HVSR data acquisition unit GEMINI-2

USER
MANUAL

_____

TABLE OF CONTENTS pg.2

Description

Gemini is an HVSR data acquisition unit: a single waterproof container holding a triaxial geophone with resonant frequency 2Hz (carefully mechanically and electrically coupled) and a specially designed 24-bit real data acquisition unit.

Gemini, connected to a computer via USB interface, allows for the saving and later data analysis directly from your computer by means of special supplied software.

The three internal geophones are positioned according to a Cartesian axes triaxial, taking on the convention described in Sesame Projectguidelines:

- Z axis = vertical geophone = Up-Down direction
- X axis = horizontal geophone = East-West direction
- Y axis = horizontal geophone = North-South direction

The label on the Gemini container contains information for correct positioning. The triaxial also needs to be levelled before acquisition, an operation which is facilitated by the aid of a spirit level mounted on the instrument body. Levelling operations on rigid ground are possible by mounting the supplied adjustable feet on the triaxial. To use on the ground, use with spikes.

Features of delivery

You have just received a carrying case containing:
- 1 Gemini triaxial
- 3 ground spikes
- 3 adjustable feet (for use on asphalt or rigid supports/materials)
- 1 USB cable for computer connection
- 1 USB key with manual, management software and technical documentation

A   B   C

The images above refer to the detail of supplied interchangeable supports, which can simply be screwed onto the Gemini container base. It is advisable to use the adjustable feet (photo B) to rest and level the Gemini on asphalt or any rigid support, turning the two ferrules of each foot to adjust the length and suitably level the triaxial. For use on ground, mount the spikes (photo C) and level manually, with delicate and progressive pressure on the triaxial which is resting on the ground.

Precautions for transport

Gemini contains high electric-mechanical characteristic sensors which can be seriously damaged in the event of improper use or impact of various kinds. Handle equipment with care, following the instructions supplied in this manual. Please note that Gemini is equipped with an <u>automatic blocking device on mobile geophone equipment which deactivates only when Gemini is connected to a computer</u> and therefore powered by said computer via USB port. This allows for safe transport of equipment in its carrying case when it is not in use.
When Gemini is connected to a computer, avoid any type of movement, impact or resting/dropping of weight on it (service under warranty will not be recognised in the event of mechanical damage to sensors).

Preliminary operations

Before using the Gemini, install application software on a computer (notebook or tablet computer are also OK, as long as they are equipped with Windows operating system).

The necessary software installation programme can be found on the USB key received with supply. To proceed, launch the programme and respond positively to any questions asked and then click on the installation button.
Drivers for proper USB device operation will also be automatically installed together with application software.

5. Product use

To use the application software, launch the programme from the icon created on the desktop. At first use, you may need to set your preferred user language by pressing the relative key.

