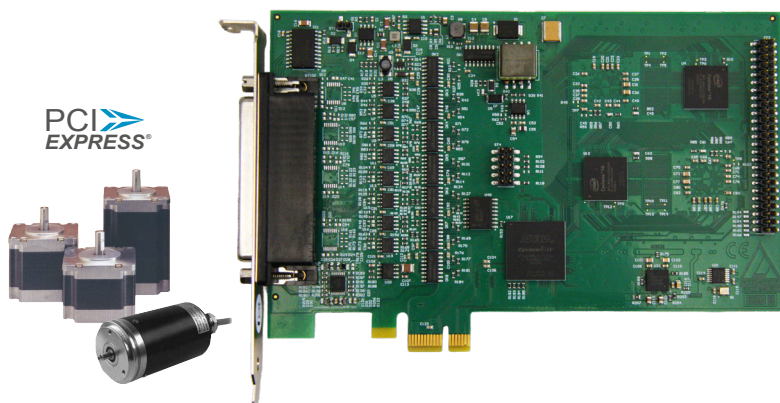


Multifunction counter board, optically isolated, fast counter inputs – programmable functions, for PCI Express



Also for **PCI**
see APCle-1710

Also for **CompactPCI™**
see CPCI-1710

Also for **CompactPCI™ Serial**
see CPCI-1711



The board APCle-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 20 MHz max.
- With RS422/TTL input/output signals (APCle-1711) or 24 V input signals (APCle-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 V_{pp}, 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

APCle-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

- 26 TTL I/O, without optical isolation

Versions

	RS422/ TTL- I/O	24 V inputs	5 V inputs	24 V outputs	TTL I/O
APCle-1711	16	12	–	4	26
APCle-1711-24V	–	28	–	4	26
APCle-1711-5V-I	16	–	12	4	26

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

Standard drivers for:

- Linux
- Signed 64-bit drivers for Windows
- Real-time use with Linux and Windows on request

Drivers and samples for the following compilers and software packages:

- Microsoft VC++

On request:

Further operating systems, compilers and samples.

Driver download: www.addi-data.com/drivers

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

Configuration example 2			
Function module 0	Function module 1	Function module 2	Function module 3
SSI	SSI	Incremental counter	digital I/O

Overview of signal generators resp. functions

*Extension module (EM) is required



The diagram illustrates the internal architecture of a PCI Express module. On the left, a 78-pin female connector is connected to a BU1 block and a DC/DC converter. The DC/DC converter provides power to the PCI Express controller. The PCI Express controller is connected to a Master block, which manages communication with four function modules (0, 1, 2, and 3). An Opto-coupler is used for signal isolation between the Master block and the function modules. The function modules are connected to an ST3 block. The entire system is connected to a PCI Express bus at the bottom.

Pin	Pin		Pin	Pin
78	EMO [12]	59	EMO [9]	20
77	EMO [11]	58	EMO [8]	19
76	EMO [10]	57	EMO [7]	18
75	EM1 [12]	56	EMO [6]	17
74	EM1 [11]	55	EM1 [9]	EM1 [2]
73	EM1 [10]	54	EM1 [8]	EM1 [1]
72	+24V / U _{ref}	53	EM1 [7]	EM1 [0]
71	H3	52	U _{ref}	GND
70	D3-	51	G3	E3
69	D3+	50	C3-	F3- 32
68	H2	49	C3+	F3- 31
67	D2-	48	G2-	B3+
66	D2+	47	C2-	F2- 29
65	H1	46	C2+	B2- 28
64	D1-	45	G1	B2+ 27
63	D1+	44	C1-	F1- 26
62	H0	43	C1+	B1- 25
61	D0-	42	G0	F0+ 24
60	D0+	41	C0-	B0- 22
		40	C0+	B0+ 21
				GND

