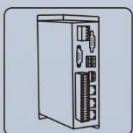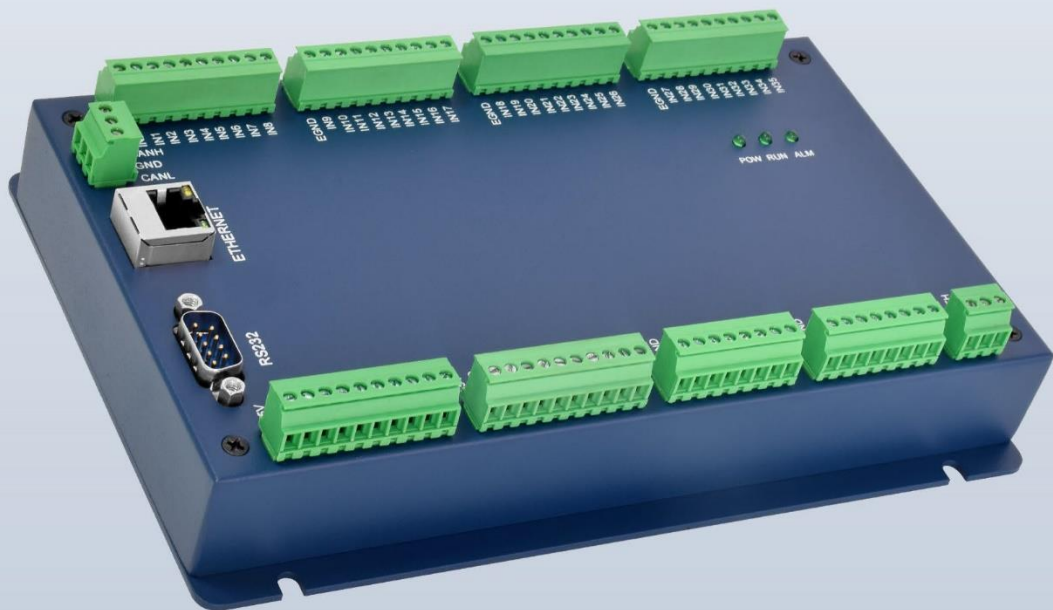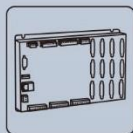# Zmotion®
正运动技术

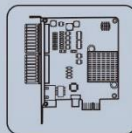# Network Pulse Motion Control Card

ECI1408

This manual is mainly for ECI1300, ECI1302, ECI10306, ECI1308, ECI1400, ECI1402, ECI1406, ECI1408.

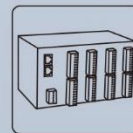| Vision Motion Controller | Motion Controller | Motion Control Card | IO Expansion Module | HMI |

Statement

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

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

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

➢ Notes

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

■ Danger

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

■ Notes

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

Content

Chapter I Production Information

1.1. Product Information

ECI is the abbreviation of the network motion control card model launched by Zmotion Technology.

ECI1000 series economical motion control card itself supports 4 axes at most, but motion control can be extended to 6 axes to achieve <u>linear interpolation, any circular interpolation, space arc, helical interpolation, electronic cam, electronic gear, synchronization follow, virtual axes, etc., and real-time motion control can be achieved through optimized network communication protocol.</u>

It integrates one Ethernet, and supports ETHERNET, CAN, RS232 communication, 36 general digital inputs, 12 general digital outputs and axis interfaces. And it can be connected to CAN bus interface of control card through CAN protocol.

ECI1000 series economical multi-axis motion control card can be used in those pulse applications within 6 axes, such as, electronic semiconductor equipment (testing equipment, assembly equipment, locking equipment, soldering machine), dispensing equipment, assembly line, etc.

1.2. Function Features

◆ 4-6 axes motion control.

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

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

◆ Maximum pulse frequency output of each axis: 5MHZ.

◆ 256 isolated inputs and 256 isolated outputs can be extended at most through CAN.

◆ Axis position limit signal / origin signal port can be configured as any input at will.

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

◆ Support linear interpolation, any circular interpolation, helical interpolation of 6 axes at most.

◆ Support point to point, electronic cam, linear interpolation, circular interpolation, continuous interpolation.

◆ Support three file single-task programming in ZBasic.

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

1.3. System Frame
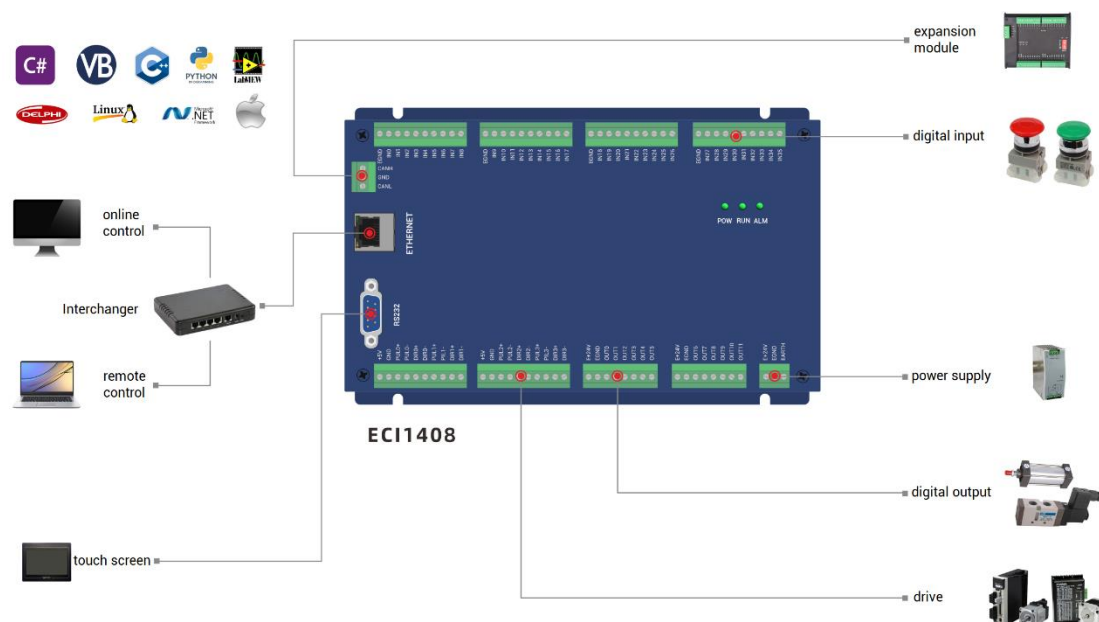
1.4. Hardware Installment

ECI1000 series economical multi-axis motion control card adopts the horizontal installation method of screw fixing, and each controller should be installed with 4 screws

for fastening.
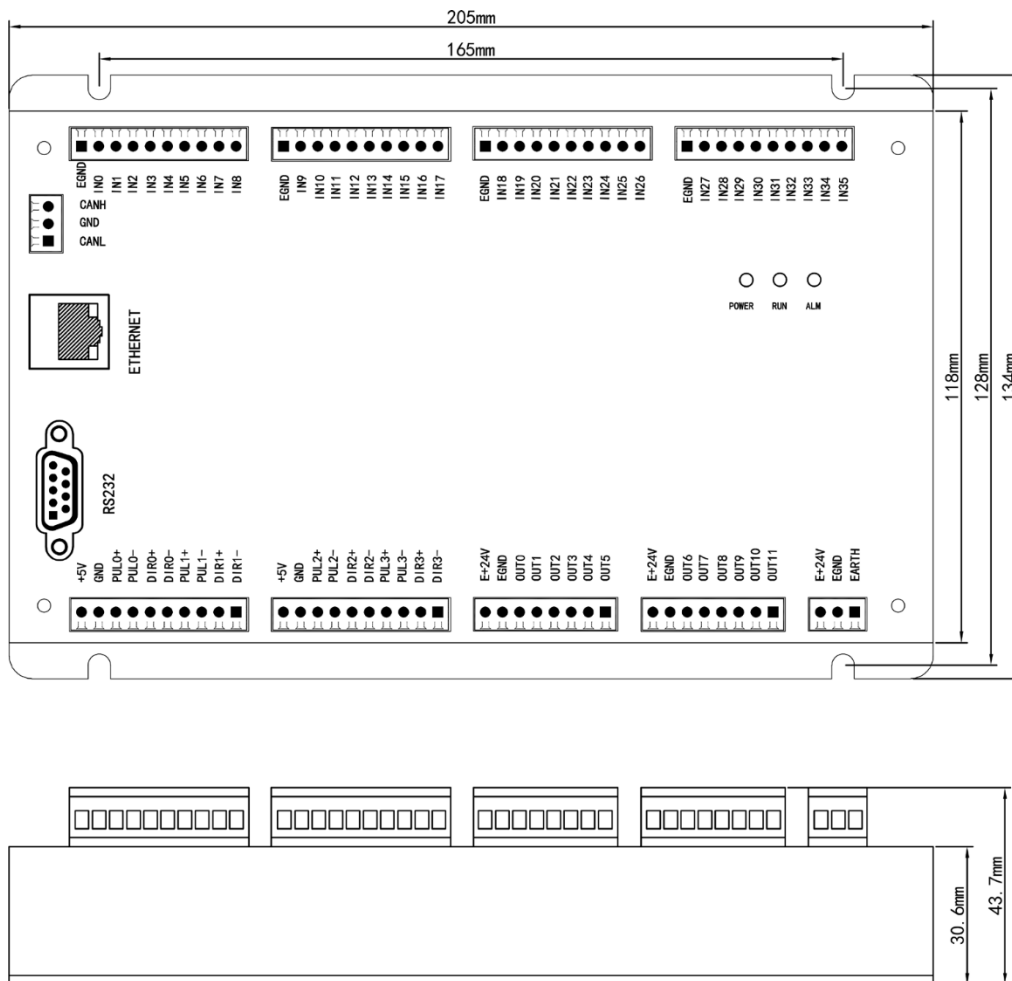
→ Unit: mm   → Installment Hole Diameter: 4.5mm

![warning] Installation attention	● Non-professionals are strictly prohibited to operate. Specifically, professionals who had been trained related electrical equipment, or who master electrical knowledge.
	● Please be sure to read the product instruction manual and safety precautions carefully before installation.
	● Before installation, please ensure that the product is powered off.
	● Do not disassemble the module, otherwise the machine may be damaged.
	● Avoid direct sunlight installation.
	● In order to facilitate ventilation and controller replacement, 2-3cm should be left between the upper and lower parts of the controller and the installation environment and surrounding components.

| | ● Considering the convenient operation and maintenance of the controller, please **do not** install the controller in the following places:
a) places where the surrounding ambient temperature exceeds the range of -10°C-55°C
b) places where the ambient humidity exceeds the range of 10%-95% (non-condensing)
c) places with corrosive gases and flammable gases
d) places with many conductive powders such as dust and iron powder, oil mist, salt, and organic solvents |

