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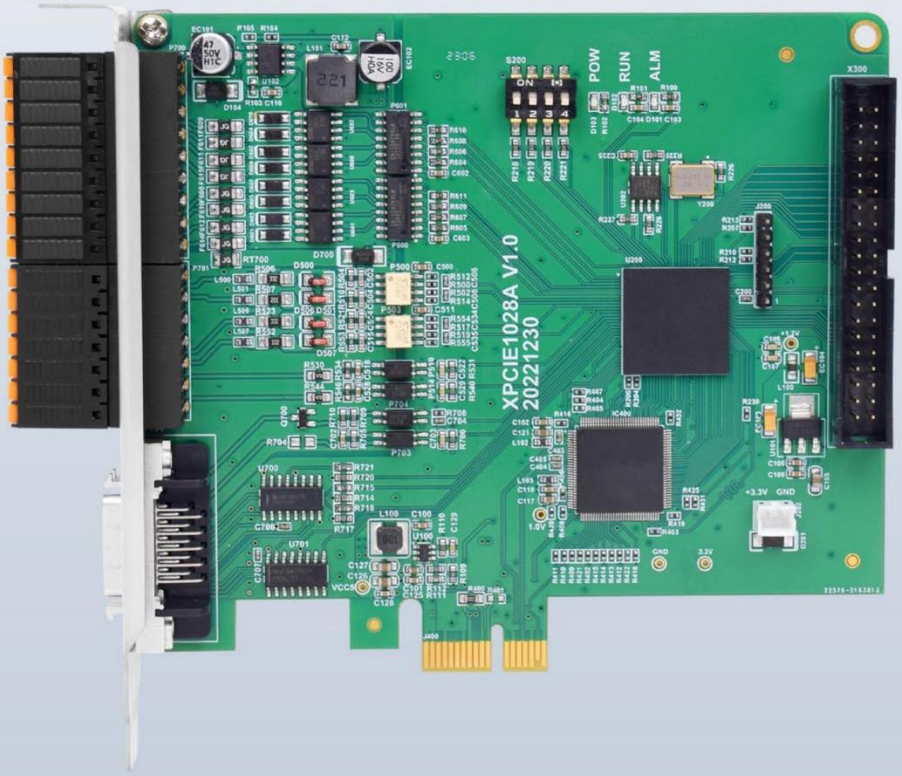
Better Motion Control, Smarter Life

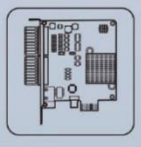
PCIE EtherCAT Motion Control Card

XPCIE1028




Vision Motion Controller


Motion Controller


Motion Control Card


IO Expansion Module


HMI

Statement

Thank you for choosing our Zmotion products. Please be sure to read this manual carefully before use so that you can use this product correctly and safely. Zmotion is not responsible for any direct or indirect losses caused by the use of this product.

The information in this manual is for reference only. Due to design improvements and other reasons, Zmotion reserves the right of final interpretation of this information! Contents are subject to change without prior notice!

➢ 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. Product Information

XPCIE1028 motion control card is a kind of new type XPCIE bus control card. It can control multiple step motors or digital servo motors.

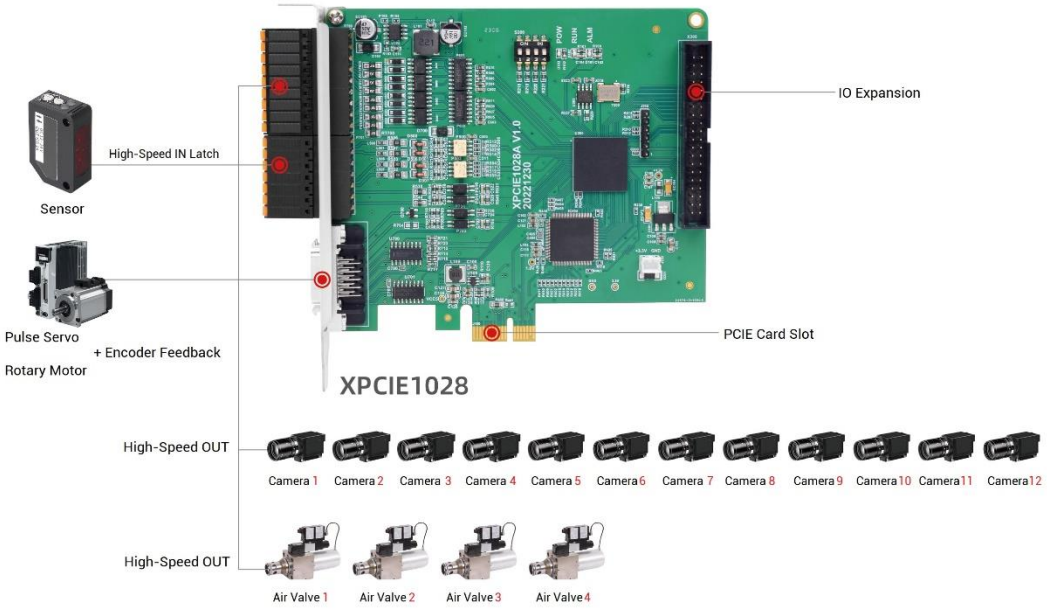
XPCIE1028 motion control card has many functions, such as, multi-axis point to point motion, interpolation, trajectory planning, handwheel control, encoder position detection, IO control, position latch, etc.

[PC Hardware Requirements]

- CPU benchmark i5-4 generation 4 cores or above
- Main frequency not lower than 2GHZ
- Running memory above 8G and hard disk above 256M.

Note: XPCIE1028 motion control cards need to be used with MotionRT7 (MotionRT7 is the software kernel).

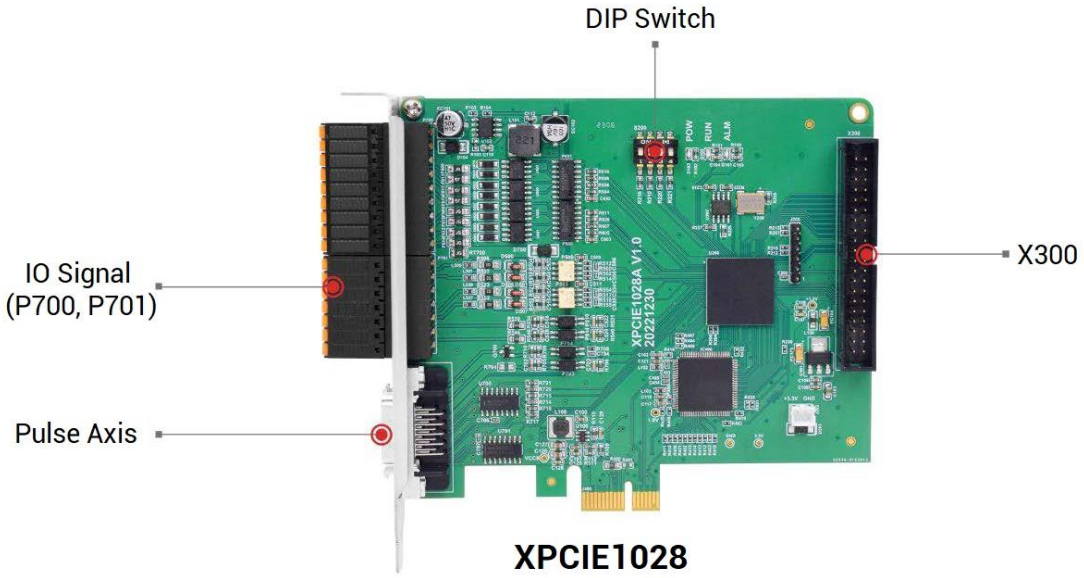
1.2. System Structure



1.3. Functional Features

- Support 4 axes motion control (standard).
- Pulse output mode: pulse / direction
- Support encoder position measurement, which can be configured as handwheel input mode.
- Maximum pulse output frequency of pulse axis is 10MHZ.
- Support 8 high-speed inputs and 4 latch inputs, support 16 high-speed outputs and 4 PWM outputs.
- The maximum output current of general digital outputs can reach 300mA, which can directly drive some kinds of solenoid valves.
- Support linear interpolation, arbitrary circular interpolation, helical interpolation and continuous interpolation.
- Support electronic cam, electronic gear, position latch, synchronous follow, virtual axis and other functions.
- Support pulse closed loop, pitch compensation and other functions.
- Support multi-file and multi-task programming in Basic.
- A variety of program encryption methods to protect the intellectual property rights of customers.

1.4. Interface Definition



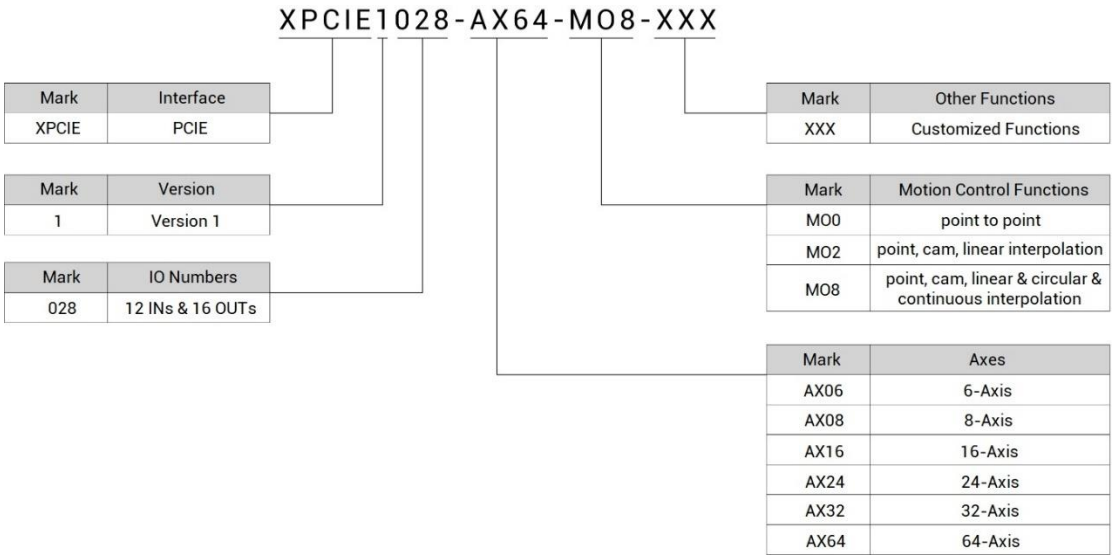
Mark	Interface	Numbers	Description
POW	State Indication Led	1	Power Led: ON when power connected
RUN		1	Run Led: ON when running normally
ALM		1	Error Led: ON when running abnormally
P700	IO Signal	1	Multi-function OUT signals: power IN, pulse signal OUT
P701	IO Signal	1	Multi-function IN signals: power OUT, encoder signal IN
P706	Local Axis	1	Include differential pulse output, encoder feedback, and IO signals.
X300	Signal	1	IO control signal. For more, please purchase ACC37 adapter board.

Chapter II Product Specification

2.1. Basic Specification

Item	Description
Model	XPCIE1028
Basic Axes	4 axes (standard), use License to configure according to requirements.
Type of Basic Axes	Local pulse axes
Digital IO	There are 30 inputs and 34 outputs (with overcurrent protection), and 8 are high-speed inputs, 16 are high-speed outputs.
Highest Pulse Frequency	10MHz
Power Supply Input	24V DC input
Dimensions	120*106mm

2.2. Nameplate & Models



2.3. Software Optional Configurations

The description of the optional configuration of software functions is shown in the form below: the selection of the number of axes, the selection of motion control functions, and the selection of other functions (PSO, vision, manipulator functions can be reselected).

Interface	Optional Functions	Definition Description
License Parameter	Frame	R1: suit to ordinary robots
	Robot	R6: 6-joint robots & special structure robots.
	NcGcode	NC: suit to NC G code function.
	ZVision	ZV: suit to vision instruction and function.
	HW	HW: suit to HW hardware comparison output function, refer to high-speed output channel numbers selection.
	Motor	Select according to actual axes, the value set of axis needs to be larger than the number of axes used. 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.
	Motion	Valid motion control functions: MOO: point to point MO2: point to point, electronic cam, linear interpolation. MO8: point to point, electronic cam, linear interpolation, circular interpolation, continuous interpolation.

2.4. Connection Configuration

External equipment / software configuration:

- Main computer / industrial control computer, wired-mouse & keyboard.
- Displayer
- Win10 operating system professional edition, RTSys 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 PC upper computer development languages (C++ / C# / LabView / Python…), also please 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. You need to download it by yourself.

Chapter III Wiring & Communication

3.1. IO Power Interface

Power input of IO signal terminal uses DC24V power supply, it is connected through PIN1 (E24V) and PIN2 (EGND).

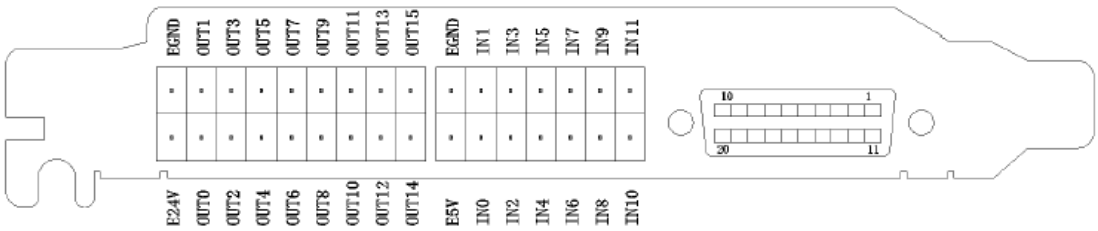
If ACC37-7103 wiring board is used together, which also needs to be supplied by DC24V power, and it is connected through PIN66 (EGND) and PIN67 (E24V) of the 5.08mm screw-type wiring terminal.

