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PPIO-AI08

User's Manual



Revision 4
December, 2000

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MEGA-FIFO, the CIO prefix to data acquisition board model numbers, the PCM prefix to data acquisition board model numbers, PCM-DAS08, PCM-D24C3, PCM-DAC02, PCM-COM422, PCM-COM485, PCM-DMM, PCM-DAS16D/12, PCM-DAS16S/12, PCM-DAS16D/16, PCM-DAS16S/16, PCI-DAS6402/16, Universal Library, *Insta*Cal, *Harsh Environment Warranty* and Measurement Computing Corporation are registered trademarks of Measurement Computing Corporation.

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1 INTRODUCTION

The PPIO-AI08 is an eight-channel, 12-Bit A/D accessory for use with a parallel port. The analog input channels are single-ended and can be in one of three ranges: ±10Vbipolar, ±5Vbipolar or 0 to 10V unipolar. The board also supports three digital inputs and four digital outputs. All digital I/O are TTL.

See the product specifications in Section 6 for more details.

2 SOFTWARE INSTALLATION

The board has a bank of switches for setting the gain. If you intend to use the default range (±5V) then no configuration is necessary. If you intend to use one of the other ranges, you should configure the board before connecting it to your PC. The simplest way to configure your board is to use the *Insta*Cal™ program provided on the CD (or floppy disk)**.**

*Insta*Cal will show you all available options, how to configure the various switches and jumpers (as applicable) to match your application requirements. It will create a configuration file that your application software (and the Universal Library) will refer to so the software you use will automatically have access to the exact configuration of the board.

Please refer to the *Extended Software Installation Manual* regarding the installation and operation of *Insta*Cal. The following hard copy information is provided as a matter of completeness, and will allow you to set the hardware configuration of the board if you do not have immediate access to *Insta*Cal and/or your computer.

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3 HARDWARE INSTALLATION

The PPIO-AI08 has one bank of switches which controls the analog input voltage range of the board. The switches are accessible by removing the cover of the PPIO-AI08. The switch settings and ranges are printed on the board. The PPIO-AI08 is shipped in the ±5V range. The other ranges are ±10V and 0 to 10V.

3.1 RANGE /GAIN SWITCH SETTING

The PPIO-AI08 is factory set to ± 5V. If you want to change to ± 10V or 0 to 10V, then:

1. Remove the cover of your PPIO-AI08 by removing the four corner screws. Be careful not to loose the rubber spacers.

   The bank of dip switches on the PPIO-AI08 control the UNIPOLAR/BIPOLAR setting and the Input Range. There are four dip switches which must be set to select a specific input range for the analog inputs.

2. Use the table below to determine the correct positions of switches S1 through S4 for the range or gain you require.

   These switches set the analog input range of all eight channels simultaneously.

S1	S2	S3	S4	GAIN	RANGE	RESOLUTION
D	U	D	U	1	±5V	2.44mV / BIT
U	D	D	U	0.5	±10	4.88mV / BIT
D	U	U	D	1	0 to 10V	2.44mV / BIT

D = Down, U = Up. Positions other than those shown are not valid.

3.2 CONNECTING THE PPIO-AI08 TO A DESKTOP COMPUTER

1. Turn the power off.

2. Remove the cover of your computer. Please be careful not to dislodge any of the cables installed on the boards in your computer as you slide the cover off.

3. Run the PPIO power cable into the computer through one of the COM accessory panel holes in the back of the PC.

4. Connect the PPIO power cable to one of the spare accessory power connectors in the PC. These are the white plastic power connectors that are used to power disk drives. There should be a few spare in your computer.

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CAUTION:

DO NOT close the case on the power cable. This could short circuit your computer power supply.

5. Connect the PPIO-AI08 parallel printer interface cable to an available parallel printer interface connector.

6. After the power is connected and the computer is closed up, turn the power back on.

3.3 CONNECTING THE PPIO-AI08 TO A LAPTOP

Connect the CIO-PPIO-AI08 parallel printer interface cable (25-pin) to the parallel printer interface of your laptop.

