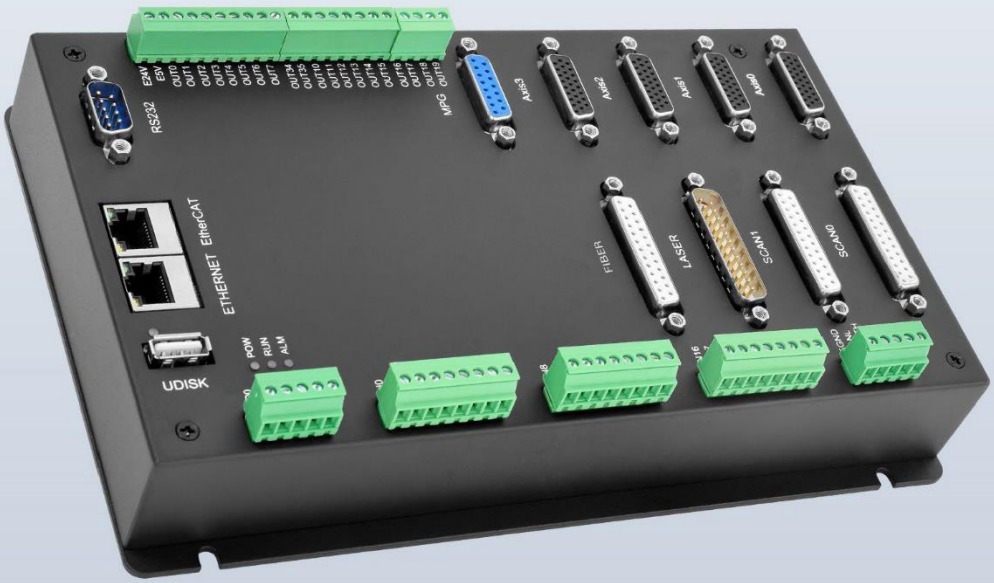
Zmotion®
正运动技术

做更好用的运动控制，智造美好生活
Better Motion Control, Smarter Life

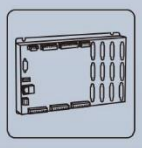
EtherCAT Laser Galvanometer Motion Controller

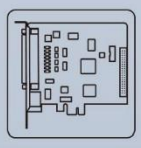
ZMC408SCAN-V22

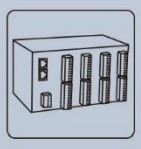


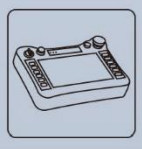
This manual is mainly for ZMC408SCAN-V22, ZMC408SCAN-V22-IFOV.


Vision Motion Controller


Motion Controller


Motion Control Card


IO Expanion Module


HMI

Statement

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

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

➢ Notes

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

■ Danger

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

■ Notes

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

Content

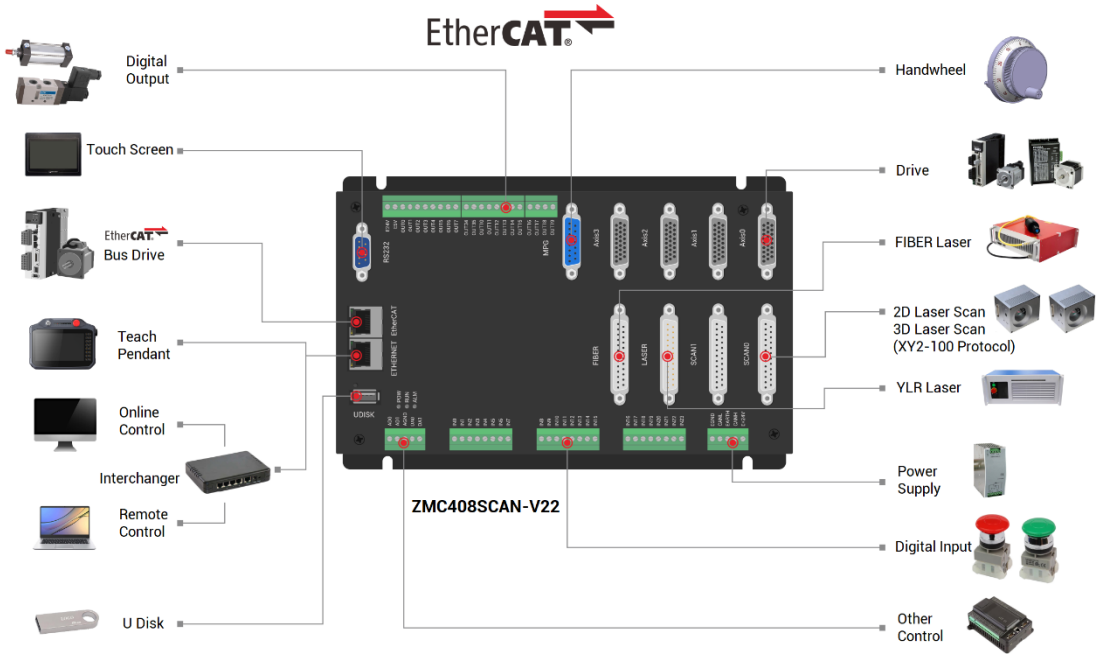
Chapter I Production Information

ZMC408SCAN-V22 is a kind of high-performance fieldbus dual-SCAN motion controller launched by Zmotion. It integrates 2 100M ethernet ports, and it supports EtherCAT, ETHERNET, CAN, RS232, RS485, 24 general digital inputs, 20 general digital outputs, 2 general analog inputs, 2 general analog outputs, 4 local differential pulse axes, 1 MPG handwheel encoder interface, 2 SCAN interfaces with feedback, 1 LASER interface (specialized for laser), and 1 FIBER laser interface.

ZMC408SCAN-V22 bus controller supports EtherCAT bus connection, the fastest refresh cycle is 500μs. It supports maximum 16-axis motion control, then it achieves linear interpolation, any circular interpolation, space arc, helical interpolation, electronic cam, electronic gear, synchronous follow, virtual axis setting, etc. And real-time motion control can be achieved through optimized network communication protocol.

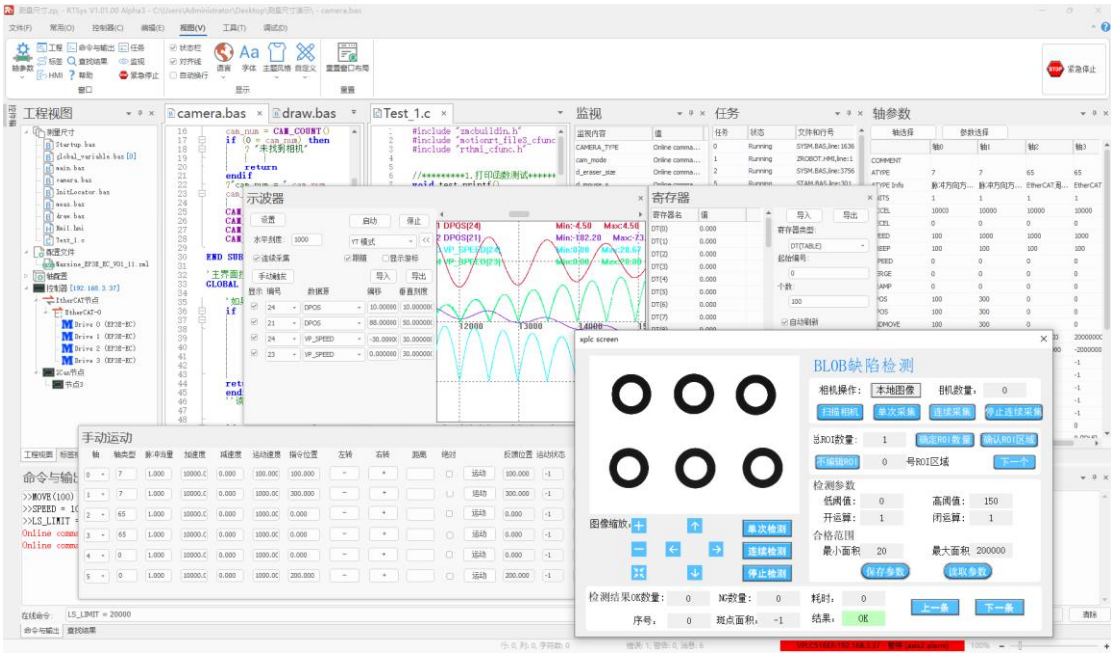
One Computer can link with up to 256 ZMC controllers at the same time.

1.1. System Connection



ZMC408SCAN-V22 supports ETHERNET, EtherCAT, USB, CAN, RS485, and RS232 communication interfaces. And it can connect to expansion modules to extend digital IO, analog IO, or motion axis by CAN or EtherCAT.

1.2. Programming



ZMC408SCAN-V22 can be debugged through RTSys development environment, which is very convenient to program, compile, and debug. And RTSys connects to controller through RS232, RS485, ETHERNET.

What's more, application program can be developed through VC, VB, VS, C++Builder, C#, etc., while debugging, it also can connect RTSys and controller at the same time. Please note, while running, it needs dynamic library Zmotion.dll.

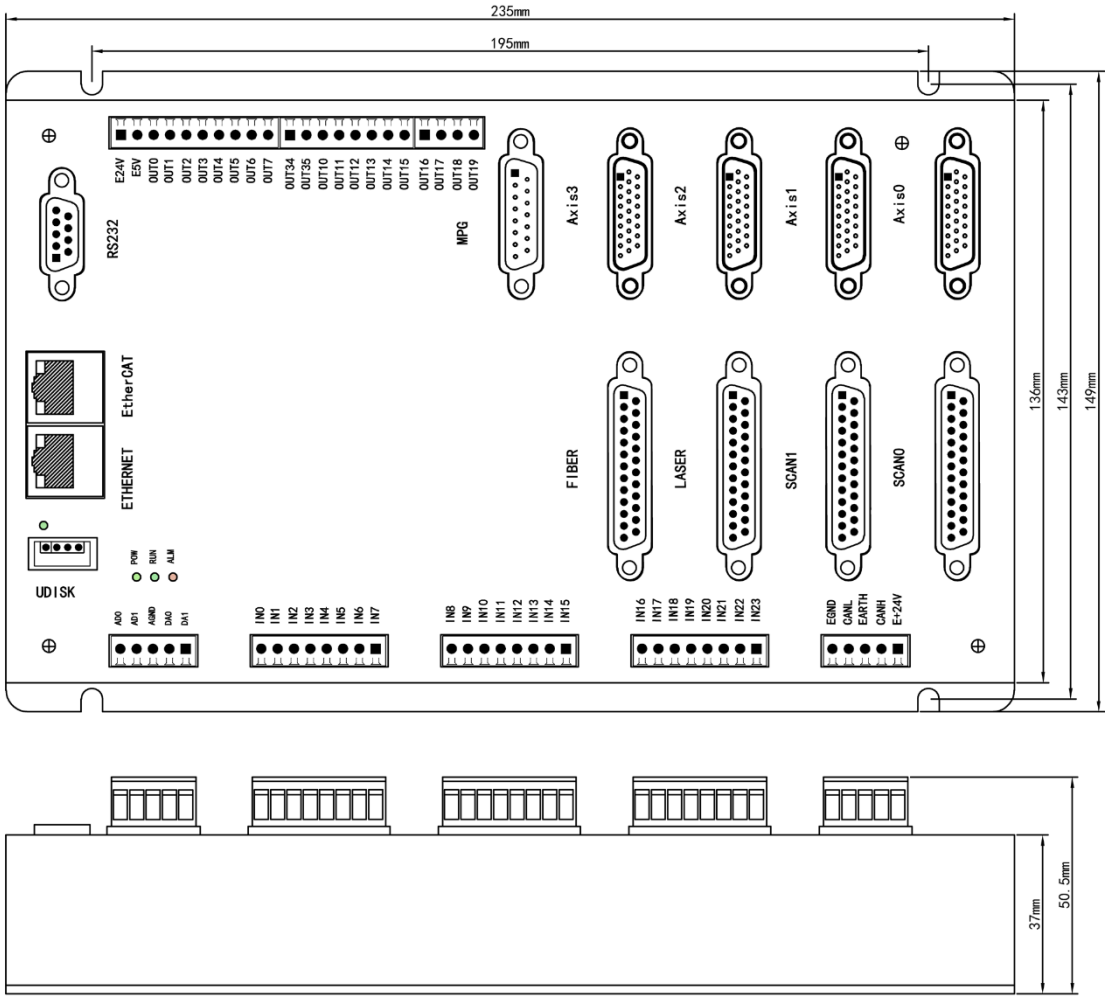
RTSys supports Chinese and English, more details, please refer to Chapter IV.

1.3. Function Features

- Motion control of up to 16 axes. (EtherCAT 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 leakage digital inputs, among them, 4 channels are high-speed inputs, 20 channels are low-speed inputs. Then, these 4 high-speed inputs can be configured as latch signals.
- There are 20 leakage 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 for storage.
- 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 supports galvanometer feedback.
- 1 “LASER” laser interface supports IPG, YLR, YLS and other laser power supplies.
- 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 Basic.
- A variety of procedure encryption methods to protect the intellectual property rights of customers.
- Support power failure detection and power failure storage.

