

Single Channel Strain Gauge Amplifier SG-AP-12E/24E-xxx



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■ 1 General Information

To ensure reliable and safe operation, the measuring amplifier must be operated in compliance with the specifications according to this technical description only. These regulations must also be observed if using accessories, that have been ordered from Althen Mess- & Sensortechnik GmbH together with the measuring amplifier.

Notice: Every person who is in charge for the start-up or service of this measuring amplifier must have read this technical manual and must have understood the safety instructions in particular.

■ 1.1 Safety Instructions

When using the amplifier, the legal- and safety regulations for each case of application must be observed. To avoid risks for the system or the operator the following points are to be considered.

- If any visual damage or malfunctions are noticed, the measuring system must be switched off and marked appropriately.
- Disconnect the supply voltage before opening the device.
- The complete measuring unit must be protected against contact and influence of unauthorized persons.
- In the case of a safety-relevant application, where a potential malfunction could cause damage to property or persons, it is imperative that an additional, independent monitor is provided.
- In combination with sensors, the maximum loads / pressures act. must never be exceeded.

If you have reasons to assume that safe operation is no longer possible, immediately take the device out of operation and secure it against unintentional operation.

■ 1.2 Qualified Personnel

This measuring system must be operated by qualified personnel and in compliance with the relevant technical specifications only. Qualified personnel include such persons who are conversant with the setting up, mounting and starting up of the measuring system and who have qualifications that are appropriate for the tasks they're about to perform.

■ 1.3 Intended Use

Amplifiers from Althen Mess- & Sensortechnik GmbH serve to measure the intended measurand and the evaluation thereof in combination with one or more sensors. Any other use over and above that is regarded as non-intended use.

■ 2 Instructions for use of the measuring amplifier

Notice: The parameterizations, further information concerning the scaling as well as the customized analogue output can be found on the additional sheet "Device-Configuration".

Since this amplifier is a highly sensitive measurement technology product, it must be used for its intended use as well as the described operating conditions only. Initial start-up and changes in setup and settings must be done by qualified personnel only. To prevent interventions / modifications made by unauthorized personnel, suitable measures must be taken. Both function and calibration must be checked regularly.

The amplifier is contained in an aluminum housing (IP20). The electrical connections are made via screw-clamps in 4-wire technology. The amplifier must be operated with a separate power source used for measurement devices only.

To avoid possible potential equalization currents over the shield of the cable to the following evaluation unit, this shield should be connected over a suitable capacitor (10 nF / 200 V).

All connection cables and the amplifier must not be installed in proximity to disturbance emitting devices or cables.

Overall the shield connections must be done properly to EMC-standards (as short as possible with large wire cross-section) and connected to a central point (star grounding). In order to not increase the disturbance sensitivity of the amplifier, all cables should be kept as short as possible and should not be extended. Possible cable-bound disturbances (i.e. noise) must be blocked very near the cable ends (evaluation unit) by suitable measures.

Notice: Changes / modification of the amplifier of any kind demand for the explicit approval of Althen Mess- & Sensortechnik GmbH. Changes of any kind done without that approval exclude all possible warranty and/or liability of Althen Mess- & Sensortechnik GmbH.

■ 2.1 Instructions for use of strain gauge sensors

Notice: Strain gauge sensors with a small range are extremely sensitive to improper handling. Force transducers can be destroyed simply by touching. Same applies for the diaphragms of pressure transducers. So, bear in mind: handle with care!

Loading the transducer in excess of the nominal range may result in an increased and lasting zero balance offset as well as damage to the sensor. The same applies to short-term force or pressure impulses that exceed the nominal range.

To most force transducers the force must be applied centrally in order to avoid shear forces, that may be harmful to the sensor, or may cause measurement inaccuracy. Centric force transmission can be ensured by rounded surfaces, joint heads or other suitable guides.

Tightening torques while mounting any sensors may result in an increased zero balance offset.

If the sensor has been replaced, the calibration of the amplifier must be checked. A new adjustment might be necessary.

■ 3 Technical description

The described single channel measuring amplifier serves to supply a strain gauge sensor with a full bridge resistance of 300 Ohms or more and the amplification of the sensor signal.

The supply voltage of the amplifier is galvanically isolated from analogue output, sensor supply and sensor signal.

The excitation voltage is a highly stable, unipolar voltage of 2,5 / 5; or 10 Volts DC.

The circuitry is in 4-wire technology. Standard analogue outputs (0 ... 10 V or ± 10 V) are available for further evaluation.

The coarse amplification is determined by an internal resistor and can be fine adjusted by a potentiometer on front of the amplifier (P-2). A second potentiometer (P-1) on front allows the correction of the zero point.