→ Specification:

Item	Description
Voltage	DC24V (-5%~5%)
The current to open	≤0.5A
The current to work	≤0.4A
Anti-reverse connection	Yes
Overcurrent Protection	Yes

3.2. IO Signal Interface

P700 and P701 are main interfaces for motion control and IO signal control of XPCIE1028. Below shows P700 and P701 signal terminal:



3.2.1. Terminal Definition

→ Terminal Definition

Pin	Name	Description	Pin	Name	Description
1	E24V	IO power 24V IN	19	E5V	5V power output
2	EGND	IO power ground / IO public end	20	EGND	5V power ground / IO public end
3	OUT0	High-speed output 0, PWM 0	21	IN0	High-speed input 0, latch R0
4	OUT1	High-speed output 1, PWM 1	22	IN1	High-speed input 1, latch R1
5	OUT2	High-speed output 2	23	IN2	High-speed input 2, latch R2
6	OUT3	High-speed output 3	24	IN3	High-speed input 3, latch R3
7	OUT4	High-speed output 4	25	IN4	High-speed in 4, encoder EA1
8	OUT5	High-speed output 5	26	IN5	High-speed in 5, encoder EB1
9	OUT6	High-speed output 6	27	IN6	High-speed in 6, encoder EZ1
10	OUT7	High-speed output 7	28	IN7	High-speed output 7
11	OUT8	High-speed output 8	29	IN8	Input 8
12	OUT9	High-speed output 9	30	IN9	Input 9
13	OUT10	High-speed output 10	31	IN10	Input 10
14	OUT11	High-speed output 11	32	IN11	Input 11
15	OUT12	High-speed output 12			
16	OUT13	High-speed output 13			
17	OUT14	High-speed output 14, single-ended DIR1			
18	OUT15	High-speed output 15, single-ended PUL1			

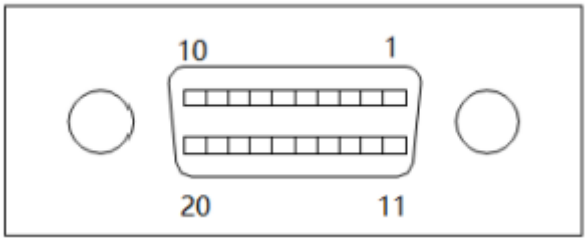
Note:

- Pay attention to the positive and negative poles of the IO power supply of XPCIE1028 to avoid burning the IO port.
- The maximum load of 5V power output is 300mA, don't connect to the load with large power to avoid damage.
- The maximum output current of XPCIE1028 is 300mA, which can be directly connected to most of loads. Please calculate the current.
- The IO port of XPCIE1028 is an isolated IO port, please input the power supply of the IO port

from EGND and E24V.

3.3. P706 Signal Interface

P706 is the main interface controlled by the motor. It supports 1 differential pulse outputs, and there is one differential encoder feedback.



3.3.1. Local Axis Terminal Definition

→ Terminal Definition

Pin	Name	Description	Pin	Name	Description
1	EZ0+	Encoder input	11	VCC5	Internal power output
2	EZ0-	Encoder input	12	DIR0+	Servo direction output
3	EB0+	Encoder input	13	DIR0-	Servo direction output
4	EB0-	Encoder input	14	GND	Internal ground
5	EA0+	Encoder input	15	PUL0-	Servo pulse output
6	EA0-	Encoder input	16	PUL0+	Servo pulse output
7	GND	Internal ground	17	GND	Internal ground
8	ALM_0/IN28	Drive alarm	18	CLR_0/OUT33	Alarm clear
9	INP_0/IN29	On-position signal	19	ENA_0/OUT32	Drive enable
10	EGND	Axis IO public end	20	E24V	+24V output

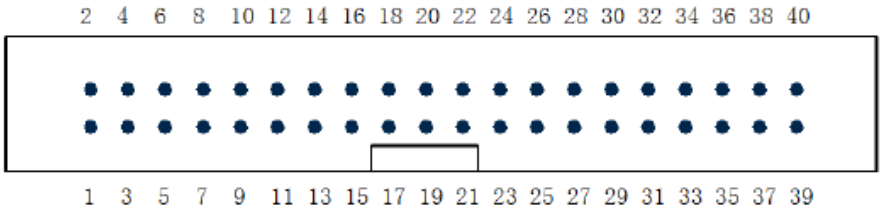
Note:

- ALM_0, INP_0, CLR_0 and ENA_0 are specialized for IO, not recommend to be as normal IO, and they don't have overcurrent protection.

3.4. X300 Signal Interface

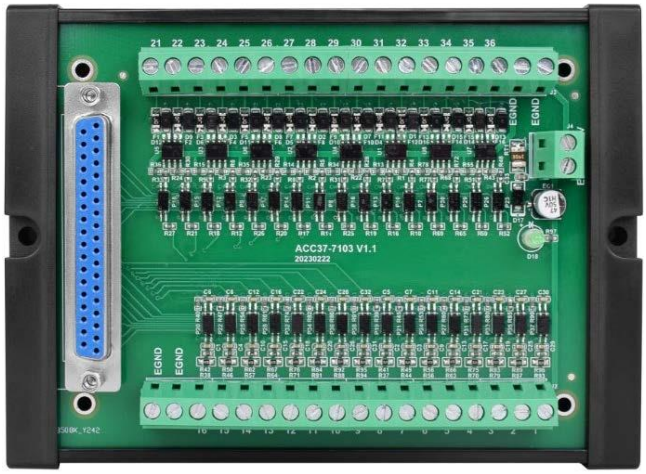
X300 interface is IO signal control interface, using ACC37-7103 adapter board to connect to external equipment, this adapter board is optional for more IOs. And it needs to be supplied by DC24V.

→ Interface Appearance



3.4.1. ACC37 Wiring Board

ACC37 is the wiring board of X301 signal, using adapter board and DB37 to connect X301.



3.4.2. Wiring Board Terminal Definition

Pin	Name	I/O	Function
1	IN12	I	Non-isolated general input signal 12
2	IN13	I	Non-isolated general input signal 13

3	IN14	I	Non-isolated general input signal 14
4	IN15	I	Non-isolated general input signal 15
5	IN16	I	Non-isolated general input signal 16
6	IN17	I	Non-isolated general input signal 17
7	IN18	I	Non-isolated general input signal 18
8	IN19	I	Non-isolated general input signal 19
9	IN20	I	Non-isolated general input signal 20
10	IN21	I	Non-isolated general input signal 21
11	IN22	I	Non-isolated general input signal 22
12	IN23	I	Non-isolated general input signal 23
13	IN24	I	Non-isolated general input signal 24
14	IN25	I	Non-isolated general input signal 25
15	IN26	I	Non-isolated general input signal 26
16	IN27	I	Non-isolated general input signal 27
17	-	-	-
18	-	-	-
Pin	Name	IO	Function
21	OUT16	O	Non-isolated general output signal 16
22	OUT17	O	Non-isolated general output signal 17
23	OUT18	O	Non-isolated general output signal 18
24	OUT19	O	Non-isolated general output signal 19
25	OUT20	O	Non-isolated general output signal 20
26	OUT21	O	Non-isolated general output signal 21
27	OUT22	O	Non-isolated general output signal 22
28	OUT23	O	Non-isolated general output signal 23
29	OUT24	O	Non-isolated general output signal 24
30	OUT25	O	Non-isolated general output signal 25
31	OUT26	O	Non-isolated general output signal 26
32	OUT27	O	Non-isolated general output signal 27
33	OUT28	O	Non-isolated general output signal 28
34	OUT29	O	Non-isolated general output signal 29
35	OUT30	O	Non-isolated general output signal 30
36	OUT31	O	Non-isolated general output signal 31
37	-	-	-

38	-	-	-

3.5. IN: Digital Input

Digital inputs are distributed in P701 (IN0-IN7) and X300 (IN8-IN27) signal interfaces.

3.5.1. Digital Input Specification & Wiring

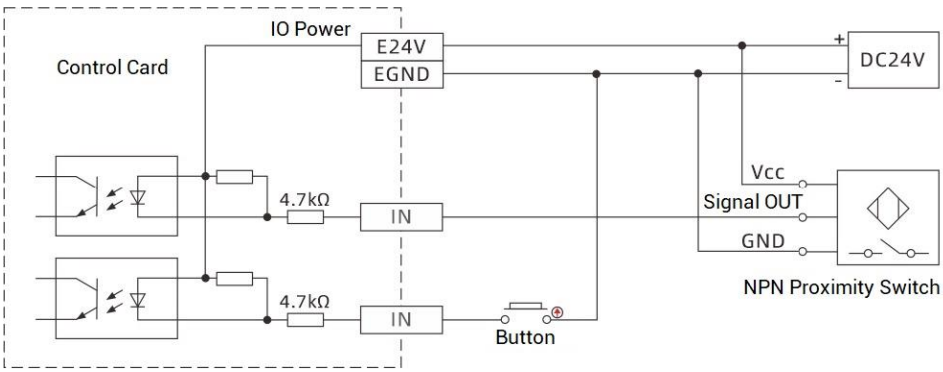
→ Specification

Item	High-speed input (IN0-IN7)	Low-speed input (IN8-IN27)
Input method	NPN type	NPN type
Voltage level	DC24V (-5%~+5%)	DC24V (-5%~+5%)
Current	6.8mA	4.8mA
Voltage to open	<15V	<14.5V
Min current	2.3mA	1.8mA
Impedance	3.3Ω	4.7Ω
Isolation	optoelectronic isolation	optoelectronic isolation
The times in the form are typical based on the resistive load, and may change when the load circuit changes.		

→ Wiring Reference

A. General input:

XPCIE1028 motion control card provides isolated general input signals, which can be used for input signals of switches, sensors or other devices.



→ Wiring Note

- The wiring principle of high-speed digital input IN (0-7) and low-speed digital input IN (8-23) is shown in the figure above. The external signal source can be an optocoupler, a key switch or a sensor, etc., all can be connected as long as the requirements on output of electric level can be achieved.
- For the public end, please connect the "EGND" port on the IO terminals to the "COM" terminal of the external input device. If the signal area power supply of the external device and the power supply of the controller are in the same power supply system, this connection also can be omitted.

3.5.2. Basic Usage Method

(1) Please follow the above wiring instructions to wiring correctly.

(2) After powered on, please connect to RTSys.

(3) State values of corresponding input can be read directly through “IN” command or through “RTSys/Tool/In”.

3.6. OUT: Digital Output

Digital outputs are distributed in P700 (OUT0-OUT15) and X300 (OUT16-OUT31) signal interfaces.

3.6.1. Digital Output Specification & Wiring

→ Specification

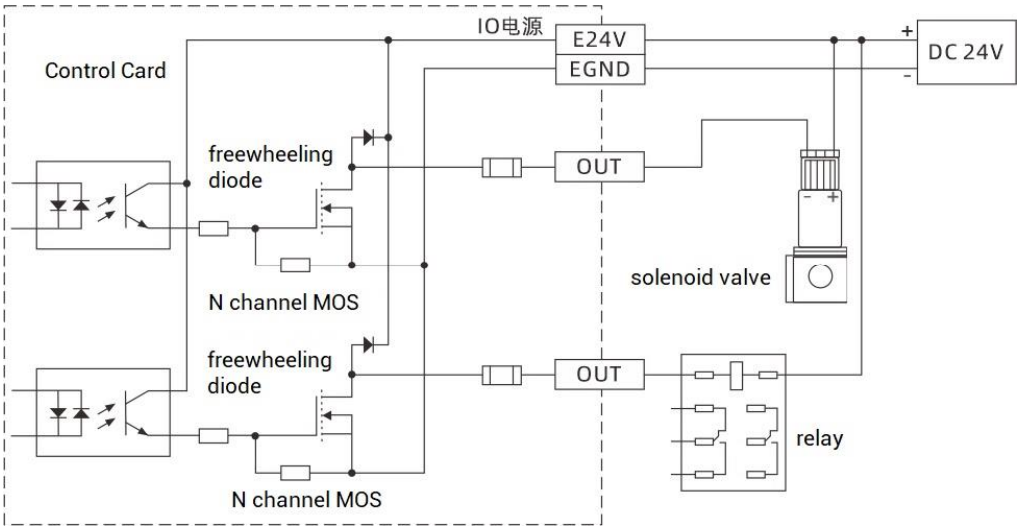
Item	High-speed output (OUT0-15)	Low-speed output (OUT16-31)
Output method	NPN type, it is 0V when outputs.	
Frequency	<500kHz	<8kHz
Voltage level	DC24V	DC24V

Max Output Current	+300mA	+300mA
Max leakage current when off	25μA	25μA
Respond time to conduct	1μs (typical value of resistive load)	12μs
Respond time to close	3μs	80μs
Overcurrent protection	Support	Support
Isolation	capacitive isolation	optoelectronic isolation

Note:

- ✧ The times in the form are typical based on the resistive load, and may change when the load circuit changes.
- ✧ Due to the NPN output, the shutdown of the output will be obviously affected by the external load circuit, and the output frequency should not be set too high in the application. For low-speed output, it is recommended to be lower than 8HKz. If there needs higher speed, please contact us to adjust parameter or custom hardware.

→ Wiring Reference



→ Wiring Note

- The wiring principle of high-speed digital output OUT (0-15) and low-speed digital input OUT (16-31) is shown in the figure above. The external signal source can be an optocoupler, a relay or a solenoid valve etc., all can be connected as long as the input current is not more than 300mA.
- For the public end, please connect the "EGND" port on the IO terminal to the negative

pole of DC power supply of external input device. If the signal area power supply of the external device and the power supply of the controller are in the same power supply system, this connection also can be omitted.

- The E24V port is the freewheeling clamp port of this part of the digital output port. When this port is suspended, each output port will not have the freewheeling function. It needs to be connected to the positive pole of the load power supply to enable this function.
- The E5V port is a 5V power output port, which can be used when some loads that need to provide an external 5V power input, and the maximum current is 300mA.

