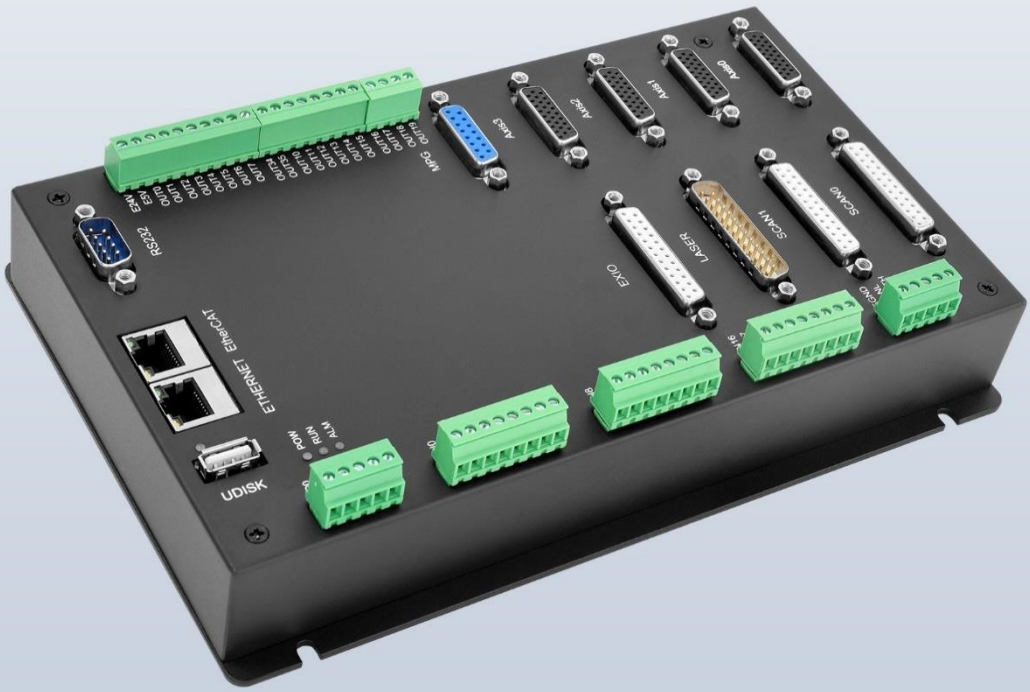
Zmotion®
正运动技术

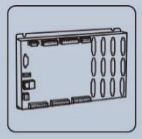
做最好用的运动控制
DO THE BEST TO USE MOTION CONTROL

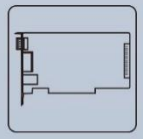
Laser Galvanometer Motion Controller

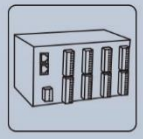
ZMC408SCAN

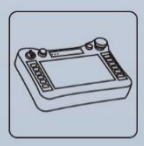



Vision Motion Controller


Motion Controller


Motion Control Card


IO Expansion Module


HMI

Foreword

The motion controller provides rich interface, and it has excellent motion control performance, which can meet the expansion requirements of various projects.

For details about the ZMC controller software and the introduction and routine of each command, please refer to the 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 debugging the machine!

Please be sure to design an effective safety protection device in the machine, and add an error handling program in the software, otherwise Zmotion has no obligation or responsibility for the loss caused.

In order to ensure the safe, normal and effective use of the product, please be sure to read this product manual carefully before installing and using the product.

Safety Statement

- This chapter describes the safety precautions required for the correct use of this product. Before using this product, please read the instructions for use and correctly understand the relevant information on safety precautions.
- This product should be used in an environment that meets the design specifications, otherwise it may cause equipment damage or personal injury, and malfunctions or component damage caused by failure to comply with relevant regulations are not within the scope of product quality assurance.
- Zmotion will not take any legal responsibility for personal safety accidents and property losses caused by failure to comply with the contents of this manual or illegal operation of products.

Safety Level Definition

According to the level, it can be divided into " Danger " and " Caution ". Failure to operate as required may result in moderate injury, minor injury or equipment damage.

Please keep this guide in a safe place for reading when needed, and be sure to hand this manual to the end user.

Install	
 Danger	◆ When the controller is disassembled, all external power supplies used by the system should be disconnected before operation, otherwise it may cause misoperation or damage to the equipment. ◆ It is forbidden to use in the following places: places with dust, oil fume, conductive dust, corrosive gas and flammable gas; places exposed to high temperature, condensation, wind and rain; places with vibration and shock. Electric shock, fire and misuse can cause product damage and deterioration.
 Notice	◆ Avoid metal shavings and wire ends falling into the hardware circuit board during installation. ◆ After installation, ensure that there are no foreign objects on the hardware circuit board. ◆ When installing, make it tightly and firmly with the mounting frame.

	◆ Improper installation of the controller may result in misoperation, failure and fire.
Wiring	
 Danger	◆ The specifications and installation methods of the external wiring of the equipment shall comply with the requirements of local power distribution regulations. ◆ When wiring, all external power supplies used by the system should be disconnected before operation. ◆ When powering on and running after the wiring work is completed, the terminals attached to the product must be installed. ◆ Cable terminals should be well insulated to ensure that the insulation distance between cables will not be reduced after the cables are installed on the terminal block.
 Notice	◆ Avoid metal shavings and wire ends falling into the hardware circuit board during installation. ◆ The cable connection should be carried out correctly on the basis of confirming the type of the connected interface. ◆ It should be confirmed that the cables pressed into the terminals are in good contact. ◆ Do not bundle the control wires and communication cables with the main circuit or power supply wires, etc., and the distance between the wires should be more than 100 mm, otherwise noise may cause malfunction. ◆ If the controller is not installed properly, it may cause electric shock or equipment failure or malfunction.

Content

Chapter I Production Information

1.1. Product Information

ZMC408SCAN Laser-Galvanometer Motion Controller is a kind of high-performance fieldbus dual-SCAN motion controller launched by Zmotion. It is designed for industrial laser + galvanometer + motion control. And multi-axis motion control can be achieved through EtherCAT bus and pulse axis interface.

ZMC408SCAN bus controller supports EtherCAT bus connection, the fastest refresh cycle is 500μs, and supports max 16 axes linear, spherical, circular, helical interpolation, electronic cam, electronic gear, synchronous following, virtual axis setting etc. Real-time motion control can be realized by using optimized network communication protocol.

One Computer can link with up to 256 ZMC controllers at the same time.

The laser galvanometer motion controller supports the galvanometer protocol of XY2-100, and the controller has a SCAN galvanometer interface and a LASER laser interface. This controller can be applied to metal or non-metal large-format splicing marking and cutting, ordinary galvanometer marking, welding and cutting, motion axis + galvanometer axis linkage marking and cutting, laser drilling and forming, etc., and it can be adapted to optical fiber, ultraviolet, carbon dioxide and other lasers with different functions.

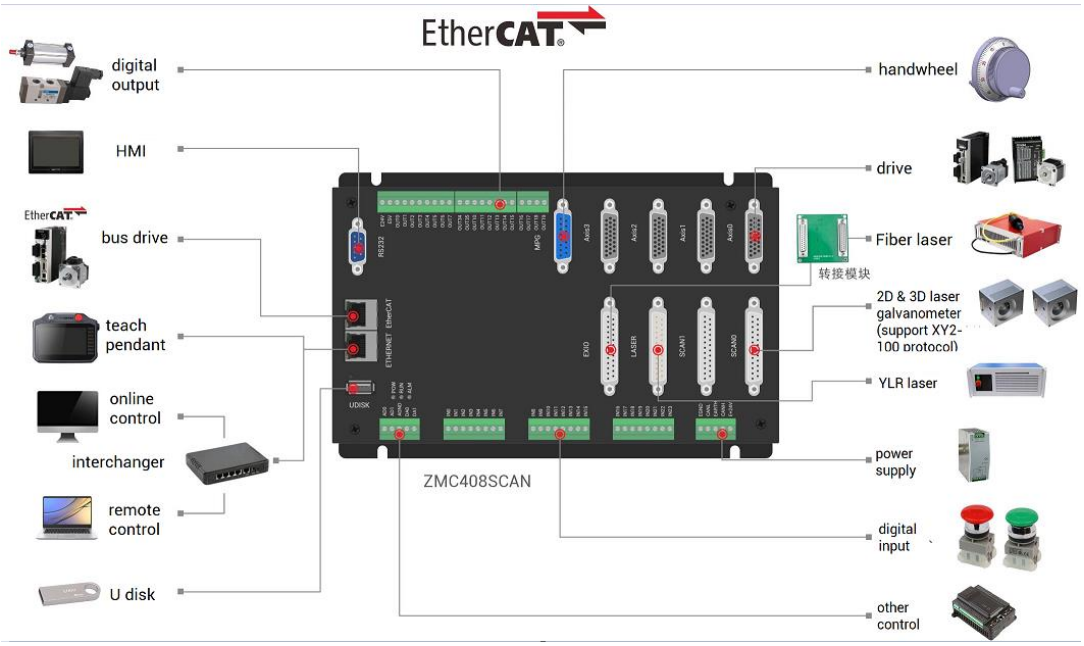
1.2. Function Features

- Motion control of up to 16 axes. (EtherCAT/pulse encoder axis/virtual axis)
- 4 AXIS interfaces support encoder position measurement and incremental drive function, which can be configured as handwheel input mode.
- 1 MPG handwheel encoder interface supports 5-24V input.
- 20 leakage digital outputs, and 8 channels are high-speed outputs, they support

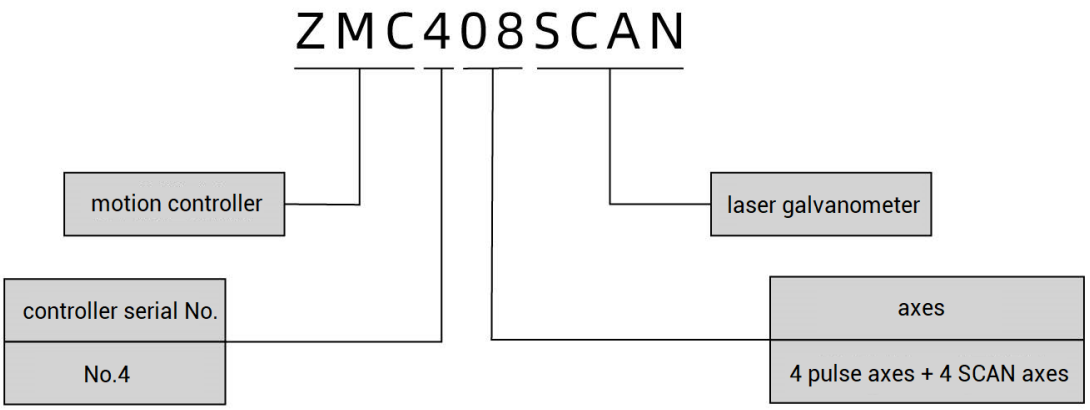
hardware comparison output, PWM, etc., then 12 are low-speed digital outputs, the max output current can reach 300mA, which can drive some solenoid valves directly.

- 24 leakage digital inputs, and 4 channels are high-speed inputs, 20 channels are low-speed inputs. In addition, high-speed input can be configured as latch signal.
- 1 100M EtherCAT interface, 4096 isolated inputs and 4096 isolated outputs can be expanded through EtherCAT bus.
- 1 USB drive interface is used to update ZAR program, import and export controller data and execute 3 file.
- 1 RS485, 1 RS232, 1 CAN and 1 100M ETHERNET interface support multi-expansion applications.
- 2 12-bit voltage type analog outputs, output measuring range is 0-10V. 2 12-bit voltage type analog inputs, input measuring range is 0-10V.
- 2 SCAN galvanometer interfaces support XY2-100 protocol and galvanometer feedback.
- 1 "LASER" interface for controlling laser power, which supports IPG, YLR, YLS and other laser power supplies.
- 1 EXIO interface is used to configurate IO expansion, other types of laser control interfaces can be expanded, like, YAG, FIBER, etc.
- Max 16 axes linear interpolation, any space circular interpolation, helical interpolation and spline interpolation.
- Support electronic cam, electronic gear, position latch, synchronous follow, virtual axis, etc.
- Support hardware comparison output (HW_PSWITCH2), hardware timer and precision output in motion.
- Support pulse closed loop, backlash compensation and pitch compensation.
- Multi-file and multi-task programming in ZBasic.
- A variety of procedure encryption methods to protect the intellectual property rights of customers.
- Support power failure detection and power failure storage.

1.3. System Frame

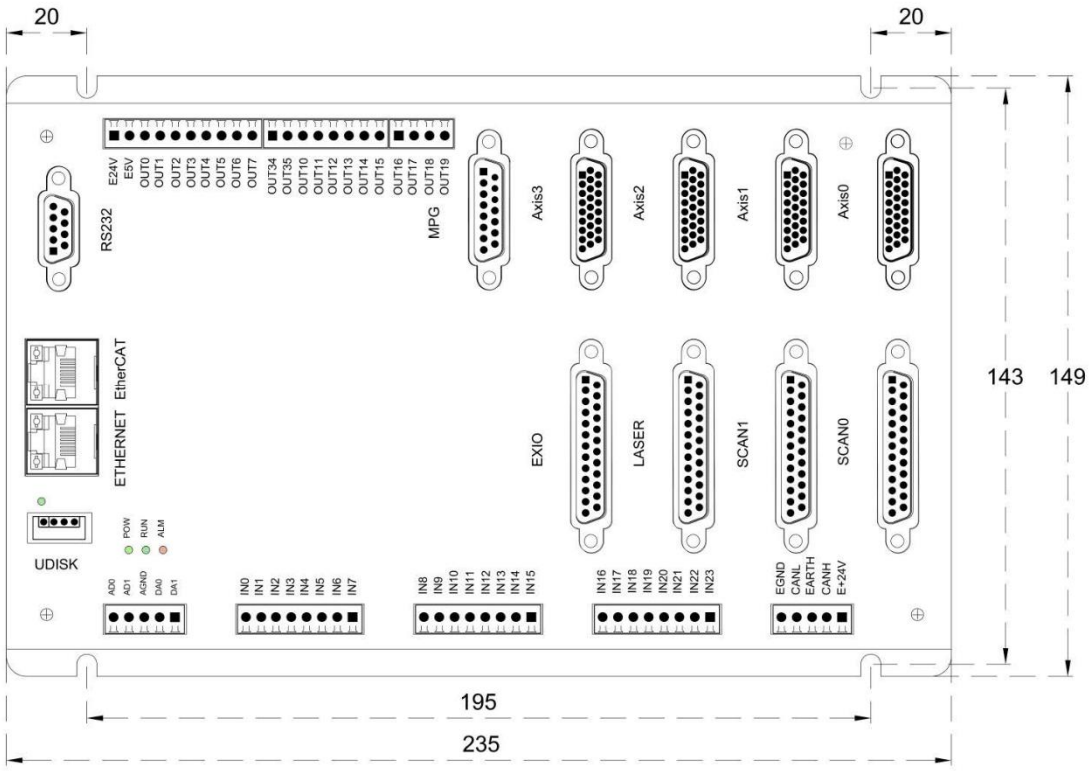


1.4. Model Introduction



1.5. Hardware Installment

The ZMC408SCAN motion controller is installed horizontally with screws, and each controller should be fastened with 4 screws.



→ Unit: mm → Mounting Hole Diameter 4.5mm

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. ● Avoid direct sunlight installation. ● 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 and maintenance of the controller, please do not install the controller in the following places: a) places where the surrounding ambient temperature exceeds the range of -10°C-55°C

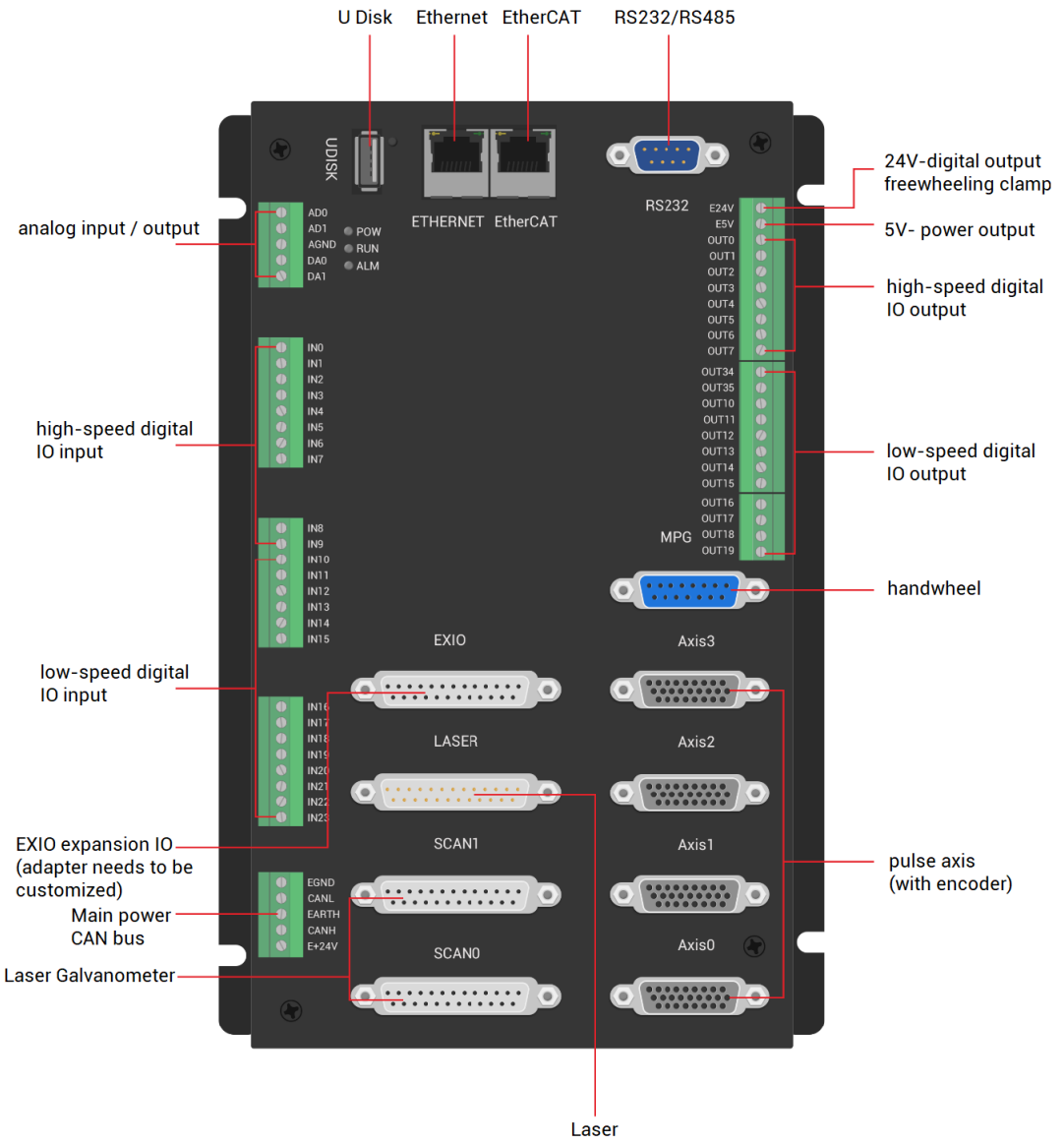
	b) places where the ambient humidity exceeds the range of 10%-95% (non-condensing) c) places with corrosive gases and flammable gases d) places with many conductive powders such as dust and iron powder, oil mist, salt, and organic solvents

Chapter II Product Specification

2.1. Basic Specification

Item	Description
Model	ZMC408SCAN
Axes	8 (4 motion axes + 4 galvanometer axes / 6 motion axes + 2 galvanometer axes)
Max Extended Axes	16 (the number of axes relates to system period and galvanometer period)
Type of basic axes	EtherCAT/local pulse axes, galvanometer axes
Internal IO	24 inputs and 20 outputs, there are another 2 general inputs and 2 general outputs on each axis terminal, which can do alarm, enable, on-position, clear error, etc.
Max extended IOs	Up to 4096 inputs and 4096 outputs
PWM	8 (general digital outputs OUT0~OUT7) + 2 (specialized laser interface, OUT8 and OUT9)
Internal AD/DA	2 general ADs and 2 general DAs. For special modes, it can custom 1 specialized laser AD and 1 specialized laser DA.
Max extended AD/DA	1024
Pulse Bits	64
Encoder Bits	64
Speed/Acceleration bits	64
Max pulse frequency	10MHz
Axis motion buffer	4096 (the number of buffers is relative to system cycle)
Array Size	2560000
Procedure space	128MByte
Flash Space	256MByte
Power Input	24V DC input
Communication	RS232, RS485, Ethernet, USB drive, CAN, EtherCAT
Size	235mm*149mm*50mm

2.2. Interface Definition



→ Interface Description

Mark	Interface	Number	Description
POW	The led that indicates the current state.	1	Power state: it lights when power is conducted.
RUN		1	Run state: it lights when runs normally
ALM		1	Error state: it lights when runs incorrectly
RS232	RS232 serial port (port0)	1	Use MODBUS_RTU protocol
RS485	RS485 serial port (port1)	1	Use MODBUS_RTU protocol

EtherCAT	EtherCAT bus interface	1	EtherCAT bus interface, connect to EtherCAT bus drive and EtherCAT bus expansion module
ETHERNET	Network port	1	Use MODBUS_TCP protocol, expand the number of network ports through the interchanger, and the number of net port channels can be checked through "?*port" command, default IP address is 192.168.0.11
UDISK	U disk interface	1	Insert U disk equipment
E+24V	Main power supply	1	24V DC power, it supplies the power for controller.
CAN	CAN bus interface	1	Connect to CAN expansion modules and CAN equipment of other standards.
IN	Digital IO input port	24	Leakage type, the power is supplied by internal 24V power supply. There are 10 high-speed inputs, and IN0-3 have the latch function.
OUT	Digital IO output port	20	Leakage type, the power is supplied by internal 24V power supply. There are 8 high-speed outputs, OUT0-7 have PWM, precision output and PSO functions.
AD	Analog input port	2	12-bit resolution, 0-10V.
DA	Analog output port	2	12-bit resolution, 0-10V.
AXIS	Pulse axis interface	4	It includes differential pulse output and differential encoder input.
MPG	Handwheel interface	1	5-24V handwheel signal input
SCAN	Laser galvanometer	2	Laser galvanometer interface is with feedback, use XY2-100 protocol.
LASER	Laser	1	OUT8-9 support PWM function, and precision output and PSO function are valid in OUT8-9. Laser power control interface support IPG, YLR, YLS and other types of laser powers.
EXIO	Expansion IO	1	Flexibly custom adapter board, FIBER, YAG and other kinds of laser power control interfaces are supported.

