

MAL-FU

Isolating frequency/voltage converter

Transformed.

Frequency becomes voltage.

Ideal for rotation measurement: The frequency/voltage converter measures frequencies and converts them into a proportional voltage signal, which is then adjusted to the input of a PC data acquisition system.

Minimum size.

Great performance. Small price.

The miniature format of the MAL-FU 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.

3 frequency ranges. 0..5V out.

Frequency ranges of 100Hz, 1kHz, or 10kHz can be configured for the MAL-FU via solder bridges. A frequency signal applied to the input generates a proportional voltage in the range of 0..5V at the output.



Clearly safe.

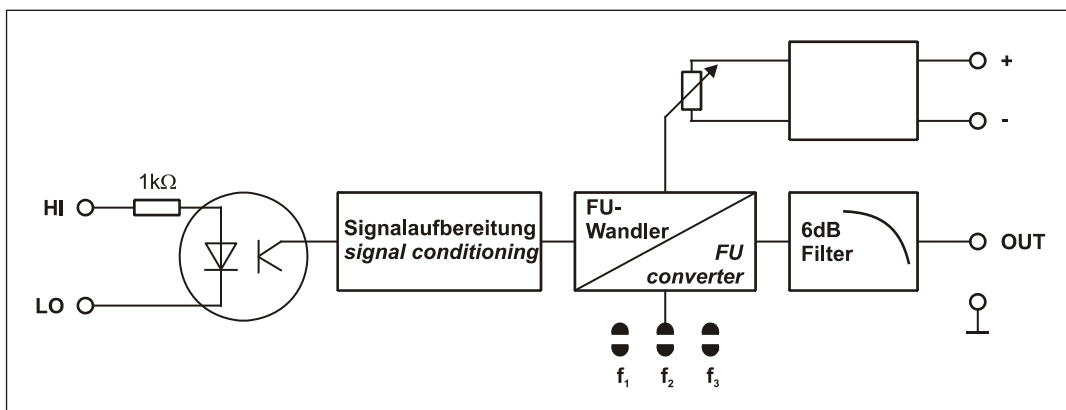
The galvanic isolation provided by a fast optocoupler at the input guarantees interference-free operation and protects the DAQ system and the PC against high potentials.

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.



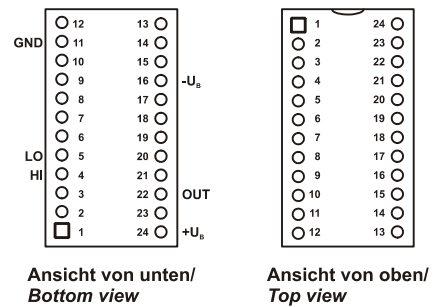
Functional diagram

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-FU is illustrated in the figure above and in the following table.

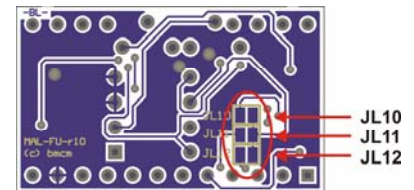
Pin	Name	Function	Pin	Name	Function
1, 2	n. c.	-	13, 14, 15	n. c.	-
3	n. c.	-	16	-U _B	supply -7.5V..-15V
4	+IN	HI signal input	17, 18	n. c.	-
5	-IN	LO signal input	19, 20	n. c.	-
6	n. c.	-	21	n. c.	-
7, 8, 9, 10	n. c.	-	22	OUT	amplifier output $\pm 5V$
11	GND	power supply ground	23	n. c.	-
12	n. c.	-	24	+U _B	supply +7.5V..+15V

3 Jumper configuration

Three frequency ranges can be chosen for the MAL-FU. Switching to another measuring range is done by changing the configuration of the solder jumpers JL10-12 on the bottom of the module (also see chapter 5 "Interfacing examples").

Factory setting of the MAL-FU is frequency measurement in the 1kHz range (default setting marked in red).

Measuring range	Frequency range	Solder bridge closed
1	0..100Hz	JL10
2	0..1kHz	JL11
3	0..10kHz	JL12



- Only close one solder bridge at a time to configure the measuring range (JL10, JL11, or J12).
- All other jumpers are for internal use only and must not be changed!

