AIO3315

Analog IO Card

Software Development Kit

Vecow

1.0 Edition 20210112

Record of Revision

Version	Date	Page	Description	Remark
0.1	2020/12/21	All	Initial Release	
1.0	2021/01/12	All	Official Release	

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CHAPTER 1 INSTALL THE SOFTWARE

1.1 How to Install the Software

1.1.1 Install PCI driver

The PCI card is a plug and play card, once you add on a new card, the window system will detect while it is booting. Please follow the following steps to install your new card.

For Windows XP / Windows 7 and up: (take Win XP as example)

1. Make sure the power is off
2. Plug in the interface card
3. Power on
4. A hardware install wizard will appear and tell you it finds a new PCI card
5. Do not response to the wizard, just Install the file (..\AIO3315_A\Software\WinXP_7_10\ or if you download from website please execute the file AIO3315_Install(Vx.x_yyyymm).exe to get the file)
6. After installation, power off
7. Power on, it's ready to use

1.1.2 Where to Find the Files

For Windows XP / Windows 7 and up, the directory will be located at your install path:

..\AIO3315\API\(header files and lib files for VB, VC, BCB, C#, VB.net)
..\AIO3315\API\x64(for x64 system, header files and lib files for VC, BCB, C#, VB.net)
..\AIO3315\Driver\(backup copy of AIO3315 drivers)
..\AIO3315\exe\(demo program and source code)

The system driver is located at windows_folder\system32\Drivers and the DLL is located at windows_folder\system.

Note:

- For Windows 32-bit system, the default directory at "C:\Program Files"
- For Windows 64-bit system, the default directory at "C:\Program Files (x86)"
- Windows folder: windows install path (usually at "C:\windows\")

For your easy startup, the demo program with source code demonstrates the card functions and help file.

1.1.3 About the Software Package

AIO3315 software includes a set of dynamic link library (DLL) and system driver that you can utilize to control the I/O card's ports and points separately.

Your AIO3315 software package includes setup driver, tutorial example and test program that help you how to setup and run appropriately, as well as an executable file which you can use to test each of the AIO3315 functions within Windows' operation system environment.

To set up and use your AIO3315 software, you need the following:

- AIO3315 software
- AIO3315 hardware Main board
- Wiring board (Option)

You have several options to choose from when you are programming AIO3315 software. You can use Borland C/C++, Microsoft Visual C/C++, Microsoft Visual Basic, or any other Windows-based compiler that can call into Windows dynamic link libraries (DLLs) for use with the AIO3315 software.

1.2 Language Support

The AIO3315 software library is a DLL used with Windows XP / Windows 7 and up. You can use these DLL with any Windows integrating development environment that can call Windows DLLs.

1.2.1 Building Applications with the AIO3315 Software Library

The AIO3315 function reference topic contains general information about building AIO3315 applications, describes the nature of the AIO3315 files used in building AIO3315 applications, and explains the basics of making applications using the following tools:

- Microsoft Visual C/C++
- Borland C/C++
- Microsoft Visual C#
- Microsoft Visual Basic
- Microsoft VB.net

If you are not using one of the tools listed, consult your development tool reference manual for details on creating applications that call DLLs.

1.2.2 AIO3315 Windows Library

The AIO3315 for Windows function library is a DLL called AIO3315.dll. Since a DLL is used, AIO3315 functions are not linked into the executable files of applications. Only the information about the AIO3315 functions in the AIO3315 import libraries is stored in the executable files. Import libraries contain information about their DLL-exported functions. They indicate the presence and location of the DLL routines. Depending on the development tools you are using, you can make your compiler and linker aware of the DLL functions through import libraries or through function declarations.

Refer to Table 1 to determine to which files you need to link and which to include in your development to use the AIO3315 functions in AIO3315.dll.

Table 1. Header Files and Import Libraries for Different Development Environment

Language	Header File	Import Library
Microsoft Visual C/C++	AIO3315.h	AIO3315VC.lib
Borland C/C++	AIO3315.h	AIO3315BC.lib
Microsoft Visual C#	AIO3315.cs	

Microsoft Visual Basic	AIO3315.bas	
Microsoft VB.net	AIO3315.vb	

CHAPTER 2 DLL FUNCTIONS

2.1 Function Format and Language Difference

2.1.1 Function Format

Every AIO3315 function is consist of the following format:

Status = function_name (parameter 1, parameter 2, … parameter n);

Each function returns a value in the Status global variable that indicates the success or failure of the function. A returned Status equal to zero that indicates the function executed successfully. A non-zero status indicates failure that the function did not execute successfully because of an error or executed with an error.

Note: Status is a 32-bit unsigned integer.

