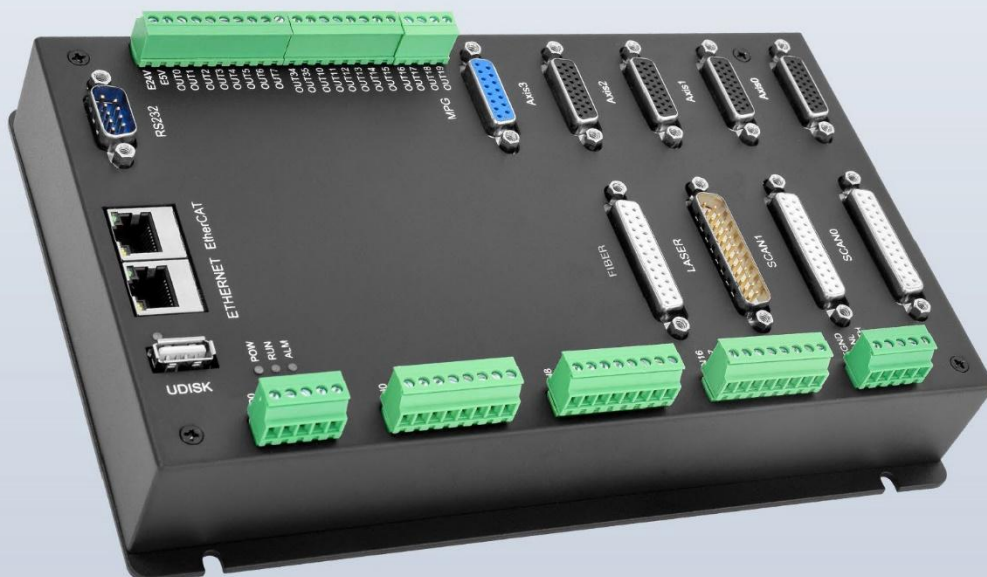
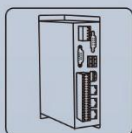


EtherCAT Laser Galvanometer Motion Controller

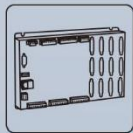
ZMC408SCAN-V22



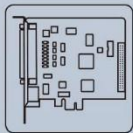
This manual is mainly for ZMC408SCAN-V22, ZMC408SCAN-V22-IFOV.



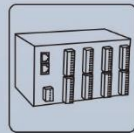
Vision Motion
Controller



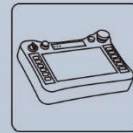
Motion
Controller



Motion
Control Card



IO Expansion
Module



HMI

Statement

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

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➤ Notes

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

■ Danger

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

■ Notes

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

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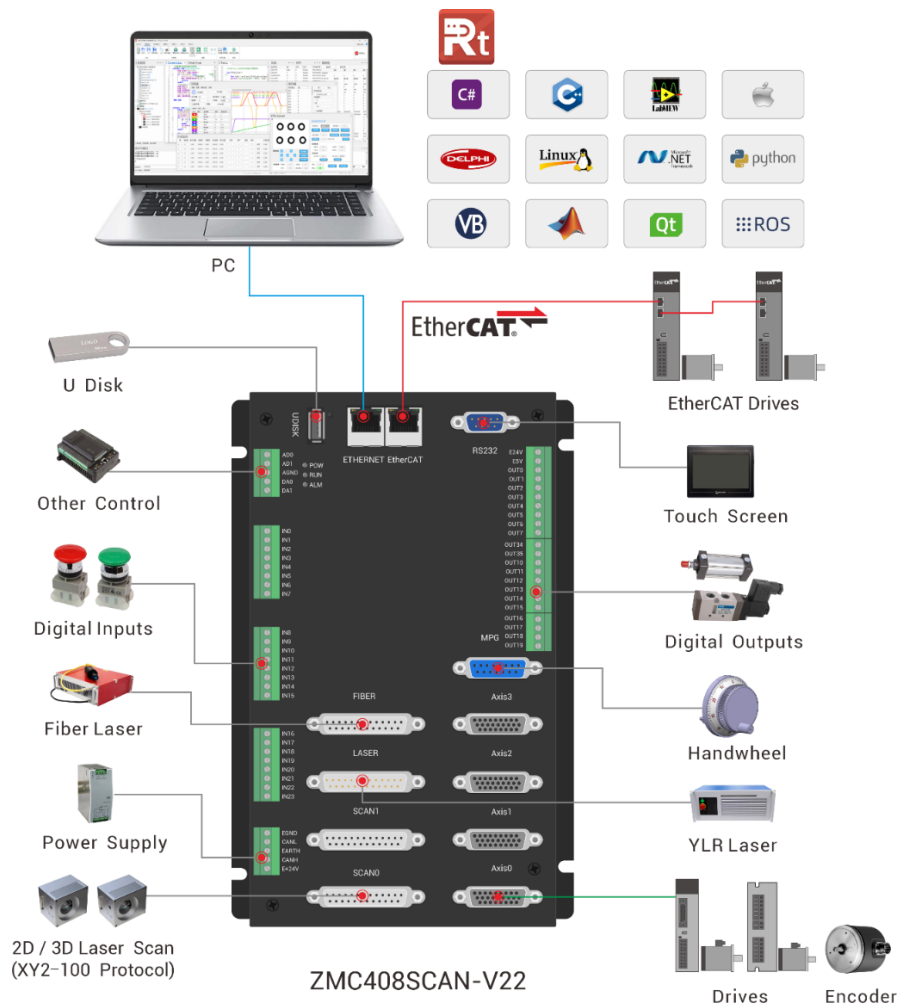
Chapter I Production Information

1.1. Product Introduction

ZMC408SCAN-V22 belongs to high-performance EtherCAT motion controller that supports dual-galvo. **It supports motion control, laser control, galvo control, I/O control.** There are EtherCAT, ETHERNET, CAN, RS232, RS485, 24 DI, 20 DO, 2 AD, 2DA, 4 differential pulse axes, 1 MPG, 2 SCAN interfaces (with feedback), 1 LASER, and 1 FIBER.

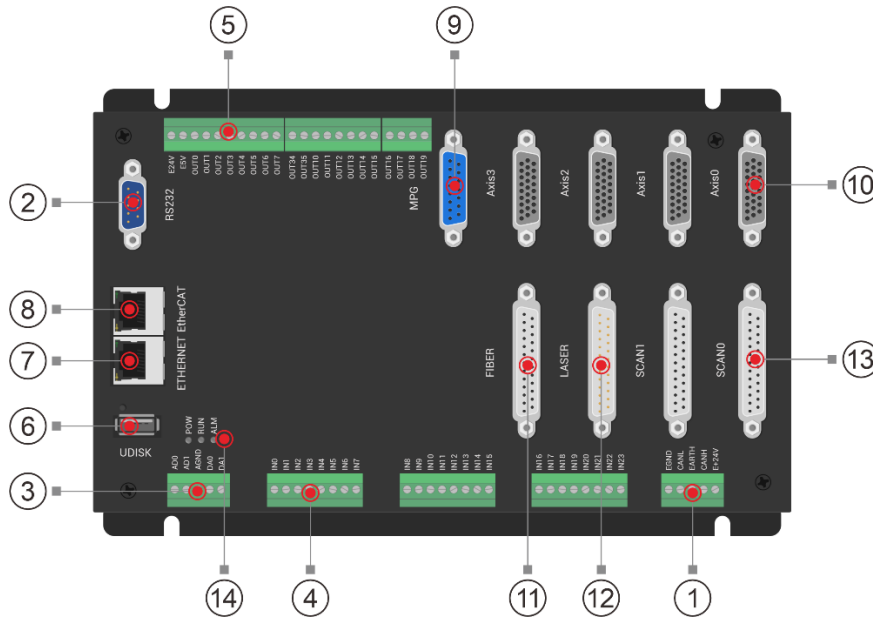
The EtherCAT refresh cycle is up to 500 μ s. And it supports maximum 16-axis motion control. Supported motion control functions include linear interpolation, any circular interpolation, space arc, helical interpolation, electronic cam, electronic gear, synchronous follow, virtual axis setting, etc. In addition, real-time motion control can be achieved through optimized network communication protocol.

256 ZMC motion controllers can be connected to one PC at the same time.



- ✚ Motion control of up to 16 axes. (EtherCAT axis/pulse axis/encoder axis/virtual axis)
- ✚ 4 AXIS interfaces support encoder position measurement, which can be configured as handwheel input mode.
- ✚ There is 1 MPG handwheel encoder interface that supports 5-24V handwheel input.
- ✚ There are 24 NPN digital inputs, among them, 4 channels are high-speed inputs, 20 channels are low-speed inputs. What's more, these 4 high-speed inputs can be configured as latch signals.
- ✚ There are 20 NPN digital outputs, among them, 4 are high-speed outputs, which can be configured as high-speed comparison, and PWM function, other 16 outputs are low-speed digital outputs, the max output current can reach 300mA, which can drive some solenoid valves directly.
- ✚ 1 100M EtherCAT interface, 4096 isolated inputs and 4096 isolated outputs can be expanded at most through EtherCAT protocol.
- ✚ 1 USB interface is used to extend a large-size memory.
- ✚ 1 RS485, 1 RS232, 1 CAN, 1 100M ETHERNET.
- ✚ 2 AD & 2 DA (12-bit, 0-10V)
- ✚ 2 SCAN galvanometer interfaces support XY2-100 protocol, and supports galvanometer feedback.
- ✚ 1 "LASER" laser interface: IPG, YLR, YLS, etc.
- ✚ There is 1 "FIBER" laser interface.
- ✚ Support up to 16 axes for 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, pitch compensation.
- ✚ Support multi-file and multi-task programming in RTBasic.
- ✚ A variety of procedure encryption methods to protect the intellectual property rights.
- ✚ Support power failure detection and power failure storage.

1.2. Interface Introduction



No.	Interfaces	Descriptions
①	Power	connect to 24V DC power supply
	CAN	connect to CAN modules to expand more resources;
②	RS232 / RS485	- connect to upper computer; - MODBUS_RTU.
③	AD/DA	- single-ended type; 12-bit, 0-10V.
④	DI	- NPN type, 24V inner power; - IN0-23; - IN0~IN3 are high-speed inputs, and they can be set as latch signals.
⑤	DO	- NPN type, 24V inner power; - OUT0-19; - OUT0~OUT3 are high-speed outputs, and they can be used to do PWM, HW (PSO).
⑥	UDISK	connect to USB external devices for program upgrading, data importing & exporting.
⑦	EtherNET	- connect to upper device (PC, etc.); - MODBUS_TCP protocol; - it can be extended by one industrial switch.

⑧	EtherCAT	- connect to EtherCAT drive; - or connect to EtherCAT expansion modules.
⑨	MPG	5-24V handwheel signal IN
⑩	AXIS (differential)	connect to servo drives, including directional / pulse, encoder, specialized I/O.
⑪	FIBER	control FIBER lasers.
⑫	LASER	control IPG, YLR, YLS lasers.
⑬	SCAN	- laser galvanometer interface that is with feedback; - XY2-100 protocol.
⑭	Controller Status Led	POW Led: ON when power is connected.
		RUN Led: ON when it runs normally.
		ALM Led: ON when it runs abnormally.

1.3. Production Specifications

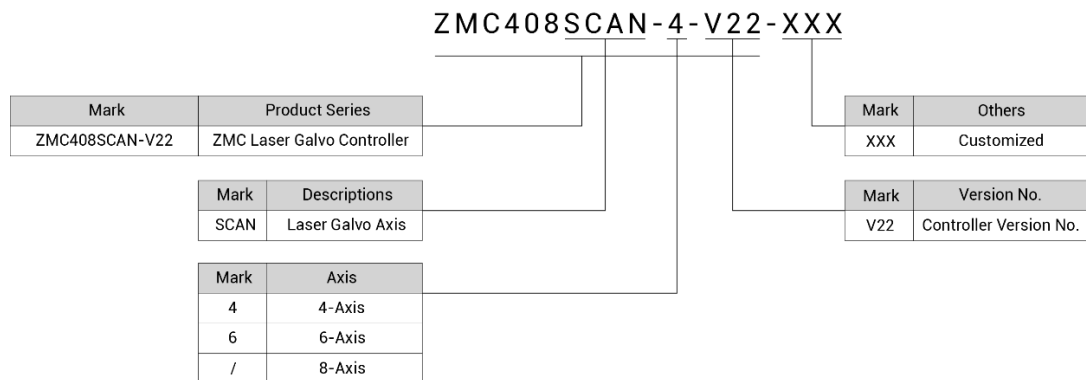
ZMC408SCAN-V22	
Base Descriptions	
Motor Axes	8 (4 differential pulse axes + 4 galvanometer axes)
Max Extended Axes	16 (motor axes + virtual axes)
Program Space	128MBYTE
Axis Motion Buffer	4096 (related to the system period)
Dimensions (mm)	235*149*50.5
Axis Type	
EtherCAT Axis	√; 1 EtherCAT bus axis
AXIS Differential Pulse Axes	4 (directional / pulse + encoder + Digital I/O)
SCAN (Galvo) Axes	2
LASER	1
FIBER	1
MPG	1
Single-Ended Pulse in DO	2 (directional / pulse)
DI & DO	
DI	24 (general) + 8 (specialized DI for AXIS) + 6 (LASER) + 3 (FIBER)
DO	20 (general) + 8 (specialized DO for AXIS) + 8 (LASER) + 14 (FIBER)

Max Extended DI	≤4096
Max Extended DO	≤4096
AD & DA	
AD	2 (normal) + 1 (special model); 0-10V, 12-bit
DA	2 (normal) + 1 (special model); 0-10V, 12-bit
Max Extended AD	≤1024
Max Extended DA	≤1024
Communication Interfaces	
EtherNET	1
EtherCAT	1
CAN	1
RS232	1
RS485	1
U Disk	1
Basic Motion Control Functions	
Point & Jog	√
Electronic Cam	
Linear Interpolation	
Circular Interpolation	
Continuous Interpolation	
Normal Robot Algorithm	
Power-Down Storage	
Advanced Motion Control Functions	
High-Speed Latch	4
Hard Comparison Output HW	4
General PWM	4 (normal) + 2 (LASER: OUT8 & OUT9) + 2 (FIBER: OUT44 & OUT45)

1.4. Nameplate & Model

Model	Description
ZMC408SCAN-V22	8 axes: 4 pulse axes + 4 scan axes Motion control functions: point motion (jog), electronic cam, linear,

	circular, continuous interpolation, robot algorithm
ZMC408SCAN-4-V22	4 axes: 2 pulse axes + 2 scan axes Motion control functions: point motion (jog), electronic cam, linear, circular, continuous interpolation, robot algorithm



1.5. Environment Requirements

Item		Parameters
Work Temperature ^[1]		-10°C-55°C
Work relative Humidity		10%-95% non-condensing
Storage Temperature		-40°C ~ 80°C (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

