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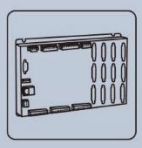
Better Motion Control, Smarter Life

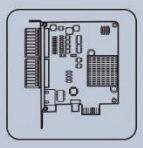
Vertical EtherCAT Motion Controller

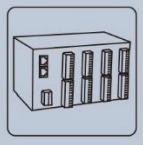
XPLC300

This manual is for XPLC304E, XPLC306E, XPLC308E, XPLC312E.


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.	

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Chapter I Production Information

1.1. Product Information

XPLC300 motion controller is a kind of EtherCAT vertical motion controller that supports ladder diagram programming. The controller itself supports max 16 axes to achieve point to point, linear interpolation, electronic cam, and other control requirements.

This manual mainly describes XPLC300 series' specification, property, usage, etc. Please read this manual carefully to know more about the product and use more safely.

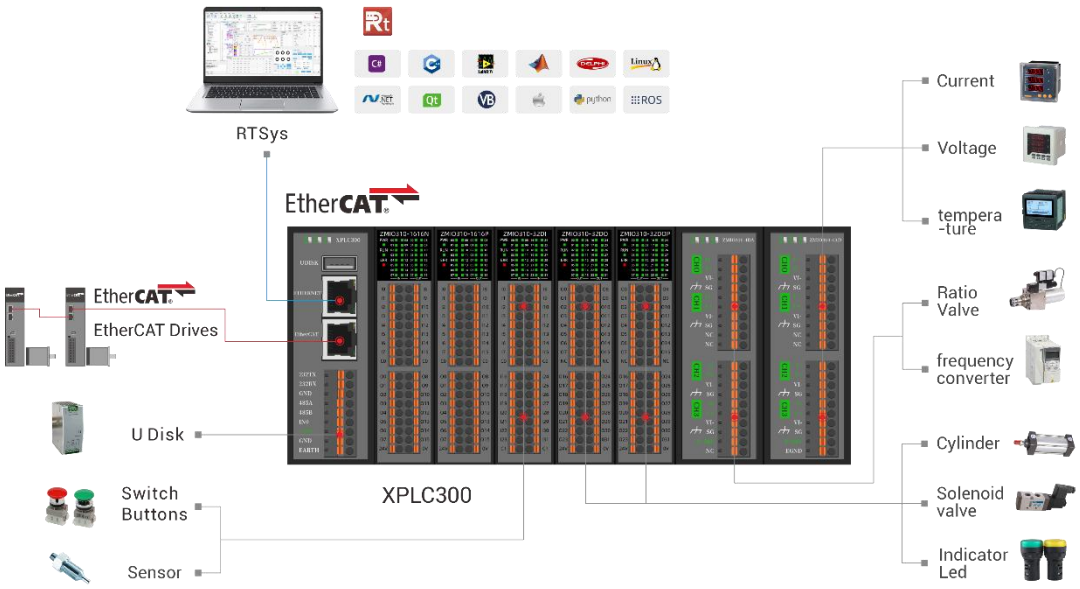
XPLC300 series motion controllers can be applied in electronic semiconductor equipment (testing equipment, assembly equipment, locking equipment, soldering machine), dispensing equipment, non-standard equipment, printing and packaging equipment, textile and garment equipment, stage entertainment equipment, medical equipment, assembly line, etc.

1.2. Function Features

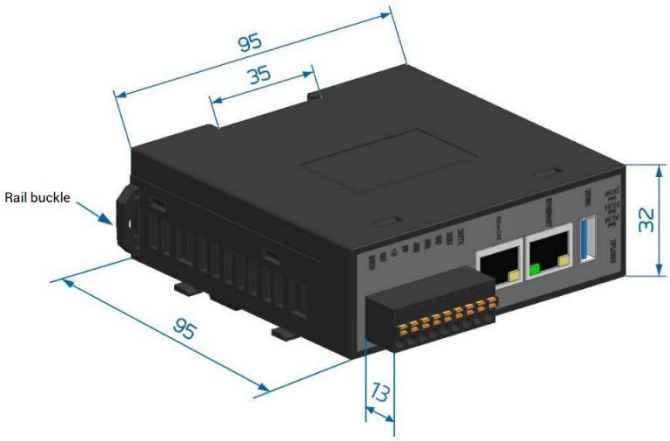
- 16 axes motion control at most.
- Max 512 isolated inputs and 512 isolated outputs can be extended by EtherCAT.
- Interfaces: EtherCAT, RS232, RS485, Ethernet.
- Support point to point, synchronous motion, motion superposition, electronic cam, linear interpolation, etc.
- Support U disk file reading and writing and application program upgrading, it is convenient to do remote maintaining on-site.
- Support RTPLC, RTBasic and RTHMI programming.
- Support secondary development on all kinds of PC platforms.

- Support multi-file and multi-task programming, and PC program and controller inner program can work at the same time.
- A variety of program encryption methods to protect your intellectual property rights.
- Support power failure detection and power failure storage. (It can detect and save when power-off)

1.3. System Frame



1.4. Hardware Installment



→ Unit: mm

→ Installation Step:

- Please use 35mm standard DIN guide rail.
- Open controller's guide rail buckle, then embed the controller in the DIN guide rail.
- Press fit controller's guide rail buckle, then fix the controller in the DIN guide rail.

 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

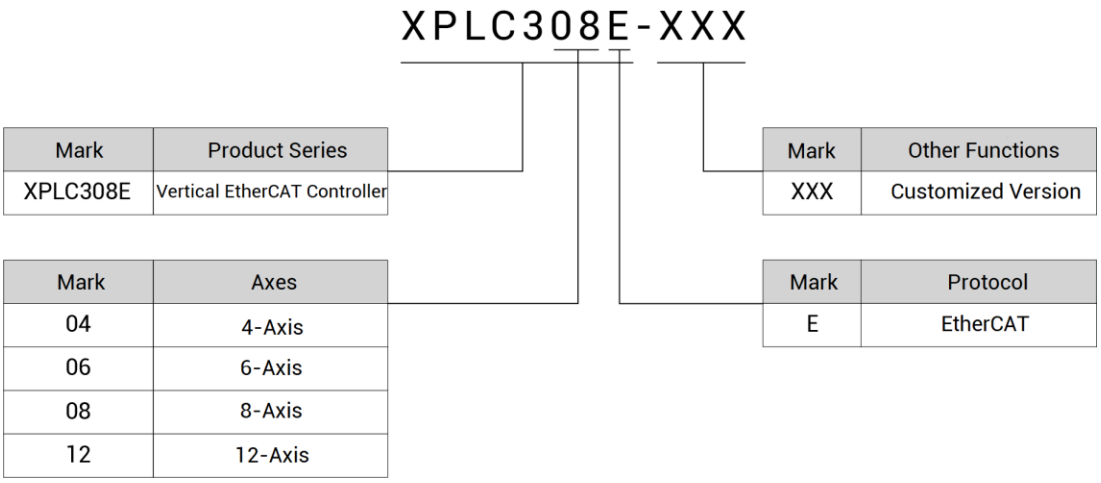
2.1. Basic Specification

Item	Description
Basic Axes	There are 4/6/8/12 axes
Total Axes	16 (basic axes + virtual axes)
Type of Basic Axes	EtherCAT axes (XPLC300 series controllers don't have pulse axis and encoder)
Digital IO	1 input and no output
Max Extended IO	512 inputs and 512 outputs
AD/DA	No
Max Extended AD/DA	128 ADs and 64 DAs
Pulse Bit	32
Encoder Bit	32
Speed and Acceleration Bit	32
Motion Buffer of Each Axis	128
Array Space	320000
VR	1024
Program Space	6144KByte
Flash Space	8192KByte
Power Supply Input	24V DC input
Communication Interfaces	RS232, RS485, Ethernet, EtherCAT
Power	2.5W
Internal power provides for behind-level module	6W
Local expansion behind-level interface ability	16 input/output modules can be expanded at most (max 512 IOs), or 8 AD/DA modules (max 32 analogs).