1.4. Hardware Installment



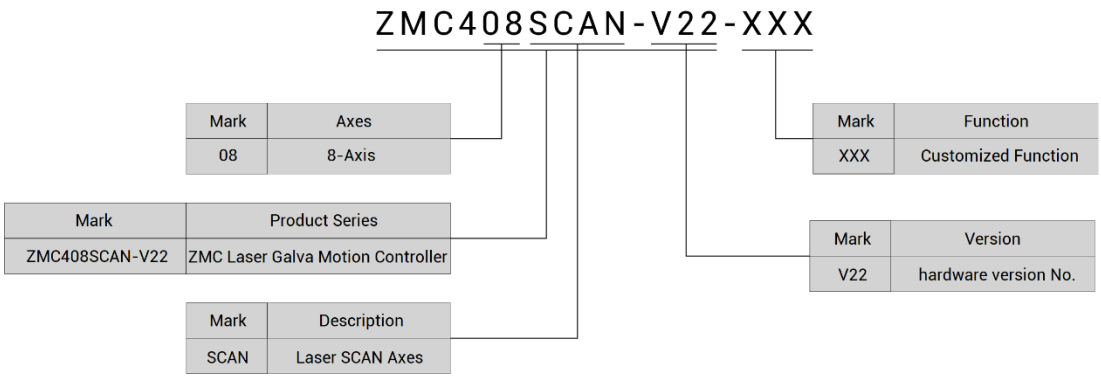
→ Unit: mm → Mounting Hole Diameter 4.5mm

Chapter II Product Specification

2.1. Basic Specification

Item	Description
Model	ZMC408SCAN-V22
Axes	8 (4 pulse axes + 4 SCAN axes)
Max Extended Axes	16 (the number of axes relates to system period and galvanometer period)
Type of basic axes	EtherCAT/local pulse axes, SCAN axes
Internal IO	24 inputs and 20 outputs (with overcurrent protection), there are another 2 general inputs and 2 general outputs on each axis terminal, which can do alarm, enable, on-position, error clearing, etc.
Max extended IOs	Up to 4096 inputs and 4096 outputs
PWM	4 (general digital outputs OUT0~OUT3) + 4 (specialized laser interface, OUT8, OUT9, OUT44, OUT45)
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 relates to system cycle)
Array Size	2,560,000
Procedure space	128MByte
Flash Space	256MByte
Power Input	24V DC input, IO ports are not included.
Communication	RS232, RS485, Ethernet, USB drive, CAN, EtherCAT
Size	235mm*149mm*37mm

2.2. Nameplate & Models

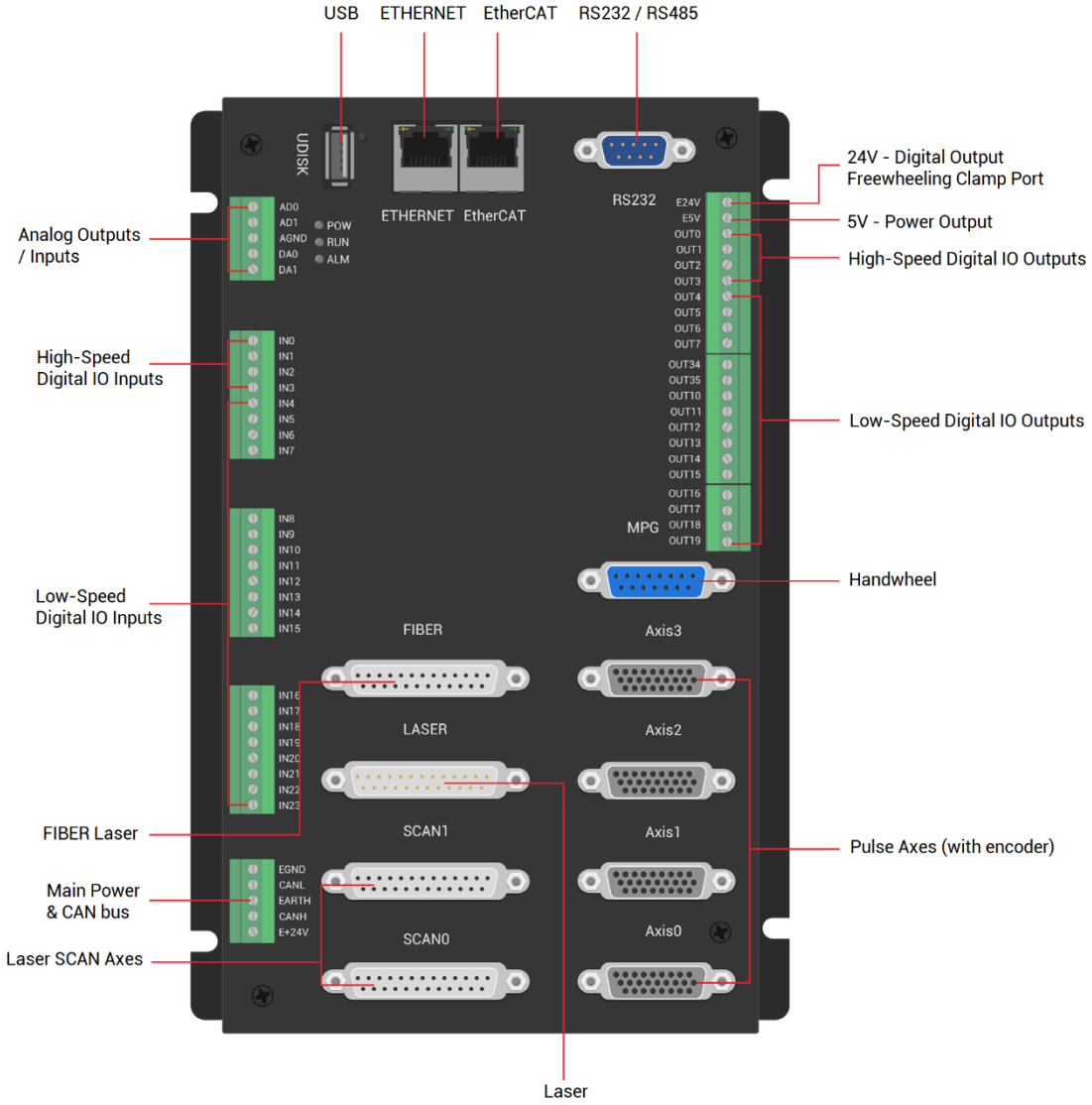


Model	Description
ZMC408SCAN-V22	8 axes: 4 pulse axes + 4 scan axes Motion control functions: point motion (jog), electronic cam, linear, circular, continuous interpolation, robot algorithm
ZMC408SCAN-4-V22	4 axes: 2 pulse axes + 2 scan axes Motion control functions: point motion (jog), electronic cam, linear, circular, continuous interpolation, robot algorithm
ZMC408SCAN-V22-IFOV	Motion control functions: point motion (jog), electronic cam, linear, circular, continuous interpolation, robot algorithm + “unlimited view linkage library".

2.3. Usage Environment

Item	Parameters
Work Temperature	0 – 60°C (32°F - 140°F)
Work Relative Humidity	5%-90% non-condensing

2.4. Interface Definition



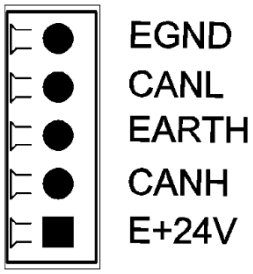
→ Interface Description

Mark	Interface	Number	Description
POW	State Indication Led	1	Indicate power state: it is ON when power is connected.
RUN		1	Indicate motion state: it is ON when it runs normally.
ALM		1	Indicate error: it is ON when it runs abnormally.
RS232	RS232 serial port (port0)	1	Use MODBUS_RTU protocol
RS485	RS485 serial port (port1)	1	Use MODBUS_RTU protocol

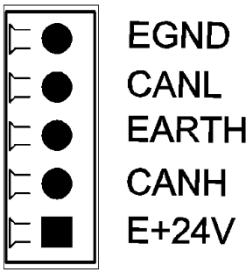
EtherCAT	EtherCAT bus interface	1	EtherCAT bus interface, connect to EtherCAT bus drive and EtherCAT bus expansion modules
ETHERNET	Network port	1	Use MODBUS_TCP protocol, expand the number of network ports through the interchanger, and the number of net port channels can be checked through "?*port" 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 other standard CAN devices.
IN	Digital IO input port	24	NPN type, the power is supplied by internal 24V power supply. There are 4 high-speed inputs, and IN0-3 have the latch function.
OUT	Digital IO output port	20	NPN type, the power is supplied by internal 24V power supply. There are 4 high-speed outputs, OUT0-3 support PWM, precision output, 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	Laser power control interface supports IPG, YLR, YLS and other types of laser powers.
FIBER	FIBER laser interface	1	For FIBER type lasers.

2.5. Power & CAN Interfaces

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.



2.5.1. Interface 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 side L
	EARTH	Earthing	Protection
	CHNH	Input/output	CAN communication side H
	E+24V	Input	Positive (+) terminal of power input

2.5.2. Power Specification

→ Specification

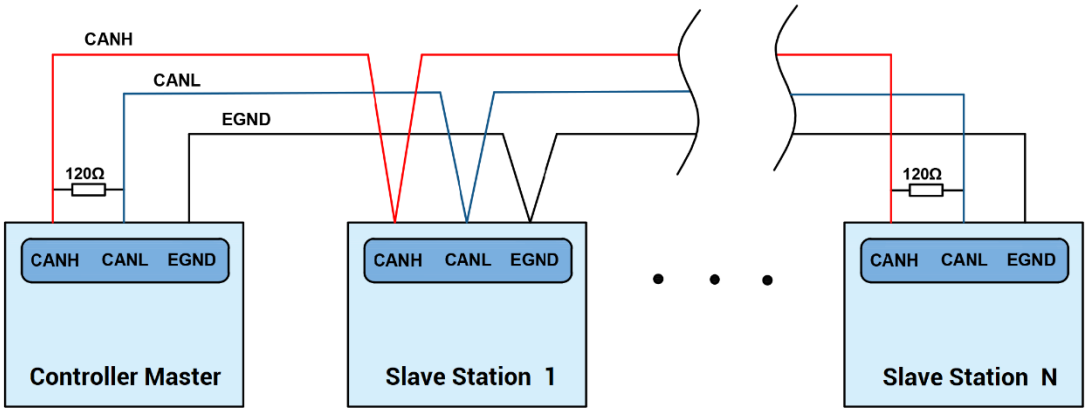
Item	Description
Voltage	DC24V (-5% ~ 5 &)
The current to open	≤0.5A
The current to work	≤0.4A

Anti-reverse connection	YES
Overcurrent Protection	YES

2.5.3. CAN Communication 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 30m is recommended.

2.5.4. CAN Communication Wiring



→ 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.

2.5.5. 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 RTSys;

(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 "RTSys/Controller/State the Controller/Communication Info" to view the CAN status intuitively, and refer to the “Basic Programming Manual" for details.

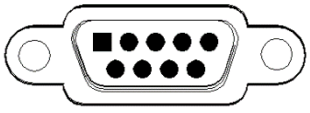
(4) Correctly set the "address" and "speed" of the slave station expansion module according to the manual of the slave station.

(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.

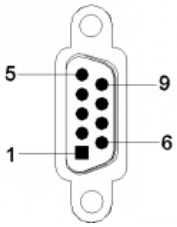
2.6. RS232/RS485 Serial Port

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



RS232

2.6.1. Interface Definition

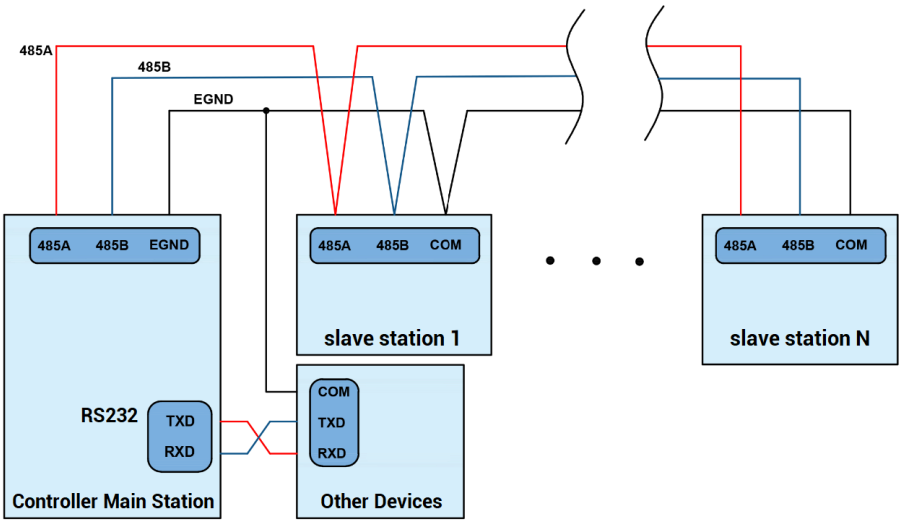
Terminal	PIN	Name	Type	Function
	1, 6, 8	NC	Spare	Reserved
	2	232RXD	Input	RS232 (port 0) signal, receive data
	3	232TXD	Output	RS232 (port 0) signal, send data
	4	485A	Input/ Output	RS485 (port1) signal A/+
	5	EGND	Output	Negative pole output of 5V power, and output for the public end
	7	485B	Input/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

2.6.2. Communication Specification

Item	RS232 (port0)	RS485 (port1)
Maximum Communication Rate	115200bps	115200bps
Terminal Resistor	No	No
Topology Structure	Connect correspondingly	Daisy chain structure

	(1 to 1)	
The number of nodes can be extended	1	127
Communication Distance	The Longer communication distance is, the lower communication rate is, maximum 5m is recommended.	The Longer communication distance is, the lower communication rate is, maximum 30m is recommended.

