CHAPTER 1
INTRODUCTION

The PCI bus 12 bit data acquisition card is a 32 bits PCI bus adapter with Plug and Play (PnP) features, it is a programmable I/O interface for Pentium or compatible computers. The PnP features let hardware configuration for IRQ and I/O address is detected by BIOS automatically, you don't need set switch and jumper.

The PCI bus 12 bit data acquisition card is a high precision data conversion/acquisition system. It contains 16 analog to digital channels with unipolar or bipolar input, 2 digital to analog channels with unipolar or bipolar output and 1 digital I/O channel with 16 bit line. The on board 8254(71054) chip provides programmable interval timer/counter functions to trig A/D conversion. The PCI bus 12 bit data acquisition card also provides interrupt driven for convention A/D input.

The features of the PCI bus 12 bit data acquisition adapter are:

- 32 bits PCI bus with Plug and Play (PnP) features.
- Programmable I/O control functions.
- Provides 16 A/D channels and the resolution is 12 bits.
- Provides 2 D/A channels and the resolution is 12 bits.
- Unipolar or bipolar selectable.
- Input voltage range from 0 to 10V or 0 to 20V for unipolar, and from –5V to 5V or –10V to 10V for bipolar.
- Provides 1 digital input/digital output channels and the resolution is 16 bits.
- Provides three 16 bits counter to trig A/D conversion.

- Provides software, external hardware signal or internal counter to trig A/D conversion.
- By using sampling and hold to get A/D signals.
- Interrupt or polling driven selectable.
- Gain control factor selectable from 1 to 8.

CHAPTER 2

UNPACKING INFORMATION

Check that your PCI bus 12 bit data acquisition package includes the following items:

- PCI bus 12 bit data acquisition adapter.
- User manual.
- Software utilities.
- Warranty form.

CHAPTER 3

SYSTEM REQUIREMENTS

Before installing your PCI bus 12 bit data acquisition adapter, make sure that:

- The host computer is an Pentium compatibles.
- The seven jumpers' blocks are correctly configured to coincide with the operating system you are using.

CHAPTER 4

HARDWARE INSTALLATION

Your PCI bus 12 bit data acquisition adapter is designed to be inserted in any available slot in your Pentium or compatibles. In order to gain access to the expansion slots, follow the steps listed below:

1. Turn off all power to your computer and all peripheral devices before installing your 12 bit data acquisition adapter.
2. Remove the cover of the computer.
3. Insert the pre-configured 12 bit data acquisition adapter into any available slot. Make sure the adapter is firmly seated in the chosen slot.
4. Replace the cover of the computer.

Note:

1. You must adjust the A/D full scalar reference voltage by screwing the VR resistor. (see VR Full Scalar Adjustment).
2. You must setup everything including the connection of the signal input/output into the DB25 and J2 connectors before turning on the PC power, otherwise it may damage the card.

CHAPTER 5

HARDWARE CONFIGURATION

5.1 Introduction

The seven jumper blocks on the PCI bus 12 bit data acquisition adapter must be configured correctly in accordance with the operating system you are using.

JP1 (Jumper 1)
Determines AD526 (gain control factor) is used.

JP2 (Jumper 2)
Determines to adjust LF398 input voltage offset.

JP3 (Jumper 3)
Determines to adjust SPT574(ADS574JP)input voltage offset.

JP4 (Jumper 4)
Determines A/D and voltage range.

JP5 (Jumper 5)
Determines unipolar or bipolar for A/D channel.

JP6 (Jumper 6)
Determines unipolar or bipolar for D/A channel 1.

