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PCL-722

144-ch Digital I/O ISA Card

User Manual

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3. If your product is diagnosed as defective, obtain an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.
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CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

FCC Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Technical Support and Assistance

Step 1. Visit the Advantech web site at **www.advantech.com/support** where you can find the latest information about the product.

Step 2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
- Product name and serial number
- Description of your peripheral attachments
- Description of your software (operating system, version, application software, etc.)
- A complete description of the problem
- The exact wording of any error messages

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Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User's Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:

a. The power cord or plug is damaged.

b. Liquid has penetrated into the equipment.

c. The equipment has been exposed to moisture.

d. The equipment does not work well, or you cannot get it to work according to the user's manual.

e. The equipment has been dropped and damaged.

f. The equipment has obvious signs of breakage.

15. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAM-

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AGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.

16. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.

The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

1. To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.
2. Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

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CHAPTER 1

Introduction

This chapter contains information on the PCL-722 and instruction on card configuration in order to match your application and prepare it for installation on your system.

Sections include:

- Features
- Specifications
- Applications
- Installation Guide
- Software Overview

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Chapter 1 Introduction

The PCL-722 144 bit DIO card is a generalized 144 line parallel digital I/O board that has six channels. Each channel emulates mode 0 of a 8255 programmable peripheral interface chip, and has 24 lines of digital input and/or output. Every channel has an individual connector with OPTO-22 compatible pin assignment. Two lines of each connector can be used to generate a hardware interrupt. These inputs are buffered and can be connected to IRQ 2, 3, 4, 5, 6 and 7. The PCL-722 is a full-size PC add-on card and can fit any full-length expansion slot in the IBM PC XT/AT or compatible computer running at any clock rate.

1.1 Features

- 144 TTL digital I/O lines, (6 connectors, each with 24 I/O lines)
- The 24 I/O lines of each connector are configured to port PA (8 bit), PB (8 bit), PC Upper (4 bit) and PC Lower (4 bit). Each port can be programmed to digital input or digital output
- Emulates mode 0 of 8255 PPI
- Programmable interrupt handling
- OPTO-22 compatible 50-pin connector
- Direct interface to wide range of peripherals

1.2 Specifications

1.2.1 Digital Input

Channels: 144 (24 channels x 6 ports) shared with output

Compatibility: 5V/TTL

Input Voltage: Logic 0: 0.0 V ~ 0.80 V @ -0.2 mA

Logic 1: 2.0 V ~ 5.25 V @ 20 uA

Interrupt Capable Ch.: Bits 0 and 3 of Port C can generate an interrupt to IRQ 2, 3, 4, 5, 6 or 7

Interrupt Bandwidth: 800Hz @ 0.5 Duty cycle

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1.2.2 Digital Output

Channels: 144 (24 channels x 6 ports) shared with input

Compatibility: 5V/TTL

Output Voltage: Port A, B, C

Logic 0: 0.4 V max. @ 24 mA

Logic 1: 2.4 V min. @ -15 mA

1.2.3 General Specifications

Power Consumption: Typical: +5 V @ 1.3 A

Max.: +5 V @ 1.8 A

Operating Temperature: 0 ~ 60°C (32 ~ 140°F)

Storage Temperature: -20 ~ 70°C (-4 ~ 158°F)

Operating Humidity: 5 ~ 95% RH, non-condensing (refer to IEC 68-2-3)

I/O Connectors: 6 x 50-pin male ribbon-cable connectors. Pin assignment are fully compatible with Opto-22 I/O modules racks

Dimensions (L x H): 334 x 100 mm (13.2" x 3.9)

1.3 Applications

- Industrial AC/DC I/O module monitoring and control
- Relay and switch monitoring and control
- Parallel data transfer
- Sensing the signals of TTL, DTL, CMOS logic
- Driving indicator LED's

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1.4 Installation Guide

Before you install your PCL-722 card, please make sure you have the following necessary components:

- PCL-722 DA&C card
- PCL-722 User Manual
- Driver software Advantech DLL drivers (in the companion CD-ROM)
- PC or workstation with a ISA-bus slot

Some other optional components are also available for enhanced operation: ActiveDAQ, ActiveDAQ Pro, LabView or other 3rd-party software packages.