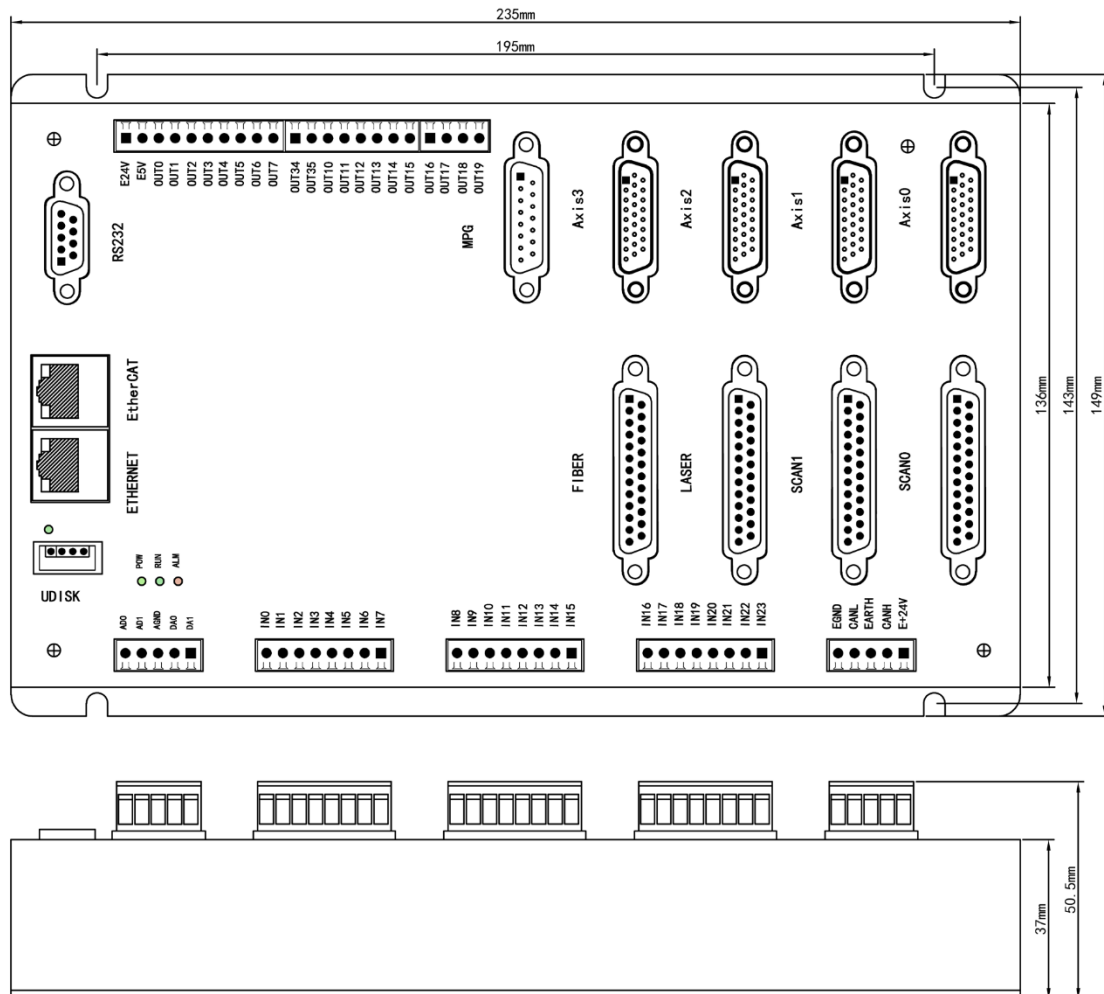
Note [1]: if the environment temperature is too high or too low, please operate fan cooling (fan) or heat Preservation, to ensure controller can work normally and stably.

1.6. Hardware Installment

The ZMC408SCAN-V22 motion controller adopts the horizontal installation method of screw fixing, and each controller should be installed with 4 screws for fastening.

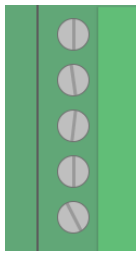
→ Unit: mm

→ Installment Hole Diameter: 4.5mm



Chapter II Hardware Interfaces

2.1. Power IN / CAN

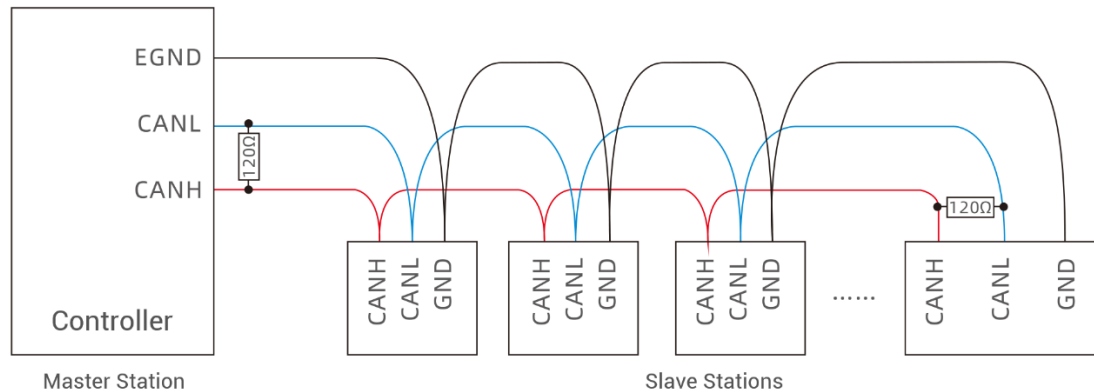
Terminal	Name	Function
 EGND CANL EARTH CANH CANH E+24V	EGND	Power IN - / CAN public end
	CANL	CAN Communication L
	EARTH	Protective Earth (PE): Connect to chassis, earth ground and shield.
	CANH	CAN Communication H
	CANH	CAN Communication H
	E+24V	Power IN +

Specification

Power	Description
IN Voltage	DC24V±5%
Max. Power	10W
Anti-Reverse Connection	√
Overcurrent Protection	√
Isolation Power	√
Cable Type	Recommend "1.0 mm ² copper conductor cable"

CAN	Description
Communication Rate	≤1Mbps
Terminal Resistor	120Ω
Topology	Daisy Chain Connection Structure
Nodes can be extended	Up to 16
Wiring Distance	<30m (500kbps)
Communication Isolation	√

Wiring



Notes:

- As above, the daisy chain topology is used (the star topology structure cannot be used). The shorter distance between nodes, the better.
- 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 communication node to prevent CAN chips from burning out.
- Please use STP (Shielded Twisted Pair), especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

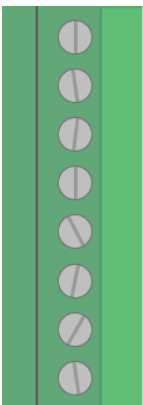
Usage Method

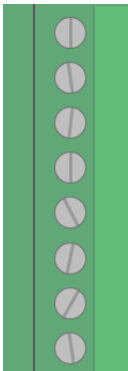
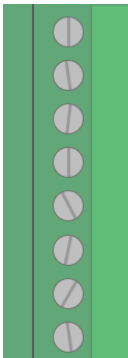
- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.

(2) How to use CAN:

- 1) Set controller as CAN master station:
 - a) Use "**CANIO_ADDRESS**" to set master station "address" and "velocity".
 - b) Use "**CANIO_ENABLE**" to enable / disable CAN master station function.
 - c) In "*RTSys>Controller>Controller Status>Communication Config*" interface, you can check communication parameters.
 - d) In "*RTSys>Controller>Controller Status>ZCanNodes*" interface, you can check bus nodes parameters.
 - 2) Correctly set the "address" and "velocity" of the slave station CAN expansion module for completing resources mapping, you can refer to ["3.1 CAN Expansion"](#).
 - 3) After configured, repower on all slave stations to build normal communication, if the slave module "ALM" led is ON, which means the communication fails.
 - 4) Note that the "velocity" settings of each node on the CAN bus must be consistent, and the "address" settings cannot cause conflicts, otherwise the communication establishment will fail or the communication will be disordered.
- (3) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

2.2. DI: Digital Inputs

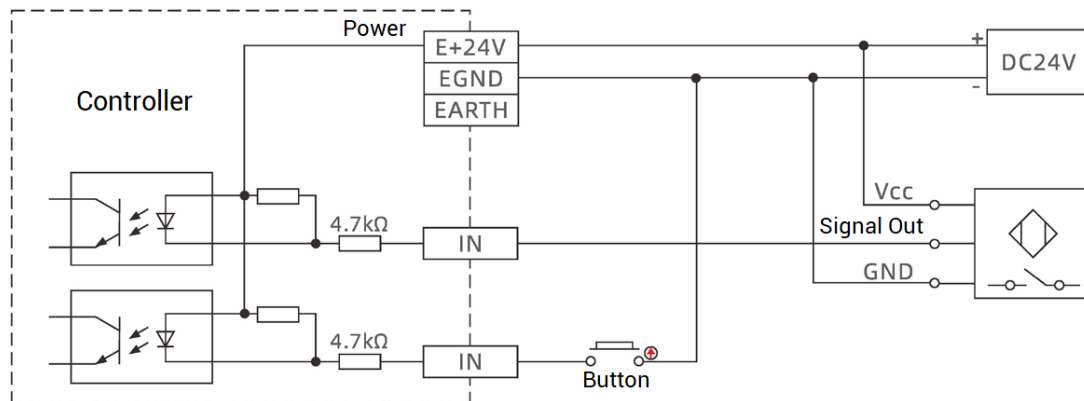
Terminal	Name	Type	Function 1	Function 2
 IN0	IN0	NPN type, high-speed input	Input 0	High Speed Latch
	IN1		Input 1	
	IN2		Input 2	
	IN3		Input 3	
IN4	IN4	NPN type, low-speed input	Input 4	/
IN5	IN5		Input 5	/
IN6	IN6		Input 6	/
IN7	IN7		Input 7	/

	IN8	NPN 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 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	/
Functions can't be reused (please choose one function).				

Specification

Item	High-Speed Input (IN0-3)	Low-Speed Input (IN4-23)
Input mode	NPN type, the input is triggered when there is low 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	1.8mA
Max current	7.5mA	6mA
Isolation mode	optoelectronic isolation	optoelectronic isolation

Wiring



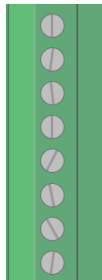
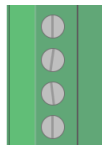
Notes:

- The wiring for the digital input is as shown in the diagram above. The external load can be a button switch, sensor, etc., but it is important to ensure that the signal specifications match.
- It is recommended to use the same power supply for both the load and the controller, otherwise, the negative terminals of two power supplies should be connected.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

Usage Method

- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.
- (2) IN states can be read directly through "IN", also, it can be read in *"RTSys / Tool / IN"*.
- (3) Latch function can be set and triggered by **"REGIST"**, **"REG_POS"**, **"REG_INPUTS"**.
- (4) Axis limit signals / origin signals can be set by **"FWD_IN"**, **"REV_IN"**, **"DATUM_IN"**.
- (5) For above and other commands, please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

2.3. DO: Digital Outputs

Terminal	Name	Type	Function 1	2	3	4
E24V E5V OUT0 OUT1 OUT2 OUT3 OUT4 OUT5 OUT6 OUT7 	E24V	/	Freewheeling Clamp Port	/	/	/
	E5V	/	5V power output, max is 300mA	/	/	/
	OUT0	NPN, high-speed	Output 0	PWM 0	HW: Hardware Comparison Output	PUL6
	OUT1		Output 1	PWM 1		DIR6
	OUT2		Output 2	PWM 2		PUL7
	OUT3		Output 3	PWM 3		DIR7
	OUT4	NPN type, low-speed output	Output 4	/	/	/
	OUT5		Output 5	/	/	/
	OUT6		Output 6	/	/	/
	OUT7		Output 7	/	/	/
OUT34 OUT35 OUT10 OUT11 OUT12 OUT13 OUT14 OUT15 	OUT34	NPN 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 OUT17 OUT18 OUT19 	OUT16	NPN type, low-speed output	Output 16	/	/	/
	OUT17		Output 17	/	/	/
	OUT18		Output 18	/	/	/
	OUT19		Output 19	/	/	/

Notes:

- ✧ E24V is the freewheeling clamp port. When inductive loads are connected to output channels, connect this port to the positive terminal of the load power supply to enable the freewheeling function for all digital output channels and 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.
- ✧ OUT8-9 supports high-speed precision output and is assigned to the laser power interface.

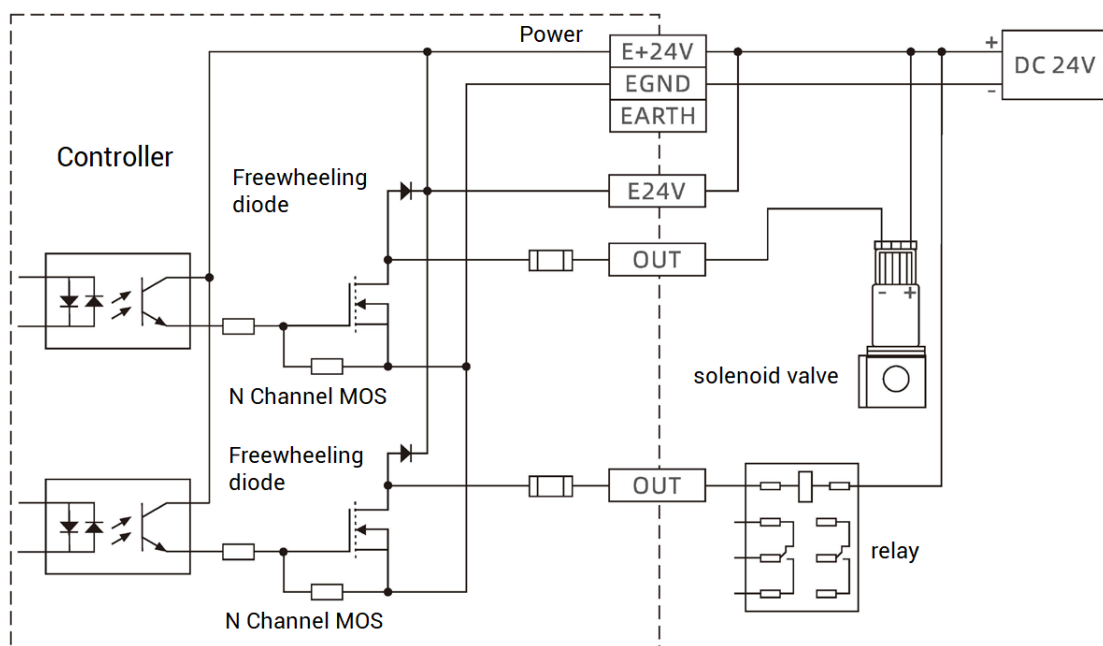
- ✧ OUT0-3 support single-ended pulse-axis (axis 6 & axis 7), and **it must use AXIS_ADDRESS command to map, then configure ATYPE (ATYPE=1)**. When ATYPE = 0, they are general outputs.
- ✧ Functions can't be reused (please choose one function).

