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做更好用的运动控制，智造美好生活
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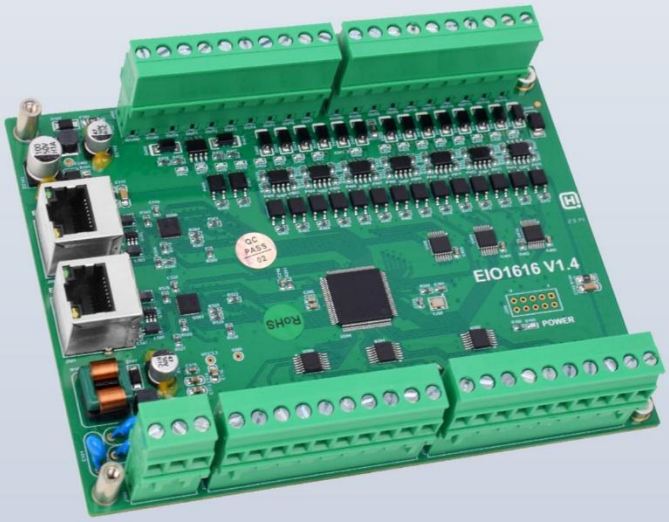
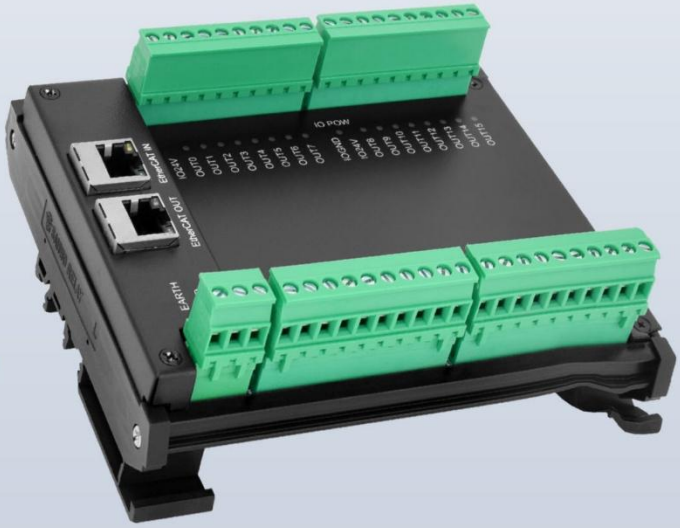
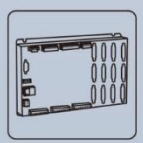
EtherCAT IO Expansion Module

EIO1616/EIO1616MT

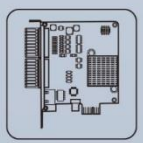




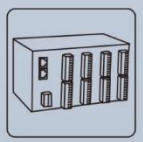
Vision Motion Controller



Motion Controller



Motion Control Card



IO Expansion Module

HMI

Statement

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

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

➢ Notes

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

■ Danger

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

■ Notes

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

Content

Chapter I Production Information

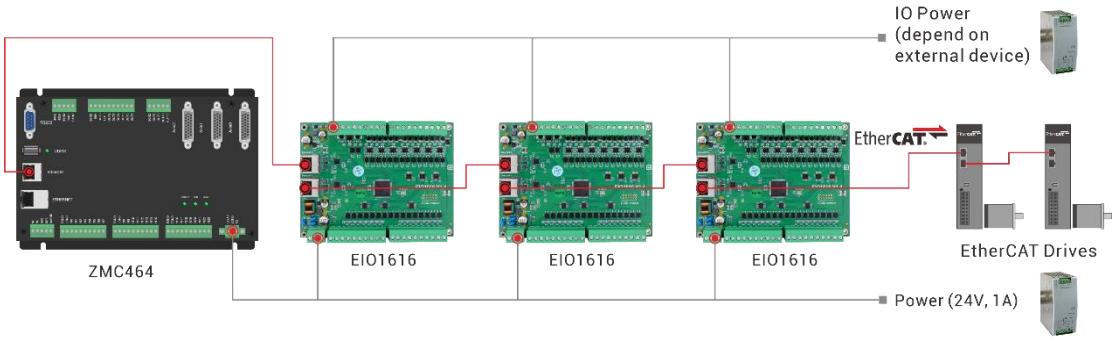
1.1. Product Information

EIO1616 expansion module is used for EtherCAT controller, when you need more IOs, EIO1616 module / modules could achieve that. And IO resources of EIO1616 can be accessed by mapping No.

