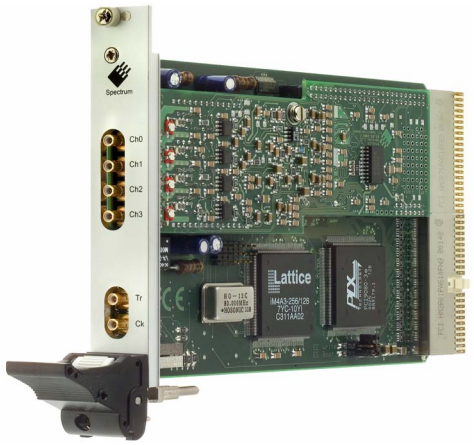
MX.31xx - 4 channel 12 bit A/D up to 25 MS/s

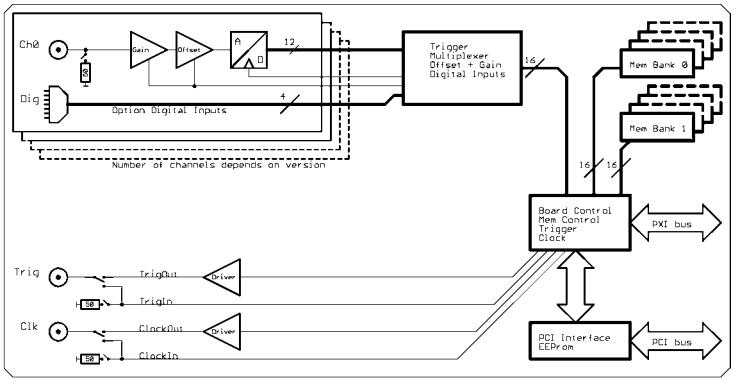
- **PXI 3U / CompactPCI 3U format**
- **12 bit A/D converter board**
- **1 MS/s, 10 MS/s or 25 MS/s**
- **2 or 4 channels per board**
- **Simultaneously sampling on all channels**
- **8 input ranges: ±50 mV up to ± 10 V**
- **Up to 64 MSample memory**
- **FIFO mode to RAM or hard disk**
- **Window and Pulsewidth trigger**
- **Input offset up to ±100%**
- **Synchronization possible**
- **Software SBench for Windows included**
- **Software SBench for Linux included**



Product range overview

Model	1 channel	2 channels	4 channels
MX.3110	1 MS/s	1 MS/s	
MX.3111	1 MS/s	1 MS/s	1 MS/s
MX.3120	10 MS/s	10 MS/s	
MX.3121	10 MS/s	10 MS/s	10 MS/s
MX.3130	25 MS/s	25 MS/s	
MX.3131	25 MS/s	25 MS/s	25 MS/s

Hardware block diagram



Software/Drivers

A large number of drivers and examples are delivered with the board:

- 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
- Visual C++/Borland C++ Builder 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
Input Range	±50 mV, ±100 mV, ±200 mV, ±500 mV, ±1 V, ±2 V, ±5 V, ±10 V
Input impedance	50 Ohm / 1 MOhm
Input Offset	±100% in steps of 1%
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	Channel, External, Software, Auto, Windows, Pulse, PXI Line[5..0], PXI Startrigger
Trigger level	1/256 to 255/256 of input range
Trigger edge	rising edge, falling edge or both edges
Trigger pulsewidth	1 to 255 samples in steps of 1 sample
Memory depth	32 up to installed memory in steps of 32
Posttrigger	32 up to 128 M in steps of 32
Multiple Recording segmentsize	32 up to installed memory / 2 in steps of 32

General Information

The MX.31xx series allows recording of two or four channels with sampling rates of 1 MS/s, 10 MS/s or 25 MS/s. Due to the proven design a wide variety of 12 bit A/D converter boards for PXI bus can be offered. These boards are available in several versions and different speed grades making it possible for the user to find an individual solution.

As an option 4 digital inputs per channel can be recorded synchronously. The installed memory of up to 64 MSample will be used for fast data recording. It can completely be used by the currently active channels. If using slower sampling rates the memory is switched to a FIFO buffer and data will be transferred on-line to the PC memory or to 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.

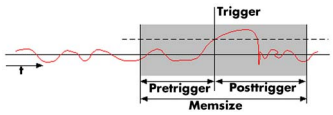
PXI trigger

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.

Input impedance

All inputs could individually be switched by software between 50 Ohm and 1 MOhm input impedance. If using fast signals and high sampling rates or have 50 Ohm cable impedance the use of the 50 Ohm termination is recommended to minimise noise and signal reflections. If using weak signal sources or standard probes the use of the 1 MOhm termination is helpful.

