

# ■ 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.

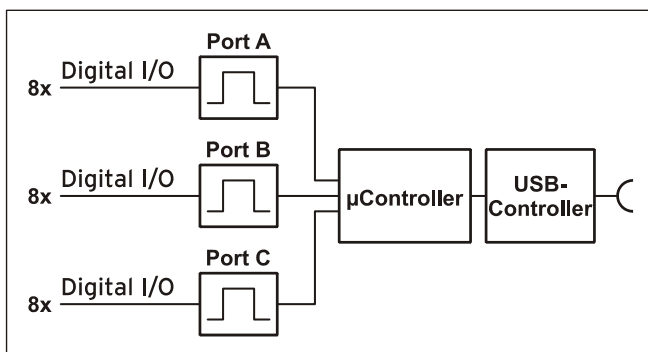
The unique idea of the USB-PIO: the device is accommodated in the D-Sub connector housing. Not only the size is extra small but also the price.

## 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 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®4. Try for Free.

The DAQ system 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-PIO.

## Get Connected.

Various optocoupler and relay cards are available at bmc 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

Install the bmc driver package (see chapter 4.1.1). Connect the USB cable of the USB-PIO to the USB-interface of the PC and start the Plug&Play installation (see chapter 4.1.2). The device is supplied with power via the USB-connection.

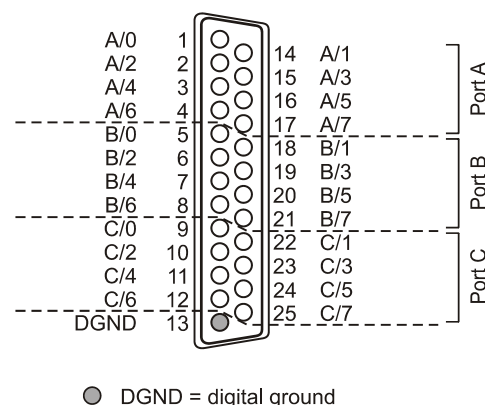
If necessary, further software components can be installed now, as described in chapter 0.

## 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)	Assignment
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.

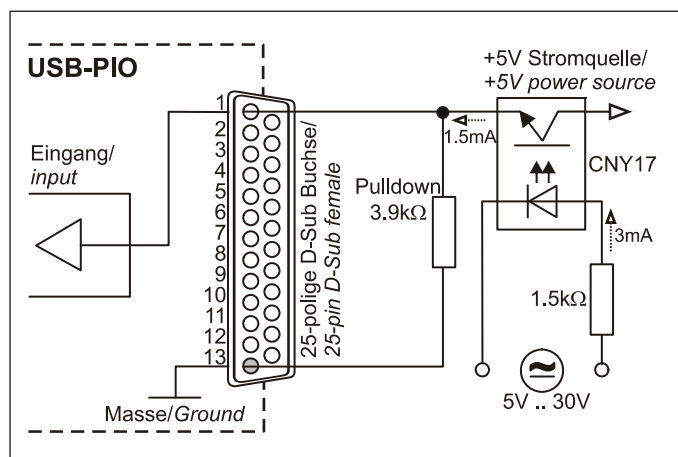
#### 3.1.1 Connecting an Optocoupler

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.



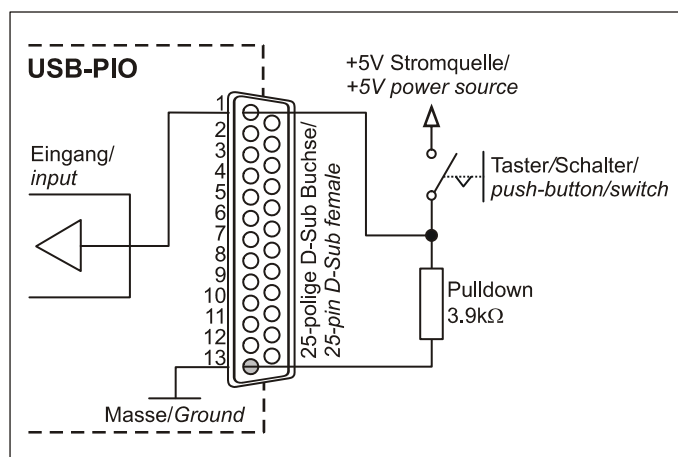
**Optocoupler cards featuring 8 inputs are available at bmcm (see chapter 0).**



