M4i.77xx-x8 - 32 Channel Digital Waveform Acquisition

- Up to 720 MBit/s sampling rate in timing analysis mode
- Up to 700 MBit/s DDR sampling rate in state clock mode (clock gaps allowed)
- Differential interface version for LVDS, (LV)PECL, (N)ECL and other differential signals
- Programmable clock delay
- Single-ended interface version for logic levels 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V
- Ultra Fast PCI Express x8 Gen 2 interface
- 4 GByte on-board memory (up to 1 GBit per channel)
- FIFO mode continuous streaming
- Modes: Single-Shot, Multiple Recording, Gated Sampling, Timestamp
- Trigger input/output with AND/OR functionality
- Synchronization of up to 8 cards per system

PCIe x8 Gen 2 Interface
- Works with x8/x16* PCIe slots
- Sustained streaming mode more than 3.4 GB/s**

### Operating Systems
- Windows 7 (SP1), 8, 10,
  Server 2008 R2 and newer
- Linux Kernel 2.6, 3.x, 4.x, 5.x
- Windows/Linux 32 and 64 bit

### Recommended Software
- Visual C++, Delphi, C++ Builder,
  GNU C++, VB.NET, C#, J#, Java,
  Python
- SBench 6

### Drivers
- MATLAB
- LabVIEW
- LabWindows/CVI

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<th>Channels</th>
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<th>State Clock</th>
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<tr>
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<td>Single-Ended</td>
<td>32</td>
<td>125 MBit/s</td>
<td>125 MBit/s</td>
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<tr>
<td>M4i.7720-x8</td>
<td>Single-Ended</td>
<td>32</td>
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</tr>
<tr>
<td>M4i.7730-x8</td>
<td>Single-Ended</td>
<td>32</td>
<td>720 MBit/s</td>
<td>700 MBit/s</td>
</tr>
<tr>
<td>M4i.7725-x8</td>
<td>differential</td>
<td>32</td>
<td>250 MBit/s</td>
<td>250 MBit/s</td>
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<tr>
<td>M4i.7735-x8</td>
<td>differential</td>
<td>32</td>
<td>720 MBit/s</td>
<td>700 MBit/s</td>
</tr>
</tbody>
</table>

### General Information

The M4i.77xx-x8 series digital waveform acquisition (logic-analyzer) cards include versions with 32 synchronous channels, either single-ended with programmable threshold levels or differential. The large on-board memory can be segmented to record different waveform sequences.

The cards feature a PCI Express x8 Gen 2 interface that offers outstanding data streaming performance. The interface and Spectrum’s optimized drivers enable data transfer rates in excess of 3.4 GByte/s** (24 GBit/s) so that all channels can continuously be recorded, even at full sample rate.

While the M4i.77xx cards have been designed using the latest technology they are still software compatible with the drivers from earlier Spectrum digital acquisition cards. Therefore existing customers can use the same software they developed for a 10 year old 60 MS/s digital input card also for an M4i.77xx series 720 MS/s logic analyzer.

*Some x16 PCIe slots are for the use of graphic cards only and can’t be used for other cards. **Throughput measured with a motherboard chipset supporting a TLP size of 256 bytes.
Software Support

Windows drivers
The cards are delivered with drivers for Windows 7, Windows 8, and Windows 10 (32 bit and 64 bit). Programming examples for Visual C++, C++ Builder, LabWindows/CVI, Delphi, Visual Basic, VB.NET, C#, #, Python, Java and IVI are included.

Linux Drivers
All cards are delivered with full Linux support. Pre compiled kernel modules are included for the most common distributions like Fedora, Suse, Ubuntu LTS or Debian. The Linux support includes SMP systems, 32 bit and 64 bit systems, versatile programming examples for GNU C++, Python as well as the possibility to get the driver sources for your own compilation.

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 possible to test the card, generate simple signals or load and replay previously stored SBench 6 signals. It’s a valuable tool for checking the cards performance and assisting with the units 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 replay modes including data streaming. Data streaming allows the cards to continuously replay data and transfer it directly from 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 and GNOME) 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.