Chapter II Product Specification

2.1. Basic Specification

Item	Description
Model	ECI1408
Basic Axes	4
Max Extended Axes	6
Basic Axes Type	Pulse output
Digital IO	36 inputs, 12 outputs
Max Extended IO	256 inputs, 256 outputs
AD/DA	/
Max Extended AD/DA	128 ADs, 64 DAs
Pulse Bit	32
Encoder Bit	32
Speed Acceleration Bit	32
Pulse Max Frequency	5MHz
Motion Axis Buffer	128
Array Space	1600
Program Space	3KByte
Flash Space	128KByte
Power Supply Input	24V DC input, IO24V input
Communication Interfaces	RS232, Ethernet, CAN.
Dimensions	205*134*30.6mm

2.2. Nameplate & Model

ECI1408-XXX

Mark	Product Series
ECI1408	ECI Pulse Control Card

Mark	Axes
3	3-Axis
4	4-Axis

Mark	Other Function
XXX	Customized Function

Mark	Motion Control Functions
0	Point Motion
2	Point, Cam, Linear Interpolation
6	Point, Cam, Linear & Circular Interpolation
8	Point, Cam, Linear & Circular & Continuous Interpolation
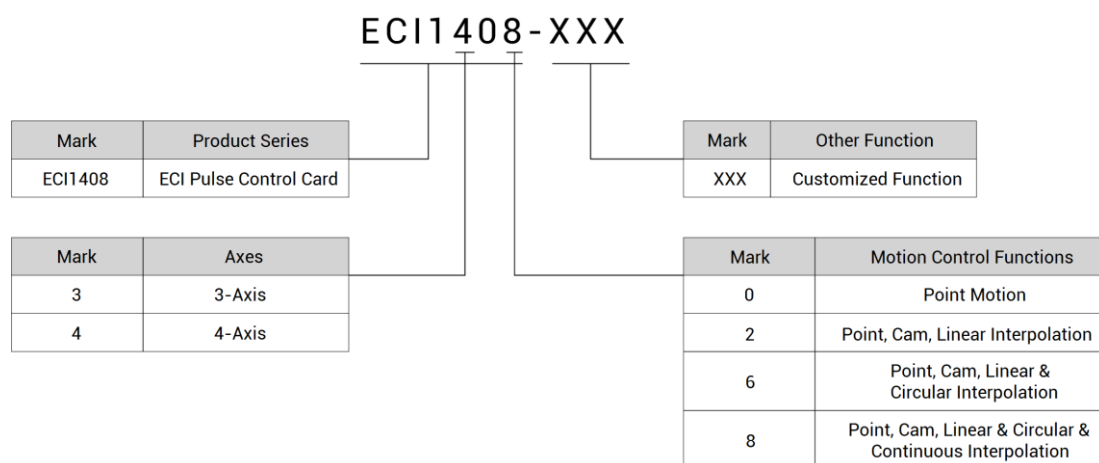
Model	Description
ECI1300	3 axes, point to point, electronic cam, doesn't support interpolation.
ECI1302	3 axes, point to point, electronic cam, linear interpolation.
ECI1306	3 axes, point to point, electronic cam, linear interpolation, circular interpolation.
ECI1308	3 axes, point to point, electronic cam, linear interpolation, circular interpolation, continuous interpolation, robotic arm instruction.
ECI1400	4 axes, point to point, electronic cam, doesn't support interpolation.
ECI1402	4 axes, point to point, electronic cam, linear interpolation.
ECI1406	4 axes, point to point, electronic cam, linear interpolation, circular interpolation.
ECI1408	4 axes, point to point, electronic cam, linear interpolation, circular interpolation, continuous interpolation, robotic arm instruction.

2.3. Interface Definition
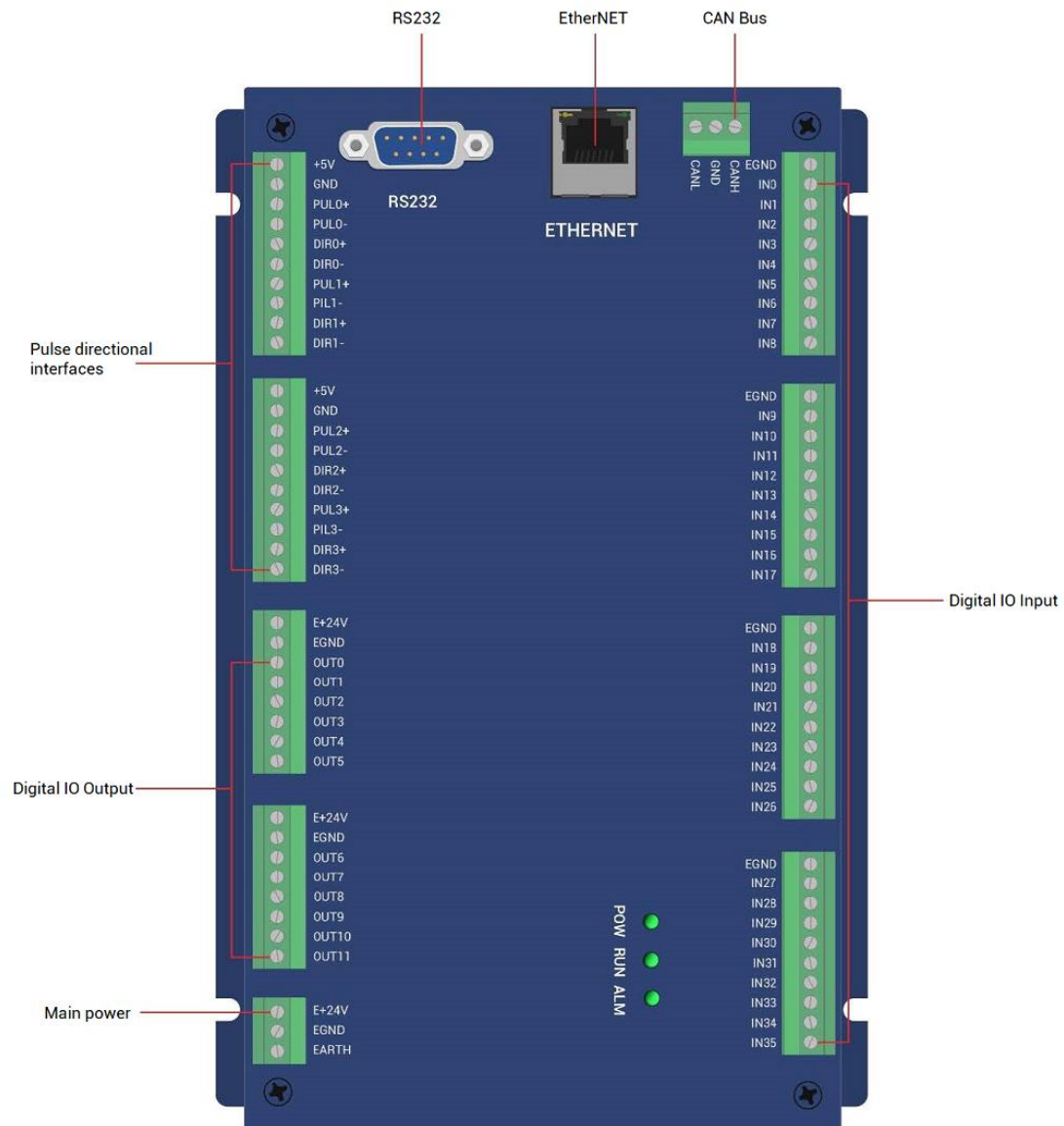
→ Interface Description

Mark	Interface	Number	Description
POW	Status Indication Led	1	Power indicator: it lights when power is conducted.
RUN		1	Run indicator: it lights when runs normally
ALM		1	Error indicator: it lights when runs abnormally
RS232	RS232 serial port (port 0)	1	Use MODBUS_RTU protocol
ETHERNET	Net port	1	Use MODBUS_TCP protocol, expand Ethernet through interchanger, the number of net port

			channels can be checked through "?*port", default IP address id 192.168.0.11
E+24V	Main power	1	24V DC power supplies for controller
CAN	CAN bus interface	1	Connect to CAN expansion module and CAN equipment of other standards
IN	Digital IO input	36	NPN type, internal 24V supply power.
OUT	Digital IO output	12	NPN type, internal 24V supply power.
PUL/DIR	Pulse directional interfaces	4 groups	Differential output signals.

2.4. Work Environment
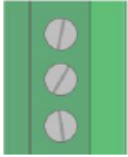
Item		Parameters
Work Temperature		-10℃-55℃
Work relative Humidity		10%-95% non-condensing
Storage Temperature		-40℃～80℃ (not frozen)
Storage Humidity		Below 90%RH (no frost)
vibration	Frequency	5-150Hz
	Displacement	3.5mm(directly install)(<9Hz)
	Acceleration	1g(directly install)(>9Hz)
	Direction	3 axial direction
Shock (collide)		15g, 11ms, half sinusoid, 3 axial direction
Degree of Protection		IP20

Chapter III Wiring & Communication

3.1. Power Input, CAN Communication Interface

The power supply input adopts a 3Pin (there are all 3 terminals) screw-type pluggable wiring terminal, and the interval (means the gap distance between two ports) should be 3.81mm.

→ Terminal Definition:

Terminal	Name	Type	Function
E+24V EGND EARTH	E+24V	Input	Power 24V input
	EGND	Input	Power ground
	EARTH	Grounding	Shield

3.1.1. Power Supply Specification
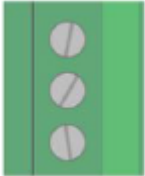
→ Specification

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

3.2. CAN Communication

The CAN communication interface adopts a 3Pin screw-type pluggable wiring terminal, and the interval should be 3.81mm.

→ Terminal Definition

Terminal	Name	Type	Function
CANH GND CANL	CANL	Input/output	CAN communication L
	GND	Grounding	CAN public end
	CANH	Input/output	CAN communication H

Note:
➢ CAN bus of ECI1000 uses internal power supply.
➢ When multiple controllers are linked on the CAN bus, a 120-ohm resistor needs to be connected in parallel to the CANL and CANH terminals of the two controllers.
➢ Both sides of the CAN bus communication must ensure that the corresponding GND is connected or the controller and the expansion module use the same power supply. When the controller and the expansion module are powered by different powers, the CAN interface GND of the controller should be connected to the GND of the expansion module, otherwise the CAN may be burned.

3.2.1. CAN Communication Specification & Wiring

The CAN interface of the control card adopts the standard CAN communication protocol, which mainly includes three ports, CANL, CANH and the public end. And it supports connecting CAN expansion modules and other standard CAN devices.

→ Specification

Item	Description
Max Communication Rate (bps)	1M
Terminal Resistor	120Ω
Topology	Daisy chain connection structure
The number of nodes can be extended	Up to 16

Communication Distance	Longer communication distance, lower communication rate, max 30m is recommended.

