High Speed Data Acquisition Cards

TPCE
TPCE-LE
TPCE-I
TPCX
High Speed Data Acquisition Solutions

Product Overview

Elys Data Acquisition Cards are high speed high precision digitizer modules. Based on a PCI or PCIe Interface a modular measurement system can be build up. Different Analog to Digital converters variants from 2 to 240 MHz are available for best fitting any high speed application. In addition, Elys Data Acquisition Cards are available in 4 or 8 channel and as single ended, differential or isolated variants.

Card Family Overview

<table>
<thead>
<tr>
<th>Parameter</th>
<th>TPCE</th>
<th>TPCE-LE</th>
<th>TPCE-I</th>
<th>TPCX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>PCIe x4</td>
<td>PCIe x1</td>
<td>PCIe x1</td>
<td>PCI</td>
</tr>
<tr>
<td>Available Sample Rates</td>
<td>2 - 240 MHz</td>
<td>2 - 240 MHz</td>
<td>1 MHz</td>
<td>2 - 80 MHz</td>
</tr>
<tr>
<td>Resolution</td>
<td>14/16 Bit</td>
<td>14 Bit (16 Bit optional)</td>
<td>16 Bit</td>
<td>14/16 Bit</td>
</tr>
<tr>
<td># of Channels</td>
<td>4 or 8</td>
<td>4 or 8</td>
<td>4 or 8</td>
<td>4 or 8</td>
</tr>
<tr>
<td>Input Ranges</td>
<td>100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V, 10 V, 20 V, 50 V, 100V</td>
<td>200 mV, 500 mV, 1 V, 2 V, 5 V, 10 V, 20 V, 50 V</td>
<td>200 mV, 400 mV, 1 V, 2 V, 5 V, 10 V, 25 V, 50 V</td>
<td>100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V, 10 V, 20 V, 50 V, 100V</td>
</tr>
<tr>
<td>Input Offset</td>
<td>0 - 100 %</td>
<td>0 - 100 %</td>
<td>fix at 50%</td>
<td>0 - 100 %</td>
</tr>
<tr>
<td>Isolation</td>
<td>-</td>
<td>-</td>
<td>400V RMS (560V Peak)</td>
<td>-</td>
</tr>
<tr>
<td>Differential Mode</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Differential Variant</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>CMRR</td>
<td>&gt; 74 dB (DC – 1 kHz); &gt; 60 dB (1 kHz – 100 kHz); &gt; 40 dB (100 kHz – 5 MHz)</td>
<td>&gt; 60 dB (DC – 1 kHz); &gt; 54 dB (1 kHz – 100 kHz); &gt; 40 dB (100 kHz – 5 MHz)</td>
<td>-</td>
<td>&gt; 74 dB (DC – 1 kHz); &gt; 60 dB (1 kHz – 100 kHz); &gt; 40 dB (100 kHz – 5 MHz)</td>
</tr>
<tr>
<td>Memory (4 channel modules)</td>
<td>32 MS/channel (128 MS/channel optional)</td>
<td>32 MS/channel (128 MS/channel optional)</td>
<td>32 MS/channel (128 MS/channel optional)</td>
<td>16 MS/channel (64 MS/channel optional)</td>
</tr>
<tr>
<td>Delivery Form</td>
<td>Board, TraNET EPC, TraNET EPC</td>
<td>Board, TraNET FE, TraNET EPC, TraNET PPC</td>
<td>Board, TraNET FE, TraNET EPC, TraNET PPC</td>
<td>Board, TraNET EPC</td>
</tr>
</tbody>
</table>

Product Variants

TPCX, TPCE and TPCE-LE boards are available in different input configuration

<table>
<thead>
<tr>
<th>Configuration</th>
<th>4 Channel Single Ended</th>
<th>8 Channel Single Ended</th>
<th>4 Channel Differential</th>
<th>8 Channel Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Channels in SE Mode *</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td># of Channels in DIFF Mode</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td># of electrical slots needed</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td># of mechanical slots needed</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Max Sampling Rate Available</td>
<td>240 MHz</td>
<td>20 MHz</td>
<td>240 MHz</td>
<td>20 MHz</td>
</tr>
<tr>
<td>Product Number</td>
<td>-ffbb-4S</td>
<td>-ffbb-8S</td>
<td>-ffbb-4D</td>
<td>-ffbb-8D</td>
</tr>
</tbody>
</table>

