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PCL-725
Relay Actuator and Isolated D/I Card
USER'S MANUAL

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TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION 1
1.1. General Description 1
1.2. Features, Application and Specifications 2

CHAPTER2. INSTALLATION 5
2.1. Initial Inspection 5
2.2. Base Address Selection 5
2.3. ConnectorPin Assignments 7
2.4. Jumpers 7
2.5. Installing The PCL-725 8

CHAPTER3. DIGITAL I/O PROGRAMMING 11

CHAPTER 4. CUSTOMIZE THE CURRENT LIMIT RESISTOR . . . 13

CHAPTER5. RELAY OUTPUT 15
5.1. Using the ContactProtection Nomograph 16

AppendixA. I/Oport Address Map 19

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CHAPTER 1. INTRODUCTION

1.1. General Description

The most common method of interfacing a microcomputer system, such as the PC, is through the use of programmable digital input and output registers.

With digital output registers, the computer can write data into the registers, treating the register as an I/O port. The output of these registers can then be wired to an interface device, such as a relay. Thus, by writing data to an output register, it would be possible to activate and deactivate a relay. The relay could, in turn, control, for example, the power to a motor.

Digital input registers are similar but are used to sample the status of signals attached to their inputs. For example, if a program wants to determine if a switch is open or closed, the switch can be tied to the input of a digital input register. A digital input register can be thought of as an I/O port that has wires attached to individual bit locations. When read, the data results reflect the state of the signals on the wires.

Designed with this idea in mind, the PCL-725 Relay Actuator & Isolated D/I card is an IBM PC add-on card that offers you 8 relay actuators and 8 opto-isolated digital inputs on a single board.

Typically, the 8 on-board relays can serve as ON/OFF control devices or small power switches. The 8 opto-isolated D/I channels are ideal devices for collecting digital inputs under noisy environment or floating potential. Also, the 8 isolated inputs provide the best method to prevent the ground loop problem.

For easy monitoring, each relay is equipped with one red LED to reflect its ON/OFF status. Each input channel is jumper selectable to either isolated or non-isolated input. Access to input and output channels is made possible through a on-board 37-pin D type connector.

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1.2. Features, Application and Specifications

Features :

* 8 Relay actuator outputs.
* 8 Opto-isolated digital inputs.
* LED indicators to show activated relays.
* Jumper selectable isolated/non-isolated input signals.
* On-board relay driver circuits.
* On-board input signal conditioning circuits.
* Easy touse andprogram

Applications :

* Digital signal sensing.
* Switch contact status sensing.
* Limit switch monitoring.
* BCD interface.
* Industrial on/off control.
* Signal switching.
* Valve/solenoid control.
* External high power relay driving.
* Alarm activating.
* Annunciator control.
* Industrial automation.
* Laboratory automation.
* Useful with A/D's and D/A's.

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Specifications:

* Isolated Digital Input

Opto-isolator:	4N25
Input channels:	8
Input current:	60 MA max for isolated input. Input buffered by voltage comparator
Input voltage:	5-24VDC
Input impedance:	560 Ohm/W
Threshold voltage:	1.5 VDC, adjustable by changing voltage dividing resistors
Input mode:	isolated or non-isolated
Withstanding voltage:	1500 VDC

* Non-isolated Digital Input

Logic level 0:	0-0.8 V
Logic level I:	2.0-5.25 V

" Relay Output

Relay Type:	4 SPDT (Form C) 4 SPST (Form A)
Contact rating:	120 V AC/DC, IA
Breakdown voltage:	1000 V AC/DC minimum
Operating time:	8 msec maximum (including Bounce)
Release time:	8 msec maximum
Insulation resistance:	100 MOhm minimum
Life expectancy:	>10 million operations at full load
Power consumption:	+12V, 33 mA for each relay, total 0.264A if ail relays are energized +5V, less than 0.2A
Power supply:	+12V from the PC bus

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* General

Dimensions :	5 3/4" x 3 3/4" (14.7 cm x 9.5 cm.)
Bus :	IBM PC bus.
Slot :	One 62-pin slot.
I/O port Address :	Hex 200 - hex 3F8.

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CHAPTER 2. INSTALLATION

2.1. Initial Inspection

Inside the shipping container, you should find this operating manual and the PCL-725 card.

The PCL-725 was carefully inspected both mechanically and electrically before shipment. It should be free of marks and scratches and in perfect electrical order on receipt.

Remove the PCL-725 interface card from its protective packaging by grasping the metal rear panel. Keep the anti-vibration package since it may be used to return the card if it needs repair. The package may also be used if the card is stored outside of the computer.

The board should be handled only by the edges. The integrated circuits on the board can be damaged by static electric discharge.

