



MI.70/MC.70/MX.70
DASYLab driver
Library mi.dll

English version

June 29, 2017

(c) SPECTRUM INSTRUMENTATION GMBH
AHRENSFELDER WEG 13-17, 22927 GROSSHANS DORF, GERMANY

SBench, digitizerNETBOX and generatorNETBOX are registered trademarks of Spectrum Instrumentation GmbH.
Microsoft, Visual C++, Visual Basic, Windows, Windows 98, Windows NT, Windows 2000, Windows XP, Windows Vista, Windows 7, Windows 8, Windows 10 and Windows Server are trademarks/registered trademarks of Microsoft Corporation.
LabVIEW, DASyLab, Diadem and LabWindows/CVI are trademarks/registered trademarks of National Instruments Corporation.
MATLAB is a trademark/registered trademark of The Mathworks, Inc.
Delphi and C++Builder are trademarks or registered trademarks of Embarcadero Technologies, Inc.
Keysight VEE, VEE Pro and VEE OneLab are trademarks/registered trademarks of Keysight Technologies, Inc.
FlexPro is a registered trademark of Weisang GmbH & Co. KG.
PCIe, PCI Express, PCI-X and PCI-SIG are trademarks of PCI-SIG.
PICMG and CompactPCI are trademarks of the PCI Industrial Computer Manufacturers Group.
PXI is a trademark of the PXI Systems Alliance.
LXI is a registered trademark of the LXI Consortium.
IVI is a registered trademark of the IVI Foundation
Oracle and Java are registered trademarks of Oracle and/or its affiliates.
Intel and Intel Xeon are trademarks or registered trademarks of Intel Corporation.
AMD and Opteron are trademarks or registered trademarks of Advanced Micro Devices.

General Information	4
Driver - structure	4
Installation Spectrum driver	4
Installation DASYLab driver	4
Channels in DASYLab	5
Digital Channels	5
Counter (Timestamp)	5
Synchronization	5
Recording/Replay modes	6
Standard Recording	6
FIFO Mode Recording	6
Replay Modes	6
Output with Singleshot and Continuous Mode	6
FIFO Output	7
Mixed I/O Mode	7
Timestamp	7
Setup the hardware	8
Synchronization	8
Board Setup	8
Trigger Setup	9
Channel Setup	9
DASYLab messages	11
Error messages	11
Please use the DrvCfg Utility	11
The Samplerate (Frequency) is not valid	11
An internal error occurred	11
The blocksize is larger the programmed memsize	11
FIFO Buffer overrun. Recording stopped !	11
Synchronisation of Timestamp to external Clock failed	11
FIFO mode is only possible up to a sum frequency of 125 MHz.	11
No Spectrum PCI board found in the system. Please check installation of board and driver	11
Output channels are not to be allowed as asynchronous. Please change setup.	11
Mixing input and output. Channels of one module must have same direction	11
Mixing input and output. Not possible with this board type	11
Mixing input and output. Not possible when using FIFO mode (continuous)	11
Output channels are not allowed to be asynchronous. Please change them to synchronous.	12
Singleshot and Continuous mode are only allowed if output is enabled.	12

General Information

Driver - structure

This driver for DASYLab is based on the standard Spectrum driver for Windows XP, Windows Vista, Windows 7 and Windows 8. New versions of the standard driver may be downloaded from the internet www.spectrum-instrumentation.com without any cost. The driver supports the DASYLab versions beginning with 5.0.

The driver consists of a DLL for the selected board.

Installation Spectrum driver

The standard Spectrum driver should be installed first. An installation guide is found in the hardware manual of the specific board. After a driver update, the PC must be rebooted.

Installation DASYLab driver

The DLL files must be copied in the installation directory of DASYLab. When installing from CD, the corresponding setup program must be called. After typing the licence code the DLL is copied to the DASYLab directory.

After starting the program the driver file must be selected. After restarting DASYLab the board could be accessed.

