Coolmay®
Automation Exper

Coolmay L01S Series PLC Programming Manual

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V25.51

Contents

Part 1 Overview

1.1 Coolmay L01S PLC Main Advantages

The L01S series CPU module is an economical standard controller. Its L01S series CPU has built-in up to 4-axis (pulse type) positioning outputs, built-in up to 4 sets of high-speed counter inputs, and a variety of network communication options, providing users with powerful network functions. Through program settings, various network device links can be established. Through the built-in memory card function of the L01S series CPU module, system settings can be quickly backed up or restored. This manual explains the basic operating functions of the L01S system, allowing users to quickly get started with the L01S system.

1. Features

- ◆ Adopting military grade 32-bit CPU+ASIC dual processors, supporting online monitoring and downloading, the fastest execution speed of basic instructions reaches 0.24us.
- ◆ The host transistor outputs high-speed pulse output with 4-axis Y0~Y3, which can reach 100KHz. Supports 2 sets of 100KHz high-speed counters.
- ◆ Comes with 1 RS232 and 2 RS485, both supporting Modbus RTU/ASCII, Freeport, and other protocols.
- ◆ Supports multiple interrupts, including input interrupts, timer interrupts, and counter interrupts, totaling 15 interrupt points.
- ◆ Easy to install. It can be installed using DIN rails (35mm wide) or fixed holes (φ 4.5mm).

2. Larger program and data memory blocks

- ◆ L01S series CPU module, program capacity up to 30k steps. Built-in 12k data registers .

3. Support independent programming software

- ◆ For L01S series CPU modules, the programming software is VTool Pro .
- ◆ Supports online editing mode, allowing users to update programs while the system is running without affecting system operation.
- ◆Supported programming languages: instruction, ladder diagram (LD), step ladder diagram (SFC) .

4. Versatile communication interface

- ◆L01S series host PLC comes with two programming ports, 1 Type-C programming port for faster download speed; 1 RS232, the interface terminal is an 8-hole mouse head female socket.
- ◆ Provide 2 RS485, support Mitsubishi programming port protocol/ Modbus RTU, modbus ASCII protocol/ free port protocol, easily realize PLC interconnection and communication with external devices such as human-machine interface and inverter.

5. Support more I/O points

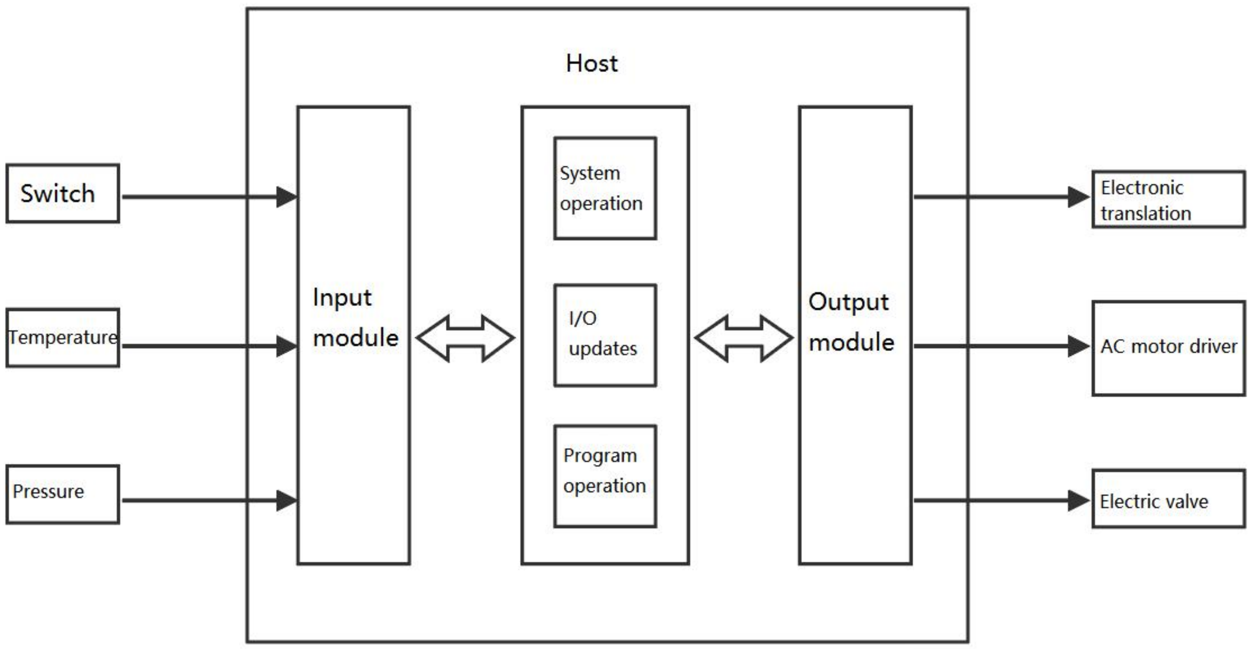
◆ The maximum I/O points of L01S series can support 168 digital points (40 points for host + 128 points for expansion).

