



Table of Contents

1	Important and general information	3
1.1	Important information	3
1.1.1	Safety and Warning instructions	3
1.2	Terms and conditions	4
1.2.1	Legend of used icons	4
1.2.2	Support	4
2	PlugIn Overview	5
2.1	PlugIn description	5
2.2	PlugIn installation	5
2.3	NI-DAQmx driver installation	6
3	PlugIn configuration	8
3.1	Hardware detection	8
4	Device 6501	10
4.1	Device Overview	10
4.2	Digital Inputs / Outputs	10
4.3	Counter Input	11
5	Devices BNC 6221 and BMC 6229	12
5.1	Device overview	12
5.2	Analog Inputs	13
5.2.1	Analog Input Tab	13
5.2.2	Extended Timing Tab	13
5.3	Analog Outputs	14
5.3.1	Timing tab sheet	14
5.4	Counter Channels	15
5.4.1	Mode (Edge counting / Pulse output)	16
5.4.2	Cycle source	16
5.5	Hardware timed Digital Inputs / Outputs	17
5.5.1	Timing type	17
5.5.2	Cycle source	17
5.5.3	Active edge	18
6	Explanations for some error messages	19
6.1	Conflict at parallel access to the same resource	19
6.2	The sampling rate of the analog inputs too high	19
6.3	General acquisition error or buffer overflow in one x channel	19
6.4	The sampling rate is invalid.	19
6.5	Maximum 4 channel can operate as analog cycle source	19
6.6	The acquisition task for the channel type "x" cannot be started.	19
6.7	A synchronization error in the acquisition of channel "x" occurred.	19

1 Important and general information

1.1 Important information

Please follow these instructions before and during the use and application on any IPETRONIK product!

1.1.1 Safety and Warning instructions

Please follow the instructions **and** information as contained in the user manual!

1. The user can **influence an electronic system by applying the IPETRONIK product**. This might cause risk of personal injury or property damages.
2. The **use and application of the IPETRONIK product is permitted only to qualified professional staff**, as well as, only in appropriate manner and in the designated use.
3. **Before using an IPETRONIK measurement system** in the vehicle it **has to be verified that no function of the vehicle, which is relevant for secure operation, might be influenced**:
 - by the installation of the IPETRONIK measurement system in the vehicle,
 - by an potential malfunction of the IPETRONIK system during the test drive.

In order to avoid possible danger or personal injury and property damages, appropriate actions are to be taken; such actions have to bring the entire system into a secured condition (e.g. by using a system for emergency stop, an emergency operation, monitoring of critical values).

Please check the following points to avoid errors:

- Adaption of sensors to components of the electrical system / electronics, brake system, engine and transmission control, chassis, body.
- Tap of one or several bus systems (CAN, LIN, ETHERNET) including the required electrical connection(s) for data acquisition.
- Communication with the vehicle's control units (ECUs), especially with such of the brake system and/or of the engine and transmission control (power train control system).
- Installation of components for remote data transmission (mobiles, GSM/GPRS modems, WiFi and Bluetooth components).



The products can be operated in extended temperature ranges greater 70 °C and therefore the operator has to take safety measures to avoid any skin burnings on hot surfaces while touching the products.

4. **Before** directly or indirectly using **the data acquired by an IPETRONIK measurement system to calibrate control units, please review the data regarding to plausibility**.
5. With regard to the application of IPETRONIK products in vehicles during use on public roads the manufacturer and/or registered user of the vehicle **has to ensure that all changes/modifications have no influence concerning the license of the vehicle or its license of operation**.
6. **User does agree to the instructions and regulations as mentioned above**. In case the user does not agree with the instructions and regulations as mentioned above, he has to notify this expressly and immediately in writing to IPETRONIK before confirming the sales contract.

1.2 Terms and conditions

See IPETRONIK website for details: <https://www.ipetronik.com/>

1.2.1 Legend of used icons

**Tip**

This icon indicates a useful tip that facilitates the application of the software.

**Information**

This icon indicates additional information for a better understanding.

**Attention!**

This icon indicates important information to avoid potential error messages.

1.2.2 Support

Headquarter:**IPETRONIK GmbH & Co. KG**

Im Rollfeld 28

76532 Baden-Baden, Germany

Phone +49 7221 9922 0

Fax +49 7221 9922 100

info@ipetronik.com

www.ipetronik.com

Limited commercial partnership with its head office in Baden-Baden, registry court HRA No. 201313

IPETRONIK Verwaltungs-GmbH Baden-Baden is an individually liable society, registry court Mannheim HRB No. 202089