Specification

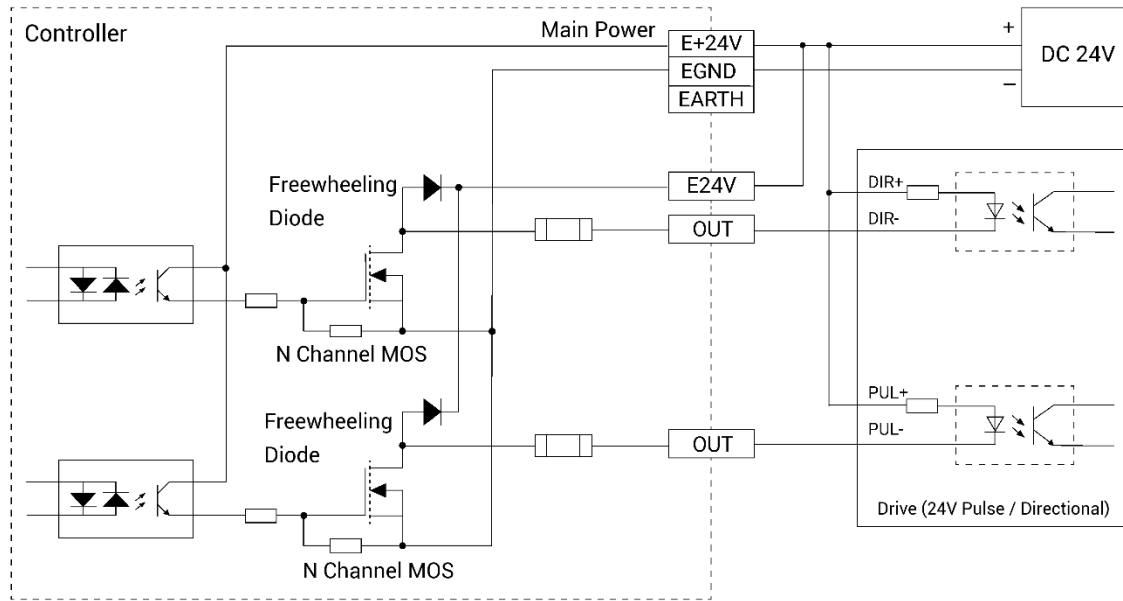
Item	High-Speed (OUT0-3)	Low-Speed (OUT4-7, 10-19, 34, 35)
Output mode	NPN type	
Frequency	<400kHz	<8kHz
Load Voltage	$\leq 30V$	$\leq 30V$
Output Current	+300mA/point	+300mA/point
Overcurrent Protection	✓	✓
Isolation Method	optoelectronic isolation	

Wiring

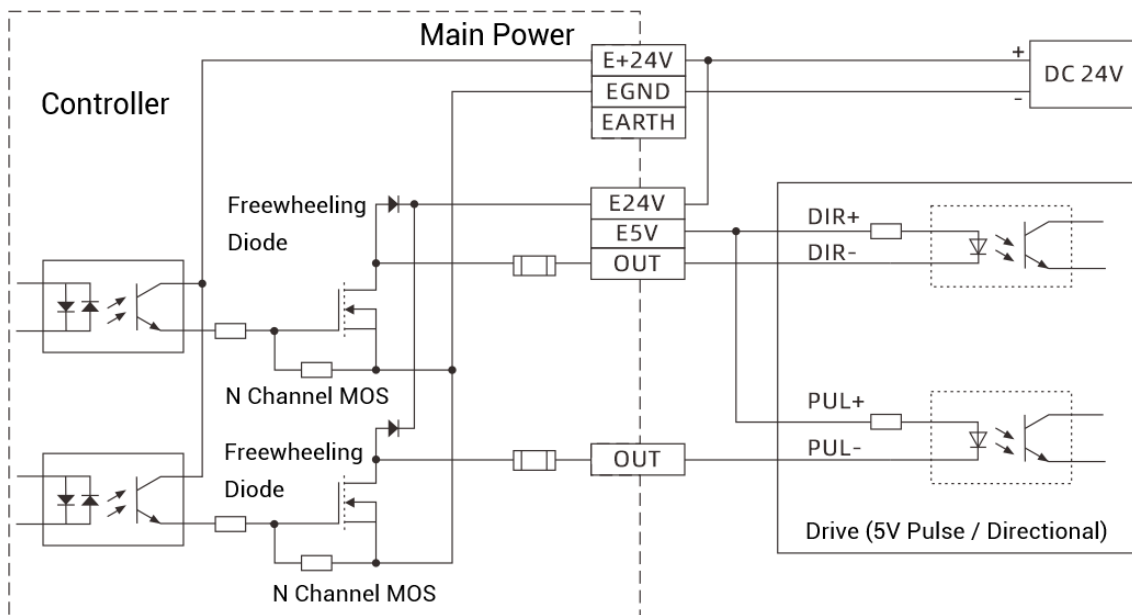
General Wiring:



24V Single-Ended Pulse Axis Wiring (Example: PUL7 & DIR7):



5V Single-Ended Pulse Axis Wiring (Example: PUL7 & DIR7):



Notes:

- The wiring for the digital output is as shown in the diagram above. The external load can be a relay, valve solenoid etc., but it is important to ensure that the signal specifications match.
- For 5V pulse direction interface, please connect PUL+ and DIR+ to E5V interface.
- It is recommended to use the same power supply for both the load and the controller,

otherwise, the negative terminals of two power supplies should be connected.

- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

Usage Method

- (1) After correct wiring & powered-on, please connect controller to [RTSys](#) by EtherNET or COM ports.
- (2) OUT can be set directly through "OP" command, also, it can be operated by *"RTSys / Tool / OP"*.
- (3) PWM function can be set by **"PWM_FREQ" (frequency)**, **"PWM_DUTY" (duty cycle)**.
- (4) Hardware comparison output can be set by **"HW_PSWITCH2"** command.
- (5) Set ATYPE of IN8-15 as 1 to achieve pulse axis function. If ATYPE = 0, they are still used as general digital inputs.
- (6) For above and other commands, please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.
- (7) Codes of "pulse-axis mapping":

'pulse axis mapping (use PUL6, DIR6)

BASE (13) 'the new (remapping) axis No., don't be same as other axis No.

ATYPE = 0

BASE (6) 'the original axis No.

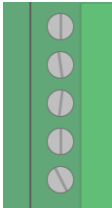
ATYPE = 0 'set axis type as 0

AXIS_ADDRESS (13) = (-1<16) + 6 'remapping the physical axis 6 as axis 13

BASE (13)

ATYPE = 1 'set axis type as pulse axis for axis 13

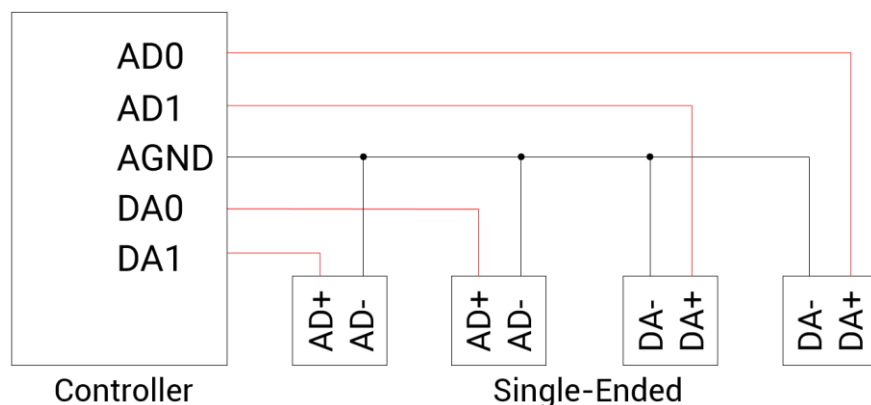
2.4. AD / DA: Analog Inputs & Outputs

Terminal	Name	Type	Function
	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)

Specification

Item	AD (0-1)	DA (0-1)
Resolution	12-bit	12-bit
Data Range	0-4095	0-4095
Signal Range	0-10V	0-10V
Data Ratio	1KHz (sampling ratio)	1KHz (refresh ratio)
Input Impedance / Output Load	$\leq 300\Omega$ (input impedance)	$\geq 1K\Omega$ (output load)
Signal Type	single-ended	single-ended
Cable Length	<5m	<5m

Wiring



Notes:

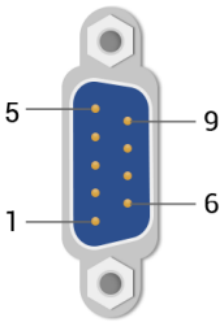
- The wiring for the analog output is as shown in the diagram above. The load signal should be matched with impedance, otherwise, it will affect precision.

- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

Usage Method

- (1) After correct wiring & powered-on, please connect controller to [RTSys](#) by EtherNET or COM ports.
- (2) AD states can be read directly through "AIN" command, and DA can be set directly through "AOUT", also, they can be checked and operated in *"RTSys / Tool / AD/DA"*.
- (3) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

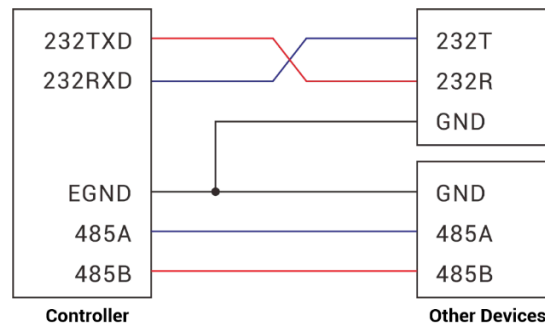
2.5. RS232 / RS485

Terminal	PIN	Name	Function
	1, 6, 8	NC	Reserved
	2	232RXD	RS232 (port 0), receive signal
	3	232TXD	RS232 (port 0), send signal
	4	485A	RS485 (port 1), signal A/+
	5	EGND	5V Power - & Public End
	7	485B	RS485 (port 1), signal B/+
	9	E5V	5V Power +, max 300mA

Specification

Item	RS232 (port 0)	RS485 (port 1)
Communication Rate	≤115200bps	≤115200bps
Terminal Resistor	No	No
Topology Structure	Point to Point	Daisy Chain
Max. Nodes (extended)	1	127
Wiring Distance	<5m	<30
Communication Isolation	√	

Wiring



Notes:

- As above, the daisy chain topology is used for CAN / RS485 wiring (the star topology structure cannot be used). The shorter distance between nodes, the better.
- 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 communication node to prevent CAN / RS485 chips from burning out.
- Please use STP (Shielded Twisted Pair), especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

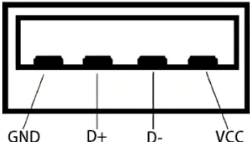
Usage Method

- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.
- (2) Please use "ADDRESS" and "SETCOM" commands to check protocol station No. and set parameters, also, you can check and set in *"RTSys>Controller>Controller Status>Communication Config"* interface.
- (3) According to description, set the third-party device parameters correctly to match each node.
- (4) After all configured, it is time to communicate.
- (5) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

2.6. U Disk

The ZMC408SCAN-V22 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, Z3P file executing, etc.

Specification

	Item	Descriptions
	Communication Protocol	USB2.0
	Communication Ratio	≤12Mbps
	Whether Isolates	No

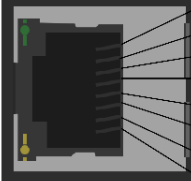
Usage Method

- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.

- (2) Insert UDISK into controller UDISK terminal, when it is connected successfully, the UDISK led will be ON, then you can use U_STATE command to check UDISK state. When you make sure the communication is OK, corresponding operations (firmware upgrade, data copy, etc.) can be done (using FILE series instructions).
- (3) Please refer to "[RTBASIC Programming Manual](#)", or check in *RTSys / Help / RTBasic*.

2.7. ETHERNET

Specification

PIN Definition				Item	Description
	PIN	Signal	Description	Communication Protocol	MODBUS_TCP
	1	TX+	Send signal (+)	Communication Velocity	100Mbps
	2	TX-	Send signal (-)	Default IP	192.168.0.11
	3	RX+	Receive signal (+)	Communication Cable	Shielded Cat 5e Cable
	4	NC	Reserved	Cable Length	<50m
	5	NC	Reserved		
	6	RX-	Receive signal (-)		
	7	NC	Reserved		
	8	NC	Reserved		

Wiring

- (1) Controller Ethernet can be connected to PC / HMI by one shielded cat 5e cable.
- (2) Controller also can be connected to the switch for expanding ethernet channels, then connect to other devices.
- (3) Ethernet LED state:

Led	Normal-ON	Shrink
Green	Build 100M communication	Now it is sending & receiving data
Yellow	Build 10M communication	Now it is sending & receiving data

Notes:

- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

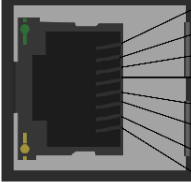
Usage Method

- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.
- (2) "IP_ADDRESS" can be used to modify controller IP, please note controller IP and PC IP should be in same net segment.
- (3) It supports custom ethernet communication, "OPEN#" can open custom ethernet communication, "CLOSE#" can close it, "GET#" can read data from the channel and save data into it.
- (4) Please refer to "[RTBASIC Programming Manual](#)", or check in *RTSys / Help / RTBasic*.

2.8. EtherCAT

Specification

PIN Definition	Item	Description
	Communication Protocol	EtherCAT
	Communication Velocity	100Mbps

	PIN	Signal	Description	Refresh Cycle	Max 500us
	1	TX+	Send signal (+)	Communication Cable	Shielded Cat 5e Cable
	2	TX-	Send signal (-)		
	3	RX+	Receive signal (+)		
	4	NC	Reserved	Cable Length	<50m
	5	NC	Reserved		
	6	RX-	Receive signal (-)		
	7	NC	Reserved		
	8	NC	Reserved		

Wiring

(1) Controller EtherCAT can be connected to EtherCAT drives / other EtherCAT devices via one shielded cat 5e cable: connect to controller EtherCAT to slave EtherCAT IN, then connect slave EtherCAT OUT to next one EtherCAT IN.

(2) Ethernet LED state:

Led	Common-ON	Shrink
Green	Build 100M communication	Now it is sending & receiving data
Yellow	Build 10M communication	Now it is sending & receiving data

Notes:

- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

Usage Method

(1) Please follow the above wiring instructions to wiring correctly, then connect the

controller to [RTSys](#) through ethernet / serial port.

(2) How to connect to drive devices through EtherCAT:

- 1) Use SLOT_SCAN command to scan the slot No. on the bus.
- 2) Use AXIS_ADDRESS command to map axis No.
- 3) Use SLOT_START to open bus, SLOT_STOP to stop.
- 4) After completed, configure and operate local pulse axis.

(3) How to connect to expansion module by EtherCAT:

- 1) Use SLOT_SCAN command to scan the slot No. on the bus.
- 2) Use AXIS_ADDRESS to map axis No., use NODE_IO / NODE_AIO to map IO No.
- 3) Use SLOT_START to open bus, SLOT_STOP to stop.
- 4) After completed, configure and operate local IO, same as axis, for details, please refer to "2.2, 2.3, 2.10" – "Usage Methods".

