MIC-3714

Simultaneous 4-CH Analog Input Card for the CompactPCI

User Manual

CE notification

The MIC-3714, developed by ADVANTECH CO., LTD., has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

On-line Technical Support

For technical support and service, please visit our support website at:

http://www.advantech.com/support

Part No. 2003371400 1st Edition

Printed in Taiwan December 2005

Product Warranty (2 years)

Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

Declaration of Conformity

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

FCC Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Class B

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

• Consult the dealer or an experienced radio/TV technician for help.

FM

The MIC-3714 has passed the FM certification. According to the National Fire Protection Association, work sites are classified into different classes, divisions and groups, based on hazard considerations. MIC-3714 is compliant with the specifications of Class I, Division 2, Groups A, B, C and D indoor hazards.

Technical Support and Assistance

Step 1. Visit the Advantech web site at **www.advantech.com/support** where you can find the latest information about the product.

Step 2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
- Product name and serial number
- Description of your peripheral attachments
- Description of your software (operating system, version, application software, etc.)
- A complete description of the problem
- The exact wording of any error messages

Document Feedback

To assist us in making improvements to this manual, we would welcome comments and constructive criticism. Please send all such - in writing to: support@advantech.com

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User's Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.

6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:

a. The power cord or plug is damaged.

b. Liquid has penetrated into the equipment.

c. The equipment has been exposed to moisture.

d. The equipment does not work well, or you cannot get it to work according to the user's manual.

e. The equipment has been dropped and damaged.

f. The equipment has obvious signs of breakage.

15. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.
16. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.

The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Wichtige Sicherheishinweise

1. 1. Bitte lesen sie Sich diese Hinweise sorgfältig durch.
2. Heben Sie diese Anleitung für den späteren Gebrauch auf.
3. Vor jedem Reinigen ist das Gerät vom Stromnetz zu trennen. Verwenden Sie Keine Flüssig-oder Aerosolreiniger. Am besten dient ein angefeuchtetes Tuch zur Reinigung.
4. Die NetzanschluBsteckdose soll nahe dem Gerät angebracht und leicht zugänglich sein.
5. Das Gerät ist vor Feuchtigkeit zu schützen.
6. Bei der Aufstellung des Gerätes ist auf sicheren Stand zu achten. Ein Kippen oder Fallen könnte Verletzungen hervorrufen.
7. Die Belüftungsöffnungen dienen zur Luftzirkulation die das Gerät vor überhitzung schützt. Sorgen Sie dafür, daB diese Öffnungen nicht abgedeckt werden.
8. Beachten Sie beim. AnschluB an das Stromnetz die AnschluBwerte.
9. Verlegen Sie die NetzanschluBleitung so, daB niemand darüber fallen kann. Es sollte auch nichts auf der Leitung abgestellt werden.
10. Alle Hinweise und Warnungen die sich am Geräten befinden sind zu beachten.
11. Wird das Gerät über einen längeren Zeitraum nicht benutzt, sollten Sie es vom Stromnetz trennen. Somit wird im Falle einer Überspannung eine Beschädigung vermieden.
12. Durch die Lüftungsöffnungen dürfen niemals Gegenstände oder Flüssigkeiten in das Gerät gelangen. Dies könnte einen Brand bzw. elektrischen Schlag auslösen.
13. Öffnen Sie niemals das Gerät. Das Gerät darf aus Gründen der elektrischen Sicherheit nur von authorisiertem Servicepersonal geöffnet werden.
14. Wenn folgende Situationen auftreten ist das Gerät vom Stromnetz zu trennen und von einer qualifizierten Servicestelle zu überprüfen:

a - Netzkabel oder Netzstecker sind beschädigt.

b - Flüssigkeit ist in das Gerät eingedrungen.

c - Das Gerät war Feuchtigkeit ausgesetzt.

d - Wenn das Gerät nicht der Bedienungsanleitung entsprechend funktioniert oder Sie mit Hilfe dieser Anleitung keine Verbesserung erzielen.

e - Das Gerät ist gefallen und/oder das Gehäuse ist beschädigt.

f - Wenn das Gerät deutliche Anzeichen eines Defektes aufweist.

15. VOSICHT: Explisionsgefahr bei unsachgemaben Austausch der Batterie.Ersatz nur durch densellben order einem vom Hersteller empfohlene-mahnlichen Typ. Entsorgung gebrauchter Batterien navh Angaben des Herstellers.

16. ACHTUNG: Es besteht die Explosionsgefahr, falls die Batterie auf nicht fach-männische Weise gewechselt wird. Verfangen Sie die Batterie nur gleicher oder entsprechender Type, wie vom Hersteller empfohlen. Entsorgen Sie Batterien nach Anweisung des Herstellers.

Der arbeitsplatzbezogene Schalldruckpegel nach DIN 45 635 Teil 1000 beträgt 70dB(A) oder weiger.

Haftungsausschluss: Die Bedienungsanleitungen wurden entsprechend der IEC-704-1 erstellt. Advantech lehnt jegliche Verantwortung für die Richtigkeit der in diesem Zusammenhang getätigten Aussagen ab.

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

1. To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.
2. Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

Contents

Chapter 1 Introduction 2

1.1 Features 2
1.2 Applications 3
1.3 Installation Guide 4
Figure 1.1:Installation Flow Chart 5
1.4 Software Overview 6
1.5 Device Drivers Roadmap 7
1.6 Accessories 9

Chapter 2 Installation 12

2.1 Unpacking 12
2.2 Driver Installation 13
Figure 2.1:Automation Software Setup Screen 14
Figure 2.2:Options for Driver Setup 14
2.3 Hardware Installation 15
2.3.1 Installing a CompactPCI Card: 15
2.4 Device Setup & Configuration 16
Figure 2.3:The Device Manager Dialog Box 17
Figure 2.4:Device Names in the Device Box 18
2.5 Device Testing 18
Figure 2.5:Device Test Dialog Box 19
Figure 2.6:Analog Input Tab 20

Chapter 3 Signal Connections 22

3.1 Overview 22
3.2 Switch and Jumper Settings 22
Figure 3.1:Connector, Jumper, and Switch Locations . 22
Figure 3.2:Power on Config. After Hot Reset (JP1) 23
3.3 Signal Connections 24
Figure 3.3:I/O Connector Pin Assignment 24

Chapter 4 Principles of Operation 26

4.1 Analog Input Range and Gains 26
4.2 Analog Input Acquisition Modes 26
Figure 4.1:Post-Trigger Acquisition Mode 27
Figure 4.2:Delay-Trigger Acquisition Mode 28
Figure 4.3:About-Trigger Acquisition Mode 29
Figure 4.4:Pre-Trigger Acquisition Mode 29
4.3 A/D Sample Clock Sources 30
Figure 4.5: MIC-3714 Sample Clock Sources 31
4.4 Trigger Sources 31
4.5 Analog Input Data Format 32

Chapter 5 Calibration 34

Figure 5.1: Setup Button launches the Device Setting 34
Figure 5.2:Calibration Button launches Calibration 35

Figure 5.3:Start-up Window for Offset Calibration 36
Figure 5.4:Adjustment of Offset Calibration 36
Figure 5.5:Offset Calibration Success 37
Figure 5.6:Offset Calibration Failed 38
Figure 5.7:Start-up Window for Gain Calibration 38
Figure 5.8: Adjustment Process for Gain Calibration .. 39
Figure 5.9:Gain Calibration Success 39
Figure 5.10:Gain Calibration Failed 40
Figure 5.11:Calibration Procedure Completed 40

Appendix A Specifications 42

Appendix B Block Diagram 46

Appendix C Register Structure & Format 48

C.1 Overview 48
C.2 Register Format 48
C.3 A/D SW Trigger 53
C.4 AI Range Control 54
C.5 A/D Converter Enable 55
C.6 Clock Source and Divider 56
C.7 Trigger Mode and Source 57
C.8 FIFO Control 59
C.9 FIFO Status 59
C.10 FIFO for Programmable Flag 61
C.11 DMA Counter 62
C.12 Interrupt Control/Flag 63
C.13 Clear Interrupt 64
C.14 Analog Trigger Threshold Voltage 65
C.15 Calibration Command 66
C.16 Board ID 67
C.17 Reset DMA Start Channel to CH0 67
C.18 AD Channel nDATA 68
C.19 DMA Request Selector 69

CHAPTER 1

Introduction

Sections include:

- Features
- Applications
- Installation Guide
- Software Overview
- Device Drivers Roadmap
- Accesories

Chapter 1 Introduction

Thank you for buying the Advantech MIC-3714. MIC-3714 is a 30MHz Simultaneous 4-CH Analog Input Card for the PCI bus. It is an advanced-performance data acquisition card based on 32-bit CompactPCI architecture. The maximum sampling rate of MIC-3714 is up to 30MHz samples per second, with an emphasis on continuous, non-stop, high-speed, streaming data of A/D samples to host memory.

The following sections of this chapter will provide further information about features of the multifunction cards, a Quick Start for installation, together with some brief information on software and accessories for the MIC-3714 card.

1.1 Features

The Advantech MIC-3714 offers the following main features:

- 32-bit PCI-Bus Mastering DMA data transfer
- 4 A/D converters simultaneously sampling
- 12-bit A/D converter up to 30M samples per second
- 4 single-ended analog input channels
- Programmable gain for each input channel
- On board FIFO memory
- Multiple A/D triggering modes
- Programmable pacer/counter
- Auto calibration

Some of them are highlighted and more detailed, such as the following:

PCI-Bus Mastering Data Transfer

MIC-3714 supports PCI-Bus mastering DMA for high-speed data transfer. By setting aside a block of memory in the PC, MIC-3714 performs bus-mastering data transfers without CPU intervention, freeing the CPU to perform other more urgent tasks such as data analysis and graphic manipulation. The function allows users to run all I/O functions simultaneously at full speed without losing data.

Simultaneous Sampling

MIC-3714 is capable of simultaneous sampling, and uses 4 identical circuitries and ADC for each analog input channel. Where the time relationship between inputs is important, this feature allows you to sample simultaneously.

S/W, Internal and External Pacer Triggering Supported

MIC-3714 supports three kinds of trigger modes for A/D conversion: software triggering, internal pacer triggering and external pacer triggering. The software trigger allows users to acquire a sample when needed; the internal pacer triggers continuous high-speed data acquisitions. MIC-3714 also accepts external trigger sources, allowing synchronous sampling with external devices.

On-board FIFO Memory

There are 32K samples of FIFO memory on MIC-3714. This is an important feature for fast data transfer and stable performance using Windows OS.

Auto Calibration

MIC-3714 features software auto calibration. There is no variable resister trimming required. This is convenient for user to calibrate.