Master Station (Controller / Coupler)	Description	Max Module Numbers
XPLC300E Series	All submodules (1616N/1616P submodule occupies 2 submodules)	16
	16DI / 16DO / 16DOP / 32DI / 32DO / 32DOP	16
	1616N / 1616P / 4AD / 4DA	8

2.2. Nameplate & Model

Here shows XPLC312E, others are the same rule.



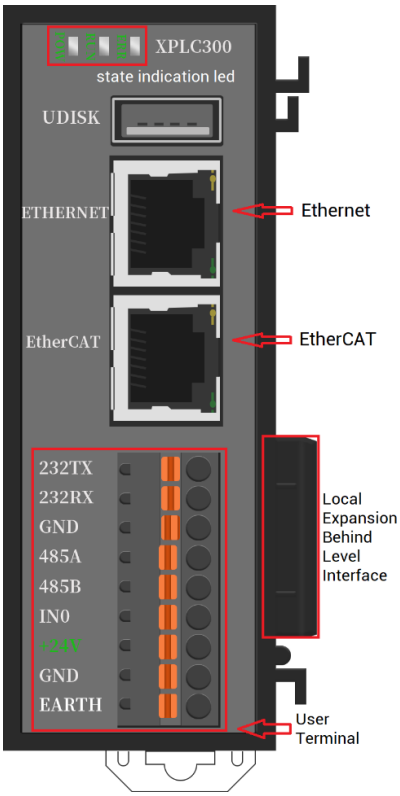
Model	Axes	Encoder	Total axes	IN/OUT	AD/DA	Description
XPLC304E	4	-	16	1/0	-	Point to point, linear interpolation, electronic cam
XPLC306E	6	-	16	1/0	-	
XPLC308E	8	-	16	1/0	-	
XPLC312E	12	-	16	1/0	-	

2.3. Firmware Information

Firmware Type	Description
XPLC300	Local behind interface is mainly connected to ZMIO300 expansion module. Also, the EtherCAT interface can connect to ZMIO310 expansion module and ZMIO300 expansion module.
XPLC300B	Local behind interface is mainly connect to ZMIO310 expansion

	module and compatible with ZMIO310 new upgraded modes. Also, the EtherCAT interface can connect to ZMIO310 expansion module and ZMIO300 expansion module.

2.4. Interface Definition



→ Interface Description

Mark	Interface	Number	Description
POW	The led that indicates the current state.	1	Power state: green, it lights when power is conducted.
RUN		1	Run state: green, it lights when runs normally
ALM		1	Error state: red, it lights when runs incorrectly
RS232	RS232 serial port (port0)	1	Use MODBUS_RTU protocol
RS485	RS485 serial port (port1)	1	Use MODBUS_RTU protocol
EtherCAT	EtherCAT bus interface	1	EtherCAT bus interface, connect to EtherCAT bus drive and EtherCAT bus expansion module

ETHERNET	Network port	1	Use MODBUS_TCP protocol, expand the number of network ports through the interchanger, and the number of net port channels can be checked through "?*port" command, default IP address is 192.168.0.11
UDISK	U disk interface	1	Insert U disk equipment
+24V	Main power supply	1	24V DC power, it supplies the power for controller.

2.5. Work Environment

Item	Parameters
Work Temperature [1]	-10℃- 55℃
Work relative Humidity	10%-95% non-condensing
Storage Temperature	-40℃ ~ 80℃ (not frozen)
Storage Humidity	Below 90%RH (no frost)
Vibration	Below 4.9m/s^2
Shock	Below 19.6m/s^2
Degree of Protection	IP20

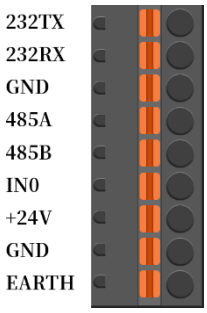
Note [1]: If the temperature around the controller is too high or too low, please install a fan or other cooling measures or take insulation measures in time to ensure that the controller can operate normally and stably for a long time.

Chapter III Wiring & Communication

3.1. User Terminal

The user terminal adopts a 9Pin (there are all 3 terminals) screw-type pluggable wiring terminal, and the interval (means the gap distance between two ports) should be 3.81mm. And power, RS485 and RS232 communication all can be connected and used through corresponding interfaces of this terminal.

→ Terminal Definition:

Terminal	Name	Type	Function
	232TX	Serial port	RS232 signal, send signal
	232RX		RS232 signal, receive signal
	GND	Public end	232, 485, IN 0 public end (can't do power negative pole)
	485A	Serial port	485 differential data A
	485B		485 differential data B
	IN0	Input	Input 0
	+24V	Power positive	Positive (+) terminal of DC power input
	EGND	Power negative	Negative (-) terminal of DC power input
	EARTH	/	case grounding protection

3.1.1. Power Specification

→ Specification

Item	Description
Voltage	DC24V (-5%~5%)
The current to open	≤0.5A

The current to work	≤0.4A
Anti-reverse connection	YES
Overcurrent Protection	YES

3.1.2. RS485, RS23 Specification & Wiring

RS485 serial port supports MODBUS_RTU protocol and custom communication, mainly including 485A, 485B and public end.

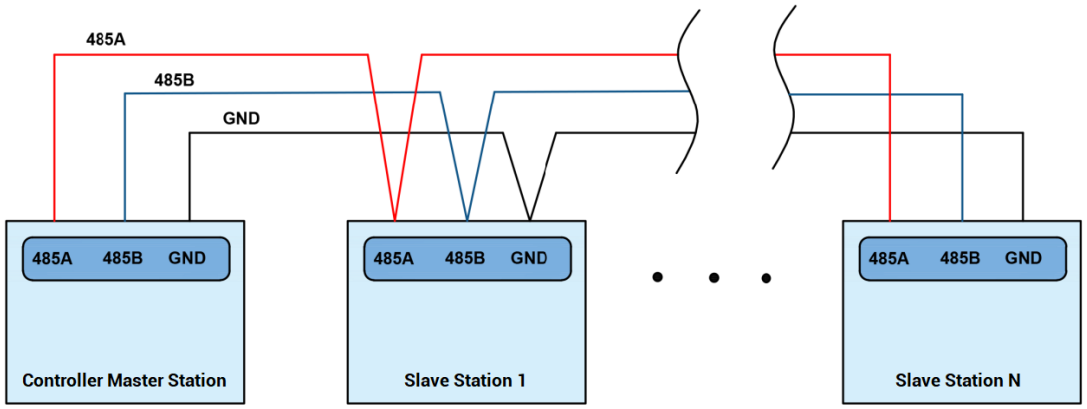
RS232 serial port supports MODBUS_RTU protocol and custom communication, mainly including 232RX, 232TX and public end.

→ Specification

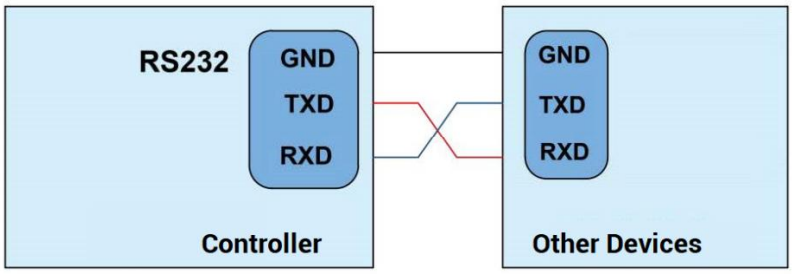
Item	RS485	RS232
Maximum Communication Rate (bps)	115200	115200
Terminal Resistor	No	No
Topological Structure	Daisy Chain Topology	1 to 1
The number of nodes can be extended	Up to 127	1
Communication Distance	The longer communication distance is, the lower communication rate is, and maximum of 30m is recommended.	The longer communication distance is, the lower communication rate is, max 5m is better.

