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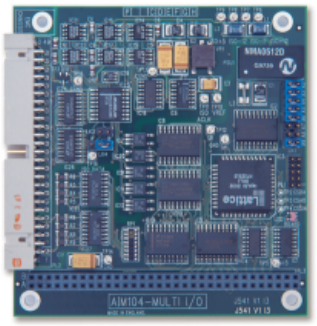
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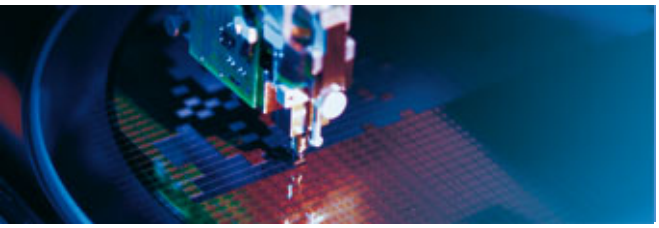
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USER MANUAL





AIM104-MULTI-I/O

8 Channel RS232 PC/104 Board

Issue G - August 2009 - ETH_AIM104-MULTI-I/O_USM

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REVISION HISTORY

Issue no.	*PCB*	*Date*	*Comments*
Issue A	V1.2	September 20th, 1996	First full release of manual.
Issue B	V1.3	December 23rd, 1996	Edits to J538, J541, J559, and AIM104 software.
Issue C	V1.3	June 4th, 1997	[ECO 2494, 2502, 2516]
Issue D	V1.3	March 3rd, 1998	[ECO 2679]
Issue E	V1.3	September 25th, 2006	Revised format and content.
Issue F	V1.3	December 21st, 2007	Revised format and content.
Issue G	V1.3	August 20th, 2009	Revised format.

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Introduction

The AIM104-MULTI-I/O is an 8-bit PC/104 module providing eight opto-isolated digital inputs, 2 analogue outputs (voltage or current loop), and sixteen single ended or eight differential analogue inputs. It provides up to 1000V electrical isolation between your PC/104 based control system and the electrical system under control. Isolation between adjacent channels is limited by the wiring and connectors to 30V.

The board includes jumper options to select all analogue inputs as sixteen single-ended or eight differential. All digital inputs include a fixed 10ms debounce filter.

Variants

There are three variants of this board:

- AIM104-MULTI-I/O : module fitted with digital inputs, analogue outputs, and analogue inputs.
- AIM104-ADC16/IN8 : module fitted with digital inputs and analogue inputs only.
- AIM104-DAC2/IN8 : module fitted with digital inputs and analogue outputs only.

Features of the eight channels of isolated digital input

- Digital input switching voltage range: 10V to 30V.
- Maximum digital input frequency: 50Hz.
- Debounce filter time constant: 10ms.
- All digital inputs include reverse input protection diodes.
- Link selectable base address.
- Board status register.
- Module access LED (on all decoded addresses).
- 8-bit PC/104 (IEEE996) bus interface.
- EMC guard plane.
- Operating temperature range: -20°C to +70°C.
- Power consumption from the PC/104 host:
  - AIM104-MULTI-I/O: max 480mA at +5v.
  - AIM104-ADC16/IN8: max 410mA at +5v.
  - AIM104-DAC2/IN8: max 380mA at +5v.
- MTBF (using generic figures from MIL-HDBK-217F at ground benign):
  - AIM104-MULTI-I/O: 267,320 hours.
  - AIM104-ADC16/IN8: 303,060 hours.
  - AM104-DAC2/IN8: 331,190 hours.

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Features of the AIM104-ADC16/IN8

- Bipolar analogue input range: -5v to +5v.
- 12-bit analogue inputs configured as sixteen channel single ended or eight channel differential.
- Channel input impedance: 10MΩ//10pF typ.
- Conversion time: 500µsec/channel.
- Calibration accuracy at 25°C: adjustable.
- Relative accuracy at 25°C: ±2LSB (-5V to +5V).
- Linearity: differential non-linearity = ±1LSB (no missing codes).
- Gain error (cal at 25°) 0.5% (-20°C to +70°C typ/0°C to 70°C max).

