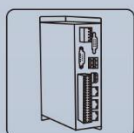
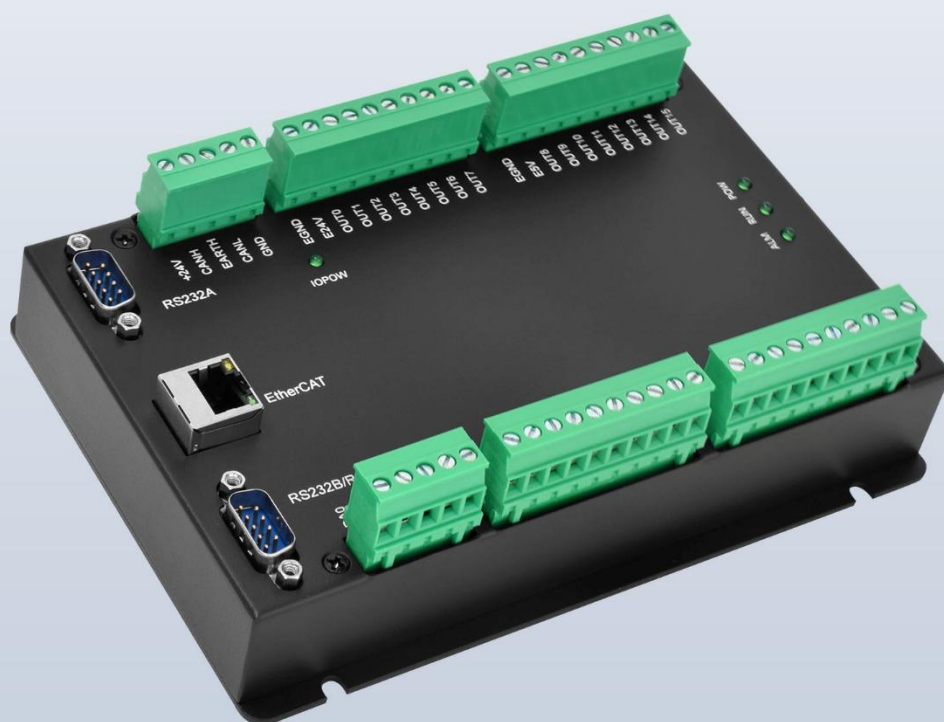
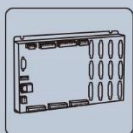


# Pulse & EtherCAT Motion Controller

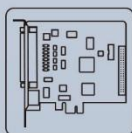
## ZMC004WEA-V2



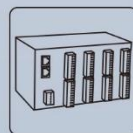
Vision Motion  
Controller



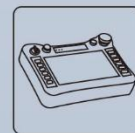
Motion  
Controller



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.

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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.                                                                              |                                       |

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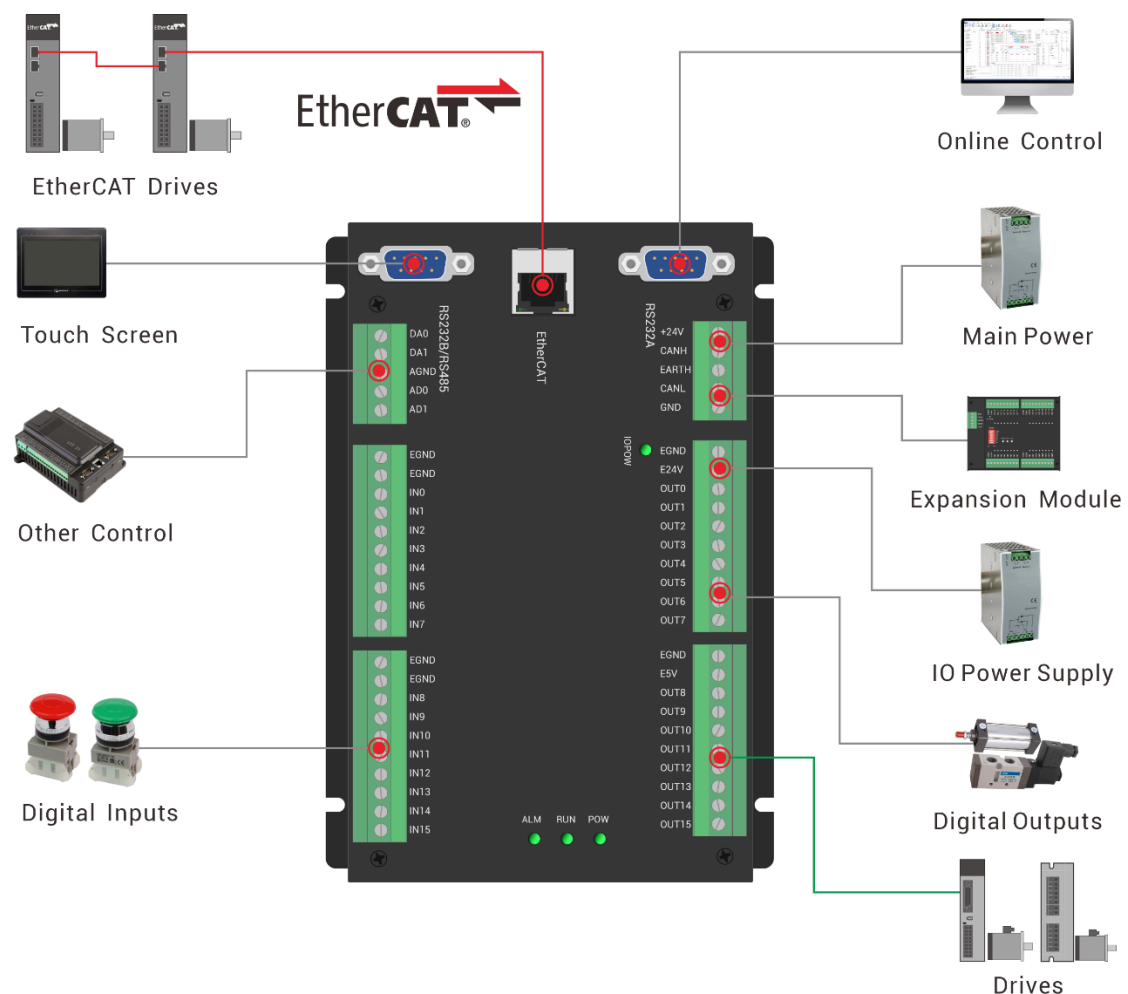
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# Chapter I Production Information

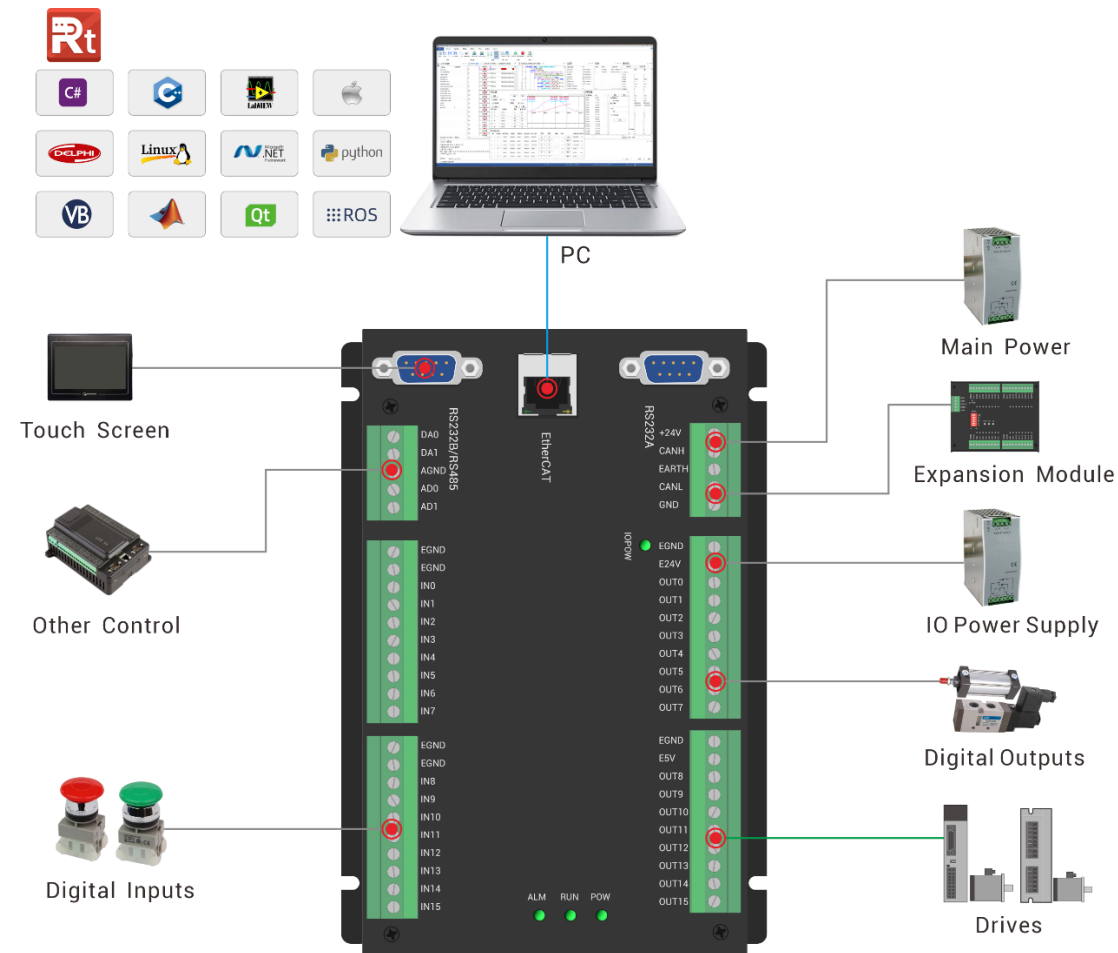
## 1.1. Product Information

ZMC004WEA-V2 economical multi-axis motion controller is a stand-alone motion controller that is compatible with EtherCAT and pulse type, which supports 4 axes (up to 6-axis) for simple trajectory control, such as, linear interpolation, circular interpolation, helical interpolation, etc.

### ➤ EtherCAT & EtherCAT Drives:



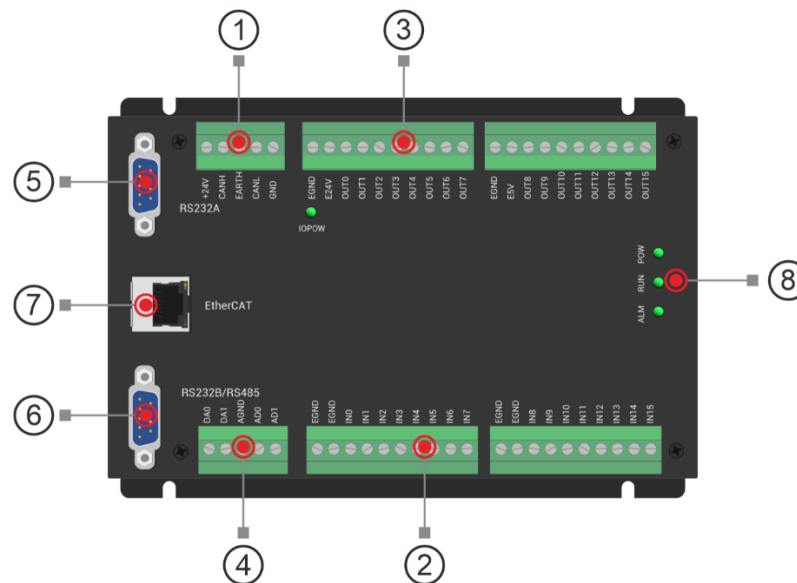
### ➤ EtherCAT as Ethernet:



- ✚ Pulse (single-ended pulse) output modes: pulse / directional or dual-pulse.
- ✚ The max output pulse frequency of each axis is 500kHz.
- ✚ It supports EtherCAT, the fastest refresh cycle is 500us.
- ✚ Axis position limit signal / origin signal port can be configured as any input at will.
- ✚ **Motion Control Functions:** point motion, electronic cam, linear interpolation, circular interpolation, continuous interpolation, robot algorithms, etc.
- ✚ **Communication Interfaces:** EtherCAT, RS232, RS485, CAN.
- ✚ It can be programmed in multi-file and multi-task by BASIC, also, PC program and controller inner RTBasic program can work at the same time.

