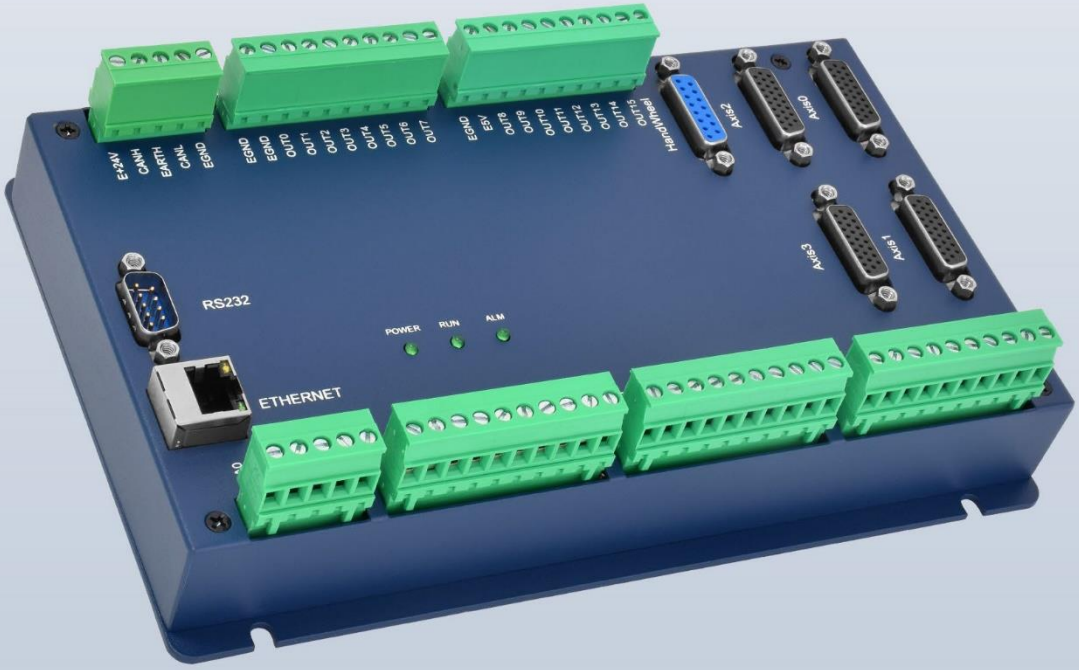
Zmotion®
正运动技术

做更好用的运动控制，智造美好生活
Better Motion Control, Smarter Life

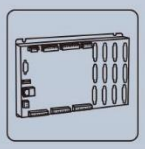
Network Motion Control Card

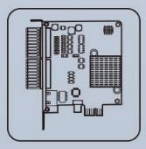
ECI2418B

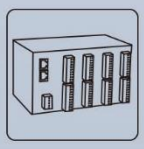
This manual is mainly for ECI2410B, ECI2412B, ECI2416B, ECI2418B, ECI2418B-HW.




Vision Motion Controller


Motion Controller


Motion Control Card


IO Expansion Module


HMI

Statement

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

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

➢ Notes

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

■ Danger

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

■ Notes

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

Content

Chapter I Production Information

1.1. Product Information

ECI2418B economical multi-axis motion control card is a kind of network motion control card that belongs to pulse type and modular type. Motion control can be extended to 12 axes to achieve some simple trajectory control requirements, such as, linear interpolation, any circular interpolation, space arc, helical interpolation, electronic cam, electronic gear, synchronization follow, virtual axes, robotic arm instruction, etc., and real-time motion control can be achieved through optimized network communication protocol.

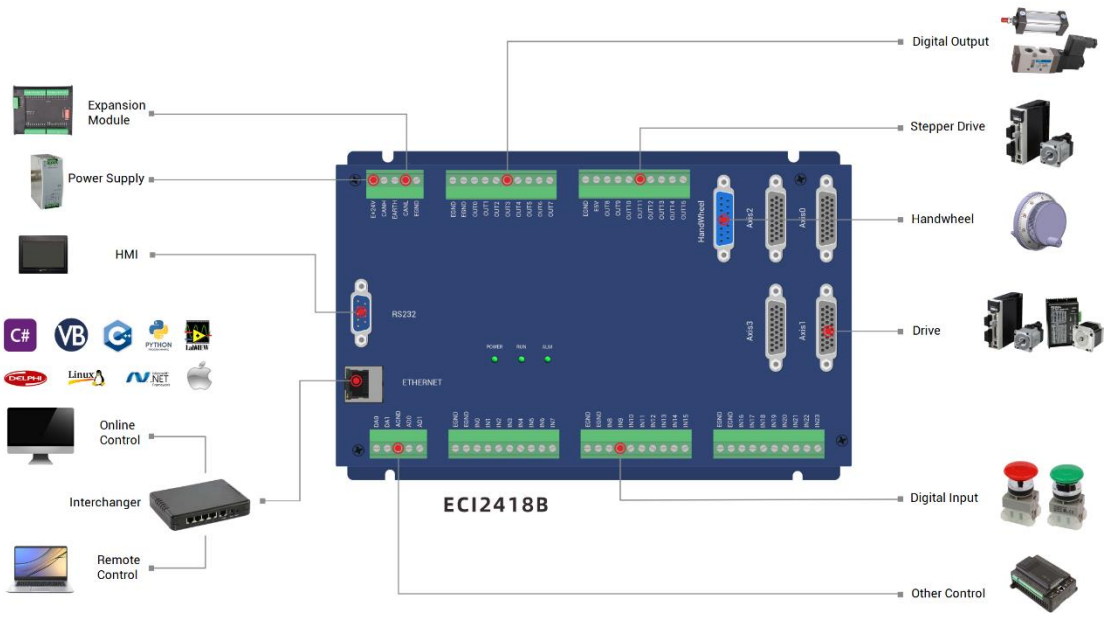
ECI2000 series economical multi-axis motion control card can be used in those pulse applications within 12 axes, such as, **electronic semiconductor equipment (testing equipment, assembly equipment, locking equipment, soldering machine), dispensing equipment, assembly line,** etc.

1.2. Function Features

- Support motion control of **4 differential pulse axes**, which can be up to 12 axes by expansion modules.
- Pulse output mode: pulse / direction or dual pulses.
- AXIS interface supports encoder position measurement, which can be configured as handwheel input mode.
- Specialized handwheel input interface.
- Maximum pulse frequency output of each axis: **10MHZ**.
- 256 isolation inputs and 256 isolation outputs can be extended at most through CAN bus.

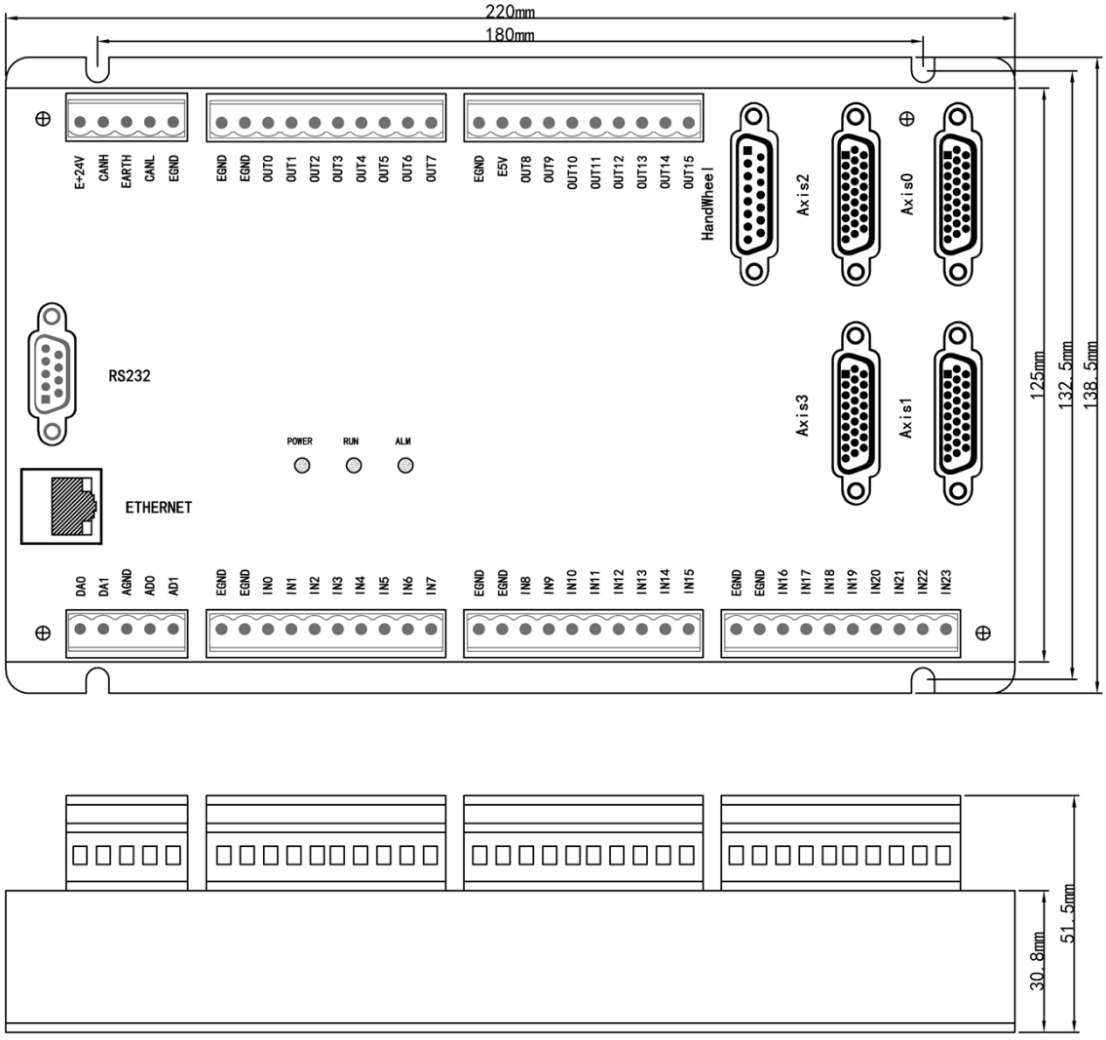
- Axis position limit signal / origin signal port can be configured as any input at will.
- The maximum output current of general digital outputs can reach 500mA, which can directly drive some kinds of solenoid valves.
- Interfaces: RS232, Ethernet, CAN.
- Support linear interpolation, any circular interpolation, helical interpolation of 12 axes at most.
- Support point to point, electronic cam, linear interpolation, circular interpolation, continuous interpolation, robotic arm instructions.
- Multi-file and multi-task programming in ZBasic (RTBasic).
- A variety of program encryption methods to protect the intellectual property rights of customers.