#### 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.



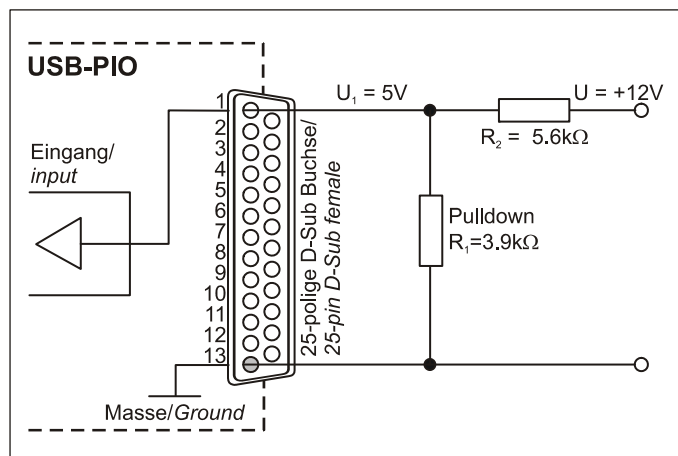
#### 3.1.3 Connecting a Voltage Divider

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).



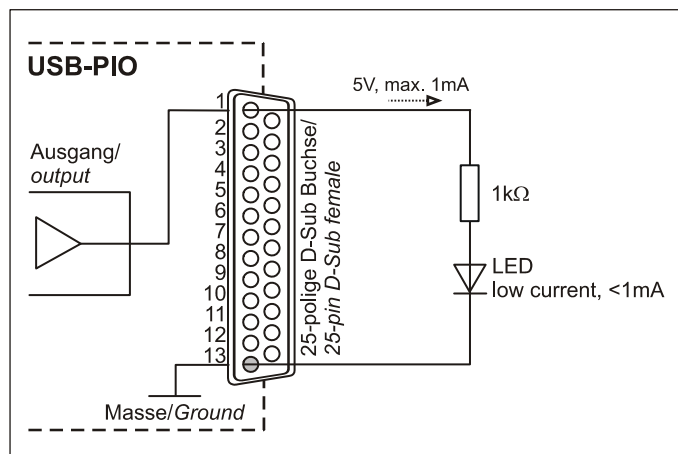
## 3.2 Interfacing Examples for Digital Outputs

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 7).

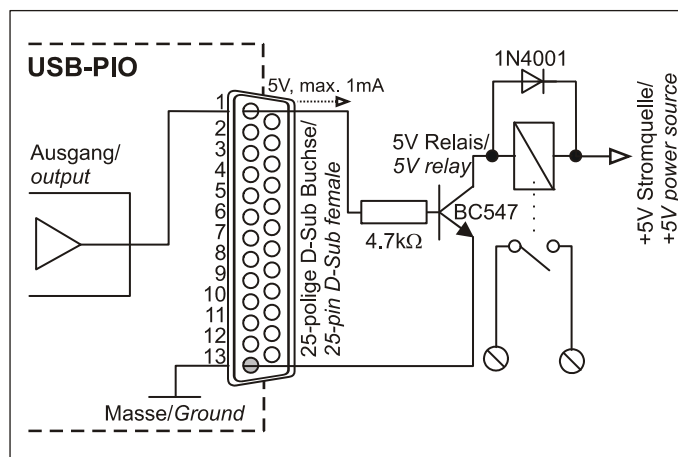


### 3.2.2 Connecting a Relay

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.