◆Extended I/0 addresses do not require programming, they are automatically assigned and the modules are plug and play. For example, the extended address of L01S-40M starts from X30 , Y20.

1. 2 Host Operation Introduction

The host is the core component of the entire L01S series. In addition to executing the user's logic program, its main job is also responsible for all I/O data transmission and reception and data communication processing. The relationship between the L01S system established by the host and related modules and the actual external devices can be simply expressed as follows:

External input device L01S system external output device



The above is a simple expression of the host operation, which simplifies the system-side processes such as initialization, diagnosis, and communication, and the program-side processes such as external interrupts and time interrupts. If the user is interested in a deeper understanding, he can refer to the complete instruction manual. The complete host operation process is listed below for reference.

Power on

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System startup initialization:

- Non-power-off memory initialization
- User program check
- CPU module parameter check
- I/O table parameter check
- Comparison between CPU memory I/O table and actual device I/O
- Download I/O settings to I/O modules
- If you install a memory card, check whether the system is set to Copy option to perform a system copy

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Diagnosis and treatment:

- Check the memory card and other settings
- Module communication check
- System parameter check

↓

I/O input data update:

- Update digital I/O module input data
- Update analog I/O module input data
- Update other module input data

↓

Program Execution:

- Execute user program
- Execute interrupt routine

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I/O output data update:

- Update digital I/O module output data
- Update analog I/O module output data
- Update other module output data

↓

Communications Services:

- Host communication port external communication processing
- Other I/O module external communication processing
- Internal communication between host and I/O module

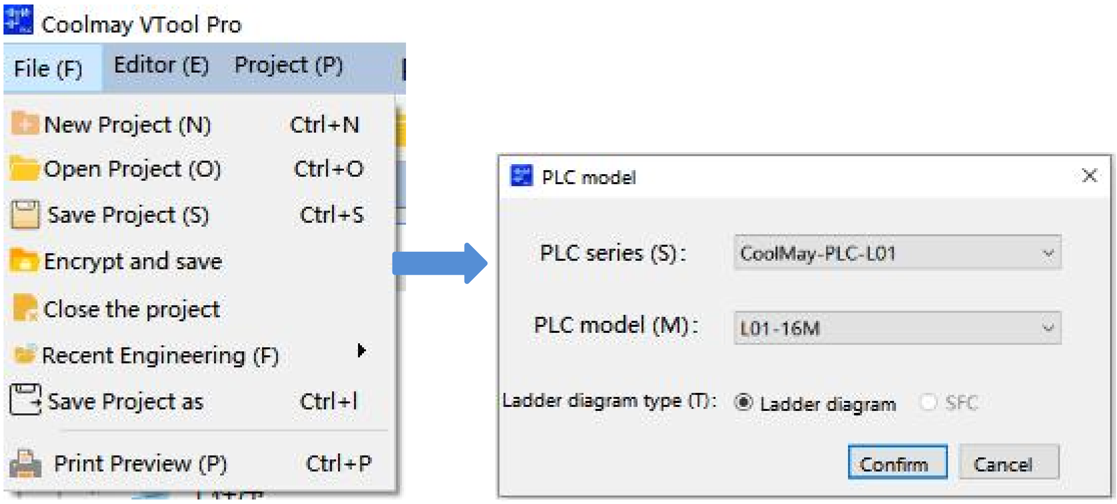
1. 3 L01S Series Host Brief Instructions