→ Wiring Reference

Connect 485A and 485B of RS485 to 485A and 485B of the controller correspondingly, and connect the public ends of RS485 communication parties together.



Connect 232RX and 232TX of RS232 to 232TX and 232RX of the controller correspondingly, and connect the public ends of RS232 communication parties together.



→ Wiring Notes:

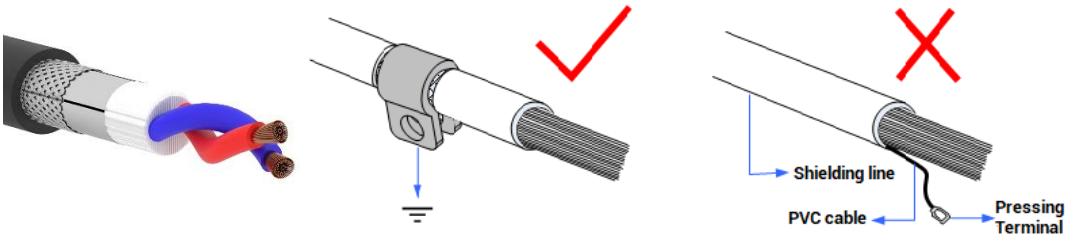
- As above, the daisy chain topology is used for wiring (the star topology structure cannot be used). When the use environment is ideal and there are no many nodes, the branch structure also can be used.
- The wiring of RS232 is above, and cross-wiring is needed when receiving and accepting signals, and it is recommended to use the cross-cable with double-female head when connecting to the computer.
- 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.

- When routing terminal wiring cables, avoid bundling them with cables with strong interference signals such as power lines, and must route them separately.

→ Cable Requirements:

Shielded Twisted Pair, and the shielded cable is grounded.



3.1.3. Basic Usage Method

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

(2) After powered on, please use any one interface among the three interfaces (ETHERNET, RS232, RS485) to connect to RTSys.

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

(4) 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 "RTBasic Programming Manual" for details.

(5) According to their respectively instructions, correctly set the relevant parameters of

the third-party equipment to match the parameters of each node.

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

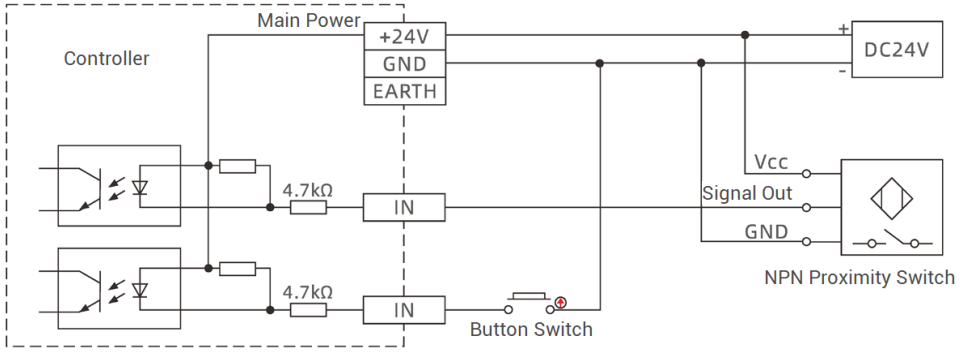
(7) After all the settings are completed, restart the power supply of all stations to establish communication.

3.1.4. Digital Input Specification & Wiring

→ Specification

Item	General input (IN0)
Input mode	NPN, input is triggered when it is low-electric level
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	-6mA (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



→ Wiring Notes:

- The wiring principle of high-speed digital input IN (0) is shown in the figure above. The external signal source can be an optocoupler, a key switch or a sensor, etc., all can be connected as long as the requirements on output of electric level can be achieved.
- For the public end, please connect the "GND" port on the power supply 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.
- When routing terminal wiring cables, avoid bundling them with cables with strong interference signals such as power lines, and must route them separately.

3.1.5. Basic Usage Method

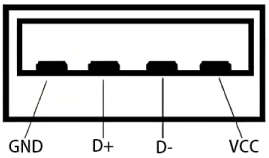
(1) Please follow the above wiring instructions to wiring correctly.

(2) After powered on, please select any one interface among the three interfaces ETHERNET, RS232 and RS485 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 “RTBasic Manual” for details.

3.2. U Disk

XPLC300 series motion controller provides a USB communication interface, which can insert the U disk device. It is used for ZAR program upgrading, controller data importing and exporting, file 3 executing, etc. Its schematic diagram is shown in the figure below:

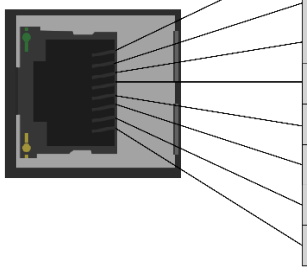


→ **Specification**

Item	USB2.0
Highest Communication Ratio	12Mbps
Max Output Current of 5V	500mA
Whether Isolates	No

3.3. ETHERNET

XPLC300 motion controller has a 100M network port, and it supports MODBUS_TCP protocol and custom communication, the default IP address is 192.168.0.11. The pin definition is as follows:



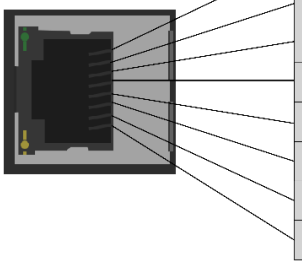
PIN	Signal	Description
1	TX+	Send signal (+)
2	TX-	Send signal (-)
3	RX+	Receive signal (+)
4	NC	Reserved
5	NC	Reserved
6	RX-	Receive signal (-)
7	NC	Reserved
8	NC	Reserved

The Ethernet port of the controller can be connected to a computer, HMI, etc. through an Ethernet cable, and point to point connection method is used.

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:

3.4. EtherCAT Bus Interface

XPLC300 motion controller has a 100M EtherCAT communication interface, and it supports EtherCAT protocol. In addition, EtherCAT driver or EtherCAT expansion module can be connected. The pin definition is as follows:



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

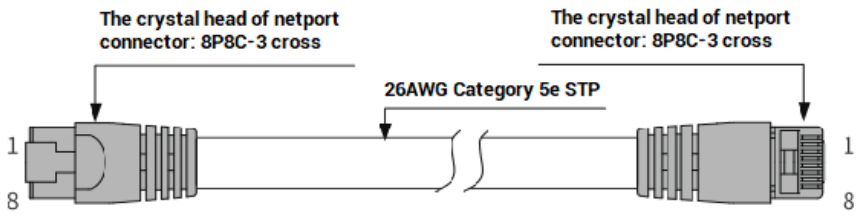
→ Specification

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

→ Communication Cable Requirements

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

The network cable adopts Category 5e STP, and the crystal head has a metal shell to reduce interference and to prevent information from being eavesdropped. As shown below:



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

Use RJ45 network cable connection method:

- When installing, hold the crystal head that is with the cable and insert it into the RJ45 interface until it makes a "click" sound (kada).
- In order to ensure the stability of communication, please fix the cables with cable ties.
- When disassembling, press the tail mechanism of the crystal head, and pull out the connector and the module in a horizontal direction.

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

→Cable production steps:

- Strip the cable insulation, the exposed copper part depends on the size of the tube-type pre-insulated terminal.
- Pass the conductor part of the cable into the tubular pre-insulated terminal and crimp it with a crimping pliers.