ZMC004WEA-V2 economical multi-axis motion controller can be applied in 6-axis pulse applications, electronic semiconductor equipment (testing equipment, assembly equipment, locking equipment, soldering machine), dispensing equipment, assembly line.

## 1.2. Interface Introduction



| No. | Interfaces | Descriptions                                                                                                                                                                  |
|-----|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ①   | Power      | <ul style="list-style-type: none"> <li>connect to 24V DC power supply</li> </ul>                                                                                              |
|     | CAN        | <ul style="list-style-type: none"> <li>connect to CAN expansion modules to expand more resources;</li> </ul>                                                                  |
| ②   | DI         | <ul style="list-style-type: none"> <li>NPN type;</li> <li>IN0-15;</li> <li>some inputs (IN0~IN1) can be set as single-ended encoder, or used to do position latch.</li> </ul> |
| ③   | IO         | <ul style="list-style-type: none"> <li>connect to 24V DC power supply</li> </ul>                                                                                              |
|     | DO         | <ul style="list-style-type: none"> <li>NPN type;</li> <li>OUT0-15;</li> <li>some outputs (OUT0~OUT3) can be used as single-ended pulse axes.</li> </ul>                       |
| ④   | DA         | <ul style="list-style-type: none"> <li>single-ended type;</li> <li>12-bit, 0-10V.</li> </ul>                                                                                  |
| ⑤   | RS232A     | <ul style="list-style-type: none"> <li>connect to upper computer;</li> <li>MODBUS_RTU.</li> </ul>                                                                             |
| ⑥   | RS232B     | <ul style="list-style-type: none"> <li>connect to upper computer;</li> </ul>                                                                                                  |
|     | RS485      | <ul style="list-style-type: none"> <li>MODBUS_RTU.</li> </ul>                                                                                                                 |
| ⑥   | RS232      | <ul style="list-style-type: none"> <li>connect to upper computer;</li> <li>MODBUS_RTU.</li> </ul>                                                                             |

|   |                       |                                                                                                                                                                           |
|---|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ⑦ | EtherCAT              | <ul style="list-style-type: none"> <li>connect to EtherCAT drive;</li> <li>or connect to EtherCAT expansion modules.</li> </ul>                                           |
|   | EtherNET              | <ul style="list-style-type: none"> <li>connect to upper device (PC, etc.);</li> <li>MODBUS_TCP protocol;</li> <li>it can be extended by one industrial switch.</li> </ul> |
| ⑧ | Controller Status Led | <ul style="list-style-type: none"> <li>POWER Led: ON when power is connected.</li> </ul>                                                                                  |
|   |                       | <ul style="list-style-type: none"> <li>RUN Led: ON when it runs normally.</li> </ul>                                                                                      |
|   |                       | <ul style="list-style-type: none"> <li>ALM Led: ON when it runs abnormally.</li> </ul>                                                                                    |

## 1.3. Product Specifications

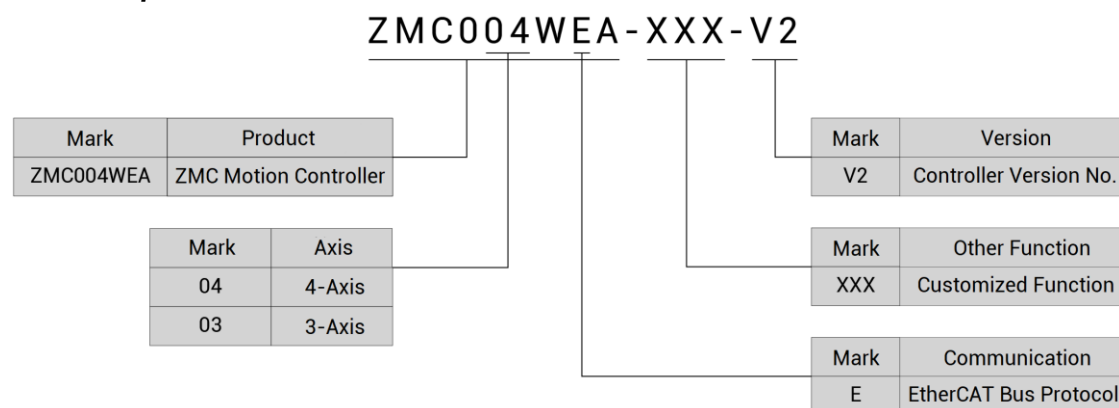
| ZMC004WEA-V2               |                               |
|----------------------------|-------------------------------|
| Base Descriptions          |                               |
| Motor Axes                 | 4                             |
| Max Extended Axes          | 6 (motor axes + virtual axes) |
| Program Space              | 380kByte                      |
| Array Space                | 16000                         |
| Flash Space                | 8MByte                        |
| Dimensions (mm)            | 177.5*121.7*30.6              |
| Axis Type                  |                               |
| EtherCAT Axis              | √; 1 EtherCAT bus axis        |
| Single-Ended Encoder in DI | 2                             |
| Single-Ended Pulse in DO   | 4                             |
| DI & DO                    |                               |
| DI                         | 16 (general)                  |
| DO                         | 16 (general)                  |
| Max Extended DI            | ≤512                          |
| Max Extended DO            | ≤512                          |
| AD & DA                    |                               |
| AD                         | 2 (0-10V, 12-bit)             |
| DA                         | 2 (0-10V, 12-bit)             |
| Max Extended AD            | ≤128                          |
| Max Extended DA            | ≤64                           |



| Communication Interfaces          |               |
|-----------------------------------|---------------|
| EtherNET                          | 1 (shared)    |
| EtherCAT                          |               |
| CAN                               | 1             |
| RS232                             | 2             |
| RS485                             | 1             |
|                                   |               |
| Basic Motion Control Functions    |               |
| Point & Jog                       | √             |
| Electronic Cam                    |               |
| Linear Interpolation              |               |
| Circular Interpolation            |               |
| Continuous Interpolation          |               |
| Power-Down Storage                |               |
| Normal Robot Algorithm            | ×             |
|                                   |               |
| Advanced Motion Control Functions |               |
| Position Latch                    | 2 (low-speed) |

## 1.4. Nameplate & Order Information

### ■ Nameplate Information:



### ■ Product Model Selection

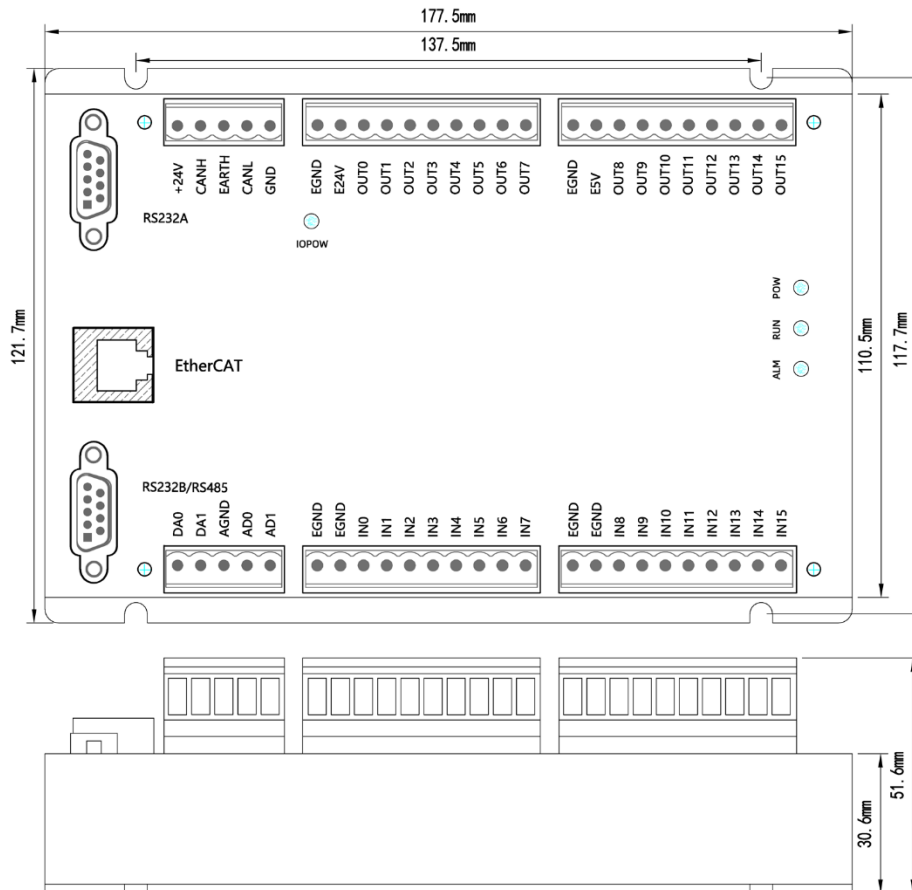
| Model        | Description                                                                                                     |
|--------------|-----------------------------------------------------------------------------------------------------------------|
| ZMC004WEA-V2 | 4 axes, point to point, electronic cam, linear interpolation, circular interpolation, continuous interpolation. |
| ZMC003WEA-V2 | 3 axes, point to point, electronic cam, linear interpolation, circular interpolation, continuous interpolation. |

## 1.5. Hardware Installment

The ZMC004WEA-V2 motion controller adopts the horizontal installation method of screw fixing, and each controller should be installed with 4 screws for fastening.

→ Unit: mm

→ Installment Hole Diameter: 4.5mm



## 1.6. Environment Requirements

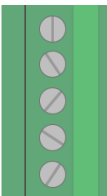
| Item                            |              | Parameters                    |
|---------------------------------|--------------|-------------------------------|
| Work Temperature <sup>[1]</sup> |              | -10°C-55°C                    |
| Work relative Humidity          |              | 10%-95% non-condensing        |
| Storage Temperature             |              | -40°C ~ 80°C (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                                        |

Note [1]: if the environment temperature is too high or too low, please operate fan cooling (fan) or heat Preservation, to ensure controller can work normally and stably.

## Chapter II Hardware Interfaces

### 2.1. Power IN & CAN

| Terminal                                                                                                               | Name  | Function                    |
|------------------------------------------------------------------------------------------------------------------------|-------|-----------------------------|
| +24V<br>CANH<br>EARTH<br>CANL<br>GND  | +24V  | DC Input +                  |
|                                                                                                                        | CANH  | CAN Side H                  |
|                                                                                                                        | EARTH | Shielded                    |
|                                                                                                                        | CANL  | CAN Side L                  |
|                                                                                                                        | GND   | DC Input - / CAN public end |

Note: please separately supply power for main power 24V and IO power 24V, it is not recommended to use the same power supply, or please use one power supply that can provide 2 isolated 24V outputs. **And please note that main power and IO power correspond to different indication led, when the LED is ON, it can be used normally, when it is off, please check the power wiring.**

| Terminal                                                                                         | Name | Function   |
|--------------------------------------------------------------------------------------------------|------|------------|
| EGND<br>E24V  | EGND | DC Input - |
|                                                                                                  | E24V | DC Input + |

Note: please separately supply power for main power 24V and IO power 24V, it is not recommended to use the same power supply, or please use one power supply that can provide 2 isolated 24V outputs. **And please note that main power and IO power correspond to different indication led, when the LED is ON, it can be used normally, when it is off, please check the power wiring.**

### Specification (Power)

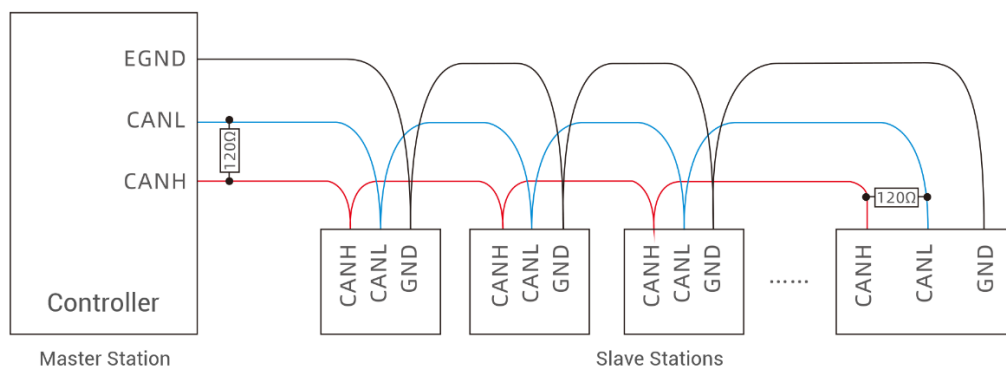
| Item                    | Main Power     | IO Power       |
|-------------------------|----------------|----------------|
| IN Voltage              | DC24V (-5%~5%) | DC24V (-5%~5%) |
| Start Current           | ≤0.5A          | ≤0.3A          |
| Work Current            | ≤0.4A          | ≤0.2A          |
| Anti-Reverse Connection | √              | √              |

|                        |                                                        |   |
|------------------------|--------------------------------------------------------|---|
| Overcurrent Protection | √                                                      | √ |
| Isolation Power        | √                                                      | √ |
| Cable Type             | Recommend "1.0 mm <sup>2</sup> copper conductor cable" |   |

## Specification (CAN)

| Item                    | CAN                              |
|-------------------------|----------------------------------|
| Communication Rate      | ≤1Mbps                           |
| Terminal Resistor       | 120Ω                             |
| Topology                | Daisy Chain Connection Structure |
| Nodes can be extended   | Up to 16                         |
| Wiring Distance         | <30m (500kbps)                   |
| Communication Isolation | √                                |

## Wiring (CAN)



### Notes:

- As above, the daisy chain topology is used for CAN / RS485 wiring (the star topology structure cannot be used). The shorter distance between nodes, the better.
- 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 communication node to prevent CAN / RS485 chips from burning out.