1.3. System Frame



1.4. Hardware Installment

ECI2418B 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

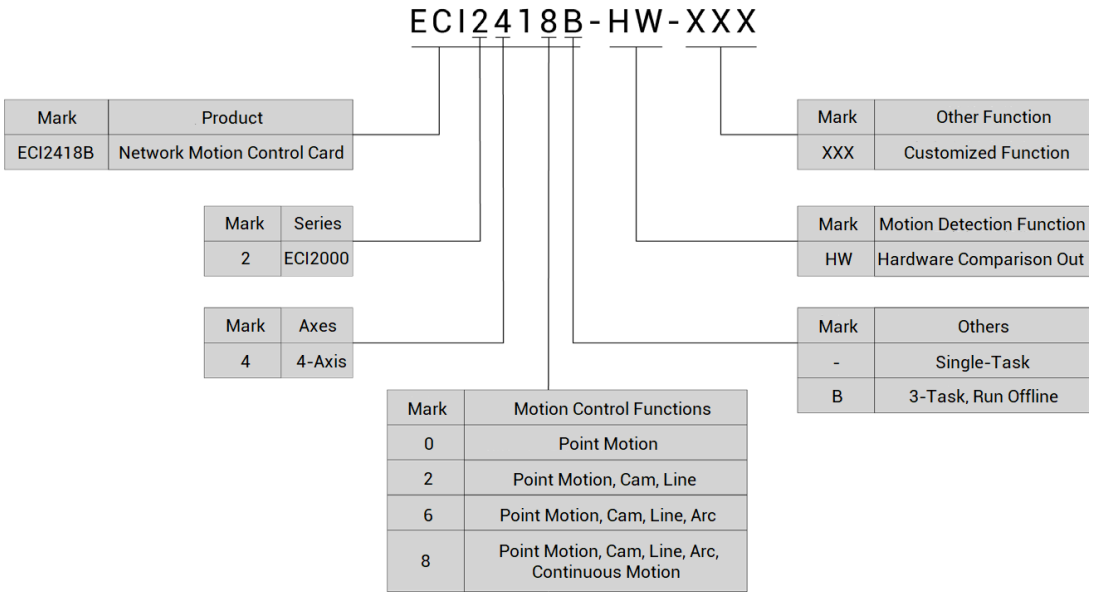
 **Installation attention**	● Non-professionals are strictly prohibited to operate. Specifically, professionals who had been trained related electrical equipment, or who master electrical knowledge. ● Please be sure to read the product instruction manual and safety precautions carefully before installation.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

Chapter II Product Specification

2.1. Basic Specification

Item	Description
Model	ECI2418B
Basic Axes	4 AXIS
Max Extended Axes	12
Basic Axes Type	Pulse/encoder
Digital IO	General IO: there are 24 inputs and 16 outputs. Axis interface IO: there are 8 inputs and 4 outputs on 4 AXIS axis interfaces.
Max Extended IO	256 inputs, 256 outputs
AD/DA	2 general ADs and 2 general DAs.
Max Extended AD/DA	128 ADs, 64 DAs
PWM	4
Pulse Bit	32
Encoder Bit	32
Speed Acceleration Bit	32
Pulse Max Frequency	10MHz
Motion Axis Buffer	128
Array Space	2000
Program Space	4KByte
Flash Space	128KByte
Power Supply Input	24V DC input
Communication Interfaces	RS232, Ethernet, CAN.
Dimensions	220mm*138.5mm*30.8mm

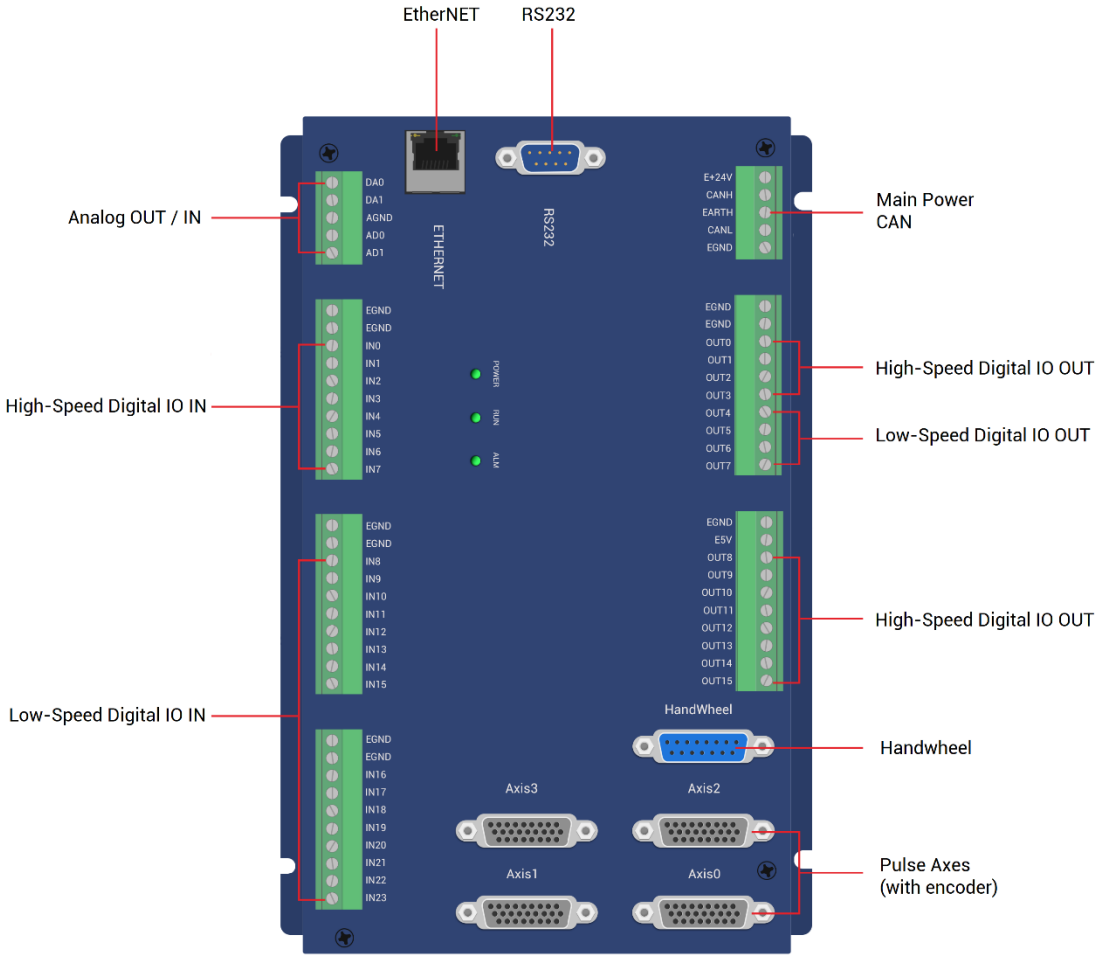
2.2. Nameplate & Model



Model	Description
ECI2410B	4 axes, point to point, electronic cam, invalid for interpolation.
ECI2412B	4 axes, point to point, electronic cam, linear interpolation.
ECI2416B	4 axes, point to point, electronic cam, linear interpolation, circular interpolation.
ECI2418B	4 axes, point to point, electronic cam, linear interpolation, circular interpolation, continuous interpolation.
ECI2418B-HW	4 axes, point to point, electronic cam, linear interpolation, circular interpolation, continuous interpolation, hardware comparison output.

- Note: ECI2418B doesn't support HW function. If you need hardware comparison output function, please choose ECI2418B-HW model, and specific usage, please refer to BASIC Manual – HW_PSWITCH2 command.

2.3. Interface Definition



→ Interface Description

Mark	Interface	Number	Description
POWER	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	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 or other standard

			CAN devices.
IN	Digital IO input	24	NPN type, internal 24V supply power.
OUT	Digital IO output	16	NPN leakage type, internal 24V supply power.
AD	Analog input	2	Resolution: 12 bits, 0-10V
DA	Analog output	2	Resolution: 12 bits, 0-10V
AXIS	Pulse axis	4	It includes differential pulse output and differential encoder input.
Handwheel	Handwheel	1	5-24V handwheel signal input.

2.4. Work Environment

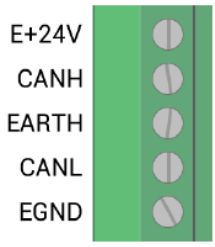
Item		Parameters
Work Temperature		-10℃-55℃
Work relative Humidity		10%-95% non-condensing
Storage Temperature		-40℃ ~ 80℃ (not frozen)
Storage Humidity		Below 90%RH (no frost)
vibration	Frequency	5-150Hz
	Displacement	3.5mm(directly install)(<9Hz)
	Acceleration	1g(directly install)(>9Hz)
	Direction	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 5Pin (there are all 5 terminals) screw-type pluggable wiring terminal, and the interval (means the gap distance between two ports) should be 5.08mm. This 5Pin terminal is the power supply shared by controller and CAN communication.

→ Terminal Definition:

Terminal	Name	Type	Function
	E+24V	Input	Power 24V Input
	CANH	Input/Output	CAN Differential Data +
	EARTH	Grounding	Shield
	CANL	Input/Output	CAN Differential Data -
	EGND	Input	24V Power Ground / CAN Communication Public End

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

3.1.2. CAN Communication Specification & Wiring

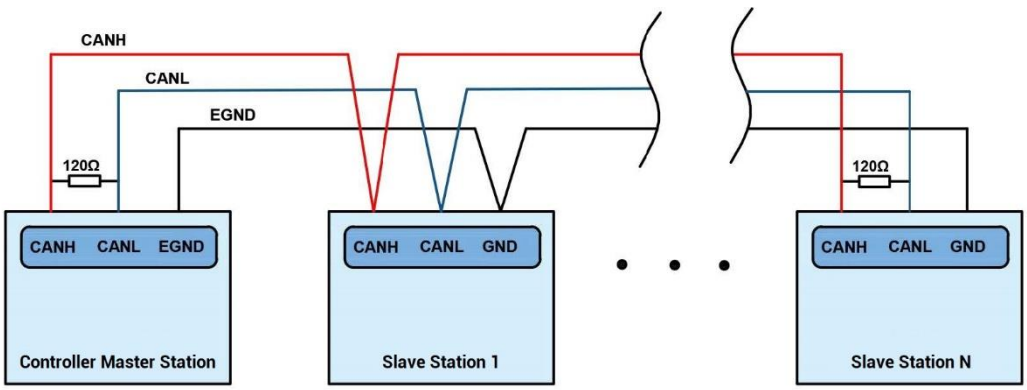
The CAN interface of the controller adopts the standard CAN communication protocol, which mainly includes three ports, CANL, CANH and the public end. And it supports connecting to CAN expansion modules and other standard CAN devices.

→ 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).

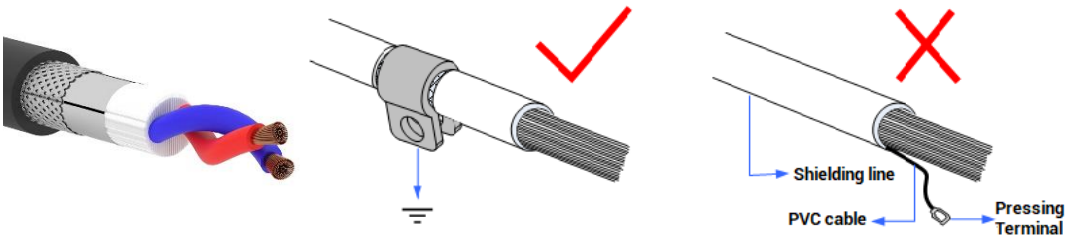


→ Wiring Notes:

- 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.



3.1.2. 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 configuraton:
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.

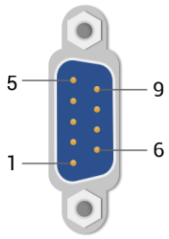
(5) After all the settings are completed, restart the power supply of all stations to establish communication.

(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.

3.2. RS232 Serial Port

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

→ Interface Definition

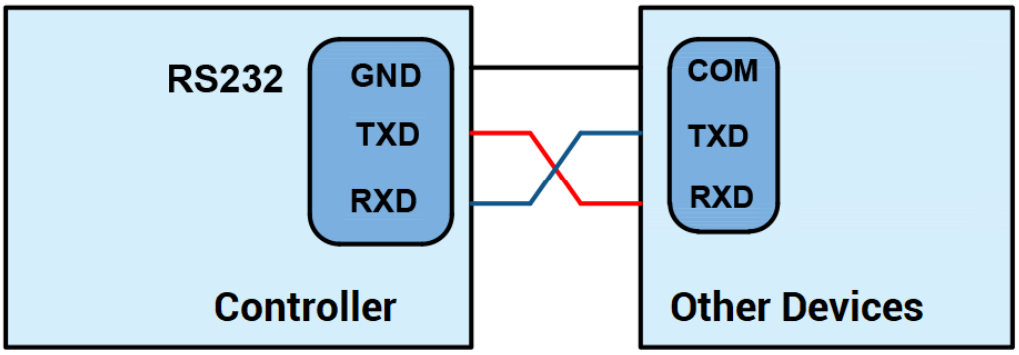
Terminal	PIN	Name	Type	Function
	1, 4, 6, 7, 8	NC	Spare	Reserved
	2	RXD	Input	RS232 signal, receive data
	3	TXD	Output	RS232 signal, send data
	5	GND	Output	Negative pole output of 5V power, and output for the public end
	9	+5V	Output	Positive pole output of 5V power, maximum is 300mA

3.2.1. 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.

3.2.2. 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.

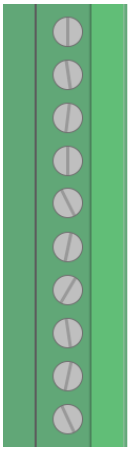
(6) Communication data of RS232 can be directly viewed through “RTSys / Controller / State the Controller / CommunicationInfo".

