GeoDAS
Software Manual

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Table of Content

1 The GeoDAS Application

1.1 Introduction

This manual describes the GeoSIG Data Acquisition System (hereafter GeoDAS or just program, application). GeoDAS is a graphical Microsoft Windows-based application running under Windows 9x/2000/NT4/XP. In case of Windows 95, at least release 2 (SR2) is required.

This Program is used for instrument configuration and for acquisition of data provided by any standard GeoSIG instrument. Data is delivered through serial communication channels. Two types of data delivery are supported. The first type is event downloading. In this case the instrument is configured as a seismic recorder, which detects events and keeps them locally in the instrument memory. These files are transferred to the PC via telephone line or direct link to GeoDAS. The second type is a continuous telemetry link or direct connection via cable providing near real-time data from the instrument, which is configured as digitiser in such case. If the serial channels to an instrument are bi-directional ones, GeoDAS can perform full configuration of the remote instrument and can monitor its state of health.

GeoDAS general tasks:

- Setup of an instrument. One can change any parameters of an instrument with GeoDAS.
- State of health (SOH) monitoring. GeoDAS performs permanent or periodical monitoring of an instrument status.
- Downloading of the event files from an instrument working as a recorder
- Off-line event data view and simple data analysis
- Support for serial data streams (GSBU GeoSIG-Bergen and CWB formats)
- Logger features. GeoDAS keeps important messages in a log file.
- Real-time data viewer for an instrument, which provides serial data stream.

GeoDAS has been designed to meet all requirements with respect to almost every possible application. It covers all the best features of the various GeoSys/SIG/Terra Tech. software products like AllView, CloseView, FieldView and GeoView. The program has an open architecture not only for multiple local recorders connected to the standard serial port, but also for networking of local recorders, supporting modem and network communications, including communication via Internet (TCP/IP protocol). These features provide flexible interfacing between GeoSIG recorders and users irrespective of how far they are located from each other.

Additionally to the features above, GeoDAS allows all the Windows standard functionality to be used in an easy and intuitive way. The Program provides a perfect software interface between users (operators) and hardware based on GeoSIG recorders of GSR/GCR/GBV product lines. Besides that, GeoDAS provides data analysis, which has been developed mainly for civil engineering purposes and preliminary seismic analysis of recorded data. With GeoDAS one can set any configuration of GeoSIG recorders, which is supported by current versions of hardware. Furthermore, the program keeps compatibility with the previous versions of GeoSys recorders based on GSR-12/16 product line as well as networks, such as recorders united in GNC-CNR systems. GeoDAS supports data exchange between the recorders and the PC both in interactive and automatic modes of operation.

1.2 GeoDAS Off-line Data Viewer

The Off-Line Data Viewer (hereafter ODV) is intended for reviewing and interactive analysis of the digital signals off-line. Original waveforms are taken from a file, which can have one of the standard formats created or supported by other GeoSIG software and by the data recorders.

ODV is developed for Windows OS platforms but it is intended to keep continuity from old GeoSys DOS-based analysis software like AllView, CloseView, FieldView and SIG DOS-based analysis software like SMACH and SMR.

ODV supports various numbers of data channels in such way that operators could display on the screen and plot any set of them in any combination, make scaling, zooming, axis style changing, export to and import from various data formats, etc. in intuitive manner. Mathematical analysis will include such operations like digital filtering, response spectra calculation, integration and differentiation of signals, CAV calculation and others.

ODV is an integral part of GeoDAS. Extended analysis functionality is provided as an option, which can or cannot be included into the standard software packet shipped along with an instrument. This part is supposed to support math functions for data analysis.

In case of the GeoDAS data analysis package (P/N GEO-DAP) has not been purchased, the “Analysis” menu is greyed, but can be activated at any later time by purchasing a valid registration number from GeoSIG Ltd.

1.3 System Resources

GeoDAS runs on IBM PC compatible computers, including laptop models, and communicates to the GSR, GCR, GNC and GBV instruments via a serial interface (either direct connection or via modem). Data retrieved from the instruments are stored on the PCs hard disk and can be reviewed and analysed later at any time.

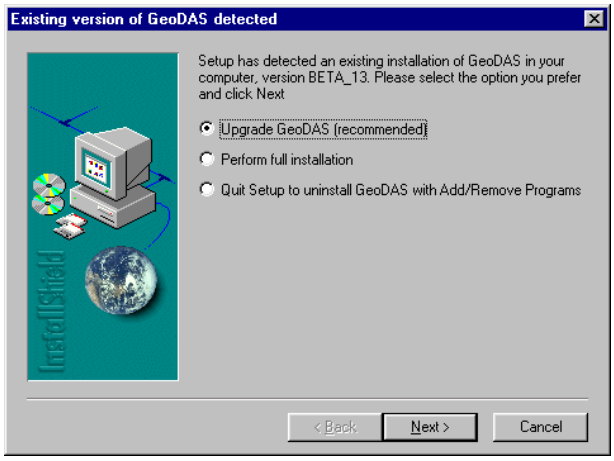
GeoDAS requires different amounts of computer memory and disk resources depending on how it is used. The minimum system however, should consist of least a standard Pentium II CPU, running Windows 9x/2000/NT4.0/XP. The amount of RAM depends on the number of instruments maintained by GeoDAS at the same time, but must be at least 64Mb in any case. Hard disk space needed must be sufficient to store event data files arriving from the instruments and to maintain ring buffers of the active data streams. Standard serial communication ports are used to provide physical channels to the instruments. Depending on the configuration of recorders, additional multi-serial equipment may be required. Communication channels to the remote recorders may utilise different kinds of communication equipment, such as modems, telemetry channels, etc.

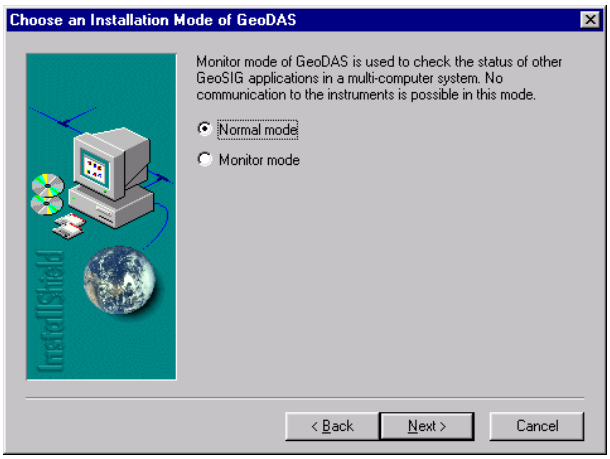
It is recommended to set the display resolution to 1024x768 pixels minimum. ODV (Off-line Data Viewer) requires 65536 colours or more.

2 Application Installation

GeoDAS is installed as many other Windows programs. In order to install GeoDAS, simply run the Setup program from an installation CD or from a diskette. The Setup program will guide you through a step-by-step installation process.

If you have a previous version of GeoDAS already installed in your computer, you will be asked to select either **quick upgrade** or **full installation**. The quick upgrade ensures that all old settings will be kept for the new version of the program and therefore it is the recommended option.

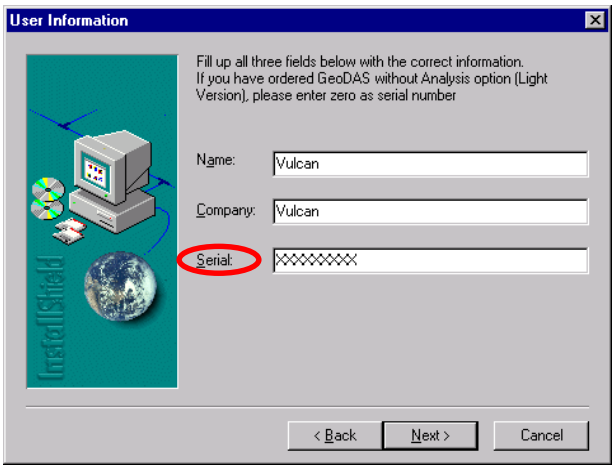




The installation mode of GeoDAS is chosen with the next setup screen. In most cases the "**Normal mode**" is the right choice. The **monitor mode** is used in special multi-computer configurations only. GeoDAS application installed as monitor can control other GeoSIG applications and can provide the general information about them to the subscribers by email an/or SMS messages.

If a full installation is performed, the next screen will ask you to enter specific user information

Please note that Off-line Data Viewer with the simple functionality is an integral part of GeoDAS. But the extended analysis functionality is provided as an option. A customer has to order it and receive a valid serial number, which must be entered during installation in order to enable access to the Analysis menu of GeoDAS



Enter a **Serial number** if you have ordered the Analysis option or enter "0" if you have not ordered it. In such case, the Program will be installed as a "Light Version". Valid serial numbers are provided in the format xxxxx-xxxxxxxx.

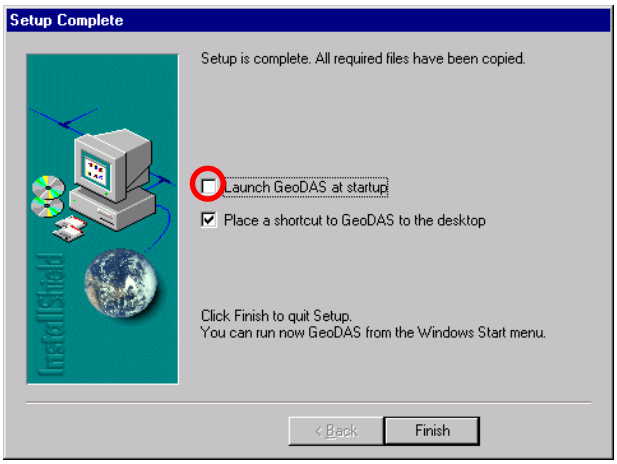
If you did not enter the Serial number or if you entered an incorrect code, the Analyse menu will be disabled and no single item of this menu can be accessed. You can also enter the correct serial number later at any time using Help->Registration menu.

Next setup screens will ask you to choose:

- a destination directory, where the main executable program files will reside;
- name of the folder, which will be created under Start->Programs menu to place a shortcut to GeoDAS there;
- location of the GeoDAS home data directory. This directory will become a root data directory for all configuration files, all event data files, etc. This directory may differ from the one, where executable modules of GeoDAS are located.

There are two options available for choosing in the very last setup screen:

- **Launch GeoDAS at startup**. This option allows GeoDAS to be launched when Windows starts up.
- **Place a shortcut to GeoDAS on the desktop**. This option, if selected, will place a program shortcut on the Windows desktop for your convenience



Note: If you intend to use GeoDAS for the data acquisition utilising an ADC board, please make sure that all required drivers and libraries provided by the board manufacturer are installed correctly in the computer running GeoDAS. Please refer to the installation instructions supplied along with your board. The GeoSIG GSR-12PC recorders already have these drivers installed.

3 Getting Started

3.1 Running GeoDAS.

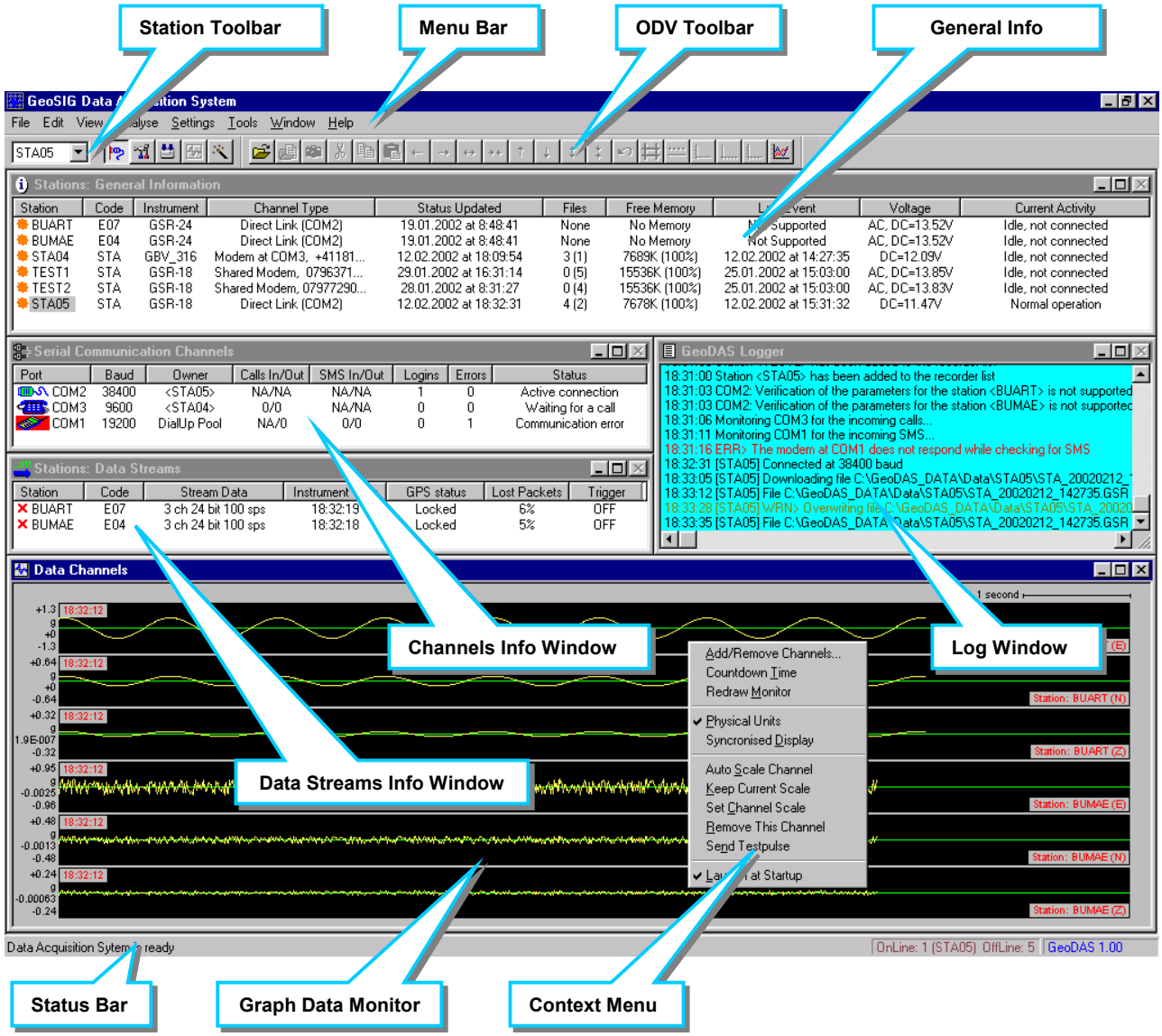
Running the GeoDAS is not different from running any other Windows application. Program can be launched from the DOS prompt typing the full program name at command prompt or by double clicking GeoDAS icon with the left mouse button in the Windows environment. After some seconds of initialisation, the main GeoDAS window will appear in the screen.

GeoDAS application is intended to serve several standard GeoSIG instruments at the same time and therefore the most of information in all windows is presented as the lists of stations (instruments) indicating different parameters.

3.2 GeoDAS Main Screen

An example of the main GeoDAS screen is shown in the figure below. The figure indicates also the basic elements of this screen.

At the top of main window you see the typical window menu - **GeoDAS main menu**. The main menu lists the basic categories of functions available: **File, Edit, View, Analyse, Settings, Tools, Window** and **Help**. All of them have pull-down submenus and all the references to items of submenus are given hereafter in the form “Main_menu_item/Submenu_item”, for instance menu item File/Exit quits the application.



Besides of the pull-down menus, there are also **context menus** available in many list view windows. Right click in a window, and the corresponding menu will appear, if available. The content of such menu and the accessibility of its items depend on the current context: whether a parent window displays some information, whether it has at least one item selected, etc. An example of such menu is shown in the picture above for the window "Data Channels".

There are two toolbars available in GeoDAS with the buttons for the main operations: **Station Toolbar** and the **ODV Toolbar**. With the first toolbar one can select a station from the list and perform the basic operations with selected station. If no station selected in the combo box of the Station toolbar then the first button initiates the procedure of Quick Login otherwise GeoDAS logs into the station, which is currently selected. The last button of this toolbar launches the Adding new station Wizard. The ODV toolbar has buttons for many operations of the Off-line Data Viewer.

The **Status Toolbar** located at the bottom of main window displays important system messages, progress indicators for the operations, which take long time and some other status information.

There are several **information windows**, which display various parameters of all the configured stations: general information, status of the data stream, parameters of the communication channels, etc. All these windows are described in the further chapters in more detail.

The **Logger window** displays the latest system messages, which are saved also to the current GeoDAS log file. This window is opened first and always exists, irrespective to the current GeoDAS configuration.

The **Data Channels** window displays current data signals arriving from the remote stations with the data streams. Many data channels can simultaneously be monitored with this window.

Other elements of the GeoDAS interactive interface are many **dialog windows**, which are used to set different working parameters or to monitor some detailed information arriving from an instrument.

Depending on its configuration, the GeoDAS may show some other information windows, such as Statistics of communication, Status of Applications. More detailed information is provided in the next chapters.

When you start GeoDAS for the first time, you will see the Logger window only. No other information windows appear in the screen because you do not have configured any station yet. Therefore the next steps after the GeoDAS installation is to configure the stations you will work with and set parameters of the instruments. You have to go step by step through the following procedures:

1. **Configure the stations, i.e. make your instruments known to GeoDAS: Configuring the Stations**
2. **Connect to every configured instrument to ensure that all communication parameters are correct and all instruments are accessible. Ensure that the settings of all instruments are set as required, otherwise adjust them with The Instrument Setup Manager**
3. **Adjust parameters of GeoDAS, including those related to its extended functionality (if required),** see **The Other Capabilities of GeoDAS.**

The above steps are described further in more details.

4 Configuring the Stations

The terms "instrument" and "station" are used in different context:

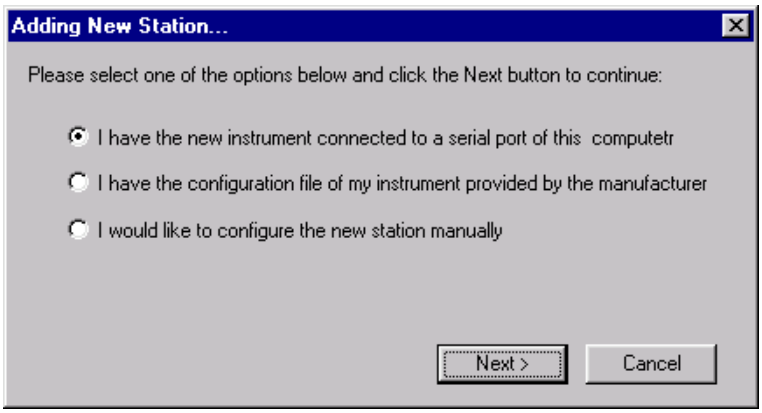
- “Instrument” refers to the physical device type (such as “GSR-18”)
- “Station” refers to a name given to a specific recorder/digitiser, installed at a specific location

One can upgrade an existing instrument without changing the station configured in GeoDAS.

Every Station is identified by its unique name and every Instrument is identified by its unique serial number.

4.1 Adding new station Wizard

The simplest way of adding a new station to the current configuration of GeoDAS is to use the Wizard of Adding a New Station. Press the wizard button in the station toolbar and the following dialog appears.



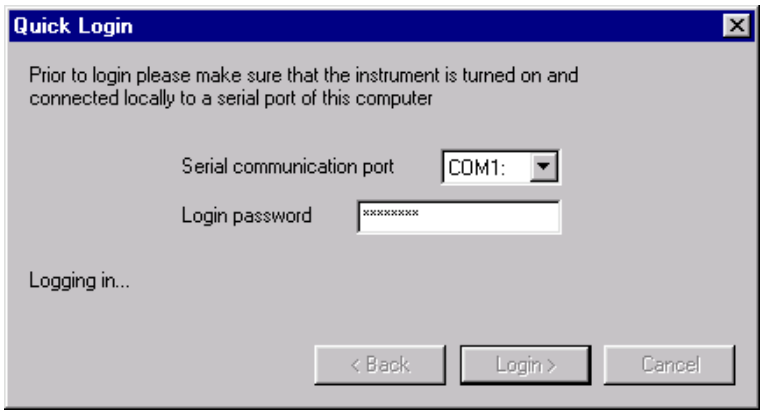
You may choose one of three ways of adding a new station. If you have only one instrument and it is connected locally to a serial port of your computer, the first option will be the best choice. In this case the Quick Login dialog will appear as soon as you press the button **[Next >]**.

If you received your instrument along with a configuration file provided by GeoSIG, you may select the second option. Then you will be asked to select this configuration file with the next dialog called Adding new station(s) using the configuration file.

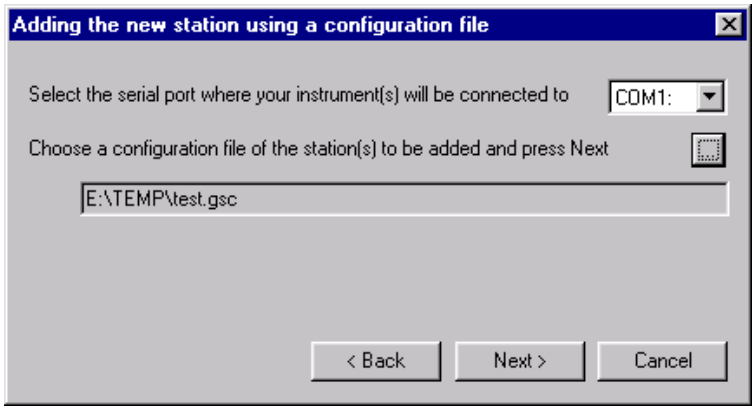
The third option is for experienced users only but it provides the most flexible way of adding a new station. You can adjust parameters of communication channel and customise different work options of your new station. This is the only way to add a station, which is accessed through a dial-up connection, or to create a configuration with many different stations. More detailed information is provided further in the issue Adding a station manually.

4.2 Quick Login

The Quick Login dialog is used to log into an instrument, which is not yet exist in the current configuration and therefore it is used also while adding a new station to login to it and to gather its main, most critical parameters. In order to perform the quick login, one has to choose the correct serial port where your instrument is connected to and to enter the valid Password. Then press the **[Login >]** button. If this method is used to add a new station but the instrument connected to the specified port exists already in the current configuration, it will not be added. On the other hand, if this method is used just to login to a station but this station does not exist yet in the current configuration, it will be added.

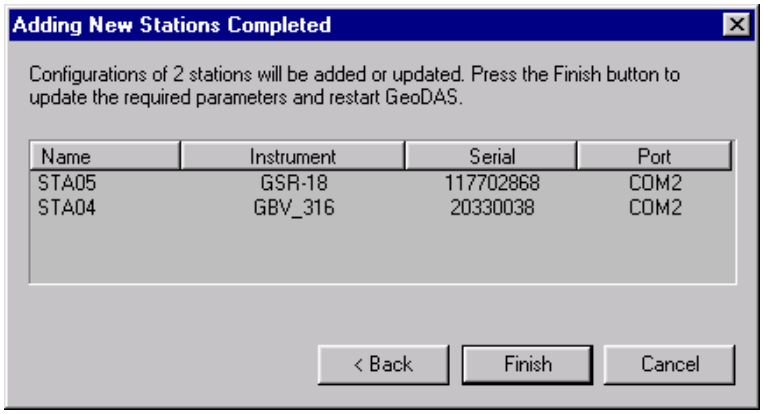


4.3 Adding new station(s) using the configuration file



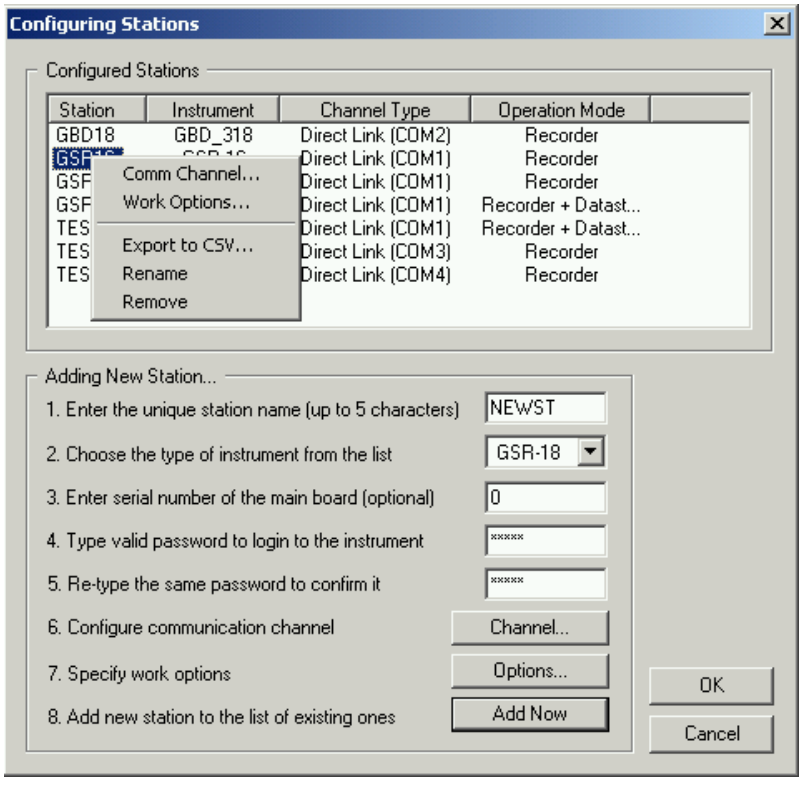
New instruments are shipped usually with the configuration file attached. Configuration files have GSC extension. They are created during factory tests and they keep all parameters of your instrument along with the other default settings. Note that such file can keep parameters of several stations, which provides the efficient way of adding them to the GeoDAS's configuration. Select a communication port and the configuration file of your new instrument(s) and press the button to complete the wizard.

4.4 Completing the procedure of adding new stations



This is the last dialog of wizard. It lists all new stations, which can be added to the current configuration. Note that GeoDAS assigns the default names to new stations added with the Quick Login method in the form STNNN, where NNN is the number from 001 to 999. If you would like to change these names, you can do it later at any time. You can also adjust other parameters of the new stations later as it is described in the issue Editing parameters of the configured stations. Press the button **[Finish]** to let GeoDAS be restarted and to complete adding the new stations.

4.5 Adding a station manually



The stations are configured manually with the dialog, which is launched either from the main GeoDAS menu (Settings) or from the context menu of the General Information window.

The upper part of the dialog window is a list of already configured stations indicating the station name, type of instrument and communication channel and the operation mode.

Below this list one can see the group of controls indicating eight steps, which must be performed in order to add a new station.

1. Type the station name. Maximum 5 characters. Station name must not have spaces or unprintable characters.
2. Select the type of the configured instrument from the list of combo box.
3. Enter the unique serial number of the main board of your instrument. The serial number is required for correct addressing of several

instruments connected to the same communication port. If it is not the case, you may leave just zero as a serial number. GeoDAS will replace this number with the correct one upon the first successful login to an instrument

Please note that the serial number you enter is the unique instrument identifier provided when the instrument is shipped out to a client and it must be correctly indicated to GeoDAS, otherwise there could be a failure connecting to an instrument. Serial numbers from 1 up to 31 are reserved by GeoDAS for internal use. The serial number of an instrument has usually 6 digits. It can be found in the documents shipped together with every instrument. The same serial number is indicated also on the the yellow sticker of the main board.

4. Enter a password. Please refer to the issue Password for more information.
5. Confirm the password by entering it once again in the Confirm Password edit box. You can change the password later at any time with the Instrument Setup manager.
6. Specify a communication channel to an instrument (button **[Channel...]**)
7. Specify work options (button **[Options...]**)
8. Now you can press the button **[Add Now]**. If all settings are correct, the station will be added to the list of configured stations.

4.6 Editing parameters of the configured stations

1. Select the station(s) you are going to configure in the list of configured stations

To simplify the procedures working with several remote stations in the same manner, the program provides a possibility for multi-selection of the stations during setup, monitoring and while performing other operations whenever is possible. Therefore you can edit communication parameters and work options of several selected stations at the same time

2. Right-click to activate the context menu and select the function:

- **Comm Channel** - to edit parameters of the communication channel
- **Work options** - to edit general options working with an instrument
- **Export to CSV** - to save current configuration of the configured stations to a CSV-file (comma-separated values). This item is always available, even if no station is selected
- **Rename** - to rename the currently selected station
- **Remove** - to remove selected station(s) from the current configuration

4.7 Password

To prevent unauthorised change of parameters or misuse of the recording system (for instance, connected via modem to the public telephone line), the recording system needs a Password to initiate communication. The Password consists of a maximum of 8 characters; the program does not distinguish between upper and lower-case.

Three levels of communication to an instrument are available for the operator. The level depends on the password being used for the Login.

Login Level 1

In this level the operator may only look at the status of the instrument and the parameters, it does not allow operators to make any changes. It is possible to retrieve data files, but not to delete any data. Default password: **login001**

Login Level 2

This level permits an access to all the operations, which are necessary to set-up and control the recording system; parameters may be changed and the memory may be cleared. Default password: **login002**

Login Level 3

This level permits all of the above function plus access to certain specific setup parameters. Default password: **login003**

4.8 Communication Channel Setup

4.8.1 Types of communication channels

GeoDAS can work as a central station for several local and/or remote instruments. Every station has a serial communication interface and can be accessed through different types of serial channels. Depending on the tasks performed by the instrument, the following general options can be used:

- Simplex channel (instrument to GeoDAS only, data steams from locally configured instruments)
- Half-duplex channel (typically UHF telemetry, GSM SMS (Short Message Service), RS-485)
- Full-duplex channel (direct or modem link, including spread spectrum radio modems)

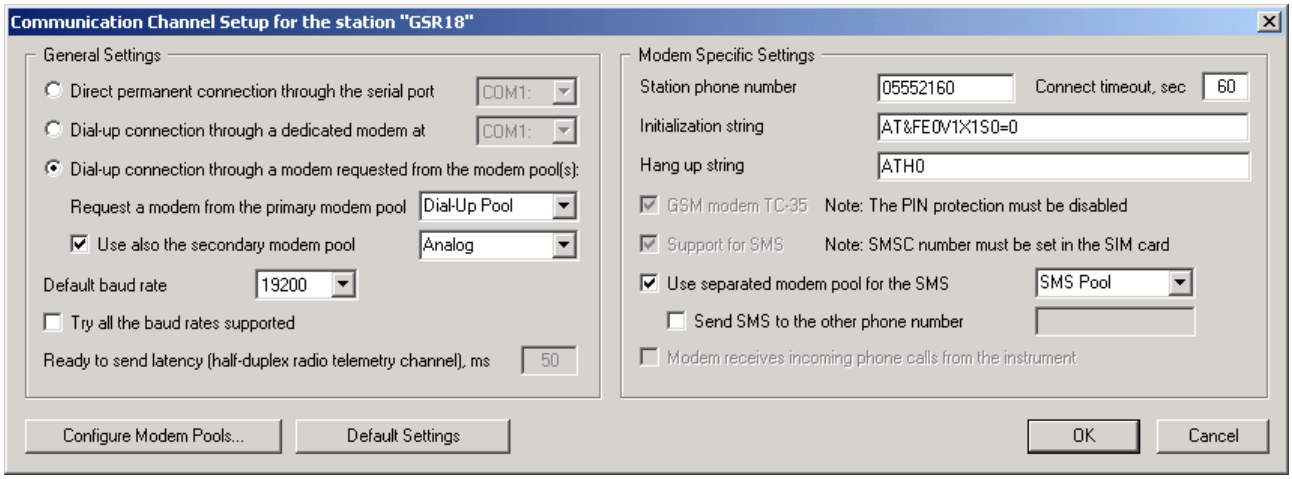
Instruments may have dedicated physical channels to GeoDAS, which provide a possibility to support permanent data streams. Instruments working as recorders only do not require to have dedicated channels. Setup of the recorders, monitoring of their State of Health (SOH) and downloading of the event files may be performed from time to time through shared channels like modem telephone lines.

In some cases several instruments can be accessible through the same physical channel at any time, for instance, while using telemetry radio channels. In order to access several instruments through the same physical serial channel, the procedure of login into an instrument uses a unique four-byte serial number of an instrument along with the password. This approach assures responding to a request only from an instrument, which has the requested unique serial number.

In all cases GeoDAS must be given information about serial channel(s), which can be used to access every configured station.

Click the **[Channel...]** button to setup communication channel (when adding a station) or choose "Comm Channel..." from the pull-down menu to launch this procedure for a configured station.

The Communication Channel Setup window will appear:

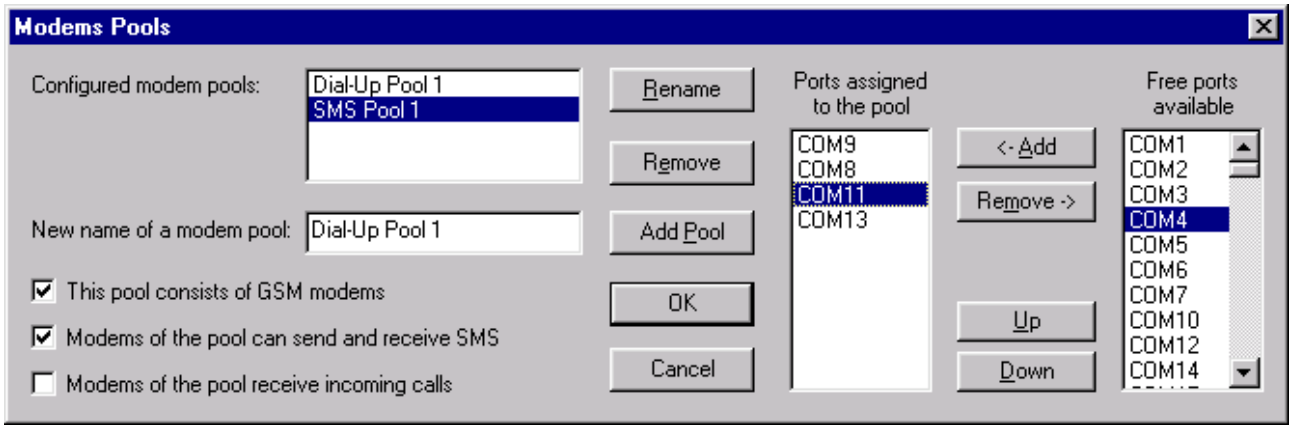


First of all, select the type of communication channel. It can be one of the followings:

1. Direct link through a dedicated serial port. This type must be used if your instrument is connected with the RS-232 serial cable or it is accessible through a radio telemetry link, spread spectrum radio modem, etc. The port number must be selected from the list.
2. Dial-up link through dedicated modem. Connection over a telephone line. The same modem is always used to connect to the station, which is configured. This type of connection also requires a serial port to select.
3. Shared Modem. Connection over a telephone line. But the modem is selected from a group of modems (modem pool). Each time the link must be established, GeoDAS searches for the first idle modem in the pool and uses it to establish the connection.

4.8.2 Modem pools

In order to configure a connection using the shared modems, you have to specify first one or several modem pools. Simply press the button **[Configure Modem Pools...]** and the following dialog will be launched:



You can enter the name of a new modem pool in the edit box and then press the button **[Add Pool]** to add it to the list of configured modem pools. If you select a modem pool from the list, you can:

a) Remove this modem pool from GeoDAS configuration by pressing the button **[Remove]**;

b) Rename it. Enter a new name in the edit box and press the button **[Rename]**;

c) Configure modem pool. Ports, which are included already to the pool, are listed under "Ports assigned to the pool". The rest of available ports are called "Free ports available". Use the corresponding buttons to add/remove ports. Buttons "Up" and "Down" arrange the order of access to the ports.

Furthermore, there are three options available in this dialog. They are applied individually to each configured pool.

- **This pool consists of GSM modems**. This option must be checked if the modem pool consists of GSM modems only.
- **Modems of the pool receive incoming calls**. If enabled, this option instructs GeoDAS to monitor incoming calls, which can be made by the stations configured to dial out on events.
- **Modems of the pool can send and receive SMS**. Makes sense for GSM modems only. Please note that not all GeoSIG instruments support SMS messages.

As soon as you have all the required modem pools configured, press the **[OK]** button to save the current pool configuration or **[Cancel]** to discard all the changes you have made and return to the Channel Setup dialog.

If you configure a channel type as the one provided with a shared modem, you have to select the name of a primary modem pool from the list. GeoDAS provides also the possibility to use a secondary modem pool for this type of communication. This allows the communication strategy to be configured in a more flexible way, for instance, one modem pool can be assigned to receive incoming calls and the other pool can be used for dialling out only. In any case the modems are requested by GeoDAS from the secondary pool only if all the primary channels are busy.

4.8.3 Other communication parameters

- **Default baud rate** specifies initial baud rate of the communication channel. GeoDAS tries first to connect to an instrument at this baud rate.
- **Try all the baud rates supported**. If an instrument does not respond at the default baud rate and if this option is enabled, GeoDAS will try the other baud rates until it gets connected to an instrument. Available baud rates are: 1200, 2400, 4800, 9600, 19200, 38400, 115200
- **Ready to send latency** is a parameter, which is important in case of half-duplex radio channels. It specifies the time interval in milliseconds, which is required to switch the radio modem from receiving to transmitting mode.

The group of parameters called "Modem Specific Settings" includes various options, which are valid for dial-up communication channels only:

- **Telephone number** of the station. Note that the default dial mode is TONE. In order to dial a phone number in the PULSE mode, simply insert the prefix 'P' before the phone number, e.g. P167924.
- **Modem initialisation string** is sent to a modem every time while establishing a connection to ensure the proper initialisation of all modem parameters. Typical components of this initialisation string are as follows: AT - gets the attention of the modem, it is leading to every command string; &F - restores factory defaults; E0 - disables the modems echo mode. For more information refer to the User Manual of your modem.
- **Hang Up string** is sent to a modem to hang up the telephone line (for Hayes compatible modems: ATH0). This sequence of commands is used to hang up the telephone line only if the link has been interrupted unconventionally. Usually GeoDAS hangs up the line automatically after a Logout.
- **Connect timeout** is a maximum time interval (in seconds) to dial a telephone number and to establish a connection to the remote instrument.
- **GSM modem** checkbox instructs GeoDAS to use an extended set of AT-commands for GSM modems.

Please make sure that the PIN code protection of your SIM card is disabled prior to use this card with a GSM modem.

- **Support for SMS**. This option is valid for GSM modems only. It allows many short messages like setup commands or SOH reports to be transferred in the batch mode using SMS. In order to use the SMS service, the telephone number of your SMS Centre must be saved in the SIM card. Usually it is done already when you purchase a subscription from the provider. But in case the SMSC number is not yet set, you have to do it manually by using any cellular phone.

Note that not all GeoSIG instruments and not all the firmware versions support currently the specific options of GSM modems, including extensions for SMS communication. Please refer to the User Manual of your instrument to check whether it is compatible with GSM modems.

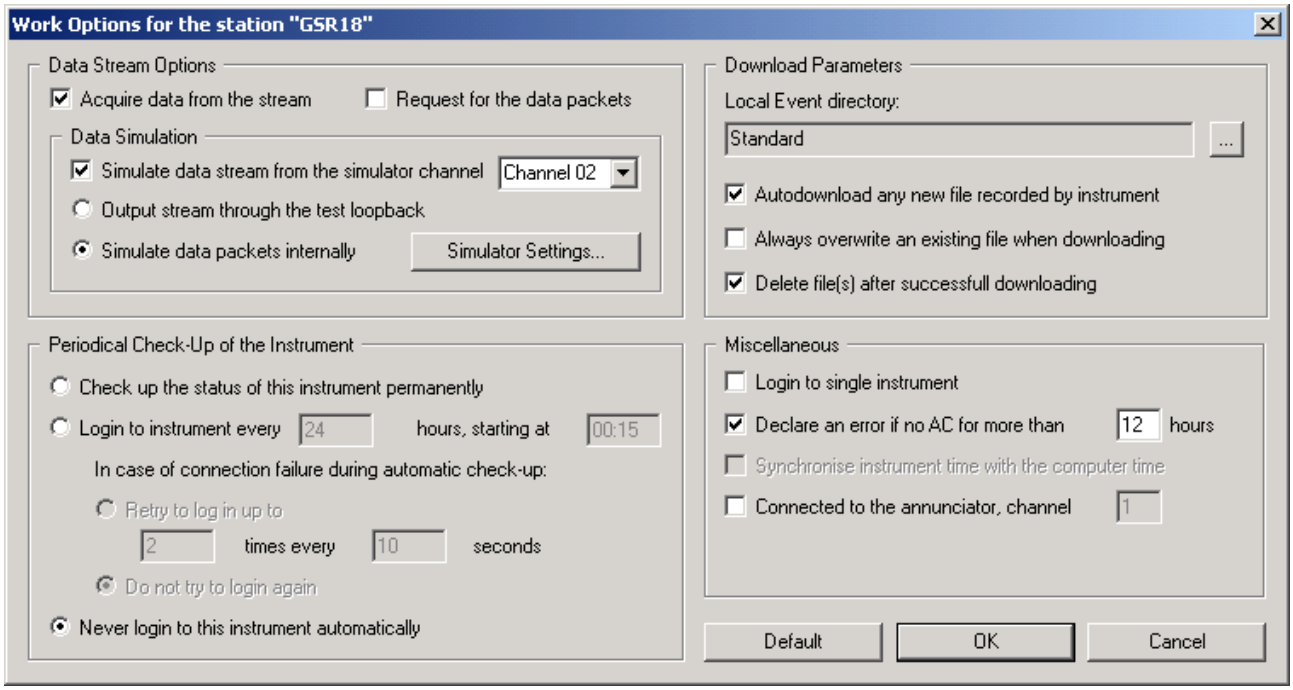
- **Use separate modem pool for SMS**. Since an SMS message can arrive at any time, even when dial-up communication is established, it might be reasonable to have different modem pools for receiving of normal calls from the remote instruments and for receiving of SMS messages. You can specify such a pool with this option.
- **Send SMS to the other phone number**. Very often the SIM card may have different phone numbers for the voice calls and for the data transfer. If you use such a card in the GSM modem of your instrument, you have to enter here the voice number of the SIM card. The number entered as a "Station phone number" must always be the data number.
- **Modem receives incoming calls.** This option applicable to all the dial-up channels and it allows the incoming calls from the stations to be received. In order to make such calls the instrument must be configured to dial out on every new event. See the issue Communication Parameters for more information.

Note that if you are configuring not a dedicated dial-up channel but a modem pool, then the options "GSM Modem", "Support for SMS" and "Modem receives incoming calls" are set while configuring the modem pool, not in this dialog.

4.9 Work Options

Press the **[Options...]** button (when adding a station) or select "Work Options..." from the context menu of the station list to set or adjust the various station options.

The Work Options dialog will appear:



Work options specify the set of parameters, which determine the strategy of GeoDAS operation. They are grouped according to their functionality:

The group **"Periodical Check-up of the Instrument"** specifies whether GeoDAS must **login periodically** to the current station in order to check its status and download event files, which might have been recorded. If check-up is enabled then you have to specify **how often and at which time** it is performed. You can also instruct GeoDAS to **retry automatic login** in case of any failure. In this case the **number of logins and interval** between them must be set. In case of the **permanent check-up**, every next login to the instrument is performed in several seconds after logout. This mode is not recommended for the dial-up and shared communication channels. If neither periodical nor permanent check-up mode is selected, GeoDAS will never initiate a connection to the instrument for a status check.

The group **"Data Stream Options"** tells GeoDAS whether the data stream must be received for the current station. Please note that only GBV, GSR-24 and some versions of GSR-18 instruments provide data streams. The instrument must be configured to send data through the serial channel. You can find more information about the data streams in the chapter Working with Data Streams.

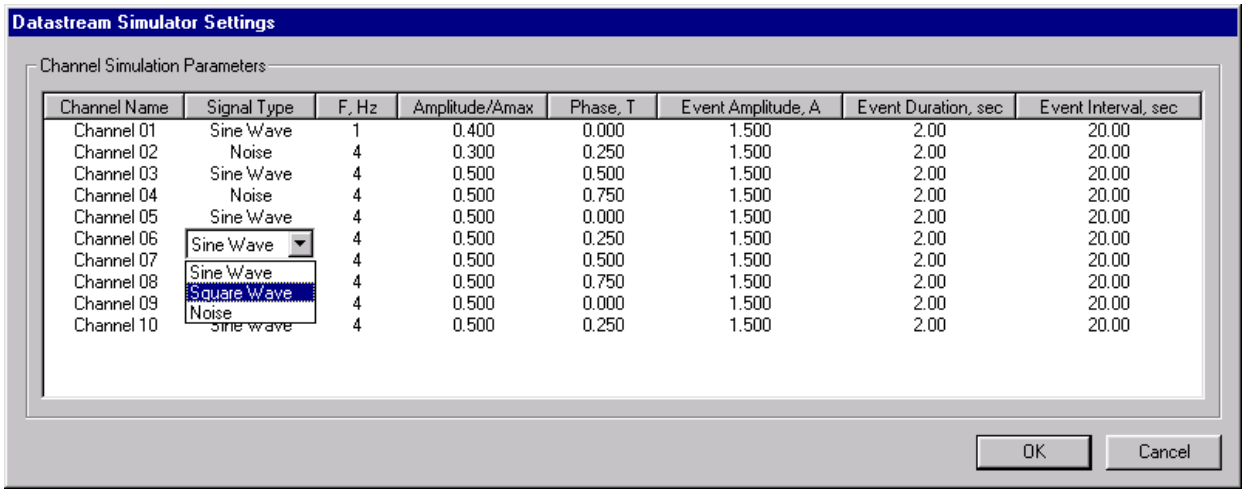
- **Acquire data from the stream**, if enabled, instructs GeoDAS to perform the required actions in order to be ready to receive data blocks from the instrument through a serial communication channel.
- **Request for the data packets**. Some instruments can be set to a mode in which they send data packets by request only. It means that GeoDAS is fully responsible for the timing of such requests but on the other hand it gives the possibility to receive several data streams from different instruments through the same communication channel (Point-to-multipoint configuration).

If your data acquisition system consists of several instruments, which provide data streams in the packet request mode, you have to make sure that:

1. *All instruments connected to the same communication port can provide data streams*
2. *All instruments have been set to communicate with GeoDAS at the same baud rate*
3. *All of them support the "data streams by request" option and this option is enabled*

4. *The number of instruments at the same port, the number of channels in the data streams, their sampling rates and the communication baud rate are selected in a way that one-second data packets from all of these instruments can be delivered to GeoDAS within one second.*

- **Data Simulation**. One can simulate data packets by selecting the simulation option. This feature is provided mainly for debug and training purposes. Two types of simulation are supported by GeoDAS: either data packets are simulated internally or they are sent out through the serial port to be received further by another serial port, as they would arrive from the real instrument. In both cases the software signal generator creates the signal. The generator has several channels and you have to select one of them from the list. Parameters of the signal can be adjusted. Press the button **[Simulator Settings...]** and the following dialog box will appear



You can set here the following parameters of the ten channels:

1. Signal type can be one of “Sine Wave”, “Square Wave” or “Noise”, which is selected from the list;
2. Signal frequency can be set to any positive reasonable value. This parameter is not used for the signal of type "Noise";
3. Amplitude of signal must be specified in interval [0 - 1.0] relative to full scale, which is equivalent to 1.0. If the instrument delivers three components (x, y, z) through the data stream then the amplitude of second component will be only ½ of the first one and the amplitude of third component – ¼ of the first one;
4. Phase of the signal must be specified in units of signal period (not used for the "Noise" type);
5. Event Amplitude is specified by a multiplication factor to the normal amplitude between events. If you do not need to generate simulated events, set this parameter to 1.0;
6. Event Duration and the Event Interval (time interval between events) are set in seconds.

