

DIO-24/DIO-96/DIO-144

User's Manual

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DIO-24 24 Bit OPTO-22 Compatible DI/O Board

1. Features

- 24 digital I/O lines
 - OPTO-22 pin compatible
 - Programmable interrupt handling
 - Buffer output for higher driving capability than 8255
 - Register compatible to 724 series
-

2. Applications

- Interfacing with any OPTO-22 compatible I/O module
 - Digital I/O control
 - Contact closure monitoring
 - Alarm monitoring
 - Useful with parallel interface devices
-

3. Specification

- Logic input and output
 - Input logic high voltage : 2.0V(Min)/5.0V(Max)
 - Input logic low voltage : -0.5V(Min)/0.8V(Max)
 - Input load current : -0.45mA(Min)/+70 μ A
 - Output sink current : +64mA(Max)
 - Output source current : -15mA
 - All outputs and inputs are TTL compatible
 - Power consumption : +5V @ 500mA (typical)
 - Environmental :
 - Operating Temperature : 0 to 60°C
 - Storage Temperature : -20°C to 80 °C
 - Humidity : 0 to 90 % non-condensing
-

4. Product Check List

In addition to this manual, the package includes the following items:

- one piece of DIO-24 card
- one piece of company floppy diskette or CD
- one piece of release note

It is recommended to read the release note firstly. All importance information will be given in release note as follows:

1. where you can find the software driver & utility
2. how to install software & utility
3. where is the diagnostic program
4. FAQ

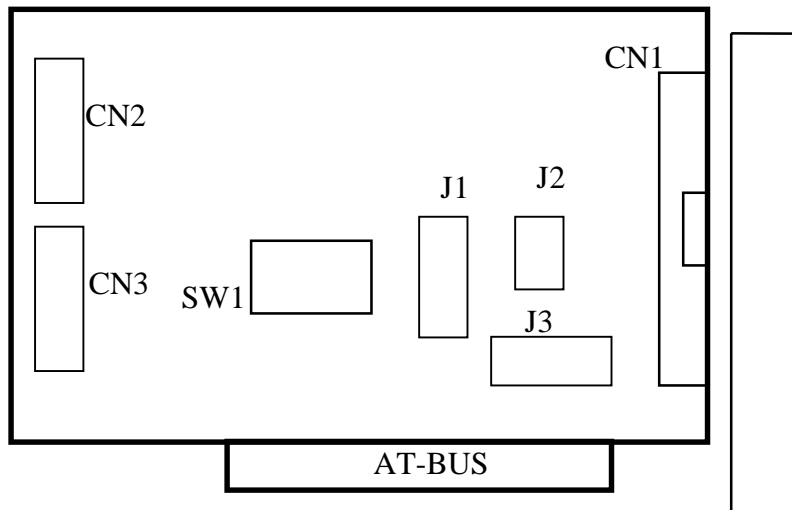
Attention!

If any of these items is missing or damaged, contact the dealer from whom you purchased the product. Save the shipping materials and carton in case you want to ship or store the product in the future.

5. Functional Description

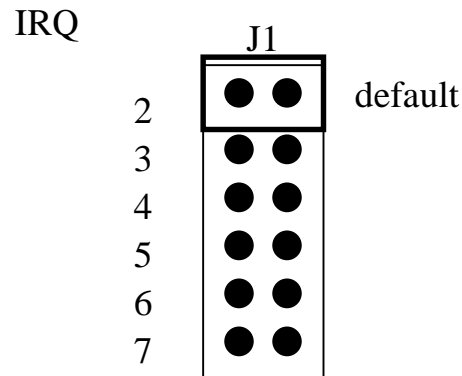
The DIO-24 provides 24 TTL digital I/O lines. The DIO-24 emulates 8255 mode 0 only and has a increased output current of 15 mA (source) and 64mA (sink), allowing it to control LED, relay, etc .The DIO-24 consists of three 8 bit bi-directional ports and two input lines for interrupt enable and interrupt. The eight bit ports are named port A(PA),port B(PB),port C(PC). The port C can be split into two nibble wide port. All ports are configured as inputs upon power-up or reset. The DIO-24 uses 4 consecutive I/O locations in I/O addressing space. The base address is selectable using an 8-position dip switch from 200 to 3FF hex. The interrupt signal can be connected to any of the interrupt levels 2 through 7 available on the PC bus via a jumper.

5.1 Layout

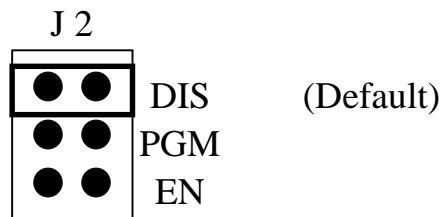


5.2 Jumper setting

5.2.1 Interrupt jumper setting



5.2.2 Interrupt Status Setting

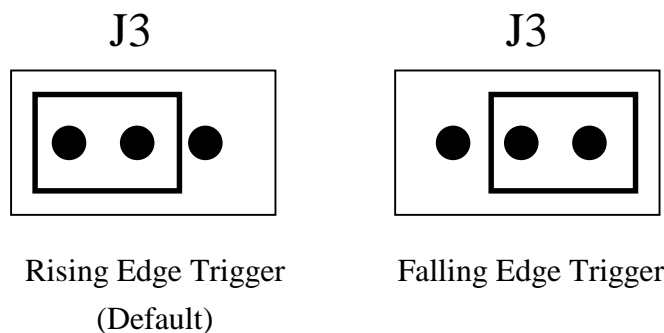


DIS :Interrupt disable (Default)

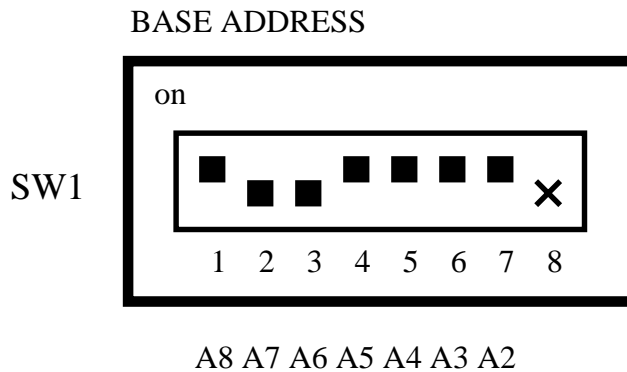
PGM :Programmable Interrupt enable , when PC-4 is low

