



GeoDAS Software Manual

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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. All recent Windows versions are supported, down to Windows 7. It may work also on the obsolete Windows XP but we no longer support it.

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 or a network link 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 in several 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 old 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/GMS 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 and GNC instruments via serial interface (direct connection, modem or Ethernet-to-Serial converters). Interface with the GMS product line is based primary on the network interface. 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 at least a minimum Pentium II CPU. The amount of RAM depends on the number of instruments maintained by GeoDAS at the same time, but must be at least 300Mb. 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.

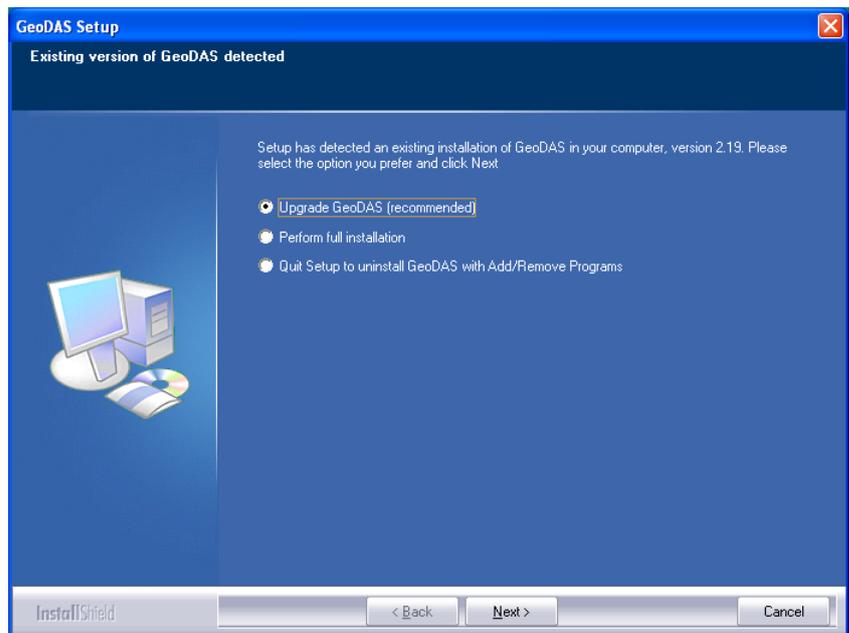
Minimum supported display resolution is 1024x768 pixels. ODV (Off-line Data Viewer) requires 65536 colours or more.

2 Application Installation

GeoDAS is installed as any other Windows programs. In order to install GeoDAS, simply run the Setup program from an installation CD. 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.

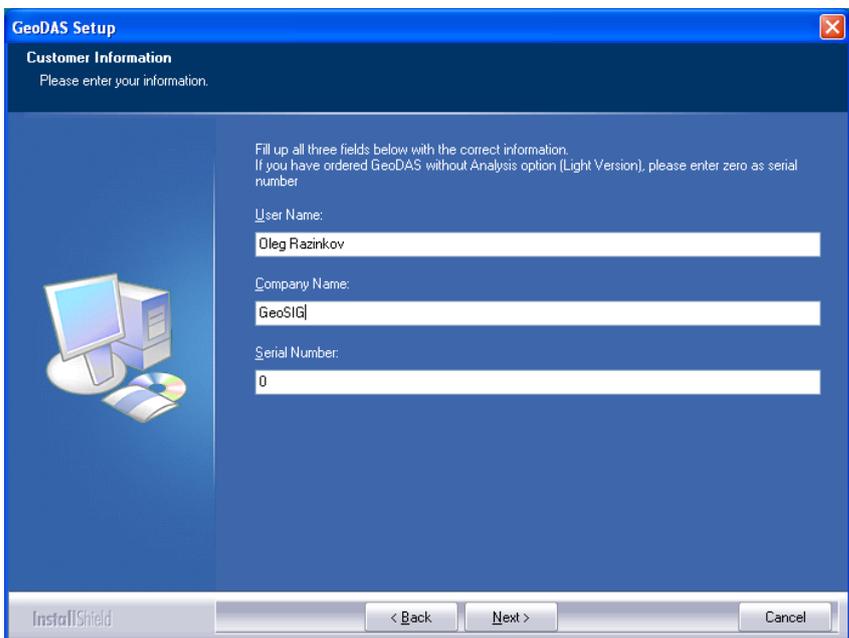
If a full installation is performed, the next screen will ask you to enter specific user information



 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 or xxxxx-xxxxxxxx-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.



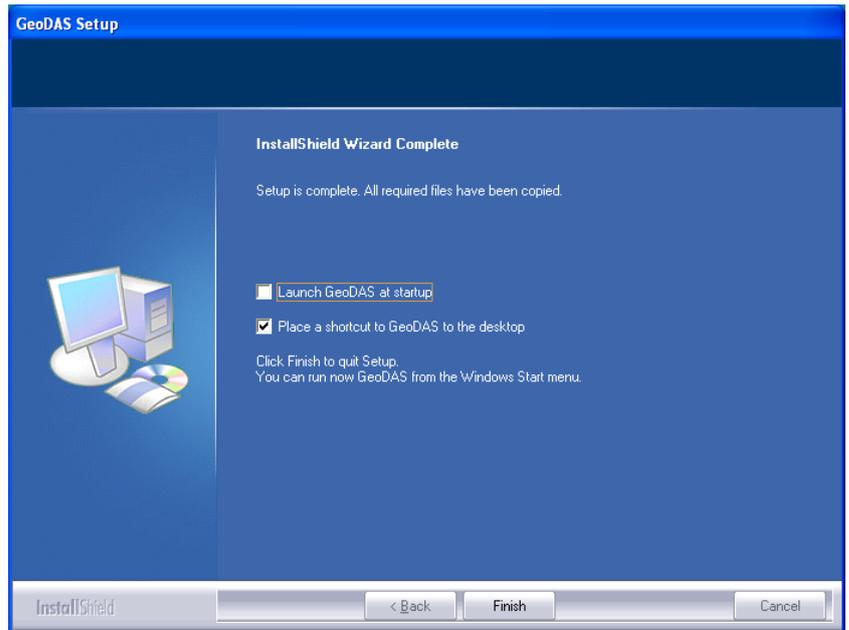
Next setup screens will ask you to choose:

- 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 start-up.** 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.

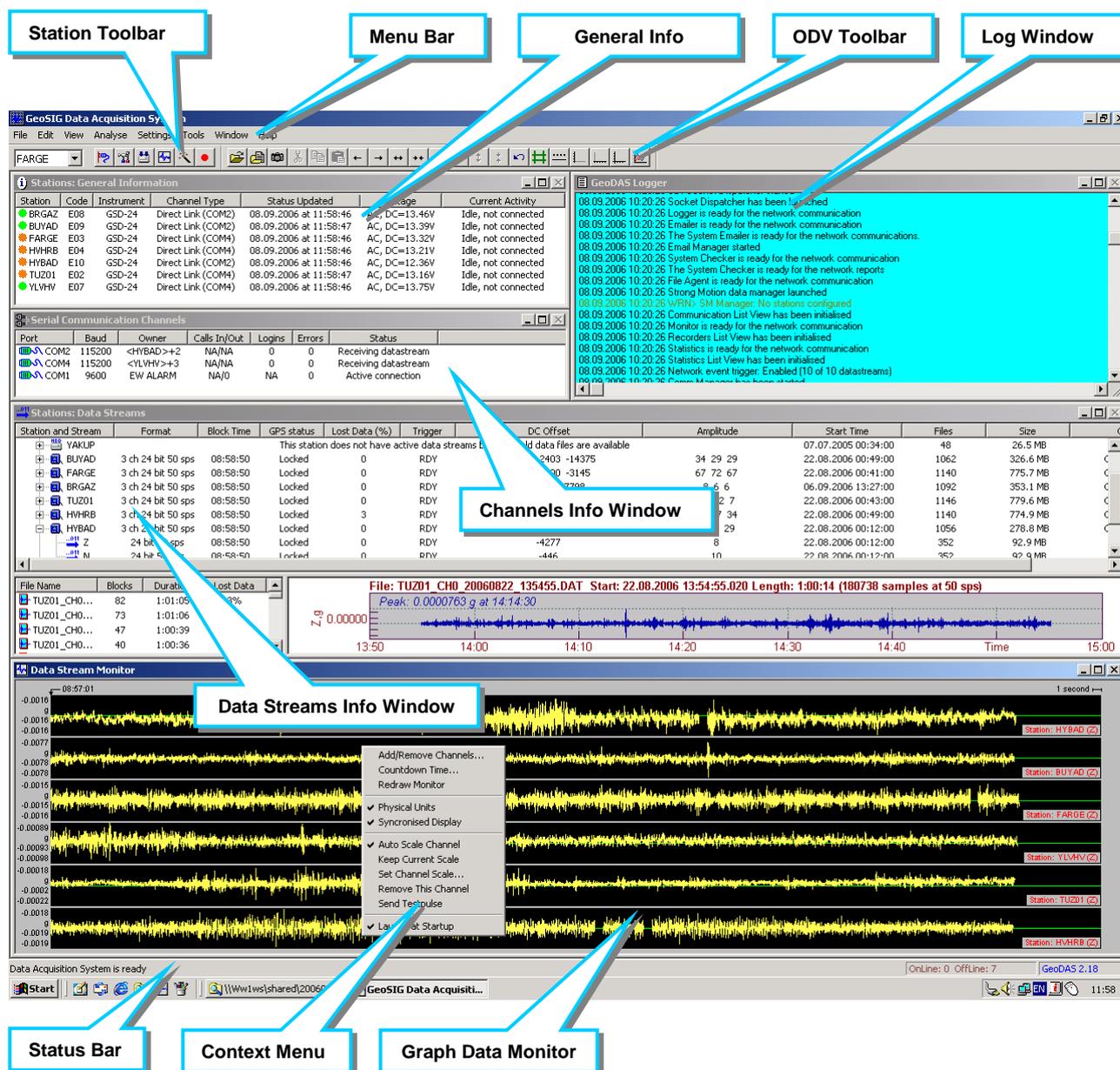
Running the GeoDAS is not different from running any other Windows application. Program can be launched by typing the full program name at command prompt (Start -> Run) or by double clicking GeoDAS icon with the left mouse button in the Windows environment. After some seconds of initialisation, the main 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 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 Stream Monitor".

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 fifth 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 on the screen because you did not configure 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 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 Stations

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

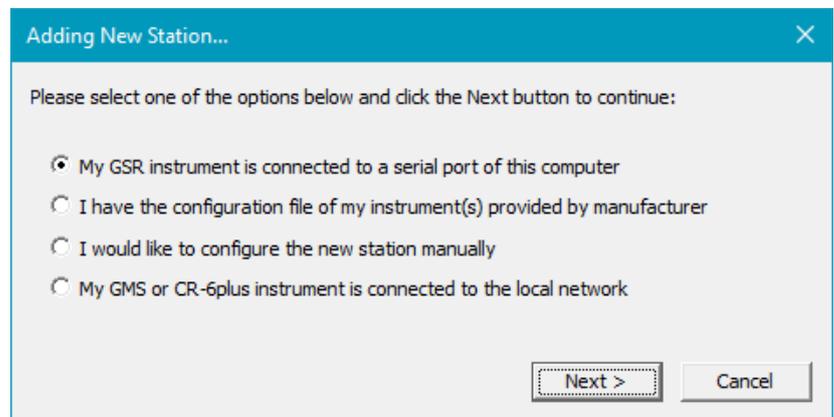
- "Instrument" refers to the physical device type (such as "GSR-18")
 - "Station" refers to a name given to a specific recorder/digitiser, installed at a specific location
- One can upgrade an existing instrument without changing the station configured in GeoDAS.

 *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 on the station toolbar and the following dialog appears.

You may choose one of the following ways of adding a new station. If you have only one instrument of the GSR product line and it is connected locally to a serial port of your computer, the first option will be the best choice. If you have a GMS instrument, make sure it is connected to the same local network as the computer running GeoDAS, and select the last option. In either case, the [Quick Login](#) dialog will appear as soon as you press the button **[Next >]**.

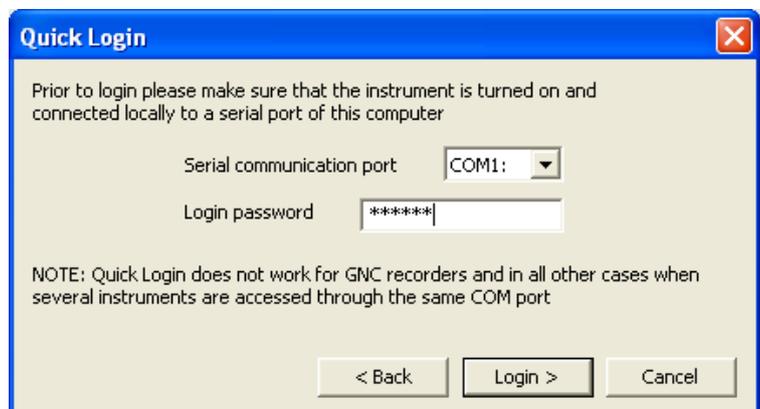


If you received your instrument along with a configuration file provided by GeoSIG, you may select the second option. Then you will be asked to select this configuration file with the next dialog called [Adding new station\(s\) using the configuration file](#).

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 stations manually](#).

4.2 Quick Login

The Quick Login dialog is used to log into an instrument, which does not exist in the current configuration yet 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.

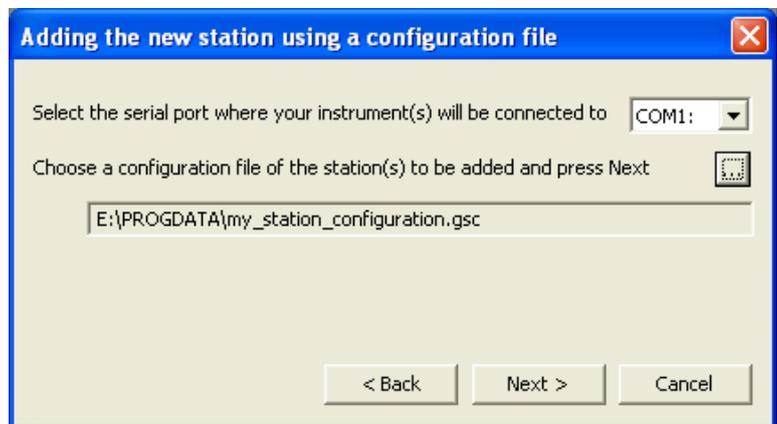


 *Important Note: Quick Login does not work for GNC recorders and in all other cases when several instruments are accessed through the same COM port. This is because several instruments may respond to*

the same Login command simultaneously causing the data corruption. In order to login first time correctly in this case you have to either use a configuration file or to add the new instrument manually into the configuration. Entering the correct serial number of the main board is mandatory.

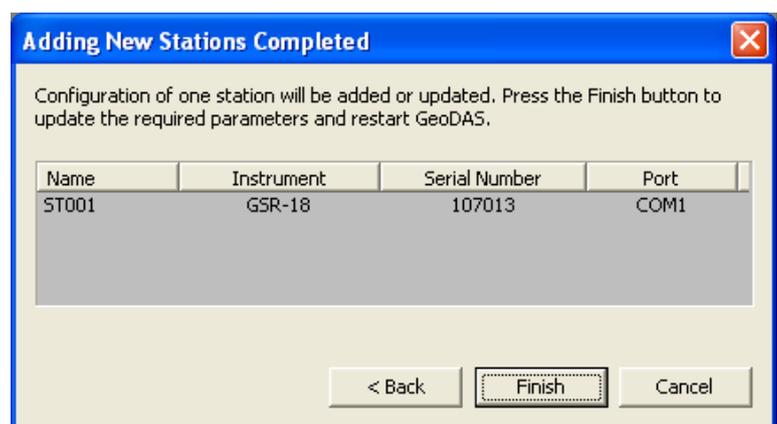
4.3 Adding new station(s) using the configuration file

New instruments are shipped usually with the configuration file supplied on the attached CD. 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 an 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 **[Next>]** 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 section [Editing parameters of the configured stations](#). Press the button **[Finish]** to let GeoDAS be restarted and to complete adding new stations.



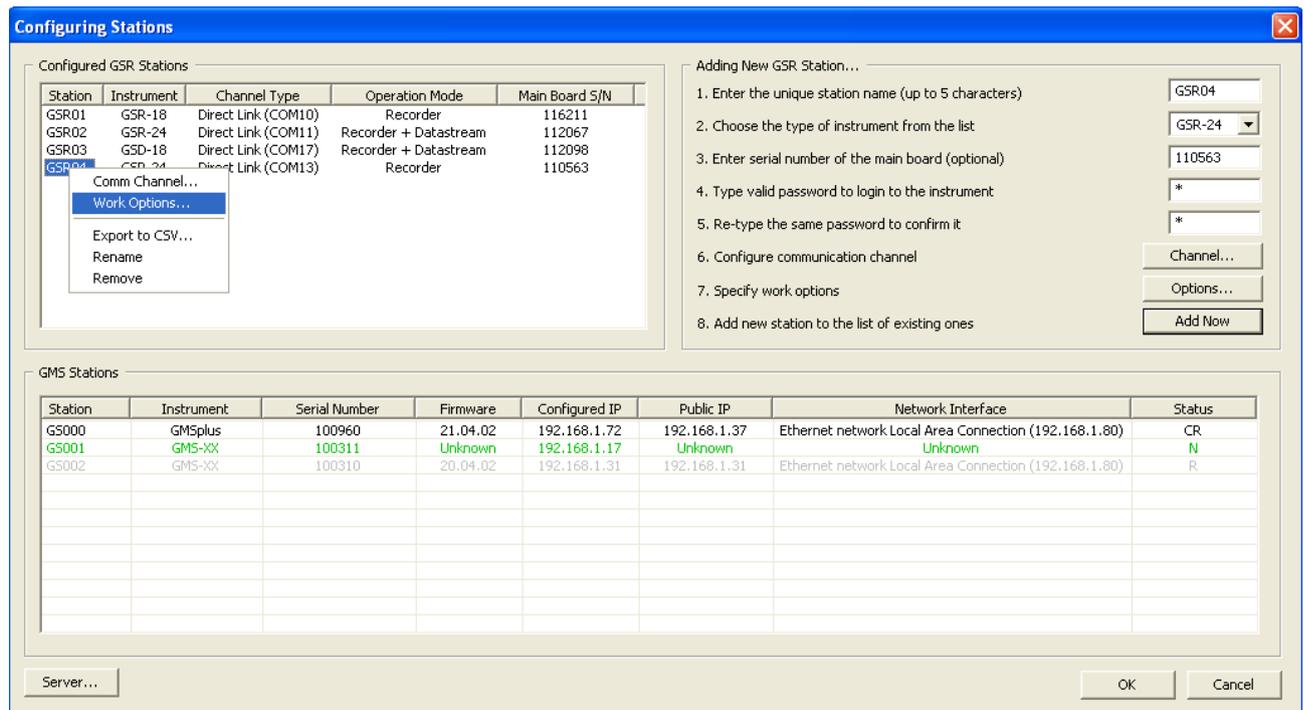
4.5 Adding stations manually

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. All types of GeoSIG instruments, except GMS-XX, are configured in the upper part of the dialog window. It contains the list of already configured stations indicating the station name, type of the instrument, communication channel, mode of operation, and the serial number of the main instrument board.

Next to 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 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.

 Next several sections, including configuration of serial communication channels and work options are applied to GSR and similar instruments. Parameters of GMS are edited right in the table described further below just by double-clicking a parameter to be edited.

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**. If different access levels are not required for the recording system, it is recommended to login always at this highest third level. While logged in, the operator can see the current level in the Communication page of the Instrument Setup Manager. It is also possible to change the current password in this page. Please refer to the [Communication Parameters](#) for more information about this issue.

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 streams 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)

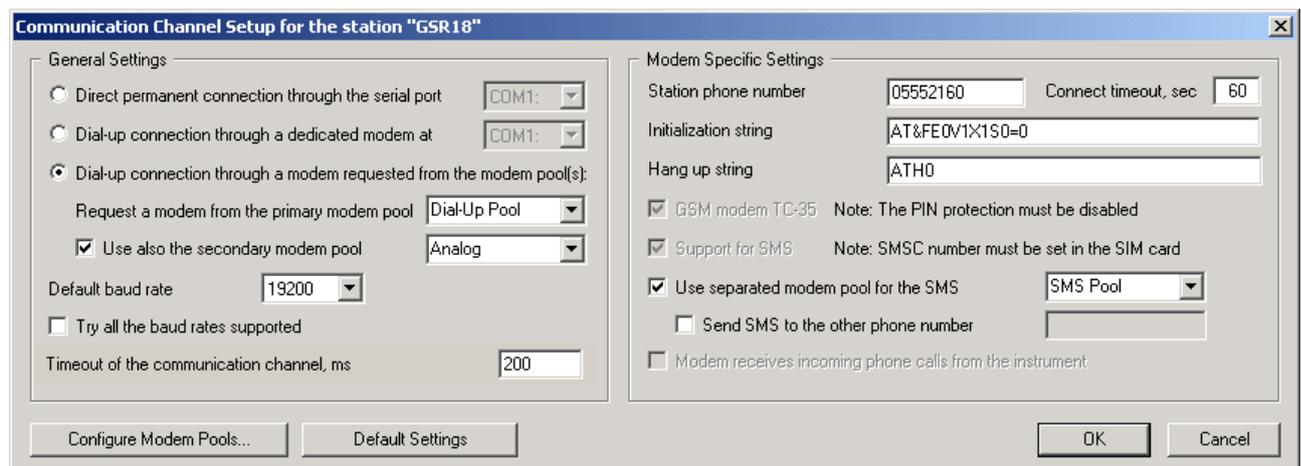
Instruments may have dedicated physical channels to GeoDAS, which provide a possibility to support permanent data streams. Instruments working as recorders only do not require to have dedicated channels. Setup of the recorders, monitoring of their State of Health (SOH) and downloading of the event files 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:

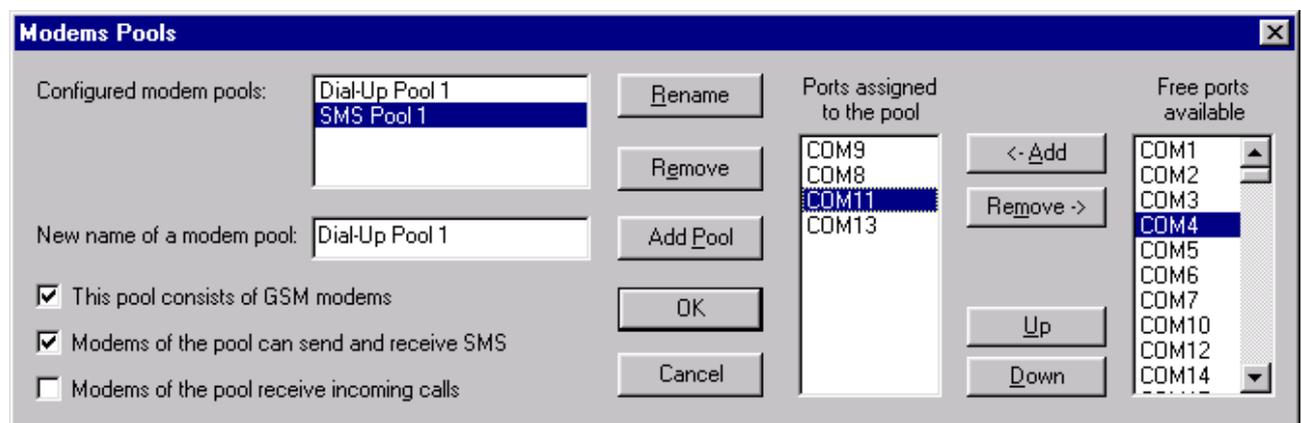


First of all, select the type of communication channel. It can be one of the followings:

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
- **Timeout of the communication channel** is set in milliseconds. If instrument does not respond within this time interval, the timeout is declared. Default value of this parameter is 1000 ms but it might be required to increase it to several seconds for slow channels, such as communication ports over the Ethernet, satellite links, GSM channels, etc.

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.

4.8.4 TCP/IP Channels

Internet Accelerographs (IA-1) are accessed over TCP/IP channels. Therefore, the configuration dialog for these types of instruments looks differently.

Currently the SSH2 protocol is used for communication with IA-1. It provides secure communication over an insecure channel by encrypting it. The following standard parameters are specified:

- **Hostname** or IP address of the IA-1 or of a relay server forwarding data from/to the instrument
- **Username** used to logon to the instrument
- **Port** of the SSH2 service, which is 22 by default if no relay server is used
- **Authentication** is currently fixed to the PublicKey. In order to authenticate the connection, GeoDAS and the target IA-1 negotiate a public key to use for the connection and then the corresponding private key is used for the signature operations.
- **Private key file** accessed only locally ensures the security. GeoDAS assumes that this file is stored in the Config directory by default but you can also specify any other location for this file by entering the full path to it.

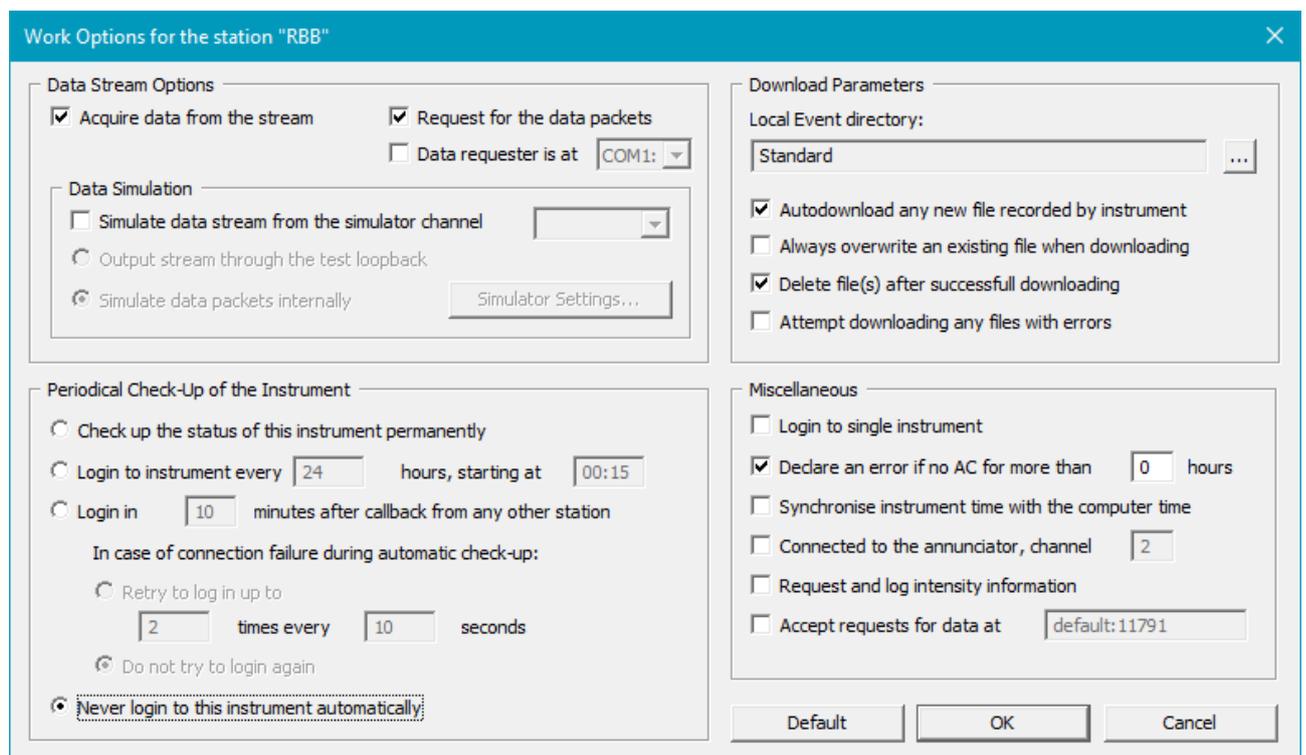
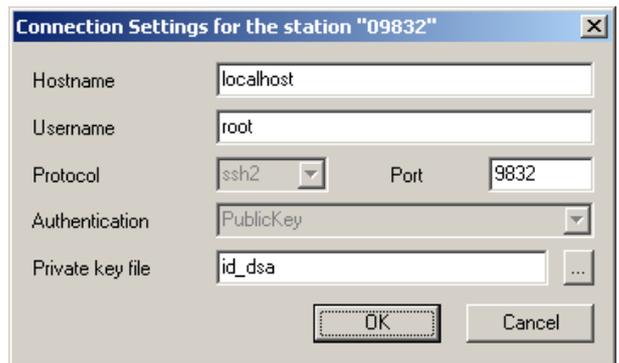
 *Private key is typically supplied with your instrument along with the configuration files. If you would like to generate new pairs of private/public keys, you have to use external SSH tools to do that, as GeoDAS does not support currently this functionality. Please refer to the IA-1 manual and to the other related documents for more information about this issue.*

Communication with GMS instruments is based on the TCP/IP link, too. But this connection is always initiated by instruments rather than by GeoDAS and therefore all parameters in this dialog are not applied to these instruments.

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 to 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. The **login in N minutes after callback from any other station** is useful when GeoDAS communicates with a network of seismic stations. If in case of an event one or more stations have called announcing newly recorded events, GeoDAS initiates check-up of all stations to ensure that event file and/or other parameters are retrieved from the entire networks of stations. If none of the above listed check-up modes is selected, GeoDAS will **never login to the instrument automatically** 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).
- **Use PC clock for time tagging**. This option should be enabled only if the instrument sending data stream is not synchronised with GPS and does not provide correct time. In this case all arriving data packets are time stamped locally by GeoDAS but the precision of those time stamps is not high: it is within several hundred milliseconds only.
- **Data requester is at...** This option is enabled for specific applications only. It is supposed that several instruments deliver data packets by requests, which are sent to all of them by GeoDAS at the same time through the separate COM port specified by this option. This approach ensures data synchronisation between different instruments. If this option is used, then two previous options shall be enabled as well.

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

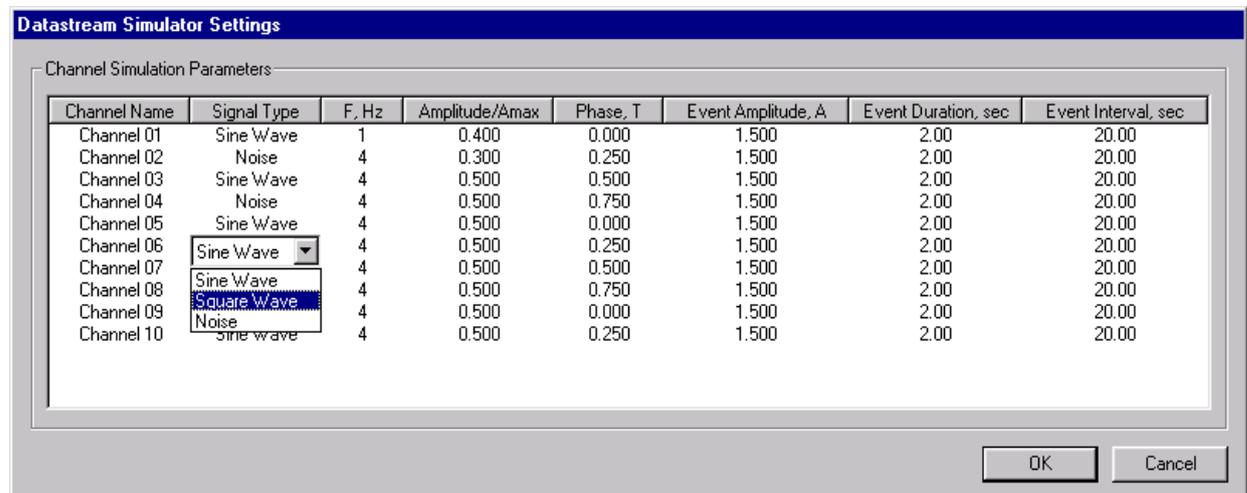
1. *All instruments connected to the same communication port can provide data streams*
 2. *All instruments have been set to communicate with GeoDAS at the same baud rate*
 3. *All of them support the "data streams by request" option and this option is enabled*
 4. *The number of instruments at the same 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 Datastream Simulation Settings dialog box appears (see below).

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

1. Signal type can be one of the types 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 $\frac{1}{2}$ of the first one and the amplitude of third component – $\frac{1}{4}$ 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. The option **"Attempt downloading any files with errors"** may only be used if you need to recover an important data file from the flash card manually, which became corrupted due to some reason. Do not use this option if the automatic file downloading is enabled. 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 store event files.

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

- **Login to single instrument.** This option, when selected, forces 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. If it is activated, 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.

- **Request and log intensity information.** This option is applicable to the Intensity recorders only. These instruments keep information about intensities of every recorded event. If the option is enabled, GeoDAS retrieves new intensity information upon every connection to the instrument and stores it into the file //GeoDAS_DATA/OutData/Intensity.csv along with the peak ground acceleration (PGA) and with some general information about every event. Refer to the Instrument Setup Manager page [Intensity Settings](#) for more information about intensity parameters.
- **Accept requests for data.** This option allow forwarding data streams to another instance of GeoDAS or to any other application, which can parse and process data packets sent by instruments. You need to indicate the IP address and port of the server (i.e. this computer where GeoDAS is running), which will be activated by GeoDAS in the format address:port. Instead of an address, you may use the word 'default', and in this case the server will be active on all network adapters of the computer.

4.10 Introducing GMS Stations to GeoDAS

Unlike GSR units, the primary communication interface of GMS instruments is Ethernet, and therefore their key parameters are listed in a separate table. Besides the **station name** defined by user, **instrument type** and a **serial number**, the table contains information about the main instrument **firmware**, and also the information about accessing instruments via the network, in particular their **Configured IP** addresses and also **Network Interface** names. The interface name as well as the **Public IP** is provided by GeoDAS for the reference only for the instruments, which are currently on-line. They cannot be altered by user. The public IP is an originating IP address from which a GMS unit connects to GeoDAS can be actually a global static IP of a router. In most cases it is the same as the IP address configured by user, which is used as a target IP when GeoDAS connects to GMS. But in certain specific configuration they can be different. If a network port forwarding is used on the other end, you may need to add a specific port number after the Configured IP.

Last column in the table is **Status**, and it may contain one or more letters, which are the following:

- N – New instrument, which did not exist in GeoDAS configuration yet
- C – already Configured earlier
- R – actual settings were Received from the instrument

The quickest way of adding new instruments into the GeoDAS configuration is to connect them to the local network and to switch them on. GeoDAS detects these instruments automatically and lists them in the table with the only status R (grey color). All you need to do for adding these instruments to the GeoDAS configuration permanently is to right-click them one by one in the table and select **Add Station to Current Configuration** from the pop-up context menu. But this approach won't work for remote units, which are behind network routers. In this case, stations shall be added manually as described below.

4.11 Context Menu of the GMS Stations Window

During configuration of GMS instruments, you can use the following functions available from the context menu activated by clicking the right mouse button.

Generate requests for configuration files

If an instrument cannot be contacted by GeoDAS at any time e.g. because it does not have a dedicated static IP address, then the only way to request something from this instrument is to generate a pending request and wait until the instrument connects and takes this request for processing. So using this menu, one can retrieve the actual configuration files from instruments, which are not connected currently.

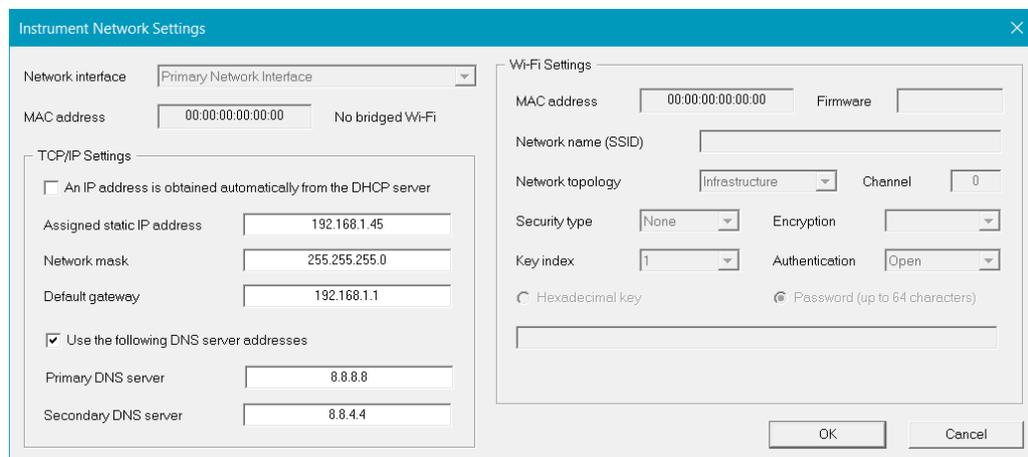
Edit Network Settings of Instrument

Unlike the network parameters listed in the dialog window Configuring Stations, these parameters are internal network settings of GMS for communication within the local area network. For instance, the static local IP address configured here cannot be entered as a **Configured IP** to access the instrument if this instrument is actually behind a network router.

GMS-18/24 instruments have the only primary network interface, which can be optionally bridged to the Wi-Fi module. GMSplus may have two fully independent network interfaces: primary wired

Ethernet and the embedded Wi-Fi interface. Each one is configured independently by selecting its type in the **Network interface** combo box.

You can configure whether the instrument receives its IP address and other network settings from the DHCP server, otherwise one has to enter the right static IP, netmask and the gateway address, as well as up to two addresses of DNS servers. You might need to consult with your network administrator before doing so.



 *If your instrument is connected to a local area network (LAN) then the automatic obtaining an IP address is the most common and correct choice unless advised to do differently by the network administrator. LANs usually have a DHCP server running and an IP will be assigned automatically. But if you connect the instrument with a network cable or wirelessly directly to your computer then you will have to assign static IP address to both unit and the computer, and the addresses must belong to the same subnetwork as set by the network mask.*

If the network interface being configured is bridged to the Wi-Fi module or if it is a secondary embedded Wi-Fi interface, one should also configure the standard wireless settings correctly:

- **SSID** (Service Set Identifier) is a public name of a wireless network, to which the instrument is connected.
- **Network topology** is set to Infrastructure if instruments communicate via an access point and it is set to Ad-Hoc in case of the direct peer-to-peer communication.
- **Channel** is a number of radio channel, which must be set for Ad-Hoc networks to ensure that all units connected to it use same radio channel frequency for communication.
- **Security settings** must match those required by the access point for wireless communication or they must be the same for all units communicating in Ad-Hoc networks. WAP, WPA and WPA2 security are supported.

Firmware number of the Wi-Fi module and its MAC address are displayed here for information only and cannot be altered.

 *As a matter of fact, the described here way of configuring network parameters works obviously only if the network link between the computer running GeoDAS and the unit is already established, i.e. the method is good for modifying the settings. For the first-time configuration of the network settings, you might still need to use the most powerful method, namely connecting to the instrument console with the serial cable and accessing related configuration parameters via the terminal application. Please refer to the GMS User Manual for the detailed information.*

Add Station to Current Configuration

As already mentioned above, this menu is used for adding autodetected stations to the GeoDAS configuration permanently.

Add New Station Manually

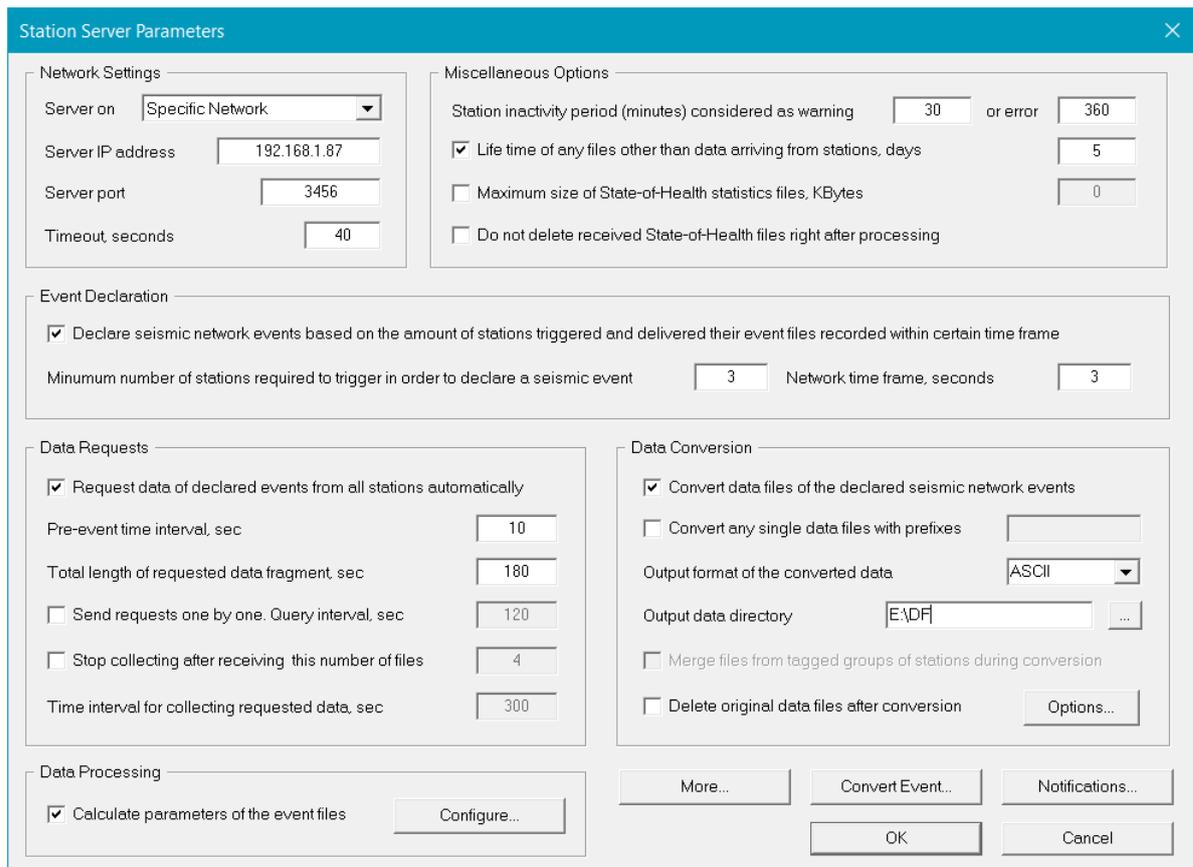
This is the only way to introduce a GMS station to GeoDAS if the station is not within the local area network or if it cannot be detected automatically due to another reason. Upon clicking this menu item,

GeoDAS adds new entry into the table, and you need to set correctly the following parameters: **station name** on your choice, a correct **serial number** of the instrument and an **IP address** to access it. The rest of information will be actualised upon the first connection to the instrument.