2.6.3. 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.

2.6.4. 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 RTSys.

(3) Please use the "ADDRESS" and "SETCOM" commands to set and view the protocol station number and configured parameters, see "Basic 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.

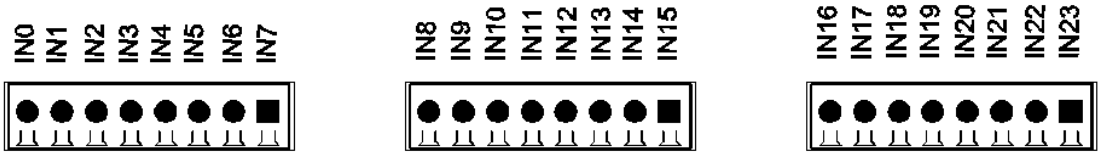
(5) When all is configured, it can start to do communicating.

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

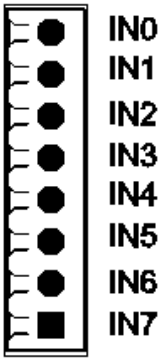
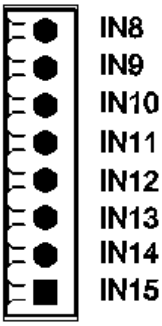
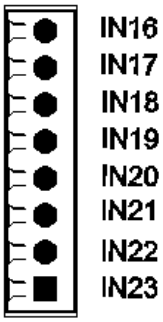
```
CAN communication settings:
CANIO_ADDRESS = 32, CANIO_ENABLE = 1
ZCAN Master
CAN baud: 500KBPS
CAN enable: ON

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
```

2.7. IN Digital Inputs

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.



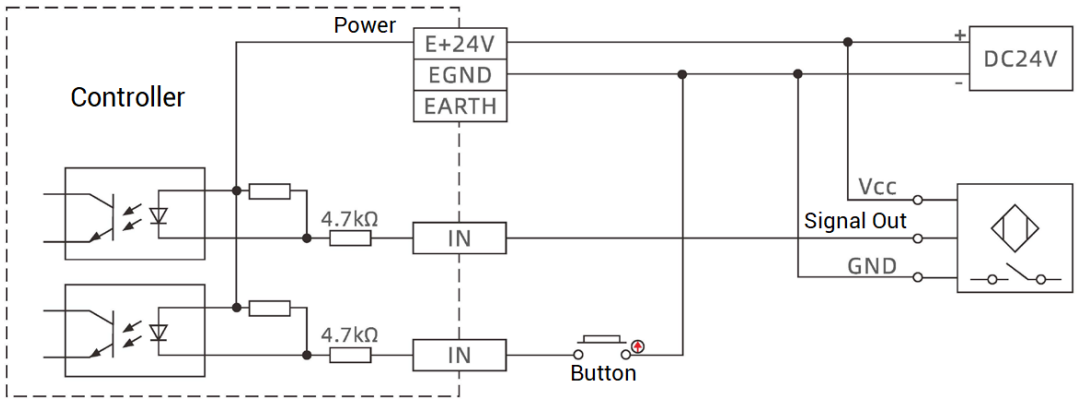
2.7.1. Interface Definition

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

2.7.2. Digital Input Specification & Wiring

Item	High-Speed Input (IN0-3)	Low-Speed Input (IN4-23)
Input mode	NPN type, the input is triggered by 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.		

2.7.3. Wiring Reference



- 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.

2.7.4. Basic Usage Method

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

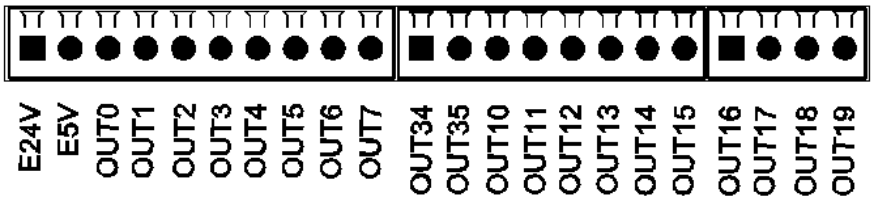
(2) After powered on, please select any one interface among the three interfaces ETHERNET, RS232 and RS485 to connect to RTSys.

(3) State values of relative input ports can be read directly through "IN" command, also, it can be read through "RTSys/Tool/In". Please refer to "Basic" 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.

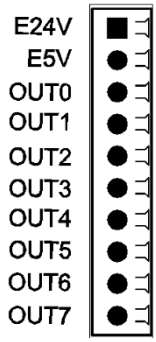
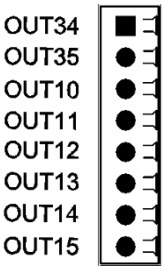
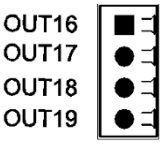
2.8. OUT Digital Outputs

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.



2.8.1. Interface Definition

Terminal	Name	Type	Function 1	Function 2	Function 3
	E24V	/	Output freewheeling clamp port	/	/
	E5V	/	5V power output, max is 300mA	/	/
	OUT0	NPN type, high-	Output 0	PWM 0	High-speed Comparison Out 0
	OUT1		Output 1	PWM 1	High-speed

		speed output			Comparison Out 1
	OUT2		Output 2	PWM 2	High-speed Comparison Out 2
	OUT3		Output 3	PWM 3	High-speed Comparison Out 3
	OUT4	NPN type, low-speed output	Output 4	/	
	OUT5		Output 5	/	
	OUT6		Output 6	/	
	OUT7		Output 7	/	
	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	NPN, low-speed output	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) support high-speed precision output and are allocated to the laser power interface.

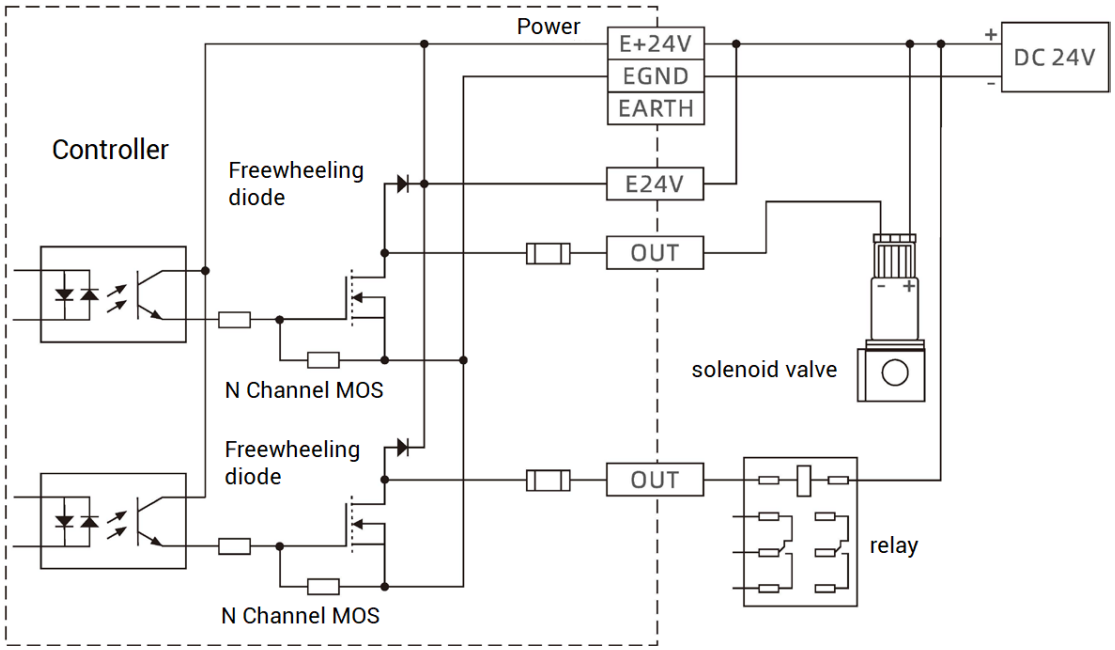
2.8.2. Digital Output Specification

Item	High Speed Output (OUT0-3)	Low Speed Output (OUT4-7, 10-19, 34, 35)
Output mode	NPN type, it is 0V when outputs	
Frequency	< 400kHz	< 8kHz
Voltage level	Load power ≤ 30V	Load power ≤ 30V
Max output current	+300mA/point	+300mA/point
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.

2.8.3. Wiring Reference



→ Wiring Note:

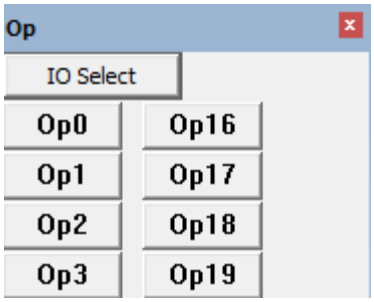
- The wiring principle of high-speed digital outputs OUT (0-3) and low-speed digital outputs OUT (4-7, 10-19, 34, 35) is shown in the figure above. The external signal receiving end can be an optocoupler or a relay or solenoid valve, all can be connected as long as the input current does not exceed 300mA.
- 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.

2.8.4. 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 RTSys.

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

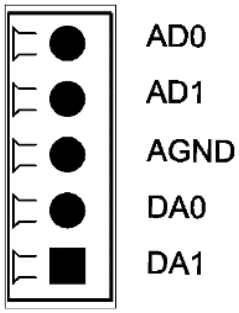


(4) The PWM function, set the frequency and duty cycle through "PWM_FREQ" and "PWM_DUTY". Please refer to Basic for details.

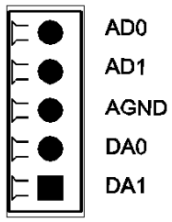
(5) Hardware comparison output can be set and opened through "HW_PSWITCH2". Please refer to Basic for details.

2.9. AD/DA Analog Input/Output

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



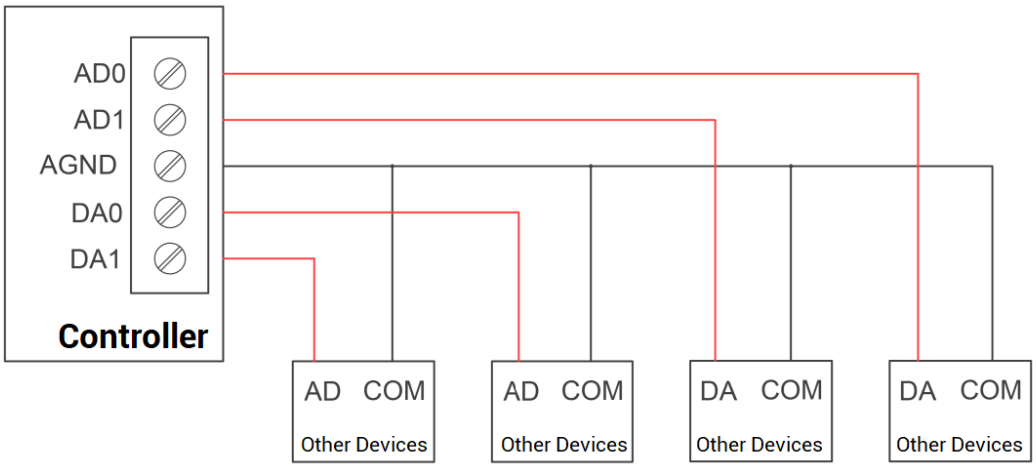
2.9.1. Interface Definition

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)

2.9.2. AD/DA Analog Input/Output 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	≤300Ω (voltage input impedance)	≥1KΩ (voltage output load)

2.9.3. Wiring Reference



- 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.

2.9.4. Basic Usage Method

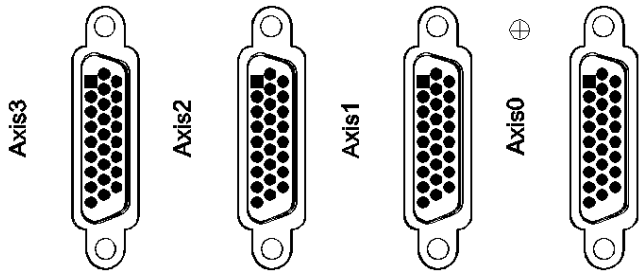
(1) Please follow the above wiring instructions to wiring correctly.

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

(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 "RTSys/Tool/AD/DA". Please refer to "Basic" for details.

