

MADE IN GERMANY



BMC Messsysteme GmbH

Emmy-Noether-Str. 20

82216 Maisach

Deutschland

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USB-PIO

Digital I/O Interface



1. Features

24 Lines. Digital. Output & Monitoring.

Record and output digital TTL signals (5V). The USB-PIO has three groups of 8 lines each with switchable direction. The lines are routed through a 25-pin D-Sub connector.

Extra small. Extra red. Extra affordable.

The unique idea behind the USB-PIO: the device is housed in a D-Sub enclosure. Not only the size is extra small but so is the price.

Modern with USB-C. Plug & Play.

The connection to the PC is made via USB-C. This allows the USB-PIO to take advantage of all typical USB features (e.g. Plug & Play, Hot-Plug). Up to 127 devices can be connected and installed while the system is running.

Powered by USB.

The device is powered entirely through the USB interface. This reduces cabling to a minimum and makes mobile operation even easier.

Optimized for Windows. 11.

The required drivers and programming interfaces are optimized for 64-bit under Windows® 11. All software for installation and programming of the USB-PIO is included free of charge.

NextView®. Try for free.

The device is supported by NextView®, the software for measurement data acquisition and analysis. A fully functional 14-day trial version is available online. This allows the functionality of the USB-PIO to be tested directly.

Connectivity-friendly.

For galvanic isolation of the digital lines, the optocoupler and relay card OR8 from bmcm is available. Simply plug in and get started.

2. Block Diagram

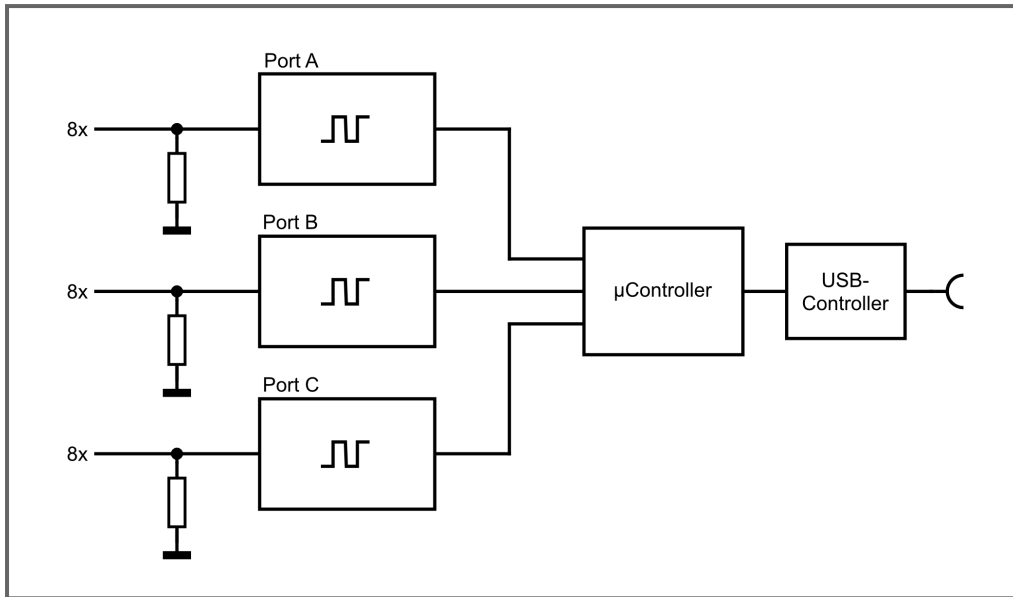


Fig. 1: Block diagram USB-PIO

3. Getting Started

All software and documentation for the USB-PIO is available at www.bmcm.de/usb-pio under the **Downloads** tab.

3.1. Device Driver Installation

To use a USB measurement system, the latest driver package must be installed. You can find it at www.bmcm.de/usb-pio under the **Downloads** tab in the BMCM - Drivers for Windows 10 / 11 category.

3.2. Connecting

Connect the USB-PIO to a free USB port on the PC using the supplied USB cable. The device is powered through the USB connection.

3.3. Using with NextView or a Custom Program

3.3.1. NextView

To use your measurement system with NextView, simply download and install the latest version of NextView from www.nextview.de/go. If you do not have a NextView license key, you can request a free trial version directly when you first launch NextView. More information about NextView, installation and licensing can be found at www.nextview.de.

3.3.2. Using the API (dll)

The LIBAD4 is a universal programming interface for products from BMC Messsysteme GmbH. It allows you to integrate BMC Messsysteme hardware into your own programs.

