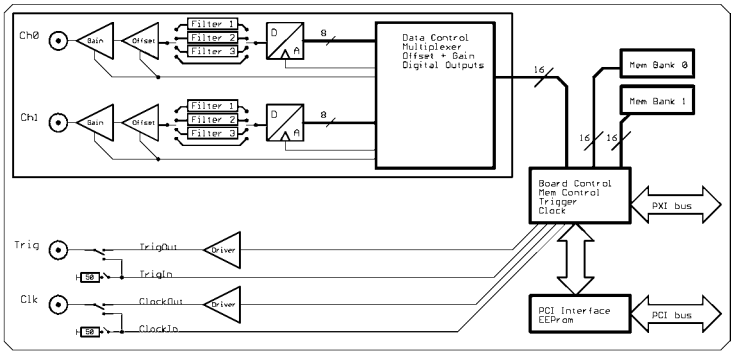
MX.61xx - 2 channel 125 MS/s Arbitrary Waveform Generator

- **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**

Product range overview

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

Hardware block diagram



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/7/8/10, 32 and 64 bit driver
- Linux 32bit and 64bit drivers
- SBench 6.x Base version for Windows and Linux
- Microsoft Visual C++ examples
- Borland Delphi examples
- Microsoft Visual Basic & Excel examples
- Python examples
- LabWindows/CVI examples
- LabVIEW - drivers and examples
- MATLAB - drivers and examples
- Other 3rd party drivers (e.g. VEE,DASYLab) are partly available upon request

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

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.

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.

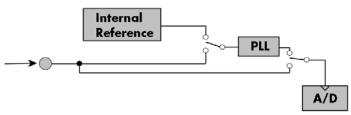
External trigger I/O

All instruments 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

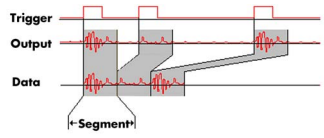
Using a dedicated connector a sampling clock can be fed in from an external system. It's also possible to output the internally used sampling clock to synchronise external equipment to this clock.

Reference clock



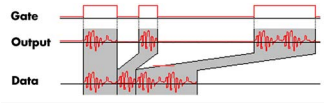
The option to use a precise external reference clock (typically 10 MHz) is necessary to synchronize the instrument for high-quality measurements with external equipment (like a signal source). It's also possible to enhance the stability of the sampling clock in this way. The driver automatically generates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

Multiple Replay



The Multiple Replay mode allows the fast output generation on several trigger events without restarting the hardware. With this option very fast repetition rates can be achieved. The on-board memory is divided into several segments of the same size. Each segment can contain different data which will then be played with the occurrence of each trigger event.

Gated Replay



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

Singleshot output

When singleshot output is activated the data of the on-board memory is played exactly one time. The trigger source can be either one of the external trigger inputs or the software trigger. After the first trigger additional trigger events will be ignored.

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 to 50°C
Max slew rate (no filter)	> 0.9 V/ns	Storage temperature	-10°C to 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)

±10 V Amplifier Card Options

Bandwidth	30 MHz
Max. input voltage	±3 V
Output impedance	50 Ω
Fixed Amplification	x 3.3
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 kΩ (with ground jumper unplugged), 0 Ω (when ground jumper is plugged)
Gain Error	≤ ±1 %
Offset Error	≤ ±50 mV

PXI Version MX.6xxxx-1Amp/2Amp/4Amp

Interface	PXI 32 Bit 33 MHz (power connection only)
Dimension (PCB without SMB connectors)	3U (160 mm x 100 mm)
Power Consumption 3.3 V	0.0 A
Power Consumption 5.0 V	-1Amp and -2Amp: 2.5 A, -4Amp: 5.0 A

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 (typ. 25.6 MHz)
Filter 2: Characteristics	4th order Butterworth
Filter 2: -3 dB bandwidth	5 MHz (typ. 5.8 MHz)
Filter 1: Characteristics	4th order Butterworth
Filter 1: -3 dB bandwidth	500 kHz (typ. 495 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 Informations

Order Informations

The card is delivered with 64 MByte on-board memory and supports standard replay (single-shot, loop, single restart), FIFO replay (streaming), Multiple Replay and Gated Replay. Operating system drivers for Windows/Linux 32 bit and 64 bit, examples for C/C++, LabVIEW (Windows), MATLAB (Windows), LabWindows/CVI, Delphi, Visual Basic, Python and a Base license of the oscilloscope software SBench 6 are included. Drivers for other 3rd party products like VEE or DASYLab may be available on request.

Versions

Order no.	1 channel	2 channels
MX.6110	125 MS/s	125 MS/s

Memory

Order no.	Option
MX.61xx-128M	Memory upgrade to 128 MB of total memory
MX.6xxx-up	Additional fee for later memory upgrade

Options

Order no.	Option
MX.6xxx-1Amp	±10 V output amplifier card with 1 channel including 15 cm SMB to SMB connection cable
MX.6xxx-2Amp	±10 V output amplifier card with 2 channels including 15 cm SMB to SMB connection cables
MX.6xxx-4Amp	±10 V output amplifier card with 4 channels including 15 cm SMB to SMB connection cables

Cables

		Order no.				
for Connections	Length	to BNC male	to BNC female	to SMA male	to SMA female	to SMB female
Analog/Clock/Trigger	80 cm	Cab-3f-9m-80	Cab-3f-9f-80	Cab-3f-3mA-80	Cab-3f-3fA-80	Cab-3f-3f-80
Analog/Clock/Trigger	200 cm	Cab-3f-9m-200	Cab-3f-9f-200	Cab-3f-3mA-200	Cab-3f-3fA-200	Cab-3f-3f-200
Probes (short)	5 cm		Cab-3f-9f-5			

Software SBench6

Order no.	
SBench6	Base version included in delivery. Supports standard mode for one card.
SBench6-Pro	Professional version for one card: FIFO mode, export/import, calculation functions
SBench6-Multi	Option multiple cards: Needs SBench6-Pro. Handles multiple synchronized cards in one system.
Volume Licenses	Please ask Spectrum for details.

Technical changes and printing errors possible