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## Foreword

First of all, thank you for purchasing and using V5 series PLC! V5 series programmable controller is a new product developed by combining the world's leading control algorithm. This product supports inching motion, linear interpolation, arc, 3D arc, electronic gear / CAM and other functions; it has a large number of convenient industry function blocks, such as chasing shear, flying shear, air defense and other functional blocks, making the application very simple; the integrated synchronous following, full closed-loop control, multi axis cooperative motion control and other functional blocks can be applied only by calling.

Project	V5-MC104
Program capacity	64K
Power down storage capacity	40K words
Basic command speed	100ns
interpolation cycle	125us~1ms
Number of axes	4+2 axis <sup>[1]</sup>
High speed input	4M (4 routes) <sup>[2]</sup> , 200k (2 routes)
High speed output	3M (4 routes) <sup>[3]</sup> , 200k (2 routes)
General input / output	22 points word input, 14 points digital output
Programmable	Ladder diagram, cam command, MC command, G code
Planning model	T / S type, symmetric / asymmetric
Sport mode	Constant velocity, dynamic position change, velocity change, acceleration change, superposition motion
interpolation	6-axis linear interpolation, arc interpolation, 3D arc interpolation, spiral interpolation
Continuous trajectory	Continuous interpolation, variable speed, pause
Electronic cam	6-axis electronic cam, chasing shear, flying shear, electronic gear, ejector pin
probe	Three, 5us response time
Analog input	2 analog input
signal communication	RS485 (2), RS422 (1), USB, Ethernet, can [4]
Expansibility	Maximum support for expansion of 6 digital input and output local expansion modules (16 in, 16 out)

[1] Scalable.

[2] It is defined as 4-axis input, which can be used as hand wheel input or feedback input, and can accept differential or single ended input.


[3] It can be used as AB phase output, CW / CCW output mode or pulse plus direction mode.


[4] Can supports CANopen ds301 and CANopen ds402 master and slave protocols.



### Safety precautions:

Please use this product by professional operators according to normal procedures. Pay attention to the following safety related precautions during use, otherwise it may cause injury to human body or property loss. Safety precautions are defined as follows.



 **Danger:** if the operation is wrong, it is very likely to cause death or serious injury;

 **Warning:** if the operation is wrong, it may lead to death or serious injury;



 **Note:** if the operation is wrong, it may cause moderate injury or slight injury, and may also cause equipment damage.

 <b>Danger</b>	<ul style="list-style-type: none"> <li>● Please set up a safety circuit outside the controller to ensure that the whole system can operate in a safe state in case of abnormal external power supply and controller failure. Misoperation and output may lead to accidents.</li> <li>● Please be sure to set emergency stop circuit, protection circuit, interlock circuit to prevent positive and reverse actions at the same time, positioning upper and lower limits and other interlocking circuits to prevent mechanical damage.</li> <li>● When the controller CPU detects the abnormality through the watchdog timer error self diagnosis function, all outputs are disconnected. In addition, when the controller CPU can not detect the abnormal input and output control part, the output control will fail. At this time, please design the external circuit and structure to ensure the safe operation of the machine.</li> <li>● Due to the fault of relay, transistor and thyristor of the output unit, sometimes the output is always on or off. In order to ensure the safe operation of the machinery, please design the external circuit and structure for the output signal which may lead to serious accidents.</li> </ul>
 <b>Notice</b>	<ul style="list-style-type: none"> <li>● Do not connect the control line with the main circuit or power line, or close to the wiring. In principle, please leave it more than 100 mm, otherwise it will cause misoperation due to noise.</li> <li>● Otherwise, make sure that the external device will not be broken when connecting.</li> </ul>


#### Installation precautions


 <b>Danger</b>	<ul style="list-style-type: none"> <li>● During the installation operation, please be sure to disconnect all power supply outside before operation, otherwise there is a risk of electric shock.</li> </ul>
 <b>Notice</b>	<ul style="list-style-type: none"> <li>● Please use in the environment of general specifications recorded in this manual. Do not use in places with dust, lampblack, conductive dust, corrosive gas, combustible gas, or exposed to high temperature, condensation, wind and rain, as well as in places with vibration and impact. Otherwise, electric shock, fire, misoperation, product damage and aging may be caused.</li> <li>● Please do not touch the conductive part of the product directly, otherwise it may cause misoperation and failure.</li> <li>● When processing and wiring, please do not drop the chips and wire chips into the ventilation hole of the controller, otherwise it may cause fire, fault and misoperation.</li> <li>● When installing the product, please use DIN rail and install the product on a flat surface.</li> <li>● The connecting cables for peripheral equipment connection, input and output, etc. should be firmly installed on the specified connector to avoid misoperation due to poor contact.</li> <li>● The local expansion module must ensure that the lock locks on both sides are locked, otherwise it may lead to poor contact and misoperation.</li> </ul>