Besides the listed above actions, you can also select one or more stations and **Remove** them from the configuration, you can **Save** (export) current configuration to a file and **Load** it to the dialog when needed. And, finally, you can **Export** your current list of settings to a **CSV file**.

4.12 Server Configuration

A button **[Server]** in the main dialog window described above becomes enabled if at least one GMS instrument is configured. It opens another configuration dialog with different options supported by GeoDAS for this type of GeoSIG instruments only:



GMS Server is an integrate part of GeoDAS intended for communication with GMS instruments. Although GeoDAS can send few commands to GMS directly, the standard way of data exchange between instruments and GeoDAS is that instruments themselves contact GeoDAS periodically according to their communication parameters. This is done because in most cases instruments in the field do not have their dedicated global IP addresses whereas the server is assigned such an address and can be contacted at any time. An instrument is identified by its serial number; therefore, it is important to enter serial numbers correctly during configuration of instruments in GeoDAS.

Upon successful connection and authentication, a file exchange between GMS and GeoDAS is performed:

- Instruments send their data files, log files, state of health, etc.
- GeoDAS may send scripts, different kinds of requests and command files as well as firmware upgrades.

GeoDAS can perform several actions upon receiving files from GMS instruments if the corresponding parameters are set in the above dialog. These parameters are described below.

Network Settings include both **IP address and a port** of the server, i.e. computer, which GeoDAS is running on. It is required if the server has several network interfaces and connections from instruments are expected from only one of them. You can also choose to activate the server **on all available networks**, i.e. GeoDAS accepts incoming connection at any interface. In the specific applications, it might be required to

use **RAS connections** only. The **timeout** is used to decide when to terminate current network connection if the remote party does not respond within the indicated time interval. Two other timeout value belong to the group of **Miscellaneous Options** and they are used to declare **Network error** or **warning** by GeoDAS. The warning or error is declared if an instrument did not communicate with GeoDAS within the indicated period of time. Make sure that this parameter is higher than the maximum period of communication with GeoDAS set for configured GMS units. You can also choose **not to delete SOH reports after processing**. If this option is selected, all received SOH reports remain in the directory [\\GeoDAS_DATA\\StatusFiles\\InfoSOH](#). Irrespective to this option, SOH information is logged to CSV files SOH_YYYYMM.csv; one file per month. The very last SOH reports are also stored in the same directory.

GeoDAS always receives files from GMS instruments into the [\\GeoDAS_DATA\\Incoming](#) directory. Event files TRG_*.msd are moved after receiving into the Data directory, and ringbuffer files RBF_*.msd are moved into the DataStreams directory. Other types of files (e.g. log files) remain in Incoming and may occupy much space after some while. Therefore, you can limit lifetime of those files by activating the option **Life time of any files other than data**.

If many instruments are configured in GeoDAS and they report their state of health (SOH) frequently, the monthly SOH statistics files may become huge and difficult to view. In order to limit size of these files, use the option **Maximum size of State-of-Health statistics files, Kbytes**.

GeoDAS can be instructed to analyse event data files received from configured GMS instruments to see if they belong to the same earthquake and to declare an event if it is so. You need to enable the option **Declare seismic network events** in order to do so. A network event is declared if at least **Minimum number of stations** triggered within the **Network time frame**. Received even files can be **converted to ASCII or Seisan format**. In the latter case, a **Seisan database** located on the same computer shall be selected. After successful completion of the above actions, **original data files can be deleted**.

 If SEISAN package is installed on the same computer, it is possible to launch any Seisan routines right after storing data into the database. For instance, automatic phase picking with autopic can be useful, or magnitude estimation with automag. The related commands shall be listed in the file [GeoDAS_DATA\\Config\\Seisan.bat](#), which is launched with a name of the last created S-file as a parameter.

One can convert not only data files that belong to a declared seismic network event but also **any single data files** in miniSEED format arriving from instruments. Just enter their prefixes, e.g. TRG_ USR_.

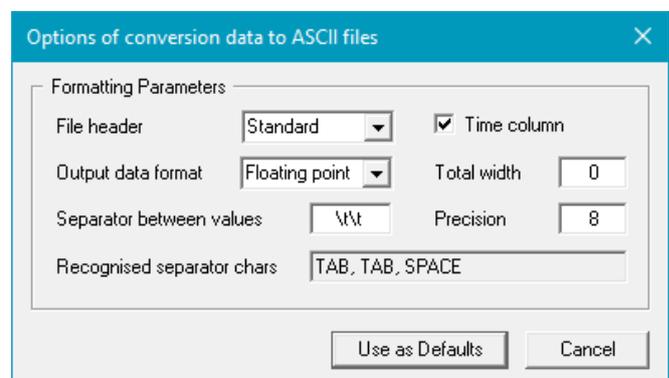
Upon declaration of seismic events as per the above described settings, one can initiate **requests for data from all stations** of the seismic network, even from those that did not report any triggers. For the data requests, you must specify the **pre-event time interval**, which will be counted back from the network trigger time, and also the **total length of data fragment** in seconds. The requests are sent to all stations simultaneously by default. However, if you would like to distribute the load on communication channels, one can also choose to **send requests one by one** and to set the **query interval** in seconds (between requests).

Requested data files can also be processed and **converted automatically** after receiving data from a **number of stations** or upon a **certain timeout**.

GeoDAS can send notifications about declared events by e-mail to a number of recipients. This feature is configured using different dialog, which is accessible by pressing the button **[Notifications...]**.

Event files can also be converted to ASCII or to SEISAN manually at any time by clicking the button **[Convert Event...]**.

Press **[Options]** for adjusting the format of ASCII files. Please refer to the [Appendix B. ASCII file format used by GeoDAS](#) for description of the ASCII file format.



 Further data processing is specific to particular applications and therefore the related parameters are set in another dialog window accessible by pressing the button **[More...]**. If you are running the standard version of GeoDAS, and your application does not require specific features, this button will be greyed (disabled).

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 described below.

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:

The screenshot shows the 'Instrument Setup Manager' dialog box for station 'STA05'. The dialog has a title bar with a close button. Below the title bar is a row of tabs: Sampling, Event Trigger, Alarms, Channels, Communication, Time Triggers, Errors and Warnings, Interconnection, Data Streams, Printer, Batch Mode, Station, Instrument, Power and Batteries, Date and Time, Test, and LCD Display. The 'Station' tab is selected. The main area is titled 'General Station Information' and contains a 'Station Info' section with fields for Station code (STA), Location (Glattbrugg), Restarts (1), Altitude (00000), Latitude (47°25.800N), and Longitude (008°33.200E). There are buttons for 'Reset Restarts Counter' and 'Update from GPS'. Below this is a 'Check and Comments' section with fields for Date of Installation (01.01.1997), Date of Last Check (01.01.1997), Checked by (GS), and a Comment field (GSR-18 GeoSIG). On the right side, there are buttons for Refresh, Put Page, Put All, Reset, Import, Export, and Exit. At the bottom, there is a Status field showing 'Normal operation' and a Disconnect button.

 The Instrument Setup Manager is launched to configure GSR and similar GeoSIG instruments. New generation of instruments (GMS units) are configured as described in the section [Configuration of GMS Instruments](#).

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.

 *The Instrument Setup Manager cannot be started prior to the very first login to the instrument. Therefore, you have to login to any newly configured instrument at least once. Then all actual instrument parameters are retrieved and, hence, can be displayed correctly in the pages described below.*

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.

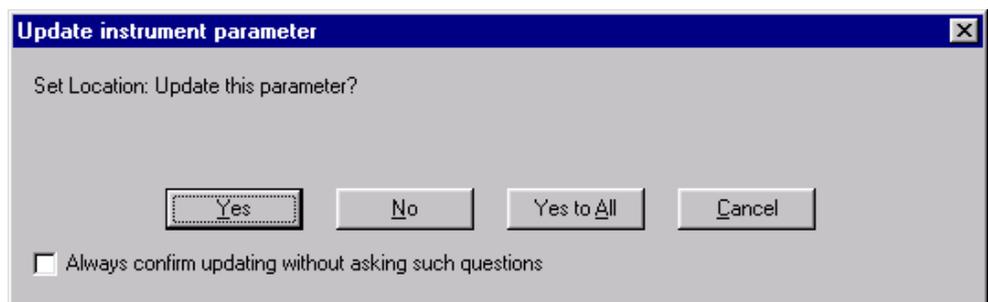
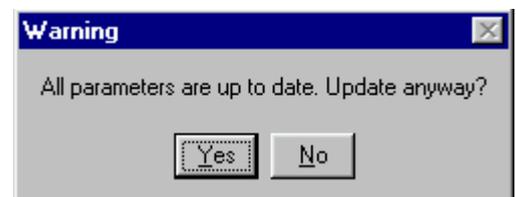
5.2 The Control Buttons

 *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.

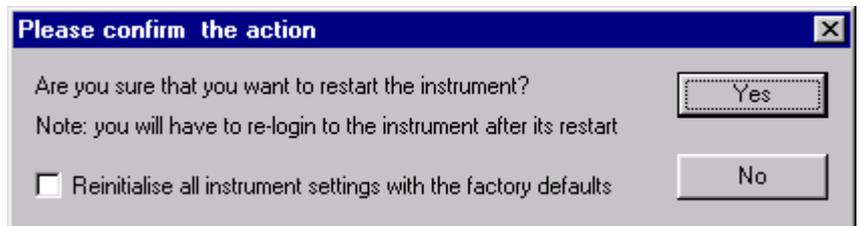
Next buttons are used to send parameters to the instrument, either those shown in the active page (**[Put Page]**) or all parameters from all the information pages (**[Put All]**). In any case the parameters to be sent out are validated first and then they are compared with the real instrument parameters. 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 though there are versions of firmware supporting up to five 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 DD - 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 Rage]** to do so.

5.4 Instrument Parameters

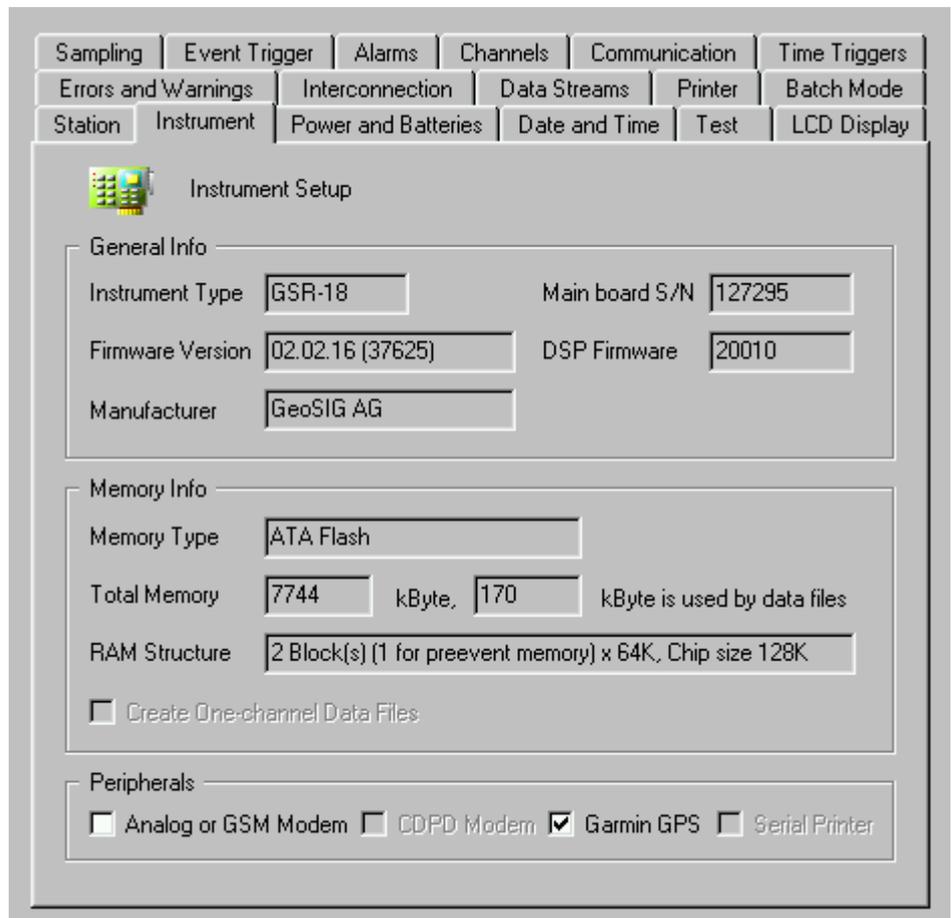
The parameters of this page indicate general information about the instrument itself. If they are greyed, they are not editable.

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.

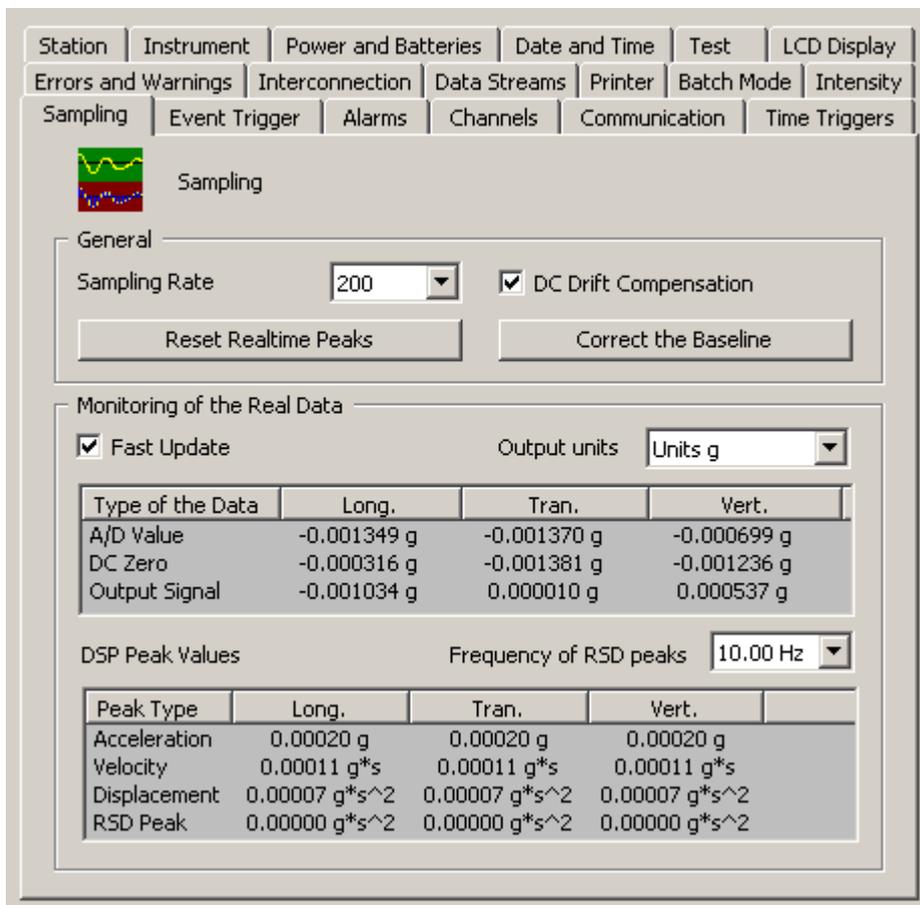
Therefore, please, refer to the instrument's manual to check for available sampling rates for your instrument.

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.



The upper table indicates three parameters: current value at the output of A/D converter, DC offset and the current value of the output signal calculated from the first two parameters. You can select with the combo box **Output units** whether these three parameters are displayed in counts or in the actual physical units. Displaying them in Volts is possible only for those firmware versions, which support the information about input ranges that should be set correctly in the **page Channels**. The option **Fast Update** causes all three parameters to be updated approximately 4-5 times per second, which can be useful while calibrating the recorder and/or sensor.

DSP peak values in the lower table are available for GSR-18 instruments only. The Response Spectrum Acceleration or Displacement (RSA or RSD) is always calculated at several frequencies. You can monitor 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 Full-scale values of the sensor.

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. Note that this list can be different for different types of instruments. If you do not see your sensor in the list, the first type ('Custom') shall be selected. In this case you have to set correctly the unit name and the full scale according to the actual parameters of your sensor.
- **Full scale** of the sensor (separately for each of three gains)
 - ☞ 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.
- **Axis direction** (positive or negative, i.e. inverted)
- Input **voltage range** of your instrument. This option is not supported by all firmware versions.
 - ☞ Note: setting of the voltage range is only required to see the actual ADC input voltage in the page Sampling correctly. This parameter does not change the real input range, which is fixed by hardware settings during manufacturing of the instrument.

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.

Channels Setup

General Settings

Gain1 is always selected Selected Gain: Gain 1

Instrument channels: 3 ADC resolution of the instrument, bits: 22

Channel Settings:

Make sure that Sensor Type is specified correctly for each channel. Verify that channel units and the sensor full scales are correct for all supported gains. Full scale is indicated as a half of real measurement range, i.e. 2.0 is for ±2g sensors.

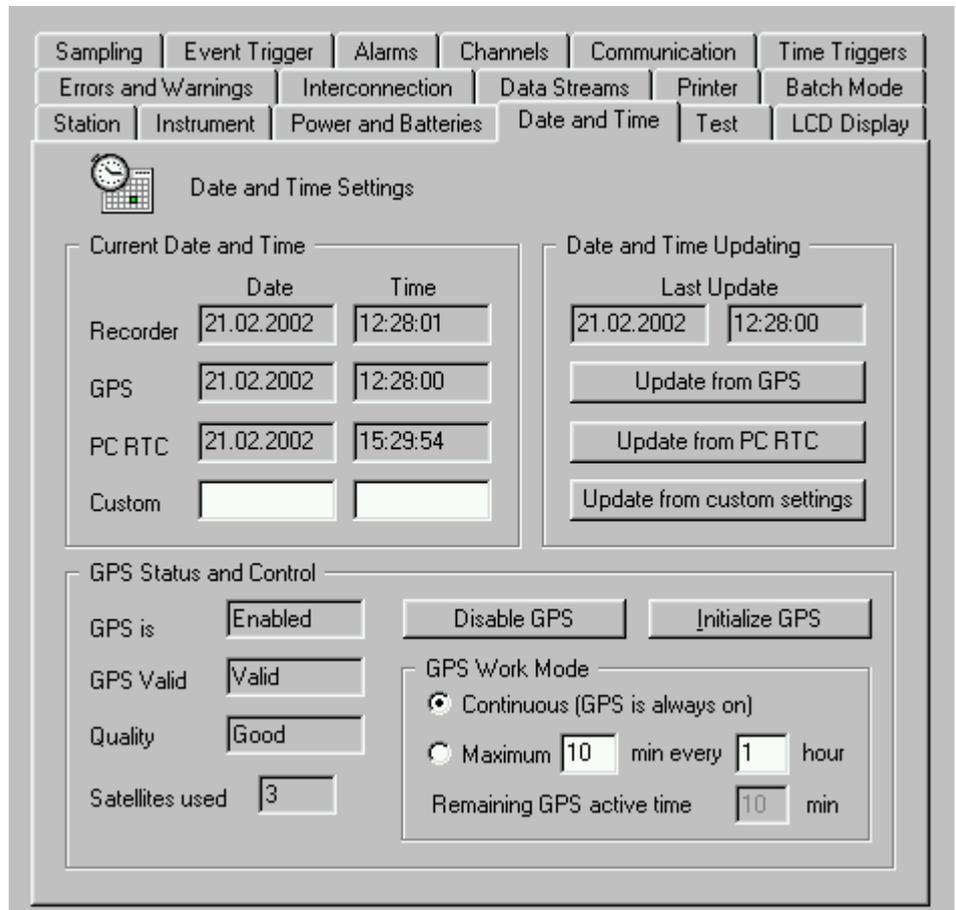
For the sensor type, which is not listed, select type "Custom" and enter correct full scale(s) and physical units.

Comp...	Units	Sensor	Gain0	Gain1	Gain2	Axis	Range
Long.	g	Custom	2.00000	2.00000	2.00000	Pos	0±10V
Tran.	g	AC-23 ±1g	1.00000	1.00000	1.00000	Pos	0±10V
Vert.	g	AC-63 ±2g	2.00000	2.00000	2.00000	Pos	0±10V

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.

The GPS related information should be interpreted as following:

GPS is	GPS Valid	Quality	Satellites used	Description
Disabled	No Info	No Info	0	GPS is disabled
Enabled	No Info	No Info	0	GPS is not connected or no information is received from it
Enabled	Invalid	Not good	0	GPS is connected and provides the information but less than three satellites are available
Enabled	Valid	Good	3 and more	Reception and the data quality are good. Data from GPS is used to update the instrument real time clock

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](#)

The screenshot shows the 'Serial Data Streams' configuration window. At the top, there is a menu bar with the following items: Sampling, Event Trigger, Alarms, Channels, Communication, Time Triggers, Station, Instrument, Power and Batteries, Date and Time, Test, LCD Display, Errors and Warnings, Interconnection, Data Streams, Printer, and Batch Mode. The 'Serial Data Streams' window is titled 'Serial Data Streams' and contains two main sections: 'Serial Data' and 'IASPEI Stream'. In the 'Serial Data' section, there is a checkbox for 'Enable Serial Data Output', a 'Serial Data Type' section with radio buttons for 'Stream of samples' and 'Stream of packets' (the latter is selected), and a checkbox for 'Send data packets by request only'. Below this is a 'Serial Data Channels' section with radio buttons for 'Three channels' (selected) and 'One Channel'. The 'IASPEI Stream' section has a 'Synchrocharacter for the output stream' field set to '0x0F' and a 'Sampling Rate of IASPEI Stream' section with radio buttons for '50 Hz, stream output at 4800 baud', '100 Hz, stream output at 9600 baud' (selected), and '200 Hz, stream output at 19200 baud'.

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 Page]**, 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 cannot 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.

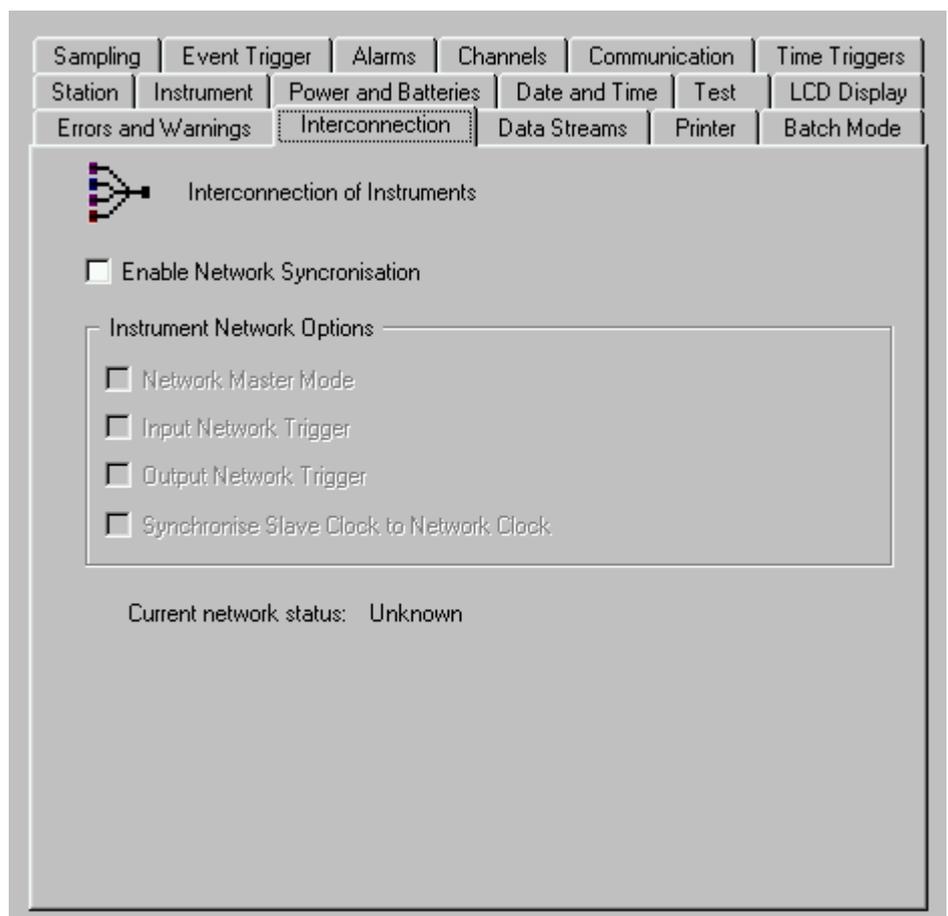
The last group of controls is intended for an instrument password change. You can enter the new password with confirmation in both on-line and off-line mode. As soon as it is entered, press the button **[Change Password]**. If you are staying off-line, the password will be changed locally and it will 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. Note that the password is changed in this way for the current login level, which is indicated as **LogOn Level**. If you would like to login at the level, which is different from the current one, you have to proceed as following:

- Press the button **[Disconnect]** to log out. The **Old Password** field becomes grey
- Enter the password corresponding to the desired login level in both **New password** and **Confirm new password** fields and press the button **[Change Password]**
- Press the button **[Connect]**. If the password is correct, you will see that the new **LogOn Level** is indicated after login. The new password is stored by GeoDAS and will be used later on as default one.

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 updated during the event recording.

Component	STA/LTA	Level	Threshold	Units
Long.	No	Yes	0.099976	g
Tran.	No	Yes	0.099976	g
Vert.	No	Yes	0.099976	g

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. Some firmware versions support also the option of **voting logic**. If it is enabled, the instrument triggers if either vertical component or both horizontal components are in the trigger state i.e. in this case either horizontal component has only half of the vote required to declare an event trigger.

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.

Com...	STA/LTA	Level	Threshold	Units	ER Save	PR Save
X	No	No	0.915525	mm/s	Yes	No
Y	No	No	0.915525	mm/s	Yes	No
Z	No	No	0.915525	mm/s	Yes	No
V.Sum	No	Yes	0.915525	mm/s	No	Yes

- **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.

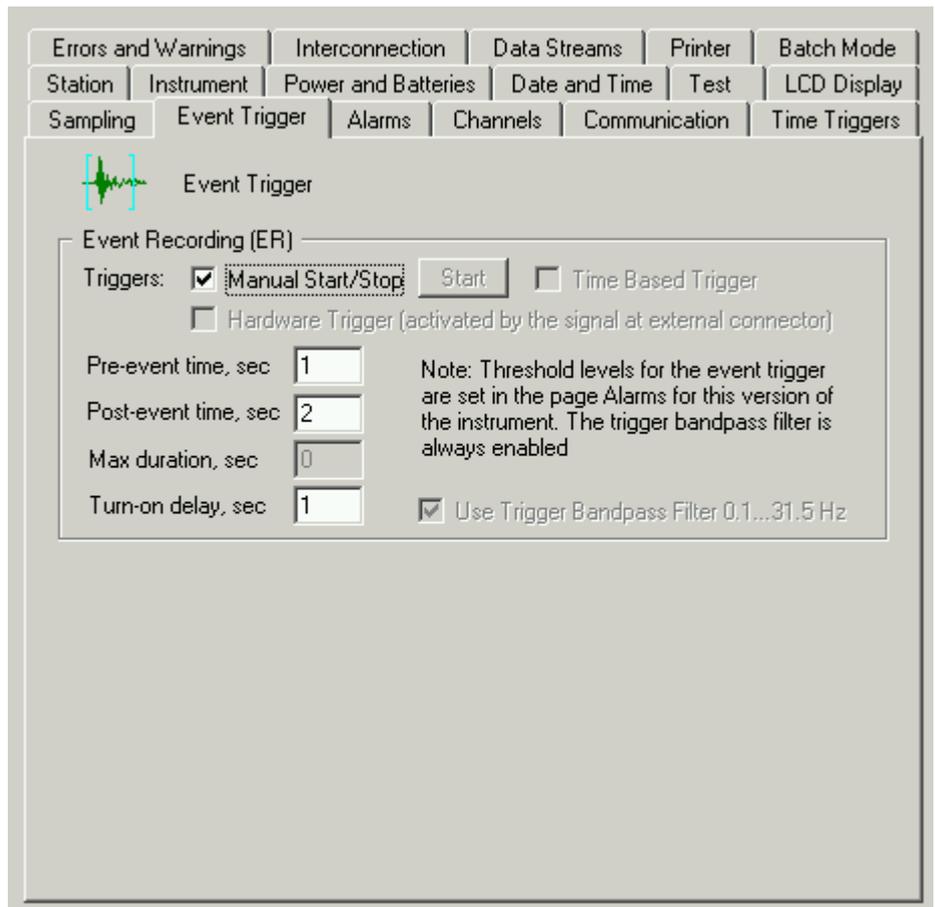
The buttons **[ER]** and **[PR]** indicate whether recording capabilities are turned on or off. These buttons are used to start or stop ER and/or PR correspondingly.

The current status of both recording types is indicated under the "Status of event trigger" with the abbreviations and corresponding colors. It can be one of the followings:

- REC (orange) – recording now
- RDY (green) - ready to record, i.e. waiting for the trigger to occur
- DIS (gray) – disabled
- OFF (gray) – recording is not possible at the moment
- ERR (red) – error, e.g. memory is full.

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 indicating 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.

Time based triggers

GBV Time Trigger

Trigger date Run time based trigger times:

Trigger time Starting from the trigger date and time

Duration, sec Daily at the indicated trigger time, or

Trigger continuously until memory is full

GCR Time Trigger

Trigger every day starting from the date ending on

Start trigger time End trigger time

GSR Time Trigger

Duration	Date	Time	Days	Hrs	Min	Sec	Num
0			0	0	0	0	0
0			0	0	0	0	0
0			0	0	0	0	0
0			0	0	0	0	0

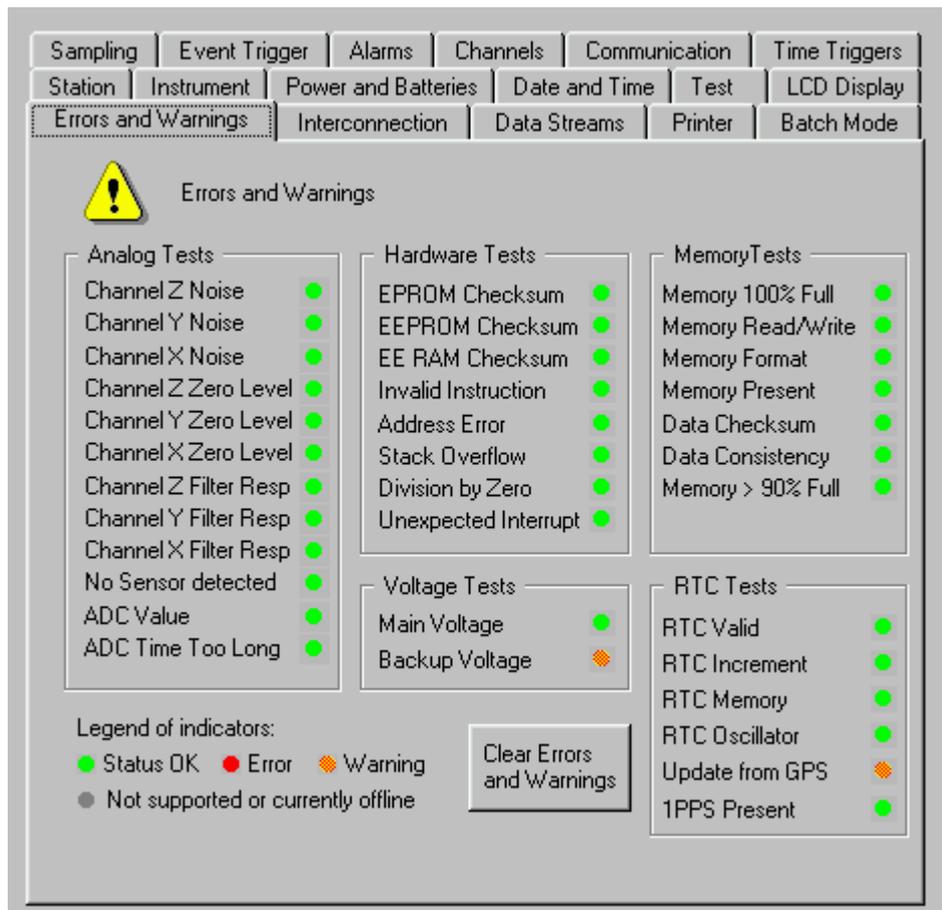
 *If you are going to use the time triggers, do not forget to enable the **Time Based Trigger** option in the [Event Trigger Parameters](#).*

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 and 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.



Errors and Warnings

Category	Item	Status
Analog Tests	Channel Z Noise	●
	Channel Y Noise	●
	Channel X Noise	●
	Channel Z Zero Level	●
	Channel Y Zero Level	●
	Channel X Zero Level	●
	Channel Z Filter Resp	●
	Channel Y Filter Resp	●
	Channel X Filter Resp	●
	No Sensor detected	●
	ADC Value	●
	ADC Time Too Long	●
Hardware Tests	EPROM Checksum	●
	EEPROM Checksum	●
	EE RAM Checksum	●
	Invalid Instruction	●
	Address Error	●
Voltage Tests	Main Voltage	●
	Backup Voltage	●
		●
Memory Tests	Memory 100% Full	●
	Memory Read/Write	●
	Memory Format	●
	Memory Present	●
	Data Checksum	●
	Memory > 90% Full	●
RTC Tests	RTC Valid	●
	RTC Increment	●
	RTC Memory	●
	RTC Oscillator	●
	Update from GPS	●
1PPS Present	●	

Legend of indicators:
 ● Status OK ● Error ● Warning
 ● Not supported or currently offline

Clear Errors and Warnings

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]**.

	Date of		Voltages, Volt	
	Installation	Replacement	Actual	Minimal
Main	20.12.2001	20.12.2004	13.52	10.6
Backup	20.12.2001	20.12.2006	3.14	2.7

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.

Component	Low Threshold	High Threshold	Units
Long.	0.099976	0.500000	g
Tran.	0.099976	0.500000	g
Vert.	0.099976	0.500000	g

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.

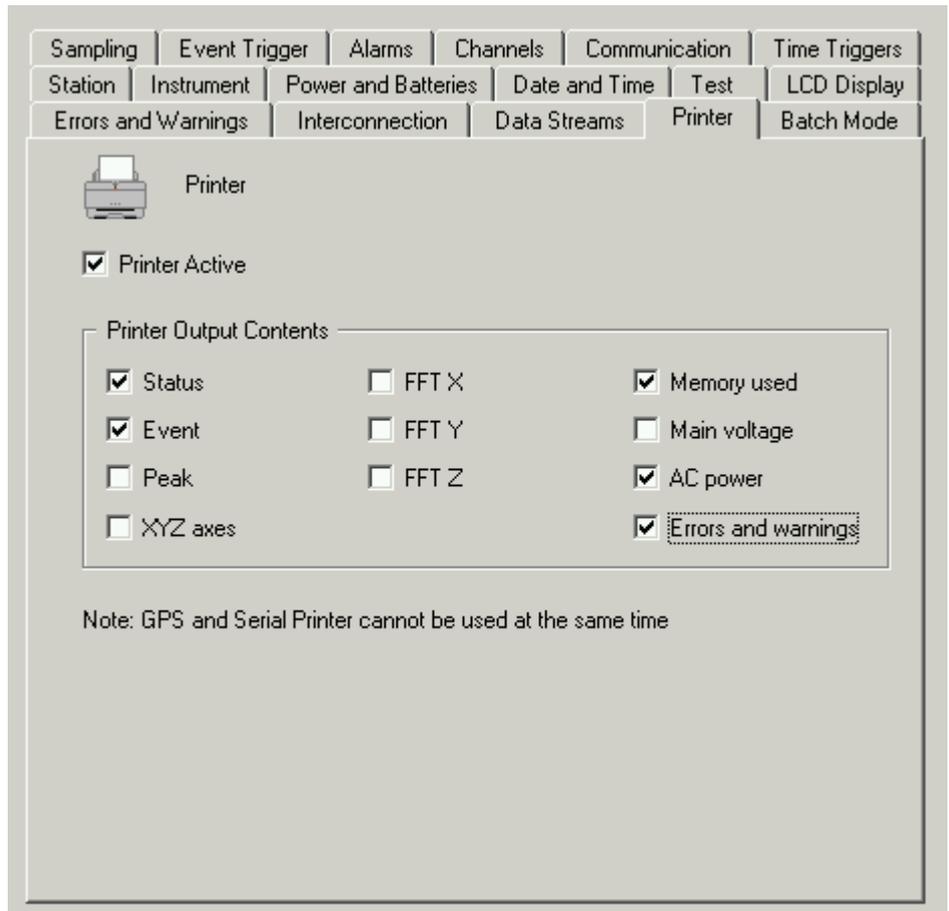
With the last group of controls, you can instruct the instrument to provide information about detected events. If **Send EVT** is enabled, the first message is sent out as soon as the event has triggered. This message can be repeated after the specified time interval if the event trigger is still active. 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. All EVT and FIL notifications (except very first EVT message, which has no valid data) decoded correctly are logged into the file SMReports_YYYY.csv, which can be found in the directory OutData located under the GeoDAS root data directory.

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 tick boxes 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.

Sampling | Event Trigger | Alarms | Channels | Communication | Time Triggers
 Errors and Warnings | Interconnection | Data Streams | Printer | Batch Mode
 Station | Instrument | Power and Batteries | Date and Time | Test | **LCD Display**

 LCD Display Settings

General	Errors and Warnings	Data and Events
<input checked="" type="checkbox"/> User Comment	<input checked="" type="checkbox"/> E/W Analog 1	<input checked="" type="checkbox"/> STA X
<input checked="" type="checkbox"/> Date	<input checked="" type="checkbox"/> E/W Analog 2	<input checked="" type="checkbox"/> STA Y
<input checked="" type="checkbox"/> Time	<input checked="" type="checkbox"/> E/W Hardware	<input checked="" type="checkbox"/> STA Z
<input checked="" type="checkbox"/> Memory Used	<input checked="" type="checkbox"/> E/W Clock	<input checked="" type="checkbox"/> LTA X
<input checked="" type="checkbox"/> Memory Free	<input checked="" type="checkbox"/> E/W Voltage	<input checked="" type="checkbox"/> LTA Y
<input checked="" type="checkbox"/> Number of Files	<input checked="" type="checkbox"/> E/W Memory	<input checked="" type="checkbox"/> LTA Z
<input checked="" type="checkbox"/> Number of Events		<input checked="" type="checkbox"/> STA/LTA X
<input checked="" type="checkbox"/> Main Voltage		<input checked="" type="checkbox"/> STA/LTA Y
<input checked="" type="checkbox"/> Modem Status		<input checked="" type="checkbox"/> STA/LTA Z
		<input checked="" type="checkbox"/> Last Peak in X
		<input checked="" type="checkbox"/> Last Peak in Y
		<input checked="" type="checkbox"/> Last Peak in Z
		<input checked="" type="checkbox"/> Absolute Peak

Other Options
 Blasting/Vibration Controller

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. If annunciator detects a trigger error, the **Error** message is indicated in this column instead of Enabled. The general system error is also activated in this case.

Ch	Site	Trigger	Status	AC power	Link
1	FFS	Enabled	Ok	Ok	Ok
2	SBS	Enabled	Ok	Ok	Ok
3	RBS	Enabled	Ok	Ok	Ok
4					

The group “**Annunciator Settings**” has several adjustable parameters. The **minimum number of stations for common trigger** 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 **PC watchdog timeout** 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. GAN counts **watchdog timeout** cases and keeps **date and time of the last timeout**. You can clear this information by pressing the **[Reset]** button.

Annunciator can generate four alarm signals, which are indicated in the **Annunciator Panel**. The exact set of alarms is hardware dependant but the most commonly used are: COMMON TRIGGER, OBE, SSE and ERROR (or COMMON TROUBLE) alarms. 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

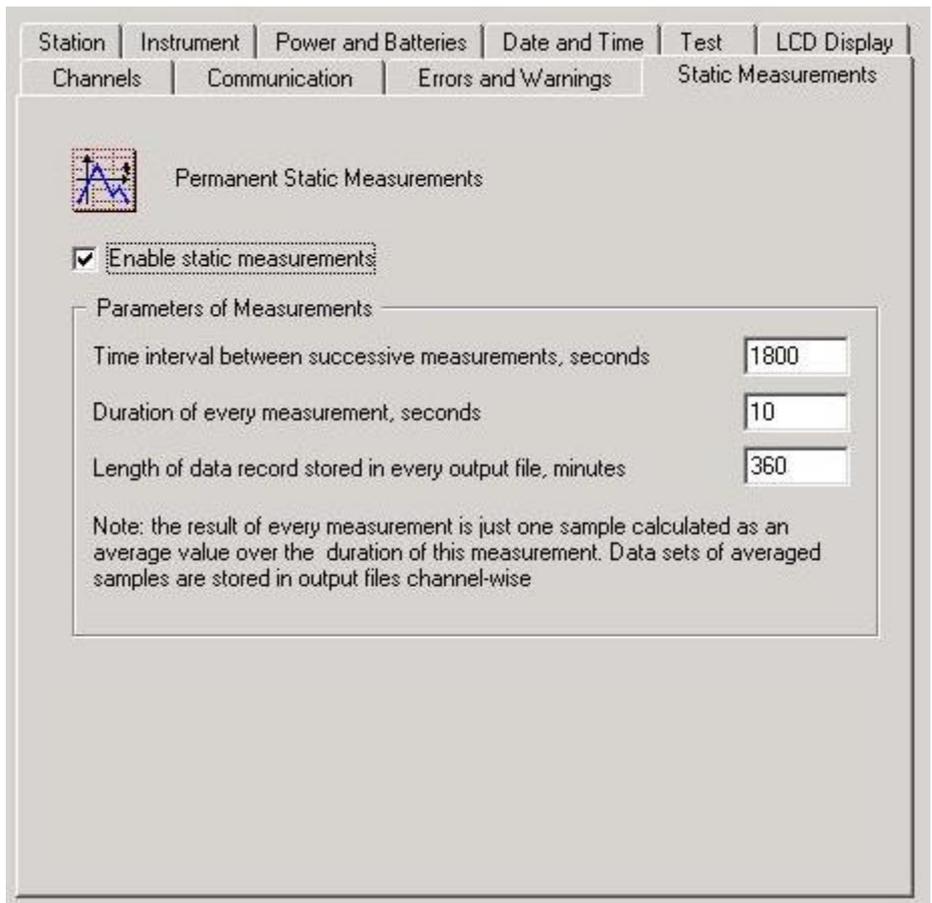
OBE/SSE event checks. Please refer to the [Appendix J. Event Checks](#) for more information about this extended GeoDAS functionality.

