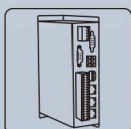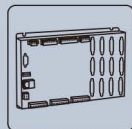# PCI464 Bus Motion Control Card
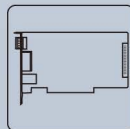
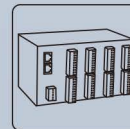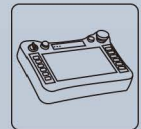## PCI464

Vision Motion Controller    Motion Controller    Motion Control Card    IO Expansion Moudle    HMI

# ✚ **Foreword**

**Zmotion®**

The motion controller provides rich interface, and it has excellent motion control performance, which can meet the expansion requirements of various projects.

This manual is copyrighted by Shenzhen Technology Co., Ltd., without the written permission of the Zmotion Technology, no person shall reproduce, translate and copy any content in this manual. The above-mentioned actions will constitute an infringement of the copyright of the company's manual, and Zmotion will investigate legal responsibility according to law.

For details about the ZMC controller software and the introduction and routine of each command, please refer to the ZBASIC software manual.

Information contained in this manual is only for reference. Due to improvements in design and functions and other aspects, Zmotion Technology reserves the final interpretation! Subject to change without notice!

Pay attention to safety when debugging the machine!

Please be sure to design an effective safety protection device in the machine, and add an error handling program in the software, otherwise Zmotion has no obligation or responsibility for the loss caused.

In order to ensure the safe, normal and effective use of the product, please be sure to read this product manual carefully before installing and using the product.

# 🔳 Safety Statement

- This chapter describes the safety precautions required for the correct use of this product. Before using this product, please read the instructions for use and correctly understand the relevant information on safety precautions.
- This product should be used in an environment that meets the design specifications, otherwise it may cause equipment damage or personal injury, and malfunctions or component damage caused by failure to comply with relevant regulations are not within the scope of product quality assurance.
- Zmotion will not take any legal responsibility for personal safety accidents and property losses caused by failure to comply with the contents of this manual or illegal operation of products.

# 🔳 Safety Level Definition

According to the level, it can be divided into " Danger " and " Caution ". Failure to operate as required may result in moderate injury, minor injury or equipment damage.

Please keep this guide in a safe place for reading when needed, and be sure to hand this manual to the end user.

| Install | |
|---|---|
| ⚠️<br>Danger | ◆ When the controller is disassembled, all external power supplies used by the system should be disconnected before operation, otherwise it may cause misoperation or damage to the equipment.<br>◆ It is forbidden to use in the following places: places with dust, oil fume, conductive dust, corrosive gas and flammable gas; places exposed to high temperature, condensation, wind and rain; places with vibration and shock. Electric shock, fire and misuse can cause product damage and deterioration. |
| ⚠️<br>Notice | ◆ Avoid metal shavings and wire ends falling into the hardware circuit board during installation.<br>◆ After installation, ensure that there are no foreign objects on the hardware circuit board.<br>◆ When installing, make it tightly and firmly with the mounting frame. |

| | ◆ Improper installation of the controller may result in misoperation, failure and fire. |
|---|---|
| **Wiring** | |
| ⚠️<br><br>Danger | ◆ The specifications and installation methods of the external wiring of the equipment shall comply with the requirements of local power distribution regulations.<br><br>◆ When wiring, all external power supplies used by the system should be disconnected before operation.<br><br>◆ When powering on and running after the wiring work is completed, the terminals attached to the product must be installed.<br><br>◆ Cable terminals should be well insulated to ensure that the insulation distance between cables will not be reduced after the cables are installed on the terminal block. |
| ⚠️<br><br>Notice | ◆ Avoid metal shavings and wire ends falling into the hardware circuit board during installation.<br><br>◆ The cable connection should be carried out correctly on the basis of confirming the type of the connected interface.<br><br>◆ It should be confirmed that the cables pressed into the terminals are in good contact.<br><br>◆ Do not bundle the control wires and communication cables with the main circuit or power supply wires, etc., and the distance between the wires should be more than 100 mm, otherwise noise may cause malfunction.<br><br>◆ If the controller is not installed properly, it may cause electric shock or equipment failure or malfunction. |

# 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. Function Features

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

◆ Pulse output mode: pulse / direction or dual pulses.

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

◆ Maximum pulse output frequency of each axis is 10MHZ.

◆ There are one EtherCAT interface, one CAN interface, one RTEX interface, one general input and output and encoder interface, and several kinds of expansion applications are valid.

◆ Refresh period of EtherCAT is 500us (it needs to custom the firmware to update the cycle).

◆ 4096 isolated inputs and 4096 isolated outputs can be extended at most through

CAN bus 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 ZBasic.

◆ A variety of program encryption methods to protect the intellectual property rights of customers.

## 1.3. Model Information



PCI    4    64

Control Card Model

Serial No.

Axes
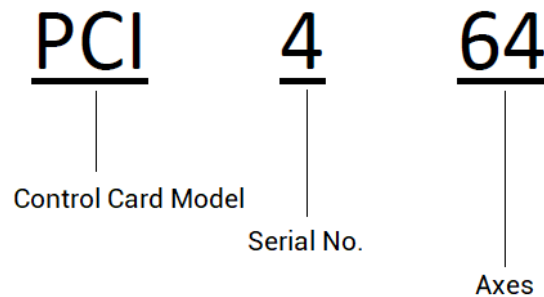
## 1.4. System Frame
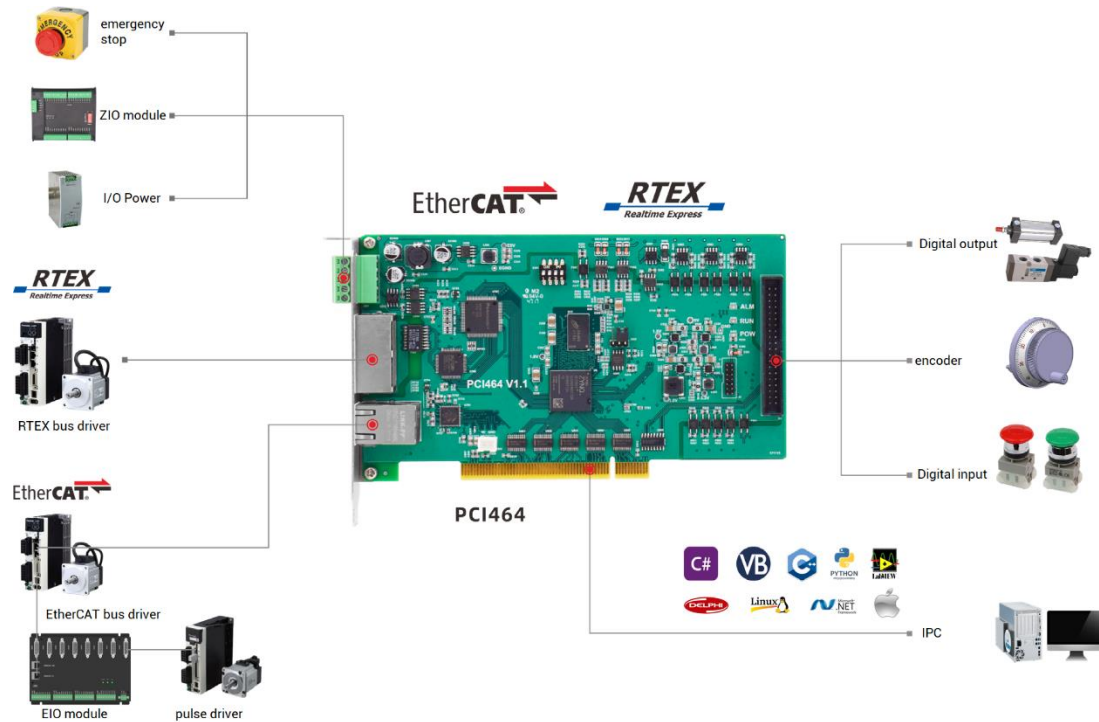


## 1.5. Hardware Installment

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

➕ CI 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.

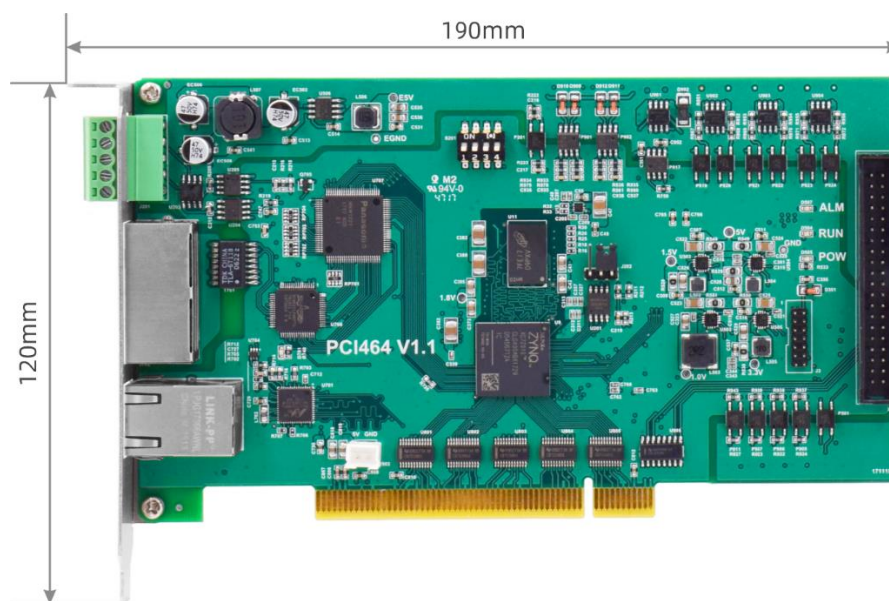| | |
|---|---|
| ⚠️ **Installation attention** | ● Non-professionals are strictly prohibited to operate. Specifically, professionals who had been trained related electrical equipment, or who master electrical knowledge.<br>● Please be sure to read the product instruction manual and safety precautions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

# Chapter II Product Specification

## 2.1. Basic Specification

| Item | Description |
|---|---|
| Model | PCI464 |
| Basic Axes | 64 |
| Type of Basic Axes | Pulse axis / EtherCAT bus axis / RTEX bus axis |
| 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 |
| Highest Pulse Frequency | 10MHz |
| 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

| Model | 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. |
|---|---|
| PCI464 | 64 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 |
|---|---|---|
| Adapter cable | ZP72-02 | 40P plug to DB37 female flat cable |
| Shield cable | DB37-150 | DB37 core male to male cable |
| Wiring board | EXDB37M-37 | DB37 wiring board |

