

# P8R8DIO / P16R16DIO

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## *User's Manual*

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# 1. Introduction

The P8R8DIO / P16R16DIO is an isolated input / output interface board for control and sensing operations.

The P8R8DIO / P16R16DIO installs in any IBM PC XT/AT or compatible computer.

## 1.1. Features and Applications

### 1.1.1. Features

P8R8DIO / P16R16DIO

- 8/16 Electromechanical Relay Outputs
- 8/16 Optically Isolated Inputs
- For IBM PC XT/AT
- AC/DC Signals Input
- AC Signal Input With Filter

### 1.1.2. Applications

- Factory Automation
- Laboratory Automation
- Annunciation
- Security Control
- Product Test
- Energy Management

---

# P8R8DIO

## 1.2. Specifications

|        |  |  |
|--------|--|--|
| INPUT  | Channels                               | 8  |
|        | Photo-coupler                          | PC-814   |
|        | Input-Current                          | 60mA Max.                                      |
|        | Input-Voltage                          | AC/DC 5 - 24 V<br>(AC 50 - 1K HZ)              |
|        | Input Impedance                        | 1.2 K $\Omega$                                 |
|        | Withstanding Voltage                   | 1KV  |
|        | Response Time                          | Without Filter 20 $\mu$ S<br>With Filter 2.2mS |
|        |  |  |
| OUTPUT | Relay Output Channels                  | 8  |
|        | Relay Type                             | 4 SPDT / 4 SPST                                |
|        | Contact Rating                         | 120 V AC/DC 0.3 A<br>30 V DC 1 A               |
|        | Breakdown Voltage                      | 1KV  |
|        | Operate Time                           | 5 m Sec  |
|        | Release Time                           | 5 m Sec  |
|        | Insulation Resistance                  | 100 M $\Omega$                                 |
|        | Expected life<br>Electrical at 30V /1A | > 100,000 Times                                |
|        | Relay Input Current                    | 16mA   |
|        |  |  |
| etc.   | Dimensions                             | 173 mm X 115 mm                                |
|        | Temperature                            | 0 ~ 50 $^{\circ}$ C                            |
|        | Power Consumption                      | +5V 160mA MAX.<br>+12V 150mA MAX.              |

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## 2. Installation

This chapter describes the P8R8DIO unpacking information; P8R8DIO layout and the jumpers and switches settings for the P8R8DIO configuration.

### 2.1. Unpacking

**CAUTION :**

Your P8R8 D/I/O Card contains sensitive electronic components can be easily damaged by static electricity.

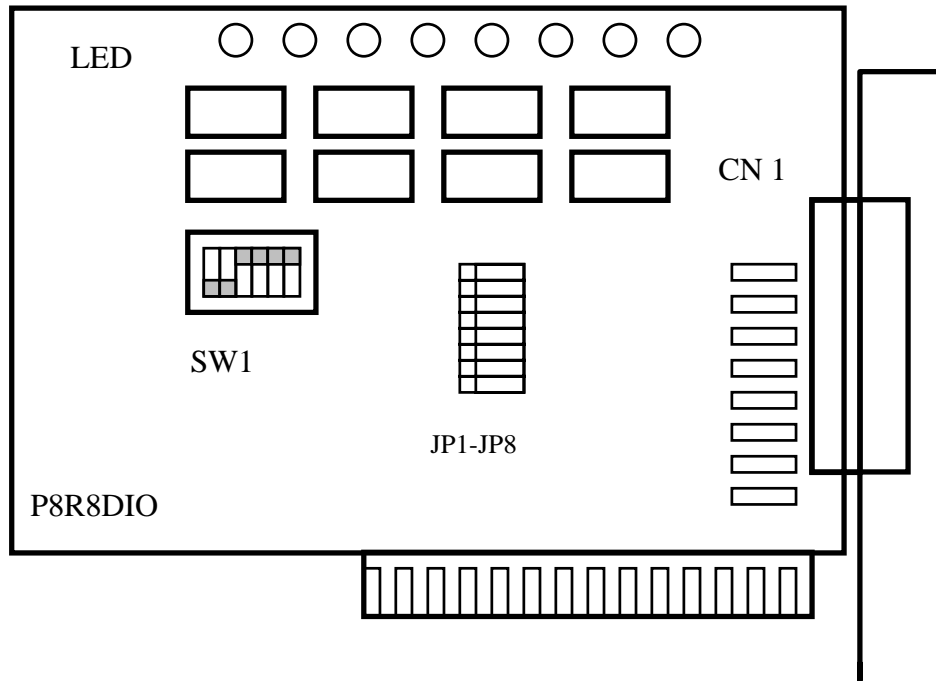
1. The P8R8DIO should be done on a grounded anti-static mat.
2. The user should wear an anti-static wristband, grounded at the same point as the anti-static mat.
3. Inspect the carton for obvious damage. Shipping & handling may cause damage to the board. Be sure there are no shipping and handling damages on the board before using.
4. After opening the carton, exact the system board and place it on a grounded anti-static surface & component side up.

**CAUTION :** Do not Apply Power to the Board if it has been damaged.

You are now ready to install your P8R8DIO.

---

## 2.2. Layout



P8R8DIO layout

## 2.3. Address & Jumper Setting

You can change the P8R8DIO configuration by setting jumper & switches on the board. The board's jumpers are set at the factory. Under normal circumstances, you should not need to change the jumper settings.

### 2.3.1. Address Setting

The P8R8DIO requires two consecutive I/O addresses, one for output & read back and the other for input. You can set the base address on any 4-byte boundary using the DIP switch (SW1). If you install one more P8R8DIO boards, you must set a different base address for each board.

The base address switch is preset at 300H (see Figure 2-1).

