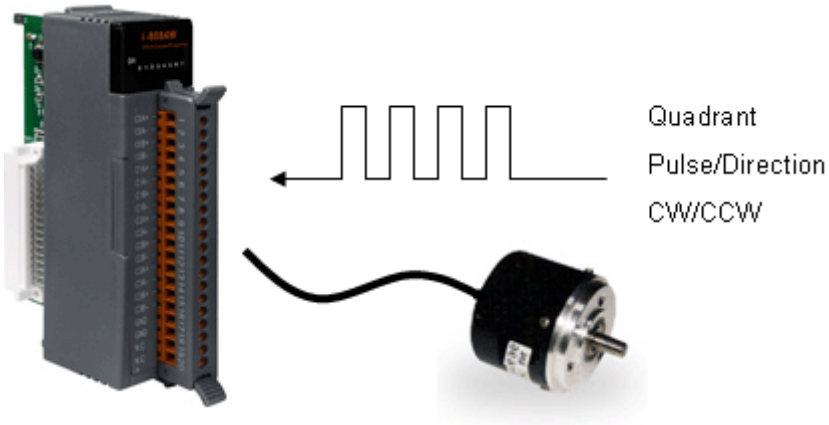
I-8093W

API Reference Manual

Version 1.0.1, August 2009

Service and usage information for

iPAC 8000 and WinPAC 8000



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Edited by Anna Huang

General Information

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1. INTRODUCTION

I-8093W is a 3-axis encoder counter board on I-8000 platform. I-8093W encoder card has 32 bits counter and high counting rate 10Mpps. The application of I-8093W board is position/distance measurement, velocity measurement, feedback for motor control, hard wheel input and so on.

Features:

- ✓ 3-axis, 32-bit encoder counter
- ✓ Encoder counting mode: CW/CCW , Pulse/Direction, A/B Phase
- ✓ Maximum counting rate: 4 MHz
- ✓ Encoder Input: A, B, Z differential
- ✓ Input Level: 5V, 12V/24V with external resistor
- ✓ A/B/Z signal isolation voltage: 2500V optical isolation
- ✓ Built-in XOR logic for active high or active low encoder input

1.1. Specification

Parallel I/O Module

3-axis, 32 bits encoder counter.

Encoder Mode

1. CW/CCW mode
2. Pulse/Dir mode
3. Quadrant mode

Maximum Counting Rate

1. CW/CCW mode 4M pulse/sec
2. Pulse/Dir mode 4M pulse/sec
3. Quadrant mode 1M pulse/sec

Input Level

1. Input level 5 V

   Logic High: 4 V ~ 5 V

   Logic Low: 0 V ~ 2 V
2. Input 12 V with external resistor 1 K ohm

   Logic High: 5 V ~ 12 V

   Logic Low: 0 V ~ 2 V
3. Input 24V with external resistor 2K ohm

   Logic High: 7 V ~ 24 V

   Logic Low: 0 V ~ 2 V

Isolated voltage output

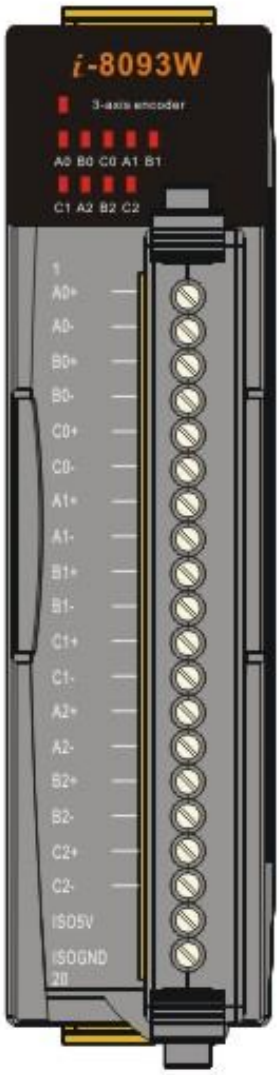
+5 V, 200 mA (max)

