

# LSI3181

## Quadrature Encoder/Linear Scale Counter Card

### User's Manual (V1.1)

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## Correction record

Version	Record
V1.0	firmware version 1.0 up
V1.0->V1.1	Modify 2. Feature-Delete Software key function

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# Notes on hardware installation

Please follow step by step as you are installing the control cards.

Be sure your system is power off.

Be sure your external power supply for the wiring board is power off.

Plug your control card in slot, and make sure the golden fingers are put in right contacts.

Fasten the screw to fix the card.

Connect the cable between the card and wiring board.

Connect the external power supply for the wiring board.

Recheck everything is OK before system power on.

External power on.

Congratulation! You have it

For more detail of step by step installation guide, please refer the file “installation.pdf” on the CD come with the product or register as a member of our user’s club at:

<http://automation.com.tw/>

to download the complementary documents.

# 1. **Forward**

Thank you for your selection of PCI bus LSI3181 quadrature encoder/linear scale interface card.

In the field of automation, encoder and linear scale as feedback or measuring element is common used in the microprocessor control system. But for the versatile application in PC based control, only a few selections you can make.

With the state of the art technology of FPGA chip, photo/magnetic coupler isolation and experienced functions such as external triggered clear counter, auto increment compare equal or FIFO pre-programmed compare equal output to trigger external devices. Another important highlight of this card is the target position offset compare function, this function enables the in-line CCD camera can catch the separate pictures to sew up the full image without align the CCD center on a line. Low cost and high performance makes this card a better choice to use in the servo control feedback and other applications which are concerning quadrature encoder or linear scale.

Other encoder/linear scale interface card:

- LSI3101/3101A single axis quadrature encoder/linear scale counter card with FIFO compare function(PCI bus)
- LSI3104 4 axes quadrature encoder/linear scale counter card (PCI bus)
- LSI3123L low cost 3 axes quadrature encoder/linear scale counter card (no touch probe trigger latch function) (PCI bus)
- LSI3123 3 axes quadrature encoder/linear scale counter card (PCI bus)
- LSI3123A 3 axes quadrature encoder/linear scale counter card with fast coordinate rebuild function (PCI bus)
- LSI3134 4 axes quadrature encoder/linear scale counter card with 1 axis FIFO compare mode (PCI bus)
- LSI3144A 4 axes quadrature encoder/linear scale counter card with 2 axes FIFO compare and PWM FIFO output mode (PCI bus)
- LSI5123 3 axes quadrature encoder counter interface (USB)
- LSI5123L 3 axes quadrature encoder counter interface (no external trigger latch mode) (USB)
- LSI5123A 3 axes quadrature encoder counter interface (High noise immunity , Accurite linear scale absolute coordinate mode) (USB)

Any comment is welcome,

please visit our website

<http://www.automation.com.tw/>

<http://www.automation-js.com/> for the up to date information.

## 2. Features

### 2.1 Main card

- 2.1.1 PCI plug and play function with card ID for 16 identical cards
- 2.1.2 High noise immunity with magnetic/photo-coupler isolation
- 2.1.3 Supports DIN rail mounted wiring board
- 2.1.4 32bit timer based on 1us time base

#### **DIO block**

- 2.1.5 8 photo isolated digital input
- 2.1.6 8 photo isolated digital output
- 2.1.7 Software debounce for digital input
- 2.1.8 Software programmable I/O polarity
- 2.1.9 Interrupt from IN00~IN07

#### **Quadrature counter block**

- 2.1.10 32-bit counter
- 2.1.11 16 MHz max. Quadrature input rate
- 2.1.12 Quadrature, pulse/direction and up/down counting
- 2.1.13 Programmable multiple rate at X1, X2, X4
- 2.1.14 Software debounce for input signals
- 2.1.15 Multiple counter reset (homing) modes
- 2.1.16 Differential or single-end input signal

#### **Counter compare function block**

- 2.1.17 3 compare mode: Single, auto increment and FIFO compare mode
- 2.1.18 Compare equal output gated control
- 2.1.19 Programmable duration for Compare output
- 2.1.20 Interrupt on compare equal, FIFO near end
- 2.1.21 8 position offset comparator
- 2.1.22 8 offset compare equal output (differential out)

2.1.23 Programmable duration for position offset compare output

2.2 Din rail mounted wiring board

2.2.1 LED display for digital I/O

2.2.2 Application specific connectors

2.2.3 Step down s.p.s. for external 5V

## 3. **Specifications**

### 3.1 LSI3181 Main card

#### **Counter block**

- 3.1.1 Number of axes: 1
- 3.1.2 Input : 5 magnetic isolation (A,B,Z,CLEAR,HOME input), TTL level
- 3.1.3 Output : 1 magnetic isolation (compare out), TTL level  
8 differential position offset compare out
- 3.1.1 Maximum quadrature input frequency : 16MHz x 4
- 3.1.2 Encoder Type: Single-end or differential (with ADP3101 DIN wiring board)
- 3.1.3 Input software debounce: 512k, 1M, 2M, 4M, 8M,10M,16M (programmable)
- 3.1.4 Input multiple rate: X1, X2, X4 programmable (quadrature signal only)
- 3.1.5 Counter length : 32 Bits
- 3.1.6 Position offset: 16 Bits
- 3.1.7 Counter Mode : (QUADRATURE) , (CLOCK/DIRECTION) ,  
(UP CLOCK/ DOWN CLOCK)
- 3.1.8 Sample clock frequency: 198MHz
- 3.1.9 PCI data width : 32 Bits
- 3.1.10 FIFO depth : 1023
- 3.1.11 Compare out one shot duration : 1 ~ 65535 us