4
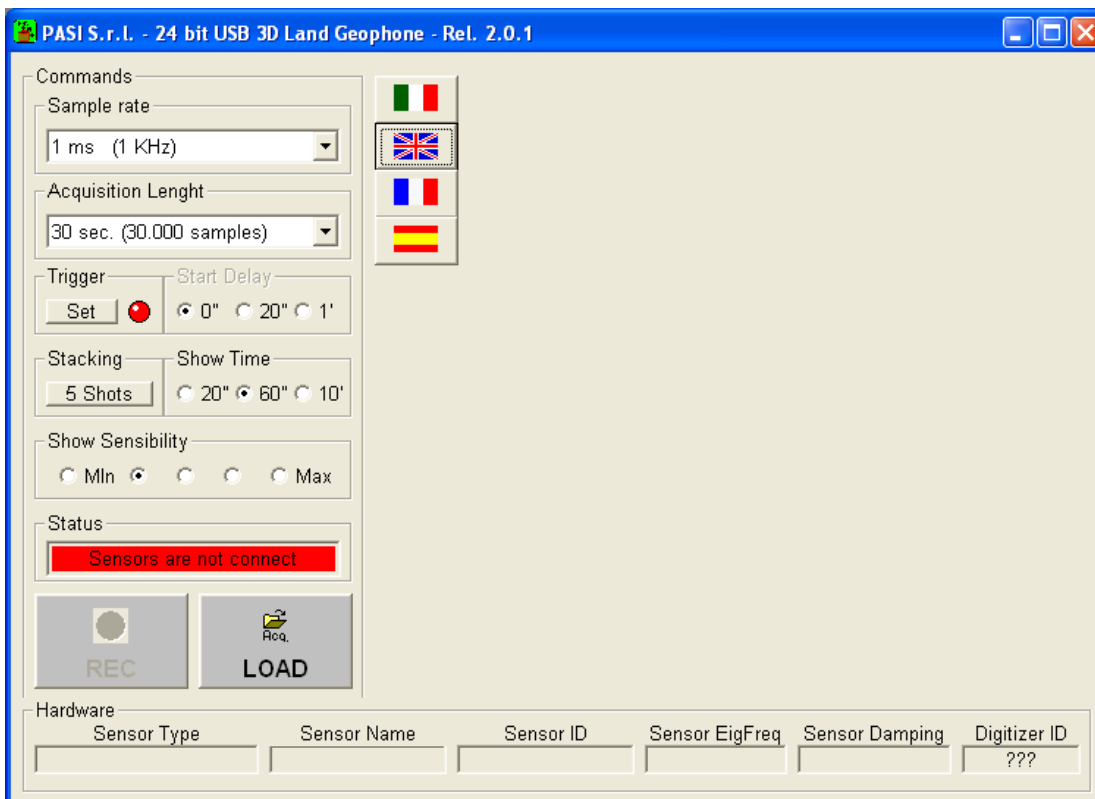
To connect Gemini to the computer, connect it with the supplied cable, inserting without forcing and then turning the ferrule clockwise until it is completely screwed on.
After having fastened the cable, connect it to a USB port on the computer. (**CAUTION: starting