nair *GMS series*

Data Acquisition System

Overview

With its optimised installation, operation and maintenance philosophy *nair* offers the real possibility to measure any dynamic motion with an abundance of features and options.

Highly reduced cost of ownership and user-friendly approach in the design make *nair* the perfect choice for the most advanced user.

Numerous optimisations within the architecture and the design yields unprecedented performance for seamless and fast execution of all system processes.

Fully compatible with existing GeoSIG sensors and can co-exist and co-perform in the same network as the GMS series recorders.

The simple upgrade path makes the *nair* "future proof".

> User-replaceable modular plug-in electronic boards make nair extremely maintainable and future-proof

Applications

- Seismic and Earthquake Recorder
- Structural Health Monitoring
- Real-time Seismology for free-field 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

Key Features

- Modular electronics for user repair and upgrade
- 3 or 6* channels, up to 5000* sps sampling rate
- Low noise individual 32-bit digitser $\Delta-\Sigma$ ADC per channel
- Internal built-in and/or external sensor options
- Wired, Wi-Fi*, cellular*, satellite* links
- Power over Ethernet and wide power range
- Smart satellite* or network timing
- USB for storage and communication devices*
- Continuous data recording to ringbuffers
- Flexible configuration of multiple triggers
- Simultaneous data streaming to several clients
- Virtual signals from realtime processed sensor signal
- Rugged aluminium housing with easy installation
- Web interface compatible with smartphones / tablets
- Simple and secure remote access over Internet
- Alarm output with up to 4 dry-contact relays*
- Internal battery*, low power consumption
- Hot swappable SD card
- Third generation of NetQuakes recorders

GeoSIG Ltd Wiesenstrasse 39, 8952 Schlieren, Switzerland. Tel.: +41 44 810 21 50

www.geosig.com

🇨🇭 *nair* GMS series Data Acquisition System
Specifications

Use and Versatility
An intuitive web interface is available for easy configuration and interaction as well as display of live data graphs and state of health information, using any web browser. The device configuration file in XML format alternatively can be edited on site through the instrument console, exchanged by replacing the memory card, remotely from a server, or through SSH from anywhere around the world. Modular plug-in electronics structure provides highly increased serviceability and maintenance as well as easy hardware field upgrades or replacements.

Data Analysis
nair can perform real-time single/double integration, differentiation, HP/LP/BP filtering, decimation, peak/average calculations on the physical sensor signal and can provide these as real-time virtual signal. All recording and monitoring features can be applied on the virtual signals, simultaneously to the physical signals.

Sensor
Internal: *nair* can include selecte GeoSIG sensors internally. In that case the model name changes accordingly & sensor levelling is achieved via *nair's* three levelling screws of the single bolt mounted base plate.

External: All GeoSIG sensors and any other third-party sensors with following specifications can be connected to nair as external sensor(s):

Sensor output:	Differential:	$\pm$ 20 V, $\pm$ 10 V, $\pm$ 2.5 V
	Software selectable	
Power to sensor:	15 or 24 VDC / 600 mA	

Digitiser
Channels:	3 or 6*
A/D conversion:	32 bit $\Delta-\Sigma$ converters individual for each channel
DSP:	32 bit output word length
Dynamic range:	
Overall:	158 dB per-bin @ 1 Hz rel. full-scale RMS
	150 dB @ 40 sps peak-peak RMS to RMS shorted input noise
Wide-band:	
0 - 500 Hz:	131 dB RMS full-scale peak to RMS shorted input noise
ANSS:	
0.002 - 50 Hz:	141 dB RMS full-scale peak to RMS shorted input noise
0.01 - 15 Hz:	146 dB RMS full-scale peak to RMS shorted input noise
15 - 30 Hz:	146 dB RMS full-scale peak to RMS shorted input noise
Sampling rate:	configurable up to 6 channels @ 5000 sps
	supports 2 different simultaneous sample rates
	each channel can have different sampling rates
Max. bandwidth*:	0 to 1000 Hz standard (other optional)
Anti-aliasing Filter:	Analog and digital FIR (finite impulse response)

Indicators
LED indicators:	RGB LEDs for Power, System, Data, Network and Sensor

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
Level:	Freely user configurable threshold
STA/LTA:	Freely user configurable STA/LTA trigger and de-trigger ratios
Schedule / manual:	After start-up, at a given date/time, after event or manual
Early Warning (EEW)*:	JMA Earthquake Early Warning
Common trigger:	Common triggering among separate units over Ethernet TCP/IP networks

Event Recording
Pre-event memory:	1 - 720 seconds typical; freely user configurable
Post-event duration:	1 - 7200 seconds typical; freely user configurable

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

Data Stream
Protocol/compatibility:	GSBU, SeedLink, Earthworm*

Ring Buffer (Continuous Recording)
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 freely configurable duration which can be uploaded automatically to data server.