1.2. Function Features

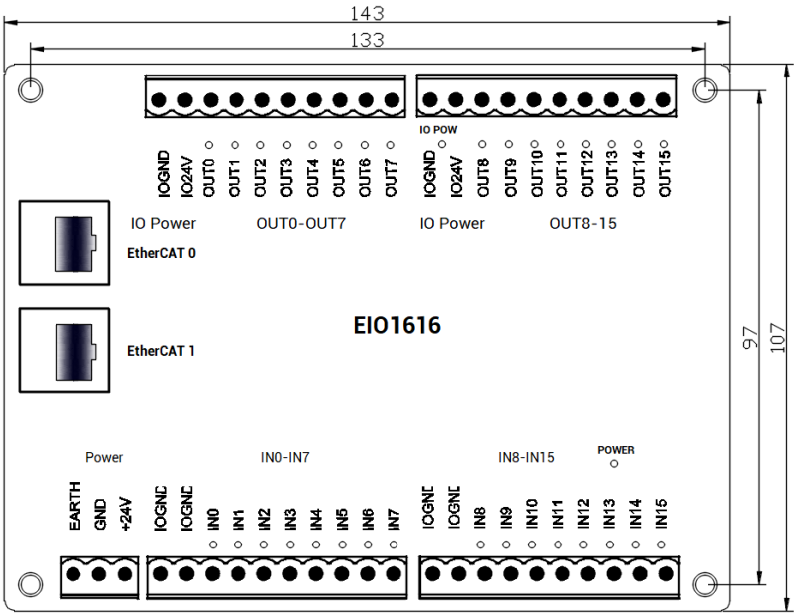
- Digital expansion: there are 16 inputs and 16 outputs (it can select PCB type, module type or module cover type)
- The fastest refresh cycle of EtherCAT is 250us.
- It has IO status display led, which can check IO status conveniently.

1.3. System Frame



1.4. Hardware Installment

EIO1616 bus expansion module is installed horizontally with screws, and each controller should be fastened with 4 screws.