#### **Digital block**

- 3.1.12 Input : 8 photo-isolated ,
- 3.1.13 ON state : 2.8Vdc(max) 4.5mA(min)
- 3.1.14 OFF state : 8Vdc(min) 3mA(max)
- 3.1.15 Switching speed : 10KHz max. (limit by photo coupler speed and debounce filter )
- 3.1.16 Software debounce: 100Hz, 200Hz, 1KHZ, No debounce (programmable)
- 3.1.17 Interrupt at IN00 ~ IN07



- 3.1.18 Output : 8 photo-isolated,
- 3.1.19 Output range : Open collector 0 ~ 45 Vdc (on card)
- 3.1.20 Output rating : (With ADP3101 DIN wiring board)
  - 3A @250Vac, 30Vdc (Relay)
  - 1A @ 24Vdc (PMOS)
  - 2A @ 240Vac (SSR)
- 3.1.21 Sink current : 500mA(peak) per channel (on card)
- 3.1.22 Switching speed : 20KHz(max)(MOS out only)

### **Timer block**

- 3.1.23 Timer time base: 1us
- 3.1.24 Timer/counter length:32 bit

### **General**

- 3.1.25 Card ID : 4 bits, 16 position
- 3.1.26 Insulation resistance : 1000Mohm (min) at 1000Vdc
- 3.1.27 Isolation voltage : 2500Vac 1 min
- 3.1.28 Connector : one 20 pin SCSI-II female connector  
one 20 pin flat cable connector
- 3.1.29 Operation temperature : 0 to +70 degree C
- 3.1.30 Storage temperature : -20 to +80 degree C
- 3.1.31 Operation humidity : 5-95% RH, non-condensing
- 3.1.32 Dimension : 130(W) \* 102(H)mm , 5.2(W) \* 4.1(H)in

## 3.2 Din rail mounted wiring board

### **ADP3101DIN DIN rail mounted wiring board**

- 3.2.1 External Supply : DC 24V  $\pm$  4V
- 3.2.2 Single end/ differential signal : jumper select
- 3.2.3 Connector: SCSI-II 20P cable to connect main and wiring board
- 3.2.4 On board build-in s.p.s. : DC+5V 500mA (max)
- 3.2.5 Dimension : 86(W) \* 103(L) \*45(H)mm;  
3.4(W)\*4.1(L)\*1.8(H)in

### **ADP9201DIN DIN rail mounted wiring board**

- 3.2.6 External Supply : DC 24V  $\pm$  4V
- 3.2.7 Input : 8 with LED indicator
- 3.2.8 Output : ADP9201DIN(R) : 8 relays (3A @250Vac, 3A @30Vdc) with LED indicator  
ADP9201DIN(S) : 8 SSR (2A @240Vac) with LED indicator  
ADP9201DIN(P) : 8 PMOS (Source 1A @24Vdc) with LED indicator
- 3.2.9 Connector: One 20-pin male flat-cable connector
- 3.2.10 Operation Temperature: 0 to +70 degree C
- 3.2.11 Operation Humidity: RH5~95%, non-condensing
- 3.2.12 Dimension: ADP9201DIN(R) / (P) : 86(W) \* 103(L) \*45(H)mm;  
3.4(W)\*4.1(L)\*1.8(H)in  
ADP9201DIN(S) : 86(W) \* 103(L) \*50(H)mm  
3.4(W)\*4.1(L)\*2.0(H)in

