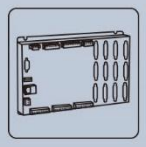
Zmotion®
正运动技术

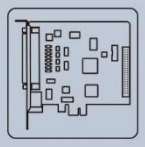
做更好用的运动控制，智造美好生活
Better Motion Control, Smarter Life

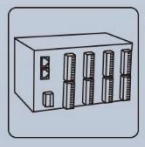
Vision Motion Controller

VPLC712

Vision Motion Controller


Motion Controller


Motion Control Card


IO Expansion Module

HMI

Statement

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

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

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

➢ Notes

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

■ Danger

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

■ Notes

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

Content

Chapter I Production Information....4
1.1. Product Information....4
1.2. Optional Configuration....6
1.3. Connection Configuration....9
Chapter II Product Specification....10
2.1. Basic Specification....10
2.2. Interface Definition....11
2.3. IO Interface Specification....13
2.4. Communication Interface Specification....14
2.5. Config Parameter Specification....14
Chapter III Wiring Communication Configuration & Network....17
3.1. Switch Button....17
3.2. Main Power Supply....17
3.3. IO Power....18
3.4. IO Signal Interface....19
3.5. IN Digital Input Interface....21
3.6. OUT Digital Output Interface....23
3.7. Single-Ended Axis Interface....25
3.8. MPG Handwheel Interface....27
3.9. EtherCAT Bus Interface....30
3.10. LAN Ethernet....32
3.11. HDMI Interface....34
3.12. USB Interface....34
3.13. COM Serial Port....35
3.14. Local Axis / Analog / PWM....38
3.15. Wiring Requirements....41
Chapter IV EtherCAT Expansion....43
4.1. EtherCAT Bus Expansion Wiring....43
4.2. EtherCAT Bus Expansion Resource Mapping....44
Chapter V Optional Configuration....46
5.1. Heat Cooling Fan....46
Chapter VI Installation Requirements....49
6.1. Installation Environment....49
6.2. Installation Size....50
6.3. Installment Method....50
Chapter VII Program & Applications....52
7.1. Program in RTSys Software....52
7.2. Upgrade Controller Firmware....57
7.3. Program in Host-Computer by PC Languages....58
Chapter VIII Operation and Maintain....61
8.1. Regular Inspection and Maintenance....61
8.2. Common Problems & Solutions....62

Chapter I Product Information

1.1. Product Information

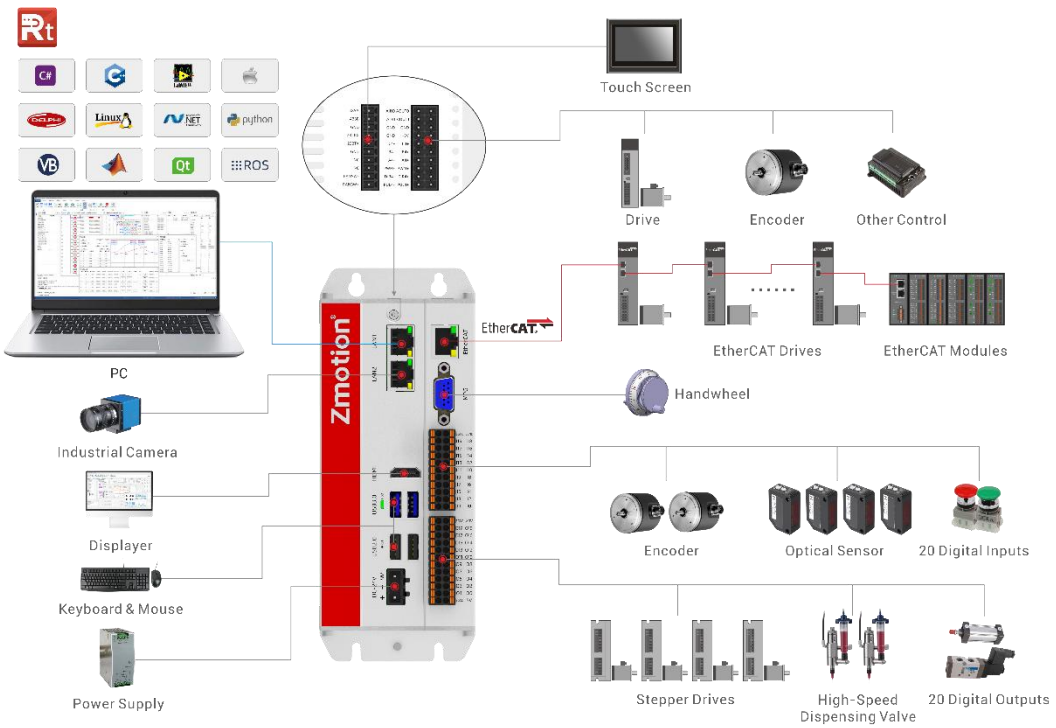
VPLC712 is a kind of IPC type product based on x86. Through PC-based, scalability, multi-area, informatization, open and visualization of system can be played well. EtherCAT bus is configured in standard, the max linkage axes can reach 64 axes, and the minimal motion period is 500us. In addition, it supports powerful motion control functions that can meet high-speed and high-precision requirements in motion control area. It also supports some functions required in automation industry, such as, DI/DO, pulse control and handwheel acquisition.

VPLC712 series controllers are used together with MotionRT real-time kernel software, then one device can achieve motion control functions, machine vision algorithm and powerful communication ability. MotionRT is Zmotion motion control real-time kernel software. Now, it has developed to generation 7 "MotionRT7". This software is one independent PC software, it has high compatibility to transplant to Linux or Windows conveniently. And MotionRT is with real-time Basic language, ladder diagram (PLC), configuration (HMI) that are easy to use.

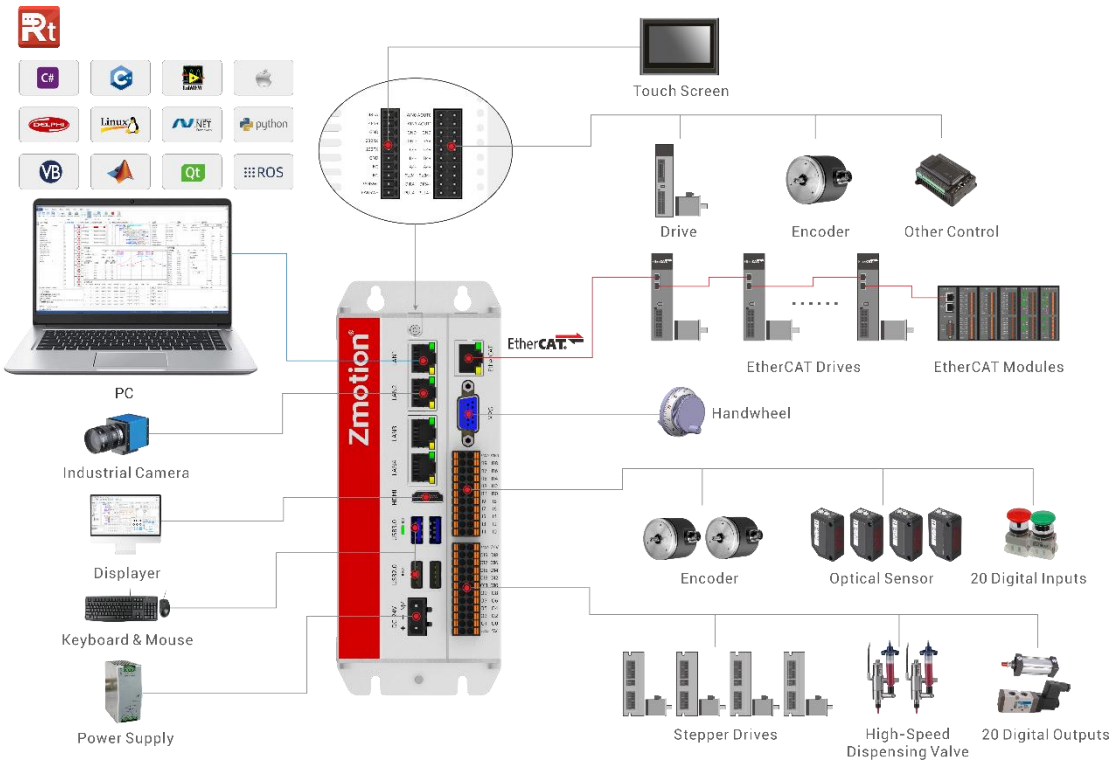
Whether it is a remote application or a local application (VS, QT and other software development), MotionRT provides a unified standard function interface (zmotion.dll/zmotion.so) to facilitate the transplantation of various external programs.

It is matched with RtSys (ZDevelop) development software to realize real-time one-stop-shop development of real-time BASIC, ladder diagram (PLC), configuration (HMI), machine vision (Vision), in this way, development time can be saved.

VPLC712A2xx (2 Gigabit Ethernet) hardware version system:



VPLC712A4xx (4 Gigabit Ethernet) hardware version system:



- It supports motion control function and machine vision function
- It supports encoder position measurement, which can be configured as handwheel input mode.

- There are 20 NPN outputs, and they are high-speed outputs, some outputs can be configured as hardware comparison outputs, PWM outputs or pulse axes. The max output current can reach 300mA, which can directly drive some solenoid valves.
- There are 20 NPN inputs, some high-speed inputs can be configured as latch, and some inputs can be used as encoder.
- There are 2 local differential pulse axes or 2 local differential encoder axes.
- It supports X86 system platform.
- It supports max 64 axes linear interpolation, any space circular interpolation, helical interpolation, spline interpolation, etc.
- It supports electronic cam, electronic gear, position latch, synchronous follow, virtual axis, etc.
- It supports hardware comparison output (HW_PSWITCH2), hardware timer, and precision output in motion.
- It supports pulse closed-loop, pitch compensation.
- It doesn't support power down interrupt, but supports VR power down storage.

The VPLC712 series enters the machine tool as IPC. Specific applications require an external display, a keyboard and mouse for interaction, an IO module for general IO input and output functions, an EtherCAT bus to connect the EtherCAT bus servo drive and the EtherCAT bus remote IO module, and a LAN interface to connect the network, camera, etc.

1.2. Optional Configuration

Selectable hardware configuration forms:

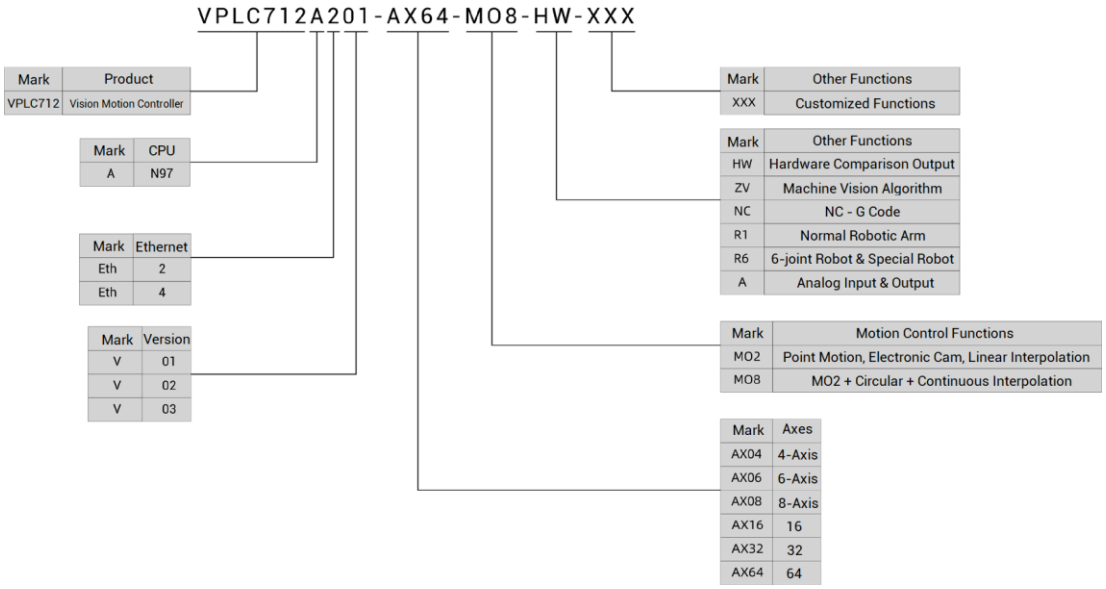
Models	**VPLC712 A201**	**VPLC712 A202**	**VPLC712 A203**	**VPLC712 A401**	**VPLC712 A402**	**VPLC712 A403**
CPU	N97					
Memory	DDR 8G	DDR 16G	DDR 16G	DDR 8G	DDR 16G	DDR 16G
Solid Disk	SSD 120G	SSD 480G	SSD 256G + 1T / machine	SSD 120G	SSD 480G	SSD 256G + 1T / machine
Ethernet	2 1000M	2 1000M	2 1000M	4 1000M	4 1000M	4 1000M

Power	DC24V	DC24V	DC24V	DC24V	DC24V	DC24V
Cooling	Heat sink cooling, optional purchase the fan cooling, if required, please note before placing an order					
Descriptions: (1) VPLC712A201 and VPLC712A401 models are standard models, others are customized. (2) For standard models, they don't have analog and specified PWM functions, please confirm before order.						

Models	**VPLC712 B201**	**VPLC712 B202**	**VPLC712 B203**	**VPLC712 B401**	**VPLC712 B402**	**VPLC712 B403**
CPU	N95					
Memory	DDR 8G	DDR 16G	DDR 16G	DDR 8G	DDR 16G	DDR 16G
Solid Disk	SSD 120G	SSD 480G	SSD 256G + 1T / machine	SSD 120G	SSD 480G	SSD 256G + 1T / machine
Ethernet	2 1000M	2 1000M	2 1000M	4 1000M	4 1000M	4 1000M
Power	DC24V	DC24V	DC24V	DC24V	DC24V	DC24V
Cooling	Heat sink cooling, optional purchase the fan cooling, if required, please note before placing an order					
Descriptions: (1) VPLC712A201 and VPLC712A401 models are standard models, others are customized. (2) For standard models, they don't have analog and specified PWM functions, please confirm before order.						

Models	**VPLC712J201**	**VPLC712J202**	**VPLC712J203**
CPU	J6412		
Memory	DDR 8G	DDR 16G	DDR 16G
Solid Disk	SSD 120G	SSD 480G	SSD 256G + 1T / machine
Ethernet	2 1000M	2 1000M	2 1000M
Power	DC24V	DC24V	DC24V
Cooling	Heat sink cooling, optional purchase the fan cooling, if required, please note before placing an order		
Descriptions: (1) VPLC712A201 and VPLC712A401 models are standard models, others are customized. (2) For standard models, they don't have analog & PWM functions.			

For software configurations, please refer to below graphic, there are axis numbers, motion control functions, other functions (PSO, vision, robot, etc.).



