Preliminary english translation

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revision
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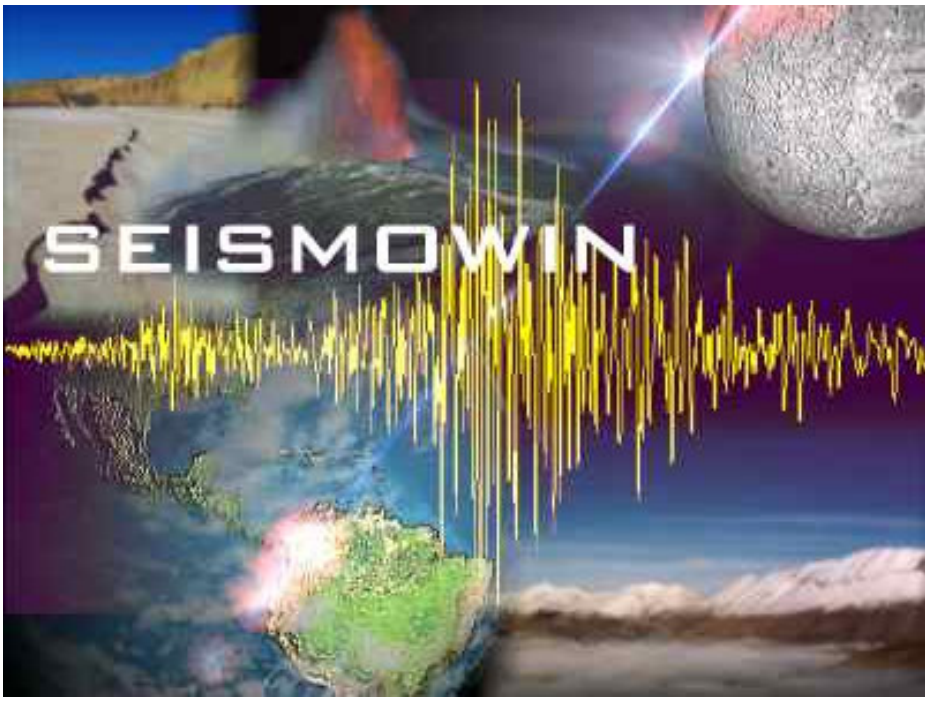
Reference Guide



Notice: Some functions and controls of the software could be recently modified,
the basic functionalities described in the manual are mantained

Important notice!
This software is for hobbistic and amateur pourpose, this mean basically for entertainment pourpose and education. It must be used in a computerized system and or other appropriate electronics boards of that assembly and setup should be accomplished by trained personnel and under the EEC laws in matter of electric safety and Electromagnetic Compatibility. All certifications of that equipments, design, are under the direct responsability of the final user. The software is provided AS IS without any warranty implicity or explicity.
The designer of the SEISMOWIN software will be no responsible of loss of any kind, damages, injuries, loss of data, casualties or other kind of damage if this software will be used in a context of life protection of any kind. This software is only proposed for training and entertainment pourposes.

Overview
The SEISMOWIN software is a program that should be used with one an electronic board able to convert signal from analogue to digital. It allows the acquisition of up to 4 channel with automatic storage of seismic events and storage of continues files (datalogging) for retrieve of past data.
The supported a/d boards are driven by SEISMOWIN in order collect data. Features available from SEISMOWIN are different for each supported boards.
Best performance, due to the explicit design of SEISMOWIN for it, are obtained from using SADC10, SADC20 and SADC30 boards supplied by SARA snc www.sara.pg.it.
These boards can use an embedded real time clock to syncronize the incoming seismic data with a very precise reference time. The a/d card embeddes an DCF77 decoder to decode the time transmission transmitted by the DCF transmitter in a pulse per second modulation or by a GPS reference using a GPS board generating a PPS encoded as the DCF PPS signal. SEISMOWIN can also be adjusted in order to have a precise timing by the PC real time clock if it is syncronized by a GPS system of a NTP server.

SEISMOWIN can be used toghether with others tools like SEISMONET and SEISMODOCTOR that are able to give extra features to your seismic station.

System requirements
SEISMOWIN require the usage of a Pentium Class processor. It is not needed a big memory of ram and the hard disk capacity is subdue to the will of the owner in order to record more or less seismic data.

Item	**Minimum requirements**	**Minumum Recomended**
Processor	Pentium 166	Pentium Celeron or Pentium 2 or higher
Ram	32 mbytes	128 Mbytes
Hard disk	200 Mbyte	2 Gigabyte
Operating system	Windows95	98se
CD rom	-	yes
Audio board	-	yes
Parallel port	-	yes
RS232 port	requested	requested
Video board	640x480 (VGA)	SVGA 1024x768
Monitor	monochrome	color

Installation
Istallation of SEISMOWIN can be executed by the proper SETUP.EXE file present in the distribution disk. SEISMOWIN should be installed in the C hard drive and in the “C:\6SMOWIN” standard folder.

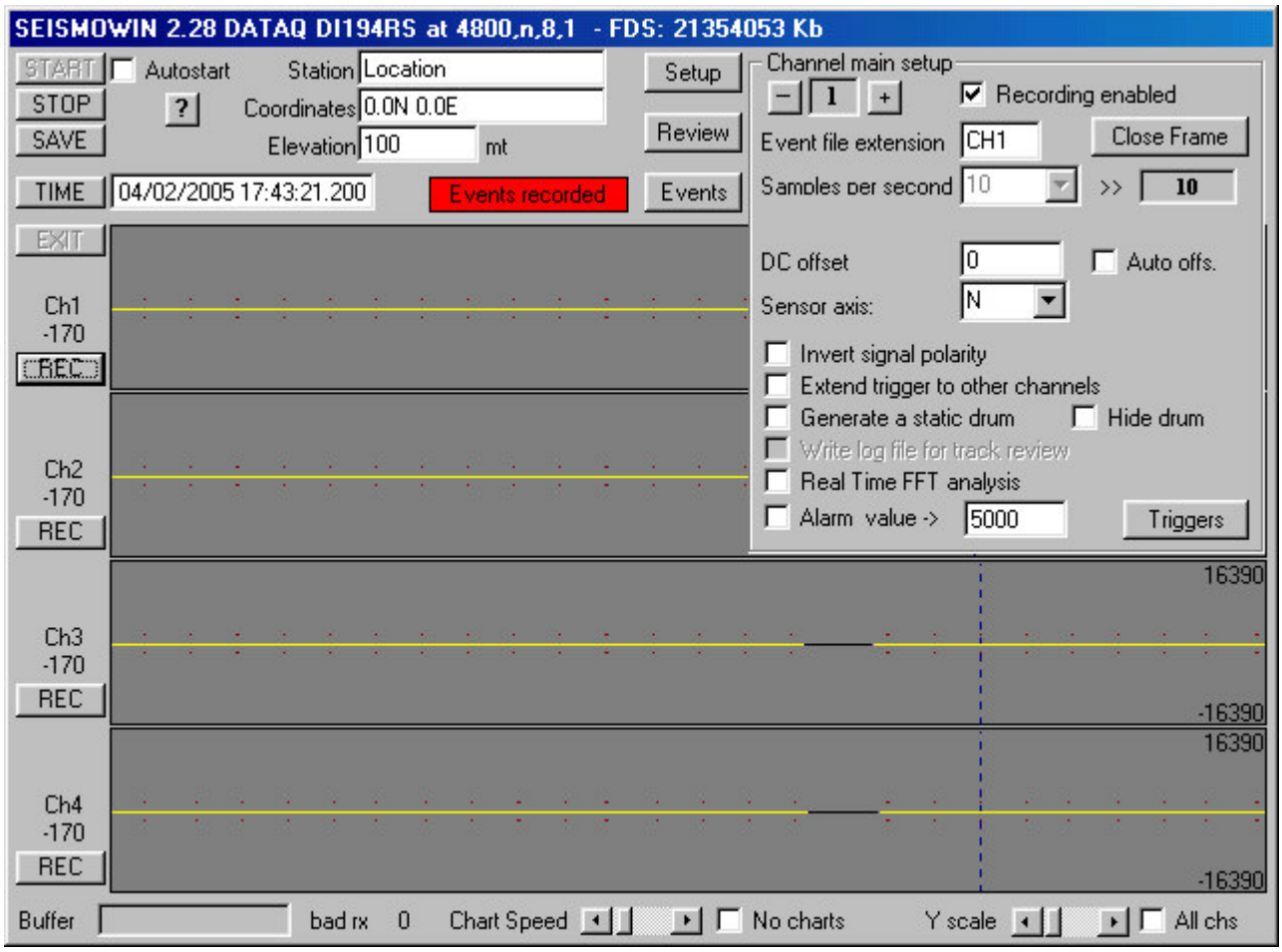
Update of the 6SMOWIN.EXE executable file can be accomplished simply by replacing the EXE file unless otherwise specifiied.

