LSI3144A

Encoder/Linear Scale Counter Card

User's Manual (V1.3)

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Correction record

Version	Record
1.0	firmware version 1.0 up
1.1	add 5.2 JM1 High speed signal I/O connector (on board)
1.2	Modify 6.2 Output diagram
1.3	Modify 2. Feature-Delete Software key function

Contents

Notes on hardware installation

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

1. Be sure your system is power off.
2. Be sure your external power supply for the wiring board is power off.
3. Plug your control card in slot, and make sure the golden fingers are put in right contacts.
4. Fasten the screw to fix the card.
5. Connect the cable between the card and wiring board.
6. Connect the external power supply for the wiring board.
7. Recheck everything is OK before system power on.
8. 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 LSI3144A 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.

We integrate 4 axes (channels) in one card with the state of the art technology of FPGA chip and provide photo/magnetic coupler isolation and experienced functions such as external triggered latch or load counter, auto increment compare equal or FIFO pre-programmed compare equal output to trigger external devices. The LSI3144A comes with new FIFO of PWM function. The compare out triggers the position FIFO and the PWM FIFO that makes different PWM output at different line interval.

Low cost and high performance makes this card a better choice to use in the servo control feedback, 3D measuring system and other applications which are concerning encoder or linear scale.

Other encoder/linear scale interface card:

LSI3101 one-axis Quadrature Encoder Counter Card
(up to 8MHz quadrature input) (PCI bus)

LSI3101A one-axis Quadrature Encoder Counter Card
(up to 16MHz quadrature input) (PCI bus)

LSI3181 one-axis Quadrature Encoder Counter Card with 8 position offset comparators
(up to 16MHz quadrature input) (PCI bus)

LSI3104 4 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)

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 16 MHz max. Quadrature input rate
- 2.1.4 Four 32-bit counters
- 2.1.5 Quadrature, pulse/direction and up/down counting
- 2.1.6 Programmable multiple rate at X1, X2, X4
- 2.1.7 Load preset value to counter by external trigger or software trigger
- 2.1.8 Latch counter value by external trigger
- 2.1.9 Multiple counter reset (homing) modes
- 2.1.10 Differential or single-end input signal
- 2.1.11 Auto increment compare mode
- 2.1.12 FIFO position compare mode (X,Z axis)
- 2.1.13 FIFO PWM control (X,Z axis)
- 2.1.14 Programmable duration for Compare out and Clear out
- 2.1.15 Interrupt on external trigger, compare equal, borrow, carry and counter clear
- 2.1.16 Supports DIN rail mounted wiring board