Board installed in the system	Driver to select	Limits of DASYLab driver
M2i.30xx/MI.30xx/MC.30xx/MX.30xx	mi.dll	
M2i.31xx/MI.31xx/MC.31xx/MX.31xx	mi.dll	
M2i.40xx/MI.40xx/MC.40xx/MX.40xx	mi.dll	
MI.45xx/MC.45xx/MX.45xx	mi.dll	
M2i.46xx	mi.dll	
M2i.47xx	mi.dll	Only channel 0 to 7 can be trigger source
M2i.49xx	mi.dll	Differential inputs not supported. Digital inputs only partly supported.
M2i.60xx/MI.60xx/MC.60xx/MX.60xx	mi.dll	
M2i.61xx/MI.61xx/MC.61xx/MX.61xx	mi.dll	
M2i.70xx/MI.70xx/MC.70xx/MX.70xx	mi.dll	
PCI.DIO32	pcidio32.dll	
PCI.248	pci248.dll	
PCI.258	pci248.dll	
PCI.412-10	pci412.dll	
PCI.412-40	pci412.dll	
PAD82a	pad82a.dll	
PAD82b	pad82b.dll	
PAD52	pad52.dll	

Channels in DASyLab

Digital Channels

The MI.70xx/MC.70xx/MX.70xx offers up to four 16 bit wide digital channels within DASyLab. The hardware bits are corresponding to the channels in DASyLab as described in the following table:

Channel in DASyLab	MI/MC/MX.7010	MI/MC/MX.7011	MI/MC.7020	MI/MC.7021
Channel 0 - 0	CH0 Bits D0 - D15	CH0 Bits D0 - D15	CH0 Bits D0 - D15	CH0 Bits D0 - D15
Channel 1 - 1	n.a.	CH0 Bits D16 - D31	CH1 Bits D0 - D15	CH0 Bits D16 - D31
Channel 2 - 2	n.a.	n.a.	n.a.	CH1 Bits D0 - D15
Channel 3 - 3	n.a.	n.a.	n.a.	CH1 Bits D16 - D31

Counter (Timestamp)

Counters are only available if the option "Timestamp" is installed on the board. Every 64 bit wide timestamp is read out parallel on four counters. The relation is as follows:

Counter 0	Bit 0 bis Bit 15
Counter 1	Bit 16 bis Bit 31
Counter 2	Bit 32 bis Bit 47
Counter 3	Bit 48 bis Bit 63

If external reference clock mode is used, the start time of the counter is automatically added to the timestamp. Counter 2 and 3 then hold the absolute time of the event in seconds elapsed since 01.01.1970 0:00.

Synchronization

On synchronisation systems the channels are available in DASyLab beginning with the index 0. if different options are installed on the boards, there could be shifting of the channels.

Example:

Board 0: M2i.3131, 4 analog channels, option "Timestamp"

Board 1: M2i.3022, 2 analog channels, option "Digital Inputs"

Board 2: M2i.3131, 4 analog channels, option "Timestamp"

Analog In	Board	Digital In	Board	Counter	Board
0	0 channel 0	0	1 digital 0	0	0 TimeStamp 0
1	0 channel 1	1	1 digital 1	1	0 TimeStamp 1
2	0 channel 2	2	1 digital 2	2	0 TimeStamp 2
3	0 channel 3	3	1 digital 3	3	0 TimeStamp 3
4	1 channel 0	4	1 digital 4	4	2 TimeStamp 0
5	1 channel 1	5	1 digital 5	5	2 TimeStamp 1
6	2 channel 0	6	1 digital 6	6	2 TimeStamp 2
7	2 channel 1	7	1 digital 7	7	2 TimeStamp 3
8	2 channel 2				
9	2 channel 3				

Recording/Replay modes

The Spectrum cards can be used in two different modes. The selection between the two modes is done in DASYLab by the Acquisition Mode:

DASYLab	Spectrum board	Description
Continuous	FIFO mode	Data is continuously recorded and transferred to DASYLab block by block.
One series	Standard mode	One acquisition (singleshot) is made.
Single series	Standard mode	A defined number of single acquisitions is made (multiple singleshots)
Continuous Series	Standard mode	Single acquisitions are made in a loop.

Standard Recording

In Standard Recording mode the data is recorded in the on-board memory and read out after finishing of the measurement. The memory size is selected in the board parameter section. DASYLab reads the memory in blocks starting at position 0. If the recording memory on the board is larger than the blocksize from DASYLab the matching number of blocks must be read out to process the complete recording.

It is necessary to record at least the number of samples to fill one block.

If the number of blocks has been read out that was defined by "blocks per series", the board is automatically restarted by DASYLab.

If more blocks are read out than there are recorded blocks on the board, the board is automatically restarted by the driver when the last recorded block had been read out.