CEOs: A. Wocke, C. Buchholz

Technical support and product information

www.ipetronik.com

e-mail: support@ipetronik.com

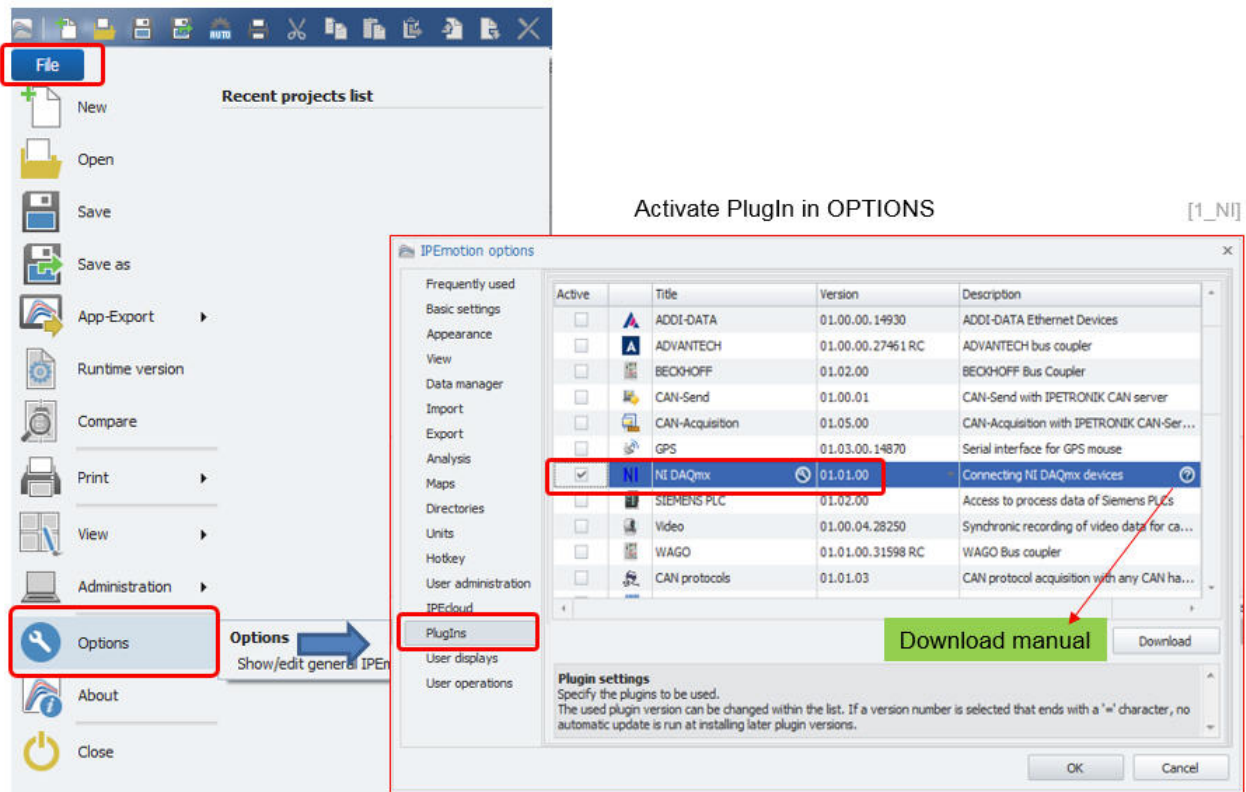
2 PlugIn Overview

2.1 PlugIn description

With the NI-DAQmx PlugIn you have access to a selected number USB cards from the DAQmx series from Nations Instruments.

2.2 PlugIn installation

The NI-DAQmx PlugIn is hosted on the IPETRONIK website www.ipetronik.com. After having installed the PlugIn, you need to restart IPEmotion. A message window will notify you, telling that a new PlugIn was found. After activation, the PlugIn can be used for data acquisition. The PlugIns are managed in the options of IPEmotion.