## 2.3. Interface Definition
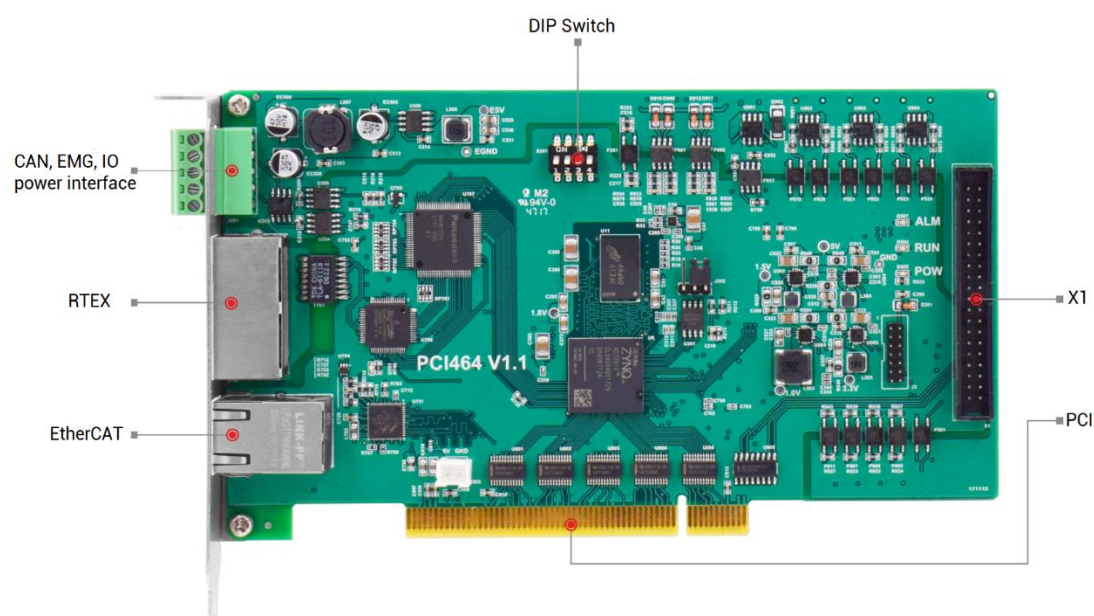


→ Interface Description

| 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 bus interface, 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%-95% 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 |

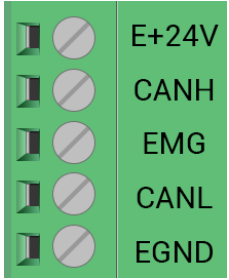| Degree of Protection | IP20 |
|---|---|

# Chapter III Wiring, Communication Configuration

## 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<br>CANH<br>EMG<br>CANL<br>EGND | E+24V | Input | Power 24V input |
| | CANH | | CAN differential data H / + |
| | EMG | | Emergency stop switch signal |
| | CANL | | CAN differential data L / - |
| | EGND | | IO power ground / communication public end |
| Notes:<br>➢ 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.<br>➢ 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 | Valid |
| Overcurrent Protection | Valid |

## 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 100m 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 together. In CAN bus left and right sides, connect a 120Ω resistor respectively (please see below graphic).
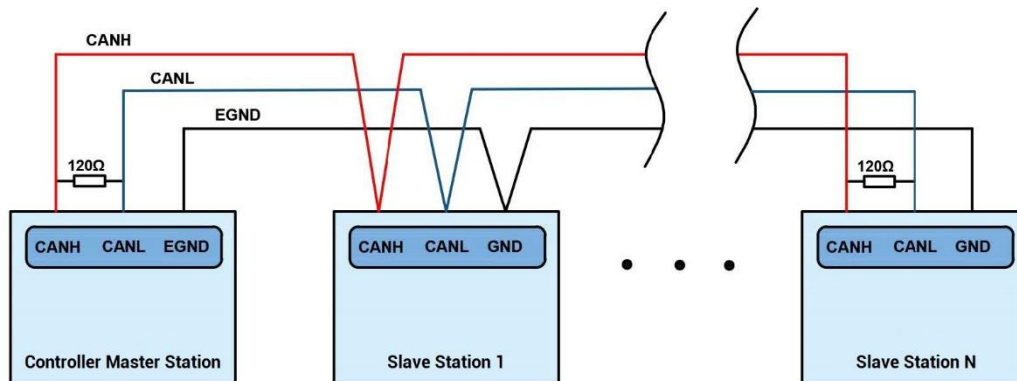


## → **Wiring Notes:**

- 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.
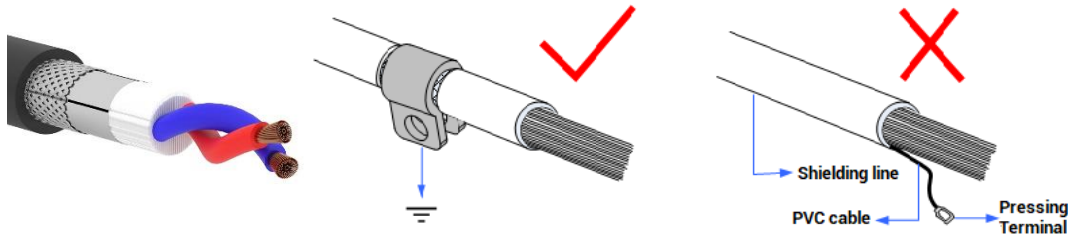


## 3.1.3. Basic Usage Method

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

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

(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 "ZDevelop/Controller/State the Controller/Communication Info" to view the CAN status intuitively, and refer to the "ZBasic 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.
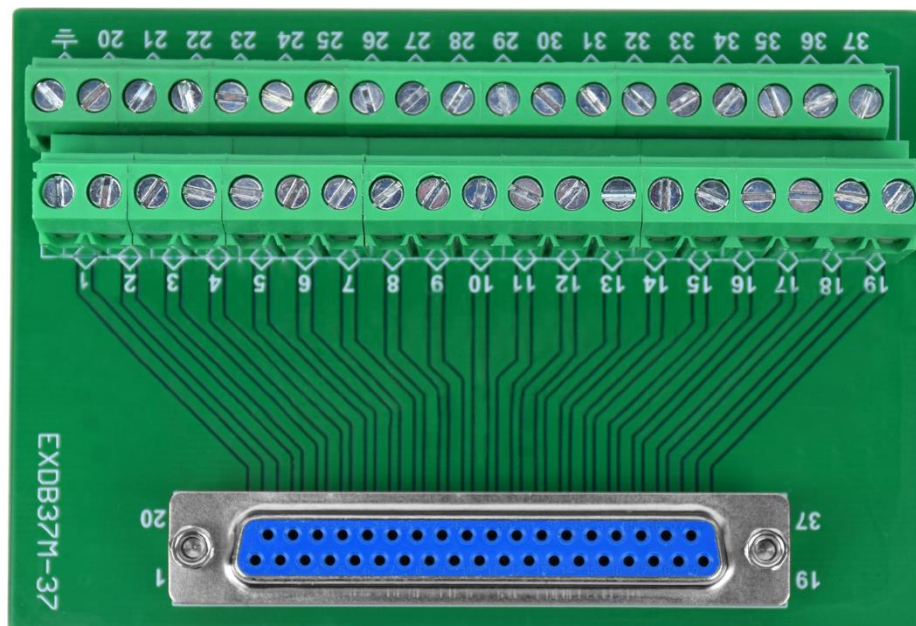
## 3.2. X1 Interface

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**
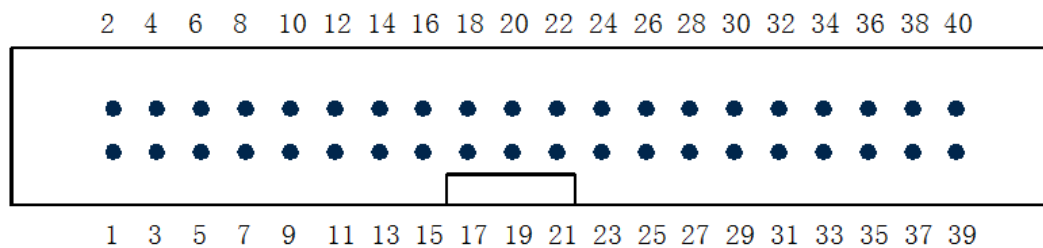


## 3.2.1. EXDB37M-37 Wiring Board

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 power 24V - / IO |
| 18 | NC | Reserved | 38 | EGND | public end |
| 19 | EGND | IO power 24V - / IO public | 39 | NC | Reserved |
| 20 | EGND | end | 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
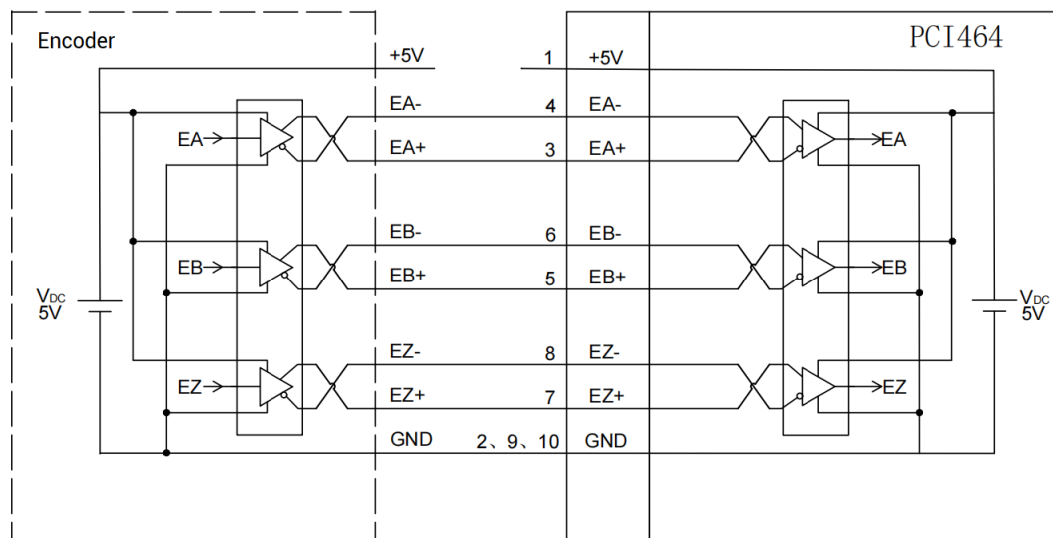
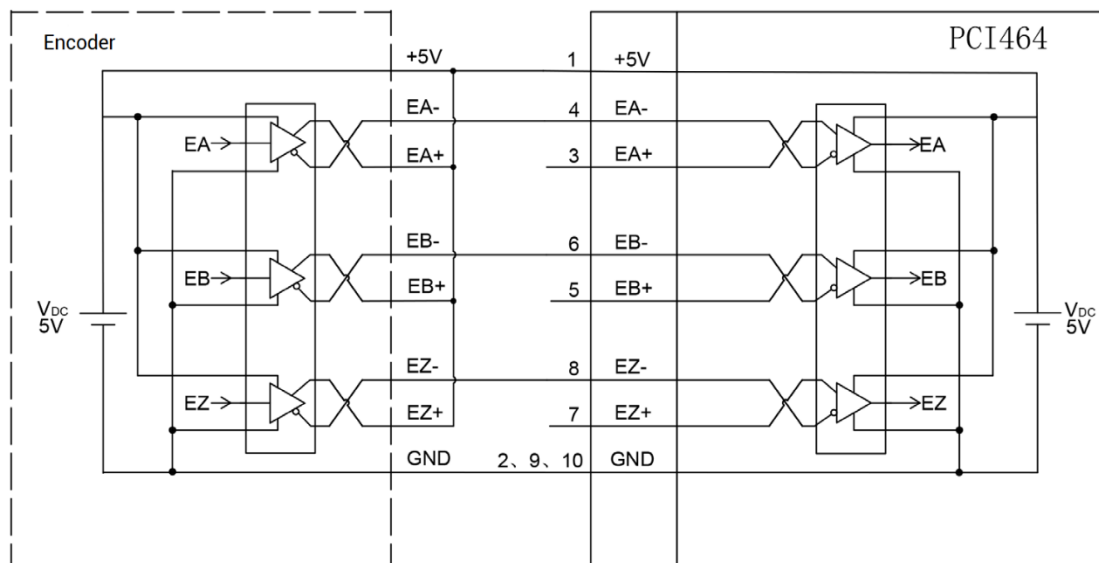## 3.3.1. Encoder Interface Specification & Wiring

