

# ■ USB-PIO

Digital I/O Interface (USB)

## 24 Channels. Digital. Signal Output & Monitoring.

Record and output digital TTL signals. The USB-PIO features three 8-bit bidirectional ports. The port lines are led out to a 25-pin D-Sub female connector.

## Extra Small. Extra Red. Extra Low-Priced.

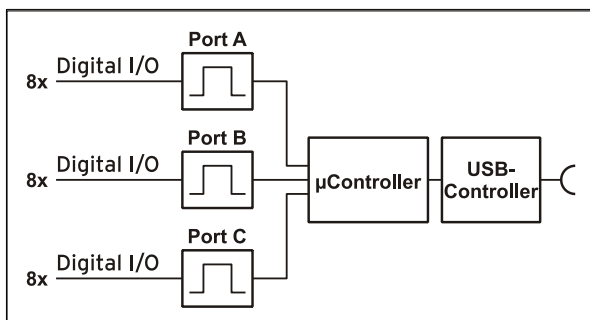
The unique idea of the USB-PIO: the device is accommodated in the D-Sub connector housing. Not only the size is extra small but also the price.

## Plug & Play.

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

## Powered by USB.

The device is supplied with power via the USB interface. This reduces cabling efforts to a minimum and makes mobile measurements a lot easier.



Functional diagram and pin assignment



## Open for Everyone.

Widely supported: The USB-PIO can be used under Windows® XP/7/8/10 as well as under Mac OS X, Free BSD, and Linux. The complete software for installation and programming of the device is included for free.

## NextView®. Try for Free.

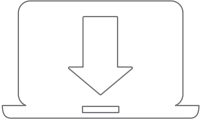
The DAQ system is supported by NextView®, the software for data acquisition and analysis. A fully functional 14-day trial is included with delivery to directly test the functionality of the USB-PIO.

## Get Connected.

Various optocoupler and relay cards are available at bmcm to electrically isolate the digital lines. For the USB-PIO it is particularly easy as only a 25-pin D-Sub extension cable is needed for connecting.

# 1 Start-up procedure

All available software and documentation for the USB-PIO are located on [www.bmcm.de/usb-pio-en](http://www.bmcm.de/usb-pio-en) in the tab **Downloads**.



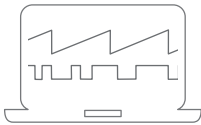
## 1. Step: Installation device driver

Install the latest driver package in order to use the USB measurement device. You will find the package on [www.bmcm.de/usb-pio-en](http://www.bmcm.de/usb-pio-en) in the tab **Downloads** in the category **BMCM – Drivers**. Open the manual device drivers on [www.bmcm.de/man-driver](http://www.bmcm.de/man-driver) for more information.



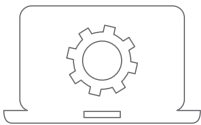
## 2. Step: Connect up

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.



## 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-en.html](http://www.nextview.de/download-en.html). 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](http://www.nextview.de) or in the manual on [www.bmcm.de/man-nextview](http://www.bmcm.de/man-nextview).



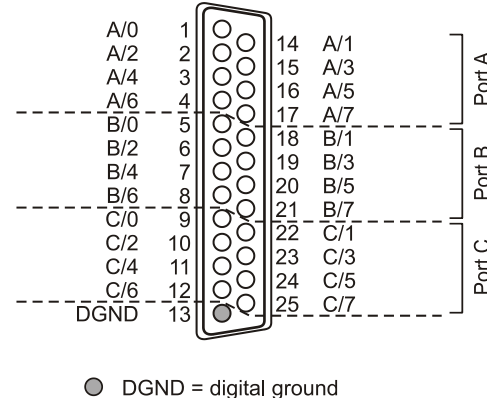
## 3b. Step: Measuring with API

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/usb-pio-en](http://www.bmcm.de/usb-pio-en) in the tab **Downloads** in the category **LIBAD – Programming Interface (API)**, too. Find more information on [www.bmcm.de/libad-en](http://www.bmcm.de/libad-en) or directly in the manual [www.bmcm.de/man-libad](http://www.bmcm.de/man-libad).

