

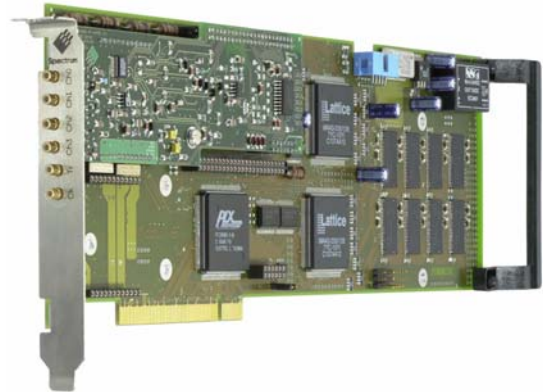


# SPECTRUM

SYSTEMENTWICKLUNG MICROELECTRONIC GMBH

## MI.61xx - 4 channel 125 MS/s Arbitrary Waveform Generator

- Standard PCI format
- Fast 8 bit arbitrary waveform generator
- 2 or 4 channel versions
- Simultaneously sampling on all channels
- Output up to  $\pm 3$  V in 50 Ohm
- Offset and amplitude programmable
- 3 software selectable filters
- Up to 512 MSample memory
- FIFO mode
- Synchronization possible



### Product range overview

Model	1 channel	2 channels	4 channels
MI.6110	125 MS/s	125 MS/s	
MI.6111	125 MS/s	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:

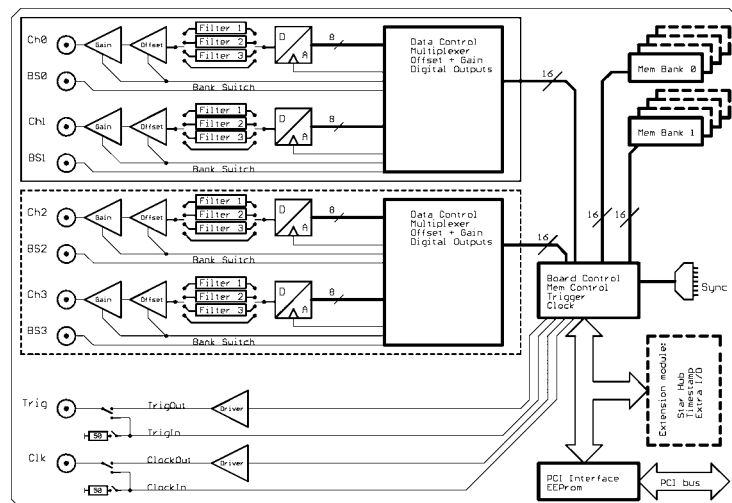
- Windows 98/ME/NT/2000/XP - drivers
- Linux - drivers
- SBench 5.2
- Microsoft Visual C++ examples
- Borland Delphi examples
- Microsoft Visual Basic examples
- Microsoft Excel examples
- LabWindows/CVI examples
- FlexPro support with SBench
- LabVIEW - drivers (as option)
- DASYLab - drivers (as option)
- MATLAB - drivers (as option)
- Agilent VEE - drivers (as option)

### General Information

The MI.61xx series offers 2 different versions of arbitrary waveform generators for the PCI bus. With these boards it is possible to generate free definable waveforms on several channels synchronously. There are two or four channels on one board with a synchronous samplerate of 125 MS/s. The internal standard Syncbus 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 MI product family like analogue or digital acquisition boards.

With the up to 512 MSample large on-board memory long waveforms could be generated even with high samplerates. The memory could also be used as a FIFO buffer to make continuous data transfer from PC memory or hard disk.

### Hardware block diagram



### Software programmable parameters

Samplerate	1 kS/s to max samplerate, external clock, ref clock
Output amplitude	$\pm 100$ mV up to $\pm 3$ V in 1 mV steps
Output offset	$\pm 3$ V selectable in 1 mV steps
Filters	no filter or one of 3 different filters as defined in technical data section
Mode	Singleshot, Continuous, Standard, Bank Switching
Clock impedance	50 Ohm / 1 MOhm
Trigger impedance	50 Ohm / 1 MOhm
Trigger mode	External, Software
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

## **Possibilities and options**

### **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.

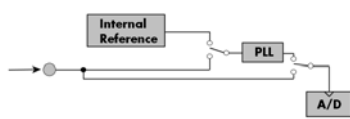
### **External trigger I/O**

All boards could be triggered using an external TTL signal. It's possible to use positive or negative edge also in combination with a programmable pulsewidth. An internally recognised trigger event could - activated by software - routed to the output connector to start external instruments.

### **External clock I/O**

Using an external connector a sampling clock could be fed in from an external system. It's also possible to put out 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 synchronise the board for high-quality mea-

surements with external equipment (like a signal source). It's also possible to enhance the quality of the sampling clock this way. The driver automatically generates the requested sampling clock from the fed in reference clock.

### **Cascading**

The cascading option synchronises up to 4 Spectrum boards internally. It's the simplest way to build up a multi channel system. There is a phase delay between two boards of about 500 pico seconds when this synchronisation option is used.

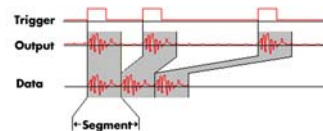
### **Star hub**

The star hub is an additional module allowing the phase stable synchronisation of up to 16 boards. Independent of the number of boards there is no phase delay between all channels. The star hub distributes trigger and clock information between all boards. As a result all connected boards are running with the same clock and the same trigger.