→ Wiring Reference

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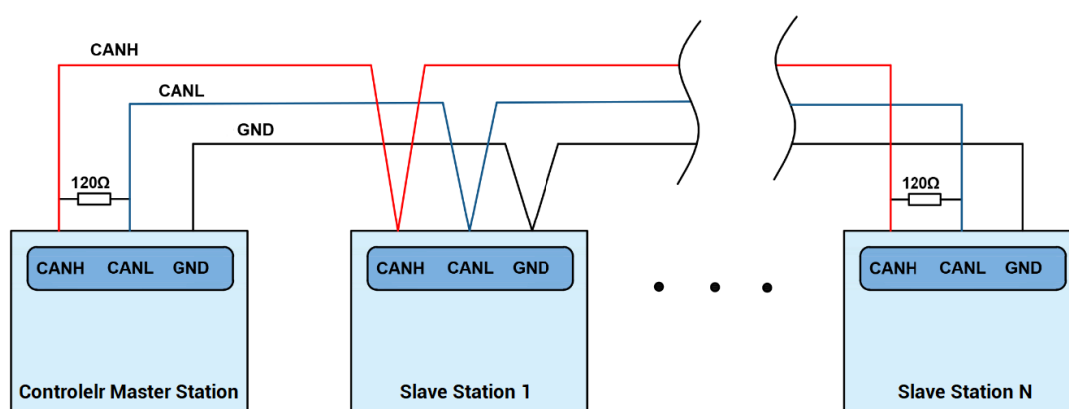

→ Wiring Notes:

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

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

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

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

● When on-site wiring, pay attention to make the distance between strong current and

weak current, it is recommended for the distance to be more than 20cm.

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

→ Cable Requirements:

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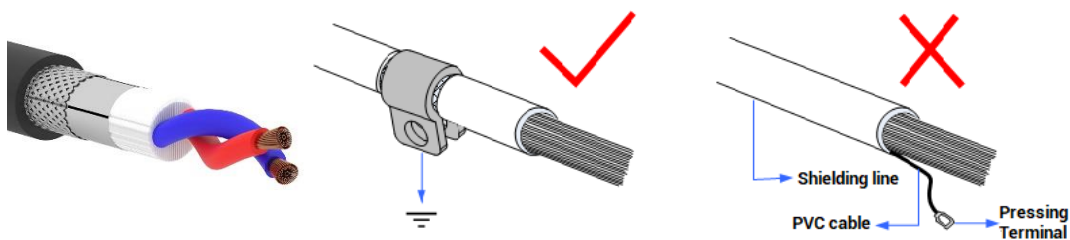
3.2.2. Basic Usage Method

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

(2) After powered on, please use ETHERNET or RS232 to connect to RTSys.

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

```
CAN communication settings:
CANIO_ADDRESS = 32, CANIO_ENABLE = 1
ZCAN Master
CAN baud: 500KBPS
CAN enable: ON

Serial port configuration:
Port0:(RS232) is ModbusSlave Mode.
Address:1, variable:2
Baud:38400
DataBits:8
StopBits:1
Parity:0
```
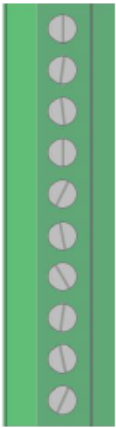
(4) Correctly set the "address" and "speed" of the slave station expansion module according to the manual of the slave station.
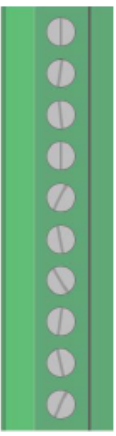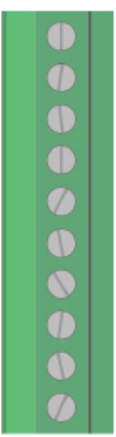
(5) After all the settings are completed, restart the power supply of all stations to establish communication.

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

3.3. IN Digital Input & High-Speed Latch Port

The digital input adopts 4 groups of 10Pin (there are 3 groups of 10 terminals) screw-type pluggable terminals, and the gap distance between terminals should be 3.81mm. In addition, the **latch function** is integrated in digital input signals.

→ **Wiring Definition**

Terminal	Name	Type	Function 1	Function 2
EGND IN0 IN1 IN2 IN3 IN4 IN5 IN6 IN7 IN8	EGND	/	IO Public End	/
	IN0	NPN, general input	Input 0	/
	IN1		Input 1	/
	IN2		Input 2	/
	IN3		Input 3	/
	IN4		Input 4	/
	IN5		Input 5	/
	IN6		Input 6	/
	IN7		Input 7	/
	IN8		Input 8	Latch R0
	EGND	/	IO Public End	/
	IN9	NPN, general input	Input 9	Latch R1
	IN10		Input 10	/
	IN11		Input 11	/
	IN12		Input 12	/
	IN13		Input 13	/
	IN14		Input 14	/
	IN15		Input 15	/

	IN16		Input 16	/
	IN17		Input 17	/

	EGND	/	IO Public End	/
	IN18		Input 18	Encoder EZ1
	IN19		Input 19	Encoder EA1
	IN20		Input 20	Encoder EB1
	IN21	NPN, general input	Input 21	Encoder EZ0
	IN22		Input 22	Encoder EA0
	IN23		Input 23	Encoder EB0
	IN24		Input 24	Home0
	IN25		Input 25	Home1
	IN26		Input 26	Home2

	EGND	/	IO Public End	/
	IN27		Input 27	Home3
	IN28		Input 28	Limit0+
	IN29		Input 29	Limit0-
	IN30	NPN, general input	Input 30	Limit1
	IN31		Input 31	Limit1-
	IN32		Input 32	Limit2
	IN33		Input 33	Limit2
	IN34		Input 34	Limit3
	IN35		Input 35	Limit3

Note:

➢ Encoder is low-speed coupler isolation, it is only used for low-speed 24V encoder, such as handwheel, and the max frequency should be less than 5kHz.

➢ Origin position limit function is configured by default, but it can be modified.

## 3.3.1. Digital Input Specification & Wiring

→ Specification

Item	General input
Channel	36 (IN0-IN35)
Input mode	NPN type
Frequency	< 5kHz
Impedance	4.7KΩ
Voltage level	DC24V
The voltage to open	<14.5V
The voltage to close	>14.7V
Minimal current	-1.8mA (negative)
Max current	-4A (negative)
Isolation mode	optoelectronic isolation
Note: the above parameters are standard values when the voltage of controller power supply (E+24V port) is 24V.	

→ Wiring Reference

■ General Wiring
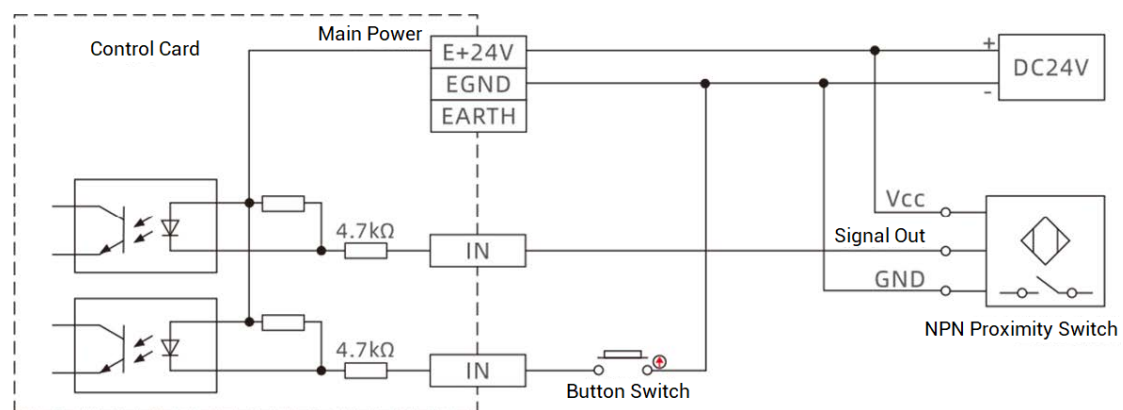
■ Single-Ended Encoder Wiring:
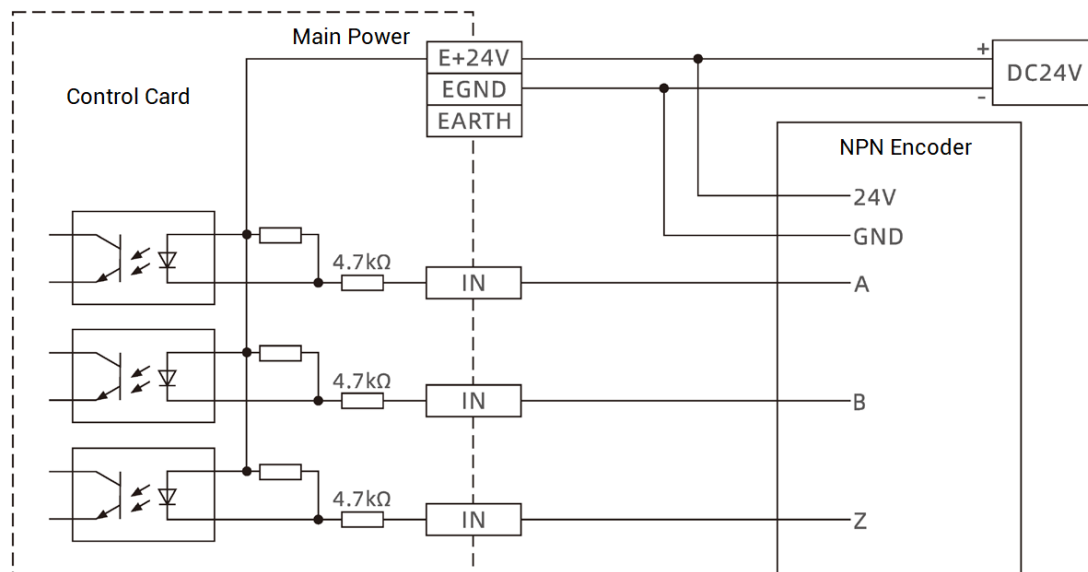
→ Wiring Note:

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

- The voltage of encoder is 24V.

3.3.2. Basic Usage Method

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

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

(3) State values of relative input ports can be read directly through "IN" command, also, it can be read through "RTSys/Tool/In". Please refer to "Basic" for details.
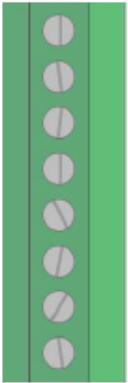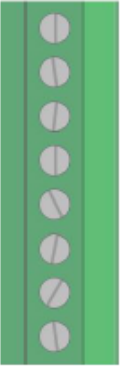
(4) Latch function can be set and triggered through "REGIST" instruction, in software, use REG_INPUTS to configure. Please refer to "Basic" for details.

3.4. OUT Digital Output

The digital output adopts 2 sets of 8in screw-type pluggable terminals with a spacing of 3.81mm.

