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

VPLC711

This manual is mainly for VPLC711B201 VPLC711B501.
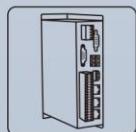
Vision Motion
Controller
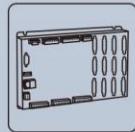
Motion
Controller
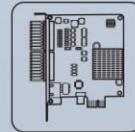
Motion
Control Card
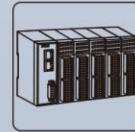
IO Expansion
Module

HMI

Copyright statement

This manual is copyrighted by Shenzhen Technology Co., Ltd., without the written permission of the Zmotion Technology, no person shall reproduce, translate and copy any content in this manual.

PCIE controller software involved in details as well as the introduction and routines of each instruction, please refer to ZBASIC software manual.

Information contained in this manual is only for reference. Due to improvements in design and functions and other aspects, Zmotion Technology reserves the final interpretation! Subject to change without notice!

⚠️Pay attention to safety when debug the machine! Be sure to design effective safety devices in the machine, and add error handling procedures in software. Zmotion has no obligation or responsibility for the loss.

Statement

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

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

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

➢ Notes

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

■ Danger

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

■ Notes

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

Content

Chapter I Production Information

1.1. Product Information

VPLC711 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.

VPLC711 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.

1.2. System Framework

VPLC711 series enters machine tool as the industrial computer, for exact applications, it needs to match with displayer outside to display, keyboard and mouse are used to interact, and IO module is used for general IO input and output function. For EtherCAT bus, it connects to EtherCAT bus servo driver and EtherCAT bus remote IO module, the LAN interface is used to connect to net, camera, etc.

Below shows VPLC711B501 (5 Gigabit Ethernets) & VPLC711B201 (2 Gigabit Ethernets) system framework:
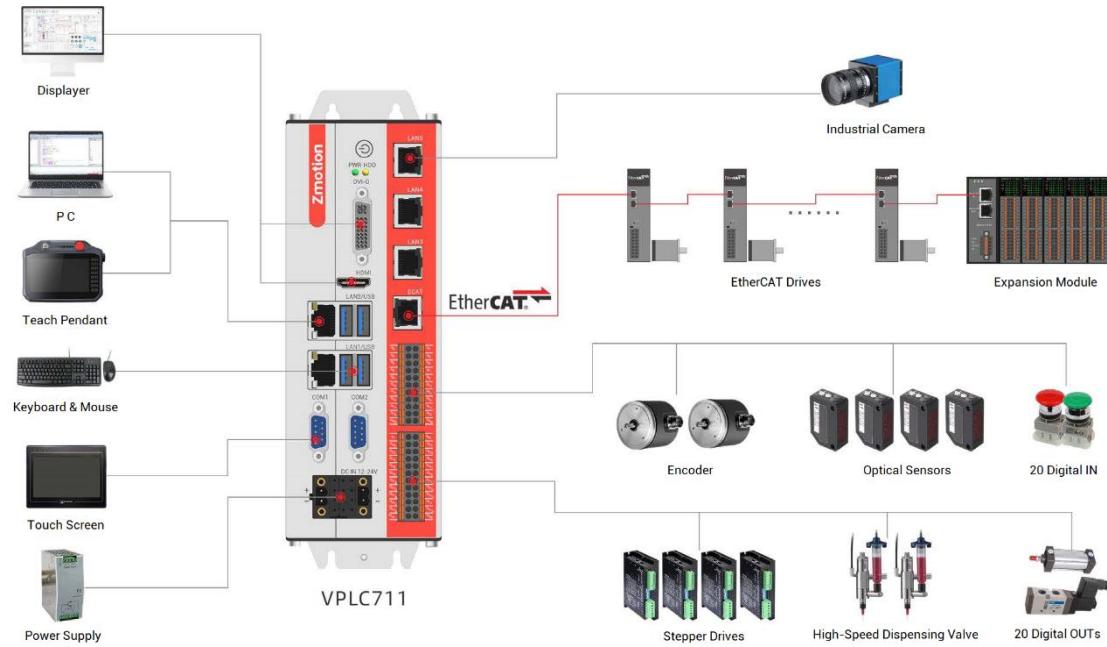
1.3. Main Features

- It supports motion control function and machine vision function

- Up to 64 axes motion control (EtherCAT axis / encoder axis / pulse axis / virtual axis)

- It supports encoder position measurement, which can be configured as handwheel input mode.

- There are 20 NPN inputs, some high-speed inputs can be configured as latch, and some inputs can be used as encoder.

- There are 20 NPN outputs, and they are high-speed outputs, some 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. For specified output, the current can reach 2A, which can do light source control output.

- There is one 100M EtherCAT bus interface, and 1024 isolated inputs and 1024 isolated outputs can be expanded through EtherCAT bus.

- There are 4 USB3.0 interfaces, they can be compatible with USB2.0 and USB1.0 interfaces. And they are mainly used to connect with camera, keyboard, mouse, U disk,

and other USB external equipment.

- There are 2 COM ports, they can be configured as RS485 serial port / RS232 serial port through DIP switch.

- 2 / 5 Gigabit ethernet interfaces support multiple kinds of expansion applications, which can connect to PC, camera and other ethernet equipment.

- There is one HDMI interface, high-definition display (1080P) is valid.

- There is one DVI-D interface, which means standard displayer is supported.

- 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 supports multi-file and multi-task programming in Basic.

- It supports a variety of program encryptions to protect user's intellectual property.

- Power-off detection is supported.

1.4. Nameplate & Models

VPLC711B201

Mark	Description
VPLC711	Vision Motion Controller

Mark	CPU Level
B	i5

Mark	Version
01	V01

Mark	EtherNET
2	2 Ethernets
5	5 Ethernets

1.5. Optional Configurations

➢　Selectable hardware configurations:

Model	VPLC711B201	VPLC711B501
CPU	i5-8500	i5-8500
Memory	DDR 8G	DDR 8G
Solid Disk	SSD 256G	SSD 256G
Ethernet	2 Gigabit	5 Gigabit
Power	DC24V	DC24V
Cooling	Fan-cooling	Fan-cooling

➢　Selectable software configurations:

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

$$VPLC711B201-AX64-MO8-HW-XXX$$

VPLC711B201-AX64-MO8-HW-XXX	
VPLC711	Windows vision motion controller
VPLC711B201-AX64-MO8-HW-XXX	
B	CPU level: i5
VPLC711B201-AX64-MO8-HW-XXX	
2	2 Ethernet ports
5	5 Ethernet ports
VPLC711B201-AX64-MO8-HW-XXX	
01	Ther version of V01
VPLC711B201-AX64-MO8-HW-XXX	
AX04	4-axis
AX06	6-Axis
AX08	8-Axis
AX16	16-Axis
AX32	32-Axis
AX64	64-Axis
VPLC711B201-AX64-MO8-HW-XXX	

MO2	Point to point, electronic cam, linear interpolation
MO8	Point motion, electronic cam, linear & circular & continuous interpolation
VPLC711B201-AX64-MO8-HW-XXX	
HW	Hardware comparison output
ZV	Machine vision algorithm
NC	NC, G code
R1	Normal robotic arm
R6	6-joint manipulator & Delta manipulator
F	Fast version
VPLC711B201-AX64-MO8-HW-XXX	
XXX	Customized function

➢ Selectable software functions:

Interface	Optional Functions	Definition Description
License Parameter	Frame	R1: suit to ordinary robots
	Robot	R6: suit to 6-joint robots and special structure robots.
	NcGcode	NC: suit to NC G code function.
	HW	HW: suit to HW hardware comparison output function, refer to high-speed output channel numbers selection.
	ZVision	ZV: suit to vision instruction and function.
	Fast	Fast version
	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.

