

preliminary version!

■ USB-OI16

Isolated digital I/O interface (USB)

**32 channels. Monitor & Control.
Galvanically isolated.**

Record and output digital signals electrically isolated. The USB-OI16 features two 16-bit ports with 16 digital inputs and outputs each. Besides that, up to 2 counters or incremental encoders can be connected at any digital inputs.

**16 optocoupler inputs.
16 semiconductor switches.**

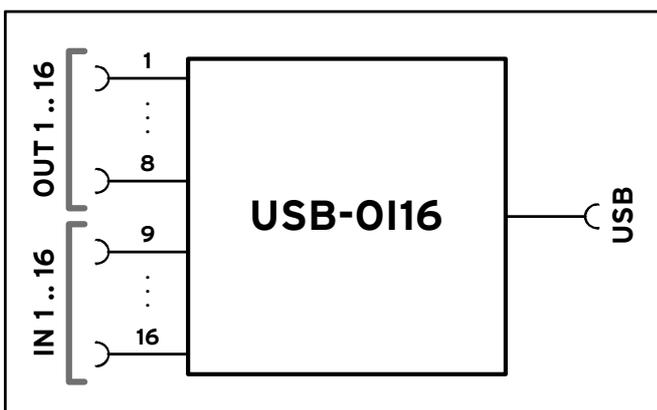
16 digital states in the 3..32V voltage range can be sampled and recorded. The 16 semiconductor switches of the USB-OI16 are realized with high-side drivers for voltages in the 5..32V range.

**Count and measure: Pulses.
Frequency. Position. Period.**

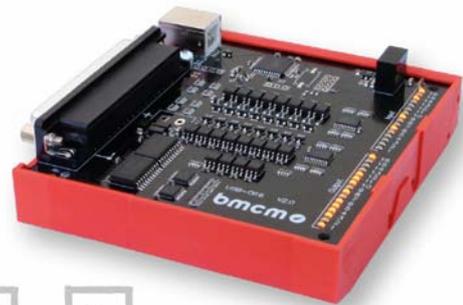
If for the acquisition of large quantities, speed measurement, or determination of position: These are only a few applications the two 32-bit counters of the USB-OI16 can be used for. The integrated pulse time measurement function produces precise results especially in the low-frequency range.

Get connected.

The digital channels of the application-specific hardware (sensor, machine, etc.) are connected at a 37-pin D-Sub female.



Functional diagram



Plug & Play.

The connection to the PC is realized via USB. The USB-OI16 provides all typical USB features (e.g. Plug&Play, Hot-Plug). Up to 127 devices can be connected and installed during operation.

Self-powered.

The device is internally supplied with 5V provided by the USB interface. This reduces cabling efforts to a minimum and makes mobile measurements a lot easier. An external supply unit can be connected for higher output switching voltages at the digital outputs (7..32V).

Open for everyone.

Widely supported: The USB-OI16 can be used under Windows® 7/XP as well as under Mac OS X, Free BSD and Linux. The software for installation and programming is included for free.