Glossary

6SMOWIN	See SEISMOWIN
A/D	Analogue to Digital (conversion)
ALIAS	Effect that corrupt the signal integrity if the A/D sampling is not correctly performed. See the related paragraph of this manual.
Baud	Speed of data transmission expressed in bit per second
Buffer	Transferring memory for serial data. It is used as queue for the data flow. When the processor is busy for other duty this buffer is filled until the processing is passed to Seismowin again to collect the data waiting in the buffer queue.
Clock	It can express two meanings. 1) the real time clock processing accomplished by a processor that keep the count of hour, minutes, seconds and fraction of seconds as well as years, months and days. 2) the oscillator that give the “tick” or the base time to a microprocessor and establish the speed at the microprocessor can crunch data.
Data rate	Speed of transferring data from the card to Seismowin. The data rate is affected not only by the baud rate but also by the transfer protocol used that decrease the effective data rate of about a factor of two.
DCF77	Time broadcasting standard for accurate timekeeping
Datalog	Data collection performed continously allowing the data to be retrieved when necessary.
Event	Seismic event, earthquake.
Extension	In the Windows world means the 3 characters following a file name. It identifies the kind of file and help the operating system to handle that file properly. For istance. 6SMOWIN.EXE the extension is “.EXE” meaning EXEcutable program.
Firmware	Software stored inside a microcontroller chip
Gain	Usually related to amplifiers (but also on A/D converters) express the magnification factor of an input signal compared to the amplitude to the output signal processed by the device.
GPS	Global Positioning System, used in seismology especially for accurate timekeeping and picking of obervation sites geographical coordinates.
GMT	Greenwich Mean Time (similar to UTC)
Handshacke	Term used to express the electrical signal used to syncronize two equipments when they need to transfer data bewteen themselfes.
Inverse filter	A filter usually reduce a number of frequency leaving unaltered others. The Inverse filter or amplify a band of frequency and leave unaltered others. In seismology it is usually used as Period Extender.
Log	See Datalog
NTP	Network Time Protocol, used to syncronize the PC’s real time clock throught Internet
Packet	Group of bytes that are related to a specific items of data to be transmitted as a single “package” and that will be decoded after received.
Period	Natural period of oscillation frequency of a sensor
Period extender	Electronic device or software routine capable to enahce or amplify the low frequency signal over

	the normal response curve of a sensor.
Purging	Automatic routine to delete old files considered no more useful for any processing pourpose.
Range	Related to A/D converter and/or signal processing the range is the maximum amplitude that the converter and/or the software can handle.
Resolution	Related to A/D converter and/or an electronic device capable to detect and process signals, it is the value that express the smallest signal detectable by the device.
RS232	Electrical standard for serial communication data. It is the same of EIA-RS232. The device widely used in personal computers is often named COM1 or COM2 on your PC. The standard interface connector is a DB9 or DB25 male on the pc, female on the communication device.
RX	Acronymous stands for Receiver, Receiving process or functions.
Sensor	Element capable to transform a physical effect in to electric signals. In this context a sensor is typically a seismometer.
SPS	Samples per second
SYNC	Abbreviation of "Syncronism" or "Syncronized" or "Syncronization" depending on the context
SEISMOWIN	The software explained in this manual. In past it was called 6SMOWIN because the number 6 is pronounced literally SEI in italian and SEISMOWIN was a too long name to be recorded in DOS-Win 3.X machines. So if you read somewhere 6SMOWIN its means SEISMOWIN.
TX	Acronymous stands for Transmitter, Transmitting process or functions.
Transducer	See "Sensor"
UTC	Universal Time Convention (similar to GMT)
FFT	Fast Fourier Transform, function to draw in a graphic the frequency amplitude of a signal. It is useful to identify the dominant signal and to make noise surveys.

Control panel
The control panel appears like the picture below. This picture is a screenshot captured running a DATAQ DI194RS a/d board. Notice the START and EXIT buttons are in light gray.



The majority of the controls are in this main window or virtual control panel; follows all the description. Note that the **Channel main setup** it is a popup frame that can be opened and closed in order to access more controls related to each channell.

Controls and buttons of the main panel window

START
This button STARTS the acquisition process and the eventually the recording of the events when they occurs. If you give the command. Note that when you click on **START** the check-box **Autostart** activates; if you will click on **SAVE** button the **Autostart** function will remain activated at the next launch of the software and the acquisition process will start automatically.

STOP
Stop the acquisition process. This button is disabled if the software is recording an event. The recording status is showed with the **signal numbers** of the channel in recording are RED.

SAVE
Click to save the system configuration to disk.

TIME
This button open the TIME SET window where the timing related options can be adjusted. The indicator at its right show time clock processed by Seismowin in that very moment.

EXIT
Button that terminate the execution of the program (There is no possibility to terminate the program using ALT+F4 or reducing it to icon). The user cannot exit the program if the acquisition process is running. (See also the STOP button description).

REC (REC/stop)
For each channel a **REC** button is available. This button activates the recording of the related channell manually. After pressing the button its caption "**REC**" change to "**STOP**" button allowing you to deactivate the recording. If you don't press on **rec/STOP** the channel will stop the recording according to the parameters selected for automatic channel event recording. If you give a manual stop the check box **Recording enabled** (in the Channel main setup frame) is automatically disabled. You'll have to re-enabled it if you need the software to record events automatically.

Signal numbers and waveform of Ch1 to Ch4
Each channel is monitored even by a numbers indicator and a graphic chart. The signal numbers can give you an idea of the magnitude of the signal the a/d board is detecting. Of course a better understendable view can be obtained watching the graphical waveform for each channel. When a recording is activated the background color of the numbers become red.
The waveform it is displayed in scope mode, being the data tracked in a continue loop. According to the Y scale factor you selected, you can see the start amplitude threshold in green dots and the stop amplitude threshold in red dots marking the chart each second The waveform chart can be enlarged giving a "double click" on it.

BUFFER LOAD
The receiving data from a/d card is performed by serial port. The gauge BUFFER LOAD shows how many data are stored in the serial port buffer. The data incoming the buffer even if effectively collected by 6SMOWIN seconds and sometimes minutes after the effective sampling time are always refferred to the time when they was sampled. The gauge indicator must not increase, it can increase sometime when the personal computer is performing something else but after that task is finished the buffer level must decrease until become zero. If the buffer load increase and increase until the color become red it mean that the total SPS received exceed the performance of the PC to collect data. If the buffer load overflow data will be lost and a warning window will happear.

BAD RX
Counts the bad packet received from the serial port. This number is automatically cleared every 10 minutes. If it reach 5 counts a warning window is opened. This counter test the reliability of the RS232 connection.

CHART SPEED
Adjust the horizontal scanning speed of the charts. This parameter is not related to any measurement unit, you can adjust as you prefer. It can enahnce the readability of some frequency on the chart.

No Chart
Enable/Disable the chart drawing allowing slow machine to have faster SPS rates.

Y Zoom
Scale Y or zoom factor for tracks graphic view. With 1 the chart has a +/-32767 (or +/-131072 if 18 bit board is used) range on the graphic window. You can select if change the scale simultaneously on all channel or only one by one checking the *All chs* checkbox.

STATION
Write the name of the place of your seismic station. This parameter will be used to mark the event files.

COORDINATES
Insert here the geographical coordinates of your station i.e. 43.19N 12.33E. The coordinates should be written in centesimal notation with in longitude/latitude order with N and E identification.

ELEVATION
Insert here the altitude above the sea level of your station in meters.

SETUP
Button for opening the Seismowin SETUP window. The SETUP contains many basic function related to the data input/output of the system.

REVIEW
Button for review of the datalog files and event file extraction.

EVENTS
This button open the window where a system log is recorded and automatic recording of seismic events are listed

Channel Main Setup *frame*

This frame collect the majority of the control related to each channel. Some controls are always accessible by the user, others can be accessed clicking on the **OPEN FRAME / close frame** button. (The **OPEN FRAME** shown in the picture display the text: CLOSE FRAME because the frame for istance is already open)

Channel number selector
The number at the top-left corner of the Channel Main Setup frame show the selected channel of the parameter are related to. You can select the channel in two ways: a) clickin on the buttons **+** and **–;** b) clicking (single click) over a chart of the channel you want to select. The parameter in the Channel Main Setup frame will show the current setting of the selected channel.

Recording enabled
This check box allow you to Enable/Disable the automatic recording of the channel.

Event File Extension
File extension of 3 chars used to store event files in the appropriate folder. You can use 3 chars without the point that is automatically added by the software. If the extension is for example "RMZ" the files will be stored in the format:
YYMMDDXXX.RMZ where YY states for YEAR, MM for MONTH, DD for DAY and XXX states for the sequential number of file event of that day. This number is automatically increased event by event. Usually the extension is related to 2 chars to code the station and the 3th char to identify the axis. This allow to recognize the desired file without open or check it.

SPS
Samples per second. Number of samples per second established as acquiring data rate for that channel. The number at right of this setting shown the real data rate recorded by **Seismowin** during the last second. If there are differences between the selected SPS rate and the real SPS rate means that there is a problem on the communication link or in the A/D card. This parameter is not reliable in the thirdy party A/D boards that doesn't issue the time together with the data but only the samples, so don't care too much of the number variation you may see with DATAQ, INFILTEC and LX1500 A/D boards.

> ***Tip!*** *To do not record anomalous signals, different from the reality, you must keep present a basic law of signal processing. To sample in digital form a signal without altering the waveform you have to sample it at least twice SPS frequency than the frequency you are interested to analyze. For example if your sensor or electronic amplifier filtering board has a bandwidth of 5 Hz you MUST sample at least 10 Hz (or SPS). Practically it will be useful to sample 5 times the interesting frequency in the example at 25 Hz. At the same time sampling more than 25 SPS if you have a bandwidth of your electronic of 5 Hz is useless and you are only capturing more data than are necessary. Obviously you must also apply an electronic filter that not allow to any frequency higher than one half of your sps rate to reach the converter. If this happens strange ALIAS phenomena will affect your recording. One way to check if you are in aliasing problem is to extend the SPS and watch if the waveform change. If it change you were observing an alias and not the real signal. You will have to apply an appropriate anti-alias filter and select the proper SPS rate.*

SPS data rate is locked using it with some kinds of a/d board (i.e. LX1500 and INFILTEC)
Not all SPS rate are allowed for all A/D boards.Seismowin knows wich rates are allowed and wich not and will warn you with explanation windows.

DC OFFSET
Offset of counts incoming from a/d board. You can use a positive or negative value to adjust small counts differences from a/d board and mantain the signal to a graphic zero point.

SENSOR AXIS
Identification of the sensitivity axis of the sensor. You can choice between V (vertical), E (east –west), N (north-south), G (geophone) or ? for unknow or undetermined.

INVERT
Enable/Disable the inversion of the polarity of the channel. You may have made a wrong wiring on your sensor (it is the human imperfection) this controlis an easy remedy to put the signal in the right polarity.