PX8001

Digital I/O

ST1711-50

50-pin D-Sub male connector

78-pin D-Sub male connector

APCLe-1711

Pin1

red cable line

FB8001

PX8001

TTL I/O

ST370-16

50-pin D-Sub male connector

50-pin D-Sub female connector

Function Parallel Interface

On request

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

There are different methods for the acquisition of the inputs:

- Timer controlled (max. resolution 1 μ s = 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 APCle-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

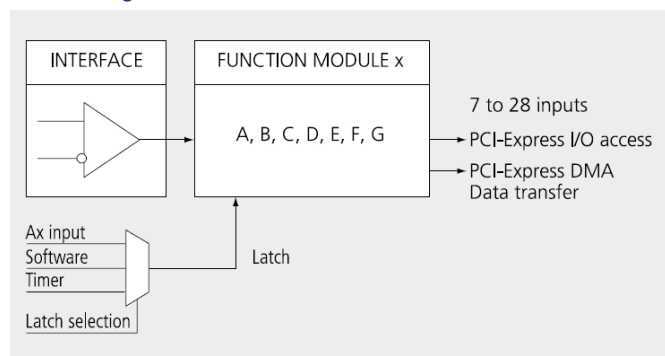
Pin name	Signal type	Function
Ax +/-	24 V*/ RS422	Digital input
Bx +/-	24 V*/ RS422	Digital input
Cx +/-	24 V*/ RS422	Digital input
Dx +/-	24 V*/ RS422	Digital input
Ex	24 V	Digital input
Fx	24 V	Digital input
Gx	24 V	Digital input

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

x: Number of the function module (See pin assignment page 119)

* 24 V for the APCle-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

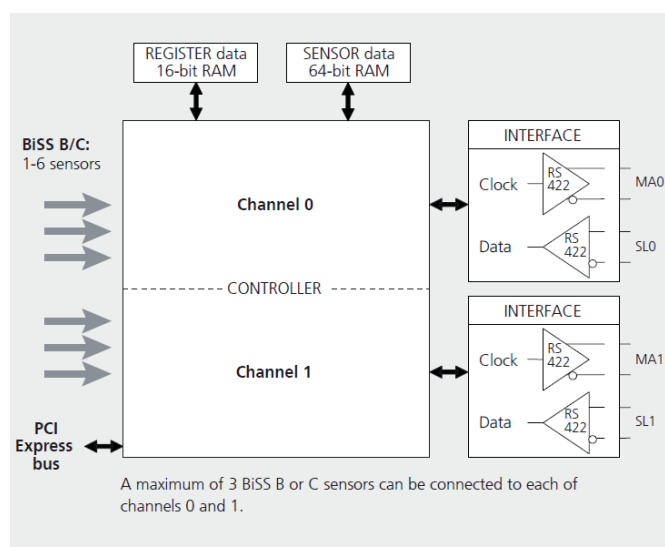
www.biss-interface.com.

Used signals

Signal name	Pin name	Signal type	Function
Output_Ch0_x+/-	Ax +/-	Differential	Channel 0: digital output (clock line from master to slave)
Input_Ch0_x+/-	Bx +/-	Differential	Channel 0: digital input (data line from slave to master)
Output_Ch1_x+/-	Cx +/-	Differential	Channel 1: digital output (clock line from master to slave)
Input_Ch1_x+/-	Dx +/-	Differential	Channel 1: digital input (data line from slave to master)

x: Number of the function module (0-3)

Block diagram BiSS-Master



Function EnDat 2.2

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).