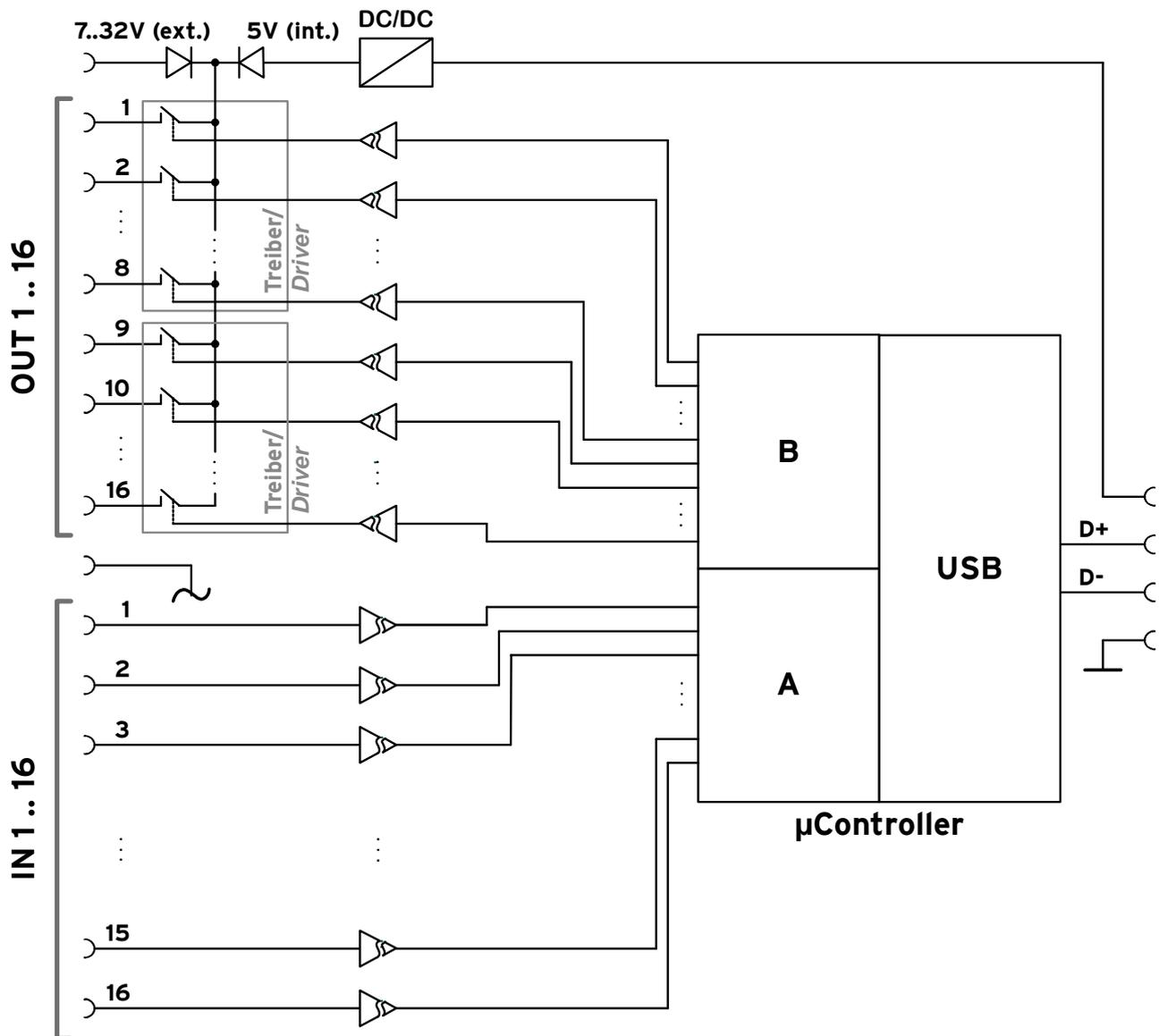
NextView®4. Test for free.

The device is supported by NextView® 4, the software for data acquisition and analysis. A fully functional 30-day trial is included with delivery to directly test the functionality of the USB-OI16.

DIN rail mounting.

The optocoupler system is suitable for DIN rail mounting. A DIN rail carrier with bracket is already included with the delivery.

1 Block diagram



2 Start-up procedure

Install the bmc driver package (see chapter 4.1.1). Connect the USB cable of the USB-OI16 to the USB interface of the PC and start the Plug&Play installation (see chapter 4.1.2). The device features an internal power supply of 5V.

If the digital outputs require a switching voltage higher than the 5V of the USB interface, an external power supply providing 7.32V (see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**) can be connected.

If necessary, further software components can be installed now, as described in chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**

3 Operating elements, connections, and pin assignments

The available connections and components of the USB-OI16 are shown in the following figure of the board (view on top of the board (fitted with components), D-Sub 37 connector on the left).

