The board APCe-1711 is a fast multifunction and multi-channel counter board for the PCI Express bus. The strengths of this board are its wide range of applications and high precision and reliability in harsh industrial environment.

With this board you can realise many different applications on the same hardware base. The board is supplied with a pool of functions which provides the user with maximum efficiency yet minimum space and parts requirement. The functions are individually configured for each channel through the supplied software. The flexible programming facilities on this board allow many different user applications to be quickly and easily developed and reconfigured as further requirements arise. Thanks to the FPGA board structure, further counting applications can be realised through software adaptation. Contact us!

**Features**

- 32-bit data access
- RS422 driver with 5 MHz max. (10 MHz for the APCe-1711-10MHz – without ESD protection)
- With RS422/TTL input/output signals (APCe-1711) or 24 V input signals (APCe-1711-24V)
- Four onboard programmable function modules

**Functions**

- Incremental counter for the acquisition of incremental encoders (90° phase-shifted signals)
- BiSS-Master (B and C mode)
- SSI Synchronous Serial Interface. The SSI function is an interface for systems which allow an absolute position information via serial data transfer.
- Counter/timer (82C54)
- Pulse acquisition
- Frequency measurement
- Pulse width modulation (PWM)
- Period duration measurement
- Velocity measurement
- Digital inputs and outputs
- Edge time measurement (ETM)
- Parallel interface
- Sin/Cos (1 Vpp, 11 µApp)
- EnDat 2.2
- Customised functions

**Available channels on one function module**

- 4 channels, programmable either as digital inputs or outputs, optically isolated, RS422
- 3 channels, digital inputs, optically isolated, 24 V
- 1 digital power output, optically isolated, 24 V

**APCe-1711**

**Available functions:**

Incremental counter, SSI Synchronous Serial Interface, counter/timer, pulse acquisition, frequency, pulse width, period duration, velocity measurement, PWM, BiSS-Master, digital inputs and outputs, Sin/Cos, EnDat 2.2 ...

**Function selection through software**

**Optical isolation**

**Inputs and outputs:** RS422, TTL, 24 V

**Customised functions**

**Additional channels**

- 28 TTL I/O, without optical isolation

**Versions**

<table>
<thead>
<tr>
<th></th>
<th>RS422/ TTL-I/O</th>
<th>24 V inputs</th>
<th>5 V inputs</th>
<th>24 V outputs</th>
<th>TTL I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>APCe-1711</td>
<td>16</td>
<td>12</td>
<td>–</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>APCe-1711-24V</td>
<td>–</td>
<td>28</td>
<td>–</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>APCe-1711-5V-I</td>
<td>16</td>
<td>12</td>
<td>28</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>APCe-1711-10MHz</td>
<td>16</td>
<td>12</td>
<td>–</td>
<td>4</td>
<td>28</td>
</tr>
</tbody>
</table>

**Safety features**

- Creeping distance IEC 61010-1
- Optical isolation 1000 V
- Noise neutralisation of the PC supply

**Applications**

- Event counting
- Position acquisition
- Motion control
- Batch counting
- ...

**Software drivers**

A CD-ROM with the following software and programming samples is supplied with the board.

**Standard drivers for:**

- Linux
- 32-bit drivers for Windows 8 / 7 / Vista / XP / 2000
- Signed 64-bit drivers for Windows 8 / 7 / XP
- Real-time use with Linux and Windows on request

**Drivers and samples for the following compilers and software packages:**

- Microsoft VC++ • Borland C++ 5.01

**On request:**

Further operating systems, compilers and samples.

Driver download: www.addi-data.com/downloads
Wide range of applications through the free combination of functions

4 function modules quickly and easily programmable with numerous functions
Each of the four modules is programmed with one function. You can program 4 times the same function or freely combine 4 different functions.

Programmable onboard modules
Each module can be programmed with the function of your choice. You can operate simultaneously up to 4 different functions on one board. If your application must be modified, you can load a new function quickly and easily.

