# PCIE Motion Control Card

XPCIE2032H
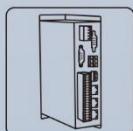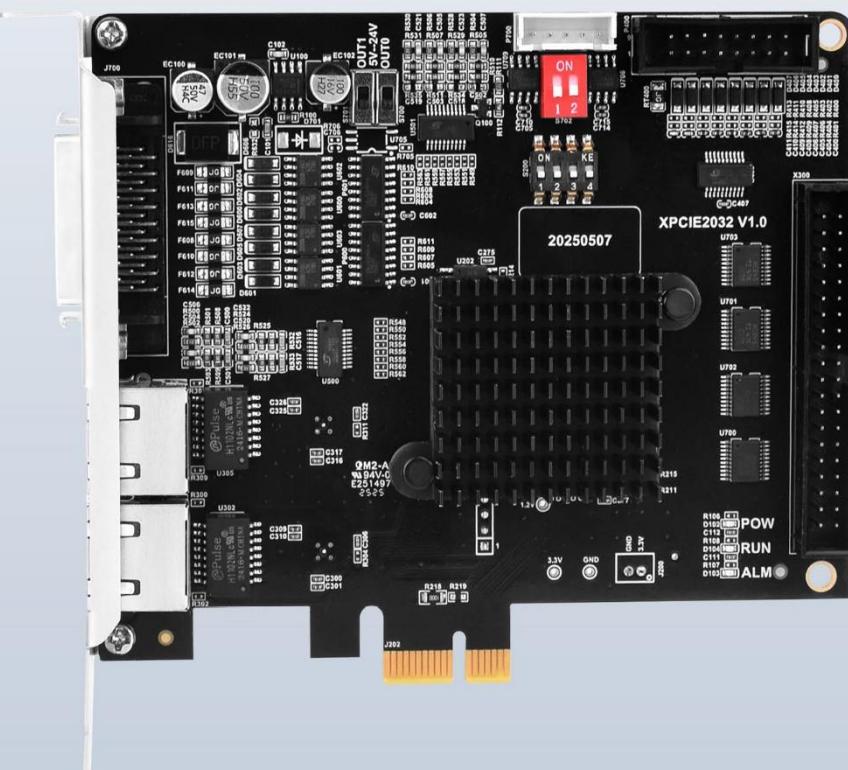
Vision Motion Controller
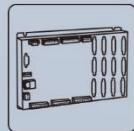
Motion Controller
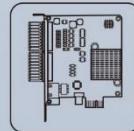
Motion Control Card
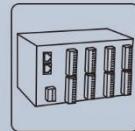
Expansion Module

HMI

Statement

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➢ Notes

In order to prevent possible harm and damage caused by incorrect use of this product, the following instructions are given on matters that must be observed.

■ Danger

Do not use it in places with water, corrosive or flammable gases, or near flammable substances.	May cause electric shock, fire, damage, etc.
When installing or disassembling, make sure the product is powered off.	
Cables should be connected securely, and exposed parts that are energized must be insulated by insulators.	
Wiring work must be performed by professionals.	

■ Notes

It should be installed within the specified environmental range.	May cause damage, mis-operation, etc.
Make sure there are no foreign objects on the product hardware circuit board.	
After installation, the product and the mounting bracket should be tight and firm.	
After installation, at least 2-3cm should be left between the product and surrounding components for ventilation and replacement.	
Never disassemble, modify, or repair it by yourself.	

Content

Chapter I Production Information

1.1. Production Introduction

XPCIE2032H motion control card is a kind of EtherCAT and pulse type that is with PCIE interface. 4-254 axes motion control can be achieved for point motion, interpolation, trajectory planning, handwheel control, encoder position detection, IO control, position latch, etc.

XPCIE2032H motion control card requires the main frequency is larger than 2GHz, the running memory is larger than 8G, and the hard disk is above 256M.
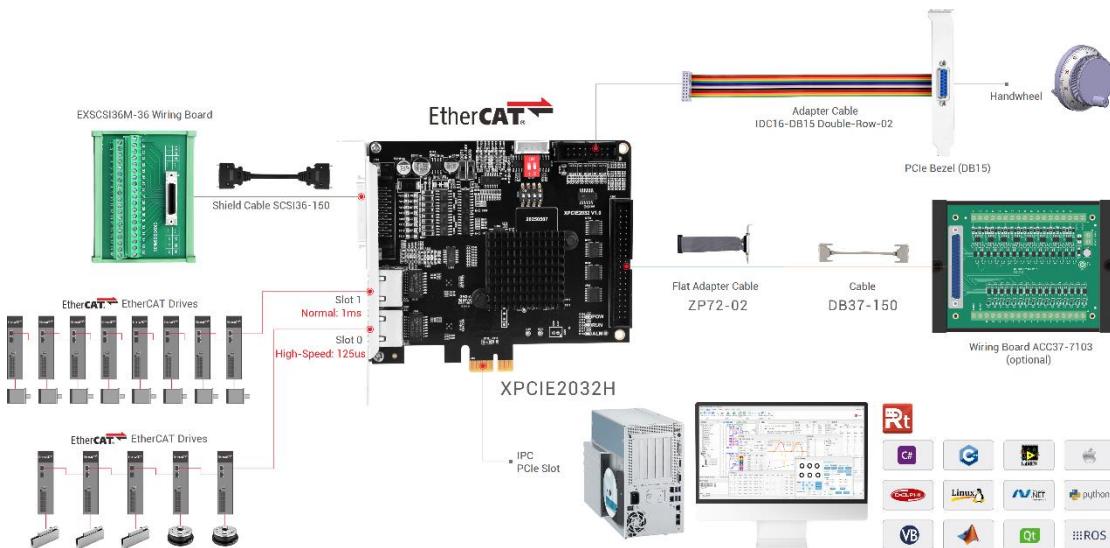
- XPCIE2032H motion control card is used together with MotionRT7.

- It supports "redundancy" function, and one EtherCAT bus slot can be up 32 axes.

- It can be up to 125us super high-speed control period (please prepare enough performance and real-time).

- The maximum output current of general digital outputs can reach 300mA, which can directly drive some kinds of solenoid valves.

- *Motion control functions: point motion, linear interpolation, circular interpolation, continuous interpolation, simple manipulator commands.*

- *Special functions: pulse closed-loop, pitch compensation, single-ended encoder, high-speed latch, single-ended pulse, PWM, HW, etc.*

❖ Special mode XPCIE2032HL supports push-pull outputs, you can select 24V / 5V.

XPCIE series motion control card can be applied in high-speed & high-precision occasions, such as, semi-conductor equipment, SMT processing, 3C automation production line, new energy equipment, laser processing, non-standard equipment.

1.2. Model & Nameplate

➢ *Nameplate Information*

XPCIE2032HL-AX64-MO8-HW-XXX

XPCIE2032HL-AX64-MO8-HW-XXX	
XPCIE	PCIE Interface
XPCIE2032HL-AX64-MO8-HW-XXX	
032	32 IOs: 16 INs & 16 OUTs
XPCIE1032HL-AX64-MO8-HW-XXX	
H	High-performance
XPCIE1032HL-AX64-MO8-HW-XXX	
L	5V / 24V push-pull output
XPCIE1032HL-AX64-MO8-HW-XXX	
AX04	4-axis
AX06	6-Axis
AX08	8-Axis
AX16	16-Axis
AX32	32-Axis
AX64	64-Axis
XPCIE1032HL-AX64-MO8-HW-XXX	
MO2	Point to point, electronic cam, linear interpolation
MO8	Point motion, electronic cam, linear & circular & continuous interpolation
XPCIE1032HL-AX64-MO8-HW-XXX	
HW	Hardware comparison output
ZV	Machine vision algorithm
NC	NC, G code

R1	Normal robotic arm
R6	6-joint manipulator & Delta manipulator
F	Fast Version
XPCIE1032HL-AX64-MO8-HW-XXX	
XXX	Customized function

➢ **XPCIE2032H Order Information:**

No.	Model	Specification
1	XPCIE2032H	EtherCAT, interpolation of line, any arc, spline, hardware comparison output.
2	XPCIE2032HL	EtherCAT, interpolation of line, any arc, spline, hardware comparison output, 5V / 24V push-pull output

➢ **XPCIE2032H Optional Accessories Order Information:**

Name	Model	Specification
Adapter Board	ACC37-7103	16 digital inputs and 16 digital outputs wiring board after converting IDC40 to DB37
Shield Cable	DB37-150	DB37 chip male to male cable
Adapter Cable	ZP72-02	Female flat cable after converting 40P to DB37
Wiring Board	EXSCI36M-36	SCSI wiring board
Shield Cable	SCSI36-150	SCSI36 data cable, male to male
Adapter Cable	IDC16-DB15 2-Row-02	From DC-16PIN to double row DB15 female connector
Adapter Cable	IDC16-DB15 3-Row-02	From DC-16PIN to three rows DB15 female connector

1.3. Software MotionRT7 Configurations

Interface	Optional Functions	Definition Description
License Parameter	Frame	R1: suit to ordinary robots
	Robot	R6: suit to 6-joint & special structure robots.
	NcGcode	NC: suit to NC G code function.

	HW	HW: suit to HW hardware comparison output function, refer to high-speed output channel numbers selection.
	ZVision	ZV: suit to vision instruction and function.
	Fast	Fast version
	Motor	Select according to actual axes. AX04: 4 axes can be used at most. AX06: 6 axes can be used at most. AX08: 8 axes can be used at most. AX16: 16 axes can be used at most. AX24: 24 axes can be used at most. AX32: 32 axes can be used at most. AX64: 64 axes can be used at most. Max 254 axes can be used.
	Motion	MO2: point, electronic cam, linear interpolation. MO8: point, electronic cam, linear interpolation, circular interpolation, continuous interpolation.

1.4. Connection Configurations

External equipment / software configuration:

➢ Main computer / industrial control computer, wired-mouse & keyboard.

➢ Displayer

➢ Win10 operating system professional edition, RTSys (ZDevelop) development platform and operating system software of various machine tool industries, etc.

(note: you can download the latest RTSys (ZDevelop) version from the official website of Zmotion or contact us. If you use other upper computer development platforms, can also contact us to obtain function library files. And this product does not come with an operating system, and there is no built-in MotionRT software. Users need to go to the official website to download the MotionRT installation package)

Chapter II Product Specification

2.1. Basic Specification

Model	XPCIE2032H	XPCIE2032HL
Basic Axes	Depend on "License", 4 axes / 6 axes / ……	
EtherCAT Axis	√	
IN Single-Ended Encoder Axis	2	
OUT Single-Ended Pulse Axis	4 (pulse + directional)	
Digital Inputs	16 (general), IN0-IN7 are high-speed inputs	
Digital Outputs	16 (general), OUT0-15 are high-speed outputs	
EtherCAT Interface	2	
CAN Interface	Reserved	
High-Speed Latch	4	
Position Comparison Output HW	16	
General PWM	4	
Push-Pull Output	0	2 (5V/24V)
Point Motion	Depend on "License"	
Electronic Cam		
Linear Interpolation		
Circular Interpolation		
Continuous Interpolation		
Simple Robot		
Power Failure Storage	√	
Dimensions	133*120	

2.2. Interface Introduction
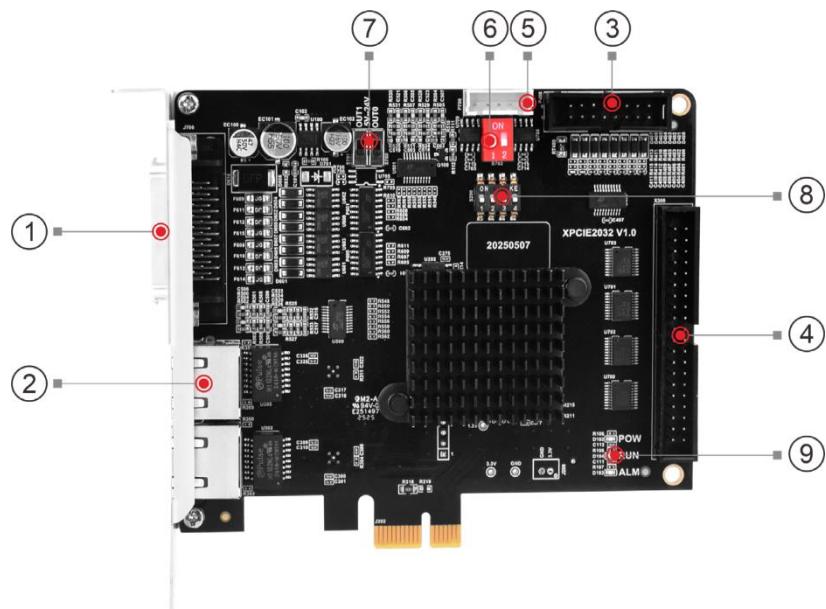
No.	Interface	Description
①	SCSI36P	IO power, connect to 24V DC power
		NPN input, IN0-15, some support latch, single-ended encoder
		NPN output, OUT0-15, some support PWM, HW, single-ended pulse
②	J301	EtherCAT connects to EtherCAT drives and EtherCAT modules
③	P400	Handwheel interface connects to 5-24V handwheel
④	X300	IO signal interface, 16 IOs for other customized specification
⑤	CAN	Reserved
⑥	S702	2 120-ohm resistor DIP, 1 = ON
⑦	S700	DIP switches 5V/24V push-pull output of OUT0 (XPCIE2032HL)
	S701	DIP switches 5V/24V push-pull output of OUT1 (XPCIE2032HL)
⑧	S200	DIP switch, used to set XPCIE2032H ID
⑨	Controller State Led	POW power led: ON when power is connected
		RUN running led: ON when it is running normally
		ALM alarm led: ON when it runs error

2.3. IO Interface Specification

Item	Specification	Description
Internal IO	16 +1 6	16 inputs, 16 outputs (with overcurrent protection)
Max extended IO	512 + 512	Match with expansion module to expand IO
High-speed input	8	IN0-7, 8 are high-speed inputs
High-speed output	16	OUT0-15, 16 are high-speed outputs
Latch input	4	4 can be configured as latch input, IN0-3
Single-ended encoder	2	Input is reused, IN0-2, IN4-6
PWM output	4	4 can be configured as PWM, OUT0-3
HW (PSO)	16	16 high-speed outputs all can be configured as HW.
Single-ended pulse output	4	Output is reused, OUT8-15
IO power input	DC24V	24 DC input, IO needs to be supplied by external power separately.

