SPECTRUM
SYSTEMENTWICKLUNG MICROELECTRONIC GMBH

MX.61xx - 2 channel 125 MS/s Arbitrary Waveform Generator

- **PXI 3U / CompactPCI 3U format**
- **Fast 8 bit arbitrary waveform generator**
- **2 simultaneous channels**
- **Output up to ± 3 V in 50 Ohm**
- **Amplifier option available for ±10 V**
- **Offset and amplitude programmable**
- **3 software selectable filters**
- **Up to 128 MSample memory**
- **FIFO mode**
- **Synchronization possible**
- **Software SPEasyGenerator included**

Product range overview

Model	1 channel	2 channels
MX.6110	125 MS/s	125 MS/s

Software/Drivers

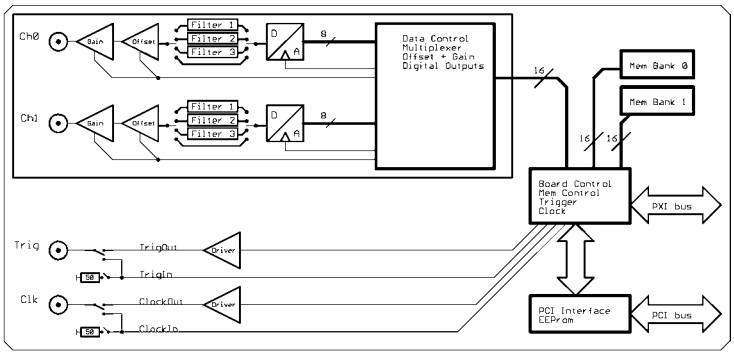
A large number of drivers and examples are delivered with the board or are available as an option:

- Windows NT/2000 32 bit drivers
- Windows XP/Vista/7 32 and 64 bit drivers
- Linux 32bit and 64bit drivers
- SBench 6.x Base version for Windows and Linux
- Microsoft Visual C++ examples
- Borland Delphi examples
- Microsoft Visual Basic examples
- Microsoft Excel examples
- LabWindows/CVI examples
- LabVIEW - drivers (as option)
- DASYLab - drivers (as option)
- MATLAB - drivers (as option)
- Agilent VEE - drivers (as option)

General Information

With the PXI board MX.6110 it is possible to generate free definable waveforms on two channels synchronously. The board works on channels with a synchronous sampling rate of 125 MS/s. The internal standard Sync-bus allows the setup of synchronous multi channel systems with higher channel numbers. It is also possible to combine the arbitrary waveform generator with other boards of the MX product family like analogue or digital acquisition boards.
With the up to 128 MSample large on-board memory long waveform can be generated even with high sampling rates. The memory can also be used as a FIFO buffer to make continuous data transfer from PC memory or hard disk.

Hardware block diagram



Software programmable parameters

sampling rate	1 kS/s to max sampling rate, external clock, ref clock, PXI clock
Output amplitude	±100 mV up to ±3 V in 1 mV steps (Amp option: ±333 mV up to ±10 V)
Output offset	±3 V selectable in 1 mV steps (Amp otpion: ±10 V in 3 mV steps)
Filters	no filter or one of 3 different filters as defined in technical data section
Mode	Singleshot, Continuous, Standard, Bank Switching
Clock mode	internal PLL, internal quartz, external, external divided, external reference clock, PXI reference clock
Clock impedance	50 Ohm / high impedance (> 4 kOhm)
Trigger impedance	50 Ohm / high impedance (> 4 kOhm)
Trigger mode	External, Software, PXI Line[5..0], PXI Startrigger
Memory depth	32 up to installed memory in steps of 32
Posttrigger	32 up to 128 M in steps of 32
Multiple Replay segmentsize	32 up to installed memory / 2 in steps of 32

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Possibilities and options

PXI bus
The PXI bus (PCI eXtension for instrumentation) offers a variety of additional normed possibilities for synchronising different components in one system. It is posible to connect several Spectrum cards with each other as well as to connect a Spectrum card with cards of other manufacturers.

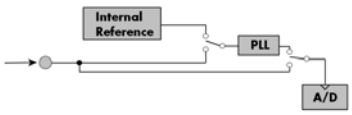
PXI reference clock
The card is able to use the 10 MHz reference clock that is supplied by the PXI system. Enabled by software the PXI reference clock is feeded in the on-board PLL. This feature allows the cards to run with a fixed phase relation.

