GeoSIG
swiss made to measure

GMS^{plus}

User Manual

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Document Revision

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1	29.08.2012	First release	MAE	FAR	MAE
2	25.09.2012	Minor corrections, chapter 13.3 added, Interface to GeoDAS updated	MAE	FAR	MAE

GeoSIG Ltd

Switzerland

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Applicability of This Manual

GMS Instruments are constantly being improved. Although the manual you receive along with your instrument corresponds to the actual software versions, you are advised to check the GeoSIG web page periodically for the most recent version of this document, and especially after performing any software upgrades. This manual is based on the following software and firmware versions:

Component	Description	Required version or higher
GeoDAS	Data acquisition and analysis software on the computer	2.23
armdas	Data acquisition software of the instrument	21.02.00
RTC	Real time clock	80.01.00
DSP	Digital signal processor	51.02.00
U-Boot	U-Boot bootloader	2010.03-r7
Linux OS	Root file system Kernel Version	rootfs-gms-68 2.6.39.3-r21

Warnings and Safety

STATIC ELECTRICITY
The instrument and if available, its sensor unit contains CMOS devices and when serviced, care must be taken to prevent damage due to static electricity. This is very important to ensure long-term reliability of the unit. Such risk exists when both the instrument cover and the front panel are removed.

INSIDE THE INSTRUMENT (MAINTENANCE)
When it is desired to fully restrict the access to the unit so that even its cover cannot be removed, lockers can be mounted in the middle of the handles, on the side of the instrument. Under normal circumstances, there is no need to remove the front panel of the instrument. In any case, only trained person should remove the front panel. Moreover untrained access may lead to serious damage to the instrument, as well as may void the warranty.
Before removing the front panel:

1. ***Turn the unit off***
2. ***Disconnect all cables connected to the unit***
3. ***Disconnect the battery***
4. ***Make sure that all LED indicators are OFF***

BATTERY LIFE
The instrument is shipped with an internal battery. Do not forget to connect the battery when you install the unit; the battery is provided with a polarised connector to avoid any wrong connections.
In order to prevent data loss, you should be aware of the replacement policy of the battery before its expected lifetime expires. Battery expected life times under normal conditions is:

Main battery	***Fiamm-FG29722, 12V 7.2Ah or similar type of battery***	***3 years***

The lifetime of the main battery can drastically change depending on operating conditions. Strong discharge of the main battery must be avoided. During normal operation, power comes from the external charger and charges the battery.

The housing provides no protection against explosive atmosphere. It must not be directly operated in area where explosive gases could be present.

Symbols and Abbreviations

ADC	Analog to Digital Converter
ARM	Main processor
Bootloader	First program executed when unit starts
CF	Compact Flash, memory card using Flash memory
Compact Flash	See CF
DSP	Digital Signal Processor in charge of controlling the ADCs
Flash	Program storage memory device. It contains the Linux file system in Read Only mode and some block areas under direct control of main program or bootloader.
GPS	Global Positioning System
GUI	Graphical User Interface
LAN	Local Area Network, a simple branch of private network using private IP address. It could have or not have access to Internet (WAN).
NTP	Network Time Protocol
PPS	Pulse Per Second
RAM	Random Access Memory
RTC	Real Time Clock
SD	Secure Digital Memory Card
SPS	Samples Per Second
SSH	Secure Shell
SSID	Service Set IDentifier, This is the identifier name of a wireless network.
STP	Shielded Twisted Pair
UTP	Unshielded Twisted Pair
VPN	Virtual Private Network
WAN	Wide Area Network, it is a network connection established between 2 LAN or a LAN and a server over the internet (usual case) or through a rented link.
WPA	Wi-Fi Protected Access. It is a secure specification that allows users to access information instantly via wireless link. It is a more modern and secure link than the WEP type.
WEP	Wired Equivalent Privacy

1. Introduction

Dear Valued GeoSIG Customer, thank you for purchasing this product.

These Instruments have been optimised to meet the requirements of the majority of customers out of the box and may have even be delivered tailored to your needs. In any case, to be able to get the most out of our product, please carefully study this manual, its appendices and referenced manuals, as well as any other documents delivered with it.

This is a reliable and easy to use device, and at the same time a sophisticated product, which requires care, attention and know-how in configuring, installing, operating and maintenance.

GeoSIG continuously improves and enhances capabilities of all products. There may be several other connectivity, hardware or software options for the instrument, which are not covered in this manual. Refer to separate documentation from GeoSIG about available options or ask GeoSIG directly.

2. Incoming Inspection

All instruments are carefully inspected both electrically and mechanically before they leave the factory. Please check if all received items correspond with the packing list and your order confirmation. In case of discrepancy please contact GeoSIG or your local representative immediately.

2.1. Damage during shipment

If requested at the time of order, all instruments can be insured prior to shipment. If you receive a damaged shipment and shipping insurance was previously arranged you should:

- Report the damage to your shipper immediately
- Inform GeoSIG or your local representative immediately
- Keep all packaging and shipping documents

Insurance claims may be void if the above procedure is not followed.

2.2. Warranty

GeoSIG Ltd (hereafter GeoSIG) warrants hardware and software products against defects in materials, workmanship and design for the defined period in the relevant contract or offer, starting from date of shipment and 5 years parts and maintenance support commitment. If GeoSIG receives notice of such defects during the warranty period, GeoSIG shall at its option either repair (at factory) or replace free of charge hardware and software products that prove to be defective. If GeoSIG is unable, within a reasonable time to repair or replace any cabinet to a condition as warranted, buyer shall be entitled to a refund of the purchase price upon return of the cabinet to GeoSIG. 50% of freight charges on shipments of warranty repairs or replacements will be borne by GeoSIG (normally one way freight).

2.2.1. Limitation of Warranty

The foregoing guarantee shall not apply to defects resulting from:

- Improper or inadequate maintenance by buyer
- Buyer supplied software or interfacing
- Unauthorised modification or misuse
- Operation and storage outside of the environmental specifications of the instrument
- Related to consumables or batteries
- Improper preparation and installation at site.

3. Storage (Instrument Shelf Life)

In case the instrument is stored, the batteries have to be maintained according to the storage duration.

Period of time	External power supply	Instrument is operating	Main battery	Real Time Clock backup battery
< 1 month	ON	YES	Connected	Connected
	ON	NO	Connected	Connected
	OFF	NO	Connected	Connected
1 – 3 months	ON	YES	Connected	Connected
	ON	NO	Connected	Connected
	OFF	NO	**Disconnected**	Connected
3 – 6 months	ON	YES	Connected	Connected
	ON	NO	Connected	**Disconnected**
	OFF	NO	**Disconnected**	**Disconnected**
More than 6 months	ON	YES	Connected	Connected
	ON	NO	Connected	**Disconnected**
	OFF	NO	**Disconnected, must be recharged every 6 months for at least 24 hours.**	**Disconnected**

Table 1, Storage instruction

Removing or replacing the backup battery must be done by a trained person only. Therefore if the instrument is stored for more than 3 month, always have it connected to power and let it running.

3.1. Main battery

If the instrument is connected to AC power through its power supply module, the main battery can remain in the unit; it will remain charged and ready for use.

Current leakage on main battery when unit is off, without external supply is about 40 µA.

3.2. Backup battery

Autonomy of Real Time Clock on its backup battery is 3 years typical at ambient temperature. The jumper JMP_BBATT on the main board has to be put in position 2-3 to disconnect this backup battery. This must be done by a trained person only as a removal of the black cover is required.

Figure 1. Position of JMP_BBATT

4. Description

4.1. Housing

The instrument is a housing mounted with a base plate. The base plate is fixed on ground and levelled one time during installation, then the instrument can be replaced without need for levelling.

Figure 2. Instrument housing[1]

4.2. Base plate

A base plate is supplied with the instrument for fixation and levelling of instrument on site. 3 levelling feet are provided to adjust horizontally the base plate. The fixation is done as a single point in the middle of the plate.

To insure correct orientation when an instrument is installed on the plate, 2 pins are provided with the plate. They can be mounted in different position, according to the orientation required and will fit in the 2 holes existing in the base of the instrument.

A connection point for earthing is also provided with the plate as a M6 thread.

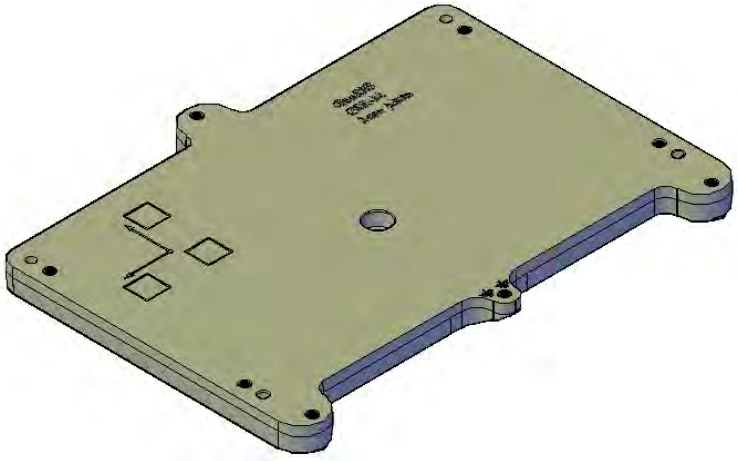


Figure 3. Instrument base plate

[1] Connectors may vary depending on ordered configuration

4.3. Connectors

The instrument has up to nine connectors and two antenna plugs:

Figure 4. Instrument with all connectors. Antennas are not mounted[2]

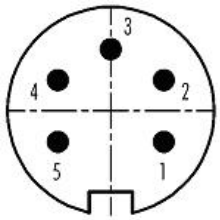
4.3.1. Standard External Connectors

These connectors well be always assembled:

POWER	Connection to the power supply module of the instrument or to an external battery.
LAN	Connection with Ethernet cable to a LAN. The cable connection is dominant other the Wi-Fi link. As soon as the cable connector is plugged in the instrument LAN socket, the Wi-Fi module will be turned off, even if the RJ45 connector at the end of the cable is not plugged into any socket.
SERIAL	Connection to the console or for the serial data stream output, depending on the cable type. Optionally also the GPRS modem can be connected to this port.
GPS	For connection to a GPS receiver.

[2] Connectors may vary depending on ordered configuration

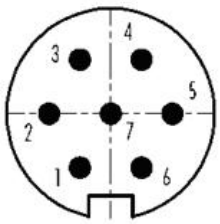
4.3.1.1. POWER Connector



Pin	Description
1	External power supply, 15 VDC
2	GND
3	External battery[3], 12 VDC
4	GND
5	Shield

Mating Type: Binder Series 423, cable connector female, 5 pole

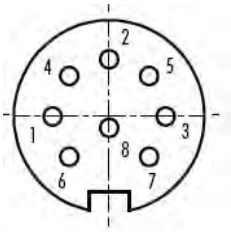
4.3.1.2. ETHERNET Connector



Pin	Description
1	Detection if cable is connected, to be connected to GND inside the cable
2	RXD+
3	RXD-
4	TXD+
5	TXD-
6	Shield / GND
7	Shield / GND

Mating Type: Binder Series 423, cable connector female, 7 pole

4.3.1.3. SERIAL Connector

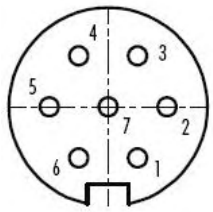


Pin	Description – COM Pinout	
1	TXDa	*COMa: ttyS2 or ttyS3*
2	RXDa	*Serial data streaming and GPRS modem*
3	RTSa	
4	CTSa	
5	TXDb	*COMb: ttyS0*
6	RXDb	*Configuration Console*
7	Power, 12 VDC	*For external GPRS modem only*
8	GND	
Pin	**Description – USB Pinout**	
1	USB Device Vbus	*USB Device Connector*
2	USB Device D+	
3	USB Device D-	
4	GND	
5	USB Host D+	*USB Host Connector*
6	USB Host D-	
7	USB Host Vbus	
8	GND	

Mating Type: Binder Series 423, cable connector male, 8 pole

[3] Replaces internal battery

4.3.1.4. GPS Connector



Pin	Description
1	TXD
2	RXD
3	n/c
4	GND
5	1PPS
6	Power, 12 VDC
7	GND

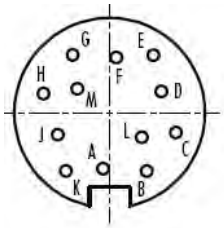
Mating Type: Binder Series 423, cable connector male, 7 pole

4.3.2. Optional External Connectors

These connectors depend on the ordered options:

SENSOR1	Connection to an external sensor.
SENSOR2	Connection to a second external sensor in case of a six channel instrument with two external sensors.
INTERCON	Connection to the interconnection network allowing common time and common triggering.
MODEM	Connection to analog phone line for the internal analog modem.
ALARM	Contacts of the internal alarm relays

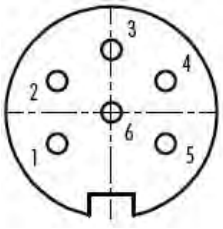
4.3.2.1. SENSOR Connectors



Pin	Description
A	X+
B	X-
C	Y+
D	Y-
E	Z+
F	Z-
G	S_Test, Calibration Test Pulse
H	GND
J	Power, 12 VDC
K	GND
L	S_Mode, Calibration Enable
M	Analog AGND

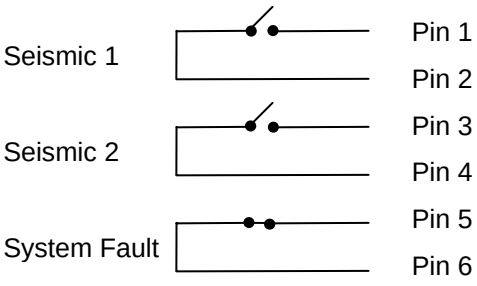
Mating Type: Binder Series 423, cable connector male, 12 pole

4.3.2.2. ALARM Connector



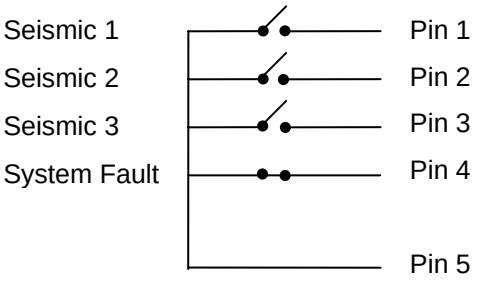
Standard Configuration

3 isolated relay contacts



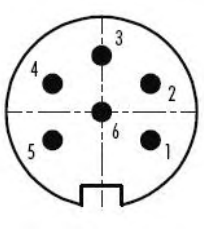
Optional Configuration

4 relay contacts with common pin



Mating Type: Binder Series 423, cable connector male, 6 pole

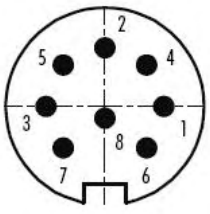
4.3.2.3. MODEM Connector



Pin	Description
1	Line a
2	Line b
3	n/c
4	n/c
5	n/c
6	HGND

Mating Type: Binder Series 423, cable connector female, 6 pole

4.3.2.4. INTERCONNECTION Connector



Pin	Description
1	Trigger +
2	Trigger -
3	Time Synchronisation +
4	Time Synchronisation -
5	RS-485 + (not used)
6	RS-485 - (not used)
7	n/c
8	GND

Mating Type: Binder Series 423, cable connector male, 8 pole

4.3.3. Optional External Antennas

Wi-Fi	Antenna connector for the wireless Internet
WiSync	Antenna connector for 433 MHz synchronisation, allowing time synchronisation of several instruments wirelessly.

4.3.4. Connectivity Options

A large variety of options can be connected to the instrument. The following figure should give an overview of the main possibilities. Ask GeoSIG for details about any specific connectivity options.

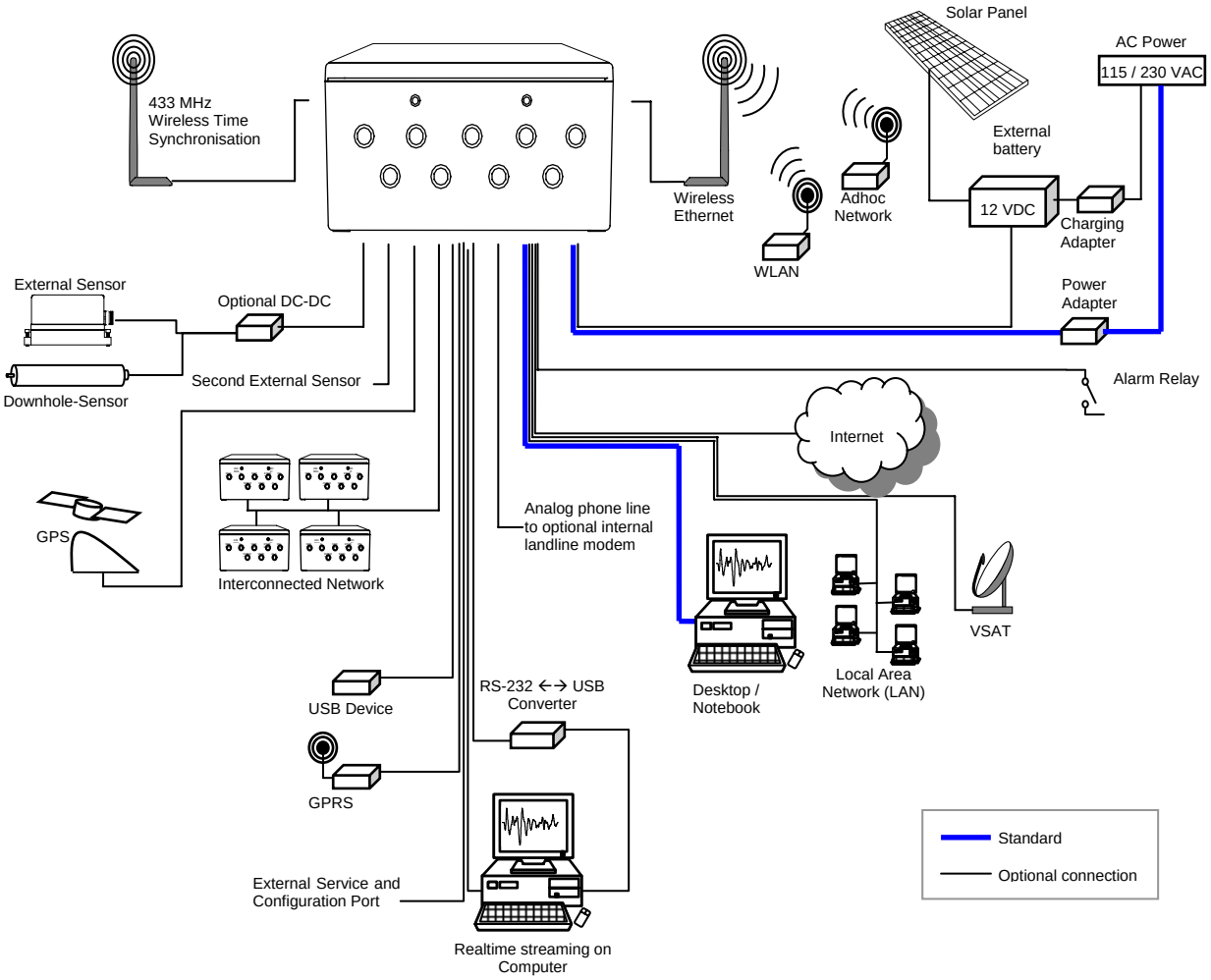


Figure 5. Connectivity options

4.3.5. Internal Connector

The instrument is equipped with an internal RS-232 connector giving access to the console. A standard RS-232 extension cable (straight, female-male) can be used to connect to a computer

Figure 6. Internal RS-232 connector for the console

4.4. Visual Indicators

Several visual indicators (LED's) show the status of the instrument.

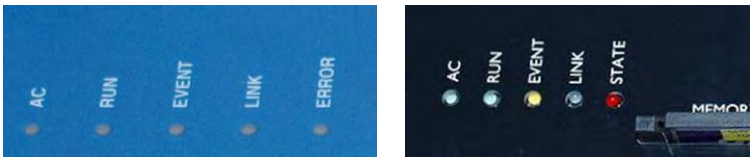


Figure 7. Visual indicators on the cover (left) and inside the instrument (right)

Indicators for left to right:

Color	Indication	States
GREEN	**AC** indicator	When ON, the external power supply is present
GREEN	**RUN** indicator	**OFF**: the unit is off **Blinking 20% ON, 80% OFF at 2 sec period**: The instrument is starting up or the data acquisition program has been stopped or is not running **Blinking 20% ON, 80% OFF at 1 sec period**: Normal operation of the instrument, data acquisition is running **Blinking 80% ON, 20% OFF at 2 sec period**: Instrument is shutting down, data acquisition is not running and the instrument will be powered down soon
YELLOW	**EVENT** indicator	**OFF**: Unit is not recording and no events are on the CF card **Blinking**: Indicates the amount of memory used on the CF card (<25%, >25%, >50%, >75%) **ON**: The unit is recording
BLUE	**LINK** indicator	**OFF:** Link with the data server is established, no communication ongoing **Blinking at 1 sec period**: Problem with the link to the data server **ON**: Link with the data server is established, communication or data transfer ongoing
RED	**ERROR / STATE** indicator	**OFF**: No problem or warning **Blinking at 2 sec period**: Warning is present **Blinking 1 sec period**: Error is present **ON**: Data acquisition is not running, e.g. during start up

Table 2. Indicators description

4.4.1. Detail Description

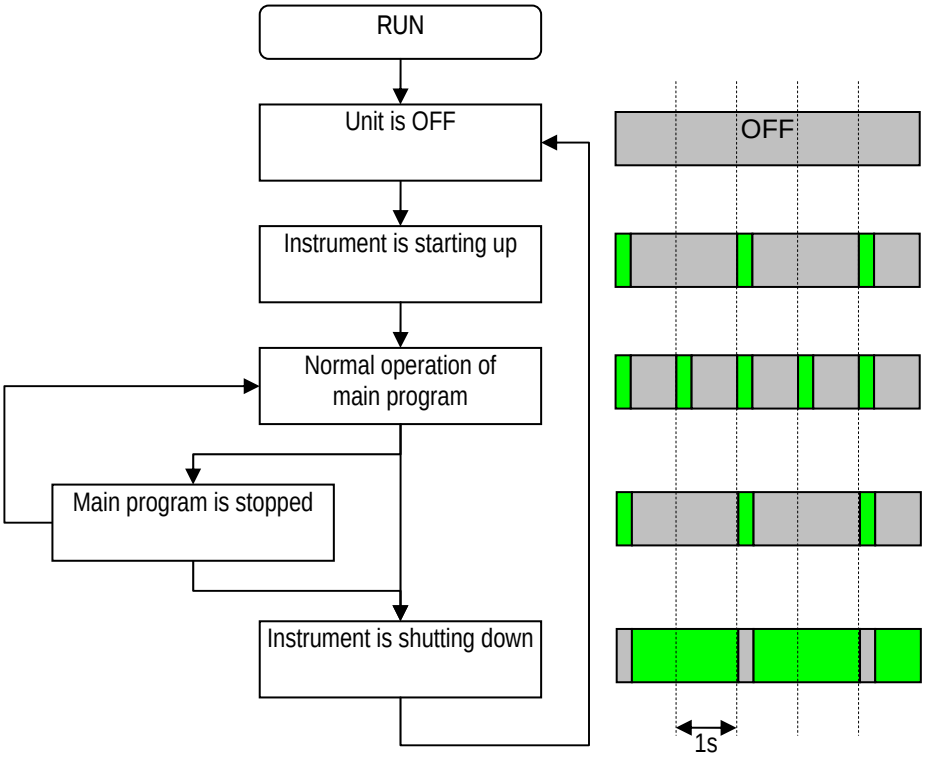


Figure 8. RUN indicator

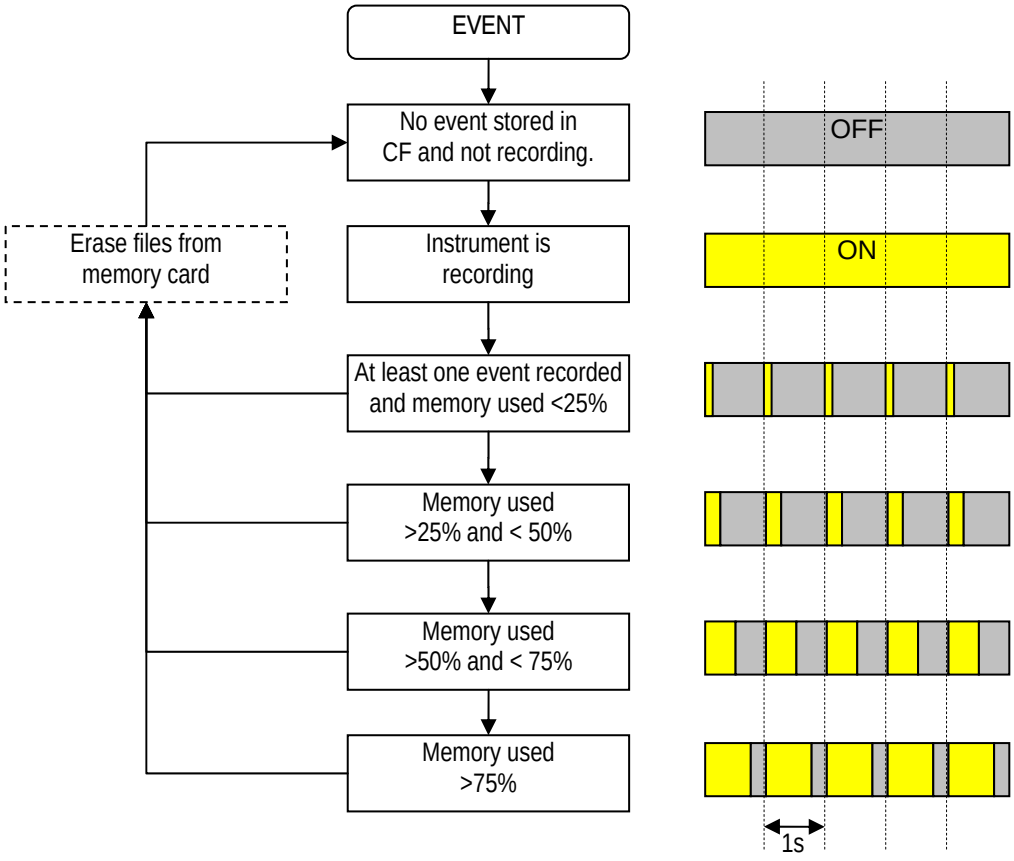


Figure 9. EVENT indicator

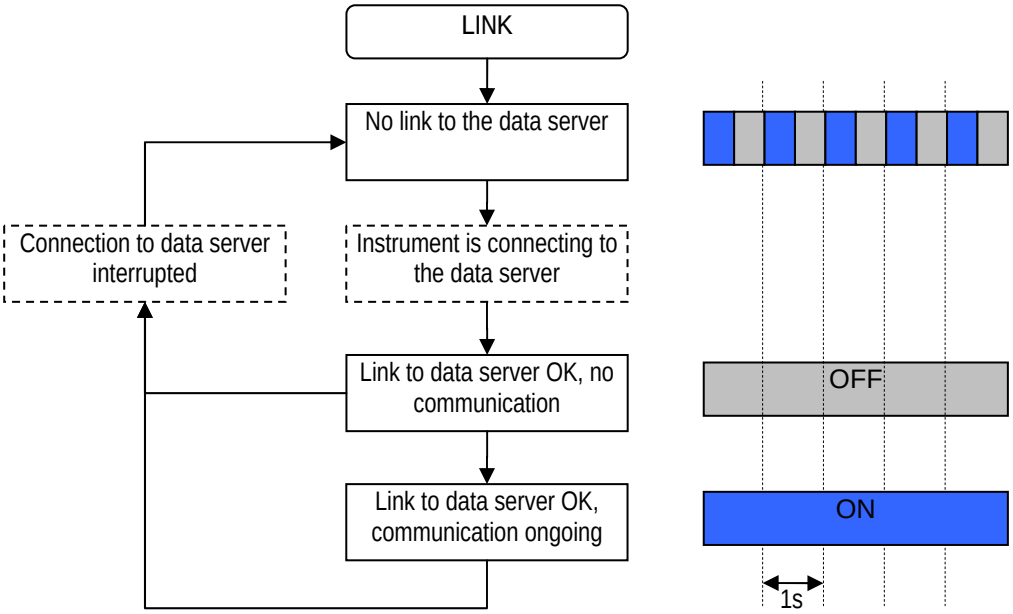


Figure 10. LINK indicator

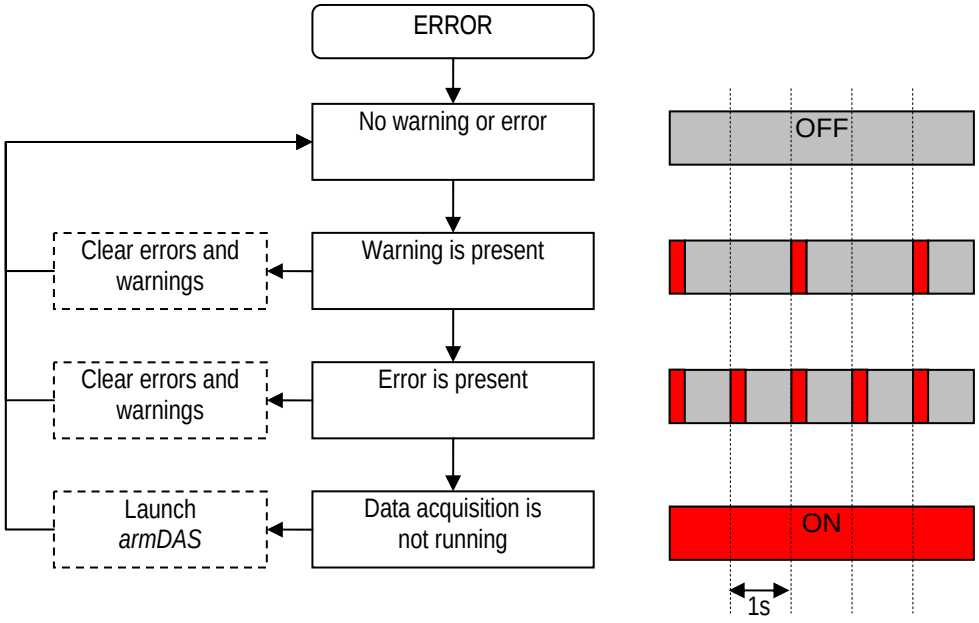
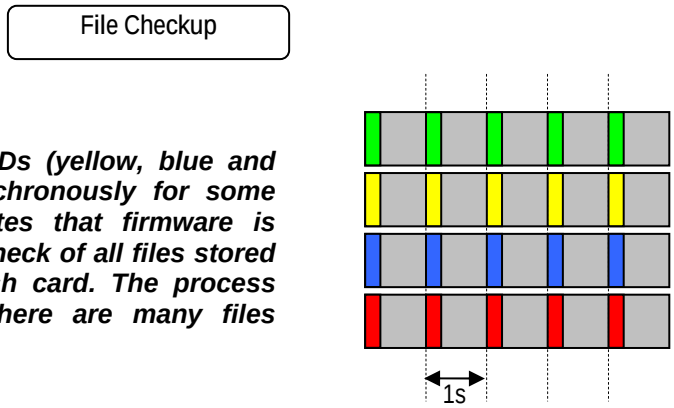


Figure 11. ERROR indicator



At startup, three LEDs (yellow, blue and red) may flash synchronously for some while, which indicates that firmware is performing the full check of all files stored on the compact flash card. The process may take long if there are many files collected.