3.6.2. Basic Usage Method

1. Please follow the above wiring instructions to wiring correctly.
2. After powered on, please connect to RTSys
3. Open or close output port directly through “OP” command, also, it can be opened or closed through “RTSys/Tool/Op”. Please refer to “Basic” for details.

3.7. Pulse Axis Specification & Wiring

P706 is a differential pulse output interface with encoder feedback, and the drive is connected through SCSI20 plug.

Part of the output ports of the IO signal terminal are multiplexed with single-ended pulse output function.

Part of the input ports of the IO signal terminal are multiplexed with single-ended encoder input function.

3.7.1. Single-ended Axis Interface Specification & Wiring

Single-ended axis (single-ended pulse and single-ended encoder) interface locate in IO signal terminal.

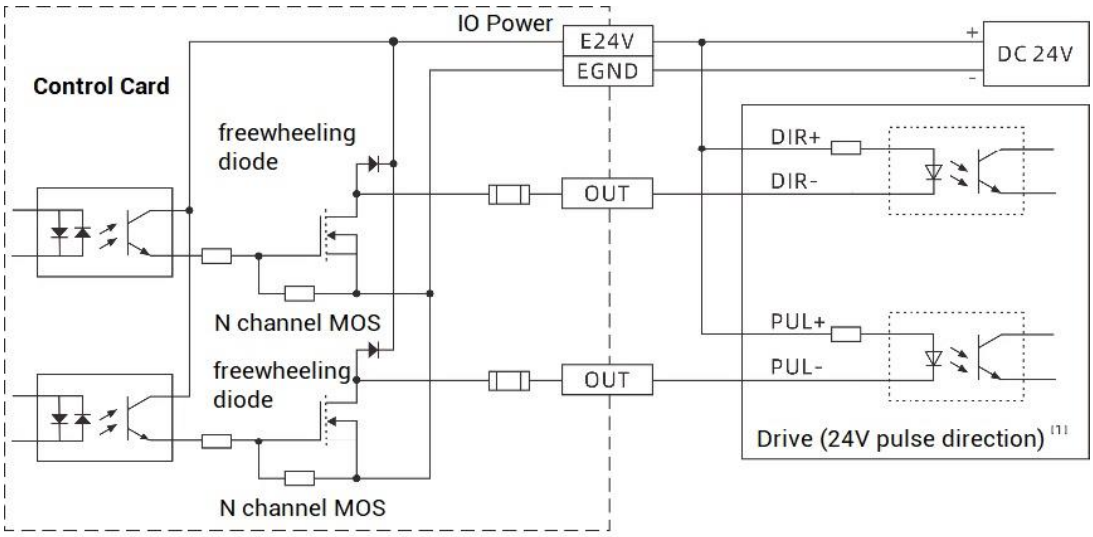
→ Specification

Item	Description
Pulse/direction (PUL/DIR) signal type	Single-ended output signal
Pulse/direction (PUL/DIR) signal voltage range	0-24V
Pulse/direction (PUL/DIR) signal max frequency	500kHz
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	500kHz
Isolation	Isolated

→ Wiring Reference

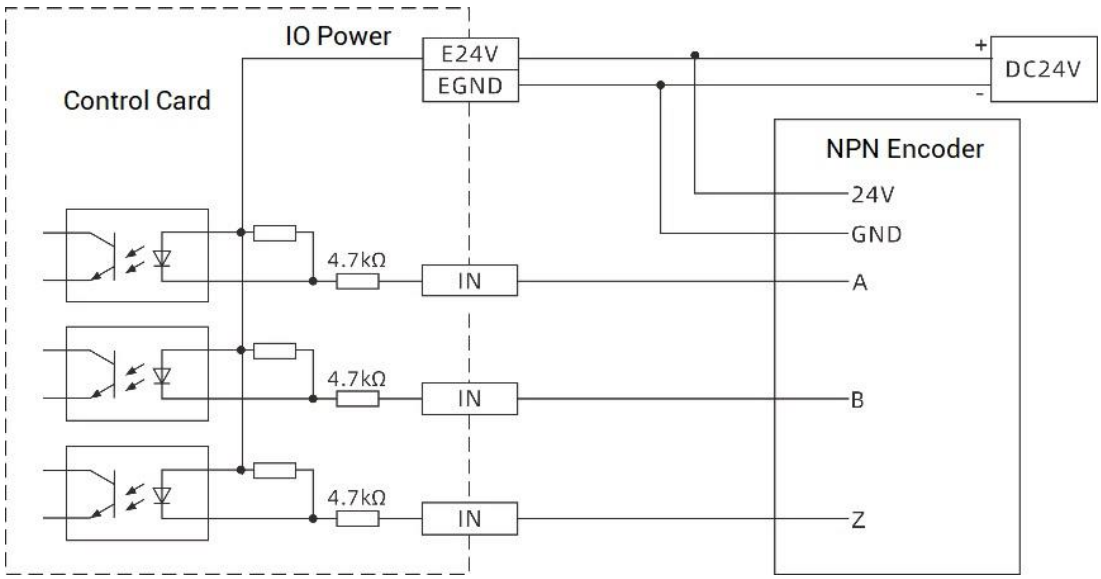
The wiring between the driver and the controller needs to connect the PUL and DIR terminals one by one, using single-ended wiring.

1. Single-ended pulse wiring reference:



Note [1]: for 5V pulse directional interface, please connect PUL+ and DIR+ to E5V.

2. Single-ended encoder wiring reference:



3.7.2. Local Axis Interface Specification & Wiring

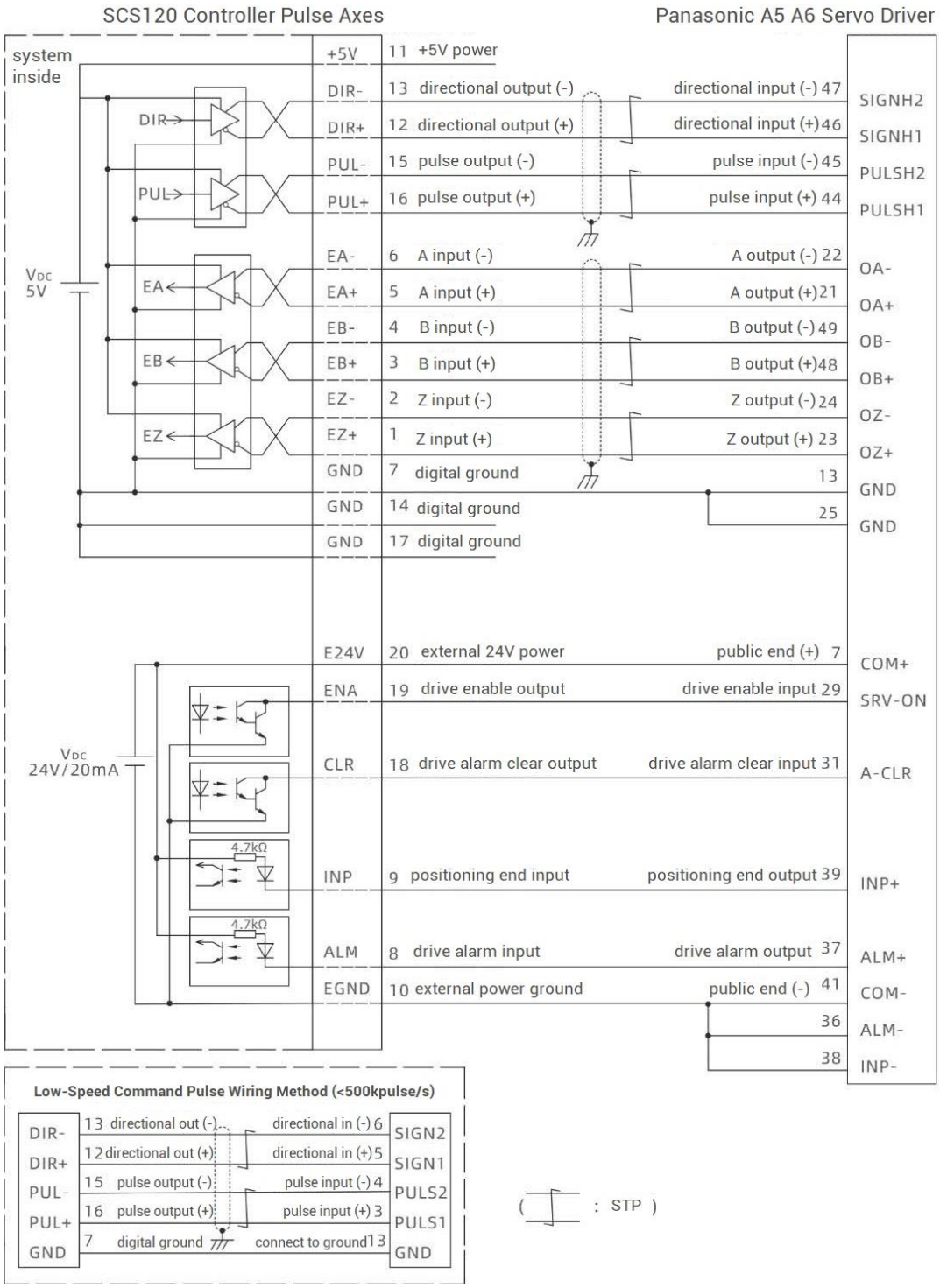
P706 is a differential pulse output interface with encoder feedback, and the drive is connected through SCSI20 plug.

→ Specification

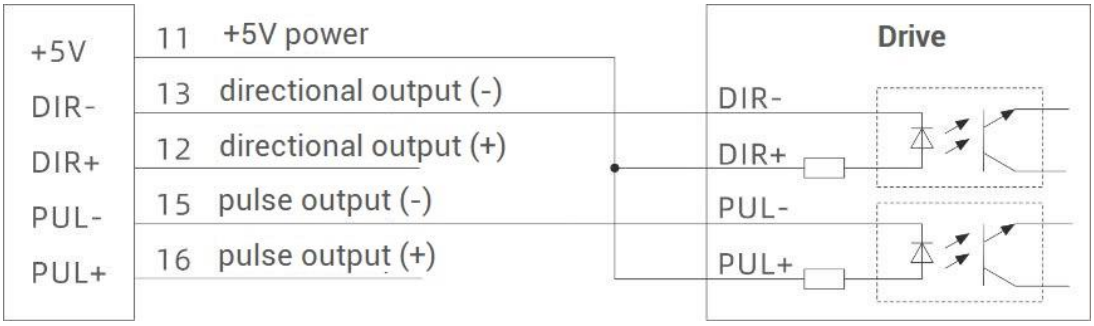
Signal	Item	Description
PUL/DIR	Signal type	Differential output signal
	Voltage range	0-5V
	Max frequency	10MHz
	Isolation method	Non-isolated
EA/EB/EZ	Signal type	Differential input signal
	Voltage range	0-5V
	Max speed ratio	10Mbps
+5V, GND	Max output current of 5V power	50mA
E24V, EGND	Max output current of 24V power	50mA

→ Wiring Reference

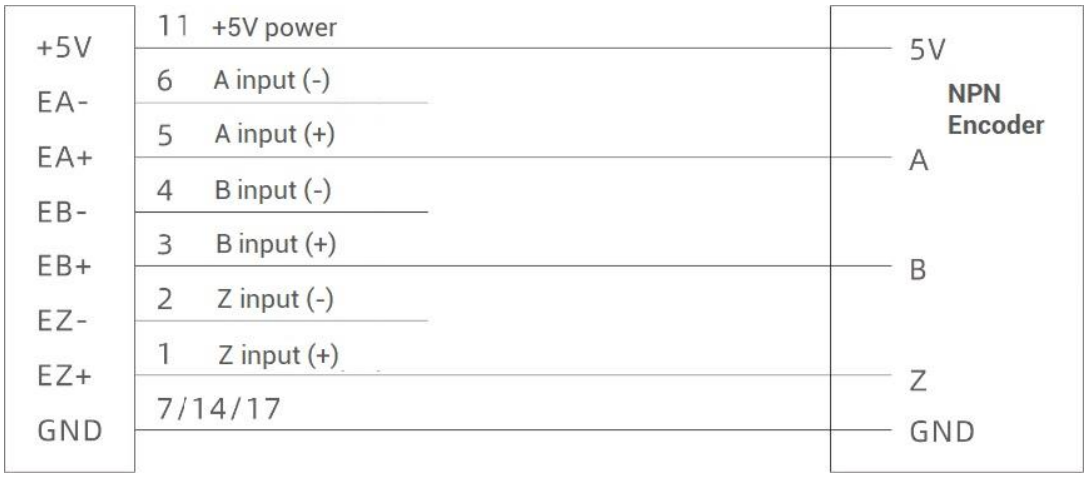
➢ **Reference example of wiring with Panasonic A5/A6 servo driver:**



➢ **Single-ended pulse axis wiring:**



➢ **Single-ended encoder wiring:**



→ Wiring Note

- The wiring principle of the differential pulse axis interface is shown in the figure above, and the wiring methods of different types of drivers are different, please connect carefully.
- Please use STP, especially when the environment is bad, and the shielding layer must be fully grounded.

3.7.3. Basic Usage Method

1. Please follow the above wiring instructions to wiring correctly.
2. After powered on, please connect to RTSys.

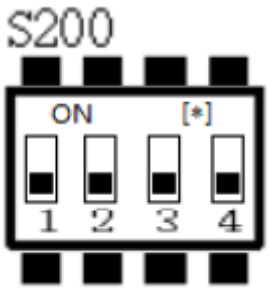
3. Set basic motion parameters, such as, ATYPE, UNITS, SPEED, ACCEL, FED_IN, REV_IN.
4. There are many parameters related to pulse axis, they can be set and checked through relative instructions, please see “axis parameter and axis status" of “Basic", or see “RTSys/Tool/Axis parameter".
5. Control corresponding motion through “Tool – Manual".

