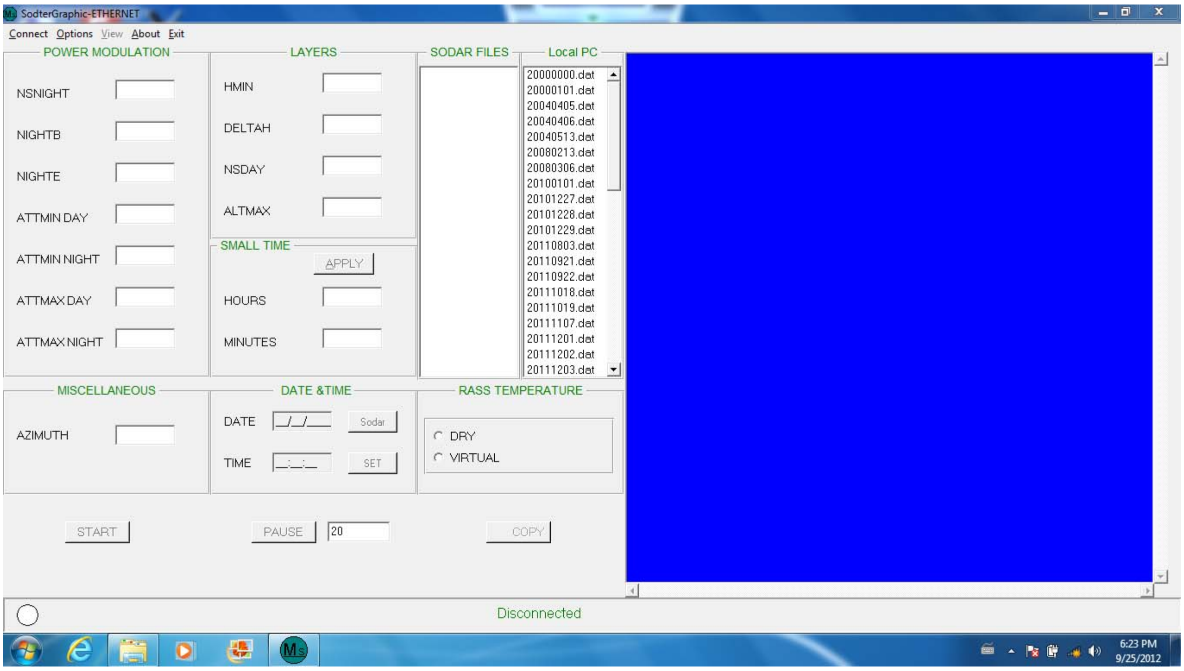
Assuming that the Ethernet cable is connected double click on the “Sodter Graphic ETHERNET” icon.

- Ethernet cable

- Sodar electronic/computer case

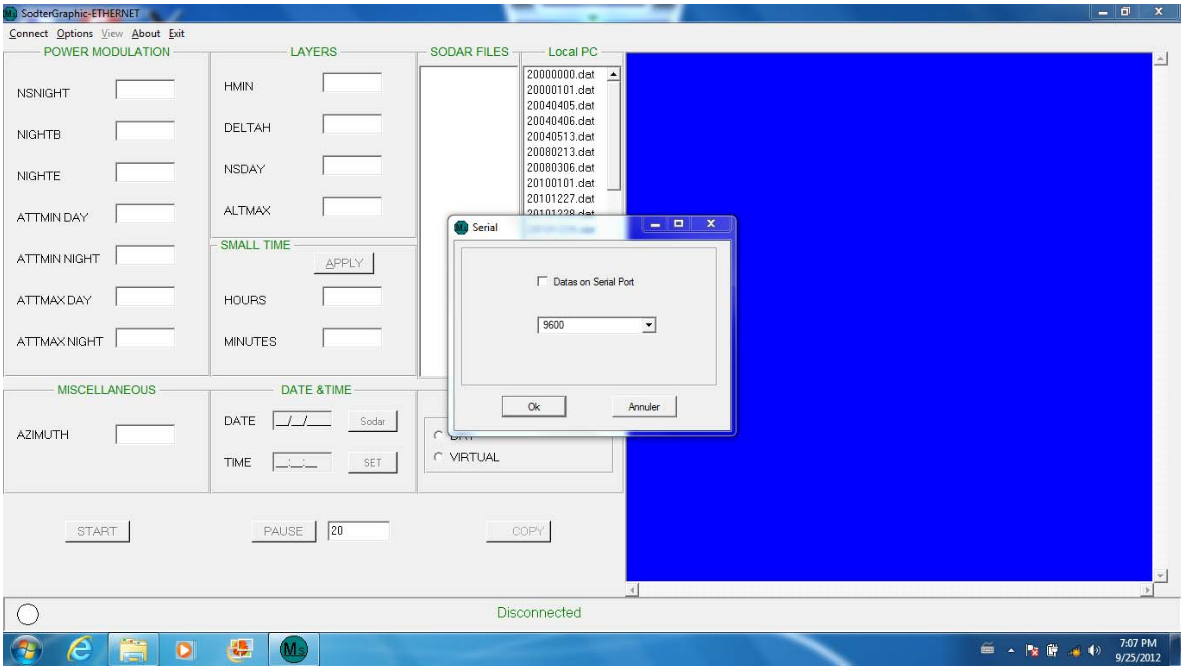
3.2 How to connect to the Sodar Con't

You should then get the following screen :



Before clicking on the "Connect" menu to establish the communication link, you can check the communication parameters by using the "Options" menu. You need to use it in case you do have a USB to COM port converter connected to the netbook. Click on "Options" and "Serial". This will give you the following screen :