→ Wiring Definition

Terminal	Name	Type	Function
E+24V EGND OUT0 OUT1 OUT2 OUT3 OUT4 OUT5	E+24V	/	24V power output
	EGND	/	24V Power Ground / IO Public End
	OUT0	NPN, general outputs	Output 0
	OUT1		Output 1
	OUT2		Output 2
	OUT3		Output 3
	OUT4		Output 4
	OUT5		Output 5
E+24V EGND OUT6 OUT7 OUT8 OUT9 OUT10 OUT11	E+24V	/	24V power output
	EGND	/	24V Power Ground / IO Public End
	OUT6	NPN, general outputs	Output 6
	OUT7		Output 7
	OUT8		Output 8
	OUT9		Output 9
	OUT10		Output 10
	OUT11		Output 11

3.4.1. Digital Output Specification & Wiring

→ Specification

Item	Specification
Channel	12 (OUT0-OUT11)
Output mode	Transistor NPN, OD output.
Voltage level	Load power is ≤ 36V
Max output current	+300mA
Max leakage current when off	25µA
Respond time to conduct	12µs
Respond time to close	80µs
Overcurrent protection	Support, trip current is 600mA-1A
Frequency	<8kHz

Note:

✧ The times in the form are typical based on the resistive load, and may change when the load circuit changes.

✧ Due to the leak-type output, the shutdown of the output will be obviously affected by the external load circuit, and the output frequency should not be set too high in the application. If there needs higher speed, please contact us to adjust parameter or custom hardware.
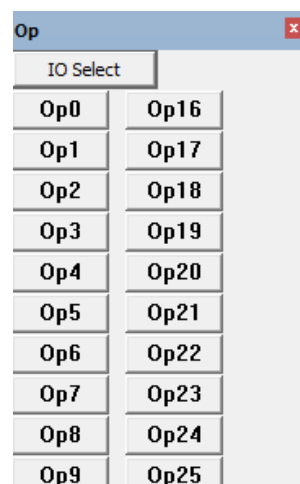
→ Wiring Reference
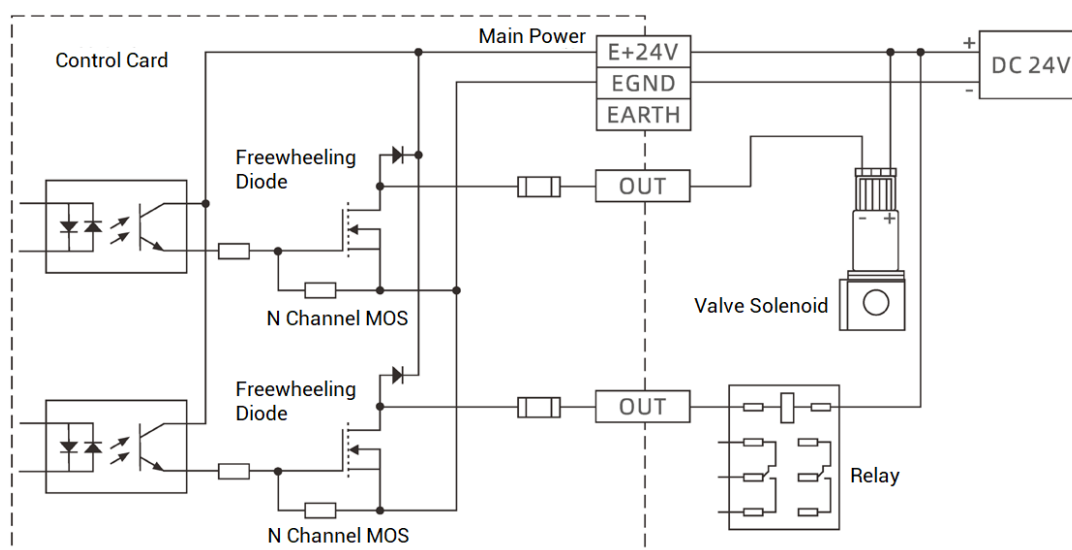
→ **Wiring Note:**

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

● E5V is the output terminal of 5V power supply, it is used when needs to provide external 5V power input load, the max current is 300mA.
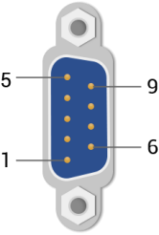
3.4.2. Basic Usage Method

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

(2) After powered on, please use ETHERNET or RS232 to connect to RTSys.

(3) Open or close output port directly through "OP" command, also, it can be opened or closed through "RTSys/Tool/Op". Please refer to "Basic" for details.

Op	
IO Select	
Op0	Op16
Op1	Op17
Op2	Op18
Op3	Op19
Op4	Op20
Op5	Op21
Op6	Op22
Op7	Op23
Op8	Op24
Op9	Op25

3.5. RS232 Serial Port

RS232 is in one standard DB9 male socket and supports MODBUS_RTU protocol and custom communication.

→ Interface Definition

Terminal	PIN	Name	Type	Function
	1, 4, 6, 7, 8	NC	Spare	Reserved
	2	RXD	Input	RS232 signal, receive data
	3	TXD	Output	RS232 signal, send data
	5	EGND	Output	Negative pole output of 5V power, and output for the public end
	9	E5V	Output	Positive pole output of 5V power, maximum is 300mA

3.5.1. RS232 Interface Specification & Wiring

→ Specification:

Item	RS232
Maximum Communication Rate (bps)	115200
Terminal Resistor	No
Topology Structure	Connect correspondingly (1 to 1)
The number of nodes can be extended	1
Communication Distance	The Longer communication distance is, the lower communication rate is, maximum 5m is recommended.

→ Wiring Reference:
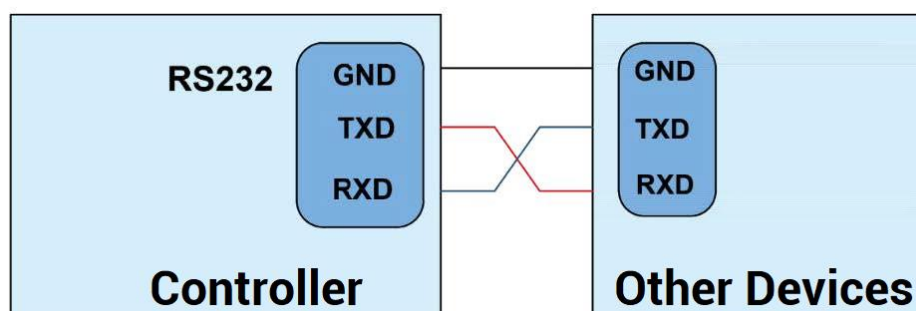
→ **Wiring Notes:**

- The wiring of RS232 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, especially in bad environments, and make sure the shielding layer is fully grounded.

3.5.2. Basic Usage Method

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

(2) After powered on, please use any ETHERNET or RS232 (there is default parameter, which can be connected directly) to connect to RTSys.

(3) Please use the "ADDRESS" and "SETCOM" commands to set and view the protocol station number and configured parameters, see "Basic Programming Manual" for details.

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

(5) When all is configured, it can start to do communicating.

(6) Communication data of RS232 can be directly viewed through "RTSys / Controller / State the Controller / CommunicationInfo".
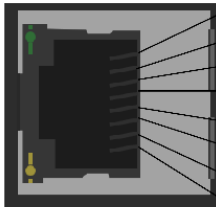
```
CAN communication settings:
CANIO_ADDRESS = 32, CANIO_ENABLE = 1
ZCAN Master
CAN baud: 500KBPS
CAN enable: ON

Serial port configuration:
Port0:(RS232) is ModbusSlave Mode.
Address:1, variable:2
Baud:38400
DataBits:8
StopBits:1
Parity:0
```
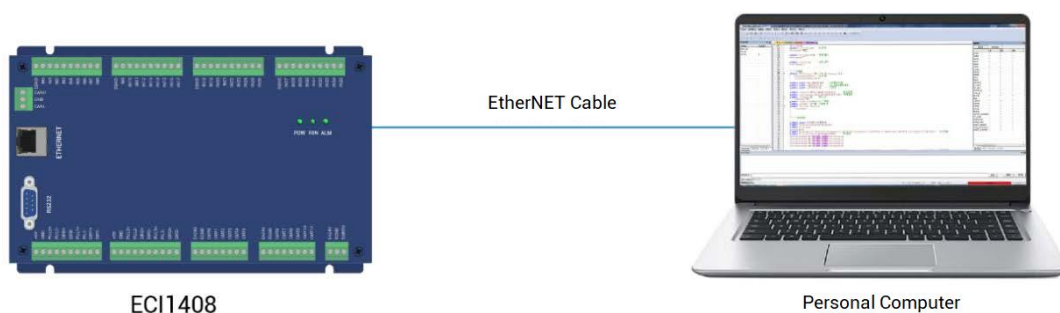
3.6. ETHERNET

ECI1408 network motion control card has an Ethernet port, and it supports MODBUS_TCP protocol and custom communication, and the default IP address is 192.168.0.11. The pin definition is as follows:

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

The Ethernet port of the controller can be connected to a computer, HMI, etc. through an Ethernet cable, and using point to point connection method. The schematic diagram is as follows:

EtherNET Cable

ECI1408

Personal Computer

The controller can also be connected to the interchanger through an Ethernet cable, and then use interchanger to connect to other devices, then multi-point connection can be achieved. The schematic diagram is as follows:
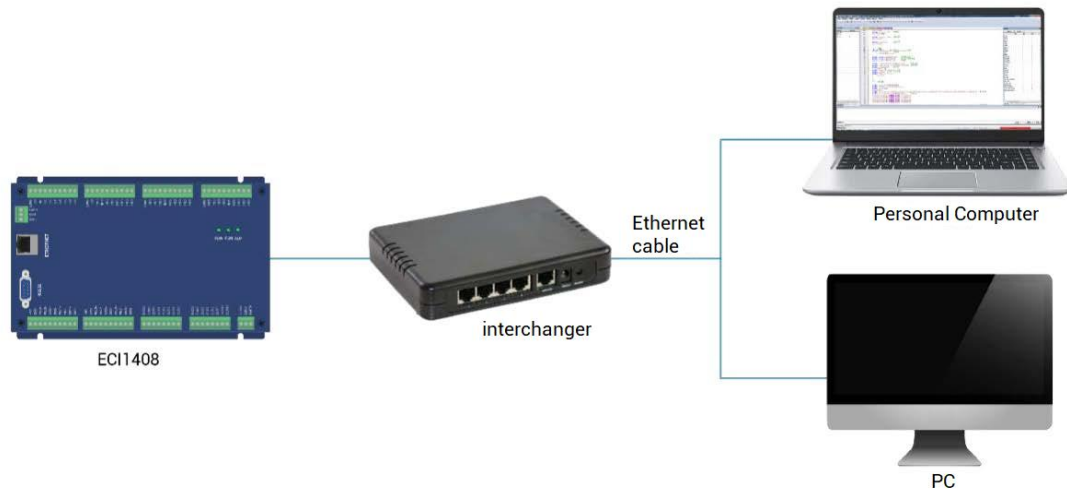
→ Communication Cable Requirements

ETHERNET communication interface adopts standard Ethernet RJ45 interface.