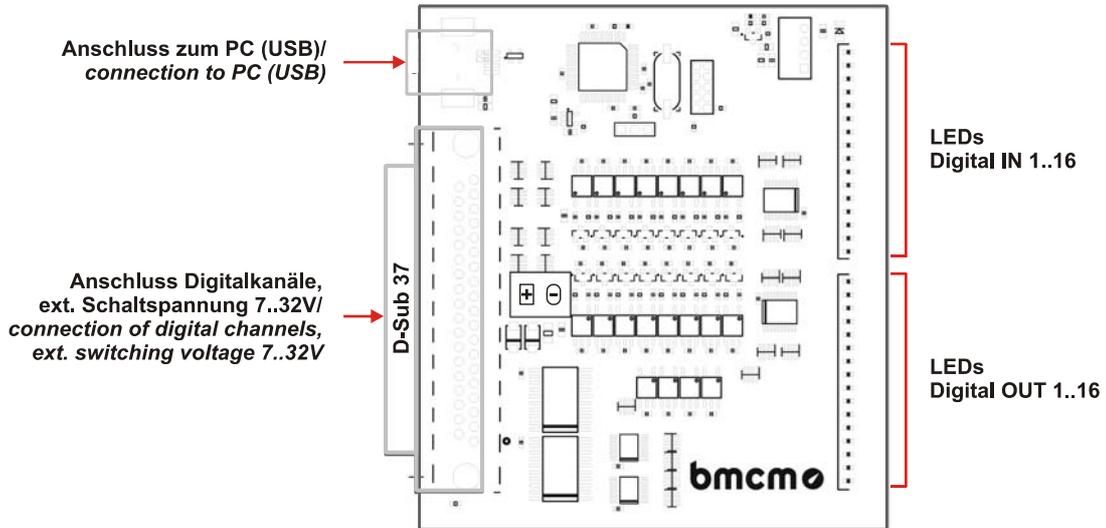


Figure 1

3.1 LEDs

16 LEDs on the USB-OI16 (see Figure 1, p. 3), each dedicated to the inputs and outputs, are turned on when a digital channel is high.

3.2 Connection to the PC

The standard USB connector (type B) serves for the connection of the USB-OI16 to the PC. 5V voltage supply is also provided via the USB interface (see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**).



3.3 Switching voltage

A 7..32V DC switching voltage for the digital outputs can be connected at the 37-pin D-Sub female (see chapter 3.4).

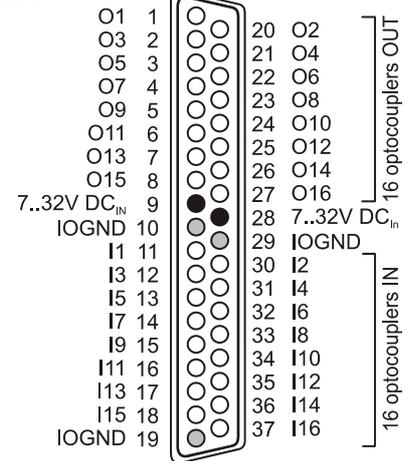
If there is no external power supply unit, a 5V power supply is generated internally for the outputs 1..16. The switching current per output in this case is 1mA.

3.4 Digital channels

The digital lines are attached to the 37-pin D-Sub female (see Figure 1, p. 3). Electrical isolation to the PC is guaranteed by optocouplers on the USB-OI16.

The digital lines are addressed via two 16-bit ports A and B by software. The 16 digital inputs (port A: I1..I16) and the 16 digital outputs (port B: O1..O16) are hard-wired at the D-Sub 37.

D-Sub 37



- IOGND = digitale Masse / digital ground
- 7..32V Versorgung für Schaltspannung / 7..32V supply for switching voltage



- Please carefully observe the polarity! Only apply voltages within the adjusted range!
- IOGND must never be connected to GND, as this would override the galvanic isolation!

3.4.1 Digital inputs

Up to 16 digital inputs are provided for digital sensors or other digital signal sources in the 3..32V range at the connections I1..I16.

The following table and figure shows the pin assignment of the digital inputs at the 37-pin D-Sub female and the related port assignment:

Digital IN	D-Sub37	Port/bit	Digital IN	D-Sub37	Port/bit
I1	11	A/0	I9	15	A/8
I2	30	A/1	I10	34	A/9
I3	12	A/2	I11	16	A/10
I4	31	A/3	I12	35	A/11
I5	13	A/4	I13	17	A/12
I6	32	A/5	I14	36	A/13
I7	14	A/6	I15	18	A/14
I8	33	A/7	I16	37	A/15