3.2 How to connect to the Sodar Con't

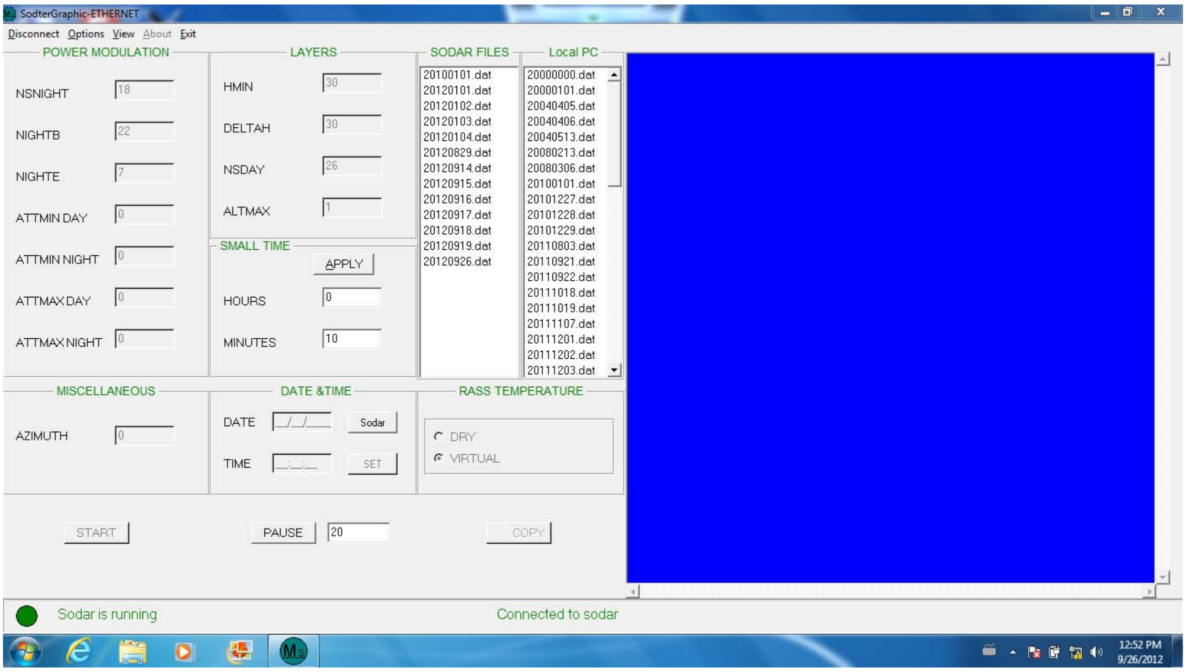


Here you can validate an automatic output of the data on a USB to COM port converter connected to the netbook and you can also select the baud rate. In case you are interested in this option please contact Remtech.

When connected to the Sodar unit you do not have access anymore to this "Options" menu.

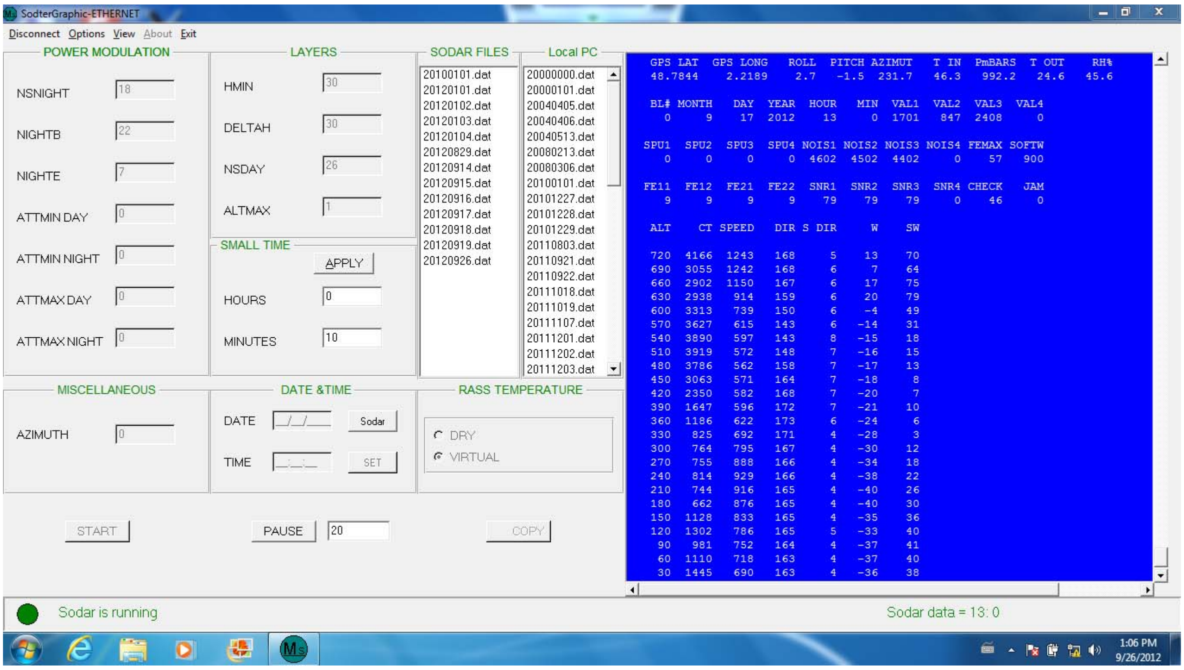
To get connected to the Sodar, click on the "Connect" menu. After a few seconds (this time can be up to around 40 seconds), you should get the following screen :

3.2 How to connect to the Sodar Con't



If this is the first time the system is running for the current day, you will have to wait for the next output to see the data automatically displayed on the blue window. In case the Sodar was already started earlier in the day roughly one minute after the connection, you will get the latest data block stored as show below :