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 Configuration

3.1. Power Input

The power supply input adopts a 5Pin (there are all 3 terminals) screw-type pluggable wiring terminal, and the interval (means the gap distance between two ports) should be 3.81mm. This 5Pin terminal is shared by controller power and CAN communication.

→ Terminal Definition:

Terminal	Name	Type	Function
	EGND	Input	Negative (-) terminal of DC power input (connect negative of power to negative of controller)
	CHNL	Input/output	CAN communication L
	EARTH	Earthing	Protect
	CHNH	Input/output	CAN communication H
	E+24V	Input	Positive (+) terminal of power input

3.1.1. Power Specification

→ Specification

Item	Description
Voltage	DC24V(-10%~10%)
The current to open	≤0.5A
The current to work	≤0.4A
Anti-reverse connection	Valid

Overcurrent Protection	Valid

3.1.2. CAN Communication Specification & Wiring

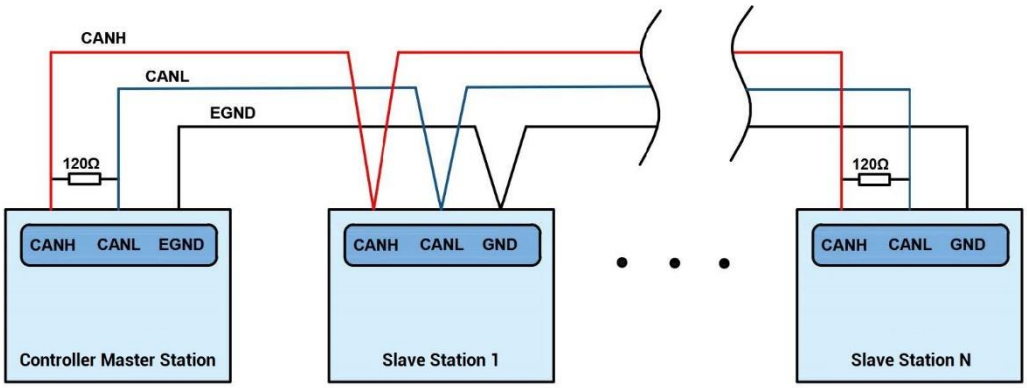
The CAN interface of the controller adopts the standard CAN communication protocol, which mainly includes three ports, CANL, CANH and the public end. And it can connect CAN expansion modules and other standard CAN devices.

→ Specification

Item	Description
Maximum Communication Rate (bps)	1Mbps
Terminal Resistor	120Ω
Topological Structure	Daisy Chain Topology
The number of nodes can be extended	Up to 16
Communication Distance	The longer communication distance is, the lower communication rate is, and maximum of 100m is recommended.

→ Wiring Reference

Connect the CANL and CANH of the standard CAN module to the CANL and CANH of the other side correspondingly. And public ends of the CAN bus communication both parties are connected together. In CAN bus left and right sides, connect a 120Ω resistor respectively (please see below graphic).

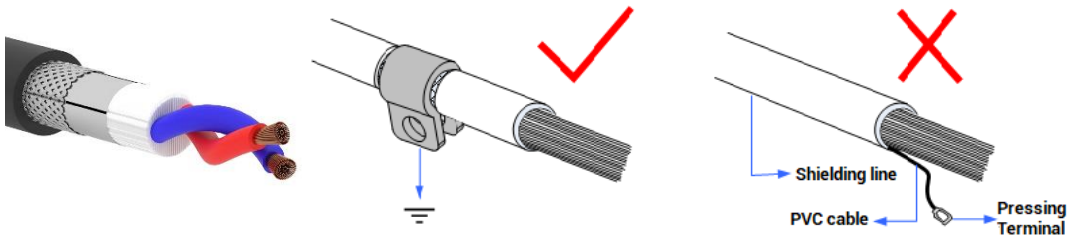


→ Wiring Notes:

- 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.
- 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.
- 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.

→ Cable Requirements:

Shielded Twisted Pair, and the shielded cable is grounded.

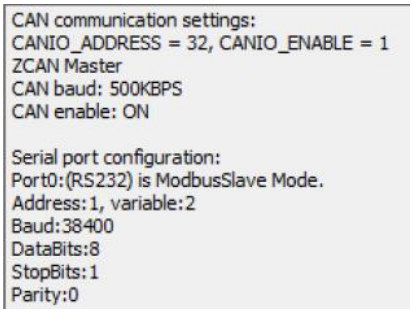


3.1.3. Basic Usage Method

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

(2) After powered on, please use any one interface among the three interfaces (ETHERNET, RS232, RS485) to connect to ZDevelop;

(3) Please use the "CANIO_ADDRESS" command to set the master's "address" and "speed" according to the needs, and use the "CANIO_ENABLE" command to enable or disable the internal CAN master function, or through "ZDevelop/Controller/State the Controller/Communication Info" to view the CAN status intuitively, and refer to the “ZBasic Programming Manual" for details.



(4) Correctly set the "address" and "speed" of the slave station expansion module according to the manual of the slave station.

(5) After all the settings are completed, restart the power supply of all stations to establish communication.

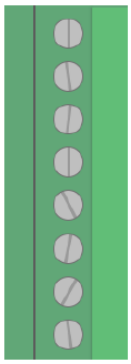
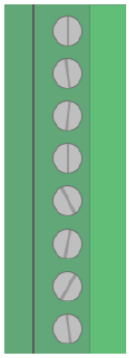
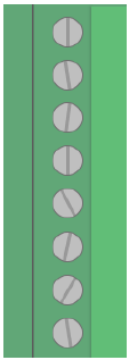
(6) Note that the "speed" settings of each node on the CAN bus must be consistent, and the "address" settings cannot cause conflicts, otherwise the "ALM" alarm light will be on, and the communication establishment will fail or the communication will be disordered.

3.2. IN Digital Input & High-Speed Latch Port

The digital input adopts 3 groups of 8Pin (there are 3 groups of 8 terminals) screw-

type pluggable terminals, and the gap distance between terminals should be 3.81mm. In addition, the high-speed latch function is integrated in digital input signals.

→ Terminal Definition

Terminal	Name	Type	Function 1	Function 2
	IN0	NPN leakage type, high-speed input	Input 0	High Speed Latch
	IN1		Input 1	
	IN2		Input 2	
	IN3		Input 3	
	IN4	NPN leakage type, low-speed input	Input 4	/
	IN5		Input 5	/
	IN6		Input 6	/
	IN7		Input 7	/
	IN8	NPN leakage type, low-speed input	Input 8	/
	IN9		Input 9	/
	IN10		Input 10	/
	IN11		Input 11	/
	IN12		Input 12	/
	IN13		Input 13	/
	IN14		Input 14	/
	IN15		Input 15	/
	IN16	NPN leakage type, low-speed input	Input 16	/
	IN17		Input 17	/
	IN18		Input 18	/
	IN19		Input 19	/
	IN20		Input 20	/
	IN21		Input 21	/
	IN22		Input 22	/
	IN23		Input 23	/

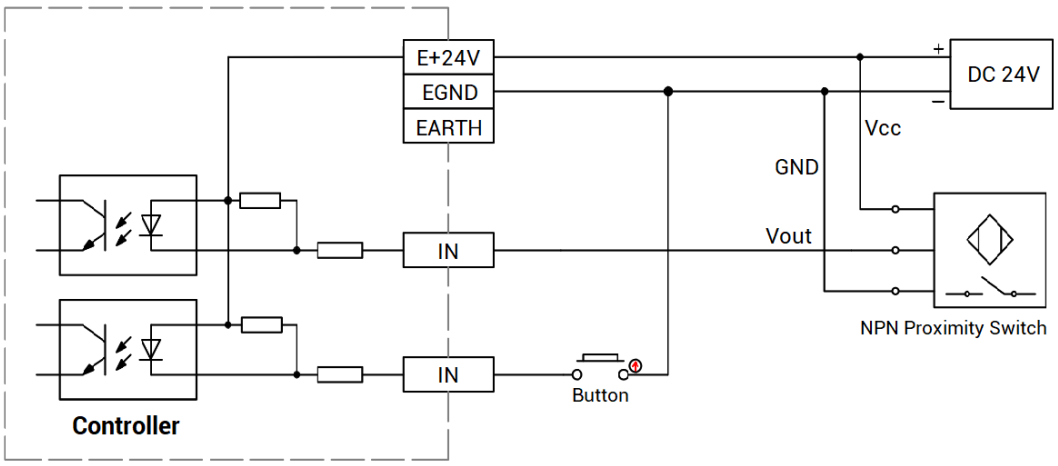
3.2.1. Digital Input Specification & Wiring

→ Specification

Item	High-Speed Input (IN0-3)	Low-Speed Input (IN4-23)
Input mode	NPN leakage type, the input is triggered when there is low-electric level	

Frequency	< 100kHz	< 5kHz
Impedance	3.3KΩ	4.7KΩ
Voltage level	DC24V	DC24V
The voltage to open	<15V	<14.5V
The voltage to close	>15.1V	>14.7V
Minimal current	-2.3mA (negative)	-1.8mA (negative)
Max current	-7.5mA (negative)	-6mA (negative)
Isolation mode	optoelectronic isolation	
Note: the above parameters are standard values when the voltage of controller power supply (E+24V port) is 24V.		

→ Wiring Reference



→ Wiring Note:

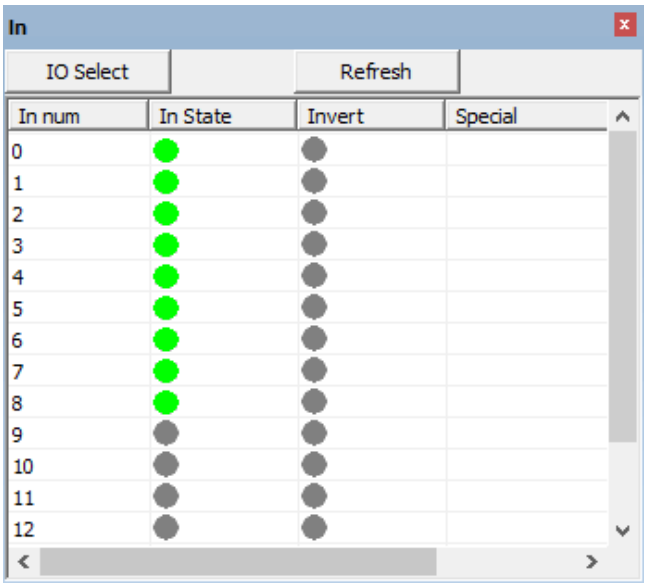
- The wiring principle of high-speed digital input IN (0-3) and low-speed digital input IN (4-23) is shown in the figure above. The external signal source can be an optocoupler, a key switch or a sensor, etc., all can be connected as long as the requirements on output of electric level can be achieved.
- For the public end, please connect the "EGND" port on the 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 controller are in the same power supply system, this connection also can be omitted.

3.2.2. Basic Usage Method

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

(2) After powered on, please select any one interface among the three interfaces ETHERNET, RS232 and RS485 to connect to ZDevelop.

(3) State values of relative input ports can be read directly through "IN" command, also, it can be read through "ZDevelop/View/In". Please refer to "ZBasic" for details.

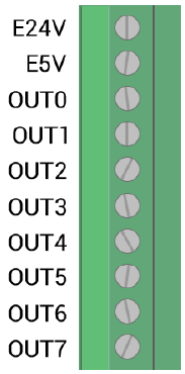
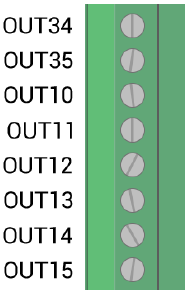
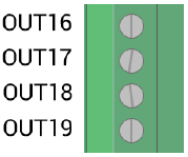


(4) Latch function can be set and triggered through "REGIST" instruction, in software, use REG_INPUTS to configure. Please refer to "ZBasic" for details.

3.3. OUT (Digital Output, PWM Terminal, Hardware Comparison Output)

The digital output adopts 3 sets of screw-type pluggable terminals with a spacing of 3.81mm, and the PWM and high-speed comparison output functions are integrated in digital output signal.

→ Terminal Definition

Terminal	Name	Type	Function 1	Function 2	Function 3
	E24V	/	Output freewheeling clamp port	/	/
	E5V	/	External 5V power output, max is 300mA	/	/
	OUT0	NPN Leakage type, high-speed output	Output 0	PWM 0	Hardware Comparison Output (0, 1, 2, 3, 4, 5, 6, 7)
	OUT1		Output 1	PWM 1	
	OUT2		Output 2	PWM 2	
	OUT3		Output 3	PWM 3	
	OUT4		Output 4	PWM 4	
	OUT5		Output 5	PWM 5	
	OUT6		Output 6	PWM 6	
	OUT7		Output 7	PWM 7	
	OUT34	NPN Leakage type, low-speed output	Output 34	/	/
	OUT35		Output 35	/	/
	OUT10		Output 10	/	/
	OUT11		Output 11	/	/
	OUT12		Output 12	/	/
	OUT13		Output 13	/	/
	OUT14		Output 14	/	/
	OUT15		Output 15	/	/
	OUT16		Output 16	/	/
	OUT17		Output 17	/	/
	OUT18		Output 18	/	/
	OUT19		Output 19	/	/

Note:

- ✧ The E24V is a freewheeling clamp port. When there is an inductive load on the output port, connecting it to the positive pole of the load power supply, then it can enable the freewheeling function of each digital output port to protect the circuit.
- ✧ The E5V power output port is used for PWM or common anode wiring of single-ended axis. It is not recommended for other purposes due to lower power.
- ✧ The output OUT (8-9) supports hardware comparison output and is allocated to the laser power interface.

3.3.1. Digital Output Specification & Wiring

→ Specification

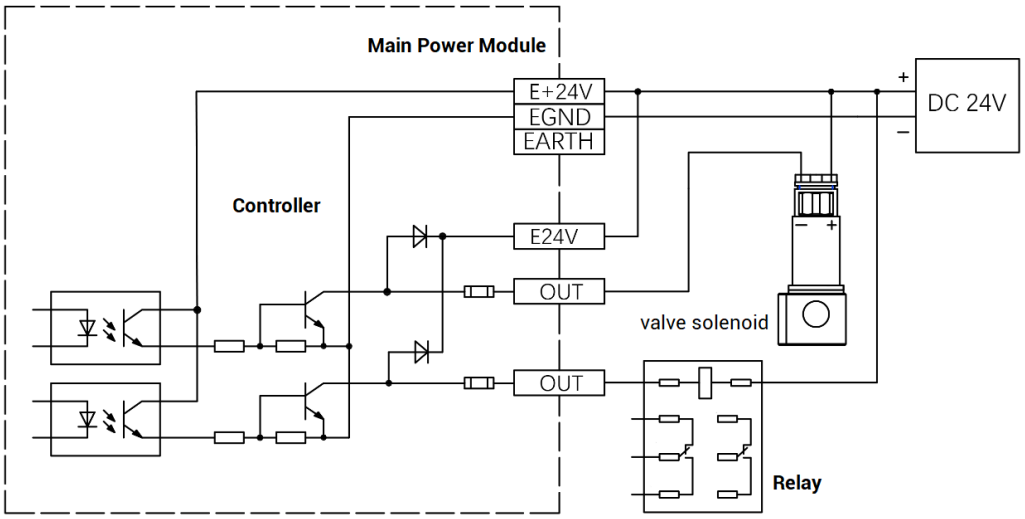
Item	High Speed Output (OUT0-7)	Low Speed Output (OUT10-19, 34-35)
Output mode	NPN leakage type, it is 0V when outputs	
Frequency	< 400kHz	< 8kHz
Voltage level	DC24V	DC24V
Max output current	+300mA	+300mA
Max leakage current when off	25μA	25μA
Respond time to conduct	1μs (resistive load typical value)	12μs
Respond time to close	3μs	80μs
Overcurrent protection	Support	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.

→ Wiring Reference



→ Wiring Note:

- The wiring principle of high-speed digital output OUT (0-7) and low-speed digital output OUT (10-19, 34, 35) 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 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 controller power supply are in the same power supply system, this connection can also be omitted.
- The E24V port is the freewheeling clamp port of this part of the digital output port. When this port is suspended, each output port will not have the freewheeling function. It needs to be connected to the positive pole of the load power supply to enable this function.
- The E5V port is a 5V power output port, which can be used when some loads need to provide an external 5V power input, the maximum current is 300mA.

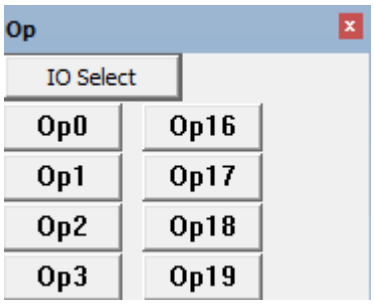
3.3.2. Basic Usage Method

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

(2) After powered on, please use any one interface among the three interfaces ETHERNET,

RS232 and RS485 to connect to ZDevelop.

(3) Open or close output port directly through "OP" command, also, it can be opened or closed through "ZDevelop/View/Op". Please refer to "ZBasic" for details.



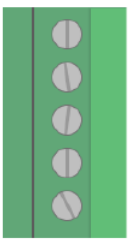
(4) The PWM function, set the frequency and duty cycle through "PWM_FREQ" and "PWM_DUTY". Please refer to ZBasic for details.

(5) Hardware comparison output can be set and opened through "HW_PSWITCH2". Please refer to ZBasic for details.

3.4. AD/DA Analog Input/Output

The analog port adopts a set of 5Pin screw-type pluggable terminals with a spacing of 3.81mm.