EN : Interrupt enable

5.2.3 Interrupt Trigger edge Setting



5.3 Base address Setting



Default DIP switch setting

I/O address (Hex)	1 A8	2 A7	3 A6	4 A5	5 A4	6 A3	7 A2	8
200-203	0	0	0	0	0	0	0	X
204-207	0	0	0	0	0	0	1	X
.....	.	.	.	.	.	.	.	X
2C0-2C3 (*)	0	1	1	0	0	0	0	X
2C4-2C7	0	1	1	0	0	0	1	X
2C8-2CB	0	1	1	0	0	1	0	X
.....								X
3F8-3FB	1	1	1	1	1	1	0	X
3FC-3FF	1	1	1	1	1	1	1	X

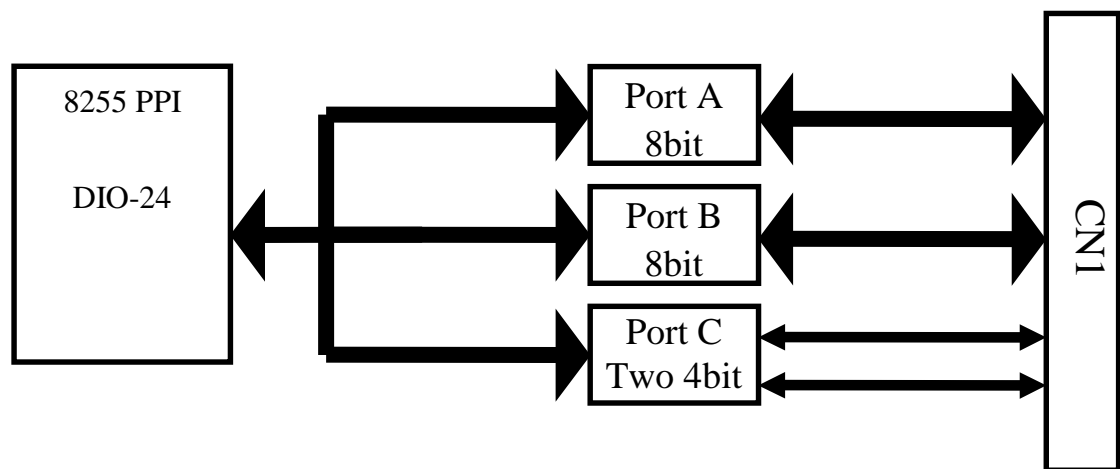
O=ON 1=OFF

(*) : **Default setting**

X = don't care

5.4 Pin Assignment

The CN1 of DIO-24 emulate as Intel 8255 general purpose programmable peripheral interface. Figure shows DIO-24 I/O port equally block diagram.



DIO-24 Block diagram

Note :

When power on computer the DIO-24 default status is input mode.

CN1: 50-pin header

Pin Number	Description	Pin Number	Description
1	PC7	2	GND
3	PC6	4	GND
5	PC5	6	GND
7	PC4	8	GND
9	PC3	10	GND
11	PC2	12	GND
13	PC1	14	GND
15	PC0	16	GND
17	PB7	18	GND
19	PB6	20	GND
21	PB5	22	GND
23	PB4	24	GND
25	PB3	26	GND
27	PB2	28	GND
29	PB1	30	GND
31	PB0	32	GND
33	PA7	34	GND
35	PA6	36	GND
37	PA5	38	GND
39	PA4	40	GND
41	PA3	42	GND
43	PA2	44	GND
45	PA1	46	GND
47	PA0	48	GND
49	+5V	50	GND

CN2: 20-pin header

Pin Number	Description	Pin Number	Description
1	PA0	2	PA1
3	PA2	4	PA3
5	PA4	6	PA5
7	PA6	8	PA7
9	PB0	10	PB1
11	PB2	12	PB3
13	PB4	14	PB5
15	PB6	16	PB7
17	GND	18	GND
19	5V	20	12V

CN3: 20-pin header

Pin Number	Description	Pin Number	Description
1	PC0	2	PC1
3	PC2	4	PC3
5	PC4	6	PC5
7	PC6	8	PC7
9	NC	10	NC
11	NC	12	NC
13	NC	14	NC
15	NC	16	NC
17	GND	18	GND
19	5V	20	12V

6. PROGRAMMING

The DIO-24 emulates MODE 0 of 8255, and Mode 0 of 8255 provides basic input and output operations through each of the ports A, B and C. Output data is latched and input data follows the peripheral.

Mode 0 of 8255 PPI functions

- 16 different configurations
- Two 8-bit port and two 4bit-ports
- Input are not latched
- Output are latched

6.1 Register

The DIO-24 each port can be defined to input or output mode.

Address	Register	Read / Write
Base+0	Port A	R/W
Base+1	Port B	R/W
Base+2	Port C	R/W
Base+3	CFG	Write only

Register Functions

D7	D6	D5	D4	D3	D2	D1	D0
1	0	0	?	?	0	?	?
1	X	X	Port A 1:Input 0:Output	Port C 1:Input 0:Output (High nibble)	X	Port B 1:Input 0:Output	Port C 1:Input 0:Output (Low nibble)

