

MAL-SG2 / MAL-SG5

Miniature amplifiers for strain gauge

Perfectly conditioned.
For strain gauge.

Load and pressure signals of strain gauges and sensors based on strain gauge technology can optimally be adjusted to the input of a PC data acquisition system with the miniature measuring amplifiers MAL-SG2 and MAL-SG5. The measuring amplifiers feature 5V sensor supply for connected sensors.

Minimum size.

Great performance. Small price.

The miniature format of the MAL-SG2 / MAL-SG5 is ideal to realize measurement applications even if the installation is in problematic locations. Despite the small size, the measuring amplifier features great functionality. All this at a reasonable price.



Connect strain gauge ($\pm 2\text{mV/V}$ or $\pm 5\text{mV/V}$). Get $\pm 5\text{V}$.

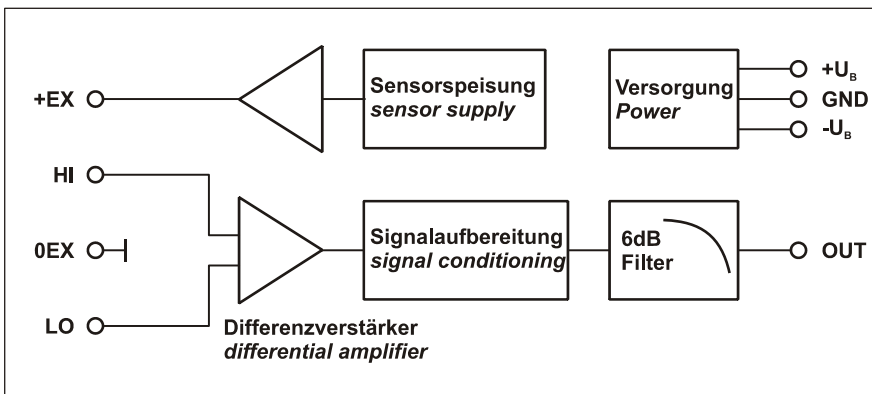
The two measuring amplifier types differ in sensitivity of $\pm 2\text{mV/V}$ (MAL-SG2) or $\pm 5\text{mV/V}$ (MAL-SG5). A $\pm 5\text{V}$ signal proportional to the input signal is provided at the output. The MAL-SG5 with less sensitivity is recommended for external supply more than $+5\text{V}$ or high offset errors.

Compatibility.

The MAL series provides a great variety of measuring amplifiers, measuring converters, or filter modules. They can be used in any combination allowing for the solution of the most individual measuring tasks.

Get connected.

With the backplanes of the BP series varying in size and design, signal connection is easy. The modules just have to be plugged on the relevant slot of the backplane.



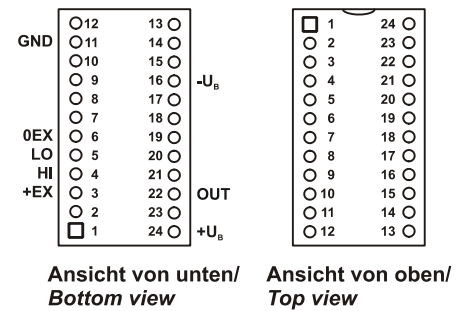
Functional diagram

1 Installation

The measuring amplifier is plugged onto a 24-pole socket. If the marking of the socket is on the left, pin 1 is bottom left.



Check for correct poling. Change modules only at no load!



2 Pin assignment

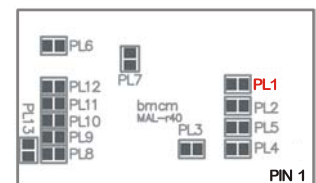
The pin assignment of the MAL-SG2 / MAL-SG5 is illustrated in the figure above and in the following table.

Pin	Name	Function
1, 2	n. c.	-
3	+EX	sensor supply +5V
4	+IN	HI signal input
5	-IN	LO signal input
6	0EX	sensor supply 0V
7, 8, 9, 10	n. c.	-
11	GND	power supply ground
12	n. c.	-

Pin	Name	Function
13, 14, 15	n. c.	-
16	-U _B	supply -7.5V..-15V
17, 18	n. c.	-
19, 20	n. c.	-
21	n. c.	-
22	OUT	amplifier output 0..5V
23	n. c.	-
24	+U _B	supply +7.5V..+15V

3 Jumper configuration

To provide the 5V power supply for active sensors at the +EX pin of the measuring amplifier, the jumper PL1 on the bottom of the module (also see chapter 4 "Interfacing examples") must be closed (factory setting).



