



VEC-VA motion controller hardware description

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VAMM001E

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Contents

Contents	I
Chapter I Product inspection and precautions	1
1.1 open-case inspection	1
1.2 Model description of the motion controller	1
1.3 Outline diagram of motion controller	2
1.4 Motion controller storage environment	2
1.5 Motion controller operating environment	2
1.6 Precautions for the use of motion controller	3
1.6.1 Safety Precautions	3
1.6.2 Design considerations	3
1.6.3 Precaution for connection	4
1.6.4 Precautions for startup and maintenance	4
1.6.5 Precautions for abandonment	4
1.7 Precautions for the installation of motion controller	4
1.7.1 Installation method of motion controller	4
1.7.2 Removal of motion controller	5
1.7.3 Motion controller placement	6
Chapter II Product Introduction	6
2.1 Terminology and Interpretation	6
2.2 Introduction to VECTOR motion controller	7
2.3 Typical system connection diagram	7
2.4 Description of motion controller Connection port	8
Chapter III Terminal description and wiring	10
3.1 Terminal Definition	10
3.1.1 Digital I/O jumper selection	10
3.1.2 Digital input wiring	11
3.1.3 Digital output cable	11
3.1.4 Definition of the RS-232 (COM1) interface	12

3.1.6 System 24V external power input port definition	13
3.1.7 Digital I/O power supply interface definition	13
3.1.8 Shaft interface definition	14
3.1.9 Analog input definition	17
3.1.10 Analog output definition	17
3.2 Connection of motion controller to servo drive	18
3.2.1 servo drive of VECTOR	18
3.2.2 Delta servo drive	19
3.2.3 Mitsubishi servo drive	20
3.2.4 Fuji servo drive	21
3.2.5 Panasonic servo drive	22
3.2.6 Yaskawa servo drive	23
ChapterIV Appendix	24
Appendix I: Installing dimension	24
Appendix II: Introduction to Extension Modules	25

Chapter I Product inspection and precautions

1.1 open-case inspection

Thank you for choosing the motion controller of VECTOR

In order to prevent the product in the purchase and transportation process of negligence, Please check the following items carefully:

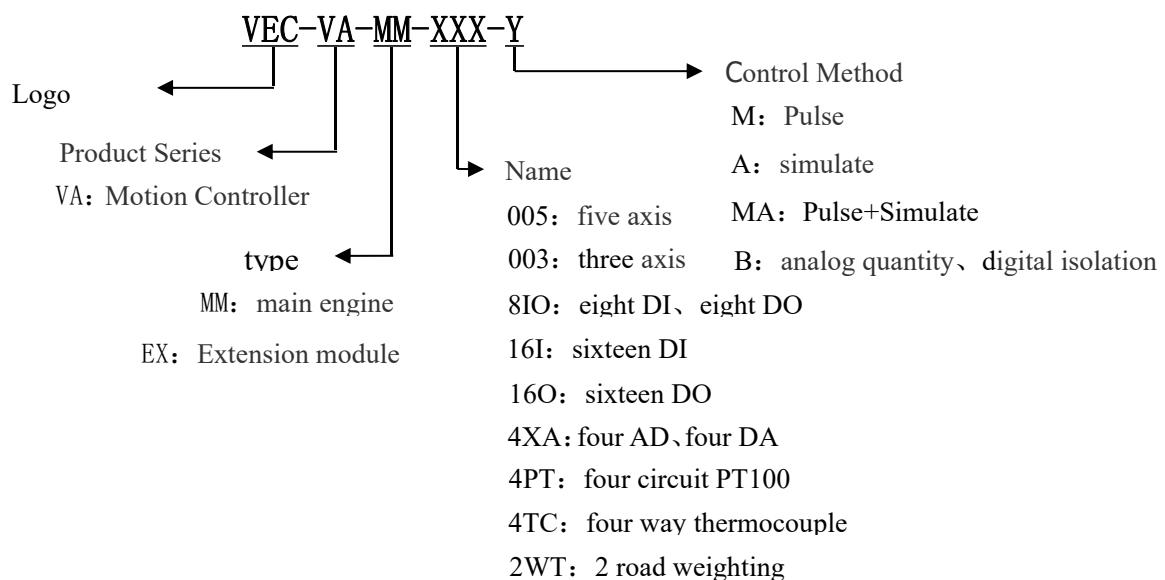
- Check whether the nameplate of the product is consistent with the outer package;
- Check the appearance of the product for scratches or mechanical damage;
- Check the product list to see whether the accessories are complete;
- Shake the chassis gently to check whether there is any foreign matter inside.

If any of the above phenomena occur, do not use, immediately contact VEVTOR or the distributor for proper treatment.

VECTOR Motion Controller Product List:

- (1)VECTOR motion controller 1 host
- (2)RS232 program download line, 1, suitable for COM1;
- (3)15PDB male ,5, suitable for AXIS0-AXIS4
- (4)Gray terminal 10PIN ,two, suitable for TM3, TM4;
- (5) Grey terminal 16PIN, one, suitable for TM1.

1.2 Model description of the motion controller



1.3 Outline diagram of motion controller



1.4 Motion controller storage environment

The product must be placed in packing box before installation; If the machine is not in use temporarily , In order to make the product can meet the company's warranty scope and future maintenance, note the following when storing:

- (1) Must be placed in a dry and grime free place;
- (2) The ambient temperature of the storage location must be within the range of -20°C to +65°C;
- (3) The relative humidity of the storage location must be in the range of 0% to 95%, and there is no condensation;
- (4) Avoid storage in an environment containing corrosive gases and liquids;
- (5) Properly packaged and stored on shelves or table.

1.5 Motion controller operating environment

The operating temperature of this product is -10°C to +40°C.

It is recommended that the ambient temperature be below +40 °C for Long hours at work. If the ambient temperature is above +40 °C , place it in a well-ventilated place to ensure product reliability. If the product is installed in a distribution box, the size and ventilation conditions of the

distribution box must be make sure all internal electronic devices are not in danger of overheating, and attention should be paid to whether vibration of the machine will affect the electronics of the distribution box .In addition, the conditions of use also include the following:

- (1) Places without high heat generating devices;
- (2) Places without water droplets, steam, dust and oily dust;
- (3) Places without non-corrosive, flammable gas, liquid places;
- (4) Places without no- floating dust and metal particles ;
- (5) Places without vibration;
- (6) Places without electromagnetic noise interference.

1.6 Precautions for the use of motion controller

1.6.1 Safety Precautions

Before installing, operating, maintaining and checking the motion controller, please be sure to read all the attached information of the operation manual and other related instructions and use it correctly. Please read the related knowledge、 safety information and precautions of all devices before using them.

Note: It can be dangerous when used incorrectly!

1.6.2 Design considerations

※Please set a safety loop outside the motion controller, so that the whole system can operate in a safe state even if the external power supply is abnormal or the motion controller fails.

※Misoperation and error output may lead to accidents.

- Be sure to add interlocking loops and positioning loops outside the motion controller.
- When the motion controller fails to detect abnormalities in the input/output control part, the output control will fail.
- The output current of the encoder to the power supply (axis0-Axis4 5V) varies with the presence and quantity of the extension module, the maximum load current not exceeding 0.5A. When current overload occurs, except for the voltage drop and the controller input not operating, all outputs will become OFF.
- Due to the transistor failure of the output unit, sometimes the output is always on or always off. In order to ensure that the machine operates in a safe state, please design the external loop and structure of important signals
- Do not bind the control line with the main loop or power line. Please control the distance

- above 30cm, Otherwise, misoperation may be caused by noise.
- When using, make sure that the cable used to connect peripherals is free from external forces, otherwise it may lead to disconnection or failure.

1.6.3 Precaution for connection

- Disconnect all power supplies before installing or connecting cables. Otherwise, the motion controller may be damaged.
- Correctly connect the isolated 24V dc power supply (the voltage and current must meet the requirements in the manual) to the wiring terminal of the system power supply according to the instructions in this manual. Otherwise, the motion controller may be damaged.
- The 24V power supply for digital IO should be provided separately from the 24V power supply for the system, Do not use the same power supply, otherwise the motion controller will be disturbed.
- Please connect the PE terminal to the ground reliably with more than 2 mm square wire, otherwise the motion controller will be disturbed.