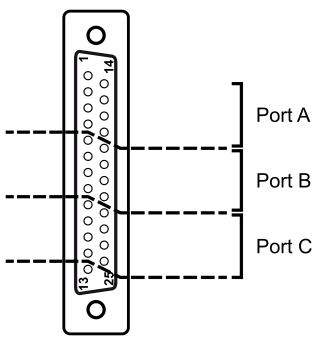
If you want to use the measurement system without NextView, you need to install the free programming interface LIBAD4. You can also find this at www.bmcm.de/usb-pio under the **Downloads** tab in the LIBAD - Programming Interface (API) category. More information and a detailed documentation can be found at www.bmcm.de/libad.

4. Connections

4.1. Digital Inputs and Outputs

The USB-PIO features a μ -controller that provides three 8-bit digital ports A, B, C. The lines are bidirectional, meaning their input/output direction can be set via software. The direction is switched port-wise; for port C in groups of 4.

The connections for the digital interfaces are accessible via the 25-pin D-Sub connector of the USB-PIO. The pin assignment is shown in the table and diagram below.

	Port A / Bit	Pin (D-SUB 25)	Port B / Bit	Pin (D-SUB 25)	Port C / Bit	Pin (D-SUB 25)
	A0	1	B0	5	C0	9
	A1	14	B1	18	C1	22
	A2	2	B2	6	C2	10
	A3	15	B3	19	C3	23
	A4	3	B4	7	C4	11
	A5	16	B5	20	C5	24
	A6	4	B6	8	C6	12
	A7	17	B7	21	C7	25
	digital ground (DGND)	13				

- Always turn on the PC first before applying voltage to the digital lines.
- Never apply voltage to the lines without protective circuitry. If two outputs drive against each other, they can be destroyed by the excessive current.
- The digital inputs are equipped with an internal 100k Ω pull-down resistor, so that open inputs are constantly low.
- After power-on, all ports are always set to input.

4.2. USB-C

The USB-PIO is equipped with a USB-C socket for power supply and data transfer (480 Mbit) and is connected to the PC using a standard USB-C cable (included in delivery). Alternatively, use high-quality cables. The shorter the cable, the more reliable the data transfer.

5. Connection Examples

In the following examples, only the first line is typically used. Of course, any of the 24 lines can be used.

5.1. Connection Examples Digital Inputs

After power-on, all ports are always set to input.

5.1.1. TTL/CMOS Signal

TTL/CMOS signals can be connected directly to the lines configured as inputs. A signal above 2.0V is interpreted as "High" (1), a signal below 0.8V as "Low" (0).

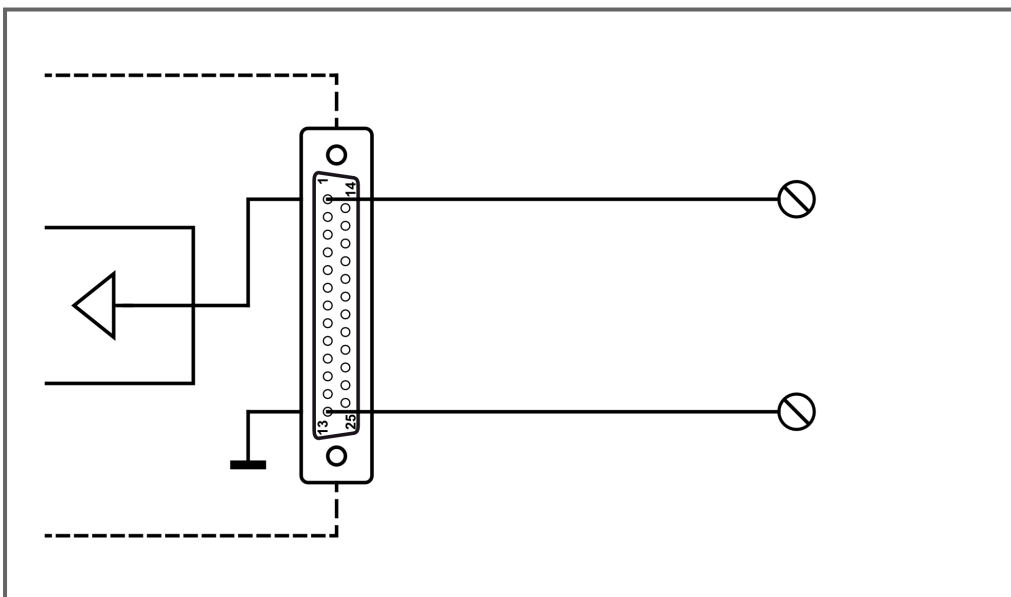


Fig. 2: Circuit example TTL/CMOS

5.1.2. Connecting an Optocoupler

Optocouplers provide optimal protection for the input lines. This makes it possible to detect higher voltages and protect the device from damage. Please also refer to the application examples of the optocoupler used.

