

I-8024W/I-9024 Module User Manual

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Table of Contents

Table of Contents	3
1. Introduction	4
1.1. Specifications	5
1.2. Pin Assignments	6
1.3. Wire Connections	8
1.4. Block Diagram	9
2. Quick Start	10
2.1. MiniOS7-based Controllers	11
2.2. Windows-based Controllers	13
3. Demo Program	15
4. API References	19
4.1. pac_i8024W_Initial	21
4.2. pac_i8024W_VoltageOut	23
4.3. pac_i8024W_CurrentOut	25
4.4. pac_i8024W_VoltageOut_Hex	27
4.5. pac_i8024W_CurrentOut_Hex	29
Appendix A. Error Code	31
Appendix B. Revision History	32

1. Introduction

The I-8024W/I-9024 is a 14-bit analog output module, which offer 4 single-ended analog output channels. Every channel can be programmed to an individual output range of, ± 10 V or 0 ~ +20 mA.

The I-8024W/I-9024 provide RF immunity level matching that defined by IEC 61000-4-3 standard, together with 4 kV ESD protection as well as 3000 VDC intra-module isolation.

The Slew rate of I-8024W module is about 16 us (62.5 K Hz) from +10 V to -10V.

Features

- 4-channel Voltage or Current Output
- Individual Channel Configuration
- 3000 VDC Intra-module Isolation
- RF Immunity
- 4 kV ESD Protection
- Wide Operating Temperature Range: -25 to +75°C

Applicable Platform table

The following table shows which platform the module applies to.

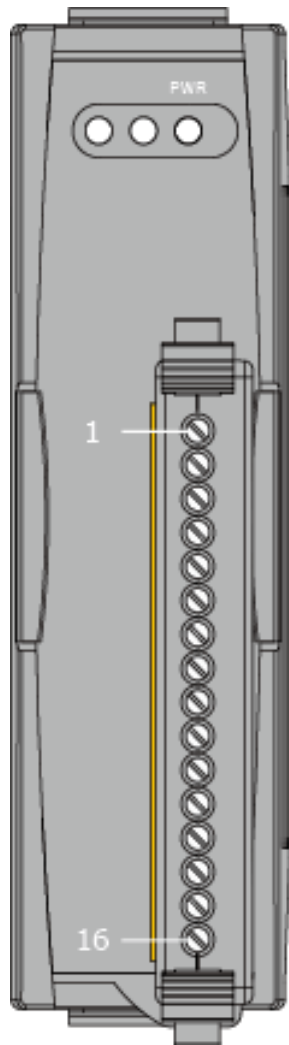
Platform	OS	Module
XPAC	XP-8000(WES)	I-8024W
	XP-8000-Atom (WES)	I-8024W
	XP-8000-WES7 (WES7)	I-8024W
	XP-8000-CE6 (WinCE 6.0)	I-8024W
	XP-8000-Atom-CE6 (WinCE 6.0)	I-8024W
	XP-9000-WES7(WES7)	I-9024
WinPAC	WP-8000 (CE 5.0/7.0)	I-8024W
	WP-9000-CE7 (CE 7.0)	I-9024
LinPAC	LinPAC-8000(Linux kernel 3.2/4.4)	I-8024W
	LinPAC-9000(Linux kernel 3.2/4.4)	I-9024
IPAC	iPAC-8000 (MiniOS7)	I-8024W
	I-8000 (MiniOS7)	I-8024W