1.6.4 Precautions for startup and maintenance

- Do not touch terminals when the power is on.,Otherwise, it may be dangerous or the motion controller may misoperate.
- To change the program during execution, perform forced output, RUN, STOP and other operations , please be sure to read the manual carefully,it can be operated under sufficient assurance of safety,Otherwise mechanical damage or accident may be caused by operation error.
- Do not disassemble or alter the product without authorization, otherwise it may cause malfunction, misoperation and fire. For maintenance matters, please consult Shenzhen VECTOR TECHNOLOGY Co., LTD.

1.6.5 Precautions for abandonment

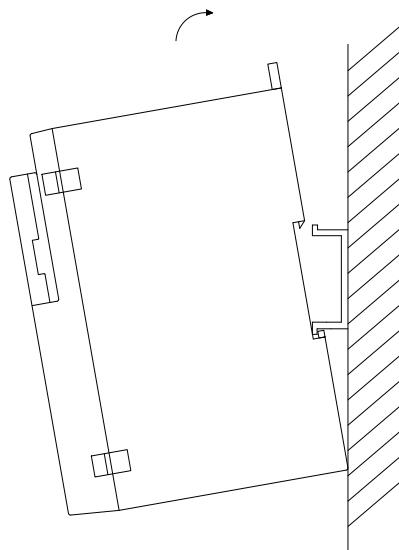
- When the product is discarded, please treat it as industrial waste.

1.7 Precautions for the installation of motion controller

1.7.1 Installation method of motion controller

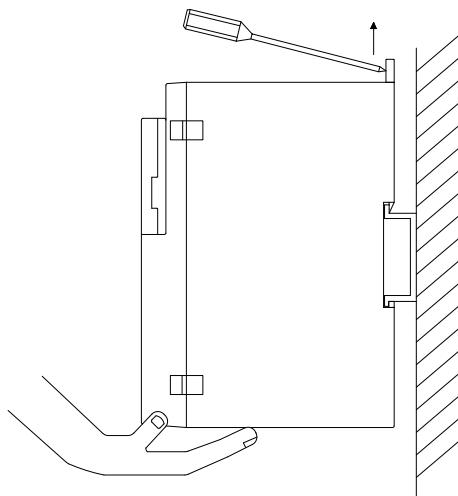
Hold the VECTOR motion controller at an Angle of approximately 15° vertically and slowly

slide up so that the lower edge of the groove on the back of the controller hooks onto the lower edge of the DIN RAIL (35mm). Then slowly apply pressure from this axis to clamp the VECTOR motion controller onto the guide rail.

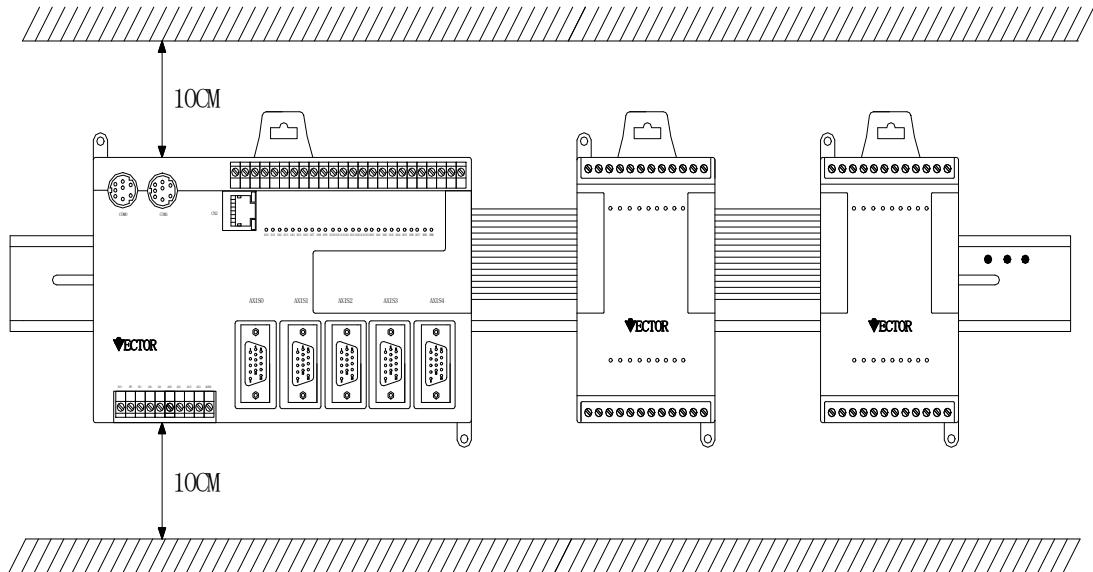


1.7.2 Removal of motion controller

Insert a long-handled flat-head screwdriver into the clip, hold the lower part of the VECTOR motion controller with your hand, and then twist or pull the screwdriver out of the clip to remove it.



1.7.3 Motion controller placement



➤VECTOR motion controllers should be positioned vertically and forward,The space between the top and bottom of the VECTOR motion controller and the PDC should be at least 10cm. The host and expansion module should be installed from left to right. A maximum of eight expansion modules can be installed regardless of type.

Chapter II Product Introduction

2.1 Terminology and Interpretation

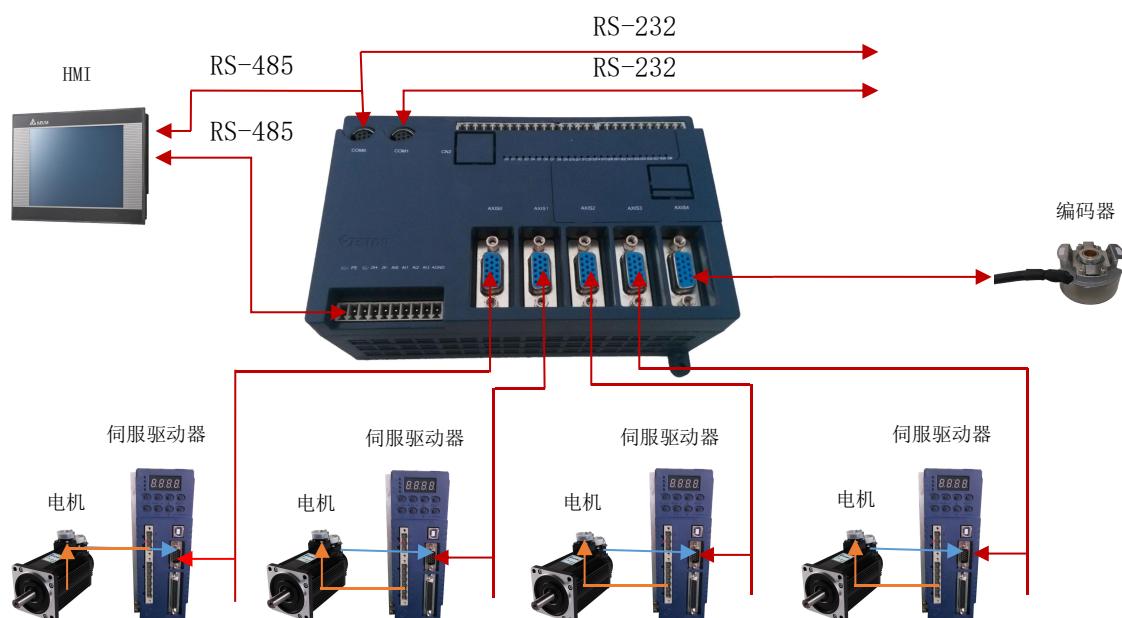
term、abbreviation	Explanation
ARM	The ARM(Advanced RISC Machine) processor is a 32-bit RISC processor with low power consumption and high performance.
FPGA	The field programmable gate array is developed on the basis of PAL, GAL, CPLD and other programmable devices.

