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GeoSIG
swiss made to measure

GMS^{plus} Measuring System

Features

- ❑ Second generation of **NetQuakes** Recorder
- ❑ **3 or 6 channels, up to 1000 sps sampling rate**
- ❑ **Low noise individual 24-bit Δ−Σ ADC per channel**
- ❑ **Internal built-in and/or external sensors**
- ❑ **Wired Ethernet, Wi-Fi and Serial links**
- ❑ **Smart NTP timing, GPS time base, or time synchronisation via radio channel or cable**
- ❑ **Enhanced connectivity via landline modems, 3G cellular devices and satellite links**
- ❑ **Recording to SD or CF cards, up to 128 GByte**
- ❑ **USB interface for external storage and communication devices**
- ❑ **Continuous data recording to ringbuffers**
- ❑ **Flexible configuration of multiple triggers**
- ❑ **Simultaneous data streaming to several clients**
- ❑ **On board data processing and evaluation**
- ❑ **Rugged aluminium housing with levelling base plate for easy installation**
- ❑ **Configuration and status monitoring via Web Interface compatible with Smartphones**
- ❑ **Simple and secure communication over Internet with full remote management**
- ❑ **Internal battery, low power consumption**
- ❑ **Alarm output with up to 4 relays flexibly configurable for different types of events**
- ❑ **Easily configurable interconnected networks with common timing and triggering**

Applications

- ❑ **Broadband Seismic, Earthquake and Structural measuring and monitoring**
- ❑ **Real-time Seismology for Freefield and Urban Areas**
- ❑ **High Density Earthquake Monitoring Networks**
- ❑ **Shake / Hazard Mapping based on Instrumental Data**
- ❑ **Earthquake Early Warning and Rapid Response**
- ❑ **Damage Estimation, Disaster Management**
- ❑ **Seismic Alarm and Safe Shutdown**
- ❑ **Ambient Vibration Testing (optionally fully wireless)**
- ❑ **Induced Vibration Monitoring and Notification**
- ❑ **Building Code Compliant Instrumentation**

Outline

GMS^{plus} is the ground breaking latest generation of the GeoSIG Measuring Systems with highest performance, excellent operational flexibility and enhanced connectivity. The unit is based on the GMS technology of NetQuakes Seismographs, which are developed in close coordination with USGS, and deployed in high quantities in North America establishing the NetQuakes network.

It includes an Ethernet connection and optionally a Wi-Fi (b/g/n) module to ensure fast and reliable data transfer. Both wired and wireless network interfaces can be used simultaneously.

Its design and efficiency makes it the first choice for any application requiring seismic instruments. With its optimized installation, operation and maintenance philosophy, the GMS^{plus} offers the real possibility to implement high density arrays with total costs at a small fraction of conventional strong-motion seismograph networks.

The instrument's software processes data in real time. If triggered by a seismic event, GMS^{plus} calculates a number of Event Parameters and reports them to a data centre immediately.

GMS^{plus} is a self-contained instrument and is equipped with an uninterruptible power-supply, which provides more than 24 hours autonomy.

The GMS^{plus} uses an "Intelligent Adaptive Real Time Clock" (IARTC) with self-learning temperature compensation, improving the accuracy of the RTC or TXCO significantly. The IARTC is able to synchronize with GPS or NTP to UTC timing to provide high timing accuracy. Optionally the unit itself can act as an NTP server as well.

The instrument can be locally connected to a laptop through its ports for configuration, testing or data retrieval. Same functions are available remotely as well.

Wired or Wireless Interconnected Network options enable the use of several units together in a time and trigger synchronised manner.

The optional USB support enables the user to connect various external devices such as high capacity storage devices, 3G modems, etc.

Set-up and Configuration

An intuitive web interface is available for easy configuration with any web browser. Alternatively the configuration file in XML format can be edited on site through the instrument console, exchanged by replacing the memory card, remotely from a server or through SSH. Even if the configuration file can be manually edited at any time, a tool is provided to edit it securely.

Data Analysis

The GeoDAS software provides basic data evaluation in the field meeting the requirements of most scientific and engineering applications. Optionally GMS^{plus} can perform certain analyses onboard.

Sensor

Various GeoSIG sensors as well as a number of other third party sensors can be housed internally or connected externally to the unit. In case of internal sensor, the levelling is done on the base plate of the GMS^{plus} via its three levelling screws. The base plate is mounted using a single bolt during installation.

Digitizer

Channels:	3 or 6
A/D conversion:	24 bit Δ–Σ converters individual for each channel
DSP:	32 bit output word length
Dynamic range:	146 dB (per bin @ 1 Hz rel. full scale rms)
	137 dB @ 50 sps
Sampling rate:	1000, 500, 250, 200, 100, 50 sps per channel
Max. bandwidth:	DC to 250 Hz
Anti Aliasing Filter:	Analog and digital FIR (finite impulse response)

CPU

Processor:	ARM 400 MHz
RAM:	64 MByte
Operating System:	GNU/Linux

Triggering

Several Trigger Sets can be defined in the instrument. Each set can be flexibly configured regarding the source of trigger, main and advanced trigger parameters, trigger processing and selected channels for storage. A voting logic based on the monitored channels can be defined.

