bmc messsysteme gmbh

MAD12b/16b

A/D converter modules for PCI-BASEII, PCIe-BASE

Assemble measurement card. Record signals. Analog.

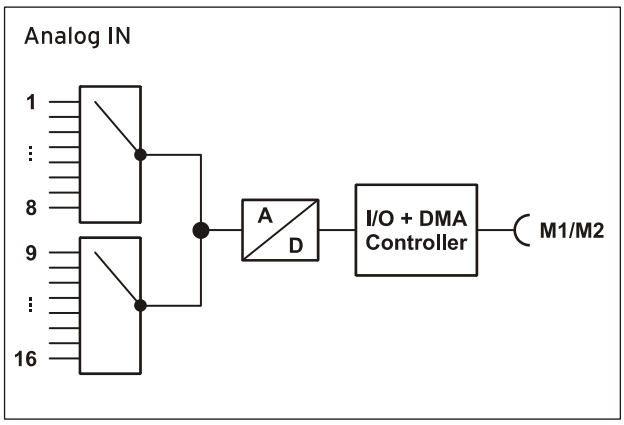
For optimum customization to a measurement application, the PCI/PCIe cards from BMC Messsysteme GmbH can be supplemented with various modules. The analog input modules of the MAD series are perfectly suitable for stationary acquisition of measurement data.

16 analog inputs. 12 or 16 bit.

The MAD modules feature 16 analog inputs. They are available at the 37-pole D-Sub female connector of the PCI/PCIe card. Depending on the version, sampling is done with 12 or 16 bit resolution and max. 100kHz sampling rate.

Measuring range ±10V, ±5V, ±2V, ±1V. Just switch.

To record analog signals, four measuring ranges (±10V, ±5V, ±2V and ±1V) are provided. The range is defined for each channel separately. Changing the measuring range does not influence the maximum sampling rate.



Functional diagram

Undisturbed.

The integrated RISC controller generates jitter-free sampling sequences.

Modularity. Individuality. Flexibility.

A great variety of analog input modules, analog output modules or CAN modules is available to equip the PCI/PCIe base board for a measurement application.
The free combinability of the modules in the two card slots creates individual solutions.

Analog-CAN combination. Synchronous.

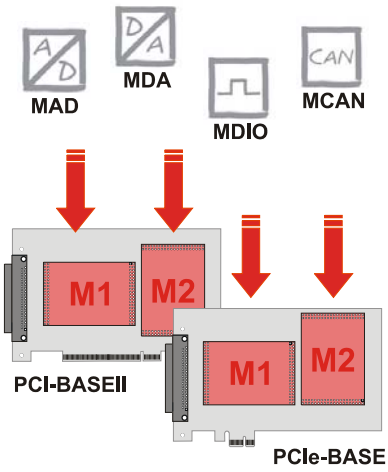
If using both an MAD and an MCAN module together on the PCI-/PCIe card, analog and CAN data are sampled synchronously in time.

1 Installation on the PCI-BASEII, PCIe-BASE

The MAD12b/16b module can be integrated on any slot of the *PCI-BASEII*, *PCIe-BASE* or older versions. Make sure the plugs and sockets fit together exactly.

If using both an MAD and an MDA module, the best solution is to plug the MAD12b/16b on slot M1 and the output module on slot M2. In this way, all analog inputs and outputs are available at the D-Sub 37 female connector of the PCI/PCIe card.

The channels of the module on slot M2 can be accessed at the internal pin connectors K3, K4 of the DAQ card. They can be led out of the PC using the *ZUKA16* connection cable (connect channel 1 (colored line) of *ZUKA16* with pin 1 of the pin connector K3 (square pad), attach 2. connector in parallel).

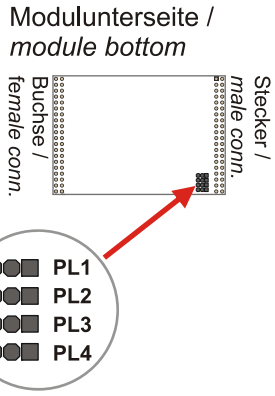


- **If the modules are not plugged correctly, the modules and/or the DAQ card may be damaged!**
- **The modules are electrostatic sensitive devices - please provide for a conductive pad connected to ground during installation.**
- **The channels of slot 2 are only available at the D-Sub37 connector of the DAQ card if the relevant solder jumpers on the base board have been configured correctly (see relating data sheet).**

2 Addressing the MAD modules

The address configuration is done via the 3-pole solder jumpers PL1-3 on the (component-free) bottom side of the module board.

The MAD12b/16b module is preset to address 0. The addresses 6 and 7 are reserved.



Address	0	1	2	3	4	5
PL1	●●□	○●■	●●□	○●■	●●□	■●○
PL2	●●□	●●□	○●■	○●■	●●□	○●■
PL3	●●□	●●□	●●□	●●□	○●■	■●○

Address 0 is factory setting, Address 2-5 available from Rev. 6.0 on

The address determines the assignment of the channels. For example, the MAD module with the lower address is assigned to the channels 1-16, the MAD module with the higher address to channel 17-32.