Example: Memsize = 128k, DASYLab block size = 32k (automatic)

Block No.	Blocks per series			
	2	4	6	8
0	Rec 0 Pos 0 - 32k	Rec 0 Pos 0 - 32k	Rec 0 Pos 0 - 32k	Rec 0 Pos 0 - 32k
1	Rec 0 Pos 32k - 64k	Rec 0 Pos 32k - 64k	Rec 0 Pos 32k - 64k	Rec 0 Pos 32k - 64k
2	Rec 1 Pos 0 - 32k	Rec 0 Pos 64k - 96k	Rec 0 Pos 64k - 96k	Rec 0 Pos 64k - 96k
3	Rec 1 Pos 32k - 64k	Rec 0 Pos 96k - 128k	Rec 0 Pos 96k - 128k	Rec 0 Pos 96k - 128k
4	Rec 2 Pos 0 - 32k	Rec 1 Pos 0 - 32k	Rec 1 Pos 0 - 32k	Rec 1 Pos 0 - 32k
5	Rec 2 Pos 32k - 64k	Rec 1 Pos 32k - 64k	Rec 1 Pos 32k - 64k	Rec 1 Pos 32k - 64k
6	Rec 3 Pos 0 - 32k	Rec 1 Pos 64k - 96k	Rec 0 Pos 0 - 32k	Rec 1 Pos 64k - 96k
7	Rec 3 Pos 32k - 64k	Rec 1 Pos 96k - 128k	Rec 0 Pos 32k - 64k	Rec 1 Pos 96k - 128k
8	Rec 4 Pos 0 - 32k	Rec 2 Pos 0 - 32k	Rec 0 Pos 64k - 96k	Rec 2 Pos 0 - 32k
9	Rec 4 Pos 32k - 64k	Rec 2 Pos 32k - 64k	Rec 0 Pos 96k - 128k	Rec 2 Pos 32k - 64k
Remarks	Pos 64k to 128k is lost	Memsize and Blocks are matching, all data is read out.	Pos 64k to 128k of every second recording is lost	Board is automatically restarted after block 3.

FIFO Mode Recording

If the driver holds an intermediate buffer that is large enough to hold about 500 ms of data. DASYLab is working with a blocksize of max. 32k, data must be copied by the driver. For this reason DASYLab can not work with the same FIFO speed that may be reached when programming the driver directly. Depending on the number of activated channels and the used display windows, FIFO mode is working up to a sum sample rate of about 500 kHz. When only streaming to disk with no display one can achieve a transfer rate of up to 10 MB/s.

Replay Modes

Due to the fact that DASYLab was originally designed for data acquisition products the capabilities of the output modes are limited when using this board under DASYLab.

Please keep in mind that the driver of this board only supports the synchronous, block orientated output. Asynchronous outputs are not supported by this hardware. If setting up the experiment setup improperly an error message will occur.

Output with Singleshot and Continuous Mode

The output mode is selected in the hardware setup window. The driver supports standard output, singleshot output, continuous output, Multiple Replay and Gated Replay. Multiple Replay and Gated Replay are only available if installed on the board. As DASYLab is doing all driver communication in a block orientated way, one must setup the system carefully to obtain the requested behaviour. Especially the Experiment Setup must be filled up correctly. Please keep in mind that there must be enough blocks generated to fill up the cards on-board memory. The following table explains the different behaviours of the board when setting the experiment and the hardware setup

Experiment Setup		Hardware Setup		Description
Block Size	Output Buffer	Memory Size	Mode	
32k	Fill Once	32k	Singleshot	Memory is filled and replayed once, afterwards DASYLab stops.
32k	Fill Once	32k	Continuous	Memory is filled and replayed continuously until user stops the output.
32k	Fill Once	128k	Any mode	Only the first 32k of memory is filled afterwards DASYLab stops to generate data and the board is never started.

Experiment Setup		Hardware Setup		Description
Block Size	Output Buffer	Memory Size	Mode	
32k	Cont Refill	64k	Singleshot	After each second block that has been generated by DASYLab the board is started and outputs the memory. Afterwards the board stops automatically and is filled up with the next two blocks of memory and again started. This continues until the user stops the output.
32k	Cont Refill	64k	Continuous	After the second block that has been generated by DASYLab the board is started and outputs the memory in a continuous loop. Meanwhile DASYLab carries on with data generation and after a short time an error message will occur „Output is blocked in Module xxx“. The output in hardware still continuous until the user stops the hardware.

FIFO Output

It is not possible under DASYLab to select whether output should run continuously in FIFO mode or in single series. Therefore the FIFO mode of the board is not supported.