from this phase, the <u>mobile geophone equipment blocking device deactivates!!!).</u>** The software will automatically recognise the instrument and will display the hardware parameters (12) and the signals in real time (11).
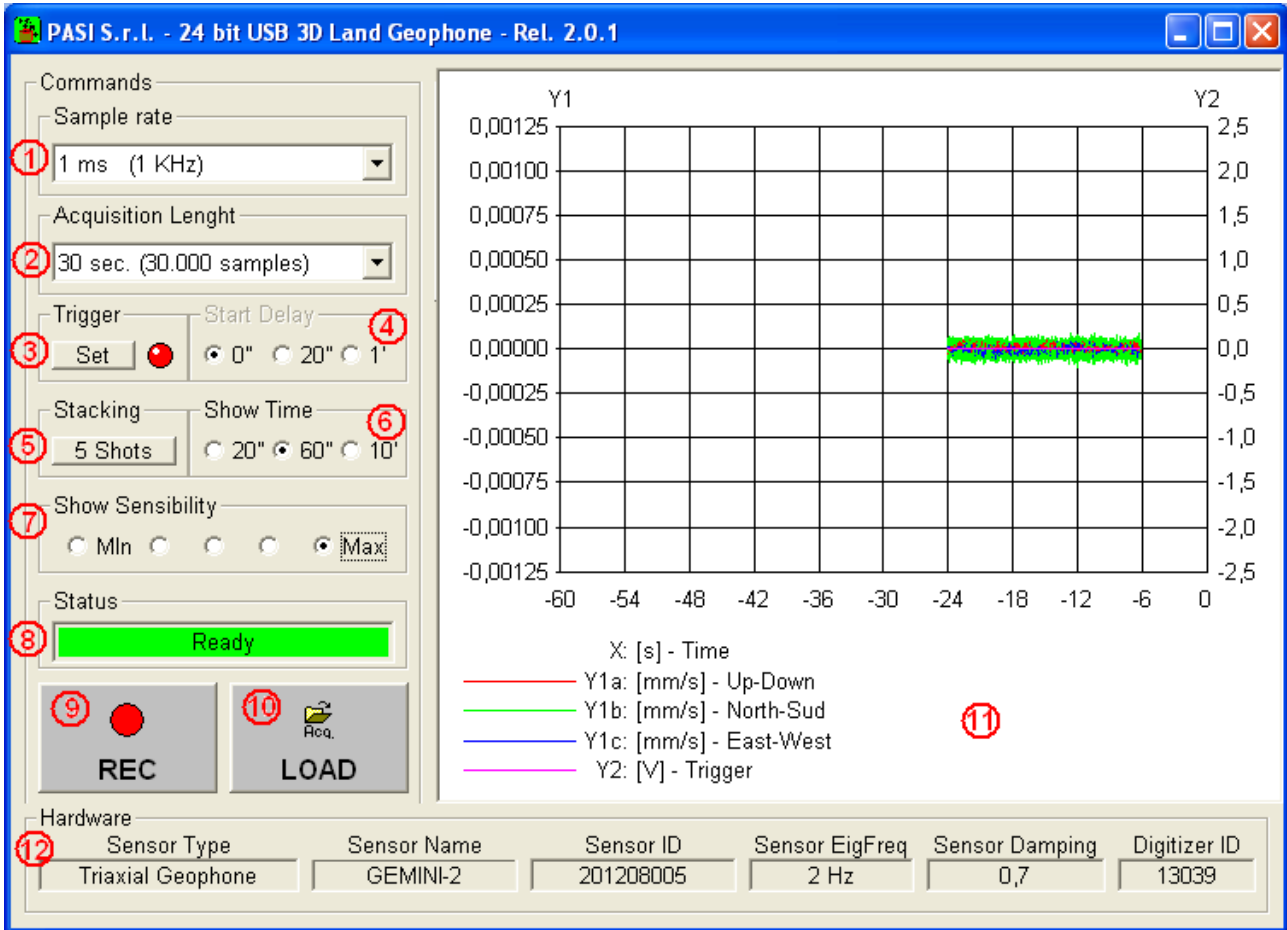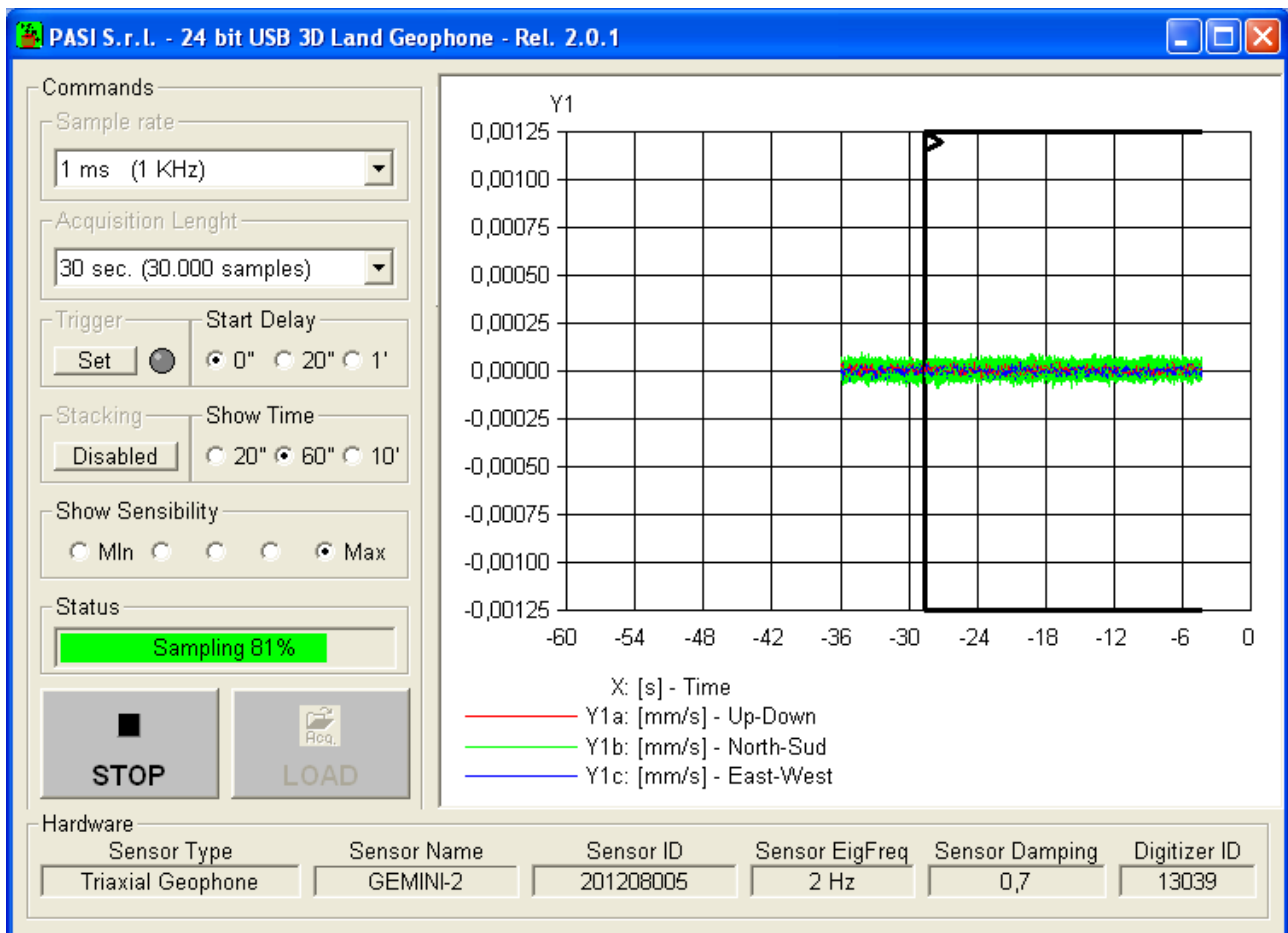