bmcm offers an optocoupler/relay expansion (ID: OR8) with 8 channels each

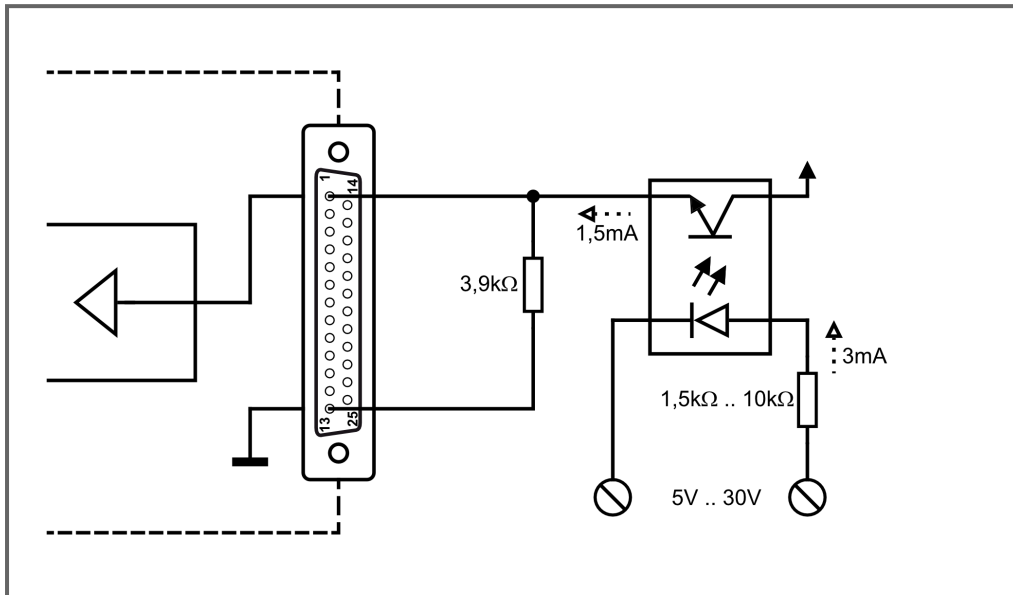


Fig. 3: Circuit example digital inputs

5.1.3. Connecting a Button/Switch

When selecting a button, make sure to use one with debounce protection. Otherwise multiple pulses may be detected. Although a 100kΩ pull-down resistor is integrated, an external 3.9kΩ pull-down can increase circuit reliability.

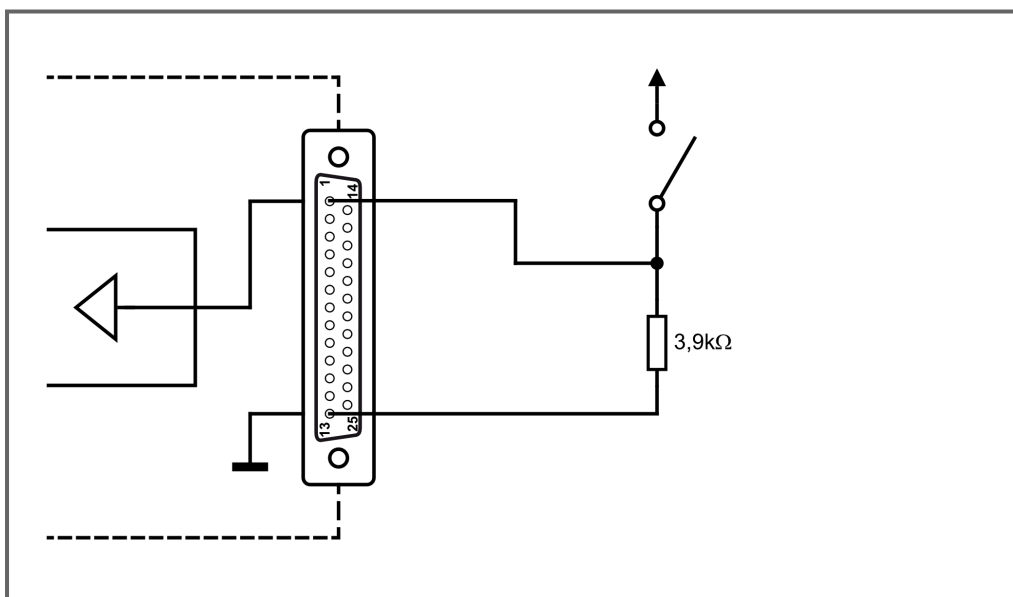


Fig. 4: Circuit example button

5.1.4. Voltage > 5V

When connecting a DC voltage greater than 5V, a voltage divider must be used to ensure a maximum of 5V at the device input. Exceeding the 5V input voltage may cause damage to the device.

