DIO-24/DIO-144

User's Manual

Warranty

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Contents

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

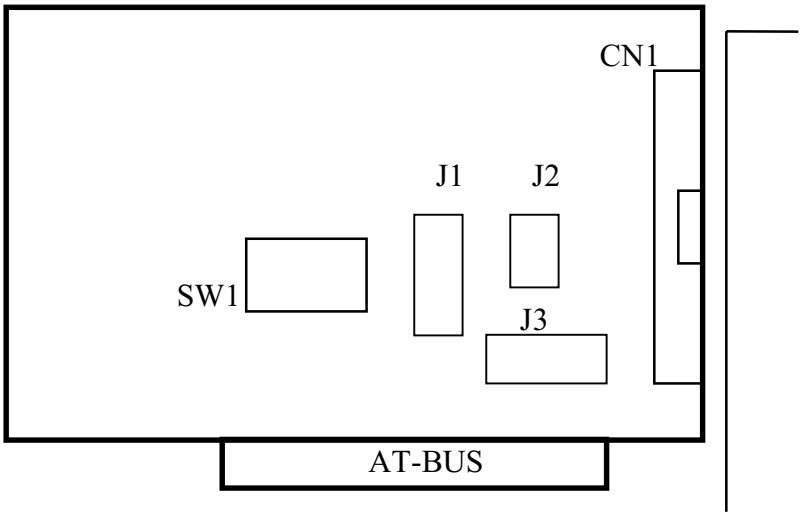
- Logic inputs and output
  Input logic high voltage : 2.0V(Min)/5.0V(Max)
  Input logic low voltage : -0.5V(Min)/0.8V(Max)
- Input load current : -0.45mA(Min)/+70μA
- Output sink current : +64mA(Max)
- Output source current : -15mA
- All outputs and inputs are TTL Compatible
- Power consumption : +5V @ 500mA (typical)
- Environmental :

  Operating Temperature : 0 to 60°C
  Storage Temperature : -20°C to 80 °C
  Humility : 0 to 90 % non-condensing

4. Functional Description

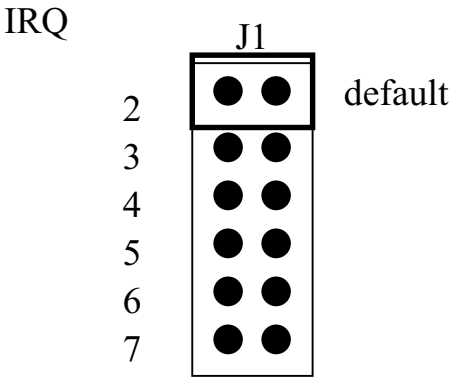
The DIO-24 provides 24 TTL digital I/O lines . The DIO-24 emulates 8255 mode 0 only and has a increased output current of 15 mA (source) and 64mA (sink) , allowing it to control LED, relay , etc .The DIO-24 consists of three 8 bit bi-directional ports and two input lines for interrupt enable and interrupt . 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 use 4 consecutive I/O location 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 .

4.1 Layout

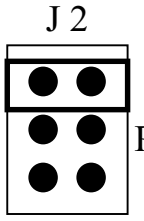


4.2 Jumper setting

4.2.1 Interrupt jumper setting



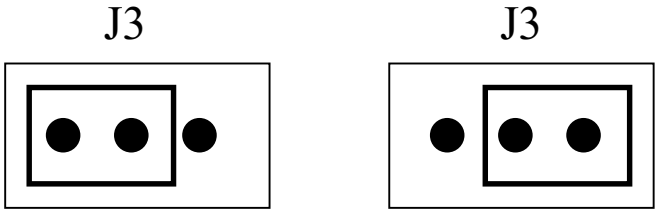
4.2.2 Interrupt Status Setting



(Default)

DIS :Interrupt disable (Default)
PGM :Programmable Interrupt enable , when PC-4 is low
EN : Interrupt enable

4.2.3 Interrupt Trigger edge Setting



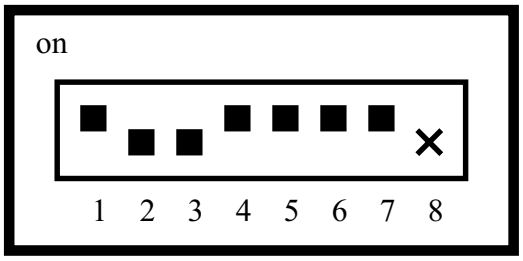
Rising Edge Trigger (Default)