1.6. 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: users can download the latest RTSys (ZDevelop) version from the official website of Zmotion or contact us. Users who use other upper computer development platforms can also contact us to obtain function library files. And this product does not come with an operating system, but there is MotionRT software built-in. Users 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	VPLC711 series
CPU	Intel CPU: Intel®6, 7, 8, 9 generation, LGA1151Celeron/Pentium/Core™ processor
Memory	Internal SSD solid hard disk: 256G
Storage	DDR4: dual-channel DIMM, DDR4 2400MHZ Max32GB (standard configuration is 8GB)
Main power	DC 12~24V: it is determined by power needs, 2 DC24V powers can be connected.
Axes	4/6/8/16/32/64: EtherCAT bus axes and 4 local pulse 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 IN0-9
Ordinary input IO frequency	≤5kHz for IN10-19
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
Storage temperature	-40°C-80°C
Work temperature	-10°C-55°C

Work humidity	10% ~ 95% (no condensation)
Volume	225mm*90mm*200mm
Weight	2.5KG

2.2. Interface Definitions

→VPLC711B201 & VPLC711B501

A. Interface Definitions

VLPC711B501
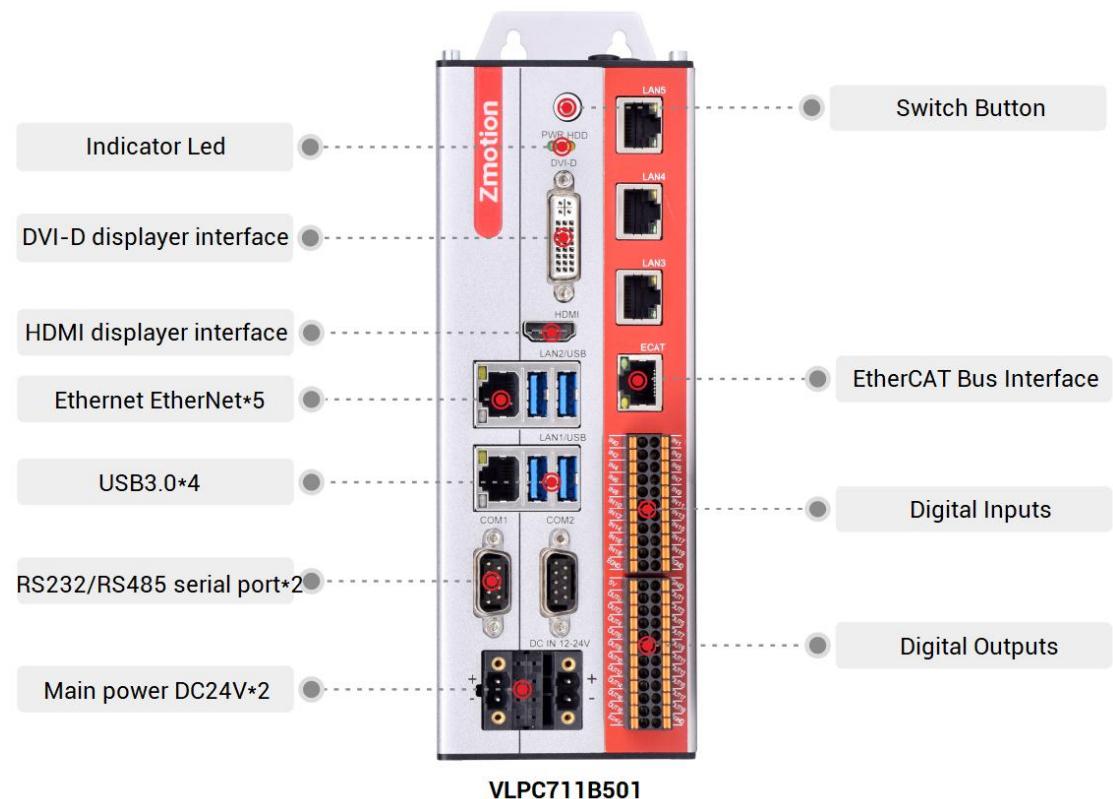
B. Interface Descriptions

No.	Name	Numbers	Details
1	PWR	1	Power status led
2	HDD	1	Hard disk status led
3	LAN1/LAN2/LAN3/LAN4/ LAN5	5*	1000M Ethernet 1/2/3/4/5

4	USB3.0	4	USB3.0
5	DVI-D	1	DVI/D displayer interface
6	HDMI	1	HDMI displayer interface
7	COM1/COM2	1/1	RS485(port1)/RS232(port2)
8	EtherCAT	1	EtherCAT Bus interface
9	IN	20	Digital inputs
10	OUT	20	Digital outputs
11	DC IN 12-24V	2	Main power inputs
12	Switch button	1	ON / OFF button

➢ Note: VPLC711B201 has only two Gigabit 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	10	IN0-9, all are high-speed inputs.
High-speed output	20	OUT0-19, all are high-speed outputs.
Latch input	4	4 inputs can be configured as latch input, IN0-3
Single-ended Encoder	2	Reuse input, No. is IN0-2, IN4-6
PWM	4	4 outputs can be configured as PWM, OUT0-3.
Hardware comparison output	4	4 outputs can be configured as hardware comparison output (PSO function), which are compatible with precision output, OUT0-3.
Single-ended pulse output	4	Reuse outputs, OUT8-15.

| Light source control | 4 | Reuse output, max output current is 2Am OUT16-19. |
| IO power input | DC24V | 24V DC input, IO needs to be supplied by external power independently. |

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.
DVI-D	Standard interface	Connect to DVI interface externally to show equipment.
HDMI	Standard interface	Connect to HDMI interface externally to show equipment.
USB3.0	Standard interface	Both support "plug and then use immediately" and "hot plug in and out", it is compatible with USB2.0.

Note:

➢ 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 configured, click (确认) to save.

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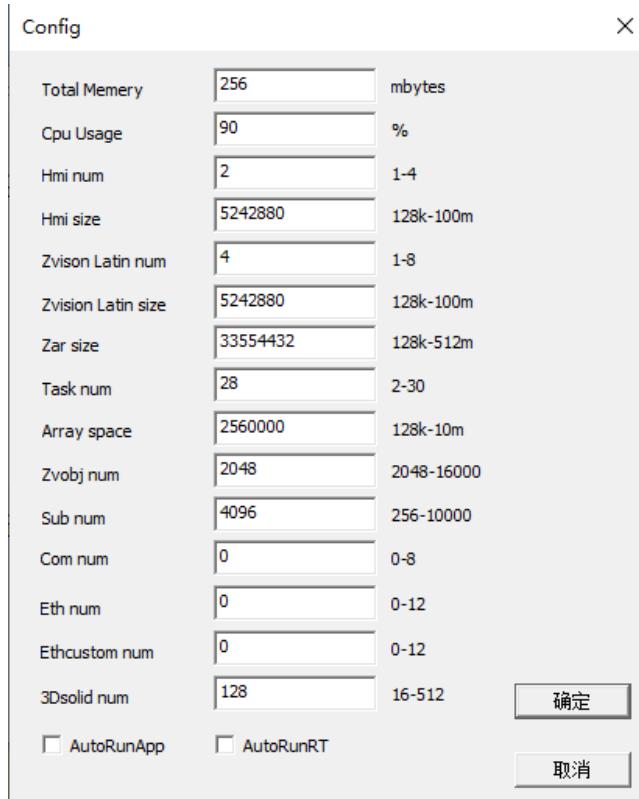
→Parameter Meaning

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.
Kenerl File	/	Depend on firmware file
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
RtLogSave	/	Save logs to log files

Chapter III Wiring & Communication

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 when power on.

■ **Notes:**

a. Please switch on and off it normally, don't power off it directly and frequently, otherwise it will damage the controller.

b. After powered down, recommend power on again spacing 3 minutes. If it can't run, please press controller ON button.

3.2. Status Led

There are two state leds on the front board, which represent power status and hard disk status respectively.