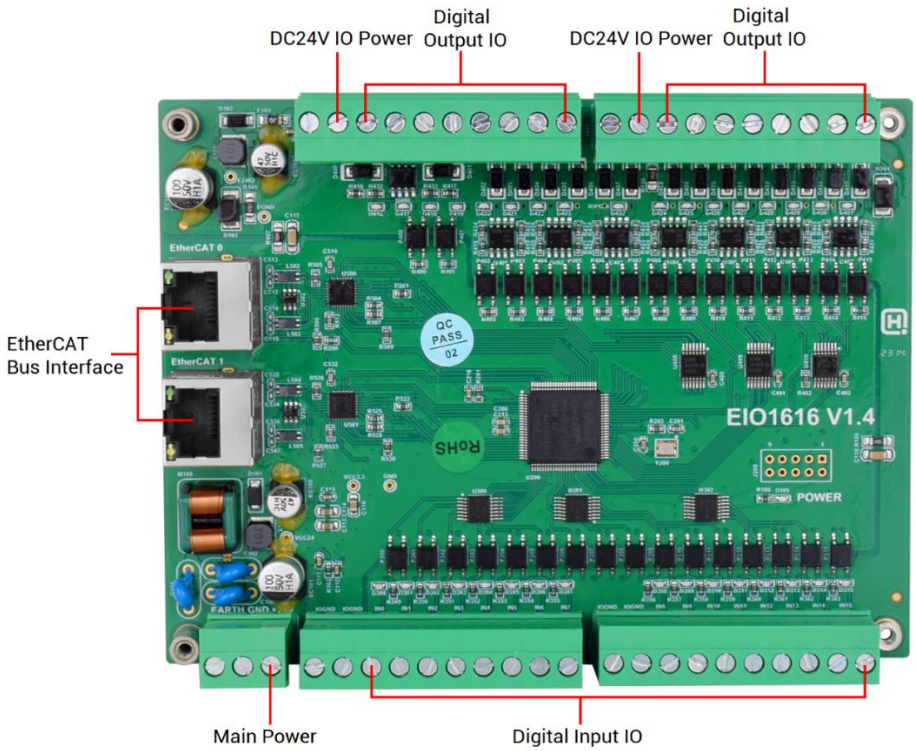


→ Unit: mm → Mounting Hole Diameter 3.5mm

 **Installation attention**	● Non-professionals are strictly prohibited to operate. Specifically, professionals who had been trained related electrical equipment, or who master electrical knowledge. ● Please be sure to read the product instruction manual and safety precautions carefully before installation. ● Before installation, please ensure that the product is powered off. ● Do not disassemble the module, otherwise the machine may be damaged. ● In order to facilitate ventilation and controller replacement, 2-3cm should be left between the upper and lower parts of the controller and the installation environment and surrounding components. ● Considering the convenient operation & maintenance of the controller, please do not install controller in the following places: a) places where the surrounding ambient temperature exceeds the range of -10°C-55°C b) places where the ambient humidity exceeds the range of 10%-95% (non-condensing) c) places with corrosive gases and flammable gases d) places with many conductive powders such as dust and iron powder, oil mist, salt, and organic solvents. e) direct sunlight installation.

Chapter II Product Specification

2.1. Interface Definition



Mark	Interface	Number	Description
IO POWER	The led that indicates the current state.	1	IO Power state: it lights when IO power is conducted.
POWER		1	Main power state: it lights when main power is conducted.
EtherCAT 0	EtherCAT bus interface	1	Connect to main controller or former level expansion module.
EtherCAT 1		1	Connect to drive equipment or behind level expansion module.
Digital input		16	NPN type, IO power 24V
Digital output		16	NPN type, IO power 24V
Main power		1	24V DC power supplies for main control area of expansion module.

2.2. Order Information

Model	Functions
EIO1616	Internal 16 digital inputs, 16 digital outputs
EIO1616M	Internal 16 digital inputs, 16 digital outputs, with module type
EIO1616MT	Internal 16 digital inputs, 16 digital outputs, with module cover type

EIO1616M

EIO1616MT

2.3. Work Environment

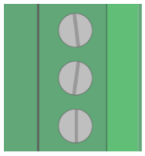
Item		Parameters
Work Temperature		-10℃-55℃
Work relative Humidity		10%-95% non-condensing
Storage Temperature		-40℃ ~ 80℃ (not frozen)
Storage Humidity		Below 90%RH (no frost)
vibration	Frequency	5-150Hz
	Displacement	3.5mm(directly install)(<9Hz)
	Acceleration	1g(directly install)(>9Hz)
	Direction	3 axial direction
Shock (collide)		15g, 11ms, half sinusoid, 3 axial direction
Degree of Protection		IP20

Chapter III Wiring & Communication

3.1. Power Input

The power supply input adopts a 3Pin (there are all 3 terminals) screw-type pluggable wiring terminal. IO power inputs are in digital outputs, power is supplied by 24V DC power.

→ Terminal Definition:

Main Power	Name	Type	Function
	EARTH	Grounding	Shield layer
	GND	Input	Power ground
	+24V	Input	Power 24V inputs
Note: please use +24V and IO24V separately for power supply. It is not recommended to use the same power supply. It is recommended to use two 24V output power supplies or a power supply that can provide two isolated 24V output.			

