

PCI8932

User's Manual



Beijing ART Technology Development Co., Ltd.

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Chapter 1 Overview

In the fields of Real-time Signal Processing, Digital Image Processing and others, high-speed and high-precision data acquisition modules are demanded. ART PCI8932 data acquisition module, which brings in advantages of similar products that produced in china and other countries, is convenient for use, high cost and stable performance.

ART PCI8932 is a data acquisition module based on PCI bus. It can be directly inserted into IBM-PC/AT or a computer which is compatible with PCI8932 to constitute the laboratory, product quality testing center and systems for different areas of data acquisition, waveform analysis and processing. It may also constitute the monitoring system for industrial production process.

Software

Analysis Software

ART PCI8932 module is well-suited for precision data acquisition analysis applications, which you can specifically address with the ART Data Acquisition Measurement Suite. The suite has two components –digital and graphics mode analysis (functions) for voltage (any signal can be transformed into the voltage signal), frequency response and other analysis.

Unpacking Checklist

Check the shipping carton for any damage. If the shipping carton and contents are damaged, notify the local dealer or sales for a replacement. Retain the shipping carton and packing material for inspection by the dealer.

Check for the following items in the package. If there are any missing items, contact your local dealer or sales.

- PCI8932 Data Acquisition Board
- ART Disk
 - a) user's manual (pdf)
 - b) drive
 - c) catalog
- Warranty Card

FEATURES

Analog Input

- Input Range: $\pm 10V$, $\pm 5V$, ± 2.5 , $0\sim 10V$
- 13-bit resolution
- Sampling Rate: 500KS/s

Note: The actual channel sampling rate = sampling rate / number of sampling channels

Frequency Formula: sampling frequency= main frequency/the number of frequency division, main frequency and frequency division are variable.

- Analog Input Mode: 16SE/8DI
- AD Conversion Time: $\leq 1.6\mu s$
- Programmable Gain: 1, 2, 4, 8 (AD8251 default)or 1, 2, 5, 10 (AD8250) or 1, 10, 100, 1000 (AD8253)
- Analog Input Impedance: $10M\Omega$

- Amplifier Set-up Time: 785ns(0.001%)(max)
- Non-linear error: ± 3 LSB(Maximum)
- System Measurement Accuracy: 0.1%
- Operating Temperature Range: 0°C~55°C
- Storage Temperature Range: -20°C~70°C

Analog Output

- Output Range: ± 10 V, ± 5 V, 0~10V, 0~5V
- 12-bit resolution
- Set-up Time: 10 μ s (0.01%)
- Channel No.: 4-channel
- Non-linear error: ± 1 LSB(Maximum)
- Output error (full-scale): ± 1 LSB

Digital Input

- Channel No.: 16-channel
- Electric Standard: TTL compatible
- High Voltage: $\cong 2$ V
- Low Voltage: $\cong 0.8$ V

Digital Output

- Channel No.: 16-channel
- Electrical Standard: TTL compatible
- High Voltage: $\cong 4.45$ V
- Low Voltage: $\cong 0.5$ V
- Power-on Reset

Timer Function

- Counter Channel No.: three independent counter
- Counter Mode: subtract count
- Counter Resolution: 24-bit
- Count Mode: six count modes, (software-configurable)
- electrical standard: TTL compatible

