

**AIO-3320/3321**

**Isolated Analog I/O and  
Digital I/O Card**

**Software Manual (V1.0)**

**健昇科技股份有限公司**

**JS AUTOMATION CORP.**

台北縣汐止市中興路 100 號 6 樓

6F, No. 100, Chungshin Rd.

Shitsu, Taipei, Taiwan, R.O.C.

TEL : 886-2-2647-6936

FAX : 886-2-2647-6940

<http://www.automation.com.tw>

E-mail : [control.cards@automation.com.tw](mailto:control.cards@automation.com.tw)

# Correction record

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# 1. **How to install the software of AIO3320**

## 1.1 Install the PCI driver

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

In Windows 98/2000/XP system you should: (take win98 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. Tell the wizard the directory of the driver files (..\aio3320\software\win98\_2k\_xp\driver or if you download from website please execute the self-unzip file aio3320\_driver.exe to get the file), then it will automatically setup the driver
6. After installation, power off
7. Power on , it's ready to use

For more detail of step by step installation guide, please refer the file "installation.pdf " on the CD come with the product or register as a member of our user's club at:

<http://automation.com.tw/>

to download the complementary documents.

## 2. **Where to find the file you need**

### **Windows98, 2000,XP**

In Windows 98, 2000,XP system, the demo program can be setup by

\aio3320\software\win98\_2k\_xp\install\Setup3320VBdemo.exe and header files setup by

\aio3320\software\win98\_2k\_xp\install\Setup3320API.exe

The directory will be located at

**../ JS Automation /AIO3320/Api** (header files and VB,VC lib files)

**../ JS Automation /AIO3320/Example** (easy source code of initial user)

**../ JS Automation /AIO3320/exe** (demo program and source code)

The system driver is located at ../system32/Driver and the DLL is located at ../system.

For your easy startup, the demo program of the cards function and help file can be setup by

\aio3320\software\nt\install\Setup3320VBdemo.exe

### **3. About the AIO-3320 software**

AIO3320 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 AIO3320 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 AIO3320 functions within Windows' operation system environment.

#### 3.1 What you need to get started

To set up and use your AIO3320 software, you need the following:

- AIO3320 software
- AIO3320 hardware
  - Main board
  - Wiring board (Option)

#### 3.2 Software programming choices

You have several options to choose from when you are programming AIO3320 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 AIO3320 software.

## 4. **AIO3320 Language support**

The AIO3320 software library is a DLL used with Windows 98/2000/XP. You can use these DLL with any Windows integrating development environment that can call Windows DLLs.

### 4.1 Building applications with the AIO3320 software library

The AIO3320 function reference topic contains general information about building AIO3320 applications, describes the nature of the AIO3320 files used in building AIO3320 applications, and explains the basics of making applications using the following tools:

#### **Applications tools**

- ◆ **Borland C/C++**
- ◆ **Microsoft Visual C/C++**
- ◆ **Microsoft Visual Basic**

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

### 4.2 AIO3320 Windows libraries

The AIO3320 for Windows function library is a DLL called **AIO3320.dll**. Since a DLL is used, AIO3320 functions are not linked into the executable files of applications. Only the information about the AIO3320 functions in the AIO3320 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 AIO3320 functions in aio3320.dll.

Header Files and Import Libraries for Different Development Environments		
<b>Development Environment</b>	<b>Header File</b>	<b>Import Library</b>
<b>Microsoft C/C++</b>	aio3320.h	aio3320vc.lib
<b>Borland C/C++</b>	aio3320.h	aio3320bc.lib
<b>Microsoft Visual Basic</b>	aio3320.bas	

**Table 1**

## 5. Software overview

These topics describe the features and functionality of the AIO3320 boards and briefly describes the AIO3320 functions.

### 5.1 Initialization and close

You need to initialize system resource each time you run your application.

[\*aiio3320 initial\(\)\*](#) will do.

Once you want to close your application, call

[\*aiio3320 close\(\)\*](#) to release all the resource.

If you want to know the physical address assigned by OS. use

[\*aiio3320 info\(\)\*](#) to get the address.

If you want to get the device handle you just opened use

[\*aiio3320 get DeviceHandle\(\)\*](#)

### 5.2 Analog input

If you are a green hand of A/D converter,

[\*aiio3320 smart AtoD\(\)\*](#) is a good selection to read your A/D. It will return the scaled conversion data according your selection range.

Expert as you are, first apply

[\*aiio3320 set AD command\(\)\*](#) to select channel , range.

[\*aiio3320 start AD conversion\(\)\*](#) to start A/D conversion.

Then check the A/D status to see if it is conversion ready,

[\*aiio3320 read AD status\(\)\*](#) will do.

If it is ready , read the conversion data for your application.

[\*aiio3320 read AD data\(\)\*](#).

### 5.3 Analog output

The analog output is as simple as digital output

[\*aiio3320 out DA data\(\)\*](#) will output the data to selected channel.

#### 5.4 Digital I/O

There are one byte isolated digital input and one byte digital output on card. To read a port data, use

[\*aio3320 read port\(\)\*](#)

and to read on bit use

[\*aio3320 read point\(\)\*](#).

To output a port data, use

[\*aio3320 set port\(\)\*](#)

and output bit data

[\*aio3320 set point\(\)\*](#) will do.

For the timer/counter applications, the digital I/O also provide the timer/counter I/O function.

