

1. PCIe-5101 Series Specifications

Multi-functional Data Acquisition Boards



Please download JYTEK [<JYPEDIA>](#), you can quickly inquire the product prices, the key features and available accessories

Overview

The JYTEK PCIe-5101 series is a high-performance multifunction data acquisition board designed for PCIe bus systems. It features up to 32 single-ended (or 16 differential) 16-bit analog input channels with a maximum aggregate sample rate of 1 MS/s, 2 analog output channels at 16-bit resolution with up to 400 kS/s update rate, 24 digital I/O lines, 2 counter/timer channels, and 24 programmable function interface (PFI) lines. Available in two variants — PCIe-5101-P7 (32 SE / 16 Diff AI) and PCIe-5101-K7 (16 SE / 8 Diff AI) — the PCIe-5101 provides a complete multifunction solution for test, measurement, and industrial automation applications.

1.1 Main Features

- **AI Features:**
 - High accuracy: 500 ppm
 - High Density: Supports up to 32 SE / 16 Diff channels (PCIe-5101-P7)
 - 16 bits ADC
 - Sampling rate: 1 MS/s aggregate
 - Selectable input ranges: ± 2.5 V, ± 5 V, ± 10 V
 - Anti-aliasing filter: 15 kHz / 39 kHz / 375 kHz (Software selectable)
- Analog/Digital/Software Trigger
- Onboard memory 192MB for analog inputs
- **AO Features:**
 - 2 simultaneous 16-bit analog output channels
 - Update rate: 400 kS/s (Per channel)
 - Output ranges: ± 5 V, ± 10 V
 - Onboard memory 32MB for analog outputs
- **CIO Features:**
 - 2 channels 32-bit timer/counter
- **DIO Features:**
 - 24 lines of Digital IO

1.2 Analog Input

Parameter	PCle-5101-P7	PCle-5101-K7
Number of channels	32 SE / 16 Diff	16 SE / 8 Diff
ADC resolution (Bits)	16	16
Single channel maximum sample rate	1 MS/s	1 MS/s
Multichannel maximum sample rate (aggregate)	1 MS/s/n (n=1,2,3...32)	1 MS/s/n (n=1,2,3...16)
Input range (V)	± 10 / ± 5 / ± 2.5	± 10 / ± 5 / ± 2.5
Anti-aliasing filter	15 kHz / 39 kHz / 375 kHz (Software selectable)	15 kHz / 39 kHz / 375 kHz (Software selectable)
Input mode	RSE / Differential	RSE / Differential
Input impedance	>1 M Ω 330 pF	>1 M Ω 330 pF
Input coupling	DC	DC
CMRR	85 dB	85 dB
Crosstalk	-85 dB	-85 dB
DNL	No Missing Code	No Missing Code
INL	70 ppm of Range Typical	70 ppm of Range Typical
Trigger sources	Any PFI, AI <0..31>, SSI	Any PFI, AI <0..15>, SSI
Trigger modes	Start trigger, Reference trigger, Re-trigger	Start trigger, Reference trigger, Re-trigger
Analog trigger voltage range	± 10 V Software Programmable	± 10 V Software Programmable
Overvoltage Protection	± 15 V	± 15 V
Onboard memory	192 MB for analog inputs	192 MB for analog inputs
Data transfers	Polling, scatter-gather DMA	Polling, scatter-gather DMA

Table 1 Analog Input Specifications

1.3 Analog Output

Parameter	PCle-5101 Series
Number of channels	2 (SE)
DAC resolution	16 bits
Maximum update rate (Per channel)	400 kS/s
Clock	100 MHz
Clock accuracy	Jitter < 20 ps
Output range (V)	±10 / ±5
Output mode	RSE
Output impedance	1.6 Ω
Output coupling	DC
Output current drive	±15 mA
Onboard memory	32 MB for analog outputs
Trigger source	Any PFI, SSI
Trigger mode	Start Trigger