### **JS51053 20PM Din rail mounted dummy wiring board**

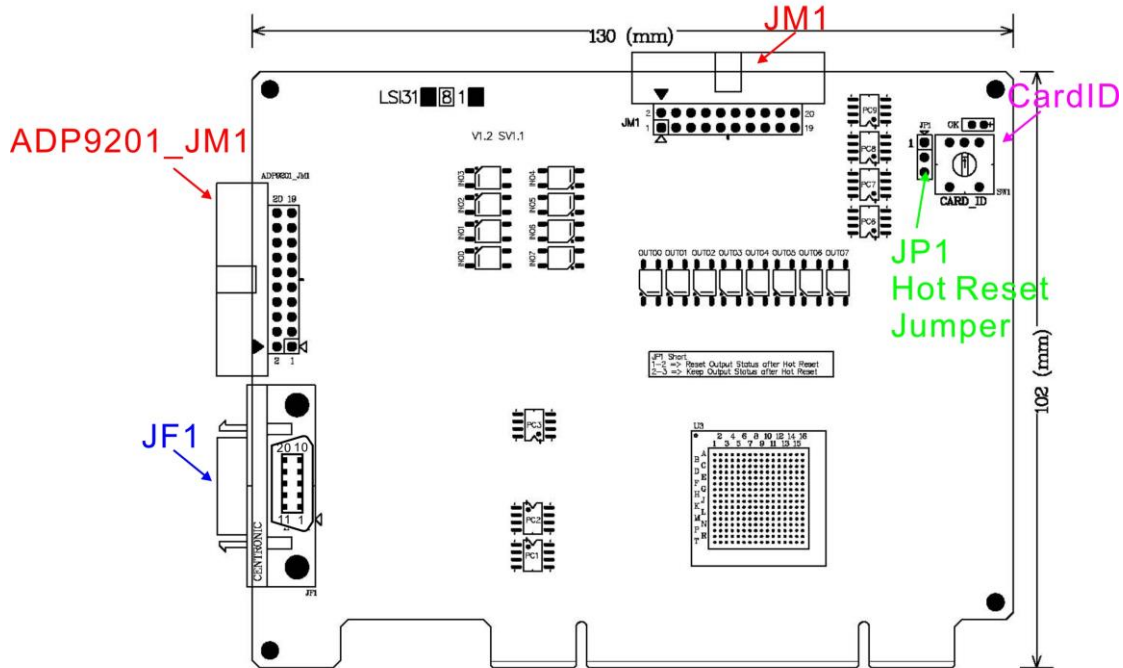
- 3.2.13 Dimension: 86(W)\*79(L)\*52(H)mm, 3.4(W)\*3.2(L)\*2.1(H)in

### **JS51050 for JM1 pulse handler interface**

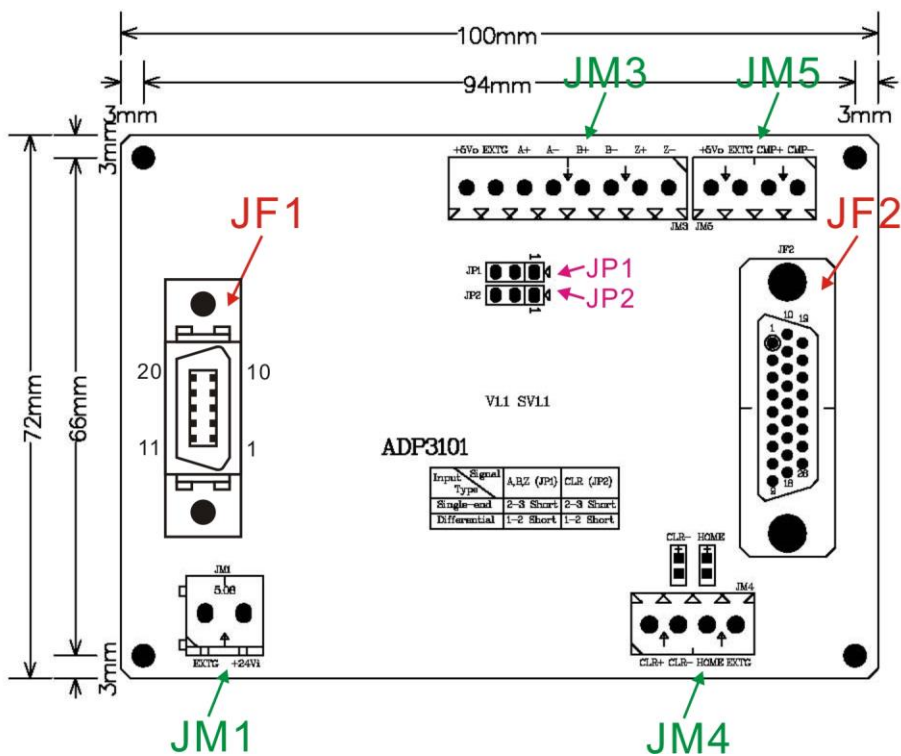
- 3.2.14 Connection cable — D-type 25P cable to connect main and wiring board
- 3.2.15 Dimension — 86(W)\*79(L)\*52(H)mm, 3.4(W)\*3.2(L)\*2.1(H)in