2.2 Introduction to VECTOR motion controller

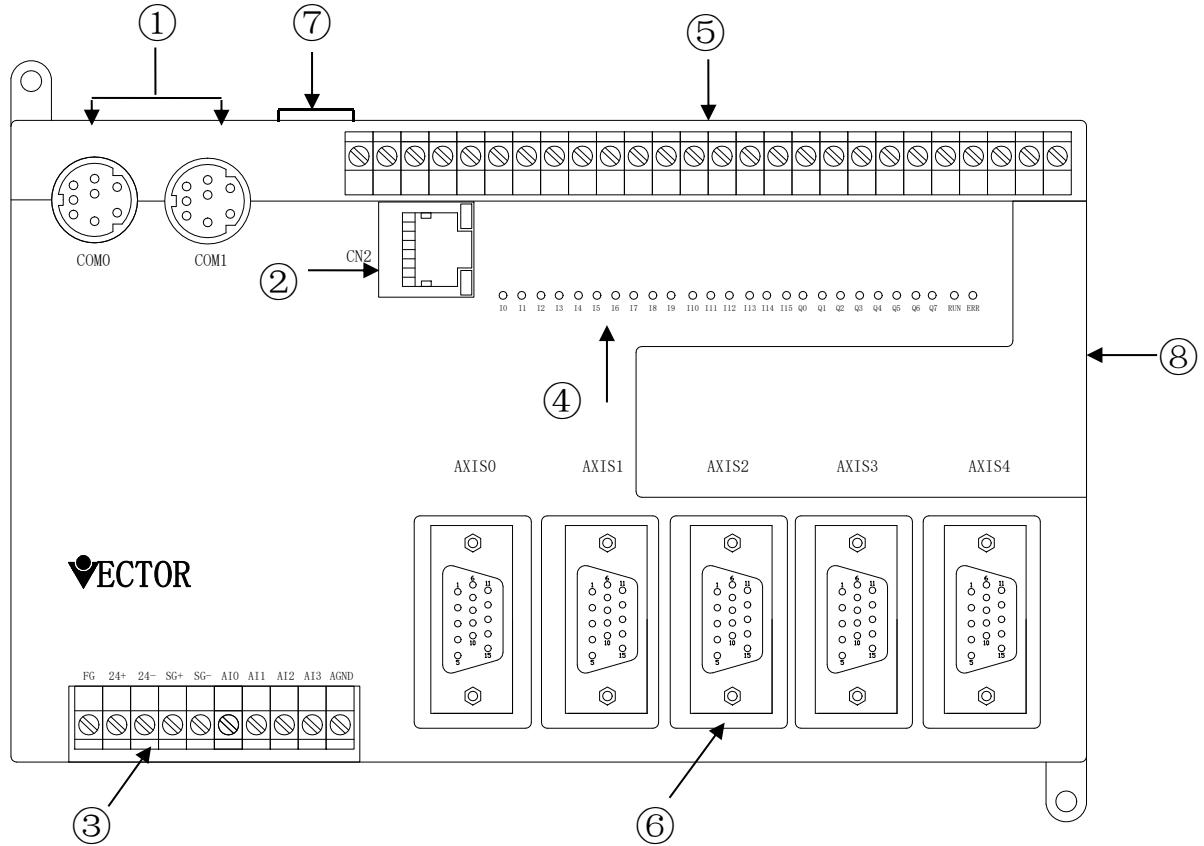
VECTOR motion controller is a new motion controller with the core of ARM and FPGA, Compact and integrated with rich motion control functions. It has five axis interface, one spindle interface and four servo axis interface, the servo axis can be extended to 16 axis, support real-time multi-task control, with advanced and easy to use simulation tools, integration of rich motion control function blocks, four servo axis motion control cycle is less than 1 millisecond. Its built-in 4-way virtual spindle, combined with servo driver and servo motor can form a complete closed-loop and precise motion control system. Using KW-Multiprog programming tools, support IEC61131-3 international standard of five programming languages, familiar with PLC programming engineers, do not need to re-learn it can be programmed.

The motion control firmware library mainly includes 9 kinds of main functions (including more than 40 kinds of function blocks), 6 kinds of return zero functions, relative point motion, absolute point motion, double closed loop, speed type electronic gear, planning type electronic CAM, custom type electronic CAM, speed superposition. The relative motion control of position closed loop supports the speed planning of trapezoidal curve and S shape (7 segments speed, 5 power, sines and cosines).Realize linear interpolation, circular interpolation, spiral interpolation and other functions. The interface of motion control function module conforms to the interface defined in PART1 and PART2 stipulated by international PLCoopen organization, realizing the perfect compatibility between the upper application program and other products.

2.3 Typical system connection diagram



2.4 Description of motion controller Connection port

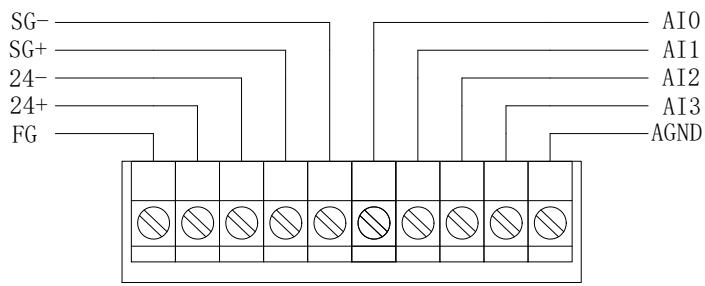


Top view of the VECTOR motion controller host

① Communication port, COM0 has RS-485 and RS-232 interface, COM1 is the program download port only the RS-232. :

② Ethernet (CN2).

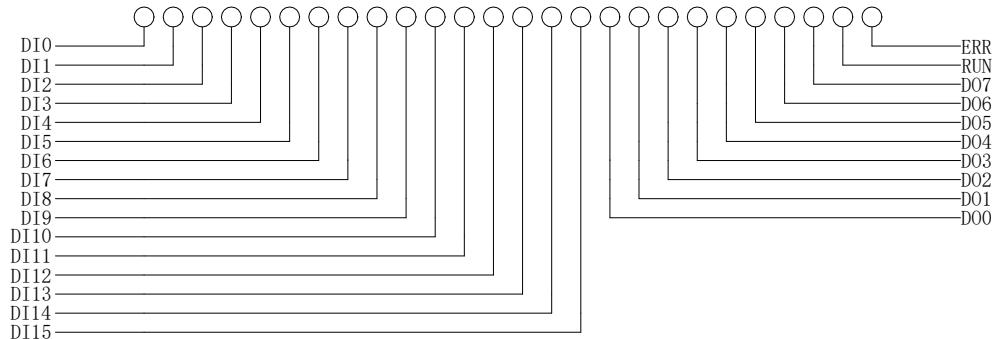
③ from left to right are: RS485 communication positive, protective ground, RS485 communication negative, system 24V power positive and negative, analog input AI0-AI3, analog ground; As shown below:



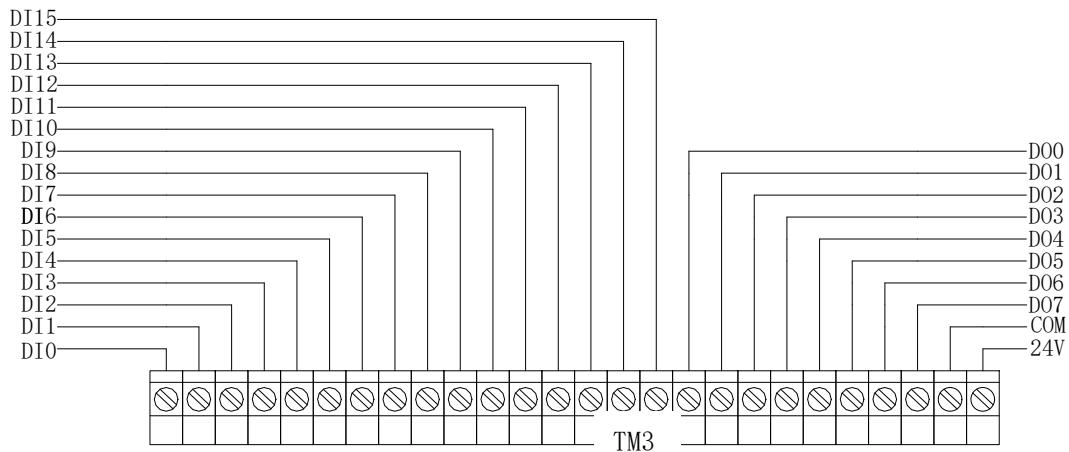
TM4

④ digital input and output and operation and error indicators (di0-DI15, DO0-DO7, RUN and

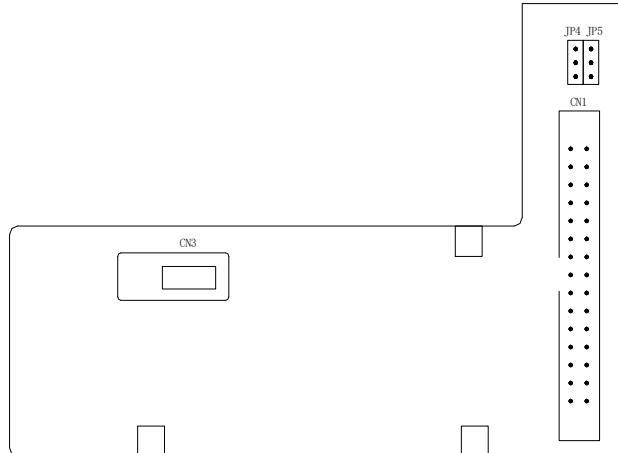
ERR respectively from left to right); As shown below:



⑤ Digital input / output and digital external power supply port (From left to right : di0-DI15, DO0-DO7, COM and 24V); As shown below:



- ⑥ Axis card interface:from left to right is AXIS0-AXIS4 , AXIS4 is the spindle interface.
- ⑦ External program memory card slot (Micro SD card).
- ⑧ CANBUS expansion module interface (see the following figure for specific interface definition).