- Please use STP (Shielded Twisted Pair), especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

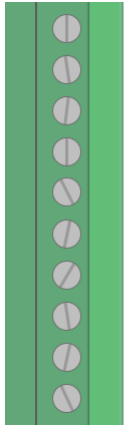
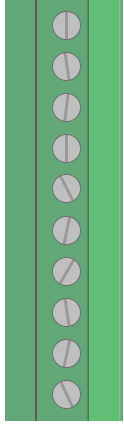
## Usage Method

- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.

### (2) How to use CAN:

- 1) Set controller as CAN master station:
    - a) Use "**CANIO\_ADDRESS**" to set master station "address" and "velocity".
    - b) Use "**CANIO\_ENABLE**" to enable / disable CAN master station function.
    - c) In "*RTSys>Controller>Controller Status>Communication Config*" interface, you can check communication parameters.
    - d) In "*RTSys>Controller>Controller Status>ZCanNodes*" interface, you can check bus nodes parameters.
  - 2) Correctly set the "address" and " velocity" of the slave station CAN expansion module for completing resources mapping, you can refer to ["3.1 CAN Expansion"](#).
  - 3) After configured, repower on all slave stations to build normal communication, if the slave module "ALM" led is ON, which means the communication fails.
  - 4) Note that the "velocity" settings of each node on the CAN bus must be consistent, and the "address" settings cannot cause conflicts, otherwise the communication establishment will fail or the communication will be disordered.
- (3) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

## 2.2. DI: Digital Inputs

| Terminal                                                                                                                                                      | Name | Type                  | Function 1    | Function 2 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------------|---------------|------------|
|  EGND<br>EGND<br>IN0<br>IN1<br>IN2<br>IN3<br>IN4<br>IN5<br>IN6<br>IN7        | EGND | /                     | IO Public End | /          |
|                                                                                                                                                               | EGND | /                     |               | /          |
|                                                                                                                                                               | IN0  | NPN, low-speed input  | Input 0       | Latch      |
|                                                                                                                                                               | IN1  |                       | Input 1       | Latch      |
|                                                                                                                                                               | IN2  | NPN, low-speed input  | Input 2       | /          |
|                                                                                                                                                               | IN3  |                       | Input 3       | /          |
|                                                                                                                                                               | IN4  |                       | Input 4       | /          |
|                                                                                                                                                               | IN5  |                       | Input 5       | /          |
|                                                                                                                                                               | IN6  |                       | Input 6       | /          |
|                                                                                                                                                               | IN7  |                       | Input 7       | /          |
|  EGND<br>EGND<br>IN8<br>IN9<br>IN10<br>IN11<br>IN12<br>IN13<br>IN14<br>IN15 | EGND | /                     | IO Public End | /          |
|                                                                                                                                                               | EGND | /                     |               | /          |
|                                                                                                                                                               | IN8  | NPN, low-speed input  | Input 8       | /          |
|                                                                                                                                                               | IN9  |                       | Input 9       | /          |
|                                                                                                                                                               | IN10 |                       | Input 10      | EZ1        |
|                                                                                                                                                               | IN11 |                       | Input 11      | EB1        |
|                                                                                                                                                               | IN12 |                       | Input 12      | EA1        |
|                                                                                                                                                               | IN13 |                       | Input 13      | EZ0        |
|                                                                                                                                                               | IN14 | NPN, high-speed input | Input 14      | EB0        |
|                                                                                                                                                               | IN15 |                       | Input 15      | EA0        |

**Notes:**

- IN 0 supports Latch IN (A), IN 1 supports Latch IN (B).
- IN10-IN15 can be set as encoder. When ATYPE = 0, they are normal inputs.
- Functions can't be reused (please choose one function).

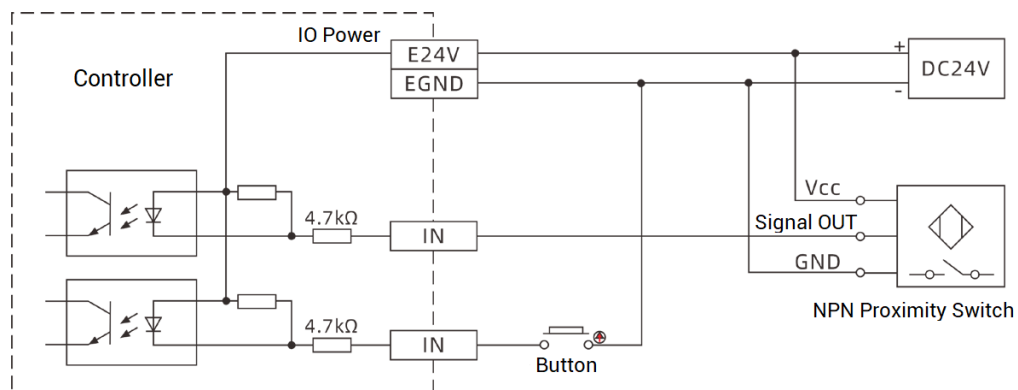
## Specification

| Item                 | High-Speed Input (IN14-15)                               | Low-Speed Input (IN0-13) |
|----------------------|----------------------------------------------------------|--------------------------|
| Input mode           | NPN type, the input is triggered when there is low level |                          |
| Frequency            | <100kHz                                                  | <5kHz                    |
| Impedance            | 3.3KΩ                                                    | 4.7KΩ                    |
| Voltage level        | DC24V                                                    | DC24V                    |
| The voltage to open  | <15V                                                     | <14.5V                   |
| The voltage to close | >15.1V                                                   | >14.7V                   |

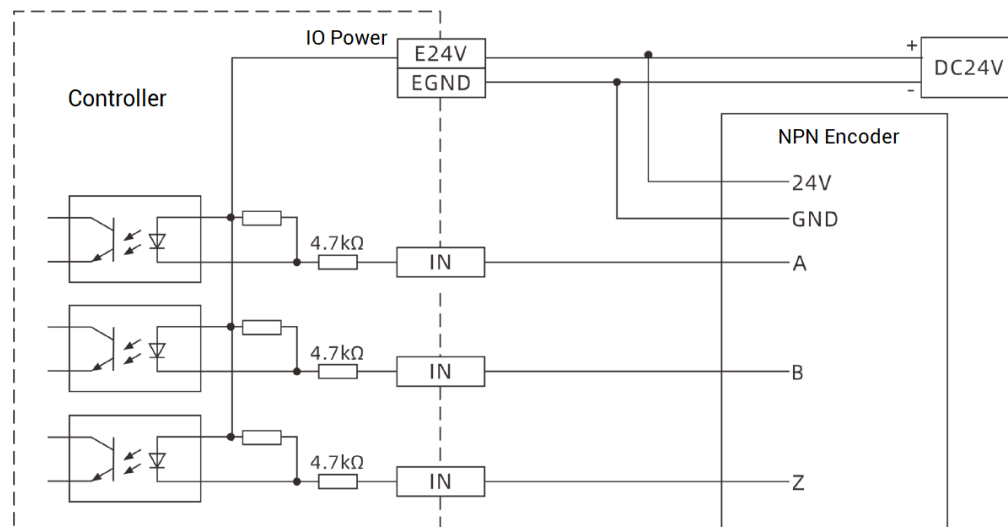
|                 |                          |                          |
|-----------------|--------------------------|--------------------------|
| Minimal current | -2.3mA (negative)        | -1.8mA (negative)        |
| Max current     | -7.5mA (negative)        | -6mA (negative)          |
| Isolation mode  | optoelectronic isolation | optoelectronic isolation |

## Wiring

### General Wiring:



### Single-Ended Encoder Wiring (Example: EA0 & EB0 & EZ0):



### Notes:

- The wiring for the digital input is as shown in the diagram above. The external load can be a button switch, sensor, etc., but it is important to ensure that the signal specifications match.
- It is recommended to use the same power supply for both the load and the controller,



otherwise, the negative terminals of two power supplies should be connected.

- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

## Usage Method

- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.
- (2) IN states can be read directly through "IN" command, also, it can be read through *"RTSys / Tool / IN"*.
- (3) Latch function can be set and triggered by "REGIST", "REV\_IN", "DATUM\_IN".
- (4) Axis position limit signals / origin signals can be set by "FWD\_IN", "REV\_IN", "DATUM\_IN" commands.
- (5) For above and other commands, please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.
- (6) Codes of "encoder-axis mapping":

'encoder axis mapping (use EA0, EB0, EZ0)

BASE (6)                    'the new (remapping) axis No., don't be same as other axis No.

ATYPE = 0

BASE (0)                    'the original axis No.

ATYPE = 0                    'set axis type as 0

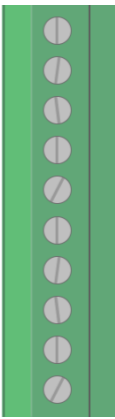
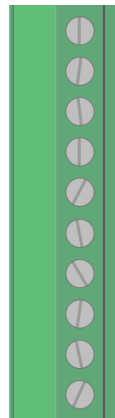
AXIS\_ADDRESS (6) = (-1<<16) + 0                    'bind local axis 0 with axis 6

BASE (6)

ATYPE = 3                    'set axis type as encoder axis for axis 6

## 2.3. DO: Digital Outputs

| Terminal | Name | Type | Function 1          | Function 2 |
|----------|------|------|---------------------|------------|
|          | EGND | /    | E24V power ground / | /          |

|                                                                                    |       |       |                                   |                                     |      |
|------------------------------------------------------------------------------------|-------|-------|-----------------------------------|-------------------------------------|------|
|   | EGND  |       |                                   | IO public end                       |      |
|                                                                                    | E24V  | E24V  | /                                 | IO power input, E24V                | /    |
|                                                                                    | OUT0  | OUT0  | NPN type,<br>low-speed<br>output  | Output 0                            | /    |
|                                                                                    | OUT1  | OUT1  |                                   | Output 1                            | /    |
|                                                                                    | OUT2  | OUT2  |                                   | Output 2                            | /    |
|                                                                                    | OUT3  | OUT3  |                                   | Output 3                            | /    |
|                                                                                    | OUT4  | OUT4  |                                   | Output 4                            | /    |
|                                                                                    | OUT5  | OUT5  |                                   | Output 5                            | /    |
|                                                                                    | OUT6  | OUT6  |                                   | Output 6                            | /    |
|                                                                                    | OUT7  | OUT7  |                                   | Output 7                            | /    |
|  | EGND  | EGND  | /                                 | E5V power ground / IO<br>public end | /    |
|                                                                                    | E5V   | E5V   | /                                 | E5V power ground, max<br>is 300mA   | /    |
|                                                                                    | OUT8  | OUT8  | NPN type,<br>high-speed<br>output | Output 8                            | DIR3 |
|                                                                                    | OUT9  | OUT9  |                                   | Output 9                            | PUL3 |
|                                                                                    | OUT10 | OUT10 |                                   | Output 10                           | DIR2 |
|                                                                                    | OUT11 | OUT11 |                                   | Output 11                           | PUL2 |
|                                                                                    | OUT12 | OUT12 |                                   | Output 12                           | DIR1 |
|                                                                                    | OUT13 | OUT13 |                                   | Output 13                           | PUL1 |
|                                                                                    | OUT14 | OUT14 |                                   | Output 14                           | DIR0 |
|                                                                                    | OUT15 | OUT15 |                                   | Output 15                           | PUL0 |

**Notes:**

- ✧ The E5V power output port is used common anode wiring of single-ended axis. It is not recommended for other purposes due to lower power.
- ✧ OUT8-15 can be set as single-ended pulse. When ATYPE = 0, they are normal outputs,
- ✧ Functions can't be reused (please choose one function).