Features of the AIM104-DAC2/IN8

- Two 12-bit analogue outputs: Current sink: 0-25mA and Bipolar voltage: -5v to +5v.
- Channel output impedance: Vout = <10Ω
- Voltage overhead at Iout pin 7.5V (min)
  .
- Channel update time: 320µsec/channel.
- Calibration accuracy at 25°C: ±2 LSB (max) (REF=5.0V).
- Linearity: Differential Non-linearity = ±0.5LSB (max).
  Integral Non-linearity = ±3.5LSB (max).
- Offset error ±4mV (-20°C to +70°C typ/0°C to 70°C max).
- Gain error (cal at 25°) 0.35% (-20°C to +70°C typ/0°C to 70°C max).

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Handling your board safely

Anti-static handling

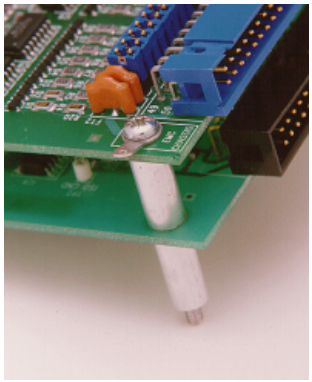
This board contains CMOS devices. These could be damaged in the event of static electricity being discharged through them. Observe anti-static precautions at all times when handling circuit boards. This includes storing boards in appropriate anti-static packaging and wearing a wrist strap when handling them.

Electromagnetic compatibility (EMC)

The AIM104-MULTI-I/O is classified as a 'component' with regard to the European Community EMC regulations and it is the user's responsibility to ensure that systems using the board are compliant with the appropriate EMC standards.

The opto-isolation provides a good barrier for noise emissions generated by the high frequency host PC/104 system. The AIM104-MULTI-I/O includes additional filter components on-board to minimise the emissions of high frequency noise. Because of this, the earth tab supplied with the module must be connected to the chassis of the system by a good earth wire.

If the electronic system requires input protection against high voltage transients (to meet CE requirements), it is recommended that an external interface board is located at the point where the external wiring enters the electronic system enclosure:



Packaging

Should a board need to be returned to Eurotech, please ensure that it is adequately packed, preferably in the original packing material.

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About this manual

This manual describes the operation and use of the AIM104-MULTI-I/O PC/104 module. It is both a reference and user manual and includes information about all aspects of the module.

Conventions

Symbols

The following symbols are used in this guide:

Symbol	Explanation
	Note - information that requires your attention.
	Tip - a handy hint that may provide a useful alternative or save time.
	Caution – proceeding with a course of action may damage your equipment or result in loss of data.

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Getting started

What items are provided?

The AIM104-MULTI-I/O is supplied with the following items:

- The AIM104-MULTI-I/O board.
- Mounting kit.

Unpacking and connecting up

To begin using the AIM104-MULTI-I/O board, follow these steps:

1. Power down your computer.
2. Install the board in a spare PCI slot.
3. Power up your computer and install the appropriate driver available from our website: www.eurotech.com.

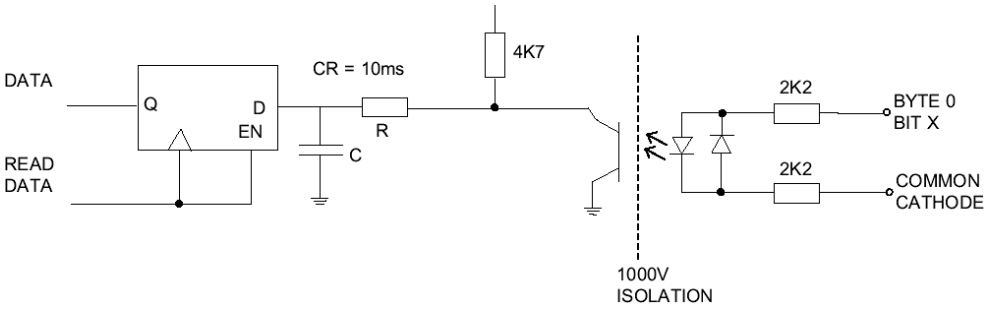
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Operation

This section describes the operation of the digital inputs, the DAC and the ADC.