Mark	LED Name	Status	Description
PWR	Power status led	OFF	Product is not powered.
		ON (green)	Product is powered on.
HDD	Hard disk status led	Shrink (orange)	Hard disk is been accessing.
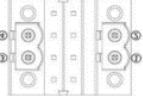
3.3. Power Supply

Main power is needed to be connected, and IO part needs to be connected to one IO power supply independently.

3.3.1. Main Power

To ensure stable power connection, 2 PIN2 power input interfaces are provided, divide the power supply into two, which means 2 power inputs are connected separately, then, it can supply power for industrial power. Range of power voltage is DC12V-24V.

→Terminal Definition

Interface	PIN No.	Signal	PIN No.	Signal
	1	DC IN 12~24V	3	DC IN 12~24V
	2	GND	4	GND

Note:

1. Pin1 and pin3 are short-circuited internally on the main board circuit, and pin2 and pin4 are internally short-circuited. The maximum current allowed by a single terminal is 8A.

2. 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

Hardware Model	VPLC711B201	VPLC711B501
Input Voltage	DC 12~24V	DC 12~24V
Power of Power Supply	≥120W	≥120W
Anti-reverse Connection	Yes	Yes
Overcurrent Protection	Yes	Yes

→ Wiring Reference

The maximum continuous current of power terminal is 8A, if exceeds the power limit, it is recommended to connect two power inputs to the power that supplies the power.

✦ Power supply wiring reference:

3.3.2. IO Power

IO needs to be powered independently. IO power IN locates on the most bottom of IO.

→Terminal Definition

| PIN No.	Signal	Description
1	E24V	IO power DC24V input
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

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

3.4. DVI-D Displayer Interface

DVI-D interface uses standard DVI-D 24 pin terminal (female connector).

Interface	PIN	Signal	PIN	Signal	PIN	Signal
	1	DATA2-	11	DATA1 SHIELD	21	NC
	2	DATA2+	12	NC	22	DATA0 SHIELD
	3	DATA2 SHIELD	13	NC	23	CLK+
	4	NC	14	+5V	24	CLK
	5	NC	15	GND	C1	NC
	6	DDC CLK	16	HPD		
	7	DDC DATA	17	DATA0-		
	8	NC	18	DATA0+		

|	9	DATA1-	19	DATA0 SHIELD		
	10	DATA1+	20	NC		
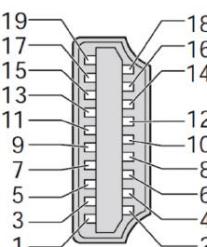
Notes:

1. If DVI-D displayer is not connected before turning on BIOS configuration, displayer may not show corresponding content, when displayer is connected normally, "on" information will be shown when system guides to open.

2. When using DVI-D to switch into VGA, corresponding interchanger that switches DVI-D to VGA is required.

3. When using DVI-D, the work environment temperature should be in 0~+45°C.

3.5. HDMI Interface

There is one standard HDMI high-definition multimedia displayer interface, which is used to collect to touch screen, VPLC717B501 and VPLC711B201 (2 Gigabit ethernet) hardware version support.
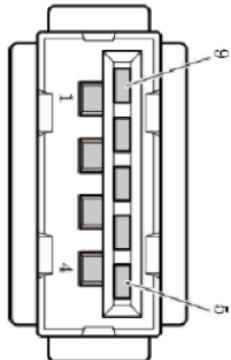
→ Interface Definition

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+		

3.6. USB Interface

4 independent USB TYPE-A interfaces are provided. They are all USB3.0 interfaces, and they can be compatible with USB2.0.

Mainly to insert U disk, mouse, keyboard, and other equipment.

Interface	PIN	Signal
	1	VCCS
	2	DATA-
	3	DATA+
	4	GND
	5	SSRX-
	6	SSRX-
	7	GND
	8	SSTX-
	9	SSTX+

→Specification

| Item	USB3.0
Max communication speed ratio	5.0Gbps
VCC (5V) max output current	500mA
Isolative	NO

3.7. LAN Ethernet
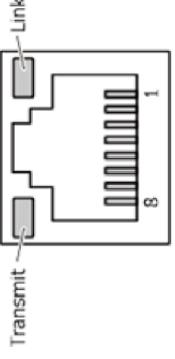
There are multiple 1000M ethernets on VPL711, and standard RJ45 interface is used.

Ethernet factory default IP addresses

LAN1: 192.168.0.11, LAN2: 192.168.1.11, etc.

Ethernet can be configured as EtherCAT.

→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-

Notes:

1. There are 2 LED 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
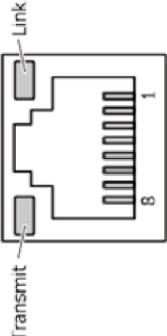
Item	Specification
Ethernet type	1000BASE-T/100BASE-TX/10BASE-T
Transmission Speed	1000Mbps/100Mbps/10Mbps
Max cable distance	100m/segment
Ethernet card type	Intel® Ethernet Controller

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

3.8. EtherCAT Bus Interface

VPLC711 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

| ECAT	PIN	Signal
	1	TX+
	2	TX-
	3	RX+
	4	NC
	5	NC
	6	RX-
	7	NC
	8	NC
Note: 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. When there is data transmission, Transmit led is shrinking in yellow.		

→ 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	1000 digital inputs and outputs are 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:
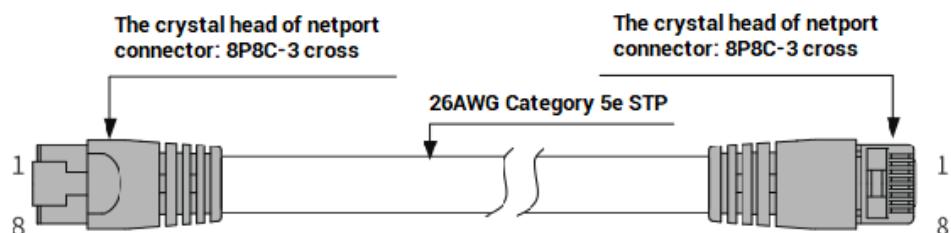
Item	Specification
Cable type	Flexible crossover cable, Category 5e
traverse	twisted pair
Line pairs	4
Isolation	cross skeleton
Connector	Crystal head with iron shell
Cable material	PVC
Cable length	< 100m

Use RJ45 network cable connection method:

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

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

● When disassembling, press the tail mechanism of the crystal head, and pull out the connector and the module in a horizontal direction.

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

3.9. COM Serial Port

VPLC711 provides 2 serial ports, COM1 and COM2. Use standard DB9 male head wiring terminal, then switch COM1/COM2 RS232/RS485 function through two DIP on the bottom. These two serial ports both can be configured independently. For the same one COM, there is only one that is valid between RS232 and RS485.

Before using, it needs to configure the number "com num" and relative parameters on MotionRT software "Config" window.
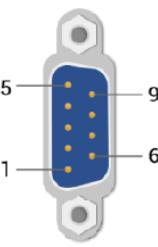
MODBUS_RTU standard protocol is used by default, and communication mode can be customized.

RS485 and RS232 can be configured as master station or slave station.

Note: when "?*portcom" is used to print port serial information, it can't identify it is 232 or 485 exactly, and they both show as RS232, but it will not influence actual operation.

3.9.1. Interface Definition

→COM Interface Definition

| COM	PIN	Signals			
		RS232	Description	RS485	Description
	1	NC	/	B	Signal B/-
	2	RXD	Signal receive	A	Signal A/+
	3	TXD	Signal send	NC	/
	4	DTR	Data terminal is ready	NC	/
	5	GND	Signal ground	GND	Signal ground
	6	DSR	Data device is ready	NC	/
	7	RTS	Request sending	NC	/
	8	CTS	Allow sending	NC	/
	9	RI	Ring vibration indication	NC	/
Note: use DIP switch at the bottom of the controller to switch RS232 or RS485 of COM1 or COM2.					

