

Features

- A/D converter module
- sampling rate up to 500kHz
- 12 or 16 Bit resolution
- integrated RISC controller
- 16 analog inputs

Applications

- measuring analog signals



The analog input modules **MAD** are designed for the

... individual equipment ...

of the PCI-BASE plate *PCI-BASE1000*.

The modules are plugged on the PCI-BASE plate providing for two module slots. The modules of the **MAD/MDA/MCAN** series can be

... combined with each other ...,

so that you can profit of the specific features of different modules at the same time.

The A/D converter modules feature

... 8 differential or 16 single-ended inputs ...

which are accessible via the 37-pole plug of the measuring card.

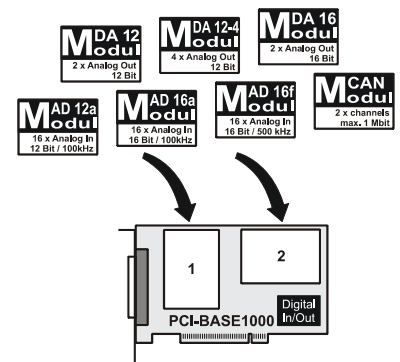
Depending on the module

... sampling rates of up to 500kHz ...

with a resolution of 12 or 16 Bit can be realized, which add up when using several **MAD16f**. So e.g. the maximum sampling rate with two **MAD16f** modules is

1MHz already, if exactly one channel per module is saved. Each channel can be assigned to one measuring range. Switching measuring ranges does not influence the maximum sampling rate. The sampling sequences are generated jitterfree by means of a RISC controller.

All modules are supplied by their own DC/DC converters thus ensuring a decoupled voltage supply for maximum measuring results.



Available MAD modules

Product	Type	Number of channels	Resolution	Scan frequency
MAD12a	Analog input module	16	12 Bit	100kHz
MAD16a	Analog input module	16	16 Bit	100kHz
MAD16f	Analog input module	16	16 Bit	500kHz

In addition we offer analog output modules **MDA12/MDA12-4/MDA16** and the CAN interface module **MCAN**. For further information please have a look at our products on our website at www.bmcm.de.

Installation on the PCI-BASE1000

The **MAD** modules can be plugged on any location of the *PCI-BASE1000*. When using an **MAD** and another module type the best solution is to plug the **MAD** on M1 and the other module on M2. In this way all analog in- and outputs of the Sub-D 37 socket of the PCI-BASE plate are available. If using two **MAD** modules the channels of the module on slot M2 can only be accessed at the internal pin connectors P9 and P10 of the *PCI-BASE1000* plate and can be lead out from the PC using the *ZUKA16* cable.

Plug the modules on the desired slot and ensure that the plugs and sockets fit together exactly (connect channel 1 (red marked line) of *ZUKA16* with pin 1 of the pin connector P9 (square pad)). If the modules are not plugged correctly, the modules and/or the *PCI-BASE1000* may be damaged! The modules are electrostatic sensitive devices - please provide for a conductive pad connected to ground during installation.

Addressing the MAD modules

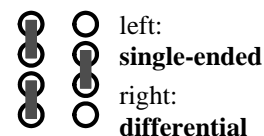
The setting of the address is done via jumpers PL23-25 (see figure below). All **MAD** modules are pre-jumpered to address 0. Addresses 6 and 7 are reserved. When using two modules two different addresses must be assigned! The address determines the assignment of the channels. The **MAD** module with the lower address for example is assigned to channel 1-16, the module with the higher address to channel 17-32.

Address	0	1	2	3	4	5
PL23						
PL24						
PL25						

Address 0 is the factory setting

Sampling sequence when using two MAD modules

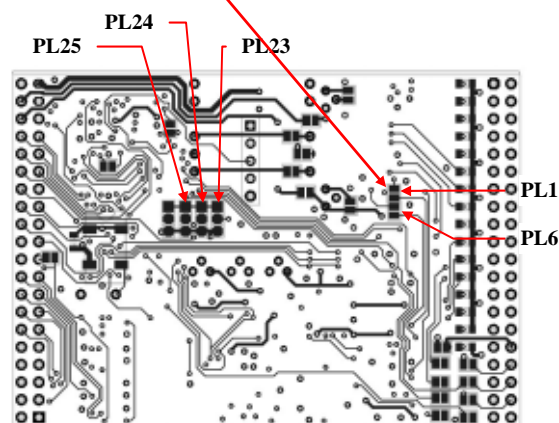
When using two **MAD** modules for sampling, the channels of the module with the lower address are always scanned first with the preset sampling rate, then the channels of the module with the higher address.