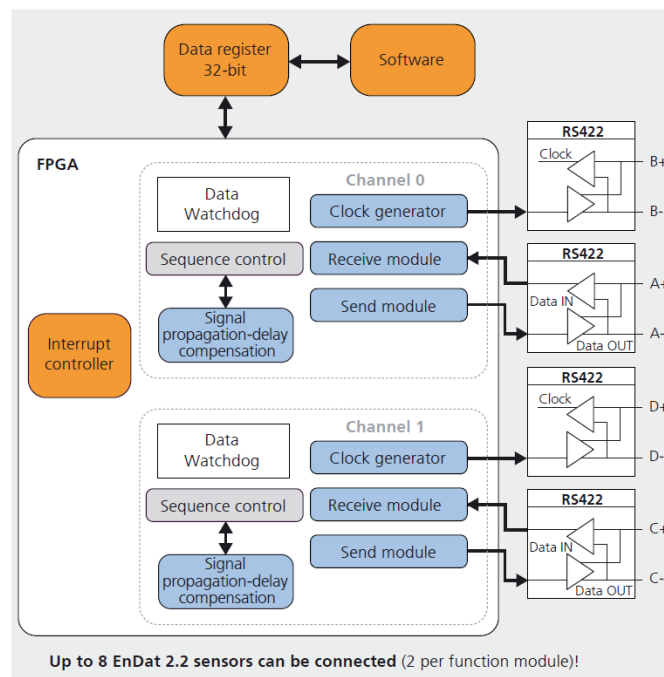
The function EnDat 2.2 is only available for the APCle-1711!
(not for the APCle-1711-24V and APCle-1711-5V-I)

Used signals

Channel	Signal name	I/O	Pin name	Function
0	DATA_0+_x	I/O	Ax +	Data line
0	DATA_0-_x	I/O	Ax -	Data line
0	CLK_0+_x	O	Bx +	Clock line
0	CLK_0-_x	O	Bx -	Clock line
1	DATA_1+_x	I/O	Cx +	Data line
1	DATA_1-_x	I/O	Cx -	Data line
1	CLK_1+_x	O	Dx +	Clock line
1	CLK_1-_x	O	Dx -	Clock line
Dig. I/O	DigIn0_x	I (24 V)	Ex	Digital inputs for free use
Dig. I/O	DigIn1_x	I (24 V)	Fx	Digital inputs for free use
Dig. I/O	DigIn2_x	I (24 V)	Gx	Digital inputs for free use
Dig. I/O	DigOut_x	O (24 V)	Hx	Digital output for free use

x: Number of the function module (0-3)

Block diagram EnDat 2.2



Application example

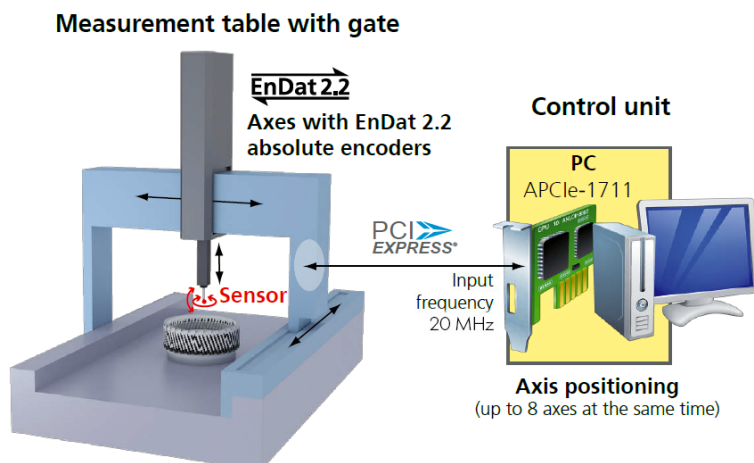
Exact positioning of axes for the regulation of surface measurement devices for rotationally symmetric parts (e.g. gear wheels)

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 save 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 APCle-1711. Thanks to its high input speed of 20 MHz and its resistance to interferences, the board is able to move the axes precisely even at high speed.



Function Sin/Cos

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-SINCOS-1V_{pp} is meant for the connection of signals with 1 V_{pp}, the EM-SINCOS-11μA_{pp} is able to acquire 11 μA_{pp} 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-SINCOS.