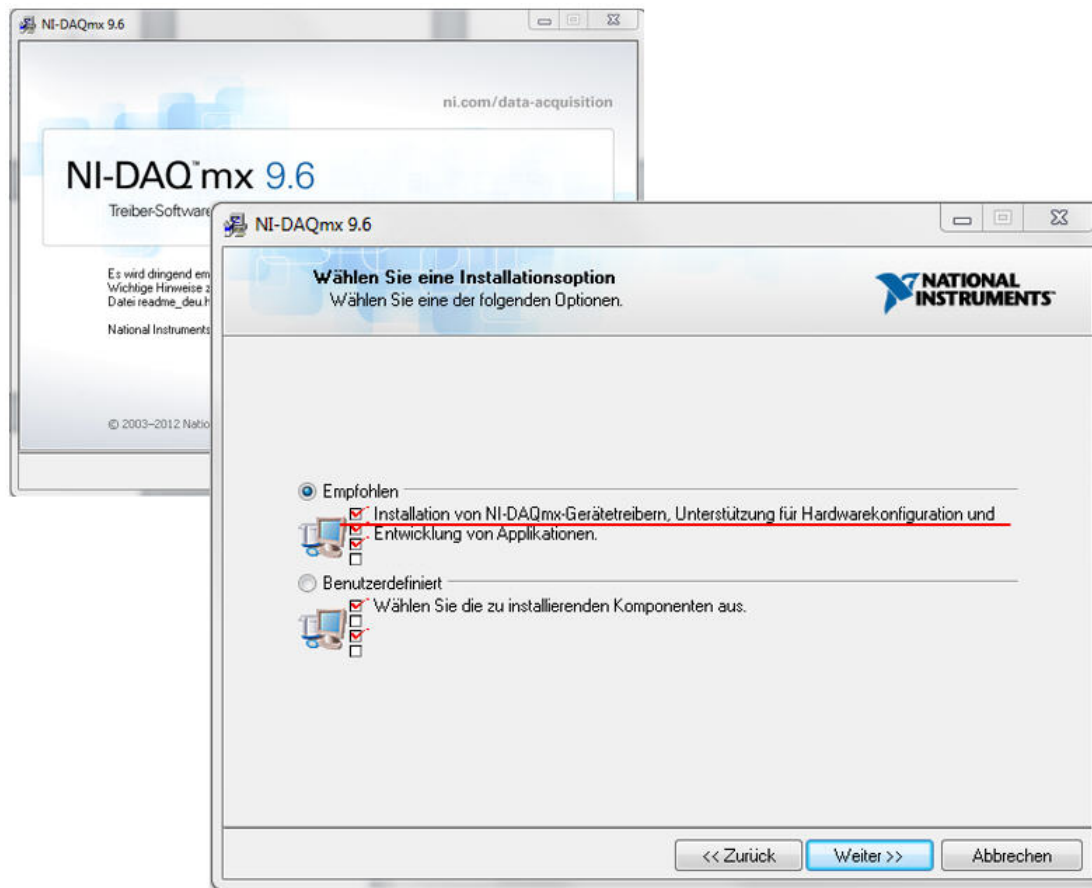


The PlugIn is supporting the following Windows operating systems:

- ▶ 32 bit

2.3 NI-DAQmx driver installation

The Ni-DAQmx PlugIn requires the NI-DAQmx driver library from national instruments. This library needs to be installed so that the devices are recognized correctly over the USB interface. The latest driver is hosted on the NI website. The NI-DAQmx device driver should be selected for the installation.



[2_NI]

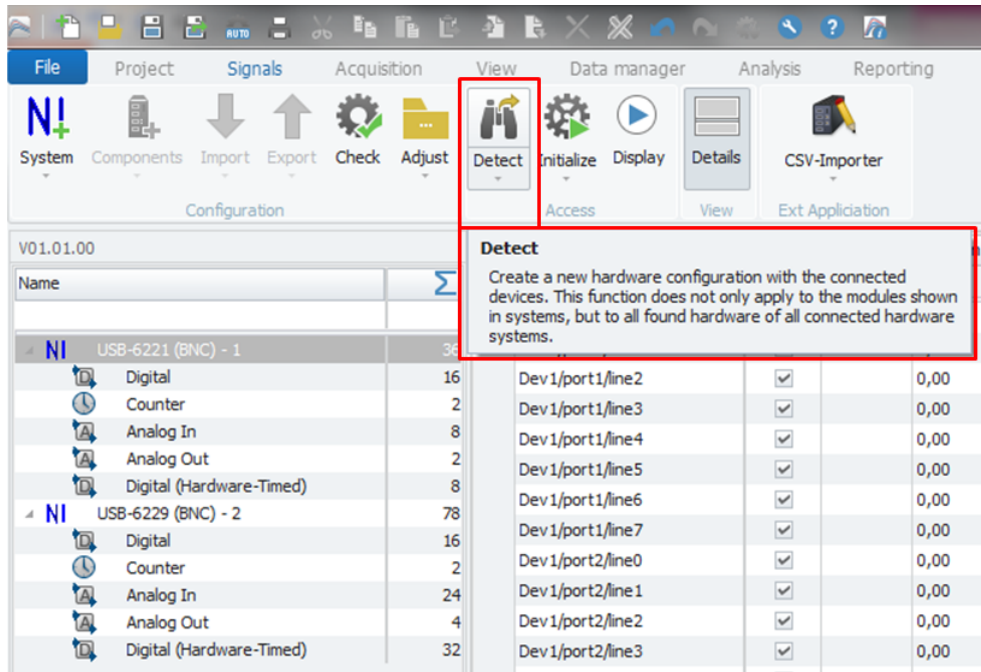
After the installation and the connection of the device to the computer the hardware is directly recognized in the “Devices and Printer” menu.



3 PlugIn configuration

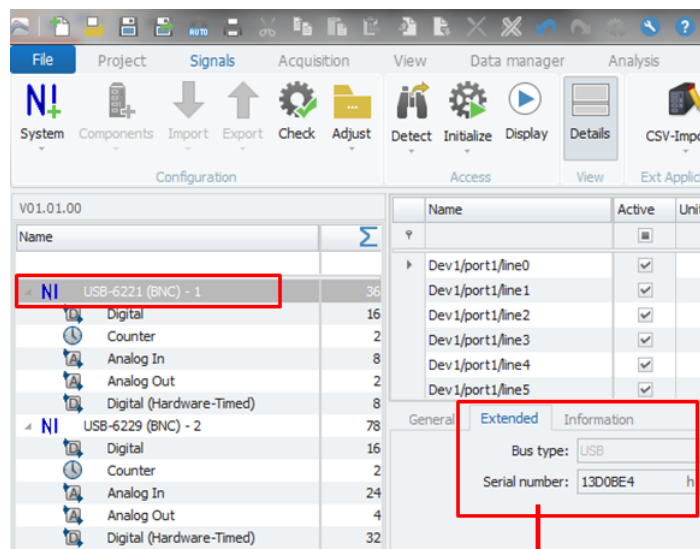
3.1 Hardware detection

IPEmotion has functions for automatic hardware detection. For USB devices like from the NI-DAQmx family it is for users very comfortable to use the automatic hardware detection to set up a communication with the board.



