



# SG1 Measurement & Simulation Modules Strain Gauge Measurement Function Modules

## 4 Channels, Strain Gauge Measurement

Module SG1 is NAI's latest generation Strain Gauge Measurement Module. This intelligent, four-channel module is used on our Multifunction Embedded I/O Boards and Single Board Computers (SBCs).

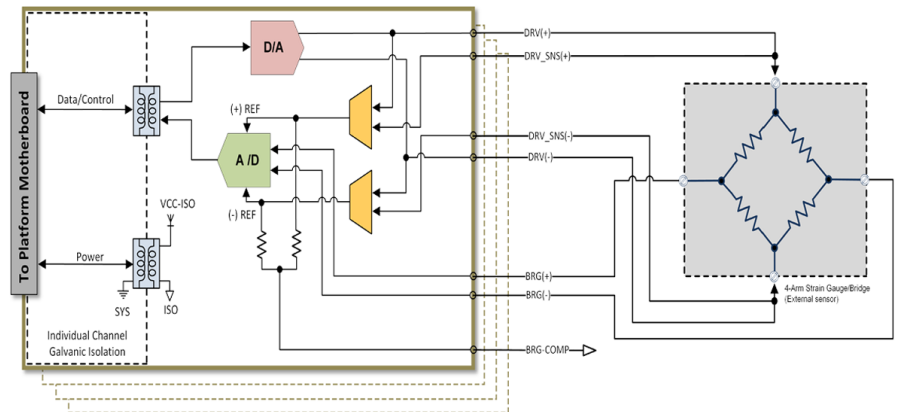
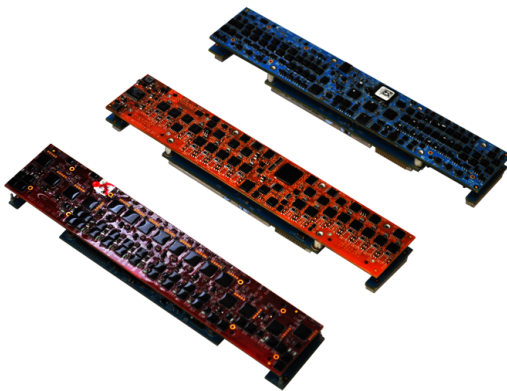
While there are several methods of measuring mechanical strain, the most common is with a strain gauge. The gauge provides electrical resistance that varies in proportion to the amount of strain in the device. The most widely used gauge is the bonded metallic strain gauge. To measure such small changes in resistance, strain gauges are almost always used in a bridge configuration with a voltage excitation source. The general Wheatstone bridge (conventional, 4-arm bridge) consists of four resistive arms with an excitation voltage,  $V_{exc}$ , that is applied across the bridge.

The SG1 module uses four independent, isolated input A/Ds. This module is designed to read output signals from a completed Wheatstone bridge (i.e., it can be used with one or more strain gauge elements as a completed 4-arm Wheatstone bridge) and is commonly used in applications requiring pressure, weight, and stress transducers interface/measurement. Each channel incorporates an  $\Sigma-\Delta$  modulator, a PGA, and on-chip digital filtering intended for the measurement of wide dynamic range signals. Each channel also contains a fourth order digital filter, with several programmable filter options. When properly applied, the filter has deep notches at either 50 or 60 Hz.

The SG1 module provides a DC excitation, programmable from 2 - 12 VDC for interfacing to most load and accelerometer gauges.

The on-board processor/FPGA resources remove the user from the details of managing the A/D interface, register access, and sample timing. The processor firmware provides the user with a simpler user interface with high-level commands and post-calibration data. The module also contains internal factory calibration values stored in Flash. The SG1 automatically recalibrates for changes in reference voltage and die temperature.

Both internal and system calibration are included, providing the user with the option of removing only offset/gain errors internal to the A/Ds or the offset/gain errors of the complete end system.



### Features

- Four independent, isolated input A/Ds
- Designed to read output signals from a completed Wheatstone bridge
- Used in applications requiring pressure, weight, and stress transducers interface and measurement
- On-chip digital filtering for wide dynamic range signal measurement
- DC excitation for load and accelerometer gauge interface (programmable from 2-12 VDC)
- Onboard management of:
  - AD interface
  - Register access
  - Sample timing
- Internal and system calibration is included

**Specifications**

Number of Channels	4 differential input channels for load cell & accelerometer measurement.
Input Interface	Conventional 4-arm Wheatstone bridge, 4 or 6-wire interface.
A/D Converter	32-bit Sigma-Delta
Output Resolution	32-bit
Accuracy	± 0.1% Full-Scale (FS) range
Digital Output	Percent of Full Scale; Ratio (Vin/Vexc)
Gain Settings	1, 2, 4, 8, 16, and 32 (programmable)
Input Impedance	> 10 MΩ
Input Coupling	DC
Bridge Excitation Voltage (Vexc)	Independent Sources, Programmable 2 - 12 VDC
Output Current (Maximum)	100 mA / source
Remote Voltage Sensing	Yes
Output Data Rate	2.5 to 38,400 Hz (dependent on programmable filter settings).
BIT (Built-in-Test)	Continuous background "online" accuracy, open detection capability.
ESD Protection	Designed to meet the testing requirements of IEC 801-2 Level 2. (4 kV transient with a peak current of 7.5 A and a time constant of approximately 60 ns)
Enhanced Functionality (pending)	Each channel provided with: Programmable FFT with selectable sample rate and number of points (up to 64K). User selectable windowing function. Store value of unstrained voltage to include as compensation value
Power	5 VDC @ 850 mA typical (est.)
Ground	Channels isolated from each other and system ground.
Weight	1.5 oz. (42 g)

**Architected for Versatility**

NAI's Configurable Open Systems Architecture™ (COSA®) offers a choice of over 100 smart I/O, communications, or Ethernet switch functions, providing the highest packaging density and greatest flexibility of ruggedized embedded product solutions in the industry. Preexisting, fully-tested functions can be combined in an unlimited number of ways quickly and easily.

**One-Source Efficiencies**

Eliminate man-months of integration with a configured, field-proven system from NAI. Specification to deployment is a seamless experience as all design, state-of-the-art manufacturing, assembly and test are performed - by one trusted source. All facilities are located within the U.S. and optimized for high-mix/low volume production runs and extended lifecycle support.

**Product Lifecycle Management**

From design to production and beyond, NAI's product lifecycle management strategy ensures the long-term availability of COTS products through configuration management, technology refresh and obsolescence component purchase and storage.

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