→Specification

| Item	RS232 (port0)	RS485 (port1)
Maximum Communication Rate	115200 (bps)	115200 (bps)
Terminal Resistor	No	No
Topology Structure	Connect correspondingly	Daisy chain structure
The number of nodes can be extended	1	127
Communication Distance	The Longer communication distance is, the lower communication rate is, maximum 5m is recommended.	The Longer communication distance is, the lower communication rate is, maximum 30m is recommended.

→COM Switching DIP

DIP locates in the bottom of controller, DIP method:

● COM1 DIP locates in 232, now, COM1 is used as RS232. COM1 DIP locates in 485, now, COM1 is used as RS485.

● COM2 DIP locates in 232, now, COM2 is used as RS232. COM2 DIP locates in 485, now, COM2 is used as RS485.
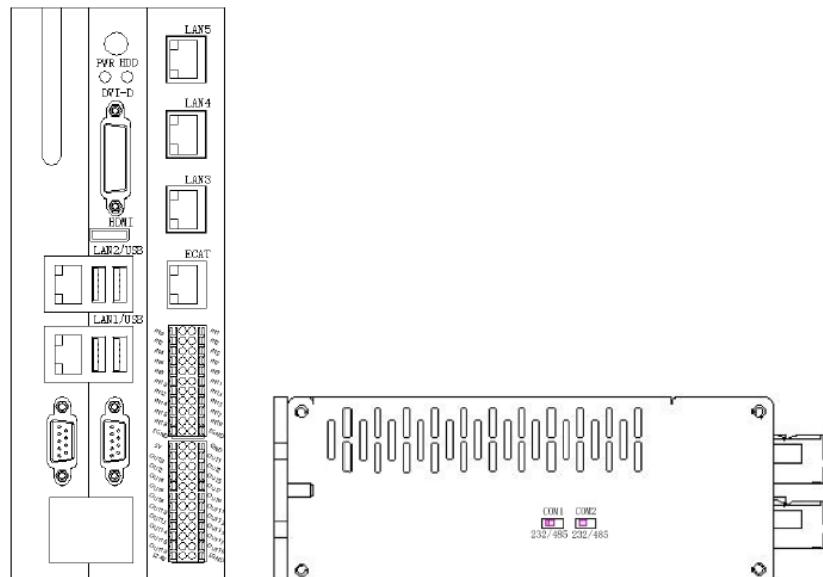
3.9.2. RS232 Serial Port Wiring
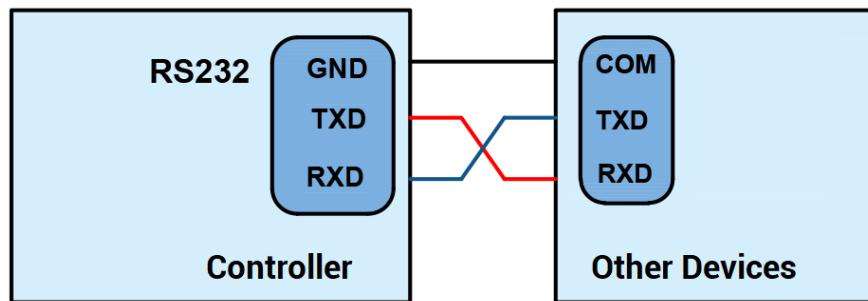
→**Wiring Notes:**

- The wiring of RS232 is as above, it needs to cross-wiring for sending and receiving signals, and it is recommended to use a double-female head cross line when connecting to a computer.

- Please be sure to connect the public ends of each communication node to prevent the communication chip from burning out.

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

3.9.3. RS485 Serial Port Wiring

Connect 485A and 485B of RS485 to 485A and 485B of the controller correspondingly, and connect the public end of RS485 communication parties together.
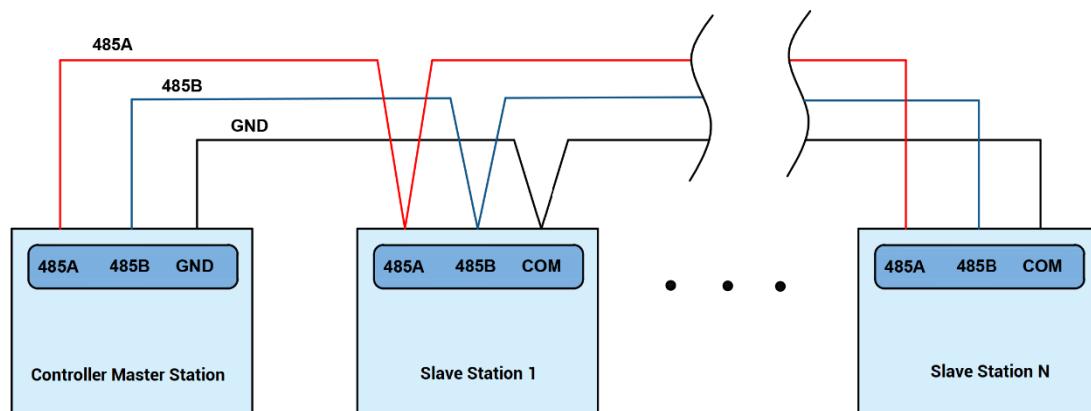
RS485 shield layer wiring reference:
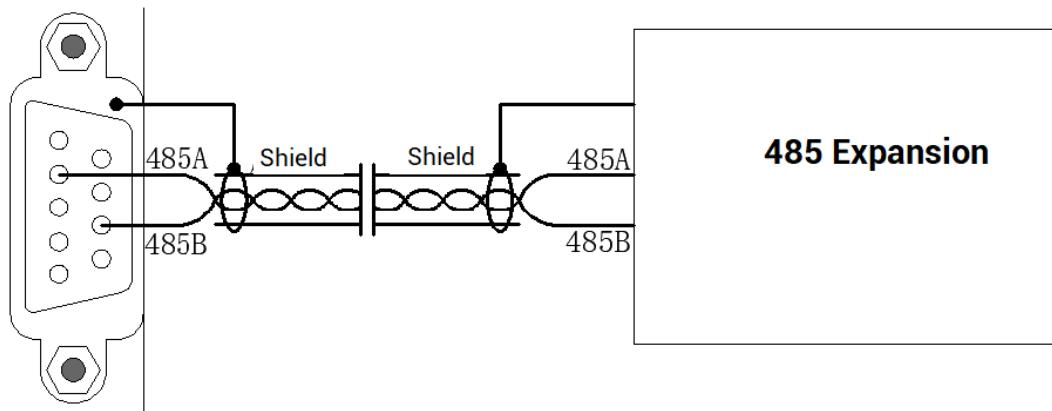
→Wiring Notes:

- RS485 interface pin definitions are different, so it is no need to use serial port cable to connect for communication, it only needs to connect corresponding PIN.

- 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.

- When there are multiple slave stations, please connect a 120Ω terminal resistor in parallel to each end of the CAN bus for matching the circuit impedance and ensuring communication stability.

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

- Each node branch cable distance on RS485 wiring circuit needs to be less than 3m.

- 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.

3.10. Digital Inputs & Outputs

General IO includes 20 inputs and 20 outputs (all are NPN types), when the number is not enough, expansion is valid. For IO, it needs to connect to 24V DC power externally.

