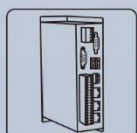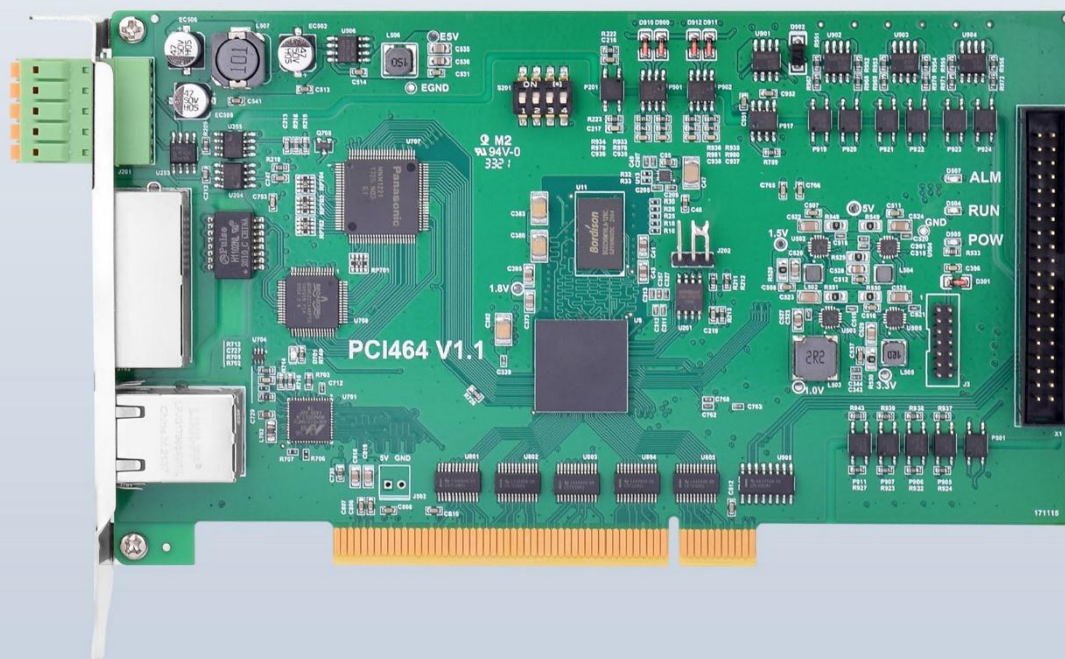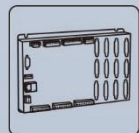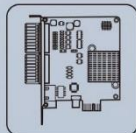# PCI Bus Motion Control Card

PCI464

This manual is for PCI464-16, PCI464-32, PCI464, PCI464R-32.
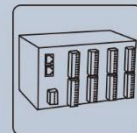

| Vision Motion Controller | Motion Controller | Motion Control Card | IO Expansion Module | HMI |

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 copyright of this manual belongs to Shenzhen Zmotion Technology Co., Ltd. And reproduction, translation, and plagiarism of any content in this manual in any form is strictly prohibited without the written permission of Zmotion.

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

PCI464 is a kind of bus type motion control card, it supports 64 axes motion control at most to achieve some complex continuous trajectory control requirements, such as, linear interpolation, circular interpolation, helical interpolation, spline interpolation, etc.

PCI464 motion control card can be applied in robots (SCARA, Delta, 6 joints), electronic semiconductor equipment (testing equipment, assembly equipment, locking equipment, soldering machine), dispensing equipment, laser processing equipment, non-standard equipment, printing and packaging equipment, textile and garment equipment, stage entertainment equipment, medical equipment, assembly line, etc.

1.2. Functional Features

◆ 64 axes motion control at most (max 64 axes for EtherCAT, max 32 axes for RTEX).

◆ Support encoder position measurement, which can be configured as handwheel input mode.

◆ There are one EtherCAT, one CAN, one RTEX, one general IN, one output OUT, and one encoder.

◆ Refresh period of EtherCAT is 500us (small period can be made by "customized firmware").

◆ 4096 isolated inputs and 4096 isolated outputs can be extended at most through CAN or EtherCAT.

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

◆ Support up to 16 axes 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 your intellectual property rights.

1.3. System Frame
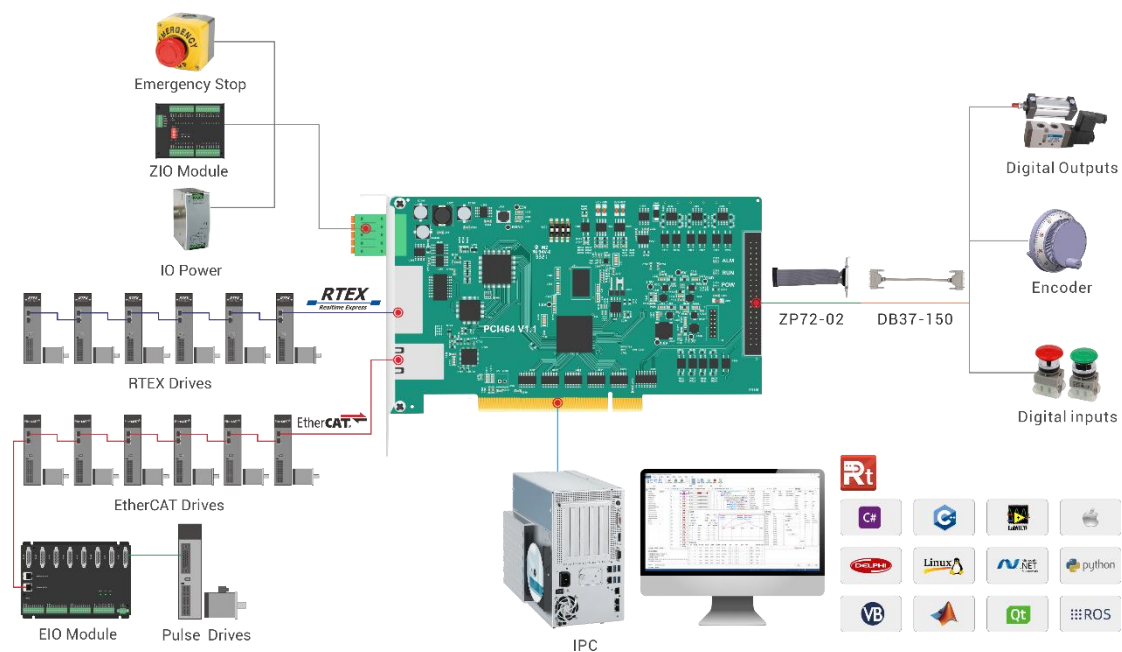
1.4. Hardware Installment

The card slot interface is designed by PCI V3.0 standard 32-bit card, which means it can be compatible with standard PCI V2.3 and below.
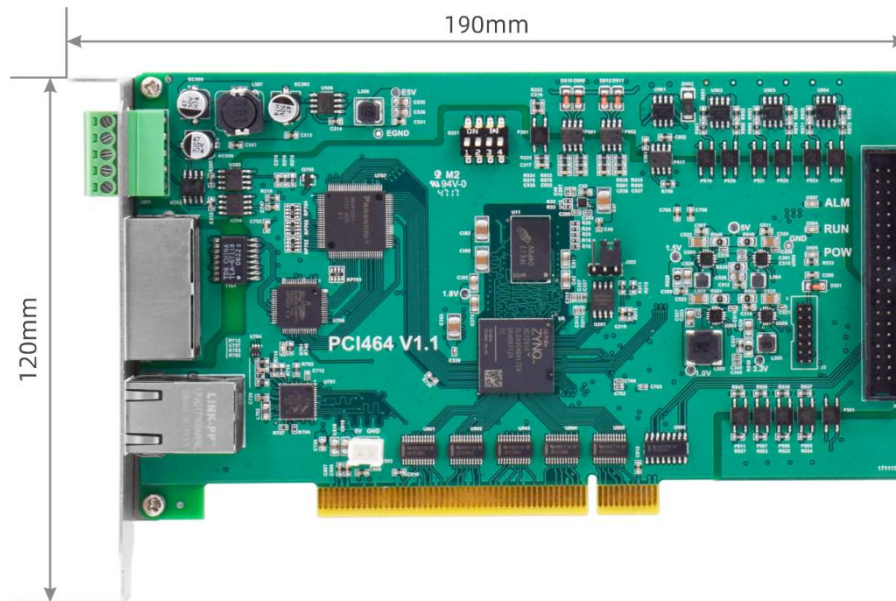
Size: 190mm*120mm*18mm

✚ PCI 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.

⚠️ **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 II Product Specification

2.1. Basic Specification

Item	Description
Model	PCI464
Basic Axes	64
Type of Basic Axes	Encoder / EtherCAT / RTEX
Digital IO	There are 8 inputs and 8 outputs.
Max Extended IO	4096 inputs, 4096 outputs
PWM	2
Max Extended AD/DA	128 ADs, 64 DAs
Pulse Bit	64
Encoder Bit	64
Speed and Acceleration Bit	64
Motion Buffer of Each Axis	512
Array Space	640000
Program Space	1920kbyte
Flash Space	4096kbyte
Power Supply Input	24V DC input
Communication Interfaces	CAN, EtherCAT, RTEX
Dimensions	190mm*120mm*18mm

2.2. Order Information

P C I 4 6 4 R - 1 6 - X X X

Mark	Product Series
PCI464	PCI Motion Control Card

Mark	Series
4	Series 4

Mark	Motion Control Function
R	Delta Robot + 6-Joint Robot

Mark	Other Function
XXX	Customized Function

Mark	Axes
16	16-Axis
32	32-Axis
64	64-Axis
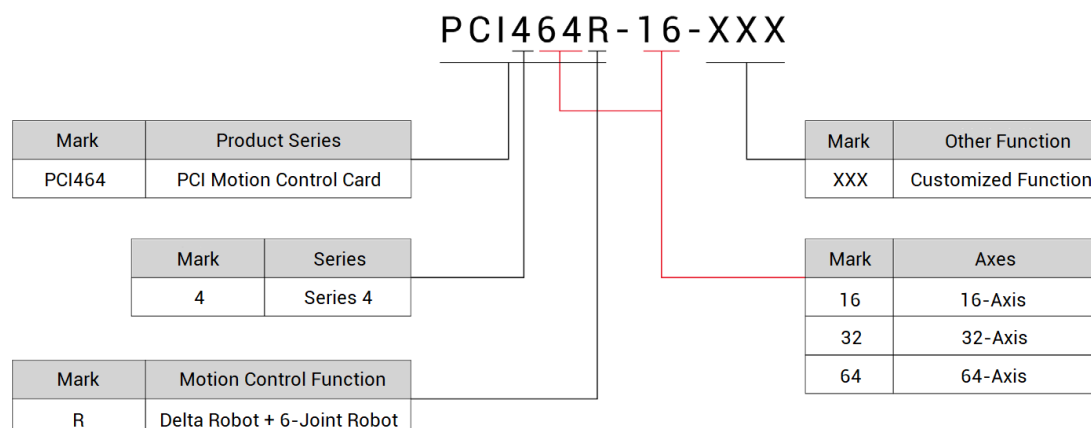
| Model (<10 & 64 axes)	Description
PCI404	4 axes, point to point, linear, circular, electronic cam, continuous trajectory motion, robot structure.
PCI406	6 axes, point to point, linear, circular, electronic cam, continuous trajectory motion, robot structure.
PCI408	8 axes, point to point, linear, circular, electronic cam, continuous trajectory motion, robot structure.
PCI410	10 axes, point to point, linear, circular, electronic cam, continuous trajectory motion, robot structure.
PCI464	64 axes, point to point, linear, circular, electronic cam, continuous trajectory motion, robot structure.
Model (>10 axes)	Description
PCI464-16	16 axes, point to point, linear, circular, electronic cam, continuous trajectory motion, robot structure.
PCI464-32	32 axes, point to point, linear, circular, electronic cam, continuous trajectory motion, robot structure.
PCI464R-32	32 axes, PCI464-32 full functions + delta + 6-joint robot.