→ Terminal Definition

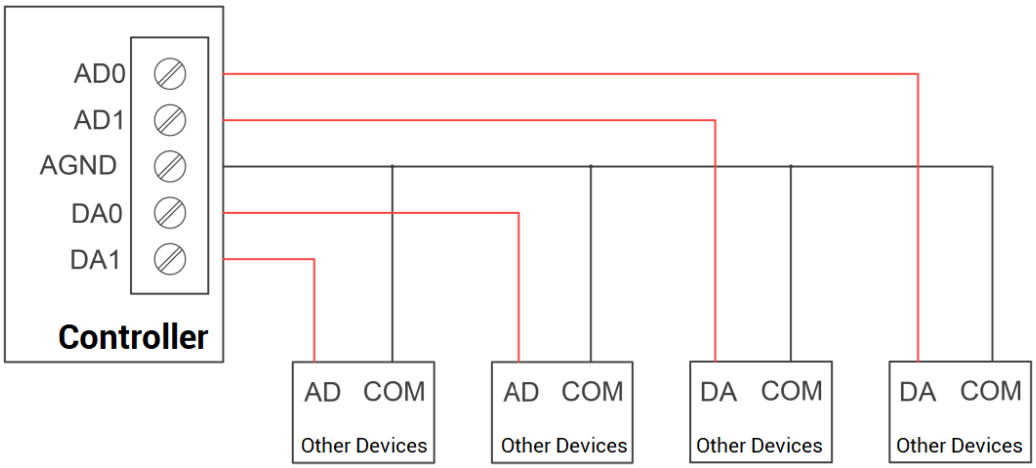
Terminal	Name	Type	Function
 AD0 AD1 AGND DA0 DA1	AD0	Input	Analog input terminal: AIN(0)
	AD1		Analog input terminal: AIN(1)
	AGND	Public End	Public end of this analog
	DA0	Output	Analog output terminal: AOUT(0)
	DA1		Analog output terminal: AOUT(1)

3.4.1. AD/DA Analog Input/Output Specification & Wiring

→ Specification

Item	AD（0-1）	DA（0-1）
Resolution	12-bit	12-bit
Data range	0-4095	0-4095
Signal range	0-10V input	0-10V output
Data refresh ratio	1KHz	1KHz
Voltage input impedance / output load	>40KΩ (voltage input impedance)	>1KΩ (voltage output load)

→ Wiring Reference

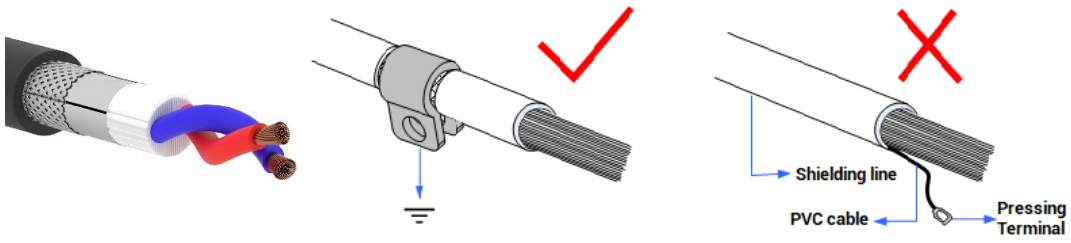


→ Wiring Note:

- The analog input/output wiring method is as shown in the figure above, and the external load signal range must match with this signal range.
- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.

→ Cable Requirements:

Shielded Twisted Pair, and the shielded cable is grounded.

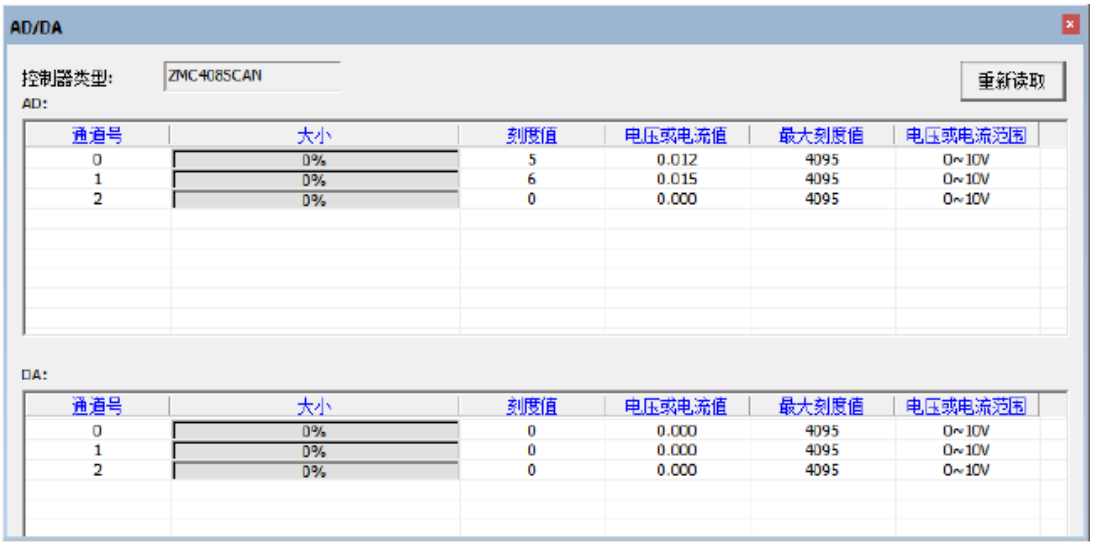


3.4.2. Basic Usage Method

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

(2) After powered on, please use EtherNET or RS232 or RS485 connect to ZDevelop.

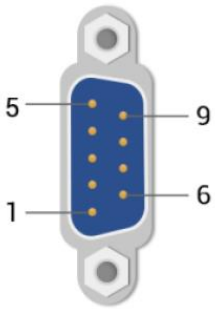
(3) Analog input voltage can be read through "AIN" command and corresponding analog voltage can be output through "AOUT" command, also, data of each channel can be checked through "ZDevelop/View/AD/DA". Please refer to "ZBasic" for details.



3.5. RS232/RS485 Serial Port

RS232 and RS485 are integrated in one standard DB9 male socket and supports MODBUS_RTU protocol and custom communication.

→ Interface Definition:

Terminal	PIN	Name	Type	Function
	1, 6, 8	NC	Spare	Reserved
	2	232RXD	Input	RS232 (port 0) signal, receive data
	3	232TXD	Output	RS232 (port 0) signal, send data
	4	485A/+	Input/Output	RS485 (port1) signal A/+
	5	EGND	Output	Negative pole output of 5V power, and output for the public end
	7	485B/-	Input/Output	RS485 (port1) signal B/-
	9	E5V	Output	Positive pole output of 5V power, maximum is 300mA

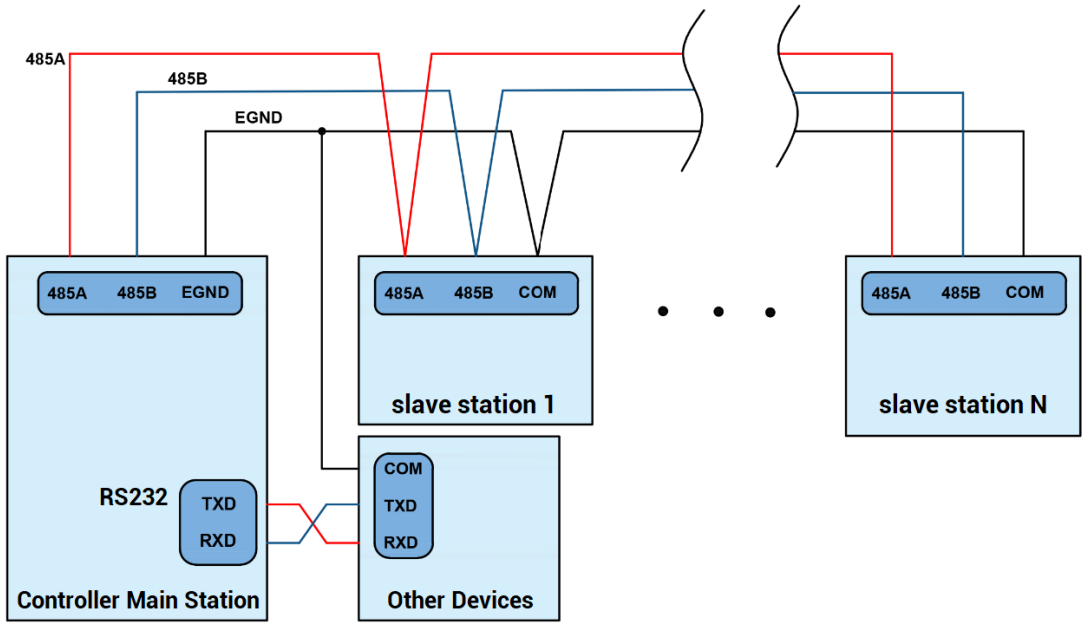
3.5.1. RS232 / RS485 Communication Interface Specification & Wiring

→ Specification:

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

	maximum 10m is recommended.	maximum 100m is recommended.

→ Wiring Reference:

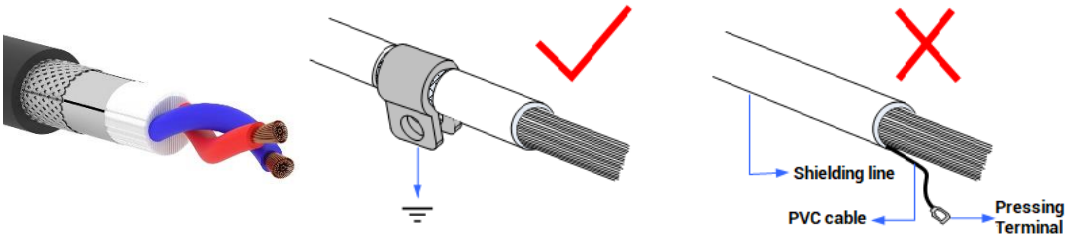


→ Wiring Notes:

- The wiring of RS232 (port0) 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.
- The wiring of RS485 (port1) is above, it is 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.
- 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.

→ Cable Requirements:

Shielded Twisted Pair, and the shielded cable is grounded.



3.5.2. Basic Usage Method

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

(2) After powered on, please use any one interface among the three interfaces ETHERNET, RS232 (there is default parameter, which can be connected directly) and RS485 (there is default parameter, which can be connected directly, but for hardware, adapter head is needed) to connect to ZDevelop.

(3) Please use the "ADDRESS" and "SETCOM" commands to set and view the protocol station number and configured parameters, see "ZBasic Programming Manual" for details.

(4) According to their respectively instructions, correctly set the relevant parameters of the third-party equipment to match the parameters of each node.

(5) When all is configured, it can start to do communicating.

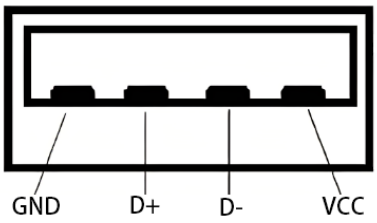
(6) Communication data of RS232 / RS485 can be directly viewed through “ZDevelop / Controller / State the Controller / CommunicationInfo".

```
CAN communication settings:
CANIO_ADDRESS = 32, CANIO_ENABLE = 1
ZCAN Master
CAN baud: 500KBPS
CAN enable: ON

Serial port configuration:
Port0:(RS232) is ModbusSlave Mode.
Address:1, variable:2 delay:400ms
Baud:38400
DataBits:8
StopBits:1
Parity:0
Port1:(RS485) is ModbusSlave Mode.
Address:1, variable:2 delay:400ms
Baud:38400
DataBits:8
StopBits:1
Parity:0
```

3.6. U Disk

The ZMC408SCAN motion controller provides a USB communication interface, which can insert the U disk device. It is used for ZAR program upgrading, controller data importing and exporting, file 3 executing, etc. Its schematic diagram is shown in the figure below:



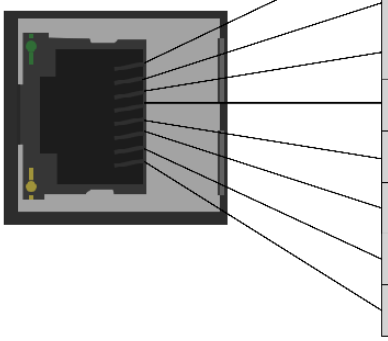
→ Specification

Item	USB2.0
Highest Communication Ratio	12Mbps
Max Output Current of 5V	500mA
Whether Isolates	No

3.7. ETHERNET

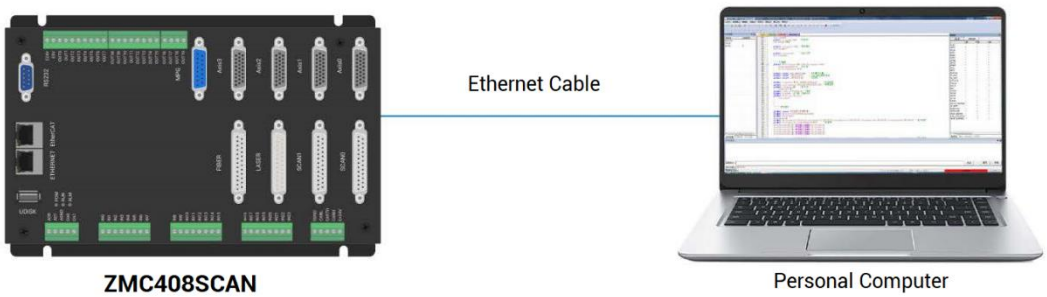
ZMC408SCAN motion controller has a 100M network port, and it supports MODBUS_TCP protocol and custom communication, the default IP address is

192.168.0.11. The pin definition is as follows:

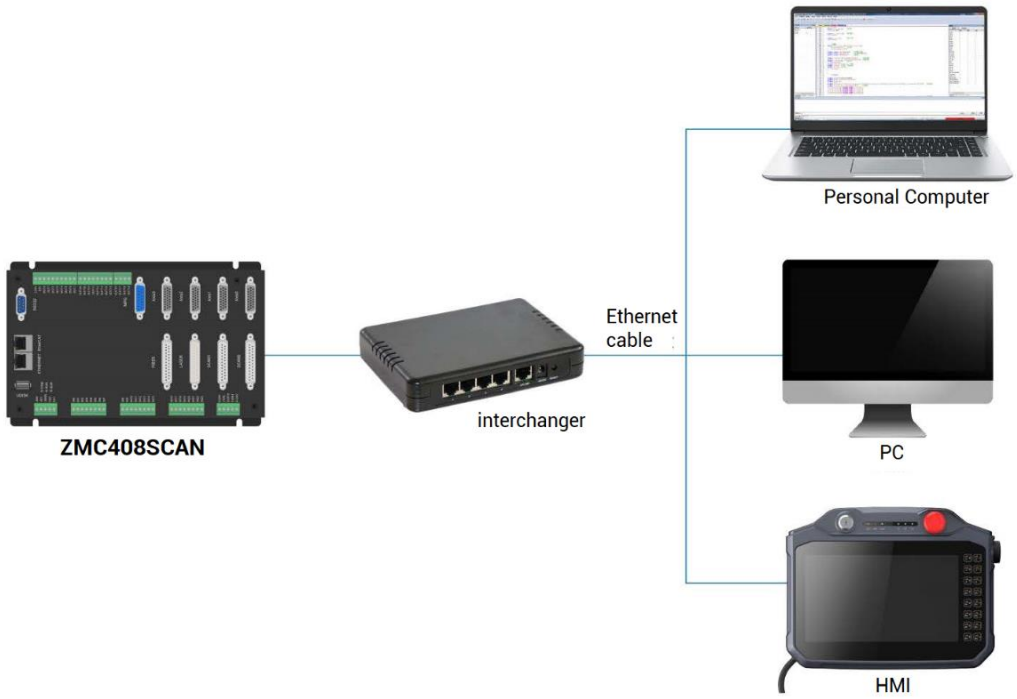


PIN	Signal	Description
1	TX+	Send signal (+)
2	TX-	Send signal (-)
3	RX+	Receive signal (+)
4	NC	Reserved
5	NC	Reserved
6	RX-	Receive signal (-)
7	NC	Reserved
8	NC	Reserved

The Ethernet port of the controller can be connected to a computer, HMI, etc. through an Ethernet cable, and using point to point connection method. The schematic diagram is as follows:

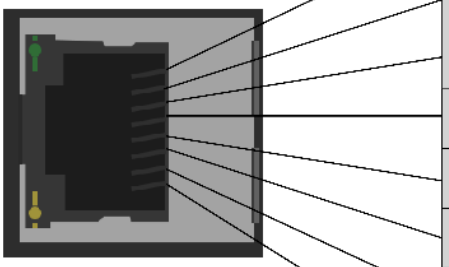


The controller can also be connected to the interchanger through an Ethernet cable, and then use interchanger to connect to other devices, then multi-point connection can be achieved. The schematic diagram is as follows:



3.8. EtherCAT Bus Interface

ZMC408SCAN bus galvanometer motion controller has a 100M EtherCAT communication interface, and it supports EtherCAT protocol. In addition, EtherCAT driver or EtherCAT expansion module can be connected. 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

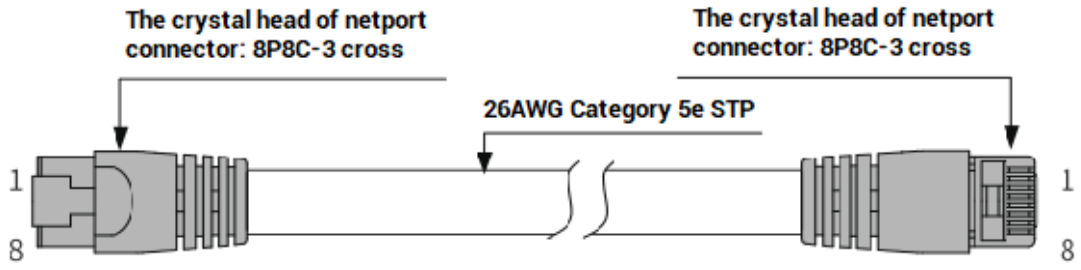
→ Specification

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

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	Less than 100m

Use RJ45 network cable connection method:

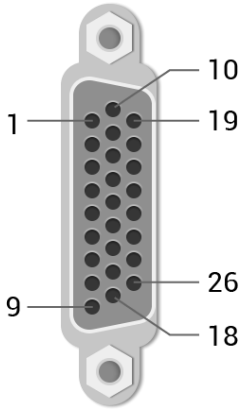
- When installing, hold the crystal head that is with the cable and insert it into the RJ45 interface until it makes a "click" sound (kada).
- In order to ensure the stability of communication, please fix the cables with cable ties.
- When disassembling, press the tail mechanism of the crystal head,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

3.9. AXIS Differential Pulse Axis Interface

This product provides 4 local differential pulse axis interfaces, each interface is a standard DB26 female socket.

→ Interface Definition

Interface	Pin	Signal	Description
	1	EGND	Negative pole of IO 24V power
	2	IN24-27/ALM	General input (recommended as driver alarm)
	3	OUT20-23 / ENABLE	General output (recommended as driver enable)
	4	EA-	Encoder differential input signal A-
	5	EB-	Encoder differential input signal B-
	6	EZ-	Encoder differential input signal Z-
	7	+5V	Positive pole of 5V power of pulse/encoder signal
	8	Reserved	Reserved
	9	DIR+	Servo or step directional output +

			(differential signal)
	10	GND	Negative pole of 5V power of pulse/encoder signal
	11	PUL-	Servo or step pulse output – (differential signal)
	12	Reserved	Reserved
	13	GND	Negative pole of 5V power of pulse/encoder signal
	14	OVCC	Positive pole of IO 24V power
	15	OUT24-27 / CLR	Digital output, recommended as drive alarm clearing
	16	IN28-31 / INP	Digital input, recommended as on-position signal
	17	EA+	Encoder differential input signal A+
	18	EB+	Encoder differential input signal B+
	19	EZ+	Encoder differential input signal Z+
	20	GND	Negative pole of 5V power of pulse/encoder signal
	21	GND	
	22	DIR-	Servo or step directional output - (differential signal)
	23	PUL+	Servo or step pulse output + (differential signal)
	24	GND	Negative pole of 5V power of pulse/encoder signal
	25	Reserved	Reserved
	26	Reserved	Reserved

Note:

- ALM, ENABLE, CLR and INP are recommended to be used as axis IO, because the drive capacity is small.
- OVCC, +5V are only used for communication between the controller and the servo driver, please do not use it as power supply for other places.