<table>
<tr><th colspan="2">Model</th><th>L01S-16M</th><th>L01S-24M</th><th>L01S-32M</th><th>L01S-40M</th><th>L01S-48M</th><th>L01S-64M</th></tr>
<tr><td colspan="2">Product images</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">External dimensions</td><td colspan="2">93*88*75mm</td><td colspan="2">143*88*75mm</td><td colspan="2">210*88*75mm</td></tr>
<tr><td colspan="2">Installation size</td><td colspan="2">74*80mm</td><td colspan="2">124*80mm</td><td colspan="2">194*80mm</td></tr>
<tr><td colspan="2">Installation method</td><td colspan="6">Installation of fixed hole (diameter 4.5mm) and 35mm standard guide rail</td></tr>
<tr><td colspan="2">supply voltage</td><td colspan="6">AC220V(-15%~20%)</td></tr>
<tr><td colspan="2">grounding</td><td colspan="6">The wire diameter specified in the grounding terminal wiring instructions shall not be less than the wire diameter of the power line (if multiple PLCs are used simultaneously, please make sure to ground them at a single point)</td></tr>
<tr><td colspan="2">Operating/Storage Environment</td><td colspan="6">Operation: Temperature 0 ℃~55 ℃, humidity 5~95%, pollution level 2
Storage: Temperature -25 ℃~70 ℃, humidity 5~95%</td></tr>
<tr><td colspan="2">Insulation impedance</td><td colspan="6">Above 5 M Ω</td></tr>
<tr><td colspan="2">No-load power consumption</td><td colspan="2">1.2W</td><td colspan="2">1.2W</td><td>1.2W</td><td>1.2W</td></tr>
<tr><td colspan="2">Full load power consumption</td><td colspan="2">MT/2.4W；MR/2.88W</td><td colspan="2">MT/2.8W；MR/3.5W</td><td>MT/3.1W
MR/3.9W</td><td>MT/3.8W
MR/4.8W</td></tr>
<tr><td colspan="2">Digital points</td><td>8DA8DO (Y0/Y1 fixed MT)</td><td>14DA10DO (Y0/Y1 fixed MT)</td><td>16DA16DO (Maximum of 14 MR, Y0/Y1 fixed MT)</td><td>24DA16DO (MT or MR, no MRT)</td><td>24DA24DO (MT or MR, no MRT)</td><td>32DA32DO (MT or MR, no MRT)</td></tr>
<tr><td colspan="2">Digital input level</td><td colspan="6">Passive NPN or PNP, common terminal isolation
Input voltage: 24VDC ± 10%</td></tr>
<tr><td colspan="2">Digital output level</td><td colspan="6">Output MT: Low level NPN, COM connected to negative
Output MR: normally open dry contact;</td></tr>
<tr><td colspan="2">Digital output type and load</td><td colspan="6">Transistor MT: 0.5A/point, 2A/4-point COM; Voltage specification: 12VDC-36VDC
Relay output load 2A/point, 4A/4 point COM; Can be connected to DC24V or AC220V</td></tr>
<tr><td colspan="2">High speed counting input</td><td colspan="6">Single phase 6-way 100KHz or AB phase 2-channel 100KHz</td></tr>
<tr><td colspan="2">High speed pulse output</td><td colspan="6">MT output: Conventional 4-channel Y0-Y3 is 100KHz (48MT/64MT: 8-channel Y0-Y7 is 100KHz), 16/24MRT output: 2-channel Y0-Y1 is 100KHz</td></tr>
<tr><td rowspan="2">Analog</td><td>Points</td><td>MAX 4AD2DA</td><td>/</td><td>MAX 4AD2DA</td><td>/</td><td>MAX 8AD8DA (6 optional channels)</td><td>MAX 4AD</td></tr>
<tr><td>input</td><td>EKST type thermocouple (supports negative temperature)/PT100/N</td><td>/</td><td>EKST type thermocouple (supports negative temperature)/ PT100/NTC1</td><td>/</td><td>4-channel isolated analog: EKST thermocouple (supporting negative</td><td>EKST type thermocouple (supports negative temperature)/ PT100/NTC1</td></tr>
</table>