3.10.1. Terminal Definition
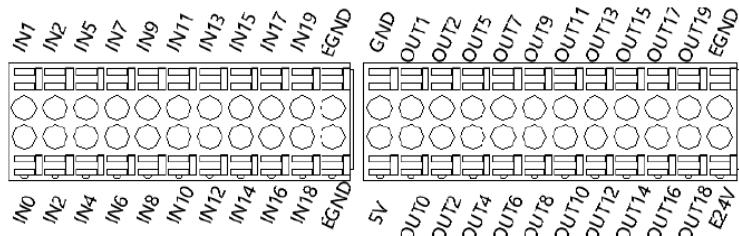
Signal	Type	Description	Note
IN 0		Input 0, latch R0, EA0	IN 0-9 are all high-speed inputs, default as general inputs, IN0-3 can be configured as latch input. IN 0-2 and IN 4-6 can be configured as two encoder inputs.
IN 1		Input 1, latch R1, EB0	
IN 2		Input 2, latch R2, EZ0	
IN 3	NPN, high-speed input	Input 3, latch R3	
IN 4		Input 4, EA1	
IN 5		Input 5, EB1	
IN 6		Input 6, EZ1	
IN 7		Input 7	
IN 8		Input 8	
IN 9		Input 9	
IN 10		Input 10	IN 10-19 are general inputs, which can be connected to button, switch, and other elements.
IN 11		Input 11	
IN 12		Input 12	
IN 13	NPN, low-speed input	Input 13	
IN 14		Input 14	
IN 15		Input 15	
IN 16		Input 16	
IN 17		Input 17	
IN 18		Input 18	

IN 19		Input 19	
EGND	/	IO public end	/
EGND	/	IO public end	/
5V	/	5V power output, max is 300mA	Supply power for external equipment
GND	/	External power ground	
OUT 0	NPN, high-speed output	Output 0, PWM0	Outputs are all high-speed outputs, default as general outputs, OUT0-3 can be configured as PWM output, hardware comparison output, and precision output. OUT8-15 can be configured as 4-channel pulse outputs. OUT16-19 are big power outputs, which can do light source control, and external hard trigger is supported, max current of each channel is 2A.
OUT 1		Output 1, PWM1	
OUT 2		Output 2, PWM2	
OUT 3		Output 3, PWM3	
OUT 4		Output 4	
OUT 5		Output 5	
OUT 6		Output 6	
OUT 7		Output 7	
OUT 8		Output 8, single-ended DIR3	
OUT 9		Output 9, single-ended PUL3	
OUT 10		Output 10, single-ended DIR2	
OUT 11		Output 11, single-ended PUL2	
OUT 12		Output 12, single-ended DIR1	
OUT 13		Output 13, single-ended PUL1	
OUT 14		Output 14, single-ended DIR0	
OUT 15		Output 15, single-ended PUL0	
OUT 16		Output 16, light source control	
OUT 17		Output 17, light source control	
OUT 18		Output 18, light source control	
OUT 19		Output 19, light source control	
E24V	/	IO power, DC24V input	IO needs to be supplied independently
EGND	/	IO power ground	

Notes:

1. Only 24V encoders can be used. The maximum pulse frequency of encoder 0 and encoder 1 is 100kHz, which can be connected to high-speed encoders.

2. The No. after inputting pulse output and encoder input is default axis No., and it can be switched into ordinary IO through ATYPE command (ATYPE = 0 of target axis: ordinary IO. ATYPE = 1: pulse output. ATYPE = 3: encoder input. ATYPE = 4: pulse output + encoder input)

3.10.2. Digital Specification

→ High-speed Digital Output Specification

Item	16 (OUT0-OUT15)	4 (OUT16-OUT19) (max current)
Output method	Transistor NPN type, OD outputs	
Output frequency	≤400kHz	≤400kHz
Voltage level	DC24V	DC24V
Max output current	+300mA	+2A
Max leakage current when off	25μA	25μA
Respond time to conduct	1μs (resistive load typical value)	
Respond time to close	3μs	3μs
Isolation method	Capacitive isolation	Capacitive isolation
Overcurrent protection	Support, action current is 600mA	Support, action current is 4A
Respond time	Below 0.5ms	Below 0.5ms

Notes:

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

2. 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. It is recommended to set below 400KHz.

→Digital Input Specification

Item	High-Speed Input (IN0-9)	Low-Speed Input (IN10-19)
Input mode	NPN type	NPN type
Frequency	≤100kHz	≤5kHz
Voltage level	DC24V (-15%~+20%)	DC24V (-15%~+20%)
Current (typical value)	6.8mA	4.8mA
The voltage to open	<15V	<14.5V
Minimal current	2.3mA	1.8mA
Impedance	3.3KΩ	4.7KΩ

Isolation method	Capacitive isolation	Capacitive isolation
Respond time	Below 10ms	Below 10ms

Notes:

There are high-speed inputs and low-speed inputs.

The above parameters are standard values when the voltage of IO power supply (E24V port) is 24V.

## 3.10.3. General Input Wiring

→ **Wiring Reference**
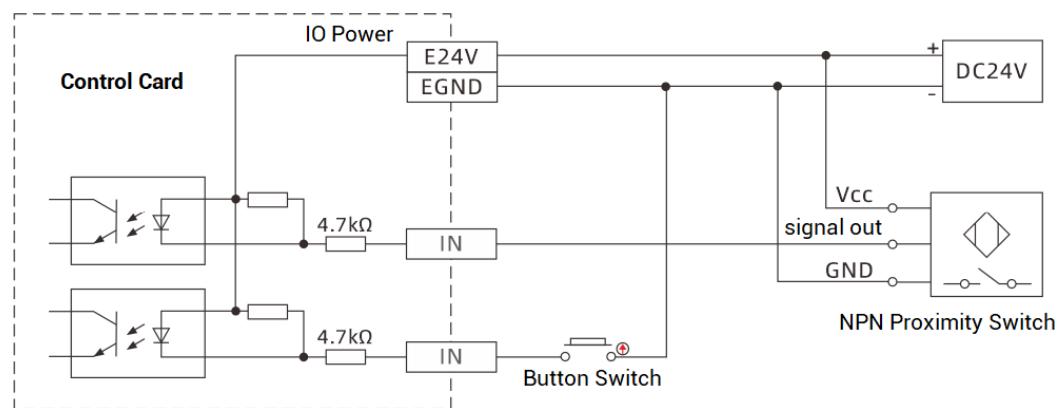
→ **Wiring Note:**

- The wiring principle of high-speed digital input IN (0-9) and low-speed digital input IN (10-19) 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 "EGND" port on the IO power supply to the "COM" terminal of the external input device.

3.10.4. General Output Wiring

→ Wiring Reference
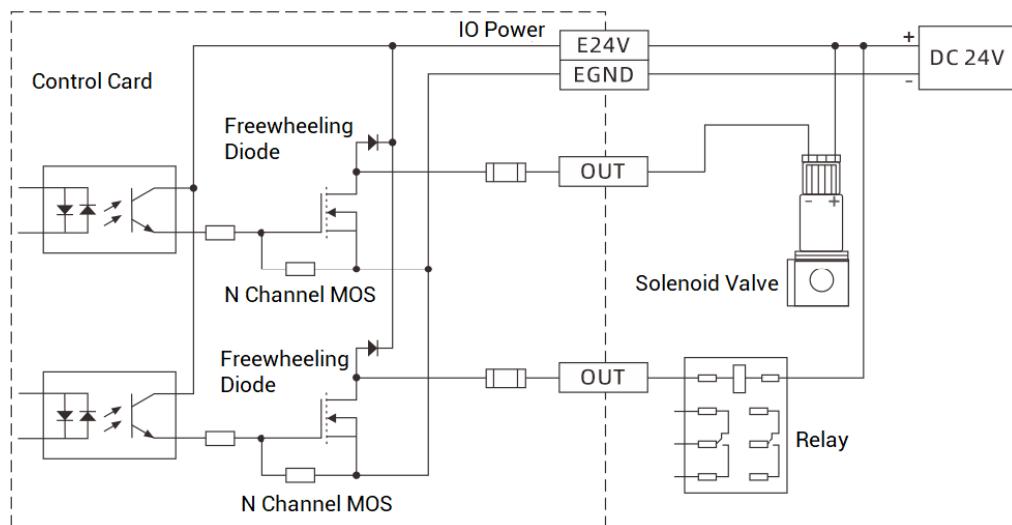
→ Wiring Note:

- The wiring principle of high-speed digital output OUT (0-19) is shown in the figure above. The external signal receiving end can be an optocoupler or a relay or solenoid valve, all can be connected as long as the input current does not exceed 300mA.

- For the connection of the public end, please connect the "EGND" port on the IO power supply to the negative pole of the DC power supply of the external input device.

