ADDI-DATA®
PARTNER FÜR PRÄZISION

Function Description

PWM

APCIe-1711, CPCIs-1711, APCI-1710 and CPCI-1710
Multifunction counter board, optically isolated

DIN EN ISO 9001:2015 certified

Edition: 02.09-04/2022

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Warning!

The following risks result from the improper implementation of the board and from use contrary to the regulations:

Personal injury

Damage to the board, the PC and peripherals

Pollution of the environment.

- Protect yourself, others and the environment!
- Read the safety precautions (yellow leaflet) carefully!

  If this leaflet is not enclosed with the documentation, please contact us and ask for it.
- Observe the instructions of this manual!

  Make sure that you do not forget or skip any step!
  We are not liable for damages resulting from the wrong use of the board.
- Pay attention to the following symbols:

NOTICE!
Designates hints and other useful information.

NOTICE!
Designates a possibly dangerous situation.
If the instructions are ignored, the board, the PC and/or peripherals may be **destroyed**.

WARNING!
Designates a possibly dangerous situation.
If the instructions are ignored, the board, the PC and/or peripherals may be **destroyed** and persons may be **endangered**.

Contents

Figures

Tables

Chapter overview

In this manual, you will find the following information:

Chapter	Content
1	Function description including block diagram and pin assignment
2	Standard software: Information on the API software functions
3	Appendix with index
4	Contact and support address

This document solely describes the function “PWM”.

For general information on the **APCIe-/CPCIs-1711** or **APCI-/CPCI-1710**, please read the respective Technical Description of these boards (see PDF links). It contains, for example, the chapter “Inserting and installing the board” that supports you in commissioning.

1 Function description

The function “PWM” is an interface for pulse width modulation. It generates a frequency with an adjustable timing of the low and high level.

This function provides the following:

- 32-bit frequency generator to set low and high levels
- 2 inputs for start or stop gate
- 2 outputs for frequency output.

Properties:

- Optical isolation of the inputs and outputs through opto-couplers to prevent ground loops
- Interrupt status at the end of a period
- Signals of up to 3.33 MHz can be output
- Start level selection
- Stop level selection
- Hardware gate
- Software gate

1.1 Board versions with “PWM” function

NOTICE!
With the 24 V version of the **APCIe-1711, CPCIs-1711** or **APCI-1710**, the “PWM” function can be used only to a limited extent.

Table 1-1: Board versions with “PWM” function

Board version	“PWM” function
APCIe-1711	x
APCIe-1711-24V	x*
APCIe-1711-5V-I	x
CPCIs-1711	x
CPCIs-1711-24V	x*
CPCIs-1711-5V-I	x
APCI-1710	x
APCI-1710-24V	x*
APCI-1710-5V-I	x

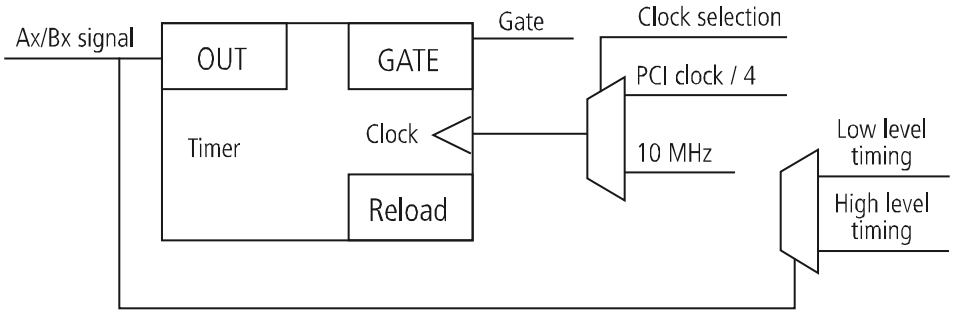
Board version	PWM function
APCI-1710-5V-I-O	x
CPCI-1710	x

* Only the 24 V digital output PWM0 (signal: DIG_OUT_H_x) is available. The maximum output frequency is load-dependent and limited by the 24 V output to 100 kHz **(APCIe-1711, CPCIs-1711)** or 5 kHz **(APCI-1710)**.

The I/O specifications of the different board versions are available in the Technical Description of the **APCIe-/CPCIs-1711** or **APCI-/CPCI-1710** (see PDF links).

