

## 3.2 Connect to the data acquisition system

The **LibadX** ActiveX control provides two functions for opening or closing the connection to a data acquisition system.

With the **Open ()** function a data acquisition system is opened, with **Close ()** the connection is closed. The following example demonstrates the basic procedure:

```
if (LIBADX1.Open ("usb-pio"))
    ...
    LIBADX1.Close
else
    MsgBox "Could not open USB-PIO device"
```

The name of the data acquisition system is passed to the function **Open ()**. This string is not case-sensitive, i.e. "usb-pio" and "USB-PIO" both open a USB-PIO. If a connection to a data acquisition system has been opened, **Open ()** returns the value **TRUE**, and **FALSE** if an error occurs.

It is not possible, to use one object for opening several devices at the same time. However, several (different) data acquisition systems can be opened with several objects. The following example opens a PCIe-BASE / PCI-BASEII/300/1000 / PCI-PIO and a USB-PIO:

```
if (LIBADX1.Open ("pcibase")
    AND LIBADX2.Open ("usb-pio"))
    ...
endif
```

### 3.2.1 Channel numbers and measuring ranges

In **LibadX**, input and output channels are identified by their channel number. The channel number depends on the data acquisition system used and is explained in the relating chapters. The first analog input of a USB-AD12f, for example, is channel 1.

In addition to the channel number, analog channels require information about the measuring range (or output range) used to scan (or to output). Like the channel

number, the measuring range depends on the data acquisition system and is documented in the following chapters.

### 3.2.2 iM-AD25a / iM-AD25 / iM3250T / iM3250

To open the iM-AD25a, iM-AD25, iM3250T or iM2350 with the **LibadX**, the string "**im:<ip-addr>**" must be passed to **Open()**. Here **<ip-addr>** must be replaced by the relating IP address. The string "**im:192.168.1.1**", for example, opens the iM device with the IP address 192.168.1.1. When opening the driver, no difference is made between different iM device types.

DAQ syst.	Analog	Channel number	Meas. range	Range	Digital
<b>iM-AD25a</b>	16 inputs	1..16	$\pm 10.24\text{V}$ $\pm 5.12\text{V}$	1 0	1: output (bit 0..3)
<b>iM-AD25</b>	16 inputs	1..16	$\pm 5.12\text{V}$	0	1: output (bit 0..3)
<b>iM3250T</b>	32 inputs	17..48	$\pm 5.12\text{V}$	0	-
<b>iM3250</b>	32 inputs	AIn 1..16: 1..16 (with 1 BPL) 17..32 (with 2 BPL) AIn 17..32: 33..48	$\pm 5.00\text{V}$	0	-



**Please note that MAL measuring amplifiers installed in the iM3250T might change the measuring range of the corresponding channels.**

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### 3.3 LAN-AD16f

Open the LAN-AD16f with the **LIBAD4** by passing the string "**lanbase:<ip-addr>**" to **Open()**. Here **<ip-addr>** must be replaced by the relating IP address. The string "**lanbase:192.168.1.1**", for example, opens the LAN device with the IP address 192.168.1.1.

DAQ system	Analog	Channel number	Measuring range	Output range	Digital	Direction
<b>LAN-AD16f</b>	16 inputs 2 outputs	1..16 1 .. 2	3 ( $\pm 10.024\text{V}$ ) 2 ( $\pm 5.012\text{V}$ ) 1 ( $\pm 2.048\text{V}$ ) 0 ( $\pm 1.024\text{V}$ )	0 ( $\pm 10.024\text{V}$ )	2 ports (16 bit each)	1: input (bit 0..15) 2: output (bit 0..15)

The 16 analog inputs of a LAN-AD16f are addressed via the channel numbers 1-16. The 2 analog outputs are reached via channel number 1 and 2.

The direction of the ports is hard-wired. The 16 lines of the first port (DIO1, channel number: 1) are set to input, the 16 lines of the second port (DIO2, channel number: 1) to output.

### 3.3.1 PCIe-BASE / PCI-BASEII/300/1000 / PCI-PIO

To open the PCIe-BASE, PCI-BASEII, PCI-BASE300, PCI-BASE1000 or PCI-PIO with the **LibadX**, the string "**pcibase**" (or "**pci300**") must be passed to **Open()**. When opening the driver, no difference is made between different versions of the PCI(e) data acquisition card.