### → 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:

➢ **Use the encoder through difference wiring:**

➢ **Use the encoder through single-ended wiring:**



## 3.3.2. Basic Usage Method

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

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

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

| Axis Parameters | | | | |
|---|---|---|---|---|
| Axis select | Parameter select | | | |
| | Axis0 | Axis1 | Axis2 | Axis3 |
| COMMENT | | | | |
| ATYPE | 0 | 0 | 0 | 0 |
| UNITS | 1 | 1 | 1 | 1 |
| ACCEL | 10000 | 10000 | 10000 | 10000 |
| DECEL | 0 | 0 | 0 | 0 |
| SPEED | 1000 | 1000 | 1000 | 1000 |
| CREEP | 100 | 100 | 100 | 100 |
| LSPEED | 0 | 0 | 0 | 0 |

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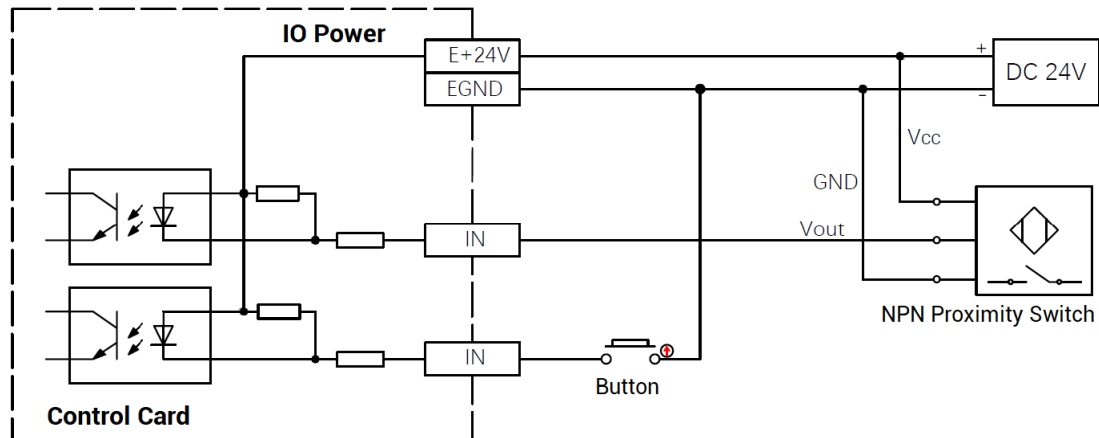


## 3.4.  IN Digital Inputs

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 type | NPN type |
| 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 power voltage (E+24V) is 24V. | | |

## → Wiring Reference



## → 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

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

(9) After powered on, please connect to ZDevelop.

(10) State values of corresponding input can be read directly through "IN" command or through "ZDevelop/View/In".
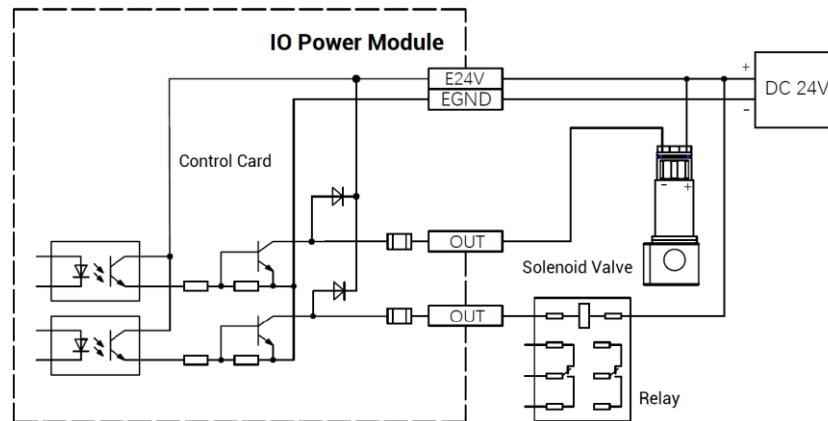
## 3.5. OUT: Digital Output

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

## 3.5.1. Digital Output Specification & Wiring

### → Specification

| Item | High-speed output (OUT0-1) | Low-speed output (OUT2-7) |
|---|---|---|
| Output method | NPN Leakage 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 400HKz. For low-speed output, it is recommended to be lower than 8HKz.
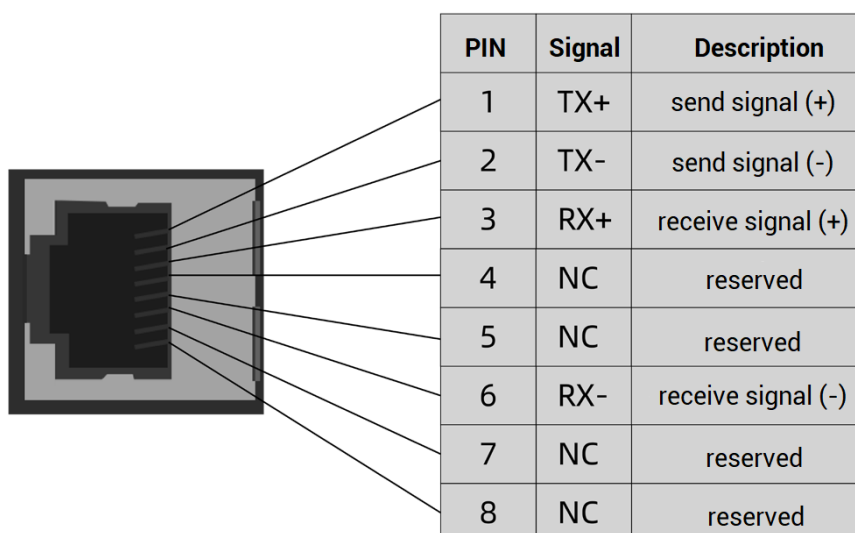
## → **Wiring Reference**



## → **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 ZDevelop.

(3)  Open or close output port directly through "OP" command, also, it can be opened or closed through "ZDevelop/View/Op". Please refer to "ZBasic" for details.
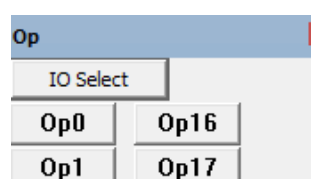
## 3.6. RTEX Bus Interface

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:
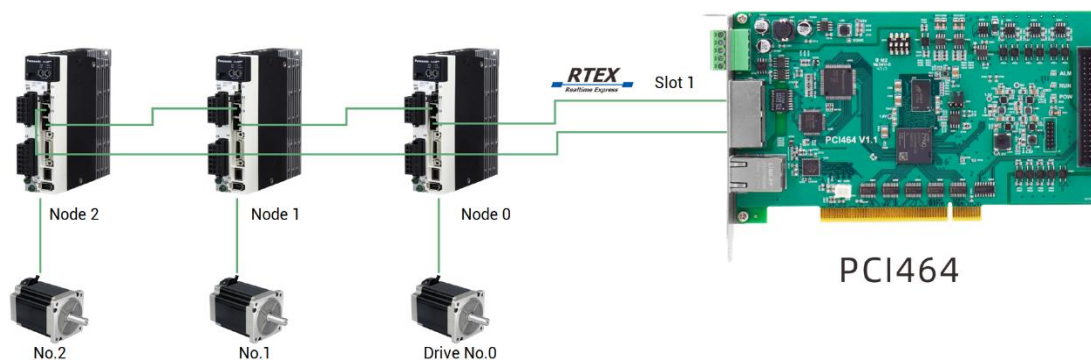


## 3.7. **EtherCAT Bus Interface**

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 |
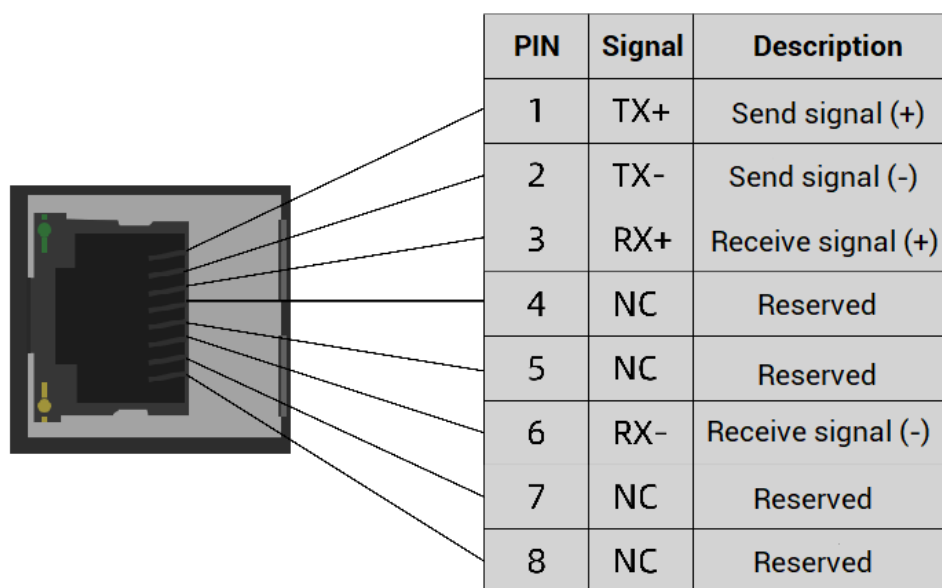
## → Specification

| 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, 16 servo axes are about 100us |