5.1.Acquisition:

Set the following parameters to start acquisition:

1. Sampling intervals: indicate the time that should elapse between a simultaneous sampling of the three signals and the subsequent sampling. This will also be expressed as reciprocal frequency.
2. Acquisition duration: the maximum duration of acquisition, after which acquisition will stop automatically. The number of samples to be acquired will also be indicated (which depends on sampling interval in addition to acquisition duration).
3. Trigger Event: the condition which must take place first for the beginning of sampling.
4. Delay : if a start delay time value is indicated, acquisition will not start right when the command is given, but will wait for the specified time in order to give the user time to move away.
5. "Stacking" acquisition number: each final acquisition will be determined by the average of a number that can be set by single acquisitions.

6. Displayed time (time scale): corresponds to the X-axis on the graph displayed in real time. It is a compromise between display quality and the quantity of signal displayed. Modification of this parameter will not in any way alter acquired data.
7. Display sensitivity (amplitude range scales): corresponds to the Y-axis on the displayed graph. Modification of this parameter will not in any way alter acquired data.
8. Status: indicates acquisition system status.
9. Acquisition start button
10. Previously acquired data file loading button
11. Real time acquired signal display
12. Hardware parameters

Press this button (7) to start acquisition. Press the same button again to stop acquisition at any time (or rather before the time set as acquisition duration).

