

ADT-8960

6-axis Motion Control Card

User's Reference Manual



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Version Upgrading Record

Version	Revised in	Descriptions
V7.0	2010/01/04	The seventh version

Remark: The three digits in the version number respectively mean:



Hardware version number



Major version number



Minor version number



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Chapter 1 General information

INTRODUCTION

ADT8940A1 Card is a kind of high-performance 4-axis servo/ stepping control card based on PCI bus and supporting Plug & Play, while one system can support up to 16 control cards and control up to 64 lines of servo/ stepping motors.

Pulse output method may be single pulse (pulse + direction) or double pulse (pulse+pulse), with the maximum pulse frequency of 2MHz. Advanced technologies are applied to ensure the frequency tolerance is less than 0.1% despite of high output frequency.

It supports 2-4 axis of linear interpolation, with the maximum interpolation speed of 1MHz.

Position management is realized through two up/ down counters, one used to manage logical positions of internally driven pulse output, and the other used to receive external input, with encoder or grating ruler inputted through A/ B phase as the input signal.

Counters are up to 32 digits, specially, the range is 2,147,483,648~+2,147,483,647. The system also provides DOS/WINDOWS95/98/NT/2000/XP/WINCE development libraries and enable software development in VC++, VB, BC++, LabVIEW, Delphi, and C++Builder.

MAIN FEATURES

- 32-digit PCI bus, enabling Plug & Play
- All the input and output are under photoelectric coupler isolation, with strong resistance to disturbance.
- 6-axis servo/ stepping motor control, with every axis able to move independently without mutual effects.
- Frequency tolerance for pulse output is less than 0.1%.
- The maximum pulse output frequency is 2MHz.
- Pulse output may be single (pulse+ direction) or double(pulse+ pulse)
- All the 6 axes have position feedback input in 32-digit counting, giving the maximum counting range of -2,147,483,648~ +2,147,483,647.
- Trapezoidal acceleration/ deceleration
- 2-6 axis linear interpolation.
- Maximum interpolation speed: 1MHz.
- Handwheel and external signal operation, position lock, large-capacity of hardware caching.



- Real-time reading of logical, real and driving speeds during movement
- 32 channels digital input/32 channels digital output with optical coupling isolation, including two positive/negative limiting signals of each axis Read the logical position, actual position, driving speed, acceleration and driving state in real time during motion Two limit input for each axis may be set as Nil and work as general input
- Up to 16 control cards supported within one system.
- DOS/WINDOWS95/98/NT/2000/XP/WIN CE supported.

APPLICATIONS

- ✎ Multi-axis engraving system
- ✎ Robot system
- ✎ Coordinate measurement system
- ✎ PC-based CNC system



Chapter 2 Hardware installation

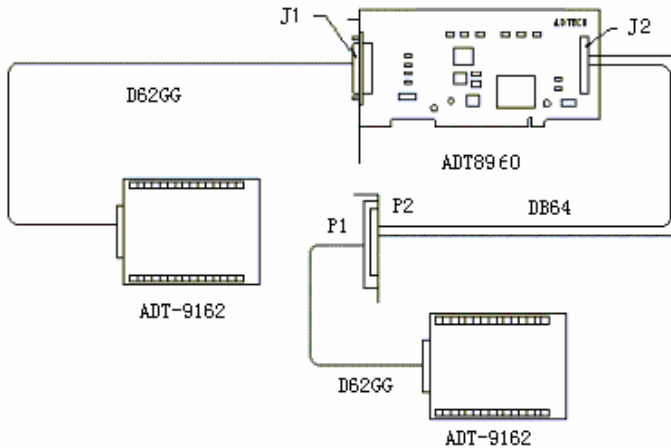
🔑 PARTS

1. ADT-8960 User Manual (this manual)
2. ADT-8960 6-axis PCI bus high-performance motion control card
3. ADT-8960 user CD
4. ADT-D62GG 2 pcs
5. ADT-9162 connecting plate 2 pcs
6. DB64 64pin cable 1 pc
7. ADT-9164 connecting plate 1 pc

🔑 INSTALLATION

1. Switch off the computer power supply (for ATX supply case, switch off the overall power)
2. Open the back cover of the computer case
3. Insert ADT-8960 into an available PCI slot
4. Ensure the golden finger of ADT-8960 has been fully inserted the slot and then fasten card with screws
5. Connect one end of the D62GG cable to J1 interface of motion card and the other end to terminal block ADT_9162.
6. Check whether it is necessary to install J2 interface cable. To install J2 if necessary:
 - (1) Connect one end of ADT-DB64 to J2 of motion card and the other end to P2 of ADT-DB64;
 - (2) Fix the ADT-DB64 on the rear side of the enclosure;
 - (3) Connect ADT-D62GG to P2 of the transition board and ADT-D62GG.

Chapter 3 Electrical connection



There are two input/ output interfaces inside an ADT8960 card, whereby J1 is for 62-pin socket and J2 is for 62-pin.

J1 is the signal cable for pulse output of X, Y, Z and A, B, C axis, switch amount input and switch amount output (OUT0-OUT7); **J2** is the signal cable for encoder input and switch amount input of X, Y, Z and A, B, C axis; switch amount input and switch amount output (OUT8-OUT15).

Signals are defined as follows:

🔑 J1 line

PUCOM0	1	32	IN3(XSTOP1)
XPU+/CW+	2	33	IN4(YLMT+)
XPU-/CW-	3	34	IN5(YLMT-)
XDR+/CCW+	4	35	IN6(YSTOP0)
XDR-/CCW-	5	36	IN7(YSTOP1)
YPU+/CW+	6	37	IN8(ZLMT+)
YPU-/CW-	7	38	IN9(ZLMT-)
YDR+/CCW+	8	39	IN10(ZSTOP0)
YDR-/CCW-	9	40	IN11(ZSTOP1)
PUCOM1	10	41	INCOM2
ZPU+/CW+	11	42	IN12(ALMT+)
ZPU-/CW-	12	43	IN13(ALMT-)
ZDR+/CCW+	13	44	IN14(ASTOP0)
ZDR-/CCW-	14	45	IN15(ASTOP1)
APU+/CW+	15	46	IN16(BLMT+)
APU-/CW-	16	47	IN17(BLMT-)
ADR+/CCW+	17	48	IN18(BSTOP0)
ADR-/CCW-	18	49	IN19(BSTOP1)
PUCOM2	19	50	IN20(CLMT+)
BPU+/CW+	20	51	IN21(CLMT-)
BPU-/CW-	21	52	IN22(CSTOP0)
BDR+/CCW+	22	53	IN23(CSTOP1)
BDR-/CCW-	23	54	OUTCOM1
CPU+/CW+	24	55	OUT0
CPU-/CW-	25	56	OUT1
CDR+/CCW+	26	57	OUT2
CDR-/CCW-	27	58	OUT3
INCOM1	28	59	OUT4
IN0(XLMT+)	29	60	OUT5
IN1(XLMT-)	30	61	OUT6
IN2(XSTOP0)	31	62	OUT7

Line number	Signal	Introduction
1	PUCOM0	Used for single-port input, not available for external power supply
2	XPU+/CW+	X pulse signal +
3	XPU-/CW-	X pulse signal -
4	XDR+/CCW+	X direction signal +
5	XDR-/CCW-	X direction signal -
6	YPU+/CW+	Y pulse signal +
7	YPU-/CW-	Y pulse signal -
8	YDR+/CCW+	Y direction signal +
9	YDR-/CCW-	Y direction signal -

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10	PUCOM1	Used for single-port input, not available for external power supply
11	ZPU+/CW+	Z pulse signal +
12	ZPU-/CW-	Z pulse signal -
13	ZDR+/CCW+	Z direction signal +
14	ZDR-/CCW-	Z direction signal -
15	APU+/CW+	A pulse signal +
16	APU-/CW-	A pulse signal -
17	ADR+/CCW+	A direction signal +
18	ADR-/CCW-	A direction signal -
19	PUCOM2	Used for single-port input, not available for external power supply
20	BPU+/CW+	B pulse signal +
21	BPU-/CW-	B pulse signal -
22	BDR+/CCW+	B direction signal +
23	BDR-/CCW-	B direction signal -
24	CPU+/CW+	C pulse signal +
25	CPU-/CW-	C pulse signal -
26	CDR+/CCW+	C direction signal +
27	CDR-/CCW-	C direction signal -
28	INCOM1	IN0-11, able to work as general input signal
29	IN0(XLMT+)	Positive direction of the Limit Signal for X,able to work as general input signal
30	IN1(XLMT-)	Negative direction of the Limit Signal for X able to work as general input signal

**ADT-8960 6-axis servo/ stepping motion control card**

31	IN2(XSTOP0)	Origin signal 0 for X, Manually decelerate, able to work as general input signal
32	IN3(XSTOP1)	STOP1- signal for X,able to work as general input signal
33	IN4(YLMT+)	Positive direction of the Limit Signal for Y,able to work as general input signal
34	IN5(YMT-)	Negative direction of the Limit Signal for Y able to work as general input signal
35	IN6(YSTOP0)	Origin signal 0 for Y, Manually decelerate, able to work as general input signal
36	IN7(YSTOP1)	STOP1- signal for Y,able to work as general input signal
37	IN8(ZLMT+)	Positive direction of the Limit Signal for Z,able to work as general input signal
38	IN9(ZLMT-)	Negative direction of the Limit Signal for Z able to work as general input signal
39	IN10(ZSTOP0)	Origin signal 0 for Z, Manually decelerate, able to work as general input signal
40	IN11(ZSTOP1)	STOP1- signal for Z,able to work as general input signal
41	INCOM2	IN12-23 Input general port
42	IN12(ALMT+)	Positive direction of the Limit Signal for A,able to work as general input signal
43	IN13(ALMT-)	Negative direction of the Limit Signal for A able to work as general input signal
44	IN14(ASSTOP0)	Origin signal 0 for A, Manually decelerate, able to work as general input signal
45	IN15(ASSTOP1)	STOP1- signal for A,able to work as general input signal


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46	IN16(BLMT+)	Positive direction of the Limit Signal for B,able to work as general input signal
47	IN17(BLMT-)	Negative direction of the Limit Signal for B able to work as general input signal
48	IN18(BSTOP0)	Origin signal 0 for B, Manually decelerate, able to work as general input signal
49	IN19(BSTOP1)	STOP1- signal for B,able to work as general input signal
50	IN20(CLMT+)	Positive direction of the Limit Signal for C,able to work as general input signal
51	IN21(CLMT-)	Negative direction of the Limit Signal for C able to work as general input signal
52	IN22(CSTOP0)	Origin signal 0 for C, Manually decelerate, able to work as general input signal
53	IN23(CSTOP1)	STOP1- signal for C,able to work as general input signal
54	OUTCOM1	OUT0-OUT7 general port
55	OUT0	Digital Output.
56	OUT1	
57	OUT2	
58	OUT3	
59	OUT4	
60	OUT5	
61	OUT6	
62	OUT7	

J2 line

XECA+	1	32	IN30
XECA-	2	33	IN31
XECB+	3	34	OUTCOM1
XECB-	4	35	OUT8
YECA+	5	36	OUT9
YECA-	6	37	OUT10
YECB+	7	38	OUT11
YECB-	8	39	OUT12
ZECA+	9	40	OUT13
ZECA-	10	41	OUT14
ZECB+	11	42	OUT15
ZECB-	12	43	INCOM4
AECA+	13	44	OUTCOM3
AECA-	14	45	I/O0
AECB+	15	46	I/O1
AECB-	16	47	I/O2
BECA+	17	48	I/O3
BECA-	18	49	I/O4
BECB+	19	50	I/O5
BECB-	20	51	I/O6
CECA+	21	52	I/O7
CECA-	22	53	INCOM5
CECB+	23	54	OUTCOM4
CECB-	24	55	I/O8
INCOM3	25	56	I/O9
IN24(XIN)	26	57	I/O10
IN25(YIN)	27	58	I/O11
IN26(ZIN)	28	59	I/O12
IN27(AIN)	29	60	I/O13
IN28(BIN)	30	61	I/O14
IN29(CIN)	31	62	I/O15

Line number	Signal	Introduction
1	XECA+	X-axis encoder A-phase input+
2	XECA-	X-axis encoder A-phase input -
3	XECB+	X-axis encoder B-phase input +
4	XECB-	X-axis encoder B-phase input -,
5	YECA+	Y-axis encoder A-phase input+
6	YECA-	Y-axis encoder A-phase input -
7	YECB+	Y-axis encoder B-phase input +
8	YECB-	Y-axis encoder B-phase input -,
9	ZECA+	Z-axis encoder A-phase input+
10	ZECA-	Z-axis encoder A-phase input -
11	ZECB+	Z-axis encoder B-phase input +
12	ZECB-	Z-axis encoder B-phase input -,

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13	AECA+	A-axis encoder A-phase input+
14	AECA-	A-axis encoder A-phase input -
15	AECB+	A-axis encoder B-phase input +
16	AECB-	A-axis encoder B-phase input - ,
17	BECA+	B-axis encoder A-phase input+
18	BECA-	B-axis encoder A-phase input -
19	BECB+	B-axis encoder B-phase input +
20	BECB-	B-axis encoder B-phase input - ,
21	CECA+	C-axis encoder A-phase input+
22	CECA-	C-axis encoder A-phase input -
23	CECB+	C-axis encoder B-phase input +
24	CECB-	C-axis encoder B-phase input - ,
25	INCOM3	IN24-IN31 General port
26	IN24(XIN)	Input points for switch amount(X-axis position lock)
27	IN25(YIN)	Input points for switch amount(Y-axis position lock)
28	IN26(ZIN)	Input points for switch amount(Z-axis position lock)
29	IN27(AIN)	Input points for switch amount(A-axis position lock)
30	IN28(BIN)	Input points for switch amount(B-axis position lock)
31	IN29(CIN)	Input points for switch amount(C-axis position lock)
32	IN30	Input points for switch amount
33	IN31	Input points for switch amount(All axis stop)
34	OUTCOM2	OUT8-OUT15 General port
35	OUT8	Output points for switch amount
36	OUT9	Output points for switch amount
37	OUT10	Output points for switch amount
38	OUT11	Output points for switch amount
39	OUT12	Output points for switch amount
40	OUT13	Output points for switch amount
41	OUT14	Output points for switch amount
42	OUT15	Output points for switch amount

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43	INCOM4	I/O0-I/O7 as Input public port
44	OUTCOM3	I/O0-I/O7 as output public port
45	I/O0	Input/output(X axis manually CW)
46	I/O1	Input/output(X axis manually CCW)
47	I/O2	Input/output(Y axis manually CW)
48	I/O3	Input/output(Y axis manually CCW)
49	I/O4	Input/output(Z axis manually CW)
50	I/O5	Input/output(Z axis manually CCW)
51	I/O6	Input/output(A axis manually CW)
52	I/O7	Input/output(A axis manually CCW)
53	INCOM5	I/O8-I/O15 as Input public port
54	OUTCOM4	I/O8-I/O15 as output public port
55	I/O8	Input/output(B axis manually CW)
56	I/O9	Input/output(B axis manually CCW)
57	I/O10	Input/output(C axis manually CW)
58	I/O11	Input/output(C axis manually CCW)
59	I/O12	Input/output
60	I/O13	Input/output
61	I/O14	Input/output
62	I/O15	Input/output

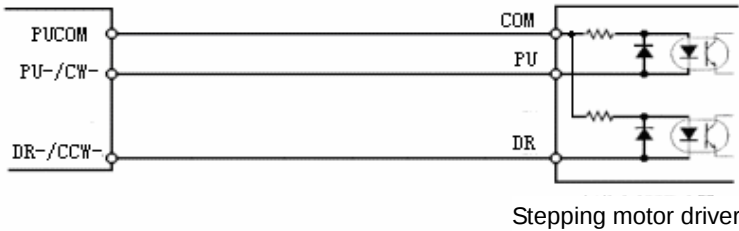
Remark: In case an encoder is used for general input signals, XECA+, XECB+, YECA+, YECB+, ZECA+, ZECB+, AECA+, AECB+, BECA+, BECB+, CECA+, CECB+ will be respectively used as public ports of corresponding input signals. Voltage at the public ports can only be +5V; in case of using an external+12V power supply, users must serially connect a 1K resistance. Please refer to the following digital input connection part for wiring method.

CONNECTION FOR PULSE/ DIRECTION INPUT SIGNAL

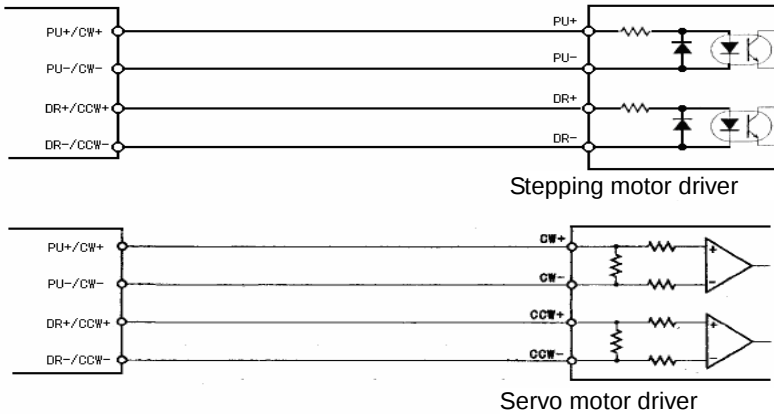
Pulse output is in differential output.

May be conveniently connected with a stepping/ servo driver

The following figure shows open-collector connection between pulse and direction.

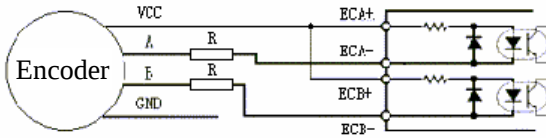


The following figure shows differential-output connection between pulse and direction signals; this method is recommended as it is differential connection with strong resistance to disturbance.

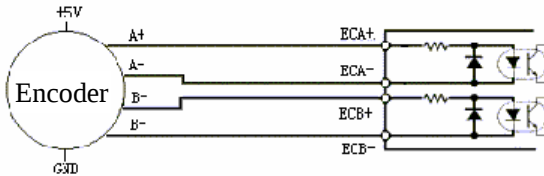


Remark: Refer to Appendix A for wiring maps of stepping motor drivers, normal servo motor driver and terminal panel.

