PCI8757
User's Manual

Beijing ART Technology Development Co., Ltd.

Contents

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 PCI8757 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 PCI8757 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 PCI8757 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.

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.

➢ PCI8757 Data Acquisition Board
➢ ART Disk
    a) user's manual (pdf)
    b) drive
    c) catalog
➢ Warranty Card

FEATURES

Analog Input

➢ Input Range: ±10V, ±5V, ±2.5, 0~10V, 0~5V
➢ 16-bit resolution
➢ Sampling Rate: 3Hz~800KHz

Note: The actual channel sampling rate = sampling rate (Synchronous sampling)

    Frequency Formula: sampling frequency= main frequency/the number of frequency division, main frequency = 50MHz, 32-bit frequency division, the number of frequency division range: 63~16666667.

➢ Input Channels: 4
➢ Analog Input Mode: Differential Input
➢ Chips Number: 4
➢ Data Read Mode: non-empty, half-full inquiry mode, interrupt mode and DMA mode
➢ FIFO Size: 8K word
➢ Memory Signs: full, non-empty and half-full
➢ Clock Source: Internal clock and external clock
➢ Trigger Mode: software trigger, hardware trigger(external trigger)
➢ Trigger Source: ATR, DTR, CONVST_IN
➢ Trigger Type: level trigger, edge trigger

- Trigger Direction: negative, positive, either positive or negative trigger
- Trigger Level: 0~10V
- Analog Trigger Source (ATR)Input Range: 0~10V
- Digital Trigger Source (DTR): TTL
- Trigger Source DTR Input Range: standard TTL level
- AD Conversion Time: ≤1.25us
- Analog Input Impedance: 10MΩ
- Non-linear error: ±3LSB(Maximum)
- System Measurement Accuracy: 0.01%
- Operating Temperature Range: 0℃~50℃
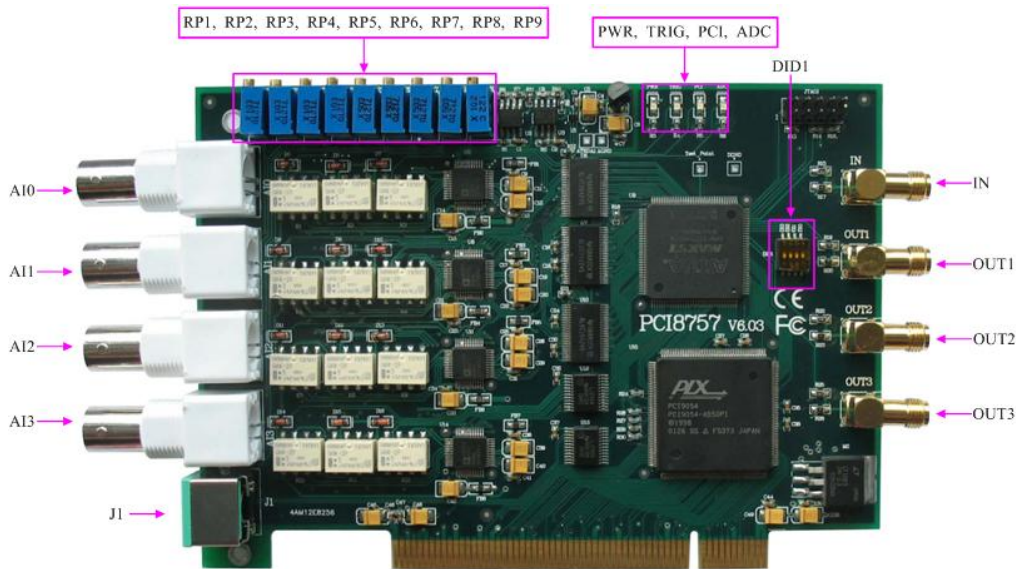- Storage Temperature Range: -20℃~70℃