Figure 12. File checkup

4.5. Internal Batteries

4.5.1. Main Battery

The battery is used in the instrument to power it in case of external power loss. If the external power is not restored when the battery reach a low level, the unit will switch off by itself to avoid deep discharge of the battery. This protects the battery against capacity reduction or destruction occurring usually in case of deep discharge for such battery type. It has the following specifications:

Description	Specification
Nominal Voltage	12 V
Capacity	7 Ah
Length	153 mm
Width	66 mm
Height	96 mm
Overall height	102 mm
Weight	2.65 kg
Connection	Faston 6.3

Table 3. Main battery specification

The following models have been checked to be compatible with the instrument:

Supplier	Model
Yuasa	NP7-12D
FIAM	FG29722
Panasonic	VRLA_LC-R127R2P

Table 4. Main battery models

4.5.2. Backup battery

The backup battery is used to maintain time in the instrument when it is powered off. It requires the following specifications:

Description	Specification
Nominal Voltage	3 V
Capacity	285 mAh
Cell diameter	24.5 mm
Cell height	3 mm
Weight	4.1 g

Table 5. Main battery specification

The following models have been checked to be compatible with the instrument:

Supplier	Model
RENATA	CR2430 MFR
DURACELL	CR2430

Table 6. Backup battery models

4.6. Power Supply

The main power is provided to the instrument from an AC/DC power module providing 15 VDC at 1 A. The AC entry is compatible with 110 / 60 Hz or 230 / 50 Hz network without any adjustment. The block has a C7 connector and can use any standard power cord with such connector. The power module and the power cord supplied as are both CE and UL approved. The power module must be connected to AC with a 2-wire power cable providing *Phase* and *Neutral*. A wall mounting clip is provided with each power supply.

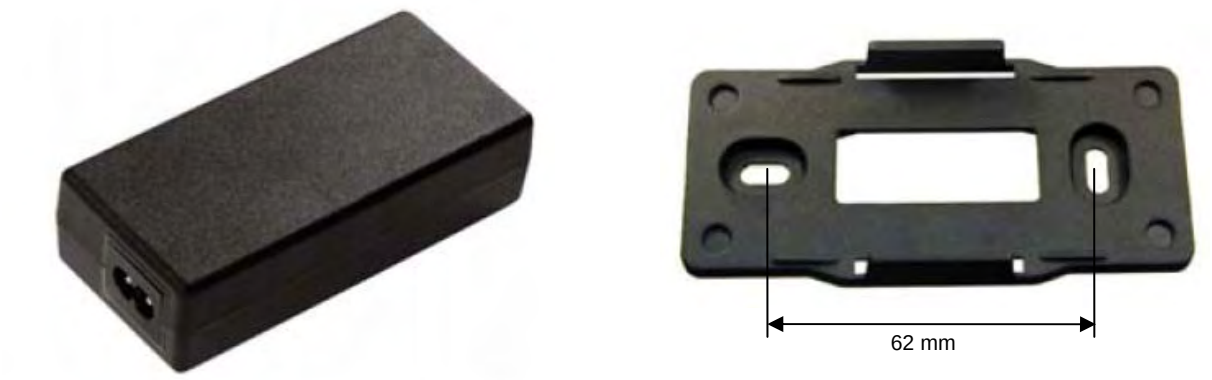


Figure 13. Power supply (left) and its mounting clip (right)

Optionally the instrument can be build to have a 9 to 36 VDC power input range. This option must be specified at order time.

4.7. Supplied and Optional Accessories

4.7.1. Standard Supplied Accessories

The following parts will be included in a shipment additional to the instrument:

- External **power supply** module, 100 to 230 VAC / 50-60 Hz, CE and UL approved.
- **AC Power cable**, depending on the shipping address with European, US or Swiss power plug
- **Fixation baseplate** with levelling feet
- **Screw and anchor bolt** for fixation
- **Ethernet cable**, category 5 cable for 10/100 Mbit network with a suitable connector for the instrument, 5 meters of cable and a standard RJ45 connector. Other cables lengths are available by request.
- **Console cable** for use on the internal RS-232 connector

4.7.2. Optional Accessories

The following parts can be ordered additionally and will be added if specified at order time:

- **GPS** time code receiver with 20 meters cable, other cable length on request. GPS is an option as the time can also be synchronised through the network using NTP.
- **Console cable** for use on the external SERIAL connector.
- **Data stream cable** for use on the external SERIAL connector.
- **SD/CF card reader for USB** for reading the memory card on a computer or laptop.
- **GPRS modem**
- **3G modem**
- Any **spare connectors**
- Any **spare antennas**
- Spare **battery**

5. Installation

This section lists the procedures involved in installation of the Instrument. The procedures will be outlined as steps to be performed in the field or in house prior to deploying the instrument in the field.

5.1. Site Selection

5.1.1. Environmental Considerations

The choice of an installation site for a seismic event recorder is similar in most respects to that of a regular continuous recording seismic station.

Although the instrument is housed in a solid, weatherproof case, it should be installed in a place free from direct sunlight, precipitation, the danger of falling materials in the event of a severe earthquake and the risk of tampering or vandalism if the unit is to be left unattended.

There are also special considerations for event recorder installations. It is important to select the site and set the trigger level to avoid unwanted data recording, such as vibration from machinery, highway traffic, aircraft, waves, etc. It is wise to check the instrument frequently during the first several days of operation after each set-up, to see if there are previously unsuspected sources of noise which are triggering the instrument and using up the memory.

In addition, the user should select a site with a provision for 115 / 230 VAC power if the unit will be left in place for a long period of time (more than 26 hours). Although this is not necessary for the operation of the device, it does preclude concerns about battery charging.

You should make note at this point of any cultural or environmental sources of noise and vibration around the selected site, which may cause false triggers of the recording mechanism. These will have to be considered when setting the trigger parameters.

5.1.2. Power Supply Considerations

The Instrument may be powered from a 115 / 230 VAC supply through the external AC/DC converter, from the internal battery, or optionally from a 12 VDC external supply such as an automotive battery or solar panels. It can also be powered from an external DC power supply from 9 to 36 VDC (this is optional and must be specified at order time).

- If the supply in the field will be from a 115 / 230 VAC supply, you need to connect the VAC cable from the external AC/DC to the power source only. The Instrument operates continuously, providing a trickle charge to the internal battery. The VAC supply must consist of Phase and Neutral.
- If the supply in the field will be from a 9 to 36 VDC supply (optional), you need to connect the power cable from Instrument to the power source only. The Instrument operates continuously, providing a trickle charge to the internal battery.
- If the instrument is running from an external battery (optional), you need to connect the delivered battery cable from Instrument to the power source only. In this case there should be no internal battery installed. The external battery must be charged with an external battery charger.
- If the supply will be exclusively from the Instrument's internal battery, it is necessary to charge the battery sufficiently beforehand. Make sure to have at least 24 hours of uninterrupted charging prior to leaving the Instrument in the field. The configuration of the instrument, of course, may be performed while the charger is connected to the Instrument. The external AC/DC converter has to be plugged to 115 / 230 VAC for charging the internal battery.

The best approach to the deployment of the Instrument is to use the internal battery along with the VAC/VDC power at the remote site. It is highly recommended, to check and configure the Instrument for the correct time, trigger and other relevant settings in the lab, prior to the installation (see chapter 7). It may then be carried to the remote site (it should be switched *OFF* to conserve the internal battery) and then connected to the VAC power through the external AC/DC converter or directly to the VDC power supply. After turning the Instrument *ON* (see chapter 10.1), the instrument runs with the pre-configured parameters. This reduces the amount of time needed to configure in the field; an important consideration in the case of an adverse condition.

5.1.3. Communication Considerations

An Ethernet connection or Wi-Fi signal must be present to have a data communication. If the Instrument uses an *NTP Server* as time source, please make sure that an internet connection is available and the network settings are properly set in the instrument. Optionally an external GPRS modem can be used for the connection to the internet. Use of NTP is not recommended when using a GPRS modem; a GPS should be used instead if possible.

If the Instrument is used as a standalone recording station, a notebook with an Ethernet connector can be used for downloading the data on a regularly basis. In a network the stations will upload the data to the configured server.

5.2. Installation

*For your convenience a training video explaining the installation of the GMS-xx and GMS^{plus} is available at **www.geosig.com → Support → 'How To …' Videos***

Many times the locations of seismic equipment are highly exposed to electrical disturbances caused by lightning or by the industrial environment. Although the instrument contains over voltage protection, it may sometimes be necessary to use additional surge protectors for the equipment. Contact GeoSIG or your local representative for more information.

5.2.1. Requirements for the Instrument Foundation

Minimum surface area requirements

- with internal sensor: 30 x 26 cm
- with external sensor (excluding area of sensor itself): 30 x 30 cm

Foundation has to be very well anchored or adhered preferably to a rock or concrete base. In case of a need for a foundation on soil, a concrete cubicle of 1 m^3 has to be cast in the ground to serve as a base.

5.2.2. Mounting the Instrument

The unit must be fixed rigidly on the building foundation, it has a base plate that must be first fixed on the ground and then the instrument mounted on it. For that purpose, the base plate has a central fixation hole (suitable for 8 mm screws) and three levelling screws. Prepare the base plate (see also Figure 14):

- Mount the 3 levelling screws ***(D)***.
- Check that the 4 M6 threads for the instrument fixation are free from dust.
- Mount the 2 polarization pins on the base plate on the side where the connectors will be ***(E/F)***.

Place the base plate at the selected location. Verify that the surface is sufficient flat and horizontal so that the three feet can level the plate. Be sure to leave enough space at the front of the Instrument for the connectors and for opening the cover. The sides of the instrument should typically not be closer than 100 mm (4") from a wall. Mark on the ground the location of the central hole in the plate. Remove the base plate.

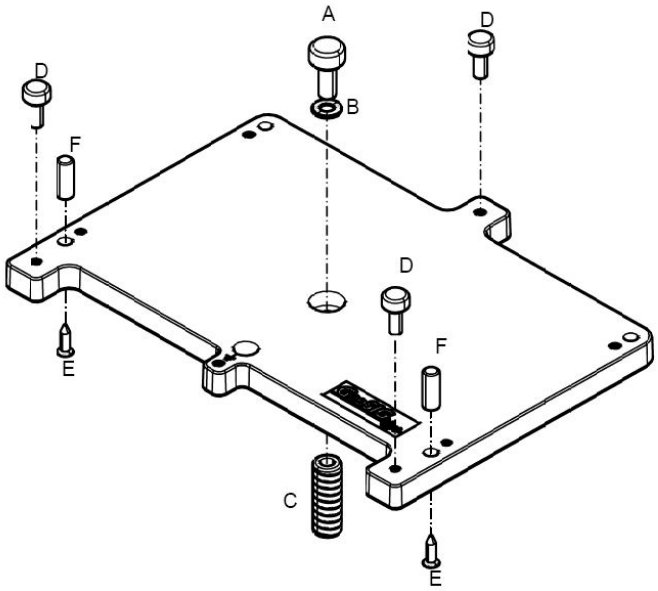


Figure 14. Installation of the base plate

Drill an 11 mm hole in the concrete with a typical depth of 50 mm for the supplied M8 concrete anchor ***(C)***. If another model is used, please adapt the hole dimensions accordingly. Clean the hole area of the dust. Insert the concrete anchor into the hole. Mount the plate in place and insert the M8 fixation screw ***(A/B)*** in its hole. Turn the plate so it is oriented according to requirement. Make a coarse levelling of the plate ***(D)***. Starts fixing the plate by tighten the M8 central screw ***(A)***. Check regularly the plate orientation and level till the plate is rigidly fixed ***(D)***. Remove the cover of the instrument and put it on the mounting plate using the 4 screws and washers to fix it. Keep care about the 2 orientation pins on the plate ***(E/F)***.

Do not overtighten the levelling screws.
Do not cause any short circuit on the battery poles or inside the unit.

5.2.3. Orientation, Levelling and Calibration of the Sensor

Check it is really fixed by pushing from all directions. If you feel any movement, recheck the fixation.

Internal Sensor: The sensor is located under the internal cover and as no setup is required for the sensor, there is no need to remove the internal cover. The levelling is done on the base plate and the sensor is already configured to operate with the recorder

External Sensor: Mount and level the sensor according to its manual and connect to the external sensor of the instrument.

5.2.4. Supply Voltage

The instrument should be powered from 110 VAC up to 240 VAC, 50 or 60 Hz through the external AC/DC converter or any other option described in chapter 5.1.2.

Optionally the instrument can be directly powered by an external battery or a 24 VDC or 48 VDC line. Please contact GeoSIG for more details.

5.2.5. Installing other Components, Options, Accessories

For installation of other components options or accessories please refer to the specified option manual.

5.3. First Start and Communication Setup

With the instrument correctly fixed on the ground through the fixation plate please proceed with chapter 7 for the first start-up and configuration.

6. Principle of Operation of the Instrument

This chapter gives an overview about the normal operation the instrument in a network or as a standalone unit.

6.1. Normal Operation

During normal operation the instruments are installed on sites and connected to a data server over Ethernet or Internet. The instrument check in a defined interval, if there are any requests or firmware updates ready for pick up on the server. Additionally – and if configured – the instruments uploads the ringbuffer files (from continuous recording) and the state of health files to the data server.

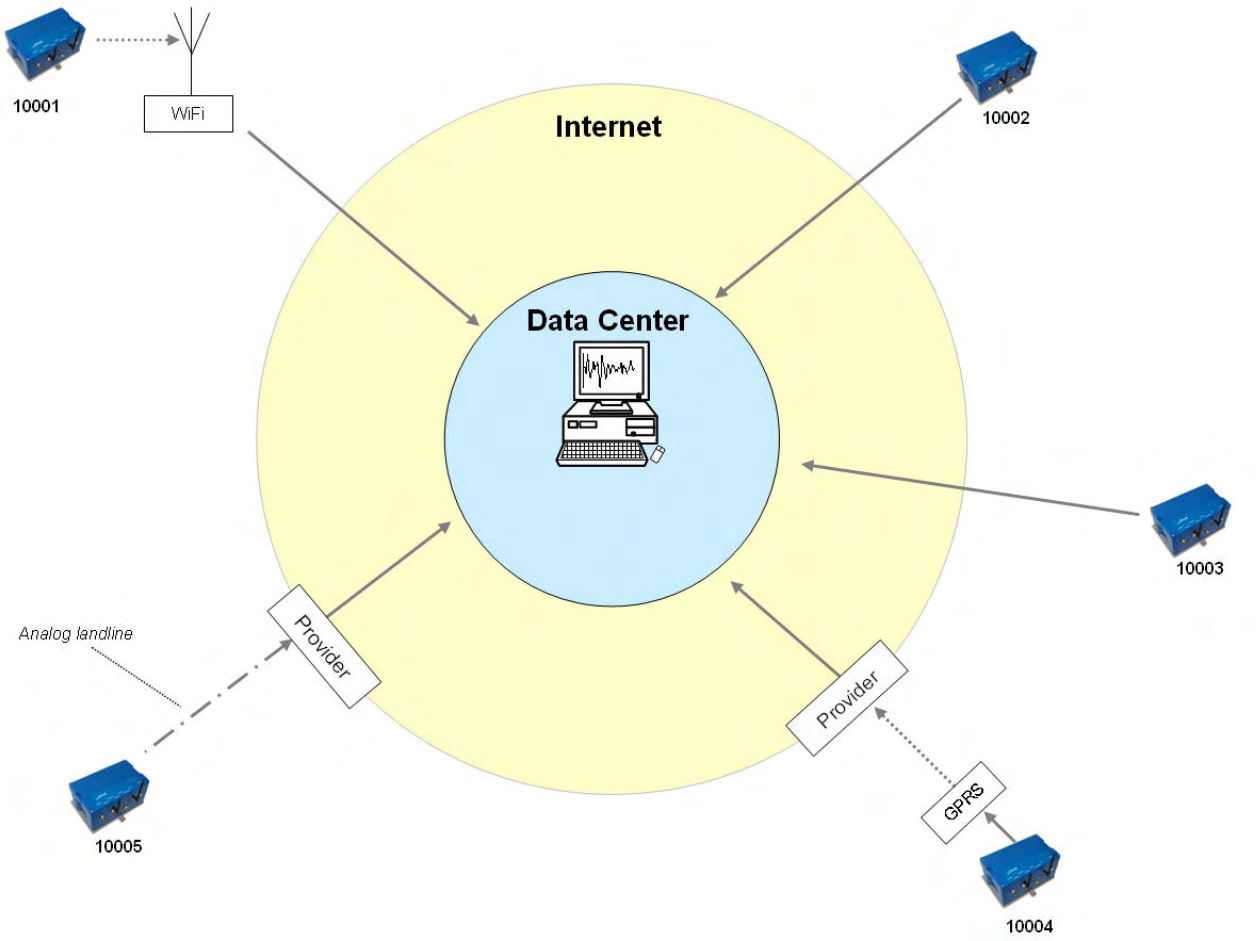


Figure 15. Normal operation in a network

6.2. Behaviour on a Seismic Event

In case there is an earthquake and the vibrations are above the trigger threshold, the instrument is recording the event and immediately uploading it to the data server (see Figure 16)

In case some of the stations are too far away from the epicentre to trigger, the data can still be collected from all instruments:

- A data request will be placed on the server
- All instruments will download the request during the next time checking the server (see Figure 17).

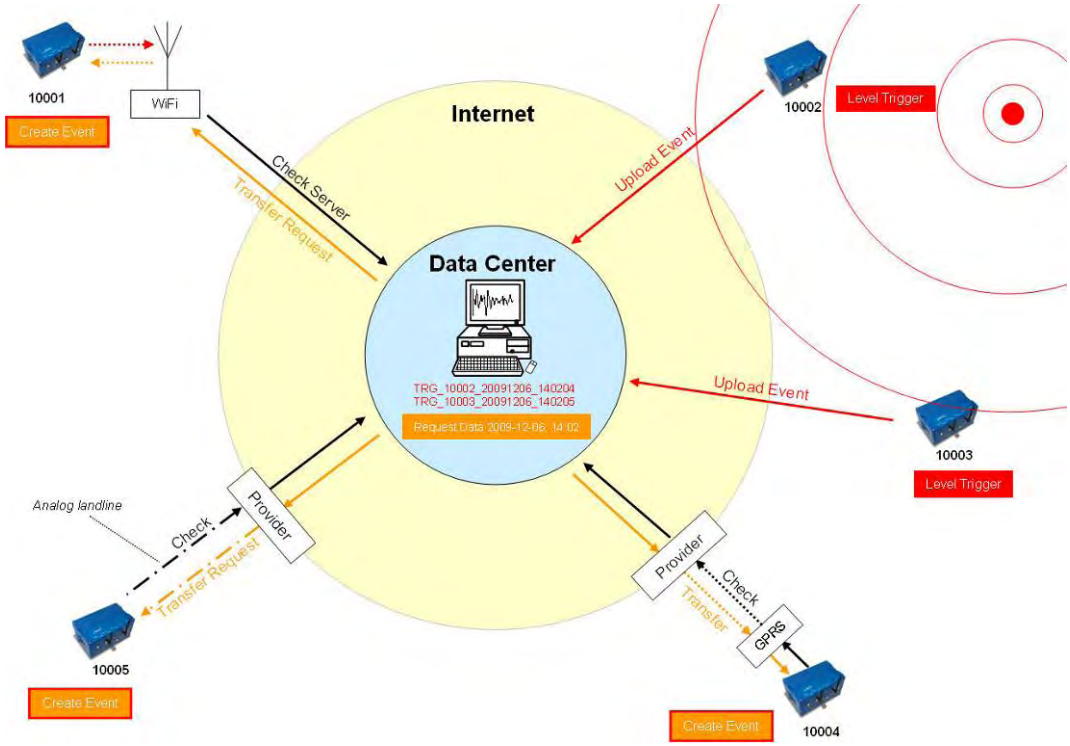


Figure 16. Upload of seismic events and download of requests from the server

- All instruments will create an event at the time listed inside the data request and extract these data out of the ringbuffer data
- The extracted event file will be uploaded to the data server (see Figure 17)

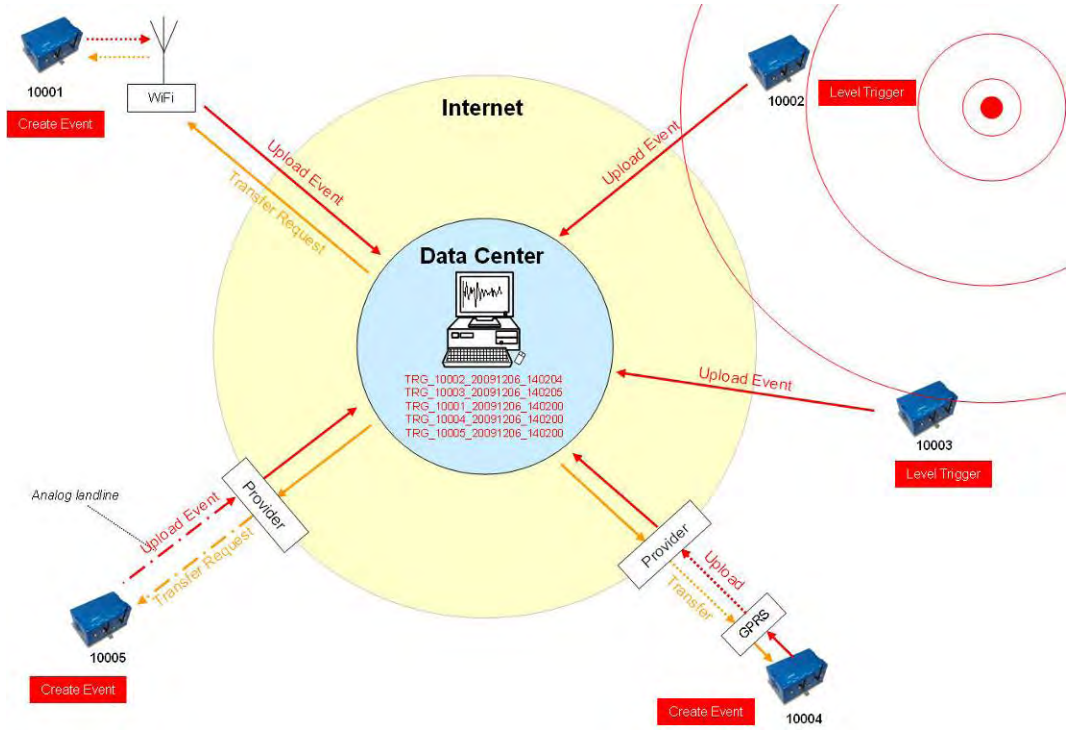


Figure 17. Behaviour on Events: Upload of extracted events

6.3. Firmware Upgrade

In case of a firmware upgrade, the new firmwares can be easily put on the server. All instruments will recognise the new firmware during the next server checkup, download and install it. See chapter 12 for details about the firmware upgrade.

The same happens also with new configurations.

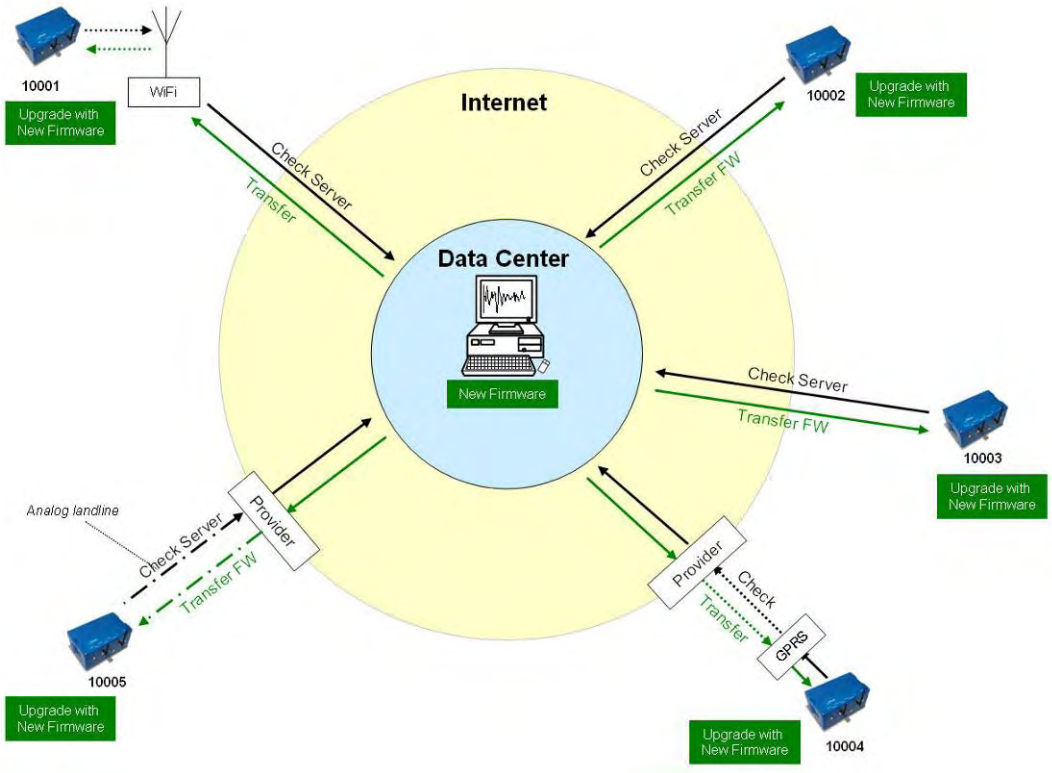


Figure 18. Firmware upgrade

6.4. Backup Server

It might be that the instrument is not able to contact the main data server anymore: Either because it is down or a wrong server has been configured, this can happen for example in case accidentally a configuration file with wrong server settings will be uploaded to an instrument. In this case the instrument will contact the backup server, configured in the bootloader. Therefore the configuration of the backup server is very important and should not be ignored. For more information how the set the backup server see chapter 7.2.

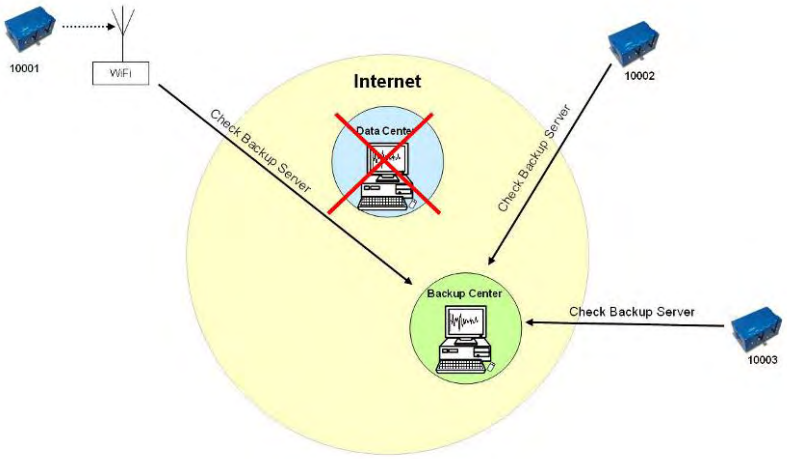


Figure 19. Connection to backup server in case connection to main server fails

7. Quick Start Up

This guide is intended to configure simple communication between the instrument and *GeoDAS* software running on a Windows workstation, working as data server.

> *It is assumed that the GeoDAS software is already installed on a computer. If not, please do the installation first with help of the GeoDAS User Manual before proceeding.*

7.1. Preparation

- Make sure the instrument is powered by the provided power supply, the green AC indicator should be *ON*
- Make sure the instrument is connected to a LAN by the supplied Ethernet cable.
- Remove instrument cover using the four screws on the top corners
- Verify that the battery is correctly fixed and connected to the system

> *In case there is no LAN available, the Ethernet cable can be connected directly to a computer. For this a crossed Ethernet cable is needed, please contact GeoSIG. Nevertheless in modern computers normally it works as well with the supplied patch cable.*
> *In any way the instrument and the computer must be configured to have a fixed IP. Please follow the procedure to adjust these settings.*

- Connect the instrument to a serial port of your computer by using a standard RS-232 patch cable.
- Open any terminal program and chose the appropriate COM port. Baud rate is 115200. Alternatively open *GeoDAS*, go to ***Tools → Terminal…*** and chose the COM Port. As Baud rate select ***115200.*** Then Press ***Connect***

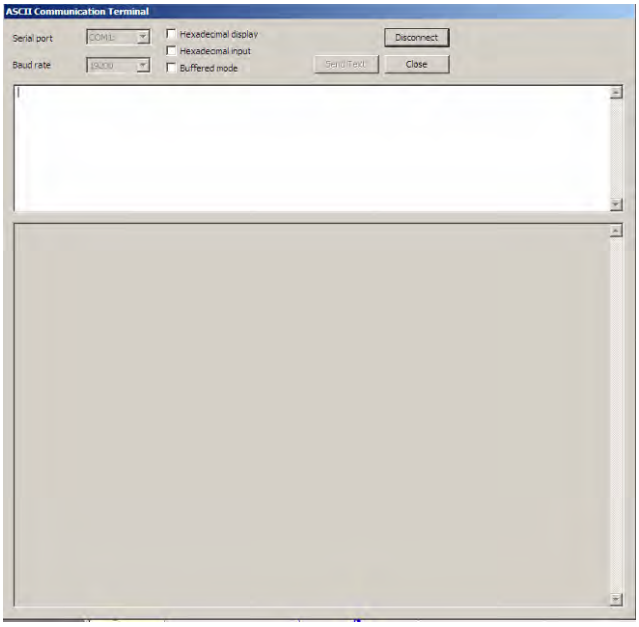


Figure 20. GeoDAS terminal

- Keep the terminal open for the next step.

7.2. Set IP Address of the Instrument

Network settings of the Instrument can be changed during startup of the instrument. By default the instrument has a dynamic IP.