optional accessories of PCI464 motion control card:

Name	Model	Description	Description
Adapter cable	ZP72-02	40P plug to DB37 female flat cable	Optional
Shield cable	DB37-150	DB37 core male to male cable	Optional
Wiring board	EXDB37M-37	DB37 wiring board	Optional

2.3. Interface Definition
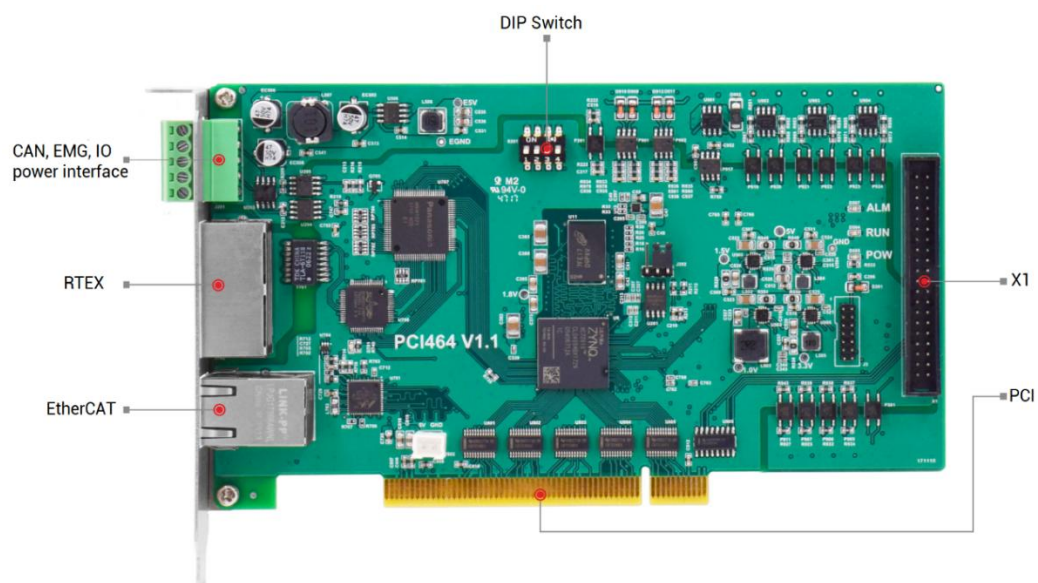
→ Interface Description

Mark	Interface	Number	Description
POW	The led that indicates the current state.	1	Power state: it lights when power is conducted.
RUN		1	Run state: it lights when runs normally
ALM		1	Error state: it lights when runs incorrectly
E+24V	IO power supply	1	24V DC power for IO
EMG	Emergency stop terminal	1	Emergency stop signal, use AXISEMG_IN to configure.
CAN	CAN bus interface	1	Connect to CAN expansion module and other standard CAN equipment.
EtherCAT	EtherCAT bus interface	1	EtherCAT, connect to EtherCAT bus drive and

			EtherCAT bus expansion module
ETHERNET	Network port	1	Use MODBUS_TCP protocol, expand the number of network ports through the interchanger, and the number of net port channels can be checked through "?*port" command, default IP address is 192.168.0.11
RTEX RX	RTEX bus receive side	1	RTEX bus is used to connect to RTEX servo driver
RTEX TX	RTEX bus send side	1	
X1	General input & output & encoder	1	Include I/O control signal and encoder signal, and EXDB37M-37 adapter board can be used.

2.4. Work Environment

Item		Parameters
Work Temperature		-10℃-55℃
Work relative Humidity		10%-90% non-condensing
Storage Temperature		-40℃ ~ 80℃ (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

Chapter III Wiring & Communication

3.1. IO Power Input & CAN Communication Interface

The power supply input adopts a 5Pin screw-type pluggable wiring terminal, and the interval (means the gap distance between two ports) should be 3.81mm. This 5Pin terminal is shared by IO power and CAN communication.

→ Terminal Definition:

Terminal	Name	Type	Function
E+24V	E+24V		Power 24V input
CANH	CANH		CAN differential data H / +
EMG	EMG	Input	Emergency stop switch signal
CANL	CANL		CAN differential data L / -
EGND	EGND		IO power ground / communication public end

Notes:

➢ Use AXISEMG_IN (axis No.) = 8 to configure the emergency stop switch. When connecting the emergency stop switch externally, pay attention that the emergency stop signal must form a circuit with EGND.

➢ When using local IO, emergency stop, and CAN expansion, an external 24V power supply needs to be connected, and RTEX, EtherCAT bus expansion, and encoder ports do not need to be connected to an external 24V power supply.

3.1.1. IO Power Specification

→ Specification

Item	IO Power Description
Voltage	DC24V(-5%~+5%)

| The current to open	≤0.15A
The current to work	≤0.1A
Anti-reverse connection	Yes
Overcurrent Protection	Yes

3.1.2. CAN Communication Specification & Wiring

The CAN interface of the controller adopts the standard CAN communication protocol, which mainly includes three ports, CANL, CANH and the public end. And it can connect to CAN expansion modules and other standard CAN devices.

→ Specification

Item	CAN
Maximum Communication Rate (bps)	1M
Terminal Resistor	120Ω
Topological Structure	Daisy Chain Topology
The number of nodes can be extended	Up to 16
Communication Distance	The longer communication distance is, the lower communication rate is, and maximum of 30m is recommended.

→ Wiring Reference

Connect the CANL and CANH of the standard CAN module to the CANL and CANH of the other side correspondingly. And public ends of the CAN bus communication both parties are connected to together. In CAN bus left and right sides, connect a 120Ω resistor respectively (please see below graphic).
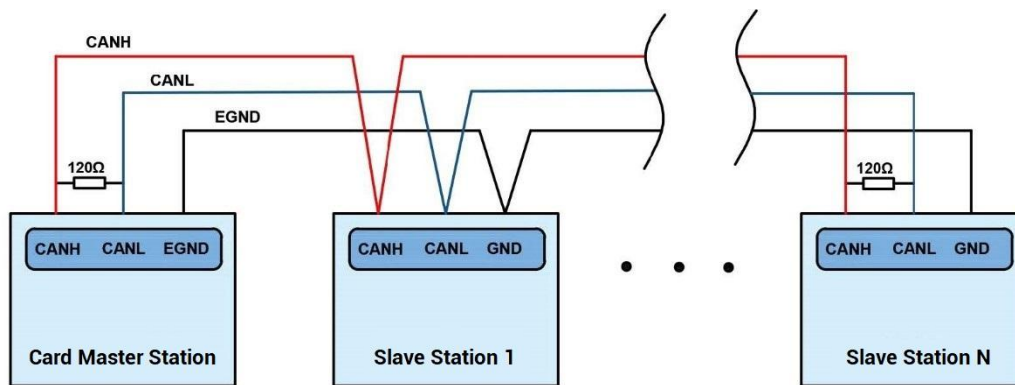
→ **Wiring Notes:**

- As above, the daisy chain topology is used for wiring (the star topology structure cannot be used). When the use environment is ideal and there are no many nodes, the branch structure also can be used.

- Please connect a 120Ω terminal resistor in parallel to each end of the CAN bus for matching the circuit impedance and ensuring communication stability.

- Please be sure to connect the public ends of each node on the CAN bus to prevent the CAN chip from burning out.

- Please use STP (Shielded Twisted Pair), especially in bad environments, and make sure the shielding layer is fully grounded.

- When on-site wiring, pay attention to make the distance between strong current and weak current, it is recommended for the distance to be more than 20cm.

- It should be noted that the equipment grounding (chassis) on the entire line must be good, and the grounding of the chassis should be connected to the standard factory ground pile.

→ Cable Requirements:

Shielded Twisted Pair, and the shielded cable is grounded.
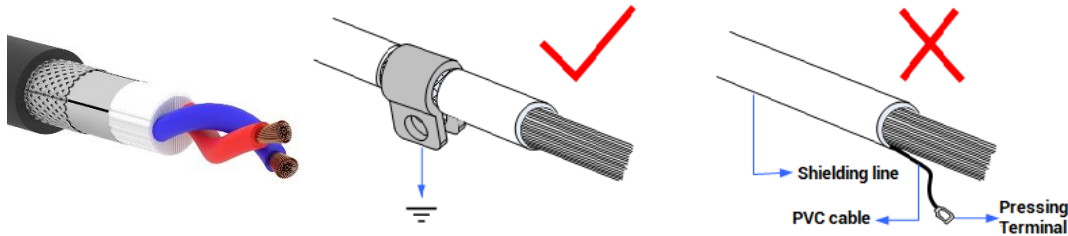
3.1.3. Basic Usage Method

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

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

(3) Please use the "CANIO_ADDRESS" command to set the master's "address" and "speed" according to the needs, and use the "CANIO_ENABLE" command to enable or disable the internal CAN master function, or through "RTSys/Controller/State the Controller/Communication Info" to view the CAN status intuitively, and refer to the "Basic Programming Manual" for details.

(4) According to their respectively instructions, correctly set the relevant parameters of the third-party equipment to match the parameters of each node.

(5) Correctly set the "address" and "speed" of the slave station expansion module according to the manual of the slave station.

(6) After all the settings are completed, restart the power supply of all stations to establish communication.

(7) Note that the "speed" settings of each node on the CAN bus must be consistent, and the "address" settings cannot cause conflicts, otherwise the "ALM" alarm led will be on, and the communication establishment will fail or will be disordered.
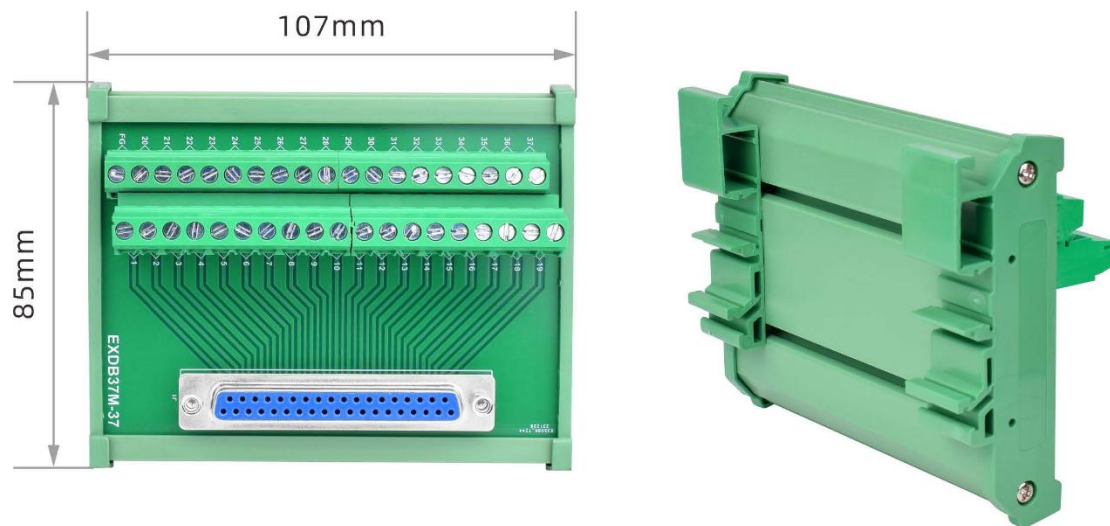
3.2. X1 Interface

The X1 interface is the I/O signal control and encoder interface, and the EXDB37M-37 adapter board is used to connect external devices. This adapter board is optional.