S 1 : Default Address 300 Hex

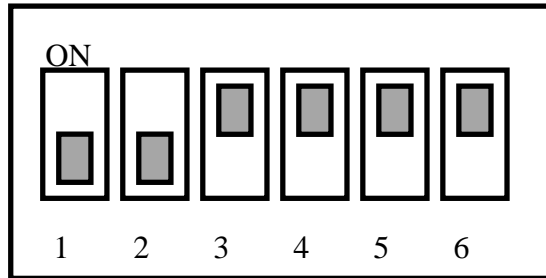


Figure 2-1

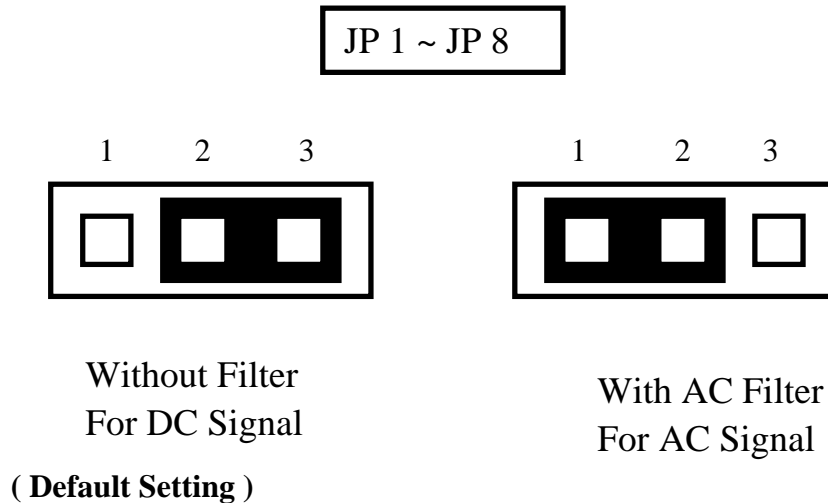
| S1 Dip Switch | 1   | 2   | 3   | 4   | 5   | 6   |
|---------------|-----|-----|-----|-----|-----|-----|
| Address (Hex) | A9  | A8  | A7  | A6  | A5  | A4  |
| 200           | OFF | ON  | ON  | ON  | ON  | ON  |
| 210           | OFF | ON  | ON  | ON  | ON  | OFF |
| 220           | OFF | ON  | ON  | ON  | OFF | ON  |
| :             | :   | :   | :   | :   | :   | :   |
| 2A0           | OFF | ON  | OFF | ON  | OFF | ON  |
| :             | :   | :   | :   | :   | :   | :   |
| 2F0           | OFF | ON  | OFF | OFF | OFF | OFF |
| (*) 300       | OFF | OFF | ON  | ON  | ON  | ON  |
| 310           | OFF | OFF | ON  | ON  | ON  | OFF |
| 320           | OFF | OFF | ON  | ON  | OFF | ON  |
| 330           | OFF | OFF | ON  | ON  | OFF | OFF |
| 340           | OFF | OFF | ON  | OFF | ON  | ON  |
| 350           | OFF | OFF | ON  | OFF | ON  | OFF |
| 360           | OFF | OFF | ON  | OFF | OFF | ON  |
| :             | :   | :   | :   | :   | :   | :   |
| 3F0           | OFF | OFF | OFF | OFF | OFF | ON  |

(\*) Default Setting      Table 2-1



## 2.3.2. Jumper Setting

Each digital input channel can be jumper selected, single-pole, RC filter with a time constant of 1.2 ms. Refer to the table 2-2 to see the list of jumper number and it's corresponding digital input channel.



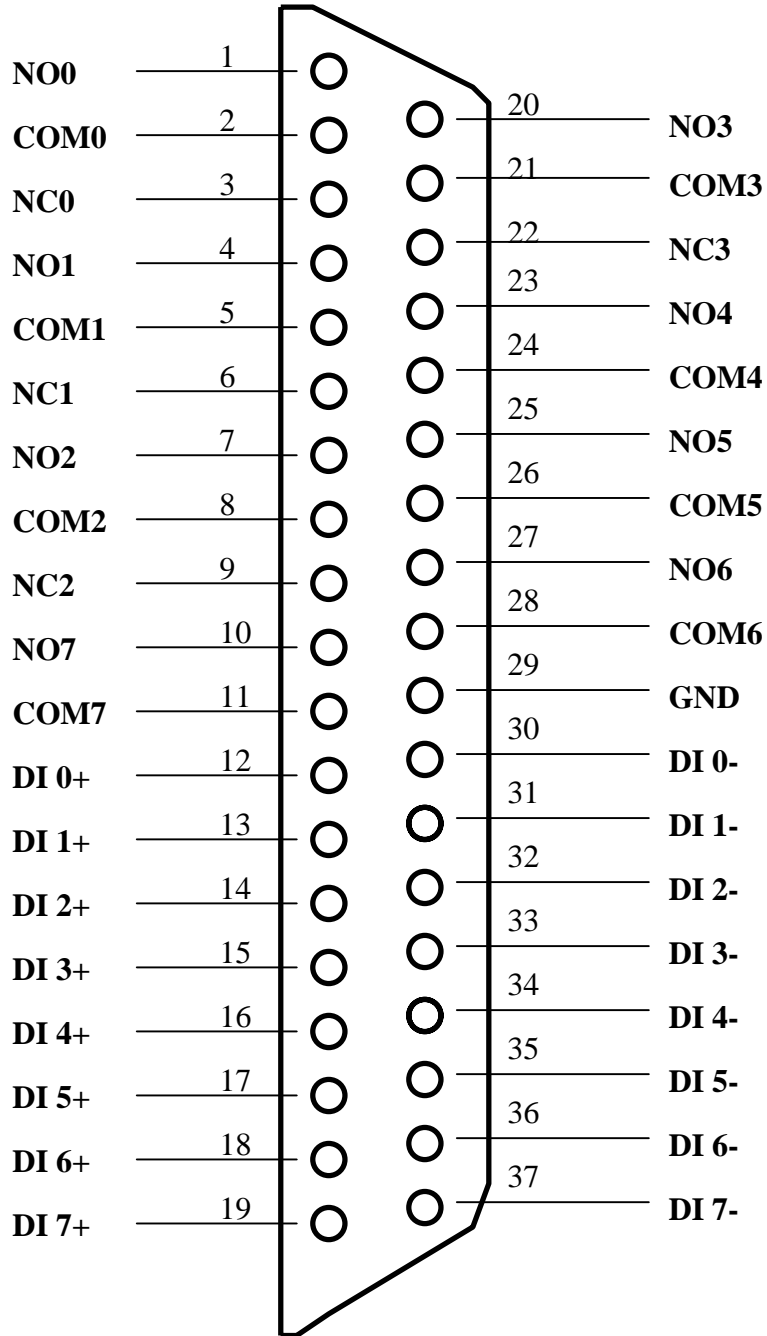
| Jumper | Input Channels |
|--------|----------------|
| JP1    | DI 0           |
| JP2    | DI 1           |
| JP3    | DI 2           |
| JP4    | DI 3           |
| JP5    | DI 4           |
| JP6    | DI 5           |
| JP7    | DI 6           |
| JP8    | DI 7           |

Table 2-2.

If you are using AC input signals, you must short the AC FILTER jumper 1-2. If you are using DC input signals, the AC FILTER is optional. If the DC input signals response less than 20 us, set the filter off. If you want a slow response (about 5 to 10 ms) for rejecting noise or contact bouncing, short the AC FILTER jumper 1-2.7

## 2.4. Pin Assignments

.Figure 2-3: CN 1 pin assignments of the P8R8DIO connector.



NO n : normally open.

COM n : common.

NC n : normally close.

DI n : Digital input channel n.

---

## 3. Programming

This chapter provides the I/O map of P8R8DIO registers. Example programs and programming information are also included.

### 3.1. Address Map

The P8R8DIO boards occupy two consecutive addresses in the computer's I/O space. The base address is selected by DIP switch. The I/O map is shown in Table 3-1.

