

# MAL-R1K

## Miniature amplifiers for resistance

### Perfectly conditioned. Resistance.

Resistance signals can optimally be adjusted to the input of a PC data acquisition system with the miniature measuring amplifier MAL-R1K. A 1mA sensor supply is provided for connected sensors.

### Minimum size. Great performance. Small price.

The miniature format of the MAL-R1K 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.

### 0..1kΩ in. 0..5V out.

The MAL-R1K measures resistances in the 0..1kΩ range. A 0..5V signal proportional to the input signal is provided at the output.



### 2-, 3-, or 4-wire technology.

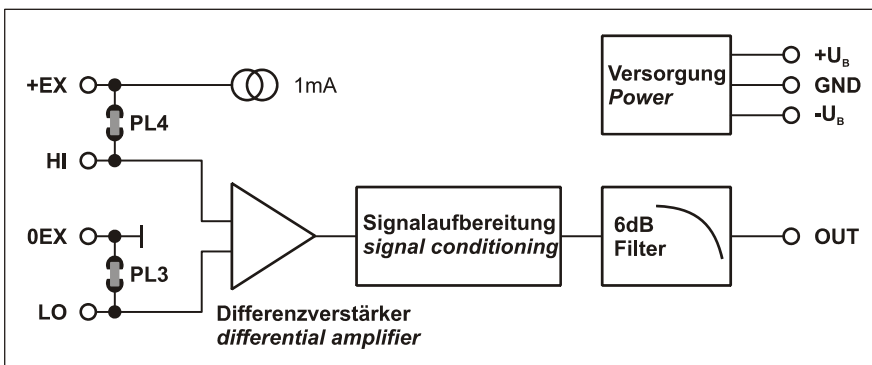
Depending on the demands concerning measuring accuracy, 2-, 3-, or 4-wire measurement is possible with the MAL-R1K. Very easy to configure with solder jumpers on the measuring amplifier.

### 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.



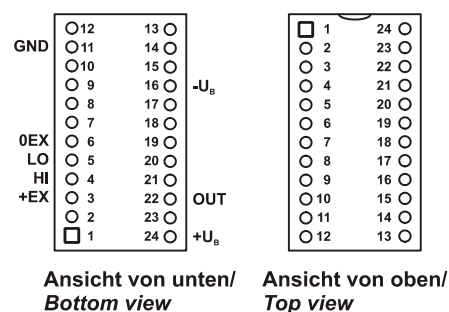
Functional diagram

## 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-R1K is illustrated in the figure above and in the following table.

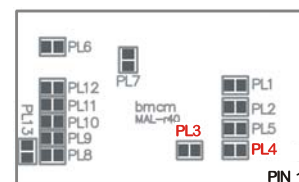
Pin	Name	Function
1, 2	n. c.	-
3	+EX	sensor supply 1mA
4	+IN	HI signal input
5	-IN	LO signal input
6	0EX	sensor supply 0mA
7, 8, 9, 10	n. c.	-
11	GND	power supply ground
12	n. c.	-

Pin	Name	Function
13, 14, 15	n. c.	-
16	-UB	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	+UB	supply +7.5V..+15V

## 3 Jumper configuration

The MAL-R1K can be used as a 2-, 3-, or 4-wire system. Switching to another operating mode is done by changing the configuration of the solder jumpers PL3 and PL4 on the bottom of the module (also see chapter 4 "Interfacing examples", p. 3).

Factory setting of the MAL-R1K is 2-wire measurement (default setting marked in red).



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

Operating mode	PL3	PL4
2-wire connection	closed	closed
3-wire connection	closed	open
4-wire connection	open	open

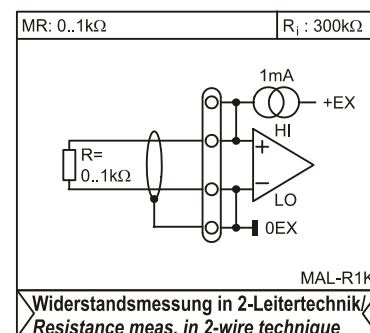
## 4 Interfacing examples

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 Resistance measurement - 2-wire technique

The MAL-R1K is linear between  $0..1k\Omega$ .

The module is precalibrated ex works for 2-wire measurement (PL3 + PL4 closed).