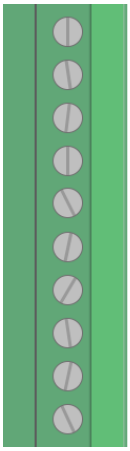
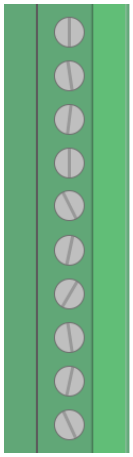
```
CAN communication settings:
CANIO_ADDRESS = 32, CANIO_ENABLE = 1
ZCAN Master
CAN baud: 500KBPS
CAN enable: ON

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

3.3. IN Digital Input & High-Speed Latch Port

The digital input adopts 3 groups of 10Pin (there are 3 groups of 10 terminals) screw-type pluggable terminals, and the gap distance between terminals should be 5.08mm. In addition, the **high-speed latch** function is integrated in digital input signals.

→ Wiring Definition

Terminal	Name	Type	Function 1	Function 2
	EGND	/	IO public terminal (don't connect to switch power)	/
	EGND	/		/
	IN0	NPN type, high-speed input	Input 0	High Speed Latch 0
	IN1		Input 1	High Speed Latch 1
	IN2		Input 2	High Speed Latch 2
	IN3		Input 3	High Speed Latch 3
	IN4		Input 4	/
	IN5		Input 5	/
	IN6		Input 6	/
	IN7		Input 7	/
	EGND	/	IO public terminal (don't connect to switch power)	/
	EGND	/		/
	IN8	NPN type, low-speed	Input 8	/
	IN9		Input 9	/

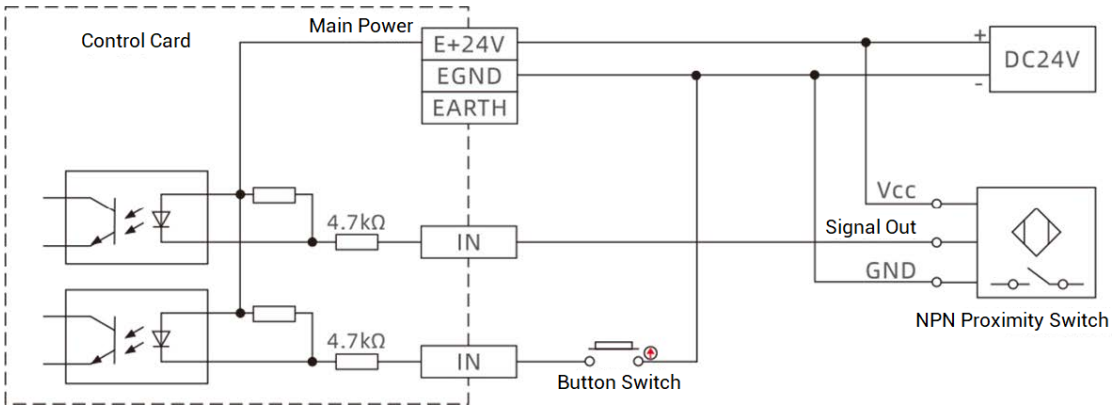
	IN10	input	Input 10	/
	IN11		Input 11	/
	IN12		Input 12	/
	IN13		Input 13	/
	IN14		Input 14	/
	IN15		Input 15	/
	EGND	/	IO public terminal (don't connect to switch power)	/
	EGND	/		/
	IN16	NPN leakage type, low-speed input	Input 16	/
	IN17		Input 17	/
	IN18		Input 18	/
	IN19		Input 19	/
	IN20		Input 20	/
	IN21		Input 21	/
	IN22		Input 22	/
	IN23		Input 23	/

3.3.1. Digital Input Specification & Wiring

→ Specification

Item	High-Speed Input (IN0-7)	Low-Speed Input (IN8-23)
Input mode	NPN type, the input is triggered by ow-electric 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
Note: the above parameters are standard values when the voltage of controller power supply (E+24V port) is 24V.		

→ Wiring Reference



→ Wiring Note:

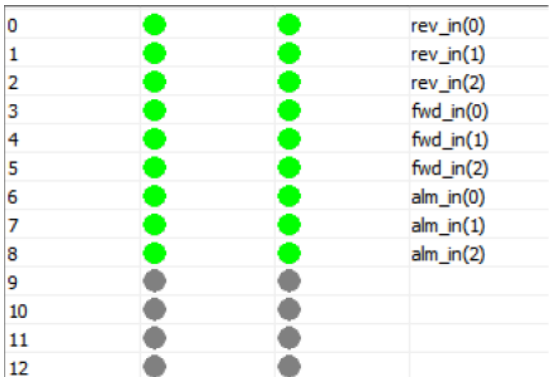
- The wiring principle of high-speed digital input IN (0-7) and low-speed digital input IN (8-23) are shown in the figure above. The external signal source can be an optocoupler, a key switch or a sensor, etc., all can be connected as long as the requirements on output of electric level can be achieved.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

3.3.2. 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.

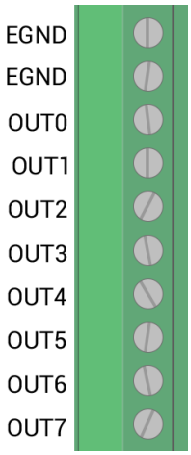


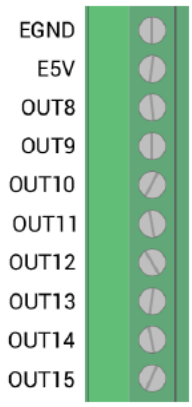
(4) Latch function can be set and triggered through "REGIST" instruction, in software, use REG_INPUTS to configure. Please refer to "Basic" for details.

3.4. OUT: Digital Output & PWM Terminal & Hardware Comparison Output

The digital output adopts 2 sets of 10Pin screw-type pluggable terminals with a spacing of 5.08mm, and PWM, hardware comparison output functions are integrated in digital output signals.

→ Wiring Definition

Terminal	Name	Type	Function 1	Function 2	Function 3
	EGND	/	IO Public End	/	/
	EGND	/		/	/
	OUT0	NPN type, high-speed output	Output 0	PWM Output 0	Hardware comparison output
	OUT1		Output 1	PWM Output 1	
	OUT2		Output 2	PWM Output 2	
	OUT3		Output 3	PWM Output 3	
	OUT4	NPN type, low-speed output	Output 4	/	/
	OUT5		Output 5	/	/
	OUT6		Output 6	/	/
	OUT7		Output 7	/	/
	EGND	/	E5V power ground / IO public end	/	/

	E5V		Output of 5V power, max is 300mA	/	/
	OUT8	NPN type, high-speed output	Output 8	/	/
	OUT9		Output 9	/	/
	OUT10		Output 10	/	/
	OUT11		Output 11	/	/
	OUT12		Output 12	/	/
	OUT13		Output 13	/	/
	OUT14		Output 14	/	/
	OUT15		Output 15	/	/

Note:

- ✧ The E5V power output port is used for PWM or common anode wiring of single-ended axis. It is not recommended for other purposes due to lower power.
- ✧ "EGND" on input port and output port are IO public ends, they can't be connected to power supply of switch.
- ✧ ECI2418B doesn't support HW function, the model's name is with HW suffix (like, ECI2418B-HW) that supports hardware comparison output function.

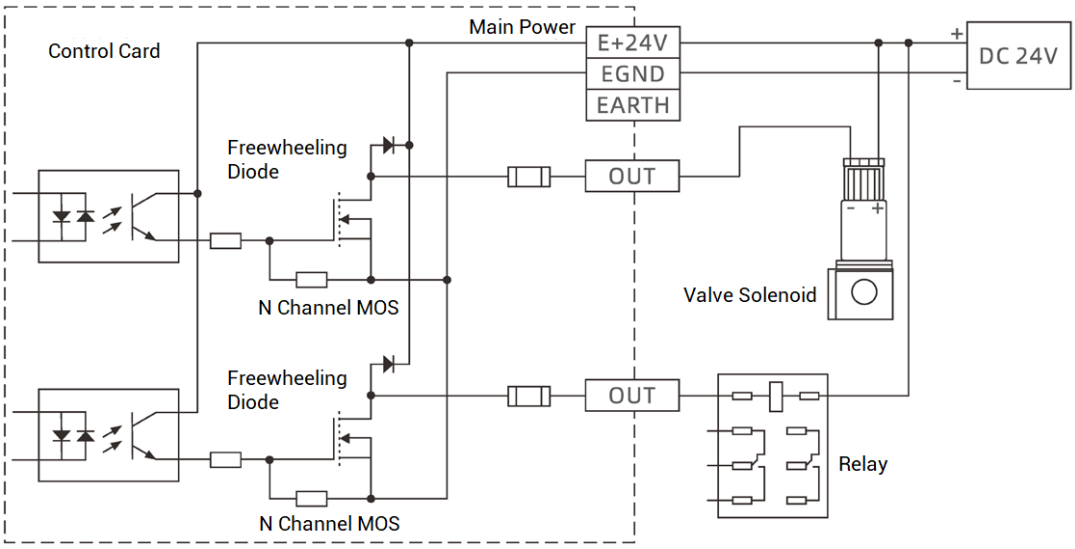
3.4.1. Digital Output Specification & Wiring

→ Specification

Item	High Speed Output (OUT0-3, 8-15)	Low Speed Output (OUT4-7)
Output mode	NPN type, it is 0V when outputs	
Frequency	< 400kHz	< 8kHz
Voltage level	DC24V	DC24V
Max output current	+500mA	+500mA
Max leakage current when off	25μA	25μA
Respond time to conduct	1μs (resistive load typical value)	12μs
Respond time to close	3μs	80μs
Overcurrent protection	Support	Support
Isolation method	optoelectronic isolation	optoelectronic isolation
Note:		

- ✧ The times in the form are typical based on the resistive load, and may change when the load circuit changes.
- ✧ Due to the NPN output, the shutdown of the output will be obviously affected by the external load circuit, and the output frequency should not be set too high in the application. For high-speed output, it is recommended to be lower than 400KHz, for low-speed output, it is recommended to be lower than 8HKz. If there needs higher speed, please contact us to adjust parameter or custom hardware.

→ Wiring Reference



→ Wiring Note:

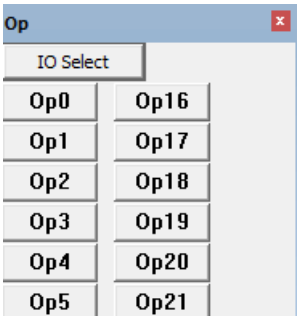
- The wiring principle of high-speed digital output OUT (0-3, 8-15) and low-speed digital output OUT (4-7) are shown in the figure above. The external signal receiving end can be an optocoupler or a relay or solenoid valve, all can be connected as long as the input current does not exceed 500mA.