Ring buffer mode



The ring buffer mode is the standard mode of all oscilloscope instruments. Digitized data is continuously written into a ring memory until a trigger event is detected. After the trigger, post-trigger samples are recorded and pre-trigger samples can also be stored. The number of pre-trigger samples available simply equals the total ring memory size minus the number of post trigger samples.

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.

Channel trigger

The data acquisition boards offer a wide variety of trigger modes. Besides the standard signal checking for level and edge as known from oscilloscopes it's also possible to define a window trigger. All trigger modes can be combined with the pulsewidth trigger. This makes it possible to trigger on signal errors like too long or too short pulses.

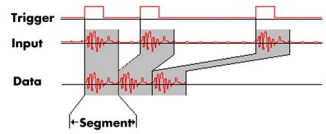
External trigger I/O

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.

Pulse width

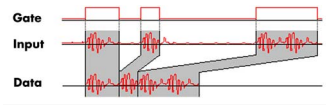
Defines the minimum or maximum width that a trigger pulse must have to generate a trigger event. Pulse width can be combined with channel trigger, pattern trigger and external trigger.

Multiple Recording



The Multiple Recording mode allows the recording of 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 filled with data if a trigger event occurs.

Gated Sampling

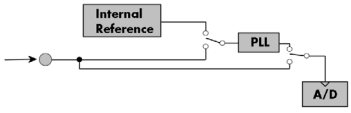


The Gated Sampling mode allows data recording controlled by an external gate signal. Data is only recorded if the gate signal has a programmed level.

External clock I/O

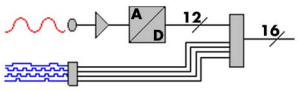
Using a dedicated connector a sampling clock can be fed in from an external system. It's also possible to output the internally used sampling clock to synchronise external equipment to this clock.

Reference clock



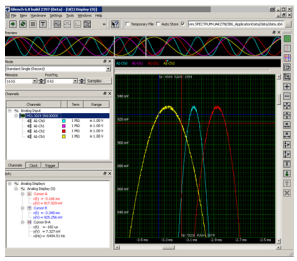
The option to use a precise external reference clock (typically 10 MHz) is necessary to synchronize the instrument for high-quality measurements with external equipment (like a signal source). It's also possible to enhance the stability of the sampling clock in this way. The driver automatically generates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

Digital inputs



This option acquires additional synchronous digital channels phase-stable with the analog data. When the option is installed there are 4 additional digital inputs for every analog A/D channel.

SBench 6



A base license of SBench 6, the easy-to-use graphical operating software for Spectrum cards, is included in the delivery. The base license makes it is possible to test the card, display acquired data and make some basic measurements. It's a valuable tool for checking the card's performance and assisting with the unit's initial setup. The cards also come with a demo license for the SBench 6 professional version. This license gives the user the opportunity to test the additional features of the professional version with their hardware. The professional version contains several advanced measurement functions, such as FFTs and X/Y display, import and export utilities as well as support for all acquisition modes including data streaming. Data streaming allows the cards to continuously acquire data and transfer it directly to the PC RAM or hard disk. SBench 6 has been optimized to handle data files of several GBytes. SBench 6 runs under Windows as well as Linux (KDE, GNOME and Unity) operating systems. A test version of SBench 6 can be downloaded directly over the internet and can run the professional version in a simulation mode without any hardware installed. Existing customers can also request a demo license for the professional version from Spectrum. More details on SBench 6 can be found in the SBench 6 data sheet.

Technical Data

Resolution	12 bit	Dimension	160 x 100 mm (Standard 3U)
Differential linearity error	≤ 1 LSB (ADC)	Width (Standard)	1 slot
Integral linearity error	≤ 2.5 LSB (ADC)	Width (with digital inputs)	2 slots
Multi: Trigger to 1st sample delay	fix	Connector	3 mm SMB male
Multi: Recovery time	< 20 samples	Input impedance	50 Ohm / 1 MOhm || 25 pF
ext. Trigger accuracy	1 Samples	Overvoltage protection (range ≤ ±1 V)	±5 V
int. Trigger accuracy	1 Sample	Overvoltage protection (range > ±1 V)	±50 V
Ext. clock: delay to internal clock	42 ns ±2 ns	Warm up time	10 minutes
input signal with 50 ohm termination	max 5 V rms	Operating temperature	0°C to 50°C
Digital Inputs input impedance	110 Ohm @ 2.5 V	Storage temperature	-10°C to 70°C
Digital Inputs delay to analog sample	-4 samples	Humidity	10% to 90%
		MTBF	100000 hours
Min internal clock	1 kS/s	Power consumption 3.3 V @ full speed	max. 1.11 A (3.7 Watt)
Min external clock	1 kS/s	Power consumption 5 V @ full speed	max. 1.11 A (5.6 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)