#### Installation precautions


 <b>Danger</b>	<ul style="list-style-type: none"> <li>● When conducting wiring operation, please be sure to disconnect all power supply outside before operation, otherwise there is a risk of electric shock and product damage.</li> </ul>
 <b>Notice</b>	<ul style="list-style-type: none"> <li>● When processing and wiring, please do not drop the chips and wire chips into the ventilation hole of the controller, otherwise it may cause fire, fault and misoperation.</li> <li>● When wiring European terminal block products, please follow the following precautions, otherwise it may cause electric shock, fault, short circuit, disconnection, misoperation and damage to the product. <b>The end of the stranded wire should be twisted so that there is no wire divergence. Do not tin the end of the wire; Do not connect wires that do not meet the specified size or exceed the specified number.</b></li> </ul>

#### Start up maintenance

 <b>Danger</b>	<ul style="list-style-type: none"> <li>● Please do not touch the terminal when power on. Please clean and plug the terminal after disconnecting all external power supply, otherwise there is a risk of electric shock and may cause misoperation.</li> <li>● Please read the operation manual of stop and run before operation. Otherwise, it is necessary to fully</li> </ul>
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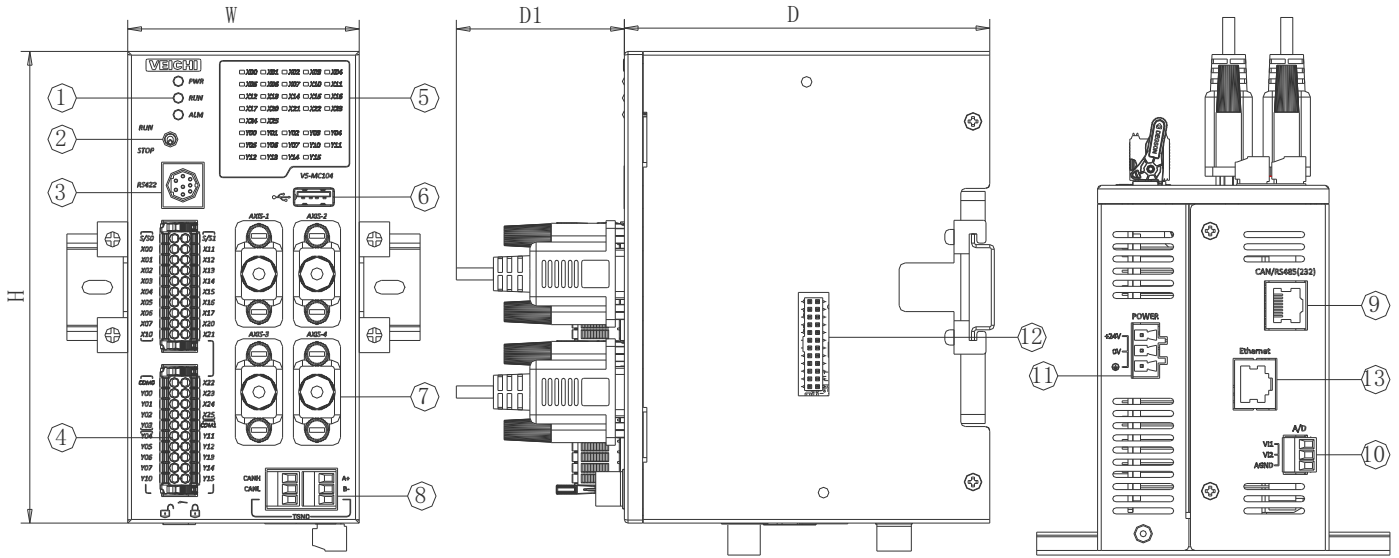
	<p>implement the operation manual of the machine which may cause damage and operation.</p> <ul style="list-style-type: none"><li>● Do not change the program in the controller from multiple peripheral devices at the same time, otherwise, the program of the controller may be destroyed and misoperation may be caused.</li></ul>
 <b>Notice</b>	<ul style="list-style-type: none"><li>● Please do not disassemble or change the product without authorization, or it may cause malfunction, misoperation and fire.</li><li>● When disassembling the expansion cable and other connecting cables, please operate after disconnecting the power supply, otherwise it may cause malfunction and misoperation.</li></ul>