		TC10K/NTC100K/ 0-10V/0-20mA/4-20mA optional		0K/NTC100K/ 0-10V/0-20mA/4-20mA optional		temperature)/ PT100/ 0-10V/0-20mA/4-20mA 4-channel non isolated analog: NTC10K/NTC100K optional	0K/NTC100K/ 0-10V/0-20mA/4-20mA optional
	output	0-10V/4-20mA optional	/	0-10V/4-20mA optional	/	0-10V/0-5V/0-20mA/4-20mA/-5~5V/-10~10V optional	/
COM. port		Comes with two PLC programming ports (1 Type-C USB port; 1 RS232 programming port, interface terminal is an 8-hole female mouse head socket)					
		The total number of communication ports is 3. Default is 1 round mouth RS232+2 RS485					
Programming software		VTool Pro					
Common model specifications：L01S-16MT/MRT-4AD2DA; L01S-24MT/MRT-485/485 L01S-32MT/MRT-4AD2DA; L01S-40MT/MR-485/485 L01S-48MT/MR-8AD2DA;L01S-64MT/MR-4AD Detailed information： "Coolmay L01S Series PLC Programming Manual" and "L01S Series PLC User Manual"							

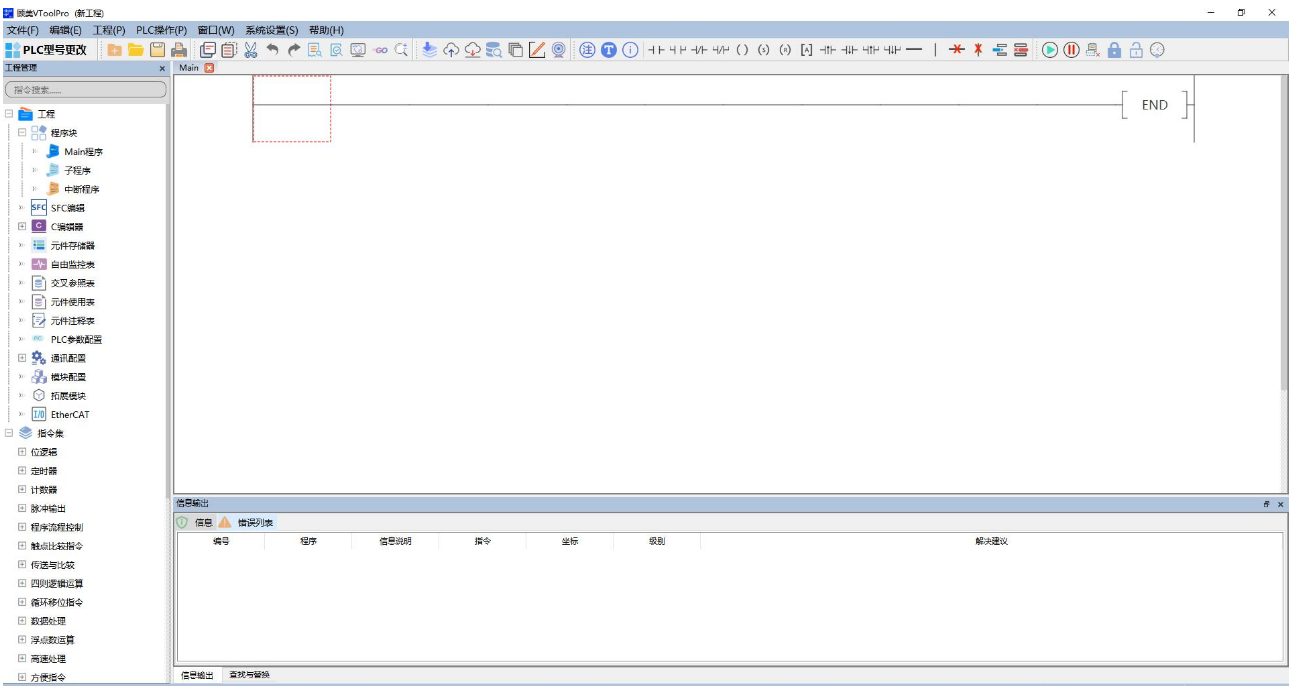
1.4 L01S Series Host Programming Notes

The PLC uses VTool Pro programming software. In the PLC model window, you can specify the corresponding PLC series and type. Once created, you can proceed with ladder diagram editing.



After completing the above settings, the ladder diagram mode window will appear, and the user can double-click on the blank space of the ladder diagram to program the PLC program.