1.2 Block diagrams

Fig. 1-1: Block diagram: PWM function



1.3 Frequencies and level times

1.3.1 Clock frequency

The following clock frequencies are available:

Table 1-2: Clock frequencies

	Clock frequency		
Board	**30 MHz**	**33 MHz**	**40 MHz**
APCIe-1711	-	-	x
CPCIs-1711	-	-	x
APCI-1710	x	x	x
CPCI-1710	x	x	x

1.3.2 Minimal level time and maximum frequency

NOTICE!
Due to the hardware, the level time limits must not be under-run (see table below).

Table 1-3: Level time limits

Board	Output	Low level timing	High level timing	Max. output frequency
APCIe-/CPCIs-1711	Ax, Bx	150 ns	150 ns	3.33 MHz
	Hx	5 µs	5 µs	100 kHz
APCI-/CPCI-1710	Ax, Bx	250 ns	250 ns	2 MHz
	Hx	5 µs	5 µs	100 kHz

1.3.3 Level time calculation

Due to the clock and the structure of the PWM function, level times can be set only in certain steps. The requested level time is passed via software function when initialising PWM. The next shorter level time is automatically used and returned as a parameter for control.
The following actual level times for the low or high level are possible, but it has to be noted that the level times indicated in the table above must not be under-run:

Table 1-4: Level times

Level time (ns) with clock frequency		
30 MHz	**33 MHz**	**40 MHz**
200	181.8	150
333.3	303	250
466.7	424.2	350
600	545.5	450
733.3	666.7	550
866.7	787.9	650
100	909.1	750
⋮	⋮	⋮

Possible level times can be calculated as follows:

Level time = ((4 * x) + 6) * (1 / clock frequency)
x = 0 to 2^{32}-1

1.4 Used signals

With each function module, the PWM function uses three outputs (A, B and H) and five inputs (C to G).