After you get the necessary components and maybe some of the accessories for enhanced operation of your multifunction card, you can then begin the installation procedure. Figure 1.1 gives users an overview of the software and hardware installation procedure:

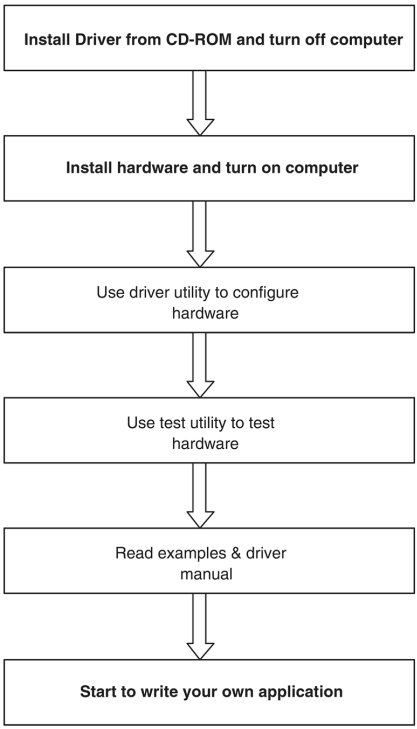


Figure 1.1: Installation Flow Chart

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1.5 Software Overview

Advantech offers a rich set of DLL drivers, third-party driver support and application software to help fully exploit the functions of your PCL-722 card:

- Device Drivers (on the companion CD-ROM)
- LabVIEW driver
- Advantech ActiveDAQ Pro

Programming Choices for DA&C Cards

You may use Advantech application software such as Advantech Device Drivers. On the other hand, advanced users can use register-level programming, although this is not recommended due to its laborious and time-consuming nature.

Device Drivers

Advantech Device Driver software is included on the companion CD-ROM at no extra charge. It also comes with all Advantech DA&C cards. Advantech's Device Drivers features a complete I/O function library to help boost your application performance. Advantech Device Drivers for Win 2000/XP works seamlessly with development tools such as Visual C++, Visual Basic, Borland C++ Builder and Borland Delphi.

Register-level Programming

Register-level programming is available for experienced programmers who find it necessary to write code directly at the level of the device register. But since register-level programming requires much effort and time, it is strongly recommend to use the Advantech Device Drivers instead.

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CHAPTER 2

Installation

This chapter contains a package item checklist, proper instructions for unpacking and step-by-step procedures for card installation.

Sections include:

- Unpacking
- Driver Installation
- Hardware Installation
- Device Configuration

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Chapter 2 Installation

2.1 Unpacking

After receiving your PCL-722 package, please inspect its contents first. The package should contain the following items:

- PCL-722 card
- Companion CD-ROM (Device Drivers included)
- User Manual

The PCL-722 cards harbor certain electronic components vulnerable to electrostatic discharge (ESD). ESD can easily damage the integrated circuits and certain components if preventive measures are ignored.

Before removing the card from the antistatic plastic bag, you should take the following precautions to ward off possible ESD damage:

Touch the metal part of your computer chassis with your hand to discharge the static electricity accumulated on your body. Alternatively, one can also use a grounding strap.

Touch the anti-static bag to a metal part of your computer chassis before opening the bag.

Take hold of the card only by the metal bracket when removing it out of the bag.

After taking out the card, you should first:

Inspect the card for any possible signs of external damage (loose or damaged components, etc.). If the card is visibly damaged, please notify our service department or our local sales representative immediately. Do not install a damaged card into your system.

Also, pay extra caution to the following aspects during installation:

Avoid physical contact with materials that could hold static electricity such as plastic, vinyl and Styrofoam.Whenever you handle the card, grasp it only by its edges. DO NOT TOUCH the exposed metal pins of the connector or the electronic components.

Note: *Keep the anti-static bag for future use. You might need the original bag to store the card I you have to remove the card from a PC or transport it elsewhere.*

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2.2 Driver Installation

We recommend you install the driver before you plug the PCL-722 into your system, since this will guarantee a smooth installation process.