***Note**: For detailed specifications of the MIC-3714, please refer to Appendix A, Specifications.*

1.2 Applications

The following are some of the possible applications of MIC-3714:

- Testing Instrument
- Ultrasound Imaging
- Gamma Camera Imaging
- CCD Camera Imaging
- Video Digitizing

1.3 Installation Guide

Before you install your MIC-3714 card, please make sure if you have the following necessary components:

MIC-3714 DA&C card	
MIC-3714 User's Manual	This manual
Driver software	Advantech DLL drivers (included in the companion CD-ROM)
Wiring cable	PCL-10901-1, PCL-1010B-1 (optional)
Wiring board	ADAM-3909 (optional)
Computer	Personal computer or workstation with a PCI-bus slot (running Windows 98/2000/XP)

Some other optional components are also available for enhanced operation:

Application software: ActiveDAQ or other 3rd party software packages

After you get the necessary components and maybe some of the accessories for enhanced operation of your Multifunction card, you can then begin the Installation procedures. Fig. 1-1 on the next page provides a concise flow chart to give users a broad picture of the software and hardware installation procedures:

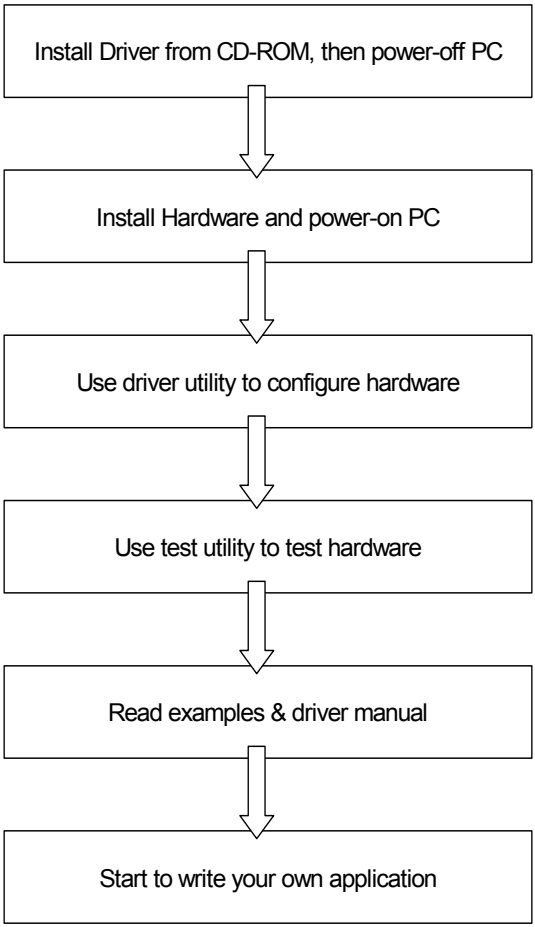


Figure 1.1: Installation Flow Chart

1.4 Software Overview

Advantech offers a rich set of DLL drivers, third-party driver supports and application software to help fully utilize the functions of your MIC-3714 card:

- Device Drivers (on the companion CD-ROM)
- LabVIEW driver

Programming choices for DA&C cards

You may use Advantech application software such as Advantech Device Drivers. On the other hand, advanced users can use another option for register-level programming, although it is not recommended due to its laborious and time-consuming nature.

Device Drivers

The Advantech Device Drivers software is included on the companion CD-ROM at no extra charge. It also comes with all Advantech DA&C cards. Advantech's device drivers feature a complete I/O function library to help boost your application performance. The Advantech Device Drivers for Windows 98/2000/XP work seamlessly with development tools such as Visual C++, Visual Basic, Borland C++ Builder and Borland Delphi.

Register-level Programming

Register-level programming is reserved for experienced programmers who find it necessary to write code directly at the level of device registers. Since register-level programming requires much effort and time, we recommend that you use the Advantech Device Drivers instead. However, if register-level programming is necessary, you should refer to the relevant information in Appendix C, Register Structure and Format, or to the example codes included on the companion CD-ROM.

1.5 Device Drivers Roadmap

This section will provide you a roadmap to demonstrate how to build an application from scratch using Advantech Device Drivers with your favorite development tools such as Visual C++, Visual Basic, Delphi and C++ Builder. The step-by-step instructions on how to build your own applications using each development tool will be given in the Device Drivers Manual. Moreover, a rich set of example source code is also given for your reference.

Programming Tools

Programmers can develop application programs with their favorite development tools:

- Visual C++
- Visual Basic
- Delphi
- C++ Builder

For instructions on how to begin programming work with each development tool, Advantech offers a Tutorial Chapter in the Device Drivers Manual for your reference.

Please refer to the corresponding sections in this chapter of the Device Drivers Manual to begin your programming efforts. You can also look at the example source code provided for each programming tool, since they can get you very well oriented.

The Device Drivers Manual can be found on the companion CD-ROM. Or if you have already installed the Device Drivers on your system, The Device Drivers Manual can be readily accessed through the Start button:

Start/Programs/Advantech eAutomation/Device Manager/Device Driver's Manual

The example source codes could be found under the corresponding installation folder such as the default installation path:

\Program Files\Advantech\ADSAPI\Examples

For information about using other function groups or other development tools, please refer to *Device Driver Programming Guide* chapter and the *Function Reference* chapter on the Device Drivers Manual.

Programming with Device Drivers Function Library

Advantech Device Drivers offers a rich function library to be utilized in various application programs. This function

library consists of numerous APIs that support many development tools, such as Visual C++, Visual Basic, Delphi and C++ Builder.

According to their specific functions or services, those APIs can be categorized into several function groups:

Device Function

Analog Input/Output Function

Digital Input/Output Function

Port I/O Function

Counter Function

Temperature Measurement Function

Alarm Function

Communication port Function

High speed Function

Hardware Function

For the usage and parameters of each function, please refer to the *Function Description* chapter in the Device Drivers Manual.

Troubleshooting Device Drivers Error

Driver functions will return a status code when they are called to perform a certain task for the application. When a function returns a code that is not zero, it means the function has failed to perform its designated function. To troubleshoot the Device Drivers error, you can pass the error code to **DRV_GetErrorMessage** function to return the error message. Or you can refer to the Device Drivers Error Codes Appendix in the Device Drivers Manual for a detailed listing of the Error Code, Error ID and the Error Message.

1.6 Accessories

Advantech offers a complete set of accessory products to support the MIC-3714 card. These accessories include:

Wiring Cable

PCL-10901-1	The PCL-10901-1 cable is specially designed for MIC-3714 cards to connect to the wiring board, ADAM-3909, for external synchronization signal source, such like an external trigger and/or clock signal.
PCL-1010B-1	The PCL-1010B-1 cable is designed for connecting to the signal source. The cable links the MIC-3714 cards with the signal source via the BNC connectors. There are all four BNC ports on board available for simultaneous signal input.

Wiring Board

ADAM-3909	The ADAM-3909 is a DB-9 Wiring Terminal for DIN-rail Mounting. This terminal module can be readily connected to the Advantech PC-Lab cards and allows easy yet reliable access to individual pin connections for the MIC-3714 card.

CHAPTER 2

Installation

Sections include:

- Installation
- Unpacking
- Driver Installation
- Hardware Installation
- Device Setup and Configuration
- Device Testing

Chapter 2 Installation

This chapter gives users a package item checklist, proper instructions about unpacking and step-by-step procedures for both driver and card installation.

2.1 Unpacking

After receiving your MIC-3714 package, please inspect its contents first. The package should contain the following items:

- MIC-3714 card
- Companion CD-ROM (DLL driver included)
- User's Manual

The MIC-3714 card harbors certain electronic components vulnerable to electrostatic discharge (ESD). ESD could easily damage the integrated circuits and certain components if preventive measures are not carefully paid attention to.

Before removing the card from the antistatic plastic bag, you should take following precautions to ward off possible ESD damage:

- Touch the metal part of your computer chassis with your hand to discharge static electricity accumulated on your body. Or use a grounding strap.
- Touch the anti-static bag to a metal part of your computer chassis before opening the bag.
- Take hold of the card only by the metal bracket when removing it from the bag.

After taking out the card, first you should:

Inspect the card for any possible signs of external damage (loose or damaged components, etc.). If the card is visibly damaged, please notify our service department or the local sales representative immediately. Avoid installing a damaged card into your system.

Also, be careful of the following aspects to ensure proper installation:

- Avoid physical contact with materials that could hold static electricity such as plastic, vinyl and Styrofoam.
- Whenever you handle the card, grasp it only by its edges. DO NOT TOUCH the exposed metal pins of the connector or the electronic components.

***Note**: Keep the anti-static bag for future use. You might need the original bag to store the card if you have to remove the card from the PC or transport it elsewhere.*

2.2 Driver Installation

We recommend you to install the driver before you install the MIC-3714 card into your system, since this will guarantee a smooth installation process.

The Advantech Device Drivers setup program for the MIC-3714 card is included on the companion CD-ROM that is shipped with your DA&C card package. Please follow the steps below to install the driver software:

Step 1: Insert the companion CD-ROM into your CD-ROM drive.

Step 2: The Setup program will be launched automatically if you have the AUTORUN function enabled on your system. When the Setup program is launched, you'll see the following setup screen.

***Note:** If the AUTORUN function is not enabled on your computer, use Windows Explorer or the Windows Run command to execute SETUP.EXE on the companion CD-ROM.*

Figure 2.1: Automation Software Setup Screen

Step 3: Select the Individual Drivers option.

Step 4: Select the specific device then just follow the installation instructions step by step to complete your device driver setup.

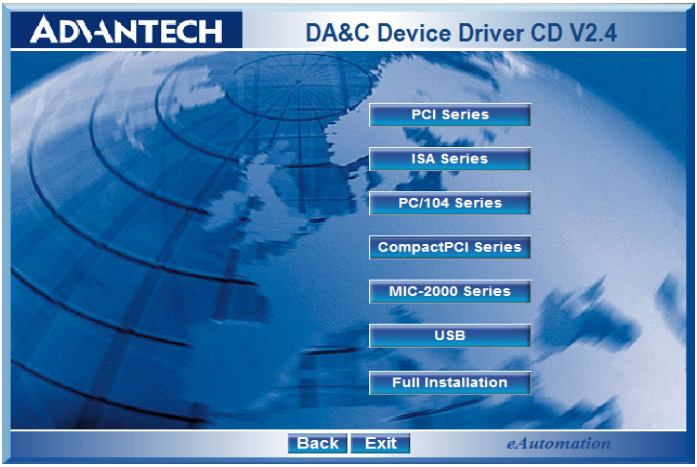


Figure 2.2: Options for Driver Setup

For further information on driver-related issues, an online version of Device Drivers Manual is available by accessing:

Start/Programs/Advantech eAutomation/Device Driver's Manual

2.3 Hardware Installation

***Note**: Make sure you first install the driver before installing the card. We strongly recommend that you install the software driver before installing the hardware into your system, since this will guarantee a smooth and trouble-free installation process. For more information about the driver installation, configuration and removal procedures for Windows 9X, Windows NT, Windows 2000 and Windows XP, please see the Device Driver Manual.*

When installing the MIC-3714 card, please make sure the DLL driver of MIC-3714 installation is completed. You can then go on to install the MIC-3714 card in your CompactPCI system. If you have any doubts, please consult the user manual or related documentation. Please follow the below steps to install the card in your system.

2.3.1 Installing a CompactPCI Card:

Step 1: Remove one cover on the unused slot of your CompactPCI computer slot.

Step 2: Hold the card vertically. Be sure that the card is pointing in the correct direction. The components of the card should be pointing to the right-hand side and the black handle of the card should be pointing to the lower edge of the backplane.

Step 3: Hold the lower handle and pull the handle down to unlock it.

Step 4: Insert the MIC-3714 card into the CompactPCI chassis carefully by sliding the lower edges of the card into the card guides.

Step 5: Push the card into the slot gently by sliding the card along the card guide until J1 meets the long needle on the backplane, then the **Blue LED** on the front panel of the card will be lit.