*) Differential boards can also be used in Single Ended mode by just using the (+) Input of the differential pair.
The inputs on the non-isolated data acquisition cards have all the same architecture. The ground referenced single ended BNC inputs can be DC, AC or ICP coupled. A gain programmable input stage allows to have different input ranges for having always the maximum resolution over the full input signal range. Two adjoining channels can be connected together for having a differential input configuration, with the drawback that only two ADC can be used.

If differential mode is your standard configuration we recommend using the differential cards which have additional input connectors and additional differential stages for using all four ADC converters.

All channel settings as for example input range, input coupling, offset and filter settings can be set individual per channel.

When more than 4 channels are needed a cost effective solution is to use the 8-Channel modules. On 8-Channel modules all channels have the same specification as on 4-Channel module but share some of the capabilities of the digital base board:

- On-board memory per channel is only 1/2 of the 4-Channel board.
- Maximum Data Throughput in continuous or ECR mode is reduced.

8-Channel cards are available up to 20 MHz sampling rate.
Isolated Analog Inputs with TPCE-I

TPCE-I cards have a different analog input architecture. They are fully channel to channel and channel to ground isolated up to 400V RMS or 560 V DC.
Filter

On each channel a Low-Pass First Order Filter with 100 kHz or 1 MHz (10 KHz, 100 kHz for TPCE-I) bandwidth can be activated.

The analog bandwidth of the amplifier itself is set around the half of the maximum sampling rate, eg. 10 MHz for a 20 MHz board.

When the cards are used below the maximum sampling rate an internal digital filtering is done. Therefore an Anti-Aliasing Filter is not needed in most situations. The picture above shows a 20 MHz card used at 1 MHz. High frequency noise above 10 MHz is filtered by the analog bandwidth of the amplifier with 20 dB/dec. Noise between 500 kHz and 10 MHz is digital filtered and will not produce any mirror signals at lower frequencies.

Trigger

Elsys DAQ cards come with two different trigger packages, the standard trigger package and the Advance Trigger package:

**Standard Trigger**
- Positive/Negative Slope
- Window In/Out

**Advance Trigger**
- all Standard Trigger
- Pulse > & Pulse <
- Delay > & Delay <
- Slew Rate Trigger
- State Trigger
- AND Trigger linking
- Trigger on multiplied signals (Power Trigger)
- Trigger on Marker Inputs (TPCE only)
- Serial Protocol Trigger for I2C and CAN (TPCE only)

Each channel can be the trigger source at once. The first channel which detects a trigger will trigger the measurement. One external Slope trigger is available on the 25-Pol D-SUB connector on the Star-Hub board.

Operation Modes

There are four different operation modes in which the data acquisition cards can be used:

**Scope**
In this mode the board runs like an Oscilloscope. Incoming data from the ADC are written into the on-board memory until a trigger condition occurs. After the trigger condition, the measurement continues until the post-trigger time is over and stops. The length of the measurement is limited by the maximum memory available on the board.

**Multi-Block**
Multi-Block Mode works like the Scope mode but with the addition that the available on-board memory is split up in several blocks. On each trigger, a new part of the memory is used. This way, the on-board memory can be used more effectively than in the Scope mode. The maximum number of blocks is limited by the block size and the available memory.
Continuous
In the Continuous mode incoming data from the ADC’s are buffered on the on-board memory and then transferred immediately to the hard disk. The maximum recording length is only limited by the hard disk size. The amount of data produced per second depends on the used sampling rate and the number of activated channels. If the data rate is higher than the PCI or PCIe interface or the hard-disk write throughput, some data from the on-board buffer get lost.

ECR (Event Controlled Recording)
The ECR mode allows targeted acquisition of cyclic or sporadically arising events. This implies that the registration of measuring data only occurs if certain signal conditions (trigger, time window, repetitions, etc.) are fulfilled. Thus many unwanted and unneeded signal data will not be stored.