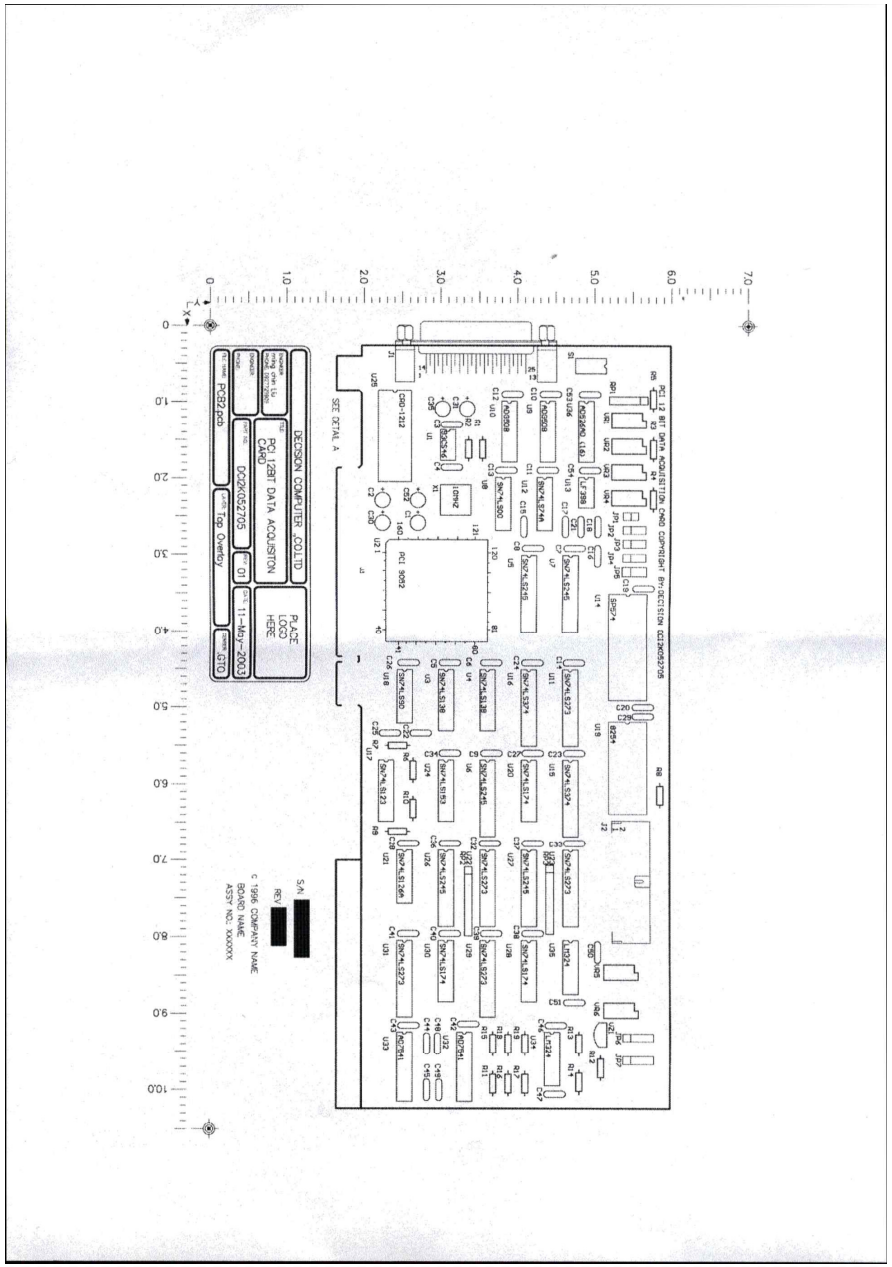
JP7 (Jumper 7)
Determines unipolar or bipolar for D/A channel 2.

SW1 (Switch 1)
Identifies card number.

5.2 Configuration for Jumper

It is important to refer to the user manual to determine the correct configuration. Please contact your supplier if you have any difficulties with configuration.

☞ Please refer to the following settings for each jumper block.



1. I/O Port Address

The plug and play features set I/O port address automatically, please refer the **device manager** of **control panel** to get base port address of this adapter.

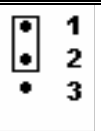
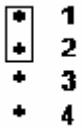
2. Voltage Range

JP4 is used to select a range of A/D voltage from 0 to 10 volts or to a maximum voltage of 20 volts. Shorting pin 1 and pin 2 will have a voltage range of 10 volts, while shorting pin 2 and pin 3 will have a voltage range of 20 volts.

