PC 81A

Analog Input Expander Card

User's Manual

First Edition

April 1997

April 1997 Printing

Information furnished in this manual is believed to be accurate and reliable; however no responsibility is assumed for its use, nor for any infringements of patents or other rights of third parties which may result from its use.

IBM, IBM PC/XT/AT and IBM PS/2 are trademarks of International Business Machine Corporation.
MicroSoft and MSDOS are trademarks of MicroSoft Corporation.

Table of Contents

Introduction

The PC-81A is an analog input expander card. It has been designed to allow extra analog input channels to be added to virtually any analog input card. In order for it to operate, it requires the following:

- The existing analog input card must have at least two differential, or four single ended analog inputs.
- There must be at least four digital output lines available. These digital output lines need not be a part of the analog input card, but can be from any other card (or, if desired, from a mechanical switch!). Users of PC/XT/AT machines can easily use a low cost PC-36A/B/C parallel interface card if their analog input cards do not have digital outputs available.
- A power supply must be available. This must have voltages of +/- 12V to +/- 15V and +5V available. If no +5V is available, then it can be obtained from the +12V to +15V by setting two jumpers on the PC-81A.

Typical applications

- Complex Process Control
- Laboratory Automation
- Energy Management
- Product Testing

Features

- Four 16 channel multiplexers, giving 64 single ended or 32 differential input channels.
- Each PC-81A card can be individually addressed (card 0 to card 255), by setting an 8way dip switch
- There are four analog outputs per PC-81A, one for each multiplexer.
- As most analog input cards have sixteen input channels, any four of these can be selected on the PC-81A by using the on-board jumpers.
- Multiple PC-81A's can be interconnected in a multitude of fashions. The two major techniques are: Parallel Interconnection and Sub-Multiplexed Interconnection.
- For simplicity with regards to cabling when using Parallel Interconnection, any number of PC-81A's can be "piggy-backed" (ie:one on top of the other), by the adding male and/or female headers supplied in the mounting kit, to pcb location H4..

- ❈ **Parallel Interconnection:**

  This technique allows the maximum possible number of channesl with the lowest possible number of PC-81’s. For every four single ended or two differential inputs on the host card, you can have:

  - ♦ 64 single ended or 32 differential inputs with 4 digital output lines and 1 PC-81;
  - ♦ 1024 single ended or 512 differential inputs with 8 digital output lines and 16 PC-81’s.
  - ♦ 16384 single ended or 8192 differential inputs with 12 digital output lines and 256 PC-81’s

- ❈ **Sub-multiplexed interconnection:**

  This technique requires a larger number of PC-81’s for a given channel density, but has less effect on accuracy for large numbers of channels. For every four single ended or two differential inputs on the host card, you can have:

  - ♦ 64 single ended or 32 differential inputs with 4 digital output lines and 1 PC-81.
  - ♦ 1024 single ended or 512 differential inputs with 8 digital output lines and 17 PC-81’s.
  - ♦ 16384 single ended or 8192 differential inputs with 12 digital output lines and 273 PC-81’s.

  Note that with sufficient digital output lines, the sub-multiplexed technique can be extended far further than this, limited only by accuracy constraints. These constraints are fully described in appendix B.

PC 81A Package

The PC-81A package consists of:

- ❈ PC-81A Analog Input Expander Card
- ❈ Mounting kit
- ❈ PC-81A User's Manual
- ❈ EDR Developers Toolkit User Manual + 3½” diskette
- ❈ A DB37 type male connector and cover.
- ❈ One 3½” diskette containing the PC-81A drivers and demonstration software

If any of the items is missing, contact your dealer immediately, specifying which components are missing.

Chapter 1: Installation

There are four aspects of the PC 81A that must be configured (Refer to figure 2):

1.1) The Multiplexer Address Selection

This address determines which of the four onboard multiplexers' 16 input channels are accessed. Address A0 to A3 are used for this purpose. The inputs to the multiplexers are the 64 input channels, CH0 to CH63, and their 4 outputs are V0 to V3. For a differential configuration, CH32 acts as the return for CH0, CH33 acts as the return for CH1, etc.
In differential configuration, output V2 is the return for V0 and V3 is the return for V1.

1.2) The Card Address Selection

This address determines which PC-81A card is accessed. This can be set by the 8-way DIP switch found onboard. The address range in parallel mode is from PC-81A-(0) to PC-81A-(255). Address lines A4 to A11 are used for this purpose. See figure 1 below:

DIP SWITCH		DIP SWITCH	POSITION	PC-81A
1	TO	8	OFF	0
1			ON	1
2			ON	2
1	AND	2	ON	3
3			ON	4
1	AND	3	ON	5
2	AND	3	ON	6
1	TO	8	ON	255

Figure 1: PC-81A 8-way DIP switch for card address setting

1.3) The A/D Card Input Channel Selection

Most A/D Multifunction Cards have 16 input channels. As the PC-81A has only 4 output channels, normally 12 of the A/D cards' input channels would not be used.

The PC-81A has four A/D Card Input Channel Selection headers, labelled BOARD 0 to 3.