Trigger Filter

Fully independent high-, low- or bandpass trigger filters can be configured.*

Level Triggering

User adjustable threshold.*

STA/LTA Triggering

User adjustable STA / LTA values and STA/LTA trigger and detrigger ratio.

Event Recording

Pre-event memory:	1 to 720 seconds, typical
Post-event duration:	1 to 7200 seconds, typical

Event Summary and Parameters

Content:	PGA, PGV, PGD, SA (at 0.3, 1, 3 Hz)
Transmission delay:	User defined from trigger time

Ring Buffer

Usage:	User can request an event from any period of the ring buffer by specifying the start time/date and the duration from the console or remotely from a server.
Method:	Ringbuffer files with configurable duration which can be uploaded automatically to data server.

Data Stream

Protocol/Compatibility:	GSBU, SeedLink (Earthworm compatible)

Storage Memory

Size and Type:	8 GByte Removable SD Card, Optionally Compact Flash Card higher capacity up to 128 GByte on request FAT32 or EXT4 formatted
Management:	Intelligent management of memory card capacity using policies as per file type and ring buffer capacity specification.
Recording format:	miniSEED with extended information encapsulated into blockette 2000
Estimated Capacity:	Sampling rate [sps] x 0.4 [MB / day / 3 channel] (example: 40 MByte / day / 3 channel @ 100 sps) typical, since the data is compressed, capacity depends on the context of the data.

Self Test

- Permanent self monitoring of hardware and software components without affecting their normal operation.
- User-configurable periodical state of health (SOH) report based on comprehensive test of instrument, which can be requested at any time.
- User-configurable periodical sensor test.

Time Base

Internal:	Intelligent Adaptive Real Time Clock (IARTC)
External:	NTP, optionally GPS, Wired or Wireless Interconnection
Standard TCXO accuracy:	±0.5 ppm (15 s/year) @ +25 °C
	±2.5 ppm (75 s/year) @ -10 to +50 °C
	Optionally higher accuracy TXCO's available.
Accuracy after learn:	< ±0.5 ppm (15 s/year or 2 ms/h)
Accuracy with NTP:	< ±4 ms typical, assuming reasonable access to NTP servers

Power Supply

Input voltage:	90 – 260 VAC / 50 – 60 Hz
Type:	Switched external UL approved power supply screw mountable on any surface (e.g. wall)
Internal battery:	12 VDC, 7.2 Ah, Rechargeable Lead-Acid
Power consumption:	130 mA @ 12 VDC for 3 channels
	200 mA @ 12 VDC for 6 channels
Autonomy:	> 1 day, higher autonomy is optionally available with external batteries.
Battery charger:	Temperature compensated with optional battery fault detection.

Indicators

● Green:	Active Charge LED
● Green:	Run/Stop LED
● Yellow:	Event/Memory LED
● Blue:	Network link/Traffic LED
● Red:	Warning/Error LED

Communication

Configuration, Data Retrieval:	Via Ethernet, Wi-Fi, Serial line, Console, or directly via removable memory card.
Network requirements:	Fixed or Dynamic IP on Ethernet LAN and/or Internet connection with Ethernet interface. Wi-Fi (b/g/n) network with WEP, WPA, WPA2 security and Enterprise Mode
Security:	GeoDAS proprietary protocol over SSL Checksum and software handshaking
Serial ports:	2 ports standard, + 3 ports optional
Baud rates:	Console: 115200 baud
	Serial Stream: 38400, 57600, 115200 baud

Alarm / Seismic Switch / Warning / Notification Option

Alarms:	3 independent or 4 common relay contacts for trigger alarm and/or error SMS notification is optionally available
Alarm levels:	Configurable based on event triggers (NO or NC selectable during order)
Relay Hold-On:	1 to 60 seconds (User programmable)
Capacity:	The contacts are suitable for a low voltage control. In case large load must be switched then external relays should be implemented.
Max voltage:	125 V / 250 mA

Interconnected Network Option

Wired (Common Time and Trigger) or Wireless (Common Time) Interconnection providing synchronisation among several units is optionally available. Common Time and Trigger alternatively can be performed over the Wired/Wi-Fi network.

Modem Option

Internal or external modems of different types, including cellular 3G modems, are available optionally.

Environment

Operational temperature:	-20 to +70 °C
Storage temperature:	-40 to +85 °C
Humidity:	0 to 100 % RH (non condensing)

Housing

Type:	Cast aluminium housing
Size:	296 x 175 x 140 mm (W x D x H)
Size with base plate:	296 x 225 x 156 mm (W x D x H)
Weight:	4.7 kg (optional < 4 kg) excl. sensor, battery, etc
	0.3 kg internal sensor, 2.6 kg battery, 1.3 kg base plate, ask for other options
Protection:	IP65 (NEMA 12), optionally IP67
Mounting:	Base plate with single bolt, surface mount. When base plate levelled and fixed, GMS^{plus} can be replaced without re-levelling.
Easy Transport:	Optional portability accessories are available to facilitate short term measurements.

GMS^{plus} can be customised to suit particular or national regulations on request. Due to such customisation, not all of the functionality mentioned in this datasheet may be available.