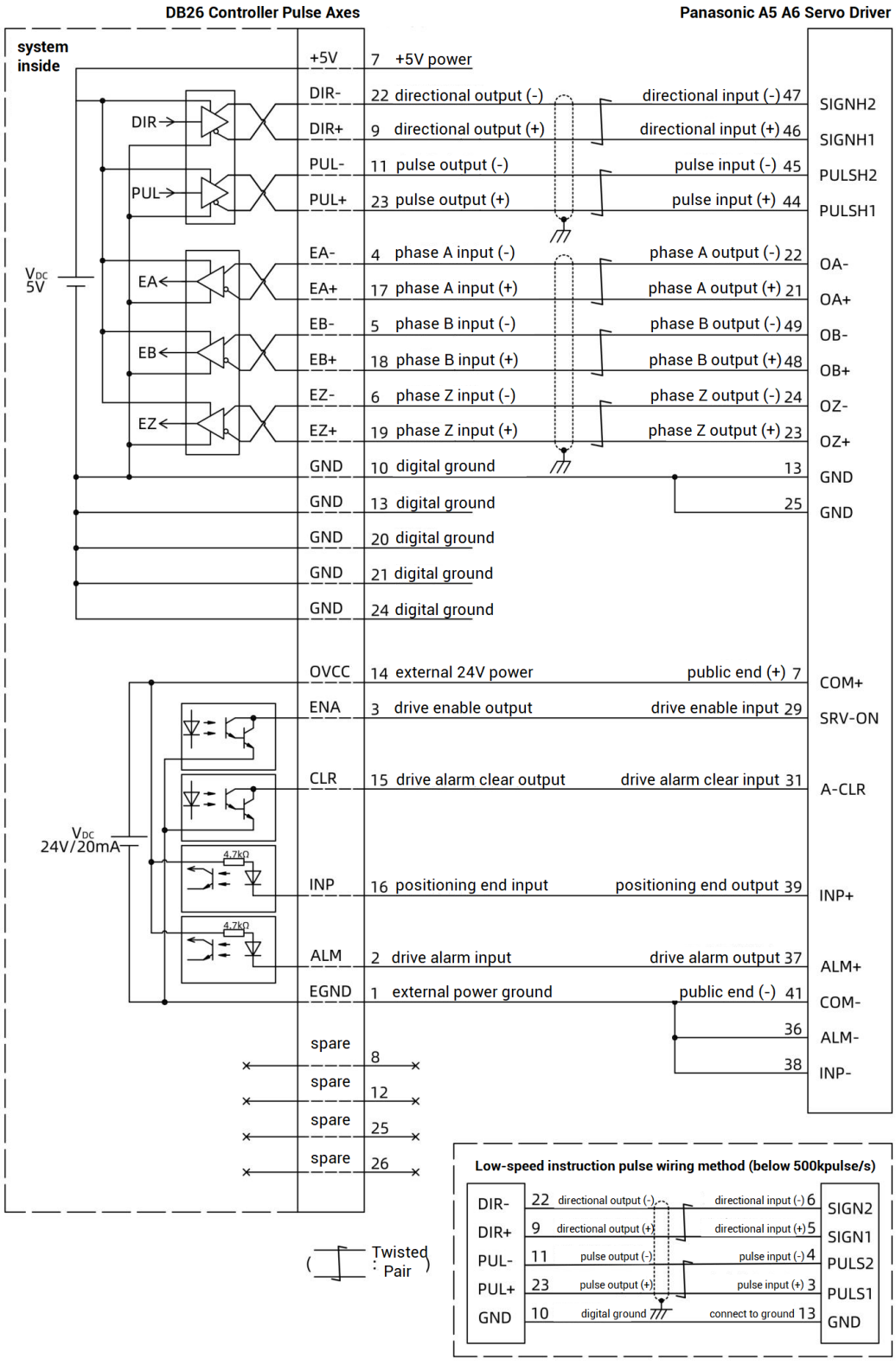
3.9.1. AXIS Interface Signal Specification & Wiring

→ Specification:

Signal	Item	Description
PUL/DIR	Signal type	Differential output signal
	Voltage range	0-5V
	Maximum frequency	10MHz
EA/EB/EZ	Signal type	Differential input signal
	Voltage range	0-5V
	Maximum frequency	5MHz
IN24-31	Input method	NPN leak type, it is triggered when low electric level is input.
	Frequency	< 5kHz
	Impedance	6.8KΩ
	Voltage level	DC24V
	The voltage to open	<10.5V
	The voltage to close	>10.7V
	Minimal current	-1.8mA (negative)
	Maximum current	-4mA (negative)
	Isolation	optoelectronic isolation
OUT20-27	Output method	NPN leak type, it is 0V when outputs
	Frequency	< 8kHz
	Voltage level	DC24V
	Maximum current	+50mA
	Overcurrent protection	No
	Isolation	optoelectronic isolation
+5V，GND	Maximum output current for 5V	50mA
OVCC, EGND	Maximum output current for 24V	50mA

→ Wiring Reference:

Reference example of wiring with Panasonic A5/A6 servo driver:



→ Wiring Note:

✧ The wiring principle of the differential pulse axis interface is shown in the figure above, and the wiring methods of different types of drivers are different, please

connect carefully.

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

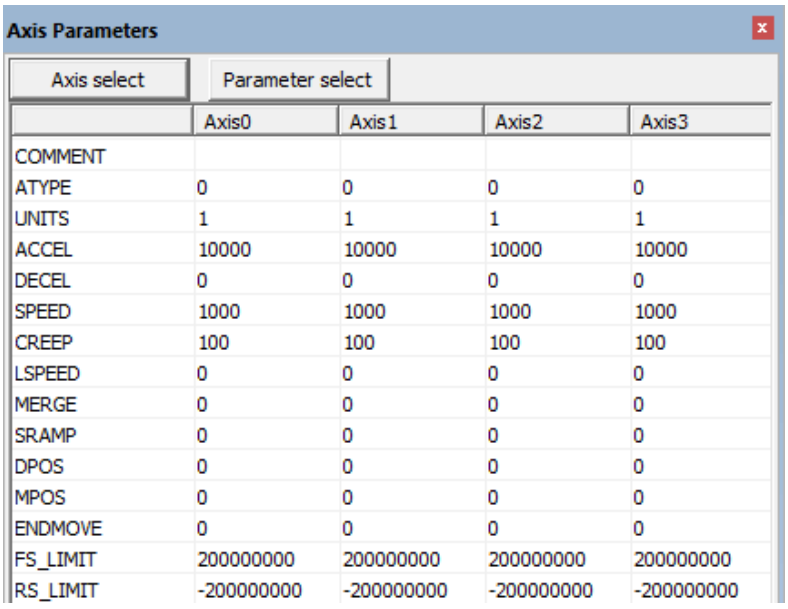
3.9.2. Basic Usage Method

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

(2) After powered on, please use any one interface among the three interfaces ETHERNET, RS232 (default parameter, it can be connected directly) and RS485 (default parameters, it can be connected directly, but for hardware, adapter head is needed) to connect to ZDevelop.

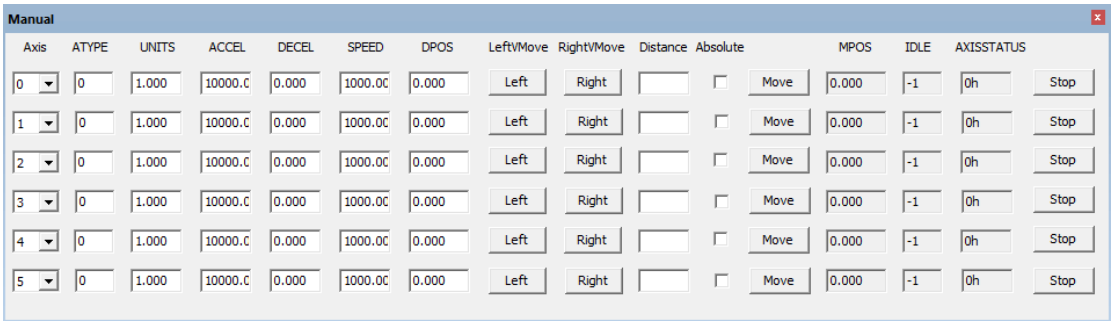
(3) Set axis parameters, such as, ATYPE, UNITS, SPEED, ACCEL, FWD_IN, REV_IN, etc.

(4) There are many parameters related to pulse axis, they can be set and checked through relative instructions, please see “axis parameter and axis status” of “ZBasic”, or see “ZDevelop/View/Axis parameter”.



	Axis0	Axis1	Axis2	Axis3
COMMENT				
ATYPE	0	0	0	0
UNITS	1	1	1	1
ACCEL	10000	10000	10000	10000
DECEL	0	0	0	0
SPEED	1000	1000	1000	1000
CREEP	100	100	100	100
LSPEED	0	0	0	0
MERGE	0	0	0	0
SRAMP	0	0	0	0
DPOS	0	0	0	0
MPOS	0	0	0	0
ENDMOVE	0	0	0	0
FS_LIMIT	200000000	200000000	200000000	200000000
RS_LIMIT	-200000000	-200000000	-200000000	-200000000

(5) Control corresponding motion through “View – Manual”.



Refer to BASIC Routine:

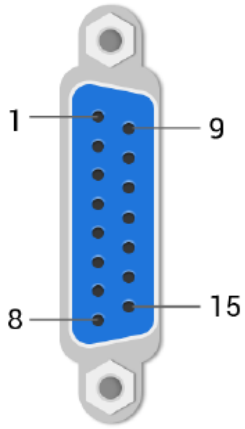
```
BASE(0,1)              'select axis 0 and axis 1
ATYPE = 1,1            'set axis 0 and axis 1 as pulse axes
UNITS = 1000,1000      'set pulse amount as 1000 pulses
SPEED = 10,10          'set axis speed as 10*1000 pulse/s
ACCEL = 1000,1000      'set axis acceleration as 1000*1000 pulse/s/s
FWD_IN = -1,-1         'prohibit using axis positive hardware position limit
REV_IN = -1,-1         'prohibit using axis negative hardware position limit
MOVE(10) AXIS(0)       'axis 0 moves distance of 10*1000 pulses in positive
MOVE(-20) AXIS(0)      'axis 0 moves distance of 20*1000 pulses in negative
```

3.10. MPG Handwheel Interface

This product provides a special interface for the local handwheel encoder axis, which is a double-row standard DB15 female seat.

→ Interface Definition

Interface	PIN	Signal	Description
	1	H-5V	Positive pole of 5V power supply for output, which supplied power for handwheel
	2	HA-	Encoder phase A signal (IN32)
	3	HB-	Encoder phase B signal (IN33)
	4	HEMGN	Emergency stop signal (IN43)
	5	NC	Reserved
	6	HX1	Select ratio X1 (IN34)
	7	HX10	Select ratio X10 (IN35)

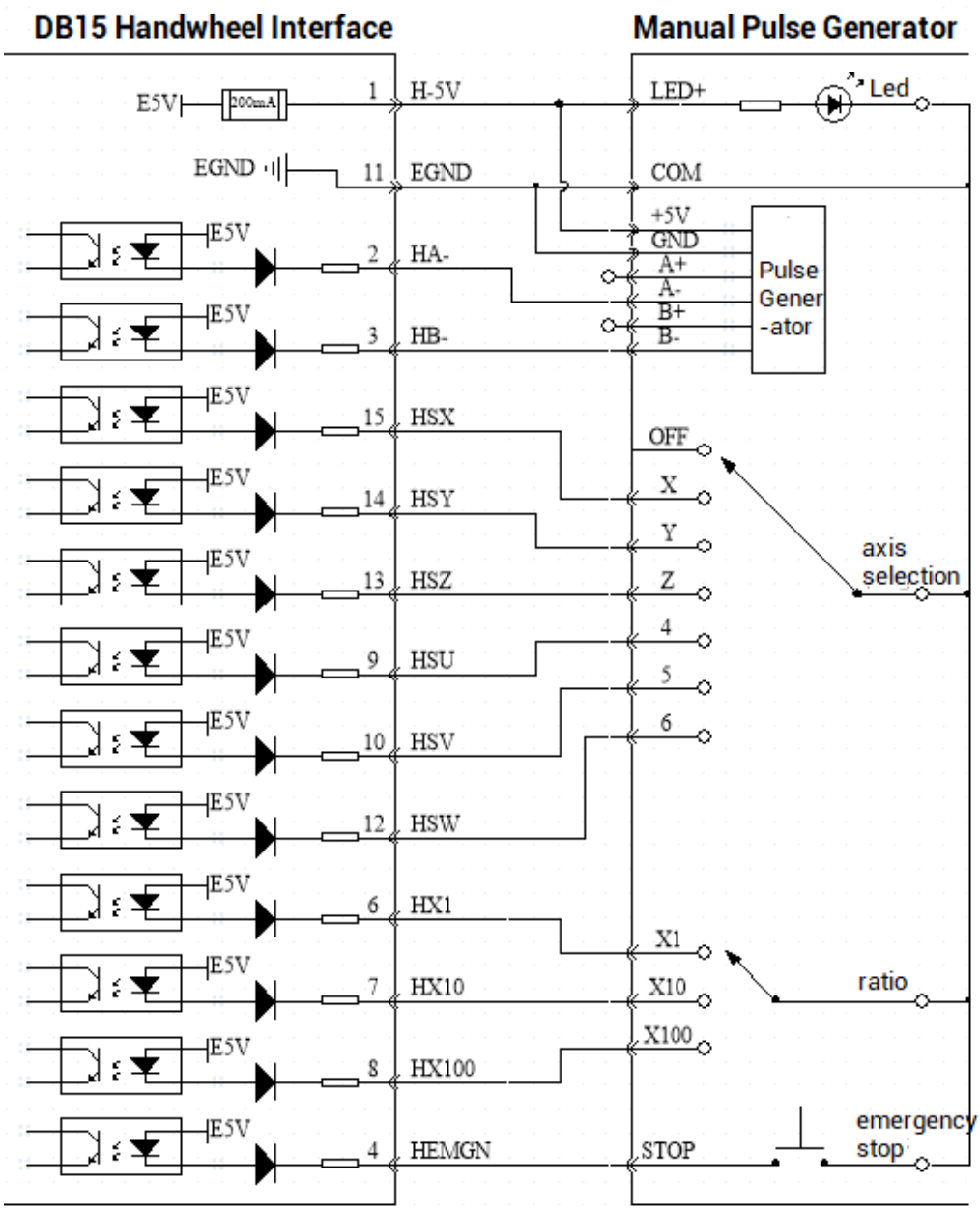
	8	HX100	Select ratio X100 (IN36)
	9	HSU	Select axis 3 (IN40)
	10	HSV	Select axis 4 (IN41)
	11	EGND	Negative pole of 5V power supply for output, signal public end
	12	HSW	Select axis 5 (IN42)
	13	HSZ	Select axis 2 (IN39)
	14	HSY	Select axis 1 (IN38)
	15	HSX	Select axis 0 (IN37)
Note: ➢ 5V power supply only supplies for handwheel, don't supply power for others. ➢ All signals of this interface are digital input signals, number is IN (32-43).			

3.10.1. MPG Handwheel Interface Specification & Wiring

→ Specification

Item	IN (32-43)
Mode (input)	NPN leakage it is triggered when low electric inputs.
Frequency (input)	<5kHz is recommended
Impedance (input)	510Ω
Max voltage (input)	24V
The current to open (input)	<2.8
The current to close (input)	>2.9A
Min current (input)	-1.8mA
Max current (input)	-5.5mA
Isolation	optoelectronic isolation
5V power supply (H-5V, EGND) max output current	100mA

→ Wiring Reference



→ Wiring Note

- The wiring principle of handwheel encoder axis interface is shown above, please connect carefully due to diversified handwheel designs.
- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.

3.10.2. Basic Usage Method

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

2. After powered on, please select ETHERNET or RS232 or RS485 to connect to ZDevelop.

3. Configure axis No., for ZMC408SCAN, axis 4 is the default handwheel interface, if there is no default AXIS axis No. (axis 10, 11, 12, 13 are recommended), remapping must be done. Followings are processes.

```
BASE(target axis number)          'the axis No. to be remapped
ATYPE(target axis number) = 0     'set axis type as 0
BASE(4)                           'handwheel interface initial axis No. is 4 (invalid)
ATYPE(4) = 0                      'set initial type of handwheel interface as 0
AXIS_ADDRESS(target axis number)=(-1<<16) + 8
                                  'bind initial axis 8 to target axis No.
ATYPE(target axis number) = 6
                                  'set this new axis interface as required axis type, such as 3 or 6
```

4. Configure IO: assign axis selection (HSX, HSY, HSZ, HSU) and ratio (HX1, HX10, HX100) and emergency stop (HEMGN) functions as required. These signals are essentially digital input signals with fixed numbers but no fixed functions. It needs ZDevelop to develop (the axis selection is the connected axis of "connect" synchronization motion, and the ratio is the "connect" ratio).

5. When completed above steps, it can start to use handwheel.

BASIC Routine Reference:

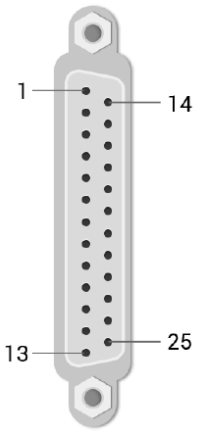
```
ATYPE(4) = 0                        'restore axis type of axis 4
ATYPE(4) = 0                        'restore default handwheel axis type
AXIS_ADDRESS(10) = (-1<<16)+4 'map the address of MPG manual pulse axis to axis 10
ATYPE(10) = 3                       'set manual pulse axis as quadrature encoder type
UNITS(10) = 1                 'set the unit as pulse for pulse amount of manual pulse axis
CONNECT(100,10) AXIS(0)
'axis 0 connects to manual pulse axis at the synchronous ration of 100
```

Chapter IV SCAN Galvanometer Interface

This product provides two interfaces specialized for local galvanometer axis, and each interface is double-row standard DB25 female socket.

ZMC408SCAN supports the XY2-100 galvanometer protocol, the refresh period is 10us-50us, and supports joint linkage interpolation motion between motion control and galvanometer. The host computer is connected to the controller through the network port, then controls the movement of the galvanometer axis through the XY2-100 galvanometer protocol, and controls the movement of the servo axis through the EtherCAT bus or pulse mode. Then realize the synchronous control of laser output and movement.

→ Interface Definition

Interface	PIN	Signals	Description
	1	Clk-	Clock signal -
	14	Clk+	Clock signal +
	2	SYNC-	Synchronization signal -
	15	SYNC+	Synchronization signal +
	3	X-	Galvanometer X channel signal -
	16	X+	Galvanometer X channel signal +
	4	Y-	Galvanometer Y channel signal -
	17	Y+	Galvanometer Y channel signal +
	5	Z-	Galvanometer Z channel signal -
	18	Z+	Galvanometer Z channel signal +
	6	Y RETURN-	Galvanometer Y channel feedback signal -
	19	Y RETURN+	Galvanometer Y channel feedback signal +
	7	Z RETURN-	Galvanometer Z channel feedback signal -
	20	Z RETURN+	Galvanometer Z channel feedback signal +
	8	X RETURN-	Galvanometer X channel feedback signal -
	21	X RETURN+	Galvanometer X channel feedback signal +
	9	NC	
	22		
	10		
	23	GND	Signal ground, public end

	11		
	24		
	12	NC	/
	25		
	13		

Attention:

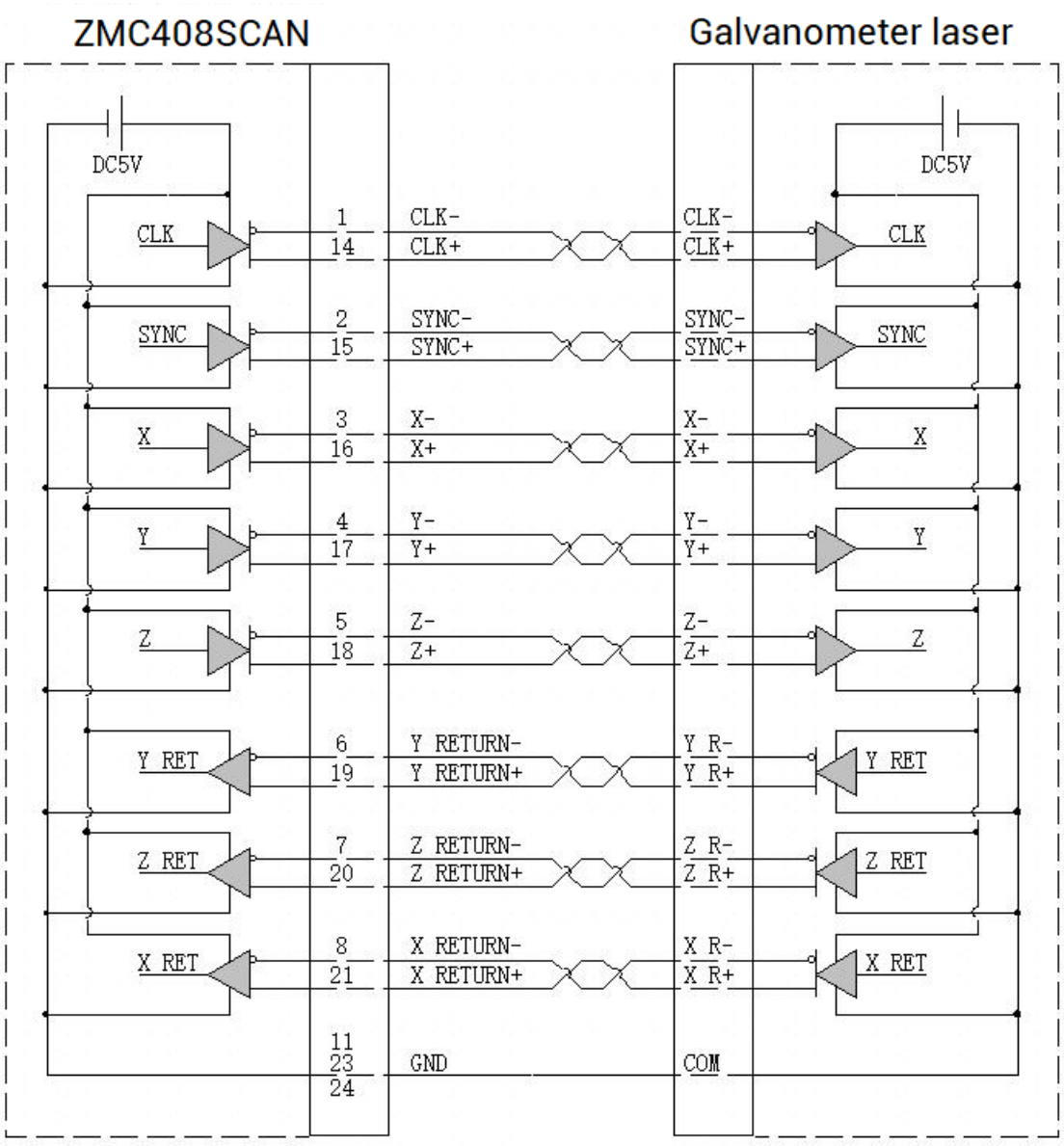
1. Under the default situation of 2D galvanometer, SCAN0 relates to Axis 4 and Axis 5 of 2D galvanometer, SCAN1 relates to Axis 6 and Axis 7 of 2D galvanometer.
2. Under the default situation of 3D galvanometer, one is only supported. SCAN0 relates to Axis 4, Axis 5 and Axis 8 of 3D galvanometer.