Ladder diagram mode:



1.5 Introduction to the hardware information of L01S series host

1. Structure introduction

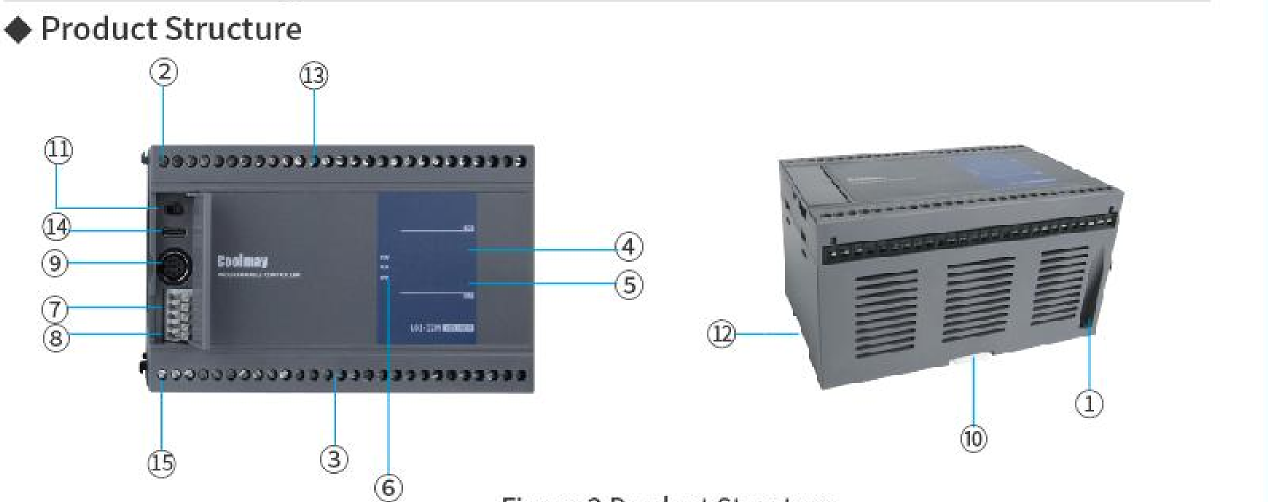


Figure 2 Product Structure

1、Installation holes
2、DC24V power output terminal block
3. Switching output terminal block
4、Switching input display LED
5. Switching output display LED
6. PWR: indicates power on status
RUN: PLC lights up during operation
ERR: The indicator light will light up when there is a program error
7、RS485/RS232
8、RS485
9. PLC programming port RS232
10. Buckle fixation
11. RUN/STOP PLC operation switch
12. DIN rail (35mm wide) mounting groove
13. Switching input terminal block
14. PLC Type-C programming port
15. AC220V power input terminal block

2、Communication port description

◆L01S series host PLC comes with a USB programming port and 1 Type-C programming port for faster download speed .

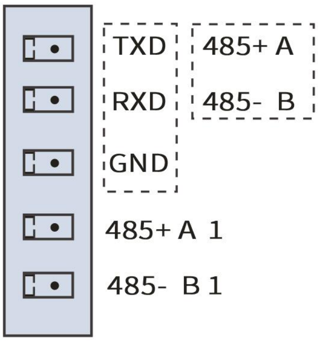
◆ Provide 1 RS232 (serial port 1), 2 RS485 (serial port 2 and serial port 3), support Mitsubishi programming port protocol/ Modbus RTU, modbus ASCII protocol/ free port protocol, easily realize PLC interconnection and communication with external devices such as human-machine interface and inverter.

Serial port 1: RS232

Pin Number	Signal	describe
4	RxD	take over
5	TXD	send
8	GND	Ground

Serial port 2: RS485 (AB);

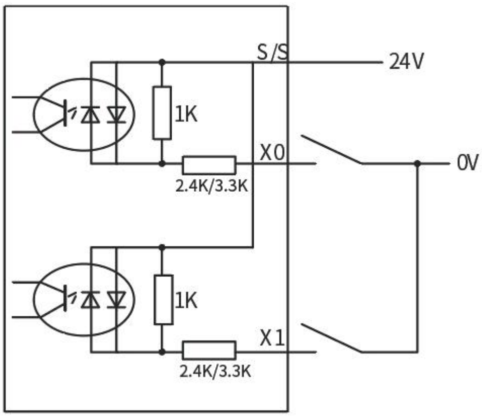
Serial port 3: RS485 (A1 B1), can be customized as RS232 (TXD RXD GND); as shown below



3、Wiring method

The PLC input (X) is a two-phase optocoupler, and users can choose NPN or PNP connection when using it. However, please note that because the common ends of the input points are all connected, a module or a host can only have one wiring method and cannot be mixed.
The 24V and 0V terminals have internal power supplies and can be used directly as point X input.