The ratio of resistors to be used is calculated using the following formula:

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

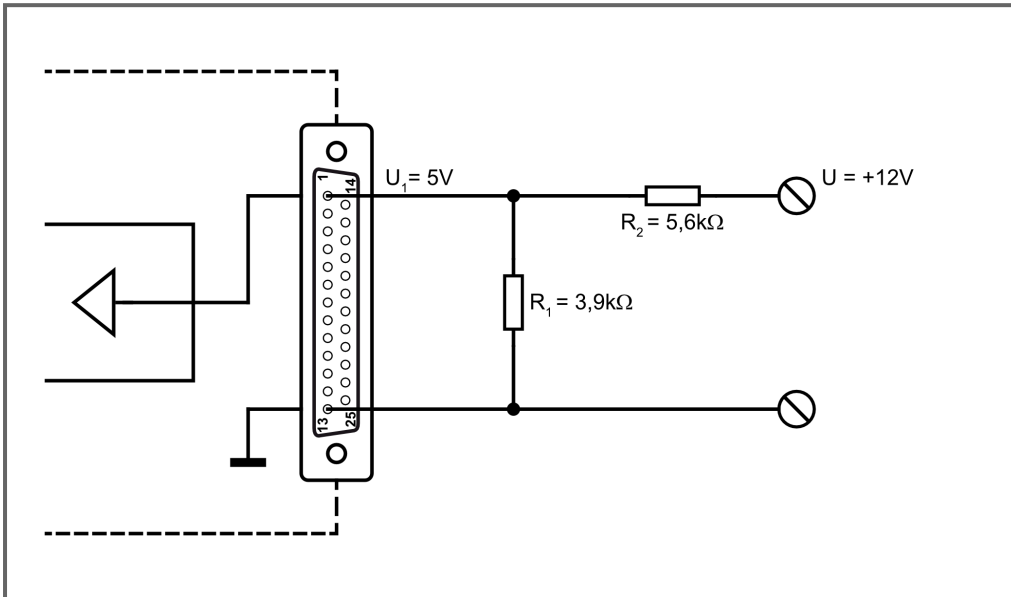


Fig. 5: Circuit example voltage divider

5.2. Digital Outputs

Never apply voltage to a port configured as an output. This can lead to destruction of the device.

5.2.1. TTL/CMOS Signal

TTL/CMOS signals can be output directly.

Pay attention to the maximum current per line and the total current ([Technical Data](#))!

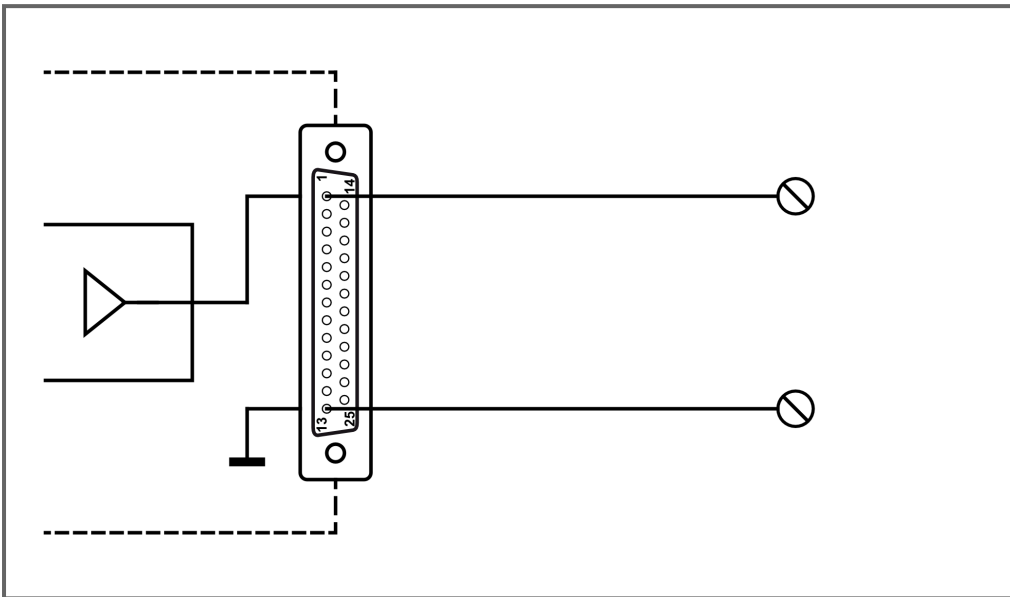


Fig. 6: Circuit example TTL/CMOS

5.2.2. Connecting an LED

Only so-called low-current LEDs can be used, as these are the only ones that light up at a current of 1mA. Please also make sure to limit the total current ([Technical Data](#)).