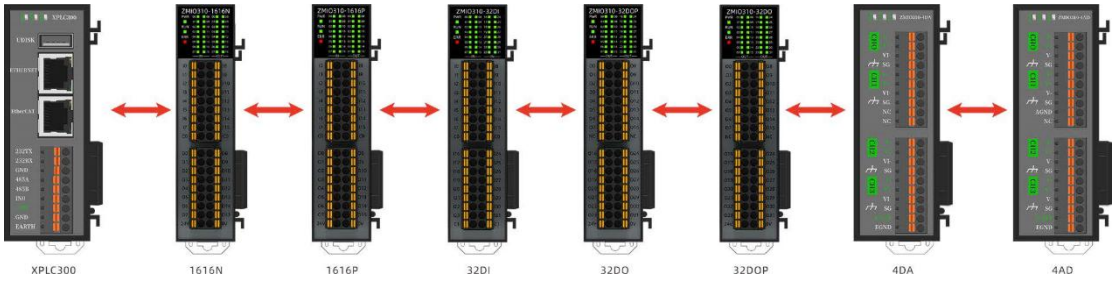
→Wire cable connection steps:

- Press the spring of the terminal to insert the cable with the tubular pre-insulated terminal into the port.
- Loosen the spring of the terminal, pull the cable lightly to check whether the cable is firmly connected.

Chapter IV Expansion Module

4.1. Local Expansion

The expansion sub-module of ZMIO310 series can be connected through the local expansion post-level interface.



➢ Install Steps:

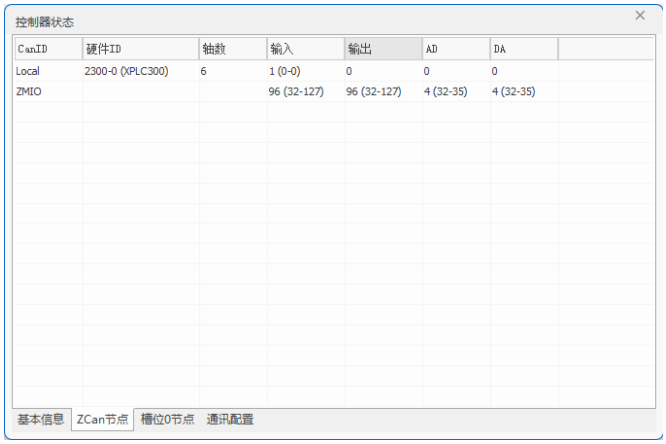
- Open the gap clips of all modules.
- Align the local expansion front-end interface of the expansion sub-module with the local expansion rear-end interface of the XPLC300 series controller (or expansion sub-module).
- Press the gap clips of all modules together.

Note: for ZMIO310 series submodules, please refer to ZMIO310 series expansion module user manual.

➢ Expansion Example:

For example, if XPLC312E is extended with 2 input modules (ZMIO310-32DI), 2 output modules (ZMIO310-32DO or ZMIO310-32DOP), 2 16-input modules (ZMIO310-1616N), 1 AD module (ZMIO310-4AD) and 1 DA module (ZMIO310-4DA). The program doesn't need to be initialized, just follow the above installation steps and then power on again.

Controller States:



The default starting address of IO, AD and DA with ZMIO extension is 32, and the addresses of modules of the same type continue automatically. If you need to offset the starting address, please refer to the content of the configuration function below.

Type	Relative instructions	Relative view	Examples
Input	IN	Input view	IN (32) ~ IN (79)
Output	OP	Output view	OP (32) ~ OP (63)
AD	AIN	AD/DA view	AIN (32) ~ AIN (35)
DA	AOUT	AD/DA view	AOUT (32) ~ AOUT (35)
The AD and DA with ZMIO extension use the standard range (0~10V) by default. If you need other ranges, please contact the manufacturer to replace them in advance.			

4.2. Function Configuration

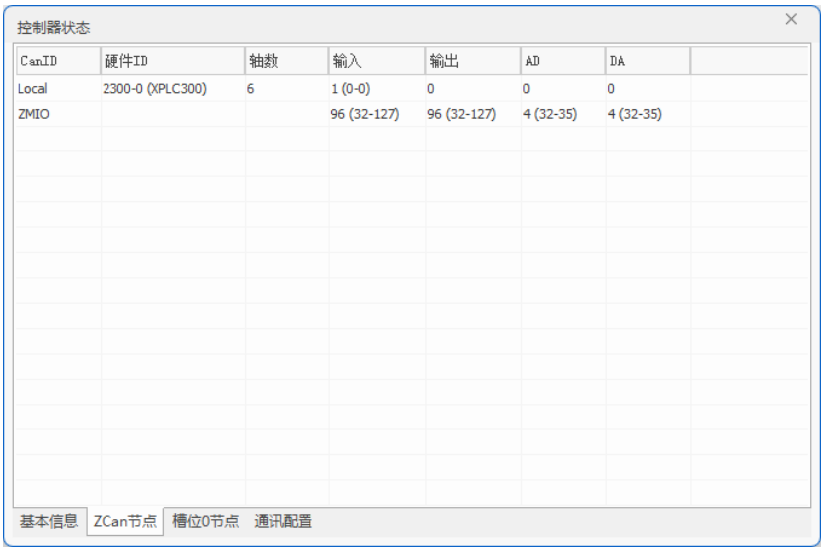
Configuration includes local offset configuration and built-in ZMIO expansion configuration, which can be further divided into IO configuration and analog configuration.

4.2.1. Local IO Offset Configuration

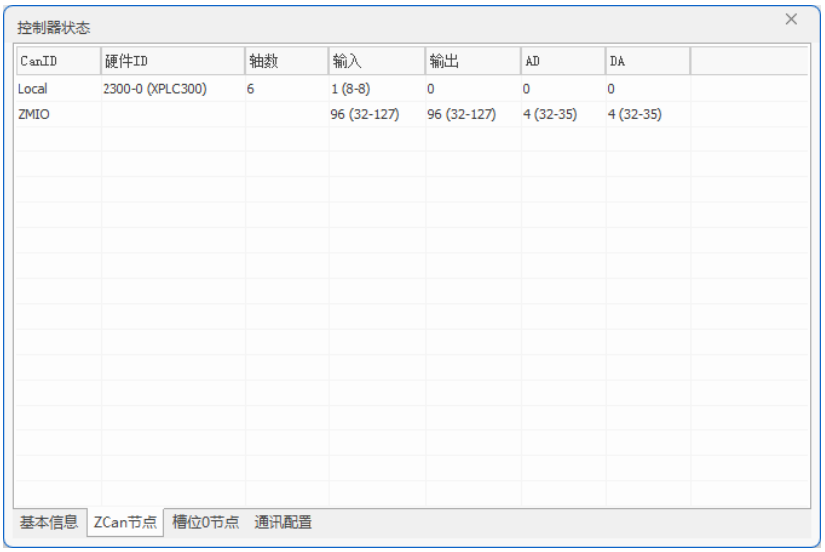
Functional Description	It is used to offset local IO address of XPLC300 controllers.		
Grammar	LOCALIO_OFFSET=value		
Parameter List	value	IO starting address	Default: multiples of 0 and 8
Example	LOCALIO_ADDRESS=8 'local IO address is offset to 8		

Note: IO starting address only can be set as the multiple of 8.

Controller status (before modification):



Controller status (after modification):



4.2.2. Local Analog Offset Configuration

Functional Description	It is used to offset local AIO address of XPLC300 controllers.		
Grammar	LOCALAIO_OFFSET=value		
Parameter List	value	AIO starting address	Default: 0
Example	LOCALAIO_ADDRESS=1 'local AIO address is offset to 1		

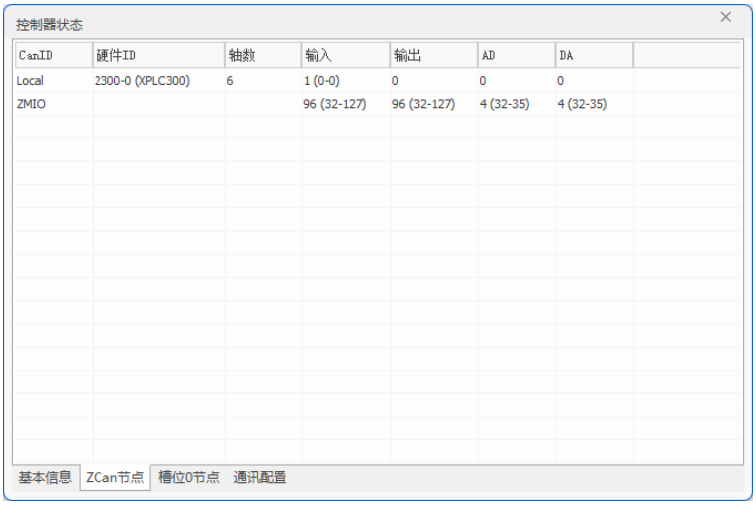
Note: there is no analogs for XPLC300 series controllers, no offset configuration effect.