Interface	Optional Functions	Definition Description
License Parameter	Frame	R1: suit to ordinary robots
	Robot	R6: suit to 6-joint robots & special structures
	NcGcode	NC: suit to NC G code function.
	ZVision	ZV: suit to vision instruction and function.
	HW	HW: suit to HW hardware comparison output function, refer to high-speed output channel numbers selection.
	Motor	Select according to actual axes, the value set of axis needs to be larger than the number of axes used. AX04: 4 axes can be used at most. AX06: 6 axes can be used at most. AX08: 8 axes can be used at most. AX16: 16 axes can be used at most. AX24: 24 axes can be used at most. AX32: 32 axes can be used at most.

		AX64: 64 axes can be used at most.
	Motion	Valid motion control functions: MO2: point to point, electronic cam, linear interpolation. MO8: point to point, electronic cam, linear interpolation, circular interpolation, continuous interpolation.

1.3. Connection Configuration

External equipment / software configuration:

- wired-mouse and wired-keyboard.
- Displayer
- Win10 operating system (professional version), ZDevelop development platform and operating system software of various machine tool industries, etc.

(note: you can download the latest RTSys (ZDevelop) version from Zmotion website or contact us. If you use PC host computer languages, like, C++/C#/labview/python, etc., you also can obtain library file from Zmotion website or contact us. And this product does not come with an operating system, but there is MotionRT software built-in. You need to install the operating system by yourselves. Before using MotionRT, open it at first, then connect).

Chapter II Product Specification

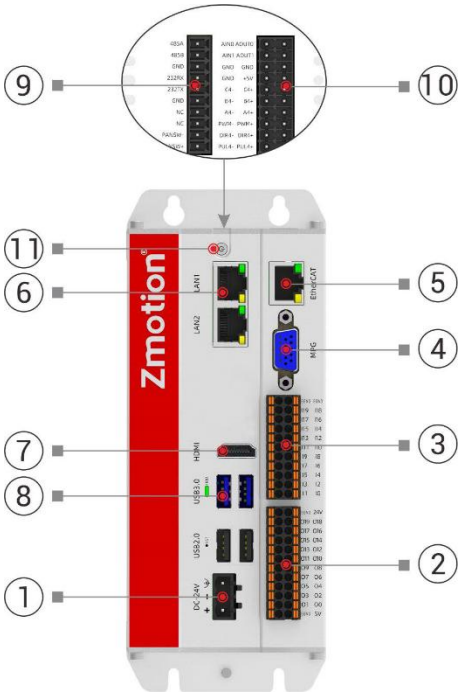
2.1. Basic Specification

Item	Description
Model	VPLC712 series
CPU	Intel CPU: there are N97 / N95 / J6412
Memory	Internal SSD solid hard disk: 128G/256G/480G/1T
Storage	DDR4: single-channel DIMM, DDR4 2666MHZ Max32GB (standard configuration is 8GB)
Main power	DC24V: it is determined by power needs.
Axes	4/6/8/16/32/64: EtherCAT bus axes + 4 single-ended pulse axes + 2 single-ended encoder axes + 2 differential pulse axes / 2 differential encoder axes
Max expanded axes	64
Basic axes type	EtherCAT bus axis, pulse axis, encoder axis, virtual axis
High-speed output IO frequency	≤400kHz for OUT0-19
High-speed input IO frequency	≤100kHz for IN0-7
Ordinary input IO frequency	≤5kHz for IN18-19
Controller cycle	1ms by default, the cycle can be checked and adjusted by SERVO_PERIOD.
VR power-down storage space	8000: power-off data can be saved about 10 years by ferroelectric memory
Cooling method	Fan cooling or heat sink (according to your model selection)
Storage temperature	-40°C-80°C
Work temperature	-10°C-55°C

Work humidity	10% ~ 95% (no condensation)
Volume	191mm*76mm*125mm
Weight	1.65KG

2.2. Interface Definition

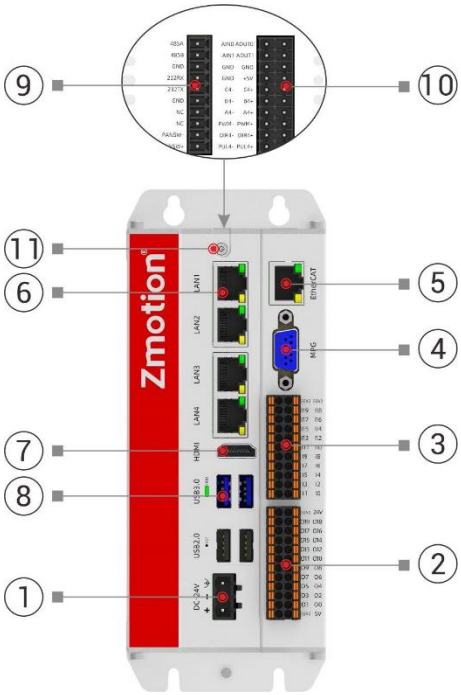
→Interface Definition of VPLC712A2xx



No.	Interface	Details
1	Main Power	Connect to 24V DC power supply
2	IO Power	Connect to 24V DC power supply
	IO OUT	NPN output
3	5V Voltage OUT	5V voltage output, current can be up to 300mA
	IO IN	NPN input
4	MPG	Handwheel interface
5	EtherCAT	EtherCAT Bus interface
6	LAN	Gigabit Ethernet 1 / 2

7	HDMI	HDMI displayer interface
8	USB2.0 / 3.0	USD interface
9	COM	RS485 (COM1), RS232 (COM2)
10	Local Axis	Differential pulse axis, encoder, PWM, and analog, for PWM and analog function, only valid in special model.
11	Switch Button	ON / OFF button

→Interface Definition of VPLC712A4xx



No.	Interface	Details
1	Main Power	Connect to 24V DC power supply
2	IO Power	Connect to 24V DC power supply
	IO OUT	NPN output
3	5V Voltage OUT	5V voltage output, current can be up to 300mA
	IO IN	NPN input
4	MPG	Handwheel interface
5	EtherCAT	EtherCAT Bus interface
6	LAN	Gigabit Ethernet 1 / 2 / 3 / 4

7	HDMI	HDMI displayer interface
8	USB2.0 / 3.0	USD interface
9	COM	RS485 (COM1), RS232 (COM2)
10	Local Axis	Differential pulse axis, encoder, PWM, and analog, for PWM and analog function, only valid in special model.
11	Switch Button	ON / OFF button

➢ Note: VPLC711A2xx has only two 1000M ethernet ports that are used for LAN1 and LAN2.

2.3. IO Interface Specification

Item	Specification	Details
Inner IOs	20+20	20 inputs and 20 outputs (with overcurrent protection).
Max extended IOs	1024 + 1024	It is matched with EtherCAT bus expansion module to expand IO or analog
High-speed input	8	IN0-7, all are high-speed inputs.
High-speed output	20	OUT0-19, all are high-speed outputs.
Latches	4	4 inputs can be configured as latch input, number is IN0-3
Single-ended Encoder	2	Reuse input, No. is IN0-2, IN4-6
PWM	4	4 outputs can be configured as PWM, No. is OUT0-3.
Hardware comparison output	4	4 outputs can be configured as hardware comparison output (PSO function), which are compatible with precision output, number is OUT0-3.
Single-ended pulse output	4	Reuse output, No. is OUT8-15.
IO power input	DC24V	24V DC input, IO needs to be supplied by

		external power independently.
Analog IN	2	12-bit resolution, -10V ~ +10V, not valid in special model.
Analog OUT	2	

2.4. Communication Interface Specification

Item	Specification	Details
LAN	Communication speed 1000Mbps	Standard 1000M Ethernet interface RJ45, it can be configured as EtherCAT.
EtherCAT	Communication speed 100Mbps	Industrial communication EtherCAT master station interface, standard Ethernet interface RJ45.
COM (RS232/ RS485)	Several kinds of Baud rate	Support MODBUS_RTU standard protocol, master station and slave station are valid, default is slave station. And default communication parameters are Baud rate 38400, data bit 8, no parity.
HDMI	Standard interface	Connect to HDMI interface externally to show equipment (some hardware support).
USB2.0 / USB3.0	Standard interface	Both support "plug and then use immediately" and "hot plug in and out", it is compatible with USB2.0.

Notes:

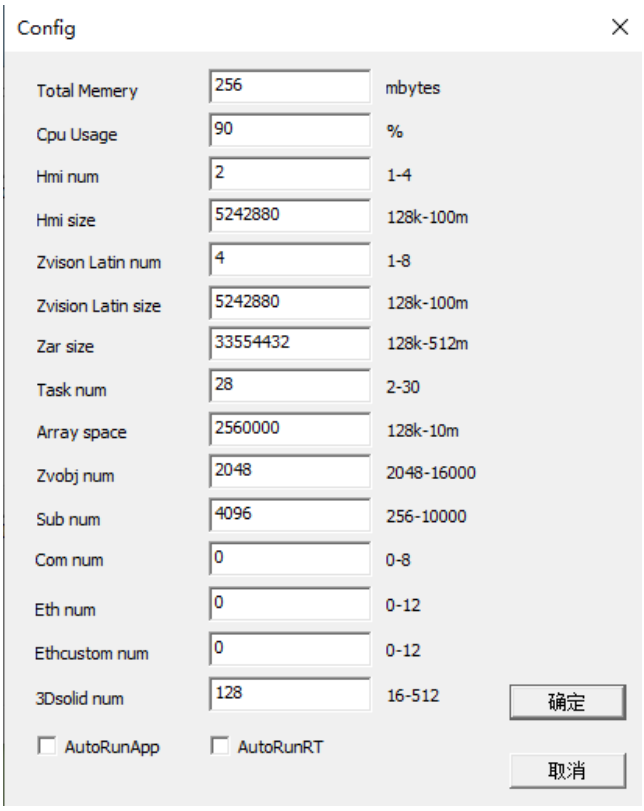
- EtherCAT specialized minimal communication period is 500us, the maximum period is 4000us, the accumulative is 500us, and the max equipment number is 64, EtherCAT bus drive and EtherCAT bus expansion module can be connected.
- LAN Ethernet both can be configured as EtherCAT custom port, the minimal communication period of EtherCAT custom port is 1000us, the maximum is 4000us, the accumulative is 500us, and the max equipment number is 16.

2.5. Config Parameter Specification

Turn on MotionRT software, it can configure parameters specification according to requirements, please see below image, it shows default parameters, information behind the parameter indicates corresponding supported range, after configurated, click (确认)

to save.

When using serial port or ethernet port, configure the number of Com or Eth in this interface, then use.



→Parameter Meaning

Item	Default Specification	Details
Total Memory	256MB	Total memory, including all controller memories that can save data, such as, array space, Zar file size, channel size, hmi resolution, etc., it is better to set the value that is above 200.
Cpu Usage	90%	CPU usage limit
Hmi num	2	Valid Hmi numbers
Hmi size	5242880KB	Resolution of one hmi
ZVision Latin num	4	Vision channel numbers
ZVision Latin size	5242880KB	Single vision channel size
Zar size	33554432KB	Zar file size

Task num	28	Max tasks can be executed
Array Space	25600000KB	Distributed array space
Zvobj num	2048	The number of vision object Zvobject
Sub num	4096	Max sub functions
Com num	0	Serial ports
Eth num	0	The number of PORT net-port, set value should be less than the max value
Ethcustom num	0	The number of customized Ethernet
3Dsolid num	128	3D solid numbers
AutoRunApp	/	Open software automatically when power on
AutoRunRT	/	Run RT software automatically when power on

Chapter III Wiring Communication Configuration & Network

3.1. Switch Button

One switch button on the front board is provided. The machine can be turned on through pressing it when power off, or can be turned off through pressing it when power on.

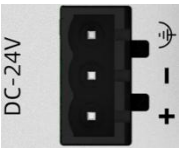
Notes:

(1) Please turn on and off normally. Don't cut down directly and frequently, otherwise, damage the controller hardware.

(2) Usually space 3 minutes between power down and power on. If it can't open normally, please press the controller ON button.

3.2. Main Power Supply

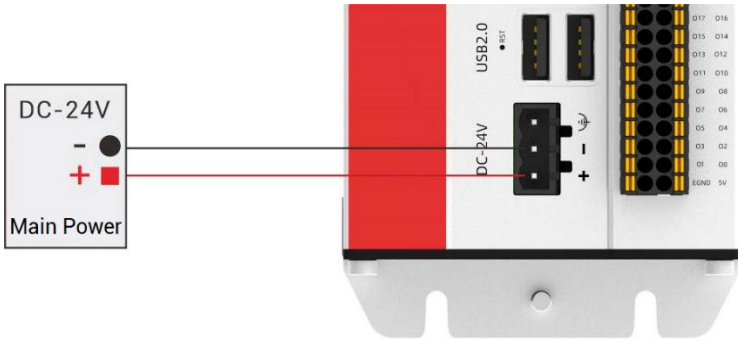
Main power input uses DC24V power supply, it connects through E24V and EGND on IO signal interface.

Interface	Name	Function
	⏚	Safe grounding / shield layer
	-	DC24V main power interface -
	+	DC24V main power interface +
Note: Please separate the main power supply and the external IO power supply DC24V for power supply. It is not recommended to use the same power supply, or use a power supply that can provide two isolated outputs.		

→Power Specification

Main Power	Description
Input Voltage	DC24V
Max Power	>60W
Anti-reverse Connection	YES
Overcurrent Protection	YES
Isolated Power	YES
Cable Type	Recommend 1.0mm^2 copper core cable

→Wiring Reference



3.3. IO Power

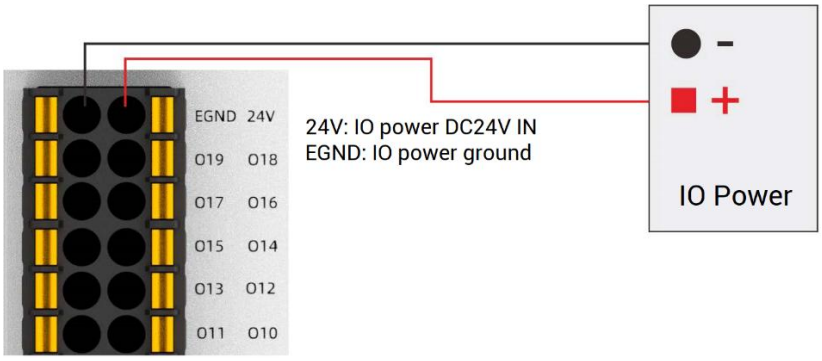
IO power input uses DC24V power supply, it connects through E24V and EGND on IO signal interface.

PIN	Signal	Description
1	24V	IO Power DC24V IN
2	EGND	IO Power Ground
Note: Please separate the main power supply and the external IO power supply DC24V for power supply. It is not recommended to use the same power supply, or use a power supply that can provide two isolated outputs.		