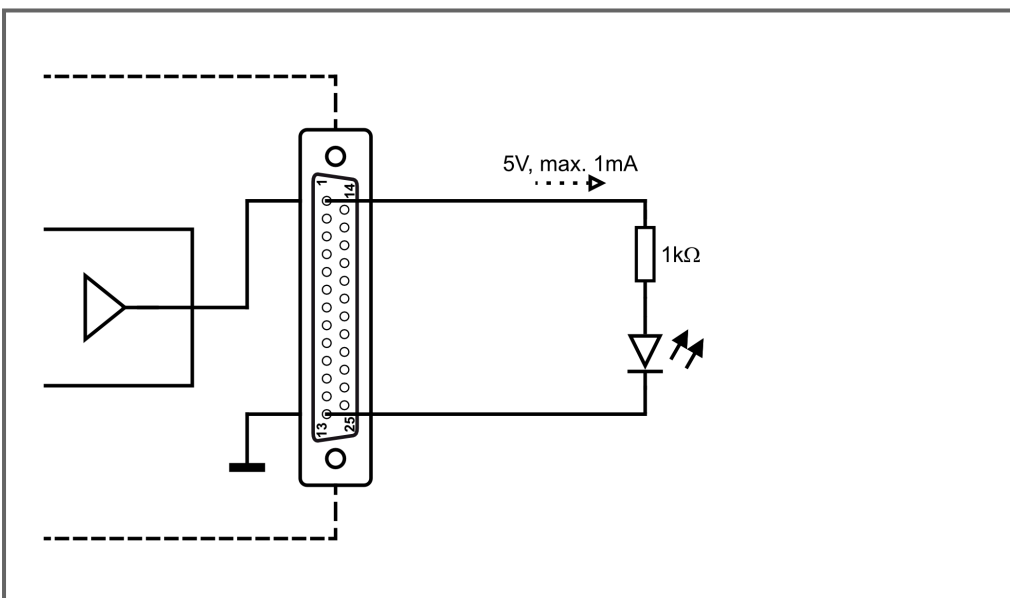


Fig. 7: Circuit example LED

5.2.3. Connecting ULN2803

The ULN2803 switching IC is ideally suited for switching lamps or relays. Since 8 switching stages are already integrated in the IC, very space-saving circuits can be built.