Jumpers on BOARD 0 inserted, direct the four mutiplexer outputs to V0,V1,V2 & V3.
Jumpers on BOARD 1 inserted, direct the four mutiplexer outputs to V4,V5,V6 & V7.
Jumpers on BOARD 2 inserted, direct the four mutiplexer outputs to V8,V9,V10 & V11.
Jumpers on BOARD 3 inserted, direct the four mutiplexer outputs to V12,V13,V14 & V15.

1.4) The Power Supply

The PC-81A operates on +12V, -12V & +5V power supplies. These can usually be obtained from the host A/D card. However, to allow for those cards which do not supply +5V, the PC- 81A has an internal provision for the generation of this voltage.from the +12V supply. Note that this considerably increases the power consumption of the PC-81A! The internal +5V is enabled by inserting jumpers H 2 & H 3.
<u>NOTE: THESE JUMPERS MUST NOT BE INSERTED IF THE HOST CARD SUPPLIES +5V!</u>

Certain host A/D cards do not have separate digital and analog ground. For these cards, jumper H1 can be inserted. This connects the two together. It is not normally required, and should be inserted only when absolutely necessary, as it's use results in an increase in noise levels.

1.5) Installation

A “Mounting kit” is provided.for this purpose.

For single PC-81A installations, fix four double-ended female hex stand-offs to each of mounting holes on the card and there after, the card to the mounting cabinet, with the screws provided. (It is not necessary to solder any male and/or female headers to location H4 on the PC-81A.)

For “Piggy-backed” Parallel PC-81A installations, first decide how many PC-81A’s are going to be used for your particular installation. This can be determined by how many analog channels you require. You then need to work out a pattern for mounting the *interconnecting* single row headers to the top and/or bottom of each PC-81A, (by soldering). It is advisable to mount the female header always on the bottom of any PC-81A, (so that if the “Piggy-backed cards are ever seperated, they can still be mounted normally). First solder a female single row header to the PC-81A to be mounted above, then plug the single row male header fully into that female. By fixing four double-ended female hex stand-offs to each of mounting holes on the lower PC-81A with four male/female hex stand-offs, and attaching the upper PC-81A by carefully lining up the the other end of the male header with the appropriate mounting holes of pcb location H4 on the PC-81A below, the male header can now be soldered into place. (The two PC-81A’s are correctly spaced by these stand-offs) After soldering, cut off the protruding pins. Continue with this procedure until all of the proposed PC-81A’s are prepared. (Remember to alternate rows with regards to mounting male/female headers to pcb location H4). Now connect all analog input wires to the lower PC-81A. Set any jumpers and/or dip switches as necessary before mounting the next PC-81A above, using another four male/femal hex stand-offs. Repeat this procedure until all of the cards are mounted. The lower PC-81A is secured to your mounting cabinet/box by using four screws supplied. The upper-most PC-81A. is also attached by four screws.(NB! This “Piggy-back” procedure can performed by the manufacturer if requested.)

This method of Parallel Interconnection, vastly reduces the space needed for mounting the PC-81A’s and the amount of wiring necessary to control them. A cable from the A/D card in the host PC with only a single DB-37 FM connector to all the PC-81A’s is now only necessary.