→Power Specification

Main Power	Description
Input Voltage	DC24V (-15%~+20%)
Anti-reverse Connection	YES
Overcurrent Protection	YES
Isolated Power	YES
Cable Type	Recommend 1.0mm^2 copper core cable

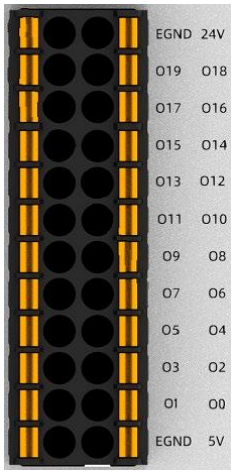
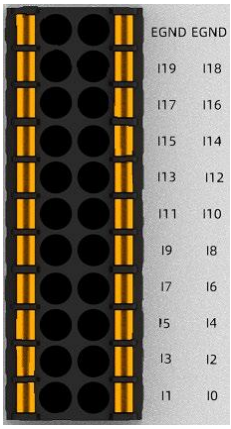
→Wiring Reference



3.4. IO Signal Interface

There are 20 inputs and 20 outputs (both are NPN type). If these are not enough, you can expand more. For IO, please connect one 24V DC power supply externally.

Terminal	Signal	Type	Description	Notes
	5V	/	5V power output, max 300mA	Supply the power for external devices.
	EGND	/	5V power ground / IO public end	
	OUT0	NPN type, high-speed output	OUT 0, PWM 0	**OUT all** are high-speed outputs.
	OUT1		OUT 0, PWM 1	
	OUT2		OUT, PWM 2	
	OUT3		OUT, PWM 3	**OUT0-3** can

	OUT4		OUT 4	be configured as PWM out and they support hardware comparison output / precision output. **OUT8-15** can be configured as 4 pulse outputs.
	OUT5		OUT 5	
	OUT6		OUT 6	
	OUT7		OUT 7	
	OUT8		OUT 8, Single-ended DIR3	
	OUT9		OUT 9, Single-ended PUL3	
	OUT10		OUT 10, Single-ended DIR2	
	OUT11		OUT 11, Single-ended PUL2	
	OUT12		OUT 12, Single-ended DIR1	
	OUT13		OUT 13, Single-ended PUL1	
	OUT14		OUT 14, Single-ended DIR0	
	OUT15		OUT 15, Single-ended PUL0	
	OUT16		OUT 16	
	OUT17		OUT 17	
	OUT18		OUT 18	
	OUT19		OUT 19	
	24V	/	IO power DC24V input	IO needs to be powered separately.
	EGND	/	IO power ground / IO public end	
	IN0	NPN type, high-speed input	IN 0, Latch R0, EA0	**IN 0-7** all are high-speed inputs. **IN0-3** can be configured as latch IN. **IN0-2 and 4-6** can be configured as 2 encoder IN.
	IN1		IN 1, Latch R1, EB0	
	IN2		IN 2, Latch R2, EZ0	
	IN3		IN 3, Latch R3	
	IN4		IN 4, EA1	
	IN5		IN 5, EB1	
	IN6		IN 6, EZ1	
	IN7		IN 7	
	IN8	NPN type, low-speed input	IN 8	**IN8-19** are normal IN, which can be connected to button, switch and others.
	IN9		IN 9	
	IN10		IN 10	
	IN11		IN 11	
	IN12		IN 12	
	IN13		IN 13	
	IN14		IN 14	

	IN15		IN 15	
	IN16		IN 16	
	IN17		IN 17	
	IN18		IN 18	
	IN19		IN 19	
	EGND	/	IO public end	/
	EGND	/	IO public end	/

Descriptions:

(1) only 24V encoder can be used. Max pulse frequency of encoder 0 and encoder 1 is 100kHz, which can connect to high-speed encoder.

(2) No. after pulse output and encoder input are default axis No., ATYPE command can switch the IO port and determine whether the IO is normal IO (target axis' ATYPE = 0 means normal IO, ATYPE = 1 means pulse output, ATYPE = 3 means encoder input, ATYPE = 4 means pulse output + encoder input).

3.5. IN Digital Input Interface

→Specification

Item	High-Speed IN	Low-Speed IN
Channels	8 (IN0-IN7)	12 (IN8-IN19)
In Method	NPN Type	NPN Type
IN Frequency	≤100kHz	≤5kHz
IN Voltage Level	DC24V (-15%~+20%)	DC24V (-15%~+20%)
IN Current (typical value)	6.8mA	4.8mA
IN ON Voltage	<15V	<14.5V
IN Min Current	2.3mA	1.8mA
IN Impedance	3.3KΩ	4.7KΩ
Isolation Method	Capacitive Isolation	Optical Isolation
Respond Time	<10ms	<10ms

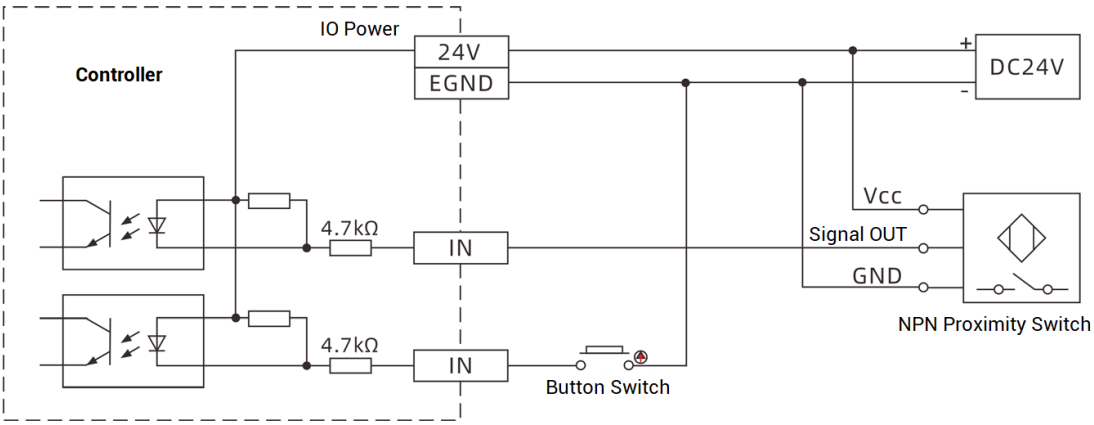
Descriptions:

(1) There are high-speed and low-speed inputs.

(2) Above parameters are typical values when the controller IO power voltage is 24V (24V terminal).

→Wiring

General IN Wiring: (for single-ended encoder axis wiring reference, please refer to "Single-Ended Axis Interface" Chapter)



Notes:

- The digital input wiring is as shown above. The external load can be a key switch or sensor, etc., and the signal specifications must be matched.
- It is recommended that the load and the controller use the same power supply, otherwise the negative poles of the two power supplies must be connected.
- When wiring on site, pay attention to the distance between the strong power supply and the strong power supply, which is recommended to be more than 30cm.
- It should be noted that the grounding of the controller should be good, and the grounding of the housing should be connected to the standard factory ground pile.

→How to Use

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

(2) After powered on, please select "PCI / Local" to connect controller 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 “ZBasic" for details.

(4) Latch function can be set and triggered through “REGIST", “REG_POS", “REG_INPUTS" instructions.

(5) Axis positive and negative position limit signals / origin signal are set by “FWD_IN", “REV_IN", “DATUM_IN" commands.

(6) Above commands and other related commands all can be referred by “RTBasic Program Manual".

3.6. OUT Digital Output Interface

→Specification

Item	High Speed Output
Channels	16 (OUT0-OUT19)
Output mode	Transistor NPN type, OD Output
Frequency	≤400kHz
Voltage level	DC24V
Max output current	+300mA
Max leakage current when off	25μA
Respond time to conduct	1μs (resistive load typical value)
Respond time to close	3μs
Isolation method	Capacitive Isolation
Overcurrent protection	YES, action current 600mA
Respond Time	<0.5ms

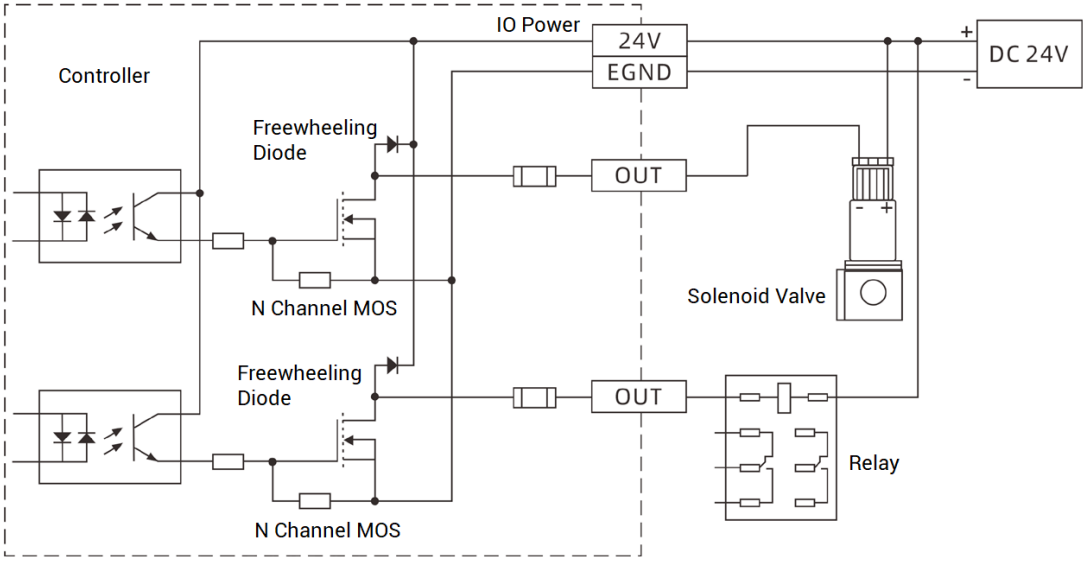
Notes:

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

✧ Due to the leak-type output, the shutdown of the output will be obviously affected by the external load circuit, and the output frequency should not be set too high in the application.

→Wiring

General OUT Wiring: (for single-ended encoder axis wiring reference, please refer to "Single-Ended Axis Interface" Chapter)



Notes:

- The digital output wiring is as shown above. The external load can be a relay or solenoid valve, etc., and the signal specifications must be matched.
- It is recommended that the load and the controller use the same power supply, otherwise the negative poles of the two power supplies must be connected.
- When wiring on site, pay attention to the distance between the strong power supply and the strong power supply, which is recommended to be more than 30cm.
- It should be noted that the grounding of the controller should be good, and the grounding of the housing should be connected to the standard factory ground pile.

→How to Use

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

(2) After powered on, please select "PCI / Local" to connect controller to RTSys.

(3) State values of relative input ports can be read directly through "OP" command, also, it can be read through "RTSys/Tool/Op". Please refer to "ZBasic" for details.

(4) For PWM function, frequency and duty cycle can be set through "PWM_FREQ", "PWM_DUTY" instructions.

(5) For hardware comparison output function, which can be opened by "HW_PSWITCH2".

(6) When it is as pulse axis, configuration is same as AXIS. For details, please refer to "2.6 Single-Ended" – "Usage".

(7) Above commands and other related commands all can be referred by "RTBasic Program Manual".

3.7. Single-Ended Axis Interface

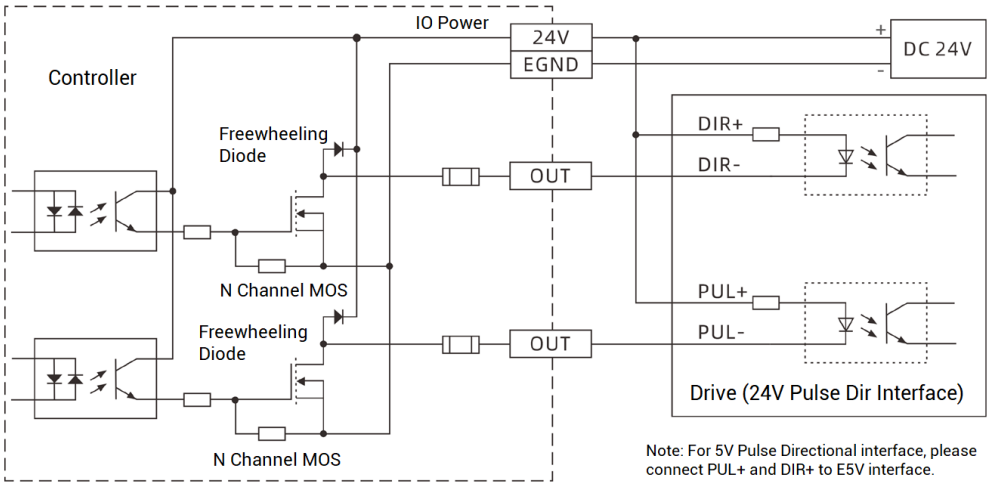
Single-ended pulse output interface and single-ended encoder input interface are distributed in IO signal interface. For details, please refer to "IO Signal Interface".

→Specification

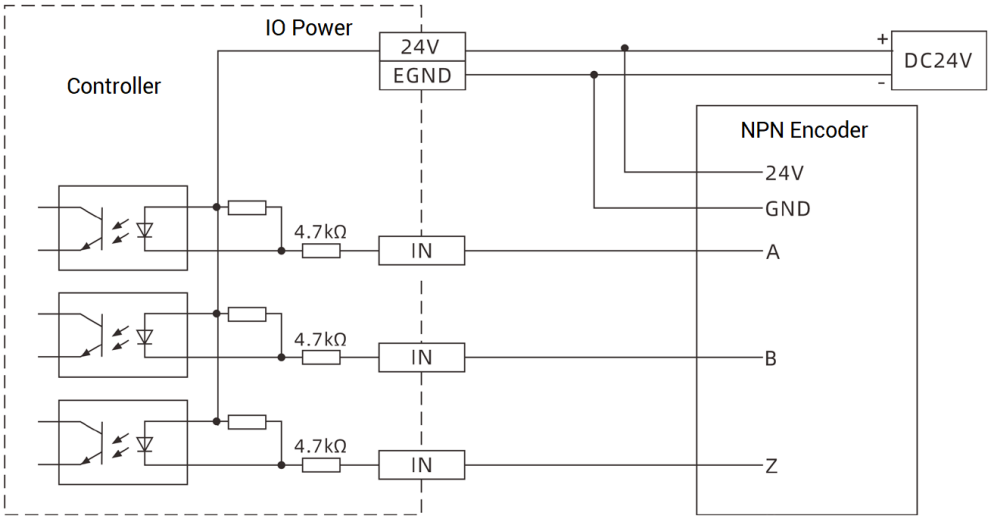
Item	Description
Pulse / Directional (PUL/DIR) Signal Type	Single-ended output signal
Pulse / Directional (PUL/DIR) Signal Voltage Range	0-24V
Pulse / Directional (PUL/DIR) Signal Max Frequency	<500kHz
Encoder (A/B/Z) Signal Type	Single-ended input signal
Encoder (A/B/Z) Signal Voltage Range	0-24V
Encoder (A/B/Z) Signal Max Frequency	<100kHz
Isolation	YES

→Wiring

"Single-Ended Pulse Wiring Reference (Take OUT14 & OUT15 as example)":



"Single-Ended Encoder Wiring Reference (Take IN0 & IN1 & IN2 as example)":



Notes:

- For local axis interface, please refer to above wiring. Different drives are with different methods, please connect carefully.
- For 5V drive pulse directional interface, please connect drive PUL+ and DIR+ to E5V.
- Please use shieled twist pair (STP), especially for bad environment, make sure the shield layer be grounded fully.