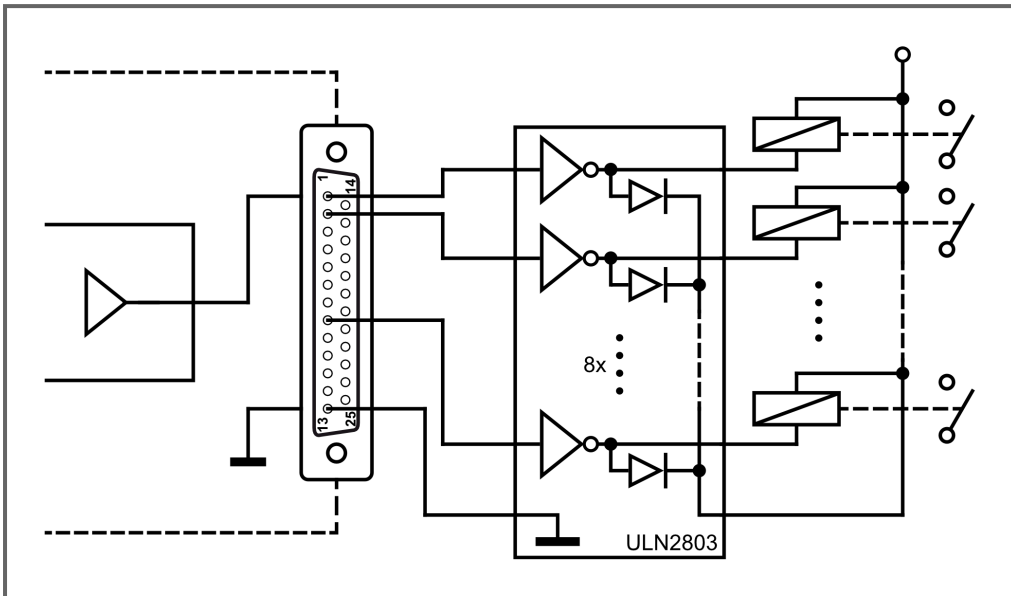


Fig. 8: Circuit example ULN2803

5.2.4. Connecting a Relay

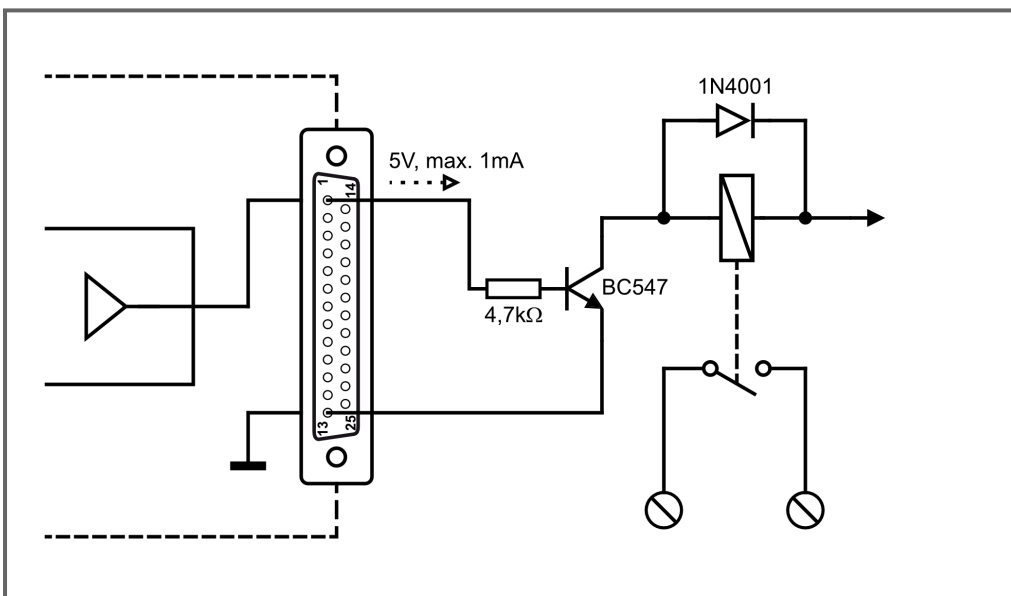


Fig. 9: Circuit example relay

A connected relay is ideal for switching higher currents. Since the relay's excitation coil requires more current than the USB-PIO can supply on a single line, a transistor is connected upstream.

bmcm offers an optocoupler/relay expansion (ID: OR8) with 8 channels each

5.2.5. Connecting a Lamp

A transistor can be used to switch higher loads. The transistor must be selected to match the maximum current to be switched. The adjacent diagram shows an application with a max. current of 100mA.

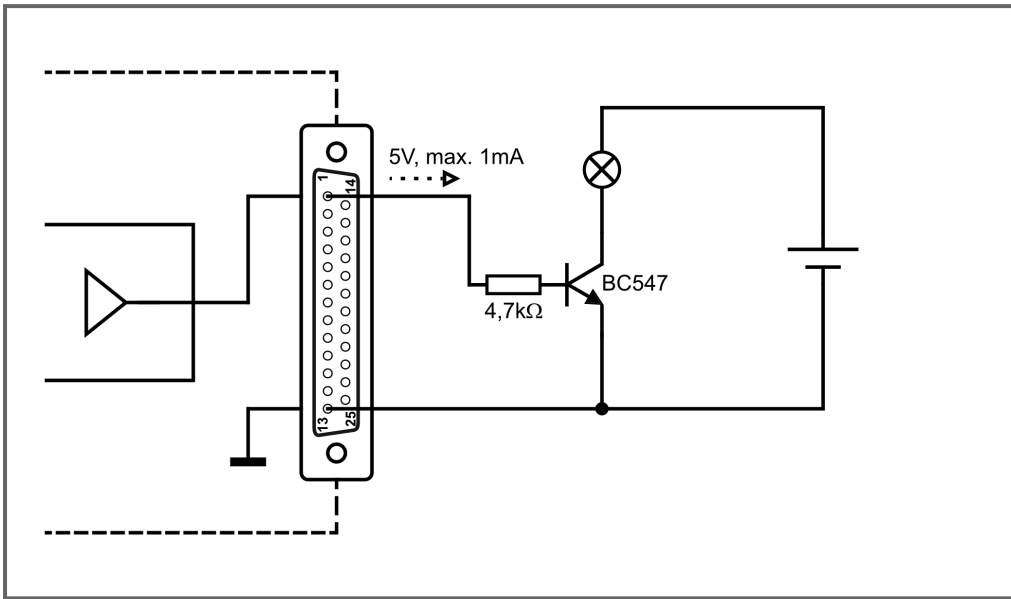


Fig. 10: Circuit example lamp

6. Accessories

Galvanic isolation between the USB-PIO and external circuits can be achieved with the optocoupler/relay card OR8. The pin assignment is directly compatible. The OR8 has 8 optocoupler inputs and 8 relays with changeover contacts. This allows voltages in the range of 5..30V to be detected and currents of up to 6A (max. 60V) to be switched.