4.1. SCAN Galvanometer Interface Specification & Wiring

→ Specification

Item	(CLK, SYN, X, Y, Z) ±	(X, Y, Z) RETURN±
Signal type	Differential output	Differential input
Electric level standard	0-5V TTL	
Max communication velocity	10Mbps	
Max current	±20mA	+5mA
Isolation method	Non-isolation	

→ Wiring Reference



→ Wiring Notes

- Wiring principle of SCAN galvanometer axis interface is above, please use standard differential wiring, and note signal specification should match each other.
- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.

4.2. Basic Usage Method

1. Please wiring correctly according to above wiring description.
2. Please select one interface among EtherNET, RS232 (default parameters can be directly connected) and RS485 (default parameters can be connected directly, need to use adapter head for hardware) to connect ZDevelop.
3. Set fundamental motion parameters, such as, Atype, UNITS, etc. (preset Units as 65536 / the max galvanometer breadth).
4. There are many parameters relate to pulse axes, and they are set and checked through relative instructions, please see "axis parameter and axis status" in "*ZBasic Program Manual*" for details, also can be viewed through "ZDevelop/View/axis parameter".
5. Through "ZDevelop/View/Manual", relative motions can be operated and controller.

Refer to BASIC routine:

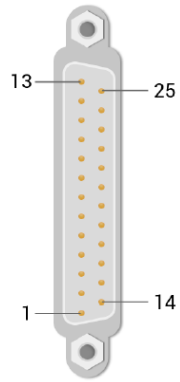
```
BASE (4, 5)                 'select axis Scan 0, Scan 1 relates to axis 6 and axis 7
ATYPE = 21, 21              'select axis 4 and axis 5 as galvanometer axes type
UNITS = 1000, 1000          'set pulse amount of axis 4, 5 as the unit of 1000 bit
DPOS = 0, 0
FORCE_SPEED = 100, 100      'set axis 4, motion speed of 5Scan is 100*1000 bit/s
MOVESCANABS(0, 0)           'galvanometer moves to center origin position
MOVESCAN(50) Axis(4)        'axis 4 moves 50*1000 bits forward
MOVESCAN (-50) Axis(5)      'axis 5 moves 50*1000 bits reverse
```

Chapter V LASER Interface

This product provides one interfaces specialized for local YLR laser, and interface is double-row standard DB25 male socket

- The LASER laser control interface supports the connection of IPG, YLR, YLS and other types of lasers.
- The laser can be operated by sending output signals such as laser, red light, and enable through the direct controller to make the laser respond accordingly.
- There are 2 PWM output ports in the DB interface, corresponding to OUT8 and OUT9.
- It can receive laser signal, display IN signal and respond accordingly.

→ Wiring Notes

Interface	PIN	Signal	Operate port	Description
	1,4,14	LAGND	LAGND	Laser analog signal reference ground
	2,3,13	NC		Reserved
	5	Guide Control	OUT32	Red light control output pin, 24V is valid
	6	ACON	OUT33	Reserve output pin, 24V is valid
	7	LaserRequest	OUT28	Laser request output, 24V is valid
	8	Program start	OUT29	Program start output, 24V is valid
	9	ERST	OUT30	Laser reset output, 24V is valid
	10	LASER ON	OUT31	Laser enable output, 24V is valid
	11	PWM/NC	OUT9	PWM signal, 24V electric level
	12	Modulation-	/	Modulate signal -
	15	LASER_AD/NC	AIN(2)	Reserve analog input, 0-10V, 16-bit resolution, special modes are valid
	16	LASER_DA/NC	AOUT(2)	Reserve analog output, 0-10V, 16-bit resolution, special modes are valid
	17	Error	IN44	Laser alarm input, 24V is valid
	18	Emission EN	IN45	Laser emission input, 24V is valid
	19	Pow Active	IN49	Laser main power has opened, 24V is valid
	20	Power ON	IN48	Laser system input when powered on,

				24V is valid
	21	Laser standby	IN47	Laser input when in standby status, 24V is valid
	22	Ready	IN46	Laser is in ready status to input, 24V is valid
	23,25	EGND	EGND	Reference ground of each digital input and output
	24	Modulation+	OUT8	Modulation signal +, 24V electric level

Attention:

1. Except PWM and Modulation, other signals of inputs and outputs in above form all support customization.
2. AIN (2) and AOUT (2) are reserved signals, but standard models don't have, please select special mode when ordering if you need.

5.1. LASER Interface Specification & Wiring

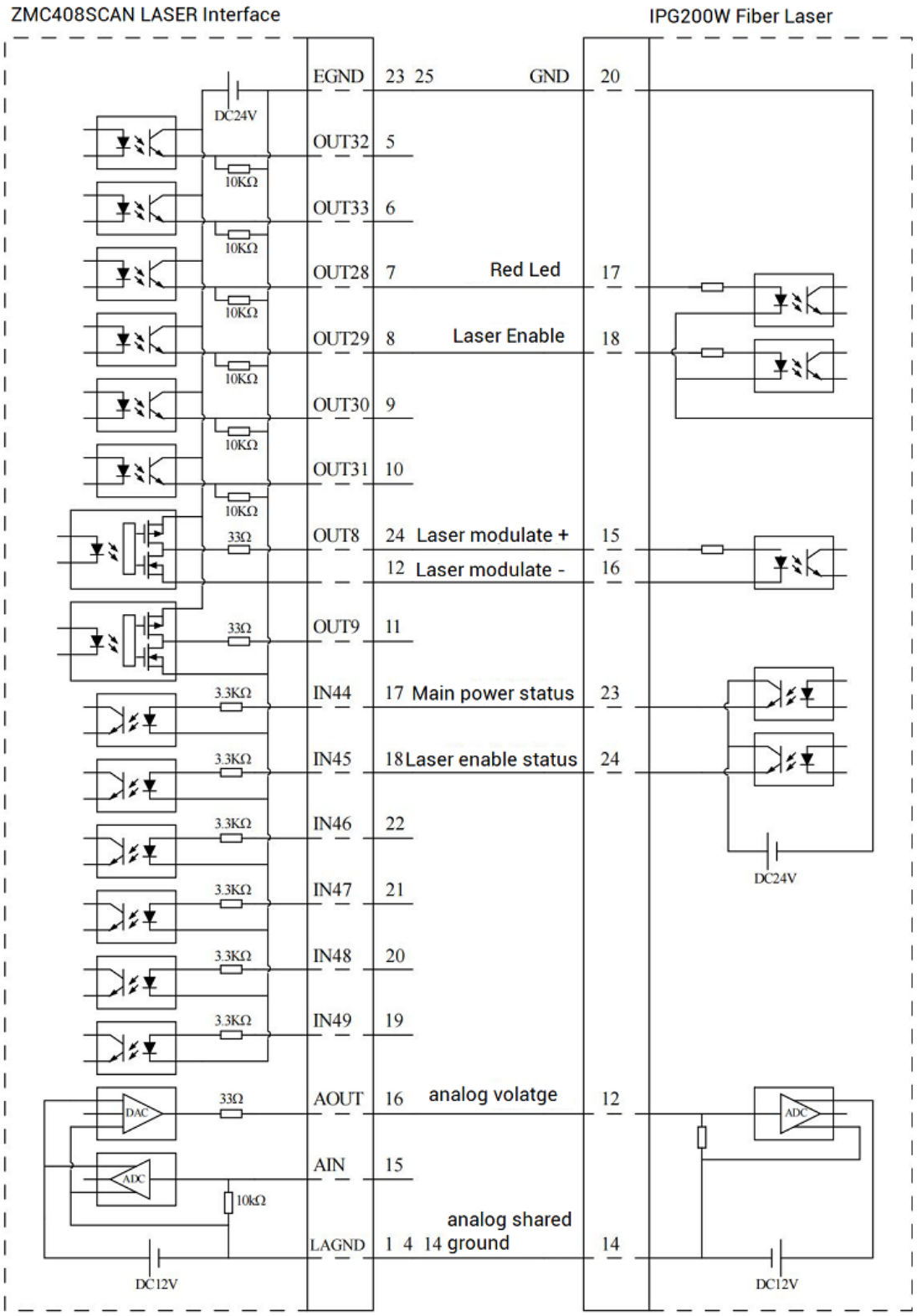
→ Specification

Signal	Item	Parameter
OUT (28-33)	Output method	PNP Source type
	Output frequency	<8kHz
	Max output voltage	24V
	Min output voltage	0V
	Normal voltage	0V
	Max output current	8mA
	Overcurrent protection	NO
	Isolation method	Optoelectrical isolation
OUT (8-9)	Output method	Push-pull output
	Output frequency	Recommendation: <1MHz
	Max output voltage	24V
	Min output voltage	0V
	Normal voltage	24V
	Max output current	±50mA
	Overcurrent protection	NO

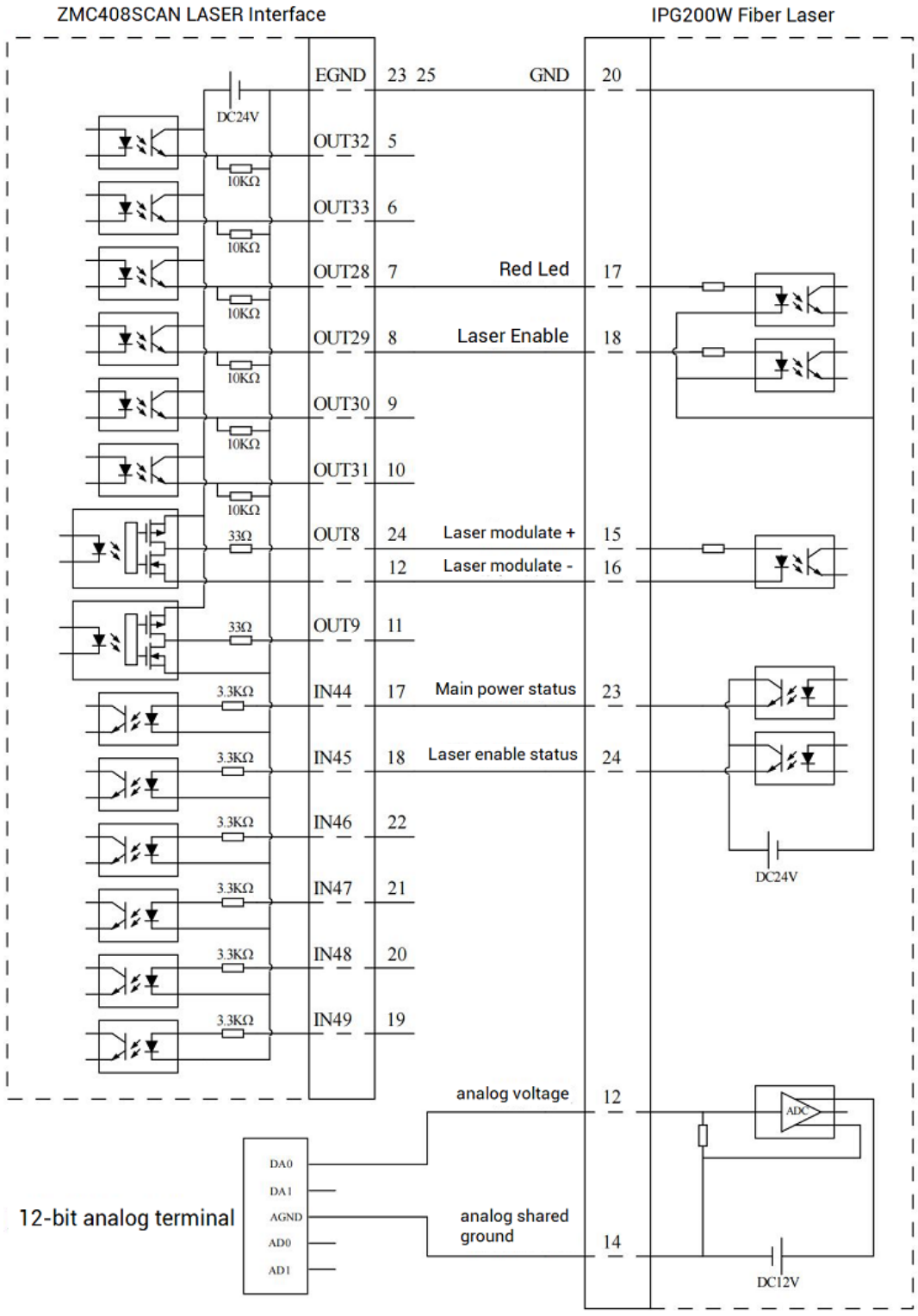
	Isolation method	Optoelectrical isolation
IN (44-49)	Input method	PNP Source type
	Input frequency	<5KhZ
	Input impedance	3.3kΩ
	Input voltage level	DC24V
	Voltage to ON	>7.2V
	Voltage to OFF	<7.1V
	Min input current	+1.8mA
	Max input current	+7.5mA
	Isolation method	Optoelectrical isolation
AOUT(2)	Resolution	16-bit
	Data range	0-65535
	Signal range	0-10V
	Data refresh ratio	1kHz
	Load impedance	<10Ω
AIN (2)	Resolution	16-bit
	Data range	0-65535
	Signal range	0-10V
	Data refresh ratio	1kHz
	Load impedance	>3.3kΩ

→ Wiring Reference

- Wiring reference of 16-DA in LASER interface:



- Wiring reference of terminal's 12-DA:



1. Wiring reference of LASER laser interface is above, except OUT8 and OUT9, other digital IOs can be customized.
2. There are 2 wiring ways for lasers that need analog input. Controller 12-DA interface can be used for not high resolution, but if you need high resolution, please use LASER interface with 16-DA.

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

5.2. Basic Usage Method

1. Please wiring correctly according to above wiring description.
2. Please select one interface among EtherNET, RS232 (default parameters can be directly connected) and RS485 (default parameters can be connected directly, need to use adapter head for hardware) to connect ZDevelop.
3. Through "ZDevelop/In, Op window to operate and watch relative IOs.
4. Through "ZDevelop/AD/DA window to operate and watch relative analog inputs and outputs.
5. In ZDevelop, send online command "PWM_FREQ (PWM No.) = frequency, PWM_DUTY (PWM No.) = duty cycle.

Refer to BASIC routine:

```
BASE (4, 5)                 'select axis Scan 0, Scan 1 relates to axis 6 and axis 7
ATYPE = 21, 21              'select axis 4 and axis 5 as galvanometer axes type
UNITS = 1000, 1000          'set pulse amount of axis 4, 5 as the unit of 1000 bit
Dpos = 0, 0
CORNER_MODE = 2, 2          'set axis corner deceleration mode is used for corner delay
DECEL_ANGLE = 30*PI/180, 30*PI/180
STOP_ANGLE = 90*PI/180, 90*PI/180
ZSMOOTH = 1000, 1000        'in galvanometer Scan instruction, Zsmooth is the max
                            delaying time 1000us when in corner delaying
FORCE_SPEED = 100, 100      'in galvanometer Scan instruction, Force_speed is axis 4/5,
                            and the Scan motion speed is 100*2000 bit/s
MOVESCANABS (0,0)           'galvanometer moves to center origin position
Base (4, 5)
AOUT (0) = 2048             'set laser power as 50% for 12-bit analog output 0, 0-10V
                            relates to 0-100% power.
Op (29, ON)                 'open laser to enable IO
FORCE_SPEED = 2000          'empty motion speed
```

```
MOVESCANABS (50, 50)      'empty move to 50, 50
MOVEOP_DELAY = -1.5       'open the light in advance 1.5ms, use Move_Delay to delay
                           switching on the light
MPVE_PWM (8, 0.5, 10000)  'set PWM duty cycle as 0.5, frequency as 10khz
MOVE_OP (8, ON)           'start to output the light when laser OP8
FORCE_SPEED = 1000        'standard scale speed
MOVESCANABS (150, 150)    'move to 150, 150
MOVEOP_DELAY = -2.5       'delay 2.5ms to switch off
MOVE_OP (8, OFF)          'laser OP8 to switch off the light
```

In the motion command application field of galvanometer processing, in the MOVESCAN and MOVESCANABS commands, here, CORNER_MODE=2 is used to enable the corner delay of the galvanometer axis, and ZSMOOTH is used to set the maximum time of the corner delay, unit is us. DECEL_ANGLE and STOP_ANGLE are used to set the initial angle and angle of the corner delay, the specific time of the corner delay is linearly distributed from 0-ZSMOOTH between these two angles.

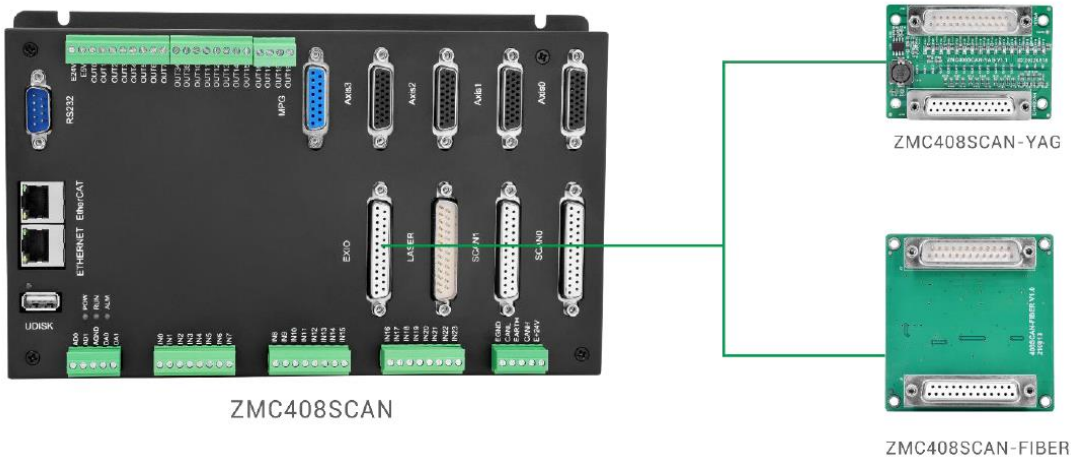
Chapter VI EXIO Expansion IO

6.1. EXIO Expansion IO Interface Description

EXIO expansion IO interface on ZMC408SCAN controller can be configured flexibility, and the EXIO interface is specially used to drive a variety of lasers on the market. It requires a special adapter board to use. And this interface cannot be connected to any load except the specified adapter board, and this interface adopts a double-row DB25 female socket.

The EXIO expansion IO interface can currently support the expansion of standard YAG, FIBER and other laser types. The expansion module is connected through the EXIO expansion interface, and the laser enable, laser switch, and laser energy control of the laser are controlled after converting the TTL signal.

After the hardware wiring is completed, it is necessary to use commands to configure the EXIO expansion interface and configure the input/output signals connected to the expansion module.