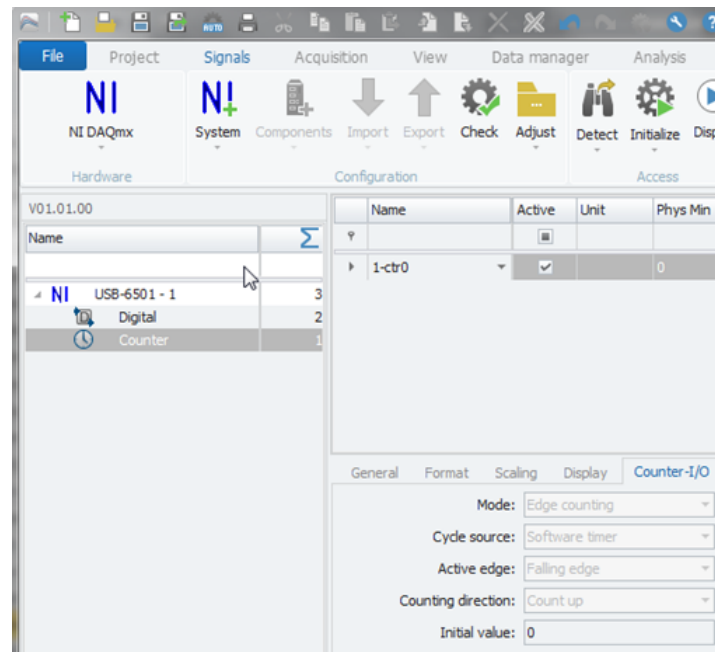
[4]

In this example 2 USB device are connected to the computer. After the detection both systems with the complete channel overview are created. All the channels are grouped on signal type. On device level in the **Extended** tab sheet the device serial number is indicated.



[5]

4.3 Counter Input



[9]

The 6501 module supports only software timed counter. The software timed counter uses a software timer, which is based on the sampling rate, for periodically sampling the data. Because of working with a period duration, only sampling rates are accepted, which can be converted into an even period duration ($1000/\text{Sampling rate}$).

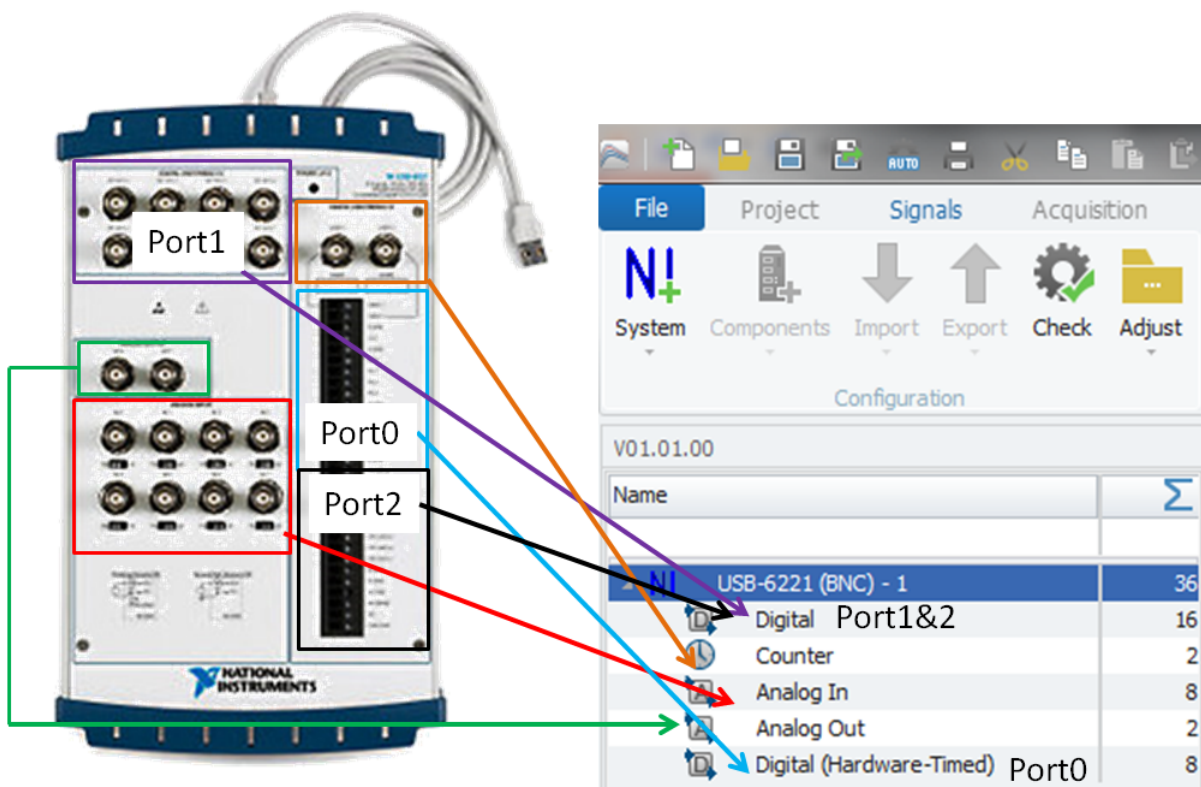
The other boards like USB-6221 or 6229 can have external cycle sources which will be discussed in then next chapters.