SCAPP – CUDA GPU based data processing
For applications requiring high powered signal and data processing Spectrum offers SCAPP (Spectrum’s CUDA Access for Parallel Processing). The SCAPP SDK allows a direct link between Spectrum digitizers, AWGs or Digital Data Acquisition Cards and CUDA based GPU cards. Once in the GPU user can harness the processing power of the GPU’s multiple (up to 5000) processing cores and large (up to 24 GB) memories. SCAPP uses an RDMA (Linux only) process to send data at the full PCIe transfer speed to and from the GPU card. The SDK includes a set of examples for interaction between the Spectrum card and the GPU card and another set of CUDA parallel processing examples with easy building blocks for basic functions like filtering, averaging, data de-multiplexing, data conversion or FFT. All the software is based on C/C++ and can easily be implemented, expanded and modified with normal programming skills.

Third-party products
Spectrum supports the most popular third-party software products such as LabVIEW, MATLAB or LabWindows/CVI. All drivers come with detailed documentation and working examples are included in the delivery. Support for other software packages, like VEE or DasyLab, can also be provided on request.

Hardware features and options

PCI Express x8
The M4i series cards use a PCI Express x8 Gen 2 connection. They can be used in PCI Express x8 and x16 slots with Gen 1, Gen 2 or Gen 3. The maximum sustained data transfer rate is more than 3.3 GByte/s (read direction) or 2.8 GByte/s (write direction) per slot. Server motherboards often recognize PCI Express x4 connections in x8 slots. These slots can also be used with the M4i series cards but with reduced data transfer rates.

Connections
- The cards are equipped with two VHDCI connectors for the digital channels as well as for the external trigger, clock input and clock output. These connectors also provide two separate multi-function inputs as well as multi-function outputs that can be individually programmed to perform different functions:
  - Trigger output
  - Status output (armed, triggered, ready, ...)
  - Asynchronous I/O lines

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 or streaming mode is designed for continuous data transfer between the digitizer card and the PC memory. When mounted in a PCI Express x8 Gen 2 interface read streaming speeds of up to 3.4 GByte/s are possible. The control of the data stream is done automatically by the driver on interrupt request basis. The complete installed onboard memory is used to buffer the data, making the continuous streaming process extremely reliable.

Multiple Recording
The Multiple Recording mode allows the recording of several trigger events with an extremely short re-arming time. The hardware doesn’t need to be restarted in between. The on-board memory is divided in several segments of the same size. Each of them is filled with data if a trigger event occurs. Pre- and posttrigger of the segments can be programmed. The number of acquired segments is only limited by the used memory and is unlimited when using FIFO mode.
**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. In addition a pre-area before start of the gate signal as well as a post area after end of the gate signal can be acquired. The number of gate segments is only limited by the used memory and is unlimited when using FIFO mode.

**Timestamp**

The timestamp function writes the time positions of the trigger events in an extra memory. The timestamps are relative to the start of recording, a defined zero time, externally synchronized to a radio clock, an IRIG-B a GPS receiver. Using the external synchronization gives a precise time relation for acquisitions of systems on different locations.

**Pattern trigger**

Pattern triggers can be defined for every bit of the digital input data. Each input for the pattern trigger can be set to high or low, depending on the expected level, or "don't care". In addition, edge detection can be used to allow triggering on rising, falling or both edges. The pattern trigger can be used to recognize a huge variety of trigger events.

**External trigger input**

The boards can be triggered using an external trigger input, that has the same exact interface capabilities as the installed data lines, either single-ended with programmable threshold or differential.

**External clock input and output**

Using a dedicated input line, that has the same exact interface capabilities as the installed data lines (either single-ended with programmable threshold or differential) a sampling clock can be fed in from an external system. Additionally it’s also possible to output the internally used sampling clock on a separate line to synchronize external equipment to this clock.

**State clock**

The state analysis mode allows to use an external clock to synchronously sample the applied data. In this mode the clock is allowed to have gaps, as long as the minimum required high and low times are met. To simplify the synchronous sampling of the data, the incoming clock signal can be shifted/delayed with regards to the data, to allow proper data capture.