IO Power	Name	Type	Function
	IO24V	Input	IO power 24V input
	IOGND	Input	IO power ground
Note: please use +24V and IO24V separately for power supply. It is not recommended to use the same power supply. It is recommended to use two 24V output power supplies or a power supply that can provide two isolated 24V output.			

3.1.1.Power Specification

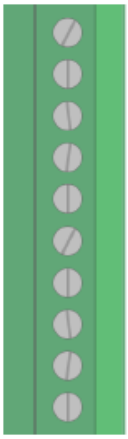
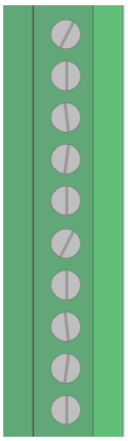
→ Specification

Item	Main Power	IO Power
Voltage	DC24V (-10%~10%)	DC24V (-5%~5%)

The current to open	≤0.5A	/
The current to work	≤0.4A	≤0.5A
Anti-reverse connection	Valid	Valid
Overcurrent Protection	Valid	Valid

3.2. IN Digital Input

→ Terminal Definition

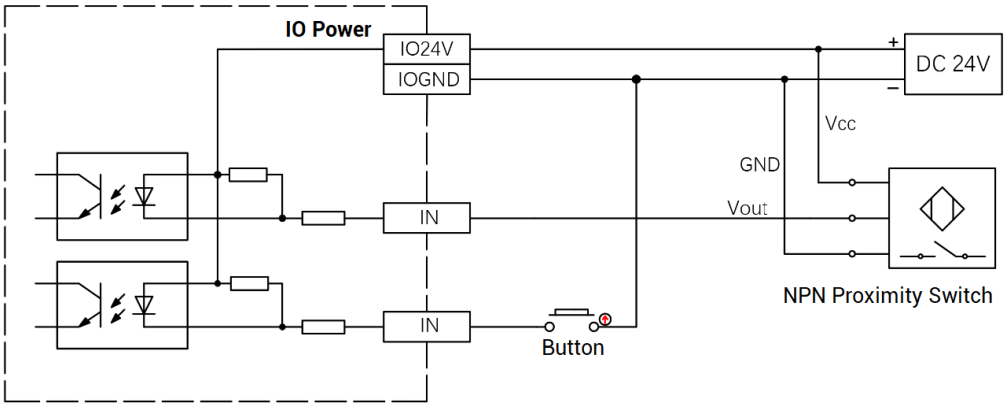
Terminal	Name	Type	Function 1
	IOGND	/	IO power ground
	IOGND	/	IO power ground
	IN0	NPN type, digital inputs	Input 0
	IN1		Input 1
	IN2		Input 2
	IN3		Input 3
	IN4		Input 4
	IN5		Input 5
	IN6		Input 6
	IN7		Input 7
	IOGND	/	IO power ground
	IOGND	/	IO power ground
	IN8	NPN type, digital inputs	Input 8
	IN9		Input 9
	IN10		Input 10
	IN11		Input 11
	IN12		Input 12
	IN13		Input 13
	IN14		Input 14
	IN15		Input 15

3.2.1. Digital Input Specification

Item	Digital input (IN0-15)
Input mode	NPN type, input is triggered when in low-electric level
Frequency	<5kHz

Impedance	4.7KΩ
Voltage level	DC24V
The voltage to open	<14.5V
The voltage to close	>14.7V
Minimal current	-1.8mA (negative)
Max current	-6mA (negative)
Isolation mode	optoelectronic isolation
Note: the above parameters are standard values when the voltage of expansion module power supply (E+24V port) is 24V.	