1.1. Specifications

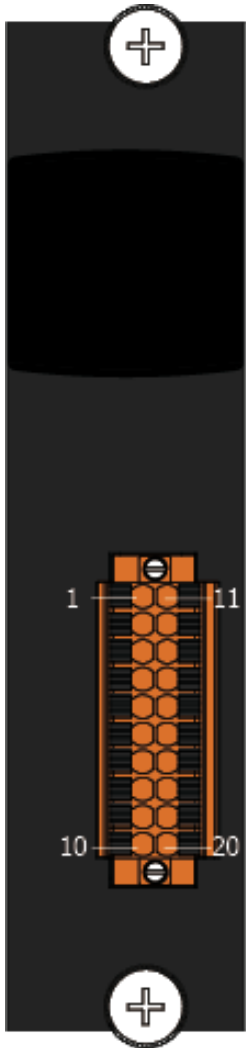
Analog Output		I-8024W	I-9024
Channels		4	
Current Output Wiring		Sink	
Range		+/- 10V, 0 ~ +20 mA	
Resolution		14-bit	
Accuracy	voltage	+/- 0.1% of FSR;	
	current	+/- 0.2% of FSR	
ReadbackAccuracy		+/-1% of FSR	
Zero Drift	Voltage	+/-30 μ V/ $^{\circ}$ C	
	Current	+/-0.2 μ A/ $^{\circ}$ C	
Span Drift		+/- 20ppm/ $^{\circ}$ C	
Voltage Output Capability		10 V @ 20 mA	
Max Current Load Resistance		External +24V : 1050 Ohms	
LED Indicators			
System LED Indicator		1 LED as Power/Communication Indicator	
Isolation			
Intra-module Isolation, Field to Logic		3000 VDC	
EMS Protection			
ESD (IEC 61000-4-2)		\pm 4 kV Contact for each Terminal	\pm 4 kV Contact for each Terminal \pm 8 kV Air for Random Point
Power			
Power Consumption		2 W Max.	
Mechanical			
Dimensions (L x W x H)		30 mm x 102 mm x 115 mm	144 mm x 31 mm x 134 mm
Environment			
Operating Temperature		-25 ~ +75 $^{\circ}$ C	
Storage Temperature		-30 ~ +80 $^{\circ}$ C	-40 ~ +85 $^{\circ}$ C
Humidity		10 ~ 90% RH, Non-condensing	

1.2. Pin Assignments

I-8024W



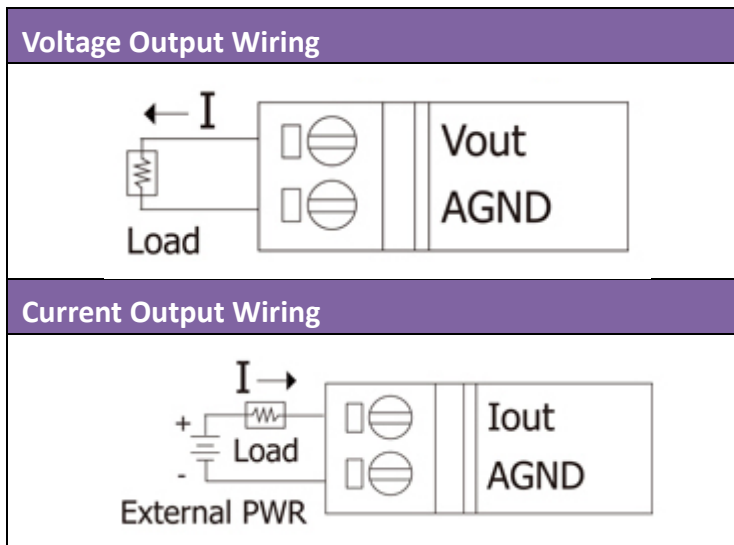
Terminal No.	Pin Assignment
01	Iout0
02	AGND
03	Iout1
04	AGND
05	Iout2
06	AGND
07	Iout3
08	AGND
09	Vout0
10	AGND
11	Vout1
12	AGND
13	Vout2
14	AGND
15	Vout3
16	AGND



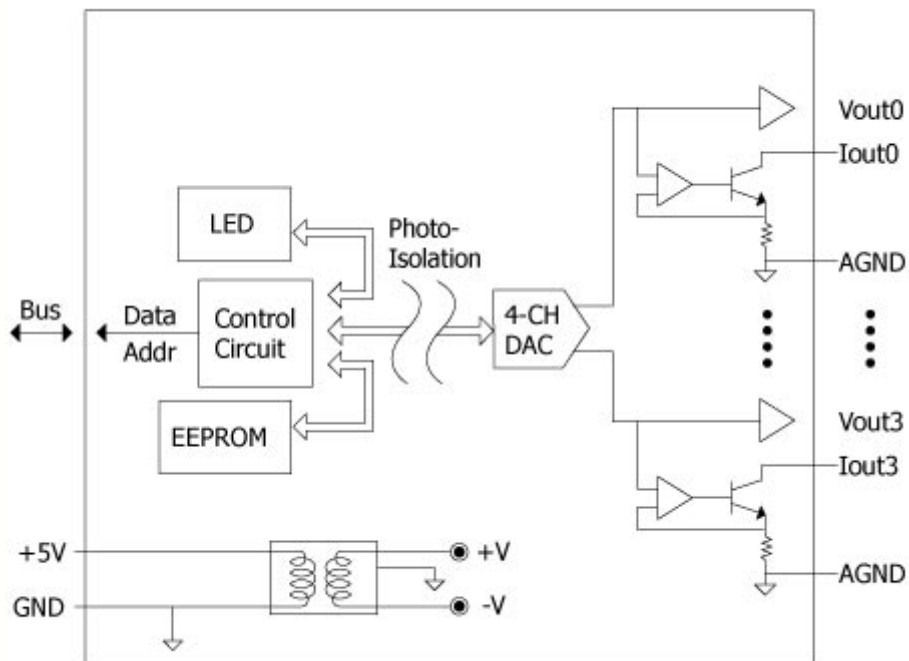
Pin Assignment	Terminal No.	Pin Assignment
VO0	01	I0
AGND	02	AGND
VO1	03	I1
AGND	04	AGND
VO2	05	I2
AGND	06	AGND
VO3	07	I3
AGND	08	AGND
-	09	-
FG	10	FG