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 LSI3144A Main card

Counter input

3.1.1 Number of axes — 4, independent

3.1.2 Maximum quadrature input frequency — 16MHz

3.1.3 Maximum input pulse frequency — 16MHz

3.1.4 Encoder Type — Single-end or differential

3.1.5 Count per encoder cycle — X1, X2, X4 programmable (quadrature signal only)

3.1.6 Counter length — 32 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 Card ID — 4 bits

3.1.11 Input channel — 4 channels X, Y, Z and A, totally 4 compatible device units can be hooked

3.1.12 Software homing (reset) counter method — 1 software trigger mode

3.1.13 Hardware homing (reset) counter method — 7 H/W trigger mode

3.1.14 External compare out mask off — INn(GATE), CLR

3.1.15 FIFO depth — 1023 (X,Z axis)

3.1.16 Compare out one shot duration — 1 ~ 16777215 us

Digital Input

3.1.17 Home — 1 per channel (Single end or differential)

3.1.18 Latch — 1 per channel (Single end or differential)

3.1.19 Clear counter — 1 per channel (Single end or differential)

3.1.20 General input — 1 per channel

3.1.21 Polarity — all input signals are software programmable

3.1.22 ON state — 2.8Vdc(max) 4.5mA(min)

3.1.23 OFF state — 8Vdc(min) 3mA(max)

3.1.24 Switching speed— 2.2 K Hz (max) for general input
2 MHz (HOME, LATCH, CLEAR_IN)

Digital Output

3.1.25 Clear output — 1 per channel

3.1.26 General output — 1 per channel

3.1.27 Polarity — all output signals are software programmable

3.1.28 Output rating — 3A @250Vac, 30V dc (Relay wiring board)
1A @120Vdc (NMOS)

3.1.29 Switching speed — 20 K Hz (max) (MOS out only)

General

3.1.30 Card ID — 4 bits, 16 position

3.1.31 Photo isolation — All digital I/O and counter input

3.1.32 Insulation resistance — 1000Mohm (min) at 1000Vdc

3.1.33 Isolation voltage — 2500Vac 1 min

3.1.34 Connector — one 68 pin SCSI-II female connector

3.1.35 Operation temperature — 0 to +70 degree C

3.1.36 Storage temperature — -20 to +80 degree C

3.1.37 Operation humidity — 5-95% RH, non-condensing

3.1.38 Dimension — 151(W) * 110(H)mm , 6.0(W) * 4.4(H)in

3.2 ADP3144DIN DIN rail mounted wiring board

3.2.1 Connection cable — SCSI-II 68P cable to connect main and wiring board

3.2.2 Power supply voltage to wiring board — DC+24V

3.2.3 On board build-in s.p.s. — DC+5V 500mA (max)

3.2.4 Dimension — 86(W) * 204(L) * 53(H)mm , 3.4(W) * 8.1(L) * 2.1(H)in

3.3 ADP3144ADIN DIN rail mounted wiring board (high speed type)

3.3.1 Connection cable — SCSI-II 68P cable to connect main and wiring board

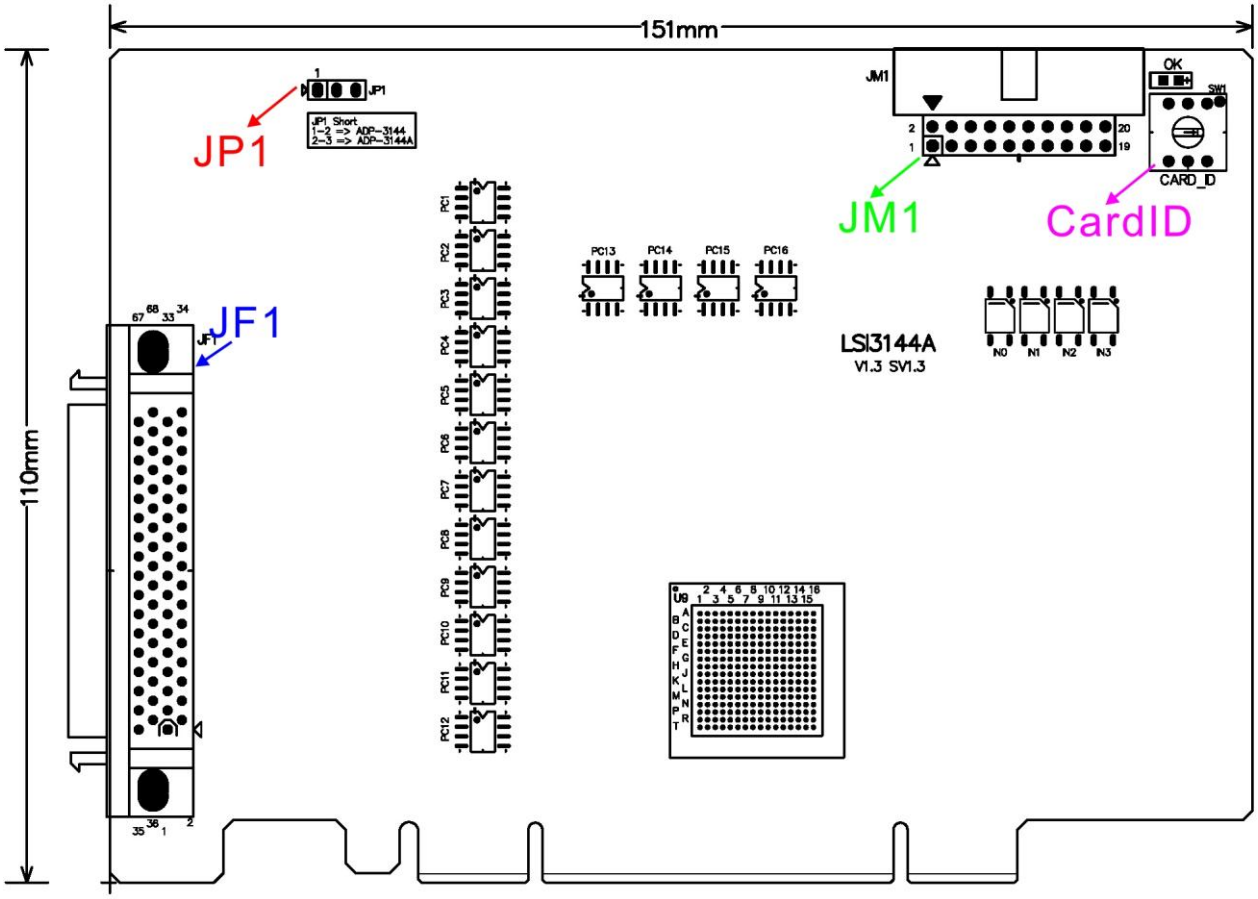
3.3.2 Power supply voltage to wiring board — DC+24V

