PCM-DAS08

Analog/Digital Inputs

USER'S MANUAL

Revision 4

October, 2000

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1 INTRODUCTION

The PCM-DAS08 is a data acquisition and control board for IBM PC compatible computers with PCMCIA-type slots. The heart of the board is an analog to digital converter. Analog signals are routed to the A/D converter via an 8:1 multiplexer controlled by a register. The analog input range is fixed at +/-5V but the board can be ordered in custom ranges.

A/D conversions can be triggered by an on-board pacer clock, an external pacer input, or software polling.

Digital I/O lines (three in and three out) provide a means of sensing and controlling discrete events.

2 INSTALLATION

2.1 SOFTWARE INSTALLATION

Before you open your computer and install the board, install and run *Insta*Cal™, the installation, calibration and test utility included with your board. Refer to the *Extended Software Installation* manual for *Insta*Cal™ installation instructions.

2.2 HARDWARE INSTALLATION

Your PCM card is completely plug and play. There are no switches or jumpers to set prior to installation in your computer. Configuration is controlled by your systems' PCMCIA Card and Socket Services. Simply insert the PCM-DAS08 into any available PCM slot. Refer to the orientation guide below for proper orientation of the card (the typical system orients the card with the label up).

> Shown here is a PCM card case looking into the connector which is inserted into the PCMCIA slot of your computer. The KEY helps to insure that the PCM board is inserted in the correct orientation.

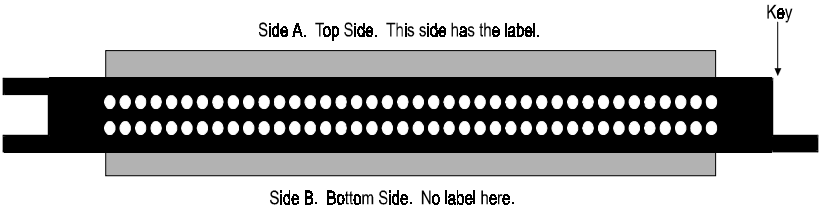

Figure 2-1. PCMCIA Connector

If you are using an operating system with support for Plug and Play (such as Windows 95 or 98), a dialog box will pop up upon insertion of the card indicating that new hardware has been detected. If the information file for this board is not already loaded onto your PC, you will be prompted for a disk containing it. The *Insta*Cal software that was supplied with your board contains this file. Just insert the disk or CD and click OK.

In order to easily test your installation, it is recommended that you install *Insta*Cal, the installation, calibration and test utility that was supplied with your board. Refer to the *Extended Software Installation Manual* for information on the initial setup, loading, and installation of *Insta*Cal and optional Universal Library software.

3 INTERFACING

The PCM-DAS08 has eight single-ended analog inputs with an analog ground, one digital input with shared function as A/D trigger input, two digital inputs, and three digital outputs. A digital ground is in the cable shield clips to either side of the 15 pins of the connector.

3.1 CONNECTOR

Figure 3-1 shows a PCM-DAS08 card looking into the connector. The KEY insures that the cable is inserted correctly.

Analog signals should be connected with the high side to the numbered analog input and the low side to the analog low level ground.

Do not connect digital signal grounds to the analog ground. Use the cable shield.

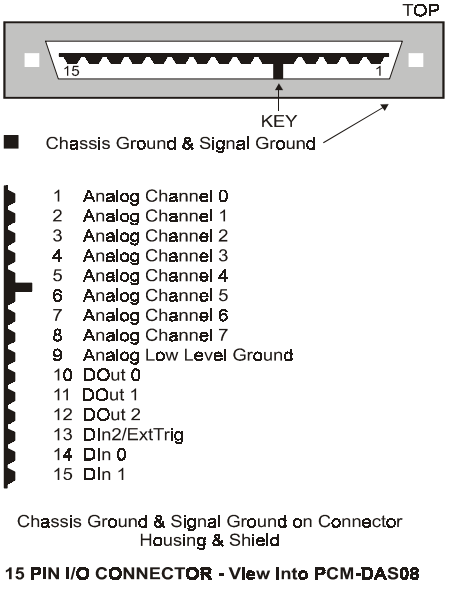

Figure 3-1. Interface Connector

WARNING!