[\*aio3320 set dedicate IO\(\)\*](#) can be used to change the IN0,IN1 as general or timer/counter dedicated input,O0,O1 as general or timer/counter dedicated output. To read back status of dedicated I/O use:

[\*aio3320 readback dedicate IO status\(\)\*](#)

#### 5.5 Counter / Timer function

There are 3 major functions of counter/timer function—to work as timer, as counter or as PWM generator. To configure the working mode use

[\*aio3320 set timer\(\)\*](#) to configure as timer and its output mode

[\*aio3320 set counter\(\)\*](#) to configure as counter and its input and output mode

[\*aio3320 set pwm\(\)\*](#) to configure as PWM generator.

Since the timer /counter has multiple clock source to choose,

[\*aio3320 set clock frequency\(\)\*](#) can be used to choose the 4MHz or 33MHz clock source.

After you configure the working mode, a constant must load into counter/timer register and the pre-load register use

[\*aio3320 load GPT\(\)\*](#) will do.

Once you have setup the data

[\*aio3320 GPT enable\(\)\*](#) will enable or disable the counter/timer function.

To check the current counter/timer value

[\*aio3320 read GPT\(\)\*](#) will do.

The special function of one shot mode can be applied by

[\*aio3320 one shot command\(\)\*](#).

To readback the parameters you set

[\*aio3320 read parameter\(\)\*](#) will response the current working mode and the parameters you set for individual timer, counter.

## 5.6 Interrupt function

Interrupt is an efficient method to quick response without occupy too much system resource.

AIO3320 provide timer/counter interrupts, to use interrupt function use

[\*ai03320\\_enable\\_IRQ\(\)\*](#) to enable it and

[\*ai03320\\_link\\_IRQ\\_process\(\)\*](#) to link your irq service routine,

[\*ai03320\\_disable\\_IRQ\(\)\*](#) to disable it.

After you enable and link interrupt, you can enable/disable timer/counter function or enable/disable interrupt function as you need.

To check the irq status

[\*ai03320\\_read\\_IRQ\\_status\(\)\*](#) will do.

## 5.7 Security function

Since AIO3320 is a general purpose card, anyone who can buy from JS Automation Corp. or her distributors. Your program is the fruit of your intelligence, un-authorized copy maybe prevent by the security function enabled.

You can use

[\*ai03320\\_set\\_password\(\)\*](#) to set password and start the security function. Use

[\*ai03320\\_change\\_password\(\)\*](#) to change it.

If you don't want to use security function after the password being setup,

[\*ai03320\\_clear\\_password\(\)\*](#) will reset to the virgin state.

Once the password is set, any function call of the dll's (except for the security functions) will be blocked until the

[\*ai03320\\_unlock\\_security\(\)\*](#) unlock the security.

You can also use

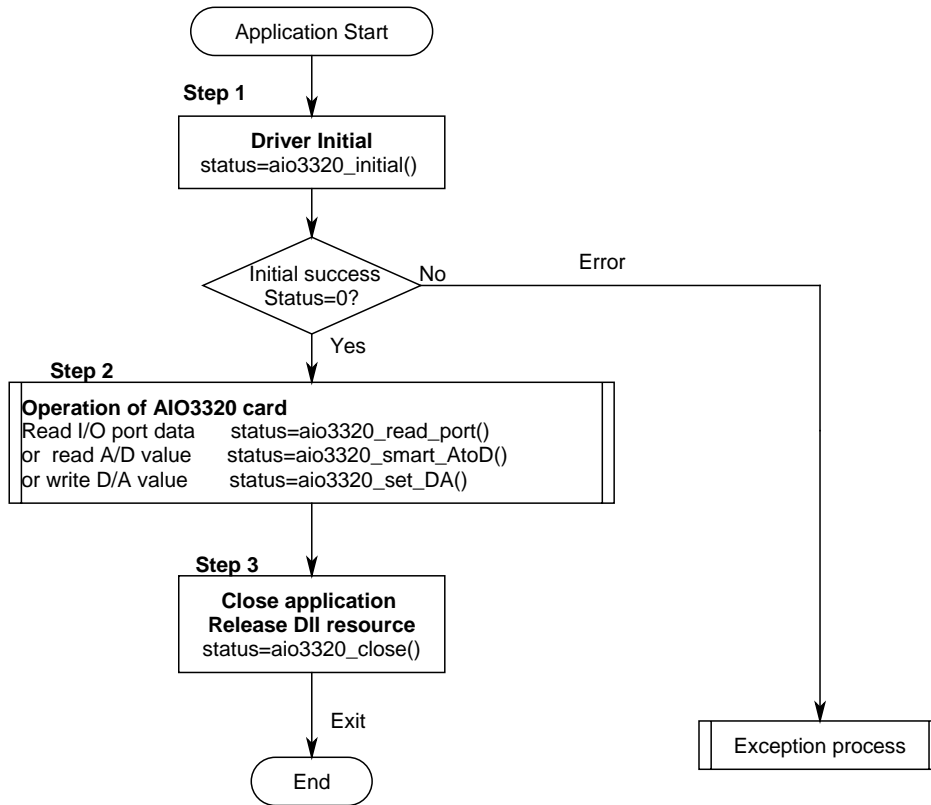
[\*ai03320\\_read\\_security\\_status\(\)\*](#) to check the current status of security.