The first parameter to almost every AIO3315 function is the parameter CardID which is located the driver of AIO3315 board you want to use those given operation. The CardID is assigned by DIP/ROTARY SW. You can utilize multiple devices with different card CardID within one application; to do so, simply pass the appropriate CardID to each function.

Note: CardID is set by DIP/ROTARY SW (0x0-0xF)

These topics contain detailed descriptions of each AIO3315 function. The functions are arranged alphabetically by function name. Refer to AIO3315 Function Reference for additional information.

2.1.2 Variable Data Types

Every function description has a parameter table that lists the data types for each parameter. The following sections describe the notation used in those parameter tables and throughout the manual for variable data types.

Table 2. Data Type Parameter Table

Primary Type Names					
Name	**Description**	**Range**	**C/C++**	**Visual BASIC**	**Pascal (Borland Delphi)**
u8	8-bit ASCII character	0 to 255	char	Not supported by BASIC. For functions that require character arrays, use string types instead.	Byte
I16	16-bit signed integer	-32, 768 to 32, 767	short	Integer (for example: Device Num%)	Small Int
U16	16-bit unsigned integer	0 to 65, 535	unsigned short for 32-bit compilers	Not supported by BASIC. For functions that require unsigned integers, use the signed integer type instead. See the i16 description.	Word
I32	32-bit signed integer	-2, 147, 483, 648 to 2, 147, 483, 647	long	Long (for example: count&)	Long Int
U32	32-bit unsigned integer	0 to 4, 294, 967, 295	Unsigned long	Not supported by BASIC. For functions that require unsigned long integers, use the signed long integer type instead. See the i32 description.	Cardinal (in 32-bit operating systems). Refer to the i32 description.
F32	32-bit single-precision floating-point value	-3.402823E+38 to 3.402823E+38	float	Single (for example: num!)	Single
F64	64-bit double-precision floating-point value	-1.797683134862 315E+308 to 1.797683134862 315E+308	double	Double (for example: voltage Number)	Double

2.1.3 Programming Language Considerations

Apart from the data type differences, there are a few language-dependent considerations you need to be aware of when you use the AIO3315 API. Read the following sections that apply to your programming language.

Note: Be sure to include the declaration functions of AIO3315 prototypes by including the appropriate AIO3315 header file in your source code. Refer to Building Applications with the AIO3315 Software Library for the header file appropriate to your compiler.

Function format for C/C++

For C or C++ programmers, parameters listed as Input/Output parameters or Output parameters are pass-by-reference parameters, which means a pointer points to the destination variable should be passed into the function. For example, the Read Port function has the following format:

*Status = AIO3315_port_read (u8 CardID, u8 port, u8*data);*

where CardID and port are input parameters, and data is an output parameter. Consider the following example:

u8 CardID, port; u8 data,

u32 Status;

Status = AIO3315_port_read (CardID, port, &data);

Function format for Visual basic

The file AIO3315.bas contains definitions for constants required for obtaining DIO Card information and declared functions and variable as global variables. You should use these constants symbols in the AIO3315.bas, do not use the numerical values.

In Visual Basic, you can add the entire AIO3315.bas file into your project. Then you canuse any of the constants defined in this file and call these constants in any module of your program. To add the AIO3315.bas file for your project in Visual Basic 4.0, go to the File menu and select the Add File... option. Select AIO3315.bas, which is browsed in the AIO3315 \ API directory. Then, select Open to add the file to the project.

To add the AIO3315.bas file to your project in Visual Basic 5.0 and 6.0, go to the Project menu and select Add Module. Click on the Existing tab page. Select AIO3315.bas, which is in the AIO3315 \ API directory. Then, select Open to add the file to the project

Function format for Borland C++ builder

To use Borland C++ builder as development tool, you should generate a .lib file from the .dll file by implib.exe.

implib AIO3315BC.lib AIO3315.dll

Then add the AIO3315BC.lib to your project and add #include “AIO3315.h” to main program.

Now you may use the DLL functions in your program. For example, the Read Port function has the following format:

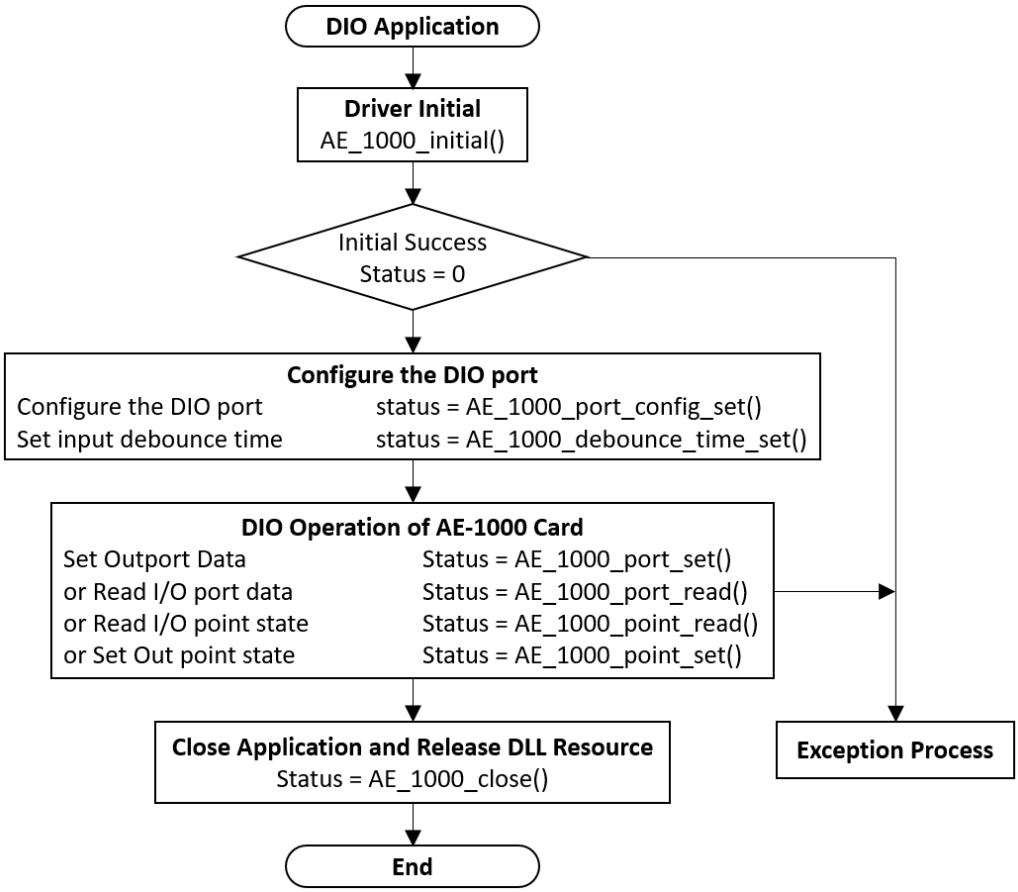
*Status = AIO3315_port_read (u8 CardID, u8 port, u8*data);*

where CardID and port are input parameters, and data is an output parameter. Consider the following example:

```
u8 CardID, port; u8 data;
u32 Status;
Status = AIO3315_port_read (CardID, port, &data);
```

2.2 Flow Chart of Application Implementation

2.2.1 Flow chart of Application Implementation



You need to initialize system resource each time you run your application. AIO3315_initial() will do. Once you want to close your application, call AIO3315_close() to release all the resource. If you want to know the physical address assigned by OS. Use AIO3315_info() to get the address and Card Type

2.3 Software Overview and DLL Function

2.3.1 DLL list

Table 3. DLL list

No.	Function Name	Description
1.	AIO3315_initial( )	AIO3315 Initial
2.	AIO3315_close( )	AIO3315 Close
3.	AIO3315_info( )	get OS. Assigned address
4.	AIO3315_DA_set( )	DA output
5.	AIO3315_DA_read( )	read back DA setting data
6.	AIO3315_AD_config_set( )	configure each channel as differential or single end
7.	AIO3315_AD_config_read( )	read back configuration of each channel
8.	AIO3315_AD_range_set( )	set up each group conversion range
9.	AIO3315_AD_range_read( )	Read back each group conversion range setting
10.	AIO3315_AD_start( )	start AD conversion of designated channel
11.	AIO3315_AD_read( )	read AD conversion data
12.	AIO3315_AD_all_read( )	Read a specific port AD data
13.	AIO3315_port_config_set( )	Port direction configuration
14.	AIO3315_port_config_read( )	Read back port configuration
15.	AIO3315_debounce_time_set( )	Set input port debounce time
16.	AIO3315_debounce_time_read( )	Read back input port debounce time
17.	AIO3315_port_set( )	Set Output port
18.	AIO3315_port_read( )	Read the register or input values of the I/O port
19.	AIO3315_point_set ( )	Set the bit data of output port
20.	AIO3315_point_read( )	Read the state of the input points or output register
21.	AIO3315_timer_set( )	Set timer constant
22.	AIO3315_timer_read( )	Read timer on the fly
23.	AIO3315_timer_start( )	Start timer operation
24.	AIO3315_timer_stop( )	Stop timer operation