☞ CONNECTION FOR ENCODER INPUT SIGNAL

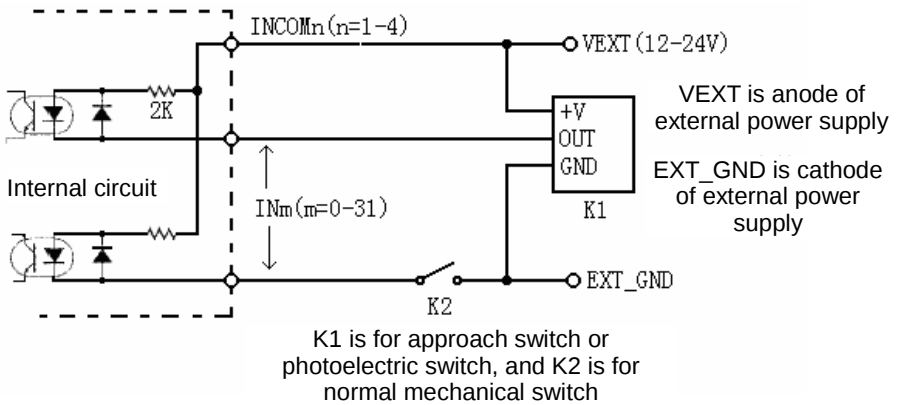


Wiring map for an open-collect output-type encoder. For +5V power supply, R is not required; for +12V power supply, R= 1K Ω ; and for +24V power supply, R= 2K Ω



Wiring map for a differential-driver output-type encoder

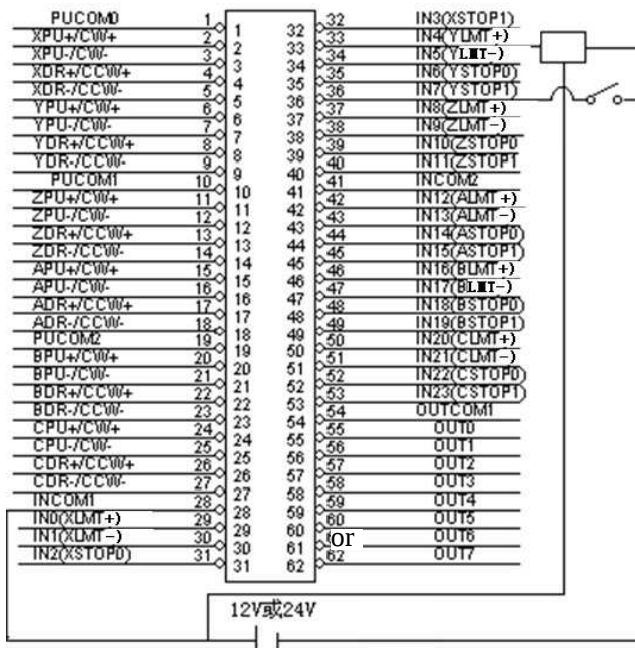
☛ CONNECTION FOR DIGITAL INPUT



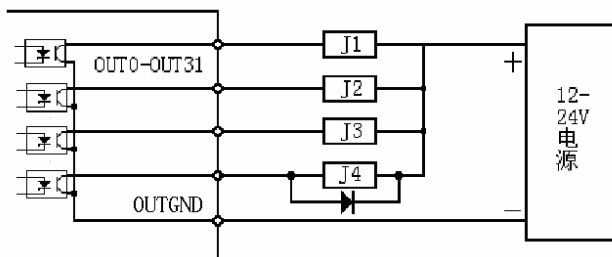
Remark:

- (1) Public terminal for IN0-IN11: INCOM1
- Public terminal for IN12-IN23: INCOM2
- Public terminal for IN24-IN31: INCOM3
- Public terminal for I/O0-I/O7: INCOM4
- Public terminal for I/O8-I/O15: INCOM5

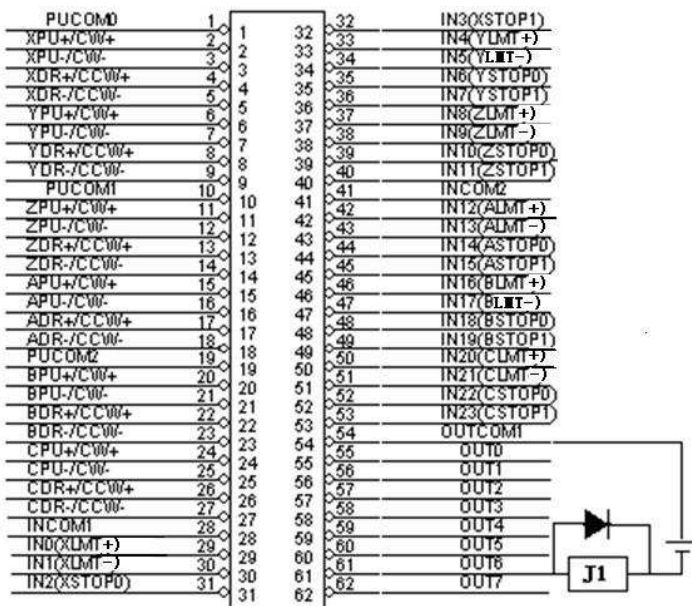
- (2) To make input signals effective, users shall make sure: firstly, the photoelectric coupling public ports for corresponding input signals (INCOM1, INCOM2, INCOM3, INCOM4 or INCOM5) have been connected with anodes of 12V/ 24V power supply; secondly, one port of the normal switch or earthing cable of the approach switch has been connected with the cathode (earthing cable); and lastly, the other port of the normal switch or the control of the approach switch has been connected with the input port corresponding by the terminal panel.
- (3) The following is the actual wiring map of power supply from normal switch and approach switch to photoelectric coupling public ports, through external power supply. (take J1 as example)



Connection of digital output.



如果为感性负载，如继电器等，应在负载两端加续流二极管，如J4所示



Chapter 4 Software installation

ADT8960 card must be used with drive installed under Win95/ Win98/ NT/ Win2000/ WinXP, but in case of DOS, no drive is required to be installed.

The following part takes Win98 and WinXP for example, and users may refer to other operating systems.

Drive for the control card is located in the Drive/ ControlCardDrive folder within the CD, and the drive file is named as ADT8960.INF.

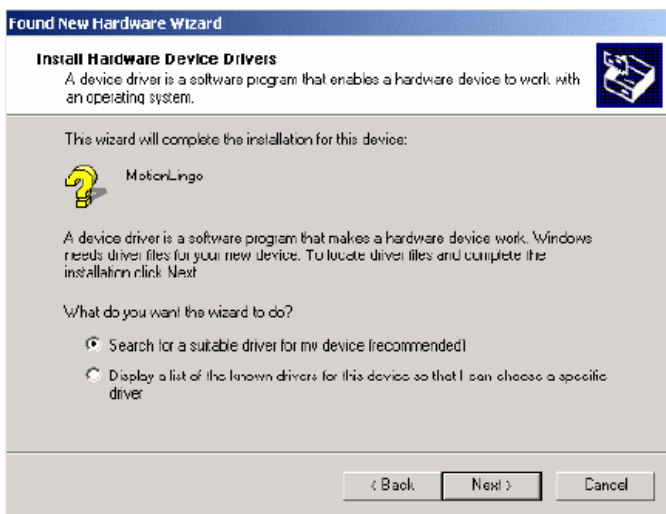
🔑 DRIVE INSTALLATION IN WIN98

The following part takes Win98 Professional Version as example to indicate installation of the drive; other versions of Win98 are similar.

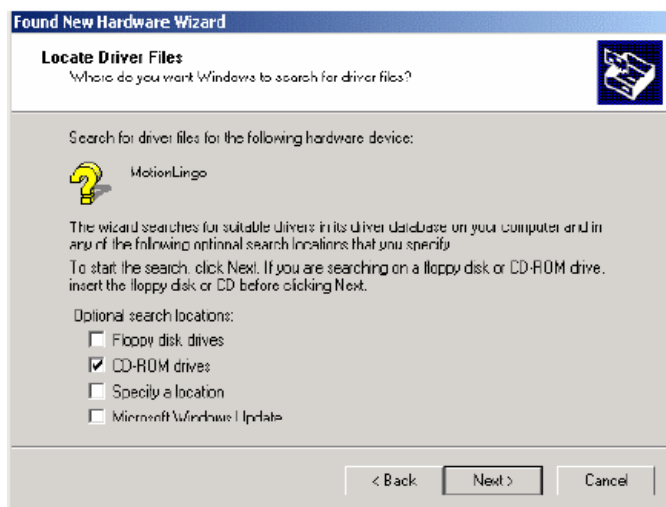
After attaching the ADT8960 card to the PCI slot of a computer, a user shall log in as administrator to the computer; upon display of the initial interface, the computer shall notify “Found new hardware” as follows:



Just click “Next” to display the following picture:



Click again “Next” to display the following picture:



Then select “Specify a location” and Click again “Next” and Click “Browse” button to select DevelopmentPackage/ Drive/ CardDrive and find the ADT8960.INF file, then click “OK” to display the following interface:



Click "Next" to display the following picture:

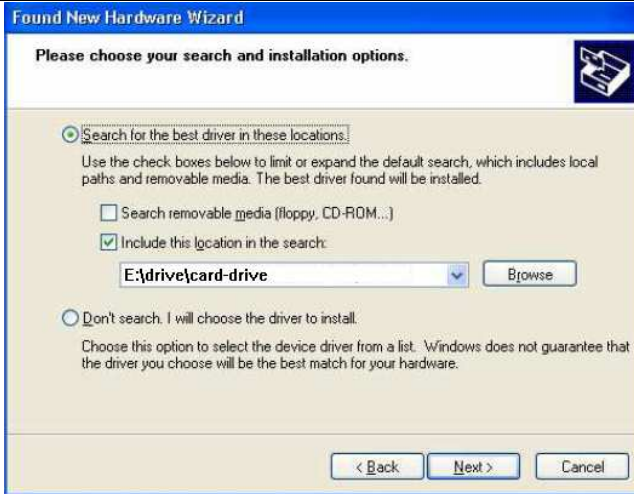


Finally click "Finish" to complete installation.

DRIVE INSTALLATION UNDER WINXP

Installation under WinXP is similar to that under Win98, specifically:





Click "Browse" button to select Drive/ CardDrive and find the ADT8960.INF file, then click "Next" to display the following interface:



Then click "Finish" to complete installation.

Chapter 5 Functions

☛ Pulse output method

Pulse output may be realized through either independent 2-pulse or 1-pulse. In case of independent 2-pulse, the positive direction drive has PU/CW outputting drive pulses, and the negative direction drive has DR/CCW outputting drive pulses. In case of 1-pulse, PU/CW outputs drive pulse and DR/CCW outputs direction signals.

Pulse/ direction is set on the positive logical level

Puls	Drive direction	Output signal waveform	
		PU/CW signal	DR/CCW signal
Independent 2-puls	+Direction		<u>Low level</u>
	-Direction	<u>Low level</u>	
1-pulse 1-direction	+Direction		<u>Low level</u>
	-Direction		Hi level

☛ Hardware limit signal

Hardware limit signals LMT+ and LMT- are respectively to limit the input signals outputted by drive pulse along positive and negative directions, which can be set as “effective”, “ineffective” with high/low levels. Actually “effective” or “ineffective” can be set for positive limit and negative limit individually. In case “ineffective” is selected, they may work as ordinary input points.

Hard limit signals STOP0 and STOP1 are input signals that may realize hardware termination for all axis drive and may be set as “effective”, “ineffective” as well as termination method for high/low levels. In case “ineffective” is selected, they may work as general input points. Besides, they, when working as drive for interpolation, are effective for the minimum interpolation axis only.

☛ Linear interpolation

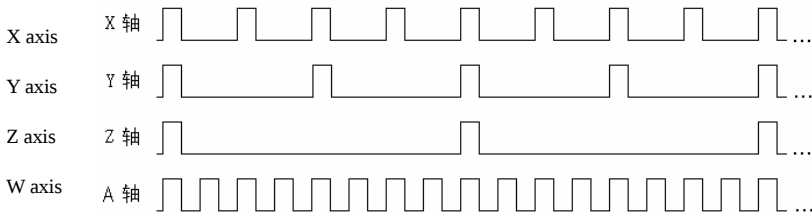
This card may work for 2~6 axes linear interpolation under the modified method of point-by-point comparison, which can ensure uniform pulse along

the long axis, giving the precision within one pulse.

Firstly, take the axis outputting the maximum pulses among the axes joining interpolation as the long axis, and proportionally distribute for the rest axes. Speed control applies only to speed of the long axis.

For example, (1-X axis, 2-Y axis, 3-Z axis, and 4-W axis).

Take four axes for linear interpolation, while Axis 1 outputs 1000 pulses, Axis 2 outputs 500, Axis 3 outputs 250 and Axis 4 outputs 2000.



From the above figure, A axis shall be the long axis, and the rest axes proportionally share the pulses.

Setting of interpolation speed takes the minimum speed of an axis among the joined axes as the benchmark, for example, if Axis 2 and Axis 3 join linear interpolation, the interpolation speed will be determined by speed of Axis 2. moreover, speed of interpolation is only half of the single axis.

For example, Axis 2 and Axis 3 work for two-axis linear interpolation, with Axis 2 outputs 10000 pulses along positive direction and Axis 3 outputs 5000 pulses along negative direction, which means Axis 2 is the long axis.

```
set_startv(0,2,1000);  
set_speed(0,2,1000);  
inp_move2(0,2,3,10000,-5000);
```

After execution of the above program, Axis 2 will send 10000 pulses in the frequency of $1000/2=500\text{Hz}$, while frequency of Axis 3 shall be

$500 \times 5000 / 10000 = 250\text{Hz}$.

If speed of Axis 2 realizes trapezoidal acceleration/deceleration, interpolation will also follow such trapezoidal acceleration/deceleration.

☛ **Quantitative velocity**

The velocity may change during motion, so as to control the speed and track more flexibly and effectively. Refer to the settings of relative functions, `set_atartv`, `set_speed`, `set_acc` and so on for change of velocity.

☛ **External signal driving**

External signal driving is the motion controlled by external signals (handwheel or switch). It is mainly used in the manual debugging of machines and teaching system. When the external signal driving is enabled, use the handwheel or mechanical switch to control the pulse and thus the motion. When the external signal function is not to be used, disable the external signal driving.

☛ **Position lock**

Realize hardware position lock function with the designated IN signal on each axis. With one lock signal, the current position, either logical or actual, of all axes can be locked. The position lock is useful in measuring system.

☛ **Manual deceleration**

Realize manual deceleration function with the designated IN signal on each axis. The manual deceleration point can be set on each axis separately. When reaching the point, it will decelerate to the designated speed automatically. The origin can be searched at the designated speed, while the origin signal should be triggered externally.

☛ **Hardware Cache**

With the large capacity hardware cache function, interpolation data can be saved in the buffer area before motion to be processed in advance, ensuring continuous output of pulse and enabling smooth and consecutive motion. Therefore, the processing precision can be effectively promoted. The memory space for FIFO is as high as 2MB.

Chapter 6 List of ADT8960 basic library functions

List of library functions

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Chapter 7 Details of ADT8960 basic library functions

☞ Category of basic parameter setting

1.1 Initialize card

int **adt8960_initial(void)**

Function:

To initialize the card

Return:

(1)>0, indicating the amount of installed ADT8960 cards; In case the Return is 3, the available card numbers shall be 0, 1, and 2;



(2) =0, indicating no installation of ADT8960 card;

(3)<0, indicating no installation of service if the value is -1 or
PCI bus failure if the value is -2.

Note: Initialization functions are preliminary conditions to call other functions thus must be called firstly so as to verify available cards and initialize some parameters.

1.2 Get output pulse mode

int set_pulse_mode(int cardno, int axis, int value,int logic,int dir_logic)

Function:

To set the output pulse mode

Parameters:

cardno Card number

axis Axis number (1-6)

Value 0: Pulse+Pulse method 1: Pulse+direction method

Pulse/ direction are both of positive logic setting

Pulse output method	Drive direction	Output signal waveform	
		PU/CW signal	DR/CCW signal
Independent 2-pulse method	Positive drive output		<u>Low level</u>
	Negative drive output	<u>Low level</u>	
1-pulse method	Positive drive output		<u>Low level</u>
	Negative drive output		<u>Hi level</u>

logic 0: Positive logic pulse 1: Negative logic pulse

Positive logic pulse:  Negative logic pulse: 

dir-logic 0: Positive logic direction of output signal 1:

Negative logic direction of output signal

Dir_logic	Output to positive direction	Output to negative direction
0	Low	Hi
1	Hi	Low

Return: 0: Correct 1: Wrong

Default mode: Pulse + direction, with positive logic pulse and positive logic direction input signal

1.3 Set mode of nLMT signal input along positive/negative direction

int set_limit_mode(int cardno, int axis, int v1,int v2,int logic)

Function:

To set mode of nLMT signal input along positive/negative direction

Parameters:

cardno Card number

axis Axis number (1-6)

v1 0: Positive limit is effective 1: Positive limit is ineffective

v2 0: Negative limit is effective 1: Negative limit is ineffective

logic 0: Low level is effective 1: High level is effective

Return: 0: Correct 1: Wrong

Default mode: positive and negative limits with low level are effective

1.4 Set mode of stop0 input signal

int set_stop0_mode(int cardno, int axis, int v,int logic)

Function:

To set mode of stop0 input signal

Parameters:

cardno Card number

axis Axis number (1-6)

v 0: stop0 is ineffective

1: stop0 is effective

logic 0: Low level is effective

1: High level is

effective

Return: 0: Correct

1: Wrong

Default mode: Stop 0 is ineffective

1.5 Set mode of stop1 input signal

int set_stop1_mode(int cardno, int axis, int v,int logic)

Function:

To set mode of stop1 input signal

Parameters:

cardno Card number

axis Axis number (1-6)

v 0: stop0 is ineffective

1: stop0 is effective

logic 0: Low level is effective

1: High level is

effective

Return: 0: Correct

1: Wrong

Default mode: stop1 is ineffective

1.6 Delay time

int set_delay_time(int cardno,long time)

Function:

To delay the time

Parameters:

cardno Card number

time Delay time

Return: 0: Correct

1: Wrong

Note: The time unit is 1/8us, with the maximum integer value as its maximum.

