DIO3216B

Digital I/O Card

Software Manual (V2.1)

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Correction record

Manual Version	Record
1.0	wdm3216B.sys V1.2
	wdm3216B.dll V1.2
2.0	wdm3216B.sys V2.0
	wdm3216B.dll V2.0
	DIO3216B.dll V2.0
2.1	DIO3216B.dll V2.1 and later
	DIO3216B_WDT_start
	DIO3216B_WDT_stop
	DIO3216B_WDT_read
	DIO3216B_WDT_reset
	DIO3216B_WDT_output_set
	DIO3216B_WDT_output_read
	disable the software key function with return value always true

Note: V2.0 and later only for DIO3216B

Contents

1. Special Notes on using DIO3216B as replacement of DIO3216A

DIO3216B is not fully software compatible with the previous model DIO3216A, but the major digital I/O functions is the same. If you use DIO3216A in your application before and now for the repair purpose, you use DIO3216B, you must confirm and take the following procedures to ensure the success of replacement.

1. Make sure that your old applications only use the digital I/O functions, if not, you can not replace the old card with DIO3216B
2. You must install the DIO3216B driver to replace the old driver. The new driver has build in digital I/O functions under the same syntax of old card. Please refer the DIO3216B.h file for more detail information. Under this condition, you do not need to re-compile your application program.
3. If you can re-compile your application program, we suggest you to use new function syntax with the DIO3216B card, refer the functions described at this manual.

2. How to install the software of DIO3216B

2.1 Install the 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.

In WinXP/7 and up system you should: (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 (..\DIO3216B\Software\WinXP_7\ or if you download from website please execute the file DIO3216B_Install.exe to get the file)
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.

3. Where to find the file you need

WinXP/7 and up

The directory will be located at

.. \ JS Automation \DIO3216B\API (header files and lib files for VB,VC,BCB,C#)

.. \ JS Automation \DIO3216B\Driver (backup copy of DIO3216B drivers)

.. \ JS Automation \DIO3216B\exe (demo program and source code)

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

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

4. About the DIO3216B software

DIO3216B 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 DIO3216B 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 DIO3216B functions within Windows' operation system environment.

4.1 What you need to get started

To set up and use your DIO3216B software, you need the following:

- DIO3216B software
- DIO3216B hardware

  Main board

  Wiring board (Option)

4.2 Software programming choices

You have several options to choose from when you are programming DIO3216B 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 DIO3216B software.

5. DIO3216B Language support

The DIO3216B software library is a DLL used with WinXP/7 and up. You can use these DLL with any Windows integrating development environment that can call Windows DLLs.

5.1 Building applications with the DIO3216B software library

The DIO3216B function reference topic contains general information about building DIO3216B applications, describes the nature of the DIO3216B files used in building DIO3216B applications, and explains the basics of making applications using the following tools:

Applications 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.

5.2 DIO3216B Windows libraries

The DIO3216B for Windows function library is a DLL called **DIO3216B.dll**. Since a DLL is used, DIO3216B functions are not linked into the executable files of applications. Only the information about the DIO3216B functions in the DIO3216B 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 DIO3216B functions in DIO3216B.dll.

Header Files and Import Libraries for Different Development Environments		
Language	**Header File**	**Import Library**
Microsoft Visual C/C++	DIO3216B.h	DIO3216BVC.lib
Borland C/C++	DIO3216B.h	DIO3216BBC.lib
Microsoft Visual C#	DIO3216B.cs	
Microsoft Visual Basic	DIO3216B.bas	
Microsoft VB.net	DIO3216B.vb	

Table 1

6. Basic concepts of digital I/O control

The digital I/O control is the most common type of PC based application. For example, on the main board, printer port is the TTL level digital I/O.

Types of I/O calssified by isolation

If the system and I/O are not electrically connected, we call it is isolated. There are many kinds of isolation: by transformer, by photo-coupler, by magnetic coupler,… Any kind of device, they can brake the electrical connection without braking the signal is suitable for the purpose.