***Note**: If your card is correctly positioned and has been slid all the way into the chassis, the handle should match the rectangular holes. If not, remove the card from the card guide and repeat step 3 again. Do not try to install a card by forcing it into the chassis*

Step 6: Now push the card into the right place, and the **Blue LED** will turn off.

Step 7: After the **Blue LED** is off, push the handle to secure the card and lock it into place.

***Note**: In case you installed the card without installing the DLL driver first, Windows 98/200/XP will recognize your card as an "unknown device" after rebooting, and will prompt you to provide the necessary driver. You should ignore the prompting messages (just click the Cancel button) and set up the driver according to the steps described in 2.2 Driver Installation.*

After the MIC-3714 card is installed, you can verify whether it is properly installed on your system in the Device Manager:

1. Access the Device Manager through:

Start /Control Panel /System /Device Manager.

2. The device name of the MIC-3714 should be listed on the Device Manager tab on the System Property Page.

***Note**: If your card is properly installed, you should see the device name of your card listed on the Device Manager tab. If you do see your device name listed on it but marked with an exclamation sign "!", it means your card has not been correctly installed. In this case, remove the card device from the Device Manager by selecting its device name and press the Remove button. Then go through the driver installation process again.*

After your card is properly installed on your system, you can now configure your device using the Device Manager program that has itself already been installed on your system during driver setup. A complete device installation procedure should include board selection and device setup. After that, you can operate this card through the operation. The following sections will guide you through the board selection, device setup and operation of your device.

2.4 Device Setup & Configuration

The Device Manager program is a utility that allows you to setup, configure and test your device, and later store your settings on the system registry. These settings will be used when you call the APIs of Advantech Device Drivers.

Setting Up and Configuring the Device

Step 1: To install the I/O device for your card, you must first run the Advantech Device Manager program by accessing:

Start/Programs/Advantech eAutomation/Device Manager/Advantech Device Manager

Step 2: You can then view the device(s) already installed on your system (if any) in the Installed Devices list box. Since you haven't installed any device yet, you might see a blank list such as the one below (Fig. 2-3).

Figure 2.3: The Device Manager Dialog Box

Step 3: After you have finished configuring the device, click OK and the device name will appear in the Installed Devices box as the following:

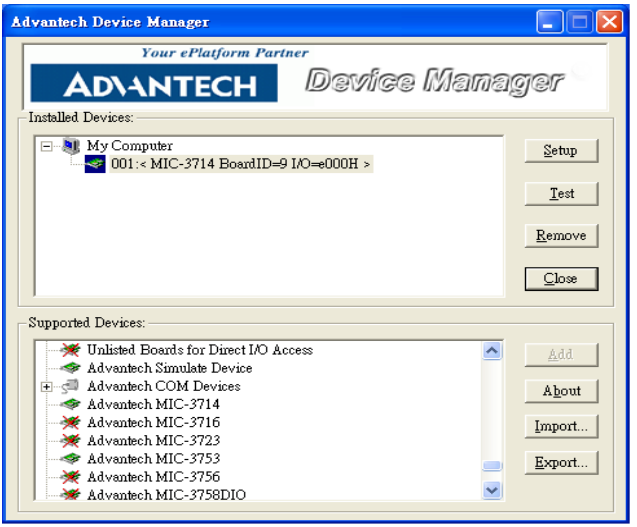


Figure 2.4: Device Names in the Device Box

***Note**: The device name "001:<MIC-3714 BoardID=9 I/O=e000H>" begins with a device number "001", which is specifically assigned to each card. The device number is passed to the driver to specify which device you wish to control.*

If you want to test the card device further, go right to the next section on the Device Testing. You can also find the rich examples on the CD-ROM to speed up your Programming.

2.5 Device Testing

Following through the Setup and Configuration procedures to the last step described in the previous section, you can now proceed to test the device by clicking the Test button on the Device Manager dialog box. A Device Test dialog box will appear accordingly (Fig. 2-5):

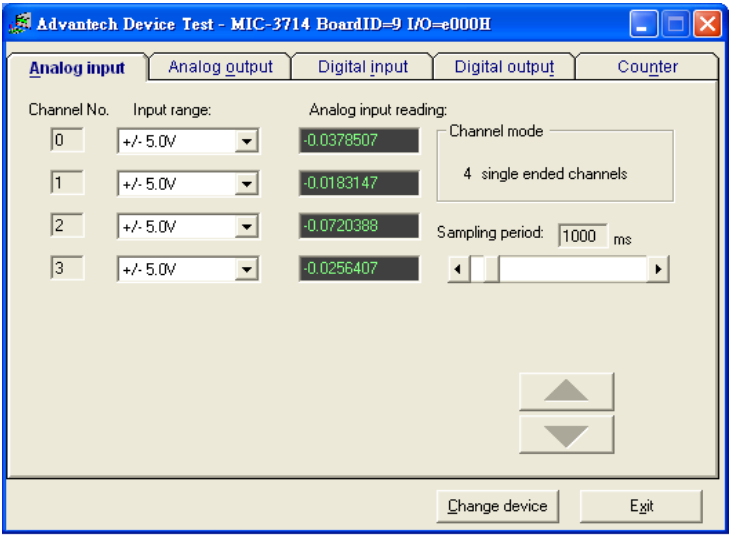


Figure 2.5: Device Test Dialog Box

On the Device Test dialog box, users are free to test various functions of MIC-3714 on the Analog input tabs, functions on the other tabs are not supported for this model.

Testing Analog Input Function

Make sure the Analog Input tab is selected, otherwise, click on the Analog Input tab to bring it up to front of the screen. Select the input range for each channel in the Input range drop-down boxes. Configure the Sampling period on the scroll bar to adjust the sampling rate, the Analog input reading windows will show the readings of all the four channels accordingly. Scroll the Sampling period scroll bar freely to test any sampling rate you want. When the device is fully tested, click Exit button to end the testing procedure.

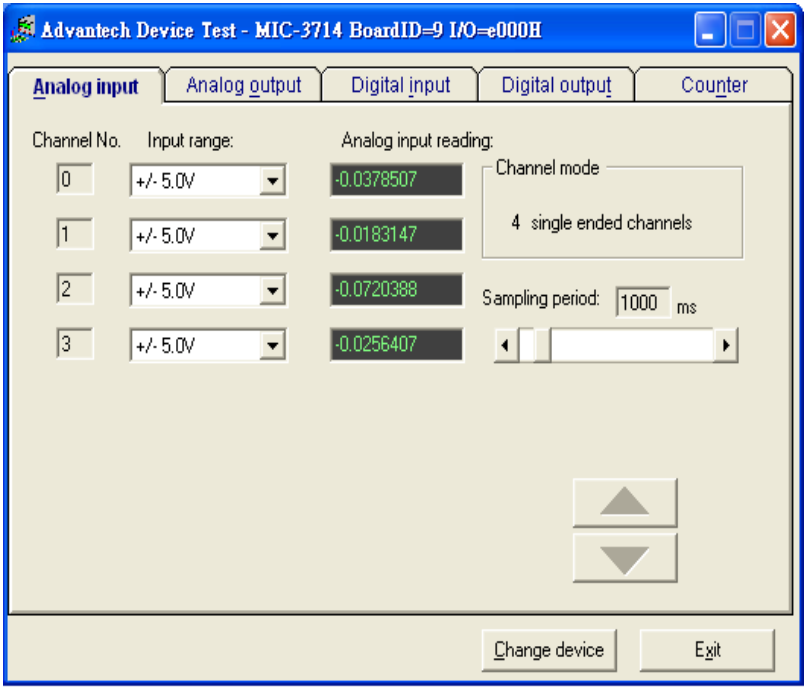


Figure 2.6: Analog Input Tab

CHAPTER 3

Signal Connections

Sections include:

- Signal Connections
- Overview
- Switch and Jumper Settings
- Software Overview
- Device Drivers Roadmap
- Accesories

Chapter 3 Signal Connections

Maintaining proper signal connections is one of the most important factors to ensure that your application system is sending and receiving data correctly. A good signal connection can avoid unnecessary and costly damage to your PC and other hardware devices. This chapter provides useful information about how to connect input and output signals to the MIC-3714 via the I/O connector.

3.1 Overview

Maintaining signal connections is one of the most important factors in ensuring that your application system is sending and receiving data correctly. A good signal connection can avoid unnecessary and costly damage to your PC and other hardware devices. This chapter provides useful information about how to connect input and output signals to the MIC-3714 via the I/O connector.

3.2 Switch and Jumper Settings

The MIC-3714 card has one function switch and five jumper settings.

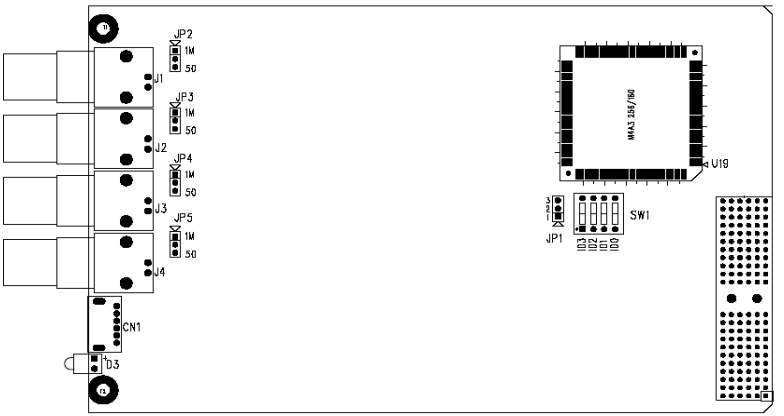


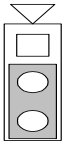
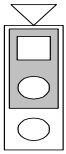
Figure 3.1: Connector, Jumper, and Switch Locations

Board ID setting (SW1)				
ID3	ID2	ID1	ID0	Board ID
1	1	1	1	0
1	1	1	0	1
1	1	0	1	2
1	1	0	0	3
1	0	1	1	4
1	0	1	0	5
1	0	0	1	6
1	0	0	0	7
0	1	1	1	8
0	1	1	0	9
0	1	0	1	10
0	1	0	0	11
0	0	1	1	12
0	0	1	0	13
0	0	0	1	14
0	0	0	0	15

Note: On: 1, Off: 0

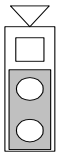
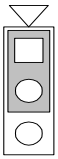
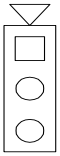
Figure 3.2: Power on Config. After Hot Reset (JP1)

User can use the JP1 to set the hot reset type of MIC-3714.

JP1	Power-on configuration after hot reset
	Keep the I/O configuration while hot reset.
	Clear the I/O configuration to default while hot reset.

Input terminator select (JP2 to JP5)

User can use the JP2 to JP5 to set input terminator value for each AI channel CH0 to CH3, respectively.

JP2, JP3, JP4, JP5	Input terminator select
	50Ω
	1MΩ
	High Impedance

3.3 Signal Connections

CN1 Pin Assignment

Fig. 3-2 shows the pin assignments for the PS-2 connector and the DB-9 connector on the cable.