#### Abandonment and transportation

 <b>Notice</b>	<ul style="list-style-type: none"><li>● When the product is discarded, please treat it as industrial waste. When disposing of batteries, please dispose of them separately according to the laws specified by each region.</li><li>● The controller belongs to precision equipment, so please avoid the impact of general specifications during transportation. Otherwise, the controller may fail. After transportation, please confirm the action of the controller.</li></ul>
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# 1 Product information

## 1.1 Product analysis chart



1	System indicator (power, operation, fault)	8	RS485-1 & CAN communication interface
2	RUN/STOP switch	9	RS485-2/RS232 & CAN communication interface RJ45 interface
3	RS422 interface	10	Analog input interface VI1/VI2
4	Switch input X、 output Y terminal	11	Power interface
5	X、 Y indicator light	12	Local expansion module port
6	USB Interface	13	Ethernet port
7	DB15 Axis control port		

## 1.2 Product size

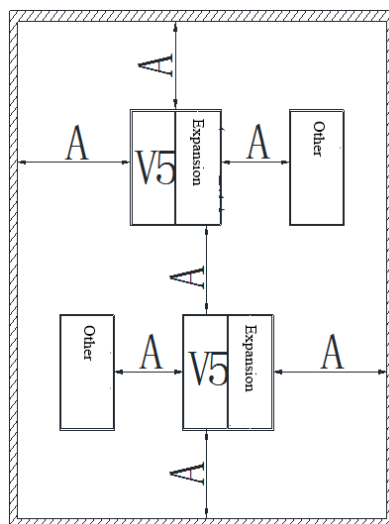
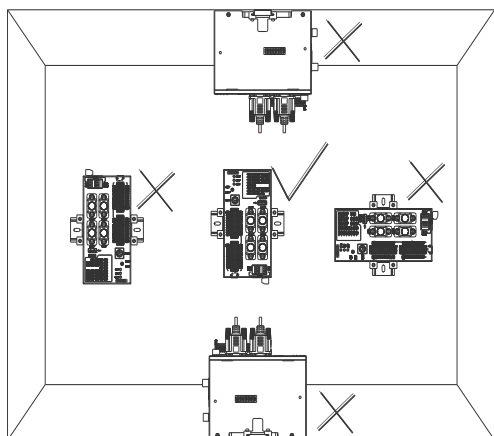
Machine model	Dimensions (mm)			
	W	H	D	D1
V5-MC104	76	155	120	75

## 2 Installation instruction

### 2.1 Environmental requirements

Project	V5 Motion programmable controller				
Ambient temperature	Run: 0~55°C, Storage: -25~75°C				
Relative humidity	Run: 5~95%RH (No condensation)				
Vibration environment		Frequency (Hz)	acceleration (m/s <sup>2</sup> )	Unidirectional amplitude (mm)	X、Y、Z10 times for each, Total 80 minutes
	DIN-Rail Mounting	10~57	--	0.035	
		57~150	4.9	--	
Usage environment	No corrosive, combustible gas, conductive dust (dust) is not serious occasions				
Use height	Below 2000m				

### 2.2 Installation position and space



1 Please pay attention to the installation position and make sure to install horizontally.

2 When installing, please consider the heat dissipation and ensure that the distance between the controller and its module  $a > 50\text{mm}$ .

### 2.3 Installation method

The V5 series of this product can be installed with DIN rail (din46277, width 35mm).

- 1) Fix DIN rail on the mounting surface in the control cabinet;
- 2) According to figure a, the lower edge of the product installation groove is horizontally buckle into the upper edge of the guide rail;
- 3) Lift the controller up 3mm according to figure B, press the upper end of the controller to the mounting surface until the upper end contacts the mounting surface, so as to ensure that the product is tightly embedded on DIN rail without any skew;
- 4) Press the clip down and screw it down as shown in Figure C.