Do not exceed the input specifications. There are no socketed or user serviceable parts in a PCM board.

ANALOG INPUTS are limited to +/-15V, (unlike the higher ratings of ISA boards).

Applying a voltage below –0.5V or greater than +5V to a DIGITAL INPUT will burn out a transistor.

Please refer to specifications before connecting any signals.

3.2 CONNECTING SIGNALS TO THE ANALOG INPUTS

Analog inputs are single-ended. There is a single analog ground, pin 9. When connecting multiple channels, verify that all signal grounds are at the same potential. Connect a DVM between any two signal grounds; the reading should be 0V.

In addition to avoiding potentials between signal grounds, also avoid potentials between signal ground and chassis ground on your computer. If you are using a laptop and are on battery power, the computer is floating with respect to earth ground, but if the laptop is on the charger unit or on wall power, the laptop may be grounded.

Whenever the computer is grounded, you must connect signals so there is no potential between PC ground and signal ground. If there is a potential, it will be added to the signal. For example, if your sensor is supplying 3.5 volts but there is a potential of −1.5V between the PC and the sensor ground, your A/D reading will be 2.0V instead of 3.5V.

Figure 3-2 shows a single-ended analog input connected correctly, to avoid a ground loop and supply a clean signal to the PCM-DAS08.

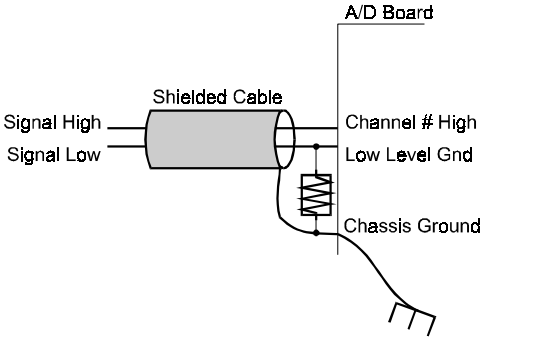

Figure 3-2. Analog Input Connection

3.3 GROUND LOOP EXAMPLE

Figure 3-3 shows a single-ended analog input connected incorrectly. The resulting ground loop may introduce an error to the input signal.

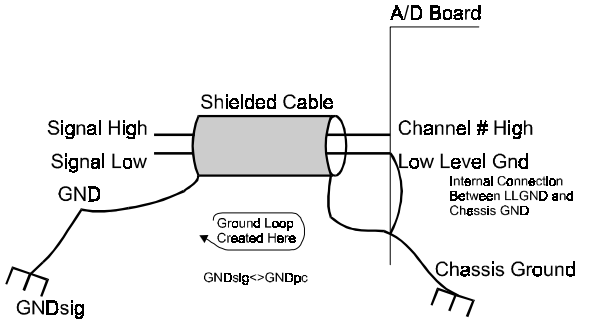

Figure 3-3. Incorrect Connections Causing a Ground Loop

3.4 BEWARE OF VOLTAGE SPIKES

Although your Laptop may not be grounded, that does not mean that you can connect the PCM-DAS08 to a signal that is subject to voltage spikes. Even though the Laptop has no reference to ground, it has more capacitive mass than the PCM-DAS08 inputs can bear. If the signal you are measuring suddenly swings greater than +/-15V, the weak link in the circuit will fail. That weak link is your PCM-DAS08 analog input circuit.

This is true of any A/D board not protected by isolation amplifiers

4 PROGRAMMING & APPLICATIONS

Your PCM-DAS08 is now installed and ready for use. Because of the close conformance to CIO-DAS08 register functions, many programs which work with the CIO-DAS08 type boards will run, without modification, with the PCM-DAS08.

4.1 PROGRAMMING LANGUAGES

Universal Library provides complete access to the PCM-DAS08 functions from a range of programming languages; both DOS and Windows. If you are planning to write programs, or would like to run the example programs for Visual Basic or any other language, please refer to the Universal Library manual.