4.2.3. IO Offset Configuration for ZMIO Expansion (that comes with XPLC300 controller)

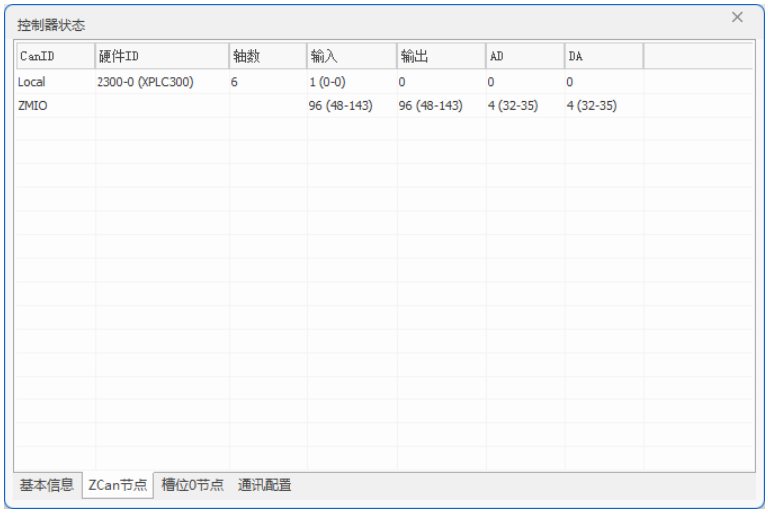
Functional Description	It is used to offset local IO address of ZMIO300 expansion that comes with XPLC300 controllers.		
Grammar	ZMIO_OFFSET=value		
Parameter List	value	IO starting address	Default: multiples of 32 and 8
Example	ZMIO_ADDRESS=48 'local IO address brought by ZMIO expansion is offset to 48		

- Note: IO starting address only can be set as the multiple of 8. If no need to connect ZMIO310 submodules, please set ZMIO_OFFSET command as negative value / make it exceed IO starting No. range (must be a multiple of 8), for example, ZMIO_OFFSET = -8 (when the XPLC300 doesn't bring with IO expansion module), ZMIO_OFFSET = 560 (the valid range is 0-511 when it connects to IO expansion module), otherwise, it will report the error of code "201".

Controller status (before modification):



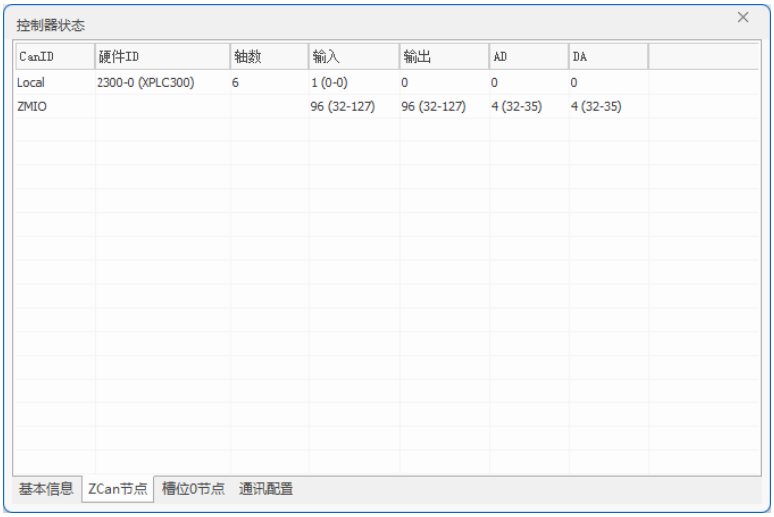
Controller status (after modification):



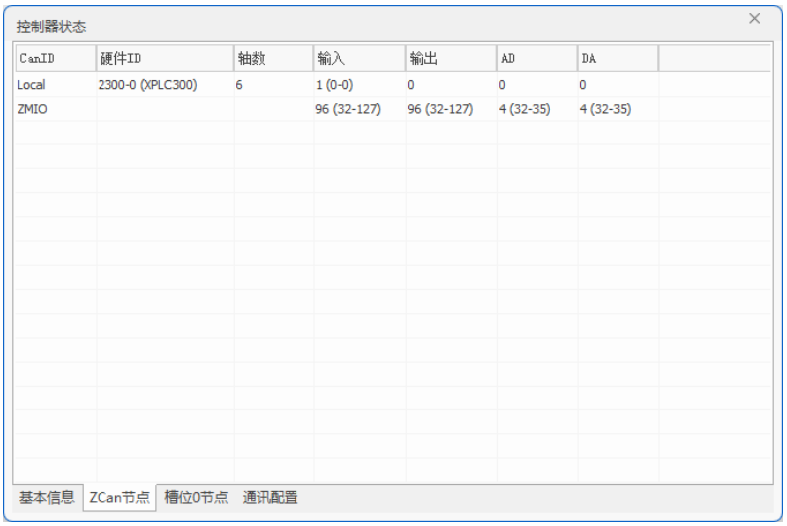
4.2.4. Analog Offset Configuration for ZMIO Expansion (that comes with XPLC300 controller)

Functional Description	It is used to offset local AIO address of ZMIO300 expansion that comes with XPLC300 controllers.		
Grammar	ZMAIO_OFFSET=value		
Parameter List	value	IO starting address	Default: 32
Example	ZMAIO_ADDRESS=33 'local AIO address brought by ZMIO expansion is offset to 33		

Controller status (before modification):



Controller status (after modification):



How to check the situation of ZMIO expansion brought by XPLC300 controller:

<table>
<tr><td>Functional Description</td><td colspan="3">It is used to check the situation of ZMIO expansion brought by XPLC300 controller.</td></tr>
<tr><td>Grammar</td><td colspan="3">Grammar 1: var=ZMIO_INFO(sel)
Grammar 2: var=ZMIO_INFO(17, node)</td></tr>
<tr><td rowspan="2">Parameter List</td><td>sel</td><td>Functional selection</td><td><table><tr><th>Function No.</th><th>Function Content</th></tr><tr><td>10</td><td>Max inputs</td></tr><tr><td>11</td><td>Max outputs</td></tr><tr><td>12</td><td>Max AIN</td></tr><tr><td>13</td><td>Max AOUT</td></tr><tr><td>16</td><td>Modules</td></tr></table></td></tr>
<tr><td>node</td><td>Module No.</td><td>Start from 0, number adds 1 when one module is connected.</td></tr>
<tr><td>Example</td><td colspan="3">?ZMIO_INFO(10) ‘print max inputs brought by ZMIO expansion
?ZMIO_INFO(11) ‘print max outputs brought by ZMIO expansion
?ZMIO_INFO(12) ‘print max AIN brought by ZMIO expansion
?ZMIO_INFO(13) ‘print max AOUT brought by ZMIO expansion
?ZMIO_INFO(16) ‘print max modules brought by ZMIO expansion
?ZMIO_INFO(17,0) ‘print the type No. of the expanded first module</td></tr>
</table>