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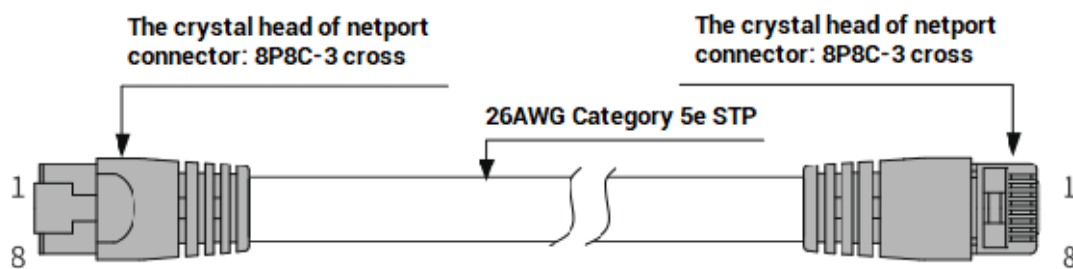
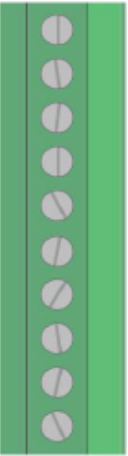| Item	Specification
Cable type	Flexible crossover cable, Category 5e
traverse	twisted pair
Line pairs	4
Isolation	cross skeleton
Connector	Crystal head with iron shell
Cable material	PVC
Cable length	Less than 100m

Use RJ45 network cable connection method:

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

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

● When disassembling, press the tail mechanism of the crystal head, and pull out the connector and the module in a horizontal direction.
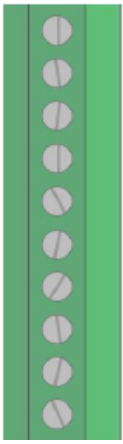
Please use tube-type pre-insulated terminals and cables with appropriate wire diameters to connect the user terminals.

3.7. Pulse Directional Axis Interfaces

The digital output adopts 2 sets of 10in screw-type pluggable terminals with a spacing of 3.81mm.

→ Wiring Definition

Terminal	PIN	Signal	Description
+5V GND PUL0+ PUL0- DIR0+ DIR0- PUL1+ PIL1- DIR1+ DIR1-	1	+5V	Internal 5V
	2	GND	5V power ground
	3	PUL0+	Pulse output + of axis 0
	4	PUL0-	Pulse output - of axis 0
	5	DIR0+	Directional output + of axis 0
	6	DIR0-	Directional output - of axis 0
	7	PUL1+	Pulse output + of axis 1
	8	PUL1-	Pulse output - of axis 1
	9	DIR1+	Directional output + of axis 1
	10	DIR1-	Directional output - of axis 1
	1	+5V	Internal 5V
	2	GND	5V power ground
	3	PUL2+	Pulse output + of axis 2
	4	PUL2-	Pulse output - of axis 2
	5	DIR2+	Directional output + of axis 2

	6	DIR2-	Directional output - of axis 2
+5V GND PUL2+ PUL2- DIR2+ DIR2- PUL3+ PIL3- DIR3+ DIR3-	7	PUL3+	Pulse output + of axis 3
	8	PUL3-	Pulse output - of axis 3
	9	DIR3+	Directional output + of axis 3
	10	DIR3-	Directional output - of axis 3

3.7.1. AXIS Interface Signal Specification & Wiring
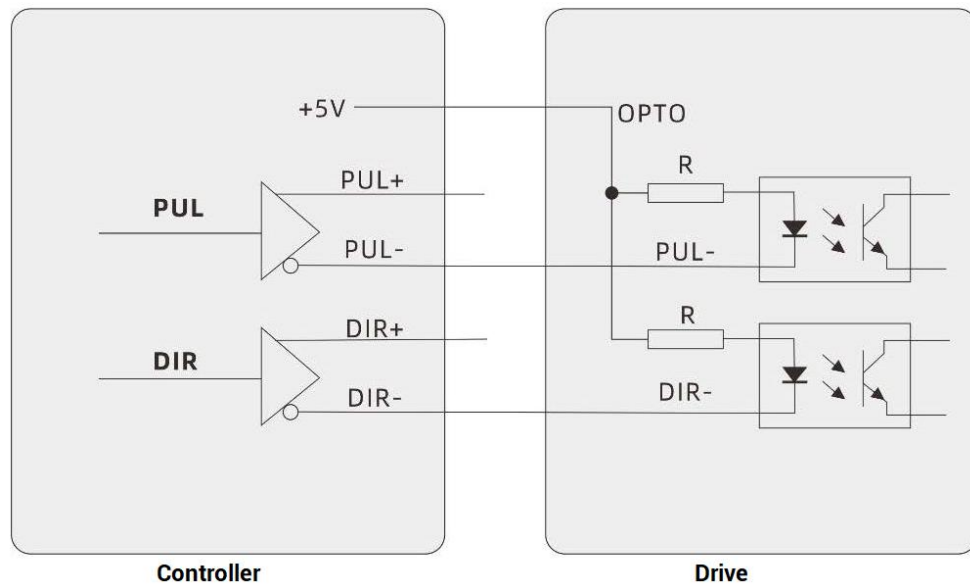
→ Specification:

Item	Description
Pulse/directional (PUL/DIR) signal type	Differential output signal
Pulse/directional (PUL/DIR) signal voltage range	0-5V
Pulse/directional (PUL/DIR) signal max frequency	5MHz
Isolation	Non-isolation
+5V power (+5V, GND) max output current	50mA

→ Wiring Reference:

■ **Differential connection**

Controller   Drive
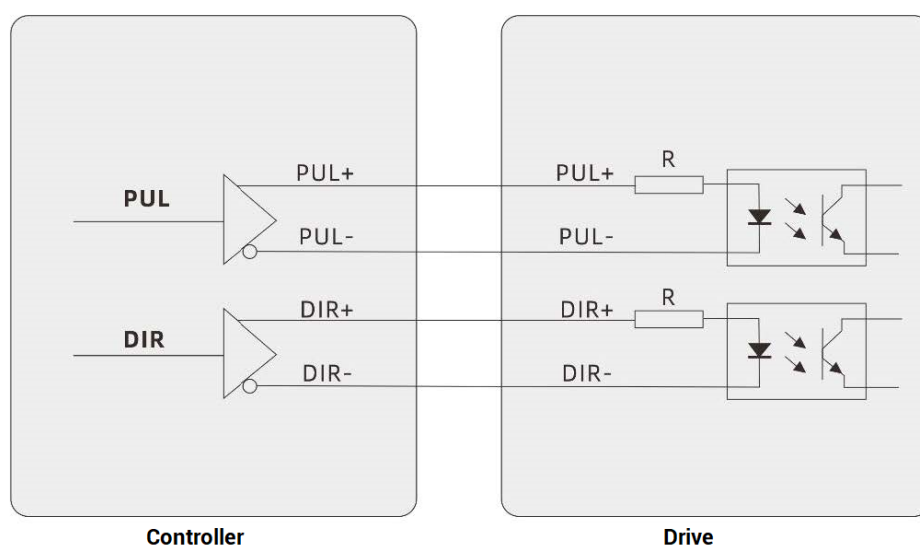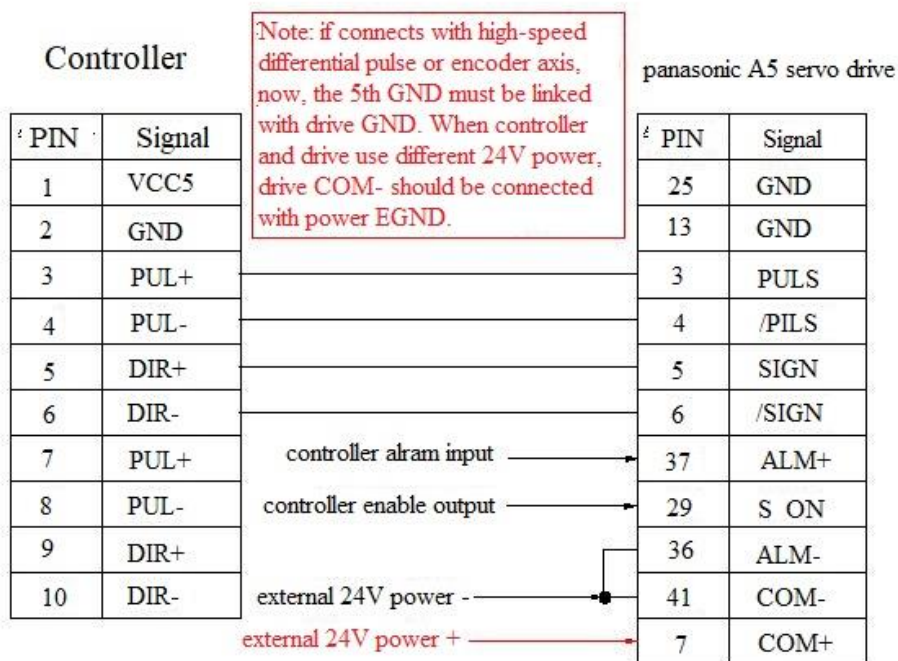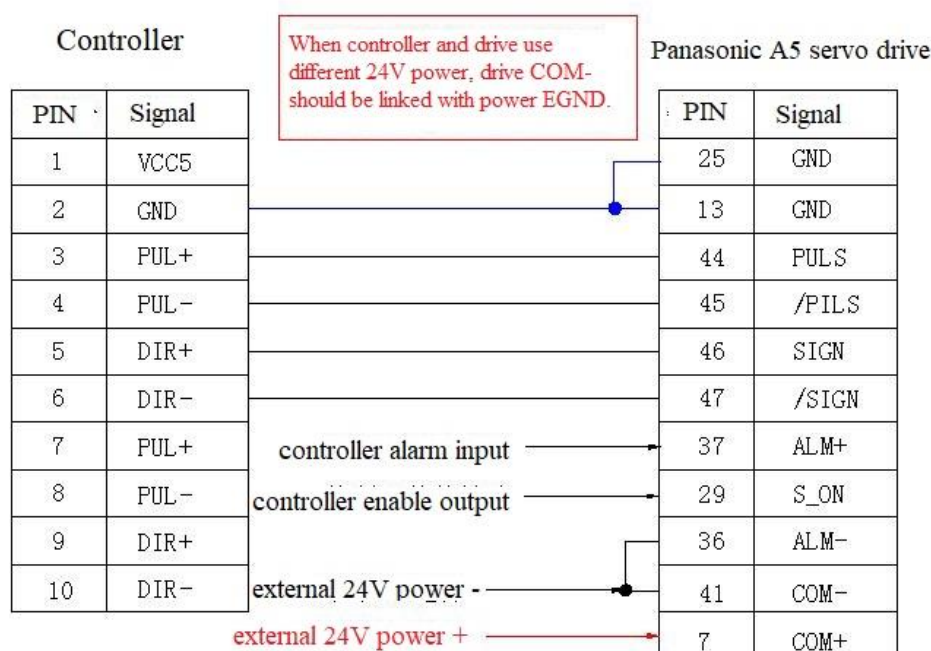
■ **Single-ended connection**