4.2 PACKAGED APPLICATIONS PROGRAMS

Many packaged application programs, such as Labtech Notebook have drivers for the PCM-DAS08. If the package you own does not appear to have drivers for the PCM-DAS08 please fax the package name and the revision number from the install disks. We will research the package for you and advise you on how to obtain the correct drivers.

5 I/O ADDRESS MAP & REGISTER FUNCTIONS

A base address register controls the beginning, or 'Base Address' of the I/O addresses occupied by the control registers of the PCM-DAS08. In all, 16 addresses are occupied (although only four have functions associated with them). The base address assigned by CSS is stored in the CB.CBG file by *Insta*Cal and read by the Universal Library.

5.1 CONTROL REGISTERS

After CSS has been installed and a base address established, the PCM-DAS08 can be controlled by writing to and reading from the control registers. While it is possible to write your own control routines, routines have been written and are available in the Universal Library for DOS and Windows programming languages.

5.2 REGISTER PROGRAMMING SUPPORT

While the complete register map is explained here, only very limited support for assembly language or direct register programming is available. Register-level programming should only be attempted by experienced programmers. We support the use of the PCM-DAS08 through high level languages using Universal Library and the example programs provided.

5.3 CONTROL REGISTERS

BASE + 0 - A/D LSB Data Register

Any write to this register will trigger an A/D conversion. This is a good method of starting conversions from software or time of day clock control.

A/D Data can be read from this address and combined with data read from Base + 1 to form a 12 bit A/D data word.

7	6	5	4	3	2	1	0
A/D7	A/D6	A/D5	A/D4	A/D3	A/D2	A/D1	A/D0

BASE + 1 - A/D MSB (4 bits)

Read data

7	6	5	4	3	2	1	0
X	X	X	X	A/D11	A/D10	A/D9	A/D8

BASE + 2 - A/D Channel, Digital Out & Status

Write control

7	6	5	4	3	2	1	0
X	DOut2	DOut1	DOut0	X	MA2	MA1	MA0

Set the digital output bits as 0 for a TTL low and 1 for a TTL high. You must know the current value of the digital outputs (the last value written) if you want to change the A/D channel and maintain the digital output lines at their current status. There is no read back for the digital outputs.

Table 5-1. A/D Channel Address Codes

Set A/D channel address via	MA2	MA1	MA0
Channel 0	0	0	0
Channel 1	0	0	1
Channel 2	0	1	0
Channel 3	0	1	1
Channel 4	1	0	0
Channel 5	1	0	1
Channel 6	1	1	0
Channel 7	1	1	1

The digital outputs are latched, and will maintain the last value until overwritten or the computer or PCM-DAS08 is reinitialized.

Read Status

7	6	5	4	3	2	1	0
EOC	DIn 2 Ex Trig	DIn1	DIn0	X	MA2	MA1	MA0

EOC is the end of conversion flag from the A/D converter. A one means the A/D is busy with a conversion. A zero indicates that the conversion is complete and the data from the most recently triggered A/D conversion may be read from base + 0 and 1.

DIn 2 / Ex Trig is always one when an external trigger source has been selected via the TRG bits in Base + 3. Otherwise the status of the TTL input on pin 13 may be read from this bit. See Base + 3.

Digital Input 0 and 1 are the PCM-DAS08 15 pin connector digital inputs. The inputs are not latched. Each read gives the current status of the input lines. A zero equals TTL low and a one equals TTL high.

MA2 to MA0 are the current A/D channel addresses.

BASE + 3 - Trigger Source & Pacer Rate

Write control - No read back. No read function

7	6	5	4	3	2	1	0
X	X	X	X	INT ENA	TRG 2	TRG 1	TRG 0

INT ENA: Interrupt Enable. Interrupts are enabled when this bit is set to one and disabled when set to zero.