(4) For slot No. and device node information, you can check in *"RTSys>controller>controller status>slot0node"*.

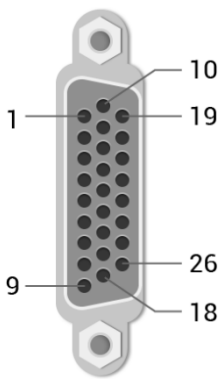
(5) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

(6) How to configure EtherCAT axis in RTSys: [RTSys – EtherCAT Quick Configurations](#).

2.9. AXIS (Differential Pulse Axis)

ZMC408SCAN-V22 provides 4 local differential pulse axis interfaces, which can be used to control servo drives.

Interface	Pin	Signal	Description
	1	EGND	Negative pole of IO 24V power
	2	IN24-27/ALM	DI (as driver alarm)
	3	OUT20-23 /	DO (as driver enable)

		ENABLE	
	4	EA-	Encoder differential input signal A-
	5	EB-	Encoder differential input signal B-
	6	EZ-	Encoder differential input signal Z-
	7	+5V	5V power + of pulse/encoder signal
	8	Reserved	Reserved
	9	DIR+	Pulse / directional differential signal +
	10	GND	5V power - of pulse/encoder signal
	11	PUL-	Pulse / directional differential signal -
	12	Reserved	Reserved
	13	GND	5V power - of pulse/encoder signal
	14	OVCC	IO 24V power +
	15	OUT24-27 / CLR	DO (as drive alarm clear)
	16	IN28-31 / INP	DI (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	5V power + of pulse/encoder signal
	21	GND	
	22	DIR-	Pulse / directional differential signal -
	23	PUL+	Pulse / directional differential signal +
	24	GND	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.			

--Pulse-Axis PIN No. & IO--

Pulse Axis No.	Related IN / ALM	Related OUT / ENABLE	Related OUT / CLR	Related IN / INP
AXIS0	IN24	OUT20	OUT24	IN28

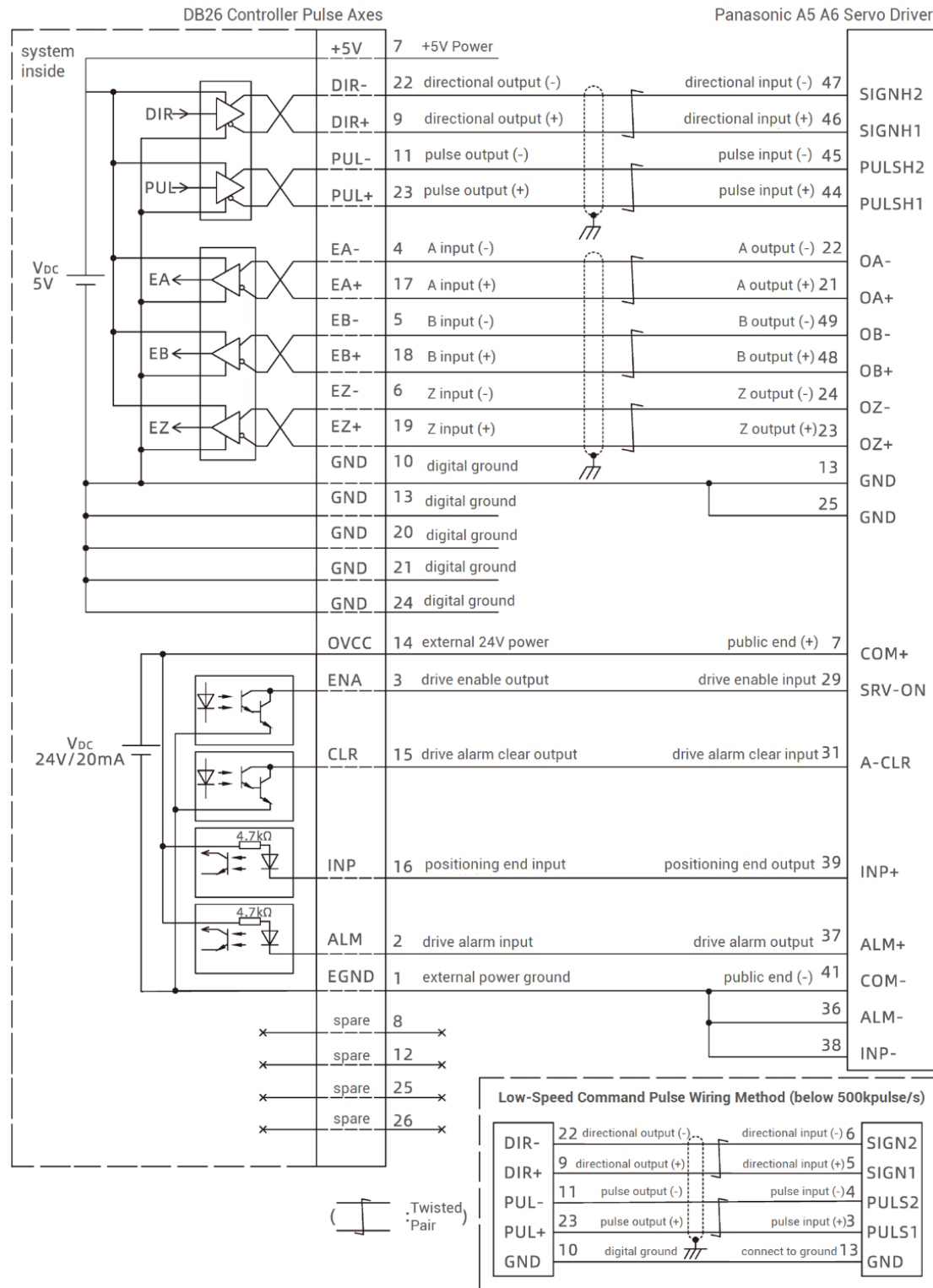
AXIS1	IN25	OUT21	OUT25	IN29
AXIS2	IN26	OUT22	OUT26	IN31
AXIS3	IN27	OUT23	OUT27	IN31

Specification

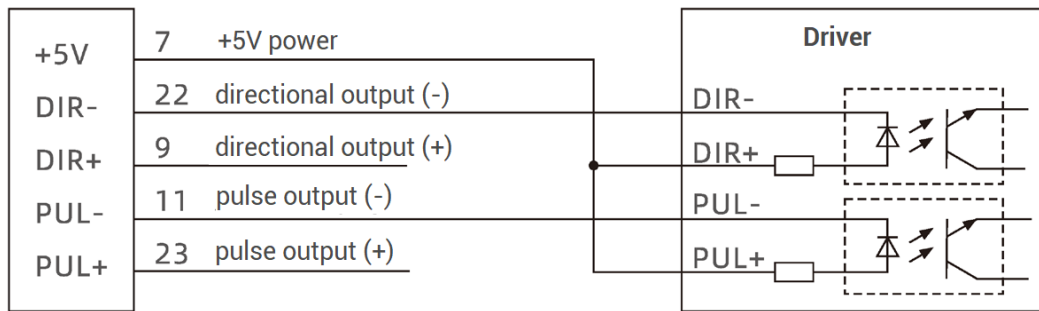
Signal	Item	Description
PUL/DIR	Signal Type	Differential output signal
	Voltage Range	0-5V
	Maximum Frequency	10MHz
EA/EB/EZ	Signal Type	Differential input signal
	Voltage Range	0-5V
	Maximum Frequency	5MHz
IN24-31	Input Method	NPN type, trigger by low level
	Input Frequency	<5kHz
	Input Impedance	6.8KΩ
	Voltage Level	DC24V
	ON Voltage	<10.5V
	OFF Voltage	>10.7V
	Minimal Current	1.8mA
	Maximum Current	4mA
	Isolation	Optoelectronic Isolation
OUT20-27	Output Method	NPN type, trigger by low level
	Frequency	<8kHz
	Load Voltage	≤24V
	Output Current	≤300mA
	Overcurrent Protection	No
	Isolation	Optoelectronic Isolation
+5V	Output Current	≤50mA
OVCC	Output Current	≤50mA

Wiring

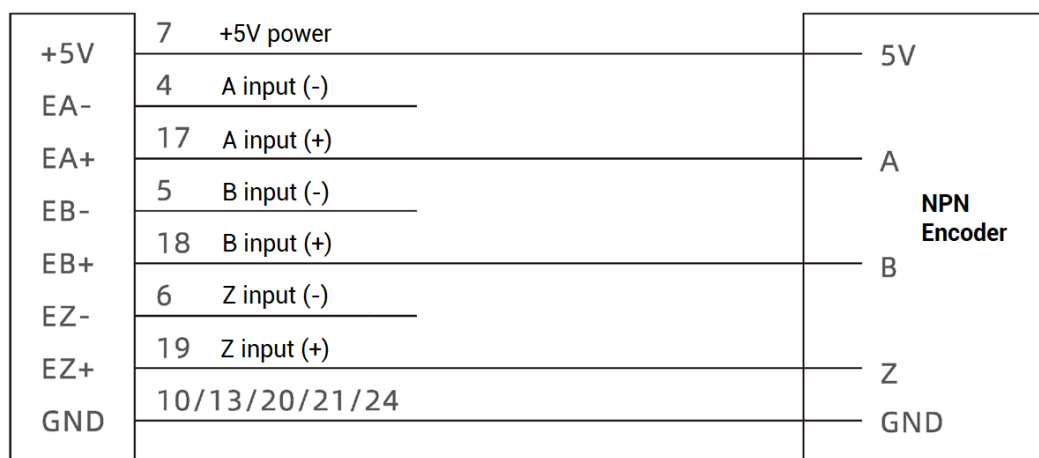
→ Wiring with Panasonic A5/A6 Servo Driver.



→ **Single-Ended Pulse-Axis Wiring (PUL / DIR):**



→ **Single-Ended Encoder-Axis Wiring (EA / EB / EZ):**



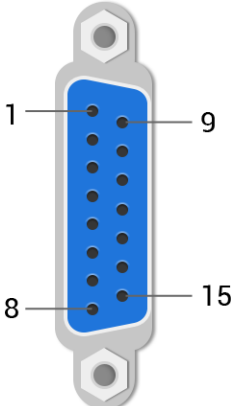
Notes:

- 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.
- When using differential signals, be sure to connect the common zero terminals of both sides to ensure communication stability and equipment security;
- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

Usage Method

- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.
- (2) Set axis basic parameters via commands of BASE, ATYPE, UNITS, SPEED, ACCEL, DECEL, etc.; and do axis remapping through AXIS_ADDRESS; enable through AXIS_ENABLE; do linear motion through MOVE.
- (3) Some parameters can be set and checked in "*RTSys / View / Axis Parameter*" window; at the same time, motions also can be operated in "*RTSys / Tool / Manual*" window
- (4) Please refer to "[RTBASIC Programming Manual](#)", or check in *RTSys / Help / RTBasic*.

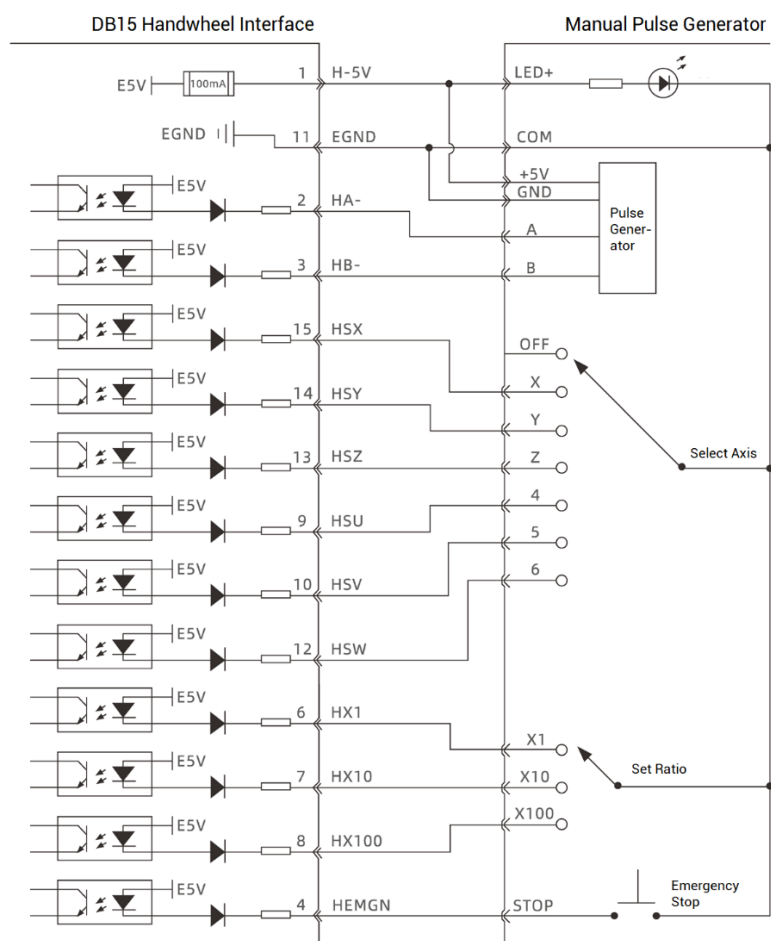
2.10. MPG Handwheel

Interface	PIN	Signal	Description
	1	H-5V	5V power output +, for handwheel MPG
	2	H-A	Encoder phase A signal (IN32)
	3	H-B	Encoder phase B signal (IN33)
	4	H-EMGN	Emergency stop signal (IN43)
	5	NC	Reserved
	6	H-X1	Select ratio X1 (IN34)
	7	H-X10	Select ratio X10 (IN35)
	8	H-X100	Select ratio X100 (IN36)
	9	H-S4	Select axis 3 (IN40)
	10	H-S5	Select axis 4 (IN41)
	11	EGND	5V power output -, signal public end
	12	H-S6	Select axis 5 (IN42)
	13	H-SZ	Select axis 2 (IN39)
	14	H-SY	Select axis 1 (IN38)
	15	H-SX	Select axis 0 (IN37)
➤ 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).			

Specification

Item	IN (32-43)
Mode (input)	NPN, triggered by low electric inputs.
Frequency (input)	<5kHz is recommended
Impedance (input)	510Ω
Max voltage (input)	26V
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 (H-5V, EGND) max output current	100mA

Wiring



Notes:

- The wiring principle of handwheel encoder axis interface is shown above, please connect carefully due to diversified handwheel designs.
- The controller supports 5V/24V handwheel; one 24V power supply can be connected externally for MPG.
- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.
- Ensure that the controller is properly grounded, and the chassis ground should be connected to a standard factory ground rod.