Base Address at 300 Hex

| Address  | Write                      | Read                        |
|----------|----------------------------|-----------------------------|
| Base + 0 | Relay Output (CH 0 ~ CH 7) | Read Back The Output Status |
| Base + 1 | NO FUNCTION                | DIGITAL INPUT (CH0~CH7)     |

Table 3-1. I/O Map.

---

## 3.2. Relay Output

You write data to relays (CH0 - CH 7 ) as a single Byte. Each of the eight bits within a byte controls a single relay. A high bit(equal to1) energizes ( closes the contacts of)a relay while a low bit (equal to 0) turns the relay off.

### 3.2.1. Output Register

Relay Output register bits are assigned as shown in Table 3-2

Base Address at 300 Hex

| Base+0         | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|----------------|----|----|----|----|----|----|----|----|
| Output Channel | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |

Table 3-2. Relay Addresses in the Relay Output Register.

For Example (Basic Language)

REM : Set all relay output is ON , ( Output data FFh)

Base=&h300                    ‘ Set Base Address at 300 (Hex)

Out Base , &hFF              ‘ Set Relay Output (Ch 0 ~ Ch 7) On

RB= Inp(Base)                ‘ Read Back Relay Output Ch 0 ~ Ch 7

REM: Set relay output CH 3 is ON, Output data 8h (00001000 BIN)

Out Base, &h8                ‘ Set relay output CH 3 ON

(For C Language)

```
outportb(0x300,0xFF);        /* Set all relay output is On*/
```

```
outportb(0x300,0x0);        /* Set all relay output is Off*/
```

---

## 3.2.2. Using Relay Output

Basic Circuitry : (Current Rating < 0.3 A ), Refer to Fig. 3-1.

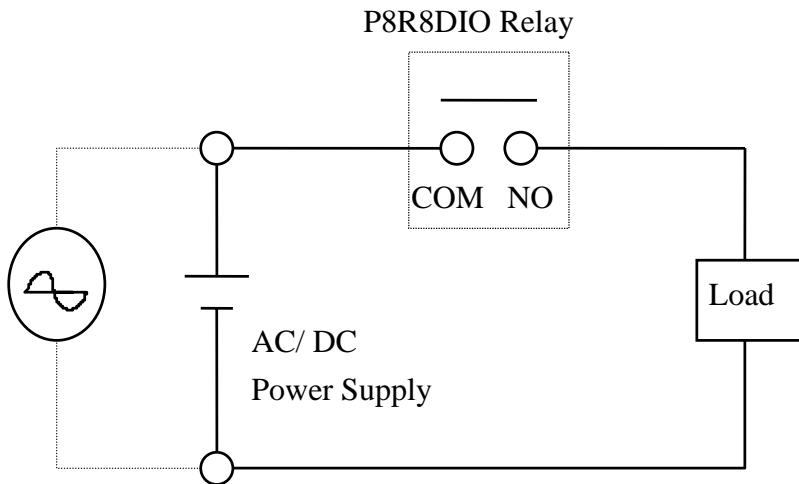


Figure 3-1.

Heavy Loading Application ( > 0.3 A ), Refer to Figure.3-2.

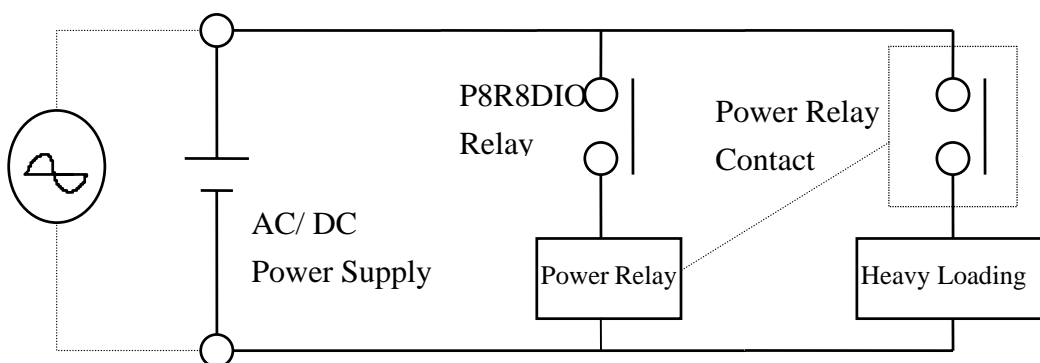


Figure 3-2.

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## 3.3. Isolated Input

The digital input state is read as a single byte from the port at base address+1. Each of the eight bits within the byte corresponds to a particular digital input so that a high bit (equal to 1) represents a high state while a low bit (equal to 0) represents a low state. Register bits are assigned as shown in Table 3-3.

### 3.3.1. Input Register

Base Address at 300 Hex

|               |    |    |    |    |    |    |    |    |
|---------------|----|----|----|----|----|----|----|----|
| Base + 1      | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| Input Channel | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |

Table 3-3 input addresses in the isolated control input Register.

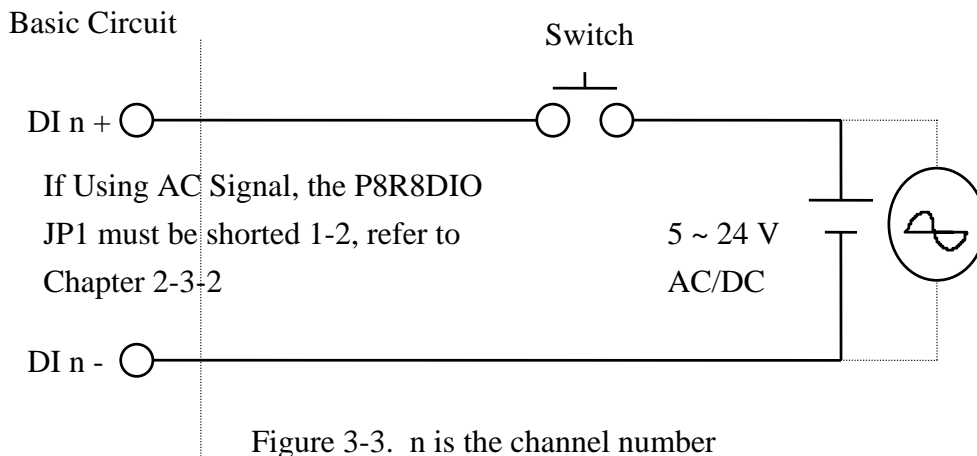
For Example (Basic Language)

```
Base=&h300          ' Set Base Address at 300 (Hex)
RIH=INP(Base+1)    ' Read Isolated Input Ch 0 ~ Ch 7
```

( C Language )

```
int rih;
rih=inportb(0x301);
```

### 3.3.2. Using Isolated Input



The normal input voltage range is 5 to 24V AC or DC. The normal input range can be changed by choosing suitable resistor to limit the current through the opto-isolator to about 10 mA ( $I_f$ ). The default resistor is 1.2 K $\Omega$  / 0.5 W.