Controller   Drive

■ **Low-speed Differential connection**

Reference example of wiring between Panasonic A5 servo and low-speed differential pulse:

Controller

Note: if connects with high-speed differential pulse or encoder axis, now, the 5th GND must be linked with drive GND. When controller and drive use different 24V power, drive COM- should be connected with power EGND.

panasonic A5 servo drive

PIN	Signal
1	VCC5
2	GND
3	PUL+
4	PUL-
5	DIR+
6	DIR-
7	PUL+
8	PUL-
9	DIR+
10	DIR-

PIN	Signal
25	GND
13	GND
3	PULS
4	/PILS
5	SIGN
6	/SIGN
37	ALM+
29	S ON
36	ALM-
41	COM-
7	COM+

controller alram input
controller enable output
external 24V power -
external 24V power +

■ **High-speed Differential connection**

Reference example of wiring between Panasonic A5 servo and high-speed differential pulse:

Controller		When controller and drive use different 24V power, drive COM-should be linked with power EGND.	Panasonic A5 servo drive	
PIN	Signal		PIN	Signal
1	VCC5		25	GND
2	GND		13	GND
3	PUL+		44	PULS
4	PUL-		45	/PILS
5	DIR+		46	SIGN
6	DIR-		47	/SIGN
7	PUL+	controller alarm input	37	ALM+
8	PUL-	controller enable output	29	S_ON
9	DIR+		36	ALM-
10	DIR-	external 24V power -	41	COM-
		external 24V power +	7	COM+

→ **Wiring Note:**

✧ Some servo drives are not optically isolated (for example, Panasonic economical servo), at this time pin 2 GND must be connected to the GND of the drive.

3.7.2. Basic Usage Method

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

(2) After power on, please use ETHERNET or RS232 (default parameter, it can be connected directly) to connect to RTSys.

(3) Set axis parameters, such as, ATYPE, UNITS, SPEED, ACCEL, FWD_IN, REV_IN, etc.

(4) There are many parameters related to pulse axis, they can be set and checked through relative instructions, please see "axis parameter and axis status" of "Basic", or see "RTSys/Tool/Axis parameter".

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

Refer to BASIC Routine:

BASE(0,1)   'select axis 0 and axis 1

ATYPE = 1,1   'set axis 0 and axis 1 as pulse axes

UNITS = 1000,1000   'set pulse amount as 1000 pulses

SPEED = 10,10   'set axis speed as 100*1000 pulse/s

ACCEL = 1000,1000   'set axis acceleration as 1000*1000 pulse/s/s

FWD_IN = -1,-1   'prohibit using axis positive hardware position limit

REV_IN = -1,-1   'prohibit using axis negative hardware position limit

MOVE(10) AXIS(0)   'axis 0 moves distance of 10*1000 pulses in positive

MOVE(-20) AXIS(0)   'axis 0 moves distance of 20*1000 pulses in negative

Chapter IV Expansion Module

The control card can expand digital IO and analogs AD/DA through CAN bus, ZIO series CAN bus expansion modules or ZMIO310-CAN series bus expansion modules can be selected. For details, please refer to corresponding user manuals.

## 4.1. CAN Bus Expansion Wiring

The ZIO expansion module is powered by the dual power supply. Except the main power supply, an additional IO power supply is required to supply independent power for IO. Both the main power supply and the IO power supply use 24V DC power supply. For ZAIO, it only needs to connect to the main power supply.

To prevent interference, separate the IO power supply from the main power supply.

Please select the expansion module according to the requirements, and select IO mapping or axis mapping according to the resources of the expansion module.

Wiring reference of connection between ZIO expansion module and control card and standard wiring of CAN bus are shown as below.
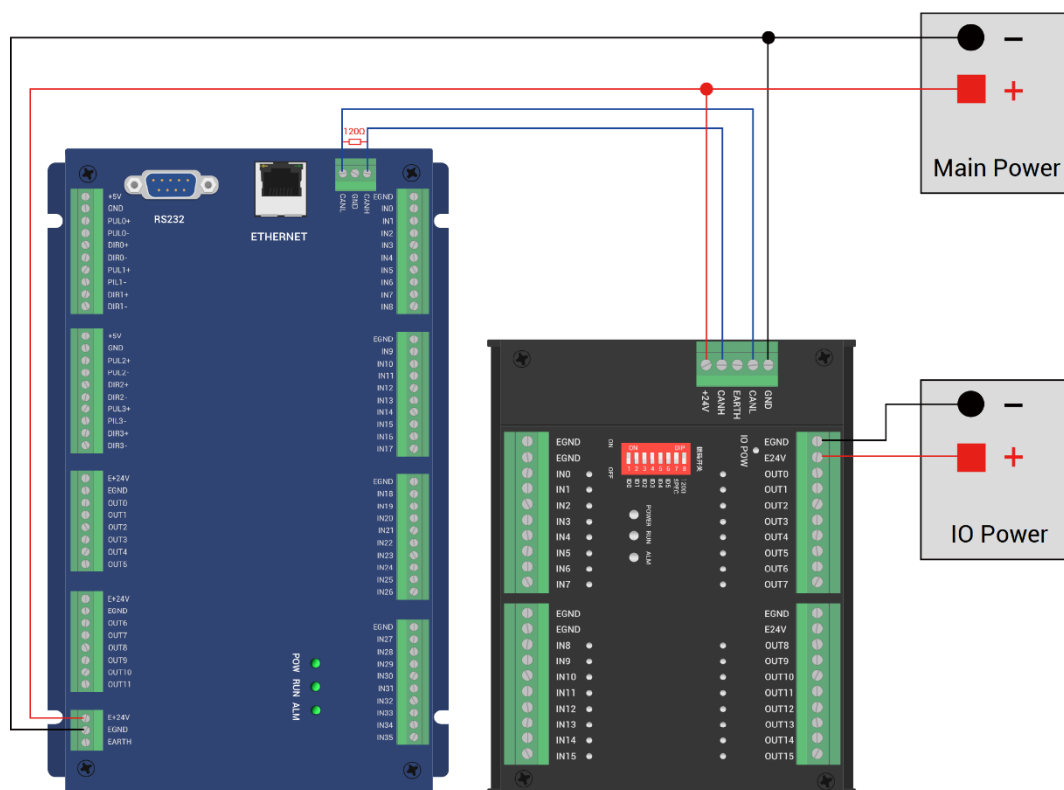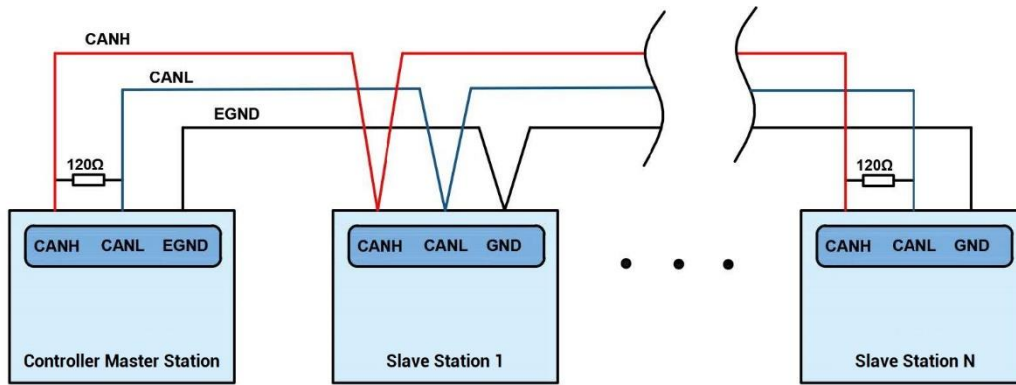
→ Wiring Note:

✧ ECI1408 control card uses single-power, and ZIO expansion module uses dual-power. When using, main power supply of expansion module and main power supply of controller can share one power. When they use different power supplies, controller power GND needs to connect to expansion module power GND, otherwise CAN may be burnt out.

✧ When connecting multiple ZIO expansion modules on the CAN bus, a 120-ohm resistor needs to be connected in parallel between the CANL and CANH terminals, for the ZIO expansion module that is with 8-digit dialing codes, the terminal resistor can be realized by dialing the code (DIP).

4.2. CAN Bus Expansion Resource Mapping

The ZCAN expansion module generally has an 8-bit DIP switch, 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.

5-6: CAN communication speed, corresponding value is 0-3, four different speeds are

optional.

7: reserved.

8: 120-ohm resistor, dial ON means a 120-ohm resistor is connected between CANL and CANH.

The IO numbers of the entire control system cannot be repeated, and existed numbers must be avoided when mapping resources. And the DIP switch must be dialed before power-on, if re-dial after power-on, it is invalid. It needs to be powered on again to take effect.

Dial 1-4 to select the CAN address, and the controller sets the IO number range of the corresponding expansion module according to the CAN DIP address. When each is dialed as OFF, the corresponding value is 0, when it is ON , it corresponds to a value of 1, and the address combination value = dial 4 $\times$ 8 + dial code 3 $\times$ 4 + dial code 2 $\times$ 2+ dial code 1.

Dial code 5-6 to select CAN bus communication speed, speed combination value=dial code 6 $\times$ 2 + dial code 5×1, the combined value range is 0-3.

The corresponding speeds are as follows:

DIP 5-6 combination value	CANIO_ADDRESS high 8-bit value	CAN communication speed
0	0 (corresponds to decimal 128)	500KBPS (default value)
1	1 (corresponds to decimal 256)	250KBPS
2	2 (corresponding to decimal 512)	125KBPS
3	3 (corresponding to decimal 768)	1MBPS

The controller side sets the CAN communication speed through the CANIO_ADDRESS command. There are also four speed parameters that can be selected. The communication speed must be consistent with the communication speed of the expansion module that corresponds to the combination value, then they can communicate with each other.

The factory default communication speed is 500 KBPS on both sides, there is no need to set this, unless you need to change the speed.

The CANIO_ADDRESS command is a system parameter, and it can set the master-slave end of CAN communication. The default value of the controller is 32, that is, CANIO_ADDRESS=32 is the master end, and the slave end is set between 0-31.

The CAN communication configuration can be viewed in the "State the Controller" window.

→ IO Mapping:

the CAN expansion module uses bit1-4 of the DIP switch. According to the number of currently included IO points(the largest number in IN and OP must include IO point in the axis interface), use the bit 1-4 to set the ID, so as to determine the number range of IO to be expanded.