JP4

Jumper	Voltage Range
short 1, 2	10 Volts
short 2, 3	20 Volts

3. Unipolar or bipolar

JP5	JP6, JP7
	

Selects unipolar/bipolar of A/D or D/A channels. JP5 is used to select unipolar or bipolar of A/D channel, JP6 is used to select

unipolar or bipolar of D/A channel 1, and JP7 is used to select unipolar of bipolar of D/A channel 2. For JP5, shorting pin 1 and pin 2 selects bipolar setting, while shorting pin 2 and pin 3 selects a unipolar setting. For JP6 and JP7, shorting pin 1 and pin 2 selects bipolar setting, while shorting pin 3 and pin 4 selects a unipolar setting.

Jumper		Polarity
JP5	JP6, JP7	
short 2, 3	short 3, 4	unipolar
short 1, 2	short 1, 2	bipolar

The combination of voltage range and polarity are shown in the following:

JP4	JP5	Voltage Range
Short 1,2	Short 1,2	-5V to 5V
Short 1,2	Short 2,3	0V to 10V
Short 2,3	Short 1,2	-10V to 10V
Short 2,3	Short 2,3	0V to 20V

JP6,7	Voltage Range
Short 3,4	0V to 10V
Short 1,2	-10V to 10V

4. Input Mode for LF398

JP2

The JP2 is used to adjust input offset of LF398. Setting the jumper to pin 2 and pin 3 will ground the input value (0V), so the data that will be converted should also be 0. This setting is used whenever we need to calibrate the VR1 variable resistors so that the minimum voltage will be attained.

Shorting jumper to pin 1 and pin 2 will make use of the channel inputs to be read and converted. It is the normal input mode.

Jumper	Input Mode
short 2, 3	Ground
short 1, 2	Normal Input

5. Input Mode for SPT574

JP3

The JP3 is used to adjust input offset of SPT574. Setting the jumper to pin 2 and pin 3 will ground the input value (0V), so the data that will be converted should also be 0. This setting is used whenever we need to calibrate the VR2 or VR4 variable resistors so that the minimum voltage will be attained.

Shorting jumper to pin 1 and pin 2 will make use of the channel

inputs to be read and converted. It is the normal input mode.

Jumper	Input Mode
short 2, 3	Ground
short 1, 2	Normal Input

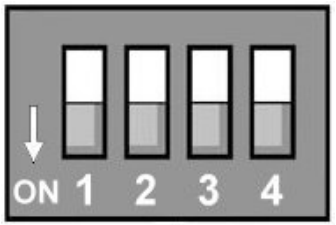
6. Programmable Gain Control Factor (AD526)

The JP1 is used to select programmable gain control factor, when not short the jumper, it enable AD526, otherwise short the pin means no AD526 work (can not control gain control factor).

JP1

Jumper	AD526
short	no AD526
open	AD526

7. Card Identifier



The switch is used to identify card number, default setting is card 15, and there are two methods to set the card number:

a. PnP mode

Just plug in PCI bus 12 bit data acquistion adapter into PCI slot, the PCI BIOS will allocate I/O address to each adapter automatically and assign card number start from 0 to each adapter. You may set any card number at PnP mode, and you need use software tools to distinguish port id. Almost all of the operating systems run at PnP mode..

b. manual mode

Set card number by card identifier switch, the PCI BIOS will assign pre-allocated I/O address to each adapter. Please set different card number to each adapter (do not duplicate card number setting).