**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.

**Star-Hub**

The Star-Hub is an additional module allowing the phase stable synchronization of up to 8 boards of a kind in one system. 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 to ensure all connected boards are running with the same clock and trigger. All trigger sources can be combined with a logical OR allowing all channels of all cards to be the trigger source at the same time.
**Technical Data**

**Differential Interface**

- Available inputs: Data D0 to D31, Trigger (TrigIn), Strobe, Clock (ClkIn), X0, X1
- Data Channel Selection: software programmable 32 channels, 16 channels, 8 channels
- Data/Control Input Compatibility: LVDS, LVPECL, PECL, (NE)ECL, universal differential inputs
- Input Coupling: DC
- Input Type: high-speed comparator
- Input maximum voltage levels: -3.0 V to +5.0 V, max difference between inputs ±8 V
- Input voltage hysteresis: 25 mV
- Input termination: differential termination with 125 Ω
- Open inputs: fail safe -> defined and fixed input level with open inputs, no external termination necessary

**Single-Ended Interface**

- Available inputs: Data D0..D31, Trigger (TrigIn), Strobe, Clock (ClkIn), Multi-Purpose In (X0,X1) + Out (X0,X1,X2)
- Data Channel Selection: software programmable 32 channels, 16 channels, 8 channels
- Data/Control Input Compatibility: compatible to 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V (LV)TTL and (LV)CMOS logic levels
- Input Coupling: DC
- Input Type: high-speed comparator
- Input threshold level: software programmable 0.0 V up to 4.0 V in steps of 10 mV, separately programmable for (D0..D7), (D8..D15), (D16..D23), (D24..D31), TrigIn, ClkIn, StrobeIn, (X0..X1)
- Input maximum voltage levels: -3.0 V to +5.0 V
- Input voltage hysteresis: 25 mV
- Input termination: software programmable 75 Ω (to GND) / 4.7 kΩ (to GND) separately programmable for (D0..D7), (D8..D15), (D16..D23), (D24..D31), TrigIn, ClkIn, StrobeIn, X0, X1
- Open inputs: fail safe -> defined and fixed input level with open inputs, no external termination necessary

**Trigger**

- Available trigger sources: External trigger, pattern trigger, software
- Trigger edge: Rising edge, falling edge or both edges
- Trigger delay: 0 to (8GSamples - 32) = 8589934576 Samples in steps of 32 samples
- Multi, Gate: re-arming time: 40 samples (+ programmed pretrigger)
- Pretrigger at Multi, Gate, FIFO: 32 up to 4096 samples in steps of 32
- Posttrigger: 32 up to 956 samples in steps of 32 (defining pretrigger in standard scope mode)
- Memory depth: 32 up to [number of active channels] samples in steps of 32
- Internal/External trigger accuracy: 1 sample
- Timestamp modes: Standard, Start/reset, external reference clock on X1 (e.g. PPS from GPS, IRIG-B)
- Data format: Std. Start/reset: 64 bit counter, increments with sample clock (reset manually or on start)
- Extra data: none, acquisition of X0/X1 inputs at trigger time
- Size per stamp: 128 bit = 16 bytes

**Multi Purpose I/O lines (on VHDCI connector)**

- Number of multi purpose lines: three named X0 and X1, separate lines for input and output, X2 (output only)
- Input: available signal types: Asynchronous Digital-In, Timestamp Reference Clock
- Output: available signal types: Asynchronous Digital-Out, Run, Arm, Trigger, PLL ReClock
- Multi Purpose input impedance (Diff.): differential termination with 125 Ω
- Multi Purpose input impedance (SE): 75 Ω (to GND) / 4.7 kΩ (to GND), separately programmable for X0 and X1
- Multi Purpose input type (Diff.): LVDS, LVPECL, PECL, (NE)ECL, universal differential inputs
- Multi Purpose input type (SE): compatible to 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V (LV)TTL and (LV)CMOS logic levels
- Multi Purpose input threshold level (SE): 0.0 V up to 4.0 V in steps of 10 mV (common programmable level for X0 and X1)
- Multi Purpose output type (Diff.): Differential LVDS
- Multi Purpose output type (SE): 3.3V (VTL) compatible