## 5.8 Error conditions

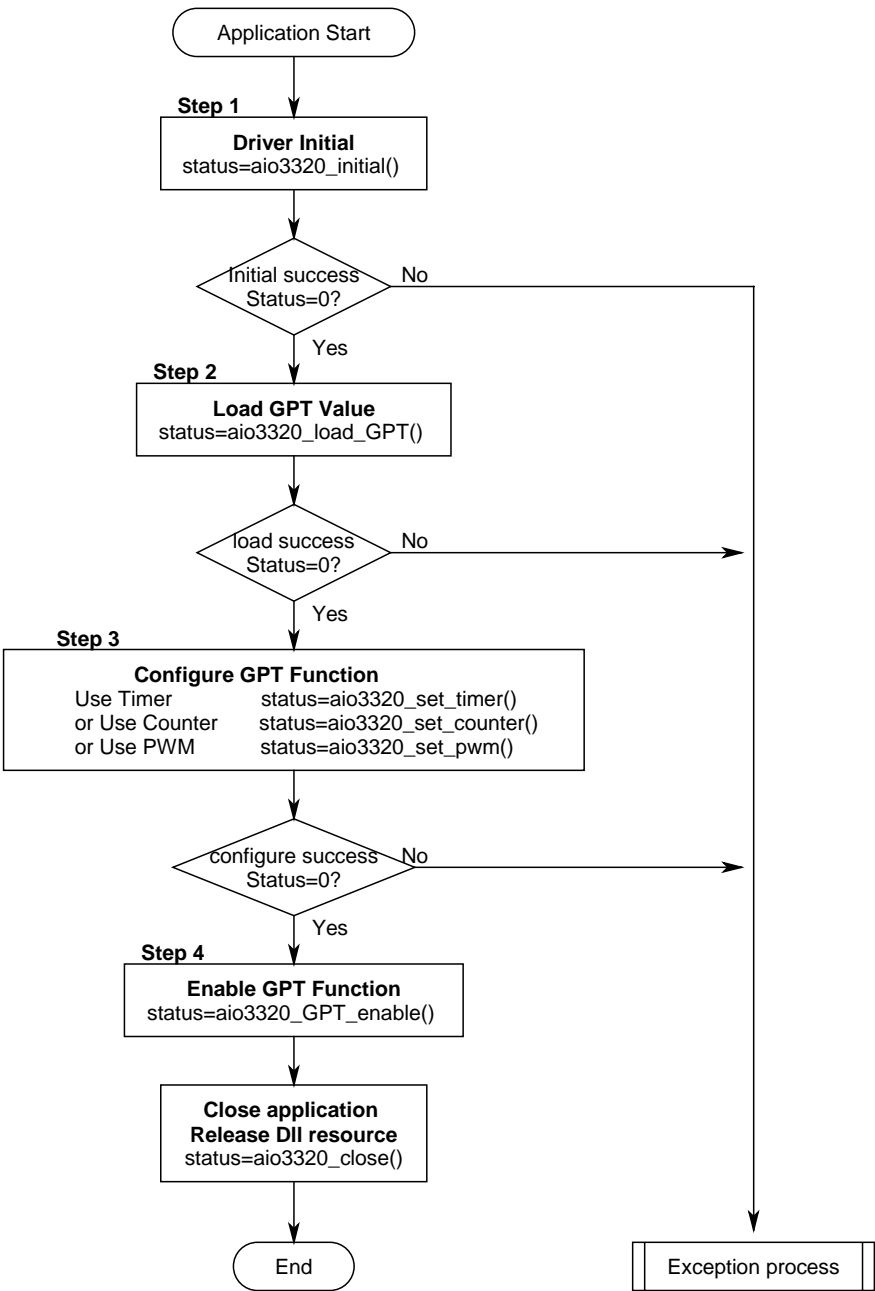
These error types may indicate an internal hardware problem on the board. Error Codes summary contains a detailed listing of the error status returned by AIO3320 functions.