3.3.3 On board build-in s.p.s. — DC+5V 500mA (max)

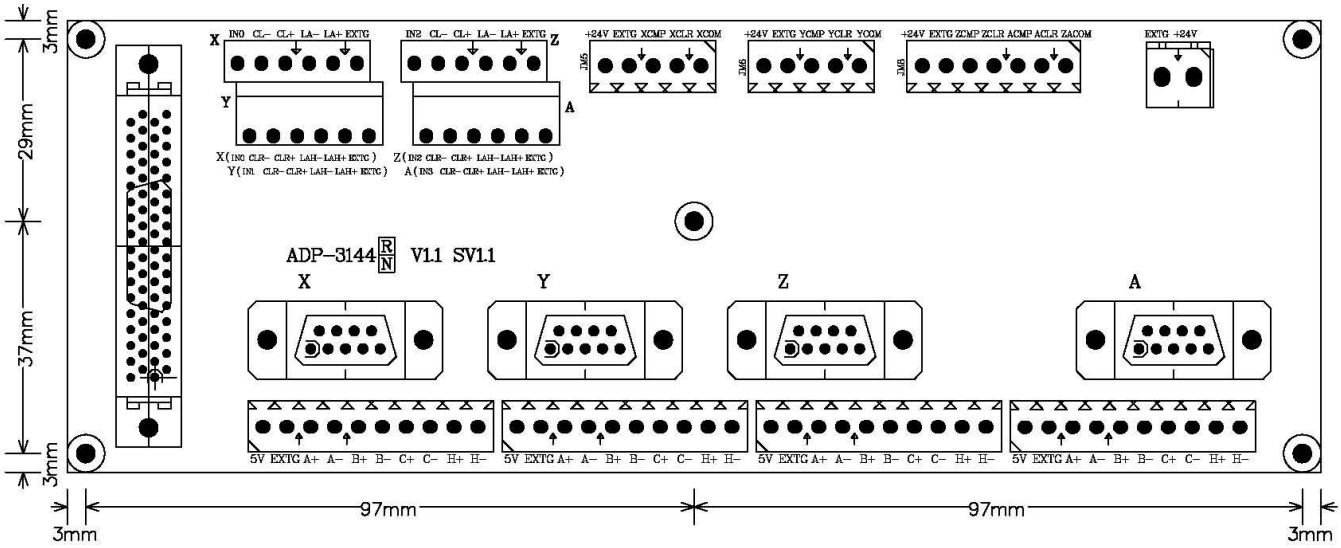
3.3.4 Dimension — 86(W) * 204(L) * 53(H)mm , 3.4(W) * 8.1(L) * 2.1(H)in