**Power Source (on VHDCI connector)**

- Number of power pins: 6
- Voltage: 3.3 V
- Maximum current: 500 mA combined on all pins
- Fuse: Self resetting fuse (PTC)
Clock

Clock Modes software programmable internal PLL, external reference clock, state clock, sync
Internal clock accuracy ≤ ±20 ppm
Internal clock setup granularity 1 Hz
Clock setup range gaps 562 MHz to 574 MHz (no clock setup possible in that range)

Primary Clk-In (Ext0) as reference clock
External reference clock range software programmable ≥ 10 MHz and ≤ 1 GHz
External reference clock input impedance (Diff.) differential termination with 125 Ω
External reference clock input type (Diff.) SVDs, IPECL, PECL, (N)ECL, universal differential inputs
External reference clock input impedance (SE) compatible to 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V (T)TL and (T)CMOS logic levels
External reference clock input impedance (SE) software programmable 75 Ω (to GND) / 4.7 kΩ (to GND)
External reference clock input threshold level (SE) software programmable 0.0 V up to 4.0 V in steps of 10 mV
External reference clock input edge Rising edge
External reference clock input duty-cycle requirement 45% to 55%
External reference clock input requirements no frequency changes, no gaps

Primary Clk-In (Ext0) as state clock
External state clock input coupling DC
External state clock input impedance (Diff.) differential termination with 125 Ω
External state clock input type (Diff.) SVDs, IPECL, PECL, (N)ECL, universal differential inputs
External state clock input type (SE) compatible to 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V (T)TL and (T)CMOS logic levels
External state clock input impedance (SE) software programmable 75 Ω (to GND) / 4.7 kΩ (to GND)
External state clock input voltage swing (ClkInAC+ to ClkInAC–) ±100 mV up to ±1.7 V
Sampling clock output type (Diff.) Differential SVDs
Sampling clock output type (SE) compatible to 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V (T)TL and (T)CMOS logic levels
Sampling clock output type (SE) compatible to 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V (T)TL and (T)CMOS logic levels
Sampling clock output frequency Internal state clock Copy of fed in state clock (not available for M4i.7730)
External state clock delay software programmable 0 ps to 2000 ps with a step size of 40 ps

Secondary Clk-In-AC (Ext1) as state clock
External secondary clock input coupling AC
External secondary clock input impedance (Diff.) differential termination with 100 Ω
External secondary clock input type (Diff.) LVPECL
External secondary clock input type (SE) compatible to 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V (T)TL and (T)CMOS logic levels
External secondary clock input impedance (SE) software programmable 75 Ω (to GND) / 4.7 kΩ (to GND)
External secondary clock input voltage swing (ClkInAC+ to ClkInAC–) ±100 mV up to ±1.7 V
Sampling clock output type (Diff.) Differential SVDs
Sampling clock output type (SE) compatible to 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V (T)TL and (T)CMOS logic levels
Sampling clock output frequency External state clock Copy of fed in state clock (not available for M4i.7730)
External state clock delay software programmable 0 ps to 2000 ps with a step size of 40 ps

Star-Hub synchronization clock modes software selectable Internal clock, External reference clock (state clock is not available with synchronization)