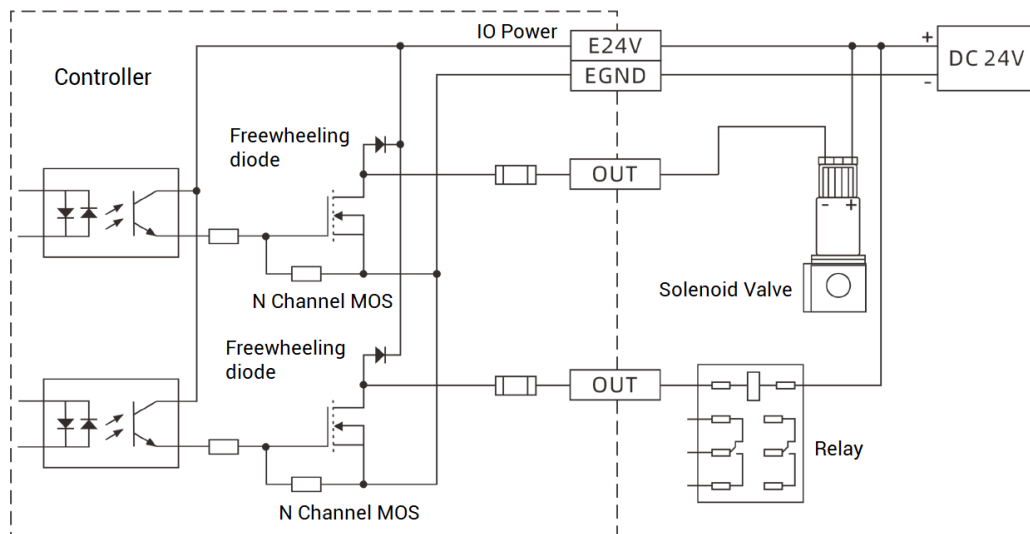
## Specification

| Item        | High Speed OUT (OUT8-15) | Low Speed OUT (OUT0-7) |
|-------------|--------------------------|------------------------|
| Output mode | NPN type                 |                        |
| Frequency   | <400kHz                  | <8kHz                  |

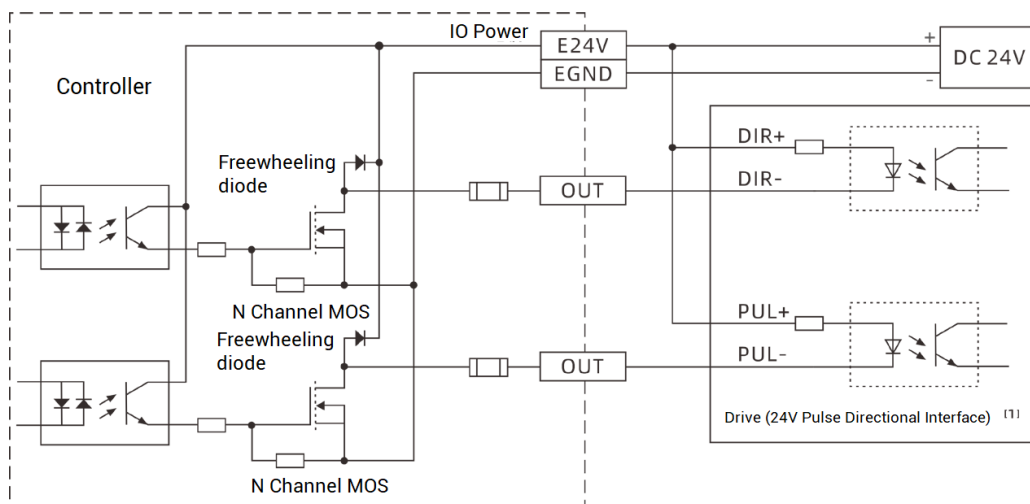
|                        |                          |        |
|------------------------|--------------------------|--------|
| Load Voltage           | ≤24V                     | ≤24V   |
| Output Current         | ≤300mA                   | ≤300mA |
| Overcurrent Protection | √                        | √      |
| Isolation method       | Optoelectronic Isolation |        |

## Wiring

### General Wiring:



### Single-Ended Pulse Axis Wiring (Example: PUL0 & DIR0):



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

### Notes:

- The wiring for the digital output is as shown in the diagram above. The external load

can be a relay, valve solenoid etc., but it is important to ensure that the signal specifications match.

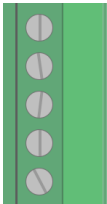
- For 5V pulse direction interface, please connect PUL+ and DIR+ to E5V interface.
- It is recommended to use the same power supply for both the load and the controller, otherwise, the negative terminals of two power supplies should be connected.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

## Usage Method

- (1) After correct wiring & powered-on, please connect controller to [RTSys](#) by EtherNET or COM ports.
- (2) OUT can be set directly through "OP" command, also, it can be operated by *"RTSys / Tool / OP"*.
- (3) When it is as pulse axis, please configure like AXIS.
- (4) For above and other commands, please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.
- (5) Codes of "pulse-axis mapping":

|                                                                          |                                                                |
|--------------------------------------------------------------------------|----------------------------------------------------------------|
| 'pulse axis mapping (use PUL0, DIR0)                                     |                                                                |
| BASE (5)                                                                 | 'the new (remapping) axis No., don't be same as other axis No. |
| ATYPE = 0                                                                |                                                                |
| BASE (0)                                                                 | 'the original axis No.                                         |
| ATYPE = 0 'set axis type as 0                                            |                                                                |
| AXIS_ADDRESS (5) = (-1<<16) + 0 'remapping the physical axis 6 as axis 5 |                                                                |
| BASE (5)                                                                 |                                                                |
| ATYPE = 1 'set axis type as pulse axis for axis 5                        |                                                                |

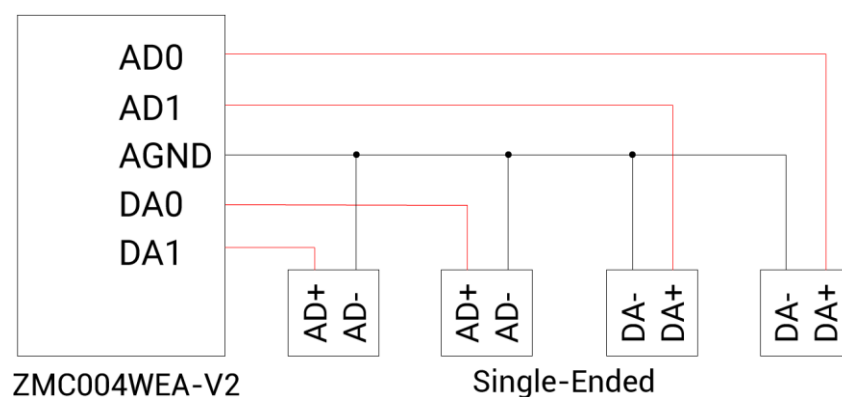
## 2.4. AD & DA: Analog Inputs & Outputs

| Terminal                                                                          | Name | Function                        |
|-----------------------------------------------------------------------------------|------|---------------------------------|
|  | DA0  | Analog output terminal: AOUT(0) |
|                                                                                   | DA1  | Analog output terminal: AOUT(1) |
|                                                                                   | AGND | Analog public end               |
|                                                                                   | AD0  | Analog input terminal: AIN(0)   |
|                                                                                   | AD1  | Analog input terminal: AIN(1)   |

## Specification

| Item                             | AD (0-1)                                   | DA (0-1)                        |
|----------------------------------|--------------------------------------------|---------------------------------|
| Resolution                       | 12-bit                                     | 12-bit                          |
| Data Range                       | 0-4095                                     | 0-4095                          |
| Signal Range                     | 0-10V input                                | 0-10V output                    |
| Data Refresh Ratio               | >1ksps (sampling rate)                     | >1ksps (refresh rate)           |
| Input Impedence /<br>Output Load | 300K $\Omega$ (voltage input<br>impedance) | >1K $\Omega$ (load requirement) |
| Signal Type                      | Single-ended                               | Single-ended                    |
| Wiring Length                    | <5 meter (recommended)                     |                                 |

## Wiring



### Notes:

- The wiring for the analog output is as shown in the diagram above. The load signal

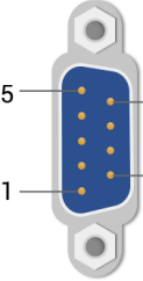
should be matched with impedance, otherwise, it will affect precision.

- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

## Usage Method

- (1) After correct wiring & powered-on, please connect controller to [RTSys](#) by EtherNET or COM ports.
- (2) AD states can be read directly through "AIN" command, and DA can be set directly through "AOUT", also, they can be checked and operated in *"RTSys / Tool / AD/DA"*.
- (3) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

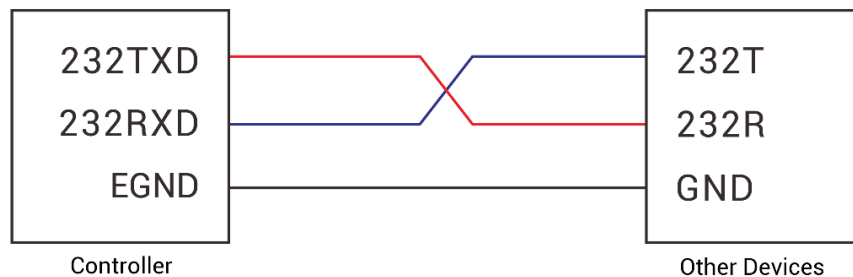
## 2.5. RS232A

| Terminal                                                                            | PIN           | Name     | Function                                                     |
|-------------------------------------------------------------------------------------|---------------|----------|--------------------------------------------------------------|
|  | 1, 4, 6, 7, 8 | NC       | Reserved                                                     |
|                                                                                     | 2             | 232A-RXD | RS232A (port0), receive signal                               |
|                                                                                     | 3             | 232A-TXD | RS232A (port 0), send signal                                 |
|                                                                                     | 5             | GND      | Negative pole output of +5V power & communication public end |
|                                                                                     | 9             | +5V      | +5V power output                                             |

## Specification

| Item                    | RS232A (port 0)                  |
|-------------------------|----------------------------------|
| Communication Rate      | $\leq 115200\text{bps}$          |
| Terminal Resistor       | No                               |
| Topology                | Connect Correspondingly (1 to 1) |
| Nodes can be Extended   | 1                                |
| Wiring Distance         | <5m (recommended)                |
| Communication Isolation | ×                                |

## Wiring



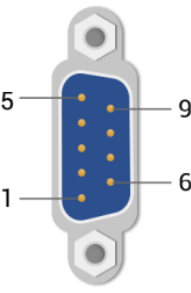
### Notes:

- The wiring of RS232A is as above, it needs to cross-wiring for sending and receiving signals, and it is recommended to use a double-female head cross line when connecting to a computer.
- Please be sure to connect the public ends of each communication node to prevent the communication chip from burning out.
- Please use STP (Shielded Twisted Pair), especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

## Usage Method

- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.
- (2) Please use "ADDRESS" and "SETCOM" commands to check protocol station No. and set parameters, also, you can check and set in *"RTSys>Controller>Controller Status>Communication Config"* interface.
- (3) According to description, set the third-party device parameters correctly to match each node.
- (4) After all configured, it is time to communicate.
- (5) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

## 2.6. RS232B / RS485

| Terminal                                                                            | PIN        | Name     | Function                 |
|-------------------------------------------------------------------------------------|------------|----------|--------------------------|
|  | 1, 6, 8, 9 | NC       | Reserved                 |
|                                                                                     | 2          | 232B-RXD | RS232B, receive signal   |
|                                                                                     | 3          | 232B-TXD | RS232B, send signal      |
|                                                                                     | 4          | 485A/+   | RS485 Signal A/+         |
|                                                                                     | 5          | GND      | communication public end |
|                                                                                     | 7          | 485B/+   | RS485 Signal B/-         |