ECR - Mode of Operation
- The digitalized signal will be stored to the on-board memory which acts as a ring buffer.
- As soon as the trigger is released, a block of samples will be read from the ring buffer and will be saved to the hard disk.
- If a new trigger event within the actual block occurs, a new overlapping block will be saved.
- If the ring buffer is full, the oldest measurement data will be overwritten with new incoming data. Usually, the overwritten data would be transferred to the hard disk before this happens. If too many events occur in a period of time, the ring buffer may overflow.

An other feature of ECR is the “Dual Mode”. It allows to store a continuous measurement at a slower sampling rate than the captured blocks. For example fast transient can be captured at 10 MS/s by the triggered blocks while storing slower signals at 100 kHz over a long period of time.

Any of these operation modes are ready to use in all driver interfaces or Application software.
Multi-Board Systems

Based on all Elsys DAQ cards, large data acquisition systems can be build-up. Depending on the host system, instruments up to 64 channel in one device can be realized. Larger or distributed systems can be build-up by synchronizing several instruments together. The maximum number of channel is 1024 by taking 16 devices with 64 channel per device.

Star-Hub

The Star-Hub synchronization board allows to synchronize up to 16 Boards inside of an instruments. The Star-Hub generates a master Clock and distributes any Trigger event from and to all connected boards. This way every board in the system can be source and destination of any trigger event. The synchronization precision is one sample over all connected boards.

Sync-Link

The Sync-Link is the next higher level of synchronization and allows to synchronize up to 16 instruments. The connection is made over standard Cat. 6 Ethernet cables up to 10 m length. When connected, the SyncLink act as master clock generator and distributes any trigger event from and to all devices. Any device can be the source of the trigger.
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Digital Input / Output

The 25 Pol D-Sub connector on the StarHub board provides sever dedicated digital inputs and outputs signals.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Pin #</th>
<th>Input / Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger Out</td>
<td>TTL Pulse when device has triggered</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Armed Sync Clock Out</td>
<td>High when device is ready for trigger / Synchronization Clock Output (Configured in TranAX)</td>
<td>14</td>
<td>Output</td>
</tr>
<tr>
<td>!Disarm</td>
<td>Deactivate any trigger when low</td>
<td>15</td>
<td>Input</td>
</tr>
<tr>
<td>Start Recording</td>
<td>Start Recording at negative slope</td>
<td>3</td>
<td>Input</td>
</tr>
<tr>
<td>Trigger In</td>
<td>TLL Trigger input</td>
<td>16</td>
<td>Input</td>
</tr>
<tr>
<td>Timebase In / PPS</td>
<td>External Timebase input or GPS PPS Input</td>
<td>4</td>
<td>Input</td>
</tr>
<tr>
<td>+5V</td>
<td>Power Output (max 500 mA)</td>
<td>17</td>
<td>Power Output</td>
</tr>
<tr>
<td>GND</td>
<td>Chassis Ground</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Marker A1</td>
<td>Digital Inputs Board A TTL Level (with internal Pull-Up)</td>
<td>18</td>
<td>Input</td>
</tr>
<tr>
<td>Marker A2</td>
<td></td>
<td>6</td>
<td>Input</td>
</tr>
<tr>
<td>Marker A3</td>
<td></td>
<td>19</td>
<td>Input</td>
</tr>
<tr>
<td>Marker A4</td>
<td></td>
<td>7</td>
<td>Input</td>
</tr>
<tr>
<td>Marker A5</td>
<td></td>
<td>20</td>
<td>Input</td>
</tr>
<tr>
<td>Marker A6</td>
<td></td>
<td>8</td>
<td>Input</td>
</tr>
<tr>
<td>Marker A7</td>
<td></td>
<td>21</td>
<td>Input</td>
</tr>
<tr>
<td>Marker A8</td>
<td></td>
<td>9</td>
<td>Input</td>
</tr>
<tr>
<td>Marker B1</td>
<td></td>
<td>22</td>
<td>Input</td>
</tr>
<tr>
<td>Marker B2</td>
<td></td>
<td>10</td>
<td>Input</td>
</tr>
<tr>
<td>Marker B3</td>
<td></td>
<td>23</td>
<td>Input</td>
</tr>
<tr>
<td>Marker B4</td>
<td></td>
<td>11</td>
<td>Input</td>
</tr>
<tr>
<td>Marker B5</td>
<td></td>
<td>24</td>
<td>Input</td>
</tr>
<tr>
<td>Marker B6</td>
<td></td>
<td>12</td>
<td>Input</td>
</tr>
<tr>
<td>Marker B7</td>
<td></td>
<td>25</td>
<td>Input</td>
</tr>
<tr>
<td>Marker B8</td>
<td></td>
<td>13</td>
<td>Input</td>
</tr>
</tbody>
</table>