## → 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:

The crystal head of netport connector: 8P8C-3 cross

The crystal head of netport connector: 8P8C-3 cross

26AWG Category 5e STP
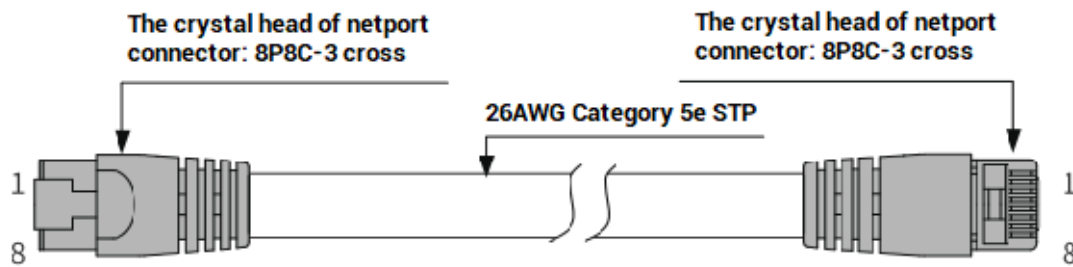
| Item | Specification |
|---|---|
| Cable type | Flexible crossover cable, Category 5e |
| traverse | twisted pair |
| Line pairs | 4 |
| Isolation | cross skeleton |
| Connector | Crystal head with iron shell |
| Cable material | PVC |
| Cable length | Less than 100m |

**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
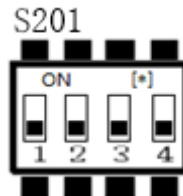


### → Usage Description

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.
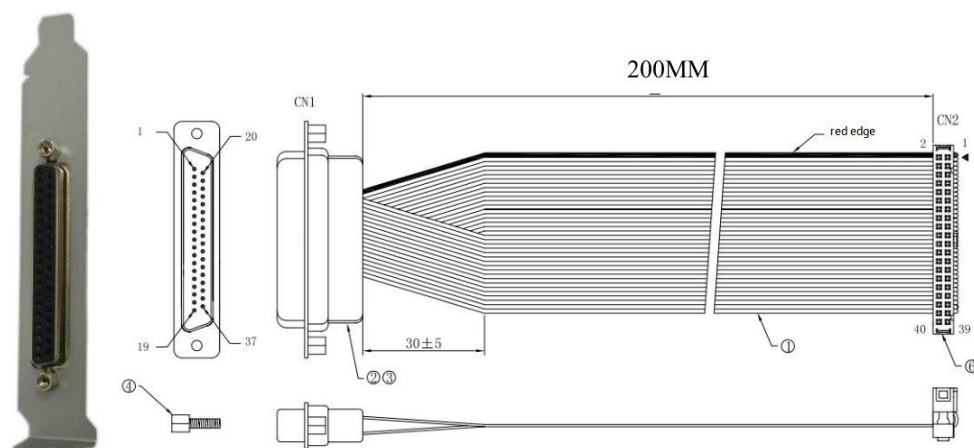


## → Cable

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.
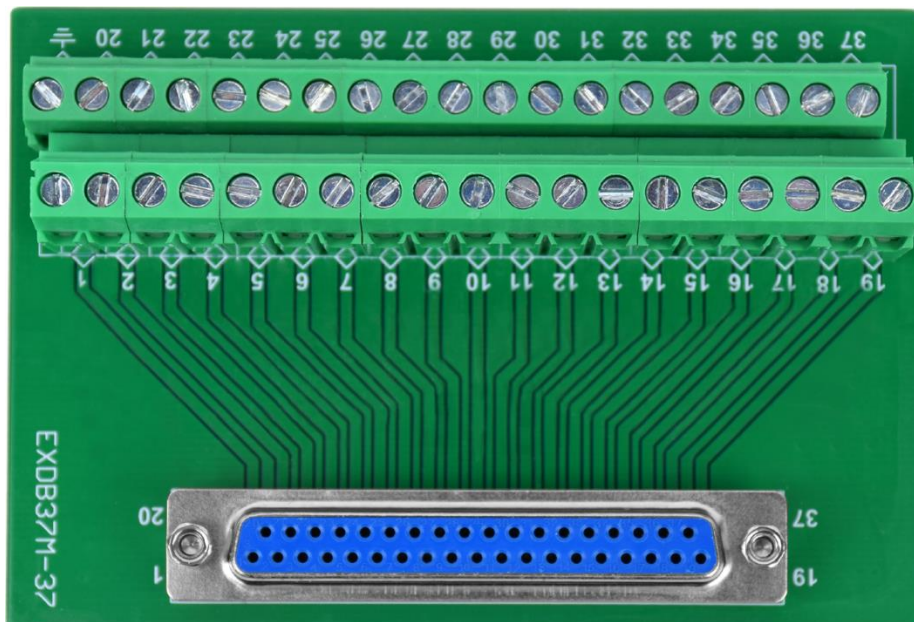
# Chapter V Installation

## 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.
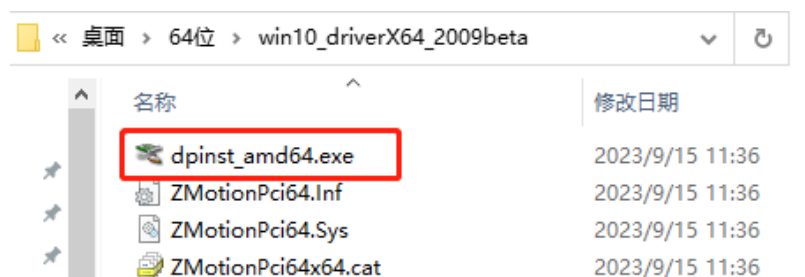


b.  when hardware was installed, open the PC, at this time, Windows will detect the motion control card automatically, then please open "find new hardware wizard", and click "next":
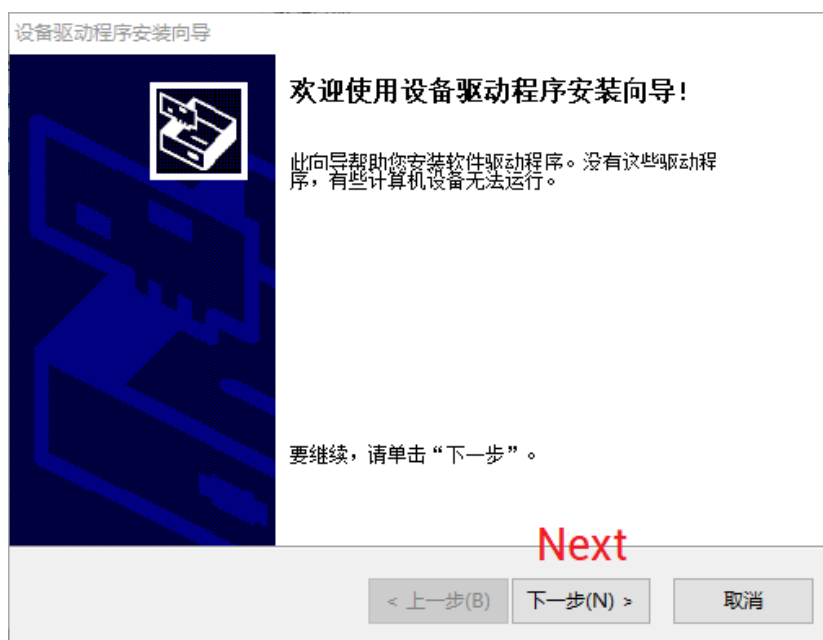
c.  after clicking "next", it is installing. If there is antivirus software or safety manager risk tip, please allow them, or you could exit corresponding software before install. When installed, below window will appear:
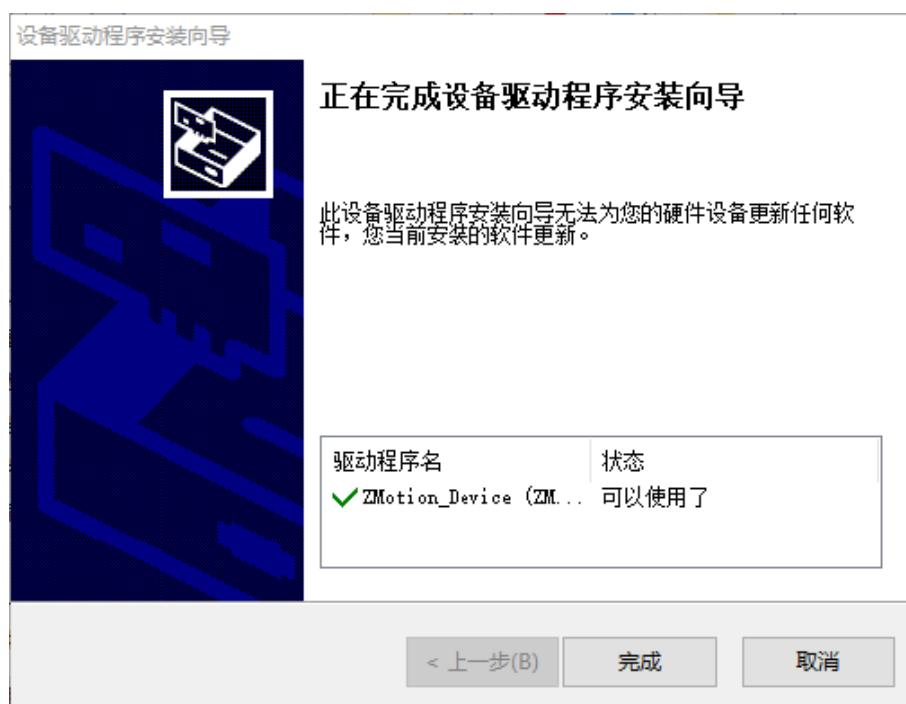