## Specification

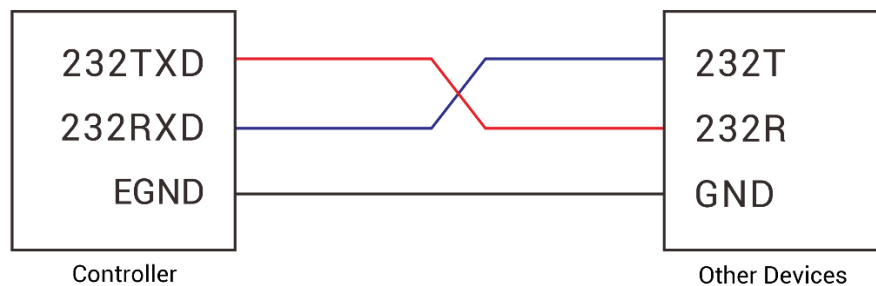
| Item               | RS232B (port 1)         | RS485 (port 2)         |
|--------------------|-------------------------|------------------------|
| Communication Rate | ≤115200bps              | ≤115200bps             |
| Terminal Resistor  | No                      | No                     |
| Topology           | Connect Correspondingly | Daisy chain connection |



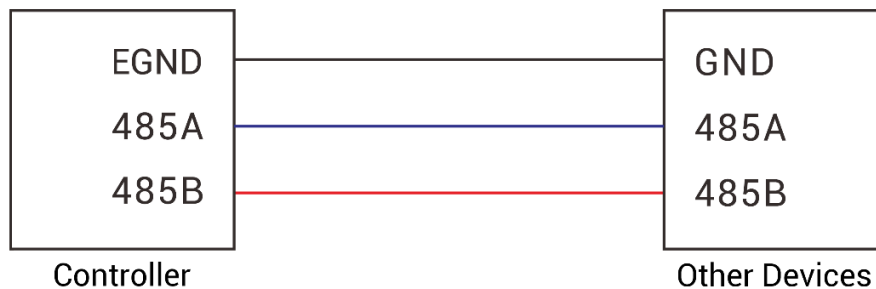
|                         | (1 to 1)          | structure          |
|-------------------------|-------------------|--------------------|
| Nodes can be Extended   | 1                 | 127                |
| Wiring Distance         | <5m (recommended) | <30m (recommended) |
| Communication Isolation | ×                 | ×                  |

## Wiring

### RS232 Wiring:



### RS485 Wiring:



### Notes:

- As above, the daisy chain topology is used for RS232 / RS485 wiring (the star topology structure cannot be used). The shorter distance between nodes, the better.
- Please be sure to connect the public ends of each communication node to prevent RS232 / RS485 chips from burning out.
- Please use STP (Shielded Twisted Pair), especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.

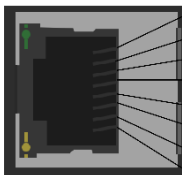
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

## Usage Method

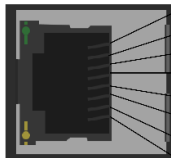
- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.
- (2) Please use "ADDRESS" and "SETCOM" commands to check protocol station No. and set parameters, also, you can check and set in *"RTSys>Controller>Controller Status>Communication Config"* interface.
- (3) According to description, set the third-party device parameters correctly to match each node.
- (4) After all configured, it is time to communicate.
- (5) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

## 2.7. EtherCAT / ETHERNET

### Specification (EtherCAT)

| PIN Definition                                                                      |     |          |                    | Item                   | Description           |
|-------------------------------------------------------------------------------------|-----|----------|--------------------|------------------------|-----------------------|
|  | PIN | Signal   | Description        | Communication Protocol | EtherCAT              |
|                                                                                     | 1   | TX+      | Send signal (+)    | Communication Velocity | 100Mbps               |
|                                                                                     | 2   | TX-      | Send signal (-)    |                        |                       |
|                                                                                     | 3   | RX+      | Receive signal (+) | Refresh Cycle          | Max: 500us            |
|                                                                                     | 4   | NC       | Reserved           | Communication Cable    | Shielded Cat 5e Cable |
|                                                                                     | 5   | NC       | Reserved           |                        |                       |
|                                                                                     | 6   | RX-      | Receive signal (-) | Cable Length           | <50m                  |
|                                                                                     | 7   | NC       | Reserved           |                        |                       |
| 8                                                                                   | NC  | Reserved |                    |                        |                       |

## Specification (ETHERNET)

| PIN Definition                                                                    |     |          |                    | Item                   | Description           |
|-----------------------------------------------------------------------------------|-----|----------|--------------------|------------------------|-----------------------|
|  | PIN | Signal   | Description        | Communication Protocol | MODBUS_TCP            |
|                                                                                   | 1   | TX+      | Send signal (+)    | Communication Velocity | 100Mbps               |
|                                                                                   | 2   | TX-      | Send signal (-)    |                        |                       |
|                                                                                   | 3   | RX+      | Receive signal (+) | Default IP             | 192.168.0.11          |
|                                                                                   | 4   | NC       | Reserved           |                        |                       |
|                                                                                   | 5   | NC       | Reserved           | Communication Cable    | Shielded Cat 5e Cable |
|                                                                                   | 6   | RX-      | Receive signal (-) |                        |                       |
|                                                                                   | 7   | NC       | Reserved           |                        |                       |
| 8                                                                                 | NC  | Reserved | Cable Length       | <50m                   |                       |

## Wiring (EtherCAT)

(1) Controller EtherCAT can be connected to EtherCAT drives / other EtherCAT devices via one shielded cat 5e cable: connect to controller EtherCAT to slave EtherCAT IN, then connect slave EtherCAT OUT to next one EtherCAT IN.

(2) Ethernet LED state:

| Led    | Common-ON                | Shrink                             |
|--------|--------------------------|------------------------------------|
| Green  | Build 100M communication | Now it is sending & receiving data |
| Yellow | Build 10M communication  | Now it is sending & receiving data |

## Wiring (ETHERNET)

(1) Controller Ethernet can be connected to PC / HMI by one shielded cat 5e cable.

(2) Controller also can be connected to the switch for expanding ethernet channels, then connect to other devices.

(3) Ethernet LED state:

| Led    | Normal-ON                | Shrink                             |
|--------|--------------------------|------------------------------------|
| Green  | Build 100M communication | Now it is sending & receiving data |
| Yellow | Build 10M communication  | Now it is sending & receiving data |

**Notes:**

- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

## Usage Method (EtherCAT)

(1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.

**(2) How to connect to drive devices through EtherCAT:**

- 1) Use SLOT\_SCAN command to scan the slot No. on the bus.
- 2) Use AXIS\_ADDRESS command to map axis No., you can refer to "[3.2 EtherCAT Expansion](#)" – "[Resource Mapping](#)".
- 3) Use SLOT\_START to open bus, SLOT\_STOP to stop.
- 4) After completed, configure and operate local pulse axis.

**(3) How to connect to expansion module by EtherCAT:**

- 1) Use SLOT\_SCAN command to scan the slot No. on the bus.
- 2) Use AXIS\_ADDRESS to map axis No., use NODE\_IO / NODE\_AIO command to map IO No., you can refer to "[3.2 EtherCAT Expansion](#)" – "[Resource Mapping](#)".
- 3) Use SLOT\_START to open bus, SLOT\_STOP to stop.
- 4) After completed, configure and operate local IO, same as axis, for details, please refer to "2.2, 2.3, 2.10" – "Usage Methods".

- (4) For slot No. and device node information, you can check in *"RTSys>controller>controller status>slot0node"*.
- (5) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.
- (6) How to configure EtherCAT axis in RTSys: [RTSys – EtherCAT Quick Configurations](#).

## Usage Method (ETHERNET)

- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.
- (2) "IP\_ADDRESS" can be used to modify controller IP, please note controller IP and PC IP should be in same net segment.
- (3) It supports custom ethernet communication, "OPEN#" can open custom ethernet communication, "CLOSE#" can close it, "GET#" can read data from the channel and save data into it.
- (4) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

## Chapter III Resources Expansion

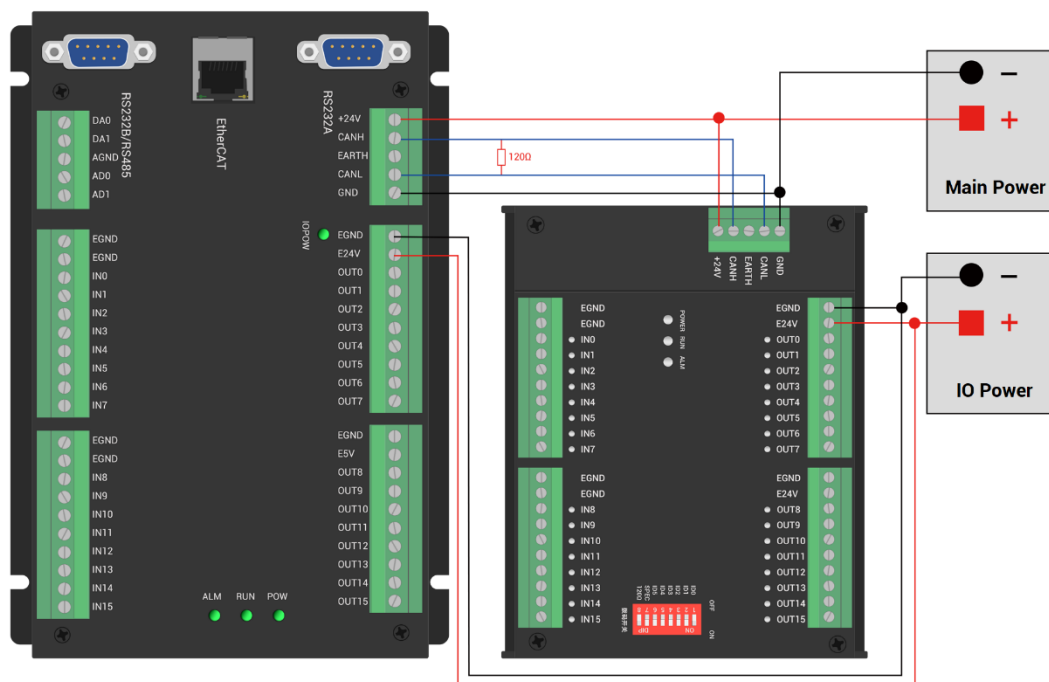
When you need more resources, expansion modules can be used by CAN / EtherCAT.

### 3.1. CAN Expansion

For Zmotion, there are 3 types [CAN bus expansion modules](#): ZIO, ZAI0, ZMIO-CAN, through them, more digital IO, analog IO, axes (up to 2) can be expanded.

Please select the expansion module according to the requirements, and select IO mapping or axis mapping according to the resources of the expansion module. Attention the No. must be different while mapping.

## Wiring



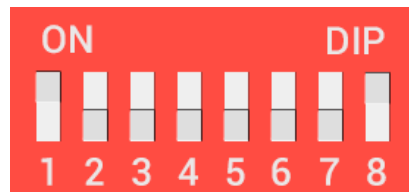
### Notes:

- The controller and modules need to share a main power supply, while the I/O power of ZIO & ZMIO310-CAN need to be independently powered to achieve isolation.
- When connecting multiple expansion modules on CAN, a 120-ohm resistor is needed

to be connected in parallel between the CANL & CANH, for the ZIO expansion module that is with 8-digit dialing codes, the terminal resistor can be realized by dialing the code (DIP).

## Resources Mapping

### A. DIP Switch



DIP Switch

Generally, the ZCAN expansion module has an 8-code DIP switch to do communication configuration and resource mapping, dial ON to take effect, and the meaning of the DIP is as follows:

- ✚ 1-4: they are used for ZCAN expansion module IO address mapping, the corresponding value is 0-15 (4-bit binary to decimal system).
- ✚ 5-6: CAN communication speed, corresponding value is 0-3 (2-bit binary to decimal system), four different speeds are optional.
- ✚ 7: reserved.
- ✚ 8: 120-ohm resistor, dial ON means a 120-ohm resistor is connected between CANL and CANH.

Dial 1-4 to select the CAN address, then the controller automatically maps expansion module IO range according to this address ID, but for axis No., please map manually.

