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GeoSIG

GMS-18 Measuring System, NetQuakes Recorder

Features

❑ **NetQuakes Recorder**

❑ **Internet Enabled, Optionally Wireless, Multifunctional Measuring System**

❑ **> 130 dB, 3 or 6 channels, up to 500 SPS**

❑ **Linux Operating System with On Board Processing and Evaluation**

❑ **Timing via NTP (Network Time Protocol), Optional GPS or 433 MHz Wi-Synch**

❑ **Enhanced Connectivity Options for GSM, GPRS, Satellite, Radio Telemetry or Landline Modem, Wired/Wireless Network**

❑ **Ring Buffer Continuous Recording**

❑ **Data Stream Output, Network Triggering**

❑ **Rugged, Water Resistant Cast Aluminium Housing with Levelling Base Plate for easy installation and Replacement**

Outline

The GMS-18 is the ground breaking second generation of the GeoSIG Measuring Systems with extended connectivity capability and flexibility. The unit is developed in close coordination with USGS and deployed in high quantities in North America establishing the NetQuakes system.

It includes an Ethernet connection and optionally a 2.4 GHz Wi-Fi module to insure fast and reliable data transfer.

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 offers the real possibility to implement such as high density arrays with total operating 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 calculates Peak Ground Acceleration (PGA), Peak Ground Velocity (PGV), Peak Ground Displacement (PGD) and Response Spectrum (RSA) at various frequencies of the event. GMS can report these parameters, which are related to the strength of shaking, to a data centre where a synopsis (such as a shakemap) for disaster management facilities can be generated in almost real time over the Internet. An event file is also recorded in the memory, which is sent out from the instrument and also securely accessible over the Internet.

GMS is self-contained and is equipped with an uninterruptible power-supply, which provides, excluding options, more than 24 hours emergency operation without external power. Since the battery and power management are critical components in applications, excessive care has been taken in the charger design and the GMS is released as the first unit that can warn of a faulty battery before it is detected by a lack of communication during an AC power loss.

The GMS uses an intelligent "Real Time Clock" (RTC) with self-learning temperature compensation at a fraction of power and thus cost of a TCXO. The RTC is able to synchronize with GPS or NTP (Network Time Protocol based on Internet UTC timing) to provide high timing accuracy.

The instrument can be locally connected to a laptop through its ports for configuration, testing or data retrieval. The internal memory card can also be simply exchanged to retrieve the data. Several advanced communication options exist such as for connection over the Internet; it can utilize a list of servers where the communication is based on a simple but highly secure file exchange.

Wired or Wireless Interconnected Network option enables the use of several units together in a time and trigger synchronised manner; wireless using the Wi-Fi and Wi-Synch options.

Specifications GMS-18 Measuring System, NetQuakes Recorder

Applications

- NetQuakes
- Seismic, Earthquake and Structural measuring and monitoring
- Urban Seismology
- High density monitoring networks
- Shake / Hazard mapping
- Disaster Management

Set-up and Configuration

Instrument setup is based on a configuration file in XML format. The configuration can be edited on site through the instrument console, exchanged by replacing the memory card or remotely from a server. Even if the configuration file can be manually edited at any time, a tool is provided to edit it securely.

Data Analysis

The GeoDAS program provides basic data evaluation in the field. The instrument supplies data in miniSEED format. The GeoDAS Data Analysis Package covers the requirements of detailed laboratory analysis for most earthquake and civil engineering applications. Any other software package reading miniSEED can as well be used.

Sensor

Various GeoSIG sensors as well as any other custom 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 via three levelling screws. The base plate is mounted using a single bolt during installation.

Digitizer

Channels:	3 or 6
A/D conversion:	24 bit delta-sigma converters running in parallel
Dynamic range:	>130 dB
Sampling rate:	Can be any integer division of:
	3 chn: 500 SPS (ie. 500, 250, 167, 125, 100, ..., 1)
	6 chn: 200 SPS (ie. 200, 100, 67, 50, 40, ..., 1)
	More options are available depending on the selected maximum rate.
Bandwidth:	40% of sampling rate
Anti Aliasing Filter	FIR (finite impulse response)

Triggering

Several "Trigger set"s can be defined in the instrument with each one freely defined regarding the source of trigger, trigger processing and selected channels for storage. For each trigger a "Minimum exceedance duration" can be defined to insure that the unit will not trigger on spikes.