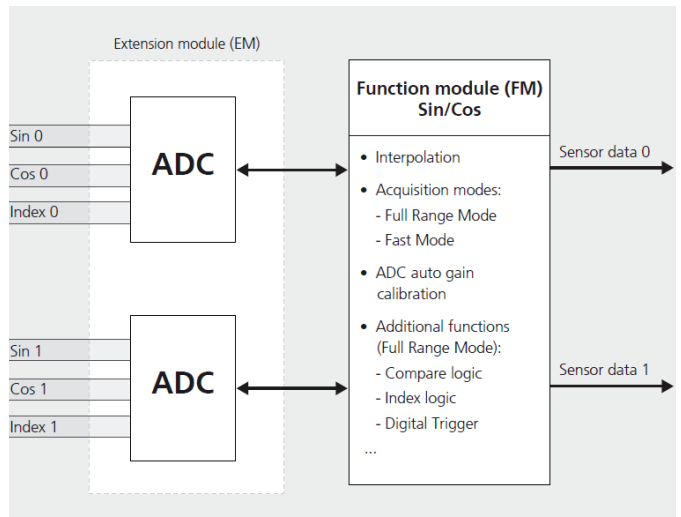
Used signals

Signal name	Pin name	Signal type	Function
EMy_Sin0+	EMy [0]	1 V _{pp} /11 μA _{pp} diff.	Trace A+ (Sine) of Sin/Cos encoder 0
EMy_Sin0-	EMy [4]	1 V _{pp} /11 μA _{pp} diff.	Trace A- (Sine) of Sin/Cos encoder 0
EMy_Cos0+	EMy [1]	1 V _{pp} /11 μA _{pp} diff.	Trace B+ (Cosine) of Sin/Cos encoder 0
EMy_Cos0-	EMy [5]	1 V _{pp} /11 μA _{pp} diff.	Trace B- (Cosine) of Sin/Cos encoder 0
EMy_Index0+	EMy [2]	differential	Trace C+ (Index) of Sin/Cos encoder 0
EMy_Index0-	EMy [6]	differential	Trace C- (Index) of Sin/Cos encoder 0
EMy_Sin1+	EMy [7]	1 V _{pp} /11 μA _{pp} diff.	Trace A+ (Sine) of Sin/Cos encoder 1
EMy_Sin1-	EMy [10]	1 V _{pp} /11 μA _{pp} diff.	Trace A- (Sine) of Sin/Cos encoder 1
EMy_Cos1+	EMy [8]	1 V _{pp} /11 μA _{pp} diff.	Trace B+ (Cosine) of Sin/Cos encoder 1
EMy_Cos1-	EMy [11]	1 V _{pp} /11 μA _{pp} diff.	Trace B- (Cosine) of Sin/Cos encoder 1
EMy_Index1+	EMy [9]	differential	Trace C+ (Index) of Sin/Cos encoder 1
EMy_Index1-	EMy [12]	differential	Trace C- (Index) of Sin/Cos encoder 1
EMy_DIG_IN	EMy [3]	24 V / optional 5 V	Digital trigger input (can be used for latch or interrupt logic)
DIG_IN_0_x	Ex	24 V / optional 5 V	Digital input for free use
DIG_IN_1_x	Fx	24 V / optional 5 V	Digital input for free use
DIG_IN_2_x	Gx	24 V / optional 5 V	Digital input for free use
DIG_OUT_Hx	Hx	24 V	Digital output for free use

y: Number of the extension module (0 or 1)

x: Number of the function module (0-3)