1	2	3	4	Card Number
OFF	OFF	OFF	OFF	15
ON	OFF	OFF	OFF	14
OFF	ON	OFF	OFF	13
ON	ON	OFF	OFF	12
OFF	OFF	ON	OFF	11
ON	OFF	ON	OFF	10
OFF	ON	ON	OFF	9
ON	ON	ON	OFF	8
OFF	OFF	OFF	ON	7
ON	OFF	OFF	ON	6
OFF	ON	OFF	ON	5
ON	ON	OFF	ON	4
OFF	OFF	ON	ON	3
ON	OFF	ON	ON	2

OFF	ON	ON	ON	1
ON	ON	ON	ON	0

☞ The card number starts from 0 to 15.

5.3 I/O Address Specification

The I/O address specification are shown in the following:

For READ input

port + 0: input 12 bit A/D data.
port + 2: clear the interrupt signal that generated from the adapter.
port + 6: 16 bit digital signal input.
port + 8: counter 0 I/O buffer (8254 IC).
port + 9: counter 1 I/O buffer (8254 IC).
port + A: counter 2 I/O buffer (8254 IC).
port + B: counter control register (8254 IC).

For WRITE output

port + 0: select A/D channel number, enable/disable the selected channel, select IRQ and select control method.
port + 2: 12 bit D/A channel 1.
port + 4: 12 bit D/A channel 2.
port + 6: 16 bit digital output.
port + 8: counter 0 I/O buffer (8254 IC).
port + 9: counter 1 I/O buffer (8254 IC).
port + A: counter 2 I/O buffer (8254 IC).
port + B: counter control register (8254 IC).

5.4 VR Full Scalar Adjustment

VR Number	Function
VR1	Offset voltage of LF398
VR2	A/D bipolar offset voltage
VR3	SPT574 reference voltage
VR4	SPT574 reference voltage
VR5	D/A channel 1
VR6	D/A channel 2

Before adjust your AD/DA voltage offset, please run PCIADV03.EXE program under MS/DOS, then select calibration function as follows.

1. D/A Calibration

VR5 is used to adjust the D/A channel 1 offset voltage, and VR6 is used to adjust the D/A channel 2 offset voltage.
To adjust D/A channel 1 offset voltage, please follow the step shown in the below:

Step 1: short pin 1 and pin 2 of JP6, then adjust VR5 to let J1-15 output range from –10V to 10V.
Step 2: short pin 3 and pin 4 of JP6, then adjust VR5 to let J1-15 output range from 0V to 10V.

To adjust D/A channel 2 offset voltage, please follow the step shown in the below:

Step 1: short pin 1 and pin 2 of JP7, then adjust VR6 to let J1-03 output range from –10V to 10V.
Step 2: short pin 3 and pin 4 of JP7, then adjust VR6 to let J1-03 output range from 0V to 10V.

2. A/D Calibration

Step 1: short pin 2 and pin 3 of JP2, pin 2 and pin 3 of JP3, pin 1 and pin 2 of JP4, and pin 1 and pin 2 of JP5, then adjust VR3 to let the output value is 2047.
Step 2: short pin 2 and pin 3 of JP2, pin 2 and pin 3 of JP3, pin 1 and pin 2 of JP4, pin 2 and pin 3 of JP5, then adjust VR2 to let the output value is 0.
Step 3: short pin 2 and pin 3 of JP2, pin 1 and pin 2 of JP3, pin 1 and pin 2 of JP4, and pin 1 and pin 2 of JP5, then adjust VR1 to let the output value is 2047.
Step 4: short pin 1 and pin 2 of JP2, pin 1 and pin 2 of JP3, pin 1 and pin 2 of JP4, and pin 2 and pin 3 of JP5, then input voltage from each A/D channel to check whether input voltage is equal to output voltage. In this step, please adjust VR4. The A/D channel is defined from J1-4 to J1-11 and J1-16 to J1-23.

You may repeat Step 1 to Step 4 if necessary.