1.7 Set stop using the hardware

```
int set_suddenstop_mode(int cardno,int v,int logical)
```

Function:

To set stop sing the hardware

Parameters:

cardno Card number

v 0: ineffective 1: effective

logical 0: low level effective 1: high level effective

Return: 0: Correct 1: Wrong

Note: Hardware stop signals are assigned to use the 33 pin at the P2 terminal panel (IN31)

1.8 Set acceleration/deceleration mode

```
int set_ad_mode(int cardno,int axis,int mode)
```

Function: To select the acceleration/deceleration mode, trapezoid or S-type

Parameters:

cardno Card number

axis Axis number (1-6)

mode 0: linear acceleration/deceleration 1:

S-type acceleration/deceleration

Return: 0: Correct 1: Wrong

Default mode: Linear acceleration/deceleration

Category of drive status check

2.1 Get status of single-axis drive

```
int get_status(int cardno,int axis,int *value)
```

Function:

To get status of single-axis drive

Parameters:

cardno Card number

axis Axis number (1-6)

value Indicator of drive status

0: Drive completed Non-0: Drive in process

Return: 0: Correct 1: Wrong

2.2 Get status of interpolation

int get_inp_status(int cardno,int *value)

Function:

To get status of interpolation

Parameters:

cardno Card number

value Indicator of interpolation

0: Interpolation completed 1: Interpolation in

process

Return: 0: Correct 1: Wrong

2.3 Get status of Delay

int get_delay_status(int cardno)

Function:

To get status of Delay

Parameters:

cardno Card number

Return: 0: Delay completed 1: Delay in process

2.4 Get hardware version

float get_hardware_ver(int cardno)

Function:

To get hardware version

Parameters:

cardno Card number

Return: 1.1: Version 1.1 1.2: Version 1.2

Note: The return value is default. Version 1.1 or 1.2 indicates the temporary version. The current version is 1.3.

☛ Category of movement parameter setting

☛* **Note:** The following parameters are not determined after

initialization, and thus must set before use.

3.1 Set acceleration

int set_acc(int cardno,int axis,long value)

Function:

To set acceleration

Parameters:

cardno Card number

axis Axis number

value Acceleration (0-32000)

Return: 0: Correct 1: Wrong

3.2 Set acceleration change rate

int set_acac(int cardno,int axis,long value)

Function: To set the acceleration/deceleration change rate

Parameters:

cardno Card number

axis Axis number

value K value (1-65535)

Return: 0: Correct 1: Wrong

3.3 Set starting speed

int set_startv(int cardno,int axis,long value)

Function:

To set starting speed

Parameters:

cardno Card number

axis Axis number

value Starting speed (1-2M)

Return: 0: Correct 1: Wrong

3.4 Set drive speed

int set_speed(int cardno,int axis,long value)

Function:

To set drive speed

Parameters:

cardno Card number

axis Axis number

Speed (1-2M)

Return: 0: Correct 1: Wrong**3.5 Set logical position counter****int set_command_pos(int cardno,int axis,long value)****Function:**

To set values for the logical position counter

Parameters:

cardno Card number

axis Axis number

value Range (-2147483648~+2147483647)

Return: 0: Correct 1: Wrong

A logical position counter can read and write at any time.

3.6 Set real position counter**int set_actual_pos(int cardno,int axis,long value)****Function:**

To set values for the real position counter

Parameters:

cardno Card number

axis Axis number

value Range (-2147483648~+2147483647)

Return: 0: Correct 1: Wrong

A real position counter can read and write at any time.

3.7 Set the symmetry speed**int set_symmetry_speed(int cardno,int axis,long lspd,long
hspd,double tacc)****Function:**To set values for the symmetry speed

Parameters:

cardno	Card number
axis	Axis number (1-6)
lpsd	start speed
hspd	running speed
tacc	acceleration time

Return: 0: Correct 1: Wrong

3.8 Set IN/OUT point

```
int set_io_mode(int cardno,int v1,int v2);
```

Function:

To set IN/OUT point

Parameters:

v1 0: Set the earlier 8 points as Input 1: Set the earlier 8 points as Output

v2 0: Set the later 8 points as Input 1: Set the later 8 points as Output

Return: 0: Correct 1: Wrong

Note: When the IO point is set as output, the IN status can be read at the same time.

☞ **Category of motion parameter check**
The following functions can be called at any time

4.1 Get logic position of each axis

```
int get_command_pos(int cardno,int axis,long *pos)
```

Function:

To get logic position of each axis

Parameters:

cardno	Card number
axis	Axis number
pos	Indicator of logic position value

Return: 0: Correct 1: Wrong

This function can get the logic position of the corresponding axis at any time, and in case of no out-step by motor, pos values just indicate the current position of the axis.

4.2 Get real position of each axis (i.e., encoder feedback input)

int get_actual_pos(int cardno,int axis,long *pos)

Function:

To get real position of each axis

Parameters:

cardno Card number

axis Axis number

pos Indicator of real position value

Return: 0: Correct 1: Wrong

This function can get the real position of the corresponding axis at any time, and even though in case of out-step by motor, pos values still indicate the real position of the axis.

4.3 Get current drive speed of each axis

int get_speed(int cardno,int axis,long *speed)

Function:

To get motion speed

Parameters:

cardno Card number

axis Axis number

speed Indicator of current drive speed

Return: 0: Correct 1: Wrong

Its data unit is same as that for drive speed setting value V.

This function can get the axis drive speed at any time.

4.4 Get status of output

int get_out(int cardno, int number)

Function:

To get status of output

Parameters:

cardno Card number
number Port number

Return: Current output point status, -1: Wrong

4.5 Get current acceleration of each axis

```
int get_ad(int cardno,int axis,long *ad);
```

Function: To get current acceleration of each axis

Parameters:

cardno Card number
axis Axis number
ad Indicator of current acceleration

Return: 0: Correct 1: Wrong

Note: The unit of the data is the same as the drive acceleration setting value, A.

☛ Category of drive

5.1 Quantitative drive

```
int pmove(int cardno,int axis,long pulse)
```

Function:

To set quantitative drive

Parameters:

cardno Card number
axis Axis number
pulse Outputted pulses
 >0: move along positive direction
 <0: move along negative direction
 Range (-268435455~+268435455)

Return: 0: Correct 1: Wrong

Note: Users must correctly set the parameters required by speed curve before making drive commands.

5.2 Continue moving

```
int continue_move(int cardno,int axis,int dir)
```

Function:

To continue moving

Parameters:

cardno Card number

axis Axis number

dir Direction 0: Positive 1: Negative

Return: 0: Correct 1: Wrong

5.3 Deceleration stop

```
int dec_stop(int cardno,int axis)
```

Function:

To set deceleration stop

Parameters:

cardno Card number

axis Axis number

Return: 0: Correct 1: Wrong

During drive pulse output, this command will make deceleration stop. Users may use this command to stop when the drive speed is lower than the starting speed.

Note: During linear interpolation, if requiring deceleration stop, users shall make command only for the earliest interpolation axis, otherwise it may fail to achieve expected results.

5.4 Sudden stop

```
int sudden_stop(int cardno,int axis)
```

Function:

To set sudden stop

Parameters:

cardno Card number

axis Axis number

Return: 0: Correct 1: Wrong

This command will suddenly stop the pulse output in process, even though it is in acceleration/deceleration drive.

Note: During linear interpolation, if requiring sudden stop, users shall make command only for the earliest interpolation axis, otherwise it may fail to achieve expected results.

5.5 2-axis interpolation

int inp_move2(int cardno,int axis1,int axis2,long pulse1,long pulse2)

Function:

To set 2-axis interpolation

Parameters:

cardno Card number

axis1 , axis 2 Axis number joining interpolation

pulse1,pulse2 Relative distance of movement Range

(-8388608~+8388607)

Return: 0: Correct 1: Wrong

5.6 3-axis interpolation

int inp_move3(int cardno,int axis1,int axis2,int axis3,long pulse1,long pulse2,long pulse3)

Function:

To set 3-axis interpolation

Parameters:

cardno Card number

axis1 , axis 2, axis 3 Axis number joining interpolation

pulse1,pulse2,pulse3 Relative distance of motion along specified axis (axis 1/2/3)

Range (-8388608~+8388607)

Return: 0: Correct 1: Wrong

5.7 4-axis interpolation

int inp_move4(int cardno, int axis1,int axis2,int axis3,int axis4,long pulse1,long pulse2,long pulse3,long pulse4)

Function:

To set 4-axis interpolation

Parameters:

cardno Card number

axis1 , axis 2, axis 3, axis 4 Axis number joining interpolation

pulse1,pulse2,pulse3,pulse4 Relative distance of movement
along axis 1/2/3/4

Range (-8388608~+8388607)

Return: 0: Correct 1: Wrong

5.8 5-axis interpolation

```
int inp_move5(int cardno,int axis1,int axis2,int axis3,int axis4,  
              int axis5,long pulse1,long pulse2,long  
              pulse3,long pulse4,long pulse5)
```

Function:

To set 5-axis interpolation

Parameters:

cardno Card number

axis1 , axis 2, axis 3, axis 4, axis 5 Axis number joining
interpolation

pulse1,pulse2,pulse3,pulse4 ,pulse5 Relative distance of
movement along axis 1/2/3/4/5

Range (-8388608~+8388607)

Return: 0: Correct 1: Wrong

5.9 6-axis interpolation

```
int inp_move6(int cardno,long pulse1,long pulse2,long  
              pulse3,long pulse4,long pulse5,long pulse6)
```

Function:

To set 6-axis interpolation

Parameters:

cardno Card number

pulse1,pulse2,pulse3,pulse4 ,pulse5,pulse6 Relative
distance of movement along axis 1/2/3/4/5/6

Range (-8388608~+8388607)

Return: 0: Correct 1: Wrong

☞ **Category of INPUT/OUTPUT**

6.1 Read single input point

int read_bit(int cardno,int number)

Function:

To read single input point

Parameters:

cardno Card number

number Input point (0-31)

Return: 0: low level 1: high level effective
-1: Wrong

6.2 Output single output point

int write_bit(int cardno,int number,int value)

Function:

To set sing output point

Parameters:

cardno Card number

number Output point (0-15)

value 0: Low 1: High

Return: 0: Correct 1: Wrong

A number corresponds to the output number.

☞ **Category of composite driving**

To provide convenience for the customers, we encapsulated composite driving functions in the basic library functions. There functions mainly integrate speed mode setting, speed parameter setting and motion functions, while absolute motion and relative motion are also considered.

7.1 Single axis symmetric relative moving

**int symmetry_relative_move(int cardno, int axis, long pulse, long
lspd ,long hspd, double tacc, long vacc, int mode)**

Function:

Refer to the current position to perform quantitative movement at

acceleration

Parameters:

cardno	Card number
axis	Axis number
pulse	Pulse of axis
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)

Return: 0: Correct 1: Wrong

7.2 Single axis symmetric absolute moving

int symmetry_absolute_move(int cardno, int axis, long pulse, long lspd, long hspd, double tacc, long vacc, int mode)

Function:

Refer to the Origin to perform quantative movement at acceleration

Parameters:

cardno	Card number
axis	Axis number
pulse	Pulse of axis
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)

Return: 0: Correct 1: Wrong

7.3 Relative moving of 2-axis symmetric linear interpolation

int symmetry_relative_line2(int cardno, int axis1, int axis2, long pulse1, long pulse2, long lspd, long hspd, double tacc, long vacc, int mode)

Function:

Refer to the current position to perform linear interpolation at acceleration

Parameters:

cardno	Card number
axis1	Axis 1
axis2	Axis 2
pulse1	Pulse 1
pulse2	Pulse 2
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)

Return: 0: Correct 1: Wrong

7.4 Absolute moving of 2-axis symmetric linear interpolation

```
int symmetry_absolute_line2(int cardno, int axis1, int axis2, long pulse1,
    long pulse2, long lspd ,long hspd, double tacc, long vacc, int mode)
```

Function:

Refer to the origin to perform linear interpolation at acceleration

Parameters:

cardno	Card number
axis1	Axis 1
axis1	Axis 2
pulse1	Pulse 1
pulse1	Pulse 2
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)

Return: 0: Correct 1: Wrong

7.5 Relative moving of 3-axis symmetric linear interpolation

```
int symmetry_relative_line3(int cardno, int axis1, int axis2, int axis3,
    long pulse1, long pulse2, long pulse3, long lspd ,long hspd, double
    tacc, long vacc, int mode)
```

Function:

Refer to the current position to perform linear interpolation at acceleration

Parameters:

cardno	Card number
axis1	Axis 1
axis1	Axis 2
axis1	Axis 3
pulse1	Pulse 1
pulse1	Pulse 2
pulse1	Pulse 3
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)

Return: 0: Correct 1: Wrong

7.6 Absolute moving of 3-axis symmetric linear interpolation

```
int symmetry_absolute_line3(int cardno, int axis1, int axis2, int axis3,
    long pulse1, long pulse2, long pulse3, long lspd ,long hspd, double
    tacc, long vacc, int mode)
```

Function:

Refer to the origin to perform linear interpolation at

acceleration

Parameters:

cardno	Card number
axis1	Axis 1
axis1	Axis 2
axis1	Axis 3
pulse1	Pulse 1
pulse1	Pulse 2
pulse1	Pulse 3
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)

Return: 0: Correct 1: Wrong

7.7 Relative moving of 4-axis symmetric linear interpolation

int symmetry_relative_line4(int cardno,int axis1, int axis2, int axis3,int axis4,long pulse1, long pulse2, long pulse3, long pulse4,long lspd ,long hspd, double tacc, long vacc, int mode)

Function:

Refer to the current position to perform linear interpolation at acceleration

Parameters:

cardno	Card number
axis1	Axis 1
axis1	Axis 2
axis1	Axis 3
axis1	Axis 4
pulse1	Pulse 1
pulse1	Pulse 2
pulse1	Pulse 3
pulse1	Pulse 4
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)

Return: 0: Correct 1: Wrong

7.8 Absolute moving of 4-axis symmetric linear interpolation

int symmetry_absolute_line4(int cardno, int axis1, int axis2, int axis3,int axis4,long pulse1, long pulse2, long pulse3, long pulse4,long lspd ,long hspd, double tacc, long vacc, int mode)

Function:

Refer to the origin to perform linear interpolation at acceleration

Parameters:

cardno	Card number
axis1	Axis 1
axis1	Axis 2
axis1	Axis 3
axis1	Axis 4
pulse1	Pulse 1
pulse1	Pulse 2
pulse1	Pulse 3
pulse1	Pulse 4
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)
Return:	0: Correct 1: Wrong

7.9 Relative moving of 5-axis symmetric linear interpolation

```
int symmetry_relative_line5(int cardno,int axis1, int axis2, int axis3,int
axis4,int axis5,long pulse1, long pulse2, long pulse3, long
pulse4,long pulse5,long lspd ,long hspd, double tacc, long vacc, int
mode)
```

Function:

Refer to the current position to perform linear interpolation at acceleration

Parameters:

cardno	Card number
axis1	Axis 1
axis1	Axis 2
axis1	Axis 3
axis1	Axis 4
axis1	Axis 5
pulse1	Pulse 1
pulse1	Pulse 2
pulse1	Pulse 3
pulse1	Pulse 4
pulse1	Pulse 5
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)
Return:	0: Correct 1: Wrong

7.10 Absolute moving of 5-axis symmetric linear interpolation

```
int symmetry_absolute_line5(int cardno, int axis1, int axis2, int axis3,int
axis4,int axis5,long pulse1, long pulse2, long pulse3, long pulse4,long
pulse5,long lspd ,long hspd, double tacc, long vacc, int mode)
```

Function:

Refer to the origin to perform linear interpolation at acceleration

Parameters:

cardno	Card number
axis1	Axis 1
axis1	Axis 2
axis1	Axis 3
axis1	Axis 4
axis1	Axis 5
pulse1	Pulse 1
pulse1	Pulse 2
pulse1	Pulse 3
pulse1	Pulse 4
pulse1	Pulse 5
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)

Return: 0: Correct 1: Wrong

7.11 Relative moving of 6-axis symmetric linear interpolation

int symmetry_relative_line6(int cardno,long pulse1, long pulse2, long pulse3, long pulse4,long pulse5, long pulse6,long lspd ,long hspd, double tacc, long vacc, int mode)

Function:

Refer to the current position to perform linear interpolation at acceleration

Parameters:

cardno	Card number
pulse1	Pulse 1
pulse1	Pulse 2
pulse1	Pulse 3
pulse1	Pulse 4
pulse1	Pulse 5
pulse1	Pulse 6
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)

Return: 0: Correct 1: Wrong

7.12 Absolute moving of 6-axis symmetric linear interpolation

int symmetry_absolute_line6(int cardno,long pulse1, long pulse2, long pulse3, long pulse4,long pulse5, long pulse6,long lspd ,long hspd, double tacc, long vacc, int mode)

Function:

Refer to the origin to perform linear interpolation at

acceleration

Parameters:

cardno	Card number
pulse1	Pulse 1
pulse1	Pulse 2
pulse1	Pulse 3
pulse1	Pulse 4
pulse1	Pulse 5
pulse1	Pulse 6
lspd	Low speed
hspd	High speed
tacc	Time of acceleration (Unit: sec)
vacc	Acceleration change rate
mode	Mode (0: trapezoid 1: S curve)
Return:	0: Correct 1: Wrong

☞ **Category of external signal driving**

8.1 Quantitative drive function of external signal

int manual_pmove(int cardno, int axis, long pos)

Function: To set quantitative drive function of external signal

Parameters:

cardno	Card number
axis	Axis number
Return:	0: Correct 1: Wrong

Note: (1) Send out quantitative pulse, but the drive does not start immediately until the external signal level changes.

(2) Ordinary button and handwheel are acceptable.

8.2 Continuous drive function of external signal

int manual_continue(int cardno, int axis)

Function: To set continuous drive function of external signal

Parameters:

cardno	Card number
axis	Axis number
Return:	0: Correct 1: Wrong

Note: (1) Send out continuous quantitative pulse, but the drive does not start immediately until the external signal level changes.

(2) Ordinary button and handwheel are acceptable.

8.3 Disable the external signal drive

int manual_disable (int cardno, int axis)

Function: To disable the external signal drive

Parameters:

cardno Card number
axis Axis number (1-6)

Return: 0: Correct 1: Wrong

Note: When using external signal to send out pulses, the function will not stop the pulse by the function. To stop the pulse, use Stop command.

🔑 **Category of position lock**

9.1 Lock the logical position and real position for all axes

int set_lock_position(int cardno, int axis,int mode,int regi,int logical)

Function: To lock the logical position and real position for all axes with signal function

Parameters:

axis Reference axis
mode Set lock mode 0: Ineffective 1: Effective
regi Register mode 0: Logical position 1: Real position
logical Level signal 0: From low to high 1: From high to low

Return: 0: Correct 1: Wrong

Note: Use the IN signal of specified axis to trigger.