Storage Memory
Size and type:	8 GByte Removable SD Card, FAT32 or EXT4 formatted Higher capacity on request*
Management:	Intelligent management of memory card capacity using storage policy to define reserved space per file type.
Recording format°:	miniSEED and extended miniSEED with 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.

▶ Advanced sensor testing with sine, saw, and square wave injections.

▶ Logging of temperature and humidity inside the unit.

Timing
Internal clock:	Intelligent Adaptive Real Time Clock (IARTC)
Sources:	Network Time Protocol (NTP), GNSS (GPS, GLONASS, BeiDou and Galileo) with external antenna up to 5 m cable, or with external module up to 100 m cable*, wired interconnection (ICC)*
Free running drift:	
without any source:	$\pm$ 0.5 ppm @ constant +25 °C
	$\pm$ 2.5 ppm @ -10 to +50 °C
after learn	
(source disconnect):	$\pm$ 0.02 ppm @ constant +25 °C
	$\pm$ 0.1 ppm @ -20 to +50 °C
Accuracy:	
running free:	calculate from above drift
with NTP:	$< \pm$ 0.5 ms
with GPS and ICC:	$< \pm$ 0.001 ms
Common time:	NTP grade timing accuracy among separate units over Ethernet TCP/IP networks

Power
Input voltage:	9 - 48 VDC
Power over Ethernet:	90 - 260 VAC / 50 - 60 Hz to 15 VDC switched UL-approved external power block*
Consumption:	130 mA @ 12 VDC for 3 channels
	200 mA @ 12 VDC for 6 channels
Internal battery*:	7.2 Ah for > 24 h autonomy with intelligent charger, higher autonomy is available with external batteries

Communication and Connectivity
Configuration, Data Retrieval:	Ethernet, Wi-Fi*, Serial line (console), Removable SD card, USB-storage*
Network Requirements:	Fixed or Dynamic IP on Ethernet LAN and/or Internet connection with Ethernet interface or OpenVPN, upload to HTTPS and SFTP severs, Wi-Fi (b/g/n) network with WEP, WPA, WPA2 security and Enterprise Mode*
Security:	GeoDAS proprietary protocol over SSL, Checksum and software handshaking
Connectors:	Power, Ethernet, Multicom (USB and Serial RS-232), SD card*, Sensor(s), GPS*, Alarm*, Option*, Intercon*, Wi-Fi*, micro-USB console*

Alarm and Notification
This provides a seismic switch functionality. SMS notification is available.*

Alarms:	4 independent solid state relay contacts for trigger alarm and/or error (user selectable)
Alarm levels:	Freely user configurable based on event triggers
Relay Hold-On:	1 to 60 seconds, typical; freely user configurable
Capacity:	The contacts are suitable for a low voltage control. In case a large load must be switched then external relays should be implemented.
Max voltage:	60 V / 250 mA per relay

Modem / WAN Interfaces*
External peripheral modules for cellular 3G/4G, SHDSL, fibre optic, etc, are available.

Environment / Reliability
Operational temperature:	-20 to 70 °C▼
Storage temperature:	-40 to 85 °C▼
Humidity:	0 to 100% RH (non-condensing)
MTBF:	> 500'000 hours (based on GMS series)

Housing
Type:	Cast aluminium housing
Connectors:	Metallic circular screwed, or MIL-style*
Size (handles included):	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*), 1.3 kg base plate, 0.3 kg internal battery, ask for other options*
Protection:	IP65 (NEMA 4), IP68 (NEMA 6)*
Mounting:	Base plate with single bolt, surface mount. When base plate levelled and fixed, *nair* can be replaced without re-levelling.
Easy transport*:	Portability accessories are available to facilitate short-term measurements.

*: optional; ▼: use of an internal battery may degrade this specification;
°: Retrieved data can be in the following formats depending on transmission, software and storage method used: miniSEED, DAT, ASCII, SEISAN, SUDS, SAC, SEG-2, Matlab, Artemis

GeoSIG Ltd Wiesenstrasse 39, 8952 Schlieren, Switzerland. Tel.: +41 44 810 21 50

www.geosig.com