bmc messsysteme gmbh

PCIe-BASE

Data Acquisition and Control Card (PCIe)

PCI EXPRESS

Measurement & Control. Multifunctional.

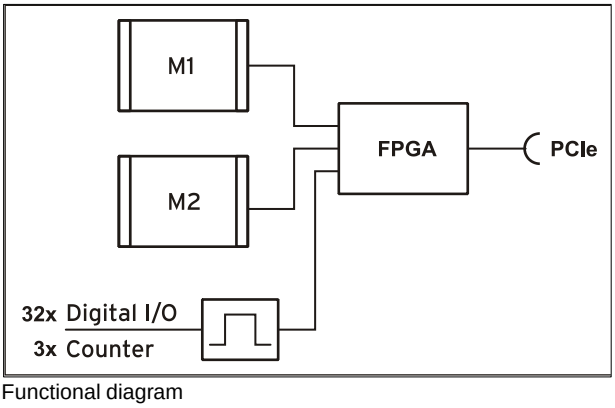
Stationary measurement data acquisition in latest "PCI Express" technology: The PCIe-BASE is a multifunctional data acquisition and control card. Its modular structure guarantees individual and flexible adjustment to a measuring task.

Modular Concept. Optimize Price-Performance-Ratio.

Perfectly adapted to the respective measurement application, data acquisition modules can be selected to equip the two module slots of the
PCIe-BASE. It is the customer who decides about performance and price of his DAQ system!

Modules: MADDA. MDA. MCAN. What Would You Like?

A great variety of analog plug-on modules is available differing in the number of inputs and outputs, resolution and sampling rate. If a MADDA module e.g. is combined with a CAN module, analog measurements and via the CAN interface are possible. Analog, digital, and CAN channels are sampled time-synchronously.



Functional diagram

32 Digital I/O. 3 Counters.

The PCIe-BASE features 32 digital lines, which means that the base board is a digital I/O card itself. The direction of the two 16-bit ports is set via software. 3 counters accessible via any digital inputs allow the acquisition of counting pulses or the connection of incremental encoders.

PCIe. Be on the Cutting Edge.

Designed in "PCIe x1" format, the PCIe-BASE can be installed in any PCIe slot. In the long term, this extremely powerful interface will completely replace the predecessor "PCI" in the PC. Due to Plug&Play, the card is recognized automatically by the PC making installation a lot easier.

Windows®. That's it.

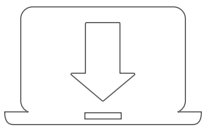
The PCIe-BASE can be used on Windows® XP/7/8/10. The entire software for installation and programming of the multifunction card is included for free.

NextView®. Try for Free.

The DAQ system is supported by NextView®, the software for data acquisition and analysis. A fully functional 14-day trial is included with delivery to directly test the functionality of the PCIe-BASE.

1 Start-up procedure

All available software and documentation for the PCIe-BASE are located on www.bmcm.de/pcie-base-en in the tab **Downloads**.



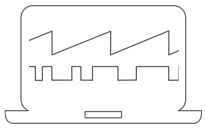
1. Step: Installation device driver

Install the latest driver package in order to use the USB measurement device. You will find the package on www.bmcm.de/pcie-base-en in the tab **Downloads** in the category **BMCM – Drivers**. Open the manual device drivers on www.bmcm.de/man-driver for more information.

2. Step: Connect up

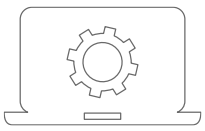
Fix the included bracket to the PCIe-BASE by means of the two hexagonal bolts. To mount the card into the PC, shut down and turn off the PC and open the PC housing. After removing a blank bracket, plug the PCIe-BASE in a free PCI slot of the off-state PC. Boot up the PC and start the Plug&Play installation. The power supply of the card is provided via the PCI bus. If required, additional software components can be installed as described in step 3.

To avoid damages to the card and the PC, turn off the PC before mounting the PCIe-BASE!



3a. Step: Measuring with NextView

To be able to use your measurement system with NextView, you just need to download and install the latest version of NextView on www.nextview.de/download. In case you did not buy NextView, request a free of charge trial version when first starting NextView. Find more information about NextView and its installation on www.nextview.de or in the manual on www.bmcm.de/man-nextview.



3b. Step: Measuring with API

In case you want to use the measurement device without NextView, you need to download and install the free of charge programming interface LIBAD4. You can find this on www.bmcm.de/pcie-base-en in the tab **Downloads** in the category **LIBAD – Programming Interface (API)**, too. Find more information on www.bmcm.de/libad-en or directly in the manual www.bmcm.de/man-libad.

2 Module Concept

2.1 Overview

The following PCB view shows the module slots M1 and M2, which can be assembled with analog data acquisition modules (MADDA series), analog control modules (MADDA/MDA series) or a CAN interface module (MCAN). They can be used in any combination.