CFG Register format

CFG Configurations Table

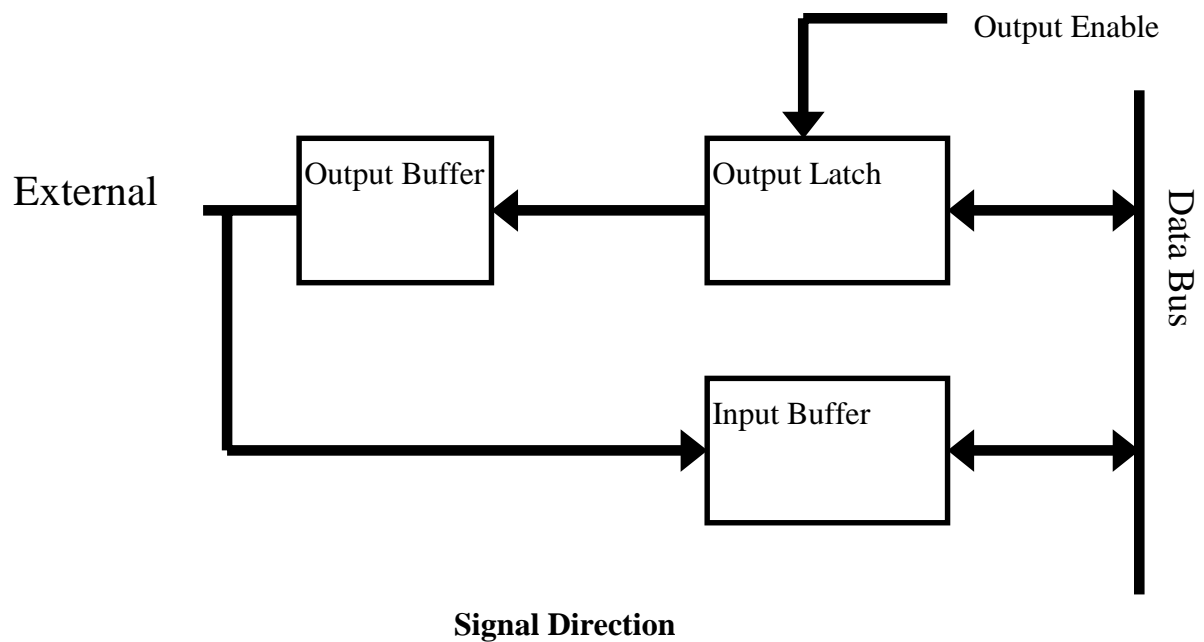
	D4	D3	D1	D0
CFG	PA0-PA7	PC4-PC7	PB0-PB7	PC0-PC3
80H	O	O	O	O
81H	O	O	O	I
82H	O	O	I	O
83H	O	O	I	I
88H	O	I	O	O
89H	O	I	O	I
8AH	O	I	I	O
8BH	O	I	I	I
90H	I	O	O	O
91H	I	O	O	I
92H	I	O	I	O
93H	I	O	I	I
98H	I	I	O	O
99H	I	I	O	I
9AH	I	I	I	O
9BH	I	I	I	I

6.2 Interrupt Handling

The Port C 0 can generate a hardware interrupt to computer. Use the interrupt you must set the IRQ level to be used. The J1 is used to select IRQ level and the J2 is used to select the desired interrupt enable mode. Then the J3 is used to select rising edge trigger or falling edge trigger .

6.3. Output Latch

The signal direction of DIO-24 is software programmable. When user turns on or reset computer, all ports are configured as input mode. When the DIO-24 is programmed as output mode, it does not output until program execute the output instruction.



6.4 Program Example

The DIO-24 I/O card is very easy to programming input/ output function.

Example (Quick Basic)

Bas=&H2C0

'===== Init DIO-24 Port A and Port B Input mode Port C output mode =====

OUT Bas+3,&H92

' Reference Configuration table

'=====

PA = INP(Bas+0)

'Read Port A Data

PB = INP(Bas+1)

'Read Port B Data

OUT Bas+2 , &HFF

'Write Data to Port C , set Channel 0-7 is high

OUT Bas+3,&H80

' Set Port A,B,C is Output Mode

OUT Bas+0, 0

' Write Data to Port A

OUT Bas+1, 0

' Write Data to port B

OUT Bas+2, 0

' Write Data to Port C

OUT Base+3,&H9B

' Set Port A,B,C is Input mode

PA=INP(Bas+0)

' Read Port A Data

PB=INP(Bas+1)

' Read Port B Data

PC=INP(Bas+2)

' Read Port C Data

DIO-144/96 144/96 Bit OPTO-22 Compatible DI/O Board

1. Features

- 144/96 digital I/O lines
 - OPTO-22 pin compatible
 - Programmable interrupt handling
 - Buffer output for higher driving capability than 8255
 - Register compatible to 722 series
-

2. Applications

- Interfacing with any OPTO-22 compatible I/O module
 - Digital I/O control
 - Contact closure monitoring
 - Alarm monitoring
 - Useful with parallel interface devices
-

3. Specification

- Logic inputs and output
 - Input logic high voltage : 2.0V(Min)/5.0V(Max)
 - Input logic low voltage : -0.5V(Min)/0.8V(Max)
- Input load current : -0.45mA(Min)/+70 μ A
- Output sink current : +64mA(Max)
- Output source current : -15mA
- All outputs and inputs are TTL compatible
- Power consumption : +5V @ 800mA/700mA max.(DIO-144/DIO-96)
- Environmental :
 - Operating Temperature : 0 to 60°C
 - Storage Temperature : -20°C to 80 °C
 - Humidity : 0 to 90 % non-condensing

4. Product Check List

In addition to this manual, the package includes the following items:

- one piece of DIO-144/96 card
- one piece of company floppy diskette or CD
- one piece of release note

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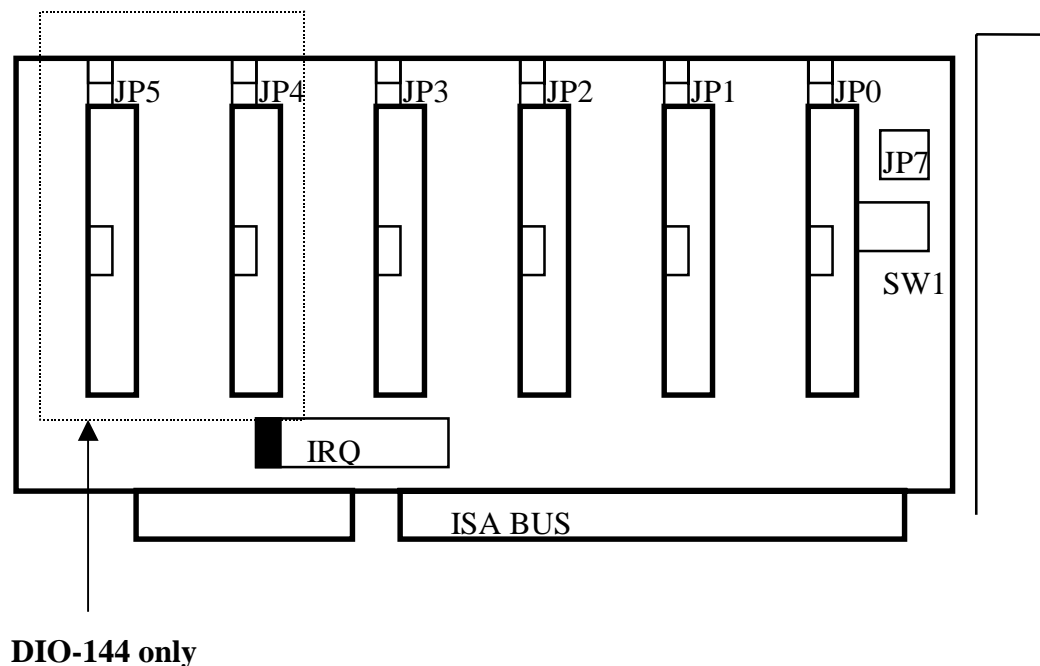
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5. Functional Description