→ Interface Appearance
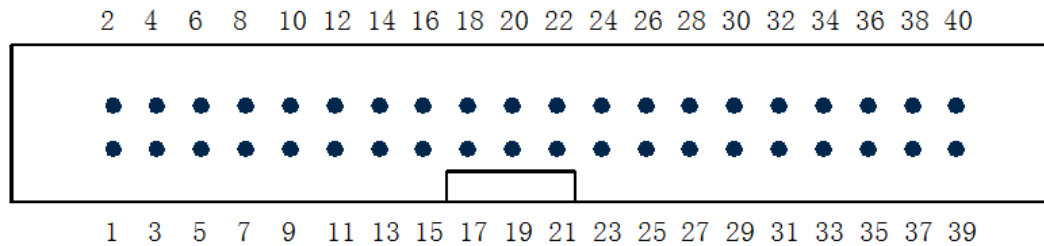
3.2.1. EXDB37M-37 Wiring Board

Exdb37m-37 is the wiring board of X1 signal terminal, using adapter cable and DB37-100 to connect to X1.

Size: 107mm*85mm*51mm (with external shell)

3.2.2. Terminal Definition

→ X1 Terminal Definition

PIN	Name	Description	PIN	Name	Description
1	+5V	Encoder signal 5V power +	21	IN0	Input 0 (high-speed)
2	GND	Encoder signal 5V power -	22	IN1	Input 1 (high-speed)
3	EA+	Encoder differential input A+	23	IN2	Input 2 (high-speed)
4	EA-	Encoder differential input A-	24	IN3	Input 3 (high-speed)
5	EB+	Encoder differential input B+	25	IN4	Input 4
6	EB-	Encoder differential input B-	26	IN5	Input 5
7	EZ+	Encoder differential input Z+	27	IN6	Input 6
8	EZ-	Encoder differential input Z-	28	IN7	Input 7
9	GND	Encoder 5V power -	29	OUT0	Output 0 (high-speed)
10	GND	Encoder 5V power -	30	OUT1	Output 1 (high-speed)
11	NC	Reserved	31	OUT2	Output 2
12	NC	Reserved	32	OUT3	Output 3
13	NC	Reserved	33	OUT4	Output 4
14	NC	Reserved	34	OUT5	Output 5
15	NC	Reserved	35	OUT6	Output 6
16	NC	Reserved	36	OUT7	Output 7
17	NC	Reserved	37	EGND	IO public end
18	NC	Reserved	38	EGND	
19	EGND	IO public end	39	NC	Reserved
20	EGND		40	NC	Reserved

Notes:

➢ +5V, GND is used for external encoders, electrically isolated from input and output, EGND.

➢ Select any pin connection between 19/20 and 21~28 for the servo alarm signal (25~28 is recommended).

➢ Select any pin connection between 19/20 and 29~36 for the servo enable signal (31~36 is recommended).

➢ IN0-IN3 are high-speed input, supporting up to 50kHz pulse input. OUT0-OUT1 are high-speed output, supporting up to 500kHz pulse output under resistive load.

3.3. Encoder Input

The encoder input is connected through the EXDB37M-37 adapter board and 5.08mm screw terminal. For specific interface, please refer to 3.2.2 Terminal Definition
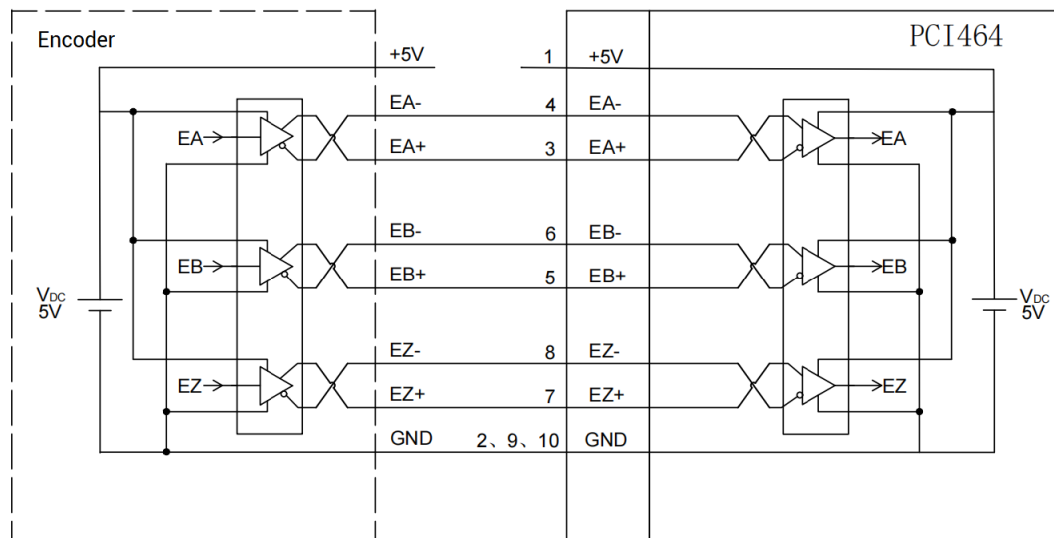
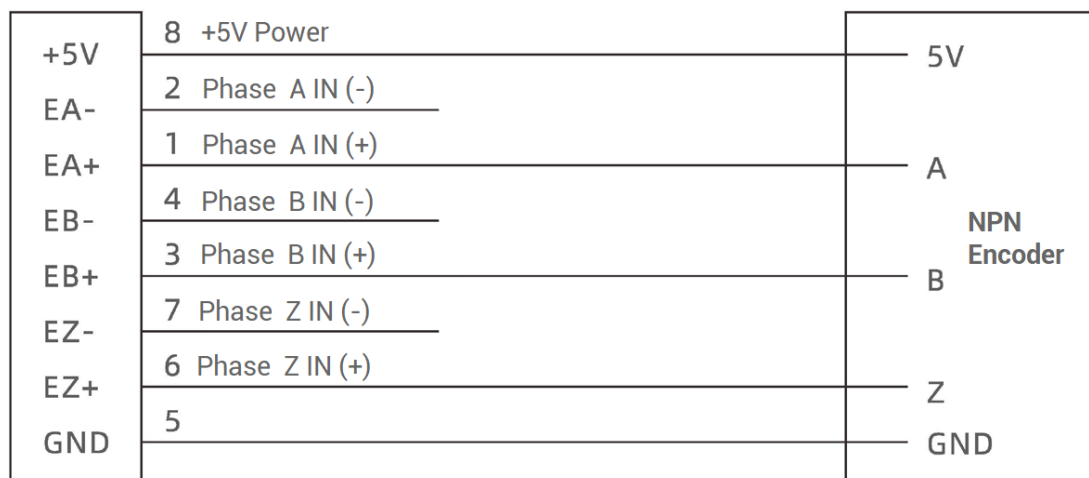## 3.3.1. Encoder Interface Specification & Wiring

→ Specification

Item	Encoder (EA, EB, EZ)
Encoder signal type	Difference input signal
Encoder signal voltage range	0-5V
Encoder signal max frequency	5MHz
Isolation	Isolated

→ Wiring Note:

➢ **Encoder Differential Wiring:**

➢ **Encoder Single-Ended Wiring:**

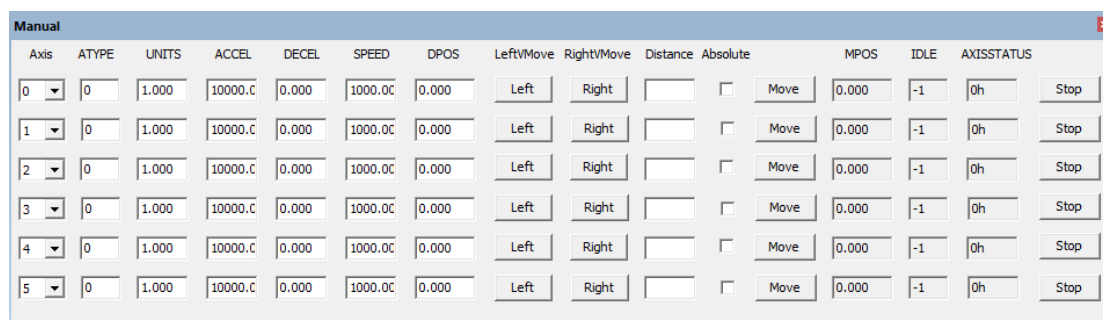| +5V	8 +5V Power		5V	
EA-	2 Phase A IN (-)			
EA+	1 Phase A IN (+)		A	
EB-	4 Phase B IN (-)			NPN Encoder
EB+	3 Phase B IN (+)		B	
EZ-	7 Phase Z IN (-)			
EZ+	6 Phase Z IN (+)		Z	
GND	5		GND	

3.3.2. Basic Usage Method

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

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

(3) There are many pulse axes related parameters, but they can be set and viewed through corresponding commands. They can be read through "RTSys/Tool/Axis Parameters". And please refer to "Basic" for details.

(4) Control corresponding motion through "Tool – Manual".

Manual															
Axis	ATYPE	UNITS	ACCEL	DECEL	SPEED	DPOS	LeftVMove	RightVMove	Distance	Absolute		MPOS	IDLE	AXISSTATUS	
0 ▼	0	1.000	10000.0	0.000	1000.00	0.000	Left	Right		☐	Move	0.000	-1	0h	Stop
1 ▼	0	1.000	10000.0	0.000	1000.00	0.000	Left	Right		☐	Move	0.000	-1	0h	Stop
2 ▼	0	1.000	10000.0	0.000	1000.00	0.000	Left	Right		☐	Move	0.000	-1	0h	Stop
3 ▼	0	1.000	10000.0	0.000	1000.00	0.000	Left	Right		☐	Move	0.000	-1	0h	Stop
4 ▼	0	1.000	10000.0	0.000	1000.00	0.000	Left	Right		☐	Move	0.000	-1	0h	Stop
5 ▼	0	1.000	10000.0	0.000	1000.00	0.000	Left	Right		☐	Move	0.000	-1	0h	Stop

3.4. IN Digital Inputs

Digital inputs are distributed in X1 (IN0-IN7) signal interface.

## 3.4.1. Digital Input Specification & Wiring

→ Specification

Item	High-speed input (IN0-IN3)	Low-speed input (IN4-IN7)
Input method	NPN, it is triggered by low electric level.	
Input frequency	<100KHz	<5KHz
Voltage level	DC24V	DC24V
Impedance	3.3KΩ	4.7KΩ
Voltage to open	<15V	<14.5V
Voltage to close	>15.1V	>14.7V
Min current	-2.3mA (negative direction)	-1.8mA (negative direction)
Max current	-7.5mA (negative direction)	-6mA (negative direction)
Isolation	optoelectronic isolation	optoelectronic isolation
Note: above parameters are typical values when control card IO power voltage (E+24V) is 24V.		

→ Wiring Reference

PCI464 motion control card provides isolated general input signals, they can be used for switch, sensor.
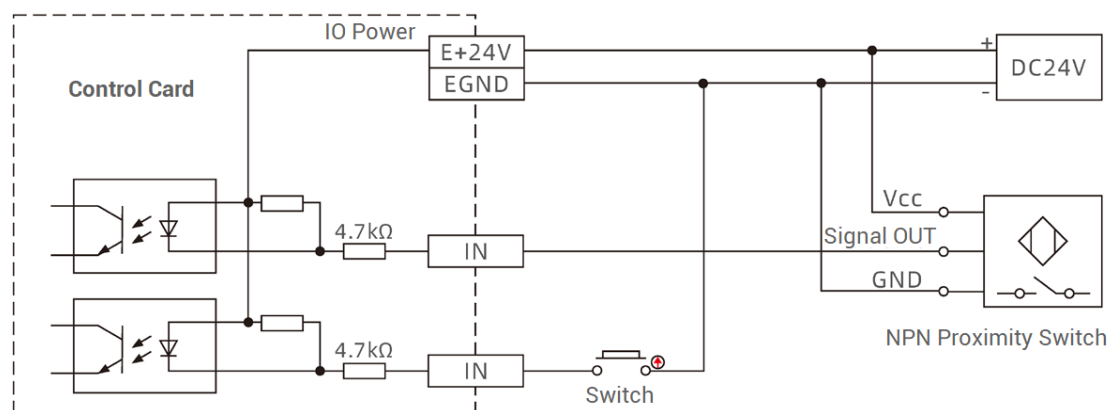
→ Wiring Note

● The wiring principle of high-speed digital IN (0-3) and low-speed digital input IN (4-7) 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.