## 2 Digital Inputs and Outputs

The USB-PIO features a  $\mu$ -controller providing three 8-bit digital ports A, B, C. The lines are bidirectional. The direction is set to input or output in groups of 8 (port C: 4) via software. The following table and figure shows the pin assignment of the 25-pin D-Sub female connector of the USB-PIO, at which the digital lines are accessible.

Pin (D-Sub 25)	Port / Bit	Pin (D-Sub 25)	Belegung
1	A/0	9	C/0
14	A/1	22	C/1
2	A/2	10	C/2
15	A/3	23	C/3
3	A/4	11	C/4
16	A/5	24	C/5
4	A/6	12	C/6
17	A/7	25	C/7
5	B/0	13	digital ground (DGND)
18	B/1		
6	B/2		
19	B/3		
7	B/4		
20	B/5		
8	B/6		
21	B/7		



- Always turn on the PC first before applying voltage to the digital lines.
- Do not apply voltage to the ports without the relevant protective circuit. Two outputs connected with each other may get damaged by the high flow of current.
- The digital inputs are equipped with an internal 100k $\Omega$  pull-down resistor for open inputs to be constantly low.
- After power-on, the direction of the digital channels is always set to input.

### 3 Interfacing Examples

#### 3.1 Interfacing Examples for Digital Inputs

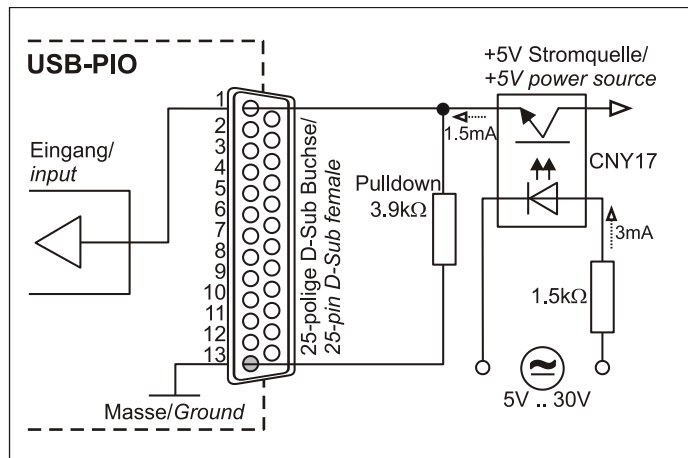
The 3.9kΩ pull-down resistor sets the input to *low* if no voltage is applied there.

##### 3.1.1 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.

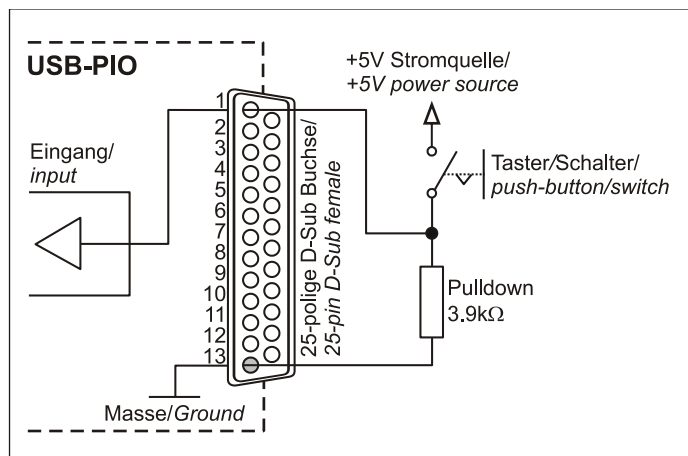
**Optocoupler cards featuring 8 inputs are available at bmcm (see chapter 6).**



##### 3.1.2 Connecting a Push-Button / Switch

Please make sure to use a push-button with debounce protection, because otherwise several pulses might be recorded.