→ Interface Definition

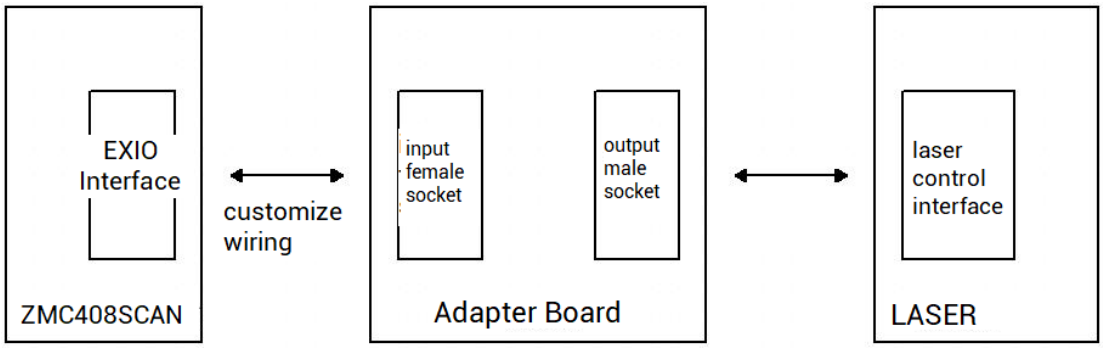
PIN	Signal name	Signal description	Map digital input	Map digital output
1	GND	Internal digital ground output	/	/
2	EXIO_0	Expand IO 0	67	53

3	EXIO_1	Expand IO1	64	50
4	EXIO_2	Expand IO2	59	9
5	EXIO_3	Expand IO3	57	43
6	GND	Internal Digital Ground Output	/	/
7	EXIO_4	Expand IO4	65	51
8	EXIO_5	Expand IO5	51	37
9	EXIO_6	Expand IO6	53	39
10	EXIO_7	Expand IO7	61	47
11	EXIO_8	Expand IO8	55	41
12	EXIO_9	Expand IO9	58	8
13	GND	Internal Digital Ground Output	/	/
14	EXIO_10	Expand IO10	66	52
15	EXIO_11	Expand IO11	68	54
16	EXIO_12	Expand IO12	56	42
17	EXIO_13	Expand IO13	60	46
18	EXIO_14	Expand IO14	62	48
19	EXIO_15	Expand IO15	63	49
20	EXIO_16	Expand IO16	50	36
21	EXIO_17	Expand IO17	52	38
22	EXIO_18	Expand IO18	54	40
23	EXIO_19	Expand IO19	69	55
24	GND	Internal Digital Ground Output	/	/
25	+5V	+5V power output	/	/

Attention:

1. EXIO_0-EXIO_19 all can be configured as inputs / outputs, and use “EXIO_DIR” instruction to configure, corresponding number is in the right.
2. Signals in this interface can't be connect to load directly, adapter board is needed to switch, and it can be customized flexibly, the communication way also can be designed according to requirements.

→ **Interface Logic:**

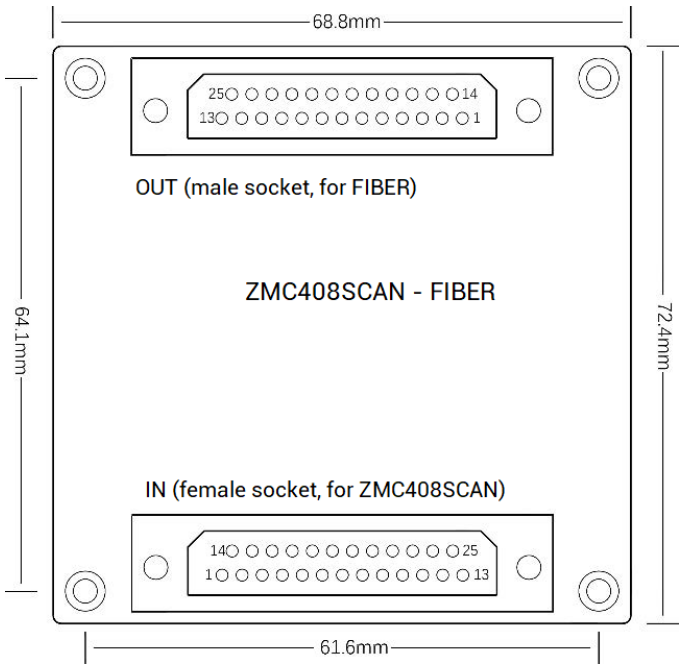


6.2. Basic Usage Method

1. Select corresponding adapter board and use matched specialized cable to connect adapter board and controller's EXIO interface.
2. Please select one interface among EtherNET, RS232 and RS485 to connect ZDevelop when power on.
3. Use IO configuration instruction "EXIO_DIR (0, $8FFFF) of Fiber adapter board, IO configuration instruction "EXIO_DIR (0, $FCBFE) and IO configuration instruction "EXIO_DIR (0, $FFFFA).
4. Waiting for configuring controller EXIO_ (0-19) ports to make digital inputs / outputs occupied by adapter board enable.
5. Customize digital IOs that are enabled, and controller can achieve laser's functional control through secondary development.

6.2.1. FIBER Laser Adapter Board

ZMC408SCAN-Fiber adapter board is below, output port adopts DB25 male socket, which can be used to connect MOPA, IPG, YLP, YLPN and other lasers. Expansion IO configuration: EXIODIR(0, $8FFFF).



→ Interface Definition

PIN	Signal	Description	Relative digital input / output signal
1	D0	Power set position D0	OUT36 (EXIO_16)
2	D1	Power set position D1	OUT37 (EXIO_5)
3	D2	Power set position D2	OUT38 (EXIO_17)
4	D3	Power set position D3	OUT39 (EXIO_6)
5	D4	Power set position D4	OUT40 (EXIO_18)
6	D5	Power set position D5	OUT41 (EXIO_8)
7	D6	Power set position D6	OUT42 (EXIO_12)
8	D7	Power set position D7	OUT43 (EXIO_3)
9	LATCH	Power latch signal, valid in rising edge	OUT46 (EXIO_13)
10	NC	Reserved	/
11	STA2	Alarm status feedback (input interface)	IN68 (EXIO_11)
12	NC	Reserved	/
13	NC	Reserved	/
14,15	GND	Negative pole of +5V output, signal public end	/
16	STA0	Alarm status feedback (input interface)	IN66 (EXIO_10)
17	+5V	+5V output positive pole, max is	/

		100mA, spare when no use	
18	M0	Main oscillator switch signal	OUT47 (EXIO_7)
19	GATE	5V PWM laser modulation signal	OUT48 (EXIO_9)
20	PRR	5V PWM laser frequency signal	OUT9 (EXIO_2)
21	STA1	Alarm status feedback (input interface)	IN67 (EXIO_0)
22	RED LIAGHT	Red light signal	OUT48 (EXIO_14)
23	EMSTOP	Emergency stop signal	OUT49 (EXIO_15)
24,25	NC	Reserved	/

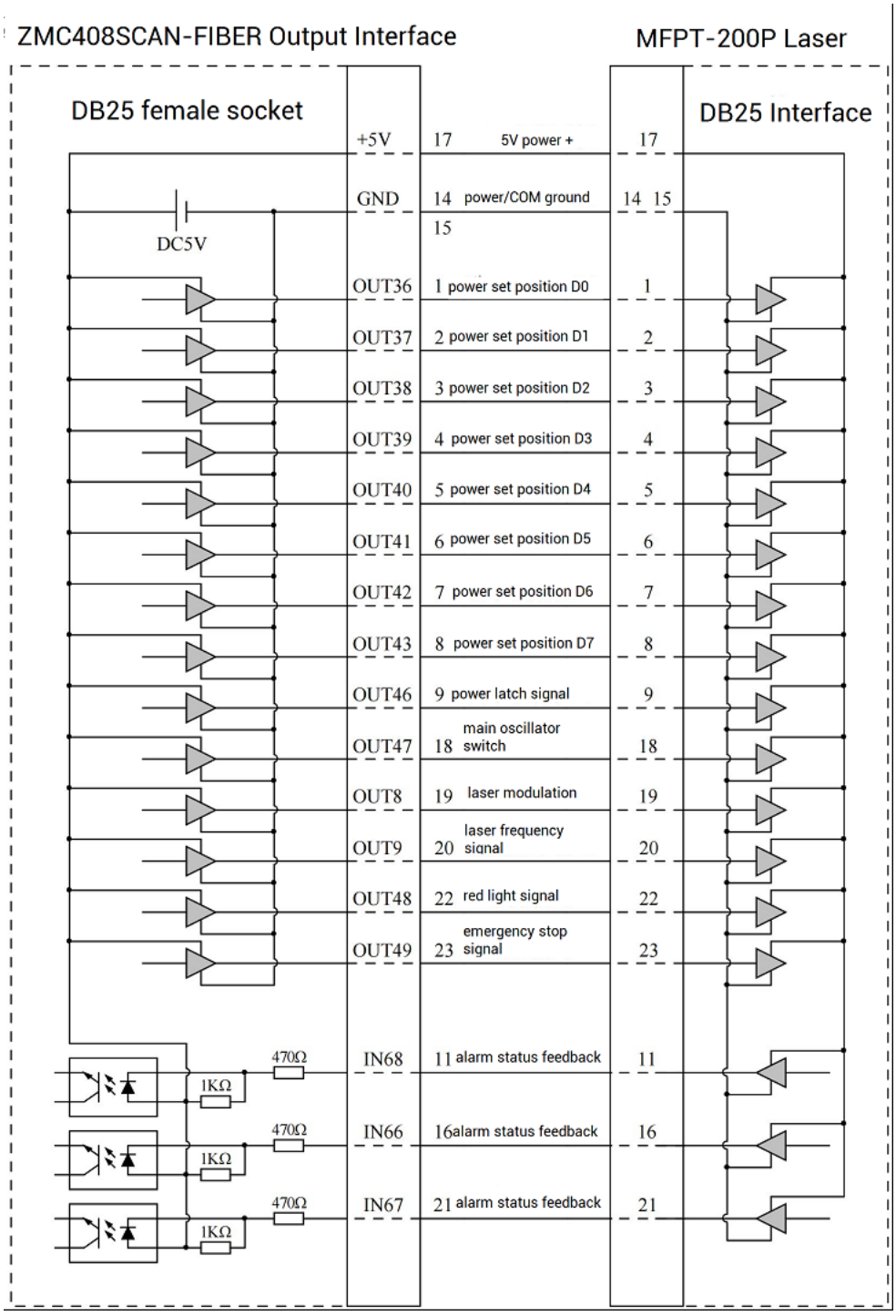
→ Specification

Item	IN (66-68)	Item	OUT (8-9, 36-43, 46-49)
Input method	Leakage type, it is triggered by low electricity	Output method	0-5V TTL output
Input frequency	Recommendation: <5kHz	Output frequency	Max 10Mbps
Input impedance	4.7KΩ	Max output voltage	4.9V
Voltage to ON	<2.9V	Min output voltage	0.1V
Voltage to OFF	>3V	Initial logic	0
Min input current	1.8mA	Max output current	± 20mA
Max input current	8.1mA	Overcurrent protection	NO
Isolation	NO	Isolation	NO
+5V max output current		100mA	

Attention:

1. Buffer output means output logic follows the logic of EXIO port that is to be mapped.
2. Initial logic is 0 after EXIO port is configured as output, namely, initial logic of OUT corresponding to above also is 0 and the output voltage is about 0.1V. If operation OUT port output is 1, then output voltage is about 4.9V.

→ Wiring Reference



→ Wiring Notes

✧ Above is the example of MFPT-200P, also, you can refer this to customize the specific pin to be connected.

✧ Please use the cable with shield, and shield layer should be connected to the ground fully (chassis).

The FIBER laser uses the EXIO extended IO interface and matches with (connects to) the FIBER adapter board to control. The laser control reference steps are as follows:

1. Laser type setting: call the command EXIO_DIR(0, $8FFFF) to set the EXIO laser type to FIBER type.

2. Laser power setting: call the command AOUT to operate DA(3) and modify the value range of D0-D7 from 0-255 to correspond to the laser power of 0-100%. The value of DA(3) also corresponds to the state of the output ports OUT36-OUT43 bit by bit.

3. Turn on the laser: call the command MOVE_OP to operate OUT47 to turn on the laser enable, and call the command MOVE_OP to operate OUT(8) after a delay of 5ms to turn on the laser.

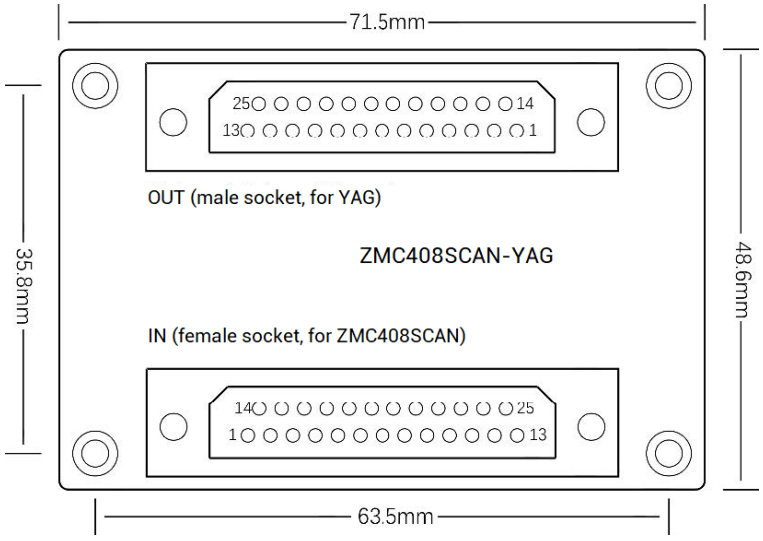
4. Laser red light: call the command MOVE_OP to operate OUT(48) to turn on the red light.

5. Laser PWM power setting: call the command PWM_FREQ to operate PWM9 to set the output frequency of the PRR signal, and call the command PWM_DUTY to operate PWM9 to set the duty cycle of the PRR signal.

Note: for terminal control, please refer to laser manual description.

6.2.2. YAG Laser Adapter Board

ZMC408SCAN-YAG adapter board is below, output port adopts DB25 male socket, which can be used connect to UW-YAG types lasers.



- Unit: mm
- Height: 35mm
- Installation Hole Diameter: 4.5mm

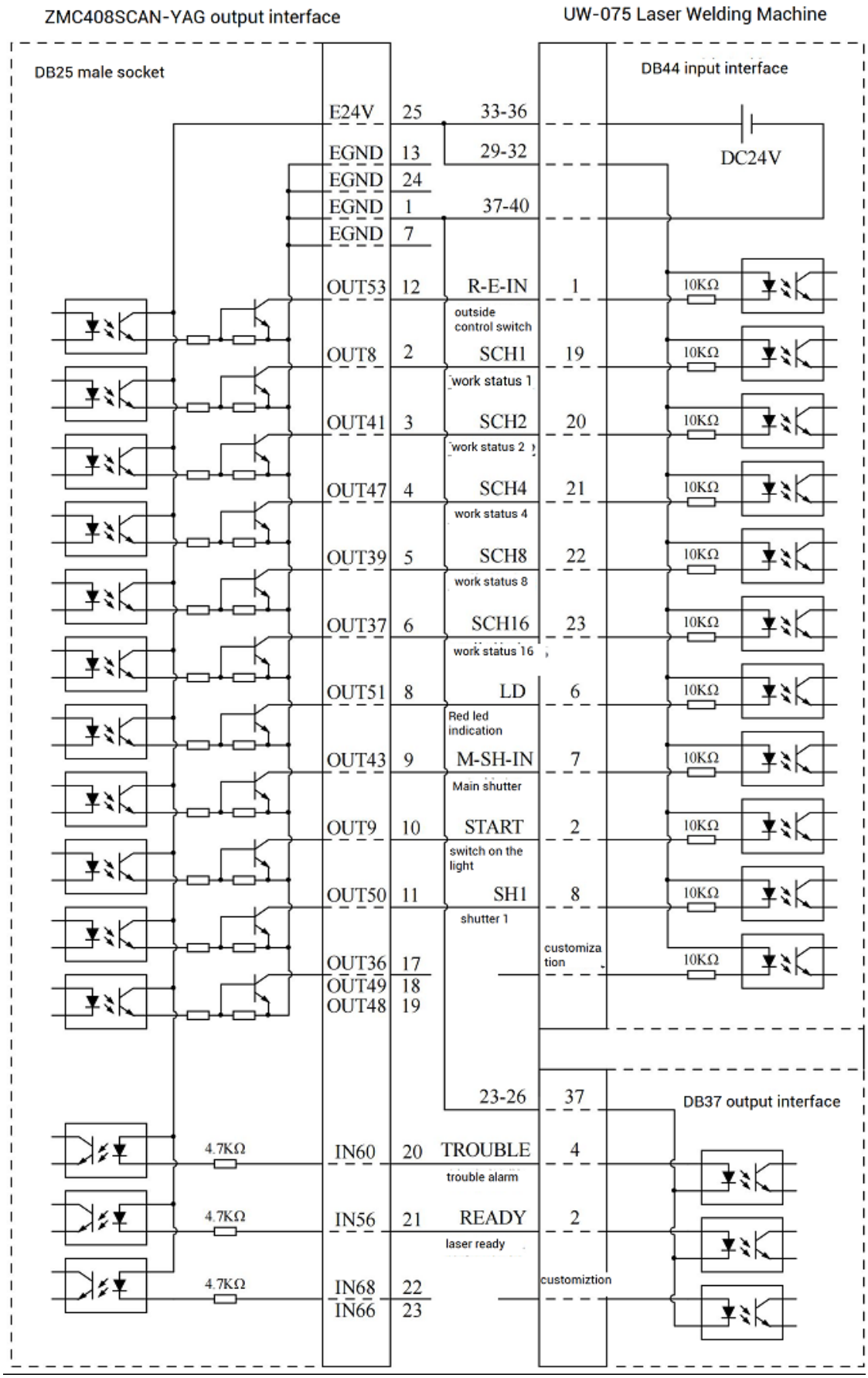
→ Interface Definition

PIN	Signal	Description	Relative digital in/out signal
1	EGND	External supply power 24V negative	/
2	SCH 1	Work status 1	OUT8 (EXIO_9)
3	SCH 2	Work status 2	OUT41 (EXIO_8)
4	SCH 4	Work status 4	OUT47 (EXIO_7)
5	SCH 8	Work status 8	OUT39 (EXIO_6)
6	SCH 16	Work status 16	OUT37 (EXIO_5)
7	EGND	External supply power 24V negative	/
8	LD	Red led switch	OUT51 (EXIO_4)
9	MAIN-SHUTTER-IN	Main shutter	OUT43 (EXIO_3)
10	START	Switch on the led	OUT9 (EXIO_2)
11	SHUTTER1	Shutter 1	OUT50 (EXIO_1)
12	REMOTER-EQUEST	Outside control switch	OUT53 (EXIO_0)
13	EGND	External supply power 24V negative	/
14,15,16	Reserved	/	/
17	/	Customized	OUT36 (EXIO_16)
18	/	Customized	OUT49 (EXIO_15)
19	/	Customized	OUT48 (EXIO_14)
20	TROUBLE-OUT	Trouble alarm	IN60 (EXIO_13)
21	READY	Laser is in ready status	IN56 (EXIO_12)
22	/	Customized	IN68 (EXIO_11)
23	/	Customized	IN66 (EXIO_10)
24	EGND	External supply power 24V negative	/
25	E24V	External supply power 24V positive	/

→ Specification

Item	IN (56, 60, 62, 63)	Item	OUT (8-9, 37, 39, 41-43, 47, 50, 51, 52, 54)	OUT 53
Input method	Leakage type, it is triggered by low electrical level	Output method	Leakage type, it is 0V when outputs	Leakage type
Input frequency	<5kHz	Output frequency	<8kHz	<400kHz
Input impedance	4.7KΩ	Max output current	300mA	
Input voltage level	DC24V	Overcurrent protection	No	
Voltage to ON	<14.5V	Isolation	Optoelectrical isolation	
Voltage to OFF	>14.7V	/	/	/
Min input current	1.8mA	/	/	/
Max input current	6mA	/	/	/
Isolation	Optoelectrical isolation	/	/	/
E24V max output current	50mA			
Attention: OUT53 is different from other OUTs, it uses high-speed optocoupler isolation, which means it allows higher communication speed ratio.				