3.4.2 Digital outputs

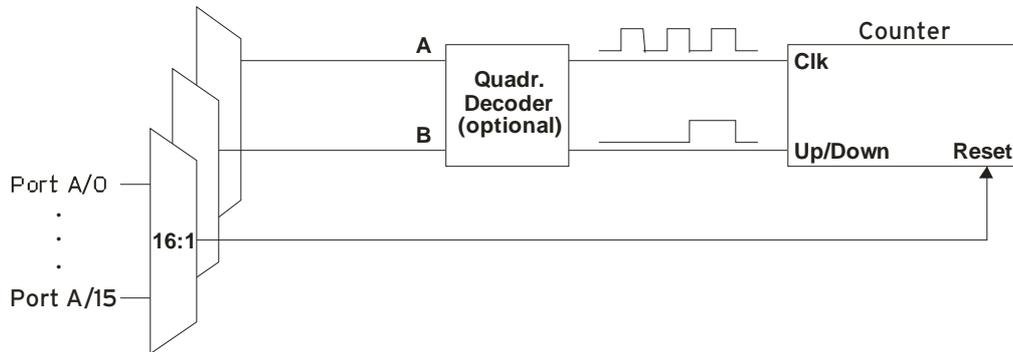
To control machines, switch a relay, etc. with 5V or 7..32V (see chapter 3.3), the 16 digital outputs O1..O16 can be used.

The following table and figure shows the pin assignment of the digital outputs at the 37-pin D-Sub female and the related port assignment:

Digital IN	D-Sub37	Port/bit	Digital IN	D-Sub37	Port/bit
O1	1	B/0	O9	5	B/8
O2	20	B/1	O10	24	B/9
O3	2	B/2	O11	6	B/10
O4	21	B/3	O12	25	B/11
O5	3	B/4	O13	7	B/12
O6	22	B/5	O14	26	B/13
O7	4	B/6	O15	8	B/14
O8	23	B/7	O16	27	B/15

3.5 Counters with pulse time measurement

The USB-OI16 features two 32-bit counters allowing the connection of incremental encoders. The counters or incremental encoders and external counter reset, if required, are attached to any digital lines (also see chapter 3.4.1).



The USB-OI16 counts the number of incoming pulses (max. 250kHz) 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 USB-OI16 must be programmed to counter operation via software.

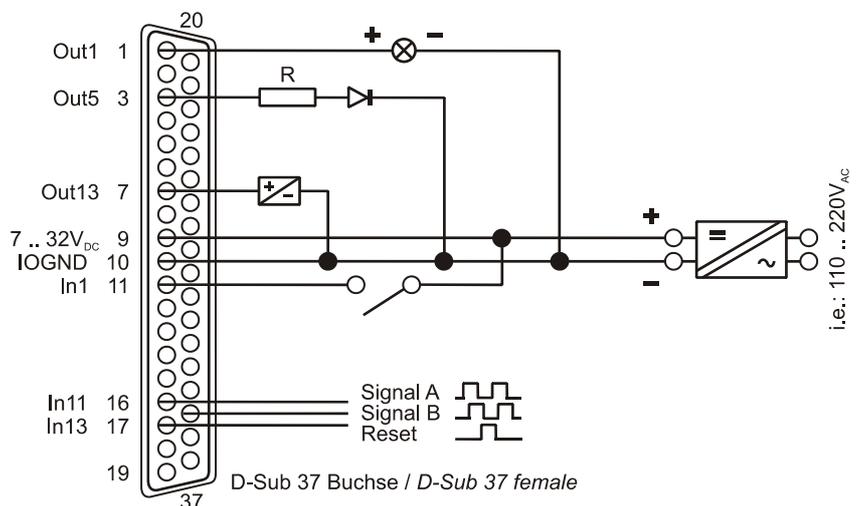
Function	Description	Max. pulse frequ.	Connection	Pins/Counter	Counting range
Counter	count ↑	250kHz	Signal A	1	$0..2^{32}-1$
Up/Down counter	count ↑↓	100kHz	Signal A, Signal B	2	$2^{31} .. 2^{31}-1$
Incremental encoder	count ↑↓	100kHz	Signal A, Signal B	2	$2^{31} .. 2^{31}-1$
Pulse time measurement	measure time betw. 2 edges	250kHz	Signal A	1	-



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

3.6 Interfacing example

The figure on the right shows the connection of an incremental encoder, a switch, a relay, an LED, and a lamp to USB-OI16 with external supply.



