CHAPTER 1
INTRODUCTION

The 12 bit data acquisition card is a high precision data conversion/acquisition system for PC/XT, PC/AT, PC/386, Pentium or compatibles. It contains 16 analog to digital channels with unipolar or bipolar input and 4 digital I/O channels with 8 bit line for each channel. The on board 8254 chip provides programmable interval timer/counter functions to trig A/D conversion. The 12 bit data acquisition card also provides interrupt driven for convention A/D input.

The features of the 12 bit data acquisition adapter are:

- Provides 16 A/D 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 4 digital input/digital output channels and the resolution is 8 bits.
- Provides three independent 16 bits counter to trig A/D conversion.
- I/O port address selectable.
- ISA bus interrupt programmable (IRQ3 to IRQ15).
- Gain control factor selectable from 1 to 8.

CHAPTER 2
UNPACKING INFORMATION

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

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

CHAPTER 3

SYSTEM REQUIREMENTS

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

- The host computer is an IBM PC/AT, PC/386, PC/486, and Pentium compatibles.
- The five jumpers' blocks are correctly configured to coincide with the operating system you are using.

CHAPTER 4

HARDWARE INSTALLATION

Your 12 bit data acquisition adapter is designed to be inserted in any available slot in your PC/AT, PC/386, PC/486, 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 analog input into the DB25 channel input before turning on the PC power, otherwise it may damage the card.

CHAPTER 5
HARDWARE CONFIGURATION

5.1 Introduction

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

JP1 (Jumper 1)
Determines A/D input voltage range.

JP2 (Jumper 2)
Determines unipolar or bipolar.

JP3 (Jumper 3)
Determines input mode.

JP4 (Jumper 4)
Determines I/O port address.

JP5 (Jumper 5)
Determines AD526 (gain control factor) is used.

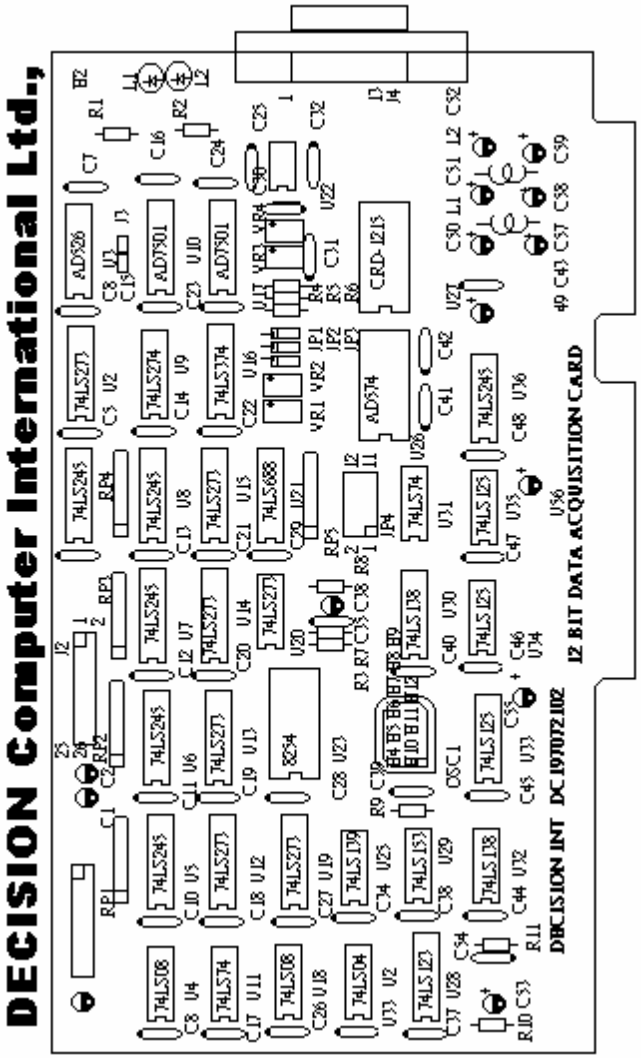
5.2 Configuration for Jumper

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

✹ ***IMPORTANT:*** CARE MUST BE TAKEN IN SELECTING THE CONFIGURATION OF JUMPERS TO ENSURE YOU

DO NOT DUPLICATE SETTINGS OF OTHER EQUIPMENT ALREADY INSTALLED IN YOUR COMPUTER. DUPLICATION OF SETTINGS WILL RESULT IN A MALFUNCTION OF ONE OR BOTH DEVICES.