POWER FROM THE LAPTOP

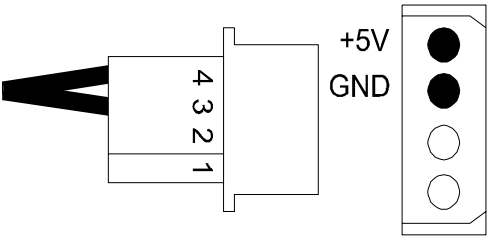
The PPIO-AI08 draws 180 mA @ 5V (typical) and can be powered from the Laptop by drawing power through the mouse port

It is not possible to power a PPIO from the parallel port because there is no access to any power via the parallel port interface

The PPIO is equipped with a power cable. In addition, you will need a C-PCPOWER-2M. This is an adapter cable that connects the mouse port of your PC to the PPIO power cable.

POWERED EXTERNALLY

The PPIO can be powered from any 5V power supply. Simply connect Ground and +5Volt power according to the diagram shown here.



Please use a high quality power supply. Use of a noisy or non-compliant power supply will degrade the performance of your PPIO-AI08.

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4.1 I/O CONNECTOR DIAGRAM

The analog connector is a 37-pin, D-type connector accessible through the top cover of the PPIO-AI08 (Figure 4-1). The signals available are identical to the DAS-08.

The connector accepts female 37-pin D-type connectors, such as those on the C73FF-2, a 2-foot cable with connectors.

If frequent changes to signal connections or signal conditioning is required, please refer to the information on the CIO-TERMINAL and CIO-MINI50 screw terminal boards.

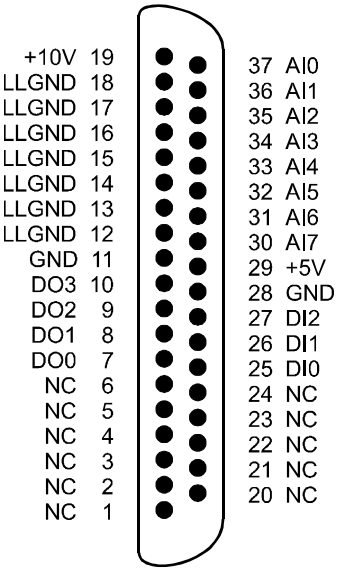


Figure 4-1 I/O Connector

4.2 I/O SIGNALS

The PPIO-AI08 analog inputs are single-ended. Single-ended inputs require two connections be made from the signal source to the PPIO-AI08. These are a high input signals (AI0 to AI7) and low level ground (LLGND).

There are three digital inputs, DI0 to DI2. They accept TTL-level signals only (see specifications). Use the GND terminal with the digital inputs.

There are four digital outputs, DO0 to DO3. They produce TTL-level signals (see specifications). Use the GND terminal with the digital outputs

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4.2.1 Analog Inputs

Analog inputs are Single Ended.

CAUTION

Measure the voltage between the ground signal at the signal source and the PC. Use a voltmeter and place the red probe on the PC ground and the black probe on the signal ground. If there is more than 500 millivolts, do not connect the PPIO-AI08 to this signal source because you will not be able to make an accurate reading.

Any voltage between the two grounds means that you will create a ground loop if you connect the signal ground to the CIO-AD board ground. Current flowing in a ground loop can damage the board and possibly the computer.

4.2.2 Single-Ended Inputs

A single-ended input is two wires connected to the PPIO-AI08; a channel high (AI#) and a Low Level Ground (LLGND). The LLGND signal must be the same ground the PC is on. The AI# is the voltage signal source.

There is no common-mode rejection on a single-ended input so grounding becomes important for both voltage differentials and noise immunity. If greater amplification or differential inputs are required, we suggest procuring a CIO-EXP32, for 32 channels or a CIO-EXP16, a 16-channel analog input multiplexer board.

4.2.3 Digital Inputs & Outputs

All the digital inputs and outputs are TTL level. TTL is an electronics industry term, short for Transistor Transistor Logic, with describes a standard for digital signals which are either near 0V or near 5V.

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5 REGISTER ARCHITECTURE

5.1 INTRODUCTION

The PPIO-AI08 is controlled and monitored by writing and reading from three consecutive 8-bit I/O registers.

The process of accessing the registers on the board is complicated by the fact that the board registers are accessed through the parallel port registers. The PPIO-AI08 is supported by the Universal Library. We recommend that you use this library rather than attempt register level programming. If you have determined that it is necessary, the information for low level programming follows:

5.2 PARALLEL PORT REGISTERS

As stated previously, access to the PPIO-AI08 registers is done through the PCs parallel port. The parallel port has 8-bits of latched data, 4-bits of control outputs, and 5-bits of status inputs. The 8-bit data port will be used for address or data to the ppio. The control outputs will be used to command address latch, write data, read data or initialize. 4 of the status inputs will be used as data input in 4-bit nibbles, plus an interrupt signal.