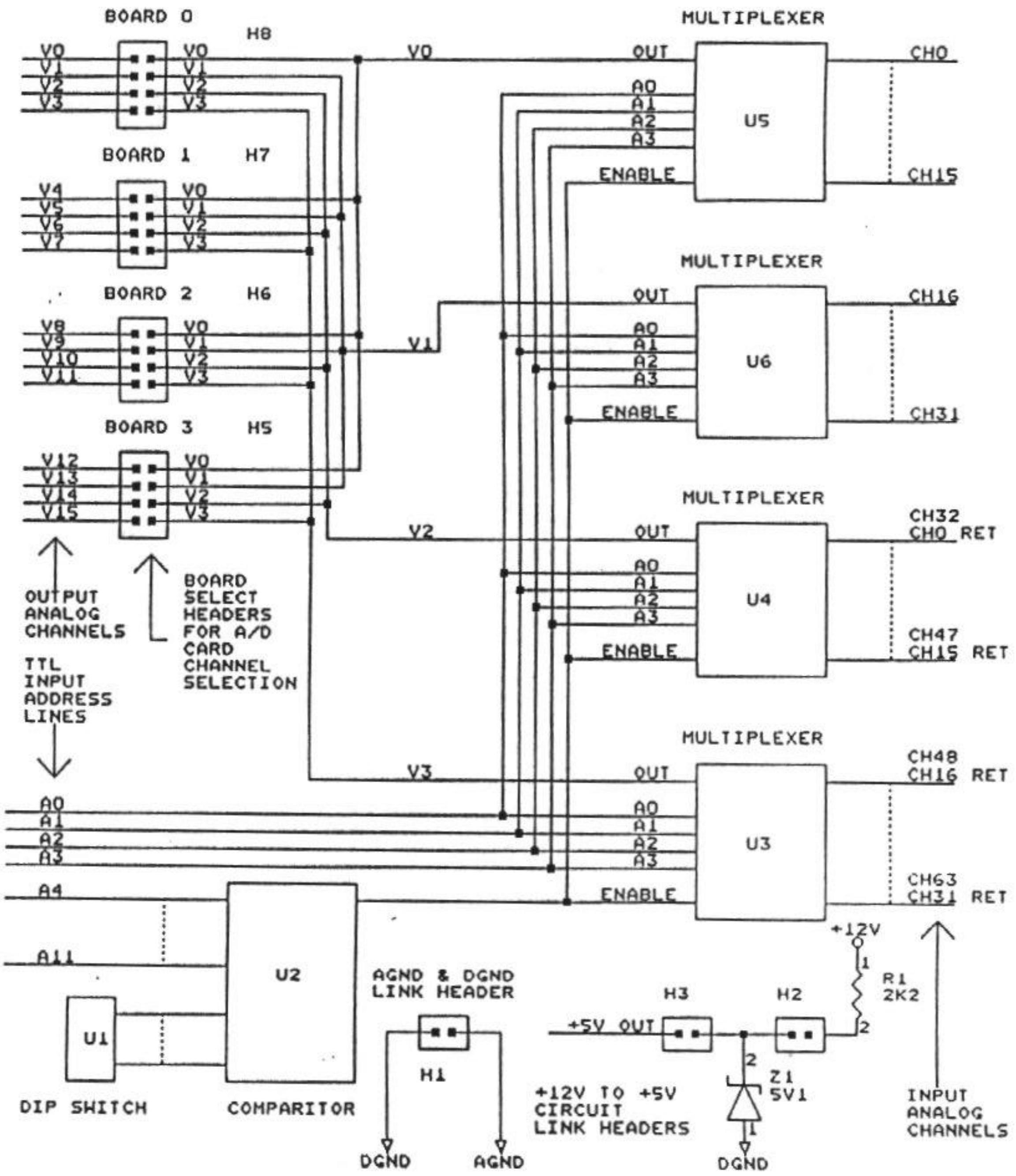


Figure 2: PC-81A Block Diagram

CHAPTER 2: Interconnections

The PC-81A can be connected to any analog input card which has at least four (preferably sixteen) A/D channels and twelve TTL output lines.

2.1) Connections to the analog card

All data transfers to the host analog card are channelled via a screened cable from the PC-81A’s User Connector.

2.2) The User Connector

The PC-81A interfaces to the external world via a 37 way D-type male connector. This connector acommodates the following signals:

❈ 16 separate analog output signals (V0 - V15)
❈ 12 address lines (A0 - A11)
❈ +5V, +12V, -12V, AGND & DGND

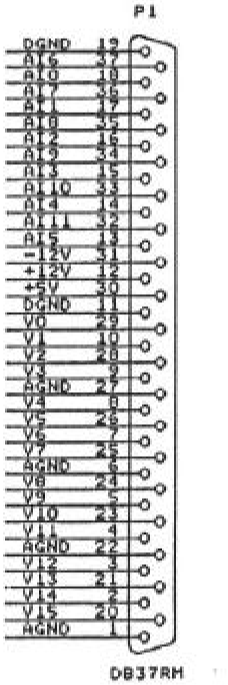


Figure 3: PC-81A User Connector
(as seen from the front)

Figure 3 graphically shows the connector together with their pin assignments. Note that the pin connections refer to the pin numbers of the connector when looking into the connector from the front. The square pad of the pcb component at location P1 represents pin1. Also note that the pin numbers are embossed on the connector itself, but please note that sometimes the connector manufacturers do make mistakes.

2.3) The 64 Analog Input, Ground and Aux Screw-terminals

Each of the sixty four analog inputs is multiplexed and redirected via the BOARD 0 - 3 headers to the User Connector.

The Auxilliary Screw-terminal connector includes (A0 - A11), (V0 - V3 and AGND) and (+5V,+12V, -12V and DGND).

2.5) *The use of multiple PC-81A's shown graphically*

2.5.1) Parallel Interconnection

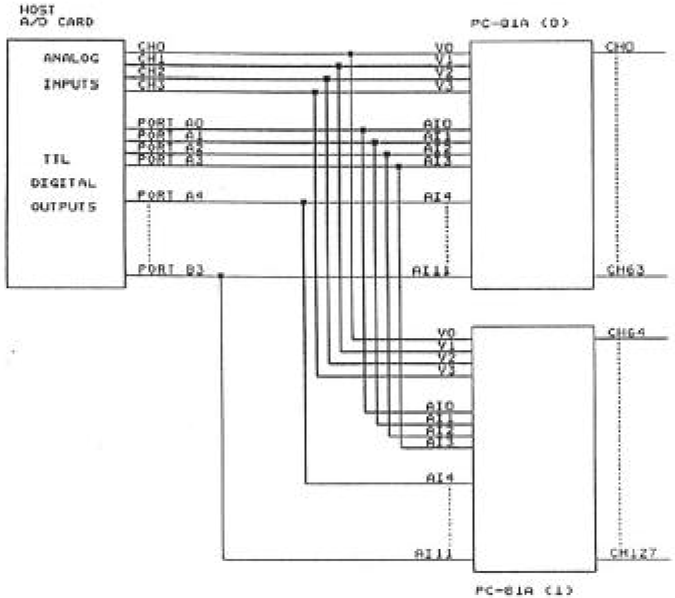


Figure 4: Parallel Interconnection: (Using only four A/D Host Card analog input channels)