2.4. Config Parameter Specification

Turn on MotionRT software, it can configure parameters specification according to requirements. Please see below image, it shows default parameters, and the information behind it indicates corresponding supported range, after configurated, click OK to save.

When using serial port / ethernet, set the number of Com or Eth in this interface, then use.
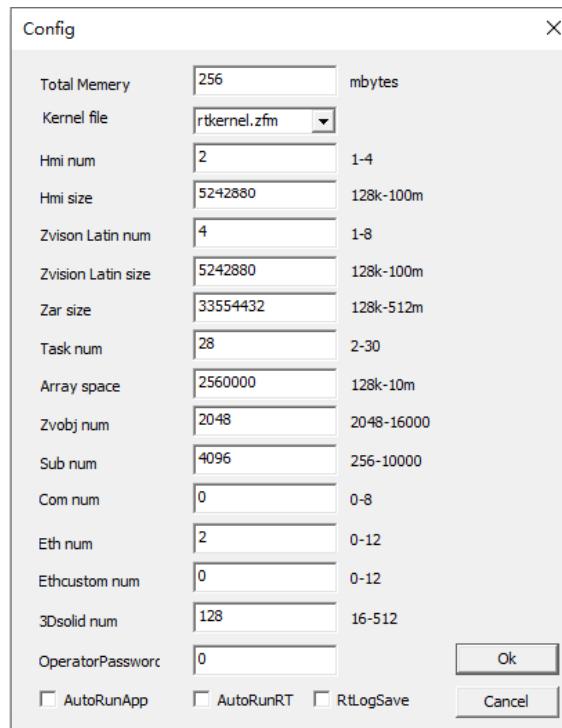
➢ **Parameter Meanings**

Item	Default Specification	Details
Total Memory	256MB	Total memory, including all controller memories that can save data, such as, array space, Zar file size, channel size, hmi resolution, etc., it is better to set the value that is above 200.
Kenerl File	/	Depend on firmware file
Hmi num	2	Valid Hmi numbers
Hmi size	5242880KB	Resolution of one hmi
ZVision Latin num	4	Vision channel numbers
ZVision Latin size	5242880KB	Single vision channel size
Zar size	33554432KB	Zar file size
Task num	28	Max tasks can be executed
Array Space	25600000KB	Distributed array space
Zvobj num	2048	The number of vision object Zvobject
Sub num	4096	Max sub functions
Com num	0	Serial ports
Eth num	0	The number of PORT net-port, set value should be less than the max value

| Ethcustom num	0	The number of customized Ethernet
3Dsolid num	128	3D solid numbers
AutoRunApp	/	Open software automatically when power on
AutoRunRT	/	Run RT software automatically when power on
RtLogSave	/	Save logs to log files

Chapter III Hardware Interfaces

3.1. IO Power Input

IO signal terminal's power uses DC24V power supply. And connect DC24V power supply to SCSI36P signal interface's PIN18 (E24V), and PIN17 (EGND).

➢ **Specification**

Power	Description
Input Voltage	DC24V±5%
Max Power	10W
Anti-reverse Connection	YES
Overcurrent Protection	YES
Isolated Power	YES
Cable Type	Recommend 1.0mm^2 copper core cable

➢ **Wiring**
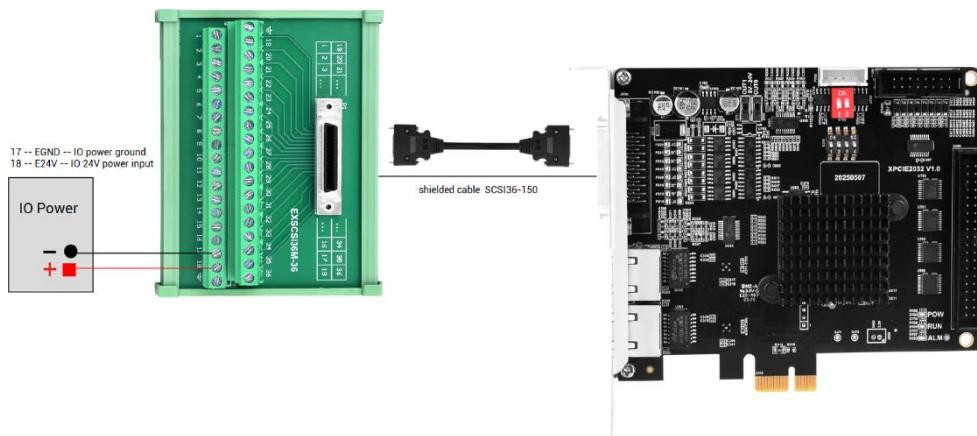
3.2. SCSI36P Signal Interface

SCSI36P signal interface is the main interface for XPCIE2032H motor control, IO signal control, using HL-SCSI-36P(CN) wiring board to connect to external equipment, please refer to below terminal graphic:
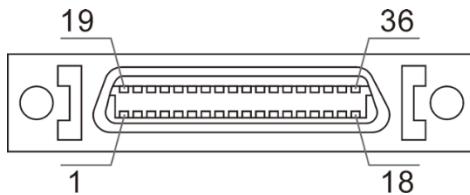
PIN No.	Signal	Description	Notes
1	OUT15	Output 15 / single-ended PUL0 / HW	**OUT all** are high-speed outputs.
2	OUT14	Output 14 / single-ended DIR0 / HW	
3	OUT13	Output 13 / single-ended PU1 / HW	**OUT0-1** can be configured as 24V/5V push-pull outputs, but please select XPCIE2032HL model.
4	OUT12	Output 12 / single-ended DIR1 / HW	
5	OUT11	Output 11 / single-ended PUL2 / HW	
6	OUT10	Output 10 / single-ended DIR2 / HW	
7	OUT9	Output 9 / single-ended PUL3 / HW	**OUT0-3** can be configured as PWM outputs in RTSys (ZDevelop).
8	OUT8	Output 8 / single-ended DIR3 / HW	
9	OUT7	Output 7 / HW	
10	OUT6	Output 6 / HW	
11	OUT5	Output 5 / HW	**OUT8-15** can be configured as 4 pulse outputs.
12	OUT4	Output 4 / HW	
13	OUT3	Output 3 / PWM 3 / HW	
14	OUT2	Output 2 / PWM 2 / HW	**OUT0-15** all can be configured as hardware comparison outputs (PSO)...
15	OUT1	Out 1 / PWM 1 / push-pull out / HW	
16	OUT0	Out 0 / PWM 0 / push-pull out / HW	
17	EGND	E24V power ground / IO public end	IO Power Terminal
18	E24V	IO power 24V IN	
19	IN15	Input 15	**IN 0-7** all are high-speed inputs.
20	IN14	Input 14	
21	IN13	Input 13	
22	IN12	Input 12	
23	IN11	Input 11	**IN0-3** can be configured as latch IN in RTSys (ZDevelop).
24	IN10	Input 10	
25	IN9	Input 9	
26	IN8	Input 8	
27	IN7	Input 7	**IN0-2 and 4-6** can be configured as 2 encoder inputs..
28	IN6	Input 6 / Encoder EZ1	
29	IN5	Input 5 / Encoder EB1	

30	IN4	Input 4 / Encoder EA1	
31	IN3	Input 3 / Latch R3	
32	IN2	Input 2 / Latch R2 / Encoder EZ0	
33	IN1	Input 1 / Latch R1 / Encoder EB0	
34	IN0	Input 0 / Latch R0 / Encoder EA0	
35	EGND	E24V power ground / IO public end	Supply power for
36	D5V	E5V power output	external equipment

Descriptions:

(1) only 24V encoder can be used. Max pulse frequency of encoder 0 and encoder 1 is 100kHz, which can connect to high-speed encoder. For others, they are normal inputs, the max pulse frequency is 10kHz, which only can connect to low-speed encoders, like, handwheel.

(2) No. after pulse output and encoder input are default axis No., ATYPE command can switch the IO port and determine whether the IO is normal IO (target axis' ATYPE = 0 means normal IO, ATYPE = 1 means pulse output, ATYPE = 3 means encoder input, ATYPE = 4 means pulse output + encoder input).

➢ *IO Specification*

Item	High-Speed IN	Low-Speed IN
Channels	8 (IN0-IN7)	8 (IN8-IN15)
In Method	NPN type (triggered by low electric level)	
IN Frequency	≤100kHz	≤10kHz
IN Impedance	4.7KΩ	4.7KΩ
IN Voltage	≤24V	≤24V
Communication Isolation	√	√

Item	High-Speed OUT (OUT0-15)
OUT Method	NPN type (triggered by low electric level)
OUT Frequency	≤100kHz
OUT Voltage	≤24V
OUT Current	≤300mA
Overcurrent protection	√
Communication Isolation	√

➢ **Single-Ended Axis Specification**

Item	Description
Pulse / Directional (PUL/DIR) Signal Type	Single-ended output signal
Pulse / Directional (PUL/DIR) Signal Voltage Range	5-24V
Pulse / Directional (PUL/DIR) Signal Max Frequency	<100kHz (single-ended speed is affected by cable material)
Encoder (A/B/Z) Signal Type	Single-ended input signal
Encoder (A/B/Z) Signal Voltage Range	0-24V
Encoder (A/B/Z) Signal Max Frequency	<100kHz (single-ended speed is affected by cable material)
Isolation	YES

✚ Description: the maximum pulse frequency under laboratory conditions can reach 400kHz, but the actual rate is limited by the material and length of the adapter cable. **Therefore, if higher speeds are required, it is recommended to route the high-speed interface separately.**

➢ **Wiring**

A. General IN Wiring
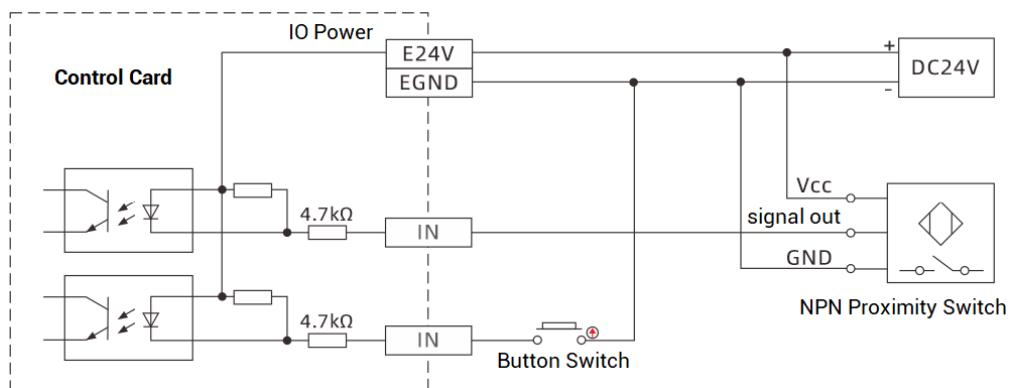
B. General OUT Wiring
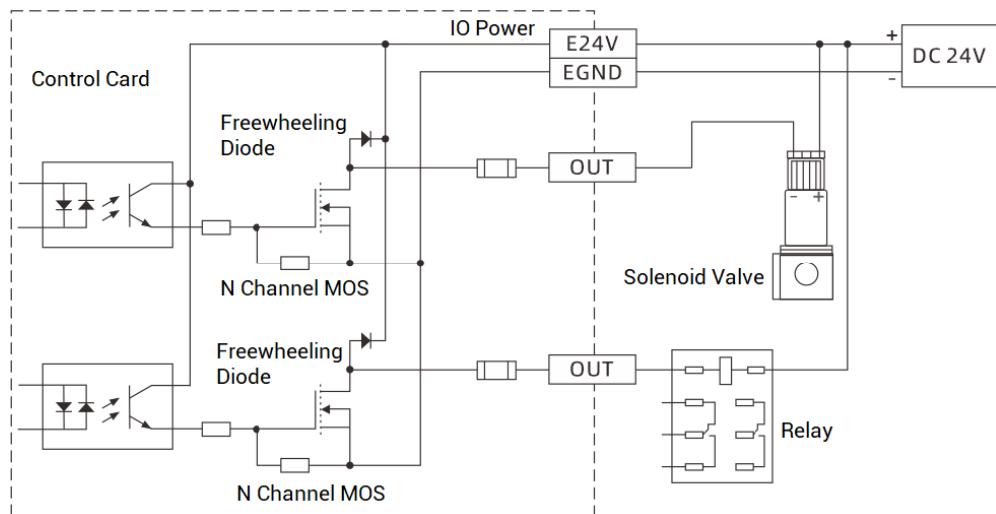
C. Single-Ended Output Wiring (take IN0, IN1, IN2 as example):
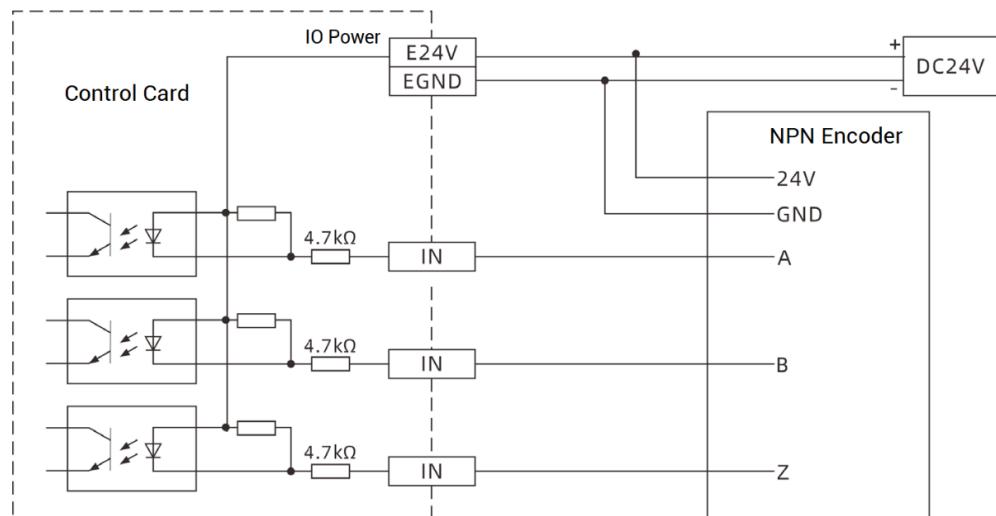
D. Single-Ended Pulse Axis Wiring (take OUT14 and OUT15 as example):
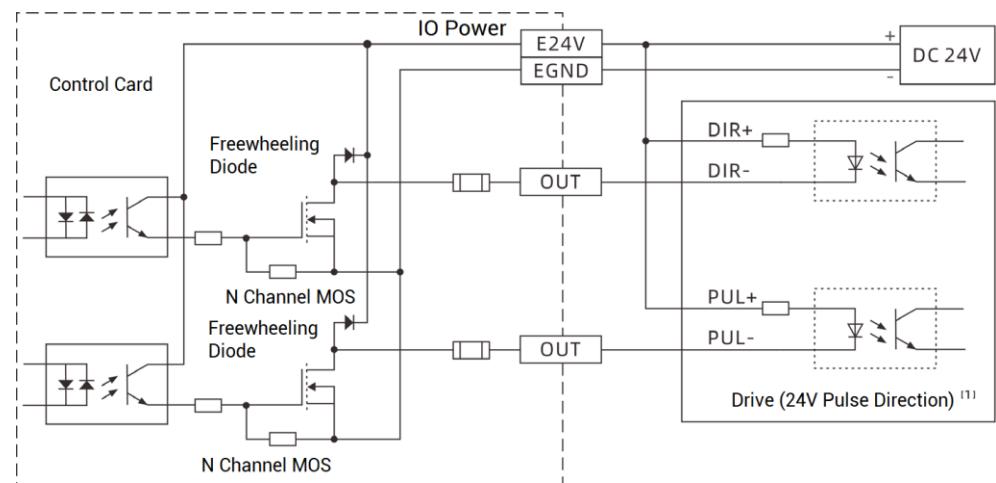
Note [1]: for 5V pulse driection interface, please connect PUL+ and DIR+ to E5V.

