PC-104-AO-001
Dual Channel
Analog Output Module

Contents

Introduction

The PC104-AO-001 is a PC104 Analog Output module. It contains two analog output channels which can be configured independently for voltage or current output. Each channel is individually user selectable to any of the following ranges: 0 to 5V, 0 to 10V, -2.5V to +2.5V, -5V to +5V, -10V to +10V or 4mA to 20mA outputs.

Features

- ❏ 2 channel analog output
- ❏ 0V to 5V, 0V to 10V, ±2.5V, ±5V, ±10V and 4mA to 20mA output range
- ❏ 15 bit resolution
- ❏ High speed
- ❏ PC104 Standard +5V, ±12V power supply

Specification

Analog Output

Number channel	2
Output voltage range	
Unipolar	0~5V, 0~10V
Bipolar	±2.5V, ±5V, ±10V
Output current range	4mA to 20mA
Voltage output current range	±5mA
Source impedence	0.1Ω max.

Accuracy

Resolution	15 bits
Nonlinearity	±4LSB
Differential nonlinearity	±4LSB
System Accuracy	0.012% FSR (Voltage Output)
	0.05% FSR (Current Output)

Dynamic Performance

Settling Time to ±0.003%FSR

1LSB output step	4μs
Slew Rate	10V/μs

Thermal Cheracteristic

Zero Drift	±0.7μV/°C
Gain Drift	±3~20ppm of FSR

Power Requirements

+5V, ±12V

Loop Supply Voltage	7.5V to 36V DC
Max power dissipation	3.8W

Physical/Environmental

|	
I/O Connector	10 pin male connector
Dimensions	3.775" x 3.55"
Weight	70-grams
Operating Temperature Range	0 ~ 70 °C
Storage Temperature Range	0 ~ 70 °C

LOCATION DIAGRAM
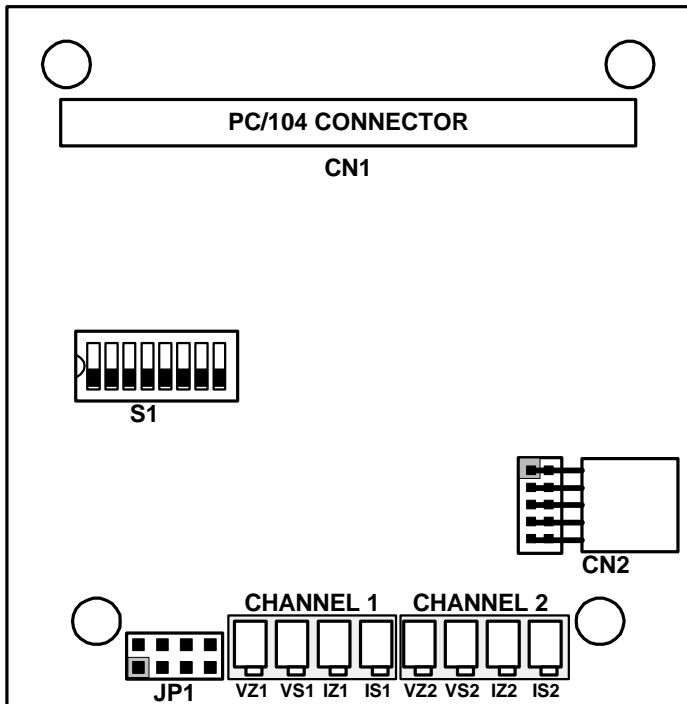
Base I/O Port Address

The PC104-AO-001 module occupies 8 consecutive locations in I/O address space. If more than one module is to be installed to the embedded system, each module must be given its own distinct I/O address or base address. No more than one module may use the same base address. The I/O Port address or base address for a particular module is can be configured by using the Dip-Switch (**S1).** To set to appropriate base address, switch the individual switches into the ON or OFF position.

The default base address setting for the PC104-AO-001 module is 3F8 (Hex) and is shown below.

Base Address Setting

Each switch represents one address weight. The desired base address is determined by adding the weight of the switches.
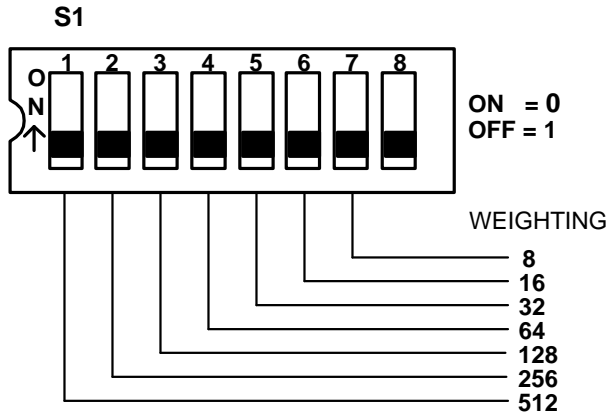
The base address calculation is as shown below.