9.2 Get lock status

int get_lock_status(int cardno, int axis, int *v)

Function: To get the status of position lock

Parameters:

cardno Card number
axis Axis number (1-6)
v 0: Unlocked 1: Locked

Return: 0: Correct 1: Wrong

Note: The function is applicable to capture the lock status.

9.3 Get lock position

int get_lock_position(int cardno,int axis,long *pos)

Function: To get lock position

Parameters:

cardno Card number
axis Axis number (1-6)
pos Lock position

Return: 0: Correct 1: Wrong

9.4 Clear lock status

int _stdcall clr_lock_status(int cardno, int axis)

Function: To clear lock status

Parameters:

cardno Card number
axis Axis number (1-6)

Return: 0: Correct 1: Wrong

☛ **Category of hardware cache**

10.1 1-axis FIFO

int fifo_inp_move1(int cardno,int axis1,long pulse1,long speed)

Function: To set single axis FIFO

Parameters:

cardno Card number
axis1 Axis number (1-6)
pulse1 Pulses in FIFO buffer
speed FIFO speed

Return: 0: Correct 1: Wrong

Note: The buffer size is 2048 bytes. Every 1-axis cache command occupies 3 bytes, i.e., 682 commands can be saved.

10.2 2-axis FIFO

int fifo_inp_move2(int cardno,int axis1,int axis2,long pulse1,long pulse2,long speed)

Function: To set 2-axis FIFO

Parameters:

cardno Card number
axis1 Axis number (1-6)
axis2 Axis number (1-6)

pulse1	Pulses in FIFO buffer
pulse2	Pulses in FIFO buffer
speed	FIFO speed

Return: 0: Correct 1: Wrong

Note: The buffer size is 2048 bytes. Every 2- axis cache command occupies 4 bytes, i.e., 512 commands can be saved.

10.3 3-axis FIFO

int fifo_inp_move3(int cardno,int axis1,int axis2,int axis3,long pulse1,long pulse2,long pulse3,long speed)

Function: To set 3-axis FIFO

Parameters:

cardno	Card number
axis1	Axis number (1-6)
axis2	Axis number (1-6)
axis3	Axis number (1-6)
pulse1	Pulses in FIFO buffer
pulse2	Pulses in FIFO buffer
pulse3	Pulses in FIFO buffer
speed	FIFO speed

Return: 0: Correct 1: Wrong

Note: The buffer size is 2048 bytes. Every 3- axis cache command occupies 5 bytes, i.e., 409 commands can be saved.

10.4 4-axis FIFO

int fifo_inp_move4(int cardno,int axis1,int axis2,int axis3,int axis4,long pulse1,long pulse2,long pulse3,long pulse4,long speed)

Function: To set 4-axis FIFO

Parameters:

cardno	Card number
axis1	Axis number (1-6)
axis2	Axis number (1-6)
axis3	Axis number (1-6)
axis4	Axis number (1-6)

pulse1	Pulses in FIFO buffer
pulse2	Pulses in FIFO buffer
pulse3	Pulses in FIFO buffer
pulse4	Pulses in FIFO buffer
speed	FIFO speed

Return: 0: Correct 1: Wrong

Note: The buffer size is 2048 bytes. Every 4-axis cache command occupies 6 bytes, i.e., 341 commands can be saved.

10.5 5-axis FIFO

```
int fifo_inp_move5(int cardno,int axis1,int axis2,int axis3,int axis4,int axis5,long pulse1,long pulse2,long pulse3,long pulse4,long pulse5,long speed)
```

Function: To set 5-axis FIFO

Parameters:

cardno	Card number
axis1	Axis number (1-6)
axis2	Axis number (1-6)
axis3	Axis number (1-6)
axis4	Axis number (1-6)
axis5	Axis number (1-6)
pulse1	Pulses in FIFO buffer
pulse2	Pulses in FIFO buffer
pulse3	Pulses in FIFO buffer
pulse4	Pulses in FIFO buffer
pulse5	Pulses in FIFO buffer
speed	FIFO speed

Return: 0: Correct 1: Wrong

Note: The buffer size is 2048 bytes. Every 5- axis cache command occupies 7 bytes, i.e., 292 commands can be saved.

10.6 6-axis FIFO

```
int fifo_inp_move6(int cardno,long pulse1,long pulse2,long pulse3,long pulse4,long pulse5,long pulse6,long speed)
```

Function: To set 6-axis FIFO

Parameters:

cardno	Card number
pulse1	Pulses in FIFO buffer
pulse2	Pulses in FIFO buffer
pulse3	Pulses in FIFO buffer
pulse4	Pulses in FIFO buffer
pulse5	Pulses in FIFO buffer
pulse6	Pulses in FIFO buffer
speed	FIFO speed

Return: 0: Correct 1: Wrong

Note: The buffer size is 2048 bytes. Every 6- axis cache command occupies 8 bytes, i.e., 256 commands can be saved.

10.7 Reset FIFO cache

int reset_fifo(int cardno)

Function: To reset FIFO cache

Parameters:

cardno	Card number
--------	-------------

Return: 0: Correct 1: Wrong

10.8 Read FIFO cache

int _stdcall read_fifo_count(int cardno,int *value)

Function: To read FIFO cache to determine the number of FIFO commands that haven't been implemented

Parameters:

cardno	Card number
value	space (bytes) of commands that haven't been

implemented

Return: 0: Correct 1: Wrong

10.9 Read FIFO status to determine whether it is empty

int read_fifo_empty(int cardno)

Function: To read whether the FIFO status is empty

Parameters:

cardno Card number

Return 0: Non-empty 1: Empty

10.10 Read FIFO status to determine whether it is full

int read_fifo_full(int cardno)

Function: To read whether the FIFO cache is full. If so, no more data can be saved.

Parameters:

cardno Card number

Return 0: Non-full 1: Full

☞ Manual deceleration function

First, set the manual deceleration mode; when the mode is valid, set manual deceleration point pos1, the origin offset pos2, and the ending speed (low speed) after manual deceleration point, endspeed.

During manual deceleration process: when arriving at pos1, it will decelerate to and operate at endspeed automatically. Search the origin signal at endspeed, while the origin signal needs to be triggered with external signal (low level triggerment of stop0). After triggerment, it stops immediately after arriving at the origin offset (pos2). If no origin signal is searched, it will keep moving at endspeed.

11.1 Set manual deceleration mode

int set_dec_mode(int cardno,int axis,int mode)

Function: To set manual deceleration mode

Parameters:

cardno Card number

axis Axis number (1-6)

mode Manual deceleration mode 0 ineffective 1 effective

Return: 0: Correct 1: Wrong

11.2 Set manual deceleration point

int set_dec_pos1(int cardno, int axis,long pos)

Function: To set manual deceleration point

Parameters:

cardno Card number
axis Axis number (1-6)
pos Deceleration point

Return: 0: Correct 1: Wrong

Note: Upon reaching the deceleration point, it will decelerate to the specified low speed motion automatically to search signal to trigger origin. If no such signal is found, it keeps moving at the speed until the motion completes.

11.3 Set manual deceleration offset

int set_dec_pos2(int cardno, int axis, long pos)

Function: To set the offset of origin

Parameters:

cardno Card number
axis Axis number (1-6)
pos Residual position

Return: 0: Correct 1: Wrong

Note: The motion of such offset requires external signal (low level of stop0) for triggerment.

11.4 Clear manual deceleration

int clr_dec_status(int cardno, int axis)

Function: To clear manual deceleration status

Parameters:

cardno Card number
axis Axis number (1-6)

Return: 0: Correct 1: Wrong

11.5 Get manual deceleration status

int get_dec_status(int cardno, int axis, int *sta)

Function: To get manual deceleration status

Parameters:

cardno Card number
axis Axis number (1-6)

sta Deceleration status

0: Searching

1: Search completed

2: Motion stopped. No deceleration point is found

3: Fail to reach the actual offset

4: Servo is turned off while searching for deceleration point

5: Deceleration point is found, which fails to get in place when moving towards offset (it might be limit triggerment)

Return: 0: Correct 1: Wrong

11.6 Set end speed

int set_end_speed(int cardno,int axis,long value);

Function: To set the endspeed to search for origin signal after manual deceleration point

Parameters:

cardno Card number

axis Axis number (1-6)

value Range (1-2M)

Return: 0: Correct 1: Wrong

Note: If no signal for triggerment (deceleration origin signal) is found after reaching the manual deceleration point (pos1), it will keep moving at such speed.

Chapter 8 Guide to motion control function library

1. Introduction to ADT8960 function library

ADT8960 function library is actually the interface for users to operate the motion control card; users can control the motion control card to execute corresponding functions simply by calling interface functions.

The motion control card provides movement function library under DOS and dynamic link library under Windows; the following part will introduce the library calling method under DOS and Windows.

2. Calling dynamic link library under Windows

The dynamic link library `adt8960.dll` under Windows is programmed in VC, saved in the `DevelopmentPackage/Drive/Dynamic Link Library`, and applicable for general programming tools under Windows, including VB, VC, C++Builder, VB.NET, VC.NET, Delphi and group software LabVIEW.

2.1 Calling under VC

- (1) Create a new project;
- (2) Copy `adt8960.lib` and `adt8960.h` files from `DevelopmentPackage/VC` in the CD to the routing of the newly created item;
- (3) Under File View of the Work Area of the new item, right click mouse to select "Add Files to Project" and then in the pop-up file dialogue select the file type to be "Library Files (.lib)", then search for "`adt8960.lib`" and select it, finally click OK to finish loading of the static library;
- (4) Add `#include "adt8960.h"` in the declaim part of the source file, header, or overall header "`StdAfx.h`";

After the above four steps, users can call functions in the dynamic link library.

Note: The calling method under VC.NET is similar.

2.2 Calling under VB

- (1) Create a new project;
- (2) Copy adt8960.bas file from DevelopmentPackage/VB in the CD to the routing of the newly created item;
- (3) Select the menu command Engineering/Add module and subsequently Save Current in the dialogue to search out the adt8960.bas module file, finally click the Open button;

After the above four steps, users can call functions in the dynamic link library.

Note: The calling method under VB.NET is similar.

2.3 Calling under C++Builder

- (1) Create a new project;
- (2) Copy adt8960.lib and adt8960.h files from DevelopmentPackage/C++Builder in the CD to the routing of the newly created item;
- (3) Select the menu command "Project/Add to Project", and in the pop-up dialogue select the file type to be "Library files(*.lib)", then search out the "adt8960.lib" file and click Open button;

- (4) Add #include "adt8960.h" in the declaim part of the program file;

After the above four steps, users can call functions in the dynamic link library.

2.4 Calling under LabVIEW8

- (1) Create a new VI;
- (2) Copy the adt8960.dll file from DevelopmentPackage/Drive/Control Card Drive in the CD to the routing of the newly created item;
- (3) Select "Call Library Function Node" under "Connectivity\Libraries & Executables" in the function module in the window of flow diagram where the function should be called and add it to the target place;
- (4) Double click the node, first select adt8960.dll dynamic link library in the pop-up dialogue "Call Library Function", subsequently select the required library function, and finally configure the return and

parameter attribute of the function;

After the above four steps, users can call functions in the dynamic link library.

3. Calling library functions under DOS

Function libraries under DOS are edited in Borland C3.1 and saved in the DevelopmentPackage/C++(or C). Library functions may be categorized into large and huge modes, applicable for standard C and Borland C3.1 or above versions.

The method of calling function library with Borland C is as follows:

- (1) Under the development environment of Borland C, select the "Project\Open Project" command to create a new project;
- (2) Copy adt8960H.LIB/adt8960L.LIB and adt8960.H files from DevelopmentPackage/C(or C++) in the CD to the routing of the newly created item;
- (3) Select the "Project\Add Item" command and further in the dialogue select "adt8960H.LIB" or "adt8960L.LIB", finally click the Add button;
- (4) Add #include "adt8960.h" statement in the user program file;

After the above four steps, users can call library functions in the program.

4. Returns of library functions and their meanings

To ensure that users will correctly know the execution of library functions, each library function in the function library after completion of execution will return to execution results of the library functions. Users, based on such Returns, can conveniently judge whether function calling has succeeded.

Except "int adt8960_initial(void)" and "int read_bit(int cardno, int number)" have special Returns, other functions have only "0" and "1" as the Returns, where "0" means success and "1" means failure.

The following list introduced meanings of function Returns.

**ADT-8960 6-axis servo/ stepping motion control card**

Function name	Return	Meaning
adt8960_initial —	-1	No installation of service
	-2	PCI slot failure
	0	No installation of control card
	>0	Amount of control card
Read_bit	0	Low level
	1	High level
	-1	Card number or input point out of limit
Other functions	0	Correct
	1	Wrong

Note: Return 1 means calling error, and the normal cause is wrong cardno (Card Number) or axis (Axis Number) passed during the process of calling library functions. Card number have their values starting as 0, 1, 2, thus in case there is only one card, the card number must be 0; similarly values of axis number can only be 1, 2, 3, 4, 5, 6, other values are all wrong.

Chapter 9 Briefing on motion control development

Some problems may be encountered during programming, but most problems are caused by misunderstanding of the principle of this control card. The following part will give explanations on some usual and easy-to-misunderstood situations.

Card initialization

At the beginning, users shall call `adt8960_initial()` function and ensure the ADT8960 card has been correctly installed, and then set pulse output mode and limit switch mode. The above parameters shall be set for individual machine, and normally only one setting is required during program initialization instead of any later setting.

Generally, the R value should be determined by the highest frequency under use, and shall not be changed during application unless the lowest frequency fails to meet the service requirement.

Note: The library function “adt8960_initial” is the door to ADT8960 card, thus calling other functions are meaningful only after successful card initialization with calling to this function.

Speed setting

2.1 Constant speed motion

Parameter setting is so simple that users just need to set the drive speed equal to the starting speed; other parameters need no setting.

Relevant functions:

`set_startv`

`set_speed`

2.2 S-type acceleration/deceleration

To achieve better acceleration for several modes with higher load, S curve is recommended. For this purpose, the value of plus the

acceleration should be set, while the calculation of plus the acceleration has a great effect on the shape of S curve. Refer to the above-mentioned example.

Relevant functions:

set_startv

set_speed

set_acc

set_acac

set_ad_mode (Set as S curve acceleration/deceleration mode)

2.3 Interpolation speed

ADT8960 card can take any 2/3/4/5/6 axes for linear interpolation.

For speed of interpolation, speed parameter for the earliest axis will apply as speed of the long axis, for example,

inp_move2 (0,3,1,100,200)

Is to apply the speed parameters of the first axis, i.e., X axis, independent of parameter sequence.

inp_move3 (0,3,4,2,100,200,500)

Is to apply the speed parameters of the second axis, i.e., Y axis, independent of parameter sequence.

Note: Speed multiple rate during interpolation is half of that during single-axis movement, which means under the same parameters speed of interpolation is only half of that of single-axis movement.

Chapter 10 Programming samples in motion control development

All movement control functions return immediately; once a drive command is made, the movement process will be controlled by the motion control card until completion; then the host computer software of users can real-time monitor the whole movement process or force to stop the process.

Note: Axis during motion are not allowed to send new drive commands to motion axis, otherwise the previous drive will be given up so as to execute the new drive.

Although programming languages vary in types, they can still be concluded as Three Structures and One spirit. Three Structures refer to sequential structure, cycling structure and branch structure emphasized by all the programming languages, and One Spirit refer to calculation and module division involved in order to complete design assignments, which is also the key and hard point in whole programming design.

To ensure that a program is popular, standard, expandable and easy for maintenance, all the later samples will be divided into the following modules in terms of project design: motion control module (to further seal library functions provided by the control card), function realization module (to cooperate code phase of specific techniques), monitoring module and stop processing module.

Now let's brief application of ADT8960 card function library in VB and VC. Users using other programming languages may take reference.

☞ VB programming samples

1.1 PREPARATION

- (1) Create a new item and save as "test.vbp";

- (2) Add the adt8960.bas module in the item following the above-mentioned method;

1.2 Motion control module

- (1) Add a new module in the project and save as “ctrlicard.bas”;
- (2) At first, within the motion control module self-define initialization functions of the motion control card and initialize library functions to be sealed into initialization functions;
- (3) Further self-define relevant motion control functions, such as speed setting function, single-axis motion function, and interpolation motion function;
- (4) Source code of ctrlicard.bas is:

```
Public Result As Integer          'Return
Const MAXAXIS = 6                'Maximum axis number
'*****Initialize the function*****
' The function includes the common library functions for card
initialization, which is the base to call other functions, so it must be first
called in the example. 'Return<=0 means initialization failure; Return >0
means initialization success
'*****
Public Function Init_Card() As Integer
    Result = adt8960_initial      'Initialize card
    If Result <= 0 Then
        Init_Card = Result
        Exit Function
    End If
    For i = 1 To MAXAXIS
        set_command_pos 0, i, 0   'Clear logical position
counter
        set_command_pos 0, i, 0   'Clear real position counter
        set_startv 0, i, 1000     'Set starting speed
        set_startv 0, i, 2000    'Set drive speed
```



set_startv 0, i, 625

'Set acceleration

Next i

Init_Card = Result

End Function

*****Get version information*****

The function is used to get the version of function library

Parameters: libver-library version

Public Function Get_Version(libver As Double) As Integer

Dim ver As Integer

ver = get_hardware_ver(0)

libver = (ver / 256)

End Function

***** Set speed module *****

Based on the value of the parameter, judge it's uniform or deceleration

Set the initial velocity, drive speed and acceleration

Parameter: axis – axis No.