4 Notes to the functionality of the module

For high linearity, the input signal must have a 1:1 duty factor and should be a rectangular signal (low: <math><1.5V</math>; high: $4..25V$). Gain and linearity errors might occur otherwise, e.g. in case of sinusoidal input signals. The gain must be recalibrated then.

The module is an analog transforming F/U converter. At the lower end of the measuring range (up to 10% of the measuring range), the input frequency has a major effect to the output signal. Operation of the module under 10% of the measuring range is not recommended therefore.

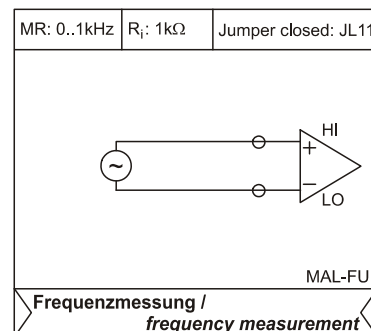
During the signal conditioning the signal is prefiltered already. The output filter decreases the residual ripple in addition.

5 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.

5.1 Frequency measurement

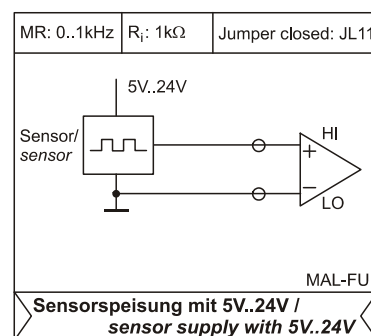
The input is decoupled by an optocoupler. The input range is 4..25V and the input resistance 1k Ω .



5.2 Sensor supply

The module does not provide a sensor supply. A 5V sensor supply can be taken from the BP16 backplane (see chapter 6) if desired.

Connect an extra power supply unit for sensors which need a higher supply voltage.



6 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 different 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 Ω)
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

7 Important notes for using the MAL-FU

- The MAL-FU 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-FU must only be operated in closed housings (for reasons relating to EMC).
- The input frequency produces an output ripple which is especially high at the lower part of the measuring range. The temperature drift of the analog F/U converter depends on the condensers. See for constant temperature conditions especially in the 100Hz measuring range.
- 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.

8 Technical data

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

• Input range

Frequency ranges:

Range-to-range accuracy:

Input voltage // Input current:

Input suppressor circuit for 1sec:

0..100Hz (JL10 closed), 0..1kHz (JL11 closed, factory setting), 0..10kHz (JL12 closed)
$\pm 10\%$, max. $\pm 20\%$
low <1.5V; high = 4..25V // 2mA at 5V, 20mA at 25V
max. 240V AC, 60V according to VDE

• Output range

Output voltage // Output load:

Non-linearity // Temperature drift:

Output filter // Output ripple:

Max. bandwidth // Filter accuracy of f_g :

0..5V DC // >1k Ω ; recommended >10k Ω for higher accuracy
$\pm 0.1\%$ // $\pm 500ppm/^\circ C$ in the 100Hz measuring range, $\pm 100ppm/^\circ C$ in the other ranges
1-pole (6dB/oct.), 10Hz // max. 100mV _{ss}
1Hz in all measuring ranges // $\pm 15\%$

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

• General

Power supply // Current consumption:

CE standards:

ElektroG // ear registration:

Max. permissible potentials:

Dimensions // Protection type:

Temperature ranges // Relative humidity:

Delivery // Available accessories:

Warranty:

$\pm 7.5V$ DC .. $\pm 15V$ DC // typ. 6mA (without connected sensor)
EN61000-6-1, EN61000-6-3, EN61010-1; for decl. of conformity (PDF) visit www.bmcM.de
RoHS and WEEE compliant // WEEE Reg.-No. DE75472248
60V DC acc. to VDE , max. 1kV ESD on open lines
plastic housing 33mm x 20mm x 15mm // IP30
operating temp.: $-25^\circ C$.. $+50^\circ C$, storage temp.: $-25^\circ C$.. $+70^\circ C$ // 0-90% (not condensing)
product, description // module backplanes: BP16, BP2, BP2-BOX
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. 1.2 08/09/2012