Table 2 Analog Output Specifications

1.4 Counter Input / Output

Parameter	PCle-5101 Series
Number of channels	2 channels (sharing the IO pin with PFI)
Resolution	32 bits
Counter Input	Edge Counting, Period Measure, SemiPeriod Measure, Frequency Measure, Pulse Measure, Two Edge Separation Measure, Quadrature Encoder, Two Pulse Encoder
Counter Output	Single, finite and continuous pulse
Onboard memory	8 MB for Counter Input
Clock	100 MHz / 5 MHz / 100 kHz
Input	Gate, Source, Aux
Output	OUT

Table 3 Counter Input/Output Specifications

1.5 PFI Specifications

Parameter	PCle-5101 Series
Number of channels	24 (shared with DIO)
External digital trigger interface	Trigger voltage: 3.3 V TTL
External digital trigger interface	Trigger edge: Rising/Falling
Initial state	Input
Functionality	Static digital input, static digital output
Timing output sources	AI, AO, counter timing signals
Debounce filter settings	Enable, disable; selectable per input

Table 4 PFI Specifications

1.6 Digital IO Specifications

Parameter	PCle-5101 Series
Number of channels	24 Lines
Ground reference	D GND
Initial state	Input
Digital Input	Logic Low: VIL Min: 0 / Max: 0.8 V
Digital Input	Logic High: VIH Min: 2 V / Max: 5.3 V
Digital Output	Logic Low: 0 V, IOL Max: 12 mA
Digital Output	Logic High: 2.6 V ~ 3.3 V, IOH: -12 mA ~ 0 mA
Overvoltage Protection	-3 ~ 20 V

Table 5 Digital IO Specifications

1.7 Basic DC AI Accuracy

PCle-5101 Series AI Basic Accuracy = $\pm(\% \text{ Reading} + \% \text{ Range})$

JY-5101 AI Basic Accuracy = $\pm(\% \text{ Reading} + \% \text{ Range})$												
Nominal Range (V)	24 Hour Tcal $\pm 1^\circ\text{C}$			90 Days Tcal $\pm 5^\circ\text{C}$			Temperature Coefficients ($^\circ\text{C}$)			24 Hr Full Scale Accuracy	90 Days Full Scale Accuracy	Full Scale Accuracy (%)
2.5	0.011	+	0.031	0.034	+	0.033	0.0025	+	0.0005	1.05 mV	1.68 mV	0.067
5	0.011	+	0.020	0.033	+	0.021	0.0024	+	0.0004	1.55 mV	2.70 mV	0.054
10	0.011	+	0.015	0.033	+	0.017	0.0026	+	0.0005	2.60 mV	5.00 mV	0.050

Accuracy valid to 97.5% of full range.

Table 6 Basic DC AI Accuracy

1.8 AI-GroupDelay

Analog filter group delay(us)			
Range(V) \ Filter	Wide	Medium	Narrow
10V	0.9	5.2	13.2
5V	0.9	6.2	13.2
2.5V	0.94	6.2	13.3

Table 7 AI-Group Delay

1.9 AI Bandwidth

Nominal Range Full Scale (V)	Filter	-3 dB Bandwidth (kHz)
All range	Narrow	15
10 V	Medium	39
5 V / 2.5 V	Medium	33
All range	Wide	375

Table 8 AI Bandwidth Specifications

1.10 System Noise

Nominal Range (V)	Filter	System Noise (μ Vrms)
10	Wide	415
5	Wide	298
2.5	Wide	228
10	Medium	192
5	Medium	109
2.5	Medium	72
10	Narrow	167
5	Narrow	91
2.5	Narrow	56

Table 9 System Noise Specifications

*Filter mode: wide/medium/narrow - refer to AI Bandwidth table

1.11 Basic AO Accuracy

PCIe-5101 Series AO Basic Accuracy = ±(% Reading + % Range)

JY-5101 AO Basic Accuracy = ±(% Reading+% Range)												
Nominal Range (V)	24 Hour Tcal ±1°C			90 Days Tcal±5°C			Temperature Coefficients(/°C)			24 Hr Full Scale Accuracy	90 Days Full Scale Accuracy	Full Scale Accuracy(%)
5	0.0022	+	0.0051	0.0054	+	0.0051	0.0000	+	0.0000	0.37 mV	0.53 mV	0.011
10	0.0017	+	0.0044	0.0041	+	0.0044	0.0000	+	0.0000	0.61 mV	0.85 mV	0.009

Accuracy valid to 97.5% of full range.