☞ Please refer to the following settings for each switch and jumper block. If you are installing more than one board, do not duplicate jumper settings for any parameter.



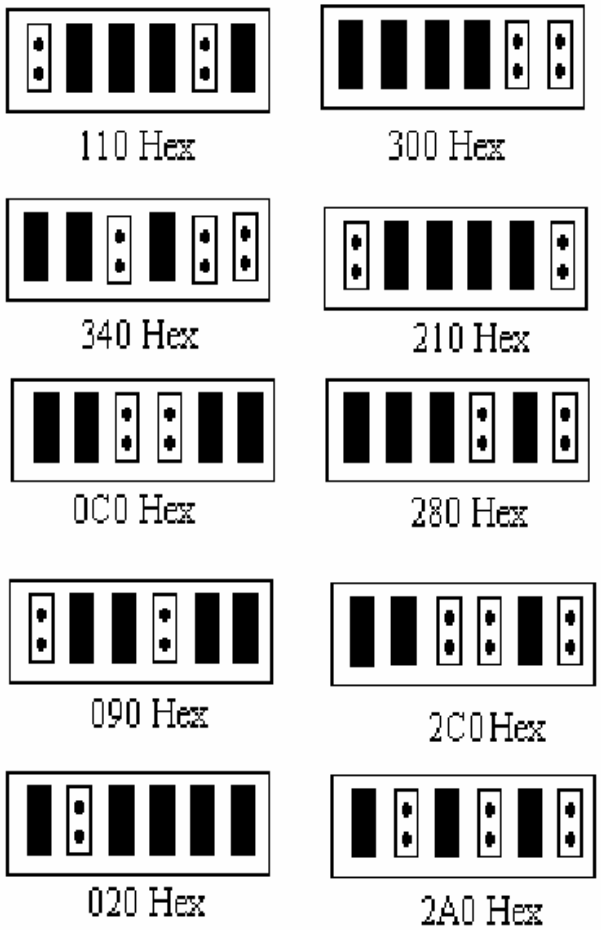
1. I/O Port Address

JP4 is used to select the base I/O address of the card. You may set the base I/O address range from 000H to 3F0H in increments of F Hex. Observe the figure below. To short a pin means that you set it as 0, while removing the jumper means that you just set it to 1. (A9, A8) (*i.e.* 0 to 3) represents the first digit of I/O address. (A7, A6, A5, A4) represents the second digit of the I/O address (*i.e.* 0 to F). The third digit of the I/O address is always 0.

JP4

If the rectangle is shaded it means that the jumper is shorted with a value of 0 otherwise it is 1. In the figure above you can see that A4 to A8 is shaded and that A9 have to dots inside the rectangle. Since A4 to A7 is shaded and it represents the second digit of the base address of the card then its value will be 0. For the first digit however, A8 is shaded which gives it a bit value of 0 and A9 will have a bit value of 1. So the first digit will then be equal to 2. The third digit will automatically be equal to 0. The base address of the above figure is 200 Hex, which is the default address of the card.

Addressing Example:



2. Voltage Range

JP1 is used to select a range of inputs from 0 to 10 volts or to a maximum voltage of 20 volts. Shorting pin1 and pin2 will have a voltage range of 10 volts, while shorting pin2 and pin3 will have a voltage range of 20 volts.

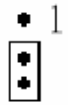
JP1

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

3. Unipolar or bipolar

Selects unipolar/bipolar of A/D channels. Shorting pin 1 and pin 2 selects bipolar setting, while shorting pin 2 and pin 3 selects a unipolar setting.

JP2



Jumper	Polarity
short 1, 2	bipolar
short 2, 3	unipolar

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

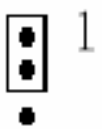
JP1	JP2	Voltage Range
Short 1,2	Short 1,2	-5V to 5V
Short 1,2	Short 2,3	0V to 10V
Short 2,3	Short 1,2	-10V to 10V
Short 2,3	Short 2,3	0V to 20V

4. Input Mode

Setting the jumper to pin 1 and pin 2 will ground the input value, so the data that will be converted should also be 0. This setting is used whenever we need to calibrate the VR or variable resistors so that the minimum voltage will be attained.

Shorting jumper to pin 2 and pin 3 will make use of the channel inputs to be read and converted.

JP3



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

5. Programmable Gain Control Factor (AD526)

The JP5 is used to select programmable gain control factor, when not short the jumper, it enable AD526, otherwise short the pin means no AD526 work.