The Advantech Device Drivers Setup program for the PCL-722 card is included in the companion CD-ROM that is shipped with your DA&C card package. Please follow the steps below to install the driver software:

1. Insert the companion CD-ROM into your CD-ROM drive.
2. The Setup program will be launched automatically if you have the autoplay function enabled on your system. When the Setup Program is launched, the Setup Screen will appear.

Note: If the autoplay function is not enabled on your computer, use Windows Explorer or Windows Run command to execute AUTORUN.EXE on the companion CD-ROM.



Figure 2.1: Advantech Automation Software Setup

3. First, install the Advantech Device Manager.
4. Select the "Individual **Drivers**" to install the specific device driver then just follow the installation instructions step by step to complete your device driver installation and setup.

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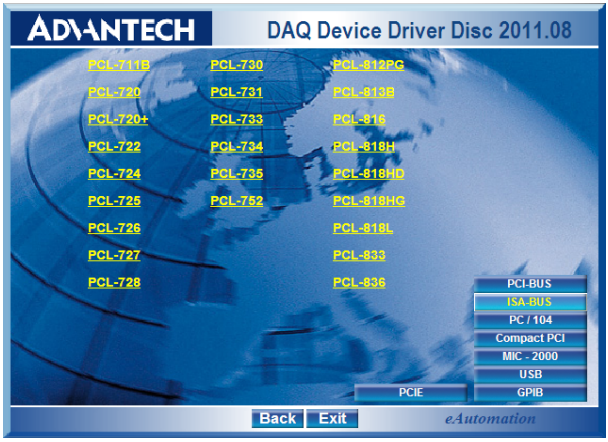


Figure 2.2: Different Options for Driver Setup

For further information on driver-related issues, an online version of the Device Drivers Manual is available by accessing the following path:

Start/Advantech Automation/Device Manager/Device Driver's Manual

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2.3 Hardware Installation

Note: Make sure you have installed the driver and Advantech Device Manager before you install the card (please refer to chapter 2.2 Driver Installation)

After the Device Drivers installation is completed you can install the PCL-722 card into any ISA slot on your computer. A complete device installation procedure should include device setup, configuration and testing. The following sections will guide you through the Setup, Configuration and Testing of your device. However, it is suggested that you refer to the computer's user manual or related documentation if you have any doubts. Please follow the steps below to install the card.

1. Turn off your computer and unplug the power cord and cables.
2. Remove the cover of your computer.
3. Remove the slot cover on the back panel of your computer.
4. Touch the metal part on the surface of your computer to neutralize the static electricity that might be on your body.
5. Insert the PCL-722 card into a ISA slot. Hold the card only by its edges and carefully align it with the slot. Insert the card firmly into place.
6. Fasten the bracket of the ISA card on the back panel rail of the computer with screws.
7. Connect appropriate accessories (50-pin flat cable, wiring terminals, etc. if necessary) to the ISA card.
8. Replace the cover of your computer chassis. Re-connect the cables you removed in step 2.
9. Plug in the power cord and turn on the computer.

After your card is properly installed on your system, you can now configure your device using the ***Advantech Device Manager Program*** that has itself already been installed on your system during driver setup.

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CHAPTER 3

Signal Connections

This chapter provides useful information about how to connect input and output signals to the PCL-722 via the I/O connector.

Sections include:

- Overview
- Switch & Jumper Settings
- Signal Connections

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Chapter 3 Signal Connections

3.1 Overview

Maintaining signal connections is one of the most important factors in ensuring that your application system is sending and receiving data correctly. A good signal connection can avoid unnecessary and costly damage to your PC and other hardware devices. This chapter provides useful information on how to connect input and output signals to the PCL-722 via the I/O connector.

3.2 Switch & Jumper Settings

The PCL-722 card has two function jumper settings.