Press the **[OK]** button to save all changes you made and dialog window will be closed after data validation.

*When you press the **[OK]** button in the dialog window, GeoDAS validates all data in all list boxes before taking them into current configuration. This process may take some time and you can see the message in the status bar of the main window "Validating data…"*

The group **“Download Parameters”.** One can specify here whether every new event must be downloaded automatically upon the connection to an instrument. If the file with the same name exists already in the local event directory, one can either skip downloading it or one can overwrite it in any case - this option is also specified here. Finally the file can be deleted from the instrument as soon as it is downloaded successfully or it can be left in the instrument memory. One can also specify the local event directory other than it is suggested by default. But it is not recommended since GeoDAS searches for the event files in the special subdirectories of its home data directory, which makes a problem to find a file in a directory other than the default one. Therefore in most cases the best choice is to leave the word “Standard” (or "default") as the directory name. GeoDAS will select the default directory to story event files.

Last group of the options: **“Miscellaneous”**. The following options are listed here:

- **Login to single instrument**. This option, when selected, forces single login to an instrument without use of its serial number. Must not be applied in multi-instrument configurations, when more than one instrument communicates through the same direct serial link.

When you replace your instrument with a new one, but the station record is left the same in GeoDAS, the option "Login to single instrument" MUST be enabled upon the first login to the new instrument. Otherwise GeoDAS will try to login using the old instrument number and this will never be successful. As soon as GeoDAS has logged once in to the new instrument, the new serial number is retrieved and this option can be disabled again.

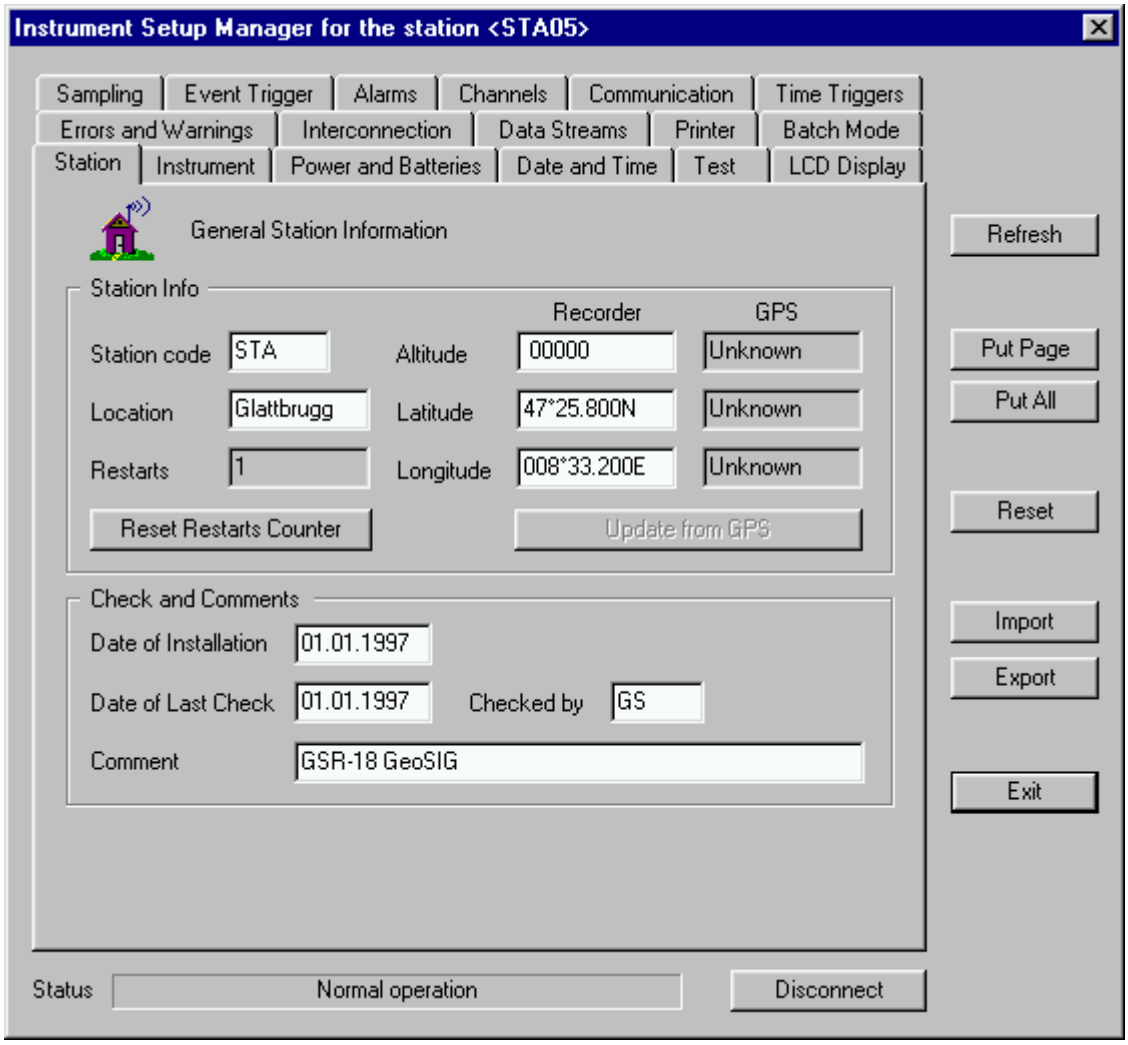
- **Declare an error if no AC …** Usually the loss of AC power is not considered as an error because instruments are equipped with a battery and can work from this battery during the long time interval. But if this option is set then GeoDAS declares an error upon login to the instrument if the specified time interval (in hours) since last power loss is elapsed. This situation is processed by GeoDAS as any other instrument error, i.e. indicated with the red point in the list of stations, logged to the protocol file, reported via messaging system, etc.
- **Synchronise instrument time with the computer time.** This option is used rarely and can only be enabled in the permanent check-up mode. The instrument time is synchronised with the computer time upon every login.
- **Connected to the annunciator…** This option is used in the special applications only, when several instruments are physically connected to the special device, GeoSIG annunciator. Refer to the Instrument Setup Manager page Annunciation for more information about annunciation options.

5 Configuring the Instrument

It was described in the previous chapter how to configure the Station, i.e. how to make your instrument known to GeoDAS, how to establish a link to the instrument by means of the different types of communication channels and how to adjust a strategy working with it. Now it is time to know how to set the parameters of an instrument, how to adjust all the settings according to which your instrument will work even without being connected to the computer. This is the job of the Instrument Setup Manager.

5.1 The Instrument Setup Manager

As soon as a station is configured and the program is restarted, the Instrument Setup Manager becomes accessible through the context menu of the main General Information window. Select a station from the General Info list and either click the item **Instrument Setup** of the context menu or push the second button on a Station toolbar. The following dialog will be launched:



As one can see from the picture, the Instrument setup window consists of two parts. On the right hand side, several control buttons are located, whereas the left part is a set of information pages or 'tabs'. They are filled up with the detailed information stored in the instrument. The following pages are available: Station, Instrument, Sampling, Channels, Date and Time, Data Streams, Communication, Interconnection, Event Trigger, Time Triggers, Error and Warnings, Test, Power and Batteries, Alarms, Printer, Batch Mode, LCD Display.

All setup instrument parameters are grouped into the pages according to their functionality. The set of pages is always the same. But the way in which every particular page looks depends on the type of instrument. If an

instrument does not use some parameter or some option is not supported, the corresponding dialog control (like edit box or check box, etc.) can be either disabled or hidden (invisible).

Some instrument parameters are read only, they cannot be edited but displayed only: the internal instrument counters, statistical data, etc. They are placed usually to the read-only edit boxes.

When you change some parameter and then try to switch to another page, the settings of the current page are checked first for correctness and if some parameter is found incorrect, you cannot change the page before you enter this parameter within the expected range.

Some buttons are enabled if on-line only, i.e. GeoDAS is logged in to an instrument. Otherwise they are greyed and the corresponding actions cannot be performed.

Please note that when sending the updated parameters to the instrument in on-line mode, it might not accept some of them because of the following reasons:

- a parameter is not within the range, available for the current type of the instrument;
- your login level is not high enough to run some particular command;

When you are on-line, the current login level is indicated in the Communication page. The 3rd level is the highest, which allows you to change every parameter.

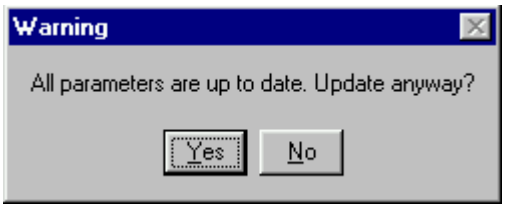
There can be also other problems running some instrument commands. Therefore always verify whether specified parameters are really updated in the instrument. If you see that some parameter has changed its state to the initial one after update, it means that the parameter is not accepted. In case of some failure an error or warning message appears usually in the Log window.

5.2 The Control Buttons

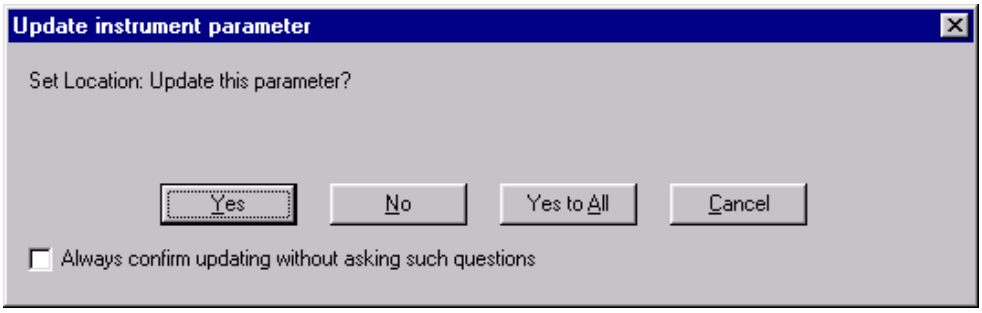
It is important to understand that in general there are two sets of instrument parameters you operate with GeoDAS. There are real parameters, which are kept in the instrument, and there are '"off-line" parameters, which are downloaded from the instrument upon the last login and which are kept locally in the setup file(s). If you are logged into the instrument currently then the real parameters are reflected in the information tabs of the Instrument Setup Manager. Otherwise the off-line set is displayed.

The content of the setup pages is fully updated upon the login to an instrument or when logging out from it. While logged in, only those parameters, which can be changed by instrument at any time, are updated permanently. But if you like to update the whole current page with the actual instrument parameters, simply press the button **[Refresh]** to do so.

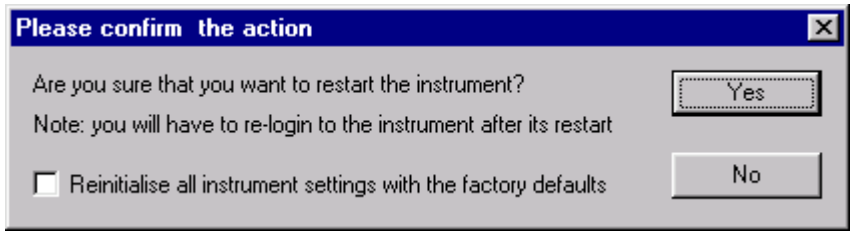
Next buttons are used to send parameters to the instrument, either those shown in the active page (**[Put Page]**) or all parameters from all the information pages (**[Put All]**). In any case the parameters to be sent out are validated first and then they are compared with the real instrument parameters. If no single difference is found, the following dialog box asks user to select the further action. You can either cancel operation answering "No" or all the parameters will be updated regardless of difference between the existing parameters and those, which are sent.



If you try to update all instrument parameters and if GeoDAS has found at least one parameter of the Setup Manager, which does not match the same parameter in the instrument, you will be asked to confirm the update. As always, **[Yes]** and **[No]** are the alternative answers. Pressing **[Cancel]** button will cancel the operation. If you select **[Yes to All]**, then all modified parameters will be sent to the instrument with no more questions. If, in addition, you select an option "**Always confirm"**, then no more questions of confirmation will be asked until the current session ends.



The **[Reset]** button performs a software reset of your instrument. This is almost similar to switching it off and then on again. Please note that not all instruments support the software reset. You have to confirm the action by pressing **[Yes]** in the following dialog. If you select the option "**Reinitialise...**" then **all the current parameters will be lost** and replaced with the default instrument parameters. This operation is applied very seldom, only in case of serious troubles. If you are not familiar well with the instrument setup parameters, it is recommended to save the parameters first to a file (see the Export operation further) prior to this operation. As soon as reset is done, you will be logged out automatically. Wait for some seconds until instrument performs all the restart operations and connect to it again. All setup pages will be filled up with the default instrument settings.



The **[Export]** button provides a possibility of saving the current set of parameters to a configuration file. You can specify the name of a configuration file, which can be placed to any local or network directory. At any time you can download these parameters to the configuration pages of Setup Manager with the button **[Import].**

Besides of the buttons described above, there is also a button, which is used to **[Exit]** from the Instrument Setup Manager and there is a button to log in (**[Connect]**) to the instrument or to logout from it.

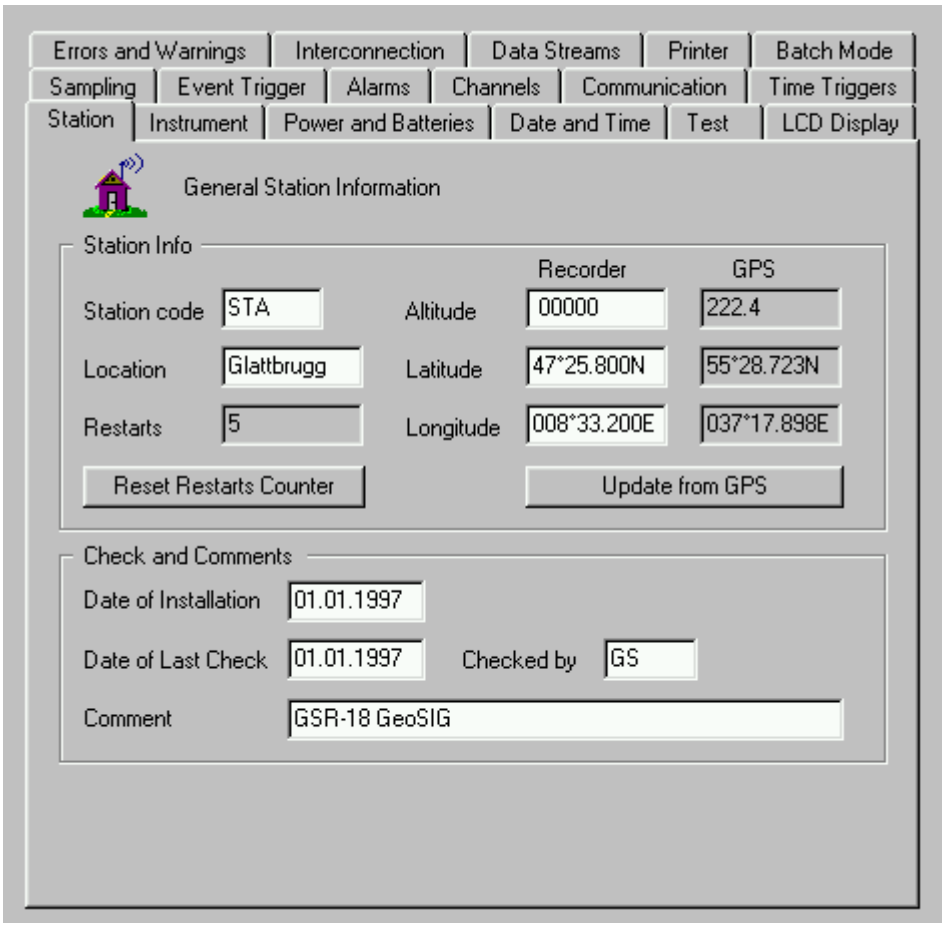
The status line below the information pages indicates briefly the current status of the station. The contents of information pages are described below in more details.

If the Instrument Setup manager is launched from the Context Menu of the General Information Window in the Batch Multi-Setup mode, the buttons **[Refresh]** and **[Put Page]** are replaced by the buttons **[Get By Batch]** and **[Set By Batch].** These buttons are used to get or set parameters of the current page with batch requests.

One more button **[Delete All]** becomes available in this mode. It is used to delete all files from the selected instruments by sending the corresponding batch command.

5.3 Station Parameters

The most of the parameters of this page are related to the place where an instrument is installed. Here you can assign a three-letter code to a station, enter the name of its location and coordinates, including altitude.



The **Station code** can be a combination of any three characters. They are indicated in the General Information window as the station identifier along with the station name. But the code is kept in the instrument, whereas the station name is known to GeoDAS only. It might be a good idea to set the station code as three last characters of the station name. In such case the two first characters can be the code of a local seismic network. This naming convention is used very often for seismic stations.

The **Location** is usually the name of a place where the instrument is installed.

Latitude, **Longitude** and **Altitude** identify the geographic coordinates of the instrument's location. If the instrument has GPS receiver connected, one can set these parameters from the GPS information, which is indicated in this page as well when the receiver provides correct information. Simply press the button **[Update from GPS]** to do so. If there is no GPS available, one can enter the coordinates manually in the following format:

- Longitude: DDD MM.MMML, where DDD - degrees, MM.MMM minutes with thousands, L - must be either W (West) or E (East);
- Latitude: DD MM.MMML, where DDD - degrees, MM.MMM minutes with thousands, L - must be either N (North) or S (South);
- The altitude is entered in meters, 6 characters maximum.

Number of **Restarts** is also indicated in this page. You can reset it to zero by pressing the button **[Reset Restarts Counter]**.

When the instrument is installed, it is recommended to enter and save the **Date of Installation** in the corresponding field.

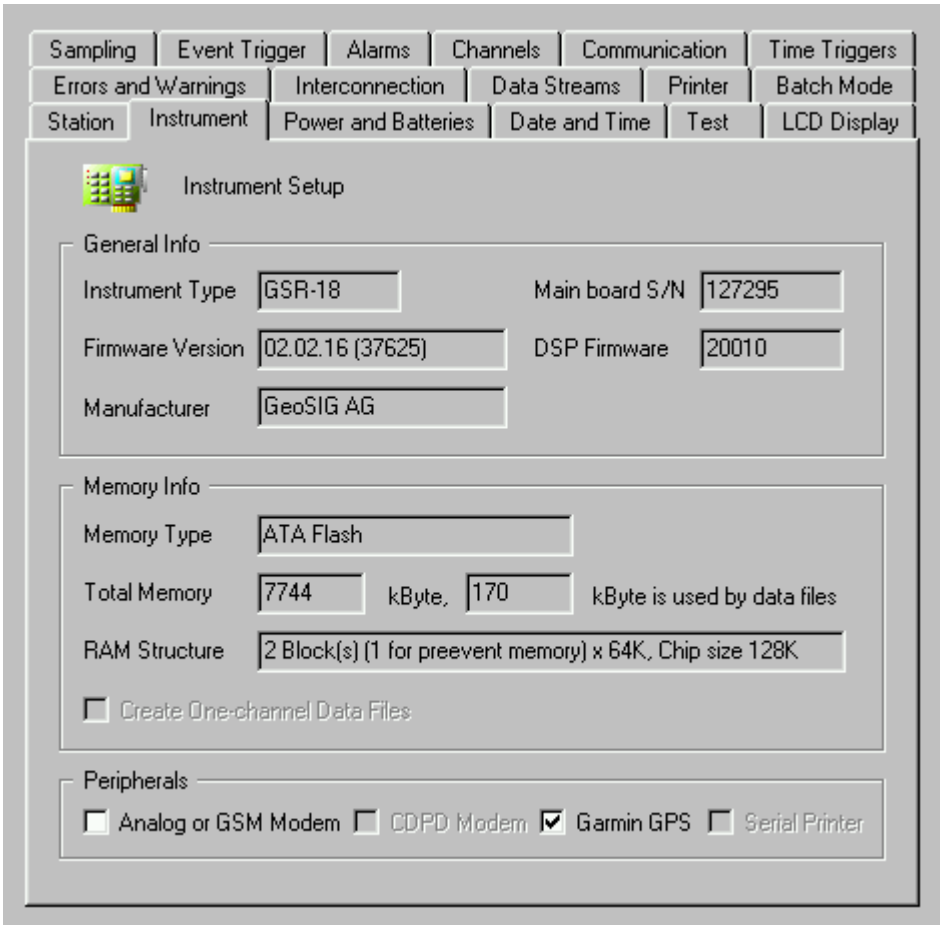
We recommend also updating the **Date of Last Check** and the field **Checked by** on every inspection of the instrument.

The field **Comment** can be filled up with any comment string, which does not exceed 50 characters.

*If you have modified some parameters and would like to save them to the instrument, do not forget to press the button **[Put]** to do so.*

5.4 Instrument Parameters

The parameters of this page indicate general information about the instrument itself. If they are greyed, they are not editable.



The **Instrument Type** and the **Manufacturer** indicate which type of Instrument is connected.

The information on **Firmware Version** might be important in case you ask for any kind of technical support at GeoSIG. Be ready to provide the information about your firmware version.

GSR-18 has a digital signal processor on board with its own software. The version of its **DSP Firmware** is indicated here too.

Main board S/N is the serial number, which you enter normally while configuring a station but this page indicates the correct number retrieved from the instrument upon the first login. The number is indicated on the main board (yellow sticker).

The group **Memory Info** contains read-only information about **Memory Type**, **Total amount of memory** and amount of memory used by data files. The physical storage for the event files is usually the Compact Flash ATA card with a capacity up to 64 MB or even more.

The **RAM Structure** is also indicated here. RAM is a fast memory, which is used by the micro controller to keep various parameters, temporary data, etc. Part of the RAM is used to keep the last several seconds of data acquired from the sensor. In case of an event is declared those data blocks can be saved to the event file as a pre-event section. Thus the amount of memory for the pre-event data is limited by the dedicated RAM size, which means that also the pre-event time has an upper limit.

The option **Create One-channel Data Files** supported by the few firmware versions only. Enable this option if you would like to keep only the first component of the signal in files, even if your instrument has a three-component sensor connected.

The group **Peripherals** specifies which devices are connected to your instrument: **Analog or GSM Modem**, **CDPD Modem**, **GPS**, **Serial Printer**. Only GSR-12/16 and GCR instruments support serial printer. Note that the serial printer and GPS receiver cannot be used at the same time. Only GT-316 instruments currently support CDPD Modem option.

5.5 Sampling Parameters

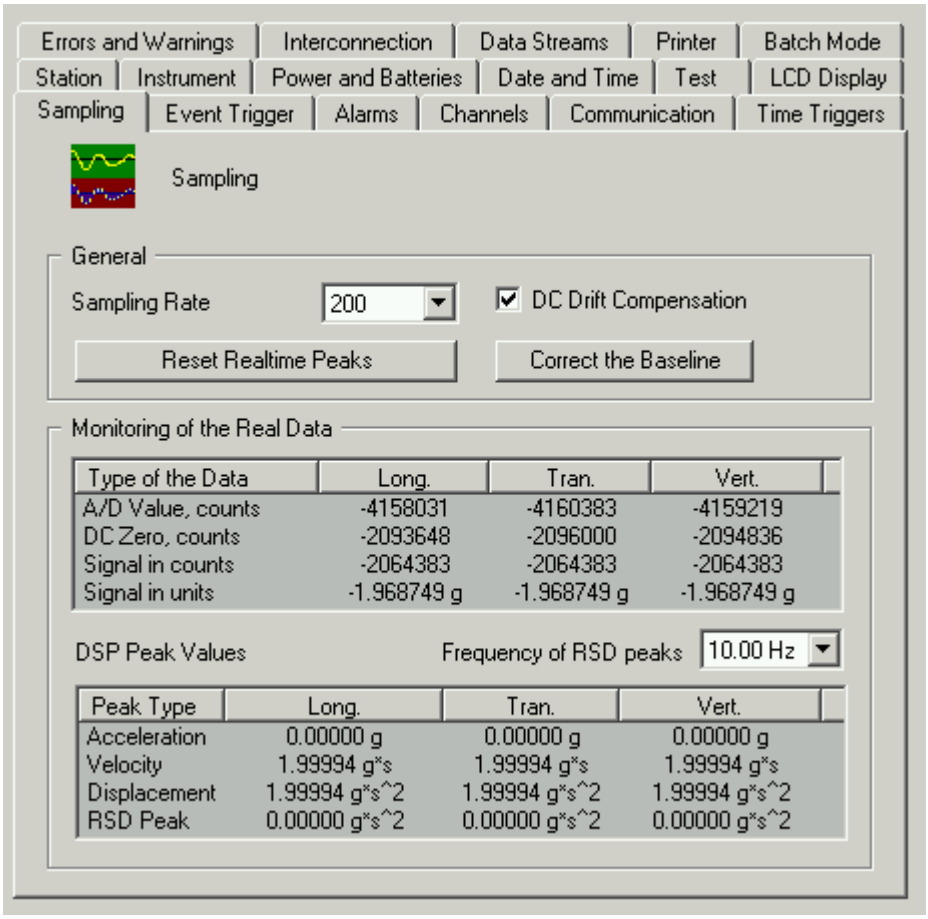
Sampling Rate is the most important parameter of this page. The sampling rate can be set to 25, 50, 64, 100, 125, 150, 200, 250, 400, 500, 800, or 1000 samples per seconds. Not all the listed sampling rates are available for every type of instruments.

Therefore, please, refer to the instrument's manual to check for available sampling rates for your instrument.

DC Drift compensation corrects any permanent offset of the sensor signal. The speed of drift compensation depends on the instrument type.

Zero level of the signal can be adjusted with the button **[Correct the Baseline]**.

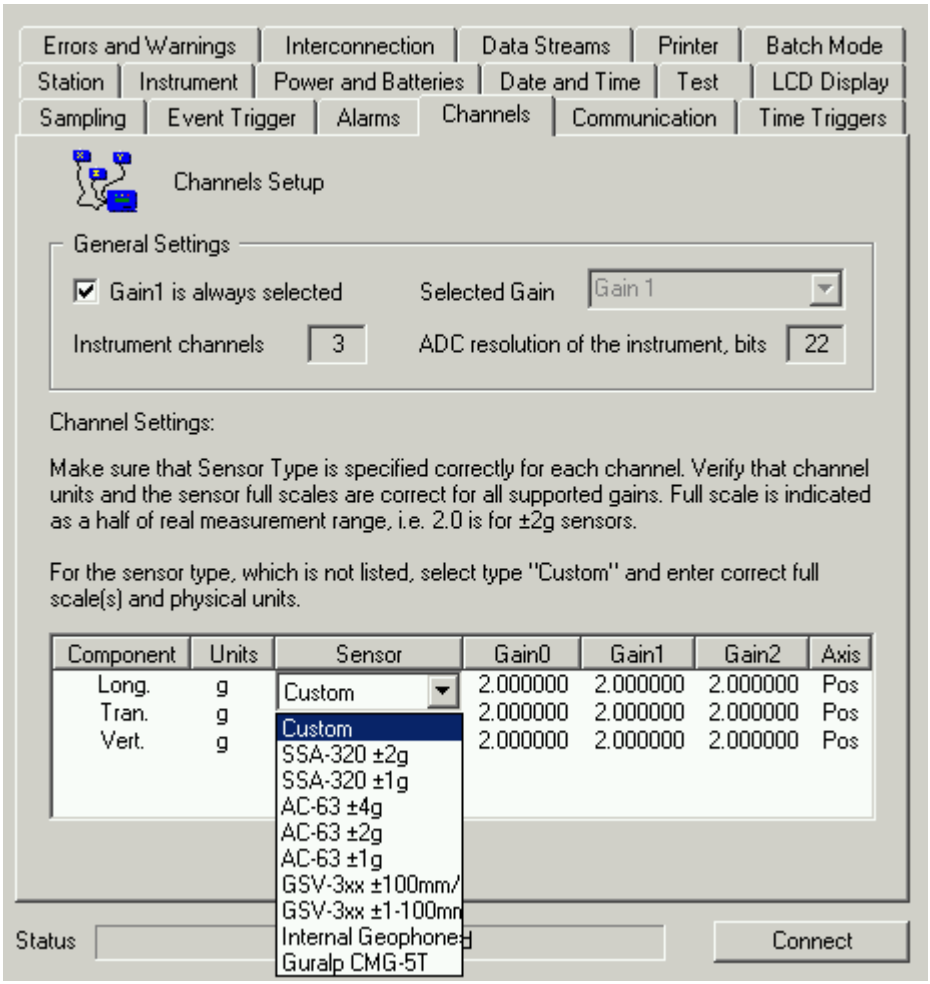
The other button, **[Reset Real time Peaks]** is available for GSR-18 only. It can be used to reset the peak values of velocity, acceleration, displacement, which are permanently calculated by the DSP.



The other group of controls called **Monitoring of the Real Data** displays the tables of current samples and peak values. Please note that the peak values are available for GSR-18 instruments only. The Response Spectrum Acceleration or Displacement (RSA or RSD) is always calculated at several frequencies. You can watch these values at any available frequency by selecting it from the list **Frequency of RSA peaks**.

5.6 Parameters of Channels

This page indicates the main parameters of the channels and the sensor scales.



Generally, three different gains can be set for the sensors with GeoDAS. You can select the desired gain from the list **Selected Gain.** But only few sensors support different gains, for the others the Gain1 is always used, which must be indicated with the option **Gain1 is always selected**.

The actual number of **Instrument channels** and the **ADC resolution** are also indicated in this page.

Main channel settings are summarised in the table. The number of rows in this table corresponds to the number of channels and can be 1, 3 or 4 (GCR instruments).

You can set the following parameters for each channel:

- Name of the channel
- Name of the physical units (typically g for accelerometers and mm/s for seismometers). This parameter is selected from the list, except for the sensor type Custom: in this case you can enter up to five any characters, which will be used as a unit name.
- Sensor type selected from the list as it is shown in the picture.
- Full scale of the sensor (separately for each of three gains)
- Axis direction (positive or negative, i.e. inverted)

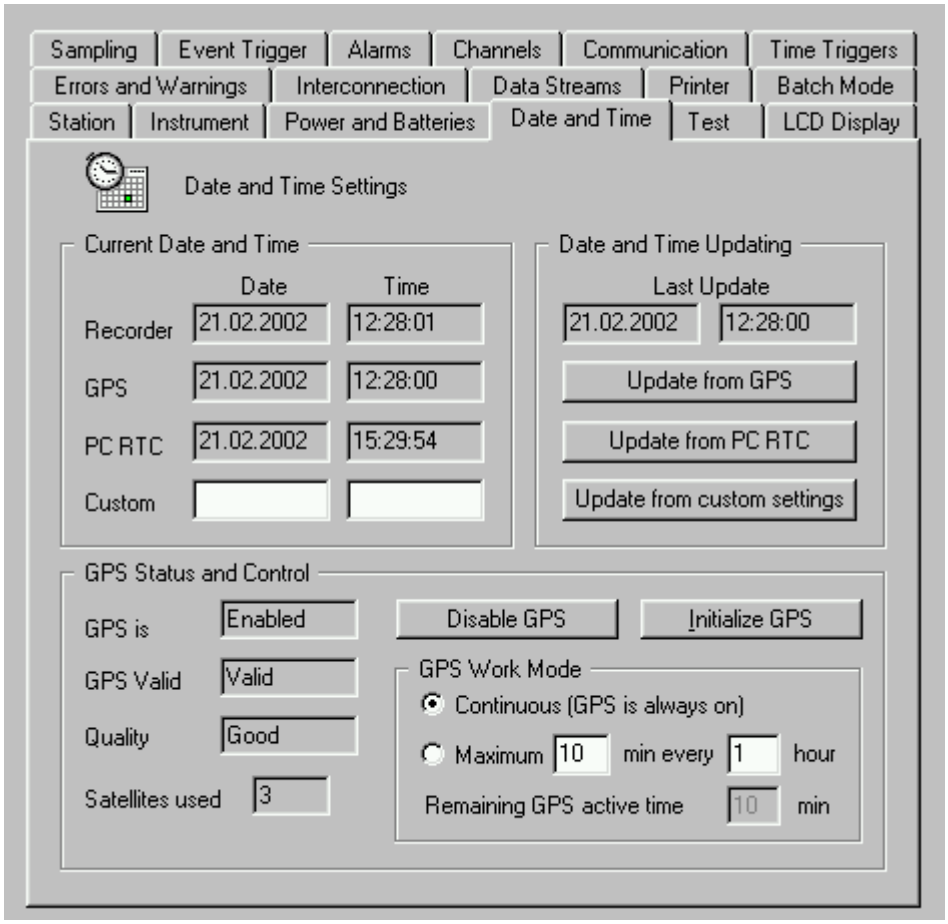
Please note that GeoDAS cannot verify whether all parameters are entered correctly for some types of sensors. Therefore always refer to the manual of your sensor to set the correct value of its full scale.

Full scale values and the unit names can be changed freely for the sensor type "Custom". Actually it can be any type of sensor and the user takes responsibility for the correct input of its parameters. All other types of sensors have fixed pre-defined parameters. As soon as sensor type is selected from the list, gain values and unit names will be set automatically.

Refer to the Appendix A. Information on LSB for more information about Full scales of the sensors and LSB.

5.7 Date and Time

All the time-related instrument settings are located in this page. Three current dates and times are displayed: **Recorder** time (as it is set in the Real Time Clock of the recorder), **PC** time and the **GPS** time (only if GPS is connected and provides valid date and time).



All time stamps of the event files, reference time of the data streams, etc. is taken from the real time clock (RTC) of the recorder and therefore it is important to ensure that this time is correct. The best way of setting the correct RTC time is to use the GPS receiver. If it is connected and provides the valid information, you can update RTC with GPS time by pressing the button **[Update from GPS]**. Usually the instrument performs this procedure automatically.

If the RTC time is not required to be very precise, you can also update it from the computer real time clock by pressing the button **[Update from PC RTC]**.

You can also enter your custom date and time in the fields **Custom** and press the button **[Update from custom settings]**. One can always see when the instrument RTC was updated last time: it is indicated under the **Last Update** label.

The group **GPS Status and Control** displays information about GPS status and its mode of operation. The GPS receiver can be switched on continuously or periodically. The last mode is preferable if the instrument is powered from battery because of the high power consumption. In this mode the GPS is turned on every several hours and remains on until either the maximum time interval of staying switched on is elapsed or the GPS gets locked and the RTC is updated. All these parameters can be adjusted with the controls of the group **GPS Work Mode**.

There is also a button, which can be pushed at any time to **[Disable GPS]** or to enable it again. It is also recommended to **[Initialise GPS]** after the first power on of the instrument.

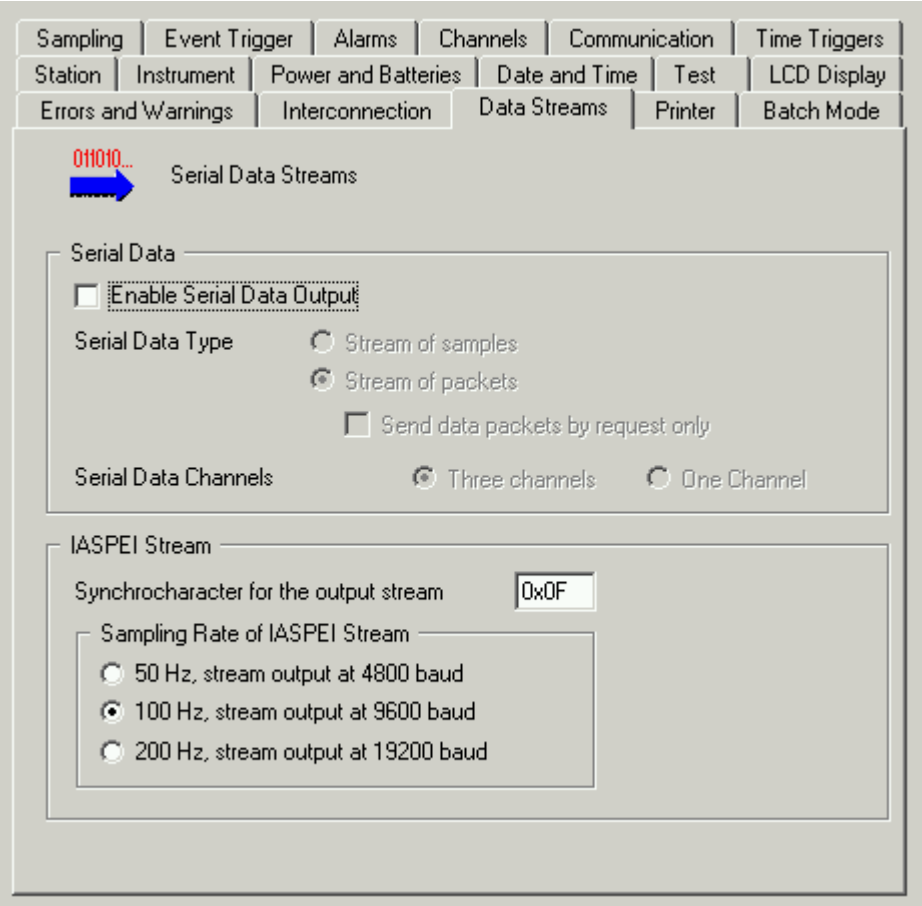
5.8 Data Streams Parameters

This page contains several parameters for the serial data streams. They are valid only for the instruments, which can provide data streams. Two types of data streams are supported. The standard stream of samples or packets is delivered through the main serial communication channel, which is normally used to login to the instrument.

The other type of stream is a stream, which is in IASPEI format (International Association of Seismology and Physics of the Earth's Interior), and which is sent out through the optional additional serial port of the instrument. Not all instruments support this kind of un-interrupted stream.

The standard stream can be either enabled or disabled with the option **Enable Serial Data Output**. One can set also the type of the serial output (either **Stream of packets** or **Stream of samples**).

The data packets can be sent either every second or by request from GeoDAS only, which is indicated by the option: **Send data packets by request only**. This functionality was already described in the issue Work Options



Some 3-channel instruments can provide one-channel data stream. If you would like to enable this functionality, tick the point at **One Channel** radio button.

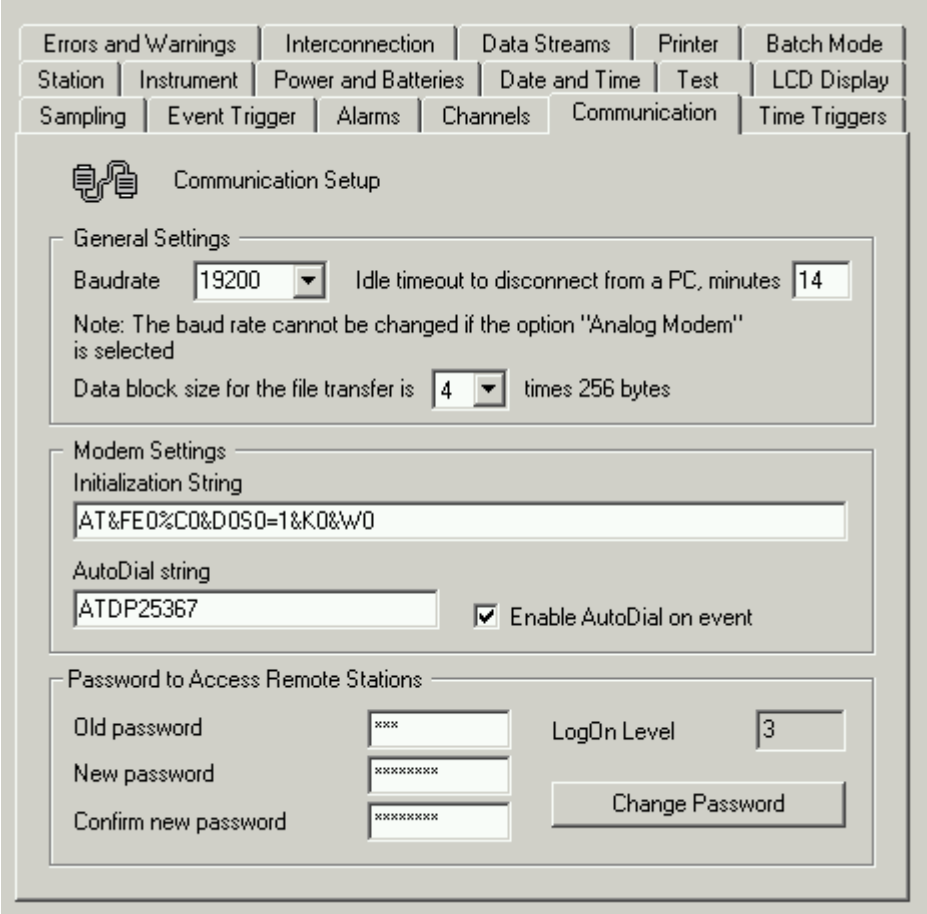
Two options can be set for the IASPEI stream if it is supported: you can specify which **synchronisation character** must be used and the **sampling rate** at which the data are provided.

5.9 Communication Parameters

The parameters of this page specify the most important communication settings. You can change, for instance, the **Baud rate** by selecting it from the list. As soon as you apply the new baud rate by pressing the button **[Put]**, the next command will be performed at the new baud rate.

Before selecting a high Baud Rate such as 38400 or 115200 Baud please verify that the computer is able to communicate at that speed and the channel supports it physically. If you have changed baud rate to a higher value but the quality of link is not enough to communicate at this speed, you will not be able to connect to the instrument anymore. You will have to connect with a short serial cable to change the baud rate back to the appropriate value.

The Baud Rate can not be changed if the recording system is communicating via modem. Usually baud rate is fixed at 38400 baud for the modem connection. To change it, you have to disable first the option 'Analog Modem' in the Instrument page. GSM modems communicate usually at 19200 baud.



Disconnection timeout specifies the maximum time interval to keep an operator logged in without communication to the instrument. On elapsing this time the instrument performs automatic Logout. If it is required to keep GeoDAS logged in to an instrument permanently, the value 255 has to be used as disconnection timeout. But this approach does not work for the dial-up channels.

Data block size is not yet supported by all GeoSIG instruments. You can specify the block size for the event transfer between 256 bytes and 4Kbyte. The bigger the block size the faster the transfer. But if the serial channel is not reliable and there are many errors during data transfer (i.e. many blocks have to be resent) it might be better not to use the biggest available size of the data blocks.

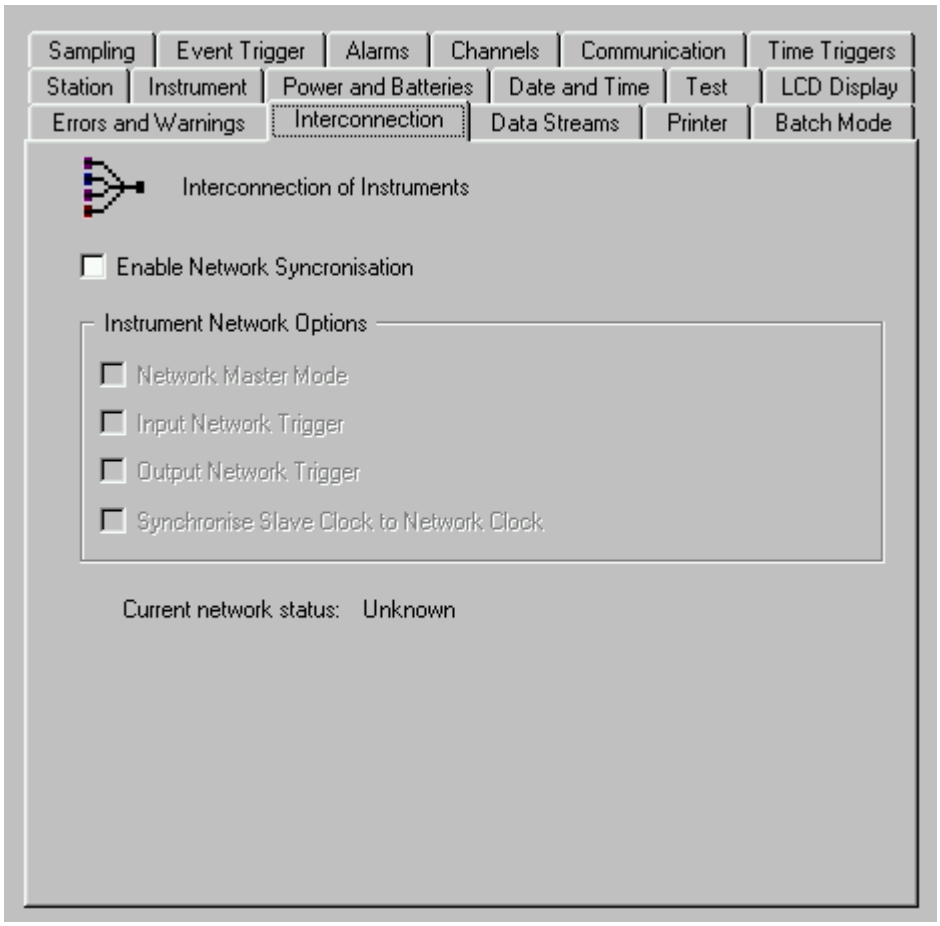
The group **Modem Settings** contains the modem specific parameters such as **Initialisation String**. Please refer to the user manual of your modem to set the optimum modem parameters in the initialisation string. If **Enable AutoDial on event** is selected, the instrument will call back as soon as a new event is recorded. Please make sure that GeoDAS accepts this call by setting the corresponding option in the Other communication parameters while configuring the station channel. The telephone number must be specified in the **AutoDial string** as it is shown in the picture above. When GeoDAS receives such a call, it logs in to the instrument and can download the new event, if the automatic downloading is enabled.

The last group of controls is intended for an instrument password change. You can enter the new password with confirmation in both on-line and off-line mode. As soon as it is entered, press the button **[Change Password]**. If you are staying off-line, the password will be changed locally and it will be used next time to login to an instrument. When connected to an instrument, the current valid password is known to GeoDAS and therefore it must be entered for verification along with the new password and with its confirmation.
Pressing a button **[Change Password]** in on-line mode causes the password change not only locally but also in the instrument.