4 Software installation



All software and documentation available for the USB-OI16 are integrated on the "Software Collection" CD included with delivery. When inserting the CD, a CD starter opens automatically (otherwise: start **openhtml.exe**).



USB-OI16

Change to the product page of the USB-OI16 by selecting the entry "Products" in the CD starter and then the hardware ("USB-OI16 ") listed under the interface "USB".



For detailed information about installing or operating the software, please see the corresponding manuals. The Adobe Acrobat Reader is required to open the documentation in PDF format.



You can run the installation directly from CD. If your browser prevents this, first save the setup program to hard disc before running it separately.

Software	Software product	Notes	Documentation
Device driver	BMCM-DR (driver package)	1. install driver package to hard disc 2. Windows® Plug&Play installation	IG-BMCM-DR (driver installation manual)
Program- ming	STR-LIBADX	ActiveX control for hardware independent programming	IG-LIBADX (installation / programming manual)
	STR-LIBADX-EX	example programs for LIBADX ActiveX control	-
	SDK-LIBAD	SDK with example programs for C/C++ on Windows®, Mac OS X, FreeBSD, Linux	UM-LIBAD4 (installation / programming manual)
Operating program	NV4.6	measuring software NextView®4 available in the Standalone versions: <ul style="list-style-type: none"> Lite: "slim" version with basic functions Pro: full version with complete functional range Analysis: version for the analysis of stored measuring data <p>NextView®4 can be used for free as a fully functional 30-day trial version. After purchasing the software, all projects, measurement files, and settings can still be used.</p>	DS-NV4 (data sheet) UM-NV4 (user manual) "First steps" in the NextView®4 demo project (displayed when first starting the software)

4.1 Driver installation



Under Windows®, the driver installation is always required for the USB-OI16. Only then additional software can be installed. To make sure the installation is done correctly, please follow the instructions in the order as described below.



Under Mac OS X, FreeBSD and Linux, driver installation is not necessary.

4.1.1 Install driver package

The prior installation of the bmc driver package [BMCM-DR](#) to the hard disc of your PC makes the driver search for Windows® much easier. Especially in case of driver updates, only the new driver package has to be installed, the hardware automatically uses the new version.

The link to install the driver package is located on the USB-OI16 product page of the "Software Collection" CD.

4.1.2 Plug&Play installation

As soon as the USB-OI16 is connected to the PC, the system announces the new hardware. Since the driver package has been copied to hard disc before, the hardware will be installed automatically under Windows® 7. Under Windows® XP, the automatic hardware detection is started by selecting the following option:



- **Windows® 7:** no specifications required
- **Windows® XP:** "Install the software automatically" (SP2: do not connect with Windows® Update!)

4.1.3 Check installation

The entry "Data Acquisition (BMC Messsysteme GmbH)" is included in the Windows® Device Manager after successful installation displaying the installed bmc hardware. To open the Device Manager, proceed as follows:



- **Windows® 7:** Start / Control Panel / System and Security / System / Device Manager
- **Windows® XP:** Install Start / Control Panel / System / TAB "Hardware" / button "Device Manager"

Double click the USB-OI16 to show its properties. For general information, any existing device conflicts, and possible sources of error, see TAB "General".

4.2 Programming

Programming the USB-OI16 with Visual Basic®, Delphi®, Visual C++™ under Windows® 7/XP is possible with the hardware independent [STR-LIBADX](#). It is available on the USB-OI16 product page of the "Software Collection" CD. After installation, the ActiveX control must be loaded into the respective programming environment.



- **Visual Basic®:** menu "Project / Components", entry "LIBADX Object Library 4.0"
- **Delphi®:** menu "Components / Import ActiveX", entry "LIBADX Object Library 4.0"

If you select the entry [STR-LIBADX-EX](#) listed directly under the installation program of the corresponding ActiveX control, you can install example programs (with source code) demonstrating how to apply the ActiveX control.



Programming the USB-OI16 under Mac OS X and Unix (FreeBSD, Linux) with C/C++ is done by means of the LIBAD4 programming interface.



The [SDK-LIBAD](#) for the respective operating system (also Windows®) is included on the product page of the USB-OI16. For further information about how to integrate the SDK in the programming environment, please see the corresponding programming manual [UM-LIBAD4](#).