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](#).

5.21 Static Measurements

This setup page is available only for the specific version of the GSR-18 recorder firmware, which permanently performs static measurements, i.e. acquisition of the slowly changing physical data. The option **Enable static measurements** shall be selected in order to activate data recording. Every stored value is an average of several measurements taken within the time interval specified by the parameter **Duration of every measurement**. The other parameter called **Time interval between successive measurements** specifies the rate of averaged samples, in seconds. **Length of data record stored in every output file** is the last parameter available for adjusting and it is set in minutes.

 *Note: deleting all files and formatting the ATA card is not possible when data acquisition is going on. One has to disable the measurement first then to perform formatting.*



Station | Instrument | Power and Batteries | Date and Time | Test | LCD Display

Channels | Communication | Errors and Warnings | Static Measurements

 Permanent Static Measurements

Enable static measurements

Parameters of Measurements

Time interval between successive measurements, seconds

Duration of every measurement, seconds

Length of data record stored in every output file, minutes

Note: the result of every measurement is just one sample calculated as an average value over the duration of this measurement. Data sets of averaged samples are stored in output files channel-wise

5.22 Intensity Settings

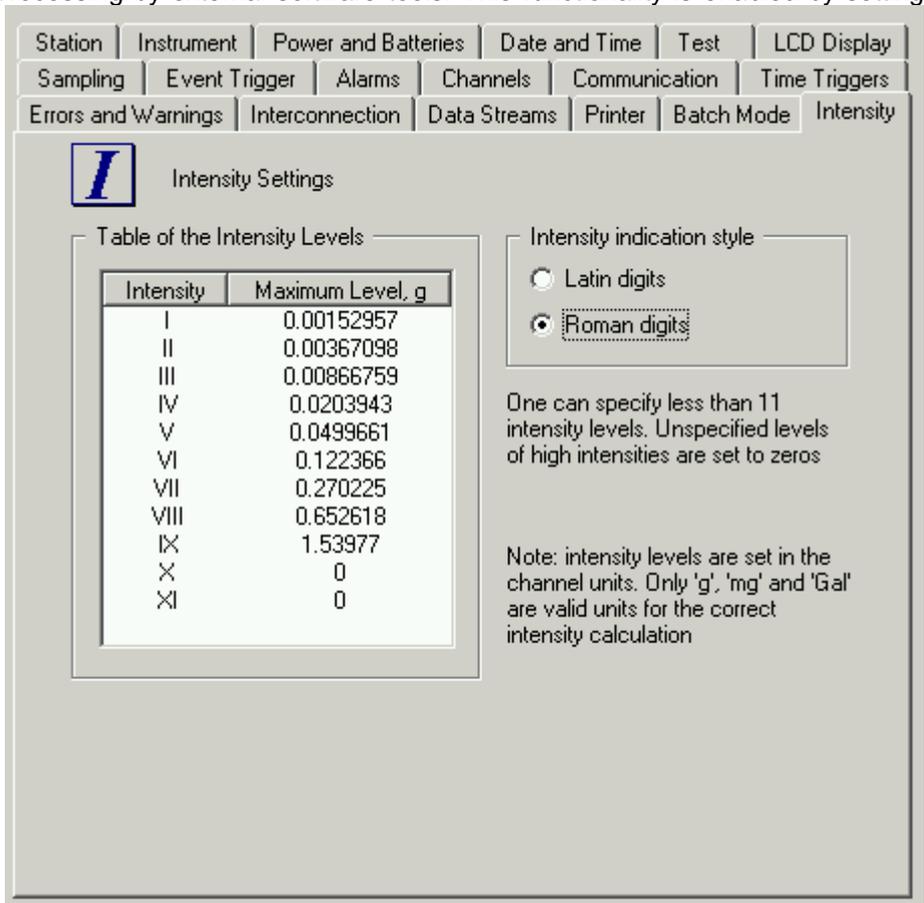
This setup page is available only for the GeoSIG Intensity Recorders. These instruments are capable of calculating intensity levels of recorded seismic signals. They deliver this information to GeoDAS, which logs it to the intensity file for further processing by external software tools. This functionality is enabled by setting the option "Retrieve and log intensity information" in the [Work Options](#) of corresponding recorder.

Table of the Intensity Levels specifies up to 12 levels of intensities, which can be adjusted by users. Note that these levels shall be provided in the channel units set in the Channels page.

 **Note:** *GeoDAS recognises only g, mg and Gal units of acceleration. Settings any other sensor units in the Channels page will cause incorrect intensity calculation.*

You may leave zero one or more last (highest) levels. They will be considered as non-specified.

Usually Roman digits represent intensity levels but you can change this **Intensity indication style** if Latin digits are preferable.



Intensity Settings

Table of the Intensity Levels

Intensity	Maximum Level, g
I	0.00152957
II	0.00367098
III	0.00866759
IV	0.0203943
V	0.0499661
VI	0.122366
VII	0.270225
VIII	0.652618
IX	1.53977
X	0
XI	0

Intensity indication style

Latin digits

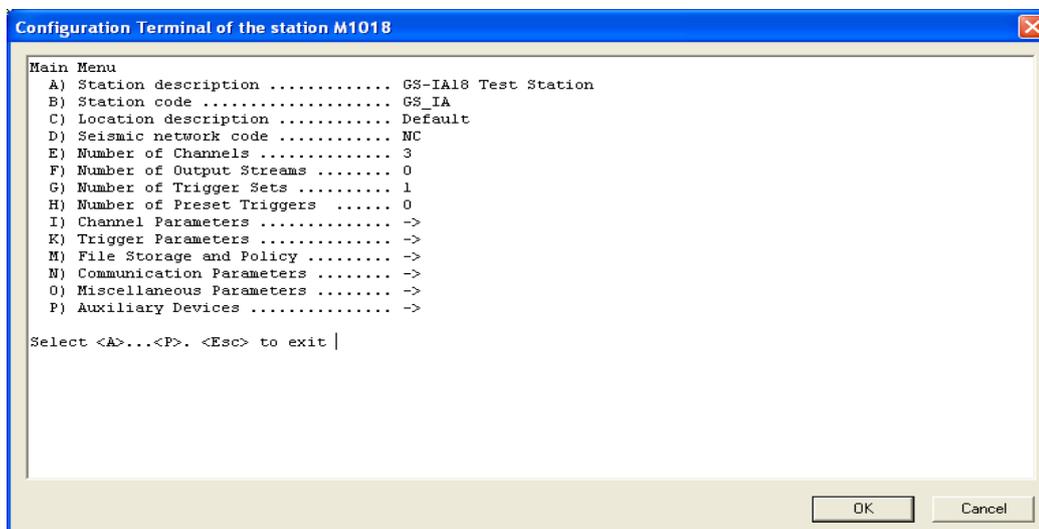
Roman digits

One can specify less than 11 intensity levels. Unspecified levels of high intensities are set to zeros

Note: intensity levels are set in the channel units. Only 'g', 'mg' and 'Gal' are valid units for the correct intensity calculation

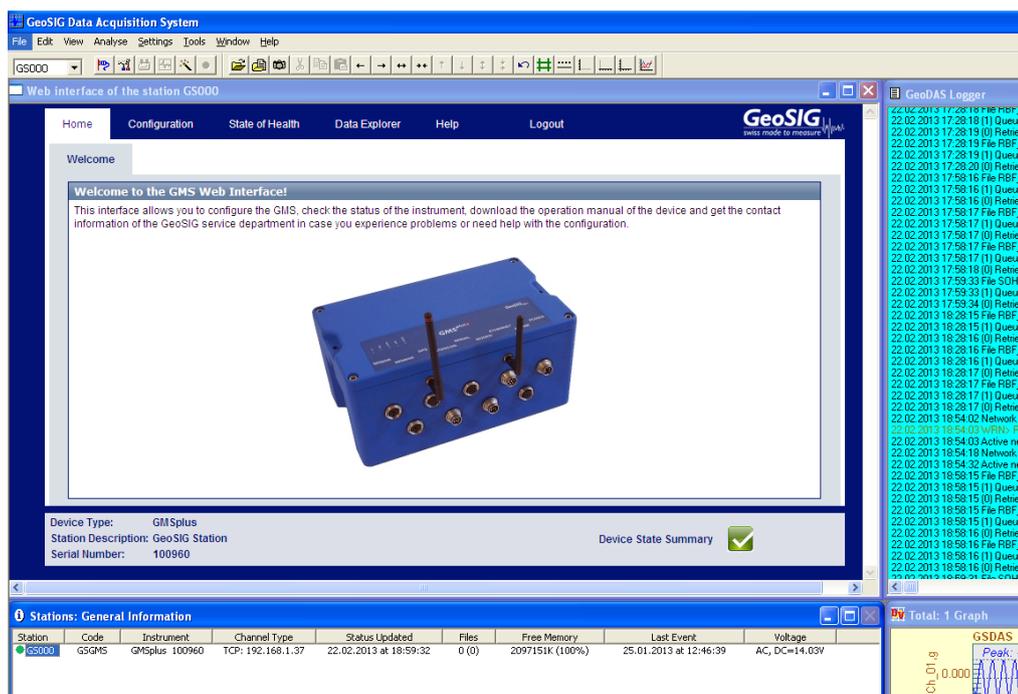
5.23 Configuration of GMS Instruments

GMS-18/24 instruments are configured differently than the standard old-style GSR instruments. Instrument Setup Manager is not applicable for them and their configuration is performed using the ASCII configuration terminal, which is shown below.



In order to modify a menu item, just press the letter key indicated next to it and <Enter>. The <Esc> key brings you up to the previous menu level. When configuration is finished, press **OK** to update the configuration file locally and to prepare it for sending to the selected GMS instrument. As soon as this instrument contacts GeoDAS next time, the file will be send to it and the instrument will be restarted in the new configuration.

Newer generation of GMS instruments, GMSplus, supports also configuration via the Web Interface, and you will be asked whether you want to use this option or the classical terminal. Selecting the 1st option opens a browser-like window in GeoDAS, and you can browse here through the different configuration, state of health, data explorer and other menu.



 For detailed description of all GMS configuration parameters, please refer to the User Manual of GMS.

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.

 *This section is not applied to GMS family of instruments.*

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.

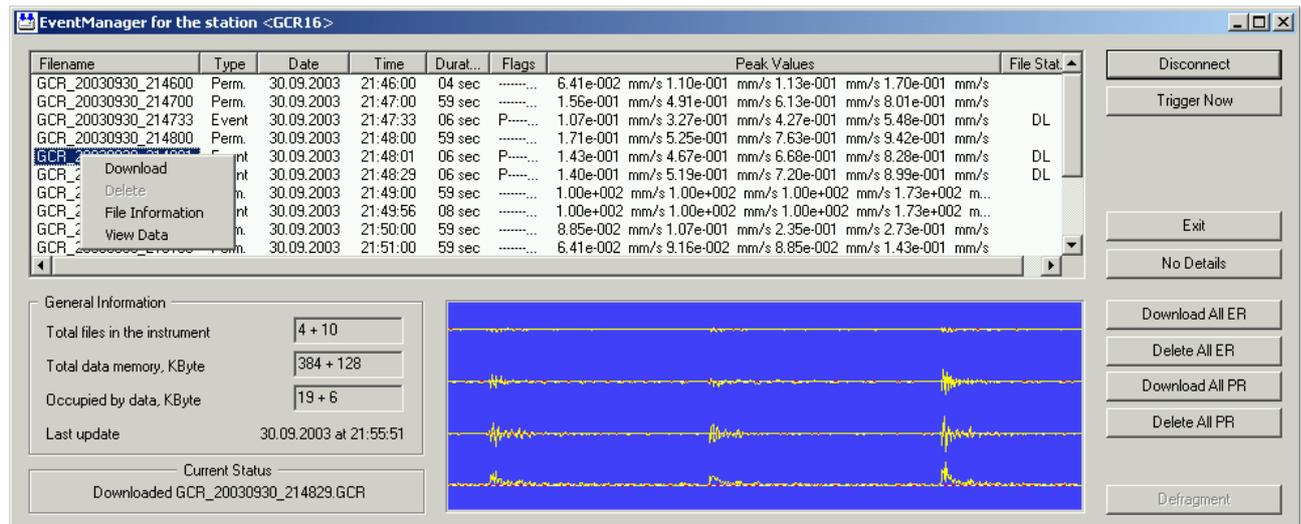
6.2.1 Working with the Event Manager

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. This operation may take long time. The button is called **[Download All ER]** in case of the GCR instrument.

[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. The button is called **[Delete All ER]** in case of the GCR instrument. If the GeoDAS password is set (Settings -> Miscellaneous) then you will be asked to type it during this operation.

[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.

- 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.*

 *Note: GeoDAS does not download ring buffer files of the IA-1 instruments automatically. This can be done in the manual mode only. Event files generated on exceeding the specified spectral intensity (SI) thresholds are downloaded automatically.*

7 The Main Menu

This section describes systematically all functions accessible via GeoDAS menu. **Note that GeoDAS menus, including the pop-up ones, may be altered automatically depending on the types of configured instruments and depending on the scope of tasks performed by the application.** Therefore, the content of certain menus shown on the screenshots in this and in some other sections may look slightly different in your particular configuration.

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.

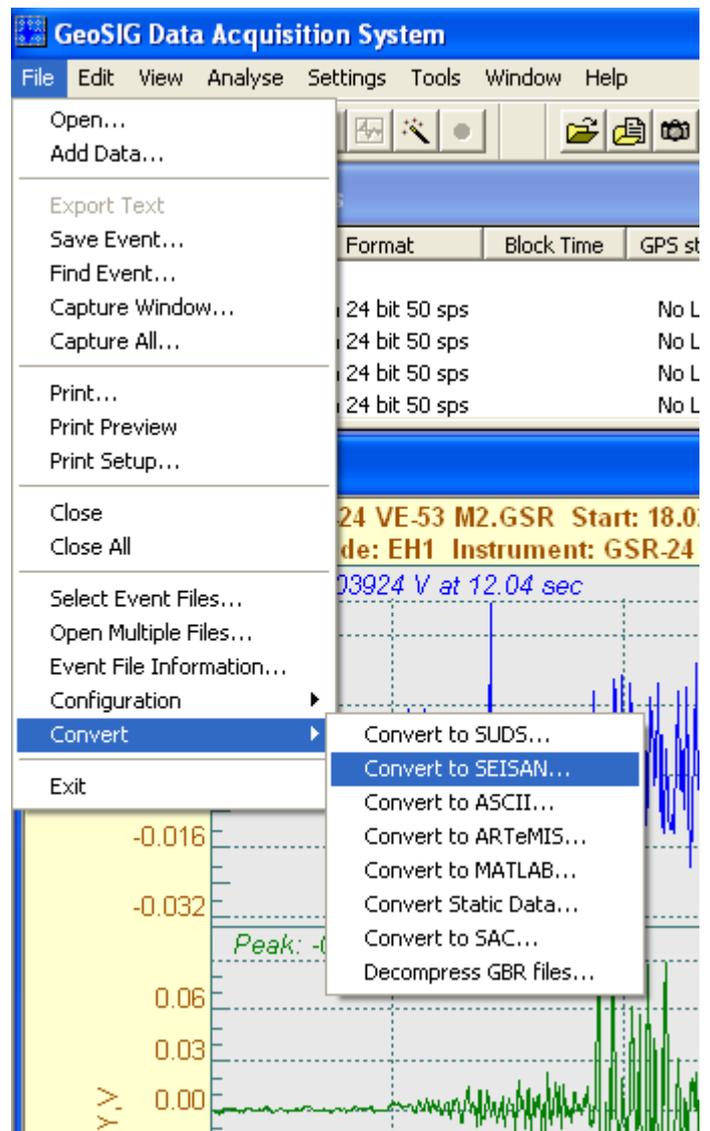
Export Text

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

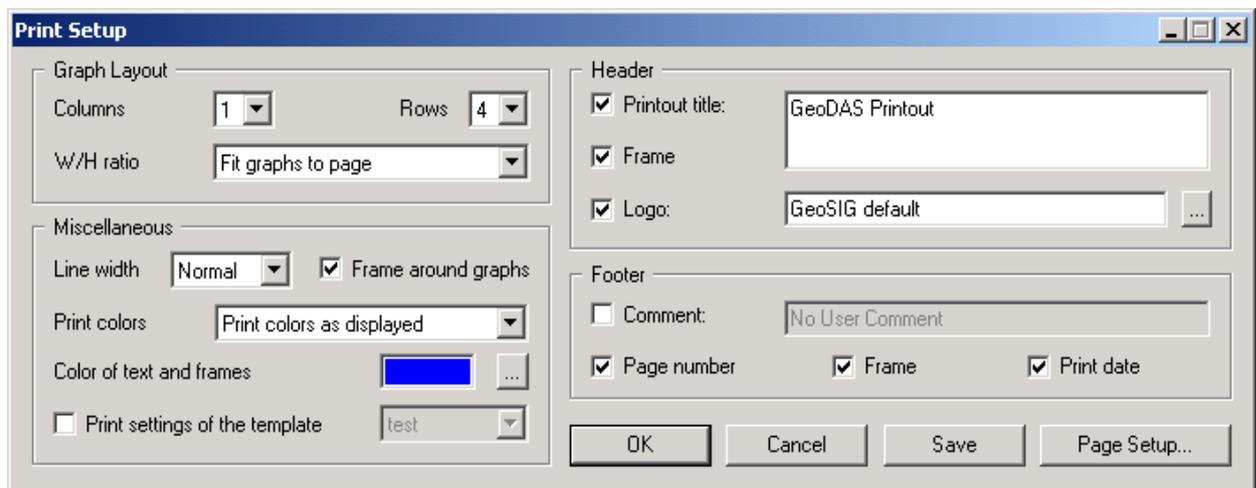
Prints the contents of an active ODV window

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 or 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 white**. The third option combines these two options in a way that the conversion is performed for the **black and white 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

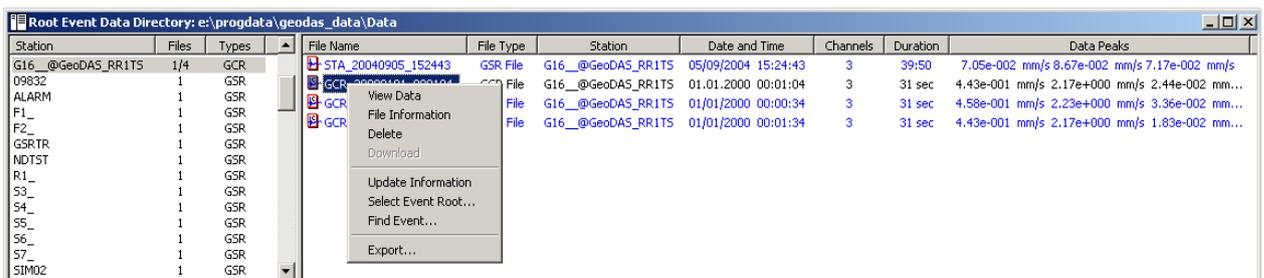
Closes the active ODV window.

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:



Station	Files	Types	File Name	File Type	Station	Date and Time	Channels	Duration	Data Peaks
G16__@GeoDAS_RR1TS	1/4	GCR	STA_20040905_152443	GSR File	G16__@GeoDAS_RR1TS	05/09/2004 15:24:43	3	39:50	7.05e-002 mm/s 8.67e-002 mm/s 7.17e-002 mm/s
09832	1	GSR	GCR_00000000_000000	GCR File	G16__@GeoDAS_RR1TS	01.01.2000 00:01:04	3	31 sec	4.43e-001 mm/s 2.17e+000 mm/s 2.44e-002 mm/s
ALARM	1	GSR							
F1_	1	GSR							
F2_	1	GSR							
GSRTR	1	GSR							
NDTST	1	GSR							
R1_	1	GSR							
S3_	1	GSR							
S4_	1	GSR							
S5_	1	GSR							
S6_	1	GSR							
S7_	1	GSR							
SIM02	1	GSR							

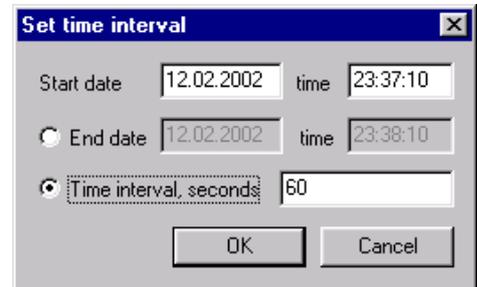
If you have an experience working with GeoSIG CloseView data analysis program, you will probably find this tool similar to the CloseView file selection procedure. First of all, select the station(s) of your interest in the left part of the window and the list of files recorded by selected station(s)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

The names of remote stations are displayed in the format station@remote_node, where remote_node is the network name of the remote instance of GeoDAS. Refer to the [Appendix G. Network Links of GeoDAS](#) for more information about the configuration of network links. Stations of the remote instances of GeoDAS appear in this window if these instances allow downloading of event files by the remote clients. 2nd column indicates how many files are already downloaded and how many files are in total. Information about remote files that are not yet downloaded is displayed in blue color in the right part of window.



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

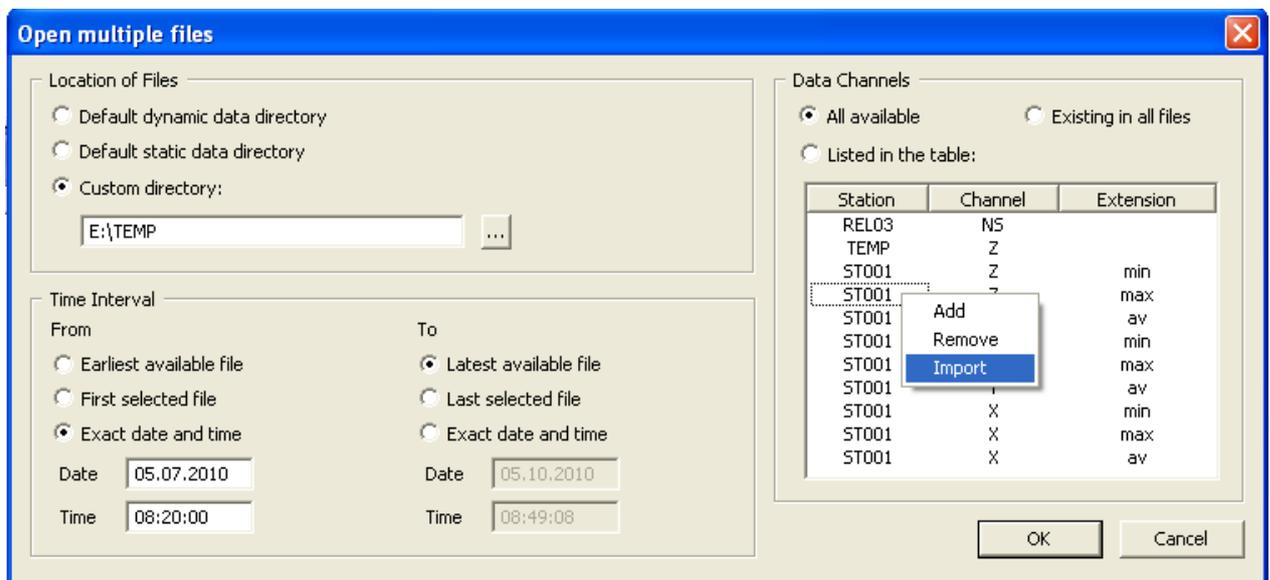
- **View Data** - displays file(s) data in the new ODV window. Double-clicking the name of a file performs the same action
- **File Information** - displays general information, which is kept in the file header;
- **Delete** - removes selected file(s) from the hard disk;
- **Download** – downloads selected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

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.

Open Multiple Files

This menu provides useful tool for finding and opening several data files. It opens the following dialog where searching criteria are set:



First of all, you need to specify a **location of files**. It can be either default **directory for dynamic data** (i.e. [\\GeoDAS_DATA\Data](#)), for **static data** (\\GeoDAS_DATA\StaticData) or **any directory** on your choice. Then you specify a time interval of your interest. You may want to open all files by selecting **earliest/latest available file** or you can also indicate the **exact time and date** of your searching interval. You can also specify the time interval just by **selecting two files** in the directory. GeoDAS will get the time and date of selected records and will use them as start and end of the time interval. And, finally, you can narrow your search by specifying **station and channel names** of the records you are going to open. If you

know the names of channels you need to view, you can **list them in the table**. Right-click the table to **add** channels manually, to **remove** selected channels from the table or to **import** them from a data file.

As soon as all searching criteria are set, press **[OK]** to start search. Note that GeoDAS searches for files in the background and the process may take quite some while, especially if your source directory contains large amount of files. All searches are recursive, i.e. GeoDAS will look also into all subdirectories of a selected directory. Upon successful completion, GeoDAS opens all found files for viewing and analysis.

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.

Configuration

Gives access to a submenu with the following options:

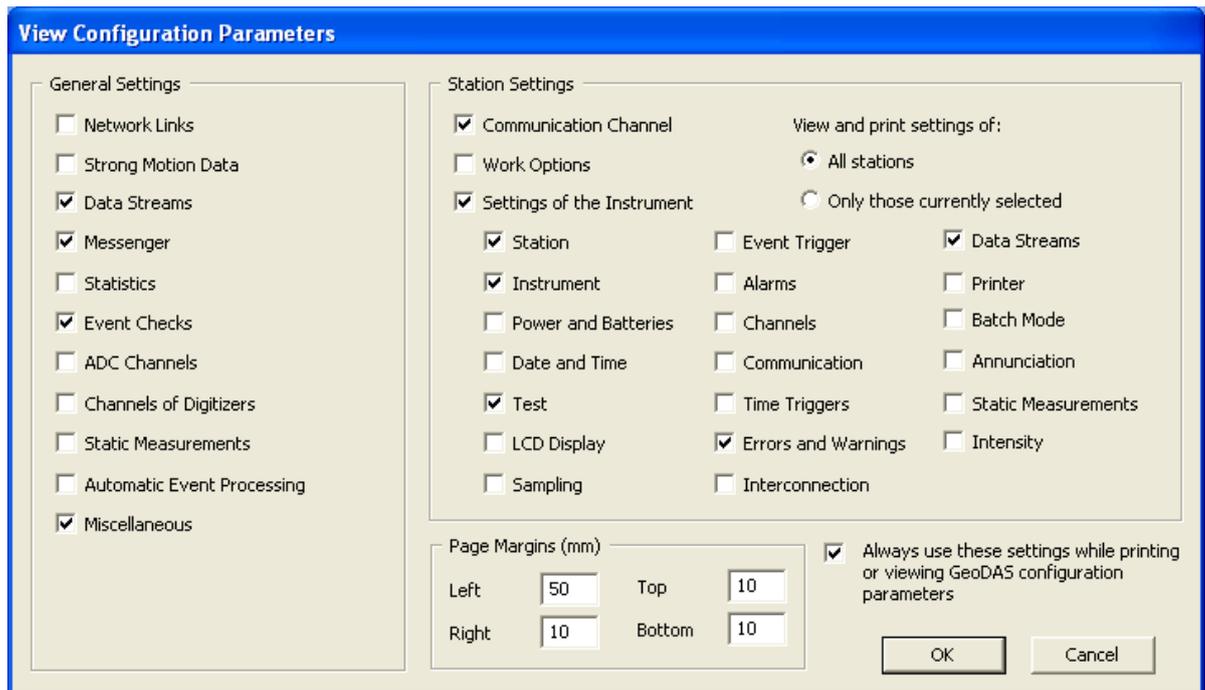
- **Backup**
It stores the entire GeoDAS settings, including all configuration files and the related Windows Registry settings into a file on user's choice. It is worth to save the current configuration before you make any major changes in case you are not very familiar with GeoDAS yet. You can always roll back to the old configuration in case something would go wrong.
- **Restore**
This menu loads a previously saved GeoDAS configuration file. Note that you would need to restart GeoDAS to make loaded settings effective. During the next start-up you will be asked to select a root data directory for the new configuration, i.e. the home directory where GeoDAS keeps data files, statistics information, configuration parameters, etc.

 *Note: if you load the configuration file created with the Backup operation on some other computer, you would need to make sure that the loaded settings match the actual hardware configuration of the computer and to adjust some parameters if required. For instance, the serial ports of another computer used to access instruments might not exist in the computer, which you move the configuration to. You would need to verify also the network links of GeoDAS if they are activated; some specific hardware (e.g. ADC units) if GeoDAS communicates with them, fixed paths to the data files, etc.*

 *GeoDAS does not restore automatically the parameters of any configured GeoSIG instruments to avoid wrong settings in case instruments are connected to some other ports in the new configuration. Therefore, please use the Export and Import functions of [The Instrument Setup Manager](#) in order to backup and restore the configuration parameters of each instrument.*

- **View**
This menu places images of the configuration dialogs to the new window, so the user can watch them all together and to make a hardcopy (File -> Print) if necessary. The user may choose which configuration screens shall be included into the view by selecting the corresponding options in the dialog described below.
- **Options**
It opens the configuration dialog shown below. The group **General Settings** corresponds to the configuration dialogs accessible through the main menu Settings, whereas the group **Station Settings** combines options related to every configured GeoSIG instrument. You may choose whether you would like to view settings of all instruments or only those which are currently selected in the list of window

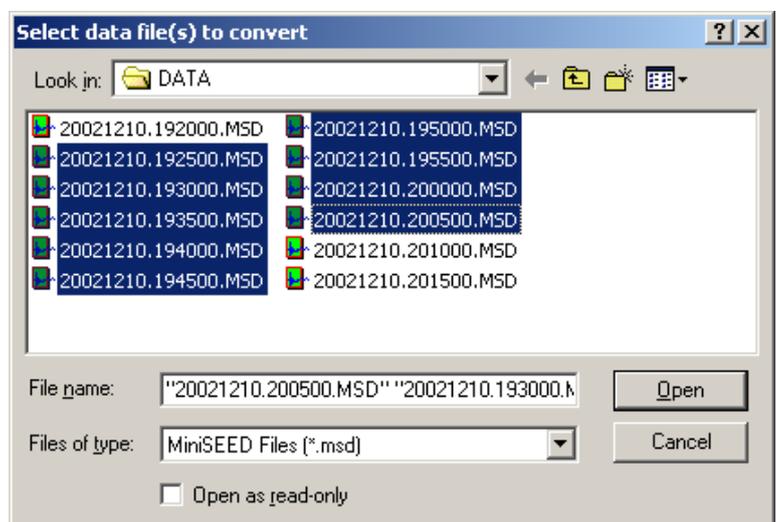
[Stations: General](#) Information. **Page Margins** are used while printing the view of settings. If the option **Always use...** is ticked, then the above dialog does not appear each time when you select View from the File -> Configuration submenu.



Convert

Opens the submenu, from which you can choose a type of conversion. GeoDAS event files can be converted to the PC-SUDS, SAC (both binary and ASCII), SEG-2, 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.

MiniSEED files and the DAT-files keeping data of the streams are converted also to a format supported by ARTEMIS Testor. This software is a part of the ARTEMIS software package developed by Structural Vibration Solutions A/S and widely used for the modal analysis applications. While converting miniSEED files, one has to select all files to be converted. These files shall contain continuous data sets with no gaps and must have the same sampling rate. For conversion of the DAT files it is sufficient to select only two files in order to indicate the start and the end of a required time interval. GeoDAS will search and convert all files recorded by instrument within the selected time interval. Converted files are stored by default in the directory OutData located under the GeoDAS root data directory.



Another useful GeoDAS data export utility is the conversion to Matlab format, which creates ASCII M-files processed by the well-known and widely used software package Matlab of MathWorks, Inc. Generated files contain not only recorded time series of data but also other information, such as instrument parameters, current settings, instrument status information, etc. Statements in the file are commented for easy understanding. Processing generated file only loads all data into the current Matlab workspace and displays original datasets in the screen. But users can easily modify this behaviour by adding their own statements to M-files and by including generated files into their own Matlab scripts for specific data processing.

Permanent records (DAT files) generated by GeoDAS can be converted to SEISAN format automatically if the corresponding option of the DataStream Manager is enabled as described in the [Processing Stream Data](#) section. Static files (data series *.std and the histogram files *.hst) are converted to the ASCII comma separated values, which can be imported and processed further by Microsoft Excel.

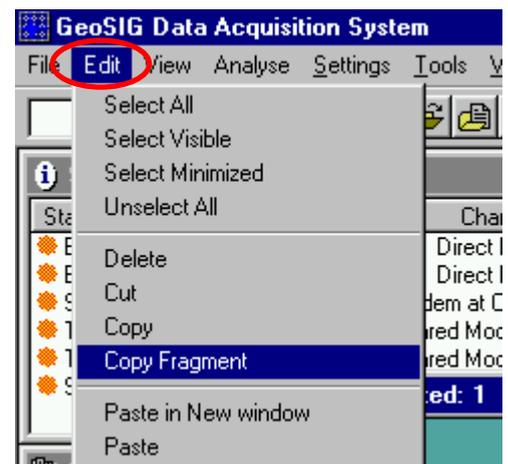
One can also convert compressed event files (GBR and GBT formats) to the standard GSR files. This functionality can be used e.g. when copying files from the flash taken from an instrument card directly to the computer's hard disk. Several files can be converted at once. You may choose the target directory.

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

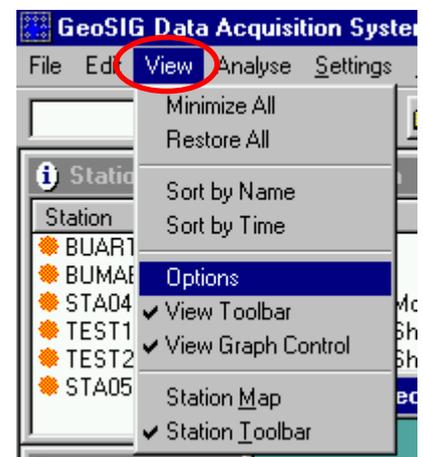
Shows/hides the ODV toolbar

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



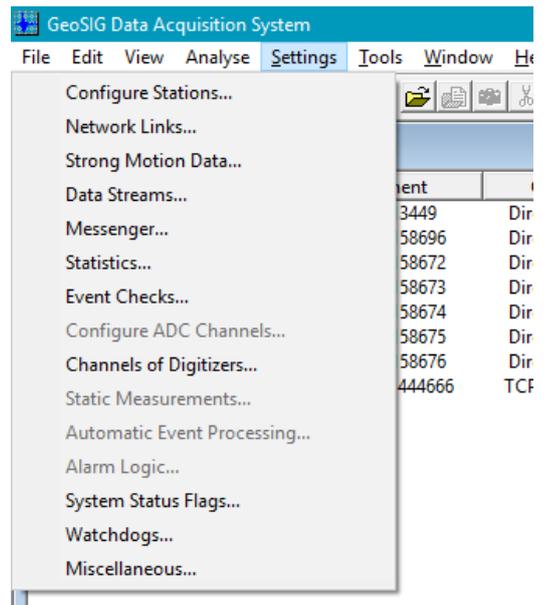
7.4 Analyse Menu

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 Stations](#) you are going to work with. Follow the link above for the step-by-step description of this procedure.

Network 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](#).

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

Opens the configuration dialog to set up the [Event Check Parameters](#).

Configure ADC Channels

Opens the dialog window used to set up the [Configuration of ADC channels](#).

Channels of Digitizers

Opens the dialog window used to configure [Channels of Digitizers](#).

Static Measurements

Opens the configuration dialog to set up parameters of the [Static Data Acquisition and Analysis](#).

Automatic Event Processing

Opens the configuration dialog for setting all parameters of the processing. More information can be found in [Appendix N. Automatic Event Processing](#).

Alarm Logic

Opens the configuration dialog for setting parameters related to this functionality. It is enabled only with a specific registration code. More information can be found in [Appendix O. Network Alarm Logic](#).

System Status Flags

System status flags are 24 bits (3 sets by 8 bits) reflecting the status of certain system events. They are configured with the following dialog window.

First of all, you have to enable the option **Maintain system status flags**, then adjusting of the other options becomes available. One can enable any of eight individual **flags** for each of three **sets A, B and C**. **Type of the event for each flag** is selected from the list. It can be event trigger, exceeding of the alarm level, error and warning states, etc. These events are **configured individually for every station**. It is also possible to make the flags reflecting the actual state of DSR, CTS and DCD signals of the COM ports used by GeoDAS.

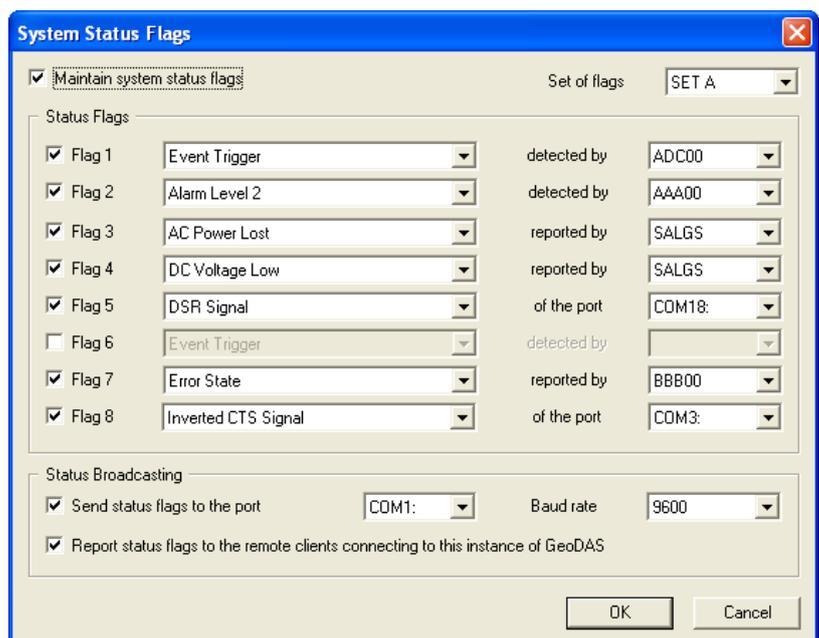
Status flags are **sent** through a selected **COM port** and/or are

reported to the remote instances of GeoDAS over the network or serial channels. In this case they are indicated in the [Remote Nodes and Applications Window](#) of a remote client. If a flag is currently active, it is shown with the letter **(A)** added after the corresponding Flag N.

System status flags are used in some specific GeoDAS applications. Please contact GeoSIG if you need more information about this issue.

Watchdogs

This menu item opens the configuration dialog to set up parameters of the system watchdogs. Current version of GeoDAS supports only the **GeoSIG GSWD** unit. It is designed mainly to monitor the supply voltage level and may switch the system off if battery voltage drops below a certain limit. This prevents batteries from full discharge and is saving their lifetime. Additionally, the watchdog can be programmed to monitor the communication over serial channels and to monitor working status of the computer itself.



In case of general communication or software failure the watchdog makes a hard reset of a particular unit or the entire system after a user defined time. All basic parameters of the watchdog are adjustable with the dialog shown below.

 There are several firmware versions of the watchdog, and not all of them support all options and features indicated in the dialog. Based on the information about the firmware version, GeoDAS may disable or hide certain controls and options in the dialog window.

Before changing any value, the desired Watchdog Board must be added to the list. Fill in a **Watchdog name** and select a way of communicating to it. In case of the serial link, you need to select the correct **COM Port** and **Baud rate**. If a watchdog is accessible via network link, then the **Watchdog IP address and port** must be provided. Press the button **[Add]** to introduce new watchdog to GeoDAS. When you adjust any settings in the group General Information of any already configured watchdog, the button **[Add]** is changed to **[Modify]** and you can save your changes by pressing it.

As soon as a watchdog is configured, GeoDAS begins communicating with it. This is done in the background, and if everything is configured correctly, the status of the watchdog is changed to **MONITORING**. GeoDAS monitors only several most critical parameters of the watchdog. But you can always initiate reading all parameters from the Watchdog Board by pressing **[Read]**. Change the desired value and store the setting back again to the Watchdog by pressing **[Apply]**.

 Before changing any value first always read out the setting from the Watchdog Board, otherwise unintentional changes may occur.

While GeoDAS is communicating with the watchdog, it monitors the **supply voltage**, **AC power status** and read values of the following counters: watchdog activations on **communication timeouts** and on **low voltage**, counter of **AC power losses** and **restarts of the watchdog** itself. You can set them to zero by pressing the button **[Reset All Counters]**.

Voltage thresholds are specified in the group of controls called **Monitoring of Voltages**. There are two thresholds: for 12 and 24 V batteries. A correct type of the battery should be set with a jumper on the watchdog board. If the battery voltage drops below the **Low** level, then watchdog waits for a time interval called **Low supply voltage – System shutdown** and disconnects the loads to avoid fully discharging of the battery. When the battery charger is back to work and the voltage goes above the **Good** threshold level, the watchdog waits for a time interval **Supply voltage recovery – System startup** and applies voltage to the loads.

The watchdog can control five different groups of loads independently and one can enable and disable (switch ON and OFF) any of them manually with the corresponding checkboxes of the **Power Control** parameters.

Another important function of the watchdog is monitoring of communication at the serial port in both directions (**from DCE** and **from DTE**) and also monitoring of the **GeoDAS activity**. All these functions can be enabled or disabled individually. If the last function is enabled, GeoDAS sends periodically a watchdog reset command to indicate its activity. This can be done in two different ways: either by the GeoDAS Watchdog Manager or **by a critical GeoDAS routine** if the corresponding option is selected. Do not activate this option, unless specifically instructed in the user manual of your equipment. GeoDAS can also **shut the computer down on low voltage level**, if this option is set. In this case, GeoDAS will try to quit all Windows processes correctly few minutes before the computer power is cut by the watchdog.