Falling Edge Trigger

4.3 Base address Setting

BASE ADDRESS

SW1



A8 A7 A6 A5 A4 A3 A2

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
2C7-2CA	0	1	1	0	0	0	1	X
2CB-2CE	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

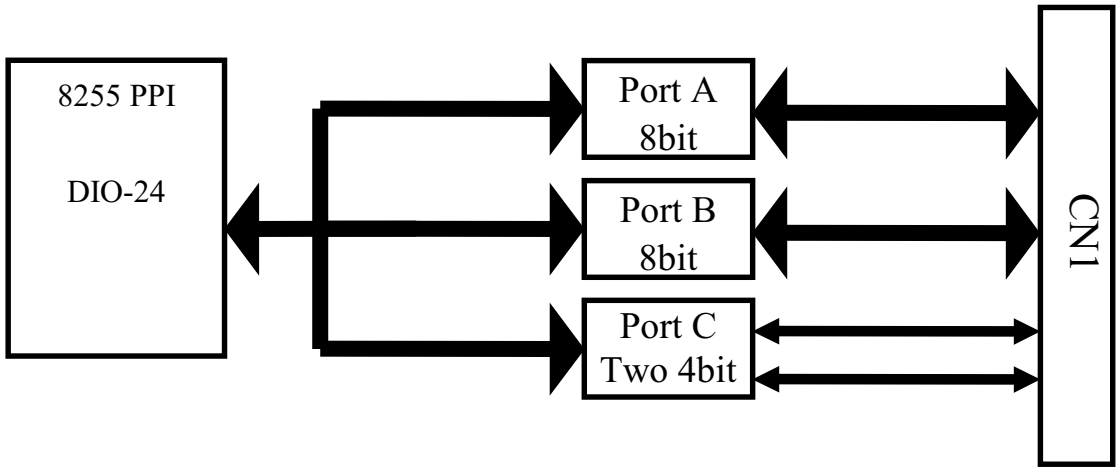
O=ON 1=OFF

(*) : **Default setting**

x = don't care

4.4 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-144 default status is input mode. (High input impedance).

CN1:

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

CN2:

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:

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

5. 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

5.1. Register

The DIO-24 each port can be define 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

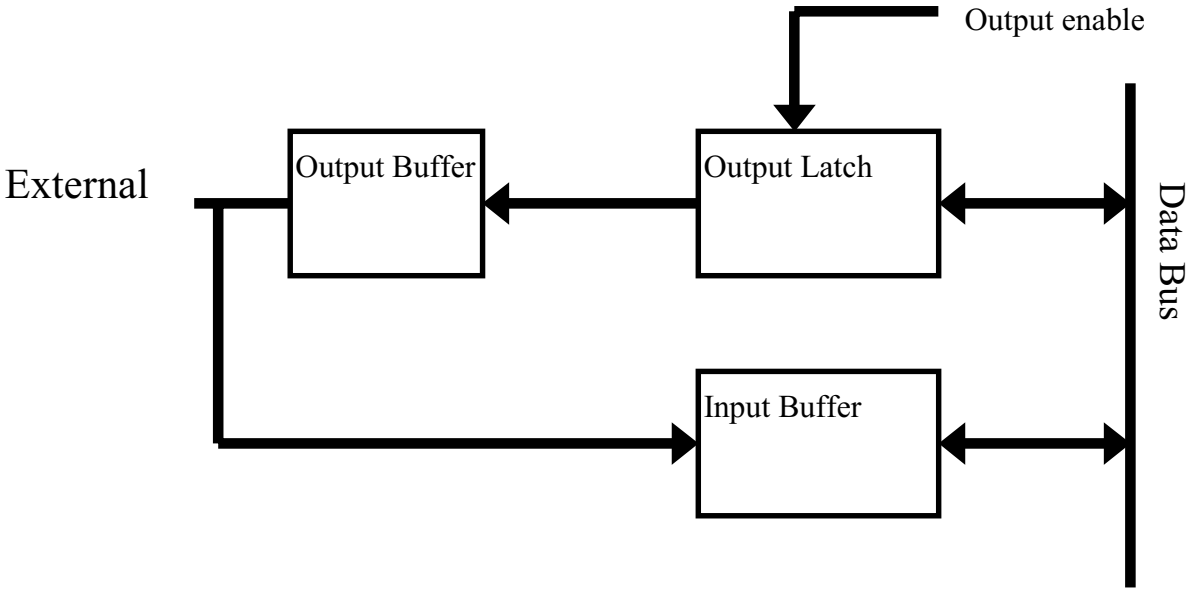
	D4	D3	D1	D0
CFG	PA0-PA7	PC4-PC7	PB0-PB7	PC0-PC3
80H	O	O	O	O
81H	O	O	O	I
82H	O	O	I	O
83H	O	O	I	I
88H	O	I	O	O
89H	O	I	O	I
8AH	O	I	I	O
8BH	O	I	I	I
90H	I	O	O	O
91H	I	O	O	I
92H	I	O	I	O
93H	I	O	I	I
98H	I	I	O	O
99H	I	I	O	I
9AH	I	I	I	O
9BH	I	I	I	I