3.2 How to connect to the Sodar Con’t



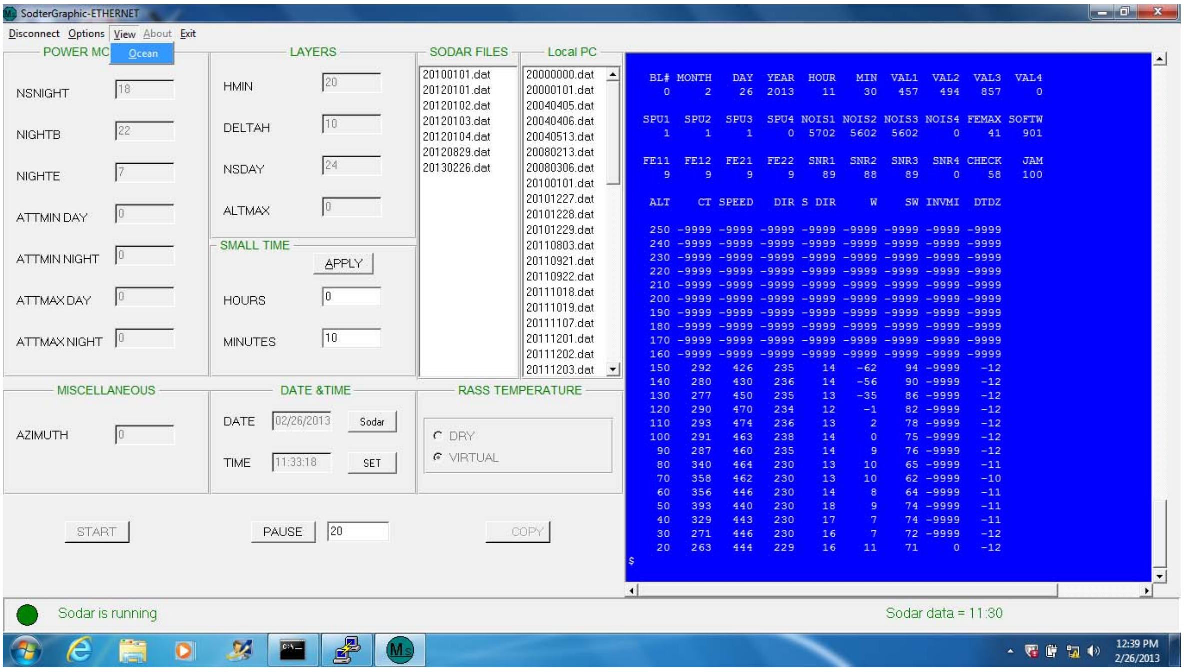
If you stay connected you will get the data automatically displayed after each averaging time.

You can of course set and modify the operating parameters (please refer to paragraph 3.4).
To save the data, refer to paragraph 3.5. page III-22

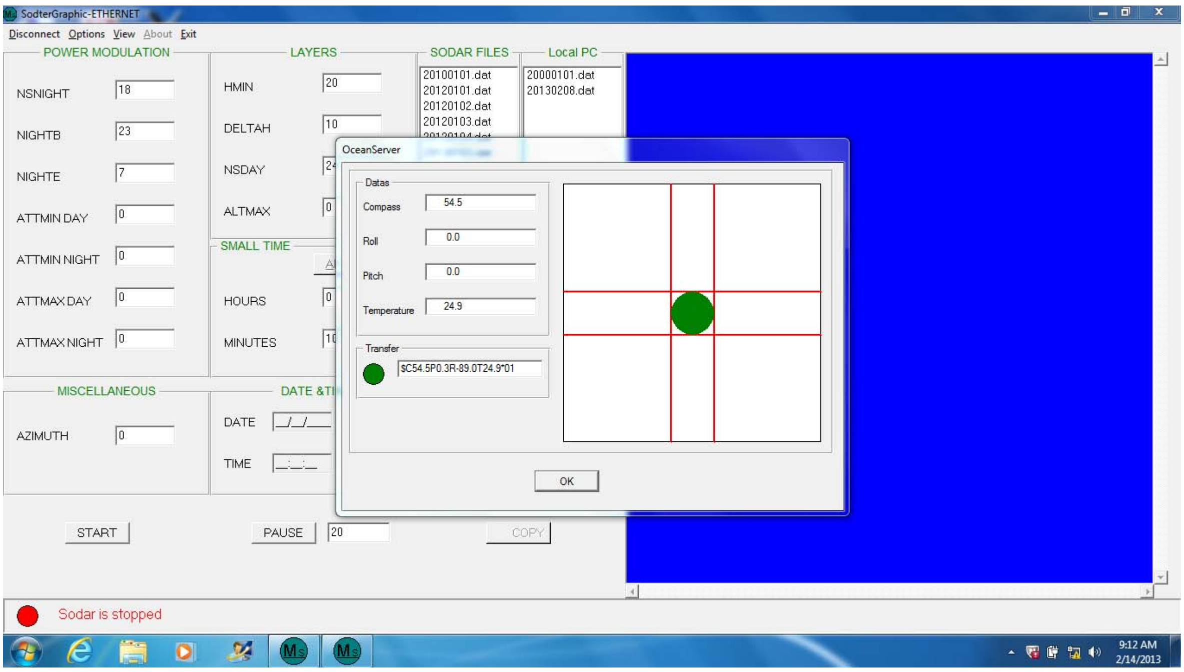
This new electronic case is equipped with some sensors : a 2D tilt sensor, a pressure and temperature sensor (giving the temperature inside the electronic box), a GPS sensor, a pressure sensor (which is also giving the temperature inside the electronic box) and a humidity sensor located at the end of the small tube to get the outside humidity. This sensor is also measuring the outside temperature. All those values are displayed with the standard data output at the end of each averaging period (see paragraph 3.5 page III-22).

The 2D tilt sensor is used to level the antenna in the horizontal position. The system has to be switched on and connected to the netbook thanks to the Ethernet link or thanks to the WiFi link.
Set the sodar system in the “PAUSE” mode (see paragraph 3.4 page III-16) for at least 200 minutes to be on the safe side and under SodterGraphic-Ethernet or under SodterGraphic-WiFi click on View and select Ocean as shown on the picture below :

3.2 How to connect to the Sodar Con't



Click on "Ocean". After a few seconds, you should get the next screen :