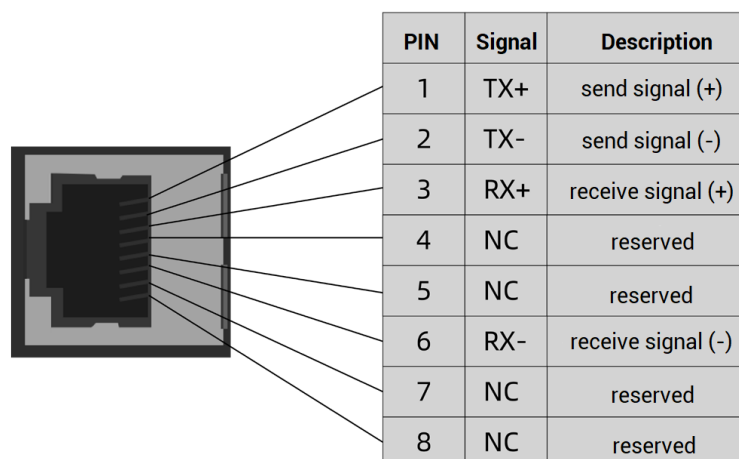● For the public end, please connect the "EGND" port on the IO terminal to the "COM" terminal of the external input device. If the signal area power supply of the external device and the power supply of the controller are in the same power supply system, this connection also can be omitted.

3.4.2. 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".

3.5. OUT: Digital Output

Digital outputs are distributed in X1 (OUT0-OUT7) signal interfaces.

3.5.1. Digital Output Specification & Wiring

→ Specification

Item	High-speed OUT (OUT0-1)	Low-speed OUT (OUT2-7)
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 (resistive load typical value)	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 leak-type 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 high-speed output, it is recommended to be lower than 400kHz. For low-speed output, it is recommended to be lower than 8kHz.

→ **Wiring Reference**
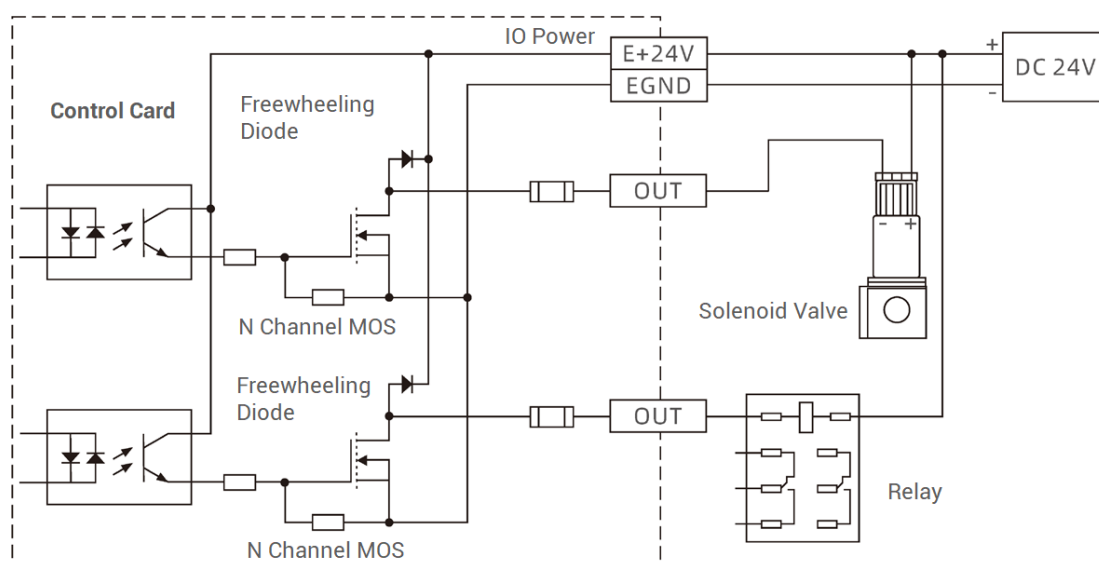
→ **Wiring Note**

● The wiring principle of high-speed digital output OUT(0-1) and low-speed digital output OUT(2-7) 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 power supply 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.

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) 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.

3.6. RTEX Bus Interface

PCI464 motion control card has two 100M RTEX communication interfaces, and it supports RTEX protocol. TX is sending side, RX is receiving side. RTEX bus is used to connect to Panasonic RTEX servo driver.

PIN	Signal	Description
1	TX+	send signal (+)
2	TX-	send signal (-)
3	RX+	receive signal (+)
4	NC	reserved
5	NC	reserved
6	RX-	receive signal (-)
7	NC	reserved
8	NC	reserved

3.6.1. RTEX Bus Interface Rule & Wiring

→ Specification

Controller default firmware is configured 1ms period, which can be checked through SERVO_PERIOD. Below shows corresponding drive parameters to configure:

7.20	RTEX Communication Period	6	1ms
7.21	RTEX Instruction Update Period	1	1ms

If controller firmware is customized, please refer to drive period configuration to adjust. For example, the firmware is with 0.5ms, corresponding drive parameters:

7.20	RTEX Communication Period	3	0.5ms
7.21	RTEX Instruction Update Period	1	0.5ms

→ Wiring Reference

Two cables are required for the RTEX bus, TX is the sending side and RX is the receiving side. TX needs to be connected to RX, RX needs to be connected to TX, all devices are connected into a loop, and disconnection is not allowed in the middle.

When connecting multiple RTEX drives, the TX port of the controller is connected to the RX port of the first servo drive, and the TX port of the first servo drive is connected to the RX port of the second drive, and so on, and the TX port of the last drive is connected to the RX port of the controller to form a complete communication loop.

Device numbers and drive numbers are automatically numbered starting from 0 in connection order, the same as the EtherCAT bus numbering convention.

See the configuration diagram below for the wiring method of RTEX:
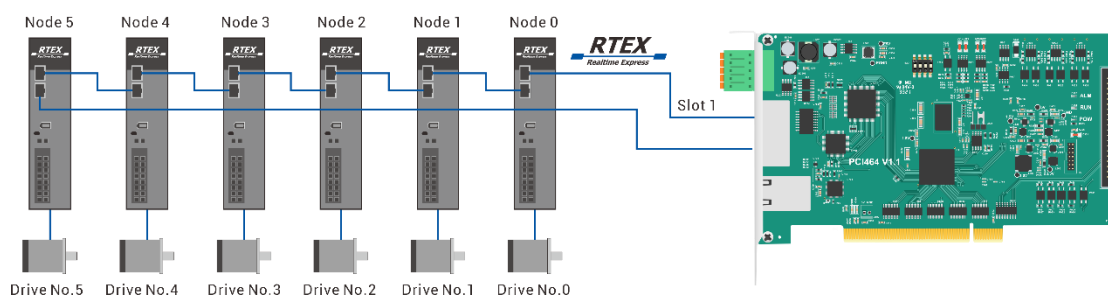
3.7. EtherCAT Bus Interface

PCI464 motion control card has a 100M EtherCAT communication interface, and it supports EtherCAT protocol. In addition, EtherCAT driver or EtherCAT expansion module can be connected. The pin definition is as follows:

PIN	Signal	Description
1	TX+	Send signal (+)
2	TX-	Send signal (-)
3	RX+	Receive signal (+)
4	NC	Reserved
5	NC	Reserved
6	RX-	Receive signal (-)
7	NC	Reserved
8	NC	Reserved
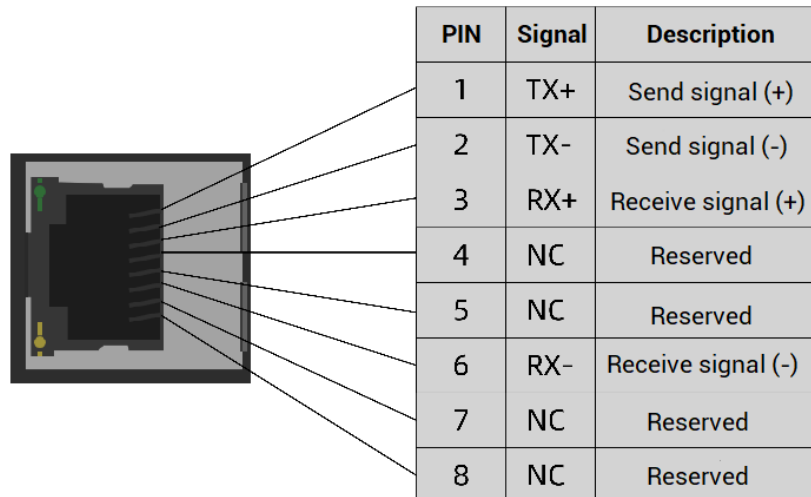
→ **Specification**

Item	Specification
Communication protocol	EtherCAT protocol
Valid service	CoE(PDO, SDO), FoE
Synchronization method	IO adopts input and output synchronization / DC-distributed clock
Physical level	100BASE-TX
Duplex mode	Full duplex
Topology	linear topology
Transfer media	Cable
Transfer distance	It is less than 100m between 2 nodes
Process data	Maximum 1486 bytes of one single frame
Synchronization shaking of two slave stations	<1us
Refresh	1000 digital input and output about is 30us

→ Communication Cable Requirements

Both RTEX communication interface and EtherCAT communication interface adopt standard Ethernet RJ45 interface.

The network cable adopts Category 5e STP, and the crystal head has a metal shell to reduce interference and to prevent information from being eavesdropped. As shown below:
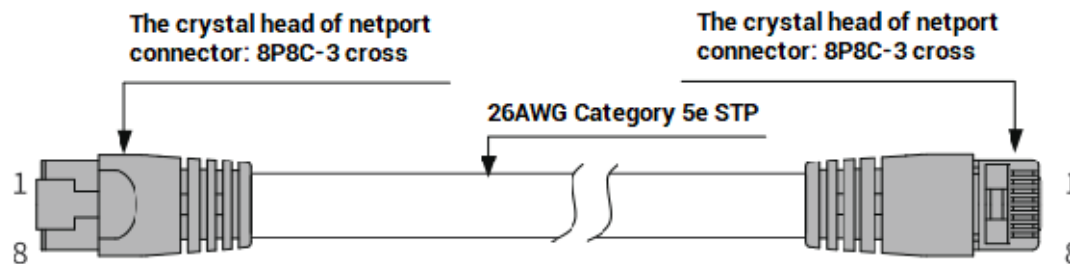
Item	Specification
Cable type	Flexible crossover cable, Category 5e
traverse	twisted pair
Line pairs	4
Isolation	cross skeleton
Connector	Crystal head with iron shell
Cable material	PVC
Cable length	Less than 100m

Use RJ45 network cable connection method:

● When installing, hold the crystal head that is with the cable and insert it into the RJ45 interface until it makes a "click" sound (kada).

● In order to ensure the stability of communication, please fix the cables with cable ties.

● When disassembling, press the tail mechanism of the crystal head, and pull out the connector and the module in a horizontal direction.

Please use tube-type pre-insulated terminals and cables with appropriate wire diameters to connect the user terminals.

3.8. DIP Switch

This product has one DIP switch.

→ DIP Switch Appearance
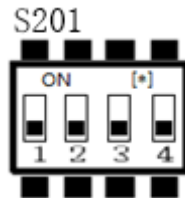
→ Usage Description

DIP switch S201 is used to set ID of PCI464.

When no dial, all are OFF: ID is 0.

When the first bit of S201 is dialed to ON: ID is 1.

When the second bit of S201 is dialed to ON: ID is 2.

When the third bit of S201 is dialed to ON: ID is 4.