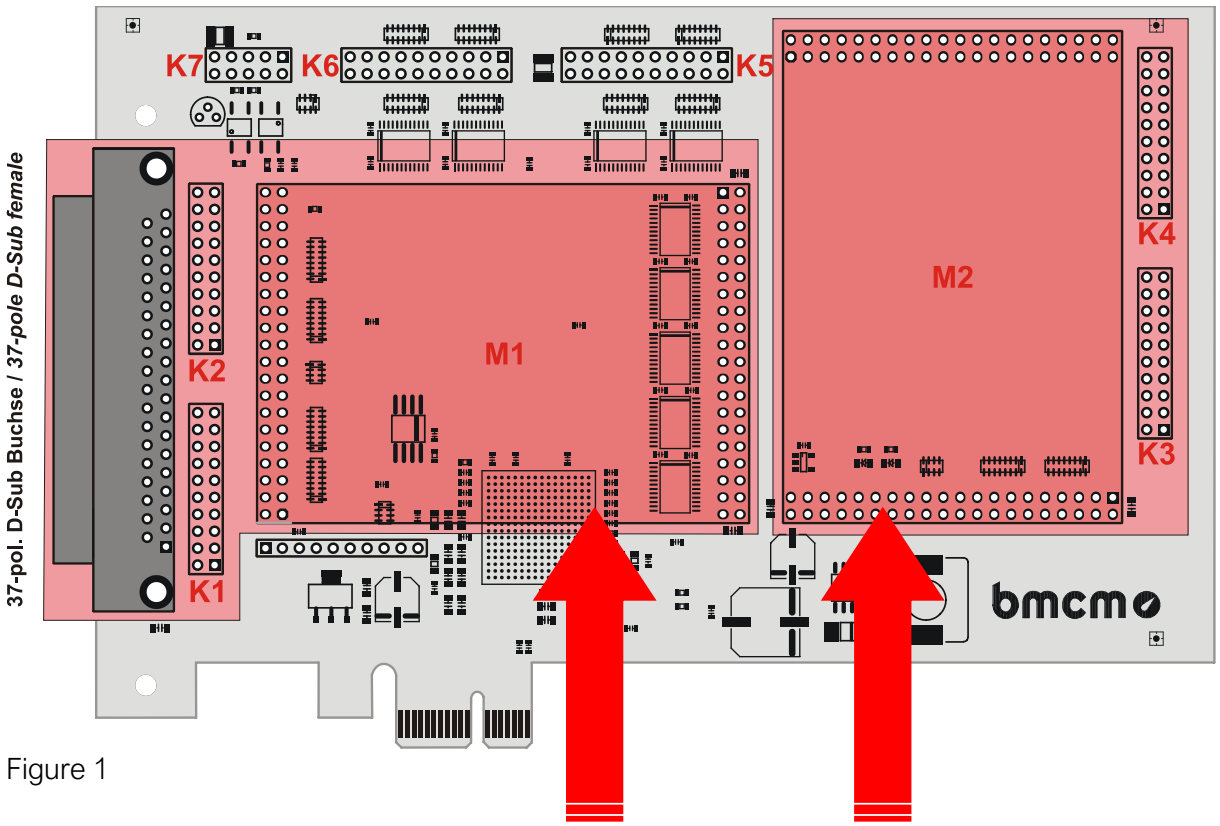


Figure 1

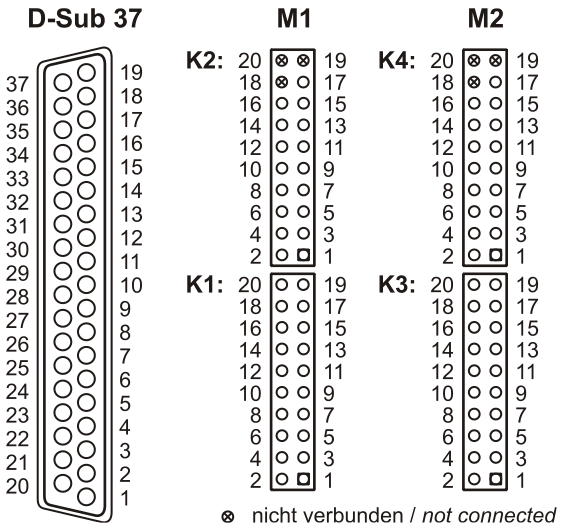
- **MADDA16**
  16 AIn (isolated),
  2 AOut (isolated),
  250kHz, 16 bit
- **MADDA16n**
  16 AIn, 2 AOut,
  250kHz, 16 bit