→How to Use

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

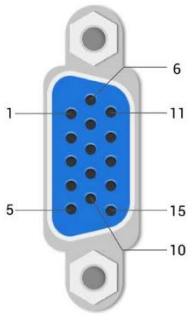
(2) After powered on, please select "PCI / Local" to connect controller to RTSys.

(3) Set axis parameters, such as, ATYPE, UNITS, SPEED, ACCEL, FWD_IN, REV_IN, etc., and do remapping for axis No. through AXIS_ADDRESS command. For enable and line motion, please use AXIS_ENBALE and MOVE commands.

(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".

(5) Above commands and others all can be referred by "RTBasic Program Manual".

3.8. MPG Handwheel Interface

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 A (IN20)
	3	H-B	Encoder signal B (IN21)
	4	H-EMGN	Emergency stop signal (IN31)
	5	NC	Spare (reserved)
	6	H-X1	Select the ration as X1 (IN22)
	7	H-X10	Select the ration as X10 (IN23)
	8	H-X100	Select the ration as X100 (IN24)
	9	H-S4	Select axis 3 (IN28)
	10	H-S5	Select axis 4 (IN29)
	11	EGND	5V power output -, signal pubic end
	12	H-S6	Select axis 5 (IN30)
	13	H-SZ	Select axis 2 (IN27)
	14	H-SY	Select axis 1 (IN26)
	15	H-SX	Select axis 0 (IN25)

Notes:

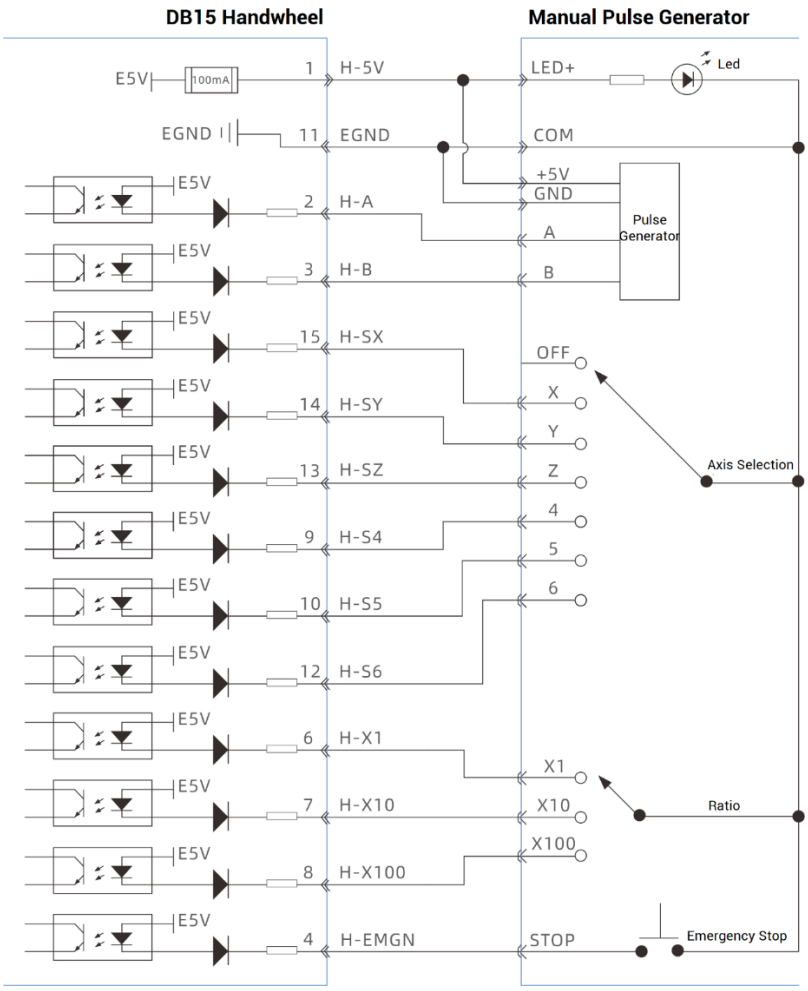
- H-5V power output is only used for handwheel power, please don't use for others.
- All signals in this interface are digital input signals, the No. is IN (20-31).

- H-A/H-B corresponding encoder IN are AXIS3 by default. When reading handwheel data, set ATYPE (3) = 3 / 6, then, MPOS(3) data means the handwheel data. if you need to map it to other axes, in software configuration, please remap, then use for others.

→Specification

Item	IN (16-27)
IN Method	NPN Type (trigger by low electric level)
IN Frequency	<5kHz
IN Impedance	510Ω
IN Voltage	≤24V
Communication Isolation	YES
H-5V OUT Current	≤100mA

→Wiring



Notes:

- 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.
- When wiring on site, pay attention to the distance between the strong power supply and the strong power supply, which is recommended to be more than 30cm.
- It should be noted that the grounding of the controller should be good, and the grounding of the housing should be connected to the standard factory ground pile.

→How to Use

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

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

(3) Configure axis No., this controller's default handwheel interface axis No. is 2. ATYPE command can set as encoder type.

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

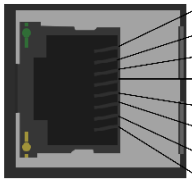
(5) When completed above steps, it needs to set basic axis parameters of handwheel axis and connected axis, then you can use.

(6) Above commands and other related commands all can be referred by "RTBasic Program Manual".

3.9. EtherCAT Bus Interface

VPLC712 motion controller has a 100M EtherCAT communication interface, and it supports EtherCAT bus protocol. In addition, EtherCAT driver or EtherCAT expansion module can be connected.

→ Interface Definition

<table>
<tr><th colspan="3">PIN</th><th>Item</th><th>Description</th></tr>
<tr><td colspan="3" rowspan="6"> 
<table>
<tr><th>PIN</th><th>Signal</th><th>Description</th></tr>
<tr><td>1</td><td>TX+</td><td>Send signal (+)</td></tr>
<tr><td>2</td><td>TX-</td><td>Send signal (-)</td></tr>
<tr><td>3</td><td>RX+</td><td>Receive signal (+)</td></tr>
<tr><td>4</td><td>NC</td><td>Reserved</td></tr>
<tr><td>5</td><td>NC</td><td>Reserved</td></tr>
<tr><td>6</td><td>RX-</td><td>Receive signal (-)</td></tr>
<tr><td>7</td><td>NC</td><td>Reserved</td></tr>
<tr><td>8</td><td>NC</td><td>Reserved</td></tr>
</table></td><td>Communication Protocol</td><td>EtherCAT</td></tr>
<tr><td>Communication Velocity</td><td>100Mbps</td></tr>
<tr><td>Refresh Period</td><td>Max 500us</td></tr>
<tr><td>Communication Cable</td><td>Super 5e STP</td></tr>
<tr><td>Cable Length</td><td>Best <50m</td></tr>
</table>

Note: there are 2 LED on RJ45, they are network Link and data transferring (Transmit). When the network connects normally, for LINK Led, it is ON Green all the time. When there is data transferring, Transmit led is shrinking Yellow.

→ Wiring

When connects to EtherCAT drives or other slave stations, using one super 5e STP cable to connect to slave station's EtherCAT IN. Then, use this slave station's EtherCAT OUT to next slave's EtherCAT IN.

"Ethernet LED"

LED & State	ON Always	Shrink
Green	Build 100M Communication	During sending & receiving data
Yellow	Build 1000M Communication	During sending & receiving data

Notes:

- Please use STP, especially in bad environments, and make sure the shielding layer is

fully grounded.

- When wiring on site, pay attention to the distance between the strong power supply and the strong power supply, which is recommended to be more than 30cm.
- It should be noted that the grounding of the controller should be good, and the grounding of the housing should be connected to the standard factory ground pile.

→How to Use

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

(2) After powered on, please select "PCI / Local" to connect to RTSys.

(3) Connect to drive device through EtherCAT:

--use "SLOT_SCAN" command to scan the slot No. on the bus.
--use "AXIS_ADDRESS" command to map axis No., you can refer to 3.2 EtherCAT Expansion & Resource Mapping.
--use "SLOT_START" command to open the bus or use "SLOT_STOP" command to close the bus.
--after that, configure and operate the local pulse axis.

(4) Connect to expansion module through EtherCAT

--use "SLOT_SCAN" command to scan the slot No. on the bus.
--use "AXIS_ADDRESS" command to map axis No., and use "NODE_IO/NODE_AIO" command to map IO No., you can refer to 3.2 EtherCAT Expansion & Resource Mapping.
--use "SLOT_START" command to open the bus or use "SLOT_STOP" command to close the bus.
--after that, operate same as local IO and axis.

(5) Slot No. node information can be known by "RTSys-Controller-Controller State—Slot0Node".

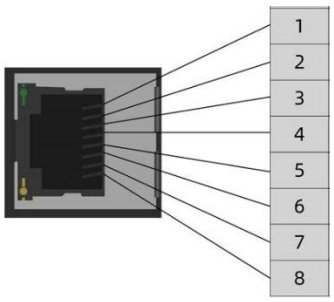
(6) Above commands and other related commands all can be referred by "RTBasic Program Manual".

3.10. LAN Ethernet

There are multiple 1000M ethernet on VPL712 series board, and standard RJ45 interface is used.

Ethernet supports EtherCAT bus interface configuration.

→Interface Definition

Ethernet	PIN	100BASE Signal	1000BASE Signal
	1	TX+	TRD0+
	2	TX-	TRD0-
	3	RX+	TRD1+
	4	NC	TRD2+
	5	NC	TRD2-
	6	RX-	TRD1-
	7	NC	TRD3+
	8	NC	TRD3-

Note:

1. There are 2 LED lights on RJ45, which represent ethernet Link and data transmission (Transmit). When ethernet is connected normally, Link led is ON in green.
2. When data transmission is in 100M, Transit led is shrinking in green. When it is 1000M, Transit led is shrinking in orange.

→Specification

Item	Specification
Ethernet type	1000BASE-T/100BASE-TX/10BASE-T
Transmission Speed	1000Mbps/100Mbps/10Mbps
Max cable distance	100m/segment
Ethernet card type	Intel® Ethernet Controller

Note: when transmission speed is 1000Mbps, the ethernet cable should be above CAT 5e at least.

→ Wiring

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.

"Ethernet LED"

LED & State	ON Always	Shrink
Green	Build 100M Communication	During sending & receiving data
Yellow	Build 1000M Communication	During sending & receiving data

Notes:

- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.
- When wiring on site, pay attention to the distance between the strong power supply and the strong power supply, which is recommended to be more than 30cm.
- It should be noted that the grounding of the controller should be good, and the grounding of the housing should be connected to the standard factory ground pile.

→How to Use

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

(2) After powered on, please select "Ethernet" to connect to RTSys.

(3) The controller IP can be modified through the "IP_ADDRESS" command. Note that the controller IP address and the PC IP address should be in the same network segment.

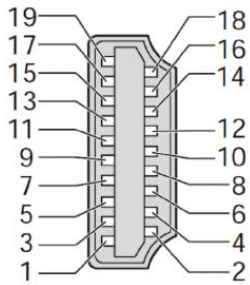
(4) Support custom network port communication. You can use the "OPEN #" command to customize network port communication, the "CLOSE #" command to close the

custom network port communication, and the "GET #" command to read/store data from the custom network port channel;

(5) Above commands and other related commands all can be referred by “RTBasic Program Manual".

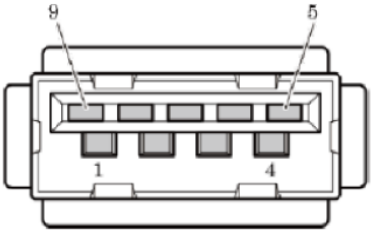
3.11. HDMI Interface

There is one standard HDMI high-definition multimedia displayer interface, which is used to touch screen.

Interface	PIN	Signal	PIN	Signal
	1	TMDS DATA 2+	11	TMDS CLOCK SHIELD
	2	TMDS DATA 2 SHIELD	12	TMDS CLOCK -
	3	TMDS DATA 2-	13	CEC
	4	TMDS DATA 1+	14	N.C.
	5	TMDS DATA 1 SHIELD	15	DDC CLOCK
	6	TMDS DATA 1-	16	DDC DATA
	7	TMDS DATA 0+	17	GND
	8	TMDS DATA 0 SHIELD	18	+5V PWR
	9	TMDS DATA 0-	19	HOT PLUG DETECT
	10	TMDS CLOCK+		

3.12. USB Interface

They are USB3.0 interfaces, and they can be compatible with USB2.0. They are mainly used to insert U disk, mouse, keyboard, and other equipment.

Interface	PIN	Signal
	1	VCC5
	2	DATA-
	3	DATA+
	4	GND
	5	SSRX-

	6	SSRX-
	7	GND
	8	SSTX-
	9	SSTX+

→Specification

Item	Description	Description
Communication Protocol	USB2.0	USB3.0
Communication Speed Ratio	≤12Mbps	≤5.0Gbps
Isolative	NO	NO

→How to Use

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

(2) After powered on, please select “Ethernet / Serial Port” to connect to RTSys.

(3) Insert the USB flash drive into the UDISK port, the USB flash drive connection success indicator will light up, and the "U_STATE" command can be used to determine the USB flash drive status to ensure subsequent operations after successful communication.

(4) The commands in the FILE series can be used to implement a series of operations such as firmware upgrades, data copying and deletion.

(5) Above commands and other related commands all can be referred by “RTBasic Program Manual”.

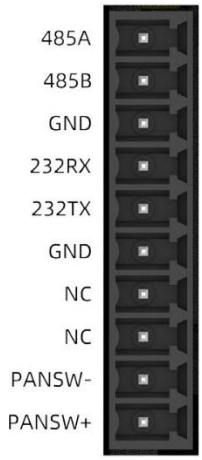
3.13. COM Serial Port

Before using, it needs to set numbers in MotionRT software's “Config” window – “com num” and other related parameters.