Other features

Board Clock Oscillation: 50MHz

Dimension

143.6mm(L) * 102mm(W)*18mm(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

AI0, AI1, AI2, and AI3: Analog signal input ports

J1: Analog signal input and output port

IN: Sync pulse signal input ports

OUT1, OUT2, and OUT3: Sync pulse signal output port

2.2.2 Potentiometer

RP1: AI0 analog signal input zero-point adjustment potentiometer

RP2: AI1 analog signal input zero-point adjustment potentiometer

RP3: AI2 analog signal input zero-point adjustment potentiometer

RP4: AI3 analog signal input zero-point adjustment potentiometer

RP5: AI0 analog signal input full-scale adjustment potentiometer

RP6: AI1 analog signal input full-scale adjustment potentiometer

RP7: AI2 analog signal input full-scale adjustment potentiometer

RP8: AI3 analog signal input full-scale adjustment potentiometer

RP9: Trigger level adjustment potentiometer

2.2.3 Physical ID of DIP Switch

DID1: Set physical ID number. When the PC is installed more than one PCI8757 , 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-bit 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 softwares of the company often use the logic ID management equipments and at this moment the physical ID DIP switch is invalid. If you want to use more than one device that are the same type in the same system at the same time, please use the physical ID as much as possible. As for the differences between logic ID and physical ID, please refer to the function explanations of "CreateDevice" and "CreateDeviceEx" of *The Prototype Explanation of Device Object Management Function* in *PCI8757S* software specification).
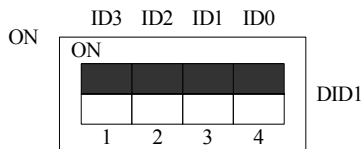
The above chart shows"1111", so it means that the physical ID is 15.
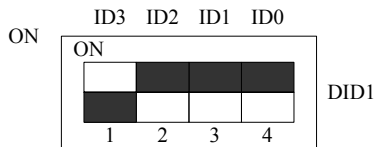
The above chart shows"0111", so it means that the physical ID is 7.
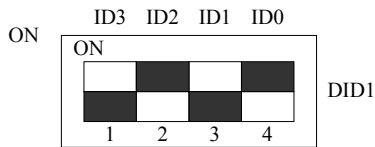
The above chart shows"0101", so it means that the physical ID is 5.

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

2.2.4 Status Indicator

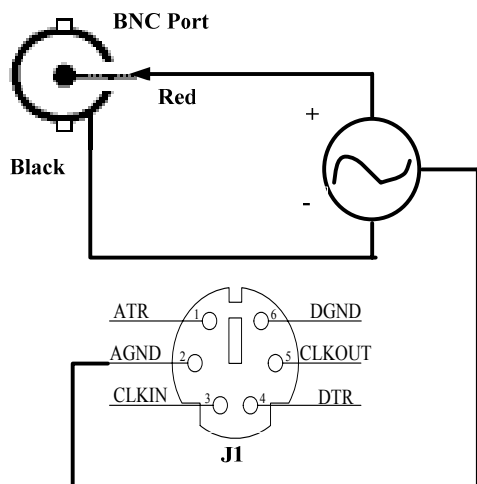PWR: Power supply status indicator

TRIG: Trigger status indicator

PCI: Overflow status indicator

ADC: A/D working status indicator

Chapter 3 Signal Connectors

3.1 Analog Input Connector (Differential Input)

3.2 Signal Input/Output Connector
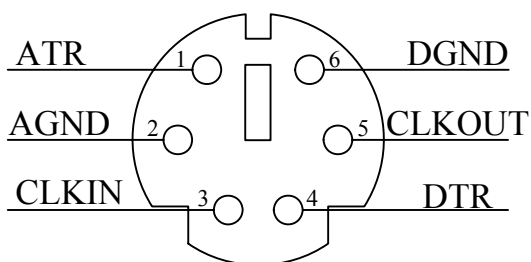
Pin definition

Pin	Name	Color	Description
1	ATR	Red	Analog trigger signal input.
2	AGND	White	Analog ground.
3	CLKIN	Green	External clock input.
4	DTR	Yellow	Digital trigger signal input.
5	CLKOUT	Blue	Internal clock output.
6	DGND	Black	Digital ground.