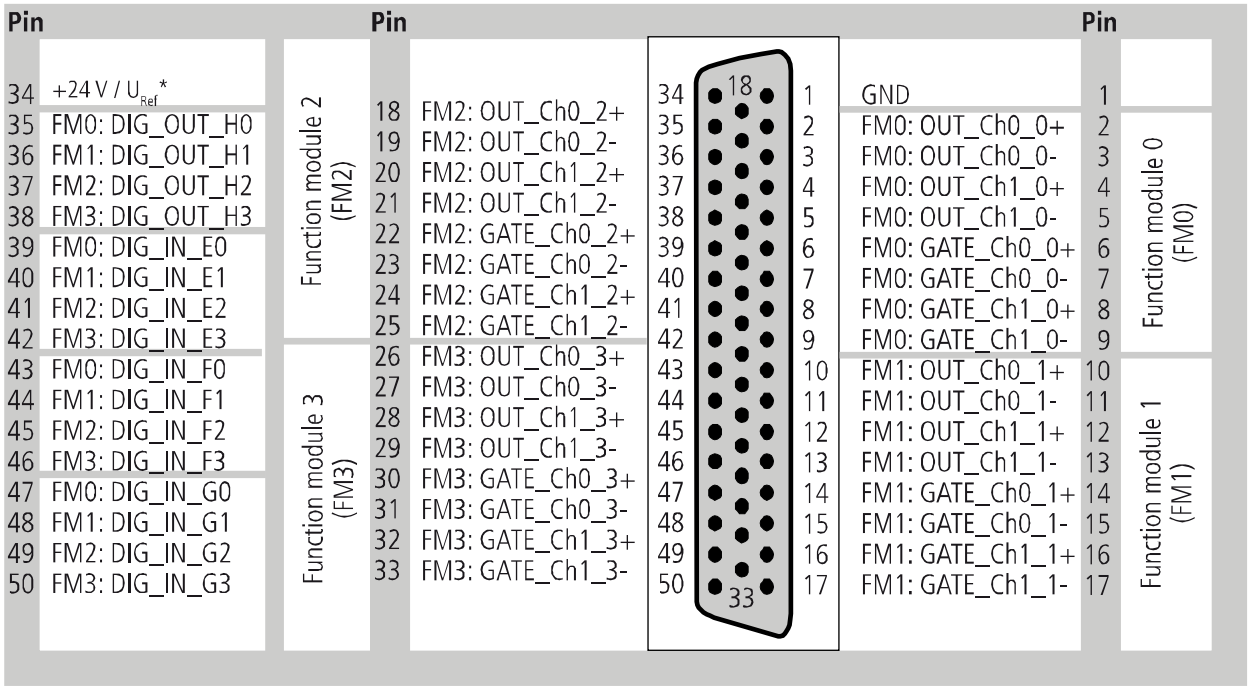
Table 1-5: Used signals

Signal name	Pin name	Signal type	Function
PWM_OUT_Ch0_x+/-	Ax+/-	RS422/TTL output	PWM 0 output
PWM_OUT_Ch1_x+/-	Bx+/-	RS422/TTL output	PWM 1 output
GATE_Ch0_x+/-	Cx+/-	RS422/TTL input	PWM 0 gate input
GATE_Ch1_x+/-	Dx+/-	RS422/TTL input	PWM 1 gate input
DIG_IN_Ex	Ex	24 V input/optional 5V	Digital input
DIG_IN_Fx	Fx	24 V input/optional 5V	Digital input
DIG_IN_Gx	Gx	24 V input/optional 5V	Digital input
DIG_OUT_Hx	Hx	24 V output/optional 5V	Digital PWM 0 output or freely controllable

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

1.5 Pin assignment: Function modules

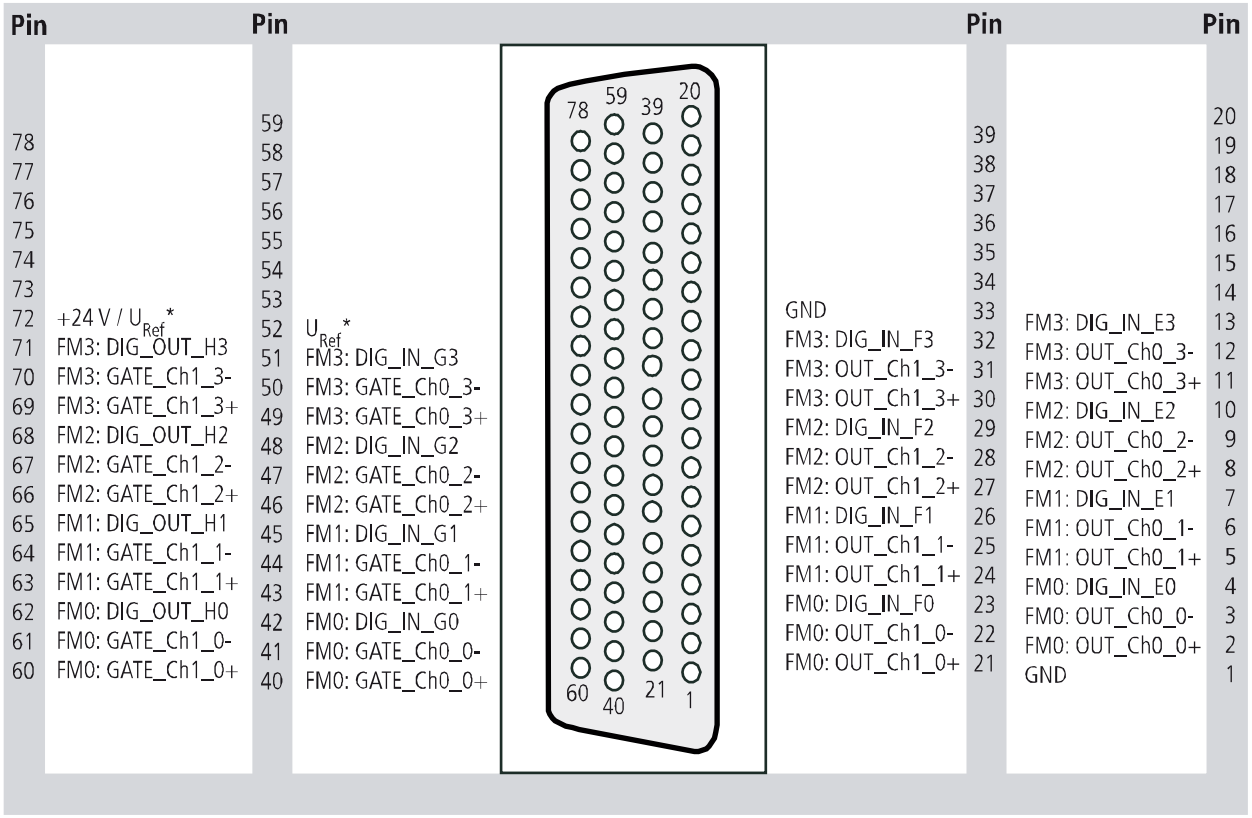
Fig. 1-2: Pin assignment: 50-pin D-Sub male connector (4 PWM modules)



* Pin 34: see Technical Description of the board

This pin assignment also applies to the **APCIe-1711** or **CPCIs-1711** if the cable **ST1711-50** is connected to the 78-pin D-Sub female connector of the board. For further information on this, please refer to the Technical Description of the **APCIe-1711** and **CPCIs-1711** (see PDF link).