3.10.5. Encoder Wiring (IN)

There are 2 24V single-ended encoder inputs on board for VPLC711.

Here, use IN4-6 to connect to encoder, when wiring is done, IN can be used as encoder input signal through ATYPE (1) = 3. IN4 is EA1, IN5 is EB1, IN6 is EZ1, and corresponding encoder axis No. is 1.
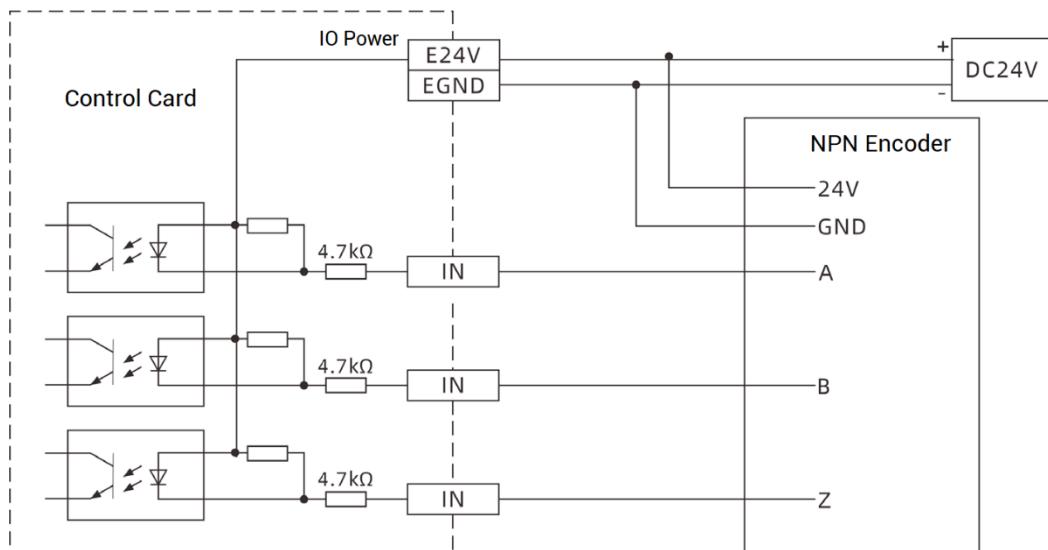
3.10.6. Pulse Wiring

There are 4 single-ended pulse outputs on board for VPLC711.

Here, use OUT8 and OUT9 to connect to driver, when wiring is done, when OUT8 and OUT9 are configured through ATYPE (3) = 1. OUT 8 is DIR3, OUT9 is PUL3, and corresponding pulse driver axis No. is 3.

E24V or E5V driver can be used.
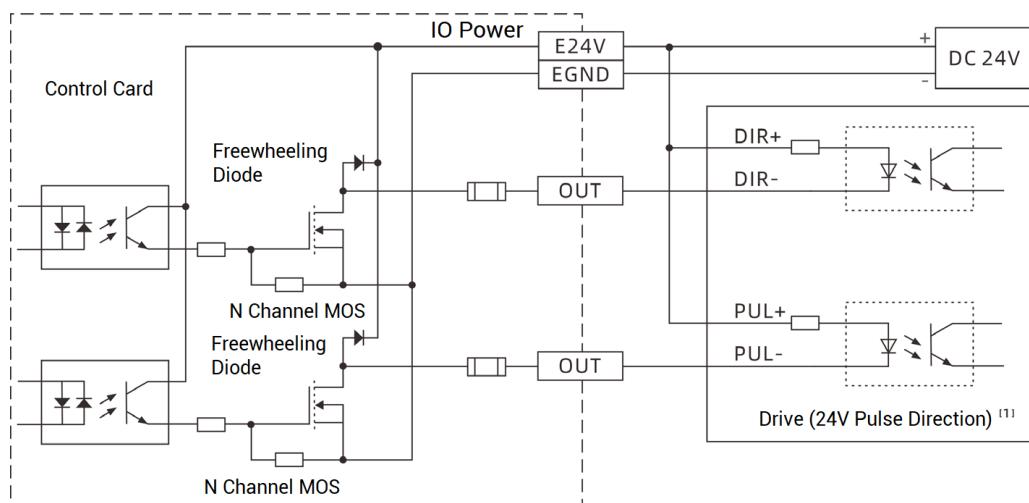
Note [1]: for 5V pulse driection interface, please connect PUL+ and DIR+ to E5V.

3.11. Wiring Requirements

3.11.1. Cable Material Requirements

(1) The network cable adopts Category 5e STP, and the crystal head has a metal shell to reduce interference.
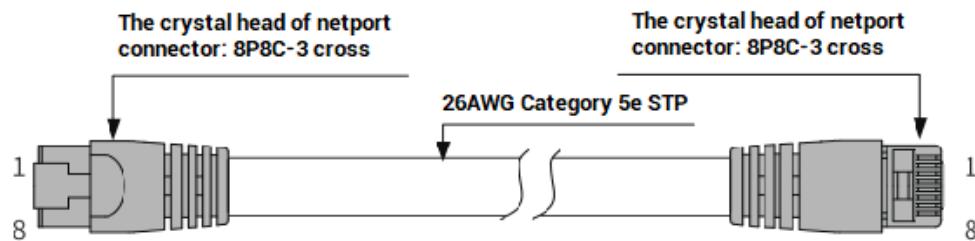
(2) RS485 uses shielded twisted pair, and the shielded cable is grounded.
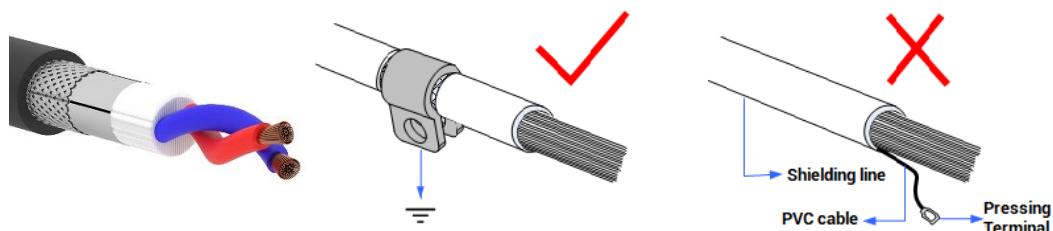
(3) HDMI and DVI-D use the cable material with good quality.

(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.