3.3 Sync pulse signal input

IN

DGND
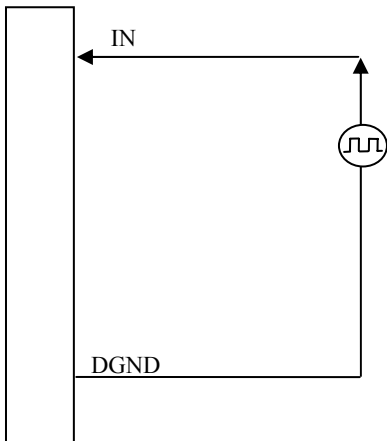
3.4 Sync pulse signal output

OUT1

OUT2

OUT3

DGND
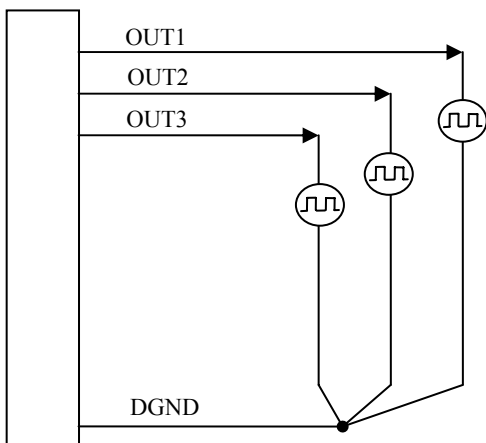
3.5 Clock input/output and trigger signal

CLKOUT

CLKIN

DTR

ATR

AGND

DGND
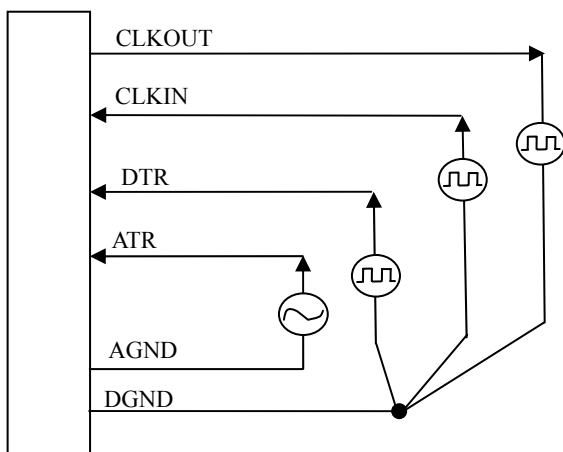
3.6 Methods of Realizing the Multi-card Synchronization

Three methods can realize the synchronization for the PCI8757, the first method is using the cascade master-slave card, the second one is using the common external trigger, and the last one is using the common external clock.

When using master-slave cascade card programs, the master card generally uses the internal clock source model, while the slave card uses the external clock source mode. After the master card and the slave card are initialized according to the corresponding clock source mode. At first, start all the slave cards, as the main card has not been activated and there is no output clock signal, so the slave card enters the wait state until the main card was activated. At this moment, the multi-card synchronization has been realized. When you need to sample more than channels of a card, you could consider using the multi-card cascaded model to expand the number of channels.
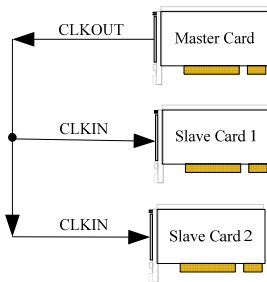
When using the common external trigger, please make sure all parameters of different PCI8757 are the same. At first, configure hardware parameters, and use analog or digital signal triggering (ATR or DTR), then connect the signal that will be sampled by PCI8757, input triggering
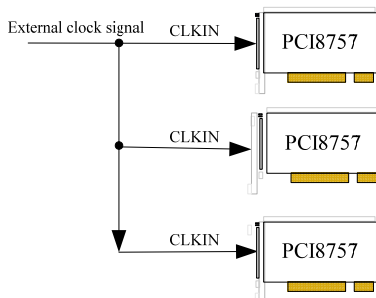
signal from ART pin or DTR pin, then click "Start Sampling" button, at this time, PCI8757 does not sample any signal but waits for external trigger signal. When each module is waiting for external trigger signal, use the common external trigger signal to startup modules, at last, we can realize synchronization data acquisition in this way. See the following figure:
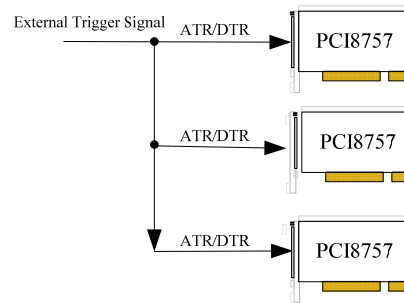
Note: when using the DTR, use the internal clock mode