Fig. 1-3: Pin assignment: 78-pin D-Sub female connector (APCIe-1711 and CPCIs-1711)



FM = Function module
* Pins 52 and 72: see Technical Description of the board

1.6 Connecting the signal generators

1.6.1 Connection to the screw terminal panel

On the screw terminal panel **PX8001**, the pins of the 50 pin D-Sub female connector and the terminals connected to them are numbered in the same way. Thus, the terminal assignment of the screw terminal panel is identical with the pin assignment of the 50-pin D-Sub male connector of the **APCI-/CPCI-1710** or with that of the 50-pin D-Sub male connector on the **ST1711-50** cable **(APCIe-/CPCIs-1711)**.

The following table is to serve as a help for you when connecting the signal generators to the screw terminal panel. The blank fields in the “Signal generator” column can be filled in on the basis of the selected signal generator type.

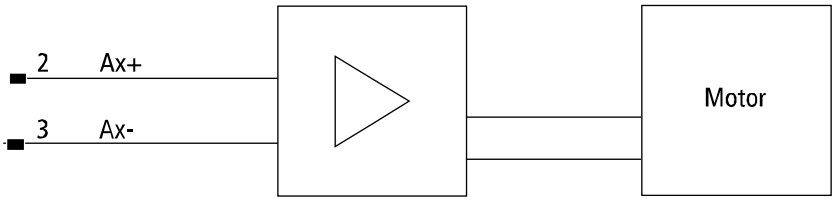
Table 1-6: Connection of the signal generators to the screw terminal panel

Signal generator			Screw terminal panel PX8001 (50-pin)							
Pin No.	Pin name	Lead colour (cable)	Signal name	Terminal name	Signal type	Terminal No.				Terminal function
						FM0	FM1	FM2	FM3	
	+24 V / U_{Ref}		+24 V / U_{Ref}	+24 V / U_{Ref}	-	34	34	34	34	see Technical Description of the board
	GND		GND	GND	-	1	1	1	1	Ground
			PWM_OUT_Ch0_x+	Ax+	RS422/TTL	2	10	18	26	PWM 0 output
			PWM_OUT_Ch0_x-	Ax-	RS422/TTL	3	11	19	27	
			PWM_OUT_Ch1_x+	Bx+	RS422/TTL	4	12	20	28	PWM 1 output
			PWM_OUT_Ch1_x-	Bx-	RS422/TTL	5	13	21	29	
			GATE_Ch0_x+	Cx+	RS422/TTL	6	14	22	30	PWM 0 gate input
			GATE_Ch0_x-	Cx-	RS422/TTL	7	15	23	31	
			GATE_Ch1_x+	Dx+	RS422/TTL	8	16	24	32	PWM 1 gate input
			GATE_Ch1_x-	Dx-	RS422/TTL	9	17	25	33	
			DIG_IN_Ex	Ex	24 V / opt. 5 V	39	40	41	42	Digital input
			DIG_IN_Fx	Fx	24 V / opt. 5 V	43	44	45	46	Digital input
			DIG_IN_Gx	Gx	24 V / opt. 5 V	47	48	49	50	Digital input
			DIG_OUT_Hx	Hx	24 V / opt. 5 V	35	36	37	38	Digital PWM 0 output or freely controllable
			-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-

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

1.7 Connection example

Fig. 1-4: Connection example



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

1.8 Procedure for using the PWM function

In order to use the PWM function, the following steps need to be performed:

1. Select a function module.
2. Select a channel.
3. Select a clock signal.
4. Define the Start/Stop level.
5. Define the Low time.
6. Define the High time.
7. “i_PCIe1711_InitPWM” or “i_PCI1710_InitPWM”
8. Select the start condition (external gate or software start)
9. Start the PWM output.

The PWM function is now ready for use.

2 Standard software

The API software functions supported by the board are listed in an HTML document. A description of how to access the respective file can be found in the document “Quick installation PC boards” (see PDF link), in the chapter “Standard software”.

3 Appendix

3.1 Index

4 Contact and support

Do you have any questions? Write or call us:

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Manual and software download from the Internet:

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