Use MODBUS_RTU standard protocol by default, at the same time, it can configure as no-

protocol mode, using custom communication.

Both support configure as master station or slave station.

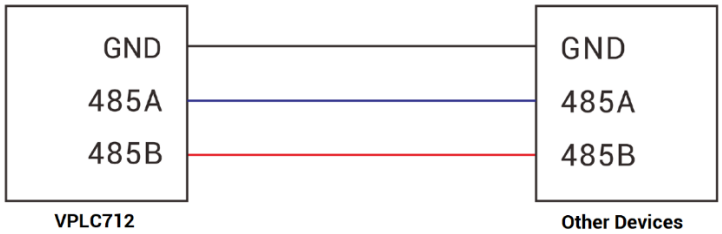
COM	Name	Function
	485A	RS485 communication signal line + / A port
	485B	RS485 communication signal line - / B port
	GND	Communication Public End
	232RX	RS232 communication RX signal port
	232TX	RS232 communication TX signal port
	GND	Communication Public End
	NC	Spare
	NC	Spare
	PANSW-	Remote Switch Button Interface -
	PANSW+	Remote Switch Button Interface +
Description: you can install one switch on PANSW terminal to achieve remote switch.		

→Specification

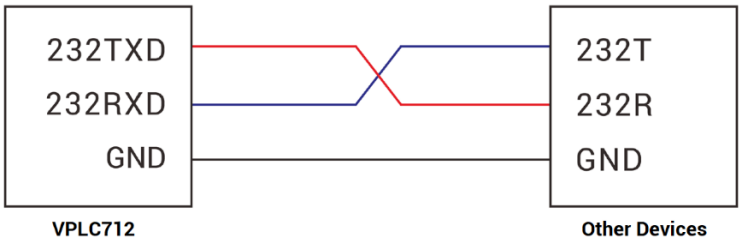
Item	RS485	RS232
Communication Velocity	≤115200	≤115200
Terminal Resistor	120ohm	NO
Topology Structure	Daisy Chain Structure	Connect (1 to 1)
Nodes can be extended	≤127	1
Wiring Length	Recommend <30m	Recommend <5m
Communication Isolation	YES	YES

→Wiring

"RS485" Wiring:



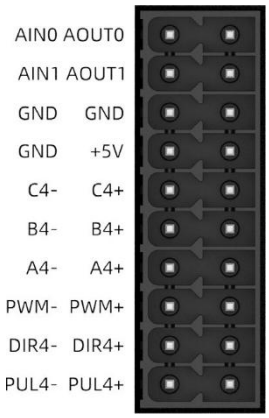
"RS232" Wiring:



Notes:

- As above, the daisy chain topology is used for RS485 wiring (the star topology structure cannot be used). The shorter between nodes, the better.
- 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.
- No need to the 120Ω terminal resistor for RS485 point to point connection. But when there are many nodes, you can 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/RS485/RS232 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 30cm.
- 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.

3.14. Local Axis / Analog / PWM

Interface	Function 1	Description 1	Function 2	Description 2
	PUL4+	Differential Pul OUT +	A5+	Differential A IN +
	PUL4-	Differential Pul OUT -	A5-	Differential A IN -
	DIR4+	Differential Dir OUT +	B5+	Differential B IN +
	DIR4-	Differential Dir OUT -	B5-	Differential BIN -
	PWM+[1]	PWM OUT +	C5+	Differential C IN +
	PWM-[1]	PWM OUT -	C5-	Differential C IN -
	PUL5+	Differential Pul OUT +	A4+	Differential A IN +
	PUL5-	Differential Pul OUT -	A4-	Differential A IN -
	DIR5+	Differential Dir OUT +	B4+	Differential B IN +
	DIR5-	Differential Dir OUT -	B4-	Differential BIN -
	PWM+[1]	PWM OUT +	C4+	Differential C IN +
	PWM-[1]	PWM OUT -	C4-	Differential C IN -
	+5V	Differential Signal 5V Common Anode Port	+5V	Differential Signal 5V Common Anode
	GND	Differential Signal Public End / Analog Public End	GND	Differential Signal Public End / Analog Public End
	GND		GND	
	GND		GND	
	AOUT1[2]	Analog OUT AOUT (1)	-	-
	AIN[2]	Analog OUT AIN (1)	-	-
	AOUT0[2]	Analog OUT AOUT (0)	-	-
	AIN0[2]	Analog OUT AIN (0)	-	-
Description: +5V power output is used for PWM / single-ended axis common anode wiring, it is small power, don't use for others. And red [1] [2] mean it needs the special version. Please confirm before order.				

→Specification

"Local Axis":

Signal	Item	Description
PUL+/PUL- DIR+/DIR-	Signal Type	Differential OUT Signal
	Signal Voltage Range	0-5V

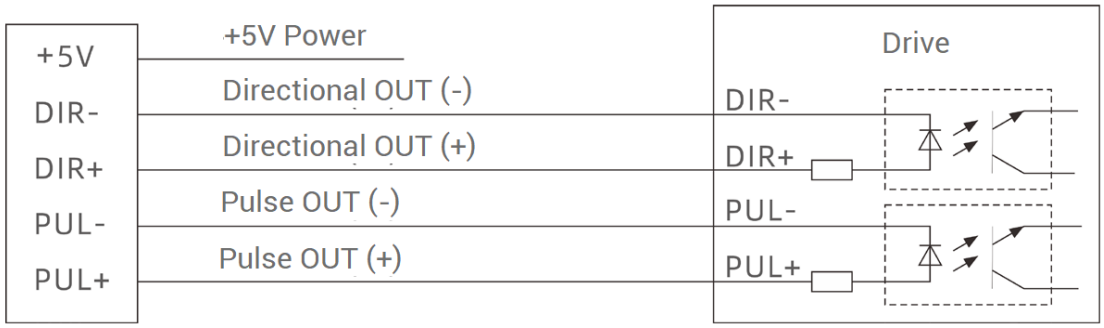
	Signal Max Frequency	10MHz
	Isolation Method	Non-isolation
A+/A- B+/B- C+/C-	Signal Type	Differential IN Signal
	Signal Voltage Range	0-5V
	Signal Max Frequency	10Mbps
+5V	Max OUT Current of 5V Power	50mA

"Analog Specification":

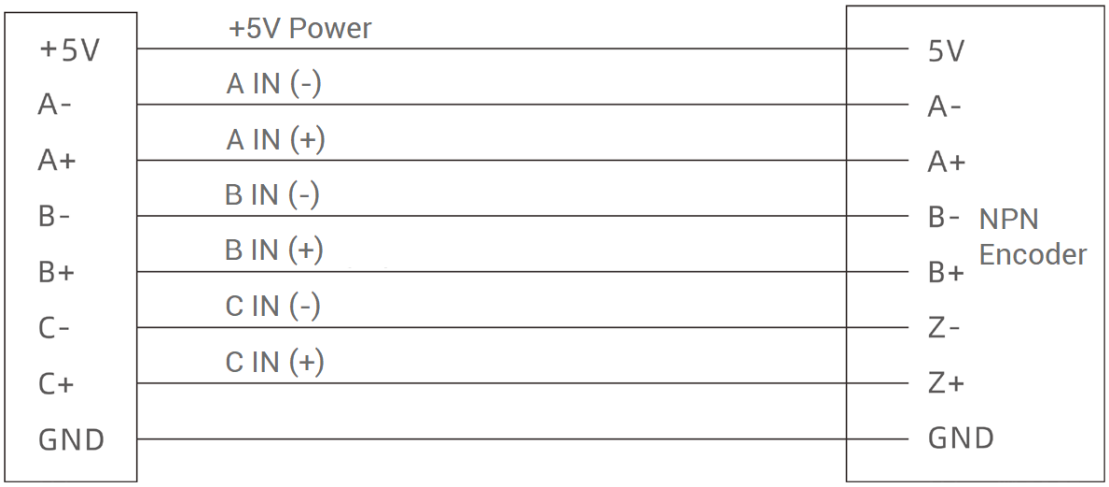
Signal	AIN (0-1)	AOUT (0-1)
Resolution	12-Bit	12-Bit
Data Range	0-4095	0-4095
Signal Range	-10V~+10V	-10V~+10V
Data Rate	>1ksps (sampling rate)	>1ksps (refresh rate)
IN Impedance / OUT Load	>40KΩ (IN Impedance)	>10KΩ (Load Needs)
Signal Type	Single-Ended Type	Single-Ended Type
Wiring Length	Recommend <5 meter	Recommend <5 meter

→Wiring (Axis)

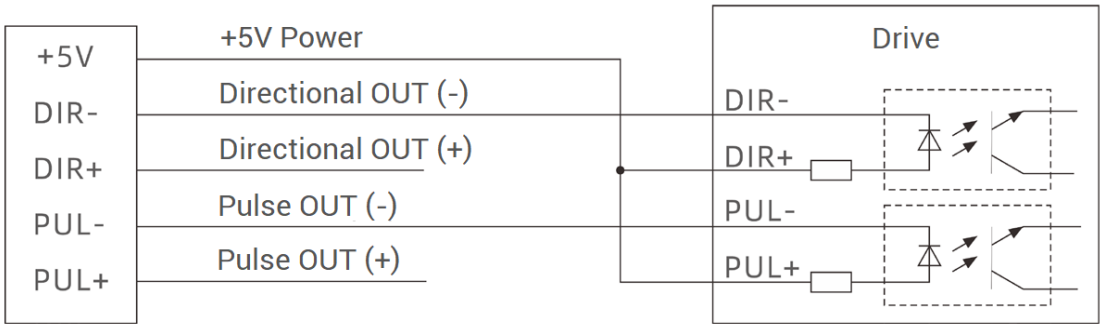
"Differential Pulse Axis Wiring":



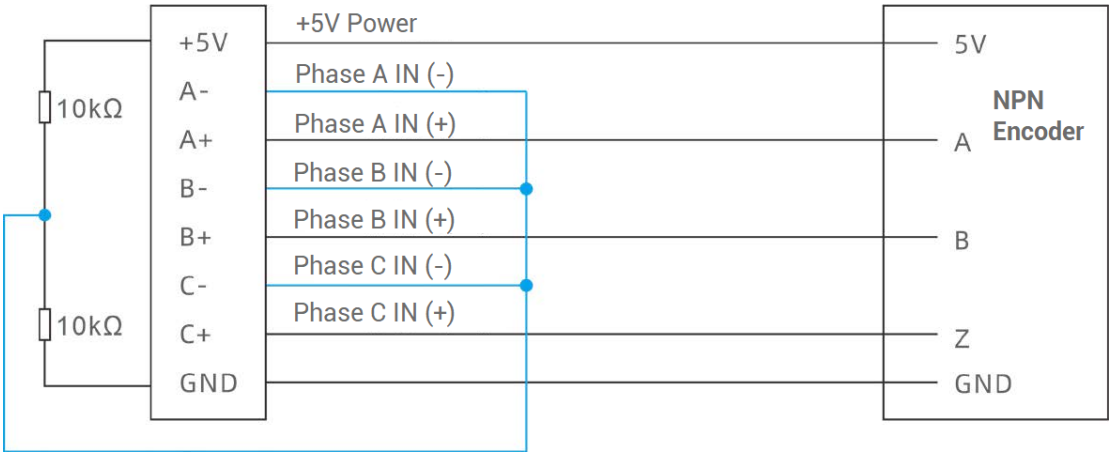
"Differential Encoder Axis Wiring":



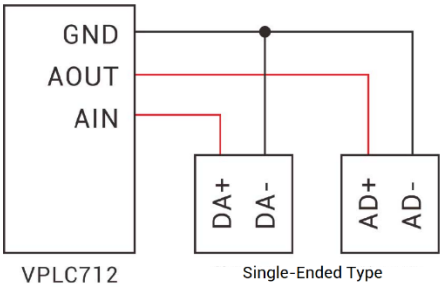
"Single-Ended Pulse Axis Wiring":



"Single-Ended Encoder Axis Wiring":



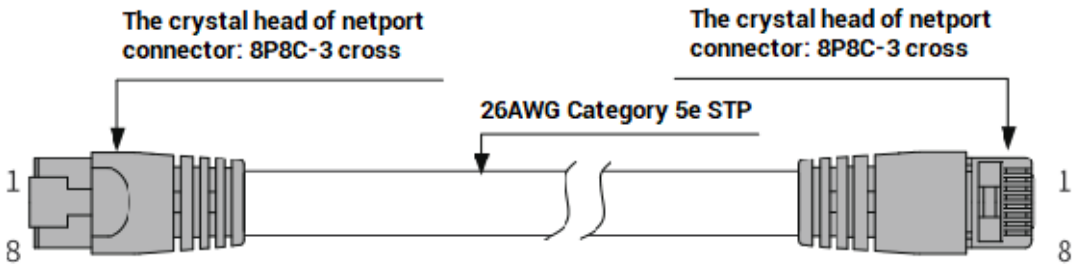
→Wiring (Analog)



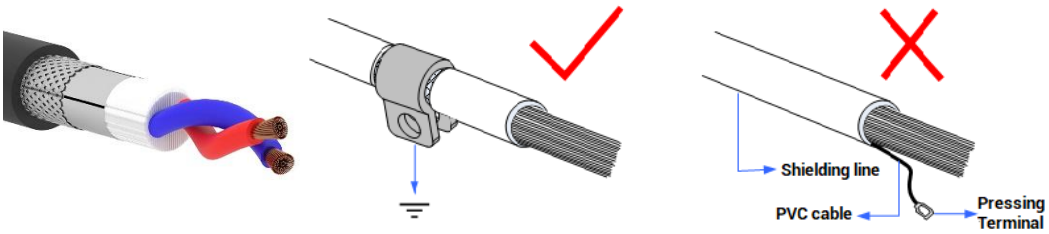
3.15. Wiring Requirements

→Cable Material Requirements

(1) 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:



(2) For serial port, it uses shielded twisted pair, and the shielded cable is grounded.