5.10 Interconnection Parameters

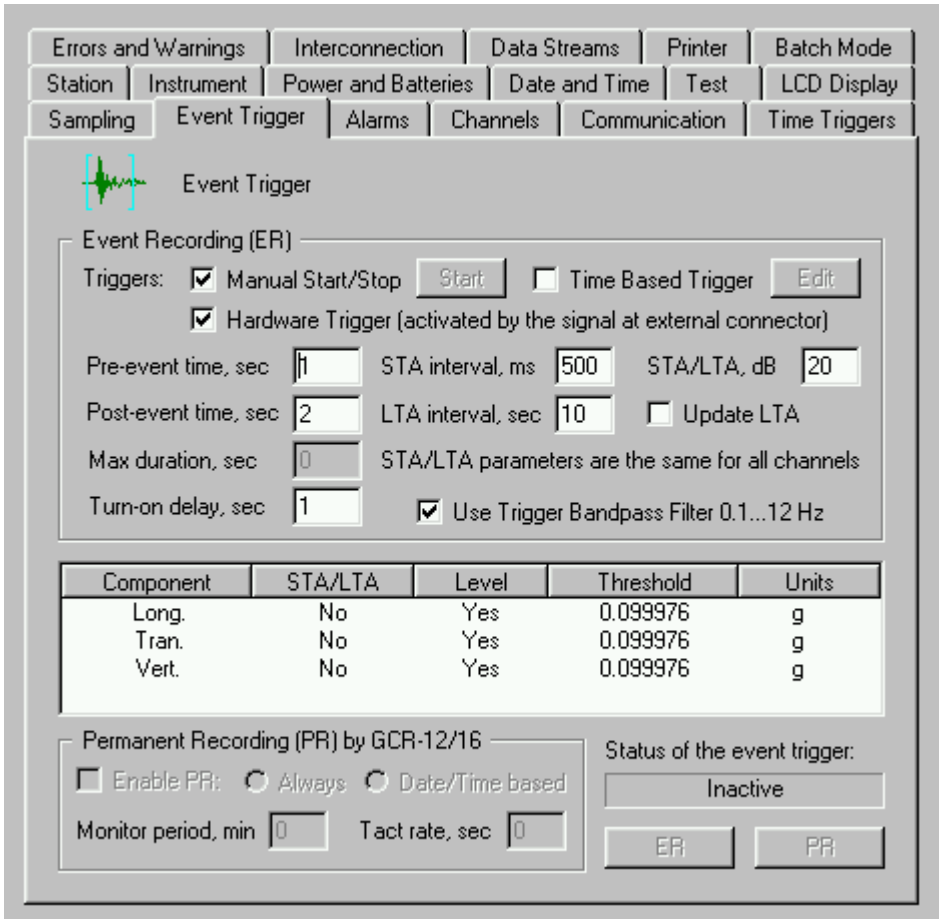
Some Instruments can be interconnected in a local network and the one, which is set as master, provides synchronisation signals for the other instruments. All network options are on this page.

If you would like to use the interconnection options, you have to **Enable Network Synchronisation** first. Then the other options become available. They specify whether the instrument works in a **Network Master Mode**, whether it issues a network trigger signal (**Output Network Trigger**) or it receives the signal from the network (**Input Network Trigger**). You can also **Synchronise Slave Clock to Network Clock** by selecting the corresponding option.



5.11 Event Trigger Parameters

All triggering options can be found in this page. They define the strategy of the event recording and therefore it is one of the most important pages of the Instrument Setup Manager.



Two main types of triggering algorithm are supported: level trigger and STA/LTA based trigger. Beside of that, the trigger can be initiated by a software command (**Manual Start/Stop**), by the external signal (**Hardware Trigger**) or it can be issued based on some predefined date/time (**Time Based Trigger**). Last three types of triggering can be either enabled or disabled by ticking of corresponding checkboxes.

Level trigger and STA/LTA based trigger can be enabled or disabled channel-wise. Set 'Yes' or 'No' in the table to enable or disable those types of triggers. The level triggers have individual thresholds for each channel, whereas the STA/LTA triggering algorithm has the same parameters for all channels. They are:

- **STA interval** in ms;
- **LTA interval** in seconds;
- **STA/LTA** threshold ratio in dB;
- **Update LTA**: whether LTA calculation must be clamped during the event recording.

Every event waveform is recorded with some additional parts before a trigger is declared and after de-trigger is declared as it is specified by the corresponding parameters (**Pre-event time** and **Post-event time**). In order to let the instrument stabilise its work parameters, the triggering algorithms do not issue a trigger within **Turn-on delay** time interval after the instrument is turned on or restarted.

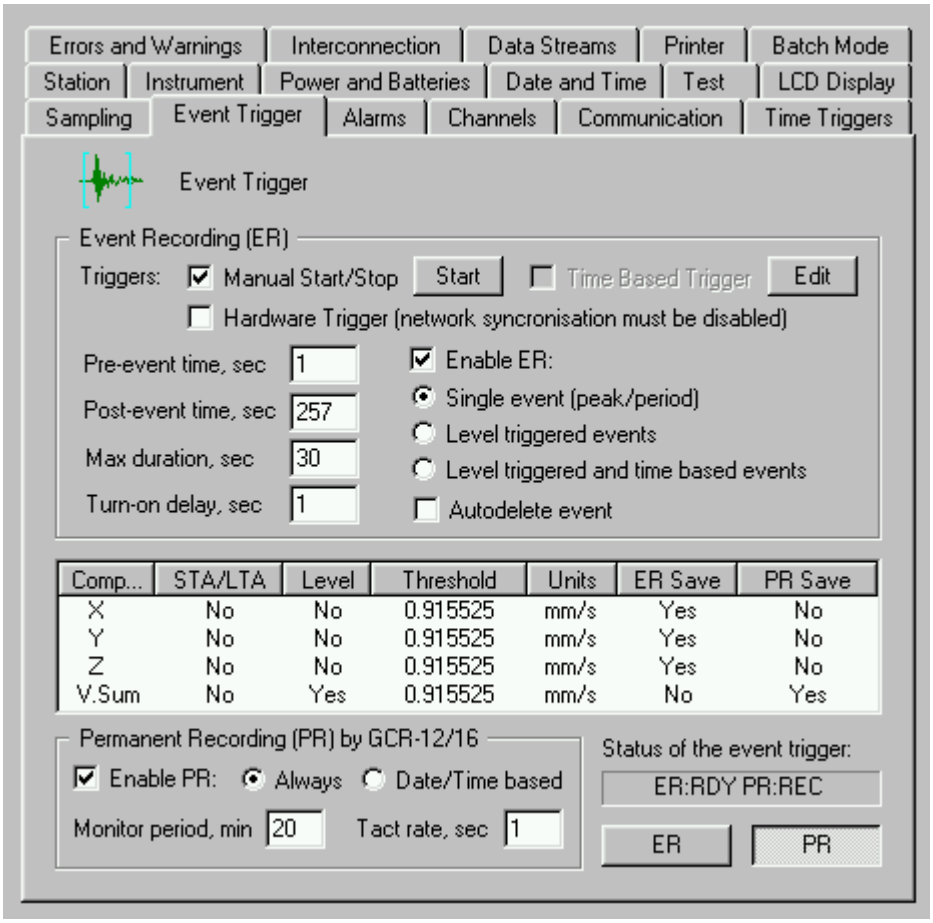
To reduce false triggers, one can select also an option: **Use trigger Bandpass filter**, which is available for GSR-18 instruments only.

Software trigger can be initiated by pressing the button **[Start]**. The same button is used to de-activate the software trigger. Current status of the trigger is also indicated in this page

A user cannot deactivate the GBV software trigger. Once it is initiated, it will last as long as pre-event plus post-event settings (seconds)

The button **[Edit]** brings you to the Time Triggers page.

The "Event Trigger" page for GCR instruments looks different. This is mostly because GCR instruments support two types of event files: event records (ER) and permanent records (PR). PR are not really events, they contain peak values of the signal within predefined time intervals **Tact Rate**, which are monitored within **Monitor Period** for every permanent record.



Permanent recording, if enabled, can be performed either **always** or according to the **GCR timetable**.

Event recording, if enabled with **Enable ER** option, can also have different options as it is specified by the corresponding controls:

- **Single event.** This mode is used in combination with the permanent recording. It will record only the highest peak event within a permanent recording period. Status of the event trigger indicates ER: RDY when the instrument is ready to trigger in this mode.
- **Level triggered events**. This mode will enable the event and permanent recording to record all events based on the trigger thresholds specified in the table.
- **Level triggered and time based events**. This mode will enable event and permanent recording to record all events based on the set trigger level but will record only during the Time and Date period, which is set in the Time Triggers.

Other GCR specific parameters:

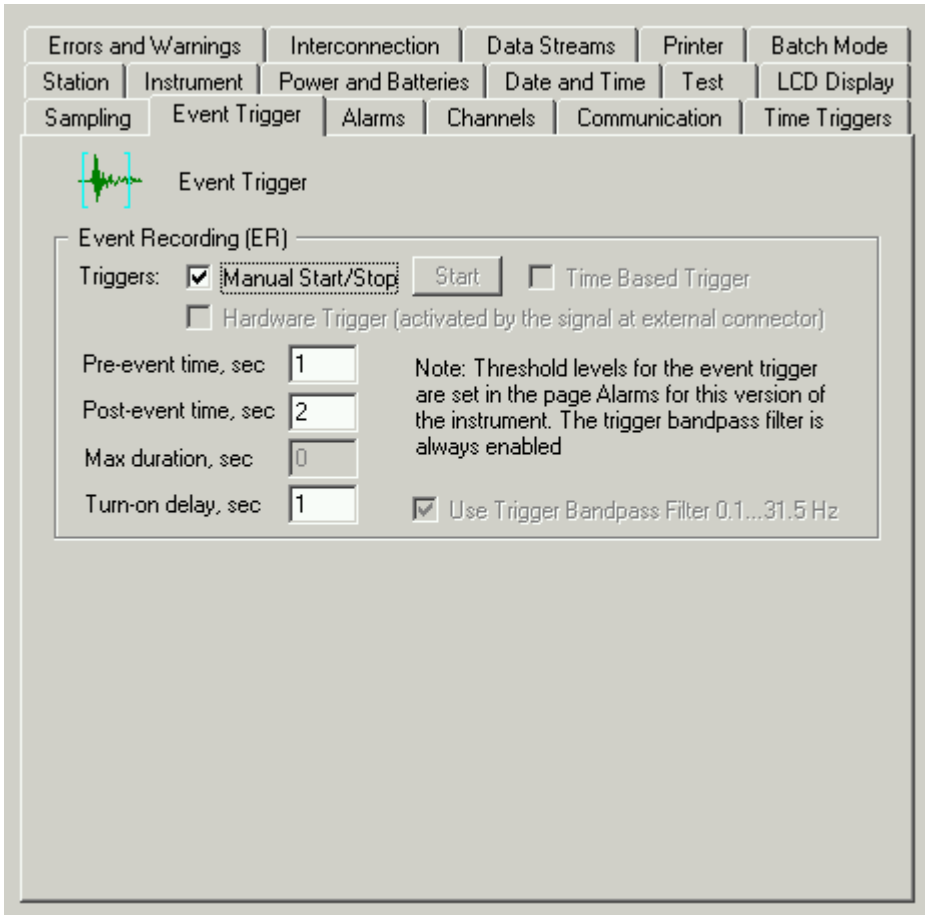
- **Autodelete event**
- **Max duration** of the event, seconds
- ER and PR will save only those components to the files, which are specified in the table in the 'ER Save' and 'PR Save' columns.

The buttons **[ER]** and **[PR]** indicate the recording status and can be used to start or stop ER and/or PR correspondingly.

The current status of both recording types is indicated under the "Status of event trigger": it can be one of the followings:
- REC - recording;
- RDY - ready to record;
- DIS – disabled;
- OFF – recording is not possible.

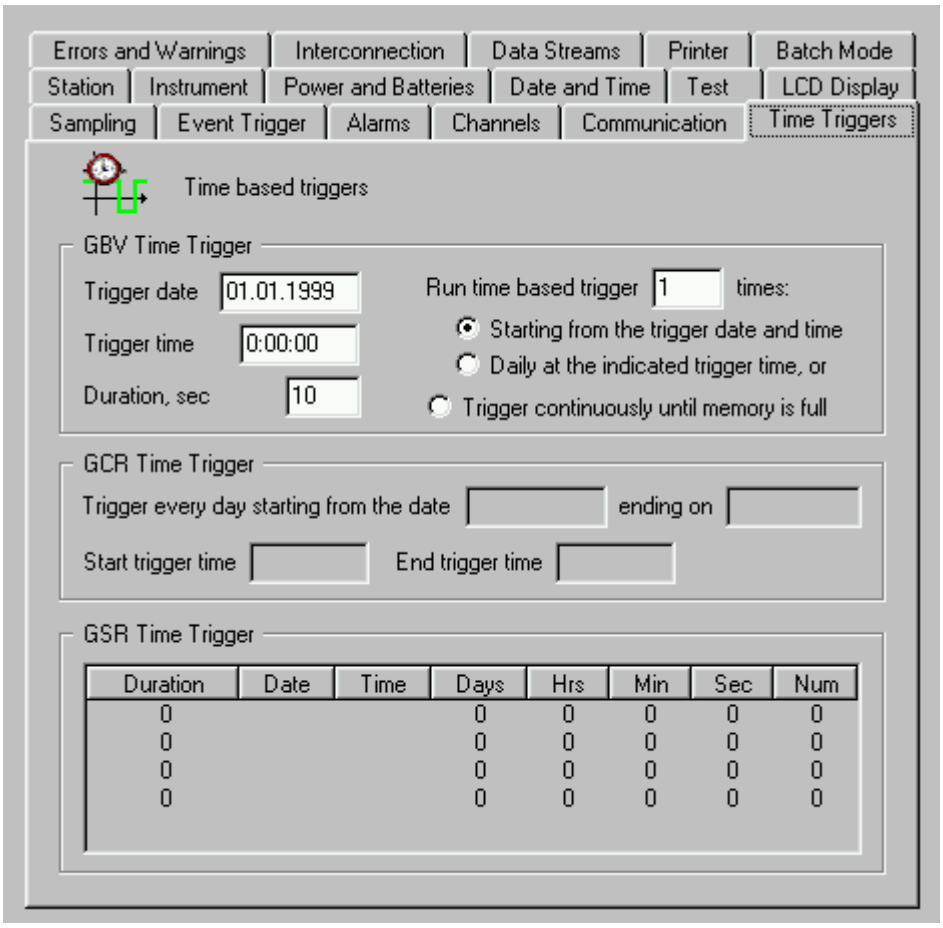
Some types of GSR-18 instruments (firmware versions 02.04.xx) require special settings of event trigger parameters. They do not support event trigger based on STA/LTA ratio, only level trigger. It is possible to set trigger thresholds independently for every component of the signal. These instruments can monitor two trigger levels: low level is used to declare the event and to start recording (which is always enabled) and the high level is used to generate an alarm. Therefore the "Event Trigger" page is simplified for this type of instruments and both trigger levels are set in the Alarms page.

The other specific feature of these instruments is the improved trigger bandpass filter 0.1…31.5 Hz, which is always enabled.



5.12 Time Triggers

The timetables for the time-based triggers are different for GBV, GCR and GSR instruments. GeoDAS supports all three types of timetables and all of them are shown in this page.



GBV has the only predefined **Trigger date** and **Trigger time** but the trigger can be performed as many times as specified either **Starting from the trigger date and time** or **Daily at the indicated time**. There is also one more option available: **Trigger continuously until the memory is full**. The duration of every record is set in the **Duration** field in seconds.

GCR time trigger can be performed only once a day but one can set the **Start and End date** as well as the **Start and End time** as it is indicate in the middle of the page.

GSR time triggers are most complicated. One can set up to four **trigger dates and times**, specify the **duration** of event and how many times the trigger must be activated (in the last column of the table). Trigger repeat interval can be set in a flexible way: from several seconds to several days. To de-activate one or more GSR time triggers, simply set its duration to zero.

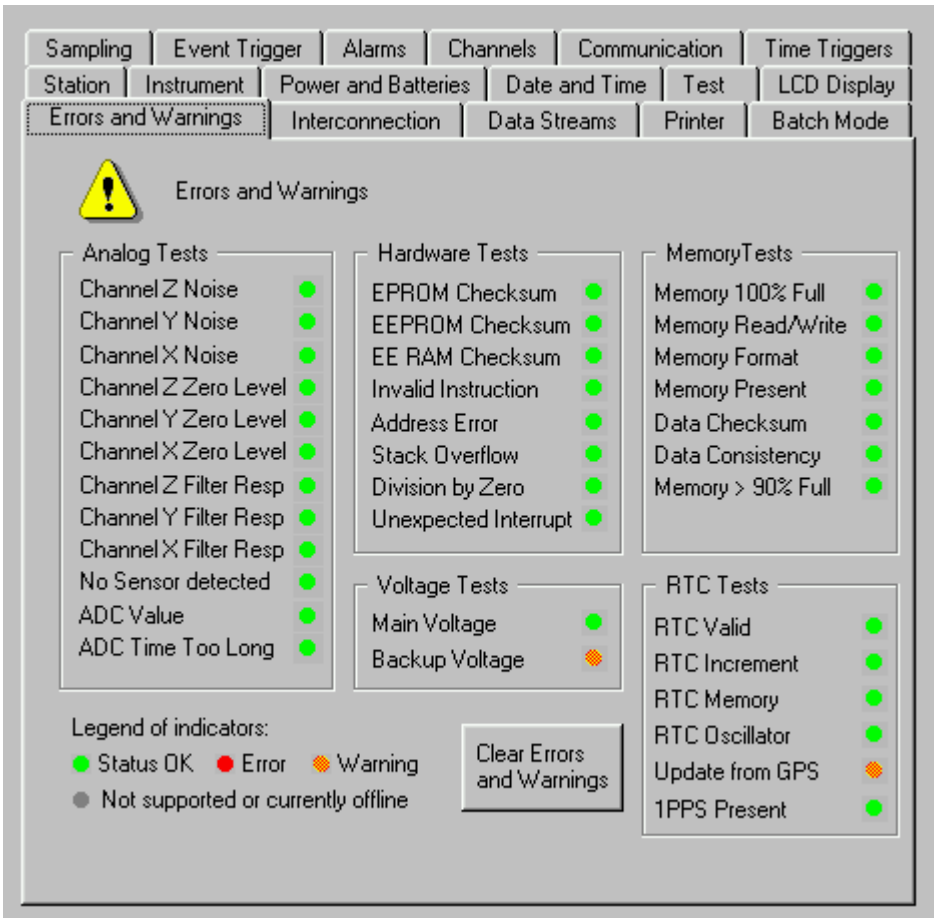
*If you are going to use the time triggers, do not forget to enable the **Time Based Trigger** option in the Event Trigger Parameters.*

5.13 Errors and Warnings

This page does not contain any changeable parameter. It just indicates the current status of errors and warnings as it is specified by the legend of indicators.

When staying connected to an instrument, one can reset all errors and warnings by pressing the button **[Clear Errors and Warnings]**. But if the reason for an error is not eliminated, it will appear again either immediately or after some time. Some errors end warnings are not monitored permanently; they can be detected during the instrument test only. Refer also to the page Test Parameters for more information.

Please note that in case of some errors the instrument will not trigger and will not record an event even if all triggering conditions are met.

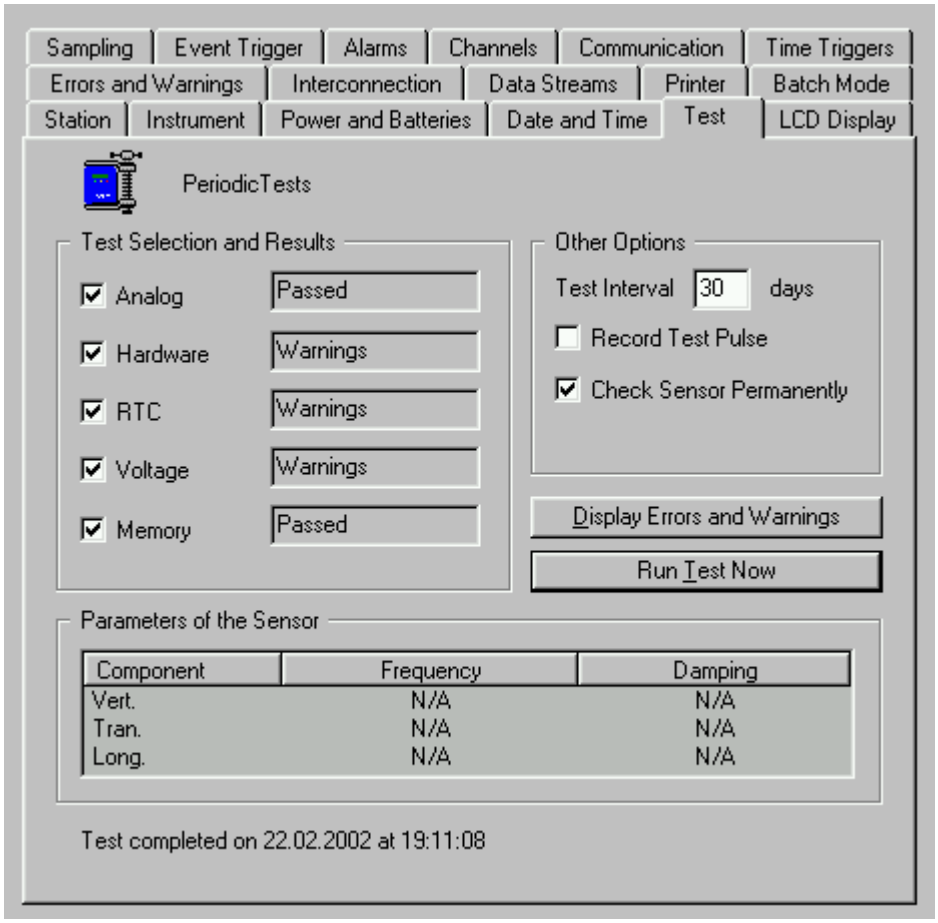


5.14 Test Parameters

The Test functions are used for thorough testing of an instrument. There are several groups of tests and every group can be selected or deselected for testing procedures. They are **Analog**, **Hardware**, **Real time clock**, **Voltage** and **Memory** tests. These five groups correspond to the five groups of errors and warnings.

Pressing the button **[Display Errors and Warnings]** will take you to the Errors and Warnings page.

An Instrument can perform tests periodically as often as specified by the **Test Interval** parameter. For some instruments the value of 0 means that periodical tests are disabled. A user can also force testing at any time. To do so, one has to connect to the instrument and press the button **[Run Test Now]**. Be patient: this operation can take long. Depending on the selected tests, it can last up to 2-3 minutes and an instrument does not accept any command during this time. If user initiates the test, the results will be logged to the self-test results file. Its format is described in the Appendix D. Format of the status files.



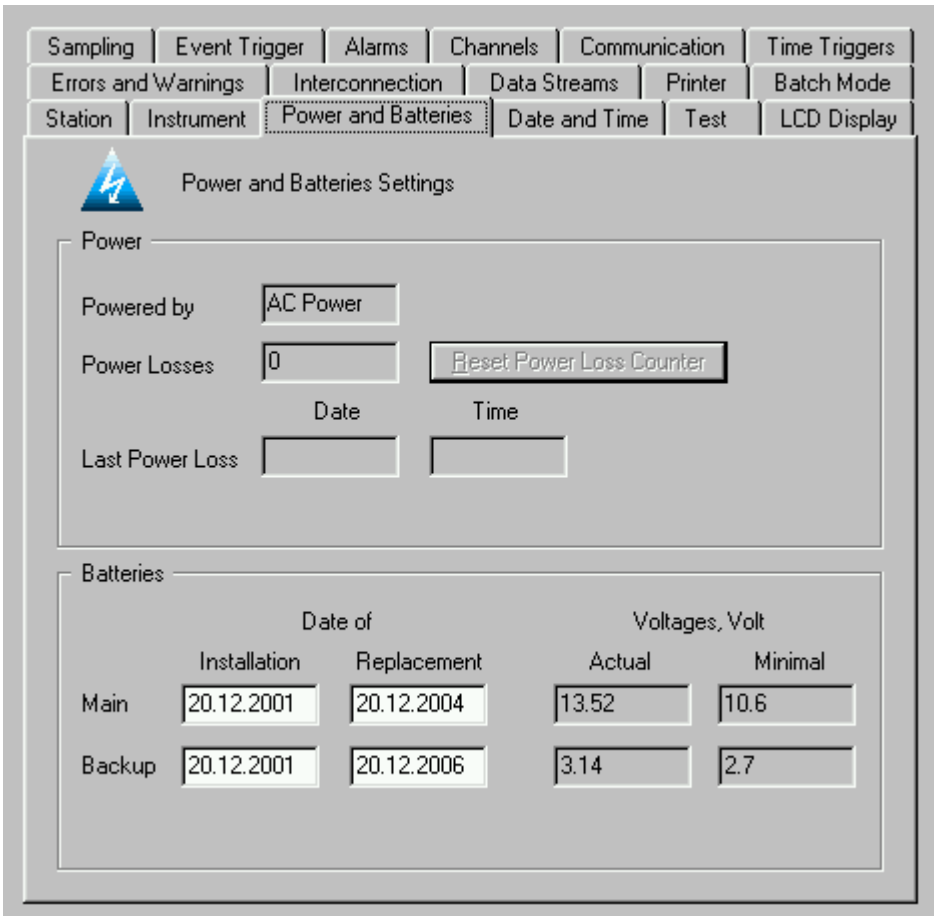
The instruments of type GSR-18 acquire the additional information during testing: natural frequency and the damping factor separately for every component. This information is displayed in the table **Parameters of the Sensor**. If the test was not performed yet or the information cannot be gathered due to some other reason, the "N/A" is indicated.

With the other options you can specify whether the **test pulse** must be saved to the test file and whether the instrument has to **check the sensor permanently.**

As soon as the test has been completed or failed, you will see the corresponding message below all controls of this page.

5.15 Parameters of the Power and Batteries

This page indicates the current status of power and batteries. The only parameter you can enter is the dates of **installation and replacement** of the **main and backup** batteries.



Every time, when you replace them, update these dates according to the actual parameters of the batteries so other people can see when the batteries must be replaced next time.

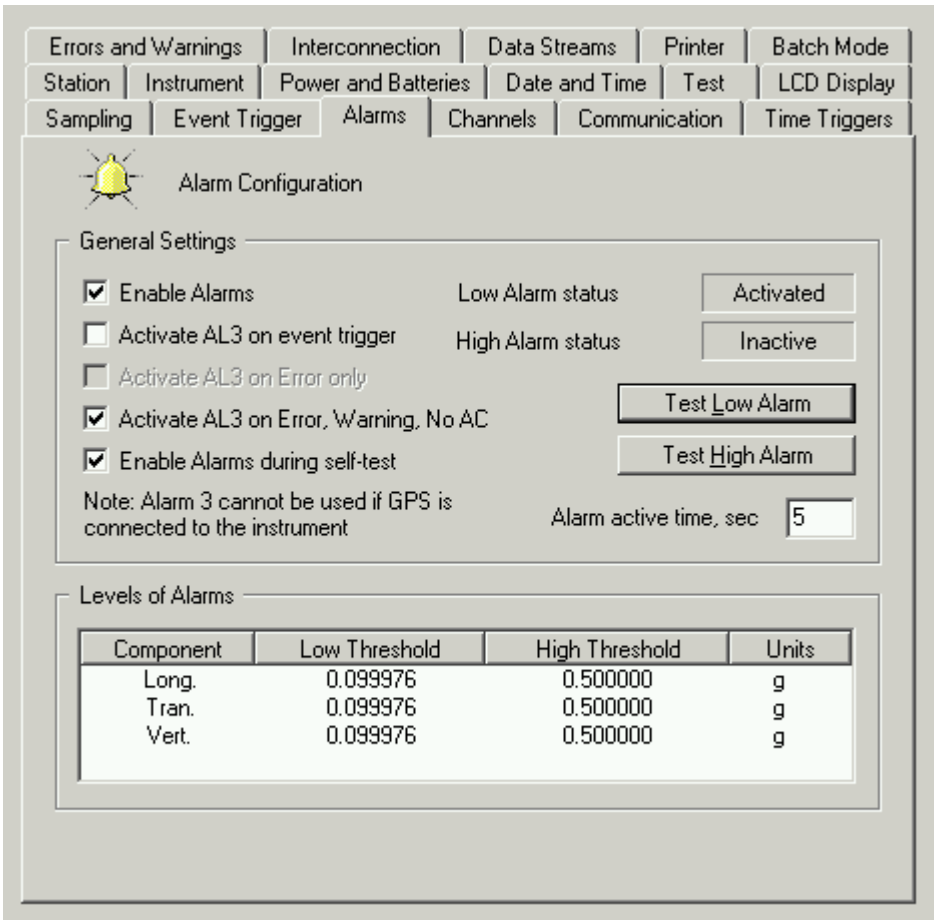
The other information provided in the group **Batteries** indicates the actual voltages of both batteries as well as their minimum voltages at which the instrument is still expected to work.

There is also information about AC power available. The field **Powered by** indicates whether AC powers the instrument. In case there were power losses detected, one can see the number of **Power losses** as well as the date and time of the **Last power loss**.

You can reset the counter of power losses at any time by pressing the button **[Reset Power Loss Counter]**.

5.16 Parameters of Alarms

This page allows the settings of the instrument alarms to be made. Alarm is the signal, which is issued to the external connector INTERCON if a specified threshold level of the signal is exceeded. Please note that your instrument has to be equipped with the alarm option. There are two main alarm signals (Low and High) and the threshold levels can be set for them channel-wise.



So if you would like the alarm(s) to be provided by the instrument, **Enable Alarms** first and then set the desired threshold levels for both high and low alarms. You can also set here the **Alarm Active Time** and instruct the instrument whether alarms are **enabled during the self-test**.

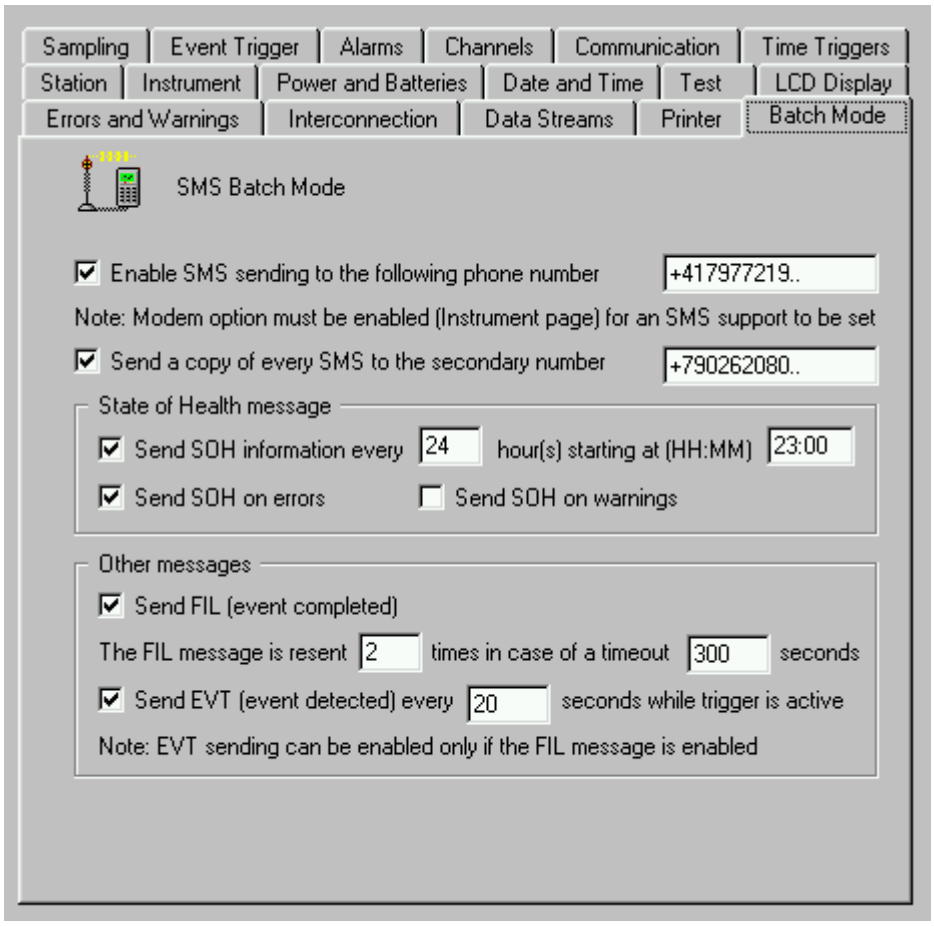
Some instruments support also one more alarm signal (AL3), which can be activated on any **Error, Warning or on AC loss** or on every **Event Trigger**. But even if it is supported, this option is not available if GPS is connected to an instrument. Latest versions of the GSR-18 instruments support one more option: they can **activate the AL3 signal on instrument errors only**.

You can test alarm signals at any time by pressing the corresponding buttons **[Test Low Alarm]** or **[Test High Alarm].** The current status of Low and High alarms is indicated below every button.

Some types of GSR-18 instruments (firmware versions 02.04.xx) use low threshold value in order to declare events and to start recording (which is always enabled) and only the high level is used to generate an alarm. The "Event Trigger" page is simplified for this type of instruments and cannot be used to set thresholds for the event trigger. These instruments do not support alarm AL3.

5.17 Parameters of the Batch Mode

The parameters of this page are available only for instruments, which support the batch mode of communication with SMS messages, such as GSR-18 firmware revision V 02.02.15 or higher.



In order to set all the parameters of this page you have to **Enable SMS sending** first. The telephone number of GSM modem, which will receive SMS messages, must be entered in the corresponding field. If the first character is '+' then it is supposed that the telephone number is provided in the international format with country code, etc.

You can also specify to **Send a copy of every SMS to the secondary number** and enter this number in the corresponding field as well.

Further one can set whether the **state of health** (SOH) information is sent by SMS. If you enable this option, one has to set how often and at which time the periodical SOH report is sent out.

The instrument can send **SOH reports** when the status of **errors** and/or **warnings** is changed.

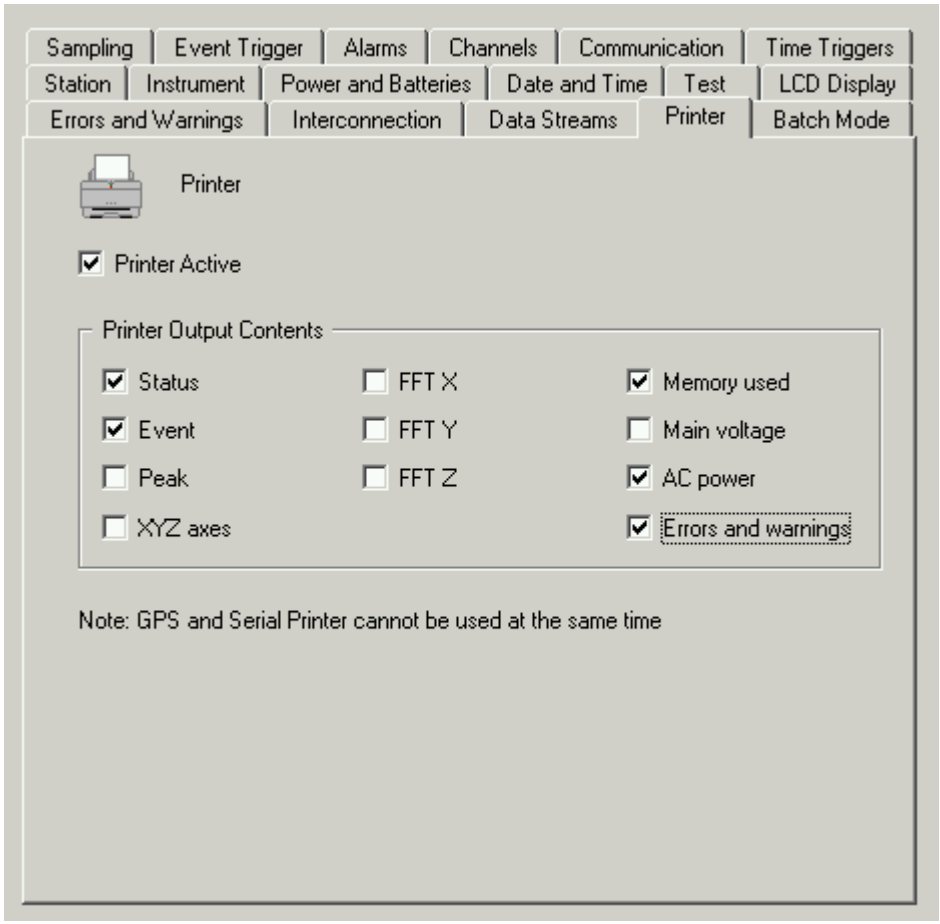
With the last group of controls you can instruct the instrument to provide an information about detected events. If **Send EVT** is enabled, the first message is sent out as soon as the event has triggered. This message can be repeated after the specified time interval if the event trigger is still active. If **Send FIL** is enabled, an SMS is also sent out on completion of the event. GeoDAS must confirm this message and if the confirmation does not arrive within the specified time interval, then the instrument resends this message again as many times as indicated.

The EVT (event detected) and FIL (event completed) are not just notifications of events. They carry important parametric information about the event parameters, such as peak values of acceleration, velocity and displacement, etc.

5.18 Parameters of the Printer

GSR-12/16 and GCR instruments support serial printer. You can either activate or de-activate printer output and if it is active, one can specify what kind of information you would like to print out with the corresponding options grouped as **Printer Output Contents**.

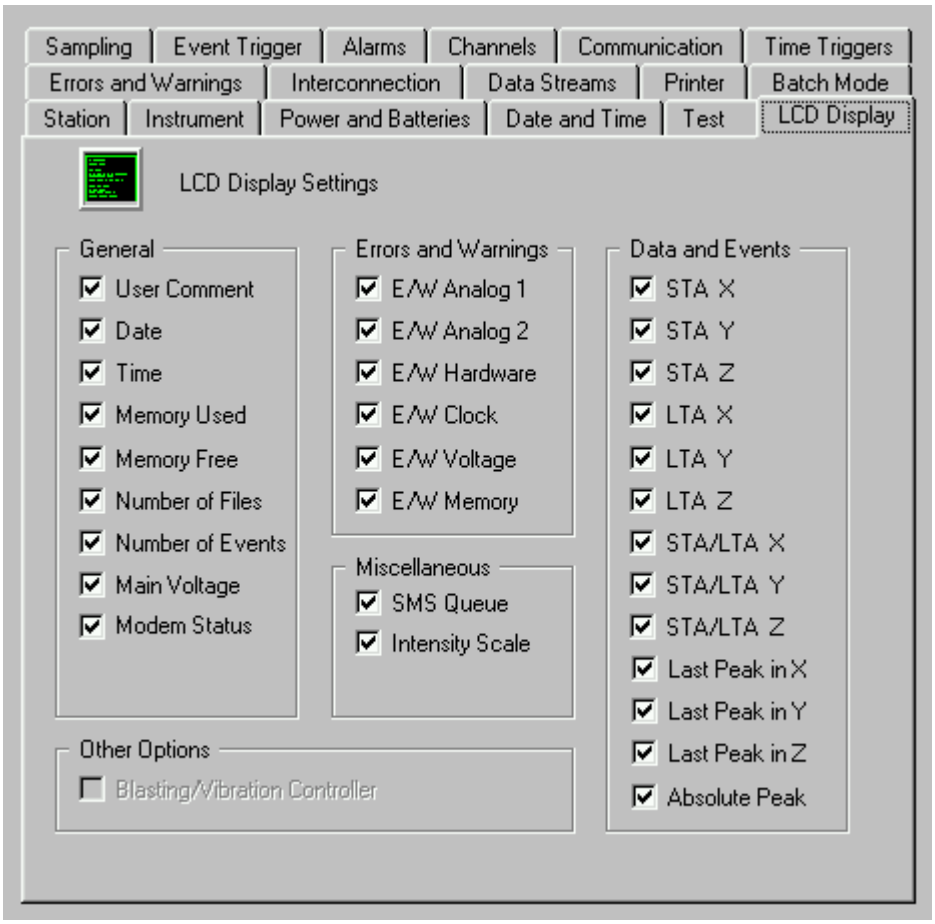
Note that the serial printer and GPS receiver cannot be connected to the instrument at the same time.



5.19 LCD Display Settings

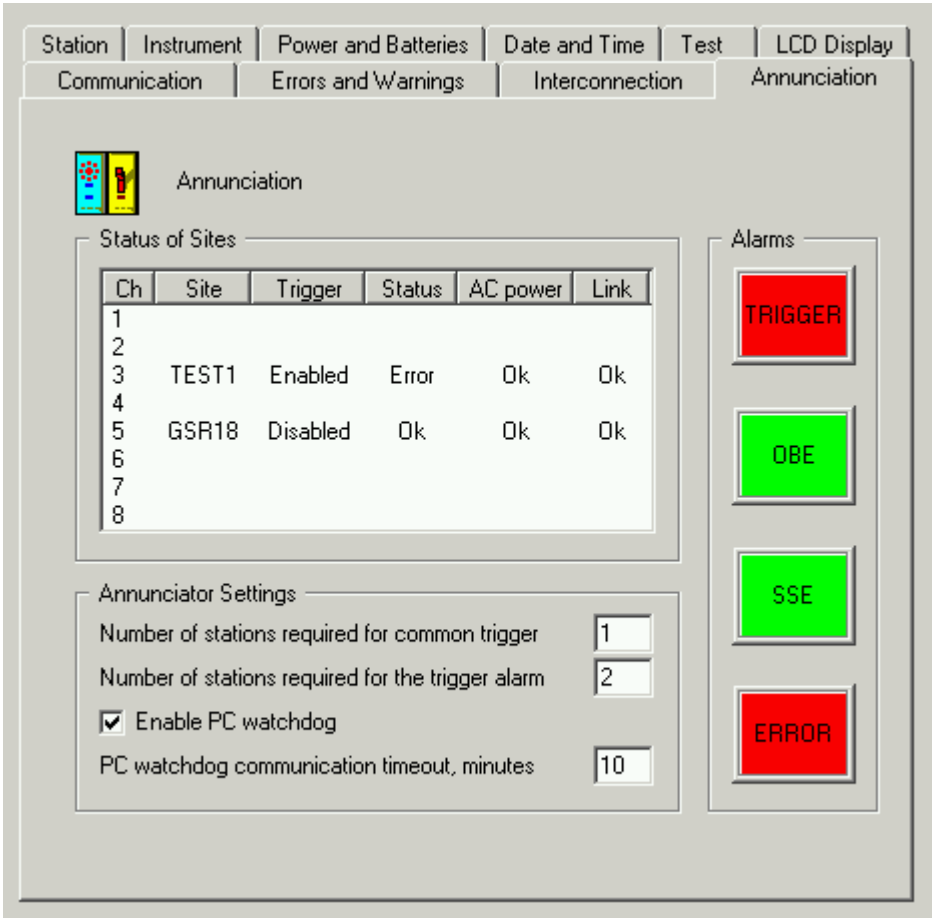
This setup page specifies which information is displayed in the instrument LCD screen. Checking of the tickboxes enables the corresponding indication in the LCD display.

This page looks different for the GCR instruments because they have some specific options to display in the LCD screen.



5.20 Annunciation

This setup page is available for the special instrument only, GeoSIG annunciator. Main functionality of annunciator is to combine the Trigger and Error hardware signals coming from several recorders (up to 8) and to manage the alarm logic. Alarm signals are indicated with the light signals and can be reset by operators with the corresponding buttons.



The GeoSIG annunciator (GAN) is configured as any other instrument through the Instrument Setup Manager but some configuration pages (Event Trigger, Data Streams, etc.) are not accessible because of the limited functionality of GAN, which does not work with seismic data.

The table **Status of Sites** indicates annunciation parameters of all recorders connected to annunciator channels. Only the sites (stations) known to GeoDAS through their Work Options as connected to the annunciator, appear in this table. The columns **Status, AC power** and **Link** indicate correspondingly whether a station experiences any hardware error, whether the AC power is lost and whether the link to this station can be established. This information is provided to annunciator by GeoDAS, which checks the status of configured sites (stations) by logging to each of them continuously. The only adjustable parameter in this table is the **Trigger** flag. Click it with the mouse to change the state from Enabled to Disabled and vice versa. Only enabled triggers are counted by the trigger logic scheme, and if their number reaches the value required for common trigger an/or alarms, annunciator takes the corresponding actions.

The group **"Annunciator Settings"** has several adjustable parameters. The **number of stations required for common trigge**r indicates how many stations must trigger simultaneously in order to produce the common trigger signal. This signal is sent by annunciator to all configured stations forcing them to record an event. If the number of stations triggering simultaneously reaches or exceeds the **number of stations required for the trigger alarm**, the corresponding TRIGGER alarm signal is generated. If the option **Enable PC watchdog** is set and there was no communication between GeoDAS and the annunciator board during the specified **communication timeout** interval (in minutes), the ERROR alarm is generated.

Annunciator can generate four alarm signals, which are indicated in the **Alarms** panel of the Annunciation setup page: TRIGGER, OBE, SSE and ERROR alarm. The ERROR alarm is set if any configured stations experiences an error or the PC watchdog is activated. Note that all the alarm indicators are shown inactive (greyed) if GeoDAS is not logged in currently into the annunciator. The TRIGGER alarm is set under the conditions described above. OBE and SSE alarm can only be set by GeoDAS based on the positive results of the OBE/SSE event checks. Please refer to the Appendix J. Event Checks for more information about this extended GeoDAS functionality.

When the status of sites is changed, it is logged into the Annunciation status file. The alarms are logged as well. The format of status file is described in the Appendix D. Format of the status files.

6 Recording the Events

The most typical operation mode of GeoSIG instruments is the standalone recorder. After the installation of such an instrument, one has to set its parameters in a way that the instrument will be capable of recording the events. The event files containing data records are kept in the recorder memory, which is usually an ATA flash memory card or on-board SRAM.