Input range	±50 mV	±100 mV	±200 mV	±500 mV	±1 V	±2 V	±5 V	±10 V
Software programmable offset	±50 mV	±100 mV	±200 mV	±500 mV	±1 V	±2 V	±5 V	±10 V
Offset error	< 1 LSB, adjustable by user							
Gain error	< 1 %	< 1 %	< 1 %	< 1 %	< 1 %	< 1 %	< 1 %	< 1 %
Noise (rms): 50 Ohm, 25 MS/s	< 1.5 LSB	< 1.2 LSB	< 1.0 LSB	< 1.0 LSB	< 1.0 LSB	< 1.0 LSB	< 1.0 LSB	< 1.0 LSB
Crosstalk 500 kHz signal, ±50 mV input, 50 Ohm	< -70 dB							

	MX.3110 MX.3111	MX.3120 MX.3121	MX.3130 MX.3131
max internal clock	1 MS/s	10 MS/s	25 MS/s
max external clock	1 MS/s	10 MS/s	25 MS/s
-3 dB bandwidth	> 500 kHz	> 5 MHz	> 10.0 MHz

Dynamic Parameters

	MX.3110 MX.3111	MX.3120 MX.3121	MX.3130 MX.3131
Test - Samplerate	1 MS/s	10 MS/s	25 MS/s
Testsignal frequency	90 kHz	1 MHz	1 MHz
SNR (typ)	> 67.5 dB	> 64.9 dB	> 63.1 dB
THD (typ)	< -62.8 dB	< -62.5 dB	< -62.5 dB
SFDR (typ), incl harm.	> 80.8 dB	> 80.5 dB	> 79.5 dB
SINAD (typ)	> 61.5 dB	> 60.5 dB	> 59.8 dB
ENOB (based on SINAD)	> 9.9 LSB	> 9.8 LSB	> 9.6 LSB

Dynamic parameters are measured at ± 1 V input range (if no other range is stated) and 50 Ohm termination with the samplerate specified in the table. Measured parameters are averaged 20 times to get typical values. Test signal is a pure sine wave of the specified frequency with > 99% amplitude. SNR and RMS noise parameters may differ depending on the quality of the used PC. SNR = Signal to Noise Ratio, THD = Total Harmonic Distortion, SFDR = Spurious Free Dynamic Range, SINAD = Signal Noise and Distortion, ENOB = Effective Number of Bits. For a detailed description please see application note 002.

Order Informations

The card is delivered with 32 MSample on-board memory and supports standard mode (Scope) and FIFO mode (streaming). 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.

Adapter cables are not included. Please order separately!

Versions

Order no.	1 channel	2 channels	4 channels
MX.3110	1 MS/s	1 MS/s	
MX.3111	1 MS/s	1 MS/s	1 MS/s
MX.3120	10 MS/s	10 MS/s	
MX.3121	10 MS/s	10 MS/s	10 MS/s

Versions

Order no.	1 channel	2 channels	4 channels
MX.3130	25 MS/s	25 MS/s	
MX.3131	25 MS/s	25 MS/s	25 MS/s

Memory

Order no.	Option
MX.3xxx-64M	Memory upgrade to 64 MSample (128 MB) of total memory
MX.3xxx-up	Additional fee for later memory upgrade

Options

Order no.	Option
MX.3xxx-dig	Additional synchronous digital inputs (4 per analog channel) including Cab-d40-idc-100

Amplifiers

Order no.	Bandwidth	Connection	Input Impedance	Coupling	Amplification
SPA.1841 [2]	2 GHz	SMA	50 Ohm	AC	x100 (40 dB)
SPA.1801 [2]	2 GHz	SMA	50 Ohm	AC	x10 (20 dB)
SPA.1601 [2]	500 MHz	BNC	50 Ohm	DC	x10 (20 dB)
SPA.1412 [2]	200 MHz	BNC	1 MOhm	AC/DC	x10/x100 (20/40 dB)
SPA.1411 [2]	200 MHz	BNC	50 Ohm	AC/DC	x10/x100 (20/40 dB)
SPA.1232 [2]	10 MHz	BNC	1 MOhm	AC/DC	x100/x1000 (40/60 dB)
SPA.1231 [2]	10 MHz	BNC	50 Ohm	AC/DC	x100/x1000 (40/60 dB)
Information	External Amplifiers with one channel, BNC/SMA female connections on input and output, manually adjustable offset, manually switchable settings. An external power supply for 100 to 240 VAC is included. Please be sure to order an adapter cable matching the amplifier connector type and matching the connector type for your A/D card input.				

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				
		to 2x20 pole IDC	to 40 pole FX2				
Digital signals (option)	100 cm	Cab-d40-idc-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.

Technical changes and printing errors possible