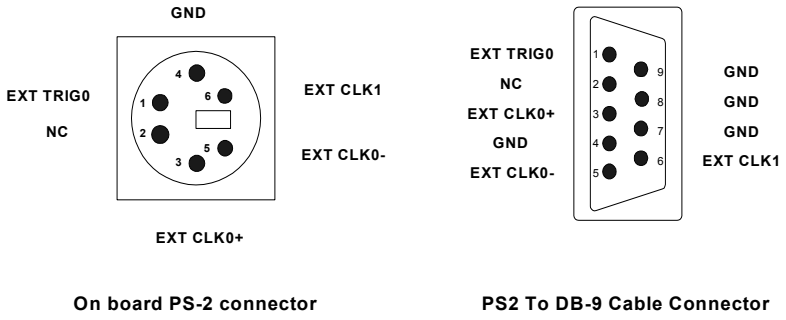


Figure 3.3: I/O Connector Pin Assignment

J1 to J4 BNC are the AI input connectors.

J1 is for AI0, J2 is for AI1, J3 is for AI2 and J4 is for AI3.

CHAPTER 4

Principles of Operation

Sections include:

- Analog Input Range and Gains
- Analog Input Acquisition Mode
- A/D Sample Clock Sources
- Trigger Sources
- Analog Input Data Format

Chapter 4 Principles of Operation

This chapter describes the following features of the MIC-3714 card:

- Analog input ranges and gains
- Analog input acquisition modes
- A/D sample clock sources
- Trigger sources
- Analog Input Data Format

4.1 Analog Input Range and Gains

Each channel on the MIC-3714 can measure bipolar analog input signals ranging within ± 5 V FSR, and can be set up with different input ranges respectively. The sampling rate can be up to 30 MS/s.

MIC-3714 also provides various gain levels that are programmable per channel. Table 4-1 lists the effective ranges supported by the MIC-3714 using these gains.

Table 4.1: Gains and Analog Input Range	
Gain	Analog Input Range
1	±5 V
2	±2.5 V
5	±1 V
10	±0.5 V

For each channel, choose the gain level that provides most optimal range that can accommodate the signal range you have to measure. For detailed information, please refer to Appendix C.4 AI Range Control.

4.2 Analog Input Acquisition Modes

The MIC-3714 can acquire data in single value, pacer, post-trigger, delay-trigger, about-trigger and pre-trigger acquisition modes. These analog input acquisition modes are described in more details in the following:

Single Value Acquisition Mode

The single value acquisition mode is the simplest way to acquire data. Once the software issues a trigger command, the A/D converter will con-

vert one data, and return it immediately. User can check the A/D FIFO status (Read BASE+10, 12) to make sure if the data is ready to be received. For detailed information, please refer to Appendix C.8 FIFO Control, Appendix C.9 FIFO Status, Appendix C.10 FIFO for Progarmmable Flag.

Pacer Acquisition Mode

Use pacer acquisition mode to acquire data if you want to accurately control the time interval between conversions of individual channels in a scan. A/D conversion clock comes from A/D counter or external clock source on connector. A/D conversion starts when the first clock signal comes in, and will not stop if the clock is still continuously sending into it. Conversion data is put into the A/D FIFO. For high-speed data acquisition, you have to use the DMA data transfer for analog input to prevent data loss.

Post-Trigger Acquisition Mode

Post-trigger allows you to acquire data based on a trigger event. Posttrigger acquisition starts when the MIC-3714 detects the trigger event and stops when the preset number of post-trigger samples has been acquired or when you stop the operation. This trigger mode must work with the DMA data transfer mode enabled. Use post-trigger acquisition mode when you want to acquire data when a post-trigger event occurs. Please specify the following parameters when using software in post-trigger acquisition mode:

- Set to Post-Trigger Acquisition Mode
- The A/D sample clock source and sampling rate
- The trigger source
- The acquired sample number N

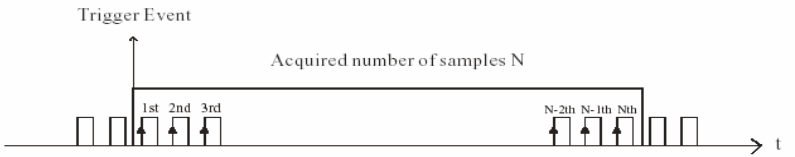


Figure 4.1: Post-Trigger Acquisition Mode

Delay Trigger Acquisition Mode

In delay trigger mode, data acquisition will be activated after a preset delay number of sample has been taken after the trigger event. The delay number of sample ranges from 2 to 65535 as defined in DMA counter.

Delay-trigger acquisition starts when the MIC-3714 detects the trigger event and stops when the specified number of A/D samples has been acquired or when you stop the operation. This triggering mode must work with the DMA data transfer mode enabled Please specify the following parameters when using software in delay trigger mode:

- Set to Delay-Trigger Acquisition Mode
- The sample clock source and sampling rate
- The trigger source
- The acquired sample number N
- The sample number M delays after the delay-trigger event happened

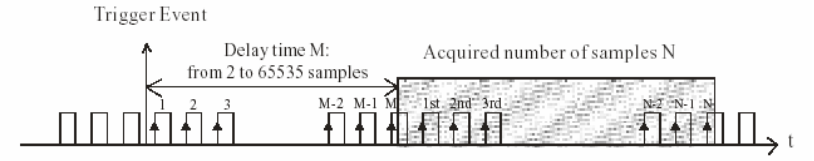


Figure 4.2: Delay-Trigger Acquisition Mode

About Trigger Acquisition Mode

Use about-trigger acquisition mode when you want to acquire data both before and after a specific trigger event occurs. This operation is equivalent to doing both a pre-trigger and a post-trigger acquisition. When using software, please specify the following parameters, when using software in About-Trigger acquisition mode:

- Set to About-Trigger Acquisition Mode
- The sample clock source and sample rate
- The trigger source
- The total acquired sample number N
- The specific sample number M after the trigger event. The range of preset sample number is from 2 to 65536 samples.

In about-trigger mode, users must first designate the size of the allocated memory and the amount of samples to be snatched after the trigger event happens. The about-trigger acquisition starts when the first clock signal comes in. Once a trigger event happens, the on-going data acquisition will continue until the designated amount of samples have been reached. When the MIC-3714 detects the selected about trigger event, the card keeps acquiring the preset number of samples, and kept the total number of samples on the FIFO.

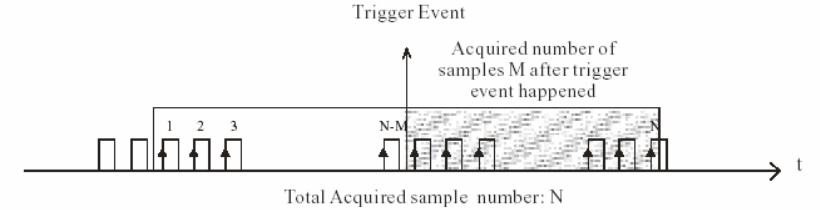


Figure 4.3: About-Trigger Acquisition Mode

Pre-Trigger Acquisition Mode

Pre-Trigger mode is a particular application of about-trigger mode. Use pre-trigger acquisition mode when you want to acquire data before a specific trigger event occurs. Pre-trigger acquisition starts when you start the operation and stops when the trigger event happens. Then the specific number of samples will be reversed in the FIFO before the pre-trigger event occurred. Please specify the following parameters, when using software in Pre-trigger acquisition mode:

- Set to Pre-Trigger Acquisition Mode
- The sample clock source and sample rate
- The trigger source
- Assume the total acquired sample number is N, then set the total sample number to be N+2.

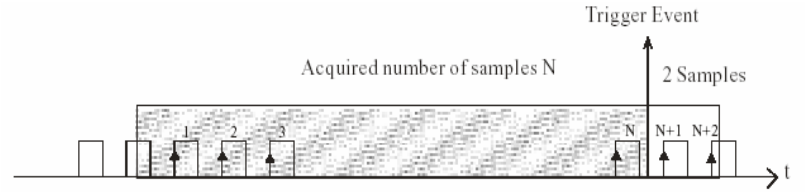


Figure 4.4: Pre-Trigger Acquisition Mode

4.3 A/D Sample Clock Sources

The MIC-3714 can adopt both internal and external clock sources for pacer, post-trigger, delay-trigger, about-trigger acquisition modes:

- Internal A/D sample clock with 8-bit Counter
- External A/D sample clock that is connected to either the EXT-CLK0 (the differential clock source) or the EXT_CLK1 (the single ended clock source) on the ADAM-3909 screw terminal board.

The internal and both external A/D sample clocks are described in more details as the following.

Internal A/D Sample Clock

The internal A/D sample clock uses a 60 MHz time base. Conversions start on the rising edge of the counter output. You can use software to specify the clock source as internal and the sampling frequency to pace the operation. The minimum frequency is 234375 S/s, the maximum frequency is 30 MS/s. According to the sampling theory (Nyquist Theorem), you must specify a frequency that is at least twice as fast as the input's highest frequency component to achieve a valid sampling. For example, to accurately sample a 300 kHz signal, you have to specify sampling frequency of at least 600 kHz. This consideration can avoid an error condition often know as aliasing, in which high frequency input components appear erroneously as lower frequencies when sampling.

External A/D Sample Clock 0

The external sample clock 0 is a sine wave signal source which is converted to a TTL signal inside the MIC-3714. This signal is AC coupled. The input impedance of external clock 0 is 50 ohms and the input level is 2 volts peak-to-peak.

Please note that the frequency of the external clock is the system clock. The maximum A/D clock frequency is half of the system clock.

External A/D Sample Clock 1

The external sample clock 1 is a digital clock. The input impedance is 50 ohms and the input level should be 2.4V~5V into the 50-ohm load. This signal is DC coupled.

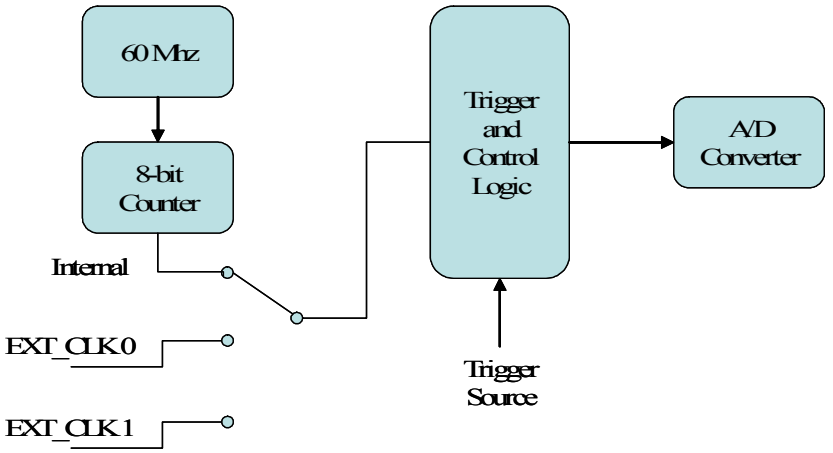


Figure 4.5: MIC-3714 Sample Clock Sources

4.4 Trigger Sources

The MIC-3714 supports the following trigger sources for post-, delay-, about- and pre-trigger acquisition modes:

- Software trigger,
- External digital (TTL) trigger, and
- Analog threshold trigger.

With MIC-3714, user can define the type of trigger source as rising-edge or falling-edge. These following sections describe these trigger sources in more detail.

Software Trigger

A software trigger event occurs when you start the analog input operation (the computer issues a write to the board to begin acquisitions). When you write the value to analog input trigger flag TRGF on Write BASE+Eh to produce either a rising-edge or falling-edge trigger, depending upon the trigger source type you choose. This edge will then act as an A/D trigger event.