25.	AIO3315_TC_set( )	load data to timer related registers
26.	AIO3315_TC_read( )	Read back data of timer related registers
27.	AIO3315_IRQ_polarity_set( )	Sets the IRQ polarity of port0
28.	AIO3315_IRQ_polarity_read( )	Read back the setting of IRQ polarity
29.	AIO3315_IRQ_mask_set( )	Mask off the IRQ
30.	AIO3315_IRQ_mask_read( )	Read back the mask
31.	AIO3315_IRQ_process_link( )	Link irq service routine
32.	AIO3315_IRQ_enable( )	Enable interrupt function
33.	AIO3315_IRQ_disable( )	Disable interrupt function
34.	AIO3315_IRQ_status_read( )	Read back the IRQ status

2.3.2 General Functions

AIO3315_initial

Format: u32 status =AIO3315_initial (void)
Purpose: Initial the AIO3315 resource when start the Windows applications.

AIO3315_close

Format: u32 status =AIO3315_close (void);
Purpose: Release the AIO3315 resource when close the Windows applications.

AIO3315_info

Format: u32 status =AIO3315_info(u8 CardID, u8 *CardType, u16 *DIO_address, u16 *TC_address);
Purpose: Read the physical I/O address assigned by O.S.
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
Output	CardType	u8	0: AIO3315 (12 bit version) 1: AIO3315A (16 bit version)
	DIO_address	u16	physical I/O address assigned to DIO block by OS
	TC_address	u16	physical I/O address assigned to timer block by OS

2.3.3 DA (Digital to Analog) Function

The digital to analog conversion function is implemented by hardware, to output analog voltage just use:

AIO3315_DA_set( ), and you can also read back the settings by
AIO3315_DA_read( ).
AIO3315_DA_set
Format: u32 status = AIO3315_DA_set(u8 CardID, u8 channel, u16 data)
Purpose: DA output
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
	channel	u8	0: DA0 channel 1: DA1 channel
	data	u16	0~0xfff (AIO3315), 0~0xffff (AIO3315A) for analog output range -10V~ +10V 0: -10V … 0x7ff (AIO3315) 0x7fff (AIO3315A): 0V … 0xfff (AIO3315) 0xffff (AIO3315A): 10V

AIO3315_DA_read

Format: u32 status = AIO3315_DA_read(u8 CardID, u8 channel, u16 *data)
Purpose: read back DA setting data
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
	channel	u8	0: DA0 channel 1: DA1 channel
Output	data	u16	0~0xfff (AIO3315), 0~0xffff (AIO3315A) for analog output –10V ~ 10V 0: -10V …

			0x7ff (AIO3315) 0x7fff (AIO3315A): 0V … 0xfff (AIO3315) 0xffff (AIO3315A): 10V

2.3.4 AD (Analog to Digital) Function

The analog input maybe single end or differential, you can configure individual channel as single end input or the corresponding pair as differential input by:

AIO3315_AD_config_set( ) and read back to verify the configuration setting by AIO3315_AD_config_read( ).

The analog inputs maybe at different voltage range, you can configure the adequate input range to fit the inputs by:

AIO3315_AD_range_set( ) and read back to verify the settings by:
AIO3315_AD_range_read( )

Once the input type and input range has been set, you can start AD conversion by:

AIO3315_AD_start ( ) and read the conversion data by
AIO3315_AD_read( ).

To read a specific port (contains 8 channels) use:

AIO3315_AD_all_read( )

AIO3315_AD_config_set

Format: u32 status = AIO3315_AD_config_set (u8 CardID, u8 port, AD_config *AD_config)
Purpose: configure each channel as differential or single end.
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
	port	u8	0: port0, AD0x 1: port1, AD1x 2: port2, AD2x 3: port3, AD3x
	AD_config	AD_config	struct _AD_config{ u8 ch01_config, u8 ch23_config, u8

			ch45_ config, u8 ch67_ config
			}
			// ch01: AIx0~AIx1
			// ch23: AIx2~AIx3
			// ch45: AIx4~AIx5
			// ch67: AIx6~AIx7
			// chNM_config:
			//0: chNM is paired differential and polarity is normal
			//1: chNM is paired differential and polarity is inverse
			//2: invalid
			//3: chNM is single end
			For example, if you will configure
			channel 0, 1 as differential with polarity normal,
			channel 2, 3 as single end
			channel 4, 5, channel 6, 7 as differential with inverse polarity then struct AD_config is {0, 3, 1, 1}

AIO3315_AD_config_read

Format: u32 status = AIO3315_AD_config_read (u8 CardID, u8 port, AD_config*AD_config)

Purpose: read back configuration of each channel.

Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
	port	u8	0: port0, AD0x 1: port1, AD1x 2: port2, AD2x 3: port3, AD3x
Output	AD_config	AD_config	struct _AD_config{ u8 ch01_config, u8 ch23_config, u8 ch45_ config, u8 ch67_ config}

AIO3315_AD_range_set

Format: u32 status = AIO3315_AD_range_set(u8 CardID, u8 port, AD_range *AD_range)

Purpose: set up each group conversion range

Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
	port	u8	0: port0, AD0x 1: port1, AD1x 2: port2, AD2x 3: port3, AD3x
	AD_range	AD_range	struct _AD_Range{ u8 ch0_ range, u8 ch1_ range, u8 ch2_ range, u8 ch3_ range u8 ch4_ range, u8 ch5_ range, u8 ch6_ range, u8 ch7_ range} // chN_range //0: +-5V //1: 0-5V //2: +-10V //3: 0-10V

Note:

- If the even channel is configured as differential input, the next odd number channel member is invalid.
- For example ch0 is configured as differential input by AIO3315_AD_config_set, then the AD_Range.ch1_range is of no use.

AIO3315_AD_range_read

Format: u32 status = AIO3315_AD_range_read(u8 CardID, u8 port, AD_range *AD_range)

Purpose: read back each group conversion range setting

Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
	port	u8	0: port0, AD0x 1: port1, AD1x 2: port2, AD2x 3: port3, AD3x
Output	AD_range	AD_range	struct _AD_Range{ u8 ch0_ range, u8 ch1_ range, u8

			ch2_ range, u8 ch3_ range
			u8 ch4_ range, u8 ch5_ range, u8 ch6_ range, u8 ch7_ range
			}
			// chN_range
			//0: +-5V
			//1: 0-5V
			//2: +-10V
			//3: 0-10V

AIO3315_AD_start

Format: u32 status = AIO3315_AD_start(u8 CardID, u8 port, u8 channel)

Purpose: start AD conversion of designated port and channel

Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
	port	u8	0: port0, AD0x 1: port1, AD1x 2: port2, AD2x 3: port3, AD3x
	channel	u8	0~7, channel no for portN

AIO3315_AD_read

Format: u32 status = AIO3315_AD_read(u8 CardID, u8 port, u16 *data)

Purpose: read AD conversion data of previous designated port and channel

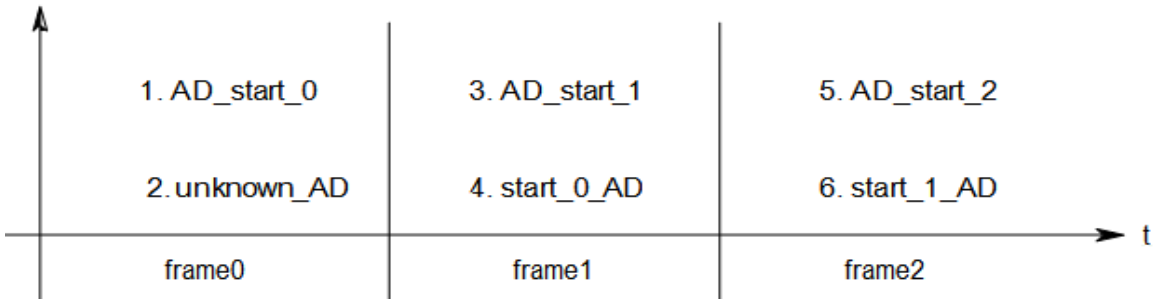
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
	port	u8	0: port0, AD0x 1: port1, AD1x 2: port2, AD2x 3: port3, AD3x
	data	u16	0~0xfff (AIO3315), 0~0xffff (AIO3315A).

			AD converted data

Note:

- AIO3315_AD_start will select the port and channel for the next AD operation.
- Before read back the data by AIO3315_AD_read, you must check the status by AIO3315_IRQ_status_read (no matter you use interrupt or not) to confirm the AD data is ready.
- The AD conversion time frame is as follows:



At the same time frame, the command starts the designated AD channel and collect the converted data. In order to confirm the operation is complete, we suggest using *AIO3315_IRQ_status_read* to verify the completeness of conversion then use *AIO3315_AD_read* to read the converted data.

AIO3315_AD_all_read

Format: u32 status = AIO3315_AD_all_read(u8 CardID, u8 port, u16 data[8])

Purpose: read AD conversion data of all channels of a specific port.

Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by jumper setting
	port	u8	0: port0, AD0x 1: port1, AD1x 2: port2, AD2x 3: port3, AD3x
	data[8]	u16	0~0xfff (AIO3315), 0~0xffff (AIO3315A). AD converted data

Note:

- To read all channels, please follow the sequence:

1. Set up start channel at channel 0 by AIO3315_AD_start.
2. Read all channels by AIO3315_AD_all_read.

2.3.5 I/O Port R/W

Before using a IO port, you must configure the port direction (as input or as output) first by *AIO3315_port_config_set( )* and any time you can read back configuration by *AIO3315_port_config_read( )*

Mechanical contact or noisy environment always induced unstable state at digital inputs, the AIO3315 provides software selectable debounce function (the former digital IO cards use hardware debounce and fixed at one frequency). You can filter out the pulse width at 10ms (100Hz), 5ms (200Hz), 1ms (1KHz) or no filter as you need.