 *Note that this functionality won't work if the watchdog does not monitor GeoDAS activity. This is because the power may be restored after shutting the computer down, and in this case the watchdog will not cut the power preventively and will have no information about status of the computer and GeoDAS.*

 *Shutting the computer down is only possible if GeoDAS is running under administrator Windows account with corresponding privileges.*

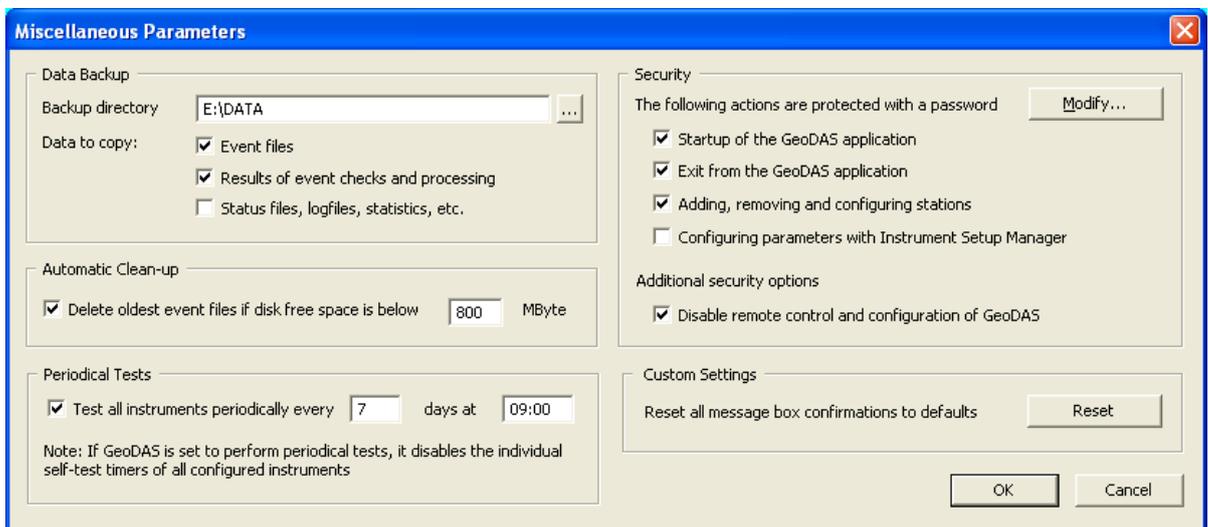
Monitoring of communication is performed according to several **time parameters** that are also adjustable in the configuration dialog. If watchdog detects that there is no communication during selected time interval, it disconnects all loads from the power source and connects them back again after the number of seconds specified as **System power off time during resets**.

When the option **Enable Sample Requester** is enabled, the watchdog sends requests for data samples to the GeoSIG digital sensors. This functionality is used in some specific applications only and should not be activated otherwise. To set all parameters to the factory default, press **[Reset to Defaults]** and confirm by clicking **[OK]** if asked. To remove a Watchdog board from the list, just select the desired **Watchdog name** and press **[Remove]**. Press **[Hide]** to send the watchdog window to the background.

More information about the GeoSIG Watchdog is available in its user manual.

Miscellaneous

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

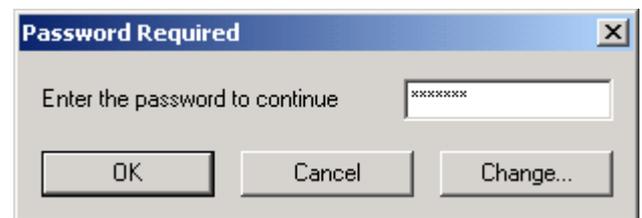


Some applications require that several configured instruments perform their self-tests by coordinated manner at strictly defined time. GeoDAS can be instructed to take care of this action by enabling the option **Test all instruments periodically**. If this option is set, GeoDAS will log into every instrument 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.*

GeoDAS can make a backup of some particular data to a **backup directory** other than its home data directory. GeoDAS tries to copy files as soon as they are modified but in some cases it might take several minutes after the file modification until it is updated also in the backup directory. You may choose to copy the following types of data files: **events, results of event checks** and different kinds of **status and log files**.

Several functions of GeoDAS can be protected with a password, such as **configuring stations, settings parameters of instruments** with Instrument Setup Manager, **startup of GeoDAS** itself and **exit from GeoDAS**. These options 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 them, you will be asked for a password, too. The password can be changed at any time by pressing the button **[Modify...]**.



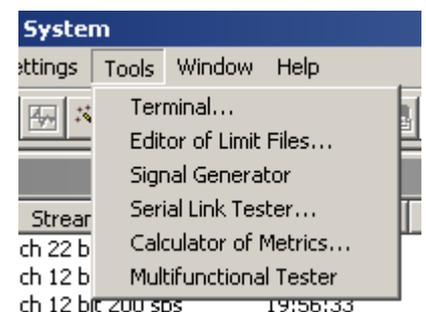
By default, certain functionality of GeoDAS can be configured and controlled from another instance of GeoDAS remotely but for security reasons the **remote control and configuration** can be disabled in this dialog.

The option **Delete oldest event files...**, if enabled, instructs GeoDAS to remove the oldest event files from the \\GeoDAS_DATA\Data directory if the free disk space goes below the indicated limit. If this option is not set, GeoDAS places a warning message to the Log window in case of the low disk free space but oldest data files are not removed automatically.

The button **[Reset]** is used to reset to the default state the options of different user choices made with the check boxes like “Don’t ask this question anymore” or “Don’t show this dialog anymore”.

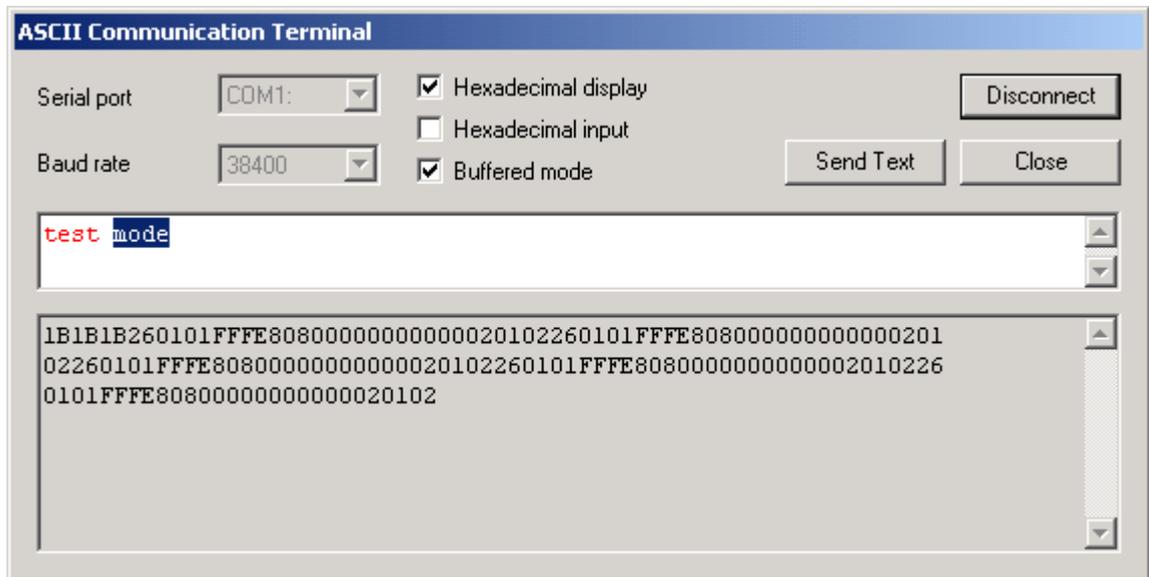
7.6 Tools Menu

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. Some of them are activated with a specific registration number.



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 data being received can be displayed not only in ASCII but also in hex format, depending on the option **Hexadecimal display**. The option **Buffered mode** enables editing entered text before it is sent to the port. The whole string of text is sent only when the Carriage Return is pressed. The **input** can also be provided in **hexadecimal** format if the corresponding option is selected. This mode is always unbuffered, i.e. as soon as a hex character is entered, it is sent out immediately. While in the buffered mode, it is possible to select any part of the text in the upper edit box and to send it out as many times as required by pressing the button **[Send Text]**.

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](#).

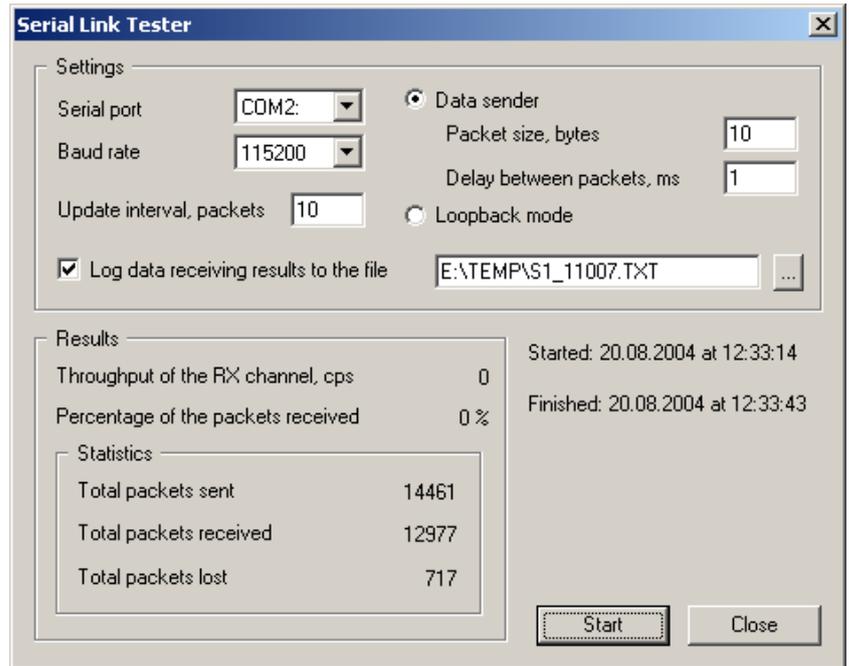
Serial Link Tester

This menu item launches the tool useful to test the quality of telemetry links. Upper part of the dialog window is used to adjust the settings. Status of the link is displayed below.

Serial Link Tester working in the **Data sender** mode sends data packets of a specified **Packet size** through the selected **Serial port** at the specified **Baud rate**. The **Delay between packets** can also be adjusted. It is supposed that on the other end of link the same tool receives data packets and the information about **Throughput, Percentage of received packets** and the packet **Statistics** is displayed. The results are updated every time interval needed to receive the number of packets defined as the **Update interval**.

If the **Loopback** mode is selected, the tester does not generate packets itself but just sends back to the port every data packet received without errors.

Every data packet is CRC16 protected, so the packets received with errors are not counted but still their bytes are counted to the throughput value. If the **Log data** option is enabled, the tester saves to the selected text file the date, time, throughput value and the percentage of received packets.



Calculator of Metrics

This tool calculates PGA, PGV and RSD at several frequencies using the input data from selected event files. Several files can be processed at once. The results are stored into the text CSV file as comma separated values. Calculation is performed in the same way as it is done by GSR-18 and therefore it can be used for verification of the metrics provided by this instrument.

Multifunctional Tester

This tool is designed to test various modules and units of GeoSIG equipment using A/D and D/A converters as well as the digital I/O channels. Several tests of the standard GeoSIG instruments do not require any additional test equipment. They are performed by direct connection to an instrument through the standard communication channel. Test procedures are written as scripts combining different commands processed by Tester at run time. Currently this tool is intended for the internal GeoSIG use only.

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

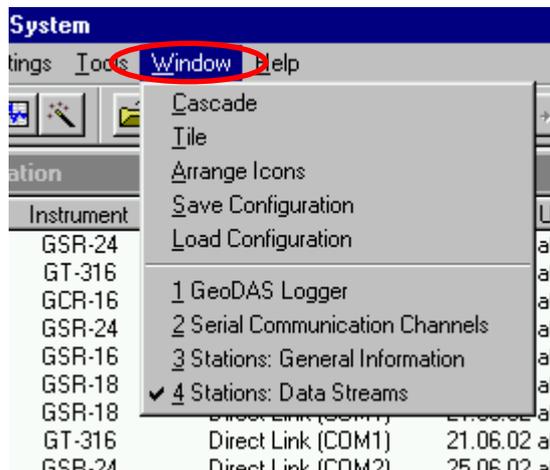
Arranges minimised GeoDAS windows (icons)

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

Feedback Assistant

Whenever you see that some functionality of GeoDAS does not work correctly, launch this Feedback Assistant in order to generate a feedback report file containing relevant information about the current GeoDAS configuration. Please describe the problem you face and send collected information to the GeoSIG software team at swsupport@geosig.com. This will help us to provide you with a technical support in solving the problem.

GeoDAS Manual

This item opens the manual of GeoDAS in the default PDF reader, if it is installed on the computer.

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. Some specific GeoDAS functionality, such as a support for ADC units, static measurements, etc. may also not work in the non-registered versions. Please contact GeoSIG if you need to activate such functions.

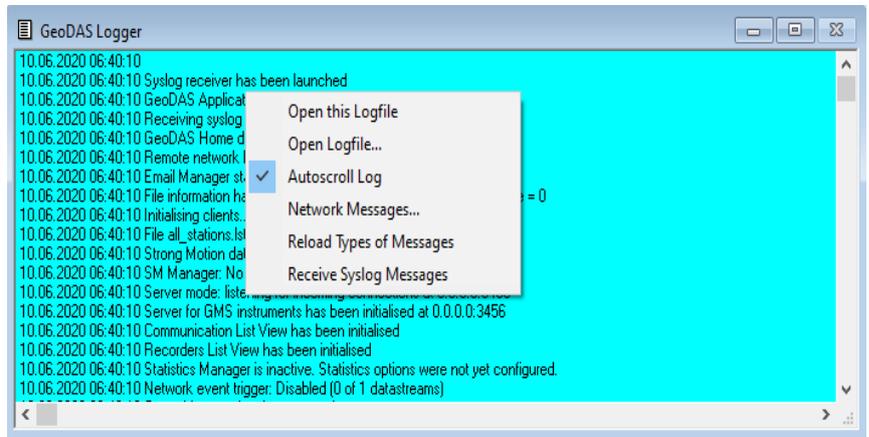
About GeoDAS

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][t]`, where **c** - to display various communication related messages, **h** – to report hardware problems, commands sent to the instrument, etc., **s** - to display additional data stream related messages, **t** – to display additional messages related to the network tunnelling. 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 network links of Logger. Those applications selected to communicate can exchange (send and/or receive) some important log messages.

Reload Types of Messages

Users can adjust types of messages in the Registry and use this menu to load them on the fly without restarting GeoDAS.

Receive Syslog Messages

When this option is enabled, the Logger will receive system status messages from the GMS series of instruments. This functionality must be enabled by using the command **Update Message Forwarding** from the Instrument Control interface.

8.2 Stations: General Information

This window contains a 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.

Station	Code	Instrument	Channel Type	Status Updated	Files	Free Memory	Last Event	Voltage	Current Activity
BUYAD	ED9	GSD-24	Direct Link (COM12)	07.09.2006 at 14:53:15	None	No Memory	Not Supported	AC, DC=13.39V	Idle, not connected
FARGE	ED3	GSD-24	Direct Link (COM14)	05.09.2006 at 19:08:56	None	No Memory	Not Supported	AC, DC=13.32V	Idle, not connected
GSRV									
GSST									
HVHF									
HYBA									
RLSD									
SIND									
SMDL									
STTR									
TUZO									
YAKL									
YLVH									

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. Gray color indicates that the status is not known yet, e.g. right after startup of GeoDAS when no connection to a station has been established yet. The names of remote stations are displayed in the format station@remote_node, where remote_node is the network name of the remote instance of GeoDAS. Refer to the Appendix G. Network Links of GeoDAS for more information about the configuration of network links. Stations of the remote instances of GeoDAS appear in this window if these instances allow monitoring the state-of-health of their stations.
Code	Station code. Three- or five-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, GMS-18, 24, etc.

Channel Type	The type of communication channel, which is used to access the instrument. Can be one of the following: Direct Link, Modem (dedicated, at some COM port), Shared Modem or the network TCP connection with IP address and port. In case of dial-up link (modem), the telephone number of the station is also indicated in the list.
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 Kbytes. If an instrument works as digitiser 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. The prefix NEW is displayed here after uploading any new file until confirmed from the context meny as described later.
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 or a status file. 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

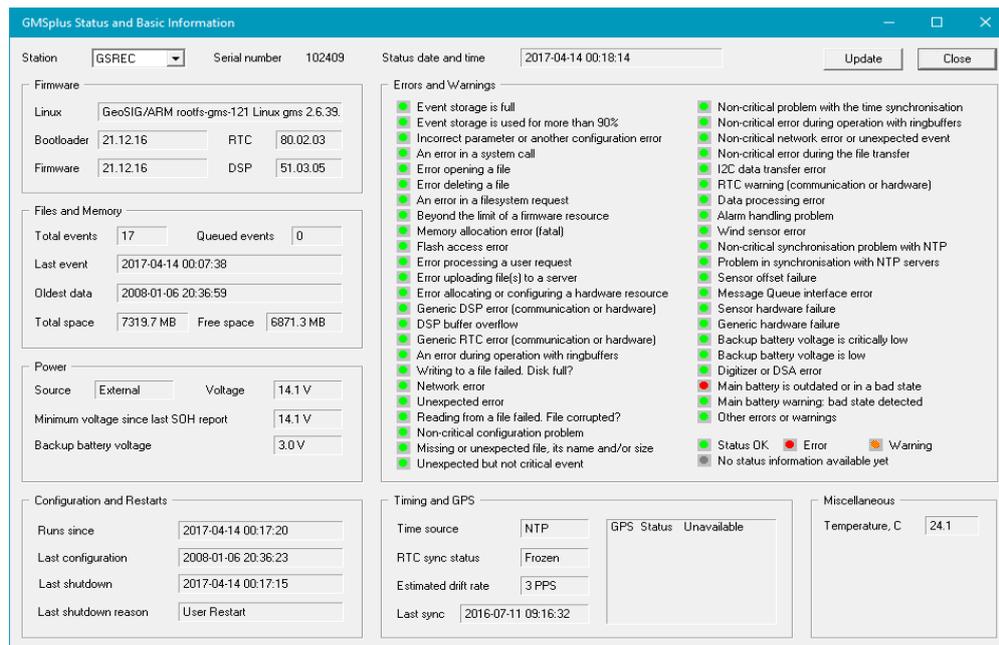
Context menu of the General Information window provides an access to the important operations with the stations. Some items in this menu are available only if a station in the list has the focus, i.e. its name is surrounded by the dotted rectangle. Only one station can have such a focus at any particular moment. A number of items is enabled only when one or more stations in the list are selected (highlighted). Some items may be always disabled or even hidden in specific configurations.

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. If it is a GSR/GCR instrument, then all its 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. The information about GMS is presented in the following dialog:



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.

Disable File Operations

The menu item is a toggle that enables or disables background operations with event files of the currently selected station. It may be useful when you login only to change a setup parameter of the instrument and do not want to read the whole instrument directory and to download files. In this case you may disable those operations by clicking this menu item right after the login.

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

Delete All Files

The menu can be used to delete all data files stored in the selected instruments. Deleted files cannot be recovered, therefore please make sure you really want to do it.

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.

Cancel Pending Requests

Use this menu item to cancel all pending requests to GMS instruments. You can see whether requests exist or not by looking at the Current Activity information for a particular GMS.

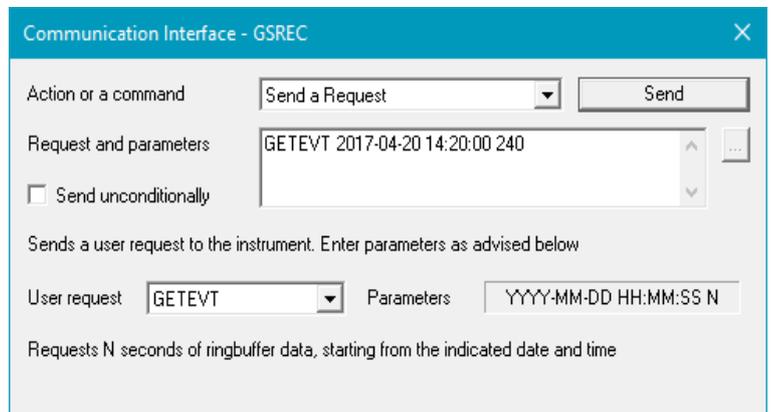
Confirm New Events

Whenever a new event file is downloaded, its last date and time displayed in the column Last Event receives the prefix NEW.

Instrument Control...

This menu item is available for GMS instruments only, and it provides simple communication interface with GMS instruments for sending different commands to them, to retrieve data, to upgrade firmware, etc.

A name of the selected GMS station is indicated in the widow title. Select **Action** or a **command** from the list, browse for a **file to attach** to your request (if required) and press the button **[Send]** to perform the selected action.

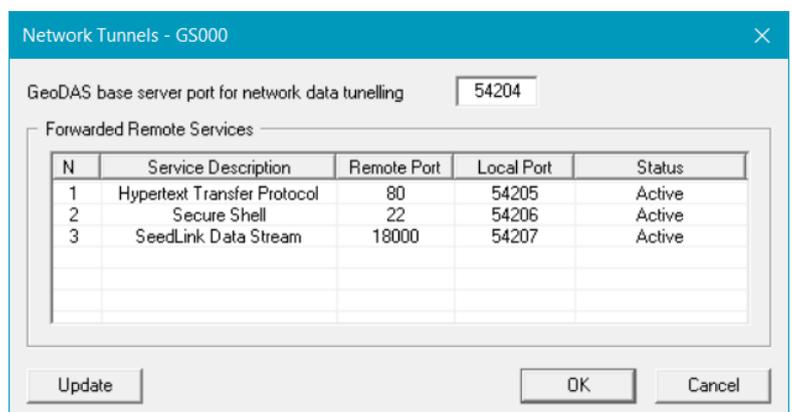


The command **Send a Request** requires name of the request followed by one or more optional parameters. A request name can be selected from the list and the format of parameters is indicated next to it for your reference. If you need to know more about different requests, please refer to the GMSplus or CR-6plus User Manuals.

 *Note that your commands are not executed immediately. Communication with GMS instruments is based on the file exchange and it is initiated in most cases by units rather than by GeoDAS. Therefore, upon pressing **[Send]**, the request file is only prepared and the actual processing of it will take place only when the instrument will contact GeoDAS next time as scheduled by its configuration parameters.*

Network Tunnels

This item is enabled for GMSplus and newer models of instruments only. It opens a window with the list of network tunnels as shown. Depending on the configuration of the instrument and available options, the tunnelled services can be different. If the instrument has a fixed static IP address and accessible from GeoDAS, this functionality is not required to communicate with the instrument and to use its services. However, if the instrument does not have a fixed IP but can connect to GeoDAS then the tunnels make services of the remote instrument exposed to local network ports of the computer where GeoDAS is running. **GeoDAS base server port** can be adjusted if required. The default value is 54204.



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 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.

Advanced Information...

It features the same functionality as for the identically named item in the [Context Menu of the Data Streams Window](#)

Status Info

The following dialog box appears when clicking this item. The basic station status information is generated periodically irrespective to the setting in this dialog window and status files are stored in the directory ...\\GeoDAS_DATA\\StatusFiles\\StationInfo. Minimum **interval** of generation of the status files is one day. The **time of making reports** is set here as well. If you would like to log not only the general station information but also the **status of data streams** and the **status of communication channels**, the corresponding options shall be checked.

GeoDAS also can send this information to recipients by SMS and/or e-mails. They are activated by checking the corresponding boxes next to the notification type called **Periodical status report**. The **list of instrument errors**, if any, can be attached to every email by selecting a checkbox for the mentioned option. The format of the instrument error file is described in the [Appendix D. Format of the status files](#). 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](#).

Notification type	SMS	Pop-up	Signal	E-mail	Attachment	Message prefix (optional)
Periodical status report	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	List of errors SOH>
Instrument errors	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ERR>
Instrument warnings	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	WRN>
Triggered events	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TRG>
New event files	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	List of events EVT>

Four more types of notifications can be enabled in this dialog window by ticking the corresponding checkboxes: instrument **errors**, **warnings**, **triggered events** and **notifications about new event files**. The difference between last two is that Triggered events are reported immediately after triggering, while the actual event file is still being recorded. Therefore, this functionality can be used for prompt alerting in case of major earthquakes. If you use email notifications about new events recorded by the instrument, you can attach to such emails the **full list of events** stored in the

instrument. These types of notifications are sent upon arrival of every event type to GeoDAS rather than periodically. Note that GeoDAS is informed about errors, warnings and new events immediately only if it is currently logged to the instrument (older GSR-XX instruments) or if the related functionality is configured in the GMS and newer instruments. Otherwise, it takes some time until such events become known to GeoDAS in one of the following ways:

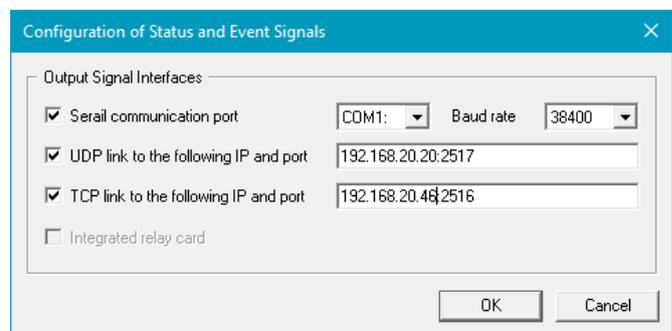
- GeoDAS receives the status upon next periodical check-up of the instrument by automatic logging into it. Activation of this mode is described in the section [Work Options](#).
- The status is delivered with a data stream if the instrument sends it and GeoDAS is configured to receive it. Please refer to the chapter [Working with Data Streams](#) for more information about datastreams.
- The status is sent by instrument to GeoDAS via SOH SMS notification as configured in the dialog [Parameters of the Batch Mode](#).

You can define specific prefixes for every type of notification, which can be useful for automatic processing of received notifications by a custom software.

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.

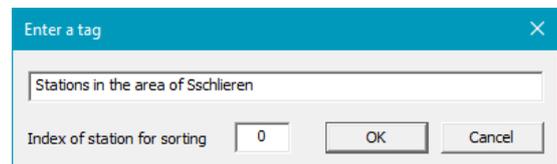
Two buttons in the left bottom corner of this window provide an access to the additional settings.

[Messenger Setup...] takes you to the configuration window described in the [Appendix F. Messenger of GeoDAS](#) and **[Signals...]** lets you configure signalling of notifications to other computers and devices through the serial or network (UDP and/or TCP packets) interfaces as shown. If the computer with GeoDAS has one of the supported relay cards plugged, the relays can be also activated by notification messages.



Assign Tag

One can assign a tag for every station listed in the General Information window. E.g. it can be a name of the cluster in networks containing dozens and hundreds of stations. Besides a name of the tag, one can specify an index, which is useful for sorting, i.e. to ensure that stations with the same tag are listed always in the same order.



8.3 Serial Communication Channels

This window displays the table filled up with the information about all the communication channels (COM ports) used by GeoDAS to access the configured stations or for other purposes. 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.

Port	Baud	Owner	Calls In/Out	SMS In/Out	Logins	Errors	Status
COM1	19200	DialUp Pool	NA/0	0/0	0	1	Communication error
COM2	115200	<BUMAE>+1	NA/NA	NA/NA	0	0	Receiving datastream
COM3	9600	<STA04>	0/0	NA/NA	0	0	Waiting for a call

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. Some communication channels can be established over TCP/IP link, and in this case a network port is shown here
Baud	Current Baud Rate of the serial channel. In case of the network link, an IP address of the remote party is indicated here
Owner	The name of a station, which this channel belongs to or a name of the GeoDAS module, which uses currently the communication channel. 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. If the channel is used by a GeoDAS software module, its name is displayed in capital letters, e.g. TERMINAL, SMS MANAGER, EW ALARM, STATIC SENDER, etc.
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

8.3.2 Context Menu of the Serial Communication Channels Window

Repeater Information

Repeater information is available only for those communication channels, which link GeoDAS to several remote instruments through the GeoSIG Software Repeater (GS_SWR). This tool is used to receive data streams from several stations and to send them all through the same communication channel. Besides the actual data from the stations, GS_SWR collects statistical information (number of data packets sent, errors, number of resets, etc.) for every remote instrument linked to it. All this information is displayed on the screen once this menu item is executed.

Open Terminal

This menu opens a terminal window of GeoDAS for the currently selected channel. In some cases, it is useful to see what kind of data is sent over the serial line. Terminal window can also be used to send configuration strings to some devices that support ASCII configuration, e.g. Güralp digitizers. Use this feature carefully because in some cases the terminal window can affect the normal data exchange over the opened serial port.

9 Working with Data Streams

9.1 General Notes

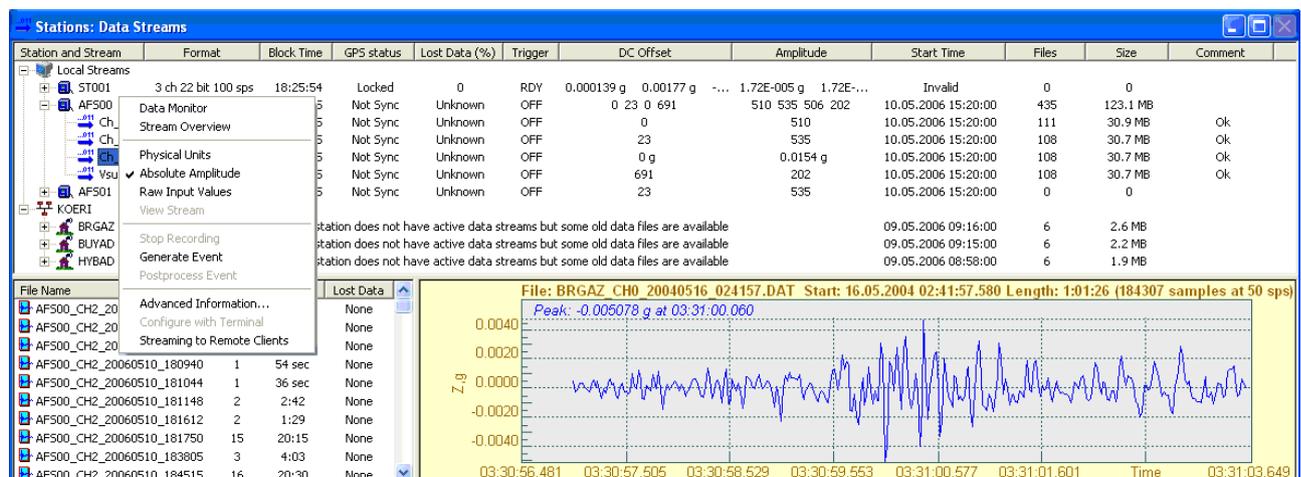
Several types of GeoSIG instruments, such as GBV and GSR-18/24, can provide the streams of data through the serial communication channel. In most cases the same communication channel is used both for login to the instrument and for sending the data stream. Therefore, it is important to realise that the 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 digitisers 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:



The window consists of three parts (views):

1. List of all stations and their data streams. First column of this list is displayed as a tree allowing hiding those streams that do not have to be displayed. Top level of the tree is a local instance of GeoDAS called "Local Streams" or a remote node configured to provide real-time data streams to the clients. Please refer to the [Appendix G. Network Links of GeoDAS](#) for more information about remote nodes. This view has a context menu described further. Double-clicking a stream name lists the ringbuffer files currently available for this stream.
2. List of the ringbuffer files. It displays the filename, number of data blocks in the file, total record duration and the percentage of lost data. Double-clicking any file opens it in the next view.
3. Stream overview. This view looks like the standard window of [Off-line Data Viewer](#) but with a limited ODV functionality. It displays either a single stream ring buffer file or an overview of datastreams, which is activated from the context menu of the first view.

9.2.1 Description of the information

The following information related to the data streams is displayed in the list:

Station and Stream	<p>This is a specific column indicating node name, station name and the stream name. This information is arranged as a tree. Stations of the remote instances of GeoDAS appear in the window if these instances (remote nodes) allow real-time data streaming over the network links. A bitmap displayed on the left to any name reflects the status of data stream or indicates the type of station. The following bitmaps can appear:</p> <ul style="list-style-type: none">  This station is not currently configured but some old ring buffer files are still available  Data stream from is suspended because the user is currently logged in to the station or the communication port is used for an ASCII terminal  Data stream is interrupted (no data packets during quite some time)  Corrupted data block received or any other single data error  Data packets are received with no errors  Local data streams (root of the tree)  Remote node  Local station  Remote station
Format	Data stream parameters (components, LSB, sampling rate)
Block time	Time stamp of the last data packet arrived 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	<p>Status of the event trigger. Available indications:</p> <ul style="list-style-type: none"> 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. Lk – local (single instrument trigger) at the level k = 1, 2 or 3 (highest) Nk – network (multiple instrument trigger) at the level k = 1, 2 or 3 (highest)
DC offset	Signal DC offset displayed either in counts or in physical units
Amplitude	Average amplitude of the signal (counts or physical units)
Start Time	Time of the oldest data available in the ringbuffers
Files	Number of ringbuffer files
Size	Total size of all ringbuffer files
Comment	Any comment related to the current item

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.

Stream Overview

This menu item opens or closes the graphical overview of data streams.

Open Recent Data

This menu opens the most recently received data blocks (few minutes) in a separate ODV window for the detailed view and analysis. It has certain limitations and may not work for all types of data streams.

Physical Units

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

Absolute Amplitude

Allows displaying amplitude values with or without a sign. Sign is important for indication of the static data channels whereas the absolute amplitude is more indicative for dynamic data channels.

Raw Input Values

If this item is selected, GeoDAS displays raw input data samples as they come from the A/D converter without any correction.

View Stream

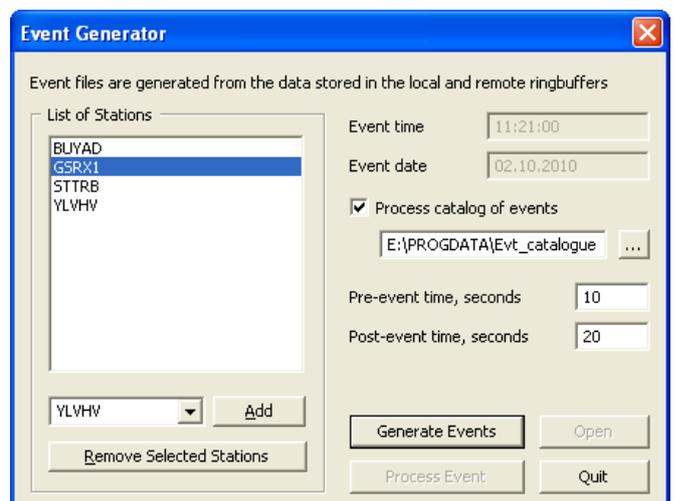
If this item is selected, GeoDAS displays current stream in the Stream Overview.

Start/Stop Recording

Running this menu item forces GeoDAS to create event file(s) and to save stream data. Pressing the last button in the **Station toolbar** performs the same action. 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 correctly. Refer to the section [Processing Stream Data](#) for more information about Datastream Manager Setup.

Generate Event

This menu opens a dialog window that is used to generate event files from the ringbuffer files stored locally and/or remotely. This is useful in case you know there was an earthquake at some particular date and time but it was not detected automatically due to some reasons. Simply create the **list of stations** whose data are kept in the ringbuffers and indicate the **event date and time** as well as **pre- and post-event intervals** in seconds. Upon pressing the



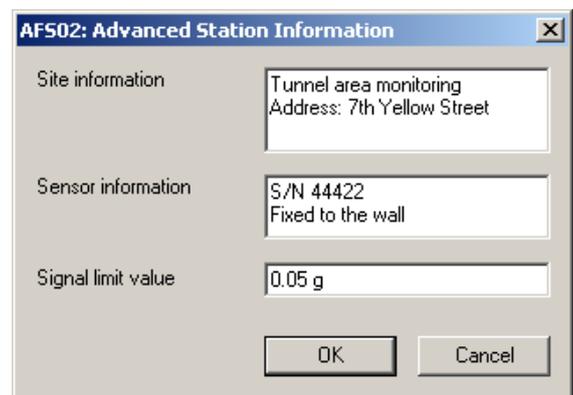
button **[Generate Event]**, GeoDAS extracts the requested portion of data from ringbuffers and stores it as the set of event files. Instead of a particular date and time of an event, you can select a **catalogue of events** and to extract data files of all events in the list just with a single mouse click. You will see how many files are created in the information string right above the group of buttons. Now you can press **[Open]** to see these event files (the Event Generator window is closed if you do it) or you can forward files for further processing by an external application by copying them to the post-processing directory. This is done with the button **[Process Event]**. See the section [Processing Stream Data](#) for more information about this issue.

Postprocess Event

With this menu item you can manually select the list of event files to be forwarded for post-processing by an external application.

Advanced Information...

This menu item opens the dialog window that is used to set any additional text describing the selected station and its sensor. This information is inserted into the reports described in [Appendix N. Automatic Event Processing](#).



Configure with Terminal

This menu is enabled only for the stations (instruments) allowing configuration with the ASCII terminal commands. It just opens the terminal window where you can enter the required commands. GeoDAS does not provide any additional support with respect to this topic. Therefore, please refer to the manual of every particular instrument for the set of available ASCII configuration commands. See description of the Terminal in the section [Tools Menu](#) of this manual.

Streaming to Remote Clients

This menu enables/disables sending data streams from local computer running GeoDAS in the server mode to the remote instances of GeoDAS linked to it over the network or serial channels. This functionality works only if the option Real time data streaming is enabled as described in [Appendix G. Network Links of GeoDAS](#). You can enable or disable streaming for each configured station either locally in the server or remotely at the client side.

 *Make sure that the communication channel is fast enough to transfer real-time data of all stations configured to send data streams. If you enable sending too many streams over the link with a low throughput you may block the normal communication between two instances of GeoDAS.*

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.



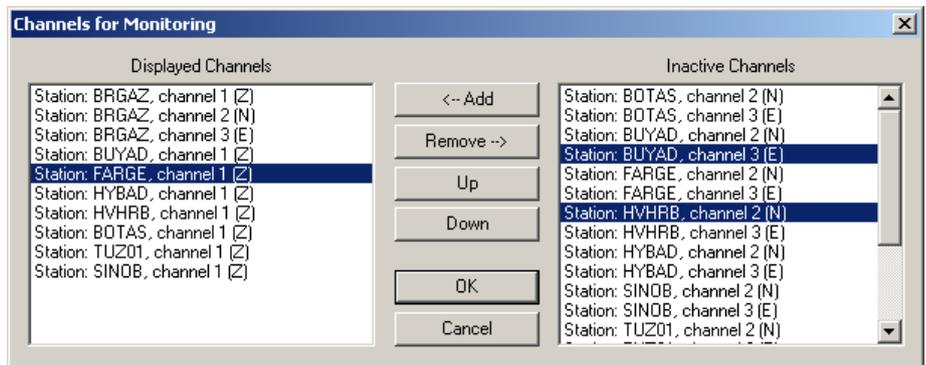
Main parameters of the Data Graph Monitor are adjustable with the context menu, which is described below.

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. The buttons [**Up**] and [**Down**] are used to arrange channels in the left list of displayed channels. Channel traces will be shown in the Data Graph Monitor window in the same order as they are listed here.



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

Open Recent Data

This menu opens the most recently received data blocks (few minutes) in a separate ODV window for a detailed view and analysis. It has certain limitations and may not work for all types of data streams.

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

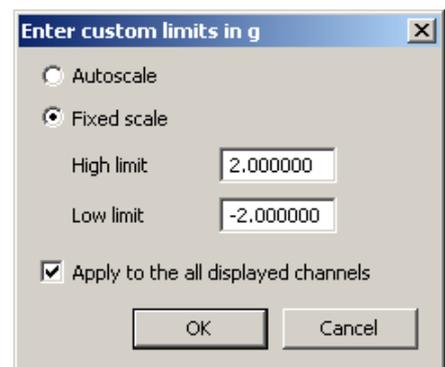
Specifies whether the scale of the current channel must be adjusted automatically. Otherwise the fixed scale specified by a user is taken.

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. You can select here whether the current channel should be scaled automatically or you can choose any fixed scale for it. If the channel scale is displayed currently in physical units then the limits shall be entered in these units, otherwise in counts. You can also choose whether the selected scale parameters are applied to all channels currently displayed in the Data Monitor window.



Remove This Channel

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

Set Channel Color...

With this menu item, you may select a color for displaying the selected channel.

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.