StartV - initial velocity

Speed - drive speed

Add - acceleration

Return value=0 right, Return value =1 wrong

Public Function Setup_Speed(ByVal axis As Integer, ByVal startv As Long, ByVal speed As Long, ByVal add As Long) As Integer

If (startv - speed >= 0) Then

Result = set_startv(0, axis, startv)

set_speed 0, axis, startv

Else

Result = set_startv(0, axis, startv)

set_speed 0, axis, speed

set_acc 0, axis, add / 250



End If

End Function

*****single axis drive function*****

'Used for driving sing motion axis

'Parameter: axis pulse

'Return value=0 right, Return value =1 wrong

Public Function Axis_Pmove(ByVal axis As Integer, ByVal pulse As Long) As Integer

Result = pmove(0, axis, pulse)

Axis_Pmove = Result

End Function

***** single axis continuous drive function *****

'Used for driving sing motion axis

'Parameter: axis pulse

'Return value=0 right, Return value =1 wrong

*****/

Public Function Axis_ConMove(ByVal axis As Integer, ByVal dir As Long) As Integer

Result = continue_move(0, axis, dir)

Axis_ConMove = Result

End Function

***** random 2 axis interpolation function *****

Used for random 2 axis interpolation

Parameter: axis1 , axis2

pulse1,pulse2

Return value=0 right, Return value =1 wrong

Public Function Interp_Move2(ByVal axis1 As Integer, ByVal axis2 As Integer, ByVal pulse1 As Long, ByVal pulse2 As Long) As Integer

Result = inp_move2(0, axis1, axis2, pulse1, pulse2)



Interp_Move2 = Result

End Function

***** random 3 axis interpolation function *****

Used for random 3 axis interpolation

Parameter: axis1 , axis2, axis3

pulse1,pulse2, pulse3

Return value=0 right, Return value =1 wrong

Public Function Interp_Move3(ByVal axis1 As Integer, ByVal axis2 As Integer,
ByVal axis3 As Integer, ByVal pulse1 As Long, ByVal pulse2 As Long, ByVal pulse3
As Long) As Integer

Result = inp_move3(0, axis1, axis2, axis3, pulse1, pulse2, pulse3)

Interp_Move3 = Result

End Function

***** random 4 axis interpolation function *****

Used for random 4 axis interpolation

Parameter: axis1 , axis2, axis3, axis4

pulse1,pulse2, pulse3, pulse4

Return value=0 right, Return value =1 wrong

Public Function Interp_Move4(ByVal axis1 As Integer, ByVal axis2 As Integer,
ByVal axis3 As Integer, ByVal axis4 As Integer, ByVal pulse1 As Long, ByVal pulse2
As Long, ByVal pulse3 As Long, ByVal pulse4 As Long) As Integer

Result = inp_move4(0, axis1, axis2, axis3, axis4, pulse1, pulse2, pulse3,
pulse4)

Interp_Move4 = Result

End Function

***** random 5 axis interpolation function *****

Used for random 5 axis interpolation

Parameter: axis1 , axis2, axis3, axis4, axis5



pulse1,pulse2, pulse3, pulse4, pulse5

Return value=0 right, Return value =1 wrong

Public Function Interp_Move5(ByVal axis1 As Integer, ByVal axis2 As Integer,
ByVal axis3 As Integer, ByVal axis4 As Integer, ByVal axis5 As Integer, ByVal
pulse1 As Long, ByVal pulse2 As Long, ByVal pulse3 As Long, ByVal pulse4 As
Long, ByVal pulse5 As Long) As Integer

Result = inp_move5(0, axis1, axis2, axis3, axis4, axis5, pulse1, pulse2, pulse3,
pulse4, pulse5)

Interp_Move5 = Result

End Function

***** random 6 axis interpolation function *****

Used for random 6 axis interpolation

Parameter: axis1 , axis2, axis3, axis4, axis5, axis6

pulse1,pulse2, pulse3, pulse4, pulse5, pulse6

Return value=0 right, Return value =1 wrong

Public Function Interp_Move6(ByVal pulse1 As Long, ByVal pulse2 As Long, ByVal
pulse3 As Long, ByVal pulse4 As Long, ByVal pulse5 As Long, ByVal pulse6 As
Long) As Integer

Result = inp_move6(0, pulse1, pulse2, pulse3, pulse4, pulse5, pulse6)

Interp_Move6 = Result

End Function

*****Stop driving function *****

'Used for stop driving, Divided into stop immediately and slow to stop

'parameter: axis, mode: 0- stop immediately, 1- slow to stop

' Return value=0 right, Return value =1 wrong

Public Function StopRun(ByVal axis As Integer, ByVal mode As Integer) As Integer

If mode = 0 Then

Result = sudden_stop(0, axis)



Else

Result = dec_stop(0, axis)

End If

End Function

*****Set position function*****

Used for set logical position and actual position

Parameter: axis pos-position setting

mode

0 – set logical position 1 – set actual position

' Return value=0 right, Return value =1 wrong

Public Function Setup_Pos(ByVal axis As Integer, ByVal pos As Long, ByVal mode As Integer) As Integer

If mode = 0 Then

Result = set_command_pos(0, axis, pos)

Else

Result = set_actual_pos(0, axis, pos)

End If

End Function

*****get motion info function*****

'Used for get logical position、actual position and running speed

'Parameter: axis logps- logical position

' actpos- actual position, speed- running speed

' Return value=0 right, Return value =1 wrong

Public Function Get_CurrentInf(ByVal axis As Integer, LogPos As Long, actpos As Long, speed As Long) As Integer

Result = get_command_pos(0, axis, LogPos)

get_actual_pos 0, axis, actpos

get_speed 0, axis, speed

Get_CurrentInf = Result



End Function

*****get motion state function*****

'Used for get axis drive state and interpolation drive state

'Parameter: axis value-stste(0-drive finish, not 0-drive running)

' mode 0-get axis drive state, not 0-get interpolation drive state

' Return value=0 right, Return value =1 wrong

Public Function Get_MoveStatus(ByVal axis As Integer, value As Long, ByVal mode As Integer) As Integer

 If mode = 0 Then

 GetMove_Status = get_status(0, axis, value)

 Else

 GetMove_Status = get_inp_status(0, value)

 End If

End Function

*****Read input port*****

 Used for read input port '

 Parameter: number-input point(0 ~ 31)'

 Return value: 0 — low level, 1 —high level, -1 — wrong'

Public Function Read_Input(ByVal number As Integer) As Integer

 Read_Input = read_bit(0, number)

End Function

*****Output axis function*****

 Used for output point signal

 Parameter: number-output point(0 ~ 15)

 value 0-low level 1—high level

 Return value=0 right, Return value =1 wrong

Public Function Write_Output(ByVal number As Integer, ByVal value As Integer) As Integer



Write_Output = write_bit(0, number, value)

End Function

*****Set pulse output mode*****

Used for set pulse working mode

Parameter: axis value-pulse mode: 0—pulse+pulse 1—pulse+direction'

' Return value=0 right, Return value =1 wrong '

Default pulse mode: pulse+direction '

Adopt default positive logic pulse+direction output signal '

Public Function Setup_PulseMode(ByVal axis As Integer, ByVal value As Integer) As Integer

Setup_PulseMode = set_pulse_mode(0, axis, value, 0, 0)

End Function

*****set limit signal*****

Used for set +/- direction limit input nLMT mode

Parameter: axis

value1 0—+ limit effective 1—+ limit invalid

value2 0—- limit effective 1—- limit invalid

logic 0—low level effective 1—high level effective

Default mode: + limit effective, - limit effective, low level effective

Return value=0 right, Return value =1 wrong

Public Function Setup_LimitMode(ByVal axis As Integer, ByVal value1 As Integer, ByVal value2 As Integer, ByVal logic As Integer) As Integer

Setup_LimitMode = set_limit_mode(0, axis, value1, value2, logic)

End Function

*****set stop0 signal mode*****

' Used for set stop0 signal mode '

' Parameter: axis

' value 0—invalid 1—effective

' logic 0—low level effective 1—high level effective '



Default mode: invalid '

' Return value=0 right, Return value =1 wrong

' *****

Public Function Setup_Stop0Mode(ByVal axis As Integer, ByVal value As Integer,
ByVal logic As Integer) As Integer

 Setup_Stop0Mode = set_stop0_mode(0, axis, value, logic)

End Function

*****set stop1 signal mode*****'

 Used for set stop1 signal mode '

 Parameter: axis

 value 0—invalid 1—effective

 logic 0—low level effective 1—high level effective

 Default mode: invalid '

 Return value=0 right, Return value =1 wrong

Public Function Setup_Stop1Mode(ByVal axis As Integer, ByVal value As Integer,
ByVal logic As Integer) As Integer

 Setup_Stop1Mode = set_stop1_mode(0, axis, value, logic)

End Function

*****set hardware stop*****

 Used for set hardware stop

 Parameter: value 0—invalid 1—effective

 logic 0—low level effective 1—high level effective

 Default mode: invalid

 Return value=0 right, Return value =1 wrong

 Hardware stop signal fixed on P3 connection board 34pin (IN31)

Public Function Setup_HardStop(ByVal value As Integer, ByVal logic As Integer) As
Integer

 Setup_HardStop = set_suddenstop_mode(0, value, logic)

End Function



*****set delayed*****

Used for set delayed '

Parameter: time – delay time (us) '

Return value=0 right, Return value =1 wrong

Public Function Setup_Delay(ByVal time As Long) As Integer

Setup_Delay = set_delay_time(0, time * 8)

End Function

*****get delay state*****

Used for get delay state

Return value 0 – delay finish 1 - delay

Public Function Get_DelayStatus() As Integer

Get_DelayStatus = get_delay_status(0)

End Function

*****set general input/output*****

' Used for set general input/output

'Parameter:

' v1 -0: the front 8 point as input 1: the front 8 point as output

' v2 -0: the back 8 point as input 1: the back 8 point as output

Return value=0 right, Return value =1 wrong

Remark: when take IO as output, can read input state as well

*****/

Public Function Set_IoMode(ByVal v1 As Integer, ByVal v2 As Integer) As Integer

Set_IoMode = set_io_mode(0, v1, v2)

End Function

*/*****Single axis relative motion*****

*Function: Refer to the current position to accelerate quantitatively movement

*Parameter:

' cardno –card No.



```
' axis ---axis No.
' pulse --pulse
' lspd ---low speed
' hspd ---high speed
' tacc--- acceleration time (s)
' Return value=0 right, Return value =1 wrong
```

```
'/*****/
```

Public Function Sym_RelativeMove(ByVal axis As Integer, ByVal pulse As Long, ByVal lspd As Long, ByVal hspd As Long, ByVal tacc As Double) As Integer

Sym_RelativeMove = symmetry_relative_move(0, axis, pulse, lspd, hspd, tacc)

End Function

```
'/*****single axis absolute motion*****/
```

*Function: Refer to the original position to accelerate quantitatively movement

*Parameter:

```
' cardno --card No.
' axis ---axis No.
' pulse --pulse
' lspd ---low speed
' hspd ---high speed
' tacc--- acceleration time (s)
' Return value=0 right, Return value =1 wrong
```

```
'/*****/
```

Public Function Sym_AbsoluteMove(ByVal axis As Integer, ByVal pulse As Long, ByVal lspd As Long, ByVal hspd As Long, ByVal tacc As Double) As Integer

Sym_AbsoluteMove = symmetry_absolute_move(0, axis, pulse, lspd, hspd, tacc)

End Function

```
'/*****2 axis linear interpolation relative movement*****/
```

*function: Refer to the current position to accelerate quantitatively movement



Parameter:

' cardno –card No.
' axis1 ---axis1
' axis2 ---axis2
' pulse1 –pulse1
' pulse2 –pulse2
' lspd ---low speed
' hspd ---high speed
' tacc--- acceleration time (s)
' Return value=0 right, Return value =1 wrong

*****/

Public Function Sym_RelativeLine2(ByVal axis1 As Integer, ByVal axis2 As Integer, ByVal pulse1 As Long, ByVal pulse2 As Long, ByVal lspd As Long, ByVal hspd As Long, ByVal tacc As Double) As Integer

Sym_RelativeLine2 = symmetry_relative_line2(0, axis1, axis2, pulse1, pulse2, lspd, hspd, tacc)

End Function

/'*****2 axis linear interpolation absolute movement*****/

function: Refer to the original position to accelerate quantitatively movement

Parameter:

' cardno –card No.
' axis1 ---axis1
' axis2 ---axis2
' pulse1 –pulse1
' pulse2 –pulse2
' lspd ---low speed
' hspd ---high speed
' tacc--- acceleration time (s)
' Return value=0 right, Return value =1 wrong

*****/

Public Function Sym_AbsoluteLine2(ByVal axis1 As Integer, ByVal axis2 As

Integer, ByVal pulse1 As Long, ByVal pulse2 As Long, ByVal lspd As Long,
ByVal hspd As Long, ByVal tacc As Double) As Integer

Sym_AbsoluteLine2 = symmetry_absolute_line2(0, axis1, axis2, pulse1,
pulse2, lspd, hspd, tacc)

End Function

/'*****3 axis linear interpolation relative movement*****'

'*function: Refer to the current position to accelerate quantitatively movement

'*Parameter:

' cardno --card No.

' axis1 ---axis1

' axis2 ---axis2

' axis3 ---axis3

' pulse1 --pulse1

' pulse2 --pulse2

' pulse3 --pulse3

' lspd ---low speed

' hspd ---high speed

' tacc--- acceleration time (s)

' Return value=0 right, Return value =1 wrong

'*****/'

Public Function Sym_RelativeLine3(ByVal axis1 As Integer, ByVal axis2 As
Integer, ByVal axis3 As Integer, ByVal pulse1 As Long, ByVal pulse2 As Long,
ByVal pulse3 As Long, ByVal lspd As Long, ByVal hspd As Long, ByVal tacc As
Double) As Integer

Sym_RelativeLine3 = symmetry_relative_line3(0, axis1, axis2, axis3,
pulse1, pulse2, pulse3, lspd, hspd, tacc)

End Function

/'*****3 axis linear interpolation absolute movement*****'

'*function: Refer to the original position to accelerate quantitatively movement

'*Parameter:



```
'      cardno --card No.
'
'      axis1 ---axis1
'
'      axis2 ---axis2
'
'      axis3 ---axis3
'
'      pulse1 --pulse1
'
'      pulse2 --pulse2
'
'      pulse3 --pulse3
'
'      lspd ---low speed
'
'      hspd ---high speed
'
'      tacc--- acceleration time (s)
'
'      Return value=0 right, Return value =1 wrong
```

```
*****/
```

```
Public Function Sym_AbsoluteLine3(ByVal axis1 As Integer, ByVal axis2 As
Integer, ByVal axis3 As Integer, ByVal pulse1 As Long, ByVal pulse2 As Long,
ByVal pulse3 As Long, ByVal lspd As Long, ByVal hspd As Long, ByVal tacc As
Double) As Integer
```

```
    Sym_AbsoluteLine3 = symmetry_absolute_line3(0, axis1, axis2, axis3,
pulse1, pulse2, pulse3, lspd, hspd, tacc)
```

```
End Function
```

```
/'*****4 axis linear interpolation relative movement*****
```

```
/*function: Refer to the current position to accelerate quantitatively movement
```

```
/*Parameter:
```

```
'      cardno --card No.
'
'      axis1 ---axis1
'
'      axis2 ---axis2
'
'      axis3 ---axis3
'
'      Axis4---axis4
'
'      pulse1 --pulse1
'
'      pulse2 --pulse2
'
'      pulse3 --pulse3
'
'      Pulse4---pulse4
```



```
'      lspd ---low speed
'      hspd ---high speed
'      tacc--- acceleration time (s)
'      Return value=0 right, Return value =1 wrong
```

```
*****/
```

```
Public Function Sym_RelativeLine4(ByVal axis1 As Integer, ByVal axis2 As
Integer, ByVal axis3 As Integer, ByVal axis4 As Integer, ByVal pulse1 As Long,
ByVal pulse2 As Long, ByVal pulse3 As Long, ByVal pulse4 As Long, ByVal
lspd As Long, ByVal hspd As Long, ByVal tacc As Double) As Integer
```

```
    Sym_RelativeLine4 = symmetry_relative_line4(0, axis1, axis2, axis3, axis4,
pulse1, pulse2, pulse3, pulse4, lspd, hspd, tacc)
```

```
End Function
```

```
/'*****4 axis linear interpolation absolute movement*****
```

```
/*function: Refer to the original position to accelerate quantitatively movement
```

```
/*Parameter:
```

```
'      cardno --card No.
'      axis1 ---axis1
'      axis2 ---axis2
'      axis3 ---axis3
'      Axis4---axis4
'      pulse1 --pulse1
'      pulse2 --pulse2
'      pulse3 --pulse3
'      Pulse4---pulse4
'      lspd ---low speed
'      hspd ---high speed
'      tacc--- acceleration time (s)
'      Return value=0 right, Return value =1 wrong
```

```
*****/
```

```
Public Function Sym_AbsoluteLine4(ByVal axis1 As Integer, ByVal axis2 As
```

Integer, ByVal axis3 As Integer, ByVal axis4 As Integer, ByVal pulse1 As Long, ByVal pulse2 As Long, ByVal pulse3 As Long, ByVal pulse4 As Long, ByVal lspd As Long, ByVal hspd As Long, ByVal tacc As Double) As Integer

Sym_AbsoluteLine4 = symmetry_absolute_line4(0, axis1, axis2, axis3, axis4, pulse1, pulse2, pulse3, pulse4, lspd, hspd, tacc)

End Function

/'*****5 axis linear interpolation relative movement*****/'

/*function: Refer to the current position to accelerate quantitatively movement

/*Parameter:

' cardno --card No.