20-pin Connector

1.3. Wire Connections



1.4. Block Diagram



2. Quick Start

This section provides a Getting Started guide when using on either the MiniOS7 or Windows platforms.

- For MiniOS7-based Controllers, see section 2.1 (i-8000 and iPAC-8000 modules)
- For Windows-based Controllers, see section 2.2 (WinCE and WES modules)

2.1. MiniOS7-based Controllers

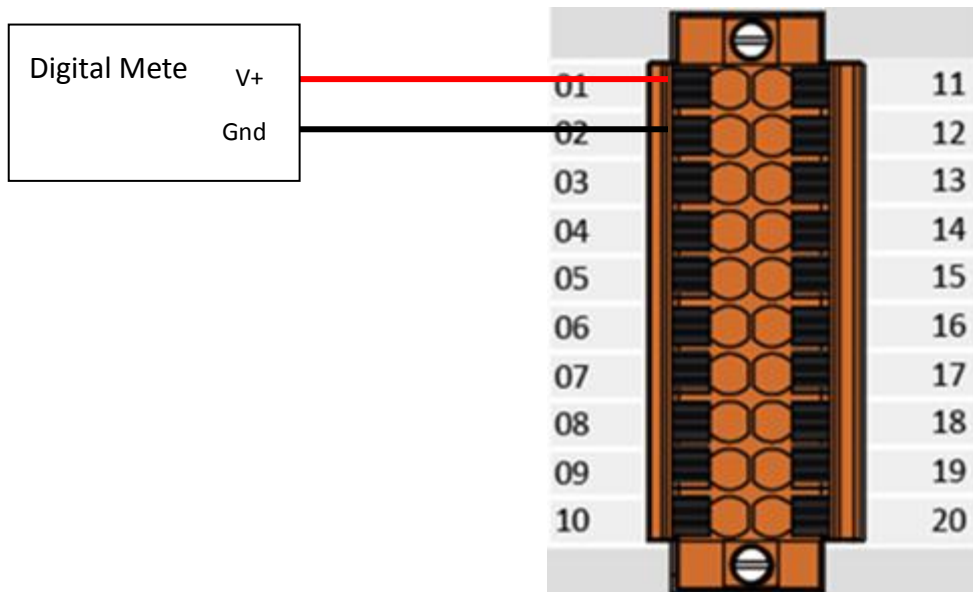
The 8024DEMO.exe executable file, which is located in the I-8024W folder of the demo programs, can be used to retrieve the basic configuration information related to the module, and to verify the AI read functions. The basic configuration information includes:

- The data output for each channel

(See the Location of the Demo Programs section for details of where to find the 8024DEMO.exe file in the demo programs folder)

Step 1. I-8024 doesn't support Hot plugging, please make sure the module plugged on the host before turn on the PAC.

Step 2. Connect to the device (e.g., Digital Meter) by the Single-ended wiring method, as illustrated below.



