1 PCIe/PXIe-9819 Specifications

Please download JYTEK <JYPEDIA>, you can quickly inquire the product prices, the key features and available accessories.

Overview

The JY-9819 PXI Express digitizer provides high speed, high quality data acquisition. Each of 4 input channels supports up to 250MS/s sampling, with up to 16-bit resolution. This allows simultaneous recording of signals on all channels with no inter-channel phase delay. The extremely large onboard memory enables long recording times even at the highest sampling rates.

The PCIe/PXIe-9819 features flexible input ranges of ±0.5V, ±1V, ±5V, and ±10V along with software selectable 50 Ω or 1MΩ input impedance. Four high resolution 16-bit A/D converters combine with a low-noise/high bandwidth analog front-end to make the PXIe-9819 perfect for applications like radar signal acquisition, fiber optic sensing, and many others.

1.1 Main Features

- 4 simultaneous analog inputs
- 16-bit resolution
- Maximum 250 MS/s sample rates
- Programmable input voltage range of ±0.5V, ±1V, ±5V, or ±10V
- Software selectable 50Ω or 1MΩ input impedance
- Up to 110 MHz bandwidth for analog input
- Up to 0.3% of full scale DC accuracy
- Scatter-Gather DMA data transfer for high speed data streaming
- Supports Multi-board synchronization
- 2GB onboard storage memory

1.2 Analog Input

JY-9810 Series	JY-9819
Sampling Rate (Per Channel)	2kS/s~250 MS/s
Number of Input channels	4
Resolution (Bits)	16
Sample Rate resolution	100 ppm
Sample Clock Source	Internal or External, software selectable
Input range(V)	±0.5/±1/±5/±10
Input mode	RSE
Connectors	SMB
Input impedance	50 Ω /1 MΩ, software selectable
Input coupling	DC / AC, software selectable
Bandwidth	Full bandwidth / 20MHz bandwidth,software selectable
Crosstalk(@1 MHz)	-103 dB
Multi-board synchronization accuracy	<500ps
Trigger Type	Analog/Digital/Software
Trigger Mode	Start trigger, Reference trigger, Re-trigger for start trigger and reference trigger modes
Interval of retrigger	5 Samples
Guaranteed Bandwidth (-3 dB)*	110MHz
AC Cutoff (-3 dB)	50Ω: 1.6KHz
	1MΩ: 0.2Hz
Maximum input overload	7Vrms, For all input range
	±10V, For 1MΩ: ±0.5V or ±1V input range
	±30V, For 1MΩ: ±5V or ±10V input range
Input current during overvoltage protection	±20 mA
Onboard memory	2GB
Operating Temperature	0 ºC～ 50 ºC
*Full bandwidth mode ,All Range	

Table 1 Analog Input Specifications

1.3 DC Accuracy

Impedance 1MΩ

JY-9819 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(%)
0.5	0.09	+	0.17	0.24	+	0.20	0.02	+	0.01	2 mV	3 mV	0.60
1	0.05	+	0.13	0.15	+	0.15	0.01	+	0.01	2 mV	3 mV	0.30
5	0.07	+	0.20	0.20	+	0.21	0.02	+	0.01	14 mV	21 mV	0.42
10	0.06	+	0.16	0.17	+	0.17	0.02	+	0.01	22 mV	34 mV	0.34

Impedance 50Ω

JY-9819 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(%)
0.5	0.50	+	0.40	1.10	+	0.40	0.10	+	0.10	5 mV	8 mV	1.60
1	0.50	+	0.30	1.10	+	0.30	0.10	+	0.10	8 mV	14 mV	1.40
5	0.50	+	0.30	1.10	+	0.30	0.10	+	0.10	40 mV	70 mV	1.40
10	0.40	+	0.30	1.10	+	0.30	0.10	+	0.10	70 mV	140 mV	1.40

Table 2 DC Accuracy of JY-9819

1.4 AC Flatness

Normal Range	Input Impedance	Flatness (dB)		
		1kHz to 50kHz	1kHz to 1MHz	1kHz to 100MHz
0.5	50 Ω	±0.08	±0.08	±0.25
1	50 Ω	±0.08	±0.08	±0.25
5	50 Ω	±0.08	±0.15	±0.5
10	50 Ω	±0.08	±0.15	±0.5
0.5	1MΩ	±0.08	±0.08	N/A
1	1MΩ	±0.08	±0.08	N/A
5	1MΩ	±0.08	±0.15	N/A
10	1MΩ	±0.08	±0.15	N/A