- Switch on the instrument by press and hold the POWER button for 2 seconds.
- Press **<Ctr> +** '**Z**' as soon the following message appears on the console to enter the test mode.

```
GMSplus s/n 100582. Firmware in the Linux image: 21.01.22
Press Ctrl+Z to enter the test mode.....
```

The following menu will appear (see chapter 11 for details):

```
Press Ctrl+Z to enter the test mode.............
Instrument serial number: 100582
Instrument MAC address: 00:50:C2:77:42:93

-------------------------------------------------------------------------------------------
Level           Shortcut   Password   Description
-------------------------------------------------------------------------------------------
User            Ctrl+U     None       Basic operations only
Powerful User   Ctrl+W     None       Also hardware options and pre-selected tests
Administrator   Ctrl+A     None       Also manual tests and altering the FLASH memory content
-------------------------------------------------------------------------------------------
Your level [U/W/A] or press B to boot now:
```

- By default, no any passwords are set, so press '**U**' to enter the User Mode, and then '**N**' to enter the menu *Network setting*s.

```
==== Network Settings ====

---- Primary network interface ----
Configure network interface (Y/N)? Y
Static IP address (1=YES, 0=AUTO)? (0 = 0x0):
```

- Select '***Y***' to change the settings and then select if the instrument should have a static or a dynamic IP by pressing '**1**' (Static) or '**0**' (dynamic). In case a dynamic IP is chosen, a DHCP server must be available in the network to provide the IP settings.
- In case a static IP is selected, an additional message will appear asking for the *Instrument IP address*, *Instrument network mask* and *Instrument gateway IP*. In case you don't know these parameters please ask your network administrator.
- In case the instrument has a Wi-Fi module, a second interface menu appears and also here static or dynamic IP can be choosen and the available Wi-Fi networks can be scanned. Please see chapter 8.4 for details.

```
---- Wireless network interface ----
Configure network interface (Y/N)? Y
Static IP address (1=YES, 0=AUTO)?
```

- In case the instrument is connected to the internet via a PPP connection (GPRS or analog modem), then the APN and password must be configured. See chapter 10.8.3 for details

```
---- PPP Communication ----
Edit Analog Modem settings (Y/N)? Y
Phone number of the service provier  [T313001]:
Login  [demo]:
Password  [demo]:
Updating configuration...
PPP settings have been updated
Edit GPRS Modem settings (Y/N)? N
```

- The instrument allows access to the operating system from remote over SSH. This feature is not needed for the normal operation of the instrument and can be disabled in case of security concerns. By default it should be kept enabled, to disable press '**1**'

```
---- Miscellaneous parameters ----
Disable remote login over ssh (1=Yes, 0=Enable)? (0 = 0x0):
```

- It's highly recommended to put a *recovery server IP* address and *recovery server port*. The instrument will contact this server every *Recovery server contact interval* in case the connection to the main data server (configured in the configuration of the instrument) is not possible anymore. This can happen for example in case accidentally a configuration file with wrong server settings will be uploaded to an instrument.

```
Recovery server IP address (192.168.10.107):
Recovery server port (3456 = 0xD80):
Recovery server contact interval, hours (24 = 0x18):
```

- As soon the following menu appears, press '**5**' to start the instrument.

```
Bootloader Menu of the GMS-XX s/n 100582
Access level: User

 --- Flash Images and Boot Options ---
L - List flash images
Q - Reset instrument configuration to the user default
V - Reset instrument configuration to the factory default
5 - Boot now
X - Reboot the instrument
Y - Power off

 --- Hardware Setup and Monitor ---
N - Network settings

 --- Security ---
O - Set password

-->
```

- As soon the instrument is running (red LED on the instrument goes off), start ***GeoDAS*** (if not already done)

7.3. No Stations Configured at first Start Up

The following steps require GeoDAS version 2.23 or higher. If you have any older version download the newest release from www.geosig.com → Support → Downloads

- When *GeoDAS* will be started for the first time, it will ask to add stations in its configuration.
- Click ***Yes***

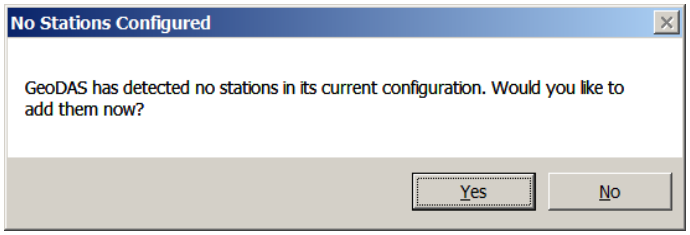


Figure 21. "No stations configured" message at startup of GeoDAS

If there are already stations configured in GeoDAS, this window will not appear. Please press the wizard button  *in the GeoDAS menu*

7.4. Adding New Stations…

Make sure the computer is connected to the same network as the instrument and in the same IP range.

- In the following window, select ***My GMS instrument is connected to the local network*** and press ***Next >***

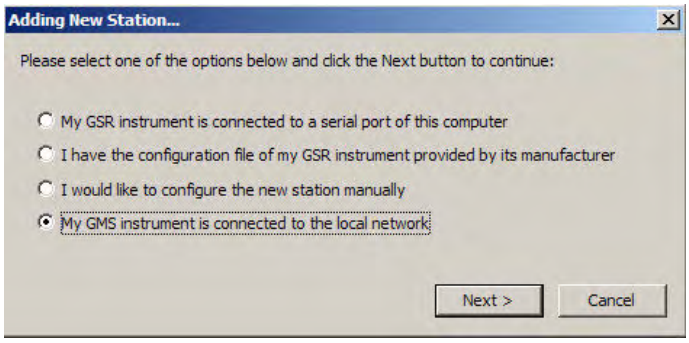


Figure 22. Instrument Wizard

- Enter the ***Serial number*** of the instrument and press ***Login >.*** It is also possible to add more than one station by entering only a fragment of the serial number which is similar on all instruments. For example if there are the serial numbers 100210, 100211 and 100234. By entering '1002' all the stations will be added. By putting '10021' just the stations 100210, 100211 will be added.

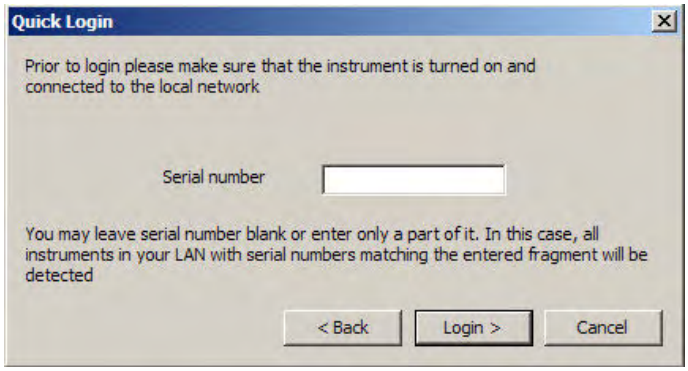


Figure 23. Quick Login Window

- All the found stations will be listed, press ***Finish*** to add them to GeoDAS

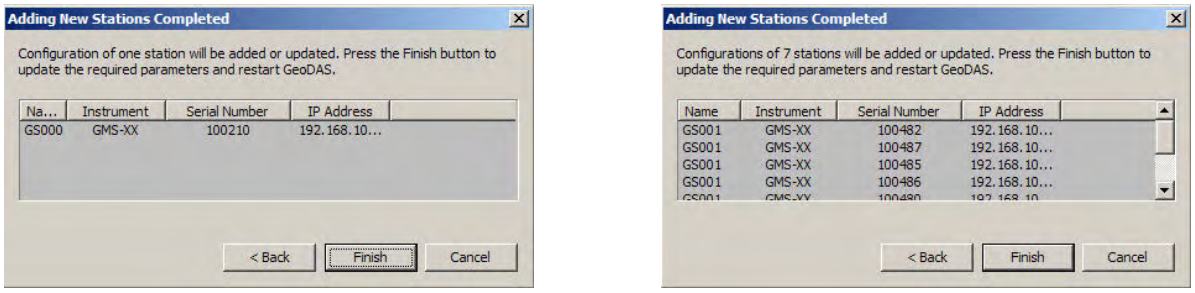


Figure 24. List of all stations found – single station left, multi-selection right side

7.5. Configuration of Data Server

- Proceed to the menu ***Settings → Configure Stations…***
- The following window will appear where all the instruments are listed in the area 1. Please see chapter 14.1 for details.

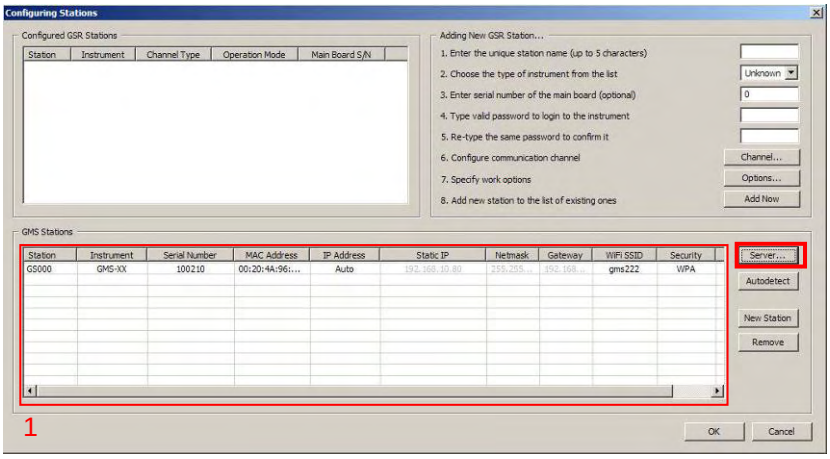


Figure 25. Configuration and overview of the stations

- Press the button ***Server…***, the window below appears and enter the following data:
  - *My server IP address* **IP of your computer**
  - *Server port* Select a user defined port, use ***3456*** by default

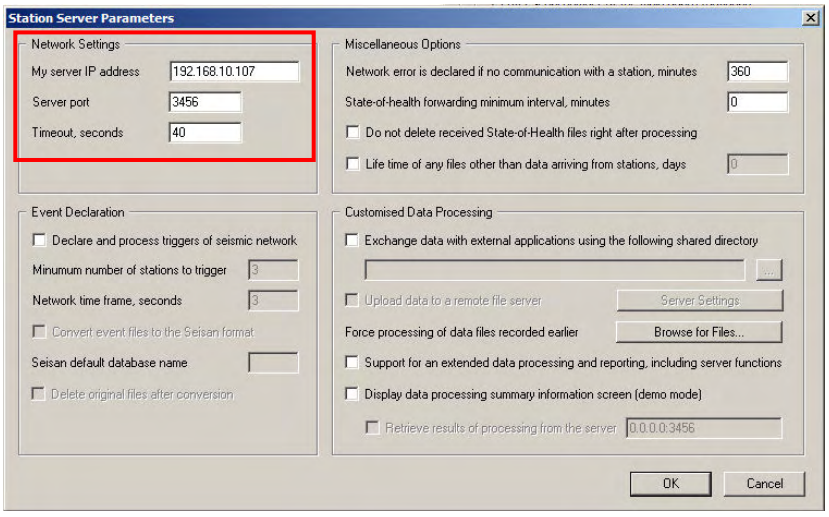
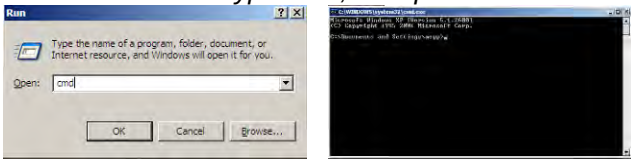


Figure 26. Data server parameter

If you don't know how to find out your IP Address, follow these steps:
*- Click Start → Run → type **cmd**, then press **OK***



*- Type **ipconfig**, then your IP appears*

```
Ethernet adapter Local Area Connection:
     Connection-specific DNS Suffix  . :
     IP Address. . . . . . . . . . . . : 192.168.10.107
     Subnet Mask . . . . . . . . . . . : 255.255.255.0
     Default Gateway . . . . . . . . . : 192.168.10.254
```

*- Type **exit***

- Write down the IP and port you have configured
- Press ***OK*** two times to exit again to the main window of *GeoDAS*

7.6. Basic Configuration of the Instrument

- In the window *Stations: General Information* make a ***right click*** on the station name

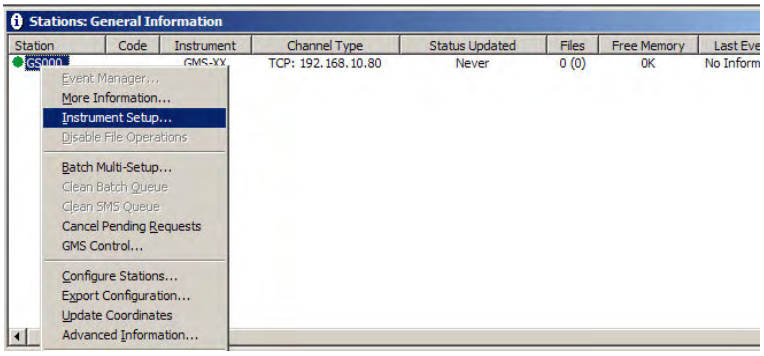


Figure 27. Instrument setup

- A window showing the Web Interface will appear.

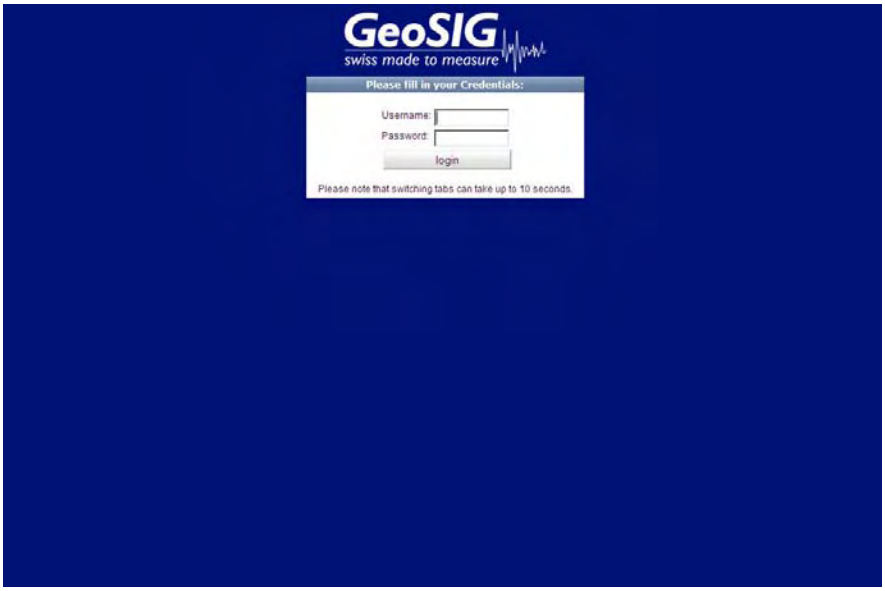


Figure 28. Configuration of the selected instrument

- To be able to adjust the configuration of the instrument it is required to authenticate oneself to the device. The default login credentials are: Username: ***admin***, password: ***123456.*** Then press ***login***
- Go to ***Configuration → armdas Configuration → File Transfer Settings***, the following screen appears.

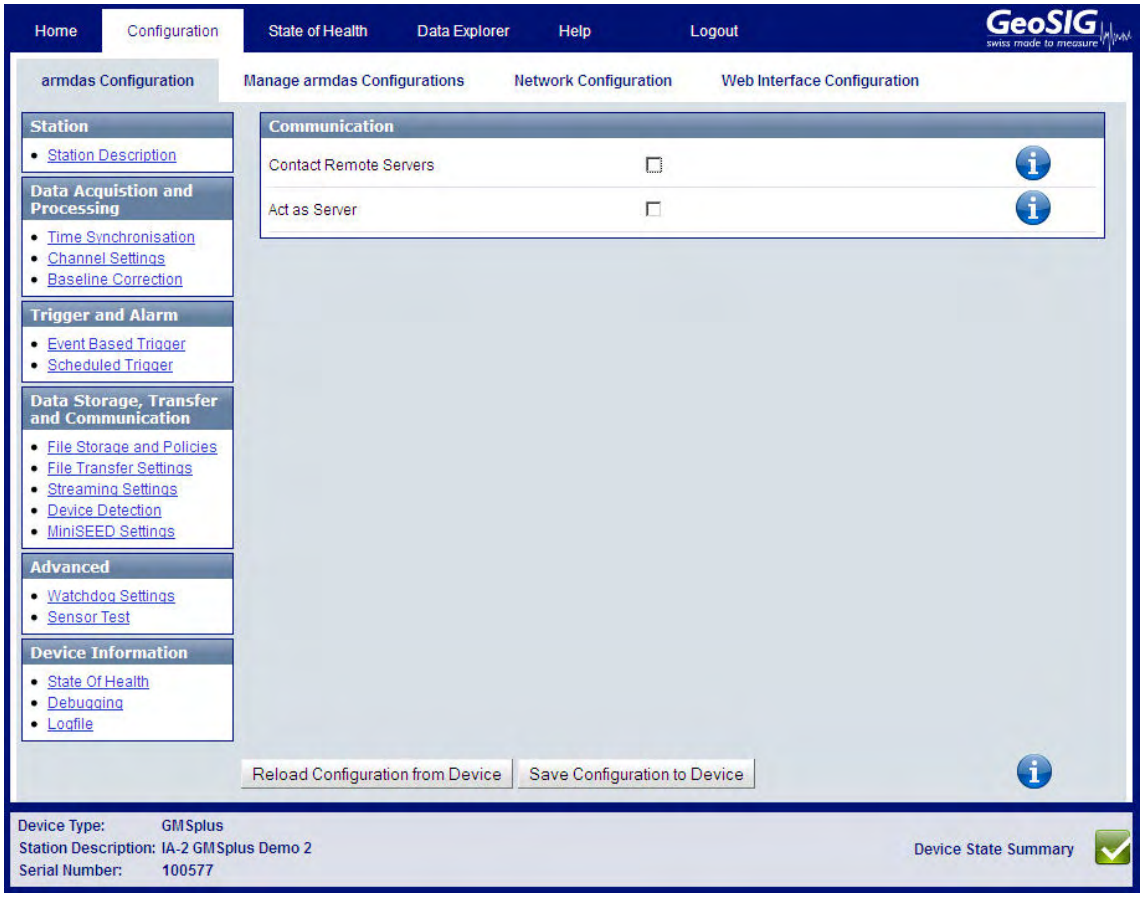


Figure 29. Server parameters

- Tick the flag ***Contact Remote Servers*** to configure a connection to a remote server
- Add the ***IP of your server*** and press ***Add Server with IP***. Under ***Settings…*** more options can be configured. The default *Server port* is ***3456*** and should be kept.

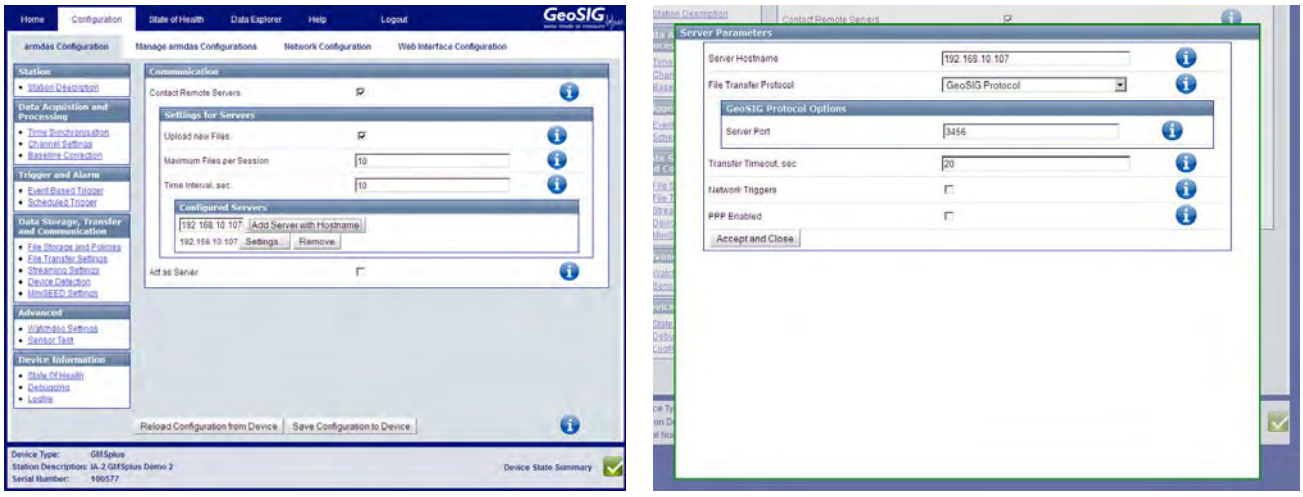


Figure 30. Added Server (left) and its parameters (right)

- Then press Save Configuration to Device
- After the instrument has restarted it is ready for operation and can be configured according to chapter 9 and 10.

8. Network Settings

The network configuration is the same in case of use of a wired network or wireless network. The specific settings related to the wireless network are described in chapter 8.3

8.1. Wired Ethernet settings through the Web Interface or GeoDAS

- To open the Web Interface please do one of the following two steps.
  - In the window *Stations: General Information* of GeoDAS make a ***right click*** on the station name and click on ***Instrument Setup …***, or
  - Open your browser and enter the IP address of the instrument (see chapter 8.5 for details) in the address bar of your browser.
- To be able to adjust the configuration of the instrument it is required to authenticate oneself to the device. The default login credentials are: Username: ***admin***, password: ***123456***
- Go to the tab ***Configuration → Network Configuration***, the following screen can be seen
- Adjust the settings under *eth0* and click ***Save Network Configuration to Device***.

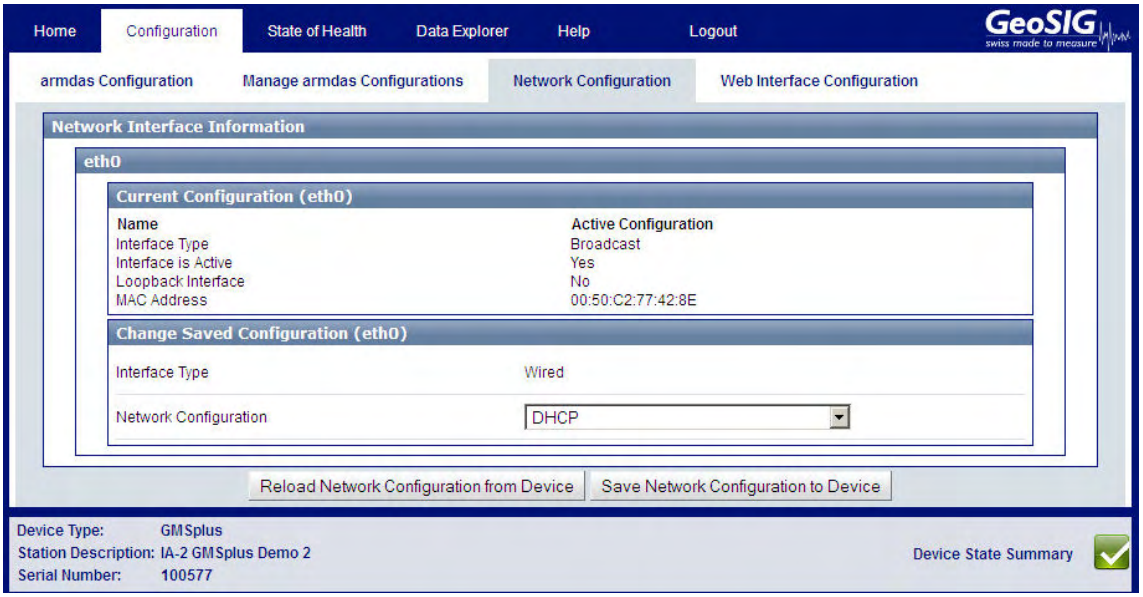


Figure 31. Configuration of network interface

8.2. Wired Ethernet settings through the local Console

Please see chapter 7.2 for details.

8.3. Wireless Settings through the Web Interface or GeoDAS

- To open the Web Interface please do one of the following two steps.
  - In the window *Stations: General Information* of GeoDAS make a ***right click*** on the station name and click on ***Instrument Setup …***, or
  - Open your browser and enter the IP address of the instrument (see chapter 8.5 for details) in the address bar of your browser.
- To be able to adjust the configuration of the instrument it is required to authenticate oneself to the device. The default login credentials are: Username: ***admin***, password: ***123456***
- Go to the tab ***Configuration → Network Configuration***, the following screen can be seen
- Adjust the settings under *wlan0* and click ***Save Network Configuration to Device***.

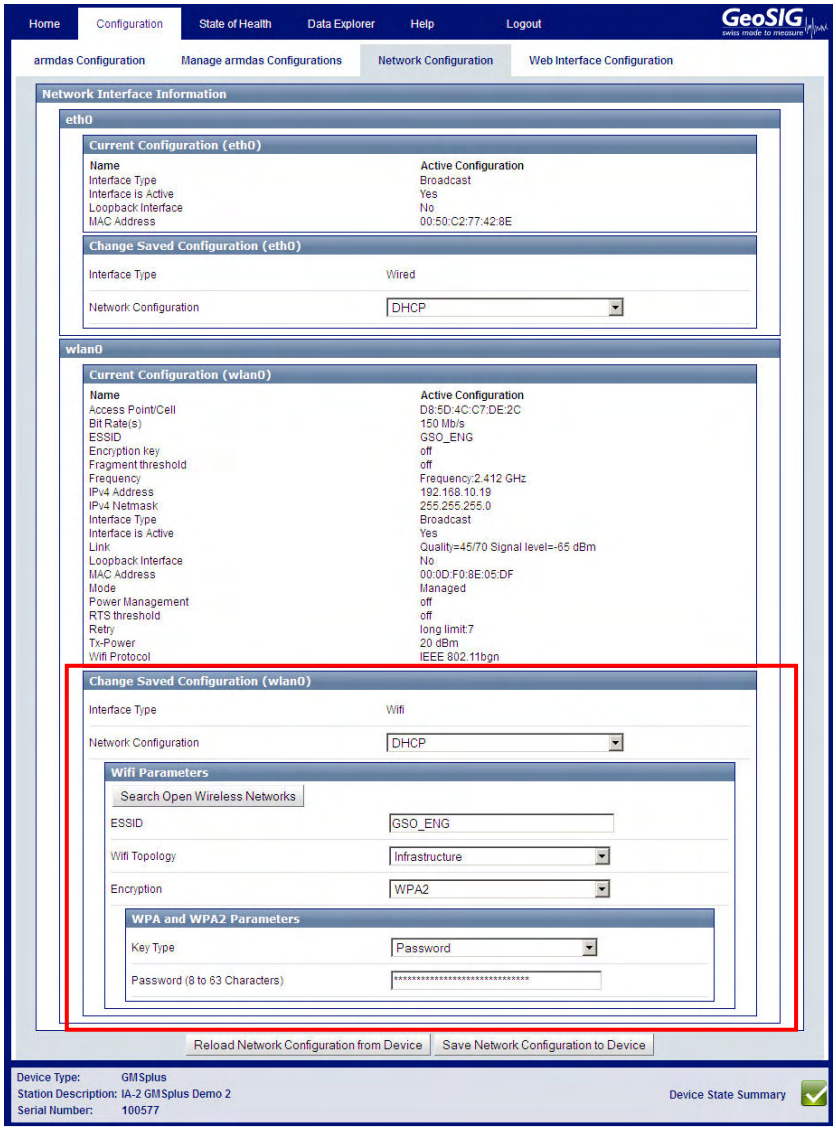


Figure 32. *Network Configuration* Screen

8.4. Wireless Settings through the local Console

- Switch on the instrument by press and hold the POWER button for 2 seconds.
- Press **<Ctr> +** '**Z**' as soon the following message appears on the console to enter the test mode.

```
GMSplus s/n 100582. Firmware in the Linux image: 21.01.22
Press Ctrl+Z to enter the test mode.....
```

The following menu will appear (see chapter 12 for details):

```
Press Ctrl+Z to enter the test mode.............
Instrument serial number: 100582
Instrument MAC address: 00:50:C2:77:42:93

-------------------------------------------------------------------------------------------
Level           Shortcut   Password   Description
-------------------------------------------------------------------------------------------
User            Ctrl+U     None       Basic operations only
Powerful User   Ctrl+W     None       Also hardware options and pre-selected tests
Administrator   Ctrl+A     None       Also manual tests and altering the FLASH memory content
-------------------------------------------------------------------------------------------
Your level [U/W/A] or press B to boot now:
```

- By default, no any passwords are set, so press '**U**' to enter the User Mode, and then '**N**' to enter the menu *Network setting*s and proceed till the following menu appears:

```
---- Wireless network interface ----
Static IP address (1=YES, 0=AUTO)?
```

- Select if the instrument should have a static or a dynamic IP by pressing '**1**' (Static) or '**0**' (dynamic). In case a dynamic IP is chosen, a DHCP server must be available in the network to provide the IP settings.
- In case a static IP is selected, an additional message will appear asking for the *Instrument IP address*, *Instrument network mask* and *Instrument gateway IP*. In case you don't know these parameters please ask your network administrator.
- By pressing 'E' the instrument is scanning the available networks and lists them. Choose the network to connect by pressing the ***number*** next to the network SSID or press '***C***' to configure the network settings manually.

```
Scanning wireless networks .
-------------------------------------------------------------------------
  N   Network SSID         Mode             Encryption   Channel   Level,%
-------------------------------------------------------------------------
  1   GSO_ENG              Infrastructure   WPA2             1       81
-------------------------------------------------------------------------
Enter the number of a network above, <S>can again or <C>onfigure manually:
```

- In case the network is encrypted, please enter the network key

```
Passphrase (8-63 ASCII) or a 64-character hex key (ad43Fd2d22):
```

- Adjust the other parameters concerning the SSH or recovery server if required.

- The instrument tries to connect to the network, this can take a while. Please be patient till the following menu appears again.

```
Bootloader Menu of the GMS-XX s/n 100577
Access level: User

 --- Flash Images and Boot Options ---
L - List flash images
Q - Reset instrument configuration to the user default
V - Reset instrument configuration to the factory default
5 - Boot now
X - Reboot the instrument
Y - Power off

 --- Hardware Setup and Monitor ---
N - Network settings

 --- Security ---
O - Set password

-->
```

- Press '**5**' to continue the boot process of the instrument.

8.5. Get IP from Instrument

- To get the IP from the instrument please press 'S' in the main user menu

```
GMSplus s/n 100582 version 21.02.00
Main menu:
C - Configuration
M - Messages ->
S - Shell command
L - List firmware images
X - Display errors (0) and warnings (0)
W - Clear errors and warnings
F - View/reset RTC trim values
T - File statistics
G - View RTC status
H - Set RTC time
U - User request
R - Restart
Q - Quit
```

- Enter the linux command ***ifconfig*** and the following reply will be shown by the instrument
- Please see the IPs of the wired Ethernet (*eth0*) and the wireless Ethernet (*wlan0*) listed and marked here in **red**.

```
Linux Command: ifconfig
eth0      Link encap:Ethernet  HWaddr 00:50:C2:77:42:8E
          inet addr:192.168.10.133  Bcast:192.168.10.255  Mask:255.255.255.0
          inet6 addr: fe80::250:c2ff:fe77:428e/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:71 errors:0 dropped:1 overruns:0 frame:0
          TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:6538 (6.3 KiB)  TX bytes:1678 (1.6 KiB)
          Interrupt:21 Base address:0x4000

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:3 errors:0 dropped:0 overruns:0 frame:0
          TX packets:3 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:172 (172.0 B)  TX bytes:172 (172.0 B)

wlan0     Link encap:Ethernet  HWaddr 00:0D:F0:8E:05:DF
          inet addr:192.168.10.94  Bcast:192.168.10.255  Mask:255.255.255.0
          inet6 addr: fe80::20d:f0ff:fe8e:5df/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:2333 errors:0 dropped:95 overruns:0 frame:0
          TX packets:636 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:271699 (265.3 KiB)  TX bytes:737148 (719.8 KiB)
```

9. The Web Interface

The instrument can be configured over a Web Interface. To be able to use the Web Interface, it is necessary that the following criteria are fulfilled:

- The IP Address of the device has to be known
- The port 80 of the device has to be accessible, from the accessing computer. This usually means that the instrument is in the same network as the accessing computer and no firewall mechanism separates the two.
- A current browser version has to be available on the accessing computer.

9.1. Accessing the Web Interface

- To access the instrument please follow one of the following two steps.
  - In the window *Stations: General Information* of GeoDAS make a ***right click*** on the station name and click on ***Instrument Setup …***, or
  - Open your browser and enter the IP-Address (e.g. 192.168.10.13) of the device in the address bar of your browser, as can be seen in Figure 35.