d.  open device manager, it can be seen it is installed successfully.
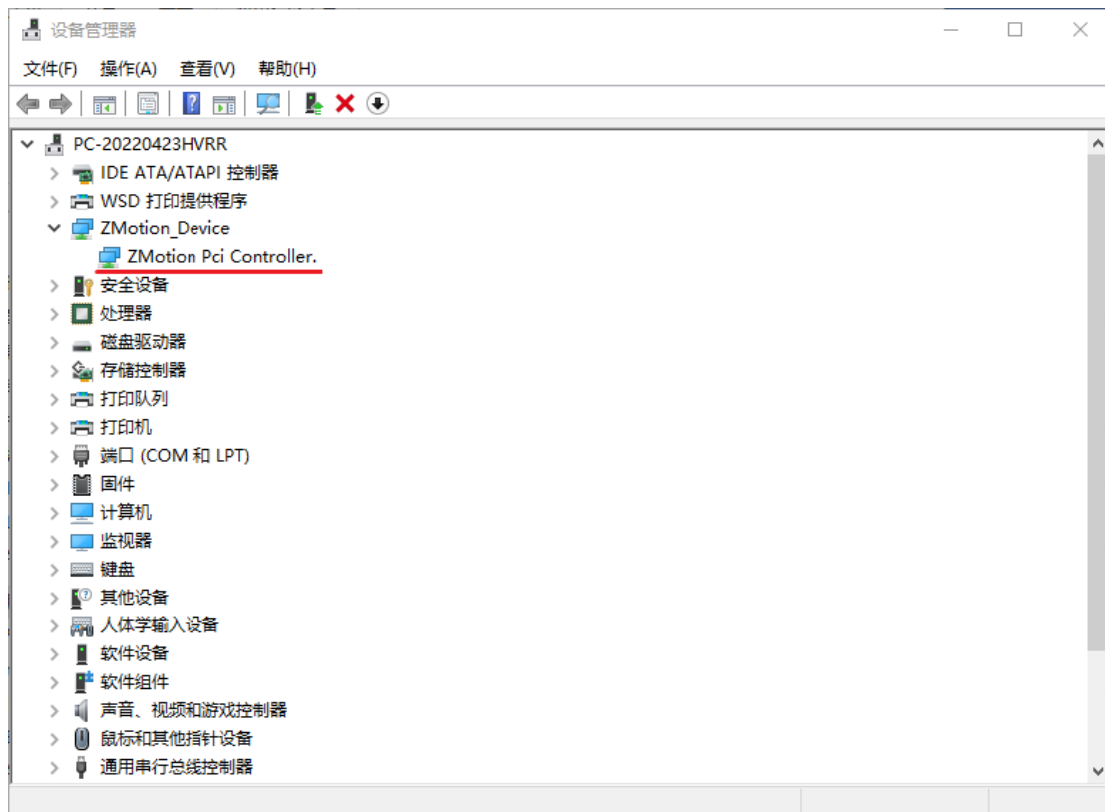
**Note:** if there is no drive program detected by Windows automatically after opening PC, or the drive program is removed, you could manually update drive program in device manager, then do above step by step.
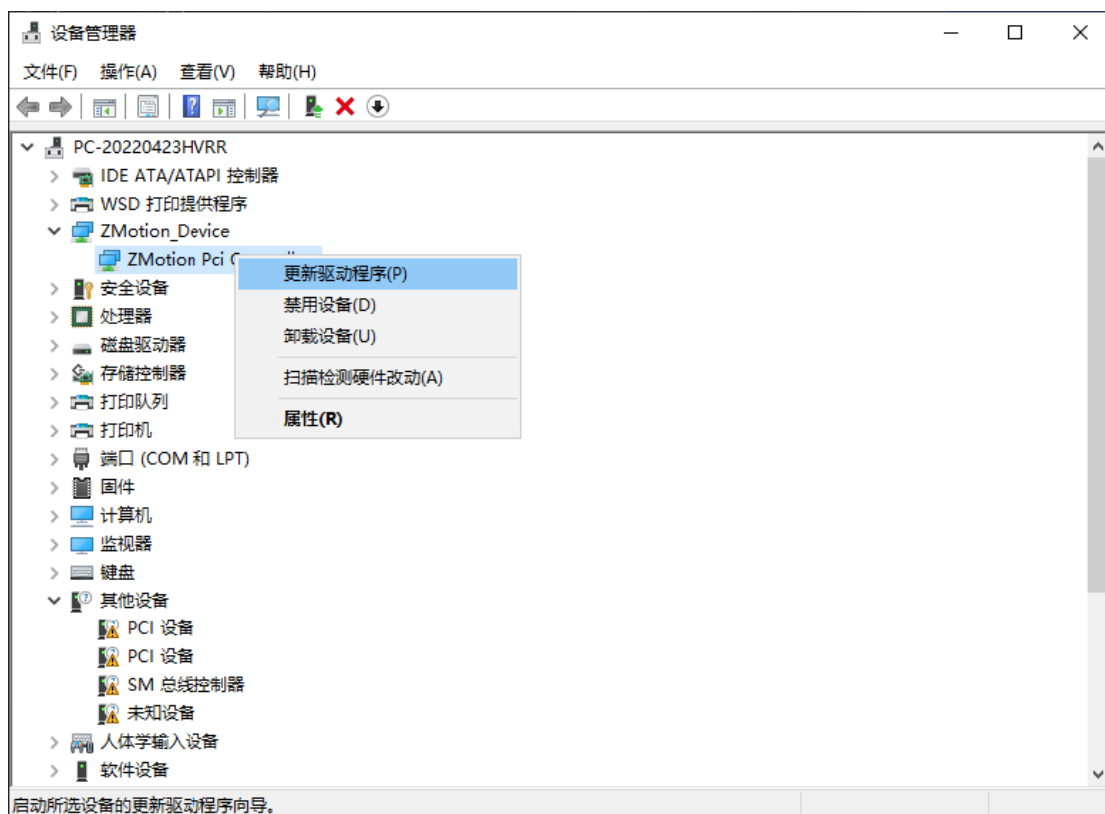
**Method 2: install manually**

a.  open the Device Manager menu and select the PCI device in Other Devices.
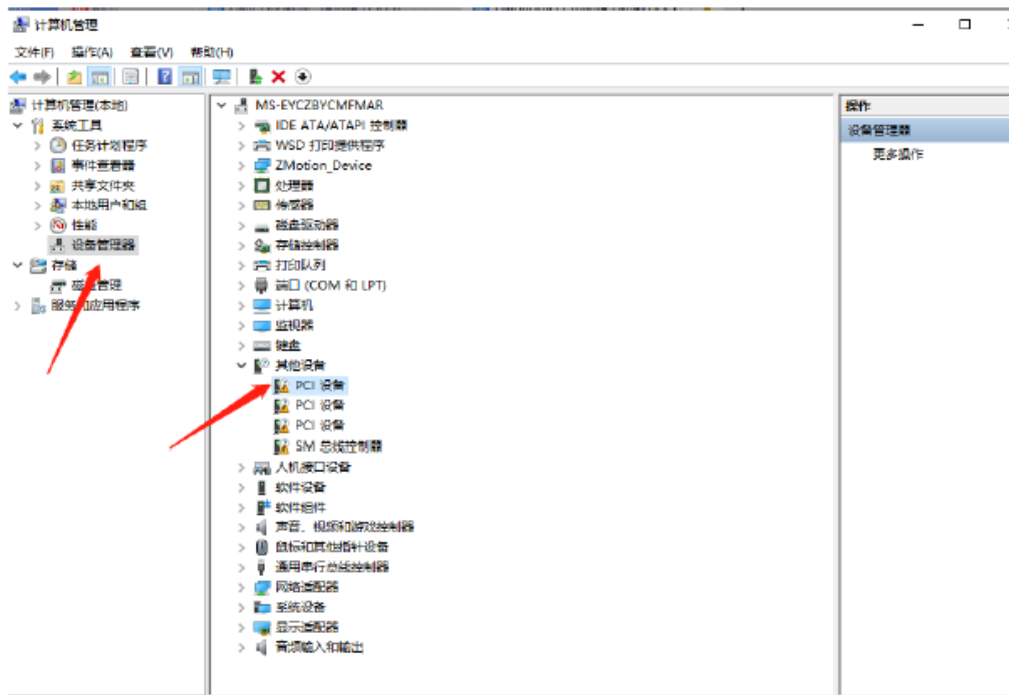


b.  if there are multiple PCI devices, right-click "Properties" to view detailed information, select "Hardware ID" for properties, and confirm that it is a PCI device starting with PCI\VEN_EF34&DEV_1234&.
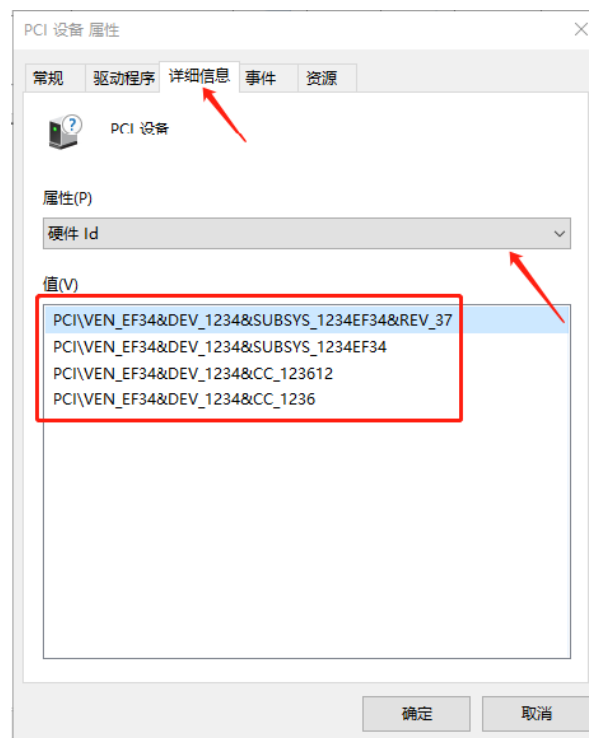
c.  find PCI Device, right-click to select "update drive program".
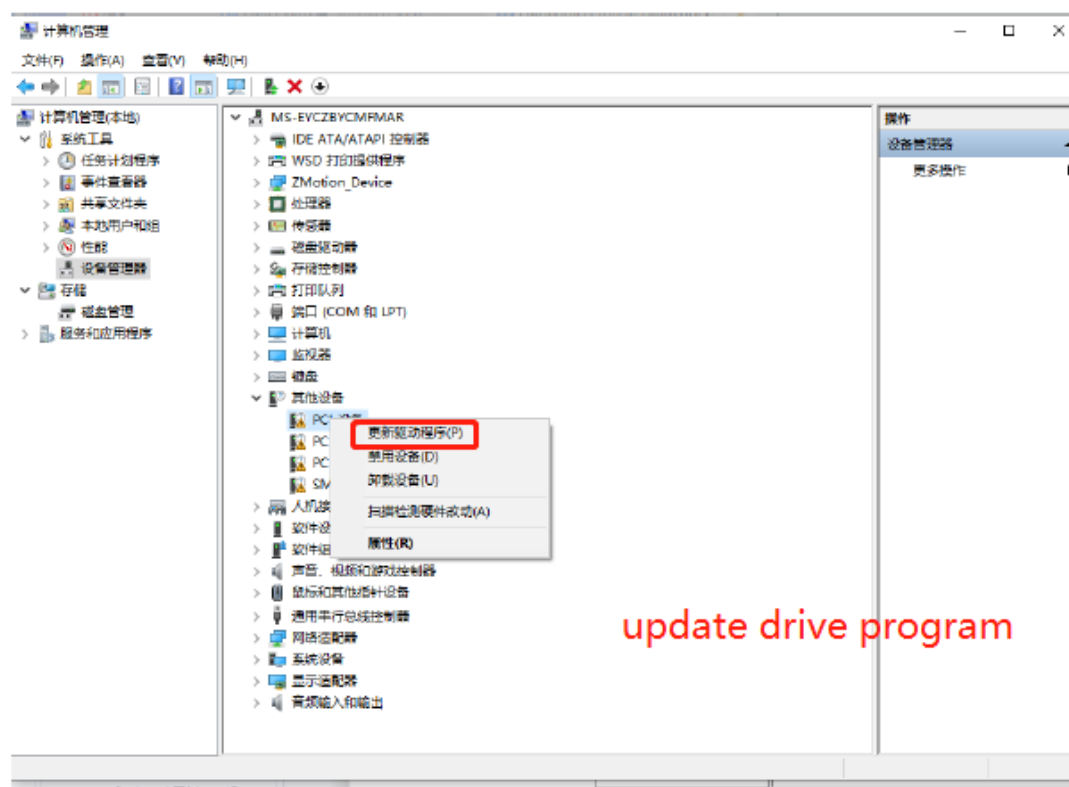