3.2.2. Digital Input Wiring

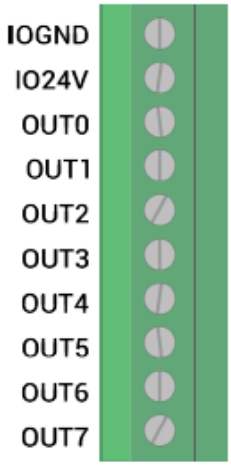
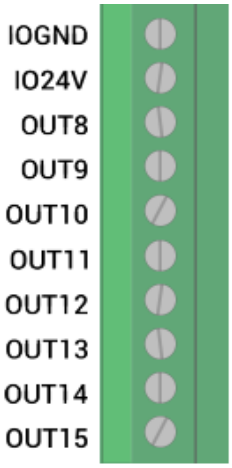


→ Wiring Note:

- The wiring principle of digital inputs IN (0-15) 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 "IOGND" port on the IO power supply to the "COM" terminal of the external input device. If the signal area power supply of the external device and the power supply of the expansion module are in the same power supply system, this connection also can be omitted.

3.3. OUT Digital Output

→ Terminal Definition

Terminal	Name	Type	Function
	IOGND	/	IO power ground
	IO24V	/	IO power input DC24V
	OUT0	NPN, digital outputs	Output 0
	OUT1		Output 1
	OUT2		Output 2
	OUT3		Output 3
	OUT4		Output 4
	OUT5		Output 5
	OUT6		Output 6
	OUT7		Output 7
	IOGND	/	IO power ground
	IO24V	/	IO power input DC24V
	OUT8	NPN, digital outputs	Output 8
	OUT9		Output 9
	OUT10		Output 10
	OUT11		Output 11
	OUT12		Output 12
	OUT13		Output 13
	OUT14		Output 14
	OUT15		Output 15

3.3.1. Digital Output Specification

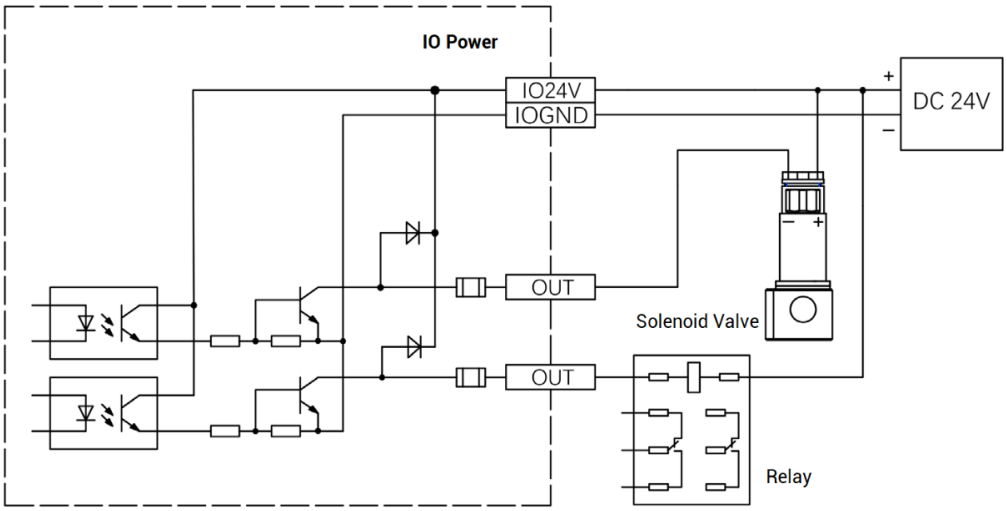
Item	Digital Output (OUT0-15)
Output mode	NPN type, it is 0V when outputs
Frequency	<8kHz
Voltage level	DC24V
Max output current	+300mA
Max leakage current when off	25μA

Respond time to conduct	12μs
Respond time to close	80μs
Overcurrent protection	Support
Isolation method	optoelectronic isolation

Note:

- ✧ The times in the form are typical based on the resistive load, and may change when the load circuit changes.
- ✧ Due to the leak-type output, the shutdown of the output will be obviously affected by the external load circuit, and the output frequency should not be set too high in the application. And it is recommended to set below 8KHz.