Use *AIO3315_debounce_time_set( )* to select the debounce frequency and read back the setting by *AIO3315_debounce_tme_read( )*.

Then you can use the following functions for I/O port output, data reading and control:
AIO3315_port_set( ) to output byte data to output port,
AIO3315_port_read( ) to read a byte data from I/O port,
AIO3315_point_set ( ) to set output bit,
AIO3315_point_read( ) to read I/O bit,

AIO3315_port_config_set

Format: u32 status =AIO3315_port_config_set (u8 CardID, u8 port, u8 configuration)
Purpose: Sets port configuration.
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	port	u8	port number 0: port0 1: port1
	configuration	u8	b0: 0: port0 as input port (default) 1: port0 as output port b1: 0: port1 as input port (default) 1: port1 as output port

AIO3315_port_config_read

Format: u32 status =AIO3315_port_config_read (u8 CardID, u8 port, u8 *configuration)

Purpose: read port configuration.

Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	port	u8	port number 0: port0 1: port1
Output	configuration	u8	b0: 0: port0 as input port (default) 1: port0 as output port b1: 0: port1 as input port (default) 1: port1 as output port

AIO3315_debounce_time_set

Format: u32 status = AIO3315_debounce_time_set (u8 CardID, u8 port, u8 debounce_time)

Purpose: set the input port debounce time

Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	port	u8	port number 0: port0 1: port1
	debounce_time	u8	Debounce time selection: 0: no debounce 1: filter out duration less than 10ms (default) 2: filter out duration less than 5ms 3: filter out duration less than 1ms

Note: only valid for port configured as input

AIO3315_debounce_time_read

Format: u32 status = AIO3315_debounce_time_read (u8 CardID, u8 port, u8 *debounce_time)

Purpose: To read back configuration of debounce mode

Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	port	u8	port number 0: port0 1: port1
Output	debounce_time	u8	Debounce time selection: 0: no debounce 1: filter out duration less than 10ms (default) 2: filter out duration less than 5ms 3: filter out duration less than 1ms

AIO3315_port_set

Format: u32 status = AIO3315_port_set (u8 CardID, u8 port, u8 data)
Purpose: Sets the output data.
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	port	u8	port number 0: port0 1: port1
	data	u8	bitmap of output values If port is configured as input, the data is registered and do not output. If port is configured as output, the data is registered and output.

Note: If you change the configuration from input to output, the previous registered data will be output.

AIO3315_port_read

Format: u32 status = AIO3315_port_read (u8 CardID, u8 port, u8 *data)
Purpose: Read the register or input values of the I/O port.
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	port	u8	port number 0: port0 1: port1

Output	data	u8	I/O data If port is configured as input, the data is external input data. If port is configured as output, the data is the output register data.

AIO3315_point_set

Format: u32 status =AIO3315_point_set (u8 CardID, u8 port, u8 point, u8 state)
Purpose: Sets the bit data of output port.
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	port	u8	port number 0: port0 1: port1
	point	u8	point number 0~7 for bit0~bit7
	state	u8	state of output point If port is configured as input, the data is registered and do not output. If port is configured as output, the data is registered and output.

Note: If you change the configuration from input to output, the previous registered data will be output.

AIO3315_point_read

Format: u32 status =AIO3315_point_read (u8 CardID, u8 port, u8 point, u8 *state)
Purpose: Read the state of the input points or output register.
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	port	u8	port number 0: port0 1: port1
	point	u8	point number of input

			0~7 for bit0~bit7
Output	state	u8	state of point of input If port is configured as input, the data is external input data. If port is configured as output, the data is the output register data.

2.3.6 Timer Function

There is a build in 32 bit timer run on 1us time base, you can set the timer constant by *AIO3315_timer_set( )* and *AIO3315_timer_read( )* to read timer value on the fly. *AIO3315_timer_start( )* to start its operation and generate interrupt, *AIO3315_timer_stop( )* to stop operation.

For the timer related registers use: *AIO3315_TC_set( )* to set registers, *AIO3315_TC_read( )* to read back registers.