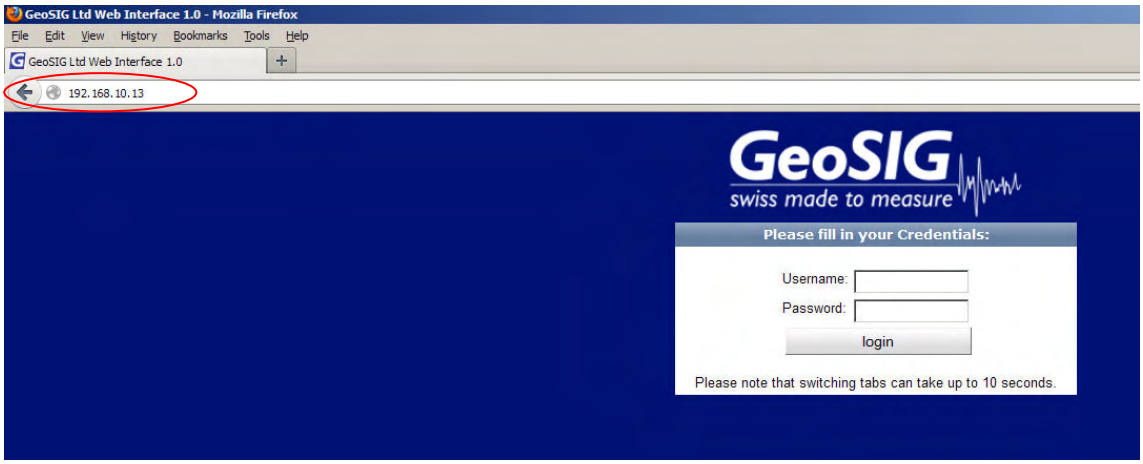


Figure 33. The login screen of the instrument at 192.168.10.13

To be able to adjust the configuration of the instrument or access its data, it is required to authenticate oneself to the device. This can be done, by entering a valid username and corresponding password in the fields of the same name and pressing the “login” button.

The default login credentials are:

- Username: admin
- Password: 123456

The default password can be changed as described in the chapter 9.3.4 of this manual. If the admin password is forgotten, please delete the webuser.txt file on the SD/CF card of the instrument to restore the default password.

The Web Interface can be disabled under Network settings in the Administrator mode of the test and configuration menu. See chapter 11 for details.

9.2. The Home Panel and the General Navigation

After the login process has ended, the screen shown in Figure 34 becomes visible. The width of the Web Interface is optimised for a screen with of 1024 pixels. If the width of the browser window is smaller than that, it might be necessary to scroll horizontally.

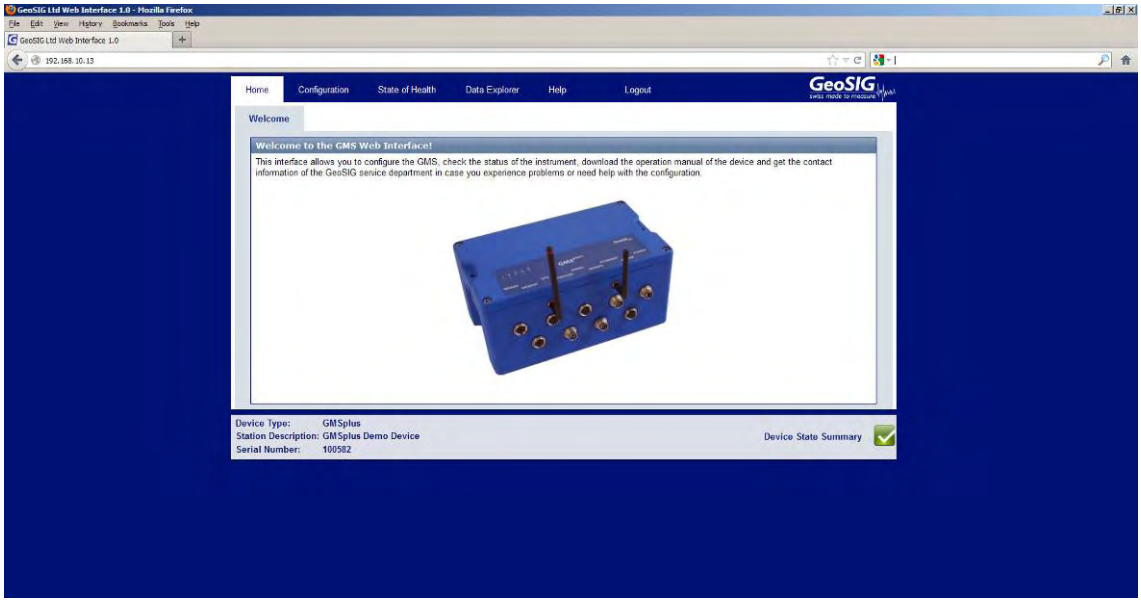


Figure 34. The Home Panel of the Web Interface

As can be seen in Figure 35, each screen in the Web Interface is separated into three sections:

1. **The Navigation Bar**: The navigation bar allows accessing all screens within the web interface. The navigation bar is further separated into two parts. The top bar is the primary navigation panel which is visible from all screens. The currently active tab marked white, while all other, inactive, tabs are blue. By changing from one tab to another, the secondary navigation panel becomes active. This secondary navigation tab allows to switch between the actual screens within a primary navigation bar.
2. **The Content Section**: This section will contain all information and configuration options. Most interaction will take place in this part.
3. **The Device State Summary**: On the left side the Station Description and Serial Number is displayed to identify the current instrument you are working on. On the right side the device state summary describes the overall status of the instrument. The states which are possible are listed in Table 7. By clicking on the overall state, information on the actual problems will be displayed. More detailed information on the error states are provided in the menu item “State of Health” as described in chapter 9.4.

Symbol	***Meaning***	***Description***
	No errors or warnings reported from the device.	As there seem to be no issues, no action is required.
	A warning is reported from the device	There seems to be an issue in this module. Although it seems not to be critical, it is recommended to check why this warning is displayed and take actions to resolve it.
	A warning is reported from the device	An error has occurred and it is required to check for the cause of the problem and resolve it, in order avoid limited functionality.

Table 7. The over all error states shown in the Web Interface

Figure 35. Division of the Screen in the Web Interface

9.3. Device Configuration

The configuration screen of the Web Interface gives access to all configuration options, the configuration management of the Data Acquisition Software as well as the Network Configuration and the Web Interface itself.

To load the configuration can take several second. During this time at the right corner of the browser ***Loading…*** is displayed. Please be patient till the screen as shown in Figure 36 appears.

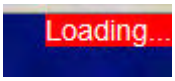


Figure 36. Configuration main menu

9.3.1. armdas Configuration

The ***armdas Configuration*** sub menu provides access to the current armdas configuration options. Armdas is the data acquisition program running on the instrument. As depicted in Figure 37, the content of this tab is divided into three sections:

1. **The Configuration Menu**: The Configuration Menu is the additional navigation menu through the currently active configuration in this particular screen. By switching between the listed items in this menu, the Configuration Value Panel can be changed.
2. **The Configuration Value Panel**: This is main part of the armdas configuration screen. Within this part of the screen all the values of the configuration of the selected Configuration Menu Item can be adjusted. Most options will provide a help button in the form of white question mark on blue ground on the right part of this section. By clicking on it information over the option will be displayed. Please note that the only way to restore the original values of the fields after making changes to them is by using the "*Reload Configuration from Device*" Button in the Action Panel.
3. **The Action Panel**: This Panel is providing the option to either reload the current configuration from the device (to discard changes or load changes done by another user) or to save the edited configuration to the device. By saving the changes to the device, the data acquisition software armdas will be restarted to load the new configuration. This will interrupt the current recording for about 20 seconds. During this time, triggers will not be executed as well. Please note, that if the device is configured to use a DHCP server, the address might change during the saving of the configuration which will make the Web Interface inaccessible under the old address.

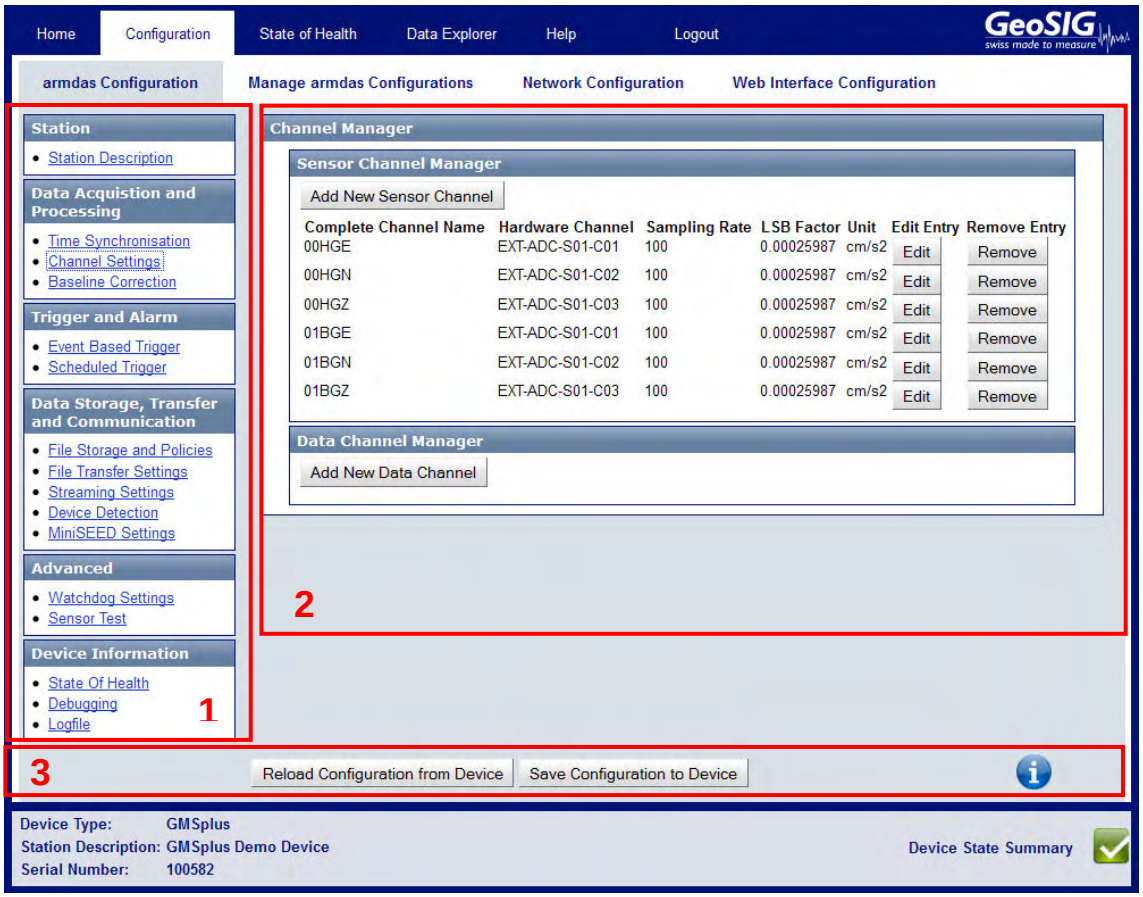


Figure 37. The *armdas Configuration* screen

9.3.2. Manage armdas Configurations

As described in the previous chapter, the *armdas Configuration* screen only allows configuring the currently used configuration. The ***Manage armdas Configurations*** screen described in this chapter allows managing several configurations, changing the current configuration upload a new configuration and so on. As depicted in Figure 38, the screen is divided into three sections:

1. **The Configuration List**: This list contains all configurations currently available on the SD or CF card. The *Current Configuration* should always be listed in this list. This configuration can be copied and downloaded, but not renamed removed or made the current configuration (as it already the current). As depicted in Figure 39, these options become available to other configurations stored on the SD or CF card (in this example after uploading a file to the device). When pressing ***Use as Current Configuration*** it will store this configuration as the *Current Configuration.* The existing configuration will be overwritten and the instrument restarted. Note that only the *Current Configuration* can be edited in the *armdas Configuration* screen. The other configuration files will remain untouched. The *Current Configuration* can be saved in a file by pressing ***Copy***.
2. **The Upload Panel**: While the *Configuration List* allows downloading configurations from the device by clicking on the name, this part of the screen provides the possibility to upload a configuration to the web interface, by selecting a configuration on the PC and using the ***Upload*** Button. As can be seen in Figure 39, after a successful upload a new file is shown in the Configuration List and the name of the newly available configuration is written on the top of the list (the name of new configuration will be created from a random string followed by "_config.xml"). The configuration can then be changed by clicking on ***Rename***. Note that the upload panel might look differently, depending on the Browser in use.
3. **User Default Panel**: With the ***Reset To Default Config***, the *Current Configuration* will be overwritten by the user default (see command SETDEFCFG in the chapter 10.11.1) and the instrument will be restarted. The *Current Configuration* can be saved as the user default by pressing the button ***Make current Config the User Default Config***

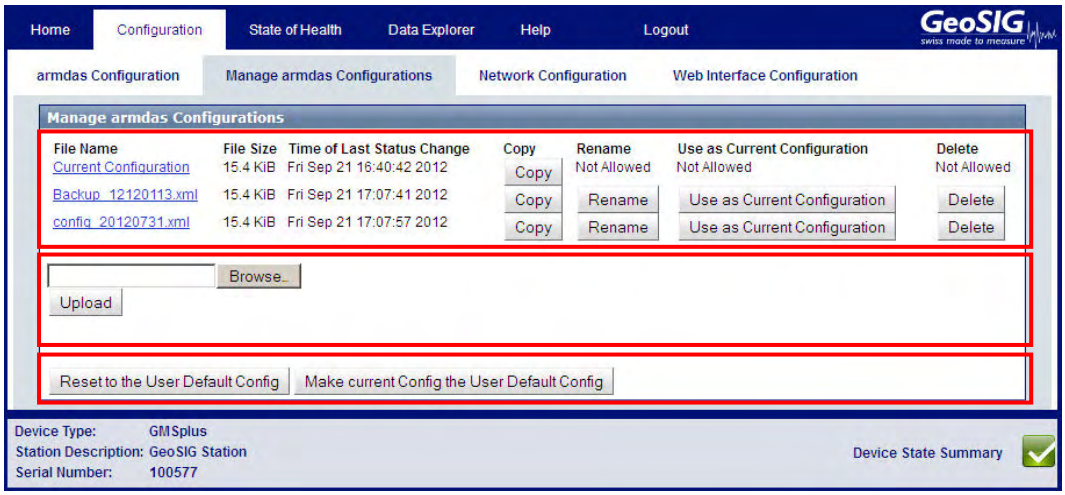


Figure 38. *The Manage armdas Configurations* screen

Figure 39. New file upload

9.3.3. Network Configuration

9.3.3.1. Wired Ethernet

The *Network Configuration* screen provides the possibility to change the network configuration of all network interfaces of the instrument. For standard instrument only one network interface is available, which is the Ethernet interface, which is present in all devices (This interface is marked as “LAN” in Figure 4). This interface can be configured in the section of the screen that is marked with the red number “1” in Figure 40. The top part of that framed, red section describes the current configuration of the interface. The part below allows changing this configuration. The name of this network interface is traditionally ***eth0***.

9.3.3.2. Wi-Fi Wireless Ethernet

Some devices contain an additional wireless interface in (marked as “Wi-Fi” in Figure 4). If this is the case, a second configuration panel is shown in the Network Configuration screen as can be seen Figure 40 (marked with the red number “2”). As with the default Ehternet interface the section surrounded by the red frame is split in two parts, where the top part defines the current settings and the bottom part provides the possibility to change the configuration. Additionally to the standard network settings like IP Address, Netmask, Gateway and so on, the actual wireless settings can be adjusted and open wireless networks scanned. The name of this network interface is traditionally ***wlan0***.

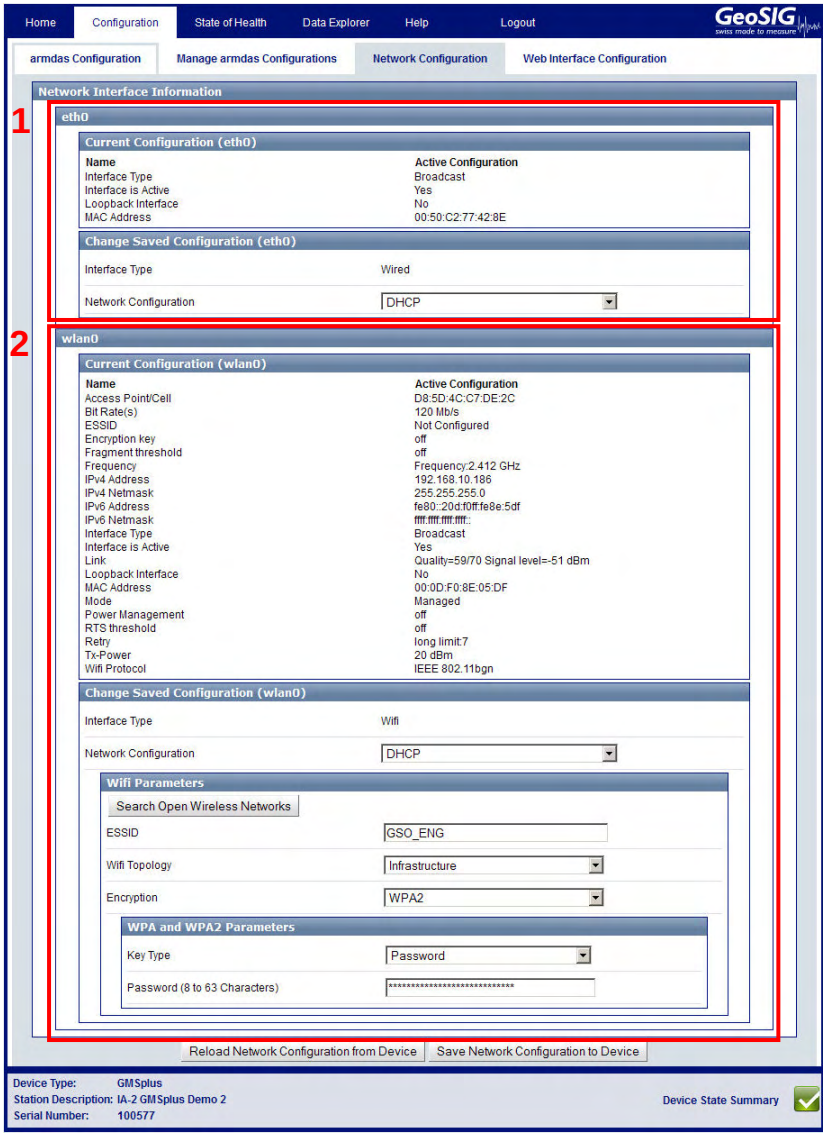


Figure 40. *Network Configuration* Screen

9.3.4. Web Interface Configuration

The *Web Interface Configuration* screen allows configuring all settings related to the Web Interface. At the moment, this solely consists of the possibility to change the password for the login. To change the password press ***Change Password***. The current password has to be known.

The default login credentials are:

- Username: admin
- Password: 123456

If the admin password is forgotten, please delete the webuser.txt file on the SD or CF card and restart the instrument to restore the default password.

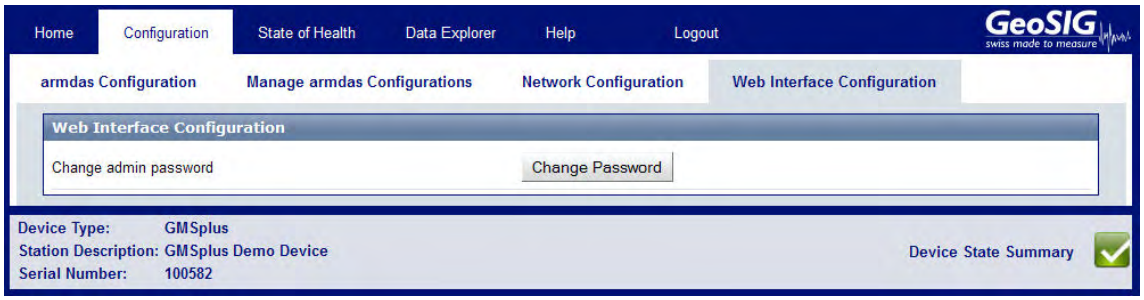


Figure 41. Web Interface Configuration Screen

9.4. State of Health

The State of Health (SOH) menu item provides all information related to the error status of the device as well on the status of the available hardware and software versions.

9.4.1. Error Status

As depicted Figure 42, this screen provides basic information on the device at hand (area no 2) as well as the error status for each module (area no 3). The summery of this SOH information are visible on each page on the bottom as the Device State Summary, described in chapter 9.2. Additionally it is possible to Download the State of Health Information as a File in XML format (this is possible in all sub-menu items of the State of Health menu) and clear the errors (area no 1).

Figure 42. *Error Status* Screen

The modules in the area 3 can have one of the states defined in Table 8 at all time.

Symbol	***Meaning***	***Description***
	No errors or warnings reported from the device.	As there seem to be no issues, no action is required.
	A warning is reported from the device	There seems to be an issue in this module. Although it seems not to be critical, it is recommended to check why this warning is displayed and take actions to resolve it.
	A warning is reported from the device	An error has occurred and it is required to check for the cause of the problem and resolve it, in order avoid limited functionality.

Table 8. The over all error states shown in the Web Interface

9.4.2. Recording Status

This screen provides all information on the recording and time synchronisation status of the device. As depicted in Figure 43, this contains besides information on the number of events also information on the timing and synchronisation status of the device.

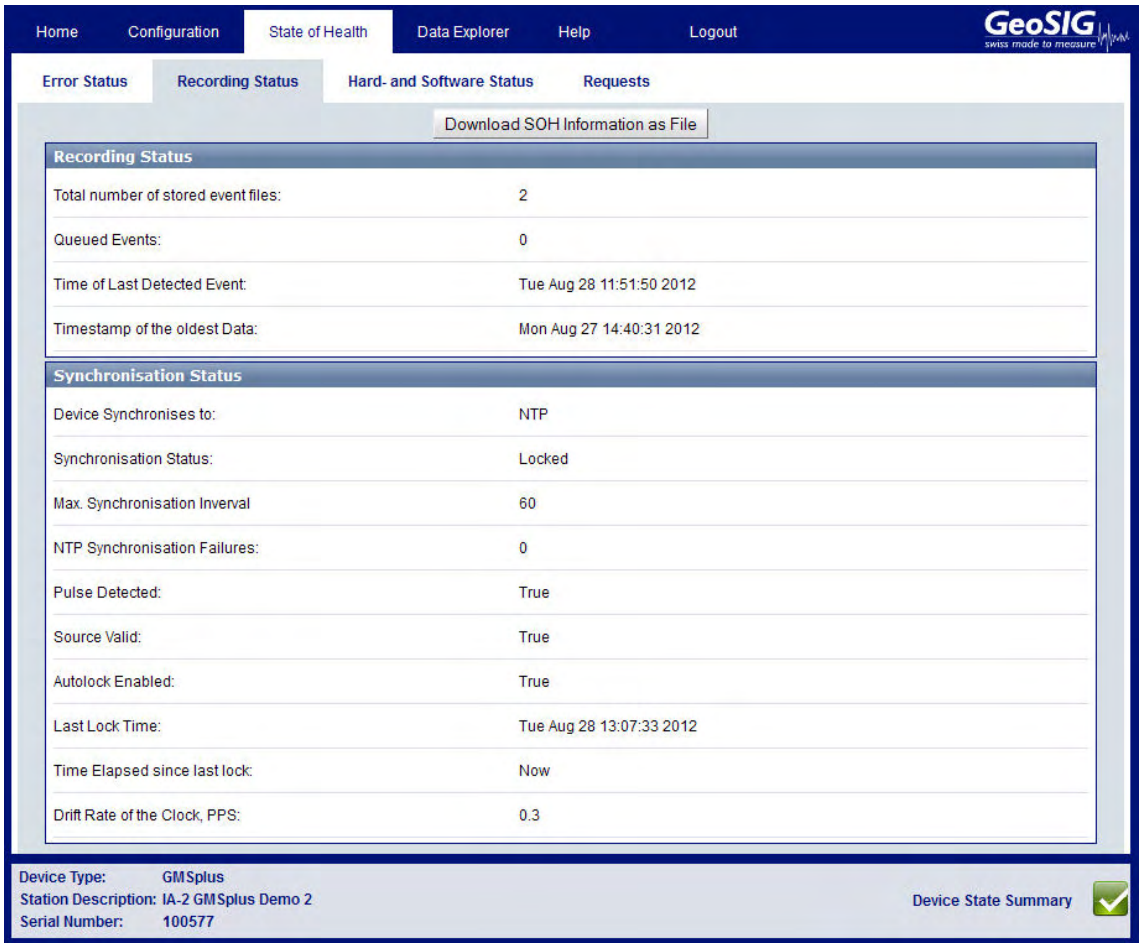


Figure 43. *Recording Status* Screen

9.4.3. Hard- and Software Status

In the Hard- and Software Status contains information on the ***Software Versions***. The ***Hardware Status*** provides information as uptime, available disk space and the device temperature and so on. Information about the available hardware options in the instrument, such as Alarm Boards, Wi-Fi Modules and Modems can be found in the section ***Hardware Configuration Status***.

Figure 44. Recording Status Screen

9.4.4. Requests

As shown in Figure 45, the Requests screen allows sending signal-related requests to the data acquisition software. Currently two such signal requests are supported:

- ***Send a Test Pulse:*** By sending this request, a test pulse will be executed. The sensor should then respond accordingly and thus provide information about its status.
- ***Remove DC from Signal:*** By sending this request, a baseline correction will be applied to the signal and therefore remove the DC from the value, caused by e.g. a slight misalignment of the sensor.

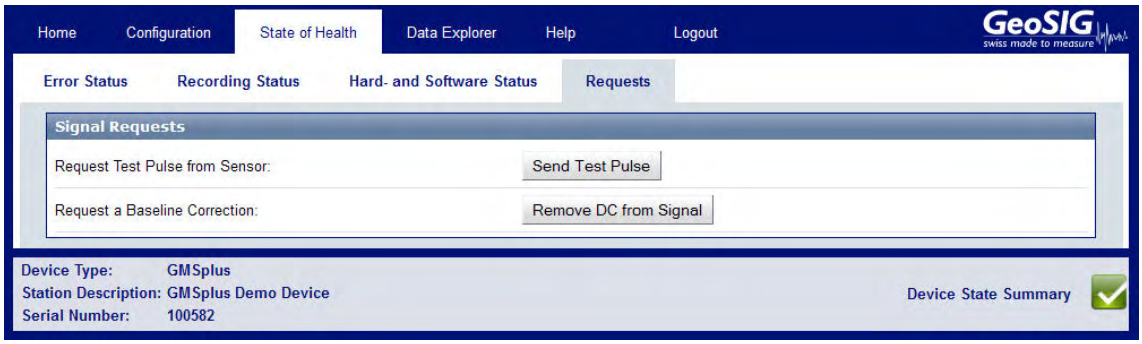


Figure 45. The Requests Screen

9.5. Data Explorer

The *Data Explorer* provides the possibility to gather information on the files stored on the SD or CF card. The file types are separated into three different file types:

- Event- and Calibration files
- Log- and SOH-files
- Ringbuffer files

With the menu on the top of the Data Explorer it is possible it is possible to switch between the file types listed above. For each listed file, the information on its file size and the last modification time are displayed. The files can be sorted according to the file name, size or modification date. By clicking on the file name, the file can be downloaded.

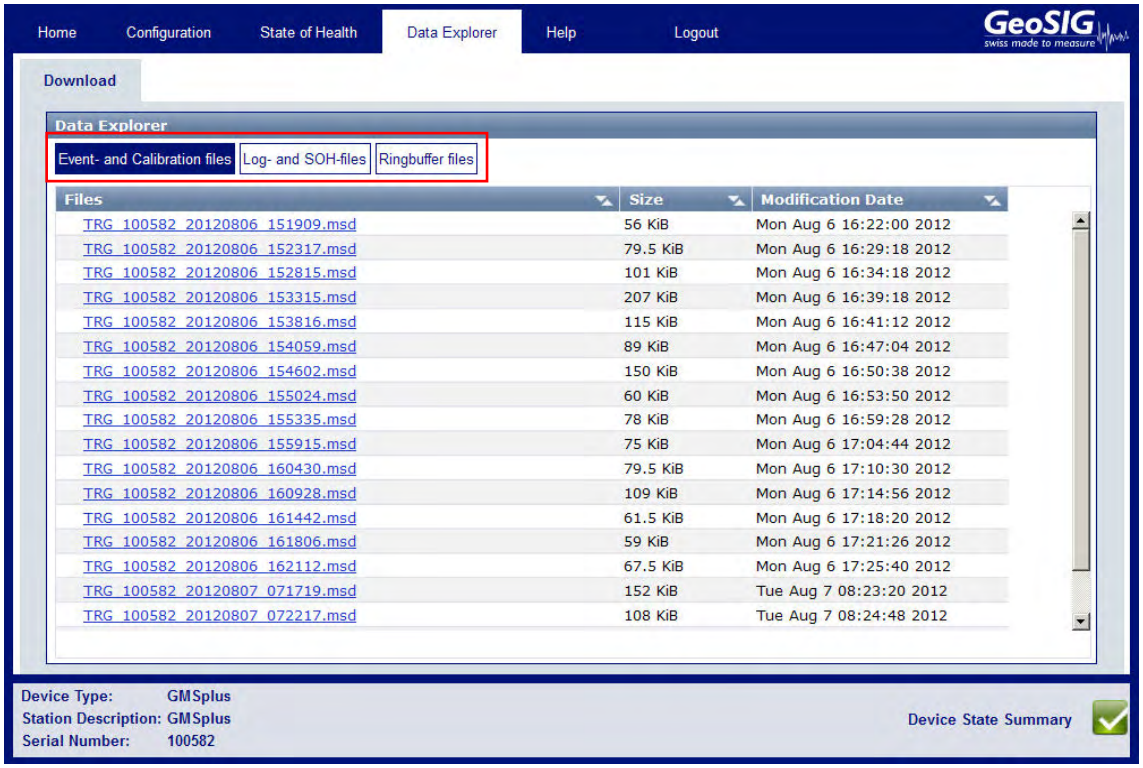


Figure 46. The Data Explorer Screen

9.6. Help

The Help Menu provides help, if there are any problems the device or the web interface.

9.6.1. Online Help

On this screen, the current version of the GMS[plus] User Manual can be downloaded from the device. This manual contains additional information on the instrument, which is not provided in the interface itself.

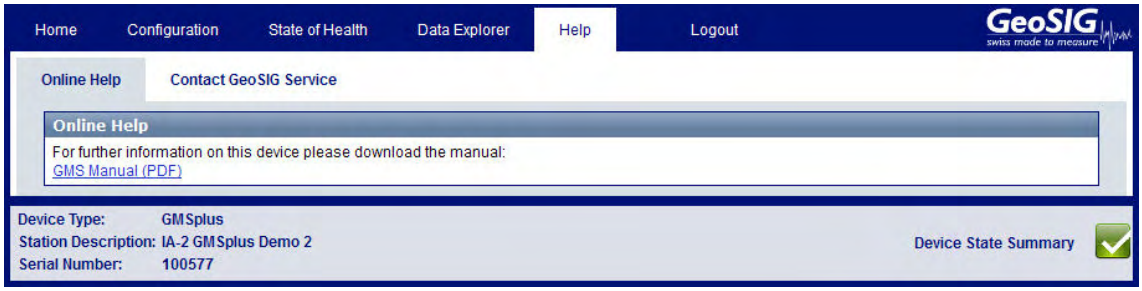


Figure 47. Download the GMS[plus] Manual

9.6.2. Contact GeoSIG Service

This screen provides information on how to contact GeoSIG service in the case of problems. The links provided on this screen, will only work if access to the internet is available.