5.2. 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 .

5.3. Output Latch

The DIO-24 Signal direction can be software programmable . When the user turn on or reset computer , all ports will be configured as input mode.
When the DIO-24 is Programmed as an output mode , it will not output until program execute the output instruction.



Signal Direction

5.4 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 Date
PC=INP(Bas+2)                     ‘ Read Port C Date
```

1. Features

- 144 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

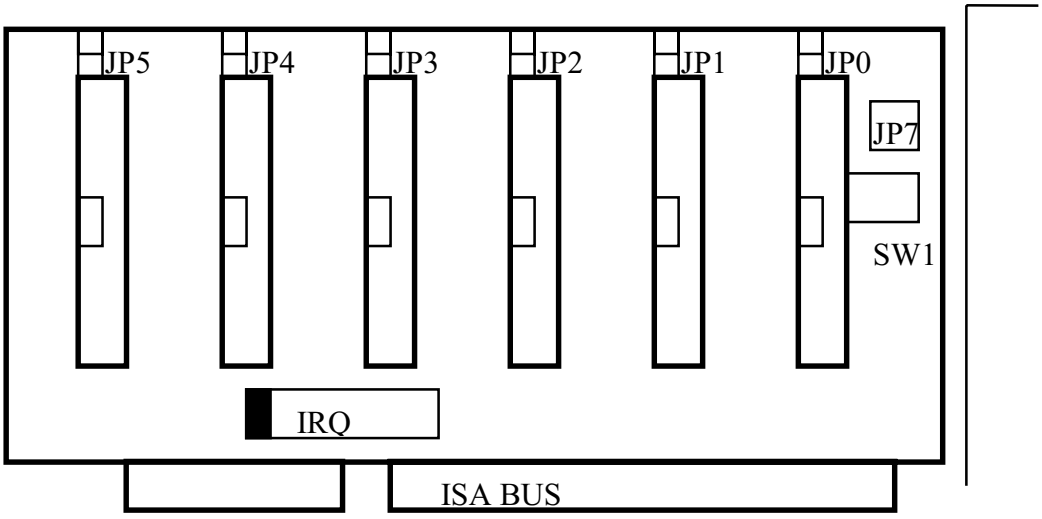
- Logic inputs and output
  Input logic high voltage : 2.0V(Min)/5.0V(Max)
  Input logic low voltage : -0.5V(Min)/0.8V(Max)
- Input load current : -0.45mA(Min)/+70μA
- Output sink current : +64mA(Max)
- Output source current : -15mA
- All outputs and inputs are TTL Compatible
- Power consumption : +5V @ 800mA max.
- Environmental :

Operating Temperature : 0 to 60°C
Storage Temperature : -20°C to 80 °C
Humility : 0 to 90 % non-condensing