3.8. DIP Switch

This product has several DIP switches.

3.8.1. DIP Switch

→ DIP Switch Appearance



→ Usage Description

DIP switch S200 is used to set ID of XPCIE1028.
When no dial, all are OFF: ID is 15.
When the first bit of S200 is dialed to OFF: ID is 1.
When the second bit of S200 is dialed to OFF: ID is 2.
When the third bit of S200 is dialed to OFF: ID is 4.
When the fourth bit of S200 is dialed to OFF: ID is 8.
When all are dialed, all are ON: ID is 0.

Chapter IV Accessories

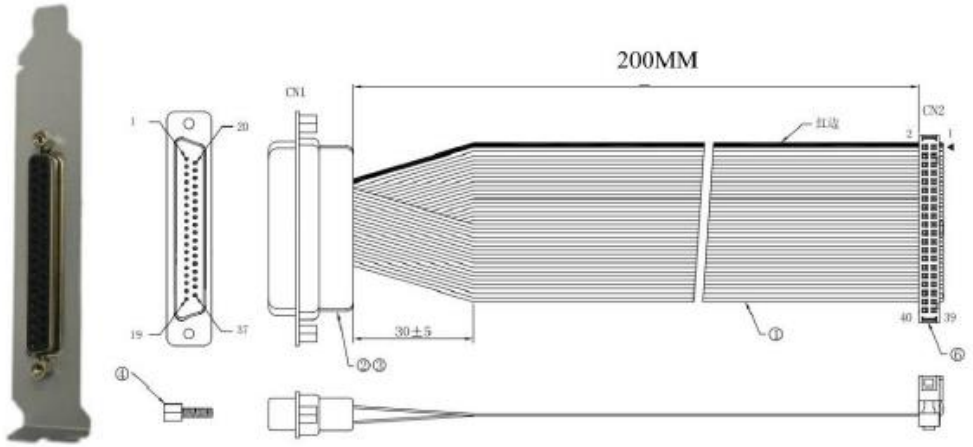
When XPCIE1028 is used, following accessories are needed. You can purchase optional accessories according as needed, for example, 16 digital IOs can be obtained by ACC37-7103 wiring board.

4.1. Optional Accessories

→ Adapter Cable

The 40P 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 industrial computer for easy wiring.

CH2 is connected to X300.



→ Cable

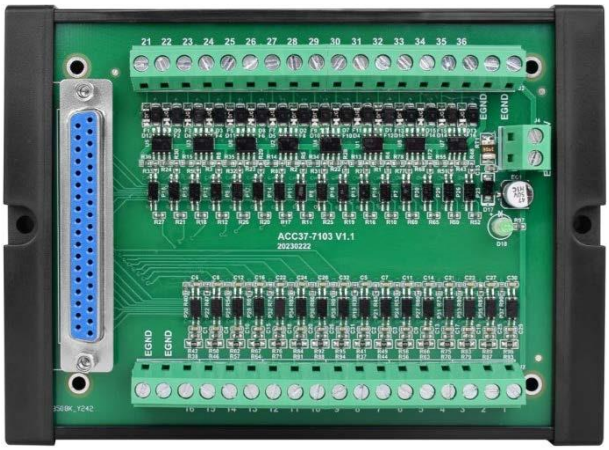
Connect the DB37-150 adapter cable to the interface board, which is convenient to install and connect the interface board.

37-pin male-to-male full contact, one-to-one correspondence, shielded.

The cable length is 1.5 meters.

→ Wiring Board

For specific parameters of ACC37-7103 wiring board, please refer to 3.3.1 ACC37 wiring board description. Size: 119.6*86.2mm.



Chapter V Installation Requirements

5.1. 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.

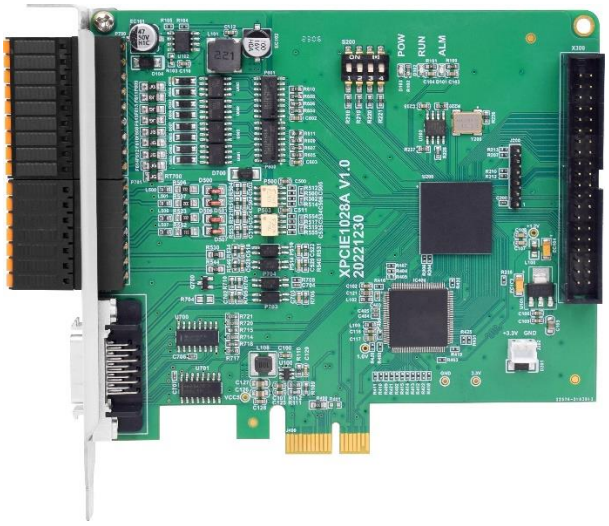
This product is installed in the cabinet and needs to be installed in the final system. The final system should provide corresponding fireproof enclosures, electrical protection enclosures, and mechanical protection enclosures, etc., in compliance with relevant IEC standards.

- ✓ CPU heat dissipation should be considered when the chassis is fully enclosed and there is no air circulation.
- ✓ The CPU generates a large amount of heat and the board space is small, so you need to install a suitable heatsink according to the gap between the chassis to dissipate heat from the chassis.

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

5.2. Installation Size



The card slot is designed according to PCIE*1, but actually it is compatible with PCIE*1 to PCIE*6.

Dimensions: 120*106mm

5.3. XPCIE1028 Installation

Install steps:

1. Turn off the power to the computer.

2. Open the computer case, select a free PCI 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.

4. Remove a baffle bar adjacent to the slot, and fix the adapter board on the slot of the chassis with screws.

- Notes

- PCI does not support hot swapping, please turn off the computer before inserting and removing the card.
- Please handle it carefully, wear anti-static gloves or touch an effectively grounded metal object for body discharge before touching the control card circuit or inserting/unplugging the control card to prevent possible static electricity from damaging the motion control card.

 Installation attention	• Non-professionals are strictly prohibited to operate. Specifically, professionals who had been trained related electrical equipment, or who master electrical knowledge. • Please be sure to read the product instruction manual and safety precautions carefully before installation. • Before installation, please ensure that the product is powered off. • Do not disassemble the module, otherwise the machine may be damaged. • In order to facilitate ventilation and controller replacement, 2-3cm should be left between the upper and lower parts of the controller and the installation environment and surrounding components. • Considering the convenient operation and maintenance of the controller, please do not install the controller in the following places: a) places where the surrounding ambient temperature exceeds the range of -10°C-55°C b) places where the ambient humidity exceeds the range of 10%-95% (non-condensing) c) places with corrosive gases and flammable gases d) places with many conductive powders such as dust and iron powder, oil mist, salt, and organic solvents e) there is direct sunlight

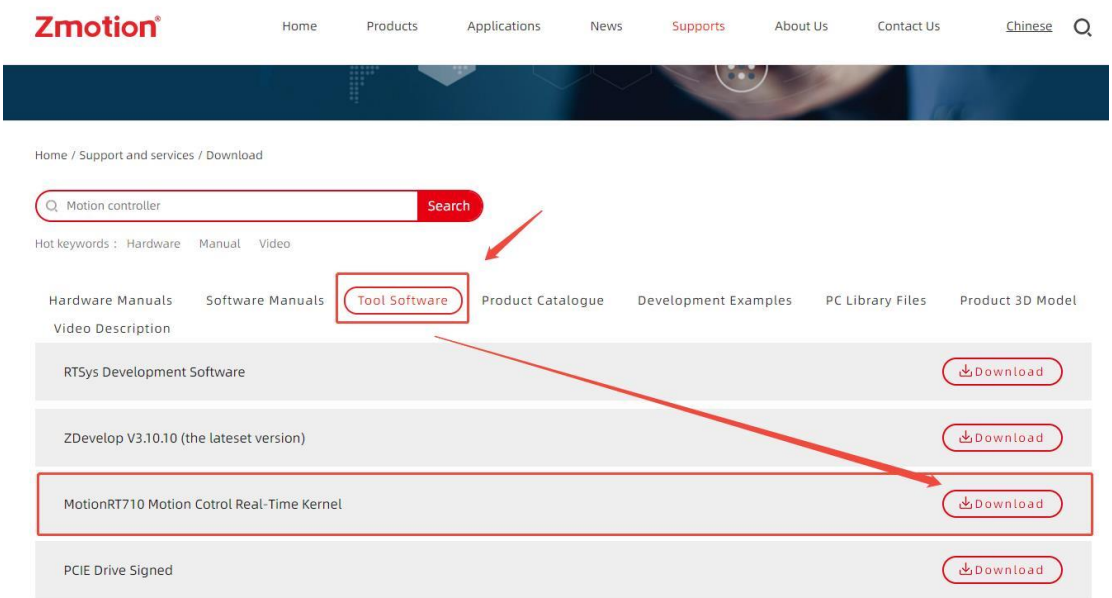
Chapter VI Installation & Uninstallation

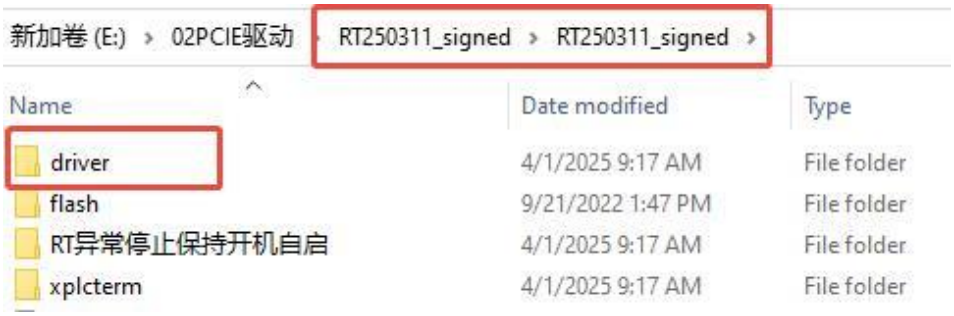
MotionRT750 is used together with XPCI/XPCIE control card.

The authorization information is saved into control card, each card has the unique No.

For RT software, it relies on PC. It needs PC CPU benchmark i5-4 generation 4 cores or above, and the main frequency ≥ 2GHZ, the running memory > 16G and hard disk > 256M.

Before that, please download and compress the latest MotionRT7 file, download address is https://www.zmotionglobal.com/download_list_14.html.





- Driver: it includes MotionRT7 drive installation file, ECAT protocol installation, guide wizard software, signed file, etc.

*ZMotionRT64.cat: signed file of drive program.

*ZmotionRT64.inf: MotionRT7 software installation info, select it when installing.

*ZmotionRT64.sys: system file.

*ZmotionRTPacket.inf: EtherCAT installation info, select this when installing ECAT.

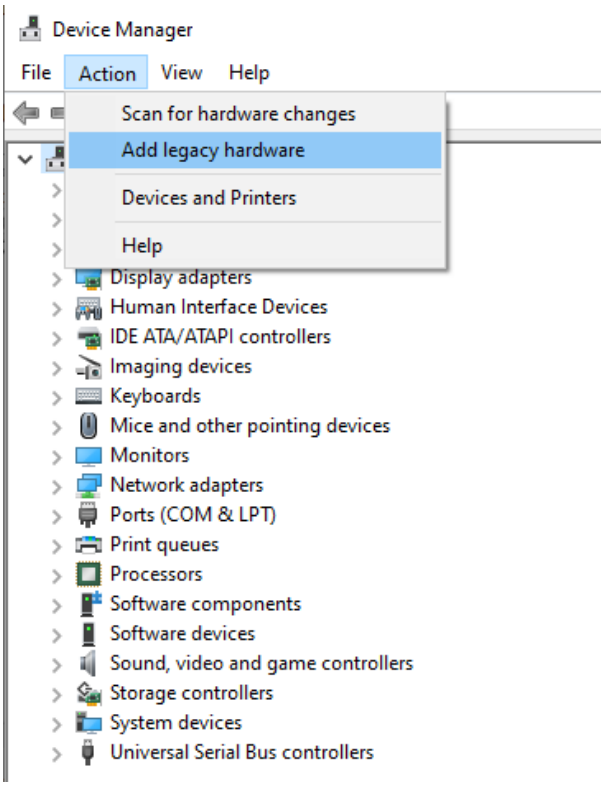
- Flash: controller system folder.
- Xplcterm: xplc screen folder, it includes xplcterm software, used as screen when using HMI.

6.1. Drive Program Installation

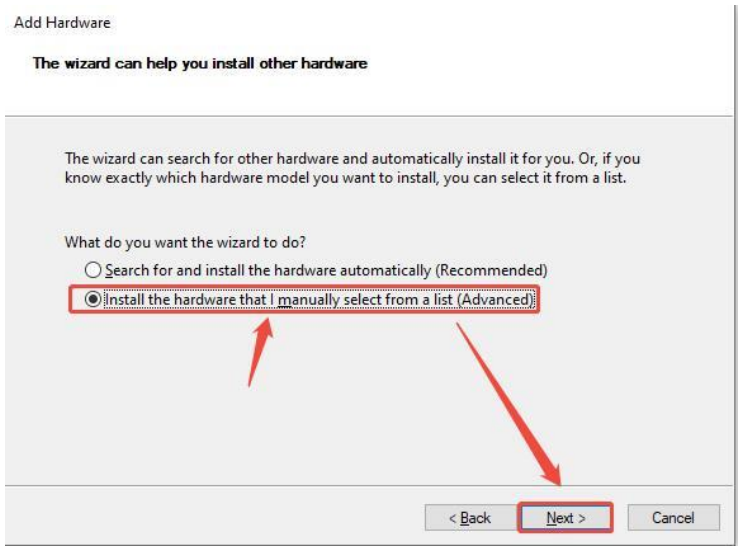
6.1.1. Install Drive without Card

When there is no PCI card device, please open the “device manager", the menu: "Action - "Add Legacy Hardware", if there is no "Action", right click.