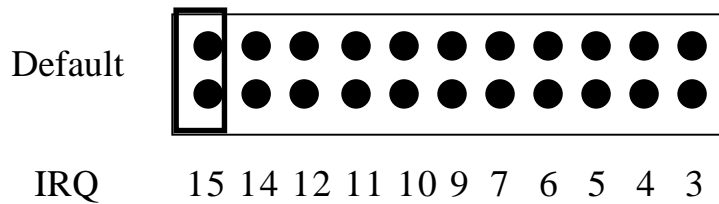
The DIO-144/96 provides 144/96 TTL digital I/O lines. It emulates six channel 8255 mode 0 (basic input/output mode) and has an increased output current of 15 mA (source) and 64mA (sink), allowing it to control LED, relay, etc. The DIO-144/96 each connector consists of three 8 bit bi-directional ports and two input lines for interrupt enable and interrupt. The eight bit ports are named port A(PA), port B(PB), port C(PC). The port C can be split into two nibbles wide port. All ports are configured as inputs upon power-up or reset. The DIO-144/96 uses 4 consecutive I/O locations in I/O addressing space. The base address is selectable by using an 8-position DIP switch from 200 to 3FF hex. The interrupt signal can be connected to any of the interrupt levels 2 through 15 available on the PC bus via a jumper.

5.1 Layout



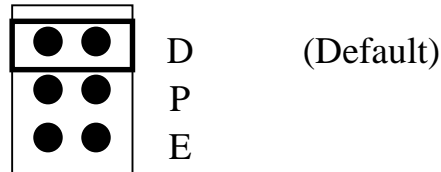
5.2 Jumper setting

5.2.1 Interrupt jumper setting



5.2.2 Interrupt Status Setting

Jumper number : JP0 , JP1 , JP2 , JP3 , JP4 , JP5



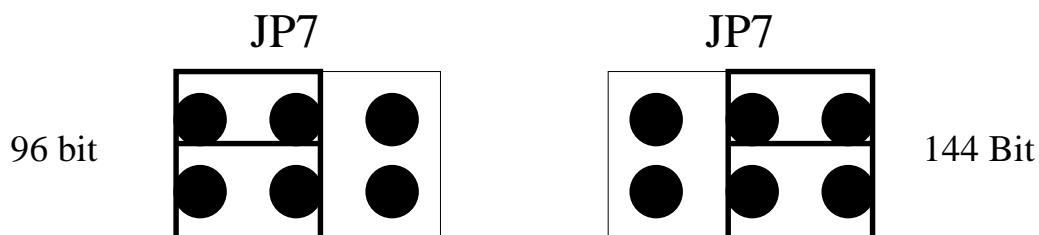
D :Interrupt disable (Default)

P: Programmable Interrupt enable , when PC-4 is low

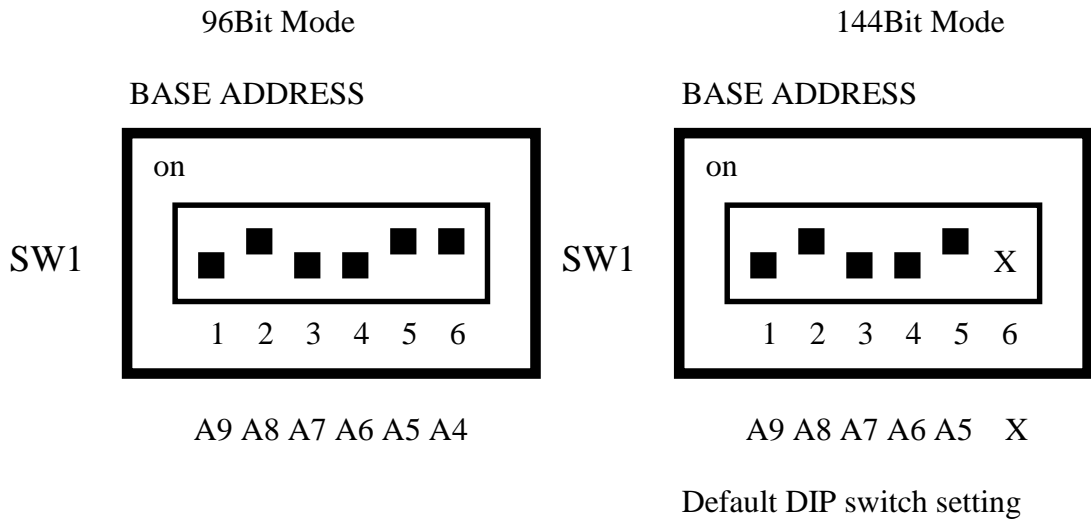
E : Interrupt enable

5.2.3 144/96 Setting

The DIO-144/96 provides 144/96 bit mode. The 144 bit mode (Channel 0-5) requires 24 consecutive locations in I/O address space, the 96 bit mode (Channel 0-3) requires 16 consecutive locations in I/O address space.