Digital Marker inputs are captured synchronous with the ADC clock and are available when 14 bit resolution is used. In 16 bit mode, additional memory bits are needed and therefor no Marker are available.

External Timebase

The External Timebase can be used for capturing the measurement data at a specific moment. The external timebase is not a reference clock but will be synchronized to the internal ADC sampling clock. Therefor the external timebase must be at least two time slower than the ADC clock.

The data acquisition card detects any rising edge on the external timebase input and capture the incoming ADC data.
# Specification TPCE 40 - 240 MHz

<table>
<thead>
<tr>
<th>Module Type</th>
<th>TPCE-24016-4</th>
<th>TPCE-12016-4</th>
<th>TPCE-8016-4</th>
<th>TPCE-4016-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Input Channels SE Module</td>
<td>4 single ended or 2 differential software switchable</td>
<td>4 single ended or 2 differential software switchable</td>
<td>4 single ended or 2 differential software switchable</td>
<td>4 single ended or 2 differential software switchable</td>
</tr>
<tr>
<td>Number of Input Channels DIF Module</td>
<td>4 single ended or 4 differential software switchable</td>
<td>4 single ended or 4 differential software switchable</td>
<td>4 single ended or 4 differential software switchable</td>
<td>4 single ended or 4 differential software switchable</td>
</tr>
<tr>
<td>Max. Sample Rate (all channels are sampled simultaneously)</td>
<td>240 MHz</td>
<td>120 MHz</td>
<td>80 MHz</td>
<td>40 MHz</td>
</tr>
<tr>
<td>Amplitude Resolution</td>
<td>16 Bit up to 60 MHz</td>
<td>14 Bit up to 240 MHz</td>
<td>16 Bit up to 60 MHz</td>
<td>14 Bit up to 120 MHz</td>
</tr>
<tr>
<td>Memory (per Module)</td>
<td>Standard: 4 x 32 MWords (= 256 MByte)</td>
<td>Optional: 4 x 128 MWords (= 1 GByte)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Input Amplifier**

- **Measurement Ranges**: ±50 mV – ±50 V resp. 0.1 V – 100 V (100 V limited to 70 V) in 1, 2, 5 Steps
- **Offset**: 0 – 100 % in steps of 0.1 % (Resolution 0.01 %)
- **Input Impedance**: 1 MΩ (± 0.2 %) or 50 Ω (± 0.5 %)