> ***Tip!*** *The standard, international signal polarity prescribe to use:*
> *Vertical axis, positive wave = ground moving from down to up*
> *East-West axis, positive wave = ground moving from West to East*
> *North-South axis, positive wave = ground moving from South to North*

EXTEND TRIGGER TO OTHER CHANNELS
Enable/Disable of the function that extend the record triggering to all others recording enabled channels. It is may be useful to trigger the recording of all channell if only one sensor detected a strong signal.

GENERATE A STATIC DRUM
Enable/Disable the virtual drum option. This option allows you to have a daily chart of the seismic activity for your reference during the day and the next day. Other settings for drum option are present on SETUP window. In the Seismowin folder the drum option store two files. DRUMx.BMP and PD_DRUMx.BMP for the current day and the previous day.

HIDE DRUM
Considering that SEISMOWIN operates without allowing the user to resize or reduce to icon the windows, the drum can be hided checking this control box.

Write LOG file for track review
Enable/Disable the recording of continous binary data recording on the selected channel. After recorded these file can be reviewed and small events or not triggered events can be extracted.

AUTO OFFS.
Enable/Disable an high-pass filter used to remove the small dc offset you could have from your electronics, it could be used instead of the manual OFFSET adjust.

HIDE DRUM
This control allows to hide the drum window related to that channel if drum is enabled. Drum images are saved as the drum is visible.

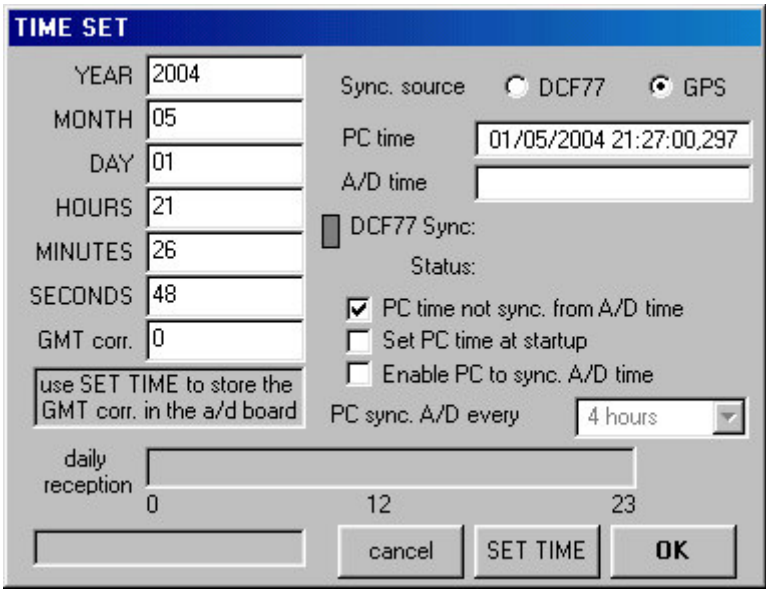
REAL TIME FFT ANALYSIS
This checkbox enable the FFT Real time analysis window. See the FFT section for details.

TRIGGERS
This button opens the windows that adjust the automatic triggering of the event recording.

ALARM and its threshold value
Enable/Disable the acoustic beep in the occasions of quake events. A WAV file can be played instead of the beep, see the SETUP window details.

TIME SETTINGS
Using the **TIME** button from the main panel you can activate this window.
From here you can adjust date and time, the time correction for the appropriate time zone. (GMT / UTC).

Notice for the users of SADCxx a/d board: The A/D card embeds its own real time clock that provides the counting of years, months, days, hours, minutes and secondss. If you have a DCF77 time receiver or a GPS time receiver the internal real time clock is syncronized by it. The internal clock counter is needed because the DCF77 receiver cannot be used as a clock but only as a clock syncronizer. The DCF77 (and the GPS too) signal is not always present, sometime it is interrupted by atmospheric storms and other electromagnetic noises. The AD90S2313 controller check the DCF77 data stream and detect errors to avoid mistakes in the syncronization. This means that often the syncronizing tag is well received only few times per day depending by environemental conditions. For this reason the time must be always adjusted with the proper time after the card is powered up. The a/d card detect from the DCF77 signal the UTC time compensation and the daylight DCF77 changeover. In case of use of a GPS as syncronization source, it always transmit UTC time. The reception of the GPS signal is much more costant and it is recomended for better results.



The fields for the DATE and TIME setup are preloaded by the software with the current time in the moment the window is opened. They can be changed before use the **SET TIME** button.

SYNC source
This control select if a DCF77 source or a GPS source is used for accurate timing.
Considering DCF77 is always transmitting +1 UTC time or +2 during summer time, GPS will always transmit UTC and a different GMT correction is needed. This correction between DCF77 and GPS is made automatically by the software. ***The GMT field must be always zero if you use Seismowin for seismological pourpose.***

PC Time
Is updated with the PC time.

A/D Time
Is updated simultaneously with the sampling rate from the a/d card and contains the time received by the a/d card.

DCF77 Sync
The box light in green for 6 seconds after a DCF77 or a GPS syncronization, the following text will show the date and time of the syncronization. Each time a correct syncronzation is received the clock inside the A/D card it is updated and the file TIMEFILE.TXT is updated for future examination.

Status

Indicator showing if the system is considered ***Locked*** or ***Not Locked*** by the time receiver (DCF or GPS).
For DCF77 receiver Locked mean that the a/d board received a sync packet within the past 60 minutes
For GPS receiver Locked mean that the a/d board received a sync within the past 5 minutes.
In all the other cases the Status indicator become: Unlocked. Variation of the Time Status are reported in the file EVTFILE.DAT.

PC time not sync. from A/D time
This selection allow to the PC clock to be not syncronized by the A/D TIME. Anyway all datas received by the A/D board are strictly associated to the time issued from the A/D board itself. So the waveform recorded will be always referred to the correct Real Time Clock.

Enable PC to sync. A/D time
This option allow SEISMOWIN to refresh the A/D time on the interval time specified at PC sync A/D every. This is useful when you want use a different kind of syncronization system like NTP or GPS that sync directly your PC. In this case PC time not sync. From a/d time must be selected to preevent sync conflicts.

PC sync A/D every
This option setup the frequency of the a/d clock refresh. For most of application a daily refresh is enough. Set the most appropriate timing according to your needs.

CANCEL
Close the TIME SET window and discard the modifications.

SET TIME
Adjust the time according to the values selected on the field at the left side of the window.

OK
Close the window accepting the setting and option in the window. The modification must be stored on disk using the SAVE button on the main window.

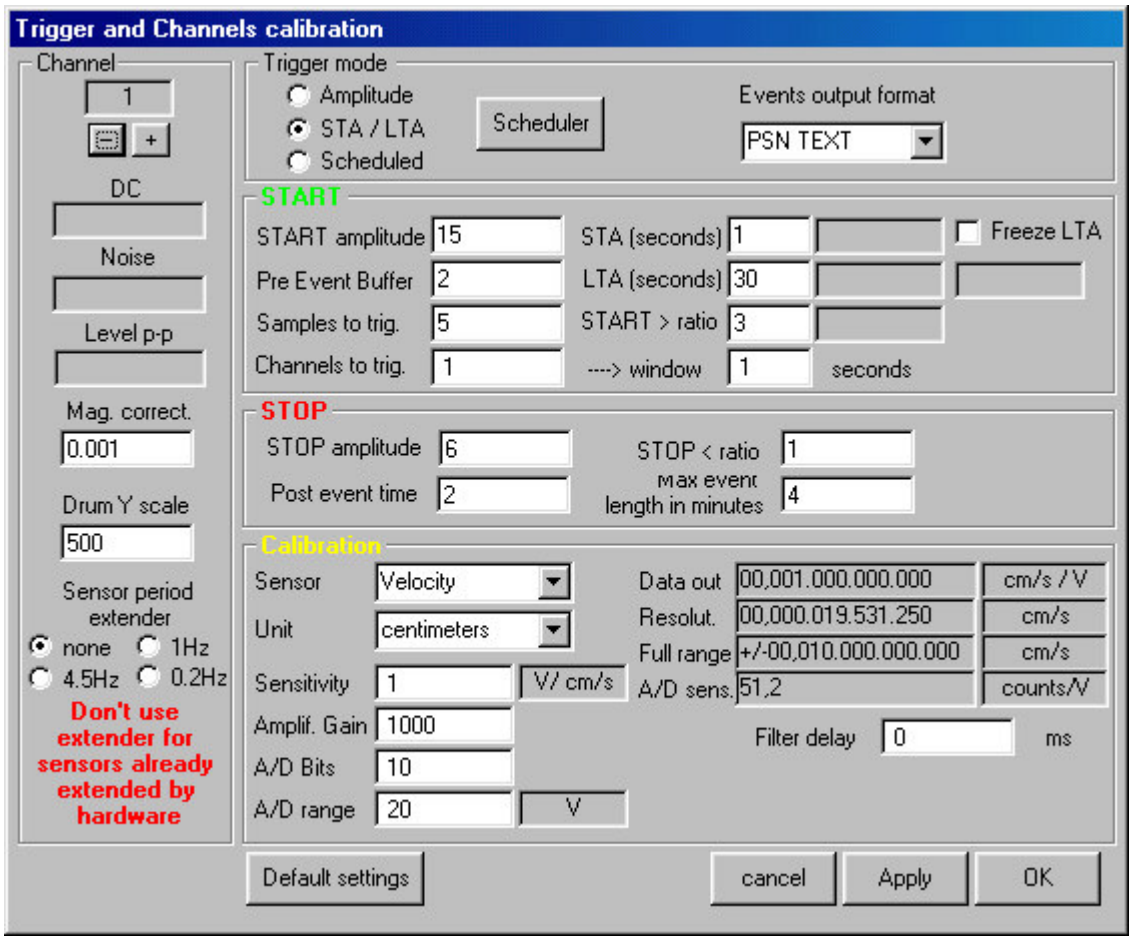
Daily SYNC reception
This chart allow to see in what hours the DCF signal is more strong. A green vertical bar is written on the chart each time a correct time frame is received. The chart can be cleared clicking on the chart. The box in the bottom left side of the window indicate if a solar time or legal time is received by the DCF77 converter.