5.3 Base address Setting



96 Bit Address Table

I/O Address	1 A9	2 A8	3 A7	4 A6	5 A5	6 A4
200	1	0	0	0	0	0
210	1	0	0	0	0	1
.....
2C0 (*)	1	0	1	1	0	0
.....
300	1	1	0	0	0	0
310	1	1	0	0	0	1
.....
3F0	1	1	1	1	1	1

O=ON 1=OFF

(*) : **Default setting**

x = don't care

144 Bit Address Table

I/O Address	1 A9	2 A8	3 A7	4 A6	5 A5	6 X
200	1	0	0	0	0	X
220	1	0	0	0	1	X
.....	.	.	.	.	.	X
2C0 (*)	1	0	1	1	0	X
2E0	1	0	1	1	1	X
.....	.	.	.	.	.	X
300	1	1	0	0	0	X
.....	.	.	.	.	.	X
3E0	1	1	1	1	1	X

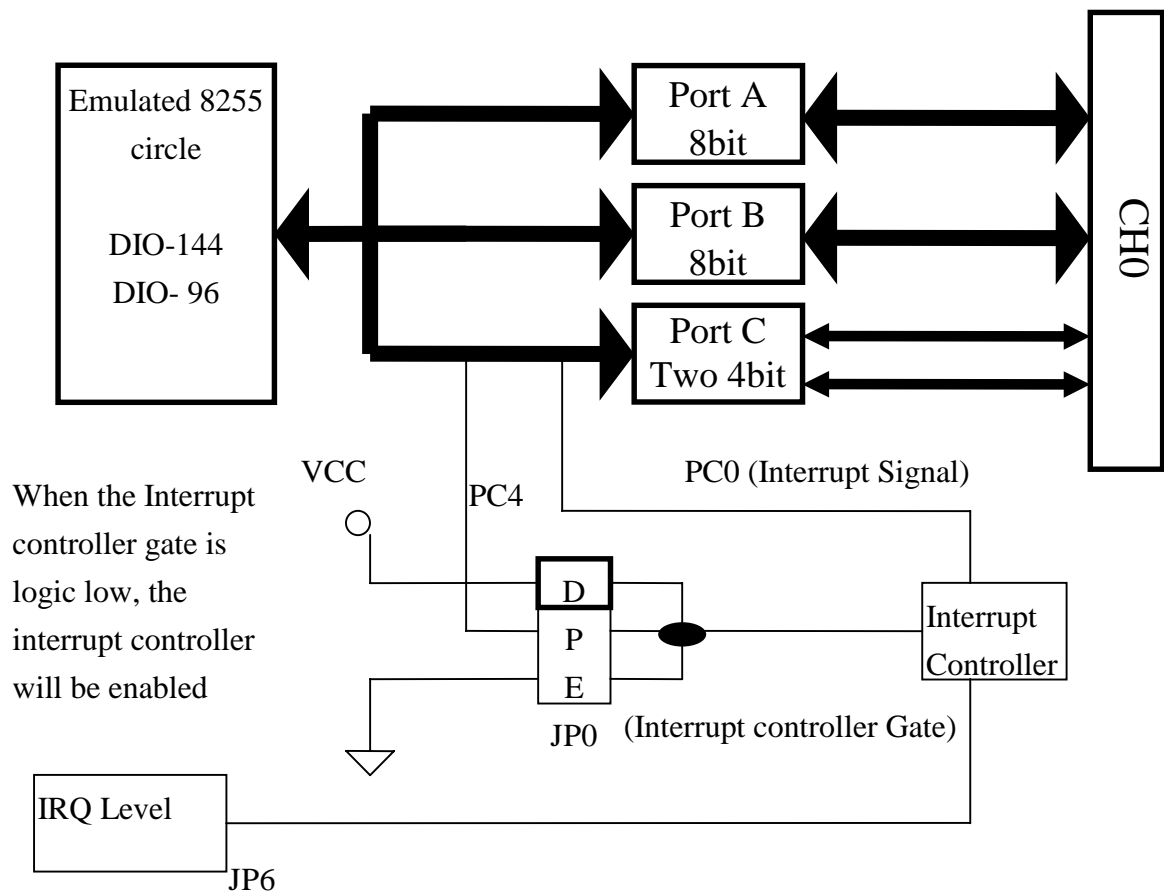
O=ON 1=OFF

(*) : **Default setting**

x = don't care


5.4 Pin Assignment

The CN1 of DIO-144/96 emulates as Intel 8255 general purposes programmable peripheral interface. Figure shows DIO-144/96 I/O port equally block diagram.



Pin assignment CH0-CH5

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



6. PROGRAMMING

The DIO-144/96 offers six/four OPTO-22 connectors, which are emulated MODE 0 of 8255. Mode 0 of 8255 provides basic input and output operations through each of the ports A, B and C. Output data is latched and input data follows the peripheral.

Mode 0 of 8255 PPI Functions

- 16 different configurations
- Two 8-bit port and two 4bit-ports
- Input are not latched
- Output are latched

6.1 Register

	I/O Address	Channel
144 Bit Mode	2C0 ~ 2DF	CH 0 ~ CH 5
96 Bit Mode	2C0 ~ 2CF	CH 0 ~ CH 3

144 Bit Mode I/O Register Default I/O Address : 0x2C0 (Hex)

Address (Hex.)	Register	Read / Write
Base + 0x00	CH 0_Port A	R/W
Base + 0x01	CH 0_Port B	R/W
Base + 0x02	CH 0_Port C	R/W
Base + 0x03	CH 0_CFG	Write only
Base + 0x04	CH 1_Port A	R/W
Base + 0x05	CH 1_Port B	R/W
Base + 0x06	CH 1_Port C	R/W
Base + 0x07	CH 1_CFG	Write only
Base + 0x08	CH 2_Port A	R/W
Base + 0x09	CH 2_Port B	R/W
Base + 0x0A	CH 2_Port C	R/W
Base + 0x0B	CH 2_CFG	Write only

Base + 0x0C	CH 3_Port A	R/W
Base + 0x0D	CH 3_Port B	R/W
Base + 0x0E	CH 3_Port C	R/W
Base + 0x0F	CH 3_CFG	Write only
Base + 0x10	CH 4_Port A	R/W
Base + 0x11	CH 4_Port B	R/W
Base + 0x11	CH 4_Port C	R/W
Base + 0x12	CH 4_CFG	Write only
Base + 0x13	CH 5_Port A	R/W
Base + 0x14	CH 5_Port B	R/W
Base + 0x15	CH 5_Port C	R/W
Base + 0x16	CH 5_CFG	Write only

96 Bit Mode I/O Register Default I/O Address : 0x2C0(Hex)

Address (Hex.)	Register	Read / Write
Base + 0x00	CH 0_Port A	R/W
Base + 0x01	CH 0_Port B	R/W
Base + 0x02	CH 0_Port C	R/W
Base + 0x03	CH 0_CFG	Write only
Base + 0x04	CH 1_Port A	R/W
Base + 0x05	CH 1_Port B	R/W
Base + 0x06	CH 1_Port C	R/W
Base + 0x07	CH 1_CFG	Write only
Base + 0x08	CH 2_Port A	R/W
Base + 0x09	CH 2_Port B	R/W
Base + 0x0A	CH 2_Port C	R/W
Base + 0x0B	CH 2_CFG	Write only
Base + 0x0C	CH 3_Port A	R/W
Base + 0x0D	CH 3_Port B	R/W
Base + 0x0E	CH 3_Port C	R/W
Base + 0x0F	CH 3_CFG	Write only

6.2 Data Format

The DIO-144/96 provides 6/4 channel opto-22 connectors and each channel have 3 digital input / output port. Each port could be programmed as input or output mode by CFG register.