Parallel port address usage:

BASE + 0: DATA TO PPIO (8-BIT)
BASE + 1: DATA FROM PPIO (4-BIT)
BASE + 2: CONTROL SIGNALS TO PPIO (RD, WR, ADDR, INIT)

5.2.1 Control Signals: (BASE + 2):

PIN	BIT	SIGNAL DESCRIPTION	COMMON NAME
1	0	WRITE STROBE	-STROBE
14	1	READ STROBE	-AUTO LF
16	2	-INIT/ENABLE	-INIT
17	3	ADDRESS STROBE	-SLCT IN
	4	IRQ EN (SW ONLY; ENABLES ACK TO IRQ7)	
	5	NA	
	6	NA	
	7	NA	

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5.2.2 Read Data Signals: (BASE + 1):

PIN	BIT	SIGNAL DESCRIPTION	COMMON NAME
	0	NA	
	1	NA	
	2	NA	
15	3	READ DATA 0 OR 4	ERROR
13	4	READ DATA 1 OR 5	SLCT OUT
12	5	READ DATA 2 OR 6	PAPER OUT
10	6	PATH FOR INTERRUPT, IF USED	ACK
11	7	READ DATA 3 OR 7	-BUSY

5.2.3 Write Data Signals: (BASE + 0):

PIN	BIT	SIGNAL DESCRIPTION	COMMON NAME
2	0	WRITE DATA OR ADDRESS	D0
3	1	WRITE DATA OR ADDRESS	D1
4	2	WRITE DATA OR ADDRESS	D2
5	3	WRITE DATA OR ADDRESS	D3
6	4	WRITE DATA OR ADDRESS	D4
7	5	WRITE DATA OR ADDRESS	D5
8	6	WRITE DATA OR ADDRESS	D6
9	7	WRITE DATA OR ADDRESS	D7

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5.3 PPIO-AI08 REGISTERS

The PPIO-AI08 register descriptions follow the format:

7	6	5	4	3	2	1	0
A/D9	A/D10	A/D11	A/D12 LSB	CH8	CH4	CH2	CH1

Where the numbers along the top row are the bit positions within the 8-bit byte and the numbers and symbols in the bottom row are the functions associated with that bit.

To write to or read from a register in decimal or HEX, the following weights apply:

BIT POSITION	DECIMAL VALUE	HEX VALUE
0	1	1
1	2	2
2	4	4
3	8	8
4	16	10
5	32	20
6	64	40
7	128	80

To write control or data to a register, the individual bits must be set to “0” or “1”, then combined to form a byte.

The registers and their function are listed on the following table. Each register has eight bits which can constitute a byte of data or eight individual set/read functions.

ADDRESS	READ FUNCTION	WRITE FUNCTION
BASE + 0	A/D Bits 1(MSB) –8	Start 12 bit A/D conversion
BASE + 1	A/D Bits 9-12(LSB)	Start 8 bit A/D conversion
BASE + 2	EOC, IP1-IP3, IRQ, MUX Address	OP1 - OP4, INTE & MUX Address

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5.3.1 A/D Data Registers

BASE + 0

7	6	5	4	3	2	1	0
A/D1 MSB	A/D2	A/D3	A/D4	A/D5	A/D6	A/D7	A/D8

READ
On read, the most significant A/D byte is read. Note that since data is read through the parallel port four bits at a time, two reads are required to obtain the entire byte from this register.

The table below has coding for input voltages.

DECIMAL	HEX	BIPOLAR	UNIPOLAR
4095	FFF	• Full Scale	• Full Scale
2048	800	0 Volts	½ Full Scale
0	0	–Full Scale	0 volts

WRITE
Writing to this register starts a 12-bit A/D conversion.

A note of caution:
Place a program loop of at least 25μs delay between consecutive 12 bit A/D conversions to avoid over-running the A/D converter.

BASE + 1

7	6	5	4	3	2	1	0
A/D9	A/D10	A/D11	A/D12 LSB	0	0	0	0

A read/write register.