All other jumpers are for internal use only and must not be changed!

4 Interfacing examples

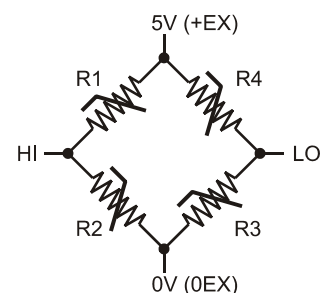
The module output is proportional to the input voltage in all operating modes and ranges. Apply cable shield at one end only. If earthing is required, connect the screen only at one end, otherwise there is a risk of hum pick-up.

4.1 Bridge circuits

The Wheatstone bridge is the preferred circuit for strain gauge measurements allowing for the acquisition of tiniest resistance changes with small efforts.

Depending on the demands, a quarter-, half- or full-bridge configuration is used.

For a bridge to be balanced (output voltage = 0V), the following relation must be fulfilled between the strain gauges and the completion resistors:
 $R_1/R_2=R_4/R_3$



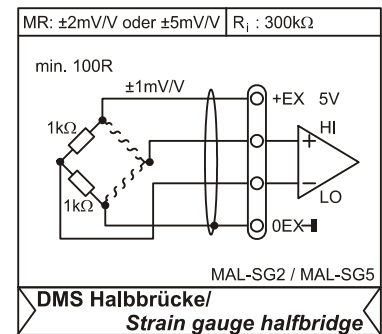
4.2 Strain gauge in half-bridge circuit

The half-bridge allows for optimum temperature compensation.

The strain gauge half bridge is supplied with +5V DC voltage. If jumper PL1 is closed (also see chapter 3), the supply can also be taken from the +EX pin of the measuring amplifier. The input amplifier of the MAL-SG2 / MAL-SG5 is operated differentially.

The output voltage decreases by 50 percent with two strain gauges being active and is quartered if only one strain gauge is active.

A strain gauge half-bridge must be supplemented with a resistor half-bridge (e.g. 2x 1k Ω , 0.1%). See for a balanced bridge circuit (see chapter 4.1). If connecting a resistor half-bridge that is not equivalent in value to the strain gauges, offset errors may occur, but which can be calibrated.

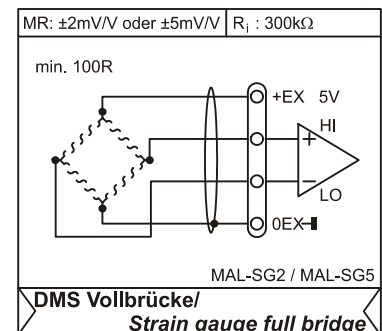


4.3 Strain gauge in full-bridge circuit

The full-bridge compensates for temperature and transverse stress.

The strain gauge full bridge is supplied with +5V DC voltage. If jumper PL1 is closed (also see chapter 3), the supply can also be taken from the +EX pin of the measuring amplifier. The input amplifier of the MAL-SG2 / MAL-SG5 is operated differentially.

The output signal of the measuring amplifier is 5V with four active strain gauges at full load and decreases by 50 percent with only two loaded sensors (like half-bridge).



5 Other MAL amplifiers and connection technology (BP series)

A great variety of miniature measuring amplifiers with or without galvanic isolation is available.

The backplanes of the BP series from bmc differ in size and design allow the comfortable connection to the data acquisition system and for the amplifier supply.

The MAL measuring converters can be plugged on the backplanes in any combination.

The following MAL modules and BP backplanes from bmc are available:



Meas. amplifier	Description
<i>MAL-ISO1/5/10/50</i>	Galv. isolating miniature amplifier for voltage ($\pm 1V/\pm 5V/\pm 10V/\pm 50V$) and current ($\pm 20mA$)
<i>MAL-FU</i>	Frequency-voltage converter in miniature format
<i>MAL-PT100</i>	Miniature amplifier for resistance (0..1k Ω)
<i>MAL-RIK</i>	Miniature amplifier for SEIKA sensors ($\pm 0.5V$ measuring range, 2.5V offset)
<i>MAL-SEIKA</i>	Miniature amplifier for strain gauge ($\pm 2mV/V$ or $\pm 5mV/V$)
<i>MAL-THR</i>	Miniature amplifier for temperature (thermocouple, type K, 0..1250 $^{\circ}C$)
<i>MAL-UI</i>	Miniature amplifier for voltage ($\pm 1V/\pm 5V/\pm 10V$) and current ($\pm 20mA$), 5V sensor supply