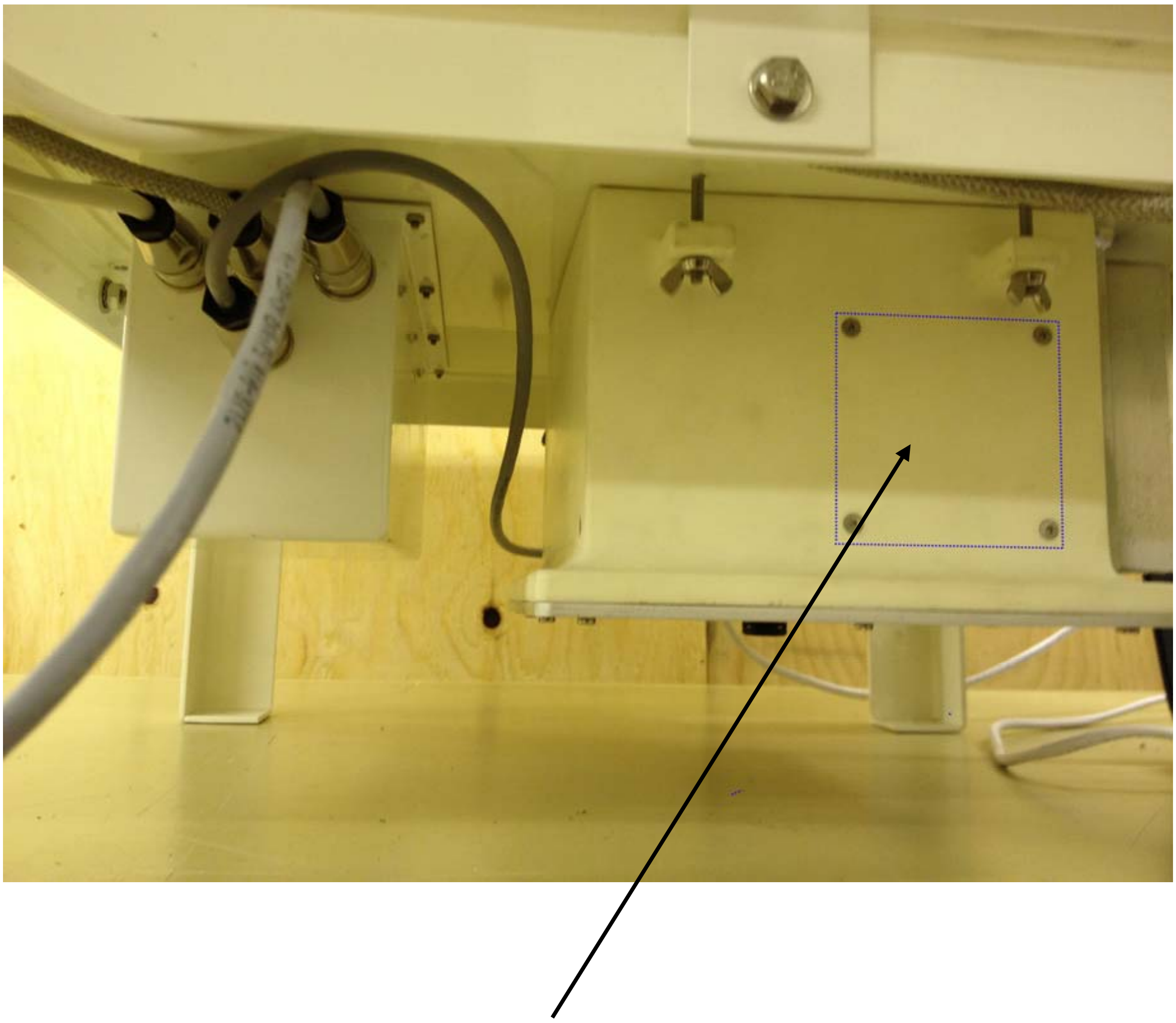
3.2 How to connect to the Sodar Con’t

If the system (at the antenna level) is perfectly horizontal the green disk should be in the middle of the red lines. If this is not the case adjust the horizontality of your system to have the green disk in
The middle of the red lines.

B) WiFi Connection

Should you like to be connected to the Sodar using the WiFi link, please note that we are using a directive antenna which is located on the opposite side of the plugs side (see next picture). So you need to be at a maximum of 50m from the system and looking as much as possible in direct line from the netbook to the WiFi antenna of the Sodar electronic box.

3.2 How to connect to the Sodar Con't



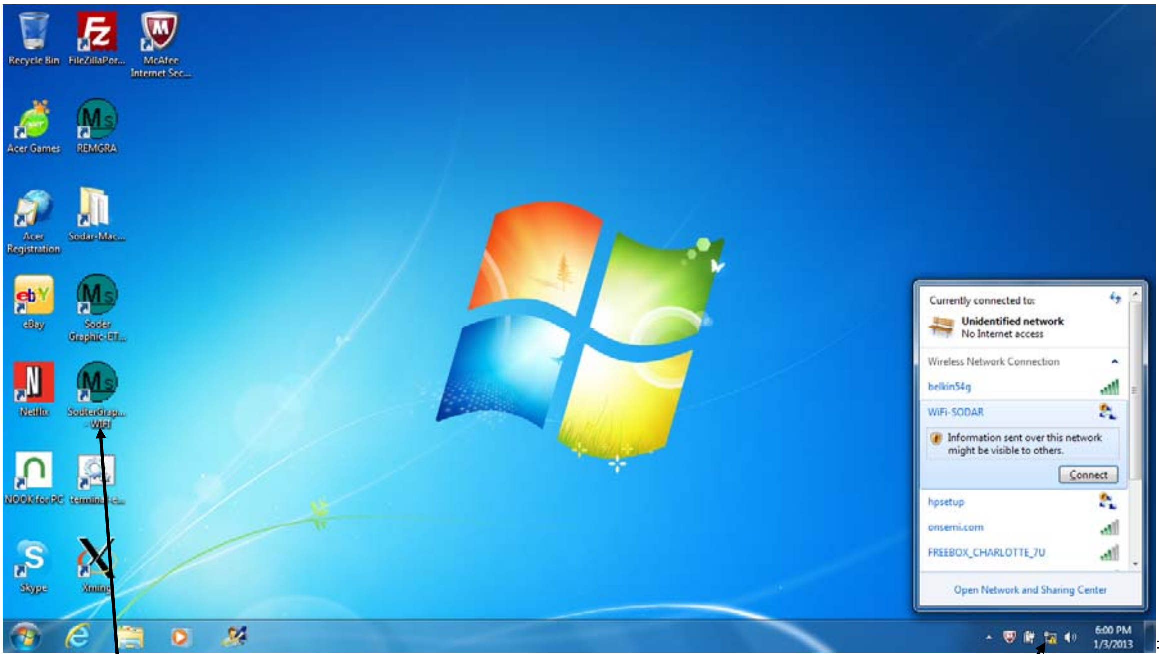
Location of the WiFi antenna (inside the electronic/computer case)

#

#

You first need to be connected to the "WiFi-SODAR" wireless network before starting the# SodterGraphic-WiFi software. In order to do so, you first need to click on the Wireless Network Connection icon, then on the "WiFi-SODAR" or "MT8105WM" network and finally on the "Connect" button as shown in the picture below :