As soon as new event files are saved to the recorder memory, one can login to this recorder with GeoDAS and can download these files to the computer. Further the event files can be viewed, processed and analysed with the Off-line Data Viewer. Thus there are three steps in getting and processing the event files:

1. Configuring the recorder and acquiring the data
2. Downloading data files to the computer
3. Analysing downloaded data files

6.1 Configuring the Recorder

In order to configure the recorder, you have to log in to it and to set its recording parameters with the Instrument Setup Manager. The most important settings are grouped in the page Event Trigger Parameters. There are following possibilities to make the recorder creating event files:

- Level trigger. An event file is created if the level of signal exceeds the threshold value;
- STA/LTA trigger. The ratio of short time average and long time average of the signal level must exceed some predefined value (which is set in dB) in order for the file is created;
- Hardware trigger. The trigger signal is issued by an external device connected to the recorder through the special interface;
- Network trigger. The trigger signal arrives from another GeoSIG recorder through the interconnection interface. Refer to the issue Interconnection Parameters for more information;
- Time based trigger. The recorder creates data files according to the predefined timetable as it is described in the Time Triggers;
- Manual trigger. The recorder can be forced to create an event file at any time by the command from GeoDAS when it is logged in to the recorder;
- Test record. It is file similar to the even file, which is recorded during the instrument self test if the test pulse recording is enabled. Refer to the issue Test Parameters for more information;

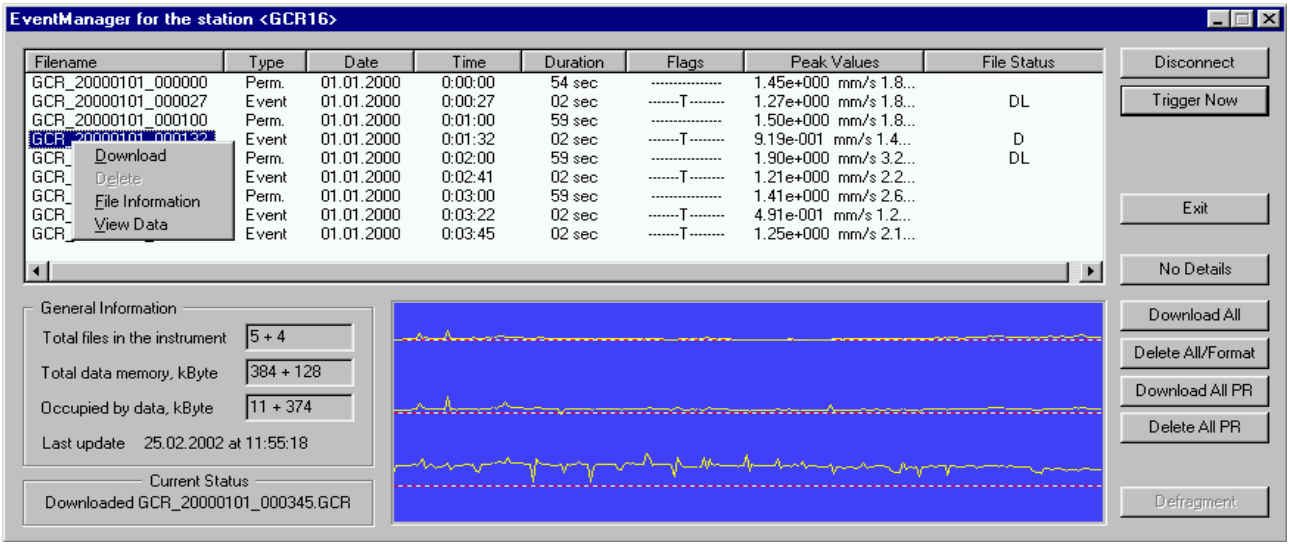
When the instrument is configured, you can logout and leave it alone to record event files.

6.2 Downloading Data Files

In general there are two possibilities: either data files are downloaded by GeoDAS automatically or the user can do so at any time in the manual mode with the Event File Manager.

6.2.1 Working with the Event Manager

This tool is launched for a selected station either from the context menu of the General Information window or by pressing the third button on the Station toolbar. The following dialog box appears:



The upper part of the window shows the list of files stored in the instrument containing most important information for each file. Below the list there is general file information, current status and the preview window. The control buttons are located at the right side. With the Event Manager one can see the instrument file directory, download files from a recorder, delete one particular file (ATA only) or all files.

As you can see, the list of files displays the following information:

- Long file name containing the station code and date/time stamp;
- File type (Event, Test or Perm. - for permanent records of GCR instruments)
- Date and time of the event
- Event duration
- Trigger flags, which show the reason of triggering this event
- Peak values of all instrument channels
- Status of the event file. The letter 'D' indicates that the file was downloaded at least once from the recorder. 'L' means that the file exists locally on the hard disk in the default data directory

When pointing to a filename with the mouse cursor and the file is stored in the ATA flash card, the small window ("tool tip box") displays a short name of the pointed file. The file is stored in ATA card under this name, which you can see if you insert ATA card into the PCMCIA slot of your computer

Point to the trigger flags with the mouse cursor to see their meaning with the tool tips

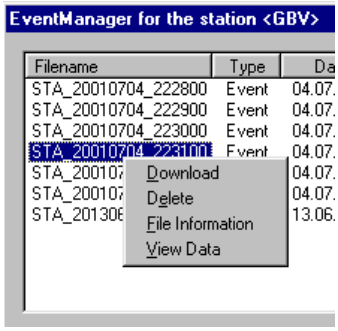
The preview window displays graphically the data of a file, which is downloading. As soon as the downloading process has been completed, you can simply double-click the preview window to launch data viewer for the current file.

The General file information indicates how many files are stored in the instruments and the amount of used and total memory. Two values are given for GCR instruments in the form: "Events + Permanent Records".

6.2.2 Brief description of the buttons

[Connect /Disconnect]	Forces login to the instrument or logout from it.
[Trigger Now]	Starts and stops the Software trigger.
[Exit]	Quits the Event Manager.
[More /No Details]	Hides/shows preview window and general information.
[Download All]	Downloads all files from the instrument. May take long time.
[Download All PR]	The same operation but for the permanent records of GCR instruments.
[Delete All/Format]	Deletes all event files from the instrument. In case of ATA instruments the formatting of ATA Flash card is also performed. All files will be lost.
[Delete All PR]	The same operation but for the permanent records of GCR instruments.
[Defragment]	De-fragments the ATA Flash card. This can take some minutes, depending on the number of files.
[Continuous Trigger]	This button is currently available for the GT-316 instruments only. When it is in the pushed state and you are logged in to an instrument, GeoDAS will force the manual trigger every time when the previous event is completed. As soon as the instrument memory is filled up with the data, GeoDAS downloads all recorded files and deletes them from this instrument. Then new series of manually triggered event files is recorded, etc. Please note that the process of downloading cannot be cancelled by releasing the button.

6.2.3 Context Menu of the Event Manager



Context menu becomes active if one or more files are selected from the list

Download

Downloads selected file(s) to the PCs hard disk

Delete

Deletes selected file(s) from the instrument memory (ATA card only)

File Information

Displays information about selected file(s)

View Data

Launches data viewer for the selected file(s). If some selected files are not yet downloaded, their waveforms will not be displayed

6.2.4 Downloading data files with Event Manager

To download data files from an Instrument with Event Manager please follow these steps:

1) Click **[Connect]** button to login to the instrument;
2) If there are files in the instrument memory, they will be displayed in the list as soon as you get connected. If you would like to select some particular files, sort list of event files first. For instance, if you would like to see the strongest events, sort the list by peaks;
3) Select desired files to download and run "**Download**" from the context menu;
4) Or just skip 2 and 3 and click the **[Download All]** button to download all events;
5) Make sure all files / selected files are downloaded;
6) Select files, which are not needed and delete them (item "**Delete**" of the context menu, which is valid for ATA-flash cards only) or delete all files by pressing the button **[Delete All/Format];**
7) If you have deleted several particular files but not all of them, perform memory de-fragmentation (ATA-flash cards only). This operation can take long and therefore we recommend avoiding it. The best approach is to download all files to the computer and then simply format the ATA card. The instrument performs quick format, which usually takes not more than several seconds;
8) Click **[Disconnect]** button to logout from the instrument.

6.3 Automatic file downloading

The data acquisition system can be configured for the automatic data downloading. While configuring a station, enable the option “Autodownload any new file…” in the Work Options, which ensures that all data files are downloaded automatically upon every login to the instrument. So if you have a direct communication channel to the instrument (cable), you can leave it on-line and GeoDAS will download every new file to the computer. It is recommended to enable also the “Autodelete…” option in order to avoid the situation when the event memory gets full. Otherwise you have to check the status of the instrument periodically and delete all unnecessary files manually.

If your instrument is accessible through the dial-up communication channel, you cannot leave it on-line all the time. But in such a case the instrument can inform GeoDAS when the new event is recorded. Setting the instrument option “Enable AutoDial on event” activates this functionality, see the issue Communication Parameters. The telephone number and the dial command must be specified in the “Auto Dial String”.

Thus in order to configure an automatic file downloading, do the following:
Enable the option “Autodownload any new file…” in the Work Options of the stations
Enable the option “Autodelete…” in the Work Options of the stations (recommended but not required)
If you have a permanent connection to the instrument, do the following:

- Select the mode **Check up the status of this instrument permanently** in the Work Options.

You can also keep GeoDAS logged in to the instrument permanently:

- Set Idle Timeout to disconnect from a PC (Communication Parameters) to 255
- Login to the instrument and leave it on-line

If you have a dial-up connection to the instrument, do the following:

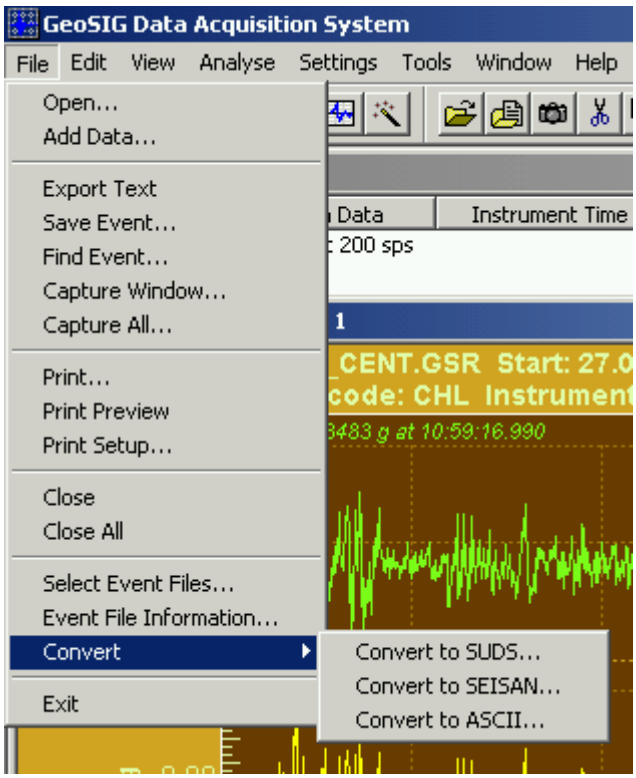
- Activate the option “Enable AutoDial on event” (Communication Parameters)
- Enter the dial command and the telephone number of your local modem in the field “AutoDial String”, for instance ATDP3178920
- Set the option “Modem receives the incoming calls…” in the Other communication parameters for the current station.

If it is not required downloading the files immediately after an event, you can do so periodically instead. The above actions 3 and 4 are not necessary in this case but you have to select “Login to the instrument…” in the Work Options and to specify the corresponding time interval.

7 The Main Menu

7.1 File Menu

Most of the items in this menu are related to the functions of ODV. These items are available only when at least one ODV window is opened. Please refer to the chapter Off-line Data Viewer for the detailed information.



Open

As all data sets are loaded from the instrument and are saved to the hard disk as data files, those files can be opened to view their data with the standard Windows File/Open routine. A Data directory and a file to open are selected with the standard Windows browser.

Since GeoDAS registers the known event file types (extensions) to the Windows environment, the event files can also be open directly from Windows Explorer simply by double-clicking them. If GeoDAS is not yet launched, it is started automatically. You can also drag the event files from the Explorer window or from the desktop and drop them to the GeoDAS window to open these files.

Add Data

Allows a data file be selected with the Windows browser and be added to the current data view.

Export Text

Exports currently viewed data into the ASCII file. The current type of the time and data scales of the graph affects the format of output file. In particular, it specifies whether the data are saved in the physical units or in counts, whether the column of time is saved, etc.

The export function works only if at least one graph is selected (highlighted). Only selected graphs are exported. The target ASCII file has the same name (but the TXT extension) and is located in the same directory as the source file.

Save Event

Creates an *.evt file (a name and the output directory can be selected with the standard File Save dialog), which contains the information about all graph data sets currently displayed in the active graph window. The corresponding data files can be in different directories and it is not required that they are time synchronised. This feature is useful to combine several independent data files recorded by different instruments into one event record.

Find Event

This menu item launches a routine, which performs the search for the data files recorded in the same time interval as the currently displayed data file. You have to select a directory where the search will be performed.

Capture Window

Saves currently active graph window (viewed area only) into a file using one of the following formats: BMP, PNG or JPG.

Capture All

Saves currently active graph window (including currently invisible area) into a file using one of the following formats: BMP, PNG or JPG.

Print

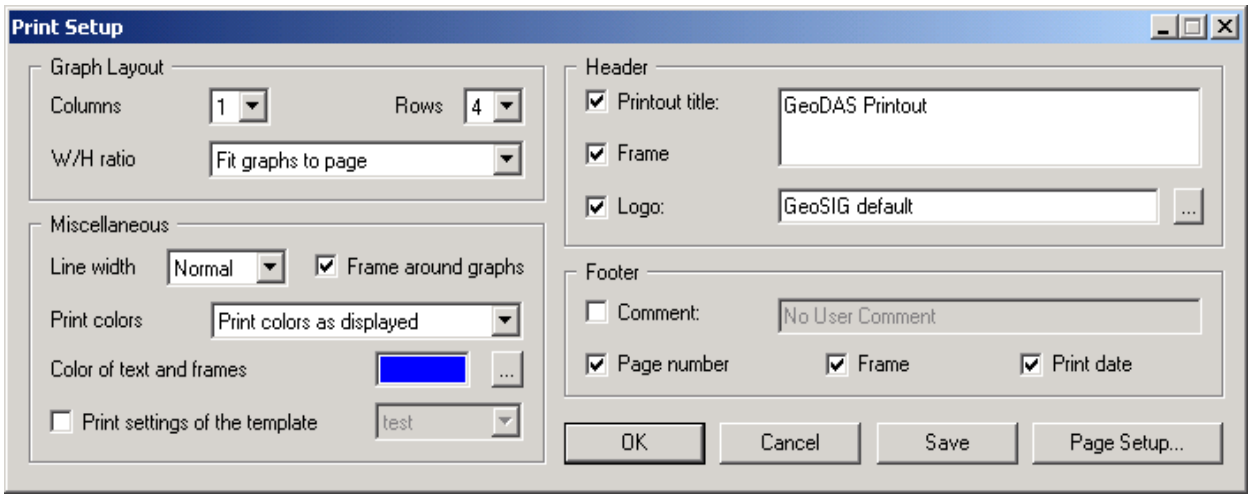
Prints the contents of an active ODV window

Print Preview

Displays the simulated printout of the currently active ODV window. The features of printout are shown as specified with the Print Setup dialog and they can be adjusted in the preview mode.

Print Setup

Launches the Print Setup dialog, which is used to tune GeoDAS printouts:



The group of parameters **"Graph Layout"** specifies how the graphs are placed to the printed page and their **aspect (width/height) ratio**, which can be one of the following:

- Default fixed. The height of every graph is equal 2/3 of its width. In this case one cannot set the exact number of rows since it is limited by the page height;
- Fit graphs to page. Every graph is fitted into the area Page width / **Columns** by Page height / **Rows**;
- Print as displayed. The height of every graph is calculated based on the width and height of the currently displayed graph.

The graphs displayed in the screen in maximised state are printed also maximised, i.e. one graph per page irrespective of the layout settings. In order to maximise the graph view, one should open more than one graph in a window and click the Maximise button located at the left side of the graph.

The groups **"Header"** and **"Footer"** set the content of the page header and footer correspondingly. If the **Frame** option is enabled, the surrounding rectangle (frame) is drawn. **Printout title** is placed in the upper left corner of the print area. It can have more than one line. In this case a smaller font size is selected automatically. You can also select a **Logo** file in the BMP of JPEG format. The logo image is printed in the upper right corner of the print page area. If the **Logo** option is enabled but no valid image file is selected then the default GeoSIG logo will be printed.

The best logo output is achieved when the logo image is not scaled therefore try to select the corresponding image taking into account the resolution of your printer.

Miscellaneous print settings include the **Line width**, whether the graphs are surrounded by the **Frame** rectangle and the colour options. You can either print the graphs **as displayed**, i.e. to keep the current screen colours or to always convert them to **black and while.** The third option combines these two options in a way that the conversion is performed for the **black and while printers only**. The user-defined graph templates may have customised printout settings. You can adjust them with this dialog window by enabling the option **Print settings of the template** and by choosing the name of the required template in the combo box. More information about graph templates is provided in the section Templates.

If the graphs are printed or can be printed coloured, you can also specify the **colour of the text and frames** used for headers and footers. Note that the colour options do not affect the logo image. It is always printed as it is set in the image file.

Besides of the **[OK]** and **[Cancel]** buttons, which perform the standard operations, there are two more control buttons in the Print Setup dialog. The **[Save]** button is used to store parameters as default ones. This means that they will be valid on the next start-up of GeoDAS, otherwise – only during the current session. The button **[Page Setup…]** takes you to the standard Page Setup and Printer Setup dialogs, which are used to customise, for instance, the print margins. Note that in the Print Preview mode the button **[OK]** is replaced with **[Apply]**, which is used to see the updated print features immediately in the preview window.

Close

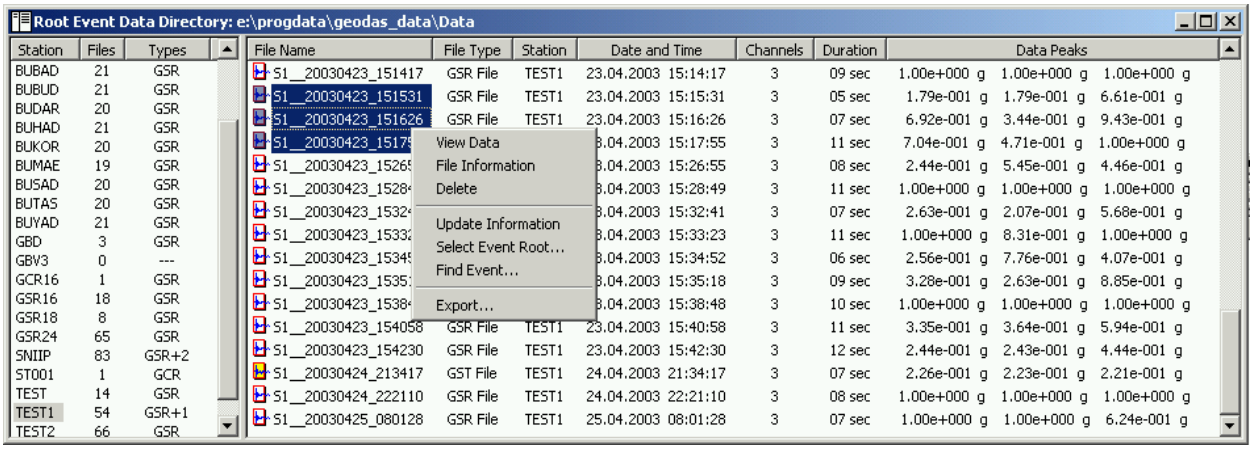
Closes the active ODV window.

Close All

Closes all windows

Select Event Files

This item is not related directly to the ODV functionality. It opens a window, which can be used to select some particular data files recorded by the currently configured stations:



If you have an experience working with GeoSIG CloseView data analysis program, you will probably find this tool similar to the CloseView file selection procedure. First of all, select the station(s) of your interest in the left part of the window and the list of files recorded by selected station(s) will appear in the right part along with brief information on each file, namely:

- Long file name consisting of the 3-character station code and the date/time stamp;
- File type: standard GSR event file, test evebt GST, compressed event file GBR, etc.;
- Station name where the event file belongs to;
- Date and time of the record;
- Number of data channels (components) stored in the file;
- Duration of the record in seconds;
- Peak value of all data components. Note that these value are only estimated ones and cannot be provided with the high precision. The exact peak values are indicated in the ODV window after opening a file.

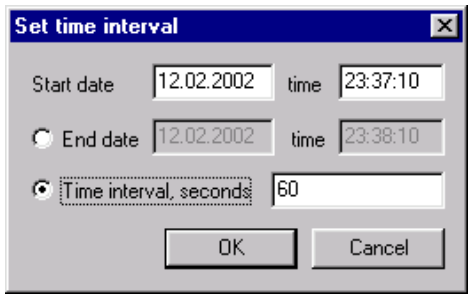
Left part of the window is a list of stations in the selected root data directory. The Files column indicates how many data files are available for each station. The third column in the left part of window displays the type of available files. If more than one type of files found in the corresponding station data directory, it is indicated as FirstTypeFound + N other types, for instance GSR+1.

Now you can select one or more files from this list and perform the following actions listed in the context menu:

- **View Data** - displays file(s) data in the new ODV window. Double-clicking the name of a file performs the same action
- **File Information** - displays general information, which is kept in the file header;
- **Delete -** removes selected file(s) from the hard disk;

Next items are always available, even if no single file selected in the list:

- **Update Information -** re-reads data directories and updates the file list;
- **Select Event Root** - allows directory other than "Data" at the current GeoDAS home directory be selected as a root data directory;
- **Find Event** - searches for the data files recorded within a specified time interval. The start and end time (or time interval) are set with the dialog box “Set time interval”.
- **Export** - exports the list of event files along with the information indicated for every event to the comma-delimited (CSV) file on your choice.



Event File Information

Displays the general information stored in the header of a selected data file. The information dialog may show different parameters, depending on the type of instrument, which has recorded the file.

Convert

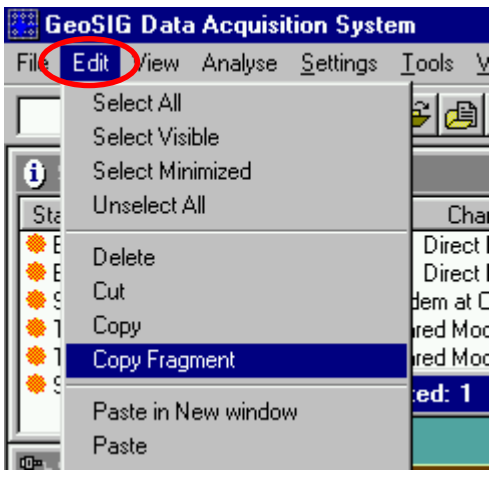
Opens the submenu, from which you can choose a type of conversion. GeoDAS event files can be converted to the PC-SUDS, SEISAN waveform or to the ASCII text format described in Appendix B. ASCII file format used by GeoDAS. The input file is selected with the standard Windows File Open dialog. The target file has the same name but different extension (depending on the selected conversion) and it is placed to the same directory as the source file.

Exit

Quits the program

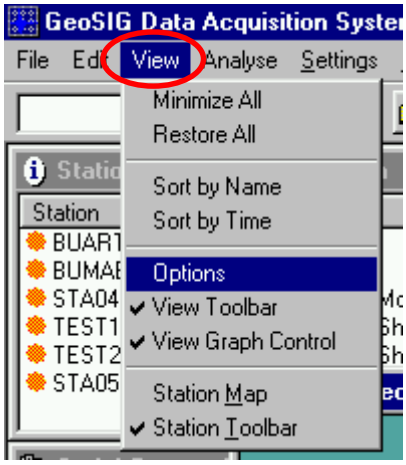
7.2 Edit Menu

All items in this menu are intended to manipulate the data graphs with the ODV and therefore they are described further in the chapter Off-line Data Viewer.



7.3 View Menu

Most of the items in this menu are related to the Off-line Data Viewer functionality and therefore they are described in the corresponding chapter, except the following items:



View Toolbar

Shows/hides the ODV toolbar

Station Map

Shows or hides the stations map, i.e. the window indicating the location of the stations with their names and with the key parameters on a schematic map. The simplest background for such picture can be just a co-ordinate grid. If a bitmap of the corresponding area is provided, it can be used as the map background. Please refer to the Appendix K. Station Map, which describes the way of providing information for the station maps.

Station Toolbar

Shows/hides the Station toolbar

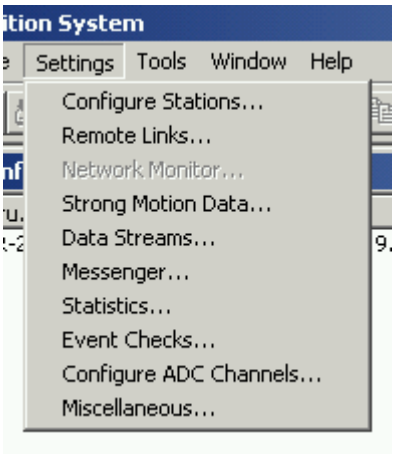
7.4 Analyse Menu

This menu contains the list of available mathematical operations, which can be performed with the graphs (data sets) shown in the current ODV window. They are described further in details in the chapter Data Analysis.

Please note that the analysis functions work in the registered GeoDAS versions only, which have the correct nonzero registration number.

7.5 Settings Menu

Various parameters of GeoDAS can be set with the items of this menu. Most of them allow the extended functionality of GeoDAS to be adjusted and therefore they are not used so often. Please refer to the corresponding articles in the chapter The Other Capabilities of GeoDAS for the detailed explanation.



Configure Stations

This item is used frequently. It helps you to make a first step after the GeoDAS installation - Configuring the Stations you are going to work with. Follow the link above for the step-by-step description of this procedure.

Remote Links

GeoDAS can communicate to the other GeoSIG applications (other instances of GeoDAS, Rapid Response mapping application) for the purpose of their monitoring, to exchange setup parameters, etc. Other applications can be installed in the same or in the different computer but in any case the TCP/IP protocol is used for this communication. GeoDAS can provide also its data streams for the further processing to an external seismic software package, for instance, to USGS Earthworm http://www.cnss.org/EWAB/toc.html. Prior to use these extended network features you have to configure the network links of GeoDAS as described in Appendix G. Network Links of GeoDAS.

Network Monitor

This feature is only available in the Monitor Mode of GeoDAS. Please refer to the Appendix I. Monitor Mode of Operation for the further detailed description of this mode.

Strong Motion Data

Allows the parameters of the strong motion data acquisition to be adjusted. Input data, such as peak ground acceleration, peak ground velocity, spectral accelerations or displacements at different frequencies can be provided by a network of GeoSIG GSR-18 seismic recorders. GeoDAS acquires all these data and forwards it for further processing to an external application. Currently the only processing program, which is supported, is the GeoSIG Rapid Response mapping application. One can find more detailed description in the Appendix E. Strong Motion Data Processing.

Data Streams

If your instrument(s) can provide data streams and this mode is enabled, one can activate the Data stream Manager with this item and set various options of data processing. You can configure local level triggers for every data stream and specify whether the event files must be created on every local trigger. You can configure the network trigger according to some simple criteria and specify whether this trigger must activate an alarm system. All data arriving with the stream can be stored as binary files and displayed afterwards with the Off-line Data Viewer. Finally you can forward streams of data for processing by the external application. All these options are described further in the chapter Processing Stream Data.

Messenger

GeoDAS can send notification messages about its status or/and about the status of the configured stations, periodical state-of-health (SOH) reports, etc. This information is delivered to recipients by e-mails or/and by SMS messages to mobile phones. In order to activate these features, you have to perform the Messenger setup as it is described in the Appendix F. Messenger of GeoDAS.

Statistics

GeoDAS can acquire some statistical information while communicating to the configured stations. This information can be used to optimise communication parameters for the purpose of debugging. Statistics setup allows this feature to be activated.

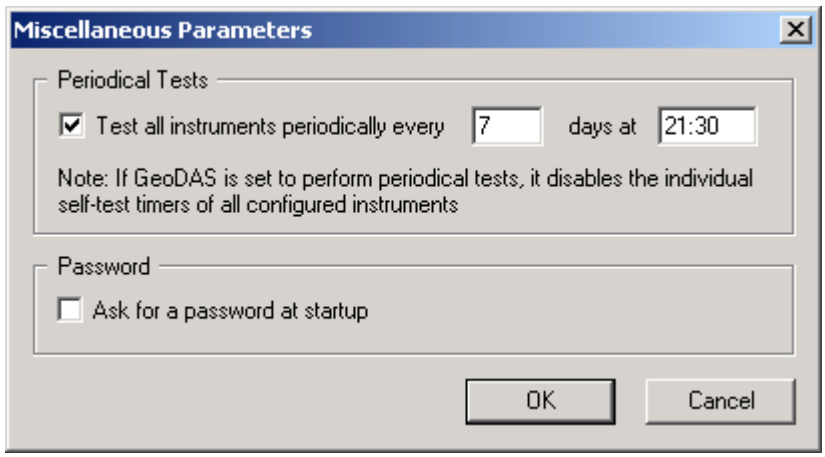
Event Checks

Launches the configuration dialog to set up the Event Check Parameters.

Configure ADC Channels

Launches the dialog window used to set up the Configuration of ADC channels.

Miscellaneous



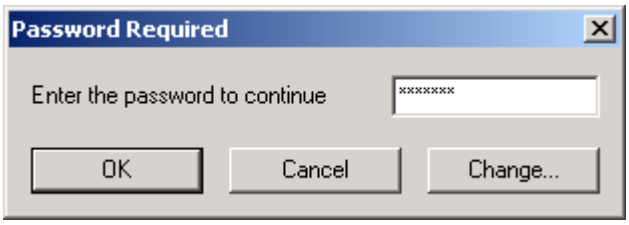
Few parameters, which do not belong to any group of settings listed above, are adjusted through the Miscellaneous Parameters dialog.

Some applications require that several configured instruments perform their self-tests by coordinated manner at strictly defined time. GeoDAS can be instructed to take care of this action by enabling the option **Test all instruments periodically**. If this option is set, GeoDAS will log into every instrument at the specified time and will force its self-test. The instruments are tested one by one with a delay of several minutes to ensure that

only one configured instrument is out of normal operation during the test procedure. Note that the test is performed according to the currently enabled test options. Therefore please make sure that the required tests are enabled in the page Test Parameters of Instrument Setup Manager. The results of self-tests are logged to the self-test status file described in the Appendix D. Format of the status files.

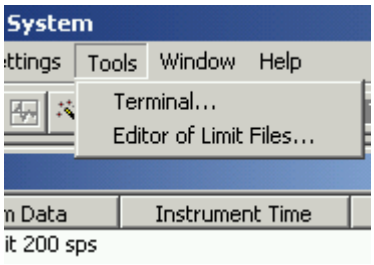
Since the instruments can perform the self-test automatically, GeoDAS tries to disable this feature by setting the test interval parameter to zero at first login. But this function works only for the latest versions of GSR-18 therefore the feature Periodical Tests can be used effectively only with this type of instruments.

The option **Ask for a password at startup** can be used in some rare cases to protect GeoDAS and the current working parameters from accessing by unauthorised persons. Note that if you change this option, you will be asked for a password too.



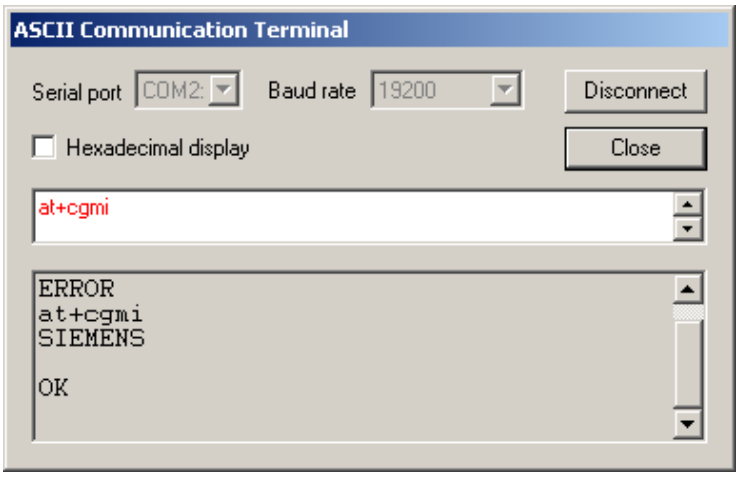
7.6 Tools Menu

GeoDAS tools are the modules providing some additional functionality, which is not related directly to the general tasks of GeoDAS application. These modules can be external programs.



Terminal

This menu item launches the GeoDAS Communication terminal. This tool is used to communicate through a serial port in manual mode. It is launched from the main menu **Tool->Terminal**. Select the **serial port** from the list of available ports and the desired **baud rate** then press the button **[Connect/Disconnect]** to open the port. Now you can enter the commands in the upper part of window and see the response in the lower part.



The receiving data can be displayed not only in ASCII but also in hex format, depending on the option **Hexadecimal display**.
Note that this dialog box is resizable, so you can make both receiving and sending fields bigger.

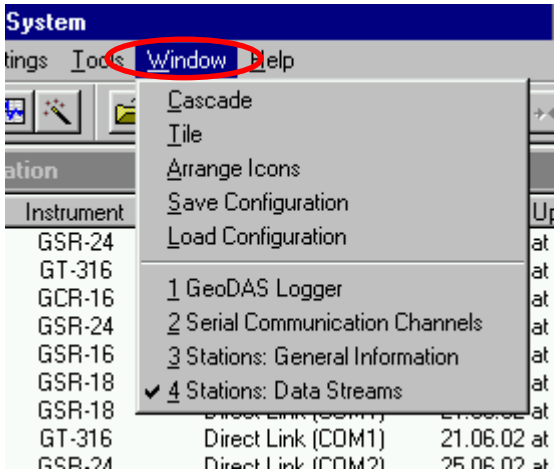
When you have finished working with Terminal, press **[Close]** to disconnect and exit from the terminal window.

Editor of Limit Files

This tool is used to create and to edit limit files, which keep the design limits of RSA and RSV used for checking events for the OBE and SSE criteria. More information is provided in the section Editor of Limit Files.

7.7 Window Menu

This menu provides a user with the standard Windows operations applicable to the GeoDAS child windows:



Cascade

Arranges GeoDAS windows in the 'Cascade' fashion

Tile

Arranges GeoDAS windows in the 'Tile' fashion

Arrange Icons

Arranges minimised GeoDAS windows (icons)

Save Configuration

Stores the sizes and positions of all GeoDAS windows, which are currently displayed

Load Configuration

Arranges all GeoDAS windows in the screen, as they were located during the previous saving of their configuration.

The second part of this menu lists all the opened child windows. The title of one, which is currently active, is shown as checked.

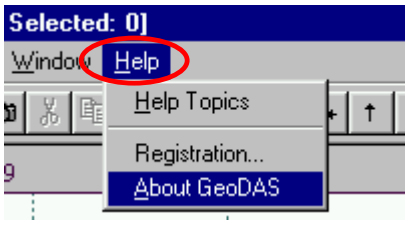
7.8 Help Menu

Help Topics

Launches the help system and displays contents of the GeoDAS on-line help.

Registration

Registration information displays the user name and company name entered during the GeoDAS installation, and a registration code (serial number). If you did not order an Analysis option, you can do so at any time. You will receive then a valid serial number of your product, which must be entered with the Registration dialog in order to make the Analysis menu accessible.

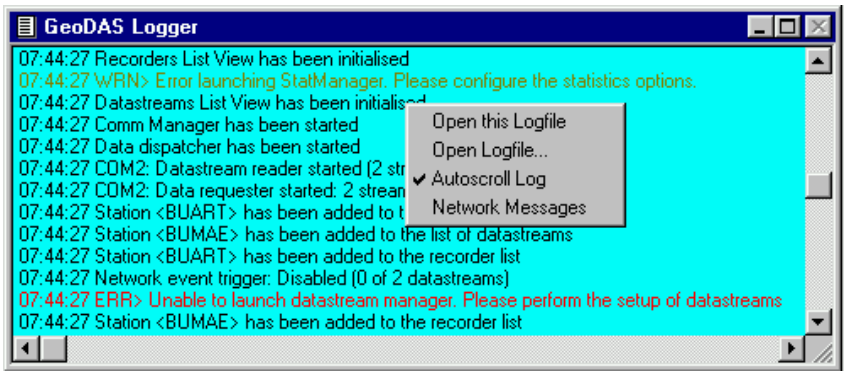


About GeoDAS

Brief information about the GeoDAS application.

8 GeoDAS Main Information Windows

8.1 GeoDAS Logger



The window called "GeoDAS Logger" displays system messages with the information about current status of the system and about the important events that are happening during operation. Messages always have a prefix that is the current time. Most of the error and warning messages have also prefixes ERR> and WRN> correspondingly. The types of messages can be distinguished by colour too: errors are indicated with red colour; warnings are marked with yellow colour; other messages are just black text.

In the log window "GeoDAS Logger" you can see only last messages. After a certain amount of messages the oldest one is deleted from the log window. But in any case all the messages are kept in files named as "LogFile_GeoDAS_TIMESTAMP", one file per day. Time stamp has the format YYYYMMDD so, for example, the log file of January 15, 2000 is called "LogFile_GeoDAS_20000115". The Log files are kept in the "LogFiles" subdirectory of the home GeoDAS directory.

You can enable more messages in the logfile for debugging purposes. In order to log additional information, GeoDAS is started with the debug option –d[c][h][s], where ***c*** *is used to log various communication related messages,* ***h*** *– to report hardware problems, commands sent to the instrument, etc. and* ***s*** *is used to log additional data stream related messages. For instance,* ***GeoDAS –dh*** *will force logging of the extended hardware-related information.*

8.1.1 Context Menu of the GeoDAS Logger

Context menu of the Logger window is shown in the picture above. It contains of the following items:

Open this Logfile

Opens Logfile of the current day with the default Windows editor (Notepad) for the detailed view and analysis of all messages. Please note that this file is already open by GeoDAS for writing and therefore you cannot save any changes you probably made to this file.

Open Logfile...

Launches the standard File Open dialog in the LogFiles directory so you can select a file you would like to open.

Autoscroll Log

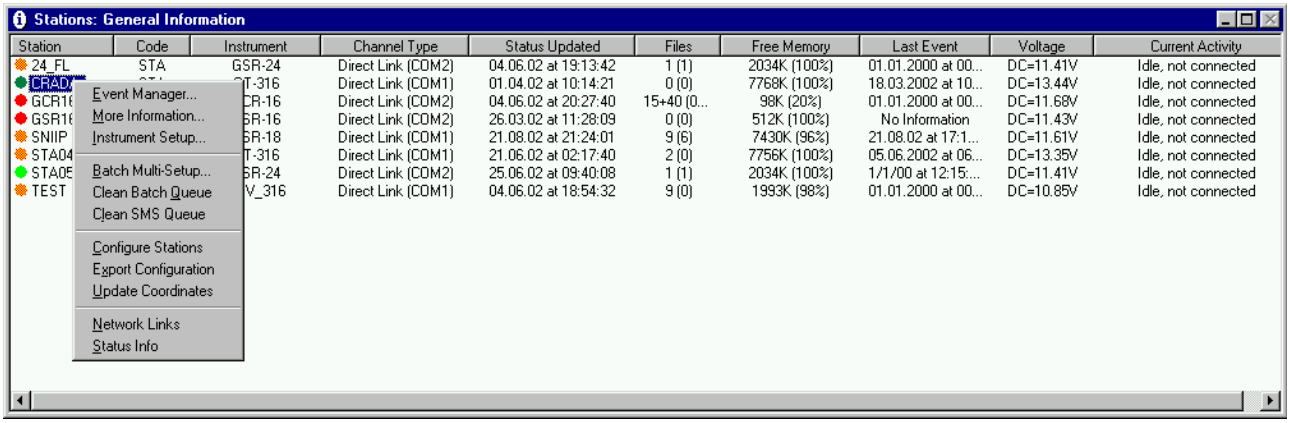
This switch specifies whether the content of the Logger window must be scrolled automatically when a new message is added to the log. This option is turned ON by default.

Network Messages

The dialog launched by clicking this item lets you configuring the remote links of Logger. Those applications selected to communicate can exchange (send and/or receive) some important log messages.

8.2 Stations: General Information

This window contains the table filled up with the general information for every configured GeoSIG seismic station. General Information window is opened if at least one station is configured. It can be minimised or restored but never closed.



8.2.1 Description of the information

The following information is displayed in this window

Station	Unique station name, which is entered while adding a station. This name is used by GeoDAS only and is not stored in the instrument memory. A coloured dot displayed on the left reflects the status of errors and warnings updated during last connection to an instrument or provided with the latest SOH report. The red colour indicates errors, orange colour indicates warnings. A green dot means normal operation. Refer to the Errors and Warnings information page (below) for more information.
Code	Station code. Three-character station identifier stored in the instrument. Can be changed by the Setup Manager (see page Station).
Instrument	Type of the instrument: GSR-12,16,18,24, GBV-116, 316, GCR-12,16, etc.
Channel Type	The type of communication channel, which is used to access the instrument. Can be either Direct Link or Modem (dedicated, at some COM port) or Shared Modem. In case of dial-up link (modem), the telephone number of the station is also indicated in the list. Refer to the Communication Channel Setup for more information about communication channels and their configuration.
Updated	Date and time of the last update (last SOH report or last connection to an instrument).
Files	Number of event files recorded (i.e. stored in the instrument) and number of files downloaded to the hard disk by GeoDAS (shown in brackets).
Free Memory	Free instrument memory in Kbyte. If an instrument works as digitizer only and does not have event memory available, "No Memory" is indicated.
Last Event	Date and time of the last recorded event or "Not Supported" if the instrument cannot record event files.
Voltage	Actual DC power voltage on the last login and the indication whether the instrument is powered with AC.
Current Activity	Current status of the link to instrument when logged in, otherwise "Not Connected"

The information listed above is updated upon every login to the instruments. Some information (status of errors and warnings, number of recorded files, amount of free memory, etc.) can be updated without logging

into an instrument, for instance, from the data stream or when GeoDAS receives a SOH SMS message. But not all types of GeoSIG instruments support these options.

You can sort the information in this window.

In order to sort a list of items in some window, click on the header of a column, which you would like to use as a sorting criterion. Next click to the same header will change the order of sorting (ascending/descending). This is a general rule for all information windows of GeoDAS.

The information displayed in this window is saved to a file when GeoDAS quits and is loaded to the window upon the next startup.

8.2.2 Context Menu of the General Information Window

Context menu of the General Information window provides an access to the important operations with the stations. First group of items in this menu is available only if some station in the list has a focus, i.e. its name is surrounded by the dotted rectangle. Only one station can have such a focus at any particular time and the listed below operations are applied to this station:

Event Manager

Launches a tool, which helps a user to manage event files stored in the instrument. When logged in, one can see the list of recorded event files with their main parameters, one can download file(s) and/or just delete them from the instrument memory and perform some other operations. Follow the link Working with the Event Manager to get familiar with this tool.

More Information

Provides detailed information about the station. All instrument parameters are grouped in to the pages according to their purpose and it is done exactly in the same way as with the Instrument Setup Manager. The only difference from it is that the pages do not contain any control buttons and the user can only monitor all parameters but cannot change them.

Instrument Setup

Almost all GeoSIG instruments can work in the standalone mode, i.e. without being connected to a computer permanently. They work according to the set of various parameters and the Instrument Setup Manager can set any of those. This is the biggest and one of the most important tasks GeoDAS can do. Detailed information is provided further in the chapter Configuring the Instrument.

Please note that the name of "focused" station appears also in the combo box of the Station toolbar. Pressing the 3rd and 2nd buttons of this toolbar launches the Event Manager and the Instrument Setup Manager correspondingly.

The following operations are applied to one or more stations selected (highlighted) in the list:

Batch Multi-Setup

The Batch Multi-Setup is a specific operation mode of the Setup Manager. It utilises the fully asynchronous, so-called "batch mode" of communication to the instruments, when several commands are send in the same packet without waiting for a confirmation of every command. So the packet can be sent out not only through the full-duplex communication channel but also through the half-duplex channel. The instruments capable of handling GSM modems receive such packets as binary SMS messages. Not all GeoDAS instruments support currently this mode because it is useful only in case there are many stations configured in GeoDAS and one has to change quickly some particular parameter(s) in all of them.

Clean Batch Queue

When a batch is sent out but not yet confirmed by the instrument, the Current Activity column in the General Information window indicates "Pending Batches: N", where N is the number of not confirmed batches. If a batch is not confirmed within some time interval, GeoDAS may re-send the request. In order to cancel this operation and to clean up the batch queue, simply run this item for the selected stations.

Clean SMS Queue

If GeoDAS is configured to support communication with configured stations by means SMS messages, all outgoing SMS are placed to the queue for sending. If you would like to cancel sending SMS to a particular station, use this command to clean up the queue.

The following items of the context menu are always available:

Configure Stations

This item has the same functionality as Settings/Configure Stations of the main GeoDAS menu. More detailed information is provided in the chapter Configuring the Stations.

Export Configuration

You may select one or several stations from the list and choose this item to save the configuration of the selected stations to a file on your choice.

Update Coordinates

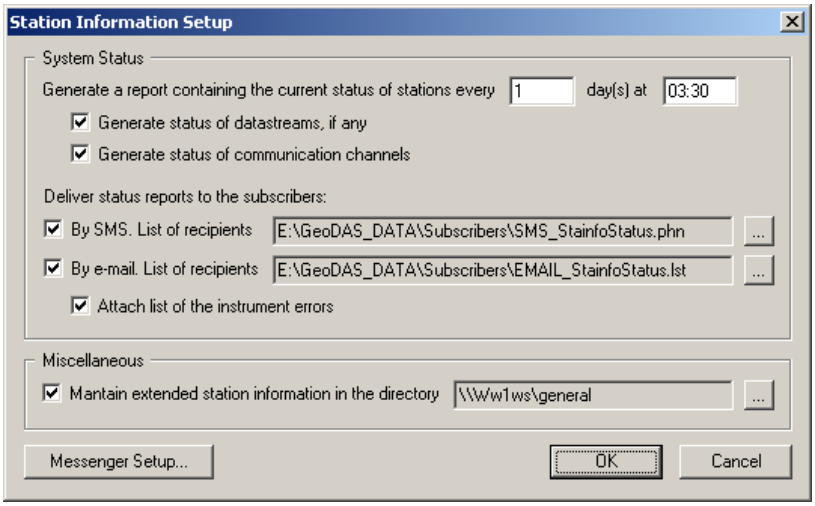
This command is used to create or update the All_stations.lst file used to plot configured stations in the station map. More information can be found in the Appendix K. Station Map. If no stations selected from the list, then all coordinates will be updated. Otherwise GeoDAS updates only the latitude and longitude of the selected stations. Make sure that locations provided by instruments are correct before running this command.

Network Links

With the dialog launched upon clicking this item, you can instruct GeoDAS to exchange general station information with the other instance(s) of GeoDAS running in the other computers. This information is sent usually to the GeoDAS working in the Monitor mode. Please see the Appendix G. Network Links of GeoDAS for the description of the "Network Links" dialog.

Status Info

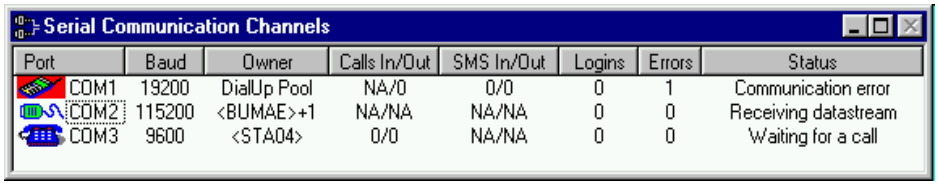
The following dialog box appears when clicking this item. You can specify here whether the station information is sent periodically to the recipients. Two ways of the information delivery are available: SMS and e-mails. In the last case the list of instrument errors (if any) can be attached to the every email. Minimum **interval for delivery** of this information is one day. The **time of sending** is set as well. If you would like to deliver not only the general station information but also the **status of data streams** and the **status of communication channels**, the corresponding options have to be checked. Recipients must be listed in the separate files for the email and for the SMS reports. The format of both types of the files is described in the Appendix F. Messenger of GeoDAS.



If you would like to attach the list of instrument errors, select the corresponding option. The format of the instrument error file is described in the Appendix D. Format of the status files.

You can also **maintain the extended station information** in a directory on your choice. If this option is checked, then every SOH report from every station will be logged into a text status file located under this root directory for extended information.

8.3 Serial Communication Channels



This window displays the table filled up with the information about all the communication channels (COM ports) used to access the configured stations. This window is opened if at least one station is configured. It can be minimised or restored but never closed, so it is always in the screen.