Step 3. Executed the Dcon_utility pro.exe on the controller, and then verify that the basic information and the data output to the Digital Meter, as indicated in the diagram below:

Check output Value

```
7188XW 1.31 [COM1:115200,N,8,1],FC=0,CTS=1, DIR=F:\edward_ku\t
C837_V2_UDP>8024DEMO.EXE
/*****
/*      8024 demo      */
/*      */
/* [7,Oct,2004]      */
/*****

Slot(0~3 or 0~7)=2
Channel(0~3)=0
Mode
0) Voltage +/- 10.0 V          (float format)
1) Current 0 ~ 20 mA          (float format)
2) Voltage +/- 10.0 V          (2's format)
3) Current 0 ~ 20 mA          (2's format)
4) Voltage +/- 10000 (mV)      (integer format)
5) Current 0 ~ 20000 (0.001 mA)(integer format)
Please choose(0~5):0
Output Voltage(+/- 10.0)(unit: V) = 10
Press 'q' or 'Q' to quit, other key to continue....
```



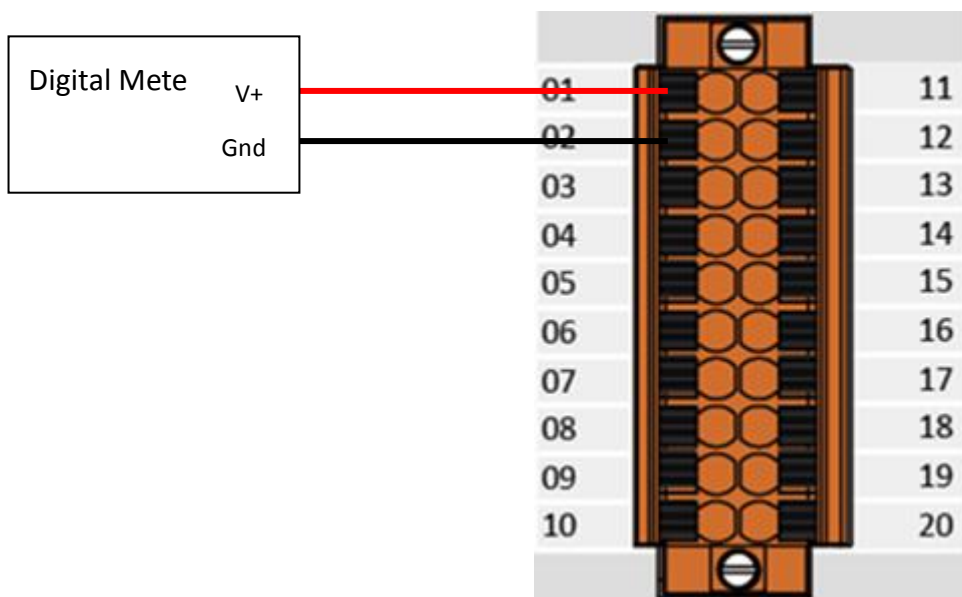
2.2. Windows-based Controllers

The Dcon_Utility_pro.exe executable file, which is located in the ICP DAS website, can be used to retrieve the basic configuration information related to the module, and to verify the AI read functions. The basic configuration information includes:

- The version number and the published date of the library.
- The FPGA version
- The Gain and Offset values for each input range
- The data output for each channel

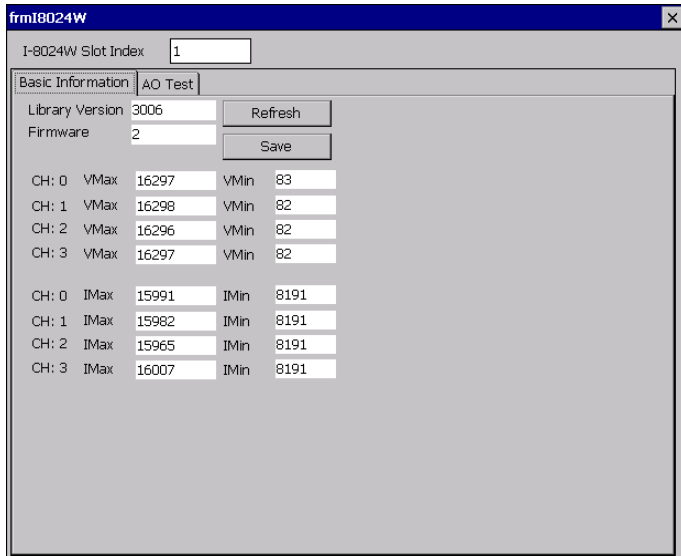
Step 1. I-9024 doesn't support Hot plugging, please make sure the module plugged on the host before turn on the PAC.

Step 2. Connect to the device (e.g., Digital Meter) by the Single-ended wiring method, as illustrated below.