Table 5-1. Pacing Source and Rate Coding

TRG 2	TRG 1	TRG 0	A/D Trigger Source and Rate
0	X	0	Software trigger by writing to base address.
0	X	1	External falling-edge trigger on pin 13
1	0	0	Internally triggered and paced at 3.125 kHz
1	0	1	Internally triggered and paced at 6.25 kHz
1	1	0	Internally triggered and paced at 12.5 kHz
1	1	1	Internally triggered and paced at 25 kHz

5.4 A/D PACER RATE SELECTION

The A/D pacer rate is programmable as can be seen from the list of rates in Table 5-1 above. The per channel rate is a function of both the programmed pacer and the number of channels being sampled. Table 5-2 shows the effects of number of channels selected on the per-channel rate.

Table 5-2. Per-Channel Rate Vs Number of Channels

Number of Channels	25 kHz	12.5 kHz	6.25 kHz	3.12 kHz
1	25	12.5	6.25	3.13
2	12.5	6.25	3.13	1.56
3	8.33	4.17	2.08	1.04
4	6.25	3.13	1.56	0.78
5	5.00	2.50	1.25	0.63
6	4.17	2.08	1.04	0.52
7	3.57	1.79	0.89	0.45
8	3.13	1.56	0.78	0.39

6 SPECIFICATIONS

Typical for 25ºC unless otherwise specified.

POWER CONSUMPTION	
+5V (Normal operation):	30 mA typ, 69 mA max
+5V (During CIS read);	59 mA typ, 98 mA max
ANALOG INPUT SECTION	
A/D converter type:	ADS574
Resolution:	12 bits
Number of channels:	8, single-ended
Input Ranges:	±5V (Set at the factory. Other ranges by special order)
Polarity	Bipolar
A/D Pacing:	Programmable: internal 25 kHz divided by 1, 2, 3 or 4, external source (DIn 2 / Ext Trig, falling edge) or software polled
A/D Trigger sources:	External polled digital input trigger (DIn 2, active level determined by software)
A/D Triggering Modes:	
Digital:	Software-polled digital input (software enables acquisition when appropriate TTL level is detected).
Data Transfer:	Interrupt or software-polled
A/D conversion time	25 µs
Throughput	25 kHz, PC-dependent
Relative Accuracy (software calibrated):	±0.5 LSB
Differential Linearity error (A/D):	±1 LSB
Integral Linearity error (A/D):	±1 LSB
No missing codes guaranteed (A/D):	12 bits
Gain drift (A/D specs):	±45 ppm/°C
Zero drift (A/D specs):	±10 ppm/°C
Input leakage current:	±200 nA over temperature
Input impedance	10 MegOhms min
Absolute maximum input voltage:	±15V

DIGITAL INPUT/OUTPUT

Digital type	FPGA
Configuration	Two ports, three bits each. 3 inputs / 3 outputs
Input low voltage	0.8V max
Input high voltage	2.0V min
Output low voltage (OIL = 4 mA)	0.32V max
Output high voltage (IOH = –4 mA)	3.86V min
Absolute maximum input voltage	–0.5V , +5.5V
Interrupts	2 to 15
Interrupt enable	Programmable
Interrupt sources	External (Ext Int, falling edge triggered) or internal pacer

ENVIRONMENTAL

Operating temperature range	0 to 70°C
Storage temperature range	–40 to 100°C
Humidity	0 to 90% non-condensing

7 PCM-C15-10-INCH CABLE

The PCM-C15-10-INCH is a 10-inch, 15-pin cable assembly for use with 15-pin PCMCIA cards. It has a connector on one end and no terminations at the other end for customer field wiring. Table 7-1 contains color coding for the 15 pins.

Table 7-1. PCM-C15-10-INCH Color Coding

PIN	COLOR	PIN	COLOR
1	Black	9	Purple
2	White	10	Gray
3	Red	11	Lt. Brown
4	Green	12	Pink
5	Brown	13	White/Blue
6	Blue	14	Blue/White
7	Orange	15	Green/Yellow
8	Yellow	SHIELD	Bare

For your notes.

EC Declaration of Conformity

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

Part Number	Description
PCM-DAS08	Analog/Digital Input Board

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.

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