■ **Notes**

a. Above shows input / output wiring, for external loads, they can be key switches / sensor, etc., please attention their signal specifications should be matched.

b. For 5V drive pulse directional interface, please connect drive PUL+ and DIR+ to E5V interface.

c. It is recommended that the load and the controller use the same power supply, otherwise the negative poles of the two power supplies must be connected.

d. When wiring on site, pay attention to the distance between the strong power supply and the strong power supply, which is recommended to be more than 30cm.

e. It should be noted that the grounding of the controller should be good, and the grounding of the housing should be connected to the standard factory ground pile.

➢ *Usages (RTBasic)*

(1) After wired and powered on, please select "PCI / Local MotionRT1" to connect controller to RTSys.

(2) State values of relative input ports can be read directly through "IN" command, also, it can be read through "RTSys/Tool/IN".

(3) Output can be switched on / off by "OP" command directly, also, it can be operated through "RTSys/Tool/OP".

(4) Latch function is configured by commands of "REGIST", "REG_POS", "REG_INPUTS".

(5) Axis position limit signal / origin signal can be set by commands of "FWD_IN", "REV_IN", "DATUM_IN".

(6) For hardware comparison output function, which can be opened by "HW_PSWITCH2".

(7) For PWM function, use "PWM_FREQ" and "PWM_DUTY" commands to set the frequency and the duty cycle.

(8) IN0-2, and IN4-6 support encoder axis function. When ATYPE=3/6, it is set as single-ended encoder axis. When ATYPE=0, it is general inputs.

(9) OUT8-15 support single-ended pulse axis function. When ATYPE=1, it is set as single-ended pulse axis. When ATYPE=0, it is general outputs.

(10) Above commands and other related commands all can be referred by "RTBasic Programming Manual".

➢ **Usages (Host Computer)**

(1) After proper wiring, power on the controller and connect it to the host software using the "ZAux_FastOpen" function.

(2) The status of the corresponding input port can be directly read using the "ZAux_Direct_GetIn"/"ZAux_Direct_GetInMulti" instructions.

(3) The port can be directly opened or closed using the "ZAux_Direct_SetOp"/"ZAux_Direct_SetOutMulti" instructions.

(4) The latch function can be configured and set using "ZAux_Direct_Regist" and "ZAux_Direct_GetRegPos."

(5) The axis positive and negative limit signals/origin signals can be set using the "ZAux_Direct_SetFwdIn", "ZAux_Direct_SetRevIn", and "ZAux_Direct_SetDatumIn" instructions.

(6) Hardware comparison output can be configured using "ZAux_Direct_HwPswitch2" command to enable.

(7) The PWM function can be used by setting the frequency and duty cycle using the "ZAux_Direct_SetPwmFreq" and "ZAux_Direct_SetPwmDuty" commands, respectively.

(8) IN0-2 and IN4-6 function as encoder axes. When ZAux_Direct_SetAtype is set to 3/6, they function as single-ended encoder axes, when it is 0, they function as general-purpose inputs.

(9) OUT8-15 function as single-ended pulse axes. When ZAux_Direct_SetAtype is set to 1, they function as single-ended pulse axes; when it is 0, they function as general-purpose outputs. For related API functions (ZAux_Direct_SetAtype, ZAux_Direct_SetUnits, ZAux_Direct_SetSpeed, ZAux_Direct_GetAxisStatus, and ZAux_Direct_GetAxisStopReason), please refer to the "Zmotion PC Function Library Manual."

(10) For detailed explanations of the above commands and other related API functions, please refer to the "Zmotion PC Function Library Manual."

3.3. P400 Handwheel Interface

XPCIE2032H supports 1 handwheel specialized interface "P400", which is double-row standard IDC-16PIN male socket.

➢ *Wiring*

Below shows the P400 wiring. It can be seen the P400 terminal is converted to DB15 female connector (double-row DB15 / three-row DB15) through IDC-16PIN adaptor cable. And PCIe bezel is installed to connect to external equipment.
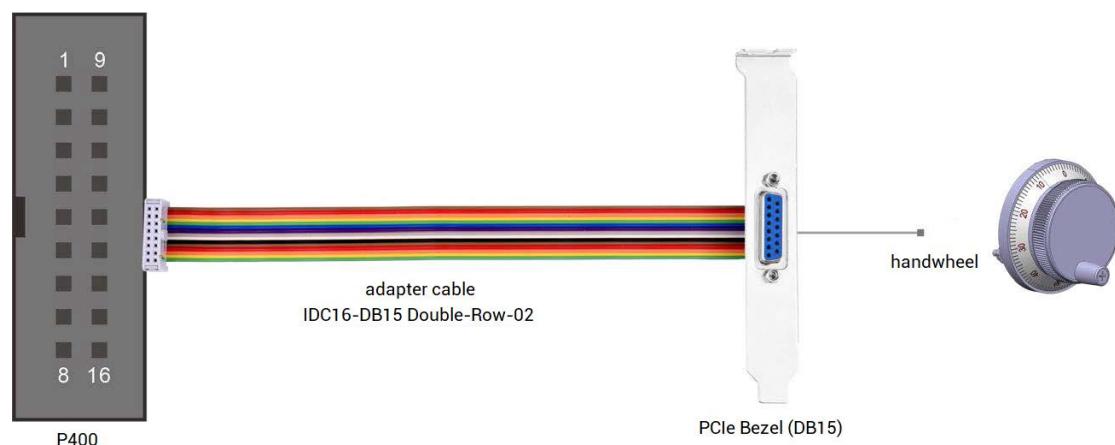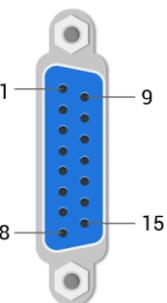

➢ **P400 Terminal**
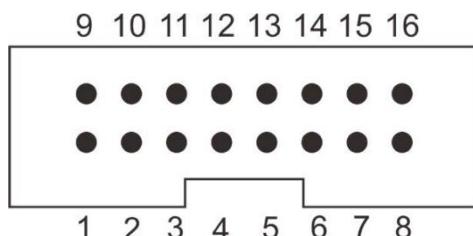
After adapted, DB15 terminal (left: double-row DB15, right: three-row DB15)
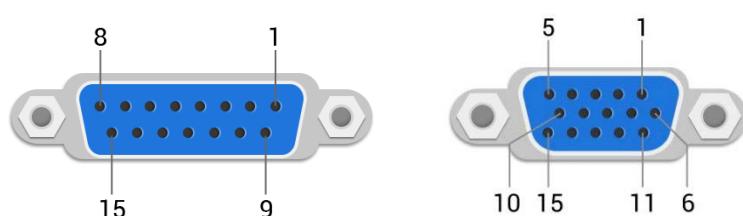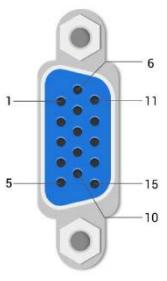
■   Double-Row DB15 PIN No.:

Interface	PIN No.	Signal	Description
	1	H-5V	5V power output +, for handwheel
	2	H-A	Encoder 2A Phase Signal (IN32)
	3	H-B	Encoder 2B Phase Signal (IN33)
	4	H-EMGN	Emergency Stop Signal (IN43)
	5	NC	Spare
	6	H-X1	X1 Ratio (IN34)
	7	H-X10	X10 Ratio (IN35)
	8	H-X100	X100 Ratio (IN36)
	9	H-S4	Axis Selection 4 (IN40)
	10	H-S5	Axis Selection 5 (IN41)
	11	EGND	5V power output -, Signal Public End
	12	H-S6	Axis Selection 6 (IN42)
	13	H-SZ	Axis Selection X (IN39)
	14	H-SY	Axis Selection Y (IN38)
	15	H-SX	Axis Selection Z (IN37)

Descriptions:

(1) The H-5V power output only powers the handwheel, do not power other devices.

(2) All signals on this interface are digital input signals, numbered IN (32-43).

(3) The encoder input corresponding to H-A/H-B defaults to AXIS2. When reading handwheel data, if ATYPE (2) = 3 or 6, the MPOS (2) data read is the handwheel data. If you need to map it to another axis, you must remap it in the software configuration to use it as another axis.

■   Three-Row DB15 PIN No.:

Interface	PIN No.	Signal	Description
	1	H-5V	5V power output +, for handwheel
	3	H-A	Encoder 2A Phase Signal (IN32)
	5	H-B	Encoder 2B Phase Signal (IN33)
	7	H-EMGN	Emergency Stop Signal (IN43)
	9	NC	Spare
	11	H-X1	X1 Ratio (IN34)

13	H-X10	X10 Ratio (IN35)
15	H-X100	X100 Ratio (IN36)
2	H-S4	Axis Selection 4 (IN40)
4	H-S5	Axis Selection 5 (IN41)
6	EGND	5V power output -, Signal Public End
8	H-S6	Axis Selection 6 (IN42)
10	H-SZ	Axis Selection X (IN39)
12	H-SY	Axis Selection Y (IN38)
14	H-SX	Axis Selection Z (IN37)

➢ **Specification**

Item	Descriptions
In Method	NPN type (triggered by low electric level)
IN Frequency	≤5kHz
IN Impedance	510KΩ
IN Voltage	≤24V
Communication Isolation	√
H-5V Output Current	≤100mA