When using the common external clock trigger, please make sure all parameters of different PCI8757 are the same. At first, configure hardware parameters, and use external clock, then connect the signal that will be sampled by PCI8757, input trigger signal from ART pin or DTR pin, then click "Start Sampling" button, at this time, PCI8757 does not sample any signal, but wait for external clock signal. When each module is waiting for external clock signal, use the common external clock signal to startup modules, at last, we realize synchronization data acquisition in this way. See the following figure:

Chapter 4 The Instruction Trigger Function

4.1 Internal Trigger Mode

When A/D is in the initialization, if the A/D hardware parameter ADPara.TriggerMode = PCI8757_TRIGMODE_SOFT, we can achieve the internal trigger acquisition. In this function, when calling the StartDeviceProAD function, it will generate A/D start pulse, A/D immediately access to the conversion process and not wait for the conditions of any other external hardware. It also can be interpreted as the software trigger.

As for the specific process, please see the figure below, the cycle of the A/D work pulse is decided by the sampling frequency.

Start Enable

Convert Pulse

The first working pulse after the A/D start pulse
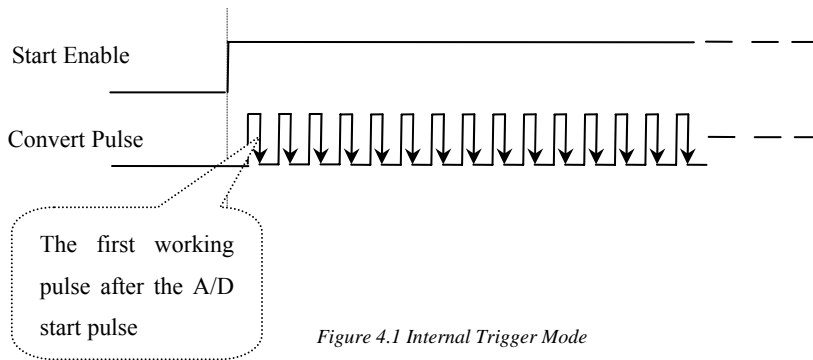
Figure 4.1 Internal Trigger Mode

4.2 External Trigger Mode

When A/D is in the initialization, if the A/D hardware parameter ADPara.TriggerMode = PCI8757_TRIGMODE_POST, we can achieve the external trigger acquisition. In this function, when calling the StartDeviceProAD function, AD will not immediately access to the conversion process but wait for the external trigger source signals accord with the condition, then start converting the data. It also can be interpreted as the hardware trigger. Trigger source includes the DTR (Digital Trigger Source) and ATR (Analog Trigger Source)

The trigger modes include the edge trigger and level trigger.

（一） **ATR Trigger**

ATR

Result

Trigger Level   Comparer

Figure 4.2 Analog compare

(1) Edge trigger function

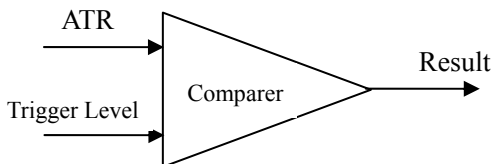Edge trigger is to capture the characteristics of the changes between the trigger source signal and the trigger level signal to trigger AD conversion. When TriggerType=PCI8757_TRIGTYPE_EDGE, it is the edge trigger type.