Although a 100kΩ pull-down resistor is integrated, an external 3.9kΩ pull-down can increase the safety of the circuit.



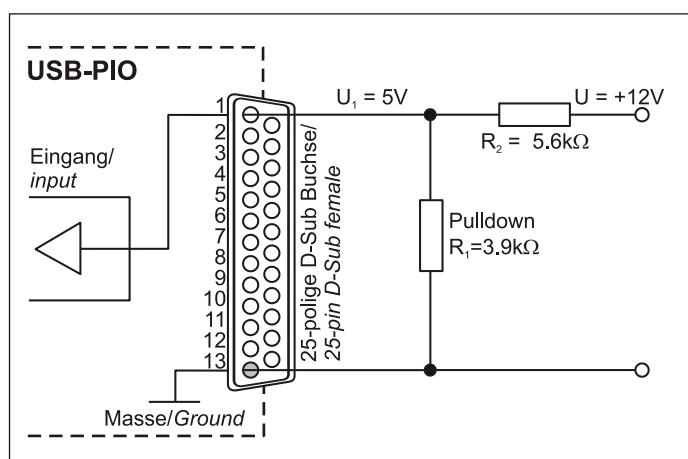
##### 3.1.3 Connecting a Voltage Divider

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).

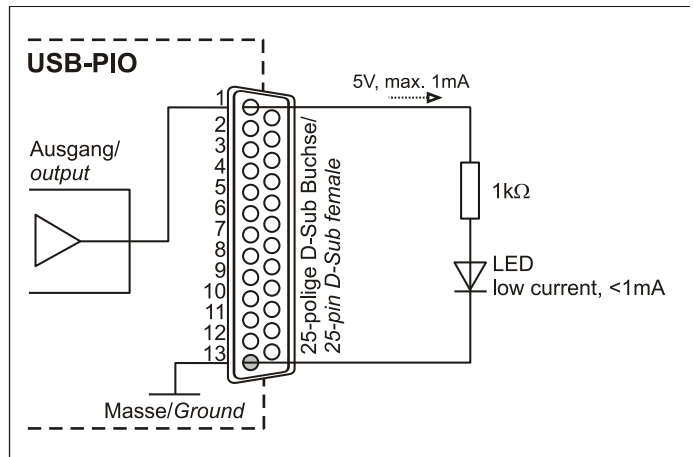


### 3.2 Interfacing Examples for Digital Outputs

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

#### 3.2.1 Connecting an LED

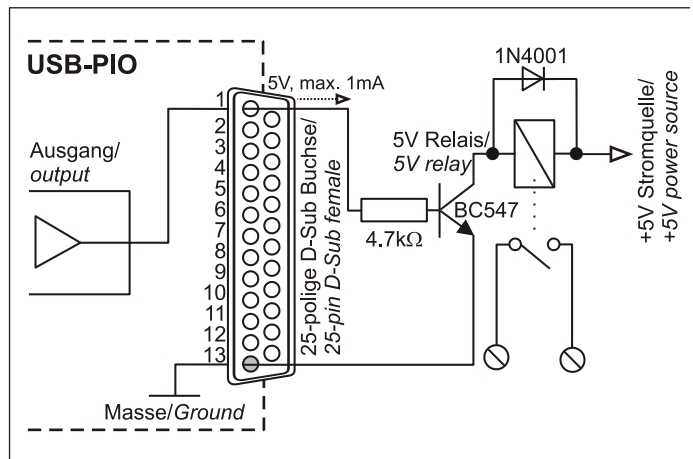
Only so-called low-current LEDs can be used, because they already work with 1mA current. Please also observe the total current listed in the technical data (see chapter 0).