Table 10 Basic AO Accuracy

1.12 Physical and Environment

Operating Environment	
Ambient temperature range	0 °C to 50 °C
Relative humidity range	20% to 80%, noncondensing
Storage Environment	
Ambient temperature range	-20 °C to 80 °C
Relative humidity range	10% to 90%, noncondensing

Table 11 Physical and Environment

1.13 Power Consumption (typical)

Voltage	Current	Power
12 V	0.5A	6W

Table 12 PCIe-5101 Power Consumption

1.14 Front Panel and Pin Definition



Figure 1 PCIe-5101 Series Front Panel

Connector0		Connector1	
Pin	Identification	Pin	Identification
1	Ctr0_Source/A	3	Ctr1_Source/A
35	Ctr0_Gate/Z	37	Ctr1_Gate/Z
2	Ctr0_Aux/B	4	Ctr1_Aux/B
36	Ctr0_Out	38	Ctr1_Out

Table 13 PCIe-5101-P7 Counter Pin Connector

PIN	Define	PIN	Define
1	PFI 0 / DIO 0	35	PFI 1 / DIO 1
2	PFI 2 / DIO 2	36	PFI 3 / DIO 3
3	PFI 4 / DIO 4	37	PFI 5 / DIO 5
4	PFI 6 / DIO 6	38	PFI 7 / DIO 7
5	PFI 8 / DIO 8	39	PFI 9 / DIO 9
6	PFI 10 / DIO 10	40	PFI 11 / DIO 11
7	PFI 12 / DIO 12	41	PFI 13 / DIO 13
8	PFI 14 / DIO 14	42	PFI 15 / DIO 15
9	DGND	43	DGND
10	PFI 16 / DIO 16	44	PFI 17 / DIO 17
11	PFI 18 / DIO 18	45	PFI 19 / DIO 19
12	PFI 20 / DIO 20	46	PFI 21 / DIO 21
13	PFI 22 / DIO 22	47	PFI 23 / DIO 23
14	DGND	48	DGND
15	AO GND	49	AO 0
16	AO GND	50	AO 1
17	AI GND	51	AI GND
18	AI 0 (AI 0+)	52	AI 8 (AI 0-)
19	AI 1 (AI 1+)	53	AI 9 (AI 1-)
20	AI 2 (AI 2+)	54	AI 10 (AI 2-)
21	AI 3 (AI 3+)	55	AI 11 (AI 3-)
22	AI 4 (AI 4+)	56	AI 12 (AI 4-)
23	AI 5 (AI 5+)	57	AI 13 (AI 5-)
24	AI 6 (AI 6+)	58	AI 14 (AI 6-)
25	AI 7 (AI 7+)	59	AI 15 (AI 7-)
26	AI GND	60	AI GND
27	AI 16 (AI 8+)	61	AI 24 (AI 8-)
28	AI 17 (AI 9+)	62	AI 25 (AI 9-)
29	AI 18 (AI 10+)	63	AI 26 (AI 10-)
30	AI 19 (AI 11+)	64	AI 27 (AI 11-)
31	AI 20 (AI 12+)	65	AI 28 (AI 12-)
32	AI 21 (AI 13+)	66	AI 29 (AI 13-)
33	AI 22 (AI 14+)	67	AI 30 (AI 14-)
34	AI 23 (AI 15+)	68	AI 31 (AI 15-)