3.2 How to connect to the Sodar Con't



#

#

SodterGraphic-WiFi Icon

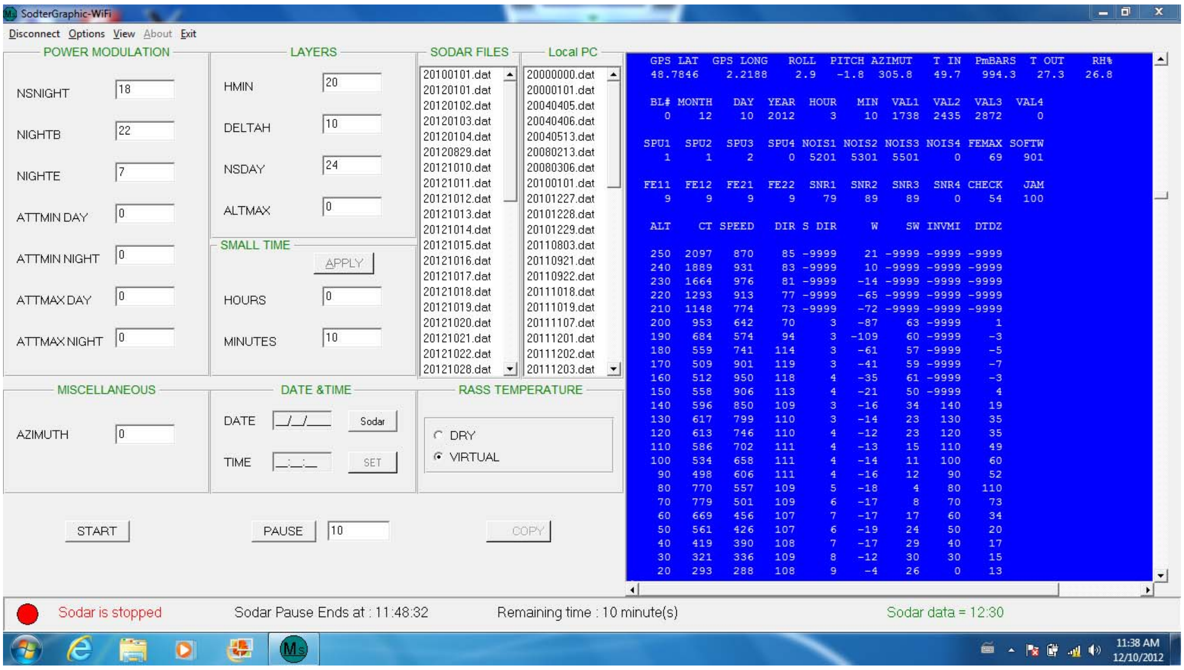
Wireless Network Connection Icon

To start the SodterGraphic-WiFi version software, double click on the "SodterGraphic WiFi" icon. Then the way of using the WiFi version of SodterGraphic is the same as the ETHERNET one.

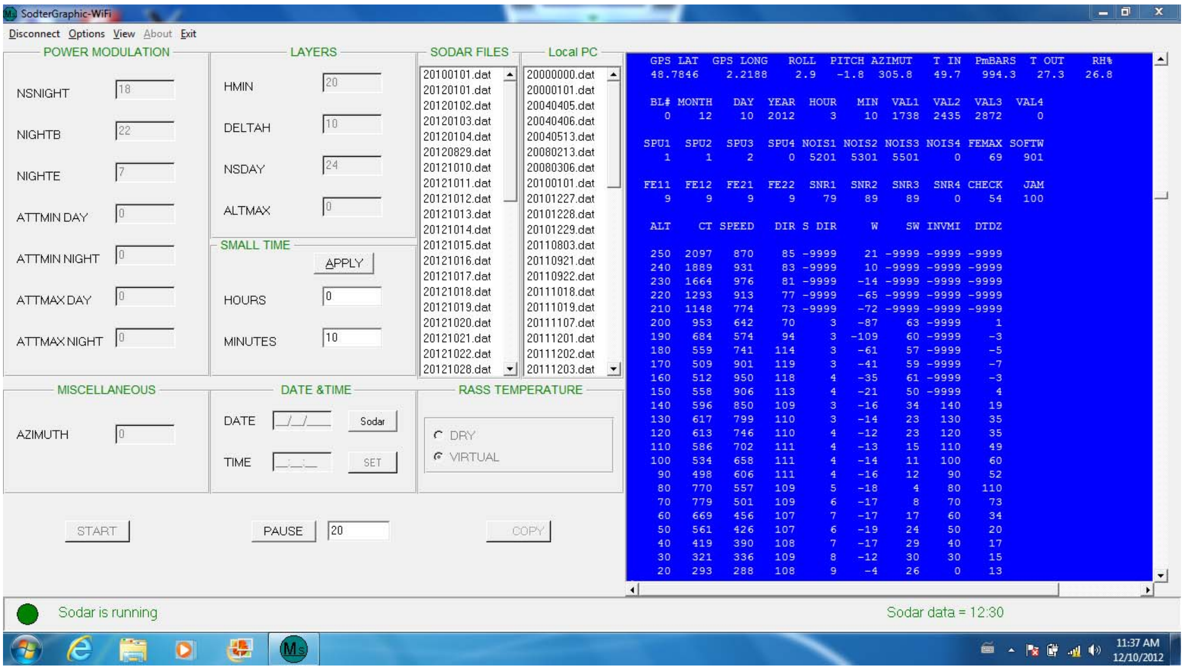
3.3 How to Turn the SODAR Off

1. You first need to PAUSE the Sodar using the SodterGraphic Ethernet or the SodterGraphic WiFi software. PAUSE it for at least 10 minutes.
   Do not shut off the system without first pausing it (Refer to paragraph 3.4 page III-16).

2. Once the "sodar is stopped" message appears (see picture below) you can switch off the Sodar with the small interface box switch (available with power DC option) or by unplugging/switching off the AC (110/220V) input depending on your power configuration.



3.4 How to set the Sodar parameters



Generally speaking if you want to change one or more measurement parameters you must :

- "PAUSE" the system (wait for "Sodar is stopped" message)
- each editing slot has it own comment which can be accessed by pointing the mouse in the corresponding slot.
- change the parameter(s)
- click on "START" button

To "PAUSE" the system, first select the number of minutes for the system to be paused (the default value is 20 minutes) and click on the "PAUSE" button. A small window will ask you a confirmation of your "PAUSE" command and after clicking on the "Yes" button you will have to wait for the message "Sodar is stopped" for the system to be in the "PAUSE" mode

3.4 How to set the Sodar parameters Con't

"SMALL TIME",

This is the averaging period in hours:minutes:seconds.