- For the connection of the public end, please connect the "EGND" port on the IO terminal 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.

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.

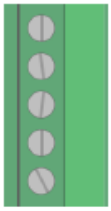


(4) For the PWM function, set the frequency and duty cycle through "PWM_FREQ" and "PWM_DUTY". Please refer to Basic for details.

3.5. AD/DA: Analog Input / Output

The analog port adopts a set of 5Pin screw-type pluggable terminals with a spacing of 5.08mm.

→ Wiring Definition

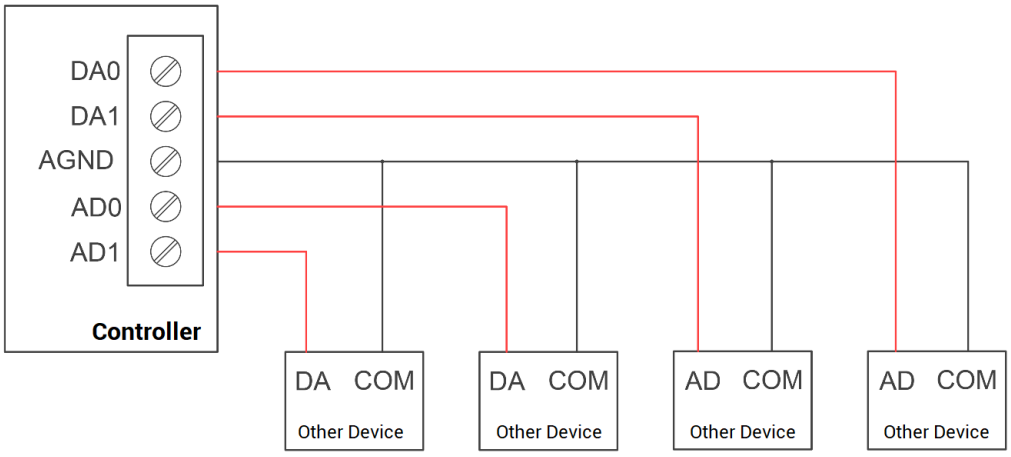
Terminal	Name	Type	Function
	DA0	Output	Analog output terminal AOUT (0)
	DA1		Analog output terminal AOUT (1)
	AGND	Public end	Analog public end
	AD0	Input	Analog input terminal AIN (0)
	AD1		Analog input terminal AIN (1)

3.5.1. Analog Input / Output Specification & Wiring

→ Specification

Item	AD (0-1)	DA (0-1)
Resolution	12-bit	12-bit
Data range	0-4095	0-4095
Signal range	0V-10V input	0V-10V output
Data refresh	1kHz	1kHz
Voltage input impedance / output load	>300KΩ (voltage input impedance)	>1KΩ (voltage output load)

→ Wiring Reference



→ Wiring Note:

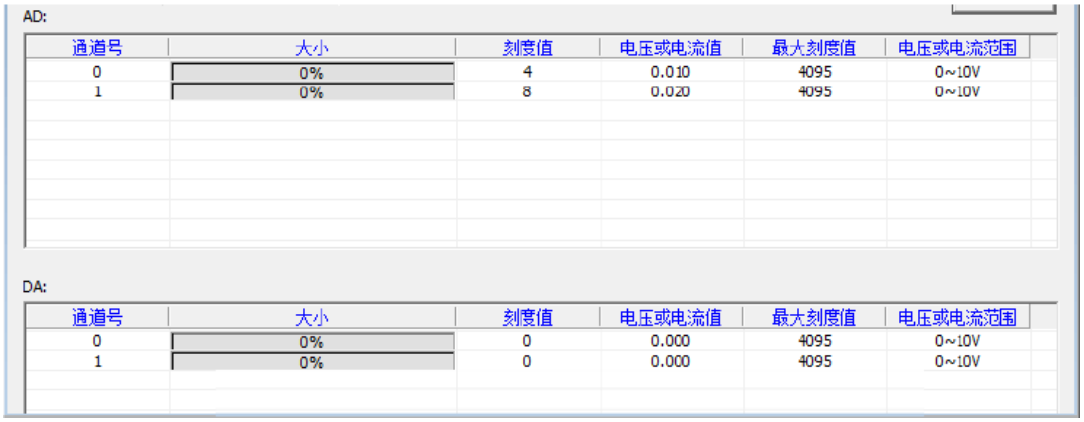
- The analog input/output wiring method is as shown in the figure above, and the external load signal range must match with this signal range.
- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.

3.5.2. Basic Usage Method

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

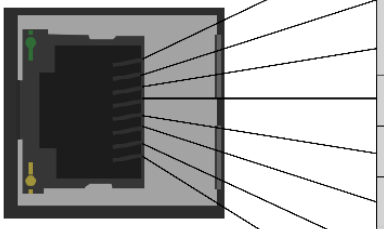
(2) After powered on, please use ETHERNET or RS232 to connect to RTSys.

(3) Analog input voltage can be read through "AIN" command and corresponding analog voltage can be output through "AOUT" command, also, data of each channel can be checked through "RTSys/Tool/AD/DA". Please refer to "Basic" for details.



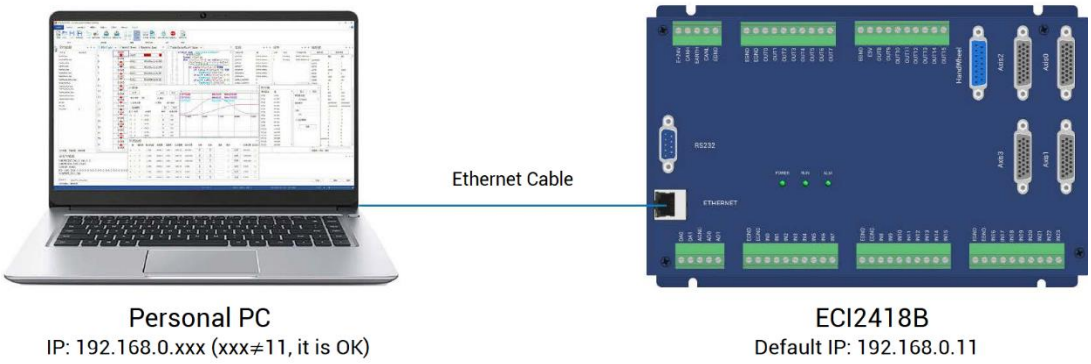
3.6. ETHERNET

ECI2418B motion controller 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:

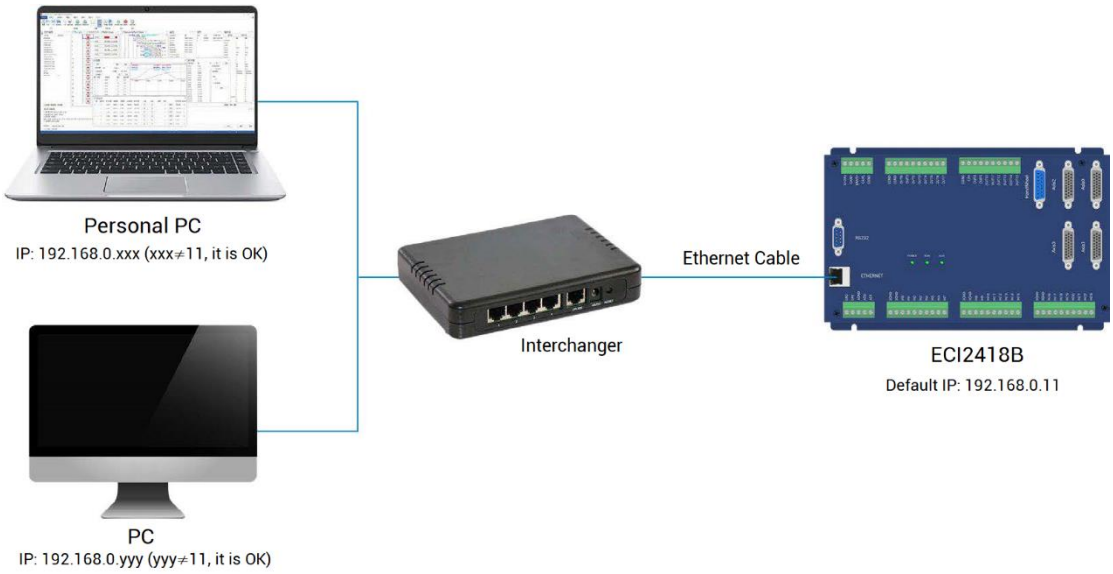


PIN	Signal	Description
1	TX+	Send signal (+)
2	TX-	Send signal (-)
3	RX+	Receive signal (+)
4	NC	Reserved
5	NC	Reserved
6	RX-	Receive signal (-)
7	NC	Reserved
8	NC	Reserved

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:



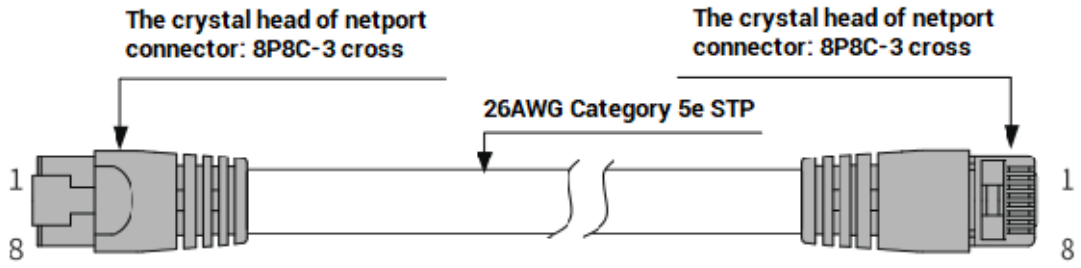
The controller can also be connected to the interchanger through an Ethernet cable, and then use interchanger to connect to other devices, then multi-point connection can be achieved. The schematic diagram is as follows:



→ 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.

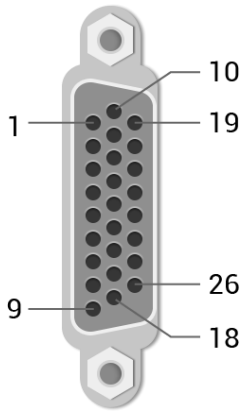
Please use tube-type pre-insulated terminals and cables with appropriate wire diameters to connect the user terminals.

3.7. Axis Interface

This product provides 4 local differential pulse axis interfaces, each interface is a standard DB26 female socket. Each terminal provides 0V and +5V output, which can provide 5V power for the encoder.

Before the axis is used, the use mode of the axis must be configured through the ATYPE parameter.

→ Interface Definition

Interface	Pin	Signal	Description
	1	EGND	Negative pole of 24V digital IO power
	2	IN24-27/ALM	General input (recommended as driver alarm)
	3	OUT16-19ENABLE	General output (recommended as driver enable)
	4	EA-	Encoder differential input signal A-
	5	EB-	Encoder differential input signal B-
	6	EZ-	Encoder differential input signal Z-
	7	+5V	Positive pole of 5V power of pulse/encoder signal
	8	Reserved	Reserved
	9	DIR+	Servo or step directional output (differential signal)
	10	GND	Negative pole of 5V power of pulse/encoder signal
	11	PUL-	Servo or step pulse output (differential signal)
	12	Reserved	Reserved
	13	GND	Negative pole of 5V power of pulse/encoder signal
	14	OVCC	Positive pole of IO 24V power
	15	Reserved	Reserved
	16	IN30-33/INPOS	Digital input (recommended as on-position signal)
	17	EA+	Encoder differential input signal A+
	18	EB+	Encoder differential input signal B+
	19	EZ+	Encoder differential input signal Z+
	20	GND	Negative pole of 5V power of pulse/encoder signal
	21	GND	
	22	DIR-	Servo or step directional output (differential signal)

	23	PUL+	Servo or step pulse output (differential signal)
	24	GND	Negative pole of 5V power of pulse/encoder signal
	25	Reserved	Reserved
	26	Reserved	Reserved

Note:

- ENABLE is recommended to be used as axis IO, because the drive capacity is small.
- OVCC, +5V are only used for communication between the controller and the servo driver, please do not use it as power supply for other places.

The relationship between pulse axis PIN and IO:

Pulse Axis No.	IN (PIN 2)	OUT (PIN 3)	IN (PIN 16)
AXIS0	IN24	OUT16	IN30
AXIS1	IN25	OUT17	IN31
AXIS2	IN26	OUT18	IN32
AXIS3	IN27	OUT19	IN33

3.7.1. AXIS Interface Signal Specification & Wiring

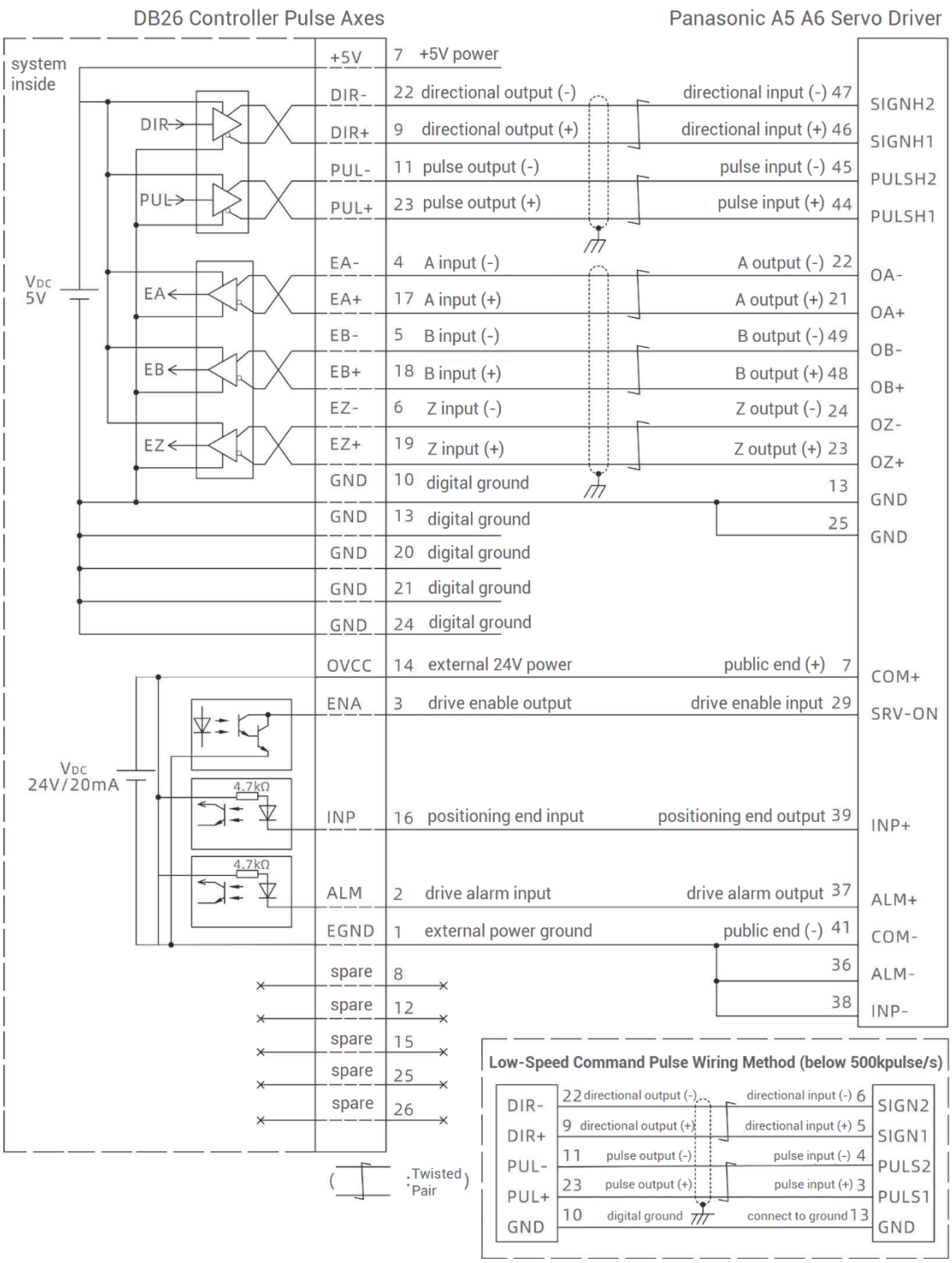
→ Specification:

Signal	Item	Description
PUL/DIR	Signal type	Differential output signal
	Voltage range	0-5V
	Maximum frequency	10MHz
EA/EB/EZ	Signal type	Differential input signal
	Voltage range	0-5V
	Maximum frequency	5MHz
IN24-27 IN30-33	Input method	NPN leak type, it is triggered when low electric level is input.
	Frequency	< 5kHz