Operation mode of the MAD modules

With the jumpers PL1 and PL6 the operating mode is switched from single-ended to differential operation mode. For the single-ended operation mode both jumpers are closed. For the differential operation mode both jumpers must be opened and only the two solder points in the middle are connected via soldering bridges (make settings on the "component-free" side of the module).

In the differential mode, the number of channels is divided by two. Input 1 for example measures the voltage applied between pin 1 (HI) and 9 (LO) etc. This mode is used when a high interference immunity is required.



- The maximum potentials against ground must not exceed $\pm 10V$ in differential mode also! Any channel overload may influence measurements of other channels and may lead to wrong values.
- Open inputs show any, non-predicative voltages.
- For high accuracy and sampling rates the signal source must be very low-resistive ($< 50\Omega$).

Pin assignment of MAD modules with PCI-BASE1000

Module Slot M1 → Sub-D 37, P1, P2

Pin Assignm. Sub-D37	MAD (s.-e.)	MAD (differential)	Pin Assignm. P1, P2
1	IN1	+ IN1	P1/1
2	IN2	+ IN2	P1/3
3	IN3	+ IN3	P1/5
4	IN4	+ IN4	P1/7
5	IN5	+ IN5	P1/9
6	IN6	+ IN6	P1/11
7	IN7	+ IN7	P1/13
8	IN8	+ IN8	P1/15
9	IN9	- IN1	P2/1
10	IN10	- IN2	P2/3
11	IN11	- IN3	P2/5
12	IN12	- IN4	P2/7
13	IN13	- IN5	P2/9
14	IN14	- IN6	P2/11
15	IN15	- IN7	P2/13
16	IN16	- IN8	P2/15
17	-	-	
18	-	-	
19	-	-	
20,21	GND	-	P1/2,4
22,23	GND	-	P1/6,8
24..27	GND	-	P1/10,12,14,16
28..35	GND	-	P2/2,4,...,14,16
36	-	-	
37	-	-	

Module Slot M2 → P9, P10, ZUKA16

Pin Assignm. P9, P10	MAD (s.-e.)	MAD (differential)	Pin Assignm. ZUKA16
P9/1	IN1	+ IN1	1
P9/3	IN2	+ IN2	2
P9/5	IN3	+ IN3	3
P9/7	IN4	+ IN4	4
P9/9	IN5	+ IN5	5
P9/11	IN6	+ IN6	6
P9/13	IN7	+ IN7	7
P9/15	IN8	+ IN8	8
P9/17	IN9	- IN1	9
P9/19	IN10	- IN2	10
P10/1	IN11	- IN3	11
P10/3	IN12	- IN4	12
P10/5	IN13	- IN5	13
P10/7	IN14	- IN6	14
P10/9	IN15	- IN7	15
P10/11	IN16	- IN8	16
	-	-	17
	-	-	18
	-	-	19
P9/2,4	GND	-	20,21
P9/6,8	GND	-	22,23
P9/10,12,...,20	GND	-	24..29
P10/2,4,...,10,12	GND	-	30..35
	-	-	36
	-	-	37

Sampling rates of the modules with PCI-BASE1000

The following table illustrates the maximum overall sampling rate (in kHz) depending on the used module combination on the PCI-BASE1000, if one analog input is saved.

	MAD12a	MAD16a	MAD16f	-
MAD12a	100	100	100/500*	100
MAD16a	100	100	100/500*	100
MAD16f	100/500*	100/500*	500 pro Modul	500

* depends on which module the saved channel belongs to



- The currently available moduls cannot be used on the former version PCI-BASE50!
- As sampling happens via the module hardware, measurements can only be done if at least one input module is plugged on the card.