Mixed I/O Mode

A mixed I/O mode is available under DASYLab with a few limitations. Please keep in mind that the I/O mode is not available on all hardware models. When using the mixed I/O mode DASYLab first tries to read out data before it writes data to the board. Therefore there's a delay between the start of DASYLab and the start of the board output. After one I/O sequence has run the mode stops automatically.

Timestamp

It is not possible to use two input channels really asynchronously within DASYLab. For this reason one timestamp is read out from the board with every block that is read out. The user must select the parameters in this way that no timestamp is lost.

If there are less timestamp recorded than there are read out, the other timestamps are set to 0.

The timestamps are copied to 4 counters of 16 bit width.

Example with memsize = 256k, Multiple Recording with 64k segment size and 32k DASYLab block size

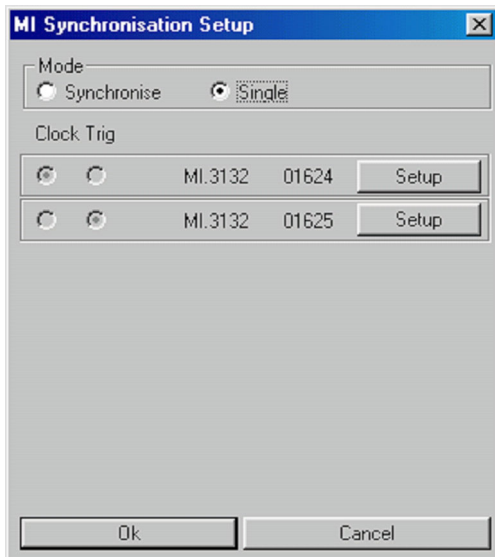
Block	Standard Recording		FIFO mode	
	Data	Counter 0-3	Data	Counter 0-3
0	Segment 0 Pos 0 - 32k	TimeStamp Segment 0	Segment 0 Pos 0 - 32k	TimeStamp Segment 0
1	Segment 0 Pos 32k - 64k	TimeStamp Segment 1	Segment 0 Pos 32k - 64k	0
2	Segment 1 Pos 0 - 32k	TimeStamp Segment 2	Segment 1 Pos 0 - 32k	TimeStamp Segment 1
2	Segment 1 Pos 32k - 64k	TimeStamp Segment 3	Segment 1 Pos 32k - 64k	0
0	Segment 0 Pos 0 - 32k	0	Segment 0 Pos 0 - 32k	TimeStamp Segment 2
1	Segment 0 Pos 32k - 64k	0	Segment 0 Pos 32k - 64k	0
2	Segment 1 Pos 0 - 32k	0	Segment 1 Pos 0 - 32k	TimeStamp Segment 3
2	Segment 1 Pos 32k - 64k	0	Segment 1 Pos 32k - 64k	0

Setup the hardware

The following chapters show how the hardware setup is done under DASLab. For further details on the different settings one must have a look in the hardware manual that has been delivered together with the board.

Synchronization

The synchronisation window is only available if more than one Spectrum board is used in the system. This window defines whether the boards are running independently or synchronously. Trigger master, clock master and board enable are also set in this window. Details are found in the hardware manual.



Mode

In Single mode all boards are running independently. If Synchronise is selected, Clock and Trig are synchronized.

Clock

If the boards are running synchronized, select the clock master board with this radio button. Depending on the hardware configuration when using cards with different maximum sampling speeds it can be that single cards are not able to be clock master. These cards are then grayed.

Trig

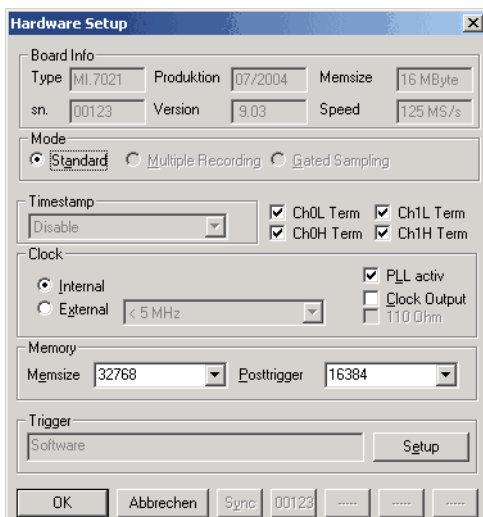
For MI/MC/MX cards inhere the trigger master board is selected for the synchronisation. M2i cards automatically have an OR/AND combined trigger and all cards are selected for trigger detection.