d.  select "browse my PC to check drive program".
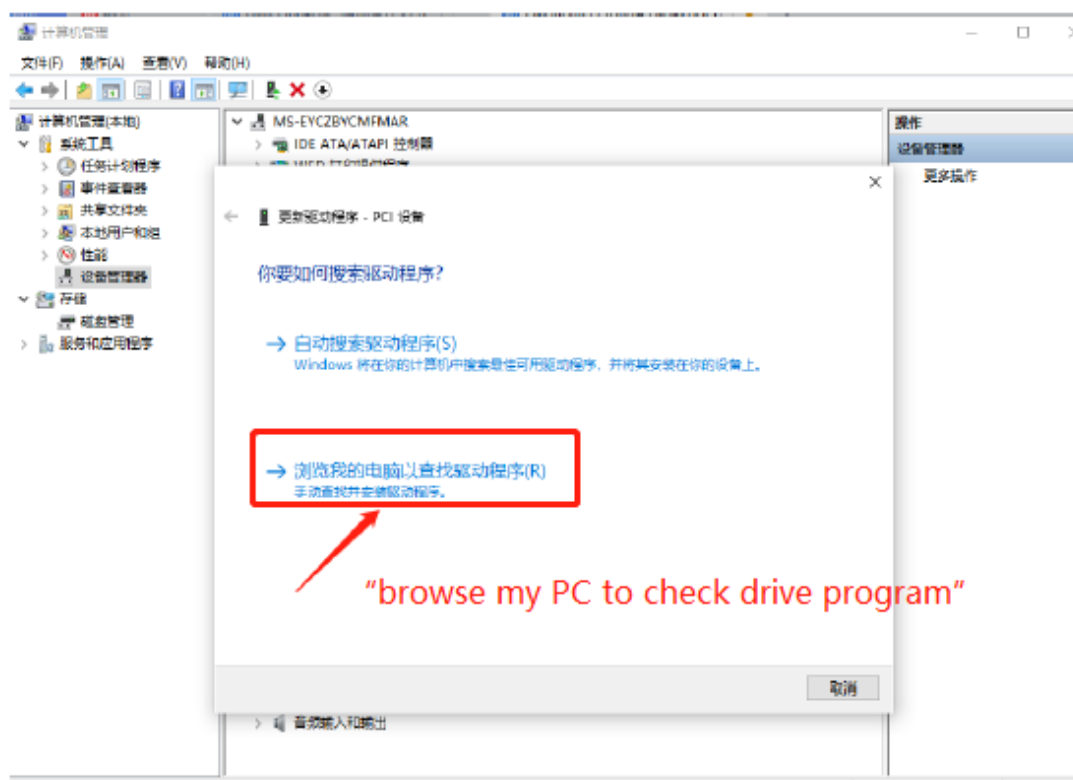
e. click "browse", and select driver folder. Then, click "next".
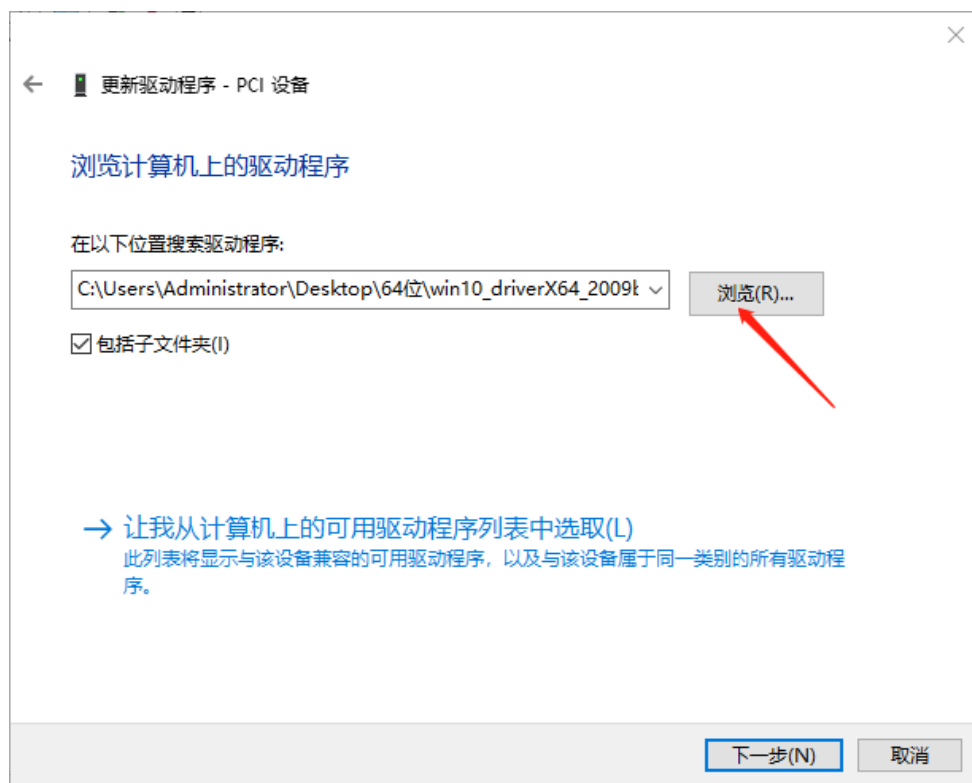