DCF77 Time
This label shows if the DCF77 is broadcasting solar time or daylight (summer) time.

> ***Tip****! To improve the DCF77 receiver setup you can apply the DCF77 pulsing signal to one of the channel of your a/d board. In this way you can able to see on the seismic channel where you applied the DCF77 signal the pulsing signal as an oscilloscope. This is very useful to determine the best orientation of the antenna. Even if during the setup the signal is disturbed, when you oriented the antenna at the best receiption angle during the next 24 hours you will surely have enough syncronizations. This is usually not needed with a GPS receiver. Keep in mind that you may have to condition the DCF77 signal in order to be accepted by the A/D board without damage to the board itself!*

Triggering and channel calibration

This window allow to adjust the parameters of automatic triggering and some other controls, everything is described in the following paragraphs.



Channel frame

The channel control allow to select directly from this window on which channel operates, from 1 to 4. You can select the channel clicking on the + and – buttons or select a channel clicking on the graphic waveform in the main panel, if it is visible.

DC

Shows the mean signal value made with a long time averaging of the signal.

Noise

Represent the maximum peak amplitude recorded. The value can be cleare clicking on the numbers.

Level p-p

Represent the last largest waveform recorded. The computation is made of the difference between the maximum last positive peak and the last maximum negative peak. A peak is considered finished when the signal cross the zero level.

Mag.Corrections

Stands for Magnitude Corrections. It is an old field used in past to give an empirical calibration control to the user of sensors that are not easy to calibrate or the calibration is unknown.

Drum Y scale

Give a graphic magnificaton factor to adjust the signal on the static drums drawing. Usually values between 1 and 10 are good for 16 / 18 bits boards.

Sensor period extender
It perform a digital signal processing allowing frequency presents below the resonance period of a sensor to be amplified and magnified in order to be more readable even at recording and at signal analysis. Typically a 4.5Hz sensor extended can reach the performances of a 1Hz sensor. A 1 Hz sensor can reach the performance of a 0.1 Hz sensor and a 0.2Hz sensors can reach a period of 0.02 Hz (50 seconds). This process is also commonly called: equalization. The notice in red recomend you to don't use this feature with sensors that already have a period extender like the 4.5Hz processed by the SEQUA10 boards, or sensor like Lennartz3D that already are frequency equalized to give a better low frequency response.

Events output format
There are 4 kinds of output formats available:

PSN TEXT	Standard ASCII format supported by WinQuake
SAC	Binary format
SEISAN	Binary format developed by University of Bergen
ASCII	Raw data in ASCII

Trigger mode
There are 3 triggering modes. The first trigger using the amplitude threshold. The second is the classic STA/LTA triggering method. The third is Scheduled.

> ***Tip!*** *Is warmly recomended to read and study this section to obtain the best results in earthquake recording. Don't give up after few paragraph but conclude the reading and verify your understanding making test with your system.*

Amplitude (overview)
Two thresholds are to be adjusted, start and stop. The program verify if the signal goes over a certain number of sample over the threshold value. If this happens a recording is triggered. The generated file will have a preevent time accordin to the pre event time setting.
When a recording is started to stop the recording a stop threshold is analyzed to see for how much time the signal remains under the stop threshold. This allow to the entire earthquake coda to be recorded.

STA/LTA (overview)
This the classic algorythm used in seismology for the event triggering in noisy environement. Usually an earthquake produce a noticeable and quick variation on the amplitude of the signal. If the seismometer is deployed near city or roads the noise can increase during day and decrease at night. If the amplitude algorythm is used the threshold fixed for night are too low during day and the threshold good for day are too high for night making loose interesting event that could be recorded in period of low background noise.
STA/LTA algorythm solve the problem monitoring not the simple amplitude of the signal but the ratio of amplitudes of two time-windows, the Short Time Average Window (that react quickly) and the Long Time Average Window reacting slowly to the amplitdude variation. So STA means Short Time Average and LTA means Long Time Average. Analyzing the ratio between these two values an event can be "declared" or triggered when the ratio increases over an preset value. In normal conditions both the averaged level are the same so the ratio will oscillate around 1. If the STA increase, the ratio also increase to values greather than 1 rising up of several units depend on the nature and level of the signal variation.
If the background noise increase, (usually slowly) the ratio will remain always near to 1 because while the STA will react more quickly than LTA also LTA react and increase its averaged value causing no triggering of false events when the background noise increase.
Appropriate setting the time windows allow to have excellent performance from the STA/LTA algorythm.
When the event has been triggered, to stop the recording a stop ratio must be reached (the ratio must remain lower than the stop ratio-value) for a the programmed time to assure the recording of the earthquake coda.

Scheduler
Clicking on the Scheduler button you can activate up to 20 scheduled triggering event to record the signal of blasts or shot for seismic refraction or reflection study. See the scheduler paragraph reported below for details.

START frame
This frame contains all the parameter that allow Seismowin to detect and trigger the recording of an event. Usually the operation of declare that a signal is interesting as a possible earthquake is called "triggering", so following this word will be used to express the automatic decision of Seismowin to initiate a recording process as well as START recording etc.

There are many ways in order to detect a signal that can be considered seismically interesting. The START frame contains a numbers of parameter that help the software to have the correct behaviour in triggering. The basic goal is to avoid false triggering as much as possible, at the same time is aboslutely needed to don't miss any earthquake. This issue cannot be always accomplished so a continous recording option (datalog) is offered by Seismowin. Anyway the START and STOP facilities offered by Seismowin are very powerful and when well settled they can offer a reliability up to 95% of correct recording.

In order to help the user to setup the parameters at the best now are reported brief description of each parameter and after an explanation of how they can be used in various forms and combinations according to the station needs, background noise, sensors sensitivity etc. It is recomended to go ahead and read all the descritpion of the parameter even if not well understood until all the section is completed. Then everything will result more clear and a second readings will surely wipe out other doubts. (If not, you can always submit your questions on the www.infoeq.it forum!)

First of all keep present the triggering and de-triggering (STOP of a recording) are conditioned basicly on the kind of triggering. The basic trigger mode are selected using the **Trigger mode** options. (The explanation of Scheduled mode is described later.)

START amplitude
Start Amplitude threshold for amplitude triggering mode.
When the signal go over this thresold and remains over it for at least a number of samples specified in **Samples to trig**a recording in initiated.

Pre Event buffer (in minutes)
Minutes of buffer used to save the data before the event declaring. This is needed to pick also the P waves often pass under the start threshold.

Samples over start
Number of samples (not counts) over the start threshold to declare triggered an event. This value work as a low-pass filter because avoid that only a single samples are able to trigger an event.

Channels to trig
Specify what channel must be associated in triggering to start a recording. This allow to makeup a sort of condtional triggering where at least 2 or more channel must have a strong signal simultaneously inside a time window specified in the **window** parameter.

→ window
Related to **Channels to trig**. It specify the time window where more triggers must be present in the channel specified in **Channel to trig** in order to declare a trigger.

STA
Short Time Average. Specify the time window where a signal averaging are made.
The value showed at the right box is the absolute amplitude value computed for the current STA time frame. This parameter must be always lower than LTA.

LTA
Long Time Average. Specify the time window where a signal averaging are made.
The value showed at the right box is the absolute amplitude value computed for the current LTA time frame. This parameter must be always greather than LTA.

Freeze LTA
This parameter specify that when a triggering is executed the LTA value must be frozen at its last value. This will allow to better record the earthquake coda.

Start ratio
Threshold ratio to start the recording. When the result of the STA/LTA division (ratio) will become higher than what is specified in this field a recording is started. The value showed at the right is the current computed ratio bewteen STA/LTA.

STOP frame
Complementary to the START frame the STOP frame contains all the parameter needed to stop a recording without truncating the earthquake coda and/or record whatever is interesting for your surveys.

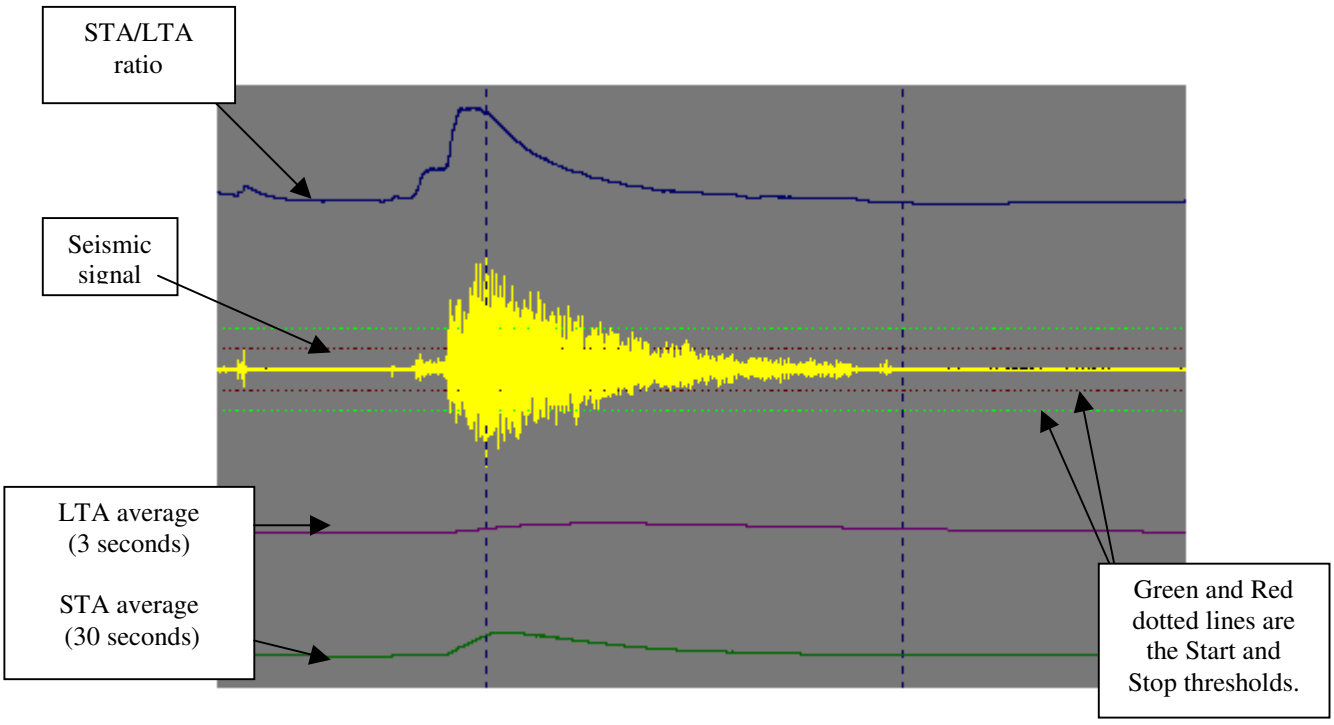
STOP amplitude
Amplitude threshold for stop event recording. This specify the level of the signal must have to consider the signal no more interesting for recording.