Clock Limits

<table>
<thead>
<tr>
<th>Interface</th>
<th>MI4I.7710-x8</th>
<th>MI4I.7720-x8</th>
<th>MI4I.7730-x8</th>
<th>MI4I.7725-x8</th>
<th>MI4I.7735-x8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum internal clock</td>
<td>610 S/s</td>
<td>610 S/s</td>
<td>610 S/s</td>
<td>610 S/s</td>
<td>610 S/s</td>
</tr>
<tr>
<td>Maximum internal clock</td>
<td>125 MS/s</td>
<td>250 MS/s</td>
<td>350 MS/s</td>
<td>250 MS/s</td>
<td>350 MS/s</td>
</tr>
<tr>
<td>Minimum state clock (Ext 0)</td>
<td>DC</td>
<td>DC</td>
<td>DC</td>
<td>DC</td>
<td>DC</td>
</tr>
<tr>
<td>Maximum state clock (Ext 1)</td>
<td>30 kHz</td>
<td>30 kHz</td>
<td>30 kHz</td>
<td>30 kHz</td>
<td>30 kHz</td>
</tr>
<tr>
<td>Maximum state clock (single data rate)</td>
<td>125 MHz</td>
<td>250 MHz</td>
<td>350 MHz</td>
<td>250 MHz</td>
<td>350 MHz</td>
</tr>
<tr>
<td>Maximum state clock (double data rate)</td>
<td>62.5 MHz</td>
<td>125 MHz</td>
<td>350 MHz</td>
<td>125 MHz</td>
<td>350 MHz</td>
</tr>
<tr>
<td>Maximum state clock data rate (SDR)</td>
<td>125 MBit/s</td>
<td>250 MBit/s</td>
<td>350 MBit/s</td>
<td>250 MBit/s</td>
<td>350 MBit/s</td>
</tr>
<tr>
<td>Maximum state clock data rate (DDR)</td>
<td>125 MBit/s</td>
<td>250 MBit/s</td>
<td>700 MBit/s</td>
<td>250 MBit/s</td>
<td>700 MBit/s</td>
</tr>
</tbody>
</table>

Timings

<table>
<thead>
<tr>
<th>Signal type</th>
<th>External reference clock Input Ext 0</th>
<th>State Clock Input Ext 0</th>
<th>State Clock Input Ext 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>tsetup</td>
<td>Setup time before clock edge input signals</td>
<td>TBD</td>
<td>720 ps</td>
</tr>
<tr>
<td>thold</td>
<td>Hold time after clock edge input signals</td>
<td>TBD</td>
<td>200 ps</td>
</tr>
<tr>
<td>tdelay</td>
<td>Delay from clock input to clock output</td>
<td>TBD</td>
<td>TBD</td>
</tr>
</tbody>
</table>

Connectors

| Number of connectors | 2 |
| Connector type      | 68 pin standard VHDCI |
| Connector impedance | 125 Ω (differential), 75 Ω (single-ended) |
| Cable recommendations | compatible to SCSI Ultra-320, double shielded, twisted pair, max length 1 m, cable drilling: Pin1/Pin35, Pin2/Pin36 ... Pin 34/68 |
Environmental and Physical Details

Dimension (Single Card) 241 mm (¾ PCIe length) x 107 mm x 20 mm (single slot width)
Dimension (Card with option SH8tm installed) 241 mm (¾ PCIe length) x 107 mm x 40 mm (double slot width)
Dimension (Card with option SH8ex installed) 312 mm (full PCIe length) x 107 mm x 20 mm (single slot width)
Weight (M4i.44xx series) maximum 290 g
Weight (M4i.22xx, M4i.66xx, M4i.77xx series) maximum 420 g
Weight (Option star-hub -sh8tm, -sh8ex) including 8 sync cables 130 g
Warm up time 10 minutes
Operating temperature 0°C to 50°C
Storage temperature -10°C to 70°C
Humidity 10% to 90%

PCI Express specific details

PCIe slot type x8 Generation 2
PCIe slot compatibility (physical) x8/x16
PCIe slot compatibility (electrical) x1, x4, x8, x16, Generation 1, Generation 2, Generation 3
Sustained streaming mode
(Card-to-System: M4i.22xx, M4i.44xx, M4i.77xx) > 3.4 GB/s (measured with a chipset supporting a TLP size of 256 bytes, using PCIe x8 Gen2)
(System-to-Card: M4i.66xx) > 2.8 GB/s (measured with a chipset supporting a TLP size of 256 bytes, using PCIe x8 Gen2)

Certification, Compliance, Warranty

EMC Immunity Compliant with CE Mark
EMC Emission Compliant with CE Mark
Product warranty 5 years starting with the day of delivery
Software and firmware updates Lifetime, free of charge