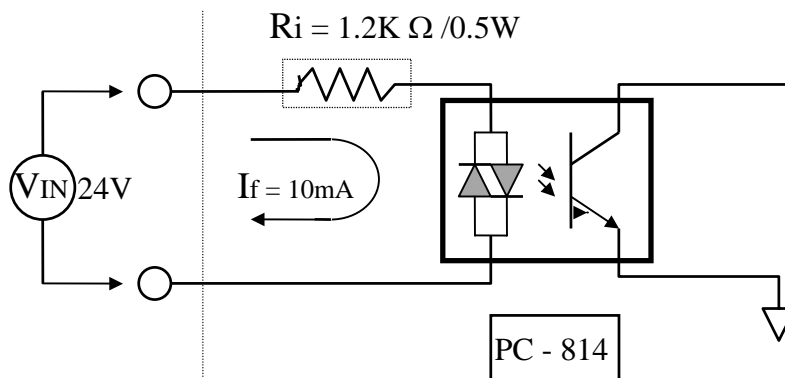


Figure 3-4.

$$R_i = V_{in} / I_f$$

$$P_w = V_{in} \times I_f$$

Calculation Example :

If  $V_{in} = 120 \text{ V}$  Then  $R_i = 120 \text{ (V)} / 0.01 \text{ (A)} = 12 \text{ K}\Omega$

$P_w = 120 \text{ (V)} \times 0.01 \text{ (A)} = 1.2 \text{ W}$

The  $R_i$  Must Replace By 12K  $\Omega$  / 2 W (1.2W)

---

# P16R16 DIO

## 4.Specifications

|        |  |  |
|--------|--|--|
| INPUT  | Channels                               | 16   |
|        | Photo-coupler                          | PC-814   |
|        | Input-Current                          | 60 mA Max.                                     |
|        | Input-Voltage                          | AC/DC 5 - 24 V<br>(AC 50 - 1K HZ)              |
|        | Input Impedance                        | 1.2 K  |
|        | Withstanding Voltage                   | 1KV  |
|        | Response Time                          | Without Filter 20 $\mu$ S<br>With Filter 2.2mS |
|        |  |  |
| OUTPUT | Relay Output Channels                  | 16   |
|        | Relay Type                             | 8 SPDT 8 SPST                                  |
|        | Contact Rating                         | 120 V AC/DC 0.3 A<br>30 V DC 1 A               |
|        | Breakdown Voltage                      | 1KV  |
|        | Operate Time                           | 5 m Sec  |
|        | Release Time                           | 5 m Sec  |
|        | Insulation Resistance                  | 100 M $\Omega$                                 |
|        | Expected life<br>Electrical at 30V /1A | > 100,000 Times                                |
|        | Relay Input Current                    | 16mA   |
|        |  |  |
| etc.   | Dimensions                             | 173 mm X 115 mm                                |
|        | Temperature                            | 0 ~ 50 $^{\circ}$ C                            |
|        | Power Consumption                      | +5V 200mA MAX.<br>+12V 260mA MAX.              |



---

# 5. Installation

This chapter describes P16R16DIO unpacking information, layout and jumpers/switches setting for the P16R16DIO configuration.

## 5.1.Unpacking

**CAUTION :**

Your P16R16DIO D/I/O Card contains sensitive electronic components can be easily damaged by static electricity.

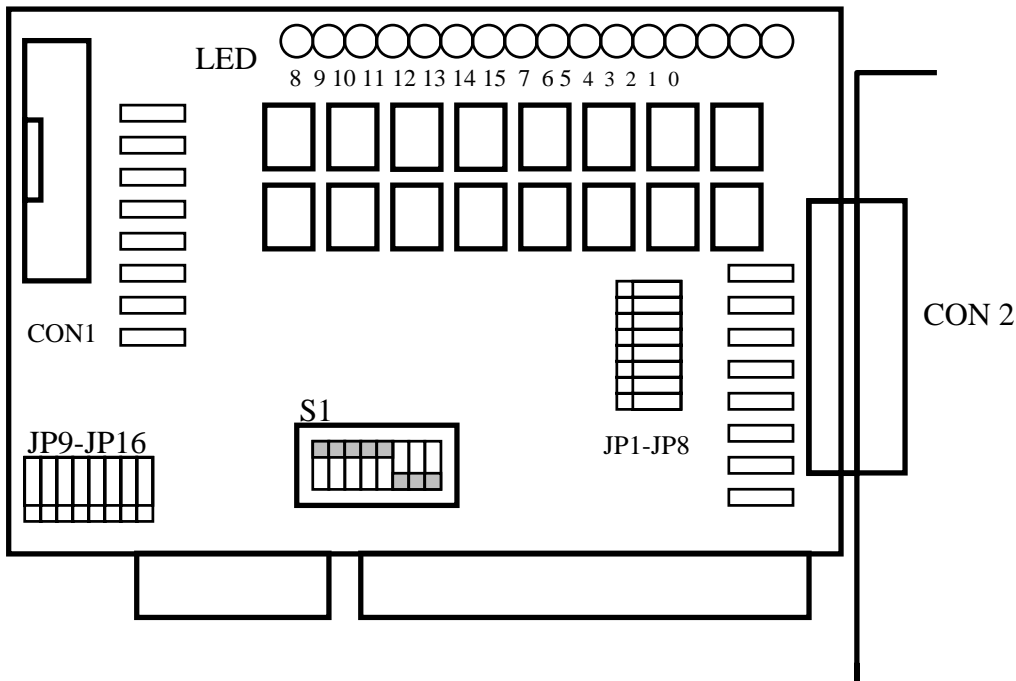
1. The P16R16DIO should be done on a grounded anti-static mat.
2. The user should wear an anti-static wristband, grounded at the same point as the anti-static mat.
3. Inspect the carton for obvious damage. Shipping & handing may cause damage to the board. Be sure there are no shipping and handing damages on the board before using.
4. After opening the carton, Place the system board handle place on a grounded anti-static surface & component side up.

**CAUTION :** Do not Apply Power to the Board if it has been damaged.

You are now ready to install your P16R16DIO.

---

## 5.2. Layout



P16R16DIO layout

## 5.3. Address & Jumper Setting

You can change the P16R16DIO configuration by setting jumper & switches on the board. The board's jumpers are set at the factory. Under normal circumstances, you should not need to change the jumper settings.

### 5.3.1. Address Setting

The P16R16DIO requires four consecutive I/O addresses, two is for output & read back and the other's is for input. You can set the base address on any 4-byte boundary using the DIP switch(S1). If you install one more P16R16DIO boards, you must set a different base address for each board.

The base address switch is preset at 300H (see Figure 2-1).