f. If there is antivirus software or safety manager risk tip during installing, please allow them, or you could exit corresponding software before install. When installed, below window will appear:
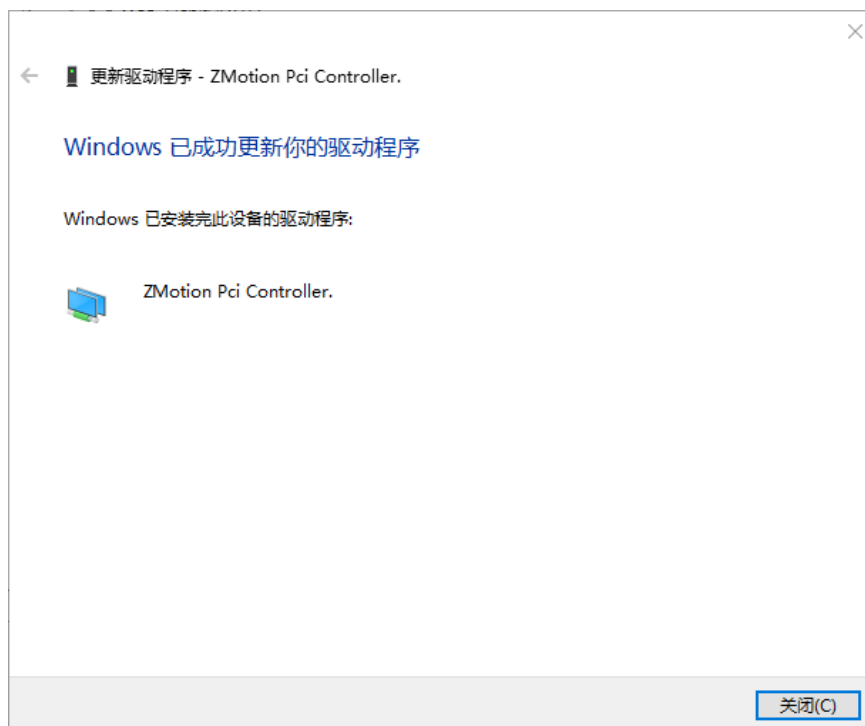
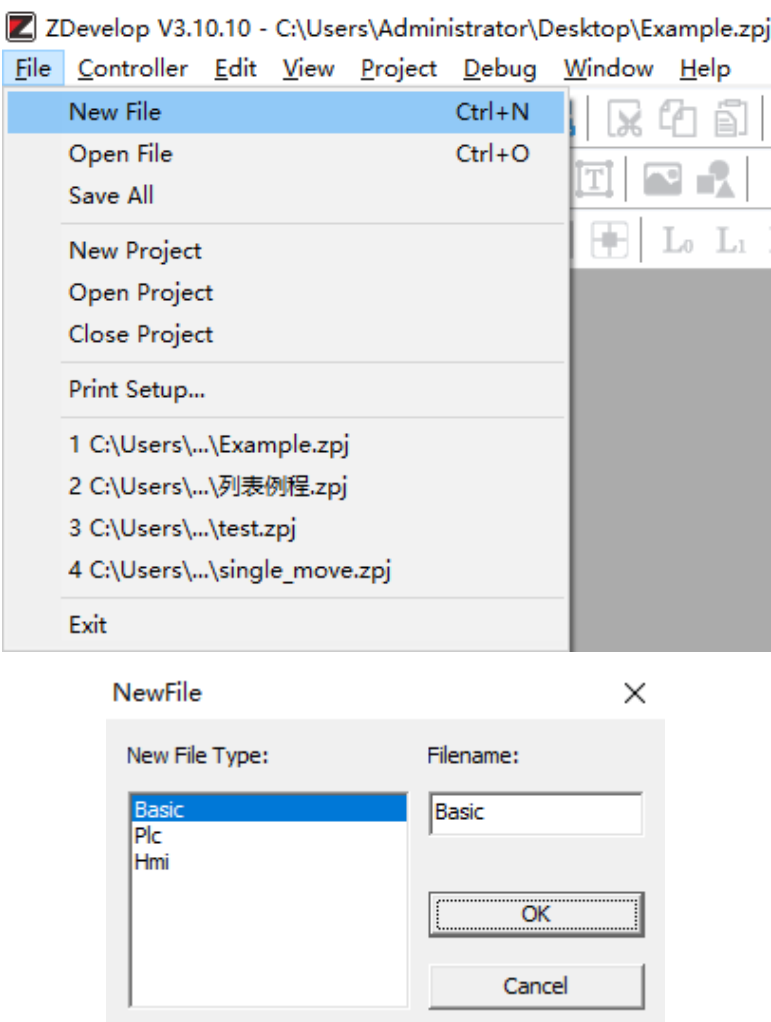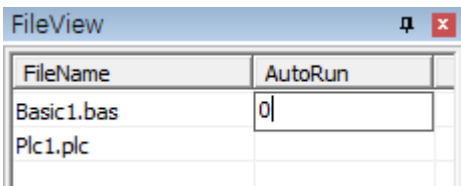g. If there is "Zmotion Pci Controller" in the device manager, the installation is successful.
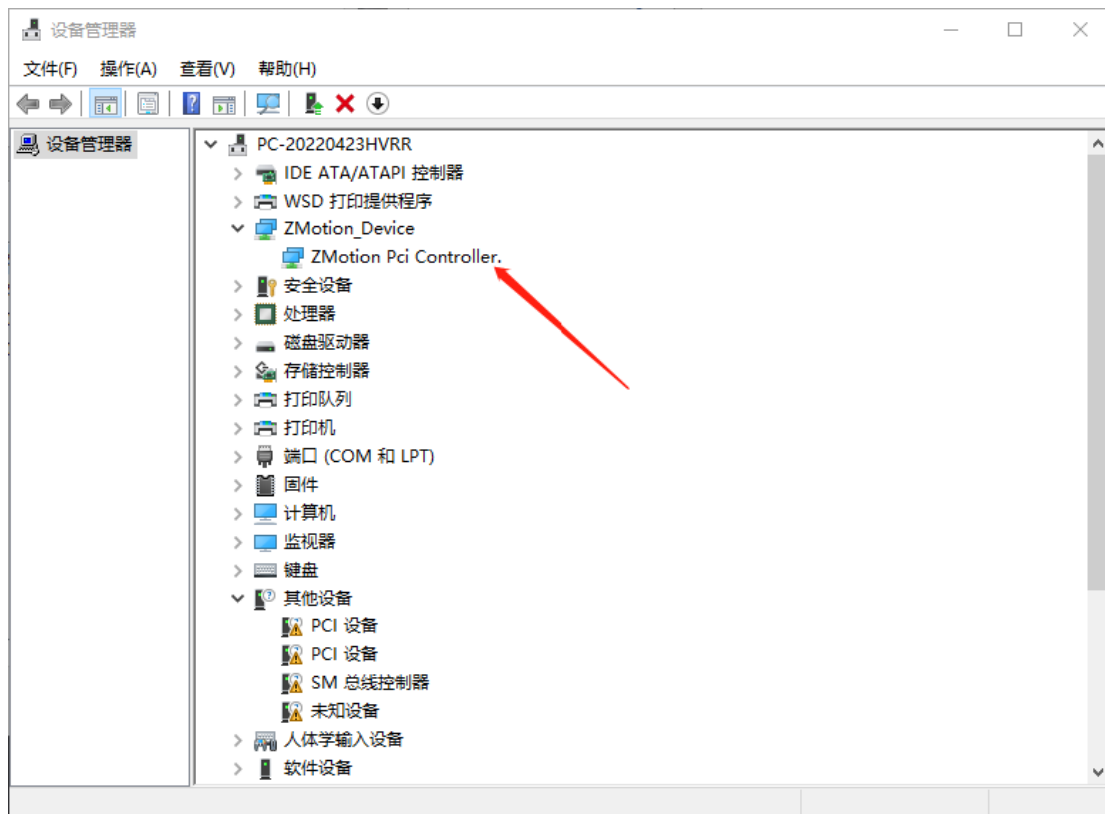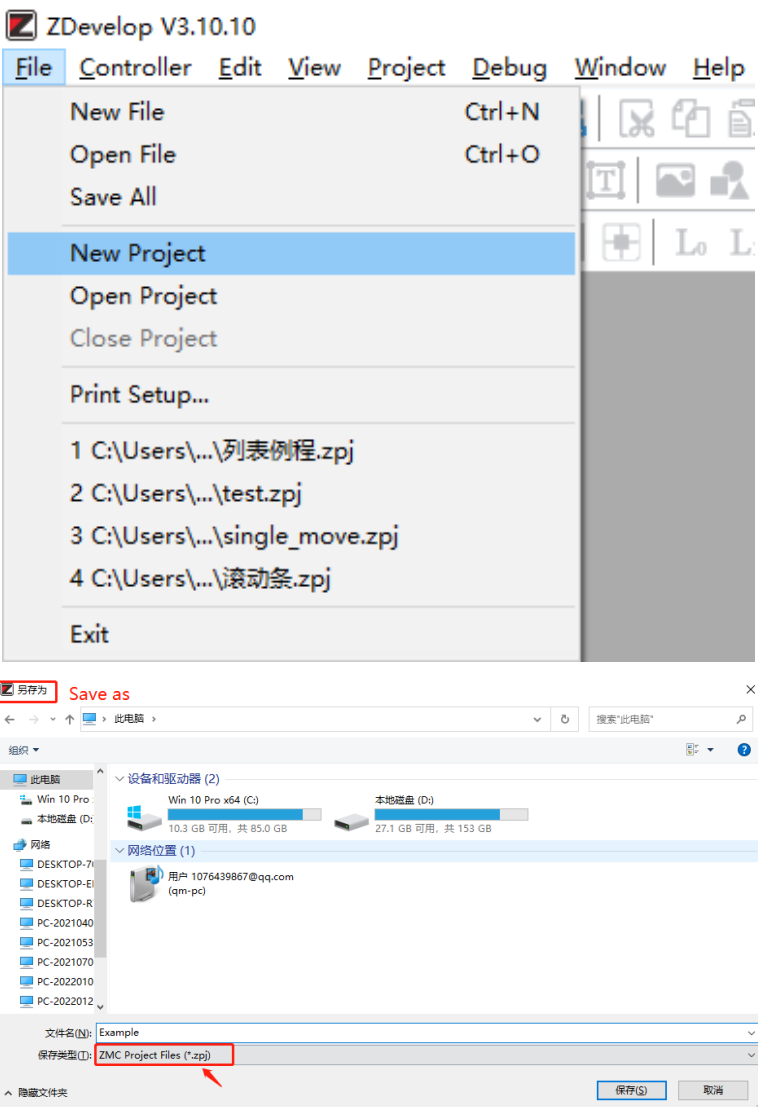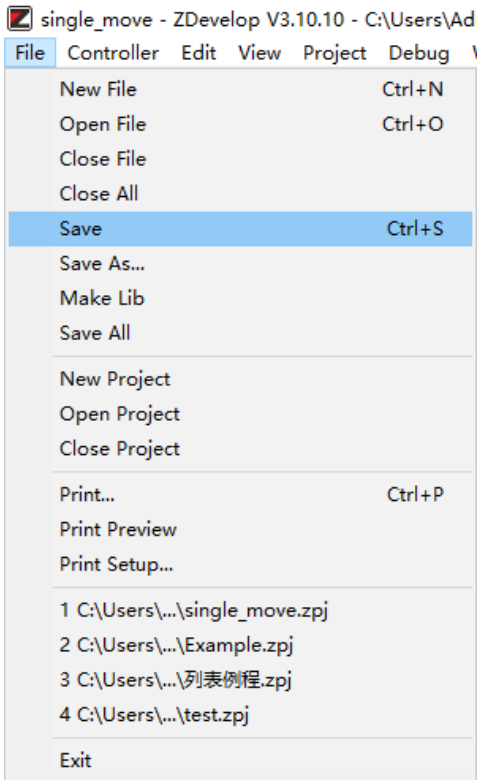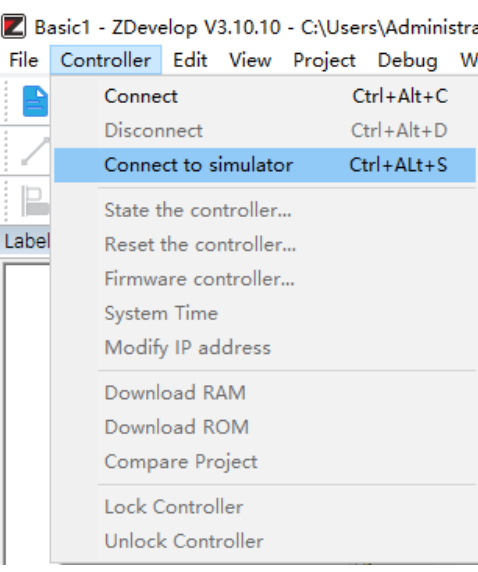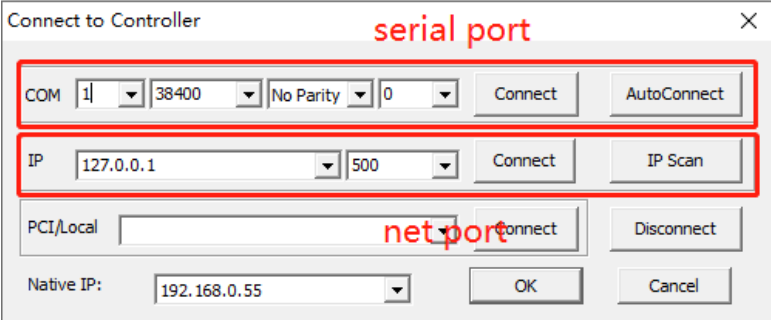
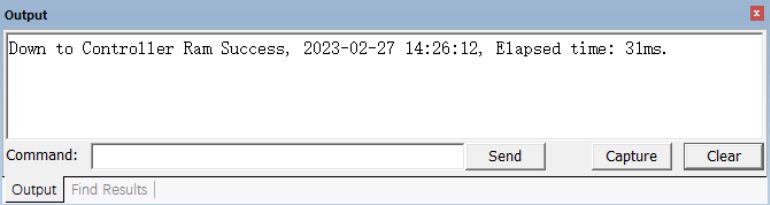# Chapter VI Program & Applications
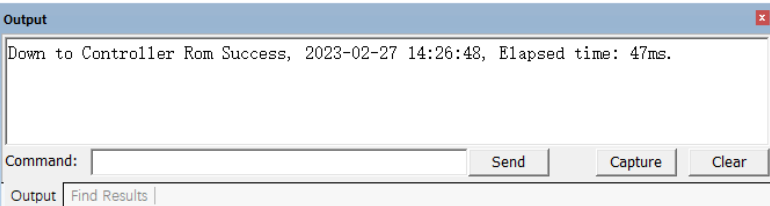
## 6.1. ZDevelop Software Usage