## 4. Layout and dimensions

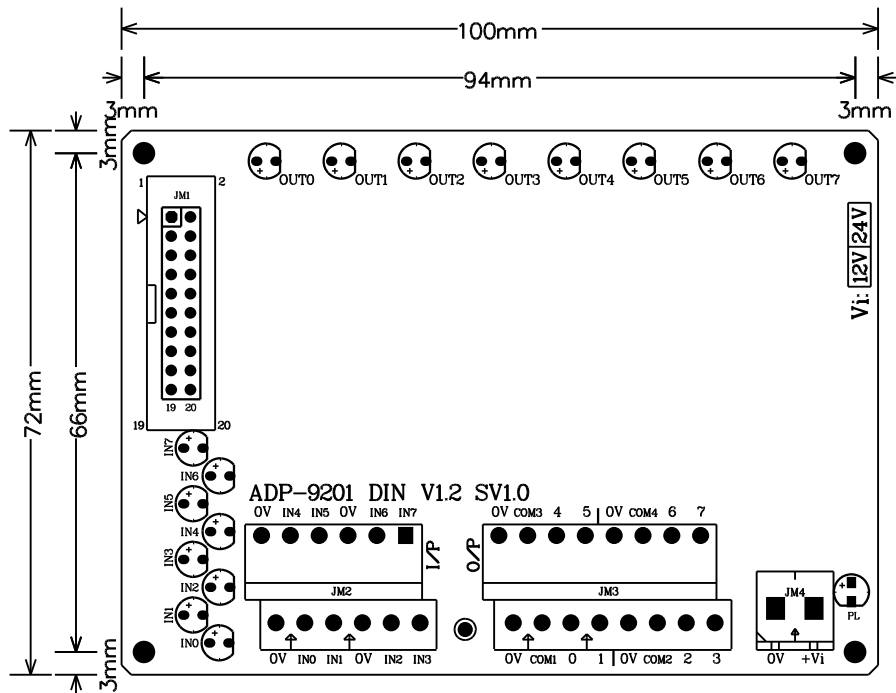
### 4.1 LSI3181 Main card



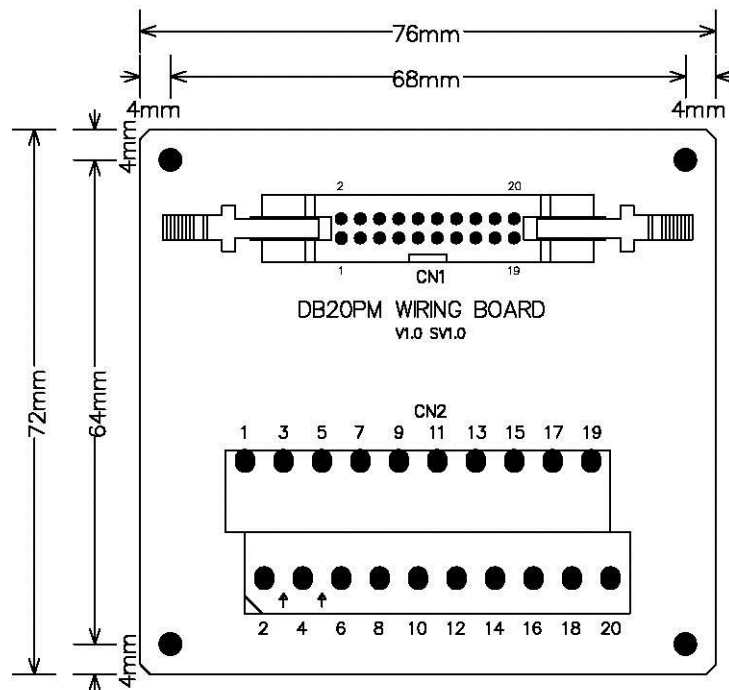
### 4.2 ADP3101DIN Din rail mounted wiring board



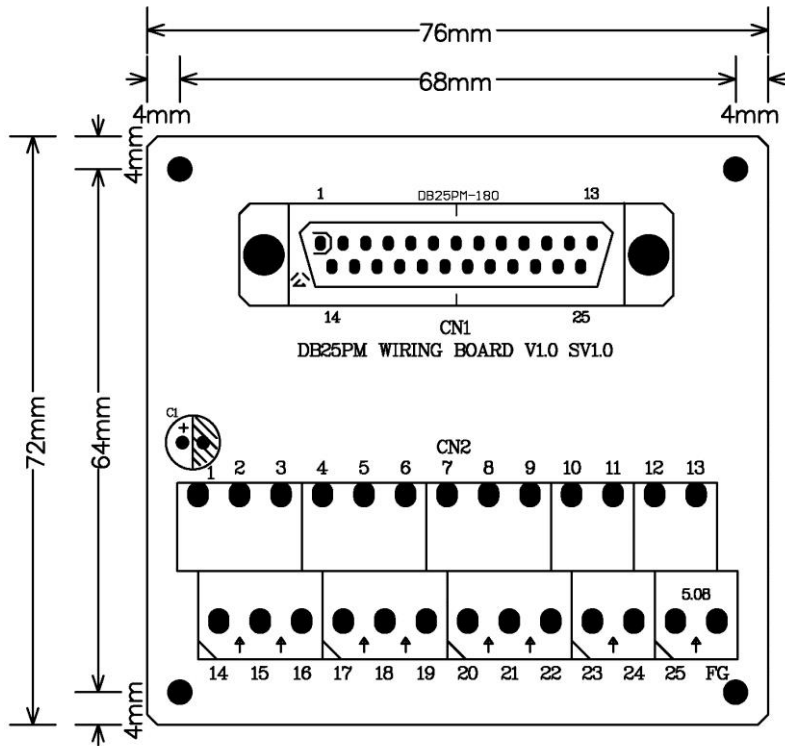
### 4.3 ADP9201DIN Din rail mounted wiring board