Table 3 AC Flatness of JY-9819

1.5 AI Bandwidth

Bandwidth(-3dB): 110MHz (Full bandwidth mode,all range)

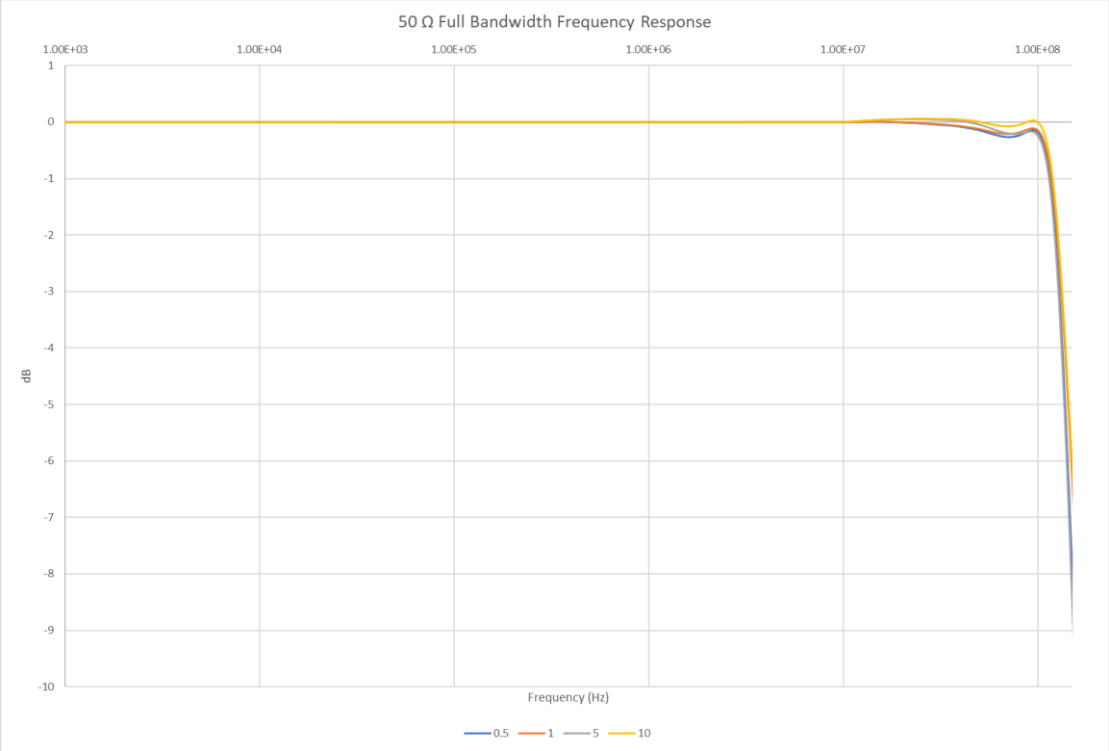

Figure 1 AI Bandwidth

1.6 Dynamic Performance

Normal Range (V)	Impedance (Ohm)	Frequency	THD (dBc)	SFDR (dBc)	ENOB (bit)
0.5	50	10MHz	-80	85	10.9
1	50	10MHz	-81	82	11.3
5	50	10MHz	-77	80	10.9
10	50	10MHz	-73	78	10.1
0.5	1M	10MHz	-80	82	10.3
1	1M	10MHz	-79	80	10.9
5	1M	10MHz	-79	80	11.0
10	1M	10MHz	-76	77	11.0

Table 4 Dynamic Performance of 9819

1.7 Multiple JY-9819 Synchronization Accuracy

<= 500 ps.