4. Layout and dimensions

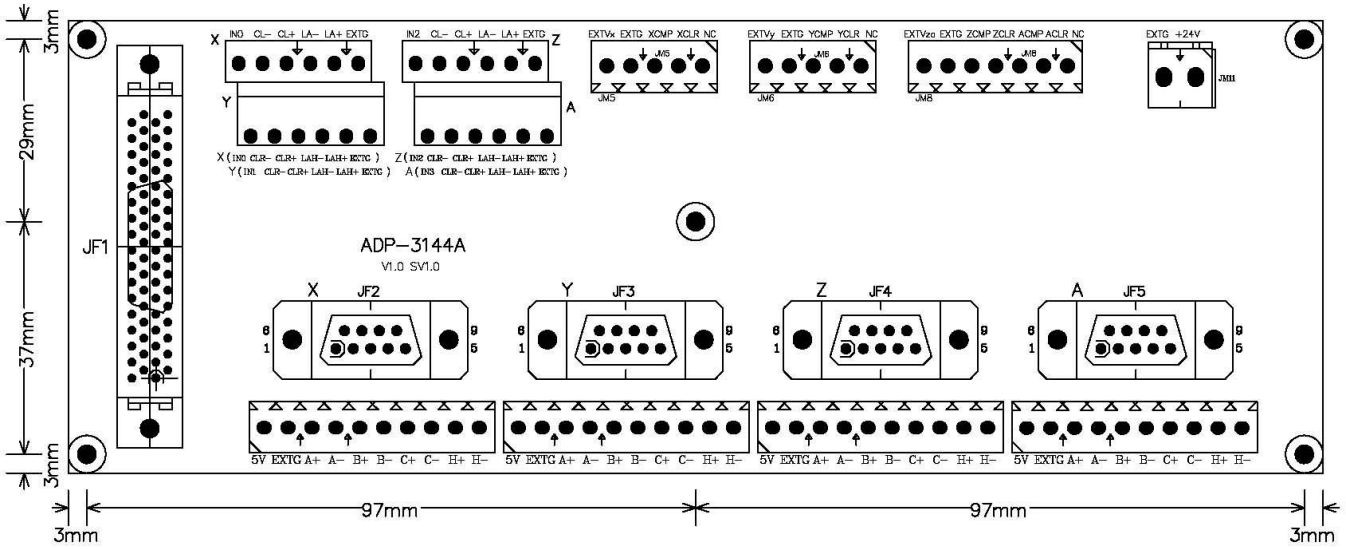
4.1 LSI3144A Main card



4.2 ADP3144DIN Din rail mounted wiring board

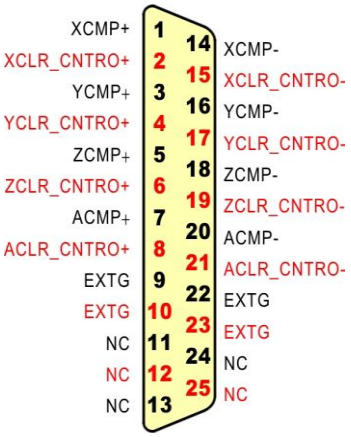


4.3 ADP3144ADIN Din rail mounted wiring board (high speed type)



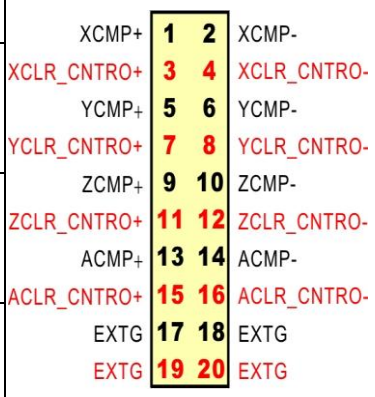
5. Pin definitions for 68P SCSI connector

5.1 JM1 High speed signal I/O connector (on bracket)

PIN	DESCRIPTIONS	JM1	PIN	DESCRIPTIONS
1	XCMP+: positive differential output of X_CMP; general purpose/compare output		14	XCMP-: negative differential output of X_CMP; general purpose/compare output
2	XCLR_CNTRO+: positive differential output of X_CLR_OUT; general purpose/compare output		15	XCLR_CNTRO-: negative differential output of X_CLR_OUT; general purpose/compare output
3	YCMP+: positive differential output of Y_CMP; general purpose/compare output		16	YCMP-: negative differential output of Y_CMP; general purpose/compare output
4	YCLR_CNTRO+: positive differential output of Y_CLR_OUT; general purpose/compare output		17	YCLR_CNTRO-: negative differential output of Y_CLR_OUT; general purpose/compare output
5	ZCMP+: positive differential output of Z_CMP; general purpose/compare output		18	ZCMP-: negative differential output of Z_CMP; general purpose/compare output
6	ZCLR_CNTRO+: positive differential output of Z_CLR_OUT; general purpose/compare output		19	ZCLR_CNTRO-: negative differential output of Z_CLR_OUT; general purpose/compare output
7	ACMP+: positive differential output of A_CMP; general purpose/compare output		20	ACMP-: negative differential output of A_CMP; general purpose/compare output
8	ACLR_CNTRO+: positive differential output of A_CLR_OUT; general purpose/compare output		21	ACLR_CNTRO-: negative differential output of A_CLR_OUT; general purpose/compare output
9	EXTG: external ground		22	EXTG: external ground
10	EXTG: external ground		23	EXTG: external ground
11	NC		24	NC
12	NC		25	NC
13	NC			

Note: To use as general purpose output, the CMP or CLR_OUT pin must configured as general purpose first and the paired differential signals work as general out (but on complementary output level).

5.2 JM1 High speed signal I/O connector (on board)

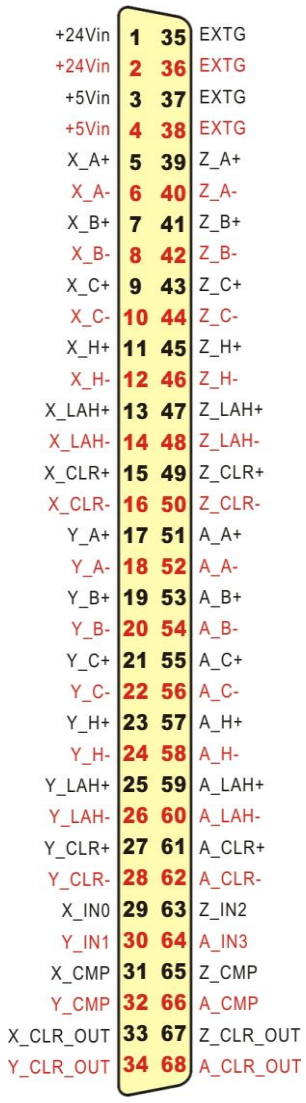
PIN	DESCRIPTIONS	JM1	PIN	DESCRIPTIONS
1	XCMP+: positive differential output of X_CMP; general purpose/compare output		2	XCMP-: negative differential output of X_CMP; general purpose/compare output
3	XCLR_CNTRO+: positive differential output of X_CLR_OUT; general purpose/compare output		4	XCLR_CNTRO-: negative differential output of X_CLR_OUT; general purpose/compare output
5	YCMP+: positive differential output of Y_CMP; general purpose/compare output		6	YCMP-: negative differential output of Y_CMP; general purpose/compare output
7	YCLR_CNTRO+: positive differential output of Y_CLR_OUT; general purpose/compare output		8	YCLR_CNTRO-: negative differential output of Y_CLR_OUT; general purpose/compare output
9	ZCMP+: positive differential output of Z_CMP; general purpose/compare output		10	ZCMP-: negative differential output of Z_CMP; general purpose/compare output
11	ZCLR_CNTRO+: positive differential output of Z_CLR_OUT; general purpose/compare output		12	ZCLR_CNTRO-: negative differential output of Z_CLR_OUT; general purpose/compare output
13	ACMP+: positive differential output of A_CMP; general purpose/compare output		14	ACMP-: negative differential output of A_CMP; general purpose/compare output
15	ACLR_CNTRO+: positive differential output of A_CLR_OUT; general purpose/compare output		16	ACLR_CNTRO-: negative differential output of A_CLR_OUT; general purpose/compare output
17	EXTG: external ground		18	EXTG: external ground
19	EXTG: external ground		20	EXTG: external ground