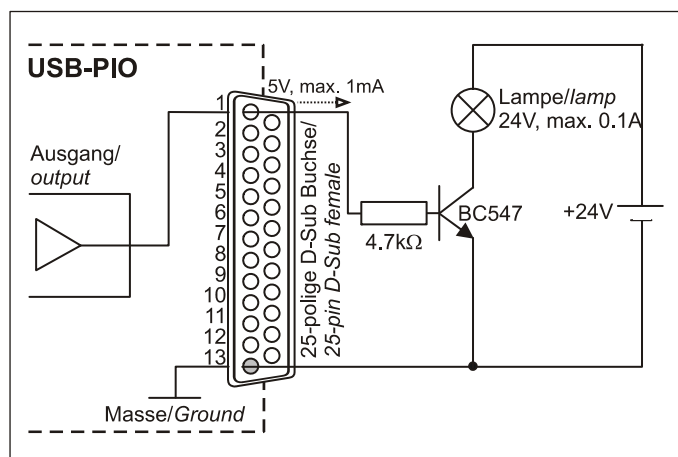
**Relay cards featuring 8 outputs are available at bmcm (see chapter 0).**



### 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 Software Installation



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



USB-PIO

Change to the product page of the USB-PIO by selecting the entry "Products" in the CD starter and then the hardware ("USB-PIO") 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	<a href="#">BMCM-DR</a> (driver package)	1. install driver package to hard disc 2. Windows® Plug&Play installation	<a href="#">IG-BMCM-DR</a> (driver installation manual)
Program- ming	<a href="#">STR-LIBADX</a>	ActiveX control for hardware independent programming	<a href="#">IG-LIBADX</a> (installation / programming manual)
	<a href="#">STR-LIBADX-EX</a>	example programs for LIBADX ActiveX control	-
	<a href="#">SDK-LIBAD</a>	SDK with example programs for C/C++ on Windows®, Mac OS X, FreeBSD, Linux	<a href="#">UM-LIBAD4</a> (installation / programming manual)
Operating program	<a href="#">NV4.6</a>	measuring software NextView®4 available in the Standalone versions: <ul style="list-style-type: none"> <li><u>Lite</u>: "slim" version with basic functions</li> <li><u>Pro</u>: full version with complete functional range</li> <li><u>Analysis</u>: version for the analysis of stored measuring data</li> </ul> <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>	<a href="#">DS-NV4</a> (data sheet) <a href="#">UM-NV4</a> (user manual) <b>"First steps"</b> 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-PIO. 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 bmcm 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-PIO product page of the "Software Collection" CD.

### 4.1.2 Plug&Play Installation

As soon as the USB-PIO 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® 7/8. Under Windows® XP, the automatic hardware detection is started by selecting the following:



- **Windows® 7/8:** 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 bmcm hardware. To open the Device Manager, proceed as follows:



- **Windows® 7:** Start / Control Panel / System and Security / System / Device Manager
- **Windows® 8:** Right-click screen corner bottom left (keyboard "Windows+X") / Device Manager
- **Windows® XP:** Start / Control Panel / System / TAB "Hardware" / button "Device Manager"

Double click the USB-PIO 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-PIO with Visual Basic®, Delphi®, Visual C++™ under Windows® XP/7/8 is possible with the hardware independent [STR-LIBADX](#). It is available on the USB-PIO 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-PIO 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-PIO. For further information about how to integrate the SDK in the programming environment, please see the corresponding programming manual [UM-LIBAD4](#).

## 4.3 Using USB-PIO 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-PIO.



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-PIO) 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.

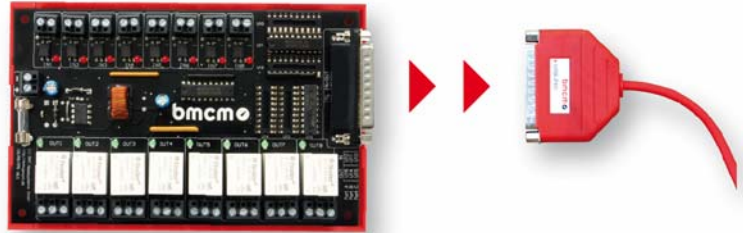


**The trial is valid for 30 days after requesting the license number. If a license is not purchased within this period, the functional range of NextView®4 will be considerably cut down!**

## 5 Connection Technology for USB-PIO

bmcM provides optocoupler and relay cards to electrically isolate the digital inputs and outputs of the USB-PIO.