Power consumption

1.0 W

Built-in XOR logic for active high or low

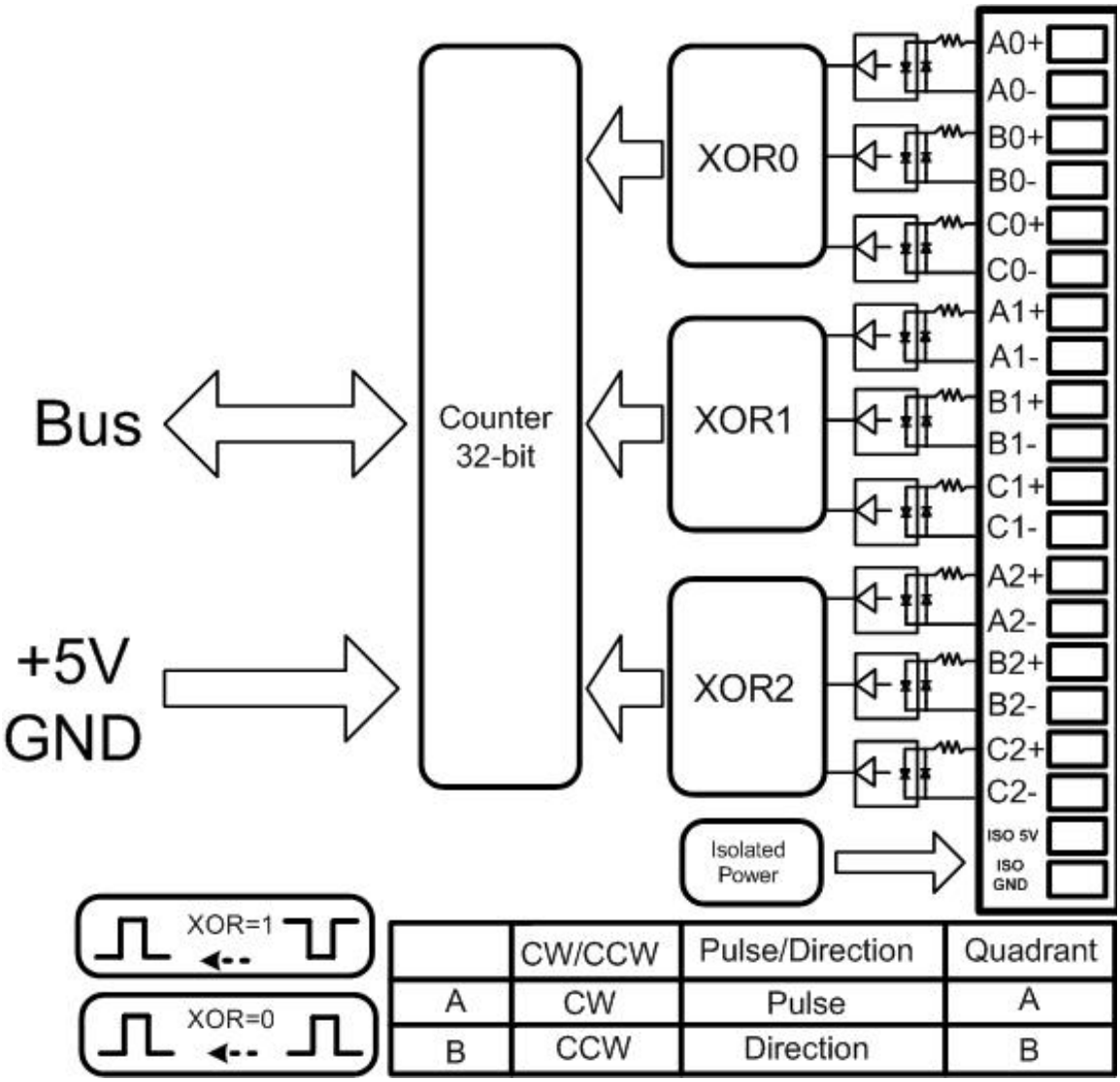
1.2. Pin Assignment



Terminal No.	Pin Assignment Name
01	A0+
02	A0-
03	B0+
04	B0-
05	C0+
06	C0-
07	A1+
08	A1-
09	B1+
10	B1-
11	C1+
12	C1-
13	A2+
14	A2-
15	B2+
16	B2-
17	C2+
18	C2-
19	ISO5V
20	ISOGND

- ✓ Pin 1 ~ 6: A0+/A0-/B0+/B0-/Z0+/Z0-, are designed for encoder0
- ✓ Pin 7 ~ 12: A1+/A1-/B1+/B1-/Z1+/Z1-, are designed for encoder1
- ✓ Pin 13~ 18: A2+/A2-/B2+/B2-/Z2+/Z2-, are designed for encoder2
- ✓ Pin 19 is isolated 5Vsupply, max: 50mA.
- ✓ Pin 20 is isolated ground.

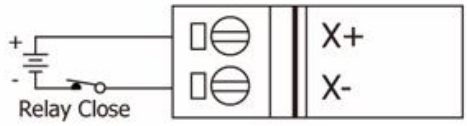
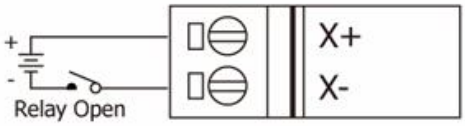
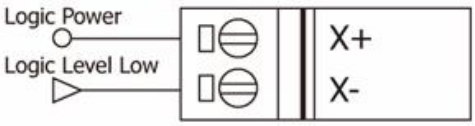
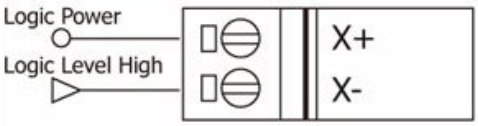
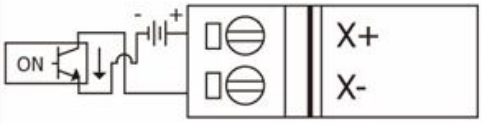
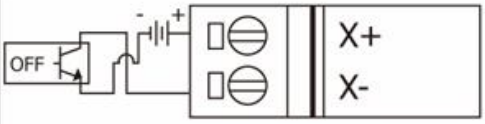
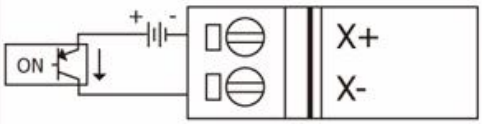
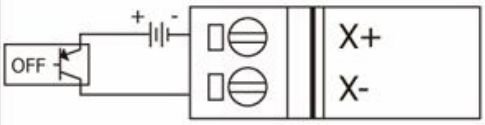
1.3. Block Diagram



	CW/CCW	Pulse/Direction	Quadrant
A	CW	Pulse	A
B	CCW	Direction	B

The input signal maybe active low or active high. The XOR0/XOR1/XOR2 are designed to invert the active low signal for internal logic requirement. If the value of XOR0/1/2 is the encoder value will have different errors. Refer to chapter 2 for more information.