Note: To use as general purpose output, the CMP or CLR_OUT pin must configured as general purpose first and the paired differential signals work as general out (but on complementary output level).

5.3 JF1 Front view of connector

PIN	DESCRIPTIONS
1	+24V : External DC +24V supply
2	+24V : External DC +24V supply
3	+5V : Regulated +5V out
4	+5V : Regulated +5V out
5	X_A+ : encoder A+ phase input
6	X_A- : encoder A- phase input
7	X_B+ : encoder B+ phase input
8	X_B- : encoder B- phase input
9	X_C+ : encoder C+ phase input
10	X_C- : encoder C- phase input
11	X_H+ : HOME+ input
12	X_H- : HOME- input
13	X_LAH+ : LATCH+ input
14	X_LAH- : LATCH- input
15	X_CLR+ : clear counter+ input
16	X_CLR- : clear counter- input
17	Y_A+ : encoder A+ phase input
18	Y_A- : encoder A- phase input
19	Y_B+ : encoder B+ phase input
20	Y_B- : encoder B- phase input
21	Y_C+ : encoder C+ phase input
22	Y_C- : encoder C- phase input
23	Y_H+ : HOME+ input
24	Y_H- : HOME- input
25	Y_LAH+ : LATCH+ input
26	Y_LAH- : LATCH- input
27	Y_CLR+ : clear counter+ input
28	Y_CLR- : clear counter- input
29	X_IN0: general purpose input
30	Y_IN1: general purpose input
31	X_CMP: general purpose/compare output
32	Y_CMP: general purpose/compare output
33	X_CLR_OUT: clear counter/general output
34	Y_CLR_OUT: clear counter/general output

JF1

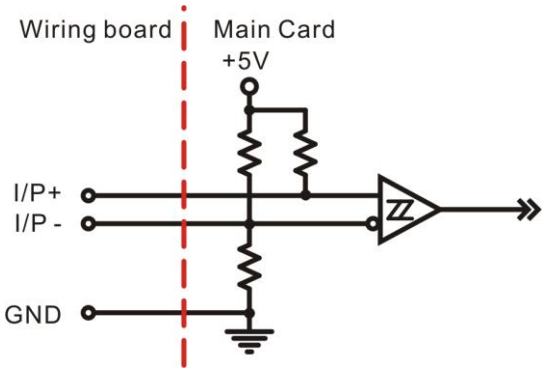


PIN	DESCRIPTIONS
35	EXTG : Ground
36	EXTG : Ground
37	EXTG : Ground
38	EXTG : Ground
39	Z_A+ : encoder A+ phase input
40	Z_A- : encoder A- phase input
41	Z_B+ : encoder B+ phase input
42	Z_B- : encoder B- phase input
43	Z_C+ : encoder C+ phase input
44	Z_C- : encoder C- phase input
45	Z_H+ : HOME+ input
46	Z_H- : HOME- input
47	Z_LAH+ : LATCH+ input
48	Z_LAH- : LATCH- input
49	Z_CLR+ : clear counter+ input
50	Z_CLR- : clear counter- input
51	A_A+ : encoder A+ phase input
52	A_A- : encoder A- phase input
53	A_B+ : encoder B+ phase input
54	A_B- : encoder B- phase input
55	A_C+ : encoder C+ phase input
56	A_C- : encoder C- phase input
57	A_H+ : HOME+ input
58	A_H- : HOME- input
59	A_LAH+ : LATCH+ input
60	A_LAH- : LATCH- input
61	A_CLR+ : clear counter+ input
62	A_CLR- : clear counter- input
63	Z_IN2: general purpose input
64	A_IN3: general purpose input
65	Z_CMP: general purpose/compare output
66	A_CMP: general purpose output
67	Z_CLR_OUT: clear counter/general output
68	A_CLR_OUT: clear counter/general output