### 4.4 JS51053 for ADP9201\_JM1 20PM Din rail mounted dummy wiring board



#### 4.5 JS51050 for JM1 25PM Din rail mounted dummy wiring board



## 5. Pin definitions for main card connectors

### 5.1 JF1 pin definitions

PIN	DESCRIPTIONS		PIN	DESCRIPTIONS
1	+5Vin: 5V input from wiring board		11	EXTG: common of +5Vin
2	+5Vin: 5V input from wiring board		12	EXTG: common of +5Vin
3	A+: phase A+ input		13	A-: phase A- input
4	B+: phase B+ input		14	B-: phase B- input
5	Z+: phase Z+ input		15	Z-: phase Z- input
6	CLR_IN+: clear+ input		16	CLR_IN-: clear- input
7	NC		17	NC
8	HOME: home limit switch input		18	NC
9	NC		19	CMP_OUT: compare equal output
10	NC		20	NC

### 5.2 JM1 pin definition

PIN	DESCRIPTIONS		PIN	DESCRIPTIONS
1	CMP0_OUT+: offset0 compare out +		14	CMP0_OUT-: offset0 compare out -
2	CMP1_OUT+: offset1 compare out +		15	CMP1_OUT-: offset1 compare out -
3	CMP2_OUT+: offset2 compare out +		16	CMP2_OUT-: offset2 compare out -
4	CMP3_OUT+: offset3 compare out +		17	CMP3_OUT-: offset3 compare out -
5	CMP4_OUT+: offset4 compare out +		18	CMP4_OUT-: offset4 compare out -
6	CMP5_OUT+: offset5 compare out +		19	CMP5_OUT-: offset5 compare out -
7	CMP6_OUT+: offset6 compare out +		20	CMP6_OUT-: offset6 compare out -
8	CMP7_OUT+: offset7 compare out +		21	CMP7_OUT-: offset7 compare out -
9	EXTG: external ground		22	NC
10	EXTG: external ground		23	NC
11	NC		24	NC
12	NC		25	NC
13	NC			

### 5.3 ADP9201\_JM1 pin definitions

PIN	Descriptions		PIN	Descriptions
1	EXT_IN00 (compare out gate input)	EXT_IN00	2	EXT_OUT00
3	EXT_IN01	EXT_IN01	4	EXT_OUT01
5	EXT_IN02	EXT_IN02	6	EXT_OUT02
7	EXT_IN03	EXT_IN03	8	EXT_OUT03
9	EXT_IN04	EXT_IN04	10	EXT_OUT04
11	EXT_IN05	EXT_IN05	12	EXT_OUT05
13	EXT_IN06	EXT_IN06	14	EXT_OUT06
15	EXT_IN07	EXT_IN07	16	EXT_OUT07
17	EXTG	EXTG	18	EXTG
19	+24Ve	EXT +24Vin	20	+24Ve

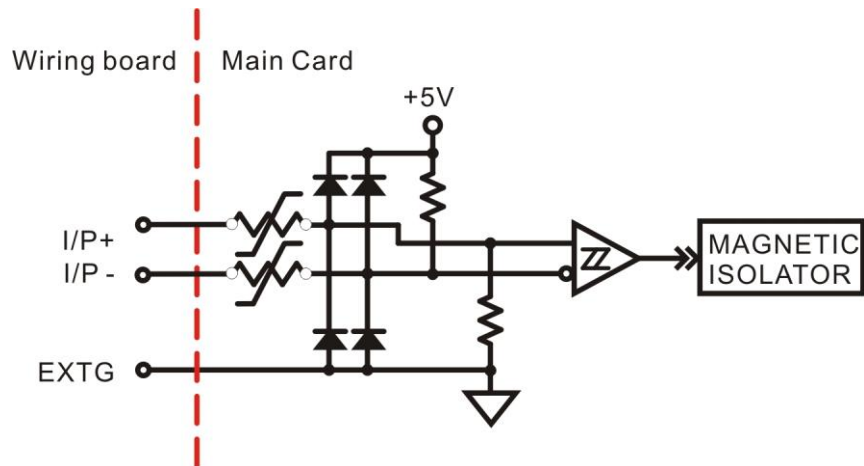
EXT_IN00	<b>1</b>	<b>2</b>	EXT_OUT00
EXT_IN01	<b>3</b>	<b>4</b>	EXT_OUT01
EXT_IN02	<b>5</b>	<b>6</b>	EXT_OUT02
EXT_IN03	<b>7</b>	<b>8</b>	EXT_OUT03
EXT_IN04	<b>9</b>	<b>10</b>	EXT_OUT04
EXT_IN05	<b>11</b>	<b>12</b>	EXT_OUT05
EXT_IN06	<b>13</b>	<b>14</b>	EXT_OUT06
EXT_IN07	<b>15</b>	<b>16</b>	EXT_OUT07
EXTG	<b>17</b>	<b>18</b>	EXTG
EXT +24Vin	<b>19</b>	<b>20</b>	EXT +24Vin