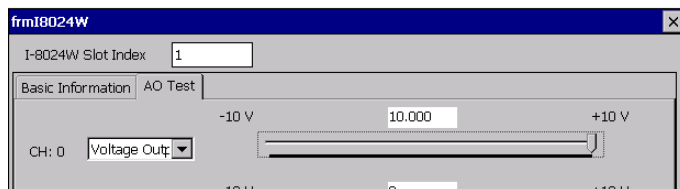


Step 3. Executed the Dcon_utility pro.exe on the controller, and then verify that the basic information and the data output to the Digital Meter, as indicated in the diagram below:

Read the FPGA version information and the Gain and Offset values for each channel.



Read the AO information for each channel and check output Value



3. Demo Program

ICP DAS provides a range of demo programs for different platforms that can be used to verify the functions of the module. The source code contained in these programs can also be reused in your own custom programs if needed. The following is a list of the locations where both the demo programs and associated libraries can be found on either the ICP DAS web site or the enclosed CD.

Platform	Location
For Windows CE5	
Library	CD:\napdos\wp-8x4x_ce50\sdk\IO_Modules or ftp://ftp.icpdas.com/pub/cd/winpac/napdos/wp-8x4x_ce50/sdk/io_modules/
Demo	eVC Demo: CD:\napdos\wp-8x4x_ce50\Demo\WinPAC\eVC\IO\Local or ftp://ftp.icpdas.com/pub/cd/winpac/napdos/wp-8x4x_ce50/demo/winpac/evc/io/local/ C# Demo: CD:\napdos\wp-8x4x_ce50\Demo\WinPAC\C#\IO\Local or ftp://ftp.icpdas.com/pub/cd/winpac/napdos/wp-8x4x_ce50/demo/winpac/c%23/io/local/
For WP-9000	
Library	CD:\WinPAC_AM335x\wp-9000\SDK\IO_Modules ftp://ftp.icpdas.com/pub/cd/winpac_am335x/wp-9000/sdk/io_modules/
Demo	VC2008 Demo: CD:\WinPAC_AM335x\wp-9000\demo\PAC\Vc2008\IO\Local ftp://ftp.icpdas.com/pub/cd/winpac_am335x/wp-9000/demo/pac/vc2008/io/local/ C# Demo: CD:\WinPAC_AM335x\wp-9000\demo\PAC\C#\IO\Local ftp://ftp.icpdas.com/pub/cd/winpac_am335x/wp-9000/demo/pac/c%23/io/local/

For XP-8000-CE6	
Library	<p>CD:\SDK\Special_IO</p> <p>ftp://ftp.icpdas.com/pub/cd/xp-8000-ce6/sdk/special_io/</p>
Demo	<p>VC2005 Demo:</p> <p>CD:\Demo\XPAC\VC2005\IO\Local</p> <p>ftp://ftp.icpdas.com/pub/cd/xp-8000-ce6/demo/xpac/vc2005/io/local/</p> <p>C# Demo:</p> <p>CD:\Demo\XPAC\C#\IO\Local</p> <p>ftp://ftp.icpdas.com/pub/cd/xp-8000-ce6/demo/xpac/c%23/io/local/</p>
For XP-8000-Atom-CE6	
Library	<p>CD:\SDK\Special_IO</p> <p>ftp://ftp.icpdas.com/pub/cd/xpac-atom-ce6/sdk/special_io/</p>
Demo	<p>VC2005 Demo:</p> <p>CD:\Demo\XPAC\VC2005\IO\Local</p> <p>ftp://ftp.icpdas.com/pub/cd/xpac-atom-ce6/demo/xpac/vc2005/io/local/</p> <p>C# Demo:</p> <p>CD:\Demo\XPAC\C#\IO\Local</p> <p>ftp://ftp.icpdas.com/pub/cd/xpac-atom-ce6/demo/xpac/c%23/io/local/</p>
For XP-8000-CE6	
Library	<p>CD:\SDK\IO</p> <p>ftp://ftp.icpdas.com/pub/cd/xp-8000/sdk/io/</p>
Demo	<p>VC2005 Demo:</p> <p>CD:\Demo \XPAC \VC2005\IO\Local</p> <p>ftp://ftp.icpdas.com/pub/cd/xp-8000/demo/pacsdk/vc/io/local/</p> <p>CD:\Demo \XPAC\C#\IO\Local</p> <p>ftp://ftp.icpdas.com/pub/cd/xp-8000/demo/pacsdk/csharp.net/io/local/windows_forms/</p>