6. I/O Interface diagram

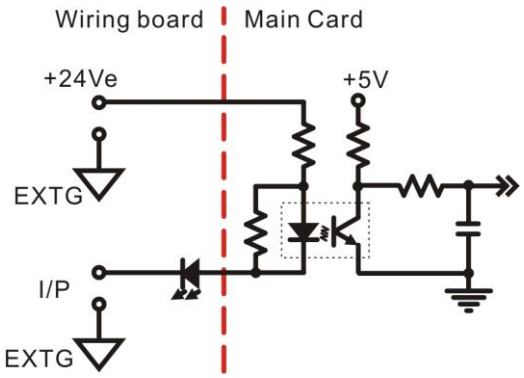
6.1 Input diagram

Type 1 input : Differential input



For A+/A-,B+/B-,C+/C-,H+/H-,CLR+/CLR-,LAH+/LAH-

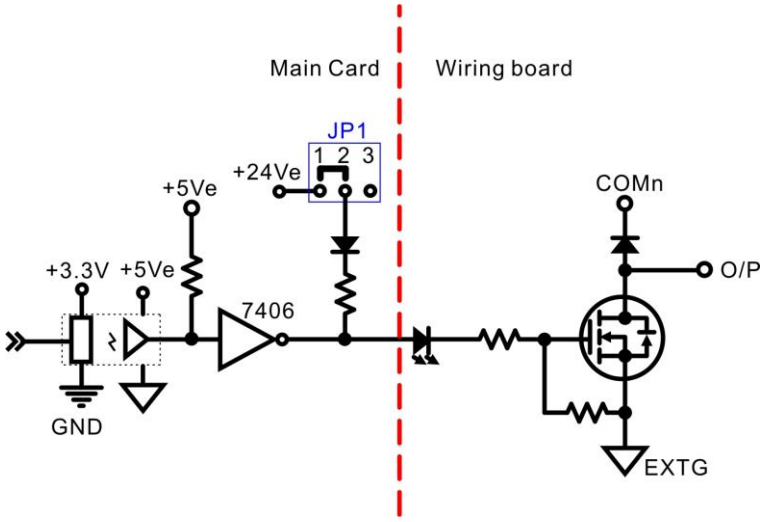
Type 2 Input:



For IN0~IN3

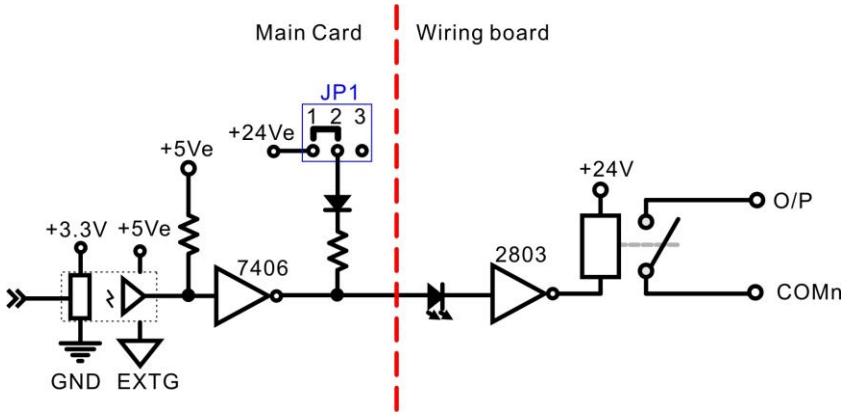
6.2 Output diagram

Type1 output: (NMOS) ADP3144DIN(N)



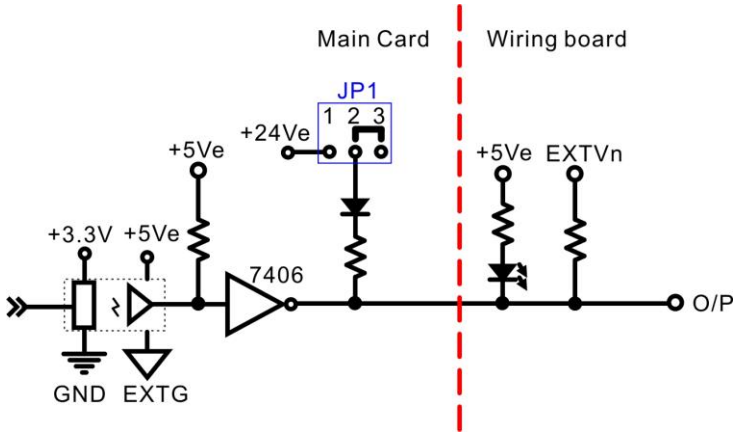
For X,Y,Z,A(OUT/CLR_OUT)

Type2 output: (Relay) ADP3144DIN(R)



For X,Y,Z,A (OUT/CLR_OUT)

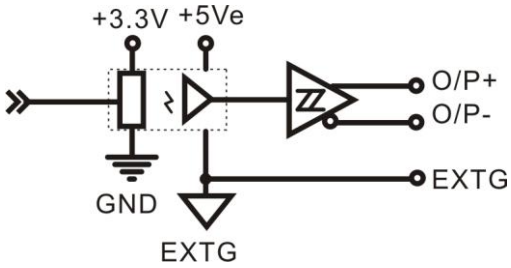
Type3 output: ADP3144ADIN



For X,Y,Z,A (OUT/CLR_OUT)