When ADPara.TriggerDir = PCI8757_TRIGDIR_NEGATIVE, choose the trigger mode as the falling edge trigger. That is, when the ATR trigger signal is on the falling edge, AD will immediately access to the conversion process, and its follow-up changes have no effect on AD acquisition.
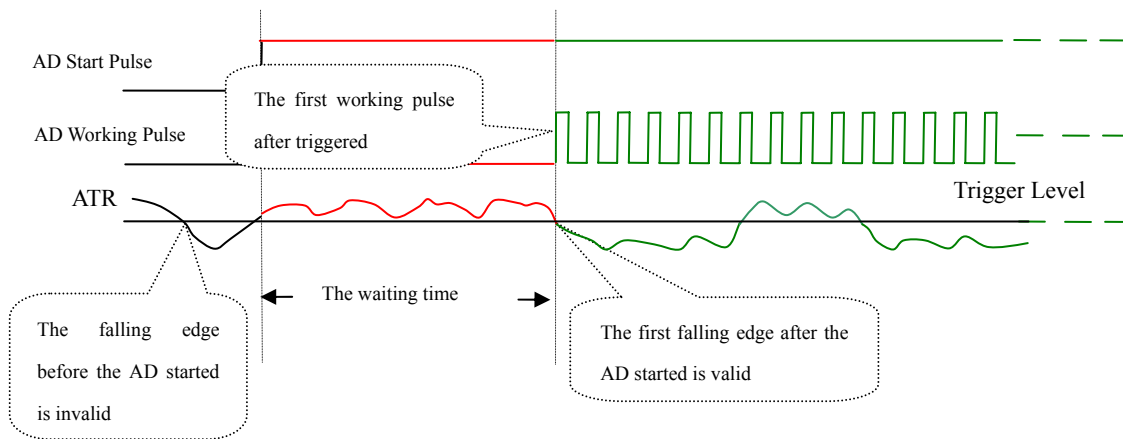

Figure 4.3 Falling edge Trigger

When ADPara.TriggerDir = PCI8757_TRIGDIR_POSITIVE, choose the trigger mode as rising edge trigger. That is, when the ATR trigger signal is on the rising edge, AD will immediately access to the conversion process, and its follow-up changes have no effect on AD acquisition.

When ADPara.TriggerDir = PCI8757_TRIGDIR_POSIT_NEGAT, choose the trigger mode as rising or falling edge trigger. That is, when the ATR trigger signal is on the rising or falling edge, AD will immediately access to the conversion process, and its follow-up changes have no effect on AD acquisition. This function can be used in the case that the acquisition will occur if the exoteric signal changes.

（2）Triggering level function

Level trigger is to capture the condition that trigger signal is higher or lower than the trigger level to trigger AD conversion. When ADPara.TriggerType = PCI8757_TRIGTYPE_PULSE, it is level trigger type.

When ADPara.TriggerDir = PCI8757_TRIGDIR_NEGATIVE, AD is in the conversion process if the ATR is lower than the trigger level. And AD conversion will automatically stop if the ATR is higher than the trigger level. AD's work status changes with changes of ATR.
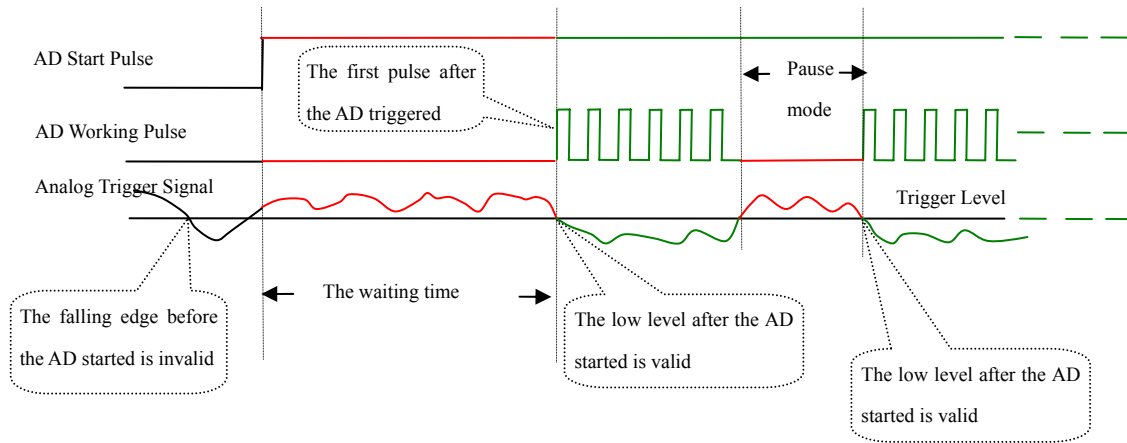
Figure 4.4 Low Level Trigger

When ADPara.TriggerDir = PCI8757_TRIGDIR_POSITIVE, AD is in the conversion process if the ATR is higher than the trigger level. And AD conversion will automatically stop if the ATR is lower than the trigger level. AD's work status changes with changes of ATR.