**Coupling**: AC / DC software switchable (AC: -3 dB at < 5 Hz), Inputs invertible

**Bandwidth at Range ≥ 1 V**
- 120 MHz
- 60 MHz
- 30 MHz
- 18 MHz

**Bandwidth at Range < 1 V**
- 80 MHz
- 50 MHz
- 8 MHz
- 7 MHz

**Slew Rate (10 – 90 %)**
- 4 ns
- 6 ns
- 13 ns
- 25 ns
- 6 ns
- 9 ns
- 50 ns
- 60 ns

**Settling Time to 1 %**
- < 200 ns
- < 200 ns
- < 200 ns
- < 200 ns

**Low Pass Filter (RC-Filter)**
- 2 Steps (1 MHz and 100 kHz) software switchable

**Antialiasing-Filter (optional)**
- 200 Hz – 5 MHz, min. 4. order Butterworth, software setable

**Common Mode Range**
- Differential-Mode: ±8 V or ±80 V at ranges > 5 V

**Range Error (±)**
- max. 0.1 % typ. 0.07 % (after autocalibration)

**Offset Error (±)**
- max. 0.1 % typ. 0.07 % (after autocalibration)

**Offset Drift (±)**
- max. 0.001 % + 0.1 mV per °C, typ. (0.0005 % + 0.03 mV) per °C

**Input Noise**: @ max. Sample Rate
- < 0.250 mVrms
- < 0.120 mVrms
- < 0.070 mVrms
- < 0.040 mVrms
- < 0.025 mVrms

**Signal to Noise Ratio SNR**: @ max. Sample Rate
- 58 dB
- 70 dB
- 72 dB
- 77 dB
- 81 dB
- 84 dB

**Channel Isolation (Crosstalk)**
- > 74 dB
- > 80 dB

**Special**: Autoadjustment of gain and offset in all measurement ranges. (initiated by software)

**Trigger**

- **Number of Trigger Channels**: 4 coupled to analog inputs, pos./neg. Edge, with or without hysteresis, Window IN, Window OUT
- **Advanced Trigger (Option)**: On all analog inputs: Slew Rate, Pulse Width, Pulse Pause or Period (too short or too long = Missing Event), State (above / below), AND link, Product (trigger signal is calculated from 2 channels)

**Miscellaneous**

- **Digital Inputs (Marker)**: 8 (2 per analog channel) (TTL)
- **Optocoupler Connection Box (5 to 48 V) as additional option**
- **Ext. Control Inputs (TTL)**: Trigger, Arm/Disarm, Ext. Sampling (fmax = 10 MHz), external command to start recording
- **Status Outputs (TTL)**: Trigger Output, Armed (=True during recording)
- **ICP® Sensor Supply (Option)**: 4mA Integrated Current Power for piezo sensors

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*1) At 16 bit modules, the resolution will be reduced to 14 bits at sample rates over 1/4 of the max. sample rate.
*2) The input noise depends on the sample rate.
*3) At 14 bit modules the SNR will be reduced by 2 dB
*4) At 8-channel modules the SNR will be reduced by 3 dB
## Specification TPCE 2 - 20 MHz

<table>
<thead>
<tr>
<th>Module Type</th>
<th>TPCE-2016-4/8</th>
<th>TPCE-1016-4/8</th>
<th>TPCE-0516-4/8</th>
<th>TPCE-0216-4/8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Input Channels SE Module</td>
<td>4-Channel Modules: 4 single ended or 2 differential</td>
<td>8-Channel Modules: 8 single ended or 4 differential</td>
<td>4-Channel Modules: 4 single ended or 4 differential</td>
<td>8-Channel Modules: 8 single ended or 8 differential</td>
</tr>
<tr>
<td>Number of Input Channels DIF Module</td>
<td>4-Channel Modules: 4 single ended or 4 differential</td>
<td>8-Channel Modules: 8 single ended or 8 differential</td>
<td>4-Channel Modules: 4 single ended or 4 differential</td>
<td>8-Channel Modules: 8 single ended or 8 differential</td>
</tr>
<tr>
<td>Max. Sample Rate (all channels are sampled simultaneously)</td>
<td>20 MHz</td>
<td>10 MHz</td>
<td>5 MHz</td>
<td>2 MHz</td>
</tr>
<tr>
<td>Amplitude Resolution</td>
<td>16 Bit up to 5 MHz</td>
<td>16 Bit up to 5 MHz</td>
<td>16 Bit up to 5 MHz</td>
<td>16 Bit up to 5 MHz</td>
</tr>
<tr>
<td>Memory 4 Channel Module</td>
<td>Standard: 4 x 32 MWords (= 256 MByte)</td>
<td>Optional: 4 x 128 MWords (= 1 GByte)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory 8 Channel Module</td>
<td>Standard: 8 x 16 MWords (= 256 MByte)</td>
<td>Optional: 8 x 64 MWords (= 1 GByte)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Input Amplifier