8.3.1 Description of the information

The information displayed in this window is described in the table below. You can find also some explanation about the types of communication channels and their parameters in the chapter Communication Channel Setup.

Port	Communication port, which provides a physical channel to an instrument. The bitmap displayed to the left indicates the type of a channel. COM2 in the picture above is configured for the permanent direct access to the instruments. Other two ports are used for the dial-up links: the analog modem is attached to the COM3 and the GSM modem is attached to COM1. Red background indicates that a link through the COM1 cannot be currently established because of a communication error.
Baud	Current Baud Rate of the serial channel.
Owner	The name of a station, which this channel belongs to. It can be also a name of a modem pool in case the channel is configured as a member of a modem pool and is not locked by any station at the moment. Station name is always given in the form <NAME>. It is possible in some cases that several stations at the same time use the same port, for instance, while receiving data streams by requests. Refer to the chapter Working with Data Streams for more information about this mode. In such cases the number of other stations that use the same port follows the owner's name: <NAME>+N.
Calls In/Out	Statistical information indicating the number of received and made calls. This is applicable to the dial-up channels only, otherwise "NA" (not applicable) is indicated.
SMS In/Out	Number of received and sent SMS. This information can be indicated for the channels, which utilize the GSM modems.
Logins	Number of successful logins to the instrument(s) made through the current port.
Errors	Number of communication errors detected by GeoDAS.
Status	Current status of the serial channel to an instrument

9 Working with Data Streams

9.1 General Notes

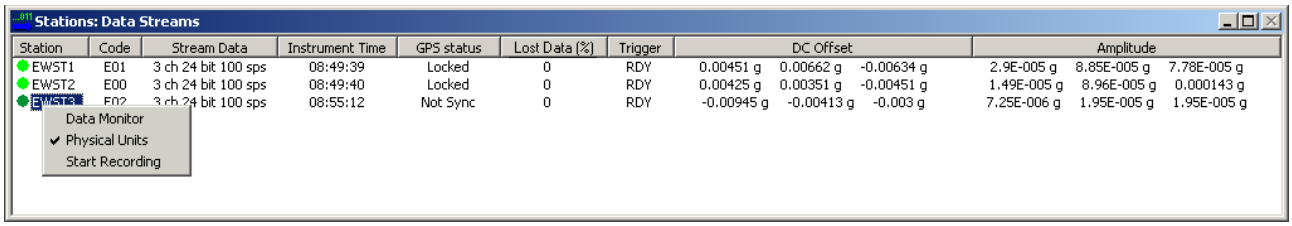
Several types of GeoSIG instruments, such as GBV and GSR-18/24, can provide the streams of data through the serial communication channel. In most cases the same communication channel is used both for login to the instrument and for sending the data stream. Therefore it is important to realise that the data stream is always interrupted when you log in to the instrument. The data streams carry either data samples, which are sent in the binary format as soon as they are gathered from the A/D converters, or data packets of samples collected within a time frame of maximum one-second interval. In general the instruments are capable of recording files and sending data streams at the same time. But very often it is not required, so the instruments may have no event memory. They work as digitizers only providing data streams.

If you intend to work with the data streams and the instrument you purchased provides this functionality, follow these steps:

1. Enable the data stream support from the GeoDAS side while configuring a station as it is described in the Data stream options of Work Options issue of this manual
2. Enable sending data streams by the instrument with the Setup Manager. Refer to the description of Data Streams Parameters of the Setup manager for more details
3. Configure GeoDAS for processing the data streams. This action will be described further in more details.

9.2 Data Streams information window

If you have enabled the support of data streams for at least one configured station, the following window appears in the screen after restart:



9.2.1 Description of the information

The following information related to the data streams is indicated:

Station	The unique station name, which is entered while adding a station. This name is used by GeoDAS only and is not stored in the instrument memory. A bitmap displayed on the left reflects the quality of data stream. Red colour indicates fatal errors (no data at all), orange colour indicates warnings (single lost packets). Green bitmap means normal operation. Red cross indicates that data stream from the corresponding station is interrupted because the user is currently logged in to the station or the communication port is used for an ASCII terminal.
Code	Station code. Three-byte station identifier stored in the instrument
Data Stream	Data stream parameters (components, LSB, sampling rate)
Instrument time	Time stamp as it is indicated in every data packet arriving from the instrument
GPS status	Status of GPS receiver if it is connected to an instrument, locked and receives 1PPS signal, the “Locked” is indicated, otherwise “Not Sync”. If there is no GPS connected, the indication is “No Info”.
Lost Data	Quality of the link to instrument (percentage of data packets lost during last minute, hour, day)
Trigger	Status of the event trigger. Available indications: OFF – the trigger is not activated for the current station;

	INI – the initialisation is performing; RDY – initialised and is ready to trigger; REC – recording an event.
DC offset	Signal DC offset displayed either in counts or in physical units
Amplitude	Average amplitude of the signal (counts or physical units)

9.2.2 Context Menu of the Data Streams Window

As one can see from the above picture, there is a context menu available in the list of data streams.

Data Monitor

One can select several data streams from the list and then launch the Data Graph Monitor (see below) to display those streams.

Physical Units

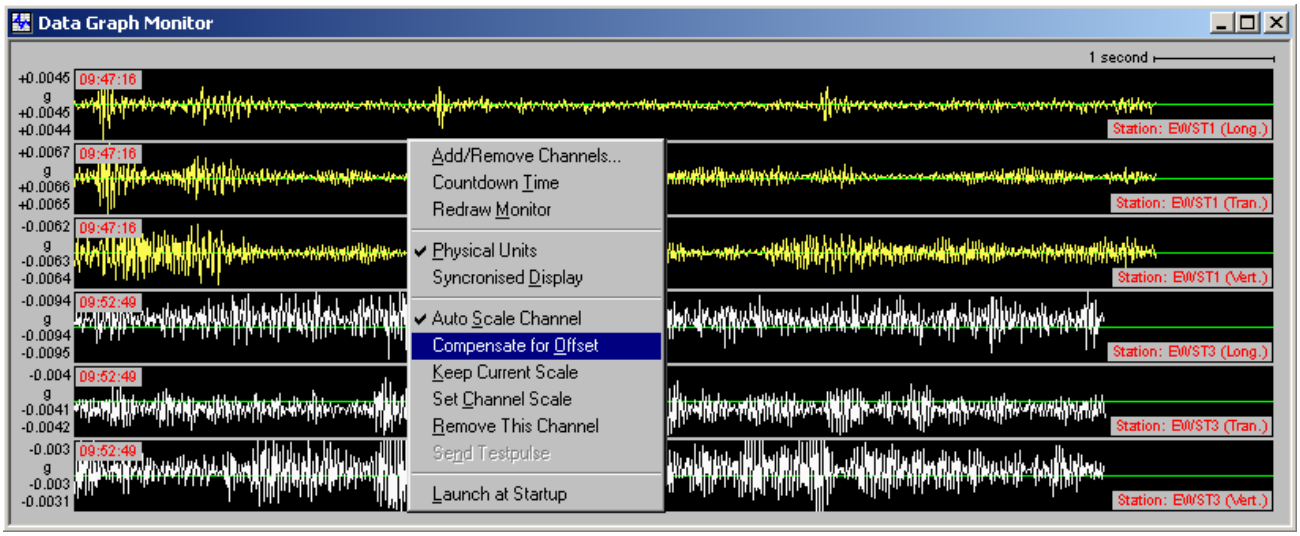
This menu item specifies whether DC offset and Amplitude must be displayed in physical units or just in counts.

Start/Stop Recording

Running this menu item forces GeoDAS to create event file(s) and to save stream data. Prior to use this feature you have to run the Datastream Manager Setup (**Settings->Data Streams**) and to enable creating event files from data streams **on any local trigger** or **on a network trigger**. Please also make sure that the column Channels of the **table of local triggers** does not indicate "None" for the stations, which will record data. Otherwise data channels are not initialised and therefore the manual trigger will not be started. Note that the manual recording is terminated automatically upon elapsing of the time interval indicated as **Max. duration**. Refer to the section Processing Stream Data for more information about Datastream Manager Setup.

9.3 Data Graph Monitor

The Data Graph Monitor is a graphical representation of the active data streams. The data signals arriving from the instrument are displayed as waveforms. They are updated upon receiving of every new packet.



9.3.1 General Information

All data channels are displayed separately. Every signal trace has its own view and they cannot be overlapped. The name of the station and the component name are indicated in the right lower corner of a view for every channel. Start time is indicated in the left upper corner of a channel view. Zero level and the

scale limits are shown as well. The synchronisation status of the signal is indicated with the trace colour: If the waveform is plotted in yellow colour, the station's GPS has synchronisation.

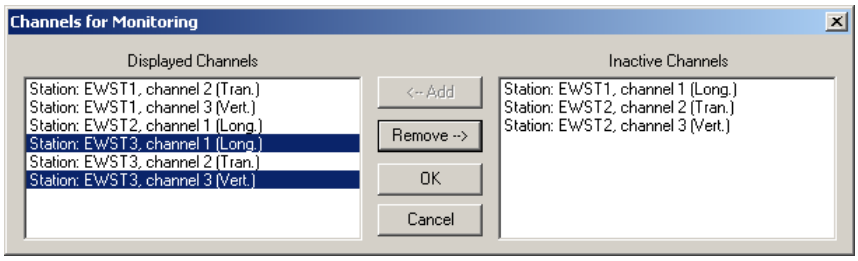
Main parameters of the Data Graph Monitor are adjustable with the context menu, which is described below.

9.3.2 Context Menu of the Data Graph Monitor

The menu has following items:

Add/remove channels

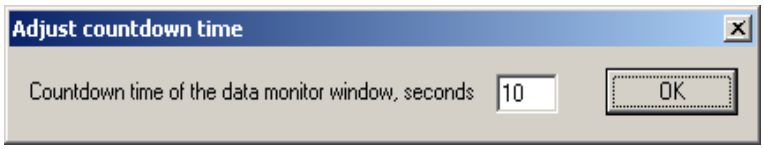
Launches the dialog to add new channels to the monitor window or to remove the existing one(s). New channels can be selected from the set of all existing data streams of the configured stations. If one or more channels are selected in the list, use the buttons **[←Add]** and **[Remove→]** to perform the corresponding actions.



Please note that the view of every channel trace has some minimum dimensions and therefore only the limited amount of data channels can be added to the window. In order to see more channels in the window, you have to increase its vertical size first and then add the channels.

Countdown Time

Lets you adjusting the length of a time frame of all displayed signals with the following dialog:



Redraw Monitor

Updates the monitor window

Physical Units

Switches between counts and physical units displayed in the Y-axis.

Synchronised Display

This option, if selected, makes all displayed channels synchronised in time, irrespective to the time when the data packets were received. Otherwise all waveforms are updated as soon as every next packet is received and the currently displaying fragment of every waveform has its own start time indicated in the upper left corner of every graph channel.

Items of the next group of the context menu are applicable to a channel trace, which is pointed currently, i.e. located under the upper left corner of the context menu.

Auto Scale Channel

Specifies whether the scale of the current channel must be adjusted automatically. Otherwise the fixed scale specified by a user is taken.

Compensate for Offset

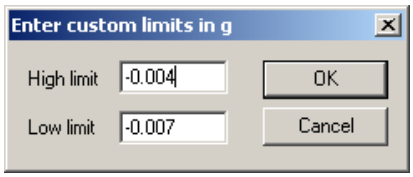
Specifies whether the signal of current channel is displayed with or without offset removed.

Keep Current Scale

Causes the current scale limits to be saved and used when the Auto Scale option is turned off.

Set Channel Scale

Launches the dialog allowing a fixed Y-scale to be set by user. Auto Scale must be off for this option to work. If the channel scale is displayed currently in physical units then the limits must be entered in these units, otherwise in counts.



Remove This Channel

Removes a channel under the upper left corner of the context menu.

Send Testpulse

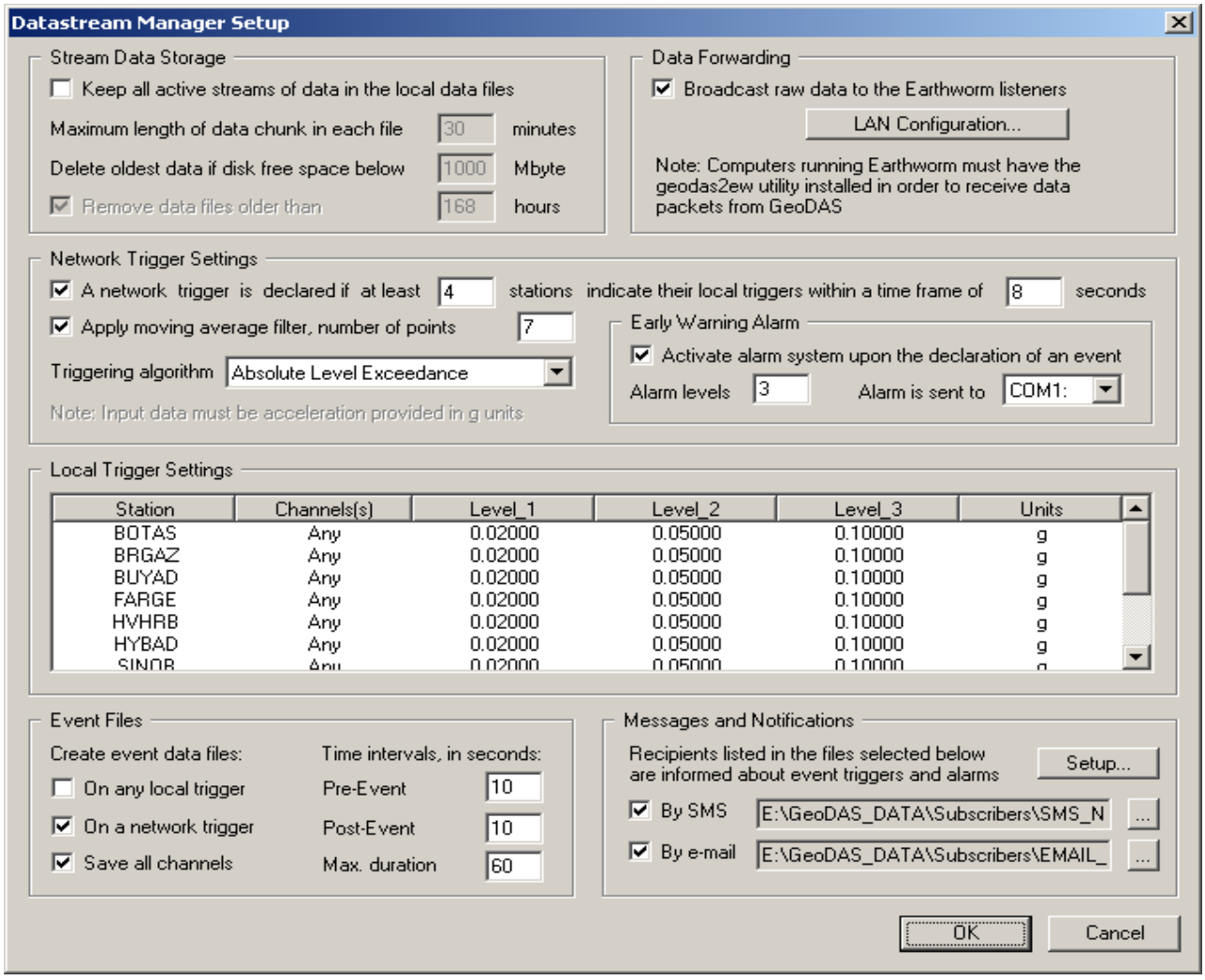
This option works only for the instruments, which send data packets by request. The instrument is forced with this command to send a test pulse, which can be seen in the screen as a “step” in the signal.

Launch at Startup

The last option of the context menu, if enabled, instructs GeoDAS to launch the Data Graph Monitor automatically when the program starts.

9.4 Processing Stream Data

Processing of data streams is disabled by default. Run **Settings->Data Streams** item from the main menu in order to configure the data stream processing. The following dialog appears:



The first group of controls specifies the data storage options. You would probably like to **keep all active streams of data in local data files**. In this case the maximum **length of data chunk** must be set as a time interval in minutes. If some data blocks of the stream are lost within this time interval, GeoDAS may create more than one file to keep the data. But each data channel creates in general only one file. For instance, if a station provides three components of the signal in a data stream then three files will be created.

Since the data files are recorded permanently, the hard disk of the computer is filled up with data quickly. Therefore care must be taken to avoid hard disk overflow. You have to set the minimum amount of a hard **disk free space**, which is allowed for the normal operation of GeoDAS and the Windows operating system. If the free space reaches this limit, GeoDAS will delete the oldest data stream files in order to continue performing normally. Additionally, the lifetime of data stream files can be set with the option **Remove data files older than** the time interval specified in hours. Data stream files can be viewed and processed in the same style as the event files with the Off-line Data Viewer.

Besides of keeping data streams locally GeoDAS can forward the data to a remote computer(s) for further processing. For instance, in order to forward the data to the USGS Earthworm software, you have to:

- enable the corresponding option **Broadcast raw data to...** in this dialog
- enable broadcasting of datagrams while configuring the network links of GeoDAS, the button **[LAN Configuration]**
- install and configure the utility geodas2ew in the computer(s) running Earthworm

The group of controls called Network Trigger combines the settings of triggering conditions. You can **enable/disable the network trigger**, specify the **time aperture** of the seismic stations network and set the **minimum number of stations**, which must issue the local trigger within the time aperture in order to declare the network trigger. There is the option of selecting the **moving average filter**. If it is checked, a **number of points to average** must be specified. You can also choose the **triggering algorithm**, which can be one of the followings: absolute level exceeding, STA/LTA based or CAV (Cumulative Absolute Velocity) based. Last algorithm requires input data to be acceleration in g units. More information is available in the Appendix C. Triggering algorithms used by GeoDAS.

The parameters of local triggers are set in the table. Most of them are specific for every triggering algorithm but in any case you have to specify which **components of the signal** are taken into account in the selected algorithm. It can be only one selected single component (x, y or z), any of two (x, y) or three components, or it can be also the vector sum of two (x, y) or three components specified in last case as square root of $(x^2+y^2+z^2)$. Up to three levels of trigger are monitored by GeoDAS. The network trigger is declared at exceeding of the 1st level. Two other levels are used by the alarm system only, see below.

A **threshold level** in physical units is set as trigger level in case of the absolute level exceeding algorithm. If the selected algorithm is STA/LTA based then the **STA/LTA ratio** is specified for all supported trigger levels. The **STA and LTA time intervals** are also adjustable. CAV based algorithm requires **CAV thresholds** to be set in units of g-sec. Other adjustable parameters for this algorithm are the **time interval used to calculate the CAV** value, and the **integration limit** provided in g.

When the network trigger becomes active, you would probably like to activate the alarm system, alerting about detected events. Enable the option **Activate alarm system...** to do so. The number of monitored alarm levels is specified in the edit box **Alarm levels**. You have to specify also a **communication port to send alarm** information out. The format of alarm ASCII data string: **<<<ALARM LEVEL N. Date: DD.MM.YYY. Local Time: HH:MM:SS.ddd>>>,** where N - can be 1, 2 or 3. DD.MM.YYYY and HH:MM:SS.ddd are date and time stamps with milliseconds. This string is sent out at the fixed baud rate 9600 baud. At the time of an alarm occurs, the above window comes up on the screen and an audible alarm signal is generated. The window remains on the screen until an operator hits the button **[Close]**. Pressing the button **[Advanced]** lets you see some additional information about the trigger conditions.

You can also set with this dialog whether the event files must be created on **any local trigger** and/or on a **network trigger**. In case of a network trigger you can also specify whether all data streams must be saved to the event files or only those, which have the local triggers activated. The other parameters adjustable here are: **pre- and post-event time interval** and the **maximum expected event duration**.

The last group of controls specifies whether an email message or SMS notification must be sent out in case of a network trigger. To activate this functionality, one has to enable the corresponding options and select the lists of recipients with the browse buttons **[…]**. The **[Setup]** of GeoDAS Messenger must be performed as well to provide the required operations. Refer to the Appendix F. Messenger of GeoDAS for more information on this topic.

10 Off-line Data Viewer

10.1 General Notes

The Off-line Data Viewer (ODV) is a tool of GeoDAS intended for displaying and for the analysis of the waveforms recorded by GeoSIG instruments. Waveforms are kept in files, which can have different formats identified by the file extension:

- GSR - standard decompressed event file format
- GST - the same as GSR but tespulse-file
- GBR - compressed event file format
- GBT - the same as GBR but tespulse-file
- GCR - standard decompressed event file format generated by GCR instruments
- GCT - the same as GCR but tespulse-file
- GPR - permanent recording format
- SMR - file generated by a SMACH recorder

ASCII text files are supported as well. ODV can export any currently displayed data set to an ASCII data file and import the same file afterwards. If an ASCII data file is created by another application, care must be taken that its format is compatible with the one supported by GeoDAS. Please refer to the Appendix B. ASCII file format used by GeoDAS for more information on this issue.

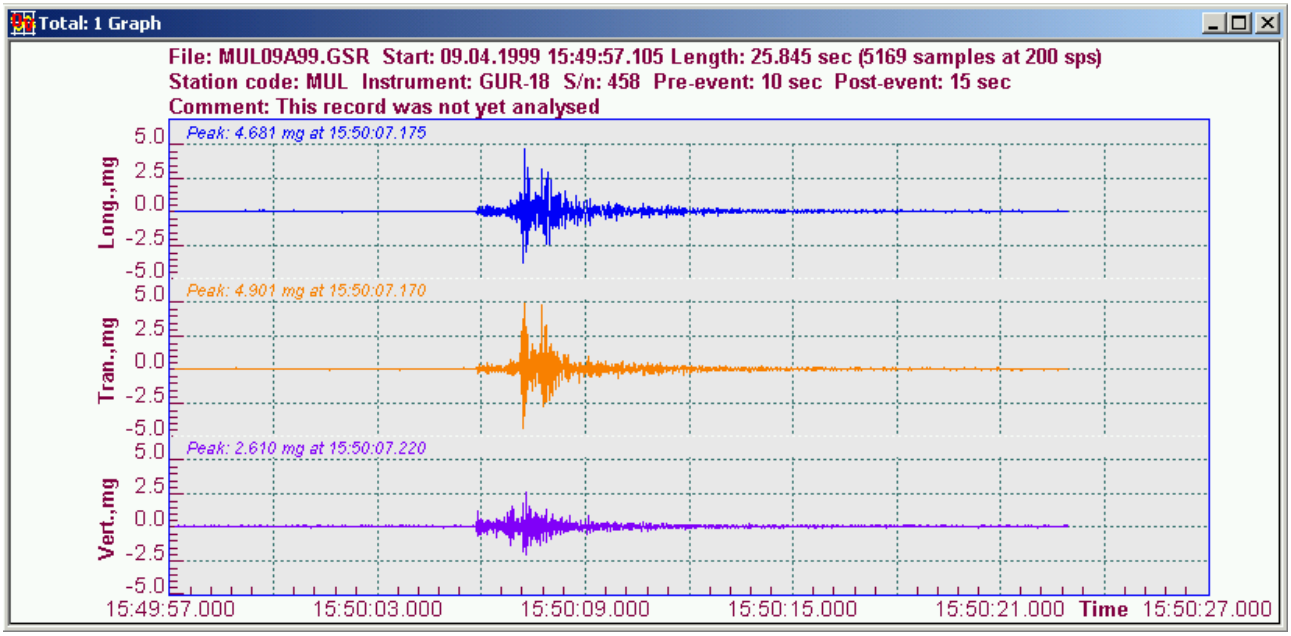
ODV can also display the data stream files created from the data received with the data streams. They have the DAT extension by default.

ODV supports the basic miniSEED format of event files. The default extension of these files is MSD.

Opening an event file with GeoDAS is as simple as with other Windows applications. Just run the menu item **File->Open** or press the first button of the ODV toolbar and select a file with the standard File Open dialog. Besides the types listed above there are two more options selectable with the File type combo box:

- Event files. These files are created by GeoDAS (**File->Save Event**) and contain the information about one or several event data files that have been downloaded by the instruments. It is useful to save the files created by several instruments but related to the same event under the single name as an "event".
- Station files. In order to open all the files, which reside in the current directory and created by the same instrument, simply select the Station file from the list and click it to open. Station files have the following names: XXX-(N).nst, where XXX is the instrument code and N - number of files in the current directory.

When opening one or several data files of any type listed above, the ODV graph window appears:



The above plot is a typical GeoDAS data presentation. There can be up to three text strings at the top of a graph. It is a **graph title**, which displays the file name, the event start time and date and other important information. The user can enter also any comment, which will be indicated in the comment line.

The data set shown above has three components. Every data set can have one, two or three **data components**, except the files created by GCR instruments. These files may contain a 4th component, which is the vector sum of all real physical components of the signal. All components of the signal have the same start time and therefore they are displayed with the same horizontal time axis. It is selectable with the context menu (item **Graph**) whether one, two or three components of the signal shall be displayed in the graphs for the multi-component data sets. The peak value and its time are indicated at the top of every graph component.

The other elements of the graph window are the **vertical and horizontal axes** with the **labels**, the **grid** for every component. If more than one graph is open in the same window then several **button-like controls** are indicated at the left part of the window. Those at the top are similar to the standard buttons of any window. They are used to minimise, maximise, restore or close the current graph. The buttons at the bottom are used to go to the next or to the previous graph. The number of the graph is indicated next to these buttons.

*In order to optimise the space used for graphs in the window you can hide those button-like controls by disabling the option **View Graph Control** in the **View** submenu of the main GeoDAS menu.*

The total number of graphs opened in the graph window and the number of selected graphs are indicated in the window title.

Many operations described further can be applied to the graphs. This is done in the following different ways:

- By running some items of the main GeoDAS menu
- By selecting a desirable action from the context menus of the graph window
- By pressing the buttons on the ODV toolbar
- With the combination of hotkeys from the keyboard

The details of different operations are described below.

10.2 Selection of the Graphs

A user has the possibility to select one or more graphs in active view. In order to select/deselect just one graph, simply **click with the mouse on the area located left of the labels of vertical graph axis**. Selected graphs are shown with inverted colours. If the graph has several components of the signal then all of them are selected as one graph.

While moving a mouse cursor over selected graph, the exact values of all its components as well as the value of X-scale are indicated at the position of the mouse cursor.

Several graphs can be selected from the submenu **Edit** of the main GeoDAS menu:

Select All

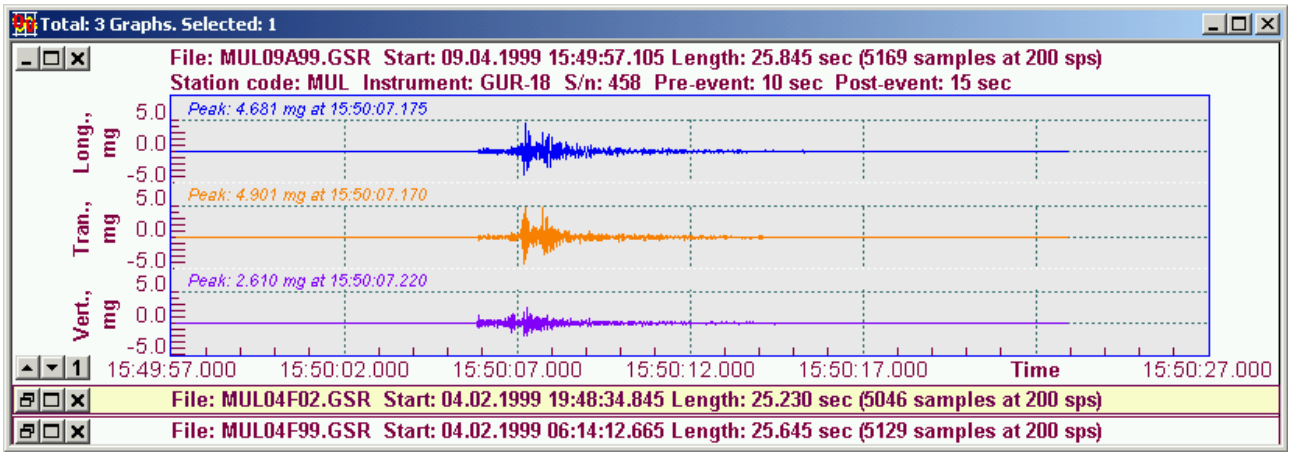
Selects all the graphs in the currently active ODV window.

Select Visible

Selects visible graphs, i.e. those maximised or restored

Select Minimised

Selects only minimised graphs, i.e. those represented by their titles only as it is shown in the picture below. Two graphs at the bottom are minimised and the third one is restored. The middle graph is selected.



*In order to minimise a single graph, simply click the leftmost button-like control of the current graph. You can also **Minimise All** or **Restore All** graphs with the corresponding items of the **View** submenu in the main GeoDAS menu.*

Unselect All

Deselects all selected graphs

As soon as selection is made, the various operations can be applied to the selected graph(s) with the items of the **Edit** submenu.

Delete

Removes selected graph from the current view window and its data set from the data stack.

Cut

Removes the graph from the view and places it to the clipboard.

Copy

Copies the whole graph to the clipboard.

Copy Fragment

Copies only the visible fragment of the graph to the clipboard.

If one or more graphs or graph fragments were copied to the clipboard, the following operations become available as well:

Paste in new window

Pastes the previously copied graph or a fragment of the graph from the clipboard to a new window.

Paste

Pastes the previously copied graph (or fragment) from a clipboard to the same view.

10.3 Sorting the Graphs

The graphs opened in the same window can be sorted. There are two options available in the View submenu of the main GeoDAS menu:

Sort by name

Sorts graphs by their names as they appear in the graph headers.

Sort by Time

Sorts graphs by their record date and time.

10.4 ASCII Data Files

The data sets displayed in ODV windows can be saved as ASCII data files. In order to do so, select the graph you are going to export to an ASCII file and run command for the main menu **File->Export Text**. This action results in saving the selected data set to the same directory and with the same name as the original event file but with the TXT extension.

The format of the output file depends on the options, which are set currently for the axes of the exported graph:

- The data is saved to the file as columns of data samples, one column per every graph component, which is currently displayed.
- If the units of Y-scale are counts then the data samples are saved in counts as well, otherwise in physical units.
- If the labels of X-scale are not set to 'None' then the time column is save to the output file. The format of this column is the same as indicated currently in the graph: relative time in seconds, absolute time or just samples.

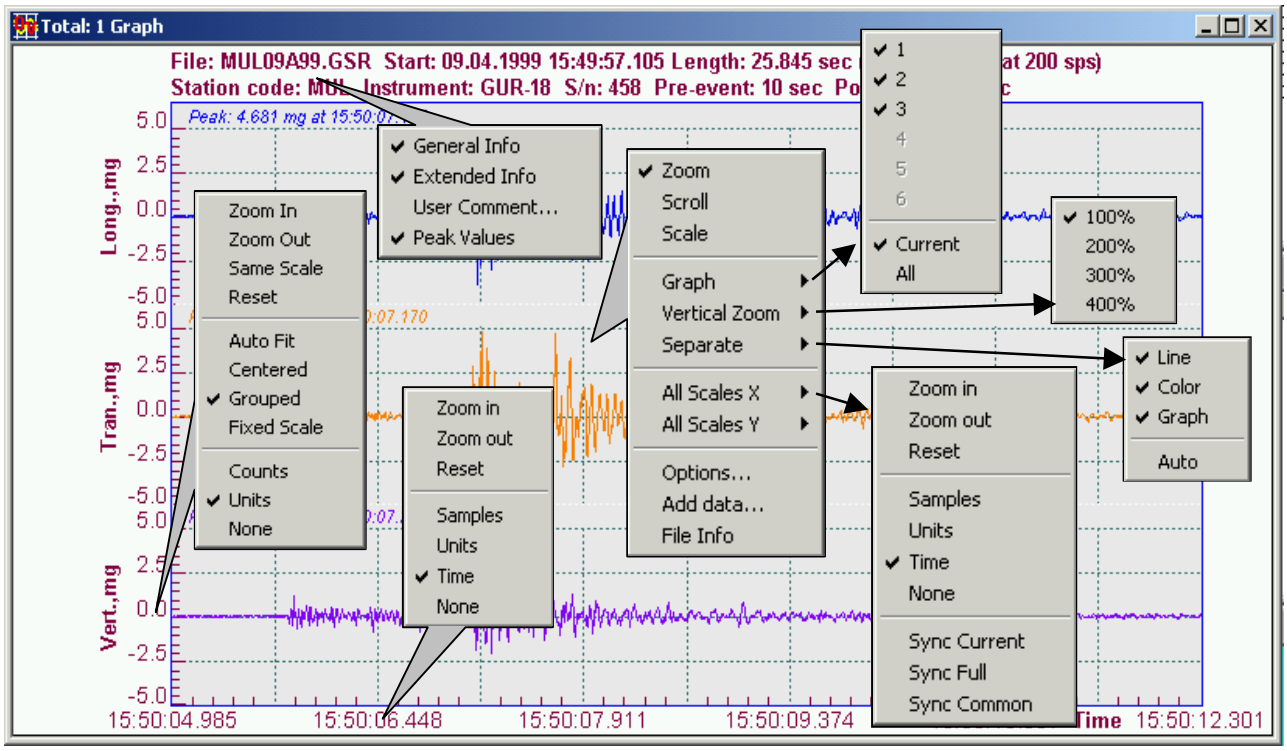
The first four strings in the file contain most important general information. The one-string title indicating the names of columns is always saved to the file. It has the following format: **[Name of the 1st column] Component1,units Component2,units** ... etc.

The **import of ASCII files** is also supported. When opening the data file with the standard browse dialog, select "**Text data**" as the type of file and choose one of the text files with the TXT extension.

If an ASCII data file is created by an external routine please make sure that it has one of the formats supported by GeoDAS. The options are listed above. Please refer to the Appendix B. ASCII file format used by GeoDAS for more information.

10.5 ODV Context Menus

Available context menus are shown in the picture below. They are different depending on the area where the user right-clicks: on the graph title, on vertical or horizontal axes or on the graph view itself. In the last case the context menu has the submenus, which are indicated in the same picture.



10.5.1 Title Context Menu

This menu allows the title information to be customised.

General Info

If this item is selected, the following information is displayed in the first string of the title: start date and time of the event, number of samples and the sampling rate. The name of file is always shown regardless the selected options in the title menu

Extended Info

If this item is selected, the following information is displayed in the second string of the title: station code name (up to three characters), type of the instrument and its serial number, pre- and post-event time in seconds. If the displayed data file contains information about trigger and/or alarm time, this time indicated in this string instead of pre- and post-event intervals:
TH2 time: HH:MM:SS.ddd - trigger time (when the event was declared)
TH1 time: HH:MM:SS.ddd - alarm time
Note that this information is available only if the file is created by a special version of GSR-18 instruments.
Extended information for the DAT files consists of the station code, number of displayed data files and data blocks and the total number of the data samples in all these blocks.

User Comment...

Selecting this item launches the simple dialog, which is used to enter any comment, which is displayed in the additional string of the graph header.

Peak Values

If this item is selected, the peak values and their time are indicated at the top of graph components.

10.5.2 Vertical Axis Context Menu

The commands of this menu are applied to that graph scale only, which is right-clicked.

Zoom in

The scale of the vertical axis is resized in a way that the graphical image gets bigger. In case of a multi-component graph this command is applied to all components only if the **Grouped** option (see further) is active. Otherwise only the scale of a component, which was clicked, is resized.

Zoom out

The scale of the vertical axis is resized in a way that the graphical image gets smaller. The action provided by this command depends on the **Grouped** option as it was described above.

Same Scale

Assign the same Y-scale to all components. The scale of a component clicked with mouse will be taken as common scale.

Reset

Resets the limits of the vertical axis scale to the original ones.

Auto Fit

This option, if selected, makes the vertical scale of the graph adjusted automatically in a way that the visible fragment of the graph is always best fit into the window. Note that one cannot scroll and scale the graphs displayed with this option.

Centered

If this option is checked, the zero line is always placed in the middle of the graph. Note that one cannot scroll the centered graphs. Some kinds of data graphs, e.g. Vector Sum, have only positive data samples and therefore they cannot be centered. There is one exception: if the graph contains only zero values, both positive and negative scales are displayed for better visualisation of such graphs.

Grouped

This option specifies whether all components of a multi-component data set are scrolled and resized synchronously. If this option is not active those operations are applied to the one component only.

Fixed Scale

This command sets the same fixed vertical scale for all components of the multi-component data set. User specifies this scale in the Graph Options window. Note that one cannot scroll and scale the graphs displayed with this option.

Counts/Units/None

This group of items specifies whether the labels of Y-axis must be indicated and if so, whether they must be shown in physical units or in counts.

10.5.3 Horizontal Axis Context Menu

The commands of this menu are applied to that graph scale only, which is right-clicked.

Zoom in

The scale of the horizontal axis is resized in a way that the graphical image gets more stretched.

Zoom out

The scale of the horizontal axis is resized in a way that the graphical image gets more condensed.

Reset

Resets the limits of the horizontal axis scale to the original ones

Samples

The labels of X-axis display the number of samples acquired from the beginning of the record

Units

In case of the time series the X-axis is labelled with the relative seconds counted from the beginning of the record. The absolute start time is indicated in the header (if selected). In case of the frequency series the X-axis is labelled with the frequency units (Hz).

Time

The labels of X-axis display absolute time in hours, minutes, seconds and milliseconds. Applied to the time series only.

None

The X-axis has no labels at all.

10.5.4 Context Menu of the Graph View

Zoom/Scroll/Scale

Only one of these items can be checked at a time. It specifies the default action, which is performed when a user holds the left mouse button pressed on the graph and moves the mouse pointer. When zooming, select the required fragment of a graph first and confirm your selection. Graphs are scaled in both vertical and horizontal directions. But the vertical scale can be changed only if the option "Auto" is off (see further). While scaling, you can either compress or expand the graph. All these functions are intuitive once and can easily be performed with a mouse only.

Graph

If the displayed data set contains of more than one component, you can hide those, which you would like not to be displayed by 'unchecking' the number of corresponding component(s). With the options **Current/All** you can specify whether your selection of the graph components has to be applied to all graphs opened in the window or to the current one only.

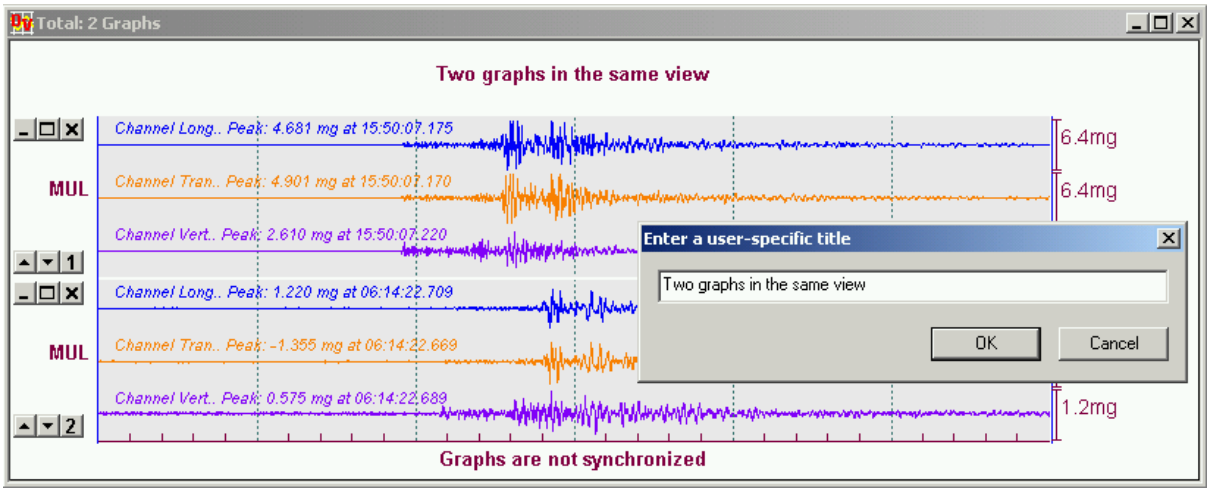
Vertical Zoom

The entire vertical graph view is scaled for 100 (default), 200, 300 or 400%. The percentage of zooming is selected from the next submenu.

Separate

This item specifies how several graphs opened in one window and their components are separated one from the other. The following options selected from submenu are available:

- **Line**. If this option is checked all components of the graphs are drawn separately, otherwise they are overlapped and always shown with the same scale
- **Color**. Specifies whether the graph components are painted with different colours
- **Graph**. If this option is enabled, then every graph in the window has its own view with the horizontal scale and labels. This is the default mode. Otherwise all the graphs are displayed in the same view as it is shown in the picture below:



The graph presentation shown above differs from the default one, which was described earlier. The graphs have no particular titles but it is possible to specify a title for all the graphs: clicking with the mouse above the graphs brings on the dialog, which lets you enter the graph title.

Instead of the Y-axis and the labels, the three-character station code is indicated on the left side of the graph. The peak-to-peak amplitude is shown on the right side of the graph for every component.

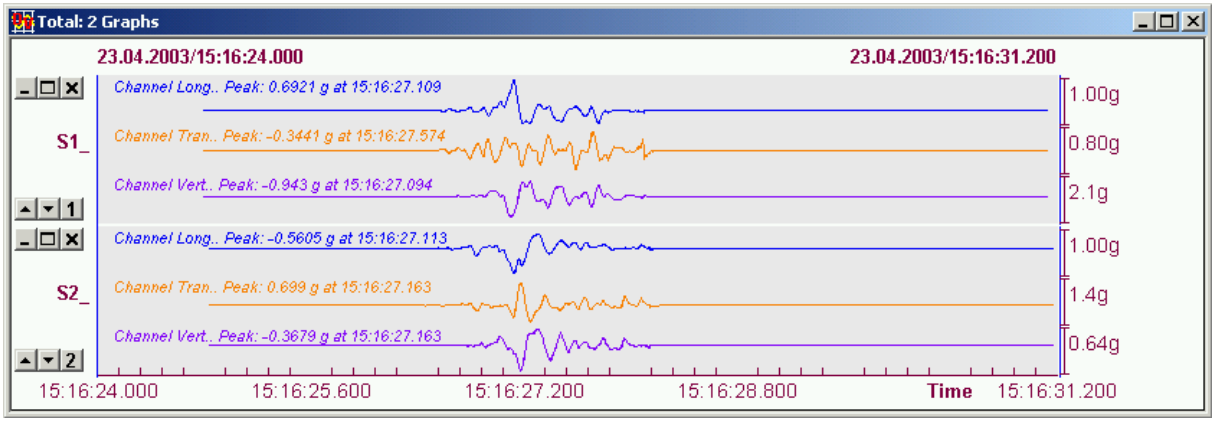
All the opened graphs are not time-synchronised by default and can have different scaling since their data sets can be recorded at any time. Therefore instead of X-axis labels the message "Graphs are not synchronised" is indicated. Such behaviour appears if **Auto** switch in the **Graph** submenu is disabled. Otherwise the separation mode is selected automatically and only time-synchronised graphs are displayed with the same X-axis.

It is also allowed to minimise, maximise and restore the graphs as well as to select and deselect them. For instance, the upper graph in the picture above is shown selected.

All Scales X

This item is used to set the options of X-scale for all the graphs opened in the current window. Most of the options are the same as those available in the context menu of X-axis but they are applied not to the one graph but to all of them in the window. The additional items are needed to synchronise several graphs in the window. The following types of synchronisation are available:

- **Sync Full**. The minimum and the maximum limits of the time scale are selected in a way that all the graphs in the window are fit within this time interval. When all the graphs have the same X-axis (the option **Separate->Graph** is disabled) then the valid time is indicated with the labels of this axis. The start and end times of the records are shown above the graphs.



- **Sync Common**. The minimum and the maximum limits of the time scale are selected as the start and end of the common time interval for all the graphs. If there is no such interval, this item is not available.
- **Sync Current**. The graphs are synchronised within the time interval, which is currently valid for all the graphs shown.

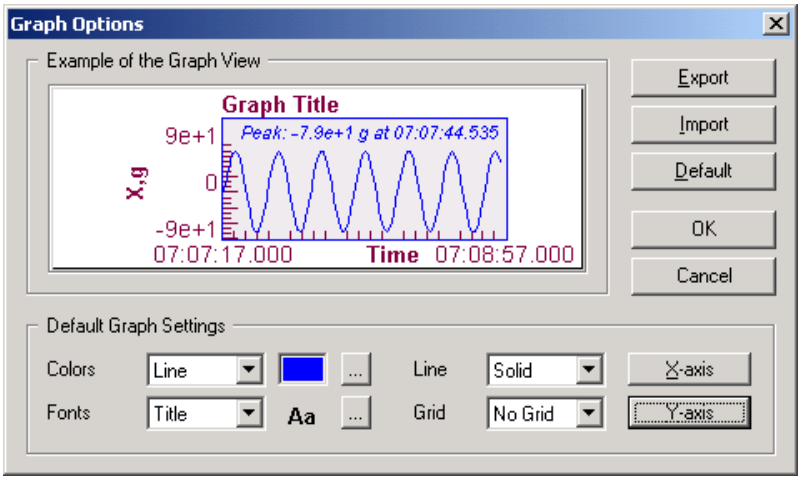
All Scales Y

This item is used to set the options of Y-scale for all the graphs opened in the current window. All options are the same as those available in the context menu of Y-axis but they are applied not only to the one graph but to all of them in the window.

Options

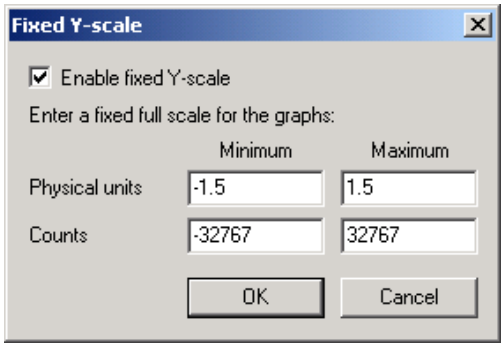
This item launches the Graph Options setup dialog. It is the same as the item **View->Options** of the main GeoDAS menu. The following parameters are set with this dialog:

- **Colour** of the **graph, background, axes, canvas** and **text;**
- **Font** of the **titles, axes, labels** and **other information**;
- **Grid type** (solid/dotted/none);
- Whether the **dots** of the graph are connected with the **solid line** or not.



In order to specify the parameters of X-axis and Y-axis one has to press the corresponding button and select the required options from the menus. Most of the options are described in the sections related to the context menus of the X-axis and Y-axis. Two more options can be set additionally for the Y-axis: **type of the output format** for the

labels of axis and **number of significant digits**. Selecting the option **Fixed Scale** shows the dialog where one can select the **minimum** and **maximum limits** in both **counts** and **physical units** for the fixed scale.



When all parameters are set as desired, press the **[OK]** button to keep them as default parameters for the ODV graph windows. The other buttons are used to **[Export]** parameters to a file and **[Import]** them from this file afterwards. You can also reset the current parameters indicated in the dialog to the default ones with the button **[Default]**.

Add Data

Adds a new data set to the graph window. The same as **File->Add Data**. A new file is selected with the standard Windows File Open dialog.