	Impedance	6.8KΩ

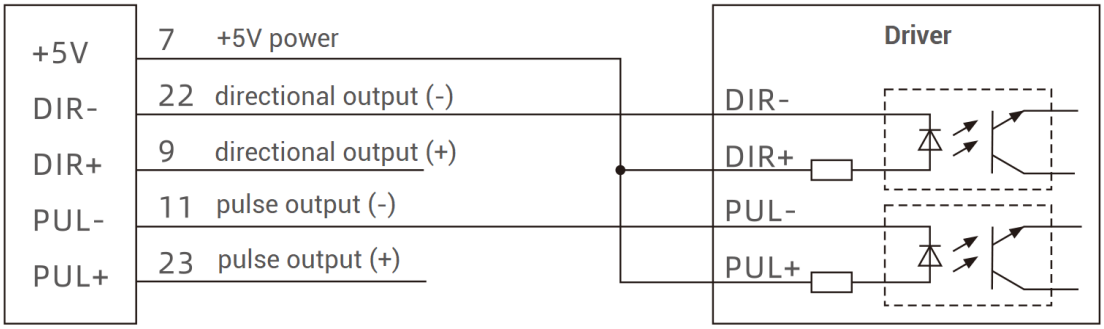
	Voltage level	DC24V
	The voltage to open	<10.5V
	The voltage to close	>10.7V
	Minimal current	-1.8mA (negative)
	Maximum current	-4mA (negative)
	Isolation	optoelectronic isolation
OUT16-19	Output method	NPN leak type, it is 0V when outputs
	Frequency	< 8kHz
	Voltage level	DC24V
	Maximum current	+50mA
	Overcurrent protection	No
	Isolation	optoelectronic isolation
+5V, GND	Max output current for 5V	50mA
OVCC, EGND	Max output current for 24V	50mA

→ Wiring References:

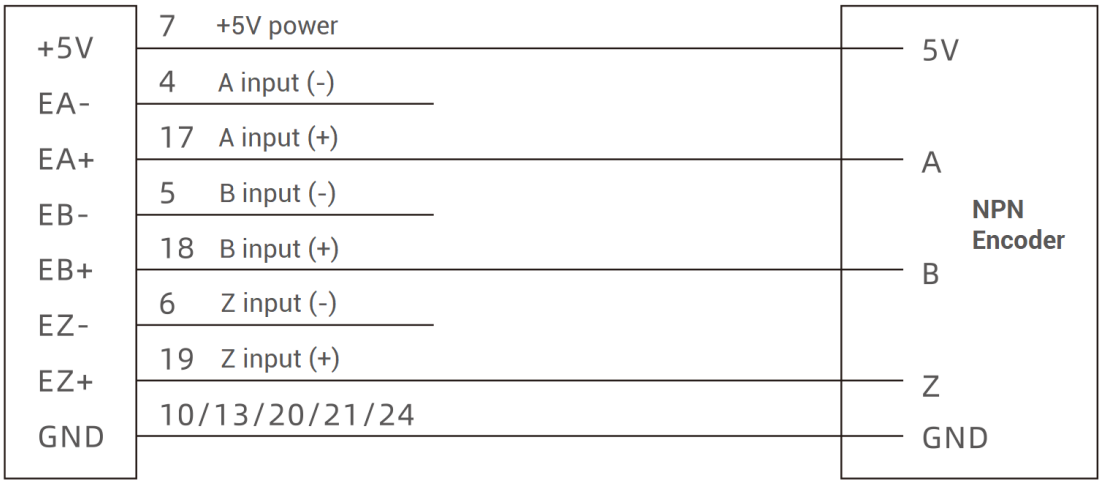
- Reference example of wiring with Panasonic A5/A6 servo driver:



➢ Wiring of single-ended pulse (PUL/DIR common anode wiring):



➢ Wiring of single-ended axis (EA/EB/EZ common anode wiring):



→ Wiring Note:

✧ The wiring principle of the differential pulse axis interface is shown in the figure above, and the wiring methods of different types of drivers are different, please connect carefully.

✧ If the speed can meet the requirements, use low-speed differential pulse port preferentially. When high-speed differential pulse interface is used, controller internal digital ground must be connected to drive high-speed pulse reference ground.

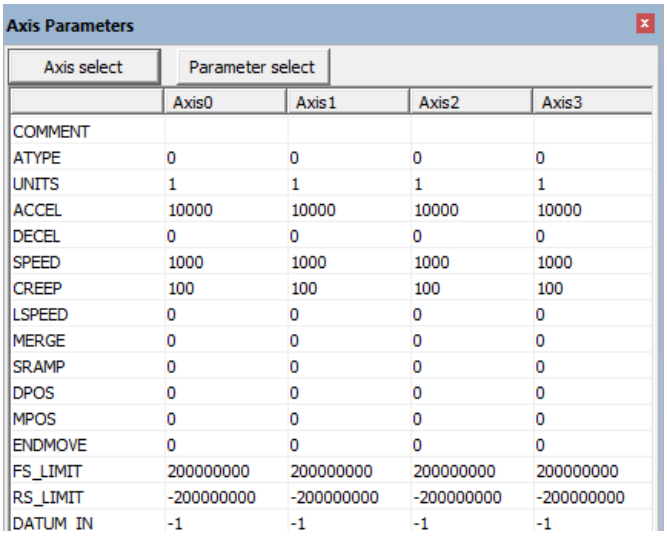
3.7.2. Basic Usage Method

(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.

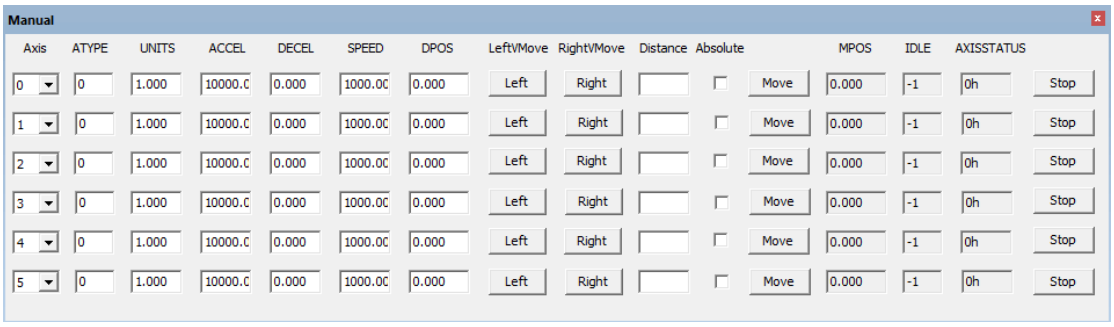
(3) Set axis parameters, such as, ATYPE, UNITS, SPEED, ACCEL, FWD_IN, REV_IN, etc.

(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 "ZBasic", or see "RTSys/Tool/Axis parameter".



	Axis0	Axis1	Axis2	Axis3
COMMENT				
ATYPE	0	0	0	0
UNITS	1	1	1	1
ACCEL	10000	10000	10000	10000
DECEL	0	0	0	0
SPEED	1000	1000	1000	1000
CREEP	100	100	100	100
LSPEED	0	0	0	0
MERGE	0	0	0	0
SRAMP	0	0	0	0
DPOS	0	0	0	0
MPOS	0	0	0	0
ENDMOVE	0	0	0	0
FS_LIMIT	200000000	200000000	200000000	200000000
RS_LIMIT	-200000000	-200000000	-200000000	-200000000
DATUM_IN	-1	-1	-1	-1

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



Refer to BASIC Routine:

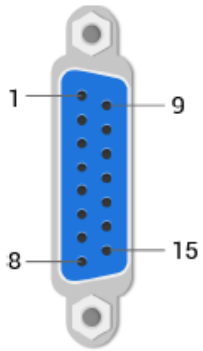
```
BASE(0,1)              'select axis 0 and axis 1
ATYPE = 1,1            'set axis 0 and axis 1 as pulse axes
UNITS = 1000,1000      'set pulse amount as 1000 pulses
SPEED = 10,10          'set axis speed as 100*1000 pulse/s
ACCEL = 1000,1000      'set axis acceleration as 1000*1000 pulse/s/s
FWD_IN = -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
```

3.8. Handwheel Interface

This product provides one interface that is specialized for local handwheel encoder axis, and the interface is double standard DB15 female socket.

→ Interface Definition

Interface	Pin	Signal	Description
	1	H-(5V)	The positive pole of 5V power supply, which supplies power only for handwheel
	2	H-A	Encoder signal phase A (IN36)
	3	H-B	Encoder signal phase B (IN37)
	4	H-EMGN	Emergency stop signal (IN47)
	5	NC	Spare (reserved)
	6	H-X1	Select the ration as X1 (IN38)
	7	H-X10	Select the ration as X10 (IN39)
	8	H-X100	Select the ration as X100 (IN40)
	9	H-S4	Select axis 3 (IN44)
	10	H-S5	Select axis 4 (IN45)
	11	EGND	IO power ground
	12	H-S6	Select axis 5 (IN46)
	13	H-SZ	Select axis 2 (IN43)
	14	H-SY	Select axis 1 (IN42)
	15	H-SX	Select axis 0 (IN41)

Notes:

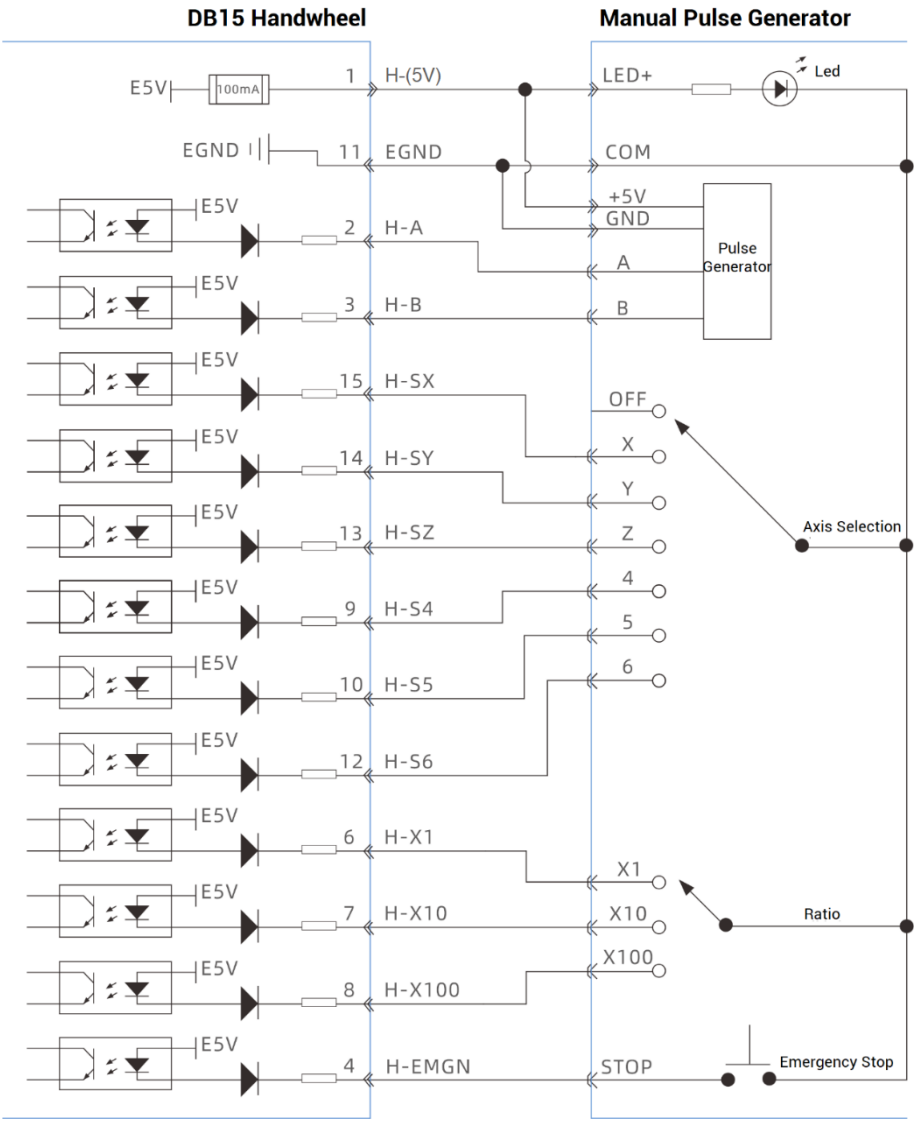
- H-(5V) power output is only used for handwheel power, please don't use for others.
- All signals in this interface are digital input signals, the No. is IN (36-47).

3.8.1. Handwheel Specification & Wiring

→ Specification

Item	High-Speed IN (36-37)	High-Speed IN (38-47)
Input Mode	NPN type, input will be triggered by low electric level	
Frequency	<100kHz (recommendation)	<5kHz (recommendation)
Impedance	510Ω	510Ω
Voltage (max)	24V	24V
Voltage to open voltage	<2.8	<2.8
Voltage to close voltage	>2.9V	>2.9V
Current (min)	-2.3mA (negative)	-1.8mA (negative)
Current (max)	-7.5mA (negative)	-5.5mA (negative)
Isolation	optoelectronic isolation	optoelectronic isolation
The max output current of 5V power (H-(5V), EGND)	100mA	100mA

→ Wiring Reference



→ Wiring Note

- The wiring principle of handwheel encoder axis interface is shown above, the design of handwheel is very rich, please pay attention to do connection.
- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.
- IN36-IN47 on handwheel can be used as 24V general inputs.

3.8.2. Basic Usage Method

1. Refer to above handwheel wiring graphic, correctly connect the handwheel to controller.

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

3. Configure axis No., if there is no default AXIS axis No. (axis 10, 11, 12, 13 are recommended) of controller handwheel interface, remapping must be done. Followings are processes (for ECI2418B, handwheel axis is axis 4 by default, no need to remap):

4. Configure IO: assign axis selection (H-SX, H-SY, H-SZ, H-S4, H-S5, H-S6) and ratio (H-X1, H-X10, H-X100) and emergency stop (H-EMGN) functions as required. These signals are essentially digital input signals with fixed No. but no fixed functions. It needs developing by RTSys (the axis selection is the connected axis of "connect" synchronization motion, and the ratio is the "connect" ratio).

5. When completed above steps, it can start to use handwheel.

BASIC Routine Reference:

```
BASE(4)                    'select axis 4
ATYPE(4) = 3               'set manual pulse axis type as quadrature encoder
UNITS(4) = 1               'set the unit as pulse for pulse amount of manual pulse axis
CONNECT(100,4) AXIS(0)
'axis 0 connects to manual pulse axis at the synchronous ration of 100
```

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.

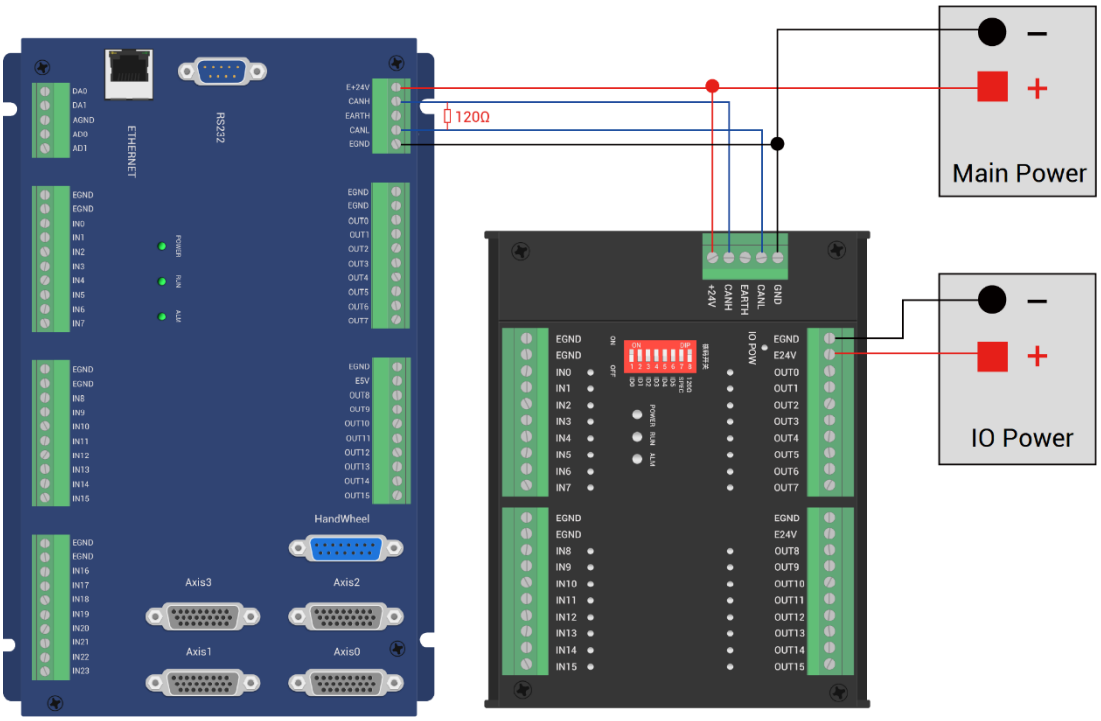
4.1. CAN Bus Expansion Wiring

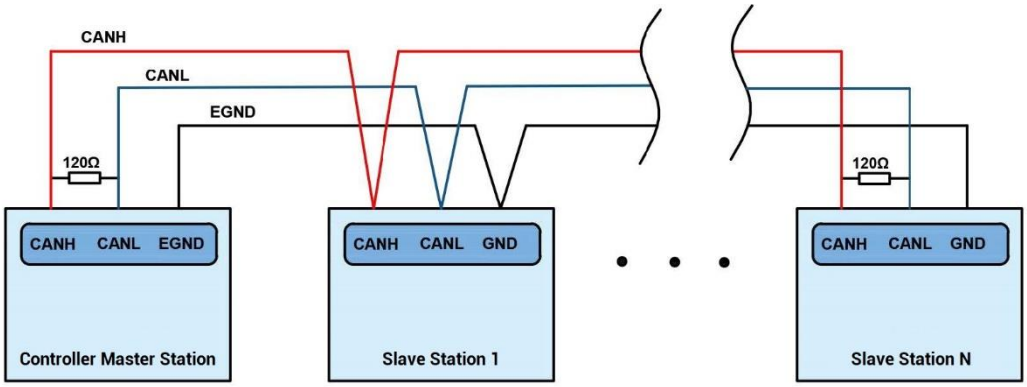
The ZIO expansion module is powered by the dual power supply. Except the main power supply, an additional IO power supply is required to supply independent power for IO. Both the main power supply and the IO power supply use 24V DC power supply. For ZAIO, it only needs to connect to the main power supply.

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:



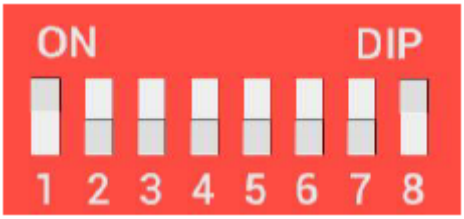


→ Wiring Note:

✧ ECI2418B 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 EGND 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 × 8 + dial code 3 × 4 + dial code 2 × 2+ dial code 1.

Dial code 5-6 to select CAN bus communication speed, speed combination value=dial code 6 × 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 (expansion board DIP ID of ECI2418B motion control card starts from 2 at least, therefore, starting IO number should start from 48 at least):

DIP 1-4 combination value	Starting IO number	End 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

→ Axis Mapping:

When the CAN bus expansion mode is used to expand the pulse axis, 2 pulses axes are extended. These two pulse axes need to be mapped and bound with the axis No., then access.

Extended axes need to perform axis mapping operations, using the AXIS_ADDRESS command to map, and the mapping rules are as follows:

AXIS_ADDRESS(axis No.)=(32*0)+ID

'the local axis interface of the expansion module AXIS 0

AXIS_ADDRESS(axis No.)=(32*1)+ID

'the local axis interface of the expansion module AXIS 1

The ID is the combined value of the DIP bit1-4 of the expansion module. After the mapping is completed and the axis parameters such as ATYPE are set, the expansion axis can be used.

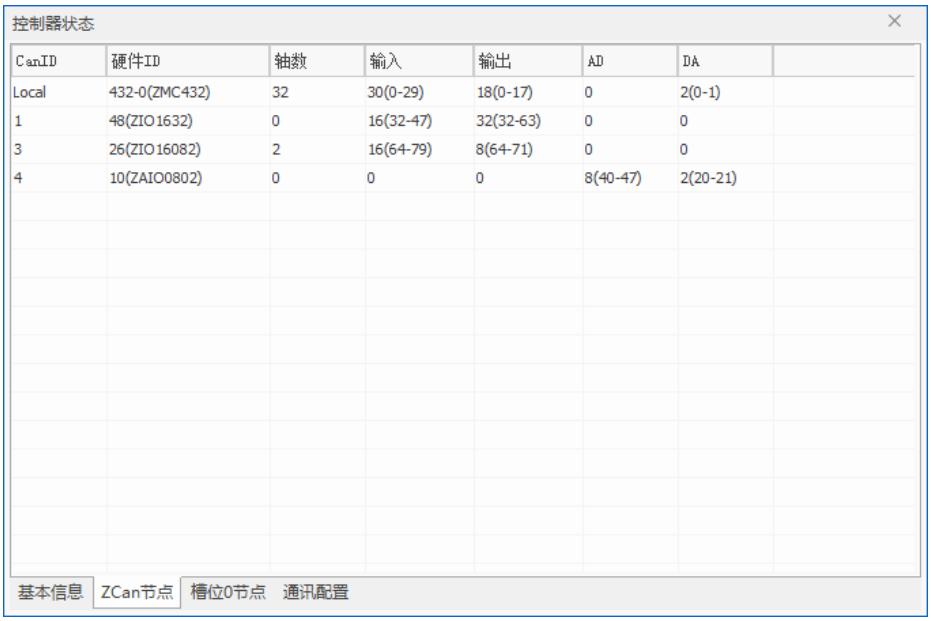
Example:

```
ATYPE(6)=0                    'set as virtual axis
AXIS_ADDRESS(6)=1+(32*0)
        'ZCAN expansion module ID 1 axis 0 is mapped to axis 6
ATYPE(6)=8      'ZCAN extended axis type, pulse direction stepping or servo
UNITS(6)=100 0 'pulse equivalent 1000
SPEED(6)=100    'speed 100uits/s
ACCEL(6)=1000    'acceleration 1000units/s^2
MOVE(100) AXIS(6) 'extended axis movement 100units
```

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:



ALM led is on, please check:

- the wiring
- resistor and dial setting
- the CANIO_ADDRESS command of the controller is set as the master end (32)?
- the CAN communication speed is consistent?

Chapter V Programming

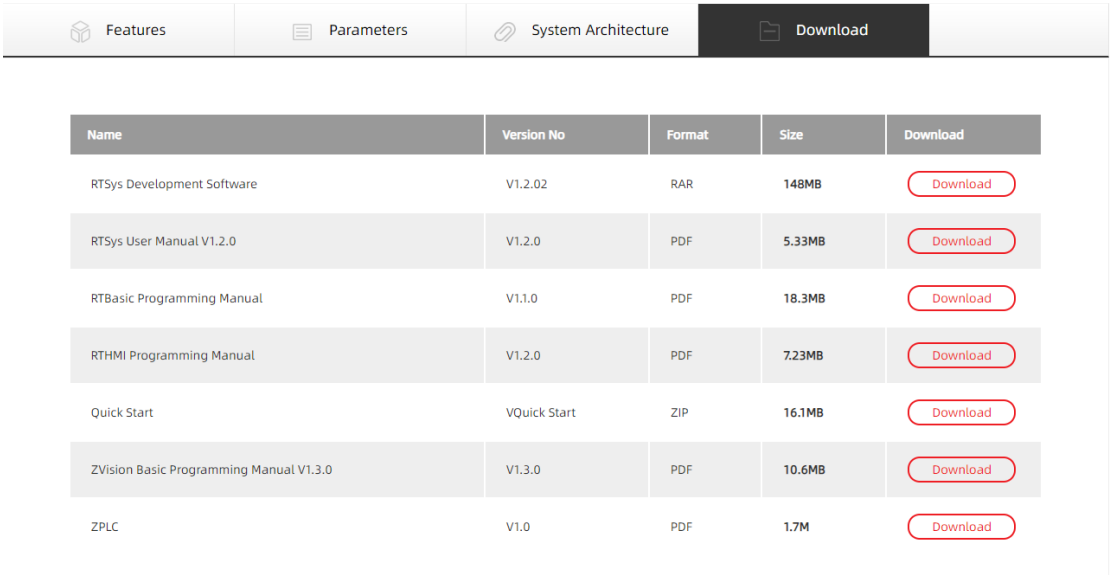
5.1. Program in RTSys Software

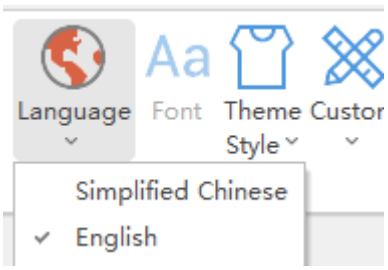
RTSys is a PC-side program development, debugging and diagnostic software for the Zmotion motion controllers. Through it, users can easily edit and configure the controller program, quickly develop applications, diagnose system operating parameters in real time, and debug the running program in real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

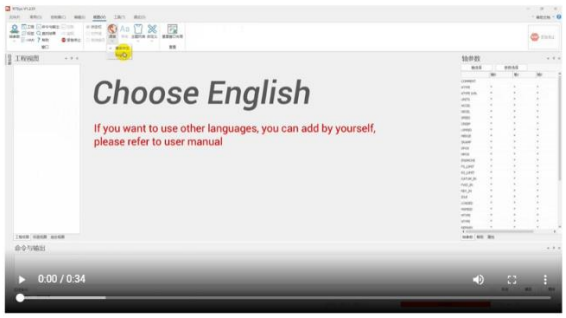
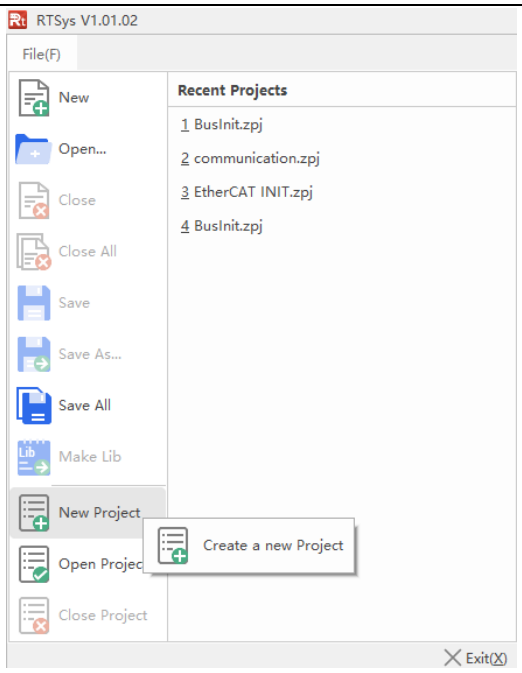
RTSys Downloading Address: https://www.zmotionglobal.com/pro_info_282.html

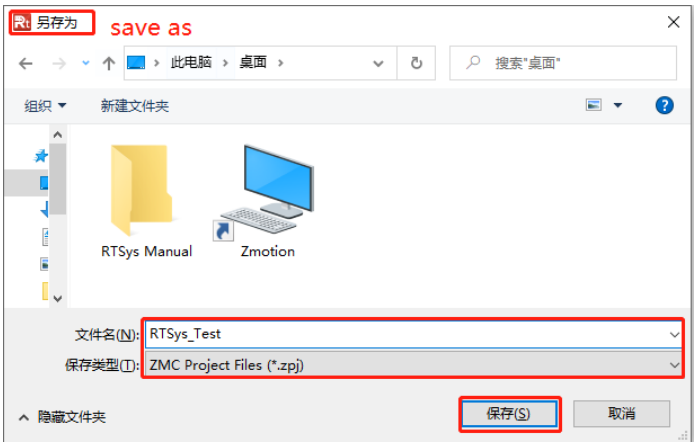
And related manuals can be found in "Download":

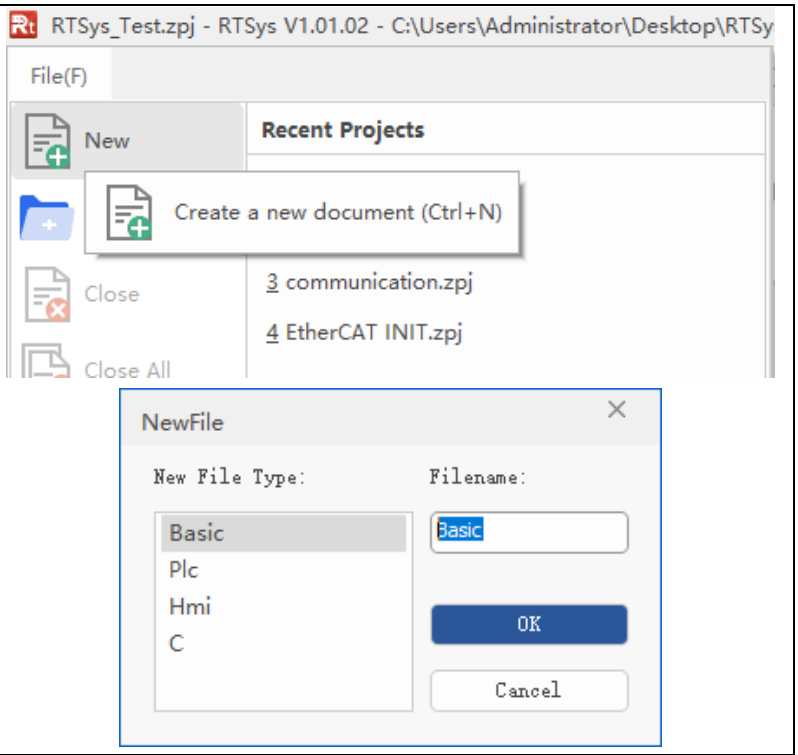
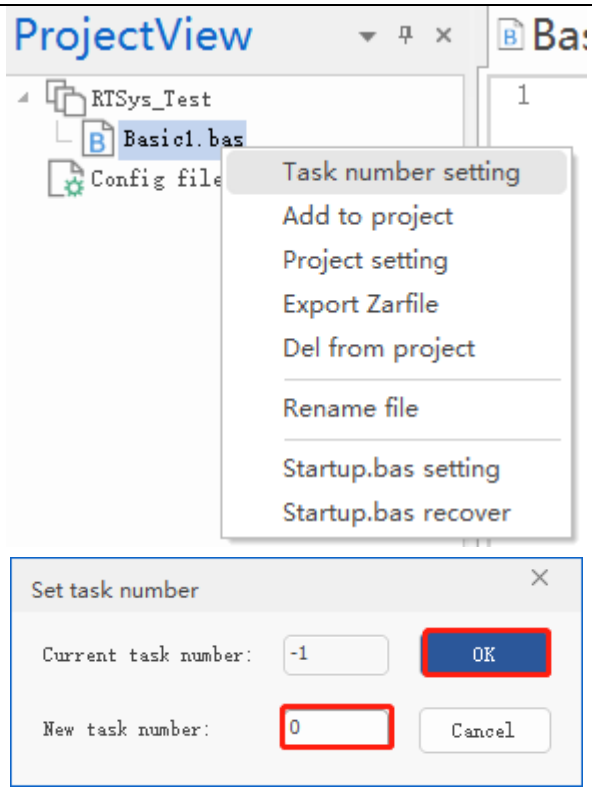


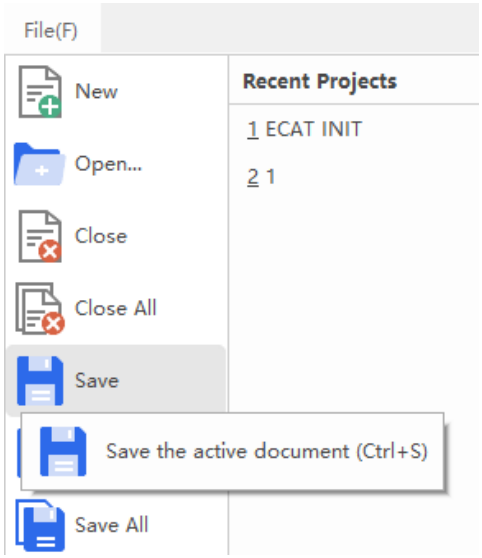
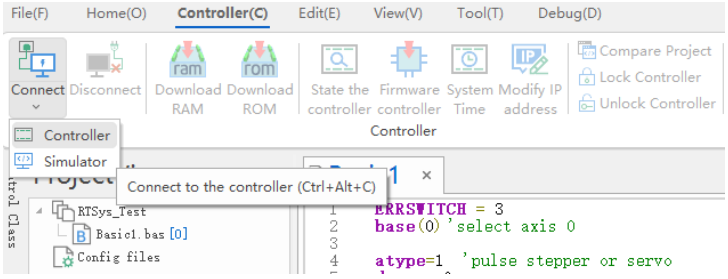
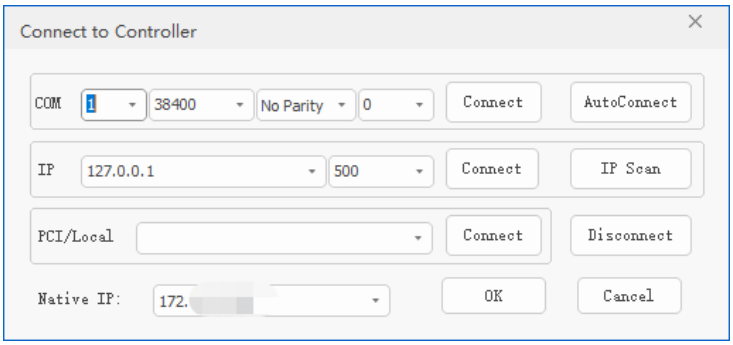
Step	Operations	Display Interface
1	Switch the Language: "Language" – "English", then there will pop	

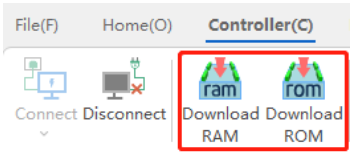
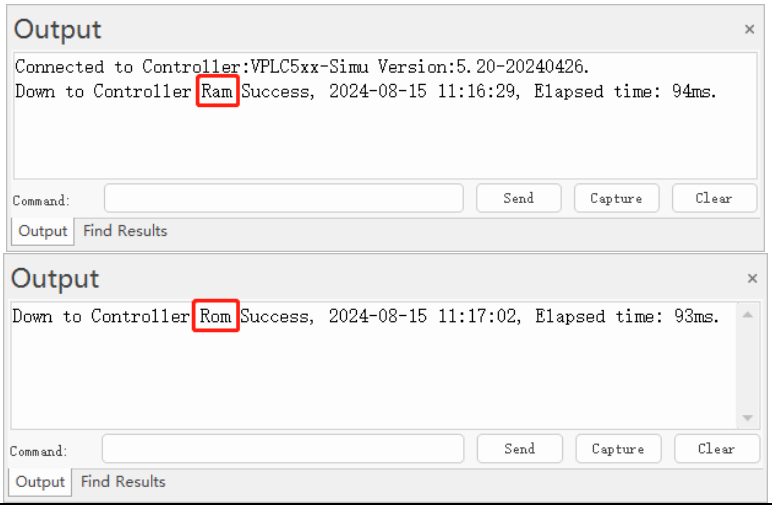
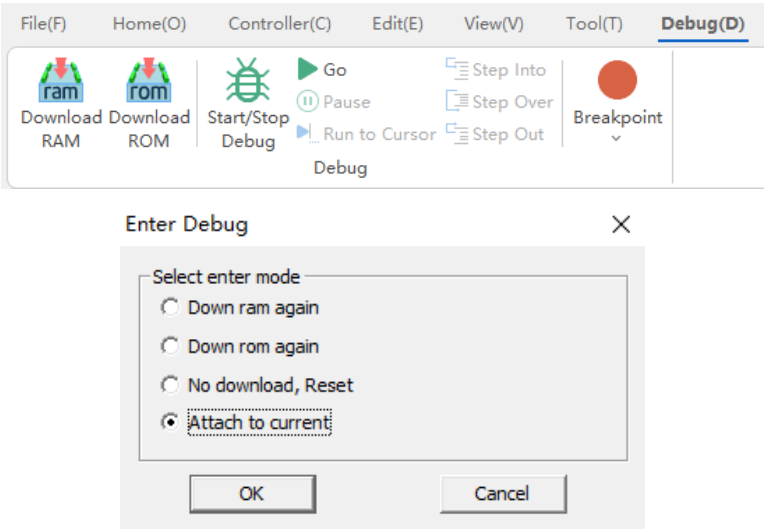
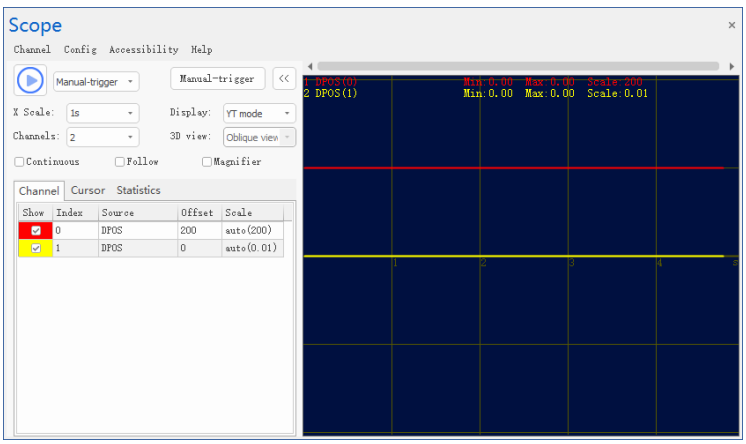
<table>
<tr>
<td></td>
<td>up one window, click OK, and restart it.</td>
<td>Language Switch Video Showing:

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

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