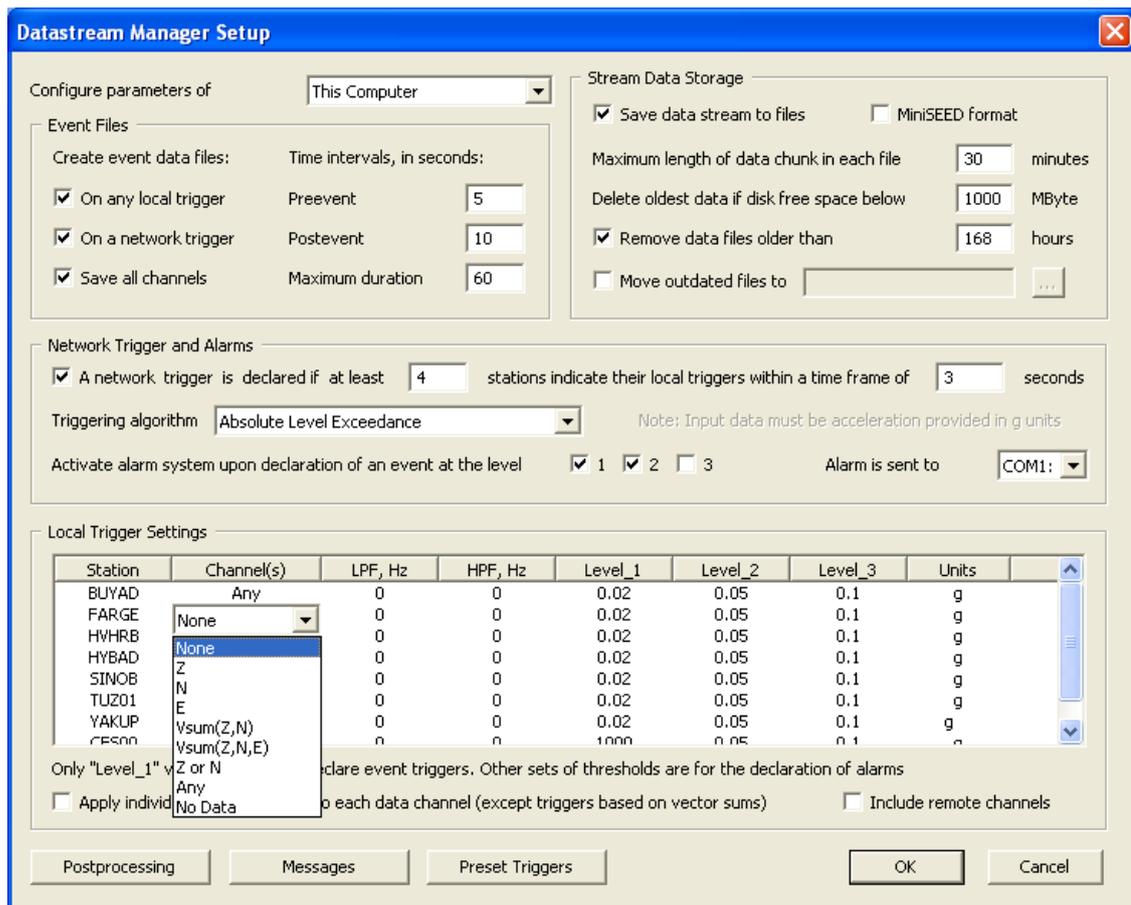
Launch at Startup

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 dialog shown below appears.

If you edit local parameters of the data stream processing then "This Computer" has to be selected in the very upper combo box. But there is also a possibility to adjust data stream parameters in the remote instances of GeoDAS if they are configured to allow remote configuration. Refer to the [Appendix G. Network Links of GeoDAS](#) for more information about this issue.



The first group of controls specifies the data storage options. You would probably like to **save data streams to files** in the binary DAT format (default) or in **MiniSEED format**. 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. If DAT format is used, then each data channel is stored in a separate file in the folders <root_data_folder>\DataStreams\Stationname. For instance, if a station provides three components of the signal in a data stream then three files will be created. If the MiniSEED format is selected, then all data channels (streams) of all stations will be combined into one file stored in the folder <root_data_folder>DataStreams. Please note that the length of data files, especially miniSEED files, may be slightly different than **length of data chunk** because of the compression and optimised data exchange between the disk storage and internal data buffers.

Since 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. Removing data files does not always mean that they are simply deleted. With the option **Move outdated files**, you can move files to a specified archive directory instead of deleting them. Data stream files can be viewed and processed in the same style as the event files with the Off-line Data Viewer.

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. 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 any of first two or three components, or it can be

also the vector sum of two or three components specified in the last case as square root of $(x^2+y^2+z^2)$. You can **apply individual trigger settings to each data channel** if the event detection algorithm is based on single components of the signal (not on the vector sum). For instance, if you would like to trigger on any channel of a 3-component signal, you need to edit the settings as following:

- tick the option "Apply individual trigger settings..."
- select 1st component (e.g. AC02Y) from the combo box in the Channels column
- adjust thresholds and other parameters in the table as required for this component
- select 2nd component and adjust the trigger settings for it
- select 3rd component and adjust the trigger settings for it
- select finally "Any" from the combo box in the Channels column.

If GeoDAS is configured to receive data streams from other instances of GeoDAS, you can include those remote streams into the table by ticking the option **Include remote channels**.

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. One can apply either or both **LP and HP filters** to the data before they pass through the event detection algorithm. The cutoff frequencies are set in Hz in the corresponding columns. Make sure that they do not exceed the half of the sampling rate for the current channel otherwise filtering would not work. Setting the frequency to zero disables the corresponding filter.

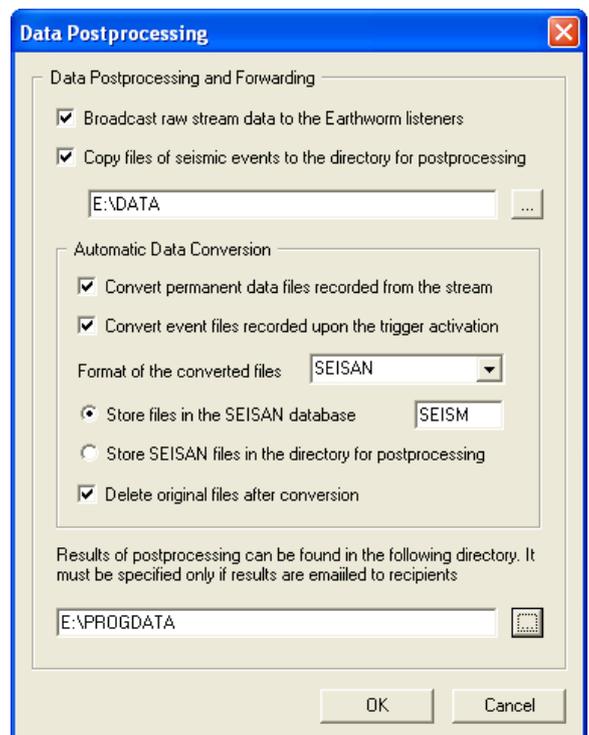
A **threshold level** in physical units is set as trigger level in case of the absolute level exceeding algorithm. If the selected algorithm is STA/LTA based then the **STA/LTA ratio** is specified for all supported trigger levels. The **STA and LTA time intervals** are also adjustable. CAV based algorithm 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. You can activate alarms for any of three levels of event thresholds. 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.



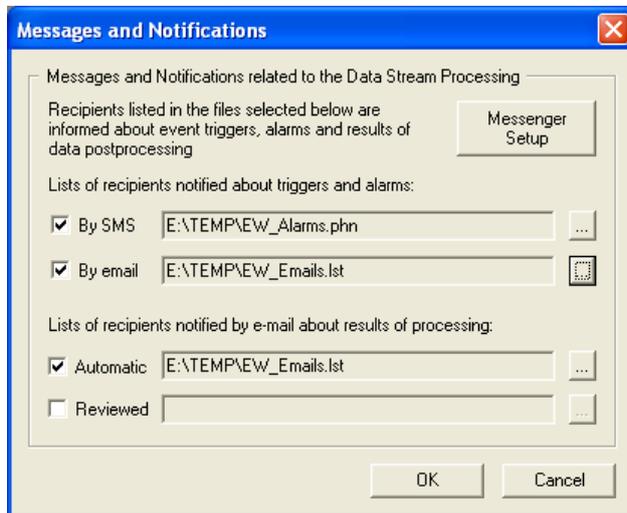
You can also set with this dialog whether the event files must be created on **any local trigger** and/or on a **network trigger**. In case of a network trigger you can also specify whether all data streams must be saved to the event files or only those, which have the local triggers activated. Streams of the stations indicated as "No Data" in the table are never recorded to the event files. The other parameters adjustable here are: **pre- and post-event time interval** and the **maximum expected event duration**.

Besides just storing data of the streams locally, GeoDAS can forward the data to a remote computer(s) for further processing. The options of data postprocessing are configured in the dialog opened by pressing the button **[Postprocessing]**. For instance, in order to forward the data to the USGS Earthworm software, you have to:



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

If permanent recording is activated, every generated DAT file can be **converted to the SEISAN format** automatically and, optionally, **deleted after successful conversion** if the corresponding options are enabled.



GeoDAS provides good integration with SEISAN software package. You can choose **automatic conversion** of both **stream data files** and **event files to the Seisan format**. If SEISAN is installed on the same computer, the best way is to let GeoDAS **storing files to the SEISAN database** automatically. Otherwise converted data files can be just **copied to a postprocessing directory** and original source files can be optionally **deleted after conversion**.

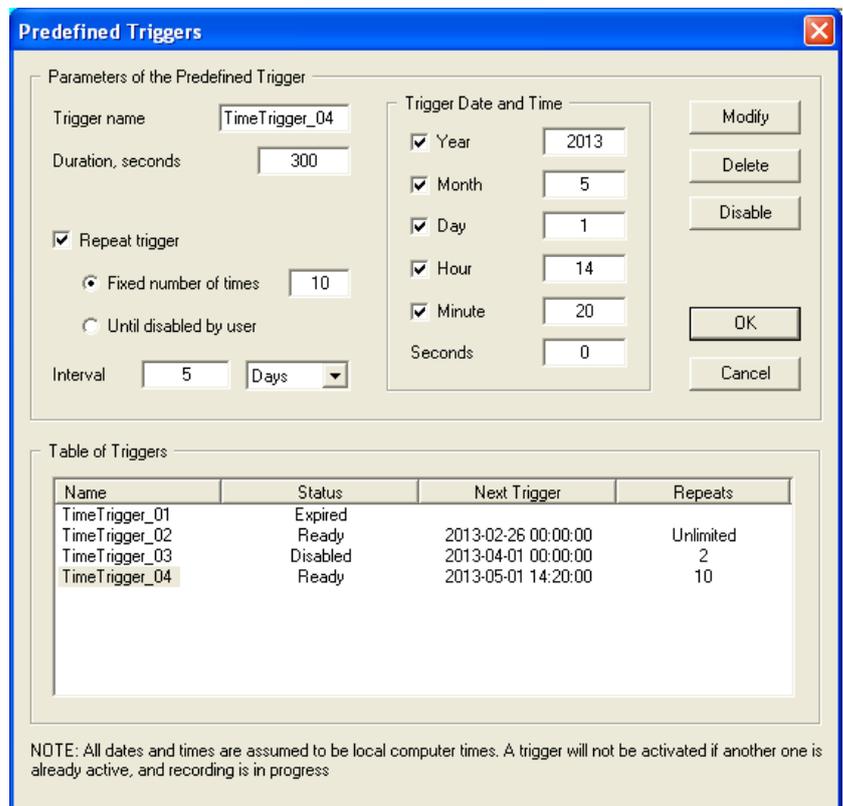
You can also choose to **Copy event files to the postprocessing directory** on your choice. Event files of any detected event will be forwarded to a selected directory for further processing by an external application. It is assumed that this application can read GSR files and it monitors the

directory permanently for any new files. After post-processing the files shall be deleted from the selected directory.

You can also specify whether an email message or SMS notification must be sent out in case of a network trigger. To activate this functionality press the button **[Messages]** to open another dialog window, and then enable the corresponding options and select the lists of recipients with the browse buttons **[...]**. The **[Messenger Setup]** must be performed as well to provide the required operations. Refer to the [Appendix F. Messenger of GeoDAS](#) for more information on this topic. One can also create two lists of recipients, which will be notified about results of event processing by SEISAN – **results of automatic processing** and results of processing made by operators. GeoDAS monitors SEISAN database permanently and any update of the SEISAN database with location information for the currently monitored event is considered by GeoDAS as completed **manual processing** of this event by SEISAN. In this case, GeoDAS sends an email containing location information.

Finally, it is also possible to configure a number or the scheduled time triggers, which will record stream data into the event files at certain date and time. Pressing the button **[Preset Triggers]** opens a dialog window with the related parameters. Triggers are identified by their **name**, and you can configure many triggers with different **start dates and times**,

duration, which can also be **repeated specific number of times** as configured or until a trigger is disabled



by user. All configured triggers are listed in the table, and each one can be **enabled/disabled, modified**, and deleted when it is no more needed.

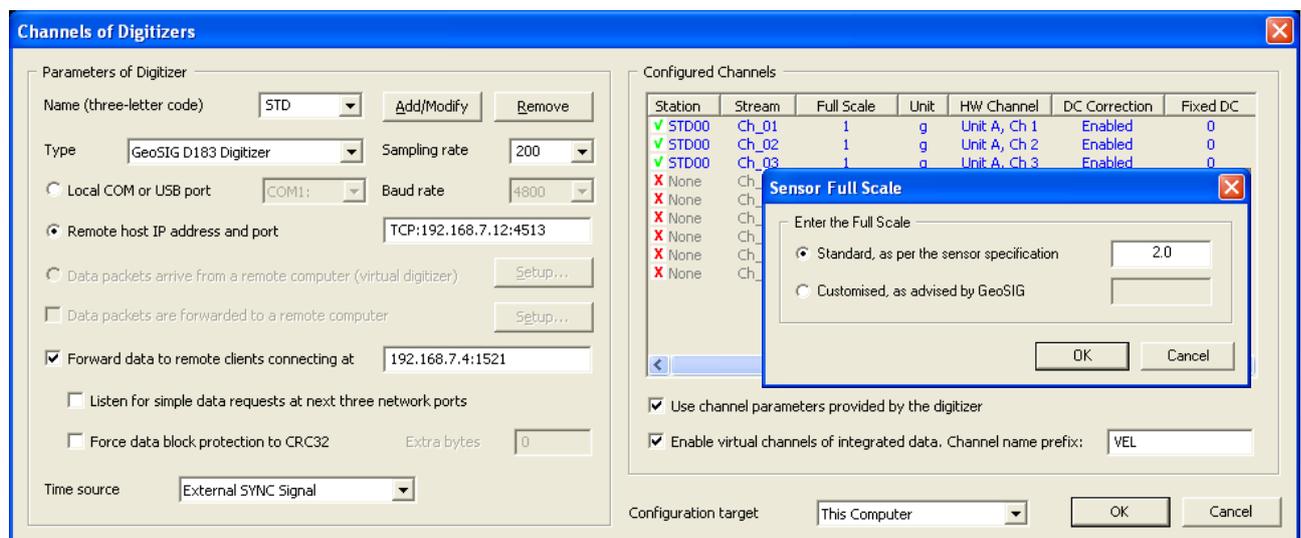
9.5 Channels of Digitizers

GeoDAS supports several types of digitizers and A/D converters and can process their data streams as described above, in the same manner as the data streams of GeoSIG instruments. Working with ADC is described in [Appendix L. Support for ADC boards](#). Digitizers are configured with the dialog window accessible through the menu Settings -> Channels of Digitizers.

In most cases the configuration of digitizers is made locally, i.e. in the same computer which digitizers are connected to. In such a case "This Computer" has to be selected as a **Configuration target**. But there is also a possibility to adjust parameters of digitizers in the remote instances of GeoDAS if they are configured as remote nodes allowing the remote configuration. Refer to the [Appendix G. Network Links of GeoDAS](#) for more information about this issue.

Type of the digitizer is selected from the list. The set of supported types may depend on the program version but the settings of configuration dialog are similar for all digitizers. If the data are delivered through the serial channels, you have to select **COM port** and the **baud rate**. If a digitizer has network interface and acts as a server, you need to provide its IP address and port in order to connect to it. Entering of the **sampling rate** is only required if data stream of the digitizer does not contain this information.

GeoDAS supports remote data transfers for some types of digitizers. If these digitizers are connected to a remote computer running GeoDAS, you may also configure them locally as **virtual digitizers** and you may also **forward data packets** of a real or virtual digitizer to the remote instance of GeoDAS. Sending and receiving data is made with the Packet Dispatcher modules that are configured by pressing the corresponding **[Setup...]** buttons. They open the configuration dialog window described in [Appendix G. Network Links of GeoDAS](#).



Additionally, for several types of digitizers, GeoDAS can act as a server and can distribute data to clients connecting to it. The option **Forward data to remote clients** must be activated to enable this functionality. Two other options (**Listen for simple data requests** and **Force data block protection to CRC32**) are provided for compatibility with few old client applications.

In order to add a new digitizer, enter its 3-character **name** and press **[Add/Modify]**. The list of channels appears in the table. Most of the digitizers provide several channels of data. GeoDAS tries to group them by three assuming 3-component sensors and to assign the default unique **stream name** to every channel and a unique **station name** to every group of channels. The groups are highlighted in the table with different colours. But you can make a group having less than three channels by right-clicking the first channel in the group and by checking the **Group** item of the context menu. Left-clicking the station name enables/disables the corresponding channel. Disabled channels are displayed in grey and are marked with the red cross. You can also **Hide Disabled** channels from the context menu.

You can edit in the table the **stream name**, **full scale** and **units** of each data channel. Clicking the column **Full Scale** pops-up the **Sensor Full Scale** dialog window for certain types of digitizers. You should select the first **Standard** option and enter the full scale as written on the sensor label, unless different settings are recommended by GeoSIG. The column called **HW Channel** displays the reference hardware names used for identification of channels. These names depend on the digitizer type. You can also enable or disable correction of the signal **DC level** and/or to add a specific **Fixed DC** value to a calculated one.

If the option **Use channel parameters provided by the digitiser** is enabled, then any parameter, which can be retrieved from a digitizer will be used instead of the one specified in this dialog. It is also possible to integrate signals of received data channels in real time with the option **Enable virtual channels of integrated data**. The most common use of this option is to generate velocity channels out of acceleration data.

Press **[OK]** to save the current configuration of digitizers and to restart the data acquisition or **[Cancel]** to leave it without changes. Pressing the button **[Remove]** deletes digitizers with the currently selected name from the configuration.

9.6 Specific settings for MiniSEED data format

When GeoDAS stores streamed data in the miniseed format, it may be required to set several parameters of miniseed headers. It is possible by using the file **LocalStation.ini** placed in the **Config** directory under GeoDAS data root. The file must have the following format:

```
[Station]
NetworkCode=NC
StationCode=SCODE
Description=Any description
Location=Any location
```

You can assign values to these variables as required. Network code is no more than 2 characters, and the station code – maximum 5 characters.

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

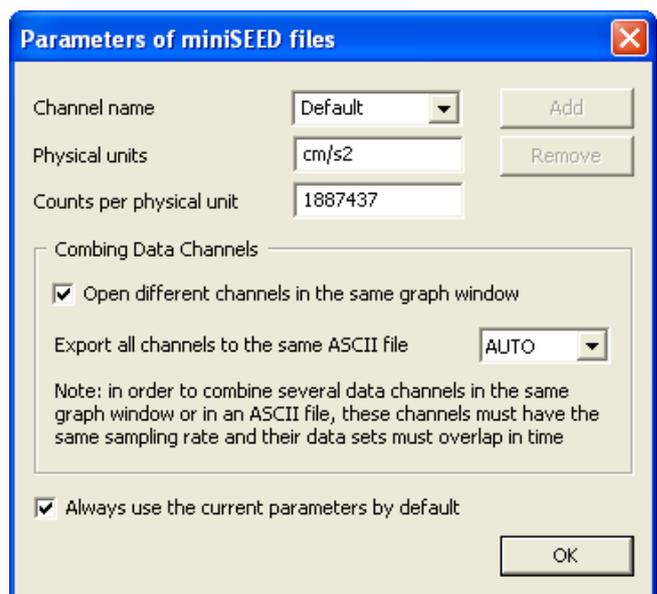
ASCII text files are supported as well. ODV can export any currently displayed data set to an ASCII data file and import the same file afterwards. If an ASCII data file is created by another application, care must be taken that its format is compatible with the one supported by GeoDAS. Please refer to 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 provides limited support for miniSEED format of event files. The default extension of these files is MSD. Basic format of these files do not contain information about physical units of the recorded signal, and therefore the user has to provide this information. While opening an MSD file, the dialog "Parameters of miniSEED files" appears. One can enter here the **physical units** (up to five characters) and the factor that will be used to convert raw **counts into the physical units** for three data components (channels).

You can set different units and scaling factors for different channel names. Just enter the related information and press **[Add]** to add channels. You can also **[Remove]** channels configured earlier at any time.

 *MiniSEED files recorded by GMS instruments usually contain extra information about scaling factors and units, although this feature can be disabled if required. If GeoDAS opens such extended miniSEED files, all necessary information is retrieved and used automatically.*



If you are working with files always recorded by the same type of instrument, it is convenient to select the option **Always use the current parameters...**

You may also want to choose whether all channels of a MiniSEED file are **opened in the same window** or if they can be fully independent while viewing and analysing them. All data channels opened in the same window must cover the same time interval, which is usually not the case for miniSEED files containing several channels, as data sets are not required to be synchronised in time. Therefore, if this option is selected, GeoDAS will cut datasets if required and will display only the time interval, which is common for all channels.

When miniSEED files are converted to ASCII, you can choose whether you want to store data of all channels to the **same file** but GeoDAS may cut these data sets partially, or if you want to convert and keep all data in the **separate ASCII files**, one file per channel. If **AUTO** is selected, then datasets of different channels will be

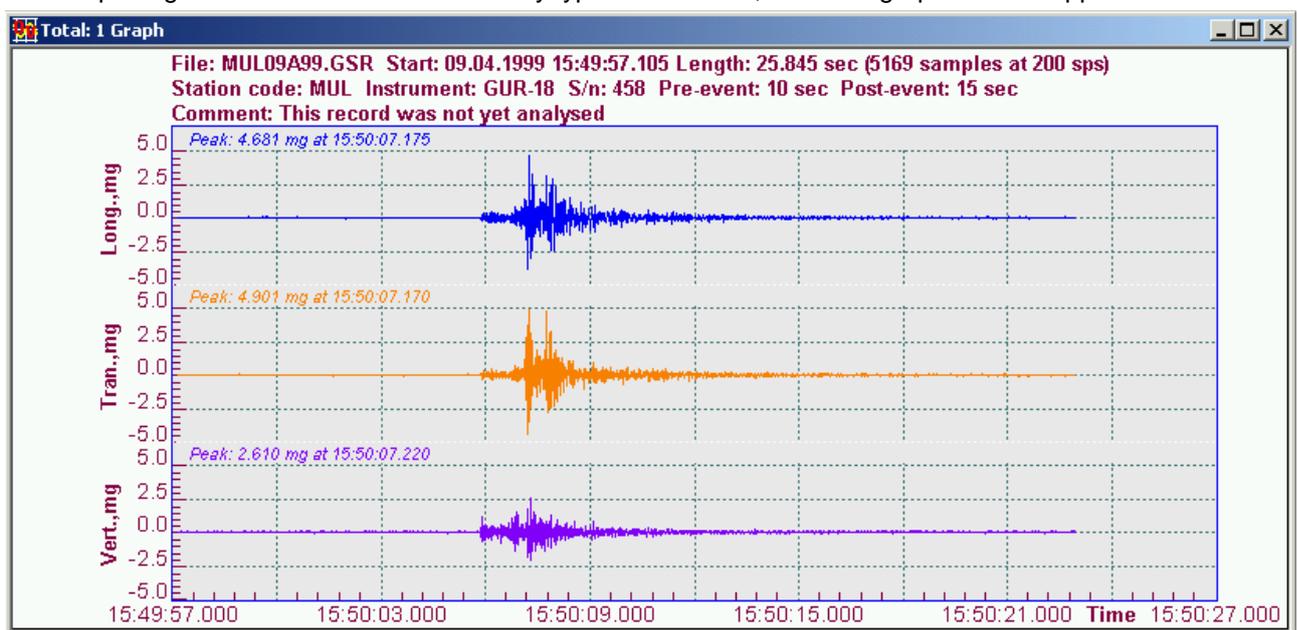
saved into different files only if they are not synchronised in time exactly. Otherwise, they will be stored into the same ASCII file.

This dialog is also accessible through the menu Analyse->Parameters by selecting the item Parameters of miniSEED files from the combo box.

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

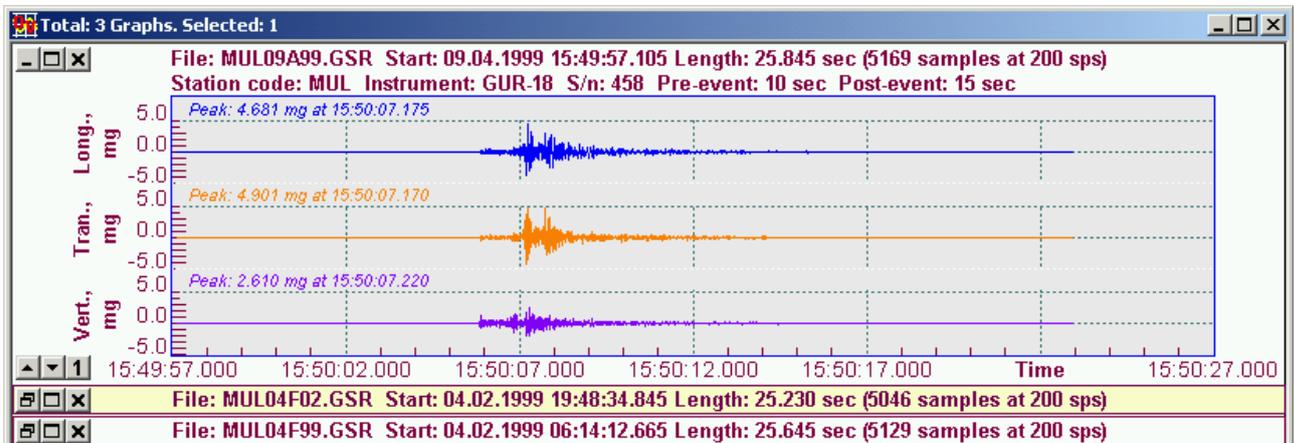
Selects all the graphs in the currently active ODV window.

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 you need to apply any math function to only to some part of the signal, if you would like to export this fragment into an ASCII file, etc. just paste the copied fragment in the new window (see below) and analyse it as if you would be doing that with the entire dataset.

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.

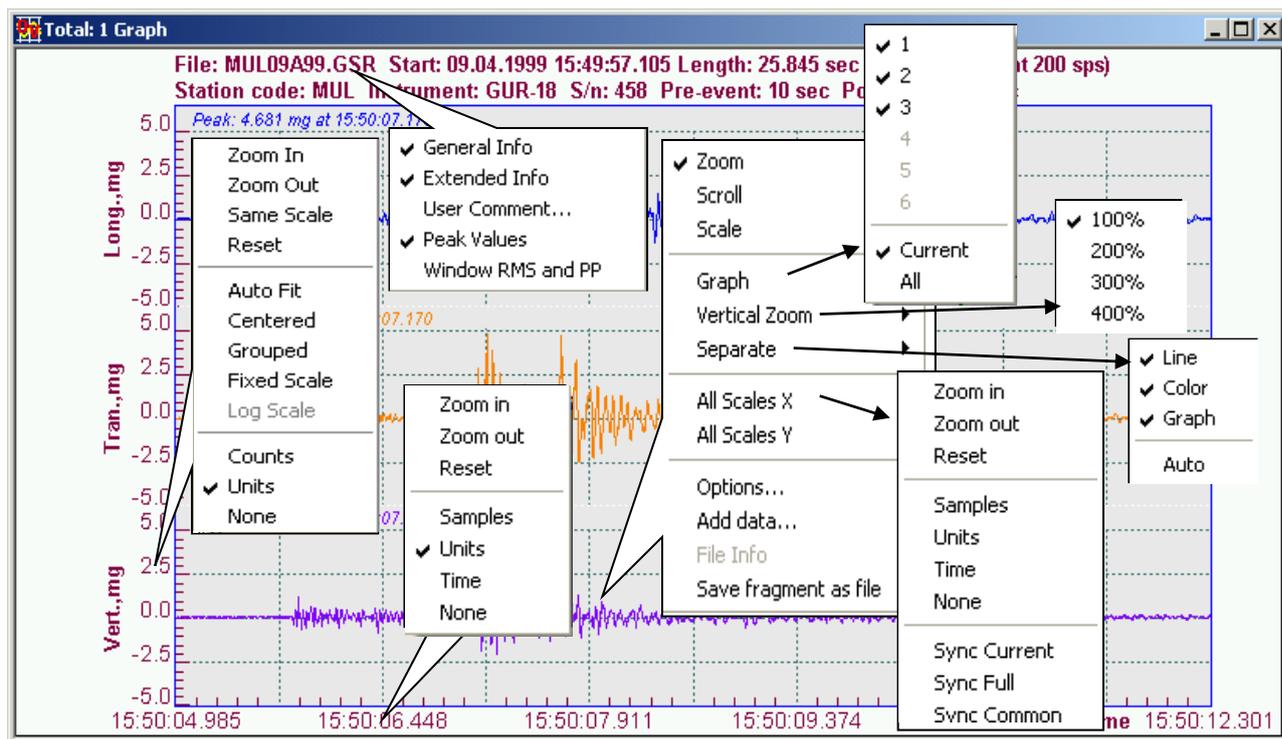
The **import of ASCII files** is also supported. When opening the data file with the standard browse dialog, select **"Text data"** as the type of file and choose one of the text files with the TXT extension. Since ASCII files

do not contain the factor of converting counts to the physical units, one cannot switch between counts and units while viewing these files.

 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 right-click is made: 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...

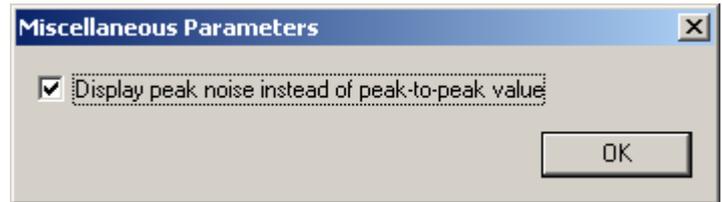
Selecting this item launches the simple dialog, which is used to enter any comment, which is displayed in the additional string of the graph header.

Peak Values

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

Window RMS and PP

If this item is selected, the Root Mean Square (RMS) and the Peak-to-Peak values are shown at the top of graph components. Both of them are calculated not for the entire dataset but for the fragment of it, which is currently displayed in the graph window. Instead of the Peak-to-Peak value one can select to indicate the noise peak-to-peak calculated as double of the maximum amplitude, which is not exceeded more than 0.1% of the time. This option is set in the dialog **Miscellaneous Parameters** accessible through the menu Analyse->Parameters by selecting the function Miscellaneous.



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 centred graphs. Some kinds of data graphs, e.g. Vector Sum, have only positive data samples and therefore they cannot be centred. 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.

Log scale

Enables logarithmic scale of Y-axis

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.

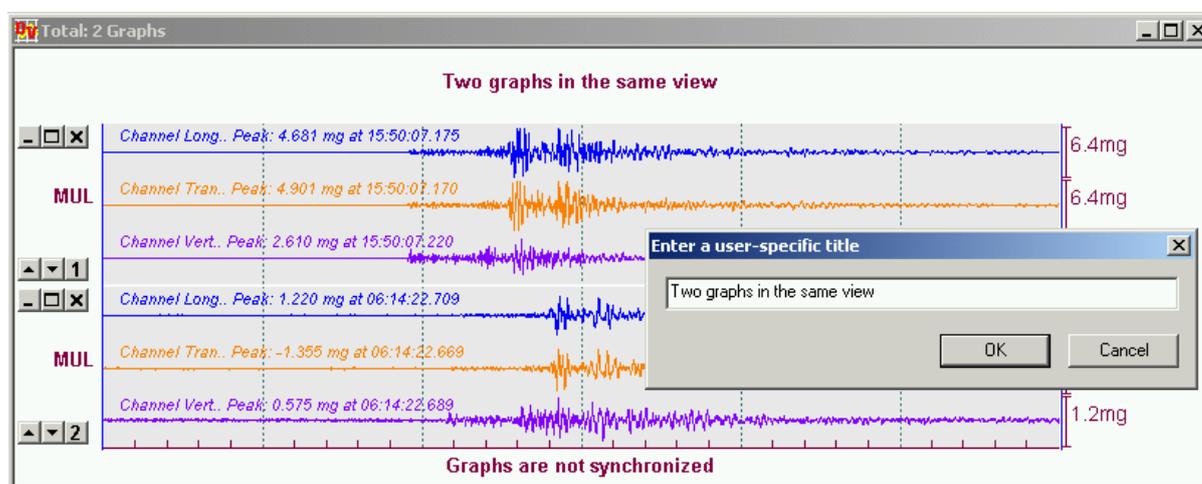
Vertical Zoom

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.

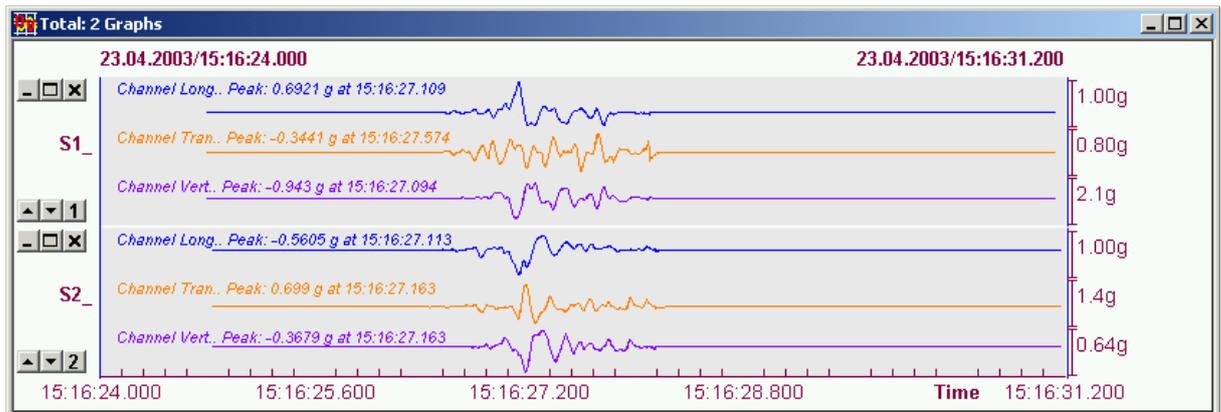
It is also allowed to minimise, maximise and restore the graphs as well as to select and deselect them. For instance, the upper graph in the picture above is shown selected.

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.

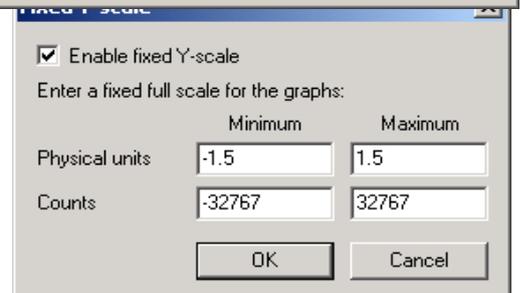
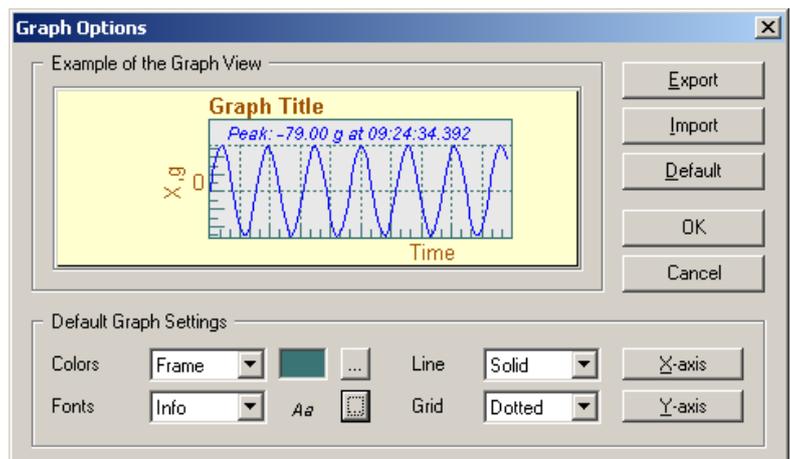
All Scales Y

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 frame, background, axes, canvas and text.** You can set also up to 6 colors for different graph components (channels) and up to 4 colors for other curves that might be displayed in the graph, such as OBE and SSE limits;
- **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.

Save fragment as file

Once you have selected a fragment of the long dataset, you can save it as a file for further analysis. This is one of the ways to extract particular events from large ringbuffer files manually.

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 centred.
-  **Scroll Down.** Current graph is scrolled downwards. The operation is performed only if Y-scale is not centred.
-  **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.** When this button is pressed 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

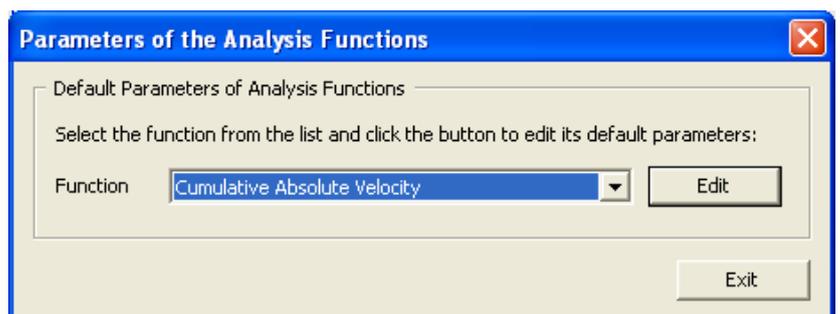
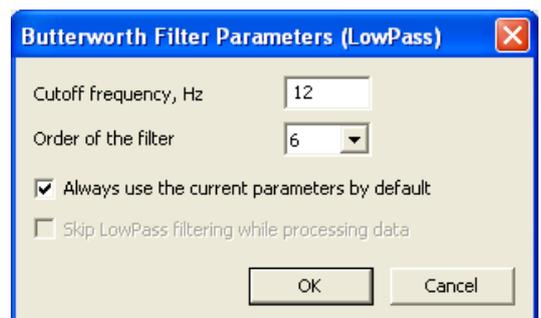
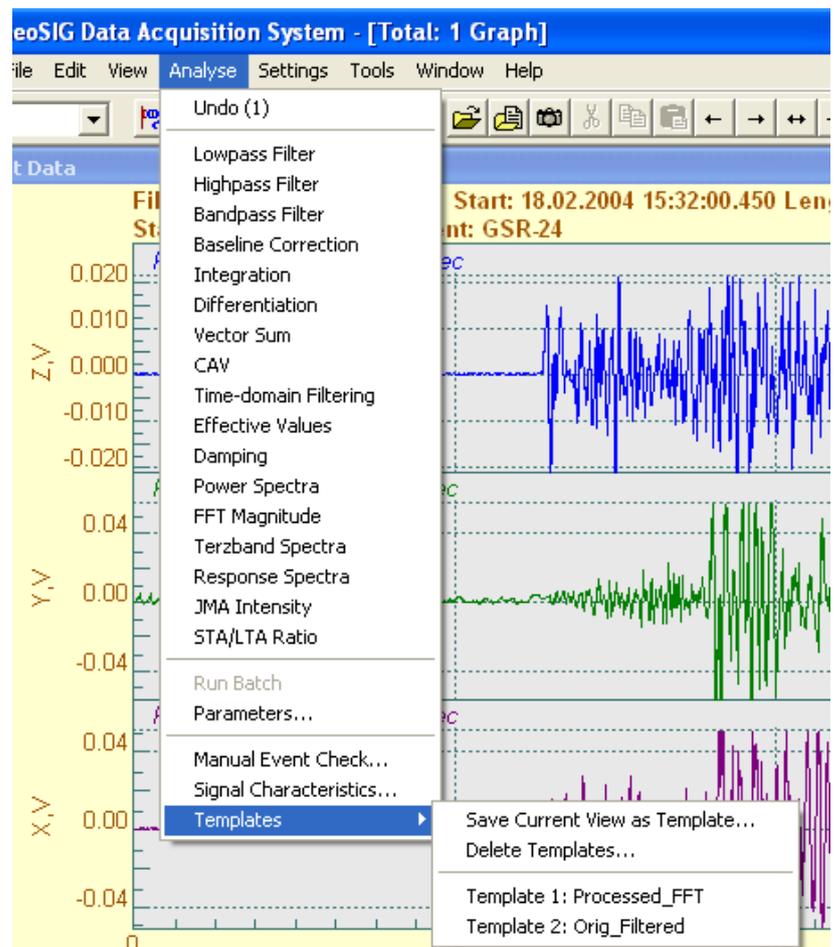
All supported math functions and other operations related to the data analysis are combined in this menu.

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 split 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.*

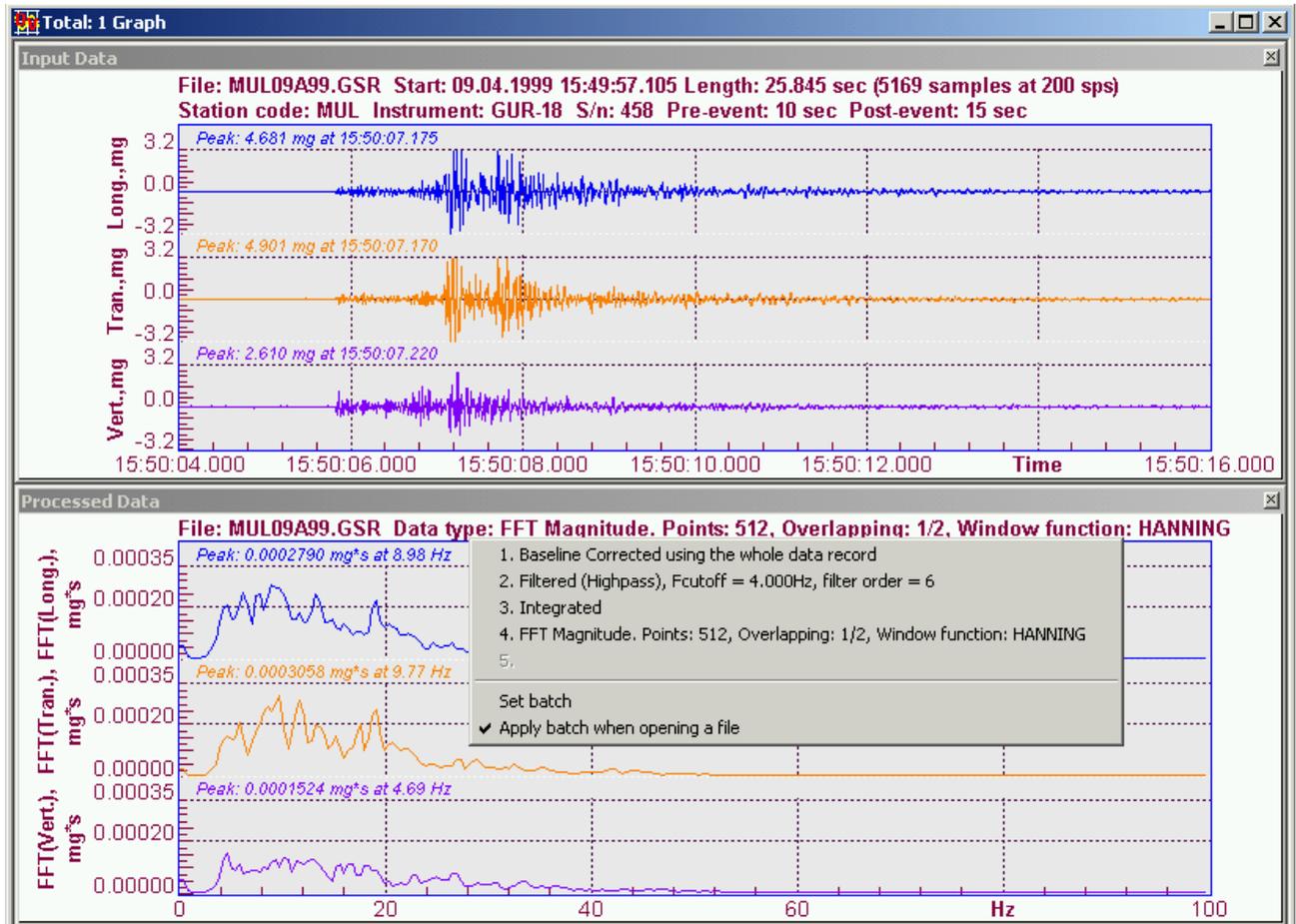
If there were more than one data set in the original ODV window, you can quickly view list the original data and the results of analysis by pressing the **arrow buttons** at the left side of the graph windows.