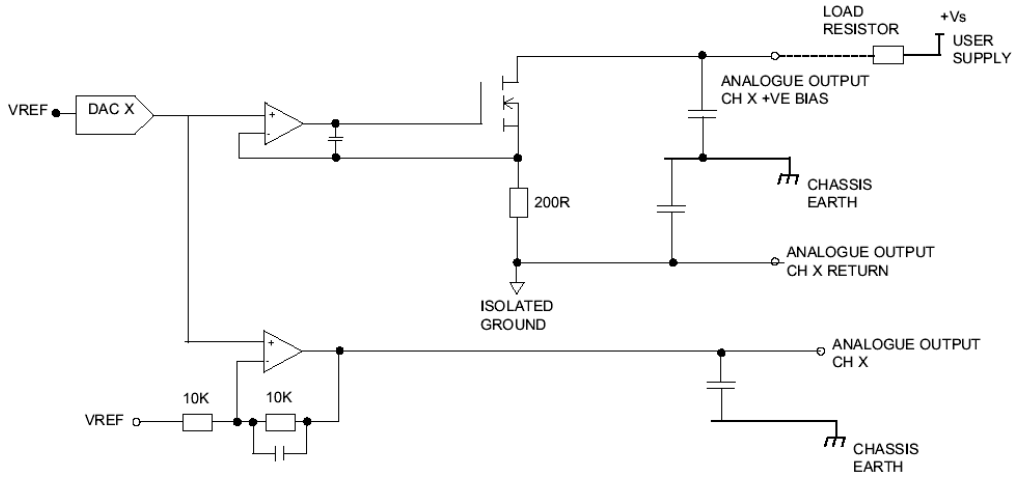
Digital input operation

The status of each digital input is read from the base address, where the bit number corresponds to the channel number. When an input is switched ON, the value read by the host is 0. Each input is configured as follows:



DAC operation

DAC data is written to DAC L-byte and DAC H-byte registers in accordance with the I/O map. Bits 4-7 of the H-byte designate the DAC channel number. A value of 0 in this position writes the data to DAC channel 0, and a value of F writes the data to DAC channel 1. This is shown below:



The ‘BUSY status’ register must be checked and the ‘BUSY’ flag bit clear before a new value is written.

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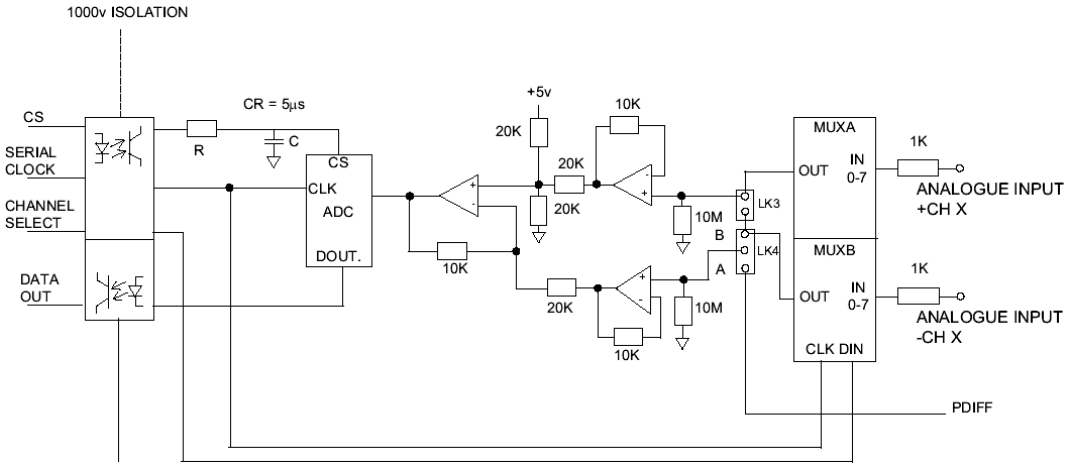
ADC operation

ADC conversion is initiated when multiplexer channel data is written to the 'ADC channel and start conversion' register. You can read conversion data from the ADC L-byte and ADC H-byte registers when the status bit in the 'BUSY status' register indicates that a conversion is complete.