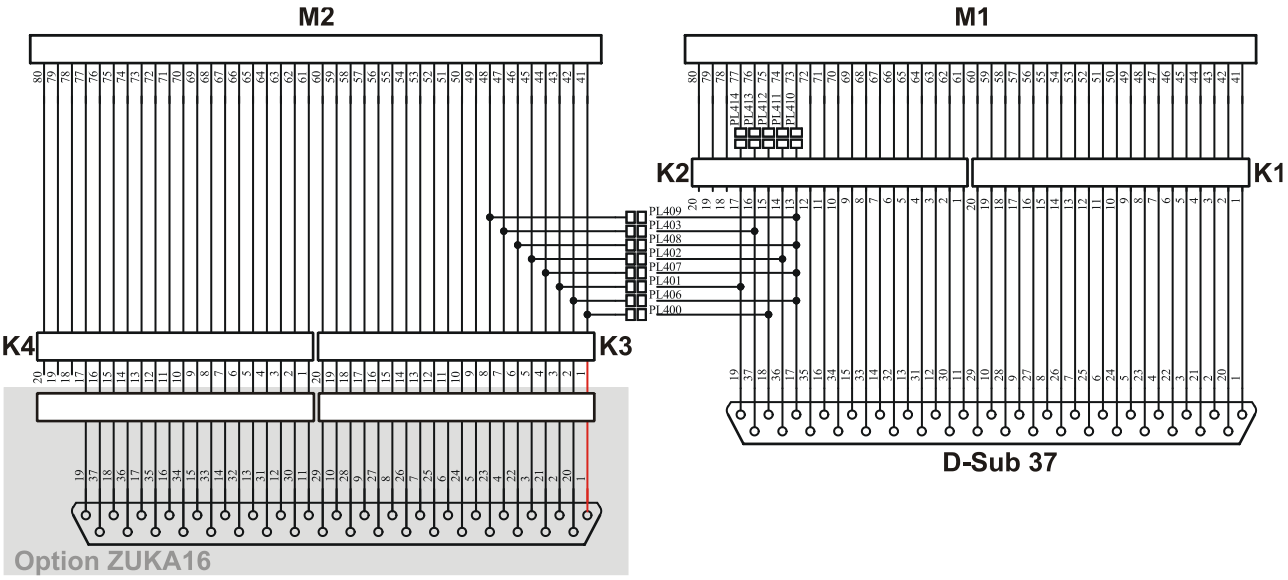
- **MDA16-8i/-4i**
  8/4 AOut (isolated),
  10µs, 16 bit

- **MCAN**
  2 CAN (isolated),
  max. 1 Mbit

2.2 Module Slots M1 and M2

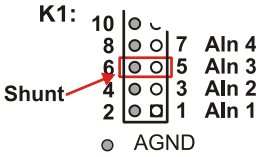
The channels of the module slot M1 are available at the 37-pin D-Sub connector as well as at the pin connectors K1, K2.
The connections of the second module slot M2 are accessible at the pin connectors K3, K4.
With the optional accessory ZUKA16 (see chapter 5), the channels of the module slot M2 are lead out to an additional D-Sub 37 female connector (connect line 1 - colored - of ZUKA16 with pin 1 of the pin connector K3 - square pad - and attach 2. connector in parallel to K4).
The figure below shows the pin assignment of the module slots M1 and M2 of the PCIe-BASE:





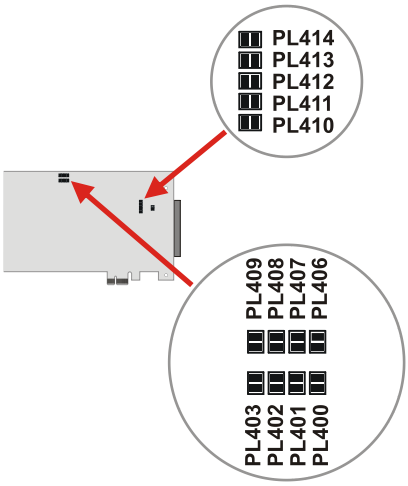
2.2.1 Current Measurement

Analog input modules (MADDA) installed on module slot M1 can be also used for current measurement. To install current shunts (e.g. ZU-CS250R) at the 20-way pin connectors K1 and K2, connect the pin of the relating analog input with the opposite ground pin by a resistor (current shunt).



2.2.2 Lead Connections from M2 to D-Sub37

By closing the solder bridges PL400-403 and PL406-409 and opening PL 410-414 on the bottom side of the PCIe-BASE board, the first four channels of an analog module (MADDA or MDA series) mounted on slot M2 are led to the free pins of the 37-pin D-Sub female to be available from the outside.



Line M2	Solder bridge		MADDA	MDA	Pin K2	D-Sub 37
	close	open				
41	400	412	AIn 1	AOut1	15	18
43	401	414	AIn 2	AOut2	17	19
45	402	411	AIn 3	AOut3	14	36
47	403	413	AIn 4	AOut4	16	37
42, 44, 46, 48	406, 407, 408, 409	410	AGND		13	17

- **Channels of MCAN modules cannot be reached in that way at the D-Sub37 female connector!**
- **The corresponding ground pin for the analog channels of the M2 module slot is exclusively available at pin 17 of the D-Sub 37.**

2.3 Pin Assignments of the Module Slots

The following table shows which pins are used to connect the analog or CAN channels. The channels of the module in slot M1 are accessible at the 37-pin D-Sub female of the DAQ card. The connections of the module in slot M2 can be led through with the add-on cable ZUKA16 to an additional 37-pin D-Sub female.

