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 the first digital inputs.

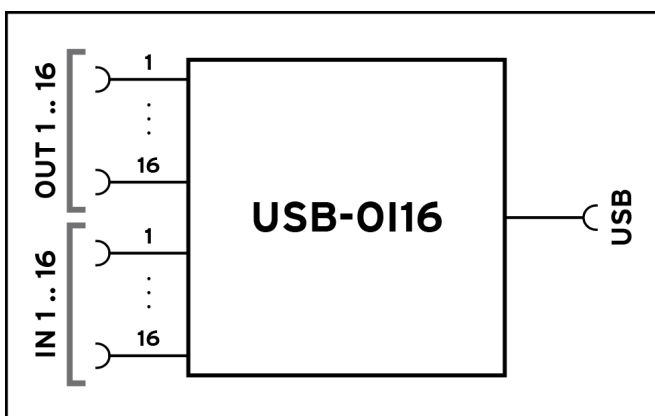### 16 Optocoupler Inputs. 16 Semiconductor Switches.

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.

Enlightened.

The state of the input and output lines is indicated by LEDs.

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 (incremental decoders) 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.

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).

Optimal for Windows.

The drivers and programming interface is optimized for 64Bit under Windows® 10/11. All software for installation and programming of the USB-OI16 is included free of charge.

NextView®. Try for Free.

The device 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 USB-OI16.

Functional diagram

1 Start-up procedure

All available software and documentation for the USB-OI16 are located on http://www.bmcm.de/usb-oi16-en in the tab **Downloads.**
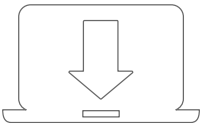
1. Step: Installation device driver
Install the latest driver package in order to use the USB measurement device. You will find the package on http://www.bmcm.de/usb-oi16-en in the tab **Downloads** in the category **BMCM – Drivers.**

2. Step: Connect up
Connect the provided USB cable to the device and to a free USB port of the PC. Then start the plug and play installation. The device gets its power supply through the USB connection. If the digital outputs require a switching voltage higher than the 5V of the USB interface, an external power supply providing 7..32V can be connected.
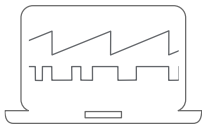
3a. Step: Measuring with NextView
To be able to use your measurement system with NextView, you just need to download and install the latest version of NextView on http://www.nextview.de/go-en. In case you did not buy NextView, request a free of charge trial version when first starting NextView. Find more information about NextView and its installation on www.nextview.de.
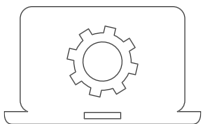
3b. Step: Measuring with API
In case you want to use the measurement device without NextView, you need to download and install the free of charge programming interface LIBAD4. You can find this on www.bmcm.de/usb-oi16-en in the tab **Downloads** in the category **LIBAD – Programming Interface (API)**, too. Find more information on www.bmcm.de/libad-en.