' axis1 ---axis1

' axis2 ---axis2

' axis3 ---axis3

' axis4 ---axis4

' axis5 ---axis5

' pulse1 --pulse1

' pulse2 --pulse2

' pulse3 --pulse3

' pulse4 --pulse4

' pulse5 --pulse5

' lspd ---low speed

' hspd ---high speed

' tacc--- acceleration time (s)

/'*****/'

Public Function Sym_RelativeLine5(ByVal axis1 As Integer, ByVal axis2 As Integer, ByVal axis3 As Integer, ByVal axis4 As Integer, ByVal axis5 As Integer, ByVal pulse1 As Long, ByVal pulse2 As Long, ByVal pulse3 As Long, ByVal pulse4 As Long, ByVal pulse5 As Long, ByVal lspd As Long, ByVal hspd As Long, ByVal tacc As Double) As Integer

Sym_RelativeLine5 = symmetry_relative_line5(0, axis1, axis2, axis3, axis4, axis5, pulse1, pulse2, pulse3, pulse4, pulse5, lspd, hspd, tacc)

End Function

/'*****5 axis linear interpolation absolute movement*****'

'*function: Refer to the original position to accelerate quantitatively movement

'*Parameter:

' cardno --card No.
 ' axis1 ---axis1
 ' axis2 ---axis2
 ' axis3 ---axis3
 ' axis4 ---axis4
 ' axis5 ---axis5
 ' pulse1 --pulse1
 ' pulse2 --pulse2
 ' pulse3 --pulse3
 ' pulse4 --pulse4
 ' pulse5 --pulse5
 ' lspd ---low speed
 ' hspd ---high speed
 ' tacc--- acceleration time (s)

/'*****/'

Public Function Sym_AbsoluteLine5(ByVal axis1 As Integer, ByVal axis2 As Integer, ByVal axis3 As Integer, ByVal axis4 As Integer, ByVal axis5 As Integer, ByVal pulse1 As Long, ByVal pulse2 As Long, ByVal pulse3 As Long, ByVal pulse4 As Long, ByVal pulse5 As Long, ByVal lspd As Long, ByVal hspd As Long, ByVal tacc As Double) As Integer

Sym_AbsoluteLine5 = symmetry_absolute_line5(0, axis1, axis2, axis3, axis4, axis5, pulse1, pulse2, pulse3, pulse4, pulse5, lspd, hspd, tacc)

End Function

/'*****6 axis linear interpolation relative movement*****'

'*function: Refer to the current position to accelerate quantitatively movement

'*Parameter:



' cardno --card No.
' axis1 ---axis1
' axis2 ---axis2
' axis3 ---axis3
' axis4 ---axis4
' axis5 ---axis5
' axis6 ---axis6
' pulse1 --pulse1
' pulse2 --pulse2
' pulse3 --pulse3
' pulse4 --pulse4
' pulse5 --pulse5
' pulse6 --pulse6
' lspd ---low speed
' hspd ---high speed
' tacc--- acceleration time (s)

*****/

Public Function Sym_RelativeLine6(ByVal pulse1 As Long, ByVal pulse2 As Long, ByVal pulse3 As Long, ByVal pulse4 As Long, ByVal pulse5 As Long, ByVal pulse6 As Long, ByVal lspd As Long, ByVal hspd As Long, ByVal tacc As Double) As Integer

Result = symmetry_relative_line6(0, pulse1, pulse2, pulse3, pulse4, pulse5, pulse6, lspd, hspd, tacc)

Sym_RelativeLine6 = Result

End Function

/'*****6 axis linear interpolation absolute movement*****/

/*function: Refer to the original position to accelerate quantitatively movement

/*Parameter:

' cardno --card No.
' axis1 ---axis1
' axis2 ---axis2



```
' axis3 ---axis3
' axis4 ---axis4
' axis5 ---axis5
' axis6 ---axis6
' pulse1 --pulse1
' pulse2 --pulse2
' pulse3 --pulse3
' pulse4 -pulse4
' pulse5 -pulse5
' pulse6 -pulse6
' lspd ---low speed
' hspd ---high speed
' tacc--- acceleration time (s)
```

```
*****/
```

```
Public Function Sym_AbsoluteLine6(ByVal pulse1 As Long, ByVal pulse2 As
Long, ByVal pulse3 As Long, ByVal pulse4 As Long, ByVal pulse5 As Long,
ByVal pulse6 As Long, ByVal lspd As Long, ByVal hspd As Long, ByVal tacc As
Double) As Integer
```

```
    Result = symmetry_absolute_line6(0, pulse1, pulse2, pulse3, pulse4,
pulse5, pulse6, lspd, hspd, tacc)
```

```
    Sym_AbsoluteLine6 = Result
```

```
End Function
```

```
/'*****
```

```
'function: get output point
```

```
'parameter:
```

```
'    cardno
```

```
'    number output point
```

```
'return value    the current state of the designated port,-1 means wrong
```

```
*****/
```

```
Public Function Get_OutNum(ByVal number As Integer) As Integer
```

```
    Result = get_out(0, number)
```



Get_OutNum = Result

End Function

Function moudle

1.31 Interface design

1.3.2 The initialization code in the form loads incident, code as below:

```
Private Sub Init_Board()
```

```
Dim count As Integer
```

```
count = Init_Card
```

```
If count < 1 Then MsgBox "adt8960 Card not installed correctly "
```

```
Get_Version g_nLibVer
```

```
CardVer.Caption = " Hardware version number: " + CStr(g_nLibVer)
```

```
End Sub
```

1.3.3 linkage code located in AxisPmove_Click, send drive order from different target, 6 target: X、Y、Z、A、B、C, code as below:

```
Private Sub AxisPmove_Click()
```

```
'*****speed setting*****'
```

```
' Initial velocity and drive speed Setting range (1~2M)'
```



' The acceleration setting range(1×250~32000×250)'

For i = 1 To 6

Setup_Speed i, m_nStartV(i - 1).Text, m_nSpeed(i - 1).Text, m_nAdd(i - 1).Text

Next i

If m_bX.value = vbChecked Then

Axis_Pmove 1, m_nPulse(0).Text

End If

If m_bY.value = vbChecked Then

Axis_Pmove 2, m_nPulse(1).Text

End If

If m_bZ.value = vbChecked Then

Axis_Pmove 3, m_nPulse(2).Text

End If

If m_bA.value = vbChecked Then

Axis_Pmove 4, m_nPulse(3).Text

End If

If m_bB.value = vbChecked Then

Axis_Pmove 5, m_nPulse(4).Text

End If

If m_bC.value = vbChecked Then

Axis_Pmove 6, m_nPulse(5).Text

End If

End Sub

1.3.4 Interpolation code located in InterpMove_Click, send drive order from different target, 6 target: X、Y、Z、A、B、C, code as below:

Private Sub InterpMove_Click()

*****Speed setting*****

' Initial velocity and drive speed Setting range (1~2M)

' The acceleration setting range (1×250~32000×250)



For i = 1 To 6

Setup_Speed i, m_nStartV(i - 1).Text, m_nSpeed(i - 1).Text, m_nAdd(i - 1).Text

Next i

***** Interpolation *****

'ADT-8960 can random 2 axis Interpolation, random 3 axis Interpolation, random 4 axis Interpolation, random 5 axis Interpolation and 6 axis Interpolation.

*****6 axis Interpolation *****

If m_bX.value = vbChecked And m_bY.value = vbChecked And m_bZ.value = vbChecked And m_bA.value = vbChecked And m_bB.value = vbChecked And m_bC.value = vbChecked Then

Interp_Move6 m_nPulse(0).Text, m_nPulse(1).Text, m_nPulse(2).Text, m_nPulse(3).Text, m_nPulse(4).Text, m_nPulse(5).Text

***** random 5 axis Interpolation *****

Elseif m_bX.value = vbChecked And m_bY.value = vbChecked And m_bZ.value = vbChecked And m_bA.value = vbChecked And m_bB.value = vbChecked Then

Interp_Move5 1, 2, 3, 4, 5, m_nPulse(0).Text, m_nPulse(1).Text, m_nPulse(2).Text, m_nPulse(3).Text, m_nPulse(4).Text

***** random 4 axis Interpolation *****

Elseif m_bX.value = vbChecked And m_bY.value = vbChecked And m_bZ.value = vbChecked And m_bA.value = vbChecked Then

Interp_Move4 1, 2, 3, 4, m_nPulse(0).Text, m_nPulse(1).Text, m_nPulse(2).Text, m_nPulse(3).Text

***** random 3 axis Interpolation *****

*****XYZ 3 axis Interpolation *****

Elseif m_bX.value = vbChecked And m_bY.value = vbChecked And m_bZ.value = vbChecked Then



```
Interp_Move3 1, 2, 3, m_nPulse(0).Text, m_nPulse(1).Text, m_nPulse(2).Text
*****XYA 3 axis Interpolation ***** Elsef
m_bX.value = vbChecked And m_bY.value = vbChecked And m_bA.value = vbChecked
Then

Interp_Move3 1, 2, 4, m_nPulse(0).Text, m_nPulse(1).Text, m_nPulse(3).Text
*****XZA 3 axis Interpolation *****

Elsef m_bX.value = vbChecked And m_bZ.value = vbChecked And m_bA.value =
vbChecked Then

Interp_Move3 1, 3, 4, m_nPulse(0).Text, m_nPulse(2).Text, m_nPulse(3).Text
*****YZA 3 axis Interpolation *****

Elsef m_bY.value = vbChecked And m_bZ.value = vbChecked And m_bA.value =
vbChecked Then

Interp_Move3 2, 3, 4, m_nPulse(1).Text, m_nPulse(2).Text, m_nPulse(3).Text
*****2 axis Interpolation *****

*****XY 2 axis Interpolation *****

Elsef m_bX.value = vbChecked And m_bY.value = vbChecked Then

Interp_Move2 1, 2, m_nPulse(0).Text, m_nPulse(1).Text
*****XZ 2 axis Interpolation *****

Elsef m_bX.value = vbChecked And m_bZ.value = vbChecked Then

Interp_Move2 1, 3, m_nPulse(0).Text, m_nPulse(2).Text
*****XA 2 axis Interpolation *****

Elsef m_bX.value = vbChecked And m_bA.value = vbChecked Then

Interp_Move2 1, 4, m_nPulse(0).Text, m_nPulse(3).Text
*****YZ 2 axis Interpolation *****

Elsef m_bY.value = vbChecked And m_bZ.value = vbChecked Then

Interp_Move2 2, 3, m_nPulse(1).Text, m_nPulse(2).Text
*****YA 2 axis Interpolation *****

Elsef m_bY.value = vbChecked And m_bA.value = vbChecked Then

Interp_Move2 2, 4, m_nPulse(1).Text, m_nPulse(3).Text
*****ZA 2 axis Interpolation *****

Elsef m_bZ.value = vbChecked And m_bA.value = vbChecked Then
```

```
Interp_Move2 3, 4, m_nPulse(2).Text, m_nPulse(3).Text
```

```
Else
```

```
MsgBox "Please select interpolation axis",, "tip"
```

```
End If
```

```
End Sub
```

1.4 Monitoring module

Monitoring module for real-time obtain all axis drive information, displaying moving information, and control the drive not send new instructions in processing. Monitoring module completed by timer events , code as follows:

```
Private Sub Timer1_Timer()
```

```
Dim nLogPos As Long 'logic position
```

```
Dim nActPos As Long 'real position
```

```
Dim nSpeed As Long 'running speed
```

```
Dim nStatus(6) As Long 'driving state
```

```
For i = 1 To 6
```

```
Get_CurrentInf i, nLogPos, nActPos, nSpeed
```

```
m_nLogPos(i - 1).Caption = nLogPos
```

```
m_nActPos(i - 1).Caption = nActPos
```

```
m_nRunSpeed(i - 1).Caption = nSpeed
```

```
Get_MoveStatus i, nStatus(i - 1), 0
```

```
' detect limit、stop0, stop1 signal
```

```
'detect + limit(XLMT+: 0,YLMT+:4,ZLMT+:8,ALMT+:12,BLMT+:16,CLMT+:20)
```

```
If Read_Input((i - 1) * 4) = 0 Then
```

```
m_bPLimit(i - 1).value = 1
```

```
Else
```

```
m_bPLimit(i - 1).value = 0
```

```
End If
```

```
detect - limit (XLMT- :1,YLMT- :5,ZLMT- :9,ALMT- :13,BLMT- :17,CLMT- :21)
```

```
If Read_Input((i - 1) * 4 + 1) = 0 Then
```

```
m_bNLimit(i - 1).value = 1
```

```
Else
```

```
m_bNLimit(i - 1).value = 0
```

```
End If
```

```
'detect stop0(XSTOP0 :
```

```
2,YSTOP0 :6,ZSTOP0 :10,ASTOP0 :14,BSTOP0 :18,CSTOP0 :22)
```

```
If Read_Input((i - 1) * 4 + 2) = 0 Then
```

```
    m_bStop0(i - 1).value = 1
```

```
Else
```

```
    m_bStop0(i - 1).value = 0
```

```
End If
```

```
'detect stop1(XSTOP1 :
```

```
3,YSTOP1 :7,ZSTOP1 :11,ASTOP1 :15,ZSTOP1 :19,ASTOP1 :23)
```

```
If Read_Input((i - 1) * 4 + 3) = 0 Then
```

```
    m_bStop1(i - 1).value = 1
```

```
Else
```

```
    m_bStop1(i - 1).value = 0
```

```
End If
```

```
Next i
```

```
If nStatus(0) = 0 And nStatus(1) = 0 And nStatus(2) = 0 And nStatus(3) = 0 Then
```

```
'driving
```

```
    AxisPmove.Enabled = True
```

```
    InterpMove.Enabled = True
```

```
    BaseparaSet.Enabled = True
```

```
    ClearPos.Enabled = True
```

```
    ComeMove.Enabled = True
```

```
    LineInpMove.Enabled = True
```

```
    IOTest.Enabled = True
```

```
Else
```

```
'driving finish
```

```
    AxisPmove.Enabled = False
```

```
    InterpMove.Enabled = False
```

```
    BaseparaSet.Enabled = False
```

```
ClearPos.Enabled = False  
ComeMove.Enabled = False  
LineInpMove.Enabled = False  
IOTest.Enabled = False
```

```
End If
```

```
End Sub
```

1.5 Stop module

Stop module mainly used to control the incidents that need immediate termination all axes in the processing. Stop module code is located in CmdStop button, code as follows:

```
Private Sub Stop_Click()  
    For i = 1 To 4  
        StopRun i, 0  
    Next i  
End Sub
```

🔑 VC programming samples

2.1 Preparation

- (1) Create a new item and save as "VCExample.dsw";
- (2) Add the "adt8960.lib" as module in the item following the above-mentioned method

2.2 Motion control module

- (1) Add a new module in the project, header file save as "CtrlCard.h", Original file save as "CtrlCard.cpp";
- (2) within the motion control module self-define initialization functions of the motion control card and initialize library functions to be sealed into initialization functions;
- (3) Further self-define relevant motion control functions, such as speed setting function, single-axis motion function, and interpolation motion function;

(4) Header file "CtrlCard.h" code as follow:

```
#ifndef __ADT8960__CARD__
#define __ADT8960__CARD__

/***** motion control module *****/
*****/

#define MAXAXIS 6 //max axis

class CCtrlCard
{
public:
    int Get_DelayStatus();
    int Setup_Delay(long time);
    int Setup_HardStop(int value, int logic);
    int Setup_Stop1Mode(int axis, int value, int logic);
    int Setup_Stop0Mode(int axis, int value, int logic);
    int Setup_LimitMode(int axis, int value1, int value2, int logic);
    int Setup_PulseMode(int axis, int value);
    void Get_Version(float &LibVer);
    int Setup_Pos(int axis, long pos, int mode);
    int Write_Output(int number, int value);
    int Read_Input(int number);
    int Get_CurrentInf(int axis, long &LogPos, long &ActPos, long &Speed);
    int Get_Status(int axis, int &value, int mode);
    int StopRun(int axis, int mode);
    int Interp_Move6(long pulse1, long pulse2, long pulse3, long pulse4, long pulse5, long pulse6);
    int Interp_Move5(int axis1, int axis2, int axis3, int axis4, int axis5, long pulse1, long pulse2, long pulse3, long pulse4, long pulse5);
    int Interp_Move4(int axis1, int axis2, int axis3, int axis4, long value1, long value2, long value3, long value4);
    int Interp_Move3(int axis1, int axis2, int axis3, long value1, long value2, long value3);
```



```
int Interp_Move2(int axis1, int axis2, long value1, long value2);
int Axis_Pmove(int axis ,long value);
int Axis_ConMove(int axis, long value);
int Setup_Speed(int axis ,long startv ,long speed ,long  add );
int Init_Board();
int Set_IoMode(int v1,int v2);
CCtrlCard();
int Result;           //return value
}; # endif
```

(5) original file "CtrlCard.cpp"code as follow:

```
#include "stdafx.h"
#include "DEMO.h"
#include "CtrlCard.h"
#include "adt8960.h"
CCtrlCard::CCtrlCard()
{
}
/***** Initialization function *****/
```

This function contains the control card initialization common library,must be based on the example program

The return value < = 0 means initialization failed, the return value is > 0 means initialization success

```
*****/
int CCtrlCard::Init_Board()
{
    Result =adt8960_initial() ;           //card Initialization function
    if (Result <= 0) return Result;
    for (int i = 1; i<=MAXAXIS; i++){
        set_limit_mode (0, i, 0, 0, 0);           //set limit mode
        set_command_pos (0, i, 0);               // Clear logical counter
        set_actual_pos (0, i, 0);                 // Clear real counter
```



```
set_startv (0, i, 1000);           //设定起始速度
set_speed (0, i, 1000);            //设定驱动速度
set_acc(0, i, 625);                //设定加速度
}
return 1;
}
```

/*****Speed setting module*****/

From the value of the parameter, judge it is uniform or deceleration

Return value=0 right, return value=1 wrong

*****/

```
int CCtrlCard::Setup_Speed(int axis, long startv, long speed, long add ,long
ratio ,double tacc)
```

```
{
    if (startv - speed >= 0)      // uniform speed
    {
        Result = set_startv(0, axis, startv/ratio);
        set_speed (0, axis, startv/ratio);
    }
    else                          // acceleration /deceleration
    {
        Result = set_startv(0, axis, startv/ratio);
        set_speed (0, axis, speed/ratio);
        set_acc (0, axis, add/250/ratio);
    }
    return Result;
}
```

/*****single axis drive function*****/

Used for drive single motion axis

Return value=0 right, return value=1 wrong

*****/



```
int CCtrlCard::Axis_Pmove(int axis, long value)
{
    Result = pmove(0, axis, value);
    return Result;
}

/***** single axis continuous drive function *****/
    Used for drive single motion axis
    Parameter:  axis, value-pulse direction
    Return value=0 right, return value=1 wrong
*****/

int CCtrlCard::Axis_ConMove(int axis, long dir)
{
    Result = continue_move(0, axis, dir);
    return Result;
}

/*****Random 2 axis Interpolation function *****/
    Used for Random 2 axis Interpolation movement
    Return value=0 right, return value=1 wrong
*****/

int CCtrlCard::Interp_Move2(int axis1, int axis2, long value1, long value2)
{
    Result = inp_move2(0, axis1, axis2, value1, value2);
    return Result;
}

/***** Random 3 axis Interpolation function *****/
    Used for Random 3 axis Interpolation movement
    Return value=0 right, return value=1 wrong
*****/

int CCtrlCard::Interp_Move3(int axis1, int axis2, int axis3, long value1, long value2,
long value3)
```



```
{
    Result = inp_move3(0, axis1, axis2, axis3, value1, value2, value3);
    return Result;
}

/***** Random 4 axis Interpolation function *****/
Used for Random 4 axis Interpolation movement
Return value=0 right, return value=1 wrong
*****/
int CCtrlCard::Interp_Move4(int axis1,int axis2,int axis3,int axis4, long value1, long
value2, long value3, long value4)
{
    Result = inp_move4(0, axis1, axis2, axis3, axis4, value1, value2, value3,
value4);
    return Result;
}

/***** Random 5 axis Interpolation function *****/
Used for Random 5 axis Interpolation movement
Parameter: axis1,axis2,axis3,axis4,axis5
pulse1,pulse2,pulse3,pulse4,pulse5-output pulse
Return value=0 right, return value=1 wrong
*****/
int CCtrlCard::Interp_Move5(int axis1,int axis2,int axis3,int axis4,int axis5,long
pulse1,long pulse2,long pulse3,long pulse4,long pulse5)
{
    Result = inp_move5(0, axis1, axis2, axis3, axis4, axis5, pulse1, pulse2,
pulse3, pulse4, pulse5);

    return Result;
}
```



/***** Random 6 axis Interpolation function *****/

Used for Random 6 axis Interpolation movement

Parameter: axis1,axis2,axis3,axis4,axis5,axis6

pulse1,pulse2,pulse3,pulse4,pulse5,pulse6-output pulse

Return value=0 right, return value=1 wrong

*****/

```
int CCtrlCard::Interp_Move6(long pulse1,long pulse2,long pulse3,long pulse4,long  
pulse5,long pulse6)
```

```
{
```

```
    Result = inp_move6(0, pulse1, pulse2, pulse3, pulse4, pulse5, pulse6);
```

```
    return Result;
```

```
}
```

/*****Obtain hardware version infomation*****/

Used for obtain version infomation

Parameter: LibVer—hardware version No.

