M2i.31XX - 8-Channel, up to 25 MS/s, 12 bit, PCI-based Transientrecorders

Features:
- PCI-X interface (100% compatible to PCI)
- Multichannel 12 bit A/D converter board
- Up to 25 MS/s on one, two or four channels
- Separate ADC and Amplifier per channel
- Simultaneous sampling on all channels
- 8 input ranges: ±50 mV up to ± 10 V
- 64 MB on-board memory expandable to 4 GB
- Sustained streaming mode to 200 MB/s
- Window, pulse-width, re-arm, OR/AND trigger
- Programmable input offset up-to +/- 100%
- Synchronization option for up-to 16 boards
- ABA mode option: combination of data logging and digitizing on trigger
- Software support for Windows and LINUX

Description:
The M2i.31xx series allows recording of two, four or eight 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 PCI/PCI-X 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 2 GSample will be used for fast data recording. It can be used completely 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.

- Completely new developed base card
- 4 GByte memory with one slot width
- Optimized low jitter clock section
- Multi, Gate with programmable pre, posttrigger and timestamp
- Zero phase delay synchronization

Applications:
- Automation
- OEM-Applications
- Quality control
- Military
- Automotive
- ATE

Product range overview
All four cards of the M2i.31xx series may use the whole installed on-board memory completely for the currently activated number of channels. See details above
Specifications:

RESOLUTION: 12bit
DIFF. NONLINEARITY: < 1 LSB typ. (ADC)
INTEGRAL NONLINEARITY: < 2.5 LSB typ. (ADC)
OFFSET ERROR: can be calibrated by the user
GAIN ERROR: < 1% of current value
PROGRAMMABLE INPUT OFFSET: +/- 100% of current input range
CROSSTALK @ +50mV, 50 Ohm, 500 kHz: < -70db between any adjacent channel
INPUT SIGNAL with 50 Ohm termination: max. 5V rms
OVER VOLTAGE PROTECTION < +/-1V: +/- 5V
OVER VOLTAGE PROTECTION > +/-1V: +/- 50V
CONNECTOR (analog and trigger/clock): 3mm SMB m

MULTI, GATE, re-arming time: < 4 Samples
MAX PRETRIGGER at MULTI, GATE, FIFO: 8176 samples as sum of all active channels
CHANNEL TRIGGER RES.: TRIGGER OUTPUT delay:
EXT. TRIGGER type: TTL compatible
EXT. TRIGGER input: low < 0.8V, high > 2V, > 2 clock periods
EXT. TRIGGER max voltage: -0.5V to +5.5V
EXT. TRIGGER output levels: TTL comp.
EXT. TRIGGER output: capable of driving a 50 Ohm load

INTERNAL CLOCK accuracy: 20 ppm
INT. CLOCK RANGE: 1 kS/s to max.
INT. CLOCK max. jitter (PPL mode):
INT. CLOCK max. jitter (Quartz mode):
INT. CLOCK stepsize: ≤ 1% of range (100M, 10M..)
INT. CLOCK stepsize example: range 1 to 10MMS/s:

Software programmable parameters M2i.31xx

<table>
<thead>
<tr>
<th>Input range</th>
<th>Trigger mode</th>
</tr>
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<tbody>
<tr>
<td>±50 mV to ±10V in steps of 1, 2, 5</td>
<td>Channel, External, SW, Auto, Pulse</td>
</tr>
<tr>
<td>50 Ohm / 1 MOhm (relais)</td>
<td>Window, Re-arm, OR/AND, Delay</td>
</tr>
<tr>
<td>±100% of input range in steps of 1%</td>
<td>Triggerlevel TBD</td>
</tr>
<tr>
<td>Clock mode: Int. PLL, int. Quartz, ext. clock, ext.div. Ext.ref.</td>
<td>Triggered</td>
</tr>
<tr>
<td>Clock impedance: 50 Ohm / high impedance (&gt;4kOhm)</td>
<td>Trigger delay</td>
</tr>
<tr>
<td>Memory depth: 8 up to (installed memory/active channels in steps of 4</td>
<td>Multiple Rec. Seg.</td>
</tr>
<tr>
<td>Channel selection</td>
<td>Any number of channels (see manual for Multi/Gated pretrigger 0 up to (8k samp./active chan.-16)</td>
</tr>
<tr>
<td>ABA Clock Driver</td>
<td>1 up to (64-1) in steps of 1</td>
</tr>
</tbody>
</table>

Power Consumption (max speed) | 3.3 V | 5 V | -12 V | +12 V | Total |
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<tbody>
<tr>
<td>M2i.31x0 (32 MS memory)</td>
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<tr>
<td>M2i.31x1 (32 MS memory)</td>
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<tr>
<td>M2i.31x2 (32 MS memory)</td>
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Please note: The M2i.30x-Series Transientrecorders extensively use SMB connectors. Cables with these connectors are not included with the boards. They have to be ordered separately if required.