PXI trigger
The Spectrum cards support star trigger as well as the PXI trigger bus. using a simple software commend one or more trigger lines can be used as trigger source. This feature allows the easy setup of OR connected triggers from different cards.

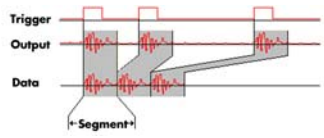
FIFO mode
The FIFO mode is designed for continuous data transfer between measurement board and PC memory (up to 100 MB /s) or hard disk (up to 50 MB/s). The control of the data stream is done automatically by the driver on interrupt request.

External trigger I/O
All boards can be triggered using an external TTL signal. It's possible to use positive or negative edge also in combination with a programmable pulse width. An internally recognised trigger event can - when activated by software - be routed to the trigger connector to start external instruments.

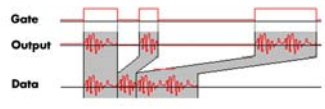
External clock I/O
Using a dedicated connector a sampling clock can be fed in from an external system. It's also possible to output the internally used sampling clock to synchronise external equipment to this clock.

Reference clock


The option to use a precise external reference clock (normally 10 MHz) is necessary to synchronize the board for high-quality measurements with external equipment (like a signal source). It's also possible to enhance the quality of the sampling clock in this way. The driver automatically generates the requested sampling clock from the fed in reference clock.

Multiple Replay


The Multiple Replay option allows the fast repetition output on several trigger events without restarting the hardware. With this option very fast repetition rates can be achieved. The on-board memory is divided in several segments of same size. Each of them is generated if a trigger event occurs.

Gated Replay


The Gated Sampling option allows data replay controlled by an external gate signal. Data is only replayed if the gate signal has a programmed level.

Singleshot output
When singleshot output is activated the data of the on-board memory is replayed exactly one time. As trigger source one can use the external TTL trigger or the software trigger.

Continuous output
When continuous output is activated the data of the on-board memory is replayed continuously until a stop command is executed. As trigger source one can use the external TTL trigger or the software trigger.

±10 V Amplifier


The amplifier board allows the output of ±10 V on up to four channels without software modification. The standard outputs of the card are amplified by factor 3.33. The amplifier which has 30 MHz bandwidth has an output impedance of 50 Ohm. This allows ±10 V with high impedance termination or ±5 V with 50 ohm termination.

Technical Data

Resolution	8 Bit	Dimension	160 mm x 233 mm (Standard 6U)
Integral linearity (DAC)	± 1.5 LSB typ.	Width (Standard)	1 slot (3U)
Differential linearity (DAC)	± 1.0 LSB typ.	Width Amplifier option	1 slot (3U)
Output resistance	< 1 Ohm	Analogue connector	3 mm SMB male
Minimum output load	35 Ohm (not short circuit protected)	Warm up time	10 minutes
Max output swing in 50 Ohm	± 3 V (offset + amplitude)	Operating temperature	0°C - 50°C
Max slew rate (no filter)	> 0.9 V/ns	Storage temperature	-10°C - 70°C
Multi: Trigger to 1st sample delay	fixed	Humidity	10% to 90%
Multi: Recovery time	< 20 samples	MTBF	100000 hours
Ext. clock: delay to internal clock	42 ns ± 2 ns	Offset stepsize	< 2 mV
Output to trigger out delay 1 channel	<10 MS/s: -10 sampl., >10 MS/s: -42 sampl.	Amplitude stepsize	< 1 mV
Output to trigger out delay 2 channels	<5 MS/s: -5 sampl., > 5 MS/s: -21 sampl.	max internal clock	125 MS/s
Crosstalk @ 1 MHz signal ±3 V	< -80 dB	max external clock	125 MS/s
Output accuracy	< 1%	-3 dB bandwidth no filter	> 60 MHz
Min internal clock	1 kS/s	Power consumption 3.3 V @ full speed	max. 1.28 A (4.2 Watt)
Min external clock	DC	Power consumption 5 V @ full speed	max. 0.90 A (5.5 Watt)
Trigger input:Standard TTL level	Low: -0.5 > level < 0.8 V High: 2.0 V > level < 5.5 V Trigger pulse must be valid ≥ 2 clock periods.	Clock input: Standard TTL level	Low: -0.5 V > level < 0.8 V High: 2.0 V > level < 5.5 V Rising edge. Duty cycle: 50% ± 5%
Trigger output	Standard TTL, capable of driving 50 Ohm. Low < 0.4 V (@ 20 mA, max 64 mA) High > 2.4 V (@ -20 mA, max -48 mA) One positive edge after the first internal trigger	Clock output	Standard TTL, capable of driving 50 Ohm Low < 0.4 V (@ 20 mA, max 64 mA) High > 2.4 V (@ -20 mA, max -48 mA)