For XP-8000-Atom	
Library	CD:\SDK\IO ftp://ftp.icpdas.com/pub/cd/xpac-atom/sdk/io/
Demo	VC Demo: CD:\Demo \pacsdk \vc\IO\Local ftp://ftp.icpdas.com/pub/cd/xpac-atom/demo/pacsdk/vc/io/local/ C# Demo: CD:\Demo \pacsdk\csharp.net\IO\Local\windows_forms ftp://ftp.icpdas.com/pub/cd/xpac-atom/demo/pacsdk/csharp.net/io/local/windows_forms/
For ippc-WES7	
Library	CD:\ippc-wes7\sdk\IO ftp://ftp.icpdas.com/pub/cd/ippc-wes7/sdk/io/
Demo io-8k	VC Demo: CD:\ippc-wes7\demo\pacsdk\vc\io\local\io-8k ftp://ftp.icpdas.com/pub/cd/ippc-wes7/demo/pacsdk/vc/io/local/io-8k/ C# Demo: CD:\ippc-wes7\demo\pacsdk\csharp.net\io\local\io-8k ftp://ftp.icpdas.com/pub/cd/ippc-wes7/demo/pacsdk/csharp.net/io/local/io-8k/
Demo io-9k	VC Demo: CD:\ippc-wes7\demo\pacsdk\vc\io\local\io-9k ftp://ftp.icpdas.com/pub/cd/ippc-wes7/demo/pacsdk/vc/io/local/io-9k/ C# Demo: CD:\ippc-wes7\demo\pacsdk\csharp.net\io\local\io-9k ftp://ftp.icpdas.com/pub/cd/ippc-wes7/demo/pacsdk/csharp.net/io/local/io-9k/

For I-8000	
Library	CD:\Napdos\8000\841x881x\demo\Lib or ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/lib/
Demo	CD:\Napdos\8000\841x881x\demo\IO_in_Slot or ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/io_in_slot/
For iPAC-8000	
Library	CD:\Napdos\iPAC8000\Demo\Basic\iP-84x1_iP-88x1\Lib or ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/ipac8000/demo/basic/ip-84x1_ip-88x1/lib/
Demo	CD:\Napdos\iPAC8000\Demo\Basic\iP-84x1_iP-88x1\IO_in_Slot or ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/ipac8000/demo/basic/ip-84x1_ip-88x1/io_in_slot/

4. API References

API naming table

The following table describes the platforms and in which the product series included and the different part of function name.

Platform	Product included	API prefix characters
Windows CE5 Windows CE6	WP-8000 series XP-8000-CE6 series XP-8000-Atom-CE6 series	"pac_i8024W_" + function name
Windows CE7	WP-8000 series WP-9000-CE7 series	"pac_i8024W_" + function name
WES	XP-8000 series XP-8000-Atom series	"pac_i8024W_" + function name
WES7	XP-8000-WES7 series XP-9000 series	"pac_i8024W_" + function name
MiniOS7	I-8000 series iPAC-8000 series	"i8024W_" + function name
Linux	LinPAC-8000 series LinPAC-9000 series	"i8024W_" + function name

The following table lists the functions provided in pac_8024W.lib for Windows platform.

Function for MiniOS7	Function for Windows	Description
I8024W_Initial	pac_i8024W_Initial	Used to initialize the module
I8024W_VoltageOut	pac_i8024W_VoltageOutput	This function makes I-8024W/I-9024 modules to output the voltage of specified floating-point value in the specified channel and slot.
I8024W_CurrentOut	pac_i8024W_CurrentOutput	This function makes I-8024W/I-9024 modules to output the current of specified floating-point value in the specified channel and slot.
I8024W_VoltageOut_Hex	pac_i8024W_VoltageOutput_Hex	This function makes I-8024W/I-9024 modules to output the specified voltage value in HEX format in the specified channel and slot.
I8024W_CurrentOut_Hex	pac_i8024W_CurrentOutput_Hex	This function makes I-8024W/I-9024 modules to output the specified current value in HEX format in the specified channel and slot.

4.1. pac_i8024W_Initial

This function is used to initialize the module, and must be called at least once before using any other function.