MODULE SLOT M1		DATA ACQUISITION and CONTROL MODULES			MODULE SLOT M2	
D-Sub37 (PCIe-BASEII)	Plug / Pin	MADDA	MDA	MCAN	D-Sub37 (ZUKA16)	Plug / Pin
1	K1/ 1	AIn 1	AOut 1	-	1	K3/ 1
2	K1/ 3	AIn 2	AOut 2	CAN1 L	2	K3/ 3
3	K1/ 5	AIn 3	AOut 3	CAN1 GND	3	K3/ 5
4	K1/ 7	AIn 4	AOut 4	-	4	K3 / 7
5	K1/ 9	AIn 5	AOut 5 [2]	-	5	K3/ 9
6	K1/11	AIn 6	AOut 6 [2]	-	6	K3/11
7	K1/13	AIn 7	AOut 7 [2]	CAN2 H	7	K3/13
8	K1/15	AIn 8	AOut 8 [2]	-	8	K3/15
9	K1/17	AIn 9	-	CAN2 5V	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 [1]	K2/13	-	-	-	17	K4/13
18 [1]	K2/15	AOut 1	-	-	18 [4]	K4/15
19 [1]	K2/17	AOut 2	-	-	19 [4]	K4/17
20	K1/ 2	AGND	AGND1 [3]	-	20	K3/ 2
21	K1/ 4	AGND	AGND1 [3]	CAN1 H	21	K3/ 4
22	K1/ 6	AGND	AGND1 [3]	-	22	K3/ 6
23	K1/ 8	AGND	AGND1 [3]	CAN1 5V	23	K3/ 8
24	K1/10	AGND	AGND2 [2 3]	-	24	K3/10
25	K1/12	AGND	AGND2 [2 3]	CAN2 L	25	K3/12
26	K1/14	AGND	AGND2 [2 3]	CAN2 GND	26	K3/14
27	K1/16	AGND	AGND2 [2 3]	-	27	K3/16
28	K1/18	AGND	-	-	28	K3/18
29	K1/20	AGND	-	-	29	K3/20
30	K2/ 2	AGND	-	-	30	K4/ 2
31	K2/ 4	AGND	-	-	31	K4/ 4
32	K2/ 6	AGND	-	-	32	K4/ 6
33	K2/ 8	AGND	-	-	33	K4/ 8
34	K2/10	AGND	-	-	34	K4/10
35	K2/12	AGND	-	-	35	K4/12
36 [1]	K2/14	AGND	-	-	36	K4/14
37 [1]	K2/16	AGND	-	-	37	K4/16

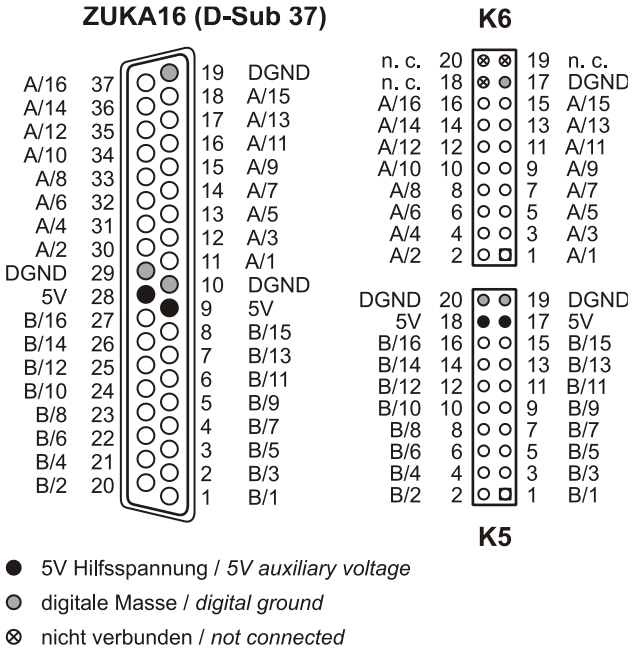
[1] assignment changes if analog channels of the 2nd slot are led through (see chapter 2.2.2) [2] only MDA16-8i

[4] AGND1 refers to AOUT1-4, AGND2 refers to AOUT5-8 of the MDA16-8i

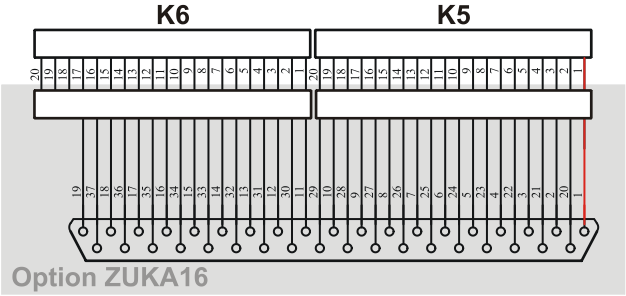
3 Digital Channels

The PCIe-BASE features two digital ports with 16 inputs or outputs each. The lines are bidirectional. The connections are designed as two 20-way pin connectors (male) on the board (see Figure 1, p.3).
Pin connector K6 => port A, line 1..16
Pin connector K5 => port B, line 1..16

- **The digital inputs and outputs are protected by serial resistors!**
- **At PC start, port A is set to input, port B to output.**
- **Digital inputs will always be read synchronously in time together with the analog inputs.**
- **Make sure the digital outputs of the device do not drive against the outputs of your signals.**



With the optional accessory ZUKA16 (see chapter 5), the digital channels are led to an additional 37-pin D-Sub female connector (connect line 1 (colored) of ZUKA16 with pin 1 of the pin connector K5 (square pad), attach 2. connector in parallel to K6).
The right figure shows the connection of the pin plugs K5, K6 with the D-Sub37 of a ZUKA16.