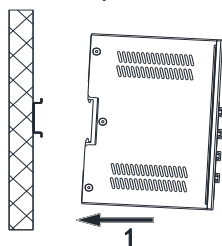


Figure A

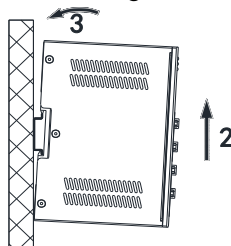


Figure B

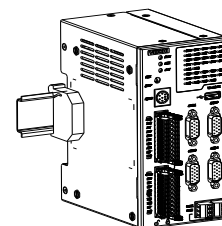
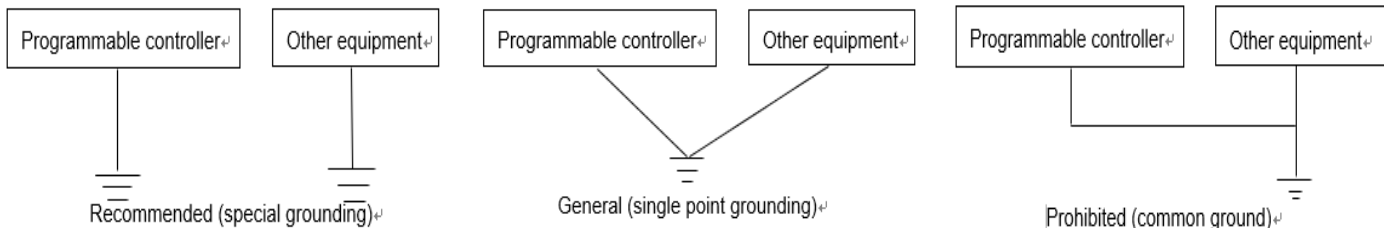


Figure C

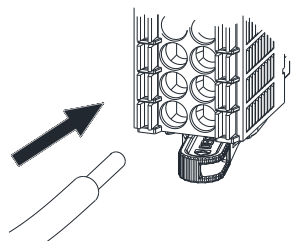
### 3 Wiring and specifications

#### 3.1 Wiring requirements

1) Grounding requirements: Use grounding or common grounding for grounding.



2) Wire end processing



The V5 input and output terminals adopt pluggable crimping terminals, and the ends of the stranded wires should be twisted out without "wire whiskers". It is recommended that the exposed bare copper wires have a length of 8 mm.