File Info

Displays the general information stored in the header of the current data file. The operation is not available for ASCII text files and for the files with SMR extension.

10.6 The ODV Toolbar

For more convenience pressing the corresponding buttons on the ODV toolbar can perform the most often used operations with the graphs. The following operations are supported:

Open file. Lets the file to be opened with the standard Windows File Open dialog. The same action is provided with **File->Open** of the main GeoDAS menu.

Add Data. Adds a new data set to the graph window. The same as **File->Add Data** of the main GeoDAS menu.

Capture Graph. Saves the graph image to a BMP, JPEG or PNG file. A destination directory as well as the file name is selected with the standard Windows browser. The same as **File->Capture All**.

Cut Graph. Selected graphs are removed from the active window and are placed to the clipboard. The same as **Edit->Cut**.

Copy Graph. Selected graphs are placed to the clipboard without removing them from the active window. The same as **Edit->Copy**.

Paste Graph. The previously saved graphs are inserted to the current window from the clipboard. The same action is provided with **Edit->Paste**.

Scroll Left. Current graph is scrolled left.

Scroll Right. Current graph is scrolled right.

Stretch Horizontally. The X-scale of the graph is changed in a way that the graph image is getting more detailed along the X-axis.

Compress Horizontally. The graph image is compressed along the X-axis.

Scroll Up. Current graph is scrolled upwards. The operation is performed only if Y-scale is not centered.

Scroll Down. Current graph is scrolled downwards. The operation is performed only if Y-scale is not centered.

Stretch Vertically. The Y-scale of the graph is changed in a way that the graph image is getting more detailed along the Y-axis.

Compress Vertically. The graph image is compressed along the Y-axis.

Reset. Performs the reset of graph view to the original one.

Grid Type. Changes the grid type (solid/dotted/no grid).

Y-axis Units. Changes units of the Y-axis labels.

Normalise View. The view of X and Y-axes is normalised. Labels are displayed in the format suitable for printing the graphs.

Graph Options. Pressing this button launches the ODV setup dialog. The same action is provided with **View->Options**.

10.7 ODV Hot Keys

Pressing the corresponding keys on the keyboard can also perform some operation with the graphs. These hot keys are summarised in the following table below.

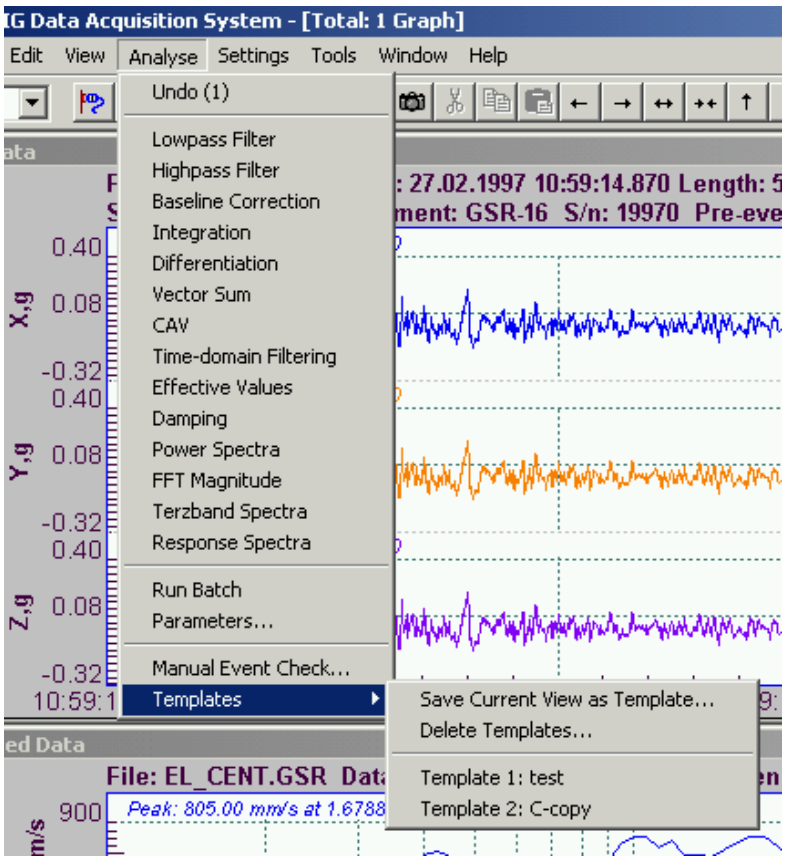
Key	Action
1,2,3,4,5,6	Number of component to be displayed (if exists)
Tab	Show next component: only 1st, only 2nd, ..., All separately, All overlapped, only 1st, ...
Arrow Up	Stretch the Y-scale
Arrow Down	Compress the Y-scale
Arrow Left	Shift the graph left, if not selected
Arrow Right	Shift the graph right, if not selected
+ (plus)	Stretch the X-scale
- (minus)	Compress the X-scale
Arrow Left	Move the pointer left to the next sample, if selected
Arrow Right	Move the pointer right to the next sample, if selected
G	The type of the grid (solid/dotted/no grid)
D	Separation of the graphs
U	Units of the Y-scale (Counts/Values/None)

You can perform the operations of scrolling and scaling (compressing/stretching) the graphs faster if you press and hold the key Ctrl, Alt or Shift while pressing the corresponding hot keys used for scrolling and scaling.

11 Data Analysis

The Data Analysis part of GeoDAS has been developed by GeoSIG especially for the strong motion, earthquake engineering and civil engineering data analysis.

Note that the analysis functions work in the registered GeoDAS versions only, which have the correct nonzero registration number.



11.1 Data Analysis Menu

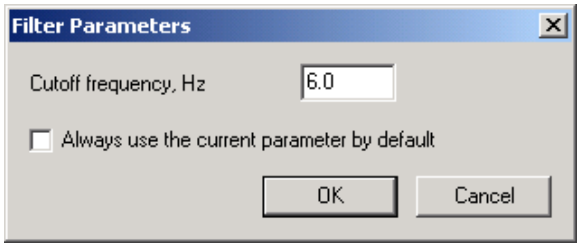
All supported math functions and other operations related to the data analysis are combined in this menu.

The operations are performed with the graphs (data sets) shown in the current ODV window. When the first math function is applied to the original data set, the current ODV window is splitted up in to two parts: the upper one displays original datasets and the lower one displays the analysed data. When the next function is applied, the lower part of the ODV window is updated with results of the last math operation. Several previous results are kept in a stack and therefore one can always cancel the results of the latest math operation and to return to the previous analysis results by running the **Undo** item of the Analyse menu.

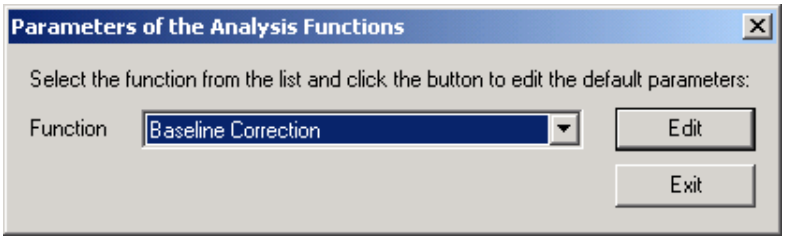
Mathematical operations are applied to selected graph(s) or to the all graphs of active window if no one data channel is selected.

If there were more than one data set in the original ODV window, you can quickly view list the original data and the results of analysis by pressing the **arrow buttons** at the left side of the graph windows.

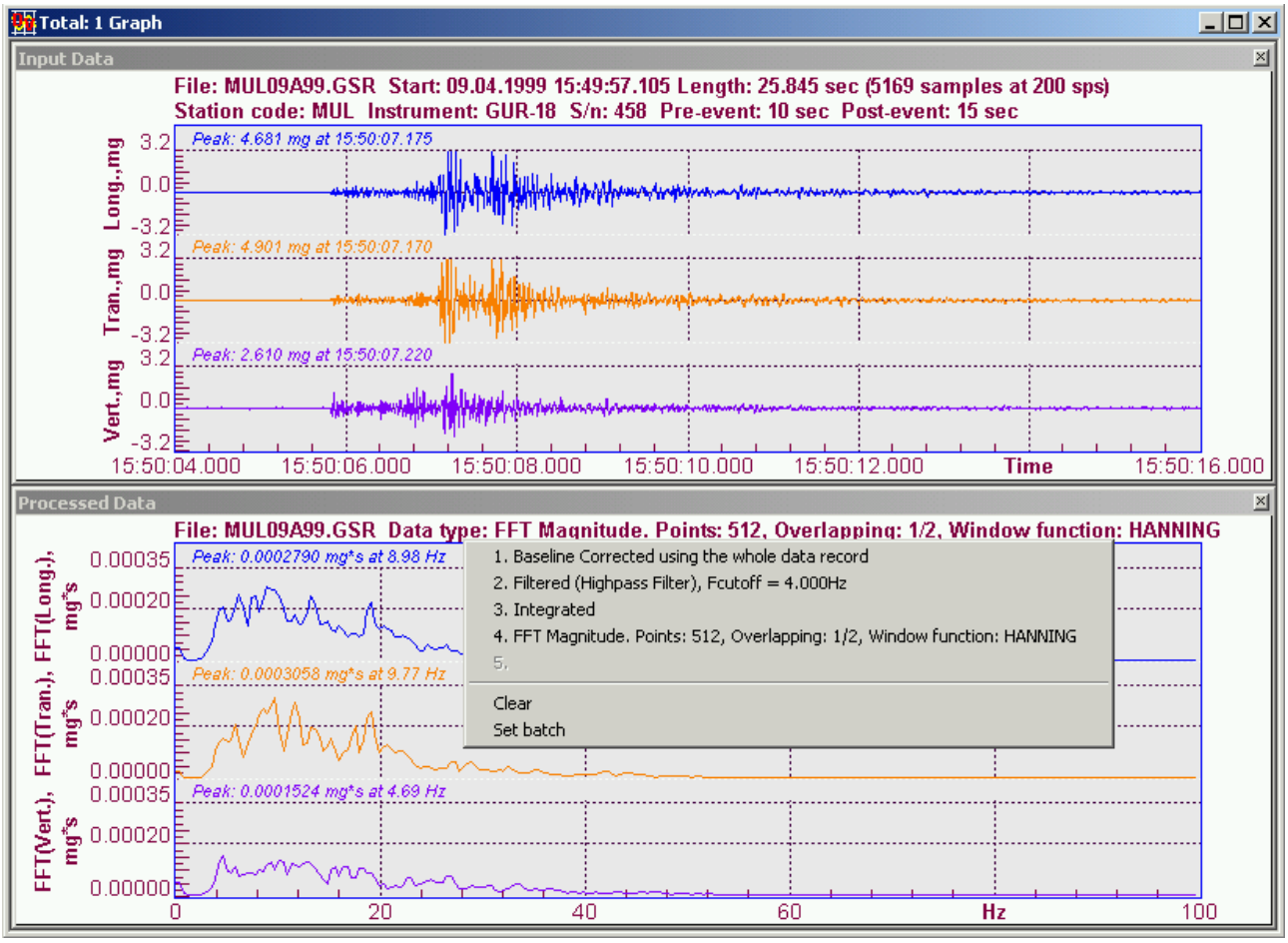
Some math functions (filtering, response spectra calculation) have one or more parameters, which can be adjusted by user prior performing a requested function, whereas some other functions (vector sum, integration) have no parameters. If the function has parameter(s), the corresponding dialog appears after splitting up the ODV window but before the operation. For instance, one can specify the cut-off frequency when filtering the data. When all required parameters are adjusted, press the button **[OK]** to perform the requested operation. Pressing the **[Cancel]** button cancels the selected operation and closes the lower part of the current ODV window. If the option **Always use the current parameter by default** is selected then the specified cut-off frequency will always be used by default for the current operation and the Filter Parameters dialog window will not appear anymore. In such a case the default parameter(s) can be edited through the menu item **Parameters**. It opens the dialog window, which is used to select an analysis function for adjusting its parameters.



A sequence of analysis functions can be fixed (saved) to apply later on to any set of the input data. For instance, the following math operations are applied one by one: the baseline correction, filtering, integration and the spectra calculation (FFT magnitude). Left



clicking now the title of the analysis part of ODV window opens the context menu, which allows to **Set batch** of the performed math functions in a way that they are saved for a future use.



The saved sequence of functions can be applied now to any input data by running the Analyse menu item **Run Batch**.

The menu item Manual Event Check covers the specific functionality related to the seismic and OBE/SSE described in the section Manual Event Check.

11.2 Functions of the Data Analysis

All mathematical functions supported by the program are listed in this section. The brief description of every function is illustrated with an example. If the function has at least one parameter, the corresponding dialog for setting of those parameters is shown as well.

Note that any combination of math operations is allowed, i.e. the program does not check the logic of working with different kinds of datasets. For instance, one can apply the FFT magnitude function and then one can perform the calculation of Cumulative Absolute Velocity (CAV), which is not correct logically and has no practical meaning. Therefore the logic correctness of a sequence of math functions is solely the user's responsibility.

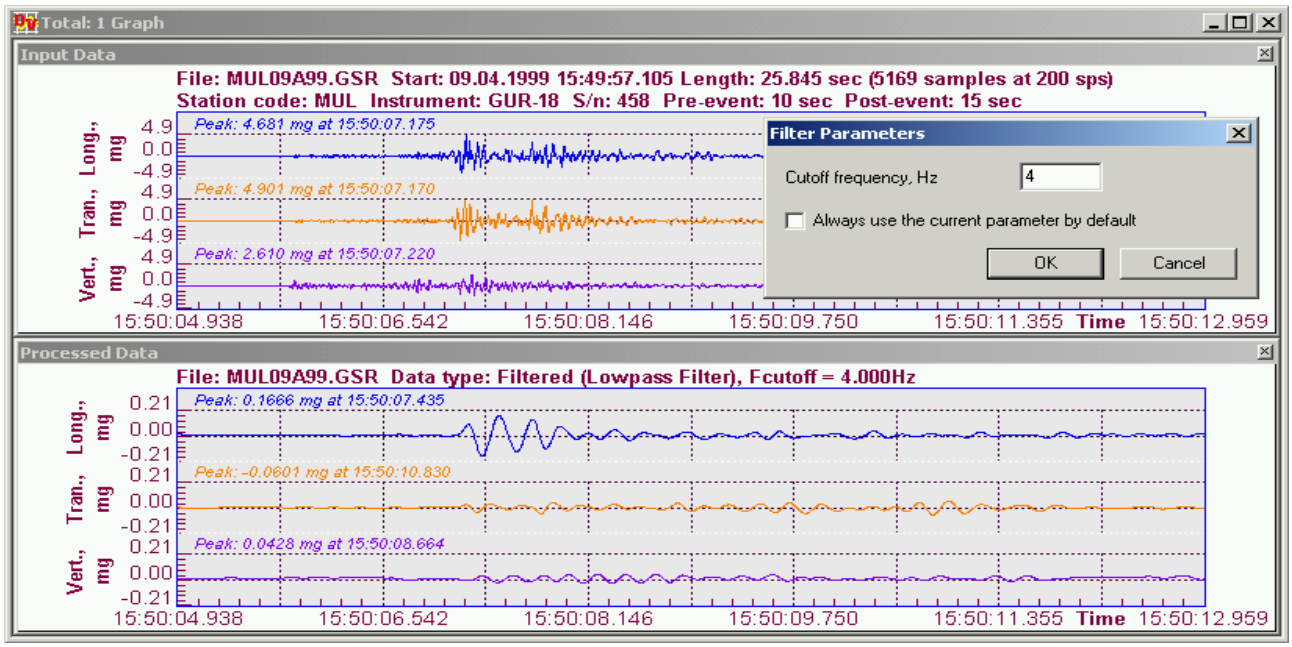
Several operations are valid only when applied to a particular kind of input data. For example, the CAV calculations are correct only for the input acceleration data in g units.

11.2.1 Lowpass Filter

A 6th order (3 times 2nd order) Butterworth Lowpass Filter is applied.

User-defined parameter:

- Cut-off frequency in Hz

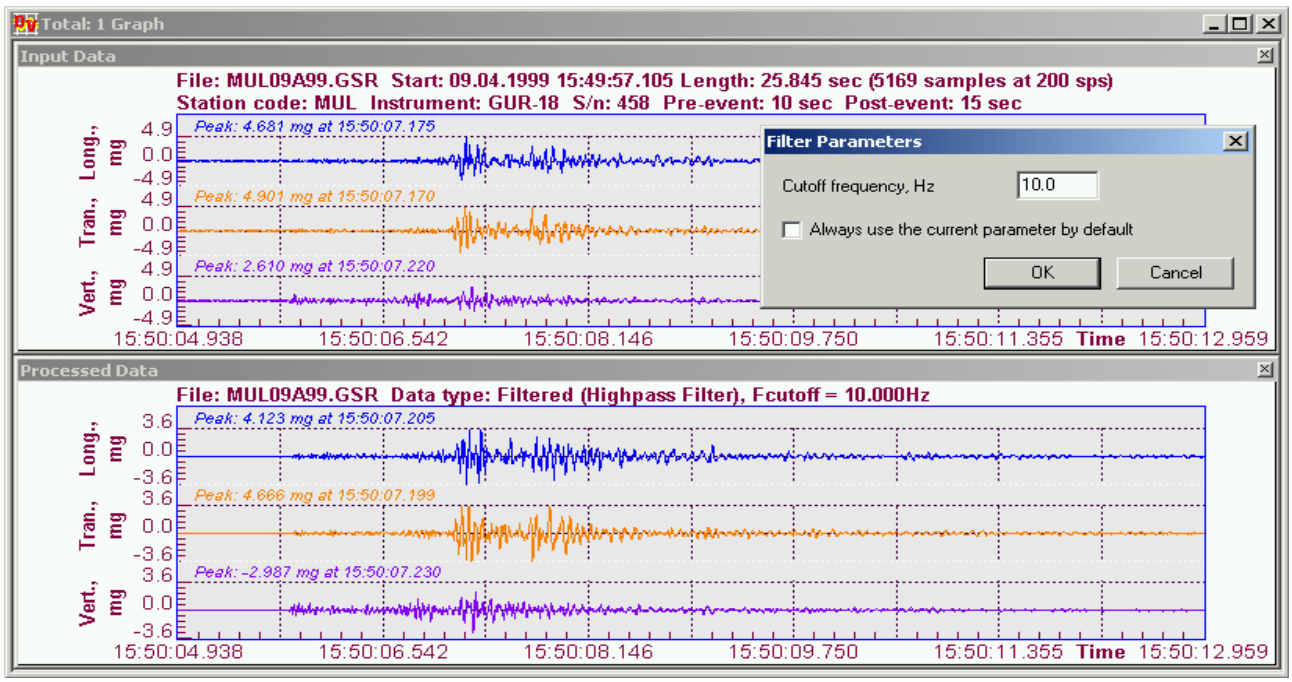


11.2.2 Hightpass Filter

A 6th order (3 times 2nd order) Butterworth Highpass Filter is applied.

User-defined parameter:

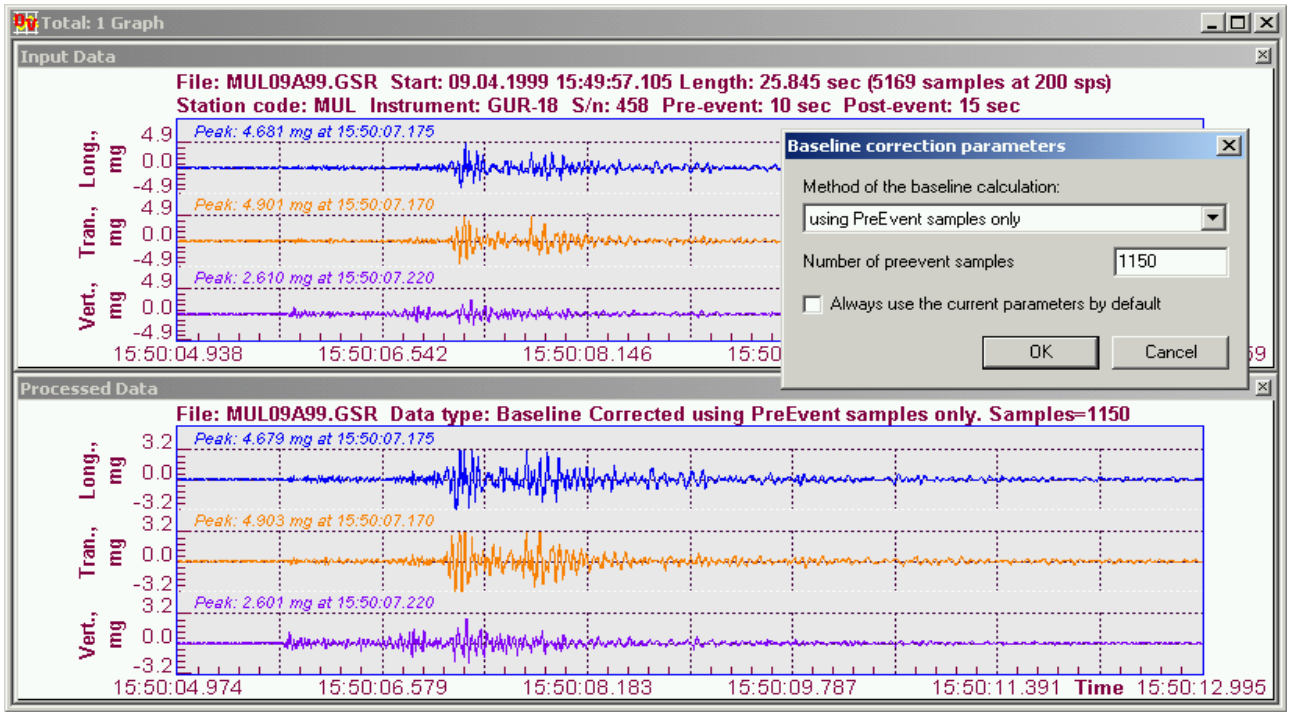
- Cut-off frequency in Hz



11.2.3 Baseline correction

This function performs a baseline correction over the whole data set. The correction method can be one of the followings:

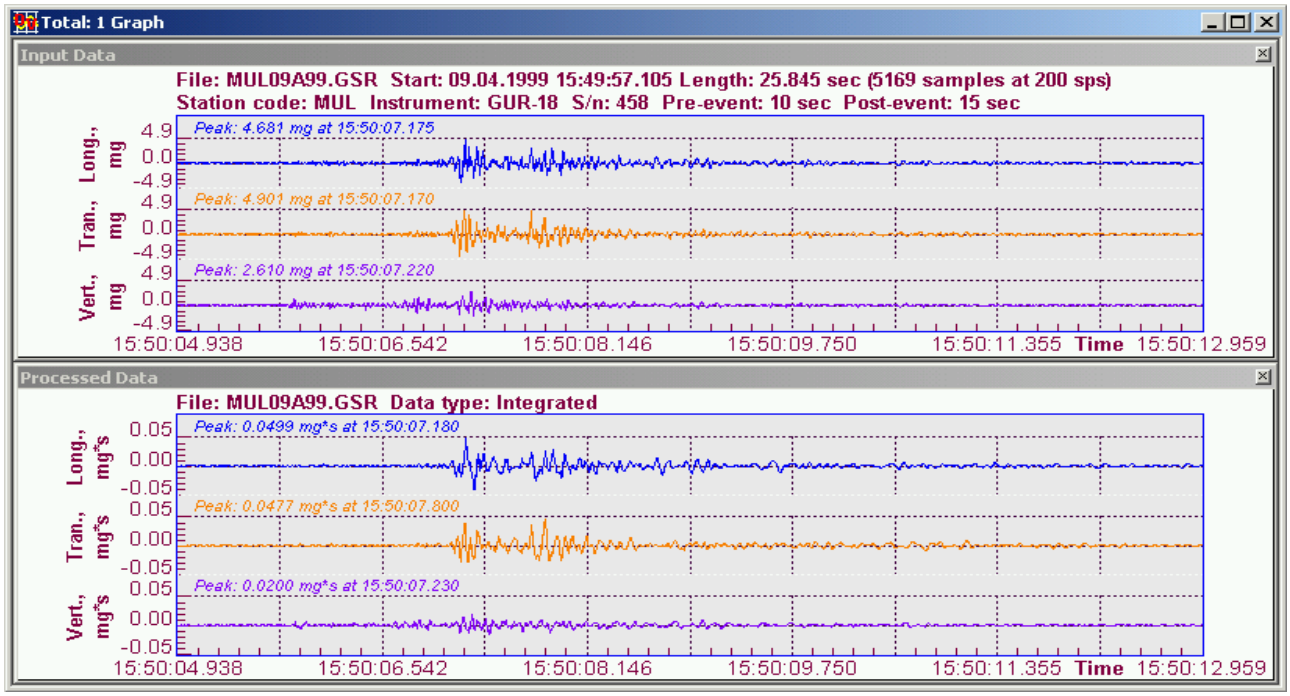
- Using PreEvent samples only. This calculates the average signal level in the pre-event time and subtracts this from the entire data signal. User specifies the number of pre-event samples.
- Using the whole data record. Default method. This calculates the average signal level of the whole event and subtracts this from the entire data signal.
- Using PreEvent samples then the whole record. This calculates the average signal level in the first half of the pre-event and subtracts this from the pre-event part of the signal and then calculates the average signal level of the rest of the event and subtracts this from the rest of the data signal. User specifies the number of pre-event samples.



11.2.4 Integration

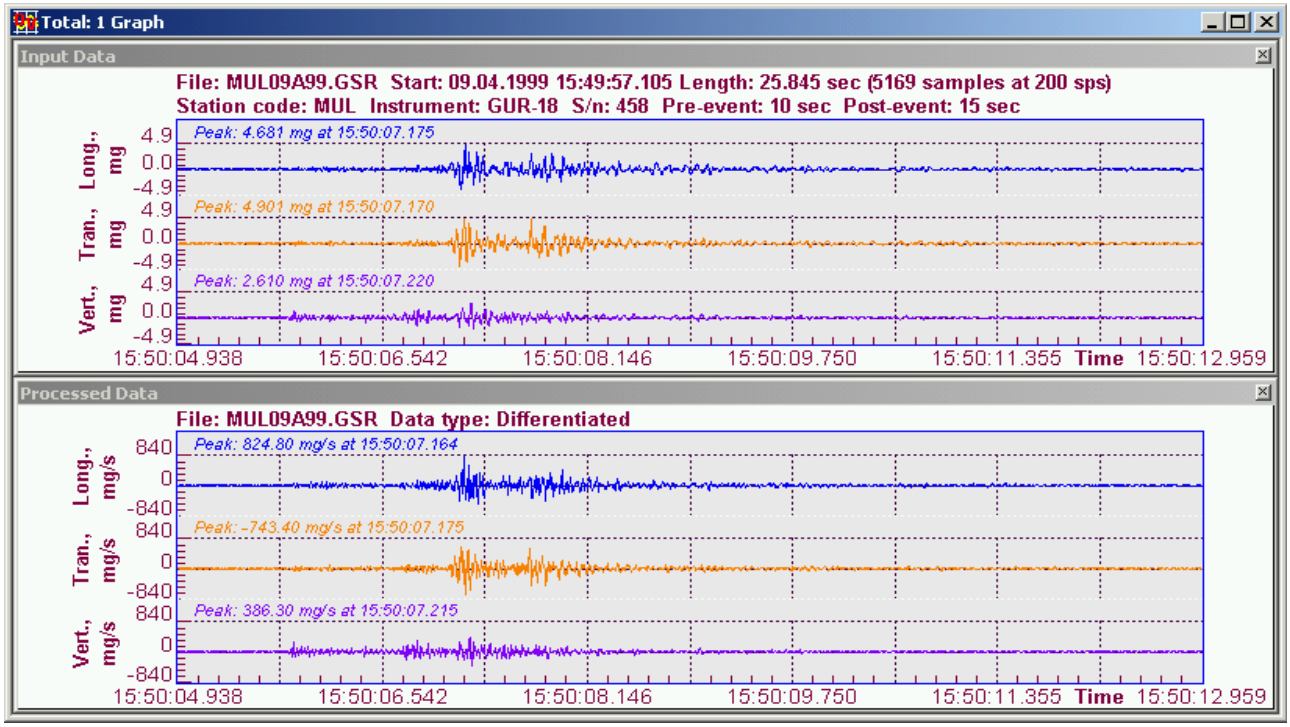
This function integrates acceleration data to the velocity or from velocity to the displacement. No correction algorithms are used by the integration function; therefore better results can be obtained by performing the baseline correction or by filtering the data prior to integration.

The result of a double integration (from acceleration to the displacement) must be analysed rather critically as integration offset levels must be assumed to be zero.



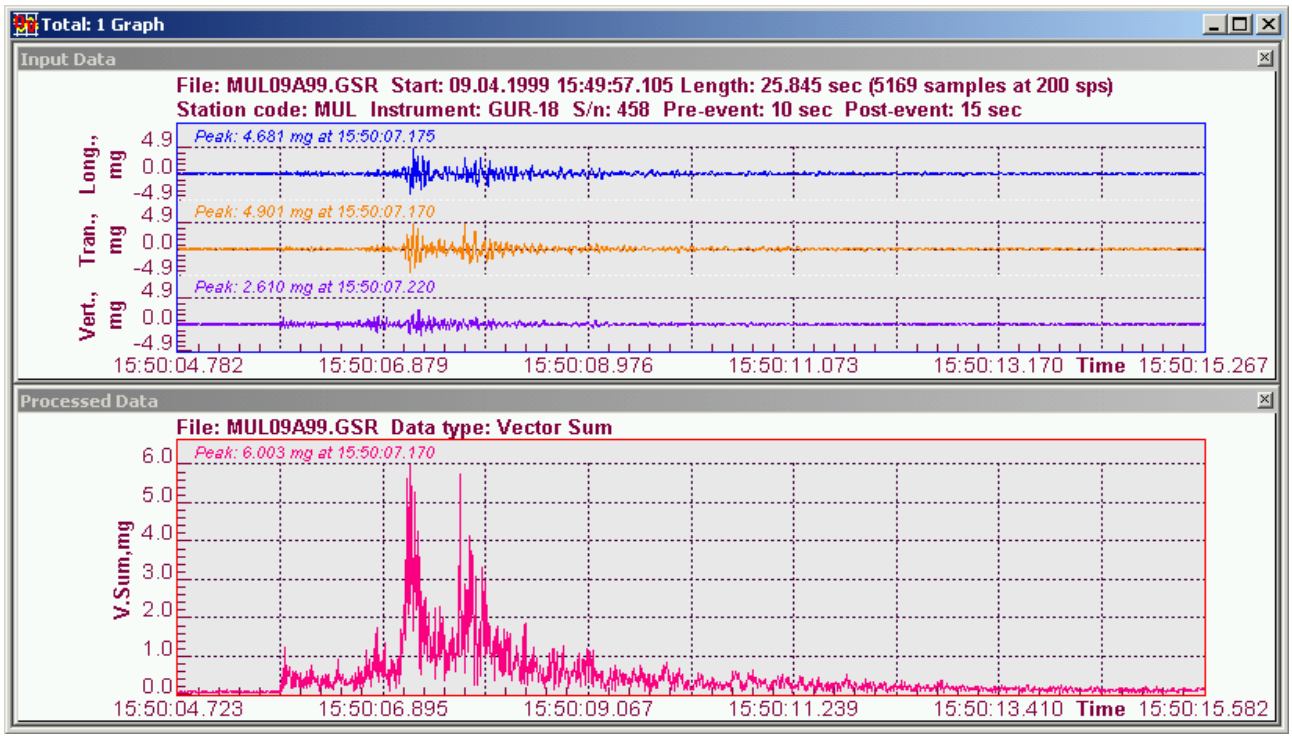
11.2.5 Differentiation

This function performs differentiates of the original data set. It is used usually to convert the velocity data to the acceleration.



11.2.6 Vector Sum

This function calculates the vector sum of three data components.

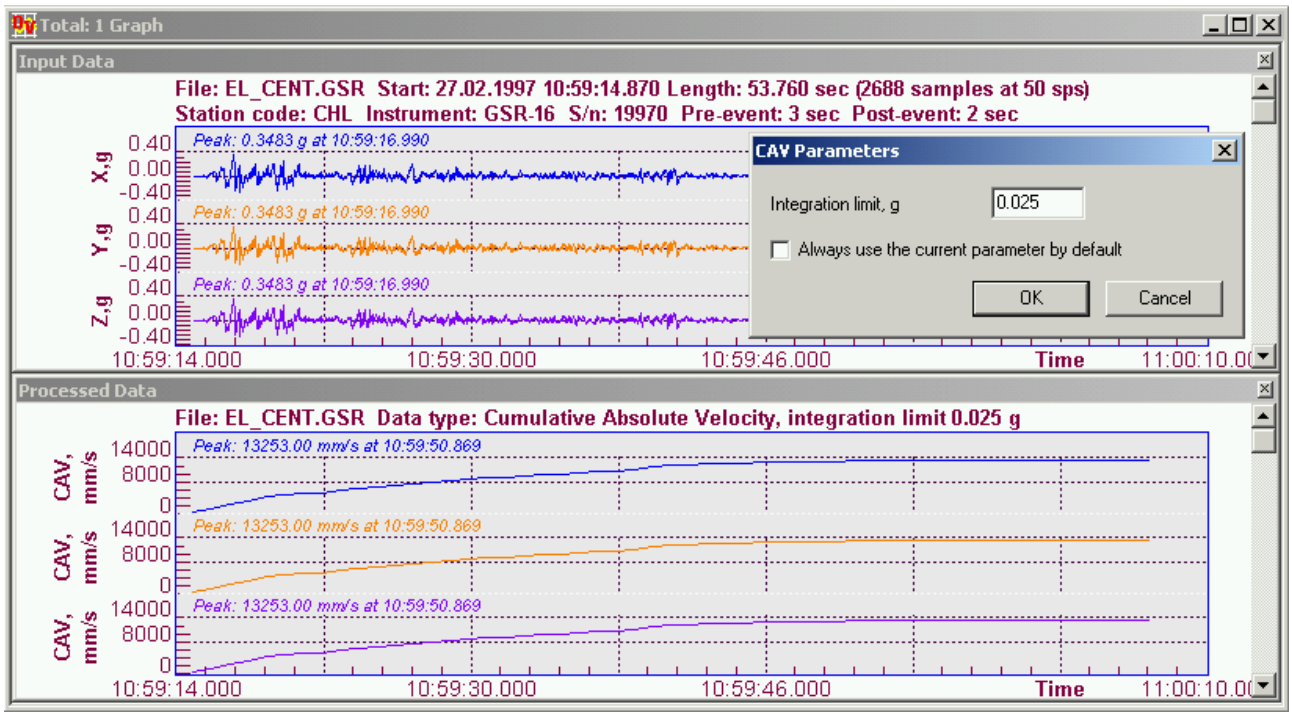


11.2.7 Cumulative Absolute Velocity (CAV)

This function calculates the Cumulative Absolute Velocity of the data by using one-second data windows, with a specified integration level. Note that the input data must be in g units. Only in this case the calculations are performed correctly. The CAV is presented in the units of mm/s.

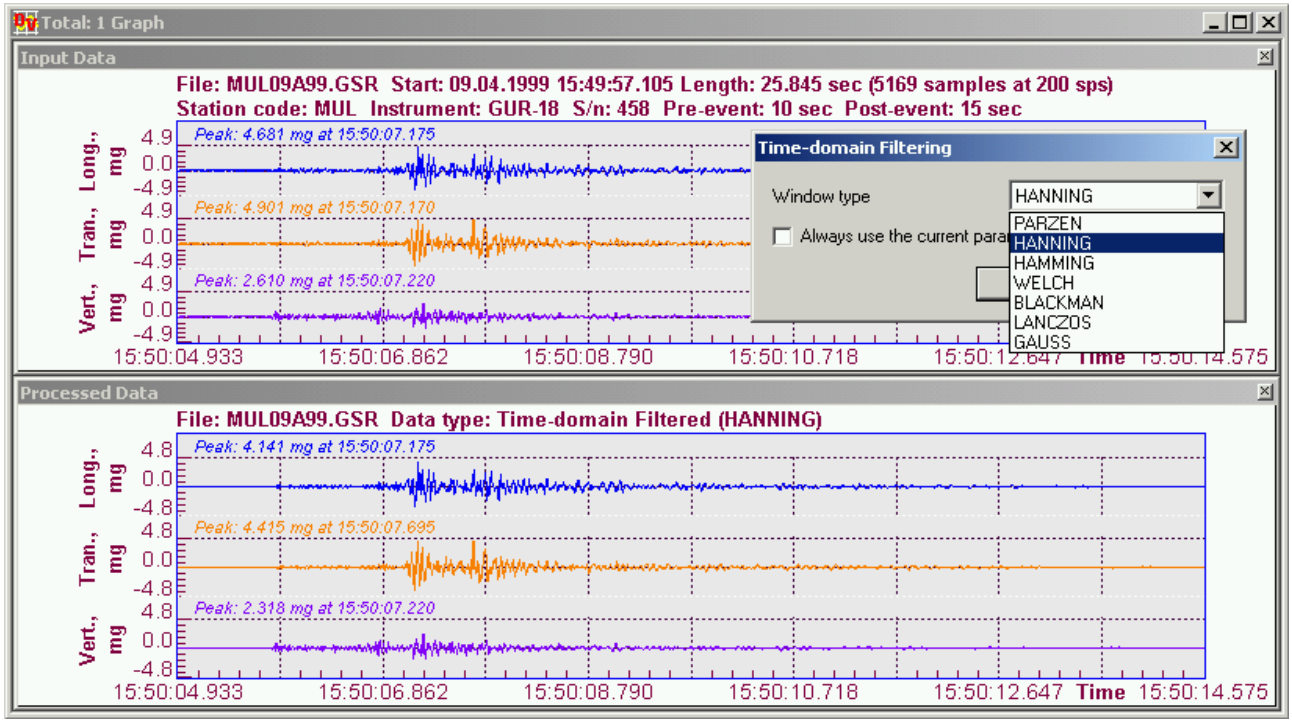
User-defined parameter:

- Integration limit in g



11.2.8 Time-domain Filtering

This function applies a window filter to the source data. The window type is one of the followings: Parzen, Hanning, Hamming, Welch, Blackman, Lanczos or Gauss.

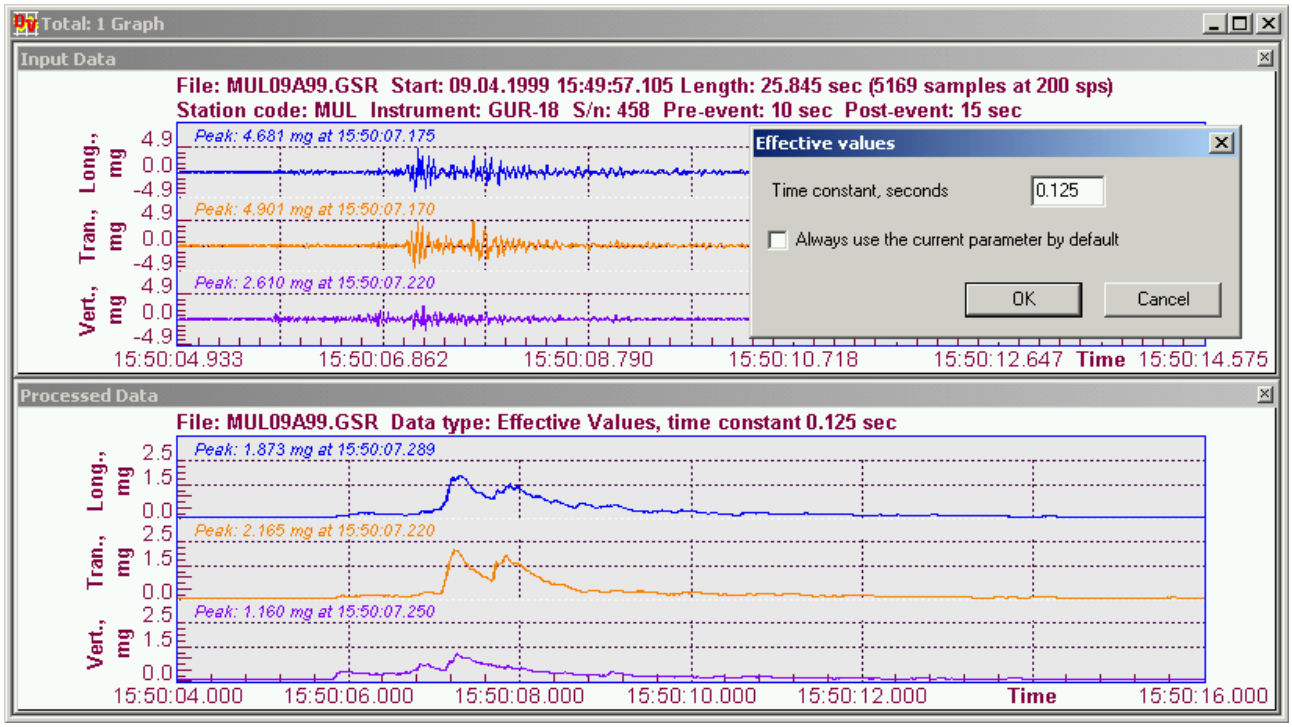


11.2.9 Effective Values

This function calculates effective values of the signal by using sliding windows in the time domain according to DIN 45669.

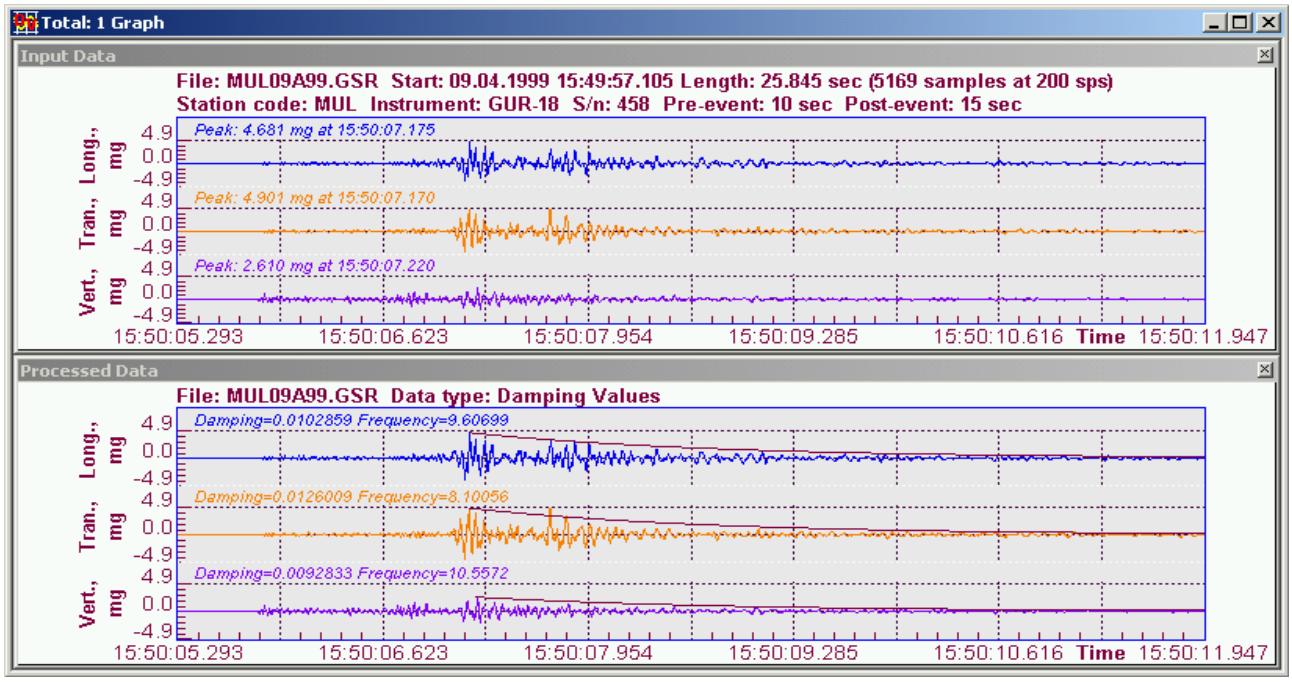
User-defined parameter:

- Time constant defining the sliding window length, in seconds



11.2.10 Damping

This function calculates the damping factor and natural frequency of the input signal in the time domain.

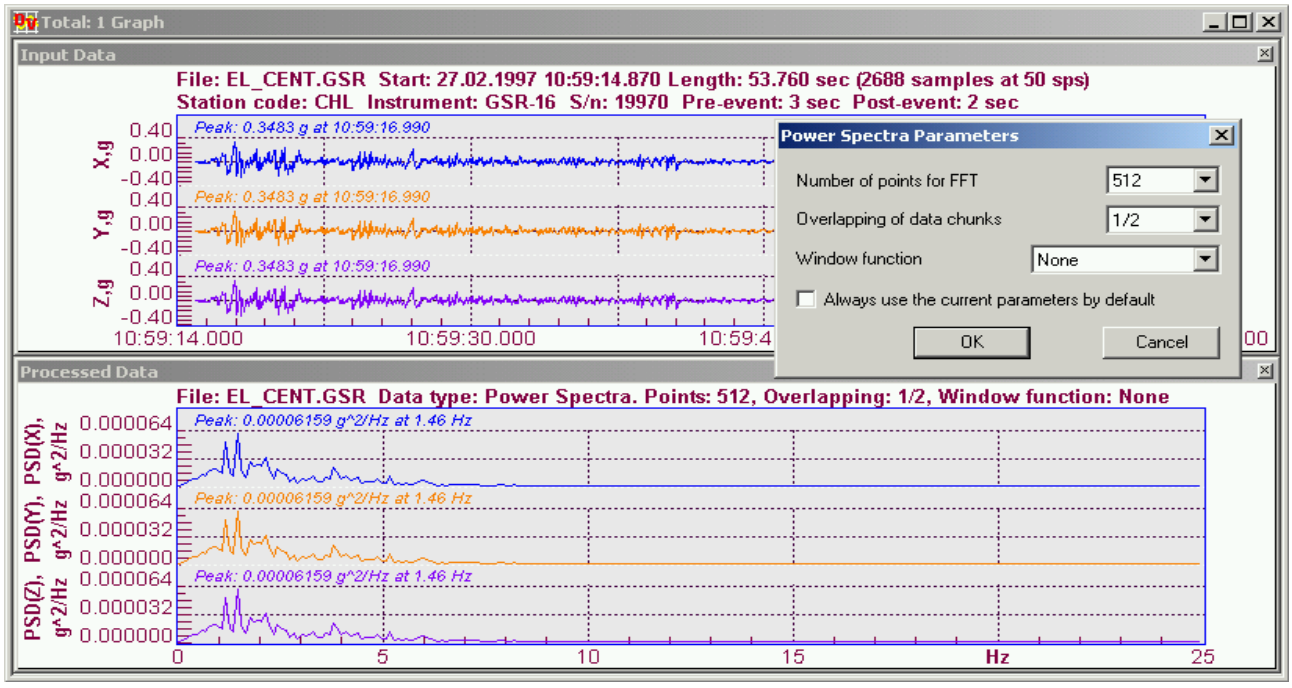


11.2.11 Power Spectra

This function performs a power spectrum calculation on the time series. The resulting function is normalised in a way that it indicates how much power is per frequency interval. Input data array is divided into several data chunks, each of them has the specified number of samples (power of 2). The chunks may overlap if specified by the user. The FFT function is applied to every data chunk, and then the result is averaged.