Usage Method

- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.
- (2) Configure axis No., for ZMC408SCAN-V22, axis 4 is the default handwheel interface, remapping (using AXIS_ADDRESS) must be done.
- (3) Configure IO: assign axis selection (H-SX, H-SY, H-SZ, H-S4, H-S5, H-S6) and ratio (HX-1, HX-10, HX-100) and emergency stop (EMGN) functions as required. These signals are essentially digital input signals with fixed No. but no fixed functions. It needs RTSys to develop (the axis selection is the connected axis of "connect" synchronization motion, and the ratio is the "connect" ratio).
- (4) After above completed, please set axis basic parameters (BASE, UNITS, etc.); for more details, please check ["2.9 AXIS – Usage Method"](#).
- (5) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.
- (6) MPG Handwheel Axis Mapping:

'axis mapping (MPG)

BASE (14) 'the axis No. (remapping), don't be the same as the current axis No.

ATYPE = 0

BASE (4) 'the original axis No.

ATYPE = 0

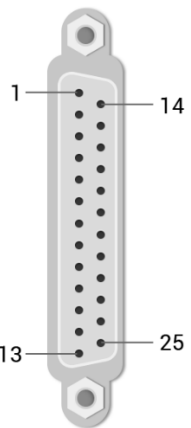
AXIS_ADDRESS (14) = $(-1 < 16) + 4$ 'map physical axis 4 as axis 14

BASE (14)

ATYPE = 3 'configure axis 14 as encoder axis

2.11. SCAN Galvo

ZMC408SCAN-V22 provides 2 local galvanometer axes, which are double-row standard DB25 female seat.

Interface	PIN	Signals	Description
	1	CLK-	Clock signal -
	14	CLK+	Clock signal +
	2	SYNC-	Synchronization signal -
	15	SYNC+	Synchronization signal +
	3	X-	SCAN X channel signal -
	16	X+	SCAN X channel signal +
	4	Y-	SCAN Y channel signal -
	17	Y+	SCAN Y channel signal +
	5	Z-	SCAN Z channel signal -
	18	Z+	SCAN Z channel signal +
	6	Y RETURN-	SCAN Y channel feedback signal -
	19	Y RETURN+	SCAN Y channel feedback signal +
	7	Z RETURN-	SCAN Z channel feedback signal -
	20	Z RETURN+	SCAN Z channel feedback signal +
	8	X RETURN-	SCAN X channel feedback signal -
	21	X RETURN+	SCAN X channel feedback signal +
	9, 10, 12, 13, 22, 25	NC	/
	11, 23, 24	GND	Signal ground, public end
✓ When in 2D SCAN (default), SCAN0 relates to Axis 4 and Axis 5 of 2D galvanometer, SCAN1			

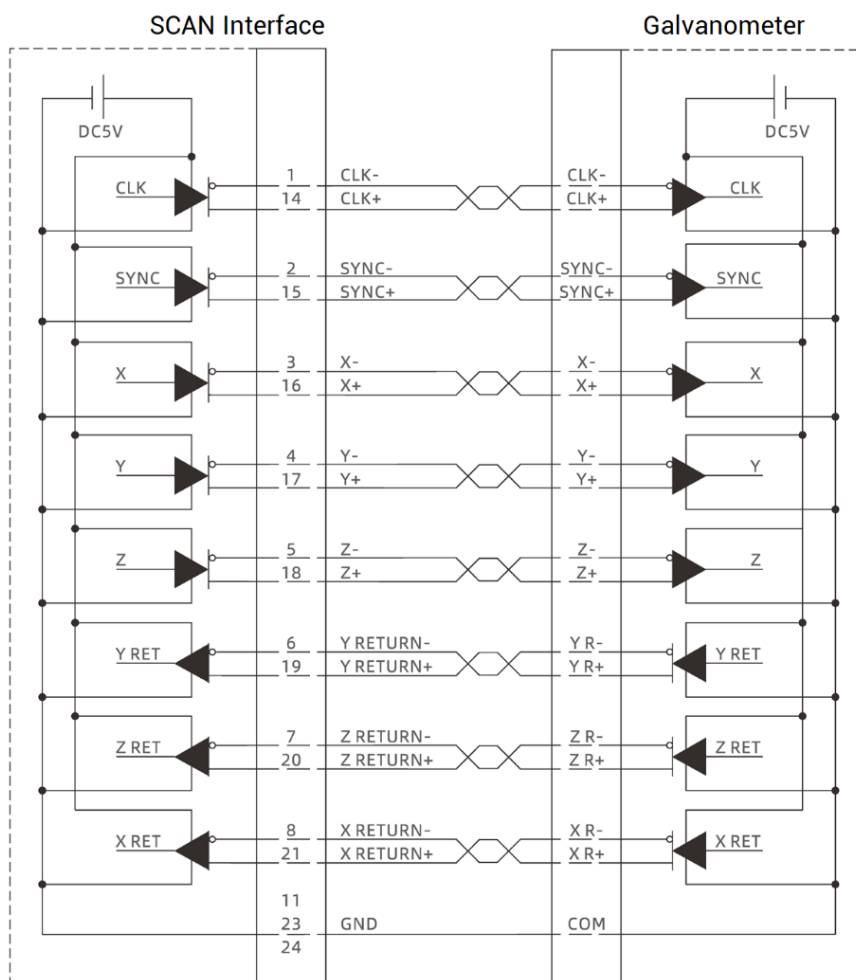
relates to Axis 6 and Axis 7 of 2D galvanometer.

- ✓ When in 3D SCAN (default), SCAN0 relates to Axis 4, Axis 5 and Axis 8 of 3D galvanometer.

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	-44μA/+8mA
Isolation method	Non-isolation	

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.
- During on-site wiring, maintain a distance from high-voltage power lines, preferably 30 cm or more.

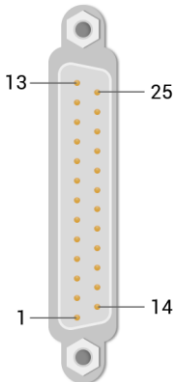
Usage Method

- (1) Please follow the above wiring instructions to wiring correctly, then connect the controller to [RTSys](#) through ethernet / serial port.
- (2) Set axis basic parameters via commands of BASE, ATYPE, UNITS, SPEED, ACCEL, DECEL, etc.; and do axis remapping through AXIS_ADDRESS; enable through AXIS_ENABLE; do linear motion through MOVE.
- (3) Some parameters can be set and checked in "*RTSys / View / Axis Parameter*" window; at the same time, motions also can be operated in "*RTSys / Tool / Manual*" window
- (4) Please refer to "[RTBASIC Programming Manual](#)", or check in *RTSys / Help / RTBasic*.

BASE (4, 5)	'SCAN 0 – axis 4; SCAN 1 – axis 5
ATYPE = 21, 21	'set axis type of axis 4 and axis 5 as scan axes
UNITS = 200, 200	'set pulse amounts of axis 4 and axis 5 as 200 (unit: bit)
DPOS = 0, 0	
FORCE_SPEED = 100, 100	'set SCAN motion speed of axis 4 & axis 5 as 100*200bit/s
MOVESCANABS (0, 0)	'move SCAN to center origin position
MOVESCAN (50) AXIS (4)	'axis 4 moves forward 50*200 bit
MOVESCAN (-50) AXIS (5)	'axis 5 moves reversely 50*200 bit

2.12. LASER

This product provides one local interface specialized for YLR, which is a double-row standard DB25 male seat.

Interface	PIN	Signal	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	OUT9	PWM signal, 24V electric level
	12	Modulation-	/	Modulation 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

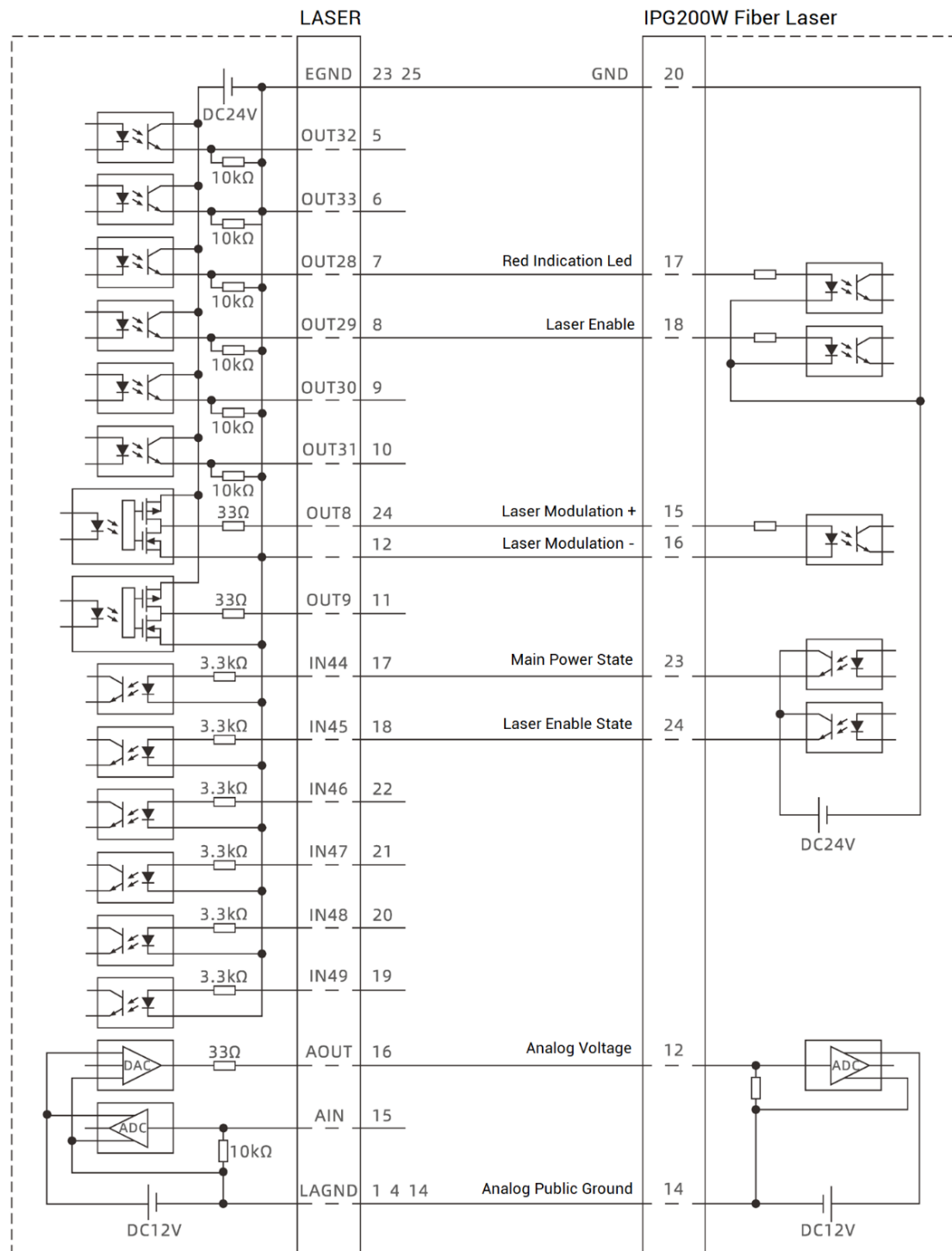
AIN (2) and AOUT (2) are reserved signals, but standard models don't have, please select special mode when ordering if you need.

Specification

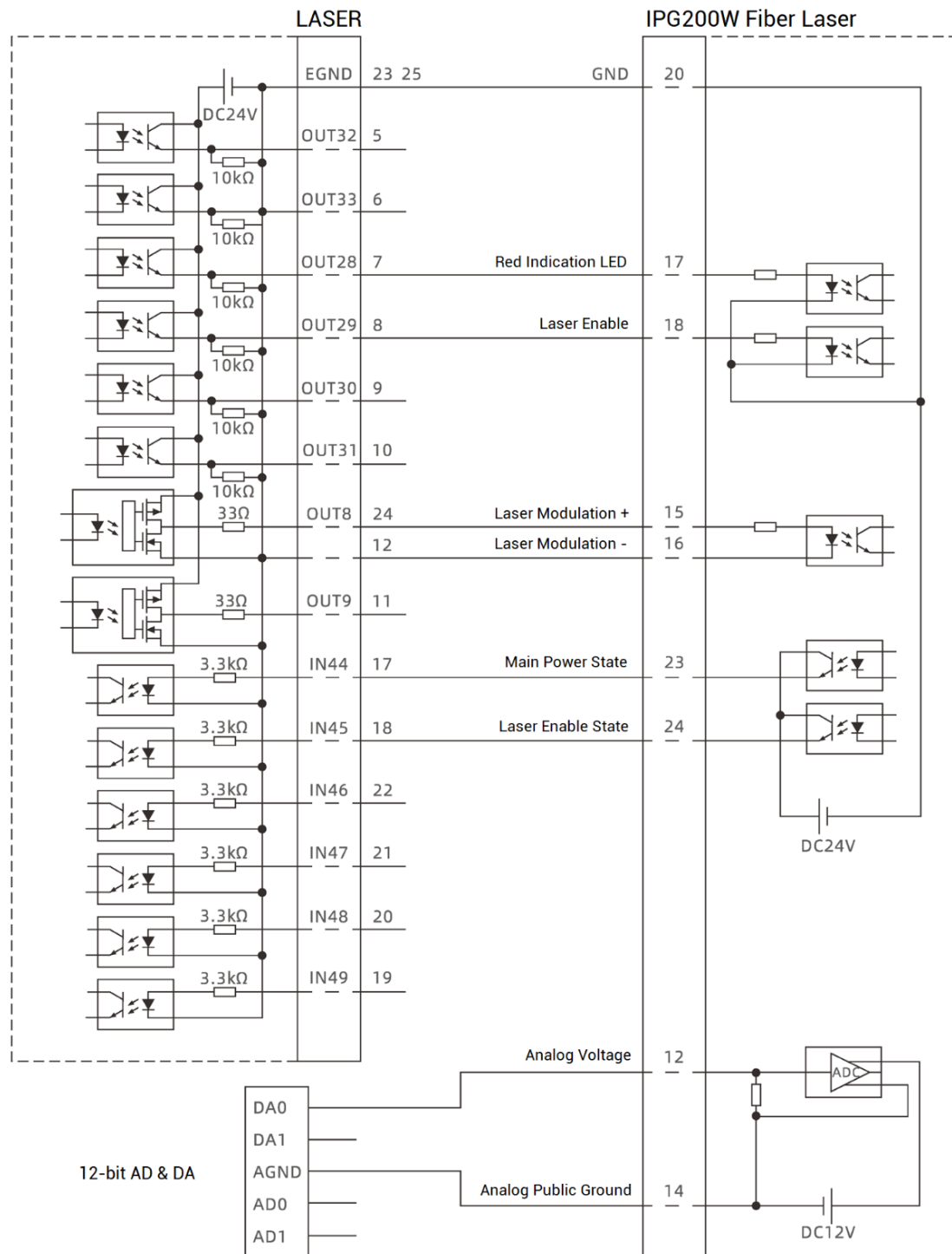
Signal	Item	Parameter
OUT (28-33)	Output method	Source type
	Output frequency	<8kHz
	Max output voltage	24V
	Min output voltage	0V
	Normal voltage	0V
	Max output current	8mA
	Overcurrent protection	NO
	Isolation method	Optoelectrical isolation
OUT (8-9)	Output method	Push-pull output
	Output frequency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

- Wiring reference of 16-DA in LASER interface (please choose the special version that supports 16-bit analog):



➤ Wiring reference of 12-bit DA:



Notes:

- Wiring reference of LASER is above, digital IOs can be customized except OUT8, OUT9.
- There are 2 wiring ways for lasers that need analog input: 12-bit DA & 16-bit DA in

LASER (special version).