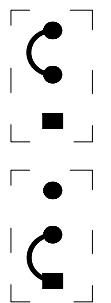


Name	Definition
CN1	Expansion module connection terminals, regardless of type, can be extended eight to the right
CN3	CANBUS extension terminal for extension between motion controllers
JP4、JP5	Digital port jumper selection, detailed instructions see 3.1.1

Chapter III Terminal description and wiring

3.1 Terminal Definition

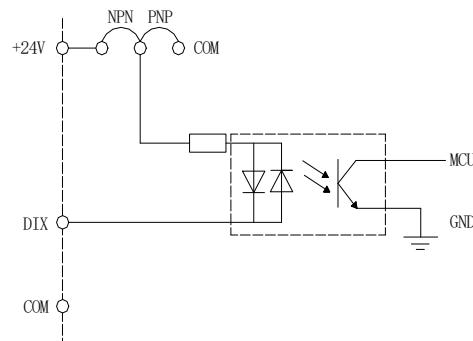
3.1.1 Digital I/O jumper selection

JP4	Digital input port signal type selection	 PNP
JP5	Select the signal type of digital output port	

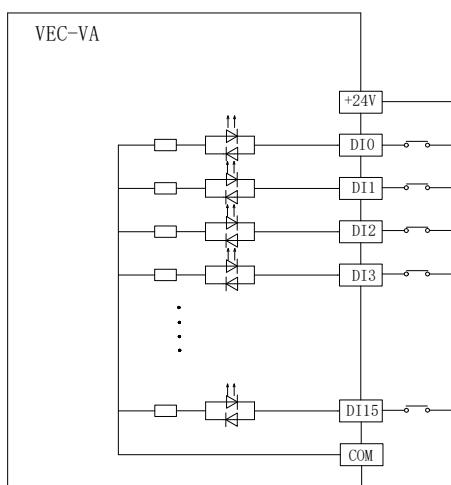
➤The factory default Settings are NPN type

3.1.2 Digital input wiring

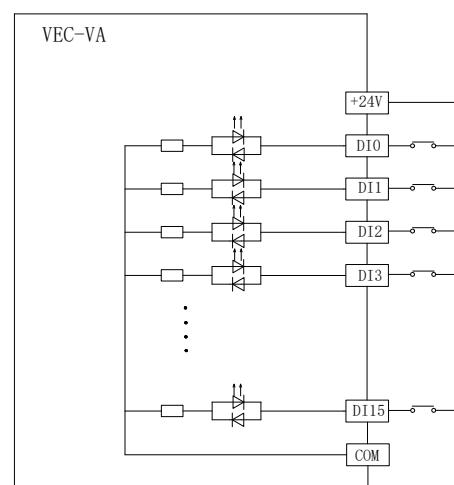
Input mode	Optical coupling isolation
Input points	16
input terminals	DI0-DI15
Effective signal	When the NPN type is selected, the DI signal is ON when it is connected to the COM terminal When the PNP type is selected, the DI signal is ON when it is connected to the +24V terminal
Input instructions	Corresponding terminal LED indicator, the indicator is on when the input is valid
pulse width	More than 5 ms



DIx input schematic



NPN wiring diagram of DIx



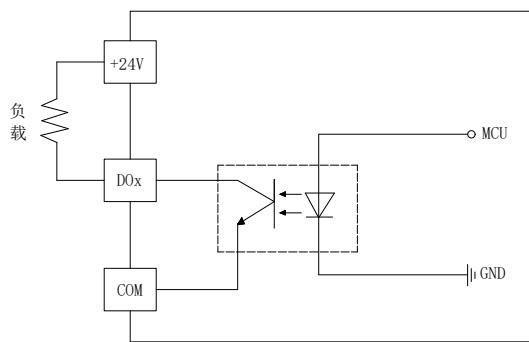
PNP wiring diagram of DIx

3.1.3 Digital output cable

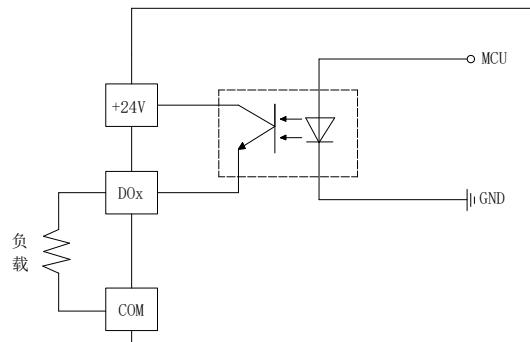
Output way	Optical coupling isolation
------------	----------------------------

Output points	8
Output terminals	DO0-DO7
Output way	Open collector
Working current	50mA
Output instructions	Corresponding terminal LED indicator, the indicator is on when there is output

➤The VECTOR motion controller uses transistor output and needs to pay attention to the output current, otherwise it may burn the DOx port.



NPN wiring diagram of DOx

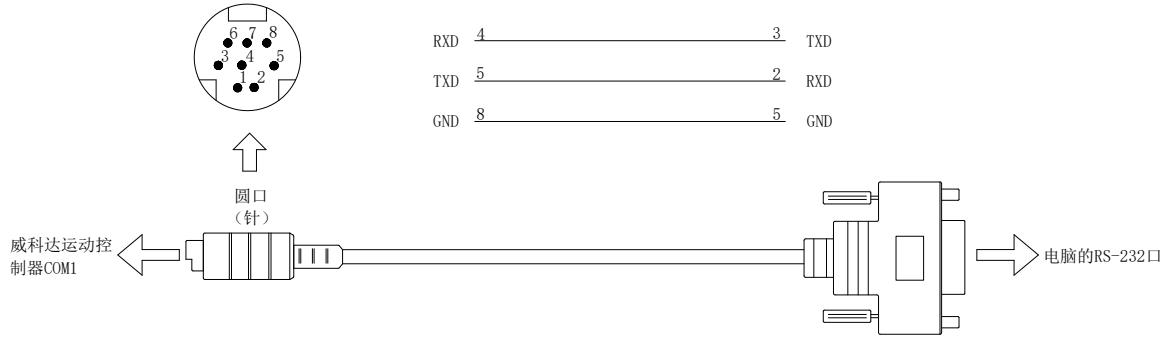


PNP wiring diagram of DOx

3.1.4 Definition of the RS-232 (COM1) interface

RS-232 (COM1)		Pin-out	definition
1		NC	
2		NC	
3		NC	
4		RXD	
5		TXD	
6		NC	
7		NC	
8		GND	

The connection to the computer is shown as below:



3.1.5 Definition of the RS-485 interface

RS-485	TM4 SG+ PE SG-	terminal	definition
		SG+	RS-485 the signal is positive
		SG-	RS-485 the signal is negative

3.1.6 System 24V external power input port definition

24V power supply	TM4 24+ 24-	terminal	definition
		24+	24V positive
		24-	24V negative
Rated input voltage	24VDC		
Permissible voltage range	24VDC±15%		
Rated current of the external power supply I	0.5A<I<1.5A		

➤ To prevent interference, use an isolated 24V switching power supply to power the system independently.