4.2.5. Set / Get Analog Range & Channel State

Functional Description	It is used to read or set expansion sub-module's AD/DA channel switch states and range types.
Grammar	Grammar 1: (to read): var = ZMIO_CONFIG (sel, moduleid) Grammar 2: (to write): ZMIO_CONFIG (sel, moduleid, value) sel: function No. moduleid: expansion submodule address value: set expansion submodule's channel or range type Specific usage, please refer to "ZBasic (RTBasic) Manual".
Example	ZMIO_CONFIG (1, 0, 10) 'set DA range type of expansion submodule whole address is 0 as 0~10V ZMIO_CONFIG (2, 0, 15) 'set AD all channels' states of expansion submodule whole address is 0 as ON ?ZMIO_CONFIG (1, 0) 'get AD/DA range type of expansion submodule whole address is 0 ?ZMIO_CONFIG (2, 0) 'get AD channel state of expansion submodule whole address is 0

Chapter V Programming

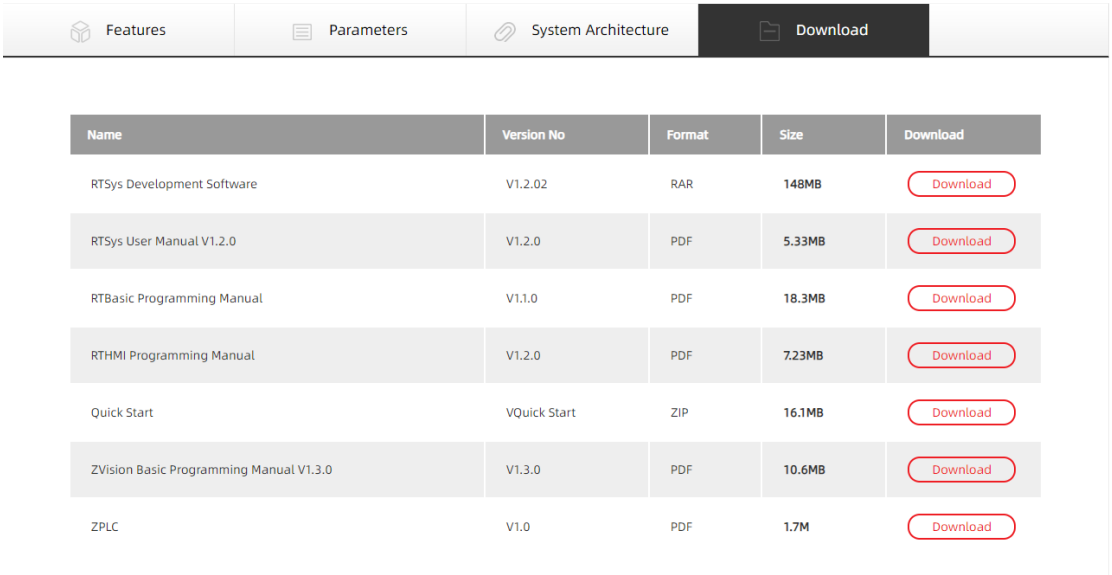
5.1. Program in RTSys Software

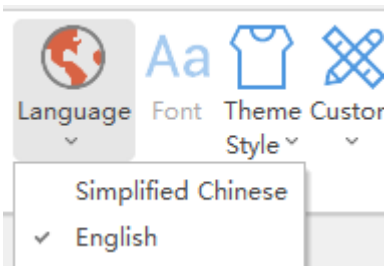
RTSys is a PC-side program development, debugging and diagnostic software for the Zmotion motion controllers. Through it, users can easily edit and configure the controller program, quickly develop applications, diagnose system operating parameters in real time, and debug the running program in real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

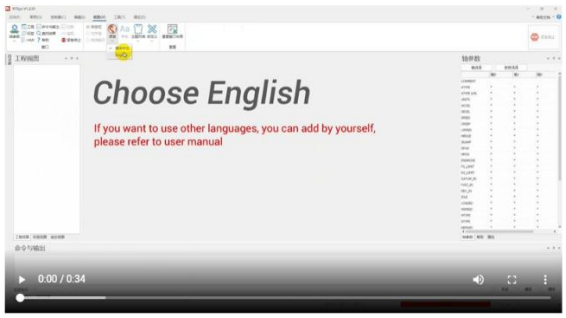
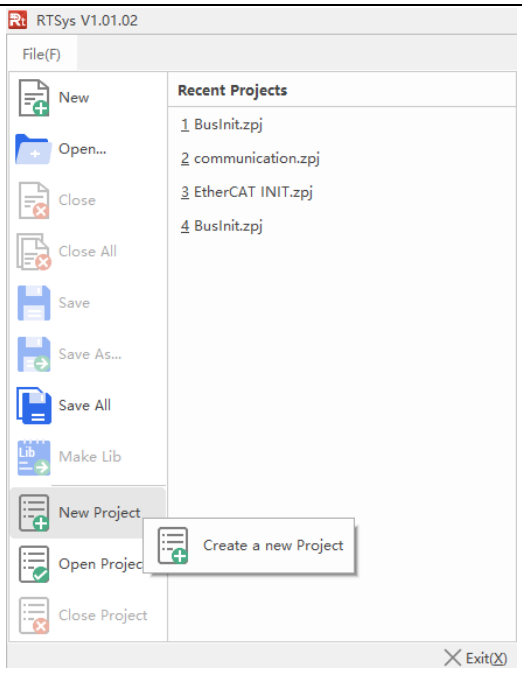
RTSys Downloading Address: https://www.zmotionglobal.com/pro_info_282.html

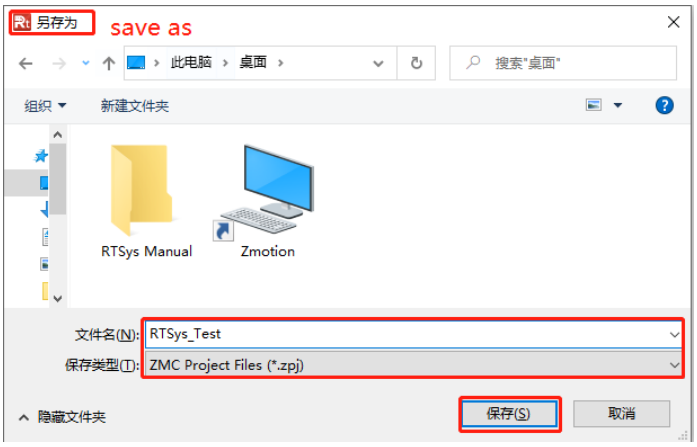
And related manuals can be found in "Download":