When ADPara.TriggerDir = PCI8757_TRIGDIR_POSIT_NEGAT, it means the trigger level is low. The effect is the same as the internal software trigger.

When the trigger signal is the analog signal, using the ATR trigger source. Trigger level needs to be set when using the ATR trigger source, two channels' output voltages of DA (AO0 and AO1) codetermines the trigger level; in this case, we need set 0-channel output voltage higher than 1-channel output voltage. There are two trigger types: edge trigger and level trigger

(二) **DTR Trigger**
(1) Edge trigger function

Edge trigger is to capture the characteristics of the changes between the trigger source signal and the trigger level signal to trigger A/D conversion.

When TriggerType = PCI8757_TRIGTYPE_EDGE, it is edge trigger.

When ADPara.TriggerDir = PCI8757_TRIGDIR_NEGATIVE, choose the trigger mode as the falling edge trigger. That is, when the trigger signal is on the falling edge, A/D will immediately access to the conversion process, and its follow-up changes have no effect on A/D acquisition.

Figure4.5 Digital Trigger Source，Falling edge Trigger

Figure4.6 Analog Trigger Source，Falling edge Trigger

When ADPara.TriggerDir = USB2815_TRIGDIR_POSITIVE, choose the trigger mode as rising edge trigger. That is, when the trigger signal is on the rising edge, A/D will immediately access to the conversion process, and its follow-up changes have no effect on A/D acquisition.
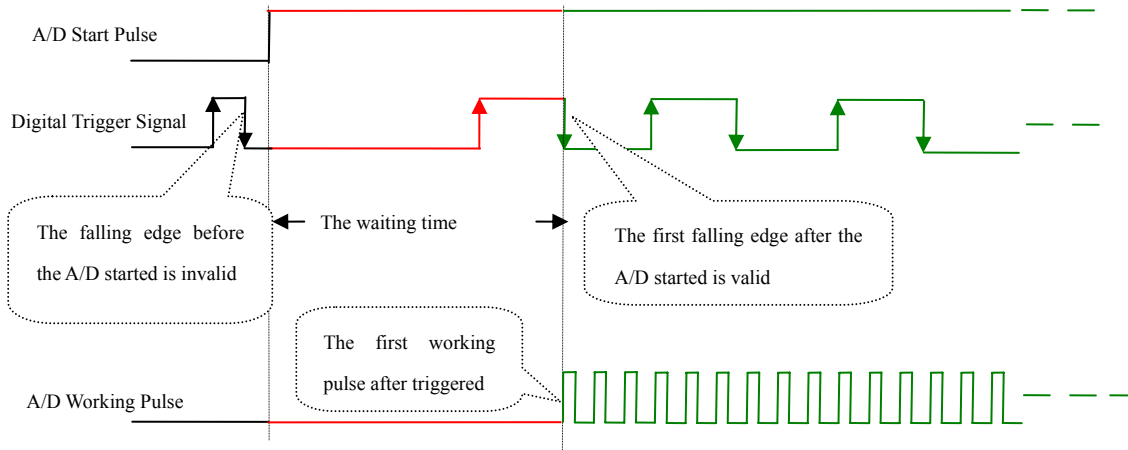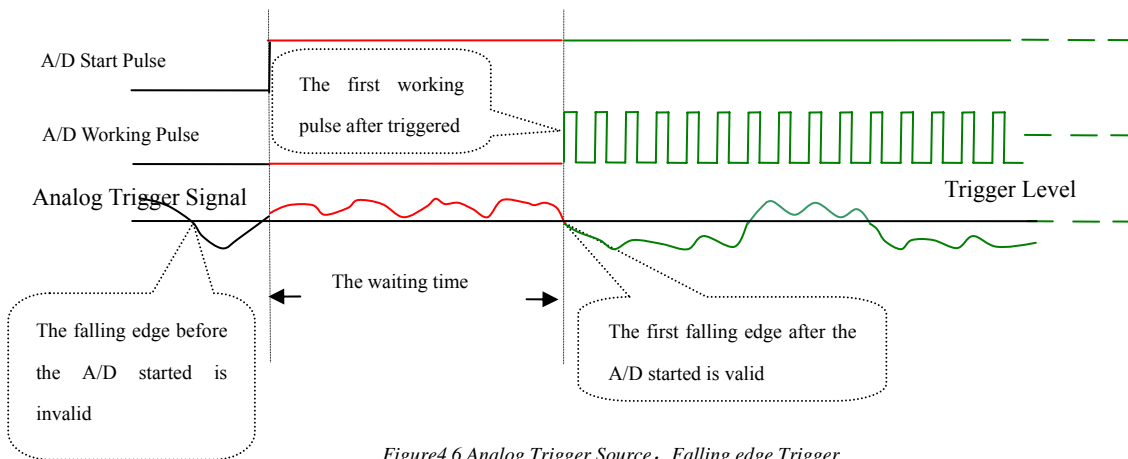
When ADPara.TriggerDir = USB2815_TRIGDIR_POSIT_NEGAT, choose the trigger mode as "either rising or falling edge trigger". That is, when the trigger signal is on the rising or falling edge, A/D will immediately access to the conversion process, and its follow-up changes have no effect on A/D acquisition. This function can be used in the case that the acquisition will occur if the **exoteric** signal changes.