3.1 Pin Assignment

The following table shows the pin assignment of the pin connectors K5, K6 and of the 37-pin D-Sub female connector of the ZUKA16, at which the digital lines are accessible:

Port/ Line	D-Sub37 (ZUKA16)	Connector / Pin
B/1	1	K5 / 1
B/2	20	K5 / 2
B/3	2	K5 / 3
B/4	21	K5 / 4
B/5	3	K5 / 5
B/6	22	K5 / 6
B/7	4	K5 / 7
B/8	23	K5 / 8
B/9	5	K5 / 9
B/10	24	K5 / 10
B/11	6	K5 / 11
B/12	25	K5 / 12
B/13	7	K5 / 13
B/14	26	K5 / 14
B/15	8	K5 / 15
B/16	27	K5 / 16

Port/ Line	D-Sub37 (ZUKA16)	Connector / Pin
A/1	11	K6 / 1
A/2	30	K6 / 2
A/3	12	K6 / 3
A/4	31	K6 / 4
A/5	13	K6 / 5
A/6	32	K6 / 6
A/7	14	K6 / 7
A/8	33	K6 / 8
A/9	15	K6 / 9
A/10	34	K6 / 10
A/11	16	K6 / 11
A/12	35	K6 / 12
A/13	17	K6 / 13
A/14	36	K6 / 14
A/15	18	K6 / 15
A/16	37	K6 / 16

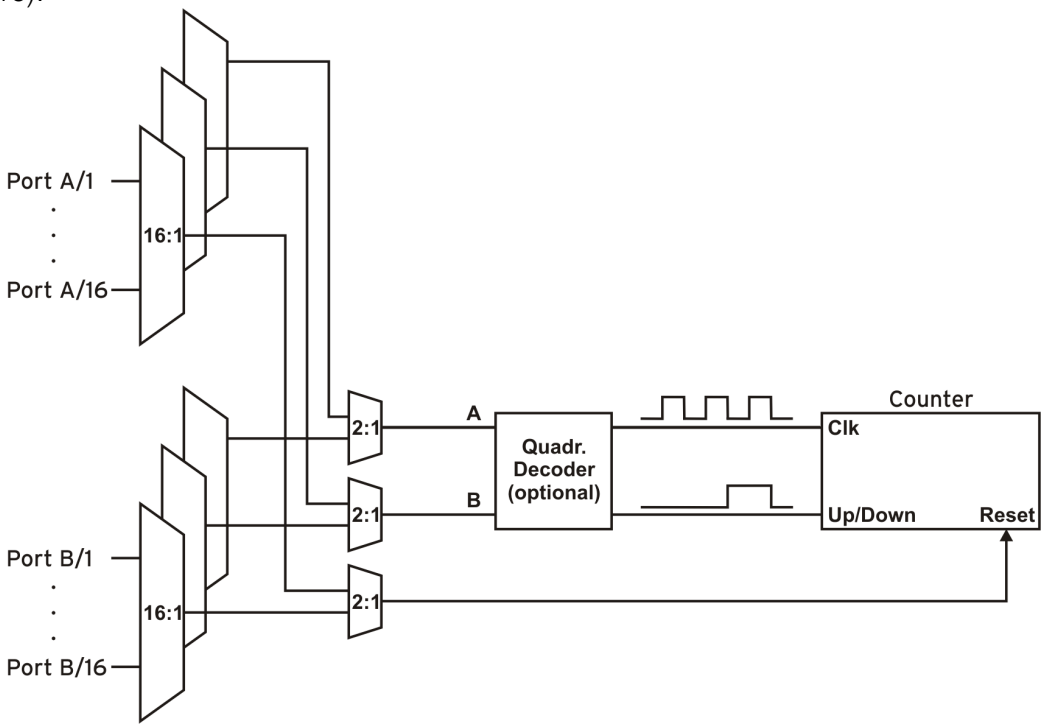
Misc.	D-Sub37 (ZUKA16)	Connector / Pin
5V	9	K5 / 17
5V	28	K5 / 18
DGND	10	K5 / 19
DGND	29	K5 / 20
DGND	19	K6 / 17
n. c.	-	K6 / 18
n. c.	-	K6 / 19
n. c.	-	K6 / 20

3.2 Auxiliary Voltage

The PCIe-BASE provides an auxiliary voltage (e.g. for sensor supply) at pin 17, 18 of the pin connector K5. The 5V DC output (100mA) is protected by a fuse (multifuse). In case of overload, it is sufficient to interrupt the power supply (turn off PC or disconnect the consumer load). After app. 1 min., the multifuse will be regenerated.