→ Wiring Reference


ZMC408SCAN-YAG output interface
UW-075 Laser Welding Machine
DB25 male socket
DB44 input interface
DC24V
E24V 25
EGND 13
EGND 24
EGND 1
EGND 7
33-36
29-32
37-40
OUT53 12
R-E-IN 1
outside control switch
OUT8 2
SCH1 19
work status 1
OUT41 3
SCH2 20
work status 2
OUT47 4
SCH4 21
work status 4
OUT39 5
SCH8 22
work status 8
OUT37 6
SCH16 23
work status 16
OUT51 8
LD 6
Red led indication
OUT43 9
M-SH-IN 7
Main shutter
OUT9 10
START 2
switch on the light
OUT50 11
SH1 8
shutter 1
customization
OUT36 17
OUT49 18
OUT48 19
10KΩ
23-26
37
DB37 output interface
4.7KΩ
IN60 20
TROUBLE 4
trouble alarm
IN56 21
READY 2
laser ready
IN68 22
IN66 23
customiztion

→ Wiring Notes

- ✧ Above is the example of UW-075, also, you can refer this to customize the specific pin to be connected.
- ✧ Please use the cable with shield, and shield layer should be connected to the ground fully (chassis).

The YAG laser uses the EXIO extended IO interface and matches with (connects to) the YAG adapter board to control. The laser control reference steps are as follows:

1. Laser type setting: call the command EXIO_DIR(0, $FCBFE) to set the EXIO laser type to YAG type.

2. Laser work state setting: call the command MOVE_OP to operate OUT53 and set laser to external control mode. Call the command MOVE_OP to operate SCH-1-SCH-16's corresponding output to select work state mode.

3. Turn on the laser: call the command MOVE_OP to operate OUT53 and set laser to external control mode, and call the command MOVE_OP to operate OUT43 to turn on the main shutter and corresponding branch shutter OUT, call MOVE_OP to operate OUT9 to control output the light.

Note: for terminal control, please refer to laser manual description.

Chapter VII Expansion Module

The controller can expand digital IO, analog IO, pulse axis and other resources through CAN bus or EtherCAT. For details, please refer to "ZIO Expansion Card Hardware Manual". Also, through EtherCAT bus (EIO series or ZMIO310 series vertical bus expansion modules) expansion of these resources also can be achieved, please refer to each EIO hardware manual for details.

7.1. CAN Bus Expansion

ZIO series expansion modules or ZMIO310-CAN coupler with sub modules can be used.

Connect control card to CAN bus expansion modules, when the eighth bit of the DIP switch of the expansion module is turned to ON, which indicates that a 120 ohm resistor has been connected, but needs to connect one 120 ohm resistor externally. When connecting multiple CAN expansion modules, you only need to dial ON for the eighth digit of the last expansion module, which means please do not dial bit-8 of other modules.

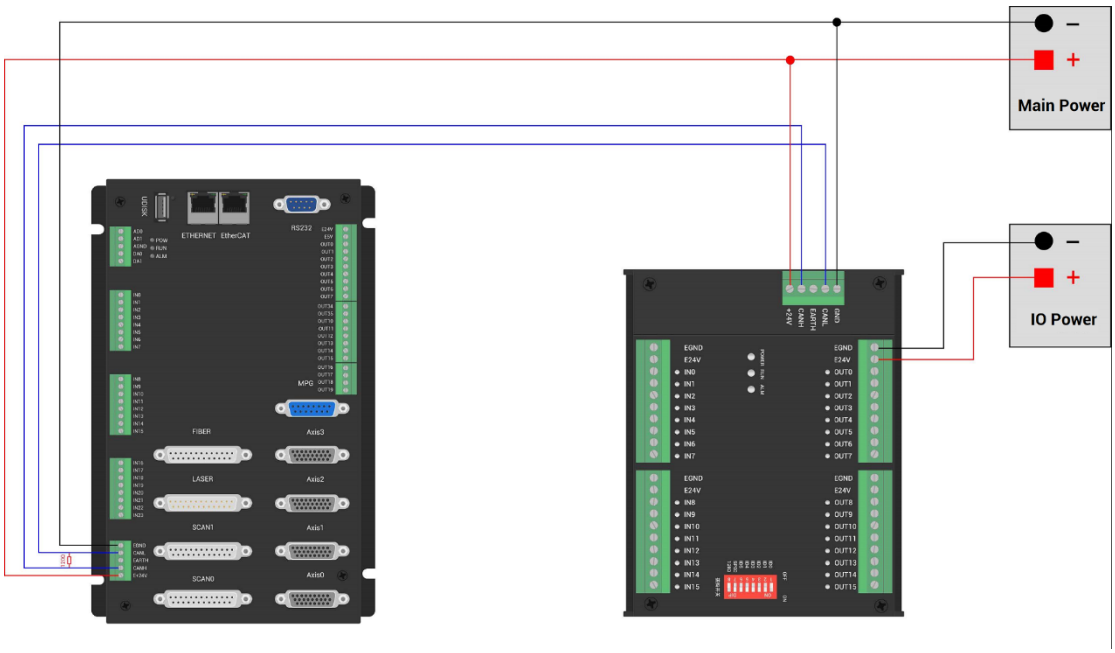
7.1.1. CAN Bus Expansion Wiring

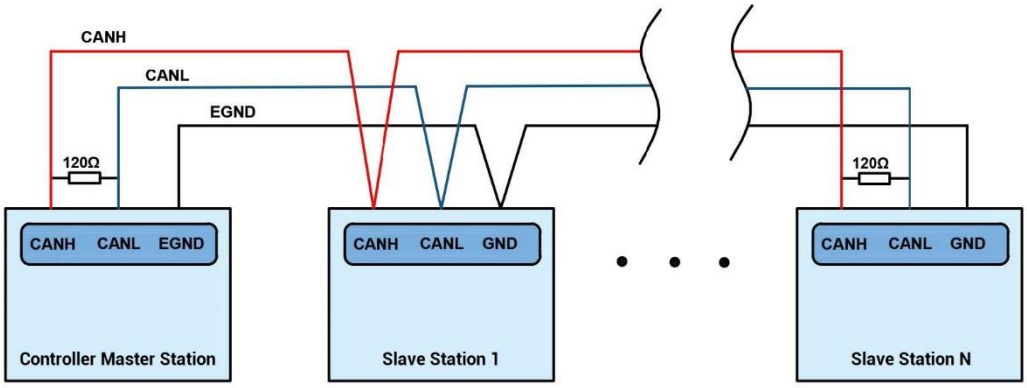
The ZIO expansion module is powered by the dual power supply. Except the main power supply, an additional IO power supply is required to supply independent power for IO. Both the main power supply and the IO power supply use 24V DC power supply. For ZAIO, it only needs to connect to the main power supply.

To prevent interference, separate the IO power supply from the main power supply.

Please select the expansion module according to the requirements, and select IO mapping or axis mapping according to the resources of the expansion module.

Wiring reference of connection between ZIO expansion module and control card and standard wiring of CAN bus are shown as below:





→ Wiring Note:

- ZMC408SCAN controller uses the single power, and ZIO expansion module uses dual-power. When using, main power supply of expansion module and main power supply of controller can share one power. When they use different power supplies, controller power EGND needs to connect to expansion module power GND, otherwise CAN may be burnt out.
- When connecting multiple ZIO expansion modules on the CAN bus, a 120-ohm resistor needs to be connected in parallel between the CANL and CANH terminals, for the ZIO expansion module that is with 8-digit dialing codes, the terminal resistor can be realized by dialing the code (DIP).

7.1.2. CAN Bus Expansion Resource Mapping

The ZCAN expansion module generally has an 8-bit DIP switch, dial ON to take effect, and the meaning of the DIP is as follows:

1-4: they are used for ZCAN expansion module IO address mapping, the corresponding value is 0-15.

5-6: CAN communication speed, corresponding value is 0-3, four different speeds are optional.

7: reserved.

8: 120 ohm resistor, dial ON means a 120 ohm resistor is connected between CANL and CANH.

The IO numbers of the entire control system cannot be repeated, and existed numbers must be avoided when mapping resources. And the DIP switch must be dialed before power-on , if re-dial after power-on, it is invalid. It needs to be powered on again to take effect.

Dial 1-4 to select the CAN address, and the controller sets the IO number range of the corresponding expansion module according to the CAN DIP address. When each is dialed as OFF, the corresponding value is 0, when it is ON , it corresponds to a value of 1, and the address combination value = dial 4 × 8 + dial code 3 × 4 + dial code 2 × 2+ dial code 1.

Dial code 5-6 to select CAN bus communication speed, speed combination value=dial code 6 × 2 + dial code 5×1, the combined value range is 0-3.

The corresponding speeds are as follows:

DIP 5-6 combination value	CANIO_ADDRESS high 8-bit value	CAN communication speed
0	0 (corresponds to decimal 128)	500KBPS (default value)
1	1 (corresponds to decimal 256)	250KBPS
2	2 (corresponding to decimal 512)	125KBPS
3	3 (corresponding to decimal 768)	1MBPS

The controller side sets the CAN communication speed through the CANIO_ADDRESS

command. There are also four speed parameters that can be selected. The communication speed must be consistent with the communication speed of the expansion module that corresponds to the combination value, then they can communicate with each other.

The factory default communication speed is 500 KBPS on both sides, there is no need to set this, unless you need to change the speed.

The CANIO_ADDRESS command is a system parameter, and it can set the master-slave end of CAN communication. The default value of the controller is 32, that is, CANIO_ADDRESS=32 is the master end, and the slave end is set between 0-31.

The CAN communication configuration can be viewed in the "State the Controller" window.

→ IO Mapping:

the CAN expansion module uses bit1-4 of the DIP switch. According to the number of currently included IO points(the largest number in IN and OP must include IO point in the axis interface), use the bit 1-4 to set the ID, so as to determine the number range of IO to be expanded.

If the controller itself contains 28 INs and 16 OPs, then the starting address set by the first extended board should exceed the maximum value of 28. According to below rule, the dial code should be set to the combination value 1 (binary combination value 0001, from right to left, dial code 1-4, at this time dial 1 is set to ON, and the others are set to OFF), the IO number on the expansion board = the expansion board number value + the initial IO number value, among them, the IOs that are vacant from 29-31 Numbers are not used. Subsequent extended boards continue to confirm the dial settings according to the IO points in turn.

The initial digital IO mapping number starts from 16 and increases in multiples of 16. The distribution of digital IO numbers corresponding to different dial IDs is as follows:

DIP 1-4 combination value	Starting IO number	Ending IO number
0	16	31
1	32	47
2	48	63
3	64	79
4	80	95
5	96	111
6	112	127

7	128	143
8	144	159
9	160	175
10	176	191
11	192	207
12	208	223
13	224	239
14	240	255
15	256	271

The initial IO mapping number of the analog AD starts from 8 and increases in multiples of 8. The initial IO mapping number of the analog DA starts from 4 and increases in multiples of 4. The allocation of digital IO numbers corresponding to different dial code IDs is as follows:

DIP 1-4 combination value	Starting AD number	End AD number	Starting DA number	End DA number
0	8	15	4	7
1	16	23	8	11
2	24	31	12	15
3	32	39	16	19
4	40	47	20	23
5	48	55	24	27
6	56	63	28	31
7	64	71	32	35
8	72	79	36	39
9	80	87	40	43
10	88	95	44	47
11	96	103	48	51
12	104	111	52	55
13	112	119	56	59
14	120	127	60	63
15	128	135	64	67

→ Axis Mapping:

When the CAN bus expansion mode is used to expand the pulse axis, ZIO16082M

can be selected to expand two pulse axes. These two pulse axes need to be mapped and bound with the axis No., then access.

Extended axes need to perform axis mapping operations, using the AXIS_ADDRESS command to map, and the mapping rules are as follows:

AXIS_ADDRESS(axis No.)=(32*0)+ID

'the local axis interface of the expansion module AXIS 0

AXIS_ADDRESS(axis No.)=(32*1)+ID

'the local axis interface of the expansion module AXIS 1

The ID is the combined value of the DIP bit1-4 of the expansion module. After the mapping is completed and the axis parameters such as ATYPE are set, the expansion axis can be used.

Example:

```
ATYPE(6)=0                    'set as virtual axis
AXIS_ADDRESS(6)=1+(32*0)
        'ZCAN expansion module ID 1 axis 0 is mapped to axis 6
ATYPE(6)=8      'ZCAN extended axis type, pulse direction stepping or servo
UNITS(6)=100 0 'pulse equivalent 1000
SPEED(6)=100    'speed 100uits/s
ACCEL(6)=1000    'acceleration 1000units/s^2
MOVE(100) AXIS(6) 'extended axis movement 100units
```

Extended resource viewing:

According to the CAN connection, after the power is turned on, and the wiring resistance dial code is set correctly, the power indication led (POWER) and the running indication led (RUN), the IO power indication led (IO POWER) are on, and the alarm indication led (ALM) is off. At the same time, the "Controller" - "State the controller" - "ZCanNodes" in the ZDevelop software displays the expansion module information and the extended IO number range.

The dial ID and the corresponding resource number when connecting multiple expansion modules are as follows:

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

ALMRM indicator light is on, please check whether the wiring, resistor and dial setting are correct, and whether the CANIO_ADDRESS command of the controller is set as the master end (32), and whether the CAN communication speed is consistent.

7.2. EtherCAT Bus Expansion

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.

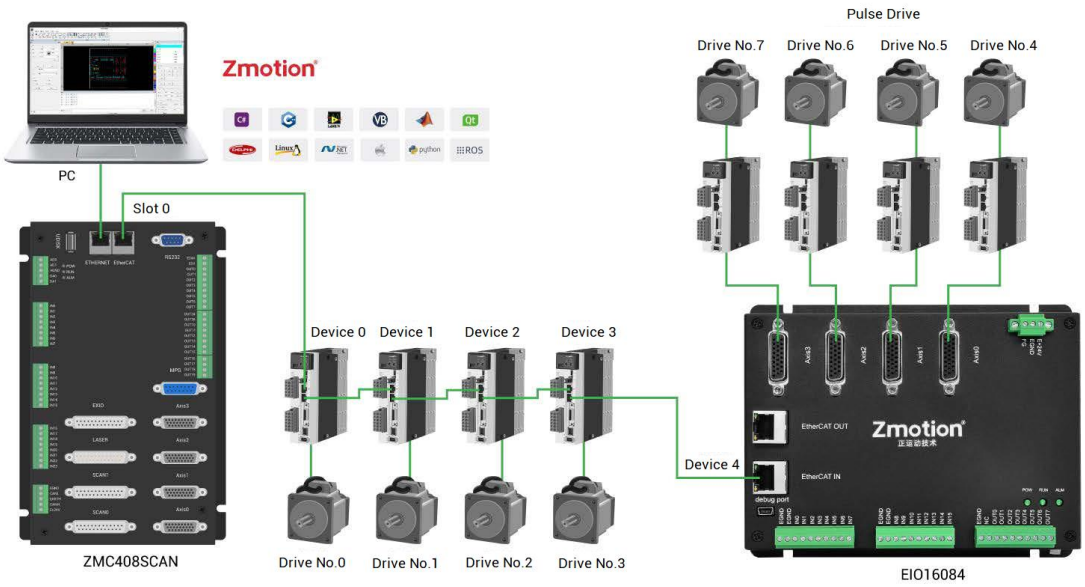
7.2.1. EtherCAT Bus Expansion Wiring

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.

EIO expansion module wiring reference example (take ZMC408SCAN as an 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.

7.2.2. EtherCAT Bus Expansion Resource Mapping

→ IO Mapping:

The program on the controller can access the resources on the expansion module

only through the IO 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

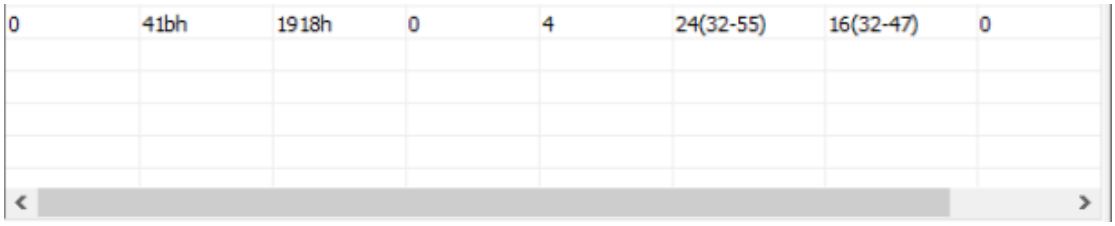
node: device number, starting from 0

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, the general input port numbers in the axis interface are 48-55, and the drive alarm inputs of axes AXIS 0-3 are 48-51 respectively. The IO numbers corresponding to the output OUT0-7 are 32-39 in sequence, the general output port numbers in the axis interface are 40-47, and the drive enable outputs of the axes AXIS 0-3 are 40-43 respectively.



→ 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

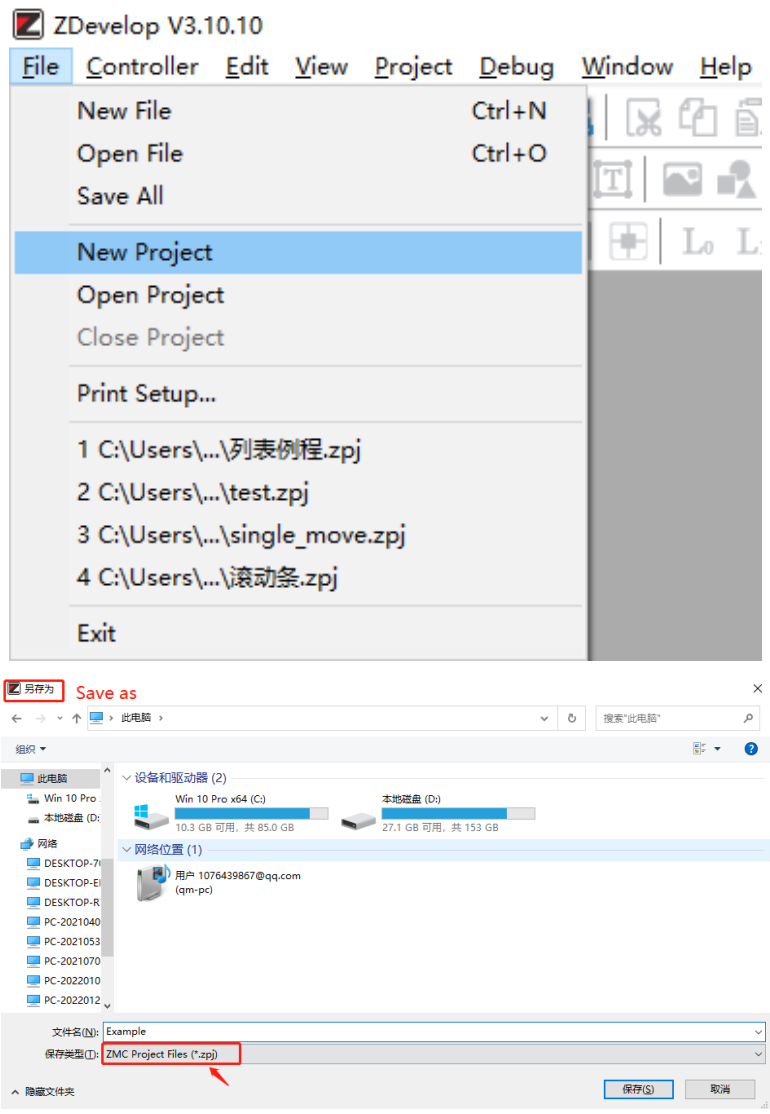
If the first node is EIO16084, and EIO16084 is connected to drive, then driver 0 here is the first pulse driver connected to EIO16084, otherwise it is the EtherCAT driver.