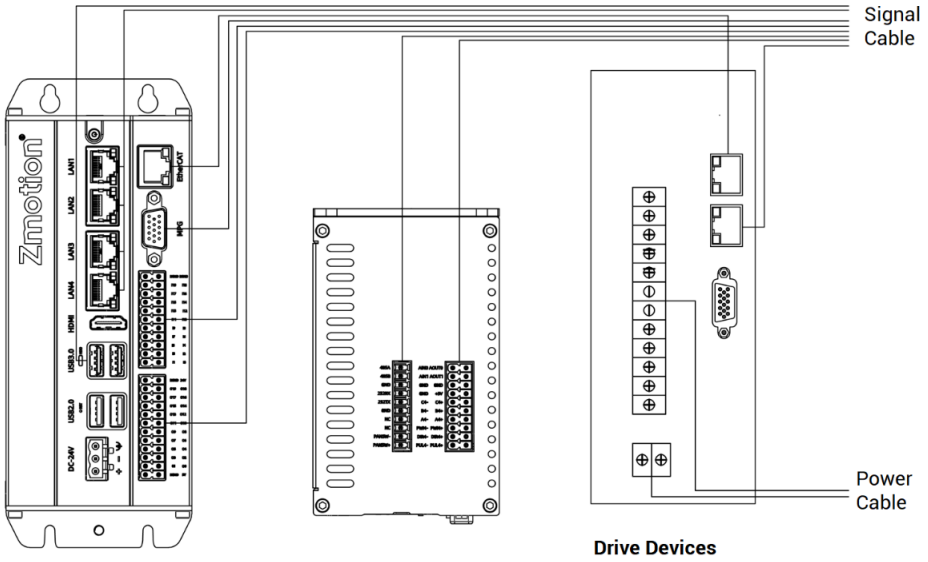


(3) HDMI use the cable material with good quality.

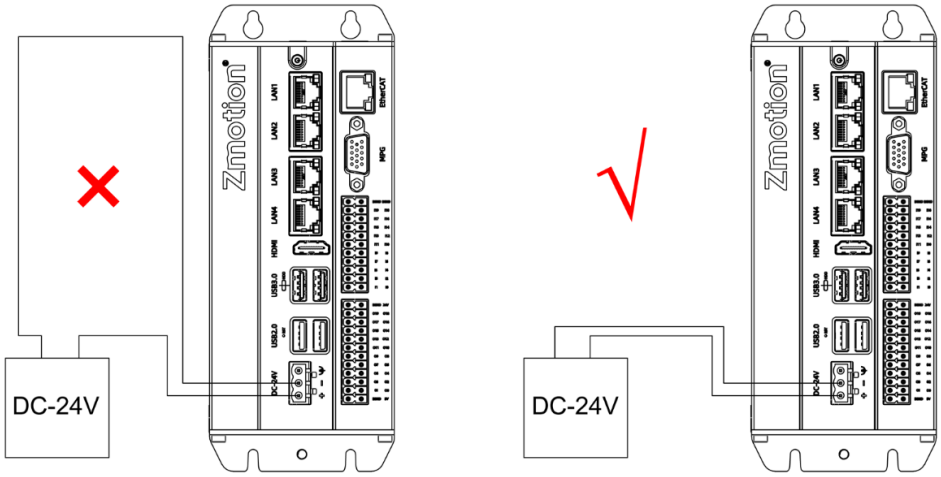
(4) Please select high-power wire for the power cord. In a harsh environment, a filter or a magnetic ring should be added between the power supply and the controller, where is close to the power supply of the controller.

→Wire-Arrangement Requirements

(1) Signal lines and power lines should be routed separately, try to adjust the position of controllers and drivers in the cabinet, and distribute signal lines and power lines in different areas.



(2) The positive and negative lines of the power line are routed in parallel to avoid interference caused by a large loop area.



→Wiring Requirements

(1) For the cable with shielding layer, both ends of the shielding layer should be connected to GND.

(2) The power supply should have a wire connected to the earth.

Chapter IV EtherCAT Expansion

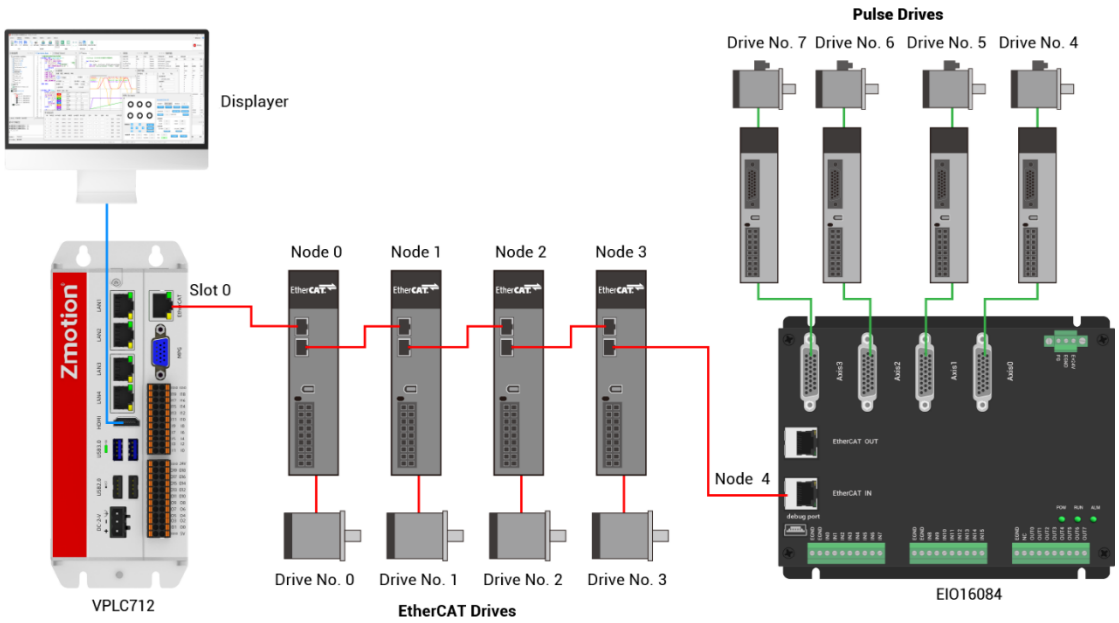
The vision motion controller can expand digital IO, analog AD/DA, pulse axis and other resources through EtherCAT bus expansion modules: EIO series & ZMIO310-ECAT series.

4.1. EtherCAT Bus Expansion Wiring

When wiring, use a Category 5e shielded twisted pair cable to connect the controller EtherCAT port to the EtherCAT IN port of the subsequent expansion device, and then use the EtherCAT OUT port of the expansion device to connect to the EtherCAT IN port of the subsequent slave device to achieve multi-level expansion;

After the expansion wiring is completed, each EIO expansion module does not require secondary development, and can be accessed after mapping the expansion module IO number and axis number in the EtherCAT master controller.

EIO expansion module wiring reference example:



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

Slot number (slot):

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

Device number (node):

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

Drive number:

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

The drive number is different from the device number. Only the drive device number on the slot is assigned, and other devices are ignored. The drive number will be used when mapping the axis number.

4.2. EtherCAT Bus Expansion Resource Mapping

→ IO Mapping:

The IO number of the EtherCAT bus expansion module is set through the bus instructions "NODE_IO" and "NODE_AIO".

Before IO mapping, check the maximum IO number of the controller (including general IO interface and dedicated IO interface), and then specify the expansion IO number in turn. The IO numbers on the bus must not overlap, otherwise the two will work at the same time.

Digital IO mapping Example:

```
NODE_IO(0,0)=32          'Set the IO starting number of device 0 to 32
```

Analog IO mapping Example:

```
NODE_AIO(0,0,3)=3        'Set the AIN starting number of device 0 to 3
```

For detailed instructions, see "RTBasic Program Manual".

→ AXIS Mapping:

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

Axis mapping syntax:

AXIS_ADDRESS(axis number)=(slot number<<16)+driver number+1

Example:

AXIS_ADDRESS(6)=(0<<16)+0+1

'the first drive on the EtherCAT bus, drive number 0, bound as axis 6

AXIS_ADDRESS(7)=(0<<16)+1+1

'the second drive on the EtherCAT bus, drive number 1, bound as axis 7

For detailed instructions, see "RTBasic Program Manual".

→ Check Expanded Resources

In RTSys, controller" - "State the controller" - "ZCanNodes" displays the expansion module information and the extended IO number range.

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

For detailed instructions, see "RTBasic Program Manual".

Chapter V Optional Configuration

5.1. Heat Cooling Fan

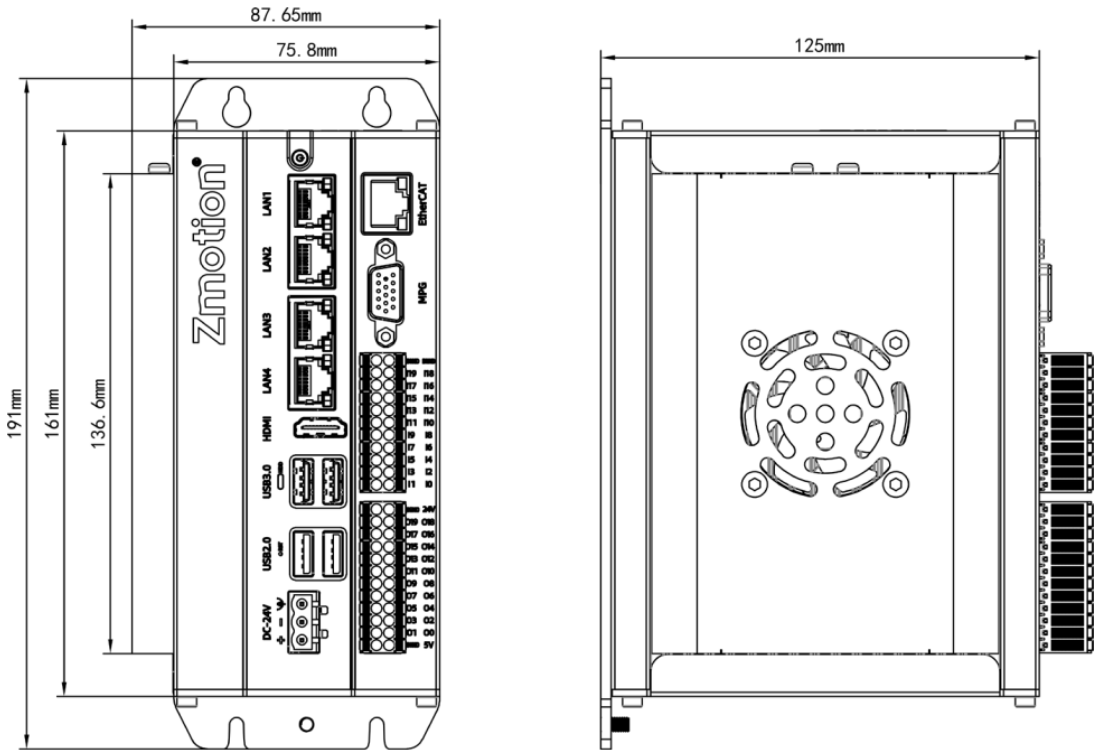
Fan cooling module (VPLC712-4V) means the external heat cooling fan, which uses DV24V power supply, and it can achieve auto ON & OFF through the temperature-control switch: when the temperature reached 45℃ (±3℃), it will start cooling; when the temperature is about 30℃ (±5℃), it will stop running.

Note: you could order ad needed.

➢ Appearance

The fan is installed in the side of the Heat sink, please see below:

➢ Installment Size (with Fan)

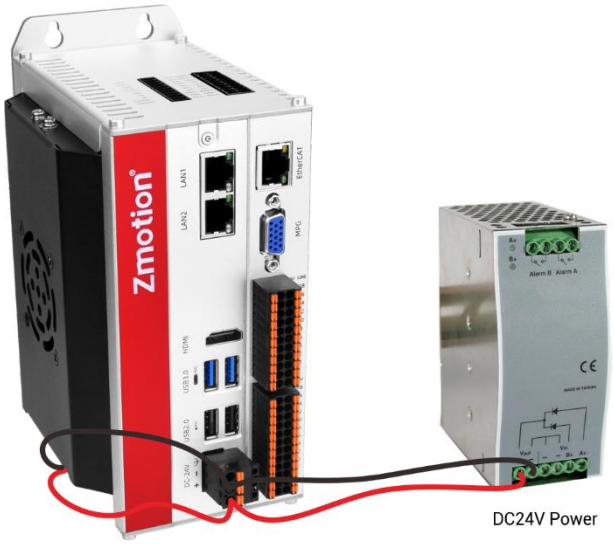


➢ Installment Steps

Step 1: please firmly insert the clip at the rear of the fan into the groove of the heat sink and then place it firmly.

Step 2: after laying it flat, use a screwdriver to tighten the screws on the other side to ensure that the fan is securely stuck and prevent it from falling off.

Step 3: after that, connect fan power cable to DC24V power, the fan will work normally.



Chapter VI Installation Requirements

6.1. Installation Environment

Environment temperature: the ambient temperature has a great impact on the life of the device, and the operating environment temperature of the device is not allowed to exceed the allowable temperature range (-10°C to 55°C).

Please install it in a place that is not easy to vibrate. Vibration should not be greater than 4.9m/s^2. Take special care to stay away from equipment such as punch presses.

Avoid placing in direct sunlight, humidity, and water drops.

Avoid installing in places with corrosive, flammable and explosive gases in the air.

Avoid installing in places with oil and dust, the pollution level of the installation place is PD2.

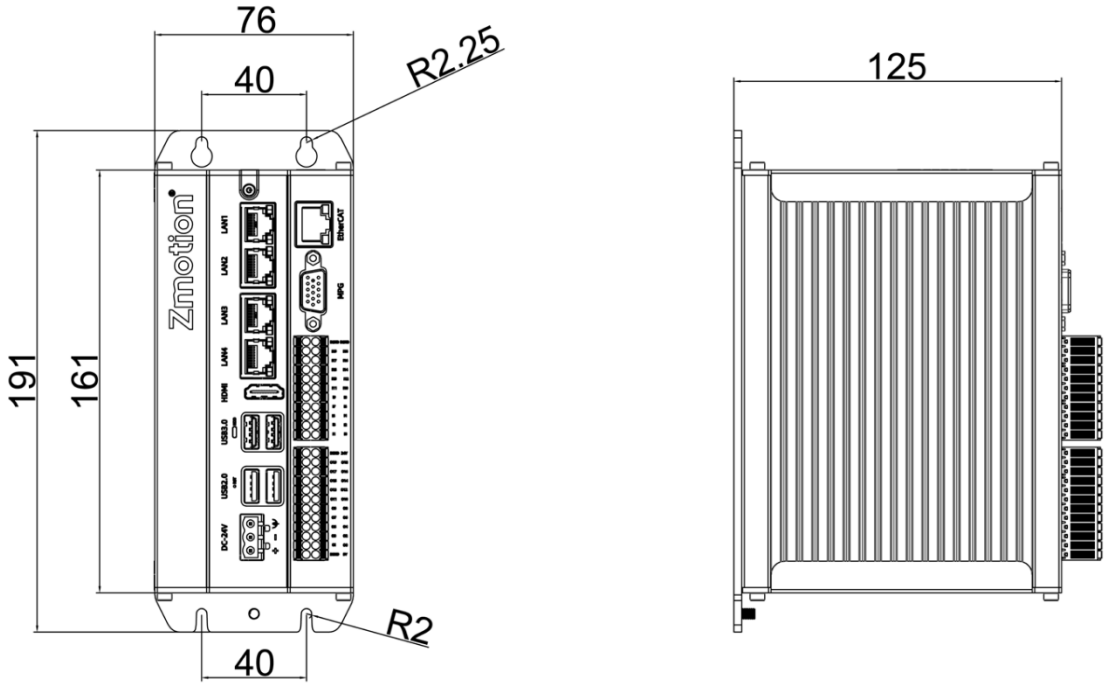
This product is installed in the cabinet and needs to be installed in the final system. The final system should provide corresponding fireproof enclosures, electrical protection enclosures, and mechanical protection enclosures, etc., in compliance with relevant IEC standards.