（2）**Level trigger function**

Level trigger is to capture the condition that trigger signal is higher or lower than the trigger level to trigger AD conversion.
When ADPara.TriggerType = PCI8757_TRIGTYPE_PULSE, it is level trigger.
When ADPara.TriggerDir = PCI8757_TRIGDIR_ NEGATIVE, it means the trigger level is low. When trigger signal is low level, AD is in the conversion process, once the trigger signal is in the high level, A/D conversion will

automatically stop, when the trigger signal is in the low level again, A/D will re-access to the conversion process that is, only converting the data when the trigger signal is in the low level.

Figure4.7 Digital Trigger Source，High Level Trigger
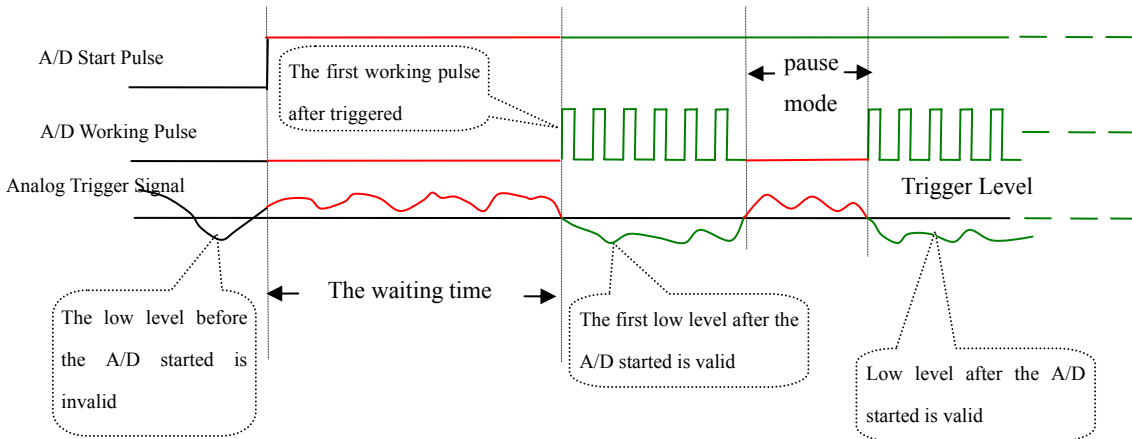
Figure4.8 Digital   Trigger Source，Low Level Trigger