JP5

Jumper	AD526
short	no AD526
not short	AD526

5.3 I/O Address Specification

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

For READ input

port + 0: input A/D low byte data.
port + 1: input A/D high byte data.
port + 2: read back control signal for data conversion.
port + 4: digital I/O channel 1.
port + 5: digital I/O channel 2.
port + 6: digital I/O channel 3.
port + 7: digital I/O channel 4.
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 and enable/disable the selected channel.
port + 1: select IRQ and select control method.
port + 2: start data conversion.
port + 3: output signal to reset/retrigger IRQ.
port + 4: digital I/O channel 1.
port + 5: digital I/O channel 2.
port + 6: digital I/O channel 3.
port + 7: digital I/O channel 4.
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	A/D bipolar offset voltage
VR2	AD574 reference voltage
VR3	A/D unipolar offset voltage
VR4	Offset voltage of LF398

VR1 is used to adjust the A/D bipolar offset voltage. JP2 should be set to pin 1 and 2 short before measuring the voltage input. After doing so, you can check if the values you get is half the input voltage by placing the multimeter probe to ground and pin 12 of AD574 (U26).

VR2 is used to adjust the reference voltage of AD574. The probe of the multimeter should be at the AD574 pin 10 (U26) and ground.

The value that you will read from the multimeter is 10 volts, otherwise you should adjust the variable resistor (VR2).

VR3 is used to adjust the A/D unipolar offset voltage. JP2 should be set to pin 2 and 3 short before measuring the voltage input. After doing so, you can check if the values you get is the same as the input voltage. You can test it by placing the multimeter probe to ground and pin 12 of AD574 (U26).

VR4 is used to adjust the offset voltage of LF398, to do so, one must short JP3 to pin 1 and 2, and make sure that JP2 is shorted at pin 2 and 3 (*i.e.* in the unipolar mode). After doing so, you should place the multimeter probe or any digital voltage reading device to ground and to LF398 pin 5 (U22) or JP1 pin 2 position. The value that you will get should be zero voltage, if not, you can adjust the VR4 to get the desired value.

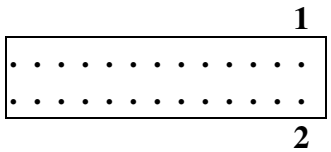
5.5 Pin Assignments

1. DB25 Pin Assignments for A/D (J3)

Pin	Function	Pin	Function
1	+ 12 V	14	-12 V
2	/EXTRG	15	No Connection
3	GND	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	-5 V
13	+5 V		

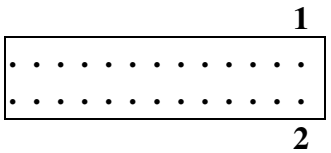
2. Digital I/O Pin Assignment for J1

Pin	Function	Pin	Function
1	+12 V	14	2D1
2	GND	15	2D2
3	+12 V	16	2D3
4	GND	17	2D4
5	1D0	18	2D5
6	1D1	19	2D6
7	1D2	20	2D7
8	1D3	21	J2-21
9	1D4	22	J2-22
10	1D5	23	+5 V
11	1D6	24	GND
12	1D7	25	-12 V
13	2D0	26	GND



3. Digital I/O Pin Assignment for J2

Pin	Function	Pin	Function
1	+12 V	14	4D1
2	GND	15	4D2
3	+12 V	16	4D3
4	GND	17	4D4
5	3D0	18	4D5
6	3D1	19	4D6
7	3D2	20	4D7
8	3D3	21	J3-21
9	3D4	22	J3-22
10	3D5	23	+5 V
11	3D6	24	GND
12	3D7	25	-12 V
13	4D0	26	GND



CHAPTER 6

SOFTWARE CONFIGURATION

6.1 Input Programming

1. port + 0

MSB							LSB
7	6	5	4	3	2	1	0

Input A/D low byte data.

2. port + 1

MSB							LSB
0	0	0	0	11	10	9	8

Input A/D high byte data.

3. port + 2

MSB							LSB
/hold	R2	R1	R0	C3	C2	C1	C0

Read back control signal for data conversion. Please refer next section for more details.

4. port + 4

MSB							LSB
1D7	1D6	1D5	1D4	1D3	1D2	1D1	1D0

Digital input channel 1.

5. port + 5

MSB							LSB
2D7	2D6	2D5	2D4	2D3	2D2	2D1	2D0

Digital input channel 2.

6. port + 6

MSB							LSB
3D7	3D6	3D5	3D4	3D3	3D2	3D1	3D0

Digital input channel 3.