The port direction of the USB-PIO must be set correctly when using the OR8, otherwise the outputs of the OR8 will drive against the outputs of the USB-PIO.

Set the USB-PIO as follows:

- Port A to output for the relay channels
- Port B to input for the optocoupler channels

Further information can be found in the corresponding datasheets.

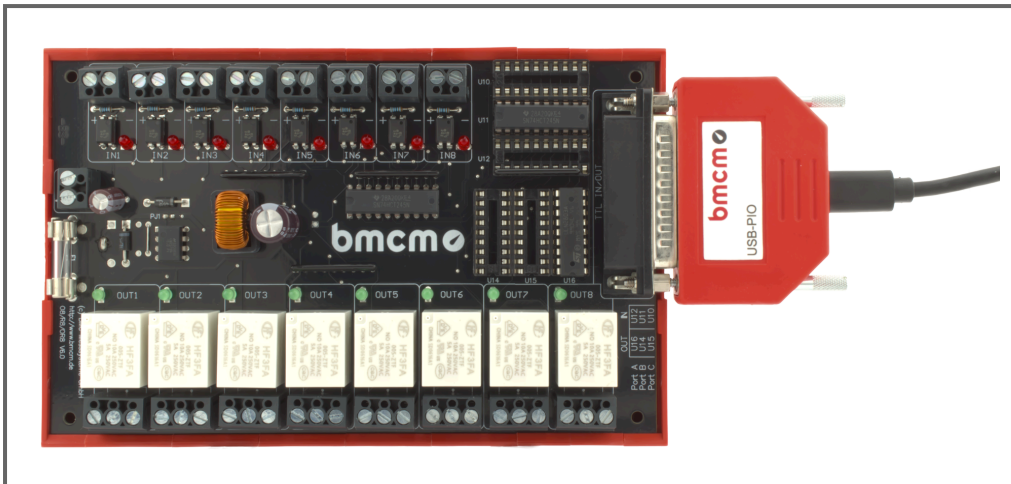


Fig. 11: Example USB-PIO connected directly to OR8

To use multiple OR8 cards, a special cable must be made.