#### 3.2 Specification requirements

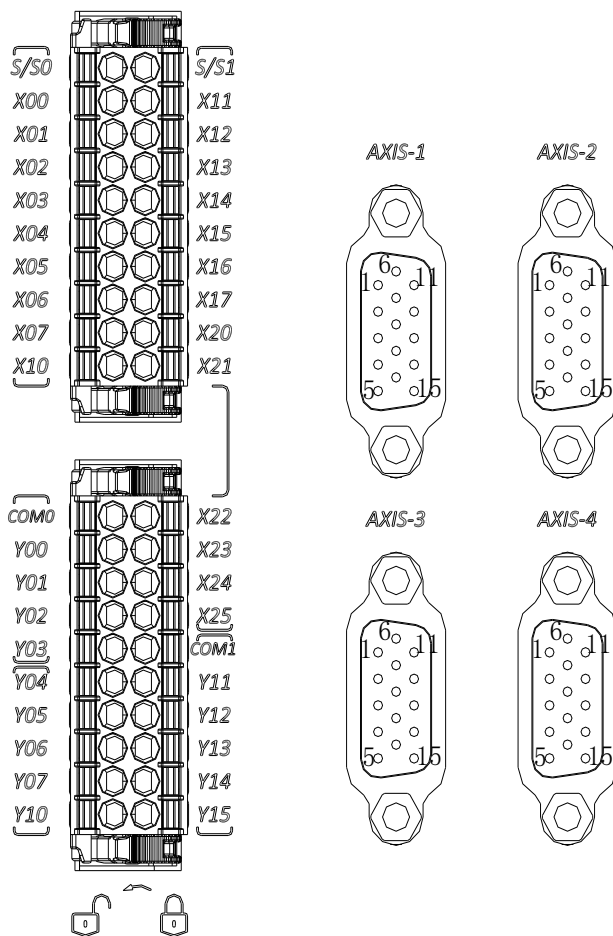
1) General specifications

Item	Specifications	
Shock proof	147m/s <sup>2</sup> , sine half-wave pulse 3 times in X, Y, Z direction	
Anti-noise	Noise Simulator with noise withstand voltage 2000Vp-p noise width 1us rising edge 1ns period 30~100HZ	
Withstand voltage	AC500V 1 mints	Between each terminal and ground
	AC1.5KV 1mints	
Grounding 1	Class D grounding (grounding resistance: 100Ω or less), it is not allowed to be grounded together with a strong electric system (please refer to "Grounding Requirements")	

2) Power Specifications

Item	Unit	Minimum	Typical	Maximum	Remark
Working Voltage	Vdc	20.4	24	28.8	Built-in anti-reverse processing
Limit working voltage	Vdc	19.0	/	30.0	
Input current	A	/	/	0.95	19.0V input, full load output
Input power	W/VA	/	/	14W/ 18.7VA	
Output voltage	5V/GND	V	4.75	5	5.25
Output current	5V/GND	mA	/	/	1000

### 3.3 Input and output terminal introduction



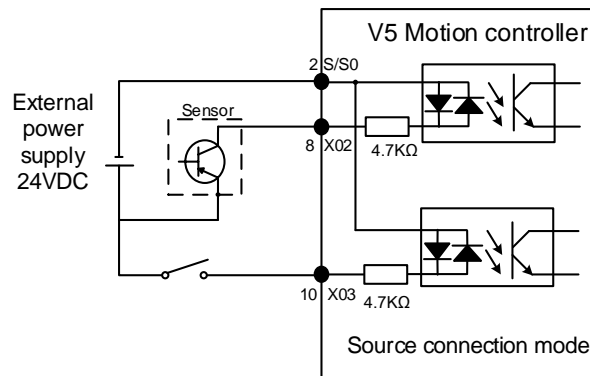
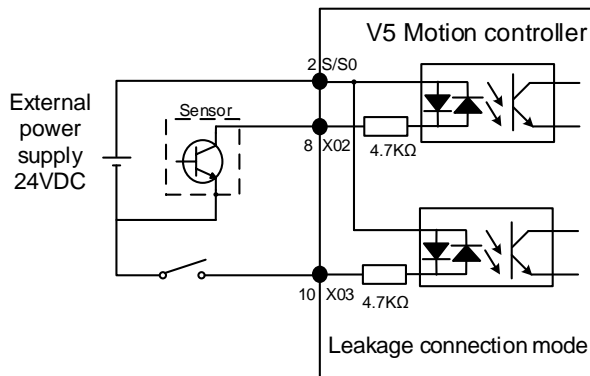
DB15 definition of axis x (X is 1, 2, 3, 4)					
Pin number	Signal	Function	Pin number	Signal	Function
1	/ENABLEx	Enable output	9	PBx-	Differential input B signal-
2	/ALARMx	Fault input	10	PAX-	Differential input A signal-
3	ECOM	Enable/fault signal	11	PULx-	Differential travel pulse signal -
4	+5V	5V power supply	12	DIRx+	Differential travel direction signal +
5	GND	5V power grounding	13	PZx+	Differential input Z signal+
6	PULx+	Differential output pulse signal +	14	PBx+	Differential input B signal+
7	DIRx-	Differential output direction signal -	15	PAX+	Differential input A signal+
8	PZx-	Differential input Z signal -			

: The differential input/output signals of the X-axis X are not isolated and are referenced to the GND of the internal logic device of the controller.



### 3.4 Input wiring

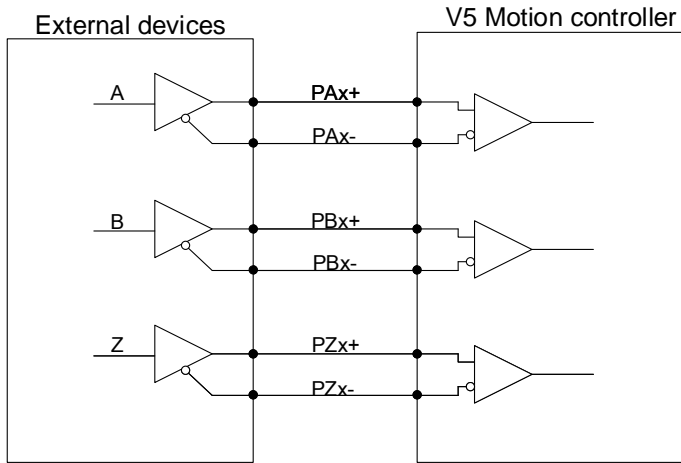
#### 3.4.1 Ordinary input wiring instructions