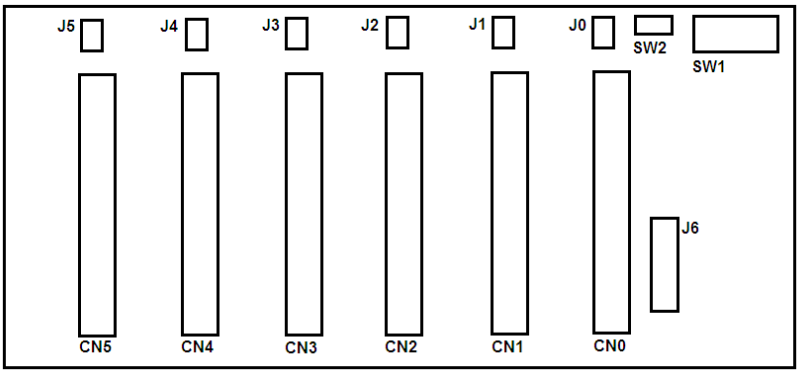


Figure 3.1: Card Connectors, Jumpers & Switches

Location	Descriptions
CN0 ~ CN5	OPTO-22 50 pin connector for digital input or output channels (Port 0 ~ Port 5)
J0 ~ J5 & J6	Interrupt setting
SW1	Base address setting
SW2	96/144-bit mode setting

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3.2.1 Base Address Selection

The PCL-722 requires 32 consecutive address locations within the I/O space. Some I/O address locations will be occupied by internal I/O and your peripherals. In order to avoid conflict with these devices, the PCL-722 address can be set by a 6 position DIP switch and placed anywhere in the IBM PC decoded external UO space.

The 200-3FF hex (512-1023 decimal) address range provides extensive unused areas of I/O space, though you should check with the IBM Standard Technical Reference Manual for possible conflicts with commonly installed peripherals.

Table 3.1: Switch Position Summary

I/O Address Range (Hex)	Switch Position					
		1	2	3	4	5
	A9	A8	A7	A6	A5	A4
----------(Fixed)----------						
200-20F	1	0	0	0	0	0
210-21F	1	0	0	0	0	1
220-22F	1	0	0	0	0	0
.....						
2C0-2CF*	1	0	1	1	0	0
.....						
300-30F	1	1	0	0	0	0
.....						
3F0-3FF	1	1	1	1	1	1

Note: *- ON=0, OFF=1*

- A4...A9 corresponds to PC bus address lines

*- * means factory setting*

- Switch position 6 is not used

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3.2.2 96/144-bit Mode Setting

The PCL-722 can limit the 32 required addresses to 16, therefore, the digital I/O is limited to 96 bits. SW2 (see Fig. 3.2 below) sets the number of usable I/O. The PCL-722 card should be left in the 144 bit mode unless this address conflicts with the addresses of other peripherals already installed or those to be installed in neighbouring slots.

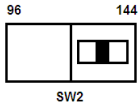


Figure 3.2: Select 144 or 96 I/O

By selecting 96 bit mode, two or more boards can be mapped consecutively on adjacent addresses. By selecting 144 bit mode, a minimum gap of 8 addresses will exist between each board. The following address list provides examples of multiple board addressing with consecutive addresses. Note that these are not the only addresses available because other combinations can be used.

Board 1	Board 2
200-20F	210-21F
230-23F	240-24F
250-25F	260-26F

Note: In 144 bit mode, base address line A4 is not in functional status, therefore, A4 of SW1 does not need to be set.

The following base addresses are available:

200,220,240,260,280,2A0,2C0,2E0

300,320,340,360,380,3A0,3C0,3E0

The following base addresses are illegal:

210,230,250,270,290,2B0,2D0,2F0

310,330,350,370,390,3B0,3D0,3F0

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You can set the address according to the information given in Table 3.1.

3.2.3 Interrupt Settings

Pins PC-0 and PC-3 of each channel of the PCL-722 generate hardware interrupts and can be set to any of the interrupt request lines IRQ2, 3, 4, 5, 6 and 7.

The IRQ signal is TRI-STATED allowing multiple PCL-722 boards to share the same interrupt line. For example, two PCL-722 boards in a system can have IRQ2 selected.

The following diagram shows the locations of interrupt enable selection jumpers (J0 ~ J5).