2.2. Base Address Selection

Most of the peripheral devices and the interface adapters in the PC are controlled and sensed using the digital input and output ports. These ports are addressed using the I/O port address space of the 8088 or 80286 microcomputer.

The I/O port base address for the PCL-725 is selectable by an 8 position DIP switch. Valid addresses are from hex 200 to hex 3FE. Refer to Figure 2.1 for the location of the DIP switch (SW1).

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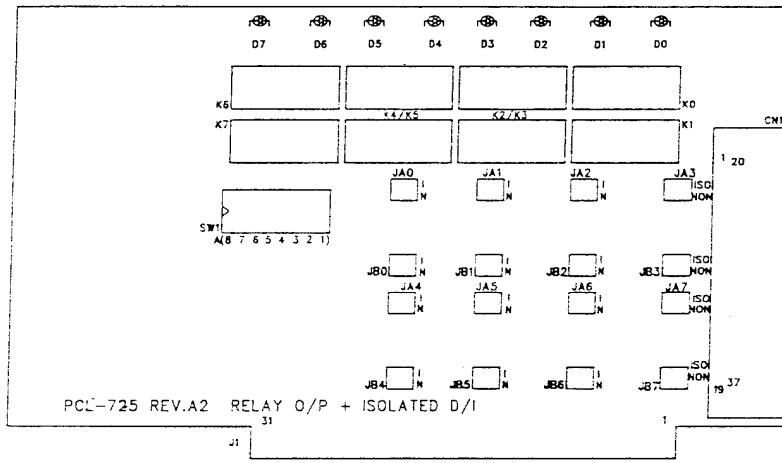


Figure 2.1 The PCL-725 Card

The required switch settings for various base addresses are illustrated as below :

Note :
- ON = 0. OFF = 1
- "X" means "don't care"
- 1..8 are switch positions
- A1..A8 correspond to address lines of the PC bus. A9 is hard-wired to be 1.
- * means factory setting

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I/O port address (Hex)	switch position 1 A8	2 A7	3 A6	4 A5	5 A4	6 A3	7 A2	8 Al
200-201	0	0	0	0	0	0	0	0
.								
.								
*2A8-2A9	0	1	0	1	0	1	0	0
.								
.								
2E8-2E9	0	1	1	1	0	1	0	0
2F8-2F9	0	1	1	1	1	1	0	0
3E8-3E9	1	1	1	1	0	1	0	0
3FE-3FF	1	1	1	1	1	1	1	1

2.3. Connector Pin Assignments

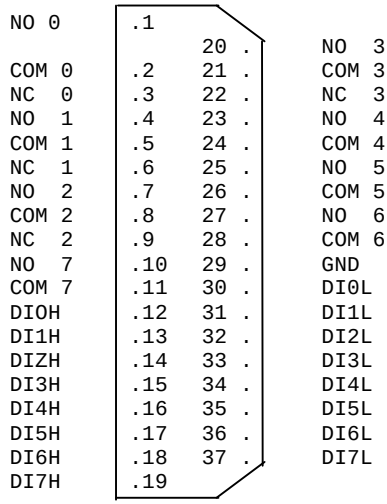
The PCL-725 card is equipped with a 37 pin D type connector accessible from the rear plate. Please refer to Figure 2.1 for the location of the connector.

The following diagram below shows its pin assignments.

Legend:

DInL	- digital input low, channeln
DInH	- digital input high, channel n
GND	-ground
NC n	- normal close pin of relay n
NO n	- normal open pin of relay n
COM n	- common pin of relay n

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2.4. Jumpers

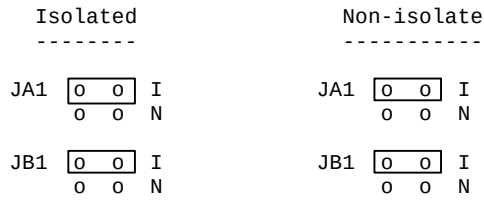
There are two jumpers associated with each digital input channel for configuring the channel as either isolated or non-isolated.

The following show the D/I channels and their corresponding jumpers :

D/I channel	Jumpers
0	JA0, JB0
1	JA1, JB1
2	JA2, JB2
3	JA3, JB3
4	JA4, JB4
5	JA5, JB5
6	JA6, JB6
7	JA7, JB7

Examples are given here to illustrate how to configure the D/I channel. D/I channel 1 is configured as isolated first, then non-isolated.

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To configure channel 1 as isolated, the jumper plugs are installed on the upper posts of JA1 and JB1. Otherwise, jumper plugs should be installed on the lower posts to configure channel 1 as non-isolated.