## 6. I/O Interface diagram

### 6.1 JF1 ADP3101DIN

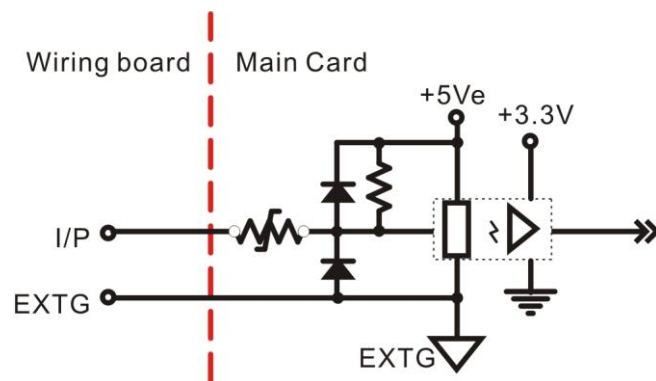
#### 6.1.1 Input diagram

**Type1 input:** Differential



For A+/A-, B+/B-, C+/C-, CLR\_IN+/CLR\_IN-

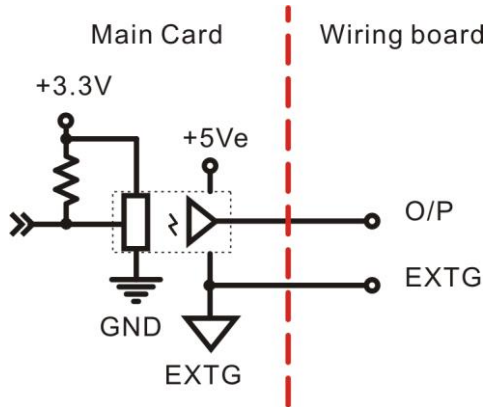
**Type2 input :** Home



For Home



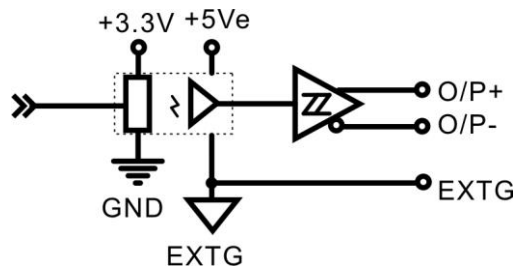
### 6.1.2 Output diagram



For compare equal output (CMP\_OUT)

## 6.2 JM1 JS51050

### 6.2.1 Output diagram

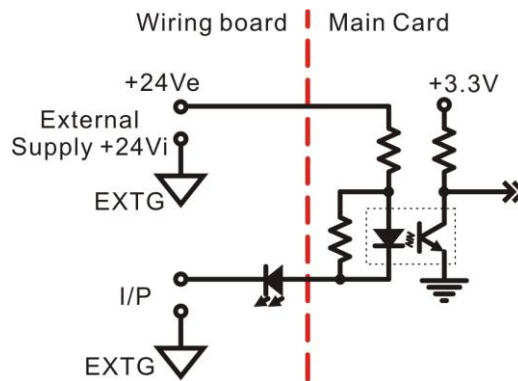


For position offset compare equal output (CMP0\_OUT ~ CMP7\_OUT)

## 6.3 ADP9201\_JM1 ADP9201DIN

### 6.3.1 Input diagram

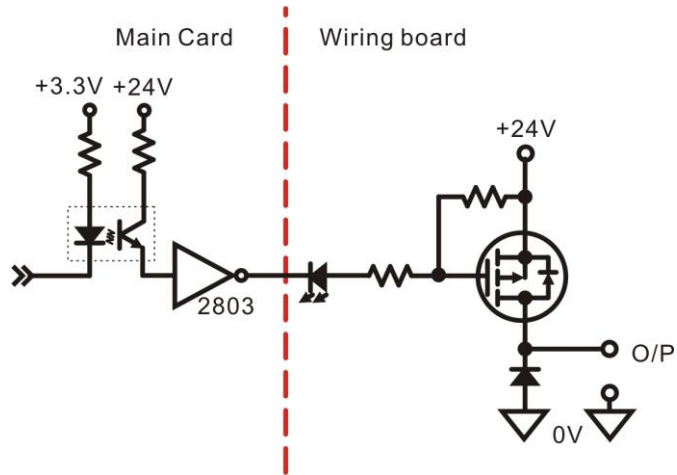
#### Type 1 Input:



For IN00~IN07

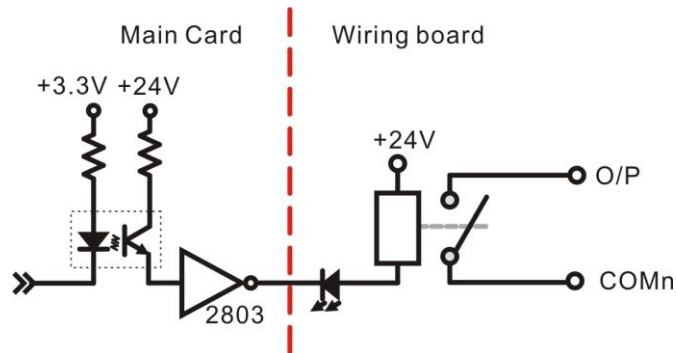
### 6.3.2 Output diagram

#### Type 1 output : (PMOS)



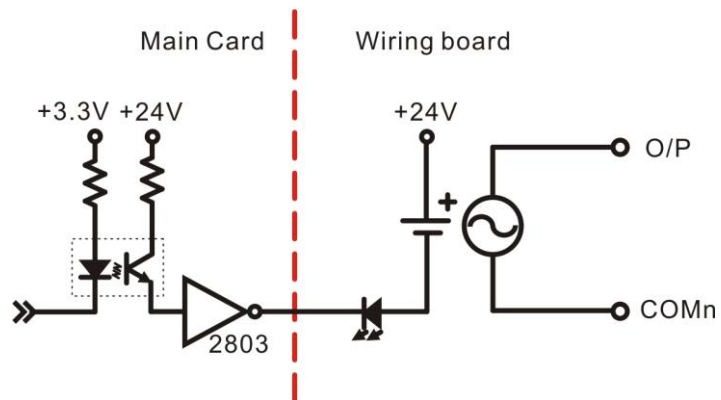
For OUT00~OUT07

#### Type 2 output : (Relay)



For OUT00~OUT07

#### Type 3 output : (SSR)



For OUT00~OUT07

## 7. Using wiring board

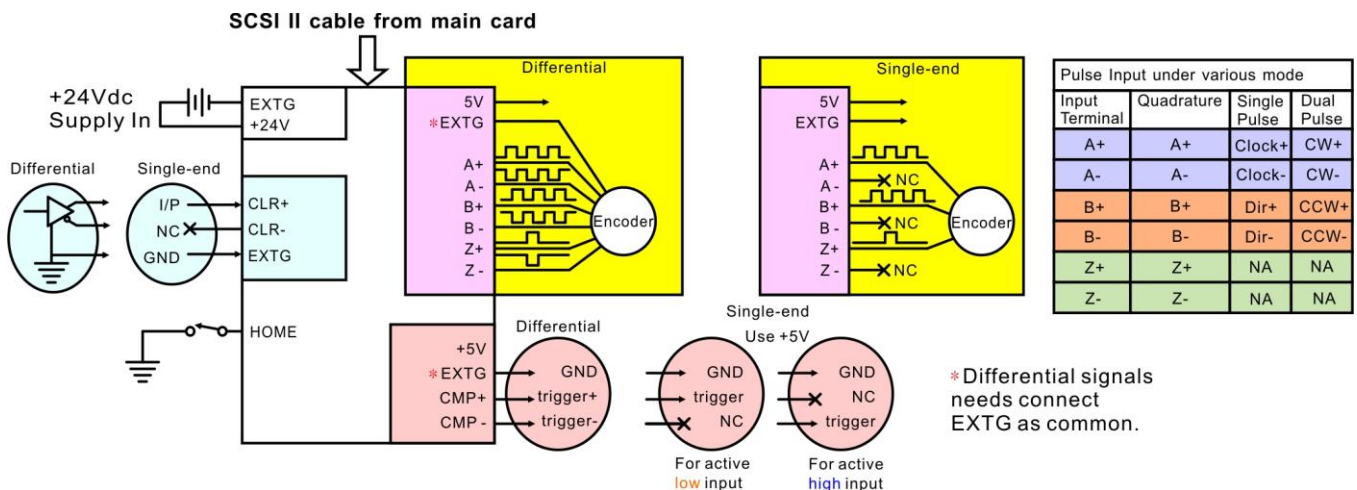
The matched wiring board provides easy interfacing between under control devices and the main control card. For different kind of under control devices, you can choose the wiring board of different interface type or just jump the selection jumper (if the wiring board have optional jumper selection).

### 7.1 ADP3101DIN wiring board

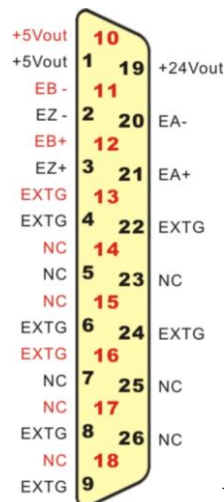
The ADP3101DIN wiring board is used for quadrature related functions, it can be set as differential input or single end input by jumper setting.

JP1		JP2	
1-2 short	2-3 short	1-2 short	2-3 short
Differential input	Single end input	Differential input	Single end input
Use A+,A-, B+,B- Z+,Z-	Use A+,B+,Z+. Leave others unconnected	Use CLR+,CLR-	Use CLR+ only, leave CLR- unconnected