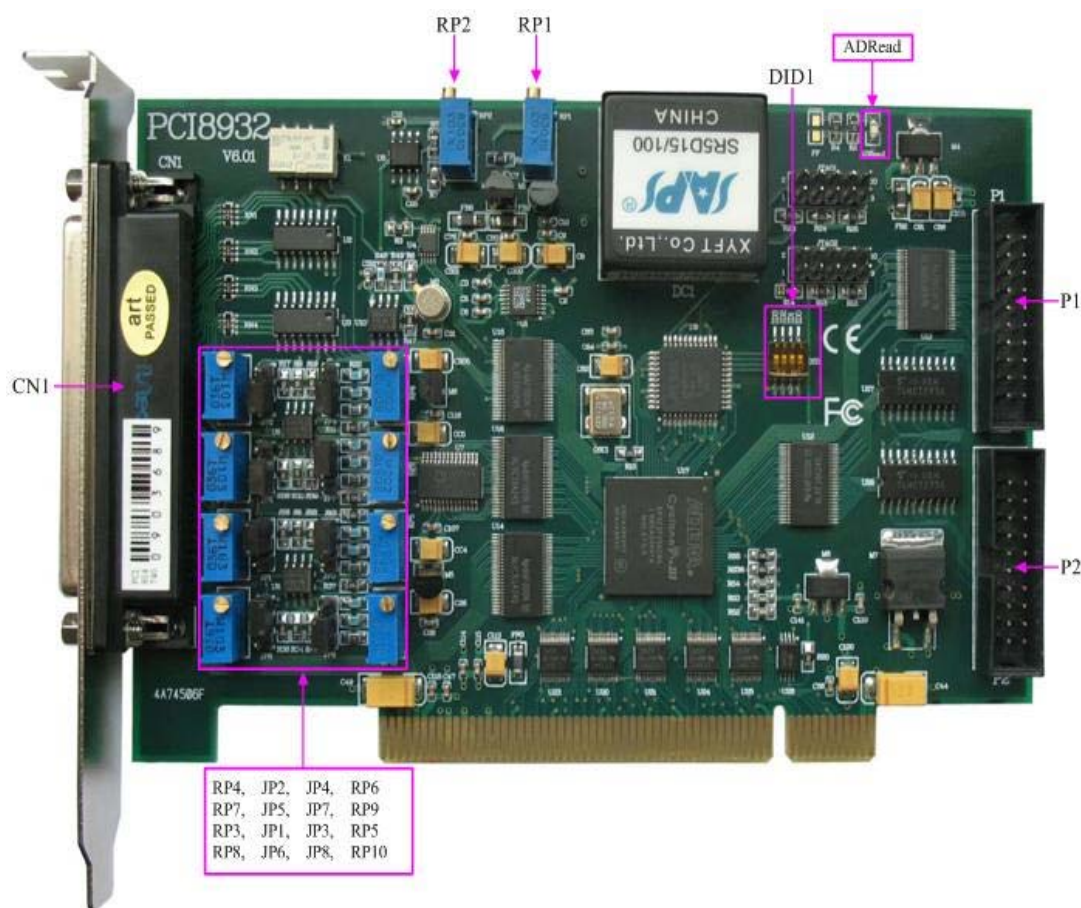
Other features

Board Clock Oscillation: 40MHz

Board Dimension: 143.8mm (L)*98mm (W) * 16mm (H)

Chapter 2 Components Layout Diagram and a Brief Description

2.1 The Main Component Layout Diagram



2.2 The Function Description for the Main Component

2.2.1 Signal Input and Output Connectors

CN1: Analog signal input and output connectors

P1: Digital input port

P2: Digital output port

2.2.2 Potentiometer

RP1: Analog signal input zero point adjustment potentiometer

RP2: Analog signal input full-scale adjustment potentiometer

RP4, RP7, RP3, RP8: Analog output VOUT0~VOUT3 zero-point adjustment potentiometer

RP6,RP9,RP5,RP10: Analog output VOUT0~VOUT3 full-scale adjustment potentiometer

2.2.3 Jumper

JP2, JP4: Analog output VOUT0 output range setting

Voltage Range	JP2	JP4
0~5V		
0~10V		
±5V		
±10V		

JP5, JP7: Analog output VOUT1 output range setting

Voltage Range	JP5	JP7
0~5V		
0~10V		
±5V		
±10V		

JP1, JP3: Analog output VOUT2 output range setting

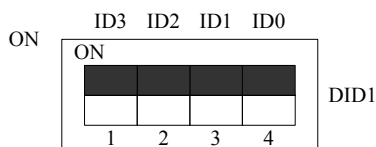
Voltage Range	JP1	JP3
0~5V		
0~10V		
±5V		
±10V		

JP6, JP8: Analog output VOUT3 output range setting

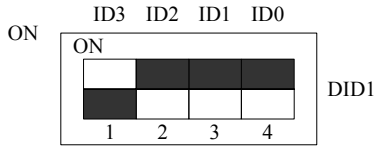
Voltage Range	JP6	JP8
0~5V		
0~10V		
±5V		
±10V		

2.2.4 Physical ID of DIP Switch

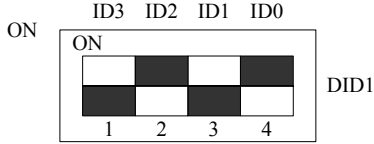
DID1: Set physical ID number. When the PC is installed more than one PCI8932 , you can use the DIP switch to set a physical ID number for each board, which makes it very convenient for users to distinguish and visit each board in the progress of the hardware configuration and software programming. The following four-place numbers are expressed by the binary system: When DIP switch points to "ON", that means "1", and when it points to the other side, that means "0." As they are shown in the following diagrams: place "ID3" is the high bit."ID0" is the low bit, and the black part in the diagram represents the location of the switch. (Test software of the company often uses the logic ID management equipments and at this moment the physical ID DIP switch is invalid. If you want to use more than one kind of the equipments in one and the same system at the same time, please use the physical ID as much as possible.).