When ADPara.TriggerDir = PCI8757_TRIGDIR_POSITIVE, it means the trigger level is high. When trigger signal is in high level, A/D is in the conversion process, once the trigger signal is in the low level, A/D conversion will automatically stop, when the trigger signal is in the high level again, A/D will re-access to the conversion process, that is, only converting the data when the trigger signal is in the high level.
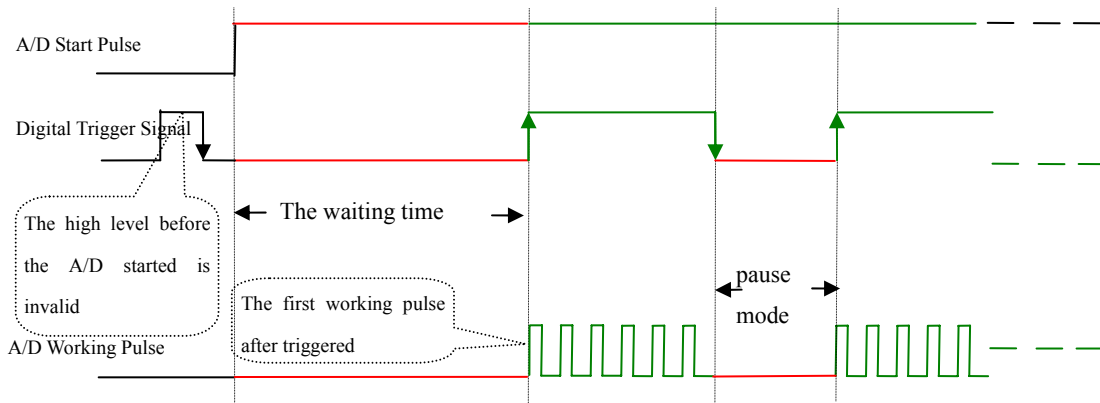
When ADPara.TriggerDir = PCI8757_TRIGDIR_POSIT_NEGAT, it means the trigger level is low. The effect is the same as choosing the internal software trigger.

Chapter 5 Methods of using Internal and External Clock Function

5.1 Internal Clock Function

Internal Clock Function refers to the use of on-board clock oscillator and the clock signals which are produced by the user-specified frequency to trigger the A/D conversion regularly. To use the clock function, the hardware parameters ADPara.ClockSource = PCI8757 _CLOCKSRC_IN should be installed in the software. The frequency of the clock in the software depends on the hardware parameters ADPara.Frequency. For example, if Frequency = 100000, that means A/D work frequency is 100000Hz (that is, 100 KHz, 10uS/point).

5.2 External Clock Function

External Clock Function refers to the use of the outside clock signals to trigger the A/D conversion regularly. The clock signals are provide by the CLKIN pin. The outside clock can be provided by PCI8757 clock output (CLKOUT), as well as other equipments, for example clock frequency generators. To use the external clock function, the hardware parameters ADPara.ClockSource = PCI8757_CLOCKSRC_OUT should be installed in the software. The clock frequency depends on the frequency of the external clock, and the clock frequency on-board (that is, the frequency depends on the hardware parameters ADPara.Frequency) only functions in the packet acquisition mode and its sampling frequency of the A/D is fully controlled by the external clock frequency.

Chapter 6 Notes, Calibration and Warranty Policy

6.1 Notes

In our products' packing, user can find a user manual, a PCI8757 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 PCI8757, in order to prevent the IC (chip) from electrostatic harm, please do not touch IC (chip) in the front panel of PCI8757 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. PCI8757 default input range: ±10V, in the manual, we introduce how to calibrate PCI8757 in ±10V, calibrations of other input ranges are similar.

Prepare a digital voltage instrument which the resolution is more than 5.5 bit, install the PCI8757 module, and then power on, warm-up for fifteen minutes.

1) Zero adjustment: Select AI0; connect a DC voltage source with value equal to 0V to AI0.Adjust RP1 until the input value 0.000V. RP2, RP3, RP4 correspond to AI1, AI2, AI3.

2) Full-scale adjustment: Select AI0; connect a DC voltage source with value equal to 9999.69mV to AI0. Adjust RP5 until the input value 9999.69mV. RP6, RP7, RP8 correspond to AI1, AI2, AI3.

3) Repeat steps above until meet the requirement.

6.3 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.