SMALL TIME is the only parameter which can also be changed without pausing the system: but once you have chosen a new averaging period (small time) you must click on the "APPLY" button

"DATE &TIME" and "TEMPERATURE" need a specific procedure:

"DATE & TIME" allows you to set the time. In order to do that you must pause the system, set date and time (put a time which is slightly ahead of the real time) and once your reference time reaches the preset time click on the "SET" button. Date is mm/dd/yyyy and time is hh:mn:ss.
For example, date 10/29/2009 and 17:32:00 means 29 October 2009 and 5.32 PM.
The time format is 24 hours a day.

"TEMPERATURE" is associated with the RASS if present. The RASS provides virtual temperature which by principle includes humidity influence and therefore allows numerical models to have only one equation on virtual temperature instead of handling two equations: one with temperature and one with humidity. However as radiosondes provide dry temperature some customers like to have the RASS provide dry temperature. This is achieved (as an approximation as the exact humidity profile is not provided) by pointing on "DRY" and then entering in the right slot to it the average humidity in per cents.

3.4 How to set the Sodar parameters Con't

Let us now review the different operating parameters.

<u>"LAYERS" family</u>

"HMIN" (integer number): Minimum altitude sampled in meters. Depending on the Sodar type and the operation mode ("ALTMAX" see below) the minimum value of "HMIN" varies. If it is set too low the Sodar will not start and you will get in SodterGraphic (Ethernet or WiFi) a first message : "Sodar is starting ..." and some seconds later the message : "Sodar is stopped". Increase HMIN until you get in the message "Sodar is running" (in green) after clicking on the "START" button.

Theoretically the minimum "HMIN" with the Sodar software V09.01 version reads (in meters)

	PA-XS	PA0	PA1/PA2	PA5
ALTMAX=0	10	13	20	45
ALTMAX=1	19	27	33	79

However these minimum altitudes can be reached only on very opened sites. See paragraph 3.5 the discussion regarding "FEMAX" value in the data block header.

"DELTAH" (integer number): layers thickness (in meters)

"NSDAY" (integer number): Number of layers measured

"ALTMAX": ALTMAX set to 0 corresponds to the finest vertical resolution, the lowest possible minimum altitude but with a medium maximum altitude range.
ALTMAX set to 1 corresponds to a long range option with sound pulses and FFT durations which are doubled when compared to the ALTMAX=0 mode. The vertical resolution is less and the minimum altitude has to be increased. The altitude range is increased by about 50%.

3.4 How to set the Sodar parameters Con't

"POWER MODULATION" Family

The power modulation parameters allow an output power reduction in order to minimize the acoustic nuisance to the surroundings. The optional "POWMOD" software must be installed. This software will, if possible reduce the output power as much as possible provided an altitude range target is reached and this differently during the day and during the night.
This range target during the day reads HMIN + (NSDAY-1) x DELTAH while it reads HMIN + (NSNIGHT-1) x DELTAH at night.
Therefore not only will the output power be (usually) reduced more during the night as the ambient acoustic noise is less than during the day but moreover by setting NSNIGHT to a smaller value than NSDAY one can achieve a very low emission mode (down to –20 dB* when compared to full power).

"NSNIGHT" (integer number): the software adapts the emitted power at night, so that the maximum altitude reached is determined by NSNIGHT instead of NSDAY

Note that "NSNIGHT does not change the output format (which is controlled by "NSDAY").

"NIGHTB" (integer number): Defines the beginning of the night period. NIGHTB is defined in 24 hours time, e.g 22 is 10 pm.

"NIGHTE" (integer number): Defines the end of the night period. NIGHTE is defined in 24 hours time, e.g. 7 is 7 am.

"ATTMIN DAY" (integer number): minimum attenuation, in db's, for day time operation (the day beginning at NIGHTE and ending at NIGHTB). Setting "ATTMIN DAY" to a value greater than 20 will stop the emission.

*The maximum attenuation is limited by software to 20 dB.

3.4 How to set the Sodar parameters Con't

"ATTMIN NIGHT" (integer number) : minimum attenuation, in db's, for night time operation (the night beginning at NIGHTB and ending at NIGHTE). Setting "ATTMIN NIGHT" to a value greater than 20 will stop the emission. This is a parameter which is offered even if the "POWMOD" optional software is not installed. In such a case the only parameters to be addressed are NIGHTB, NIGHTE and ATTMIN NIGHT.

"ATTMAX DAY" (integer number): maximum attenuation, in db's, for day time operation (the day beginning at NIGHTB and ending at NIGHTE). During the period of the day , this parameter corresponds to the maximum number of dB's that the Sodar will attenuate if it reachs the required range. The noise level will then be reduced. On the contrary if the required range is not reached the Sodar will automatically increase the dB's level up to ATTMIN DAY in order to get the required range. This is done for each output.

"ATTMAX NIGHT" (integer number): maximum attenuation, in db's, for night time operation (the night beginning at NIGHTB and ending at NIGHTE)
As for the day period the sodar will automatically minimize the power output between ATTMIN NIGHT and ATTMAX NIGHT.

As you know a sodar altitude range depends upon many factors, one – very important- being the ambient acoustic noise level. Of course you should not try to reach a very high altitude and then expect a significant power output reduction. After a few days of operation you should have come up with a satisfactory set of parameters.