Currently, photo-coupler isolation is the most popular selection, isolation voltage up to 2000V or over is common. But the photo-coupler is limited by the response time, the high frequency type cost a lot. The new selection is magnetic coupler, it is design to focus on high speed application.

The merit of isolation is to avoid the noise from outside world to enter the PC system, if the noise comes into PC system without elimination, the system maybe get "crazy" by the noise disturbance. Of course the isolation also limits the versatile of programming as input or output at the same pin as the TTL does. The inter-connection of add-on card and wiring board maybe extend to several meters without any problem.

The non-isolated type is generally the TTL level input/output. The ground and power source of the input/output port come from the system. Generally you can program as input or output at the same pin as you wish. **The connection of wiring board and the add-on board is limited to 50cm or shorter** (depends on the environmental noise condition).

Types of Output calssified by driver device

There are several devices used as output driver, the relay, transistor or MOS FET, SCR and SSR.

Relay is electric- mechanical device, it life time is about 1,000,000 times of switching. But on the other hand it has many selections such as high voltage or high current. It can also be used to switch DC load or AC load.

Transistor and MOS FET are basically semi-permanent devices. If you have selected the right ratings, it can work without switching life limit. But the transistor or MOS FET can only work in DC load condition.

The transistor or MOS FET also have another option is source or sink. For PMOS or PNP transistor is source type device, the load is one terminal connects to output and another connects to common ground, but NPN or NMOS is one terminal connects to output and the other connects to VCC+. **If you are concerned about hazard from high DC voltage while the load is floating, please choose the source type driver device.**

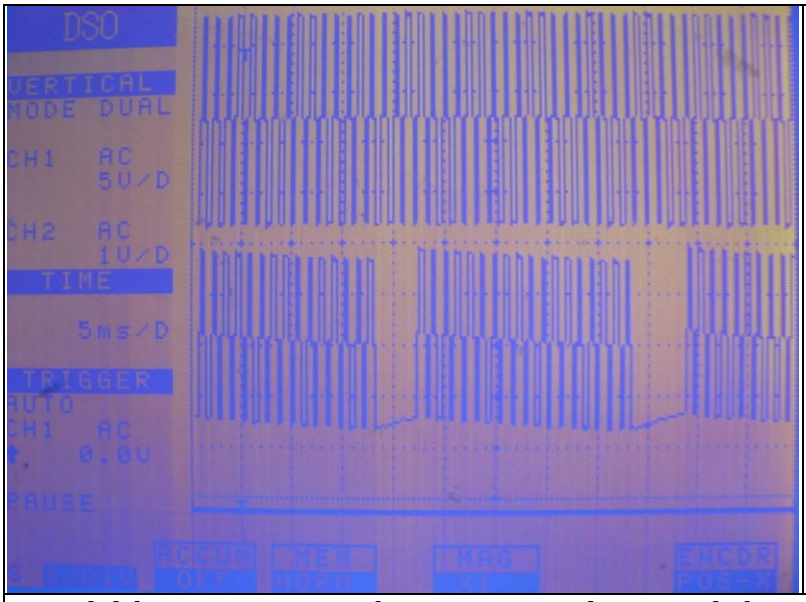
SCR (or triac) is seldom direct connect to digital output, but his relative SSR is the most often selection. In fact, SSR is a compact package of trigger circuit and triac. You can choose zero cross trigger (output command only turn on the output at power phase near zero to eliminate surge) or direct turn on type. SSR is working in AC load condition.

Input debounce

Debounce is the function to filter the input jitters. From the microscope view of a switch input, you will see the contact does not come to close or release to open clearly. In most cases, it will contact-release-contact-release… for many times then go to steady state (ON or OFF). If you do not have the debounce function, you will read the input at high state and then next read will get low state, this maybe an error data for your decision of contact input.

Debounce can be implemented by hardware or software. Analog hardware debounce circuit will have fixed time constant to filter out the significant input signal, if you want to change the response time, the only way is to change the circuit device.