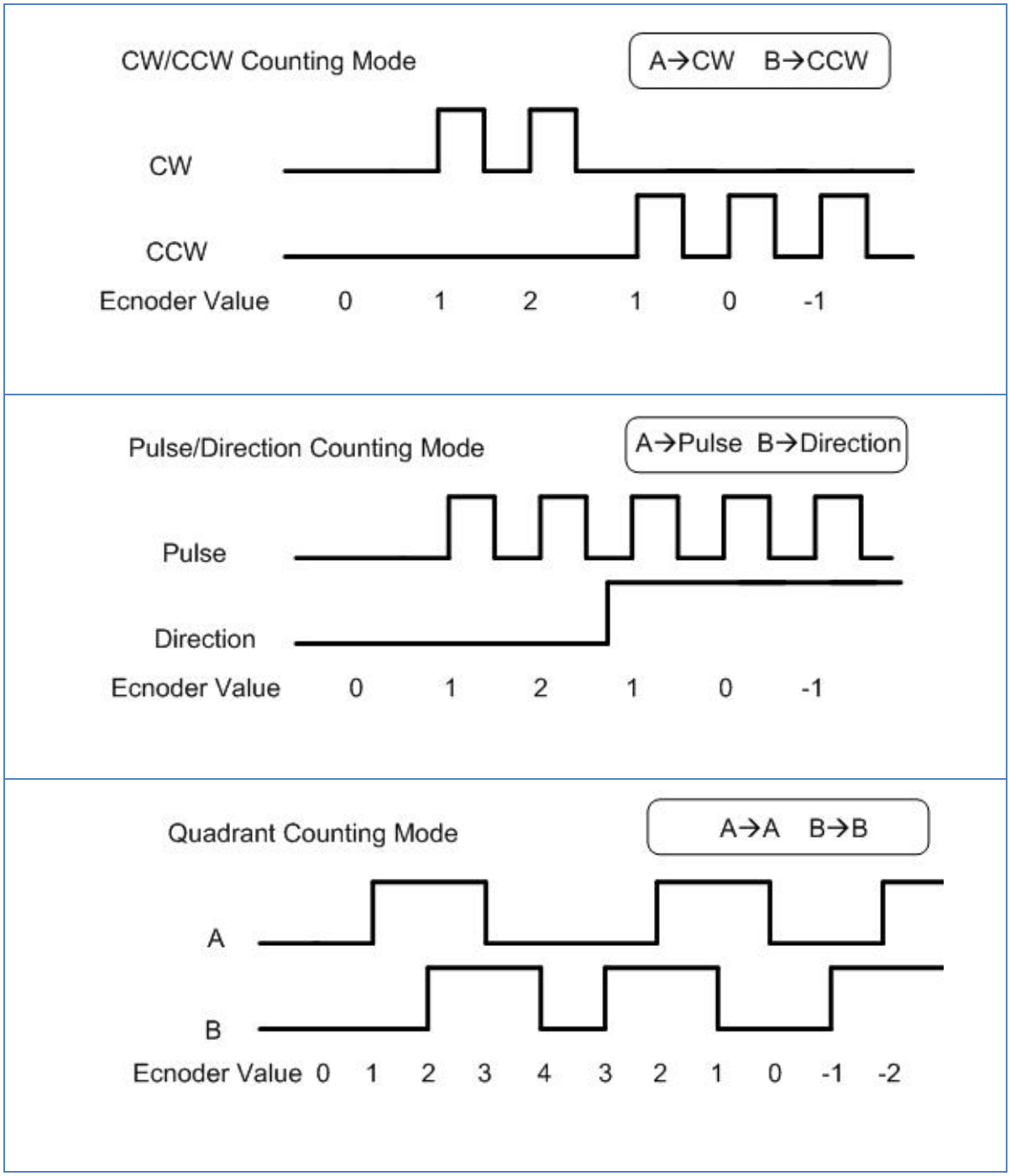
1.4. Wiring Connection

Input Type	ON State LED ON Readback as 0	OFF State LED OFF Readback as 1
Relay Contact	Relay ON	Relay Off
		
TTL/CMOS Logic	Voltage > 4V	Voltage < 0.8V
		
NPN Output	Open Collector On	Open Collector Off
		
PNP Output	Open Collector On	Open Collector Off
		

2. HARDWARE OPERATION PRINCIPLE

2.1. Counting Mode

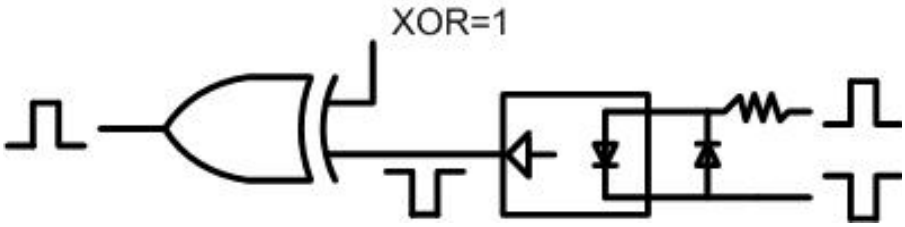
There are 3 counting modes, CC/PD/AB, given as follows:



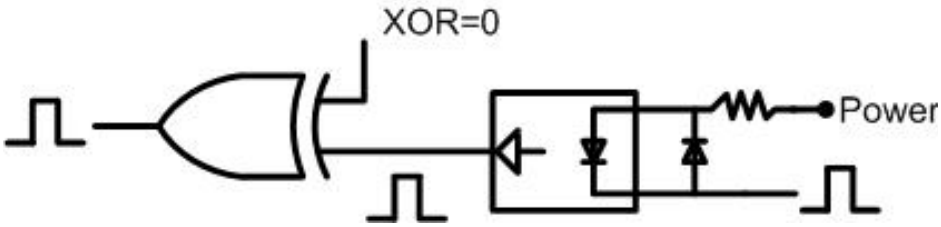
Note: -1=0xffffffff, -2=0xfffffffe

The internal counting logic is expected as active high. User can use XOR control bit to select the proper waveform as follows:

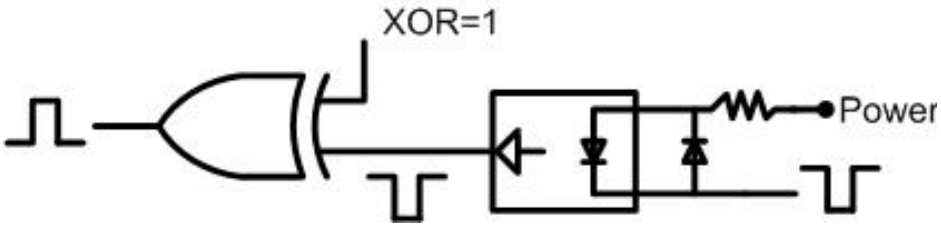
Case 1: differential input, set XOR=1



Case 2: active high single-ended input, set XOR=0



Case 3: active low single-ended input, set XOR=1

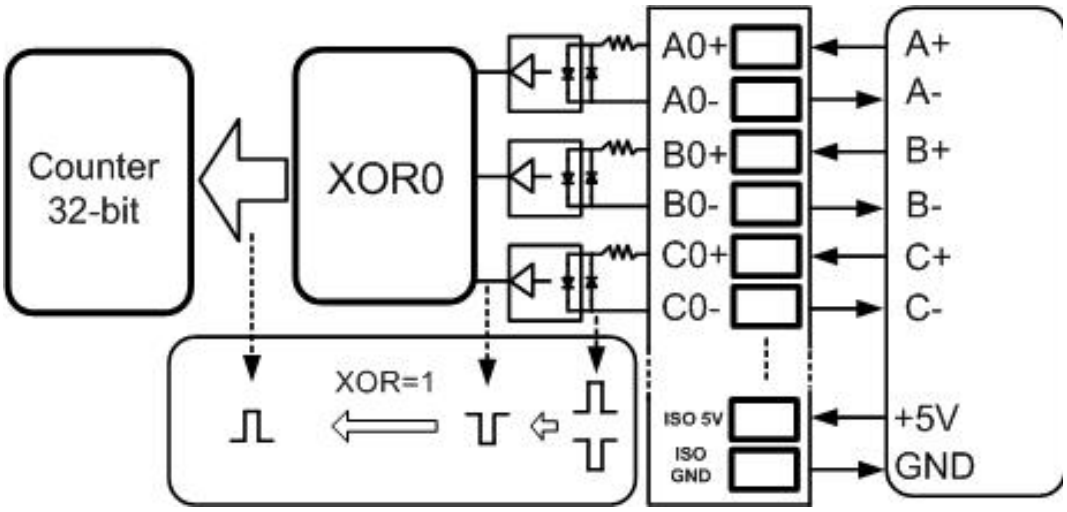


If the value of XOR control bit is error, the encoder value will have different errors given as follows:

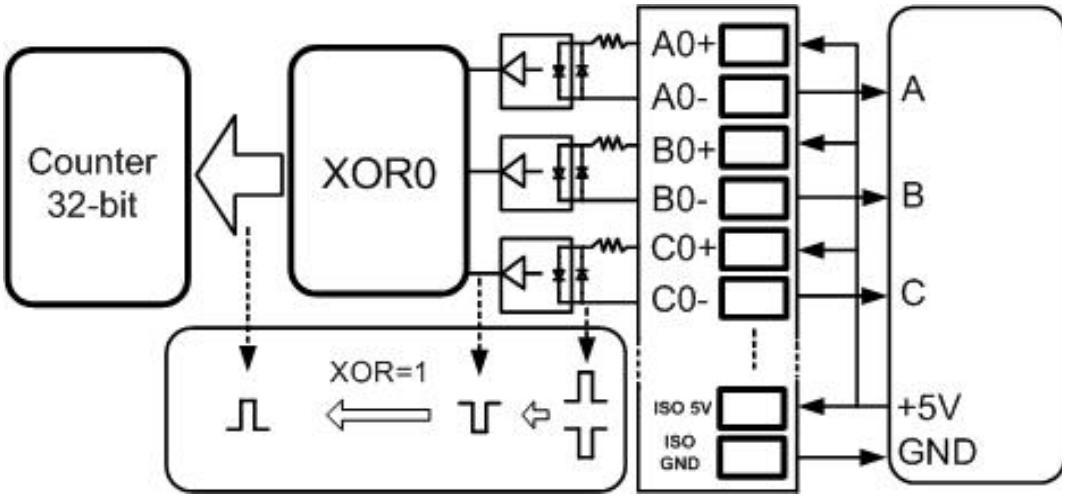
- ✓ The counting direction will be inverted
- ✓ The Z is inverted