Overview of signal generators resp. functions

<table>
<thead>
<tr>
<th>Application</th>
<th>Max. number of signal generators or functions for each function module</th>
<th>Max. number of function modules for each APCie-1711</th>
<th>Max. number of signal generators or functions for each APCie-1711</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental counter</td>
<td>1 (32-bit) or 2 (16-bit)</td>
<td>4</td>
<td>4 or 8</td>
<td>180</td>
</tr>
<tr>
<td>SSI</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>180</td>
</tr>
<tr>
<td>Chronos</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>181</td>
</tr>
<tr>
<td>BiSS-Master</td>
<td>6</td>
<td>4</td>
<td>24</td>
<td>142</td>
</tr>
<tr>
<td>Counter/Timer</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>182</td>
</tr>
<tr>
<td>TOR</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>183</td>
</tr>
<tr>
<td>Pulse acquisition</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>184</td>
</tr>
<tr>
<td>PWM</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>184</td>
</tr>
<tr>
<td>ETM</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>185</td>
</tr>
<tr>
<td>Digital I/O</td>
<td>8</td>
<td>4</td>
<td>32</td>
<td>185</td>
</tr>
<tr>
<td>TTL</td>
<td>24</td>
<td>1</td>
<td>24</td>
<td>–</td>
</tr>
<tr>
<td>Parallel Interface</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>142</td>
</tr>
<tr>
<td>Sin/Cos*</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>144</td>
</tr>
<tr>
<td>EnDat 2.2</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>143</td>
</tr>
</tbody>
</table>

*Extension module (EM) is required

Customer-tailored modifications, designed to suit your needs. Hardware and software, firmware, PLDs, ... Contact us!
Function Parallel Interface

With the **Parallel Interface** function, the digital inputs of the APCIe-1711 are acquired in parallel. Up to 28 digital inputs, 24 V, can be acquired with the APCIe-1711-24 V. Up to 16 RS422 and 12 digital 24 V inputs can be acquired with the APCIe-1711.

There are different methods for the acquisition of the inputs:
- Timer controlled (max. resolution 1 µs = 1 MHz)
- Digital input (by masking the digital inputs, rising or falling edge)
- Software

This function can be loaded up to 4 times for each APCIe-1711, i.e. it is possible to acquire 8-bit (7 inputs), 16-bit (14 inputs), 24-bit (21 inputs) or 32-bit (28 inputs) in parallel. If an external trigger signal is used (maskable, rising or falling edge), there is no need to use one of the inputs for triggering.

The data is transferred directly via DMA into the RAM of the PC. If the **Parallel Interface** function is loaded on all function modules up to 28 digital inputs (RS422 / 24 V) are available.

### Used signals

<table>
<thead>
<tr>
<th>Pin name</th>
<th>Signal type</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ax +/-</td>
<td>24 V / RS422</td>
<td>Digital input</td>
</tr>
<tr>
<td>Bx +/-</td>
<td>24 V / RS422</td>
<td>Digital input</td>
</tr>
<tr>
<td>Cx +/-</td>
<td>24 V / RS422</td>
<td>Digital input</td>
</tr>
<tr>
<td>Dx +/-</td>
<td>24 V / RS422</td>
<td>Digital input</td>
</tr>
<tr>
<td>Ex</td>
<td>24 V</td>
<td>Digital input</td>
</tr>
<tr>
<td>Fx</td>
<td>24 V</td>
<td>Digital input</td>
</tr>
<tr>
<td>Gx</td>
<td>24 V</td>
<td>Digital input</td>
</tr>
</tbody>
</table>

The 24 V switching level can be adjusted optionally down to 1 V

x: Number of the function module (See pin assignment page 141)

* 24 V for the APCIe-1711-24 V

### Block diagram Parallel Interface

---

Function BiSS-Master

The **BiSS-Master** function is a bidirectional sensor interface for the communication with up to 6 sensors. BiSS B and C are supported.

### Features of the BiSS-Master function:

- 1 function module with a maximum amount of 6 sensors (3 per channel) for cascading the sensors it is necessary that each sensor has a data input and data output
- Read sensor data
- Read/Write register data

Get more information about the function range of the BiSS interface at www.biss-interface.com.