■ 4 Terminal Assignment

The electrical connections are made via screw clamps. The numbering can be found on the front of the clamps and on the label. The maximum wire cross section is 2,5 mm².

Clamp	Description	Clamp	Description
1	+Supply voltage (+Ub)	7	+ Excitation
2	Supply ground (Ub)	8	- Signal
3	+Supply voltage (+Ub)	9	+ Signal
4	Supply ground (Ub)	10	- Excitation
5	Analogue output ground	11	Housing / Shield
6	Analogue output (0 ... +10 V or. ±10 V)		

Supply ground and analogue ground are isolated galvanically. To unset this isolation clamps 2 and 5 have to be bridged.

■ 4.1 Supply voltage

The supply voltage of version -24E is in the range of 18 to 30 VDC and version -E12 within 10 to 18 VDC. The presence of the supply / internal operating voltage is indicated by a green LED on the front.

To protect the electronics an (to the supply voltage version corresponding) internal self-healing "polyswitch-resettable®" fuse is built in. Whether an external additional fuse is necessary has to be considered. However, an additional external delay fuse of 0,315 A is recommended.

If the indicator LED goes off, the supply voltage and possibly existing external protection has to be checked.

Notice: During switch-on phase the amplifier is capacitive. Thus, the switch-on current is greater than the operating current. This must be taken into consideration when dimensioning and selecting the power pack, especially if several amplifiers are being wired to the same power source.

■ 4.1.1 Galvanic isolation

The supply voltage of the amplifier is galvanically isolated from analogue output, sensor supply and sensor signal. To unset this isolation, clamp 3 and 5 have to be bridged.

■ 4.2 Strain gauge excitation voltage

The described measuring amplifier is able to supply one strain gauge transducer. Any strain gauge full bridge with a bridge resistance of 300 Ohms or more may be connected. The transducer can be supplied with a unipolar voltage of either 2,5 / 5 V or 10 V. This value can be selected by internal solder points LP-3

LP-3-1	LP-3-2	LP-3-3	excitation
set	not set	not set	10 VDC
not set	set	not set	5 VDC
not set	not set	set	2,5 VDC

■ 4.3 Analogue output

Version ...010:

The output is 0 ... 10 V (max. 1 mA)

Version ...B10:

The output is -10 ... +10 V (max. 1 mA)

If a sensor is capable of being loaded in both directions (tension and compression), but the analogue output has to be 0 ... 10 Volts anyways, the zero point can be set up to 5 V.

Other analogue outputs available on request. For parameter settings, further information concerning scaling, or customized analogue outputs, please refer to the additional sheet "Allocation / Device Configuration).

■ 5 Startign up

If an adjustment (A-K-1K / A-D-1K) has been ordered in combination with the amplifier(-s) and/or transducers(-s) it may be necessary for a slight fine adjustment nonetheless. This is due to possible various environmental influences as well as to mounting etc.

If any visual damage or malfunctions are noticed, the measuring system must be switched off and marked appropriately.

- Mount transducer and amplifier
- Connect transducer to the amplifier
- Connect multimeter to analogue output
- Connect supply voltage – consider pin assignment
- Allow the system about 30 min. to warm up
- Check function and calibration of the system

Notice: The allocation of transducer / amplifier is to be complied with. After replacing a transducer, the calibration has to be checked. It is to be noted that there is a slight dependence between zero-point adjustment and amplification (gain).

■ 5.1 Zero point adjustment range

It is to be noted that there is a slight dependence between zero-point adjustment and amplification (gain). The zero-point adjustment range is approx. $\pm 10\%$.

Notice: A base load reduces the remaining load capacity by just that value. Overloading may cause damage!

$$\text{Base load / tare} + \text{maximum load to measure} = \text{capacity of transducer}$$

■ 5.2 Check / adjustment of the amplifier

In order to adjust or calibrate the amplifier a multimeter has to be connected to the analogue output.

Functional Check:

- Unload the measuring device.
- Connect the multimeter (refer to chapter 4 "Terminal Assignment").
- Set the analogue output to 0 Volts.
- Load the measuring device (i.e. the transducer) at least 3 times with its maximum load.
- Load the device with 80 % of its maximum load.
- Check if the analogue outputs complies with the load and is within the designated specs.
- If not, the measurement system might need to be re-adjusted. Above that, the installation position and the overall setup might need an inspection.

Adjustment:

- Unload the measuring device*.
- Connect the multimeter (refer to chapter 4 "Terminal Assignment").
- Set the analogue output to 0 Volts.
- Load the measuring device (i.e. the transducer) at least 3 times with full load.
- Load the device with 80 % of its maximum load.
- Check if the analogue outputs comply with the load and is in the designated specs.
The analogue output value, corresponding to the load is to be set by a qualified person by using "Cal. G".