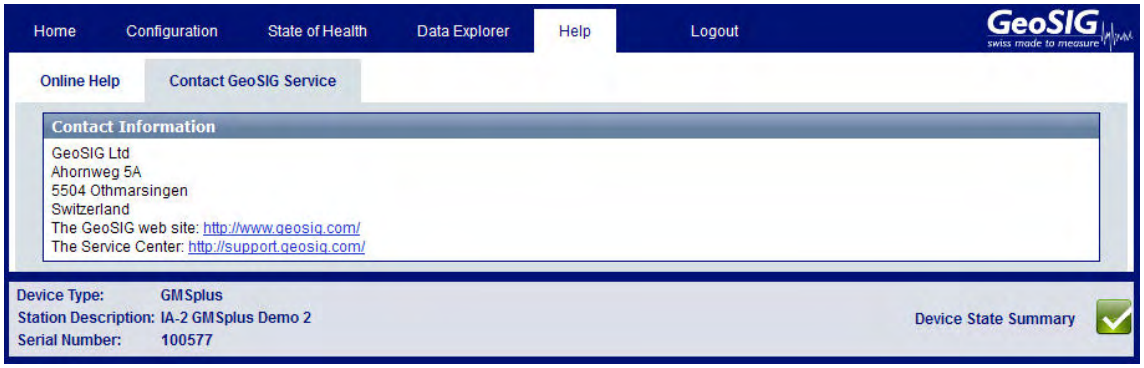


Figure 48. Contact information

10. Detailed Configuration of the Instrument

10.1. Switch ON and OFF the instrument

The main power switch operates as follow:

- Open the cover of the instrument by removing the four screws in the corners.
- Press the *POWER* button for 2 seconds to switch the instrument **ON**.
- The green *RUN* indicator blinks during 0.4 seconds every 2 seconds during the start-up procedure until it is ready to operate (see Figure 8 and Table 2 for details).
- The *RUN* indicator is blinking one time a second (20% ON) to show normal operation (see Figure 8 and Table 2 for details).
- To turn the instrument **OFF**, press the power button for a minimum of 2 seconds. The *RUN* indicator blinks approximately 16 seconds every 2 seconds during shutdown process and then turns OFF when power is really off. (see Figure 8 and Table 2 for details).

10.2. General Comments to the Configuration

All the configuration changes can be either done over the network by the Web Interface and GeoDAS or on the instrument itself using a RS-232 cable on the serial connector and a terminal program.

10.2.1. Change Configuration by the Web Interface

- Open an internet browser and enter the IP-Address of the device in the address bar of your browser
- Login with the username: *admin* and the password *123456*

See chapter 8.5 for the full explanation of the Web Interface.

10.2.2. Change Configuration by GeoDAS

- In the window *Stations: General Information* make a ***right click*** on the station name

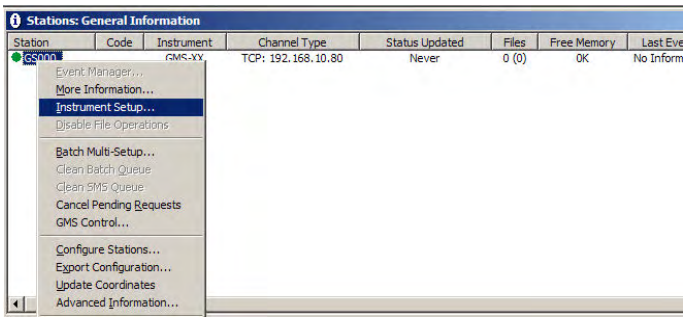


Figure 49. Instrument setup

- GeoDAS is opening the default internet browser and the Web Interface of the instrument will appear. See chapter 8.7 for the full explanation of the Web Interface.

10.2.3. Changing Configuration by the Console

- Connect the GMS-xx to a serial port of your computer and switch on the GMS-xx if not already done.
- In GeoDAS go to ***Tools → Terminal…*** and chose your COM Port. As Baud rate select ***115200.*** Then Press ***Connect***
- Press ***<Enter>***, the following menu appears:

```
GMSplus s/n 100582 version 21.02.00
Main menu:
C - Configuration
M - Messages ->
S - Shell command
L - List firmware images
X - Display errors (0) and warnings (0)
W - Clear errors and warnings
F - View/reset RTC trim values
T - File statistics
G - View RTC status
H - Set RTC time
U - User request
R - Restart
Q - Quit
```

- To configure armdas, from GMS^{plus} console, press '**C**' and ***<Enter>***, if you are asked, select ***Edit current configuration***, by pressing '**C**' again.
- Change the configuration as described in the following chapters
- Press **<Esc>** to leaf the configuration menu. If asked, select ***save as current configuration***, by pressing '**C**'

10.2.4. Explanation of the Structure in the Manual

As sometimes in the configuration the parameters depend on each other, not all parameters are shown all the time. The configuration is also sorted in several sub-menus. Therefore the explanation of the menu is explained as following:

Parameter in the menu			***Possible selections*** or 'User selectable'	Explanation
Switch-Parameter			***Possible selections*** or 'User selectable'	Explanation: The following three lines depend on the selection and are only visible if not set to '**No**'
	This Parameter is only visible if Switch-Parameter has been set to Yes		***Possible selections*** or User selectable	Explanation
	This Parameter is only visible if Switch-Parameter has been set to Yes		***Possible selections*** or User selectable	Explanation
	Submenu, only visible if Switch-Parameter has been set to Yes	***Parameter in the Submenu***	***Possible selections*** or 'User selectable'	Explanation
		Parameter in the Submenu	***Possible selections*** or 'User selectable'	Explanation
Submenu	***Parameter in the Submenu***		***Possible selections*** or 'User selectable'	Explanation
	Parameter in the Submenu		***Possible selections*** or 'User selectable'	Explanation
	Switch-Parameter in the Submenu		***Possible selections*** or 'User selectable'	Explanation
		This Parameter is only visible if Switch-Parameter has been set to Yes	***Possible selections*** or 'User selectable'	Explanation

Table 9. Explanation table structure

10.3. Configuration of the Channels

10.3.1. In the Web Interface or by GeoDAS

- Go to ***Configuration → armdas Configuration → Channel Settings***

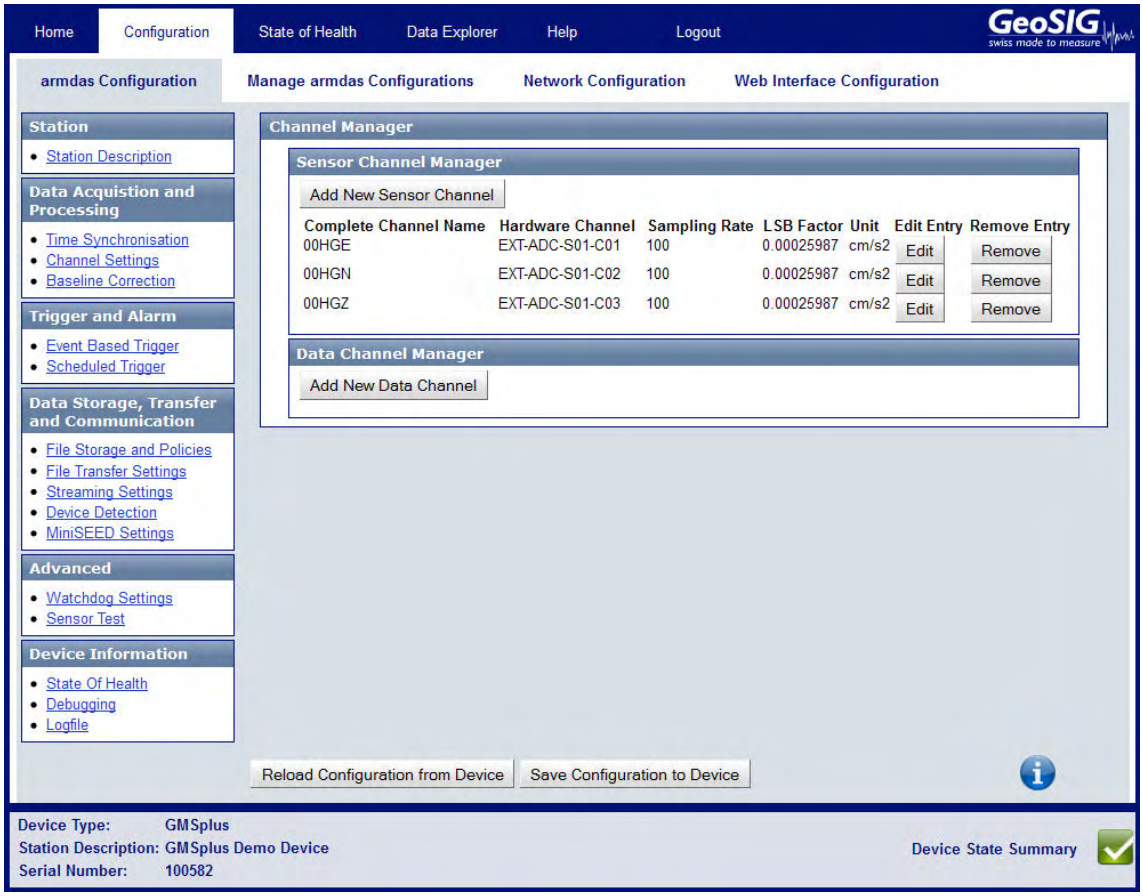


Figure 50. Channel Settings

- Add new sensor or virtual channels by the buttons ***Add New Sensor Channel*** or ***Add New Data Channel***. Channels can be removed again by ***Remove***.
- The edit a channel press the button ***Edit*** and adjust the parameters in the pop-up window. See Table 10 for additional information.

10.3.2. Via Local Serial Console

- Press '***E***' to select the number of channels. By default three channels are configured as most sensors have three channels normally.

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 0
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Signal Characteristics .......... ->
```

- Press '***I***' to get to the *Channel Parameters* menu to adjust the settings of the channels. The following menu appears

```
Main Menu | Channel 1 of 3
  A) Data source ..................... INT-ADC-S01-C01
  E) Channel name .................... C01
  F) Location code ................... CH
  G) Data unit ....................... g
  H) LSB factor ...................... 3.97364e-007
  I) Sampling rate, sps .............. 200 (0xC8)
  K) Negative axis ................... No
  L) Offset compensation ............. No
  M) Signal simulator ................ ->
  N) Maintain the ringbuffer ......... Yes
  R) Decimation and peaks ............ None
```

- Each channel can be adjusted according to your wishes. To change the channels press '**+**' or '**-**'. The following parameters can be adjusted:

Data source	The source of the channel can be defined	
	INT-ADC-Sxx-Cxx	See chapter 10.3.4
	EXT-ADC-Sxx-Cxx	
	DATACHAN	Virtual channels
	DATAVSUM	Vector sum of two channels
	DATAVSU3	Vector sum of three channels
Source channel name	*User selectable*	The source of the virtual channel can be any other channel
Second source channel	*User selectable*	In case of the vector sum a second or third source has to be selected
Third source channel	*User selectable*	
Channel name	*User selectable*	The channel name in the record is a combination of the location code and channel name
Location code	*User selectable*	
Data unit	*User selectable*	Data unit of the selected channel
LSB factor	*User selectable*	LSB factor, depending on the connected sensor. See chapter 10.3.3 for details and Table 11 for the specific values of the sensors.
Sampling rate	***50, 100, 200, 500***	Sampling rate of the selected channel
Negative axis	***Yes***	Inversion of the axis is enabled
	No	Inversion of the axis is disabled
Offset compensation	***Yes***	Compensation is enabled
	No	Compensation is disabled
		Detail behavior of the offset compensation can be configured as described in chapter 10.8.3
Maintain Ringbuffer	***Yes***	Permanent recording is enabled
Continuously Record Data	***No***	Permanent recording is disabled
Decimation and peaks	The data can be decimated or just peaks can be stored	
Online Decimation	***Decimation***	Additional down sampling of the data
	Peak Values	Peak values of the data within a certain interval
	Average Values	Average values of the data within a certain interval
Decimation factor	*User selectable*	The signal will be decimated by the selected factor. E.g. if the sample rate is 50 and the decimation factor 10, then the output sample rate is 5 SPS. Be aware that no anti-aliasing filtering is done prior to decimation!
Interval of averaging, sec	*User selectable*	The Peak or Average values of the signal within the time defined in the *Interval of averaging* will be written into the ringbuffer with the specified *Output sampling interval* in [seconds]. Interval of averaging should be equal or higher than the Output sampling interval.
Output sampling interval	*User selectable*	

Table 10. Channel configuration menu structure

10.3.3. Calculation of the LSB factor

In the Web Interface, the conversion from LSB to Full Scale and backwards is done automatically. In case the instrument is configured over GeoDAS or the console, the LSB value must be entered.

10.3.3.1. Overview

The LSB's of all GeoSIG sensors can be found in the following table

Sensor type	Full Scale	Output Voltage Range	LSB
AC-xx	0.5 g	+/- 10 V	0.662'274e-7 g/count
	1 g	+/- 10 V	1.324'548e-7 g/count
	2 g	+/- 10 V	2.649'095e-7 g/count
	3 g	+/- 10 V	3.973'643e-7 g/count
	4 g	+/- 10 V	5.298'191e-7 g/count
VE-13 VE-23	1 mm/s	+/- 10 V	1.324'548e-7 mm/s/count
	10 mm/s	+/- 10 V	1.324'548e-6 mm/s/count
	100 mm/s	+/- 10 V	1.324'548e-5 mm/s/count
VE-33	**Sensitivity:** 27.3 V/m/s (27.3 Vs/m)		4.851'822e-8 m/s/count 4.851'822e-5 mm/s/count
VE-53	**Sensitivity:** 1000 V/m/s (2x 500 V/m/s)		1.324'548e-9 m/s/count 1.324'548e-6 mm/s/count
	Sensitivity: 200 V/m/s (2x 100 V/m/s)		6.622'738e-9 m/s/count 6.622'738e-6 mm/s/count

Table 11. LSB of all GeoSIG sensors

If you have a different kind of sensor, the LSB can be calculated according to the following chapters

10.3.3.2. Calculate LSB from Sensors with given Full Scale

Output Voltage of the sensor must be +/- 10 V

$$\text{LSB} = \frac{FullScale}{0.9 \cdot 2^{23}} = \frac{FullScale}{754'9747.2}$$

Example, 3 g sensor

$$LSB = \frac{3g}{0.9 \cdot 2^{23} counts} = \frac{3g}{754'9747.2 \text{ counts}} = \underline{\underline{3.973643e-7 \, {}^{g}\!/_{count}}}$$

10.3.3.3. Sensors with given Sensitivity

$$\text{LSB} = \frac{\frac{10V}{Sensitivity}}{0.9 \cdot 2^{23} counts} = \frac{1.324547e-6 \frac{V}{counts}}{Sensitivity}$$

Example, 1000 V/m/s sensor

$$LSB = \frac{\frac{10V}{1000 \frac{V}{m/s}}}{0.9 \cdot 2^{23}} = \frac{1.324547e-6 \frac{V}{counts}}{1000 \frac{V}{m/s}} = \underline{\underline{1.324547e-9 \, {}^{\frac{m}{s}}\!/_{count}}}$$

10.3.4. Channel Naming

The naming of the channels is organised as following. All internal sensors start with **INT-ADC**, all external sensors with **EXT-ADC**

xxx-ADC-Sxx-Cxx

Channel	C01 … C03	
Sensor	3ch: S01 6ch: S01, S02	Sensor number
Source	INT	Internal Sensor
	EXT	External Sensor

For example if there are two external sensor are connected, the following channels are available

EXT-ADC-S01-C01	EXT-ADC-S02-C01
EXT-ADC-S01-C02	EXT-ADC-S02-C02
EXT-ADC-S01-C03	EXT-ADC-S02-C03

10.4. Configuration of Data Streams

10.4.1. In the Web Interface or by GeoDAS

- Go to ***Configuration → armdas Configuration → Streaming Settings***

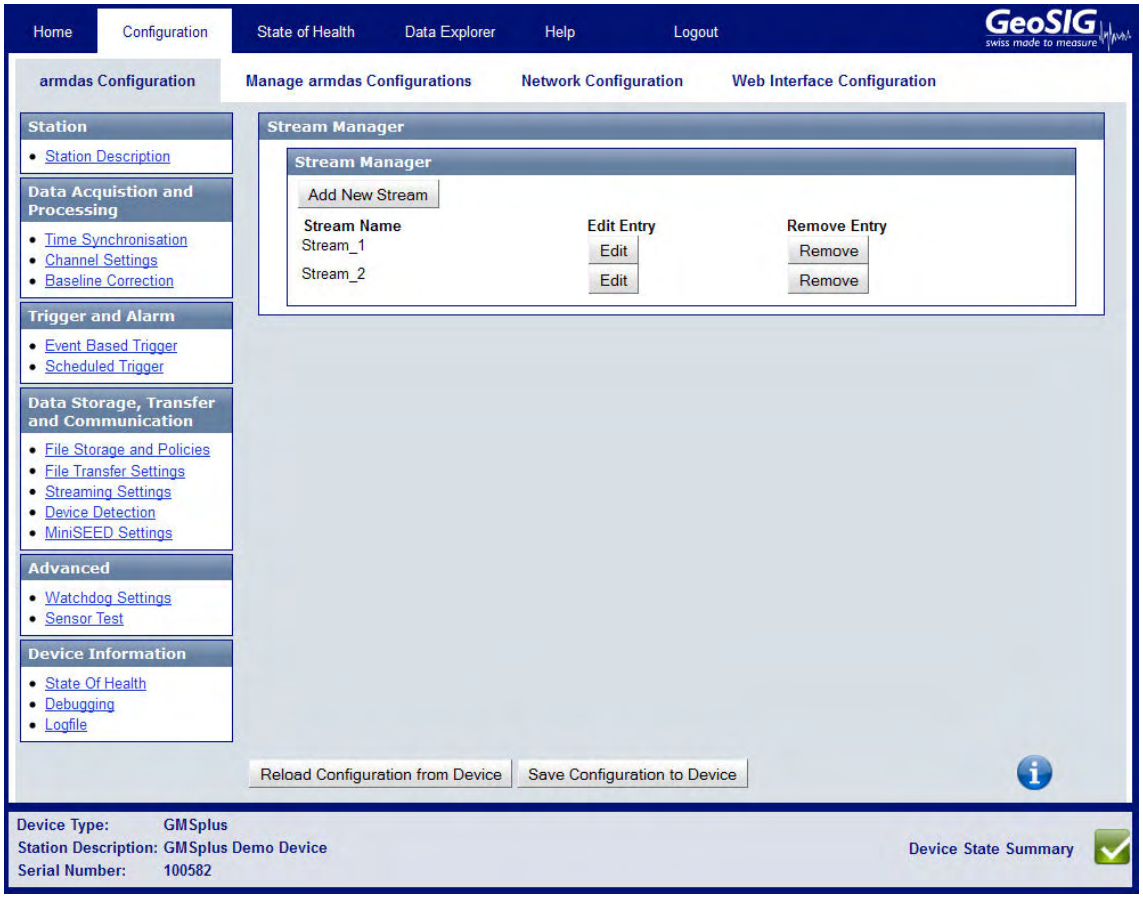


Figure 51. Streaming Settings

- Add new data stream channels by the button ***Add New Stream.*** Streaming channels can be removed again by ***Remove***.
- The edit a streaming channel press the button ***Edit*** and adjust the parameters in the pop-up window. See Table 12 for additional information.

10.4.2. Via Local Serial Console

- Press '***F***' to select the *Number of Output Streams*. One output stream can have several channels.

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 0
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Signal Characteristics .......... ->
```

- Press '***J***' to get to the *Stream Parameters* menu to adjust the settings of the output streams. The following menu appears

```
Main Menu | Stream
  A) Stream name ................. Stream_1
  B) Stream type ................. GSBU
  C) Port configuration .......... ->
  D) Channels in the stream ...... 3
  E) List of streamed channels ... ->
  F) Data frames per packet ...... 5 (0x05)
  G) CRC32 protected packets ..... No
  H) Number of padding bytes ..... 0 (0x00)
```

- Each output stream can be adjusted according to your wishes. To change the output stream press '**+**' or '**-**'. The following parameters can be adjusted:

Stream name	*User selectable*	Name of the output stream
Stream type	***GSBU***	Streaming possibly in GSBU format only
Channels in the stream	*User selectable*	Number of channels which should be streamed
List of streamed channels	*User selectable*	Depending on the number of channels for every channel a different source can be selected, '**+**' and '**-**' can be used to change the channel, the source can be selected by pressing '***A***'
Data frames per packet	*User selectable*	Specifies the packet length of the streams, one data frame is equal to 200 ms. For example in case '***5***' is selected, then every second a packet with the last second of data will be sent
CRC32 protected packets	*Yes or No*	Whether data packets are sent CRC32 protected or 16-bit checksum protected See GSBU Protocol description for details.
Number of padding bytes	*User selectable*	The number of zero bytes added to the packet right after CRC32 or checksum

Port configuration	***Communication Port***	***TCP/IP***	Streaming over the network
		ttyS1	Do NOT use this port
		ttyS02	Streaming over the external SERIAL connector
		ttyS03	Do NOT use this port
		ttyS04	Do NOT use this port
		ttyS05	Do NOT use this port
	Protocol	**TCP (Server)**	GeoDAS software or any other client supporting the selected protocol connects to the IP configured under 'IP Address' for data streaming
	Network Port	*User selectable*	Server port listening for incoming connections
	Baud Rate	***1200***	Baud rate of the serial data stream. Make sure that the serial port of the computer is configured to the same baud rate
		2400	
		4800	
		9600	
		19200	
		38400	
		57600	
		115200	

Table 12. Data streaming configuration menu structure

10.4.3. Set up of Data Streams

In this chapter there will be described how to set up an Instrument for data streaming.

10.4.3.1. In the Web Interface or by GeoDAS

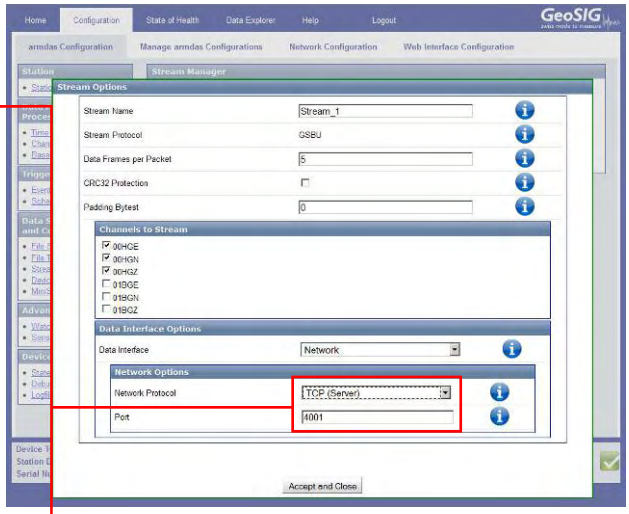
- Connect to the Web Interface and go to ***Configuration → armdas Configuration → Streaming Settings***
- Add a new stream by pressing ***Add New Stream***, one output stream can have several channels.
- Click ***Edit*** to adjust the settings of the output streams.

10.4.3.2. Via Local Serial Console

- Connect to the Instrument and Press '***F*** to select the *Number of Output Streams*. One output stream can have several channels.
- Press '***J***' to get to the *Stream Parameters* menu to adjust the settings of the output streams.

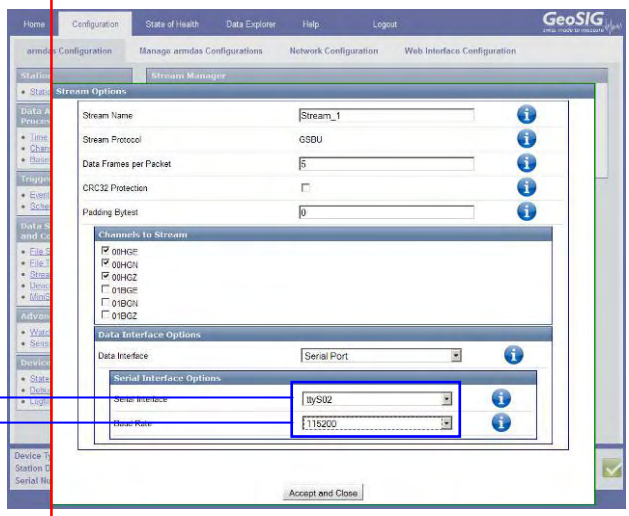
- Adjust the settings according to chapter 10.4. Carefully select the settings in the *Port Configuration*. In case you want to stream over Ethernet, choose ***TCP/IP*** and ***TCP (Server)***.

```
Main Menu | Stream | Port
  A) Communication port ... TCP/IP
  C) Protocol ............. TCP (Server)
  E) Network port ......... 4001 (0xFA1)
```



- In case you want to stream over the SERIAL port on the front of the instrument choose ***ttyS02***.

```
Main Menu | Stream | Port
  A) Communication port ... ttyS02
  B) Baud rate ............ 115200
```



- Open ***GeoDAS*** and go to the menu *Settings* → ***Channels of Digitizers…*** The following window appears:

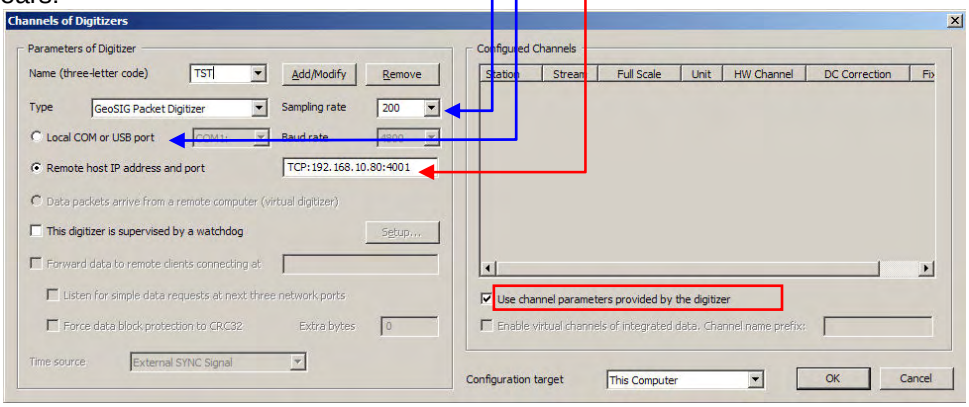


Figure 52. Channels of Digitisers...

- Adjust the ***Name,*** chose any three-letter code for the data stream
- Select as ***Type*** the ***GeoSIG Packet Digitiser***

- Press ***Add/Modify***
- Make sure the selected ***Sample rate*** is the same as in the instrument
- Chose either the ***Local COM port*** (in case connected over RS-232) or the ***Remote host IP address and port*** (in case connected over Ethernet). The IP must be known from the instrument.
- Check the flag ***Use channel parameters provided by the digitizer***
- Press ***OK***
- After a restart of *GeoDAS*, the window *Stations:Data Streams* appears

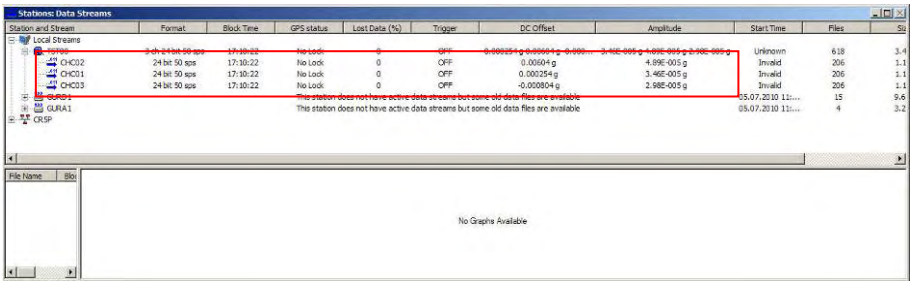


Figure 53. Stations: Data streams

- To view the data make a right click on the station name (here *TST00*) and select ***Data Monitor***

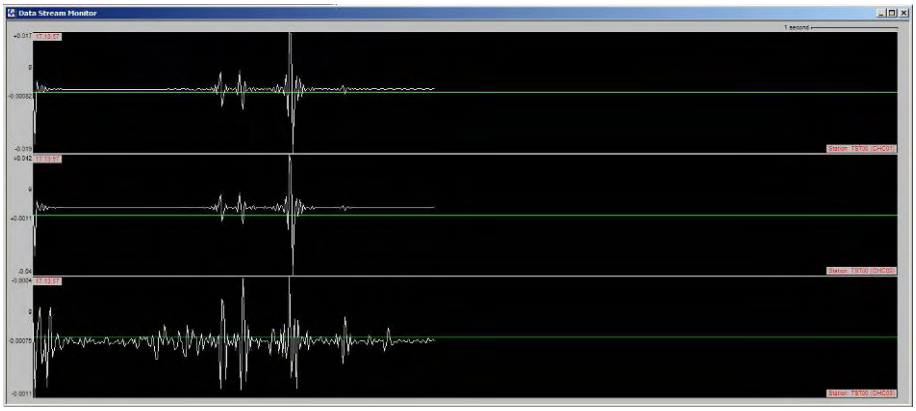


Figure 54. Data stream window

10.5. Trigger Settings

The instrument allows having several triggers with independent sources in parallel.

10.5.1. In the Web Interface or by GeoDAS

- Go to ***Configuration → armdas Configuration → Event Based Trigger***

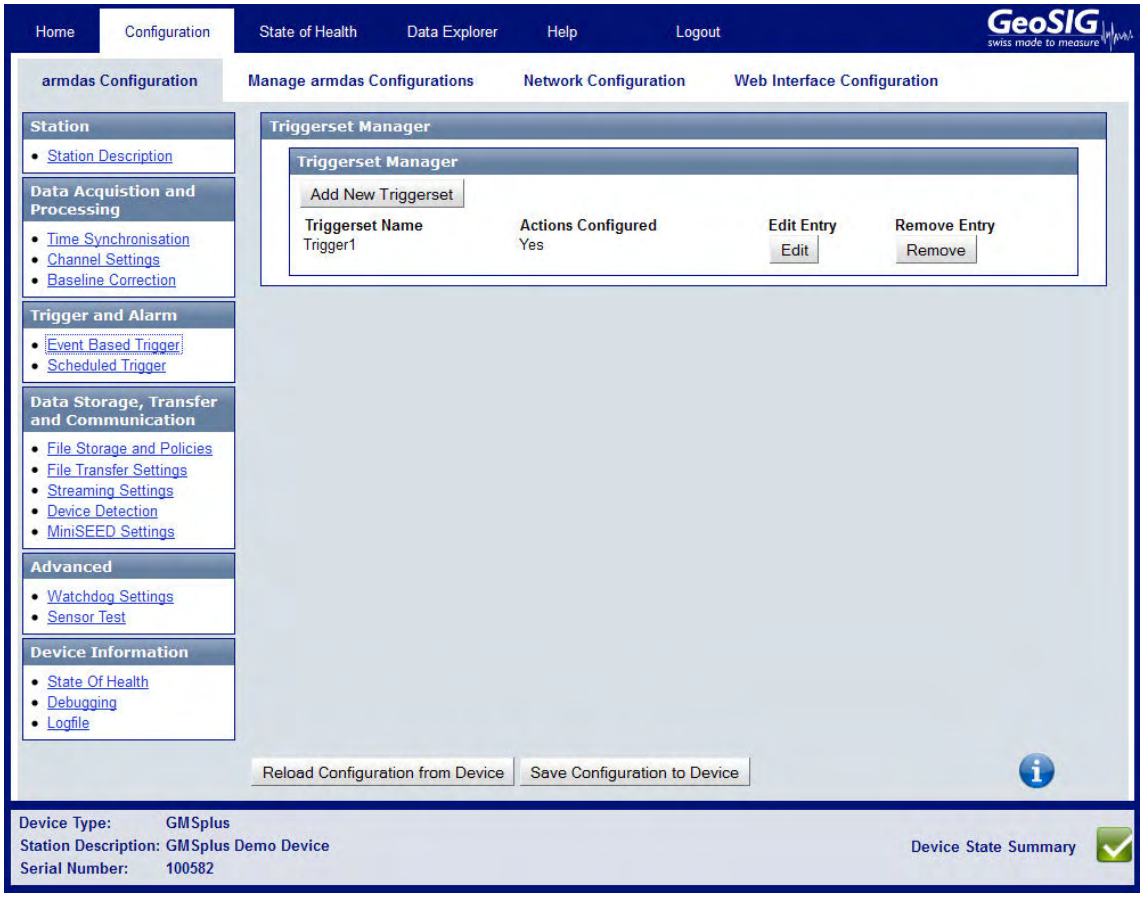


Figure 55. Streaming Settings

- Add new triggerset by the button ***Add New Triggerset.*** Triggersets can be removed again by ***Remove***.
- The edit a triggerset press the button ***Edit*** and adjust the parameters in the pop-up window. See Table 13 for additional information.