6.3 High speed port I/O diagram (JM1)

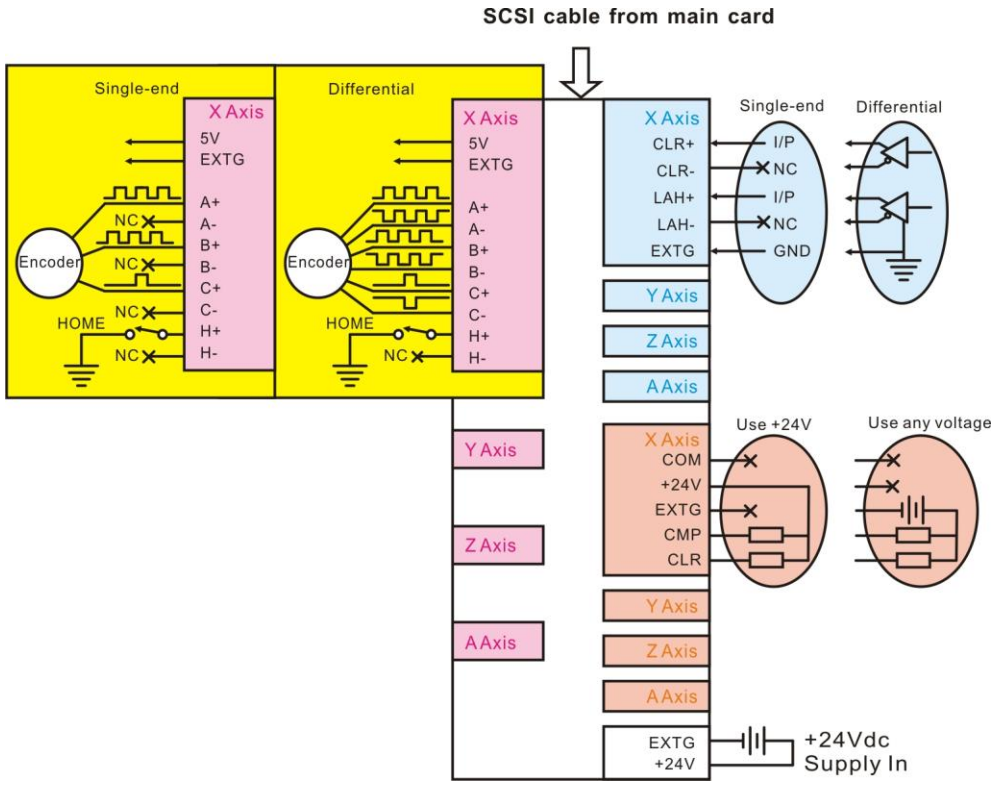
Output:



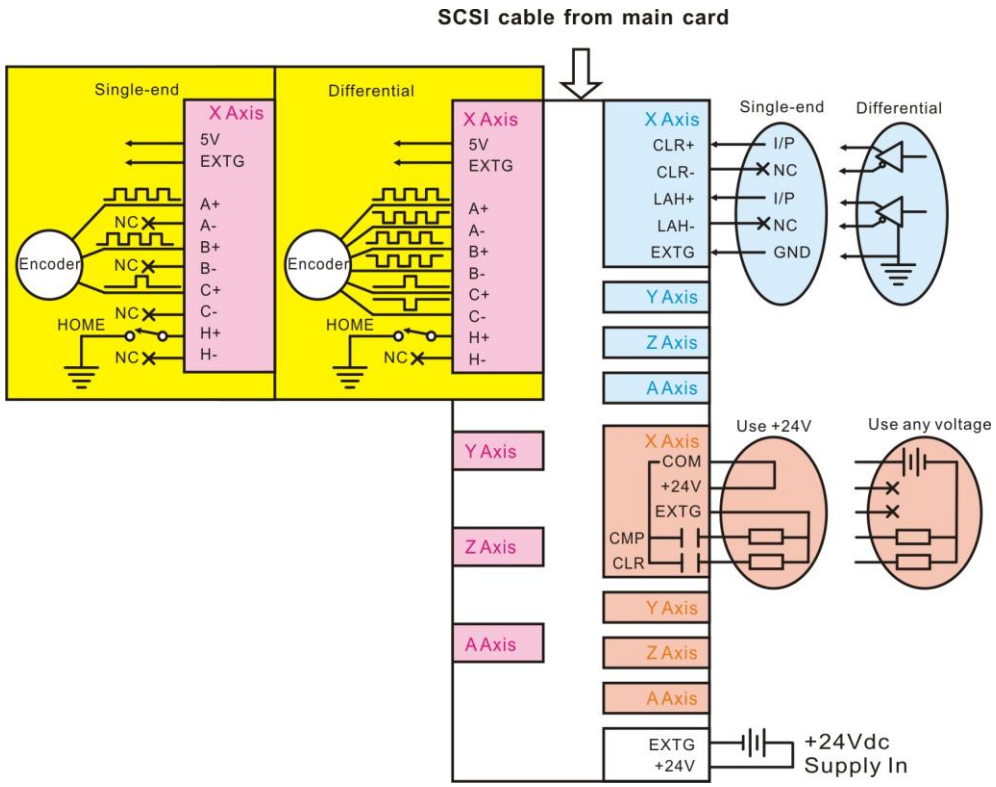
For X,Y,Z,A (CMP+/CMP-, CLR_CNTRO+/CLR_CNTRO-)

Note: The signal sources are the same as CLR_OUT and CMP but the interface with faster chips.