CFG Register Formatted

D7	D6	D5	D4	D3	D2	D1	D0
1	0	0	?	?	0	?	?
1			Port A 1:Input 0:Output	Port C 1:Input 0:Output (High nibble)		Port B 1:Input 0:Output	Port C 1:Input 0:Output (Low nibble)

Configurations Table

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

The DIO-144/96 each port can be CFG register initial to input port or output port .
 The port A and port B is 1 byte (1 byte = 8 bits) and the port C is 2 nibble byte
 (nibble byte = 4 bits) .

Input / Output Port Data Format

Port_A

Port_A_7	Port_A_6	Port_A_5	Port_A_4	Port_A_3	Port_A_2	Port_A_1	Port_A_0
D7	D6	D5	D4	D3	D2	D1	D0

Port_B

Port_B_7	Port_B_6	Port_B_5	Port_B_4	Port_B_3	Port_B_2	Port_B_1	Port_B_0
D7	D6	D5	D4	D3	D2	D1	D0

Port_C

Port_C_7	Port_C_6	Port_C_5	Port_C_4	Port_C_3	Port_C_2	Port_C_1	Port_C_0
High nibble3	High nibble2	High nibble1	High nibble0	Low nibble3	Low nibble2	Low nibble1	Low nibble0
D7	D6	D5	D4	D3	D2	D1	D0

Example : Initialize

1. Initial channel 0 Port A input mode, Port B input mode, Port C output mode
 - 1.1 Reference I/O register table : channel 0 CFG = Base + 0x03
 - 1.2 Reference CFG format table : Port_A_I , Port_B_I , Port_C_O = 0x92
 Note : Port_A_I means : Port A Input mode
 Port_C_O means : Port C Output mode
 - 1.3 Output initial data to CFG register : outputb (Base + 0x03 , 0x92);
 - 1.4 Then you can reading data from Port A & Port B and output data to Port C of channel 0
2. Initial channel 1 port A output mode , port B output mode , port C input mode
 - 2.1 Reference I/O register table : channel CFG = Base + 0x07
 - 2.2 Reference CFG format table : Port_A_O , Port_B_O , Port_C_I = 0x89
 - 2.3 Output initial data to CFG register : outputb (Base +0x07 , 0x89);
 - 2.4 Then you can output data to port A & port B and reading data from port C
3. Other channel initialize as same as step 1 and step2.

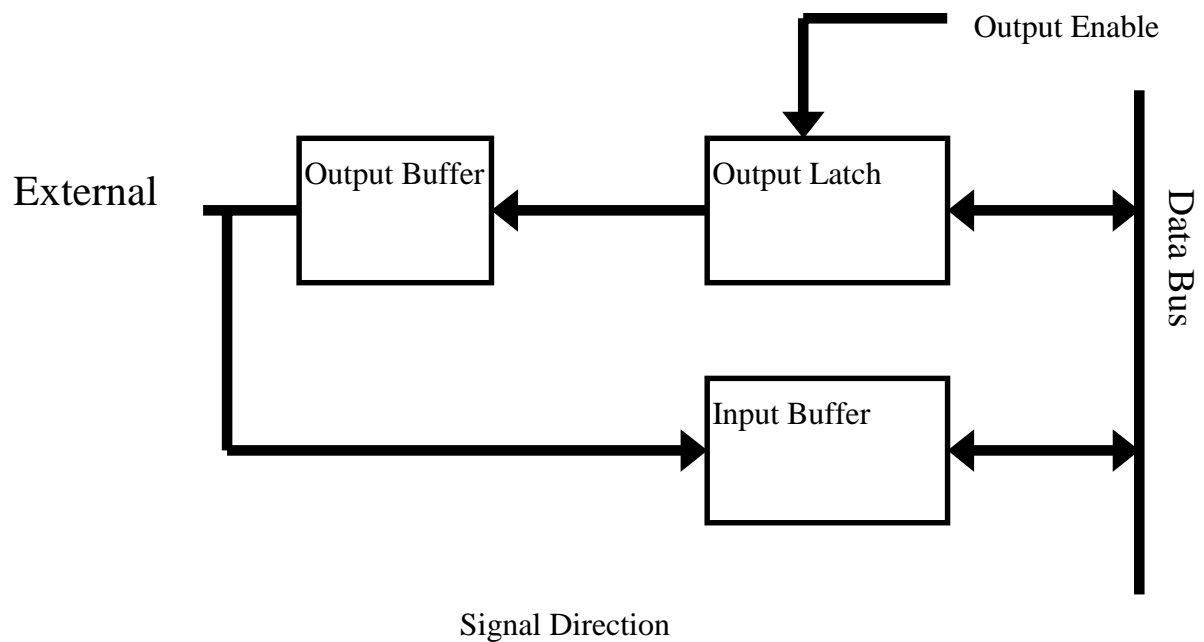
6.3 Interrupt Handling

The Port C_0 of each connector can generate a hardware interrupt to computer. Use the interrupt you must set the IRQ level to be used. The JP6 is used to select IRQ level and the JP0-JP6 is used to select the desired interrupt enable mode.

6.4 Output Latch

The DIO-144/96 signal direction is software programmable. When users turn on or reset computer, all ports are configured as input mode.

When the DIO-144/96 is programmed as output mode, it does not output until program execute the output instruction.



6.5 Program Example

The DIO-144/96 I/O card is very easy to programming input/ Output function.