For instance a first recommendation for a PA0 operating at a site with 55 dBA's ambient acoustic noise would be:

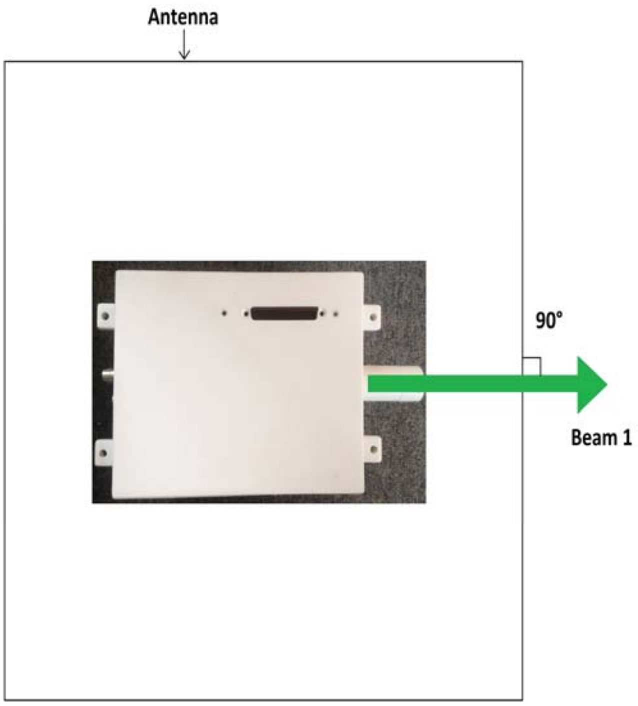
NIGHTB : 22
NIGHTE : 7
ATTMIN DAY : 5
ATTMAX DAY : 10
ATTMIN NIGHT : 10
ATTMAX NIGHT : 15
for an altitude range target of 500 meter AGL (in this case we have inferred NSNIGHT = NSDAY).

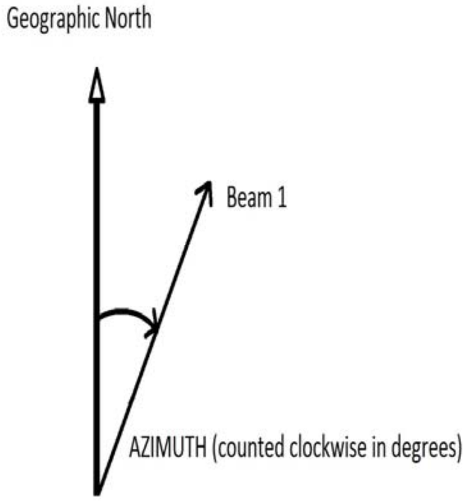
3.4 How to set the Sodar parameters Con’t

“MISCELLANEOUS” family:

“AZIMUT” (integer number): Angle in degrees between the geographical North and the axis of beam 1. It is counted clockwise.

Beam 1 vector is from the antenna going outside along the cylindrical part of the electronic case for PA-XS and PA0 Sodar’s. For the PA5 Sodar beam 1 is only indicated by a label.





3.5 How to Manage Data

Data are stored in ASCII format and one file is created every 24 hours on the flash memory of the electronics computer small case.

The name of the files is defined as follow :

yyyymmdd.dat

where : yyyy is the year
mm is the month
dd is the day

example : 20090830.dat includes all the data collected on August 30, 2009.

These data files appear in the "SODAR FILES" window under SodterGraphic (Ethernet or WiFi). They can be retreived on the netbook computer by clicking on one file and then on the "COPY" button. After some time the file will have been transferred on the hard disk of the netbook and its name will be displayed in the "Local PC" window. You can open this file (by double clicking on it), transfer it ...

All those data files are stored in the following directory :

Computer > Local Disk (C:) > Users > sodar > My Documents > Sodar-Machine

On the Desktop screen of the netbook, there is a "Sodar-Machine" shortcut to go directly to this directory

Description of a SODAR Data Block

The SODAR data block consists of two parts: the header and the measurements. Both parts appear in a column format, with the header on top and the measurements below the header. Both parts appear in a printout of data. An example data block is shown in the next figure.

The header contains four lines.

The first line of the header displays the values of the different sensors which are now available with this new electronic case design. It contains the GPS coordinates (GPS LAT and GPS LONG), the values of the 2D inclinometer (ROLL and PITCH) in degrees, ignore the compass reading (AZIMUT is presently entered manually, refer to page III-24), the temperature inside the electronic box (T IN) in Celsius degrees, the pressure (PmBARS) in millibars, The outside temperature (T OUT) in Celsius degrees and the relative humidity (RH%) in percentage.

3.5 How to Manage Data Con't

The second line of the header contains the block number (BL#), the date, (MONTH, DAY, and YEAR), the time (HOUR and MIN), and the number of validations for each beam (VAL1, VAL2, and VAL3). On average the validations should be a few hundred per beam.The values appear on the line directly beneath the header type.

The third line of the header begins with the normalized probabilities of false signals (SPU1, SPU2 and SPU3). If the SPU values average around 3 or less, everything is normal. If the SPU's have higher average values please check the quality of the grounding if you are running on AC power. High values can also be due to a jamming acoustic source such as a pump for instance.

The environmental noise values for each beam are indicated by NOIS1, NOIS2, and NOIS3 in dBA units when ignoring the two last digits (which is the number of dB's which have been cancelled by the noise subtraction technique). The performance of a Sodar highly depends on the ambient acoustic noise level. We recommend that this level would not exceed 65/70 dBA's for a PA-XS and a PA0 and 55/60 dBA's for a PA5. If the last digit for one beam exceeds 5 dB's the corresponding beam is very likely under the influence of a spurious noise source (typically such as an air conditioner, a pump, or even a fan from a sensor on top of a nearby meteorological tower because of the corresponding high elevation angle the antenna diagram is less efficient). Improving the situation is done by slightly re-orienting the antenna (keep in mind that there are 4 tilted beams perpendicular to the antenna sides) and/or by "baffling" the identified noise source.

The FEMAX value in CT units/10 corresponds to the maximum ground clutter for all tilted beams and whatever the distance to the obstacle. It should be less than 300.

SOFTW indicates the Sodar/RASS software version.

The fourth line of the header lists the number of frequencies emitted along the considered tilted beam: the titles FE stand for fixed echo and the indexes are 11 for the direct beam 1, 12 for its symmetrical, 21 for the direct beam 2 and 22 for its symmetrical. The system will automatically use up to 9 frequencies. If the number is less than 9 this means that the Sodar has automatically suppressed some emitted frequencies in order to minimize ground clutter for the corresponding beam. If this is the case you may re-orient the antenna in order to improve the situation.
Keep in mind that looking for the obstacle which may cause the ground clutter you must consider the direct tilted beam and its opposite as the Sodar uses 4 tilted beams (perpendicular to the antenna sides).

Ignoring the last digit for each, SNR 1, 2 and 3 stand for the average signal-to-noise ratios for beams (11,12), (21,22), 3.