Post event time (in minute)
Post event record duration. This parameter setup the length of the recording after the triggering allowing to record all the coda. It establish for how many time the signal must remains under the stop threshold (if the amplitude algorythm is used) or under the Stop ratio threshold if the STA/LTA algorythm is used to declare a "stop recording".

Stop ratio
Threshold of stop ratio for STA/LTA algorythm.

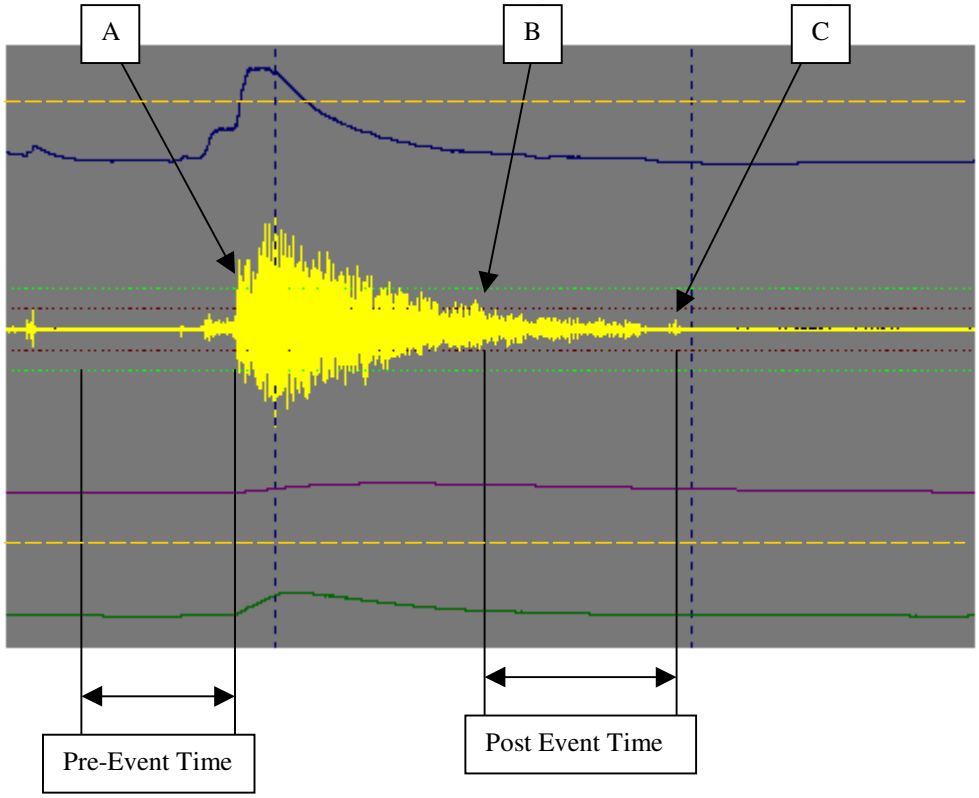
Max event length
Max length of an event. Reached this time in any condition the event recording is terminated even if all other stop condition are not satisfied.

USE of START/STOP recording parameters and their meanings.
In this paragraph a summary of all controls will be listed using an example chart. Please look the chart carefully and try to familiarize with the parameters and their description. Measurements unit are not necessary in this moment, notice only that the base line of the STA/LTA ratio represent the unity value (one, 1).
The same chart will be interpreted in the various triggers mode, so the first is only descriptive.



Triggering with amplitude method

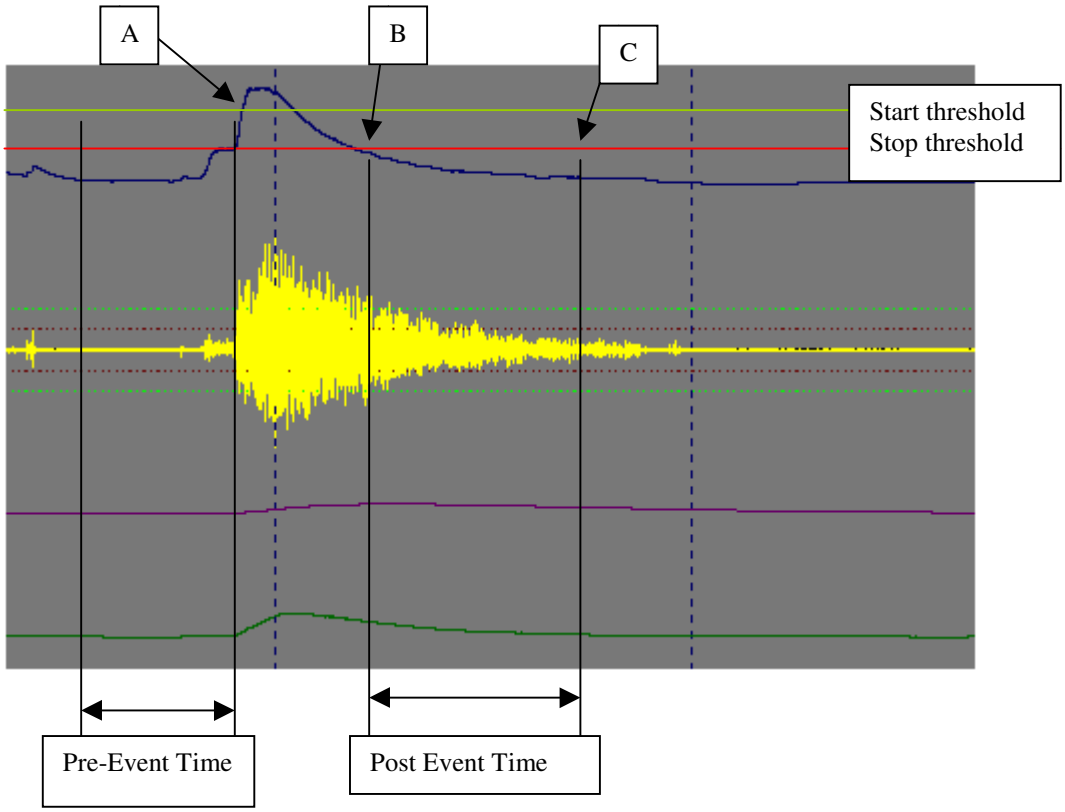
Looking at this chart you can see how the noise at the right side of the chart was not able to trigger a recording. It would if it would reach the green dotted line representing the start threshold. Neither the P waves of the recorded earthquake would be able to trigger it, (for this reason exist a pre-event buffer). Only at point A the recording begins. At point B the signal amplitude become constant under the level of the Stop (red) threshold but only at point C where the STOP post event time elapsed the recording is finished.



You may preferr to record exactly 1 minutes before the event and 1 minutes after the event; use the Amplitude method and adjust the START threshold as you prefer according to the background noise of the site(like the green thrshold of the picture); then adjust the STOP threshold to the maximum allowed or let's say at 10000 count or more (like the orange dashed line). Set the pre-event time at 1 minutes and the post event time at 1 minutes. The majority of the events will be surely already under the STOP threshold as soon an event is declared; 1 minutes of buffer will be recorded in the file, then the STOP sequence will be intiated due the signal is already under the STOP thereshold and just after 1 minutes from the START time the event will be stopped having an event length of 2 minutes.

Triggering with STA/LTA

With the STA/LTA algorythm the triggering is performed keeping in count not the absolute value of the signal but its averaging in a short time period window and a long time period window. This averaging react in different times to the variation of the recorded signal. You can see in the picture a purple line showing the long time average and a green line showing the short time average. As you can see the STA react faster.
The blue line is the ratio computed (graphically enphasized) between LTA and STA.



Also in this case you can easily see how the recording start at point A and also all the preevent time is recorded. Then the recording runs and cross the point B where the post-event time begins until the recording is stopped at point C. The advantage of this method is that the system adapt itself to the noise backround level.

Scheduler triggering
The scheduler windows allow to select up to 20 timed events to record the seismic signal.
This allow to accomplish refraction or reflection seismic study or simply to check the background noise level at various time of the day. Up to 20 events are allowed.

This window allow to set, modify or delete the scheduling list.

Use Add to add an event, Delete to delete an event, Modify to modify and event.
Clicking on a TIME in the Scheduled recording list the row selected become colored and the time appear in the editing fields YYYY/MM/DD HH:MM:SS Ch.

You can also select what channel must record the event, alternatively the trigger will be exteded on all channel with Xtrig option enabled.

Give Apply to make opoerative the changes, remember to click on SAVE button of the main control panel to save the parameters, else at the next launch of seismowin the scheduled events will be lost.

Calibration frame
This frame contains all the data needed to calibrate your data with the sensor output and the electronic system.

Sensor
You can select four different types of sensor from Unknow, Velocity, Displacement, Acceleration.

Unit
This allow to select the measurement unit. You can chose from meters to nanometers.