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

Usage Method

- (1) After correct wiring & powered-on, please connect controller to [RTSys](#) by EtherNET or COM ports.
- (2) AD states can be read directly through "AIN" command, and DA can be set directly through "AOUT", also, they can be checked and operated in *"RTSys / Tool / AD/DA"*.
- (3) Set PWM frequency and PWM duty cycle through "PWM_FREQ", "PWM_DUTY" commands to control the laser.
- (4) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

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 = 200, 200	'set pulse amount of axis 4, 5 as the unit of 200 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*200 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 early 1.5ms, use Move_Delay to delay switching on the light

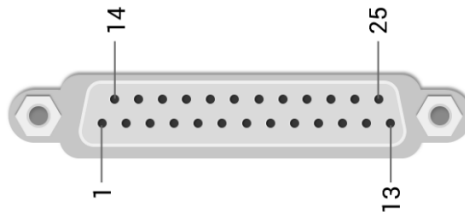
MPVE_PWM (8, 0.5, 10000) 'set PWM duty cycle as 0.5, frequency as 10000K
 MOVE_OP (8, ON) 'start to output the light when laser OP8

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 commands 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.

2.13. FIBER

FIBER interface is one 5V TLL electrical level control interface for laser, which can control JPT, MOPA, TPG, YLP, YLPN, Maxphotonics, Raycus, etc. This interface is one double-row standard DB25 female male.



PIN	Signal	Description	DI / DO
1	D0	Power set position D0	OUT36
2	D1	Power set position D1	OUT37
3	D2	Power set position D2	OUT38
4	D3	Power set position D3	OUT39
5	D4	Power set position D4	OUT40
6	D5	Power set position D5	OUT41
7	D6	Power set position D6	OUT42
8	D7	Power set position D7	OUT43
9	LATCH	Power latch signal, valid in rising edge	OUT46

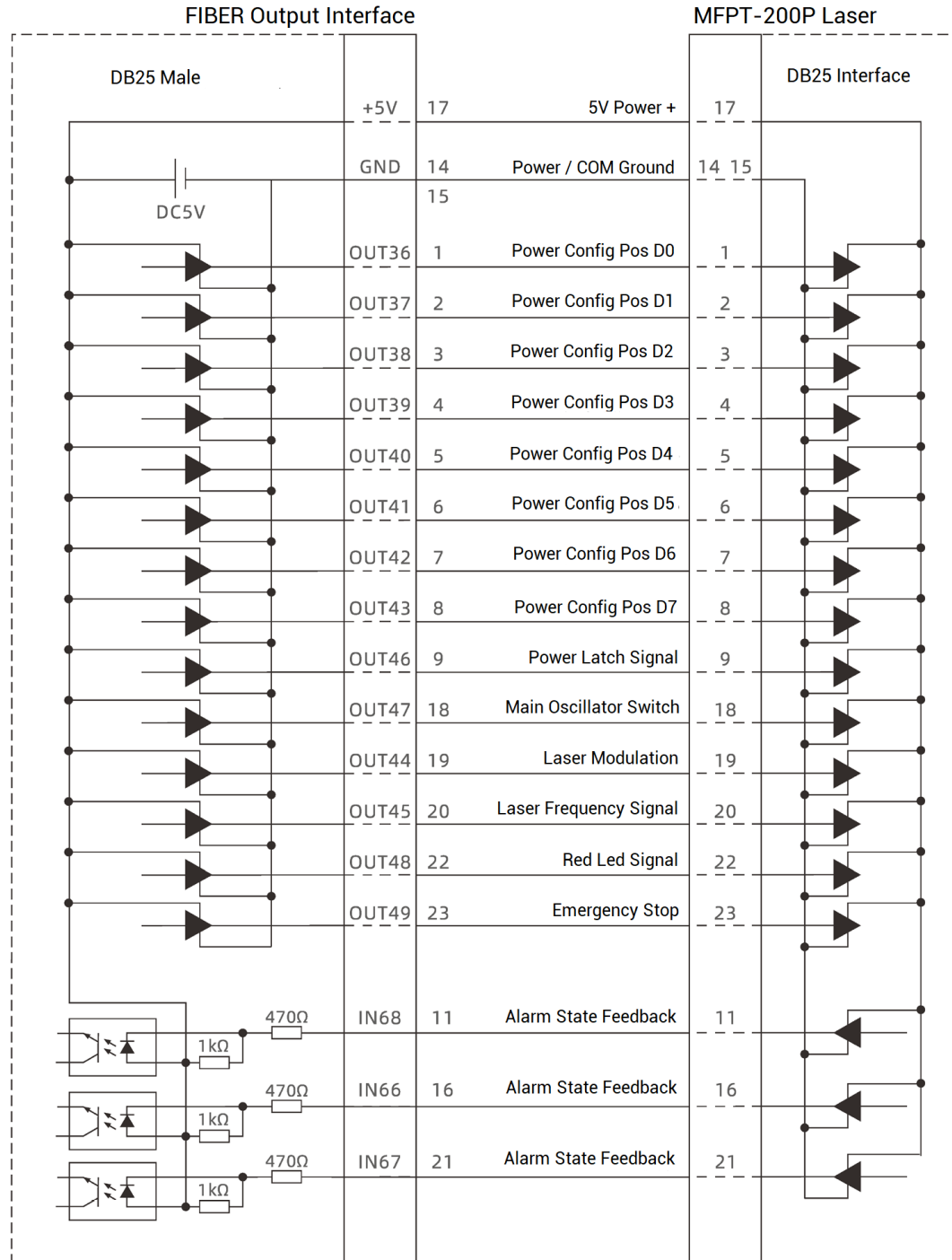
10	NC	Reserved	/
11	STA2	Alarm status feedback (input interface)	IN68
12	NC	Reserved	/
13	NC	Reserved	/
14,15	GND	+5V output -, signal public end	/
16	STA0	Alarm status feedback (input interface)	IN66
17	+5V	+5V output +, max is 100mA, spare when no use	/
18	M0	Main oscillator switch signal	OUT47
19	GATE	Laser modulation signal	OUT44 (PWM10)
20	PRR	Laser frequency signal	OUT45 (PWM11)
21	STA1	Alarm status feedback (input interface)	IN67
22	RED LIAGHT	Red light signal	OUT48
23	EMSTOP	Emergency stop signal	OUT49
24,25	NC	Reserved	/

Specification

Item	IN (66-68)	Item	OUT (36-49)
IN method	NPN, triggered by low level	Output method	0-5V TTL output
IN frequency	<5kHz	Output frequency	Max 10Mbps
IN 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	

Wiring

➤ MFPT – 200P Laser Wiring:



Notes:

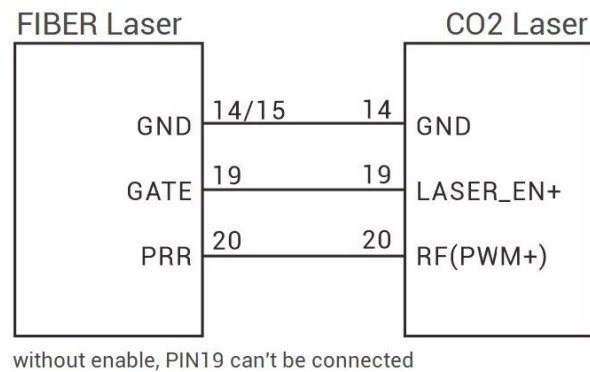
- Above is the example of MFPT-200P.
- Please use shielded cable, connecting the shield layer to the ground fully (chassis).

➤ CO2 Laser Wiring:

--CO₂ laser PIN definition--

PIN	Signal Name	Description
14	GND	Reference ground
19	LASER_EN+	Enable signal
20	RF (PWM+)	Modulation signal TTL output

--Wiring Reference--

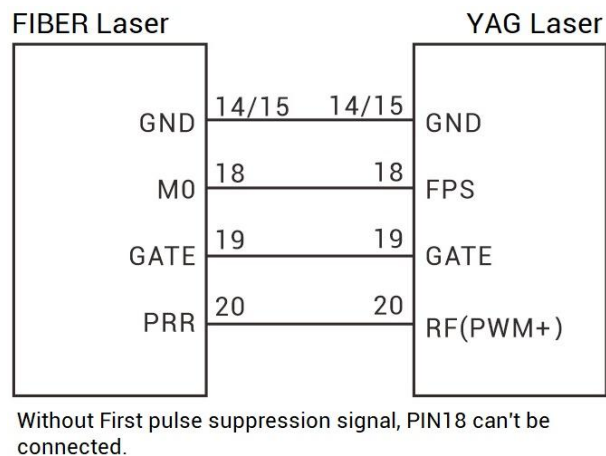


➤ YAG Laser Wiring:

--YAG laser PIN definition--

PIN	Signal Name	Description
14	GND	Reference ground
18	FPS	First pulse suppression signal
19	GATE	Shutter signal
20	RF (PWM+)	Modulation signal TTL output

--Wiring Reference--



Usage Method

- (1) After correct wiring & powered-on, please connect controller to [RTSys](#) by EtherNET or COM ports.
- (2) AD states can be read directly through "AIN" command, and DA can be set directly through "AOUT", also, they can be checked and operated in *"RTSys / Tool / AD/DA"*.
- (3) Set PWM frequency and PWM duty cycle through "PWM_FREQ", "PWM_DUTY" commands to control the laser.
- (4) Please refer to ["RTBASIC Programming Manual"](#), or check in *RTSys / Help / RTBasic*.

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 = 200, 200	'set pulse amount of axis 4, 5 as the unit of 200 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*200 bit/s
MOVESCANABS (0,0)	'galvanometer moves to center origin position
Base (4, 5)	
LASER_SET (1, 1)	'map AOUT3 to OUT36-43, control laser power by AOUT3
AOUT (3) = 127	'set laser power as 50%, 0-255 relates to 0-100% power.
Op (47, 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 early 1.5ms, use Move_Delay to delay switching on the light
MPVE_PWM (11, 0.5, 10000)	'set PWM duty cycle as 0.5, frequency as 10000K
MOVE_OP (44, ON)	'start to output the light when laser OP44
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 (44, OFF)	'laser OP44 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 commands 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 III Resources Expansion

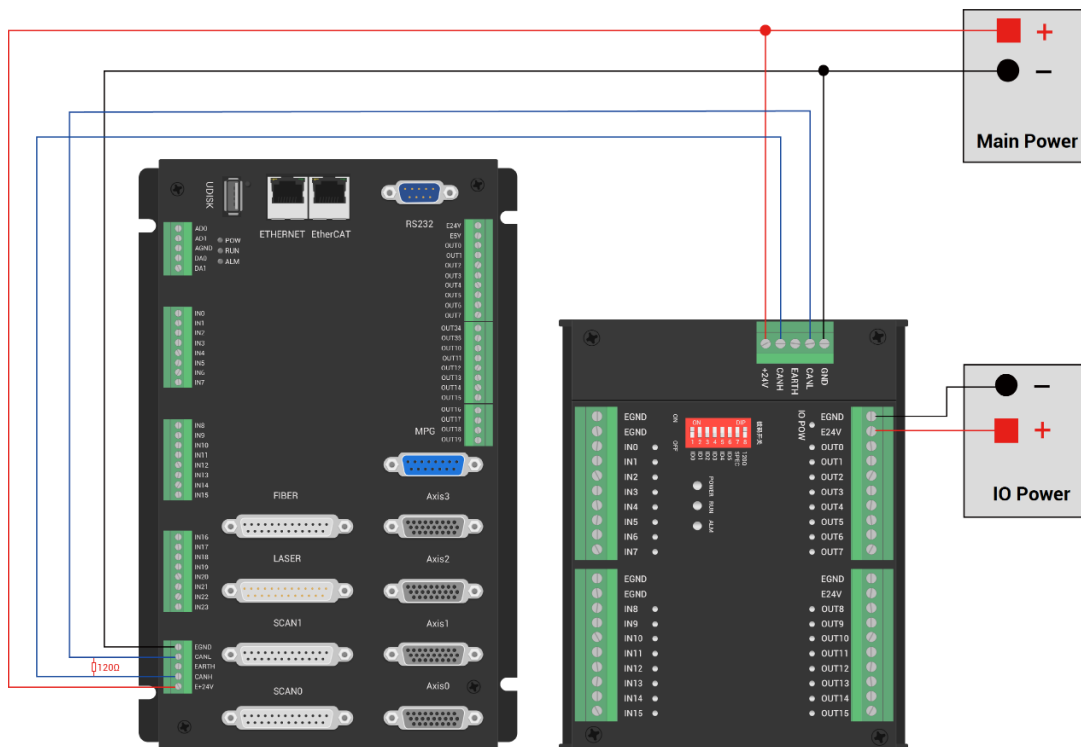
When you need more resources, expansion modules can be used by CAN / EtherCAT.

3.1. CAN Expansion

For Zmotion, there are 3 types [CAN bus expansion modules](#): ZIO, ZAI0, ZMIO-CAN, through them, more digital IO, analog IO, axes (up to 2) can be expanded.

Please select the expansion module according to the requirements, and select IO mapping or axis mapping according to the resources of the expansion module. Attention the No. must be different while mapping.

Wiring



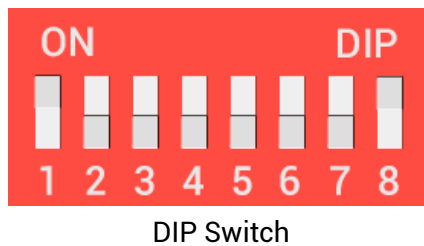
Notes:

- ZMC408SCAN-V22 controller uses the single power, but ZIO expansion module uses dual-power. When using, connect two channels of IO power into 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-code DIP switch, the terminal resistor can be realized by dialing the code (DIP).

Resource Mapping

A. DIP Switch



Generally, the ZCAN expansion module has an 8-code DIP switch to do communication configuration and resource mapping, 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 (4-bit binary to decimal system).
- ✚ 5-6: CAN communication speed, corresponding value is 0-3 (2-bit binary to decimal system), four different speeds are optional.
- ✚ 7: reserved.
- ✚ 8: 120-ohm resistor, dial ON means a 120-ohm resistor is connected between CANL and CANH.

Dial 1-4 to select the CAN address, then the controller automatically maps expansion module IO range according to this address ID, but for axis No., please map manually.

Dial code 5-6 to select CAN bus communication speed, the corresponding speeds are as follows:

Code 6	Code 5	DIP 5-6 combination value	CAN communication speed
0	0	0	500KBPS (default value)
0	1	1	250KBPS
1	0	2	125KBPS
1	1	3	1MBPS

Notes:

- "How to configure controller as master station", please check ["2.5 RS485 & RS232"](#) – ["Usage Methods"](#).
- Communication velocities of each node on the CAN bus must be consistent, please note mapped IO No. and axis No. can't conflict.