2.2. Input Level

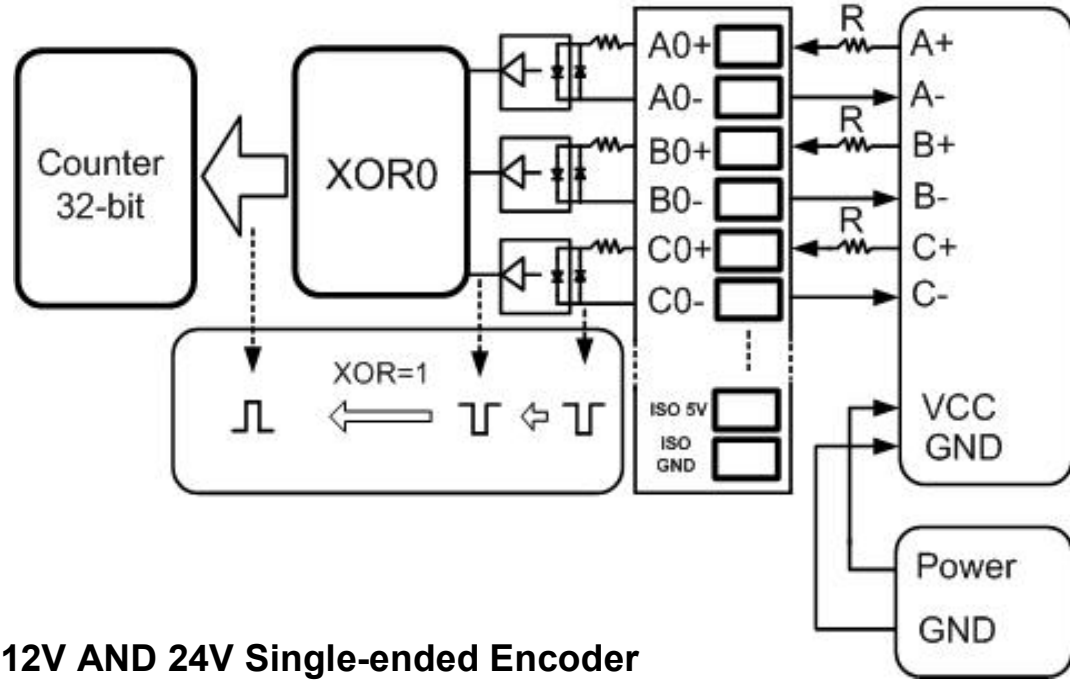
5V Differential Encoder



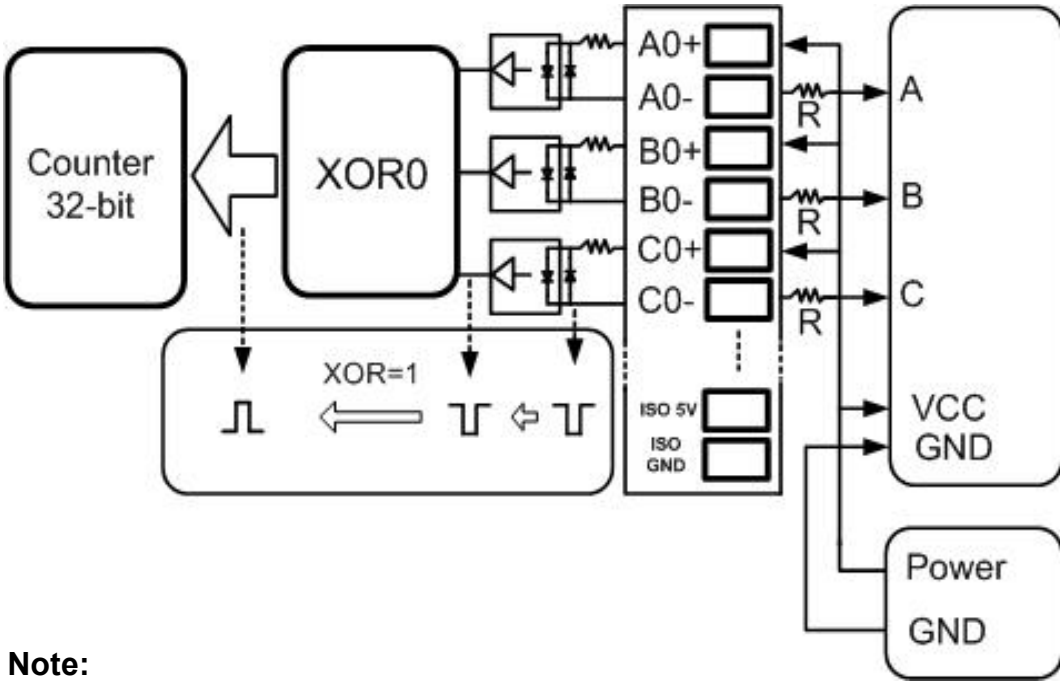
5V Single-ended Encoder



12V AND 24 V Differential Encoder



12V AND 24V Single-ended Encoder



Note:

1. Input 12V with external resistor(R) 1K ohm
2. Input 24V with external resistor(R) 2K ohm

3. USAGE AND API FOR IPAC-8000

iPAC Introduction and Software Development

8084W can be plugged on the IPAC-8000 . Please refer to the Web site

http://www.icpdas.com/products/PAC/i-8000/ip-8x41.htm

or view the iPAC-8000 User manual for getting more information ：

http://ftp.icpdas.com/pub/cd/8000cd/napdos/ipac8000/document/

Software Development using C language

Please refer to the Web site

http://ftp.icpdas.com/pub/cd/8000cd/napdos/ipac8000/c_language_guide_eng.html

I-8093W Demo and library for IPAC-8000

The latest library and demo as below:

Library：

http://ftp.icpdas.com/pub/cd/8000cd/napdos/ipac8000/demo/basic/lib/

Demo：

http://ftp.icpdas.com/pub/cd/8000cd/napdos/ipac8000/demo/basic/io_in_slot/8093/

3.1. i8093W_Init

This function can initial the I-8093W and can check the hardware ID, if return 0 for input slot index, it means the ID of this slot index is I-8093W,if return -1, it means there is no I-8093W for this slot index.

Syntax

```
int i8093W_Init(int slot);
```

Parameter

slot: 0 ~ 7

Return Values

Please refer to Error Code Table.

Examples

[C]

```
int slotIndex,err;
err=i8093W_Init(slotIndex);
if(err==0)
{
  printf("There is an I-8093W at slot %d\n",slotIndex);
}
else
{
  printf("There is no I-8093W at slot %d\n",slotIndex);
}
```

3.2. i8093W_GetFirmwareVersion

This function gets the firmware version of I-8093W hardware.

Syntax

```
short i8093W_GetFirmwareVersion(int slot);
```

Parameter

slot: 0 ~ 7

Return Values

The firmware version of I-8093W hardware

Examples

[C]

```
short firmware_version;
firmware_version = i8093W_GetFirmwareVersion (slot);
```

3.3. i8093W_GetLibVersion

This function gets the library version of i8093W.dll.

Syntax

```
short i8093W_GetLibVersion ();
```

Parameter

none

Return Values

The library version of i8093W.dll

Examples

[C]

```
short version;
version = i8093W_GetLibVersion ();
```

3.4. i8093W_GetLibDate

This function gets the library built date of i8093W.dll.

Syntax

```
void i8093W_GetLibDate(char *LibDate);
```

Parameter

LibDate the string buffer of library built date

Return Values

The library built date of i8093W.dll

Examples

[C]

```
char lib_date[32];
i8093W_GetLibDate(lib_date);
```

3.5. i8093W_SetMode

This function to set the operation mode of I-8093W.

Syntax

```
int i8093W_SetMode(int slot, int ch, int mode);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

mode:

1: CW/CCW counting mode

2: Pulse/Direction counting mode

3: AB Phase (Quadrant counting) mode

Return Values

Please refer to Error Code Table.

Examples

[C]

```
int slot,ch;
slot = 0;
for(ch=0;ch<3;ch++)
{
  i8093W_SetMode(slot,ch,3); // AB Phase
}
```

3.6. i8093W_GetMode

This function to get the operation mode of I-8093W.

Syntax

```
int i8093W_GetMode(int slot, int ch, int* mode);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

mode:

1: CW/CCW counting mode

2: Pulse/Direction counting mode

3: AB Phase (Quadrant counting) mode

Return Values

Please refer to Error Code Table.

Examples

[C]

```
int slot,ch,mode;
slot = 0;
for(ch=0;ch<3;ch++)
{
  i8093W_SetMode(slot,ch,&mode);
}
```

3.7. i8093W_SetXOR

This function to set the xor of I-8093W for each channel.

Syntax

```
int i8093W_SetXOR (int slot, int ch, int xor);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

xor: 0/1

Return Values

Please refer to Error Code Table.

Examples

[C++]

```
int slot,ch;
slot = 0;
for(ch=0;ch<3;ch++)
{
  i8093W_ SetXOR (slot,ch,0);
}
```

3.8. i8093W_GetXOR

This function to get the xor of I-8093W for each channel.

Syntax

```
int i8093W_GetXOR (int slot, int ch, int* mode);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

mode:

1: CW/CCW counting mode

2: Pulse/Direction counting mode

3: AB Phase (Quadrant counting) mode

Return Values

Please refer to Error Code Table.

Examples

[C]

```
int slot,ch,mode;
slot = 0;
for(ch=0;ch<3;ch++)
{
  i8093W_SetMode(slot,ch,&mode);
}
```

3.9. i8093W_GetLineStatus

This function to get A,B and Z status of I-8093W.