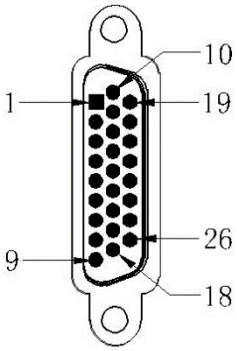
2.10. AXIS Axis Interface

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



2.10.1. 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.

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

Pulse Axis No.	Related IN (PIN2)	Related OUT (PIN3)	Related OUT (PIN15)	Related IN (PIN16)
AXIS1	IN24	OUT20	OUT24	IN28
AXIS2	IN25	OUT21	OUT25	IN29
AXIS3	IN26	OUT22	OUT26	IN31
AXIS4	IN27	OUT23	OUT27	IN31

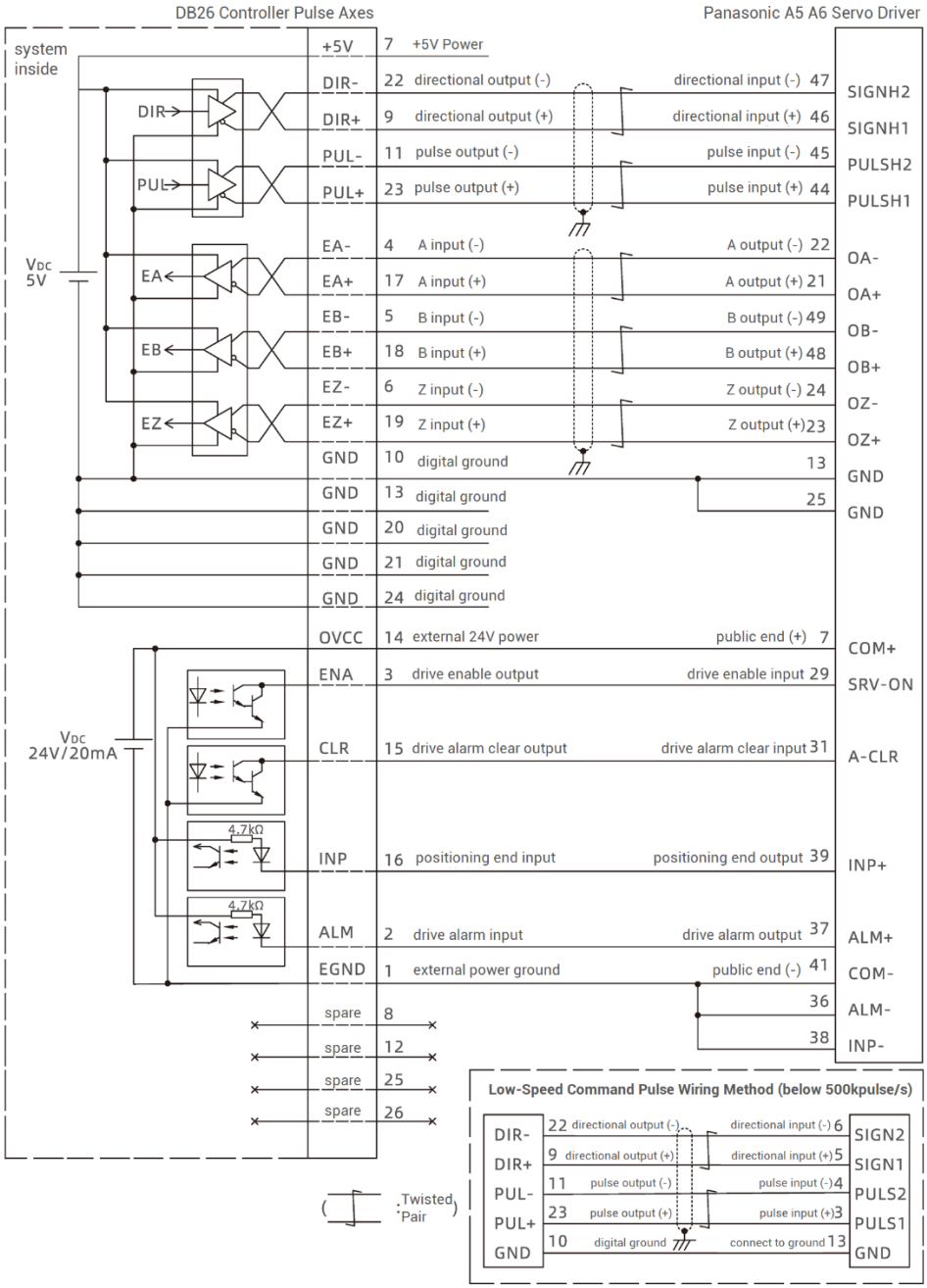
2.10.2. Signal Specification

Item	Description
Pulse / Direction (PUL/DIR) Signal type	Differential output signal
Pulse / Direction (PUL/DIR) Signal Voltage Range	0-5V
Pulse / Direction (PUL/DIR) Signal Max Velocity	10Mbps
Encoder (EA/EB/EZ) Signal Voltage Range	0-5V
Encoder (EA/EB/EZ) Signal Max Velocity	10Mbps
Input Method (IN24-31)	Leakage type, it is triggered by low level
Input Frequency (IN24-31)	< 5kHz
Input Impedance (IN24-31)	6.8KΩ
Input Voltage Level (IN24-31)	DC24V
Input ON Voltage (IN24-31)	<10.5V
Input OFF Voltage (IN24-31)	>10.7V
Min Input Current (IN24-31)	1.8mA
Max Input Current (IN24-31)	4mA
Isolation Method (IN24-31)	optoelectronic isolation
Output method (OUT20-27)	NPN, it is 0V when outputs
Output Frequency (OUT20-27)	<8kHz
Max Output Current (OUT20-27)	300mA

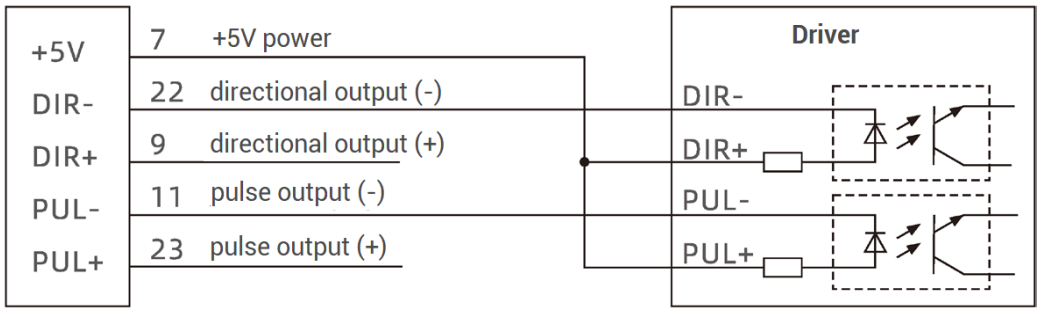
Overcurrent protection (OUT20-27)		NO
Isolation Method (OUT20-27)		optoelectronic isolation
5V Power Supply (+5V, GND)	Max Output Current	50mA
24V Power Supply (OVCC, GND)	Max Output Current	50mA

2.10.3. Wiring Reference

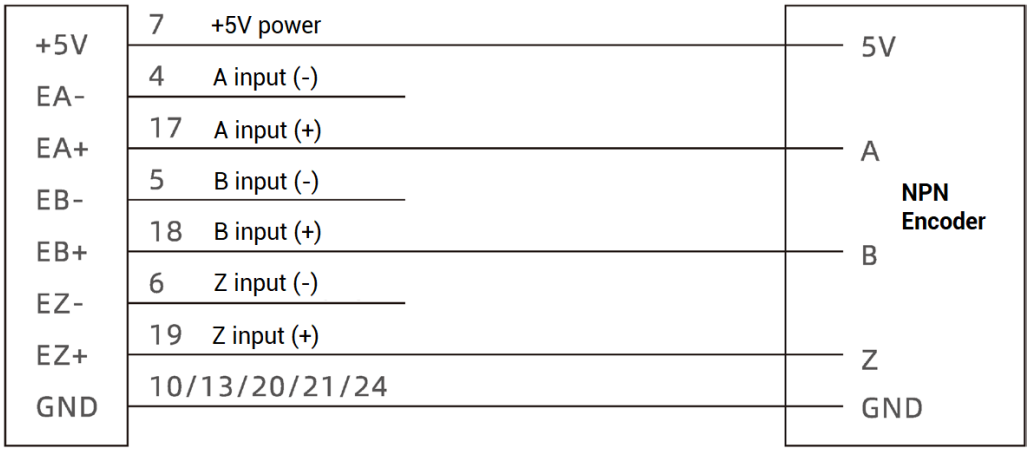
→ Wiring with Panasonic A5/A6 Servo Driver:



→ **Single-Ended Pulse-Axis Wiring:**



→ **Single-Ended Encoder-Axis Wiring:**



● 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.

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

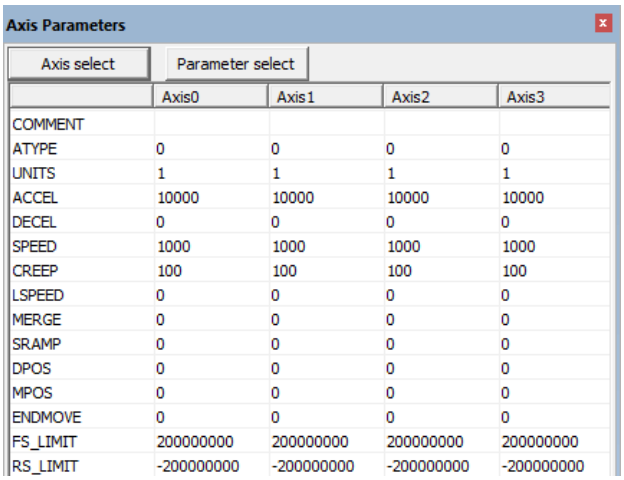
2.10.4. Basic Usage Method

(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 RTSys.

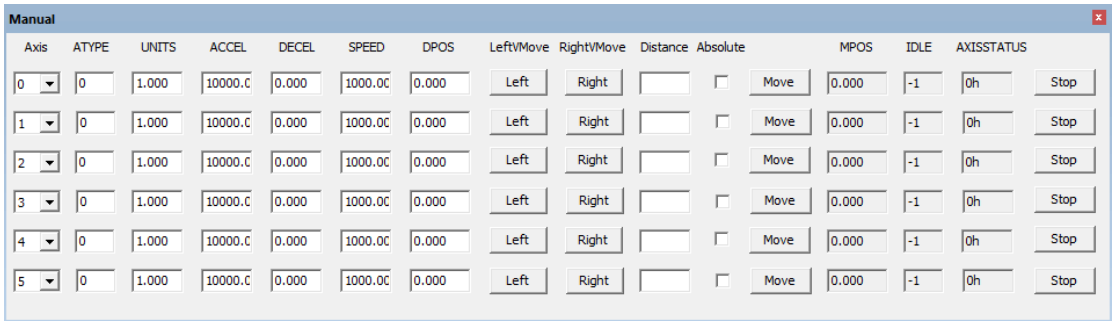
(3) Set axis parameters, such as, ATYPE, UNITS, SPEED, ACCEL, FWD_IN, REV_IN, etc.

(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 “Basic”, or see “RTSys/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”.



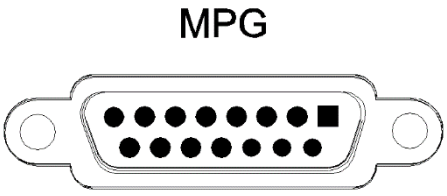
Refer to BASIC Routine:

```
BASE(0,1)              'select axis 0 and axis 1
ATYPE = 1,1            'set axis 0 and axis 1 as pulse axes
UNITS = 100,100        'set pulse amount as 100 pulses
SPEED = 10,10          'set axis speed as 10*100 pulse/s
ACCEL = 1000,1000      'set axis acceleration as 1000*100 pulse/s/s
```

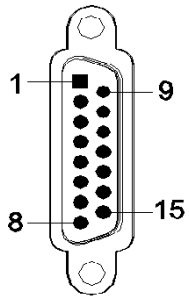
```
FWD_IN = -1,-1          'prohibit using axis positive hardware position limit
REV_IN = -1,-1          'prohibit using axis negative hardware position limit
MOVE(10) AXIS(0)        'axis 0 moves distance of 10*1000 pulses in positive
MOVE(-20) AXIS(0)       'axis 0 moves distance of 20*1000 pulses in negative
```

2.11. MPG Handwheel Interface

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



2.11.1. 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).			

2.11.2. MPG Handwheel Interface Specification

→ Specification

Item	IN (32-43)
Mode (input)	NPN, it is triggered when 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 supply (H-5V, EGND) max output current	100mA

2.11.3. 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 RTSys.