Table 14 PCIe-5101-P7 Pin Connector

PIN	Define	PIN	Define
1	PFI 0 / DIO 0	35	PFI 1 / DIO 1
2	PFI 2 / DIO 2	36	PFI 3 / DIO 3
3	PFI 4 / DIO 4	37	PFI 5 / DIO 5
4	PFI 6 / DIO 6	38	PFI 7 / DIO 7
5	PFI 8 / DIO 8	39	PFI 9 / DIO 9
6	PFI 10 / DIO 10	40	PFI 11 / DIO 11
7	PFI 12 / DIO 12	41	PFI 13 / DIO 13
8	PFI 14 / DIO 14	42	PFI 15 / DIO 15
9	DGND	43	DGND
10	PFI 16 / DIO 16	44	PFI 17 / DIO 17
11	PFI 18 / DIO 18	45	PFI 19 / DIO 19
12	PFI 20 / DIO 20	46	PFI 21 / DIO 21
13	PFI 22 / DIO 22	47	PFI 23 / DIO 23
14	DGND	48	DGND
15	AO GND	49	AO 0
16	AO GND	50	AO 1
17	AI GND	51	AI GND
18	AI 0 (AI 0+)	52	AI 8 (AI 0-)
19	AI 1 (AI 1+)	53	AI 9 (AI 1-)
20	AI 2 (AI 2+)	54	AI 10 (AI 2-)
21	AI 3 (AI 3+)	55	AI 11 (AI 3-)
22	AI 4 (AI 4+)	56	AI 12 (AI 4-)
23	AI 5 (AI 5+)	57	AI 13 (AI 5-)
24	AI 6 (AI 6+)	58	AI 14 (AI 6-)
25	AI 7 (AI 7+)	59	AI 15 (AI 7-)
26	AI GND	60	AI GND
27	NC	61	NC
28	NC	62	NC
29	NC	63	NC
30	NC	64	NC
31	NC	65	NC
32	NC	66	NC
33	NC	67	NC
34	NC	68	NC

Table 15 PCIe-5101-K7 Pin Connector

Note:

At PCIe-5101 Series AI channel synchronization, each bank can only select one;

In RSE mode, the following is the distribution of the banks:

RSE mode	AI channel
Bank 1	AI 0 - AI 7
Bank 2	AI 8 - AI 15
Bank 3	AI 16 - AI 23 (5101-P7 only)
Bank 4	AI 24 - AI 31 (5101-P7 only)

Table 16 PCIe-5101 Series Banks-RSE

In DIFF mode, the following is the distribution of the banks:

DIFF mode	AI channel
Bank 1	AI 0 - AI 7
Bank 2	AI 8 - AI 15 (5101-P7 only)

Table 17 PCIe-5101 Series Banks-DIFF

Please pay attention to the wiring method.

Signal	Description
AI_GND	Analog Input Reference Ground
AI<0..31>	Analog Input Channel
AO_GND	Analog Output Reference Ground
AO<0..1>	Analog Output Channel
D_GND	Digital Signal Reference Ground
DIO<0..23>	Digital I/O Channel
PFI<0..23>	Programmable Function Interface

Table 18 Cable Specification

2. Order Information

- PCIe-5101-P7 (PN: JY9936435-01)
AI: 32-CH, 16-Bit, 1 MS/s, AO: 2-CH, 16-Bit, 400 kS/s, DIO 24/2 Counters PCIe Multifunction I/O Module
- PCIe-5101-K7 (PN: JY2006398-01)
AI: 16-CH, 16-Bit, 1 MS/s, AO: 2-CH, 16-Bit, 400 kS/s, DIO 24/2 Counters PCIe Multifunction I/O Module

Accessories:

- DIN-68 (PN: JY1717615-01)
SCSI 68-pin Terminal board
- ACL-1016868-1 (PN: JY1016868-01)
1M 68pin VHDCI68M-SCSI68M cable
- ACL-1016868-2 (PN: JY1016868-02)
2M 68pin VHDCI68M-SCSI68M cable

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3. Special Operation Note

In the operation of the PCIe-5101 Series, it is crucial to note that the device does not support the mixed use of single-ended and differential measurements. All channels within a task must be configured uniformly as either single-ended or differential.