7. port + 7

MSB							LSB
4D7	4D6	4D5	4D4	4D3	4D2	4D1	4D0

Digital input channel 4.

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

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

10. port + A
Counter 2 I/O buffer (8254 IC).

11. port + B
Counter control register (8254 IC).

6.2 Output Programming

1. port + 0

MSB							LSB
x	R2	R1	R0	C3	C2	C1	C0

Select A/D channel number and enable/disable the selected channel. The R0 to R2 are used to select gain control factor, and the C0 to C4 are used to select A/D input channel. If JP5 is short, the Ro 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.

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. port + 1

MSB							LSB
ENX	X	T1	T0	SL3	SL2	SL1	SL0

Select IRQ and select control method. The T1 and T2 are used to select trig method for A/D converter, and the SL0 to SL3 are used to select interrupt line. When user select external trig(T1=1 and T0=0), he must connect J3 pin 2.

ENX	Enable/Disable
0	Gate Disable
1	Gate Enable

T1	T0	Selection
0	0	Software trigger by port address + 2
0	1	Trig by 8254
1	0	External trig from J3-2
1	1	No trigger

When user select trig by 8254 (T1=0 and T0 =1), he must enable the gate by set ENX bit. The clock rate of 8254 is 2M, 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.

SL3	SL2	SL1	SL0	Interrupt Selection
0	x	x	x	No selection
1	0	0	0	IRQ3
1	0	0	1	IRQ4
1	0	1	0	IRQ5
1	0	1	1	IRQ7
1	1	0	0	IRQ10
1	1	0	1	IRQ11
1	1	1	0	IRQ12
1	1	1	1	IRQ15

3. port + 2

Start data conversion. When you select the software trigger (T1=0, T0=0) to start the A/D converter process, you can write any value to this address and start A/D converter process. It needs about 200ns to convert the signal.

4. port + 3

Output signal to reset/retrigger IRQ. When the A/D chip finish the converter process, they generate interrupt request selected by your choice channel. After your program finish the job, you must write any value to this address to clear the interrupt request signal.

5. port + 4

MSB							LSB
1D7	1D6	1D5	1D4	1D3	1D2	1D1	1D0

Digital output channel 1.

6. port + 5

MSB							LSB
2D7	2D6	2D5	2D4	2D3	2D2	2D1	2D0

Digital output channel 2.

7. port + 6

MSB							LSB
3D7	3D6	3D5	3D4	3D3	3D2	3D1	3D0

Digital output channel 3.

8. port + 7

MSB							LSB
4D7	4D6	4D5	4D4	4D3	4D2	4D1	4D0

Digital output channel 4.

9. port + 8

counter 0 I/O buffer (8254 IC).

10. port + 9

counter 1 I/O buffer (8254 IC).

11. port + A

counter 2 I/O buffer (8254 IC).

12. port + B

counter control register (8254 IC).

6.3 Programming Examples

If you want port+4, port+5, port+6, and port+7 as input channel, you must write FFH value to this port. In the following, we show a C language example.