BASE ADDRESS = 8+16+32+64+128+256+512
= 1016 (Decimal)
= 3F8 (Hexadecimal)

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I/O PORT RANGE	DIP SWITCH POSITION							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Hexadecimal	**A9**	**A8**	**A7**	**A6**	**A5**	**A4**	**A3**	**X**
200 - 207	1	0	0	0	0	0	0	X
208 - 20F	1	0	0	0	0	0	1	X
210 - 217	1	0	0	0	0	1	0	X
218 - 21F	1	0	0	0	0	1	1	X
220 - 227	1	0	0	0	1	0	0	X
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
3F0 - 3F7	1	1	1	1	1	1	0	X
(*) 3F8 - 3FF	1	1	1	1	1	1	1	X

0 = ON,   1 = OFF,   (*) = Default Setting

Jumper Setting of JP1

Channel 1

4 ~ 20 mA Output
0 ~ 10V Output
±10V Output

```
  2    4    6    8
  ■    ■    ■    ■      JP1
  ■    ■    ■    ■
  1    3    5    7
```
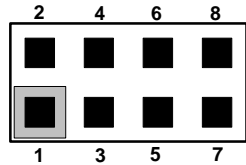
Channel 1

0 ~ 5V Output
± 5V Output

```
  2    4    6    8
  █    ■    ■    ■      JP1
  █    ■    ■    ■
  1    3    5    7
```

Channel 1

±2.5V Output

```
  2    4    6    8
  █    █    ■    ■      JP1
  █    █    ■    ■
  1    3    5    7
```

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Jumper Setting of JP1

Channel 2

4 ~ 20 mA Output
0 ~ 10V Output
±10V Output

JP1

Channel 2

0 ~ 5V Output
± 5V Output

JP1

Channel 2

±2.5V Output

JP1

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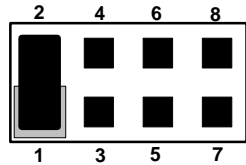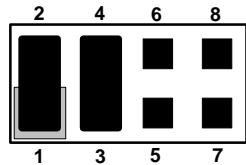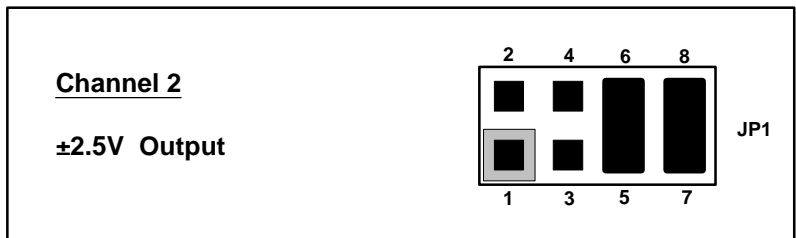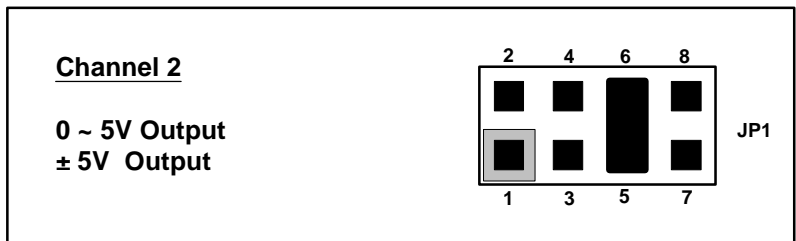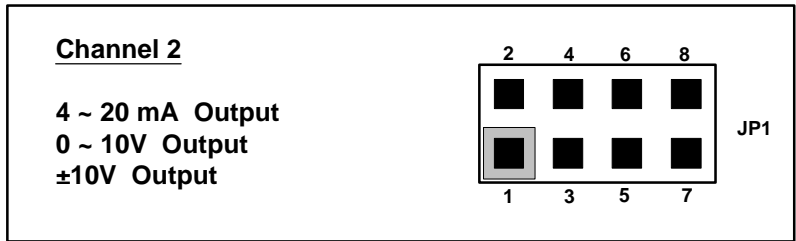
Connector Pin Assignments (CN2)

```
+V Loop1  1 | ■ ■ | 2   I_out1
   Vout1  3 | ■ ■ | 4   GND1
+V Loop2  5 | ■ ■ | 6   I_out2
   Vout2  7 | ■ ■ | 8   GND2
     NC   9 | ■ ■ | 10  NC

              CN2
```
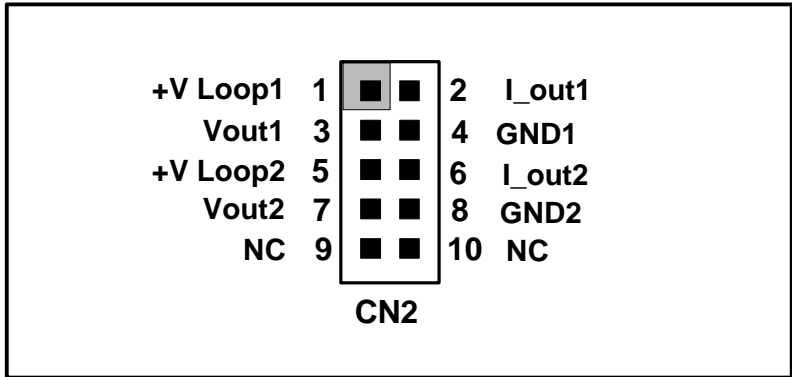
PIN No of CN2	PIN NAME	DESCRIPTION
1	+V Loop1	Channel 1 Loop Supply Voltage
2	I_out1	Channel 1 Current Output
3	Vout1	Channel 1 Voltage Output
4	GND1	Channel 1 Ground
5	+V Loop2	Channel 2 Loop Supply Voltage
6	I_out2	Channel 2 Current Output
7	Vout2	Channel 2 Voltage Output
8	GND2	Channel 2 Ground
9	NC	No Connection
10	NC	No Connection