- Single-ended mode: In this mode, each signal is measured with respect to a common ground.
- Differential mode: In this mode, the measurement is taken between two input signals, ensuring noise rejection and higher signal integrity.

If your application requires switching between these two modes, it is recommended to reconfigure the channels uniformly before starting a new measurement session.

4. Software

3.1 Supported Operating System

Windows 7/10, x64/x86, Linux. See additional information.

3.2 Programming Languages

Microsoft C#. See additional software information for other languages.

5. JYPEDIA

JYPEDIA is an excel file. It contains JYTEK product information, pricing, inventory information, drivers, software, technical support, knowledge base and more. JYPEDIA can be downloaded from www.jytek.com or from JYTEK sales representative.

6. Additional Hardware Information

6.1 Basic DC AI Accuracy

PCIe-5101 Series AI Basic Accuracy = $\pm(\% \text{ Reading} + \% \text{ Range})$

JY-5101 AI Basic Accuracy = $\pm(\% \text{ Reading} + \% \text{ Range})$												
Nominal Range (V)	24 Hour Tcal $\pm 1^\circ\text{C}$			90 Days Tcal $\pm 5^\circ\text{C}$			Temperature Coefficients ($^\circ\text{C}$)			24 Hr Full Scale Accuracy	90 Days Full Scale Accuracy	Full Scale Accuracy (%)
2.5	0.011	+	0.031	0.034	+	0.033	0.0025	+	0.0005	1.05 mV	1.68 mV	0.067
5	0.011	+	0.020	0.033	+	0.021	0.0024	+	0.0004	1.55 mV	2.70 mV	0.054
10	0.011	+	0.015	0.033	+	0.017	0.0026	+	0.0005	2.60 mV	5.00 mV	0.050

Table 19 PCIe-5101 Series AI Accuracy

6.2 Basic AO Accuracy

PCIe-5101 Series AO Basic Accuracy = $\pm(\% \text{ Reading} + \% \text{ Range})$

JY-5101 AO Basic Accuracy = $\pm(\% \text{ Reading} + \% \text{ Range})$												
Nominal Range (V)	24 Hour Tcal $\pm 1^\circ\text{C}$			90 Days Tcal $\pm 5^\circ\text{C}$			Temperature Coefficients ($^\circ\text{C}$)			24 Hr Full Scale Accuracy	90 Days Full Scale Accuracy	Full Scale Accuracy (%)
5	0.0022	+	0.0051	0.0054	+	0.0051	0.0000	+	0.0000	0.37 mV	0.53 mV	0.011
10	0.0017	+	0.0044	0.0041	+	0.0044	0.0000	+	0.0000	0.61 mV	0.85 mV	0.009

7. Additional Software Information

7.1 System Requirements

The PCIe-5101 Series can be used in a Windows or a Linux operating system.

Microsoft Windows: Windows 7 32/64 bit, Windows 10 32/64 bit.

Linux Kernel Versions: There are many Linux versions. It is not possible JYTEK can support and test our devices under all different Linux versions. JYTEK tested the following Linux versions:

Linux Distribution	Kernel Version
Ubuntu 18.04 LTS	4.15
Ubuntu 20.04 LTS	5.4
Ubuntu 22.04 LTS	5.15
CentOS 7	3.10
CentOS 8	4.18

Table 20 Supported Linux Versions

7.2 System Software

When using the PCIe-5101 Series in the Windows environment, you need to install the following software from Microsoft website:

Microsoft Visual Studio Version 2015 or above,

.NET Framework version is 4.0 or above.

.NET Framework is coming with Windows 10. For Windows 7, please check .NET Framework version and upgrade to 4.0 or later version.