Block diagram Sin/Cos

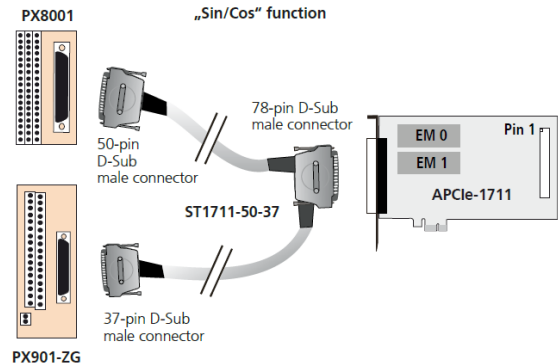


Pin assignment – 50-pin D-Sub Sin/Cos connector

Pin		Pin		Pin
34	+24 V / U _{Ref}	18		34
35	FM0: DIG_OUT_H0	19		35
36	FM1: DIG_OUT_H1	20		36
37	FM2: DIG_OUT_H2	21		37
38	FM3: DIG_OUT_H3	22		38
39	FM0: DIG_IN_0_0	23		39
40	FM1: DIG_IN_0_1	24		40
41	FM2: DIG_IN_0_2	25		41
42	FM3: DIG_IN_0_3	26		42
43	FM0: DIG_IN_1_0	27		43
44	FM1: DIG_IN_1_1	28		44
45	FM2: DIG_IN_1_2	29		45
46	FM3: DIG_IN_1_3	30		46
47	FM0: DIG_IN_2_0	31		47
48	FM1: DIG_IN_2_1	32		48
49	FM2: DIG_IN_2_2	33		49
50	FM3: DIG_IN_2_3			50

FM = Function module

ADDI-DATA connection



Pin assignment – 37-pin D-Sub male connector

EM0_Sin0+	20	1	EM0_Sin0-
EM0_Cos0+	21	2	EM0_Cos0-
EM0_Index0+	22	3	EM0_Index0-
EM0_Sin1+	23	4	EM0_Sin1-
EM0_Cos1+	24	5	EM0_Cos1-
EM0_Index1+	25	6	EM0_Index1-
	26	7	
	27	8	
GND	28	9	EM0_DIG_IN
GND	29	10	EM1_DIG_IN
EM1_Sin0+	30	11	EM1_Sin0-
EM1_Cos0+	31	12	EM1_Cos0-
EM1_Index0+	32	13	EM1_Index0-
EM1_Sin1+	33	14	EM1_Sin1-
EM1_Cos1+	34	15	EM1_Cos1-
EM1_Index1+	35	16	EM1_Index1-
	36	17	
	37	18	
		19	U _{Ref}

EM = Extension 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)
- BiSS-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

Differential inputs or outputs (A, B, C, D)

Differential inputs, RS422:	16 (can be used as inputs or outputs)
Nominal voltage:	3.3 VDC
Common mode range:	+12 / -7 V
Input sensitivity:	200 mV
Input hysteresis:	50 mV
Input impedance:	12 kΩ
Terminal resistor:	120 Ω (not supplied)
Max. input frequency:	20 MHz (at nominal voltage)
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 voltage:	3.3 VDC
Maximum output frequency:	20 MHz (diff. outputs)
Max. number of outputs:	16 (if they are not used as diff. inputs)
Digital outputs, 24 V (H)	
Output type:	High-side (load to ground)
Number of outputs:	4
Nominal voltage:	24 VDC
Supply voltage range:	4.75 V to 35 VDC (via 24 V ext. pin)
Maximum current:	90 mA per output / 270 mA for all outputs (PTC)
Overtemperature:	165 °C (all outputs switch off)

Technical data APCle-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)	Unominal: 24 V UH max.: 30 V UH min.: 18 V UL max.: 16 V UL min.: 0 V

Functions

On the board APCle-1711-24V Ax, Bx, Cx 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.

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 APCle-1711:	3.3 V / 341 mA 12 V / 76 mA typ.
Front connector:	78-pin D-Sub female connector
Additional connector:	50-pin pin header (ST3) for the TTL I/O function
Temperature range:	0 to 60 °C (with forced cooling)

Ordering information

APCle-1711

Multifunction counter board, optically isolated, fast counter inputs – programmable functionality, for PCI Express.
Incl. technical description and software drivers.

APCle-1711:	Isolated counter board with programmable functionality
APCle-1711-24V:	24 V instead of RS422 (A, B, C, D)
APCle-1711-5V-I:	5 V inputs instead of 24 V (E, F, G)

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 _{pp} inputs, 1 dig. output, 24 V
EM-SINCOS-1VPP:	Extension module, 2 x 1 V _{pp} 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