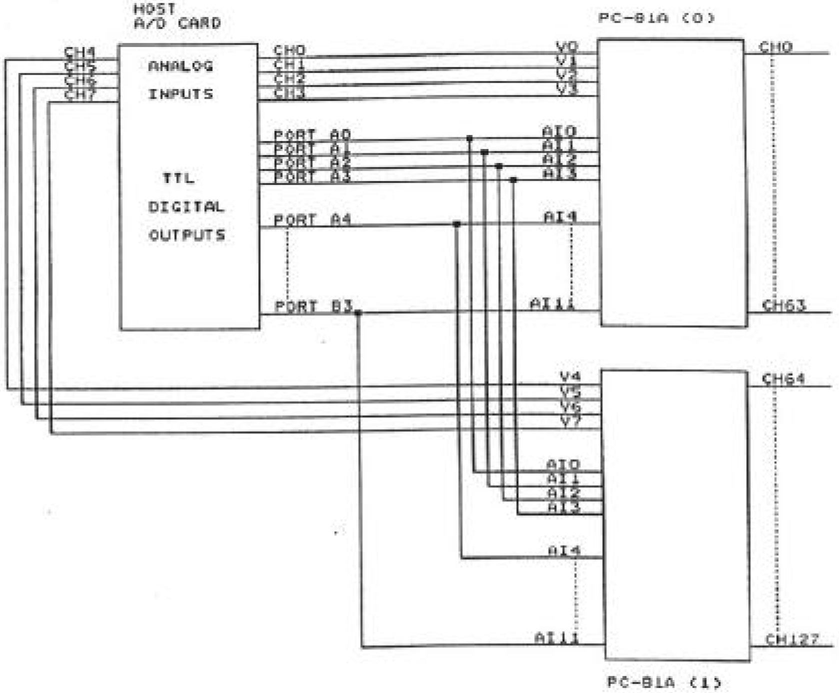


Figure 5: Parallel Interconnection: (Using more than four A/D Host Card analog input channels)

2.5.2) Sub-Multiplexed Interconnection

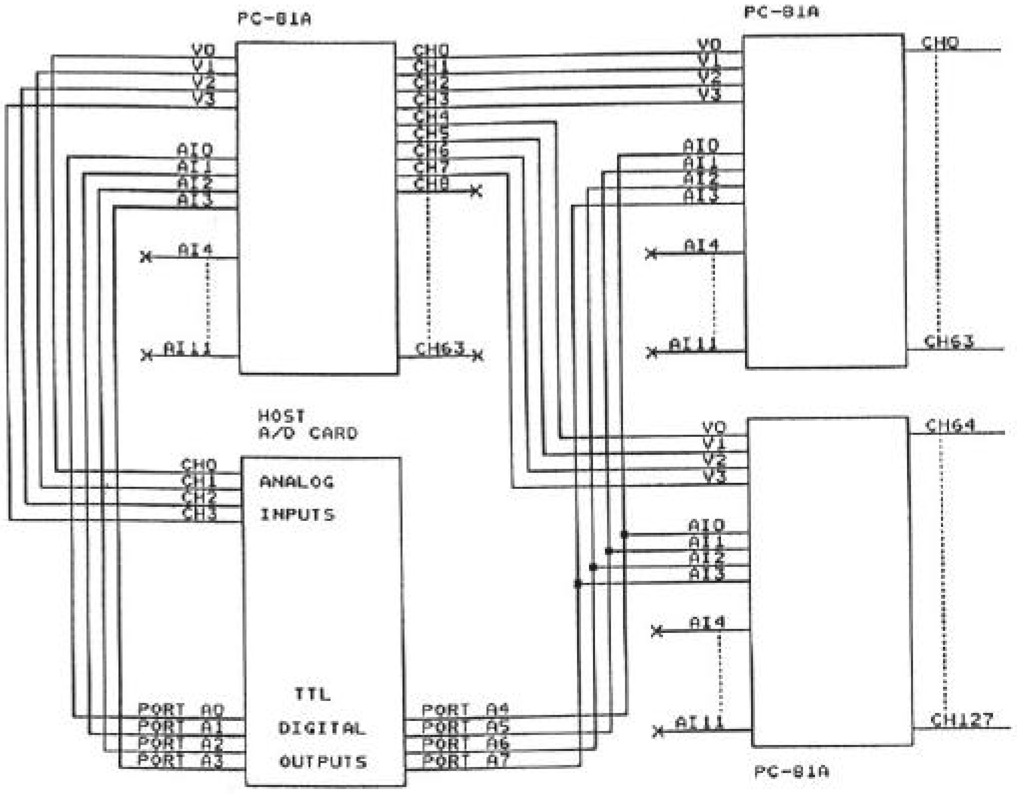


Figure 6: Sub-Multiplexed Interconnection: (Using only four A/D Host Card analog input channels)

Chapter 3: Software Guide

This chapter discusses the software considerations necessary for A/D host cards which use the PC-81A.