If the controller itself contains 28 INs and 16 OPs, then the starting address set by the first extended board should exceed the maximum value of 28. According to below rule, the dial code should be set to the combination value 1 (binary combination value 0001, from right to left, dial code 1-4, at this time dial 1 is set to ON, and the others are set to OFF), the IO number on the expansion board = the expansion board number value + the initial IO number value, among them, the IOs that are vacant from 29-31 Numbers are not used. Subsequent extended boards continue to confirm the dial settings according to the IO points in turn.

The initial digital IO mapping number starts from 16 and increases in multiples of 16. The distribution of digital IO numbers corresponding to different dial IDs is as follows:

DIP 1-4 combination value	Starting IO number	Ending IO number
0	16	31
1	32	47
2	48	63
3	64	79
4	80	95
5	96	111
6	112	127
7	128	143
8	144	159
9	160	175
10	176	191
11	192	207
12	208	223

13	224	239
14	240	255
15	256	271

The initial IO mapping number of the analog AD starts from 8 and increases in multiples of 8. The initial IO mapping number of the analog DA starts from 4 and increases in multiples of 4. The allocation of digital IO numbers corresponding to different dial code IDs is as follows:

DIP 1-4 combination value	Starting AD number	End AD number	Starting DA number	End DA number
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

Extended resource viewing:
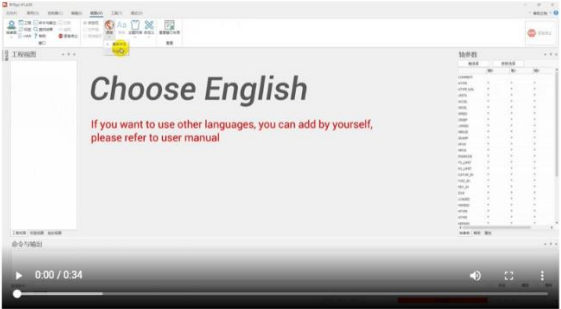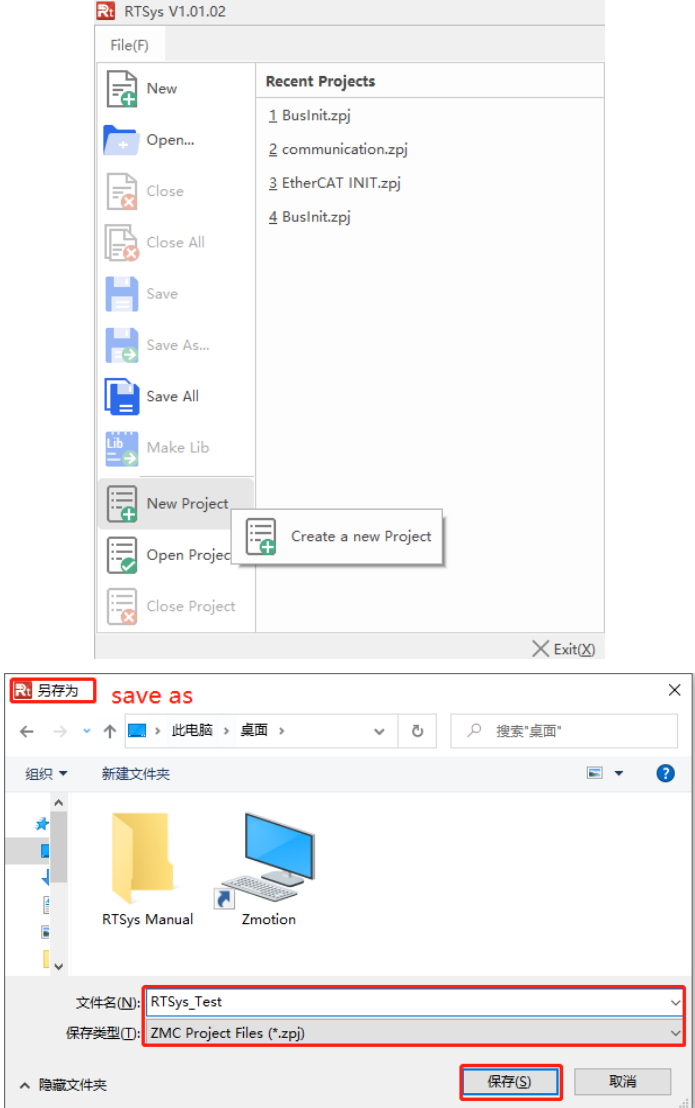
According to the CAN connection, after the power is turned on, and the wiring resistance dial code is set correctly, the power indication led (POWER) and the running indication led (RUN), the IO power indication led (IO POWER) are on, and the alarm indication led (ALM) is off. At the same time, the "Controller" - "State the controller" - "ZCanNodes" in the RTSys software displays the expansion module information and the extended IO number range.
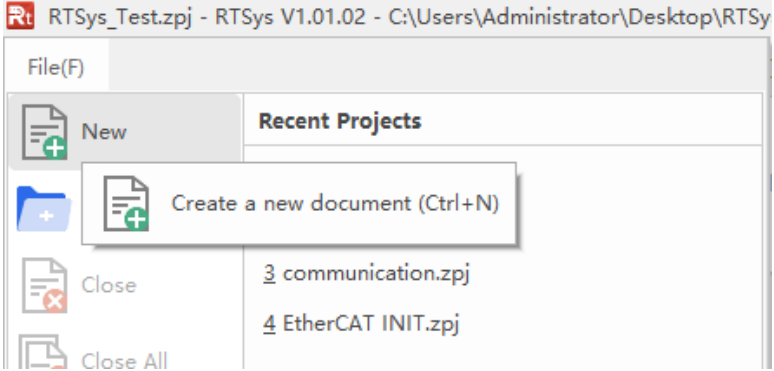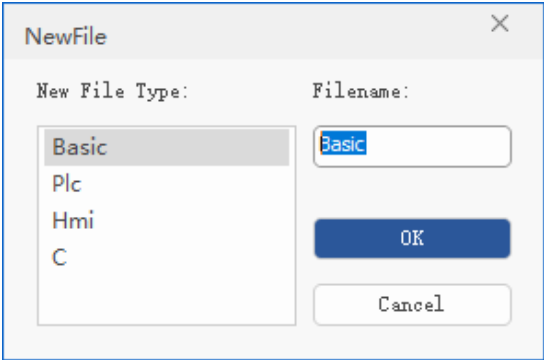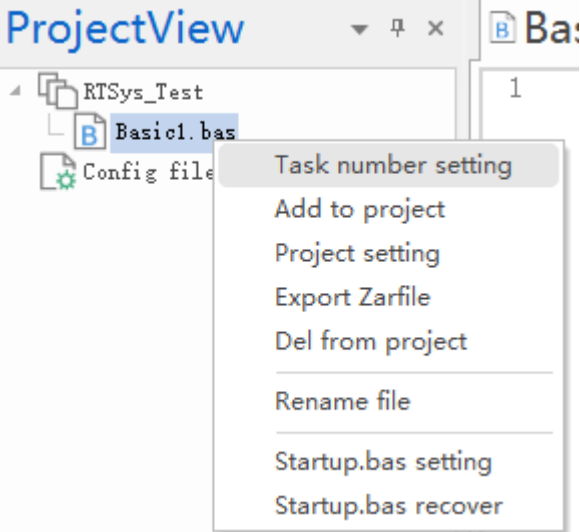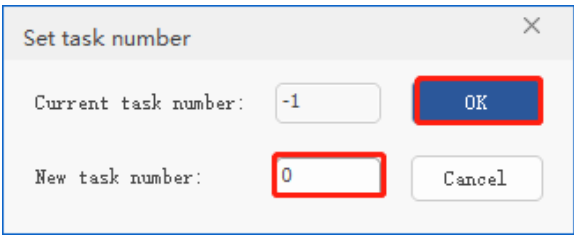
The dial ID and the corresponding resource number when connecting multiple

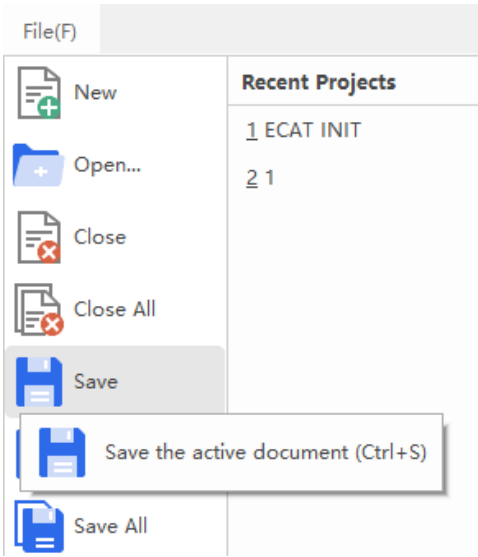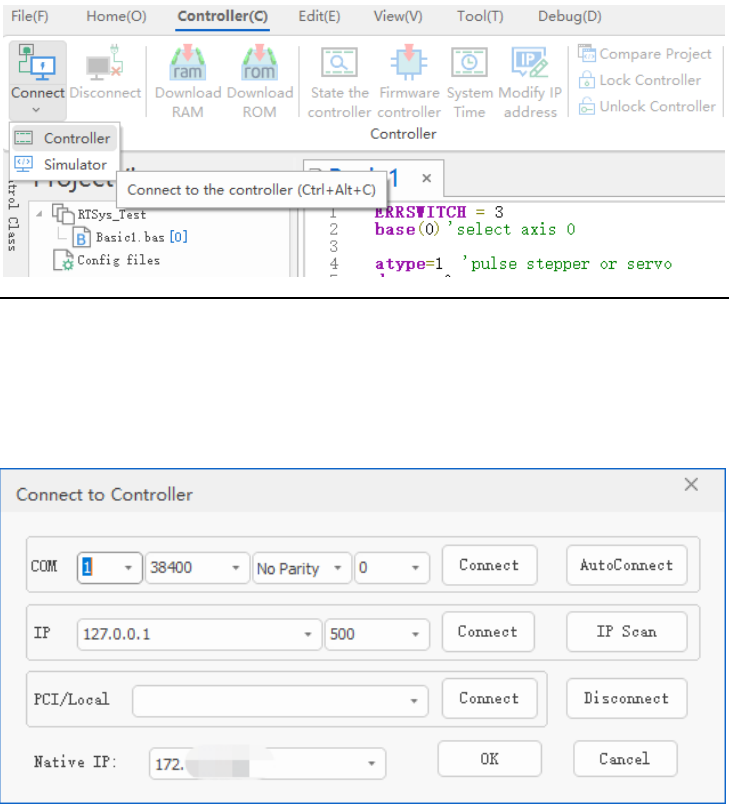expansion modules are as follows:

Local	432-0(ZMC432)	32	30(0-29)	18(0-17)	0	2(0-1)	
1	48(ZIO1632)	0	16(32-47)	32(32-63)	0	0	
3	26(ZIO16082)	2	16(64-79)	8(64-71)	0	0	
4	10(ZAIO0802)	0	0	0	8(40-47)	2(20-21)	

ALM indicator light is on, please check whether the wiring, resistor and dial setting are correct, and whether the CANIO_ADDRESS command of the controller is set as the master end (32), and whether the CAN communication speed is consistent.