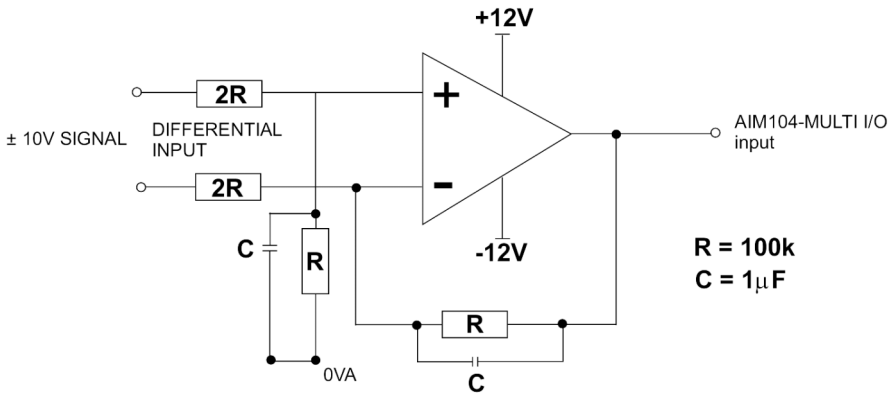
While the board is in the 'BUSY' state, you should only access the 'BUSY status' register and the 'opto inputs' register. Accessing other registers before the status bit is cleared for both ADC and DAC cycles may result in data corruption.

The following diagram illustrates ADC operation:



ADC input range

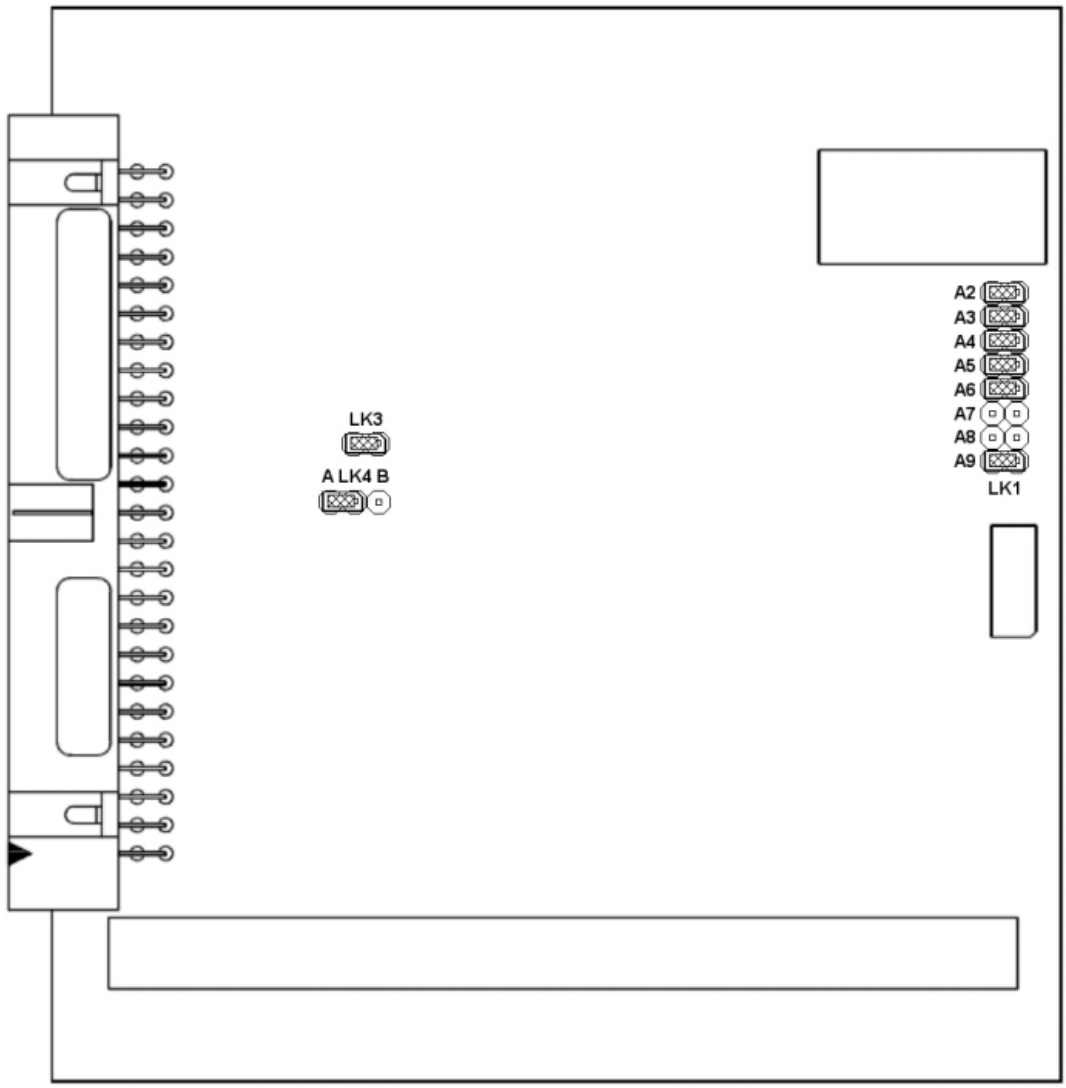
The standard analogue input range for the AIM104-MULTI-I/O and AIM104-ADC16/IN8 is ±5V. Signals with a greater span than this, such as ±10V, can be buffered with a simple amplifier circuit. The diagram below shows suggested values, which can be varied to suit the application:



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Links

Use LK1 to set the base address of the module. Inserting a jumper selects a 0 for the address line value. The following diagram illustrate the link positions:



Use links LK3 and LK4 to select the analogue input channel configurations. For 16 channel single ended operation, insert LK3 and insert LK4 in position A. In this configuration, PDIFF should be used as the ground reference. For 8 channel differential operation, remove LK3 and insert LK4 in position B.

This following table summarises the link positions required for the two modes:

Mode	LK3	LK4
16 CH SE	IN	A
8 CH DIFF	OUT	B

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The board 'access' LED gives a momentary flash when the board is accessed successfully. Access the module registers at the following locations:

Address	Read/write	Register name	Register function
Base	Read	Opto inputs	Bit 0 –7 0 = Input ON 1 = Input OFF
Base +1	Write	ADC channel select and start conversion	Bit 0 -3 (Mux A) Bit 4 - 7 (Mux B)
Base +1	Read	BUSY status	Bit 0 (0 = BUSY, 1 = CLEAR)
Base +2	Read	ADC L-byte	Bit 0 - 7 (D0 .. D7)
Base +3	Read	ADC H-byte	Bit 0 - 3 (D8 .. D11)
Base +2	Write	DAC L-byte	Bit 0 - 7 (D0 .. D7)
Base +3	Write	DAC H-byte and transfer channel	Bit 0 - 3 (D8 .. D11) Bit 4 - 7 (0 = CH0 F = CH1)

ADC channel select byte (Base +1)

The following diagram illustrates the ADC channel select byte (Base +1) for eight channel differential operation:

Differential channel:	0	1	2	3	4	5	6	7
Select byte:	88	99	AA	BB	CC	DD	EE	FF

The following diagram illustrates the ADC channel select byte (Base +1) for sixteen channel single ended operation:

Single ended channel:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Select byte:	08	80	09	90	0A	A0	0B	B0	0C	C0	0D	D0	0E	E0	0F	F0

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Connector (PL2) pin assignments