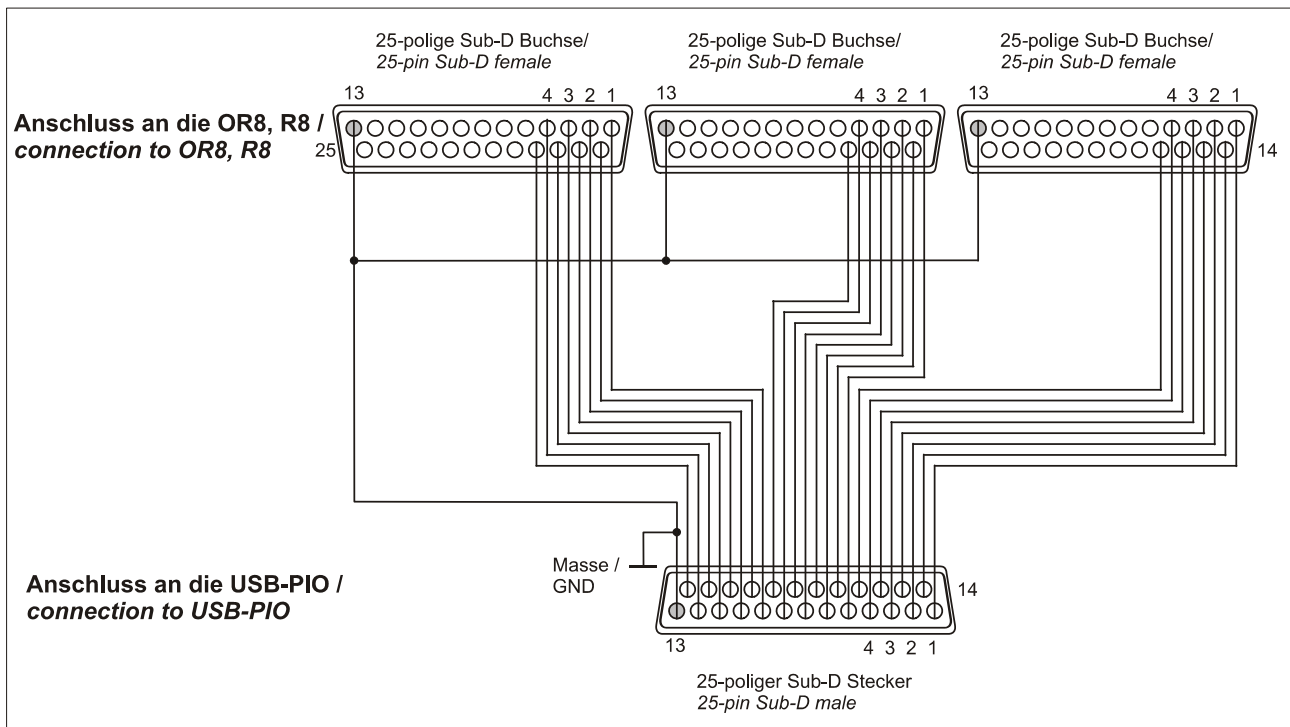
The connectors are directly compatible for a 25-pin D-Sub standard cable to be used. If connecting several OR8, R8 to the USB-PIO, a special cable has to be made (see figure below).



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



## 6 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.

## 7 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:	100kΩ pull-down resistor (PC off: 1kΩ)
Surge protection:	max. ±5.5V, max. max. ±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 <sup>3</sup> , USB cable app. 1.1m
Protection type:	IP30
Delivery:	device in plastic housing with USB cable, "Software Collection" CD, description
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 on CD (included):	ActiveX Controls LIBADX (hardware independent) for programming on Windows® XP/7/8; LIBAD4 SDK for C/C++ programming on Windows® XP/7/8, 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® XP/7/8