Programming Reference

PC104-AO-001 analog output module is especially designed for 4 to 20mA analog output application. The module consists of two 16-bit D/A channels and are designed to accept positive-true binary two's completement (BTC) input codes which are compatible with bipolar analog output operation.

The method of transferring the input data to each D/A converter is as follow.

The module is designed to accept the Lower 8-bits of the First channel at the *Base address* and then the Higher 8-bits of the First channel is at the address of *Base address + 1.* Then the Lower 8-bits of the Second channel is at *Base address + 2* and the Higher 8-bits of the Second channel is to be written at the address of *Base address + 3*. Both of D/A converters output will be enabled and updated when the address of *Base address + 4* is sent.

It is necessary to calibrate whenver the output configuration is made changes.

For *Unipolar operation* and *4 to 20mA Current output operation*, the input code should be **7FFF$_H$** as Full Scale and **0000$_H$** as Zero.

For *Bipolar analog output configuration*, the following table shows the digital input codes and their related analog output voltages respectively.

DIGITAL INPUT CODE BINARY TWO'S COMPLEMENT BTC	ANALOG OUTPUT (V)	DESCRIPTION
$7FFF_H$	+9.999695	+Full Scale – 1LSB
$\mid$	$\mid$	
4000_H	+5.000000	¾ Scale
$\mid$	$\mid$	
0001_H	+0.000305	BPZ + 1LSB
$\mid$	$\mid$	
0000_H	0.000000	Bipolar Zero (BPZ)
$\mid$	$\mid$	
$FFFF_H$	-0.000305	BPZ – 1LSB
$\mid$	$\mid$	
$C000_H$	-5.000000	¼ Scale
$\mid$	$\mid$	
8000_H	-10.000000	Minus Full Scale

Current Output Connection Diagram

+V Loop1 OR +V Loop2

V_{LOOP} (7.5V to 36V)

R_L

I_out1 OR I_out2
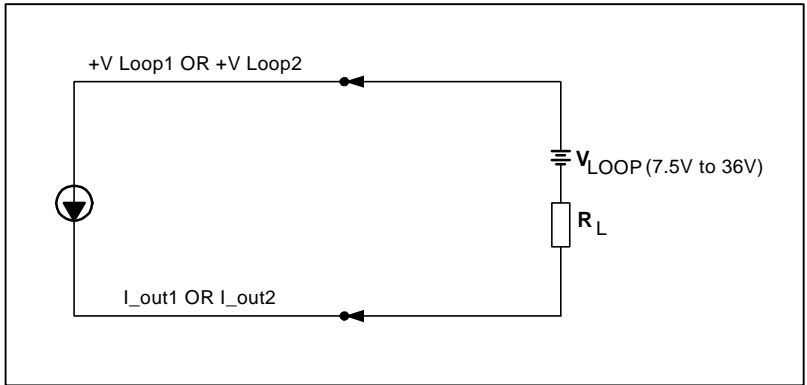
Voltage Output Connection Diagram