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(8)                           'handwheel interface initial axis No. is 8 (invalid)
ATYPE(8) = 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
```

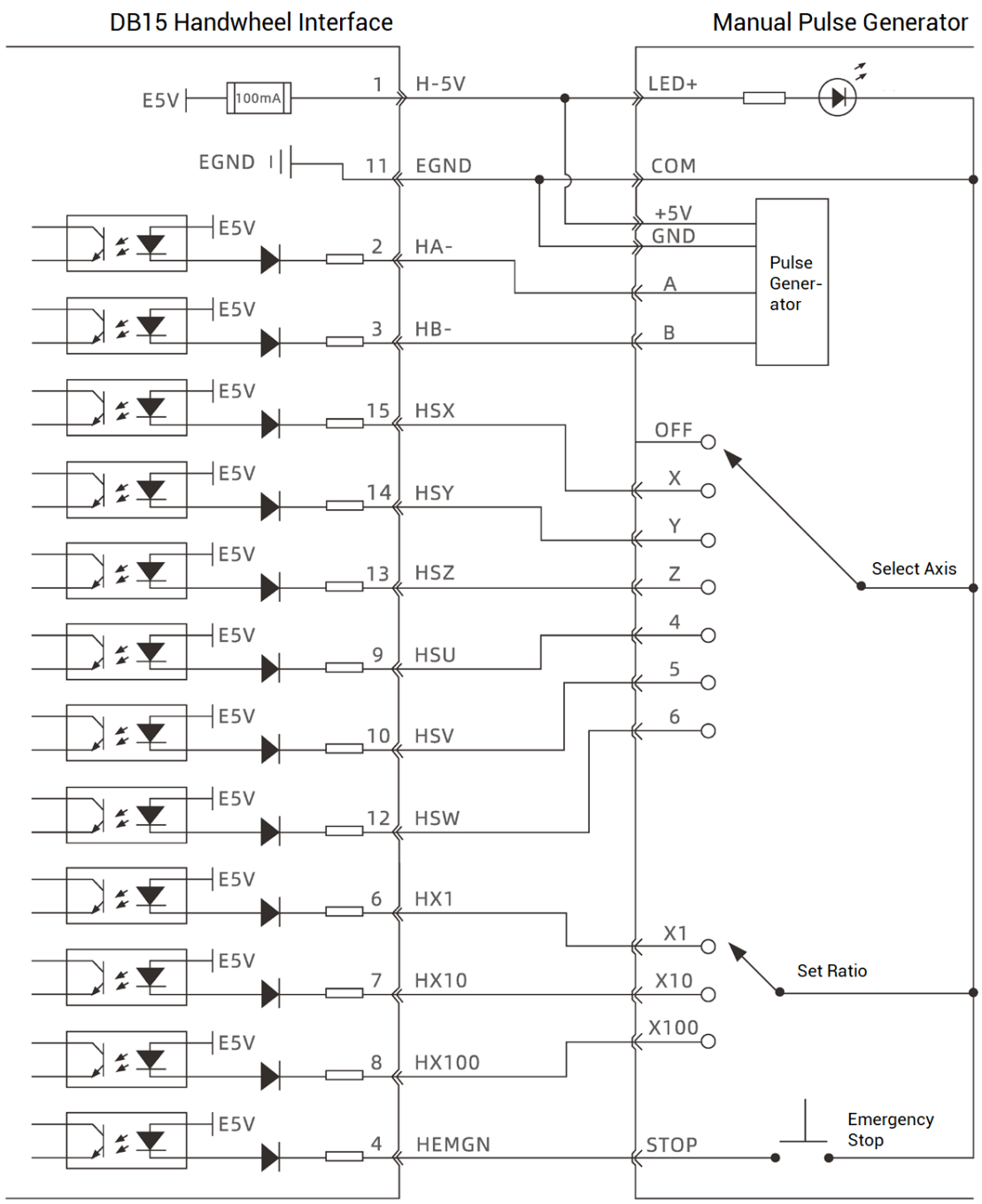
4. Configure IO: assign axis selection (HSX, HSY, HSZ, HSU) and ratio (HX1, HX10, HX100) and emergency stop (HEMGN) functions as required. These signals are essentially digital input signals with fixed numbers but no fixed functions. It needs RTSys to develop (the axis selection is the connected axis 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(6) = 0                      'restore axis type of axis 8
ATYPE(8) = 0                      'restore default handwheel axis type
AXIS_ADDRESS(10) = (-1<<16)+8 '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
```

2.11.4. Wiring Reference

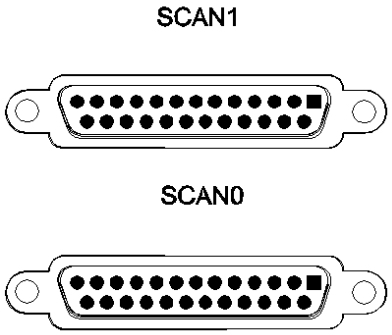


Notes:

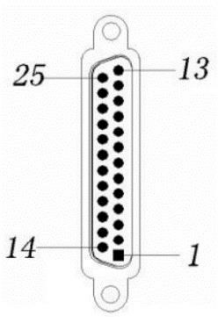
- The wiring principle of handwheel encoder axis interface is shown above, please connect carefully due to diversified handwheel designs.
- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.

2.12. SCAN Interface

This product provides a special interface for the local handwheel encoder axis, which is a double-row standard DB25 female seat.



2.12.1. Interface Definition

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

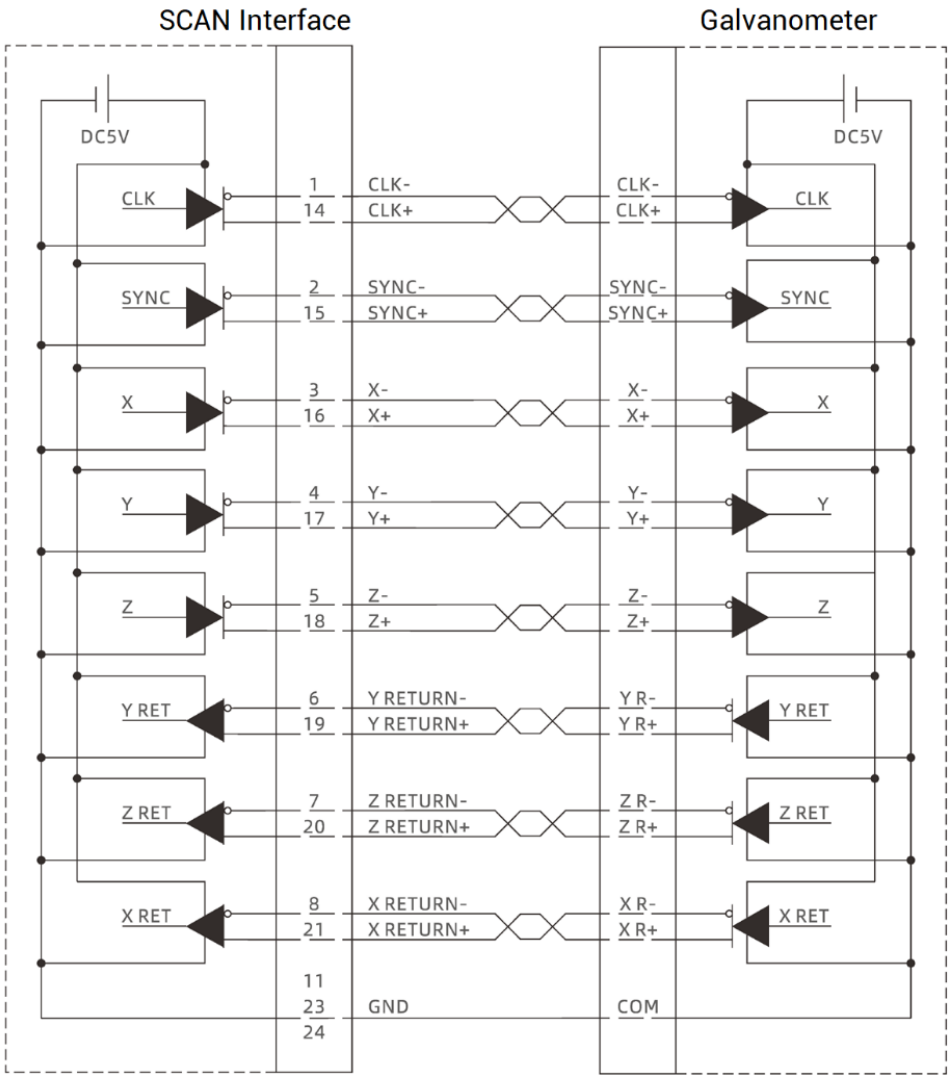
Attention:

1. 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.
2. When in 3D SCAN (default), SCAN0 relates to Axis 4, Axis 5 and Axis 8 of 3D galvanometer.

2.12.2. Signal 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	

2.12.3. 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.

2.12.4. Basic Usage Method

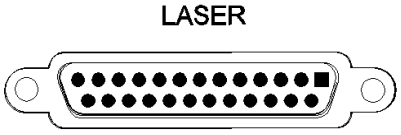
- Please wiring correctly according to above wiring description.
- Please select one interface among EtherNET, RS232 (default parameters can be directly connected) and RS485 (default parameters can be connected directly, need to use adapter head for hardware) to connect RTSys.
- Set fundamental motion parameters, such as, ATYPE, UNITS, etc. (preset Units as 65536 / the max galvanometer breadth).
- 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 "RTSys/View/axis parameter".
- Through "RTSys/View/Manual", relative motions can be operated and controller.

Refer to BASIC routine:

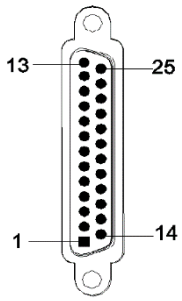
```
BASE (4, 5)                 'select axis Scan 0, Scan 1, they relate to axis 6 and axis 7
ATYPE = 21, 21              'select axis 4 and axis 5 as galvanometer axes type
UNITS = 200, 200            'set pulse amount of axis 4, 5 as the unit of 200 bit
DPOS = 0, 0
FORCE_SPEED = 100, 100      'set axis speed as 100*200 bit/s
MOVESCANABS(0, 0)           'galvanometer moves to center origin position
MOVESCAN(50) Axis(4)        'axis 4 moves 50*200 bits forward
MOVESCAN (-50) Axis(5)      'axis 5 moves 50*200 bits reverse
```

2.13. LASER

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



2.13.1. Interface Definition

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

Attention:

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

2.13.2. Signal 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

2.13.3. Basic Usage Method

- Please wiring correctly according to above wiring description.
- 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 RTSys.
- Through "RTSys/In, Op window to operate and watch relative IOs.
- Through "RTSys/AD/DA window to operate and watch relative analog inputs and outputs.
- In RTSys, send online command "PWM_FREQ (PWM No.) = frequency, PWM_DUTY (PWM No.) = duty cycle.

Refer to BASIC routine:

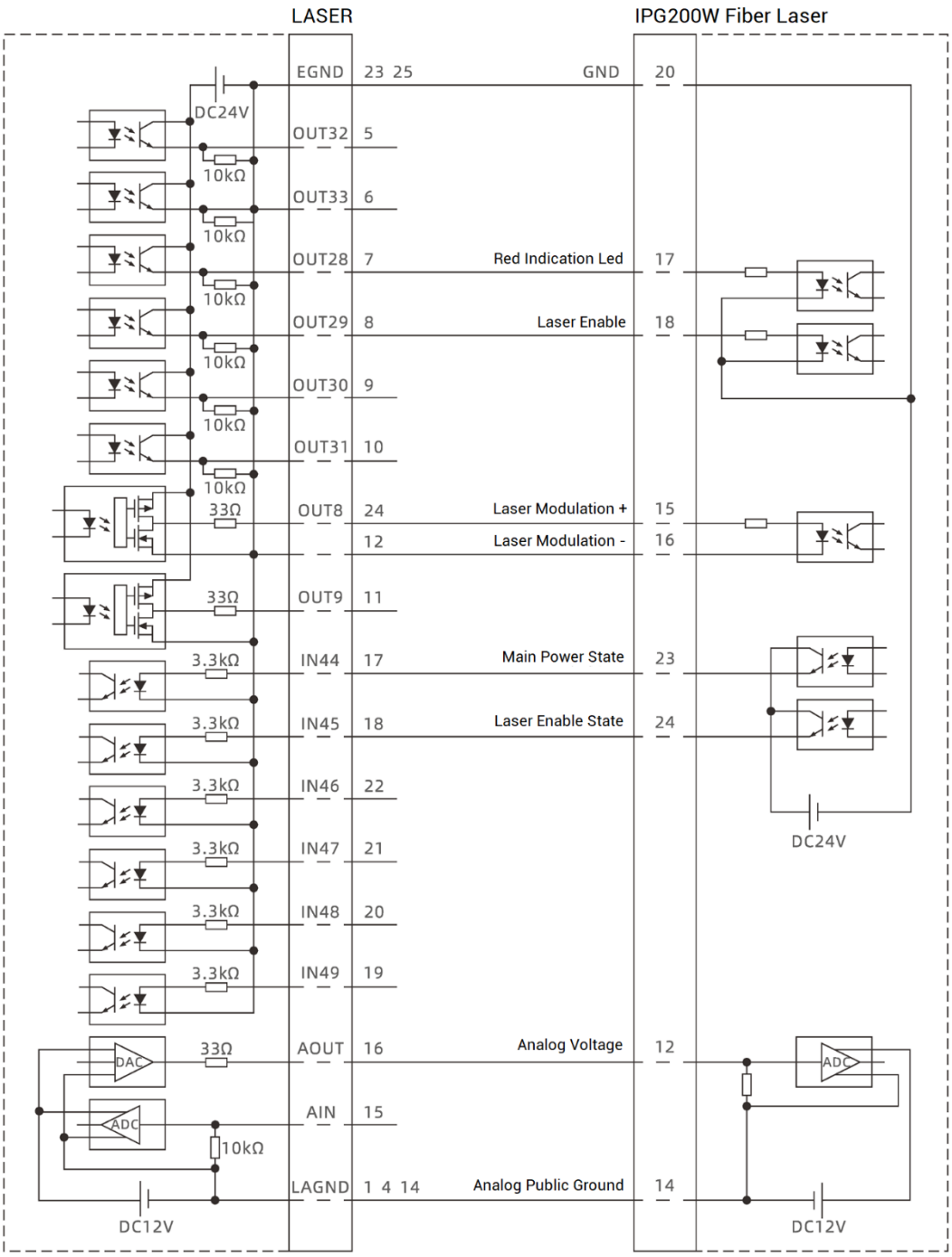
```
BASE (4, 5)                 'select axis Scan 0, Scan 1 relates to axis 6 and axis 7
ATYPE = 21, 21              'select axis 4 and axis 5 as galvanometer axes type
UNITS = 200, 200            'set pulse amount of axis 4, 5 as the unit of 200 bit
Dpos = 0, 0
CORNER_MODE = 2, 2          'set axis 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 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 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
```