S 1 : Default Address 300 Hex

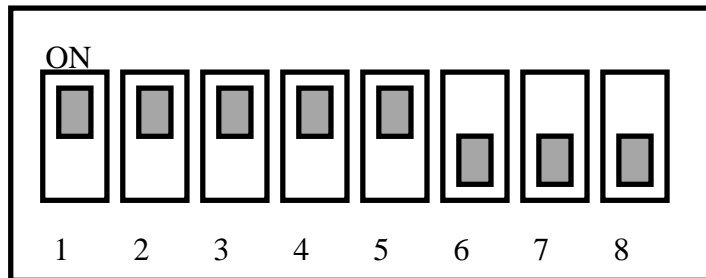


Figure 2-1

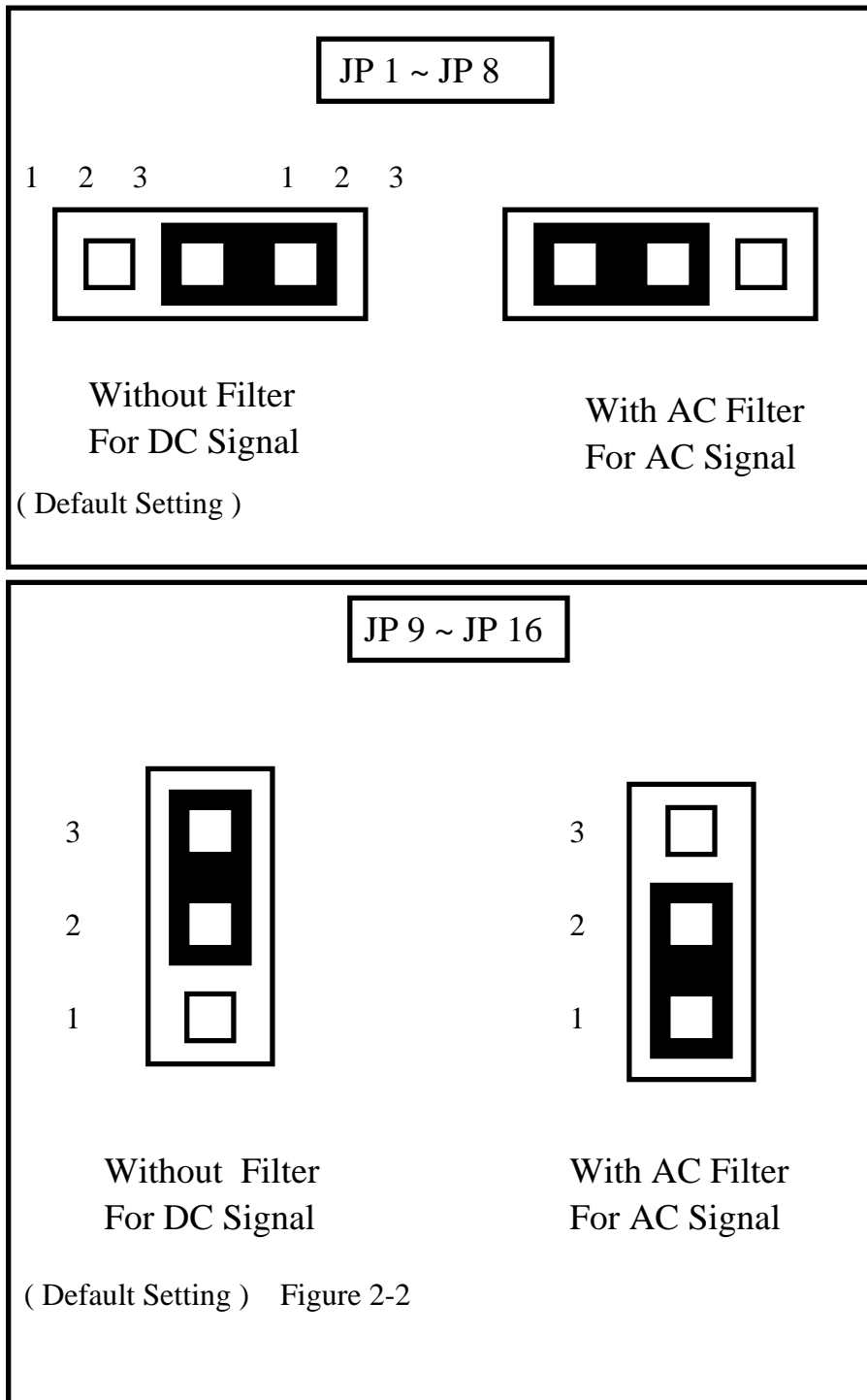
| S1 Dip Switch | 8 | 7   | 6   | 5   | 4   | 3   | 2   | 1   |
|---------------|---|-----|-----|-----|-----|-----|-----|-----|
| Address (Hex) | X | A9  | A8  | A7  | A6  | A5  | A4  | A3  |
| 200           |   | OFF | ON  | ON  | ON  | ON  | ON  | ON  |
| :             |   | :   | :   | :   | :   | :   | :   | :   |
| 2A0           |   | OFF | ON  | OFF | ON  | OFF | ON  | ON  |
| :             |   | :   | :   | :   | :   | :   | :   | :   |
| (*) 300       |   | OFF | OFF | ON  | ON  | ON  | ON  | ON  |
| 308           |   | OFF | OFF | ON  | ON  | ON  | ON  | OFF |
| 310           |   | OFF | OFF | ON  | ON  | ON  | OFF | ON  |
| 318           |   | OFF | OFF | ON  | ON  | ON  | OFF | OFF |
| :             |   | :   | :   | :   | :   | :   | :   | :   |
| 3E8           |   | OFF | OFF | OFF | OFF | OFF | ON  | OFF |
| 3F0           |   | OFF | OFF | OFF | OFF | OFF | OFF | ON  |
| 3F8           |   | OFF | OFF | OFF | OFF | OFF | OFF | OFF |

(\*) Default Setting      Table 2-1

---

## 5.3.2. Jumper Setting

Each digital input channel can be jumper selected, single-pole, RC filter with a time constant of 1.2 ms. Refer to Figure 2-2 to see the location of jumper and its corresponding digital input channel number.