When the fourth bit of S201 is dialed to ON: ID is 8.

Chapter IV Accessories

When PCI464 is used, following accessories are needed. Users can also purchase optional accessories according to their needs.

When users need to use IO and encoder, EXDB37M-37 wiring board can be used, which can be up to 8 input ports and 8 output ports.

→ 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.

CN2 is connected to X1.
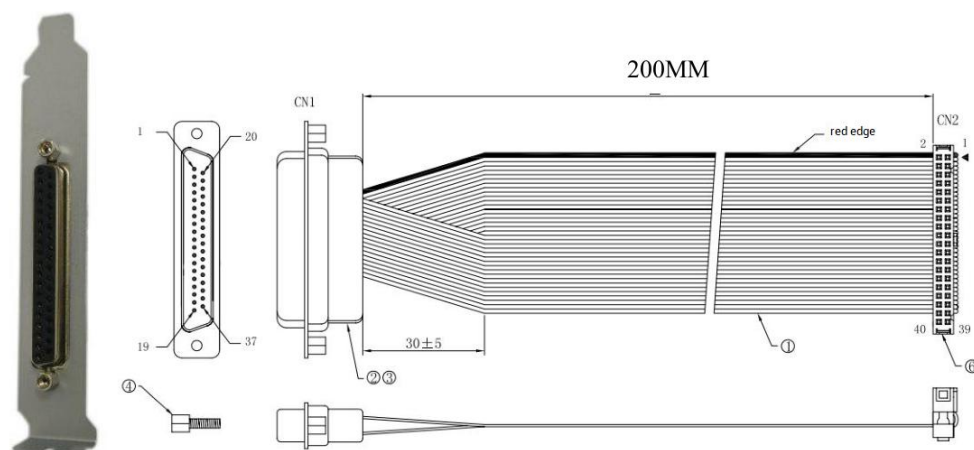
→ Cable

Connect the DB37-150 adapter cable to the interface board, which is convenient for users 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 EXDB37M-37 wiring board, please refer to 3.2.1 EXDB37M-37 wiring board description.
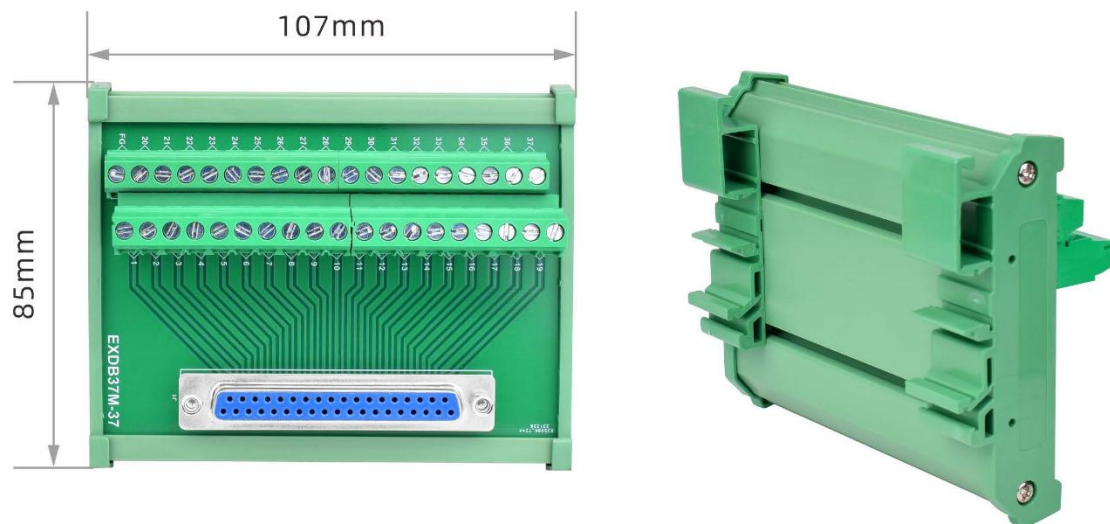
Chapter V Installation

5.1. PCI464 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.

5.2. Drive Program Installation

Method 1: install automatically

a. 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.
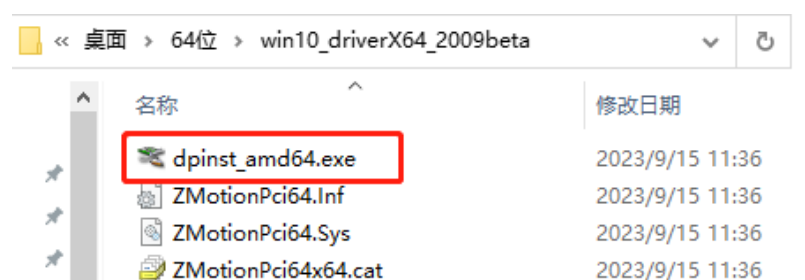
b. when hardware was installed, open the PC, at this time, Windows will detect the motion control card automatically, then please open "find new hardware wizard", and click "next":
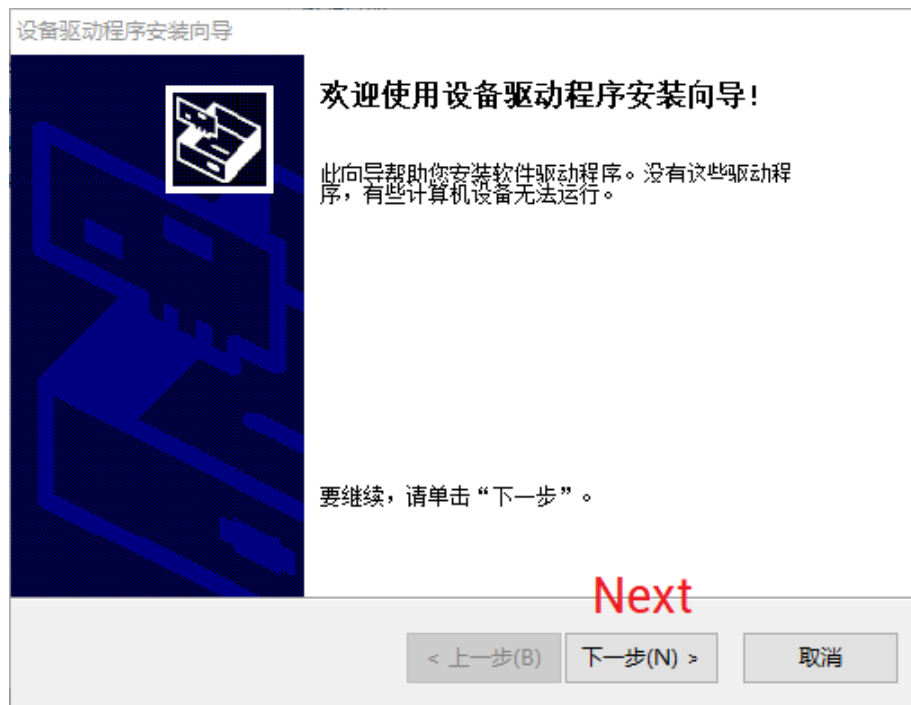
c. after clicking "next", it is installing. If there is antivirus software or safety manager risk tip, please allow them, or you could exit corresponding software before install. When installed, below window will appear:
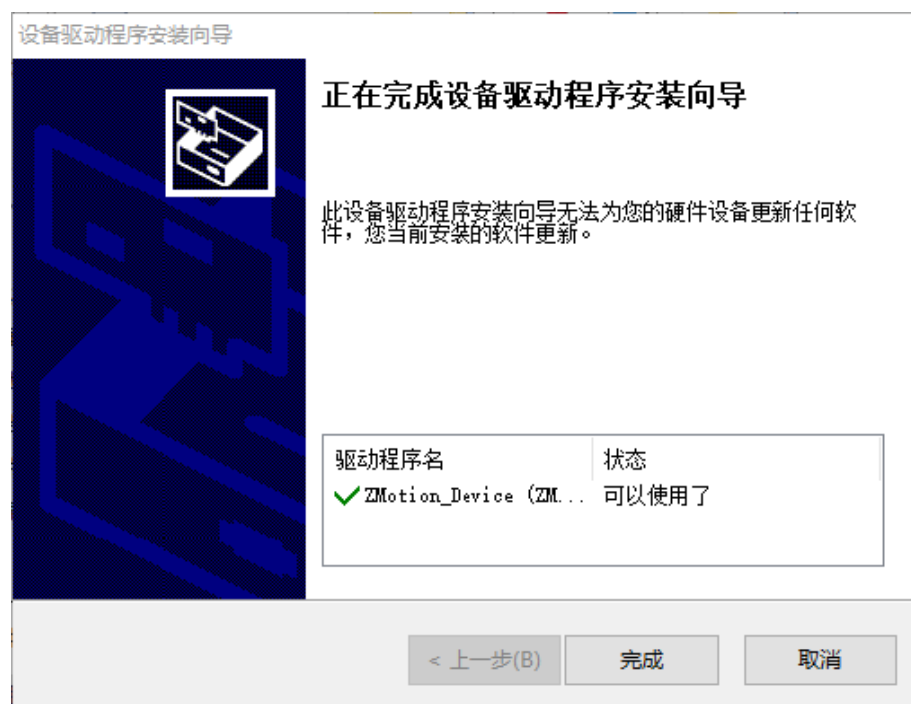
d. open device manager, it can be seen it is installed successfully.
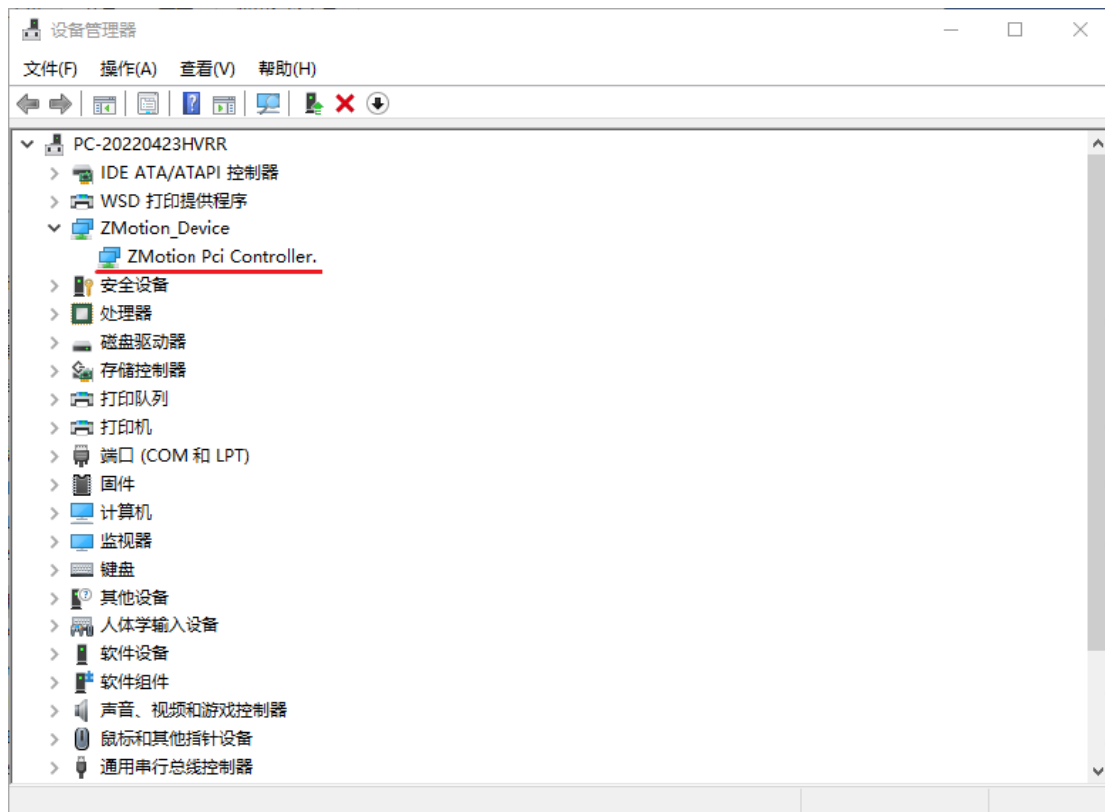
Note: if there is no drive program detected by Windows automatically after opening PC, or the drive program is removed, you could manually update drive program in device manager, then do above step by step.
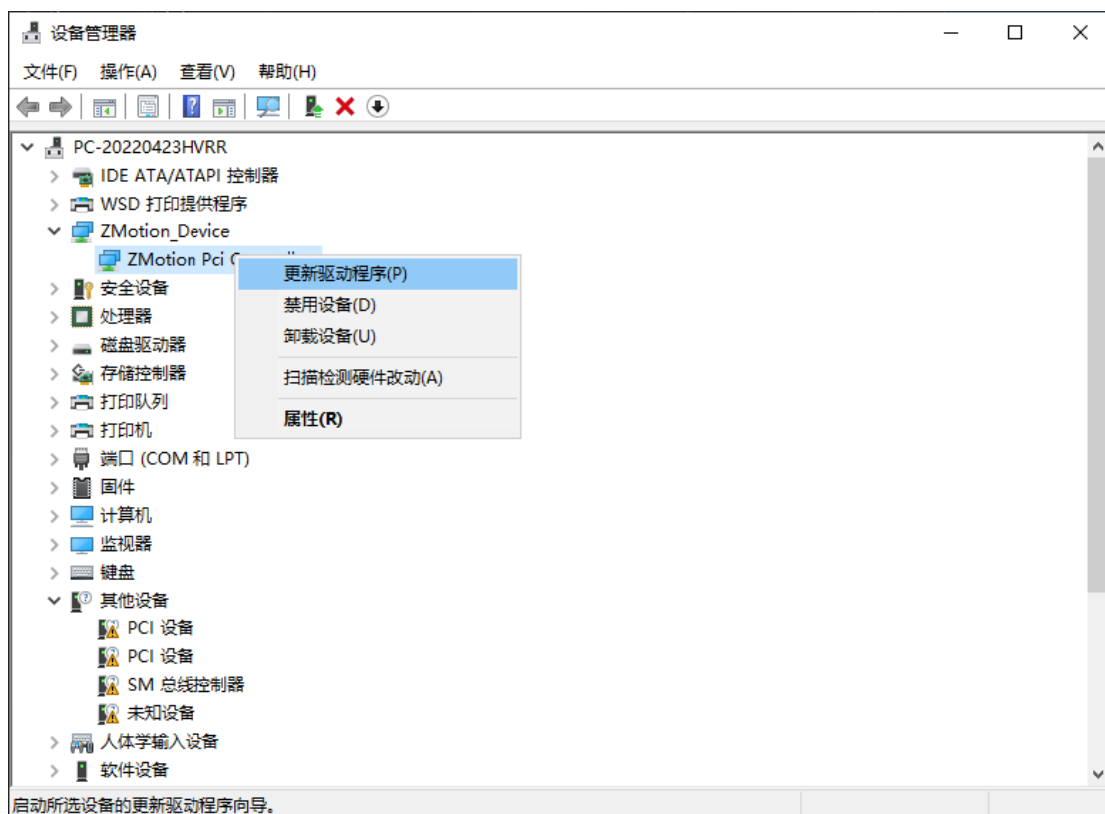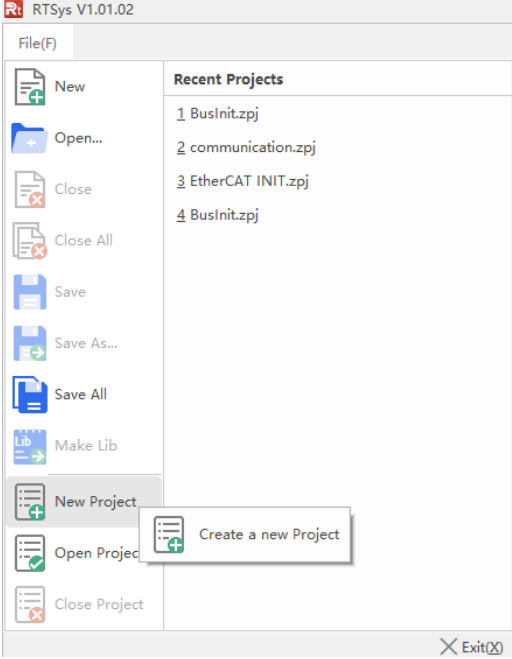
Method 2: install manually