#### 3.2.2 Connecting a Relay

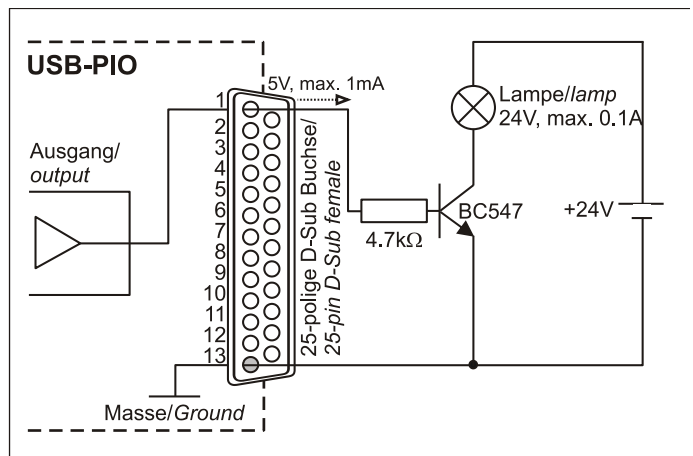
A connected relay is ideal to switch higher currents. Since the field coil of the relay requires a higher current than provided by the measurement system at one line, a transistor is connected ahead.

**Relay cards featuring 8 outputs are available at bmc**  
(see chapter 6).



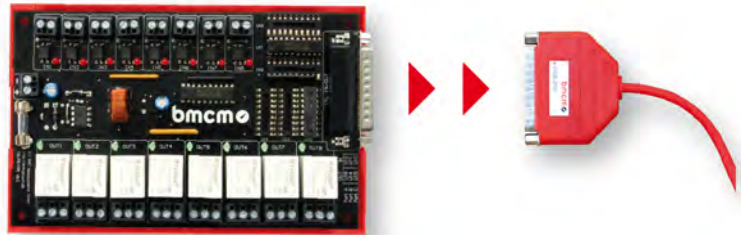
#### 3.2.3 Connecting a Lamp

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.