CPU heat dissipation should be considered when the chassis is fully enclosed and there is no air circulation.

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

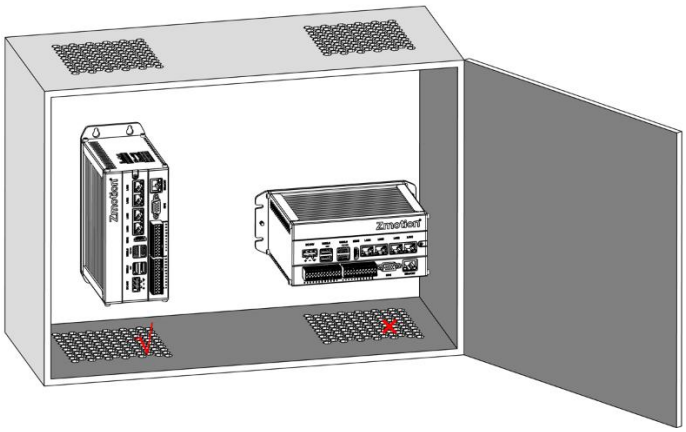
Degree of Protection	IP20

6.2. Installation Size

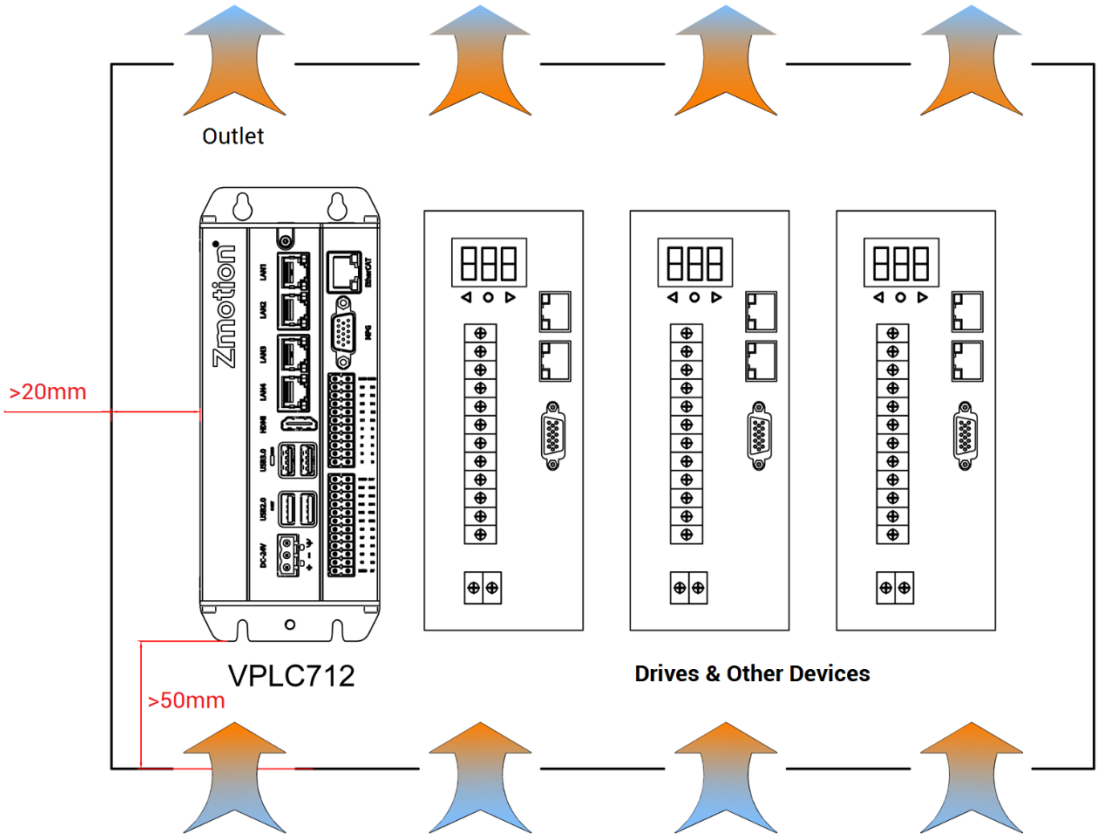


6.3. Installment Method

Fix the controller to the mounting surface through two M5 screws. When installing, please pay attention to the installation position. Please face the front of the controller (the actual installation surface of the operator) to the operator and make it perpendicular to the wall.



Due to the large power consumption and volume of this product, in order to facilitate ventilation and heat dissipation and easy module replacement, a corresponding distance should be reserved between the upper and lower parts of the module and the building and surrounding components, as shown in the figure:



Chapter VII Program & Applications

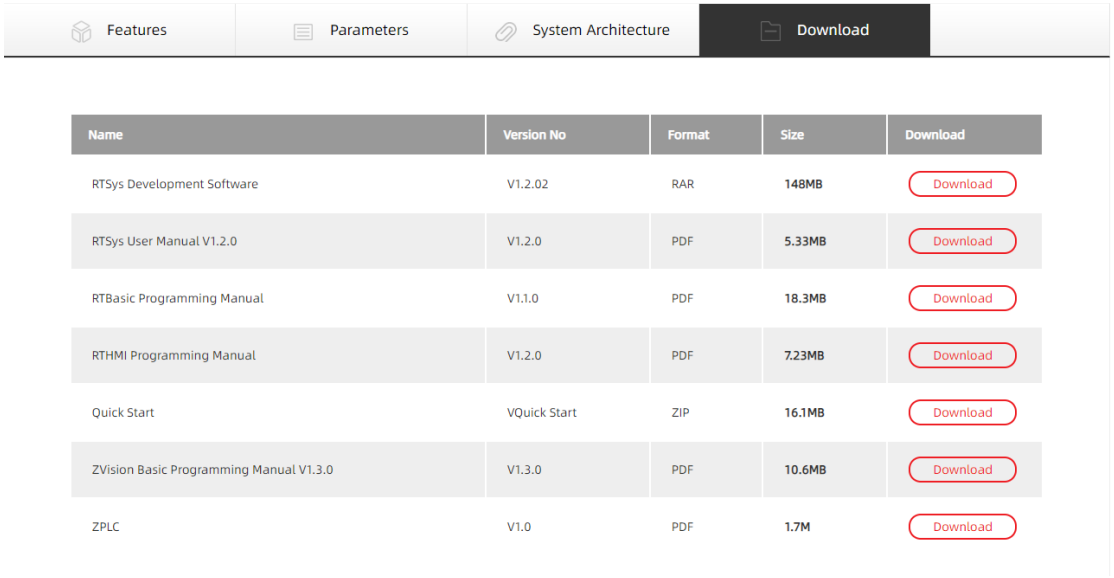
7.1. Program in RTSys Software

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

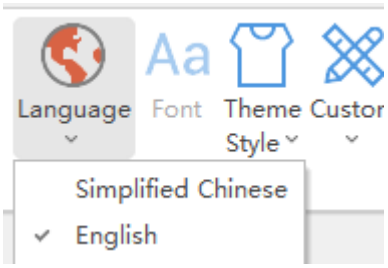
In RTSys, there are 4 programming languages for motion control development, Basic, PLC, HMI and C language, they can run multi-tasks among them, especially for Basic, multi-task running can be achieved separately, hybrid programming is also OK with PLC, HMI and C language.

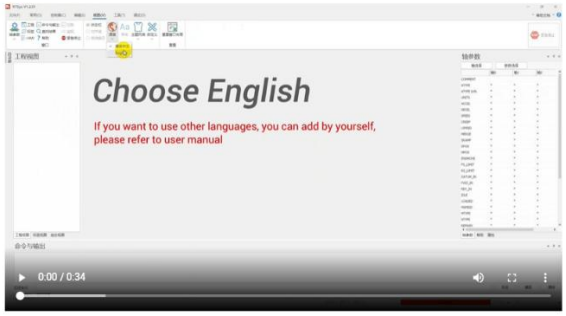
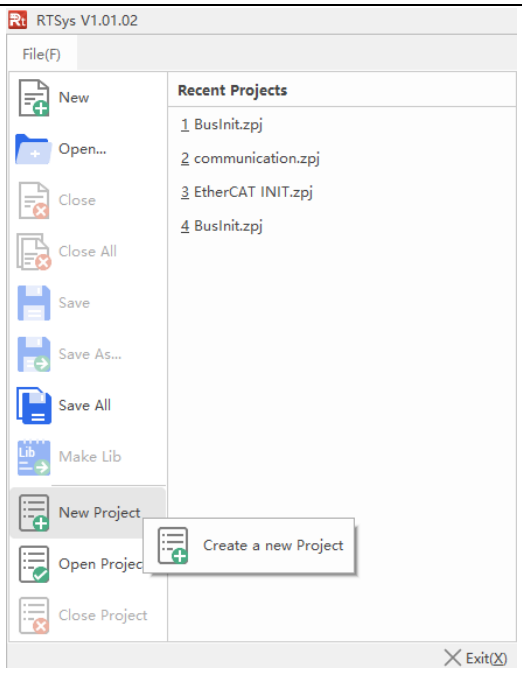
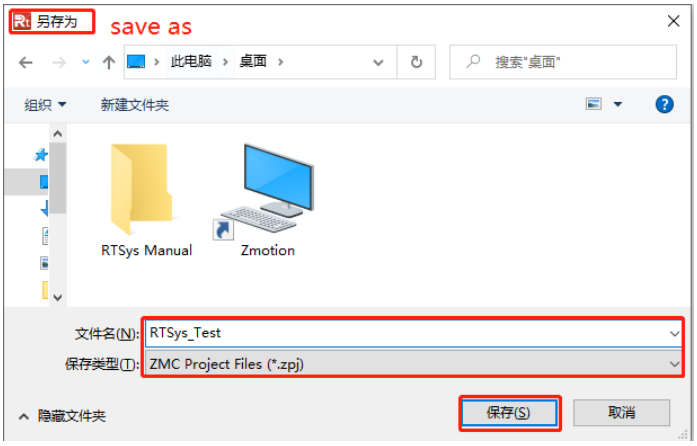
RTSys Downloading Address: https://www.zmotionglobal.com/pro_info_282.html

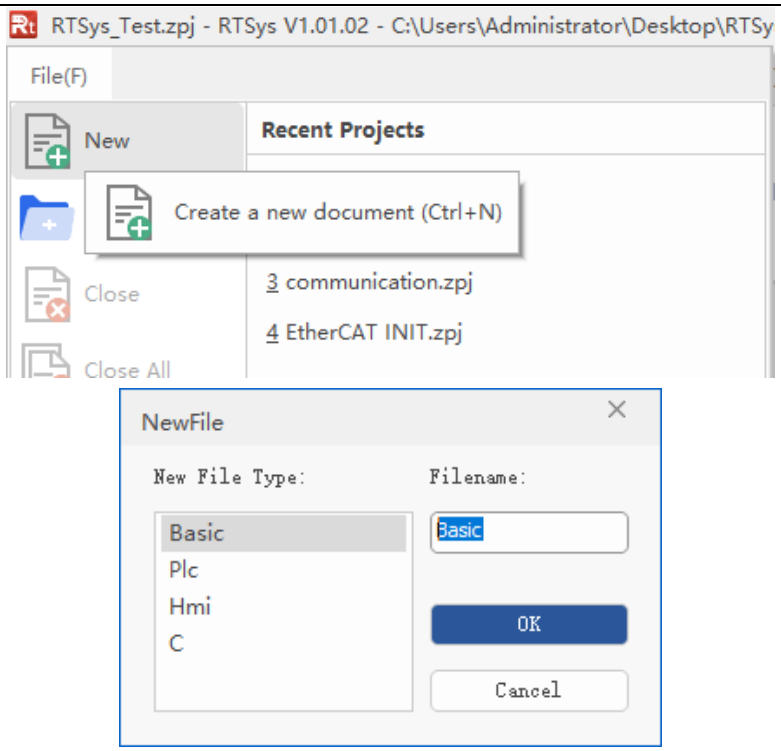
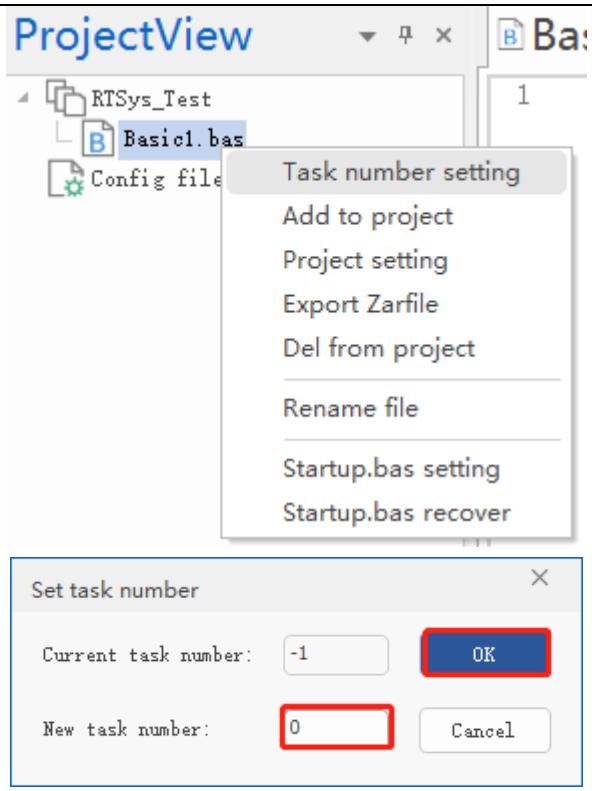
And related manuals can be found in "Download":