5 Devices BNC 6221 and BMC 6229

5.1 Device overview

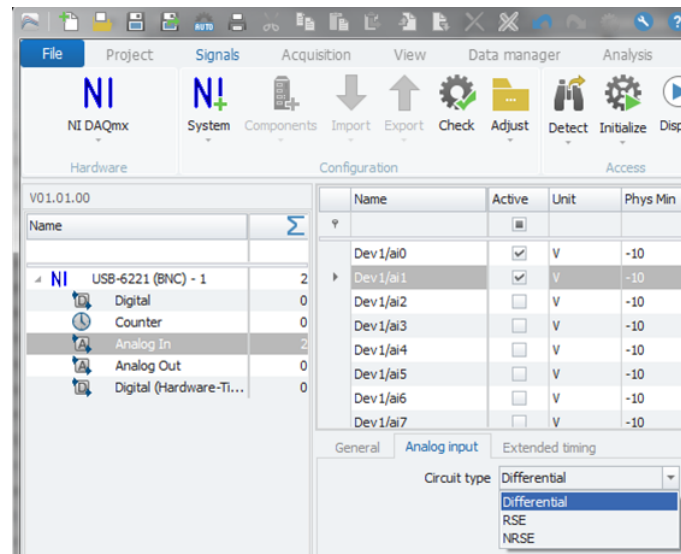
The channels in IPEmotion are grouped in the same structure as on the board. For example the USB BNC 6221 board has the following channels configuration.

- ▶ 8 x differential BNC analog inputs (16-bit, 250 kS/s)
- ▶ 2 x BNC analog outputs (16-bit, 833 kS/s),
- ▶ 8 x BNC Digital Inputs (hardware timed)
- ▶ 16 x BNC Digital Inputs
- ▶ 2 x BNC 32-bit counters



[10]

5.2 Analog Inputs



[11]

All analog inputs operate with the same sample rate. When it is defined on one channel it is update on all other channels automatically.



Information

Please note that the maximum sampling rate depends on the active channel count. This results per channel from the maximum sampling rate divided by the channel count. The more input channels are active, the less sampling rates per channel are possible.

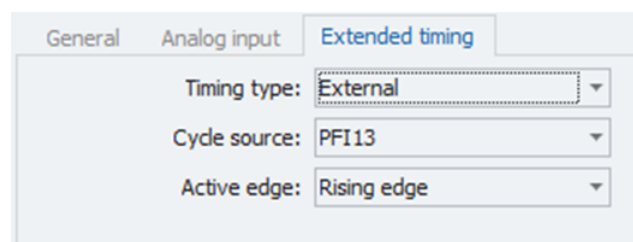
5.2.1 Analog Input Tab

Using the **Analog input** tab you can define the **Circuit type**. The circuit type defines the type of grounding for the analog input channels. A detailed description can be found in the documentation of the NI DAQmx driver.

5.2.2 Extended Timing Tab

By using the **Extended timing** tab you can define the following settings:

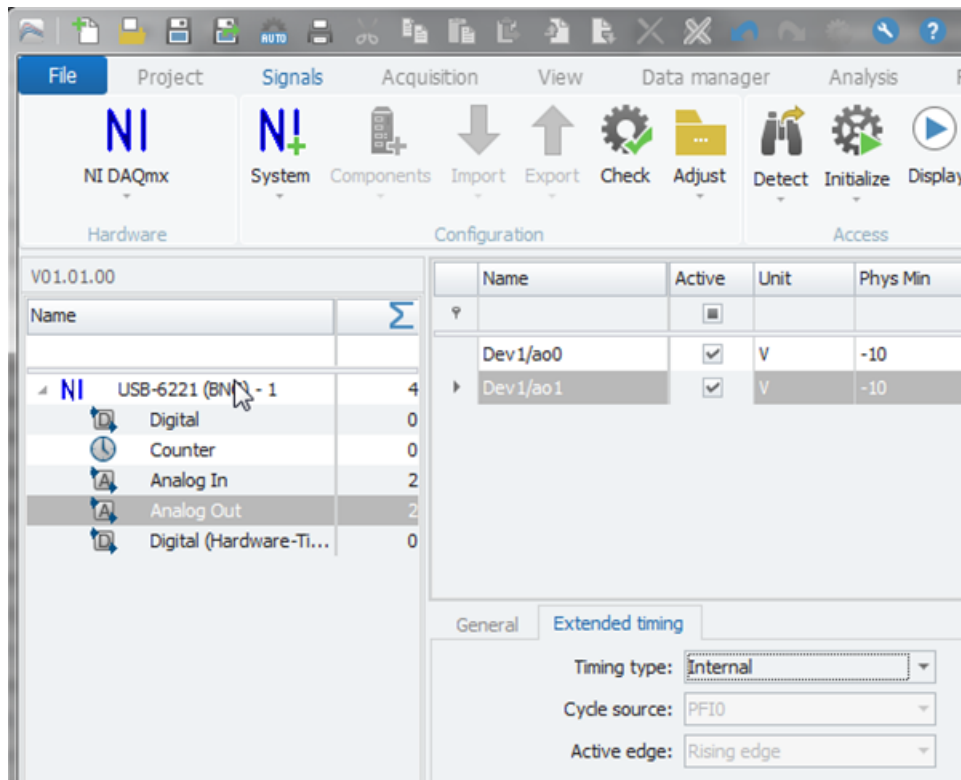
- ▶ Timing type
- ▶ Cycle source
- ▶ Active edge