Using the LIBAD4 requires advanced programming experience!

4.3 Using USB-OI16 with NextView®4

Install the fully functional trial of the professional software NextView®4 for measurement data acquisition and processing to directly test the features and functions of the USB-OI16.



The setup program [NV4.6](#) is available on the product page of the card. When first starting the software, request a license number with the option "Request 30 days free trial version" being checked and select your device (USB-OI16) in the following dialog "Device Setup".

The data sheet and the start project of NextView®4 contain first instructions about how to install and operate the program. For detailed information, an online help is provided.

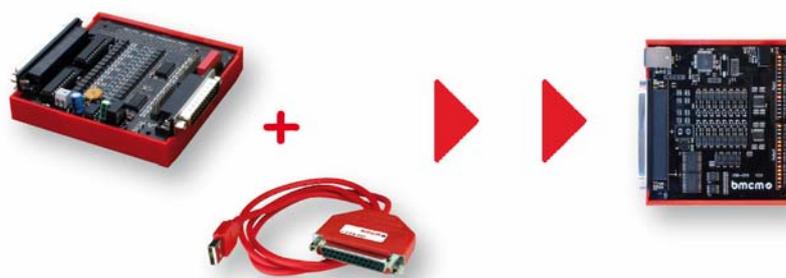


The trial is valid for 30 days after requesting the license number. If a license is not purchased within this period, the functional range of NextView®4 will be considerably cut down!

5 Compatibility of the USB-OI16 to USB-PIO with OI16

The USB-OI16 incorporates all functions in one device provided by the combination of a USB-PIO and OI16.

Therefore, the USB-OI16 can serve as an alternative for this hardware combination. All previously used applications are fully compatible.



6 Important notes for using the USB-OI16

- The USB-OI16 is only suitable for extra-low voltages – please observe the relevant regulations!
- An electrically isolated power unit (with CE) must be used for power supply.
- All accessible pins are electrostatic sensitive devices. Provide for an earthed conductive work place when installing.
- Only use non-solvent detergents for cleaning. The product is designed to be maintenance-free.
- The board 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., +5V supply)

• Digital inputs

Number:	16 digital inputs, galvanically isolated by 16 optocouplers
Counters:	2 counters/incremental encoders (32 bit, opt. counter reset) can be connected at any digital inputs
Counter frequency:	max. 250kHz
Input voltage:	3..32V DC (>2.5V = high)
Surge protection:	max. 60V DC for 10sec.
Input current // Input resistance:	max. 0.35mA // app. 100k Ω

• Digital outputs

Number:	16 digital outputs, galvanically isolated by 16 optocouplers with 2 high-side drivers
Switching voltage:	5V DC (internal supply) or 7..32V DC (external supply)
Voltage drop (with ext. supply):	app. 1.5V at the high-side driver
Switching current (with ext. supply):	max. 0.25A per output, max. 0.8A in total per 8-bit high-side driver at 25°C

• General

Power supply:	internal: 5V DC; external: 7..32V DC at 37-pin D-Sub female
Digital connection:	37-pin D-Sub female
USB interface:	attach to PC at USB connector (type B), USB 2.0
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 (galv. isolation):	60V DC acc. to VDE , max. 1kV ESD on open lines
Temperature ranges:	operating temp. -25..60°C, storage temp. -25..70°C
Relative humidity:	0..90% (not condensing)
Dimensions (L x W x H):	app. 97mm x 105mm x 30mm
Delivery:	device with DIN rail carrier, USB cable, "Software Collection" CD with drivers, description
Available accessories (optional):	connecting cables ZUKA37SB, ZUKA37SS, D-Sub plug ZU37ST, gender changer ZU37SS, waterproof housings ZU-PBOX-PG
Warranty:	2 years from date of purchase at bmcM, claims for damages resulting from improper use excluded

• Software

Software on CD (included):	ActiveX Controls LIBADX (hardware independent) for programming on Windows® 7/XP; LIBAD4 SDK for C/C++ programming on Windows® 7/XP, Mac OS X, Unix (FreeBSD, Linux); trial version of the measuring software NextView®4 to test and operate the hardware
NextView®4 (optional):	professional software (versions: Professional, Lite) for the acquisition and analysis of measurement data on Windows® 7/XP