- **If using two modules (also of different type), two different addresses must be assigned!**
- **If using two MAD modules, the channels of the module with the lower address are scanned with the preset sampling rate first, then the channels of the module with the higher address.**

3 Pin assignment of the MAD modules with the PCI/PCIe card

The following tables show which pins are used for the connection of the analog inputs, depending which slot the MAD module is plugged on or if the connector cable ZUKA16 is used.

MODULE SLOT M1		INPUT MODULE	MODULE SLOT M2	
D-Sub37 PCI(e)-BASE	Connector/Pin PCI(e)-BASE	MAD12b MAD16b	D-Sub37 ZUKA16	Connector/Pin PCI(e)-BASE
1	K1/1	AIn 1	1	K3/1
2	K1/3	AIn 2	2	K3/3
3	K1/5	AIn 3	3	K3/5
4	K1/7	AIn 4	4	K3/7
5	K1/9	AIn 5	5	K3/9
6	K1/11	AIn 6	6	K3/11
7	K1/13	AIn 7	7	K3/13
8	K1/15	AIn 8	8	K3/15
9	K1/17	AIn 9	9	K3/17
10	K1/19	AIn 10	10	K3/19
11	K2/1	AIn 11	11	K4/1
12	K2/3	AIn 12	12	K4/3
13	K2/5	AIn 13	13	K4/5
14	K2/7	AIn 14	14	K4/7
15	K2/9	AIn 15	15	K4/9
16	K2/11	AIn 16	16	K4/11
17*, 18*, 19*	K2/13, K2/15, K2/17	-	17, 18, 19	K4/13, K4/15, K4/17
20, 21, .. , 29	K1/2, K1/4, .. , K1/20	AGND	20, 21, .. , 29	K3/2, K3/4, .. , K3/20
30, 31, .. , 35	K2/2, K2/4, .. , K2/12	AGND	30, 31, .. , 35	K4/2, K4/4, .. , K4/12
36*, 37*	K2/14, K2/16	-	36, 37	K4/14, K4/16

*** assignment changes if analog channels of the 2nd slot are led through (see chapter 1)**

- **The maximum potentials against ground must not exceed ±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 (<50Ω).**

4 Important notes for using the MAD12b/16b

- 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.
- Only use non-solvent detergents for cleaning. The product is designed to be maintenance-free.
- The product 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.
- Improper installation of the modules on the PCI/PCIe card may damage the modules and/or the DAQ card.
- Exposing the card to strong vibrations requires additional protection of the module.
- To remove the module, first loosen it on one plugged side by levering the module with the utmost caution using a blunt object.
- 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 included software drivers read them out and correct the offset if necessary. Gain errors are documented 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 converter range are used. As a result, the measuring ranges are slightly larger (±5.12V) than the indicated measuring ranges, providing the advantage that overranges can be recognized.
- The AD converter of the MAD16b module has a code noise of up to ±5 LSB. For 16-bit accuracy, you must average 10 times in order to suppress the noise.
- If connecting internal ribbon cables to the PCI/PCIe base board, please make sure the modules are well ventilated to prevent excess heating. Also observe the temperature ranges of the PC.

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.

5 Technical data

(typical at 20°C, after 5min.)

- **Analog inputs**

	MAD12b	MAD16b
Total sampling rate*:	100kHz	100kHz
Min. scan time per channel:	10µs	10µs
Measuring ranges**:	±10V, ±5V, ±2V, ±1V	±10V, ±5V, ±2V, ±1V
Typ. noise in the relev. measuring range:	±2 LSB	±5 LSB
Rel. accuracy in the measuring ranges:	0.025%	0.0015%
Resolution in the relevant meas. range:	12 bit (=5mV at ±10V MR)	16 bit (=0.3125mV at ±10V MB)
Converter error:	max. ±4 LSB	
Error between ranges:	typ. ±0.1%	
Basic adjustment in the meas. range:	with static calibration signal in the measuring range ±5V with ±1 LSB	
Channels:	16 single-ended	
Surge protection:	±35V (when turned on), ±20V (when turned off), max. ±20mA in total of all input channels!	
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. ±50ppm/°C, max. ±100ppm/°C // typ. ±50ppm/°C, max. ±100ppm/°C	
Frequency accuracy // Frequency drift:	max. ±100ppm (with regard to real time) // max. ±50ppm/°C	

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

*** The total sampling rate is the sum of the sampling rates of the individual used channels (e.g. if 5 channels are scanned with 10kHz, the total sampling rate adds up to 50kHz). For high accuracy and sampling rates the signal source must be very low-resistive (<50Ω).**

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

- **General data**

Power supply:	+4.5V..+5.5V from PCI-BASEII or PCIe-BASE, max. 300mA
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 // Relative humidity:	operating temp.: –25°C..+50°C, storage temp.: –25°C..+70°C // 0-90% (not condensing)
Dimensions // Delivery:	~ 74 x 52 x 13 mm^3 // product, description
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. 5.0 22.02.2011