➢ **Wiring:**

The wiring diagram shows the pin No. and signal definitions for a dual-row DB15 port. For a triple-row DB15 port, only the signal definitions are provided as a reference. The pin numbers shown in the diagram are not for reference.
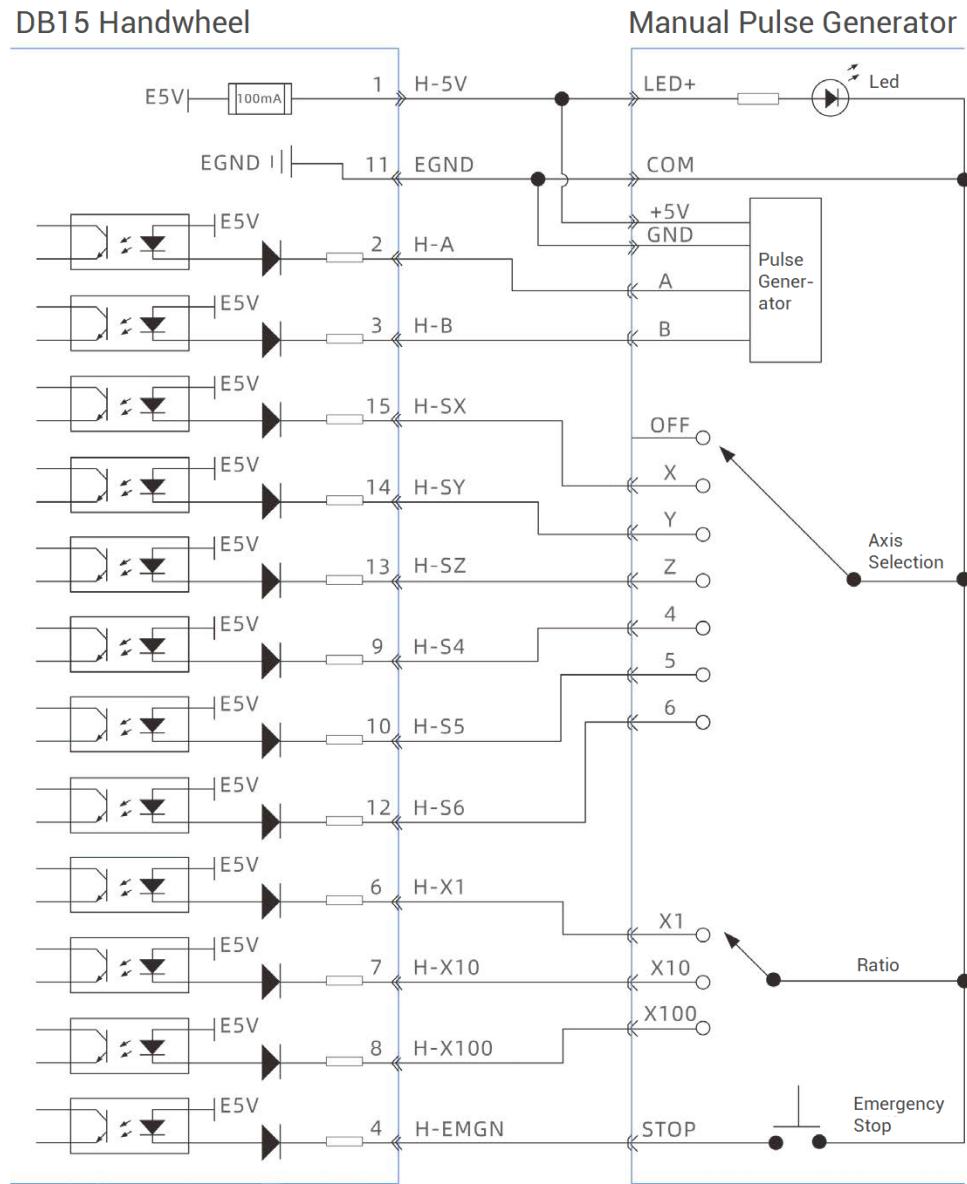
■ Notes

a. The wiring principle of handwheel encoder axis interface is shown above, the design of handwheel is very rich, please pay attention to do connection

b. Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.

c. When wiring on site, pay attention to the distance between the strong power supply and the strong power supply, which is recommended to be more than 30cm.

d. It should be noted that the grounding of the controller should be good, and the grounding of the housing should be connected to the standard factory ground pile.

➤ *Usage (RTBasic*

(1) After powered on, please select ETHERNET or RS232 to connect to RTSys.

(2) Configure axis No., the default handwheel axis No. is 2, remapping must be done by AXIS_ADDRESS.

```
BASE(target axis No.)              'the axis No. to be remapped
ATYPE(target axis No.) = 0         'set axis type as 0
BASE(8)                            'handwheel interface initial axis No. is 8 (invalid)
ATYPE(8) = 0                       'set initial type of handwheel interface as 0
AXIS_ADDRESS(target axis No.)=(-1<<16) + 8   'bind initial axis 8 to target axis No.
ATYPE(target axis No.) = 6         'set this new axis interface as required axis type,
```
such as 3 or 6

(3) Configure IO: assign axis selection (H-SX, H-SY, H-SZ, H-S4, H-S5, H-S6) and ratio (H-X1, H-X10, H-X100) and emergency stop (H-EMGN) functions as required. These signals are essentially digital input signals with fixed No. but no fixed functions. It needs RTSys development (the axis selection is the connected axis of "connect" synchronization motion, and the ratio is the "connect" ratio

(4) When completed above steps, please set handwheel axis and connected axis' basic parameters (ATYPE, UNITS, etc.), then it can start to use handwheel.

➤ *Usage (Host Computer)*

(1) After proper wiring, power on the controller and connect it to the host software using the "ZAux_FastOpen" function.

(2) Configure the axis No. The default axis No. for the controller's handwheel interface is 2. This must be remapped by "ZAux_Direct_SetAxisAddress" command at first..

(3) Configure the IO, assigning axis selections (H-SX, H-SY, H-SZ, H-S4, H-S5, H-S6), overrides (H-X1, H-X10, H-X100), and the emergency stop function (H-EMGN) as needed. These signals are essentially digital inputs with fixed No. but no fixed functions. If specific functions are required, develop corresponding functions at the user level. The name indicates the recommended configuration function. The axis selection is the connected axis for synchronized motion in "ZAux_Direct_Connect," and the override is the ratio in "ZAux_Direct_Connect."

(4) After completing the above configuration, you must set basic axis parameters for the

handwheel axis and the connected axis (ZAux_Direct_SetAtype, ZAux_Direct_SetUnits) as needed before use.

(5) For detailed explanations of the above commands and other related API function instructions, please refer to the "Zmotion PC Function Library Manual."

3.4. X300 Expansion Interface

X300 is I/O signal control interface. Use ACC37-7103 adapter board (16 inputs & 16 outputs, PIN No.1 – No.16 corresponds to IN8-IN23, PIN No.21 – No.36 corresponds to OUT8-OUT23) to connect to external device (this adapter board is optional when more IO are needed). For more details, please refer to Chapter IV.

X300 interface itself is the inner IO, is not-isolated signal, which means it can't connect to external devices directly, it needs ACC37 wiring board, or the wiring board that supports isolation function.

Note: when there is no wiring board installed, this interface's IO signals only can be shown in software interface, but the real functions are invalid, that is, it can do normal data transferring / signal interaction.
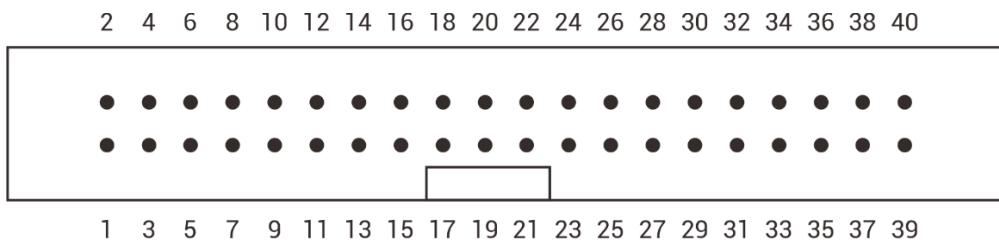
PIN	Name	Description	PIN	Name	Description
1	IN16	General IO Signal	21	OUT16	General IO Signal
2	IN17	General IO Signal	22	OUT17	General IO Signal
3	IN18	General IO Signal	23	OUT18	General IO Signal
4	IN19	General IO Signal	24	OUT19	General IO Signal
5	IN20	General IO Signal	25	OUT20	General IO Signal
6	IN21	General IO Signal	26	OUT21	General IO Signal
7	IN22	General IO Signal	27	OUT22	General IO Signal
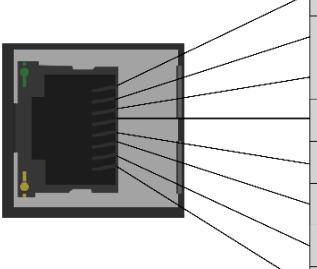
8	IN23	General IO Signal	28	OUT23	General IO Signal
9	IN24	General IO Signal	29	OUT24	General IO Signal
10	IN25	General IO Signal	30	OUT25	General IO Signal
11	IN26	General IO Signal	31	OUT26	General IO Signal
12	IN27	General IO Signal	32	OUT27	General IO Signal
13	IN28	General IO Signal	33	OUT28	General IO Signal
14	IN29	General IO Signal	34	OUT29	General IO Signal
15	IN30	General IO Signal	35	OUT30	General IO Signal
16	IN31	General IO Signal	36	OUT31	General IO Signal
17	/	/	37	/	/
18	/	/	38	/	/
19	/	/	39	/	/
20	/	/	40	/	/

Note: terminal definition of X300 and AC337 adapter board are the same. And for position limit, alarm, origin, they are same as ECI card, ON is valid.

3.5. EtherCAT Interface

XPCIE2032H motion control card has 2 EtherCAT communication interfaces to connect to EtherCAT device. It supports "redundancy".

➢ **Specification**

PIN			Item	Description
PIN 1 TX+ Send signal (+)			Communication Protocol	EtherCAT
PIN 2 TX- Send signal (-); 3 RX+ Receive signal (+)			Communication Velocity	100Mbps
4 NC Reserved			Refresh Period	Max 500us
5 NC Reserved; 6 RX- Receive signal (-)			Communication Cable	Super 5e STP
7 NC Reserved; 8 NC Reserved			Cable Length	Best <50m

➤ *Wiring*

When connects to EtherCAT drives or other slave stations, using one super 5e STP cable to connect to slave station's EtherCAT IN. Then, use this slave station's EtherCAT OUT to next slave's EtherCAT IN.

"Ethernet LED"

LED & State	ON Always	Shrink
Green	Build 100M Communication	During sending & receiving data
Yellow	Build 1000M Communication	During sending & receiving data

■ **Notes:**

● Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.

● When wiring on site, pay attention to the distance between the strong power supply and the strong power supply, which is recommended to be more than 30cm.

● It should be noted that the grounding of the controller should be good, and the grounding of the housing should be connected to the standard factory ground pile

➤ *How to Use (RTBasic)*

(1) After powered on, please select "PCI" to connect to RTSys.

(2) Connect to drive device through EtherCAT:

--use "SLOT_SCAN" command to scan the slot No. on the bus.
--use "AXIS_ADDRESS" command to map axis No., you can refer to 3.2 EtherCAT Expansion & Resource Mapping.
--use "SLOT_START" command to open the bus or use "SLOT_STOP" command to close the bus.
--after that, configure and operate the local pulse axis.

(3) Connect to expansion module through EtherCAT

--use "SLOT_SCAN" command to scan the slot No. on the bus.
--use "AXIS_ADDRESS" command to map axis No., and use "NODE_IO/NODE_AIO" command to map IO No., you can refer to 3.2 EtherCAT Expansion & Resource

Mapping.

--use "SLOT_START" command to open the bus or use "SLOT_STOP" command to close the bus.

--after that, operate same as local IO and axis.

(4) Slot No. node information can be known by "RTSys-Controller-Controller State－Slot0Node".

(5) Above commands and other related commands all can be referred by "RTBasic Programming Manual".

➢ **How to Use (RTBasic)**

(1) After proper wiring, power on the controller and connect it to the host software using the "ZAux_FastOpen" function.

(2) Connect to EtherCAT drives / expansion modules:

a) use the "ZAux_BasDown" command to download the initialization bas file to the controller for initialization.

b) once completed, control the axis or I/O.

(3) For detailed explanations of the above commands and other related API function instructions, please refer to the "Zmotion PC Function Library Manual."

3.6. DIP Switch

XPCIE2032H has one DIP switch.
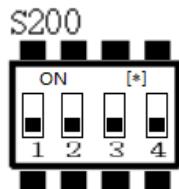
This DIP switch S200 is used to set XPCIE2032H ID, and ID can be checked through ID_PCICARD command in RTSys command input window.

Code 1	Code 2	Code 3	Code 4	Card ID
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15
ON = 1, OFF = 0.				

Chapter IV Expansion Module

The control card can expand digital IO, analog AD/DA, pulse axis and other resources through EtherCAT bus expansion module or ZMIO310-ECAT series vertical bus expansion module.

➢ *Wiring*

For wiring, use a Category 5e shielded twisted-pair cable to connect the controller's EtherCAT to the EtherCAT IN port of the expansion device. The expansion device's EtherCAT OUT port can then be connected to the EtherCAT IN port of its slave device to achieve multi-level expansion.

After wiring each EIO expansion module, no further development is required, simply map the expansion module's IO No. and axis No. on the EtherCAT master controller…

EIO expansion module wiring reference example:
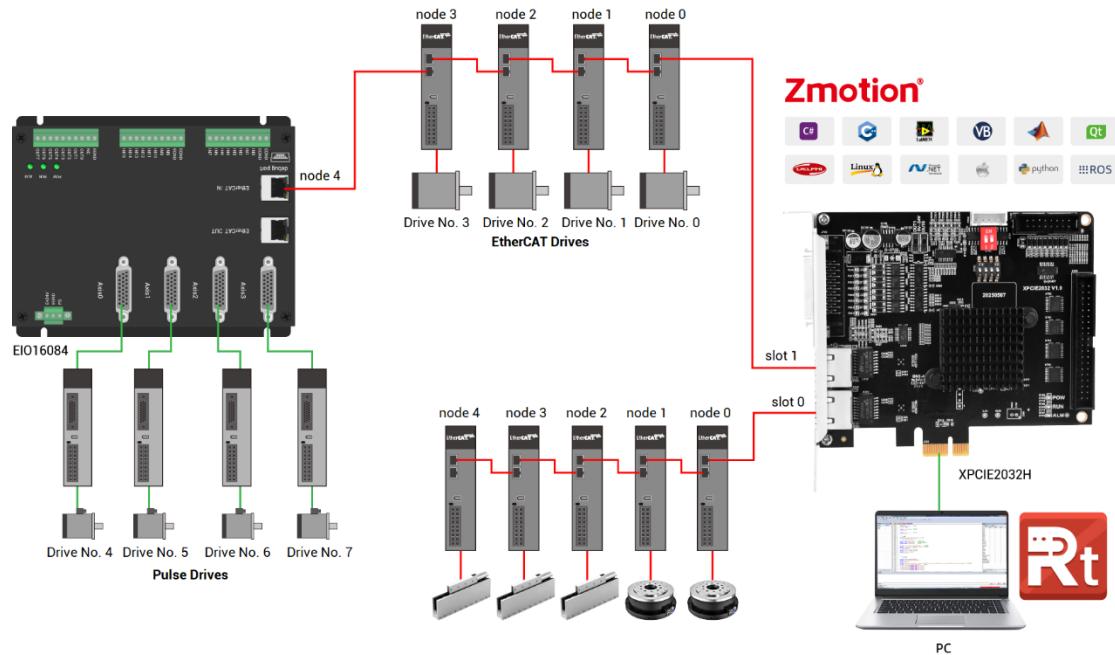
Involved number concepts in above figure are as follows: the bus-related command parameters will use the following numbers:

● **Slot No. (slot):**

The slot number refers to the number of the bus interface on the controller, and the slot number of the EtherCAT bus is 0.