Jumper settings of ADP3101DIN wiring board



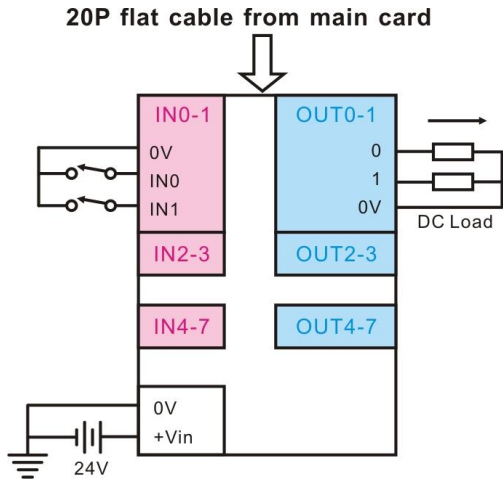
Sample wiring of ADP3101DIN



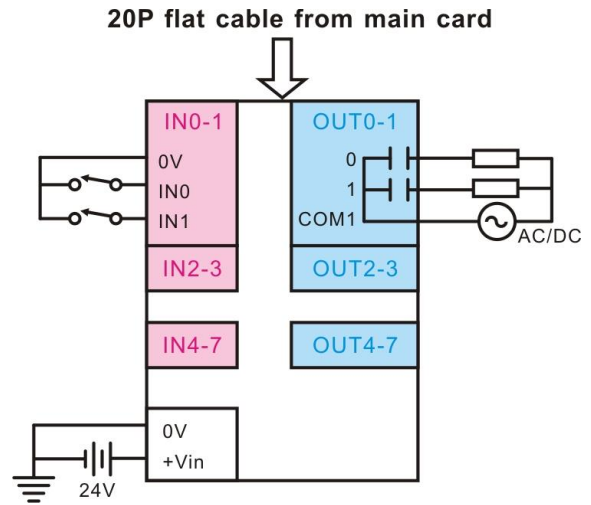
Wiring board DB26 specific connector

## 7.2 ADP9201DIN wiring board

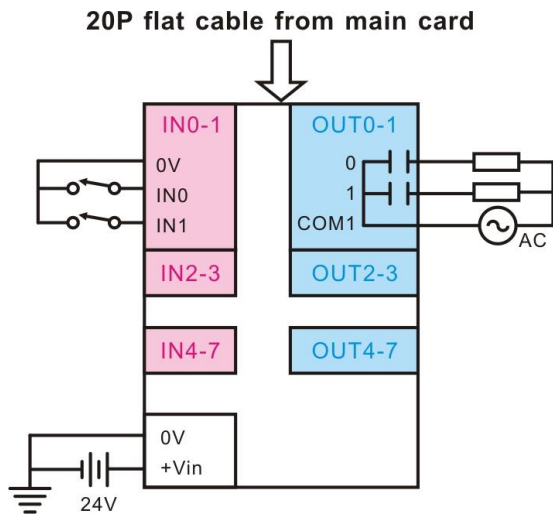
The ADP9201DIN wiring board is used for general purpose digital I/O, there are 3 output types can choose. The following diagram are sample wiring method for different output types.



wiring board with PMOS output



wiring board with Relay output

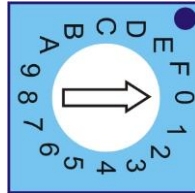


wiring board with SSR output

## 8. Main card hardware settings

### 8.1 Card ID setting

Since PCI cards have plug and play function, the card ID is required for programmer to identify which card he/she will control without knowing the physical address assigned by the Windows. A 4 bits rotary switch for extinguishing the 16 identical card. Do not select the same card ID number, if you use more than one same type card in your system.



### 8.2 JP1 warm reset jumper

Output relay contact type setting (JP1)	
Reset output after warm reset	Keep output after warm reset

## 9. Applications

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For counting pulses on the fly, such as:

- Encoder on various kinds of servo motor
- Encoder on DC/AC motor
- Optical scale output signal
- Magnetic linear scale output
- Timing disc
- Revolution sprocket
- Proximity sensor/detector with relative motion
- Timer counter

Compare position on the fly

Pulse signal receiver /display

X-Y Table linear Scale F/B

## 10. Ordering information

<u>PRODUCT</u>	<u>DESCRIPTIONS</u>
LSI3181	magnetic isolated one-axis Quadrature Encoder Counter Card with position offset compare function (up to 16MHz quadrature input)
ADP3101DIN	DIN rail mounted wiring board for LSI3101/3181/3188 quadrature counter related function.
ADP9201DIN(P)	DIN rail mounted wiring board for general digital I/O, PMOS out
ADP9201DIN(R)	DIN rail mounted wiring board for general digital I/O, relay out
ADP9201DIN(S)	DIN rail mounted wiring board for general digital I/O, SSR out
JS51053	DIN rail dummy wiring board for general digital I/O, Transistor out
JS51050	DIN rail mounted dummy wiring board (D type 25p male to terminals ) for JM1
M262020150	20-pin SCSI-II cable 1.5M
M262020300	20-pin SCSI-II cable 3.0M
M23207	20-pin flat cable 1.5M
M23209	20-pin flat cable 3.0M
M270325X4	D type 25p male-female cable 1.5M
M270325X4S	D type 25p male-female cable 1.5M,shielding
M270325X0	D type 25p male-female cable 3.0M
M270325X0S	D type 25p male-female cable 3.0M,shielding
SM23415	Extension kit for JM1 (bracket and flat cable for 25P female D type connector)