If digital debounce is implemented, maybe several filter frequency you can choose. To choose the filter frequency, please keep the Nyquist–Shannon sampling theorem in mind: filter sample frequency must at least twice of the input frequency. The following sample is a bad selection of debounce filter, the input frequency is not as low as les than half of the sample frequency, the output will generate a beat frequency.



<- Input frequency at 835Hz

<- Output of digital filter,
Please note the beat frequency.

Digital debounce circuit work at 1KHZ sample rate and observe the output of filter from 835Hz input

Software debounce will consumes the CPU time a lot, we do not recommend to use except for you really know you want.

Input interrupt

You can scan the input by polling, but the CPU will spend a lot of time to do null task. Another way is use a timer to sample the input at adequate time (remind the Nyquist–Shannon sampling theorem, at least double of the input frequency). The third one is directly allows the input to generate interrupt to CPU. To use direct interrupt from input, the noise coupled from input must take special care not to mal-trigger the interrupt.

Read back of Output status

Some applications need to read back the output status, if the card do not provide output status read back, you can use a variable to store the status of output before you really command it output. Some cards provide the read back function but please note that **the read back status is come from the output register, not from the real physical output.**

7. Function format and language difference

7.1 Function format

Every DIO3216B 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 DIO3216B function is the parameter **CardID** which is located the driver of DIO3216B 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 DIO3216B function. The functions are arranged alphabetically by function name. Refer to DIO3216B Function Reference for additional information.

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)**
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: deviceNum%)	SmallInt
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&)	LongInt
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	-1.797683134862315E+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 DIO3216B API. Read the following sections that apply to your programming language.