For detailed information, please refer to Appendix C.7 Trigger Mode and Source.

External Digital (TTL) Trigger

For analog input operations, an external digital trigger event occurs when the MIC-3714 detects either a rising or falling edge on the External A/D TTL trigger input signal from screw terminal EXT_TRIG on the ADAM-3909 screw terminal board. The trigger signal is TTL-compatible.

Analog Threshold Trigger

For analog input operations, an analog trigger event occurs when the MIC-3714 detects a transition from above a threshold level to below a threshold level (falling edge), or a transition from below a threshold level to above a threshold level (rising edge). User should connect the analog signals from the external device to one of the four BNC source connectors. Which one of the four sources is selected as the trigger source can be defined or identified by writing to or reading from the flags from TS0 to TS2 of Write/Read BASE+Eh. On the MIC-3714, the analog trigger threshold voltage level is set using a dedicated 8-bit DAC; you can write or read the flags from AT0 to AT7 on Write/Read BASE+24h to define or identify the analog trigger threshold voltage level. Please also refer to the Appendix C.14 Analog Trigger Threshold Voltage for more details.

4.5 Analog Input Data Format

Table 4.2: Analog Input Data Format

A/D Code		Mapping Voltage
Hex.	Dec.	
000h	0d	-FS
7FFh	2047d	-1 LSB
800h	2048d	0
FFFh	4095d	FS-1 LSB
1LSB		FS/2048

Table 4.3: Various Input Voltage Ranges

Gain	Range	FS
1	±5	5
2	±2.5	2.5
5	±1	1
10	±0.5	0.5

CHAPTER 5

Calibration

Chapter 5 Calibration

This chapter offers you a brief guide to the calibration procedure. The MIC-3714 has been well calibrated at the factory for initial use. Users are not necessary to calibrate the MIC-3714 in normal conditions. However, if some other conditions that the users have to calibrate the MIC-3714, then they can follow the procedure listed below to perform the necessary calibration.

To perform an effective calibration, the user has to prepare a standard 4-1/2 digits resolution, stable and low-noise DC voltage source. It is important that the accuracy of the device will depend on the accuracy of the DC source.

Calibration Procedure

Step 1: Click the Setup button on the Advantech Device Manager window (Fig.5-1) to launch the MIC-3714 Device Setting window (Fig.5-2).

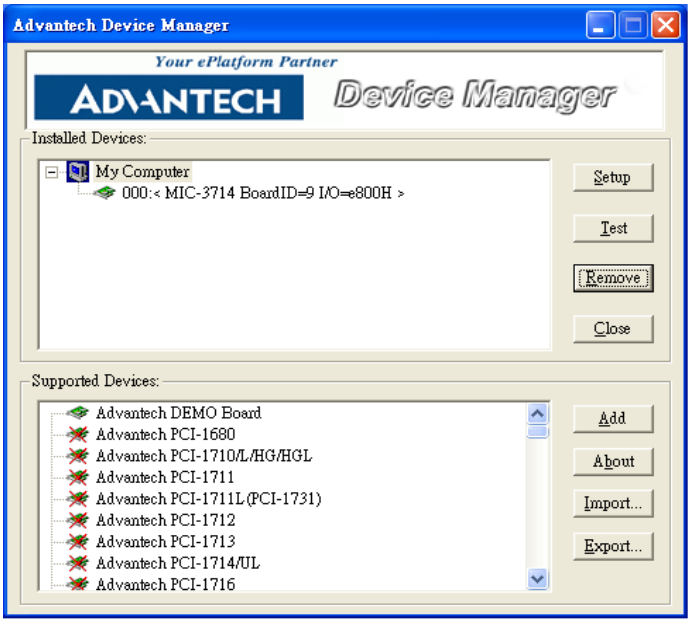


Figure 5.1: Setup Button launches the Device Setting

Step 2: Select the input range of the channel which you want to calibrate.

Step 3: Click the Calibration button to start the calibration process. The Calibration Wizard window will pop up.

***Note**: Each calibration process can calibrate only one channel and one input range at a time.*

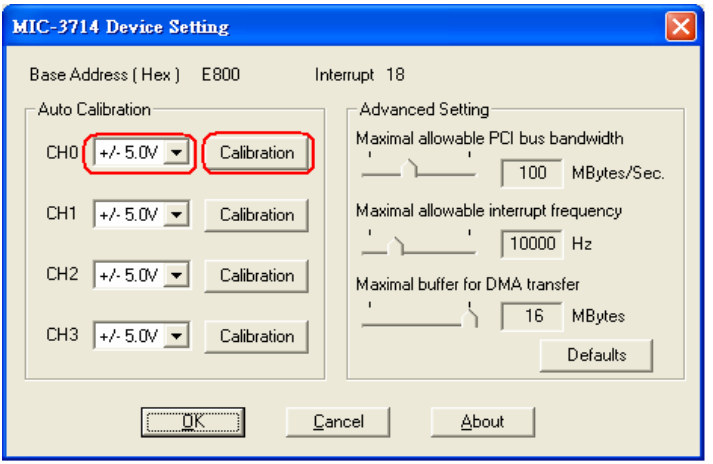


Figure 5.2: Calibration Button launches Calibration

Step 4: Follow the instruction of Calibration Wizard to input a correct DC voltage as a reference and click the Next button to proceed to the next step.

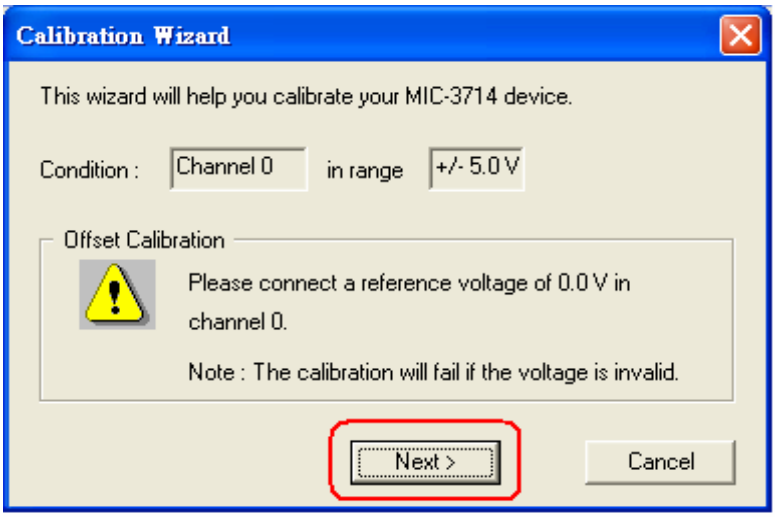


Figure 5.3: Start-up Window for Offset Calibration

Step 5: Click the Start button to start the Offset Calibration. Note that the Status will indicate Unknown as default at the beginning.

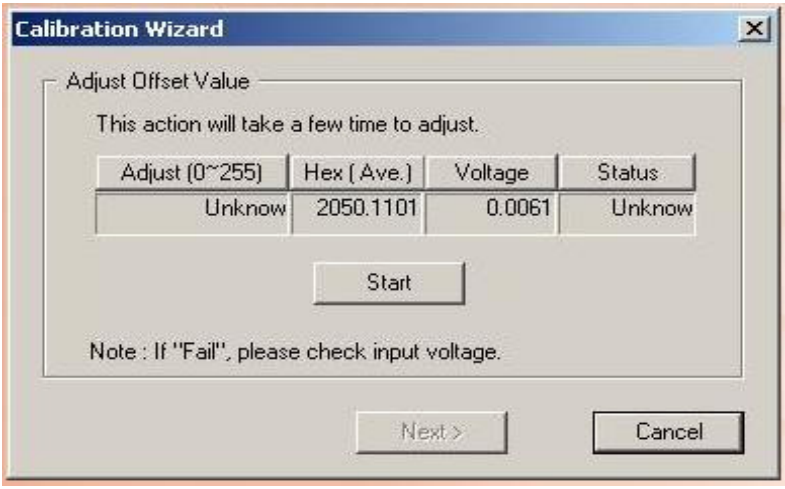


Figure 5.4: Adjustment of Offset Calibration

Step 6: If the reference DC voltage source and the wiring are both correct, the calibration will proceed automatically after the Start button is clicked. When the offset calibration is completed, the Status will indicate Succeeded, then click the Next button to proceed to the next step.

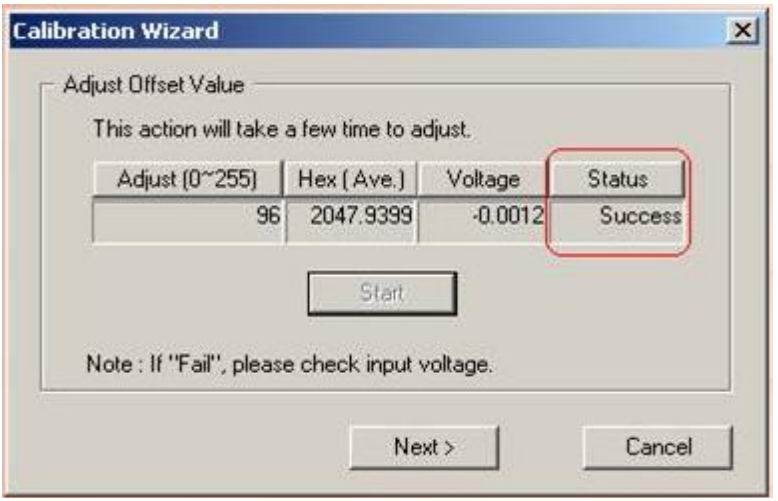


Figure 5.5: Offset Calibration Success

Step 7: Once the Status indicates Failed, please check if both the wiring and the input voltage are correct. When finished checking, click the Start button again to restart the procedure, or click the Cancel button to stop the calibration.

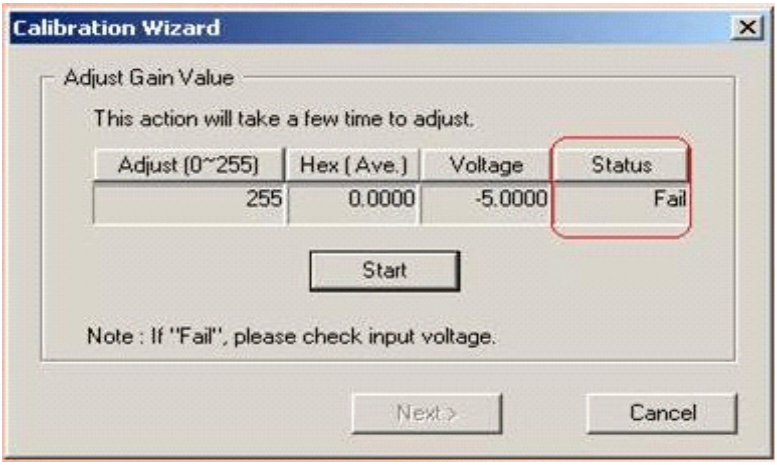


Figure 5.6: Offset Calibration Failed

Step 7: If the offset calibration is completed, then it is going to proceed to the Gain Calibration. The steps of gain calibration are quite similar to those of the offset calibration. Follow the instructions of the Calibration Wizard to input a correct DC voltage and click the Next button to proceed.