Setup

The setup window for this board is called. See below for the settings that could be made there.

Board Setup

If only one board is installed in the system, all setup is done in this window. If several boards are installed, one setup window is available for every installed board.



Board Info

Board information of the currently selected board from the on-board EEPROM is shown here. You'll find the type, serial number, production date, hardware version, installed memory size and speed here.

Mode

Select the recording mode for the board. The modes are explained in detail in the hardware manual. Depending on the selected mode some of the other settings may change also.

Timestamp

If Timestamp is installed on the board, the timestamp mode could be selected here.

Termination

This part is only visible when using a digital I/O board. Each 16 bit input channel of the digital i/o board can be terminated against ground with 110 Ohms by activating one of the checkboxes.

Clock-Mode

If board is running in Single mode or as a clock master, the clock source could be selected with the radio button. The external clock range must be selected in external clock mode. See hardware manual for details.

Clock-PLL

PLL is used for clock generation. If deactivated the internal quartz clock is used

Clock Output

Activates internal clock output to connector.

Clock 50/110 Ohm

Activates the clock input termination. Only available if external clock is selected.

Memory

Memsize and Posttrigger value for standard mode. The memsize must be at least as large as the DASYLab block size.

Trigger

Start the trigger window if board is running in Single mode or as a trigger master

Sync

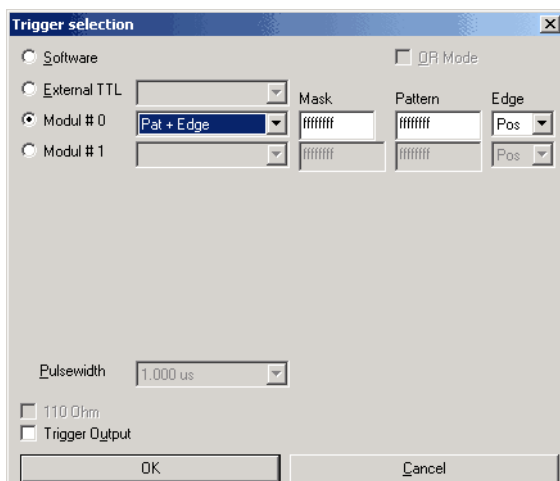
Call the synchronisation window to set up the synchronization. The synchronization window itself is explained in the chapter before.

Serial number

These buttons select the board setup of the particular board. With the buttons at the bottom it is possible to switch between the setup screens of the different boards.

Trigger Setup

This window defines the used trigger. The trigger setup is called directly from the setup window of the board. Settings that are not available at the moment are disabled. The selected trigger mode is used for the next acquisition or generation and is also used for Multiple Recording or Gated Sampling mode if one of these options is installed and activated on your board.

**Software**

Software trigger will start the board immediately without waiting for a trigger event.

External TTL

External TTL waits for a TTL signal on the trigger connector. There are several different external trigger modes selectable.

Modul # 0/1

Activates one of the pattern trigger modes. On each module there is one trigger detection engine. Depending on the used hardware there are between 16 and 32 bit on each module.

Pulsewidth

Pulsewidth is used with some trigger modes and defines the time a trigger condition must be present. Depending on the selected mode a trigger event is detected if either the condition is present longer than the programmed pulsewidth or if it's present for a shorter time.

Mask + Pattern

These two registers define the trigger pattern and the bit that is used for edge detection for the appropriate trigger modes. The values are directly typed in as hex values. Please see the hardware manual to examine the meaning of the bits.

Edge

Selects the type of edge that is used for the trigger modes that combine pattern and edge.

110 Ohm

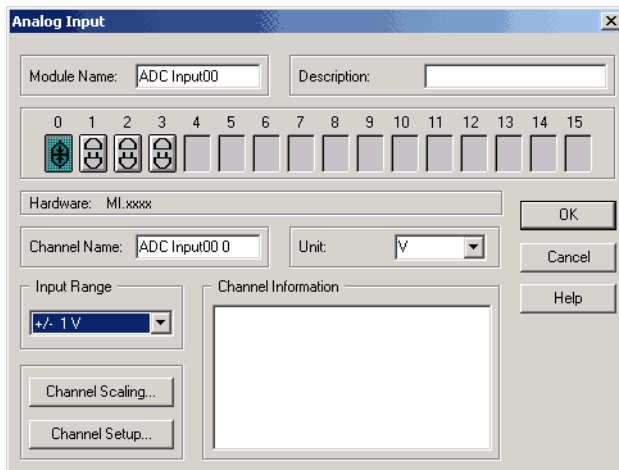
When activated the external trigger input is terminated with 110 Ohm against ground. Only available if external trigger is selected.