Item		General input	High speed input
Signal input method		When the common S/Sx terminal is shorted to 24V, it is a sink input; when the common S/Sx terminal is shorted to COM, it is a source input.	
Input Channel		X02~X25	X00、X01
Electrical parameters	Detection voltage	DC24V <sup>[1]</sup>	DC24V <sup>[1]</sup>
	input resistance	4.3K	3.9K
	Input is ON	Input current less than 3.6mA	Input current more than 6.0mA
	Output is OFF	Input current more than 1.5mA	Input current less than 1.5mA
	Isolation voltage	3750Vrms@AC,1min	
Input response time/frequency		The IO port is hardware RC filtering, and the RC constant time is about 10ms.	200KHz, the narrowest pulse width is 1.25us
Input loop isolation		Optocoupler isolation	
Common terminal		The input common terminal is S/Sx, the common end of X0~X10 is S/S0, and the X11~X25 common end S/S1	

**☑【1】:** 15V~24V is ON, and less than 5V is OFF. The maximum limit is 30V. When all inputs are kept ON for a long time, in order to ensure the reliability of the controller, the input voltage derating should be processed. It is recommended that the input voltage not exceed 26.0V.

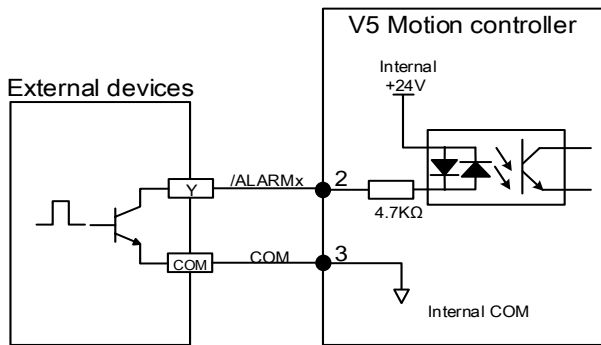
### 3.4.2 Differential Input Wiring Instructions



Item	Description
Input	Differential input, RS-422 standard
Maximum input frequency	4MHz <sup>[1]</sup>
Maximum input frequency	About 100ns
Differential signal common mode voltage input range	-7V~+7V
Wire requirements	Shielded twisted pair

**【1】** The pulse frequency of the AB phase quadrature pulse before the quadruple frequency.

### 3.4.3 Fault input wiring instructions

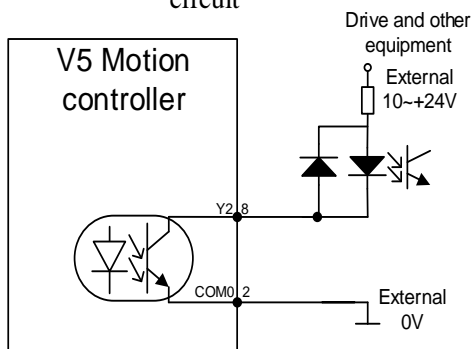


Item	Description
Input	DC24V
ON/OFF response time	About 10ms
Input resistance	4.3K
Input is ON	Input current more than 3.5mA
Input is OFF	Input current less than 1.5mA

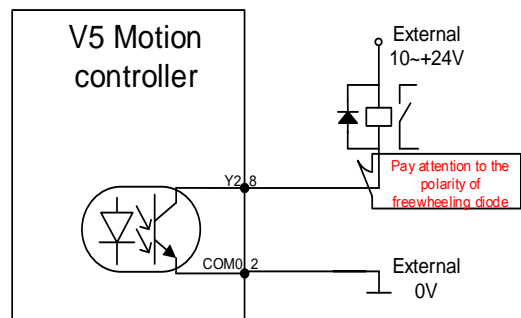
## 3.5 Output wiring

### 3.5.1 Normal / High Speed Transistor Output Wiring Instructions

Example of optocoupler circuit



Example of relay circuit



Project	High speed transistor NPN output	Ordinary transistor NPN output
Loop supply voltage	DC5~24V	DC5~24V
Loop insulation	Optocoupler isolation	Optocoupler isolation
Action indication	LED is lit when optocoupler is driven	LED light is lit when the optocoupler is driven
Leakage current when open circuit	Less than 0.1mA/DC30V	Less than 0.1mA/DC30V
Minimum load	5mA(DC5~24V)	5mA(DC5~24V)