- **Measurement Ranges**: ±50 mV – ±50 V resp. 0.1 V – 100 V (100 V limited to 70 V) in 1, 2, 5 Steps
- **Offset**: 0 – 100 % in steps of 0.1% (Resolution 0.01 %)
- **Input Impedance**: 1 MΩ (± 0.2 %) // 35 pF (± 5 %)
- **Coupling**: AC / DC software switchable (AC: -3 dB at < 5 Hz), Inputs invertible
- **Bandwidth at Range ≥ 1 V**: 10 MHz 5 MHz 2.5 MHz 1 MHz
- **Bandwidth at Range < 1 V**: 6 MHz 4 MHz 2.5 MHz 1 MHz
- **Slew Rate (10 – 90 %) @ Range ≥ 1 V**: 40 ns 70 ns 80 ns 180 ns
- **Slew Rate (10 – 90 %) @ Range < 1 V**: 70 ns 80 ns 80 ns 180 ns
- **Settling Time to 1 %**: < 200 ns < 200 ns < 300 ns < 500 ns
- **Low Pass Filter (RC-Filter)**: 2 Steps (1 MHz and 100 kHz) software switchable
- **Antialiasing-Filter (optional)**: 200 Hz – 5 MHz, min. 4. order Butterworth, software setable
- **Common Mode Range**: Differential-Mode: ±8 V or +/-80 V at ranges > 5 V
- **Common Mode Rejection**: > 74 dB (DC – 1 kHz); > 60 dB ( – 100 kHz); > 40 dB ( – 20 MHz)
- **Range Error (±)**: max. 0.1 % typ. 0.03 % (after autocalibration)
- **Offset Error (±)**: max. 0.1 % typ. 0.03 % (after autocalibration)
- **Offset Drift (±)**: max. (0.0100 % + 0.1 mV) per °C, typ. (0.0050 % + 0.03 mV) per °C (will be compensated by autocalibration)

### Input Noise:

<table>
<thead>
<tr>
<th>Sample Rate</th>
<th>SNR @ max.</th>
<th>SNR @ 10 MHz</th>
<th>SNR @ 5 MHz</th>
<th>SNR @ 1 MHz</th>
<th>SNR @ 100 kHz</th>
<th>SNR @ 10 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 MHz</td>
<td>67 dB</td>
<td>70 dB</td>
<td>72 dB</td>
<td>72 dB</td>
<td>84 dB</td>
<td>90 dB</td>
</tr>
<tr>
<td>5 MHz</td>
<td>70 dB</td>
<td>70 dB</td>
<td>72 dB</td>
<td>72 dB</td>
<td>84 dB</td>
<td>90 dB</td>
</tr>
<tr>
<td>1 MHz</td>
<td>72 dB</td>
<td>72 dB</td>
<td>72 dB</td>
<td>72 dB</td>
<td>84 dB</td>
<td>90 dB</td>
</tr>
<tr>
<td>2.5 MHz</td>
<td>79 dB</td>
<td>79 dB</td>
<td>79 dB</td>
<td>79 dB</td>
<td>84 dB</td>
<td>84 dB</td>
</tr>
<tr>
<td>1 MHz</td>
<td>84 dB</td>
<td>84 dB</td>
<td>84 dB</td>
<td>84 dB</td>
<td>90 dB</td>
<td>90 dB</td>
</tr>
</tbody>
</table>

### Signal to Noise Ratio SNR:

<table>
<thead>
<tr>
<th>Sample Rate</th>
<th>SNR @ max.</th>
<th>SNR @ 10 MHz</th>
<th>SNR @ 5 MHz</th>
<th>SNR @ 1 MHz</th>
<th>SNR @ 100 kHz</th>
<th>SNR @ 10 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 MHz</td>
<td>67 dB</td>
<td>70 dB</td>
<td>72 dB</td>
<td>72 dB</td>
<td>84 dB</td>
<td>90 dB</td>
</tr>
<tr>
<td>5 MHz</td>
<td>70 dB</td>
<td>70 dB</td>
<td>72 dB</td>
<td>72 dB</td>
<td>84 dB</td>
<td>90 dB</td>
</tr>
<tr>
<td>1 MHz</td>
<td>72 dB</td>
<td>72 dB</td>
<td>72 dB</td>
<td>72 dB</td>
<td>84 dB</td>
<td>90 dB</td>
</tr>
<tr>
<td>2.5 MHz</td>
<td>79 dB</td>
<td>79 dB</td>
<td>79 dB</td>
<td>79 dB</td>
<td>84 dB</td>
<td>84 dB</td>
</tr>
<tr>
<td>1 MHz</td>
<td>84 dB</td>
<td>84 dB</td>
<td>84 dB</td>
<td>84 dB</td>
<td>90 dB</td>
<td>90 dB</td>
</tr>
</tbody>
</table>