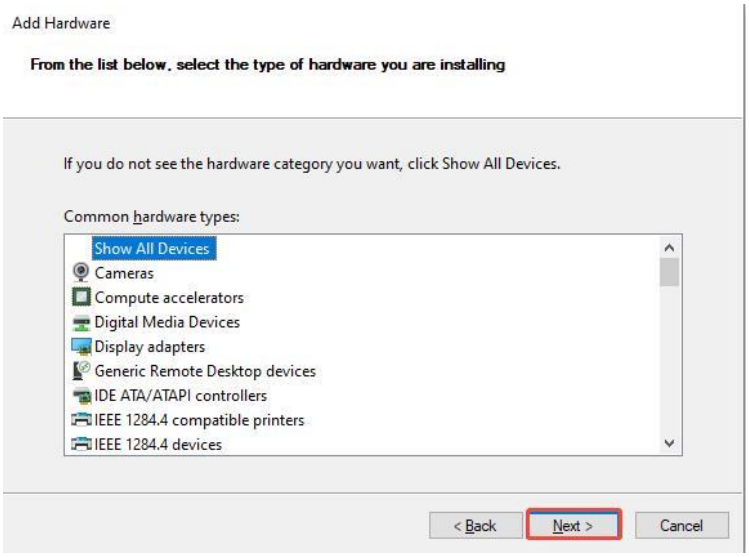
1. Find “Add Legacy Hardware".



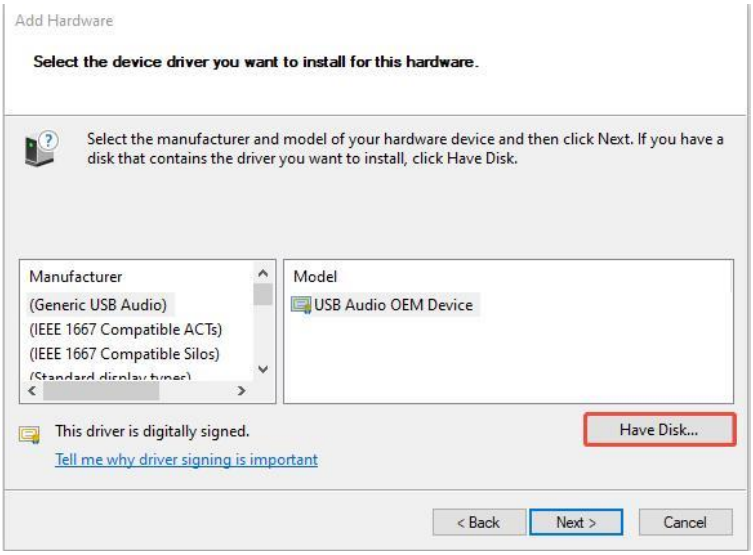
2. Click it, then “Next” – “Manual” – “Next”.



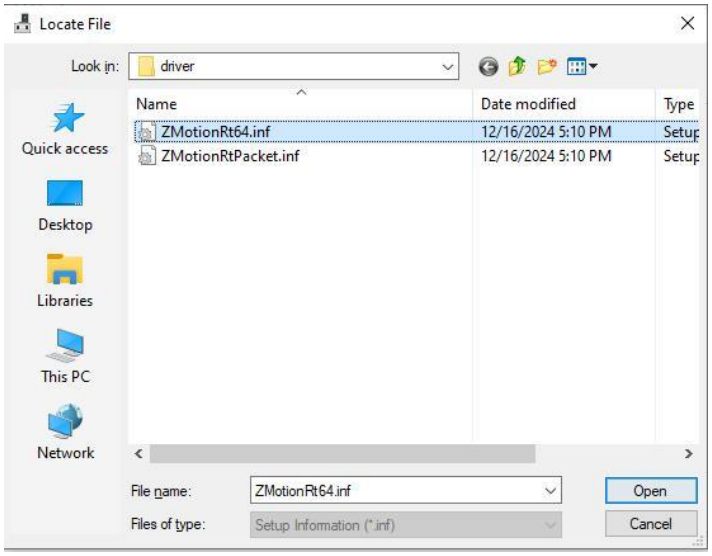
3. Directly click Next.



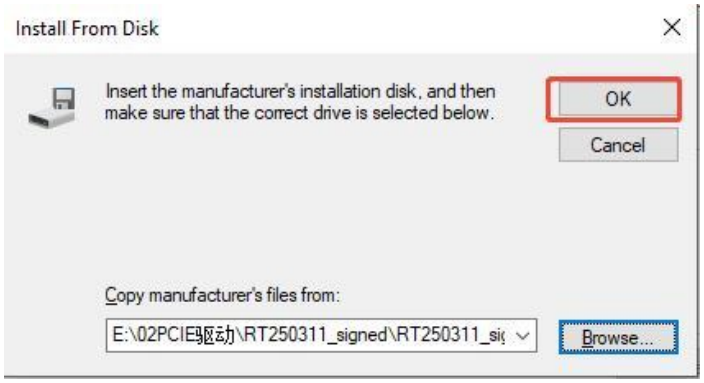
4. Choose to install from disk, (all options are default items, no need to choose manufacturer and model)



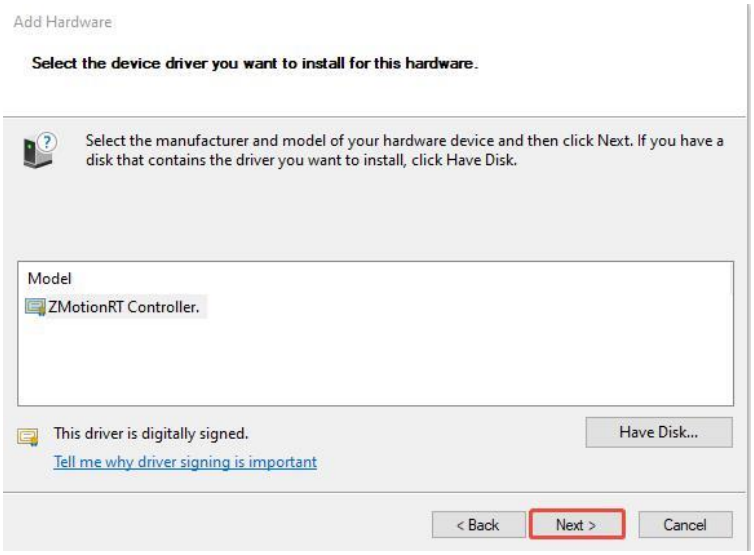
5. Select RT driver directory, then select ZmotionRT64.inf file, and click open.

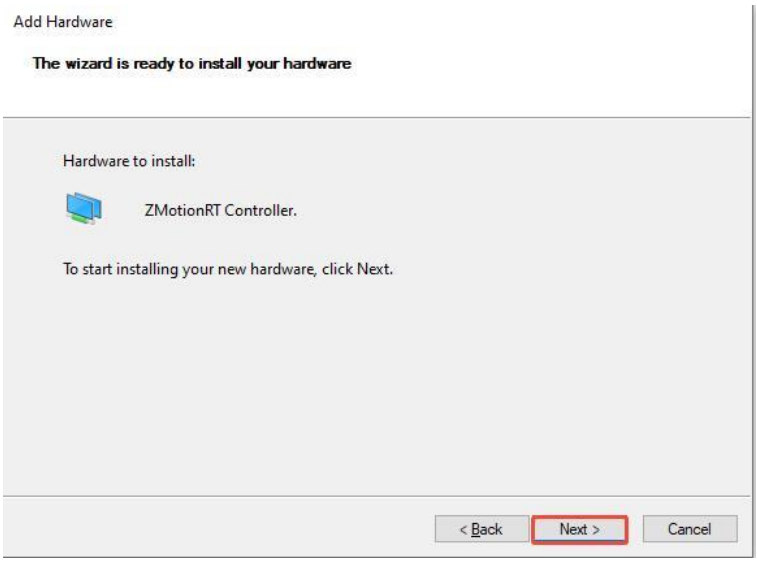


6. Click OK.

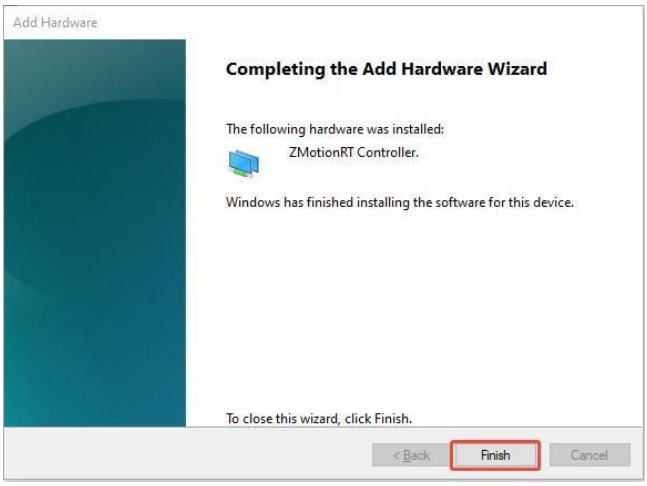


7. Click next – Next, then, it will install, please wait.

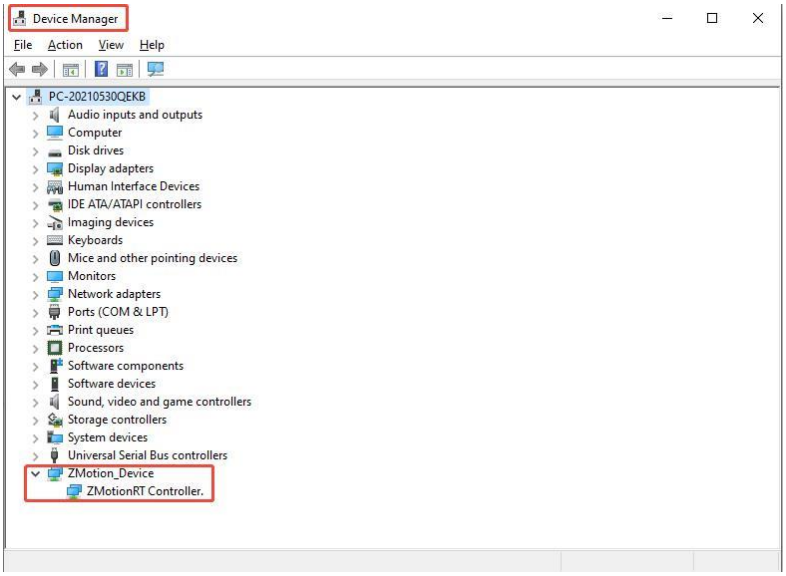




8. Installed, click Finish.



9. If there is ZMotionRT Controller in the device manager, the installation is successful. If no, right click any device, and select “scan to detect hardware changing”. Fail to install, restart the PC, and scan again to install again.

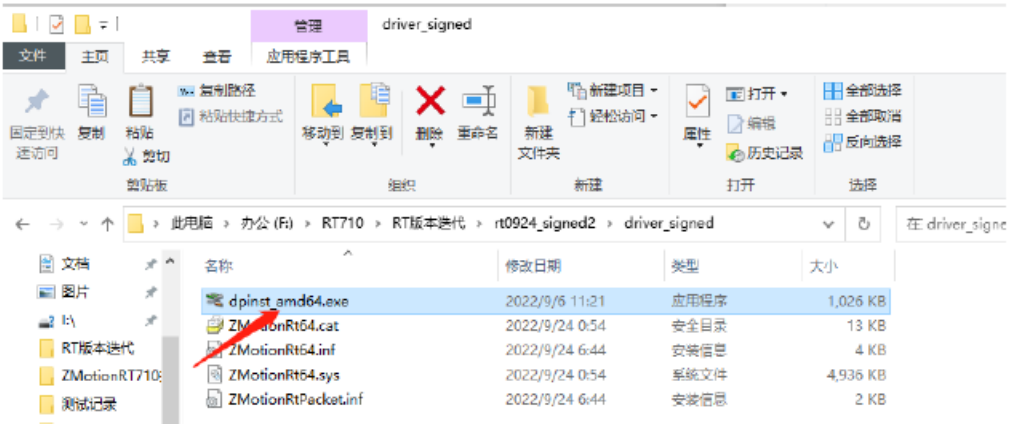


6.1.2. Install Drive with Real Card

It is used with the card.

Method 1: install automatically

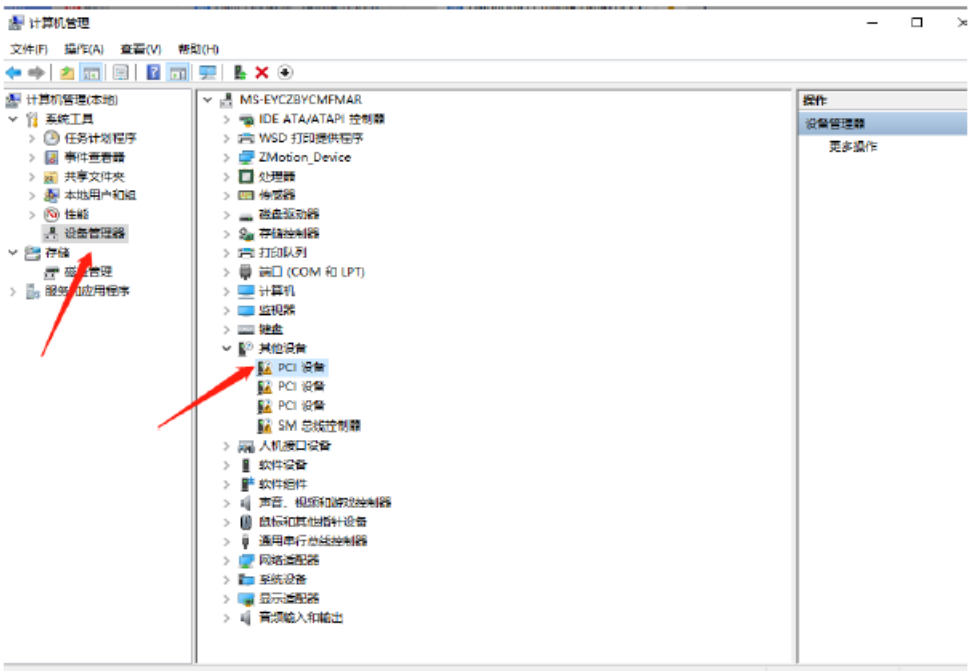
Use the built-in installation wizard software dpinst_amd64.exe in the driver directory to automatically install, and the specific operation is according to the software guide.