5.5 Diagnostic Test

The PCIADV03.EXE also provides some diagnostic test functions:

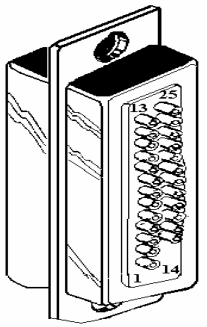
1. DIO loopback test
2. DIO output test
3. DIO input test
4. A/D and D/A loopback test
   Please short pint 1 and pin 2 of JP5, pin 2 and pin 3 of JP4, pin 1 and pin 2 of P3, pin 1 and pin 2 of JP2, and pin 1 and pin 2 of JP1, also short D/A channel (J1-15) to A/D input channel, then check whether the error value is less than 20.
5. D/A output test

6. A/D input test

5.6 Pin Assignments

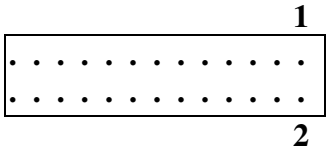
1. J1

Pin	Function	Pin	Function
1	+ 12 V	14	-12 V
2	/EXTRG	15	D/A channel 1
3	D/A channel 2	16	CH15
4	CH14	17	CH13
5	CH12	18	CH11
6	CH10	19	CH9
7	CH8	20	CH7
8	CH6	21	CH5
9	CH4	22	CH3
10	CH2	23	CH1
11	CH0	24	GND
12	GND	25	
13	+5 V		



2. J2

Pin	Function	Pin	Function
1		14	D1
2	GND	15	D2
3	+12 V	16	D3
4	GND	17	D4
5	D8	18	D5
6	D9	19	D6
7	D10	20	D7
8	D11	21	
9	D12	22	
10	D13	23	+5 V
11	D14	24	GND
12	D15	25	-12 V
13	D0	26	GND



CHAPTER 6

I/O PORT CONTROL

6.1 Input Port

1. port + 0

MSB															LSB
0	0	0	0	11	10	9	8	7	6	5	4	3	2	1	0

Input A/D data, only D0 to D11 are useable, the highest nibble are 0.

2. port + 2

When read this port means clear the interrupt signal that generated from the adapter.

3. port + 6

MSB															LSB
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Digital input channel. Before read this port, you must write FF value to this port.

4. port + 8

Counter 0 I/O buffer (8254 IC).

5. port + 9

Counter 1 I/O buffer (8254 IC).

6. port + A

Counter 2 I/O buffer (8254 IC).

7. port + B

Counter control register (8254 IC).

6.2 Output Port+0

The output port address+0 is used to control A/D conversion. The low 8 bit control format is :

MSB							LSB
x	R2	R1	R0	C3	C2	C1	C0

1. Select A/D channel number

The C0 to C3 are used to select input channel number.

C3	C2	C1	C0	Input Channel
0	0	0	0	CH0
0	0	0	1	CH1
0	0	1	0	CH2
0	0	1	1	CH3
0	1	0	0	CH4
0	1	0	1	CH5
0	1	1	0	CH6
0	1	1	1	CH7
1	0	0	0	CH8
1	0	0	1	CH9
1	0	1	0	CH10
1	0	1	1	CH11
1	1	0	0	CH12
1	1	0	1	CH13
1	1	1	0	CH14
1	1	1	1	CH15

2. Select gain control factor

The R0 to R2 are used to select gain control factor, if JP1 is short, the R0 to R2 are disable.

R2	R1	R0	Gain Control Factor
0	0	0	*1
0	0	1	*2
0	1	0	*3
0	1	1	*4
1	0	0	*5
1	0	1	*6
1	1	0	*7
1	1	1	*8

The gain control factor is used to scale your input voltage. For example, if you select unipolar and its voltage range from 0 to 20V, and the gain control factor is *8, then your input voltage range is from 0 to 2.5V, because whole the input voltage was scale 8 times.

3. Sampling and hold

The "x" bit is used to control sampling and hold, when write 0 to this bit, it latch the input voltage to let A/D converter get the input voltage, otherwise when write 1 to this bit, it enter sampling mode. Normally, this bit is 1.

x bit value	Action
0	Hold
1	Sampling

The high 8 bit control format of port address+0 is:

MSB							LSB
X	X	X	TRI	INT	ENX	SE1	SE0

4. Select trig method

The SE0 and SE1 are used to select trig method for A/D converter, user can select software trig, external hardware trig or trig by 8254.