### Channel Isolation (Crosstalk) @ 10 kHz

<table>
<thead>
<tr>
<th>Ranges &lt; 1 V</th>
<th>≥ 80 dB</th>
<th>&gt; 60 dB</th>
</tr>
</thead>
</table>

**Special**: Autocalibration

- Auto adjustment of gain and offset in all measurement ranges. (Initiated by software)

### Trigger

- **Number of Trigger Channels**: 4 or 8, coupled to analog inputs, pos./neg.Edge, with or without hysteresis, Window IN, Window OUT
- **Advanced Trigger (Option)**: On all analog inputs: Slew Rate, Pulse Width, Pulse Pause or Period (too short or too long = Missing Event), State (above / below), AND link, Product (trigger signal is calculated from 2 channels)
- **External Trigger input**: 1 per System (TTL), pos. or neg. Edge
- **Trigger Delay**: -100 % (Pretrigger) to +200 % (Posttrigger) in 1 % steps

### Miscellaneous

- **Digital Inputs (Marker)**: 8 rsp. 16 (2 per analog channel) (TTL)
- **Optocoupler Connection Box**: 5 to 48 V as additional option
- **Ext. Control Inputs (TTL)**: Trigger, Arm/Disarm, Ext. Sampling (fmax = 1/4 of the max sample rate), external command to start recording
- **Status Outputs (TTL)**: Trigger Output, Armed (=True during recording)
- **ICP® Sensor Supply (Option)**: 4mA Integrated Current Power for piezo sensors

*1) At 16 bit modules, the resolution will be reduced to 14 bits at sample rates over 1/4 of the max.

*2) The input noise depends on the sample rate.

*3) At 14 bit modules the SNR will be reduced by 2 dB

*4) At 8-channel modules the SNR will be reduced by 3 dB
Software API

All DAQ cards as also the TraNET devices are based on the same Server-Client Software architecture. Any client application can access the data acquisition device over an IP address either locally or over a network. This way distributed measurement set-ups can be easily built-up.

The lowest level accessible from a user application is a C++ interface. This interface handles all network communication between the Application and the Application Server.

![Control/DAQ Software diagram](image)

Control/DAQ Software runs on machine where the DAQ cards are installed.

![Control/DAQ Software diagram](image)

Control/DAQ Software runs on a different machine and controls multiple DAQ instruments.

C# Applications can access a high level API for easy software integration. Several application can access the same device on the same time and get updated about any status change of the device automatically.

Elsys provides a LabVIEW instrument driver which is fully compliant with the NI driver design guidelines.

The application server encapsulates all necessary task for controlling the different measurement modes described above, including data streaming to the hard drive. Therefor no challenging programming is needed for streaming application as this is already integrated into the Server software.
Software

TranAX 4
TranAX 4 is the universal data acquisition software from Elsys designed for TPCX/TPCE/TPCE-I data acquisition cards and the turnkey TraNET data acquisition instruments.

Key Features:

- Configures quick and easy many analog input channels, no programming required
- Data visualization in Multi-Waveform displays
- Several cursor for easy data readout and reporting
- X-Y data display
- FFT Analysis width different scaling and windows function
- Measurement data - video synchronization
- More than 40 scalar functions to measure any significant waveform parameter on time or FFT curves
- Powerful formula editor for more than 60 mathematics functions, syntax highlighting, for-loops, array calculations, string manipulations, etc.
- Curve fitting (Polynomial regression)
- Autosequence-macro’s for easy to set up, fast automated measurements
- English and German version