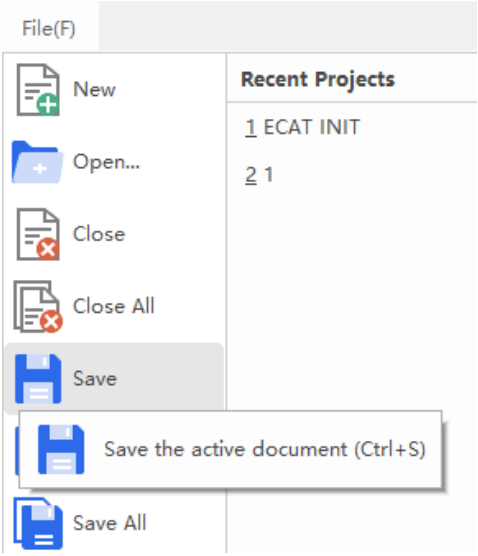
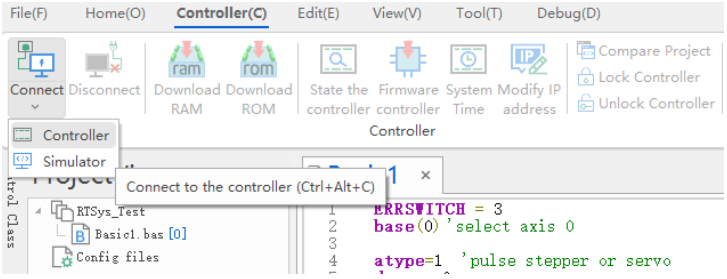
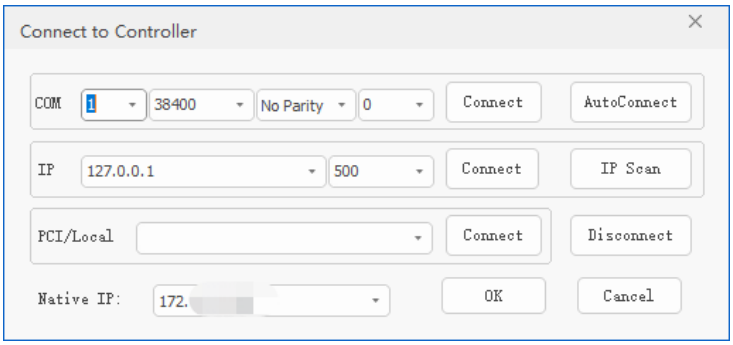


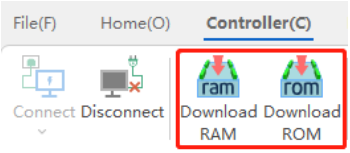
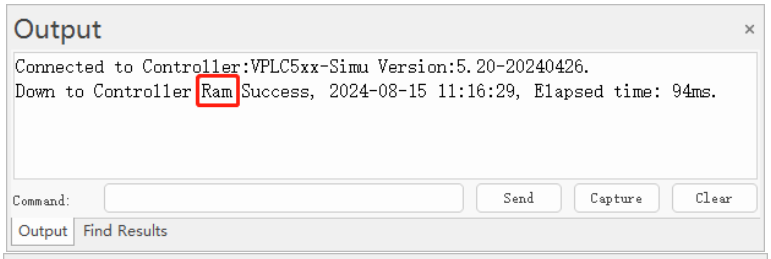
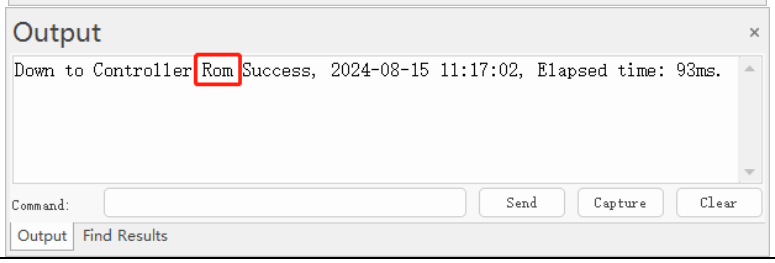
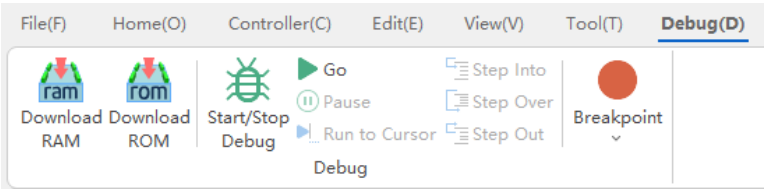
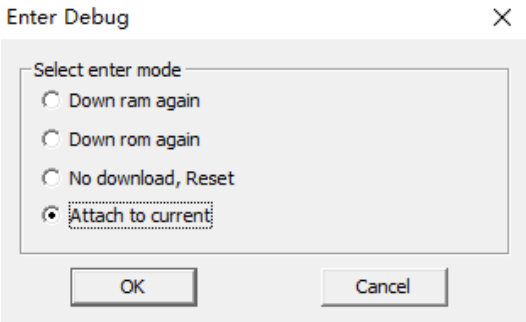
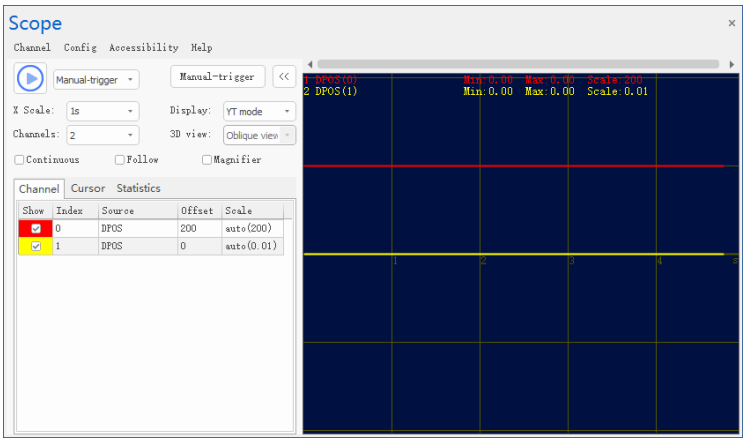
Name	Version No	Format	Size	Download
RTSys Development Software	V1.2.02	RAR	148MB	Download
RTSys User Manual V1.2.0	V1.2.0	PDF	5.33MB	Download
RTBasic Programming Manual	V1.1.0	PDF	18.3MB	Download
RTHMI Programming Manual	V1.2.0	PDF	7.23MB	Download
Quick Start	VQuick Start	ZIP	16.1MB	Download
ZVision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

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

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

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

7.2. 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

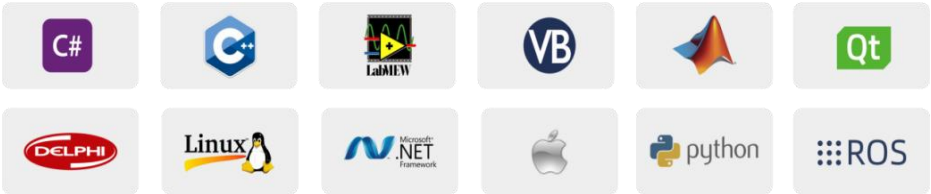
system enters ZBIOS state, please click “update” again.

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.

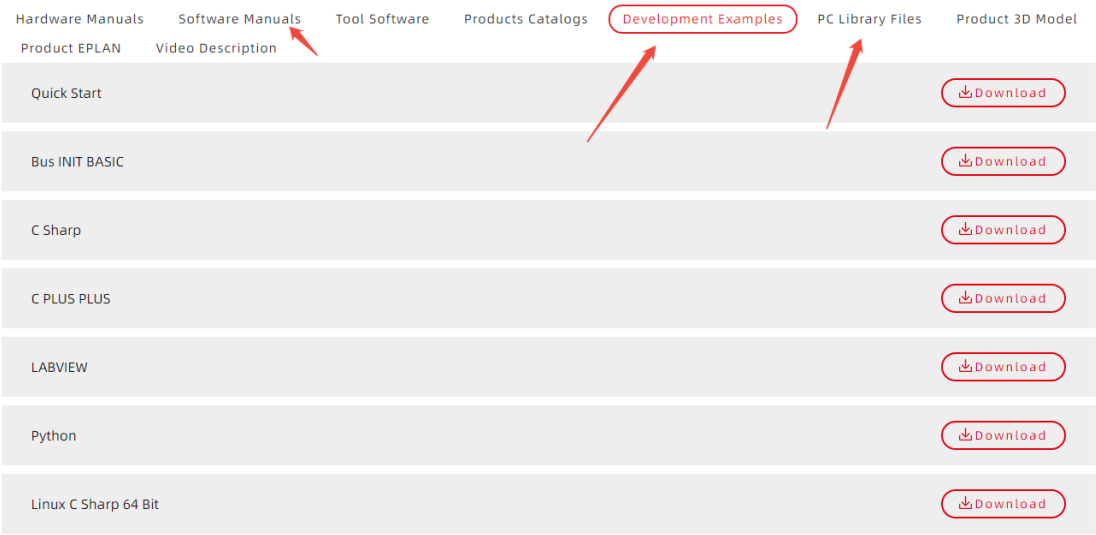
7.3. Program in Host-Computer by PC Languages

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

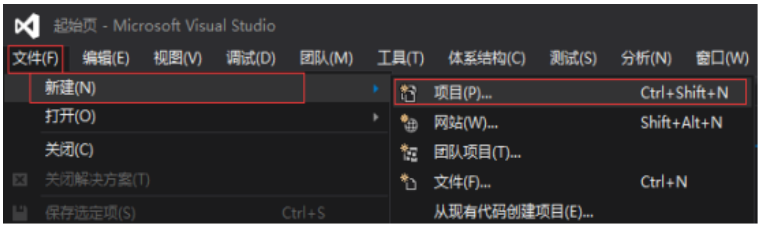
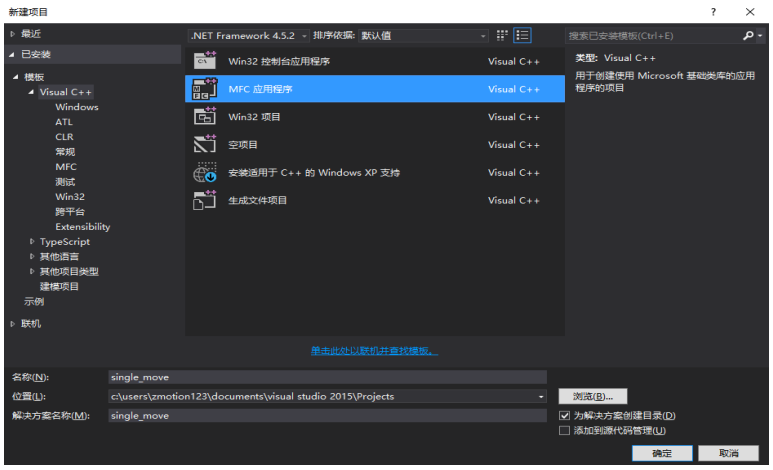
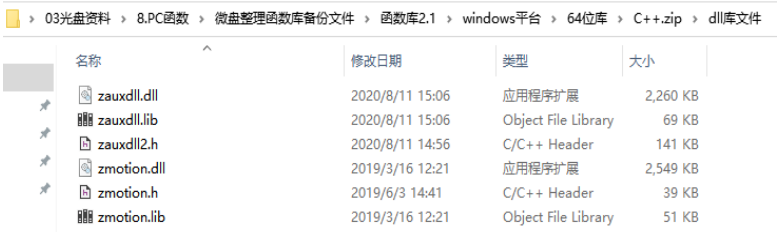


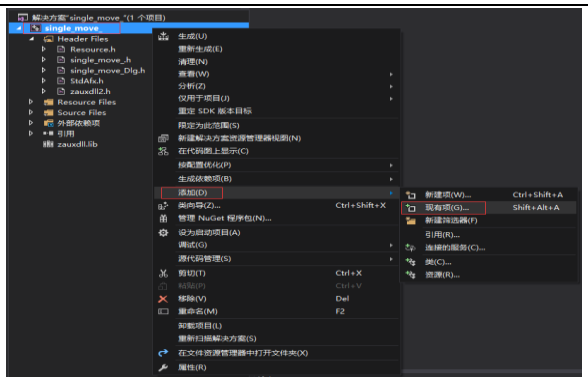
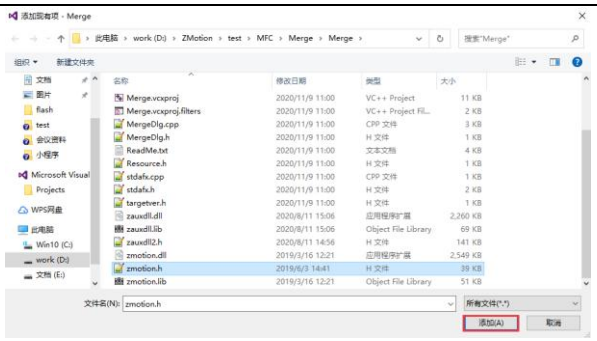
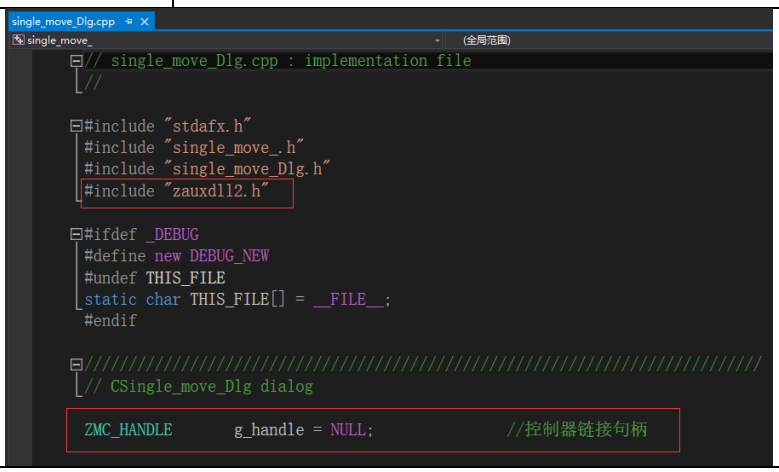
The program developed using the PC software cannot be downloaded to the controller, and it is connected to the controller through the dll dynamic library. The dll library needs to be added to the header file and declared during development.

- Get PC library file, example: https://www.zmotionglobal.com/download_list_17.html



The c++ project development process in VS is as follows:

Step	Operations	Display Interface
1	Open VS, click “File” – “New” – “Project”.	
2	Select development language as “Visual C++” and the select program type as “MFC application type”.	
3	Select “Based on basic box”, click “next” or “finish”	
4	Find C++ function library provided by manufacturer. Routine is below (64-bit library)	
5	Copy all DLL related library files under the above path to the newly created project.	

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

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

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

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

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

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

Chapter VIII 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.

8.1. 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

8.2. 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 ZDevelop error code, and check application program.
Fail to connect controller to PC through serial port.	1. Check whether the serial port parameters are modified by the running program, you can check all the current serial port configurations through ?*SETCOM. 2. Check whether the serial port parameters of the PC match the controller. 3. Open the device manager and check whether the serial driver of the PC is normal.
CAN expansion module cannot be connected.	1. Check the CAN wiring and power supply circuit, whether the 120 ohm resistor is installed at both

	ends. 2. Check the master-slave configuration, communication speed configuration, etc. 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.