The above chart shows "1111", so it means that the physical ID is 15.



The above chart shows "0111", so it means that the physical ID is 7.



The above chart shows "0101", so it means that the physical ID is 5.

ID3	ID2	ID1	ID0	Physical ID (Hex)	Physical ID (Dec)
OFF (0)	OFF (0)	OFF (0)	OFF (0)	0	0
OFF (0)	OFF (0)	OFF (0)	ON (1)	1	1
OFF (0)	OFF (0)	ON (1)	OFF (0)	2	2
OFF (0)	OFF (0)	ON (1)	ON (1)	3	3
OFF (0)	ON (1)	OFF (0)	OFF (0)	4	4
OFF (0)	ON (1)	OFF (0)	ON (1)	5	5
OFF (0)	ON (1)	ON (1)	OFF (0)	6	6
OFF (0)	ON (1)	ON (1)	ON (1)	7	7
ON (1)	OFF (0)	OFF (0)	OFF (0)	8	8
ON (1)	OFF (0)	OFF (0)	ON (1)	9	9
ON (1)	OFF (0)	ON (1)	OFF (0)	A	10
ON (1)	OFF (0)	ON (1)	ON (1)	B	11
ON (1)	ON (1)	OFF (0)	OFF (0)	C	12
ON (1)	ON (1)	OFF (0)	ON (1)	D	13
ON (1)	ON (1)	ON (1)	OFF (0)	E	14
ON (1)	ON (1)	ON (1)	ON (1)	F	15

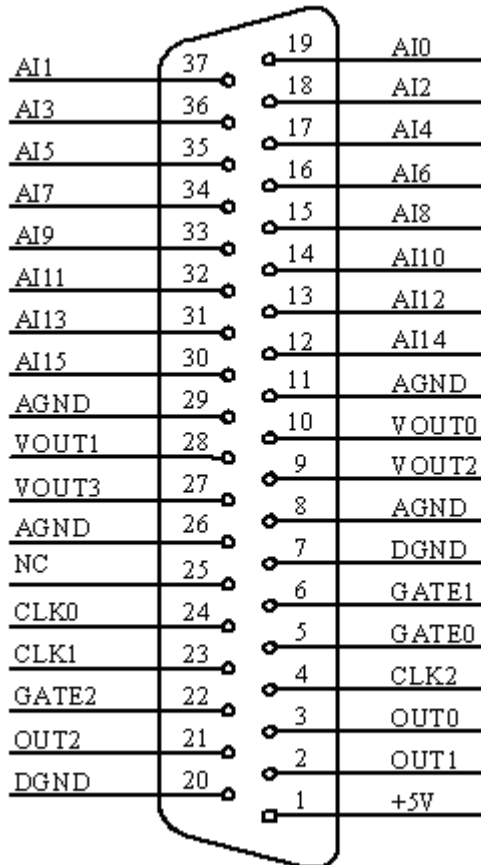
2.2.5 Status indicator

ADRead: AD working status indicator

Chapter 3 Signal Connectors

3.1 The Definition of Signal Input and Output Connectors

37 core plug on the CN1 pin definition

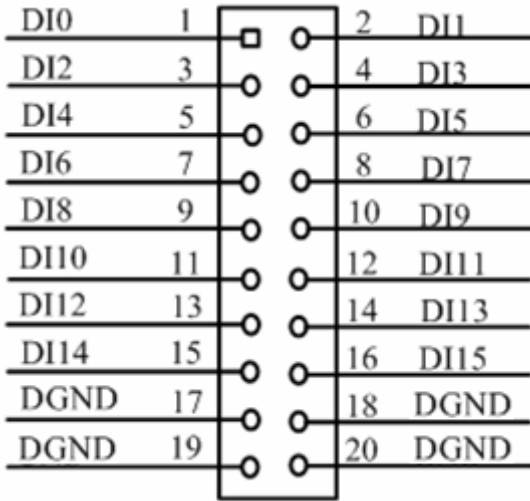


Pin definition about CN1:

Pin name	Pin feature	Pin function definition
AI0~AI15	Input	Analog input, reference ground is AGND.
VOUT~VOUT3	Output	Analog output, reference ground is AGND.
AGND	GND	Analog ground. This AGND pin should be connected to the system's AGND plane.
DGND	GND	Digital ground. This DGND pin should be connected to the system's DGND plane.
CLK0~CLK2	Input	Counter clock input.
GATE0~GATE2	Input	Counter gate.
OUT0~OUT2	Output	Counter out.
+5V	Output	5V power supply output.
NC		NC

3.2 Digital Input Connector

20 core plug P1 pin definition

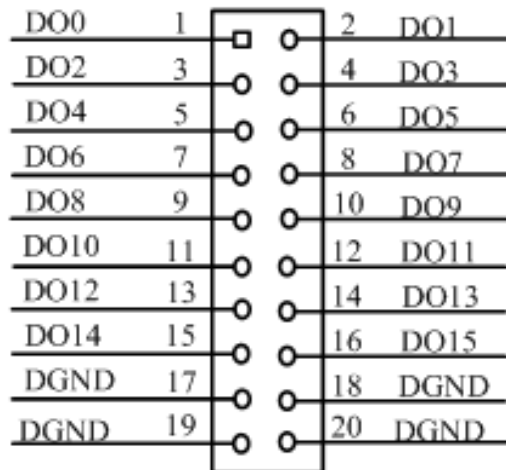


P1 pins definition

Signal Name	Type	Function definition
DI0-DI15	Input	Digital signal input pins, reference ground is DGND.
DGND	GND	Digital signal ground

3.3 Digital Output Connector

20 core plug P2 pin definition



P2 pins definition

Signal Name	Type	Function definition
DO0-DO15	Output	Digital signal input pins, reference ground is DGND.
DGND	GND	Digital signal ground

Chapter 4 Connection Ways for Each Signal

4.1 Analog Input Single-ended Connection

Single-ended mode can achieve a signal input by one channel, and several signals use the common reference ground. This mode is widely applied in occasions of the small interference and relatively many channels.

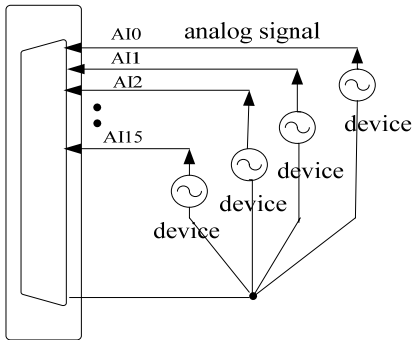


Figure 4.1 single-ended input connection

4.2 Analog Input Differential-ended Mode

Double-ended input mode, which was also called differential input mode, uses positive and negative channels to input a signal. This mode is mostly used when biggish interference happens and the channel numbers are few. Single-ended/double-ended mode can be set by the software, please refer to PCI8932 software manual.

According to the diagram below, PCI8932 board can be connected as analog voltage double-ended input mode, which can effectively suppress common-mode interference signal to improve the accuracy of acquisition. Positive side of the 8-channel analog input signal is connected to AI0~AI7, the negative side of the analog input signal is connected to AI8~AI15, equipments in industrial sites share the AGND with PCI8932 board.