3.1) Obtaining an A/D Sample

The steps required to obtain an A/D sample are as follows:

I) Set the A/D card input channel.
II) Set the PC-81A channel.
III) Wait for the PC-81A to settle.
IV) Trigger the A/D converter in the A/D host card.
V) Wait for the A/D conversion to complete.
VI) Read in the result.

A demonstration program, PC-81A.--- supplied on the disk included with the PC-81A, shows how this is done. This program is written in ------------ and displays -------(finish this later).

3.2) PC-81A Settling Time

As may be seen from the above, the major software consideration in using the PC-81A is the seetling time..

When using only an A/D card, the settling time of the cards's internal multiplexer is included in the card's conversion time, and hence does not require any attention. If a PC-81A is used however, the settling time of the multiplexers on the PC81A must be taken into account. This is normally done by a timing loop, although certain A/D cards have timers on board which could be used for this purpose. The use of a timing loop is shown in the demonstration program. (finish this later)

The actual settling time of the PC-81A is dependant on several factors, namely:

- Cable length - The longer the cable between the PC-81A and the A/D host card, the longer the settling time.
- Source resistance - The effect of the cable is mainly to increase capacitance , which must be charged from the voltage to be measured. The higher the source impedance, the longer this will take.
- PC-81A configuration - When using multiple PC-81A's, the way in which they are connected significantly effects the settling time . In general, the settling time of sub-multiplexed PC-81A's is significantly lower than that of parallel PC-81A's.

The following figures may be taken as general guidelines for applications which use relatively short cables (less than 1 metre in length).

- For a single PC-81A - approximately 5uS.
- For multiple PC-81A's in sub-multiplexed mode - add 5uS for each layer of PC-81A's.
- For multiple PC-81A's in parallel mode - add 2uS for each PC-81A.

Chapter 4: Driver Software

Full driver software is supplied with the PC 63C package. Full details are explained in the EDR Software developers kit User Manual. A summary of what these drivers consist of are explained below.

Both DOS and Windows Languages are supported: They are:

DOS Languages:

Borland C/C++ Version 3.1 or 4.0
Microsoft C/C++ Version 6.0 or 7.0
Borland Pascal / Turbo Pascal Version 6.0 or 7.0
Microsoft QuickBasic Version 4.5
National Instruments LabWindows Version 2.0

Windows Languages:

Borland C/C++ 3.1 or 4.0
Microsoft C/C++ 6.0 or 7.0
Borland Pascal / Turbo Pascal Version 6.0 or 7.0

4.1) Board Handles

All EDR functions used above require a board handle as the first parameter. The board handle defines which board is affected by the function call. Using this method has several advantages, For example, there is no need for a 'select board' function; working with parallel boards is much easier; different applications using the EDR at the same time will not conflict with each other.

Board handle are integers obtained by calling EDR_AllocBoardHandle (see 7.2 of EDR Developers Toolkit). Once allocated a board handle must be initialised to the PC 63C before it can be accessed. this is achieved by calling EDR_InitBoard or EDR_InitBoardType (see 7.5 of EDR manual) with the base address or EDR_loadConfiguration (see section 7.8 of EDR manual).

EDR_InitBoard will attempt to detect the PC63C at the base address specified.

4.2) Interrupt functions

Since the external trigger line on the PC 63C is connected to a hardware interrupt, an ISR can be installed using the EDR driver functions provided.

These functions are only callable from C/C++ or Borland/Turbo Pascal.

4.3) Quick Function Reference

The PC 63C Enhanced Reed Relay Board utilises the following functions calls contained in the EDR driver developers toolkit. They are:

Function Name	Description
EDR_DIOPortOutput	Writes a byte of data to the PC63C I/O port
EDR_DIOPortInput	Reads a byte of data from the PC 63C I/O Port. If the port is an output port then the last value written to the port is returned.
EDR_DIOLineOutput	Changes a single line (bit) on the PC63C I/O port. This in turn switches one the reed relays (ON/OFF) on the PC 63C.
EDR_DIOLineOutput	Obtains the status of a single line in a digital I/O port on the PC 63C. This function determines whether any one of the reed relays is ON/OFF.
EDR_InstallISR	Installs an ISR for the specified hardware interrupt request
EDR_UninstallISR	Removes an interrupt service routine that was installed with EDR_InstallISR
EDR_InstallBoardISR	Installs an ISR for a particular type of interrupt installed on the PC 63C.
EDR_UninstallBoardISR	Removes an interrupt service routine that was installed with EDR_InstallBoardISR
EDR_MaskIRQ	Masks or unmasks a particular IRQ level
EDR_MaskBoardIRQ	Masks or unmasks a particular board interrupt
EDR_EnableInterrupt	Enables / disables a specified interrupt on hte PC 63C
EDR_ResetInterrupt	Resets an interrupt latch on the PC 63C and sends an EOI command to one of the PCs interrupt controllers on completion of the interrupt
EDR_AllocBoardHandle	Allocates a new board handle to the PC 63C. If no board handles are available then a 0 is returned. This is particularly useful is multiple PC 63C are present in the same.computer.
EDR_FreeBoardHandle	Releases a board handle allocated to the PC 63C making it available to any other PC card
EDR_InitBoardType	Initialises a board and allocates a board handle to it
EDR_ConfigDialog	Diplays a dialog box that allows the user to manually configure the driver for the Board in the computer
EDR_SaveConfiguration	Function writes configuration information to a file for later loading with EDR_LoadConfiguration
EDR_LoadConfiguration	Loads details of the Cards configuration from the file created by EDR_SaveConfiguration
EDR_RestoreDefaults	Restores factory default configuration for a baord attached to a handle
EDR_IsBaseAddressInUse	Checks if any board initialised with EDR is using the specified I/O address
EDR_DetectBoard	Tries to determine the type of board present at a specified I/O address.
EDR_SetBoardType	Changes the board type attached to a board handle
EDR_SetIRQLevel	Set the IRQ level EDR will use for the interrupt ID specified.