[12]

There are two different timing types available: internal and external. The first type of the **internal** timing uses the frequency defined as sampling rate for generating the samples. The cycle generation runs in the device itself. The second type of the **external** timing uses the device for generating the samples by using an external cycle. Please note that the sampling rate of the inputs must correspond to the external cycle for avoiding potential synchronization problems between the device and IPEmotion. The **cycle source** defines the input where the external timing signal is coming from. The **active edge** defines the time for generating the samples based on a rising edge or falling edge.

5.3 Analog Outputs



[13]

All analog inputs operate with the same sample rate. When it is defined on one channel it is updated on all other channels automatically.



Information

Please note that the maximum sampling rate depends on the active channel count. This results per channel from the maximum sampling rate divided by the channel count. The more input channels are active, the less sampling rates per channel are possible.

5.3.1 Timing tab sheet

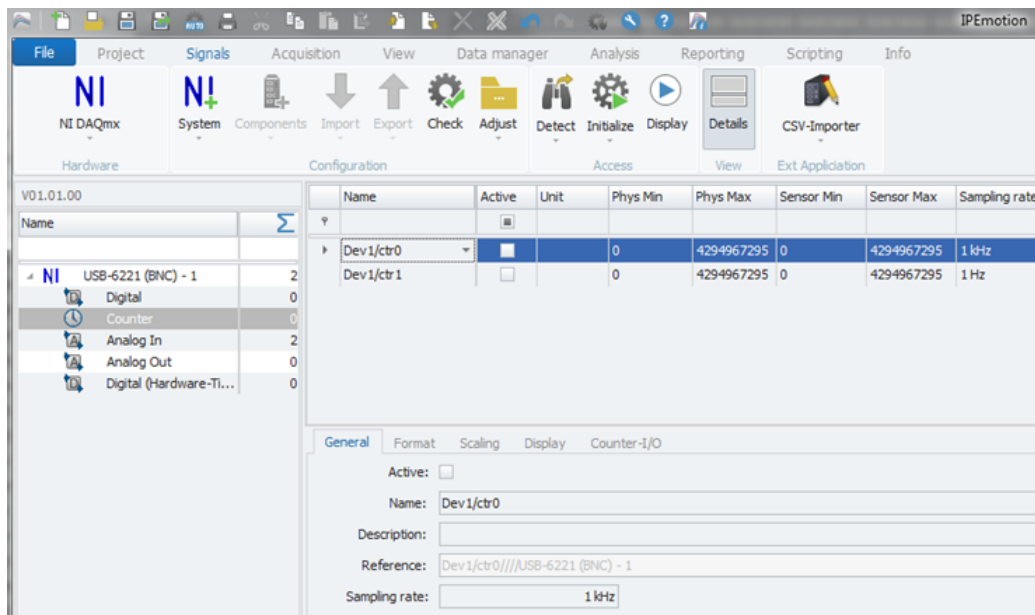
There are two different timing types available: internal and external.

The first type of the **internal** timing uses the frequency defined as sampling rate for generating the samples. The cycle generation runs in the device itself.

The second type of the **external** timing uses the device for generating the samples by using an external cycle. Please note that the sampling rate must correspond to the external cycle for avoiding potential synchronization problems between the device and IPEmotion.

- ▶ Cycle source The cycle source defines the input with the external timing.
- ▶ Active edge The active edge defines the time for generating the samples.

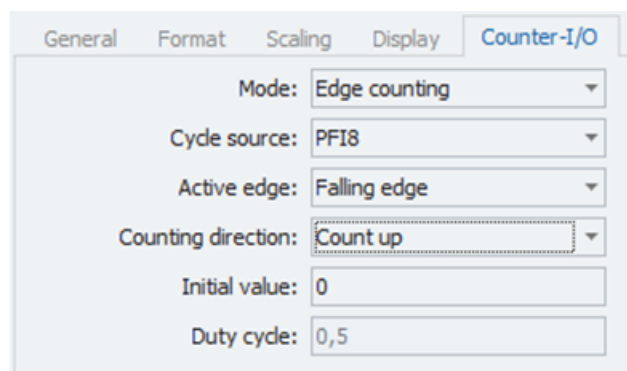
5.4 Counter Channels



[14]

You have generally to distinguish between two different counter types: Whereas the counter of the “USB-6501” can only be used as a software timed module, the counter of the “USB-6221 (BNC)” can use an external cycle source and offers therefore various definition possibilities. The software timed counter uses a software timer, which is based on the sampling rate, for periodically. Each counter channel can use its own sampling rate. The settings are defined on the respective channel itself. By using the **Counter-I/O** tab you can define the following settings:

- ▶ Mode
- ▶ Cycle source
- ▶ Active edge
- ▶ Counting direction
- ▶ Initial value
- ▶ Duty Cycle



[15]

5.4.1 Mode (Edge counting / Pulse output)

There are two different modes available: the edge counting and the impulse sequence.