B. IO Mapping

IO mapping of CAN expansion module is determined by dial code 1-4, below shows digital IO mapping and analog IO mapping No. allocation:

--Digital IO Mapping No.--

(0: OFF, 1: ON)

Code 4	Code 3	Code 2	Code 1	Address ID	Start IO No.	End IO No.
0	0	0	0	0	16	31
0	0	0	1	1	32	47
0	0	1	0	0	0	63
0	0	1	1	3	64	79
0	1	0	0	4	80	95
0	1	0	1	5	96	111
0	1	1	0	6	112	127
0	1	1	1	7	128	143
1	0	0	0	8	144	159
1	0	0	1	9	160	175
1	0	1	0	10	176	191
1	0	1	1	11	192	207
1	1	0	0	12	208	223
1	1	0	1	13	224	239
1	1	1	0	14	240	255
1	1	1	1	15	256	271

--Analog IO Mapping, for bit 1-4 code state & ID, please refer to above form--

Address ID	Start AD No.	End AD No.	Start DA No.	End AD No.
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

C. Axis Mapping

When expanding pulse axis through CAN, max 2 pulse axes can be expanded, and these two should be bound with axis No. by **AXIS_ADDRESS** at first.

"AXIS_ADDRESS(axis No.)=(32*expanded axis)+ID "

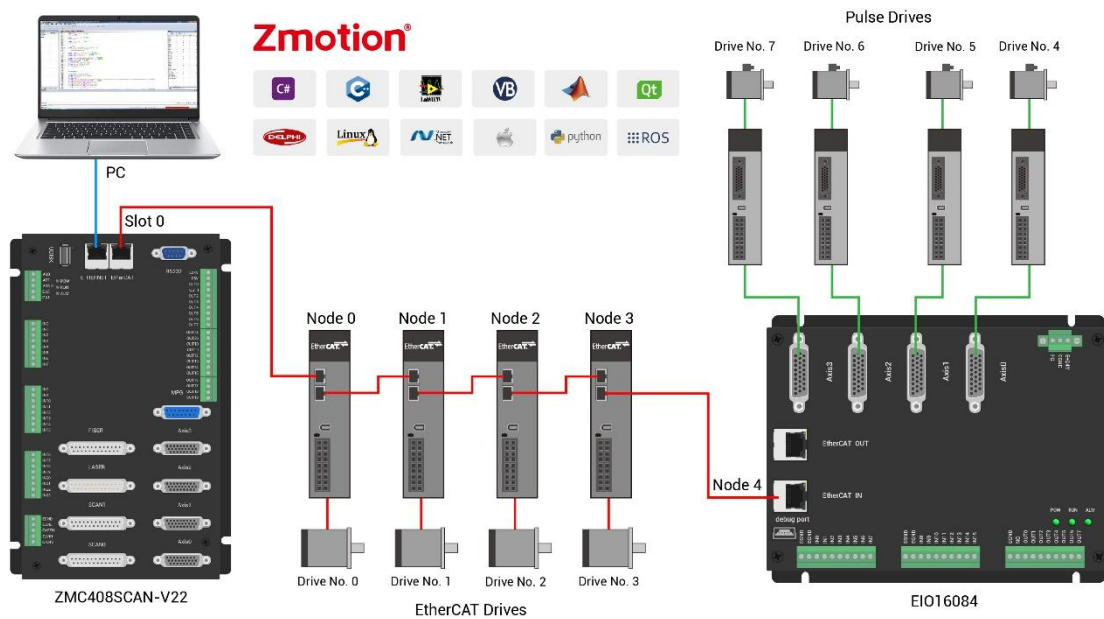
AXIS_ADDRESS(6)=(32*0)+2 'map axis 0 expanded by CAN module (ID is 2) as axis 6

AXIS_ADDRESS(7)=(32*1)+2 'map axis 1 expanded by CAN module (ID is 2) as axis 6

Please refer to "[RTBASIC Programming Manual](#)", or check in *RTSys / Help / RTBasic*.

D. Extended Resources Checking

Connect the controller to RTSys at first, then in RTSys, enter "*controller > controller status > ZCanNode*" interface, you can know expansion module ID and corresponding mapping No.
(below take ZMC432-V2 controller as the example).



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

■ **Slot No. (slot):**

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

■ **Device No. (node):**

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

■ **Drive No.:**

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 No. is different from the device No. Only the drive device number on the slot is assigned, and other devices are ignored. While mapping axis No., drive No. will be used.

Resource Mapping

A. IO Mapping:

For EtherCAT expansion module IO No., they are set by **NODE_IO** and **NODE_AIO**.

When IO mapping, first check the maximum IO No. 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 No. of the controller itself, both two will work at the same time, so the IO mapped No. must not be repeated in the entire control system.

Examples (IO & AIO):

NODE_IO(0,0)=32	'set the IO start No. of slot 0 interface device 0 to 32
NODE_AIO(0,0,3)=3	'set the AIO start No. of slot 0 interface device 0 to 3

B. 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 No.)=(slot No.<<16)+driver No.+1

Example:

AXIS_ADDRESS(6)=(0<<16)+0+1 '1st drive on EtherCAT, drive No. 0, bound as axis 6

AXIS_ADDRESS(7)=(0<<16)+1+1 '2nd drive on EtherCAT, drive No. 1, bound as axis 7

C. Extended Resources Checking

Connect the controller to RTSys at first, then in RTSys, enter "**controller > controller status > Slot**" interface, you can know expansion module ID and corresponding mapping No.

Chapter IV Programming

4.1. Program in RTSys Software

RTSys is a PC-side program development, debugging and diagnostic software for the Zmotion motion controllers. Through it, users can easily edit and configure the controller program, quickly develop applications, diagnose system operating parameters in real time, and debug the running program in real time. What's more, it supports Chinese and English bilingual environments.

In RTSys, there are 4 programming languages for motion control development, Basic, PLC, HMI and C language, they can run multi-tasks among them, especially for Basic, multi-task running can be achieved separately, hybrid programming is also OK with PLC, HMI and C language.

RTSys Downloading Address: https://www.zmotionglobal.com/pro_info_282.html

And related manuals can be found in "Download":

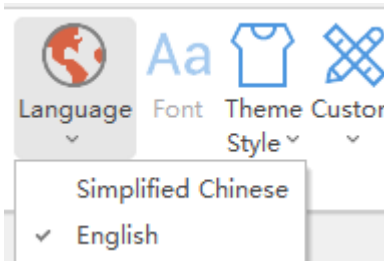
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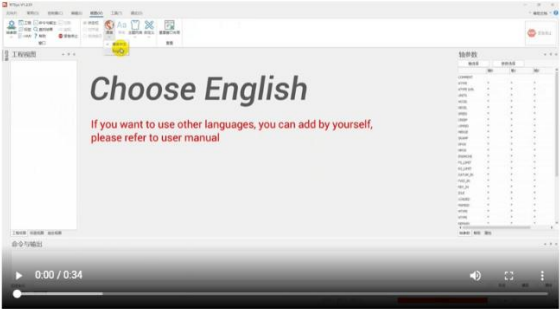
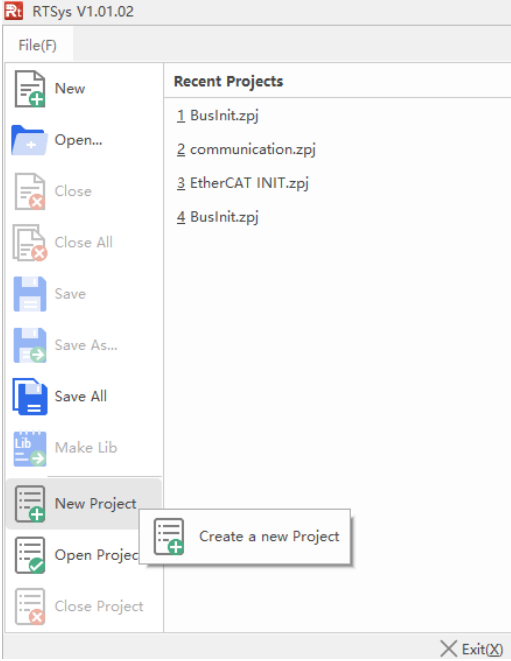
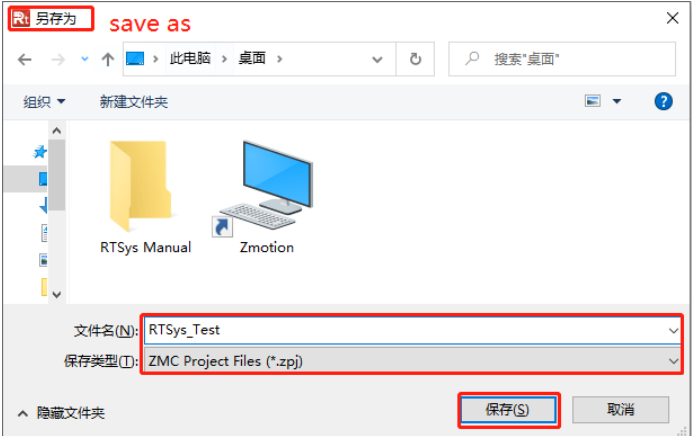
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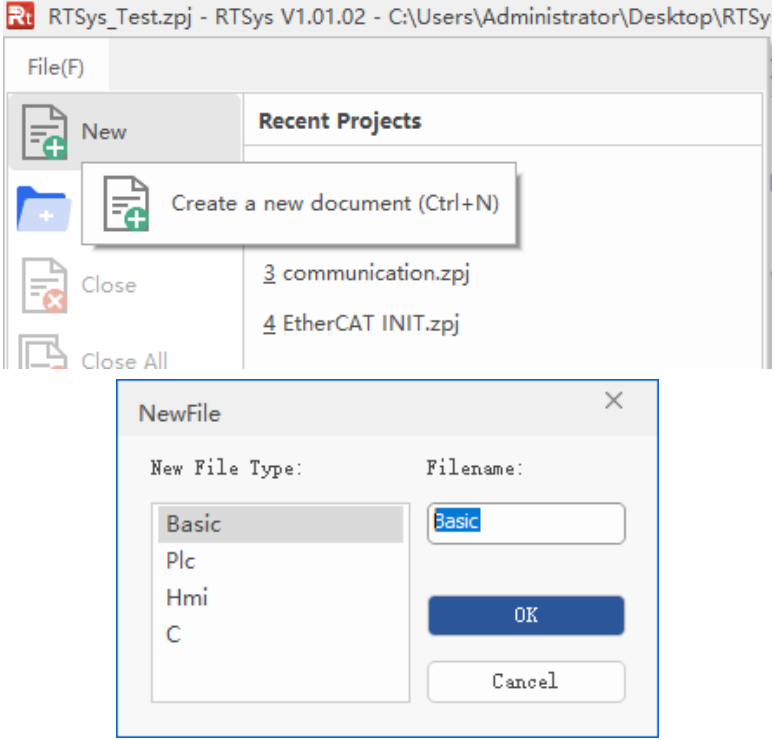
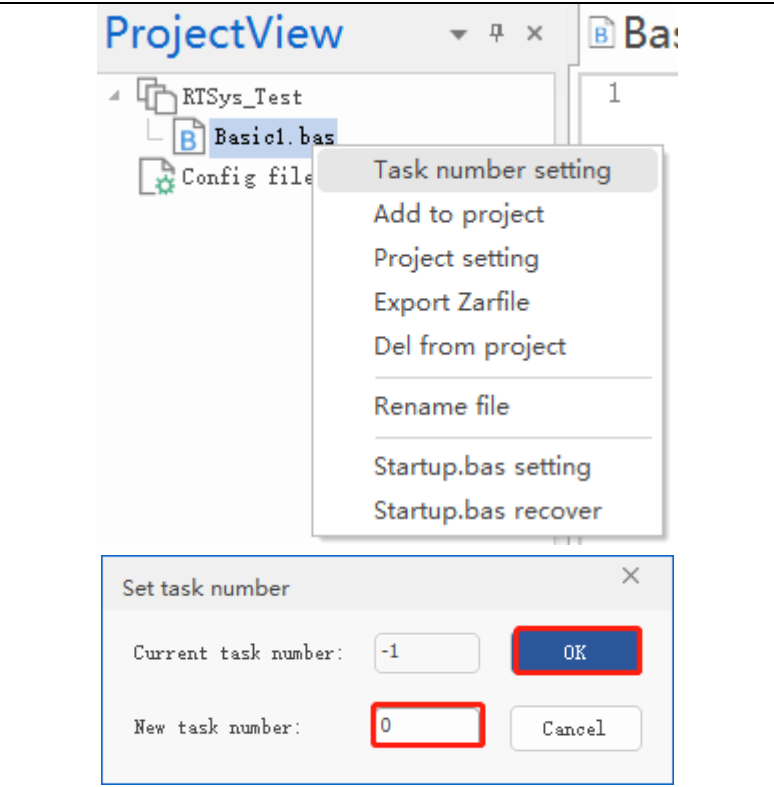
System Architecture