### **Extra I/O**

The Extra I/O module adds 24 additional digital I/O lines and 4 analog outputs on an extra connector. These additional lines are independent from the standard function and could be controlled asynchronously. There is also an internal version available with 16 digital I/Os and 4 analog outputs that could be used directly at the rear board connector.

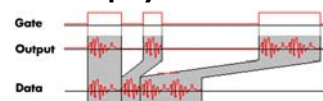
### **Multiple Replay**



The Multiple Replay option allows the fast repetition output on several trigger events without restarting the hardware. With this option very fast repetition rates could 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 program-

med 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.

## Technical Data

Resolution	8 Bit
Integral linearity (DAC)	± 1.5 LSB typ.
Differential linearity (DAC)	± 1.0 LSB typ.
Output resistance	< 1 Ohm
Max output swing in 50 Ohm	± 3 V (offset + amplitude)
Max slew rate (no filter)	> 0.9 V/ns
Multi: Trigger to 1st sample delay	fixed
Multi: Recovery time	< 20 samples
Ext. clock: delay to internal clock	42 ns ± 2 ns
Trigger output delay	1 Sample
Crosstalk @ 1 MHz signal ±3 V	< -80 dB

Min internal clock	1 kS/s
Min external clock	DC

Dimension	312 mm x 107 mm
Width (Standard)	1 full size slot
Width (with star hub option)	2 full size slots
Analogue connector	3 mm SMB male
Warm up time	10 minutes
Operating temperature	0°C - 50°C
Storage temperature	-10°C - 70°C
Humidity	10% to 90%
Offset stepsize	< 2 mV
Amplitude stepsize	< 1 mV

Power consumption 5 V @ full speed	max 3.7 A (18.5 Watt)
Power consumption 5 V @ power down	max 2.3 A (11.5 Watt)

	MI.6110	MI.6111
max internal clock	125 MS/s	125 MS/s
max external clock	125 MS/s	125 MS/s
-3 dB bandwidth no filter	> 60 MHz	> 60 MHz

## Dynamic Parameters

	MI.6110	MI.6111
Test - Samplerate	125 MS/s	125 MS/s
<b>Filter 3</b>		
Characteristics	5th order Butterworth	
-3 dB bandwidth	25 MHz	25 MHz
SNR ±1 V in 50 ohm	-49 dB	
THD ±1 V in 50 ohm	-42 dB	
<b>Filter 2</b>		
Characteristics	4th order Butterworth	
-3 dB bandwidth	5 MHz	5 MHz
SNR ±1 V in 50 ohm	-42 dB	
THD ±1 V in 50 ohm	-67 dB	
<b>Filter 1</b>		
Characteristics	4th order Butterworth	
-3 dB bandwidth	500 kHz	500 kHz
SNR ±1 V in 50 ohm	-72 dB	
THD ±1 V in 50 ohm	-54 dB	

Dynamic parameters are measured at ± 1 V output level and 50 Ohm termination with a spectrum analyser. The samplerate selected is the maximum possible samplerate. Signal frequency is equal to the cut-off frequency of the filter. SNR and RMS noise parameters may differ depending on the quality of the used PC. SNR = Signal to Noise Ratio, THD = Total Harmonic Distortion

## Order information

Order No	Description	Order No	Description
MI6110	MI.6111 with 16 MSample memory and drivers/SBench 5.x	MI61xx-32M	Option: 32 MSample mem instead of 16 MSample standard mem
MI6111	MI.6111 with 16 MSample memory and drivers/SBench 5.x	MI61xx-64M	Option: 64 MSample mem instead of 16 MSample standard mem
MI6xxx-mr	Option Multiple Replay: Memory segmentation	MI61xx-128M	Option: 128 MSample mem instead of 16 MSample standard mem
MI6xxx-gs	Option Gated Sampling: Gate signal controls replay	MI61xx-256M	Option: 256 MSample mem instead of 16 MSample standard mem
MI6xxx-cs	Synchronisation of 2 - 4 boards, one option per system	MI61xx-512M	Option: 512 MSample mem instead of 16 MSample standard mem
MI6xxx-smhd	Star Hub: Synchronisation of 2 - 16 boards, one option per system	MI61xx-up	Additional handling costs for later memory upgrade
MIxxxx-xio	Extra I/O, internal connector: 16 DI/O, 4 Analog out	MI61xx-dl	DASYLab driver for MI.61xx series
MIxxxx-xmf	Extra I/O, external connector: 24 DI/O, 4 Analog out, incl. cable	MI61xx-hp	VEE driver for MI.61xx series
		MI61xx-lv	LabVIEW driver for MI.61xx series
		MATLAB	MATLAB driver for all MI.xxxx, MC.xxxx and MX.xxxx series.
Cab-3f-9m-80	Adapter cable: SMB female to BNC male 80 cm	Cab-3f-9f-80	Adapter cable: SMB female to BNC female 80 cm
Cab-3f-9m-200	Adapter cable: SMB female to BNC male 200 cm	Cab-3f-9f-200	Adapter cable: SMB female to BNC female 200 cm

technical Changes and printing errors possible