10.5.2. Via Local Serial Console

- Press '***G***' to select the *Number of Trigger Sets*

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 0
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Signal Characteristics .......... ->
```

Press 'K' to get to the *Trigger Parameters* menu to adjust the settings of the triggers. The following menu appears. In case the *number of trigger sets* is set to '0' this menu can not be selected.

```
Main Menu | Triggerset
  A) Triggerset name ..................................... Trigger1
  B) Event recording ..................................... No
  D) Alarm activation .................................... No
  E) SMS Alarm ........................................... No
  I) Trigger time frame, sec ............................. 3 (0x03)
  K) Monitored channels .................................. 3
  L) Trigger settings .................................... ->
  O) Be a source of network triggers (received from LAN) ... No
  P) Activate on network triggers (received from LAN) ..... No
  Q) Be a source of network triggers (Interconnection) ..... No
  R) Activate on network triggers (Interconnection) ....... No
```

- Each trigger set can be adjusted according to your wishes. To change the trigger set press '**+**' or '**-**'. The following parameters can be adjusted:

Triggerset name	*User selectable*	Name of the trigger set
Event recording	***Yes***	An event file will be recorded on a trigger
	No	No event file will be recorded on a trigger
Pre-Event	*User selectable*	Pre-Event time, seconds
Post-Event	*User selectable*	Post-Event time, seconds
Max. event duration, sec	*User selectable*	Maximum duration of an event in seconds. After this time, an event file will be closed
Stored channels	*User selectable*	Number of channels, which should be stored into an event file in case of a trigger
List of stored channels	*User selectable*	Depending on the number of stored channels different sources can be selected. '**+**' and '**-**' can be used to change the channel, the source can be selected by pressing '***A***'

Alarm activation (Only visible in case alarm relay card is installed)		***Yes*** ***No***	An alarm relay will be activated on a trigger No alarm relay will be activated on a trigger This option has an effect only in case the instrument has internal alarm relays
	Alarm output to activate	***AL1, AL2, AL3, AL4***	Select alarm relay
	Alarm deactivation delay	*User selectable*	Time in seconds the alarm relay deactivates again after the signal falls below the trigger threshold. Can be compared to the post event time for the recording
SMS Alarm		***Yes*** ***No***	An SMS will be sent upon a trigger No SMS will be sent upon a trigger This option is available only in case an external GPRS modem is connected to the instrument. Note that this GPRS modem cannot be used for the PPP connection at the same time
SMS Alarm Configuration	***Number of Recipients***	*User selectable*	The number of recipients of the SMS alarm can be selected
	Recipient	*User selectable*	Phone number of the recipient. Use numbers only, no '+' or any other character allowed
Trigger time frame, sec		*User selectable*	See chapter *10.5.5* for details
***Monitored* channels**		*User selectable*	Number of channels which will be monitored by the selected trigger set
Trigger settings	To go through the monitored channels press '**+**' or '**-**'.		
	Assigned channel name	*User selectable*	
	Trigger filter	***Yes*** ***No***	Trigger filter is used as defined under Filter Parameters Trigger filter is not used
	Filter parameters	*User selectable*	One can select a trigger type (Low, High and Bandpass, order of the filter and corner frequency(ies))
	Level Trigger	***Yes*** ***No***	Level trigger is enabled Level trigger is disabled
	Threshold	*User selectable*	As soon the data is above the configured threshold the trigger is activated
	STA/LTA Trigger	***Yes*** ***No***	STA/LTA trigger is enabled STA/LTA trigger is disabled
	STA time frame	*User selectable*	Length of STA time window, seconds
	LTA time frame	*User selectable*	Length of LTA time window, seconds
	STA/LTA trigger ratio	*User selectable*	As soon the data is above the configured STA/LTA ratio the trigger is activated
	STA/LTA detrigger ratio	*User selectable*	As soon the data is below the configured STA/LTA ratio again the trigger is activated
	Clamp LTA during event	***Yes*** ***No***	The LTA value will not be updated during the event The LTA value will be updated during the event

	Min. level exceedance	*User selectable*	The threshold or STA/LTA ratio has to be exceeded at least for the configured time in seconds to active the trigger
	Channel trigger weight	*User selectable*	See chapter 10.5.4 for details
Stored channels		*User selectable*	Number of channels, which should be stored into an event file in case of a trigger
List of stored channels		*User selectable*	Depending on the number of *stored channels* different sources can be selected. '**+**' and '**-**' can be used to change the channel, the source can be selected by pressing '***A***'
Be a source of network triggers (received from LAN)		***Yes*** ***No***	In case the instrument is interconnected over LAN with other instruments. It can be selected, if all the other instruments should be alerted in case of a local trigger A master instrument must be defined to use this functionality. See chapter 10.5.6 for details.
Activate on network triggers (received from LAN)		***Yes*** ***No***	In case the instrument is interconnected over LAN with other instruments. It can be selected if the instrument should trigger in case it will be alerted over the interconnection network A master instrument must be defined to use this functionality. See chapter 10.5.6 for details.
Be a source of network triggers (Interconnection)		***Yes*** ***No***	In case the instrument is interconnected over the RS-485 interconnection network with other instruments It can be selected, if all the other instruments should be alerted in case of a local trigger.
Activate on network triggers (Interconnection)		***Yes*** ***No***	In case the instrument is interconnected over the RS-485 interconnection network with other instruments It can be selected if the instrument should trigger in case it will be alerted over the interconnection network
Event processing		***None*** ***PGM Parameters***	No event processing will be done Peak ground motion parameters will be calculated in case of an event and will be sent to the server if configured according to chapter 10.7
	Max. summary interval	*User selectable*	The PGM parameters will be sent after an earthquake record has been completed or latest after the defined time in seconds, whichever comes first

Table 13. Trigger configuration menu structure

10.5.3. STA/LTA trigger

The STA/LTA (Short Time Average/Long Time Average) ratio trigger computes the short term and long term averages of the input (sensor) signal. When the STA exceeds a pre-selected multiple of the LTA (STA/LTA ratio), the instrument begins to record data. 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. The probability of having a false trigger due to noise will 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 pre-event time. If not, the initial portion of an event may not be recorded. During the steady state of the system, the STA and the LTA will be nearly equal. The shorter STA averaging period, the more quickly it will change with the input.

10.5.4. Trigger Weight

To activate a trigger the total trigger weight must be equal or bigger than 100%. By default all channel have a weight of 100%, means if a threshold is exceeded on one channel only, then the trigger is activated. If the trigger weight would be reduced on all channels to 50%, then at least on two channels the threshold has to be exceeded to reach 100% (50% + 50%) and activate the trigger. See Figure 56 for details.

10.5.5. Trigger Time Frame

Depending on the settings it can be, that on two or more channels the threshold has to exceed to activate the trigger (see chapter 10.5.4 for details). The time of the threshold-exceedances might be slightly different on the channels, especially if two sensors are connected and installed on different places. To make sure that even due to this time difference the trigger is working a *trigger time frame* can be defined. See Figure 56 for details.

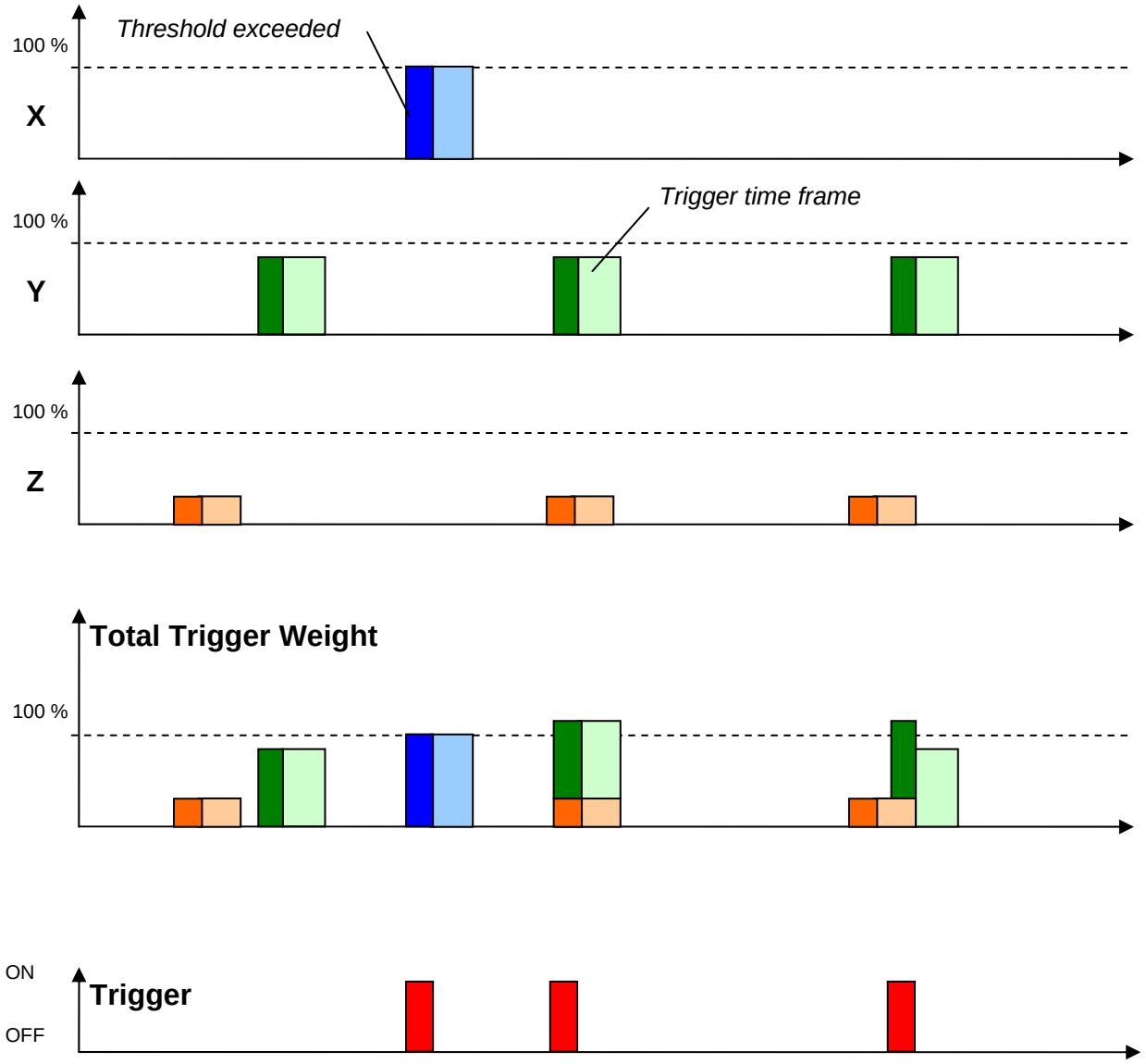


Figure 56. Overview of trigger weight and trigger time frame

10.5.6. Trigger Interconnection over LAN

In case there are several instruments in the same LAN, they can be interconnected over Ethernet for common triggering.

One instrument has to be set up as a master, whereas all other instruments are like slaves, sending the trigger alarms to the master instrument. The master instrument distributes then the trigger alarm to all slaves.

All the communication between the data server and the slave instruments will go via the master instrument. This means that the master instrument will download the requests first and forward it to the appropriate slave instrument. On the other hand, the slave instruments will upload all the files to the master, who will upload it to the data server.

10.5.6.1. Set up of the Master Instrument

- Press 'K' to enter the menu *Communication Parameters and* activate the *Server mode* by pressing '***H***'

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 1
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  L) Parameters of Preset Triggers ... ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Signal Characteristics ..........->
```

To do the settings in the Web Interface go to ***Configuration → armdas Configuration → File Transfer Settings*** *and Enable the flag* ***Act as Server****. Then just do the steps described below in the GUI of the Web Interface*

- Specify the *Port of incoming connections* and adjust the number of slaves in the parameter *Number of clients.* Write down the *Port of incoming connections* (use ***3456*** as default) and the *IP of the instrument*, as they are used again during the configuration of the slave instruments.

```
Main Menu | Communication
  A) Contact remote servers ............. Yes
  B) Number of servers .................. 1
  C) Time interval, sec ................. 10 (0x0A)
  D) Maximum files per session .......... 10 (0x0A)
  E) Connect if there are new files ..... Yes
  F) Connect by requests from clients ... Yes
  G) Server Parameters .................. ->
  H) Server mode ........................ Yes
  I) Port for incoming connections ...... 3456 (0xD80)
  J) Secure authentication .............. No
  K) Number of clients .................. 1
  L) Clients Parameters ................. ->
  M) Seedlink Server .................... Yes
```

- The details of every slave instrument have to be filled out. Additionally make sure that the *Data forwarding* and the *Network triggers* is set to ***Yes***. To change the slave (client) instrument press '**+**' or '**-**'.

```
Main Menu | Communication | Client 1 of 2
  A) Client IP Address ....... 0.0.0.0
  B) Client serial number .... 000000
  C) Transfer timeout, sec ... 20 (0x14)
  D) Data forwarding ......... Yes
  E) Network triggers ........ Yes
```

10.5.6.2. Set up of the Slave Instruments

- Press 'K' to enter the menu *Communication Parameters*

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 1
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  L) Parameters of Preset Triggers ... ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Signal Characteristics ...........->
```

*To do the settings in the Web Interface go to **Configuration → armdas Configuration → File Transfer Settings**. Then just do the steps described below in the GUI of the Web Interface*

- Press '***A***' and change *Contact remote servers* to **Yes** if not already set and then go to *Server Parameters* menu by pressing '***G***'

```
Main Menu | Communication
  A) Contact remote servers ............. Yes
  B) Number of servers .................. 1
  C) Time interval, sec ................. 10 (0x0A)
  D) Maximum files per session .......... 10 (0x0A)
  E) Connect if there are new files ..... Yes
  F) Connect by requests from clients ... Yes
  G) Server Parameters .................. ->
  H) Server mode ........................ No
  M) Seedlink Server .................... Yes
```

- IP and Port from the master instrument must be adjusted in the field *Server IP Address* and *Port* (use ***3456*** as default). Make sure the *Network triggers* are activated by putting ***Yes***

```
Main Menu | Communication | Server
  A) Server IP Address ...................... 192.168.10.02 (IP of the Master)
  B) Protocol ............................... Custom
  C) Port ................................... 3456 (0xD80)
  H) Transfer timeout, sec .................. 40 (0x28)
  I) Network triggers ....................... Yes
  J) Connect through PPP link ............... No

Select <A>...<Q>. <Esc> back to Main Menu | Communication
```

10.5.6.3. Trigger Parameters for Master and Slave instruments

The following settings must be done on the master and the slave instruments.

- Make sure on all instruments that the *Number of Trigger Sets* is not zero and then press '***K***' to enter the menu *Trigger Parameters*

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 1
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  L) Parameters of Preset Triggers ... ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Auxiliary Devices ............... ->
```

*To do the settings in the Web Interface go to **Configuration → armdas Configuration → File Transfer Settings**. Then just do the steps described below in the GUI of the Web Interface*

- Configure the triggerset according to the description in chapter 10.5 and make sure that on all instruments *Be a source of network triggers (received from LAN)* and *Activate on network triggers (received from LAN)* is set to ***Yes***

```
Main Menu | Triggerset
  A) Triggerset name ..................................... Trigger1
  B) Event recording ..................................... Yes
  C) Record on network triggers only ..................... No
  D) Alarm activation .................................... No
  E) SMS Alarm ........................................... No
  G) Pre-Event, seconds .................................. 5 (0x05)
  H) Post-Event, seconds ................................. 10 (0x0A)
  I) Trigger time frame, sec ............................. 3 (0x03)
  J) Max. event duration, sec ............................ 60 (0x3C)
  K) Monitored channels .................................. 3
  L) Trigger settings .................................... ->
  M) Stored channels ..................................... 3
  N) List of stored channels ............................. ->
  O) Be a source of network triggers (received from LAN) ... Yes
  P) Activate on network triggers (received from LAN) ..... Yes
  Q) Be a source of network triggers (Interconnection) ..... No
  R) Activate on network triggers (Interconnection) ........ No
  S) Event processing .................................... None
```

In case an instrument should trigger on network triggers, but not alarm the other instruments about an own trigger (e.g. in a noisy area) the *Be a source of network triggers (received from LAN)* should be set to ***No***

In case an instrument should alarm the other instruments over the LAN about a trigger, but not be activated on network triggers, then *Activate on network triggers (received from LAN)* should be set to ***No***

10.6. Preset Trigger Settings

The instrument allows having several predefined triggers, e.g. time triggers in parallel.

10.6.1. In the Web Interface or by GeoDAS

- Go to ***Configuration → armdas Configuration → Scheduled Trigger***

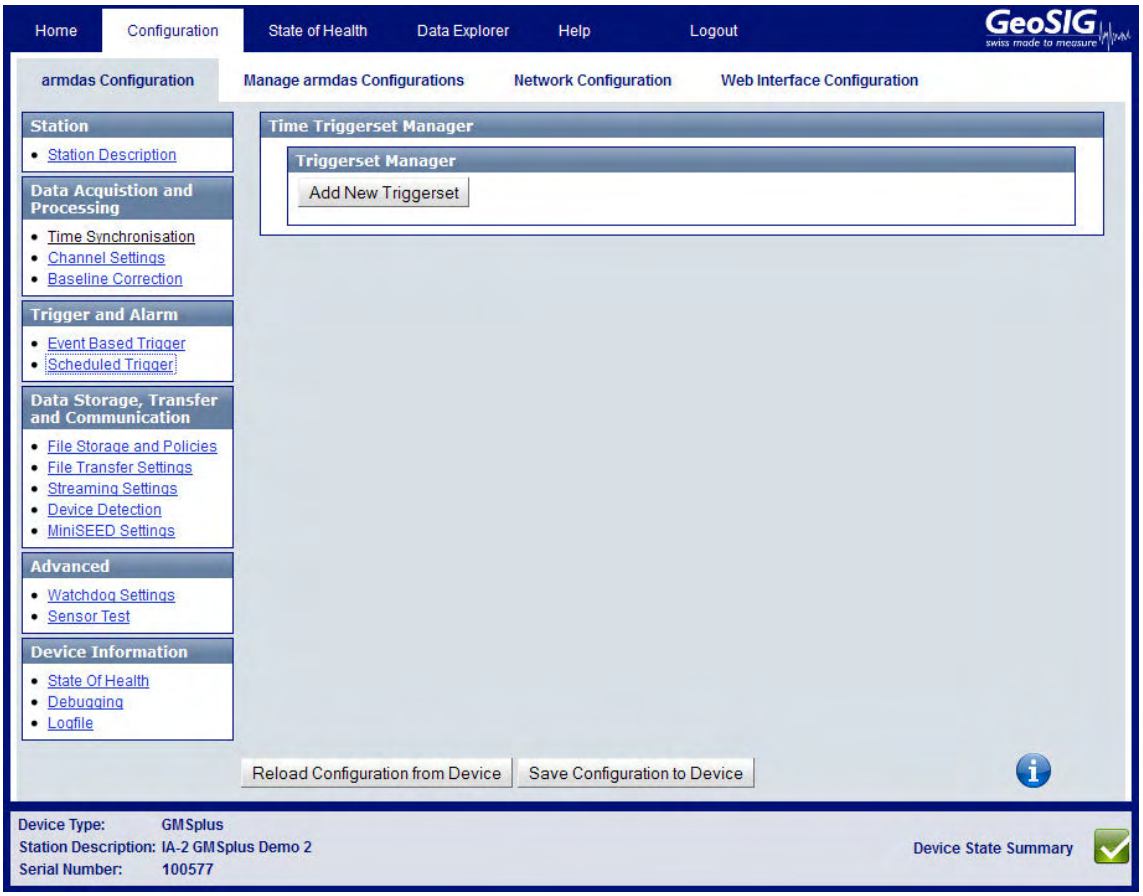


Figure 57. Preset Trigger Settings

- Add new triggerset by the button ***Add New Triggerset.*** Triggersets can be removed again by ***Remove***.
- The edit a triggerset press the button ***Edit*** and adjust the parameters in the pop-up window. See Table 14 for additional information.

10.6.2. Via Local Serial Console

- Press '**H**' to select the Number of Preset Triggers

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 1
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  L) Parameters of Preset Triggers ... ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Signal Characteristics .......... ->
```

- Press '***L***' to get to the *Parameters of Preset Triggers* menu to adjust the settings of the preset triggers. The following menu appears only in case the *number of preset triggers* is higher than '***0***'.

```
Main Menu | TimeTableTrigger
  A) Preset trigger name .......... Trigger1
  B) First trigget type ........... After Startup
  H) Duration, seconds ............ 30 (0x1E)
  I) Total number of triggers ..... 1 (0x01)
  O) Stored channels .............. 1
  P) List of stored channels ...... ->
```

- Each trigger set can be adjusted according to your wishes. To change the preset trigger set press '**+**' or '**-**'. The following parameters can be adjusted:

Preset trigger name	*User selectable*	Name of the preset trigger set
First trigger type	There are several possible predefined triggers to choose	
	Manual Trigger	A trigger is activated/stopped by the user command TRIGGERNOW/STOPTRIGGER sent either from the console or remotely from a server
	After Even	A trigger is activated after recording of any event file
	After Startup	First trigger is activated after the instrument startup
	Date and Time	First trigger is activated at the defined date/time
Total number of triggers	*User selectable*	After reaching the configured number of triggers the preset trigger will not be activated anymore
Delay after event	*User selectable*	In case After Event is selected, then the time between the end of the event to the begin of the activation of the preset trigger can be configured
First trigger time, year	*User selectable*	Date and time of the first trigger
First trigger time, day	*User selectable*	
First trigger time, hour	*User selectable*	
First trigger time, minute	*User selectable*	

Stored channels	*User selectable*	Number of channels which should be stored into an event file in case of a trigger
List of stored channels	*User selectable*	Depending on the number of stored channels different sources can be selected. '**+**' and '**-**' can be used to change the channel, the source can be selected by pressing '**A**'

Table 14. Preset trigger configuration menu structure

10.7. File Storage and Policy

It can be configured in the instrument how all the files should be treated.

10.7.1. In the Web Interface or by GeoDAS

- Go to ***Configuration → armdas Configuration → Scheduled Trigger***

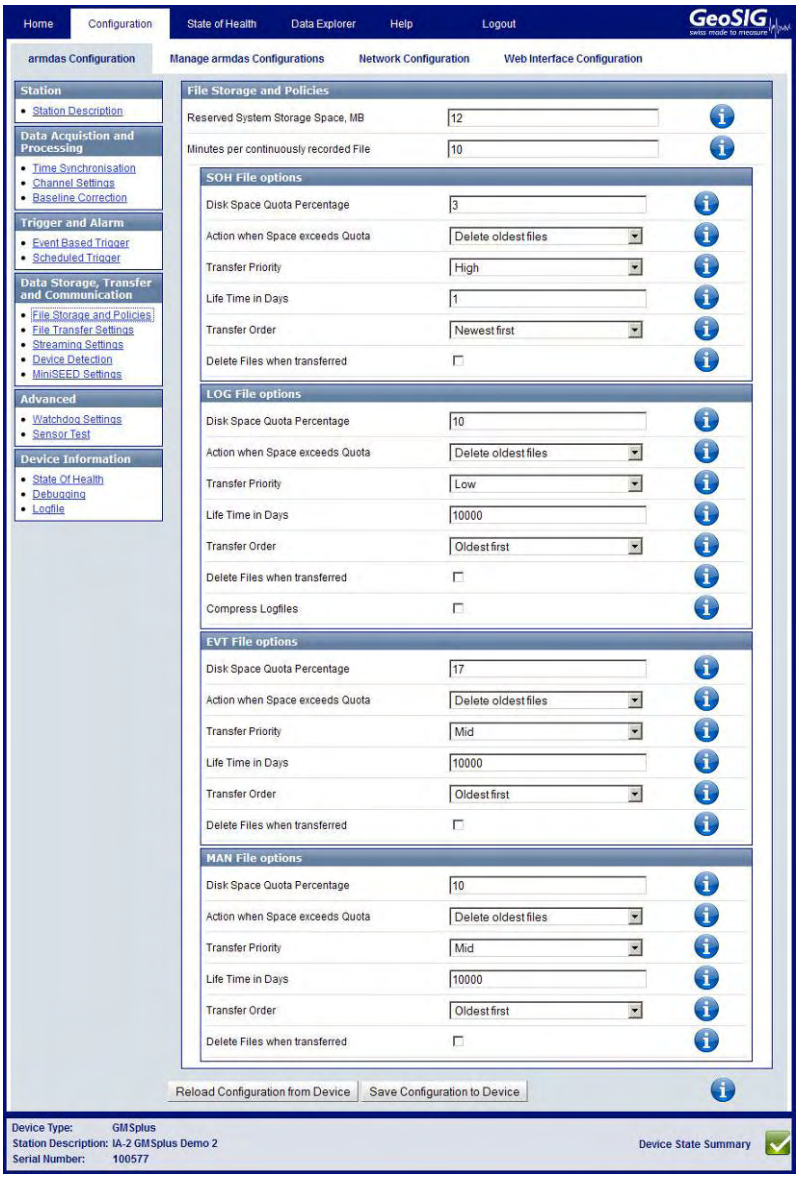


Figure 58. Streaming Settings

- Parameters for the following file types can be configured
  - SOH – State of health information and requested data files
  - LOG – System log files
  - EVT – Events and PGM files
  - RBF – Ringbuffer files
  - MAN – Scheduled manual recordings

- See Table 15 to get more information about the parameters which can be configured.

10.7.2. Via Local Serial Console

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 1
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  L) Parameters of Preset Triggers ... ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Signal Characteristics .......... ->
```

- Press ‘M’ to get to the *File Storage and Policy* menu to adjust the settings of the file storage. The following menu appears:

```
Main Menu | File Storage
  A) System reserved space, Mb ........ 12 (0x0C)
  B) Length of one RB file, minutes ... 10 (0x0A)
  C) SOH and requested data files ..... ->
  D) System log files ................. ->
  E) Events and PGM files ............. ->
  F) Ringbuffer files ................. ->
  G) Scheduled manual recordings ...... ->
  H) Miscellaneous files .............. ->
```

- The following parameters can be adjusted for (see *Filetypes*):

  - SOH – State of health information and requested data files
  - LOG – System log files
  - TRG – Events and PGM files
  - RBF – Ringbuffer files
  - MAN – Scheduled manual recordings
  - Miscellaneous files

System reserved space		*User selectable*	Amount of memory reserved for the operating system in [Mb]. Keep **12** Mb by default
Length of one RB file		*User selectable*	Permanent data will be stored in ringbuffer files; here the length of one ringbuffer file in minutes can be specified. After this time the file will be closed and a new one started.
Filetypes	***Disk space quota***	*User selectable*	Reserved memory on the SD/CF-Card for the SOH files in [%]
	If over quota	***Delete oldest files***	In case the reserved memory is full the oldest files will be deleted first
	Life time	*User selectable*	After the configured time in [days] the files will be deleted from the SD/CF-Card
	Transfer priority	***Never Transfer*** ***Low*** ***Mid*** ***High*** ***Highest***	In case a lot of files have to transferred, the priority of the file upload can be configured here. If Never Transfer is configured, then no files will be uploaded
	Transfer order	***Newest first*** ***Oldest first***	Most recent files are transferred first Most old files are transferred first
	Delete transferred	***Yes*** ***No***	Files will be deleted after upload to the server Files will be not deleted after upload to the server

Table 15. *File Storage and Policies* menu structure

- Additionally the system log files can be compressed. This can be separately enabled under the menu point *D) System log files*:

Compress files	***Yes***	Files will be sent gzip-compressed (.gz)
	No	Original text files will be sent (default)

10.8. Communication Parameters

This chapter explains how to set up the server parameters

10.8.1. In the Web Interface or by GeoDAS

- Go to ***Configuration → armdas Configuration → File Transfer Settings***

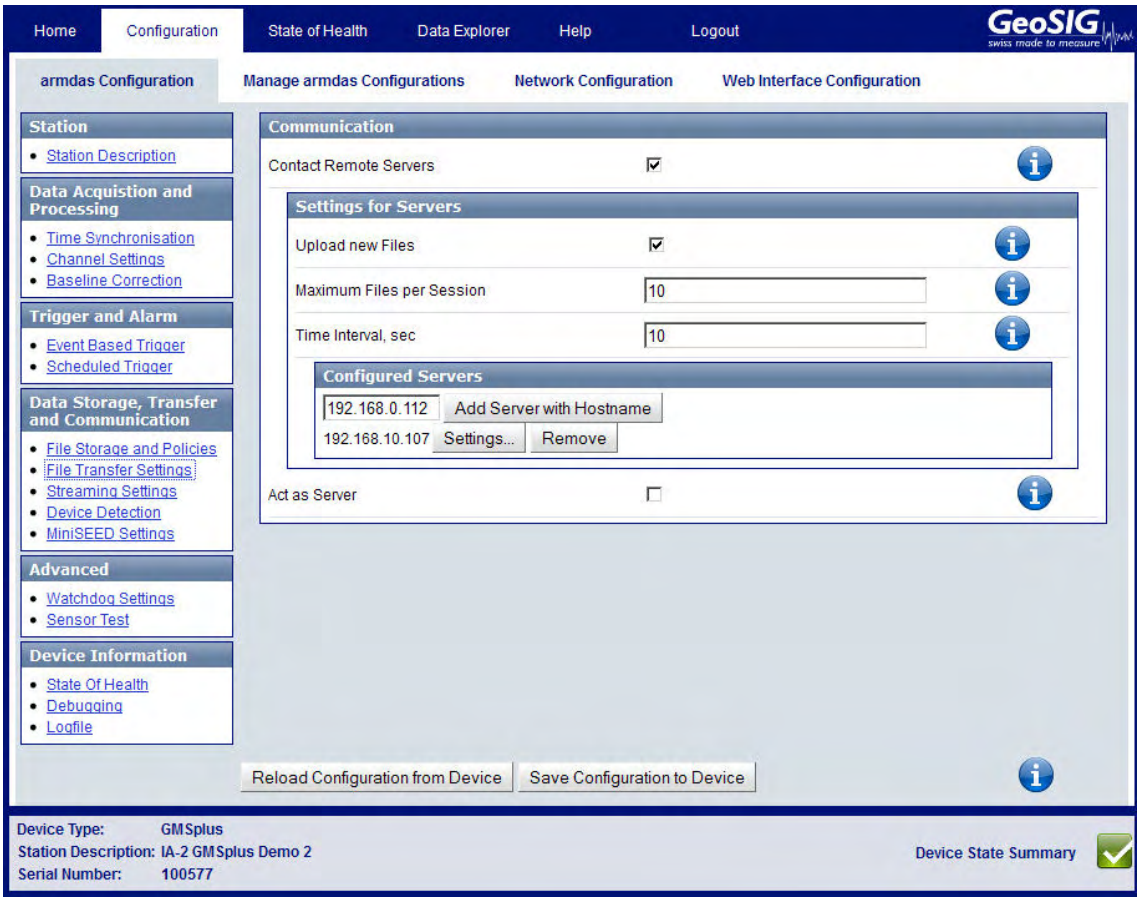


Figure 59. Server parameters

- Tick the flag ***Contact Remote Servers*** to configure a connection to a remote server
- Add the IP of your server and press ***Add Server with Hostname.*** Servers can be removed again by ***Remove***.
- Then press Settings… to adjust the parameters as shown in the Table 16
- In case the instrument should act as Server for other GMS-xx or GMS^{plus} instruments, tick the flag ***Act as Server*** and follow the steps as described in chapter 10.8.2.1