### Used signals

<table>
<thead>
<tr>
<th>Signal name</th>
<th>Pin name</th>
<th>Signal type</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output_Ch0_x</td>
<td>Ax +/-</td>
<td>RS422</td>
<td>Dig. output 0 (clock line from master to slave) MA0</td>
</tr>
<tr>
<td>Input_Ch0_x</td>
<td>Bx +/-</td>
<td>RS422</td>
<td>Dig. input 0 (data line from slave to master) SL0</td>
</tr>
<tr>
<td>Output_Ch1_x</td>
<td>Cx +/-</td>
<td>RS422</td>
<td>Dig. output 1 (clock line from master to slave) MA1</td>
</tr>
<tr>
<td>Input_Ch1_x</td>
<td>Dx +/-</td>
<td>RS422</td>
<td>Dig. input 1 (data line from slave to master) SL1</td>
</tr>
</tbody>
</table>

x: Number of the function module (See pin assignment page 141)

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### Block diagram BiSS-Master

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EnDat 2.2 is a bidirectional synchronous-serial interface for position measurement devices. This interface allows the reading out of absolute position values and parameters, the writing of status and initialisation registers and the transfer of additional information about the position value. Furthermore, the EnDat 2.2 function modules support the analysis of diagnostic values and access to the OEM memory. Data transfer is effected serially.

On one board you can use up to 8 EnDat 2.2 sensors (2 sensors per function module). Each function module has its own clock pulse line (B or D) and data line (A or C).

The function EnDat 2.2 is only available for the APCie-1711! (not for the APCie-1711-24V and APCie-1711-5V-I)

### Used signals

<table>
<thead>
<tr>
<th>Channel</th>
<th>Signal name</th>
<th>I/O</th>
<th>Pin name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>CLK_0+</td>
<td>O</td>
<td>Bx +</td>
<td>Clock pulse line</td>
</tr>
<tr>
<td>0</td>
<td>CLK_0-</td>
<td>O</td>
<td>Bx -</td>
<td>Clock pulse line</td>
</tr>
<tr>
<td>0</td>
<td>DATA_0+</td>
<td>I/O</td>
<td>Ax +</td>
<td>Data line</td>
</tr>
<tr>
<td>0</td>
<td>DATA_0-</td>
<td>O</td>
<td>Ax -</td>
<td>Data line</td>
</tr>
<tr>
<td>1</td>
<td>CLK_1+</td>
<td>O</td>
<td>Dx +</td>
<td>Clock pulse line</td>
</tr>
<tr>
<td>1</td>
<td>CLK_1-</td>
<td>O</td>
<td>Dx -</td>
<td>Clock pulse line</td>
</tr>
<tr>
<td>1</td>
<td>DATA_1+</td>
<td>I/O</td>
<td>Cx +</td>
<td>Data line</td>
</tr>
<tr>
<td>1</td>
<td>DATA_1-</td>
<td>O</td>
<td>Cx -</td>
<td>Data line</td>
</tr>
<tr>
<td>Dig. I/O</td>
<td>DigIn0_x</td>
<td>I (24 V)</td>
<td>Ex</td>
<td>Digital channel for unrestricted use</td>
</tr>
<tr>
<td>Dig. I/O</td>
<td>DigIn1_x</td>
<td>I (24 V)</td>
<td>Fx</td>
<td>Digital channel for unrestricted use</td>
</tr>
<tr>
<td>Dig. I/O</td>
<td>DigIn2_x</td>
<td>I (24 V)</td>
<td>Gx</td>
<td>Digital channel for unrestricted use</td>
</tr>
<tr>
<td>Dig. I/O</td>
<td>DigOut_x</td>
<td>O (24 V)</td>
<td>Hx</td>
<td>Digital channel for unrestricted use</td>
</tr>
</tbody>
</table>

x: Number of the module (See pin assignment page 141)

### Application example

**Exact positioning of axes for the regulation of surface measurement devices for rotationally symmetric parts (e.g. gear wheels)**

**Challenge**

For the measurement of the surfaces of rotationally symmetric parts numerous axes must be positioned. Furthermore the signals must be fastly transferred in order to detect the position as exactly as possible. To safe time, absolute encoders are used because they do not need any reference runs when started.