---

| Jumper | Input Channels |
|--------|----------------|
| JP1    | DI 0           |
| JP2    | DI 1           |
| JP3    | DI 2           |
| JP4    | DI 3           |
| :      | :              |
| JP13   | DI 12          |
| JP14   | DI 13          |
| JP15   | DI 14          |
| JP16   | DI 15          |

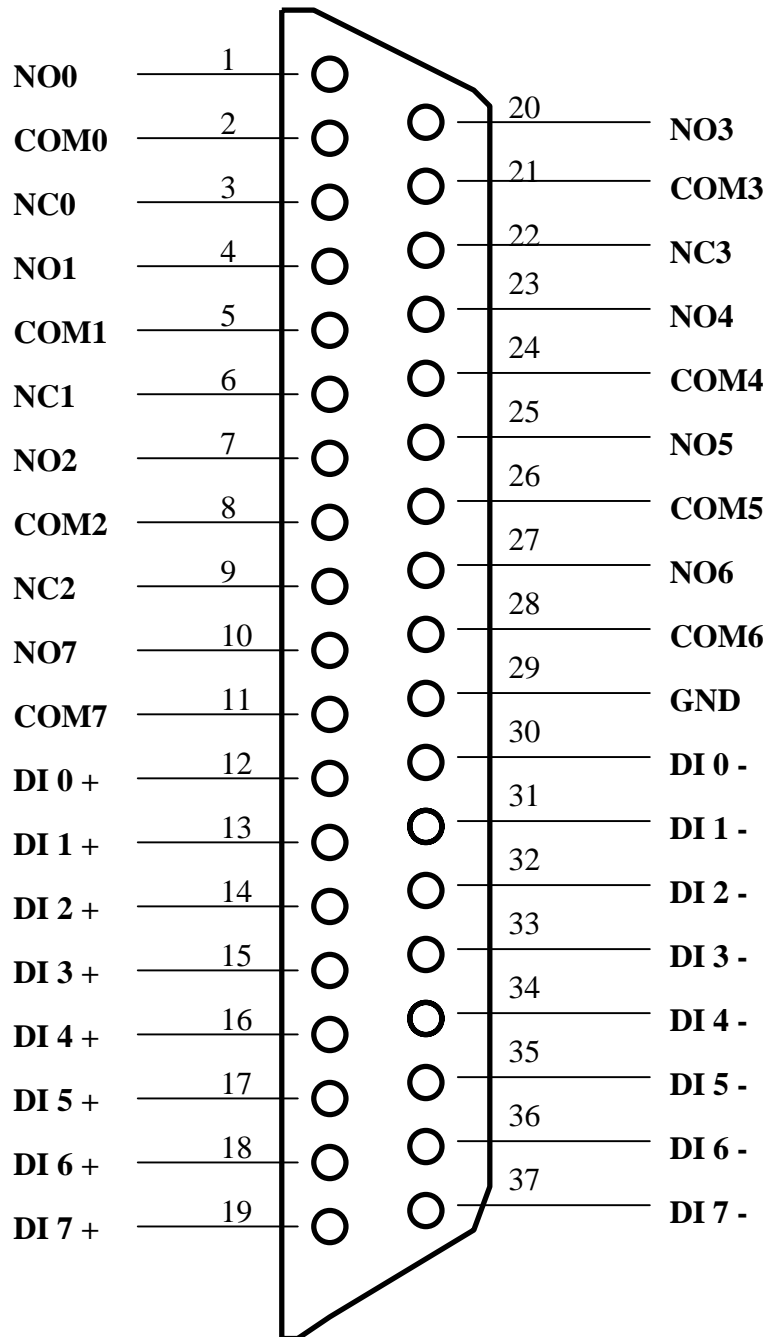
Table 2-2.

If you are using AC input signals, you must short the AC FILTER jumper 1-2 .

If you are using DC input signals, the AC FILTER is optional. If the DC input signals response less than 20 us, set the filter off. If you want a slow response (about 5 to 10 ms)for rejecting noise or contact bouncing , short the AC FILTER jumper 1-2.

### 5.3.3.Pin-assignments

Figure 2-3: CN 2 pin assignments of the P16R16DIO connector.



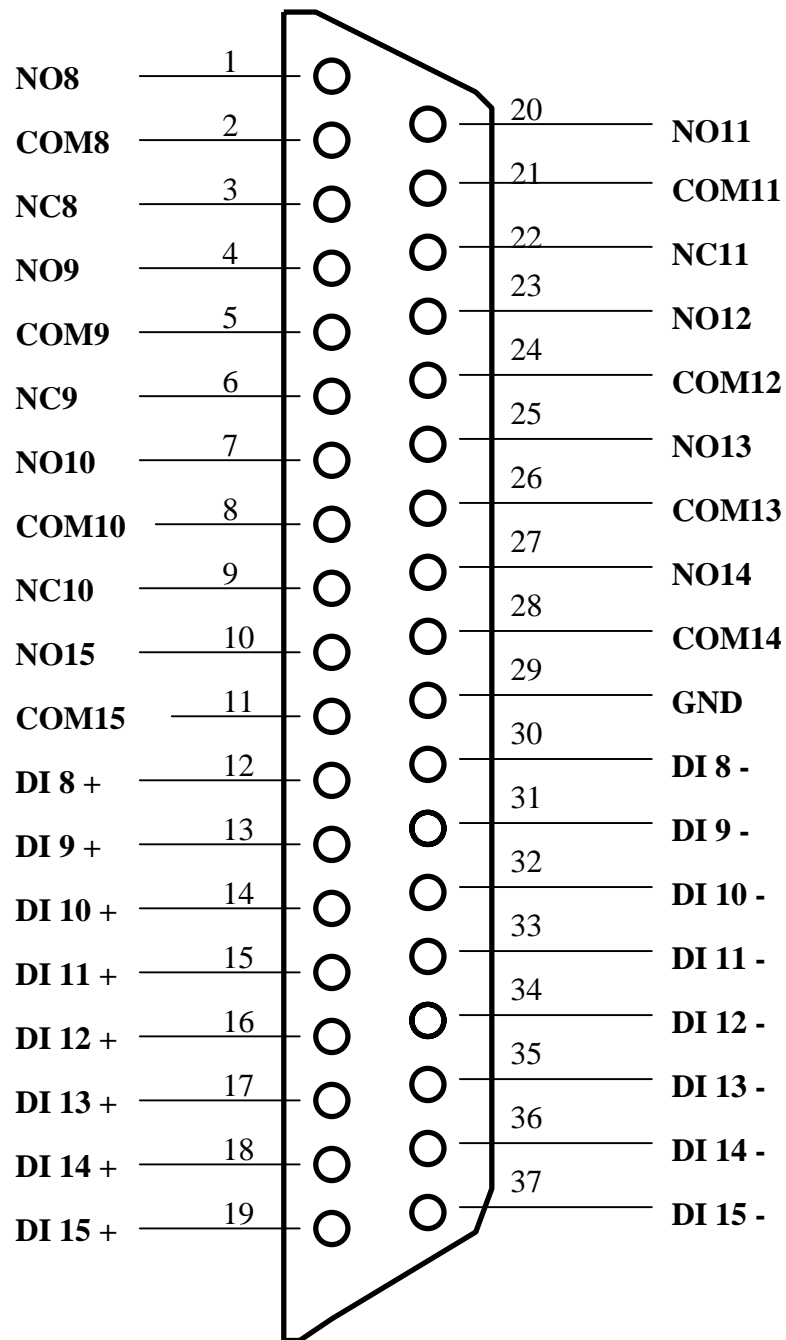
NO n : normally open.