*****/

```
void CCtrlCard::Get_Version(float &LibVer)
```

```
{
```

```
    int Ver;
```

```
    Ver = get_hardware_ver(0);
```

```
    LibVer = float(Ver/256);
```

```
}
```

/*****Obtain motion information*****/

Used for feedback logic position, real position and running speed.

Return value=0 right, return value=1 wrong

*****/

```
int CCtrlCard::Get_CurrentInf(int axis, long &LogPos, long &ActPos, long &Speed)
```

```
{
```

```
    Result = get_command_pos(0, axis, &LogPos);
```

```
    get_actual_pos (0, axis, &ActPos);
```



```
get_speed (0, axis, &Speed);  
return Result;
```

```
}
```

```
/******Stop axis driving*****
```

Used for stop driving immediately or slow down.

Return value=0 right, return value=1 wrong

```
*****/
```

```
int CCtrlCard::StopRun(int axis, int mode)
```

```
{
```

```
    if (mode == 0)
```

```
        Result = sudden_stop(0, axis);           //stop
```

```
    else
```

```
        Result = dec_stop(0, axis);              //slow down
```

```
    return Result;
```

```
}
```

```
/******get driving state *****
```

Used for get driving state and interpolation state

Return value=0 right, return value=1 wrong

```
*****/
```

```
int CCtrlCard::Get_Status(int axis, int &value, int mode)
```

```
{
```

```
    if (mode==0)                               //get sing axis driving state
```

```
        Result=get_status(0,axis,&value);
```

```
    Else                                       //get interpolation driving state
```

```
        Result=get_inp_status(0,&value);
```

```
    return Result;
```

```
}
```

```
/****** set hardware stop *****
```

Used for set hardware stop



Parameter: value 0—invalid 1—effective
 logic 0—low level effective 1—high level effective

Default mode: invalid

Return value=0 right, Return value =1 wrong

Hardware stop signal fixed on P3 connection board 34pin (IN31)

*****/

```
int CCtrlCard::Setup_HardStop(int value, int logic)
```

```
{  
    Result = set_suddenstop_mode(0, value, logic);  
    return Result;
```

```
}
```

```
/****** set delayed *****
```

Used for set delayed '

Parameter: time – delay time (us) '

Return value=0 right, Return value =1 wrong

*****/

```
int CCtrlCard::Setup_Delay(long time)
```

```
{  
    Result = set_delay_time(0, time*8);  
    return Result;
```

```
}
```

```
*****get delay state*****
```

Used for get delay state

Return value 0 – delay finish 1 - delay

*****/

```
int CCtrlCard::Get_DelayStatus()
```

```
{  
    Result = get_delay_status(0);  
    return Result;
```

```
}
```

```
/******function: set delay time*****
```



function: set delay time

cardno card No.

time delay time

return value 0: right 1: wrong

unit of time 1/8us

*****/

int CCtrlCard::Set_Delay(long time)

```
{
    Result = set_delay_time(0,time);
    return Result;
}
```

*****set general input/output*****

' Used for set general input/output

'Parameter:

' v1 -0: the front 8 point as input 1: the front 8 point as output

' v2 -0: the back 8 point as input 1: the back 8 point as output

Return value=0 right, Return value =1 wrong

Remark: when take IO as output, can read input state as well

*****/

int CCtrlCard::Set_IoMode(int v1,int v2)

```
{
    Result= set_io_mode(0,v1,v2);
    return Result;
}
```

/******Single axis relative motion*****

*/Function: Refer to the current position to accelerate quantitatively movement

*/Parameter:

' cardno --card No.

' axis ---axis No.

' pulse --pulse

' lspd ---low speed



' hspd ---high speed
' tacc--- acceleration time (s)
' Return value=0 right, Return value =1 wrong

*****/

```
int CCtrlCard::Sym_RelativeMove(int axis, long pulse, long lspd ,long hspd, double tacc)
{
    Result= symmetry_relative_move(0,axis, pulse, lspd ,hspd, tacc);
    return Result;
}
```

/'*****single axis absolute motion*****'

/*Function: Refer to the orignal position to accelerate quantitatively movement

/*Parameter:

' cardno --card No.
' axis ---axis No.
' pulse --pulse
' lspd ---low speed
' hspd ---high speed
' tacc--- acceleration time (s)
' Return value=0 right, Return value =1 wrong

*****/

```
int CCtrlCard::Sym_AbsoluteMove(int axis, long pulse, long lspd ,long hspd, double tacc)
{
    Result= symmetry_absolute_move(0,axis, pulse, lspd ,hspd, tacc);
    return Result;
}
```

/'*****2 axis linear interpolation relative movement*****'

/*function: Refer to the current position to accelerate quantitatively movement

/*Parameter:

' cardno --card No.
' axis1 ---axis1



```
'      axis2 ---axis2
'      pulse1 –pulse1
'      pulse2 –pulse2
'      lspd ---low speed
'      hspd ---high speed
'      tacc--- acceleration time (s)
'      Return      value=0      right      ,      Return      value      =1      wrong
*****/
int CCtrlCard::Sym_RelativeLine2(int axis1, int axis2, long pulse1, long pulse2, long
lspd ,long hspd, double tacc)
{
    Result= symmetry_relative_line2(0, axis1, axis2, pulse1,pulse2, lspd ,hspd,tacc);
    return Result;
}

'/******2 axis linear interpolation absolute movement*****
'function: Refer to the original position to accelerate quantitatively movement
'*Parameter:
'      cardno –card No.
'      axis1 ---axis1
'      axis2 ---axis2
'      pulse1 –pulse1
'      pulse2 –pulse2
'      lspd ---low speed
'      hspd ---high speed
'      tacc--- acceleration time (s)
'      Return      value=0      right      ,      Return      value      =1      wrong
*****/
int CCtrlCard::Sym_AbsoluteLine2(int axis1, int axis2, long pulse1, long pulse2, long
lspd ,long hspd, double tacc)
{
    Result= symmetry_absolute_line2(0, axis1, axis2, pulse1, pulse2, lspd ,hspd, tacc);
```

```
return Result;}
```

```
/******3 axis linear interpolation relative movement*****
```

```
*/function: Refer to the current position to accelerate quantitatively movement
```

```
*/Parameter:
```

```
'      cardno --card No.
```

```
'      axis1 ---axis1
```

```
'      axis2 ---axis2
```

```
'      axis3 ---axis3
```

```
'      pulse1 --pulse1
```

```
'      pulse2 --pulse2
```

```
'      pulse3 --pulse3
```

```
'      lspd ---low speed
```

```
'      hspd ---high speed
```

```
'      tacc--- acceleration time (s)
```

```
'      Return      value=0      right      ,      Return      value      =1      wrong
```

```
*****/
```

```
int CCtrlCard::Sym_RelativeLine3(int axis1, int axis2, int axis3, long pulse1, long pulse2,  
long pulse3, long lspd ,long hspd, double tacc)
```

```
{  
    Result= symmetry_relative_line3(0,axis1, axis2, axis3, pulse1, pulse2, pulse3,  
lspd ,hspd, tacc);
```

```
    return Result;
```

```
}  
  
/******3 axis linear interpolation absolute movement*****
```

```
*/function: Refer to the original position to accelerate quantitatively movement
```

```
*/Parameter:
```

```
'      cardno --card No.
```

```
'      axis1 ---axis1
```

```
'      axis2 ---axis2
```

```
'      axis3 ---axis3
```



```
'      pulse1 --pulse1
'      pulse2 --pulse2
'      pulse3 --pulse3
'      lspd ---low speed
'      hspd ---high speed
'      tacc--- acceleration time (s)
'      Return value=0 right ,      Return value =1 wrong
*****/
int CCtrlCard::Sym_AbsoluteLine3(int axis1, int axis2, int axis3, long pulse1, long pulse2,
long pulse3, long lspd ,long hspd, double tacc)
{
    Result= symmetry_absolute_line3(0, axis1, axis2,axis3,pulse1, pulse2, pulse3,
lspd , hspd, tacc);
    return Result;
}

'/*****4 axis linear interpolation relative movement*****/
'*function: Refer to the current position to accelerate quantitatively movement
'*Parameter:
'      cardno --card No.
'      axis1 ---axis1
'      axis2 ---axis2
'      axis3 ---axis3
'      Axis4---axis4
'      pulse1 --pulse1
'      pulse2 --pulse2
'      pulse3 --pulse3
'      Pulse4---pulse4
'      lspd ---low speed
'      hspd ---high speed
'      tacc--- acceleration time (s)
'      Return value=0 right, Return value =1 wrong
```



*****/

```
int CCtrlCard:: Sym_RelativeLine4(int axis1,int axis2,int axis3,int axis4,long pulse1, long
pulse2, long pulse3, long pulse4,long lspd ,long hspd, double tacc)
```

```
{
    Result=symmetry_relative_line4( 0, axis1,axis2,axis3,axis4,pulse1, pulse2,
pulse3, pulse4,lspd ,hspd, tacc);
    return Result;
}
```

/'*****4 axis linear interpolation absolute movement*****'

'*function: Refer to the originalposition to accelerate quantitatively movement

'*Parameter:

' cardno --card No.

' axis1 ---axis1

' axis2 ---axis2

' axis3 ---axis3

Axis4---axis4

' pulse1 --pulse1

' pulse2 --pulse2

' pulse3 --pulse3

Pulse4---pulse4

' lspd ---low speed

' hspd ---high speed

' tacc--- acceleration time (s)

' Return value=0 right , Return value =1 wrong

*****/

```
int CCtrlCard::Sym_AbsoluteLine4(int axis1,int axis2,int axis3,int axis4,long pulse1, long
pulse2, long pulse3, long pulse4,long lspd ,long hspd, double tacc)
```

```
{
    Result= symmetry_absolute_line4(0, axis1,axis2,axis3,axis4, pulse1, pulse2,
pulse3, pulse4, lspd , hspd, tacc);
    return Result;
}
```

```
}

/******5 axis linear interpolation relative movement*****
*function: Refer to the current position to accelerate quantitatively movement
*Parameter:
'    cardno --card No.
'    axis1 ---axis1
'    axis2 ---axis2
'    axis3 ---axis3
'    axis4 ---axis4
'    axis5 ---axis5
'    pulse1 --pulse1
'    pulse2 --pulse2
'    pulse3 --pulse3
'    pulse4 --pulse4
'    pulse5 --pulse5
'    lspd ---low speed
'    hspd ---high speed
'    tacc--- acceleration time (s)
*****/

int CCtrlCard:: Sym_RelativeLine5(int axis1,int axis2,int axis3,int axis4,int axis5,long
pulse1, long pulse2, long pulse3, long pulse4,long pulse5,long lspd ,long hspd, double
tacc)
{
    Result=symmetry_relative_line5( 0, axis1,axis2,axis3,axis4,axis5,pulse1, pulse2,
pulse3, pulse4,pulse5,lspd ,hspd, tacc);
    return Result;
}

/******5 axis linear interpolation absolute movement*****
*function: Refer to the original position to accelerate quantitatively movement
*Parameter:
'    cardno --card No.
```



```
' axis1 ---axis1
' axis2 ---axis2
' axis3 ---axis3
' axis4 ---axis4
' axis5 ---axis5
' pulse1 --pulse1
' pulse2 --pulse2
' pulse3 --pulse3
' pulse4 --pulse4
' pulse5 --pulse5
' lspd ---low speed
' hspd ---high speed
' tacc--- acceleration time (s)
```

*****/

```
int CCtrlCard::Sym_AbsoluteLine5(int axis1,int axis2,int axis3,int axis4,int axis5,long
pulse1, long pulse2, long pulse3, long pulse4,long pulse5,long lspd ,long hspd, double
tacc)
```

```
{
    Result= symmetry_absolute_line5(0,      axis1,axis2,axis3,axis4,axis5,pulse1,
pulse2, pulse3, pulse4, pulse5, lspd , hspd, tacc);
    return Result;
}
```

/'*****6 axis linear interpolation relative movement*****/

/*function: Refer to the current position to accelerate quantitatively movement

/*Parameter:

```
' cardno --card No.
' axis1 ---axis1
' axis2 ---axis2
' axis3 ---axis3
' axis4 ---axis4
' axis5 ---axis5
```



```
' axis6 ---axis6
' pulse1 --pulse1
' pulse2 --pulse2
' pulse3 --pulse3
' pulse4 --pulse4
' pulse5 --pulse5
' pulse6 --pulse6
' lspd ---low speed
' hspd ---high speed
' tacc--- acceleration time (s)
```

*****/

```
int CCtrlCard:: Sym_RelativeLine6(long pulse1, long pulse2, long pulse3, long
pulse4,long pulse5, long pulse6,long lspd ,long hspd, double tacc)
```

```
{
    Result=symmetry_relative_line6( 0, pulse1, pulse2, pulse3, pulse4,pulse5,
pulse6,lspd ,hspd, tacc);
    return Result;
}
```

/'*****6 axis linear interpolation absolute movement*****'

/*function: Refer to the original position to accelerate quantitatively movement

/*Parameter:

```
' cardno --card No.
' axis1 ---axis1
' axis2 ---axis2
' axis3 ---axis3
' axis4 ---axis4
' axis5 ---axis5
' axis6 ---axis6
' pulse1 --pulse1
' pulse2 --pulse2
' pulse3 --pulse3
```



- ' pulse4 –pulse4
- ' pulse5 –pulse5
- ' pulse6 –pulse6
- ' lspd ---low speed
- ' hspd ---high speed
- ' tacc--- acceleration time (s)

*****/

```
int CCtrlCard::Sym_AbsoluteLine6(long pulse1, long pulse2, long pulse3, long pulse4, long pulse5, long pulse6, long lspd, long hspd, double tacc)
```

```
{
    Result= symmetry_absolute_line6(0, pulse1, pulse2, pulse3, pulse4, pulse5, pulse6, lspd, hspd, tacc);
    return Result;
}
```

/*****

'function: get output point
'parameter:
' cardno
' number output point
'return value the current state of the designated port,-1 means wrong

*****/

```
int CCtrlCard::Get_OutNum(int number)
```

```
{
    Result=get_out(0,number);
    return Result;
}
```

2.3 Function moudle

2.3.1 Interface design



ADT-8960 DEMO

ADT-8960 示范程序 硬件版本号: 1.0

轴号	初始速度	驱动速度	加速度	加速时间
X	1000	5000	1500	0.01
Y	1000	5000	1500	0.01
Z	1000	5000	1500	0.01
A	1000	5000	1500	0.01
B	1000	5000	1500	0.01
C	1000	5000	1500	0.01

延时
延时时间: 0 us
开始延时 ☐ 延时状态

联动 ☒ 正向 ☐ 负向 停止 单轴绝对运动
插补 变速 基本参数 单轴相对运动
连续 位置清零 IO测试 插补相对运动

轴号	目标位置	逻辑位置	实际位置	运行速度	负限位	正限位	STOP0	STOP1
☐ X	100000	0	0	0	☐	☐	☐	☐
☐ Y	100000	0	0	0	☐	☐	☐	☐
☐ Z	100000	0	0	0	☐	☐	☐	☐
☐ A	100000	0	0	0	☐	☐	☐	☐
☐ B	100000	0	0	0	☐	☐	☐	☐
☐ C	100000	0	0	0	☐	☐	☐	☐

2.3.2 The initialization code in the form loads incident, code as below:

```
if (g_CtrlCard.Init_Board() <= 0)
```

```
{
```

```
    MessageBox("Initialization failed!");
```

```
}
```

```
else
```

```
    MessageBox("card can used!");
```

```
float LibVer;          //version No.
```

```
g_CtrlCard.Get_Version(LibVer);
```

```
CStatic *lbl;
```

```
CString str;
```

```
lbl=(CStatic*)GetDlgItem(IDC_INFO_VER);
```

```
str.Format("hardware version No:%1.1f\n",LibVer);
```

```
lbl->SetWindowText(str);
```

```
//***** set default speed 1000 *****
```

```
m_nStartvX = 1000;
```



```
m_nStartvY = 1000;
m_nStartvZ = 1000;
m_nStartvA = 1000;
//*****set default drive speed to 2000*****
m_nSpeedX  = 2000;
m_nSpeedY  = 2000;
m_nSpeedZ  = 2000;
m_nSpeedA  = 2000;
//***** set default acceleration speed to 1500*****
m_nAddX    = 1500;
m_nAddY    = 1500;
m_nAddZ    = 1500;
m_nAddA    = 1500;
//*****set default target position to100000*****
m_nPulseX  = 100000;
m_nPulseY  = 100000;
m_nPulseZ  = 100000;
m_nPulseA  = 100000;
//*****set acceleration time*****
m_dTaccX = 0.1;
m_dTaccY = 0.1;
m_dTaccZ = 0.1;
m_dTaccA = 0.1;
//*****set delay time to 0*****
m_nDelayTime = 0;
UpdateData(FALSE);
SetTimer(1001,100,NULL);           //start timer
```