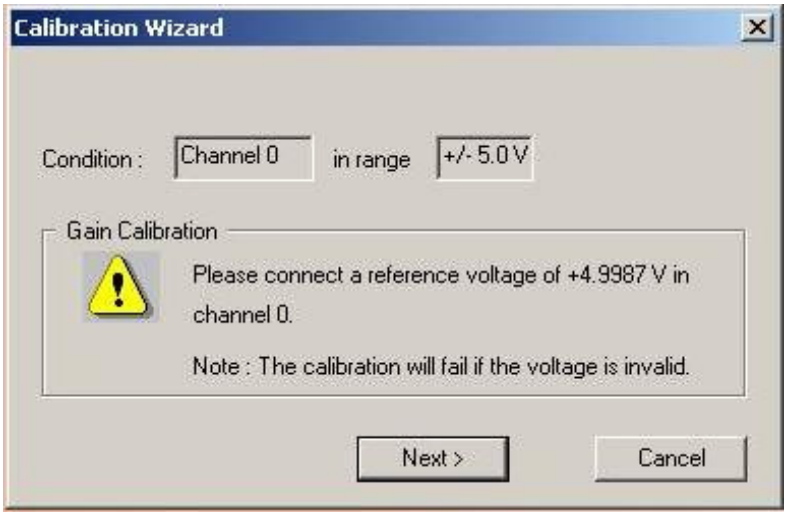


Figure 5.7: Start-up Window for Gain Calibration

Step 8: Click the Start button to start gain calibration. Note that the Status will indicate Unknown as default at the beginning.

Figure 5.8: Adjustment Process for Gain Calibration

Step 9: When the gain calibration is completed then click the Next button to proceed.

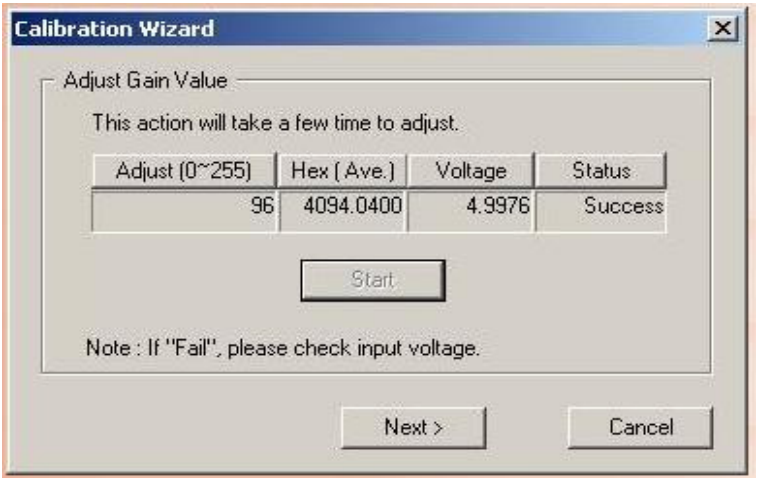


Figure 5.9: Gain Calibration Success

Step 9: Once the Status indicates Failed, please check if both the wiring and the input voltage are correct. When finished checking, click the Start button again to restart the procedure, or click the Cancel button to stop the calibration.

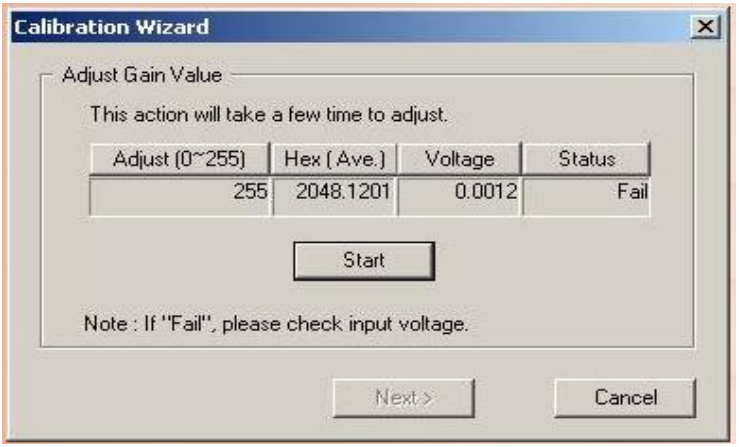


Figure 5.10: Gain Calibration Failed

Step 10: When the current channel is calibrated, click the Finish button to end the procedure. You can proceed to Step 3 to select another channel for calibration, and repeat from Step 4 to Step 9, until the rest of the channels are all calibrated one after one.

Figure 5.11: Calibration Procedure Completed

APPENDIX A

Specifications

Appendix A Specifications

Table A.1: Analog Input					
Channels	4 single-ended analog input channels				
Resolution	12-bit		FIFO Size	32K locations	
Max. Sampling Rate[1]	Up to 30MHz[1]				
Common Mode Voltage	±11 V max. (operational)				
Input Range and Gain List	Gain	1	2	5	10
	Range	±5V	±2.5V	±1V	±0.5V
Drift	Gain	1	2	5	10
	Zero (μV/°C)	200	100	40	20
	Gain (ppm/°C)	±30	±30	±30	±30
Small Signal Bandwidth for PGA	Gain	1	2	5	10
	Bandwidth (-3dB)	7MHz	7MHz	7MHz	7MHz
Max. Input Voltage	±15 V		Input Surge Protect		30 Vp-p
Input Impedance	50Ω /1MΩ /∞ jumper selectable 100pF				
Trigger Mode	Software, pacer, post-trigger, pre-trigger, delay-trigger, about-trigger				
Accuracy	DC	DNLE: ±1LSB (No Missing Codes:12 Bits Guaranteed)			
		INLE: ±2LSB			
		Offset error	Adjustable to ±1LSB		
		Gain error	Adjustable to ±1LSB		
	AC	SINAD: S/(N+D): 64 dB ENOB: 10.33bits THD: -71 dB			
External Clock 1	Logic level	TTL (Low: 0.8V max. High: 2.0V min.)			
	Input impedance	50 ohms			
	Input coupled	DC			
	Frequency	Up to 10 MHz			
External Clock 0	Logic level	5.0V peak to peak sin wave			
	Input impedance	Hi Z			
	Input coupled	AC			
	Frequency	Up to 10 MHz			

External Trigger 0	Logic level	TTL (Low: 0.8V max. High: 2.0V min.)
	Input impedance	Hi Z
	Input coupled	AC
	Frequency	Up to 10 MHz
External Analog Trigger Input	Range	By analog input range
	Resolution	8-bit
	Frequency	Up to 1 MHz

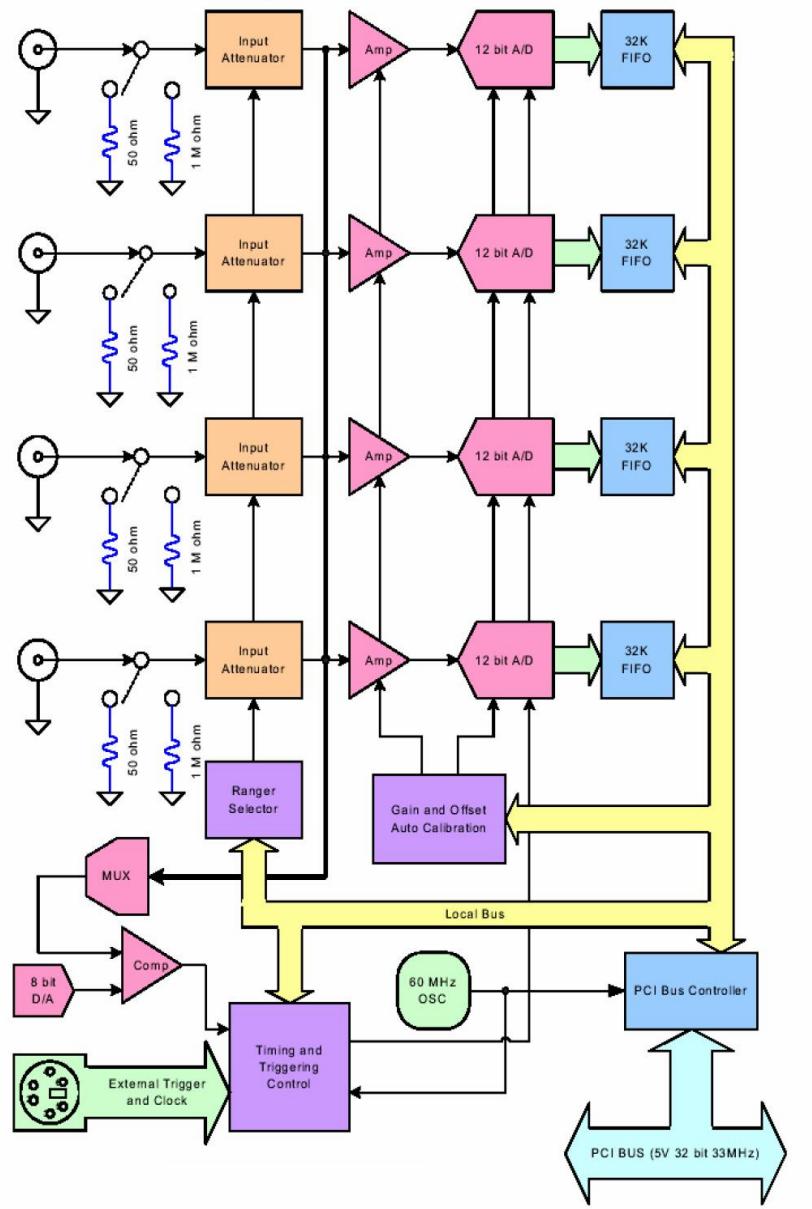
Table A.2: General		
I/O Connector Type	4 BNC connector for AI 1 PS2 connector for ext. clock and trigger	
Dimensions	160mm x 100mm (6.3" x 3.9")	
Power Consumption	Typical	+5 V @ 850 mA ; +12 V @ 600 mA
	Max.	+5 V @ 1 A ; +12 V @ 700m A
Temperature	Operation	0~+70°C(32~158°F)
	Storage	-20~+85°C(-4~185°F)
Relative Humidity	5~95%RH non-condensing (refer to *IEC 68-2-3*)	
Certification	CE certified	

Note[1]: 30 MHz is only for FIFO depth (32K). Continuous acquisition depends on platform performance.

APPENDIX B

Block Diagram

Appendix B Block Diagram



APPENDIX C

Register Structure & Format

Appendix C Register Structure & Format

C.1 Overview

The MIC-3714 is delivered with an easy-to-use 32-bit DLL driver for user programming under the Windows 98/2000/XP operating systems. We advise users to program the MIC-3714 using the 32-bit DLL driver provided by Advantech to avoid the complexity of low-level programming by register.

The most important consideration in programming the MIC-3714 at register level is to understand the function of the card's registers. The information in the following sections is provided only for users who would like to do their own low-level programming.

C.2 Register Format

The register format is the basis to control the MIC-3714.

There are some rules for programmer's reference:

1. All registers are 32-bit format. Please use the DWORD command in your own software.
2. Some registers are used only for write or read.
3. Some registers can support write and read back, they usually use the same name.
4. Some registers could write any value to complete a command.
5. In general, read only register is called status register, write only register is called control register.
6. Some registers are very similar, usually denote as a group. For example, A4, A3, A2, A1, A0 usually denote as A4: A0.
7. In this document, 1Fh means hexadecimal number 1F.

Table C-1 shows the function of each register of the MIC-3714 or driver and its address relative to the card's base address.