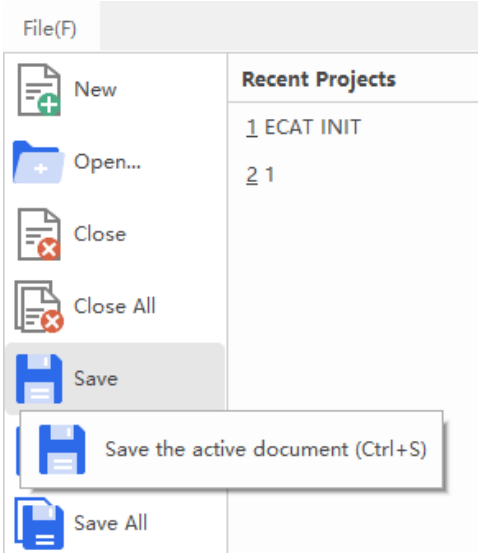
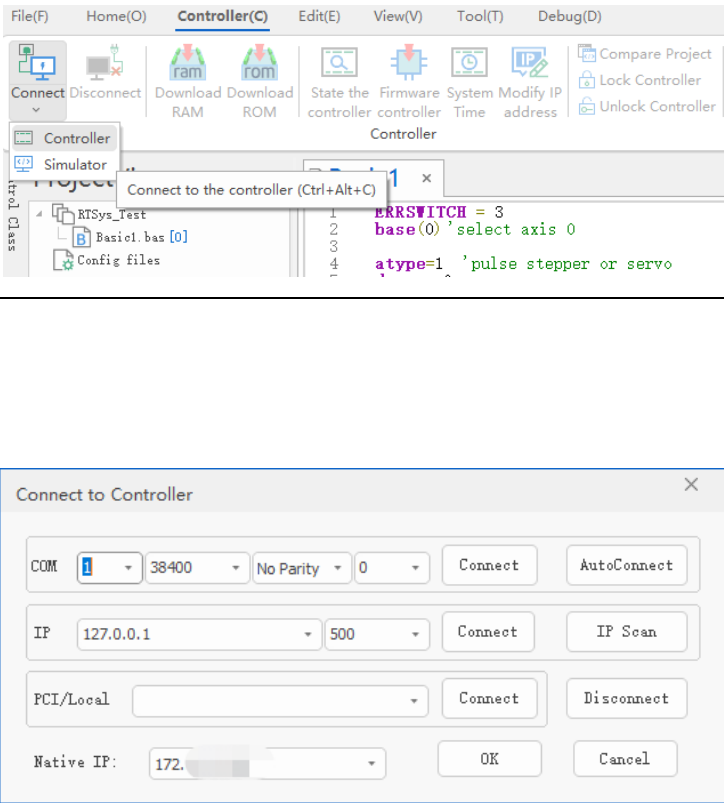
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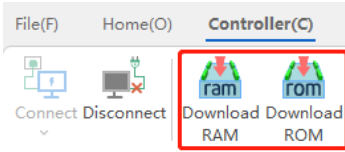
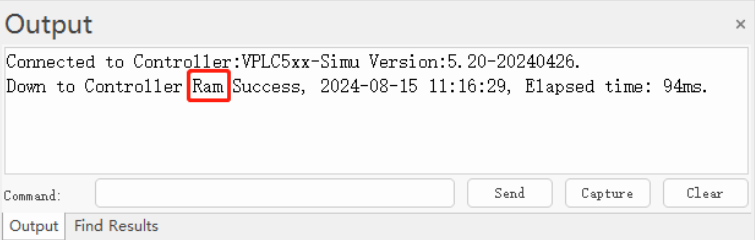
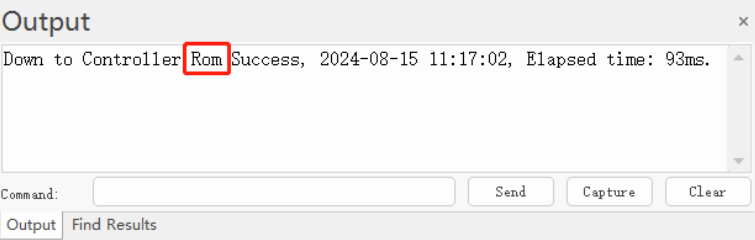
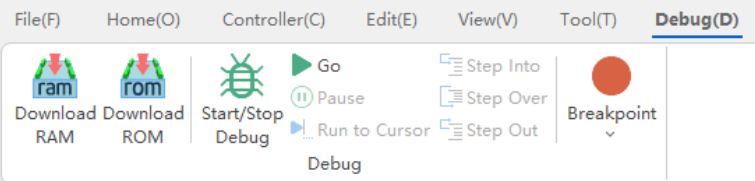
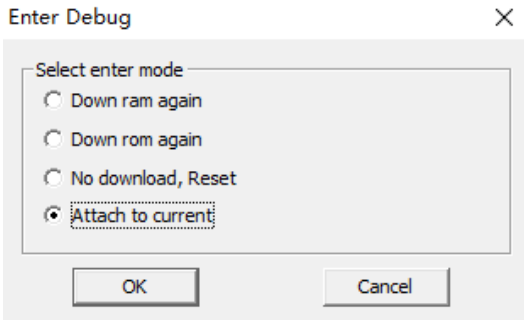
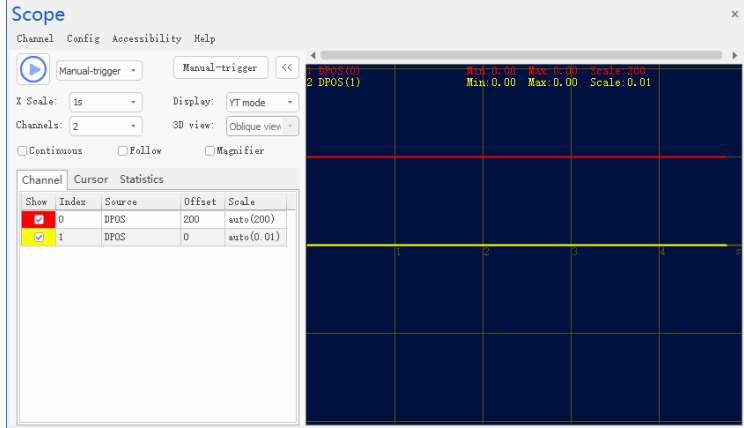
Name	Version No	Format	Size	Download
RTSys Development Software	V1.2.02	RAR	148MB	Download
RTSys User Manual V1.2.0	V1.2.0	PDF	5.33MB	Download
RTBasic Programming Manual	V1.1.0	PDF	18.3MB	Download
RTHMI Programming Manual	V1.2.0	PDF	7.23MB	Download
Quick Start	VQuick Start	ZIP	16.1MB	Download
ZVision Basic Programming Manual V1.3.0	V1.3.0	PDF	10.6MB	Download
ZPLC	V1.0	PDF	1.7M	Download

Step	Operations	Display Interface
1	Switch the Language: "Language" – "English", then there will pop	

	up one window, click OK, and restart it.	<u>Language Switch Video Showing:</u> E. How to Switch the Language Find “视图” (the fourth one in the above menu), then find the “语言”, choose English, restart RTSys. English RTSys will take effect when opened again. 
2	New Project: “File” – “New Project”, Save as window will pop up, then enter file name, save the project file with suffix “zpj.”.	 

3	New File: "File" – "New File", select file type to build, here select Basic, click "OK".	
4	Set Auto Run No.: right click the file, open task number setting window, enter task No., which can be any + value, no priority, but not the same.	

5	Save File: edit the program in program editing window, click "save", new built file will be saved under "zpj." project automatically. "Save all" means all files under this project will be saved.	
6	Connection: 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".	
7	Download Program into	● RAM: it will not save when power off. ● ROM: it will save data when power off, and when the program

	Controller: “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.	is connected to controller again, running according to task No.   
8	Debug: “Debug” – “Start/Stop Debug” to call “Task” and “Watch” window, because it was downloaded before, here select “Attach the current”.	 
9	Scope function: Click “View” – “Scope” to open oscilloscope. It can capture needed data, for debugging.	

Notes:

- 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**

4.2. Upgrade Controller Firmware

Firmware upgrade can be achieved by downloading zfm firmware package in RTSys. zfm file is the firmware upgrade package of controller, please select corresponding firmware because different models are with different packages, please contact manufacturer).

How to update:

- a. Open [ZDevelop](#) / [RTSys](#) software, then click "controller – connect", find PCI/LOCAL method, click "connect". If connected, there will be "Connected to Controller: PCIE464 Version: 4.93 – 20231220." In "output" window.
- b. Click "controller – state the controller", find basic info, then current software version can be checked.
- c. Click "controller – update firmware", current controller model and software version can be viewed.
- d. Click "browse", and select saved firmware file, click "update", then one window will pop up, please click "ok".
- e. After that, "connect to controller" window appears again, and please select "PCI/Local" again, and click "connect".
- f. When connection is successful, "firmware update" interface is shown. Now

system enters ZBIOS state, please click "update" again.

- g. When it is loaded, "firmware update" window disappears, now in output window, it shows "Update firmware to Controller Success".
- h. Do step a and step b again, check whether the firmware is updated or not.

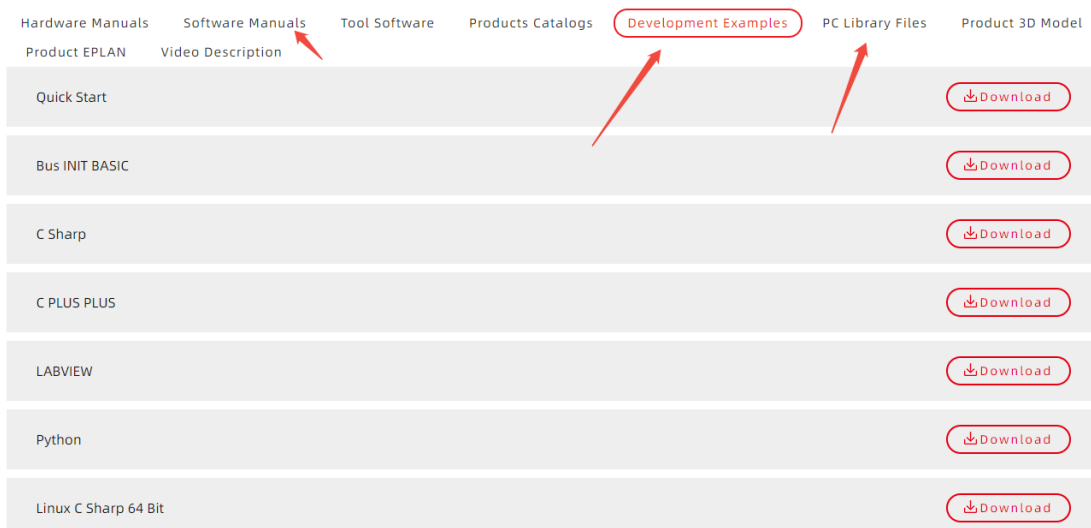
4.3. Program in Host-Computer by PC Languages

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](#)".

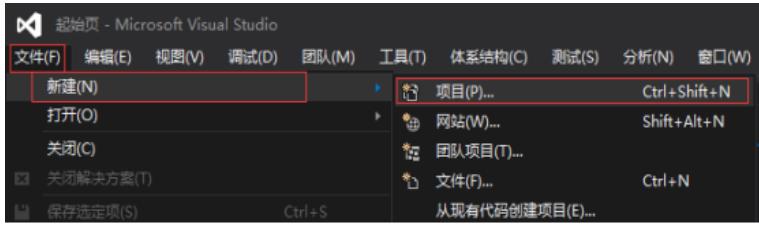
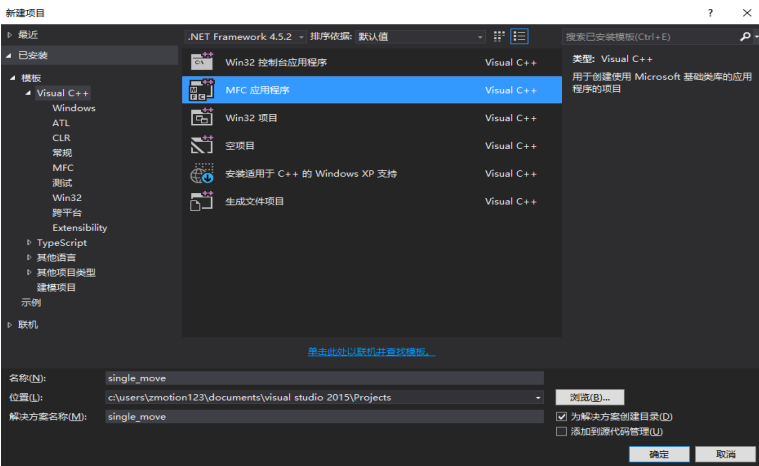
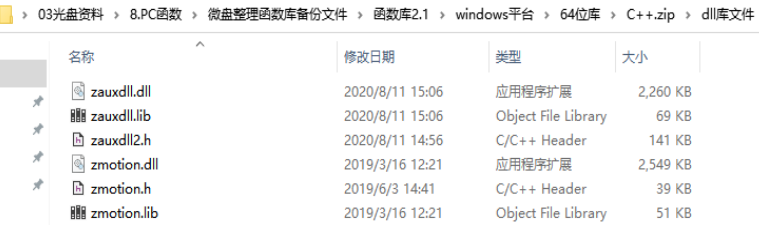


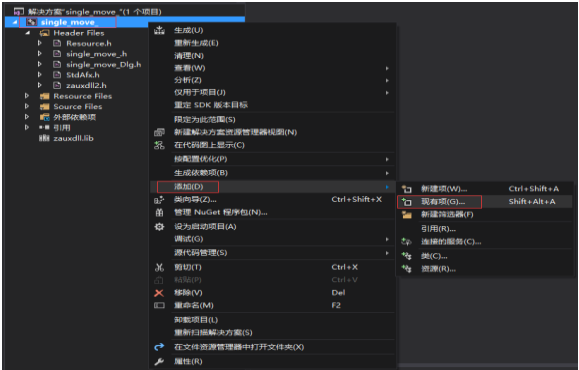
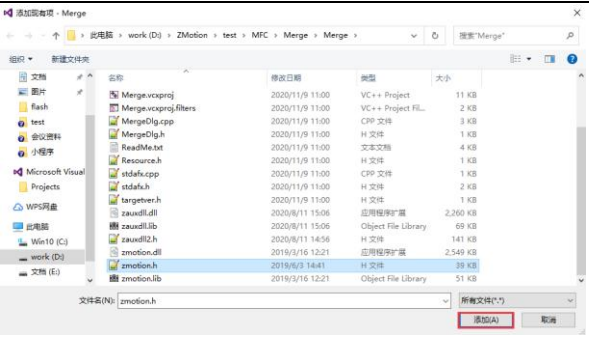
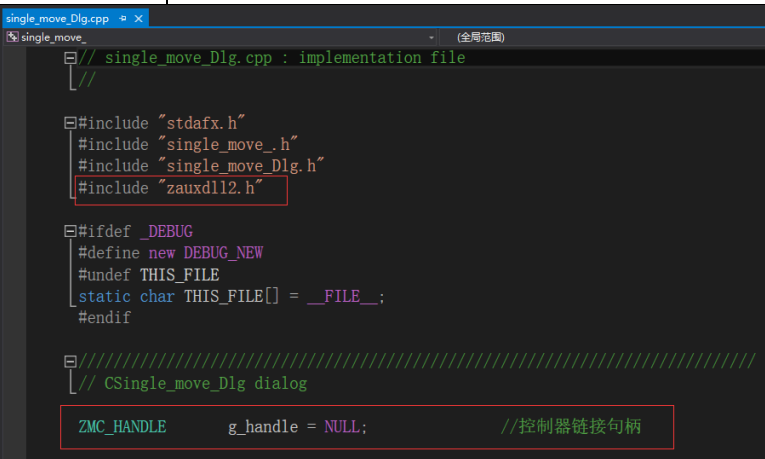
The program developed using the PC software cannot be downloaded to the controller, and it is connected to the controller through the dll dynamic library. The dll library needs to be added to the header file and declared during development.

- Get PC library file, example: https://www.zmotionglobal.com/download_list_17.html



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: <code>zauxdll.lib</code>, <code>zmotion.lib</code> Related header files: <code>zauxdll2.h</code>, <code>zmotion.h</code>	1) Right-click the header file first, and then select: "Add" → "Existing Item". 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.		

Chapter V Operation and Maintain

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

5.1. Regular Inspection and Maintenance

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

Check item	Check content	Inspection standards
power supply	Check whether the voltage is rated	DC 24V (-5%~5%)
surroundings	Whether the ambient temperature is within the specified range (when installed in the cabinet, the temperature inside the cabinet is the ambient temperature)	-10°C - 55°C
	Whether the ambient humidity is within the specified range (when installed in the cabinet, the humidity in the cabinet is the ambient humidity)	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	No

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

5.2. Common Problems & Solutions

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 invalid.	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.
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 RTSys 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.