a.   open the Device Manager menu and select the PCI device in Other Devices.
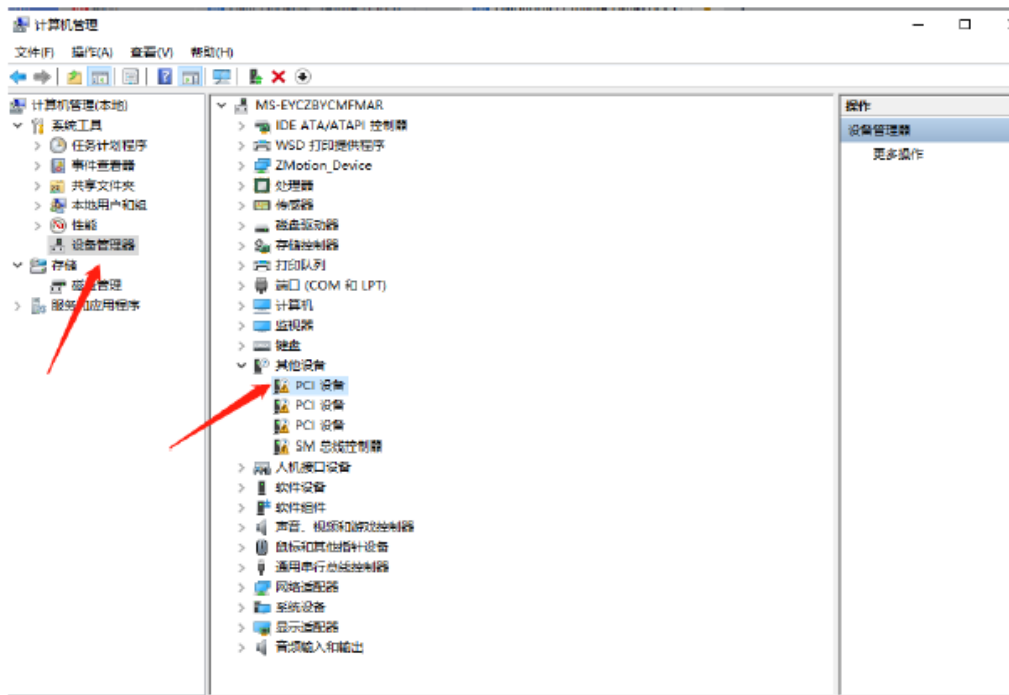
b.   if there are multiple PCI devices, right-click "Properties" to view detailed information, select "Hardware ID" for properties, and confirm that it is a PCI device starting with PCI\VEN_EF34&DEV_1234&.
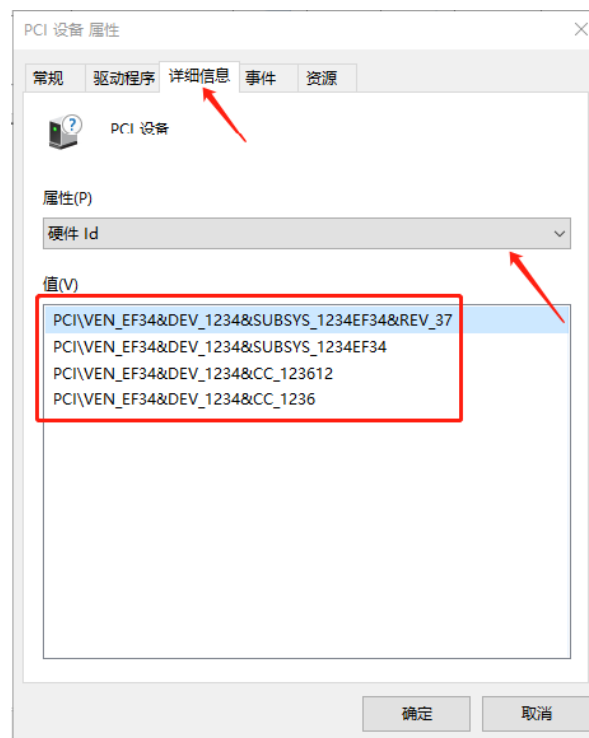
c.   find PCI Device, right-click to select "update drive program".
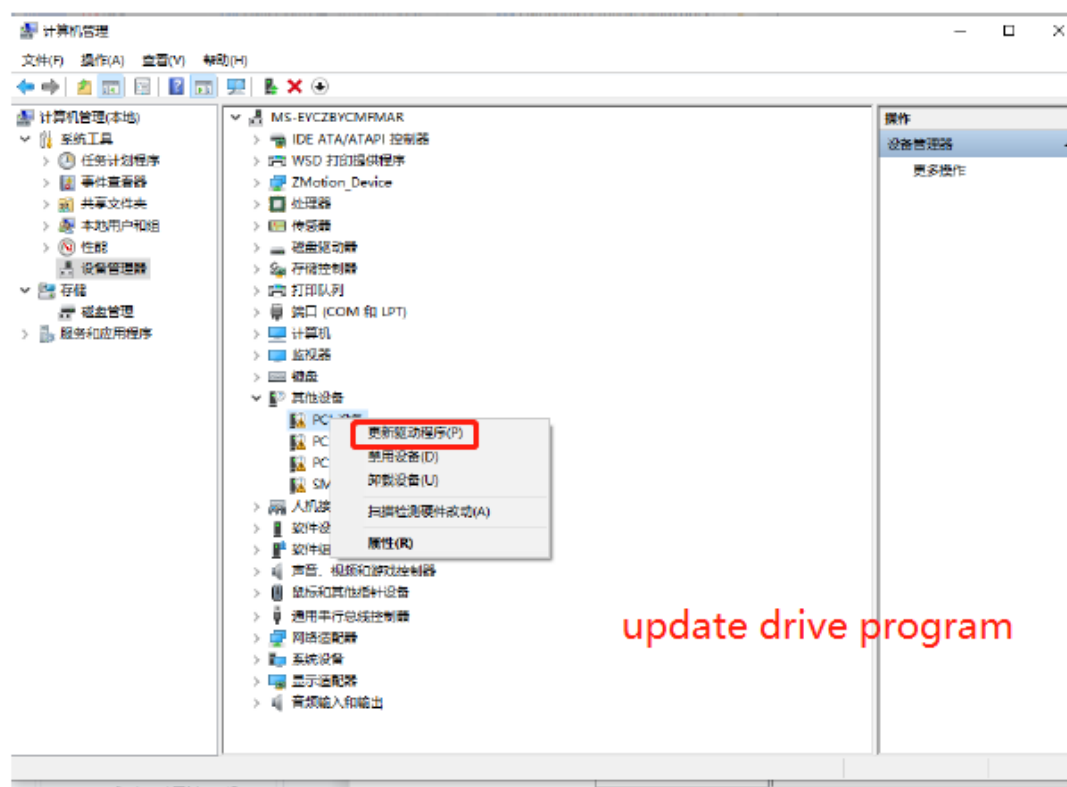
d.   select "browse my PC to check drive program".
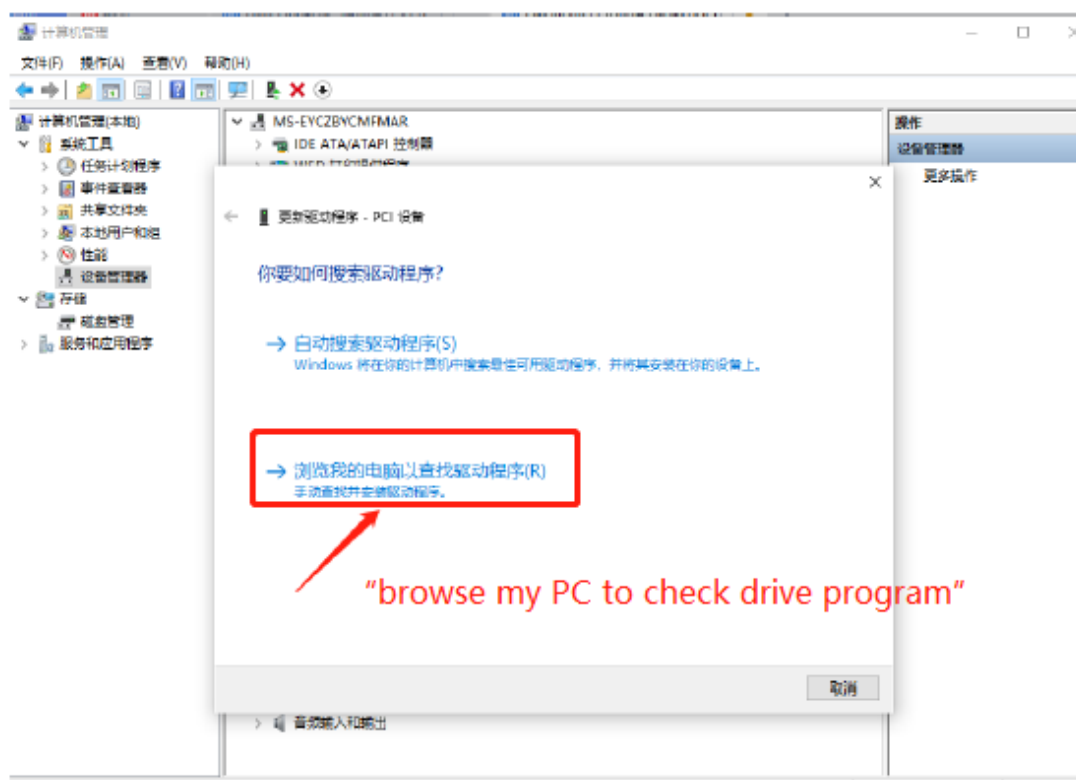