- **Device No. (node):**

The device number refers to the number of all devices connected to a slot. It starts from 0 and is automatically numbered according to the connection sequence of the devices on the bus. You can view the total number of devices connected to the bus through the NODE_COUNT(slot) command.

- **Drive No.:**

The controller will automatically identify the drive on the slot, and the number starts from 0, and the number is automatically numbered according to the connection sequence of the drive on the bus.

The drive number is different from the node. Only the drive device number on the slot is assigned, and other devices are ignored. The drive number will be used when mapping the axis No.

➢ *IO Mapping:*

IO No. and AIO No. extended by EtherCAT expansion module is set by NODE_IO and NODE_AIO commands.

Before IO mapping, please check the maximum IO number of the controller itself (including the external IO interface and the interface in the pulse axis), and then use the command to set. They can't be the same, otherwise they both work at the same time.

Digital IO Mapping
NODE_ IO(slot, node) = iobase
Example:
NODE_IO(0,0) = 32   'set the IO start No. of slot 0 interface device 0 to 32

Analog IO Mapping
NODE_ AIO(slot, node [,idir]) = aiobase
Example:
NODE_IO(0,0,3) = 3   'set the IO start No. of slot 0 interface device 0 to 3

> ➢ **AIO Mapping:**

Before using the axis of the expansion module, you need to use the AXIS_ADDRESS command to map the axis No., and the axis mapping also needs to pay attention to the axis number of the entire system cannot be repeated. The mapping syntax of the EIO series extended axis is the same as that of the bus driver.

Axis Mapping

AXIS_ADDRESS (axis No.) = (slot No. << 16) + driver No. + 1

Example:

AXIS_ADDRESS(0)=(0<<16)+0+1

'the first drive on the EtherCAT bus, drive number 0, bound as axis 0

AXIS_ADDRESS(1)=(0<<16)+1+1

'the second drive on the EtherCAT bus, drive number 1, bound as axis 1

> ➢ **Extended Resources Checking:**

When the controller is connected to RTSys, you can check expansion module ID and corresponding resource mapping No. in "controller – controller state – slot 0 node" interface.

Chapter V Optional Accessories

For XPCIE2032H motion control card, there are several optional accessories, you can order as needed.

5.1. EXSCSI366M-36 Wiring Board

EXSCSI36M-36 wiring board is for SCSI36P signal interface, using SCSI cable to connect to SCSI36P signal interface. Therefore, please refer to SCSI36P signal interface specification.

5.2. SCSI36-150 Shield Cable

Use SCSI36-150 shielded cable to connect SCSI36P signal interface to EXSCSI36M-36 wiring board. It is convenient for users to install and wire.

5.3. ACC37 Wiring Board

ACC37 is the wiring board for X300 signal, using flat adaptor cable and DB37 to connect to X300. For this wiring board specification, please refer to X300 signal interface specification.
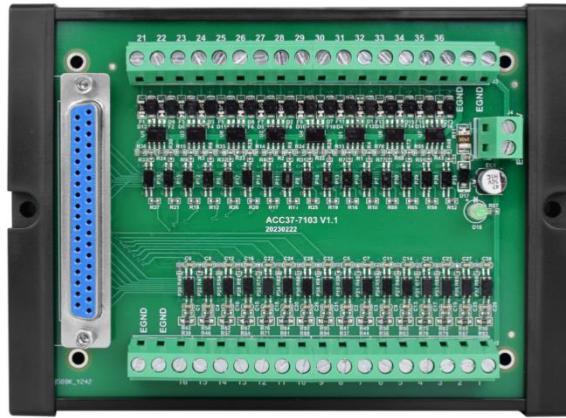
Size: 144mm*104mm

When you need more IO, ACC37-7103 can be purchased together. It can be up to 16 inputs and 16 outputs. While using adapter board, it also needs DC24V power to supply for adapter board.

If there are more other inputs and outputs:

Model	Specification
ACC37-2408M	24 inputs & 8 outputs
ACC37-3200M	32 inputs
ACC37-0824M	8 inputs& 24 outputs
ACC37-0032M	32 outputs

5.4. ZP72-02 Adaptor Cable

The 40P X300 socket of the control card can be converted to DB37 through the ZP72-02 conversion cable, and can be installed on the card slot of the IPC for easy wiring. Connect CN1 to DB37-150 cable, connect CN2 to X300.
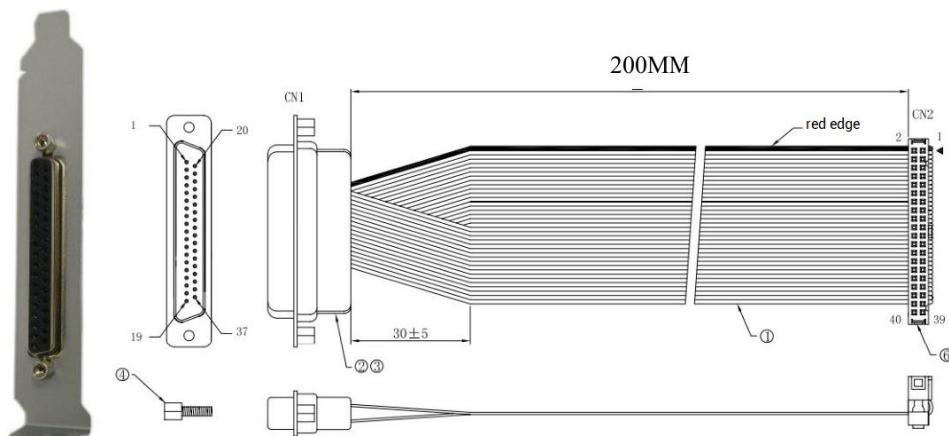
5.5. DB37-150 Shield Cable

Use DB37-150 shielded cable to connect ZP72-02 adaptor cable CN1 interface to ACC37 wiring board, which is convenient for users to install and wire. DB37-150 cable is one 37-pin male-to-male full contact, that is, they are corresponding and with shield. The cable length is 1.5 meters.

5.6. IDC16-DB15 Double-Row-02

Use this to convert control card 16P P400 handwheel plug to double-row DB15, and it can be installed into IPC slot. For DB15 female head, please refer to P300 handwheel interface specification
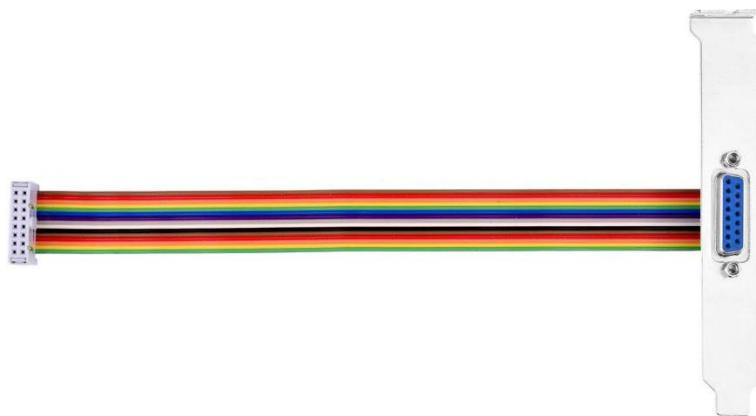
5.7. IDC16-DB15 Three-Row-02

Use this to convert control card 16P P400 handwheel plug to three-row DB15, and it can be installed into IPC slot. For DB15 female head, please refer to P300 handwheel interface specification
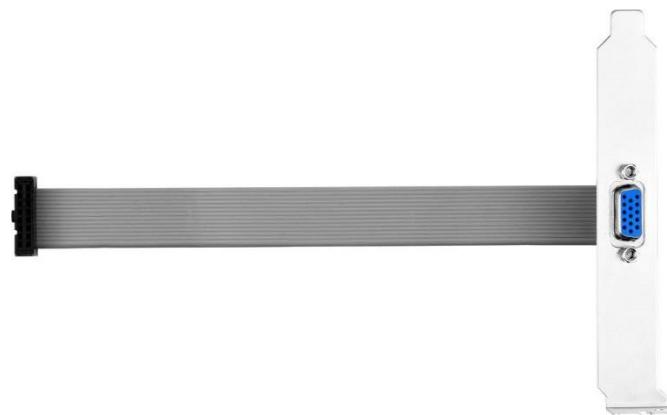
Chapter VI Installation Requirements

6.1. Installation Environment

Environment temperature: the ambient temperature has a great impact on the life of the device, and the operating environment temperature of the device is not allowed to exceed the allowable temperature range (-10°C to 55°C).

Please install it in a place that is not easy to vibrate. Vibration should not be greater than 4.9m/s^2. Take special care to stay away from equipment such as punch presses.

Avoid placing in direct sunlight, humidity, and water drops.

Avoid installing in places with corrosive, flammable and explosive gases in the air.

Avoid installing in places with oil and dust, the pollution level of the installation place is PD2.

This product is installed in the cabinet and needs to be installed in the final system. The final system should provide corresponding fireproof enclosures, electrical protection enclosures, and mechanical protection enclosures, etc., in compliance with relevant IEC standards.

CPU heat dissipation should be considered when the chassis is fully enclosed and there is no air circulation.

Item		Parameters
Work Temperature		-10℃-55℃
Work relative Humidity		10%-95% non-condensing
Storage Temperature		-40℃～70℃ (not frozen)
Storage Humidity		Below 90%RH (no frost)
vibration	Frequency	5-150Hz
	Displacement	3.5mm(directly install)(<9Hz)
	Acceleration	1g(directly install)(>9Hz)
	Direction	3 axial direction
Shock (collide)		15g, 11ms, half sinusoid, 3 axial direction

Degree of Protection	IP20

6.2. Installation Size
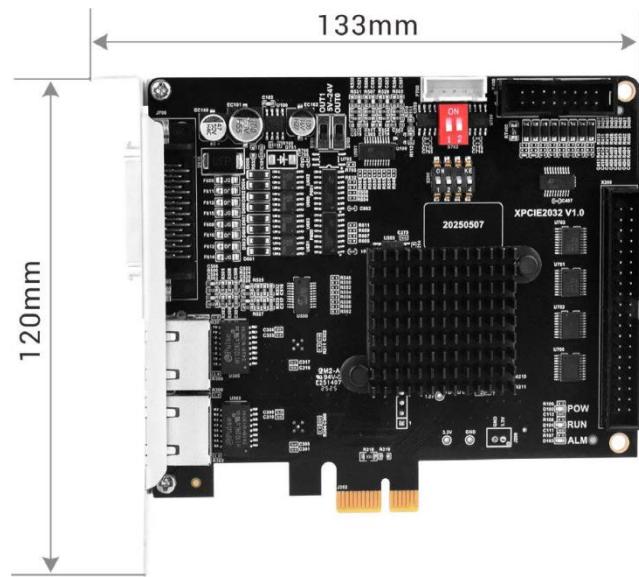
The card slot is designed according to PCIE*1, it is compatible with PCIE*1 to PCIE*6.

➕ PCIE doesn't support plug in or pull out when in hot, so please close the computer before inserting and pulling the card.

➕ Please handle it carefully. Before touching the control card circuit or inserting/pulling the control card, please wear anti-static gloves or touch an effectively grounded metal object to discharge the human body to prevent possible static electricity from damaging the motion control card.

6.3. Installment Method

1. Turn off the power to the computer.
2. Open the computer case, select a free XPCIE card slot, and use a screwdriver to remove the corresponding baffle strip.
3. Insert the motion control card into the slot securely, and tighten the fixing screws on the baffle strip.

Chapter VII How to Use MotionRT750

It is recommended to match MotionRT750 with XPCI / XPCIE card, then it can play better performance. The authorization information is saved into the control card, each control card has unique No.

Note: this software requires enough strong PC / IPC performance and real-time. Currently, AMD CPU is not supported.

Before that, please obtain latest MotionRT7 file and compress it.

Address: https://www.zmotionglobal.com/download_list_14.html

driver	2025/3/27 9:24	文件夹
flash	2022/9/21 13:47	文件夹
RT异常停止保持开机自启	2025/3/27 14:11	文件夹
xplcterm	2025/3/27 8:40	文件夹

➢ Driver: the driver folder, it includes MotionRT7 drive installation information file, ECAT protocol installation information, installation software, safety content file, sys system file, signature file, etc.

ZMotionRt64.cat	2025/3/26 18:12	安全目录	13 KB
ZMotionRt64.inf	2025/2/25 16:49	安装信息	5 KB
ZMotionRt64.sys	2025/3/26 18:12	系统文件	285 KB
ZMotionRtPacket.inf	2025/2/25 16:49	安装信息	2 KB

✓ ZMotionRT64.cat: the digital signature file of drive program.

✓ ZMotionRT64.inf: MotionRT7 software drive installation information, while installing the drive, select this file by browsing folder.

✓ ZMotionRT64.sys: system file.

✓ ZMotionRTPacket.inf: ethercat protocol installation information, while installing ECAT protocol, select this file by browsing folder.