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

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

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

Notes:

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

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”.

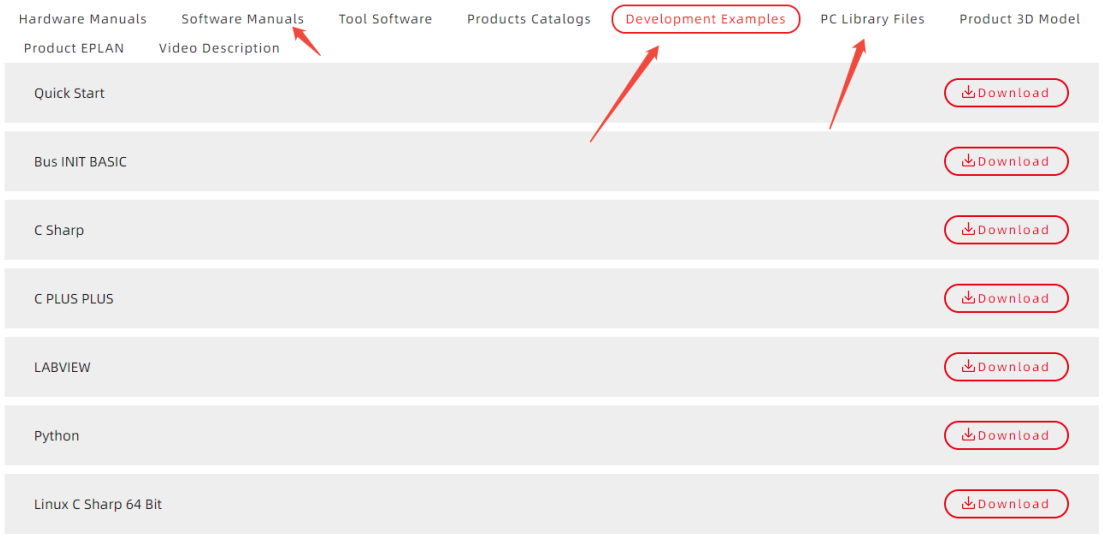
h. Do step a and step b again, check whether the firmware is updated or not.

5.3. Program in Host-Computer by PC Languages

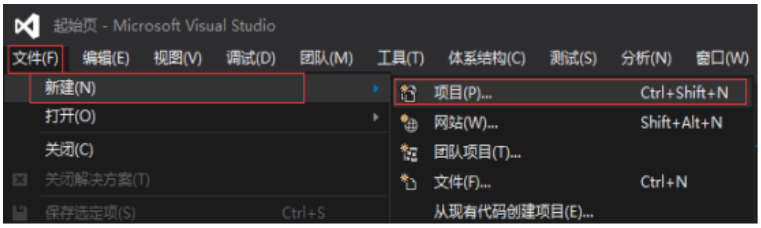
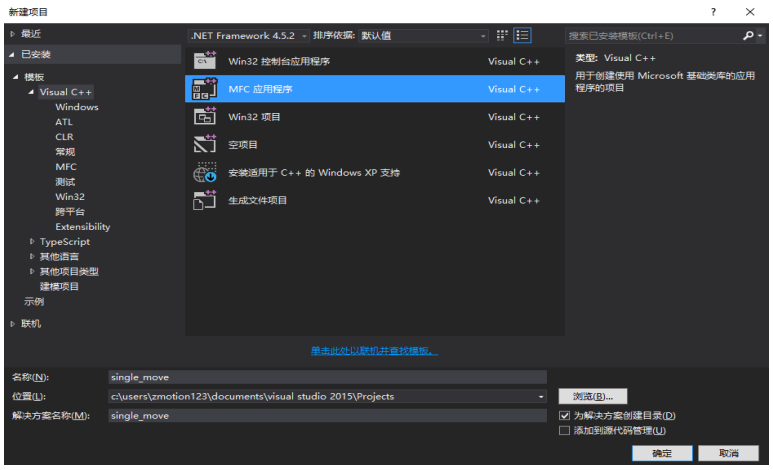
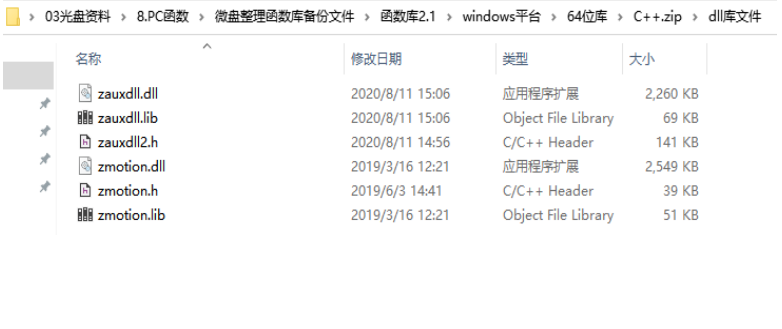
The controller supports development under various operating systems such as windows, linux, Mac, Android, and wince, and provides dll libraries in various environments such as vc, c#, vb.net, and labview, as shown in the figure below. PC software programming refers to "Zmotion PC Function Library Programming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

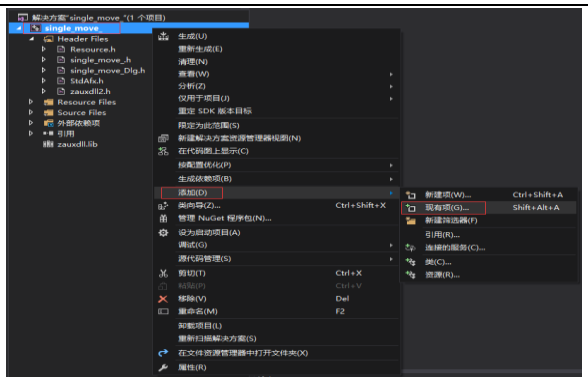
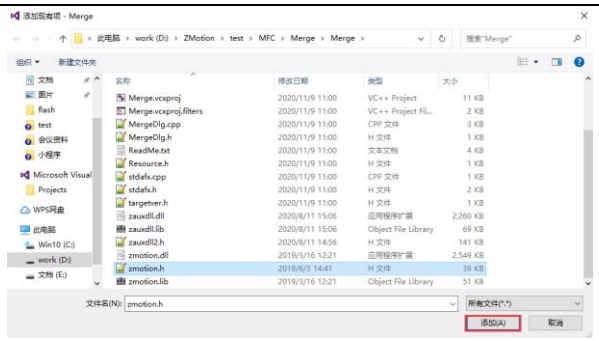
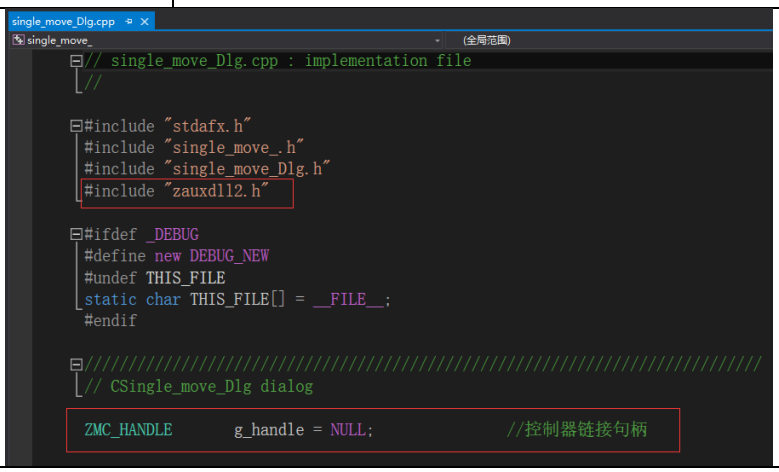
The program developed using the PC software cannot be downloaded to the controller, and it is connected to the controller through the dll dynamic library. The dll library needs to be added to the header file and declared during development.

- 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.	

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

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.	6. Check whether the ATYPE of the controller is correct. 7. Check whether hardware position limit, software position limit, alarm signal work, and whether axis states are normal. 8. Check whether motor is enabled successfully. 9. Confirm whether pulse amount UNITS and speed values are suitable. If there is the encoder feedback, check whether MPOS changes. 10. Check whether pulse mode and pulse mode of drive are matched. 11. Check whether alarm is produced on motion controller station or drive station. 12. Check whether the wiring is correct. 13. 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.