Syntax

For MiniOS7

```
void I8024_Initial(  
    int Slot  
);
```

For Windows

```
short pac_i8024W_Initial(  
    int Slot  
);
```

Parameters

slot [in]

specifies the slot number (0 - 7).

Return Values

Refer to Appendix A: "Error Code" for more details.

Examples

[C++]

```
int slot;  
I8024W_Init(slot);
```

[C#]

```
int slot;  
pac8024W.Init(slot);
```

4.2. pac_i8024W_VoltageOut

This function makes the module output a voltage value of specified floating-point.

Syntax

For MiniOS7

```
void I8024_VoltageOut(  
    int slot,  
    int ch,  
    float fData  
);
```

For Windows (CE and WES)

```
void pac_i8024W_VoltageOut(  
    int slot,  
    int ch,  
    float fData  
);
```

Parameter

slot [in]

specifies the slot number (0 - 7).

ch [in]

Specifies the channel number(0 to 3).

fData[in]

Specifies the analog output value in float format (Voltage range: -10 ~ +10V).

Return Values

None

Examples

[C++]

```
int slot , ch ;  
float data ;  
I8024_VoltageOut(slot, ch, data);
```

[C#]

```
int slot, ch;  
float data;  
pac8024W.VoltageOut(slot, ch, data);
```


4.3. pac_i8024W_CurrentOut

This function makes the module to output a current value of specified floating-point.

Syntax

For MiniOS7

```
void I8024_CurrentOut(  
    int slot,  
    int ch,  
    float fData  
);
```

For Windows (CE and WES)

```
void pac_i8024W_CurrentOut(  
    int slot,  
    int ch,  
    float fData  
);
```

Parameter

slot [in]

specifies the slot number (0 - 7).

ch [in]

Specifies the channel number(0 to 3).

fData[in]

Specifies the analog output value in float format (Current range: 0 ~ + 20 mA).

Return Values

None

Examples

[C++]

```
int slot , ch ;  
float data;  
I8024_CurrentOut(slot, ch, data);
```

[C#]

```
int slot, ch;  
float data;  
pac8024W.CurrentOut(slot, ch, data);
```

4.4. pac_i8024W_VoltageOut_Hex

This function makes the module to output the specified voltage value in HEX format.

Syntax

For MiniOS7

```
void I8024_VoltageOut_Hex(  
    int slot,  
    int ch,  
    int hData  
);
```

For Windows (CE and WES)

```
void pac_i8024W_VoltageOut_Hex(  
    int slot,  
    int ch,  
    int hData  
);
```

Parameter

slot [in]

specifies the slot number (0 - 7).

ch [in]

Specifies the channel number(0 to 3).

hData [in]

Specifies the analog output value in hexadecimal format (8000h ~ 7FFFh).

Return Values

None

Examples

[C++]

```
int slot, ch, data;  
I8024_VoltageOut_Hex(slot, ch, data);
```

[C#]

```
int slot, ch, data;  
pac8024W.VoltageOut_Hex (slot, ch, data);
```

4.5. pac_i8024W_CurrentOut_Hex

This function makes the module to output the specified current value in HEX format.

Syntax

For MiniOS7

```
void I8024_CurrentOut_Hex(  
    int slot,  
    int ch,  
    int hData  
);
```

For Windows (CE and WES)

```
void pac_i8024W_CurrentOut_Hex(  
    int slot,  
    int ch,  
    int hData  
);
```

Parameter

slot [in]

specifies the slot number (0 - 7).

ch [in]

Specifies the channel number(0 to 3).

data [in]

Specifies the analog output value in hexadecimal format (0h ~ 7FFFh).

Return Values

None

Examples

[C++]

```
int slot, ch, data;  
I8024_CurrentOut_Hex(slot, ch, data);
```

[C#]

```
int slot ,ch, data;  
pac8024W.CurrentOut_Hex(slot, ch, data);
```

Appendix A. Error Code

Error Code	Definition	Description
0	NoError	This indicates that there have been no errors
-1	ID_ERROR	There was a problem with the module ID

Appendix B. Revision History

This chapter provides revision history information to this document.

The table below shows the revision history.

Revision	Date	Description
1.0.1	January 2018	Initial issue
3.0.0	July 2018	<ul style="list-style-type: none">• Added content for the I-9024 module• Modify library , demo path• Added WP-9000 , ippc-wes7 library , demo path• Modify API References