**Solution**

The measurement device consists of a measurement table with a gate. The rotationally symmetric parts are fixed on the measurement table and their surface is tested with a sensor connected to the gate. To move the sensor around the parts the gate has several axes equipped with EnDat 2.2 absolute encoders. The precision of the axis position is assured by the PCI Express counter board APCie-1711: Thanks to its high input speed of 10 MHz (optional APCie-1711-10MHZ version) and its resistance to interferences, the board is able to move the axes precisely even at high speed.
With the function **Sin/Cos**, up to 4 Sin/Cos sensors can be used on one board (function module 0 or 1 as well as 2 or 3). The extension module EM-SIN COS-1 is meant for the connection of signals with 1 Vpp. The EM-SIN COS-1 is able to acquire 11 µVpp signals. A signal period of the Sin/Cos signal is divided in a predefined number of steps, depending on the chosen resolution. The maximum input frequency of the counter input also depends on the chosen resolution.

**Please note:** The function **Sin/Cos** can only be used with the extension module EM-SIN COS.

### Used signals

**Signal name** | **Signal type** | **Function**
--- | --- | ---
EM_Sin+ | 1 V/11 µVpp | Trace A (Sinus) of Sin/Cos sensor 0
EM_Cos+ | 1 V/11 µVpp | Trace B (Cosinus) of Sin/Cos sensor 0
EM_Index0+ | differential | Trace C (Index) of Sin/Cos sensor 0
EM_Index1+ | differential | Trace C (Index) of Sin/Cos sensor 1
EM_Sin+ | 1 V/11 µVpp | Trace A (Sinus) of Sin/Cos sensor 1
EM_Cos+ | 1 V/11 µVpp | Trace B (Cosinus) of Sin/Cos sensor 1
EM_Index0+ | differential | Trace C (Index) of Sin/Cos sensor 1
EM_Index1+ | differential | Trace C (Index) of Sin/Cos sensor 1
EM_DIG_IN | 24 V / optional 5 V | Digital trigger input (can be used for latch resp. interrupt logic)

**Digit0...** | 24 V / optional 5 V | Digital input for unrestricted use
**Digit1...** | 24 V / optional 5 V | Digital input for unrestricted use
**Digit2...** | 24 V / optional 5 V | Digital input for unrestricted use
**DigitOut...** | 24 V | Digital output for unrestricted use

x: Number of the extension module (0 resp. 1); y: Number of the function module (0 to 3)

### Pin assignment — 50-pin D-Sub male connector

**FM = Function module**

### Pin assignment — 78-pin D-Sub male connector

**EM = Extension Module**

### Pin assignment — 78-pin D-Sub female connector

**FM = Function module**
### Specifications

**Free programming of the functions**
- Acquisition of incremental encoders (1 x 32-bit or 2 x 16-bit)
-SSI (max. 3 encoders per module)
- Counter/Timer (3 counters similar to 82C54)
- Pulse counter (4 x 32-bit counters per module)
- Chronos (chronometer)
- TOR (pulse counter with time slices, ...)
- Digital I/O (8 I/O, 24 V, TTL, RS422)
- PWM (pulse width modulation, 2 x per module)
- BG-S-Master (B and C mode)
- ETM (Timer interface for period duration measurement, edge time, ...)
- TTL (TTL I/O without isolation)
- Parallel Interface
- EnDat 2.2
- Sin/Cos
- Customised functions

### Signals

Digital I/O signals, TTL or RS422, 24 V

### Inputs

<table>
<thead>
<tr>
<th>Differential or outputs (A, B, C, D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential, RS422: 16 (can be used as inputs or outputs)</td>
</tr>
<tr>
<td>Nominal voltage: 4.3 VDC</td>
</tr>
<tr>
<td>Common mode range: ±12 V / ±7 V</td>
</tr>
<tr>
<td>Input sensitivity: 200 mV</td>
</tr>
<tr>
<td>Input hysteresis: 50 mV</td>
</tr>
<tr>
<td>Input impedance: 12 kΩ</td>
</tr>
<tr>
<td>Terminal resistor: 120 Ω (not supplied)</td>
</tr>
<tr>
<td>Max. input frequency: APCIe-1711: 5 MHz (at nominal voltage) APCIe-1711-10MHz: 10 MHz (at nominal voltage)</td>
</tr>
</tbody>
</table>