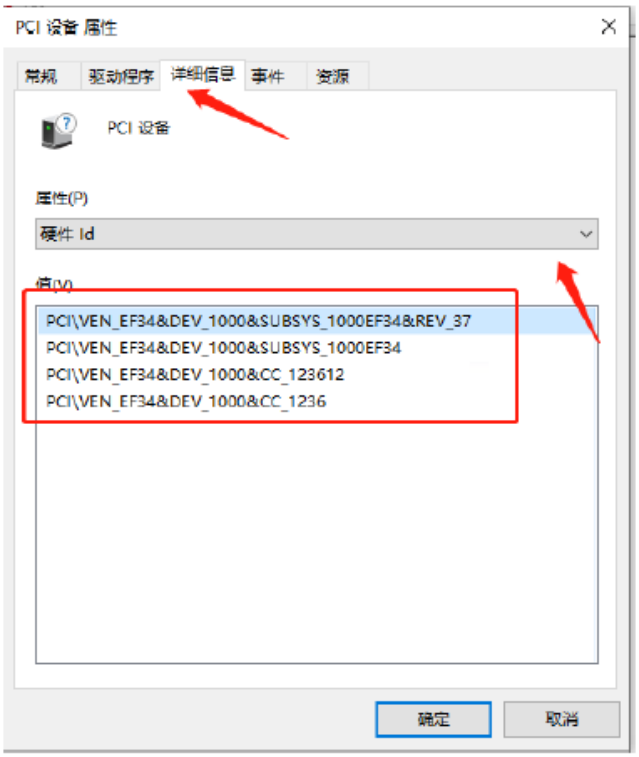
Note: If there is no PCI device, the software cannot be installed successfully, only the ZMotionRT64.sys file can be installed!!!

Method 2: install manually

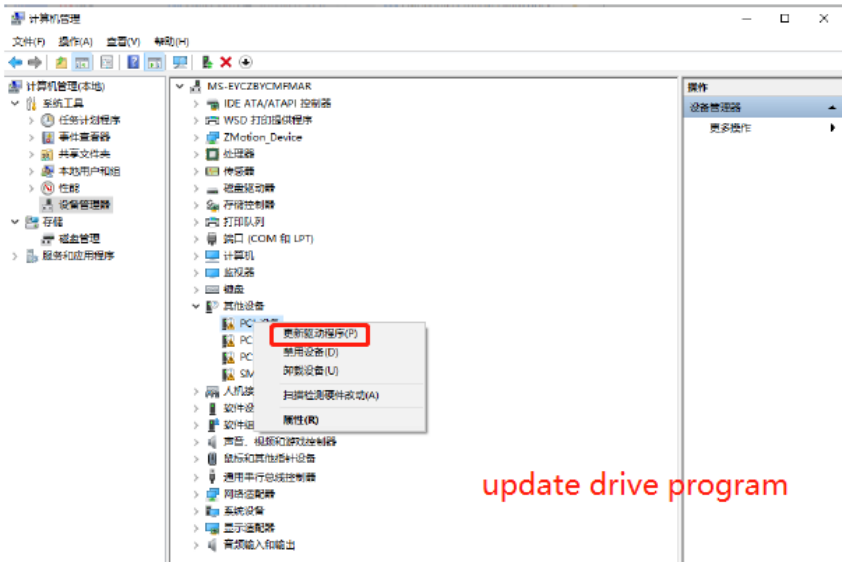
1. Open the Device Manager menu and select the PCI device in Other Devices.



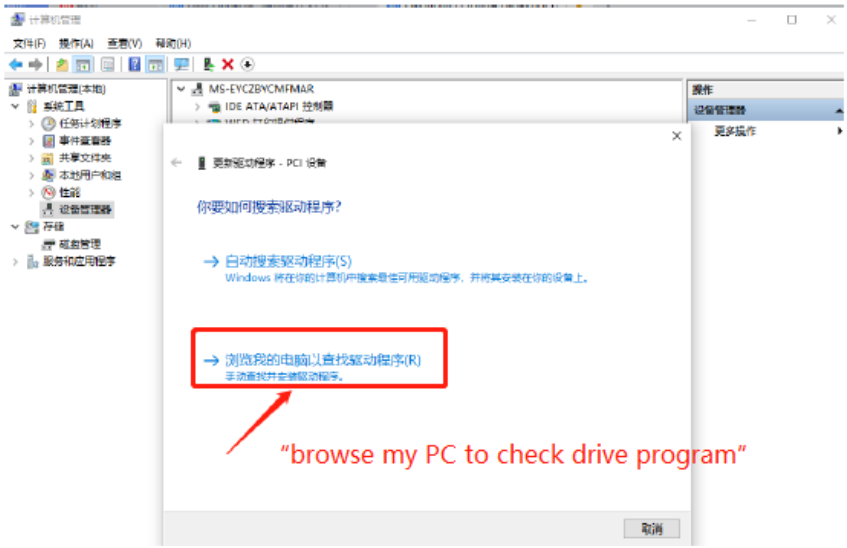
2. If there are multiple PCI devices, right-click "Properties" to view detailed information, select "Hardware ID" for properties, and confirm that it is a PCI device starting with PCI\VEN_EF34&DEV_1000&.



3. Find PCI Device, right-click to select “update drive program".

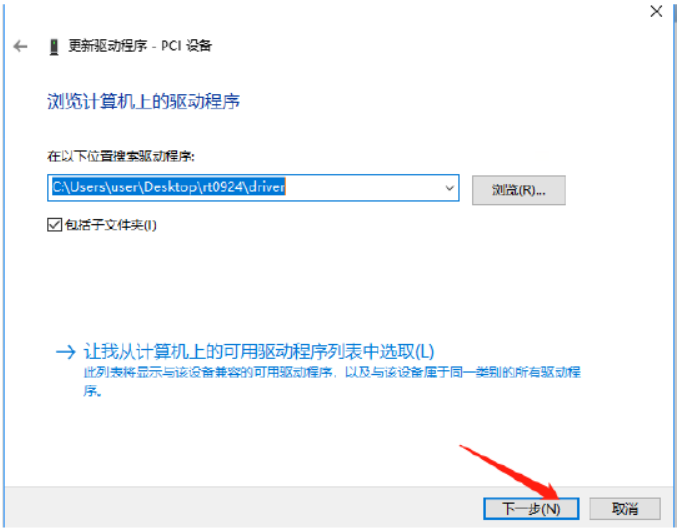


4. Select “browse my PC to check drive program".

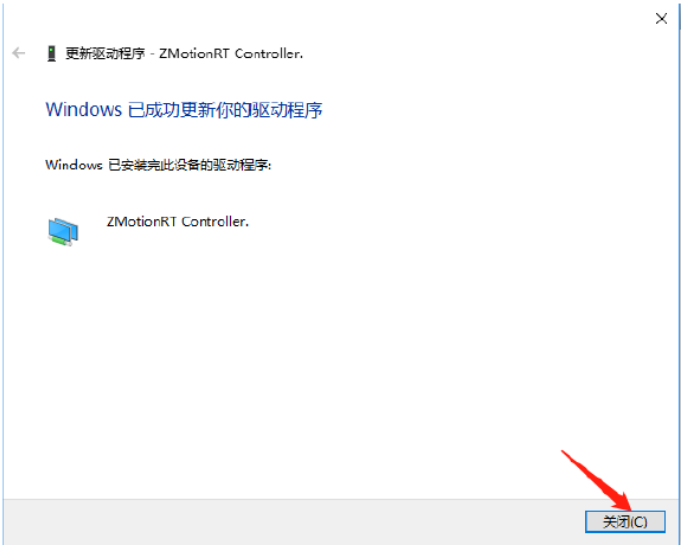


5. Click “browse", and select driver folder.

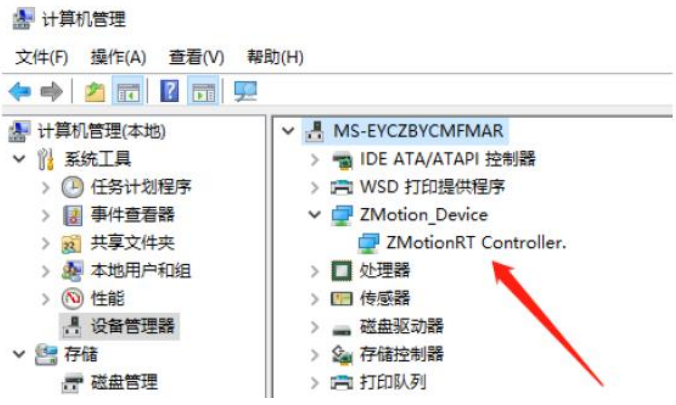
6. Click “next step”.



7. Wait until installed, click close.



8. If there is ZMotionRTController in the device manager, the installation is successful.

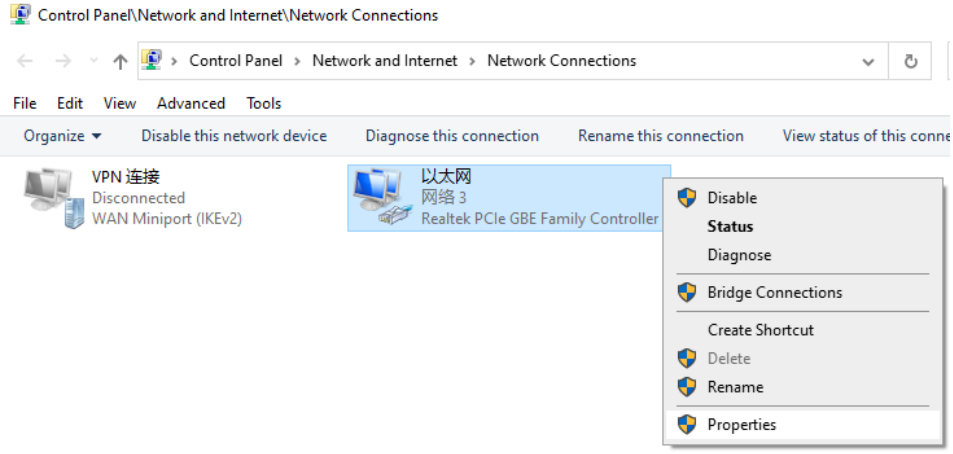


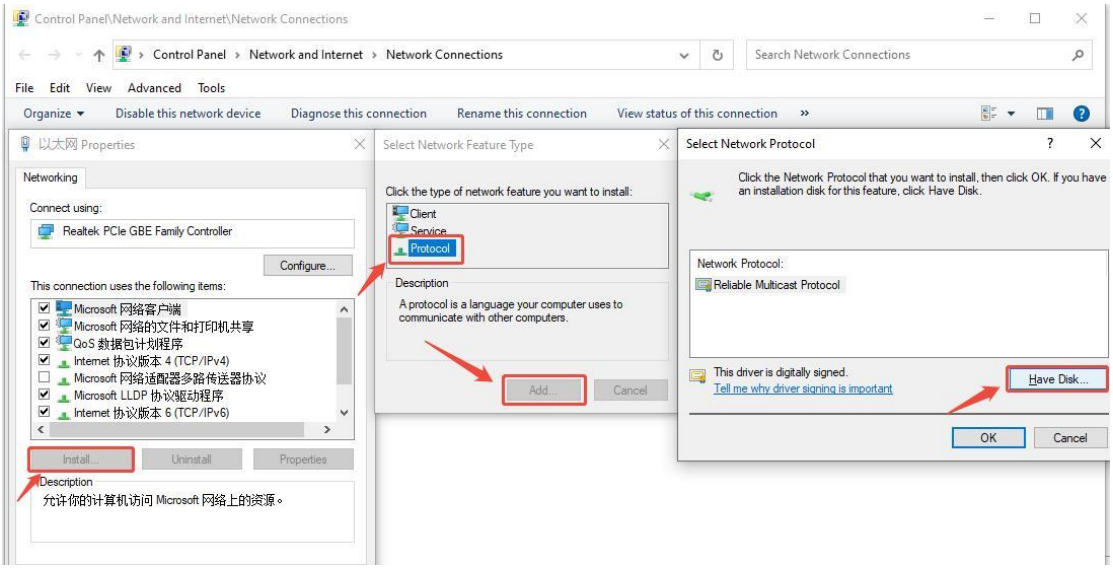
6.2. Install EtherCAT Protocol for Ordinary Network Card

MotionRT750 supports XPCI/XPCIE ECAT, also supports the common network port of the computer as ETHERCAT.

--How to Install--

Open “Control Panel”, find Network and Internet – Network Connections. Then, select one network (make it as EtherCAT). Right click it: Properties > Install > Protocol > Add > Have Disk, then find ZMotionRTPacket.inf, click OK.