1.8 Crosstalk

Impedance	Frequency	Crosstalk * (dB)
50ohm	1MHz	-103
50ohm	10MHz	-86
50ohm	50MHz	-74
50ohm	100MHz	-69
1Mohm	1MHz	-105
1Mohm	10MHz	-102
1Mohm	50MHz	-85
1Mohm	100MHz	-77
*Full bandwidth mode		

Table 5 Crosstalk

1.9 Noise

Normal Range (V)	20MHz bandwidth Idle Channel Noise* (uVrms)	Full bandwidth Idle Channel Noise* (uVrms)
0.5	110	120
1	220	225
5	1200	1325
10	2270	2370
*Both impedance 50 ohm and 1M ohm		

Table 6 Noise of 9819

1.10 Voltage Standing Wave Ratio (VSWR)

Input Impedance	Norminal Range (V)	VSWR(100MHz)
50 Ω	0.5	1.38
50 Ω	1	1.38
50 Ω	5	1.1
50 Ω	10	1.1

Table 7 1.10 Voltage Standing Wave Ratio

1.11 Trigger and PFI Specifications

Trigger Modes	Start trigger, Reference trigger, Re-trigger for start trigger and reference trigger modes
Trigger types	Immediate trigger, Software trigger, Analog trigger, and Digital trigger.

Analog Trigger	Sources	CH0 to CH3
	Types	Edge, Hysteresis, Window

Digital Trigger	Sources	Trig(Front panel), PFI[0..7](Front panel), PXI Trigger Bus [0..7], PXI_STAR, PXIe_DSTARB
	Types	Rising edge, Falling edge

TRIG	As an Input(Trigger):	
	Input type	SMB
	Compatibility	3.3 V TTL, 5V tolerant
	impedance	50kΩ
	Input high threshold (VIH)	2.0 V
	Input Low threshold (VIL)	0.8 V
	Maximum input overload	-0.5 V ~ +5.5 V
	Impedance	50 kΩ
	Trigger pulse width	20 ns minimum
	As an Output (event):	
	impedance	50Ω
	Logic type	3.3V TTL
	Maximum drive current	24mA
	Source	Start trigger , Reference trigger

PFI<0..7>	As an Input(Trigger):	
	Input type	Mini HDMI
	Compatibility	3.3 V TTL, 5V tolerant
	impedance	50kΩ
	Input high threshold (VIH)	2.0 V
	Input Low threshold (VIL)	0.8 V
	Maximum input overload	-0.5 V ~ +5.5 V
	Impedance	50 kΩ
	Trigger pulse width	20 ns minimum
	As an Output (event):	
	impedance	50Ω
	Logic type	3.3V TTL
	Maximum drive current	12mA
	Source	Start trigger , Reference trigger

Table 8 Trigger and PFI Specifications

1.12 Aux Power output 3.3V

Power Output (+3.3V)		
	Connector	Front panel Mini HDMI pin number 18
	Voltage output	3.3V±10%
	Maximum current drive	0.5A
	Output impedance	<1 ohm

Table 9 Trigger and PFI Specification

1.13 Timebase

Sample Clock	
Sources	
Internal	Onboard clock
External	CLK IN (front panel SMB connector) PXIe_DSTARA (backplane connector)
Sample rate range, real-time[19]	2kS/s to 250 MS/s
Internal onboard reference clock accuracy	<±2ppm
Timebase frequency	
Internal	74.0625 MHz to 250 MHz
External	10 MHz to 250 MHz
Duty cycle tolerance	45% to 55%
Phase-Locked Loop (PLL) Reference Clock	
Sources	
Internal	Onboard clock (internal TCXO)
External	CLK IN (front panel SMB connector) PXIe_Clk100 (backplane connector) PXIe_DSTARA (backplane connector)
Duty cycle tolerance	45% to 55%
External Sample Clock from CLK IN	
Source	CLK IN (front panel SMB connector)
Impedance	50 Ω
Coupling	AC
Input voltage range	
As a sine wave	-5dBm through 18 dBm
As a fast slew rate input (square wave, V_{pk-pk})	0.35 V to 5 V
Duty cycle tolerance	45% to 55%
Maximum input overload	
sine wave	20 dBm
As a fast slew rate input (square wave, V_{pk-pk})	6 V
External Reference from Clock In	
Source	CLK IN (front panel SMB connector)
Impedance	50 Ω
Coupling	AC
Frequency	10 MHz(default,can be configured)
Input voltage range	
sine wave	-5dBm through 18 dBm
As a fast slew rate input (square wave, V_{pk-pk})	0.35 V to 5 V
Duty cycle tolerance	45% to 55%
Sample Clock Out	
Source	Phase-Locked Loop (PLL)
Destination	CLK OUT (front panel SMB connector)
Output impedance	50 Ω
Logic type	3.3V LVCMOS
PXIe_DStarA	
Source	System timing slot
Destinations	Onboard clock reference (PLL) FPGA
PXIe_Clk100	
Source	PXI backplane
Destination	Onboard clock reference (PLL) FPGA