AIO3315_timer_set

Format: u32 status = AIO3315_timer_set (u8 CardID, u32 Timer_constant)
Purpose: set time constant.
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
	Timer_constant	u32	Timer _constant based on 1us time base

Note:

1. Time constant is based on 1us clock, period T= (time_constant +1) * 1us

2. If you also enable the timer interrupt, the period T must at least larger than the system interrupt response time else the system will be hanged by excess interrupts.

AIO3315_timer_read

Format: u32 status = AIO3315_timer_read (u8 CardID, u32 * Timer_constant)
Purpose: To read timer value on the fly
Parameters:

I/O	Name	Type	Description

Input	CardID	u8	assigned by DIP/ROTARY SW
Output	Timer_constant	u32	timer value on the fly

AIO3315_timer_start

Format: u32 status = AIO3315_timer_start (u8 CardID)
Purpose: start timer function.
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW

Note: timer time out will generate interrupt if you do not mask off by using AIO3315_IRQ_mask_set.

AIO3315_timer_stop

Format: u32 status = AIO3315_timer_stop (u8 CardID)
Purpose: stop timer function.
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW

AIO3315_TC_set

Format: u32 status= AIO3315_TC_set (u8 CardID, u8 index, u32 data)
Purpose: To load data to timer related registers
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
	index	u8	0: TC_CONTROL 1: PRELOAD 2: TIMER
	data	u32	For index = TC_CONTROL 0: stop timer operation 1: timer run For index = PRELOAD or TIMER Data is the constant to be load

Note: PRELOAD is the register for timer to re-load, the value will be valid while timer count to zero and reload the data.

AIO3315_TC_read

Format: u32 status= AIO3315_TC_read (u8 CardID, u8 index, u32 *data)
Purpose: To read data from timer related registers
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by DIP/ROTARY SW
	index	u8	0: TC_CONTROL 1: PRELOAD 2: TIMER
Output	data	u32	Data read back

2.3.7 Interrupt Function

Sometimes you want your application to take care of the I/O while special event occurs, interrupt function is the right choice. AIO3315 provide IO00 ~ IO07 as external event trigger input. You may configure the trigger polarity by:
AIO3315_IRQ_polarity_set( ) and read back by
AIO3315_IRQ_polarity read( )
For timer, AD and digital IO interrupts, you can mask off the source you don' want by
AIO3315_IRQ_mask_set( ) and read back by
AIO3315_IRQ_mask_read( ).
After all the above is prepared, you must first link your service routine to the driver by
AIO3315_IRQ_process_link( )
Now all is ready, you can enable the interrupt by AIO3315_IRQ_enable( ) or disable by AIO3315_IRQ_disable( ).
To read back the interrupt status (at interrupt service routine or polling routine) use AIO3315_IRQ_status_read( ).
After reading the status register on card will be cleared.

AIO3315_IRQ_polarity_set

Format: u32 status = AIO3315_IRQ_polarity_set (u8 CardID, u8 polarity)
Purpose: Sets the IRQ polarity of port0 (IO00~IO07)
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	polarity	u8	Data to be set, 0x0 ~ 0xff bit0: IO00 0:normal (default) 1:invert … bit7: IO07 0:normal (default) 1:invert

Note: Port0 must configured as input port for IO00~IO07 IRQ function.

AIO3315_IRQ_polarity_read

Format: u32 status = AIO3315_IRQ_polarity_read (u8 CardID, u8 *polarity)
Purpose: Read the IRQ polarity of the IO00~IO07
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
Output	polarity	u8	Data to be set, 0x0 ~ 0xff bit0: IO00 0:normal (default) 1:invert … bit7: IO07 0:normal (default) 1:invert

AIO3315_IRQ_mask_set

Format: u32 status = AIO3315_IRQ_mask_set (u8 CardID, u8 source, u8 mask)
Purpose: Mask interrupt from port0 IO07~IO00 or timer
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	source	u8	0: digital I/O block 1: AD block 2: timer block
	mask	u8	Digital IO block: b0=0, IO00 input disable irq b0=1, IO00 input can generate irq …

			b7=0, IO07 input disable irq b7=1, IO07input can generate irq AD block: b0=1 means AD0 end of conversion can generate interrupt b0=0 AD0 will not generate interrupt while end of conversion b1=1 means AD1 end of conversion can generate interrupt b1=0 AD1 will not generate interrupt while end of conversion b2=1 means AD2 end of conversion can generate interrupt b2=0 AD2 will not generate interrupt while end of conversion b3=1 means AD3 end of conversion can generate interrupt b3=0 AD3 will not generate interrupt while end of conversion Timer block: b0=1 means timer time out can generate interrupt b0=0 timer will not generate interrupt while time out

AIO3315_IRQ_mask_read

Format: u32 status = AIO3315_IRQ_mask_read (u8 CardID, u8 source, u8 *mask)