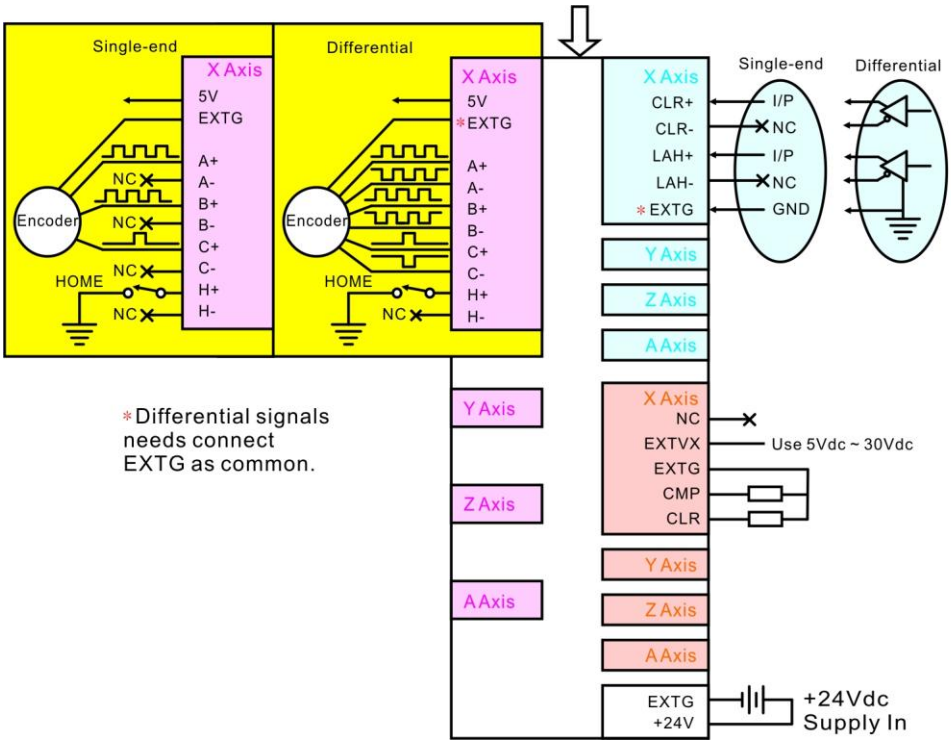
7. External wiring diagram



wiring board with NMOS output (ADP3144DIN(N))

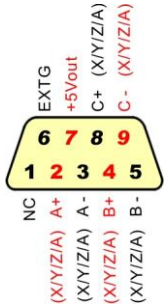


wiring board with Relay output (ADP3144DIN(R))



Pulse Input under various mode			
Input Terminal	Quadrature	Single Pulse	Dual Pulse
A+	A+	Clock+	CW+
A-	A-	Clock-	CW-
B+	B+	Dir+	CCW+
B-	B-	Dir-	CCW-
C+	C+	NA	NA
C-	C-	NA	NA

wiring board ADP3144ADIN

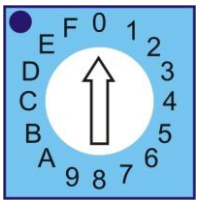


Wiring board DB9 specific connector

8. 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.



8.2 Matched wiring board setting

The LSI3144A can adopt the wiring board ADP3144DIN or ADP3144ADIN, the high speed type wiring board. Owing to the difference of voltage level, we must setup the interface configuration on the main card, JP1 jumper setting.

	
ADP3144DIN	ADP3144**A**DIN

9. Applications

- 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
- Image checker (trigger to take picture at different postion)
- Laser grooving (needs different position with different laser power)
- Pulse signal receiver /display
- Touch /non touch probe trigger to latch position
- X-Y Table linear Scale F/B

10. Ordering information

PRODUCT	DESCRIPTIONS
LSI3144A	4-axis Quadrature Encoder Counter Card
ADP3144DIN(N)	DIN rail mounted wiring board for LSI3144/LSI3144A, General output : 8 power NMOS
ADP3144DIN(R)	DIN rail mounted wiring board for LSI3144/LSI3144A, General output : 8 Relays
ADP3144ADIN	high speed type DIN rail mounted wiring board for LSI3144A
M2668681501	68-pin SCSI-II cable 1.5M
M2668683001	68-pin SCSI-II cable 3.0M