*Unloaded means with:

Force transducers: no applied force at all

Pressure transducers no pressure, except atmospheric influence

In this unloaded state, adjust the zero-point by using potentiometer "Cal. Z".

In order to reach the required accuracy, it may be necessary to repeat these steps.

Notice: After re-adjusting the potentiometers should be sealed with anti-tamper seal.

■ 5.3 Calculation of amplification determining resistor

The amplification is:

$$G_{\text{total}} = G_{\text{differential amplifier}} \times G_{\text{output stage}}$$

The amplification of the output stage is adjustable with the potentiometer P-02 (GAIN). The adjustable range is:

$$G_{\text{output stage}} = 9,5 \dots 10,5 \text{ Volts}$$

Calculation of the coarse amplification resistor R_G (applies for 10 Volts output):

$$G_{\text{differential amplifier}} = \frac{1000 \text{ mV}}{\text{Exc. (V)} \times \text{Signal} \left(\frac{\text{mV}}{\text{V}}\right)}$$

$$R_G = \frac{60 \text{ kOhm}}{(G_{\text{differential amplifier}} - 4)}$$

Example:

Transducer: 2,5000 mV/V (0,0025V/V)

Excitation: 10,000 V

$$R_G = \frac{60 \text{ kOhm}}{\left(\frac{1\text{V}}{10 \text{ V} \times 0,0025 \text{ V}} - 4\right)} = 1667 \text{ Ohm}$$

■ 6 Maintenance

The flawless function and calibration of the whole measuring system is to be checked regularly. This inspection is also necessary after every repair or change of any component of the measurement system.

■ 7 Old appliances disposal



According to European and German law, it is prohibited to dispose old electronic devices into household waste, but must be collected and disposed of separately.

Amplifiers and measurement units manufactured and sold by Althen Mess- & Sensortechnik GmbH serve B2B purposes only. Therefore, those old appliances must not be given to the communal disposer, but must be given back to the seller or disposed of properly. If you need any further information, please contact your local authorities.

These measures serve to protect the environment and allow recycling and recovery of valuable materials. Furthermore, do electronic devices contain substances that may cause damage to the environment if burned or dumped with normal household waste.

■ Appendix

■ Datasheet

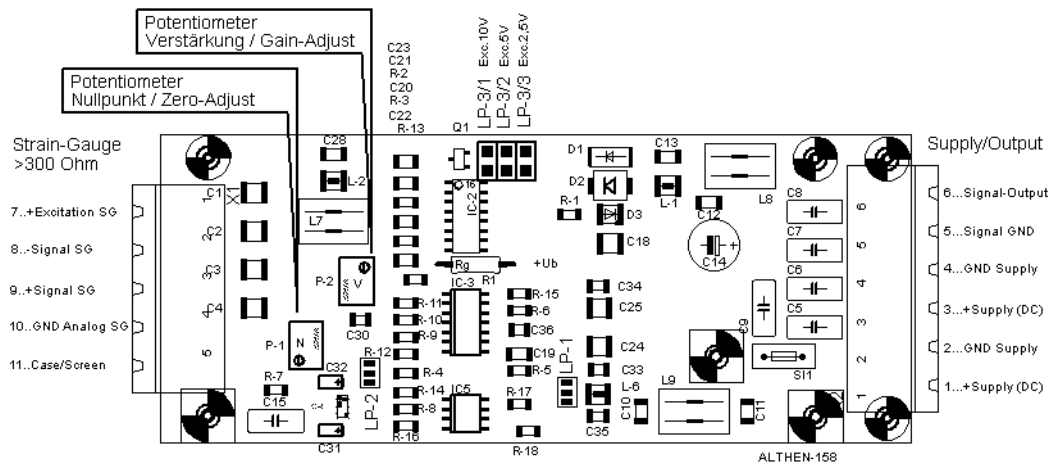
Number of measuring channels	1	Strain gauge full bridge >300 Ω
Supply voltage	12E: 10 ... 18 VDC 24E: 18 ... 30 VDC	Electronic protected against voltage reversal
Isolating proof voltage input to output:	200 V	Higher isolated proof voltage on request
Power consumption	max. 2 W	
Excitation supply	2,5 / 5 / 10 V	
Analogue output	0...10 V / ± 10 V	max. 1 mA Short-period short-circuit protection
Limit-frequency (-3 dB):	1 kHz	
Input resistance	>3 MΩ	
Input sensitivity:	Version...-1: 1 mV/V Version...-2: 2 mV/V Version...-3: 3 mV/V	(Adjustment Range ± 0,5 mV/V) customized on request 0,5 mV/V to 20 mV/V @ 10 V exc. 0,5 mV/V to 40 mV/V @ 5 V exc.
Non-linearity	±0,05 % v.E.	
Electrical connection	Pluggable screw-clamps	
Enclosure	Aluminum-Enclosure (IP20)	
Dimensions (L x H x W):	125x30x55 mm	
Weight	140 g	
Temperature, storage	-20°C ... +60°C	
Operating temperature	+10°C ... +50°C	