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 same can be done automatically for every file you open if the option “**Apply batch when opening a file**” is checked.

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

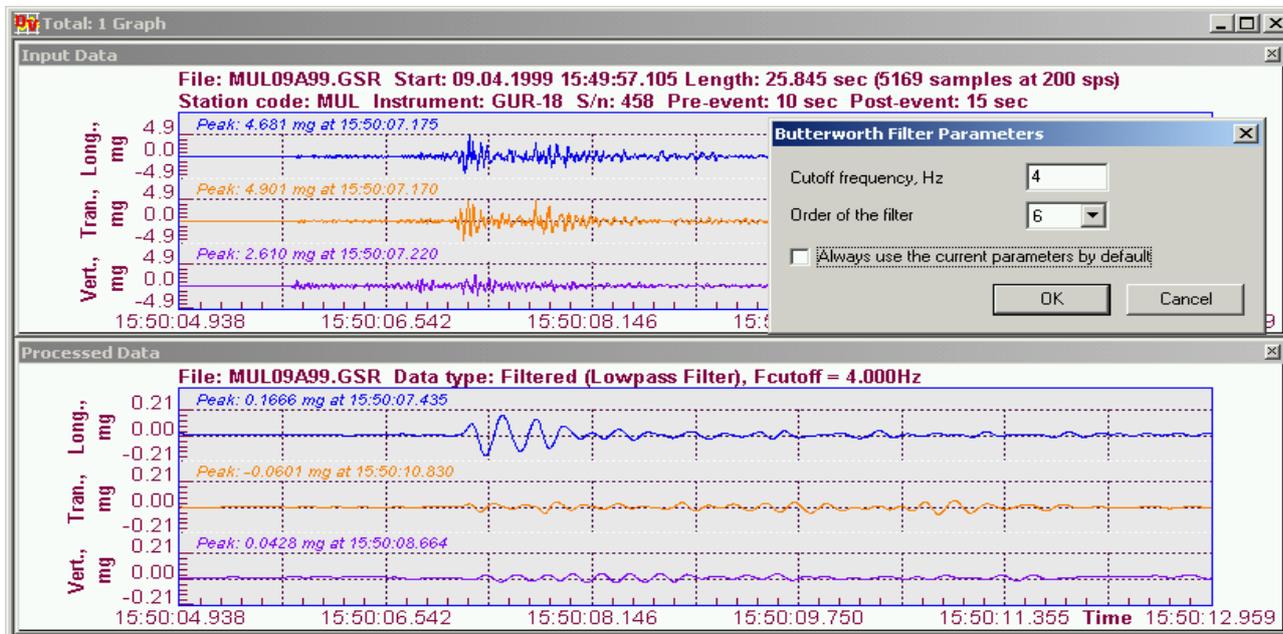
Several operations are valid only when applied to a particular kind of input data. For example, the CAV calculations are correct only for the input acceleration data in g units.

11.2.1 Lowpass Filter

An even-order Butterworth Lowpass Filter is applied.

User-defined parameters:

- Cut-off frequency in Hz
- Order of the filter

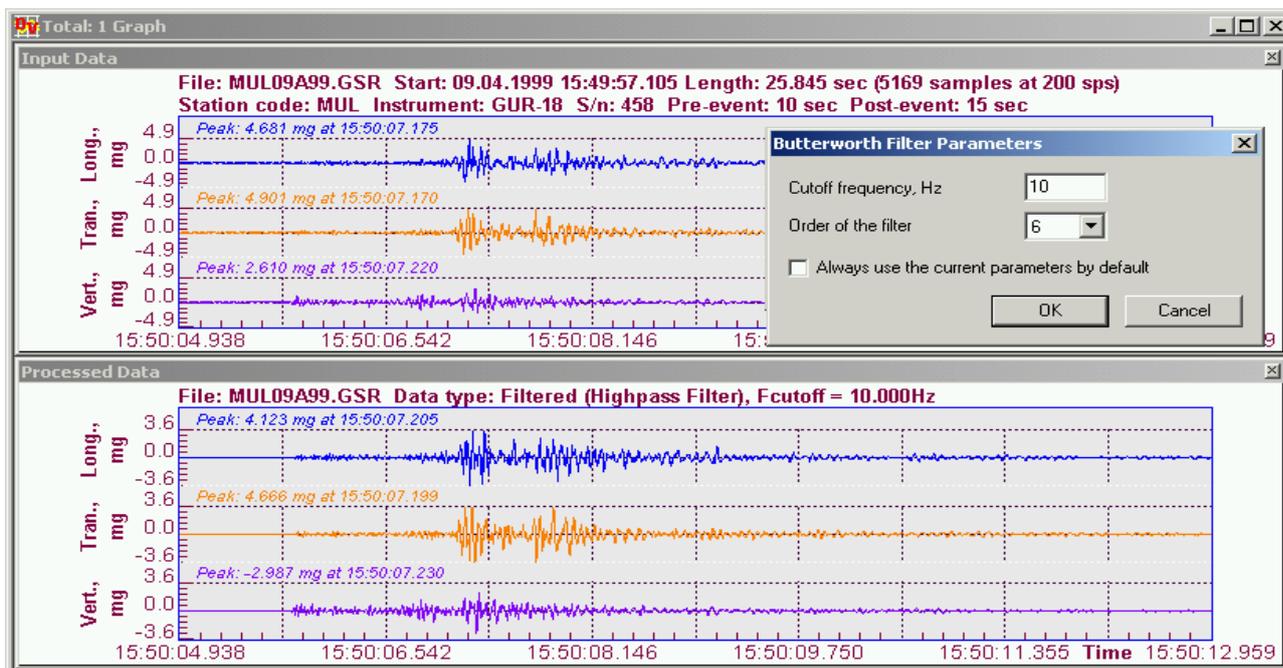


11.2.2 Highpass Filter

An even-order Butterworth Highpass Filter is applied.

User-defined parameters:

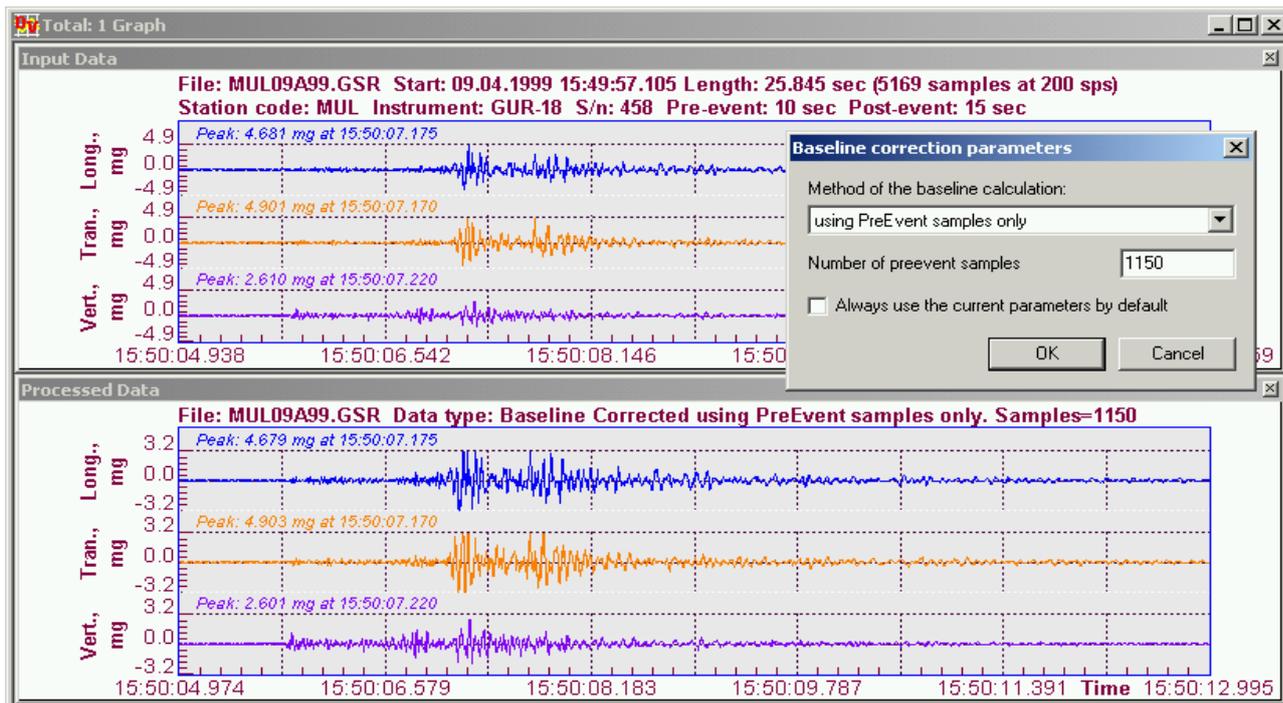
- Cut-off frequency in Hz
- Order of the filter



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:

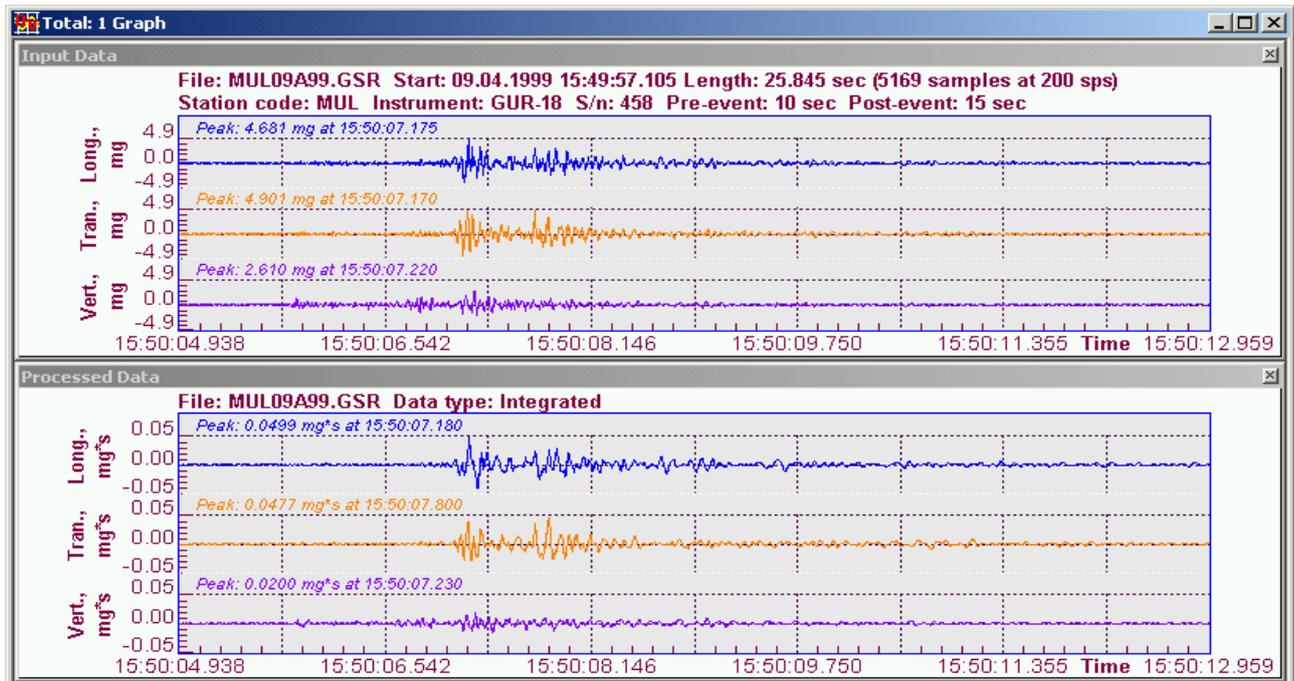
- Using PreEvent samples only. This calculates the average signal level in the pre-event time and subtracts this from the entire data signal. User specifies the number of pre-event samples.
- Using the whole data record. Default method. This calculates the average signal level of the whole event and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

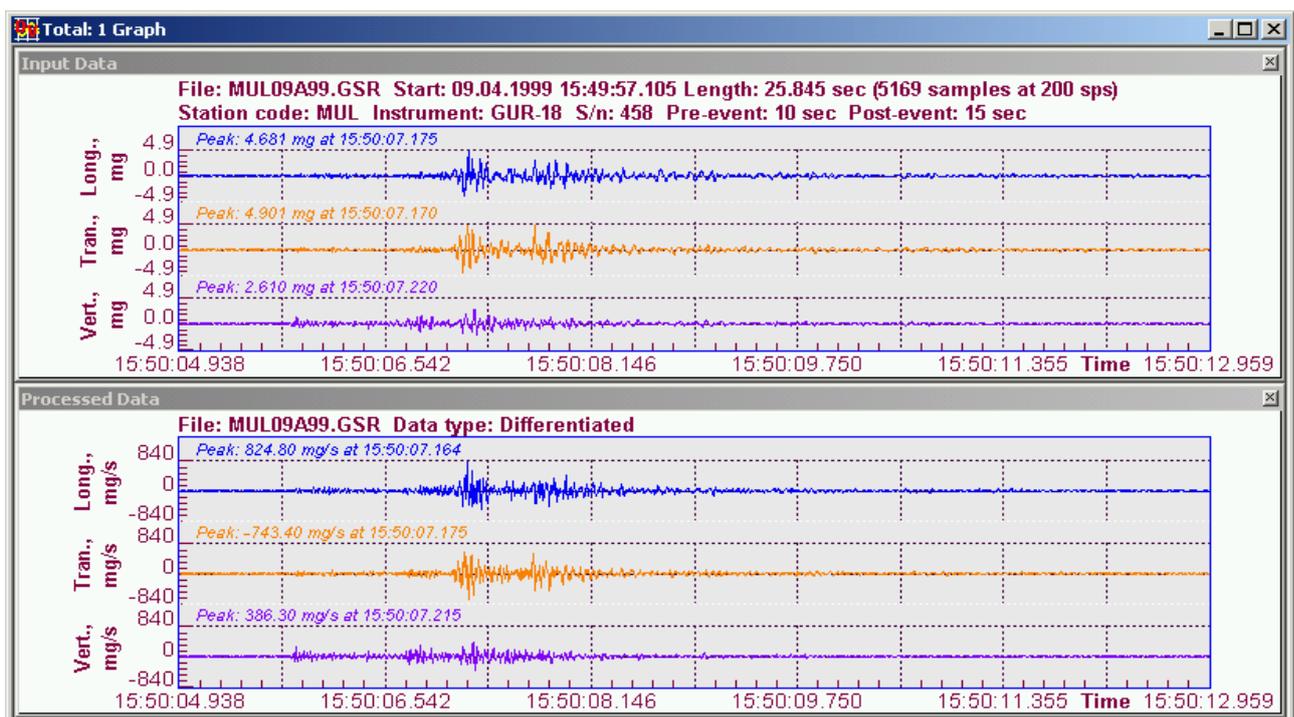
This function integrates acceleration data to the velocity or from velocity to the displacement. No correction algorithms are used by the integration function; therefore, better results can be obtained by performing the baseline correction or by filtering the data prior to integration.

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.



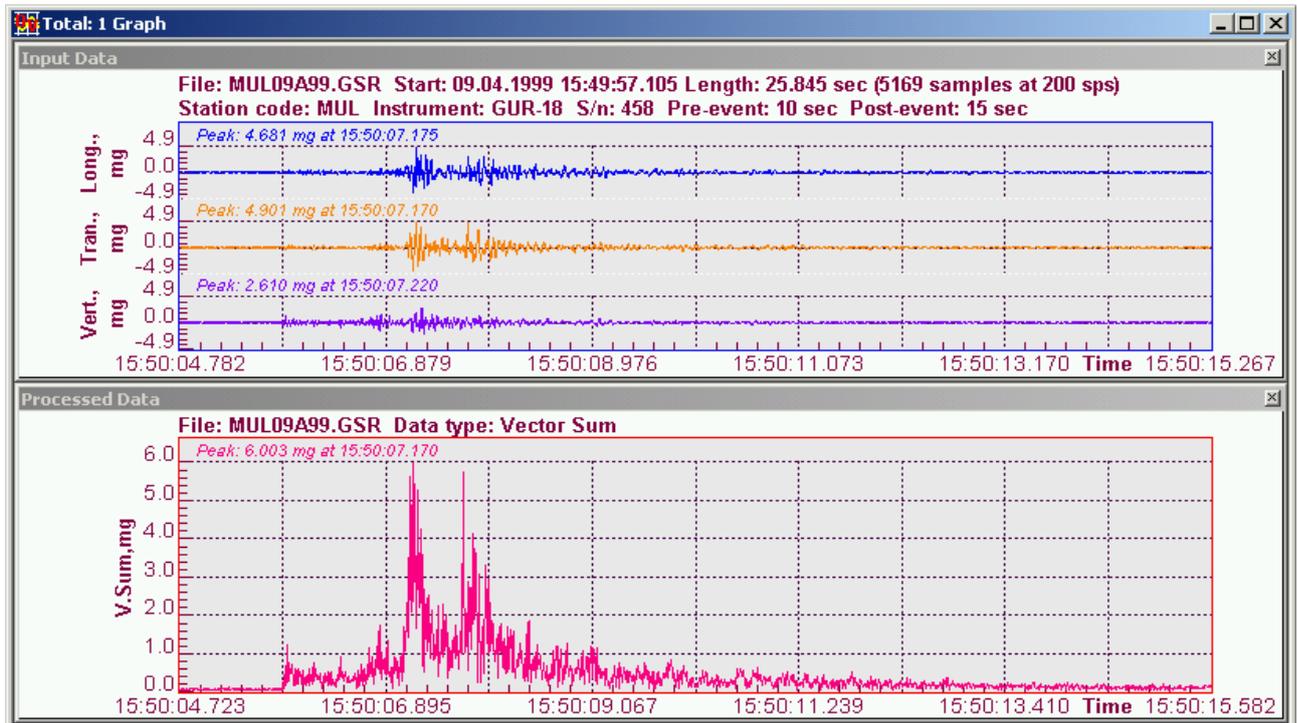
11.2.5 Differentiation

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.

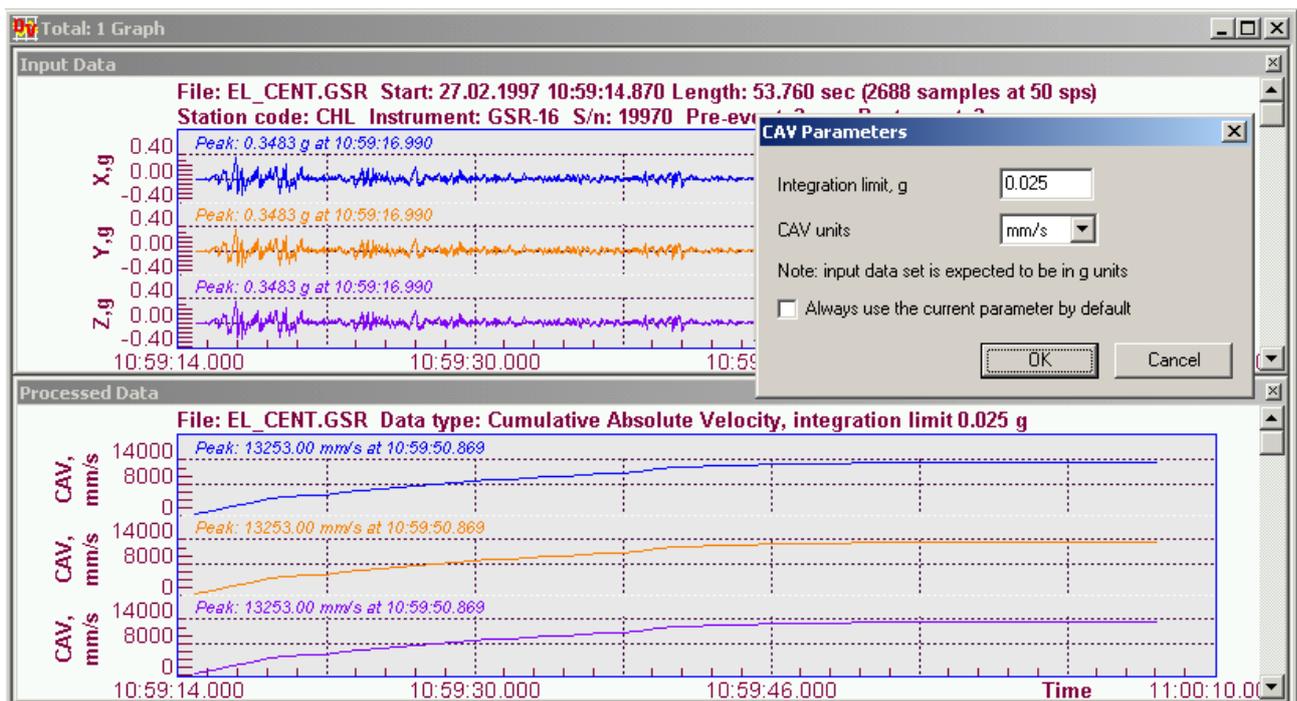


11.2.7 Cumulative Absolute Velocity (CAV)

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 or in g-sec units.

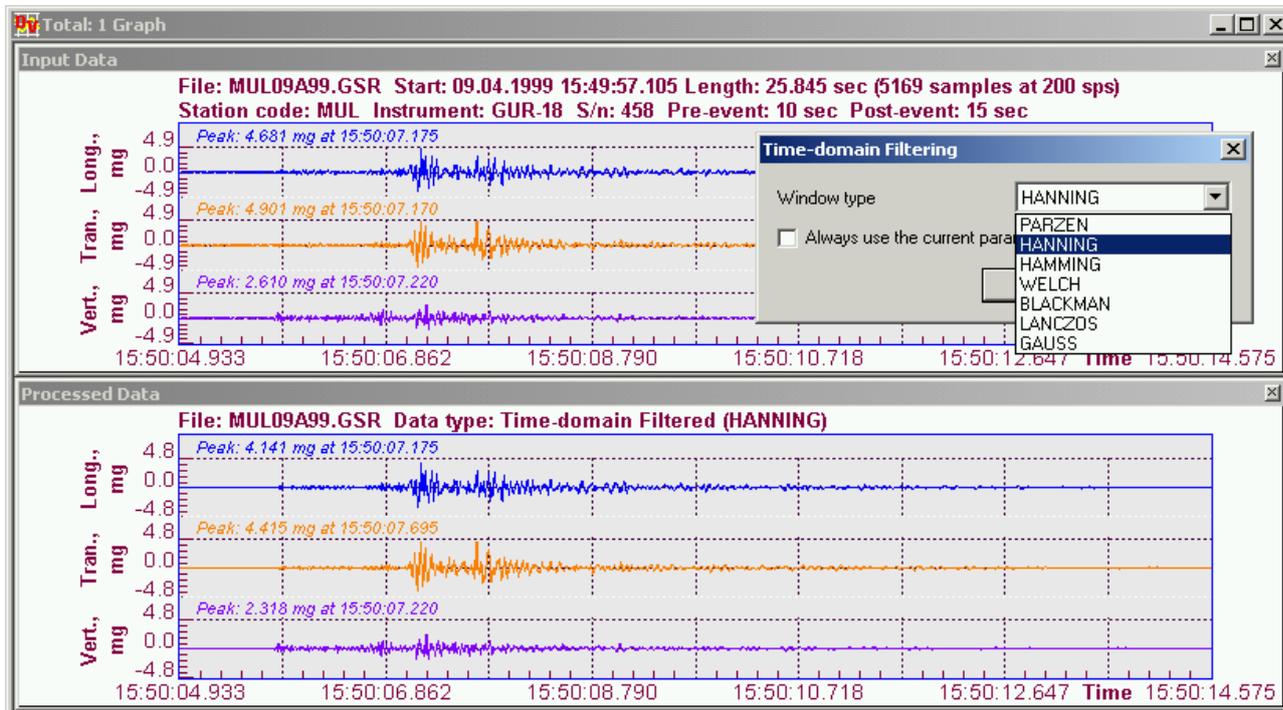
User-defined parameters:

- Integration limit in g
- Type of the output units



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.

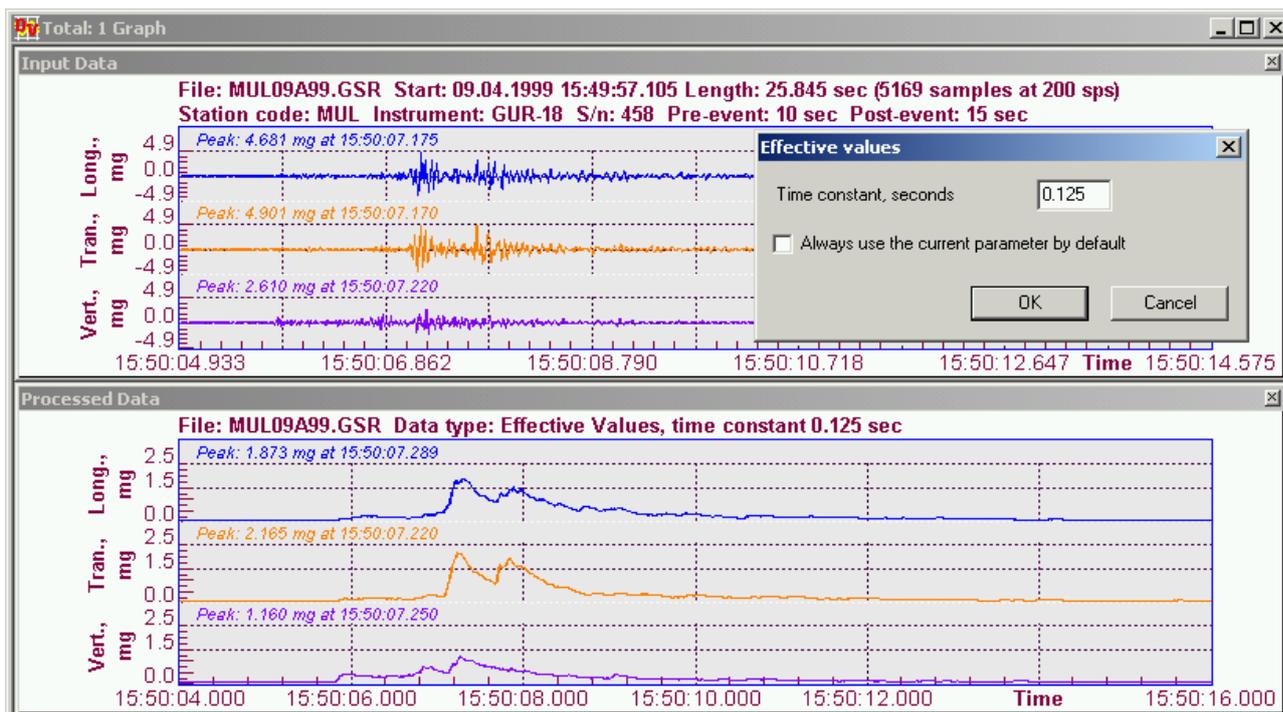


11.2.9 Effective Values

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

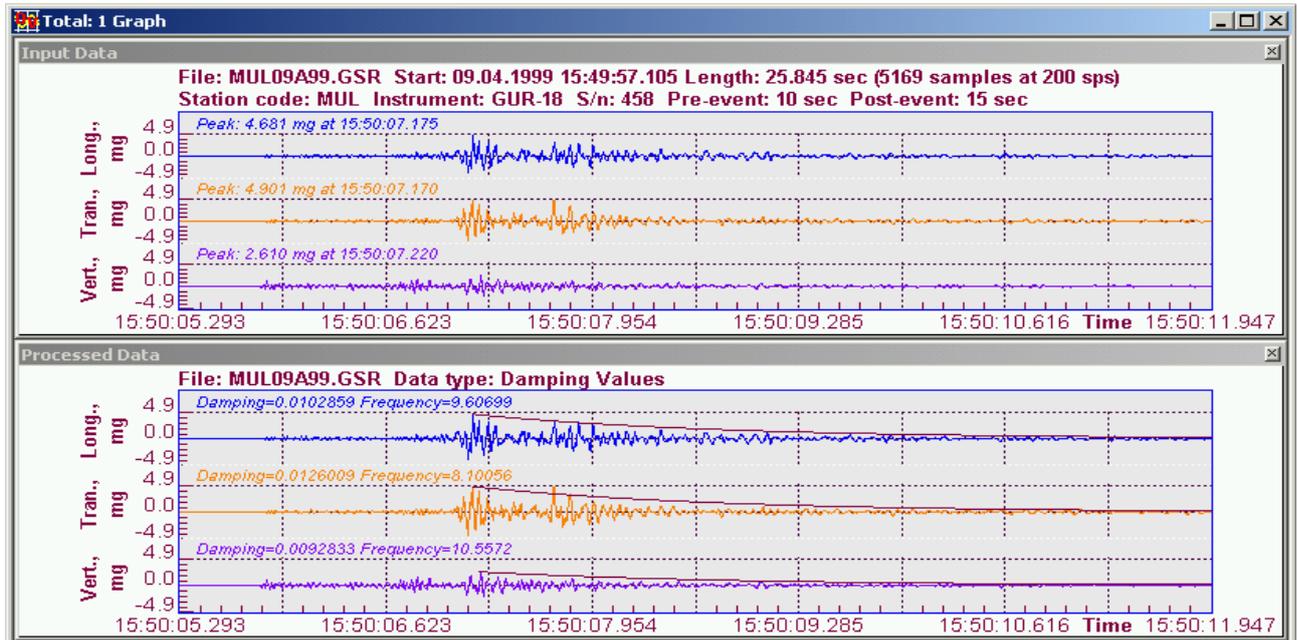
User-defined parameter:

- 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.



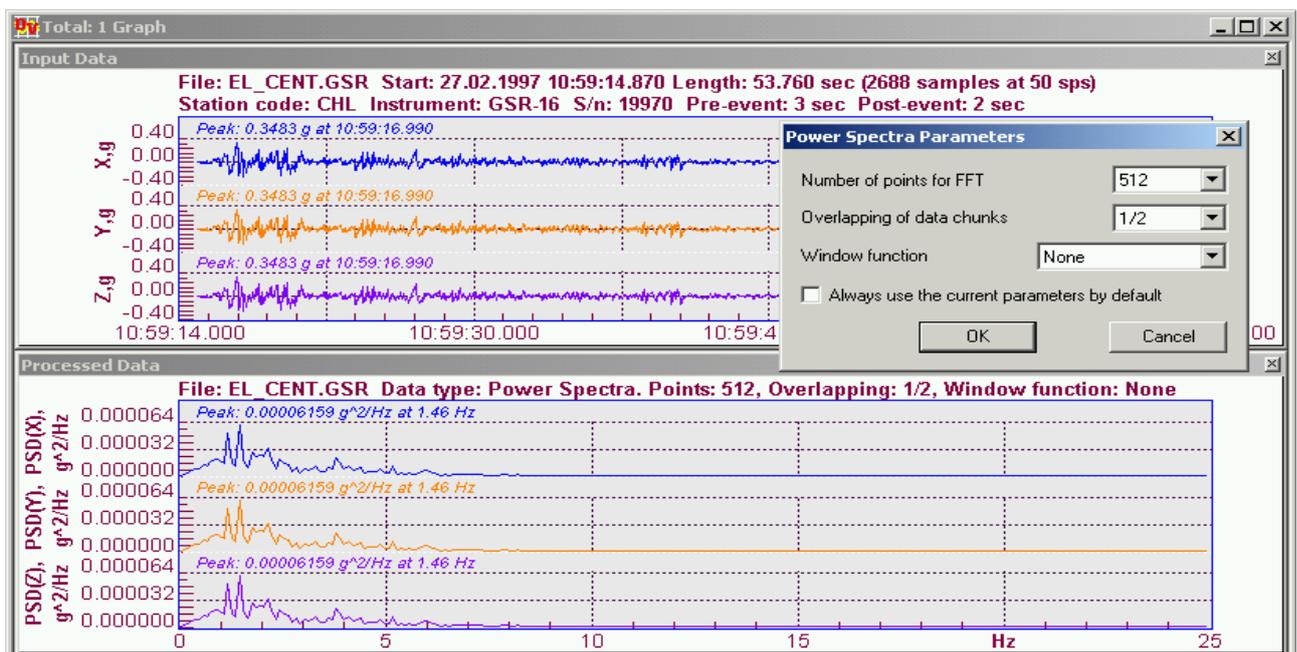
11.2.11 Power Spectra

This function performs a power spectrum calculation on the time series.

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

Default parameters for the implemented Welch's method assume 50% overlapping of the data segments and the Hamming window function applied to each segment before making an FFT. Results of all FFT are averaged to receive the final power spectra, which is then normalised to the sampling frequency in order to receive the PSD, i.e. power per frequency interval.

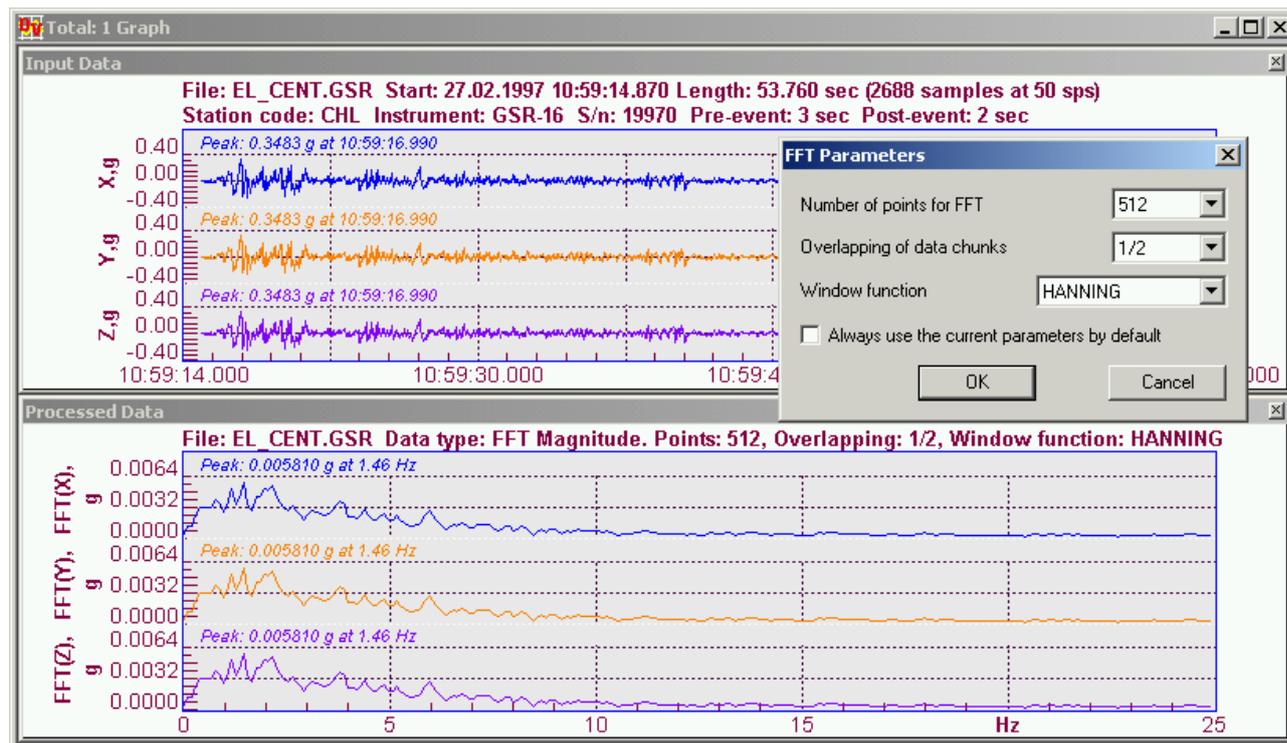


11.2.12 FFT Magnitude

This calculates the FFT Magnitude. The resulting spectra is normalised either by 1/N factor if no window function applied or by the corresponding factor of the window function. 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

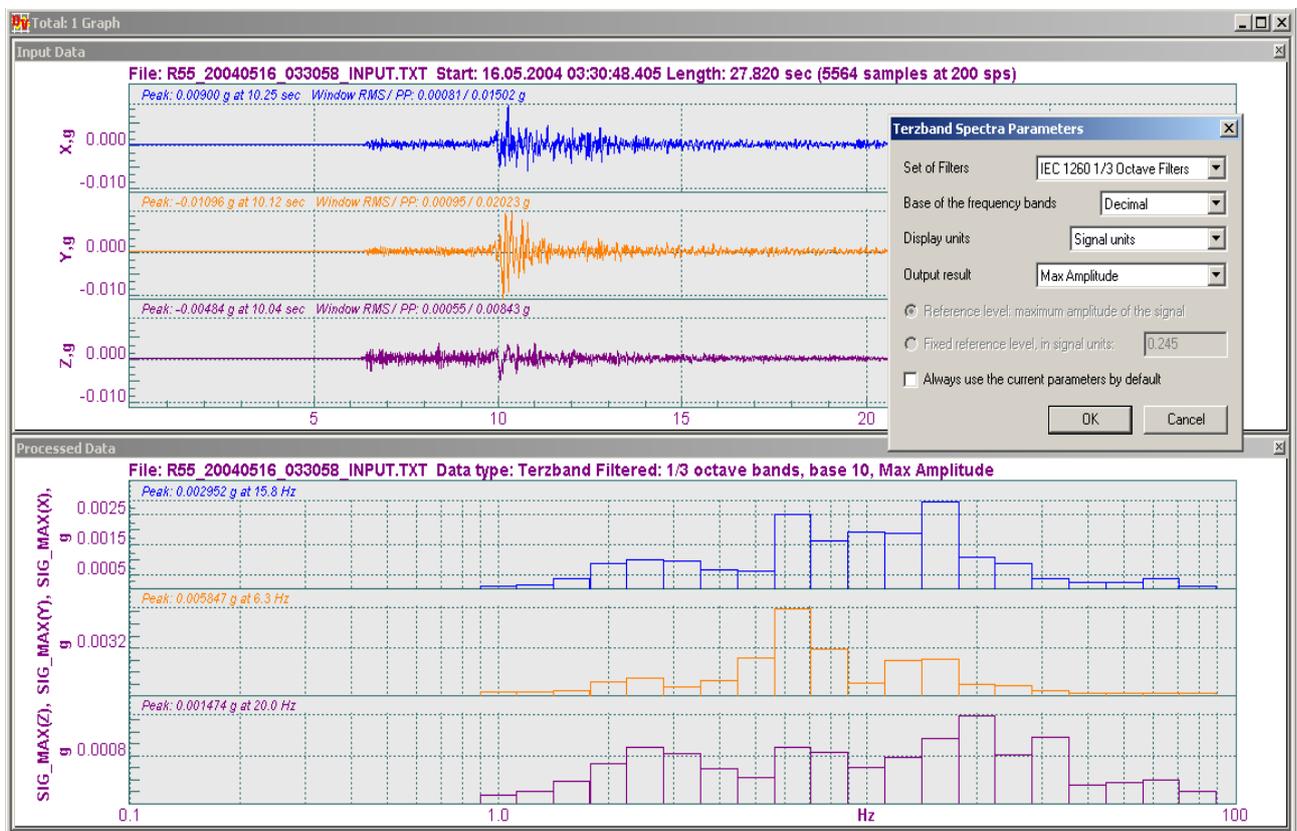
This function calculates peak values of the signal when it is passed through the set of band-pass filters (Class 0) in the time domain. The set of frequency bands and other related issues are specified by the standard IEC 1260.

The type of peak values selected by user can be one of the followings:

- Max. Amplitude: The maximum value of raw signal is displayed
- RMS Amplitude: The RMS value of the raw signal is displayed
- 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

Other user-defined parameters:

- Set of filters: either one-third octave bands (default) or the full octave bands
- Decimal (default) or binary base for the frequency bands
- Display units: either the actual signal units or dB. In the last case one can specify the reference level or one can use a maximum signal level by default.