2   Block Diagram
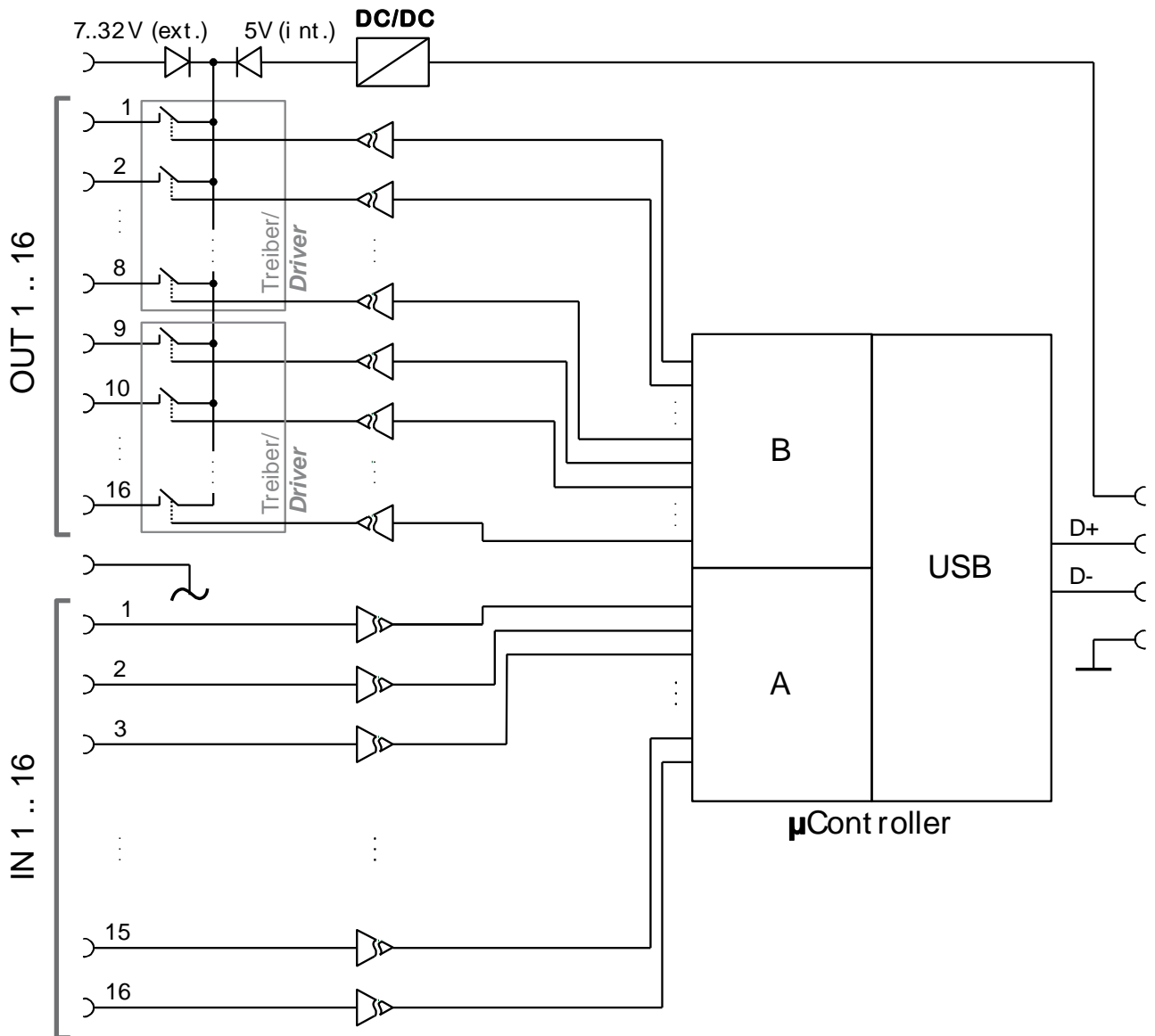
3 Operating Elements, Connections, and Pin Assignments

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).
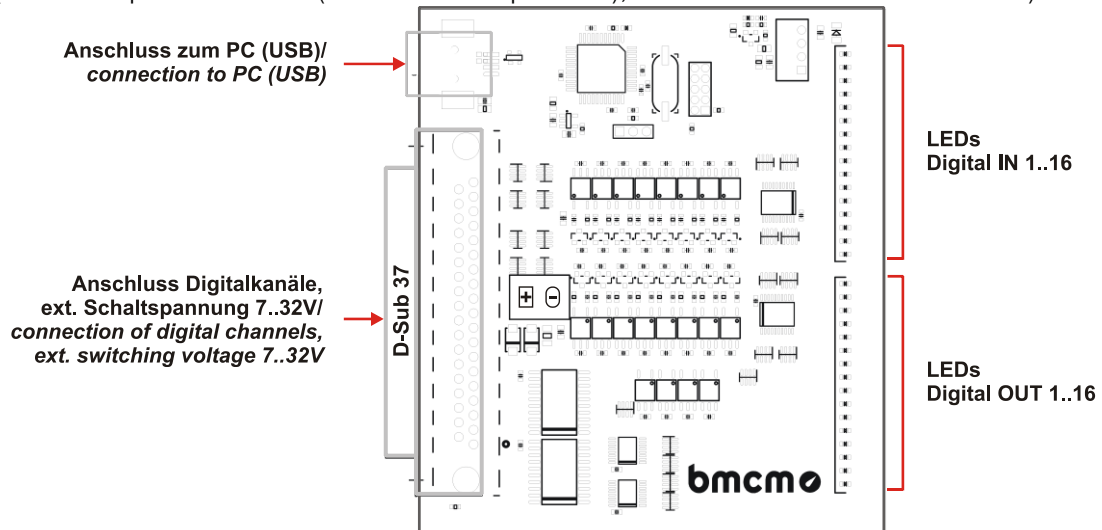
Anschluss zum PC (USB)/
connection to PC (USB)