Note: Be sure to include the declaration functions of DIO3216B prototypes by including the appropriate DIO3216B header file in your source code. Refer to Building Applications with the DIO3216B 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 = DIO3216B_read_port(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 = DIO3216B_read_port (CardID, port, &data);
```

7.3.2 Visual basic

The file DIO3216B.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 DIO3216B.bas, do not use the numerical values.

In Visual Basic, you can add the entire DIO3216B.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 DIO3216B.bas file for your project in Visual Basic 4.0, go to the **File** menu and select the **Add File... option**. Select DIO3216B.bas, which is browsed in the DIO3216B \ API directory. Then, select **Open** to add the file to the project.

To add the DIO3216B.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** DIO3216B.bas, which is in the DIO3216B \ 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 DIO3216BBC.lib DIO3216B.dll

Then add the **DIO3216BBC.lib** to your project and add

#include "DIO3216B.h" to main program.

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

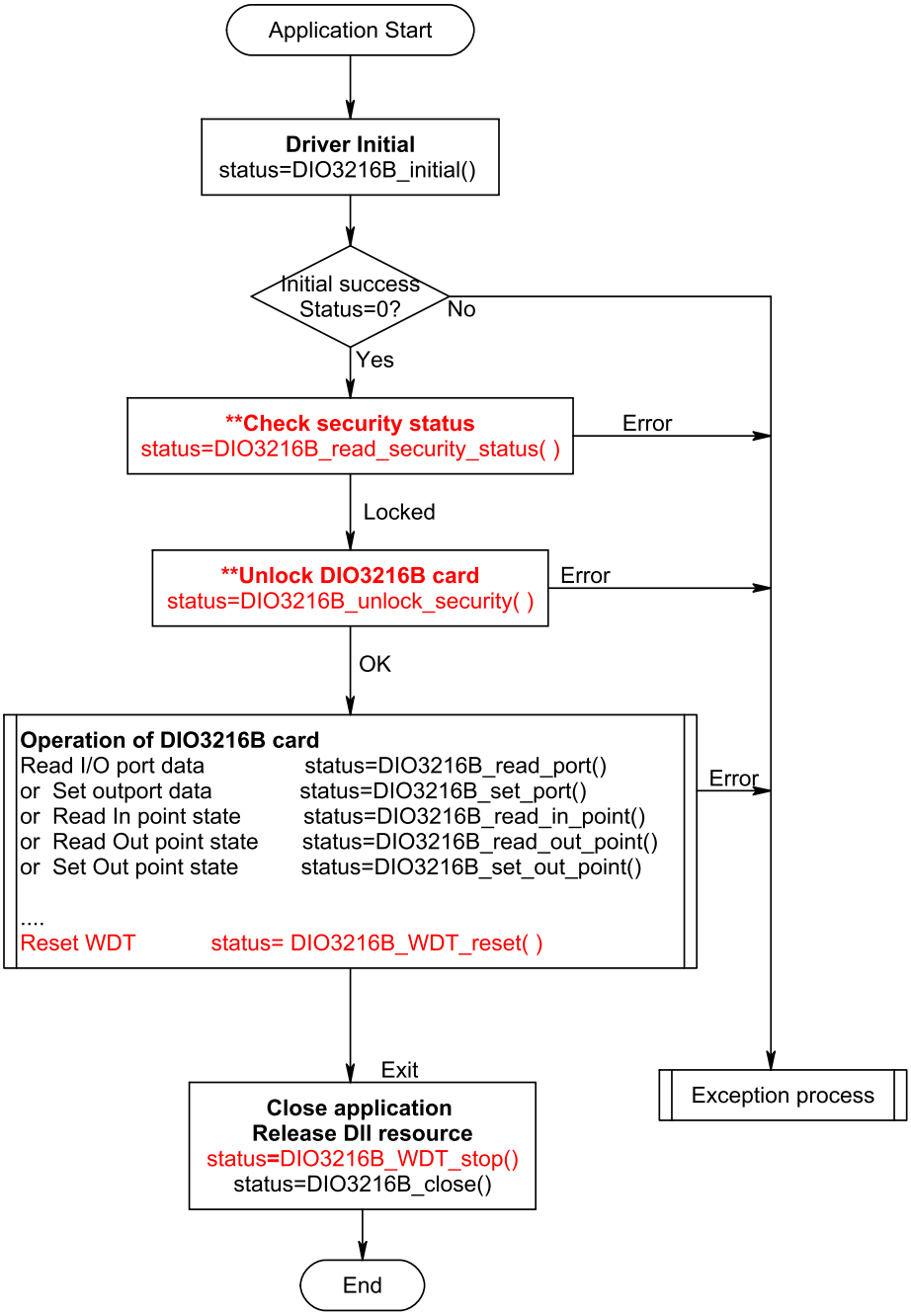
Status = DIO3216B_read_port(u8 CardID, u8 port, u8*data);

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

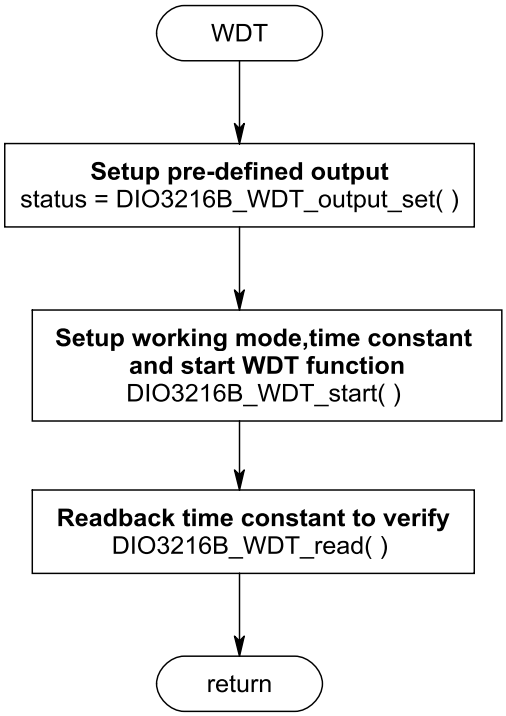
u8 CardID, port;
u8 data;
u32 Status;
Status = DIO3216B_read_port (CardID, port, &data);

8. Flow chart of application implementation

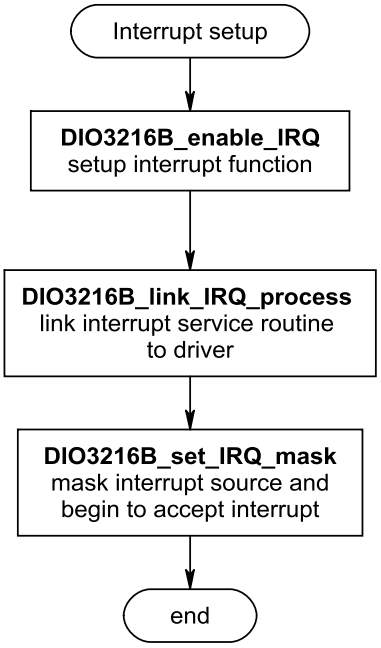
8.1 DIO3216B Flow chart of application implementation



**If the password has been enabled previously.



**** Note: If the WDT work in manual mode, the application program must call DIO3216B_WDT_reset( ) before WDT time up to prevent WDT blocking the IO operation.**



9. Software overview and dll function

9.1 Initialization and close

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

DIO3216B_initial( ) will do.

Once you want to close your application, call

DIO3216B_close( ) to release all the resource.

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

DIO3216B_info( ) to get the address .

- **DIO3216B_initial**

Format : **u32 status =DIO3216B_initial (void)**

Purpose: Initial the DIO3216B resource when start the Windows applications**.**

- **DIO3216B_close**

Format : **u32 status =DIO3216B_close (void);**

Purpose: Release the DIO3216B resource when close the Windows applications.

- **DIO3216B_info**

Format : **u32 status =DIO3216B_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

9.2 I/O Port R/W

Use the following functions for I/O port output value reading and control:

DIO3216B_read_port( ) to read a byte data from I/O port,

DIO3216B_set_port( ) to output byte data to output port,

DIO3216B_set_out_point( ) to set output bit,

DIO3216B_read_in_point( ) to read I/O bit,

DIO3216B_read_out_point( ) to read back output bit.

Mechanical contact or noisy environment always induced unstable state at digital input, the DIO3216B 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 ***DIO3216B_set_debounce_time( )*** to select the debounce frequency and read back the setting by ***DIO3216B_read_debounce_time( ).***

- **DIO3216B_read_port**

Format : u32 status = DIO3216B_read_port (u8 CardID , u8 port , u8 *data)

Purpose: Read the output values of the I/O port.

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW
port	u8	port number 0: input port IN00-IN07 1: input port IN10-IN17 2: output port OUT00-OUT07 3: output port OUT10-OUT17

Output:

Name	Type	Description
data	u8	I/O data

- **DIO3216B_set_port**

Format : u32 status = DIO3216B_set_port (u8 CardID,u8 port, u8 data)

Purpose: Sets the output data.

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW
port	u8	2: output port for OUT00-OUT07 3: output port for OUT10-OUT17
data	u8	bitmap of output values

- **DIO3216B_set_out_point**

Format : **u32 status =DIO3216B_set_out_point(u8 CardID, u8 point, u8 state)**

Purpose: Sets the bit data of output port.

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW
point	u8	point number 0~7 for OUT00-OUT07 8~15 for OUT10-OUT17
state	u8	state of output point

- **DIO3216B_read_in_point**

Format : **u32 status =DIO3216B_read_in_point(u8 CardID, u8 point, u8 *state)**

Purpose: Read the input state of the input points.

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW
point	u8	point number of input 0~7 forIN00-IN07 8~15 for IN10-IN17

Output:

Name	Type	Description
state	u8	state of point of input

- **DIO3216B_read_out_point**

Format : **u32 status =DIO3216B_read_out_point(u8 CardID, u8 point, u8 *state)**

Purpose: Read the output state of the output points.

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW
point	u8	point number 0~7 for OUT00-OUT07 8~15 for OUT10-OUT17

Output:

Name	Type	Description
state	u8	state of output point

- **DIO3216B_set_debounce_time**

Format : u32 status = DIO3216B_set_debounce_time (u8 CardID , u8 port , u8 debounce_mode)

Purpose: Set the input port debounce time

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW
port	u8	port number 0: input port0 for IN00-IN07 1: input port1 for IN10-IN17
debounce_mode	u8	Debounce time selection: 0: no debounce 1: filter out over 100Hz (default) 2: filter out over 200Hz 3: filter out over 1KHz

- **DIO3216B_read_debounce_time**

Format : u32 status = DIO3216B_read_debounce_time (u8 CardID , u8 port , u8 *debounce_mode)

Purpose: Read the input port debounce time setting

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW
port	u8	port number 0: input port0 for IN00-IN07 1: input port1 for IN10-IN17

Output:

Name	Type	Description
debounce_mode	u8	Debounce time selection: 0: no debounce 1: filter out over 100Hz (default) 2: filter out over 200Hz 3: filter out over 1KHz

9.3 Interrupt function

Sometimes you want your application to take care of the I/O while special event occurs, interrupt function is the right choice. DIO3216B provide IN00 and IN01 as external event trigger input. To use it, first of all you must enable IRQ function by:

DIO3216B_enable_IRQ( ).

If you do not use interrupt any more and you will close your application program, be sure to use

DIO3216B_disable_IRQ( ) to release the resource.

Next tell the driver your interrupt service routine by

DIO3216B_link_IRQ_process( )

Finally you should enable / disable the hardware of the interrupt source,

DIO3216B_set_IRQ_mask( ) will do and your program is waiting an interrupt to service.

DIO3216B_read_IRQ_mask( ) to read back the setting.

In interrupt service routine, if you want to know the interrupt status, use

DIO3216B_read_IRQ_status( ) to identify the source of interrupt.

For the application program do not use interrupt, you can also use

DIO3216B_read_IRQ_status( ) as fast response input latch. You just