Important notes for using the MAD modules

- The modules are only suitable for extra-low voltages - please observe the relevant regulations!
- The modules must only be used in closed PC housings (for reasons relating to EMC).
- All accessible pins are electrostatic sensitive devices. Provide for a grounded conductive work place. Wrong installation of the modules on the *PCI-BASE1000* can damage the modules and/or the *PCI-BASE1000*.
- To remove the module first loosen it on one plugged side by levering the module with the utmost caution using a blunt object (e.g. plastic ballpoint pen). Then carefully lift up the other side with your hand moving it back and forth. Exposing the card to strong vibrations requires additional protection of the modules.
- The module ground is electrically connected to the chassis of the PC, which is usually also connected to ground. Be sure to avoid ground loops since they will cause measuring errors!
- The modules are equipped with EEPROMS in which the parameters of the modules are stored. The drivers included with the software read them out and correct the offset if necessary. GAIN errors are recorded in the test report and may be adjusted in the measuring software if necessary. The measuring range is shifted by the offset values resulting in the fact that measurements in the upper ranges may exceed or underlie the true values.
- The Gain is adjusted to "even" values. Therefore only 4000 values (with 12 Bit) and 64000 values (with 16 Bit) of the full range of the converter are used. As a result, the measuring ranges are slightly larger ($\pm 5.12V$) than the indicated measuring ranges, providing the advantage that overranges can be recognized.
- The AD converter of the **MAD16f** module has a code noise of up to ± 5 LSB. For a 16 Bit accuracy, you must average 10 times in order to suppress the noise.
- For cleaning use water and mild detergent only. The modules are designed to be maintenance-free.
- The modules 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.

Technical data MAD modules (typ. at 20°C, 5V, after 10min.)

• Analog input modules (with measuring and analysis software NextView®4)

	MAD12a	MAD16a	MAD16f
Overall sampling rate*:	100kHz	100kHz	500kHz
Min. scan time per channel:	10µs	10µs	2µs
Resolution in the relevant meas. range:	12 Bit (=5mV at $\pm 10V$ MR)	16 Bit (=0.3125mV at $\pm 10V$ MB)	16 Bit (=0.3125mV at $\pm 10V$ MR)
Rel. accuracy in the measuring ranges:	0.025%	0.0015%	0.0015%
Max. noise in the relev. measuring range:	max. ± 2 LSB	max. ± 5 LSB	max. ± 5 LSB
Measuring ranges**:	$\pm 10V, \pm 5V, \pm 2V, \pm 1V$	$\pm 10V, \pm 5V, \pm 2V, \pm 1V$	$\pm 10V, \pm 5V, \pm 2V, \pm 1V$
Basic adjustment in the meas. range:	with static calibration signal in the measuring range $\pm 5V$ with ± 1 LSB		
Converter error in the relev. meas. range:	max. ± 4 LSB		
Error between measuring ranges:	typ. $\pm 0.1\%$		
Channels:	16 single-ended or 8 differential, adjustable with jumpers		
Surge protection:	$\pm 35V$ (when turned on), $\pm 20V$ (when turned off), max. $\pm 20mA$ in total of all input channels!		
Potentials for differential measurements:	max. $\pm 10V$ against ground		
Skew (jitter) with 32-channel operation:	max. 1µs between 1. + 2. module		
Input resistance // Input capacity:	1MΩ (with PC turned off: 1kΩ) // 5pF		
Zero shift // Gain drop:	typ. $\pm 50ppm/^\circ C$, max. $\pm 100ppm/^\circ C$		
Gain drop:	typ. $\pm 50ppm/^\circ C$, max. $\pm 100ppm/^\circ C$		
Frequency accuracy (reg. real time):	max. $\pm 100ppm$		
Frequency drift:	max. $\pm 50ppm/^\circ C$		

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

* The overall sampling rate is the total of the individual channel sampl. rates (e.g. 5 channels à 10µs = 50µs => 20kHz cum. sampl. rate).

** The AD modules are factory set in the range of $\pm 5V$. The measuring range can be set for each channel separately.

For high accuracy and sampling rates the signal source must be very low-resistive ($< 50\Omega$).

• General data

Power supply:	+4.5V..+5.5V from PCI-BASE1000, max 250mA
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. perm. potentials:	60V DC acc. to VDE, max. 1kV ESD on open lines
Temperature ranges // rel. humidity:	operating temp. $-25^\circ C..+50^\circ C$, storage temp. $-25^\circ C..+70^\circ C$ // 0-90% (not condensing)
Dimensions:	~ 74 x 52 x 13 mm ³
Delivery:	product, description
Guarantee:	2 years with effect from sales date, damages at product resulting from improper use excluded

Manufacturer: BMC Messsysteme GmbH. Subject to change due to technical improvements. Errors and printing errors excepted. Rev. 7.0 11/04/2006