Tip! With WinQuake you must use centimeters (cm)

Sensitivity
You should put here the signal value in Volts that your sensor generates. The measurement unit of this number depends on the sensor type. The measurement unit is showed in the box at right of this control. For example if you have a velocity sensor you should be able to obtain how much Volts it generates at one meter per second velocity.

Amplif. Gain
Put here the gain factor of your amplifier. You can compute it looking carefully to the schematic you have or ask to who supplied your amplifier.

A/D Bits
Put here the number of bit of resolution your a/d has. Usually 14, 16, 18, 24 bits are common size. You can also use this field to know how a a/d converter can behave in seismic analisys rather one another.

A/D range
Put here the full range of your a/d. Put the peak-to-peak value. For example if your a/d is able to pick signal from –10V to +10V your full range is 20V.

Data Output
This is an output field. Data output mean what signal is generated for a unity of measurement of your sensor. It is the reciprocal of the Sensor Sensitivity multiplied for the amplifier gain factor.

Resolution
This is the final resolution of your system. It represent what is the smallest measurement unit your system is able to resolve. Smaller is this value more precise is your system. Go low in resolution can be accomplished increasing the gain of the amplifier but this make narrow the full range of your system.

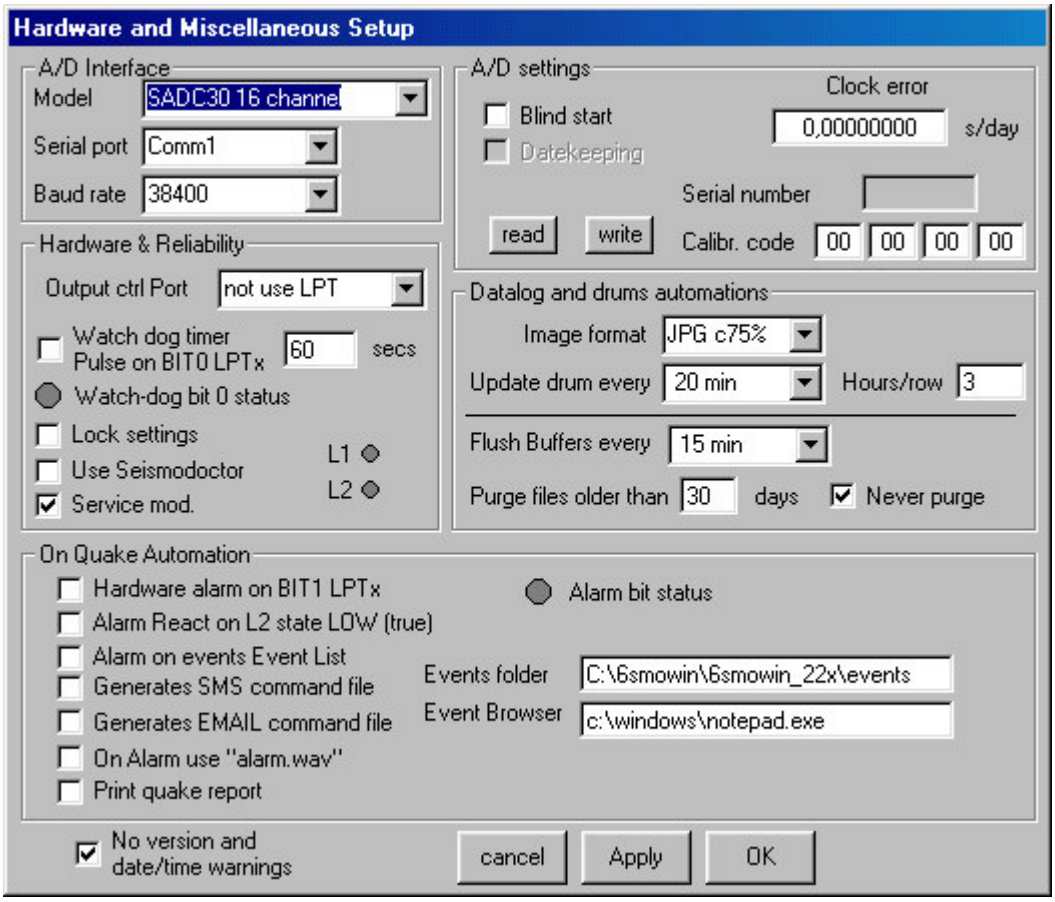
Full range
This is the maximum amount of measure your system is able to record in the selected measurement unit.

A/D sensitivity
This represent the a/d sensitivity in count per Volts. It is used in the internal computation of resolution.

Default settings
This button activates the preset settings for the channels, the softaweare will ask if you want to setup the channel for teleseismic or regional monitoring.

Filter delay
This data is not used at moment, it will be used in future to compensate the delay of analogue or digital filters.

SETUP WINDOW
This window allow to setup several functions and controls for hardware and software automation.



A/D Interface
This section allow to setup the hardware connected to Seismowin. You must choice what board are you using and in which serial port is connected.

Interface type
Select the board to be used for a/d conversion processing.
Version 2.27 of SEISMOWIN supports 4 kinds of boards:

- SADC10 (16 bit board) SARA snc 16 bit 4 channel board with timing
- SADC18 (18 bit board) SARA snc 16 bit 4 channel board with timing
- INFILTEC 16b 9600 baud Infilter 16 bit 1 channel board
- N.E. LX1500 9600 baud Nuova Elettronica 16 bit 1 channel board
- DATAQ 194 4800 baud DataQ 12 bit 4 channel board
- SADC20 (24 bit board) SARA snc 24 bit 3 channel board with timing
- SADC30 (16 bit board) SARA snc 16 bit 16 channel board with timing (only 4 available using Seismowin)

Serial Port
Select the communication serial porto from 1 to 4. The number at the right side is an error counter. It counts any transmission error detected from the a/d card. If it increases mean that something is bad on the link. Maybe the interface of the PC or the A/D card or in the cable.

Baud Rate
This parameter allow Seismowin to select the baud rate of your a/d board.

Clock error
This selection allow to specify how many second per day the a/d board cristal have as absolute frequency error. This allow to clear the Crystal Absolute Frequency tolerance. This feature is available basicly only for old boards. If your a/d board have a low drift crystal oscillator select always the hex value FF FF FF FF as calibration code.
Pressing the key ENTER on your keyboard when you are on this field allow you to recompute the s/day hex code to be written in the a/d board pressing the *write* button.
You can check the value of the board pressing the *read* button.

Blind Start
This control avoid the checking of the Seismowin on the firmware and a/d board speed. This function allow to have a *one direction communication line* like in a radio link or a half duplex modem link. Seismowin simply starts with the selected board speed 14400 as default or 38400 if selected function.

S/N
This box contains the serial number read from the a/d board.

Hardware and Reliability
Seismowin can control a parallel port to executes some hardware functions.

Output control port
This control selecty what parallel port use to drive bits for hardware automations.

Watch dog timer pulse on BIT0 LPTx
Select if a pulse to refresh an eventually external watch-dog circuit must be used or not. A Watch-dog circuit is a special timer (long time timer) that is able to RESET your pc if it is not refreshed periodically. This allow to a system to reboot automatically if it hangs.
An appropriate watchdog device should reset the PC acting on the power supply unit or on the RESET switch push-button contacts. The period of the pulsing signal is set by the SECONDS parameter.

WATCH-DOG BIT0 STATUS
This indicator monitor the action of the bit in the parallel port circuit.

L1
The indicator L1 is related to the ON/OFF input in the a/d card. This signal is used to decode the DCF77. If a receiver is present and used by the a/d card this indicator will blink. The blinking of this indicator is not in real time with the DCF77 pulse per second sequence.

L2
This indicator is connected to the ON/OFF input number 2 of the a/d card.

Lock settings
This parameter allow to lock the settings of whole program. A password is required to lock and unlock the settings. The password setting is not visible so you must remember it. Anyway the password is visible inside the 6smowin.ini file at the line "PSW=…."

Use Seismodoctor
This function tell to seismowin to generate a file that link Seismowin and Seismodoctor in order to preevent system hangs. When this option is used the Seismodoctor software is looked in the c:\6smodct folder with the name 6smodct.exe. If it is present it will be automatically executed after Seismowin startup.

Service mode
This function allow seismowin to enter in service mode. The service mode allow to show up the trimming window and the FFT functions. These functions are not so user friendly it is recomended to use the service mode only with the direct assistance of an expert. The FFT can be used freely, even if it is not well documented, experiments will not compromise the program running.

On Quake Automations
Some function can be enabled to be executed when a Seismic Event is recorded.

Hardware alarm on bit1 LPTx
This control set if the BIT 1 of the selected LPT parallel port should be used as a signal to give an electric alarm. The bit change the state and it can drive a relay contact when a quake is recorded.

Alarm react on L2 state low
This control set if the BIT 1 of the selected LPT parallel port should react on the changing state of L2 to ground. This function can be useful to read the signal of a seismoscope or as an intrusion alarm system on the place where sensors are. The signal to be detected must remains closed for at least 2 seconds.

Alarm on events Event list
This control set the hardware alarm bit (BIT 1 of selected LPT) must be excited in occasions of events added on Event List.

Generates SMS command file
This control allow the update of the file SENDSMS.TXT on the application folder. It can be used to send an updated SMS message.

Generates EMAIL command file
Thic control allow the update of the file SENDMAIL.TXT on the application folder. It can be used to sens an updated email message.

Alarm bit status
Indicator of the status of BIT1 of the selected LPT parallel port.

Event folder
Identify the folder where events should be recorded.
For standard operation selects: C:\6SMOWIN\EVENTS

On Alarm use ALARM.WAV
This check box allow you to ask Seismowin to recall the file ALARM.WAV from the SEISMOWIN folder to be reproduce as a WAV file. The WAV file can contains any sound or speech not more long of few seconds. The file will be played when the recording is active and over the threshold instead of a normal beep from PC speaker.