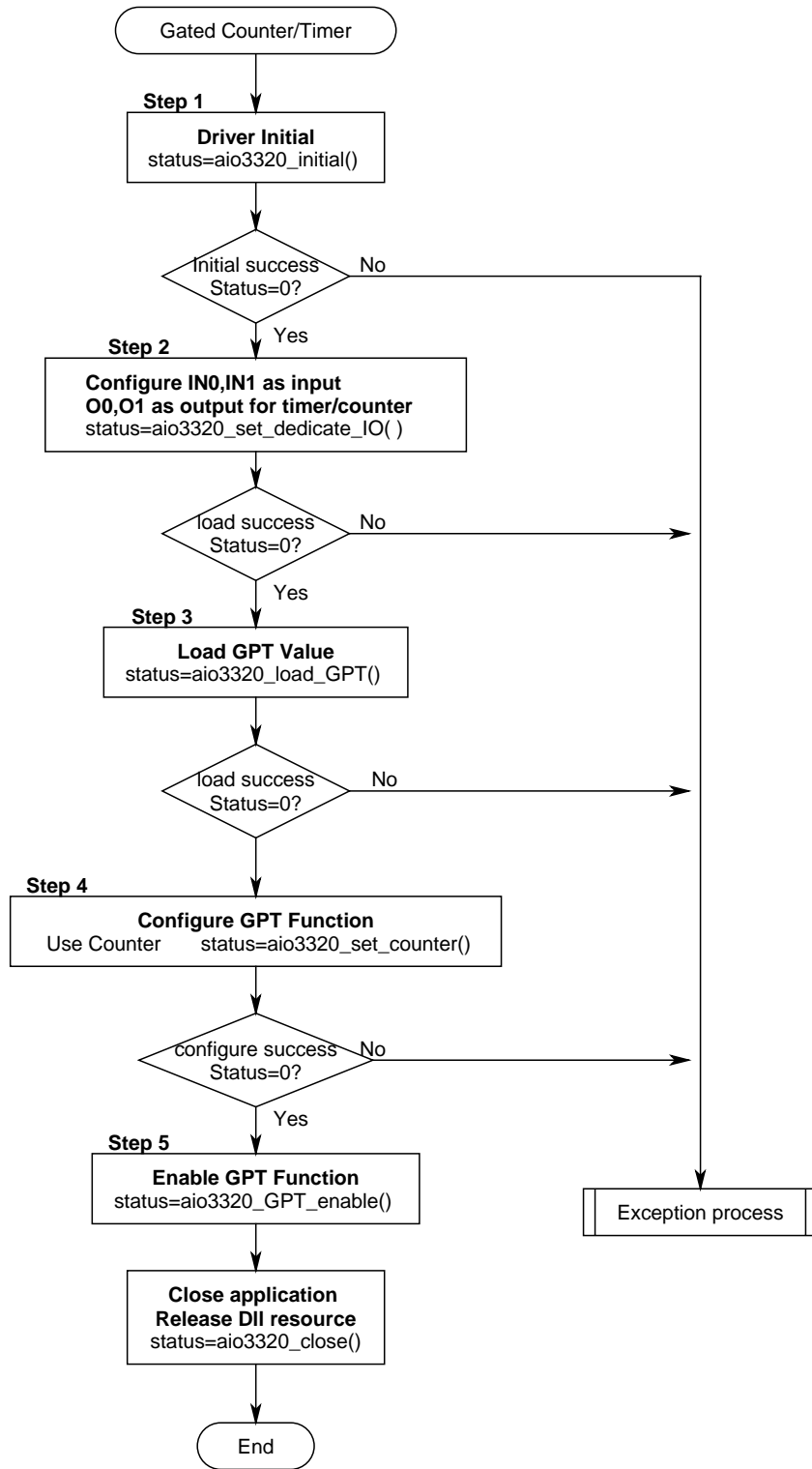
## 6. Flow chart of implement an application

### 6.1 AIO3320/3321 Flow chart of implementation

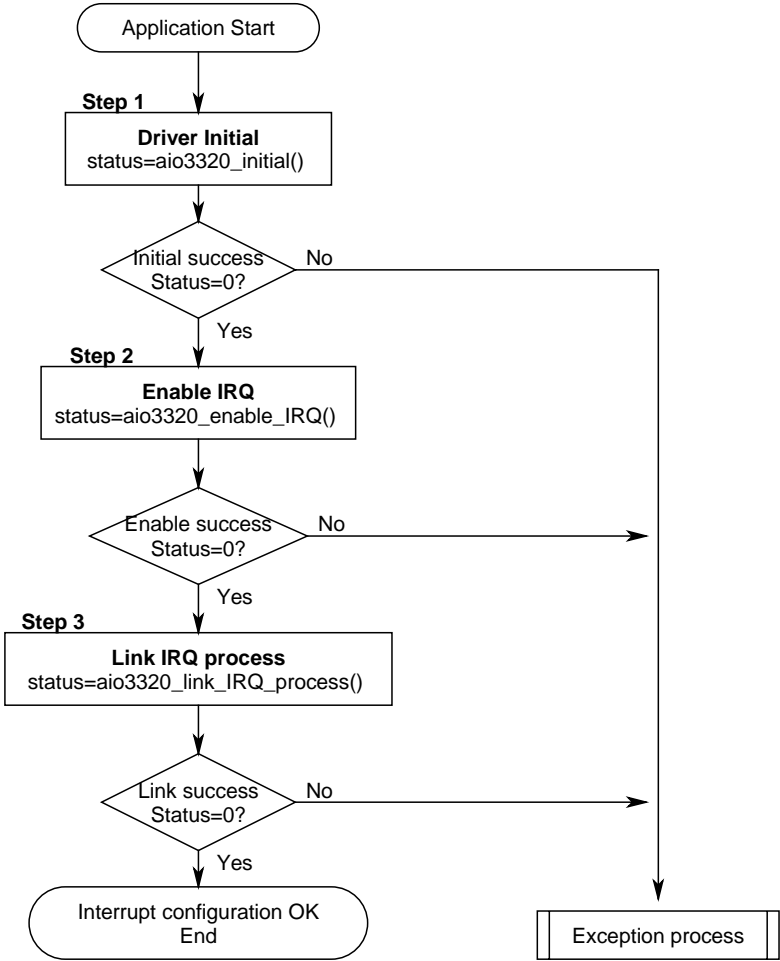


6.2 AIO3320/3321 Flow chart of Timer / Counter / PWM application





6.3 AIO3320/3321 Flow chart of interrupt



## 7. **Function reference**

### 7.1 Error codes and CardID

Every AIO3320 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 AIO3320 function is the parameter **CardID** which is located the driver of AIO3320 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**)