An example of the using external trigger interrupt function is shown below. This program is also found in the EDR Driver Toolkit.

```
/*
 * Simple external interrupt demo.
 *
 * Installs an ISR to count external interrupt inputs from the board.
 *
 * Main functions demonstrated:
 *
 *          EDR_InstallBoardISR
 *          EDR_MaskBoardIRQ
 *          EDR_EnableInterrupt
 *          EDR_UninstallBoardISR
 *          EDR_ResetInterrupt
 *
 * Boards supported: All boards with an external interrupt input.
 *
 * (c)1994 David Tinker
 */

#include "..\edr.h"           /* driver functions */

#include <stdio.h>
#include <stdlib.h>
#include <conio.h>
#include <ctype.h>
#include <string.h>
#include <dos.h>

volatile int bh;                          /* our board handle */
volatile unsigned long icount=0;    /* interrupts processed */

void printerror(int r); /* displays error msg and exits */
void quit(int c);       /* release our board handle and exit */
void interrupt ISR();   /* our interrupt handler */

void main(int argc,char *argv[])
{
int baseaddr;
int boardtype;
int i,j,k,ch;
char s[80];

printf("EXTINT - External interrupt demo\n\n");
if (argc==2) sscanf(argv[1],"%x",&baseaddr);
else baseaddr=0x300;

/* first get a board handle to use */
bh=EDR_AllocBoardHandle();
if (!bh) {  /* this should never happen with DOS */
      printf("No free board handles\n");
      exit(1);
      }

/* ask if user wants auto detection */
printf("Autodetect board type (only works with no cables attached) "
         "(Y/N) ?");
do { i=toupper(getch()); } while ((i!='Y') && (i!='N'));
printf(" %c\n",i);
if (i=='Y') {     /* look for board at specified base address */
      i=EDR_InitBoard(bh,baseaddr);
      if (i<0) printerror(i);
      }
else { /* ask user for type of installed board */
      printf("Choose board type from the following list:\n");
      for (i=1; i<NUMBOARDTYPES; i++) {
            sprintf(s,"%02d ",i);
            EDR_StrBoardType(i,s+3);
            for (; strlen(s)<14; ) strcat(s," ");
            printf("%s  ",s);
            }
      printf("\nType the number of the board installed (enter to exit): ");
      gets(s);
      i=atoi(s);
      if (!i) quit(1);
      i=EDR_InitBoardType(bh,baseaddr,i);
      if (i<0) printerror(i);
      }

/* let the user chose the base address */
EDR_ConfigDialog(bh,-1,-1,-1,-1,-1,-1,-1);

/* copy the board type into a var */
EDR_GetBase(bh,&baseaddr);
EDR_GetBoardType(bh,&boardtype);

/* make sure this board has an external interrupt input */
if (!EDR_ValidInterruptID(boardtype,EDR_INT_EXTINPUT)) {
      printf("This board does not have an external interrupt input.\n");
      quit(1);
      }

/* install our ISR for first external interrupt */
/* the second would be EDR_INT_EXTINPUT+1 and so on */
j=EDR_InstallBoardISR(bh,EDR_INT_EXTINPUT,ISR);
if (j<0) printerror(j);
EDR_MaskBoardIRQ(bh,EDR_INT_EXTINPUT,0);  /* unmask the IRQ */
EDR_EnableInterrupt(bh,EDR_INT_EXTINPUT,1);     /* start generating ints */

/* display count until esc is pressed */
printf("\n");
do {
      printf("%lu interrupts have occured - press esc to exit%c",icount,13);
      if (kbhit()) ch=getch();
      else ch=0;
      } while (ch!=27);
printf("\n\n");

/* undo interrupt stuff (very important!) */
EDR_EnableInterrupt(bh,EDR_INT_EXTINPUT,0);     /* stop generating ints */
EDR_MaskBoardIRQ(bh,EDR_INT_EXTINPUT,1);  /* mask the IRQ */
EDR_UninstallBoardISR(bh,EDR_INT_EXTINPUT);     /* remove our ISR */

/* release the board handle (not necessary for DOS) */
EDR_FreeBoardHandle(bh);
}

void interrupt ISR()
/* this gets called for every external interrupt */
{
icount++;
EDR_ResetInterrupt(bh,EDR_INT_EXTINPUT);  /* signal interrupt complete */
}

void printerror(int r)
/* displays error msg and exits */
{
char s[80];
EDR_StrError(r,s);      /* convert error number into a string */
printf("%s\n",s);
quit(1);
}

void quit(int c)
/* release our board handle and exit */
{
EDR_FreeBoardHandle(bh);
exit(c);
}
```