This program uses the minimum resources of the 12 bit data acquisition. It only uses IRQ5 and an analog channel and checks digital channels in the card, but before you can use the option for digital I/O you must have a 2 x 26 pin cable connector placed in J1 and J2.

```
#include <stdio.h>
#include <conio.h>
#include <dos.h>
#include <ctype.h>
#include <process.h>
#include <stdlib.h>

#ifdef __cplusplus
     #define __CPPARGS ...
#else
     #define __CPPARGS
#endif

int channel = 0, address = 0x200;
unsigned int hibyte, lobyte;
float ad;
long int countint;

void main();

void interrupt (*old_interrupt)(__CPPARGS);    //interrupt
handler

void interrupt dataacq_interrupt(__CPPARGS)  //interrupt
service routine
{
countint++;  //interrupt counter
outportb(address, channel);  //selects the channel that will
send a signal
outportb(address + 3, 0x00);  //resets the IRQ
hibyte = inportb(address + 1); //captures hibyte data
lobyte = inportb(address);  //captures lobyte data
outportb(0x20, 0x20); //end of interrupt
}


void one_channel()
```

```
{
int looping, OldMask1, NewMask1;
char select_irq, get_ch;

countint = 0;
clrscr();
old_interrupt = getvect(0x0d);   //save old interrupt service
routine
disable();                          //disable interrupts
setvect(0x0d, dataacq_interrupt);  //use new ISR
enable();                     //enable interrupts
OldMask1 = inportb(0x21);           //save old interrupt mask
NewMask1 = OldMask1 & 0xDF;       //0xDF masks the interrupt
to be used
outportb(0x21, NewMask1);         //output new interrupt mask

//controls output of counter to 100hz
outportb(address + 11, 0x36);
outportb(address + 8, 0xff);
outportb(address + 8, 0x03);
outportb(address + 11, 0x76);
outportb(address + 9, 0x14);
outportb(address + 9, 0x00);

clrscr();
gotoxy(21,3);printf("Channel             Received Value");
gotoxy(20,22);printf("Press 'Space' To Pause and Any Key To
Quit");
outportb(address + 1, 0x9A); // output to selected irq
outportb(address + 3, 0x00);  //reset IRQ

do
    {
    gotoxy(1,1);printf("Interrupt Count: %ld", countint);
//loop counter

    while(kbhit())//if key is pressed
        {
        get_ch = toupper(getch());
        if(get_ch == 0x20)  //if space bar
            {
            getch();
            }
        else
            {
```



```
            disable(); //disable interrupt
            setvect(0x0d, old_interrupt);  //restore old
ISR
            enable(); //enable interrupt
            outportb(0x21, OldMask1);   //restore old mask
            main();
            }
        }
      ad = ((hibyte & 0x0f) << 8) + (lobyte & 0xff);
           //convert  hex   value to decimal
    ad = (ad * 10) / 0xfff;

    for(int z=0;z<=50;z++)     //loop counter
    for(int y=0;y<=100;y++)

    gotoxy(24,5);printf("%d", channel);  //display channel
    gotoxy(45, 5);printf("%.3f ", ad);  //display data

      }
while(!kbhit());
disable();
setvect(0x0d, old_interrupt);
enable();
outportb(0x21, OldMask1);
main();
}


void digital_io()
{
int four_digital_io, all_hi, digital_addr, count_by_5,
digital_send;
int data_read;
long int loop_count = 0;
char esc_key;

do
    {
    clrscr();
    gotoxy(28,20);printf("Press Any Key To Quit");
    gotoxy(1,1);printf("Loops: %ld    ", loop_count);

    for(count_by_5 = 0; count_by_5 <= 255; count_by_5 +=5)
        {
        delay(5);
```

```
        while(kbhit())
             {
             main();
             }
        gotoxy(1,4);printf("Transfer Data J3-1D to J2-3D");
        outportb(address + 4, count_by_5);
        outportb(address + 6, 0xff);
        data_read = inportb(address + 6);
        gotoxy(1,5);printf("Digital Input = %d
",data_read);
        if(count_by_5 == data_read)
             {
             gotoxy(25,5);printf("...Pass  ");
             }
        else
             {
             gotoxy(25,5);printf("...Error");
             gotoxy(25,20);printf("Press Any Key To
Continue");
             esc_key = getch();
             if(esc_key == 0x1b)
                  {
                  main();
                  }
             }
        }
    loop_count++;
    }
while(!kbhit());
}

void main()
{
char main_select;

clrscr();

//main menu
gotoxy(25,7);printf("12 BIT DATA ACQUISITION CARD");
gotoxy(28,9);printf("[1] Test Analog Input");
gotoxy(28,10);printf("[2] Digital I/O");
gotoxy(28,11);printf("[3] Exit");
gotoxy(30,13);printf("Choose Option: ");

do
```



```
    {
    gotoxy(45,13);main_select = toupper(getch());
    switch(main_select)
         {
         case '1':
              //menu select for analog input function
              one_channel();
              break;
         case '2':
              digital_io();
              break;
         case '3':
                   //Terminates the program whenever the
                   user chooses 5 from the main menu
              exit(0);
              break;
         }
    }
while(1);
}
```

APPENDIX A

WARRANTY INFORMATION

A.1 Copyright

Copyright 1997, 1998 DECISION COMPUTER INTERNATIONAL CO., LTD. All rights reserved. No part of 12 BIT DATA ACQUISITION CARD software and manual may be reproduced, transmitted, transcribed, or translated into any language or computer language, in any form or by any means, electronic, mechanical, magnetic, optical, chemical, manual, or otherwise, without the prior written permission of DECISION COMPUTER INTERNATIONAL CO., LTD.

Each piece of 12 BIT DATA ACQUISITION CARD package permits user to use 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 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 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 12 BIT DATA ACQUISITION CARD.

To ensure that your 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 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

32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47