Pin no.	Function	Pin no.	Function
1	Common cathode input	2	Byte 0 – bit 0 anode
3	Byte 0 – bit 1 anode	4	Byte 0 – bit 2 anode
5	Byte 0 – bit 3 anode	6	Byte 0 – bit 4 anode
7	Byte 0 – bit 5 anode	8	Byte 0 – bit 6 anode
9	Byte 0 – bit 7 anode	10	Common cathode input
11	0VA	12	Analogue input + Ch 0 (Ch 0)
13	Analogue input - Ch 0 (Ch 1)	14	Analogue input + Ch 1 (Ch 2)
15	Analogue input - Ch 1 (Ch 3)	16	Analogue input + Ch 2 (Ch 4)
17	Analogue input - Ch 2 (Ch 5)	18	Analogue input + Ch 3 (Ch 6)
19	Analogue input - Ch 3 (Ch 7)	20	PDIFF
21	0VA	22	Analogue input + Ch 4 (Ch 8)
23	Analogue input - Ch 4 (Ch 9)	24	Analogue input + Ch 5 (Ch 10)
25	Analogue input - Ch 5 (Ch 11)	26	Analogue input + Ch 6 (Ch 12)
27	Analogue input - Ch 6 (Ch 13)	28	Analogue input + Ch 7 (Ch 14)
29	Analogue input - Ch 7 (Ch 15)	30	PDIFF
31	0VA	32	n/c
33	n/c	34	Analogue Ch 0 Current Loop
35	0VA	36	Analogue Ch 0 Return
37	n/c	38	Analogue Ch 1 Current Loop
39	0VA	40	Analogue Ch 1 Return
41	n/c	42	n/c
43	Analogue Ch 0 Vout	44	Analogue Ch 1 Vout
45	n/c	46	n/c
47	n/c	48	n/c
49	n/c	50	n/c



Single ended channels are shown in brackets.

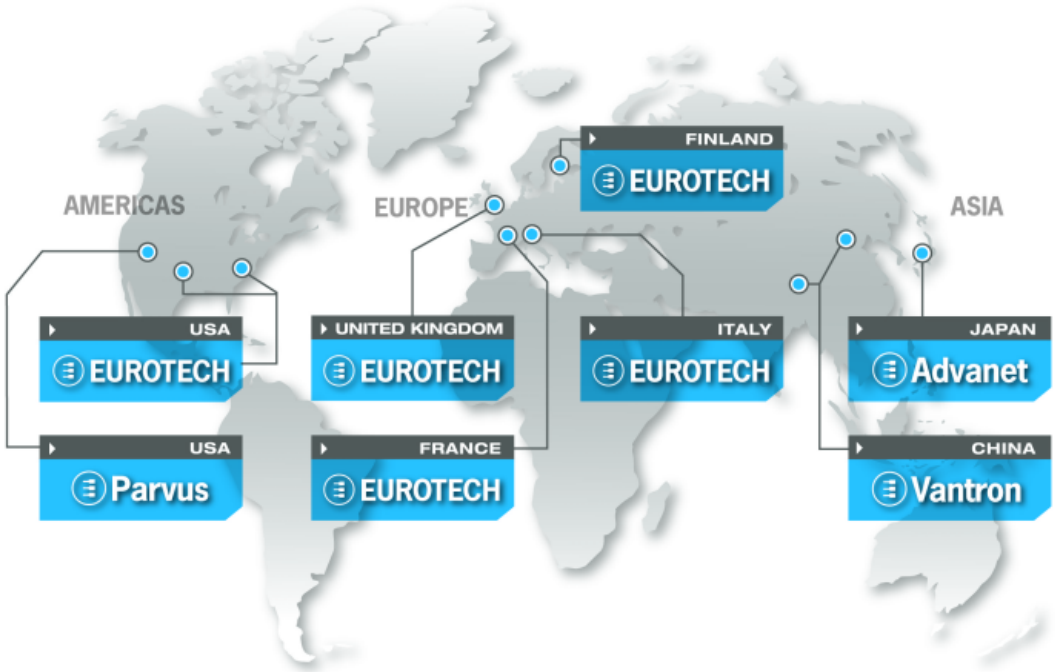
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Calibration

You should not need to calibrate the AIM104-MULTI-I/O before operation, as it is pre-calibrated. Periodically, you may like to check the calibration and, if required, adjust the on-board reference. Adjust the multi-turn trimmer VR1 while monitoring TP10. The voltage at TP10 should be 5.0v. You should use software to achieve further calibration

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