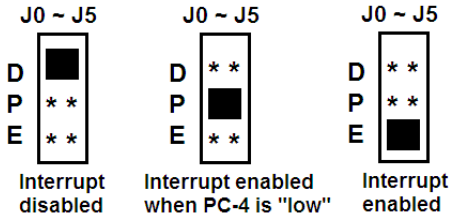


Figure 3.3: Interrupt Enable Selection

The interrupt channels setting (J6):



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3.3 Signal Connections

The PCL-722 card emulates MODE 0 of 8255 PPI, and is pin compatible with popular industrial solid state I/O racks and modules such as those manufactured by OPTO-22, Potter Brumfield, Gordos, and others.

The PCL-722 has six 50-pin male IDC connectors that interface with position OPTO-22 racks 8, 16 and 24.

Two of the I/O lines (PC-0, PC-3) of each channel can be used to generate a hardware interrupt.

Note: The PCL-722 emulates MODE 0 of 8255 PPI, therefore, it is in effect the same as a 8255 controller card and all packages or programs that support the 8255 in MODE 0 can be used on PCL-722 without reconfiguring software.

3.3.1 Configuration

Mode 0 of 8255 provides simple input and output for each of the three ports and no handshaking is required as data is written directly to or read from a specified port (see 8255 MODE 0 Function Definitions).

Read-back is another useful function of the PCL-722 and this allows the user to monitor each output port of each channel.

8255 MODE 0 FUNCTION DEFINITIONS

- Two 8-bit ports (Port A, Port B)
- Two 4-bit ports (Port C upper, Port C lower)
- Any port can be used for input or output
- Outputs are latched whereas inputs are not latched
- 16 different input/output configurations are available in this mode.

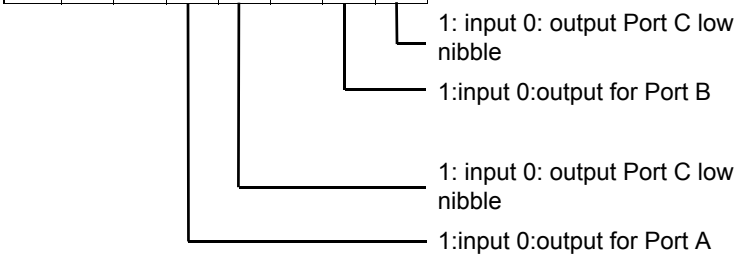
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Table 3.2: 8255 Address Map		
Register	Address	Function
Port A	BASE ADDRESS +0	Read/Write
Port B	BASE ADDRESS +1	Read/Write
Port C	BASE ADDRESS +2	Read/Write
CFG REG	BASE ADDRESS +3	Write Only

Example” Base address set at 300

Table 3.3: CFG register format (mode 0)						
	CH0	CH1	CH2	CH3	CH4	CH5
Port A	300	304	308	30C	310	314
Port B	301	305	309	30D	311	315
Port C	302	306	30A	30E	312	316
CFG Port	303	307	30B	30F	313	317

D7	D6	D5	D4	D3	D2	D1	D0
1	0	0	?	?	0	?	?



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The following table lists all possible configured “commands” to configure 8255 in mode 0.

Table 3.4: 8255 Mode 0 Configuration Table

	D4	D3	D1	D0
Config.	PA0-PA7	PC4-PC7	PB0-PB7	PC0-PC3
80H	output	output	output	output
81H	output	output	output	input
82H	output	output	input	output
83H	output	output	input	input
88H	output	input	output	output
89H	output	input	output	input
8AH	output	input	input	output
8BH	output	input	input	input
90H	input	output	output	output
91H	input	output	output	input
92H	input	output	input	output
93H	input	output	input	input
98H	input	input	output	output
99H	input	input	output	input
9AH	input	input	input	output
9BH	input	input	input	input