Table C.1: MIC-3714 Register Format (Part 1)

Base Address		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0h	W	AI Channel 0 Single Value Acquisition															
	R	AI Channel 0 Data															
		TRGF	OV	G1	G0	AD11	AD10	AD9	AD8	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0
2h	W	AI Channel 1 Single Value Acquisition															
	R	AI Channel 1 Data															
		TRGF	OV	G1	G0	AD11	AD10	AD9	AD8	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0
4h	W	AI Channel 2 Single Value Acquisition															
	R	AI Channel 2 Data															
		TRGF	OV	G1	G0	AD11	AD10	AD9	AD8	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0
6h	W	AI Channel 3 Single Value Acquisition															
	R	AI Channel 3 Data															
		TRGF	OV	G1	G0	AD11	AD10	AD9	AD8	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0
8h	W	AI Range Control Register															
										CH3_G1	CH3_G0	CH2_G1	CH2_G0	CH1_G1	CH1_G0	CH0_G1	CH0_G0
	R																
										CH3_G1	CH3_G0	CH2_G1	CH2_G0	CH1_G1	CH1_G0	CH0_G1	CH0_G0
Ah	W	A/D Converter Enable Register															
														CH3	CH2	CH1	CH0
	R																
														CH3	CH2	CH1	CH0
Ch	W	Clock Source and Divider Register															
								CKS1	CKS0	DIV7	DIV6	DIV5	DIV4	DIV3	DIV2	DIV1	DIV0
	R																
								CKS1	CKS0	DIV7	DIV6	DIV5	DIV4	DIV3	DIV2	DIV1	DIV0
Eh	W	Trigger Mode and Source Register															
		TRGF	DMA_TCF							TSE	TS2	TS1	TS0		TM2	TM1	TM0
	R																
		TRGF	DMA_TCF							TSE	TS2	TS1	TS0		TM2	TM1	TM0

Table C.2: MIC-3714 Register Format (Part 2)

Base Address		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
		MIC-3714 Register Format															
10h	W	FIFO Control Register															
								FRST1	FCLR1							FRST0	FCLR0
	R	FIFO Status Register															
				FIFO1_AF	FIFO1_AE		FIFO1_FF	FIFO1_HF	FIFO1_EF			FIFO0_AF	FIFO0_AE		FIFO0_FF	FIFO0_HF	FIFO0_EF
12h	W	FIFO Control Register															
								FRST3	FCLR3							FRST2	FCLR2
	R	FIFO Status Register															
				FIFO3_AF	FIFO3_AE		FIFO3_FF	FIFO3_HF	FIFO3_EF			FIFO2_AF	FIFO2_AE		FIFO2_FF	FIFO2_HF	FIFO2_EF
14h	W	FIFO 0 Programmable Flag Register															
			PF14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
	R	FIFO 0 Programmable Flag Register															
			PF14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
16h	W	FIFO 1 Programmable Flag Register															
			PF14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
	R	FIFO 1 Programmable Flag Register															
			PF14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
18h	W	FIFO 2 Programmable Flag Register															
			PF14	PF13 FP12		PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
	R	FIFO 2 Programmable Flag Register															
			PF14	PF13 FP12		PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
1Ah	W	FIFO 3 Programmable Flag Register															
			PF14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
	R	FIFO 3 Programmable Flag Register															
			PF14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
1Ch	W	DMA Counter Register															
		CN15	CN14	CN13	CN12	CN11	CN10	CN9	CN8	CN7	CN6	CN5	CN4	CN3	CN2	CN1	CN0
	R																
		CN15	CN14	CN13	CN12	CN11	CN10	CN9	CN8	CN7	CN6	CN5	CN4	CN3	CN2	CN1	CN0
1Eh	W	Rest DMA Counter															
	R																

Table C.3: MIC-3714 Register Format (Part 3)

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
20h	W	Interrupt Control Register															
		INTE							DMA_TC	FIFO3_AF	FIFO3_HF	FIFO2_AF	FIFO2_HF	FIFO1_AF	FIFO1_HF	FIFO0_AF	FIFO0_HF
	R																
		INTF							INTF8	INTF7	INTF6	INTF5	INTF4	INTF3	INTF2	INTF1	INTF0
22h	W	Clear Interrupt															
	R	N/A															
24h	W	Analog Trigger Threshold voltage Register															
										AT7	AT6	AT5	AT4	AT3	AT2	AT1	AT0
	R	Analog Trigger Threshold voltage Register															
										AT7	AT6	AT5	AT4	AT3	AT2	AT1	AT0
26h	W	N/A															
	R	N/A															
28h	W	Calibration Command Register															
				CG1	CG0	X	CM2	CM1	CM0	CD7	CD6	CD5	CD4	CD3	CD2	CD1	CD0
	R																
				CG1	CG0	CBUSY	CM2	CM1	CM0	CD7	CD6	CD5	CD4	CD3	CD2	CD1	CD0
2Ah	W																
	R																
2Ch	W	Board ID															
	R																
														BID3	BID2	BID1	BID0
2Eh	W																
	R																

Table C.4: MIC-3714 Register Format (Part 4)

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
30h	W	Reset start read channel to CH0															
	R	AD Channel n DATA															
		TR GF	OV	G1	G0	AD 11	AD 10	AD 9	AD 8	AD 7	AD 6	AD 5	AD 4	AD 3	AD 2	AD 1	AD 0
32h	W	N/A															
	R	AD Channel n+1 DATA															
		TR GF	OV	G1	G0	AD 11	AD 10	AD 9	AD 8	AD 7	AD 6	AD 5	AD 4	AD 3	AD 2	AD 1	AD 0
34h	W	DMA Request selector															
																	DS0
	R																

C.3 A/D SW Trigger

In single value acquisition mode (SW trigger), the A/D converter will convert one sample when you write to the register Write BASE+0, 2, 4, 6 with any value. User can check the A/D FIFO status (FIFOn_FE) to make sure if the data is ready to be received.

Table C.5: Register for Single Value Acquisition

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0h	W	AI Channel 0 Single Value Acquisition															
	R	AI Channel 0 Data															
		TR GF	OV	G1	G0	AD 11	AD 10	AD 9	AD 8	AD 7	AD 6	AD 5	AD 4	AD 3	AD 2	AD 1	AD 0
2h	W	AI Channel 1 Single Value Acquisition															
	R	AI Channel 1 Data															
		TR GF	OV	G1	G0	AD 11	AD 10	AD 9	AD 8	AD 7	AD 6	AD 5	AD 4	AD 3	AD 2	AD 1	AD 0
4h	W	AI Channel 2 Single Value Acquisition															
	R	AI Channel 2 Data															
		TR GF	OV	G1	G0	AD 11	AD 10	AD 9	AD 8	AD 7	AD 6	AD 5	AD 4	AD 3	AD 2	AD 1	AD 0
6h	W	AI Channel 3 Single Value Acquisition															
	R	AI Channel 3 Data															
		TR GF	OV	G1	G0	AD 11	AD 10	AD 9	AD 8	AD 7	AD 6	AD 5	AD 4	AD 3	AD 2	AD 1	AD 0

AD11: AD0 12 bits Data of A/D Conversion

AD0 The least significant bit (LSB) of A/D data.

AD11 The most significant bit (MSB) of A/D data.

G1: G0 Range Code

These 2 bits indicate the input range of the data.

G1	G0	Input range
0	0	-5 to +5V
0	1	-2.5 to +2.5V
1	0	-1 to +1V
1	1	-0.5 to +0.5V

OV Over Range Flag

This bit indicates whether the input voltage is over range or not. Read 1 means over range.

TRGF Trigger Flag

The trigger flag indicates whether a trigger event has happened during A/D conversion process.

C.4 AI Range Control

Table C.6: Register for Analog Input Range Control

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8h	W	AI Range Control Register															
										CH3_G1	CH3_G0	CH2_G1	CH2_G0	CH1_G1	CH1_G0	CH0_G1	CH0_G0
	R																
										CH3_G1	CH3_G0	CH2_G1	CH2_G0	CH1_G1	CH1_G0	CH0_G1	CH0_G0

Analog Input Range Selector

These registers are used to select the analog input range for each channel.

CHn_G1	CHn_G0	Input range
0	0	-5 to +5 V
0	1	-2.5 to +2.5 V
1	0	-1 to +1 V
1	1	-0.5 to +0.5 V

(n = 0~3)

C.5 A/D Converter Enable

Table C.7: Register for A/D Converter Enable

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Ah	W	A/D Converter Enable Register															
														CH 3	CH 2	CH 1	CH 0
	R																
														CH 3	CH 2	CH 1	CH 0

CH3, CH2, CH1, CH0 A/D Converter Enable bit

These bits control the A/D converter working. Write 0 will disable the A/D, 1 enable. They could be read back for check.

C.6 Clock Source and Divider

Table C.8: Register for Clock Source and Divider

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Ch	W	Clock Source and Divider Register															
								CKS1	CKS0	DIV7	DIV6	DIV5	DIV4	DIV3	DIV2	DIV1	DIV0
	R																
								CKS1	CKS0	DIV7	DIV6	DIV5	DIV4	DIV3	DIV2	DIV1	DIV0

DIV7: DIV0 Clock Divider

When select the internal clock source (60MHz) the clock will pre-divide by the clock divider. The divider is 8-bit wide, so it could divide from 2 to 256.

DIV7: DIV0	Divide value
00h	N/A
01h	divide by 2
02h	divide by 3
.	.
FEh	divide by 255
FFh	divide by 256

CKS1: CKS0 Clock Source Selector

These 2 bits select the clock source feed to the A/D converters.

CKS1	CKS0	Clock source
0	0	Internal clock 60MHz
0	1	External clock 0
1	0	External clock 1
1	1	Off

C.7 Trigger Mode and Source

Table C.9: Register for Trigger Mode and Source

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Eh	W	Trigger Mode and Source Register															
		TRGF	DMA_TCF							TSE	TS2	TS1	TS0		TM2	TM1	TM0
	R																
		TRGF	DMA_TCF							TSE	TS2	TS1	TS0		TM2	TM1	TM0

TM2: TM0 Trigger Mode Selector

There are 5 trigger modes for MIC-3714. Please refer to the operation theorem for more information.

TM2	TM1	TM0	Meaning
0	0	0	Single value acquisition mode (SW trigger)
0	0	1	Pacer acquisition mode
0	1	0	Post-trigger acquisition mode
0	1	1	Delay-trigger acquisition mode
1	0	0	About-trigger acquisition mode
1	0	1	N/A
1	1	0	N/A
1	1	1	N/A

TS2: TS0 Trigger Source Selector

TS2	TS1	TS0	Meaning
0	0	0	Analog input CH0
0	0	1	Analog input CH1
0	1	0	Analog input CH2
0	1	1	Analog input CH3
1	0	0	Digital trigger input
1	0	1	N/A
1	1	0	N/A
1	1	1	N/A

TSE Trigger Edge Selector:

Rising edge trigger

Falling edge trigger

DMA_TCF DMA Counter Terminal Count Flag

DMA counter is not terminal count

DMA counter is terminal count

TRGF Trigger Flag

Trigger not occurred

Trigger occurred

C.8 FIFO Control

Table C.10: Register for FIFO Control

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
10h	W	FIFO Control Register															
								FRST1	FCLR 1							FRST0	FCLR 0
12h	W	FIFO Control Register															
								FRST3	FCLR 3							FRST2	FCLR 2

FCLRn (n = 0~3) **FIFO Clear Register**

Write 1 to this bit to clear FIFO data.

