# scai Data Acquisition System

## Features

- Modular electronics for user repair and upgrade
- 3 or 6* channels, up to 2000 sps sampling rate
- Low noise individual 24-bit Δ-Σ ADC per channel
- Internal built-in and/or external sensor options
- Wired, Wi-Fi*, GSM*, 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

## 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

With its optimized installation, operation and maintenance philosophy scai 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 scai 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 scai "future proof".

User-replaceable modular plug-in electronic boards make scai extremely maintainable and future-proof.
Use and Versatility
An intuitive web interface is available for easy configuration and interaction as well as display of live data graphs and status of health information, using any web browser.

The device configuration file in XML format can be alternatively edited on site through the instrument console, exchanged by replacing the memory card, remotely from a server or through SSH.

Modular plug-in electronics structure provides highly increased serviceability and maintenance as well as easy hardware field upgrades or replacements.

Data Analysis
scpi can perform real-time single/double integration, differentiation, HPLP/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, simultaneous to the physical signals.

Sensor*
Internal: scpi can include select GeoSIG sensors internally. In that case the model name changes accordingly and the sensor levelling is achieved via the three levelling screws of the single bolt mounted base plate of the scpi.

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

- **Sensor output:**
  - Differential: ± 20 V, ± 10 V, ± 2.5 V
  - Single ended*: 0 - 20 V, 0 - 10 V, 0 - 2.5 V
  - Current loop*: 4 - 20 mA

- **Power to sensor:** 15 or 24 VDC / 600 mA

Digitizer
- **Channels:** 3 or 6*
- **A/D conversion:**
  - 24 bit ±1/2 converters individual for each channel
  - 32 bit output word length
- **Dynamic range:**
  - Overall: 146 dB per-bin @ 1 Hz rel. full scale RMS
  - 137 dB @ 50 sps peak-peak RMS to RMS shorted input noise
- **Wide-band:**
  - 0 - 50 Hz: 118 dB RMS full-scale peak to RMS shorted input noise
  - 0.002 - 50 Hz: 127 dB RMS full-scale peak to RMS shorted input noise
  - 0.01 - 15 Hz: 132 dB RMS full-scale peak to RMS shorted input noise
  - 15 - 30 Hz: 133 dB RMS full-scale peak to RMS shorted input noise
  - Sampling rate: 50 sps
  - Supports 2 different simultaneous sample rates
  - Each channel can have different sampling rates
  - Max. bandwidth*: 0 to 1000 Hz
- **Anti-aliasing Filter:** Analog and digital FIR (finite impulse response)

Triggering
Several Trigger Sets can be defined in the instrument. Each set can be flexibly configured concerning 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-bandpass trigger filters can be configured.
- **Level:**
  - User adjustable threshold.
- **ST/ALTA:**
  - User adjustable ST / LTA values and ST/ALTA trigger and de-trigger ratio.
- **Scheduled / Manual:**
  - After start-up, at a given date/time, after event or manual triggers.
- **Early Warning (EEW)**: JMA Earthquake Early Warning

Event Recording
- **Pre-event memory:** 1 - 720 seconds, typical
- **Post-event duration:** 1 - 7200 seconds, typical
- **Event Summary and Parameters:**
  - Content: PGA, PGV, PS (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:** GGBU, SeedLink, compatible to Earthworm

Storage Memory
- **Size:** 8 GByte removable SD Card, 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 and extended miniSEED with information encapsulated into blockette 2000.
- **Estimated Capacity:**
  - Sampling rate [sp.s] x 0.4 [MB / day / 3 channels] (example: 40 MB / day / 3 channel @ 100 sp.s) typical, since the data is compressed, capacity depends on the context of the data

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

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, 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 ft cable, or Wi-Fi (b/g/n) network with up to 100 m cable*, wired interconnection (ICCI)*

Free running drift:
- **without any source:** ± 0.5 ppm @ constant ±25 °C
- **±2.5 ppm @ -10 to +50 °C**

Accuracy:
- **after learn** (source disconnect): < ±0.5 ppm @ -20 to +50 °C
- **Running free:** calculate from above drift
- **Running with GPS or ICC:** < ±0.001 ms

Power Supply
- **Input voltage:** 9 - 48 VDC
- **Power over Ethernet:**
  - Mode A and B
- **Power 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
- **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 FTP servers, Wi-Fi (b/g/n) network with WEP, WPA, WPA2 security and Enterprise Mode*
- **Security:** GeoSIG proprietary protocol over SSL.
- **Checksum and software handshaking:**
  - Checksum and software handshaking
  - Serial ports: 2 ports (console and streaming)
- **Baud rates:**
  - Console: 115200 baud
  - Serial Stream*: 38400, 57600, 115200 baud

Alarm and Notification*
- **Alarms:**
  - 3 independent or common solid state relay contacts (user selectable) for trigger alarm and/or error; with "acknowledge input" support. This provides a seismic switch functionality.
  - SMS notification is available.
- **Alarm levels:**
  - Configurable based on event triggers
  - Relay Hold-On: 1 to 60 seconds
  - User programmable
- **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:**
  - 125 V / 250 mA

Wired Interconnection (ICCI)*
GeoSIG proprietary wired common time and common trigger interconnection network via special dedicated cable, distributing GPS-grade time precision among several units.

Modem / WAN / LAN 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 aluminum housing
- **Connectors:** Metalic circular screwed, or MIL-style*
  - 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:**
  - 1.3 kg base plate, 0.3 kg internal sensor, 2.6 kg internal battery, ask for other options*
- **Protection:** IP65(NEMA 4), IP67(NEMA 6)*
- **Mounting:** Base plate with single bolt, surface mount. When base plate levelled and fixed, can be replaced without re-orientation.
- **Easy Transport**: Portability accessories are available to facilitate short term measurements

GMS series are produced in different types to suit particular specifications or regulations. Specifications mentioned in this dataset may be different among different types.

*: 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, Anemis

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