3.5 How to Manage Data Con't

Their minimum value is 10 and they should stay below 15 on average. The last digit is in tens of % the total bandwidth with "standard" spectral characteristics. If it gets below 5 very often, please contact us (you may face electrical grounding problems for instance).

CHECK represents the noise (in dBA) which is measured by the reference antenna, which is made of the 4 transducers at the 4 corners of the antenna

The difference between NOIS 1, 2, and 3 on one side (ignoring the last digit) and CHECK on the other should remain roughly constant. If not, the directivity of the active antenna has degraded. In such case please contact us (it is very unlikely that the antenna itself would be the cause but most probably the phased array steering electronics.

JAM summarizes the status of the system as well as the online test results. The first digit is either 1 when the system operates at full power or 0 if the output power has been reduced using the corresponding parameters. The second digit is 1 if the operating mode is long range ("ALTMAX" parameter set to 1) or 0 for short range (and fine vertical resolution with "ALTMAX" set to 0).
The last 3 digits should be 100 unless very exceptional cases. This means that the pre-amplifiers and the analog filters before A/D conversion are nominal, that the A/D conversion is nominal and that the audio amplifiers are also nominal (in phase and amplitude). If this is not the case (most of the time the 3 last digits are not 100) please contact Remtech.

Before describing the different data outputs we would like to clarify the general approach of our software.

By principle of the spectral analysis method it is impossible to infer that all measurements are good even with our multi-frequency coding technique which not only allows much more power output without loosing vertical resolution but which most of all is a very powerful consensus technique. As a consequence at the end of the averaging period the data gathered include right and wrong data.

By "pausing" at intervals (the Sodar does not emit and goes through all the usual processing) we are able to characterize the false validations probability. With sophisticated algorithms which control more than 1,000 signal to noise ratio thresholds (one per beam and per frequency point) we are able to keep the false validation threshold under a predetermined level.

Then at the end of the averaging period by asking for a given total of validations (true and false) we can guarantee the precision of our outputs. If this is not the case the system automatically outputs –9999 at the corresponding altitude for the considered parameter.

Contrary to all other remote sensing systems we do not need any quality factor to be used after the fact. Our systems are fully real time.

3.5 How to Manage Data Con’t

The measurements appear below the header, in columns. The first column always contains the altitude of the measurements. A listing of all other possible measurement types appears below.

TITLE	PARAMETER DESCRIPTION	UNIT
ALT	Altitude	meters
CT	echo strength	no unit
SPEED	horizontal wind speed	cm/s
DIR	wind direction	degrees
S DIR	standard deviation of the wind direction	degrees
W	vertical wind speed	cm/s
SW	standard deviation of the vertical wind speed	cm/s
SU	standard deviation of the horizontal wind (along wind)	cm/s
SV	standard deviation of the horizontal wind (cross wind)	cm/s
INVMI	inversion and/or mixing height	meters
STAB	stability class	1 (F) stable 2(E) slight stable 3(D) neutral 4(C) slightly unstable 5 (B) unstable
ETAM	turbulent mechanical dissipation rate coefficient	cm^2s^{-5}
KZ	vertical turbulent eddy diffusion coefficient	m^2s^{-3}
DT/DZ	Lapse rate estimation	degrees Centigrade/km
ECH T	RASS echo	no unit
T	RASS temperature	°C x 10
ST	standard deviation of the RASS temperature	°C x 10
–9999	This value indicates that no measurement is available for that altitude.	no unit

3.5 How to Manage Data Con't

GPS LAT	GPS LONG	ROLL	PITCH	AZIMUT	T IN	PmBARS	T OUT	RH%
43.5400	1.2454	-0.2	-0.1	40.0	30.5	989.1	12.7	69.1

BL#	MONTH	DAY	YEAR	HOUR	MIN	VAL1	VAL2	VAL3	VAL4
7704	3	14	2018	8	45	448	558	400	0

SPU1	SPU2	SPU3	SPU4	NOIS1	NOIS2	NOIS3	NOIS4	FEMAX	SOFTW
1	2	0	0	4003	4003	4102	34	571	9064

FE11	FE12	FE21	FE22	SNR1	SNR2	SNR3	SNR4	CHECK	JAM
7	8	7	7	146	145	148	0	42	11100

ALT	CT	SPEED	DIR	W
700	1882	1574	128	1
680	1843	1553	128	1
660	1803	1526	128	1
640	1764	1502	128	0
620	1725	1477	128	1
600	1685	1452	128	2
580	1505	1427	128	2
560	901	1402	128	0
540	298	1377	127	-2
520	186	1352	127	0
500	219	1325	127	6
480	237	1300	127	5
460	220	1274	127	-4
440	203	1247	127	-13
420	214	1222	127	-14
400	231	1196	126	-11
380	268	1171	124	-11
360	342	1151	122	-18
340	415	1116	121	-24
320	469	1068	121	-22
300	520	1013	122	-18
280	592	938	122	-17
260	699	871	122	-18
240	805	824	123	-18
220	828	778	123	-16
200	842	736	124	-13
180	862	699	126	-12
160	889	643	128	-13
140	916	578	130	-14
120	910	525	131	-14
100	903	490	133	-13
80	1013	446	134	-12
60	1249	386	130	-13
40	1486	331	126	-13

An example of a PA0 SODAR data block.

3.5 How to Manage Data Con't

Saving/visualizing the data files

As explained at the beginning of this paragraph, thanks to SodterGraphic (Ethernet or WiFi), the data files can be easily saved on the netbook in the Sodter-Machine directory. Then to save them on a USB flash memory key, you just need to use the Windows 7 functionnalities to copy the files from the Sodter-Machine directory to your USB key.
To visualize a data file, open the SodterGraphic (Ethernet or WiFi) software and in the "Local PC" window double click on the file you want to look at.

3.6 How to Setup a Network Connection

A) GPRS CONNECTION

To get the GPRS manual please consult us.

B) SATELLITE CONNECTION

To get the SATELLITE CONNECTION manual please consult us.

3.7 How to Install an Update

The way to install any update you will get from REMTECH is the following :

You will receive an e-mail including a link for you to download the file that will execute the update.

- Download the file.

- Copy it on a USB memory key.

- Have the system switched on and in the "PAUSE" mode (the ethernet cable has to be installed).

- Insert the USB key in one available slot of the netbook.

- Double click on the file located on the USB key and follow the instructions displayed on the screen.