3.1.7 Digital I/O power supply interface definition

Digital 24 v	TM3 COM 24V	terminal	definition
		24V	24V positive
		COM	24V negative

Rated input voltage	24VDC
Permissible voltage range	24VDC±10%
Rated current of the external power supply I	I>1A

➤Do not use the same power supply as the 24V of the system

3.1.8 Shaft interface definition

AXIS0-AXIS3 servo axis:

		pin-out	definition	Functional specifications
AXIS Shaft card interface		1	X+	Number of pulses output differential signal positive pole
		2	X-	Number of pulses output differential signal negative pole
		3	Y+	Pulse direction output differential signal positive pole
		4	Y-	Pulse direction output differential signal negative pole
		5	A0	Analog output
		6	A+	Encoder A-phase input differential signal positive pole
		7	A-	Encoder A-phase input differential signal negative pole
		8	B+	Encoder B-phase input differential signal positive pole
		9	B-	Encoder B-phase input differential signal negative pole
		10	AGND	Analog signal ground
		11	Z+	Encoder Z-phase input differential signal positive pole
		12	Z-	Encoder Z-phase input differential signal negative pole
		13	+5V	5VDC
		14		Empty pin-out
		15	DGND	Digital signal land

AXIS4 spindle:

		pin-out	Definition	Functional specifications
AXIS Shaft card interface		1	X+	Number of pulses output differential signal positive pole
		2	X-	Number of pulses output differential signal negative pole
		3	Y+	Pulse direction output differential signal positive pole
		4	Y-	Pulse direction output differential signal negative pole
		5		Empty pin-out
		6	A+	Encoder A-phase input differential signal positive pole
		7	A-	Encoder A-phase input differential signal negative pole
		8	B+	Encoder B-phase input differential signal positive pole
		9	B-	Encoder B-phase input differential signal negative pole
		10	AGND	Analog signal ground
		11	Z+	Encoder Z-phase input differential signal positive pole
		12	Z-	Encoder Z-phase input differential signal negative pole
		13	+5V	5VDC
		14		Empty pin-out
		15	DGND	Digital signal land

➤ The VECTOR motion controller has five axis interfaces that can be used to control five servos .AXIS4 is the main axis, and the pins are defined the same as the other four servo axes, except that there is no analog output for the fifth pin.

Specification of shaft card interface signal:

pin	explanation
X+	The motion controller outputs a differential pulse signal, Maximum

X-	drive current 20mA
Y+	The motion controller outputs differential direction signals ,
Y-	Maximum drive current 20mA
A+	Motion controller receives differential orthogonal A signal ,
A-	Maximum receiving frequency 4MHZ (after frequency doubling), Receive effective differential voltage V: V>+200mv or V<-200mv
B+	Motion controller receives differential orthogonal B signal ,
B-	Maximum receiving frequency 4MHZ (after frequency doubling), Receive effective differential voltage V: V>+200mv or V<-200mv
AO	Motion controller outputs analog voltage , the default is $\pm 10V$ (Programmable to 0-10V) , resolution is 12bit, refresh cycle is
AGND	200us
+5V	Motion controller output 5V voltage, 5 axis share a drive power supply, make sure that the total load is not greater than 200mA
DGND	

3.1.9 Analog input definition

input voltage	$\pm 10V$
input points	4
input terminals	AI0-AI3
resolution ratio	12bit

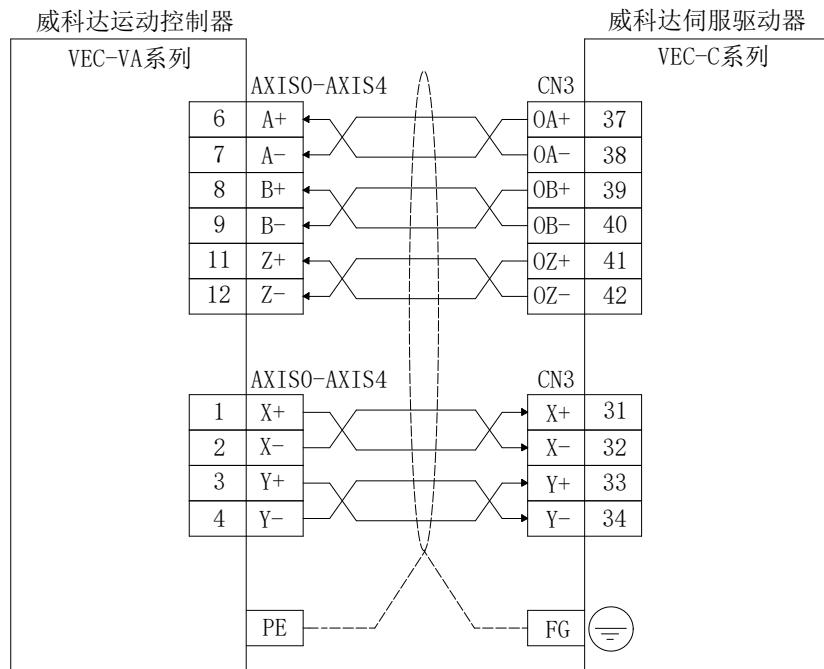
3.1.10 Analog output definition

output type	$\pm 10V$ 或 0-10V (Upper computer programming optional)
output points	4
output terminals	the fifth pin-out of AXIS0-AXIS3
resolution ratio	12bit
output cycle	200us

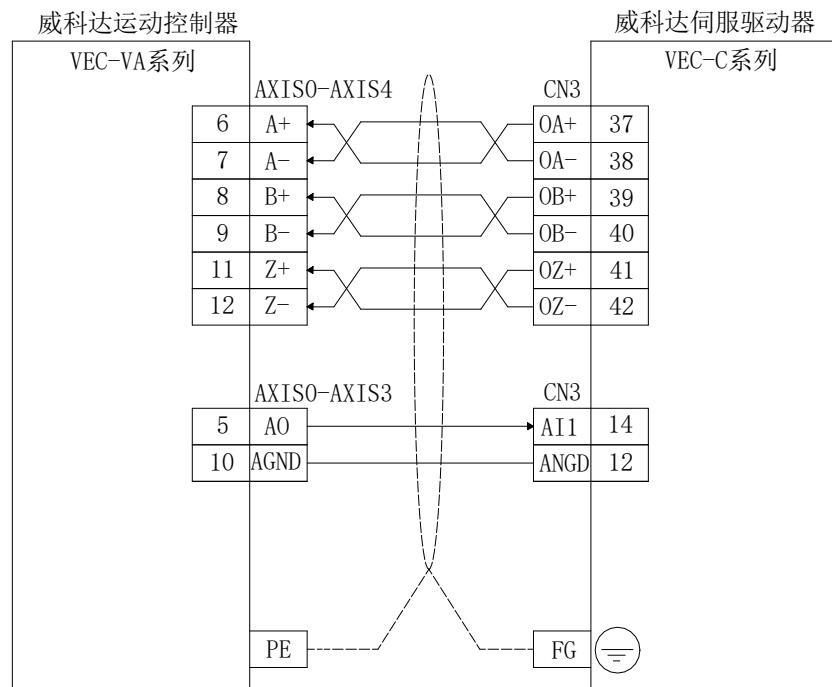
3.2 Connection of motion controller to servo drive

3.2.1 servo drive of VECTOR

pulse control mode:

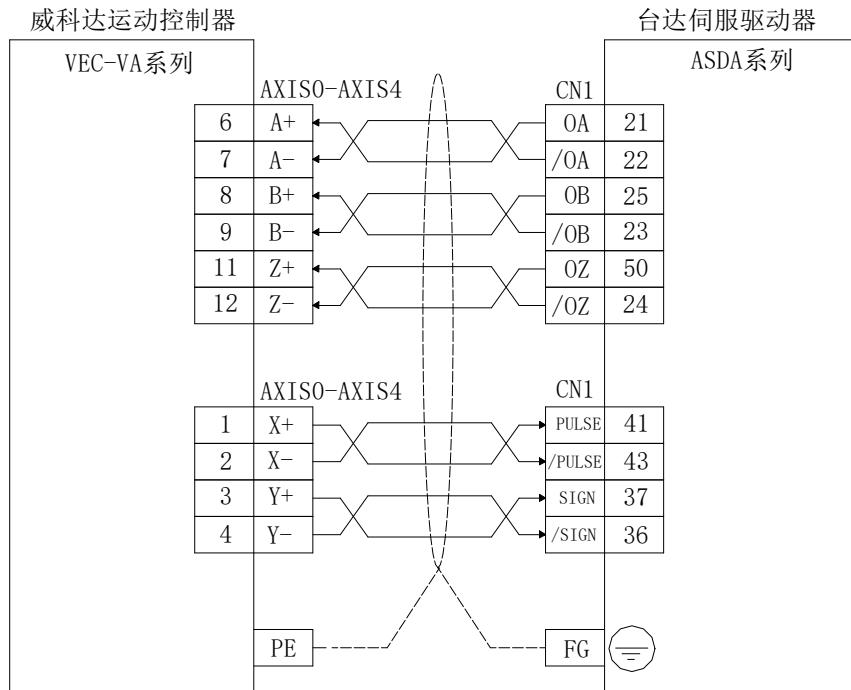


analog quantity control mode:

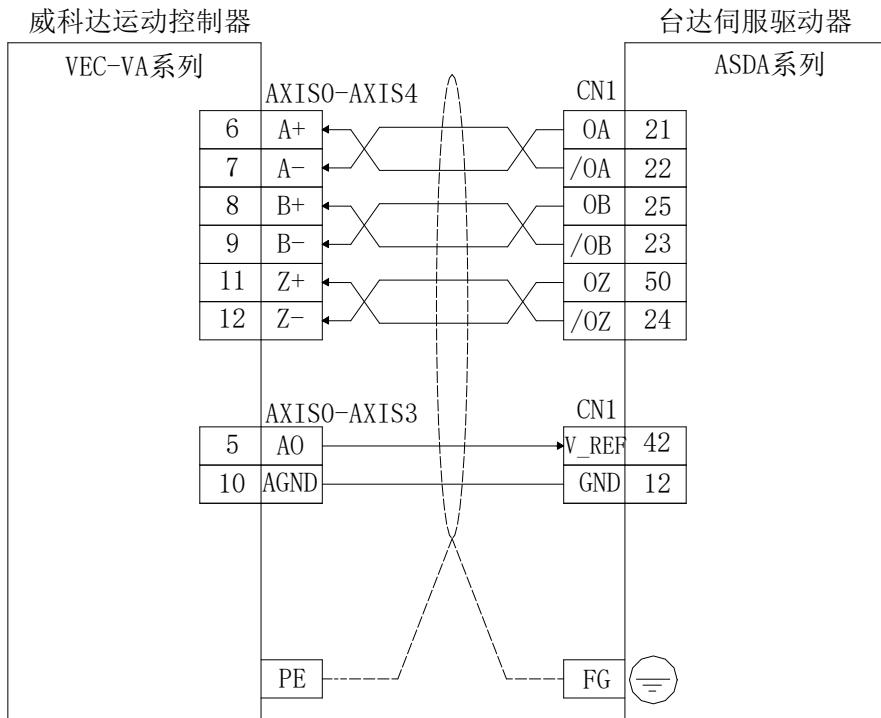


3.2.2 Delta servo drive

pulse control mode:

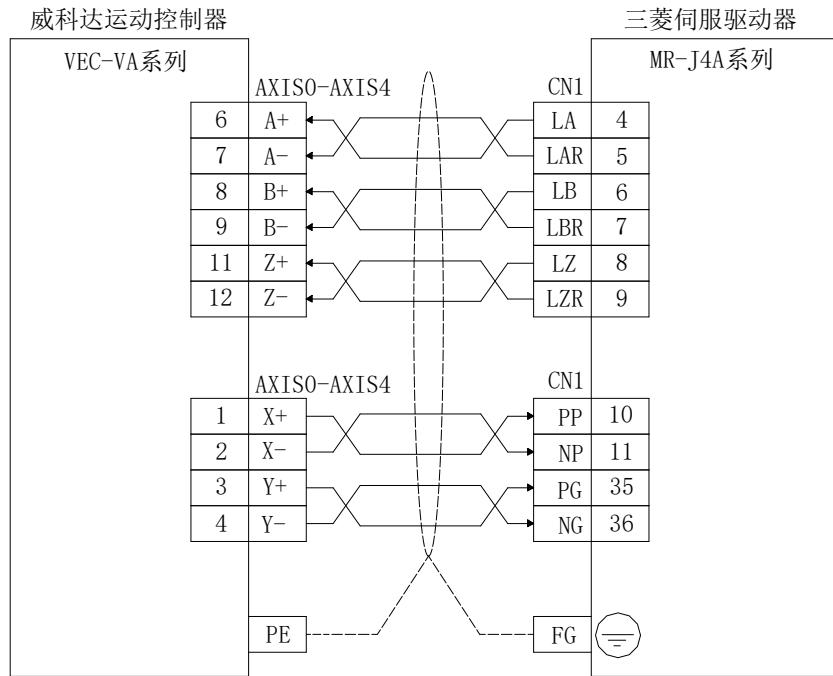


analog quantity control mode:

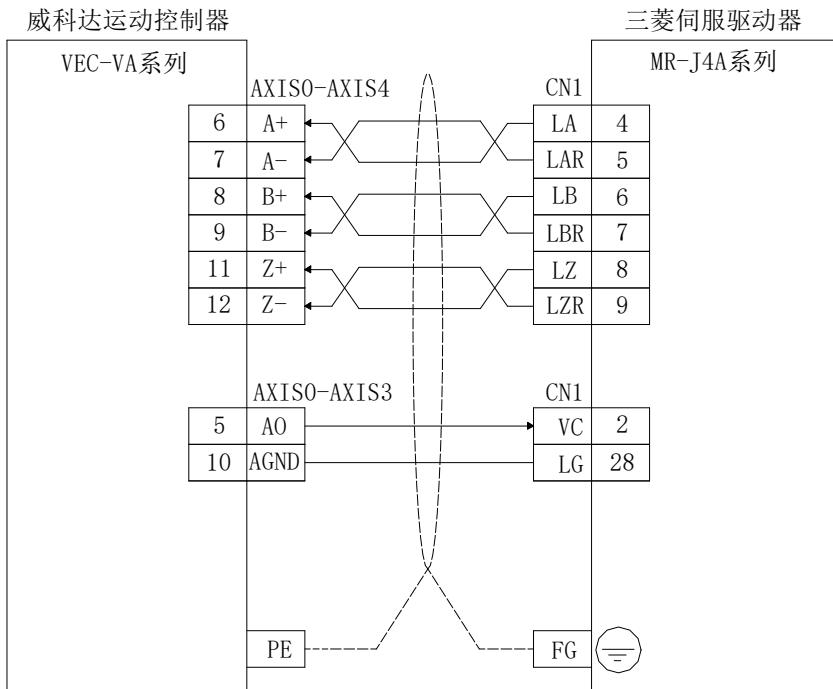


3.2.3 Mitsubishi servo drive

pulse control mode:

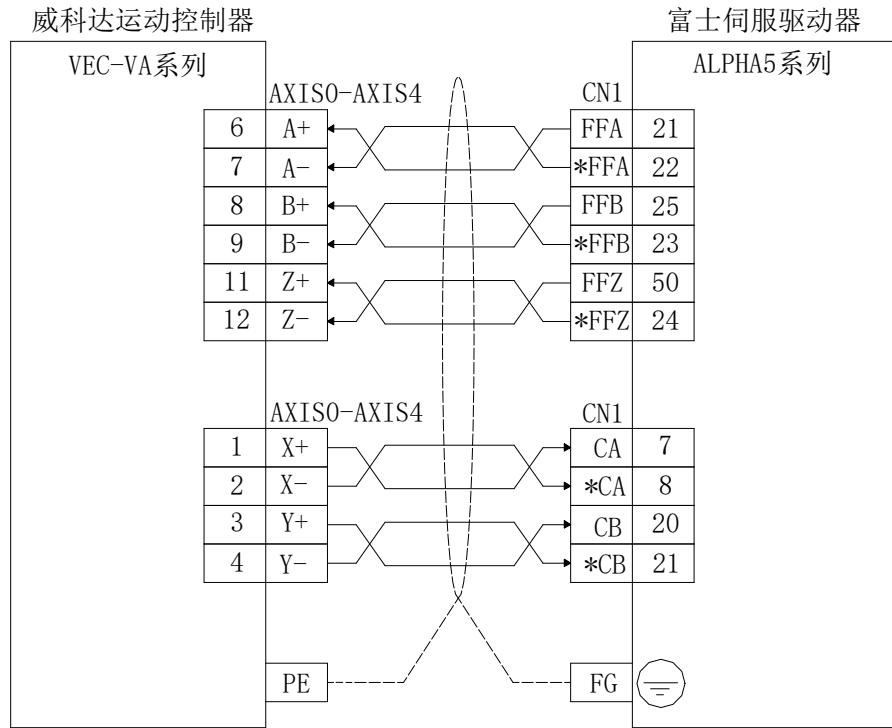


analog quantity control mode:

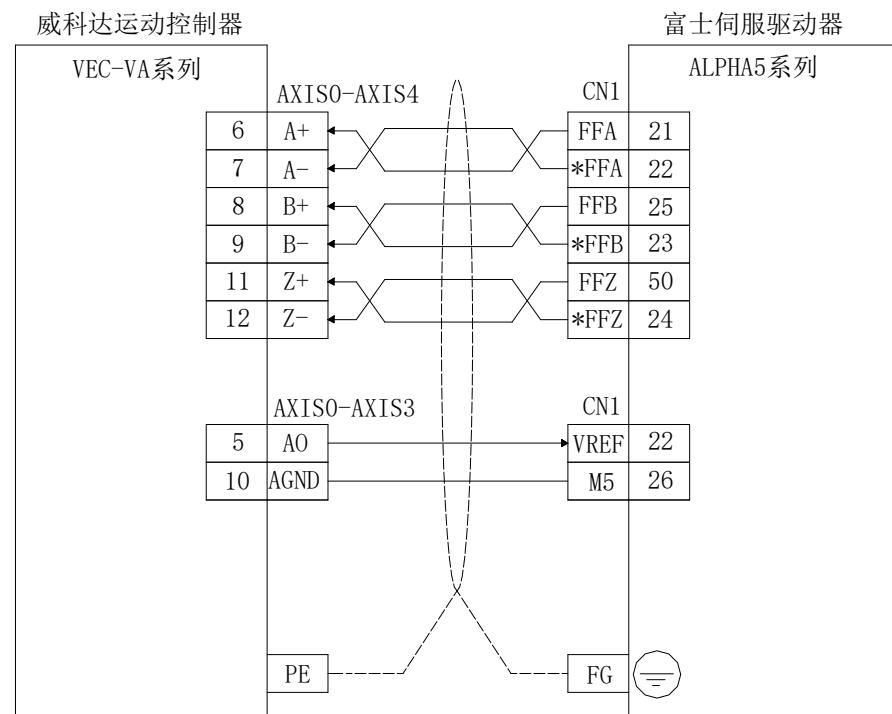


3.2.4 Fuji servo drive

pulse control mode:

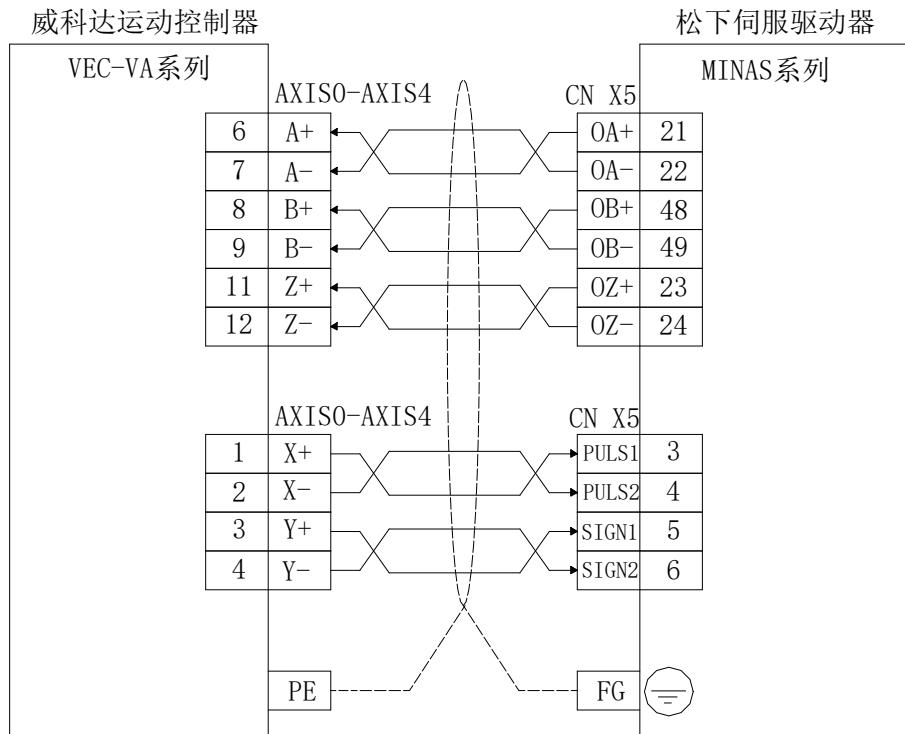


Analog quantity control mode:

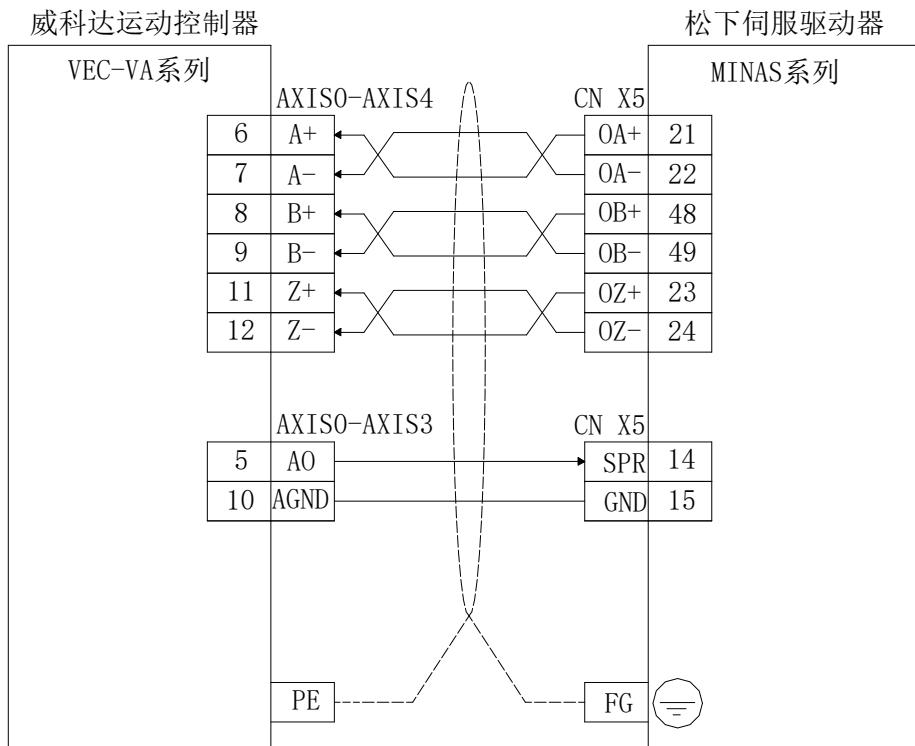


3.2.5 Panasonic servo drive

Pulse control mode:

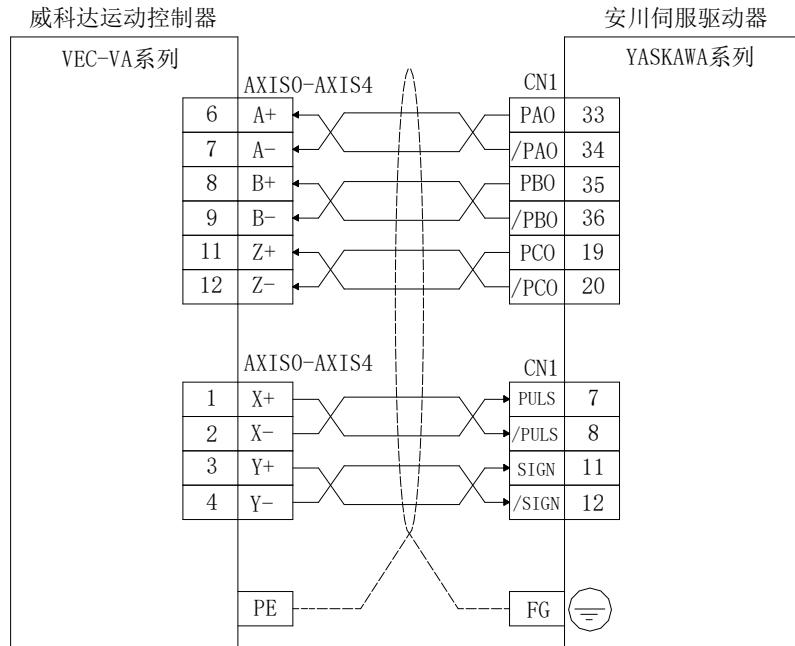


Analog quantity control mode:

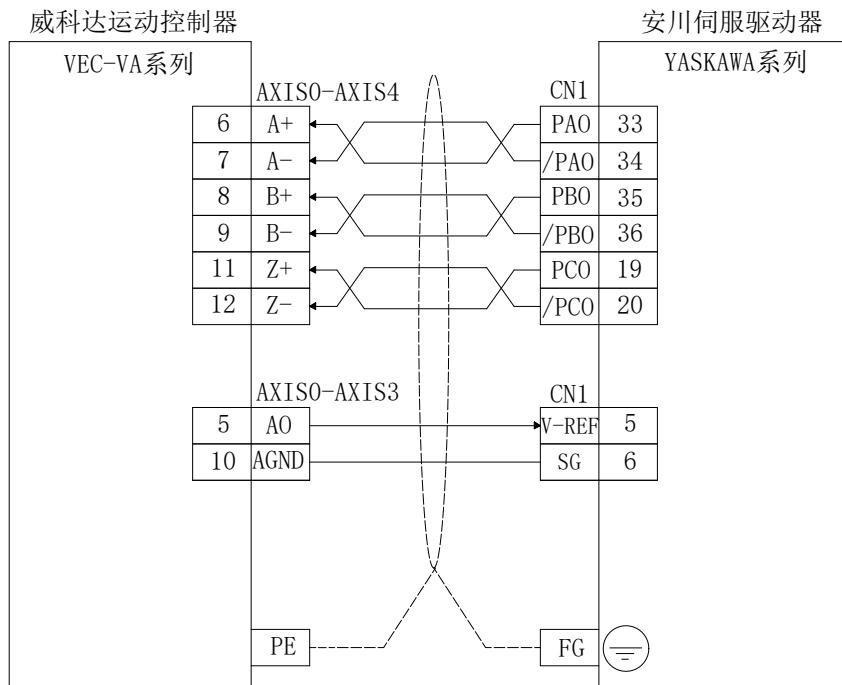


3.2.6 Yaskawa servo drive

Pulse control mode:



Analog quantity control mode:

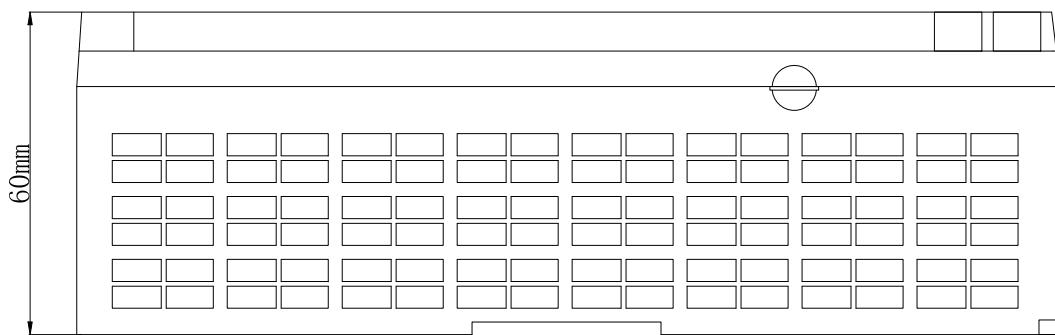
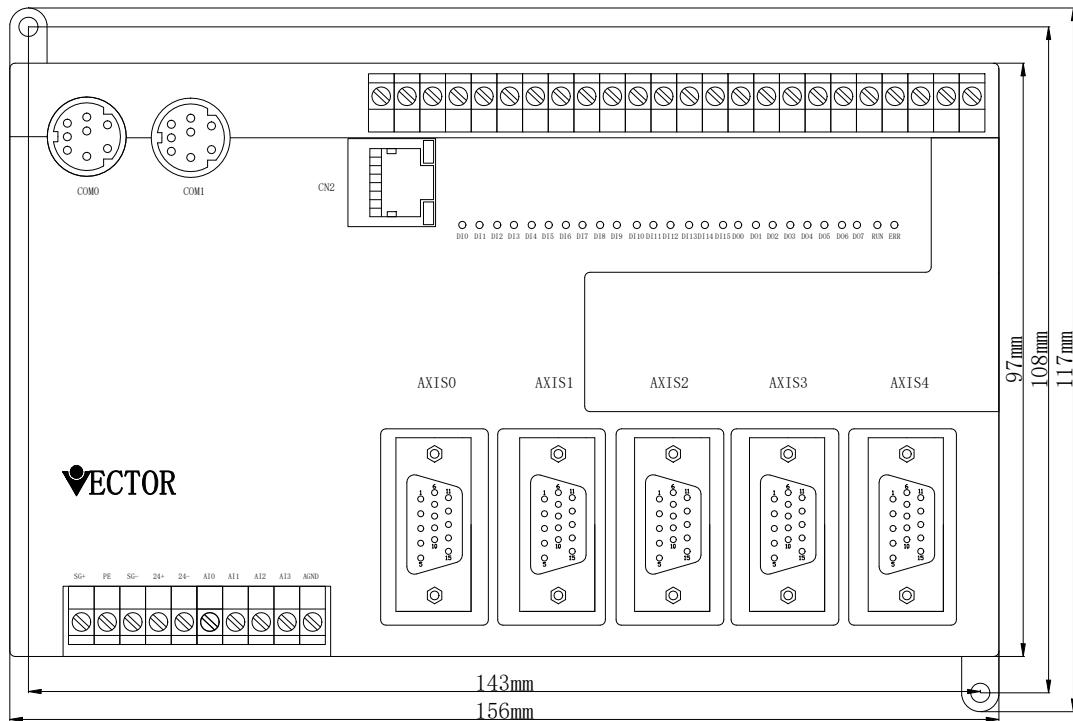


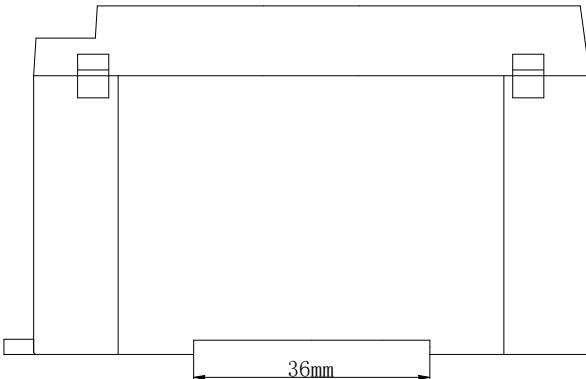
- When the coder and pulse signal are differential signals input, please use the twisted pair connection mode.
- Analog control and pulse control cannot be used at the same time.
- When the analog signal is disturbed, the analog ground and the earth can be connected together.

ChapterIV Appendix

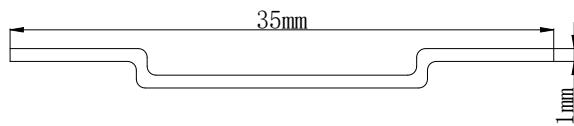
Appendix I: Installing dimension

1. Appearance and dimensions of the host





2. Installation guide rail size



Appendix II: Introduction to Extension Modules

VECTOR motion controller extension modules are available in the following types

type	function
VEC-VA-EX-8IO	8-channel digital input, 8-channel digital output module; The output type is transistor output
EC-VA-EX-16I	16-channel digital input module.
EC-VA-EX-16O	16-channel digital output module; The output type is transistor output.
EC-VA-EX-4XA-B	4 channels AD input, 4 channels DA output module; The resolution is 12bit. The AD input can be configured as 0-5v, 0-10v, ±10V and 0-20ma, and the DA output can be configured as 0-5v, 0-10v and ±10V through the software.
EC-VA-EX-4PT-B	4-way three-wire PT100 input module; Temperature range -200-+600°C, 1mA constant current source drive, 0.1°C measurement accuracy.
EC-VA-EX-4TC-B	4-channel thermocouple input module; Support up to 8 types of thermocouples, broken couple detection, 0.1°C measurement accuracy.
EC-VA-EX-2WT-B	2-channel weighing module; Multiple eigenvalues are optional, 24bit high resolution sampling.

All of the above extensions can be added to the right of the VECTOR motion controller host. A host can be expanded to a maximum of eight modules. The host automatically identifies the extension module type and assigns an address.

➤ Details of the extension module can be downloaded from the VECTOR technology website for reference.