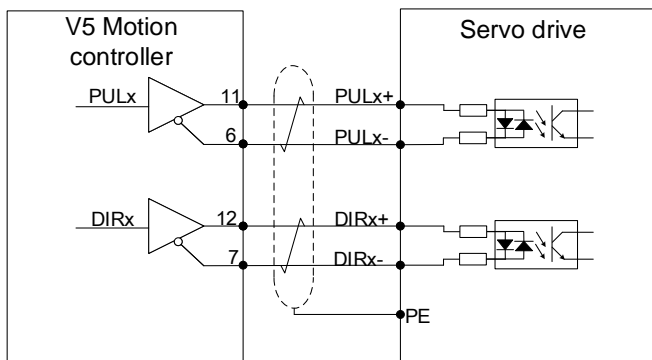
Maximum output current	Resistive load	0.2A/port	0.5A/ port; 0.8A/ 4 ports; 1.6A/ 8 ports
	Inductive load <sup>[1]</sup>	2.9W/DC24V	12W/DC24V
	Lamp load <sup>[2]</sup>	0.9W/DC24V	1.5W/DC24V
ON response time	1us	0.5ms	
OFF response time			
High speed output frequency	200KHz per channel [3] (highest)		/
Output common	Each group shares a common COM, the public end of Y0~Y3 is COM0, and the common end of Y4~Y15 is COM1. Among them, Y0/Y1 is a high speed output.		
Fuse protection	Fuse protection		

[1] The transistor NPN output circuit has its own voltage regulator inside to prevent the inductive load from breaking the reverse electromotive force. However, if the load capacity exceeds the specification, please add a freewheeling diode externally.

[2] The normal transistor NPN outputs a certain overcurrent capability, but does not have a short-circuit protection function. If the load is short-circuited, the transistor may be damaged. The high-speed transistor NPN output has short-circuit protection function, so it can't work and there is current exceeding the rated specification, including instantaneous current. Otherwise, the short-circuit protection will stop output after starting, and the control output needs to be invalid in the program to cancel the protection state. Therefore, if there is a light load and a capacitive load, please use the normal transistor NPN output. For inductive or resistive load, please use the high speed transistor NPN output.

[3] High-speed NPN transistor output has distributed capacitance. If it is running at 200K, please ensure that the conduction current is above 12mA. The receiving device can be accelerated by parallel resistance. The recommended resistance value is 2kΩ.

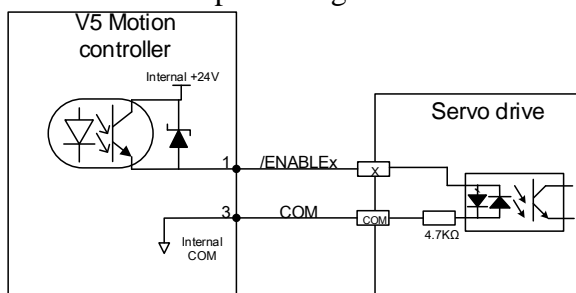
### 3.5.2 High Speed Differential Output Wiring Instructions



Item	Differential output
Loop supply	Active output, no external power supply required
Circuit isolation	No isolation from the PLC, no isolation between channels
Action indication	ON when output + greater than -
Highest frequency	3MHz <sup>[1]</sup>
The output voltage	±5V (3.1V at 100 ohm load)
ON state	VOx+ minus VOx- is 5V
OFF state	VOx+ minus VOx- is 5V

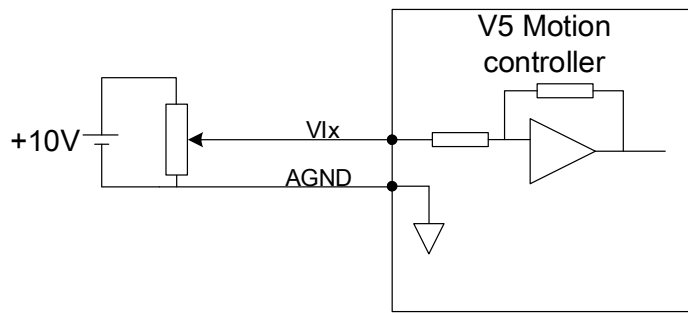
**【1】** Refers to the pulse frequency before the quadruple frequency of the AB phase quadrature pulse.