➢ Flash: controller system folder

➢ Xplcterm: xplc screen folder, it includes xplcterm software, which is used as screen to show HMI interface

7.1. How to Install MotionRT750 Drive (with Card)

1. Open the Device Manager menu and select the PCI device in Other Devices.
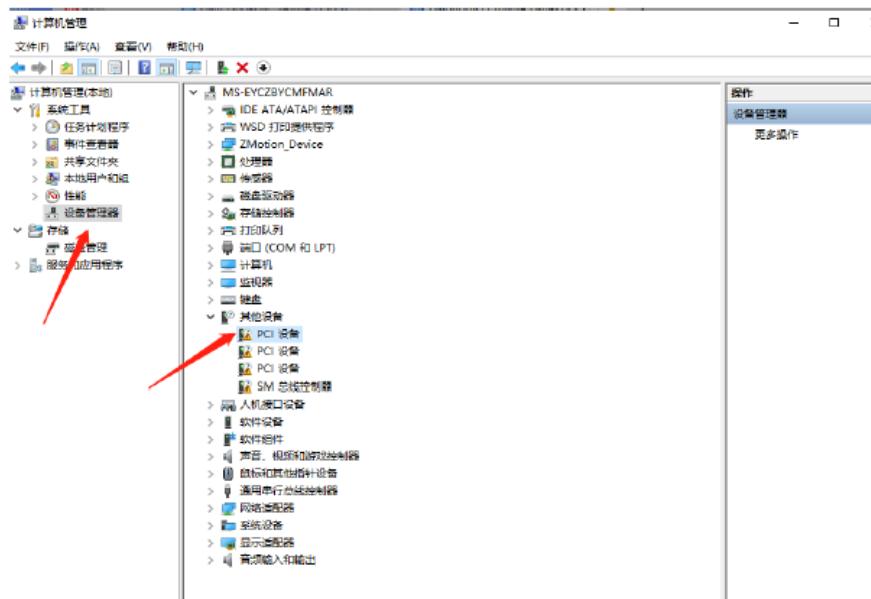
2. If there are multiple PCI devices, right-click "Properties" to view detailed information, select "Hardware ID" for properties, and confirm that it is a PCI device starting with PCI\VEN_EF34&DEV_1000&.
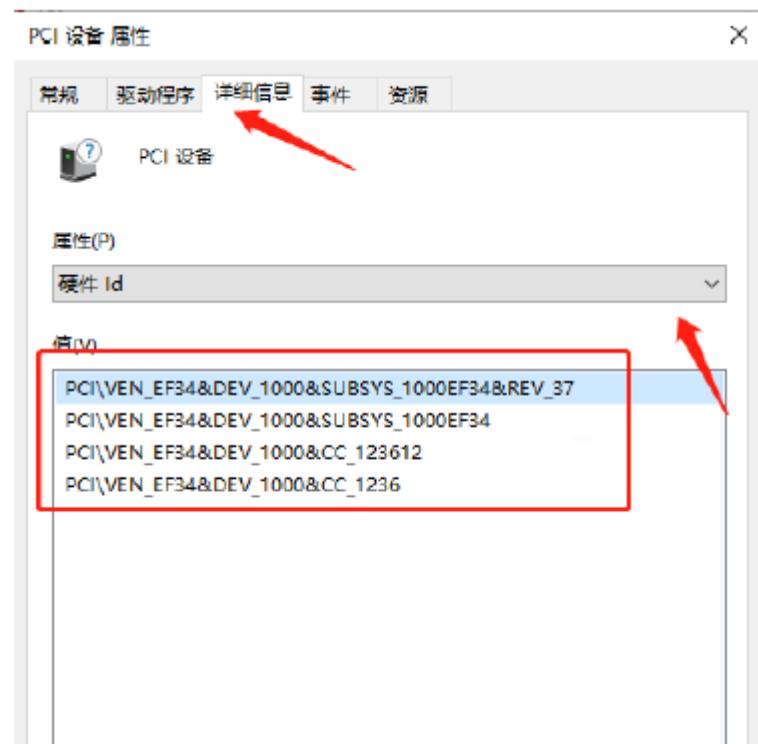
3. Find PCI Device, right-click to select "update drive program".
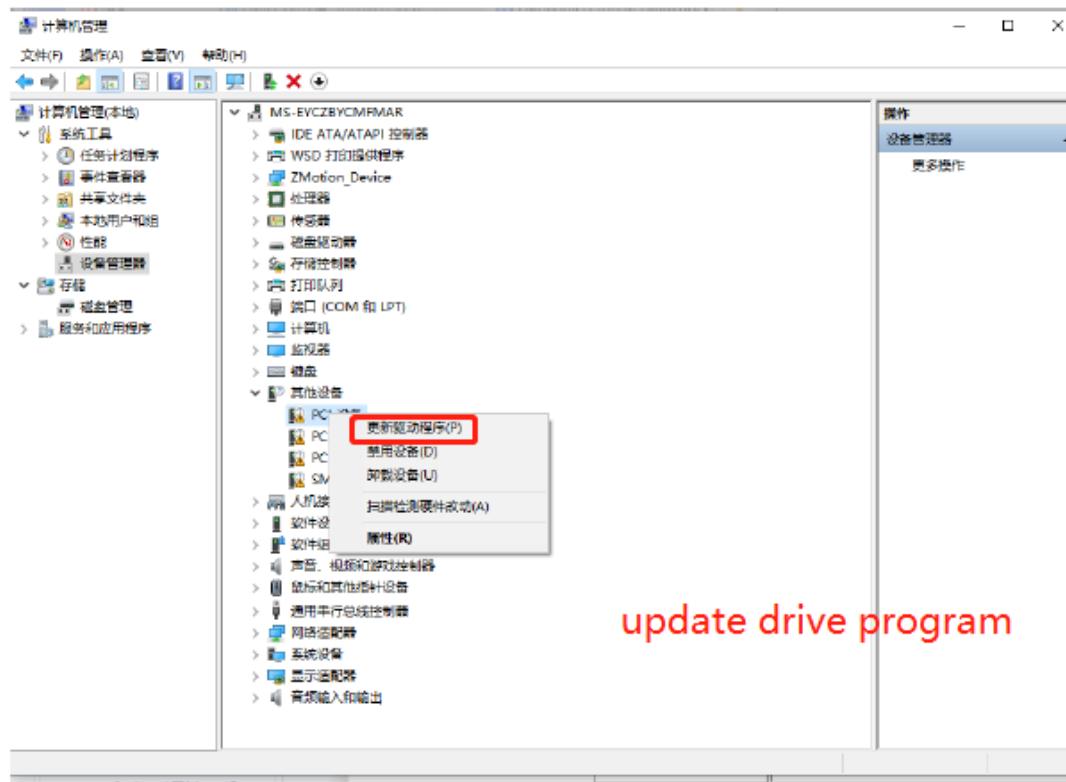
4. Select "browse my PC to check drive program".
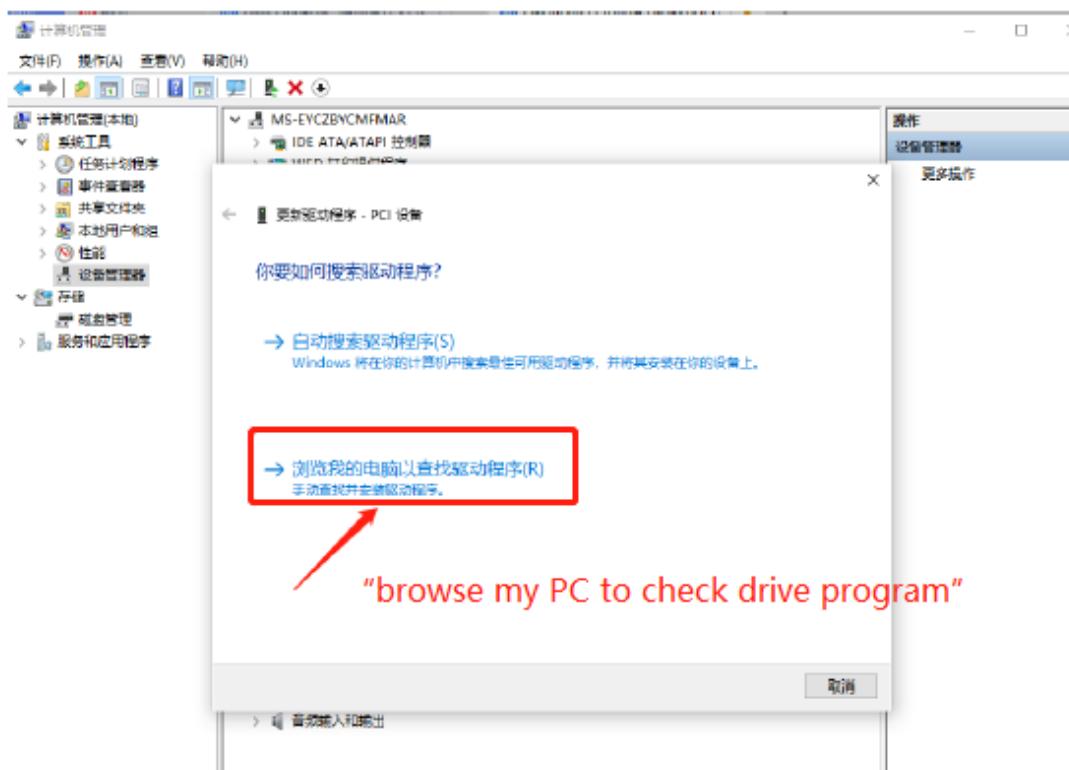
5. Click "browse", and select driver folder of RT750 drive.
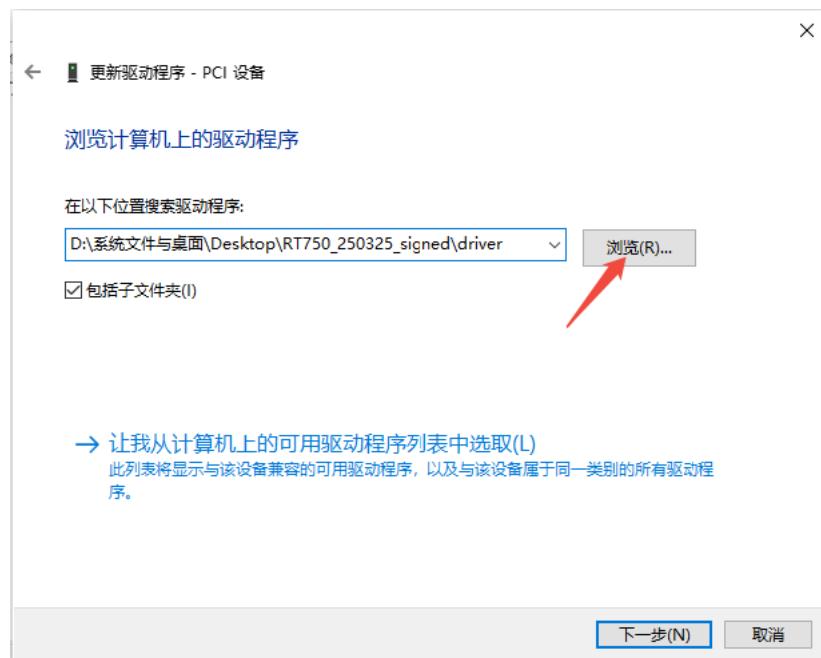
6. Click "next step".

7. Wait until installed, click close.
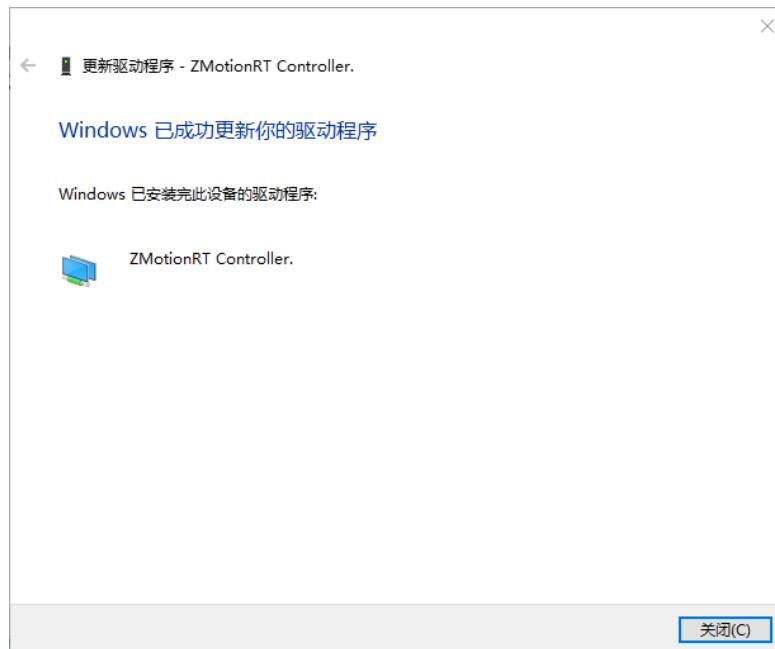
8. If there is ZMotionRTController in the device manager, the installation is successful.
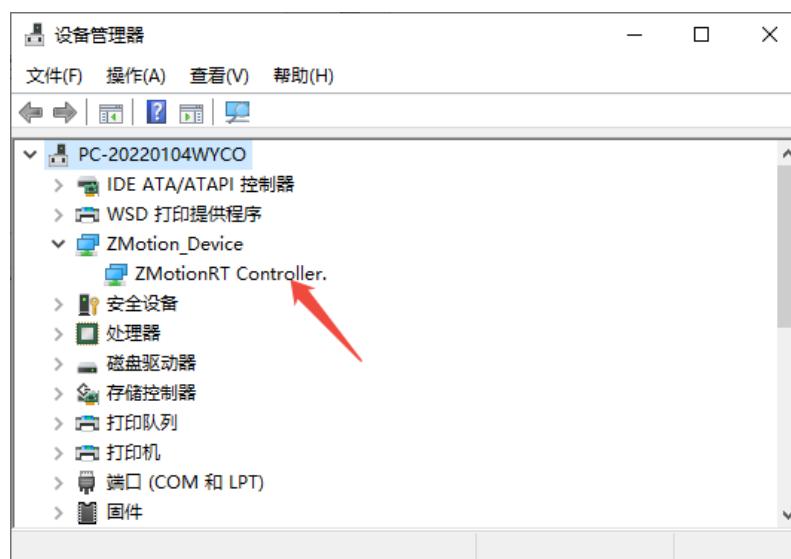
7.2. How to Unload MotionRT750

1. Before that, stop MotionRT7, and close software program.

2. Find ZmotionRT Controller from device manager, right click "Uninstall Device"
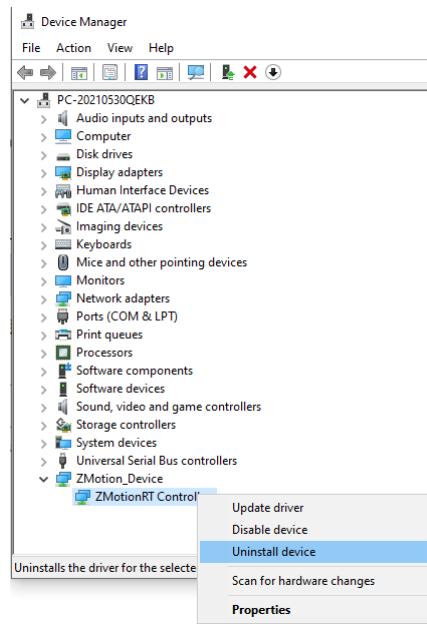
3. Check "delete this device's drive program software", then click "uninstall".