Event Browser
Identify the standard event browser path to be called automatically from EVENT LIST

Datalog and drums automations
Long term recordint (for further data retrevial) and daily virtual drum recording function are provided. Select the best graphic and periodic datalog save for best performance of your system.

Drums Section
The software can (if selected from the main control panel) activate a sort of virtual drum to watch to a daily overview recording. A JPG file is saved each morning (00.00am) and / or after a STOP command. A file is saved also periodically according to the selection: *Update DRUM every x minutes* in order to update networks archives.

Hours per row
Select how many hours you want to see in the drum.
Keep present that a drum is related to 24 hours of the day. Selecting 3 hours 8 rows will compose the drum, selecting 4 hour the drum will be composed of 6 rows and so on.

Image format
Allow you to select the image format of the drums images between JPG, BMP or GIF format.

Datalogger
If continous LOG of data is selected on main control panel this control perform the buffer flush every time is selected accordin to the control: *Flush Buffers every x minutes*

File purging
SEISMOWIN can retain all datalog files. This mean that the disk will fill continously until it become filled or someone or something not erase unused data. For this reason this automatic purge function is prepared. To wipe out old datalog files. The control *Purge file older than x days* will remove all the files older than N days.

Never Purge
If you preferr to save all datalog file check this control.

How Datalog Files are recorded
The datalog files are recorded continously if the Datalog option is activated on one or more channell. Here you can find a brief description on how they are recorded and the naming convention of the datalog files.

The datalog files are recorded in the ..\datalog\ folder od Seismowin, typically inside: C:\6SMOWIN\DATALOG

Each time the system is started, stopped, restarted by a cold start the old file is closed and a new file is opened for recording. The same happens when the flush period expires, the old one is closed (flushed) and a new one is opened for recording.

The name convention is the following:

YYYYMMDD_HHNNSS_RRRRT.LGX

Where

YYYY = year MM = month DD = day HH = hour NN = minute SS = second

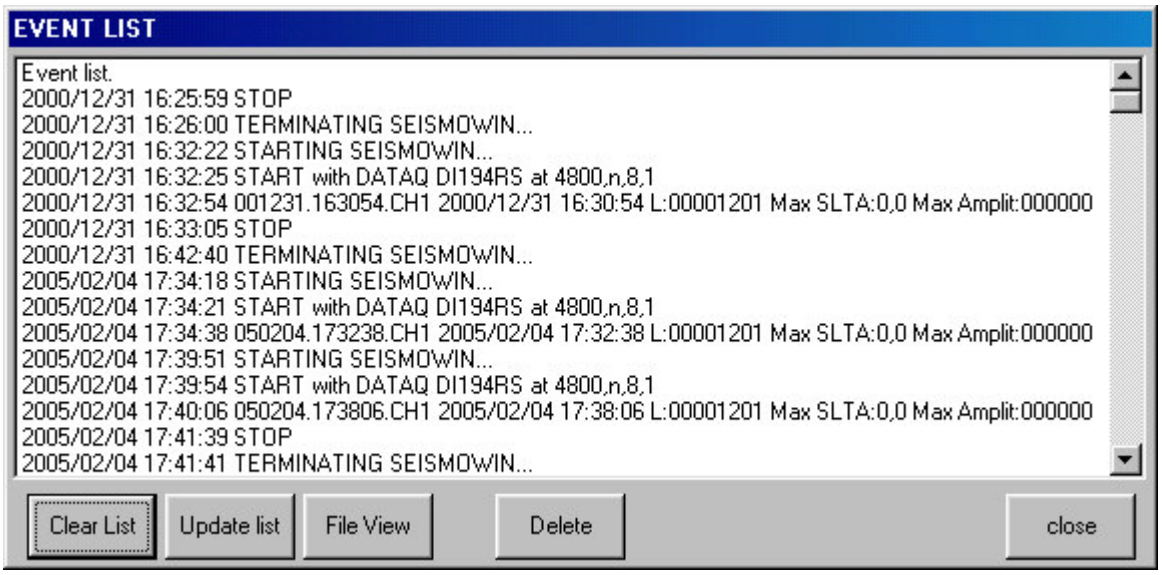
RRRR = sampling rate (from 0001 to 9999) T = time locked or not locked (L = locked N = not locked)

LG is a suffix always present

X is the channell number

Datalog Data format
The datalog files are stored in RAW 16 or 32 bit binary format depending of the a/d board used, for all 16 bit models a 16 bit word is used for 18 or more bit a/d board a 32 bit format is used.
Low/high order or Low/Middle/High order.

Event list window
From the main panel window clicking on button **EVENT** the **Event list Window** is activated.
This window allow to see the description of the warning messages and the events description recorded by the triggering methods.



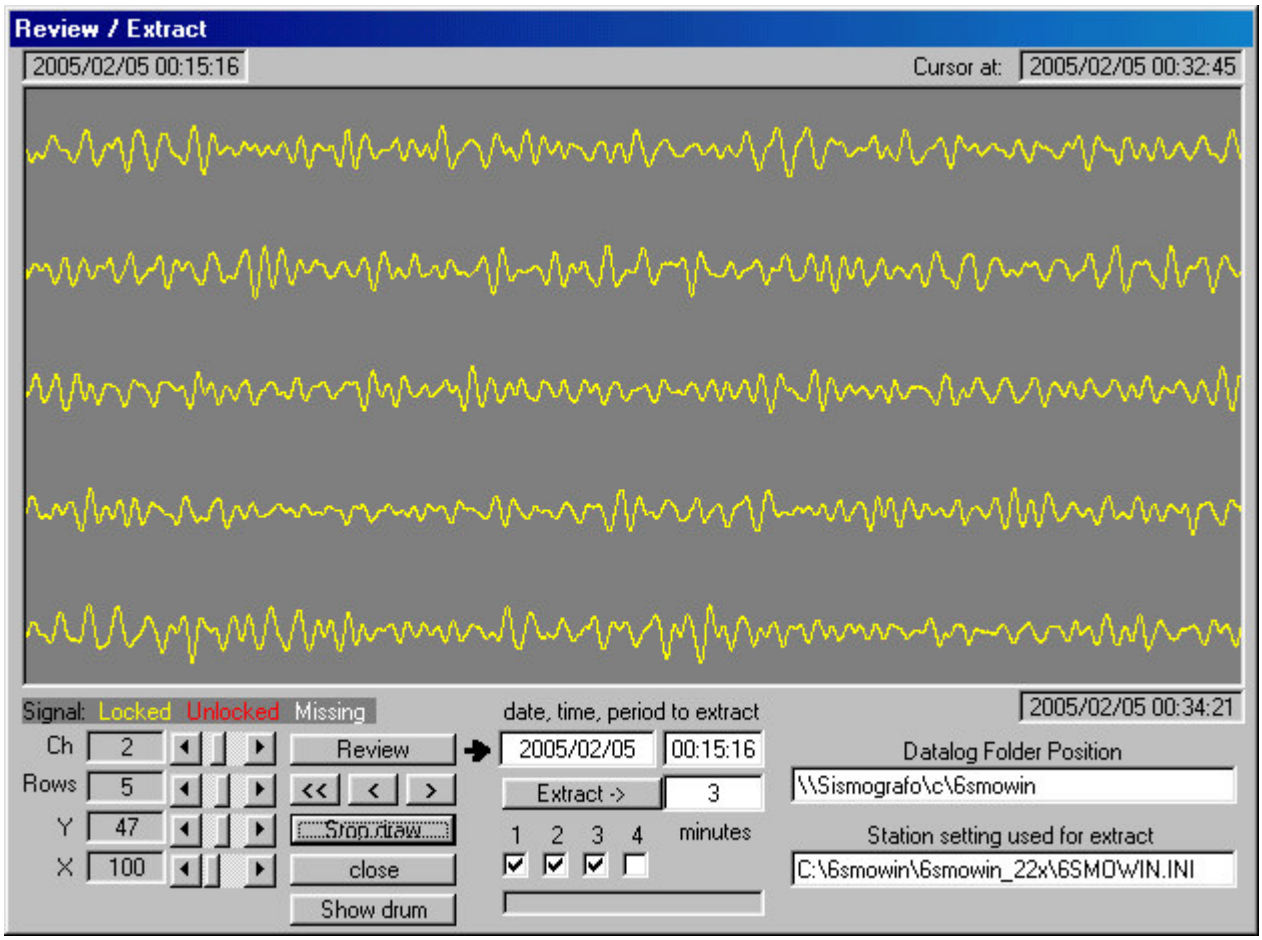
Clear List
Clean the eventlist file. Files recorded are not removed. It is cleared only the list.

Update List
Refresh the text list of the event list.

Close
Close the Event List window

File view or double click on event file.
Selecting an event file and clicking on File View you can open automatically your favourite event browser.
(The event browser is selected in the **SETUP** window)

Review and Extract
Using this window you can review datalogged files in the past days.
It is possible to point at one specific time and extract a piece of recorded file from there.



Ch	Select what channel to replay
Rows	Select how many rows see in the screen
Y	Adjust the Y scaling factor
X	Adjust the X scaling factor
Review	Start the replay of the LOG file selected by the channel option beginning from the date and time selected in the fields at right (Date/Time)
<<	Fast Rewind to 00:00:00 time of the selected day
<	Go back one page
>	Go ahead of one page
Stop draw	Stop the current review
Close	Close the Review/Extract window
Extract	Extract the selected minutes beginnig from the selected time.

Datalog Folder position	Select the path where find the datalog files
1, 2, 3, 4	Select the track to be extracted
Show drum	Show the current drum active. If present. To close the drum window, close the Review window.
Chart picture	Double clicking on the chart you can start the review of the following data starting from where you clicked. The mouse movement point at the time on the chart. You can see the time in the indicator above the chart.

How to browse the datalog and extract an event
To extract an event you may already know the date and time to look for. You can enter the date and the time right before the expected time and click on review.

Be sure to enable the proper channel you want to see. If data are present they will be drawn in yellow color. The chart maybe in red indicating the data are present but they are far from the last useful time syncronization and they could be not reliable in time location.