Vout1 OR   Vout2

R

GND1 OR   GND2
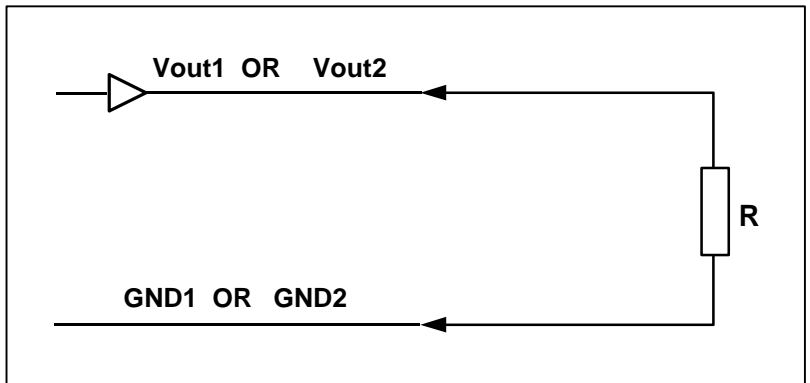
Channel 1 Voltage and Current Output Adjustments

VZ1 *= Voltage Output Zero Adjustment for Channel 1*.

CHANNEL 1   CHANNEL 2

VZ1 VS1 IZ1 IS1 VZ2 VS2 IZ2 IS2

VS1 *= Voltage Output Span Adjustment for Channel 1.*

CHANNEL 1   CHANNEL 2

VZ1 VS1 IZ1 IS1 VZ2 VS2 IZ2 IS2
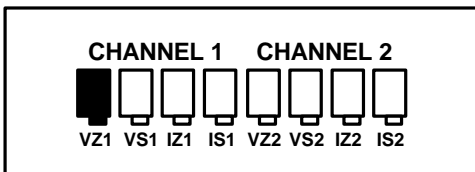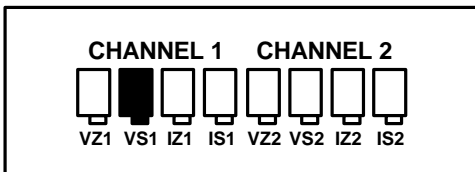
IZ1 *= Current Output Zero Adjustment for Channel 1.*

CHANNEL 1   CHANNEL 2

VZ1 VS1 IZ1 IS1 VZ2 VS2 IZ2 IS2

IS1 *= Current Output Span Adjustment for Channel 1.*

CHANNEL 1   CHANNEL 2

VZ1 VS1 IZ1 IS1 VZ2 VS2 IZ2 IS2

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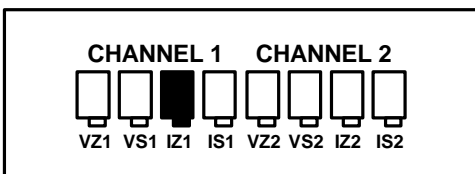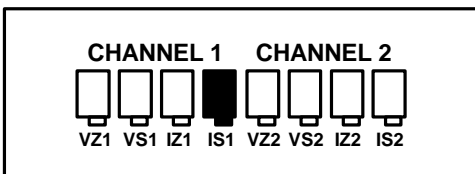
Channel 2 Voltage and Current Output Adjustments

VZ2 = *Voltage Output Zero Adjustment for Channel 2*.

CHANNEL 1   CHANNEL 2

VZ1 VS1 IZ1 IS1 VZ2 VS2 IZ2 IS2

VS2 = *Voltage Output Span Adjustment for Channel 2.*

CHANNEL 1   CHANNEL 2

VZ1 VS1 IZ1 IS1 VZ2 VS2 IZ2 IS2

IZ2 = *Current Output Zerot Adjustment for Channel 2.*

CHANNEL 1   CHANNEL 2

VZ1 VS1 IZ1 IS1 VZ2 VS2 IZ2 IS2

IS2 = *Current Output Span Adjustment for Channel 2.*

CHANNEL 1   CHANNEL 2

VZ1 VS1 IZ1 IS1 VZ2 VS2 IZ2 IS2

Notes