4. Functional Description

The DIO-144 provides 144 TTL digital I/O lines . It is emulates six channel 8255 mode 0 (basic input / output mode)and has a increased output current of 15 mA (source) and 64mA (sink) , allowing it to control LED, relay , etc. The DIO-144 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 nibble wide port . All ports are configured as inputs upon power-up or reset. The DIO-144 use 4 consecutive I/O location 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 15 available on the PC bus via a jumper .

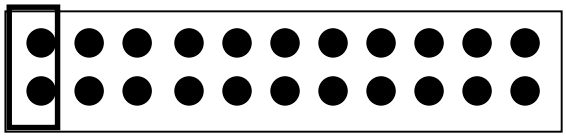
4.1 Layout



4.2 Jumper setting

4.2.1 Interrupt jumper setting

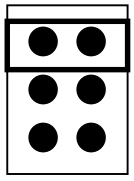
Default



IRQ 15 14 12 11 10 9 7 6 5 4 3

4.2.2 Interrupt Status Setting

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



D (Default)

P

E

D :Interrupt disable (Default)

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

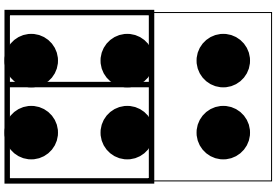
E : Interrupt enable

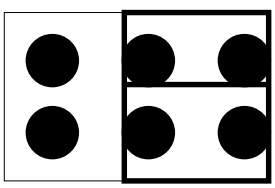