## 7.2 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.

Primary Type Names					
Name	Description	Range	C/C++	Visual BASIC	Pascal (Borland Delphi)
<b>u8</b>	8-bit ASCII character	0 to 255	char	Not supported by BASIC. For functions that require character arrays, use string types instead.	Byte
<b>I16</b>	16-bit signed integer	-32,768 to 32,767	short	Integer (for example: deviceNum%)	SmallInt
<b>U16</b>	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
<b>I32</b>	32-bit signed integer	-2,147,483,648 to 2,147,483,647	long	Long (for example: count&)	LongInt
<b>U32</b>	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.
<b>F32</b>	32-bit single-precision floating-point value	-3.402823E+38 to 3.402823E+38	float	Single (for example: num!)	Single
<b>F64</b>	64-bit double-precision floating-point value	-1.797683134862315E+308 to 1.797683134862315E+308	double	Double (for example: voltage Number)	Double

**Table 2**

### 7.3 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 AIO3320 API. Read the following sections that apply to your programming language.

**Note :** Be sure to include the declaration functions of AIO3320 prototypes by including the appropriate AIO3320 header file in your source code. Refer to section 4.1 Building Applications with the AIO3320 Software Library for the header file appropriate to your compiler.

#### 7.3.1 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 = aio3320_read_port(CardID, *data);
```

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

```
u8 CardID;
```

```
u8 data,
```

```
u32 Status;
```

```
Status = aio3320_set_port (CardID, data);
```

#### 7.3.2 Visual basic

The file aio3320.bas contains definitions for constants required for obtaining AIO3320 card information and declared functions and variable as global variables. You should use these constants symbols in the aio3320.bas, do not use the numerical values.

In Visual Basic, you can add the entire aio3320.bas file into your project. Then you can use any of the constants defined in this file and call these constants in any module of your program. To add the aio3320.bas file for your project in Visual Basic 4.0, go to the **File** menu and select the **Add File... option**. Select aio3320.bas, which is browsed in the aio3320 \ api directory. Then, select **Open** to add the file to the project.

To add the aio3320.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** aio3320.bas, which is in the aio3320 \ api directory. Then, select **Open** to add the file to the project.

### 7.3.3 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 aio3320bc.lib aio3320.dll
```

Then add the **aio3320bc.lib** to your project and add

```
#include "aio3320.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 = aio3320_read_port(CardID, *data);
```

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

```
u16 CardID;
```

```
u8 data;
```

```
u32 Status;
```

```
Status = aio3320_set_port (CardID, data);
```

## 7.4 AIO3320 Functions

These topics contain detailed descriptions of each AIO3320 function. The functions are arranged by dll function block.

### Initialization and close

#### ● **aio3320\_initial**

**Format :** u32 Status =aio3320\_initial (void)

**Purpose:** Initial the AIO3320 resource when start the Windows applications.

#### ● **aio3320\_close**

**Format :** u32 Status =aio3320\_close (void);

**Purpose:** Release the AIO3320 resource when close the Windows applications.

#### ● **aio3320\_info**

**Format :** u32 status =aio3320\_info(u8 CardID,u16 \*address)

**Purpose:** Read the physical I/O address assigned by O.S..

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW

**Output:**

Name	Type	Description
address	u16	physical I/O address assigned by OS

#### ● **aio3320\_get\_DeviceHandle**

**Format :** u32 status =aio3320\_get\_DeviceHandle(u8 CardID,HANDLE \*DeviceHandle)

**Purpose:** Read the device handle assigned by O.S..

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW

**Output:**

Name	Type	Description
DeviceHand	HANDLE	Handle assigned by O.S.

## Analog Input

### ● aio3320 smart AtoD

**Format :** u32 status = aio3320\_smart\_AtoD(u8 CardID,u8 channel,u8 mode,f32 \*value)

**Purpose:** Read A/D value then convert to scale.

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
channel	u8	A/D channel number
mode	u8	scale range: 0: 0V ~ 5V 1: -5V ~ +5V 2: 0V ~ 10V 3: -10V ~ +10V

**Output:**

Name	Type	Description
value	f32	data (converted)

### ● aio3320 set AD command

**Format :** u32 status = aio3320\_set\_AD\_command(u8 CardID,u8 channel,u8 mode )

**Purpose:** Set channel selection and mode to A/D .

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
channel	u8	select A/D channel number (0~7)
mode	u8	scale range: 0: 0V ~ 5V 1: -5V ~ +5V 2: 0V ~ 10V 3: -10V ~ +10V

- **aio3320 start AD conversion**

**Format :** u32 status = aio3320\_set\_AD\_conversion(u8 CardID )

**Purpose:** Start A/D conversion on previously selected channel .

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW

- **aio3320 read AD status**

**Format :** u32 status = aio3320\_read\_AD\_status( u8 CardID,u8 \*status)

**Purpose:** Read A/D status (on previous selected channel) for checking if it is ready

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW

**Output:**

Name	Type	Description
status	u8	0: busy, not ready 1: ready (end of conversion)

- **aio3320 read AD data**

**Format :** u32 status = aio3320\_read\_AD\_data(u8 CardID,u8 channel,i16 \*data )

**Purpose:** Read A/D conversion result (data).

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
channel	u8	A/D channel number to be read

**Output:**

Name	Type	Description
data	i16	For 0~5V or 0~10V mode data will be in 0~0xFFF. For -5V~+5V or -10V ~+10V mode data will be in 2's complement format.