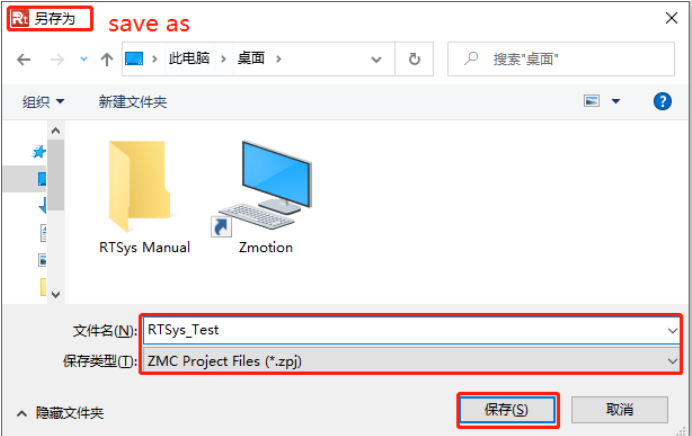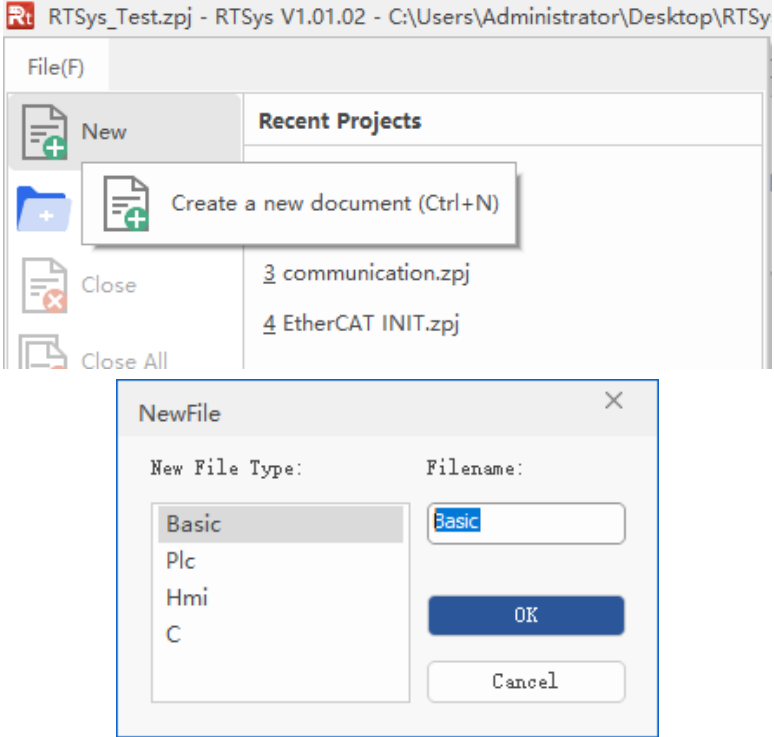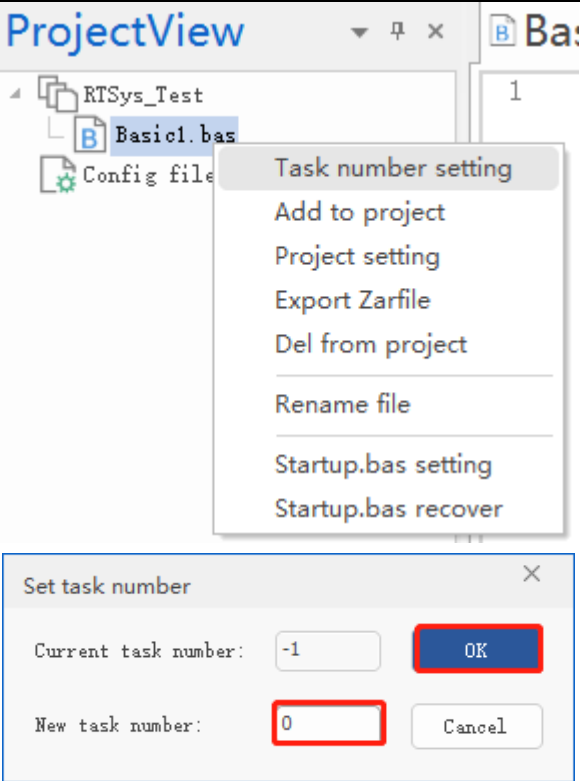e. click "browse", and select driver folder. Then, click "next".
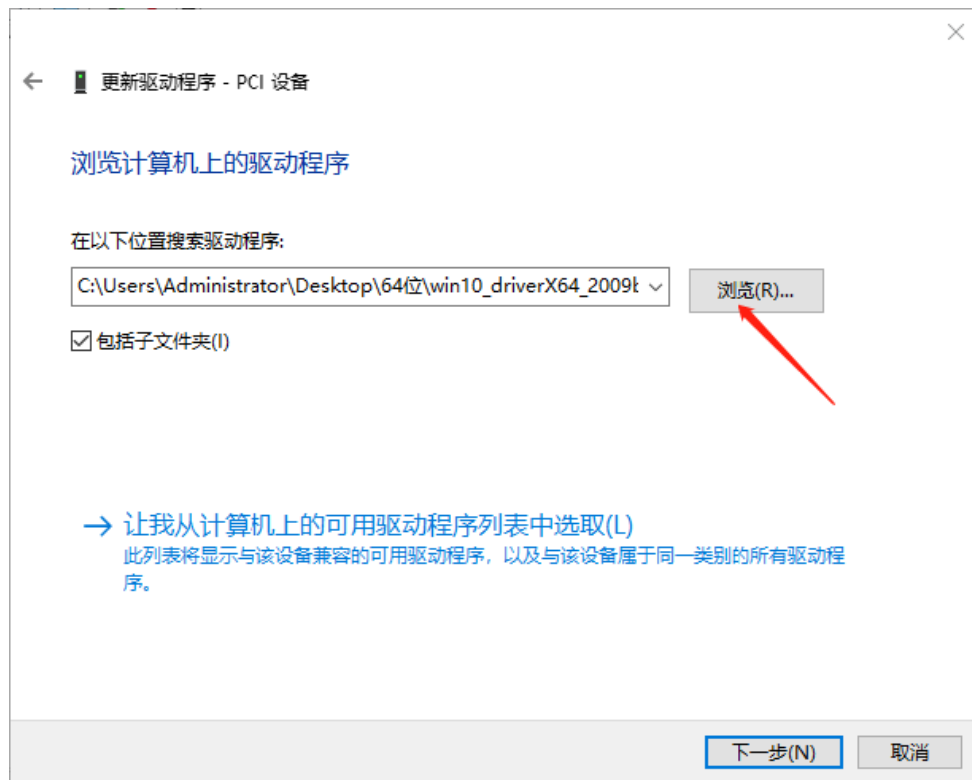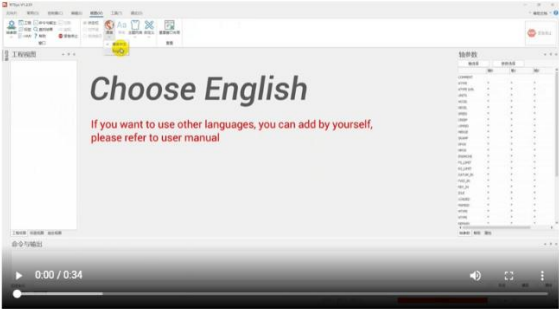
f. If there is antivirus software or safety manager risk tip during installing, please allow them, or you could exit corresponding software before install. When installed, below window will appear:
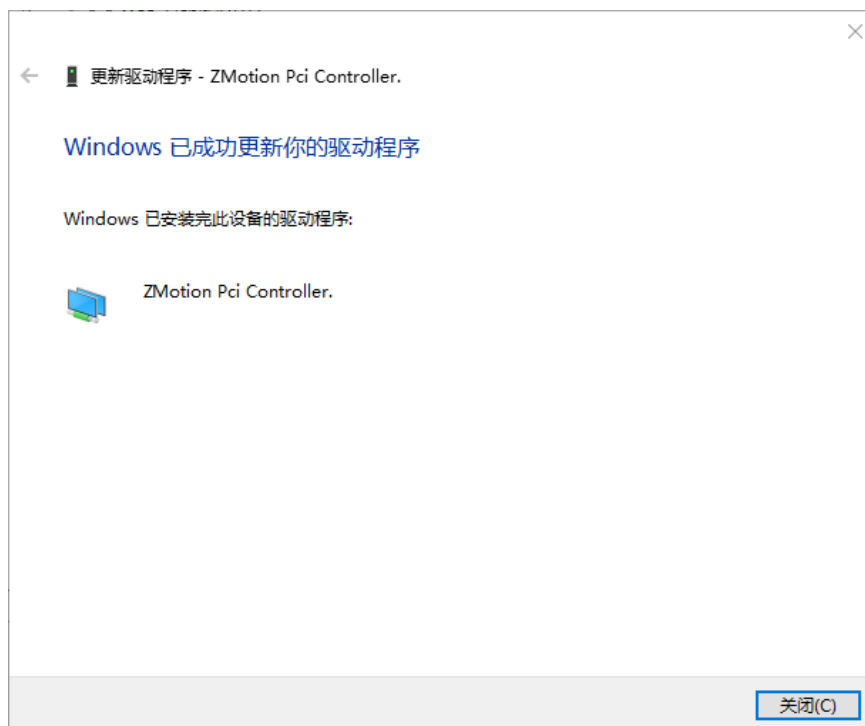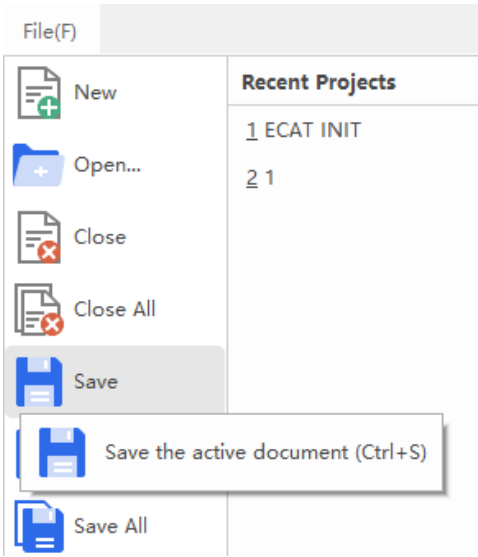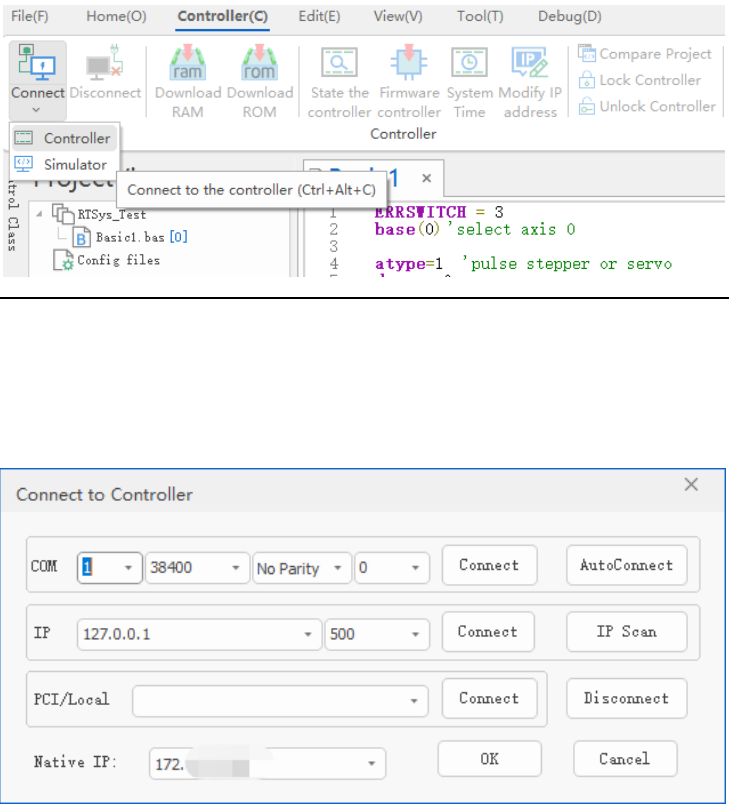
g. If there is "Zmotion Pci Controller" in the device manager, the installation is successful.