5.2 Acquisition Display:

Once acquisition has been completed (or after having loaded a previously acquired data file), the system passes automatically to the acquired signal display:
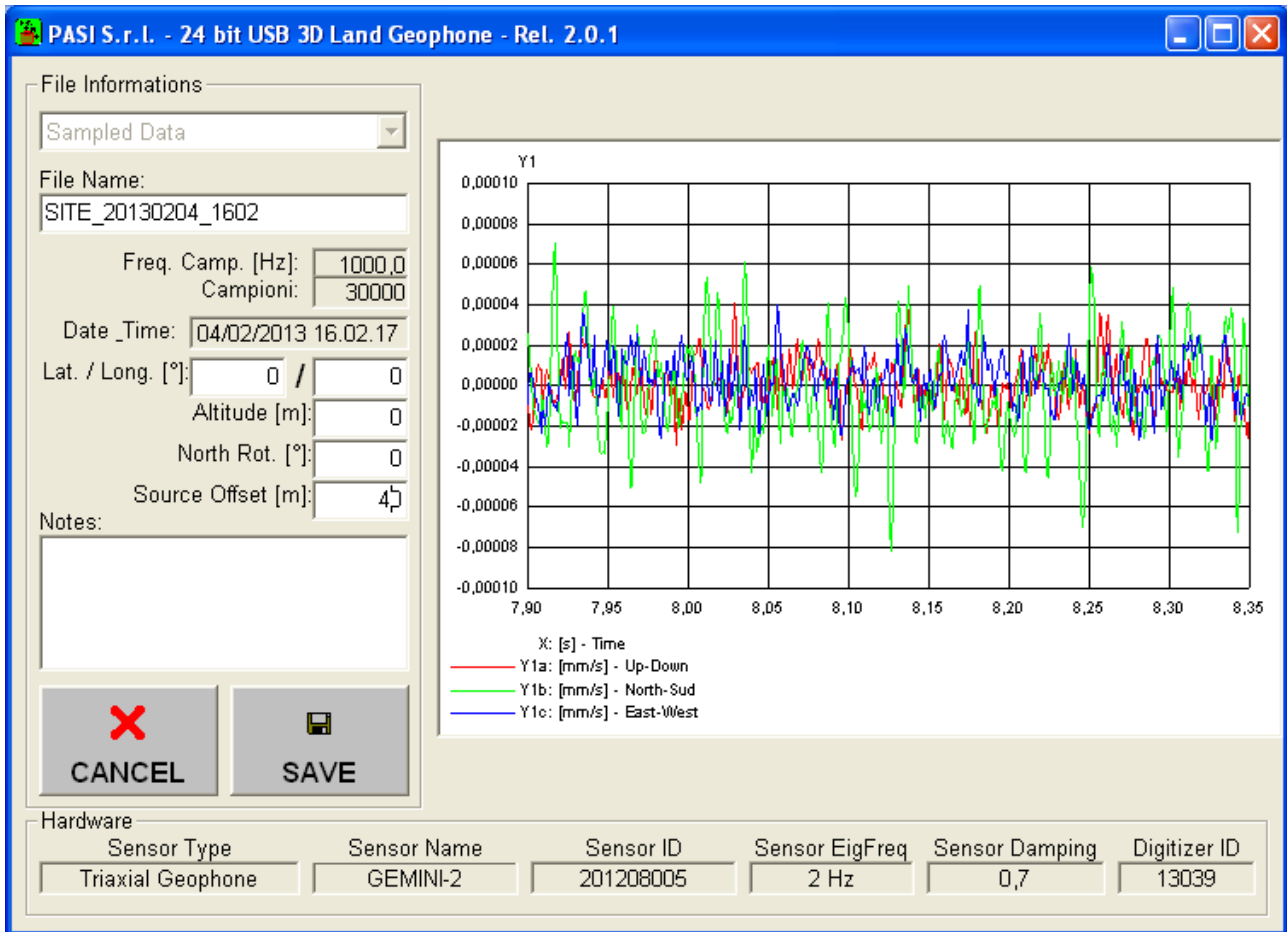

Zoom onto signals by clicking the mouse on the corner of the related area of the graph. Release the mouse after dragging it to the opposite corner and a graph inside the indicated box will automatically be brought to maximum dimensions. Right-click on the graph to access other functions such as reverse zoom and graph printing.

You can also add additional information to acquired data, such as geographical coordinates, altitude above sea level and the rotation of the triaxial geophone with respect to geographic North. Notes can also be entered.