## Analog output

- **aio3320 out DA data**

**Format :** u32 status = aio3320\_out\_DA\_data(u8 CardID,u8 channel,i16 data)

**Purpose:** To output DA data

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
channel	u8	DA channel no.
data	i16	data to be output 0 : 0V 32767: 10V -32767: -10V

## Digital I/O

### ● aio3320\_read\_port

**Format :** u32 status = aio3320\_read\_port(u8 CardID, u8 port, u8 \*data )

**Purpose:** To read data input or read back the output data

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
port	u8	0: input port 1: output port

**Output:**

Name	Type	Description
data	u8	port data

### ● aio3320\_read\_point

**Format :** u32 status = aio3320\_read\_point(u8 CardID, u8 port, u8 point, u8 \*state )

**Purpose:** To read data input or read back the output data of a specific point

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
port	u8	0: input port 1: output port
point	u8	bit designation 0: bit0                      1: bit 1 2: bit 2                      3: bit 3 4: bit 4                      5: bit 5 6: bit 6                      7: bit 7

**Output:**

Name	Type	Description
state	u8	bit data

### ● aio3320\_set\_port

**Format :** u32 status = aio3320\_set\_port(u8 CardID,u8 data )

**Purpose:** To output data

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
data	u8	data to be output

- **aio3320 set point**

**Format :** u32 status = aio3320\_set\_point(u8 CardID,u8 point,u8 state)

**Purpose:** To set/reset specific bit output to port

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
point	u8	bit designation 0: bit0                      1: bit 1 2: bit 2                      3: bit 3 4: bit 4                      5: bit 5 6: bit 6                      7: bit 7
state	u8	bit data to be output

- **aio3320 set dedicate IO**

**Format :** u32 status = aio3320\_set\_dedicate\_IO(u8 CardID,u8 enable)

**Purpose:** To set IN0, IN1, O0, O1 as dedicate I/O or general I/O

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
enable	u8	0: general I/O 1: dedicate I/O for timer/counter IN0,O0 for timer/counter0 IN1,O1 for timer/counter1

- **aio3320 readback dedicate IO status**

**Format :** u32 status = aio3320\_readback\_dedicate\_IO\_status(u8 CardID,u8 \*enable)

**Purpose:** To set IN0, IN1, O0, O1 as dedicate I/O or general I/O

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW

**Output:**

Name	Type	Description
enable	u8	0: general I/O 1: dedicate I/O for timer/counter IN0,O0 for timer/counter0 IN1,O1 for timer/counter1

## Counter / Timer function

- **aio3320 set timer**

**Format :** u32 status = aio3320\_set\_timer(u8 CardID,u8 TimerID,u8 To\_mode )

**Purpose:** To set timer / counter at timer mode and configure its timer output function.

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
TimerID	u8	timer/counter designation 0: timer/counter0 1: timer/counter1
To_mode	u8	designation of timer output mode: 0: To will pulse low for one clock cycle when terminal count is reached 1: To will pulse low for 8 clock cycle when terminal count is reached 2: To will toggle whenever terminal count is reached 3: no output function

● **aio3320 set counter**

**Format :** u32 status = aio3320\_set\_counter(u8 CardID,u8 TimerID,u8 To\_mode,u8 Ti\_mode )

**Purpose:** To set timer / counter at counter mode and configure its counter input and counter output function.

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
TimerID	u8	timer/counter designation 0: timer/counter0 1: timer/counter1
To_mode	u8	counter output mode designation: 0: To will pulse low for one clock cycle when terminal count is reached 1: To will pulse low for 8 clock cycle when terminal count is reached 2: To will toggle whenever terminal count is reached 3: no output function
Ti_mode	u8	counter input mode designation: 0: Counter decrease with system clock (4/33MHz) while Ti is low 1: Counter decrease with system clock (4/33MHz) while Ti is high 2: Counter decrease 1 while Ti is high to low transition 3: Counter decrease 1 while Ti is low to high transition

**Notes:**

1. Counter/Timer0 input is at IN0, Counter/Timer1 input is at IN1.
2. Counter/Timer0 output is at O0, Counter/Timer1 output is at O1, and before using this function, port should be configured as dedicated port by aio3320\_set\_dedicate\_IO( ).

● **aio3320 set\_pwm**

**Format :** u32 status = aio3320\_set\_pwm(u8 CardID,u8 TimerID )

**Purpose:** To set timer/counter at PWM mode and map the PWM output to port1 bit n for timer/counter n.

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
TimerID	u8	timer/counter designation 0: timer/counter0 1: timer/counter1

**Note:**

1. You must configure digital i/o port1 as output to get PWM out from O0(timer/counter0) ,O1(timer/counter1).
2. Each timer/counter has 32 bit register length, if you program as PWM mode, the register is divided as 2 16 bit width, the upper 16 bit work as the pulse high width and the lower 16 bit work as PWM frequency register.

For example: if you program timer/counter0 work at PWM mode and load its constant with 0x0005000A, you will get a PWM output from O0. Its working frequency is 400KHz (system frequency is 4MHz and divide by 0xA,ie. 10 system clock period) with 5 system clock period high( the high word is 0x5).