FRSTn (n = 0~3) **FIFO Reset Register**

Write 1 to this bit to clear FIFO data and reset the AE and AF flag position to 7FH.

C.9 FIFO Status

Table C.11: Register for FIFO Status

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
10h	R	FIFO Status Register															
				FIFO1_AF	FIFO1_AE		FIFO1_FF	FIFO1_HF	FIFO1_EF			FIFO0_AF	FIFO0_AE		FIFO0_FF	FIFO0_HF	FIFO0_EF
12h	R	FIFO Status Register															
				FIFO3_AF	FIFO3_AE		FIFO3_FF	FIFO3_HF	FIFO3_EF			FIFO2_AF	FIFO2_AE		FIFO2_FF	FIFO2_HF	FIFO2_EF

FIFOn_EF (n = 0~3) **FIFO Empty Flag**

1 FIFO is empty

0 FIFO is not empty

FIFOn_HF (n = 0~3) **FIFO Half Full Flag**

1 FIFO is half full

0 FIFO is not half full

FIFOn_FF (n = 0~3) **FIFO Full Flag**

1 FIFO is full

0 FIFO is not full

FIFOn_AE (n = 0~3) **FIFO Almost Empty Flag**

1 FIFO is almost empty

0 FIFO is not almost empty

FIFOn_AF (n = 0~3) **FIFO Almost Full Flag**

1 FIFO is almost full

0 FIFO is not almost full

C.10 FIFO for Programmable Flag

Table C.12: Register for FIFO Programmable Flag

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
14h	W	FIFO 0 Programmable Flag Register															
			PF 14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
	R	FIFO 0 Programmable Flag Register															
			PF 14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
16h	W	FIFO 1 Programmable Flag Register															
			PF 14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
	R	FIFO 1 Programmable Flag Register															
			PF 14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
18h	W	FIFO 2 Programmable Flag Register															
			PF14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
	R	FIFO 2 Programmable Flag Register															
			PF 14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
1Ah	W	FIFO 3 Programmable Flag Register															
			PF 14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0
	R	FIFO 3 Programmable Flag Register															
			PF 14	PF13	FP12	PF11	PF10	PF9	PF8	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0

PF14: PF0 FIFO n Programmable Flag Register (n = 0 ~3)

The FIFO on MIC-3714 is very powerful. It allow user to define the indicate flag in any depth. There are two flags could be defined: FIFO Almost Empty flag and FIFO Almost Full flag. To define these flags must follow the procedure:

First write is the Almost Empty flag offset count from the empty.

Second write is the Almost Full flag offset count from the full.

Read procedure is the same as write. Once set the offset, the value will keep until FIFO reset.

C.11 DMA Counter

Table C.13: Register for DMA Counter

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1Ch	W	DMA Counter Register															
		CN 15	CN 14	CN 13	CN 12	CN 11	CN 10	CN 9	CN 8	CN 7	CN 6	CN 5	CN 4	CN 3	CN 2	CN 1	CN 0
	R																
		CN 15	CN 14	CN 13	CN 12	CN 11	CN 10	CN 9	CN 8	CN 7	CN 6	CN 5	CN 4	CN 3	CN 2	CN 1	CN 0
1Eh	W	Reset DMA Counter															

CN15: CN0 DMA counter register:

DMA counter is a16-bit counter designed for ABOUT and DELAY trigger mode only. Set the counter value for about trigger data counts after the trigger event. Also the value for delay trigger data counts after the trigger event.

Reset DMA Counter

Before start the DMA counter, write the BASE + 1Eh to reset the DMA counter.

C.12 Interrupt Control/Flag

Table C.14: Register for Interrupt Control/Flag

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
20h	W	Interrupt Control Register															
		INTE							DMA_TC	FIFO3_AF	FIFO3_HF	FIFO2_AF	FIFO2_HF	FIFO1_AF	FIFO1_HF	FIFO0_AF	FIFO0_HF
	R	Interrupt Flag															
		INTF							INTF8	INTF7	INTF6	INTF5	INTF4	INTF3	INTF2	INTF1	INTF0

Interrupt Control Register

MIC-3714 provides 9 sources to generate the interrupt. Write 1 to enable the interrupt, write 0 to disable. The INTE is control the total interrupt.

FIFO0_HF FIFO 0 Half Full

FIFO0_AF FIFO 0 Almost Full

FIFO1_HF FIFO 1 Half Full

FIFO1_AF FIFO 1 Almost Full

FIFO2_HF FIFO 2 Half Full

FIFO2_AF FIFO 2 Almost Full

FIFO3_HF FIFO 3 Half Full

FIFO3_AF FIFO 3 Almost Full

DMA_TC DMA counter Terminal Count

INTE Total Interrupt Enable

Interrupt Flag

These bits correspond to the same bit number of the interrupt control register to indicate which interrupt occurred. Read 1 means interrupt occurred.

INTF0 FIFO 0 Half Full interrupt flag

INTF1 FIFO 0 Almost Full interrupt flag

INTF2 FIFO 1 Half Full interrupt flag

INTF3 FIFO 1 Almost Full interrupt flag

INTF4 FIFO 2 Half Full interrupt flag

INTF5 FIFO 2 Almost Full interrupt flag

INTF6 FIFO 3 Half Full interrupt flag

INTF7 FIFO 3 Almost Full interrupt flag

INTF8 DMA counter Terminal Count interrupt flag

INTF Total Interrupt flag

C.13 Clear Interrupt

Table C.15: Register for Clear Interrupt

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
22h	W	Clear Interrupt															

Clear Interrupt

Write any value to this address will clear interrupt. It will clear all flags to 0 if there is no any interrupt in coming.

C.14 Analog Trigger Threshold Voltage

Table C.16: Register for Analog Trigger Threshold Voltage

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
24h	W	Analog Trigger Threshold voltage Register															
										AT7	AT6	AT5	AT4	AT3	AT2	AT1	AT0
	R	Analog Trigger Threshold voltage Register															
										AT7	AT6	AT5	AT4	AT3	AT2	AT1	AT0

AT7: AT0 Analog Trigger Threshold Voltage Register

These registers set the analog trigger threshold voltage level.

AT7: AT0	±0.5V	±1V	±2.5V	±5V
FFh	0.496	0.992	2.48	4.96
FEh	0.492	0.984	2.46	4.92
.	.	.	.	.
81h	0.004	0.008	0.02	0.04
80h	0	0	0	0
79h	-0.004	-0.008	-0.02	-0.04
.	.	.	.	.
01h	-0.496	-0.992	-2.48	-4.96
00h	-0.5	-1	-2.5	-5

C.15 Calibration Command

Table C.17: Register for Calibration Command

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
28h	W	Calibration Command Register															
				CG1	CG0	X	CM2	CM1	CM0	CD7	CD6	CD5	CD4	CD3	CD2	CD1	CD0
	R																
				CG1	CG0	CBUSY	CM2	CM1	CM0	CD7	CD6	CD5	CD4	CD3	CD2	CD1	CD0

CD7: CD0 Calibration Data

The value is form 00h to FFh.

CM2: CM0 Calibration Command Register

CM2	CM1	CM0	Meaning
0	0	0	Analog input CH0 offset adjustment
0	0	1	Analog input CH0 gain adjustment
0	1	0	Analog input CH1 offset adjustment
0	1	1	Analog input CH1 gain adjustment
1	0	0	Analog input CH2 offset adjustment
1	0	1	Analog input CH2 gain adjustment
1	1	0	Analog input CH3 offset adjustment
1	1	1	Analog input CH4 gain adjustment

G1: G0 Calibration Range Code

G1	G0	Input Range
0	0	-5 to +5 V
0	1	-2.5 to +2.5 V
1	0	-1 to +1 V
1	1	-0.5 to +0.5 V

CBUSY Calibration command busy flag

This bit indicates the calibration command is complete and ready for next command input.

C.16 Board ID

Table C.18: Register for Board ID

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2Ch	R	Board ID															
														BID3	BID2	BID1	BID0

BID3: BID0 Board ID

Board ID selector value is from 0 to 15. Please refer to board ID switch setting.

C.17 Reset DMA Start Channel to CH0

Table C.19: Register for Reset DMA Start Channel to CH0

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
30h	W	Reset DMA start channel to CH0															

Reset DMA Start Channel to CH0

Write any value to BASE+30h to reset DMA transfer data from CH0. Before start DMA transfer, user has to reset the start channel to CH0. This only for four channels DMA data transfer.

C.18 AD Channel nDATA

Table C.20: Register for AD Channel nDATA

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
30h	R	AD Channel n DATA															
		TRGF	OV	G1	G0	AD11	AD10	AD9	AD8	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0
32h	R	AD Channel n+1 DATA															
		TRGF	OV	G1	G0	AD11	AD10	AD9	AD8	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0

AD Channel nDATA (n = 0 or 2)

BASE + 30, 32 are for four channels DMA data transfer. Data transfer will alternate from CH0 + CH1 to CH2 + CH3 automatically. The format is the same as BASE + 0, 2 or BASE + 4, 6. CH0 + CH1 is first 32-bit, CH2 + CH3 is the second and CH0 + CH1, …and so on. User only want to transfer CH0 + CH1, please use BASE + 0, 2, transfer CH2 + CH3, please use BASE + 4, 6. About DMA data transfer, please refer to PCI9056 datasheet.

DMA data transfer support 1, 2 or 4 channels data acquisition.

For 1 channel data acquisition, only channel 0 or 2 is acceptable. For 2 channels data acquisition, only channel 0,1 or 2,3 is acceptable.

The DMA data transfer to memory format are list as below:

1. One channel CH0

Memory Address	**D31**	**D16**	**D15**	**D0**
N	CH0 data 1		CH0 data 0	
N+1	CH0 data 3		CH0 data 2	
N+2	CH0 data 5		CH0 data 4	
N+3	CH0 data 7		CH0 data 6	
:	:		:	

2. Two channel CH0 + CH1

Memory Address	D31	D16	D15	D0
N	CH1 data 0		CH0 data 0	
N+1	CH1 data 1		CH0 data 1	
N+2	CH1 data 2		CH0 data 2	
N+3	CH1 data 3		CH0 data 3	
:	:		:	

3. Four channel CH0 + CH1 + CH2 + CH3

Memory Address	D31	D16	D15	D0
N	CH1 data 0		CH0 data 0	
N+1	CH3 data 0		CH2 data 0	
N+2	CH1 data 1		CH0 data 1	
N+3	CH3 data 1		CH2 data 1	
:	:		:	

C.19 DMA Request Selector

Table C.21: Register for DMA Request Selector

Base Address + HEX		MIC-3714 Register Format															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
34h	W	DMA Request selector															
																	DS0

DS0 **DMA Request Selector**

This bit select the DMA request (hardware signal DREQ), user could use FIFO 0 flag or FIFO 2 flag to generate DREQ.

0 FIFO 0 flag

1 FIFO 2 flag

Note: *When the user applies the single AI channel (channel 0), this bit should be set to 0. If user applied AI to channel 0 and channel 1, this bit should be set to 1. In the other words, if the user sets AI to channel 2 and channel 3, this bit will be set as 1. When the user applies the total 4 AI channels, this bit can be either 0 or 1.*