DIO3216B_set_IRQ_mask( ) to setup the points you want to monitor and polling by

DIO3216B_read_IRQ_status( ) to check the input. After reading, the status on card will automatically cleared.

- **DIO3216B_enable_IRQ**

Format : u32 status = DIO3216B_enable_IRQ (u8 CardID, HANDLE *phEvent)

Purpose: Enable interrupt from selected source

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW

Output:

Name	Type	Description
phEvent	HANDLE	event handle

- **DIO3216B_disable_IRQ**

Format : u32 status = DIO3216B_disable_IRQ (u8 CardID)

Purpose: Disable interrupt from selected source

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW

- **DIO3216B_link_IRQ_process**

Format : **u32 status = DIO3216B_link_IRQ_process (u8 CardID,**
void (__stdcall *callbackAddr)(u8 CardID));

Purpose: Link irq service routine to driver

Parameters:

Input:

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

- **DIO3216B_set_IRQ_mask**

Format : **u32 status = DIO3216B_set_IRQ_mask (u8 CardID, u8 mask)**

Purpose: Mask interrupt from IN00~ IN07

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW
mask	u8	Bit0 =0 disable irq from IN00 =1 enable irq from IN00 Bit1 =0 disable irq from IN01 =1 enable irq from IN01 …. Bit7 =0 disable irq from IN07 =1 enable irq from IN07

- **DIO3216B_read_IRQ_mask**

Format : **u32 status = DIO3216B_read_IRQ_mask (u8 CardID, u8 *mask)**

Purpose: Read back the mask of interrupt

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW

Output:

Name	Type	Description
mask	u8	Bit0 =0 disable irq from IN00 =1 enable irq from IN00 Bit1 =0 disable irq from IN01 =1 enable irq from IN01 …. Bit7 =0 disable irq from IN07 =1 enable irq from IN07

- **DIO3216B_read_IRQ_status**

Format : u32 status = DIO3216B_read_IRQ_status (u8 CardID, u8 *Event_Status)

Purpose: To read back the interrupt source to identify IN00~ IN07

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by Rotary SW

Output:

Name	Type	Description
Event_Status	u8	Bit0 =1 irq from IN00 Bit1 =1 irq from IN01 …. Bit7 =1 irq from IN07

Note:

1. This command can be used in non-interrupt application for scanning the input change, but once you read the status, the on chip register will also be cleared for next transition input.
2. For interrupt application, you can read the status for identification of interrupt sources to determine the response you want to take.

9.4 Software key function

From the dll version 4.0 and later, we remove the software key function owing to some customers complained about the card locked on some unknown occasion. We only remain the functions to comply with the existing programs but the returned value always true.

Since DIO3216B 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

DIO3216B_set_password( ) to set password and start the security function.

DIO3216B_change_password( ) to change it.

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

DIO3216B_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

DIO3216B_unlock_security( ) unlock the security.

You can also use

DIO3216B_read_security_status( ) to check the current status of security.

- **DIO3216B_set_password**

Format : u32 status = DIO3216B_set_password(u8 CardID,u16 password[5]);

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

Parameters:

Input:

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

Note on password:

If the password is all "0", the security function is disabled.

- **DIO3216B_change_password**