2.5. Installing The PCL-725

POWER MUST ALWAYS BE SWITCHED OFF when removing or inserting the PCL-725 card and connecting or disconnecting cables.

Use a screw driver to remove the cover mounting screws from the rear of the system unit.

Slide the system unit's cover away from the rear and to the front. When the cover will go no further, tilt it up, remove it from the base, and set it aside.

The PCL-725 is configured at the factory for the IBM PC, PC/XT, PC/AT and all IBM PC compatibles. If you need further changes to the configuration please refer to Chapter 2. Installation.

Use a screw driver to remove the screw that secures the expansion slot cover. Save the screw for installation of the interface card.

The 37 pin connector should be pressed through the rear panel first, then press the card carefully into the main board expansion slot.

Secure the PCL-725 with the 3/16" mounting screw, then attach an appropriate

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cable to the connector.

Slide the system unit's cover back on. Align the system unit tabs with the cover holes and reinstall the 1/4 mounting screws.

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CHAPTER 3. DIGITAL I/O PROGRAMMING

On the PCL-725 card, 8 digital input channels and 8 relay output channels are provided. Two I/O port addresses (started from BASE +0) are reserved for accessing these channels.

The two addresses are allocated as :

BASE +0 D/O channel 0 - 7
BASE +1 D/I channel 0 - 7

A read operation on BASE+1 will read in the value (8 bits) of the 8 corresponding digital input channels.

To access these channels in BASIC, use the statement:

```
VALUE = INP(BASE+1)
```

A write operation on BASE +0 will set the desired status (1 =ON, 0 = OFF) on the 8 corresponding relay output channels. To program these channels in BASIC, use the following statement :

```
OUT BASE,XYZ
```

Where XYZ should be a number between 0 and 255. The status of the relay outputs can be monitored by reading back the BASE+0 byte as shown below:

```
STATUS = INP(BASE)
```

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CHAPTER 4. CUSTOMIZE THE CURRENT LIMIT RESISTOR

The default voltage input range of the PCL-725 is from 0V to 24V. To accept higher voltage input, users can replace the current limit resistors, RAO through RA7, for each channel.

It is easy to choose the proper current limit resistor. Since the 4N25 isolator has a current rating of 60 mA, your input current can not exceed 60 mA. The formula is shown as below:

$$\mathbf{I}_{in} = \mathbf{V}_{in}/\mathbf{R}_{limit}$$

where I_{in}: input current
V_{in}: input voltage
R_{limit}: current limlit resistor

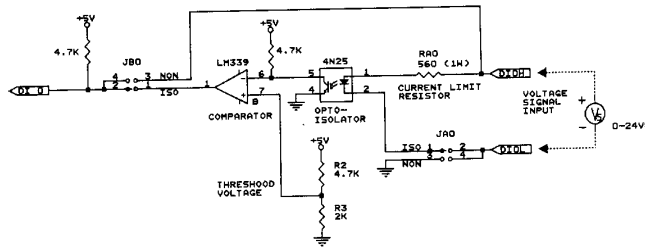
Note: It is suggested that the I_{in} is within 20 mA.

Additionally, you should consider the current limit resistor's maximum power rating. The maximum power consumption should not exceed the power rating of your resistor. The approximate formula is shown as below:

$$\mathbf{P}_{in}=\mathbf{V}_{in}*\mathbf{I}_{in}$$

where I_{in}: input current
V_{in}: input voltage
P_{in}: input power

For example, if your maximum voltage input is 50V, and the current limit resistor you choosed is 1K Ohm, then the maximum current input becomes 50mA. The power consumption of the current linmit resistor is approximately 2.5 Watts. In such situation, the power rating of your resistor should be more than 2.5 Watts.



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CHAPTER 5. RELAY OUTPUT

After power on, the initial relay output status of the PCL-725 is shown as below:

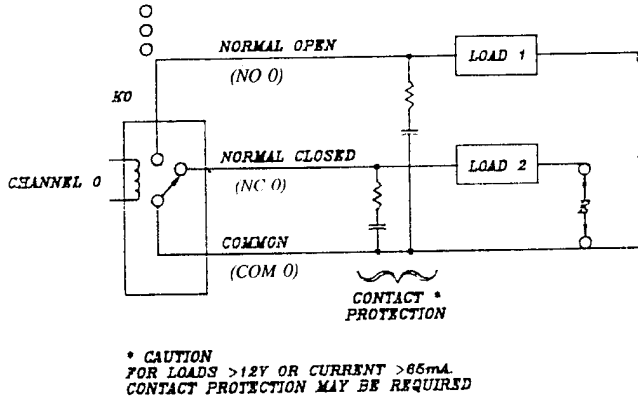


Fig. 5-1

A write operation to I/O address, BASE+O, will change the output status of each relay. For example, if Bit 0 of BASE+0 is set as "1" (logic high), relay 0, K0, will switch from position "NORMAL CLOSE", NC0, to position "NORMAL OPEN", NO0. This means that load2 will be de-energized, while loadl is energized.