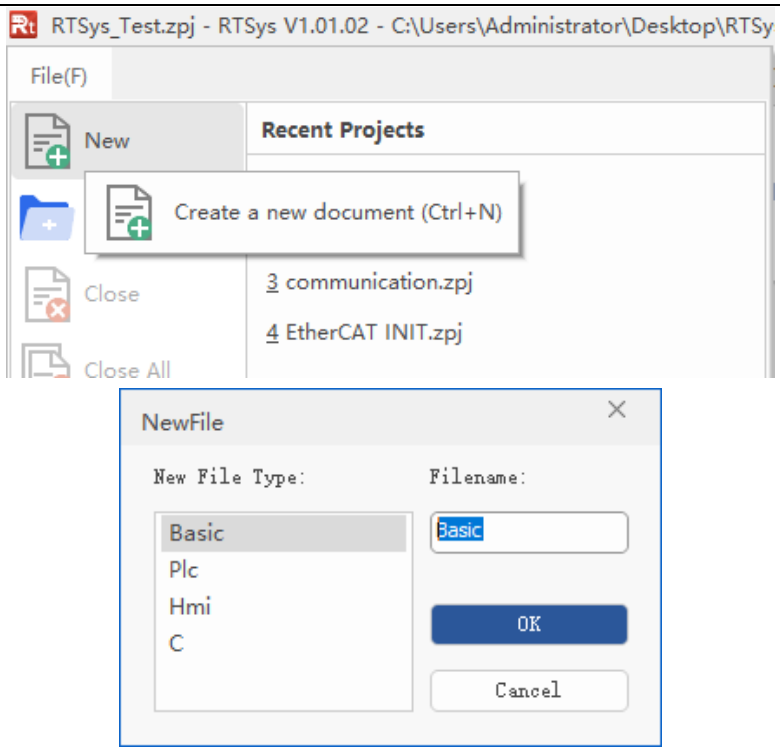
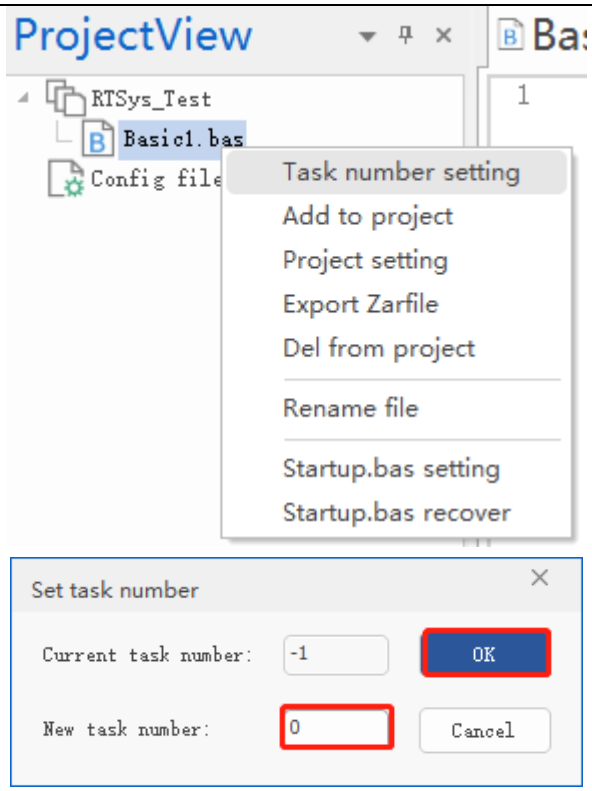


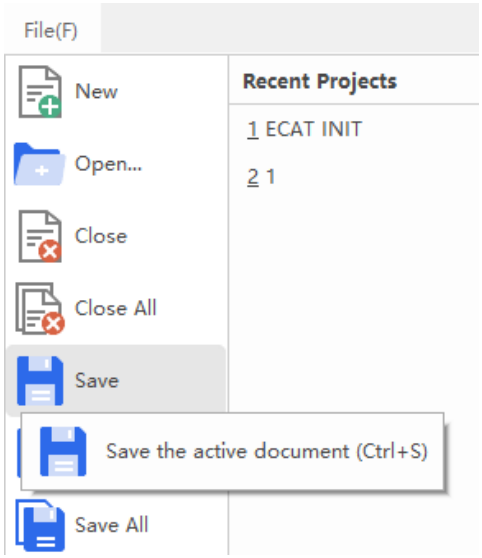
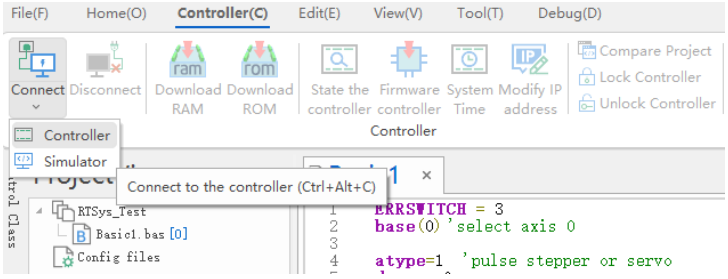
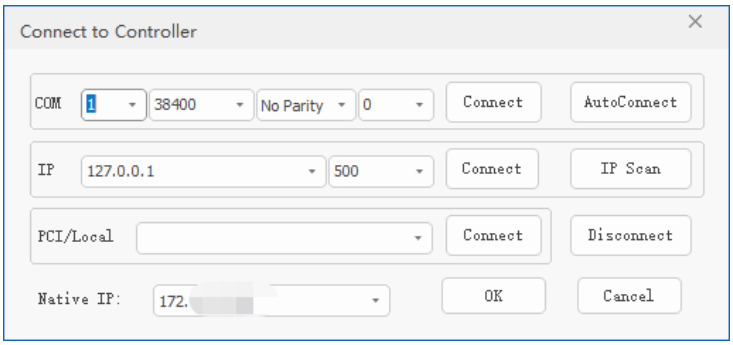
Step	Operations	Display Interface
1	Switch the Language: "Language" – "English", then there will pop	

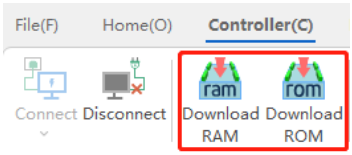
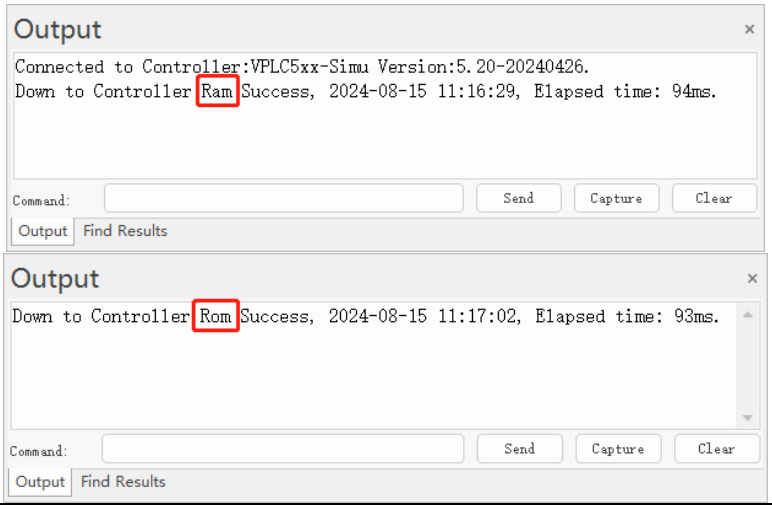
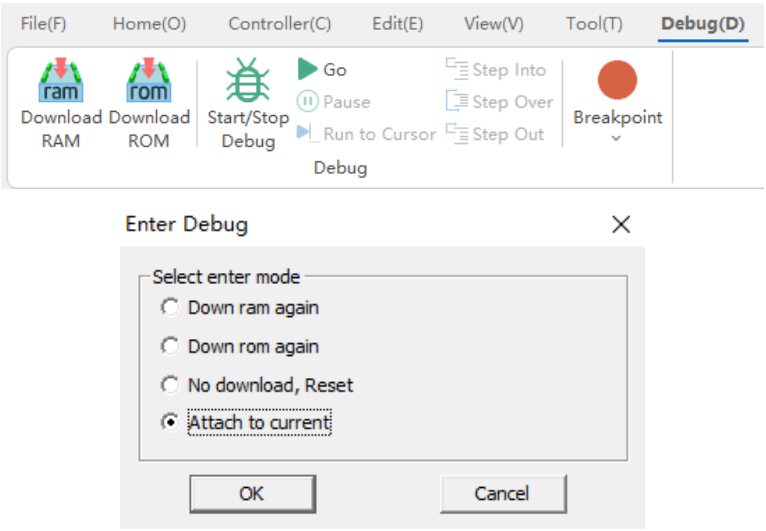
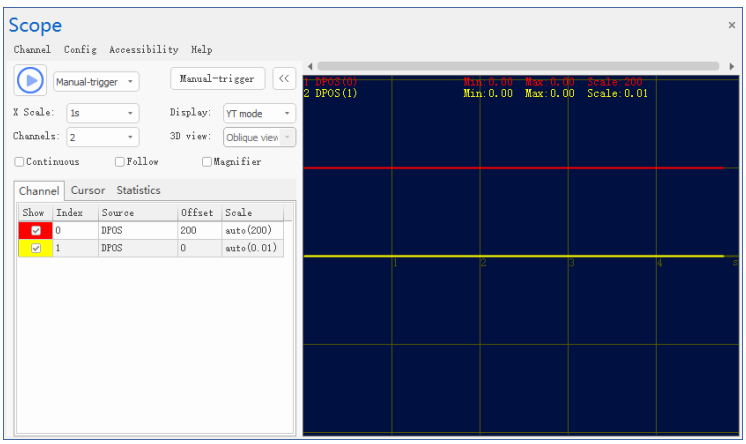
<table>
<tr>
<td></td>
<td>up one window, click OK, and restart it.</td>
<td>Language Switch Video Showing:

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”.