3.3 Counter

The PCIe-BASE features three 32-bit counters allowing the connection of incremental encoders. The counter inputs (A, B, and Reset) can be assigned to any digital lines of the two digital ports (configure by software).



The PCIe-BASE counts the number of incoming pulses (max. 16MHz) sampled at the connection of signal A. If the maximum counting range is reached, the counter will be reset to the minimum value of the counting range. If the external counter reset is connected, the counter can be reset at any time. In comparison to a counter, the quadrature decoder considers the counting direction by decoding a second phase-shifted signal.
To activate the counting function, the respective digital lines of the PCIe-BASE must be assigned to the counter via software.

Function	Description	Max. pulse frequ.	Connection	Dig. pins used	Counting range
Counter	count ↑	16MHz	Signal A	1	$0..2^{32}-1$
Up/Down counter	count ↑↓	16MHz	Signal A, Signal B	2	$-2^{31} .. 2^{31}-1$
Incremental encoder	count ↑↓	4MHz	Signal A, Signal B	2	$-2^{31} .. 2^{31}-1$

Please refer to the relevant documentation of your product for further information about connecting your incremental encoder.

4 Interfacing Examples

In the following examples, the signal is always connected at port A, line 1 (pin 11). Before, however, the relating digital port must have been switched to input (see chapter 4.1) or output (see chapter 4.2).

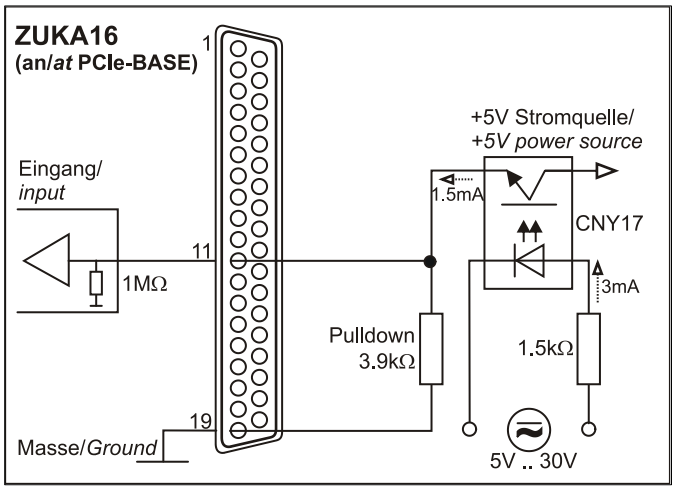
4.1 Interfacing Examples for Digital Inputs

The 3.9kΩ pull-down resistor sets the input to low if no voltage is applied there.

4.1.1 Connecting an Optocoupler

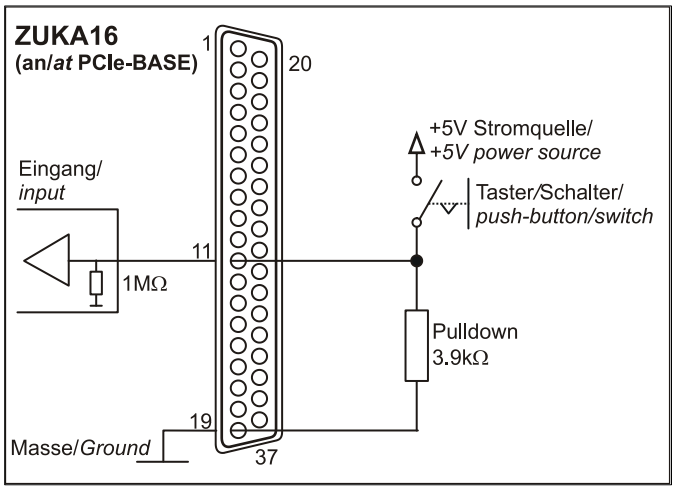
Optocouplers provide optimum protection at each input line. With them, it is possible to connect higher voltages and to protect the hardware from being destroyed.
In this regard, please also see application examples of the optocoupler you use.

Optocoupler cards featuring 8 inputs are available at bmcm.



4.1.2 Connecting a Push-Button / Switch

Please make sure to use a push-button with debounce protection, because otherwise several pulses might be recorded.
The 3.9kΩ pull-down resistor is absolutely necessary to create a defined low signal!