Table 10 Onboard Reference

1.14 Warmup Time

Recommended warmup time	15 minutes

Table 11 Onboard Reference

1.15 Data Storage and Transfer

Onboard memory	2GB, shared among four analog inputs
Transfer mode	Scatter-Gather DMA data transfer

Table 12 Data Storage and Transfer

1.16 Connector

Connector type: SMB

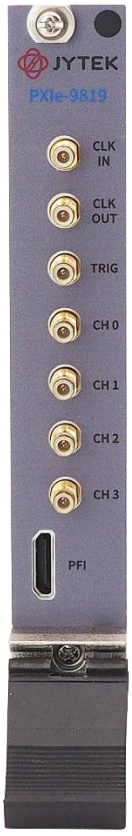

Figure 2 JY-9819 Front Panel

1.17 Physical and Environment

Dimensions:	3U, one-slot, PXI Express Module, 165 (W) x 100 (H) mm
Weight	404 g
Bus interface:	PXI Express Gen2 x 8
Operating ambient temperature:	0° C to 50° C (32° F to 122° F)
Storage ambient temperature:	-20°C to 80°C (-4°F to 176°F)
Relative humidity for operating & storage:	5% to 95%, noncondensing

Table 13 Physical and Environment

2 Table of Contents

Table of Contents

3 Software

3.1 System Requirements

JY-9819 modules can be used in a Windows or a Linux operating system.

Microsoft Windows: Windows 7 32/64 bit, Windows 10 32/64 bit. We highly recommend the user to use Windows 10 whenever possible.

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 will at the best support the following Linux versions.

Linux Version
Ubuntu LTS
16.04： 4.4.0-21-generic(desktop/server)
16.04.6：4.15.0-45-generic(desktop) 4.4.0-142-generic(server)
18.04： 4.15.0-20-generic(desktop) 4.15.0-91-generic(server)
18.04.4：5.3.0-28-generic (desktop) 4.15.0-91-generic(server)
Localized Chinese Version
中标麒麟桌面操作系统软件（兆芯版）V7.0（Build61）: 3.10.0-862.9.1.nd7.zx.18.x86_64
中标麒麟高级服务器操作系统软件V7.0U6: 3.10.0-957.el7.x86_64

Table 14 Supported Linux Versions

3.2 System Software

When using JY-9819 board in the Window environment, you need to install the following software from Microsoft:

Visual Studio Version 2015 or above,

.NET version is 4.0 or above.

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

Given the resources limitation, JYTEK only tested JY-9819 modules with .NET 4.0 with Visual Studio 2015. JYTEK relies on Microsoft to maintain the compatibility for the newer versions.

3.3 C# Programming Language

All JYTEK default programming language is Microsoft C#. This is Microsoft recommended programming language in Visual Studio and is particularly suitable for the test and measurement applications. C# is also a cross platform programming language.

3.4 C ++ Programming Language

JYTEK provides QT C++ drivers for C++ programmers. We also provide many QT C++ examples. However, due to our limited resources, we do not support C++ based applications.

3.5 JY-9819 Hardware Driver

After installing the required application development environment as described above, you need to install the JY-9810 hardware driver of PCIe/PXIe-9819 in JYPEDIA files.

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

Common Driver Kernel Software (FirmDrive): FirmDrive is the JYTEK's kernel software for all hardware products of JYTEK instruments. You need to install this kernel software before using any other JYTEK hardware products. FirmDrive only needs to be installed once. After that, you can install the hardware specific driver.

Hardware Specific Driver: Each JYTEK hardware has a C# hardware specific driver. This driver provides rich and easy-to-use C# interfaces for users to operate various JY-9819 function. JYTEK has standardized the ways JYTEK and other vendor's DAQ cards are used by providing a consistent user interface, using the methods, properties and enumerations in the object-oriented programming environment. Once you get yourself familiar with how one JYTEK DAQ card works, you should be able to know how to use all other DAQ hardware using the same methods.