Syntax

```
int i8093W_GetLineStatus (int slot, int ch, int* A,int*B,int*Z);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

A: 0/1

B: 0/1

Z: 0/1

Return Values

Please refer to Error Code Table.

Examples

[C]

```
int slot,ch,A,B,Z;
slot = 0;
for(ch=0;ch<3;ch++)
{
  i8093W_GetLineStatus (slot,ch,&A,&B,&Z);
}
```

3.10. i8093W_GetIndex

This function to get Z index status of I-8093W.

Syntax

```
int i8093W_GetIndex (int slot, int ch, int*Z);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

Z: 0/1

Return Values

Please refer to Error Code Table.

Examples

[C]

```
int slot,ch,Z;
slot = 0;
for(ch=0;ch<3;ch++)
{
  i8093W_GetIndex (slot,ch,&Z);
}
```

3.11. i8093W_Read32BitEncoder

This function to get 32-Bit Encoder value of I-8093W.

Syntax

```
int i8093W_Read32BitEncoder(int slot, int ch, long*encVal);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

encVal: 32-Bit Encoder value of I-8093W (0 ~ 0xffffffff)

Return Values

Please refer to Error Code Table.

Examples

[C]

```
int slot,ch;
long encoder=0;
slot = 0;
for(ch=0;ch<3;ch++)
{
  i8093W_ Read32BitEncoder(slot,ch,&encoder);
}
```

3.12. i8093W_ResetEncoder

This function to reset 32-Bit Encoder value to zero.

Syntax

```
int i8093W_ResetEncoder (int slot, int ch);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

Return Values

Please refer to Error Code Table.

Examples

[C]

```
int slot,ch;
slot = 0;
for(ch=0;ch<3;ch++)
{
  i8093W_ResetEncoder (slot,ch);
}
```

4. API FOR WINPAC-8000

WinPAC Introduction and Software Development

WinPAC-8000 Introduction and user rmanual

I-8093W can be plugged on the WinPAC-8000 . Please refer to Web site

http://www.icpdas.com/products/PAC/winpac/introduction.htm

or view the WinPAC User manual for getting more information

http://ftp.icpdas.com/pub/cd/winpac/napdos/wp-8x4x_ce50/document/

Software Development using eMbedded Visual C++ or .NET

Both eMbedded Visual C++ and Visual Studio .NET can develop the programon on the WinPAC-8000. Please refer to the Web site:

http://www.icpdas.com/products/PAC/winpac/download/winpac_8000/download_documents.htm

and select the necessary document

I-8093W Demo and library for WinPAC-8000

Please refer to this page to download WinPAC-8000I demo

http://www.icpdas.com/products/PAC/winpac/download/winpac_8000/download_demo.htm

The latest 8084W library and demo as below:

Library:

.Net

ftp://ftp.icpdas.com/pub/cd/winpac/napdos/wp-8x4x_ce50/sdk/io_modules/dotnet/

eVC:

ftp://ftp.icpdas.com/pub/cd/winpac/napdos/wp-8x4x_ce50/sdk/io_modules/evc/

Demo:

.NET:
ftp://ftp.icpdas.com/pub/cd/winpac/napdos/wp-8x4x_ce50/demo/winpac/dotnet/c%23.net/pac_io/local/

eVC:

ftp://ftp.icpdas.com/pub/cd/winpac/napdos/wp-8x4x_ce50/demo/winpac/evc/pac_io/local/

4.1. pac_i8093_Init

This function can initial the I-8093W and can check the hardware ID, if return 0 for input slot index, it means the ID of this slot index is I-8093W,if return -1, it means there is no I-8093W for this slot index.

Syntax

```
int pac_i8093_Init(int slot);
```

Parameter

Slot: 0 ~ 7

Return Values

Please refer to Error Code Table.

Examples

[C++]

```
int slotIndex,err;
err=pac_i8093_Init(slotIndex);
if(err==0)
{
  printf("There is an I-8093W at slot %d\n",slotIndex);
}
Else
{
  printf("There is no I-8093W at slot %d\n",slotIndex);
}
```

[C#]

```
using pac8093WNet;
int slotIndex,err;
err= pac8093W.Init(slotIndex);
if(err==0)
{
  printf("There is an I-8093W at slot %d\n",slotIndex);
}
else
{
  printf("There is no I-8093W at slot %d\n",slotIndex);
}
```

4.2. pac_i8093_GetFirmwareVersion

This function gets the firmware version of I-8093W hardware.

Syntax

```
short pac_i8093_GetFirmwareVersion(int slot);
```

Parameter

slot

Return Values

The firmware version of I-8093W hardware

Examples

[C++]

```
short firmware_version;
firmware_version = pac_i8093_GetFirmwareVersion (slot);
```

[C#]

```
using pac8093WNet;
short version;
firmware_version = pac8093W.GetFirmwareVersion (slot);
```

4.3. pac_i8093_GetLibVersion

This function gets the library version of pac_i8093.dll.

Syntax

```
short pac_i8093_GetLibVersion ();
```

Parameter

none

Return Values

The library version of pac_i8093.dll

Examples

[C++]

```
short version;
version = pac_i8093_GetLibVersion ();
```

[C#]

```
using pac8093WNet;
short version;
version = pac8093W.GetLibVersion ( );
```

4.4. pac_i8093_GetLibDate

This function gets the library built date of pac_i8093.dll.