READ
On read, it contains the least significant four digits of the Analog input data.

These four bits of analog input data must be combined with the eight bits of analog input data in BASE + 0, forming a complete 12 bit number. The data is in the formof 0 = minus full scale. 4095 = +FS.

WRITE
Writing any data to the register causes an immediate 8-bit A/D conversion.

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5.3.2 Status And Control Register

BASE + 2

This register address is two registers, one is read-active and one is write-active.

7	6	5	4	3	2	1	0
EOC	IP3	IP2	IP1	IRQ	MUX2	MUX1	MUX0

READ = STATUS

EOC = 1, the A/D is busy converting and data should not be read.

EOC = 0, the A/D is not busy and data can be read.

IP3 to IP1 are the digital input lines (DI#) on the 37-pin I/O connector.

IRQ is the status of an edge triggered latch connected to pin 24 of the analog connector. It is high (1) when a positive edge has been detected. It can be reset to 0 by writing to the INTE mask at BASE + 2 write.

MUX 2 to MUX 0 is the current multiplexer channel. The current channel is a binary-coded number between 0 and 7 .

WRITE = CONTROL

7	6	5	4	3	2	1	0
OP4	OP3	OP2	OP1	NA	MUX2	MUX1	MUX0

OP4 to OP1 are the digital output (DO#) lines on the 37-pin I/O connector.

NA = Not Applicable. On a CIO-DAS8, this bit controls the passing of interrupts into the PC bus. The PPIO does not reside on the bus and does not have access to interrupts.

MUX2 to MUX0. Set the current channel address by writing a binary coded number between 0 and 7 to these three bits.

NOTE

Every write to this register sets the current A/D channel MUX setting to the number in bits 2-0.

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6 SPECIFICATIONS

POWER CONSUMPTION

+5V Supply	180 mA typical / 300 mA max.

ANALOG INPUTS

Number of Channels	8, Single-ended
Resolution	12 bits, 4096 divisions of full scale.
Accuracy	0.01% of reading ± 1 bit.
Type	Successive-approximation
Speed	25 µs - AD574
Throughput via LPT	1kHz typical, 3 kHz maximum
Monotonicity	Guaranteed over operating temperature
Linearity	± 1 bit
Ranges	± 5 Volts
	± 10 Volts
	0 to 10 Volts
Overvoltage	± 30 Volts Continuous
Input Current	100 nA max @ 25 deg. C.
Input Impedance	10 MegOhms
Gain Temp. Coef. +FS	± 25 ppm/deg C
	–FS ± 10 µV/deg C
Zero Drift	10 ppm/deg C max.
Gain Drift	50 ppm/deg C max.

SAMPLE & HOLD AMP.

Acquisition Time	15 µs to 0.01%
Dynamic error	1 bit @ 2000 V/Sec

REFERENCE VOLTAGE OUTPUT

Reference	+10 Volts ± 0.1 V
Temp. Coef.	50 ppm/deg C max
Load Current	2 mA max.

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DIGITAL I/O

OP1 - OP4 low (outputs)	0.5V max @ 8 mA current sink
OP1 - OP4 high	2.7V Min @ −0.4 mA current source
IP1 - IP3 low (inputs)	0.8V Max
IP1 - IP3 high	2V max @ 20 µA

ENVIRONMENTAL

Operating Temperature	0 to 50 deg C
Storage Temperature	−20 to 70 deg C
Humidity	0 to 90% non-condensing
Weight	5 oz

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EC Declaration of Conformity

We, Measurement Computing Corporation, declare under sole responsibility, that the product:

PPIO-AI08	Parallel Port I/O Card
Part Number	Description

to which this declaration relates, meets the essential requirements, is in conformity with, and CE marking has been applied according to the relevant EC Directives listed below using the relevant section of the following EC standards and other normative documents:

EU EMC Directive 89/336/EEC: Essential requirements relating to electromagnetic compatibility.

EU 55022 Class B: Limits and methods of measurements of radio interference characteristics of information technology equipment.

EN 50082-1: EC generic immunity requirements.

IEC 801-2: Electrostatic discharge requirements for industrial process measurement and control equipment.

IEC 801-3: Radiated electromagnetic field requirements for industrial process measurements and control equipment.

IEC 801-4: Electrically fast transients for industrial process measurement and control equipment.

Carl Haapaoja, Director of Quality Assurance

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