■ Order designation

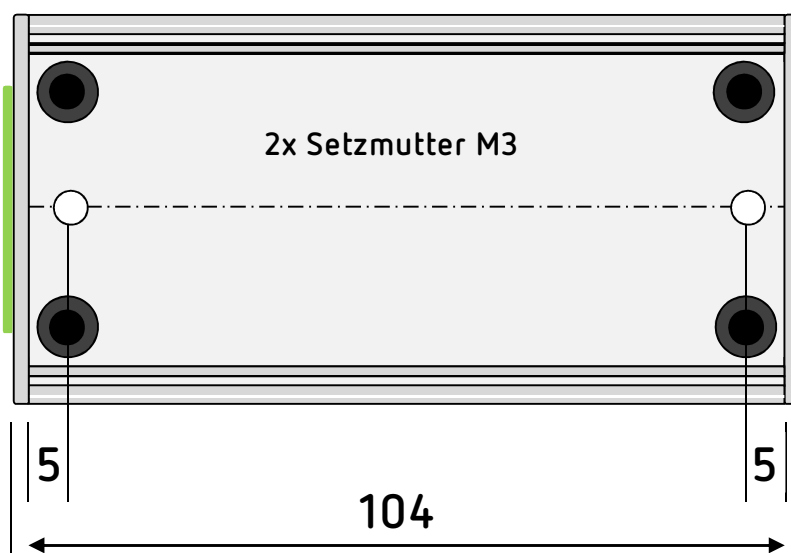
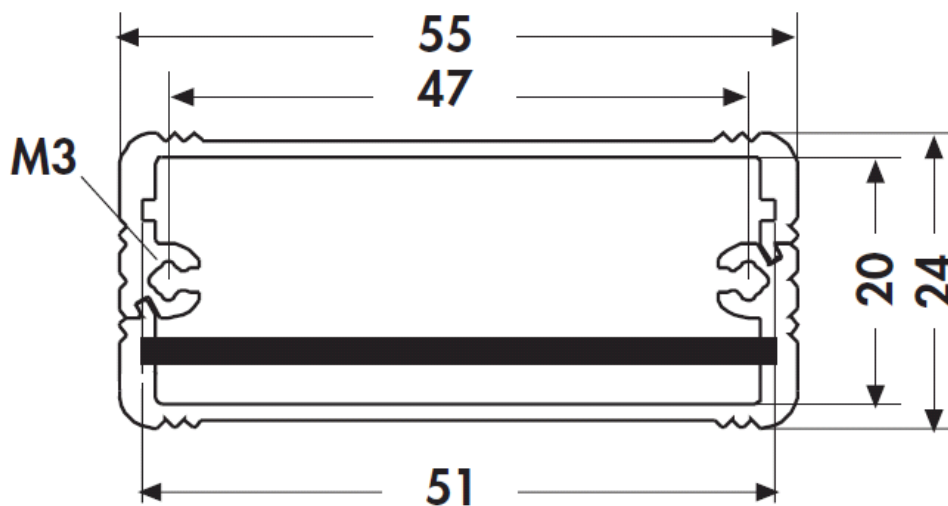
SG-AP...	Single Channel Amplifier in Aluminum Enclosure
...-12E-...	Supply voltage 10 ... 18 VDC
...-24E-...	Supply voltage 18 ... 30 VDC
...-010-...	Analogue output 0...10 V
...-B10-...	Analogue output ±10 V
...-1-...	input sensitivity: 1 mV/V (<i>Adjustment Range Cal. G: 0,5...1,5 mV/V</i>)
...-2-...	input sensitivity: 2 mV/V (<i>Adjustment Range Cal. G: 1,5...2,5 mV/V</i>)
...-3-...	input sensitivity: 3 mV/V (<i>Adjustment Range Cal. G: 2,5...3,5 mV/V</i>)
No declaration	0,5 mV/V to 20 mV/V @ 10 V exc. 0,5 mV/V to 40 mV/V @ 5 V exc.

If an adjustment (A-x-1K) has been ordered with the amplifier, the last part (regarding the standard-sensitivity) of the ordering code is irrelevant. Please state the desired sensitivity along with the order.

■ Component diagram



■ Housing dimensions



■ Overview

Verstärkung Cal. G
Amplification Cal. G

LED Versorgungsspannung
LED Voltage supply



Subject to modifications.

All information describes our products in general form.