

## **MAL-UI**

### Miniature amplifiers for voltage and current

#### Perfectly conditioned. Voltage and current.

Voltage and current signals can optimally be adjusted to the input of a PC data acquisition system with the miniature measuring amplifier MAL-UI. It features a 5V sensor supply for connected sensors.

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

The miniature format of the MAL-UI 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.

#### $\pm 10V$ , $\pm 5V$ , $\pm 1V$ in. $\pm 5V$ out.

Input ranges of  $\pm 10V$ ,  $\pm 5V$ , or  $\pm 1V$  can be configured for the MAL-UI via solder bridges. A  $\pm 5V$  signal proportional to the input signal is provided at the output.



#### Versatile.

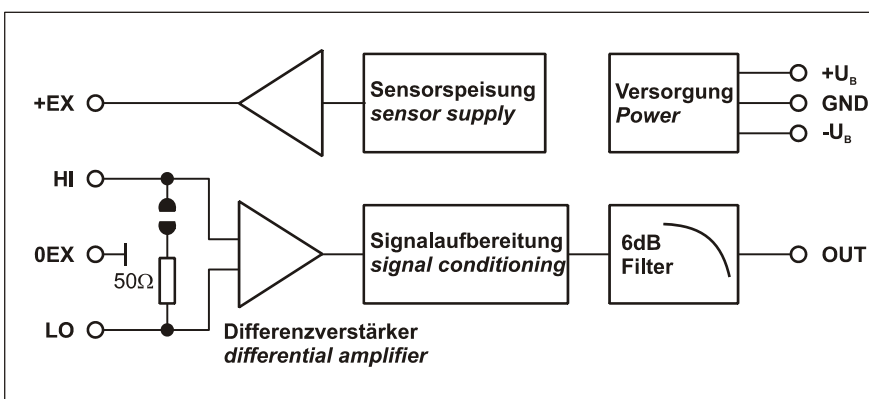
In addition to signal conditioning of voltages, the MAL-UI can be used for current measurement in the  $\pm 20mA$  range. Changing the operating mode is done via soldering bridges on the bottom side of the board.

#### 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.



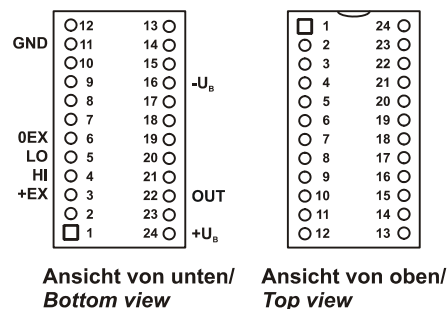
Functional diagram

## 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-UI 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	-UB	supply -7.5V..-15V
17, 18	n. c.	-
19, 20	n. c.	-
21	n. c.	-
22	OUT	amplifier output $\pm 5V$
23	n. c.	-
24	+UB	supply +7.5V..+15V

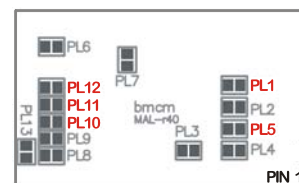
## 3 Jumper configuration

The MAL-UI can process both voltage (measuring range  $\pm 10V$ ,  $\pm 5V \pm 1V$ ) and current (measuring range  $\pm 20mA$ ) signals. Switching to another operating mode (voltage/current measurement) or measuring range is done by changing the configuration of the solder jumpers on the bottom of the module (also see chapter 4 "Interfacing examples").

The cut-off frequency of the MAL-UI is set via the solder bridges PL8 and PL9, its value varying in dependence of the chosen measuring range.

With PL1 closed, a 5V power supply for active sensors is provided at the +EX pin of the measuring amplifier. It can be used, for example, in the backplanes of the BP series (see chapter 5) of bmcM.

Factory setting of the MAL-UI is voltage measurement in the  $\pm 10V$  range with 140Hz cut-off frequency and 5V sensor supply (default setting marked in red).



Operating mode	Bridge closed	Measuring range	Cut-off frequency $f_c$		
			PL8 closed , PL9 open	PL8 closed , PL9 open	PL8+PL9 open
Voltage	PL12	$\pm 10V$	140Hz	15Hz	340Hz
Voltage	PL11	$\pm 5V$	75Hz	8Hz	340Hz
Voltage	PL10	$\pm 1V$	15Hz	2Hz	340Hz
Current	PL5 + PL10	$\pm 20mA$	15Hz	2Hz	340Hz



- Only close one solder bridge at a time to configure the operating mode (PL10, PL11, or PL12) and the cut-off frequency (PL8 or PL9).
- All other jumpers are for internal use only and must not be changed!

## 4 Interfacing examples

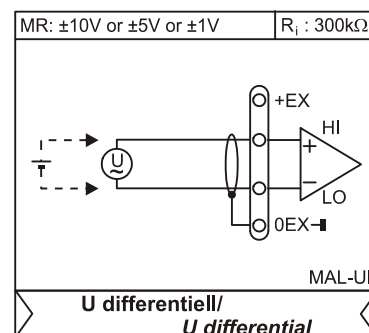
The module output is proportional to the input voltage in all operating modes and ranges. Apply cable shield at one end only. If earthing is required, connect the screen only at one end, otherwise there is a risk of hum pick-up.

### 4.1 Voltage measurement (DC)

DC voltages within the allowed input range are provided at the output as a  $\pm 5V$  signal to be connected to a PC data acquisition system.

- PL12 closed:  $\pm 10V$  (input)  $\approx \pm 5V$  (output)
- PL11 closed:  $\pm 5V$  (input)  $\approx \pm 5V$  (output)
- PL10 closed:  $\pm 1V$  (input)  $\approx \pm 5V$  (output)

Connect LO and 0EX for unipolar measurement.

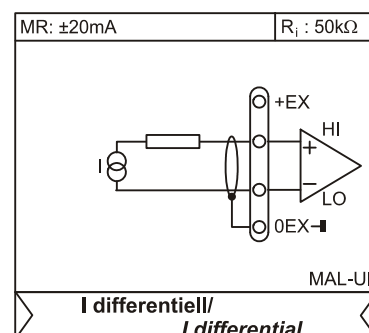


### 4.2 Current measurement

For current measurement with MAL-UI, a  $50\Omega$  shunt is activated (PL5 closed). The measurement is done in the  $\pm 1V$  measuring range.



**Do not connect any power sources as otherwise the shunt might be overloaded!**



## 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 bmcM 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-PT100	Miniature amplifier for temperature (PT100, 0..300°C)
MAL-RIK	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-UI

- The MAL-UI 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-UI 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

Measuring range DC:	$\pm 10V$ (close PL12, ex works), $\pm 5V$ (close PL11), $\pm 1V$ (close PL10) or 20mA (close PL5 + PL10)
Gain calibration at // Input resistance diff.:	+10V // 300k $\Omega$ (for U) or 50 $\Omega$ (for I)
Input suppressor circuit for 1sec:	max. 200V (not in case of current measurement)

### • Output range

Output voltage:	$\pm 5V$ DC
Output load:	>1k $\Omega$ ; recommended for higher accuracy: >10k $\Omega$
Amplifier accuracy // Temperature drift:	typ. 0.2% // 50ppm/°C
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.) // 2-340Hz (configurable with solder bridges PL8 + PL9)

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 // 1mA (without connected sensor)
Sensor supply:	+5V DC supply voltage with $\pm 5\%$ accuracy (typ.)
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