User-defined parameters:

- Number of samples in every data chunk
- Overlapping factor: no overlapping, 50% or 67%
- Whether a window function is applied to the input time series, and if yes – which one

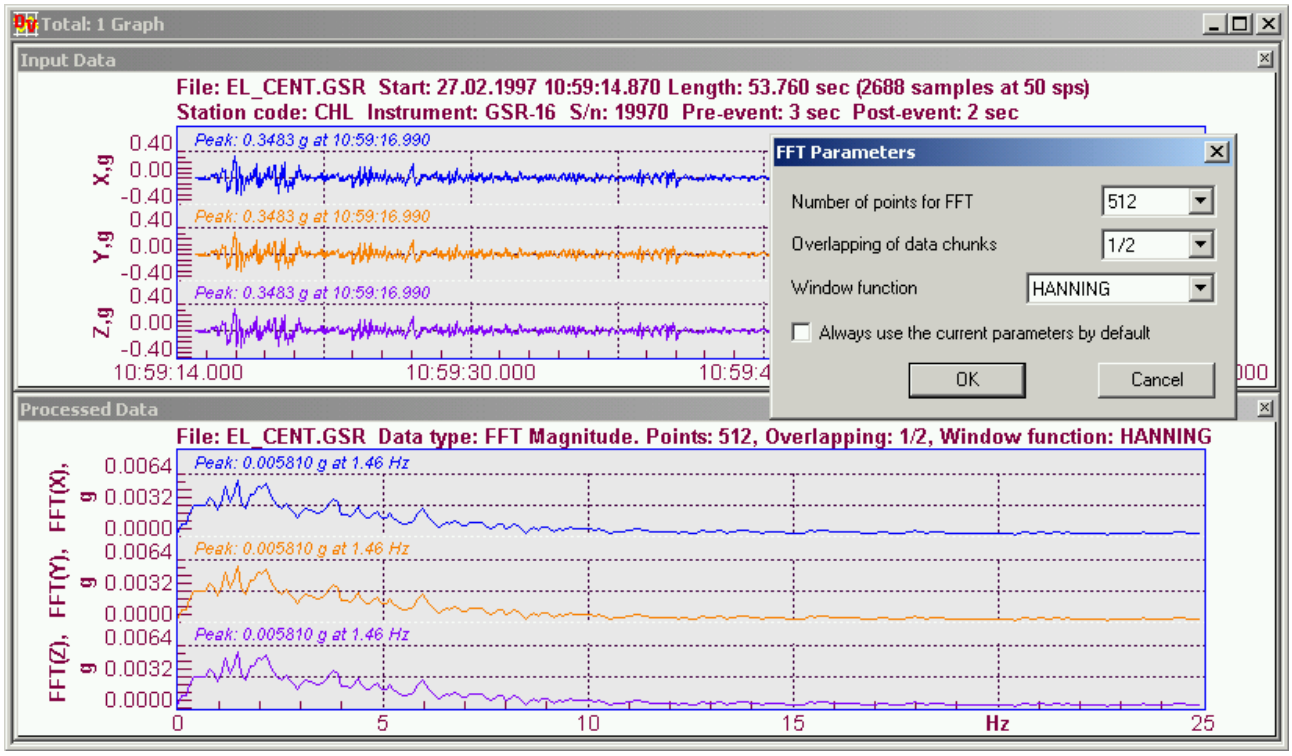


11.2.12 FFT Magnitude

This calculates the FFT Magnitude. The resulting spectra is normalised by 1/N factor. Input data array is divided into several data chunks, each of them has the specified number of samples (power of 2). The chunks may overlap if specified by the user. The FFT function is applied to every data chunk, and then the result is averaged.

User-defined parameters:

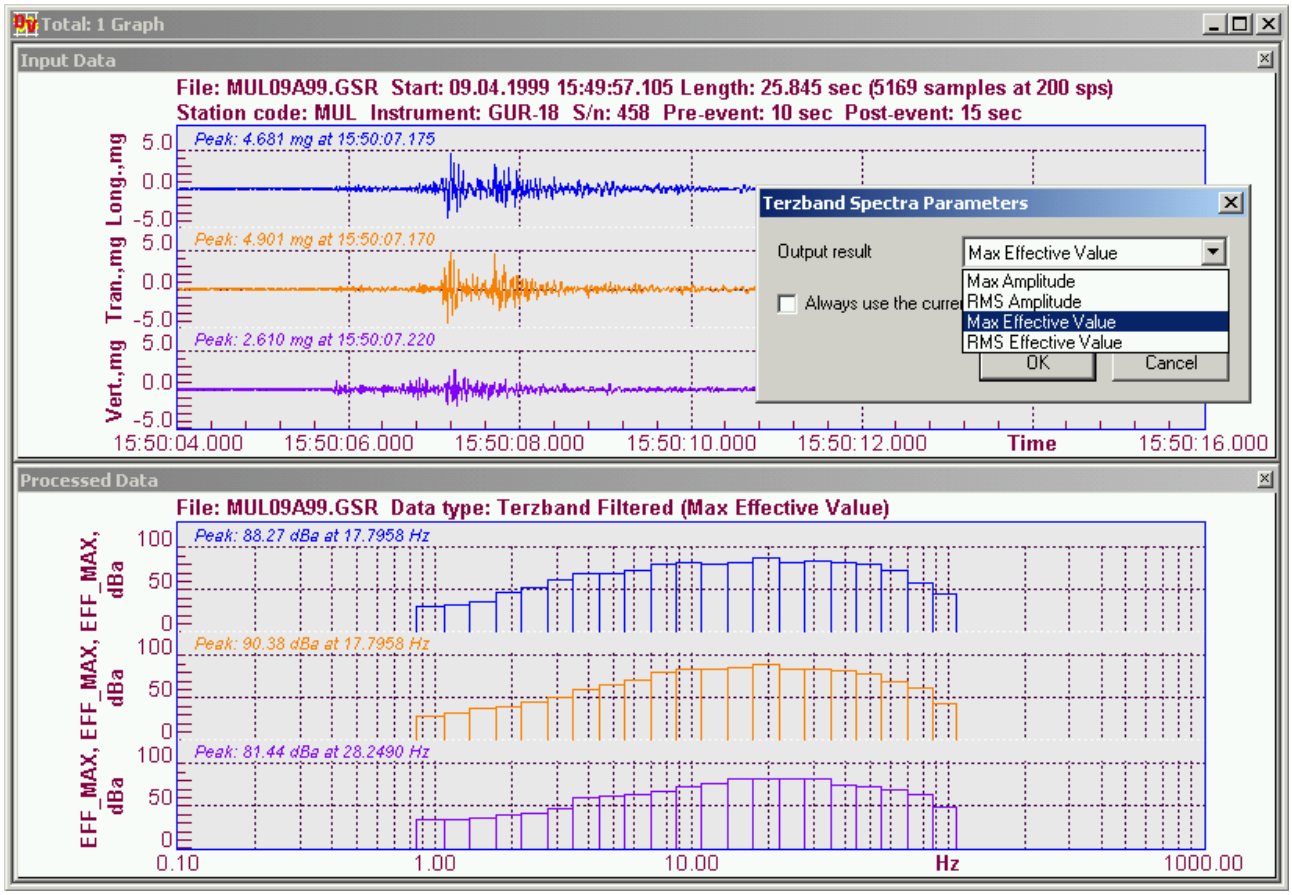
- Number of samples in every data chunk
- Overlapping factor: no overlapping, 50% or 67%
- Whether a window function is applied to the input time series, and if yes – which one



11.2.13 Terzband Spectra

This function calculates the peak values of the data signal when it is passed through the equally spaced band-pass filters in the time domain. The type of peak values selected by user can be one of the followings:

- Max. Amplitude: The maximum value of raw signal is displayed (Max-Hold on raw signal)
- RMS Amplitude: The RMS value of the raw signal is displayed (RMS-Fast on raw signal)
- Max. Effective Value: The effective value function is applied to the raw signal before calculating of the maximum value
- RMS Effective Value: The effective value function is applied to the raw signal before calculating the RMS value

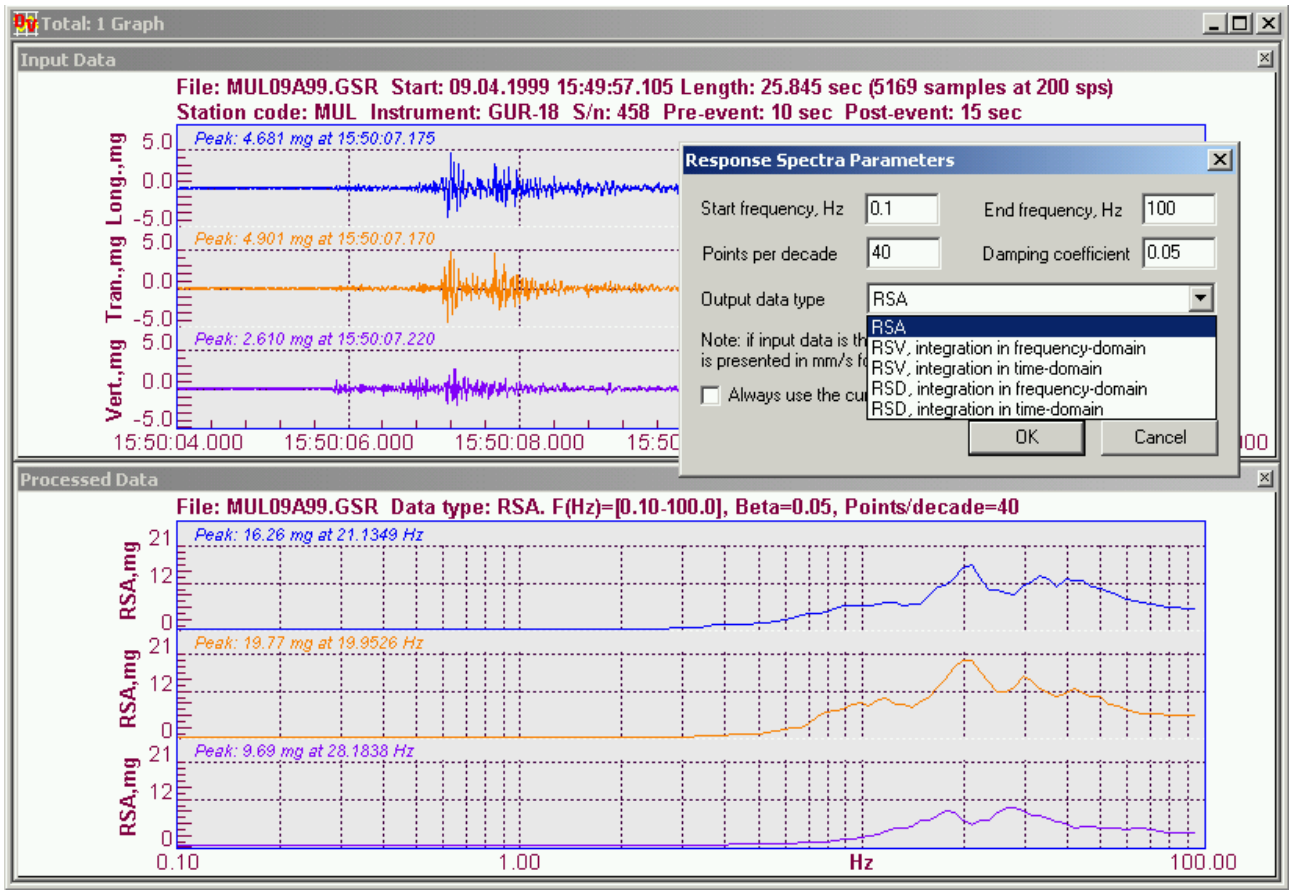


11.2.14 Response Spectra

This function performs a response spectrum analysis on the data. The output data can be the Response Spectrum Acceleration (RSA) or the Response Spectrum Velocity (RSV) or the Response Spectrum Displacement (RSD). The user can select the integration method for RSV and RSD between integration in the frequency domain and the integration in the time-domain. Integration in the time domain for RSV (double integration for RSD) is performed prior to the response spectra calculation.

User-defined parameters:

- Start (lowest) frequency of the resulting spectrum in Hz
- End (highest) frequency of the resulting spectrum in Hz
- Damping factor, always < 1, i.e. damping of 5% is specified as 0.05
- How many points per decade are calculated in the resulting signal
- Type of the output spectra and the integration method for RSV and RSD selected from the list



11.3 Templates

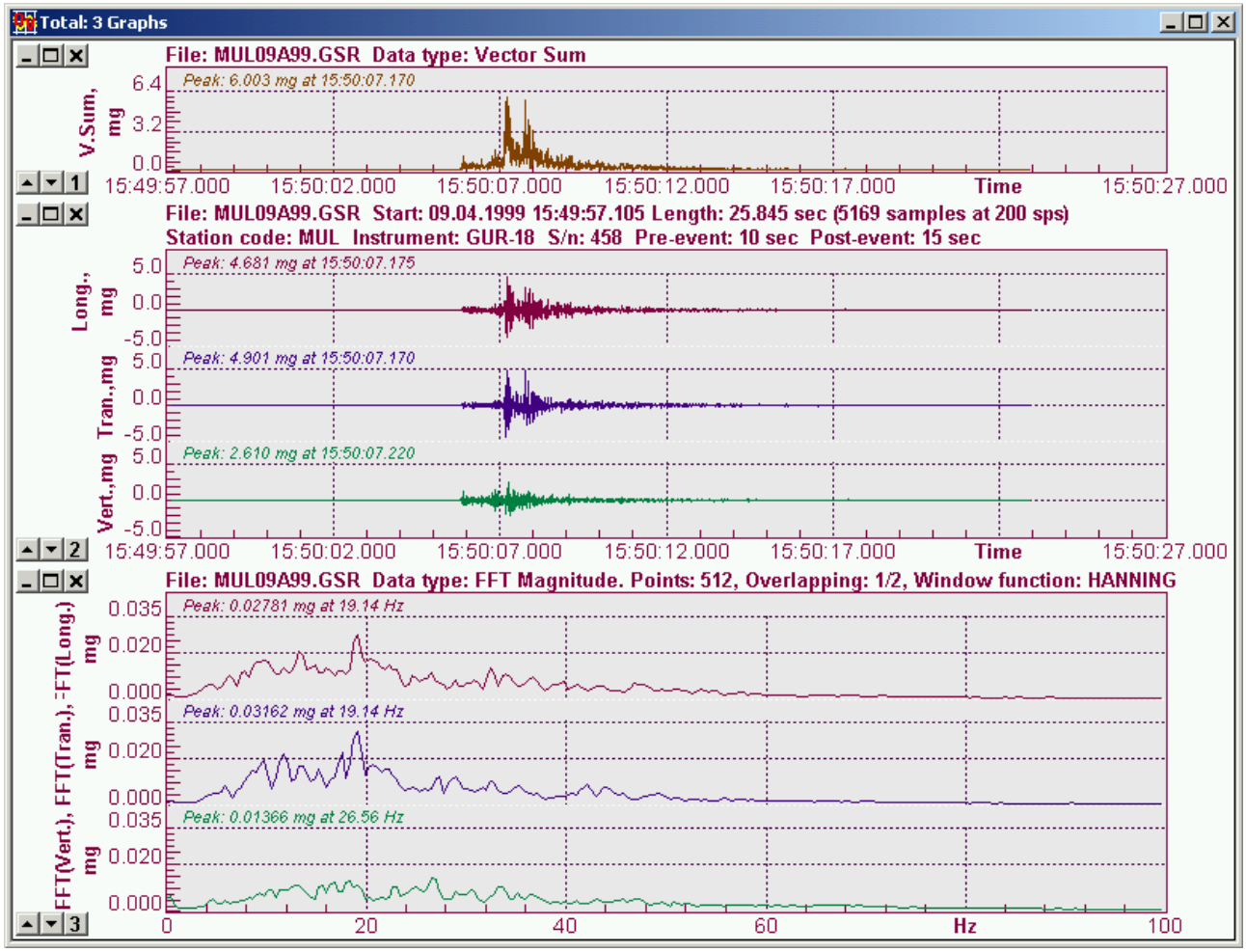
Templates are developed for effective analysis of the big amount of similar data. Let us consider an example for better understanding of this issue. Suppose we have many event files, which contain acceleration data, and we need to analyse their spectra and to receive also the vector sum of every data file. Further all these files shall be printed along with the results of analysis.

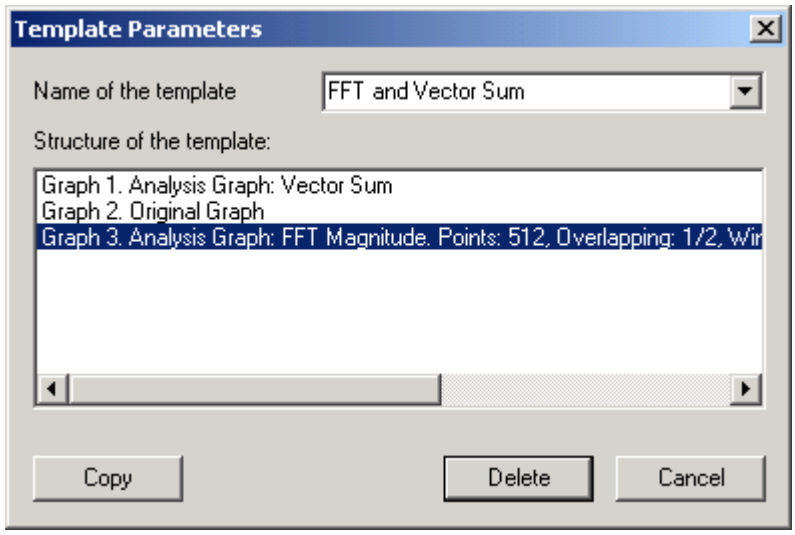
First step is to **create the corresponding template using one data file**. The required actions are listed below:

1. Open the same file three times in three different windows
2. Apply the FFT Magnitude function with the required parameters to the input data in 2nd window
3. Close the upper part of window (Input data) and select the remaining results of FFT Magnitude by clicking the graph canvas
4. Press the Copy button on the toolbar (or execute Edit->Copy), close 2nd window, activate the 1st window and press the button Paste (or Edit->Paste). First window contains now the original graph plus the result of the FFT Magnitude operation
5. Apply the Vector Sum function to the input data in 3rd window
6. Close the upper part of window (Input data) and select the remaining result of Vector Sum by clicking the graph canvas
7. Press the Copy button on the toolbar (or execute Edit->Copy), close 3rd window, activate the 1st window and press the button Paste (or Edit->Paste). First window contains now the original graph plus the result of the FFT Magnitude and Vector Sum operations
8. Set the required order of graphs by using the arrow buttons at the left side of the graphs. For instance, you would probably like to exchange graphs to have the result of Vector Sum at the top

Now you can adjust the properties of the graphs. For instance, you would probably like to set the option Grouped for the Y-scale of the original graph in order to display all three components with the same scale.

The resulting window looks now as following:





Now it is the time for a next step: **to save this customised ODV window as a template**. This is done with the menu item Analyse->Templates->**Save Current View as Template**. The dialog Template Parameters comes up. The window **Structure of the template** lists all the graphs with their parameters, if any. Enter a name of the template and press the button **[Save]**. The newly created template is stored with all currently assigned parameters. This name appears from now on in the list of templates under the submenu Analyse->Templates. The same dialog is used to delete templates when they are not needed anymore. In order to delete a template, run the menu item Analyse->Templates->**Delete Templates**, select from the list a name of the template you wish to delete and press the button **[Delete]**. The button **[Copy]** copies selected text strings in the window Structure of the template to the system clipboard.

From now on the new template can be used to process and analyse the data. For instance, one can open many data files at once and apply the template to all opened files by running the menu Analyse->Templates->FFT and Vector Sum. All data files in the current ODV window will be processed, the results of the FFT Magnitude and Vector Sum operations will be placed to the same window and all the graphs are sorted correspondingly so one can easily view them and take the printouts.

12 The Other Capabilities of GeoDAS

The general functionality of GeoDAS described in the previous chapters is used in most applications based on GeoSIG equipment. But GeoDAS has also several special features, which are required for particular applications or can be activated in some special cases only. Therefore the sections describing all these functionalities are not included to the standard manual but can be provided as separated appendixes for the special applications or by the user's request.

13 Appendix A. Information on LSB

The Gain Position, Full Scale and LSB Value (Resolution)

The "LSB Value" (LSB = Last Significant Bit) represents the value of 1 raw digital count. The 12-bit recorder describes maximum 4096 digital counts (± 2048 digital counts) and the 16 bit recorder maximum 65536 digital counts (± 32768 digital counts).
The LSB value is calculated by:

$$LSB = \frac{R}{2^{(\text{Number of Bits})}} \qquad R = 2 \text{ times full scale range of sensor}$$

Enter the LSB Values for each channel and for each gain position. These values are given in the sensor calibration sheet.

The typical LSB values for a velocity sensor and 12 Bit are:

Gain Position	Full Scale	LSB Value (Resolution)
Gain 0	± 100 mm/s	0.0488282 mm/s
Gain 1	± 10 mm/s	0.00488282 mm/s
Gain 2	± 1 mm/s	0.000488282 mm/s

The typical LSB values for the acceleration sensor and 12 Bit are:

Range, g	LSB Value
2	9.76563e-4 g
1	4.88282e-4 g
.5	2.44141e-4 g
.25	1.22070e-4 g

14 Appendix B. ASCII file format used by GeoDAS

If an ASCII data file is created by any external application for importing this file to GeoDAS for the off-line data analysis the format of ASCII file must be compatible with one used by GeoDAS.

The main rules are listed below:

- An ASCII file must have the extension "txt";
- The four-string header shown in the example below is mandatory. The key words of this header must contain underscore character instead of spaces between words (for instance, "Start_date");
- The data values of every component (data channel) are saved in separate column;
- The one-string title indicating the names of columns is mandatory. It must have the following format: **[Name of the 1st column] Component1,units Component2,units** ... etc.
- The "**Name of the 1st column**" can be one of the following:
  - **Time** is used for absolute times in the format hh:mm:ss.ms, example 1
  - **Time:sec** is used for relative times (seconds from the start time), example 2
  - **Samples** is used just to count the samples (string numbers), example 3
  - The name of 1st column can be omitted, i.e. only component columns exist in the file, example 4
- If the unit names are "**Counts**", it is supposed that the data values are provided in integer format (example 2)

===== Example 1

```
Station_code    STA
Sampling_rate   200.0000
Start_date      24.01.2002
Start_time      22:59:58.824
Time    Long.,g    Tran.,g    Vert.,g
22:59:58.824  -2.0704e-003    2.3823e-003    4.0054e-005
22:59:58.829  -2.0514e-003    2.3937e-003    3.4332e-005
22:59:58.834  -2.0685e-003    2.3813e-003    2.7657e-005
22:59:58.839  -2.0409e-003    2.3727e-003    2.8610e-005
```

===== Example 2

```
Station_code    STA
Sampling_rate   200.0000
Start_date      24.01.2002
Start_time      22:59:58.824
Time:sec   Long.,Counts    Tran.,Counts    Vert.,Counts
0.0000e+000    -2171         2498         42
5.0000e-003    -2151         2510         36
1.0000e-002    -2169         2497         29
1.5000e-002    -2140         2488         30
```

===== Example 3

```
Station_code    STA
Sampling_rate   200.0000
Start_date      24.01.2002
Start_time      22:59:58.824
Samples   Long.,g    Tran.,g    Vert.,g
0            -2.0704e-003    2.3823e-003    4.0054e-005
1            -2.0514e-003    2.3937e-003    3.4332e-005
2            -2.0685e-003    2.3813e-003    2.7657e-005
3            -2.0409e-003    2.3727e-003    2.8610e-005
```

===== Example 4

```
Station_code    STA
Sampling_rate   200.0000
Start_date      24.01.2002
Start_time      22:59:58.824
  Long.,g    Tran.,g    Vert.,g
 -2.0704e-003    2.3823e-003    4.0054e-005
 -2.0514e-003    2.3937e-003    3.4332e-005
 -2.0685e-003    2.3813e-003    2.7657e-005
 -2.0409e-003    2.3727e-003    2.8610e-005
```

15 Appendix C. Triggering algorithms used by GeoDAS

Several algorithms are used by GeoDAS to declare an event trigger for every monitored data channel received with data streams. They are handled by the Data stream manager and can be set through the main menu Settings -> Data Streams.

1. Absolute Level Exceeding

This algorithm permanently compares the signal amplitude to a threshold value. The trigger is declared when the amplitude exceeds the pre-set **threshold value**. This algorithm is the simplest one. No data averaging is performed and no additional conditions are set. Every single sample of high amplitude can cause activation of the trigger. Therefore in order to avoid false triggers due to accidental spikes it is recommended to filter the signal to remove harmonics of high frequencies before analysing this signal by the triggering algorithm. Other important issue is that the DC offsets from all data channels must be continuously monitored and removed.

2. Algorithm based on STA/LTA ratio

The STA/LTA (Short Time Average/Long Time Average) ratio trigger computes the short term and long term averages of signal. When the STA exceeds a pre-selected multiple of the LTA, the event is declared. The advantage of this trigger type is that the trigger sensitivity adapts to the seismic background signal. With an increasing noise level the trigger sensitivity decreases and therefore less false triggering occur.

To use the STA/LTA ratio trigger, the following information must be supplied:

- the **short term time period**;
- the **long term time period** (may not be set smaller than the STA);
- the **ratio of short term average to long term average** which will declare an event

The probability of having a false trigger due to noise can be minimised if a long STA averaging time is selected. Obviously, the STA should not be chosen longer than the shortest event of interest. In addition, the STA should be shorter than the block of pre-event data stored in the Pre-event Memory. If not, the initial portion of an event may not be recorded.

The average period for the LTA should be chosen short enough to adapt to any changes in the level of background noise. However, the LTA time should be long compared to the STA time, otherwise, the LTA will adapt to an event as if it was simply a change in the background noise level.

3. Algorithm based on Cumulative Absolute Velocity

It is supposed that the incoming data channels deliver acceleration in g units. The Cumulative Absolute Velocity (CAV) is computed for only those 1-sesond intervals where peak acceleration is greater than an integration limit (usually 0.02g) using the following algorithm:

CAV (t) = Integral from 0 to t [abs(a) dt], where

a - is the sampled acceleration in g;
dt - is the sampling interval in sec;
CAV is counted in g-sec.

The important parameter required for the analysis of continuos data streams is the **total time interval** to calculate the CAV, which is specified as last N seconds of received input data.
Other parameter, which must be specified for this algorithm is the **integration limit** mentioned above. For most of application the default value is 0.02 g.
The last parameter is the **CAV threshold** itself. When any calculated CAV exceeds this threshold value, an event is declared.

16 Appendix D. Format of the status files

GeoDAS creates few status files during its continuous work with the configured stations. These files are described below.

16.1 Results of the instrument self-tests

Location GeoDAS_home_data_directory\StatusFiles\StationInfo
Filename Selftest_Results_yyyy.csv where yyyy is the current year
Format CSV (comma-separated values)
Structure The results of every test are packed to the single line, which consists of the following data:

1. Station name. The name of tested station (instrument)
2. Whether the test was performed: either 'Tested' or 'Test Error'
3. Date of the test completion
4. Time of the test completion
5. Results of tests for Analog part, Hardware, Clock, Voltage, Memory. The results can be Ok, Error, Warning or Skipped. In the last case it means that the corresponding test action was not selected by user and therefore not performed
6. Error and Warning flags in hex format
7. Description of the code returned by the test command. It is "Processed OK" if the test was performed correctly, otherwise an error description is given.

Example

```
Station;Result;Date;Time;Analog;Hardware;Clock;Voltage;Memory;Error Flags;Warning Flags;Test Result Code;
TEST2;Tested;24.04.2003;21:31:17;Skipped;Ok;Ok;Ok;Ok;[000000000000];[000000000000];Processed OK;
TEST1;Tested;24.04.2003;21:34:50;Ok;Ok;Ok;Ok;Skipped;[000000000000];[000000000000];Processed OK;
GBD;Tested;05.05.2003;21:38:13;Warnings;Ok;Ok;Ok;Ok;[000000000000];[180000000000];Processed OK;
TEST1;Tested;12.05.2003;21:37:15;Ok;Ok;Ok;Warnings;Ok;[000000000000];[000000002000];Processed OK;
GSR18;Tested;12.05.2003;21:40:14;Ok;Ok;Ok;Warnings;Ok;[000000000000];[000000002000];Processed OK;
```

16.2 Status file of the annunciation actions

Location GeoDAS_home_data_directory\StatusFiles\Annunciation
Filename Events_<annunciator_name>_yyyy.csv where yyyy is the current year
Format CSV (comma-separated values)
Structure The information about every annunciation action (event) is written to the single line, which consists of the following data:

1. Date of the event
2. Time of the event
3. Site (station), which the event belongs to. If it is an 'internal' event of annunciator (e.g. the declaration of an alarm), the annunciator's name is given here. Otherwise it is the name of a station connected to annunciator and the number of channel for this station
4. Event description
5. Error status of all stations connected to annunciator, their AC power errors and the link errors. The symbol dash ('-') means NO ERROR state, the asterisk ('*') indicates an ERROR. There are 8 characters in the line. They correspond to 8 annunciator channels, from 1st to 8th. For instance, the record --*----- means that the station connected to the 3rd cahnnel experinces an error
6. Status of four annunciator alarms: TRIGGER, OBE, SSE, ERROR (from left to right)

Example

```
Date;Time;Site;Event;Status;AC power;Link;Alarms;
05.05.2003;16:11:49;ANNUN;GeoDAS Startup;--*-*---;--------;--------;*---;
05.05.2003;16:12:08;GBD (1);ERROR;*-*-*---;--------;--------;*---;
05.05.2003;16:13:42;GBD (1);NO ERROR;--*-*---;--------;--------;*---;
05.05.2003;16:20:57;ANNUN;OBE Alarm;--*-*---;--------;--------;**--;
```

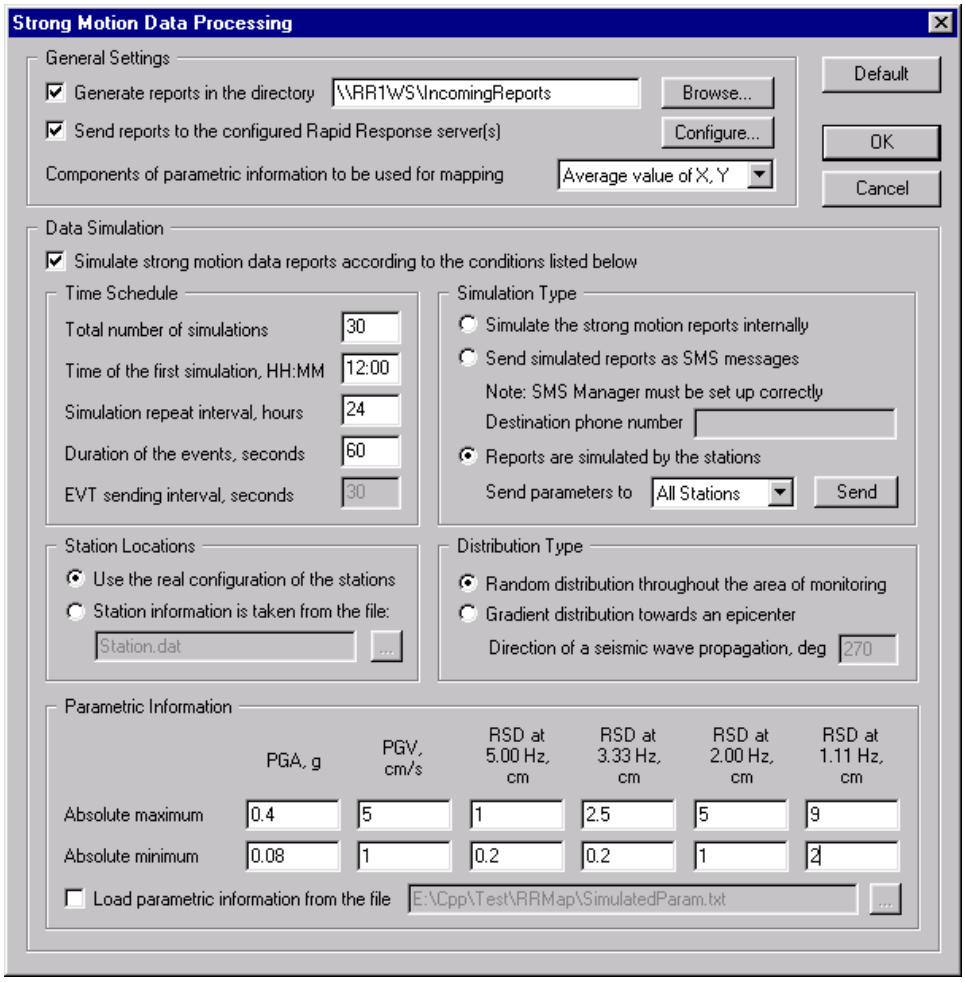
16.3 Logfile of the instrument errors

Location GeoDAS_home_data_directory\StatusFiles\StationInfo
Filename StationErrors_Current
Format CSV (comma-separated values)
Structure The information logged to this file is eaxcly the same as shown in the Stations: General Information window. The error and warning flags are placed at the end of every status line. Every new status line is added to this file when the error status of a particular station is changed.

17 Appendix E. Strong Motion Data Processing

The GeoSIG GSR-18 instruments can provide parametric information containing the peak values and spectral characteristics of the shaking parameters. This information can be used to estimate the intensity of the shake in those points where instruments are located and to create a distribution of these parameters throughout the area monitored by several or many instruments. Such a processing is performed by another application and therefore GeoDAS is only responsible to acquire the parametric information from all configured stations and to deliver this information to that application.

The main processing parameters are configured with the following dialog, which is launched from the main menu **Settings->Strong Motion Data**. As one can see from the picture, there are two ways of data delivery to a processing application. The strong motion parametric data (reports) can be saved to a **local file in a directory** on user's choice or/and they can be **send directly to the processing application through Windows sockets**. Press the button **[Browse…]** to select a directory and the button **[Configure…]** to configure the module "SM Data Source" as it is described in the Appendix G. Network Links of GeoDAS. This module is responsible for delivering the parametric information to the consumers. The vertical component of parametric information is not used for estimation of the shake intensity. But you can select **how the horizontal components are used**: either average value of x,y is taken or maximum of them.



As a rule, the most important parametric information is generated under real conditions rather seldom (such as in case of a strong earthquake), it is important to provide the simulation options for a data processing application. The dialog window shown above lets you simulate the parametric information in a flexible way. First activate the option **Simulate strong motion data reports…** and the other controls become available.

It is assumed that many instruments are installed in the area of monitoring. The simulation takes also into account that the parametric reports are delivered to GeoDAS with SMS messages from the stations. The selection of **Simulation Type** depends on what must be achieved by this simulation. If the main purpose is to test the data processing algorithm, then GeoDAS can simulate the reports **internally**. If it is important to test also the receiving part of the system, one can simulate the reports and send them out **by SMS** with the GeoDAS SMS Manager. The third type of simulation allows the functionality of the instruments installed in the field to be tested. In order to do so, you have to set all the other simulation parameters and send them to the instruments of your station network by pressing the button **[Send]**. Note that there are two options available: you can either send the same parameters to **All Stations** or you can also send specific parameters to **any single station** by selecting its name from the list. The **stations will perform the simulation** at specified time.

The Time Schedule specifies the **time of first simulation** as well as the **time interval** to repeat this action and **how many times** the simulation must be performed. The other parameters are the **total event duration** and the **time interval to send the EVT** (event detected) messages.

The **Station Locations** can be either the real ones, i.e. the locations of the **existing configured stations** can be used for simulation or you can specify any **model configuration of the station** with a configuration file. The file is selected from any directory with the browse button **[…]**. The format of this file is the same as described in the Appendix K. Station Map for the file **all_stations.lst**.

You can also choose between the **random resulting distribution** of shaking parameters and the **gradient distribution**. In the last case the **direction of the seismic wave propagation** must also be set.

With the last group of controls one can set the lower and the upper limits for the following **parametric information**: **PGA** (peak ground acceleration), **PGV** (peak ground velocity) and the **spectral displacements** at four different fixed frequencies. You are fully responsible for the correctness of this information. GeoDAS accepts any data without special checks and generates the random values for all stations within the specified limits.

If it is necessary to provide some fixed customised parametric information for simulation, one can create a text file containing this information for all configured stations, enable the option **Load parametric information from the file** and enter the name of the prepared file or select it wit the browse button **[…]**.

When all parameters are set correctly, simply press the **[OK]** button to save them. If you have enabled the simulation option, then the first simulation will be performed at specified time.

The strong motion data processing options of GeoDAS are adjusted currently for the GeoSIG Rapid Response Mapping application. Please contact us in case of any questions related to this application.

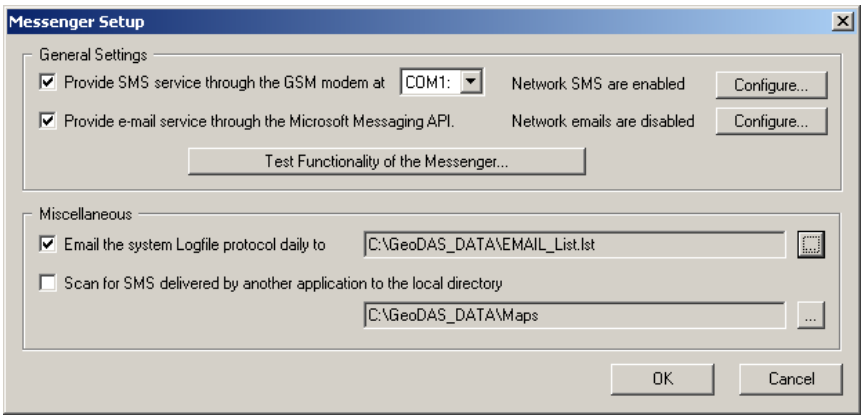
18 Appendix F. Messenger of GeoDAS

This is a tool, which is used to deliver different types of information from GeoDAS to the subscribers. Two ways of delivery are currently supported: email and SMS (short message service).

In order to provide the SMS service, any GSM modem must be connected to a serial port of the computer. Short messages are sent through this local GSM modem only. Sending SMS through the public or restricted Internet services of GSM providers is not yet supported.

While sending an email out, GeoDAS does not connect directly to the POP3 and IMAP email servers. It utilises instead the MAPI service provided by the default email client installed in Windows. Therefore if order to use this functionality, you have to configure first any email client (such as Microsoft Outlook Express).

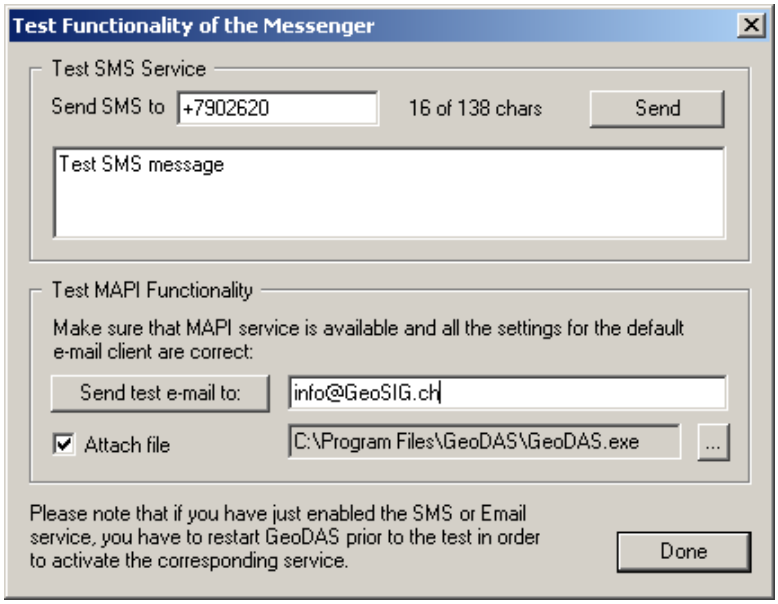
Parameters of the GeoDAS Messenger are adjusted with the following dialog, which is launched from the main menu **Settings->Messenger**.



Check the options of the **General Settings** to enable the corresponding service. In case you enable the SMS service, the **communication port** where GSM modem is attached to must be chosen from the list.

Messengers of the different instances of GeoDAS located in the different computers can exchange with the data. Those messengers, which do not have the corresponding services enabled, still can send the emails and SMS by forwarding them to the "master" Messenger. In this case both master (which has the services enabled and can provide them) and the slave messengers (which have the corresponding services disabled) must be configured for the network communication. Press the button **[Configure…]** for the corresponding service to perform such a configuration.

The functionality of the Messenger can be tested at any time. Pressing the button **[Test Functionality of the Messenger]** launches the following dialog.



In order to test the SMS service functionality type any text message (up to 138 characters) and the mobile telephone number. Then press the button **[Send]**. If the message arrives everything works correctly.

In order to test the email service functionality type the e-mail address where you can receive a message from and press the button **[Send test e-mail to:]**. You can also attach any file to your test e-mail.

There are two more miscellaneous options in the Messenger Setup dialog. You can enable **sending the system Log protocol by email daily**. The list of subscribers containing the destination email addresses is selected with the browse button **[…]**. The format of files containing email addresses and the mobile telephone numbers for sending the SMS messages is described below.

The other option specifies an alternative method of delivering the SMS messages to GeoDAS. Usually it receives the SMS directly from GSM modems. But they can also be delivered in any other way, for instance,

through the FTP or HTTP service and received by another application. Further all these messages are dumped into the files and GeoDAS picks them up from there. This will take place if you enable the option **Scan for SMS…** The directory where the files are kept is selected with the browse button **[…]**.

Address Files of the GeoDAS Messenger

Messenger of GeoDAS works with two types of messages: emails and the SMS messages. The names of the lists of recipients must be provided for every type of messages in the corresponding setup dialogs. These lists are simple text files.

Every line of the list of e-mail recipients must have the following format:
<Name of the Recipient> <its@email.address.com>

For instance:
GeoSIG_Info_Service info@GeoSIG.ch

The name of recipient is optional.

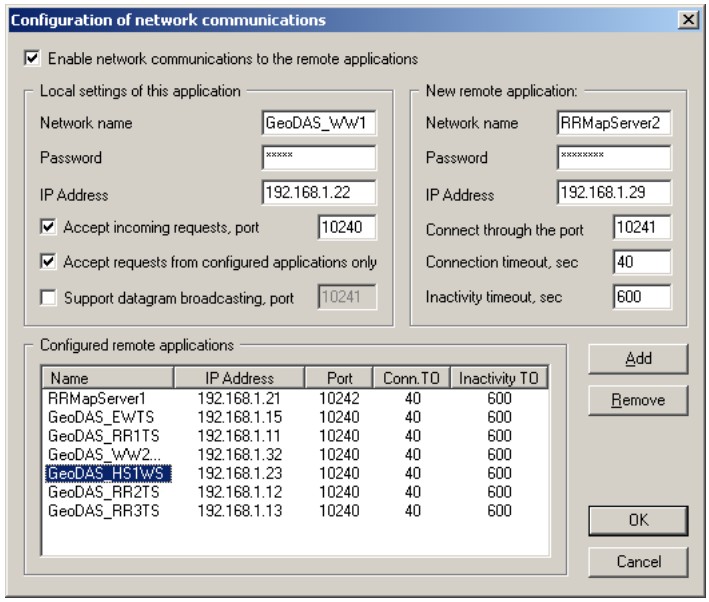
The lists of email recipients must have the extension “LST”.

Every line of the list of SMS recipients must consist just of the telephone number of a message recipient. International format of phone numbers is preferable

The lists of email recipients must have the extension "PHN".

19 Appendix G. Network Links of GeoDAS

GeoDAS can communicate to other instances of itself as well as to other applications developed by GeoSIG through Windows sockets. In order to set up the network communication parameters of GeoDAS the following dialog must be launched from the main menu **Settings->Remote Links**.



First you have to select the option **Enable network communication to the remote applications**, then the other controls become available.

The following parameters must be specified for both local and the remote GeoDAS applications: **network name** of the application, **password** to access it and the **IP address** of the computer where the application resides.

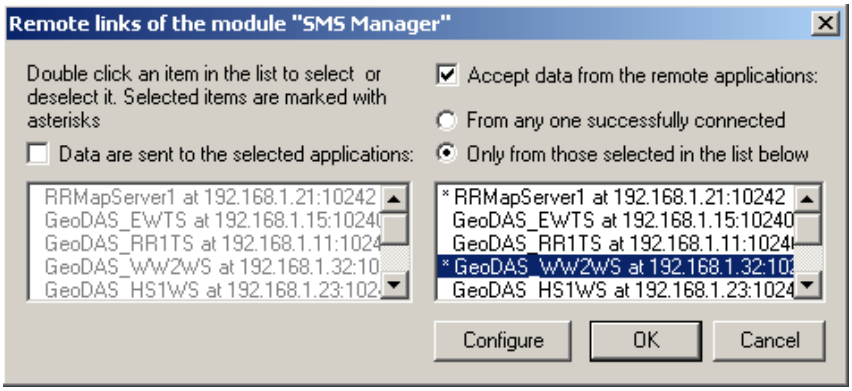
If it is supposed that the local instance of GeoDAS will **accept the requests from remote** instances of GeoDAS and/or from other applications, simply enable the corresponding option and enter the port, which will be used by the remote applications to connect to this local GeoDAS. You can also apply the restrictions for the remote requests by enabling the option **Accept requests from configured applications only**. This means that only those applications listed in the **Configured remote applications** table will be accepted to connect. The option **Support datagram broadcasting** is required to be enabled if you are going to forward the information provided by data streams to the remote applications. Refer also to the issue Processing Stream Data for more information.

Except those settings, which were mentioned already, the following parameters must be specified for every remote application: its **server port** and two timeout intervals. If a connection is not established within the **Connection timeout** interval, then GeoDAS retries to connect. If there is no data transfer through the existing connection during the **Inactivity timeout** interval, this connection is closed by GeoDAS.

When all the parameters for the new remote application are set correctly, you can add it to the list of configured applications by pressing the button **[Add]**. In order to remove a remote application form the scope of network communications, select it from the list and press the button **[Remove]**.

Press **[OK]** button to save all the changes you made and to exit from the configuration of the network communications. Note that you have to restart GeoDAS in order to the new settings take effect.

If you have the remote applications configured with the above dialog, you can specify the details of network communications between the program modules. This procedure is performed locally while configuring the corresponding module. For instance, if you would like the local Messenger of GeoDAS to exchange with the SMS messages with the Messengers of the remote GeoDAS, press the corresponding button while configuring the Messenger. The following dialog will appear.



Here you can specify whether the information is **sent to and/or received** from the remote applications by enabling the corresponding options. The remote applications configured with the described above dialog are listed in both sending and receiving lists. Those applications selected for communication **must be marked with asterisks**

by double-clicking their names in the list. If you have decided to accept the data **from any application**, which is connected to the local GeoDAS successfully, then no selection is required in the receiving list.