Trigger filter

High pass filter:	None, 0.1, 0.2, 0.5, 1 or 2 Hz*
Low pass filter:	None, 2, 5, 10 or 20 Hz*
Band pass filter response:	2 poles on each side* (40 dB / decade)

*: Any other value is freely useable, as long as does not lead to data loss.

Level Triggering

Range:	0.01 to 100 % of full scale

STA/LTA Triggering

STA period:	0.01 to 100 seconds
LTA period:	1 to 1000 seconds
STA/LTA-Ratio:	1 to 100 ratio

Event recording

Pre-event memory:	1 to 100 seconds
Post-event duration:	1 to 1000 seconds

Event summary

Including:	PGA, PGV, PGD, RSA
Transmission delay:	User defined from trigger time

Ring Buffer

Usage:	User can request backward from console or remotely from server for portion of the buffer as start time/date and duration.
Method:	Ringbuffer files with configurable duration.

Data stream

Total Data Time Lag:	0 ms, full correction included
Protocol:	GSBU, optionally Seedlink, Earthworm

Storage Memory

Size and Type:	2 GByte Removable Compact Flash Card higher capacity up to 32 GByte on request FAT32 formatted
Management:	Intelligent management of memory card capacity using policies as per file type and ring buffer capacity specification.
Recording format:	miniSEED
Estimated Capacity:	50 SPS: 18 Mb / day
	100 SPS: 36 Mb / day
	200 SPS: 72 Mb / day
	500 SPS: 180 Mb / day
	since the data is compressed, capacity depends on the context of the data.

CPU

Processor:	Freescale ColdFire
RAM:	32 MByte
Flash:	16 MByte
Operating System:	uCLinux

Time Base

Standard accuracy:	20 ppm (10 min/year @ -10 to +50 °C), higher accuracy optional
Accuracy after learn:	0.5 ppm (16 s/year or 2 ms/h)
Accuracy with NTP:	±10 ms accuracy, assuming reasonable access to NTP-servers
External time interfaces:	GPS (optional), Interconnection (optional)

Power Supply

Input voltage:	90 - 260 VAC / 50 – 60 Hz
Type:	Switched external power supply
Internal battery:	Rechargeable, 12 VDC, 7.2 Ah Lead battery
Power consumption:	130 mA @ 12 VDC
Autonomy:	> 1 day
Battery charger:	Temperature compensated with battery fault detection.

Indicators

🟢 Green:	AC Power present LED,
🟢 Green:	Run/Stop LED
🟡 Yellow:	Event/Memory LED
🔵 Blue:	Network link/Traffic LED
🔴 Red:	Warning/Error LED

Communication

Configuration, Data Retrieval:	via ETHERNET, SERIAL or CONSOLE, or directly from removable memory card.
Network requirements:	Fixed or Dynamic IP on Ethernet LAN and/or Internet connection with Ethernet interface. Wifi network with WEP or WPA security parameters for instrument configuration.
Security:	GeoDAS proprietary protocol Checksum and software handshaking
Serial ports:	2 ports, 3 ports optional
Baud rates:	Console: 19200 bauds
	Stream: 38400, 57600, 115200 bauds

Alarm / Seismic Switch / Warning Option

Alarms:	4 independent relay contacts for trigger alarm or error
Alarm levels:	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:	125VAC / 125 VDC
Max current:	250 mA

Interconnected Network Option

Wired or Wireless (Wi-Synch) time synchronisation (Common Time) among several units are optional. Trigger synchronisation (Common Trigger) is handled over the Wired/Wireless Ethernet.

Modem

Internal or external modems of different types are available optionally.

Self Test

Permanent self monitoring of hardware and software components without affecting their normal operation.
Periodical state of health report based on comprehensive test of instrument.
Period can be set in minutes and/or hours and/or days.
Periodical sensor test. Period can be set in days.

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 can be replaced without re-levelling.