10.8.2. Via Local Serial Console

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 0
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Signal Characteristics .......... ->
```

- Press '***N***' to get to the *Communication Parameters* menu to adjust the settings of the file storage. The following menu appears:

```
Main Menu | Communication
  A) Contact remote servers ............. Yes
  B) Number of servers .................. 1
  C) Time interval, sec ................. 10 (0x0A)
  D) Maximum files per session .......... 10 (0x0A)
  E) Connect if there are new files ..... Yes
  G) Server Parameters .................. ->
  H) Server mode ........................ No
```

- The following parameters can be adjusted:

Contact remote servers		***Yes***	The instrument connects to the configured data server(s)
		No	The instrument does not connect to any data servers
	Number of servers	*User selectable*	Number of data servers. If the instrument can not connect to the first data server it will connect to the second data server, if this one is down it connect to the third and so on. Scanning of servers stops after first successful connection
	Time interval	*User selectable*	Interval of connection to data servers in seconds
	Maximum files per session	*User selectable*	Maximum number of files, which will be uploaded during one session. Although data servers support concurrent connections, this parameter helps distributing the load of data processing by the server among several instruments
	Connect if there are new files	***Yes***	Instrument connect to the server in case there are new files recorded and are ready to be transmitted
		No	Instrument does not connect to the server in case there are new files. It just connects periodically as defined with the parameter **Time interval**
	Server parameters	'**+**' and '**-**' can be used to change between the clients	
		Server IP Address	User selectable	IP address of the data server
		Protocol	**Custom**	Protocol of communication, can not be changed so far

Port	User selectable	Communication port of the data server
Transfer timeout	User selectable	Instruments gives up to contact the server after the configured timeout in seconds
Network triggers	**Yes** **No**	Triggers are sent to the server, for event detection as described in chapter 14.2 Triggers are not sent to the server
Connect through PPP link	***Yes*** ***No***	Instrument connects to the data through PPP link Instrument does not connect to the data server through PPP
Use PPP only if main link fails	***Yes*** ***No***	Use PPP in case no connection is possible to the data server over Ethernet or Wi-Fi Use PPP for every connection, independent from the main connection status
Preferable PPP link type	**Internal analog modem** **External GPRS modem**	Use internal analog modem first Use external GPRS modem first
Number of failures to give up	User selectable	Number of trials until giving up
Try alternate PPP link on failure	***Yes*** ***No***	Tries the alternative modem in case the first one fails Does not try further in case connection fails with the first modem

Table 16. *Communication Parameters* menu structure

10.8.2.1. Instrument acts in the Server Mode

The instrument can be configured to act as a server. In this case other instruments can upload their files to this instrument. The server-instrument can then forward the data to a main server by another communication medium. For example, two instruments (clients) upload their files to the instrument-server, which forwards the data to a GeoDAS server by GPRS.

The serial numbers and IP's of all client instruments must be configured in the server, so that requests from GeoDAS can be correctly forwarded.

This setup is not recommended, as it creates a big load for the server instrument. Special care must be taken during design and setup. Whenever possible, all instruments shall have a direct communication path to the GeoDAS server.

Server mode	***Yes*** ***No***	The instrument acts as a data server for other instruments The instrument does not act as a data server
Port for incoming connections	User selectable	Port for incoming connections. Other instruments have to set the same port under Server parameters
Secure authentication	***Yes*** ***No***	Secure authentication (SSL encryption) enabled Secure authentication (SSL encryption) disabled
Number of clients	User selectable	Number of client instruments which upload data to this instrument

Clients Parameters	'**+**' and '**-**' can be used to change between the clients		
	Client IP Address	User selectable	IP of the client instrument which connects to this instrument
	Client serial number	***Custom***	Serial number of the client instrument. Use 000000 to allow instruments with any serial numbers to connect
	Transfer timeout	User selectable	Network timeout in seconds
	Data forwarding	***Yes***	Data from the data server will be forwarded to the client instruments and the other way round
		No	Data will not be forwarded
	Network triggers	***Yes***	Network triggers will be sent to the server
		No	Network triggers will not be sent to the server

Table 17. *Server Parameters* menu structure

10.8.3. Connection over PPP (GPRS or analog Phone Line)

If it is required to use PPP link for communication of instrument with the GeoDAS server, then the configuration must be set accordingly in armdas (see chapter 10.8). It is also required to configure PPP for selected ISP (Internet Service Provider). The ISP configuration settings are described in the following chapters

The GeoDAS server must have a real static IP-address (please, consult with ISP to obtain such a service). In this example, 62.15.87.98 IP-address will be used for the GeoDAS server. GeoDAS server must be configured as described in chapter

10.8.3.1. armd Configuration

To configure armdas, connect to instrument through serial console or from GeoDAS as described in chapter 10.

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 0
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Signal Characteristics .......... ->
```

- Press '**N**' to enter the Communication Parameters

```
Main Menu | Communication
  A) Contact remote servers ............. Yes
  B) Number of servers .................. 1
  C) Time interval, sec ................. 60 (0x3C)
  D) Maximum files per session .......... 10 (0x0A)
  E) Connect if there are new files ..... Yes
  G) Server Parameters .................. ->
  H) Server mode ........................ No
  M) Seedlink Server .................... No
```

- Change *Contact remote servers* to ***Yes***, then adjust the *Server Parameters* by pressing '***G***'

```
Main Menu | Communication | Server
  A) Server IP Address ..................... 62.15.87.98
  B) Protocol .............................. Custom
  C) Port .................................. 3456
  H) Transfer timeout, sec ................. 40 (0x28)
  I) Network triggers ...................... No
  J) Connect through PPP link .............. Yes
  K) Preferable PPP link type .............. Internal analog modem
  L) Number of failures to give up ......... 3 (0x03)
  M) Try alternate PPP link on failure ..... Yes
  N) Startup time for analog modem (temp) ... 2 (0x02)
  O) Startup time for GPRS modem (temp) ..... 20 (0x14)
  P) Connect time for analog modem (temp) ... 30 (0x1E)
  Q) Connect time for GPRS modem (temp) ..... 5 (0x05)
```

- GeoDAS server IP address must be set as *Server IP Address* and port number for *Port* parameter such as for server in GeoDAS configuration (see Figure 26).
- *Connect through PPP link* should be ***Yes***.
- *Preferable PPP link type* can be ***Internal analog modem*** or ***External GPRS modem*** (depends from used modem type).
- If the user wants to use two modems (analog and GSM) together, one of which is in a role of an alternate link, then required to set *Try alternate PPP link on failure* to ***Yes***. In this case, if the preferred modem will fail after the *Number of failures to give up*, then alternate modem will be used to establish link.
- After this adjustments exit from submenus by ***<ESC>*** key, save configuration with '***C***' and restart armdas by pressing '***R***'.

10.8.3.2. The ISP Configuration for PPP

- The ISP configuration must be done in the test and configuration menu during startup.
- Switch on the instrument by press and hold the POWER button for 2 seconds.
- Press ***<Ctr> + 'Z'*** as soon the message appears on the console to enter the test and configuration mode, the following message appears:

```
Press Ctrl+Z to enter the test mode.............
```

- Press ***<Ctr> + 'Z'*** as soon the message appears on the console to enter the test and configuration mode, the following message appears:
- By default, no any passwords are set, so press '**U**' to enter the User Mode, and then '**N**' to enter the menu *Network setting*s.

```
==== Network Settings ====

---- Primary network interface ----
Configure network interface (Y/N)? Y
Static IP address (1=YES, 0=AUTO)? (0 = 0x0):
```

- Press '***N***' till the following message appears to adjust the ISP settings for the analog phone line

```
---- PPP Communication ----
Edit Analog Modem settings (Y/N)?:
```

- Press '***Y***' and enter the phone number, login and password given by your internet service provider. Add a **T** in front of the number for tone dial, or a **P** for pulse dial.

```
Phone number of the service provider  [T313001]:
Login  [demo]:
Password  [demo]:
```

- In case an external GPRS modem is used, proceed to

```
Edit GPRS Modem settings (Y/N)?:
```

- Select '***Y***' to change the settings and then enter the correct information provided by your mobile service provider.

In case of troubles with connection to the used ISP, please contact the ISP support service.

10.9. Miscellaneous Parameters

The Time synchronisation, State of Health files, messaging and debugging can adjusted under this menu

10.9.1. In the Web Interface or by GeoDAS

The parameters of this menu item is splitted up in several pages

- To adjust the time synchronisation, go to ***Configuration → armdas Configuration → Time Synchronisation***
- To adjust the Offset correction, go to ***Configuration → armdas Configuration → Baseline Correction***
- To adjust how many times the SOH information shall be sent, go to ***Configuration → armdas Configuration → State of Health***
- To adjust the type and the number of the sensor test pulses, go to ***Configuration → armdas Configuration → Sensor Test***
- To enable/disable the autodetection of Web Interface, go to ***Configuration → armdas Configuration → Device Detection***
- To enable additonal debug messages in the system log files, go to ***Configuration → armdas Configuration → Debugging***
- To adjust, when the system log files shall be sent, go to ***Configuration → armdas Configuration → Logfile***

Adjust the parameters as shown in the Table 18.

10.9.2. Via Local Serial Console

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 1
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  L) Parameters of Preset Triggers ... ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Signal Characteristics .......... ->
```

- Press '**O**' to get to the *Miscellaneous Parameters* menu to adjust time synchronisation offset detection, signal simulator and other settings. The following menu appears:

```
Main Menu | Miscellaneous
  A) Offset detection time, sec ............... 10 (0x0A)
  B) Offset correction time, sec .............. 0 (0x00)
  C) Offset correction counts ................. 1 (0x01)
  D) MiniSEED record length ................... 512
  E) Extended MiniSEED format ................. Yes
  F) State of health .......................... ->
  G) Test configuration ....................... ->
  H) Messaging and debugging .................. ->
  I) Time synchronization ..................... ->
  J) Instrument configuration options ......... ->
  K) Instrument configuration options ......... ->
  L) Time for sending daily logfile, hour ..... 0 (0x00)
  M) Time for sending daily logfile, minute ... 0 (0x00)
```

- The following parameters can be adjusted:

Offset detection time	*User selectable*	Time in seconds, which the input values is measured after start-up to define the offset
Offset correction time	*User selectable*	The instrument takes the average over the number of seconds, configured in the *Offset correction time* and adds or subtracts the number of counts defined under *Offset correction counts*
Offset correction counts	*User selectable*	
MiniSEED record length	*User selectable*	Length of one data block inside the miniSEED file. In most applications, the default value 512 shall be kept.
Extended MiniSEED format	***No*** ***Yes*** *(default)*	MiniSEED files do not include any additional information. This option shall be used only if you face any problems in reading extended format of miniSEED files with your customized software. MiniSEED files include configuration and state of health information. When you open such files with GeoDAS, there is no need to enter LSB factors and units (see the chapter 14.4) as this information is retrieved from files. This feature is supported

			from GeoDAS version 2.21.
State of health	***SOH report type***	***None***	No State-Of-Health file will be created
		No	State-Of-Health files will be created and uploaded to the server according to the settings in chapter 0
	SOH reporting interval , days	*User selectable*	Defines the interval between the SOH reports in days, hours and minutes
	SOH reporting interval, hours	*User selectable*	
	SOH reporting interval, minutes	*User selectable*	
	Time of the first SOH report	***Startup***	First SOH report will be created at startup
		Random	Time of the first SOH is random. This is to avoid all instruments use the network at the same time.
		User defined	First SOH report will be created at the user defined time
	First SOH report time, hours	*User selectable*	Defines the hour and minute of the first SOH report
	First SOH report time, minutes	*User selectable*	
	Activate alarm on errors	***Yes***	Activates an alarm relay in case of an error
		No	Alarm relay will not be activated in case of an error
	Activate alarm when system is inactive	***Yes***	Alarm relay is activated in case *armdas* is not running (e.g. during startup or after quit)
		No	Alarm relay will not be activated
	Error and inactivity alarm output	***AL1, AL2, AL3, AL4***	Alarm relay which should be activated in case of an error or *armdas* is not running
	Activate alarm on selected errors only	***No***	Selected alarm relay is activated on all errors
		Yes	Selected alarm relay is activated on selected errors only. The errors can be selected by pressing '***L***' to '***T***'
Test configuration	***Sensor test type***	***None***	No test pulse is generated
		Pulse	Test pulse is generated, depending on the following settings
	Sensor test interval	*User selectable*	Interval between two sensor tests
	Time of the first test	***Startup***	First test will be done at startup, next after the defined interval
		Random	Time of the fist test is random. This is to avoid, that all instruments in a network are doing the test in exactly the same moment. This would be critical in case of an earthquake at this time.
		User defined	First test will be done at the user defined time

Messaging and debugging	***Console messages***	***Yes*** ***No***	Enables console messages Disables all console messages
	Debug: memory allocation	***Yes*** ***No***	Enables or disables specific debug messages. These are for service or advances users only. Keep *No* by default.
	Debug: system and processes		
	Debug: flash memory		
	Debug: configuration		
	Debug: network links		
	Debug: data streams		
	Debug: data sources		
	Debug: ring buffers		
	Debug: event triggers		
	Debug: time synchronisation		
	Debug: file manager		
	Debug: cryptographic info		
	Debug: hardware related info		
Time Synchronization	***Time source***	***RTC*** ***GPS*** ***NTP*** ***AUTO*** ***NET1PPS***	RTC is not synchronizing itself to any source RTC is synchronizing to the connected GPS RTC is synchronizing to a NTP server RTC synchronizes to NTP in case GPS is not available RTC is synchronizing to the 1PPS signal distributed by the 433 MHz module or the interconnection network.
	NTP server 1	*User selectable*	IP of the primary NTP Server
	NTP server 2	*User selectable*	IP of the secondary NTP Server
	NTP server query interval	*User selectable*	Interval time in seconds the NTP server is contacted by the instrument
	NTP requests in a row	*User selectable*	Every time the instrument is contacting the NTP server the configured number of requests will be sent. **For service and advanced user only, do not change** the default value of '***4***'
	NTP network timeout	*User selectable*	Maximum time to receive a reply from the NTP server in [seconds]. **For service and advanced user only, do not change** the default value of '***3***'
	NTP maximum error	*User selectable*	Above this time in [seconds] the RTC will make a time jump to the NTP time. Otherwise the time will be tuned slowly. **For service and advanced user only, do not change** the default value of '***1***'
	GPS reception timeout, min	*User selectable*	If GPS signal is lost, after this time in [minutes] the RTC will change its synchronization to NTP

	GPS check interval in NTP mode, min	*User selectable*	If in the '***Auto***' mode, the RTC is synchronized to the NTP the instruments checks in the configured interval if the GPS is available again
	GPS check duration in NTP mode, sec	*User selectable*	
	Send SOH upon RTC status change	***Yes***	In case RTC status changes, a SOH message will be uploaded to the server
		No	No SOH message will be sent upon RTC status change
	WiSync transmission interval, min	*User selectable*	If a 433 MHz WiSync module is installed, the radio module is switched on in the user defined interval.
	WiSync transmission duty cicly	*User selectable*	Defines how long the 433 MHz WiSync module remains enabled. In % of the defiend interval.
Instrument configuration options	***Enable autodetection of the instrument***	***Yes***	Instrument can automatically be found by GeoDAS in the LAN
		No	Instrument can not automatically be found by GeoDAS
	Configurable with a browser	***Yes***	Web Interface is enabled and instrument can be configured with the browser
		No	Web Interface is disabled
Time for sending daily logfile, hour		User selectable	If transfer is activated in chapter 10.7, at this time the daily logfile will be sent to the server. Can be adjusted to avoid that all instruments send the logfile at exactly the same time
Time for sending daily logfile, minutes		User selectable	

Table 18. *Miscellaneous Parameters* menu structure

10.9.3. Time synchronization

The system has a Real Time Clock (RTC) that maintains internal time when the unit is turned off. During normal operation the RTC is responsible to provide the most accurate time possible to the system and perform time synchronization with other available external time source as:

- NTP (Network Time Protocol) server from the Ethernet interface.
- GPS time code receiver on the GPS interface.

It also keeps under control the sampling clock of the ADCs and is self-calibrating its oscillator against temperature and aging when it is connected with an accurate external time signal.

The DSP receive a continuous 1 PPS signal from the RTC with the best accuracy that can provide the RTC, including temperature compensation, based on the saved coefficients. The DSP will sync the sampling clock with this 1 PPS signal to have accurate sample timing.

10.9.3.1. Temperature compensation

RTC uses the internal temperature sensor of the micro-controller to define the current operating temperature. When good time synchronization occurred, typically using a GPS, the RTC check its own drift against the signal of the GPS and adds the correction coefficients in a trim table. With a NTP time source, the accuracy is worst but the same process occurred with more averaging and on longer period of time.

During factory test, all the coefficients are initialized to the room temperature coefficient using a GPS. After installation, the unit will learn it self on site the correction parameters according to the ambient conditions at site and also according to the aging of the oscillator.

10.10. System Characteristics

Customised protocols may be available in this section

```
Main Menu
  A) Station description ............. Demo GMSplus
  B) Station code .................... DEMO
  C) Location description ............ Switzerland
  D) Seismic network code ............ CH
  E) Number of Channels .............. 3
  F) Number of Output Streams ........ 1
  G) Number of Trigger Sets .......... 1
  H) Number of Preset Triggers  ...... 1
  I) Channel Parameters .............. ->
  J) Stream Parameters ............... ->
  K) Trigger Parameters .............. ->
  L) Parameters of Preset Triggers ... ->
  M) File Storage and Policy ......... ->
  N) Communication Parameters ........ ->
  O) Miscellaneous Parameters ........ ->
  P) Signal Characteristics .......... ->
```

- Press '**P**' to get to the *Signal Characteristics* menu

```
  Main Menu | Signal characteristics
  A) Calculate signal characteristics ... Yes
  B) Format ............................. QSCD20
  C) Window length, seconds ............. 10 (0x0A)
  D) Log to files ....................... Yes
  E) Number of recipients ............... 1
  F) UDP data recipients ................ ->
```

- The following parameters can be adjusted:

Calculate signal characteristics		***Yes***	Customized signal characteristics are enabled
		No	Customized signal characteristics are disabled
	Format	***QSCD20***	Specific format required for South Korean market.
	Window length, seconds	*User selectable*	Window length for average and peak values
	Log to file	***Yes***	MMA streams are stored into files
		No	MMA streams are not stored, just streamed to recipients
	Number of recipients	*User selectable*	Number of recipients of the MMA stream
UDP data recipients	'**+**' and '**-**' can be used to change between the recipients		
	IP Address	*User selectable*	IP address of the recipient
	Network port	*User selectable*	Communication port of the recipient

10.11. Other Options in the Instrument Main Menu

Next to the edit of the instrument configuration, there are other actions possible from the main menu shown below:

```
GMSplus s/n 100582 version 21.02.00
Main menu:
C - Configuration
M - Messages ->
S - Shell command
L - List firmware images
X - Display errors (0) and warnings (0)
W - Clear errors and warnings
F - View/reset RTC trim values
T - File statistics
G - View RTC status
H - Set RTC time
U - User request
R - Restart
Q - Quit
```

	Action or command	Description
C	***Configuration***	Change of the configuration of the instrument. See chapter 10 for details
M	***Messages →***	Possibility to configure, what kind of messages are shown in the console.
S	***Shell command***	Allows executing a Linux shell command from *armdas*. For advanced users only
L	***List firmware images***	Displays the list of firmware images and configuration stored in the non-volatile memory of the instrument. There are two copies of each type of firmware, except for the Bootloader, which has only one image
X	***Display errors (n) and warnings (m)***	Shows present errors and warnings
W	***Clear errors and warnings***	Clears all errors and warnings
F	***View/reset trim values***	Shows trim values of the RTC. Trim table can be erased as well. For advanced users only.
G	***View RTC status***	Shows the actual state of the real time clock and if the RTC is synchronized to NTP or GPS
H	***Set RTC time***	Allows setting the time of the instrument manually. Keep in mind, that if a GPS is connected or a NTP server is configured, the time will be synchronized to them after a while, not immediately.
U	***User request***	See chapter 10.11.1 for details
R	***Restart***	Restarts the instrument, e.g. after a change of the configuration
Q	***Quit***	Stops *armdas* data acquisition and exits to the Linux console. For advanced users only

10.11.1. User requests

Several actions can be initiated by the user:

- In the main menu press '**U**' to enter the *User request* menu, type ***HELP*** to see all the possible commands

```
GMS-XX s/n 100710 version 20.00.97
Main menu:
C - Configuration
M - Messages ->
S - Shell command
L - List firmware images
X - Display errors (1) and warnings (0)
W - Clear errors and warnings
F - View/reset RTC trim values
T - File statistics
G - View RTC status
H - Set RTC time
U - User request
R - Restart
Q - Quit

Command or HELP for more information --> help
```

The list of all supported user requests (commands) along with their description is provided in the table below.

Action or command	Description
GETEVT YYYY-MM-DD HH:MM:SS N	The instrument creates an event with the length of N seconds from the ringbuffer data, starting from the indicated date and time and uploads the data to the server if configured (see chapter 10.8).
LASTDT YYYY-MM-DD HH:MM:SS	Set date and time of the last transferred file The instrument saves the date and time of the latest uploaded file and will not upload any file which is created before this date and time. Under normal conditions this will be never the case. But if the time is changed backwards by the user - e.g. from 10:00 to 06:00 - the instrument will not upload any data till 10:00 again. So the time of the last transferred file can be adjusted here and should be set to 06:00 in this example.
GETSOH	The instrument generates a SOH file with the current state-of-health information and uploads to the server if configured (see chapter 10.8.3).
GETLOG	The instrument uploads today's logfile to the server.
SETMSG flags	For service only, do not change
CLRMSG flags	
TSTSENSOR 1	The instrument generates a sensor test pulse. When a level trigger is activated an event will be recorded of this test pulse and uploaded to *GeoDAS_DATA\Incoming\NNNNNN*\
RESETERR	Reset errors and warnings of the instrument
TRIGGERNOW [trigger_name]	Activate a manual trigger to start recording, the manual trigger must be configured as described in the chapter 10.6
STOPTRIGGER [trigger_name]	Deactivates the manual trigger
GETTRIM	The instrument will upload a SOH file containing the actual values from the RTC trim table. The latest SOH file can be found under *GeoDAS_DATA\StatusFiles\InfoSOH.xml*

CLRTRIM	The instrument will clear the RTC trim table
REMOVEDC	Remove offsets from signals
TCAL <Tcur>	Calibration of the internal temperature sensor by applying the actual temperature in °C. Temperature is used for the learning of the RTC.
REBOOT	Performs full reboot of the instrument
FORMAT	Formats the data storage media. **All data will be lost, and instrument will be restarted**
SETDEFCFG	Makes the current instrument configuration as user default one. Whenever you change parameters of the instrument, they are saved in the non-volatile instrument memory as Current Configuration, and used to set all parameters of the data acquisition at startup. But if due to some reason the current configuration get corrupted, and GMS cannot load or cannot process it, the Default Configuration file, which is created by this command, will be used instead. Note that Default Configuration is compiled from the actual parameters of the running system, and therefore it is already approved by GMS and is supposed to be correct. Thus, we recommend sending this command to the instrument after you are sure that your GMS is started with the latest configuration correctly and everything works as expected. The default configuration can also be set and restored in the web interface, see chapter 9.3.2
CANCEL	Leave the menu

The same request can also be done from GeoDAS by choosing 'Send a Request' from the 'GMS Communication Interface'. See chapter 14.3.4 for details.

11. Test and Configuration Menu

The test and configuration menu can only be accessed locally at the instrument over the serial cable

- Switch on the instrument by press and hold the POWER button for 2 seconds.
- Press ***<Ctr> + 'Z'*** as soon the message appears on the console to enter the test and configuration mode, the following message appears:

```
Press Ctrl+Z to enter the test mode..............
Instrument serial number: 100582
Instrument MAC address: 00:50:C2:77:42:93

-------------------------------------------------------------------------------------------
Level           Shortcut   Password   Description
-------------------------------------------------------------------------------------------
User            Ctrl+U     None       Basic operations only
Powerful User   Ctrl+W     None       Also hardware options and pre-selected tests
Administrator   Ctrl+A     None       Also manual tests and altering the FLASH memory content
-------------------------------------------------------------------------------------------
Your level [U/W/A] or press B to boot now:
```

Bootloader has three access levels as outlined above: User, Powerful User and Administrator, and each level can be protected by a password. Instead of pressing ***<Ctrl>+'Z'***, once can press ***<Ctrl>+'U'***, ***<Ctrl>+'W'*** or ***<Ctrl>+'A'*** to bypass the above messages and to proceed directly to a menu of the desired level. The Administrator has an access to the most complete menu but the majority of functions are not used for the standard instrument operation, and therefore they are not described here in details. The useful options are highlighted and described below. Other menu items are for the service only, and should not be used during normal operation.

```
Bootloader Menu of the GMS-XX s/n 100577
Access level: User

 --- Flash Images and Boot Options ---
L - List flash images
Q - Reset instrument configuration to the user default
V - Reset instrument configuration to the factory default
5 - Boot now
X - Reboot the instrument
Y - Power off

 --- Hardware Setup and Monitor ---
N - Network settings

 --- Security ---
O - Set password

-->
```

```
Bootloader Menu of the GMS-XX s/n 100577
Access level: Powerful User

 --- Flash Images and Boot Options ---
L - List flash images
Q - Reset instrument configuration to the user default
V - Reset instrument configuration to the factory default
5 - Boot now
X - Reboot the instrument
Y - Power off

 --- Hardware Setup and Monitor ---
K - Instrument hardware parameters
N - Network settings
T - Battery installation dates

 --- Security ---
O - Set password

-->
```

```
Bootloader Menu of the GMS-XX s/n 100577
Access level: Administrator

 --- Flash Images and Boot Options ---
L - List flash images
Q - Reset instrument configuration to the user default
V - Reset instrument configuration to the factory default
5 - Boot now
X - Reboot the instrument
Y - Power off

 --- Hardware Setup and Monitor ---
K - Instrument hardware parameters
N - Network settings
T - Battery installation dates

 --- Test Functions ---
P - Test RTC
M - Test GPS

 --- Security ---
O - Set password

-->
```

--- Flash Images and Boot Options ---

L	***List flash images***	Lists all the current firmwares in the image
Q	***Reset instrument configuration to the user default***	Forces the instrument to load the user default configuration. See description of the command SETDEFCFG in the chapter 10.11.1
V	***Reset instrument configuration to the factory default***	Forces the instrument to load the factory default settings
5	***Boot from the default image***	Exits the bootloader menu and starts the instrument normally
X	***Reboot the instrument***	Forces the watchdog to completely restart the instrument
Y	***Power off***	Forces the watchdog to switch off the instrument

--- Hardware Setup and Monitor ---

K	***Instrument hardware parameters***	Check what HW is installed in the instrument and adjust the number of sensors
N	***Network settings***	Enters the menu to adjust the network settings (dynamic or fixed IP, subnet and gateway), the PPP settings, enable/disable the SSH and Web Interface and configure the backup server. For details see chapter 7.2.
T	***Battery installation dates***	Whenever you install a new battery, you are highly recommended to set the installation dates using this menu.
O	***Set password***	Setting the password to prevent from unauthorised access to the current level of bootloader configuration.

- Leave the *Bootloader* by pressing '***5***' or '***Y***'

11.1. Comparison of Functionalities

	User	Powerful User	Administrator
Flash Images and Boot Options			
List Flash images	X	X	X
Reset instrument configuration to the user default	X	X	X
Reset instrument configuration to the factory default	X	X	X
Boot now	X	X	X
Reboot the instrument	X	X	X
Power off	X	X	X
Hardware Setup and Monitor			
Instrument hardware parameters		X	X
Network settings	X	X	X
Battery installation dates		X	X
Test Functions			
Test RTC			X
Test GPS			X
Security			
Set password	X	X	X
Reset passwords			X

Table 19. Comparison of test and configuration menu users

12. Firmware Upgrades

All the firmware for

- Linux operating system
- armdas firmware
- DSP
- RTC

can be upgraded by the user by using *GeoDAS* as described in the following chapters. The firmware will be released only as a complete package, containing all the firmwares listed above. Please see *www.geosig.com → Support → Downloads* to download the latest firmware release package.

0

Even there is no case know that some data has been lost during the upgrade, we recommend to back up all recorded data and the configuration before starting the upgrade.

After any firmware upgrade, the configuration and the correct function of the instrument should be fully verified.

If the instruments are configured to contact a server, it is possible to upgrade all or specific Instruments remotely using GeoDAS. Before trying to upgrade remotely, be sure the Instruments have a working network connection to the server. To proceed with the firmware upgrade, please do the following steps:

- Make right click on the Station in the GeoDAS main window and select ***GMS Control…***

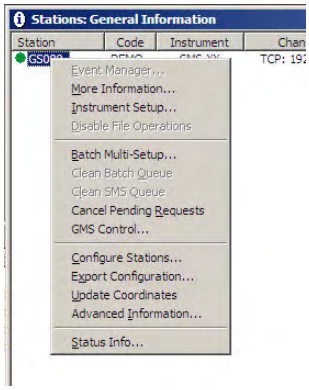


Figure 60. Select GMS Control

- A list box will appear.

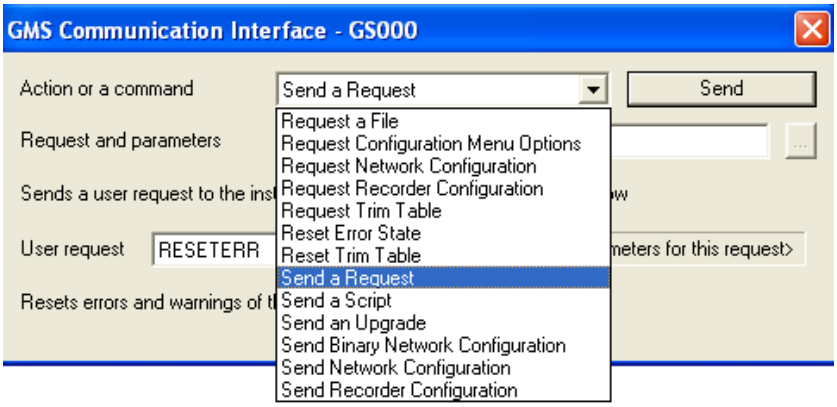


Figure 61. GMS Communication Interface

- Select the item Send an Upgrade
- Press on the button Browse **[…]** to select the required firmware. Select a firmware container with the extension ****.gsfw***.
- If the file is selected, press the ***Send*** button. GeoDAS identifies the firmware and asks for confirmation. Please double check if the correct firmware has been selected.

- Upon pressing the ***[Yes]*** button, the firmware will be placed in the Outgoing directory, so that it can be collected by the instrument(s) upon next connection.

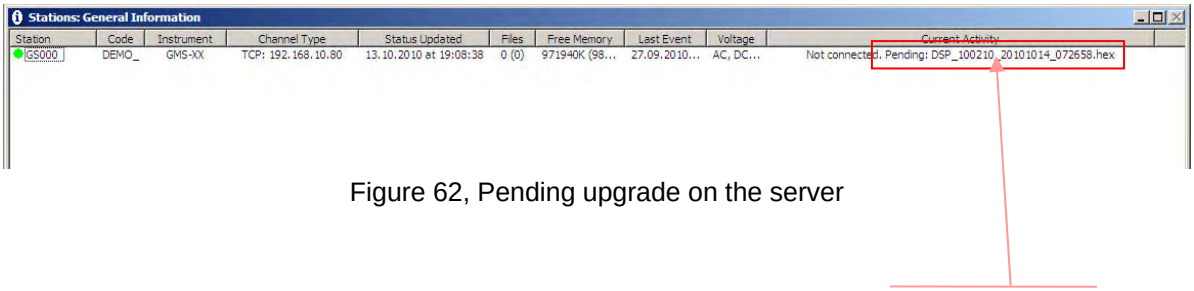


Figure 62, Pending upgrade on the server

- As soon the instrument has downloaded the new firmware, the text *Pending: xxx.gsfw* disappears. The instrument will verify the firmware and once the upgrade process is finished, the instrument will restart.

When the instrument software receives such a file, it checks the actual version and only if the file contains more recent firmware than the existing one, it will start the upgrade. After the upgrade, the new firmware will be in “trial” mode and a reboot is done. If the reboot and instrument operation is correct, the new firmware will be accepted. If the instrument reboots through its watchdog because the firmware was faulty the previous firmware version will be used and the system will be restored to its state before the upgrade.

Downgrades to the older firmware versions might be required in some specific cases. They are possible, too. Please contact GeoSIG support for the exact procedure of such downgrade.

13. Remote Access to the Instrument over SSH

The following chapter is for advanced users only.
Warranty will be void in case if something damaged by user during changes in the root file system.

Secure Shell (SSH) is a network protocol for secure data communication, remote shell services or command execution and other secure network services between two networked computers that it connects via a secure channel over an insecure network: a server and a client (running SSH server and SSH client programs, respectively).

The armdas console can not be shown through the SSH. This is a limitation of the armdas firmware

The instrument supports all types of remote access through SSH. User can connect from his PC by SSH client program to the SSH server of the instrument. Simple ssh client program can be used for this purpose. Use *root* as login and corresponding password, the login information are

Login: ***root***

Password: ***swiss***

Sign '#' is a command prompt where you can type console commands.

The password can be changed by **passwd** command.

Warranty will be void in case password is changed and forgotten.

13.1. SSH Clients for Linux OS

For the Ubuntu or other Debian-like GNU/Linux OS, SSH client program, with command line interface, can be installed by command