Backplane	Description
BP16	16 slots, external device in aluminum housing, 5V sensor supply, connections: 2x Sub-D37
BP2	2 slots, for DIN rail mounting, 5V sensor supply, connections: screw terminals
BP2-BOX	2 slots, external device in IP65 box, 5V sensor supply, connections: screw terminals

6 Important notes for using the MAL-SG2 / MAL-SG5

- The MAL-SG2 / MAL-SG5 are only suitable for extra-low voltages - please observe the relevant regulations!
- Only use an electrical isolated power supply unit (with CE).
- Turn off the power before mounting the module onto the carrier board.
- All accessible pins are electrostatic sensitive devices. Provide for a grounded conductive work place.
- MAL-SG2 / MAL-SG5 must only be operated in closed housings (for reasons relating to EMC).
- Only use non-solvent detergents for cleaning. The product is designed to be maintenance-free.
- The module must not be used for safety-relevant tasks. With the use of the product, the customer becomes manufacturer by law and is therefore fully responsible for the proper installation and use of the product. In the case of improper use and/or unauthorized interference, our warranty ceases and any warranty claim is excluded.



Do not dispose of the product in the domestic waste or at any waste collection places. It has to be either duly disposed according to the WEEE directive or can be returned to bmcm at your own expense.

7 Technical data

(typical at 20°C, after 5min., +7.5V supply)

• Input range

Input voltage DC:
Sensitivity:
Gain calibration at:
Input resistance differential:
Input suppressor circuit for 1sec.:

	MAL-SG2	MAL-SG5
Input voltage DC:	±10mV	±25mV
Sensitivity:	±2mV/V	±5mV/V
Gain calibration at:	+10mV	+25mV
Input resistance differential:	300kΩ	300kΩ
Input suppressor circuit for 1sec.:	max. 200V	max. 200V

• Output range

Output voltage:
Output load:
Amplifier accuracy:
Temperature drift:
Output interference or output ripple:
Current supply sensitivity:
Output filter:
Filter cut-off frequency f_g :

Output voltage:	±5V DC
Output load:	>1kΩ; recommended for higher accuracy: >10kΩ
Amplifier accuracy:	typ. 0.2%
Temperature drift:	100ppm/°C (gain and offset)
Output interference or output ripple:	typ. 5mV _{ss} at app. 100kHz (from DC/DC converter of the backplane)
Current supply sensitivity:	typ. ±10mV/V
Output filter:	1-pole (6dB/oct.)
Filter cut-off frequency f_g :	app. 1kHz

The values for accuracy always relate to the respective measuring range. Errors might add at worst.

• Generator

Generator voltage:
Accuracy:
Connectable sensors:

Generator voltage:	+5V DC
Accuracy:	±0.25%
Connectable sensors:	100Ω..1000Ω

• General

Power supply:
Current consumption:
CE standards:
ElektroG // ear registration:
Max. permissible potentials:
Dimensions:
Protection type:
Temperature ranges:
Relative humidity:
Delivery:
Available accessories:
Warranty:

Power supply:	±7.5V DC .. ±15V DC
Current consumption:	1mA (without sensor) and 51mA..6mA (with sensor 100Ω..1000Ω in full-bridge circuit)
CE standards:	EN61000-6-1, EN61000-6-3, EN61010-1; for decl. of conformity (PDF) visit www.bmcm.de
ElektroG // ear registration:	RoHS and WEEE compliant // WEEE Reg.-No. DE75472248
Max. permissible potentials:	60V DC acc. to VDE , max. 1kV ESD on open lines
Dimensions:	plastic housing 33mm x 20mm x 15mm
Protection type:	IP30
Temperature ranges:	operating temp.: -25°C..+50°C, storage temp.: -25°C..+70°C
Relative humidity:	0-90% (not condensing)
Delivery:	product, description
Available accessories:	module backplanes: BP16, BP2, BP2-BOX (2x MAL-SG2/5 not with BP2/BP2-BOX!)
Warranty:	2 years from date of purchase at bmcm, claims for damages resulting from improper use excluded