Trigger Output

Enables the trigger signal output of an internally recognized modul trigger.

Channel Setup

The channel settings are done directly in the analog input module. Which analog input corresponds to which hardware channel is described in the chapter before.

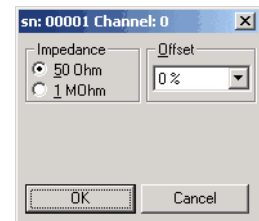


Input Range

For each channel there is a list for different input ranges available. By activating one of the input channels one can change the range for that channel with one mouse click.

Channel Setup

The Channel Setup button starts an extra window with some additional channel settings. This channel setup window is shown in the top right corner.



Impedance (Channel Setup Window)

Every analog channel can be set to either 50 ohm termination (for high frequency signals and low noise) or to 1 MOhm impedance (for sources that are not designed to drive 50 ohm loads or for probe heads)

Offset (Channel Setup Window)

An analogue offset in percent of the input range could be selected for every input. The needed offset is simply set by selecting it from the list. The signal is then shifted in hardware by the selected percentage value.

DASYLab messages

Error messages

This list of error messages explains all errors that could occur when using the Spectrum boards with DASYLab. Not all of these error messages are relevant for all boards.

Please use the DrvCfg Utility...

When using Windows NT, Windows 2000 or Windows XP ISA boards are installed using the DrvCfg utility. If this error message is shown this board is not matching the loaded driver. Either DASYLab has loaded the wrong driver or the board was not set-up correctly under Windows NT. Please have a look at the hardware manual for a detailed description.

The Samplerate (Frequency) is not valid...

The samplerate is not in the valid range. Please compare the selected value with the allowed values from the hardware description. The samplerate could only be set to even divider from the maximal possible samplerate. No other settings are allowed.

An internal error occurred...

This message is shown if an internal error occurred in the driver. Please document the values shown in the error message as well as all other settings and the action that was made before this error occurs. Send this information to the developer of the driver to get an error free version.

The blocksize is larger the programmed memsize

The block size defined in DASYLab for data transfer is larger than the programmed memory size on the board. Either the memory size on the board must be increased or the block size in DASYLab must be decreased. A recording with the given parameters is not useful.

FIFO Buffer overrun. Recording stopped !

The internal FIFO buffer of the board or the FIFO buffer of the driver overruns because DASYLab could not process the data fast enough. Recording has been stopped. Start recording again with a slower samplerate or minimise the number of modules that process the data.

Synchronisation of Timestamp to external Clock failed.

The synchronisation to the external seconds signal of the radio clock did not work. Perhaps the connection is interrupted. If no radio clock is installed, please use another timestamp mode.

FIFO mode is only possible up to a sum frequency of 125 MHz.

The sum frequency of all activated channels is higher than 125 MHz. FIFO mode could only work up to a sum frequency of 250 MB/s (125 MHz). Deactivate some channels or select a lower samplerate.

No Spectrum PCI board found in the system. Please check installation of board and driver.

No Spectrum board was found in the system. Please check whether the board is installed properly in the system and whether the driver of the operating system was loaded correctly.

Output channels are not to be allowed as asynchronous. Please change setup.

This board could only make a data output that is synchronously with the data acquisition. An asynchronous output is not possible. Please change the experiment setup to have synchronous outputs.

Mixing input and output. Channels of one module must have same direction

Due to hardware limitations all channels on one module must be programmed in the same direction. Please change the setup and use other channels to perform the desired task.

Mixing input and output. Not possible with this board type

This hardware type doesn't allow to mix input channels and output channels.

Mixing input and output. Not possible when using FIFO mode (continuous)

It is not possible to use FIFO mode at the same time for output and for data acquisition. Please change the acquisition mode in the experiment setup.

Output channels are not allowed to be asynchronous. Please change them to synchronous.

The output channels are synchronous fast channels. Therefore the output mode is not allowed to be set to asynchronous mode. Please change the setting before proceeding.

Singleshot and Continuous mode are only allowed if output is enabled.

The both modes singleshot and continuous are pure output modes. Therefore these modes can only be used if the board is used as an output mode. They cannot be used with acquisition mode or mixed mode.