4.2.3 96/144 Setting

The DIO-144 provides 144 bit or 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.

JP7 JP7

96 bit





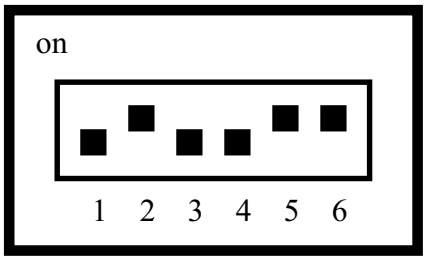
144 Bit

4.3 Base address Setting

96Bit Mode

BASE ADDRESS

SW1

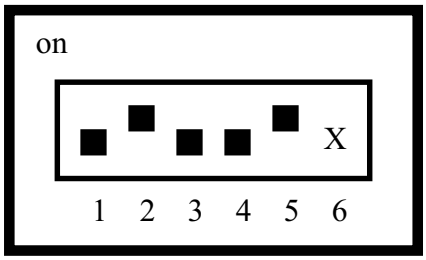


A9 A8 A7 A6 A5 A4

144Bit Mode

BASE ADDRESS

SW1



A9 A8 A7 A6 A5 X

Default DIP switch 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

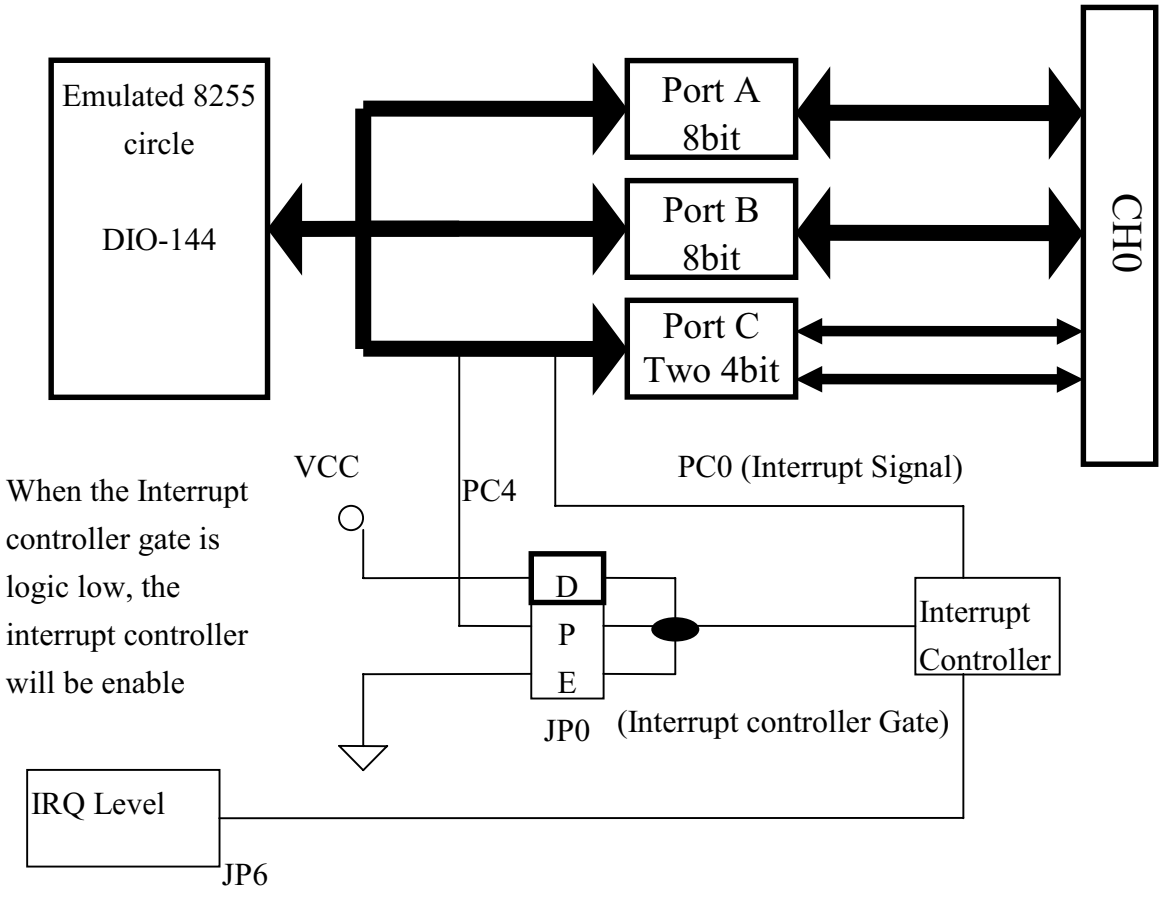
O=ON 1=OFF

(*) : **Default setting**

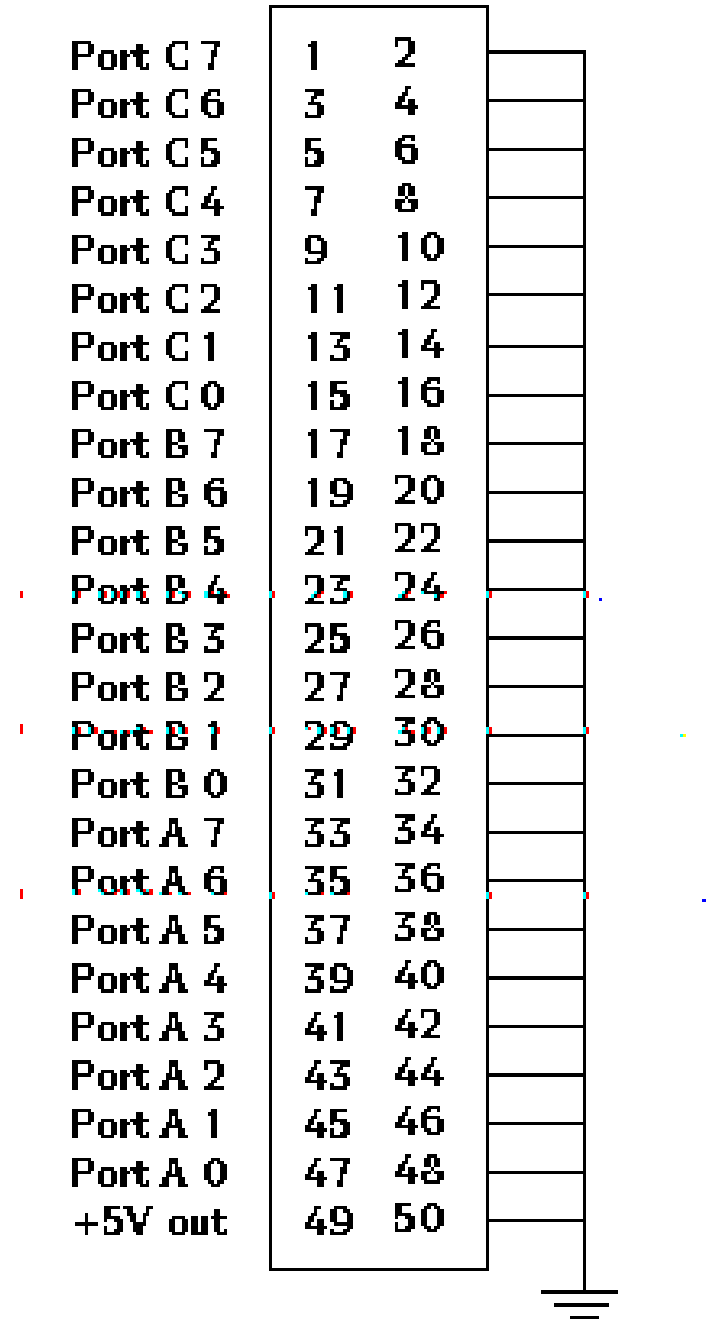
x = don't care

4.4 Pin Assignment

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



Pin assignment CH0-CH5



5. PROGRAMMING

The DIO-144 offers six OPTO-22 connector it is 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

5.1. 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

5.2. Data Format

The DIO-144 provides 6 channel opto-22 connector and each channel have 3 digital input / output port. you can define each port 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 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