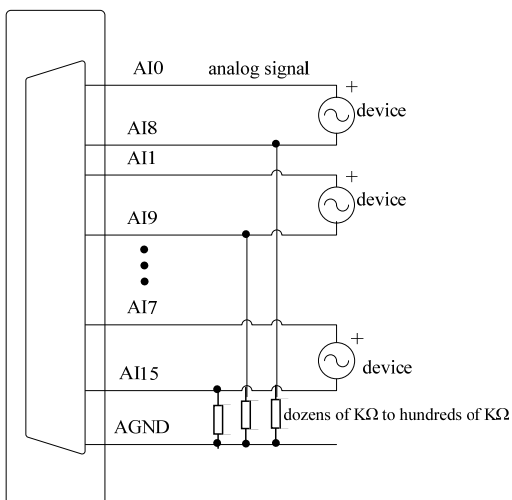


Figure 4.2 double-ended input connection

4.3 Other Connections

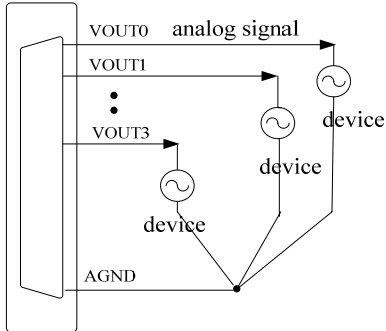


Figure 4.3 analog signal output connection

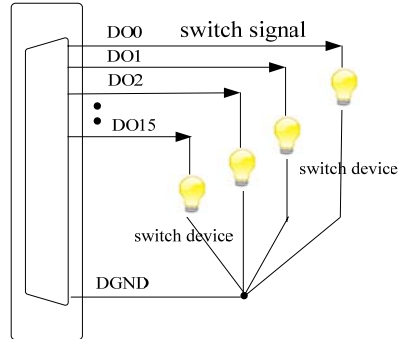


Figure 4.5 digital signal output connection

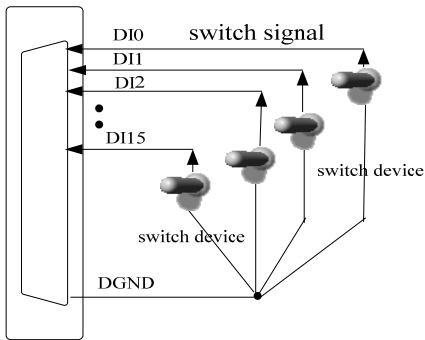


Figure 4.4 digital signal input connection

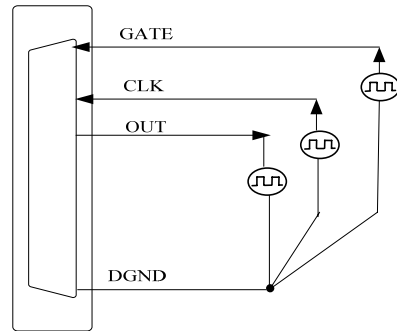


Figure 4.6 Clock Input/Output and Trigger Signal Connection

Chapter5 Subtractive Counter

Mode 0: Interrupt on terminal count

Under this mode, when given the initial value, if GATE is high level, the counter immediately begins to count by subtracting “1” each time, the counter output OUT turns into low level; when the count ends and the count value becomes 0, the counter output OUT becomes and keeps high level until given the initial value or reset. If a counter which is counting is given a new value, the counter will begin to count from the new value by subtracting “1” each time. GATE can be used to control the count, GATE=1 enables counting; GATE=0 disables counting.

OUT signal changes high from low can be used as interrupt request.

Time diagram is shown in Figure 1.

Mode 0

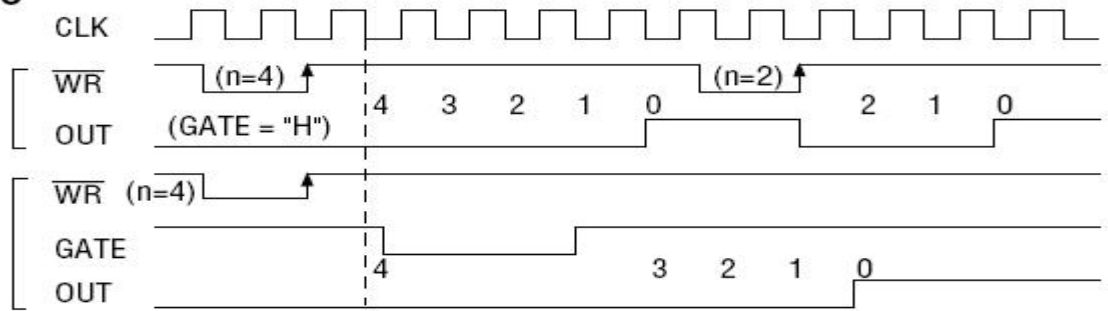


Figure 1

Mode 1: Hardware retriggerable one-shot

The mode can work under the role of GATE. After given the initial count value N, OUT becomes high level, the counter begins to count until the appearance of the rising edge of GATE, at this moment OUT turns into low level; when the count ends and the count value becomes 0, OUT becomes high level, that is, the output one-shot pulse width is determined by the initial count value N. If the current operation does not end and another rising edge of GATE appears, then the current count stops, the counter begins to count from N once again, and then the output one-shot pulse will be widened. When the count reduction of the counter has not yet reached zero, but it is given a new value N1. Only when it is the rising edge of GATE, the counter starts to count from N1.

Time diagram is shown in Figure 2.