If there are no data at all the line will be drawn a straight white line.

When you have isolated the portion of waveform to extract you can click right before it and the date and time will assume the desidered start time. Select a duration in minutes typing the number of minutes to extract and select the number of channels you want to extract from 1 to 4. When the window opens the software automatically select the numbers of channels currently selected for datalogging.

If one or more data are missing a message will be displayed explaining what is missing.

The extracted data will be writte in the usual Seismowin event folder.

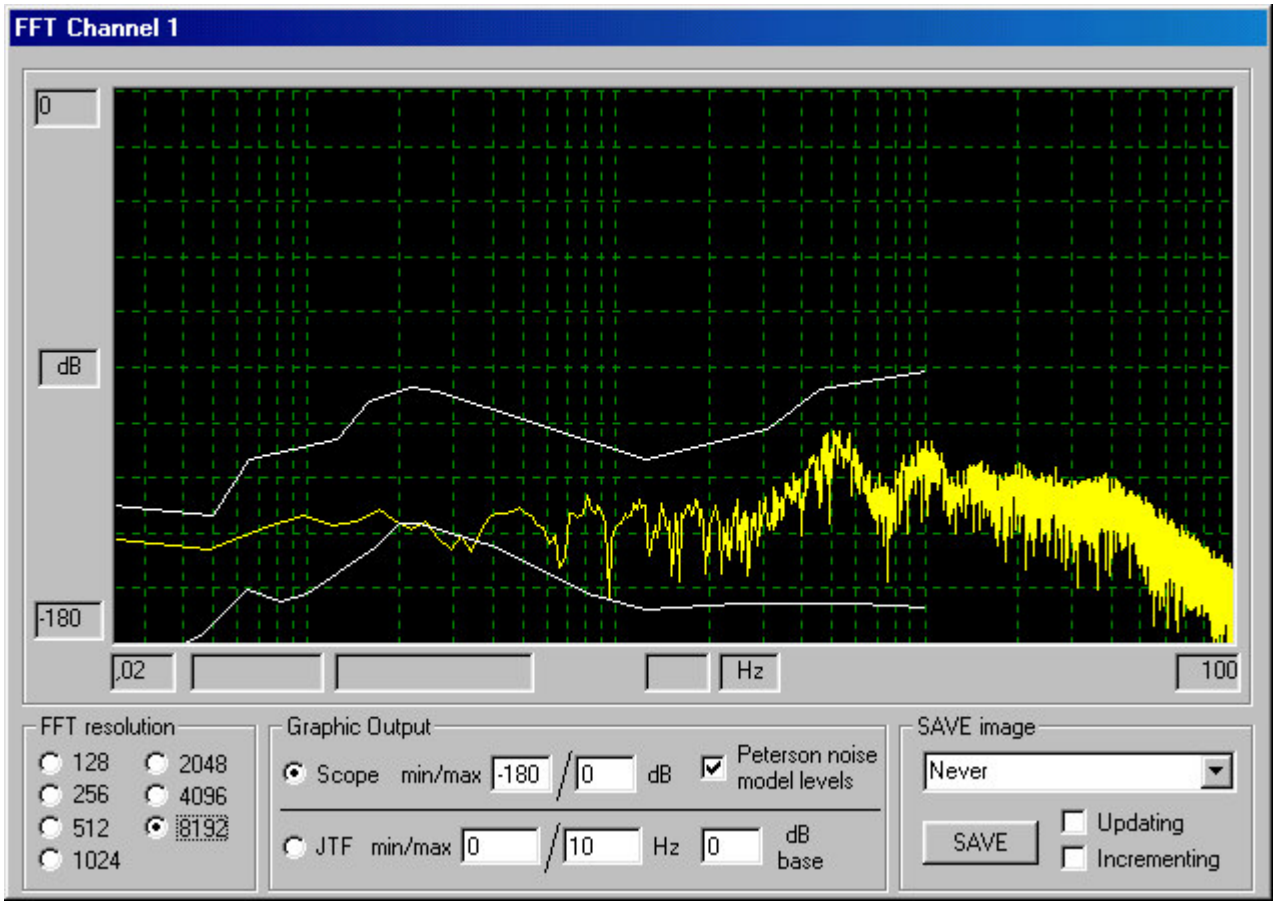
FFT SPECTRUM ANALYZER

This window is enabled from the main control panel in the channel setup frame. It can be opened and managed indipendently for each channel. It allow to see the spectrum of the recorded waveform either in scope or time-frequency mode (JTF). The scope mode is very useful to watch the noise performance of your system and compare it with the Peterson noise curve model.

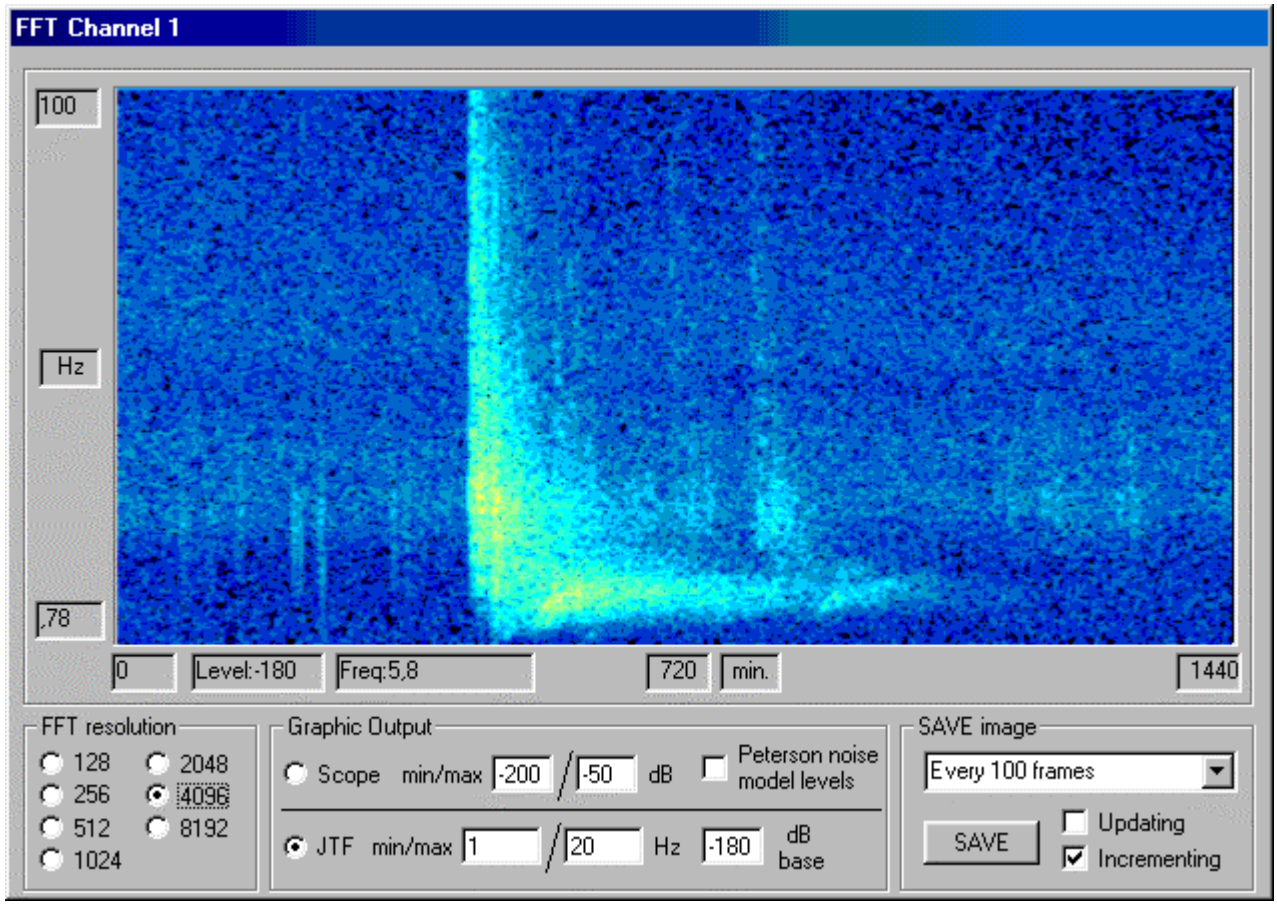
The Peterson noise model describe the maximum and the minumum noise recorded in about 75 professional seismic stations around the world. The site selection for seismology should be choosen using this comparison. If the spectrum curve falls in the model limits it is acceptable for seismic recording.

JTF diagram join the frequency domain analisys in time. The frequency response is recorded during a long period of time (24 hours in seismowin chart) and allow to see the varation of the noise during the day. Colors identify the signal level. Also earthquake can be recorded in this graphic mode the following picture shows a teleseismic event recorded with such JTF diagram.

Frequency domain spectrum



Time/Frequency domain spectrum



FFT controls

FFT resolution
These option from 128 or 8192 select the numbers of samples used to draw the FFT. Of course you cannot see low frequency signal using low numbers of samples because the FFT algorythm needs more samples in order to detect low frequency and long period waves.

Scope / JTF selection
Select the Scope or JTF diagram

Scope Min/Max
These are the minimum and maximum dB level showed in the Y axis of the scope diagram.

JTF Min/Max
These are the minimum and maximum frequency values showed in the Y axis of the JTF diagram.

Peterson noise mode levels
This option enable the draw of the Peterson's curves on the diagram allowing the direct comparisons with the measured signal.

SAVE mode
This control allow to select if and how often the picture will be saved. It allow to select every how many frames it is saved. One frame means one spectrum diagram refresh.

Updating
This selection save the spectrum picture always in the same file named SPEC_x.GIF or JPG or BMP (according to the drum saving mode) where x is the channel number.

Incrementing
It allow to save images with a name including date and time saving a different picture for each save operation.

Image window cursors
The image window allow the cursor to pinpoint the frequency and level. Se the indicators in the left bottom corner vary moving the cursor around the diagram.