D7	D6	D5	D4	D3	D2	D1	D0

Example : Initialize

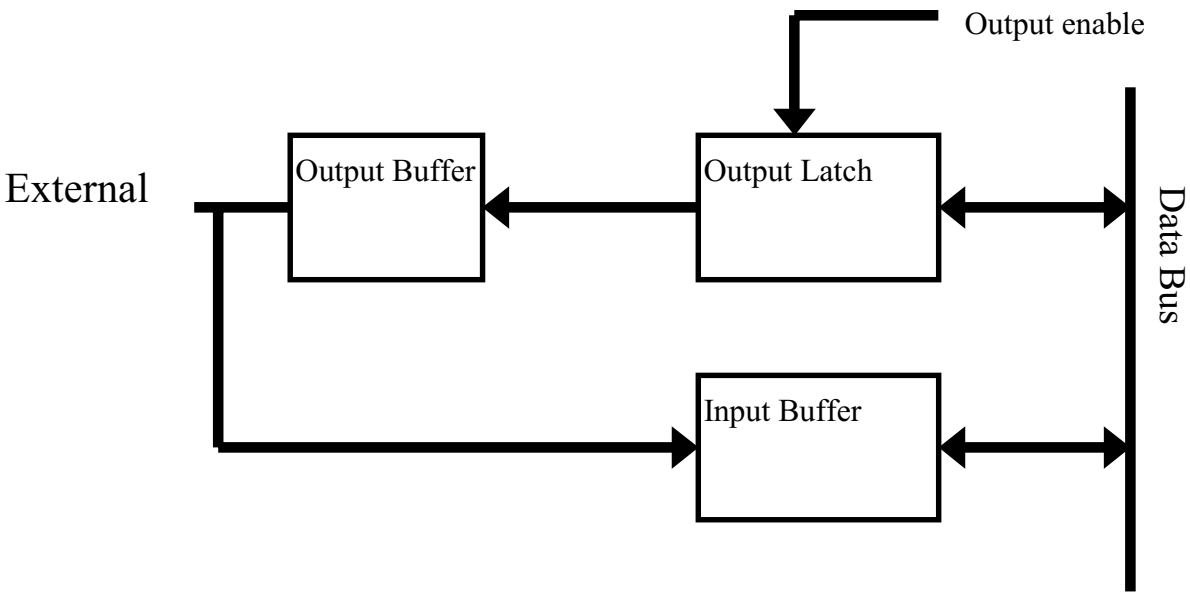
1. Initial channel 0 Port A input mode , Port B input mode, Port C Output mode
   1.1 Reference I/O register table : channel 0 CFG = Base + 0x03
   1.2 Reference CFG format table : Port_A_I , Port_B_I , Port_C_O = 0x92
   Note : Port_A_I means : Port A Input mode
   Port_C_O means : Port C Output mode
   1.3 Output initial data to CFG register : outportb (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 .

5.2. 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 .

5.3. Output Latch

The DIO-144 Signal direction can be software programmable . When the user turn on or reset computer , all ports will be configured as input mode.
When the DIO-144 is Programmed as an output mode , it will not output until program execute the output instruction.



Signal Direction

5.4 Program Example

The DIO-144 I/O card is very easy to programming input/ Output function .
Example (Quick Basic)