PC 7	1	2	GND
PC 6	3	4	GND
PC 5	5	6	GND
PC 4	7	8	GND
PC 3	9	10	GND
PC 2	11	12	GND
PC 1	13	14	GND
PC 0	15	16	GND
PB 7	17	18	GND
PB 6	19	20	GND
PB 5	21	22	GND
PB 4	23	24	GND
PB 3	25	26	GND
PB 2	27	28	GND
PB 1	29	30	GND
PB 0	31	32	GND
PA 7	33	34	GND
PA 6	35	36	GND
PA 5	37	38	GND
PA 4	39	40	GND
PA 3	41	42	GND
PA 2	43	44	GND
PA 1	45	46	GND
PA 0	47	48	GND
+5V	49	50	GND

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3.4 Interrupt Handling

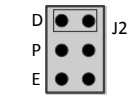
The PCL-722 has two lines (PC-0, PC-3) for each channel to generate hardware interrupt.

The interrupts are edge-triggered. PC-0 traps a rising edge signal, while PC-3 traps a falling edge signal. To use the interrupts, simply insert the appropriate IRQ jumper to select the desired interrupt level (IRQ 2-7).

To determine which input generated the interrupt, read Port C lower, bits 0 and 3, to locate the current state of inputs. Note that the inputs are not latched and no “first event” trapping is provided to determine which input was active first.

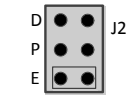
The user can select which channel is to be interrupt enable by setting interrupt enable jumpers J0, J1, J2, J3, J4 and J5. Refer to the table below:

NO INTERRUPT REQUEST

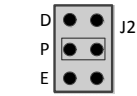


Interrupt disabled

BUS STATUS		RESPONSE
PC-0	PC-3	
H	X	NO INTERRUPT REQUEST
L	H->L	INTERRUPT REQUEST
X	L	NO INTERRUPT REQUEST
L->H	H	INTERRUPT REQUEST



Interrupt enabled



* if PC-4 ‘Low’,
Interrupt enabled
* if PC-4 ‘High’,
Interrupt disabled

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Note: In the event that an interrupt signal is generated from a rising-edge or a falling-edge change, and if additional interrupt signals are still to be inputted, the bit-status must be reset to its original station, i.e. PC-0 should be set at 0 and PC-3 should be set at 1 before such signals can be inputted. For example, Ixx0 (1000, 1010, 1100, 1110)

Although interrupt signals are normally received from external peripherals, the PCL-722 can also execute a (test) output signal to simulate an interrupt being inputted from an external device. See the example in Appendix.

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APPENDIX A

Programming Examples

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Appendix A Programming Examples

The PCL-722 is easily programmed and the following section lists some program examples. All the program examples below have been fully tested on PC-XT/AT or compatible computers.

Note: The following programs should be run under Turbo C version 1.5 or 2.0.

DEMO1.C :

```
/*************************************************************\
*  This demo program demonstrates how to use the read back    *
*  function of the PCL-722 to monitor the output status.      *
*  HARDWARE SETTING :                                         *
*         1. Base address set at 0x2C0                        *
*         2. select 144 lines I/O (by adjusting SW2)          *
\*************************************************************/

#include <stdio.h>
#include <conio.h>
#include <process.h>
#include <dos.h>

struct  channel     /* define channel structure */
{
 int    portA;
 int    portB;
 int    portC;
 int    config;
}

main()
struct  channel CN[6];  /* there are six connectors        */
int     base = 0x2c0;   /* set base address at 2C0 (in hex) */
int     portA;         /" save read back value of port A   */
int     portB;         /* save read back value of port B   */
int     portC;         /* save read back value of port C   */
int     i,j;

/* screen  handle x/
```


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```
  clrscr();
  gotoxy(25,1);
  textattr(0x70);
  cputs("PCL-722 DEMO PROGRAME");
  gotoxy(1,2);
  printf("Testing CN : ");
  for (i=0;i<3;i++)
       { gotoxy(1,4+i*2);
         printf("Port%c  output value --> ",'A'+i)i
         gotoxy(40,4+i*2);
         printf("ReadBack -->");
       }

  /* calculate port addresses of each CN */

  for (i=0;i<6;i++)
       { CN[i].portA = base + i*4 + 0;
         CN[i].portB = base + i*4 + 1;
         CN[i].portC = base + i"4 + 2;
         CN[i].config= base + i+4 + 3;