Dial code 5-6 to select CAN bus communication speed, the corresponding speeds are as follows:

| Code 6 | Code 5 | DIP 5-6 combination value | CAN communication speed |
|--------|--------|---------------------------|-------------------------|
| 0      | 0      | 0                         | 500KBPS (default value) |
| 0      | 1      | 1                         | 250KBPS                 |
| 1      | 0      | 2                         | 125KBPS                 |
| 1      | 1      | 3                         | 1MBPS                   |

**Notes:**

- "How to configure controller as master station", please check ["2.1 Power IN & CAN"](#) – ["Usage Methods"](#).
- Communication velocities of each node on the CAN bus must be consistent, please note mapped IO No. and axis No. can't conflict.

**B. IO Mapping**

IO mapping of CAN expansion module is determined by dial code 1-4, below shows digital IO mapping and analog IO mapping No. allocation:

--Digital IO Mapping No.--

(0: OFF, 1: ON)

| Code 4 | Code 3 | Code 2 | Code 1 | Address ID | Start IO No. | End IO No. |
|--------|--------|--------|--------|------------|--------------|------------|
| 0      | 0      | 0      | 0      | 0          | 16           | 31         |
| 0      | 0      | 0      | 1      | 1          | 32           | 47         |
| 0      | 0      | 1      | 0      | 0          | 0            | 63         |
| 0      | 0      | 1      | 1      | 3          | 64           | 79         |
| 0      | 1      | 0      | 0      | 4          | 80           | 95         |
| 0      | 1      | 0      | 1      | 5          | 96           | 111        |
| 0      | 1      | 1      | 0      | 6          | 112          | 127        |
| 0      | 1      | 1      | 1      | 7          | 128          | 143        |
| 1      | 0      | 0      | 0      | 8          | 144          | 159        |
| 1      | 0      | 0      | 1      | 9          | 160          | 175        |
| 1      | 0      | 1      | 0      | 10         | 176          | 191        |
| 1      | 0      | 1      | 1      | 11         | 192          | 207        |
| 1      | 1      | 0      | 0      | 12         | 208          | 223        |
| 1      | 1      | 0      | 1      | 13         | 224          | 239        |
| 1      | 1      | 1      | 0      | 14         | 240          | 255        |
| 1      | 1      | 1      | 1      | 15         | 256          | 271        |

--Analog IO Mapping, for bit 1-4 code state & ID, please refer to above form--

| Address ID | Start AD No. | End AD No. | Start DA No. | End AD No. |
|------------|--------------|------------|--------------|------------|
| 0          | 8            | 15         | 4            | 7          |



|    |     |     |    |    |
|----|-----|-----|----|----|
| 1  | 16  | 23  | 8  | 11 |
| 2  | 24  | 31  | 12 | 15 |
| 3  | 32  | 39  | 16 | 19 |
| 4  | 40  | 47  | 20 | 23 |
| 5  | 48  | 55  | 24 | 27 |
| 6  | 56  | 63  | 28 | 31 |
| 7  | 64  | 71  | 32 | 35 |
| 8  | 72  | 79  | 36 | 39 |
| 9  | 80  | 87  | 40 | 43 |
| 10 | 88  | 95  | 44 | 47 |
| 11 | 96  | 103 | 48 | 51 |
| 12 | 104 | 111 | 52 | 55 |
| 13 | 112 | 119 | 56 | 59 |
| 14 | 120 | 127 | 60 | 63 |
| 15 | 128 | 135 | 64 | 67 |

## C. Axis Mapping

When expanding pulse axis through CAN, max 2 pulse axes can be expanded, and these two should be bound with axis No. by **AXIS\_ADDRESS** at first.

"AXIS\_ADDRESS(axis No.)=(32\*expanded axis)+ID "

AXIS\_ADDRESS(6)=(32\*0)+2 'map axis 0 expanded by CAN module (ID is 2) as axis 6

AXIS\_ADDRESS(7)=(32\*1)+2 'map axis 1 expanded by CAN module (ID is 2) as axis 6

Please refer to "[RTBASIC Programming Manual](#)", or check in *RTSys / Help / RTBasic*.

## D. Extended Resources Checking

Connect the controller to RTSys at first, then in RTSys, enter "*controller > controller status > ZCanNode*" interface, you can know expansion module ID and corresponding mapping No. (below take ZMC432-V2 controller as the example).

[illegible]

### 3.2. EtherCAT Expansion

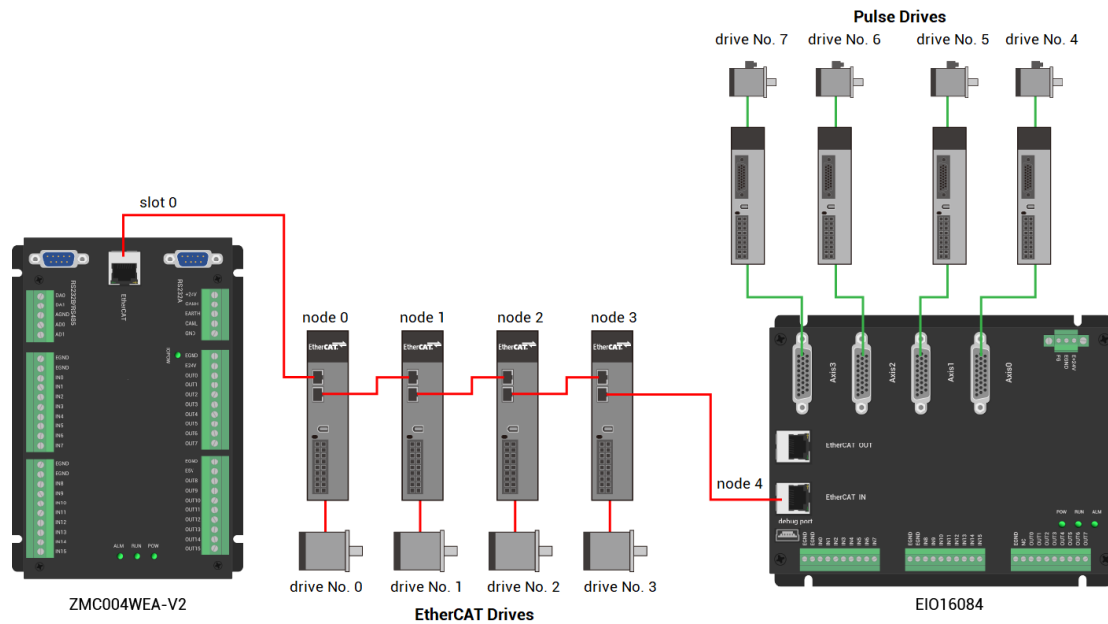
The [EIO expansion modules](#) and [ZMIO310-ECAT](#) are expansion modules used to expand digital IO / analog IO / pulse axis by EtherCAT.

## Wiring

During wiring, use a “shielded category 5e (Cat 5e) twisted pair cable” to connect the controller’s EtherCAT port to the EtherCAT IN port of the slave expansion device. Additionally, more slave devices can be connected, also, connect the EtherCAT OUT port of this expansion = to the EtherCAT IN port of the slave device to achieve multi-level expansion.

After completing the wiring for each EIO expansion module, no secondary development is required. Simply map the IO numbers and axis numbers of the expansion modules in the EtherCAT master controller to access them.

EIO expansion module wiring reference example:



Involved number concepts in above figure are as follows: the bus-related command parameters will use the following numbers:

#### ■ Slot No. (slot):

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

#### ■ Device No. (node):

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

#### ■ Drive No.:

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

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

## Resources Mapping

### A. IO Mapping:

For EtherCAT expansion module IO No., they are set by **NODE\_IO** and **NODE\_AIO**.

When IO mapping, first check the maximum IO No. of the controller itself (including the external IO interface and the interface in the pulse axis), and then use the command to set. If the extended IO coincides with the IO No. of the controller itself, both two will work at the same time, so the IO mapped No. must not be repeated in the entire control system.

#### Examples (IO & AIO):

|                   |                                                          |
|-------------------|----------------------------------------------------------|
| NODE_IO(0,0)=32   | 'set the IO start No. of slot 0 interface device 0 to 32 |
| NODE_AIO(0,0,3)=3 | 'set the AIO start No. of slot 0 interface device 0 to 3 |

### B. AXIS Mapping:

Before using the axis of the expansion module, you need to use the **AXIS\_ADDRESS** command to map the axis number, and the axis mapping also needs to pay attention to the axis number of the entire system cannot be repeated. The mapping syntax of the EIO series extended axis is the same as that of the bus driver.

#### Axis mapping syntax:

**AXIS\_ADDRESS**( axis No.)=(slot No.<<16)+driver No.+1

#### Example:

**AXIS\_ADDRESS**(6)=(0<<16)+0+1 '1<sup>st</sup> drive on EtherCAT, drive No. 0, bound as axis 6

**AXIS\_ADDRESS**(7)=(0<<16)+1+1 '2<sup>nd</sup> drive on EtherCAT, drive No. 1, bound as axis 7

### C. Extended Resources Checking

Connect the controller to RTSys at first, then in RTSys, enter "**controller > controller status > Slot**" interface, you can know expansion module ID and corresponding mapping No.

# Chapter IV Programming

## 4.1. 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](https://www.zmotionglobal.com/pro_info_282.html)

And related manuals can be found in "Download":

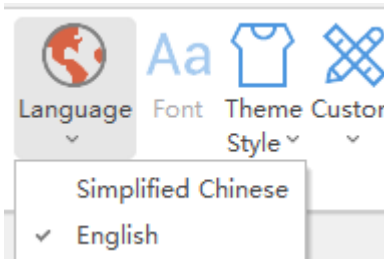
Features

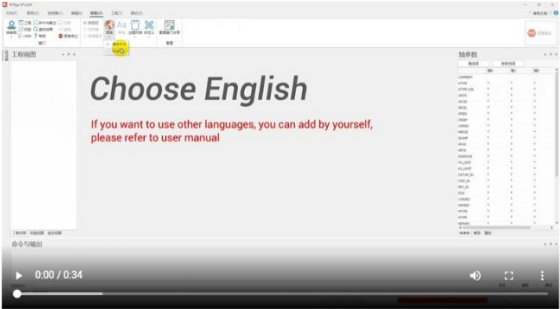
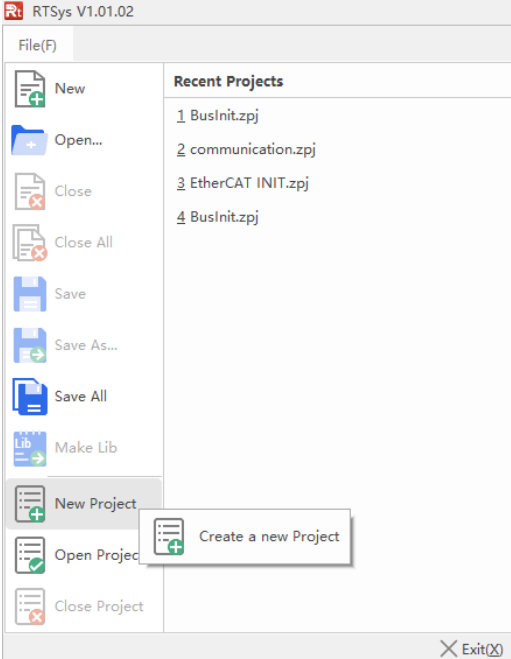
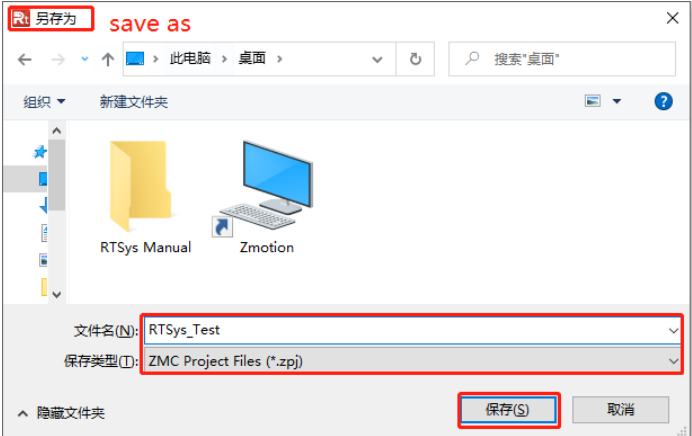
Parameters