Chapter V Programming

5.1. Program in RTSys Software

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

In RTSys, there are 4 programming languages for motion control development, Basic, PLC, HMI and C language, they can run multi-tasks among them, especially for Basic, multi-task running can be achieved separately, hybrid programming is also OK with PLC, HMI and C language.

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

And related manuals can be found in "Download":

Name	Version No	Format	Size	Download
RTSys Development Software	V1.2.02	RAR	148MB	Download
RTSys User Manual V1.2.0	V1.2.0	PDF	5.33MB	Download
RTBasic Programming Manual	V1.1.0	PDF	18.3MB	Download
RTHMI Programming Manual	V1.2.0	PDF	7.23MB	Download
Quick Start	VQuick Start	ZIP	16.1MB	Download
ZVision Basic Programming Manual V1.3.0	V1.3.0	PDF	10.6MB	Download
ZPLC	V1.0	PDF	1.7M	Download

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

	up one window, click OK, and restart it.	Language Switch Video Showing: E. How to Switch the Language Find "视图" (the fourth one in the above menu), then find the "语言", choose English, restart RTSys. Enligsh RTSys will take effect when opened again. **Choose English** If you want to use other languages, you can add by yourself, please refer to user manual ▶ 0:00 / 0:34
2	New Project: "File" – "New Project", Save as window will pop up, then enter file name, save the project file with suffix "zpj.".	RTSys V1.01.02 File(F) New **Recent Projects** Open... 1 BusInit.zpj Close 2 communication.zpj Close All 3 EtherCAT INIT.zpj Save 4 BusInit.zpj Save As... Save All Make Lib New Project Create a new Project Open Project Close Project ✕ Exit(X) save as 此电脑 > 桌面 组织 ▾ 新建文件夹 RTSys Manual Zmotion 文件名(N): RTSys_Test 保存类型(T): ZMC Project Files (*.zpj) 保存(S) 取消 ⌃ 隐藏文件夹

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

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

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

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

5.2. 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.

5.3. Program in Host-Computer by PC Languages

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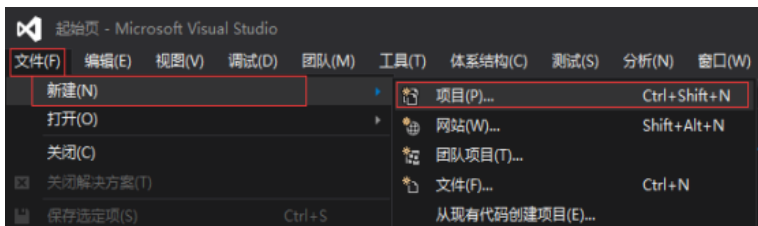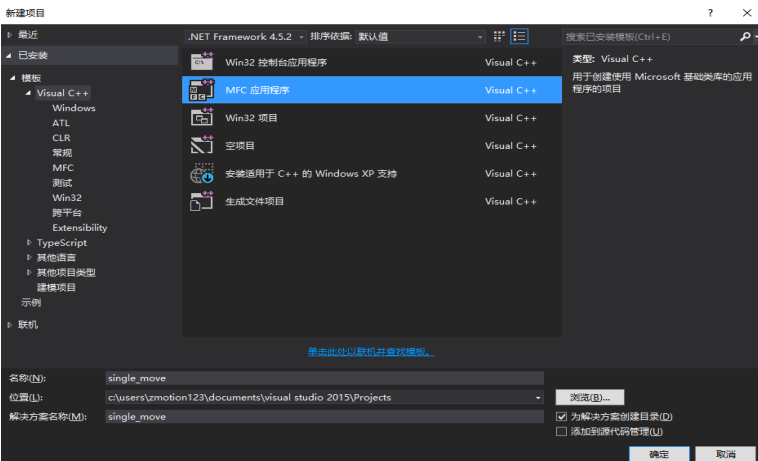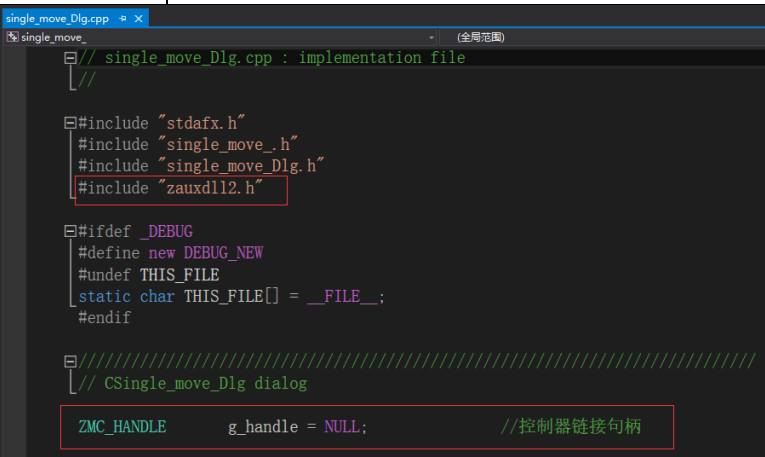

The program developed using the PC software cannot be downloaded to the controller, and it is connected to the controller through the dll dynamic library. The dll library needs to be added to the header file and declared during development.

● Get PC library file, example: https://www.zmotionglobal.com/download_list_17.html
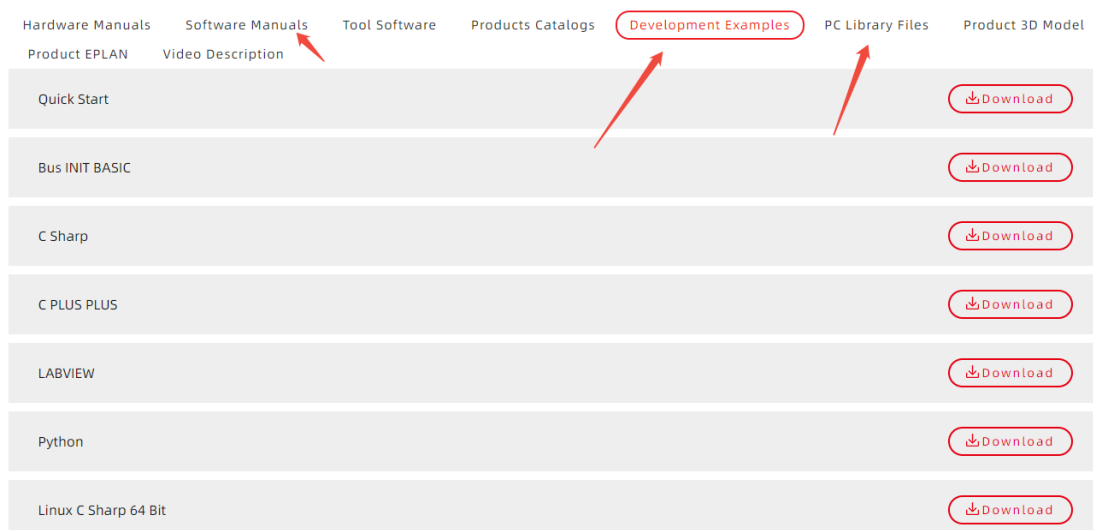
The c++ project development process in VS is as follows:
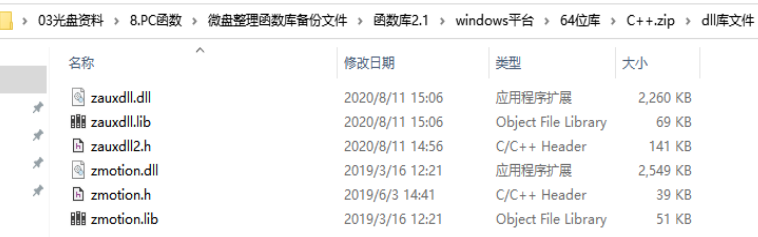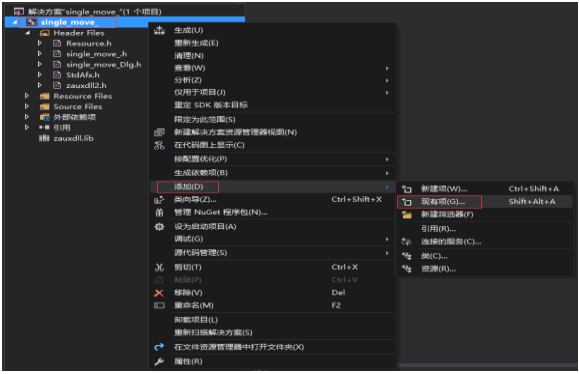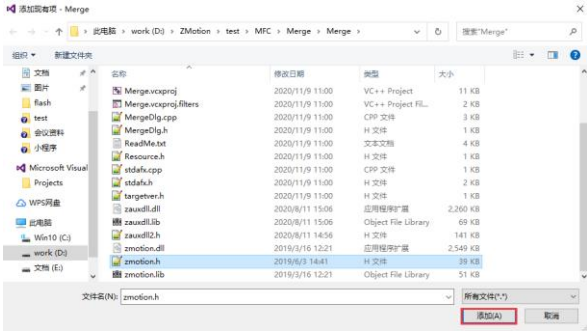
Step	Operations	Display Interface
1	Open VS, click "File" – "New" – "Project".	
2	Select development language as "Visual C++" and the select program type as "MFC application type".	
3	Select "Based on basic box", click "next" or "finish"	
4	Find C++ function library provided by manufacturer. Routine is below (64-bit library)	
5	Copy all DLL related library files under the above path to the newly created project.	

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

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

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

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

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

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

Chapter VI 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.

6.1. 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

6.2. Common Problems & Solutions

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

The position limit signal is invalid.	1. Check whether the limit sensor is working normally, and whether the "input" view can watch the signal change of the limit sensor. 2. Check whether the mapping of the limit switch is correct. 3. Check whether the limit sensor is connected to the common terminal of the controller.
No signal comes to the input.	1. Check whether the limit sensor is working normally, and whether the "input" view can watch the signal change of the limit sensor. 2. Check whether the mapping of the limit switch is correct. 3. Check whether the limit sensor is connected to the common terminal of the controller.
The output does not work.	1. Check whether IO power is needed. 2. Check whether the output number matches the ID of the IO board.
POWER led is ON, RUN led is OFF.	1. Check whether the power of the power supply is sufficient. At this time, it is best to supply power to the controller alone, and restart the controller after adjustment. 2. Check whether the ALM light flickers regularly (hardware problem).
RUN led is ON, ALM led is ON.	1. Program running error, please check RTSys error code, and check application program.
Fail to connect controller to PC through serial port.	1. Check whether the serial port parameters are modified by the running program, you can check all the current serial port configurations through ?*SETCOM. 2. Check whether the serial port parameters of the PC match the controller. 3. Open the device manager and check whether the serial driver of the PC is normal.
CAN expansion module cannot be connected.	1. Check the CAN wiring and power supply circuit, whether the 120 ohm resistor is installed at both

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