  /* Initialization */

         outportb (CN[i].portA , 0x00);
         outportb (CN[i].portB , 0x00);
         outportb (CN[i].portC , 0x00);
         outportb (CN[i].config, 0x80);  /* all as OUTPUT */
        }



/********************** main program **********************/

for(i=0;i<6;i++)
    {  gotoxy(13,2);            /*                */
       textattr(0x09);          /*  print CN number  */
       cprintf("%d",i);         /*                */

       for(j=0;j<0x100;j++)
            { outportb ( CN[i].portA, j);  /* out j to port A */
              gotoxy(25,4);
              printf("%2x",j);
              portA = inportb (CN[i].portA);   /" read back */
              gotoxy(53,4);
              printf("%2x",portA);
              if ( portA != j)
                  { printf("\7");   /* beep */
                    gotoxy(1,20);
                    textattr(0x09);
                    cprintf("CN %d port A readback error!",i);
                    getch();
                    exit(1);       /* quit to dos */
                  }
              outportb ( CN[i].portB, j);  /* out j to port B */
              gotoxy(25,6);
```


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```
            printf("%2x",j);
            portB = inportb (CN[i].portB);   /* read back */
            gotoxy(53,6);
            printf("%2x",portB);
               if ( portB I= j)
                  { printf("\7");   /* beep */
                    textattr(0x87);
                    gotoxy(1,20);
                    cprintf("CN %d port B readback error!",i);
                    getch();
                    exit(1);        /* quit to dos */
                  }
            outportb ( CN[i].portC, j);   /" out j to port C */
            gotoxy(25,8);
            printf("&2x",j);
            portC = inportb (CN[i].portC);   /* read back x/
            gotoxy(53,8);
            printf("%2x",portC);
               if ( portC != j)
                  { printf("\7");   /" beep "/
                    gotoxy(1,20);
                    textattr(0x87);
                    cprintf("CN %d port C readback error!",i);
                    getch();
                    exit(1);        /" quit to dos */
                  }
         }
      }
printf("\n\nPass test ! Press any key to quit...\n");
getch();
}
```


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DEMO2.C

```
/*****************************************************************\
*  This demo program demonstrates how to use the capability   *
*  of interrupt handling of the PCL-722 card.                  *
*                                                              *
* HARDWARE SETTING :                                           *
*  In this program, the BASE ADDRESS is set at '0x2C0',       *
*  and the interrupt level is set at IRQ2 ( associated to     *
*  INT OAH ISR ), and all the interrupt setting jumpers        *
*  of each channel are set at the 'P' position, i.e. the      *
*  interrupt request of each channel can be programmed to     *
*  be enabled or disabled.                                     *
* PROGRAM DESCRIPTION :                                        *
*  In this program, the original INT OAH ISR is replaced      *
*  by a new ISR named 'alarm'. If a hardware interrupt         *
*  signal is generated, the PC will beep.(alarm)               *
\*****************************************************************/


#include <dos.h>
#include <stdio.h>
#include <conio.h>

/* new INT OAH ISR */

void interrupt alarm (void)
{
 char Port61_Old_Status;
 char Port61_New_Status;
 int DelayTime = 0x300;
 int Count = 0;
 int i;

/**  get original port 61H status, and save it  **/

 Port61_New_Status = Port61_Old_Status = inportb(0x61);

/**  set port 61h bitl = '0'  **/

 Port61_New_Status &= Oxfd;     /* 1111 1101 in binary */

 for ( Count=O ; Count<0x300 ; Count++ , DelayTime--)
       {
        Port61_New_Status ^= 0x02;     /*  On/Off bitl  */
        outportb (0x61 , Port61_New_Status);
        for (i=O ; i<DelayTime ; i++);
       }
 outportb (0x61 , Port61_Old_Status);
 outportb (0x20, 0x20);               /* send EOI to 8259 */
}
```