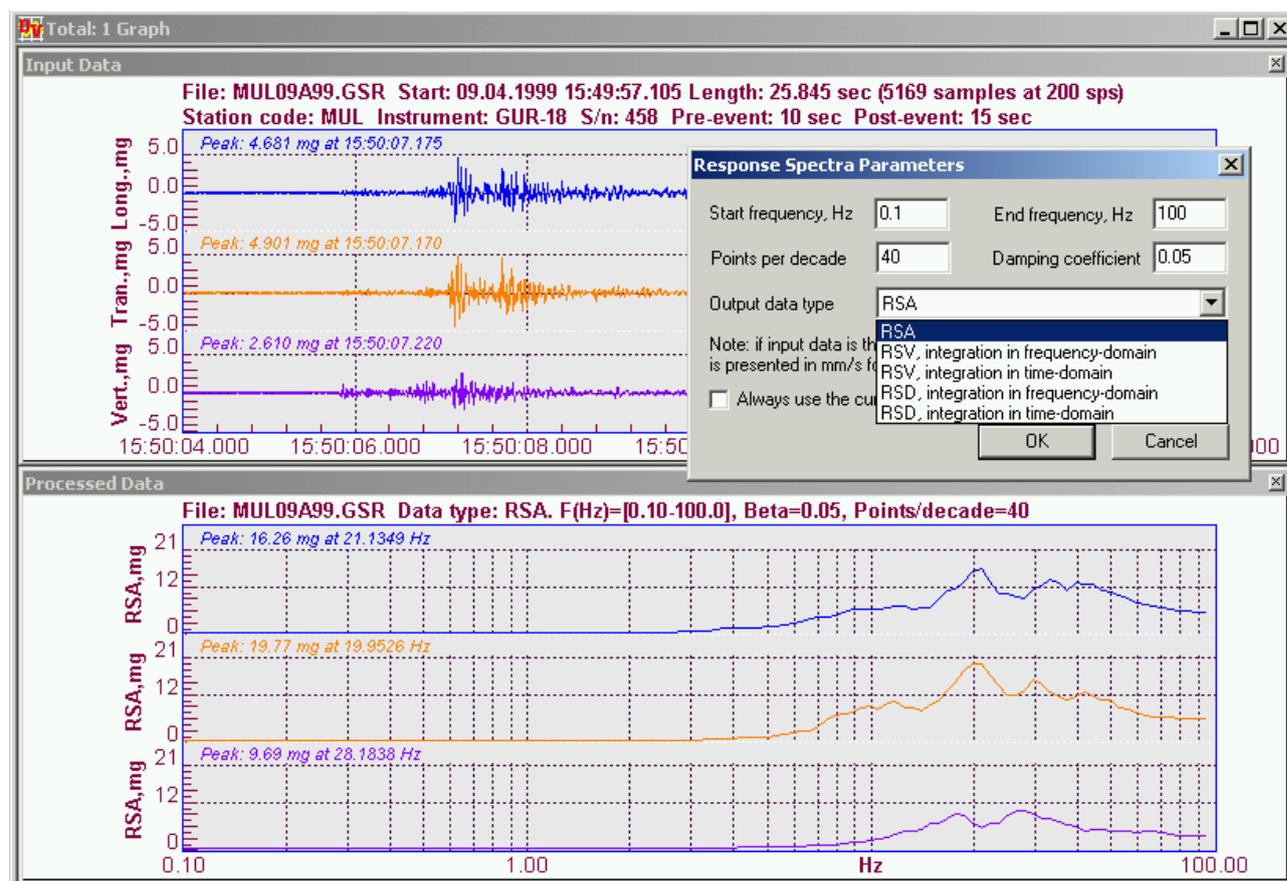


11.2.14 Response Spectra

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

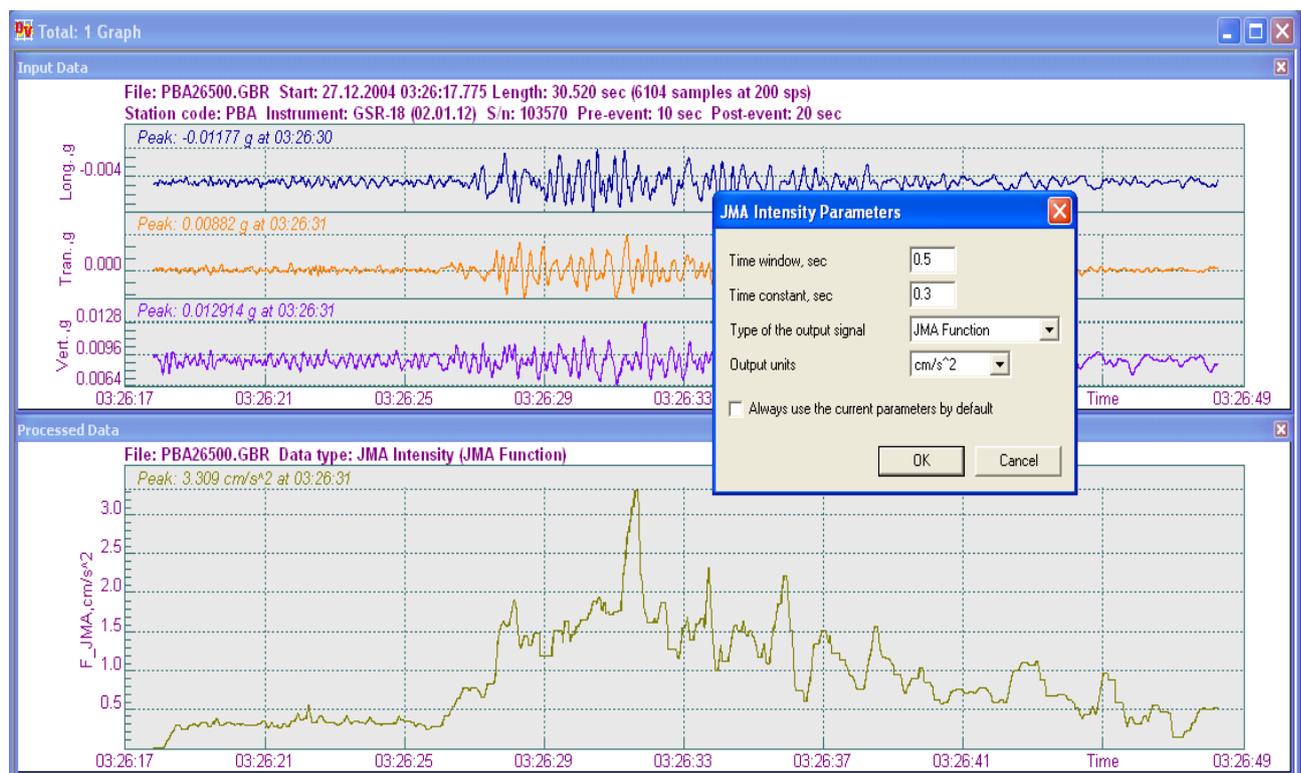


11.2.15 JMA Intensity

This function performs calculations of the seismic intensity in order to estimate severity of the ground motion at the site of measurements. There are few methods of the intensity scale calculation, the most known are MMI (Modified Mercalli Intensity) and MSK (Medvedev-Sponheuer-Karnik) scales. This particular method utilizes the concept of calculations developed by Japan Meteorological Agency and therefore abbreviated as JMA. Each of three components of the input signal is filtered with a specific band-pass filter and the vector sum of those is taken. Then every point of JMA function is defined as a value of acceleration as a vector taken at some cumulative time offset dt in a sliding time window dT ($dT > dt$) representing sorted accelerations within this window. The intensity values are calculated from those points using an empirical formula.

User-defined parameters:

- Length of the time window dT , seconds
- Time constant (offset dt in the window), seconds
- Type of the output signal, one of the followings:
 - JMA Function – the set of vector accelerations, as described above
 - Empirical Intensity – the resulting JMA intensity
 - Vector Sum – square root of the sum of squares of all three filtered components
 - Vector Sum Sorted – the same as above but the values are displayed sorted
 - 1st Channel Filtered – 1st component of the signal after applying the bandpass filter
 - Maximum Acceleration – set of the maximum vector accelerations calculated in each window dT
- Output units: either the original units of the input signal or cm/s^2

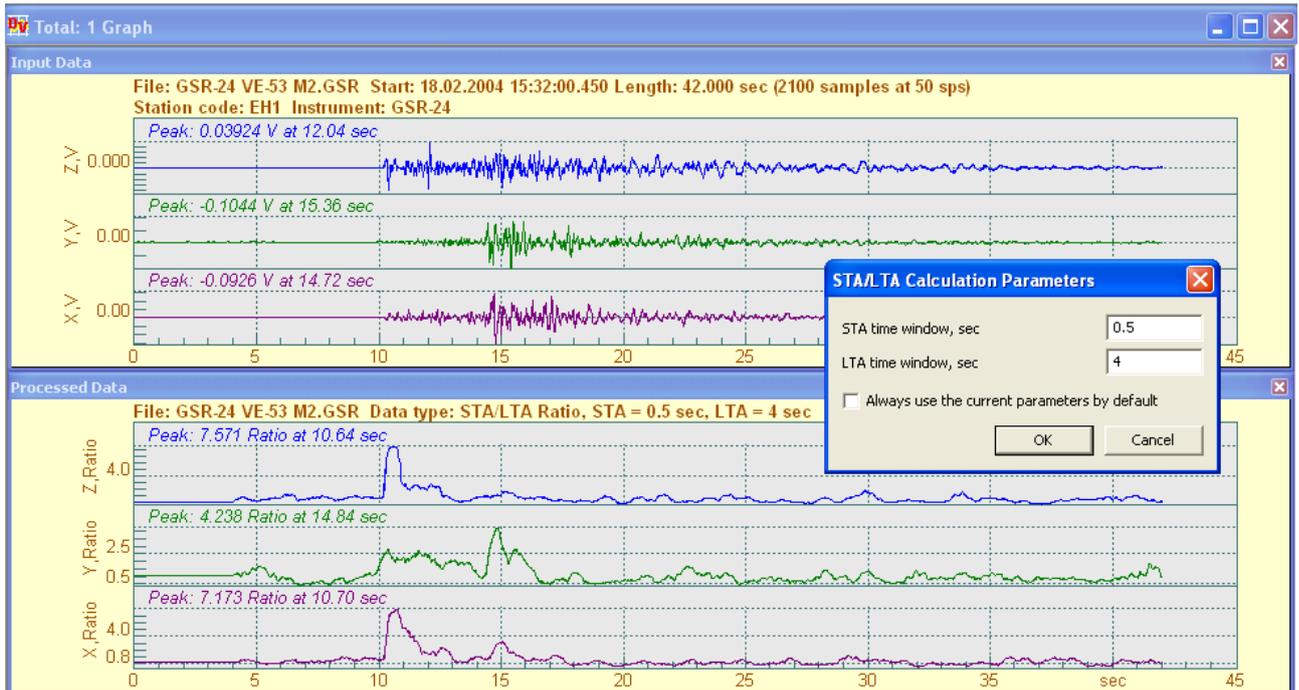


11.2.16 STA/LTA Ratio

This function illustrates how the STA/LTA algorithm works. Using the specified short and long time windows for the signal averaging, it calculates the ratio of these two average values and plots it graphically. Note that first LTA seconds the ratio is plotted as zero because no LTA average is calculated yet. If the entire duration of the dataset is less than LTA time window, the function is undefined.

User-defined parameters:

- STA time window seconds
- LTA time window, seconds



11.3 Templates

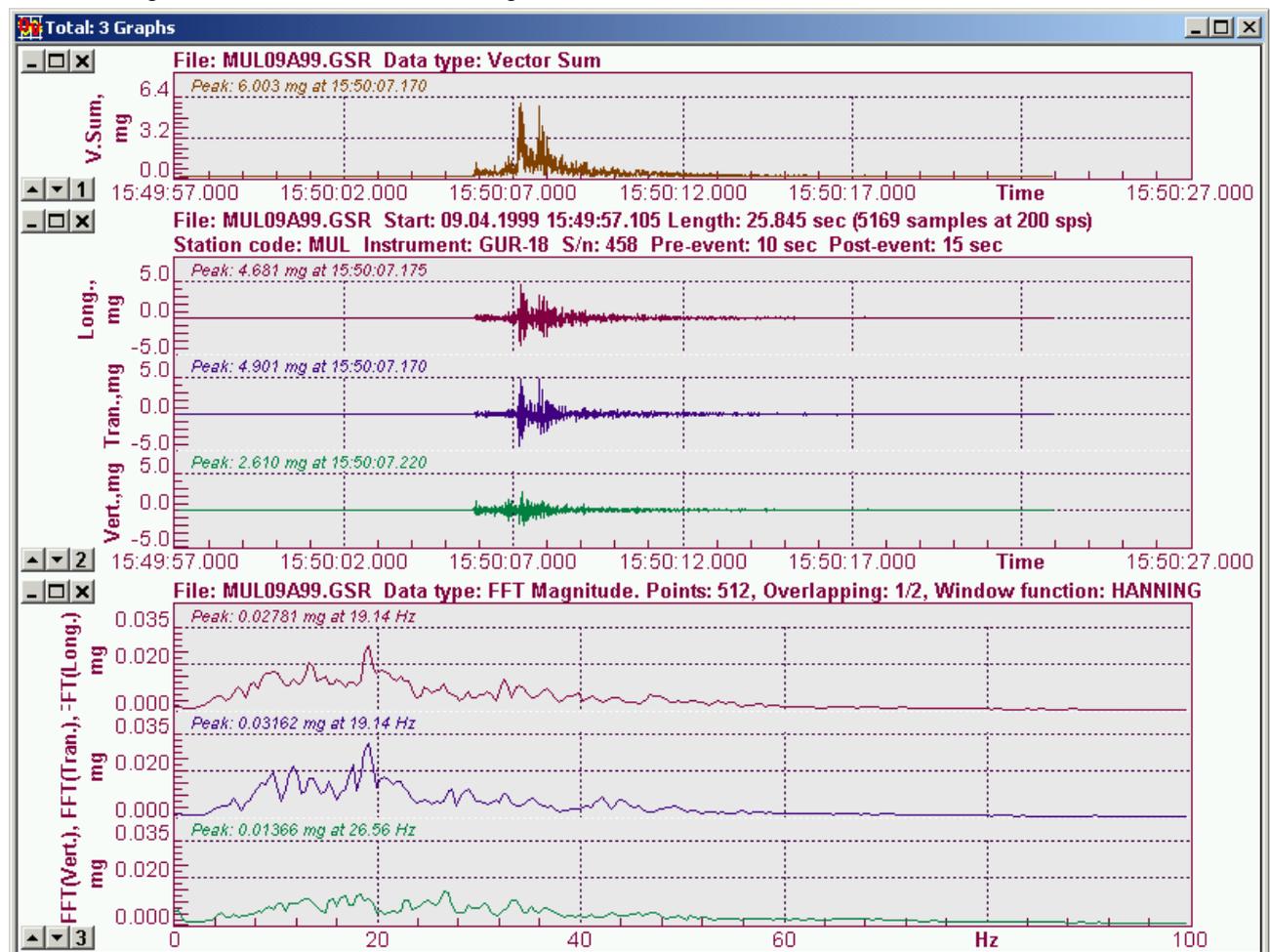
Templates are developed for effective analysis of the large amount of similar data. Let us consider an example for better understanding of this issue. Suppose we have many event files, which contain acceleration data, and we need to analyse their spectra and to receive also the vector sum of every data 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:

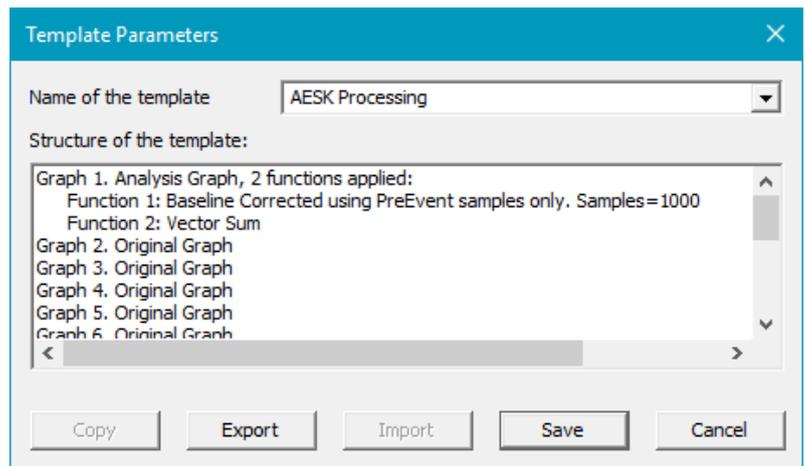
1. Open the same file three times in three different windows
2. Apply the FFT Magnitude function with the required parameters to the input data in 2nd window
3. Close the upper part of window (Input data) and select the remaining results of FFT Magnitude by clicking the graph canvas
4. Press the Copy 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.

Templates can be exported to files and imported to some other instance of GeoDAS on another computer.

11.4 Signal Characteristics

This analysis tool is useful to generate a table of the main parameters of recorded signals. First step is to select a file or group of files for analysis. Then the output file name is selected. GeoDAS creates output files in the CSV text format. Information stored for every processed file is the following:

- General parameters, such as date, time, duration of the record, channels names, etc.
- Maximum amplitude and peak-to-peak values for every channel
- RMS and Effective values
- Frequencies of the peak spectral amplitudes

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. Note that some extended functionalities (e.g. support for ADC boards) may not work without a special serial registration number. Please contact GeoSIG if you need to activate such functions.

[Appendix E. Strong Motion Data Processing](#)

[Appendix F. Messenger of GeoDAS](#)

[Appendix G. Network Links of GeoDAS](#)

[Appendix H. Statistics of Communications](#)

[Appendix I. Network Monitor](#)

[Appendix J. Event Checks](#)

[Appendix K. Station Map](#)

[Appendix L. Support for ADC boards](#)

[Appendix M. Static measurements](#)

[Appendix N. Automatic Event Processing](#)

[Appendix O. Network Alarm Logic](#)

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:

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

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;
- whether **LTA is updated** when event trigger is active

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-second intervals where peak acceleration is greater than an integration limit (usually 0.02g) using the following algorithm:

$$\text{CAV}(t) = \text{Integral from } 0 \text{ to } t [\text{abs}(a) dt], \text{ where}$$

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 continuous 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 applications 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;  
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 channel experiences an error
 6. Status of four annunciator alarms: TRIGGER, OBE, SSE, ERROR (from left to right)
 7. Other information, mostly intended for debugging purposes
 8. Status of the trigger errors