SE1	SE0	Selection
0	0	Software trigger by TRI bit
0	1	Software trigger by TRI bit
1	0	External trig from J1-2
1	1	Trig by 8254

5. Enable/disable external hardware trig

ENX is used to enable/disable external hardware trig, when this bit is set to 0, it means disable external trig, otherwise this bit is set to 1 means enable external trig. When user select external hardware trig, he must connect external signal to J1 pin 2. When 8254 trig is selected, this bit must be set to 1.

ENX	Enable/Disable
0	Disable external trig
1	Enable external trig

6. Enable/disable interrupt

INT is used to enable/disable interrupt. If user enable interrupt, then after A/D conversion is finish, the hardware will generate interrupt. To set this bit to 0 means disable interrupt, otherwise set this bit to 1 to enable interrupt.

INT	Enable/Disable
0	Disable interrupt
1	Enable interrupt

7. Start software trig

TRI is used to start software trig. Normally, this bit is 0, when user start software trig, he must set this bit to 1, to let A/D converter start to convert. This software trig is enable while the signal from 0 to 1.

TRI	Enable/Disable
0	Normal
1	Start software trig

8. Start 8254 trig

When user select trig by 8254 (SE1=1 and SE0 =1), he must enable the gate by set ENX bit. The clock rate of 8254 is 1M, it is connected to counter 0, then the output of counter 0 is connected to counter 1, so that user need divide the clock by counter 0 then divide it by counter 1. The divided clock rate of counter 1 is used to trig A/D conversion.

6.3 Data Output Port

1. port + 2

MSB LSB

0	0	0	0	11	10	9	8	7	6	5	4	3	2	1	0

The 12 bit D/A output channel 1.

2. port + 4

MSB LSB

0	0	0	0	11	10	9	8	7	6	5	4	3	2	1	0

The 12 bit D/A output channel 2.

3. port + 6

MSB LSB

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Digital output channel.

4. port + 8
counter 0 I/O buffer (8254 IC).

5. port + 9
counter 1 I/O buffer (8254 IC).

6. port + A
counter 2 I/O buffer (8254 IC).

7. port + B
counter control register (8254 IC).

CHAPTER 7

PROGRAMMING EXAMPLES

To use A/D converter, user must following the steps:

Step 1: Select A/D channel number.
Step 2: Hold the input signal.
Step 3: Start A/D conversion.
Step 4: Get results.

In the following we will describe each step:

7.1 Select A/D Channel Number

Set C3 to C0 of port address+0 (low 8 bits) to select A/D channel number.

MSB							LSB
				C3	C2	C1	C0

C3	C2	C1	C0	Input Channel
0	0	0	0	CH0
0	0	0	1	CH1
0	0	1	0	CH2
0	0	1	1	CH3
0	1	0	0	CH4
0	1	0	1	CH5
0	1	1	0	CH6
0	1	1	1	CH7
1	0	0	0	CH8
1	0	0	1	CH9

1	0	1	0	CH10
1	0	1	1	CH11
1	1	0	0	CH12
1	1	0	1	CH13
1	1	1	0	CH14
1	1	1	1	CH15

7.2 Hold the Input Signal

Set x bit of port address+0 (low 8 bits) to 0 to latch input signal.

MSB							LSB
x							

7.3 Start A/D Conversion

Set SE0 and SE1 of port address+0 (high 8 bits) to select trig method for A/D converter.