The first mode of the **Edge counting** is a common event counter. Because of not offering a possible internal cycle generation, the counter depends on an external timer if it is not used as a software timed counter. This cycle defines the frequency for generating and storing the samples.

The second mode **Creating an impulse sequence** uses the counter as an output and an impulse sequence can be generated. The sampling rate defines the frequency for generating an impulse sequence. The duty cycle defines the relation between the logical status (Example: A duty cycle of 0.5 corresponds according to the impulse duration 50% High level and 50% Low level).



Information

The channel type in the Format tab does not have to be changed separately at changing between the edge counting and the creation of an impulse sequence because it adapts automatically to the required status.

5.4.2 Cycle source

In addition to the use of an external cycle source, you have the ability to define the internal timers of the analog in- and outputs as external timer for the counter. The corresponding descriptions in the drop-down menu are **ai/SampleClock** for the analog inputs timer and **ao/SampleClock** for the analog outputs. The internal timer of the analog in- and outputs can only be used as external cycle source if the channels are active. That means that at least one channel of this type has to be active and the timer was started.

The use of the analog timers at the same time is limited. Maximum four resources for every device can access the analog timer at the same time. The analog in- and outputs are already included. At using this limitation, it is not relevant if the timer is one of the analog in- or outputs.



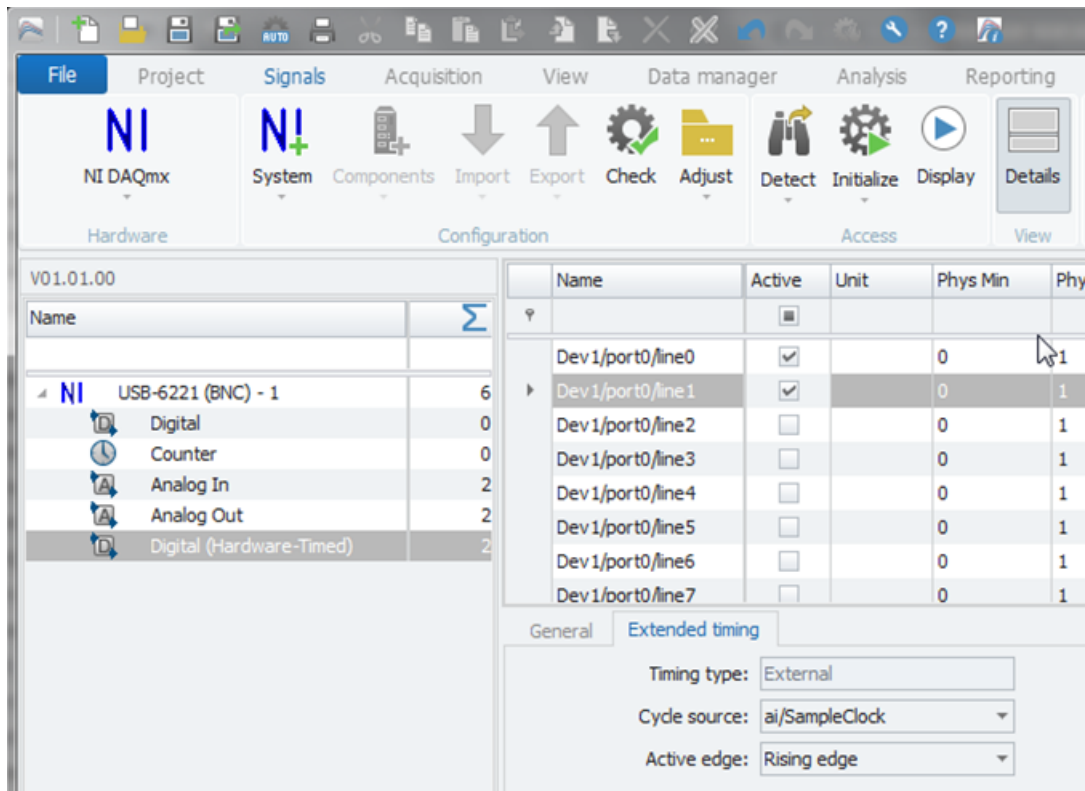
Information

Please note that the sampling rate must correspond to the external cycle for avoiding potential synchronization problems between the device and IPEmotion.

The external cycle source should not be mixed up with the event counter input. The event counter input differs from device type to device type and can be found in the corresponding device description.

- ▶ Active edge The active edge defines the time for generating the samples.
- ▶ Counting direction The counting direction defines the upward and downward motion of the event counter.
- ▶ Initial value The initial value defines the value for starting the counting.
- ▶ Duty Cycle The duty cycle defines the relation between the logical status (Example: A duty cycle of 0.5 corresponds according to the impulse duration 50% High level and 50% Low level).

5.5 Hardware timed Digital Inputs / Outputs



[16]

In contrast to the software timed digital in- and outputs the hardware timed channels can access an external cycle source. A timing by using the software timer is not possible. By using the Extended timing tab you can define the following settings:

- ▶ Timing type
- ▶ Cycle source
- ▶ Active edge

5.5.1 Timing type

There are two different timing types available: internal and external.

The first type of the **internal** timing uses the frequency defined as sampling rate for generating the samples. The cycle generation runs in the device itself.