Purpose: read back interrupt Mask of IO07~IO00 or ADC or timer

Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	source	u8	0: digital I/O block 1: AD block 2: timer block
Output	mask	u8	Digital IO block: b0=0, IO00 input disable irq b0=1, IO00 input can generate irq

			… b7=0, IO07 input disable irq b7=1, IO07input can generate irq AD block: b0=1 means AD0 end of conversion can generate interrupt b0=0 AD0 will not generate interrupt while end of conversion b1=1 means AD1 end of conversion can generate interrupt b1=0 AD1 will not generate interrupt while end of conversion b2=1 means AD2 end of conversion can generate interrupt b2=0 AD2 will not generate interrupt while end of conversion b3=1 means AD3 end of conversion can generate interrupt b3=0 AD3 will not generate interrupt while end of conversion Timer block: b0=1 means timer time out can generate interrupt b0=0 timer will not generate interrupt while time out

AIO3315_IRQ_process_link

Format: u32 status = AIO3315_IRQ_process_link (u8 CardID, void (stdcall *callbackAddr)(u8 CardID))

Purpose: Link irq service routine to driver

Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	callbackAddr	void	callback address of service routine

AIO3315_IRQ_enable

Format: u32 status = AIO3315_IRQ_enable (u8 CardID, HANDLE *phEvent)
Purpose: Enable interrupt from selected source
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
Output	phEvent	HANDLE	event handle

AIO3315_IRQ_disable

Format: u32 status = AIO3315_IRQ_disable (u8 CardID)
Purpose: Disable interrupt from selected source
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW

AIO3315_IRQ_status_read

Format: u32 status = AIO3315_IRQ_status_read (u8 CardID, u8 source, u8 *Event_Status)
Purpose: To read back the interrupt status to identify the source
Parameters:

I/O	Name	Type	Description
Input	CardID	u8	assigned by Rotary SW
	source	u8	0: digital I/O block 1: AD block 2: timer block
Output	Event_Status	u8	Digital IO block: b0=1, IO00 input generate irq … b7=1, IO07 input generate irq AD block: b0=1, AD0 end of conversion and data is ready b0=0, AD0 is under conversion b1=1, AD1 end of conversion and data is ready b1=0, AD1 is under conversion

			b2=1, AD2 end of conversion and data is ready b2=0, AD2 is under conversion b3=1, AD3 end of conversion and data is ready b3=0, AD3 is under conversion Timer block: b0=1 means timer count up occurred. b0=0 means timer not count up.

Note:

- Status read back will also clear the on board status register.
- The status will reflect the on board digital input or timer count up status are irrelevant to the IRQ_MASK

2.3.8 Error Conditions

The status returned by AIO3315 functions may indicate an internal hardware problem on the board.

Error Codes contains a detailed listing of the error. AIO3315 card's error conditions. There are three possible fatal failure modes:

- System Fail Status Bit Valid
- Communication Loss
- Hardware not ready

Please take the error code as reference to solve the problem.

2.4 Error Code Table

2.4.1 Error Code Table

Error Code	Symbolic Name	Description
0	DRV_NO_ERROR	No error.
1	DRV_READ_DATA_ERROR	Read data error
2	DRV_INIT_ERROR	Driver initial error
100	DEVICE_IO_ERROR	Device Read/Write error
101	DRV_NO_CARD	No AIO3315 card on the system.
102	DRV_DUPLICATE_ID	AIO3315 CardID duplicate error.
103	DRV_NOT_INSTALL	AIO3315 driver not installed completely
300	ID_ERROR	Function input parameter error. CardID setting error, CardID doesn't match the DIP SW setting
301	PORT_ERROR	Function input parameter error. Parameter out of range.
302	POINT_ERROR	Function input parameter error. Parameter out of range.
303	DATA_ERROR	Function input parameter error. Parameter out of range.
304	CONFIGURATION_ERROR	Hardware version can not match with software version
305	DEBOUNCE_TIME_ERROR	Debounce timer setting error
400	INDEX_ERRROR	TC register index error
401	CONSTANT_ERROR	Time constant error
402	TC_CONTROL_ERROR	TC control register setting error
500	DA_DATA_ERROR	DA setting data error
501	DA_CHANNEL_ERROR	DA channel selection error
600	AD_PORT_ERROR	AD port selection error
601	AD_CHANNEL_ERROR	AD channel selection error
602	AD_CONFIG_ERROR	AD channel configuration error
603	AD_RANGE_ERROR	AD range setting error
700	SOURCE_ERROR	IRQ source error
701	POLARITY_ERROR	IRQ polarity error
702	MASK_ERROR	IRQ mask error

For further support information, please contact chris.huang@vecow.com

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All product offerings and specifications are subject to change without prior notice.