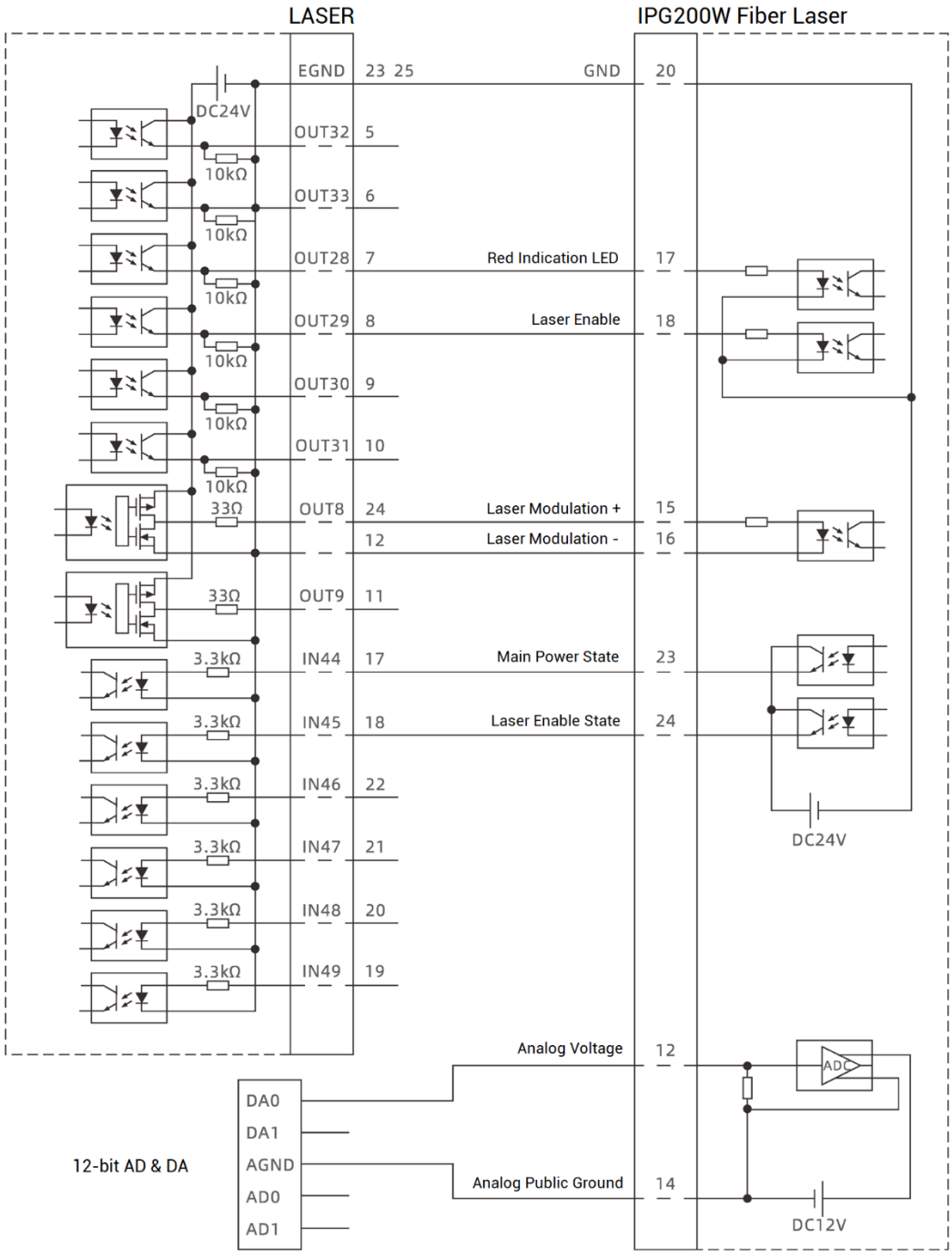
In the motion command application field of galvanometer processing, in the MOVESCAN and MOVESCANABS commands, here, CORNER_MODE=2 is used to enable the corner delay of the galvanometer axis, and ZSMOOTH is used to set the maximum time of the corner delay, unit is us. DECEL_ANGLE and STOP_ANGLE commands 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.

2.13.4. Wiring Reference

- Wiring reference of 16-DA in LASER interface (it needs to custom special version for with 16-bit analog)



- Wiring reference of terminal's 12-DA:

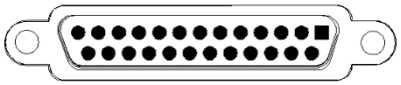


- Wiring reference of LASER laser interface is above, except OUT8 and OUT9, other digital IOs can be customized.
- There are 2 wiring ways for lasers that need analog input. Controller 12-DA interface can be used for not high resolution, but if you need high resolution, please use LASER interface with 16-DA.
- Please use STP, especially in bad environments, and make sure the shielding layer is fully grounded.

2.14. FIBER Laser

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

FIBER



2.14.1. Laser Output Interface Definition

PIN	Signal	Description	Relative digital input / output signal
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	Negative pole of +5V output, signal public end	/
16	STA0	Alarm status feedback (input interface)	IN66
17	+5V	+5V output positive pole, 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	/

2.14.2. Signal Specification

Item	IN (66-68)	Item	OUT (36-49)
Input method	NPN 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	

2.14.3. Basic Usage Method

- Please wiring correctly according to above wiring description.
- 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 RTSys.

- Through "RTSys /In, Op window to operate and watch relative IOs.
- Through "RTSys /AD/DA window to operate and watch relative analog inputs and outputs.
- In RTSys, send online command "PWM_FREQ (PWM No.) = frequency, PWM_DUTY (PWM No.) = duty cycle.

Refer to BASIC routine:

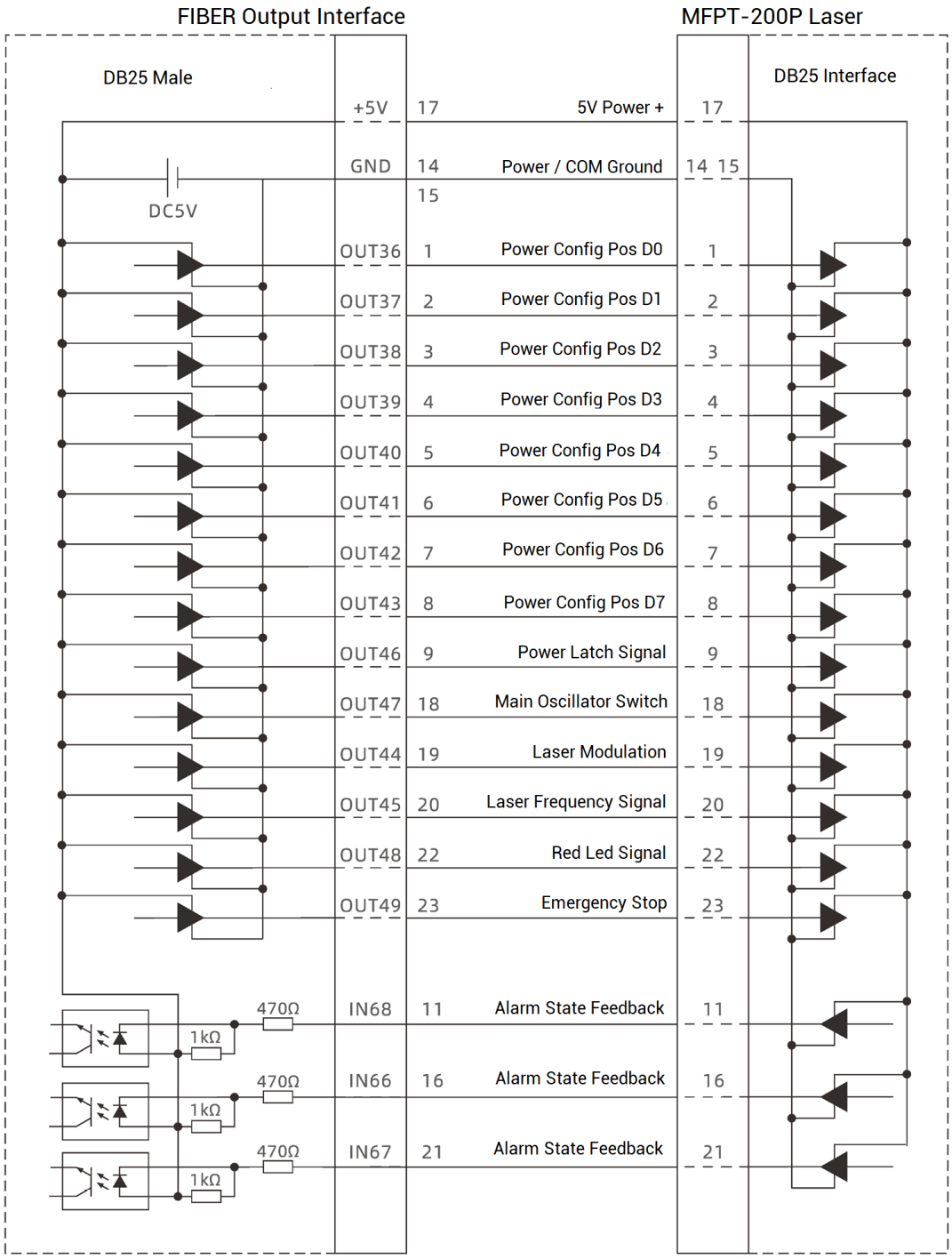
```
BASE (4, 5)                  'select axis Scan 0, Scan 1 relates to axis 6 and axis 7
ATYPE = 21, 21               'select axis 4 and axis 5 as galvanometer axes type
UNITS = 200, 200             'set pulse amount of axis 4, 5 as the unit of 200 bit
Dpos = 0, 0
CORNER_MODE = 2, 2       'set axis 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 in advance 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.

2.14.4. Wiring Reference

➢ **MFPT – 200P Laser Wiring:**



→ Wiring Notes

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

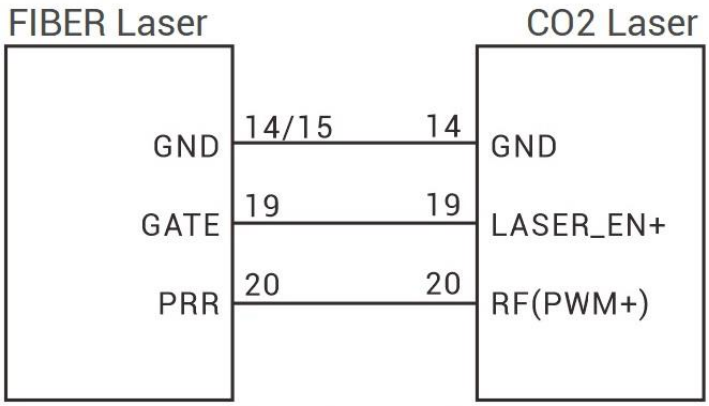
✧ Please use the cable with shield, and shield layer should be connected to the ground fully (chassis).

➢ **CO_2 Laser Wiring:**

--CO_2 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--



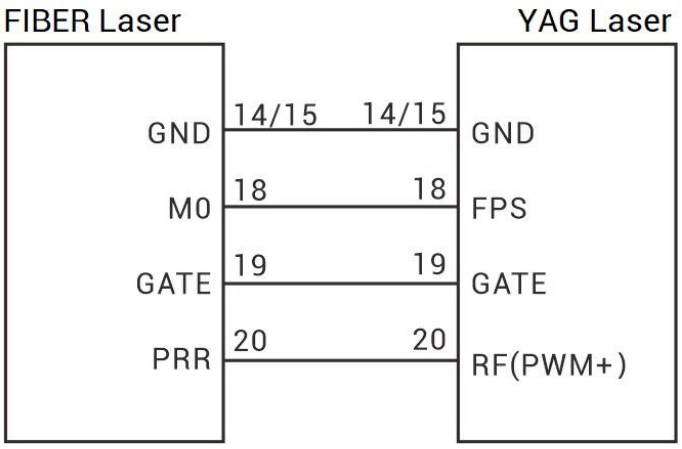
without enable, PIN19 can't be connected

➢ **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--

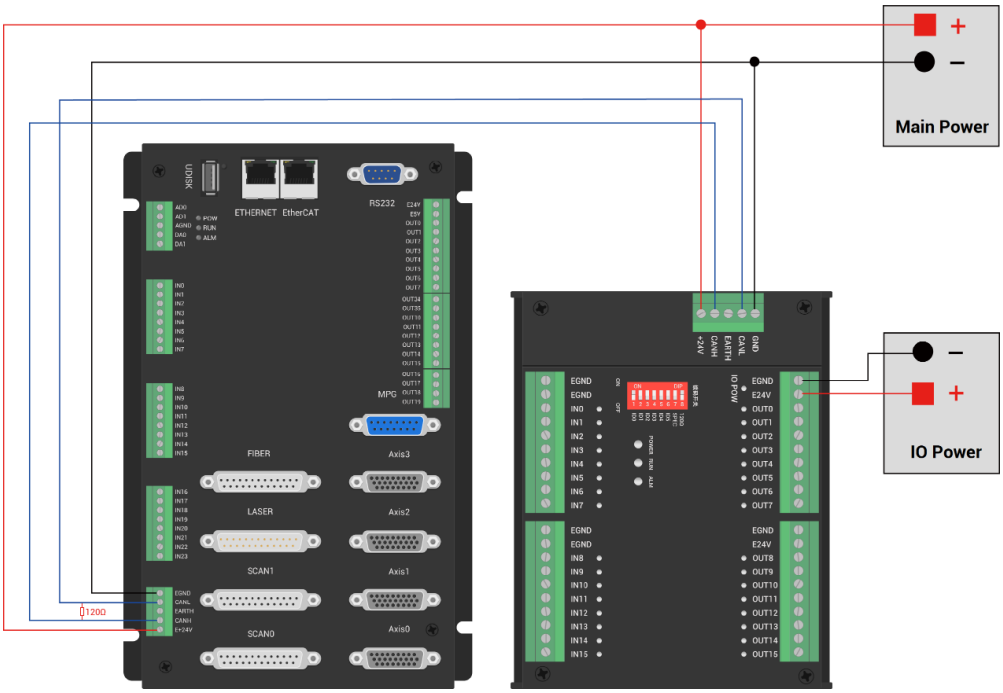


Without First pulse suppression signal, PIN18 can't be connected.

Chapter III 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.

For ZIO expansion board, following shows the wiring example:



→ Wiring Note:

✧ 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-cdoe DIP switch, the terminal resistor can be realized by dialing the code (DIP).

Chapter IV Programming

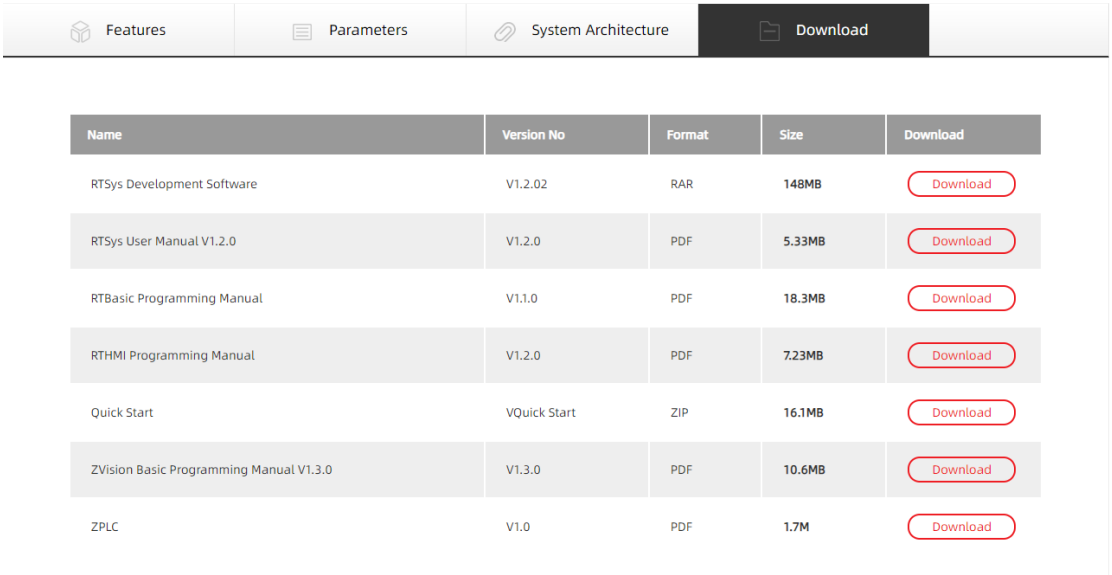
4.1. Program in RTSys Software

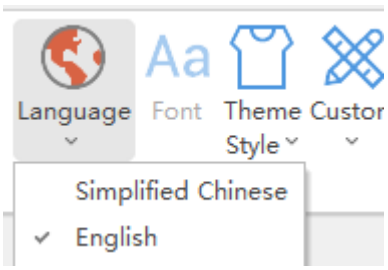
RTSys is a PC-side program development, debugging and diagnostic software for the Zmotion motion controllers. Through it, users can easily edit and configure the controller program, quickly develop applications, diagnose system operating parameters in real time, and debug the running program in real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

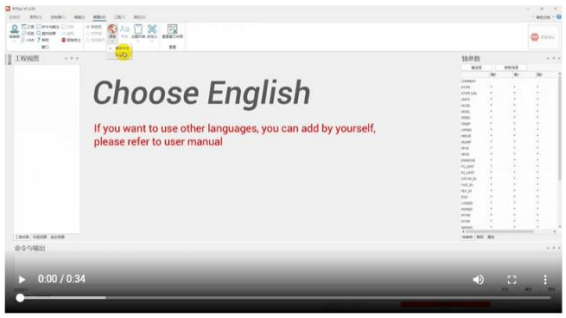
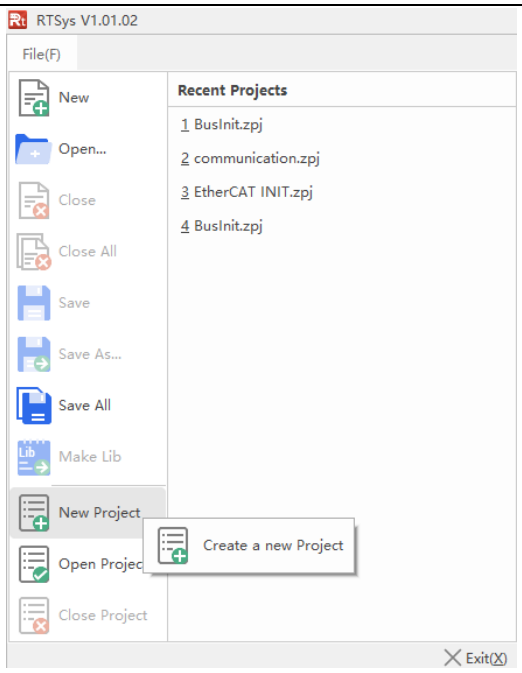
RTSys Downloading Address: https://www.zmotionglobal.com/pro_info_282.html

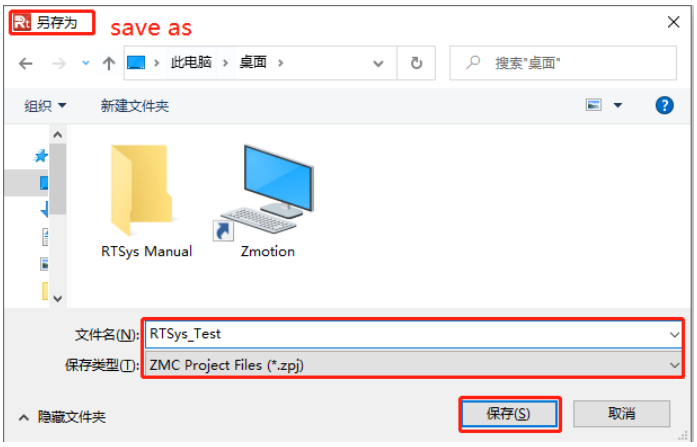
And related manuals can be found in "Download":

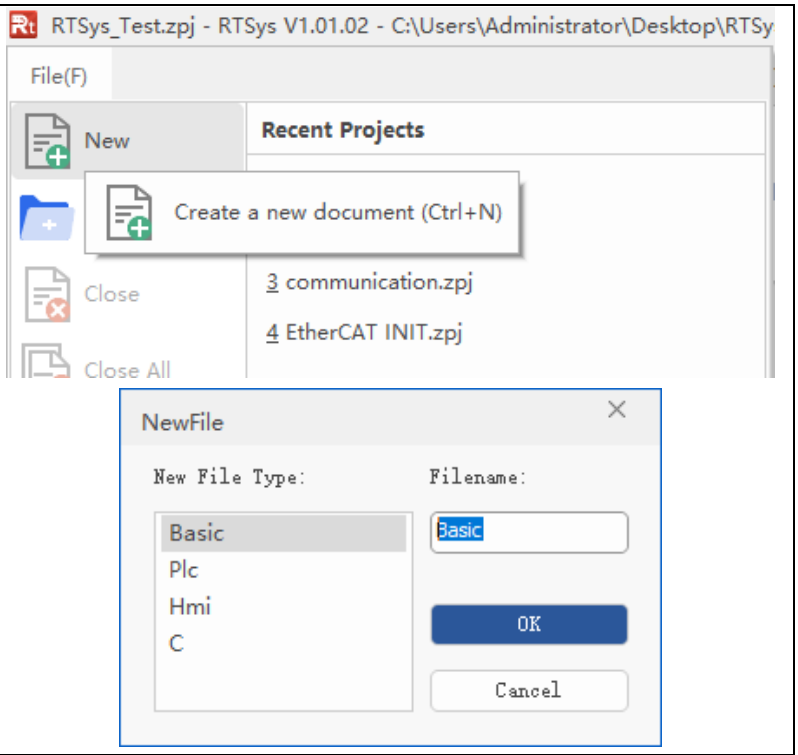
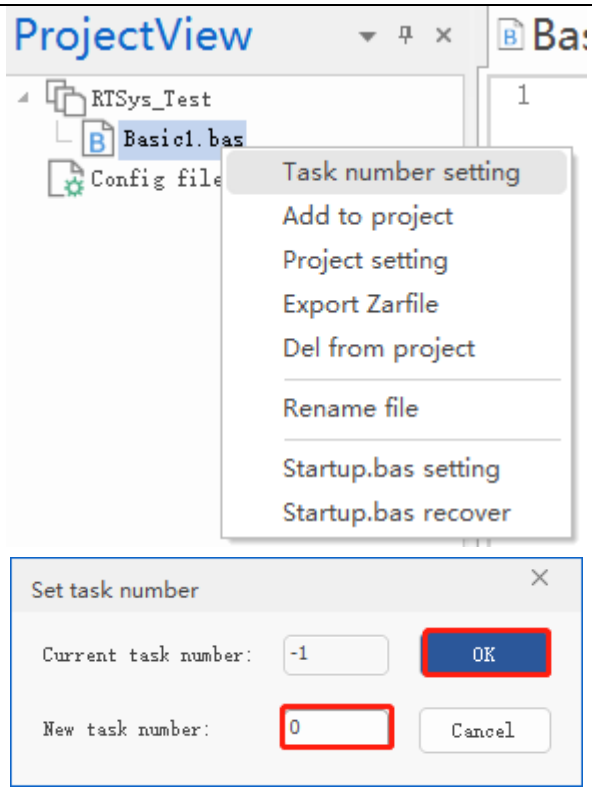


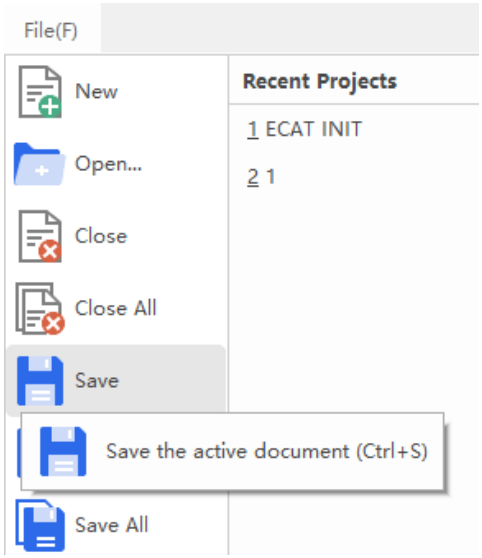
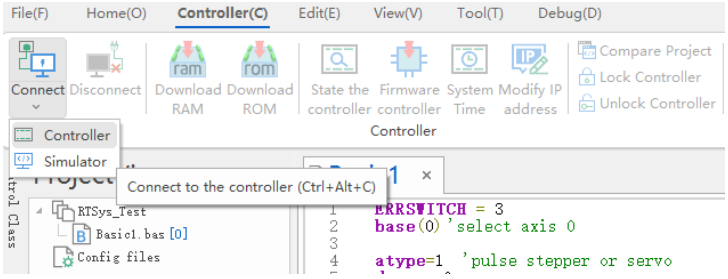
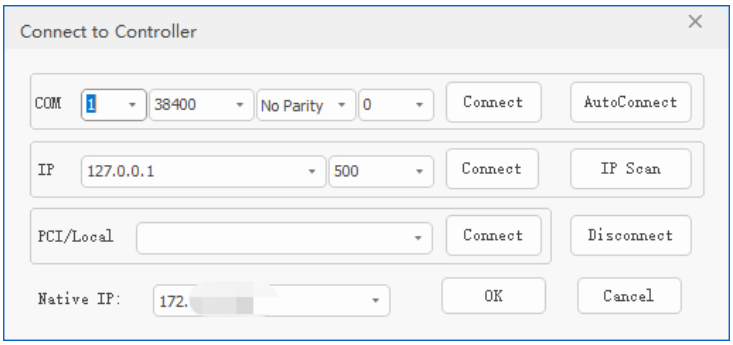
Step	Operations	Display Interface
1	Switch the Language: "Language" – "English", then there will pop	