Example (Quick Basic)

Bas=&H2C0

‘===== Init DIO-144/96 Port A and Port B Input mode Port C output mode =====

OUT Bas+3,&H92 ‘ Reference Configuration table

‘=====

PA = INP(Bas+0) ‘Read Port A Data

PB = INP(Bas+1) ‘Read Port B Data

OUT Bas+2 , &HFF ‘Write Data to Port C , set Channel 0-7 is high

‘===== initial channel 1 =====

OUT Bas+7,&H80 ‘ Set Port A,B,C is Output Mode

OUT Bas+4, 0 ‘ Write Data to Port A

OUT Bas+5, 0 ‘ Write Data to port B

OUT Bas+6, 0 ‘ Write Data to Port C

‘===== initial channel 2 =====

OUT Base+&HB,&H9B ‘ Set Port A,B,C is Input mode

PA=INP(Bas+&H8) ‘ Read Port A Data

PB=INP(Bas+&H9) ‘ Read Port B Data

PC=INP(Bas+&HA) ‘ Read Port C Data

Appendix: Daughter Board

Daughter Board Comparison Table

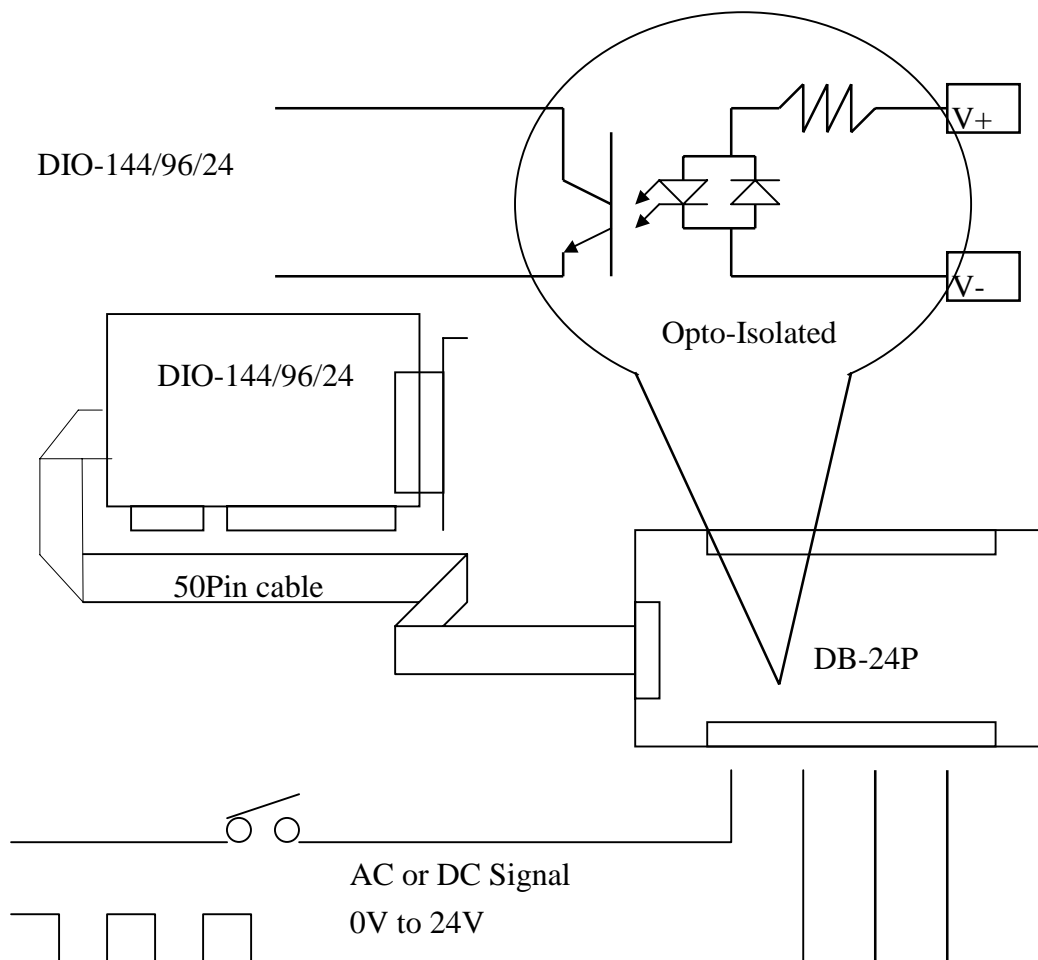
	20-pin flat-cable	50-pin flat-cable	D-sub 37-pin
DB-37	No	No	Yes
DN-37	No	No	Yes
ADP-37/PCI	No	Yes	Yes
ADP-50/PCI	No	Yes	No
DB-24P	No	Yes	No
DB-24PD	No	Yes	Yes
DB-16P8R	No	Yes	Yes
DB-24R	No	Yes	No
DB-24RD	No	Yes	Yes
DB-24C	Yes	Yes	Yes
DB-24PR	Yes	Yes	No
Db-24PRD	No	Yes	Yes
DB-24POR	Yes	Yes	Yes
DB-24SSR	No	Yes	Yes

The DIO-24 /DIO-144/96 offers 50 pin Opto-22 connector which could be connected to daughter board, such as

1. DB-24PD: 24 OPTO-isolated Digital Input Terminal Board.
2. DB-24RD: 24 Relay Output Board
3. DB-24PRD: 24 Power Relay Output Board