5.3 Acquisition Saving:

Click on SAVE to save data in "SAF" format inside an appropriately identified file. Click on the button with the X (CANCEL) to permanently delete acquired data and, in both cases, then proceed another acquisition or with loading another data file.
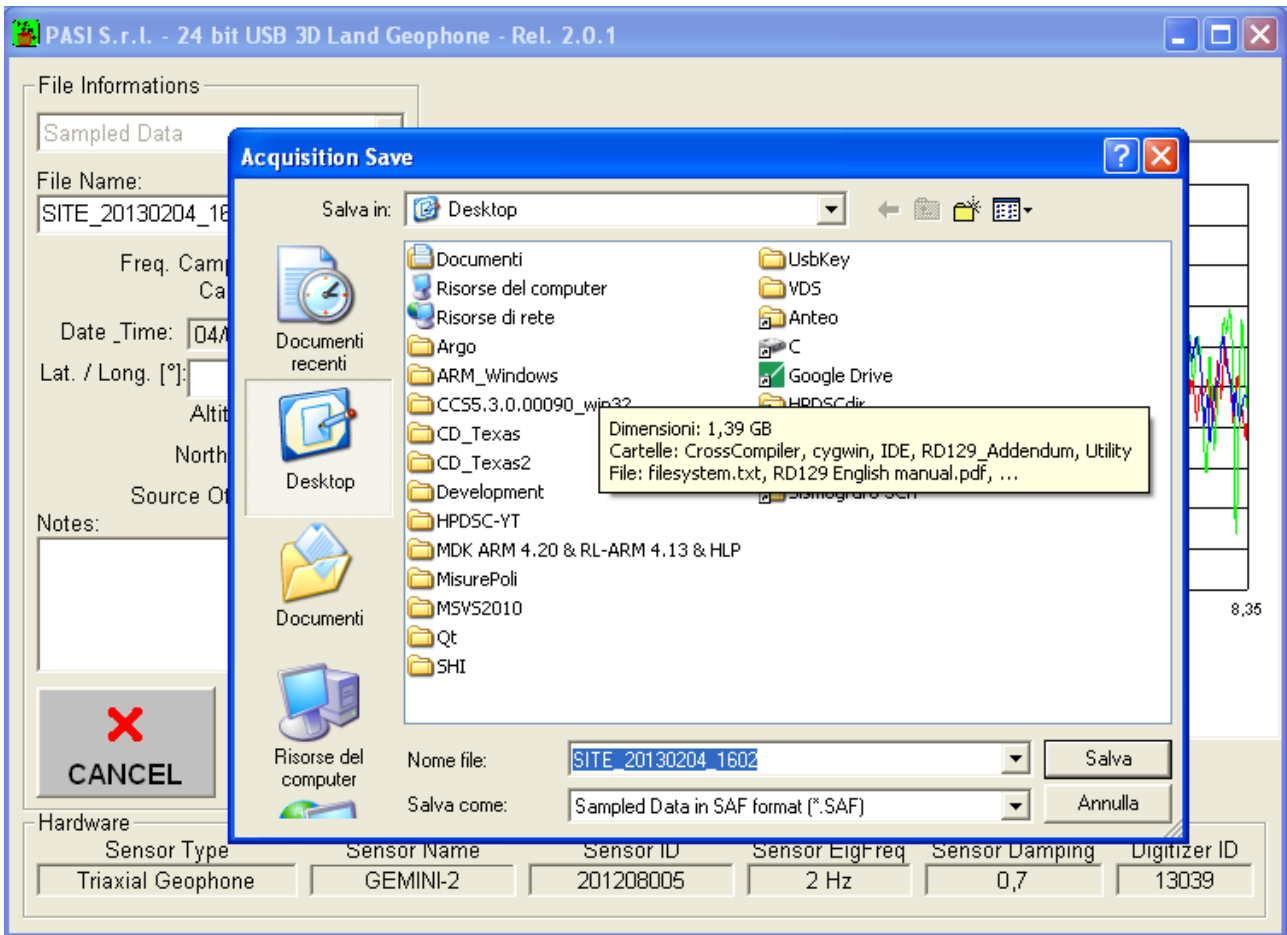
To load a file present in the memory, select the LOAD button (10).
In this way, you access the "Acquisition Load" window, where you can select an acquisition from among those previously performed and display it on the monitor.