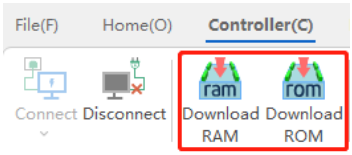
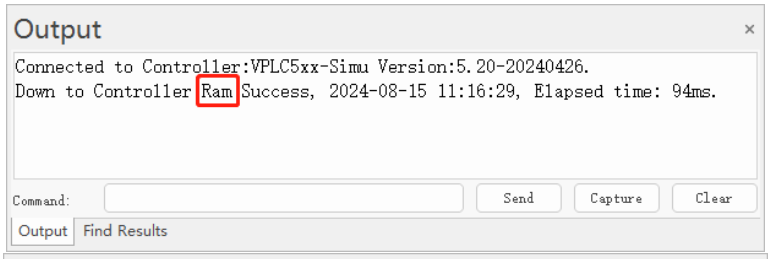
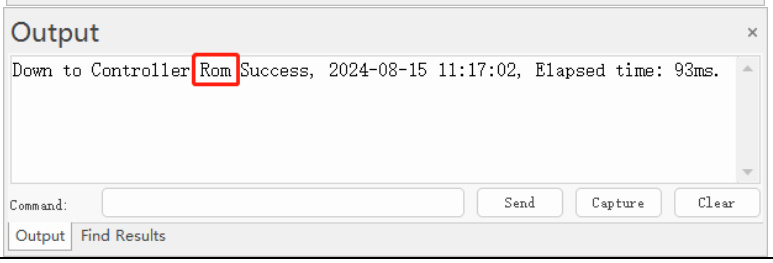
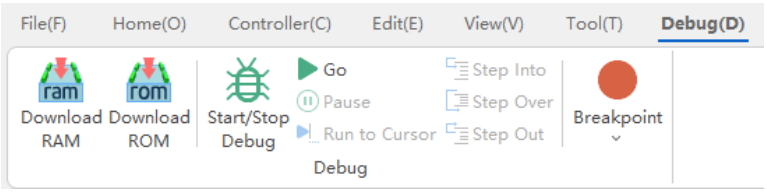
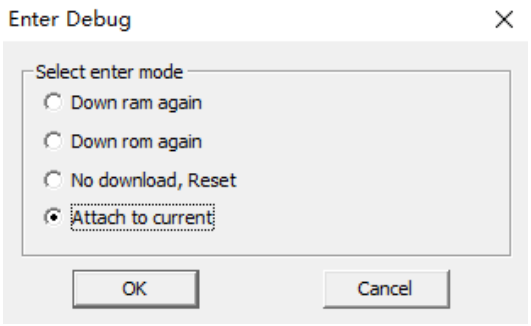
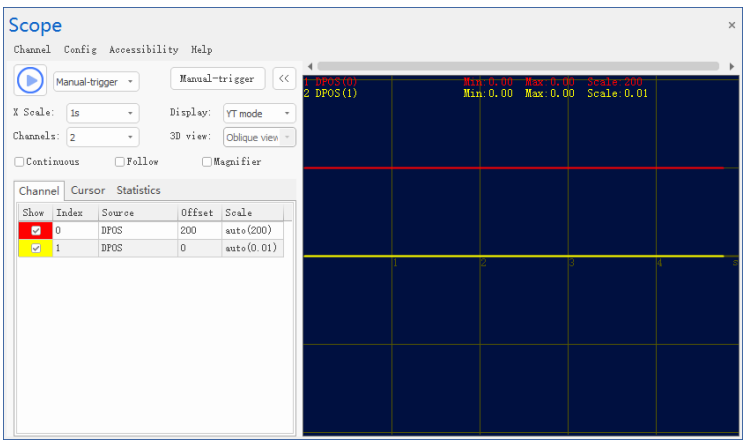
<table>
<tr>
<td></td>
<td>up one window, click OK, and restart it.</td>
<td>Language Switch Video Showing:

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. Enligsh RTSys will take effect when opened again.
 
</td>
</tr>
<tr>
<td>2</td>
<td>New Project: “File” – “New Project”, Save as window will pop up, then enter file name, save the project file with suffix “zpj.”.</td>
<td> 

 
</td>
</tr>
</table>

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”.

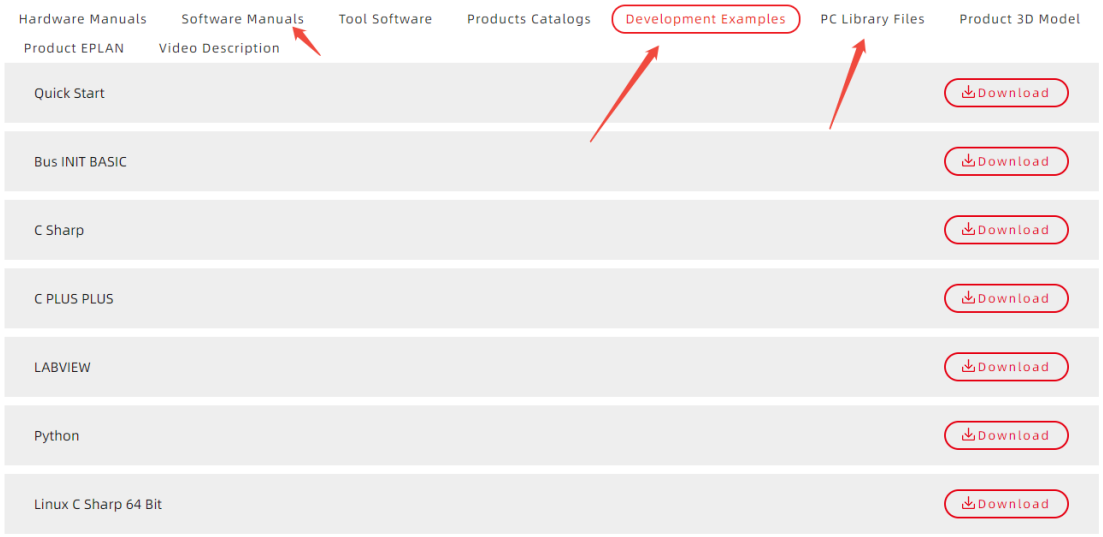
h. Do step a and step b again, check whether the firmware is updated or not.

4.3. Program in Host-Computer by PC Languages

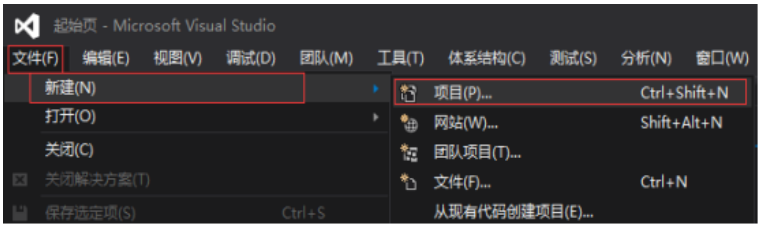
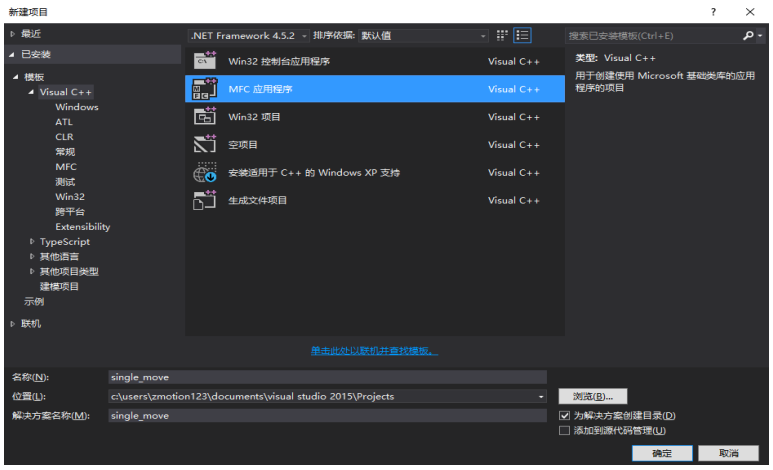
The controller supports development under various operating systems such as windows, linux, Mac, Android, and wince, and provides dll libraries in various environments such as vc, c#, vb.net, and labview, as shown in the figure below. PC software programming refers to "Zmotion PC Function Library Programming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

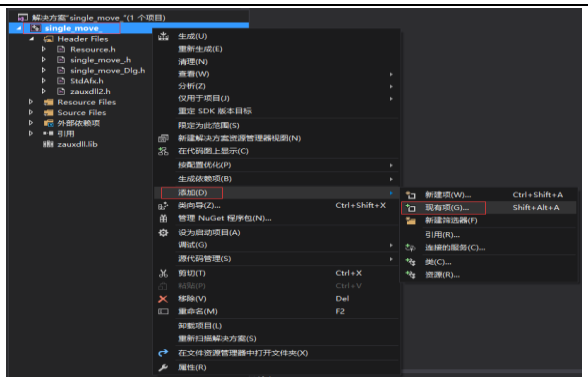
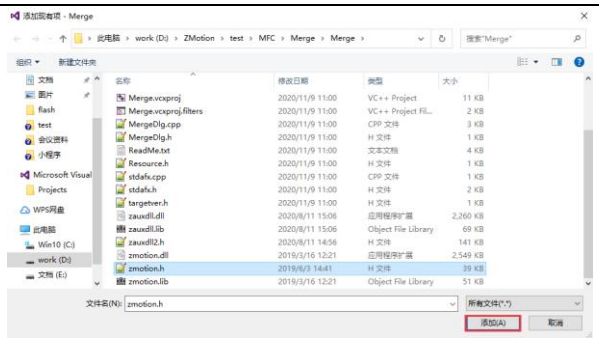
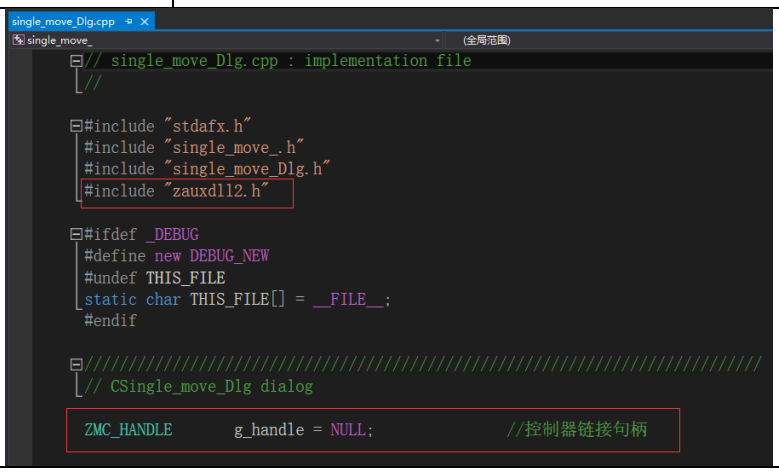
The program developed using the PC software cannot be downloaded to the controller, and it is connected to the controller through the dll dynamic library. The dll library needs to be added to the header file and declared during development.

- 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.	

<table>
<tr><td rowspan="2">6</td><td rowspan="2">Add a static library and related header files to the project. Static library: zauxdll.lib, zmotion.lib
Related header files: zauxdll2.h, zmotion.h</td><td>1) Right-click the header file first, and then select: "Add" → "Existing Item".</td><td>  </td></tr>
<tr><td>2) Add static libraries and related header files in sequence in the pop-up window.</td><td>  </td></tr>
<tr><td>7</td><td>Declare the relevant header files and define the controller connection handle, so far the project is newly created.</td><td colspan="2"> 
</td></tr>
</table>

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.