Example

```
Date;Time;Site;Event;Status;AC power;Link;Alarms;Info;Locked Triggers;  
05.05.2004;16:11:49;ANNUN;GeoDAS Startup;--*-*---;-----;-----;*---;-----;-----;  
05.05.2004;16:12:08;GBD (1);ERROR;*-*-*---;-----;-----;*---;-----;-----;  
05.05.2004;16:13:42;GBD (1);NO ERROR;--*-*---;-----;-----;*---;-----;-----;  
05.05.2004;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 exactly 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.

	PGA, g	PGV, cm/s	RSD at 5.00 Hz, cm	RSD at 3.33 Hz, cm	RSD at 2.00 Hz, cm	RSD at 1.11 Hz, cm
Absolute maximum	0.4	5	1	2.5	5	9
Absolute minimum	0.08	1	0.2	0.2	1	2

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 with 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, in order to use this functionality, you have to configure first any email client (such as Microsoft Outlook Express).

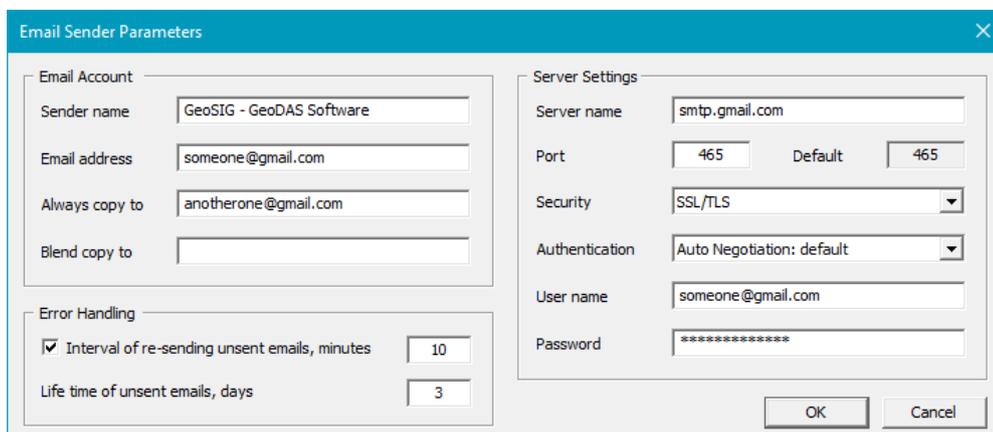
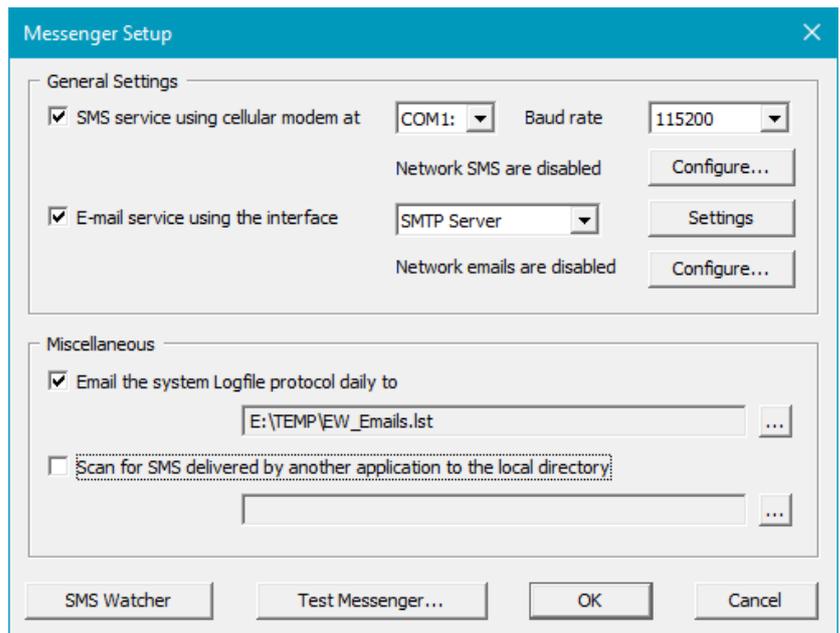
Parameters of the GeoDAS Messenger are adjusted with the following dialog, which is launched from the main menu **Settings->Messenger**.

Tick 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, as well as the desired **baud rate**.

The **E-mail service** can be provided in two different ways: through the **Messenger API** by using a default e-mail client installed on this computer (e.g. Mozilla Thunderbird), or by direct connection to an **SMTP server**. If you have chosen the latter,

press **[Settings]** to configure parameters of the server as shown in the window below. You need to have an email account for sending emails and to enter its settings in the related fields. Please consult with your e-mail service provider if you are not familiar with these settings. Most SMTP servers support several types of security and authentication methods. It is strongly recommended to try the secure SSL/TLS connection first. If you are unsure about the right authentication method, select the the default Auto Negotiation.

Please note that e-mail server can be temporary unavailable due to maintenance or network connection problems. In that case, you will receive an error of sending an email. However, you can tick the option **Interval of re-sending...** and enter the desired interval. GeoDAS will keep unsend e-mails for the configured **Life time** interval in days and will keep trying to send them every few minutes as configured.



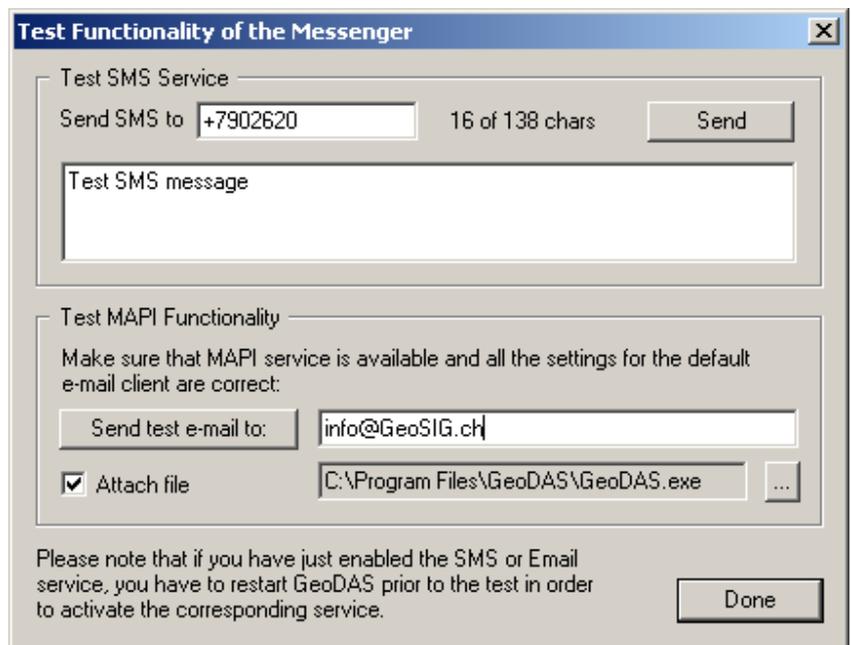
Messengers of the different instances of GeoDAS located in the different computers can exchange with the data. Those messengers, which do not have the corresponding services enabled, still can send the emails

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.

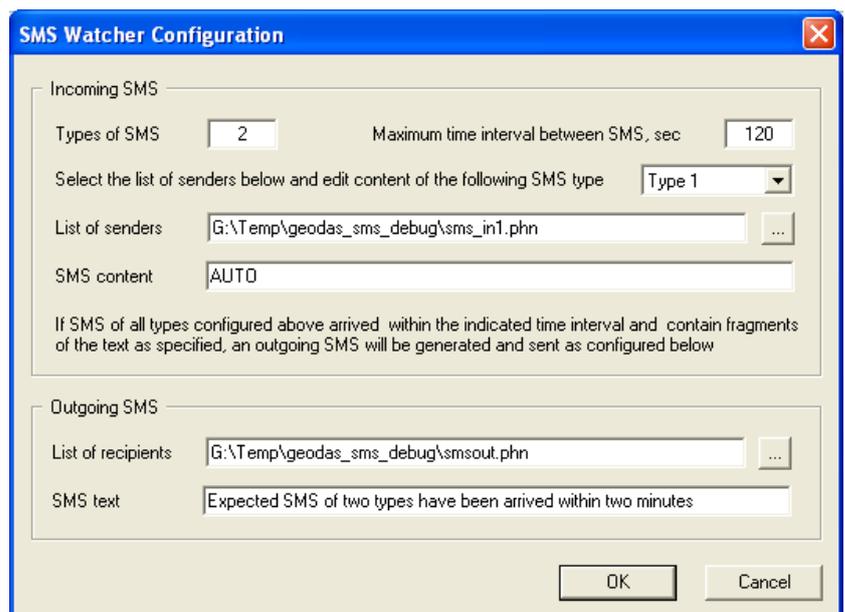


There are two more miscellaneous options in the Messenger Setup dialog. You can enable **sending the system Log protocol by email daily**. The list of subscribers containing the destination email addresses is selected with the browse button **[...]**. The format of files containing email addresses and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

SMS Watcher

It is a tool, which listens for incoming SMS messages and analyses their content. If messages are received within certain configured **time interval** and contain expected fragments of text, the SMS Watchers generates **outgoing SMS** with the preconfigured content and sends it out. The related parameters are set in the configuration dialog opened with the button **[SMS Watcher]**. You can define several **types of SMS**, and can specify for each type the **list of senders** and the **key content of SMS**.



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 SMS 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->Network Links**.

First of all, you have to select the option **Enable network links with the remote applications**, and then the other controls become available.

Network Links

Enable network links with the remote applications

Local settings of this application

Network name: GeoDAS_WW1WS

Password: *****

IP Address: Default

Accept requests from the remote clients at port: 10240

Accept requests from the configured applications only

Support functions of a remote node: Options...

Support broadcasting of datagrams, port: 10241

Launch the application:

Remote application

Network name: RRMapServer1

Password: *****

IP Address: 192.168.1.21

Connect through the port: 1024

Connection timeout, sec: 40

Inactivity timeout, sec: 600

Remote node: Options...

Permanent monitoring: Monitor...

Packet mode: Settings...

Configured remote applications

Name	Link Parameters	Conn.TO	Inactivity TO	Node	Monitor
RRMapServer1	TCP 192.168.1.21:1024	40	600	No	Yes
RRMapServer2	TCP 192.168.1.22:1024	40	600	No	Yes
GeoDAS_RR1TS	UDP 46400:192.168.1.11:46200	40	600	Yes	Yes
GeoDAS_RR2TS	UDP 46402:192.168.1.12:46202	40	600	Yes	Yes
GeoDAS_WW2WS	TCP 192.168.1.34:1024	40	600	No	Yes
GeoDAS_SERIAL	COM1, 19200 baud	40	600	Yes	Yes

Add

Remove

Update

OK

Cancel

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. IP address of the local computer may be set to "Default". This is useful in case a DHCP server assigns the address. But this approach may not work if your local computer has more than one network interface. In this case you have to specify a correct static IP address explicitly.

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 broadcasting of datagrams** 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. One can also **Launch an external application** that can be a communication utility or any other program required to be working when GeoDAS is active. GeoDAS monitors the status of this application and restarts it in case it is terminated due to some reason. The application started by GeoDAS works in the background.

The option **Support functions of a remote node** enables different GeoDAS services, which become available for the remote clients if you enable them. These services are selected with the dialog that appears upon pressing the button **[Options...]**. They are:

- **Monitoring SOH of the configured stations**

Status of the instruments configured in the local instance of GeoDAS is available to the remote instances of GeoDAS established connection to the local computer. Note that this option is forced to the active state if any other option is enabled.

- **Downloading events and ring buffer files**

Remote clients may download event and DAT files stored in the local computer under the root GeoDAS directory.

- **Requests for statistics of communication**

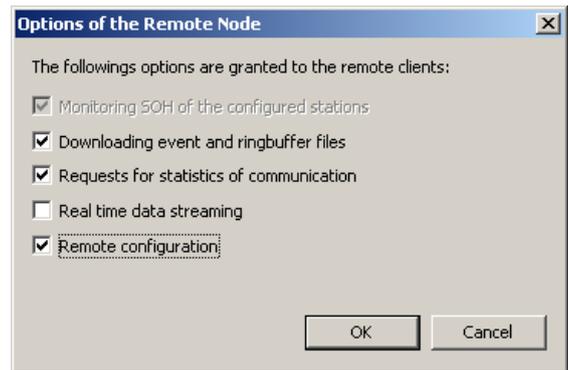
The clients may request and receive statistical information from the local instance of GeoDAS. Note that this option automatically enables the support for statistics in the local computer. More information about this issue is provided in [Appendix H. Statistics of Communications](#).

- **Real time data streaming**

Data streams received from the configured instruments and from the ADC can be forwarded to the remote clients. This option works reliable for the fast network connections only.

- **Remote configuration**

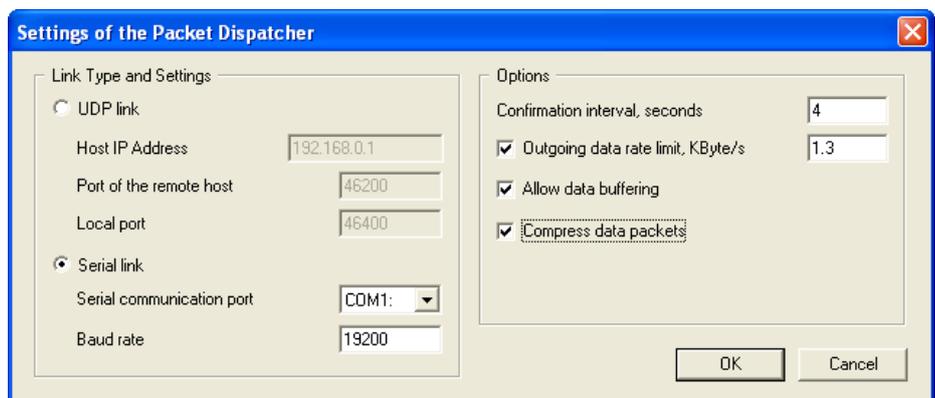
The clients are granted the rights to configure this instance of GeoDAS. In particular, the configuration of instruments and the parameters of ADC boards can be changed remotely.



Right part of the dialog window is intended to set parameters of the remote applications. Except those settings, which were mentioned already (network name, password and the IP address), 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. If you are going to use the described above services of the remote application, enable the option **Remote node**, click the button **[Options...]** and select the required services with the dialog **Options of the Remote Node** described above. If you do not know which services are granted by the remote application, you may try to get this information by pressing the button **[Query Options]**.

The option **Permanent monitoring** activates the feature of network monitor for the current application. You can adjust the key parameters of monitoring by pressing the button **[Monitor...]**. These parameters are described in [Appendix I. Network Monitor](#).

If the option **Packet mode** is selected, you have to press the button **[Settings...]** next to it and to adjust the settings of Packet dispatcher in the next dialog window. Packet mode of communication over the network channel utilises **UDP** protocol rather than TCP. You need to specify for this type of link both **local and remote ports** and the **host IP address**. But packet



mode can be used not only for the network link but also for any link between two instances of GeoDAS over **serial ports**. In this case the **COM port** and the communication **baud rate** shall be set correctly. The group of controls Options combines the following parameters:

- **Confirmation interval.** Important information sent in packets is confirmed by the remote party. But these confirmations are sent not for every received packet but for several packets instead in order to minimise the handshake overhead. You can tune with this parameter how often the groups of packets are confirmed;

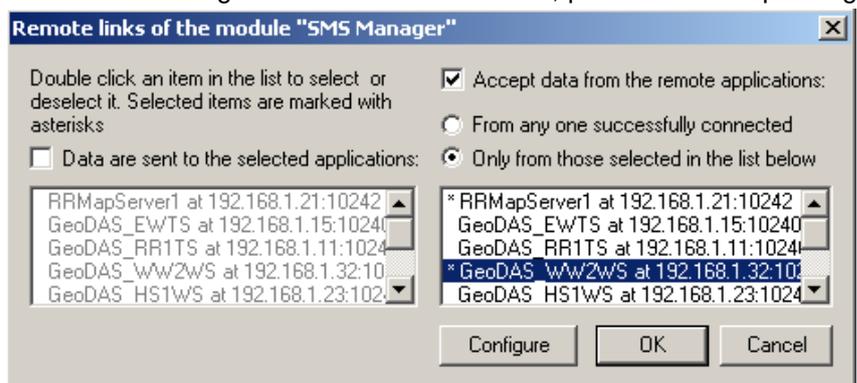
- **Outgoing data rate limit**, in Kb per second. This option is required in some cases if you use slow communication channel that is shared between different processes or modules. This option can be useful also for the half-duplex serial radio channels to let the transceiver switch to the receive mode from for a while within at least every few seconds and to limit the duty cycle of the radios, if needed;
- **Allow data buffering**. This option should be enabled in most cases because it prevents from the data loss if the communication channel is temporary out of operation;
- **Compress data packets**. This option should be enabled for slow data channels in order to minimise data traffic over those.

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 from the scope of network communications, select it from the list and press the button **[Remove]**. You can also edit network parameters of the already configured remote applications. Click in the list a name of the application you are going to modify, make the required changes in the group of controls **Remote application** and press the button **[Update]** to take the modified settings back to the table of configured applications.

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.

Beside of the mentioned above network service, you can specify the details of network communications between several program modules that support networking features. 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 appears.

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.



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.

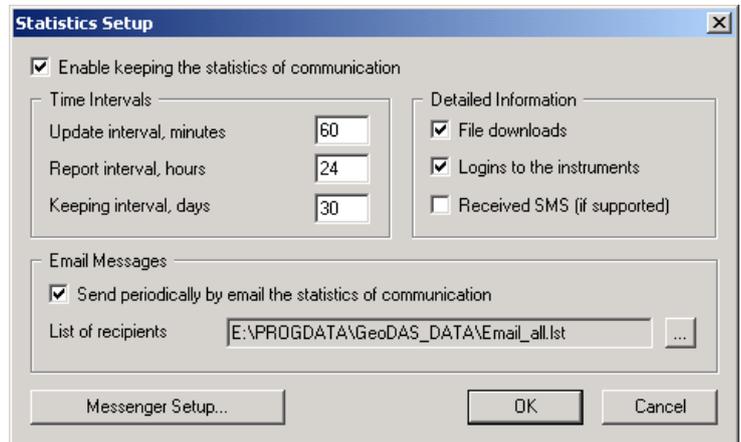
 *The same dialog is used to configure any other modules participating in the network communications.*

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:

Station	Logins	OnLine Time	Downloads	Transfer Rate, bps	Get Channel, sec	Connect, sec	Failed Logins	EVT Message	FIL Message	SOH Message
RR5T2	1-2	173	2(8K)-2(8K)	195/232/216	8/8/8	60/64/62	0-0	3-10	3-12	1-1
RR5T1	1-1	79	2(10K)-2(10K)	244/244/244	7/7/7	42/42/42	0-0	0-0	0-0	1-1
RR5T3	0-0	9	0(0)-0(0)	0/0/0	0/0/0	0/0/0	1-1	0-0	0-0	0-0

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. The names of remote stations are displayed in the format station@remote_node, where remote_node is the network name of the remote instance of GeoDAS. Refer to the Appendix G. Network Links of GeoDAS for more information about the configuration of network links. Stations of the remote instances of GeoDAS appear in this window if these instances allow requests for the communication statistics.
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 onto 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. Network Monitor

Network monitor is used in the 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 and/or by SMS messages.

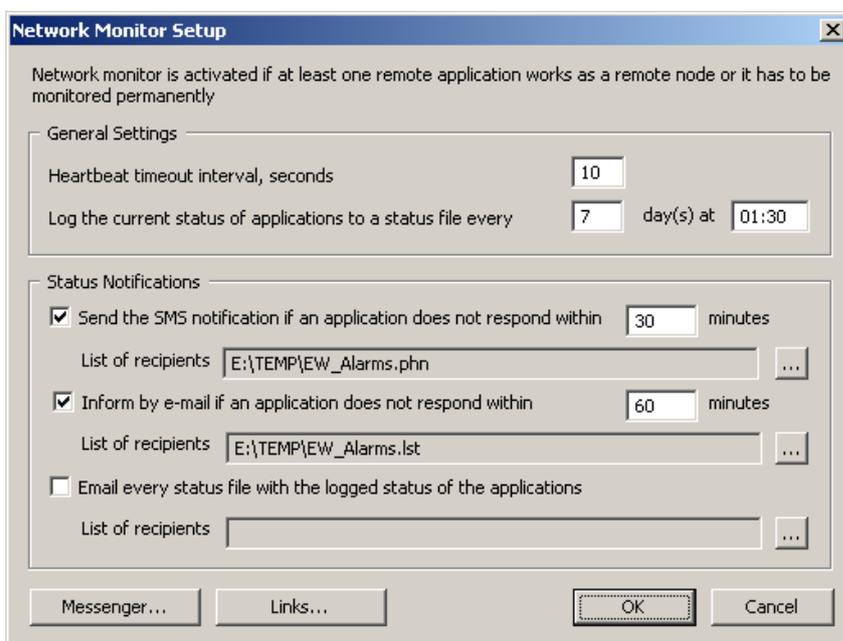
Different instances of GeoDAS communicate through the Windows sockets and therefore the network links must be configured correctly as described in [Appendix G. Network Links of GeoDAS](#).

Network Monitor window appears on the screen if this instance of GeoDAS uses the services of at least one remote application or at least one remote application has to be monitored permanently. If GeoDAS works just as a remote node providing services to the clients, the Network Monitor window is not active.

21.1 Network Monitor Setup

The parameters of the Network Monitor are set with the setup dialog, which is accessible from the Network Links dialog window. There you select which applications are monitored. The Network monitor periodically checks the status of these 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 Remote Nodes and Applications Window

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

Net Name	Link Parameters	Last Restart	Last Heartbeat	Net Modules	Connections	Free Memory	PhysMemory, Kb	VirMemory, Kb	HDD Space, Mb	In/Out Rate, Kb/s	System Flags	Status
● REMOTE	TCP 192.168.0.101:10240	20:21:54	20:26:21	1	2	36%	667108 of 1048048	1997076 of 2097024	103035 of 152617	0.0/0.0	A=00 B=00 C=00	OnLine

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
Link Parameters	Parameters identifying the link to remote application
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
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.
In/Out Rate, Kb/s	Current rate for incoming and outgoing data over the link in kilobytes per second
System Flags	Current state of the system flags at the remote application, if supported
Status	Status of the monitored application: OnLine, OffLine, Error. It has the same meaning as the bitmap placed before the application name.

21.3 Context menu of the Remote Nodes and Applications window

The items of this menu provide the following functionality:

Connect/Disconnect

Used to connect to or to disconnect from the selected remote application. If the application is not monitored permanently, you have to connect to it first before accessing its services.

Restart

Run this item to restart the remote instance of GeoDAS.

Update Now

Forces the Network Monitor to request information about selected station(s).

Reboot Remote Computer

Performs the hardware restart of the remote computer.

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.

Event Check Parameters

Seismic Check Parameters
 An event should meet the following criteria in order to be declared as seismic one:

Minimum number of sites triggered	2
Time frame for all triggers, sec	3
Minimum duration of the event, sec	2
Threshold for estimation of duration, g	0.003
Max frequency of the FFT peak, Hz	33

OBE/SSE Check Parameters

Check levels of an earthquake: **OBE and SSE**

Use Acceleration Response Spectrum (RSA)
 Use Velocity Response Spectrum (RSV)
 Use Cumulative Absolute Velocity (CAV)

OBE/SSE exceeding criteria: (RSA or RSV) and CAV

Frequency range and floor limits for: OBE SSE

Frequency Range	From	To
RSA check range, Hz	2	10
RSV check range, Hz	1	2

Absolute Exceedance Limits	Horizontal	Vertical
RSA limits, g	0.2	0.2
RSV limits, mm/s	152.4	152.4
CAV limits, mm/s	1569.6	1569.6

Automatic Event Checks

Events recorded by the stations listed below are checked automatically for OBE and SSE

Station	Ala...	Print	RSA Limits	RSV Limits
FFS	Yes	AM	RSA_CNE.lmf	RSV_CNE.lmf
SBS	No	AM	RSA_CNE.lmf	RSV_CNE.lmf
RBS	No	AM	RSA_CNE.lmf	RSV_CNE.lmf

Results of event checks can be forced for test purposes:

Force to Seismic
 Force to OBE
 Force to SSE
 Support for test mode

If a station is chosen to generate alarms and an event recorded by this station meets the OBE or SSE criteria, the corresponding alarm signals are sent to the all configured annunciators

Path to the limit files: E:\GeoSIG\GeoDAS_DATA\Config [Edit Limit Files...]

Automatic Report Generation

Print reports on the default system printer Make PDF reports

The following types of events are reported: **OBE and SSE events**

Path to report files as specified in the PDF writer: []

Adjust template of the reports: [First Page... Other Pages...]

Parameters of Calculation

Response spectrum range, Hz: **0.1 - 100** RSV calculation method:
 Integration in the frequency domain
 Integration in the time-domain

Frequency points per decade: **40**

CAV integration limit, g: **0.025**

[OK] [Cancel]

The first group of parameters called “**Seismic Check Parameters**” specifies the criteria used to check whether an event is seismic one. Three parameters (**Minimum duration of the event**, **Threshold for estimation of duration** 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**. Duration of every event is calculated as a sum of all time intervals when the signal level is above the threshold for estimation of the duration.

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.

Using the related checkboxes **Use...**, one can choose the criteria to be used during calculations out of RSA, RSV and CAV. This feature is useful in case when not all design criteria are available, e.g. if only RSA spectrum is defined. One can also choose whether seismic events are checked against both **OBE and SSE** levels or **OBE only**.

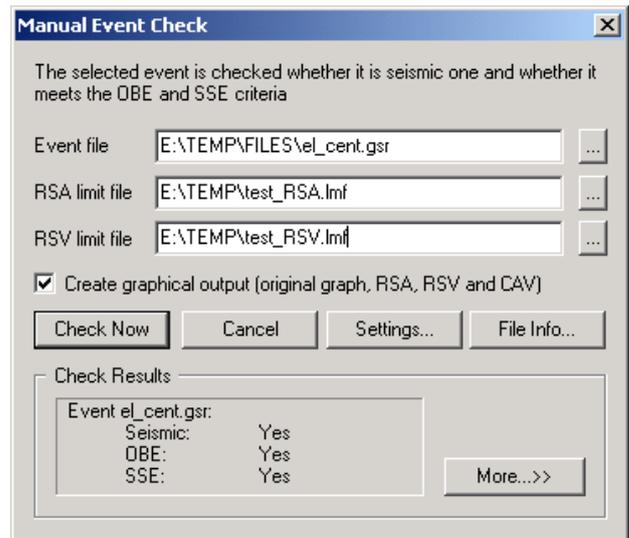
 *It is also possible to perform analysis of the **PGA** threshold exceedance, along with the standard criteria like RSA, RSV and optionally CAV, and to include related results into the Event Check Report. Specific version of GeoDAS or a different activation key is required. Please contact GeoSIG for customisation and for more information about this functionality.*

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**. Letters in the Print column indicate whether the data files recorded by each station are included into the **(A)**utomatic printout and/or into the **(M)**anual printout, i.e. the one generated by the command of operator. The list of stations and several options for each station are 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. The group of parameters **Automatic Report Generation** specifies whether the reports on results of event checks are **printed automatically on the default system printer** and for which **types of events**. It is also possible to **make PDF reports** automatically if the appropriate third-party printer emulation software is installed. Please [contact](#) GeoSIG if you need to activate this functionality. 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.

The option **Support for test mode** and the **Path to report files** are used for integration of the GeoSIG seismic monitoring system controlled by GeoDAS into the plant simulation system. Please contact GeoSIG if you need more information about this functionality.

22.2 Manual Event Check

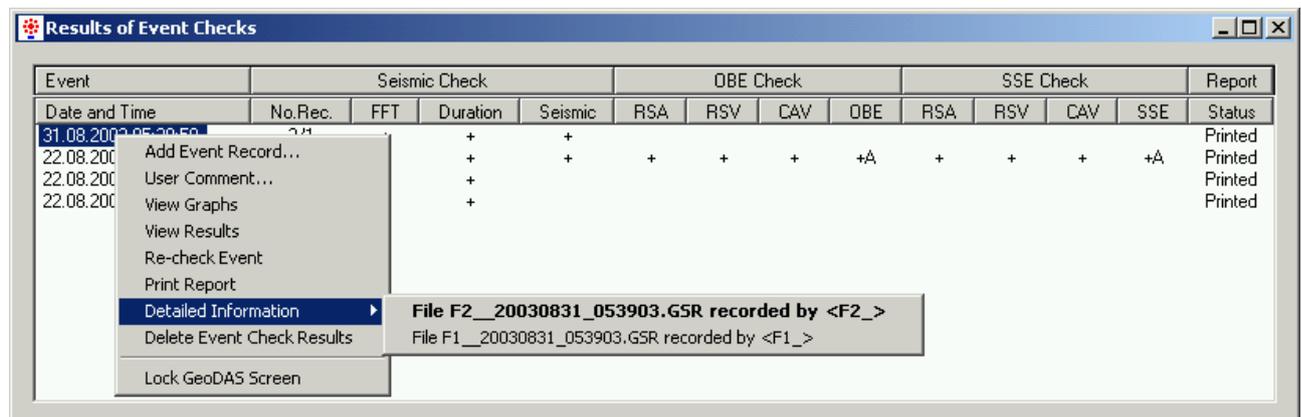
Any event file can be checked manually if it meets the seismic and OBE/SSE criteria. This is done with the menu item **Analyse -> Manual Event Check**. First of all, you will be asked to select an event file for checking, then the Manual Event Check window comes up. You have to select both the RSA and 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 meets 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

	parameter "Minimum duration...".
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: <ul style="list-style-type: none"> • 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 • Making PDF – PDF document is being created • 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

 The pop-up context menu described above may have other items, which become enabled in customised versions of GeoDAS or after activating specific functionality. Please refer to the dproject specific documentation for descriptions of such items.

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

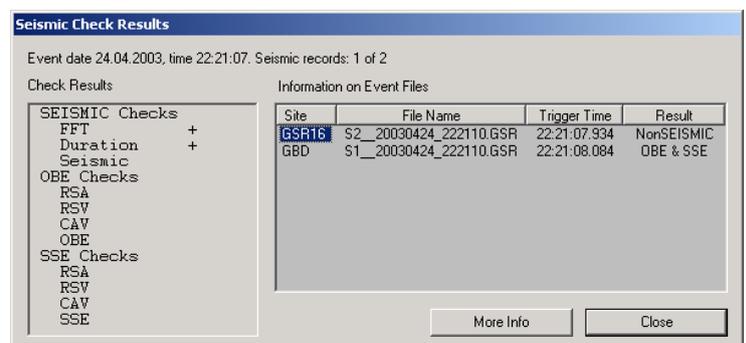
Shows all event waveforms in one window.

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. First page of the report is displayed in a separate 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



The screenshot shows a window titled "Seismic Check Results" with the following content:

Event date 24.04.2003, time 22:21:07. Seismic records: 1 of 2

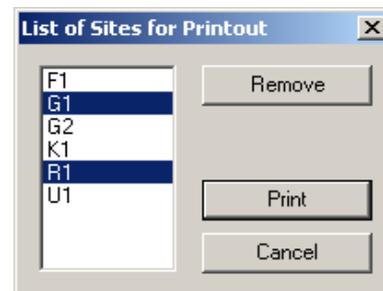
Check Results		Information on Event Files			
SEISMIC Checks		Site	File Name	Trigger Time	Result
FFT	+	GSR16	S2_20030424_222110.GSR	22:21:07.934	NonSEISMIC
Duration	+	GBD	S1_20030424_222110.GSR	22:21:08.084	OBE & SSE
Seismic					
OBE Checks					
RSA					
RSV					
CAV					
OBE					
SSE Checks					
RSA					
RSV					
CAV					
SSE					

Buttons: More Info, Close

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](#). When printing reports manually, the List of Sites for Printout comes up. It is possible to remove unnecessary data from the report. If it is required, select the sites, which you do not want to appear in the printout and press the button **[Remove]** before you press **[Print]** to continue.

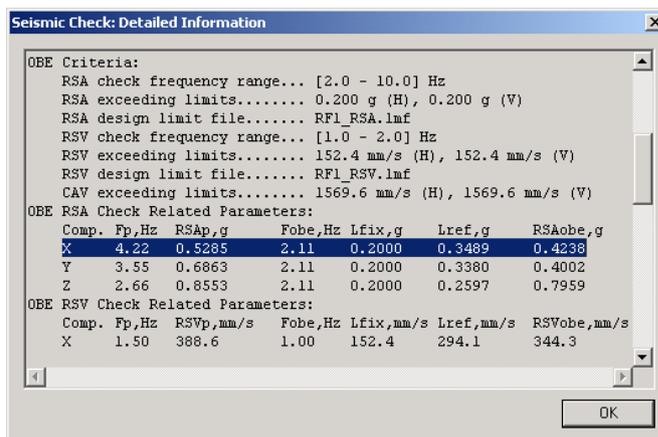


Detailed Information

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.

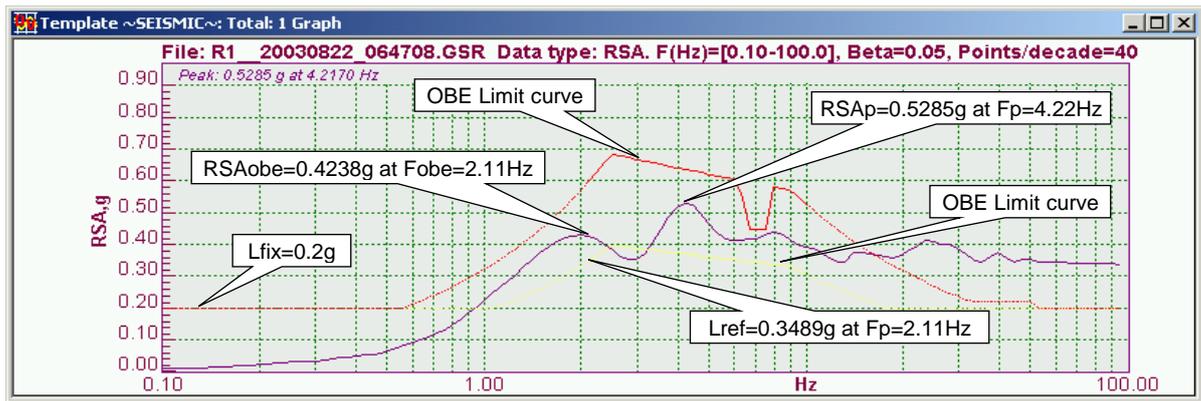
OBE/SSE RSA and RSV check related parameters have the following meaning:

- 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 example 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 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 e.g. a memory stick. The name is expected to follow the standard GeoDAS naming convention (includes station name, date and time stamp) and it is not longer than 25 characters.

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.

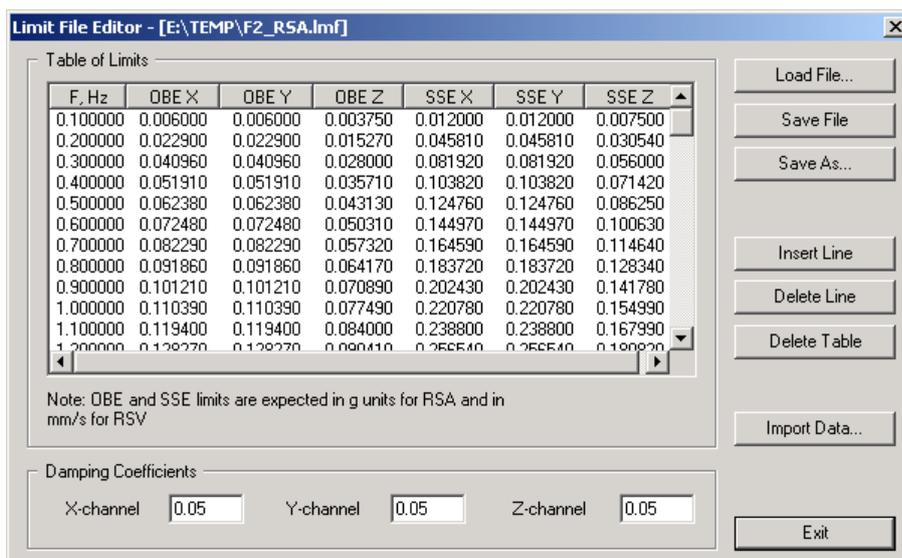
Delete Event Check Results

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

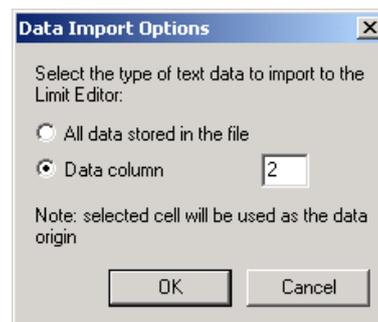
Limit files keep the design limits of RSA and RSV used for checking the events for OBE and SSE criteria. The absolute RSA and RSV exceeding limits, which are set through the [Event Check Parameters](#) dialog, are constants within the entire frequency check range. This is not satisfying to receive the 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

Your company name
GeoSIG

Example of the event check report
 User comment line

Event date: 31.08.2003
 Event time: 05:38:58 UTC

Result seismic: Yes(TEST)
 Result OBE alarm: Yes(TEST)
 Result SSE alarm: No

Station	Event file	Limit file
S1_	F1_20030831_053803.GSR	RSA:F1_RSA.lmf, RSV:F1_RSV.lmf
S2_	F2_20030831_053803.GSR	RSA:F1_RSA.lmf, RSV:F1_RSV.lmf
S3_	No file recorded	
S4_	No file recorded	
S5_	No file recorded	
S6_	No file recorded	
S7_	No file recorded	

Station	Seismic check			OBE			SSE			
	Trigger	FFT Peak	Duration	RSA	RSV	CAV	RSA	RSV	CAV	
S1_	X	No	14.2 Hz	0.0 s	No	No	No	No	No	No
S2_	Y	No	12.2 Hz		No	No	No	No	No	No
S3_	Z	No	13.8 Hz		No	No	No	No	No	No
S4_	X	No	9.4 Hz	0.0 s	No	No	No	No	No	No
S5_	Y	No	13.2 Hz		No	No	No	No	No	No
S6_	Z	No	15.8 Hz		No	No	No	No	No	No

Test results

Station	Seismic check	OBE	SSE	OBE Alarm	SSE Alarm
S1_	Yes(TEST)	Yes(TEST)	No	Yes(TEST)	No
S2_	Yes(TEST)	Yes(TEST)	No	Yes(TEST)	No
S3_	-	-	-	This station does not generate alarms	
S4_	-	-	-	This station does not generate alarms	
S5_	-	-	-	This station does not generate alarms	
S6_	-	-	-	This station does not generate alarms	
S7_	-	-	-	This station does not generate alarms	

Seismic criteria

	Limit
Number of triggered recorders	min. 1
FFT Peak	max. 33.0 Hz
Duration	min. 2.45 s

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

Example of the event check report
GeoSIG

File: F1_20030831_053803.GSR Start: 31.08.2003 05:38:58.484 Length: 19.190 sec (3838 samples at 200 sps)
 Station code: F1 Instrument: GSR:10 (02/01/21) Sns: 107300 Pre-event: 5 sec Post-event: 5 sec

File: F1_20030831_053803.GSR Data type: RSA, F(0.1-10.100 Hz), Beta=0.85, Points/decade=48

File: F1_20030831_053803.GSR Data type: RSV, integration in frequency domain, F(0.1-10.100 Hz), Beta=0.85, Points/decade=48

File: F1_20030831_053803.GSR Data type: Cumulative Absolute Velocity, integration limit 0.025 g

23 Appendix K. Station Map

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

23.1 Static map using background image file

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 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: pixel coordinates of the left bottom and right top corners of the map area on the background image:
(left, bottom, right, top).

Image coordinate information in pixels can be obtained from any imaging software.

Line 3: corresponding real coordinates of the left bottom and right top corners of the map area:
(left longitude, bottom latitude, right longitude, top latitude).

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.

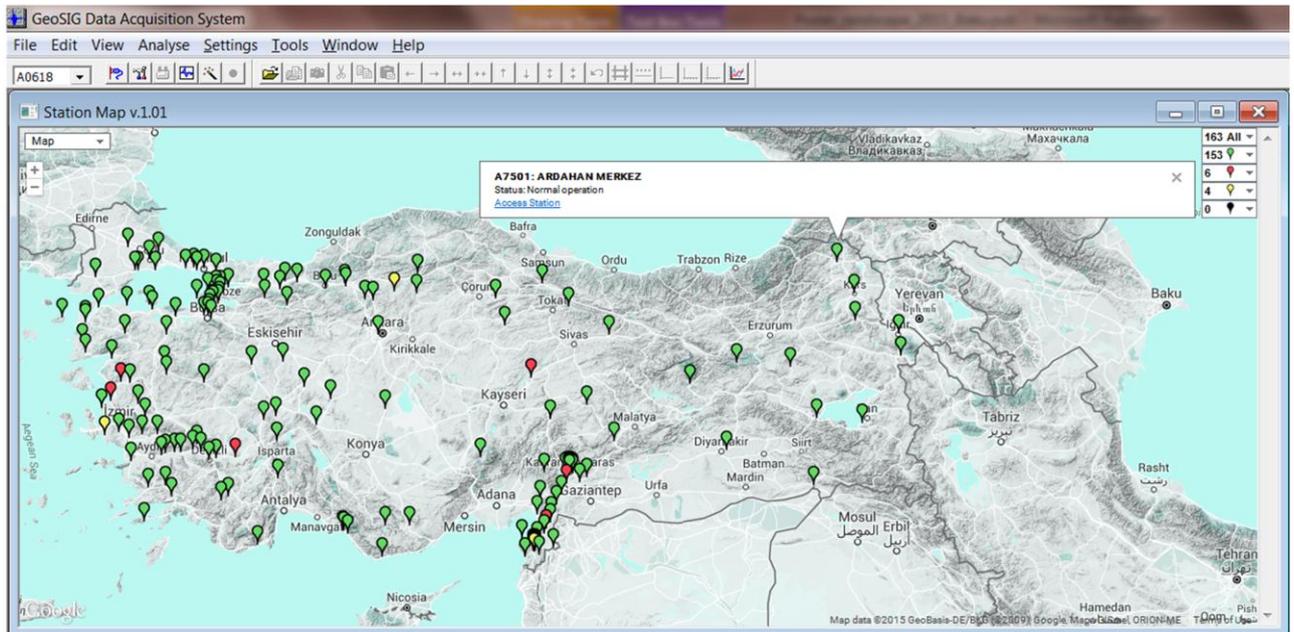
23.2 Interactive station map

GeoDAS supports also an advanced way of displaying network of seismic stations on the Google map or on the basic street map. The access to Internet is required to load maps dynamically. The map is opened in a separate window within GeoDAS frame. GeoDAS updates information on the map automatically upon any change of the station status. By default, the following parameters are processed and reflected on the map:

- ID and name of each configured station
- Coordinates of stations
- Brief description (usually location)
- Current status of the station

Some other project-specific information can also be included in the map. Please contact GeoSIG if you need to display other information on the google map of your seismic network.

If everything is configured correctly, GeoDAS will display the map upon selecting the menu item **View->Station Map** as following:



Color of marks on the map indicates the status of stations. By default, the following colors are used:

- GREEN normal operation
- YELLOW state of health of the station contains warnings
- RED state of health of the station contains errors
- BLACK station does not communicate

Upon clicking a station, a window pops up and displays the available information about this station, as well as the link to its web interface for configuration and for the detailed information (if the direct link is available).

 *Note: Google maps are available in the registered GeoDAS versions only. Please contact GeoSIG to receive the required registration code.*

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 types of ADC boards supported currently are the PCIM-DAS16 board and PC-CARD boards DAS-16/12 and DAS-16/16 manufactured by Measurement Computing Inc. (MCC). GeoSIG Ltd. has developed the computer-based version of seismic recorder named GSR-12/16PC, which utilises these types 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.

Configuration of ADC Channels

Configuration Parameters

ADC unit name (up to 3 characters) Configuration target

ADC unit identification number

ADC unit type

ADC voltage range

Sampling rate for all channels, sps

Single-ended channels Vector sum channels

GSR-12/16PC LED control Master ADC

ADC Channel Parameters

N	Enabled	Name	Sensor	FS Gain0	FS Gain1	FS Gain2	Unit	Drift Comp.
1	Yes	Ch_01	AC-63 ±2g	2.000e+...	2.000e+000	2.000e+000	g	Yes
2	Yes	Ch_02	AC-23 ±1g	1.000e+...	1.000e+000	1.000e+000	g	Yes
3	Yes	Ch_03	Custom	0.0	13.0	0.0	V	Yes
4	Yes	Ch_04	GSV-3xx ±1-10...	1.000e+...	1.000e+001	1.000e+000	mm/s	Yes
5	Yes	Ch_05	Guralp CMG-5T	2.000e+...	2.000e+000	2.000e+000	g	Yes
6	Yes	Ch_06	Custom	0.0	10.0	0.0	V	Yes
7	Yes	Ch_07	Custom	0.0	10.0	0.0	V	Yes
8	Yes	Ch_08	Custom	0.0	10.0	0.0	V	Yes

Sensor gain Note: Gain 1 must be selected for the sensors, which do not support different gains

Edit: Full Scale Permanent DC Offset

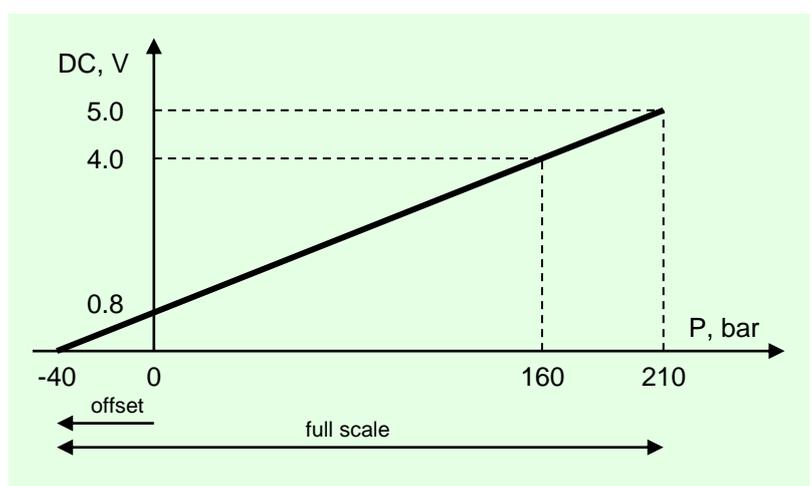
Note: Neither offset correction nor drift compensation is performed for the channels with nonzero permanent offset

In most cases the configuration of ADC units and channels is edited locally, i.e. in the same computer where ADC units are installed. In such a case "This Computer" has to be selected as a **Configuration target**. But there is also a possibility to configure ADC units in the remote instances of GeoDAS if they are configured as remote nodes allowing the remote configuration. Refer to the [Appendix G. Network Links of GeoDAS](#) for more information about this issue.

The group of controls called **Configuration Parameters** includes main 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. You may select the **ADC input voltage range** but you have to make sure that the selected ADC supports it. The **sampling rate** is the same for all channels and can be one of the following fixed values: 10, 20, 50, 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. The option **Single-ended channels** should be selected **only** for the custom applications, which do not utilise differential circuits for connection of sensors. If there are more than one board of the same type in the configuration, the unique board **identification number** must be provided for every board. It is the same number as the one assigned to the board by the configuration utility provided by ADC board manufacturer. The option **GSR-12/16PC LED control** is enabled only for the ADC units integrated into the GSR-1xPC recorders. The option **Master ADC** is used if several boards of the same type are served simultaneously. In this case one can connect the clock output of the master board to the external clock input of the other board(s), which does ensure synchronisation between them with the precision of one sample. Note that this option is available not for all types of ADC supported by GeoDAS. The option **Vector sum channels** enables simulation of the additional channel for every three-channel station, which is a square root of $(x^2+y^2+z^2)$ and x, y, z are three components of the signal.

Parameters of ADC channels are indicated in 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**. If you use one of the standard GeoSIG sensors, simply select it from the list by double-clicking items of the column Sensor, and the corresponding **Full Scale** values as well as the correct units will be shown in the next four columns. In case you select the sensor type Custom, these parameters can be adjusted. Refer to the [Appendix A. Information on LSB](#) for more information about full scales and LSB factors used to convert raw counts into the physical units. 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**.

You can also specify a **permanent DC offset** of every channel for every gain. Once you click the corresponding radio button below the table, it will indicate DC offsets for all three gains instead of the full scale and those offsets can be adjusted by editing the table. Setting permanent offsets is required very often e.g. for temperature sensors of different kinds. Make sure that the full scale is set correctly in case of non-zero offset. Required full scale should be corrected in a way that the offset is subtracted from it. For instance, the full measurement range of a pressure sensor is 0 - 160 bar, which corresponds to the output voltages from 0.8 to 4.0 VDC. In this case the DC offset should be set to -40 bar and the full scale is set to $(160 - (-40)) * 5/4 = 250$ bar assuming that the full A/D converter input range is 5 VDC.



 *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.*

Last column in the table of channel parameters is called **Drift Compensation**, you can select between **Yes** and **No**. This compensation means that the offset (zero level) of the channel calculated as an average value of the signal during first 20-30 seconds after the GeoDAS startup is slowly adjusted during the data acquisition according to the actual parameters of the signal.

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 Unit]**. 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 from the data streams provided by ADC units do not contain some instrument-specific information, such as battery voltages, errors and warnings, location information, etc.

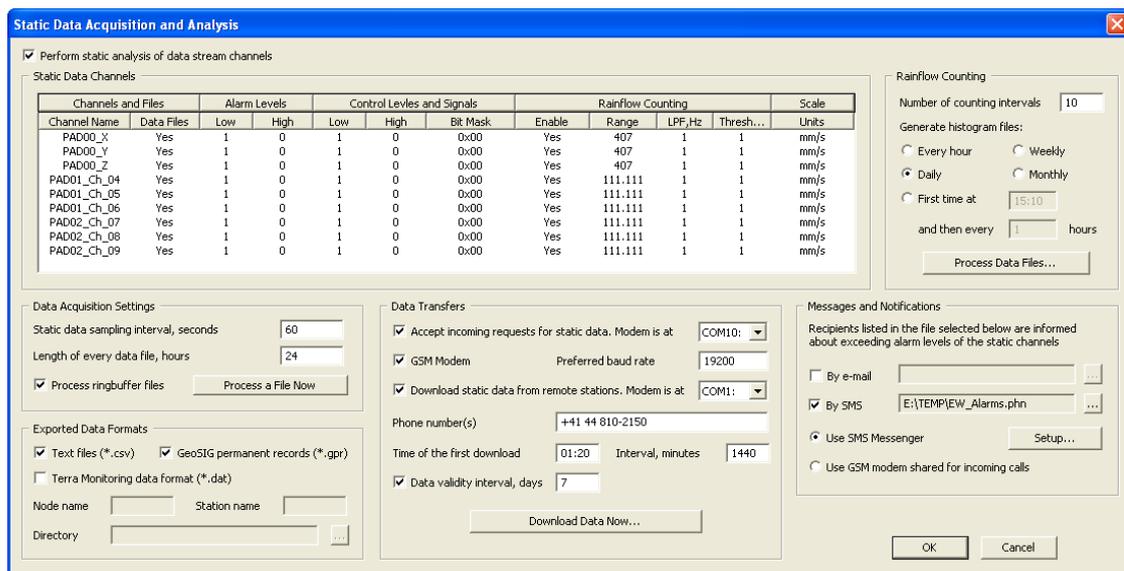
As it takes place with the data streams from standard instruments, both permanent and the event-based recording of data are possible for ADC channels. In order to keep compatibility with the standard GSR event files, the enabled data channels of any configured ADC unit are split into the groups, which 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 Appendix M. Static measurements

If GeoDAS is configured to work with data stream channels, you can configure all or some of these channels for static measurements. The term 'static' does not mean that the signal decimated and delivered by such channel is constant. It changes of course but rather slowly, so it can be sampled with a time interval of several seconds, minutes or even hours. A typical example of static data is the air temperature. While dynamic data are very often high pass filtered to remove the DC offset, the main measured characteristics of the static channels is their offset, which is never removed or compensated.

25.1 Static Data Acquisition and Analysis

Static measurements are configured with the dialog launched from the main menu Settings->Static Measurements.



The option **Perform static analysis of data stream channels** must be selected in order to activate processing of the static data. **Length of every data file**, which is set in hours and the **sampling interval in seconds** are the main parameters of data acquisition. The standard mode of operation is receiving real-time streams continuously and decimating them down to the specified sampling interval. But you can also enable **processing ringbuffer files**, which are arriving periodically. In this case, the decimation of data is performed in the same way but real time monitoring of static data and alarm functionality make no sense.

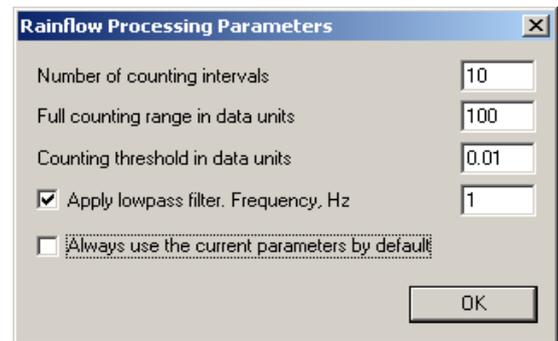
The table Static Data Channels lists all parameters that are set channel-wise:

- **Channel Name** and **Units** cannot be modified here. They are taken from the configuration of data stream channels and are provided here for the reference. Channel name includes also the station name as a prefix;
- **Data Files** flag specifies whether data samples of a channel are stored to the static data files;
- **Low** and **High Alarm Levels** (in Units) set the allowable range for the channel data. As soon as at least one sample is out of this range, the alarm is generated. If Low value is greater than the High one, the alarms are disabled for this channel;
- **Low** and **High Control Levels** (in Units) can be used to take some actions in case the signal goes out of the range specified by Low and High levels. When it happens GeoDAS activates digital output bits specified by the **Bit Mask**. For instance, according to the settings shown in the above dialog a heating system activated by the first (0x01) digital channel works if the outside temperature monitored by the channel AFS02_Tair drops below 5 °C. If Low value is greater than the High one, the control is disabled for this channel;
- **Rain Flow** flag specifies whether the rainflow counting algorithm¹ is applied to the channel data;
- **Range** is the full range (in Units) for the rainflow counting;

¹ This algorithm is based on the original article "Simple rainflow counting algorithms" by S.D.Downing and D.F.Socie, INT.J.FATIGUE January 1982.

- **LPF** (in Hz) is the cut-off frequency of the low pass filter applied to the original data stream samples (i.e. before the decimation). Filtered data are used for the rainflow algorithm only. If this parameter is set to zero, the filtering is disabled;
- **Threshold** (in Units) is the minimum level that a static sample must exceed to be counted by the rainflow algorithm. It is obvious that this parameter should be smaller than Range divided by the number of counting intervals.

General parameters of the rainflow counting applied to all channels are: the **number of counting intervals** and the **interval of generation histogram files**. Note that rainflow counting is the accumulated process and therefore the number of counting intervals cannot be changed without resetting the statistics once the static measurements are started. Rainflow algorithm can be applied to the already recorded data files by pressing the button **[Process Data Files...]**. It opens the dialog **Rainflow Processing Parameters** where parameters of the data processing are adjusted. Next step is to choose the file(s) to be processed. The results of processing are converted automatically to the ASCII format of comma-separated values and are displayed with the default Windows viewer.



By default, GeoDAS stores static data files in its internal binary format. These files have the STD (STatic Data) extension. They are placed to the StaticData directory under the GeoDAS data root directory. But these files can be **converted automatically** to the ASCII **CSV** (comma-separated values) format and to the permanent data files in **GPR** format. In the last case GPR files are saved to the corresponding event data directory under GeoDAS data root. One file per each three-channel station is created. Some other output data formats can be supported as well. Please contact GeoSIG for more information about this issue.

If alarm levels of the static channels are exceeded the **SMS notification** can be sent to recipients listed in the selected *.phn file. In order to provide this service, the computer running GeoDAS must have at least one **GSM modem** configured either **for the static data transfers** (see below) or for the use by **GeoDAS Messenger**. If the computer is connected to network, **e-mails** can be sent as well if the corresponding option is selected. They are sent to the recipients listed in the selected *.lst file. GeoDAS Messenger must be activated for this option to work. Refer to the [Appendix F. Messenger of GeoDAS](#) for more information about this issue.

GeoDAS processing static data can send generated data files to another instance of GeoDAS over the dial-up link. The group of controls **Data Transfers** combines all the required parameters of this functionality. In order to send data, one has to enable the option **Accept incoming requests for static data**, select the **COM port** where the modem is attached to and to set the desired **baud rate**. If it is a **GSM modem**, the corresponding option must be enabled. The default baud rate is 19200 baud for GSM modems and 38400 baud for other analog modems.

GeoDAS requesting static data from remote sites for further processing may not have static channels configured. It should just have the option **Download static data from remote stations** enabled and the **COM port for outgoing calls** selected. Several phone numbers of the remote sites can be listed in the string **Phone number(s)**, they are separated by comma or semicolon. Data downloads are done automatically at the specified **download time** with the specified **interval between successive downloads**. Data can also be requested at any time by pressing the button **[Download Data Now...]**. Again, the **baud rate** must be set and **GSM modem** option is enabled if required.

Since it takes usually rather long time until every static data file is completed at the remote site, the data transfer is allowed even for those files, which are not yet completed. GeoDAS checks if some more data samples were added to every file since last download and if it is so, the new samples are added to the already downloaded file. In order to optimise data transfers one can set the **option of the data validity interval**. In this case only the files generated during the last days specified as the **validity interval** are checked for update and are downloaded.

26 Appendix N. Automatic Event Processing

This software module is designed for automatic processing of event files recorded within a selected time interval, usually several hours or days. The processing is done in the following steps. First of all, GeoDAS makes an overview of static data for the specified processing interval. Therefore, it is required that the static data acquisition is activated as described in [Appendix M. Static measurements](#). You have to make sure also that the vector sum channels are enabled; see [Configuration of ADC channels](#). Next step for GeoDAS is to create event files from the ring buffers extracting data recorded at specified times if the corresponding option of automatic data processing is enabled. It is assumed in this case that the data streams of the stations being processed are available and are saved to the DAT files. Refer to the chapter [Working with Data Streams](#) for more information about this issue. Last step is to process all event files one by one by applying a template preliminary generated as described in the section [Templates](#). Results of processing are combined into the report that is forwarded for printing them out at the default system printer. At the same time all processed data are stored together in a directory and can be printed later manually at any time.

The main processing parameters are configured with the following dialog, which is launched from the GeoDAS menu **Settings-> Automatic Data Processing**. First action to take during the configuration is to decide which stations will be processed automatically and to create the **List of these stations**. Local stations that are currently configured in GeoDAS appear in the combo box below the list, so you can simply select a **station** and press the button **[Add]**. You can also enter the name of a **channel** next to the station combo box. If you do so, then only this channel will be displayed in the overview (2nd) page of the report. If you do not enter a channel name, all channels of the selected station will be displayed. Channel name is displayed in the list next to the station name in parentheses. If the station is not configured at the moment but its data files for the selected period exist in the corresponding GeoDAS directories, they can also be processed. Just type the name of such station in the combo box and, optionally, the name of a channel and then press **[Add]**. It is also possible to process data files existing at the remote

instances of GeoDAS. In this case the station name should be as following: name@remote_geodas where "remote_geodas" must be a valid name of the remote GeoDAS application configured as described in [Appendix G. Network Links of GeoDAS](#). In order to delete stations from the list, select them and press **[Remove Selected Stations]**.

Once the list of stations is built up, you may select the option **Enable automatic processing...** and to set all other parameters. You have to select the **start time** of first processing interval and the **duration of this interval** in minutes. Nonzero **delay time** is set if you need to process data automatically at some particular time, which does match end time of the processing interval. These parameters will be valid upon the next startup of GeoDAS. But you can also process data within a selected time interval manually by pressing the button **[Process Now!]**. For the manual processing you may enter also a date next to the start time. If no

date is set the current one is assumed. One can process either **already detected and recorded events** or one can **generate events from the ringbuffer files**, or do both. There are two options of processing of the recorded events: GeoDAS can process either **all event files** or only those related to the **network events**, i.e. events detected by several stations at the same time. Information about parameters of the network events is given in the section [Processing Stream Data](#). If the option **Generate ASCII Output** is enabled, then GeoDAS creates intermediate processed static data in the ASCII text format.

Both automatically and manually processed data are stored in the subdirectory **ResultsAEP** under the root directory of GeoDAS. One can always print data using the button **[Print]** or printing is performed automatically if the option **Print processed events automatically** is selected. Other **Print Options** specify how the printed report of automatic event processing looks like. First page is the list of stations with their advanced information that is set through [Context Menu of the Data Streams Window](#). You can customize the print setup of this page by pressing the button **[1st Page]**. Second page contains graphs of the static data (vector sum channels Vsum) of all processed stations. This page can also have a specific print setup, which is adjusted with the Print Setup dialog window opened by the button **[2nd Page]**. In order to adjust parameters of the static data graphs, such as e.g. scale limits, it is necessary to create a template first with the desired options and then select this template in the corresponding combo box. Refer to the section [Templates](#) for more information. Other pages of the report contain the results of processing of all event files, one file per page. Processing is made as specified by the corresponding template and the print setup for these pages is adjusted with the button **[Other Pages]**.

If you select a printer emulator (such as PDF Writer) as the default printer, it will create an image of the printed document. In this case it is possible to send this document out by email automatically. You would need to enter a **path to the report files** and the **e-mail** address(es) of recipients in the groups of options Reporting. Brief reports contain two pages only: first summary page and the overview of static channels.

 *Note: the corresponding printing software is not included into the GeoDAS package. It should be installed separately.*

Configuration parameters of the automatic event processing can be saved to a file with the button **[Save]** and they can be loaded later at any time with the button **[Load]**. This is useful for the manual processing of different lists of stations. The **[OK]** button saves current parameters as default ones for the automatic event processing.

27 Appendix O. Network Alarm Logic

This functionality is used to monitor network of seismic instruments in real time, to receive alarms from these instruments upon exceeding configured setpoints by the seismic signal and to issue the common alarm based on the N-out-of-M logic taking into account the locations of triggered stations. Instruments in the filed must be GeoSIG GMSplus seismic recorders or newer models. Because the alarms are delivered and processed within fractions of a second only, this functionality can be utilised in the Earthquake Early Warning systems.

Configuration parameters are accessed through the menu Configure -> Alarm Logic:

Configuration of Alarm Logic

Enable logic of alarms received from network of seismic instruments

Processed Signals

Name	Type	Status	Min.Stations	Location	Hold-on Time, sec	Reset
AL_MAJOR	Trigger	Enabled	3	Adjacent	7	Manual
AL_MINOR	Trigger	Enabled	3	Adjacent	7	Manual
System Errors	Error	Enabled	2	Any	7	Manual
System Warnings	Warning	Enabled	2	Any	7	Manual

Modbus Interface

Modbus server IP and port: 172.172.0.100:502

Base address of modbus holding registers: 16896

Maximum number of client connections: 2

Miscellaneous Settings

Minimum duration of local triggers, sec: 8

Station status report timeout, sec: 6

OK Cancel

The check box **Enable logic...** must be selected, and then one can add alarms to the table below by right-clicking it and selecting **Add Alarm** from the context menu. There are three types of alarm signals, which can be selected in the column Type: **Trigger**, **Error** and **Warning**. You need to assign individual unique **names** to each configured signal. Names of Triggers must match the names of trigger sets configured in GMSplus, and names of Errors and Warnings can be any. No more than one Error and one Warning shall be configured. One can set a **Status** of any signal to Disable, and then it will remain configured but will not be processed and displayed on the main screen.

Other parameters in the table of signals:

- **Min. Stations** is the minimum number of stations with active local signals at the same time, which are required to activate common signal
- **Location** defines whether these stations must be adjacent ones or if can be located anywhere in the network
- **Hold-on time** is the minimum active time of the common resulting signal. If the duration of the actual signal is shorter, then it is extended to this configured time interval
- **Reset** can be either Auto (default) or Manual. In the latter case, the main screen displays number of local (per station) and common activations of a signal since last reset

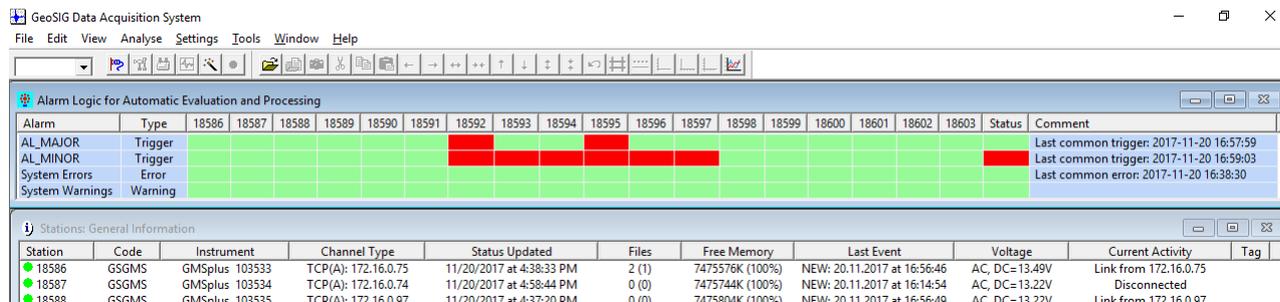
Miscellaneous settings:

- **Station status report timeout** is a time frame within which each station is expected to report its status at least once. If it does not happen, then a communication timeout is declared
- **Minimum duration of local triggers** defines an aperture of the seismic network. Roughly, it is a distance between most distant stations in any group of Min.Stations divided by the typical velocity of the seismic wave.

Modbus Interface settings:

GeoDAS runs modbus server at the configured **IP address and port** (default = 502). The IP address can be set to an address of the specific network interface. One can use also 0.0.0.0 to instruct server to listen on all network interfaces. Support of the modbus interface in this particular application is limited to the function No. 3 (read holding registers). The first register is assigned the **base address** as configured here. You can also specify the **maximum number of clients** connecting to the modbus server of GeoDAS. Please contact GeoSIG for the detailed information about the content of holding registers.

Press [OK] to save the configuration. GeoDAS must be restarted for the new settings to take effect, and then the following screen appears:



The window Alarm Logic displays the matrix of remote seismic stations and their signals, as well as the common signal in the Status column. The color-coding is the following:

- GREEN** normal operation. Stations are on-line and have no active signals and alarms
- YELLOW** active Warning signal
- RED** active Trigger or Error signal
- ORANGE** no communication with the station
- GRAY** signals are disabled

One can disable signals of a station temporary, e.g. for maintenance, by clicking its name in the header of the above table.

The status of all individual (per station) and common signals is reflected in the Modbus registers immediately and it can be read by all connected Modbus clients.

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