5.4. End of acquisition and device shut-down

After measuring:
1) exit from the programme by pressing the "X" on the upper right of the window.

2) **disconnect the USB cable before the computer (to unlock sensors)**

3) disconnect Gemini (**CAUTION: starting from this phase, the <u>mobile geophone equipment blocking device reactivates!!!</u>)**, which at this point can be replaced back into the carrying case (remember to remove spikes and adjustable feet).
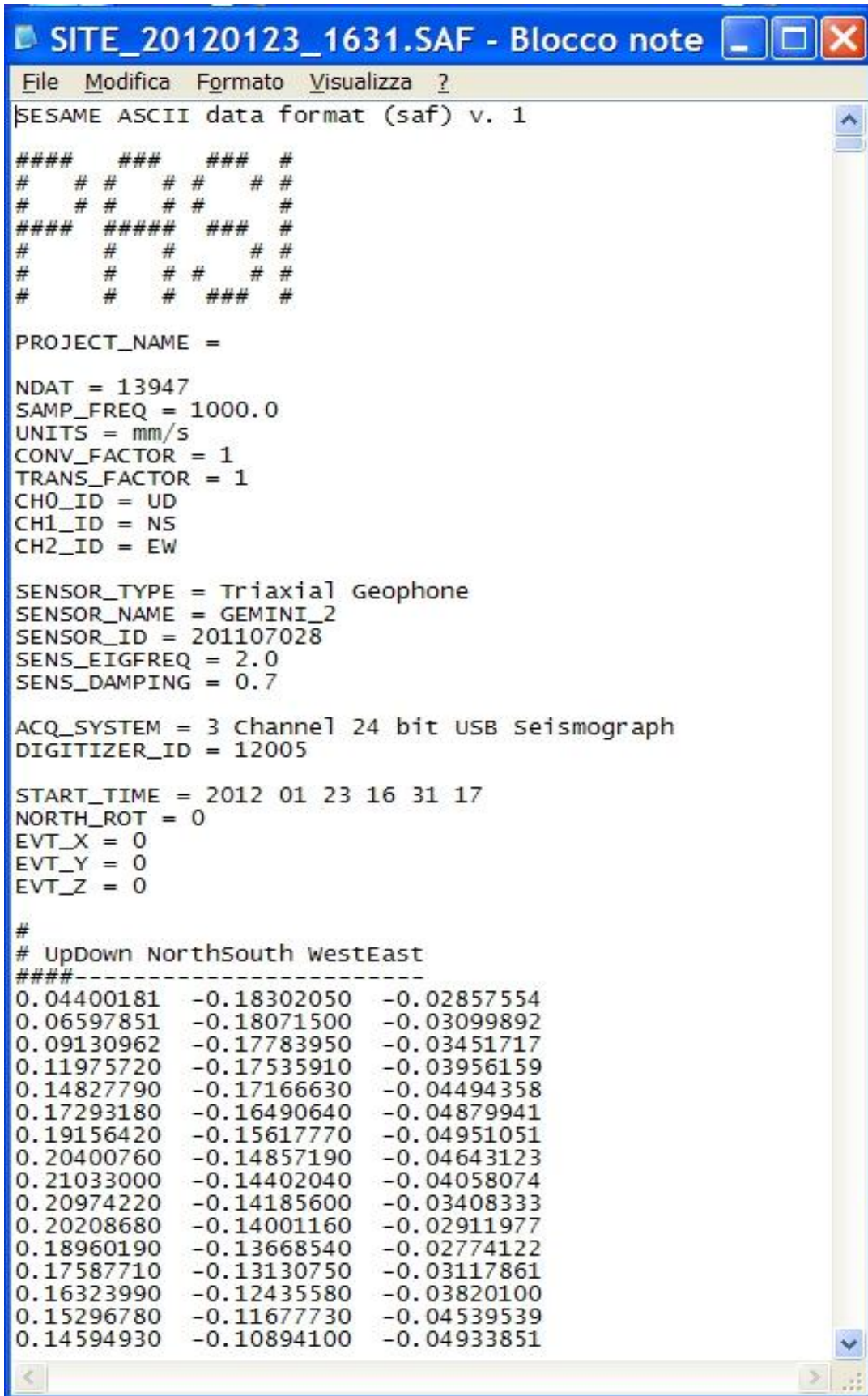
6. Technical specifications
Nominal technical specifications of the Gemini-2 triaxial geophone (ref. temp.=20°C)