### 3.5.3 Enable output wiring instructions



Item	Enable signal output
Loop power	Motion controller internal 24V
Loop insulation	Optocoupler isolation
Leakage current	Less than 0.1mA/DC30V
Minimum load	5mA(DC15~24V)
ON/OFF response time	0.5ms

### 3.6 Analog input circuit

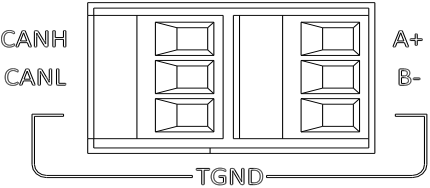
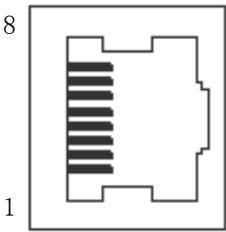
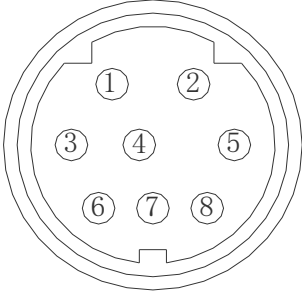


Item	Analog input
Input channel	VI1, VI2
Input voltage range	0~+10V
Rated digital quantity	0~4096
Voltage input impedance	>1MΩ
Resolution	12 digits
sampling time	1ms
Limit voltage	+15V

## 4 Communication guidance

### Function introduction of communication terminal

The CON1 communication interface of V5 series needs customer wiring, which adopts plug-in terminal. Its terminals are defined as follows:

Name	Function description	Sketch
RS485+, RS485-	The first group of RS485 communication signal lines	
CANH, CANL	CAN Communication line	
TGND	RS485 / can reference level tgn. When multiple sets are used, please ensure that each tgn. is connected to each other	
RS232-R, RS232-T	RS232 communication signal (cannot be used with rs485-2 at the same time)	 <p style="text-align: center;">CAN/485 (232)</p> <ul style="list-style-type: none"> <li>1. CANH</li> <li>2. CANL</li> <li>3. CANG</li> <li>4. RS485-2-</li> <li>5. RS485-2+</li> <li>6. RS232-T</li> <li>7. TGND</li> <li>8. RS232-R</li> </ul>
TGND	RS232/RS485-2 Reference ground	
RS485-2+, RS485-2-	The second group of RS485 communication signal lines	
CANH, CANL, TGND	The reference level of CAN communication line is tgn. When multiple sets are used, please ensure that each tgn. is connected to each other	 <p style="text-align: center;">RS422</p> <ul style="list-style-type: none"> <li>1. RXD-</li> <li>2. RXD+</li> <li>3. TGND</li> <li>4. TXD-</li> <li>5. T5V</li> <li>6. none</li> <li>7. TXD+</li> <li>8. none</li> </ul>
RXD-, RXD+	422 Receive signal	
TXD-, TXD+	422 Send a signal	
T5V, TGND	5V The power supply is isolated from the internal signal ground.	

## 5 Appendix

### 5.1 Controller programming

The V5 series controller adopts vcautodesignsoft Ver1.0 and above programming environment to compile and debug user program; please refer to instruction and programming manual of V5 series PLC for details.

### 5.2 Cable selection

Name	Item No	Specifications
Motion controller	9020111001	V5-MC104
IO Expansion module	9120091005	V5-1616ETN
PLC Programming cable	4070000058	USB-SC-09
V5 & SD700 Connecting line	3010000062	DB15P-RVVP_14X-SCSI50P-2M2 A
V5 & SD600 Connecting line	3010001066	DB15P-2464_24A14X-DB44P-2M
Touch screen cable (maintenance control)	3010001050	VI10-FX
Terminal accessories (terminal fixings)	1300040006	AF-00