3.11.2. 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.
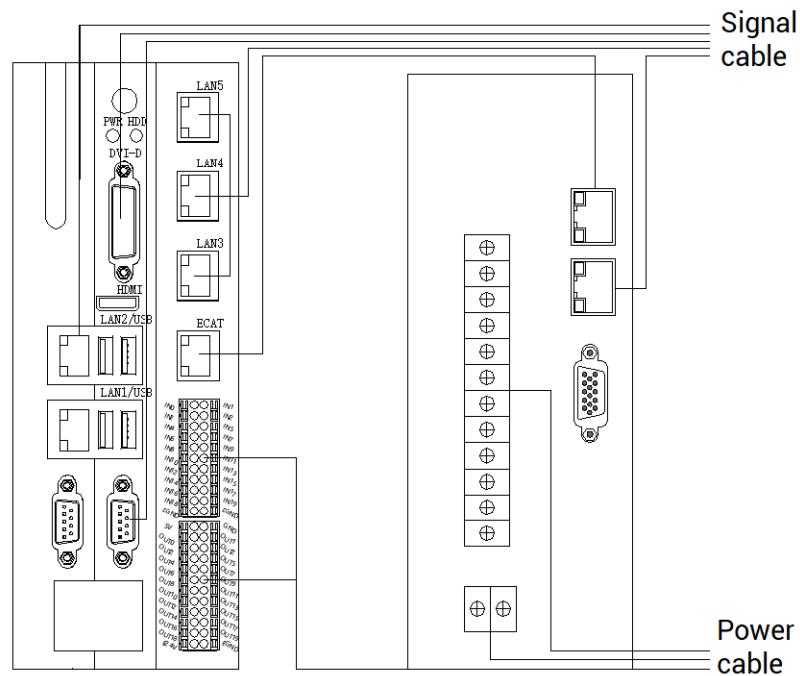
(2) The positive and negative lines of the power line are routed in parallel to avoid interference caused by a large loop area.
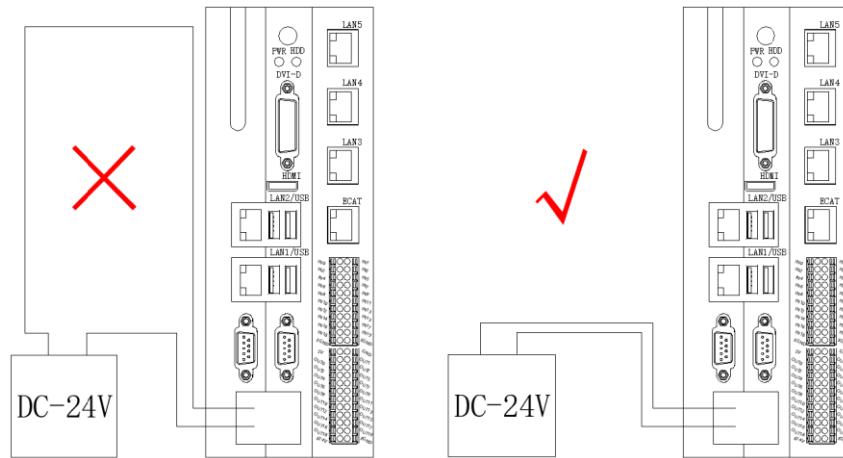
3.11.3. Wiring Requirements

1. For the cable with shielding layer, both ends of the shield layer are connected to GND.

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

Chapter IV Expansion Module

The control card can expand digital IO, analog AD/DA, pulse axis and other resources through EtherCAT bus expansion module or ZMIO310-ECAT series vertical bus expansion module.

The EIO expansion modules and ZMIO310-ECAT are expansion modules used by the EtherCAT bus controller. For example, EIO series can expand the resources of digital IO and pulse axis. When the resources of the controller are insufficient, the EtherCAT bus controller can be connected to multiple EIO expansion modules for expansion, you can view the maximum number of IO expansion points and the maximum number of expansion axes of the controller, and in this way, it supports IO remote expansion.

4.1. EtherCAT Expansion Wiring

After the expansion wiring is completed, each EIO expansion module does not need to develop again. It only needs to manually configure the unique IO address and axis address in the EtherCAT master controller, and it can be accessed after the configuration is completed.

The IO address number is set through the bus command NODE_IO, and the program on the controller can access the resources on the expansion module only through the IO number. The configuration of the axis address uses the AXIS_ADDRESS command to map axis number, and when the binding is completed, specify the axis number through the BASE or AXIS command.

When wiring, pay attention that EtherCAT IN is connected to the upper-level module, and EtherCAT OUT is connected to the lower-level module. The IN and OUT ports cannot be mixed.
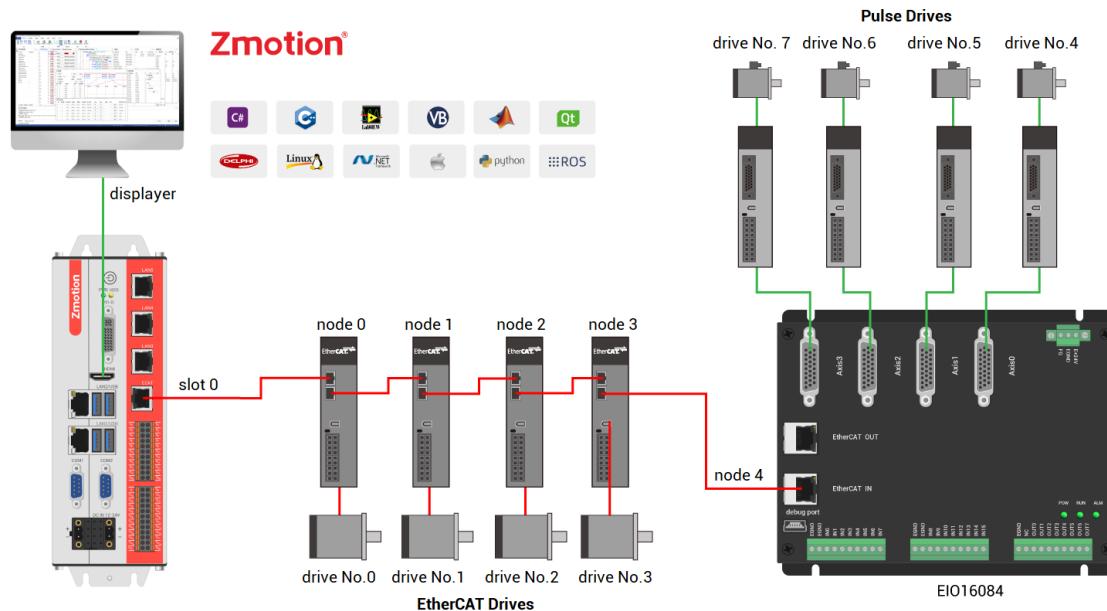
Involved No. concepts in above figure are as follows: the bus-related command parameters will use the following numbers:

- **Slot No. (slot):**

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

- **Device No. (node):**

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

- **Drive 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 Expansion Resource Mapping

→ IO Mapping:

The program on the controller can access the resources on the expansion module only through the IO number. The IO number of the EtherCAT bus expansion module is set through the bus command NODE_IO, and the input and output are configured at the same time.

When IO mapping, first check the maximum IO number of the controller itself (including the external IO interface and the interface in the pulse axis), and then use the command to set.

If the extended IO coincides with the IO number of the controller itself, the two will work at the same time, so the mapped number of the IO mapping must not be repeated in the entire control system.

IO mapping syntax:

NODE_ IO(slot, node) = iobase

slot: slot number, 0-default

node: device number, starting from 0

iobase : mapping the IO start number, the setting result will only be a multiple of 8

Example:

NODE_IO(0,0)=32   'set the IO start number of slot 0 interface device 0 to 32

If device 0 is EIO16084, after configuration according to the above syntax, the IO numbers corresponding to input IN0-15 are 32-47 in turn, and the IO numbers corresponding to OUT0-7 are 32-39 in turn.

0	41bh	1918h	0	4	24(32-55)	16(32-47)	0

→ 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(0)=(0<<16)+0+1

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

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

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

If the first node is EIO16084, and EIO16084 is connected to drive, then driver 0 here is the first pulse driver connected to EIO16084, otherwise it is the EtherCAT driver.