3.6 Install the SeeSharpTools from JYTEK

To efficiently and effectively use JY-9819 boards, you need to install a set of free C# utilities from JYTEK SeeSharp Test and Measurement platform. The SeeSharp platform offers rich user interface functions you will find convenient in developing your applications. They are also needed to run the examples come with JY-9819 hardware.

Please register and download the latest SeeSharpTools from our website www.jytek.com.

3.7 Running C# Programs in Linux

Most C# written programs in Windows can be run by Microsoft Mono development system in a Linux environment. You would develop your C# applications in Windows using Visual Studio. Once it is done, run this application in the Mono environment. This is JYTEK recommended way to run your C# programs in a Linux environment.

If you want to use your own Linux development system other than Mono, you can do it using our Linux driver. However, JYTEK does not have the capability to support the Linux applications. JYTEK completely relies upon Microsoft to maintain the cross-platform compatibility between Windows and Linux using Mono.

4 Order Information

- PXIe-9819 (PN: JY2370729-01)
  4-CH, 250 MS/s, 16-bit, ±10 V, BW:110 MHz PXIe Digitizer

5 JYPEDIA

JYPEDIA is an excel file. It contains JYTEK product information, pricing, inventory information, drivers, software, technical support, knowledge base etc. You can register and download a JYPEDIA excel file from our web www.jytek.com. JYTEK highly recommends you use this file to obtain information from JYTEK.

6 Additional Hardware Information

6.1 DC Accuracy

DC voltage measurement refers to the measurement of a slowly changing voltage. The accuracy of the DC measurement is affected by gain error and offset error. An instrument's DC accuracy is defined by the gain and offset errors as follows:

$$\text{Accuracy} = \text{Gain Error (\% of reading)} + \text{Offset Error (\% of range)}$$

Equation 1 Gain and Offset Errors

It should be noted when the reading is close to zero, the gain error is very small and negligible, the offset error is dominant; when the reading is getting close to the full range, the gain error becomes more significant.

The AI DC Accuracy of JY-9819 is shown in Table 2.

6.2 AC Accuracy

The accuracy of the AC voltage measurement is represented by the percentage of the RMS value of the input AC signal. The AC Accuracy of JY-9819 is shown in Table 3.

6.3 Dynamic Performance

JY-9819 offers excellent dynamic performances as shown in Table 4, where THD stands for the total harmonic distortion; SINAD stands for Signal-to-Noise and Distortion; SFDR stands for Spurious-Free Dynamic Range.

7 Additional Software Information

7.1 System Requirements

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JYTEK provides QT C++ drivers for C++ programmers. We also provide many QT C++ examples. However, due to our limited resources, we do not support C++ based applications.

7.5 Python

JYTEK provides and supports a native python driver for JY-9819 card. There are many different versions of Python. JYTEK has only tested in CPython version 3.5. There is no guarantee that JYTEK python drivers will work correctly with other versions of Python. If you want to be our partner to support different Python platforms, please contact us.

8 Operating JY-9819

This manual provides information on how to use the JY-9819 of digitizers. It assumes that the user is already familiar with Microsoft Visual Studio and C# programming language.

8.1 Installing JY-9819 Hardware Driver

After installing the required application development environment as described above, you need to install the JY-9810 series hardware driver to use JY-9819.

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

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If you want to use your own Linux development system other than Mono, you can do it using our Linux driver. However, JYTEK does not have the capability to support the Linux applications. JYTEK completely relies upon Microsoft to maintain the cross-platform compatibility between Windows and Linux using Mono.

9 Calibration

JYTEK 9819 board are precalibrated before the shipment. We recommend you recalibrate JY-9819 board periodically to ensure the measurement accuracy. A commonly accepted practice is one year. If you need to recalibrate your board, please contact JYTEK.

10 Appendix

10.1 Abbreviations

- AI: Analog Input
- ADC: Analog-to-Digital Conversion
- PFI: Programmable Function Interface
- THD: Total Harmonic Distortion
- SINAD: Signal to Noise and Distortion Ratio
- SFDR: Spurious Free Dynamic Range

10.2 What is a digitizer and how does it work?

A digitizer, also known as a data acquisition system, is an electronic instrument that captures and records signals from a variety of sources, such as sensors, transducers, and other instruments. Digitizers typically consist of analog-to-digital converters (ADCs), which convert analog signals into digital data that can be analyzed and processed by a computer or other device.