To distinguish between several cards, the card number is explicitly used (1. card with "**pcibase:0**", 2. card with "**pcibase:1**", etc.).

A DAQ card is also directly accessible via its serial number. The card with the serial number 157 can be addressed with "**pcibase:@157**", for example.

#### 3.3.1.1 Digital ports and counters

The PCIe-BASE / PCI-BASEII/300/1000 / PCI-PIO features two 16-bit digital ports.

The digital lines of the PCIe-BASE, PCI-BASEII und PCI-PIO are bidirectional. Their direction can be changed in groups of 8. After boot-up, the default direction of the first port is input and output of the second.

The ports of the PCI-BASE300/1000 are hard-wired. The first port is set to input, the second port to output.

In addition, some versions are provided with one (PCIe-BASE) or three (PCI-BASEII, PCI-PIO) 32-bit counters.

#### 3.3.1.2 MAD12/12a/12b/12f/16/16a/16b/16f

The first analog input channel of a MAD12/12a/12b/12f/16/16a/16b/16f starts with 1. If there is a second analog input module on the PCI(e) multi-function card (not: PCI-PIO), the first input of the second module is addressed by the number 257 ( $0 \times 100 + 1$ ).

Of course, one input module can be operated in differential (not MAD12b/16b) and the other in single-ended mode, thus providing for 24 input channels.

The measuring ranges of the input channels depend on the module. If different input modules are plugged on the PCI(e) data acquisition card (not PCI-PIO), the

measuring ranges of the channel 1..16 may differ from the measuring ranges of the channels 17..32.

Module	Analog	Channel number	Meas. range	Range
<b>MAD12,</b> <b>MAD16</b>	16 inputs (single-ended) 8 inputs (differential)	1..16 (se) 17..24 (diff)	±1.024V	0
			±2.048V	1
			±5.120V	2
			±10.240V 0.06V..5.06V	3 4
<b>MAD12a,</b> <b>MAD12f,</b> <b>MAD16a,</b> <b>MAD16f</b>	16 inputs (single-ended) 8 inputs (differential)	1..16 (se) 17..24 (diff)	±1.024V	0
			±2.048V	1
			±5.120V ±10.240V	2 3
<b>MAD12b,</b> <b>MAD16b</b>	16 inputs (single-ended)	1..16	±1.024V	0
			±2.048V	1
			±5.120V	2
			±10.240V	3

### 3.3.1.3 MDA12/12-4/16/16-2i/16-4i/16-8i

Corresponding to the MAD12/12a/12b/12f/16/16a/16b/16f, the channels of a second analog output module are accessible from number 257 (0x100+1) on.

Module	Analog	Channel number	Output range	Range
<b>MDA12,</b> <b>MDA16</b>	2 outputs	1..2	±10.24V	0
			±5.12V	1
<b>MDA12-4</b>	4 outputs	1..4	±10.24V ±5.12V	0 1
<b>MDA16-2i</b>	2 outputs	1..2	±10.24V	0
<b>MDA16-4i</b>	4 outputs	1..4	±10.24V	0
<b>MDA16-8i</b>	8 outputs	1..8	±10.24V	0

The output ranges of the output modules MDA12/MDA12-4 and MDA16 are configured on the hardware. The user must ensure that the passed measuring range complies with the configuration set on the module.

### 3.3.2 meM-AD /-ADDA /-ADf / -ADfo

Open the meM-AD/-ADDA/-ADf/-ADfo with the **LibadX** by passing the string "**memadusb**" (meM-AD), "**memaddausb**" (meM-ADDA), "**memadfusb**" (meM-ADf) or "**memadfpusb**" (meM-ADfo) to **Open ()**. To distinguish between several USB data acquisition systems, the device number is explicitly used (e.g. 1st device with "**memadusb:0**", 2nd device with "**memadusb:1**", etc.). The device order results from the order of connecting.

As USB data acquisition systems can be plugged and unplugged during operation, it may happen that the device numbers are not assigned consecutively. For example, if the second of three connected meM-ADDA devices is removed, the remaining meM-ADDA devices are addressed with "**memaddausb:0**" and "**memaddausb:2**".

To avoid managing the order of connecting, a device is also accessible via its serial number. The device with the serial number 157 can be addressed with "**memadfpusb:@157**", for example.