FAST ComTec supports LINUX
Software Support

Windows drivers

Linux Drivers
All cards are delivered with full Linux support. Pre compiled kernel modules are included for the most common distributions like RedHat, Suse or Debian. The linux support is enhanced by SMP support, versatile programming examples as well as the possibility to get the driver sources for own compilation.

SBench
A full licence of SBench the easy-to-use graphical operating software for the Spectrum cards is included in the delivery. The version 6 is running under Windows as well as under Linux (KDE and GNOME).

Third-party products
A lot of third-party products are supported as an option. Choose between LabVIEW, MATLAB, DASYLab and Agilent VEE. All drivers come with examples and detailed documentation.

MI Software compatibility layer
To allow an easy change from MI cards to the new M2i cards for existing software a special software compatibility layer is delivered with the cards. This DLL converts MI calls to M2i calls and simulates a MI card in the software.

Hardware features and options
The analog inputs can be adapted to real world signals using a wide variety of settings that are individual for each channel. By using software commands the input termination can be changed between 50 Ohm and 1 MOhm, one can select a matching input range and the signal offset can be compensated for.

Ring buffer mode
The ring buffer mode is the standard mode of all oscilloscope boards. Data is written in a ring memory of the board until a trigger event is detected. After the event the posttrigger values are recorded. Because of this continuously recording into a ring buffer there are also samples prior to the trigger event visible: Pretrigger = Memsize - Posttrigger.

FIFO mode
The FIFO mode is designed for continuous data transfer between measurement board and PC memory (up to 225 MB/s on a PCI-X slot and up to 115 MB/s on a PCI slot) or hard disk. The control of the data stream is done automatically by the driver on interrupt request. The complete installed on-board memory is used for buffer data, making the continuous streaming extremely reliable.

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 pulselength trigger. This makes it possible to trigger on signal errors like too long or too short pulses. In addition to this a re-arming mode (for accurate trigger recognition on noisy signals) the AND/OR conjunction of different trigger events is possible. As a unique feature it is possible to use deactivated channels as trigger sources.

External trigger I/O
All boards 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 option 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 into 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 option 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 option 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 synchronised to a radio clock, or a GPS receiver. With this option acquisitions of systems on different locations can be set in a precise time relation.
ABA mode

The optional ABA mode combines slow continuous data recording with fast acquisition on trigger events. The ABA mode works like a slow data logger combined with a fast digitizer. The exact position of the trigger events is stored as timestamps in an extra memory.

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 (normally 10 MHz) is necessary to synchronise the board for high-quality measurements with external equipment (like a signal source). It’s also possible to enhance the quality 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 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. All trigger sources can be combined with OR/AND allowing all channels of all cards to be trigger source at the same time. The star-hub is available as 5 card and 16 card version. The 5 card version doesn’t need an extra slot.

<table>
<thead>
<tr>
<th>Dynamic Parameters</th>
<th>M2i.3110</th>
<th>M2i.3111</th>
<th>M2i.3112</th>
<th>M2i.3120</th>
<th>M2i.3121</th>
<th>M2i.3122</th>
<th>M2i.3130</th>
<th>M2i.3131</th>
<th>M2i.3132</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max internal clock</td>
<td>1 MS/s</td>
<td>1 MS/s</td>
<td>10 MS/s</td>
<td>10 MS/s</td>
<td>25 MS/s</td>
<td>25 MS/s</td>
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<tr>
<td>Max external clock</td>
<td>1 MS/s</td>
<td>1 MS/s</td>
<td>10 MS/s</td>
<td>10 MS/s</td>
<td>25 MS/s</td>
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<td>-3 dB bandwidth</td>
<td>DC..0.5 MHz</td>
<td>DC..0.5 MHz</td>
<td>DC..5 MHz</td>
<td>DC..5 MHz</td>
<td>DC..12.5 MHz</td>
<td>DC..12.5 MHz</td>
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<td>Zero noise level (&lt;125 MS/s)</td>
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<tr>
<td>Zero noise level (&gt;125 MS/s)</td>
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<tr>
<td>Test Signal frequency (SNR, THD, SFDR, ENOB)</td>
<td>10 /90 kHz</td>
<td>10 /90 kHz</td>
<td>0.09 / 1 MHz</td>
<td>0.09 / 1 MHz</td>
<td>1 / 4 MHz</td>
<td>1 / 4 MHz</td>
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<tr>
<td>SNR typ (dB)</td>
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<td>SFDR typ. excl. harmonics (dB)</td>
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<tr>
<td>ENOB based on SNR (LSB)</td>
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<tr>
<td>ENOB based on SINAD (LSB)</td>
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</tbody>
</table>