4. Click "action" again, find "scan for hardware changes", PCI device shown in other devices = uninstalled successfully.

7.3. How to Use One Single Card / Multi-Card

1. Insert motion control card into IPC (please operate it when power off).

2. When there are several cards, you can set card ID No. in advance. For single one, skip this step.

3. Install drive and MotionRT750 software.

4. Right-click and select "Run as Administrator" to open configtool.exe (included in the MotionRT750 installation package) to enter the CPU configuration. Generally, the reserve setting is set to 1 by default and does not need to be changed. Simply click

"Config" to confirm the setting. The CPU config setting is displayed as default and generally does not need to be changed. Simply click "OK".

[How to disable Hyper-Threading Technology varies depending on the brand or system. Please search for the corresponding method on the web.]

➢ Notes:

● The corresponding version of the driver must be installed before execution.

● The console program must be closed before execution.

● It needs administer permission.

● MotionRT750 can't be used without CPU configuration. If don't use MotionRT750, please set reserve as 0, and click "ClearSet" to clear configurations, restart the PC.
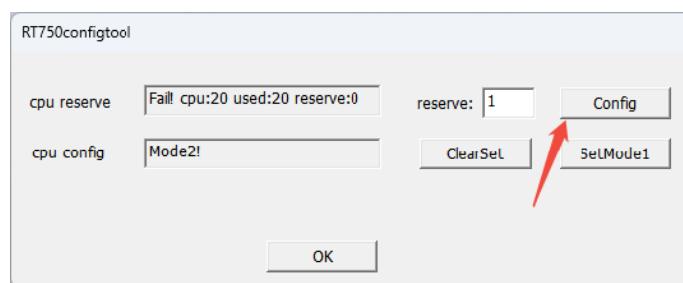
"configtool" -- not be configured
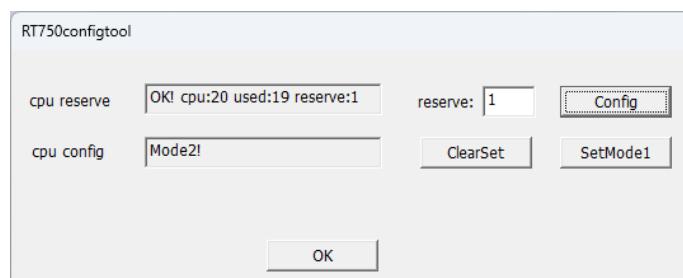
"configtool" -- be configured successfully

5. Click OK and the following window will pop up. Select "Yes" to restart the PC immediately. (This step may not be supported on some computers. If the computer becomes unresponsive or freezes when running software after restarting, or other applications become unusable, the computer may not support MotionRT750. You can use MotionRT710 instead.)

➢ Note: The CPU configuration will take effect only after restarting the computer!!!
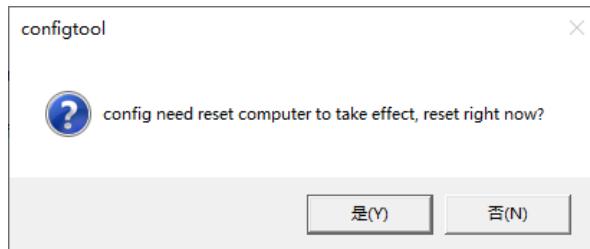
6. After restarting, open and run MotionRT750.exe (if it prompts CPU configuration error, please check steps 4 and 5)

7. Configure parameters reasonably in RT console.

8. Start: after configuring the parameters -- save -- click the Start button to start the RT software. To change the configuration parameters, you need to stop and then start the RT again.

9. Connect to card by LOCAL / IP, then download into card.

Chapter VIII Programming

8.1. Program in RTSys Software
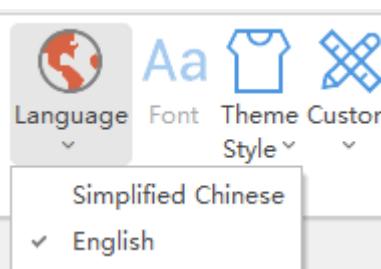
RTSys is a PC-side program development, debugging and diagnostic software for the Zmotion motion controllers. Through it, users can easily edit and configure the controller program, quickly develop applications, diagnose system operating parameters in real time, and debug the running program in real time. What's more, it supports Chinese and English bilingual environments.

In RTSys, there are 4 programming languages for motion control development, Basic, PLC, HMI and C language, they can run multi-tasks among them, especially for Basic, multi-task running can be achieved separately, hybrid programming is also OK with PLC, HMI and C language.
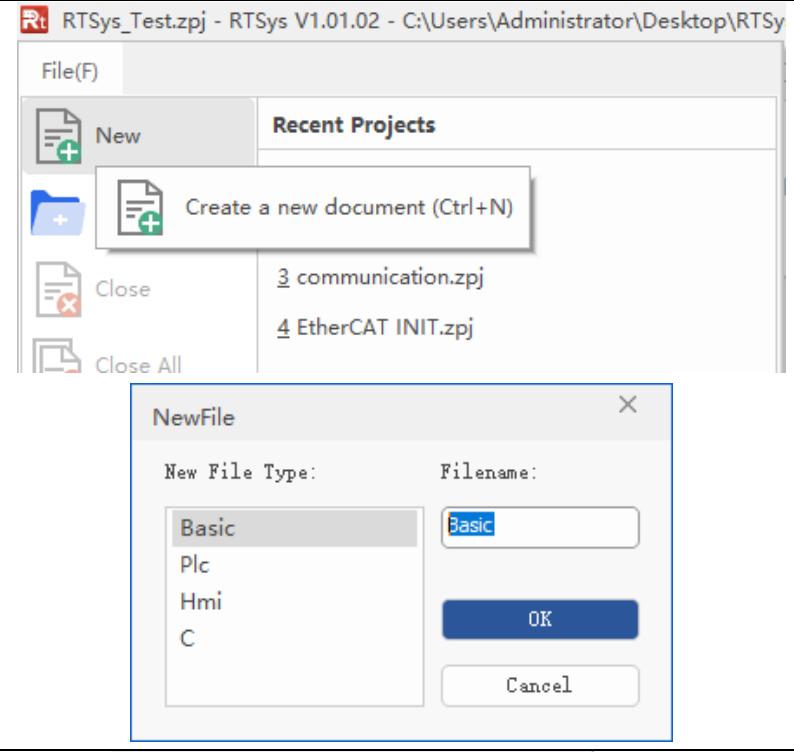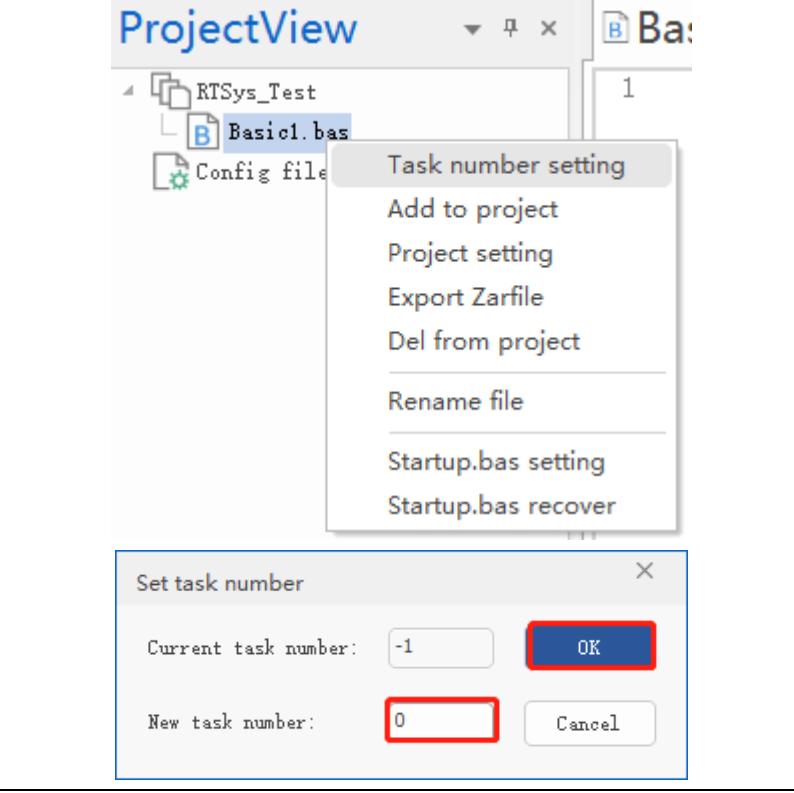
RTSys Downloading Address: https://www.zmotionglobal.com/pro_info_282.html
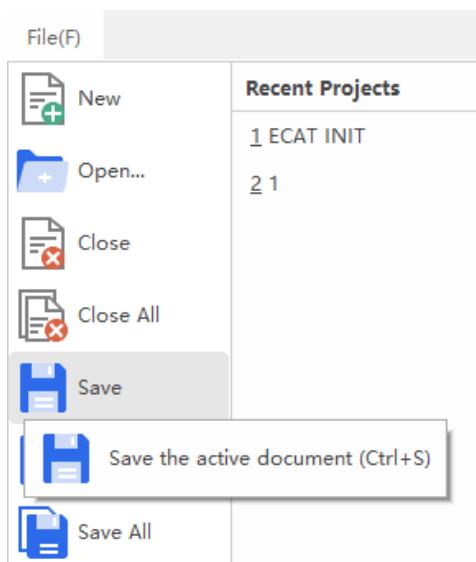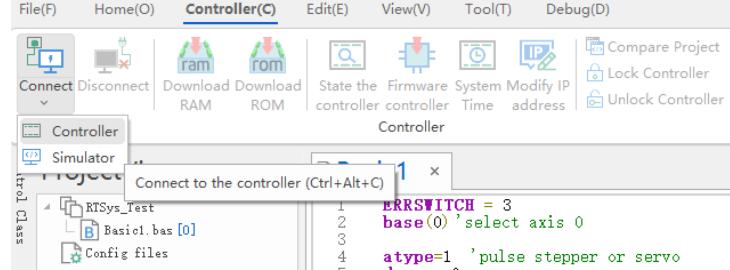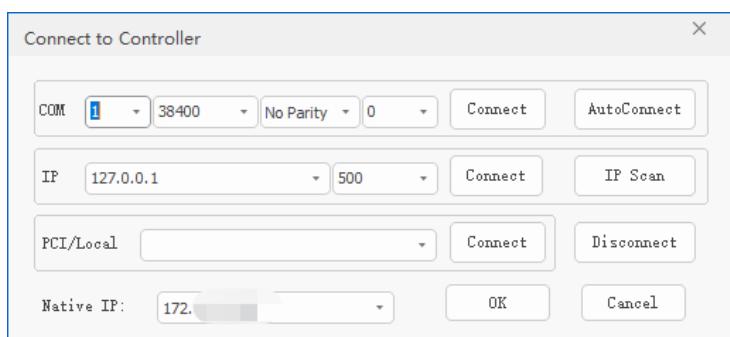
And related manuals can be found in "Download":
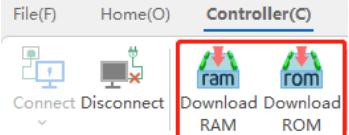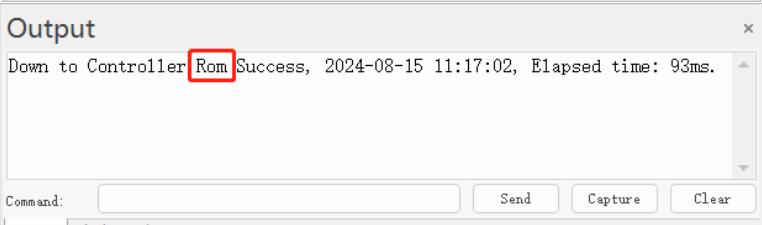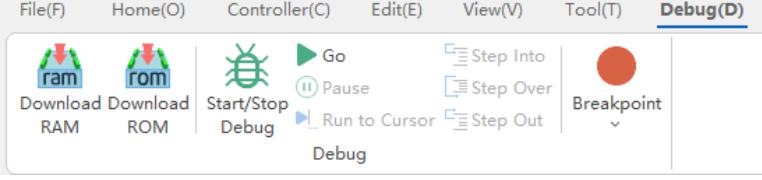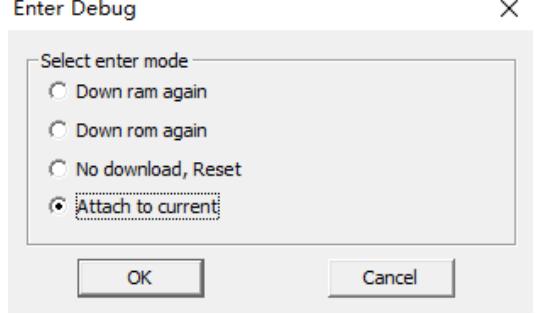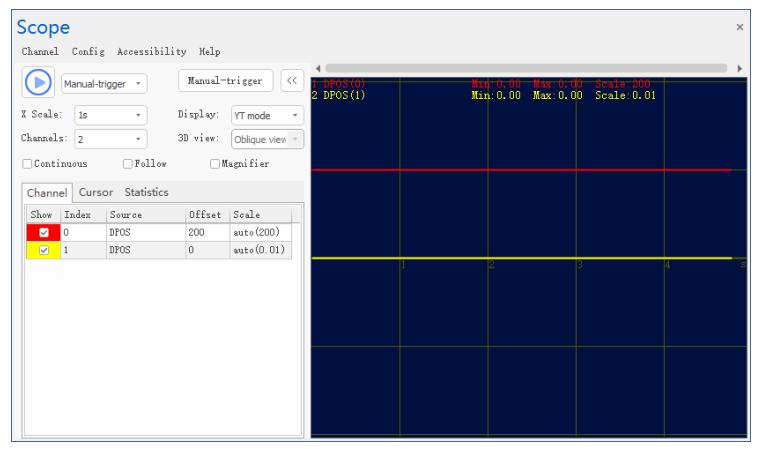
Name	Version No	Format	Size	Download
RTSys Development Software	V1.2.02	RAR	148MB	Download
RTSys User Manual V1.2.0	V1.2.0	PDF	5.33MB	Download
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Quick Start	VQuick Start	ZIP	16.1MB	Download
ZVision Basic Programming Manual V1.3.0	V1.3.0	PDF	10.6MB	Download
ZPLC	V1.0	PDF	1.7M	Download