ZDevelop is a PC-side program development, debugging and diagnostic software for the ZMoiton series motion controllers of Zmotion Technology. Through it, users can easily edit and configure the controller program, quickly develop applications, diagnose system operating parameters in real time, and watch the motion controller. The running program is debugged in real time and supports Chinese and English bilingual environments.
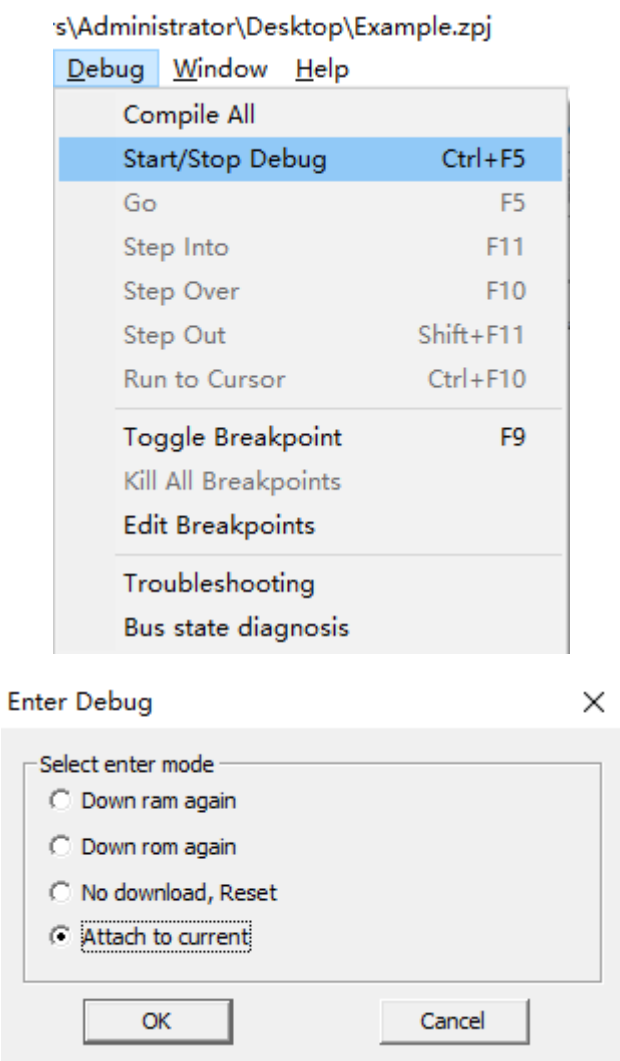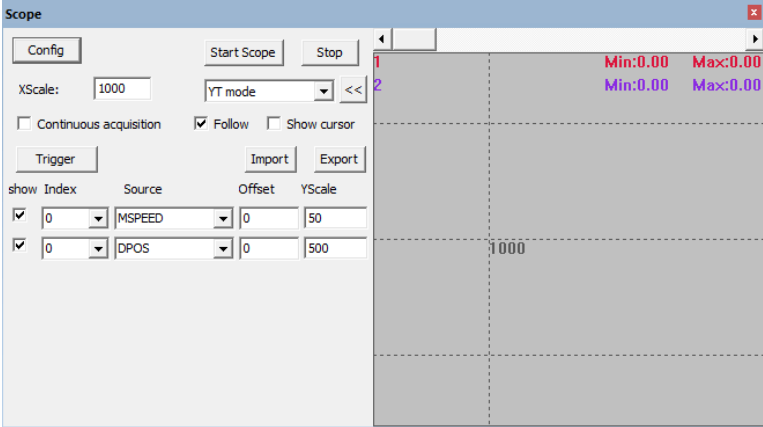
ZBasic, ZPLC and ZHMI can run multi-tasks, and ZBasic can run multi-tasks, and can be mixed with ZPLC and ZHMI.

| Step | Operations | Display Interface |
|------|-----------|-------------------|
| 1 | Open ZDevelop, click "File" – "New Project", Save as window will pop up, then enter file name, save the project file with suffix "zpj.". |  |

| 2 | Click "File" – "New File", select file type to build, here select Basic, click "OK". |  |
|---|---|---|
| 3 | Double click "AutoRun", enter task number 0. |  |

| 4 | Edit the program in program editing window, click "save", new built basic file will be saved under "zpj." project automatically. "Save all" means all files under this project will be saved. |  |
|---|---|---|
| 5 | 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". | |
| 6 | Click "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. RAM: it will not save when power off. ROM: it will save data when power off, and when the program is connected to controller again, running according to task number. | **Output** <br> Down to Controller Ram Success, 2023-02-27 14:26:12, Elapsed time: 31ms. <br> Command: [ ] Send Capture Clear <br> Output \| Find Results <br><br> **Output** <br> Down to Controller Rom Success, 2023-02-27 14:26:48, Elapsed time: 47ms. <br> Command: [ ] Send Capture Clear <br> Output \| Find Results |

| 7 | Click "Debug" – "Start/Stop Debug" to call "Task" and "Watch" window, because it was downloaded before, here select "Attach the current". | s\Administrator\Desktop\Example.zpj <br><br> Debug  Window  Help <br><br> Compile All <br> Start/Stop Debug          Ctrl+F5 <br> Go                              F5 <br> Step Into                      F11 <br> Step Over                      F10 <br> Step Out                  Shift+F11 <br> Run to Cursor            Ctrl+F10 <br><br> Toggle Breakpoint            F9 <br> Kill All Breakpoints <br> Edit Breakpoints <br><br> Troubleshooting <br> Bus state diagnosis <br><br> Enter Debug                      × <br><br> Select enter mode <br> ○ Down ram again <br> ○ Down rom again <br> ○ No download, Reset <br> ◉ Attach to current <br><br> OK            Cancel |
| --- | --- | --- |
| 8 | Click "View" – "Scope" to open oscilloscope. | Scope <br> Config    Start Scope   Stop <br> XScale:  1000    YT mode   << <br> ☐ Continuous acquisition  ☑ Follow  ☐ Show cursor <br> Trigger    Import  Export <br> show Index    Source    Offset  YScale <br> ☑ 0  MSPEED  0  50 <br> ☑ 0  DPOS  0  500 <br> Min:0.00  Max:0.00 <br> Min:0.00  Max:0.00 <br> 1000 |

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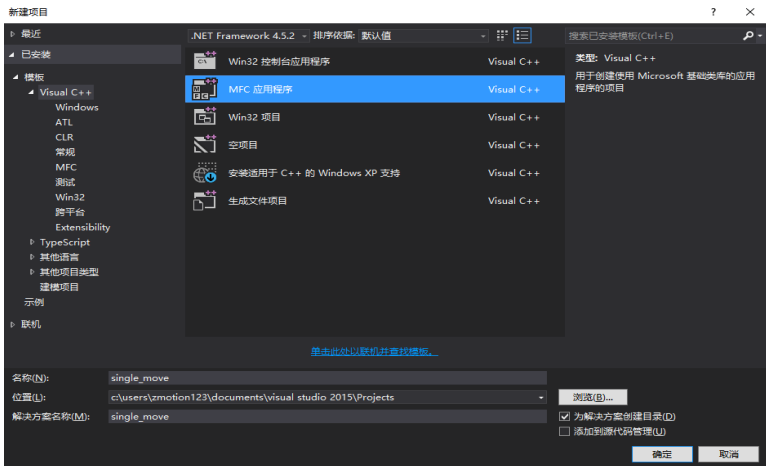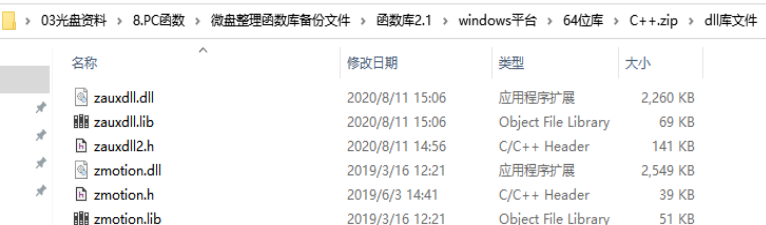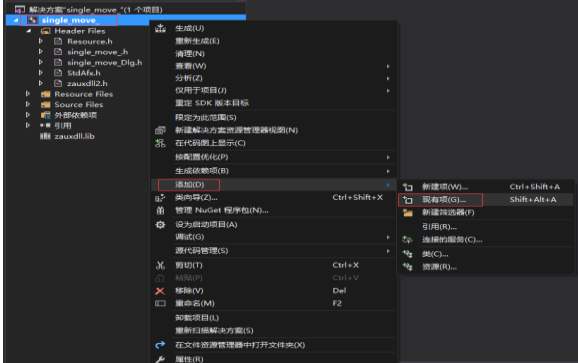
The controller supports development under various operating systems such as windows, linux, Mac, Android, and wince, and provides dll libraries in various environments such as vc, c#, vb.net, and labview, as shown in the figure below. PC software programming refers to "ZMotion PC Function Library Programming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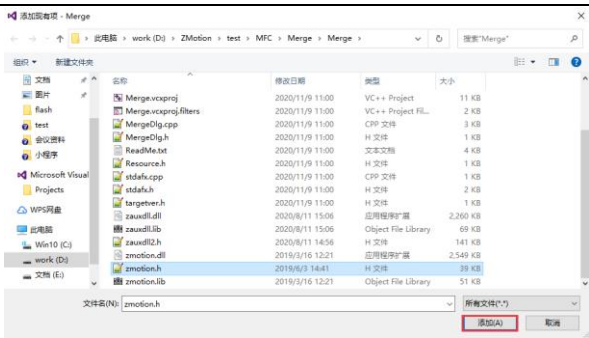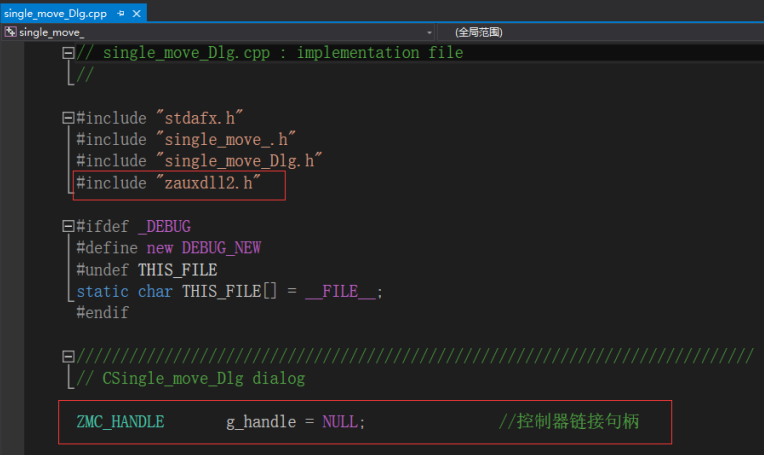


The program developed using the PC software cannot be downloaded to the controller, and it is connected to the controller through the dll dynamic library. The dll library needs to be added to the header file and declared during development.

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, | 1) Right-click the header file first, and then select: "Add" → "Existing |  |

| | zmotion.lib Related header files: zauxdll2.h, zmotion.h | 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 Run 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 motion controller 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 | DC24V ( -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 explosive gases or articles | No |

| | 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

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

| invalid. | 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 ZDevelop 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.<br><br>3. Check the DIP switch to see if there are multiple expansion modules with the same ID.<br><br>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.<br><br>2. Check controller IP address, it can be checked and captured after connection through serial port.<br><br>3. When net port led is off, please check wiring.<br><br>4. Check whether controller power led POWER and running indicator led RUN are ON normally.<br><br>5. Check whether the cable is good quality, change one better cable to try again.<br><br>6. Check whether controller IP conflicts with other devices.<br><br>7. Check whether controller net port channel ETH are all occupied by other devices, disconnect to other devices, then try again.<br><br>8. When there are multiple net cards, don't use other net cards, or change one computer to connect again.<br><br>9. Check PC firewall setting.<br><br>10. Use "Packet Internet Groper" tool (Ping), check whether controller can be Ping, if it can't, please check physical interface or net cable.<br><br>11. Check IP address and MAC address through arp-a. |