Syntax

```
void pac_i8093_GetLibDate(char *LibDate);
```

Parameter

LibDate the string buffer of library built date

Return Values

The library built date of pac_i8093.dll

Examples

[C++]

```
char lib_date[32];
pac_i8093_GetLibDate(lib_date);
```

[C#]

```
using pac8093WNet;
string lib_date;
lib_date = pac8093W. GetLibDate ( );
```

4.5. pac_i8093_SetMode

This function to set the operation mode of I-8093W.

Syntax

```
int pac_i8093_SetMode(int slot, int ch, int mode);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

mode:

1: CW/CCW counting mode

2: Pulse/Direction counting mode

3: AB Phase (Quadrant counting) mode

Return Values

Please refer to Error Code Table.

Examples

[C++]

```
int slot,ch;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac_i8093_SetMode(slot,ch,3); // AB Phase
}
```

[C#]

```
using pac8093WNet;
int slot,ch;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac8093W.SetMode(slot,ch,3); // AB Phase
}
```

4.6. pac_i8093_GetMode

This function to get the operation mode of I-8093W.

Syntax

```
int pac_i8093_GetMode(int slot, int ch, int* mode);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

mode:

1: CW/CCW counting mode

2: Pulse/Direction counting mode

3: AB Phase (Quadrant counting) mode

Return Values

Please refer to Error Code Table.

Examples

[C++]

```
int slot,ch,mode;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac_i8093_SetMode(slot,ch,&mode);
}
```

[C#]

```
using pac8093WNet;
int slot,ch,mode=0;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac8093W.GetMode(slot,ch,ref mode);
}
```

4.7. pac_i8093_SetXOR

This function to set the xor of I-8093W for each channel.

Syntax

```
int pac_i8093_SetXOR (int slot, int ch, int xor);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

xor: 0/1

Return Values

Please refer to Error Code Table.

Examples

[C++]

```
int slot,ch;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac_i8093_ SetXOR (slot,ch,0);
}
```

[C#]

```
using pac8093WNet;
int slot,ch;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac8093W. SetXOR (slot,ch,0);
}
```

4.8. pac_i8093_GetXOR

This function to get the xor of I-8093W for each channel.

Syntax

```
int pac_i8093_GetXOR (int slot, int ch, int* mode);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

mode:

1: CW/CCW counting mode

2: Pulse/Direction counting mode

3: AB Phase (Quadrant counting) mode

Return Values

Please refer to Error Code Table.

Examples

[C++]

```
int slot,ch,mode;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac_i8093_SetMode(slot,ch,&mode);
}
```

[C#]

```
using pac8093WNet;
int slot,ch,xor=0;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac8093W.GetXOR(slot,ch,ref xor);
}
```

4.9. pac_i8093_GetLineStatus

This function to get A,B and Z status of I-8093W.

Syntax

```
int pac_i8093_GetLineStatus (int slot, int ch, int* A,int*B,int*Z);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

A: 0/1

B: 0/1

Z: 0/1

Return Values

Please refer to Error Code Table.

Examples

[C++]

```
int slot,ch,A,B,Z;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac_i8093_GetLineStatus (slot,ch,&A,&B,&Z);
}
```

[C#]

```
using pac8093WNet;
int slot,ch,A=0,B=0,Z=0;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac8093W.GetLineStatus (slot,ch,ref A,ref B, ref Z);
}
```

4.10. pac_i8093_GetIndex

This function to get Z index status of I-8093W.

Syntax

```
int pac_i8093_GetIndex (int slot, int ch, int*Z);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

Z: 0/1

Return Values

Please refer to Error Code Table.

Examples

[C++]

```
int slot,ch,Z;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac_i8093_GetIndex (slot,ch,&Z);
}
```

[C#]

```
using pac8093WNet;
int slot,ch, Z=0;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac8093W.GetIndex(slot,ch, ref Z);
}
```

4.11. pac_i8093_Read32BitEncoder

This function to get 32-Bit Encoder value of I-8093W.

Syntax

```
int pac_i8093_Read32BitEncoder(int slot, int ch, long*encVal);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

encVal: 32-Bit Encoder value of I-8093W (0 ~ 0xffffffff)

Return Values

Please refer to Error Code Table.

Examples

[C++]

```
int slot,ch;
long encoder=0;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac_i8093_ Read32BitEncoder(slot,ch,&encoder);
}
```

[C#]

```
using pac8093WNet;
int slot,ch, Z=0;
long encoder=0
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac8093W. ReadEncoder(slot,ch, ref encoder);
}
```

4.12. pac_i8093_ResetEncoder

This function to reset 32-Bit Encoder value to zero.

Syntax

```
int pac_i8093_ResetEncoder (int slot, int ch);
```

Parameter

slot: 0 ~ 7

ch: 0 ~ 2

Return Values

Please refer to Error Code Table.

Examples

[C++]

```
int slot,ch;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac_i8093_ResetEncoder (slot,ch);
}
```

[C#]

```
using pac8093WNet;
int slot,ch;
slot = 0;
for(ch=0;ch<3;ch++)
{
  pac8093W.ResetEncoder (slot,ch);
}
```

APPENDIX A. ERROR CODE

0	OK
-1	ID_ERROR
-2	SLOT_OUT_RANGE
-3	CHANNEL_OUT_RANGE
-4	MODE_ERROR