```
$ sudo apt-get install openssh-client
```

To login into the instrument console, “ssh root@192.168.1.10” command can be issued from any terminal emulator as following figure shows:

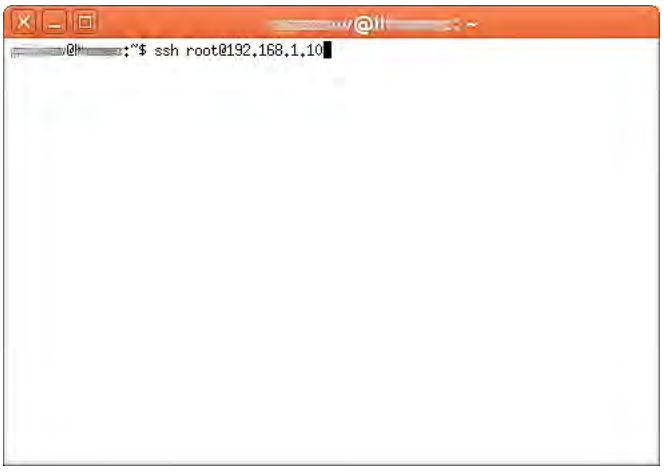


Figure 63. Command line SSH client at terminal emulator

Alternatively, the PuTTY SSH client with GUI interface can be installed by command

```
$ sudo apt-get install putty
```

This software can be found in a menu ***Applications → Internet → PuTTY SSH Client*** and its configuration dialog looks like:

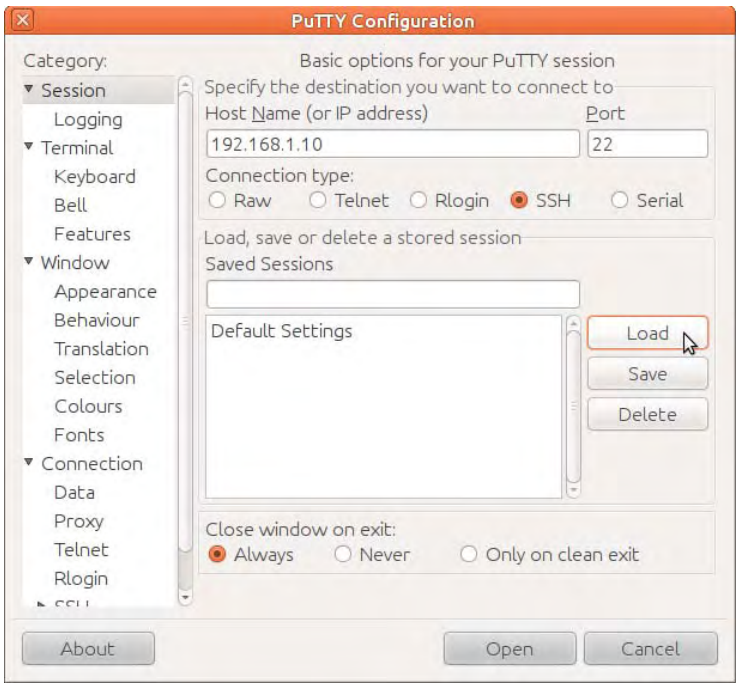


Figure 64. Configuration window of PuTTY

IP address 192.168.1.10 from examples above should be changed by real IP address of the instrument.

13.2. SSH Clients for Windows OS

The same PuTTY as for GNU/Linux OS or alternatively TeraTerm software can be used for Windows OS to have remote access to the instrument by means of SSH.

Its connection window is shown below

Figure 65. TeraTerm Connection Window

The PuTTY software for Windows OS operates the same as PuTTY for Linux OS.

The PuTTY software can be downloaded from http://www.chiark.greenend.org.uk/~sgtatham/putty/.

The TeraTerm software can be downloaded from http://ttssh2.sourceforge.jp/.

13.3. SFTP access for Windows OS

WinSCP is an open source free SFTP client for Windows. Its main function is the easy file transfer between a local computer and the instrument.

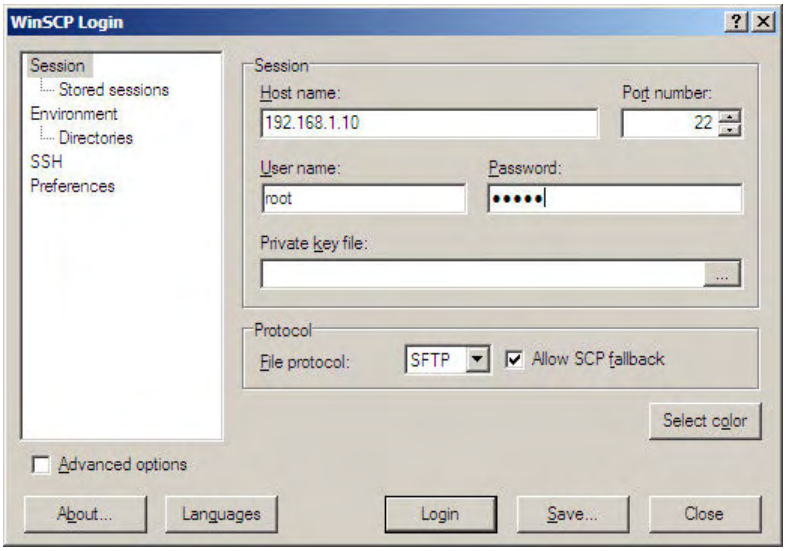


Figure 66. WinSCP login window

To connect to the instrument put the IP of the GMS^{plus} and enter the following user name and password:

User name: ***root***
Password: ***swiss***

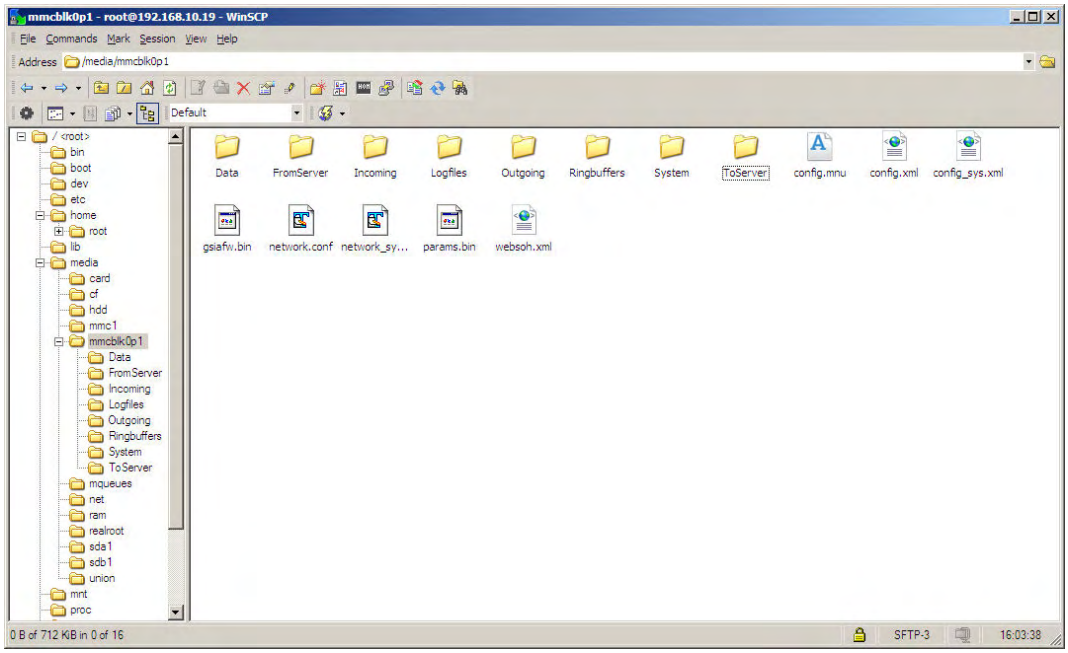


Figure 67. Explorer mode of WinSCP when connected to the instrument

It is then possible to browse through the available data on the instrument and copy files from or to the computer. The file structure is described in the following chapter.

The WinSCP can be downloaded from here: http://winscp.net/eng/download.php

13.4. File Structure on the Instrument

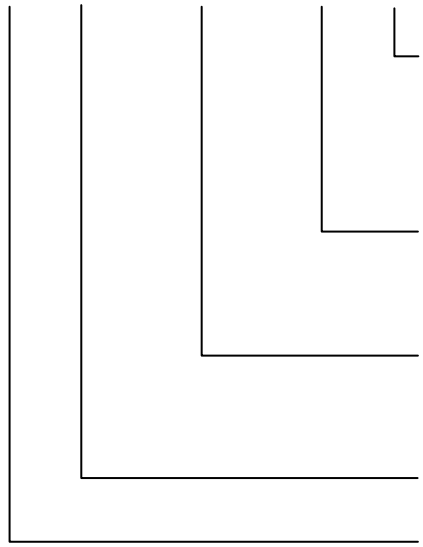
On the instrument the files are organized as following

\media\mmcblk01\...	in case an SD card is installed
\media\sda1\...	in case a CF card is installed

… Data	Event files
… Ringbuffers	Permanent recording files
… Logfiles	Log files of armdas

The filenames contain the following information

XXX_SNSNSN_YYYYMMDD_HHMMSS.ext



Extension		Depending on file type
	.msd	MiniSEED containing waveform data
	.xml	SOH and PGM information
	.txt	LOG and ERR files
	.bin	MMA packets (special for Korean market)
Time	HH	Hour
	MM	Minutes
	SS	Seconds
Date	YYYY	Year
	MM	Month
	DD	Day
S/N	SNSNSN	Six digit serial number of instrument
Type	TRG	Event trigger
	USR	User request
	TTT	Time table trigger
	CAL	File with test pulse
	MAN	Manual trigger
	RBF	Permanent recording
	LOG	Log files
	SOH	State of Health information
	PGM	PGM information of event
	ERR	Error messages
	MMA	MMA packets (special for Korean market)

14. GeoDAS Settings

14.1. Configuration of Stations

To be able to communicate with the instrument, the GeoDAS must act as a server. This chapter should help to find the correct settings.

- Open *GeoDAS* and Go to the menu ***Settings → Configure Stations…*** , the following window will appear

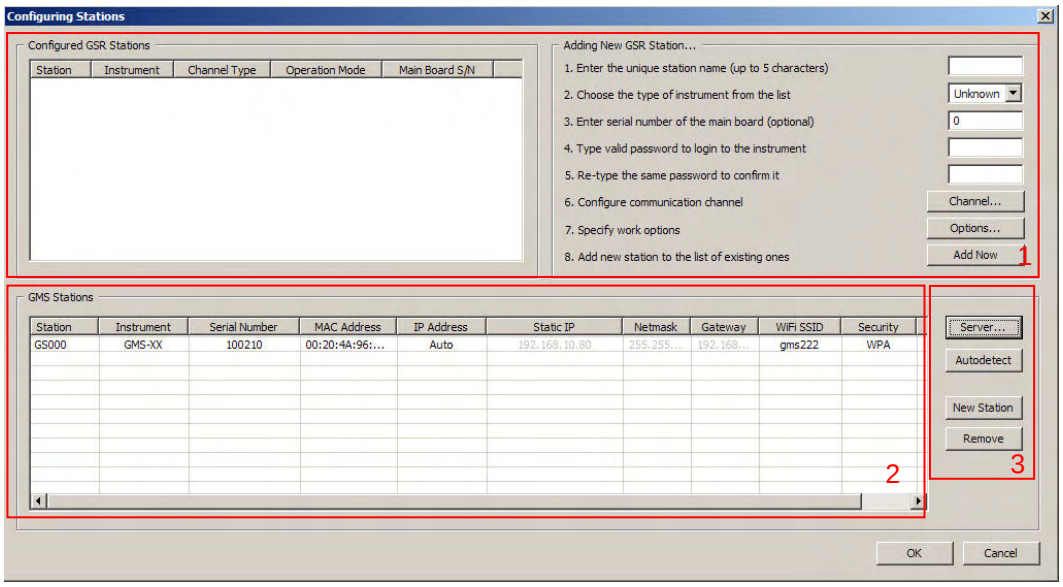


Figure 68. Configuration Stations

Area	***Topic***	Description
1	Configured GSR Stations	Details about the configured GSR-xx and GCR-xx stations. Check separate *GeoDAS Manual* for details.
2	GMS Stations	Details about the configured instruments. ***Station*** name can be changed by a double click on the field you want to change. Network settings can be done according to chapter 8. The last column in the table is *Status*, which is indicated by one or more letters, which are the following: • N – New instrument • C – already Configured earlier • A – Altered parameters • R – actual settings were Received from the instrument

3	Buttons	***Server*** Configuration of the Server, see chapter 14.2
		Autodetect Checks for instruments which are located in the same LAN. Autodetection must be enabled in the instrument, see chapter 10.8.3 for configuration (by default it is set to ON)
		New Station Add manually an instrument. S/N of the instrument must be known

For more details please see *GeoDAS Manual*

14.2. Configuration of Server Parameters

- Press the button ***Server…***, the window below appears

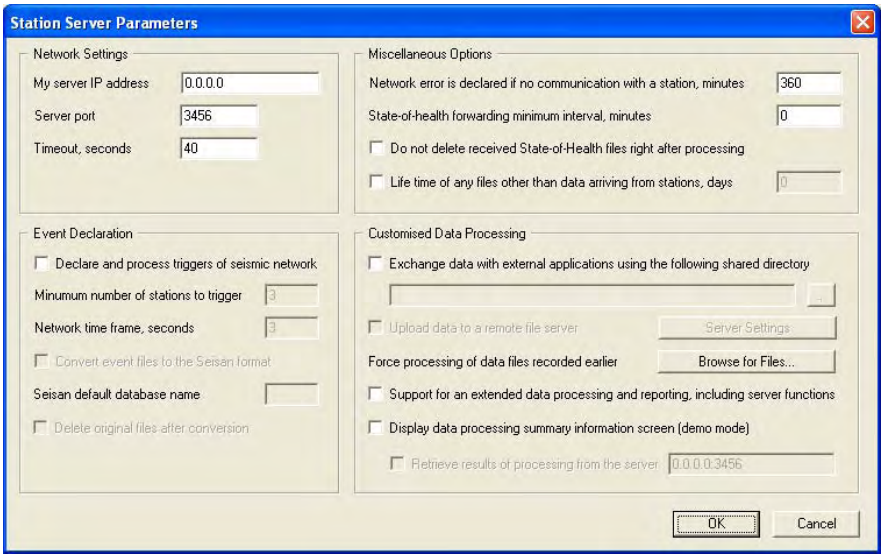


Figure 69. Data server parameter

Group of Controls	Description
Network Settings	***IP address and port*** of the server, i.e. computer which GeoDAS is running on as well as the network ***Timeout*** in seconds. If server has several network interfaces and connections from Instruments are expected from only one of them, then its IP address must be specified. Otherwise, leave it zero, which means that GeoDAS accepts incoming connection at any interface. The timeout is used to decide when to terminate current network connection if the remote party does not respond within the indicated time interval.
Miscellaneous Options	***Network error*** is declared if an instrument did not communicate with *GeoDAS* within the indicated period of time. Make sure that this parameter is higher that the communication interval set in the instrument as described in chapter 10.8. If **State-of-health forwarding interval** is set to nonzero value, then SOH reports are collected within this period of time and only then are forwarded. 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*
Event Detection	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 and process triggers of seismic network*** 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 Seisan format and stored in Seisan database on the same computer.
Customised Data Processing	This is not a standard feature of GeoDAS. Therefore please check the GeoDAS Manual and contact GeoSIG for further details if you need to use this functionality.

14.3. Instrument Control in GeoDAS

By making a right click on the station name in the window *Stations: General Information* several options become available to control and check the instrument. See the figure below:

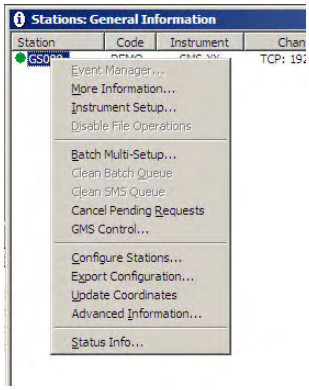


Figure 70, Instrument control of the GMS in GeoDAS

14.3.1. More Information… (State of Health of the instrument)

The status of the instruments can be easily checked, if the instrument is set up to transfer periodically the SOH file to the server (See details about SOH configuration in chapter 0 and 10.8.3).

- Make right click on the Station in the GeoDAS main window and select ***More Information…*** , the following window will appear:

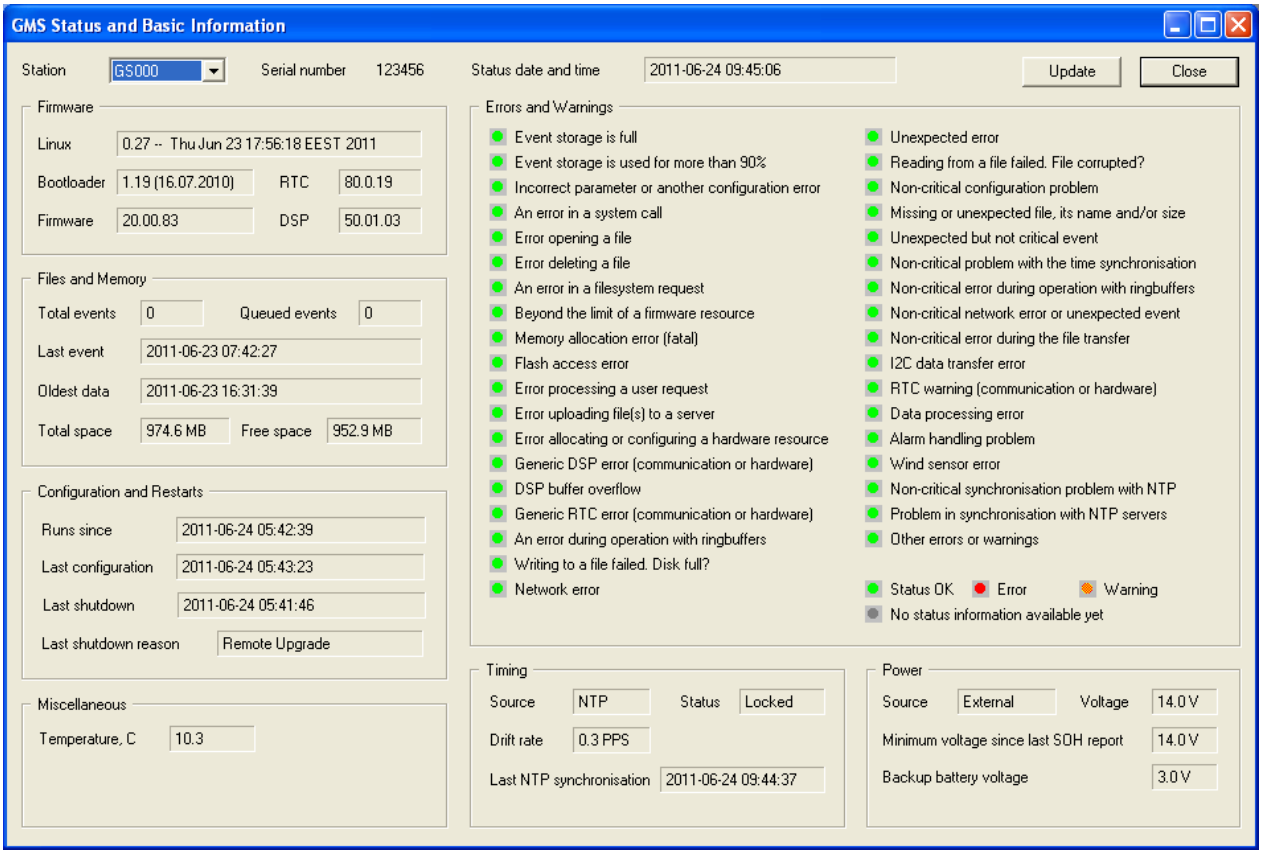


Figure 71. SOH information in GeoDAS

Information Area	Description
Status date and time	Before analysing the SOH data always make sure that the SOH files are current ones by checking the time and date here.
Firmware	Here the firmware versions of all components can be viewed.
File and Memory	Information about events and available memory.
Configuration and Restarts	Date and time of the last restart, the last configuration change and the last shutdown are shown. Additionally the reason of the last shutdown is indicated.
Miscellaneous	Ambient temperature, measured inside the instrument.
Errors and Warnings	List of all errors and warnings of the instrument.
Timing	Status of the RTC.
Power	Status of the power supply and the battery voltages.

14.3.2. Instrument Setup…

See the chapter 10.2.2 for details.

14.3.3. Cancel Pending Request

The pending requests on the server as shown in the Figure 38 can be cancelled by the user.

14.3.4. GMS Communication Interface

- Make right click on the Station in the GeoDAS main window and select ***GMS Control…*** , the following window will appear:

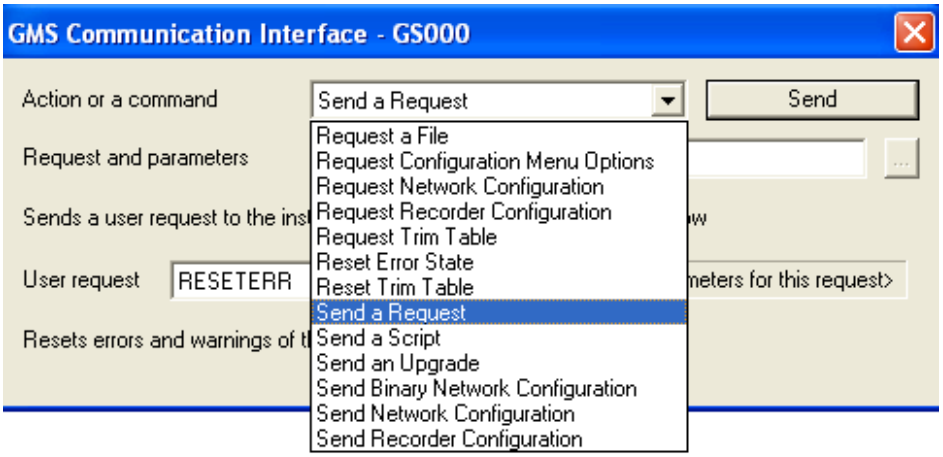


Figure 72. GMS Communication Interface

Action or command	Description
Request a File	Request a file from the instrument, the full path to the file must be specified
Request Configuration Menu Options	The instrument uploads the structure of the configuration menu and saves the file in *\\GeoDAS_DATA\Config\Stationname.mnu.* This file is needed for offline configuration of the instrument as described in chapter 10.2.1.
Request Network Configuration	The instrument uploads the network settings of the instrument and saves the file in *\\GeoDAS_DATA\Config\Stationname.net*
Request Recorder Configuration	The instrument uploads the configuration of the instrument and saves the file in *\\GeoDAS_DATA\Config\Stationname.xml.* This file is needed for offline configuration of the instrument as described in chapter 10.2.1.
Request Trim Table	The instrument will upload a SOH file containing the actual values from the RTC trim table. The latest SOH file can be found under *\\GeoDAS_DATA\StatusFiles\InfoSOH.xml*
Reset Error State	The instrument will clear all errors and warnings
Reset Trim Table	The instrument will clear the RTC trim table
Send a Request	Sends a user request to the instrument. For details see chapter 10.11.1
Send a Script	The instrument will download and execute the attached script. This function is for advanced users only, as it can seriously damage the instrument if the script is not written correctly.
Send an Upgrade	The instrument will download the attached file, which can be any type of the firmware, namely: Bootloader, RTC, DSP, main firmware and or the entire Linux image. More details about the upgrade of the firmware see chapter 12.
Send Binary Network Configuration	The instrument will download binary network configuration file from the server.
Send Network Configuration	The instrument will download the attached manually adjusted network configuration file from the server.
Send Recorder Configuration	The instrument will download the attached manually adjusted recorder configuration from the server.

14.4. Open recorded miniSEED files in GeoDAS

The system is recording miniSEED files (.MSD). For viewing such files, GeoDAS can be used. As the signal is stored inside the mini-seed file in counts, a scaling factor has to be applied when opening the data. If an ***Extended format of MiniSEED files*** is used (see the chapter 10.8.3), scaling factors are applied by GeoDAS automatically, and you may skip the information below.

- Open ***GeoDAS***
- Open recorded mini-seed file from the menu ***File → Open…***

*Event**Error! Bookmark not defined.** files are stored under: \\GeoDAS_DATA\Data\STATION_NAME*
Ringbuffer files are stored under: \\GeoDAS_DATA\DataStreams\STATION_NAME
Testpulses are stored under: \\GeoDAS_DATA\Incoming\NNNNNN

- When you open a '.MSD' file with *GeoDAS*, the following dialog box for scaling factor appears

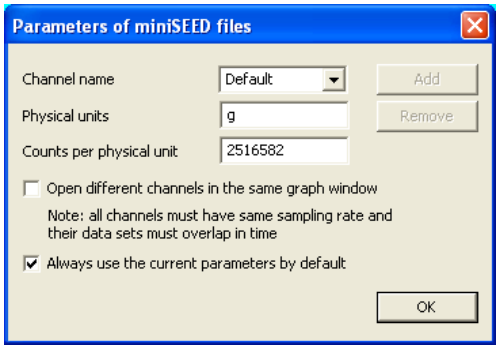


Figure 73, GeoDAS miniSEED parameters

- The values *Physical unit* and *Counts per physical unit* must be set for correct display data in GeoSIG software GeoDAS. The values can be found in the Table 20 or calculated as described in chapter 14.4.2.

Do not tick "Always use the current parameters by default" as it is better to be remembered that scale has to be defined manually for such file type.

- Press ***OK***
- If instead of the scale prompt you get directly the graph, use menu: *Analyse → Parameters… → Parameters of miniSEED files* and press **Edit**:

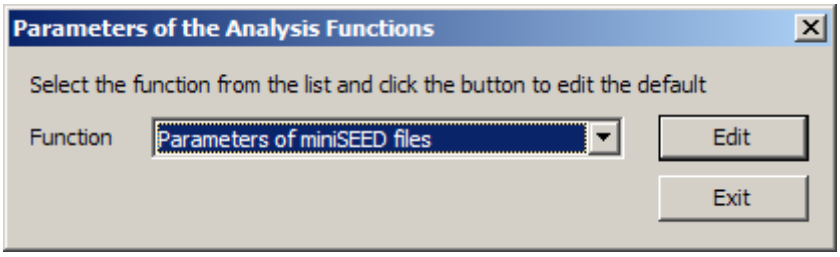


Figure 74, GeoDAS analyses parameters

- Now the dialog box for scaling factor should be seen. Enter the correct values, close and reopen the file you want to see. You will be prompted again for scale, just press Ok as the scale is now correct.

14.4.1. Save predefined Scaling Factors

The scaling factor set under Counts per physical unit is always valid for all channels in the same miniSEED file. In case the channels have different physical units (e.g. if a six channel instrument with two different types of sensors is used) a scaling factor for each channel separately can be defined.

To define a scaling factor for a specific channel, enter the full channel name (e.g. LCAX1) in the *filed Channel name* and press ***Add***

All channels which are not specifically defined are converted with the scaling factor saved under *Default*.

14.4.2. Calculation of the Scaling Factors

If you don't know how to calculate the scaling factor, follow these steps:

Sensors with given full scale

Output Voltage of the sensor must be +/- 10 V

$$\text{LSB} = \frac{FullScale}{0.9 \cdot 2^{23}} = \frac{FullScale}{754'9747.2}$$

$$\text{Scale factor} = \frac{1}{LSB} = \frac{0.9 \cdot 2^{23}}{FullScale} = \frac{754'9747.2}{FullScale}$$

Example, 3 g sensor

$$Scaling\ factor = \frac{0.9 \cdot 2^{23} counts}{3g} = \frac{754'9747.2\,\text{counts}}{3g} = \underline{\underline{2516582\,\text{counts/g}}}$$

Sensors with given Sensitivity

$$\text{LSB} = \frac{\frac{10V}{Sensitivity}}{0.9 \cdot 2^{23} counts} = \frac{1.324547e-6 \frac{V}{counts}}{Sensitivity}$$

$$\text{Scale factor} = \frac{1}{LSB} = \frac{0.9 \cdot 2^{23} counts}{\frac{10V}{Sensitivity}} = \frac{Sensitivity}{1.324547e-6 \frac{V}{counts}}$$

Example, 1000 V/m/s sensor

$$LSB = \frac{0.9 \cdot 2^{23}}{\frac{10V}{1000 \frac{V}{m/s}}} = \frac{1000 \frac{V}{m/s}}{1.324547e-6 \frac{V}{counts}} = \underline{\underline{150994944\, counts/m/s}}$$

The scaling factors of all GeoSIG sensors can be found in the following table

Sensor type	Full Scale	Output Voltage Range	Scaling factor
AC-xx	0.5 g	+/- 10 V	15’099’494 counts/g
	1 g	+/- 10 V	7’549’747 counts/g
	2 g	+/- 10 V	3’774’874 counts/g
	3 g	+/- 10 V	2’516’582 counts/g
	4 g	+/- 10 V	1’887’437 counts/g
VE-13 VE-23	1 mm/s	+/- 10 V	7’549’747 counts/mm/s
	10 mm/s	+/- 10 V	754’975 counts/mm/s
	100 mm/s	+/- 10 V	75’497 counts/mm/s
VE-33	**Sensitivity:** 27.3 V/m/s (27.3 Vs/m)		20’610’820 counts/m/s 20’611 counts/mm/s
VE-53	**Sensitivity:** 1000 V/m/s (2x 500 V/m/s)		754’974’720 counts/m/s 754’974 counts/mm/s
	Sensitivity: 200 V/m/s (2x 100 V/m/s)		150’994’944 counts/m/s 150’994 counts/mm/s

Table 20. Scaling factors of different sensors

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