```
Bas=&H2C0
‘=========      Init DIO-144 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 Date
PC=INP(Bas+&HA)                   ‘ Read Port C Date
```

Appendix : Daughter Board

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

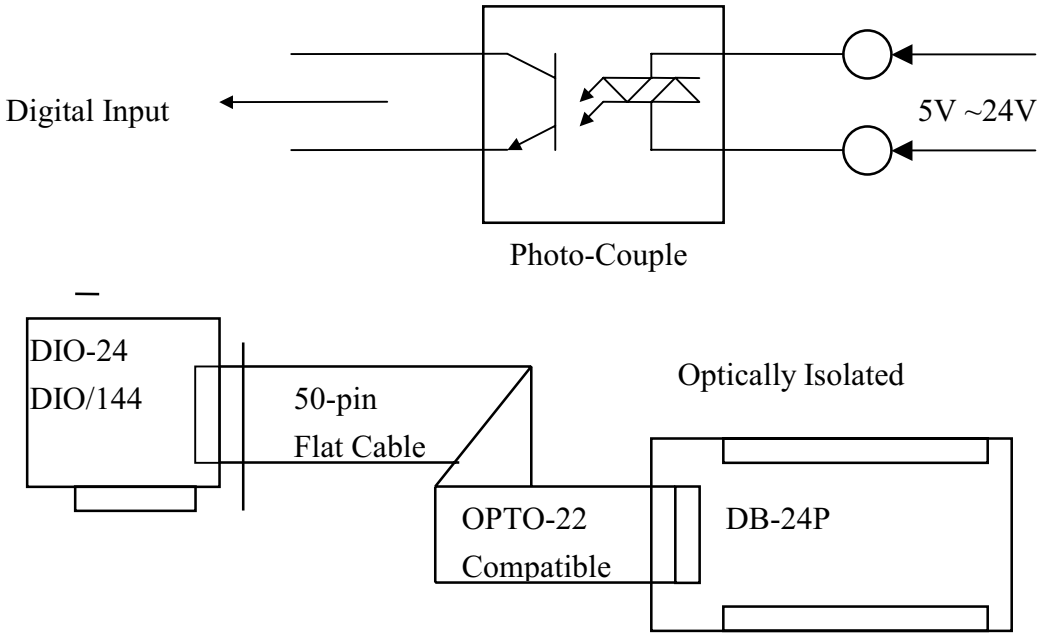
1. DB-24P 24 OPTO-isolated Digital Input Terminal Board
2. DB-24R 24 Relay Output Board
3. DB-24PR 24 Power Relay Output Board

6.1 DB-24P (Isolated Input board)

The DB-24P is a 24 Opto-isolated Digital input terminal board.

Features:

- 24 optically isolated digital input channels
- AC/DC signal Input
- AC Signal Input with filter
- Input buffer with voltage comparators.
- Maximum input voltage : 24VDC or 24VAC.
- Board Dimension : 8.66”(220mm) X 5.20” (132mm)



6.2 DB-24R (Relay Board)

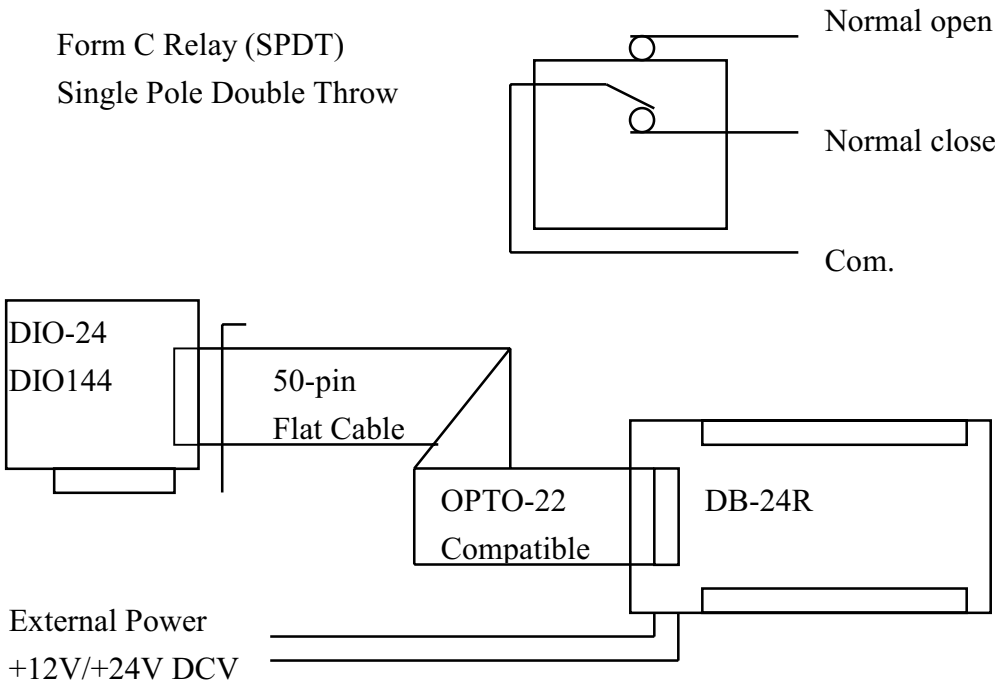
The DB-24 is a 24 channel relay output board