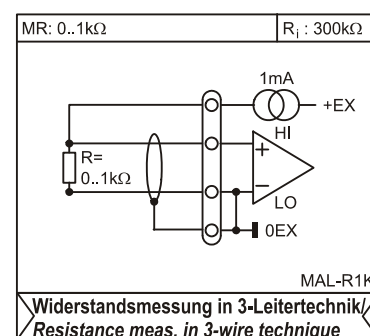


### 4.2 Resistance measurement - 3-wire technique

3-wire technique can be used with long cables ( $>5m$ ) and equal line resistances.

In this case, open jumper PL4 on the module bottom of the MAL-R1K, PL3 remains closed (see chapter 3).

This operating mode only works in carrier boards being prepared and configured for 3-wire technique (e.g. *BP2*, *BP16*, see chapter 5).

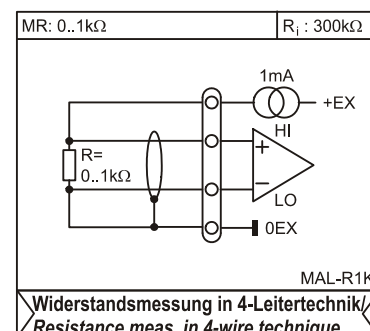


### 4.3 Resistance measurement - 4-wire technique

To eliminate measuring inaccuracies due to high line resistance and other interferences, 4-wire technique is recommended for long cables ( $>5m$ ).

Open jumpers PL3 and PL4 on the module bottom of the MAL-R1K to change to 4-wire technique (see chapter 3).

This operating mode only works in carrier boards being prepared and configured for 4-wire technique (e.g. *BP2*, *BP16*, see chapter 5).



## 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 bmcM are available:

Product	Description
MAL-ISOI/5/10/50	Galv. isolating miniature amplifier for voltage ( $\pm 1V/\pm 5V/\pm 10V/\pm 50V$ ) and current ( $\pm 20mA$ )
MAL-FU	Frequency-voltage converter in miniature format
MAL-R1K	Miniature amplifier for temperature (PT100, 0..300°C)
MAL-R1K	Miniature amplifier for resistance (0..1k $\Omega$ )
MAL-SEIKA	Miniature amplifier for SEIKA sensors ( $\pm 0.5V$ measuring range, 2.5V offset)
MAL-SG2/5	Miniature amplifier for strain gauge ( $\pm 2mV/V$ or $\pm 5mV/V$ )
MAL-THR	Miniature amplifier for temperature (thermocouple, type K, 0..1250°C)
MAL-UI	Miniature amplifier for voltage ( $\pm 1V/\pm 5V/\pm 10V$ ) and current ( $\pm 20mA$ ), 5V sensor supply
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-R1K

- The MAL-R1K is 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-R1K 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

Meas. range (resistance) // Gain calibration:	0..1k $\Omega$ // calibrated at: 1k $\Omega$
Supply current // Input resistance diff.:	1mA // 300k $\Omega$

### • Output range

Output voltage:	0..5V DC
Output load:	>1k $\Omega$ ; recommended for higher accuracy: >10k $\Omega$
Amplifier accuracy:	typ. 0.1%
Temperature drift:	100ppm/°C (gain and offset)
Output interference or output ripple:	typ. 5mV <sub>ss</sub> at app. 100kHz (from DC/DC converter of the backplane)
Current supply sensitivity:	typ. $\pm 10mV/V$
Output filter // Filter cut-off frequency $f_g$ :	1-pole (6dB/oct.) // app. 15Hz

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

### • General

Power supply // Current consumption:	$\pm 7.5V$ DC .. $\pm 15V$ DC // typ. 3mA
CE standards:	EN61000-6-1, EN61000-6-3, EN61010-1; for decl. of conformity (PDF) visit <a href="http://www.bmcM.de">www.bmcM.de</a>
ElektroG // ear registration:	RoHS and WEEE compliant // WEEE Reg.-No. DE75472248
Max. permissible potentials:	<b>60V DC acc. to VDE</b> , max. 1kV ESD on open lines
Dimensions // Protection type:	plastic housing 33mm x 20mm x 15mm // 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
Warranty:	2 years from date of purchase at bmcM, claims for damages resulting from improper use excluded

Manufacturer: BMC Messsysteme GmbH. Subject to change due to technical improvements. Errors and printing errors excepted. Rev. 4.5 01/19/2012