

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

- CompactPCI 6U format
- Fast 8 bit arbitrary waveform generator
- 2 or 4 channel versions
- Simultaneously sampling on all 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 512 MSample memory
- FIFO mode
- Synchronization possible



Product range overview

| Model | 1 channel | 2 channels | 4 channels |
|---------|-----------|------------|------------|
| MC.6110 | 125 MS/s | 125 MS/s | |
| MC.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:

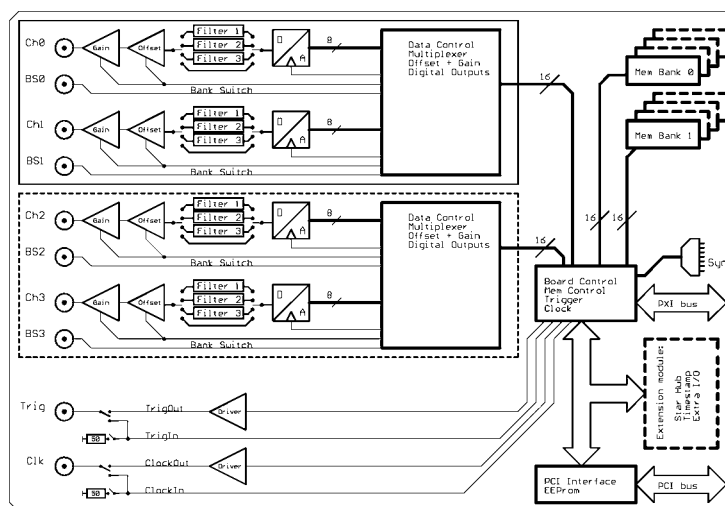
- Windows NT/2000 32 bit drivers
- Windows XP/Vista/7/8/10, 32 and 64 bit driver
- Linux 32bit and 64bit drivers
- SBench 6.x Base version for Windows and Linux
- Microsoft Visual C++ examples
- Borland Delphi examples
- Microsoft Visual Basic & Excel examples
- Python examples
- LabWindows/CVI examples
- LabVIEW - drivers and examples
- MATLAB - drivers and examples
- Other 3rd party drivers (e.g. VEE, DASyLab) are partly available upon request

General Information

The MC.61xx series offer two different versions of arbitrary waveform generators for the CompactPCI 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 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 MC product family like analogue or digital acquisition boards.

With the up to 512 MSample large on-board memory long waveforms can be generated even with high sampling rates. The memory can also be used as a FIFO buffer to make continuously 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 |
| 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 option: ± 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, int.quartz, external, ext. divided, ext. reference clock |
| Clock impedance | 50 Ohm / high impedance (> 4 kOhm) |
| Trigger impedance | 50 Ohm / high impedance (> 4 kOhm) |
| 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.

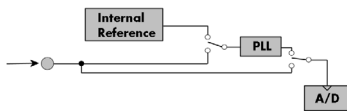
External trigger I/O

All 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.

Cascading

The cascading option synchronises up to 4 Spectrum boards internally. It's the easiest 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.

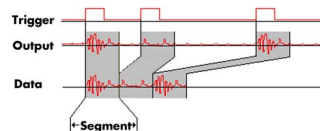
Star-Hub

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 can be controlled asynchronously. There is also an internal version available with 16 digital I/Os and 4 analog outputs that can be used directly at the rear board connector.

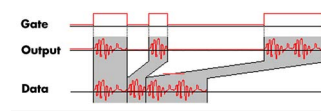
Multiple Replay



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



programmed level.

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

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 (6U) |
| Differential linearity (DAC) | ± 1.0 LSB typ. | Width (with star hub option) | 2 slots (6U) |
| Output resistance | < 1 Ohm | Width Amplifier option | 1 slot (3U) |
| Minimum output load | 35 Ohm (not short circuit protected) | Analogue connector | 3 mm SMB male |
| Max output swing in 50 Ohm | ± 3 V (offset + amplitude) | Warm up time | 10 minutes |
| Max slew rate (no filter) | > 0.9 V/ns | Operating temperature | 0°C to 50°C |
| Multi: Trigger to 1st sample delay | fixed | Storage temperature | -10°C to 70°C |
| Multi: Recovery time | < 20 samples | Humidity | 10% to 90% |
| Ext. clock: delay to internal clock | 42 ns ± 2 ns | MTBF | 100000 hours |
| Output to trigger out delay 1 channel | <10 MS/s: -10 sampl., >10 MS/s: -42 sampl. | Offset stepsize | < 2 mV |
| Output to trigger out delay 2 channels | <5 MS/s: -5 sampl., > 5 MS/s: -21 sampl. | Amplitude stepsize | < 1 mV |
| Crosstalk @ 1 MHz signal ±3 V | < -80 dB | Output accuracy | < 1% |
| Min internal clock | 1 kS/s | Power consumption 3.3 V @ full speed | max. 1.51 A (5.0Watt) |
| Min external clock | DC | Power consumption 5 V @ full speed | max. 1.53 A (7.7 Watt) |
| Trigger input: Standard TTL level | Low: -0.5 V > 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 |
| Analogue 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

| | MC.6110 | MC.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 |

| | |
|---------------------------|------------------------|
| 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

| | MC.6110 MC.6111 | MC.6110 MC.6111 |
|------------------------|--------------------|--------------------|
| 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

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 | 4 channels |
|-----------|-----------|------------|------------|
| MC.6110 | 125 MS/s | 125 MS/s | |
| MC.6111 | 125 MS/s | 125 MS/s | 125 MS/s |

Memory

| Order no. | Option |
|--------------|--|
| MC.61xx-128M | Memory upgrade to 128 MB of total memory |
| MC.61xx-256M | Memory upgrade to 256 MB of total memory |
| MC.61xx-512M | Memory upgrade to 512 MB of total memory |
| MC.6xxx-up | Additional fee for later memory upgrade |

Options

| Order no. | Option |
|------------------|---|
| MC.6xxx-cs | Option Cascading: Synchronization of up to 4 cards (one option needed per system) |
| MC.6xxx-smod (1) | Option Star-Hub: Synchronization of up to 16 cards (one option needed per system) |
| MC.6xxx-xfm (1) | Option Extra I/O with external connector, 24 digital I/O + 4 analog outputs. Including one cable Cab-d40-idx-100. |
| MC.6xxx-1Amp | ±10 V output amplifier card with 1 channel including 15 cm SMB to SMB connection cable |
| MC.6xxx-2Amp | ±10 V output amplifier card with 2 channels including 15 cm SMB to SMB connection cables |
| MC.6xxx-4Amp | ±10 V output amplifier card with 4 channels including 15 cm SMB to SMB connection cables |

Cables

| for Connections | Length | Order no. | | | | |
|--------------------------|--------|------------------|-----------------|----------------|----------------|---------------|
| | | 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-3f80 |
| Analog/Clock/Trigger | 200 cm | Cab-3f-9m-200 | Cab-3f-9f-200 | Cab-3f-3mA-200 | Cab-3f-3fA-200 | Cab-3f-3f200 |
| Probes (short) | 5 cm | | Cab-3f-9f-5 | | | |
| | | to 2x20 pole IDC | to 40 pole FX2 | | | |
| Digital signals (option) | 100 cm | Cab-d40-idx-100 | Cab-d40-d40-100 | | | |

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. |

⁽¹⁾ : Just one of the options can be installed on a card at a time.

⁽²⁾ : Third party product with warranty differing from our export conditions. No volume rebate possible.

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