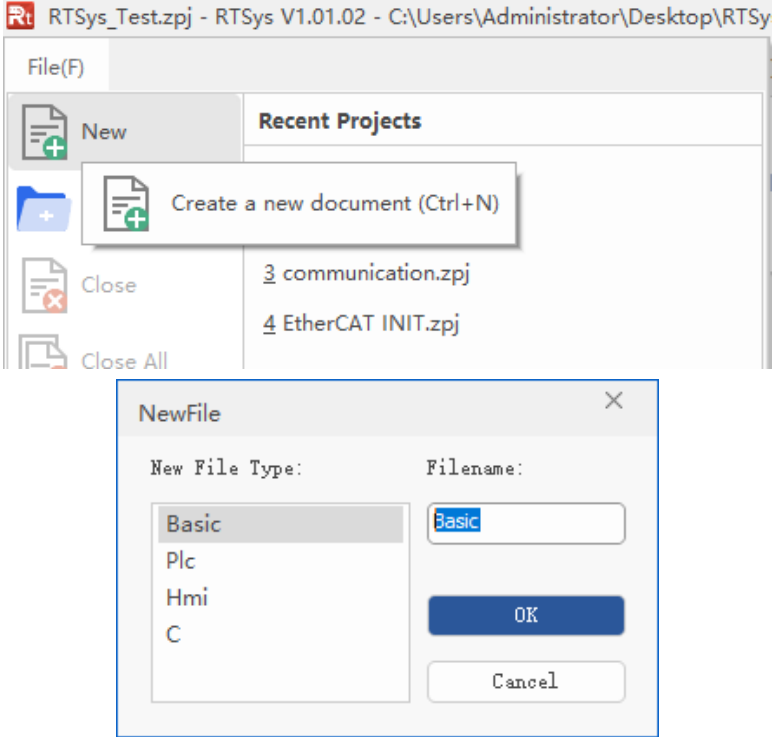
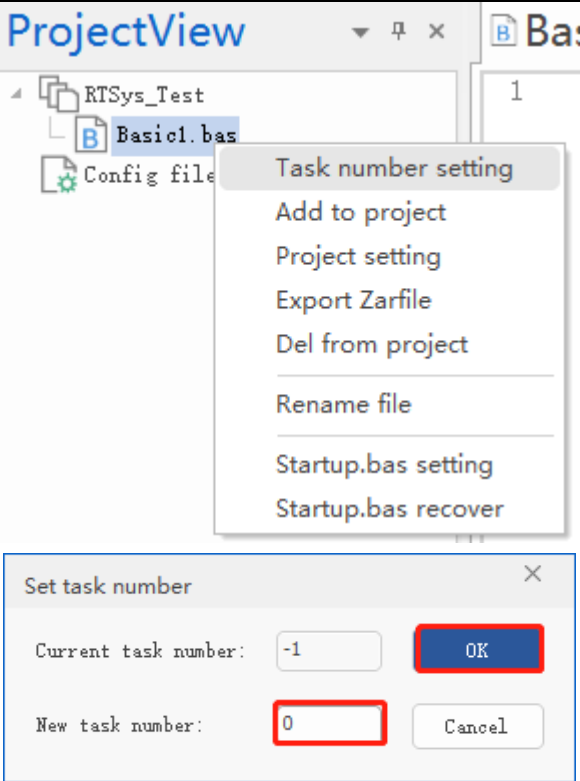
System Architecture

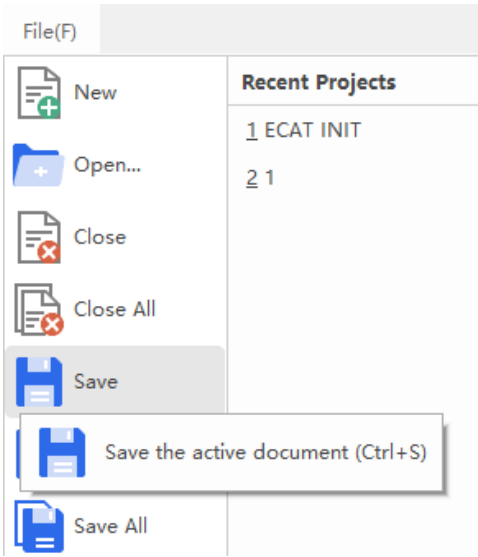
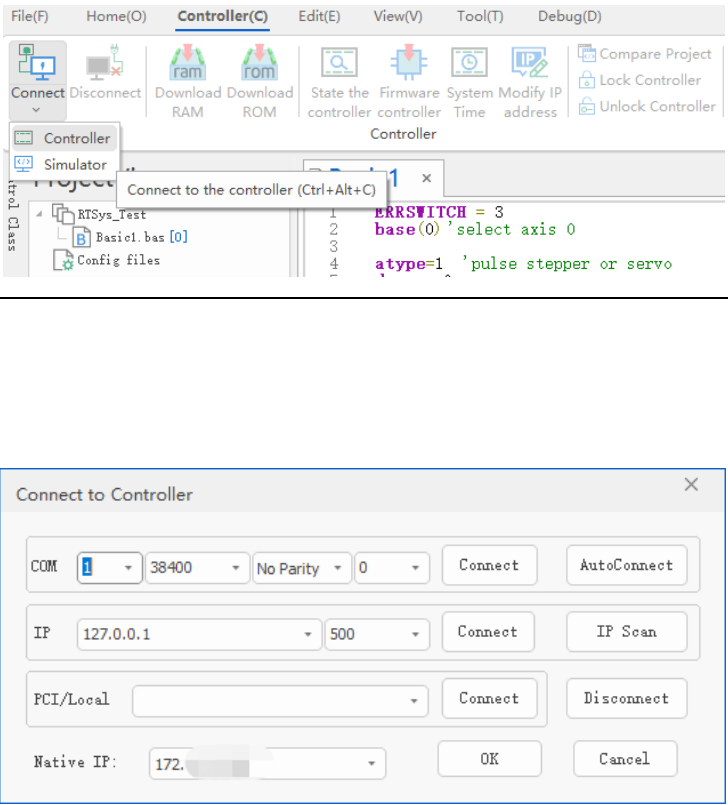
Download

| Name                                    | Version No   | Format | Size   | Download                 |
|-----------------------------------------|--------------|--------|--------|--------------------------|
| RTSys Development Software              | V1.2.02      | RAR    | 148MB  | <a href="#">Download</a> |
| RTSys User Manual V1.2.0                | V1.2.0       | PDF    | 5.33MB | <a href="#">Download</a> |
| RTBasic Programming Manual              | V1.1.0       | PDF    | 18.3MB | <a href="#">Download</a> |
| RTHMI Programming Manual                | V1.2.0       | PDF    | 7.23MB | <a href="#">Download</a> |
| Quick Start                             | VQuick Start | ZIP    | 16.1MB | <a href="#">Download</a> |
| ZVision Basic Programming Manual V1.3.0 | V1.3.0       | PDF    | 10.6MB | <a href="#">Download</a> |
| ZPLC                                    | V1.0         | PDF    | 1.7M   | <a href="#">Download</a> |

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

|   |                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <p>up one window, click OK, and restart it.</p>                                                                                                      | <p><u><a href="#">Language Switch Video Showing:</a></u></p> <p>E. How to Switch the Language</p> <p>Find "视图" (the fourth one in the above menu), then find the "语言", choose English, restart RTSys. English RTSys will take effect when opened again.</p>  |
| 2 | <p><b>New Project:</b></p> <p>"File" – "New Project", Save as window will pop up, then enter file name, save the project file with suffix "zpj".</p> |                                                                                                                                                                         |

|   |                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | <p><b>New File:</b> "File"<br/>– "New File",<br/>select file type<br/>to build, here<br/>select Basic,<br/>click "OK".</p>                                                                      |  <p>The screenshot shows the 'File(F)' menu with options: New, Recent Projects, Close, and Close All. A tooltip for 'New' says 'Create a new document (Ctrl+N)'. The 'Recent Projects' list includes 'communication.zpj' and 'EtherCAT INIT.zpj'. Below the menu is the 'NewFile' dialog box. It has a 'New File Type:' list with 'Basic', 'Plc', 'Hmi', and 'C'. The 'Filename:' field contains 'Basic'. There are 'OK' and 'Cancel' buttons.</p>                                                                                               |
| 4 | <p><b>Set Auto Run No.:</b> right click<br/>the file, open<br/>task number<br/>setting window,<br/>enter task No.,<br/>which can be<br/>any + value, no<br/>priority, but not<br/>the same.</p> |  <p>The screenshot shows the 'ProjectView' window with a tree structure containing 'RTSys_Test', 'Basie1.bas', and 'Config file'. A right-click context menu is open over 'Basie1.bas' with options: Task number setting, Add to project, Project setting, Export Zarfile, Del from project, Rename file, Startup.bas setting, and Startup.bas recover. Below the menu is the 'Set task number' dialog box. It has two input fields: 'Current task number:' with '-1' and 'New task number:' with '0'. There are 'OK' and 'Cancel' buttons.</p> |

|   |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5 | <p><b>Save File:</b> edit the program in program editing window, click "save", new built file will be saved under "zpj." project automatically.</p> <p><b>"Save all"</b> means all files under this project will be saved.</p>                                                                                |                                                                                              |
| 6 | <p><b>Connection:</b></p> <p>Click "controller – connect", if no controller, select connect to simulator.</p> <p>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".</p> |                                                                                             |
| 7 | <p><b>Download Program into</b></p>                                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>● <b>RAM:</b> it will not save when power off.</li> <li>● <b>ROM:</b> it will save data when power off, and when the program</li> </ul> |



|                                     | <p><b>Controller:</b></p> <p>“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.</p> | <p>is connected to controller again, running according to task No.</p> <div><div><div>File(F)Home(O)<b>Controller(C)</b></div><div><div><div>ram</div><div>rom</div></div><div>Download Download</div><div>RAM ROM</div></div></div><div><div>Output</div><div>Connected to Controller:VPLC5xx-Simu Version:5.20-20240426.<br/>Down to Controller <b>Ram</b> Success, 2024-08-15 11:16:29, Elapsed time: 94ms.</div><div>Command: <input type="text"/> Send Capture Clear</div><div>OutputFind Results</div></div><div><div>Output</div><div>Down to Controller <b>Rom</b> Success, 2024-08-15 11:17:02, Elapsed time: 93ms.</div><div>Command: <input type="text"/> Send Capture Clear</div><div>OutputFind Results</div></div></div>                                                                                                                                                                                                                                          |        |             |        |        |       |                                     |   |      |     |            |                                     |   |      |   |             |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------|--------|--------|-------|-------------------------------------|---|------|-----|------------|-------------------------------------|---|------|---|-------------|
| 8                                   | <p><b>Debug:</b> “Debug” – “Start/Stop Debug” to call “Task” and “Watch” window, because it was downloaded before, here select “Attach the current”.</p>                                                    | <div><div><div>File(F)Home(O)Controller(C)Edit(E)View(V)Tool(T)<b>Debug(D)</b></div><div><div><div>ram</div><div>rom</div></div><div>Download Download</div><div>RAM ROM</div></div><div><div><div>Start/Stop Debug</div><div>Go</div><div>Pause</div><div>Run to Cursor</div></div><div>Step IntoStep OverStep Out</div></div><div><div>Breakpoint</div></div></div></div> <div><div>Enter Debug</div><div><div>Select enter mode</div><div><div><div><input type="radio"/> Down ram again</div><div><input type="radio"/> Down rom again</div><div><input type="radio"/> No download, Reset</div><div><input checked="" type="radio"/> Attach to current</div></div></div><div><div>OK</div><div>Cancel</div></div></div></div>                                                                                                                                                                                                                                               |        |             |        |        |       |                                     |   |      |     |            |                                     |   |      |   |             |
| 9                                   | <p><b>Scope function:</b></p> <p>Click “View” – “Scope” to open oscilloscope. It can capture needed data, for debugging.</p>                                                                                | <div><div><div>Scope</div><div>Channel Config Accessibility Help</div><div><div><div>Manual-trigger</div><div>Manual-trigger</div></div><div><div>X Scale: 1s</div><div>Display: YT mode</div></div><div><div>Channels: 2</div><div>3D view: Oblique view</div></div><div><div><input type="checkbox"/> Continuous</div><div><input type="checkbox"/> Follow</div><div><input type="checkbox"/> Magnifier</div></div></div><div><div>Channel</div><div>Cursor</div><div>Statistics</div></div><div><table><tr><th>Show</th><th>Index</th><th>Source</th><th>Offset</th><th>Scale</th></tr><tr><td><input checked="" type="checkbox"/></td><td>0</td><td>DPOS</td><td>200</td><td>auto (200)</td></tr><tr><td><input checked="" type="checkbox"/></td><td>1</td><td>DPOS</td><td>0</td><td>auto (0.01)</td></tr></table></div></div><div><div>1 DPOS(0)</div><div>2 DPOS(1)</div><div>Min: 0.00 Max: 0.00 Scale: 200</div><div>Min: 0.00 Max: 0.00 Scale: 0.01</div></div></div> | Show   | Index       | Source | Offset | Scale | <input checked="" type="checkbox"/> | 0 | DPOS | 200 | auto (200) | <input checked="" type="checkbox"/> | 1 | DPOS | 0 | auto (0.01) |
| Show                                | Index                                                                                                                                                                                                       | Source                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Offset | Scale       |        |        |       |                                     |   |      |     |            |                                     |   |      |   |             |
| <input checked="" type="checkbox"/> | 0                                                                                                                                                                                                           | DPOS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 200    | auto (200)  |        |        |       |                                     |   |      |     |            |                                     |   |      |   |             |
| <input checked="" type="checkbox"/> | 1                                                                                                                                                                                                           | DPOS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0      | auto (0.01) |        |        |       |                                     |   |      |     |            |                                     |   |      |   |             |