### Mass-related inputs, 24 V (E, F, G):

| Number of inputs: 12 |
| Nominal voltage: 24 VDC |
| Logic input levels: Unominal: 24 V UH max.: 30 V UH min.: 19 V UL max.: 14 V UL min.: 0 V |
| Maximal input frequency: 1 MHz (at nominal voltage) depending on the function |

### Outputs

| Nominal output frequency: 5 MHz (diff. outputs) |
| Max. number of outputs: 16 (if they are not used as diff. inputs) |

### Technical data APCIe-1711-24V version

- 24 V inputs (channels A to G).
- This board version is intended for the connection of 24 V encoders.
- Only 24 V signals can be connected to the inputs.

| Nominal voltage: 24 VDC |
| Max. input frequency: 1 MHz (at nominal voltage) depending on the function |
| Logic input levels: (Standard) UH max.: 30 V UH min.: 18 V UL max.: 16 V UL min.: 0 V |

### Functions

<table>
<thead>
<tr>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>On the board APCIe-1711-24V A, B, Lx and Dx are only available as 24 V inputs and not as outputs. Therefore not any function can be used on any version of the board.</td>
</tr>
<tr>
<td>Available functions:</td>
</tr>
<tr>
<td>- Incremental counter</td>
</tr>
<tr>
<td>- Sin/Cos</td>
</tr>
<tr>
<td>Partially available:</td>
</tr>
<tr>
<td>- PWM</td>
</tr>
</tbody>
</table>

Please find more detailed information in the respective function manual.

### Safety

- Optical isolation: 1000 V

### EMC – Electromagnetic compatibility

The product complies with the European EMC directive. The tests were carried out by a certified EMC laboratory in accordance with the norm from the EN 61326 series (IEC 61326). The limit values as set out by the European EMC directive for an industrial environment are complied with. The respective EMC test report is available on request.

### PC system requirements and environmental conditions

- Dimensions: 168 x 98 mm
- System bus: Acc. to PCI Express base specification, Revision 1.0a (PCI Express 1.0a)
- Space required: 1-/4-/8-/16-lane PCI Express slot
- Operating voltage: +3.3 V / +12 V from the PC +24 V ext.
- Current consumption APCIe-1711: 3.3 V / 341 mA 12 V / 76 mA typ.
- Front connector: 78-pin D-Sub female connector
- Additional connector: 50-pin D-Sub male connector
- Temperature range: 0 to 60 °C (with forced cooling)

### PX8001:

- 3-row screw terminal panel with housing for DIN rail

### ST1711-50:

- Standard round cable, shielded, twisted pairs, 2 m, 78-pin male connector to 50-pin male connector

### Option

Opt. 5V: 3.3 V outputs instead of 24 V (H0, H1, H2, H3)

### Accessories

- PX8001: 3-row screw terminal panel with housing for DIN rail
- ST1711-50: Standard round cable, shielded, twisted pairs, 2 m, 78-pin male connector to 50-pin male connector
- For the TTL I/O function
- ST370-16: Standard round cable, shielded, twisted pairs, 2 m
- FB8001: Ribbon cable

### For the Sin/Cos function

EM-SINCOS-11µAPP:
- Extension module, 2 x 11 µA inputs, 1 dig. output, 24 V

EM-SINCOS-1VPP:
- Extension module, 2 x 1 Vpp inputs, 1 dig. output, 24 V

ST1711-50-37:
- Y-cable, round, shielded, twisted pairs, 78-pin D-Sub male connector to 50-pin D-Sub male connector and 37-pin D-Sub male connector

PX901-ZG:
- Screw terminal panel for DIN rail

* Preliminary product information