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```
void main()
{
 int IMR;
 void interrupt (*Int_A_Old_Vector)();
 Int_A_Old_Vector = getvect(0x0a);   /* get old int Oah ISR */
 setvet (OxOa , alarm);              /* set new int Oah ISR */
 IMR = inportb(0x21);   /* get 8259 interrupt mask register */
 /* initialization */

 outportb (0x2c0, OxO);      /* CNO, port A */
 outportb (0x2c1, OxO);      /* CNO, port B */
 outportb (0x2c2 , 0x08);    /* CNO,PC4=O-->interrupt enable */
                        /*     PC3=1                */
                        /*     PCO=O                */
 outportb (0x2c3 , 0x80);    /* set CNO as output function   */

 clrscr();
 printf("Press any key to generate a rising edge interrupt");

   getch();
   outportb(0x21,0xfb & IMR);         /* set IRQ2 nonmasked */

   printf("\n\nCN0 -- Port C = %x",inportb(0x2c2));
  /* generate a rising edge signal at CNO, PCO */
   outportb (0x2c2 , 0x9);

   printf("\n\nCN0 -- Port C = %x",inportb(0x2c2));
   printf("\n\npress any key to continue...");
   getch();
   clrscr();
   printf("Press any key to generate a falling edge interrupt");
   getch();
   outportb(0x21,0xfb & IMR);         /* set IRQ2 nonmasked */

   outportb (0x2c2 , 0x08);  /* CNO,PC4=O-->interrupt enable */
                        /*    PC3 = 1                */
                        /*    PCO = O                */
   printf("\n\nCN0 -- Port C = %x",inportb(0x2c2));

  /* generate a falling edge signal at CN)O, PC3 */

   outportb (0x2c2 , OxO);

   printf("\n\nCN0 -- Port C = %x",inportb(0x2c2));
   printf("\n\npress any key to quit...");
   getch();

  /* set CNO as INPUT to release IRQ2 line */

   outportb(0x2c3,0x9b);

  /" restore old INT OAH ISR */

   setvect (OxOa , Int_A_Old_Vector);

   outportb(Ox21,IMR);  /* restore 8259 interrupt mask */
  `
```

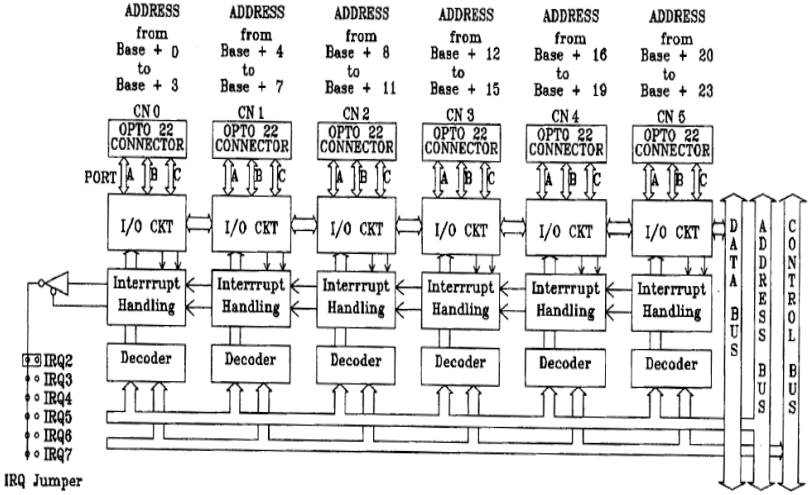

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APPENDIX B

Block Diagram

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Appendix B Block Diagram



PCL-722 BLOCK DIAGRAM

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APPENDIX C

PC I/O PORT ADDRESS MAP

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Appendix C PC I/O Port Address Map

I/O Address Range (Hex)	Function
000-1FF	Base system
200	Reserved
201	Came control
202-277	Reserved
278-27F	Second printer port
280-2F7	Reserved
2F8-2FF	COM2
300-377	Reserved
3713-37F	First printer port
380-3AF	Reserved
3B0-3BF	Mono Disp/Print adapter
3C0-3CF	Reserved
3D0-3DF	Color/Graphics
3E0-3EF	Reserved
3F0-3F7	Floppy disk drive
3F8-3FF	COM1

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