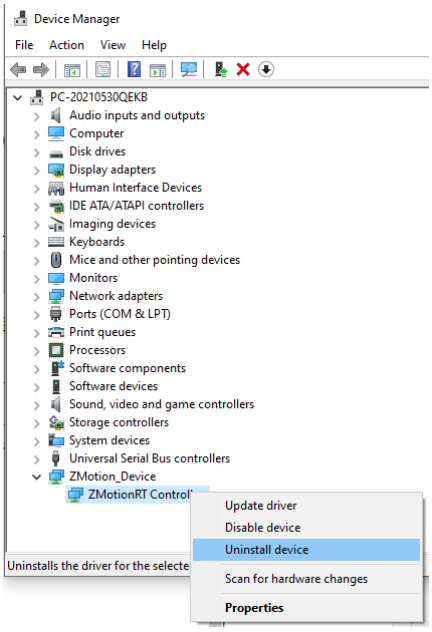
Note: The installation wizard software cannot install this protocol!!!

If there is ZMotionRT64PacketProtocolDriver in the properties, it means the installation is successful, and you can add the corresponding network port bus protocol if you check it. The network port that does not connect to the device can be unchecked here.

6.3. Uninstall RT Drive

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.

6.4. Notes

1) Please attention “anti-shielded”, recommend use specialized anti-shielded cable.

2) If “fail to scan”, please scan in cycle, until it is OK, then open it. Generally, it will appear at the first scanning when device powers on / add & delete devices.

3) If “success to scan but device number is 0”: please check whether the slot No. is matched. If it is correct, but still error, try to stop MotionRT, then start again.

4) if there is strong interference on the site, it may lose data, and continuous losing will cause motor stop / drive error. Please power-down and restart. For specialized port, ZTEST (60, 3, 0) can check the lose situation, ZTEST (61, 1) can check interrupt situation. For others, please use EtherCAT packages tool.

5) Not sure whether the problem is interference, try to stop MotionRT7 only (not power down), then redownload the program. If it repots error, interference is confirmed. Also, you can check Ethernet network connection situation.

6) Please design the environment with allowed device numbers. If there are over devices, scanning will be abnormal / other errors.

Chapter VII Programming

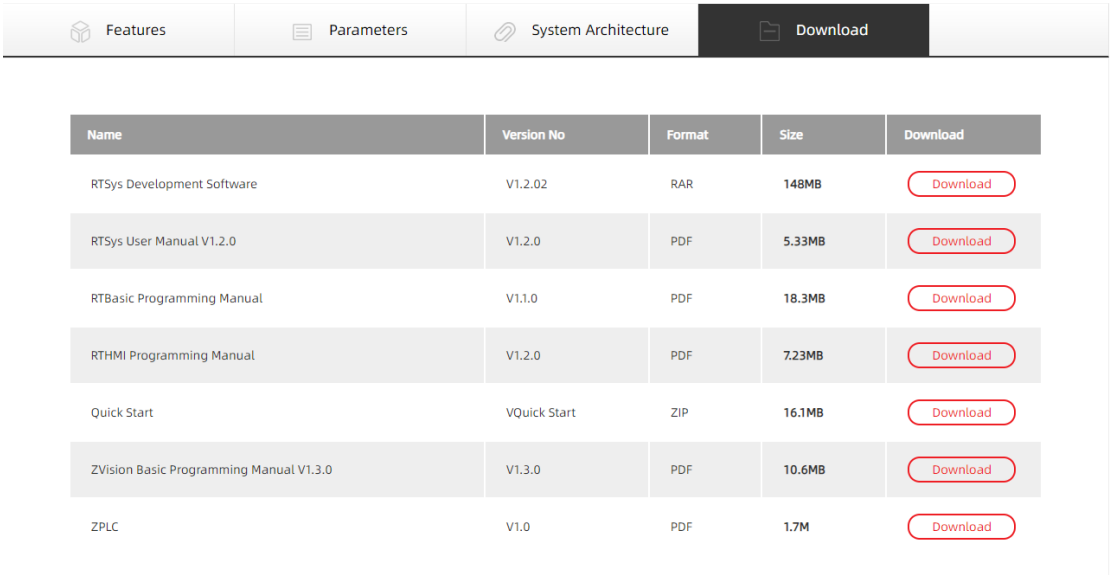
7.1. Program in RTSys

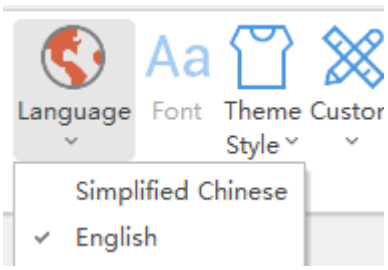
RTSys is a PC-side program development, debugging and diagnostic software for the Zmotion motion controllers. Through it, users can easily edit and configure the controller program, quickly develop applications, diagnose system operating parameters in real time, and debug the running program in real 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.

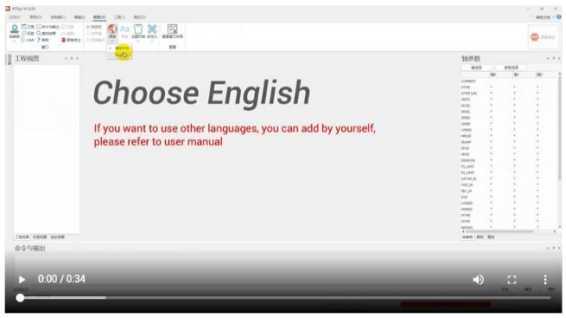
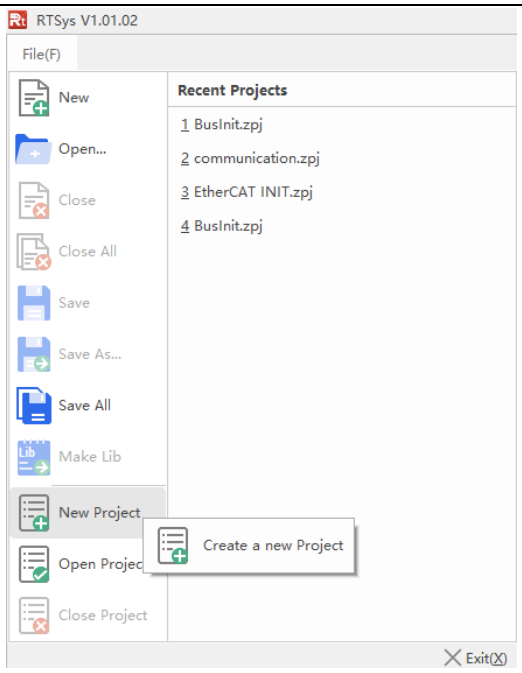
RTSys Downloading Address: https://www.zmotionglobal.com/pro_info_282.html

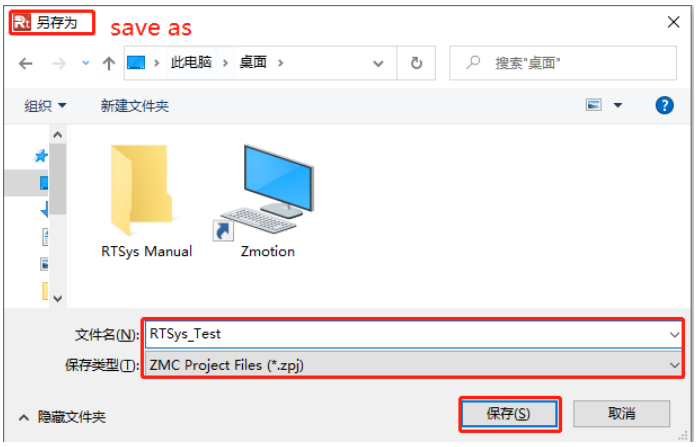
And related manuals can be found in "Download":

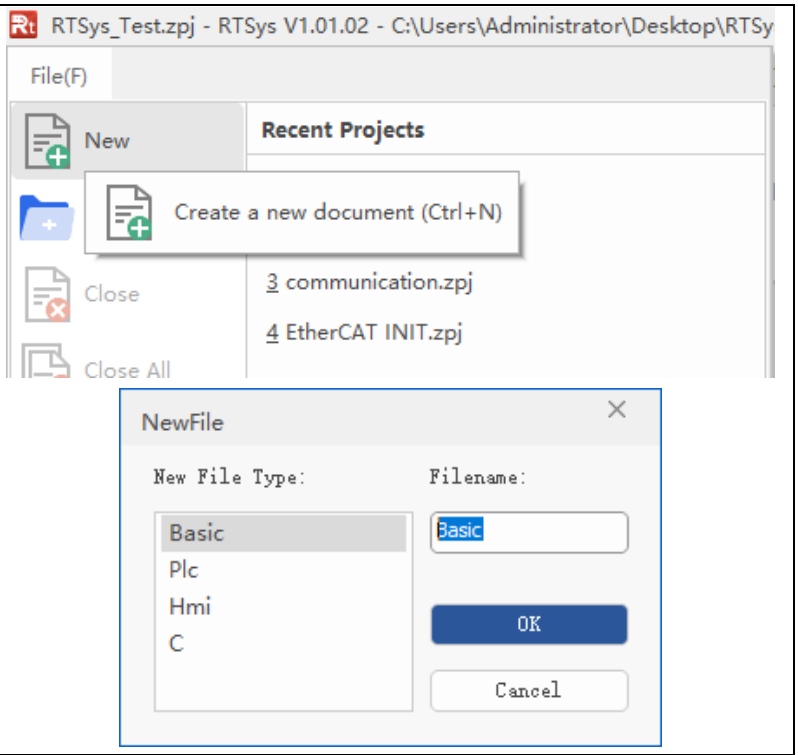
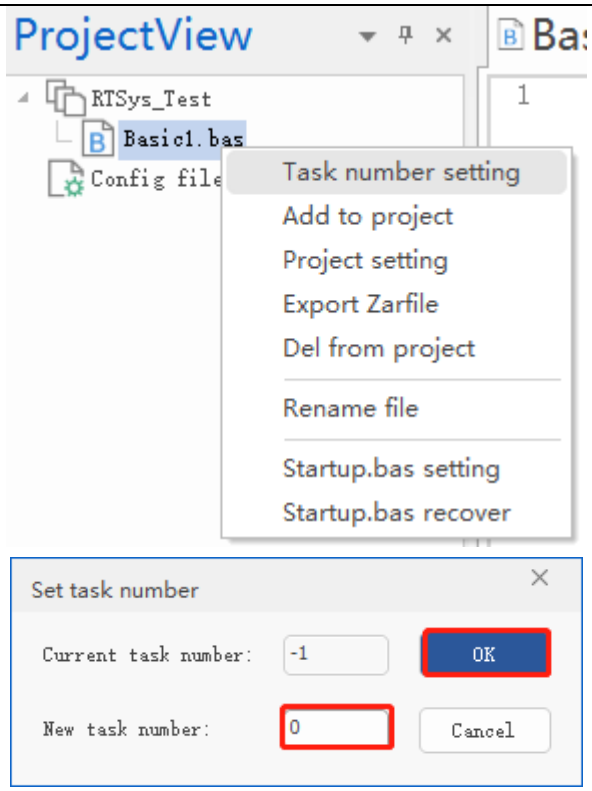


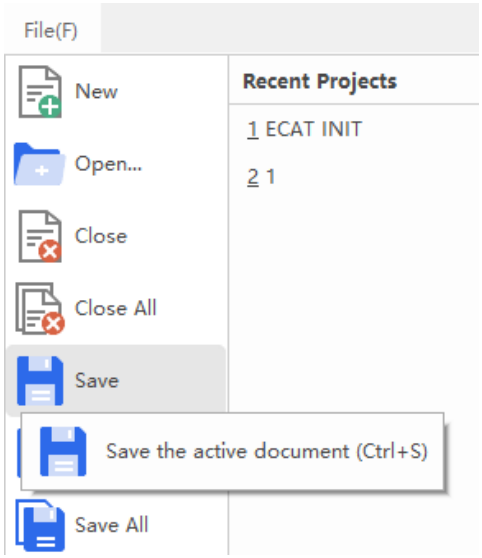
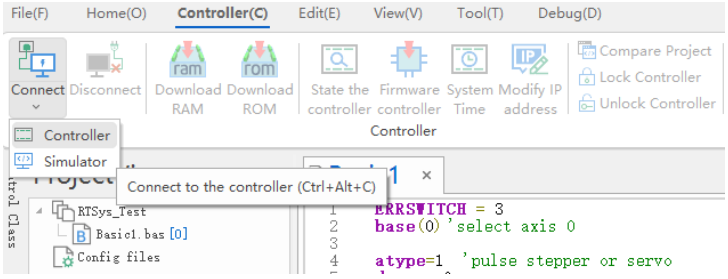
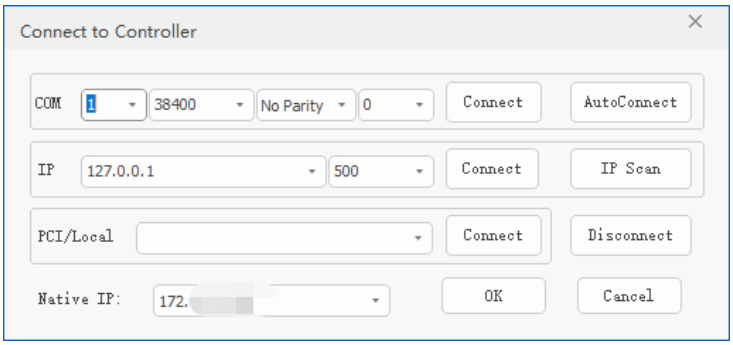
Step	Operations	Display Interface
1	Switch the Language: "Language" – "English", then there will pop	