To summarize, the "COMMON" line connected to the "NORMAL CLOSED" line, if the corresponding bit is set as 0 (power-on initial status). Otherwise, if the corresponding bit is set as i, then the "COMMON" line will connect to the "NORMAL OPEN" line.

Warning: External circuits connected to the PCL-725's relay output port must be fused at 1A or less, and be rated at 120VA or less. Voltage must not exceed +/- 120V peak.

For maximum relay contact life, and to prevent RFI if arcing occurs, contact protection is required for inductive loads greater than 12 V, @64mA.

For more information, please refer to section 5.1.

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5.1. Using the Contact Protection Nomograph

Loads which may cause relay contact arcing may also cause contact failure, unless contact protection is provided. The nomograph, provided in Figure 5-3, provides suitable guidelines for R-C network design for most loads. For PCL-725, you should provide relay contact protection if the load to be switched is greater than 12 V @ 65 mA. Figure 5-2 illustrates an example of a relay contact protection network. For instance, if the load to be switched is 50 V @ 300 mA, then R = 56 ohms and C = 0.009 u*F* (remember that, for PCL-725's relay output, E = 120 V maximum).

The R-C network should be mounted as close to the relay contacts as possible.

NOTE: The nomograph indicates that for 70<E<100 V, R can be +/- 50% of the nominal chart value.

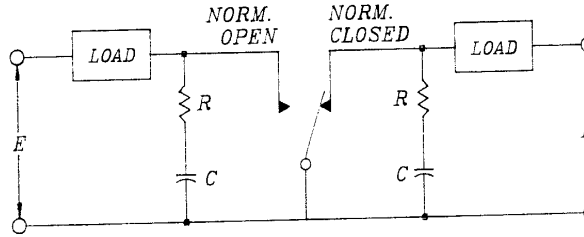


Figure 5-2

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CONTACT PROTECTION

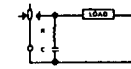
Contact loads that can cause arcing may result in contact failure unless contact protection is provided. It should be wired close to the relay terminals.

The R-C network shown is suitable for most loads. Component values may be obtained from the nomograph. Capacitance may be increased (up to 10 times) to minimize inductive load transients. Use peak values for ac circuits.

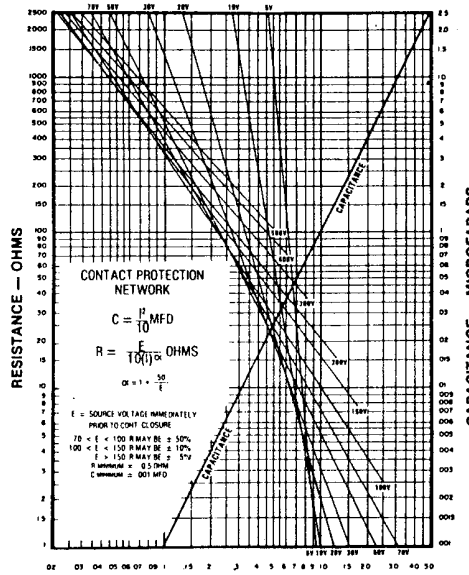
No protection is required for voltages below 12 volts or currents below 65ma.

The resistor may be eliminated for voltages below 50 volts with currents below 0.5A. The capacitor should not exceed the chart value.

Highly capacitize loads do not require protection.



CONTACT PROTECTION NOMOGRAPH



HOW TO USE THE NOMOGRAPH

To determine C, the load current value is found on the CURRENT axis. Reading directly up to the sloping capacitance line, the C value is determined from the right hand CAPACITANCE scale. To determine R, read directly up from the load current value to its intersection with the appropriate load voltage line. The value of R is then read from the left hand RESISTANCE scale. For ac loads, peak current and voltage values must be used.

Figure 5-3

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Appendix A. I/O Port Address Map

I/O address range (Hex)	Uses
000-1FF	Used by base system board
200	Not used
201	Game control
202-277	Not used
278-27F	Second printer port
280-2F7	Not used
2F8-2FF	COM2
300-377	Not used
378-37F	Printer port
380-3AF	Not used
3B0-3BF	Monochrome and printer
3C0-3CF	Not used
3D0-3DF	Color & graphics
3E0-3EF	Not used
3F0-3F7	5 1/4 inch diskette drive
3F8-3FF	COM1

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