Power Consumption

<table>
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<tr>
<th>PCI EXPRESS</th>
<th>3.3V</th>
<th>12V</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4i.771x-x8, M4i.772x-x8</td>
<td>Power output 0mA</td>
<td>0.2 A</td>
<td>2.9 A</td>
</tr>
<tr>
<td>M4i.773x-x8</td>
<td>Power output 0mA</td>
<td>0.2 A</td>
<td>3.1 A</td>
</tr>
</tbody>
</table>

MTBF

MTBF 100000 hours

Block diagram differential input version
Block diagram single-ended input version

Order Information
The card is delivered with 4 GByte on-board memory and supports standard acquisition (Scope), FIFO acquisition (streaming), Multiple Recording, Gated Sampling and Timestamps. Operating system drivers for Windows/Linux 32 bit and 64 bit, examples for C/C++, LabVIEW (Windows), MATLAB (Windows and Linux), LabWindows/CVI, .NET, Delphi, Java, Python and a Base license of the oscilloscope/logic-analyzer 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!

PCI Express x8

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Channels</th>
<th>Interface</th>
<th>Standard mem</th>
<th>Sampling Clock</th>
<th>State Clock</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4i.7710-x8</td>
<td>32</td>
<td>Single-Ended</td>
<td>4 GByte</td>
<td>125 MBit/s</td>
<td>125 MBit/s</td>
</tr>
<tr>
<td>M4i.7720-x8</td>
<td>32</td>
<td>Single-Ended</td>
<td>4 GByte</td>
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<td>M4i.7730-x8</td>
<td>32</td>
<td>Single-Ended</td>
<td>4 GByte</td>
<td>720 MBit/s</td>
<td>700 MBit/s</td>
</tr>
<tr>
<td>M4i.7725-x8</td>
<td>32</td>
<td>Differential</td>
<td>4 GByte</td>
<td>250 MBit/s</td>
<td>250 MBit/s</td>
</tr>
<tr>
<td>M4i.7735-x8</td>
<td>32</td>
<td>Differential</td>
<td>4 GByte</td>
<td>720 MBit/s</td>
<td>700 MBit/s</td>
</tr>
</tbody>
</table>

Options

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4i.xxxx-SH8ex (1)</td>
<td>Synchronization Star-Hub for up to 8 cards (extension), only one slot width, extension of the card to full PCI Express length (312 mm). 8 synchronization cables included.</td>
</tr>
<tr>
<td>M4i.xxxx-SH8tm (1)</td>
<td>Synchronization Star-Hub for up to 8 cards (top mount), two slots width, top mounted on card. 8 synchronization cables included.</td>
</tr>
<tr>
<td>M4i-upgrade</td>
<td>Upgrade for M4i.xxxx: Later installation of option Star-Hub</td>
</tr>
</tbody>
</table>

VHDCI Cable

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cab-v68-v68-100</td>
<td>Shielded twisted-pair cable VHDCI to VHDCI, 100 cm, 125 Ω differential, 90 Ω single-ended</td>
</tr>
<tr>
<td>Cab-v68-v68-300</td>
<td>Shielded twisted-pair cable VHDCI to VHDCI, 300 cm, 125 Ω differential, 90 Ω single-ended</td>
</tr>
</tbody>
</table>

Software SBench6

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBench6</td>
<td>Base version included in delivery. Supports standard mode for one card.</td>
</tr>
<tr>
<td>SBenchPro</td>
<td>Professional version for one card: FIFO mode, export/import, calculation functions</td>
</tr>
<tr>
<td>SBench6-Multi</td>
<td>Option multiple cards. Needs SBenchPro. Handles multiple synchronized cards in one system.</td>
</tr>
<tr>
<td>Volume Licenses</td>
<td>Please ask Spectrum for details.</td>
</tr>
</tbody>
</table>

Software Options

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPc-RServer</td>
<td>Remote Server Software Package - LAN remote access for M2i/M3i/M4i/H4x/H38 cards</td>
</tr>
<tr>
<td>SPc-SCAPP</td>
<td>Spectrum's CUDA Access for Parallel Processing- SDK for direct data transfer between Spectrum card and CUDA GPU. Includes RDMA activation and examples. Signed NDA needed for access.</td>
</tr>
</tbody>
</table>

(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

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