Chapter VI Programming

6.1. 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":

Features	Parameters	System Architecture	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
RTBasic Programming Manual	V1.1.0	PDF	18.3MB	Download
RTHMI Programming Manual	V1.2.0	PDF	7.23MB	Download
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:** 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. **Choose English** If you want to use other languages, you can add by yourself, please refer to user manual ▶ 0:00 / 0:34
2	**New Project:** "File" – "New Project", Save as window will pop up, then enter file name, save the project file with suffix "zpj.".	RTSys V1.01.02 File(F) New **Recent Projects** Open... 1 BusInit.zpj Close 2 communication.zpj Close All 3 EtherCAT INIT.zpj Save 4 BusInit.zpj Save As... Save All Make Lib New Project Create a new Project Open Project Close Project ✕ Exit(X) 另存为 **save as** ← → ↑ 📁 此电脑 › 桌面 › 组织 ▾ 新建文件夹 RTSys Manual Zmotion 文件名(N): RTSys_Test 保存类型(T): ZMC Project Files (*.zpj) ∧ 隐藏文件夹 保存(S) 取消

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

6.2. 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.

6.3. 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
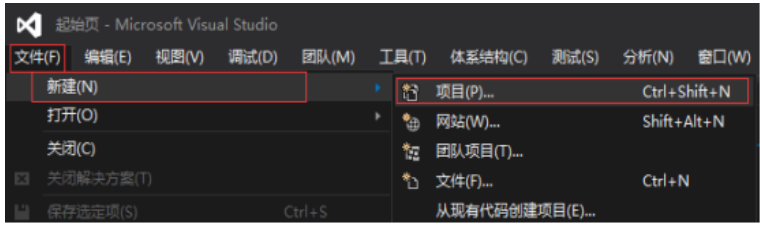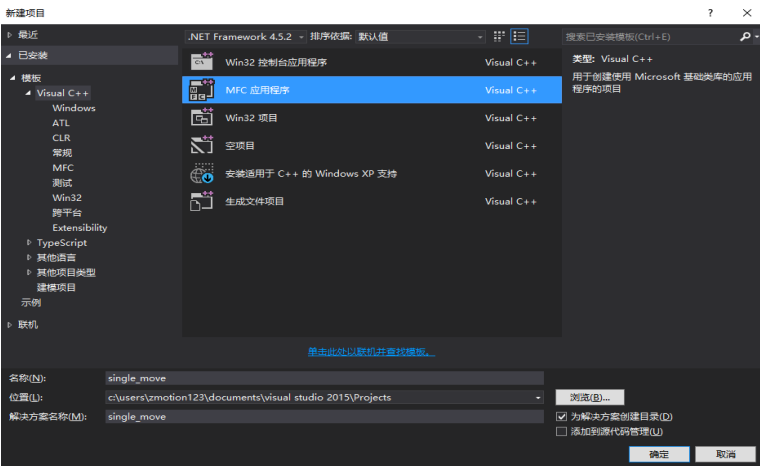to "Zmotion PC Function Library Programming Manual".
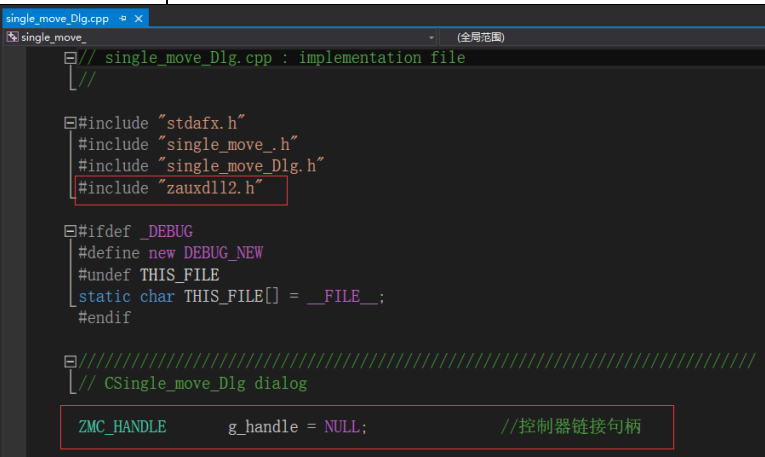
The program developed using the PC software cannot be downloaded to the controller,
and it is connected to the controller through the dll dynamic library. The dll library needs
to be added to the header file and declared during development.

● Get PC library file, example: https://www.zmotionglobal.com/download_list_17.html
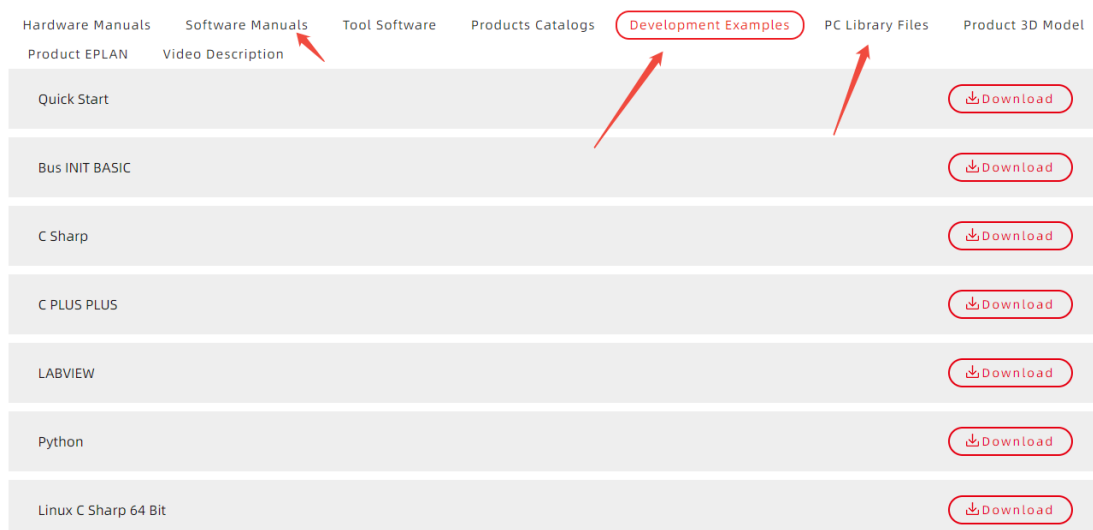
The c++ project development process in VS is as follows:
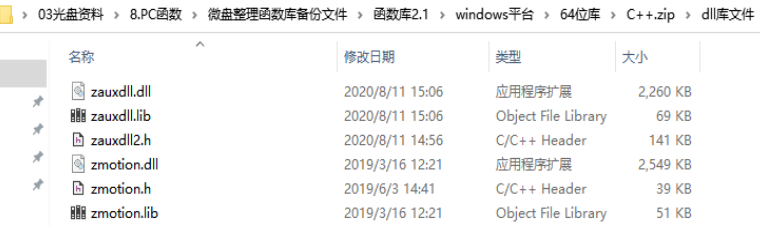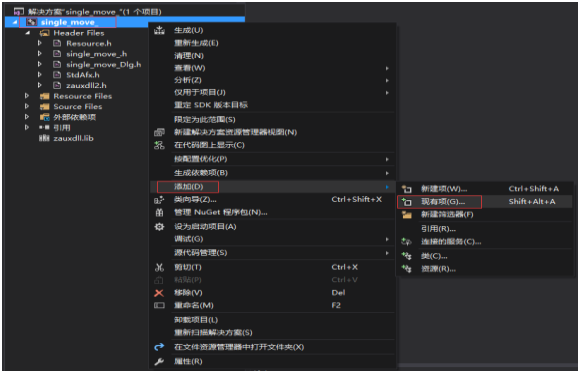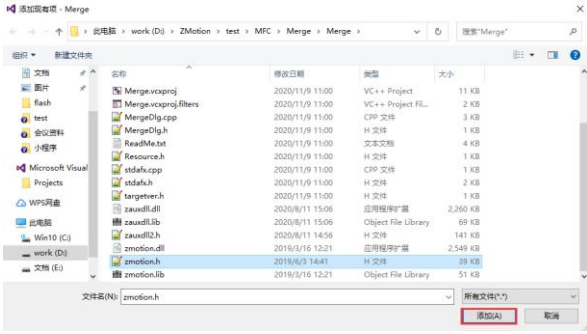
Step	Operations	Display Interface
1	Open VS, click "File" – "New" – "Project".	
2	Select development language as "Visual C++" and the select program type as "MFC application type".	
3	Select "Based on basic box", click "next" or "finish"	
4	Find C++ function library provided by manufacturer. Routine 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 VII 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.

7.1. 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

7.2. Common Problems & Solutions

Problems	Suggestions
Motor does not rotate.	1. Check whether the ATYPE of the controller is correct. 2. Check whether hardware position limit, software position limit, alarm signal work, and whether axis states are normal. 3. Check whether motor is enabled successfully. 4. Confirm whether pulse amount UNITS and speed values are suitable. If there is the encoder feedback, check whether MPOS changes. 5. Check whether pulse mode and pulse mode of drive are matched. 6. Check whether alarm is produced on motion controller station or drive station. 7. Check whether the wiring is correct. 8. 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.