Strain Gauge Amplifier

SGA-2 MK2

Precise, High-Bandwidth Strain Gauge Amplifier in a Robust Modular Design

- 4-Wire and 6-Wire
- Internal ½- and ¾ Bridge Completion
- Switchable Gain x1, x10, x100
- Bandwidth up to 1.5 MHz
- Auto-Offset Compensation
- USB / RS485 Interface
High Speed Data Acquisition Solutions

SGA-2 Strain Gauge Amplifier

The Strain Gauge Amplifier SGA-2 is designed as a differential front-end amplifier to connect full, half or ¼ bridge strain gauges with internal bridge completion. While the SGA-2 is matched to connect to an Elsys high-precision Transient Recorder it is also suitable for any 3rd part data acquisition system.

Key Capabilities
- 4-wire and 6-wire configuration
- Internal ½- and ¾ bridge completion
- 2 independent channels per module
- Gain x1, x10, x100
- 1.5 MHz bandwidth with gain x1 and x10
- Low offset voltage drift
- Low output noise
- Auto-Offset compensation
- USB or RS485 interface for configuring all settings and read back of the actual output signal.

Applications
- Deformation testing for material characterization
- High speed dynamic material deformation
- Load Cell measurements

Mode of Operation

Gain
The amplification of the signal can be 1, 10 or 100 and is selectable manual per module (2-Channel) or per channel over the software interface (USB or RS485).

Offset
Offsets due unbalanced bridges can be compensated by the amplifier. The SGA-2 MK2 has a build-in auto-offset calibration.

Voltage Excitation
The SGA-2 provides a precision voltage excitation (Vex). As there could be a voltage drop between the power output of the SGA-2 and the bridge, a 2-wire sense signal is fed back to the power supply for precise voltage control. The precision of the excitation voltage is important as it influence directly the output signal. There are two excitation voltages available which are switchable over the software interface or manually.

Output
The output voltage of the amplifier is given by:

Load Cell:
\[ V_{out} [\text{mV}] = G * V_{ex} [\text{V}] * \text{Sensitivity [mV/V]} * \text{Load/Rated Load} \]

Single Micro Strain Sensor (approx.) :
\[ V_{out} = G * V_{ex} * \Delta R_g / R_g * 1/4 \]
\[ V_{out} = G * V_{ex} * G_f * \epsilon * 1/4 \]
\[ V_{out} = G * V_{ex} * G_f * \Delta L / L * 1/4 \]

where \( G_f = \text{Gage Factor} \)

The bridge must be fully compensated.
## Specification

### SGA-2-P/7 MK2
- Module with 2 channels as plug-in to a 19" Rack chassis

### SGA-2-Box/7 MK2
- Alu-box ca. 104 x 165 x 35 mm

### Configurable Modes
- 6-Wire, 4-Wire, Internal ½ Bridge, Internal ¾ Bridge

### Gain (switch selectable)
- x1, x10, x100

### Input stage
- Differential Amplifier

### Bandwidth
- 1.5 MHz (G=1, 10), 600 kHz (G=100)

### Input Impedance
- 2 x 1 MO ca. 25 pF to GND

### Input Bias Current
- < ±60 nA

### Offset Voltage (related to output, *1)
- < ± 2.5 mV

### Offset Voltage Drift (related to output)
- < ± (30 + 1 * Gain) uV/°C

### Gain Error
- < ± 0.1% (G = 1, 10), < ± 0.5% (G = 100)

### Output Impedance
- 50 Ω ±0.5%

### Max. Output Voltage Swing
- ±10 V (no Load)
- ±5 V (Load = 50 Ω)

### Max. Input Voltage
- max. ±42 V (Signal Inputs)
- max. ±2 V (Excitation Voltage Pins)

### Excitation Voltage
- 10 V or 5 V, ±0.1% Configurable by Dip-Switches or Software

### Note: *1) after 1 h Warm-Up Time at T<sub>amb</sub> = 25°C

### Power Supply
- 12 VDC ± 10%, max. 6 W per 2 Ch

### Operating Temperature
- 0 to 45 °C

### Storage Temperature
- -20 to 60 °C

### Rel. Humidity
- < 80% (up to 31 °C) decreasing to < 50% at 31 to 45 °C

### Max. Operating Altitude
- 2'000 m

### Input Connector Type
- Lemo 7-pol. or 16-pol Lemo

### Output
- BNC

### Output Noise

<table>
<thead>
<tr>
<th>Gain</th>
<th>100 kHz</th>
<th>Full</th>
<th>100 kHz</th>
<th>Full</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.03 mVrms</td>
<td>0.3 mVrms</td>
<td>0.05 mVrms</td>
<td>0.8 mVrms</td>
</tr>
<tr>
<td>10</td>
<td>0.08 mVrms</td>
<td>0.6 mVrms</td>
<td>0.3 mVrms</td>
<td>2.5 mVrms</td>
</tr>
<tr>
<td>100</td>
<td>0.6 mVrms</td>
<td>4 mVpp</td>
<td>1.5 mVrms</td>
<td>20 mVrms</td>
</tr>
</tbody>
</table>

### Rack-Version
- 2-Channel Rack-Modules SGA-P/7 or SGA-P/16
- Amp-BU-10 (for up to 5 modules / 10 channels)
- Amp-BU-24 (for up to 12 modules / 24 channels)
- USB interface (emulated COM port) for accessing all installed amplifier. (Internally over RS485)

### Boxed Version
- 2-Channel Modules SGA-Box/7 or SGA-Box/16
- USB interface (emulated COM port)
- External power supply

## Strain Gauge Amplifier Order Information

<table>
<thead>
<tr>
<th>Model Unit</th>
<th>Description</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amp-BU-10 MK2</td>
<td>Rack Case for max. 5 SGA-2 modules (10 channels)</td>
<td>USB</td>
</tr>
<tr>
<td>Amp-BU-24 MK2</td>
<td>Rack Case for max. 12 SGA-2 modules (24 channels), USB Interface</td>
<td>USB</td>
</tr>
<tr>
<td>SGA2-P/7 MK2</td>
<td>2-channel strain gauge amplifier module, input connector 7-pol Lemo, rack-mount</td>
<td>USB</td>
</tr>
<tr>
<td>SGA2-P/16 MK2</td>
<td>2-channel strain gauge amplifier module, input connector 16-pol Lemo, rack-mount</td>
<td>RS485</td>
</tr>
<tr>
<td>SGA2-Box/7 MK2</td>
<td>2-channel strain gauge amplifier in external box, input connector 7-pol Lemo</td>
<td>USB</td>
</tr>
<tr>
<td>SGA2-Box/16 MK2</td>
<td>2-channel strain gauge amplifier in external box, input connector 16-pol Lemo</td>
<td>USB</td>
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