Mode 1

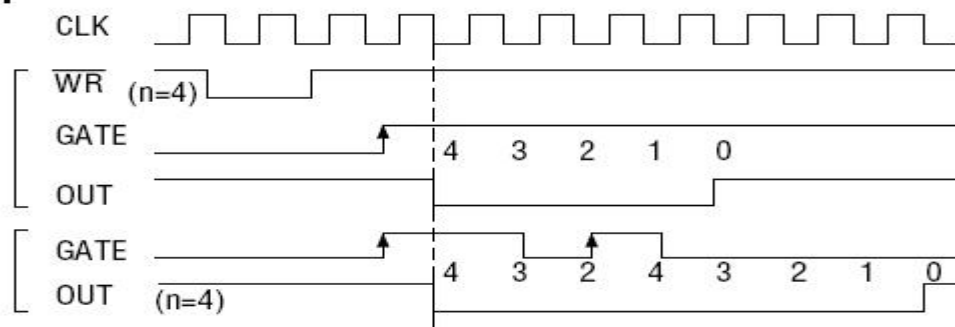


Figure 2

Mode 2: Rate Generator

Under this mode, the counter is given the initial count value N and begins to count from (N-1), OUT becomes high level. When the count value becomes 0, OUT turns into low level. After a CLK cycle, OUT resumes high level, and the counter automatically load the initial value N and begin to count from (N-1). Thus the output will continue to output a negative pulse, its width is equal to one clock cycle, the clock number between the two negative pulses is equal to the initial value that is given to the counter. GATE=1 enables counting; GATE=0 disables counting. GATE has no effect on OUT. If change the initial count when counting, it will be effective next time.

Time diagram is shown in figure 3.

Mode 2

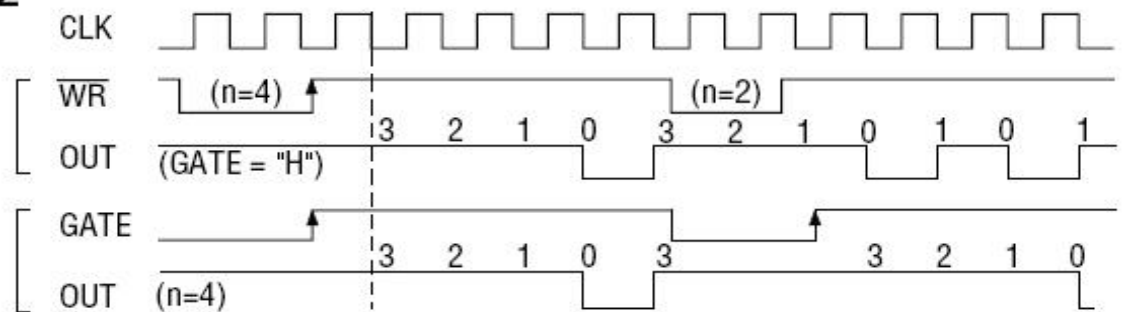


Figure 3

Mode 3: Square wave mode

Similar to Mode 2, the counter is given the initial count value N and begins to count from (N-1). When the signal of GATE is high level, it starts to count, timer/counter begins to count by subtracting “1” each time, more than half the initial count value. The output OUT has remained high level, when the count value is more than half of the initial count value; but the output OUT becomes low level, when the count value is less than half of the initial value. If the initial count value N is an even number, the output is 1:1 square-wave; if the initial count value N is an odd number, the output OUT has remained high level during the previous $(n+1)/2$ count period; but the output OUT becomes low level during the post $(n-1)/2$ count period, that is, the high level has one clock cycle more than the low level. If change the initial count when counting, it will be effective next time. When GATE = 0, the count is prohibited, when GATE = 1, the count is permitted. Time diagram is shown in figure 4.

Mode 3

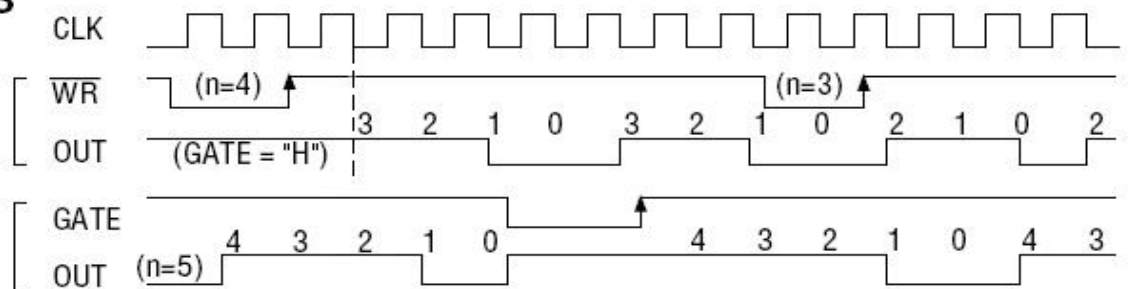


Figure 4

Mode 4: Software triggered strobe

Under this mode, the counter is given the initial count value N and begins to count, the output OUT becomes high level. When the count value becomes 0, it immediately outputs a negative pulse which is equal to the width of one clock cycle. If given a new count value when counting, it will be effective immediately. GATE=1 enables counting; GATE=0 disables counting. GATE has no effect on OUT. Time diagram is shown in figure 5.