Certifications and Compliances: EMC Immunity and emission: compliant with CE Mark
## Ordering Information

### M2i.31xx-12 bit A/D conv., up to 25 MS/s, up to 8 channels, memory 32 MS (64 MB) , PCI-Bus

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Order No</th>
</tr>
</thead>
<tbody>
<tr>
<td>M2i.3110</td>
<td>1ch</td>
<td>1MS</td>
</tr>
<tr>
<td>M2i.3111</td>
<td>1ch</td>
<td>1MS</td>
</tr>
<tr>
<td>M2i.3112</td>
<td>1ch</td>
<td>1MS</td>
</tr>
<tr>
<td>M2i.3120</td>
<td>10MS</td>
<td>10MS</td>
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<tr>
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<td>10MS</td>
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<tr>
<td>M2i.3130</td>
<td>25MS</td>
<td>25MS</td>
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<tr>
<td>M2i.3131</td>
<td>25MS</td>
<td>25MS</td>
</tr>
<tr>
<td>M2i.3132</td>
<td>25MS</td>
<td>25MS</td>
</tr>
</tbody>
</table>

### Drivers M2i.31x

- M2i.ml: MATLAB driver for all M2i cards
- M2i.31-ly: LabVIEW driver for all M2i.31xx cards
- M2i.31-dl: DASYLab driver for all M2i.31xx cards
- M2i.31-vee: Agilent VEE driver for all M2i.31xx cards

### Memory Expansions M2i.3x, M2i.4x

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Order No</th>
</tr>
</thead>
<tbody>
<tr>
<td>M2i.64MS</td>
<td>Mem. Exp. to 64 MS (128MB) for M2i.3x and M2i.4x series</td>
<td>TR64MS</td>
</tr>
<tr>
<td>M2i.128MS</td>
<td>Mem. Exp. to 128 MS (256MB) for M2i.3x and M2i.4x series</td>
<td>TR128MS</td>
</tr>
<tr>
<td>M2i.256MS</td>
<td>Mem. Exp. to 256 MS (512MB) for M2i.3x and M2i.4x series</td>
<td>TR256MS</td>
</tr>
<tr>
<td>M2i.512MS</td>
<td>Mem. Exp. to 512 MS (1 GB) for M2i.3x and M2i.4x series</td>
<td>TR512MS</td>
</tr>
<tr>
<td>M2i.1GS</td>
<td>Mem. Exp. to 1 GS (2 GB) for M2i.3x and M2i.4x series</td>
<td>TR1GS</td>
</tr>
<tr>
<td>M2i.2GS</td>
<td>Mem. Exp. to 2 GS (4 GB) for M2i.3x and M2i.4x series</td>
<td>TR2GS</td>
</tr>
</tbody>
</table>

### Options

- M2i.mr: Option Multiple Recording
- M2i.mgt: Option Multiple Recording, Gated Sampling, Timestamp
- M2i.mgtab: Option Multiple Rec., Gated Sampling, Timestamp, ABA Modus
- M2i.SH5: Synchronisation Star-Hub for up to 5 cards, only 1 slot width
- M2i.SH16: Synchronisation Star-Hub for up to 16 cards, only 1 slot width
- M2i.bxio: Option BaseXIO: 8 digital I/O lines for asynchronous I/O, timestamp

### Options for M2i.3x

- M2i.3-dig: Additional synchronous digital inputs (4 per analog channel)

### Cables for all M2i boards

- Cab-1m-9m-80: Adapter cable MMCX male to BNC male, 80 cm (for analog inputs)
- Cab-1m-9f-80: Adapter cable MMCX male to BNC female, 80 cm (for analog inputs)
- Cab-1m-9m-200: Adapter cable MMCX male to BNC male, 200 cm (for analog inputs)
- Cab-3f-9m-80: SMB female to BNC male 80cm
- Cab-3f-9f-80: SMB female to BNC female 80cm
- Cab-3f-3f-80: SMB female to SMB female 80cm
- Cab-3f-9m-200: SMB female to BNC male 200cm
- Cab-3f-9f-200: SMB female to BNC female 200cm
- Cab-3f-3f-200: SMB female to SMB female 200cm
- Cab-3f-9f-5: Adapter cable SMB female to BNC female, 5 cm (short cable especially for oscilloscope probes)

### Cables for M2i.4x and M2i.3x

- Cab-d40-icd-100: Flat ribbon cable 40 pin FX2 dig. conn. to 2x20 pin IDC conn.100 cm
- Cab-d40-d40-99: Flat ribbon cable 40 pin FX2 for digital connector to 40 pin digital FX2 conn., 100 cm