Step	Operations	Display Interface
1	Switch the Language: "Language" – "English", then there will pop	

	up one window, click OK, and restart it.	Language Switch Video Showing:
2	New Project: "File" – "New Project", Save as window will pop up, then enter file name, save the project file with suffix "zpj.".	

3	New File: "File" – "New File", select file type to build, here select Basic, click "OK".	
4	Set Auto Run No.: right click the file, open task number setting window, enter task No., which can be any + value, no priority, but not the same.	

5	Save File: edit the program in program editing window, click "save", new built file will be saved under "zpj." project automatically. "Save all" means all files under this project will be saved.	
6	Connection: Click "controller – connect", if no controller, select connect to simulator.	
	Then, "connect to controller" window will pop up, you can select serial port or net port to connect, select matched serial port parameters or net port IP address, then click "connect".	
7	Download Program into	● **RAM:** it will not save when power off. ● **ROM:** it will save data when power off, and when the program

	Controller: "Ram/Rom" – "download RAM / download ROM", if it is successful, there is print indication, at the same time, program is downloaded into controller and runs automatically.	is connected to controller again, running according to task No.
8	Debug: "Debug" – "Start/Stop Debug" to call "Task" and "Watch" window, because it was downloaded before, here select "Attach the current".	
9	Scope function: Click "View" – "Scope" to open oscilloscope. It can capture needed data, for debugging.	

> **Notes:**
> ● When opening an project, choose to open the zpj file of the project. If only the Bas file is opened, the program cannot be downloaded to the controller.
> ● When the project is not created, only the Bas file cannot be downloaded to the controller.
> ● The number 0 in automatic operation represents the task number, and the program runs with task 0, and the task number has no priority.
> ● If no task number is set for the files in the entire project, when downloading to the controller, the system prompts the following message WARN: no program set autorun

8.2. Upgrade Controller Firmware

Firmware upgrade can be achieved by downloading zfm firmware package in RTSys. zfm file is the firmware upgrade package of controller, please select corresponding firmware because different models are with different packages, please contact manufacturer).

How to update:

a. Open ZDevelop / RTSys software, then click "controller – connect", find PCI/LOCAL method, click "connect". If connected, there will be "Connected to Controller: PCIE464 Version: 4.93 – 20231220." In "output" window.

b. Click "controller – state the controller", find basic info, then current software version can be checked.

c. Click "controller – update firmware", current controller model and software version can be viewed.

d. Click "browse", and select saved firmware file, click "update", then one window will pop up, please click "ok".

e. After that, "connect to controller" window appears again, and please select "PCI/Local" again, and click "connect".

f. When connection is successful, "firmware update" interface is shown. Now

system enters ZBIOS state, please click "update" again.

g. When it is loaded, "firmware update" window disappears, now in output window, it shows "Update firmware to Controller Success".

h. Do step a and step b again, check whether the firmware is updated or not.

8.3. Program in Host-Computer by PC Languages

The controller supports development under various operating systems such as windows, linux, Mac, Android, and wince, and provides dll libraries in various environments such as vc, c#, vb.net, and labview, as shown in the figure below. PC software programming refers to "Zmotion PC Function Library Programming Manual".
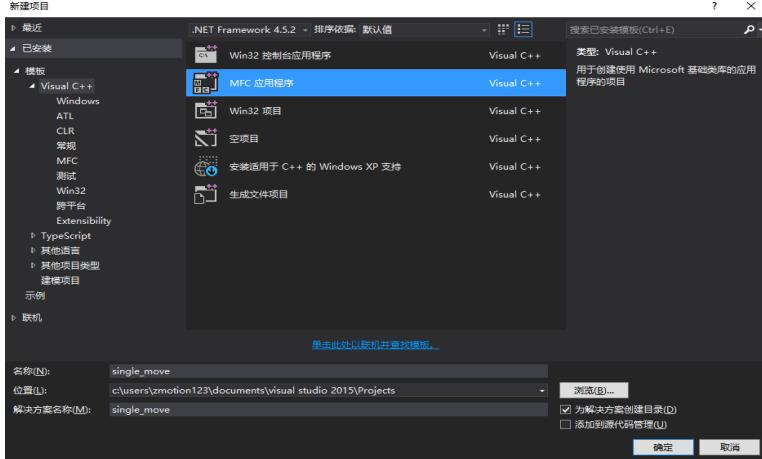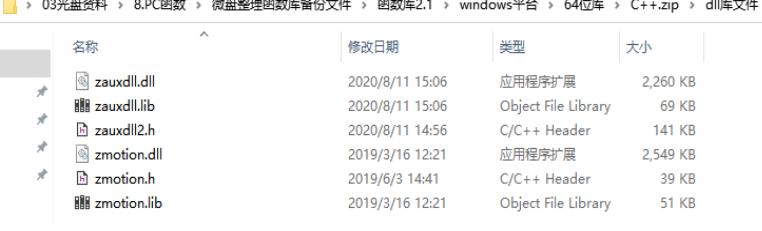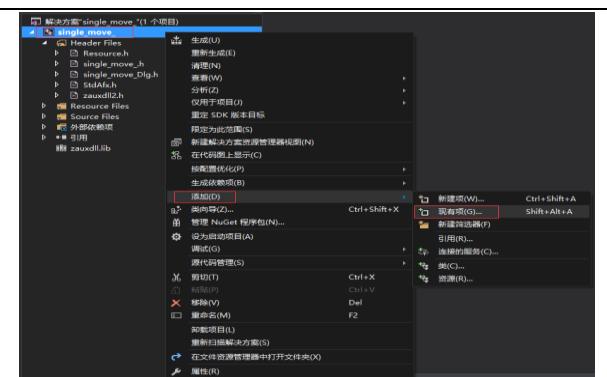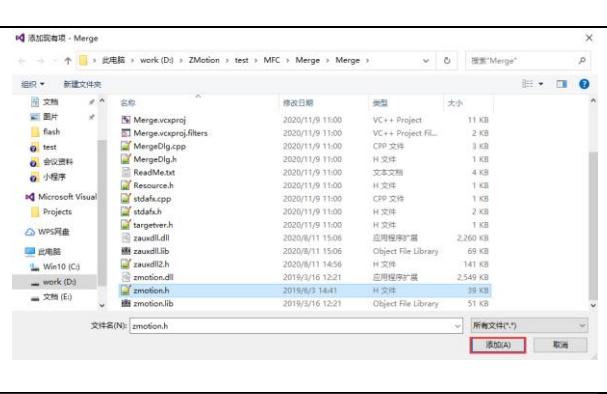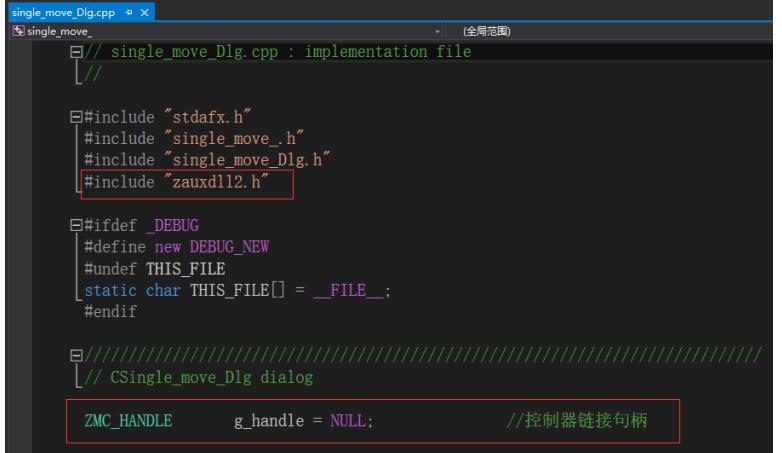

The program developed using the PC software cannot be downloaded to the controller, and it is connected to the controller through the dll dynamic library. The dll library needs to be added to the header file and declared during development.

● Get PC library file, example: https://www.zmotionglobal.com/download_list_17.html

The c++ project development process in VS is as follows:

Step	Operations	Display Interface
1	Open VS, click "File" – "New" – "Project".	
2	Select development language as "Visual C++" and the select program type as "MFC application type".	
3	Select "Based on basic box", click "next" or "finish"	
4	Find C++ function library provided by manufacturer. Routine is below (64-bit library)	
5	Copy all DLL related library files under the above path to the newly created project.	

6	Add a static library and related header files to the project. Static library: zauxdll.lib, zmotion.lib Related header files: zauxdll2.h, zmotion.h	1) Right-click the header file first, and then select: "Add" → "Existing Item".	
		2) Add static libraries and related header files in sequence in the pop-up window.	
7	Declare the relevant header files and define the controller connection handle, so far the project is newly created.		

Chapter VIII Run and Maintain

9.1. Regular Inspection and Maintenance

The working environment has an impact on the device. Therefore, it is usually inspected regularly based on the inspection cycle of 6 months to 1 year. The inspection cycle of the device can be appropriately adjusted according to the surrounding environment to make it work within the specified standard environment.

Check item	Check content	Inspection standards
Whole machine	Whether there is accumulation of garbage, dirt and dust on the surface.	Confirm whether the power distribution cabinet is powered off. Use a vacuum cleaner to remove garbage or dust to avoid touching the parts, if the surface dirt cannot be removed, wipe it with alcohol and let it dry and evaporate completely.
Cable	Whether the power line and connection are discolored. Whether the insulation layer is aged or cracked.	Replace cracked cables. replace damaged connection terminals.
Electromagnetic contactor peripheral	Whether the suction is not firm or makes abnormal noise during the action. whether there is a short circuit, water contamination, expansion, or rupture of peripheral devices	Replace abnormal components.
Air duct vent	Whether the air duct and heat sink are blocked. Whether the fan is damaged.	Clean the air duct. Change the fan.
Control circuit	Whether the control components are with poor contact. Whether the terminal screws	Clean the foreign objects on the surface of control lines and connection terminals. Replace damaged and corroded

are loose. Whether the control cables have insulation cracks.	control cables.

9.2. Common Problems

Problems	Suggestions
Motor does not rotate.	10. Check whether the ATYPE of the controller is correct. 11. Check whether hardware position limit, software position limit, alarm signal work, and whether axis states are normal. 12. Check whether motor is enabled successfully. 13. Confirm whether pulse amount UNITS and speed values are suitable. If there is the encoder feedback, check whether MPOS changes. 14. Check whether pulse mode and pulse mode of drive are matched. 15. Check whether alarm is produced on motion controller station or drive station. 16. Check whether the wiring is correct. 17. Confirm whether controller sends pulses normally.
Controller works normally, and pulses are sent normally, but motor doesn't rotate.	1. Check whether the connection between driver and motor is correct, and whether the wiring between driver and controller is good contact. 2. Please ensure driver works normally, no warning appeared.
Motor can rotate, but it works abnormally.	1. Check whether set deceleration and speed exceed the equipment limit. 2. Check whether output pulse frequency exceeds driver receive limit. 3. Check whether controller and driver are grounded correctly, and whether anti-interference is well done. 4. The current limiting resistor used in the photoelectric isolation circuit of the pulse and direction signal

	output is too large, but the working current is too small.
It can control motor, but motor appears vibration or overshoot.	1. Driver parameter configuration may be incorrect, check driver parameters. 2. Set improper acceleration and deceleration time and motion speed.
No signal comes to the input.	1. Check whether the limit sensor is working normally, and whether the "input" view can watch the signal change of the limit sensor. 2. Check whether the mapping of the limit switch is correct. 3. Check whether the limit sensor is connected to the common terminal of the controller.
The output does not work.	1. Check whether IO power is needed. 2. Check whether the output number matches the ID of the IO board.
Fail to connect controller to PC through net port.	1. Whether net port led is ON? 2. Whether DC net cable is used but PC doesn't support automatic wiring. 3. Whether controller IP address is modified. 4. Whether IP address of PC network card and controller are in the same network segment.
XPCIE card can not be found.	1. Whether specified drive is installed. 2. Is the XPCIE card inserted properly and the baffle is fixed with screws? 3. Is the XPCIE card inserted before the computer is turned on?