● **aio3320 set\_clock\_frequency**

**Format :** u32 status = aio3320\_set\_clock\_frequency(u8 CardID,u8 freq\_mode )

**Purpose:** To set the time base frequency of timer/counter0 and timer/counter1.

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
freq_mode	u8	timer/counter time base frequency 0: 4MHz 1: 33MHz

- **aio3320 load GPT**

**Format :** u32 status = aio3320\_load\_GPT (u8 CardID,u8 TimerID,u32 value,u8 preset)

**Purpose:** To load reload register or current register of timer/counter

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
TimerID	u8	timer/counter designation 0: timer/counter 0 1: timer/counter 1
value	u32	data to be load
preset	u8	0: value is load to current register 1: value is preset to reload register,

- **aio3320 read GPT**

**Format :** status=aio3320\_read\_GPT (u8 CardID,u8 TimerID,u32 \*value,u8 preset)

**Purpose:** To read reload register or current register of timer/counter

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
TimerID	u8	timer/counter designation 0: timer/counter 0 1: timer/counter 1
preset	u8	0: value is read from current register 1: value is read from reload register,

**Output:**

Name	Type	Description
value	u32	data load

- **aio3320 one shot command**

**Format :** status=aio3320\_one\_shot\_command (u8 CardID,u8 TimerID,u32 duration\_time)

**Purpose:** To generate an one shot output from timer0/1 at programmed duration

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
TimerID	u8	timer/counter designation 0: timer/counter 0 , output at DIO10 1: timer/counter 1 , output at DIO11
duration_time	u32	the duration time constant of one shot. Duration time = time constant *T for 4MHz frequency T=0.25us for 33MHz frequency T=0.03us

**Notes:**

Counter/Timer0 output is at O0, Counter/Timer1 output is at O1, and before using this function, port should be configured as dedicated port by aio3320\_set\_dedicate\_IO( ).

● **aio3320 read parameter**

**Format :** status=aio3320\_read\_parameter(u8 CardID,u8 parameter,u32 \*data)

**Purpose:** To read parameter data from counter/timer

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
parameter	u8	0: read current working mode of timer/counter0 1: readback To_mode of Timer0 2: readback To_mode of Counter0 3: readback Ti_mode of Counter0 4: read current working mode of timer/counter1 5: readback To_mode of Timer1 6: readback To_mode of Counter1 7: readback Ti_mode of Counter1

**Output:**

Name	Type	Description
data	u32	For reading current working mode of timer/counter 0: disable 1: Timer 2: Counter 3: PWM For Ti_mode of counter, refer to <i>aio3320_set_counter</i> For To_mode of counter, refer to <i>aio3320_set_counter</i> For Ti_mode of timer, refer to <i>aio3320_set_timer</i>

● **aio3320 GPT enable**

**Format :** u32 status = aio3320\_GPT\_enable(u8 CardID,u8 TimerID,u8 enable)

**Purpose:** To enable/disable timer/counter function that was set by aio3320\_set\_timer( ), aio3320\_set\_counter( ), aio3320\_set\_pwm( )

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
TimerID	u8	port designation 0: timer/counter0 1: timer/counter1
enable	u8	0: disable timer/counter function 1: enable or resume timer/counter function

## Interrupt function

### ● **aio3320 enable IRQ**

**Format :** u32 status = aio3320\_enable\_IRQ(u8 CardID,u8 IRQ\_Source,HANDLE \*phEvent

**Purpose:** Enable interrupt of timer/counter

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
IRQ_Source	u8	0: timer/counter0 1: timer/counter1

**Output:**

Name	Type	Description
phEvent	HANDLE	The returned handle of event

### ● **aio3320 disable IRQ**

**Format :** u32 status = aio3320\_disable\_IRQ(u8 CardID,u8 IRQ\_Source)

**Purpose:** To disable interrupt from timer/counter but please note that “timer/counter is still working”

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
IRQ_Source	u8	0: timer/counter0 1: timer/counter1

### ● **aio3320 read IRQ status**

**Format :** u32 status = aio3320\_IRQ\_status(u8 CardID,u8 IRQ\_Source,u8 \* status)

**Purpose:** To read IRQ status

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
IRQ_Source	u8	0: timer/counter0 1: timer/counter1

**Output:**

Name	Type	Description
status	u8	0: disable 1: enable

- **aio3320 link IRQ process**

**Format :** u32 status = aio3320\_link\_IRQ\_process(u8 CardID,u8 IRQ\_Source,void  
(\_\_stdcall \*callbackAddr(u8 CardID))

**Purpose:** To link the interrupt source with the callback function.

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
IRQ_Soure	u8	0: timer/counter0 1: timer/counter1
callbackAddr	void	the address of your callback function

## Security function

### ● aio3320 set password

**Format :** u32 status = aio3320\_set\_password(u8 CardID,u16 password[5])

**Purpose:** To set password and if the password is not all “0”, security function will be enabled.

**Note:** If the password is all “0”, the security function is disabled.

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
password[5]	u16	Password, 5 words

### ● aio3320 change password

**Format :** u32 status = aio3320\_change\_password(u8 CardID,u16 Oldpassword[5],  
u16 password[5])

**Purpose:** To replace old password with new password.

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
Oldpassword [5]	u16	The previous password
password[5]	u16	The new password to be set