**LEDs
Digital IN 1..16**

D-Sub 37

**Anschluss Digitalkanäle,
ext. Schaltspannung 7..32V/**
*connection of digital channels,
ext. switching voltage 7..32V*

**LEDs
Digital OUT 1..16**

bmcm

Figure 1

3.1 LEDs

16 LEDs on the USB-OI16 (see Figure 1, p. 4), 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.

3.3 Switching Voltage

A 7..32V DC switching voltage for the digital outputs can be connected at the 37-pin D-Sub female. 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.
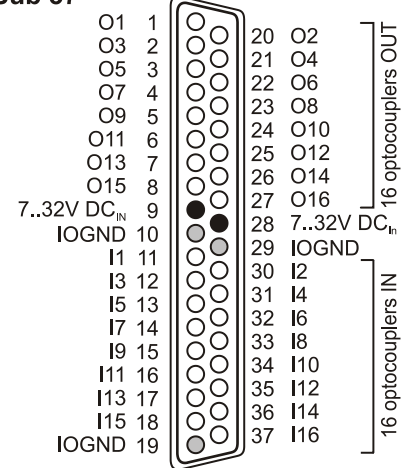
3.4 Digital Channels

D-Sub 37

The digital lines are attached to the 37-pin D-Sub female (see Figure 1, p. 4). 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.

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

Pin		Pin	
O1	1	20	O2
O3	2	21	O4
O5	3	22	O6
O7	4	23	O8
O9	5	24	O10
O11	6	25	O12
O13	7	26	O14
O15	8	27	O16
7..32V DC$_{IN}$	9	28	7..32V DC$_{In}$
IOGND	10	29	IOGND
I1	11	30	I2
I3	12	31	I4
I5	13	32	I6
I7	14	33	I8
I9	15	34	I10
I11	16	35	I12
I13	17	36	I14
I15	18	37	I16
IOGND	19		

16 optocouplers OUT

16 optocouplers IN

○ IOGND = digitale Masse / *digital ground*

● 7-32V Versorgung für Schaltspannung / *7..32V supply for switching voltage*

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.
counter :

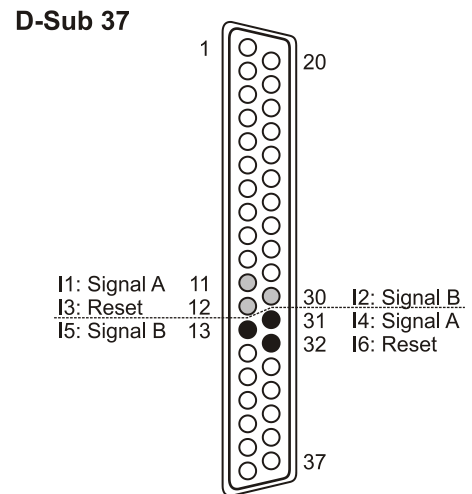| Digital OUT	D-Sub37	Port/Bit	Digital OUT	D-Sub37	Port/Bit
O1	1	B/0	O9	5	B/8
O2	20	B/1	O10	24	B/9
O3	2	B/2	O11	6	B/10
O4	21	B/3	O12	25	B/11
O5	3	B/4	O13	7	B/12
O6	22	B/5	O14	26	B/13
O7	4	B/6	O15	8	B/14
O8	23	B/7	O16	27	B/15

3.5   Counters with Pulse Time Measurement

The USB-OI16 features two 32-bit counters allowing the connection of incremental encoders.
The counter inputs (A, B, and Reset) are configured by software and can be reached then at the first digital input pins (counter 1: I1-I3; counter 2: I4-I6).
The following table and figure shows the pin assignment of the counter inputs at the 37-pin D-Sub female:

D-Sub 37

I1: Signal A   11
I3: Reset   12
I5: Signal B   13

30   I2: Signal B
31   I4: Signal A
32   I6: Reset

◯ Zähler 1 / *counter 1*   ● Zähler 2 / *counter 2*

Counter 1	D-Sub37
Signal A	11
Signal B	30
Reset	12

Counter 2	D-Sub37
Signal A	31
Signal B	13
Reset	32

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 assigned to the counter via software.
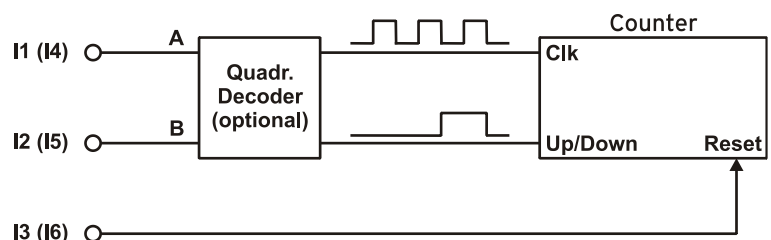
Function	Description	Max. pulse frequ.	Connection	Pins/Counter	Counting range
Counter	count ↑	250kHz	Signal A	1	$0..2^{32}-1$
Up/Down counter	count ↑↓	100kHz	Signal A, Signal B	2	$-2^{31} .. 2^{31}-1$
Incremental encoder	count ↑↓	100kHz	Signal A, Signal B	2	$-2^{31} .. 2^{31}-1$
Pulse time measurement	measure time betw. 2 edges, resolution 41,67ns	250kHz	Signal A	1	0 - 178,96s

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.
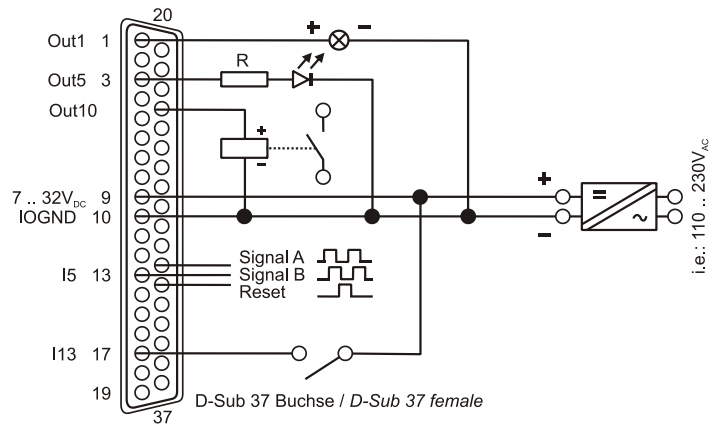
4   Compatibility of the USB-OI16 to USB-PIO with OI16

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.
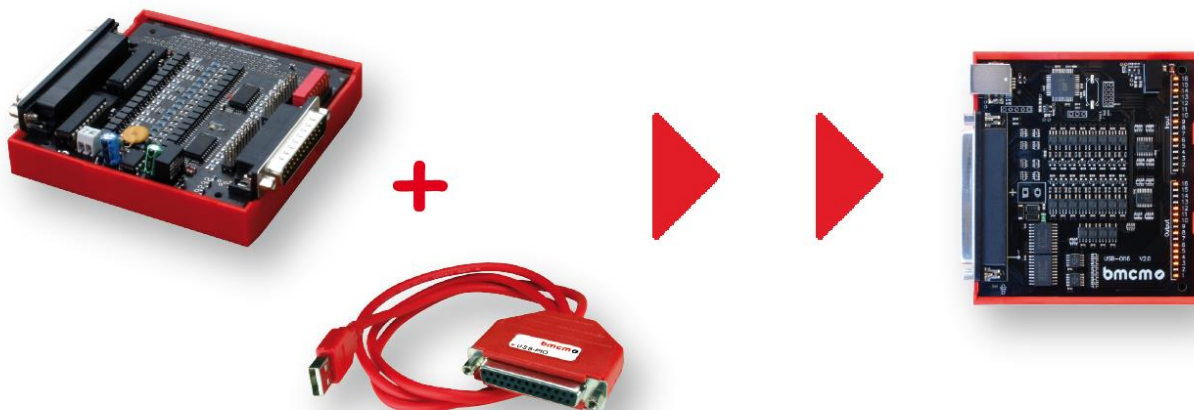
5 Important Notes for Using the USB-OI16

- 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.

6 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 the first 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. 100kΩ

- ## 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 and bracket, USB cable
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 free of charge download:	LIBAD4 SDK for C/C++ programming on Windows® 10/11 trial version of the measuring software NextView® to test and operate the hardware
NextView® (optional):	professional software (versions: Professional, Lite) for the acquisition and analysis of measurement data on Windows® 10/11

Manufacturer: BMC Messsysteme GmbH. Subject to change due to technical improvements. Errors and printing errors excepted. Rev. 2.4 **16.10.2023**

Seite 8