DB-24P/24PD Isolated Input Board

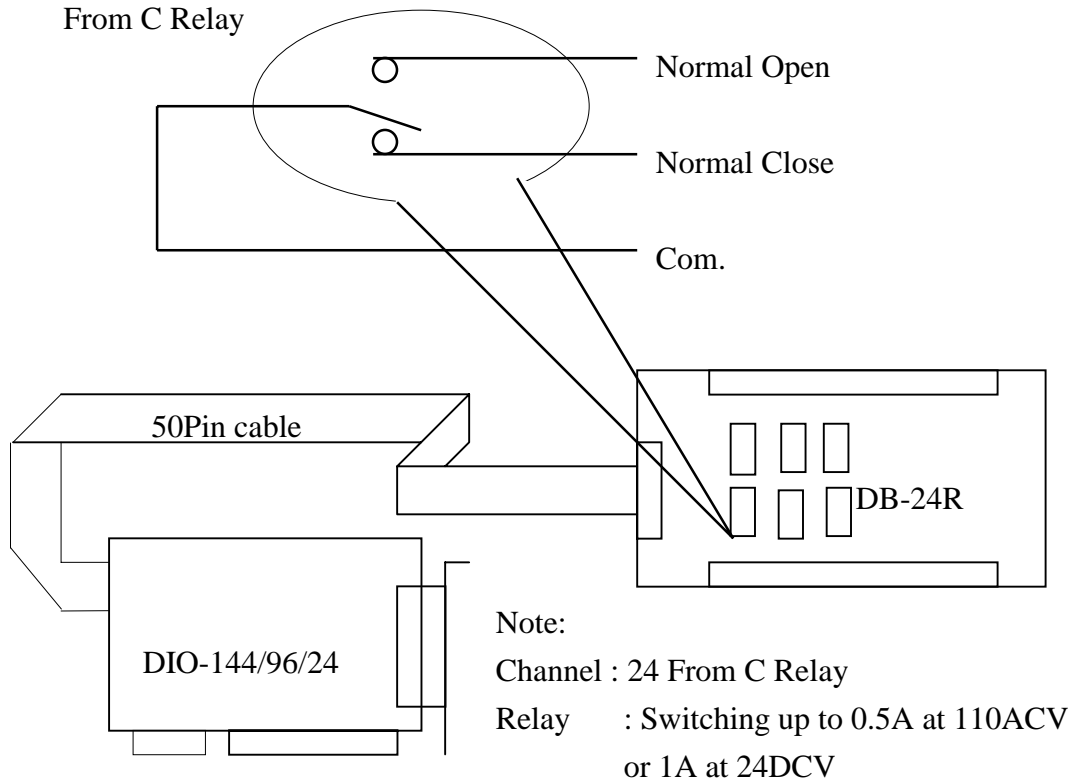
The DB-24P/24PD is a 24-channel isolated digital input daughter board. The optically isolated inputs of the DB-24P/24PD consist of a bi-directional optocoupler with a resistor for current sensing. You can use the DB-24P/24PD to sense DC signal from TTL levels up to 24V or use the DB-24P to sense a wide range of AC signals. You can use this board to isolate the computer from large common-mode voltage, ground loops and transient voltage spike that often occur in industrial environments.



	DB-24P	DB-24PD
50-pin flat-cable header	Yes	Yes
D-sub 37-pin header	No	Yes
Other specifications	Same	

DB-24R, DB-24RD Relay Board

The DB-24R/DB-24RD, 24-channel relay output board, consists of 24 form C relays for efficient switch of load by programmed control. The relay are energized by apply 12V/24V voltage signal to the appropriated relay channel on the 50-pin flat connector. There are 24 enunciator LEDs for each relay, light when their associated relay is activated.



	DB-24R	DB-24RD
50-pin flat-cable header	Yes	Yes
D-sub 37-pin header	No	Yes
Other specifications	Same	

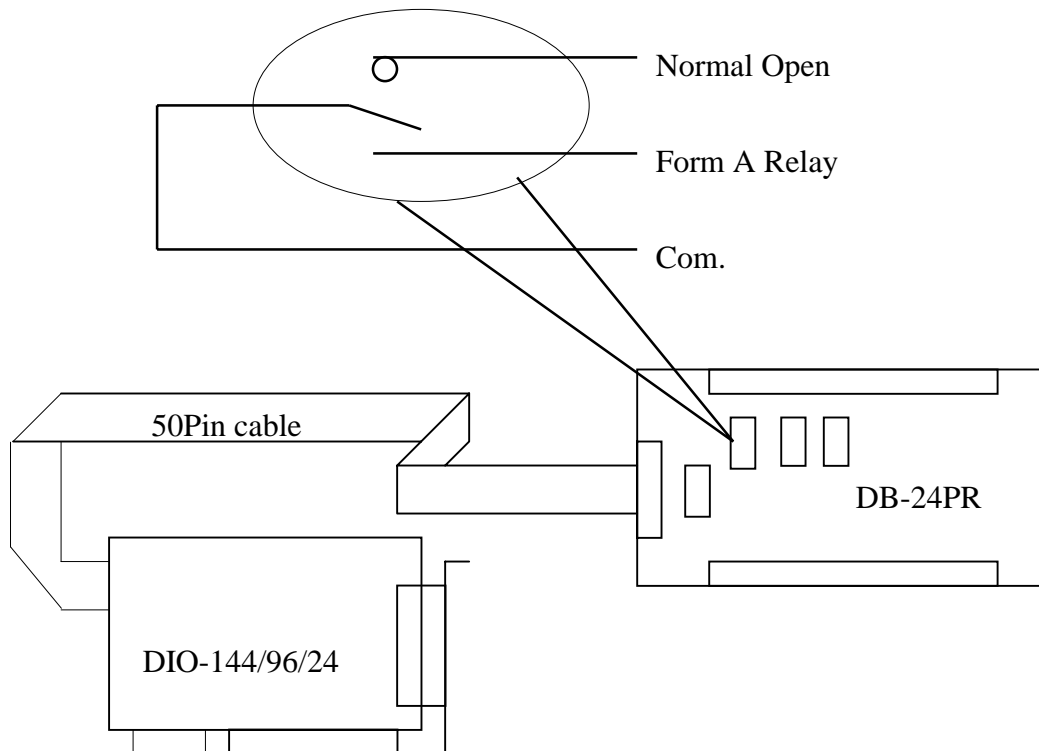
The other output daughter boards are given as following:

DB-24R, DB-24RD	24*Relay (120V, 0.5A)
DB-24PR, DB-24PRD	24* Power Relay (250V, 5A)
DB-24POR	24*photo MOS Relay (350V, 0.1A)
DB-24SSR	24*SSR (250VAC, 4A)
DB-24C	24*O.C. (30V, 100 mA)
DB-16P8R	16*Relay (120V, 0.5A) + 8*isolated input

DB-24PR, DB-24PRD

DB-24PR	24* power relay, 5A/250V
DB-24POR	24*photo MOS relay, 0.1A/350VAC
DB-24C	24*open collector, 100mA per channel, 30V max.

The DB-24PR, 24-channel power relay output board, consists of 8 form C and 16 form A electromechanical relays for efficient switching of load programmed control. The contact of each relay can control a 5A load at 250VAC/30VDC. The relay is energized by applying 5V signal to the appropriate relay channel on the 20-pin flat cable connector (just used 16 relays) or 50-pin flat cable connector(OPTO-22 compatible, for DIO-24 series). Twenty-four enunciator LEDs, one of each relay, light when their associated relay is activated. To avoid overloading your PC's power supply, this board needs a +12VDC or +24VDC external power supply.



Note:

Channel : 8 form C relays (SPDT) and 16 form A relay

Relay : Switch up to 5A at 250 VAC / 5A at 30VDC