DAQ system	Analog	Channel number	Input/Output range	Range	Digital	Channel number
<b>meM-AD</b>	16 inputs	1..16	$\pm 5.12V$	0	-	-
<b>meM-ADDA, meM-ADf</b>	16 inputs 1 output	1..16 1	$\pm 5.12V$	0	2 ports (4 bit each)	1: input (bit 0..3) 2: output (bit 0..3)
<b>meM-ADfo</b>	16 inputs 1 output	1..16 1	$\pm 5.12V$	0	2 ports (8 bit each)	1: input (bit 0..7) 2: output (bit 0..7)

The 16 analog inputs of a meM-AD/-ADDA/-ADf/-ADfo are addressed via the channel numbers 1-16. The analog output is reached via channel number 1.

The direction of the digital ports is hard-wired. The 4 (meM-ADfo: 8) lines of the first port (DIO1, channel number: 1) are set to input, the 4 (meM-ADfo: 8) lines of the second port (DIO2, channel number: 2) to output.

### 3.3.3 meM-PIO / meM-PIO-OEM

Open the meM-PIO/meM-PIO-OEM with the **LibadX** by passing the string "**mempiousb**" to **Open()**. To distinguish between several USB data acquisition systems, the device number is explicitly used (e.g. 1st device with "**mempiousb:0**", 2nd device with "**mempiousb:1**", etc.). The device order results from the order of connecting.

As USB data acquisition systems can be plugged and unplugged during operation, it may happen that the device numbers are not assigned consecutively. For example, if the second of three connected meM-PIO devices is removed, the remaining meM-PIO devices are addressed with "**mempiousb:0**" and "**mempiousb:2**".

To avoid managing the order of connecting, a device is also accessible via its serial number. The device with the serial number 157 can be addressed with "**mempiousb:@157**", for example.

DAQ system	Digital	Channel number
meM-PIO, meM-PIO-OEM	3 ports (8 bit each)	1..3 (bit 0..7)

The line direction is set for each port separately in groups of eight (see "**DigitalDirection**", S. 57). The first port (DIO1) has channel number 1, the second port (DIO2) channel number 2 and the third port (DIO3) channel number 3.

### 3.3.4 USB-AD

Open the USB-AD with the **LibadX** by passing the string "**usb-ad**" to **Open()**. To distinguish between several USB data acquisition systems, the device number is explicitly used (e.g. 1. device with "**usb-ad:0**", 2. device with "**usb-ad:1**", etc.). The device order results from the order of connecting.:

As USB data acquisition systems can be plugged and unplugged during operation, it may happen that the device numbers are not assigned consecutively. For example, if the second of three connected USB-AD devices is removed, the remaining USB-AD devices are addressed with "**usb-ad:0**" and "**usb-ad:2**".

To avoid managing the order of connecting, a device is also accessible via its serial number. The device with the serial number 157 can be addressed with "**usb-ad:@157**", for example.

DAQ system	Analog	Channel number	Measuring range	Output range	Digital	Direction
<b>USB-AD</b>	16 inputs 1 output	1..16 1	0 ( $\pm 5.12V$ )	0 ( $\pm 5.12V$ )	2 ports (4 bit each)	1: input (bit 0..3) 2: output (bit 0..3)

The 16 analog inputs of a USB-AD are addressed via the channel numbers 1-16. The analog output is reached via channel number 1.



**For compatibility reasons, the measuring range 33 can be used for analog inputs and the output range 1 for the analog output.**

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The direction of the digital ports is hard-wired. The 4 lines of the first port (DIO1, channel number: 1) are set to input, the 4 lines of the second port (DIO2, channel number: 2) to output.

### 3.3.5 USB-AD12f

Open the USB-AD12f with the **LibadX** by passing the string "**usbad12f**" to **Open()**. To distinguish between several USB data acquisition systems, the device number is explicitly used (e.g. 1st device with "**usbad12f:0**", 2nd device with "**usbad12f:1**", etc.). The device order results from the order of connecting.

As USB data acquisition systems can be plugged and unplugged during operation, it may happen that the device numbers are not assigned consecutively. For example, if the second of three connected USB-AD12f devices is removed, the remaining USB-AD12f devices are addressed with "**usbad12f:0**" and "**usbad12f:2**".

To avoid managing the order of connecting, a device is also accessible via its serial number. The device with the serial number 157 can be addressed with "**usbad12f:@157**", for example.