3.3.2. Digital Output Wiring

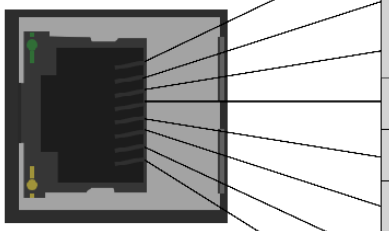


→ Wiring Note:

- The wiring principle of digital outputs OUT (0-15) 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 "IOGND" port on the IO power supply to the negative pole of the DC power supply of the external input device. If the DC power supply of the external device and the expansion module power supply are in the same power supply system, this connection can also be omitted.

3.4. EtherCAT Interface

EIO1616 bus expansion module has 2 100M EtherCAT communication interfaces, and they support EtherCAT protocol. EtherCAT 0 is connected to main controller or former level expansion module, but EtherCAT 1 is connected to drive equipment or next level expansion module, they can not be mixed. The pin definition is as follows:



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

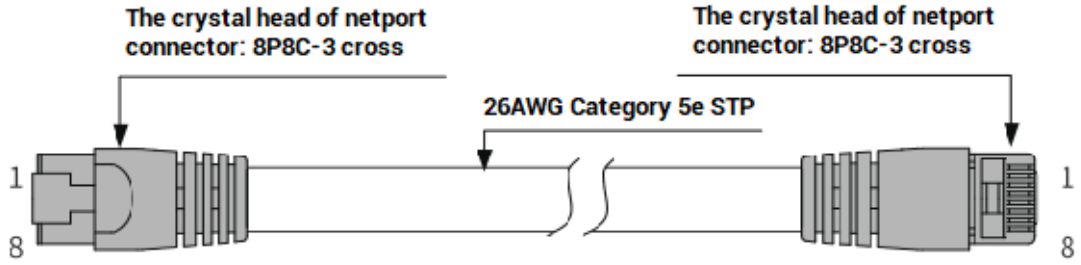
→ Specification

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

→ Communication Cable Requirements

EtherCAT communication interface adopts standard Ethernet RJ45 interface.

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



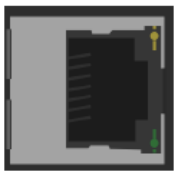
Item	Specification
Cable type	Flexible crossover cable, Category 5e
traverse	twisted pair
Line pairs	4
Isolation	cross skeleton
Connector	Crystal head with iron shell
Cable material	PVC
Cable length	Less than 100m

Use RJ45 network cable connection method:

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

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

→ Interface Indicator Led Definition

Item	Function	Color	Status	Description
	Link / Act	Yellow	OFF commonly	MAC is not connected
			Shrink	MAC has been connected and data has been sent & received.
			ON commonly	MAC has been connected but no data sent & received.
	Link / Act	Green	OFF commonly	PHY is not connected
			Shrink	PHY has been connected and data has been sent & received.
			ON commonly	PHY has been connected but no data sent & received.

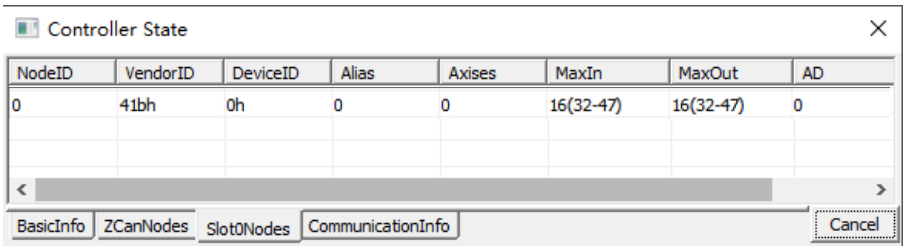
3.5. Expansion Module Usage

1) Please follow the above wiring instructions to correctly complete the wiring of power supply, EtherCAT bus, IO signal and other modules.