The button **[Configure]** brings you to the procedure of configuration of the network communications, which was described above. Press the **[OK]** button to save all the changes you made and to exit from the configuration of the network communications of a local program module. Note that you have to restart GeoDAS in order to the new settings take effect.

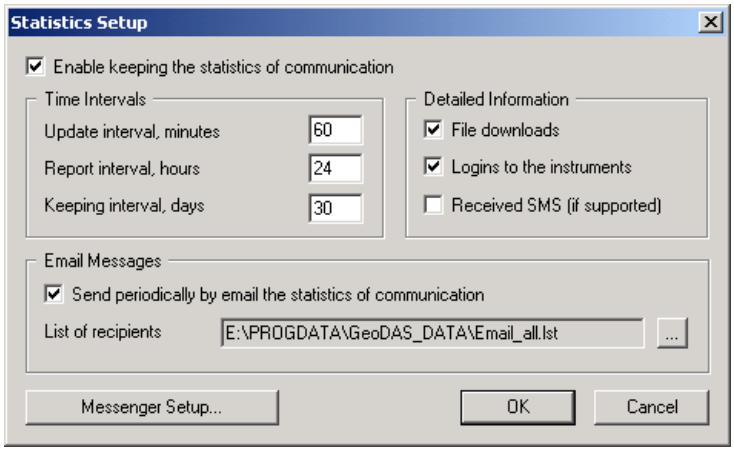
The same dialog is used to configure any other modules, which participate in the network communications.

20 Appendix H. Statistics of Communications

GeoDAS can acquire some statistical information while communicating to the configured stations. This information can be used to optimise communication parameters for the purpose of debugging. Statistics setup launched from the main menu **Settings->Statistics** allows this feature to be activated.

20.1 Parameters of the Statistics

If you **enable keeping the statistics of communication**, the other options become available. Statistical information is kept in the file, which is updated every **update interval** minutes, i.e. the new line of information containing data for the above period is added to this file. As soon as the **report interval** has elapsed, the total statistical figures are calculated, the file is closed and the new file is created. The completed file is sent by e-mail to the subscribers according to the **List of recipients** if the option **Send periodically…** is enabled. Statistical files are kept on the hard disk as long as specified with the **keeping interval** parameter.

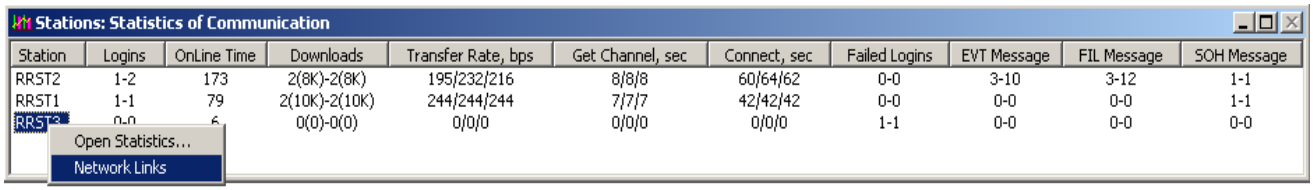


You can also specify whether more detailed information must be gathered and send by email (if enabled) by selecting the following options: information on **file downloads**, on **logins to the instruments** and about **received SMS** if your instruments support them.

The button **[Messenger Setup…]** provides the same functionality as the menu item **Settings->Messenger**. Pressing the **[OK]** button saves all the changes you made and exits from the Statistics Setup. Note that you have to restart GeoDAS in order to the new settings take effect.

20.2 Statistics Window

Statistical information, if enabled, is displayed in the following information window:



Statistical information displayed in the window is described below:

Station	The unique station name, which is entered while adding a station. This name is used by GeoDAS only and is not stored in the instrument memory
Logins	Number of successful logins to the instrument. The first value is a number of logins during the current update interval. The second value is the total number of logins during the report interval. The same style of indication is applied to the number of downloads and messages (see below).
Online Time	Total time interval when GeoDAS was logged in to the instruments. Indicated in seconds
Downloads	The number of downloaded files and their total size
Transfer Rate	The rate of data transfer from the instrument. Three values are indicated: minimum, maximum and the mean value over the report interval. The same style of indication is applied to the next two columns
Get Channel	Three values (minimum/maximum/mean) indicate how long GeoDAS was waiting for a free communication channel to lock it and get an access to the current station. Indicated in seconds
Connect	Again three values display how long it was taken to dial out (in case of a dial-up channel only) and to connect to the instrument.
Failed Logins	Number of attempts to login to the instrument, which failed
EVT Message	Number of EVT (event detected) messages received during the current update interval and the total number of them received during the report interval
FIL Message	Number of EVT (event completed) messages received during the current update interval and the total number of them received during the report interval
SOH Message	Number of SOH (state of health) messages received during the current update interval and the total number of them received during the report interval

GeoDAS resets the statistical information each time when the report interval elapses.

21 Appendix I. Monitor Mode of Operation

The monitor mode is used in multi-computer configurations only. A GeoDAS application installed as monitor can control other GeoSIG applications and can provide general information about them to the subscribers by email an/or by SMS messages. In order to install GeoDAS in this mode you have to choose it during the Application Installation. Note that GeoDAS cannot communicate to the instruments if it is installed in the Monitor mode

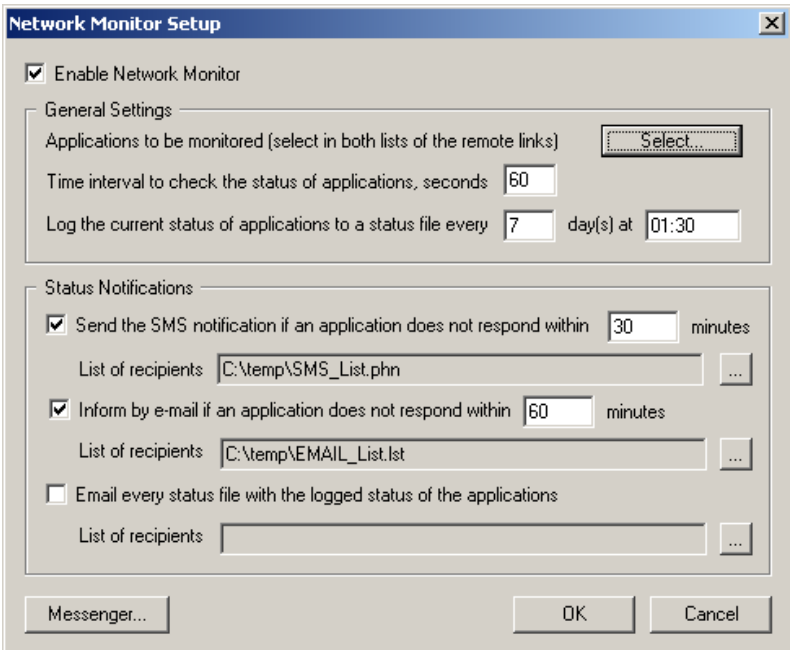
The other instances of GeoDAS communicate to the Monitor through Windows sockets and therefore the remote links must be configured.

GeoDAS displays the following information windows in the Monitor mode: Logger, General Information and the Statistics of communications (if enabled). Additionally one more information window becomes available: Network Monitor.

21.1 Network Monitor Setup

The parameters of the Network Monitor are set with the setup dialog, which is launched from the main menu **Settings->Network Monitor**.

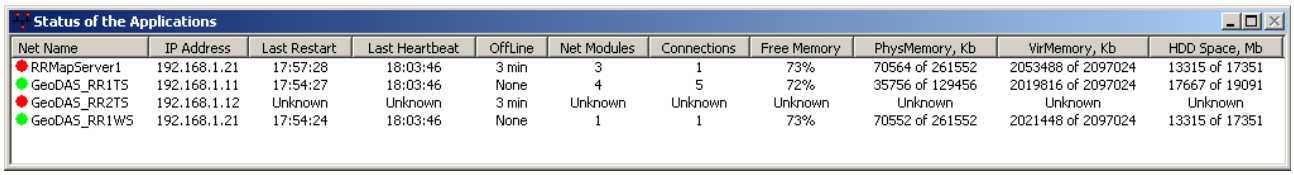
First **Enable network monitor**, then the other options become available. The applications to be monitored are selected with the standard dialog of the network module links, which is launched with the button **[Select…]**. The Network monitor periodically checks the status of applications, according to the **time interval**, which is set in the dialog,. The status information is also logged to the status file at **specified time** as often as it is set in the same setup dialog.



The Network Monitor can send information about monitored applications by email and/or by SMS if the corresponding services are supported and enabled. Press the button **[Messenger…]** to make the required settings of the messenger options. You can select to send an **SMS notification message** if any monitored application does not respond within the specified **time interval**. The list of recipients can be in any directory. It is selected with the browse button **[…]**. The same notification can be send by email also with more detailed information attached. The **status of applications** can be also **send by email periodically** if the corresponding option is activated.

21.2 Network Monitor Window

The following window appears in the screen when the Network Monitor is activated. It displays the information described below.



Net Name	The name of the remote application as it is assigned while configuring the remote links. The bitmap to the left indicates the status of application: green color - Ok, red color - does not respond, orange color indicates that the request is being processed
IP Address	IP address of the computer where the monitored application resides
Last Restart	Time of the last restart of the application. If the application never responded, then "Unknown" is indicated. The same is for the other columns also.
Last Heartbeat	Time of the last response from the application
Offline	Total time interval when it was not possible to communicate to the application
Net Modules	Number of the modules of the monitored application, which communicate over the network
Connections	Number of connections, which are currently active
Free Memory	The percentage of the free memory
PhysMemory	The total amount of physical memory and the amount of free memory available. Provided in kilobytes.
VirtMemory	The total amount of virtual memory and the amount of the free virtual memory available. Provided in kilobytes.
HDD Space	The total amount of HDD space and the amount of the free space available. Indicated in megabytes.

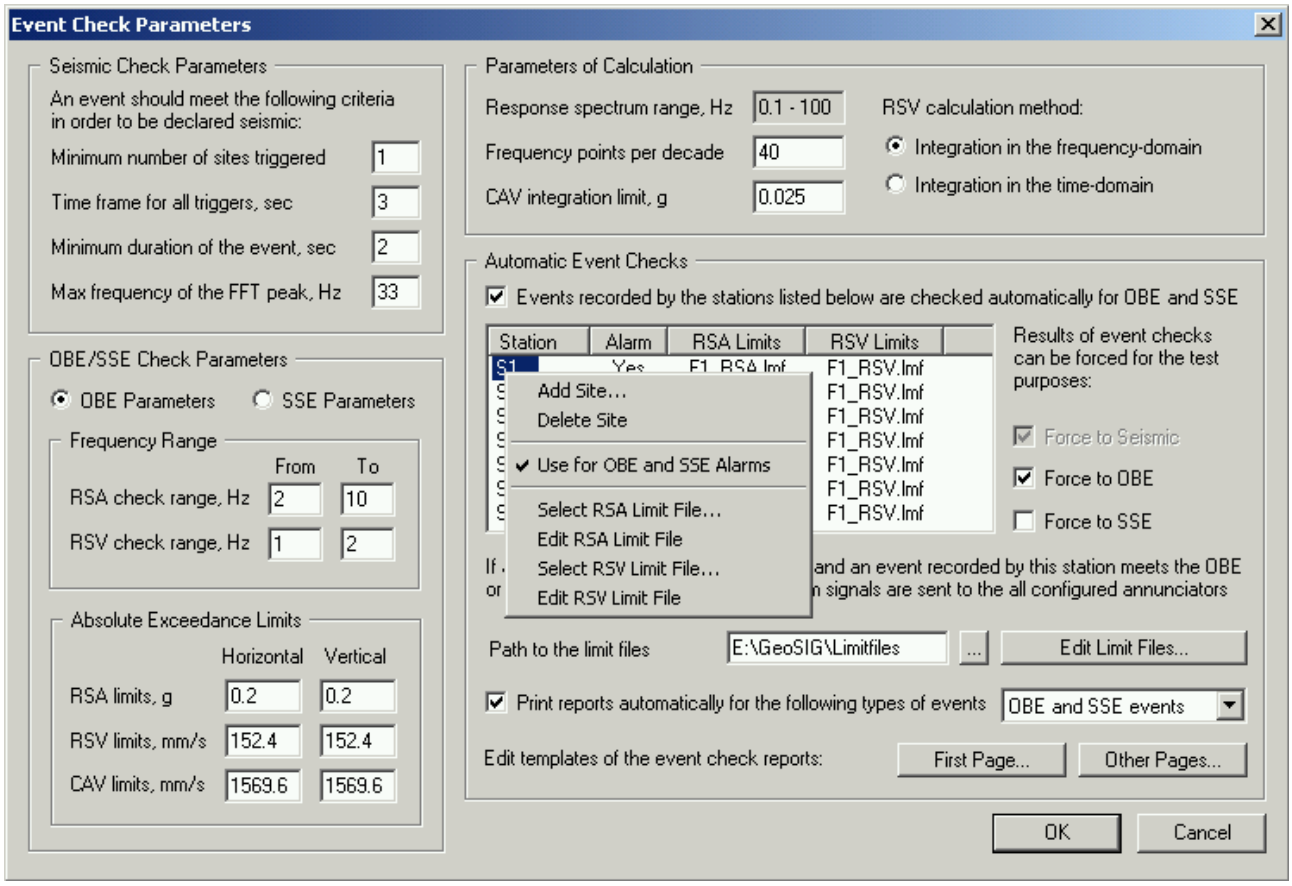
22 Appendix J. Event Checks

The event files are analysed by GeoDAS in order to check whether they can be declared as seismic ones and whether they meet the Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE) criteria. These checks are required for the applications of the Nuclear Power Plants (NPP) seismic instrumentation. The main role of such instrumentation is the prompt evaluation of seismic response of the safety-significant plant features after an earthquake. The analysis parameters are selected based on the following Standards and the Regulatory Guides:

- NRC Regulatory Guide 1.12, "Nuclear Power Plant Instrumentation For Earthquakes", Revision 2, March 1997
- NRC Regulatory Guide 1.166, "Pre-earthquake Planning and Immediate Nuclear Power Plant Operator Postearthquake Actions", March 1997
- EPRI TR-100082-T2, "Standardization of the Cumulative Absolute Velocity", December 1991

22.1 Event Check Parameters

They are set and adjusted with the dialog window launched through the main GeoDAS menu **Settings -> Event Checks.** The parameters specified here are used for both manual check of single even files (**Analyse -> Manual Event Check**) and for automatic check of the group of event files provided by several stations and declared as the single seismic event.



The first group of parameters called **"Seismic Check Parameters"** specifies the criteria used to check whether an event is seismic one. Two parameters (**Minimum duration of the event** and **Maximum frequency of FFT peak**) are applied to every event data file. The other two parameters are used during the automatic analysis of several event files. In order to declare such event as seismic, the number of these files must be equal or greater the **Minimum number of sites triggered** and all the event triggers must be declared within a **Time frame for all triggers**.

If an event is declared seismic, it is checked for OBE and SSE criteria. The group **"Parameters of Calculation"** sets several important parameters used for calculation of the response spectrum acceleration (RSA), response spectrum velocity (RSV) and the cumulative absolute velocity (CAV) as these data used in

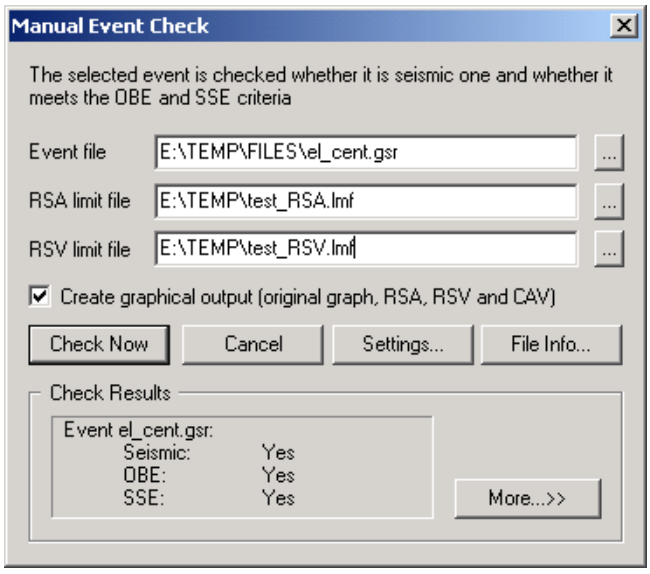
the Boolean formula for calculation of OBE and SSE: **OBE = (RSA or RSV) and CAV**. The calculation parameters are:

- **Response spectrum range**. It is fixed between 0.1 and 100 Hz. Both RSA and RSV calculations are performed within this frequency range;
- The number of **frequency points per decade** is usually not more than 120. This parameter is also applied to both RSA and RSV calculations;
- One of two **RSV calculation methods** can be selected: as the input data is acceleration, the integration to velocity can be performed either in the frequency domain or in the time domain;
- **CAV integration limit** can be adjusted too though it is not required for the standard applications because the default value of 0.025g is specified by the Regulatory Guide 1.166 based on EPRI TR-100082.

The group **"OBE/SSE Check Parameters"** specifies two sets of frequency ranges and the absolute limits for OBE and SSE. Click the corresponding radio button to switch between these two sets of parameters. The event meets OBE or SSE criterion if at least one CAV component exceeds the specified limits and if at least one component of RSA or RSV exceeds their limits within the specified frequency range interval. The limits are set separately for horizontal and the vertical components.

The group of parameters called **"Automatic Event Checks"** is used for this type of checks only. First of all, enable the automatic checks by setting the option **Event recorded by**… Then the other parameters can be adjusted. Only those events recorded by the sites (stations) listed in the table will be checked automatically. The list of stations indicates which **limit file** belongs to which station and whether the results of event check of a particular station are used to generate the OBE and SSE alarms. The list of stations is edited through the context menu. The limit files are selected also with this menu from the directory specified as **Path to limit files**. Please refer to the section Editor of Limit Files for more information about these files. The editor is launched directly from the Event Check Parameters dialog by pressing the button **[Edit Limit Files…]**. The results of event checks can be forced to positive for testing purposes by enabling one or more **Force…** options. Note that if you would like to force the events to OBE or SSE, they will be forced also to Seismic. You can also specify whether the **reports on results of event checks are printed automatically** and for which **types of events**. An Example of the report of event check is presented below. Several features of this printout, such as title and the logo can be modified and they can be different for the first and for next pages of the report. Press the buttons **[First Page…]** and **[Other Pages…]** correspondingly to adjust the layout of report pages with the standard Print Setup dialog. Note that the parameters, which are shown in grey colour, cannot be changed.

22.2 Manual Event Check

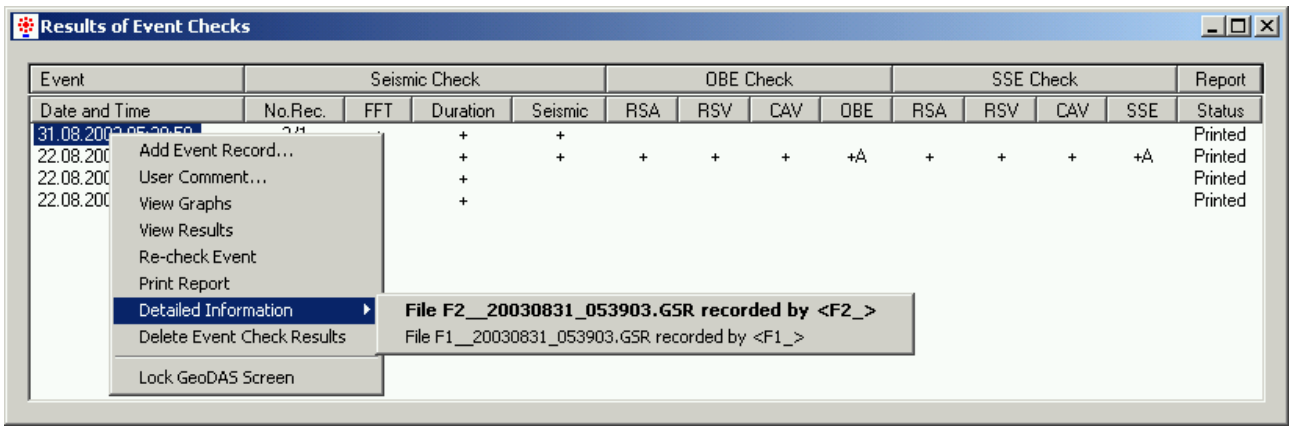


Any event file can be checked manually if it meets the seismic and OBE/SSE criteria. This is done with the menu item **Analyse -> Manual Event Check**. First of all you will be asked to select an event file for checking, then the Manual Event Check window comes up. You have to select both the RSA and RSV limit files, which are used during the check procedure. Other check parameters are those specified in the Event Check Parameters dialog window. You can modify them for every performed check by pressing the button **[Settings…]**. In order to query the information about selected file press the button **[File Info…]**. The general information stored in the header of a selected data file will be displayed. To perform the check itself press the button **[Check Now]**. This opens the lower part of window where the brief results are displayed. In order to view and analyse the detailed results of the event check, press the button **[More…>>]**. The right hidden part of the window containing all the detailed results will be open. If the option **Create graphical output…** was enabled prior to check, the graph window containing the RSA, RSV and CAV curves with the corresponding limits as well as the original waveforms is created.

Event files checked for OBE/SSE must hold acceleration data in 'g' units. Only in this case the checks are performed correctly.

22.3 Results of Event Checks

This window comes up at GeoDAS startup if the automatic event check (i.e. the option **Event recorded by the stations…**) is enabled in the Event Check Parameters dialog. The window cannot be closed, it can only be minimised instead. The information indicated in this window is described below. Note that this information reflects the results of checking of a single event file, which has the maximum number of positive check results. This is true for all columns except: Date and Time, No.Rec, Seismic and Status. They indicate characteristics of the group of event files related to the common event.



Event date and time	The date and time of the very first local trigger out of all files related to the current event. This time is declared as the event time
No.Rec.	This and the next three parameters are related to the seismic checks. It is indicated in the form A/B, where A is the total number of event files with the trigger times within the specified time frame whereas B is the number of files, which meet the next two criteria and therefore they can be declared seismic
FFT	The character '+' (plus) in this column indicates that the event meet FFT criterion, i.e. its FFT peak is below the specified maximum
Duration	The character '+' (plus) in this column indicates that the event duration is longer than the
Seismic	Indicates with '+' whether the event is seismic. The common event must meet all seismic criteria, including the number of seismic files in the event. If the character 'T' (test) appears next to plus, this event was forced to seismic for the test purposes.
OBE RSA, RSV and CAV	The results of corresponding OBE-related checks. Plus indicates that the signal exceeded the specified limit for RSA, RSV and CAV correspondingly
OBE	The result of OBE check: OBE = (RSA or RSV) and CAV. Plus indicates that the event is OBE. 'T' indicates that the positive result is forced. If the OBE alarm was generated, it is indicated with the letter 'A'
SSE RSA, RSV and CAV	The results of corresponding SSE-related checks. Plus indicates that the signal exceeded the specified limit for RSA, RSV and CAV correspondingly
SSE	The result of SSE check: SSE = (RSA or RSV) and CAV. Plus indicates that the event is SSE. 'T' indicates that the positive result is forced. If the SSE alarm was generated, it is indicated with the letter 'A'
Report Status	Indicates whether report with the results of event check was printed. The status can be one of the followings: • No Report – the report will not be printed automatically • Pending – the report was prepared and will be printed automatically within 2 minutes • Printing – printing is in progress • Printed – the report was printed at least once, either automatically or by the user's request. The report can be re-printed at any time

22.4 Context Menu of the Results of Event Checks Window

This context menu is shown in the above picture. Most of the items are available only if some event in the list has a focus, i.e. its date/time is surrounded by the dotted rectangle. Only one event can have such a focus at any particular time and the listed below operations are applied to this event:

User Comment

Lets the operator to enter any comment line, which appears on the first page of the printed report right below the title.

View Graphs

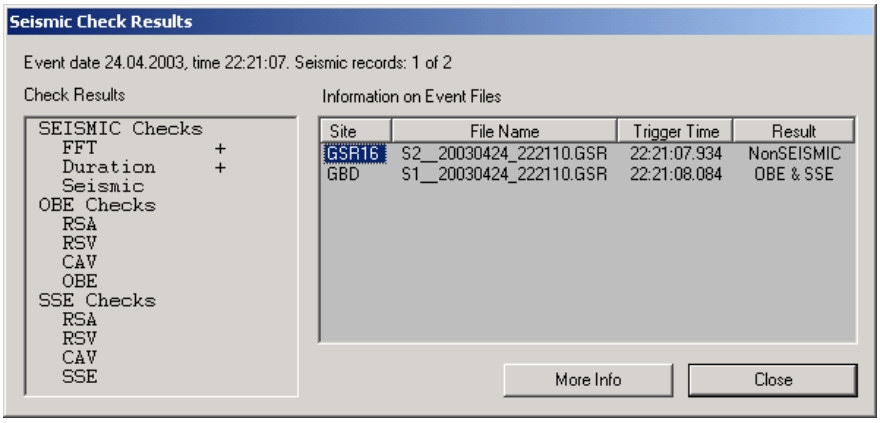
Shows all event waveforms in one window.

View Results

Shows the results of event check for the selected event. The original waveform of every event record as well as the results of RSA, RSV and CAV operations are presented in one ODV window.

Re-check Event

The event is re-checked with the **current** Event Check Parameters. If these parameters have been changed since the time of first event check, the results can differ from the ones indicated in the table. The results are shown in the Seismic Check Results window. The left part of this window shows common seismic and OBE/SSE check results. The event records are listed in the right part of window. The results indicated here are related to the particular event record only. In order to view and analyse the detailed information on every event file, select a site in the table and press the button **[More Info]**.



Print Report

Lets the user to re-print the report on event check at any time. This might be needed if one or several more event files were added to the event after printing the report for the first time. An example of printout is shown below; see Example of the report of event check.

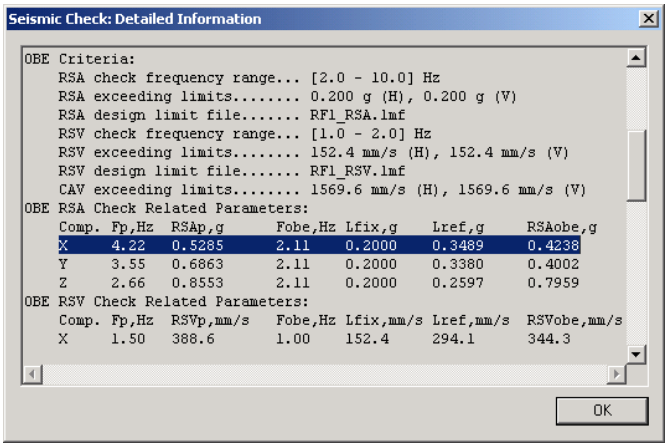
Detailed Information

All event files, which belong to the current event, are listed in this submenu. The strongest event showing the maximum number of positive checks is highlighted. Upon choosing any file from this submenu the window displaying the detailed information comes up.

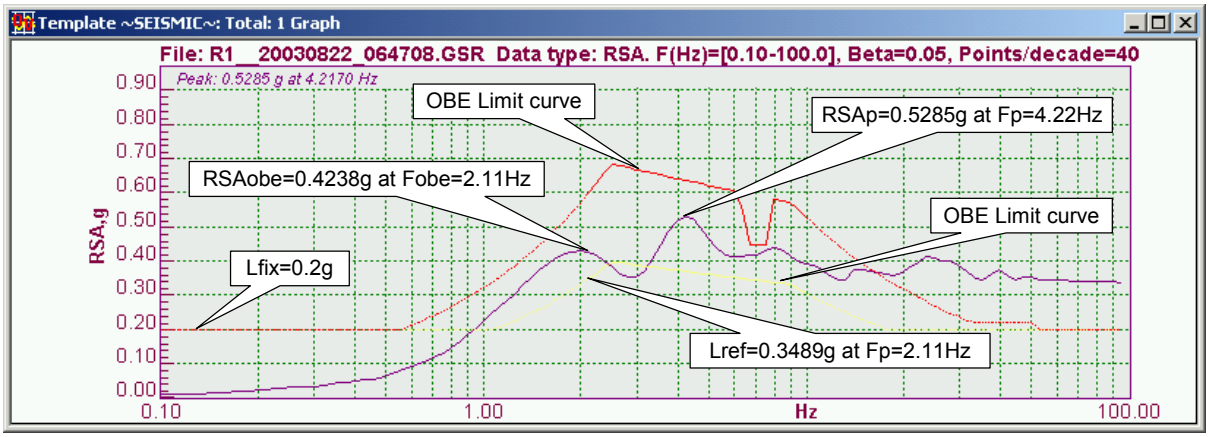
OBE/SSE RSA and RSV check related parameters have the following meaning:

- Comp. – name of the data component;
- Fp – frequency (Hz), at which the response spectrum curve reaches its maximum;
- RSA(V)p – maximum value of the response spectrum;
- Fobe(sse) – frequency (Hz) within the specified check frequency range, at which the OBE or SSE limit exceeding was detected for the first time;

- RSA(V)obe(sse) – value of the response spectrum at above frequency Fobe(sse);
- Lfix – specified fixed OBE or SSE limit;
- Lref – reference OBE or SSE limit at the frequency Fobe(sse). If no design OBE or SSE limit (taken from the corresponding design limit file) is specified at this frequency then Lref is always equal to Lfix, otherwise it is the maximum value of Lfix and the interpolated design OBE or SSE limit at the frequency Fobe(sse).



All values described above are indicated in the graph below using an exapmle of OBE RSA Check related parameters for the component X highlighted in the “Detailed Information” dialog. Note that though OBE exceeding takes place below 1Hz, it was declared only at 2.11Hz, which is the first calculated frequency point that lays within the specified frequency check interval 2 to 10Hz.



OBE/SSE CAV check related parameters are similar to those described above, except there is no design limit for CAV and the relative time values (from the beginning of the record) are given in seconds instead of the frequency points.

The next two menu items are always available irrespective of event selection.

Add Event Record

With this menu item the operator can select manually any event file located everywhere on the hard disk or diskette and add it to the list of events. This is useful in case GeoDAS cannot access a particular station through the communication channel but still this station records event files, so they can be retrieved locally, e.g. with a laptop, and then can be read from a diskette.

Lock GeoDAS Screen

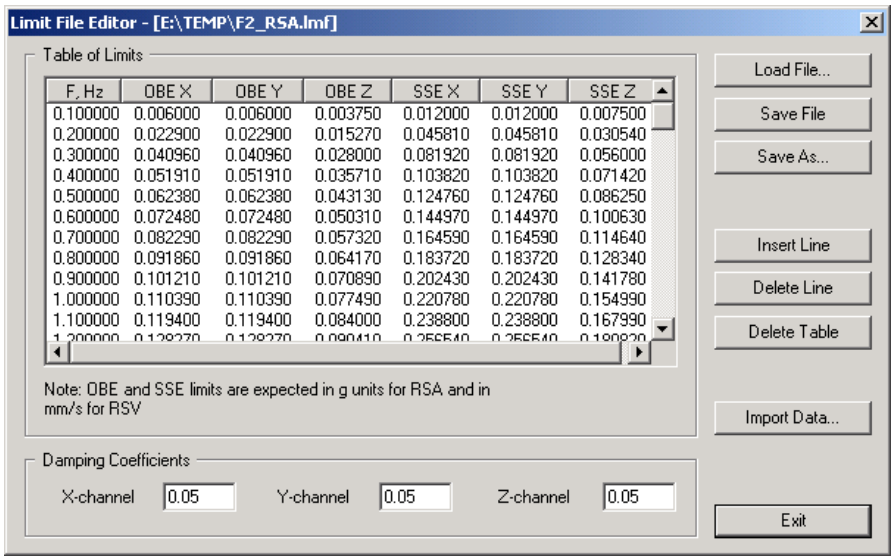
For security reasons the main GeoDAS window can be locked (made invisible) so the unauthorised persons cannot access the main menu, change important parameters, etc. This action is protected with a password. The window Results of Event Checks still remains visible so the operators can see the results of performed checks, can print reports, etc. The same menu item is used for unlocking the GeoDAS screen.

The next menu item is available when one or more events are selected (highlighted) in the list.

Delete Event Check Results

The selected events are removed from the list permanently. Since this operation causes the loss of important information, it is protected with a password. It is the same password that is used for locking the GeoDAS screen.

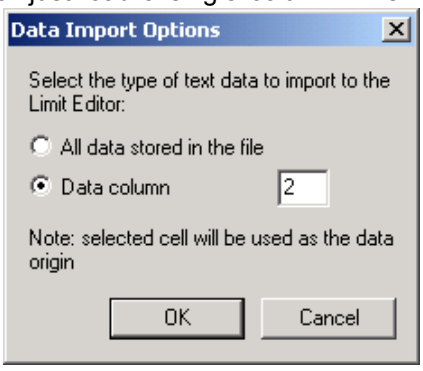
22.5 Editor of Limit Files



Limit files keep the design limits of RSA and RSV used for checking the events for OBE and SSE criteria. The absolute RSA and RSV exceeding limits, which are set through the Event Check Parameters dialog, are constants within the entire frequency check range. This is not satisfying to receive the precise results of event checks in many cases. In order to improve the situation, one can design any limit curves for all checked components of the source data by setting RSA and RSV limits in several frequency points within the check range. If both absolute and the design limits are available, the algorithm of event checks takes the **greater limit** to see whether the analysed signal exceeds it.

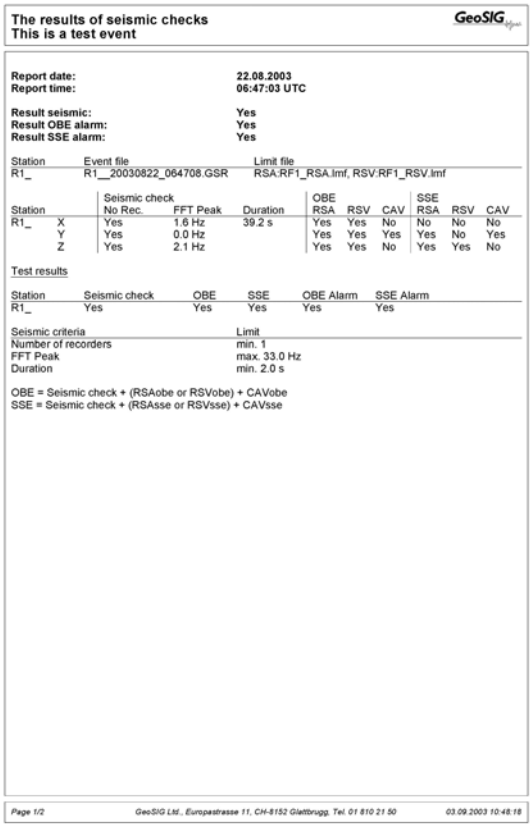
Every line of the **Table of Limits** sets six limits for every frequency point: three of them are OBE limits for three different components of the signal and the other three are SSE limits. In order to add one more frequency point, one should press first the button **[Insert Line]** and then to enter a frequency and all six limits. Any value in the table is edited by double-clicking it. In order to delete a frequency point from the table, one should select the corresponding frequency and press the button **[Delete Line]**.

The button **[Import Data]** is used to load the OBE and SSE limits from any text file. You can import either the entire ASCII limit table if it matches the format of the Limit Editor table or just load a single column. The number of column is selected with the Data Import Options dialog, which pops up after selecting a file to import. The data column(s) will be imported starting from the data cell currently selected (highlighted) in the Table of Limits.



Limit files keep also the damping coefficients for every component of the signal. Typical damping value is 5%, which is entered as 0.05.

22.6 Example of the report of event check



The results of seismic checks
This is a test event

GeoSIG

Report date: **22.08.2003**
Report time: **06:47:03 UTC**

Result seismic: **Yes**
Result OBE alarm: **Yes**
Result SSE alarm: **Yes**

Station	Event file	Limit file
R1_	R1__20030822_064708.GSR	RSA:RF1_RSA.lmf, RSV:RF1_RSV.lmf

Station		Seismic check No Rec.	FFT Peak	Duration	OBE RSA	OBE RSV	OBE CAV	SSE RSA	SSE RSV	SSE CAV
R1_	X	Yes	1.6 Hz	39.2 s	Yes	Yes	No	No	No	No
	Y	Yes	0.0 Hz		Yes	Yes	Yes	Yes	No	Yes
	Z	Yes	2.1 Hz		Yes	Yes	No	Yes	Yes	No

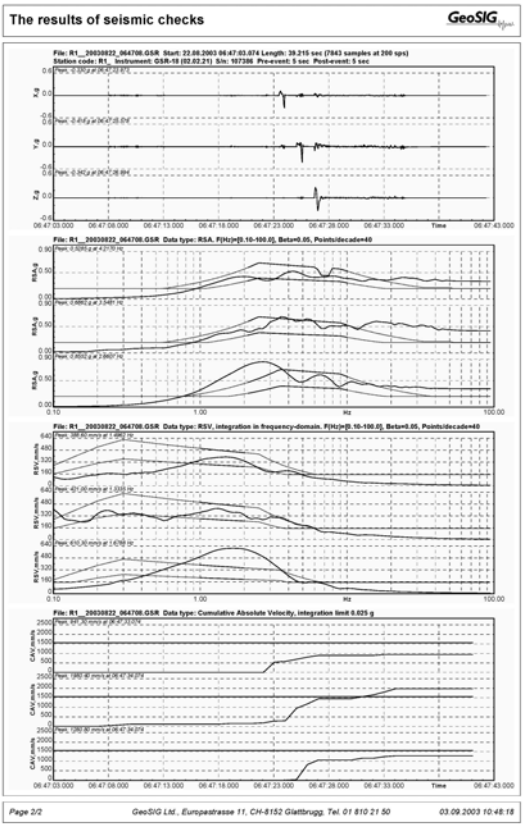
Test results

Station	Seismic check	OBE	SSE	OBE Alarm	SSE Alarm
R1_	Yes	Yes	Yes	Yes	Yes

Seismic criteria	Limit
Number of recorders	min. 1
FFT Peak	max. 33.0 Hz
Duration	min. 2.0 s

OBE = Seismic check + (RSAobe or RSVobe) + CAVobe
SSE = Seismic check + (RSAsse or RSVsse) + CAVsse

Page 1/2 GeoSIG Ltd., Europastrasse 11, CH-8152 Glattbrugg, Tel. 01 810 21 50 03.09.2003 10:48:18



The results of seismic checks

GeoSIG

Page 2/2 GeoSIG Ltd., Europastrasse 11, CH-8152 Glattbrugg, Tel. 01 810 21 50 03.09.2003 10:48:18

23 Appendix K. Station Map

If you have many stations configured, it might be useful to prepare the map showing the area where they are located. GeoDAS can display this map.

First of all, the image file with the background map information must be prepared. For instance the JPEG format can be used for such a file. This file can be placed to any directory. The next step it is to provide the information on how to convert the graphical offsets in the image to the real latitude and longitude. In order to do so, prepare the text file **GeoDAS_Maps.gsm** and save it in the subdirectory **Maps** of the GeoDAS home data directory.

This file must have the following format:
Line 1: the full path to the background map file
Line 2: graphical co-ordinates (left, top, right, bottom)
Line 3: corresponding real co-ordinates (long1, lat1, long2, lat2)

Example of GeoDAS_Maps.gsm file:

```
e:\cpp\test\geodas\maps\map.jpg
51 35 997 680
28.5 40.75 29.5 41.3
```

The locations of the stations are taken from the file **all_stations.lst**, which is kept in the subdirectory **Config** of the GeoDAS home data directory. Every line of this file indicates the name of a station, its latitude and longitude.

Example of all_stations.lst file:

```
ST000 40.842029   28.962203
ST001 40.942618   28.618076
ST002 41.105617   29.178060
ST003 41.214980   29.038469
ST004 41.152524   28.638798
ST005 40.784211   29.137410
ST006 40.759095   29.212271
ST007 41.120540   28.986831
```

If everything was prepared correctly then the background map with the stations placed on it will be displayed upon clicking the item **View->Station Map** of the main GeoDAS menu.

24 Appendix L. Support for ADC boards

GeoDAS can acquire data directly from an A/D converter board, which is installed in the computer where it runs. The only type of ADC boards supported currently is the PC-CARD DAS16/12 manufactured by Measurement Computing Inc. (MCC). GeoSIG Ltd. has developed the computer-based version of seismic recorder named GSR-12PC, which utilises this type of A/D converter. For more information regarding GSR-12PC product please refer to the corresponding hardware manual.

24.1 Installation of the ADC board drivers

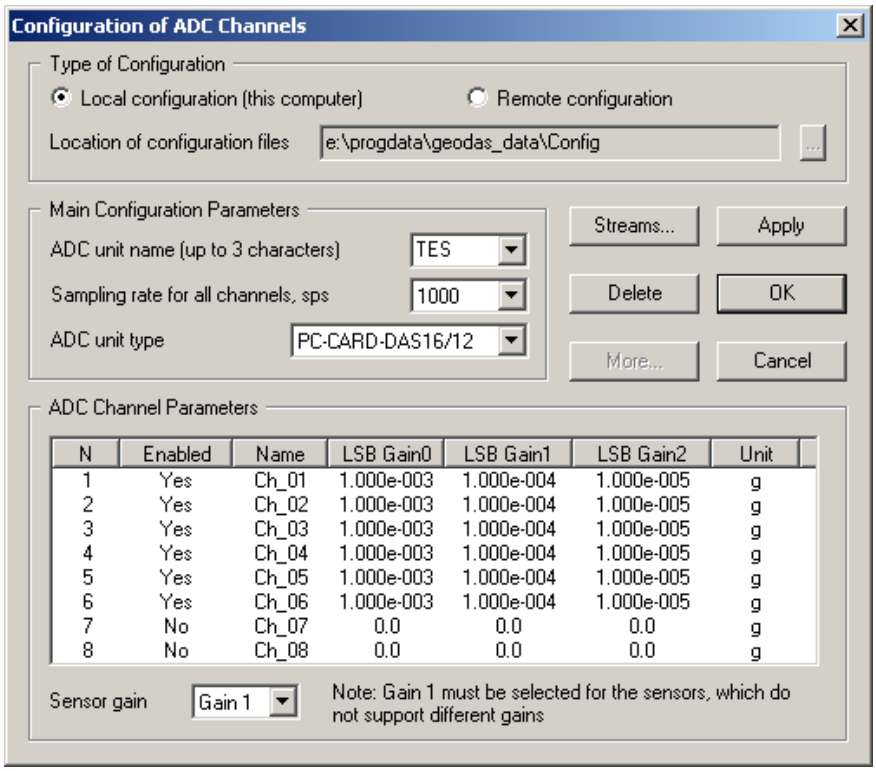
Prior to use GeoDAS with an ADC board make sure that all required drivers and libraries provided by the board manufacturer are installed correctly in the computer running GeoDAS. Please refer to the installation instructions supplied along with your board.

In some case it is required to run a configuration utility, which is used to adjust the main hardware settings of the ADC board and to test its general functionality.

24.2 Configuration of ADC channels

The A/D units are introduced to GeoDAS with the following configuration dialog launched from the main menu Settings->Configure ADC Channels.

In most cases the configuration of ADC units and channels is edited locally, i.e. in the same computer where they are installed. In such a case the **Local configuration** type has to be selected. The location of configuration files is shown below. It is the Config directory, which is under the GeoDAS root data directory of the local computer. This location cannot be changed unless GeoDAS is fully reinstalled. When the type **Remote configuration** is selected, one can choose any **location of the configuration files** either by pressing the browse **[…]** button or simply by typing any valid path in the edit bar. This feature is used to edit the configuration of a remote GeoDAS based data acquisition system accessible via network. The corresponding configuration directory on the remote computer must be shared as a network resource for the remote access.



The group of controls called **Main Configuration Parameters** includes three settings. **ADC unit name** is assigned by user and may have up to three characters. In order to add an ADC unit into the current configuration simply type the desired name and press the button **[Apply]**, which is used to verify and to update the current parameters of the dialog window. The **sampling rate** is the same for all channels and can be on of the following fixed values: 100, 200, 250, 500, 800 and 1000 samples per second. **ADC unit type** is the type of your A/D converter board. Besides of the real ADC unit, you may select also the type called Internal Simulator. In this case the data are generated internally by GeoDAS, which is useful for the test purposes. The button **[More…]** available for this type brings you to the Datastream Simulator Settings dialog described in the chapter Work Options. Here you can edit parameters of all ten simulated channels.

Parameters of ADC channels are placed to the table at the bottom of configuration dialog. For every available channel one can select whether it provides data to the acquisition system (**enabled** - Yes) or not, one can

enter up to five characters for both **channel name** and a **unit name**. The **LSB values** are the factors used to convert raw counts to the physical units indicated in the last column of the table. The Appendix A. Information on LSB contains some more information about this issue. Since some types of GeoSIG sensors support three different gains, three sets of LSB factors can be entered for every configured channel. The selection of an appropriate gain for these sensors is made with the combo box **Sensor gain**.

The Gain 1 must be chosen for the sensors, which do not support different gains. Please refer to the hardware manual of your sensor for more information about supported gains in order to select the correct LSB factors.

The button **[Streams…]** opens the Datastream Manager Setup window described in the chapter Processing Stream Data. It is used to adjust trigger settings and some other parameters for processing of data streams. Note that it is possible to edit both local and remote sets of parameters depending on the type of configuration currently selected. But there are exceptions: options of the data forwarding, messages and notifications and the target communication port for the Early Warning alarm messages cannot be adjusted remotely.

An ADC unit is removed from the current configuration by pressing the button **[Delete]**. When all parameters are adjusted as required, hit the **[OK]** button, and the local data acquisition and processing will be restarted after the confirmation. If the parameters of a remote GeoDAS were modified, it will usually take 10-20 seconds to update all parameters and to restart data acquisition at the remote computer. If the restart was performed correctly, you will receive the corresponding message.

24.3 Processing ADC data channels

The acquisition and processing of the data provided by ADC channels is very similar to processing of the data streams delivered by the standard GeoSIG instruments, such as GSR-18/24 and GBV. All aspects of this issue are described in details in the chapter Working with Data Streams. Several little differences are listed below:

- Synchronisation with the GPS time is not currently supported and therefore the GPS status is always indicated as “Not Sync”;
- In case of the normal operation of ADC units, the data packets are never lost, so the percentage of data lost is not counted;
- Recording of the sensor test pulse files is only possible for the ADC units of the type PC-CARD DAS16/12 integrated into the GSR-12PC recorders;
- Event files recorded form the data streams provided by ADC units do not contain some instrument-specific information, such as battery voltages, errors and warnings, location information, etc.

As it takes place with the data streams from standard instruments, both permanent and the event-based recording of data are possible for ADC channels. In order to keep compatibility with the standard GSR event files, the enabled data channels of any configured ADC unit are splitted into the groups, which appear in the Data Streams information window as ‘stations’ with the names consisting of three-character unit name and trailing numbers 01, 02, etc. Three first enabled channels are assigned to the station 01, three next enabled channels are assigned to the station 02, etc.

25 Index

26 Notes