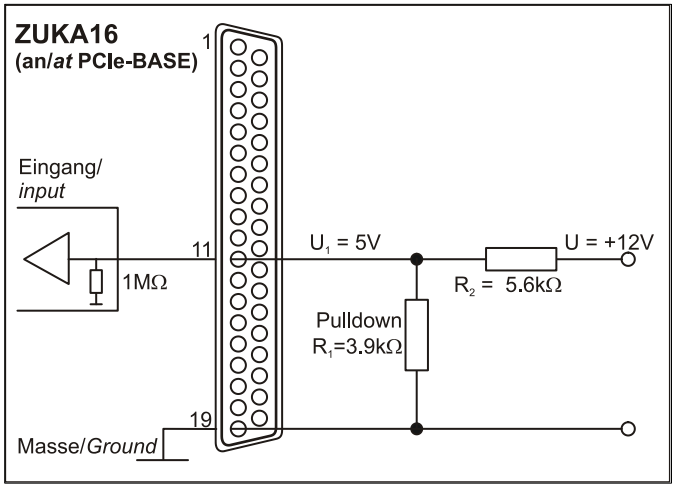


4.1.3 Connecting a Voltage Divider

If connecting a DC voltage higher than 5V, a voltage divider must be used so that 5V at the maximum are applied at the device input. Exceeding the 5V input voltage might cause damages to the device.
The relation between the two resistors to be used is calculated with the following formula:

$$U/U_1 = (R_1+R_2)/R_1$$

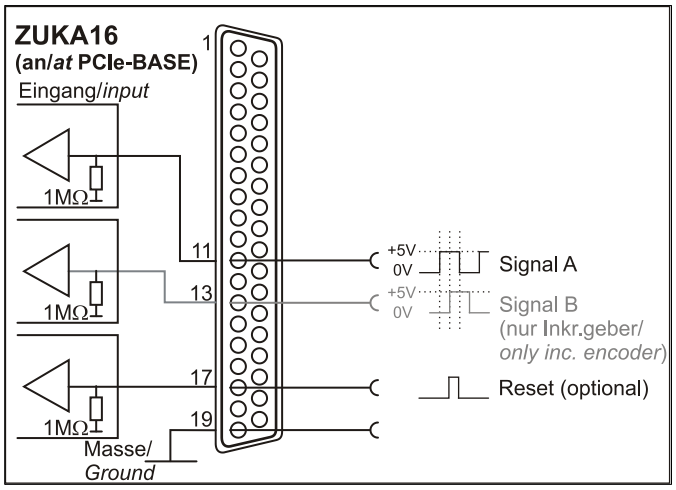
Input voltages less than 5V are also sufficient (*high* ≥3V).



4.1.4 Connecting a Counter / Incremental Encoder

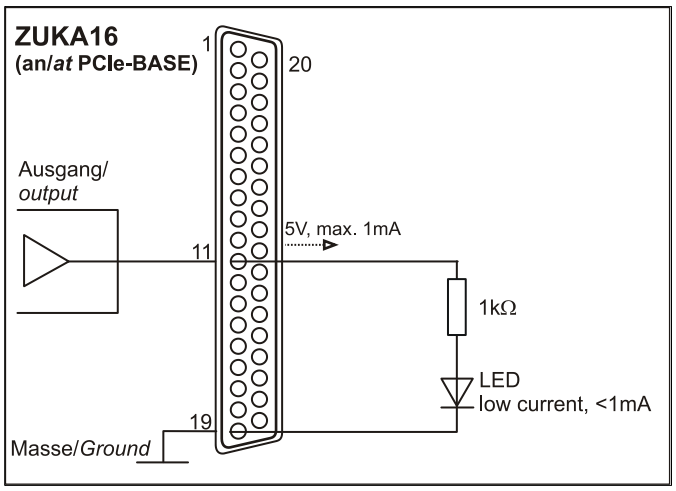
The connection of "Signal A", "Signal B" and "Reset" is possible at any digital line.

Make sure to configure the relating digital lines as input and to assign them to the counter.



4.1.5 Connecting an LED

Only so-called low-current LEDs can be used, because they already work with 1mA current. Please also observe the total current listed in the technical data (see chapter 7).



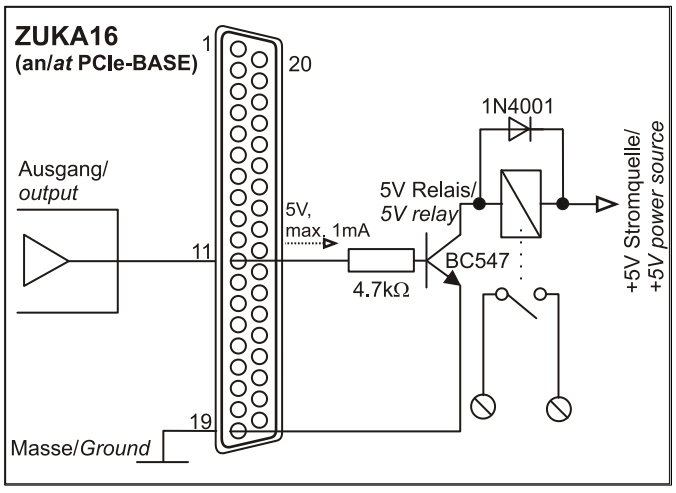
4.2 Interfacing Examples for Digital Outputs

Serial resistors in the output lines limit the current and protect the hardware from being destroyed.