**sdNotes:**

- 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**

## 4.2. 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.

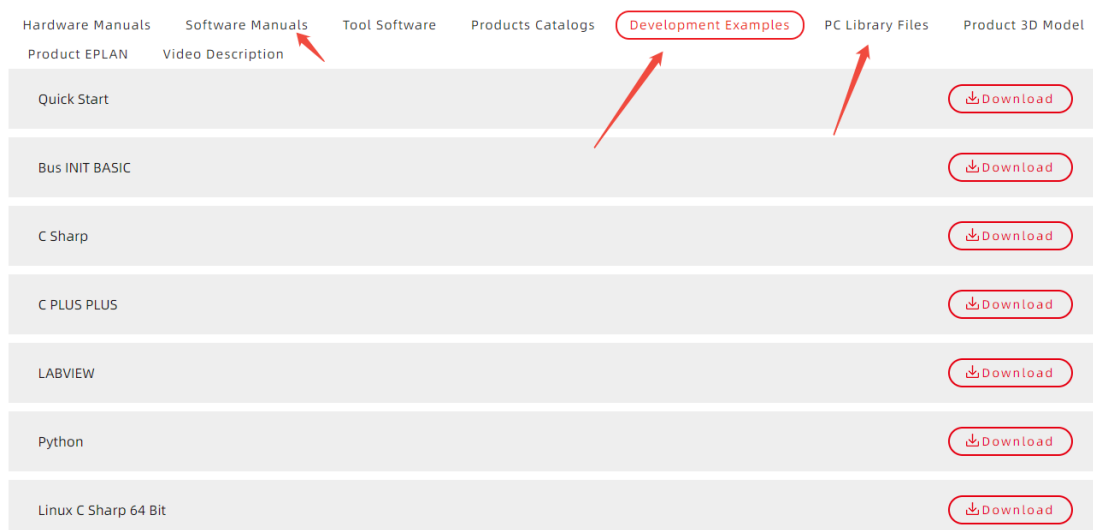
## 4.3. Program in Host-Computer by PC Languages

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](#)".

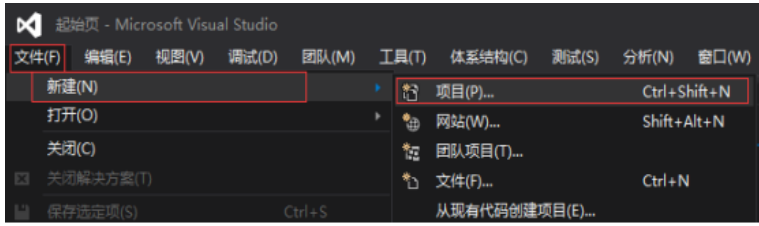
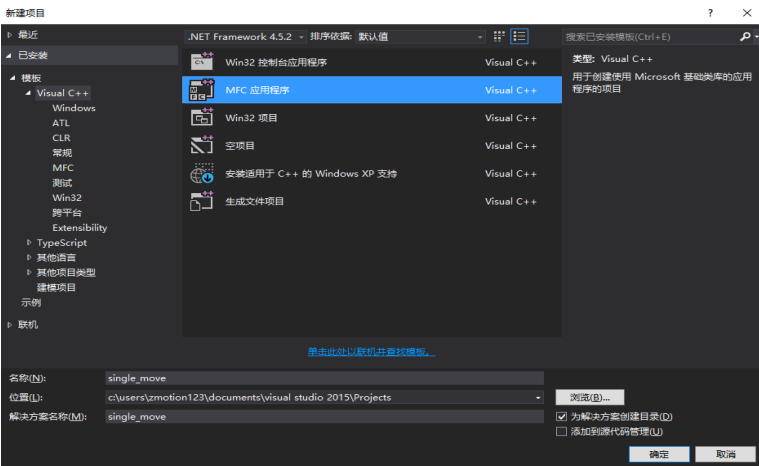
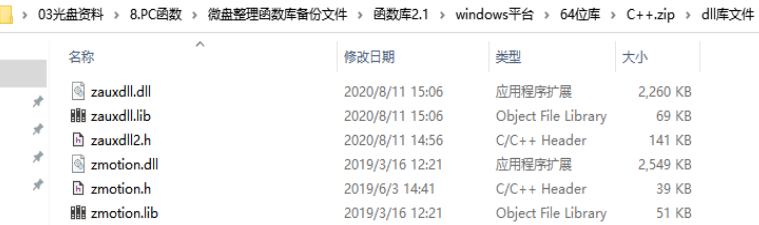


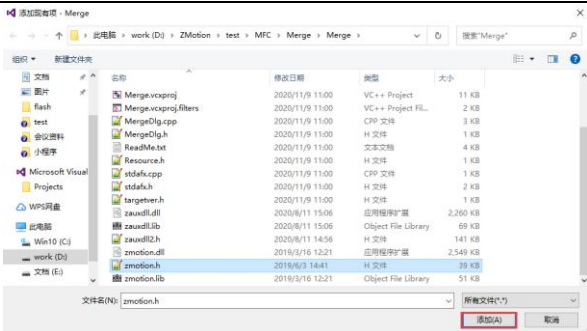
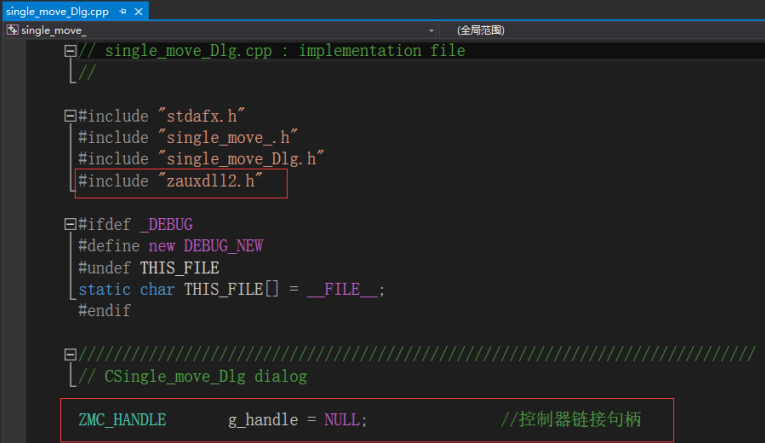
The program developed using the PC software cannot be downloaded to the controller, and it is connected to the controller through the dll dynamic library. The dll library needs to be added to the header file and declared during development.

- Get PC library file, example: [https://www.zmotionglobal.com/download\\_list\\_17.html](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 | <p>Add a static library and related header files to the project. Static library: <code>zauxdll.lib</code>, <code>zmotion.lib</code></p> <p>Related header files: <code>zauxdll2.h</code>, <code>zmotion.h</code></p> | <p>1) Right-click the header file first, and then select: "Add" → "Existing Item".</p> <p>2) Add static libraries and related header files in sequence in the pop-up window.</p> |                                                                                                                                                                                                                                               |
| 7 | <p>Declare the relevant header files and define the controller connection handle, so far the project is newly created.</p>                                                                                           |                                                                                                                                                                                  |  <pre> // single_moveDlg.cpp : implementation file // #include "stdafx.h" #include "single_move.h" #include "single_moveDlg.h" #include "zauxdll2.h"  #ifdef _DEBUG #define new DEBUG_NEW #undef THIS_FILE static char THIS_FILE[] = __FILE__; #endif  // CSingle_moveDlg dialog  ZMC_HANDLE g_handle = NULL; //控制器链接句柄 </pre> |

## Chapter V 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.

### 5.1. 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                          |

## 5.2. Common Problems & Solutions

| Problems               | Suggestions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Motor does not rotate. | <ol style="list-style-type: none"> <li>1. Check whether the ATYPE of the controller is correct.</li> <li>2. Check whether hardware position limit, software position limit, alarm signal work, and whether axis states are normal.</li> <li>3. Check whether motor is enabled successfully.</li> <li>4. Confirm whether pulse amount UNITS and speed values are suitable. If there is the encoder feedback, check whether MPOS changes.</li> <li>5. Check whether pulse mode and pulse mode of drive are matched.</li> <li>6. Check whether alarm is produced on motion controller station or drive station.</li> <li>7. Check whether the wiring is correct.</li> <li>8. Confirm whether controller sends pulses normally.</li> </ol> |

|                                                       |                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The position limit signal is invalid.                 | <ol style="list-style-type: none"> <li>1. Check whether the limit sensor is working normally, and whether the "input" view can watch the signal change of the limit sensor.</li> <li>2. Check whether the mapping of the limit switch is correct.</li> <li>3. Check whether the limit sensor is connected to the common terminal of the controller.</li> </ol>                                  |
| No signal comes to the input.                         | <ol style="list-style-type: none"> <li>1. Check whether the limit sensor is working normally, and whether the "input" view can watch the signal change of the limit sensor.</li> <li>2. Check whether the mapping of the limit switch is correct.</li> <li>3. Check whether the limit sensor is connected to the common terminal of the controller.</li> </ol>                                  |
| The output does not work.                             | <ol style="list-style-type: none"> <li>1. Check whether IO power is needed.</li> <li>2. Check whether the output number matches the ID of the IO board.</li> </ol>                                                                                                                                                                                                                              |
| POWER led is ON, RUN led is OFF.                      | <ol style="list-style-type: none"> <li>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.</li> <li>2. Check whether the ALM light flickers regularly (hardware problem).</li> </ol>                                                                                   |
| RUN led is ON, ALM led is ON.                         | <ol style="list-style-type: none"> <li>1. Program running error, please check ZDevelop error code, and check application program.</li> </ol>                                                                                                                                                                                                                                                    |
| Fail to connect controller to PC through serial port. | <ol style="list-style-type: none"> <li>1. Check whether the serial port parameters are modified by the running program, you can check all the current serial port configurations through ?*SETCOM.</li> <li>2. Check whether the serial port parameters of the PC match the controller.</li> <li>3. Open the device manager and check whether the serial driver of the PC is normal.</li> </ol> |
| CAN expansion module cannot be connected.             | <ol style="list-style-type: none"> <li>1. Check the CAN wiring and power supply circuit, whether the 120 ohm resistor is installed at both</li> </ol>                                                                                                                                                                                                                                           |



|                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                    | <p>ends.</p> <ol style="list-style-type: none"> <li>2. Check the master-slave configuration, communication speed configuration, etc.</li> <li>3. Check the DIP switch to see if there are multiple expansion modules with the same ID.</li> <li>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)</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Fail to connect controller to PC through net port. | <ol style="list-style-type: none"> <li>1. Check IP address of PC, it needs to be at the same segment with controller IP address.</li> <li>2. Check controller IP address, it can be checked and captured after connection through serial port.</li> <li>3. When net port led is off, please check wiring.</li> <li>4. Check whether controller power led POWER and running indicator led RUN are ON normally.</li> <li>5. Check whether the cable is good quality, change one better cable to try again.</li> <li>6. Check whether controller IP conflicts with other devices.</li> <li>7. Check whether controller net port channel ETH are all occupied by other devices, disconnect to other devices, then try again.</li> <li>8. When there are multiple net cards, don't use other net cards, or change one computer to connect again.</li> <li>9. Check PC firewall setting.</li> <li>10. Use "Packet Internet Groper" tool (Ping), check whether controller can be Ping, if it can't, please check physical interface or net cable.</li> <li>11. Check IP address and MAC address through arp-a.</li> </ol> |