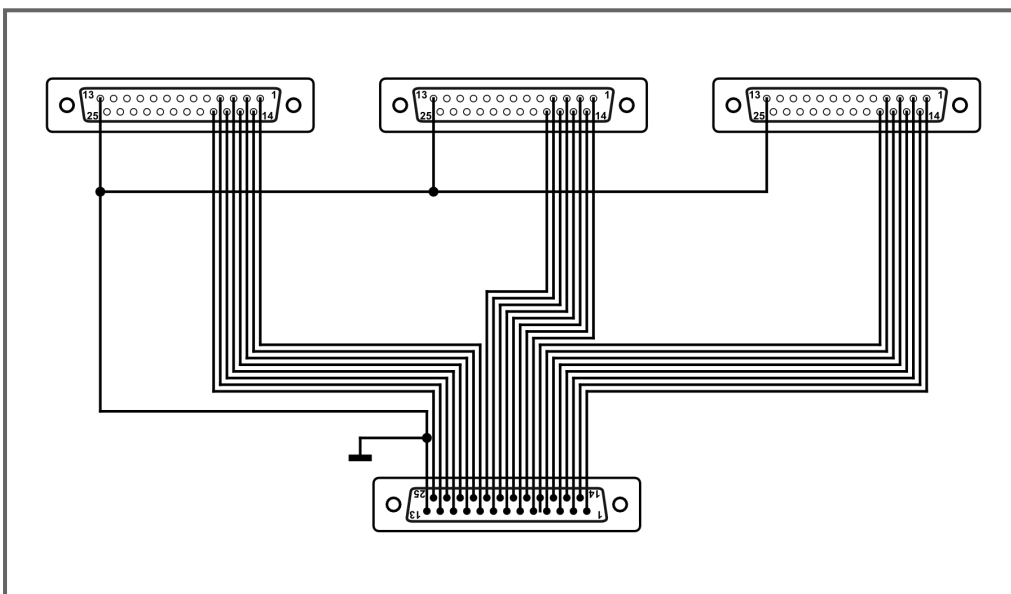


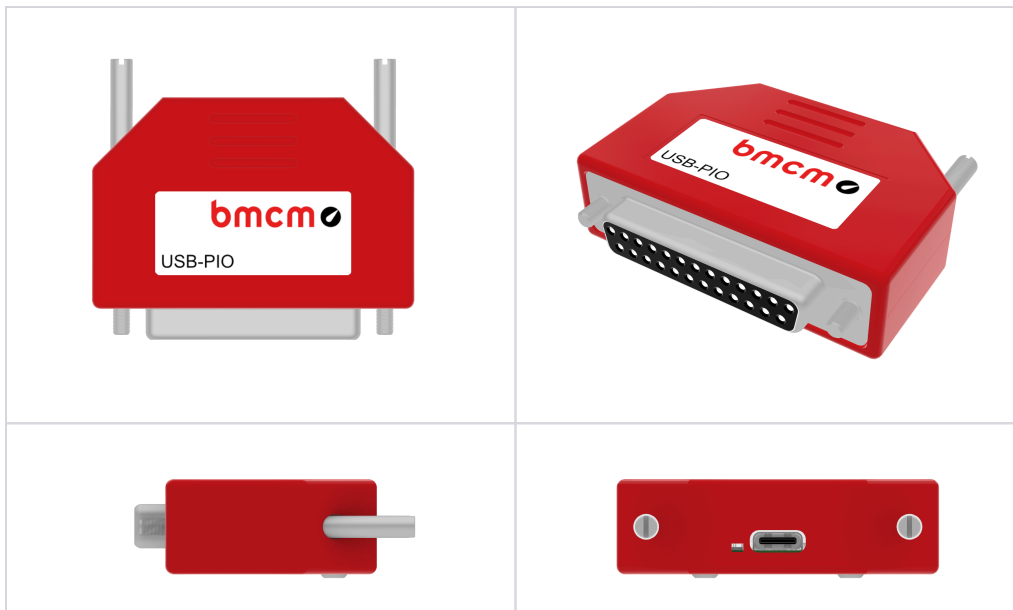
Fig. 12: Example cable for operating three OR8 with one USB-PIO

7. General User Notes for the USB-PIO

- The device is only suitable for low voltages, observe the relevant regulations! Operate the device only in a closed enclosure. ESD voltages on open lines can cause malfunctions during operation.
- For cleaning the device, use only water with dish soap. No maintenance is intended.
- Signals are connected at the 25-pin D-Sub connector; use shielded cables where possible. For good noise suppression, connect the shield on one side only. Terminate open inputs if necessary.
- The device ground and the enclosure are electrically connected to the PC ground. In most cases, the PC ground is also earth-grounded. Ensure that no earth or ground loops occur, as these will cause measurement errors!
- Ungrounded PCs (laptops) often generate high potentials at the USB socket relative to earth, preventing reliable operation. If necessary, the measurement system must be grounded.

- The product must not be used for any safety-critical tasks. By integrating the product, the customer becomes the manufacturer by law and assumes responsibility for correct installation and use. Any modifications and/or use other than intended will void the warranty, and all liability claims are excluded.
- The product must not be disposed of via public waste collection points or trash bins. It must either be disposed of properly in accordance with the WEEE directive or can be returned to bmcm at the customer's own expense.

8. Views



9. Technical Data

(typ. at 20°C, after 5 min., +5V supply)

Digital Inputs/Outputs	
Lines	3x 8 lines (bidirectional, switchable in groups of 8, port C in groups of 4)
Level	CMOS/TTL compatible (low: 0V..0.8V; high: 2V..5V)
Port output current	per output pin: max. 5mA (at approx. 4V level), max. 20mA total across all outputs!
Sampling rate	up to 500 values/second achievable (PC/software dependent)
Input resistance	100kΩ pull-down (PC off: 1kΩ)
Overvoltage protection	max. +5.5V, max. 20mA total across all inputs!
USB interface	USB-C, USB 2.0 compatible (full-speed)

General Data	
Supply	+4.5V..+5.5V from the PC's USB port, max. 100mA
Digital connectors	all 24 channels on one 25-pin D-Sub connector
CE standards	EN61000-6-1, EN61000-6-3, EN61010-1
ElektroG // ear registration	RoHS and WEEE compliant // WEEE Reg. No. DE75472248
Max. potentials	60V DC per VDE, max. 1kV ESD on open lines
Temperature range	Operating temperature 0..70°C, storage temperature -25..70°C
Relative humidity	0-90% (non-condensing)
Dimensions	58 x 44 x 17 mm ³
Protection class	IP30
Scope of delivery	Device in plastic enclosure; USB cable (C->A)
Available accessories	Cable ZUKA25, 25-pin D-Sub connector ZU25ST, optocoupler/relay cards OR8
Warranty	2 years from date of purchase at bmcm; damage to the product due to improper use is excluded
Software	
Free software download	LIBAD4 SDK for programming under Windows 10/11; measurement software NextView® as trial version for testing and operating the USB-PIO
NextView® (optional)	professional software in versions Professional and Lite for acquisition and analysis of measurement data under Windows® 10/11

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