Amplifier Option

Power consumption	**3,3 V**	**5 V**
1 Channel version	0.0 A	2.5 A
2 Channel version	0.0 A	2.5 A
5 Channel version	0.0 A	5.0 A

Number of amplified channels	1, 2 or 4
Max. input voltage	±3 V
Output impedance	50 Ohm
Max. Output Voltage (into high impedance load)	±10 V
Max. Output Voltage (into 50 Ohm load)	±5 V
Analog ground to PC system ground impedance	10 kOhm (with ground jumper unplugged)
	0 Ohm (when ground jumper is plugged)
Gain Error	≤ ±1 %
Offset Error	≤ ±50 mV

Clock and Filter

	MX.6110
max internal clock	125 MS/s
max external clock	125 MS/s
-3 dB bandwidth no filter	> 60 MHz
Filter 3: Characteristics	5th order Butterworth
Filter 3: -3 dB bandwidth	25 MHz
Filter 2: Characteristics	4th order Butterworth
Filter 2: -3 dB bandwidth	5 MHz
Filter 1: Characteristics	4th order Butterworth
Filter 1: -3 dB bandwidth	500 kHz

Dynamic Parameters

	MX.6110	MX.6110
Test - Samplerate	125 MS/s	125 MS/s
Output Frequency	400 kHz	4 MHz
Output Level	±2 V	±2 V
Used Filter	500 kHz	5 MHz
SNR (typ)	> 60.5 dB	> 54.8 dB
THD (typ)	< -68.8 dB	< -57.8 dB
SFDR (typ), excl harm.	> 71.5 dB	> 65.2 dB

Dynamic parameters are measured at the given output level and 50 Ohm termination with a high resolution data acquisition card and are calculated from the spectrum. The sample rate that is selected is the maximum possible one. All available channels are activated for the tests. SNR and SFDR figures may differ depending on the quality of the used PC. SNR = Signal to Noise Ratio, THD = Total Harmonic Distortion, SFDR = Spurious Free Dynamic Range

Order information

Order No	**Description**	**Order No**	**Description**
MX6110	MX.6111 with 16 MSample memory and drivers/SBench 5.x	MX61xx-32M	Option: 32 MSample mem instead of 16 MSample standard mem
		MX61xx-64M	Option: 64 MSample mem instead of 16 MSample standard mem
MX61xx-dl	DASYLab driver for MX.61xx series	MX61xx-128M	Option: 128 MSample mem instead of 16 MSample standard mem
MX61xx-hp	VEE driver for MX.61xx series	MX61xx-up	Additional handling costs for later memory upgrade
MX61xx-lv	LabVIEW driver for MX.61xx series		
MATLAB	MATLAB driver for all MI.xxxx, MC.xxxx and MX.xxxx series.	MX6xxx-mr	Option Multiple Replay: Memory segmentation
		MX6xxx-gs	Option Gated Sampling: Gate signal controls replay
Cab-3f-9m-80	Adapter cable: SMB female to BNC male 80 cm		
Cab-3f-9m-200	Adapter cable: SMB female to BNC male 200 cm	MX6xxx-1Amp	±10 V Amplifier board with 1 channel
Cab-3f-9f-80	Adapter cable: SMB female to BNC female 80 cm	MX6xxx-2Amp	±10 V Amplifier board with 2 channels
Cab-3f-9f-200	Adapter cable: SMB female to BNC female 200 cm	MX6xxx-4Amp	±10 V Amplifier board with 4 channels