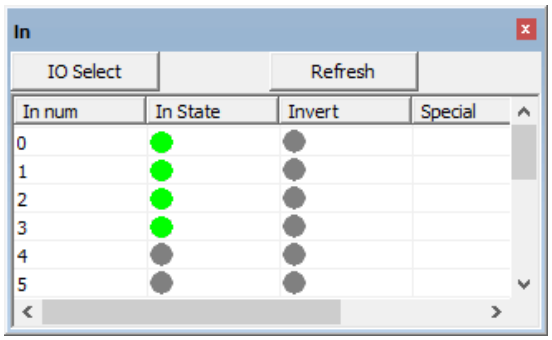
2) After the controller is powered on, please use the ETHERNET to connect to RTSys.

3) Set the IO No. of the expansion module through the bus command NODE_IO, and configure the input and output at the same time. The program on the controller can access the resources on the expansion module only through the IO No. 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. The IO NO. mapping must not be repeated in the whole control system.

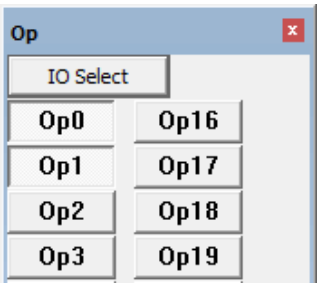
4) After the setting is completed, the communication can be established. If the communication is successful, "controller status" - "Slot0Nodes " will display the information of the expansion module.



5) The state value of the corresponding input port can be directly read through the "IN" command, and the state of the input port can also be visually checked through the "RTSys/Tool/IN" interface or the IO indicator light on the expansion module. For details, see "RTBasic Programming Manual".



6) The port can be turned on or off directly through the "OP" command, or it can be turned on or off by clicking directly on the "RTSys/Tool/OP" interface, or the IO indicator on the expansion module can visually check the output port status. For details, see "RTBasic Programming Manual".



Chapter IV Expansion Module

4.1. EtherCAT Expansion Wiring Reference

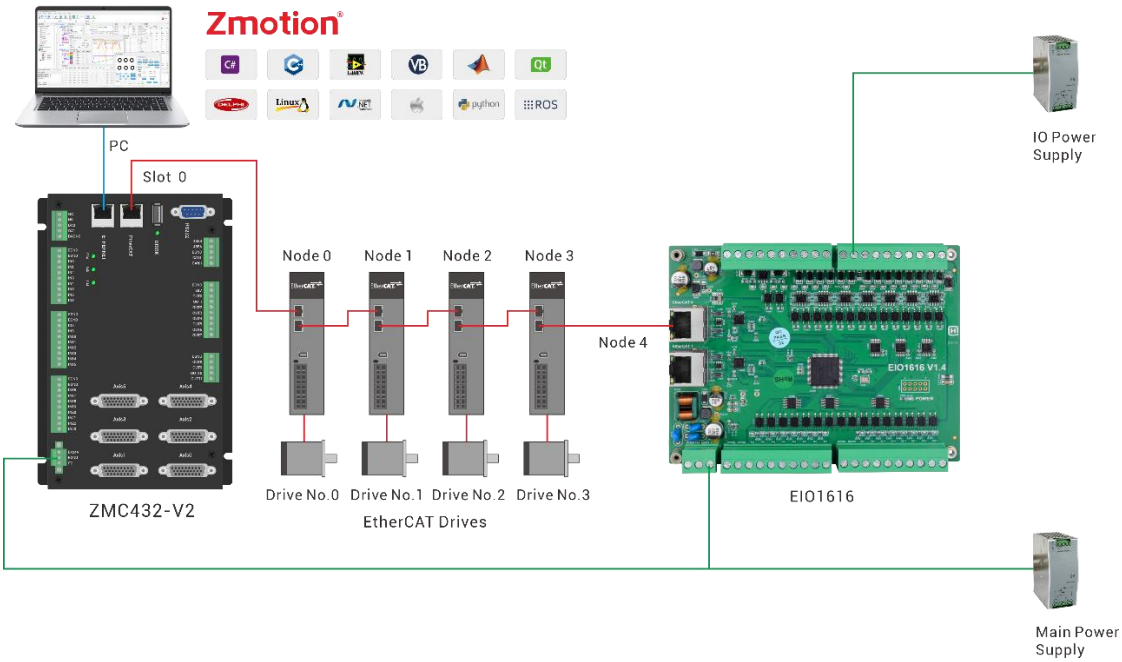
EIO digital expansion module is powered by the dual power. Except the main power, one IO power is needs connecting additionally to supply power for IO independently. Main power and IO power both use 24V DC power.