10.3 What is the difference between a digitizer and an oscilloscope?

Both digitizers and oscilloscopes are used to capture and analyze electronic signals, but there are some key differences between the two. Oscilloscopes are typically used to display and analyze signals in real-time, while digitizers are designed for high-speed data acquisition and can capture and store signals for later analysis. Additionally, digitizers often have more channels and higher bandwidths than oscilloscopes, and are used in a wider range of applications.

10.4 What are the different types of digitizers?

There are several types of digitizers available, each with its own set of features and capabilities. Some of the most common types include benchtop digitizers, PXI modular digitizers, and USB digitizers. Benchtop digitizers are standalone units that are designed for use in a laboratory or other fixed location. Modular digitizers are designed to be integrated into larger systems, and are often used in industrial or scientific applications. USB digitizers are small, portable units that can be used with a laptop or other computer.

10.5 What are some of the key specifications to consider when selecting a digitizer?

When selecting a digitizer, there are several key specifications to consider, including sampling rate, bandwidth, resolution, dynamic range, and input impedance. Sampling rate refers to the number of samples per second that the digitizer can acquire, while bandwidth refers to the range of frequencies that the digitizer can capture. Resolution refers to the number of bits used to represent each sample, while dynamic range refers to the range of amplitudes that the digitizer can accurately capture. Input impedance refers to the electrical resistance of the digitizer's input circuitry, and can affect the accuracy of the measurements.

10.6 How do I calibrate my digitizer?

Calibration is an important step in ensuring the accuracy of your digitizer. Most digitizers come with a built-in calibration routine that can be used to verify and adjust the unit's performance. The calibration process typically involves connecting the digitizer to a known signal source and measuring the response. The results of the calibration can then be used to adjust the digitizer's settings or to apply calibration factors to the acquired data.

10.7 How can I improve the performance of my digitizer?

There are several steps that can be taken to improve the performance of your digitizer, including selecting the appropriate settings for your application, using high-quality signal cables and connectors, and avoiding sources of noise and interference. Additionally, performing regular calibration and maintenance on your digitizer can help to ensure that it is operating at peak performance.

10.8 What are some common applications for digitizers?

Digitizers are used in a wide range of applications, including scientific research, engineering, telecommunications, and medical diagnostics. Some common uses of digitizers include signal analysis, data acquisition, and waveform generation. Digitizers are also commonly used in fields such as aerospace, automotive, and consumer electronics, where they are used to test and evaluate new products and technologies.

11 About JYTEK

11.1 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 is a joint venture between Adlink Technologies and a group of experienced professionals form the industry. JYTEK independenly develop the software and hardware products and is entirely focused on the Chinese market. Our Shanghai headquarters and production service center have regular stocks to ensure timely supply; we have R&D centers in Xi'an and Chongqing to develop new products; we also have highly trained direct technical sales representatives in Shanghai, Beijing, Tianjin, Xi'an, Chengdu, Nanjing, Wuhan, Haerbin, and Changchun. We also have many patners who provide system level support in various cities.

11.2 JYTEK Hardware Products

According to JYTEK's agreement with our equity paNEGer Adlink Technologies, JYTEK's hardware is manufactured by the state-of-art manufacturing facility located in Shanghai Zhangjiang Hi-Tech Park. Adlink has over 20 years of the world-class low-volumn and high-mix manufacturing expertise with ISO9001-2008, China 3C, UL, ROHS, TL9000, ISO-14001, ISO-13485 certifications. Its 30,000 square meters facilities and three high-speed Panasonic SMT production lines can produce 60,000 pieces boards/month; it also has full supply chain management - planning, sweeping, purchasing, warehousing and distribution. Adlink's manufacturing excellence ensures JYTEK's hardware has word-class manufacturing quality.

One core technical advantage is JYTEK's pursue for the basic and fundamental technology excellence. JYTEK China has developed a unique PCIe, PXIe, USB hardware driver architecture, FirmDrive, upon which many our future hardware will be based.

In addition to our own developed hardware, JYTEK also rebrands Adlink's PXI product lines. In addition, JYTEK has other rebranding agreements to increase our hardware coverage. It is our goal to provide the complete product coverage in PXI and PCI modular instrumentation and data acquisition.

11.3 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.

11.4 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.

12 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 explaination for PCIe/PXIe-9819 of temperature sensor data acquisition cards. The manual is copyrighted by JYTEK.

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