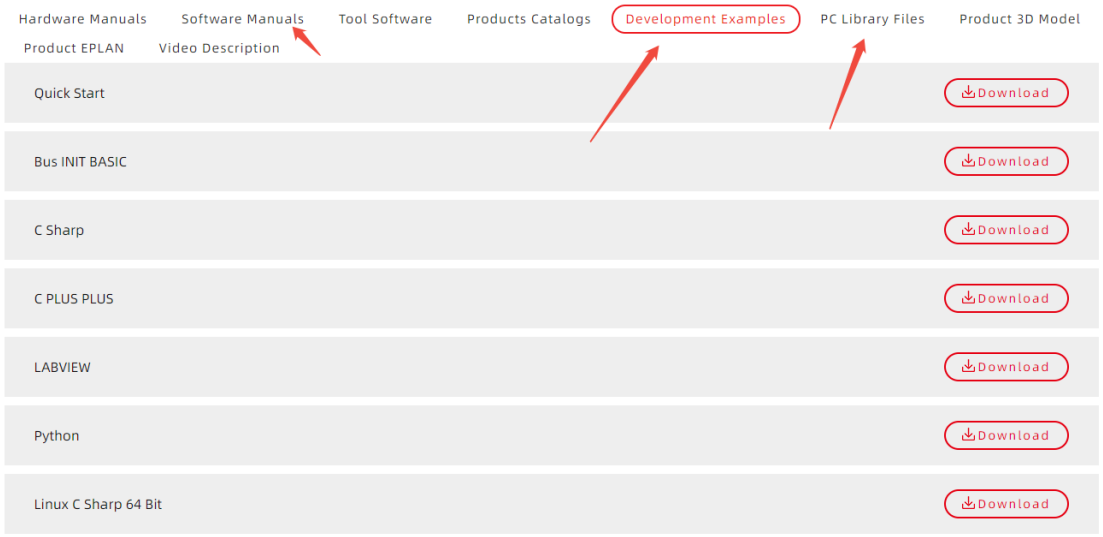
h. Do step a and step b again, check whether the firmware is updated or not.

5.3. Program in Host-Computer by PC Languages

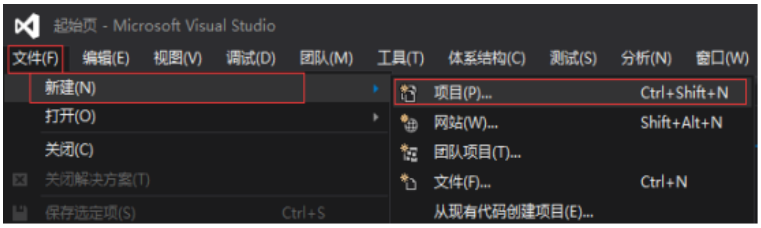
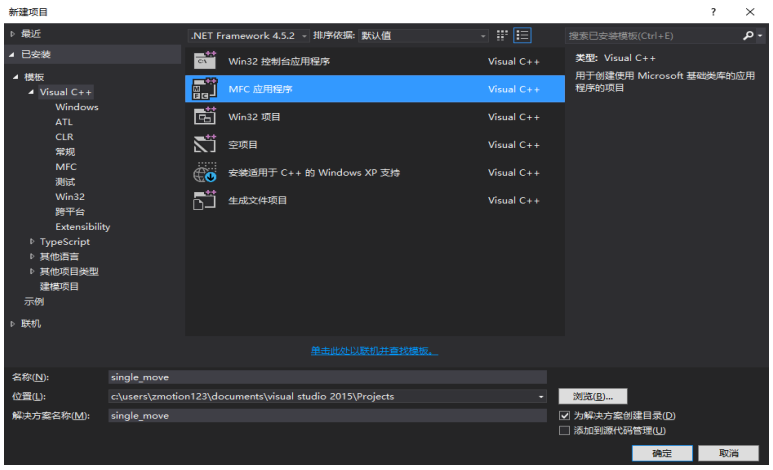
The controller supports development under various operating systems such as windows, linux, Mac, Android, and wince, and provides dll libraries in various environments such as vc, c#, vb.net, and labview, as shown in the figure below. PC software programming refers to "Zmotion PC Function Library Programming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

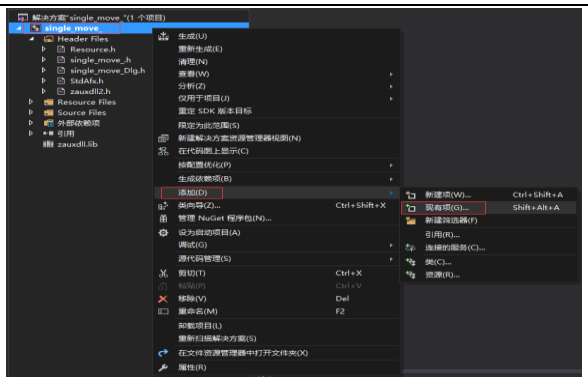
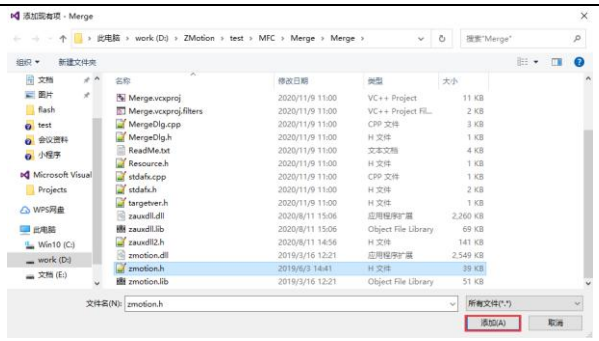
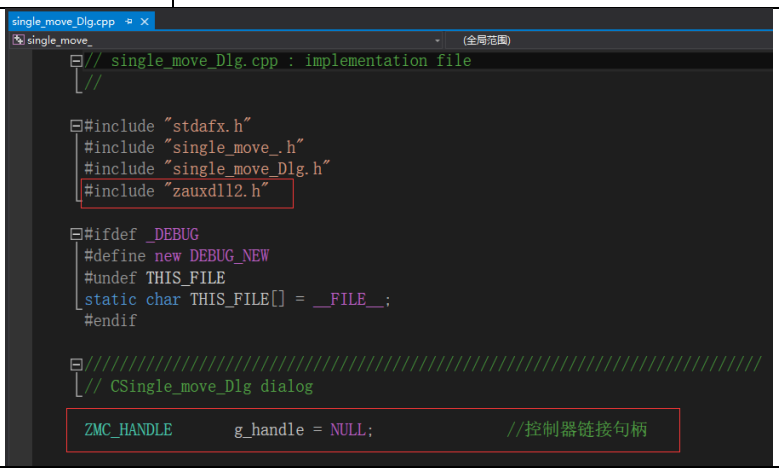
The program developed using the PC software cannot be downloaded to the controller, and it is connected to the controller through the dll dynamic library. The dll library needs to be added to the header file and declared during development.

- 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.	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.