Features

- 24 Form C Relays
- Switch up to 1A at 30VDC or 110VAC
- LED's indicated relay status
- Screw terminals for easy field wiring

Order information:

- DB-24R/12V 24 Channel Relay output Board (Coil Voltage : 12VDC)
- DB-24R/24V 24 Channel Relay output Board (Coil Voltage : 24VDC)



6.3 DB-24PR (Power Relay Board)

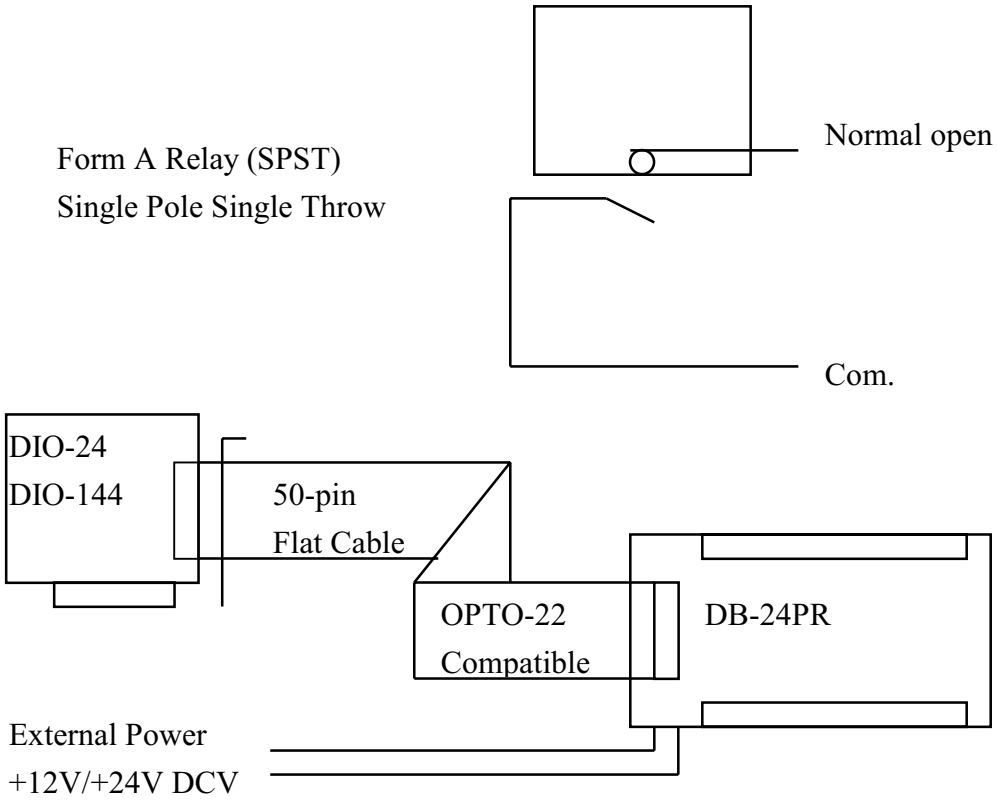
The DB-24PR is 24 Channel Power Relay output Board.

Specification:

- 16 Form A Relays (SPST) and 8 form C Relays (SPDT)
- Switch up to 5A at 250VAC or 30VDC
- Designed varistor to protect each channel's high voltage spike.
- LED's indicated relay status
- Screw terminals for easy field wiring

Order Information:

- DB-24PR/12V : 24 Channel 5A/250VAC Relay Board / 12V Coil Voltage Version
- DB-24PR/24V : 24 Channel 5A/250VAC Relay Board / 24V Coil Voltage Version



MEMO :