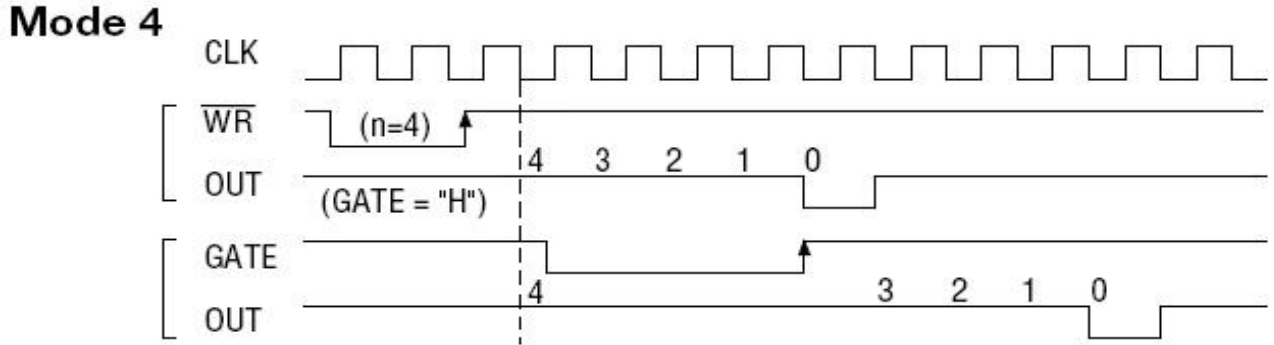


Figure 5

Mode 5: Hardware triggered strobe

Under this mode, when the signal of GATE is on the rising edge, the counter starts to count (so it is called hardware trigger), the output OUT has remained high level. When the count value becomes 0, it outputs a negative pulse which is equal to the width of one clock cycle. And then the rising edge of GATE signal can re-trigger, the counter starts to count from the initial count value again, in the count period, the output has remained high level. When the count reduction of the counter has not yet reached zero, but it is given a new value N1. Only when it is the rising edge of GATE, the counter starts to count from N1. Time diagram is shown in figure 6.

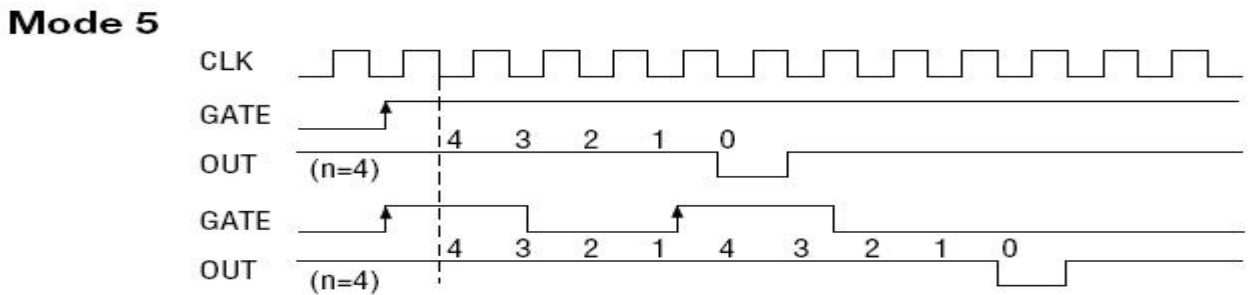


Figure 6

Chapter6 Notes, Calibration and Warranty Policy

6.1 Notes

In our products' packing, user can find a user manual, a PCI8932 module and a quality guarantee card. Users must keep quality guarantee card carefully, if the products have some problems and need repairing, please send products together with quality guarantee card to ART, we will provide good after-sale service and solve the problem as quickly as we can.

When using PCI8932, in order to prevent the IC (chip) from electrostatic harm, please do not touch IC (chip) in the front panel of PCI8932 module.

6.2 Analog Signal Input Calibration

Every device has to be calibrated before sending from the factory. It is necessary to calibrate the module again if users want to after using for a period of time or changing the input range. PCI8932 default input range: $\pm 10V$, in the manual, we introduce how to calibrate PCI8932 in $\pm 10V$, calibrations of other input ranges are similar.