Chapter 5: Repair Service

The PC-81A is guaranteed for a period of 1 year. If the board is faulty within this period, we will gladly repair it free of charge provided that the maximum specifications was not exceeded. If any burn't tracks are seen on the PC-81A Card or any of the multiplexers are blown, the warranty will be void. A repair charge will then be levied if the user requires the board to be repaired.

Our repair service centre will be available to repair our products even after the 1 year warranty. A reasonable service fee will be levied which usually covers the cost of the components that are faulty and the labour cost per hour or part thereof.

Chapter 6: Specifications

Number of channels:	64 Single-ended, 32 Differential.
Resistance, input to output:	2K Ohm channel ON, 100M Ohm channel OFF.
Input capacitance:	20pF (max)
Output capacitance:	20pF (max)
Leakage current, inputs:	5nA (max) @ 25º C, 100nA (max) @ 70º C.
Leakage currrent, outputs:	5nA (max) @ 25º C, 100nA (max) @ 70º C.
Settling time:	1.5uS (max) with a 10 Ohm source impedance and a 50pF load.
Minimum host impedance:	100M Ohm.
Digital inputs:	TTL compatible, 100uA (max) leakage current.
Power supply current, +12V:	4mA (max), with internal +5V power supply disabled.and 10mA (max), with internal +5V power supply enabled.
Power supply current, -12V:	4mA (max).
Power supply current, +5V:	500uA (max).
Power supply range, +12V:	+11.5V to +15V.
Power supply range, -12V:	-11.5V to -15V.
Power supply range, +5V:	+4.5V to +5.5V.

Chapter 7: Error Analysis

Any extra components in the signal path of a data acquisition system will result in measurement errors. In the case of the PC-81A, and multiplexers in general. it is the effect of the leakage current which is by far the most significant cause. This is especially the case for large numbers of multiplexers.

7.1) Multiplexer leakage current

All multiplexers have some leakage current. For most multiplexers, including those uesd on the PC-81A , this is strongly temperature dependant, typically doubling every10º C. For this reason, leakage currents are specified both at 25º C and at 70º C. For the PC-81A, and almost all multiplexers used on A/D cards, maximum current at 25º C is 1nA.

7.2) Parallel operation

For parallel operation, the error due to leakage can be calculated as follows:

Verr = (Nm + 2) (Rm + Rs) Im

where: Verr - is the error voltage due to leakage current;
Nm - is the number of PC-81A's;
Rm - is the PC-81A's ON resistance;
Rs - is the source resistance;
Im - is the PC-81A leakage current.

Note that this calculation assumes that the A/D card contains a similar multiplexer to that in the PC-81A. This is almost always the case.

7.3) Sub-multiplexed mode operation

For sub-multiplexed mode operation, the error due to leakage can be calculated as follows:

Verr = (N1 (N1 + 1) Rm / 2 + N1Rs) Im

where: Verr - is the error voltage due to leakage current;
N1 - is the number of layers of multiplexers (including the multiplexer on the host A/D card);
Rm - is the PC-81A's ON resistance;
Rs - is the source resistance;
Im - is the PC-81A leakage current.

Note that this calculation assumes that the A/D card contains a similar multiplexer to that in the PC-81A, and that this calculation uses the number of layers of multiplexers, NOT the number of multiplexers. For example, in the the figure ----(still not finished), N1 would be 3.

Note also that because the error in the case of sub-multiplexed mode operation is dependant on the number of layers, rather than the number of multiplexers, errors for sub-multiplexed mode operation are considerably lower if large numbers of channels are used.