### ● aio3320 clear password

**Format :** u32 status = aio3320\_clear\_password(u8 CardID,u16 password[5])

**Purpose:** To clear password, to set password to all “0”, i.e. disable security function.

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
password[5]	u16	The password previous set

- **aio3320\_unlock\_security**

**Format :** u32 status = aio3320\_unlock\_security(u8 CardID,u16 password[5])

**Purpose:** To unlock security function and enable the further operation of this card

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
password[5]	u16	The password previous set

- **aio3320\_read\_security\_status**

**Format :** u32 status = aio3320\_read\_security\_status(u8 CardID,u8 \*lock\_status,  
u8 \*security\_enable )

**Purpose:** To read security status for checking if the card security function is unlocked.

**Parameters:**

**Input:**

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW

**Output:**

Name	Type	Description
lock_status	u8	0: security unlocked 1: locked 2: dead lock (must return to original maker to unlock)
security_enable	u8	0: security function disabled 1: security function enabled

## 7.5 Dll list

	<b>Function Name</b>	<b>Descriptive Name</b>
1	aio3320_initial( )	AIO3320 Initial
2	aio3320_close( )	AIO3320 Close
3	aio3320_info( )	Read the I/O address of specific card
4	aio3320_get_DeviceHandle( )	Read device handle
5	aio3320_smart_AtoD( )	Read A/D in smart mode (convert to scale)
6	aio3320_set_AD_command( )	write command to AD chip
7	aio3320_start_AD_conversion( )	start A/D conversion
8	aio3320_read_AD_status( )	Read AD status
9	aio3320_read_AD_data( )	read AD conversion data
10	aio3320_out_DA_data( )	output D/A data
11	aio3320_read_port( )	Read I/O port data
12	aio3320_read_point( )	Read a specific point data of I/O port
13	aio3320_set_port( )	Write data to output port
14	aio3320_set_point( )	Write bit of data to output port
15	aio3320_set_dedicate_IO( )	Set IN0, IN1, O0, O1 as dedicate I/O or general I/O
16	aio3320_readback_dedicate_IO_status( )	Readback the mode previously set
17	aio3320_set_timer( )	To set timer / counter at timer mode
18	aio3320_set_counter( )	To set timer / counter at counter mode
19	aio3320_set_pwm( )	Set timer/counter at PWM mode
20	aio3320_set_clock_frequency( )	Set the time base clock frequency
21	aio3320_load_GPT( )	Write data to GPT(general purpose timer/counter register)
22	aio3320_GPT_enable( )	Enable/disable timer/counter function
23	aio3320_read_GPT( )	Read GPT(general purpose timer/counter register) data
24	aio3320_one_shot_command( )	Generate an one shot
25	aio3320_read_parameter( )	Read parameter
26	aio3320_enable_IRQ( )	Enable interrupt of timer/counter
27	aio3320_link_IRQ_process( )	Link IRQ pprocess
28	aio3320_disable_IRQ( )	Disable interrupt of timer/counter
29	aio3320_read_IRQ_status( )	Readback IRQ status
30	aio3320_set_password( )	Set password
31	aio3320_change_password( )	Change password
32	aio3320_clear_password( )	Clear password
33	aio3320_unlock_security( )	Unlock security function
34	aio3320_read_security_status( )	Read security status

## 8. AIO-3320/3321 Error codes summary

### 8.1 AIO3320/3321 Error codes table

Error Code	Symbolic Name	Description
0	JSDRV_NO_ERROR	Success, No error.
2	JSDRV_INIT_ERROR	Driver initial error
3	JSDRV_UNLOCK_ERROR	Security unlock failure
4	JSDRV_LOCK_COUNTER_ERROR	Dead lock, unlock failure more than 10 times
5	SDRV_SET_SECURITY_ERROR	Password overwrite error
100	DEVICE_RW_ERROR	Device Read/Write error
101	JSDRV_NO_CARD	No AIO3320/3321 card on the system.
102	JSDRV_DUPLICATE_ID	AIO3320/3321 CardID duplicate error.
104	JSDRV_PAR_ERROR	Bad parameter or illegal parameter
300	JSDIO_ID_ERROR	Function input parameter error. CardID setting error, CardID doesn't match the DIP/ROTARY SW setting
301	JSAIO_MODE_ERROR	Mode parameter error. Parameter out of range.
302	JSAIO_CHANNEL_ERROR	Channel parameter error. Parameter out of range.
305	JSAIO_CONVERSION_ERROR	Conversion time over. Maybe no hardware or bad hardware.
306	JSAIO_CONVERSION_BUSY	A/D is busy in conversion
400	JSAIO_PORT_ERROR	Port parameter error. Parameter out of range.
401	JSAIO_STATE_ERROR	State parameter error. Parameter out of range.
402	JSAIO_POINT_ERROR	Point parameter error. Parameter out of range.
403	JSAIO_EEPROM_RW_ERROR	Eeprom R/W error
405	JSAIO_CALIBRATION_ERROR	Calibration error. Maybe out of range.
406	JSAIO_TIMERID_ERROR	TimerID parameter error. Parameter out of range.
407	JSAIO_TO_MODE_ERROR	To_mode parameter error. Parameter out of range.
408	JSAIO_TI_MODE_ERROR	Ti_mode parameter error. Parameter out of range.
409	JSAIO_PARAMETER_ERROR	Parameter error. Parameter out of range.
500	JSAIO_EVENT_ERROR	Event error. Maybe no event created.