Natural Frequency:	2Hz $\pm$ 10%
Sensitivity:	2V/cm$*$s^{-1} $\pm$ 10%
Internal Resistance:	5.8 K$\Omega$$\pm$5%
Dumping:	0.7$\pm$10%
Harmonic distortion:	$\leq$ 0.2%
Operating temperature:	-25°C ~ +55°C
Dimensions:	$\varnothing$ 128 x 80mm (spikes excl.)
Weight:	2.10 kg

Technical specifications of software and sampling electronics:

Input impedance:	2 MΩ
Sampling frequencies:	20, 100, 200, 500, 1000 Hz
A/D Conversion resolution:	24-bit real
Record Length:	from 250 ms to 120 minutes
Number of channels acquired:	3 + 1 AUX (trigger)
Maximum theoretical dynamic:	144 dB
S/N ratio to Fc=1KHz:	117 dB
Bandwidth at Fc=1KHz:	110 Hz, proportional to Fc
Operating temperature:	- 25°C ~ +55°C

7. Example of SAF file

```
SITE_20120123_1631.SAF - Blocco note

File   Modifica  Formato  Visualizza  ?

SESAME ASCII data format (saf) v. 1

####    ###    ###   #
#   # #   # #   # #   # #
#   # #   # #   # #       #
####  #####   ###   #
#       #     #       # #
#       #     # #     # #
#       #     #   ###   #

PROJECT_NAME =

NDAT = 13947
SAMP_FREQ = 1000.0
UNITS = mm/s
CONV_FACTOR = 1
TRANS_FACTOR = 1
CH0_ID = UD
CH1_ID = NS
CH2_ID = EW

SENSOR_TYPE = Triaxial Geophone
SENSOR_NAME = GEMINI_2
SENSOR_ID = 201107028
SENS_EIGFREQ = 2.0
SENS_DAMPING = 0.7

ACQ_SYSTEM = 3 Channel 24 bit USB Seismograph
DIGITIZER_ID = 12005

START_TIME = 2012 01 23 16 31 17
NORTH_ROT = 0
EVT_X = 0
EVT_Y = 0
EVT_Z = 0

#
# UpDown NorthSouth WestEast
####--------------------------
0.04400181   -0.18302050   -0.02857554
0.06597851   -0.18071500   -0.03099892
0.09130962   -0.17783950   -0.03451717
0.11975720   -0.17535910   -0.03956159
0.14827790   -0.17166630   -0.04494358
0.17293180   -0.16490640   -0.04879941
0.19156420   -0.15617770   -0.04951051
0.20400760   -0.14857190   -0.04643123
0.21033000   -0.14402040   -0.04058074
0.20974220   -0.14185600   -0.03408333
0.20208680   -0.14001160   -0.02911977
0.18960190   -0.13668540   -0.02774122
0.17587710   -0.13130750   -0.03117861
0.16323990   -0.12435580   -0.03820100
0.15296780   -0.11677730   -0.04539539
0.14594930   -0.10894100   -0.04933851
```