MSB							LSB
X	X	X	TRI	INT	ENX	SE1	SE0

SE1	SE0	Selection
0	0	Software trigger by TRI bit
0	1	Software trigger by TRI bit
1	0	External trig from J1-2
1	1	Trig by 8254

1. By using software trigger

1.1 Set or reset INT bit to enable/disable interrupt.

INT	Enable/Disable
0	Disable interrupt
1	Enable interrupt

1.2 Write 0 to TRI bit to start conversion.

2. By using 8254 trigger

2.1 Set or reset INT bit to enable/disable interrupt.
2.2 Set the ENX bit to 1.
2.3 Start 8254 counter.

The clock rate of 8254 is 1M, it is connected to counter 0, then the output of counter 0 is connected to counter 1, so that user need divide the clock by counter 0 then divide it by counter 1. The divided clock rate of counter 1 is used to trig A/D conversion

3. By using external trigger

3.1 Set or reset INT bit to enable/disable interrupt.
3.2 Set the ENX bit to 1.
3.3 Send "1" to "0" pulse from J1-02 pin.

7.4 Get Results

There are two methods to get the results of A/D conversion.

1. By using polling

After start conversion, wait about 50us to get the conversion result.

2. By using interrupt

2.1 Write an interrupt service routine.
2.2 After conversion, the adapter will generate an interrupt to start the interrupt service routine.
2.3 The interrupt service routine read 12 bits result from port address + 0.

MSB															LSB
0	0	0	0	11	10	9	8	7	6	5	4	3	2	1	0

2.4 The interrupt service routine read port address + 2 to clear interrupt signal.

7.5 How to Use D/A Converter

1. Write 12 bits D/A to port address + 2 (D/A channel 1).

MSB															LSB
0	0	0	0	11	10	9	8	7	6	5	4	3	2	1	0

2. Write 12 bits D/A to port address + 4 (D/A channel 2).

MSB															LSB
0	0	0	0	11	10	9	8	7	6	5	4	3	2	1	0

3. After 30us, the D/A converter will finish output procedure.

7.6 How to Use Digital Output Channel

Write data to port address + 6.

MSB															LSB
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

7.7 How to Use Digital Input Channel

1. Write FF to port address + 6.
2. Read digital input from port address + 6.

APPENDIX A

WARRANTY INFORMATION

A.1 Copyright

Each piece of PCI BUS 12 BIT DATA ACQUISITION CARD package permits user to use PCI BUS 12 BIT DATA ACQUISITION CARD only on a single computer, a registered user may use the program on a different computer, but may not use the program on more than one computer at the same time.

Corporate licensing agreements allow duplication and distribution of specific number of copies within the licensed institution. Duplication of multiple copies is not allowed except through execution of a licensing agreement. Welcome call for details.

A.2 Warranty Information

DECISION warrants that for a period of one year from the date of purchase (unless otherwise specified in the warranty card) that the goods supplied will perform according to the specifications defined in the user manual. Furthermore that the PCI BUS 12 BIT DATA ACQUISITION CARD product will be supplied free from defects in

materials and workmanship and be fully functional under normal usage.

In the event of the failure of a PCI BUS 12 BIT DATA ACQUISITION CARD product within the specified warranty period, DECISION will, at its option, replace or repair the item at no additional charge. This limited warranty does not cover damage resulting from incorrect use, electrical interference, accident, or modification of the product.

All goods returned for warranty repair must have the serial number intact. Goods without serial numbers attached will not be covered by the warranty.

Transportation costs for goods returned must be paid by the purchaser. Repaired goods will be dispatched at the expense of PCI BUS 12 BIT DATA ACQUISITION CARD.

To ensure that your PCI BUS 12 BIT DATA ACQUISITION CARD product is covered by the warranty provisions, it is necessary that you return the Warranty card.

Under this Limited Warranty, DECISION's obligations will be limited to repair or replacement only, of goods found to be defective as specified above during the warranty period. DECISION is not liable to the purchaser for any damages or losses of any kind, through the use of, or inability to use, the PCI BUS 12 BIT DATA ACQUISITION CARD product.

DECISION reserves the right to determine what constitutes warranty repair or replacement.

Return Authorization: It is necessary that any returned goods are clearly marked with an RA number that has been issued by DECISION. Goods returned without this authorization will not be attended to.

APPENDIX B

DATA SHEET

33 34 35 36 37 38 39 40 41 42 43 44 45 46 47