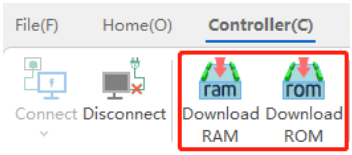
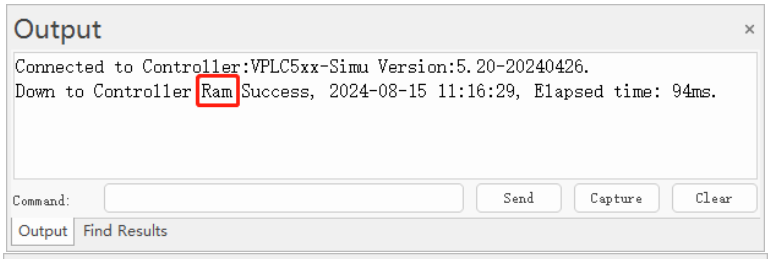
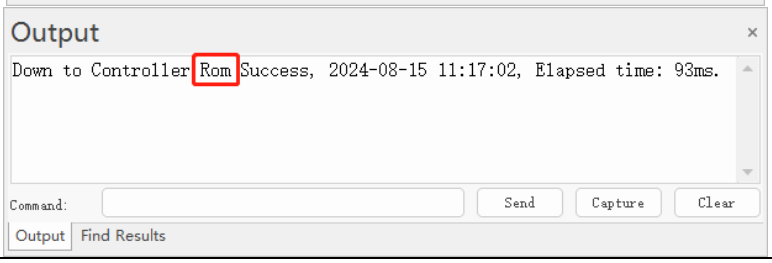
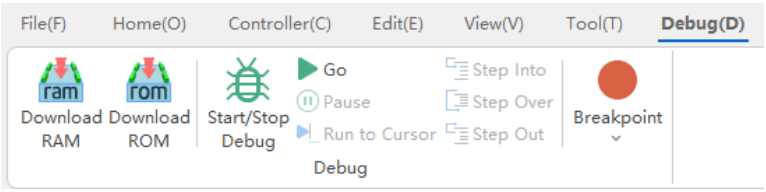
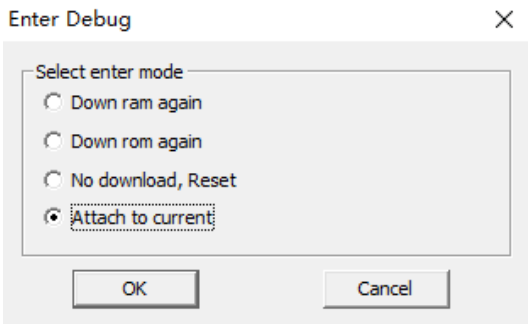
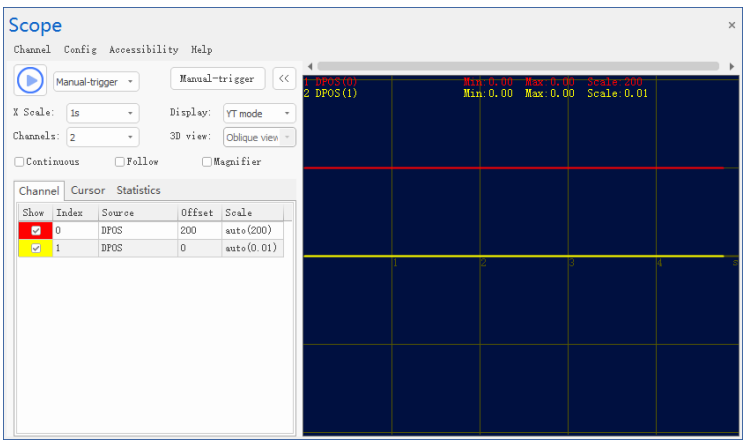
<table>
<tr>
<td></td>
<td>up one window, click OK, and restart it.</td>
<td>Language Switch Video Showing:

E. How to Switch the Language
Find "视图" (the fourth one in the above menu), then find the "语言", choose English, restart RTSys. Enligsh RTSys will take effect when opened again.
 
</td>
</tr>
<tr>
<td>2</td>
<td>New Project: “File” – “New Project”, Save as window will pop up, then enter file name, save the project file with suffix “zpj.”.</td>
<td> 

 
</td>
</tr>
</table>

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

7.2. 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”.

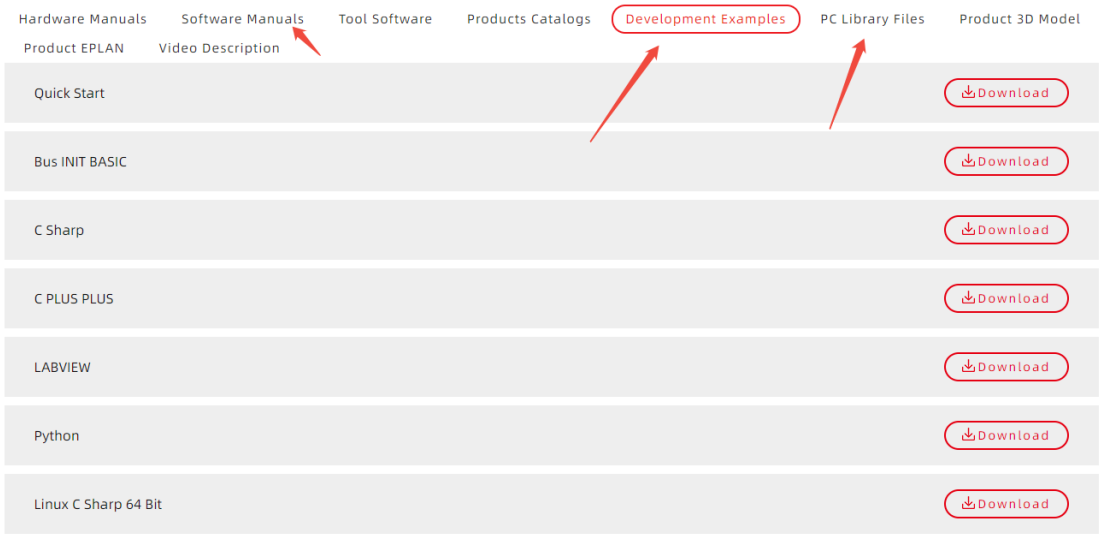
h. Do step a and step b again, check whether the firmware is updated or not.

7.3. Program in Host-Computer by PC Languages

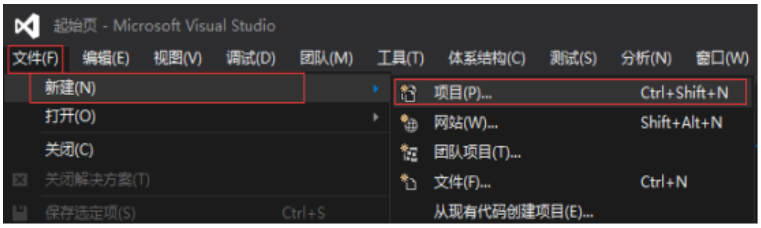
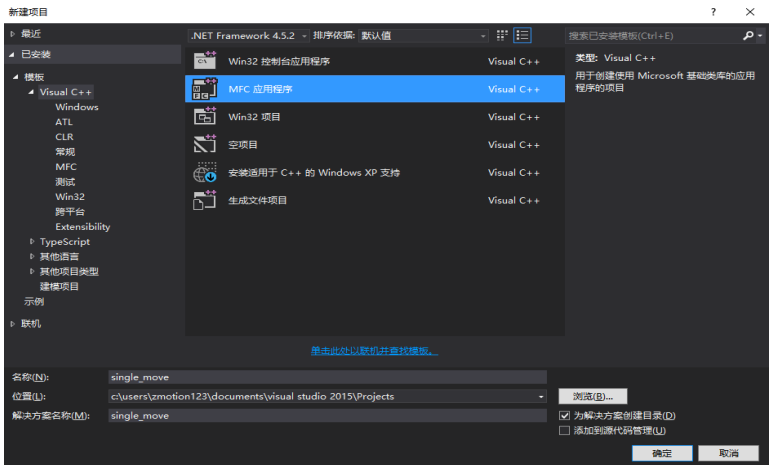
The controller supports development under various operating systems such as windows, linux, Mac, Android, and wince, and provides dll libraries in various environments such as vc, c#, vb.net, and labview, as shown in the figure below. PC software programming refers to "Zmotion PC Function Library Programming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

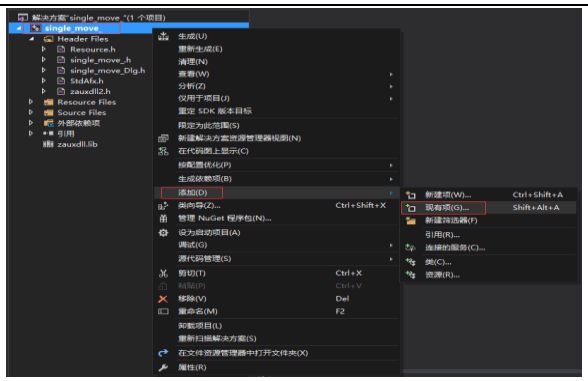
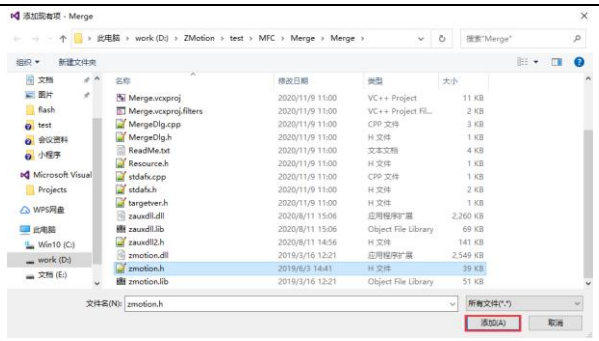
The program developed using the PC software cannot be downloaded to the controller, and it is connected to the controller through the dll dynamic library. The dll library needs to be added to the header file and declared during development.

- 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.	

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

```
// single_move_Dlg.cpp : implementation file
//

#include "stdafx.h"
#include "single_move_.h"
#include "single_move_Dlg.h"
#include "zauxdll2.h"

#ifdef _DEBUG
#define new DEBUG_NEW
#undef THIS_FILE
static char THIS_FILE[] = __FILE__;
#endif

/////////////////////////////////////////////////////////////////////////////
// CSingle_move_Dlg dialog

ZMC_HANDLE      g_handle = NULL;            //控制器链接句柄
```

</td></tr>
</table>

Chapter VIII Operation and Maintain

The correct operation and maintenance of the device can not only guarantee and extend the life cycle of the equipment itself, but also take technical management measures according to the pre-specified plan or the corresponding technical conditions to prevent equipment performance degradation or reduce the probability of equipment failure.

8.1. 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
power supply	Check whether the voltage is rated	DC 24V (-5%~5%)
surroundings	Whether the ambient temperature is within the specified range (when installed in the cabinet, the temperature inside the cabinet is the ambient temperature)	-10°C - 55°C
	Whether the ambient humidity is within the specified range (when installed in the cabinet, the humidity in the cabinet is the ambient humidity)	10%-95% non-condensing
	Is there direct sunlight	No
	With or without droplets of water, oil, chemicals, etc.	No
	Whether there is dust, salt, iron filings, dirt	No
	Whether there is corrosive gas	No
	Whether there are flammable and	No

	explosive gases or articles	
	Whether the device is subjected to vibration or shock	Should be within the range of vibration resistance and impact resistance
	Is the heat dissipation good	Keep good ventilation and heat dissipation
Installation and Wiring Status	Whether the basic unit and the expansion unit are installed firmly	The mounting screws should be tightened without loosening
	Whether the connecting cables of the basic unit and the expansion unit are fully inserted	The connection cable cannot be loosened
	Are the screws of the external wiring loose	Screws should be tightened without loosening
	Whether the cable is damaged, aged, cracked	The cable must not have any abnormal appearance

8.2. Common Problems & Solutions

Problems	Suggestions
Motor does not rotate.	5. Check whether the ATYPE of the controller is correct. 6. Check whether hardware position limit, software position limit, alarm signal work, and whether axis states are normal. 7. Check whether motor is enabled successfully. 8. Confirm whether pulse amount UNITS and speed values are suitable. If there is the encoder feedback, check whether MPOS changes. 9. Check whether pulse mode and pulse mode of drive are matched. 10. Check whether alarm is produced on motion controller station or drive station. 11. Check whether the wiring is correct. 12. Confirm whether controller sends pulses normally.

The position limit signal is invalid.	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.
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.
POWER led is ON, RUN led is OFF.	1. Check whether the power of the power supply is sufficient. At this time, it is best to supply power to the controller alone, and restart the controller after adjustment. 2. Check whether the ALM light flickers regularly (hardware problem).
RUN led is ON, ALM led is ON.	1. Program running error, please check RTSys error code, and check application program.
Fail to connect controller to PC through serial port.	1. Check whether the serial port parameters are modified by the running program, you can check all the current serial port configurations through ?*SETCOM. 2. Check whether the serial port parameters of the PC match the controller. 3. Open the device manager and check whether the serial driver of the PC is normal.
CAN expansion module cannot be connected.	1. Check the CAN wiring and power supply circuit, whether the 120 ohm resistor is installed at both

	ends. 2. Check the master-slave configuration, communication speed configuration, etc. 3. Check the DIP switch to see if there are multiple expansion modules with the same ID. 4. Use twisted-pair cables, ground the shielding layer, and use dual power supplies for severe interference (the main power supply of the expansion module and the IO power supply are separately powered)
Fail to connect controller to PC through net port.	1. Check IP address of PC, it needs to be at the same segment with controller IP address. 2. Check controller IP address, it can be checked and captured after connection through serial port. 3. When net port led is off, please check wiring. 4. Check whether controller power led POWER and running indicator led RUN are ON normally. 5. Check whether the cable is good quality, change one better cable to try again. 6. Check whether controller IP conflicts with other devices. 7. Check whether controller net port channel ETH are all occupied by other devices, disconnect to other devices, then try again. 8. When there are multiple net cards, don't use other net cards, or change one computer to connect again. 9. Check PC firewall setting. 10. Use “Packet Internet Groper” tool (Ping), check whether controller can be Ping, if it can't, please check physical interface or net cable. 11. Check IP address and MAC address through arp-a.