4.2.1 Connecting a Relay

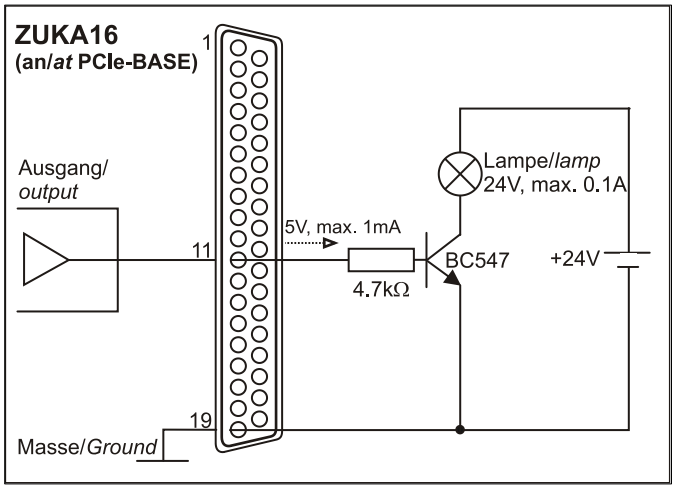
A connected relay is ideal to switch higher currents. Since the field coil of the relay requires a higher current than provided by the measurement system at one line, a transistor is connected ahead.

Relay cards featuring 8 outputs are available at bmcm.



4.2.2 Connecting a Lamp

A transistor can be used to switch higher loads. The selected transistor must comply with the maximum switchable current.
The figure on the right shows an application with a maximum current of 100mA.



5 Connection Cable ZUKA16

Via a flat ribbon cable, the optionally available connection cable ZUKA16 leads the channels provided at two 20-way pin connectors each to a 37-pin D-Sub female connector with bracket, which is mounted at a free PC slot.
With the ZUKA16, the channels provided by module slot M2 (see chapter 2.2) and the digital lines of the PCIe-BASE (see chapter 3) can be reached externally.
The line of the flat ribbon cable leading to pin 1 of the D-Sub37 is colored.

6 Important Notes for Using the PCIe-BASE

- The device is only suitable for extra-low voltages - please observe the relevant regulations! Only use the card with PC housing closed. ESD voltages at open lines may cause malfunction.
- Only use non-solvent detergents for cleaning. The product is designed to be maintenance-free.
- Signal cables are connected at the 37-pin D-Sub female connector – preferably use shielded cables. For best possible interference suppression, connect shield at one end only. Close open inputs if necessary.
- The device 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 PCIe-BASE may damage the modules and/or the PCIe-BASE. When removing the modules, only use blunt tools! Exposing the card to strong vibrations requires additional protection of the modules.
- If connecting internal ribbon cables to the PCIe-BASE, please make sure the modules are well ventilated to prevent excess heating. Also observe the temperature ranges of the PC.
- In case of overload, interrupt the power supply (turn off PC) so that the multifuse on the board is regenerated. The fuse will be ready for use after app. 1 min.

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.)

- **Sampling Parameters (with Measuring and Analysis Software NextView®)**

Max. total sampling rate*:	dep. on the modules used, max. 250kHz
FIFO:	4kByte
Memory depth:	depending on the RAM or HD space available

*** 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).**

- **Digital Input/Outputs**

Channels:	2x 16 lines (bidirectional, set in groups of 8), 3x counters/incremental encoders (32 bit, opt. counter reset) connectable at any digital inputs
Level:	CMOS/TTL compatible (low: 0V..0.7V; high: 3V..5V)
Input resistance:	1MΩ
Surge protection:	20V DC, max. ±20mA in total of all inputs!
Output resistance:	1kΩ
Output current:	1mA

- **Signal Connection**

Channels of the plug-on modules:	all channels are accessible at a 37-pin D-Sub female connector at the PC card bracket, via pin connectors or (with ZUKA16 option) at an additional PC slot bracket (37-pin D-Sub female)
Digital channels (of PCIe-BASE):	2x20-way pin connectors on the board; with ZUKA16 (opt.) accessible at a PC slot bracket (D-Sub 37)

- **General Data**

Bus connection:	PCIe x1 (PCIe bus)
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. permissible potentials:	60V DC acc. to VDE, max. 1kV ESD on the lines
Temperature ranges:	operating temp. –25°C..+50□C, storage temp. –25°C..+70□C
Relative humidity:	0–90% (not condensing)
Size:	without PC card bracket: 174 x 111 x 16 mm3
Delivery:	product, PC card bracket
Available accessories:	cable with PC card bracket for internal connection ZUKA16, 37-pin D-Sub plug ZUST37, connecting cables ZUKA37SB, ZUKA37SS, connector panels ZU37BB/-CB/-CO, current shunt ZU-CS250R, modules of the series MADDA/MDA/MCAN
Warranty:	2 years from date of purchase at bmcm, claims for damages resulting from improper use excluded

- **Software**

Software free of charge download:	LIBAD4 SDK for C/C++ programming on Windows® XP/7/8/10, trial version of the measuring software NextView® to test and operate the hardware
NextView® (optional):	professional software (versions: Professional or Lite) for the acquisition and analysis of measurement data on Windows® 8/10