Prepare a digital voltage instrument which the resolution is more than 5.5 bit, install the PCI8932 module, and then power on, warm-up for fifteen minutes.

- 1) Zero adjustment: select one channel of analog inputs, take the channel AI0 for example, connect 0V to AI0, and then run ART Data Acquisition Measurement Suite in the WINDOWS. Choose channel 0, $\pm 10V$ input range and start sampling, adjust potentiometer RP2 in order to make voltage value is 0.000V or about 0.000V. Zero adjustment of other channels is alike.
- 2) Full-scale adjustment: select one channel of analog inputs, take the channel AI0 for example, connect 9995.11mV to AI0, and then run ART Data Acquisition Measurement Suite in the WINDOWS. Choose channel 0, $\pm 10V$ input range and start sampling, adjust potentiometer RP1 in order to make voltage value is 9995.11mV or about 9995.11mV. Full-scale adjustment of other channels is alike.
- 3) Repeat steps above until meet the requirement.

6.3 Analog Signal Output Calibration

In the manual, we introduce how to calibrate PCI8932 in $\pm 10V$ input range; calibrations of other input ranges are similar.

- 1) Connect the ground of Digital Voltage Meter to any analog (AGND) of CN1 37-core D-type plug, and connect the Voltage Meter Input to the DA channels that need calibration. Run PCI8932 testing procedure under Windows, select the DA output detection.
- 2) To set analog output to 0V, by adjusting the zero potentiometer (RP4, RP7, RP3, RP8), so that the corresponding output is 0.000V.
- 3) To set analog output to 9995.11V, by adjusting the full-scale potentiometer (RP6, RP9, RP5, RP10), so that the corresponding output is 9995.11V.
- 4) Repeat the above step 2), step 3), until meet the requirement.

6.4 DA use

In demonstration program, the continuous output interval of waveform output can not be carried out; the main objective is to test the strength of DA output.

6.5 Warranty Policy

Thank you for choosing ART. To understand your rights and enjoy all the after-sales services we offer, please read the following carefully.

1. Before using ART's products please read the user manual and follow the instructions exactly. When sending in damaged products for repair, please attach an RMA application form which can be downloaded from: www.art-control.com.
2. All ART products come with a limited two-year warranty:
 - The warranty period starts on the day the product is shipped from ART's factory
 - For products containing storage devices (hard drives, flash cards, etc.), please back up your data before sending them for repair. ART is not responsible for any loss of data.
 - Please ensure the use of properly licensed software with our systems. ART does not condone the use of pirated software and will not service systems using such software. ART will not be held legally responsible for products shipped with unlicensed software installed by the user.
3. Our repair service is not covered by ART's guarantee in the following situations:
 - Damage caused by not following instructions in the User's Manual.
 - Damage caused by carelessness on the user's part during product transportation.
 - Damage caused by unsuitable storage environments (i.e. high temperatures, high humidity, or volatile chemicals).
 - Damage from improper repair by unauthorized ART technicians.
 - Products with altered and/or damaged serial numbers are not entitled to our service.
4. Customers are responsible for shipping costs to transport damaged products to our company or sales office.
5. To ensure the speed and quality of product repair, please download an RMA application form from our company website.

Products Rapid Installation and Self-check

Rapid Installation

Product-driven procedure is the operating system adaptive installation mode. After inserting the disc, you can select the appropriate board type on the pop-up interface, click the button **【driver installation】** ; or select CD-ROM drive in Resource Explorer, locate the product catalog and enter into the APP folder, and implement Setup.exe file. After the installation, pop-up CD-ROM, shut off your computer, insert the PCI card. If it is a USB product, it can be directly inserted into the device. When the system prompts that it finds a new hardware, you do not specify a drive path, the operating system can automatically look up it from the system directory, and then you can complete the installation.

Self-check

At this moment, there should be installation information of the installed device in the Device Manager (when the device does not work, you can check this item.). Open "Start -> Programs -> ART Demonstration Monitoring and Control System -> Corresponding Board -> Advanced Testing Presentation System", the program is a standard testing procedure. Based on the specification of Pin definition, connect the signal acquisition data and test whether AD is normal or not. Connect the input pins to the corresponding output pins and use the testing procedure to test whether the switch is normal or not.

Delete Wrong Installation

When you select the wrong drive, or viruses lead to driver error, you can carry out the following operations: In Resource Explorer, open CD-ROM drive, run Others-> SUPPORT-> PCI.bat procedures, and delete the hardware information that relevant to our boards, and then carry out the process of section I all over again, we can complete the new installation.