To prevent interference, the IO power supply is separated from the main power supply.

After the EIO1616 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 No. 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.

When wiring, 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.

EIO expansion module wiring reference example:



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

Slot number (slot):

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

Device number (node):

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

Drive number:

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

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

4.2. EtherCAT Bus Expansion Resource Mapping

→ IO Mapping:

The program on the controller can access the resources on the expansion module only through the IO No. 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 EIO1616, 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 the output OUT0-15 are 32-47 in sequence.

0	41bh	1ab0h	0	8	32(32-63)	16(32-47)	0

Chapter V Run and Maintain

The correct operation and maintenance of the device can not only guarantee and extend the life cycle of the equipment itself, but also take technical management measures according to the pre-specified plan or the corresponding technical conditions to prevent equipment performance degradation or reduce the probability of equipment failure.

5.1. Regular Inspection and Maintenance

The working environment has an impact on the device. Therefore, it is usually inspected regularly based on the inspection cycle of 6 months to 1 year. The inspection cycle of the device can be appropriately adjusted according to the surrounding environment to make it work within the specified standard environment.

Check item	Check content	Inspection standards
power supply	Check whether the voltage is rated	DC 24 V (-5~5%)
surroundings	Whether the ambient temperature is within the specified range (when installed in the cabinet, the temperature inside the cabinet is the ambient temperature)	-10°C -55°C
	Whether the ambient humidity is within the specified range (when installed in the cabinet, the humidity in the cabinet is the ambient humidity)	5%-90% non-condensing
	Is there direct sunlight	No
	With or without droplets of water, oil, chemicals, etc.	No
	Whether there is dust, salt, iron filings, dirt	No
	Whether there is corrosive gas	No
	Whether there are flammable and explosive gases or articles	No

	Whether the device is subjected to vibration or shock	Should be within the range of vibration resistance and impact resistance
	Is the heat dissipation good	Keep good ventilation and heat dissipation
Installation and Wiring Status	Whether the basic unit and the expansion unit are installed firmly	The mounting screws should be tightened without loosening
	Whether the connecting cables of the basic unit and the expansion unit are fully inserted	The connection cable cannot be loosened
	Are the screws of the external wiring loose	Screws should be tightened without loosening
	Whether the cable is damaged, aged, cracked	The cable must not have any abnormal appearance

5.2. Common Problems

Problems	Suggestions
Controller and EIO expansion module can't communicate.	1. Check the controller or expansion module is powered on. 2. Check wiring, check the cable, try to change one cable, check whether EtherCAT 0 and EtherCAT 1 connect correctly. 3. Check whether EtherCAT interface of expansion module or controller is damaged. 4. Check whether bus initialization program is correct. 5. Check whether the expansion module address is conflict, and whether IO mapping and axis mapping configuration are correct. 6. Check whether the controller or expansion module has firmware problem, try to update the firmware. 7. Check whether the controller supports expansion module, if not, please find XML file to match it.

No signal can't be detected.	1. Check whether IO power is needed. 2. Check whether the limit sensor works normally, and whether the "input" view can watch the signal change of the limit sensor. 3. Check whether the mapping of the limit switch is correct. 4. Check whether the limit sensor is connected to the public end of the controller.
Operate output, no respond	1. Check whether IO power is needed. 2. Check whether output No. is matched with the one that is operated.
No voltage and current signals for input channel	1. Check whether IO power is needed. 2. Check whether output No. is matched with the one that is operated.