COM n : common.

NC n : normally close.

DI n : Digital input channel n.

Figure 2-4: the CN1 linked to 37 pin D-sub connector pin assignment.



NO n : normally open.

COM n : common.

NC n : normally close.

DI n : Digital input channel n.

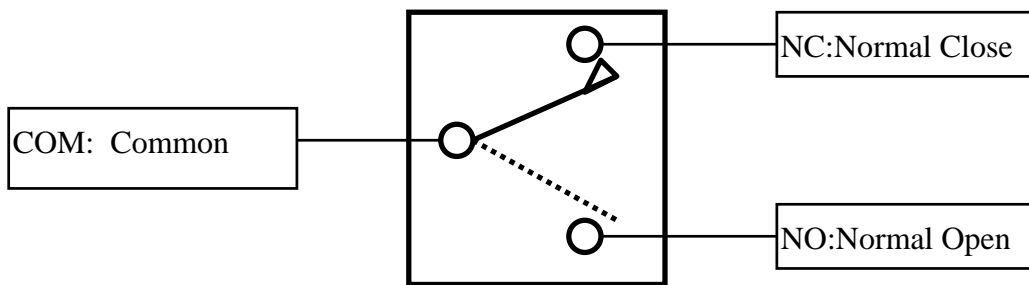


Figure 3-4. SPDT RELAY: Single Pole Double Throw.

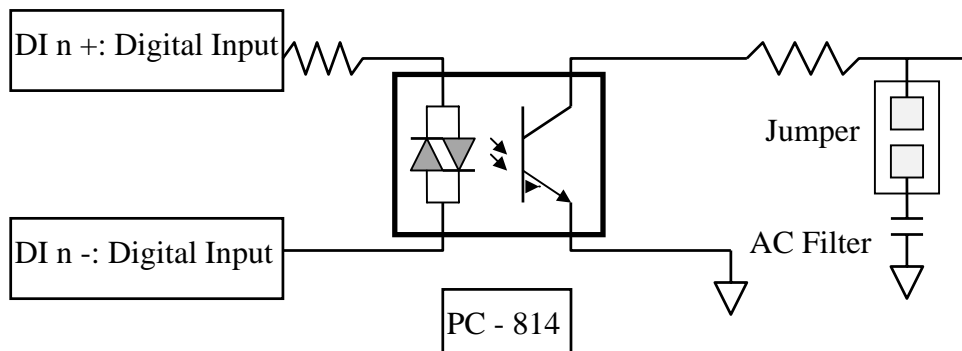


Figure 3-5. **Isolated Input.**



---

## 6. Programming

This chapter provides the I/O map of P8R8DIO / P16R16DIO registers. Example programs and programming information are also included.

### 6.1. Address Map

The P16R16DIO boards occupy four consecutive addresses in the computer's I/O space. The base address is selected by DIP switch, The I/O map are shown in Table 3-1.

P16R16DIO Base Address at 300 Hex

| Address  | Write                      | Read                        |
|----------|----------------------------|-----------------------------|
| Base + 0 | Relay Output (CH 0 ~ CH 7) | Read Back The Output Status |
| Base + 1 | Relay Output (CH 8 ~ CH15) | Read Back The Output Status |
| Base + 2 | No Function                | Digital Input (CH0~CH7)     |
| Base + 3 | No Function                | Digital Input (CH8~CH18)    |

Table 3-1. P16R16DIO I/O Map.

## 6.2. Relay Output

You write data to relays as a single Byte. Each of the eight bits within a byte controls a single relay. A high bit (equal to 1) energizes (closes the contacts of) a relay while a low bit (equal to 0) turns the relay off.

### 6.2.1. Output Register

Relay Output register bits are assigned as shown in Table 3-2.

P16R16DIO Base Address at 300 Hex

|                |    |    |    |    |    |    |    |    |
|----------------|----|----|----|----|----|----|----|----|
| Base+0         | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| Output Channel | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |
| Base+1         | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| Output Channel | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  |

Table 3-2 P16R16DIO Relay Addresses in the Relay Output Register.

|                   |    |    |    |    |    |    |    |    |
|-------------------|----|----|----|----|----|----|----|----|
| Base+0            | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| Read back channel | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |
| Base+1            | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| Read back channel | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  |

Table 3-3. Relay output read back register.

For Example (Basic Language)

REM: Set all relay output is ON , ( Output data FFh)

Base=&h300                    ‘ Set Base Address at 300 (Hex)

Out Base , &hFF            ‘ Set Relay Output (Ch 0 ~ Ch 7) On

Out Base +1, &hFF        ‘ Set Relay Output (Ch 8 ~ Ch 15) On

RBL= Inp(Base)            ‘ Read Back Relay Output Ch 0 ~ Ch 7

RBH= Inp(Base+1)        ‘ Read Back Relay Output Ch 8 ~ Ch 15

REM : Set relay output CH 3 is ON ,Output data 8h (00001000 BIN)

Out Base,&h8                ‘ Set relay output CN2 D3 ON

---

## 6.3. Relay Output

You write data to relays ( CH0 - CH 7 ) as a single Byte. Each of the eight bits within a byte controls a single relay. A high bit (equal to1) energizes (closes the contacts of)a relay while a low bit (equal to 0) turns the relay off.

### 6.3.1. Output Register

Relay Output register bits are assigned as shown in Table 3-2.

Base Address at 300 Hex

| Base+0         | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|----------------|----|----|----|----|----|----|----|----|
| Output Channel | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |

Table 3-2. Relay Addresses in the Relay Output Register.

For Example (Basic Language)

REM: Set all relay output is ON , ( Output data FFh)

Base=&h300                    ‘ Set Base Address at 300 (Hex)

Out Base , &hFF            ‘ Set Relay Output (Ch 0 ~ Ch 7) On

RB= inp(Base)              ‘ Read Back Relay Output Ch 0 ~ Ch 7

REM : Set relay output CH 3 is ON ,Output data 8h (00001000 BIN)

Out Base, &h8              ‘ Set relay output CH 3 ON

---

## 6.3.2. Using Relay Output

Basic Circuitry: (Current Rating < 0.3A), Refer to Figure 3-1.