Chapter V Installation Requirements

5.1. 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

5.2. Installation Size
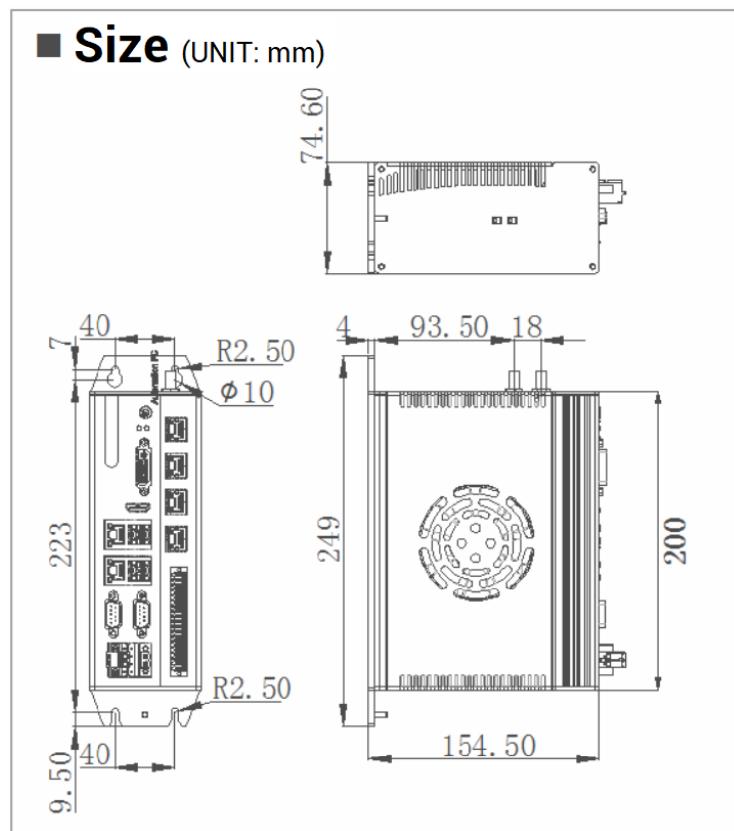
5.3. Installment Method

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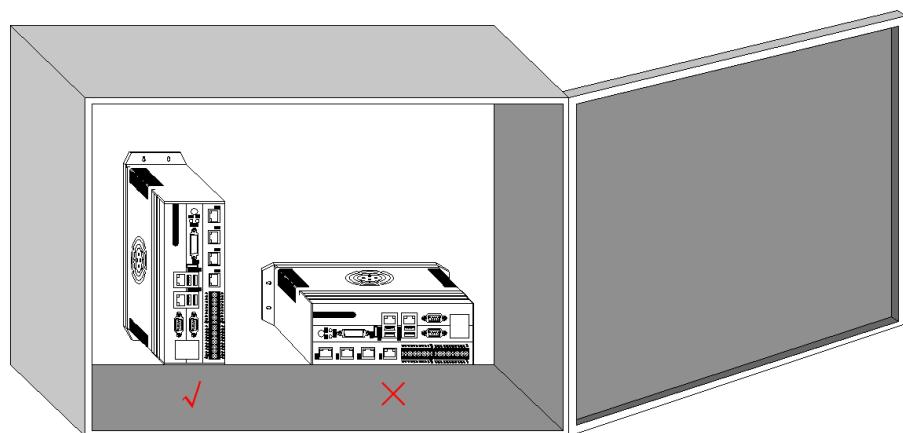
Due to the large power consumption and volume of this product, in order to facilitate ventilation and heat dissipation and easy module replacement, a corresponding distance should be reserved between the upper and lower parts of the module and the building and surrounding components, as shown in the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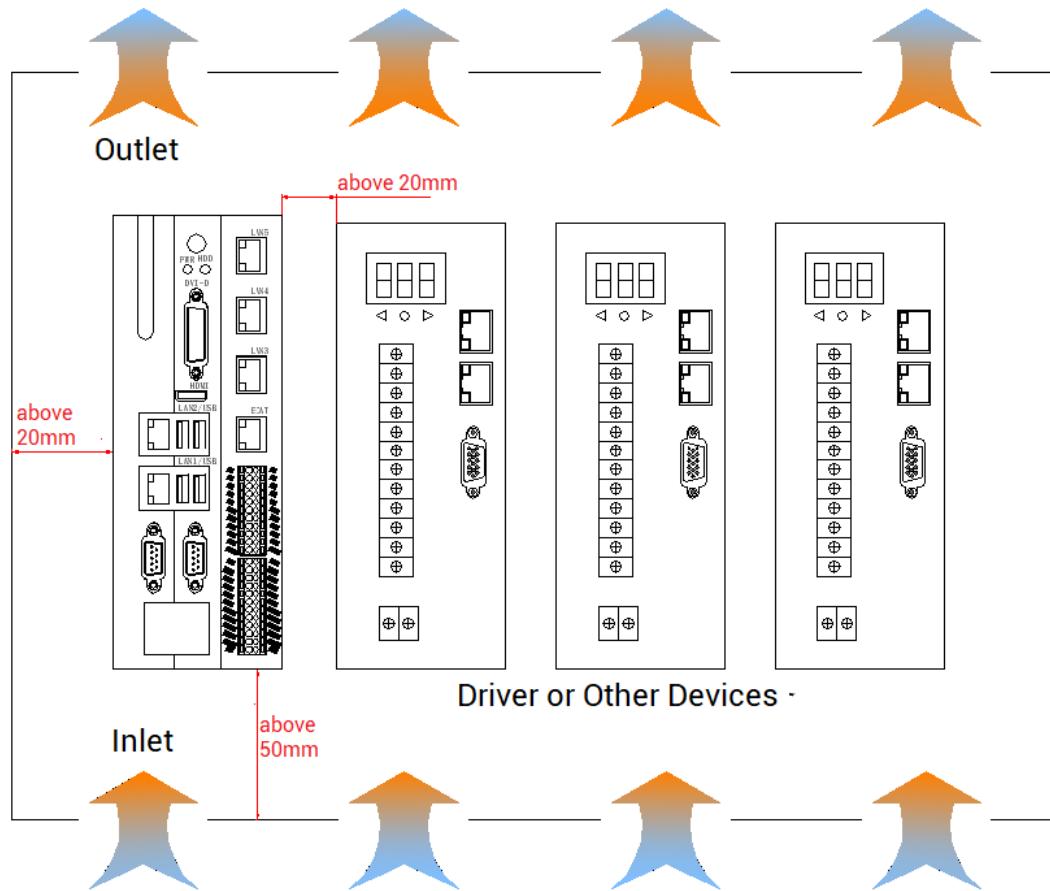
Chapter VI Run and Maintain

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.

Please regularly check the places that are difficult to check during operation. Keep the controller in a clean state, effectively remove the dust on the product surface, and prevent the accumulated dust from entering the product, especially metal dust.

Check item	Check content	Inspection standards
Whole machine	Whether there is accumulation of garbage, dirt and dust on the surface.	Confirm whether the power distribution cabinet is powered off. Use a vacuum cleaner to remove garbage or dust to avoid touching the parts, if the surface dirt cannot be removed, wipe it with alcohol and let it dry and evaporate completely.
Cable	Whether the power line and connection are discolored. Whether the insulation layer is aged or cracked.	Replace cracked cables. replace damaged connection terminals.
Electromagnetic contactor peripheral	Whether the suction is not firm or makes abnormal noise during the action. whether there is a short circuit, water contamination, expansion, or rupture of peripheral devices	Replace abnormal components.
Air duct vent	Whether the air duct and heat sink are blocked. Whether the fan is damaged.	Clean the air duct. Change the fan.

Control circuit	Whether the control components are with poor contact. Whether the terminal screws are loose. Whether the control cables have insulation cracks.	Clean the foreign objects on the surface of control lines and connection terminals. Replace damaged and corroded control cables.

6.2. Common Problems

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 pulse mode and pulse mode of drive are matched. 4. Use test software to test, and observe whether pulses are normal.
Controller works normally, and pulses are sent normally, but motor doesn't rotate.	1. Check whether the connection between driver and motor is correct, and whether the wiring between driver and controller is good contact. 2. Please ensure driver works normally, no warning appeared.
Motor can rotate, but it works abnormally.	1. Check whether set deceleration and speed exceed the equipment limit. 2. Check whether output pulse frequency exceeds driver receive limit. 3. Check whether controller and driver are grounded correctly, and whether anti-interference is well done. 4. The current limiting resistor used in the photoelectric isolation circuit of the pulse and direction signal output is too large, but the working current is too small.

It can control motor, but motor appears vibration or overshoot.	1. Driver parameter configuration may be incorrect, check driver parameters. 2. Set improper acceleration and deceleration time and motion speed.
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.
Fail to connect controller to PC through net port.	1. Whether net port led is ON? 2. Whether DC net cable is used but PC doesn't support automatic wiring. 3. Whether controller IP address is modified. 4. Whether IP address of PC network card and controller are in the same network segment.
Fail to connect controller to PC through serial port.	1. Whether serial port parameters are modified by running operation, current all serial port configuration can be checked through "?*SETCOM".