Given the resources limitation, JYTEK only tested PCIe-5101 with .NET Framework 4.0 with Microsoft Visual Studio 2015. JYTEK relies on Microsoft backward compatibility to support other versions.

7.3 C# Programming Language

All JYTEK default programming language is Microsoft C#. This is Microsoft recommended programming language in Microsoft Visual Studio and is particularly suitable for test and measurement industry.

7.4 PCIe-5101 Series Hardware Driver

After installing the required application development environment as described above, you need to install the PCIe-5101 hardware driver.

JYTEK hardware driver has two parts: the shared common driver kernel software (FirmDrive) and the specific hardware driver.

Common Driver Kernel Software (FirmDrive): FirmDrive is the JYTEK's kernel software for all hardware products of JYTEK instruments. You need to install FirmDrive first before installing the specific hardware driver.

Specific Hardware Driver: Each JYTEK hardware has a C# specific hardware driver. This driver provides rich and easy-to-use C# interfaces for users to operate the hardware.

Note that this driver does not support cross-process, and if you are using more than one function, it is best to operate in one process.

7.5 Install the SeeSharpTools from JYTEK

To efficiently and effectively use PCIe-5101 board, you need to install a set of free C# utilities, SeeSharpTools from JYTEK. The SeeSharpTools provide various tools for data visualization, signal processing, and instrument control.

7.6 Running C# Programs in Linux

Most C# written programs in Windows can be run by MonoDevelop development system in a Linux environment. You would develop your C# applications in Windows and then run them in a Linux environment.

If you want to use your own Linux development system other than MonoDevelop, you can do it by using our Linux driver. However, JYTEK does not have the resources to provide technical support for all different Linux development environments.

8. About JYTEK

8.1 JYTEK China

Founded in June, 2016, JYTEK China is a leading Chinese test & measurement company, providing complete software and hardware products for the test and measurement industry. The company has evolved from re-branding and reselling PXI(e) and DAQ products to a fully-fledged product company. The company offers complete lines of PXI, DAQ, USB products. More importantly, JYTEK has been promoting open-sourced based ecosystem and offers complete software products. Presently, JYTEK is focused on the Chinese market. Our Shanghai headquarters and production service center have regular stocks to ensure timely supply; we also have R&D centers in Xi'an and Chongqing. We also have highly trained direct technical sales representatives in Shanghai, Beijing, Tianjin, Xi'an, Chengdu, Nanjing, Wuhan, Guangdong, Haerbin, and Changchun. We also have many partners who provide system level support in various cities.

8.2 JYTEK Software Platform

JYTEK has developed a complete software platform, SeeSharp Platform, for the test and measurement applications. We leverage the open sources communities to provide the software tools. Our platform software is also open sourced and is free, thus lowering the cost of tests for our customers. We are the only domestic vendor to offer complete commercial software and hardware tools.

8.3 JYTEK Warranty and Support Services

With our complete software and hardware products, JYTEK is able to provide technical and sales services to wide range of applications and customers. In most cases, our products are backed by a 1-year warranty. For technical consultation, pre-sale and after-sales support, please contact JYTEK of your country.

9. Statement

The hardware and software products described in this manual are provided by JYTEK China, or JYTEK in short.

This manual provides the product review, quick start, some driver interface explanation for JY-5320 family of temperature sensor data acquisition cards. The manual is copyrighted by JYTEK.

No warranty is given as to any implied warranties, express or implied, including any purpose or non-infringement of intellectual property rights, unless such disclaimer is legally invalid. JYTEK is not responsible for any incidental or consequential damages related to performance or use of this manual. The information contained in this manual is subject to change without notice.

While we try to keep this manual up to date, there are factors beyond our control that may affect the accuracy of the manual. Please check the latest manual and product information from our website.

Shanghai Jianyi Technology Co., Ltd.

Address: Room 201, Building 3, NO.300 Fangchun Road, Shanghai.

Post Code: 201203

Tel: 021-5047 5899

Website: www.jytek.com