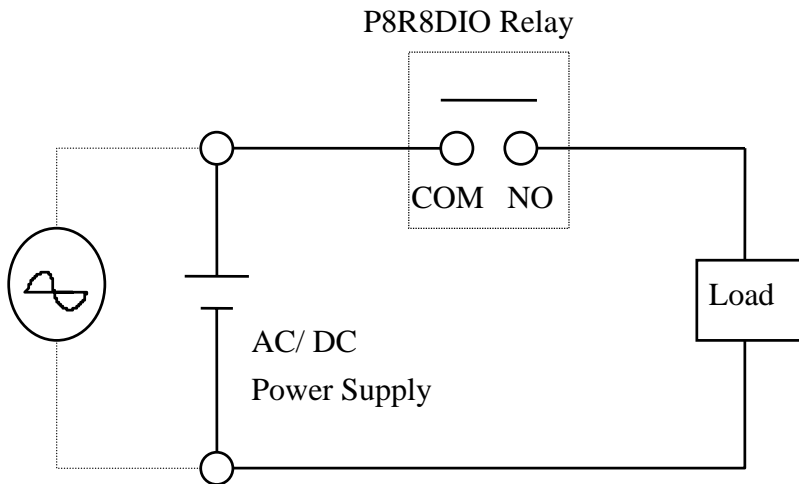


Figure 3-1.

Heavy Loading Application (>0.3A). Refer to Figure 3-2.

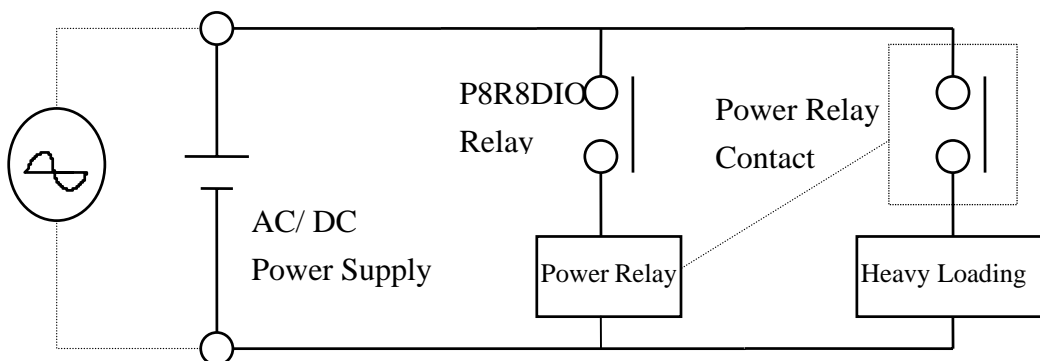


Figure 3-2.

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## 6.4. Isolated Input

The digital input state are read as a single byte from the port at base address+1 . Each of the eight bits within the byte corresponds to a particular digital input so that a high bit (equal to 1 ) represent a high state while a low bit (equal to 0) represent a low state . Register bits are assigned as shown in Table 3-3

### 6.4.1. Input Register

Base Address at 300 Hex

|               |    |    |    |    |    |    |    |    |
|---------------|----|----|----|----|----|----|----|----|
| Base + 1      | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| Input Channel | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |

Table 3-3. input addresses in the isolated control input Register.

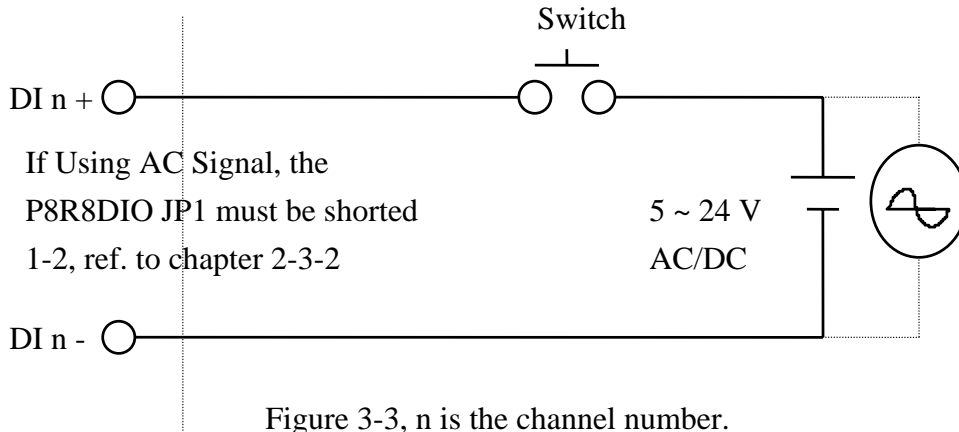
For Example (Basic Language)

Base=&h300      ‘ Set Base Address at 300 (Hex)

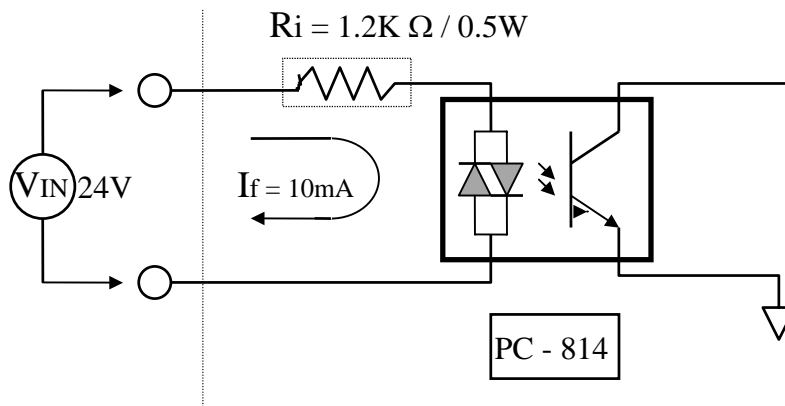
RIH=Inp(Base+1)      ‘ Read Isolated Input Ch 0 ~ Ch 7

## 6.4.2. Using Isolated Input

### Basic Circuit



The normal input voltage range is 5 to 24V AC or DC. The normal input range can be changed by choosing suitable resistor to limit the current through the opto-isolator to about 10 mA ( $I_f$ ). The default resistor is 1.2 K $\Omega$  / 0.5 W.



$$R_i = V_{in} / I_f$$

$$P_w = V_{in} \times I_f$$

Figure 3-4.

Calculation Example :

If  $V_{in} = 120 V$  Then  $R_i = 120 (V) / 0.01 (A) = 12 K \Omega$

$P_w = 120 (V) \times 0.01 (A) = 1.2 W$

The  $R_i$  Must Replace By 12K  $\Omega$  / 2 W (1.2W)

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# 7. Troubleshooting

If your P8R8DIO board is not operating properly, use the information in this chapter to isolate the problem.

## 7.1. Problem Isolation

You can use an ohmmeter to check operation of the relay outputs and a low voltage power supply to check the isolated inputs. You can use DOS DEBUG program to exercise relay outputs or read the input ports, or you can use the INP and OUT commands of the BASIC language. For example, using DEBUG for a P8R8DIO at a base address set to &H300 is as follows:

|   |        |                          |
|---|--------|--------------------------|
| O | 300 FF | 'Turn On all Relays.     |
| O | 300 0  | 'Turn Off all Relays.    |
| O | 300 08 | 'Turn On Bit D3 Relay.   |
| I | 300    | 'Read back Relay status  |
| I | 301    | 'Read Digital Input Data |