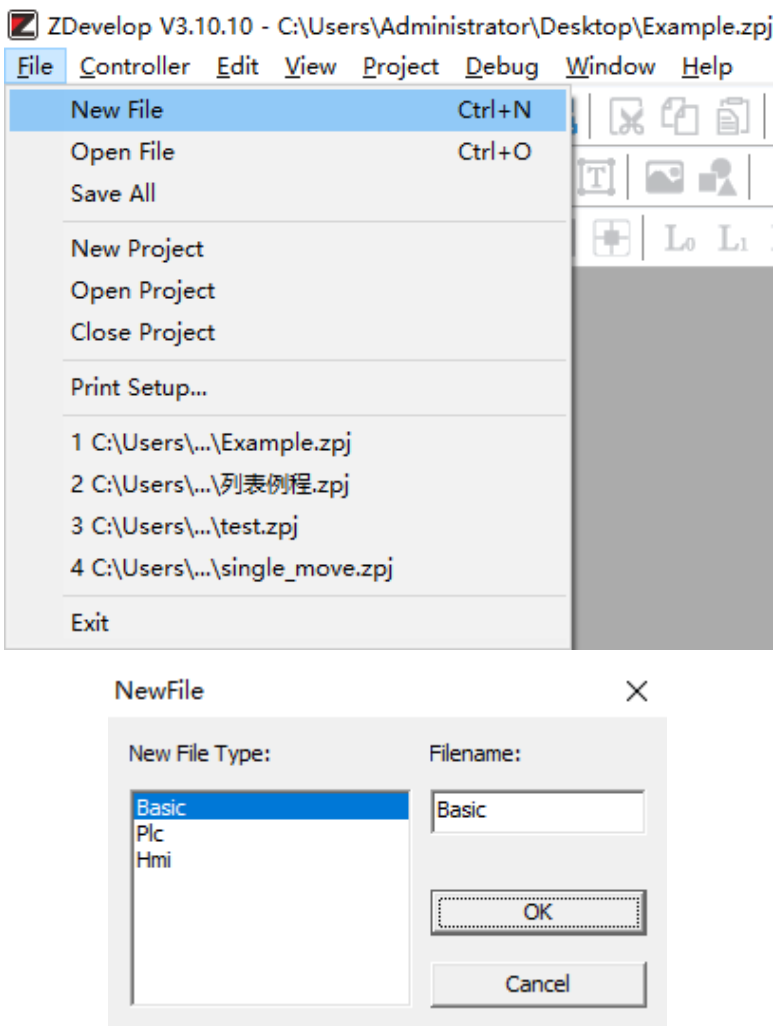
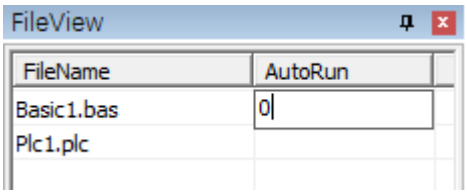
Chapter VIII Program & Applications

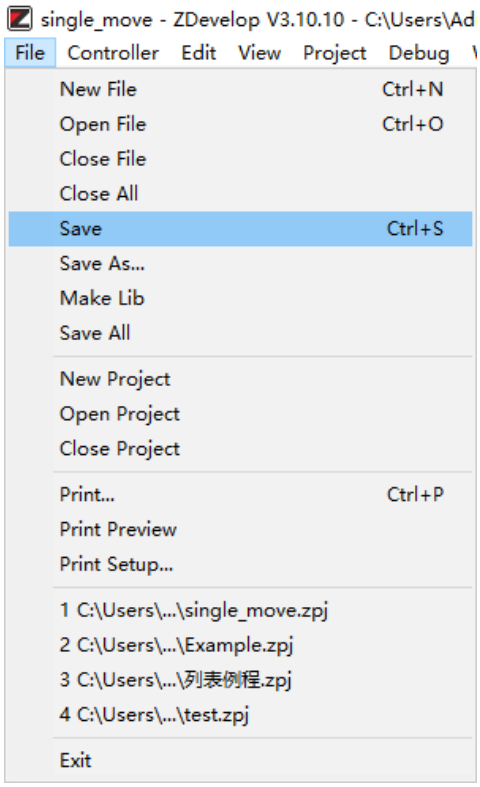
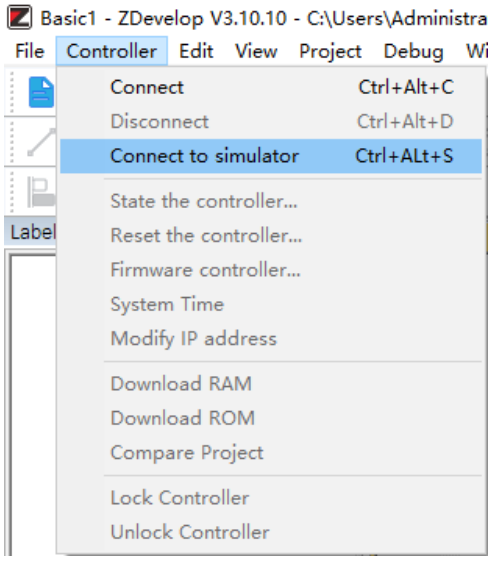
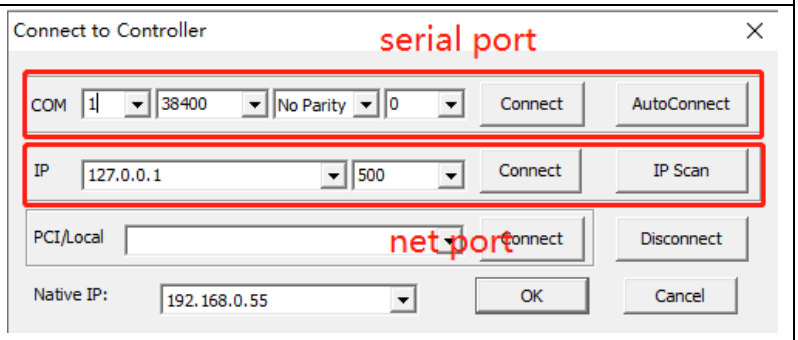
8.1. ZDevelop Software Usage

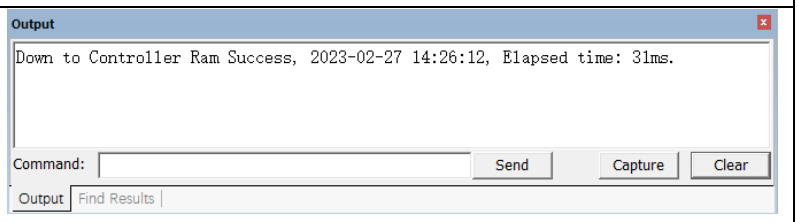
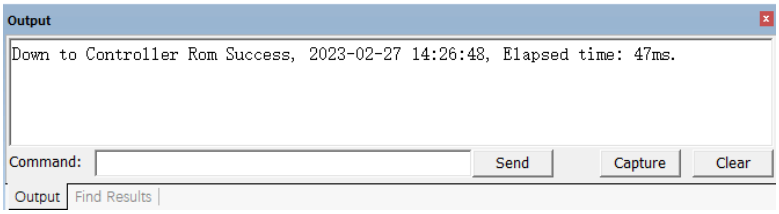
ZDevelop is a PC-side program development, debugging and diagnostic software for the ZMoiton series motion controllers of Zmotion Technology. Through it, users can easily edit and configure the controller program, quickly develop applications, diagnose system operating parameters in real time, and watch the motion controller. The running program is debugged in real time and supports Chinese and English bilingual environments.

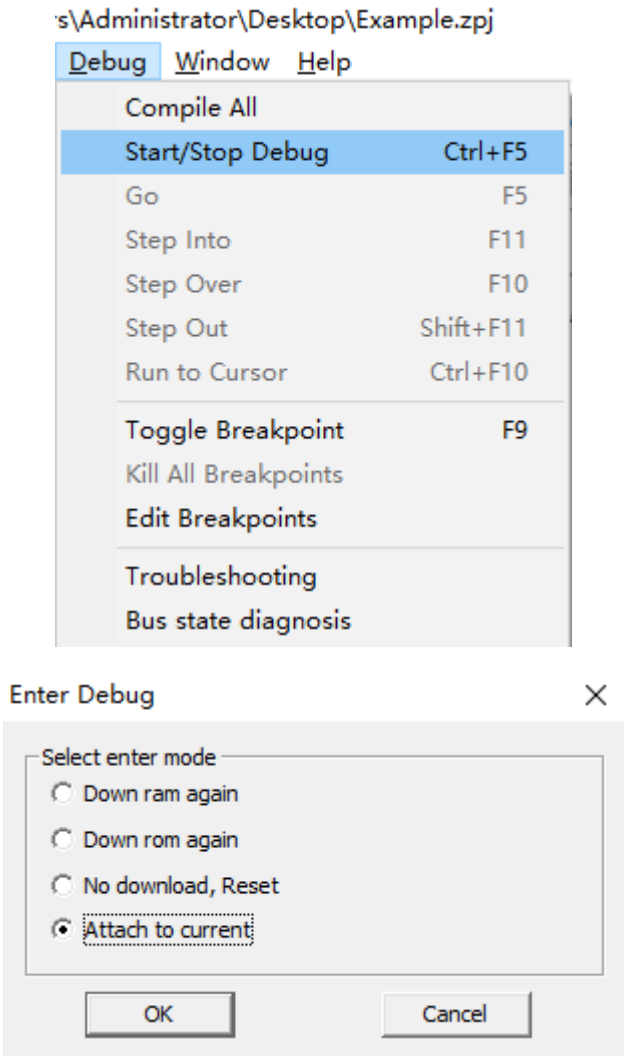
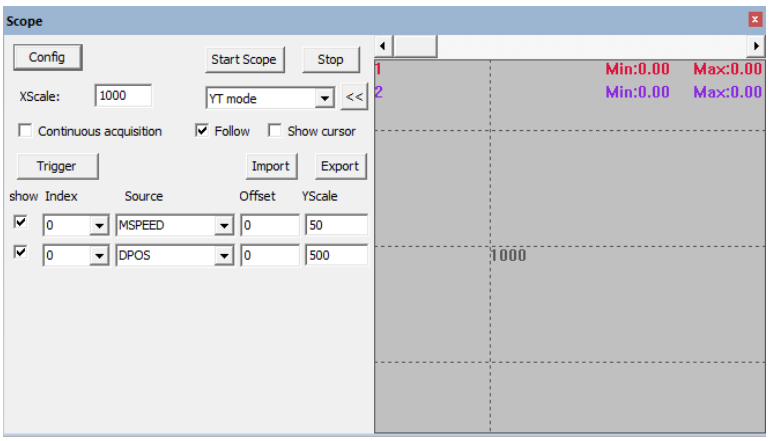
ZBasic, ZPLC and ZHMI can run multi-tasks, and ZBasic can run multi-tasks, and can be mixed with ZPLC and ZHMI.

Step	Operations	Display Interface
1	Open ZDevelop, click "File" – "New Project", Save as window will pop up, then enter file name, save the project file with suffix "zpj.".	

2	Click “File” – “New File”, select file type to build, here select Basic, click “OK”.	
3	Double click “AutoRun”, enter task number 0.	

4	Edit the program in program editing window, click "save", new built basic file will be saved under "zpj." project automatically. "Save all" means all files under this project will be saved.	
5	Click "controller – connect", if no controller, select connect to simulator.	
	Then, "connect to controller" window will pop up, you can select serial port or net port to connect, select matched serial port	

	parameters or net port IP address, then click “connect”.	
6	Click “Ram/Rom” – “download RAM / download ROM”, if it is successful, there is print indication, at the same time, program is downloaded into controller and runs automatically. RAM: it will not save when power off. ROM: it will save data when power off, and when the program is connected to controller again, running according to task number.	 

7	Click “Debug” – “Start/Stop Debug” to call “Task” and “Watch” window, because it was downloaded before, here select “Attach the current”.	
8	Click “View” – “Scope” to open oscilloscope.	

Note:

- When opening an project, choose to open the zpj file of the project. If only the Bas file is opened, the program cannot be downloaded to the controller.
- When the project is not created, only the Bas file cannot be downloaded to the controller.
- The number 0 in automatic operation represents the task number, and the program

runs with task 0, and the task number has no priority.

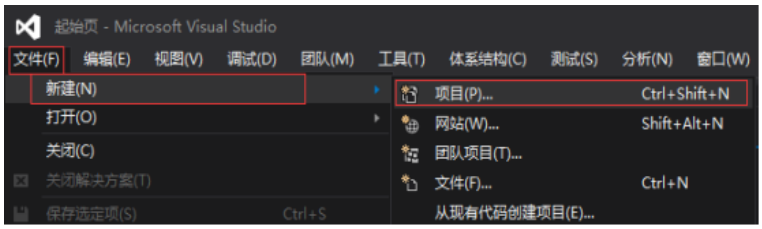
- If no task number is set for the files in the entire project, when downloading to the controller, the system prompts the following message WARN: no program set autorun

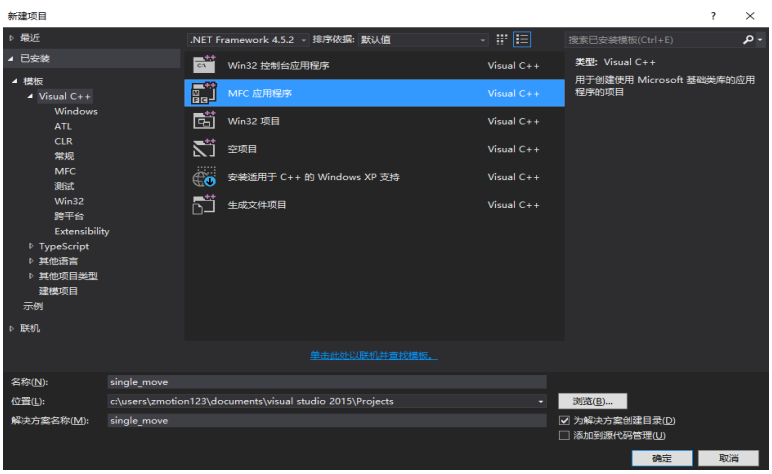
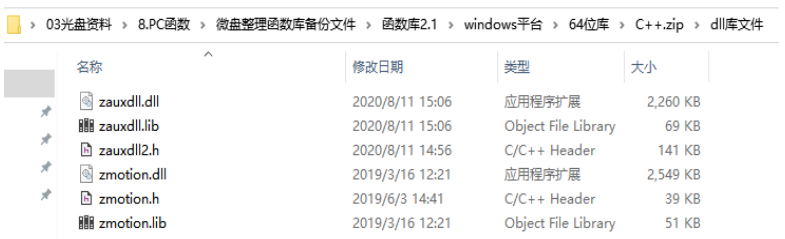
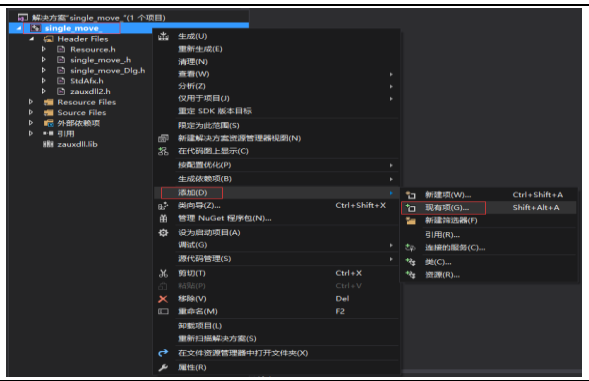
8.2. PC Upper-Computer Program Application

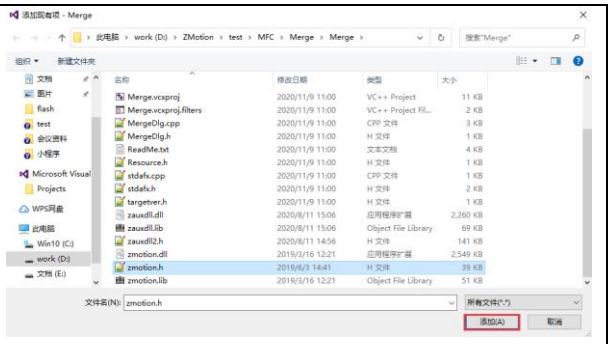
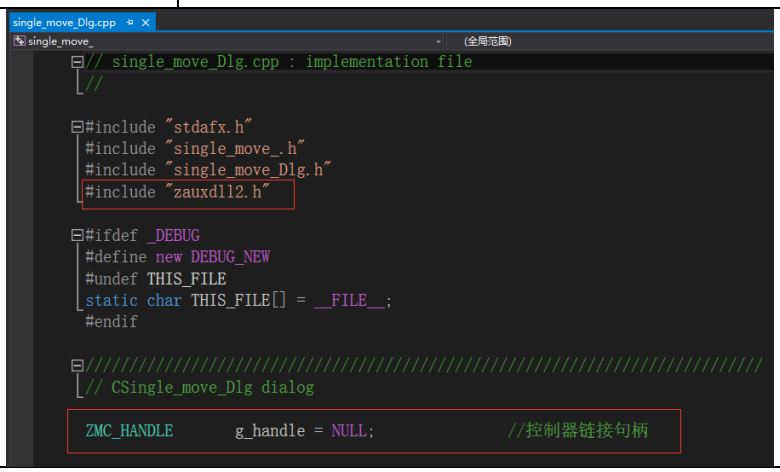
The controller supports development under various operating systems such as windows, linux, Mac, Android, and wince, and provides dll libraries in various environments such as vc, c#, vb.net, and labview, as shown in the figure below. PC software programming refers to "ZMotion PC Function Library Programming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

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

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

Step	Operations	Display Interface
1	Open VS, click “File” – “New” – “Project”.	

2	Select development language as “Visual C++” and the select program type as “MFC application type”.	
3	Select “Based on basic box”, click “next” or “finish”	
4	Find C++ function library provided by manufacturer. Routine is below (64-bit library)	
5	Copy all DLL related library files under the above path to the newly created project.	
6	Add a static library and related header files to the project. Static library: zauxdll.lib,	1) Right-click the header file first, and then select: "Add" → "Existing Item". 

	zmotion.lib Related header files: zauxdll2.h, zmotion.h	2) Add static libraries and related header files in sequence in the pop-up window.	
7	Declare the relevant header files and define the controller connection handle, so far the project is newly created.		

```
single_move_Dlg.cpp
single_move_                                   (全局范围)
// single_move_Dlg.cpp : implementation file
//

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

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

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

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

Chapter VIIII Run and Maintain

The correct operation and maintenance of the motion controller 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.

9.1. 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 (-10%~10%)
surroundings	Whether the ambient temperature is within the specified range (when installed in the cabinet, the temperature inside the cabinet is the ambient temperature)	-10°C - 55°C
	Whether the ambient humidity is within the specified range (when installed in the cabinet, the humidity in the cabinet is the ambient humidity)	10 %-95% non-condensing
	Is there direct sunlight	No
	With or without droplets of water, oil, chemicals, etc.	No
	Whether there is dust, salt, iron filings, dirt	No
	Whether there is corrosive gas	No
	Whether there are flammable and 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

9.2. 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 motor is enabled successfully. 4. Confirm whether pulse amount UNITS and speed values are suitable. If there is the encoder feedback, check whether MPOS changes. 5. Check whether pulse mode and pulse mode of drive are matched. 6. Check whether alarm is produced on motion controller station or drive station. 7. Check whether the wiring is correct. 8. Confirm whether controller sends pulses normally.
The position limit signal is	1. Check whether the limit sensor is working normally,

invalid.	and whether the "input" view can watch the signal change of the limit sensor. 2. Check whether the mapping of the limit switch is correct. 3. Check whether the limit sensor is connected to the common terminal of the controller.
No signal comes to the input.	1. Check whether the limit sensor is working normally, and whether the "input" view can watch the signal change of the limit sensor. 2. Check whether the mapping of the limit switch is correct. 3. Check whether the limit sensor is connected to the common terminal of the controller.
The output does not work.	1. Check whether IO power is needed. 2. Check whether the output number matches the ID of the IO board.
POWER led is ON, RUN led is OFF.	1. Check whether the power of the power supply is sufficient. At this time, it is best to supply power to the controller alone, and restart the controller after adjustment. 2. Check whether the ALM light flickers regularly (hardware problem).
RUN led is ON, ALM led is ON.	1. Program running error, please check ZDevelop error code, and check application program.
Fail to connect controller to PC through serial port.	1. Check whether the serial port parameters are modified by the running program, you can check all the current serial port configurations through ?*SETCOM. 2. Check whether the serial port parameters of the PC match the controller. 3. Open the device manager and check whether the serial driver of the PC is normal.
CAN expansion module cannot be connected.	1. Check the CAN wiring and power supply circuit, whether the 120 ohm resistor is installed at both ends.

	2. Check the master-slave configuration, communication speed configuration, etc. 3. Check the DIP switch to see if there are multiple expansion modules with the same ID. 4. Use twisted-pair cables, ground the shielding layer, and use dual power supplies for severe interference (the main power supply of the expansion module and the IO power supply are separately powered)
Fail to connect controller to PC through net port.	1. Check IP address of PC, it needs to be at the same segment with controller IP address. 2. Check controller IP address, it can be checked and captured after connection through serial port. 3. When net port led is off, please check wiring. 4. Check whether controller power led POWER and running indicator led RUN are ON normally. 5. Check whether the cable is good quality, change one better cable to try again. 6. Check whether controller IP conflicts with other devices. 7. Check whether controller net port channel ETH are all occupied by other devices, disconnect to other devices, then try again. 8. When there are multiple net cards, don't use other net cards, or change one computer to connect again. 9. Check PC firewall setting. 10. Use “Packet Internet Groper” tool (Ping), check whether controller can be Ping, if it can't, please check physical interface or net cable. 11. Check IP address and MAC address through arp-a.