Format : u32 status = DIO3216B_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

- **DIO3216B_clear_password**

Format : **u32 status = DIO3216B_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

- **DIO3216B_unlock_security**

Format : **u32 status = DIO3216B_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

- **DIO3216B_read_security_status**

Format : **u32 status = DIO3216B_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

Note on security status:

The security should be unlocked before using any other function of the card, and any attempt to unlock with the wrong passwords more than 10 times will cause the card at dead lock status. Any further operation even with the correct password will not unlock the card. The only way is to send back to the card distributor or the original maker to unlock to virgin state.

9.5 WDT (Watch Dog Timer)

For some special case, your system maybe hung by unknown reasons and leave your control program run at un-predict condition. This may damage the device under control or hurts human. To prevent the abnormal conditions using a WDT (watch dog timer) is an intelligent approach. The WDT is a special hardware timer, proving a fixed time to down count, once it is time up, it will reset the system or do some action predefined by hardware. To prevent the WDT time up, you must intend to reset the timer before it time up.

The on card WDT does not intend to reset the computer but only block the IO operation and overrides a predefined output to prevent further damage.

Before start the WDT, you must setup the predefined output during WDT block the IO operation. Of course the output is based on the system protection and alarm generation. Using

DIO3216B_WDT_output_set( ) to set up the output at abnormal occurs and read back by

DIO3216B_WDT_output_read( )

After the predefined output setup, you can start the WDT with it time constant and working mode by: ***DIO3216B_WDT_start( )*** and stop the WDT operation by:

DIO3216B_WDT_stop( )

If the WDT in manual working mode, the user must reset before it is time up. This means if your application is alive, the WDT will reset before it is time up.

DIO3216B_WDT_reset( ) will do.

To read the WDT time constant or timer value on the fly, using

DIO3216B_WDT_read( )

- **DIO3216B_WDT_output_set**

Format : **u32 status = DIO3216B_WDT_output_set(u8 CardID, u8 output);**

Purpose: To set WDT default output on OUT00~OUT07.

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
output	u8	WDT default output data on OUT0~OUT07

- **DIO3216B_WDT_output_read**

Format : **u32 status = DIO3216B_WDT_output_read(u8 CardID,u8 *output);**

Purpose: To read back WDT output on OUT00~OUT07.

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW

Output:

Name	Type	Description
output	u8	WDT default output data (OUT00~OUT07)

- **DIO3216B_WDT_start**

Format : **u32 status = DIO3216B_WDT_start(u8 CardID, u16 WDT_time_constant, u8 WDT_mode);**

Purpose: To start WDT function.

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
WDT_time_ constant	u16	time constant of WDT timer at 1ms time base
WDT_mode	u8	0: auto mode, user no need to reset WDT, the driver will auto reset WDT on every 0.5*WDT_time_constant 1: manual mode, user must reset WDT before its time up

- **DIO3216B_WDT_stop**

Format : **u32 status = DIO3216B_WDT_stop(u8 CardID);**

Purpose: To stop WDT function.

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW

- **DIO3216B_WDT_reset**

Format : **u32 status = DIO3216B_WDT_reset(u8 CardID);**

Purpose: To reset WDT timer, used for manual mode.

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW

- **DIO3216B_WDT_read**

Format : **u32 status = DIO3216B_WDT_read(u8 CardID, u8 index, u16 *data);**

Purpose: To read back WDT related registers.

Parameters:

Input:

Name	Type	Description
CardID	u8	assigned by DIP/ROTARY SW
index	u8	0: start/stop 1: WDT time constant 2: WDT timer on the fly

Output:

Name	Type	Description
data	u16	if index=0, data=0, WDT stops data=1, WDT run if index=1, data=1~65535, the preset WDT time constant if index=2, data=0~65535, the WDT time on the fly

9.6 Error conditions

DIO3216 cards minimize error conditions. There are three possible fatal failure modes:

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

These error types may indicate an internal hardware problem on the board. Error Codes contains a detailed listing of the error status returned by DIO3216B functions.

10. Dll list

	Function Name	Description
1.	DIO3216B_initial( )	DIO3216B Initial
2.	DIO3216B_close( )	DIO3216B Close
3.	DIO3216B_info( )	get OS. Assigned address
4.	DIO3216B_read_port( )	Read Port Data (word)
5.	DIO3216B_set_port( )	Set Output port(word)
6.	DIO3216B_set_out_point( )	Set Output Point State(bit)
7.	DIO3216B_read_in_point( )	Read Input Point State(bit)
8.	DIO3216B_read_out_point( )	Read Output Point State(bit)
9.	DIO3216B_set_debounce_time( )	Set input port debounce time
10.	DIO3216B_read_debounce_time( )	Read input port debounce time
11.	DIO3216B_enable_IRQ( )	Enable interrupt function
12.	DIO3216B_disable_IRQ( )	Disable interrupt function
13.	DIO3216B_link_IRQ_process( )	Link interrupt service routine to driver
14.	DIO3216B_set_IRQ_mask( )	Set interrupt mask
15.	DIO3216B_read_IRQ_mask( )	
16.	DIO3216B_read_IRQ_status( )	Read back irq status
17.	DIO3216B_set_password( )	Set software key
18.	DIO3216B_change_password( )	Change software key
19.	DIO3216B_clear_password( )	Clear software key
20.	DIO3216B_unlock_security( )	Unlock software key
21.	DIO3216B_read_security_status( )	Read software key status
22.	DIO3216B_WDT_output_set( )	set WDT default output on OUT00~OUT07
23.	DIO3216B_WDT_output_read( )	read back WDT output on OUT00~OUT07
24.	DIO3216B_WDT_start( )	start WDT function with time constant and working mode
25.	DIO3216B_WDT_stop( )	stop WDT function
26.	DIO3216B_WDT_reset( )	reset WDT timer
27.	DIO3216B_WDT_read( )	read back WDT related registers

11. DIO3216B Error code table

Error Code	Symbolic Name	Description
0	JSDRV_NO_ERROR	No error.
2	JSDRV_INIT_ERROR	Driver initial error
3	JSDRV_UNLOCK_ERROR	Software key unlock error
4	JSDRV_LOCK_COUNTER_ERROR	Software key unlock error count over
5	JSDRV_SET_SECURITY_ERROR	Software key setting error
100	DEVICE_RW_ERROR	Device Read/Write error
101	JSDRV_NO_CARD	No DIO3216B card on the system.
102	JSDRV_DUPLICATE_ID	DIO3216B CardID duplicate error.
300	JSDIO_ID_ERROR	Function input parameter error. CardID setting error, CardID doesn't match the DIP SW setting
301	JSDIO_PORT_ERROR	Function input parameter error. Parameter out of range.
302	JSDIO_IN_POINT_ERROR	Function input parameter error. Parameter out of range.
303	JSDIO_OUT_POINT_ERROR	Function input parameter error. Parameter out of range.
304	JSDIO_VERSION_ERROR	Hardware version can not match with software version
306	JSDIO_DEBOUNCE_MODE_ERRO R	Bad debounce time parameter