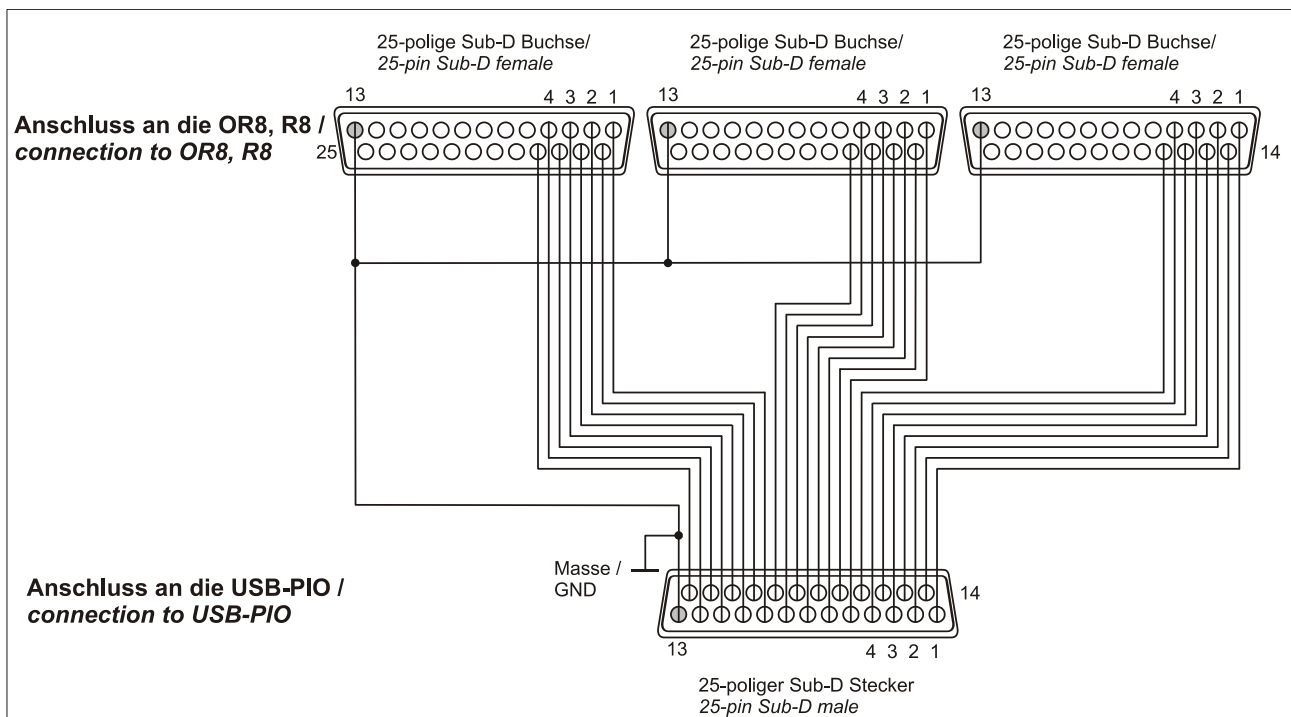
## 4 Connection Technology for USB-PIO

bmcM provides optocoupler and relay cards to electrically isolate the digital inputs and outputs of the USB-PIO. The connectors are directly compatible for a 25-pin D-Sub-standard cable to be used. If connecting several OR8, R8 to the USB-PIO, a special cable has to be made (see figure below).



Channel	OR8	R8
IN (optocoupler input)	8	-
OUT (relay output)	8	8
I/O (bidirectional)	-	-

- The port direction of the USB-PIO must comply with the settings of the optocoupler/relay card to avoid damages (optocoupler channels to input, relay channels to output).
- For further information, please see the relevant data sheets.



Interfacing example

## 5 Important Notes for Using the USB-PIO

- The device is only suitable for extra-low voltages - please observe the relevant regulations! Only use the device with 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 25-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 ground and the chassis are 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!
- PCs (notebooks) which are not grounded often produce high potentials to earth at the USB socket so that safe operation cannot be guaranteed. In this case, connect the measuring system to earth.
- 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.



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/Outputs

Lines:	3x 8 lines (bidirectional, set in groups of 8, port C in groups of 4)
Level:	CMOS/TTL compatible (low: 0V..0.7V; high: 3V..5V)
Current pick-up per output pin:	max. 5mA (with app. 4V-level), max. 20mA in total of all output channels!
Sampling rate:	up to 500 values/second can be sampled (depending on software and PC)
Input resistance:	100k $\Omega$ pull-down resistor (PC off: 1k $\Omega$ )
Surge protection:	max. $\pm$ 5.5V, max. max. $\pm$ 20mA in total of all channels!
USB interface:	USB 2.0 compatible (full-speed)

### • General Data

Power supply:	+4.5V..+5.5V from USB connection to the PC, max. 100mA
Digital connections:	all 24 lines at 25-pin D-Sub female
CE standards:	EN61000-6-1, EN61000-6-3, EN61010-1; for decl. of conformity (PDF) visit <a href="http://www.bmcm.de">www.bmcm.de</a>
ElektroG // ear registration:	RoHS and WEEE compliant // WEEE Reg.-No. DE75472248
Max. permissible potentials:	<b>60V DC acc. to VDE</b> , max. 1kV ESD on open lines
Temperature ranges:	operating temp. 0..70 °C, storage temp. -25..+70 °C
Relative humidity:	0-90% (not condensing)
Dimensions:	53 x 44 x 16 mm; USB cable app. 1.1m
Protection type:	IP30
Delivery:	device in plastic housing with USB cable
Available accessories (optional):	connecting cable ZUKA25, 25-pin D-Sub plug ZU25ST, optocoupler/relay cards OR8, R8
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, Mac OS X, Unix (FreeBSD, Linux); 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 8/10