The second type of the **external** timing uses the device for generating the samples by using an external cycle. Please note that the sampling rate must correspond to the external cycle for avoiding potential synchronization problems between the device and IPEmotion.

5.5.2 Cycle source

The hardware timed digital channels need an external cycle source because they do not have a timing unit. In addition to the use of an external cycle source, you have the ability to define the internal timers of the analog in- and outputs as external timer for the counter. The corresponding descriptions in the drop-down menu are **ai/SampleClock** for the analog inputs timer and **ao/SampleClock** for the analog outputs. The internal timer of the analog in- and outputs can only be used as external cycle source if the channels are active. That means that at least one channel of this type has to be active and the timer was started.

The use of the analog timers at the same time is limited. Maximum four resources for every device can access the analog timer at the same time. The analog in- and outputs are already included. At using this limitation, it is not relevant if the timer is one of the analog in- or outputs.

**Information**

Please note that the sampling rate must correspond to the external cycle for avoiding potential synchronization problems between the device and IPEmotion.

The external cycle source should not be mixed up with the event counter input. The event counter input differs from device type to device type and can be found in corresponding device description.

5.5.3 Active edge

The active edge defines the time for generating the samples.

- ▶ The same sample rate is configured for one channel and is automatically applied to all other digital inputs.

Define the data direction:

- ▶ The Format tab defines the channel type as an in- or output. Over this configuration it is defined whether the channel is operated as an input or output

The screenshot shows the IPEmotion software interface with the 'Format' tab selected. The 'Channel type' section shows 'Output' checked and 'Input' unchecked. The table below shows the configuration for various digital channels.

Name	Active	Unit	Phys Min	Phys Max	Sensor Min	Sensor Max	Sampling rate
Dev 1/port0/line0	<input checked="" type="checkbox"/>		0	1	0	1	10 Hz
Dev 1/port0/line1	<input checked="" type="checkbox"/>		0	1	0	1	10 Hz
Dev 1/port0/line2	<input type="checkbox"/>		0	1	0	1	10 Hz
Dev 1/port0/line3	<input type="checkbox"/>		0	1	0	1	10 Hz
Dev 1/port0/line4	<input type="checkbox"/>		0	1	0	1	10 Hz
Dev 1/port0/line5	<input type="checkbox"/>		0	1	0	1	10 Hz
Dev 1/port0/line6	<input type="checkbox"/>		0	1	0	1	10 Hz
Dev 1/port0/line7	<input type="checkbox"/>		0	1	0	1	10 Hz

General | **Format** | Scaling | Output | Display

Data type
Type: 1-bit Task: Default

NoValue / DefaultValue
Value: +FullScale Deactivate NoValue and use Default Value

Channel type
Input: Output:

[17]

6 Explanations for some error messages

The following chapter provides information about potential error messages and known behavioural patterns of the NI DAQmx PlugIn.

6.1 Conflict at parallel access to the same resource

Different functions of a device use sometimes the same physical channel. A counter, which is defined as an output, physically generates for instance its data on a Digital-I/O channel. If the digital channel is defined as an input and the counter channel as an output, a resource conflict occurs.

You should generally avoid a multiple use of the same physical channels. You can find the respective channel configuration in the data sheet of the corresponding module

6.2 The sampling rate of the analog inputs too high

The possible selection of the analogue in-/outputs sampling rate depends on the number of active channels within a module. Please note in general that the maximum sampling rate can only be selected according to the maximum possible sampling rate divided by the active channel count in the module. "x" indicates the maximum sampling rate, which can be selected with the current configuration.

A possible solution is to reduce the sample rate or reduce the number of channels.

6.3 General acquisition error or buffer overflow in one x channel

The data storage has been stopped during an acquisition because of missing valid data from the device. This often results from a buffer overflow but can also have other reasons. A detailed error description can be found in the send NI error code in the documentation of the NI DAQmx driver.

A possible solution is the selection of a lower sampling rate.

6.4 The sampling rate is invalid.

The used software timer runs with a period duration. For limiting the user in selection the sampling rate as less as possible, no fixed values are given but any defined sampling rate is checked on validity. Therefore, the sampling rate must be selected for being converted into a period duration without decimal places.

(Calculation: $\text{Period duration} = 1000/\text{Sampling rate}$)

A possible solution is the selection of a new sampling rate.

6.5 Maximum 4 channel can operate as analog cycle source

As already described in the chapters above, maximum four resources can access the internal timer of the analog channels at the same time, otherwise a resource conflict can result.

A possible solution is the access limitation of the analog channels timer to four.

6.6 The acquisition task for the channel type "x" cannot be started.

Channels are eventually used by several tasks at the same time. You can find a detailed description of this limitation in the point above "Conflict at parallel access to the same resource".

A possible solution is the definition of the module and channel settings.

6.7 A synchronization error in the acquisition of channel "x" occurred.

A synchronization error in the acquisition of channel "x" occurred. The sampling rate eventually does not corresponds to the external timer.

If an external cycle source is used, the sampling rate of the current module/channel has to correspond to the cycle source frequency. If they are not conform, an asynchrony between the device and IPEmotion results and the time stamp of the values does not corresponds to the expected times.

A possible solution is the exact customization of the sampling rate to the external cycle.

Author: FOT