2.3.3 linkage code located in button Click, send drive order from different target,
code as below

```
void CDEMOMlg::OnButtonPmove()
```

```

{
    UpdateData(TRUE);
    longStartv[]={m_nStartvX,m_nStartvY,m_nStartvZ,m_nStartvA,m_nStartvB,m_nStartvC};
    longSpeed[]={m_nSpeedX,m_nSpeedY,m_nSpeedZ,m_nSpeedA,m_nSpeedB,m_nSpeedC};
    long Add[]={m_nAddX,m_nAddY,m_nAddZ,m_nAddA,m_nAddB,m_nAddC};
    for(int i=1;i<MAXAXIS+1;i++)
    {
        g_CtrlCard.Setup_Speed(i, Startv[i-1], Speed[i-1], Add[i-1]);
    }
    if(m_bX)
    {
        g_CtrlCard.Axis_Pmove(1, m_nPulseX);
    }

    if(m_bY )
    {
        g_CtrlCard.Axis_Pmove(2, m_nPulseY);
    }
    if(m_bZ )
    {
        g_CtrlCard.Axis_Pmove(3, m_nPulseZ);
    }
    if(m_bA )
    {
        g_CtrlCard.Axis_Pmove(4, m_nPulseA);
    }
    if(m_bB )
    {
        g_CtrlCard.Axis_Pmove(5, m_nPulseB);
    }
    if(m_bC )
    {
        g_CtrlCard.Axis_Pmove(6, m_nPulseC);
    }
}
}

```

2.3.4 Interpolation code located in button Click, send drive order from different target, code as below:

```

void CDEMODlg::OnButtonInpmove()
{
    UpdateData();
    longStartv[]={m_nStartvX,m_nStartvY,m_nStartvZ,m_nStartvA,m_nStartvB,m_nStartvC};
    longSpeed[]={m_nSpeedX,m_nSpeedY,m_nSpeedZ,m_nSpeedA,m_nSpeedB,m_nSpeedC};
    long
    Add[]

```



```
={m_nAddX,m_nAddY,m_nAddZ,m_nAddA,m_nAddB,m_nAddC}; //
加速度
longPulse[]={m_nPulseX,m_nPulseY,m_nPulseZ,m_nPulseA,m_nPulseB,m_nPulseC};
for(int i=1;i<MAXAXIS+1;i++)
{
    g_CtrlCard.Setup_Speed(i, Startv[i-1], Speed[i-1], Add[i-1]);
}
if(m_bX && m_bY && !m_bZ && !m_bA && !m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move2(1, 2, Pulse[0], Pulse[1]);
}
else if(m_bX && !m_bY && m_bZ && !m_bA && !m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move2(1, 3, Pulse[0], Pulse[2]);
}
else if(m_bX && !m_bY && !m_bZ && m_bA && !m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move2(1, 4, Pulse[0], Pulse[3]);
}
else if(m_bX && !m_bY && !m_bZ && !m_bA && m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move2(1, 5, Pulse[0], Pulse[4]);
}
else if(m_bX && !m_bY && !m_bZ && !m_bA && !m_bB && m_bC)
{
    g_CtrlCard.Interp_Move2(1, 6, Pulse[0], Pulse[5]);
}
else if(!m_bX && m_bY && m_bZ && !m_bA && !m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move2(2, 3, Pulse[1], Pulse[2]);
}
else if(!m_bX && m_bY && !m_bZ && m_bA && !m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move2(2, 4, Pulse[1], Pulse[3]);
}
else if(!m_bX && m_bY && !m_bZ && !m_bA && m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move2(2, 5, Pulse[1], Pulse[4]);
}
else if(!m_bX && m_bY && !m_bZ && !m_bA && !m_bB && m_bC)
{
    g_CtrlCard.Interp_Move2(2, 6, Pulse[1], Pulse[5]);
}
else if(!m_bX && !m_bY && m_bZ && m_bA && !m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move2(3, 4, Pulse[2], Pulse[3]);
}
```



```
}
else if(!m_bX && !m_bY && m_bZ && !m_bA && m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move2(3, 5, Pulse[2], Pulse[4]);
}
else if(!m_bX && !m_bY && m_bZ && !m_bA && !m_bB && m_bC)
{
    g_CtrlCard.Interp_Move2(3, 6, Pulse[2], Pulse[5]);
}
else if(!m_bX && !m_bY && !m_bZ && m_bA && m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move2(4, 5, Pulse[3], Pulse[4]);
}
else if(!m_bX && !m_bY && !m_bZ && m_bA && !m_bB && m_bC)
{
    g_CtrlCard.Interp_Move2(4, 6, Pulse[3], Pulse[5]);
}
else if(!m_bX && !m_bY && !m_bZ && !m_bA && m_bB && m_bC)
{
    g_CtrlCard.Interp_Move2(5, 6, Pulse[4], Pulse[5]);
}
else if(m_bX && m_bY && m_bZ && !m_bA && !m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move3(1, 2, 3, Pulse[0], Pulse[1], Pulse[2]);
}
else if(m_bX && m_bY && !m_bZ && m_bA && !m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move3(1, 2, 4, Pulse[0], Pulse[1], Pulse[3]);
}
else if(m_bX && m_bY && !m_bZ && !m_bA && m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move3(1, 2, 5, Pulse[0], Pulse[1], Pulse[4]);
}
else if(m_bX && m_bY && !m_bZ && !m_bA && !m_bB && m_bC)
{
    g_CtrlCard.Interp_Move3(1, 2, 6, Pulse[0], Pulse[1], Pulse[5]);
}
else if(m_bX && !m_bY && m_bZ && m_bA && !m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move3(1, 3, 4, Pulse[0], Pulse[2], Pulse[3]);
}
else if(m_bX && !m_bY && m_bZ && !m_bA && m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move3(1, 3, 5, Pulse[0], Pulse[2], Pulse[4]);
}
else if(m_bX && !m_bY && m_bZ && !m_bA && !m_bB && m_bC)
{
```



```
g_CtrlCard.Interp_Move3(1, 3, 6, Pulse[0], Pulse[2], Pulse[5]);
}
else if(!m_bX && m_bY && m_bZ && m_bA && !m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move3(2, 3, 4, Pulse[1], Pulse[2], Pulse[3]);
}
else if(!m_bX && m_bY && m_bZ && !m_bA && m_bB && !m_bC)
{
    g_CtrlCard.Interp_Move3(2, 3, 5, Pulse[1], Pulse[2], Pulse[4]);
}
else if(!m_bX && m_bY && m_bZ && !m_bA && !m_bB && m_bC)
{
    g_CtrlCard.Interp_Move3(2, 3, 6, Pulse[1], Pulse[2], Pulse[5]);
}
else if(!m_bX && !m_bY && m_bZ && m_bA && m_bB && !m_bC) {
    g_CtrlCard.Interp_Move3(3, 4, 5, Pulse[2], Pulse[3], Pulse[4]);
}
else if(!m_bX && !m_bY && m_bZ && m_bA && !m_bB && m_bC) {
    g_CtrlCard.Interp_Move3(3, 4, 6, Pulse[2], Pulse[3], Pulse[5]);
}
else if(!m_bX && !m_bY && !m_bZ && m_bA && m_bB && m_bC) {
    g_CtrlCard.Interp_Move3(4, 5, 6, Pulse[3], Pulse[4], Pulse[5]);
}

else if(m_bX && m_bY && m_bZ && m_bA && !m_bB && !m_bC) //XYZA 4
axis interpolation
{
    g_CtrlCard.Interp_Move4(1,2,3,4,Pulse[0], Pulse[1], Pulse[2], Pulse[3]);
}
else if(m_bX && m_bY && m_bZ && m_bA && m_bB && !m_bC) //XYZAB 5
axis interpolation
{
    g_CtrlCard.Interp_Move5(1,2,3,4,5,Pulse[0], Pulse[1], Pulse[2], Pulse[3],
Pulse[4]);
}
else if(m_bX && m_bY && m_bZ && m_bA && m_bB && m_bC) //XYZABC
6 axis interpolation
{
    g_CtrlCard.Interp_Move6(Pulse[0], Pulse[1], Pulse[2], Pulse[3], Pulse[4],
Pulse[5]);
}
else
{
    MessageBox
```

}

2.4 Monitoring module

Monitoring module for real-time obtain all axis drive information, displaying moving information, and control the drive not send new instructions in processing. Monitoring module completed by timer events , code as follows:

```
void CDEMODlg::OnTimer(UINT nIDEvent)
{
    long log=0,act=0,spd=0;
    UINtnID1[]={IDC_POS_LOGX,IDC_POS_LOGY,IDC_POS_LOGZ,IDC_POS_LOGA,IDC_POS_LOGB,IDC_POS_LOGC};
    UINtnID2[]={IDC_POS_ACTX,IDC_POS_ACTY,IDC_POS_ACTZ,IDC_POS_ACTA,IDC_POS_ACTB,IDC_POS_ACTC};
    UINtnID3[]={IDC_RUNSPEED_X,IDC_RUNSPEED_Y,IDC_RUNSPEED_Z,IDC_RUNSPEED_A,IDC_RUNSPEED_B,IDC_RUNSPEED_C};
    CStatic *lbl;
    CString str;
    int status[6];
    for (int i=1; i<MAXAXIS+1; i++)
    {
        g_CtrlCard.Get_CurrentInf(i,log,act,spd); //read logic position, real position and running speed

        lbl=(CStatic*)GetDlgItem(nID1[i-1]);
        str.Format("%ld",log);
        lbl->SetWindowText(str);
        lbl=(CStatic*)GetDlgItem(nID2[i-1]);
        str.Format("%ld",act);
        lbl->SetWindowText(str);
        lbl=(CStatic*)GetDlgItem(nID3[i-1]);
        str.Format("%ld",spd);
        lbl->SetWindowText(str);
        g_CtrlCard.Get_Status(i,status[i-1],0);
    }
    UINtnIDIN[]={ IDC_LIMIT_X,IDC_LIMIT_X2, //X axis +/- limit
        IDC_STOP0_X, IDC_STOP1_X ,
        IDC_LIMIT_Y, IDC_LIMIT_Y2, //Y axis +/- limit
        IDC_STOP0_Y,IDC_STOP1_X2,
        IDC_LIMIT_Z,IDC_LIMIT_Z2, //Z axis +/- limit
        IDC_STOP0_Z,IDC_STOP1_Z,
        IDC_LIMIT_A,IDC_LIMIT_A2, //A axis +/- limit
        IDC_STOP0_A,IDC_STOP1_A,
        IDC_LIMIT_B,IDC_LIMIT_B2, //B axis +/- limit
        IDC_STOP0_B,IDC_STOP1_B,
        IDC_LIMIT_C,IDC_LIMIT_C2, //C axis +/- limit
        IDC_STOP0_C,IDC_STOP1_C,
    };
}
```

```
int io[]={0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23};
CButton *btn;
int value;
for (i=0; i<24; i++)
{
    value=g_CtrlCard.Read_Input(io[i]);                //read signal

    btn=(CButton*)GetDlgItem(nIDIN[i]);

    btn->SetCheck(value==0?1:0);
}
if(status[0]==0 && status[1]==0 && status[2]==0 && status[3]==0)
{
    btn=(CButton*)GetDlgItem(IDC_BUTTON_PMOVE);
    btn->EnableWindow(TRUE);
    btn=(CButton*)GetDlgItem(IDC_BUTTON_INPMOVE);
    btn->EnableWindow(TRUE);
    btn=(CButton*)GetDlgItem(IDC_BUTTON_CLEARPOS);
    btn->EnableWindow(TRUE);
    btn=(CButton*)GetDlgItem(IDC_BUTTON_BASEPARA);
    btn->EnableWindow(TRUE);
}
else
{
    //*****driving*****
    btn=(CButton*)GetDlgItem(IDC_BUTTON_PMOVE);
    btn->EnableWindow(FALSE);
    btn=(CButton*)GetDlgItem(IDC_BUTTON_INPMOVE);
    btn->EnableWindow(FALSE);
    btn=(CButton*)GetDlgItem(IDC_BUTTON_CLEARPOS);
    btn->EnableWindow(FALSE);
    btn=(CButton*)GetDlgItem(IDC_BUTTON_BASEPARA);
    btn->EnableWindow(FALSE);}
CDialog::OnTimer(nIDEvent);
}
```

2.5 Stop module

Stop module mainly used to control the incidents that need immediate termination all axes in the processing. Stop module code is located in CmdStop button, code as follows:

```
void CDEMOMDg::OnButtonStop()
{
    for (int i = 1; i<=MAXAXIS; i++)
    {
```

```
g_CtrlCard.StopRun(i,1);  
}  
}
```

Chapter 11 Normal failures and solutions

Motion control card detection failure

During use of control card, if encountering failure to detect the control card, users may follow the following items to check:

- (1) Check whether the drive program for the control card has been installed step by step following installation guide and whether there is dynamic library file for the control card under the system menu (system 32 or System);
- (2) Check the contact between the motion control card and the slot. Users may test it by re-inserting or changing the slot, alternatively, use a rubber to clean dirt on the golden finger of the control card and re-insert;
- (3) Under the system equipment manager, check whether there is conflict between the control card and other hardware. In case of use of PCI card, users may remove other cards or boards first, such as found card and network card; in case of PC104 card, users may adjust the dialing switch and reset the base address, while the base address used during card initialization must be the same as the actual base address;
- (4) Check whether there are any problems with the operating system; users may test it through re-installing other versions of operating systems;
- (5) If failing to find the control card after the above steps, users may change the control card for further detection so as to discover whether there is damage with the control card.

Motor service failure

In case the motor breakdowns while the motion control card works normally, users may follow the following points for troubleshooting.

- (1) Motor makes no reaction when the control card outputs pulses
 - Check the cable between the control card and the terminal panel;
 - Check whether the pulse and direction signal wire of the motor driver has been correctly connected to the terminal panel;
 - Check the connection of the external power supply for the servo driver;
 - Check whether there is alarming status in the servo/stepping motor driver; in case of any alarm, follow codes corresponding to alarms to check the reason;

- Check connection to the servo SON and whether there is excitation status in the servo motor;
 - In case of servo motor, check control method of the driver, the control card of our company supports the Position Control Method;
 - Damage to motor/driver
- (2) Stepping motor makes abnormal noise during service and motor makes obvious out-steps.
- Calculate motor speed and make sure the stepping motor is under 10-15 rounds per second instead of faster speed;
 - Check internal obstruction in the mechanical part or resistance to the machine;
 - Change to large-moment motors if the current motor is not sufficient;
 - Check current and voltage of the driver; current shall be set as 1.2 of the nominated current and supply voltage shall be within the nominated range;
 - Check the starting speed of the controller; normally, it shall be 0.5-1 and the acceleration/deceleration time shall be over 0.1 second.
- (3) Servo/stepping motor makes obvious vibration or noises during processing
- Reduce the position ring gain and speed ring gain of the driver while allowed by the positioning precision, if the cause is such ring gains are too big;
 - Adjust machine structure if the cause is poor machine rigidity;
 - Change to large-moment stepping motors if the current motor is not sufficient;
 - Avoid the co-vibration area of the motor or increase partitions so as not to have the speed of stepping motor within the co-vibration area of the motor.
- (4) Motor positions inaccurately
- Check whether the mechanic screw pitch and pulses per round comply with the parameters set in the actual application system, i.e., pulse equivalent;
 - Enlarge position ring gain and speed ring gain in case of servo motor;
 - Check screw gap of the machine in the way of measuring the backward gap of a screw through a micrometer and adjust the screw if there is any gap;
 - In case of inaccurate positioning out of regular time or position, check external disturbance signals;
 - Check whether it is due to non-powerful motor that there is shaking or out-step.
- (5) Motor makes no direction
- Check DR+/DR- cable for connection error or loose connection;
 - Make sure the pulse mode applied in the control card comply with the actual driver mode; this control card support either "pulse+direction" or "pulse+pulse" mode;
-

- Check broken cables or loose connection along the motor cable, in case of stepping motor.

Abnormal switch input

In case some input signals give unusual detection results during system adjusting and running, users may check in accordance with the following methods.

(1) No signal input

- Check whether the wiring is correct according to the above-mentioned wiring maps for normal switch and approach switch and ensure the public port for photoelectric coupling of input signals have been connected with anode of internal or external power supply (+12V or 24V);
- Check switch model and wiring mode; the input switch for I/O points of our company is of NPN model;
- Check whether there is damage with the photoelectric coupler. In case of normal wiring, input status will not change no matter the input point is broken or closed; users may use multi-use meter to check whether the photoelectric coupler has been broken, and if so, replace with a new one;
- Check the 12V or 24V power supply to the switch;
- Check whether there is damage to the switch.

(2) Non-continuous signals

- Check whether there is disturbance by detecting signal status in the I/O test interface; in case of disturbance, increase with Model 104 multiple layer capacitor or apply blocking cables;
- If the machine vibrates obviously or stops abnormally during normal service, check whether there is disturbance to the limit switch signals or the limit switch work reliably;
- Check connection of external cables.

(3) Inaccurate reset

- Too high speed decreases reset speed;
- Check disturbance source if the problem is there is external disturbance to signals;
- Wrong resetting direction;
- Improper installation position of the reset switch or loose switch.

(4) Limit out of use

- Check whether the limit switch still works under the I/O test;
- Too high speed during manual or automatic processing;
- Check disturbance source if the problem is there is external disturbance to signals;
- Wrong manual direction;
- Improper installation position of the limit switch or loose switch.

Abnormal switch output

Abnormal switch output may be checked in the following methods.

(1) Abnormal output

- Check whether the wiring is correct following the above-mentioned wiring for output points and ensure the output public port (earthing line) has been connected with the earthing line of the used power supply;
- Check whether there is any damage to the output components;
- Check whether there is damage with the photoelectric coupler. Users may use multi-use meter to check whether the photoelectric coupler has been broken, and if so, replace with a new one;
- Safety issue. Continuous dioxide (model: IN4007 or In4001) must be serial connected in case of output with sensitive loading.

(2) Judgment method for improper output

Break the external cable at the output point and connect at the output point a pull up resistor of around 10K to the power supply, while earthing line of the output must be connected with GND of the power supply; then users use the red pen of a multi-use meter to touch the 12V anode, and black pen to touch the signal output port, at the same time of using hand to touch the button on the test interface to see whether there is voltage output. If case of any voltage output, check the external circuit, otherwise check connection to the public port of boards/cards and internal photoelectric couplers.

Abnormal encoder performance

Abnormal encoder performance may be checked in the following methods.

- (1) Check encoder cables and make sure they comply with the above-mentioned differential or collecting electrode wiring method;
- (2) Check encoder voltage. The motion control card normally accepts +5V signals. In case a +12V or +24V encoder is selected, users must serial connect a 1K (+12V) resistor between the Phase A/B of the encoder and Phase A/B of the terminal panel;
- (3) Inaccurate encoder counting. External cables to the encoder must be blocking double-twisted cables, and shall be tied free from those cables with strong disturbance such as strong electricity, specially, they shall be separated for over 30-50 MM.