DAQ system	Analog	Channel number	Measuring range	Output range	Digital	Direction
<b>USB-AD12f</b>	16 inputs 1 output	1..16 1	0 ( $\pm 10.24V$ )	0 ( $\pm 5.12V$ )	2 ports (4 bit each)	1: input (bit 0..3) 2: output (bit 0..3)

The 16 analog inputs of a USB-AD12f are addressed via the channel numbers 1-16. The analog output is reached via channel number 1.

The direction of the digital ports is hard-wired. The 4 lines of the first port (DIO1, channel number: 1) are set to input, the 4 lines of the second port (DIO2, channel number: 2) to output.

The first digital input (bit 1) can be used as a 16-bit counter. It is treated like an analog channel by the **LibadX**. In this case, the channel number of the counter must be extended by the counter channel type (**hex 0x08000000**) in the analog functions **AnalogIn** (see p. 54), **AnalogOut** (see p. 54) and **ScanAnalogIn** (see p. 48) so that the counter has channel number **0x08000001** in hexadecimal notation. The range parameter to be passed is always '0'. Passing the value 0 with the command **AnalogOut** resets the counter.

### 3.3.6 USB-AD16f

Open the USB-AD16f with the **LibadX** by passing the string "**usbbase**" to **Open()**. To distinguish between several USB-AD16f data acquisition systems, the device number is explicitly used (1. device with "**usbbase:0**", 2. device with "**usbbase:1**", etc.). The device order results from the order of connecting. AD16f:O

As USB data acquisition systems can be plugged and unplugged during operation, it may happen that the device numbers are not assigned consecutively. For example, if the second of three connected USB-AD16f devices is removed, the remaining USB-AD16f devices are addressed with "**usbbase:0**" and "**usbbase:2**".

To avoid managing the order of connecting, a device is also accessible via its serial number. The device with the serial number 157 can be addressed with "**usbbase:@157**", for example.

DAQ system	Analog	Channel number	Measuring range	Output range	Digital	Direction
<b>USB-AD16f</b>	16 inputs 2 outputs	1..16 1 .. 2	3 ( $\pm 10.024V$ ) 2 ( $\pm 5.012V$ ) 1 ( $\pm 2.048V$ ) 0 ( $\pm 1.024V$ )	0 ( $\pm 10.024V$ )	2 ports (4 bit each)	1: input (bit 0..3) 2: output (bit 0..3)

The 16 analog inputs of a USB-AD16f are addressed via the channel numbers 1-16. The 2 analog outputs are reached via channel number 1 and 2.

The direction of the ports is hard-wired. The 4 lines of the first port (DIO1, channel number: 1) are set to input, the 4 lines of the second port (DIO2, channel number: 1) to output.

The USB-AD16f additionally features a counter input, which is treated like an analog channel by the **LibadX**. In this case, the channel number of the counter must be extended by the counter channel type (**hex 0x08000000**) in the analog functions **AnalogIn** (see p. 54), **AnalogOut** (see p. 54) and **ScanAnalogIn** (see p. 48) so that the counter has channel number **0x08000001** in hexadecimal notation. The range parameter to be passed is always '0'. Passing the value 0 with the command **AnalogOut** resets the counter.

### 3.3.7 USB-PIO

Open the USB-PIO with the **LibadX** by passing the string "**usb-pio**" to **Open()**. To distinguish between several USB data acquisition systems, the device number is explicitly used (e.g. 1. device with "**usb-pio:0**", 2. device with "**usb-pio:1**", etc.). The device order results from the order of connecting.

As USB data acquisition systems can be plugged and unplugged during operation, it may happen that the device numbers are not assigned consecutively. For example, if the second of three connected USB-PIO devices is removed, the remaining USB-PIO devices are addressed with "**usb-pio:0**" and "**usb-pio:2**".

To avoid managing the order of connecting, a device is also accessible via its serial number. The device with the serial number 157 can be addressed with "**usb-pio:@157**", for example.

DAQ system	Digital	Channel number
<b>USB-PIO</b>	3 ports (8 bit each)	1..3 (bit 0..7)

The line direction is set for each port separately in groups of eight (see "**DigitalDirection**", S. 57). The first port (DIO1) has channel number 1, the second port (DIO2) channel number 2 and the third port (DIO3) channel number 3.