- Chapter 8: PC-26/30AT Considerations

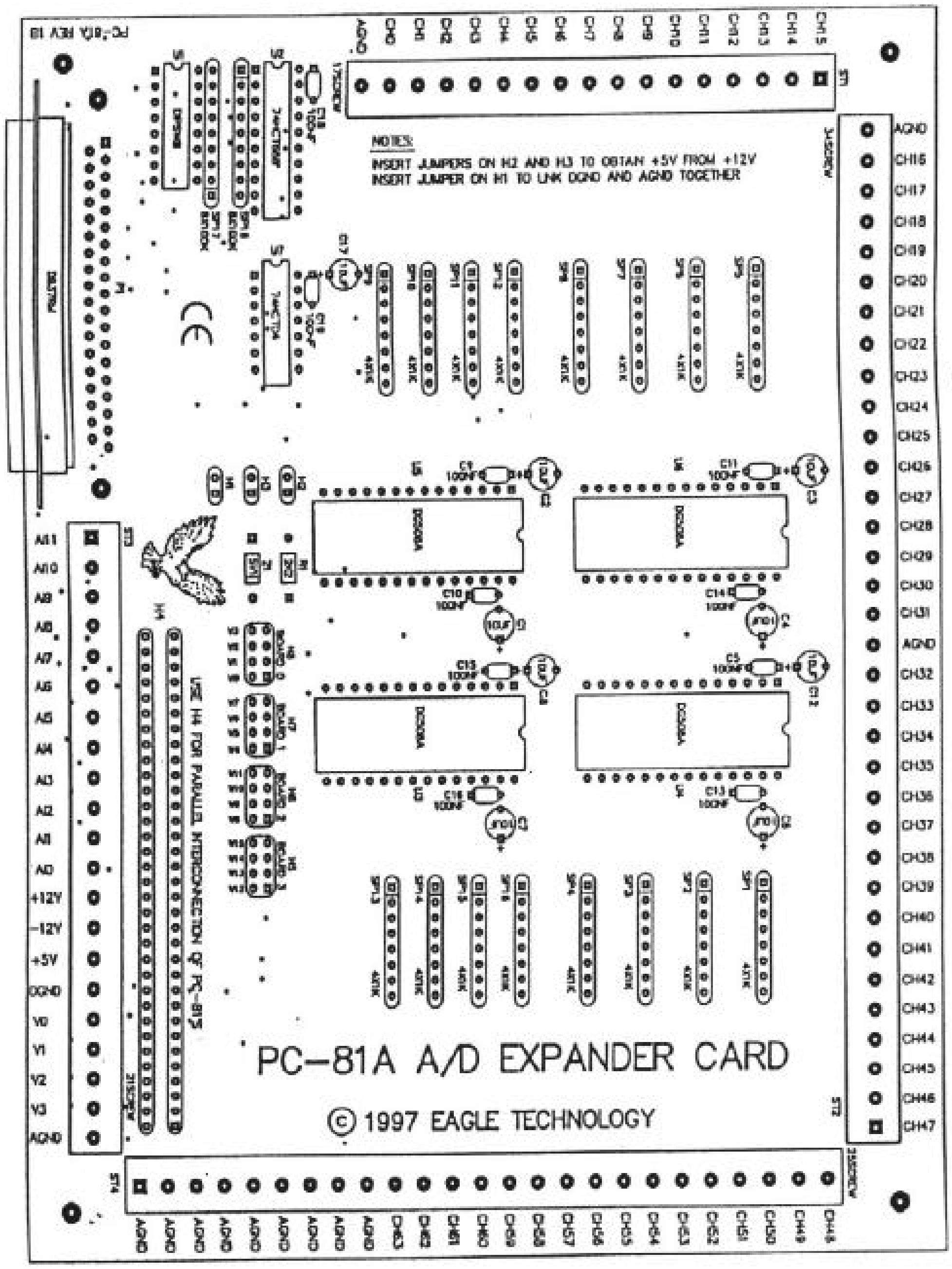
For users of the older PC-26/30AT data acquisition cards, certain special considerations apply.

PC-26/30AT cards have built-in termination resistors, in order to prevent errors due to open inputs. These termination resistors must be removed to allow operation in conjunction with a PC-81A.

The components in question are the 22K Ohm resistor arrays R9 and R10, and the discrete 22K Ohm resistors R6 and R7. We recommend removal by simply cutting the leads of these components on the component side of the board. Attempting to de-solder the components is NOT recommended, unless you are an experienced technician with the correct equipment for the job.

Appendix A

PC-81A PCB Layout Diagram



PC-81A REV 1B
AGND
CH0
CH1
CH2
CH3
CH4
CH5
CH6
CH7
CH8
CH9
CH10
CH11
CH12
CH13
CH14
CH15
ST1
NOTES:
INSERT JUMPERS ON H2 AND H3 TO OBTAIN +5V FROM +12V
INSERT JUMPER ON H1 TO LINK DGND AND AGND TOGETHER
AGND
CH16
CH17
CH18
CH19
CH20
CH21
CH22
CH23
CH24
CH25
CH26
CH27
CH28
CH29
CH30
CH31
AGND
CH32
CH33
CH34
CH35
CH36
CH37
CH38
CH39
CH40
CH41
CH42
CH43
CH44
CH45
CH46
CH47
ST2
ST3
AI11
AI10
AI9
AI8
AI7
AI6
AI5
AI4
AI3
AI2
AI1
AI0
+12V
-12V
+5V
DGND
V0
V1
V2
V3
AGND
ST4
AGND
AGND
AGND
AGND
AGND
AGND
AGND
AGND
AGND
CH63
CH62
CH61
CH60
CH59
CH58
CH57
CH56
CH55
CH54
CH53
CH52
CH51
CH50
CH49
CH48
74HCT08
74HCT04
DG508A
DG508A
DG508A
DG508A
100NF
10UF
47K
H1
H2
H3
H4
BOARD 0
BOARD 1
BOARD 2
BOARD 3
USE H4 FOR PARALLEL INTERCONNECTION OF PC-81S
PC-81A A/D EXPANDER CARD
© 1997 EAGLE TECHNOLOGY