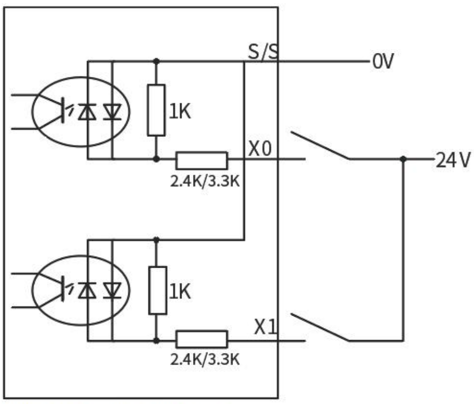
◆ PLC switch input wiring:



NPN Input Wiring Diagram

NPN reference wiring method：

- ❖ Port short circuit: The S/S of the PLC input terminal is connected to 24V, and the X terminal is connected to a power supply of 0V, indicating that there is a signal input;
- ❖ Two wire system (magnetic control switch): PLC switch input is connected to a two-wire magnetic control switch, with the positive pole of the magnetic control switch connected to the X terminal and the negative pole connected to 0V;
- ❖ Three wire system (photoelectric sensor or encoder): The PLC switch is connected to the photoelectric sensor or encoder of the three wire system, and the power supply of the sensor or encoder is connected to the positive pole of the power supply, and the signal line is connected to the X terminal; Encoders and photoelectric sensors require NPN type.

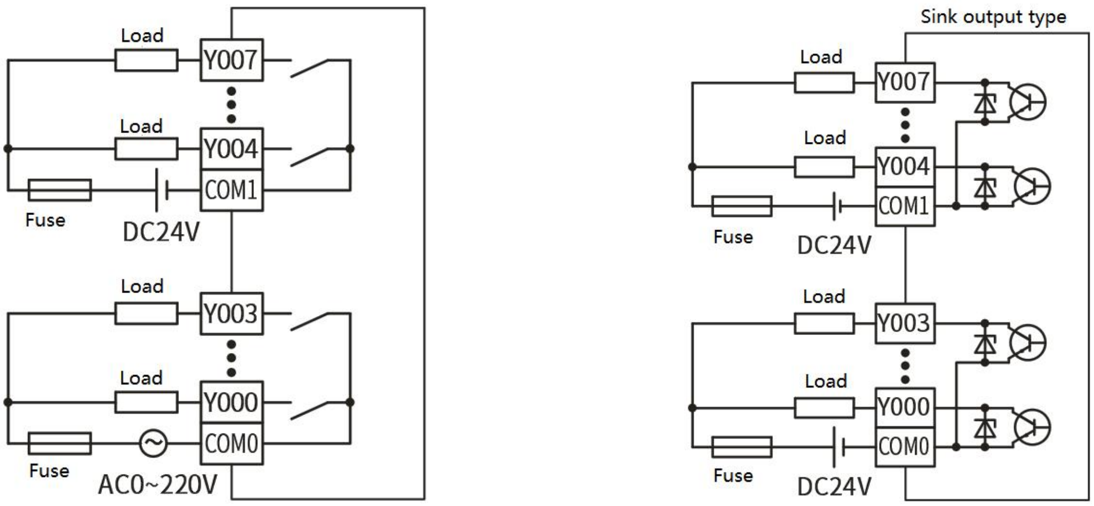


PNP input wiring diagram

PNP reference wiring method:

- ❖ Port short circuit: The S/S of the PLC input terminal is connected to 0V, and the X terminal is connected to the 24V power supply, indicating that there is a signal input;
- ❖ Two wire system (magnetic control switch): PLC switch input is connected to a two-wire magnetic control switch, with the negative pole of the magnetic control switch connected to the X terminal and the positive pole connected to 24V;
- ❖ Three wire system (photoelectric sensor or encoder): The PLC switch is connected to the photoelectric sensor or encoder of the three wire system, and the power supply of the sensor or encoder is connected to the positive pole of the power supply, and the signal line is connected to the X terminal; The encoder and photoelectric sensor require PNP type.

◆ PLC switch output wiring:

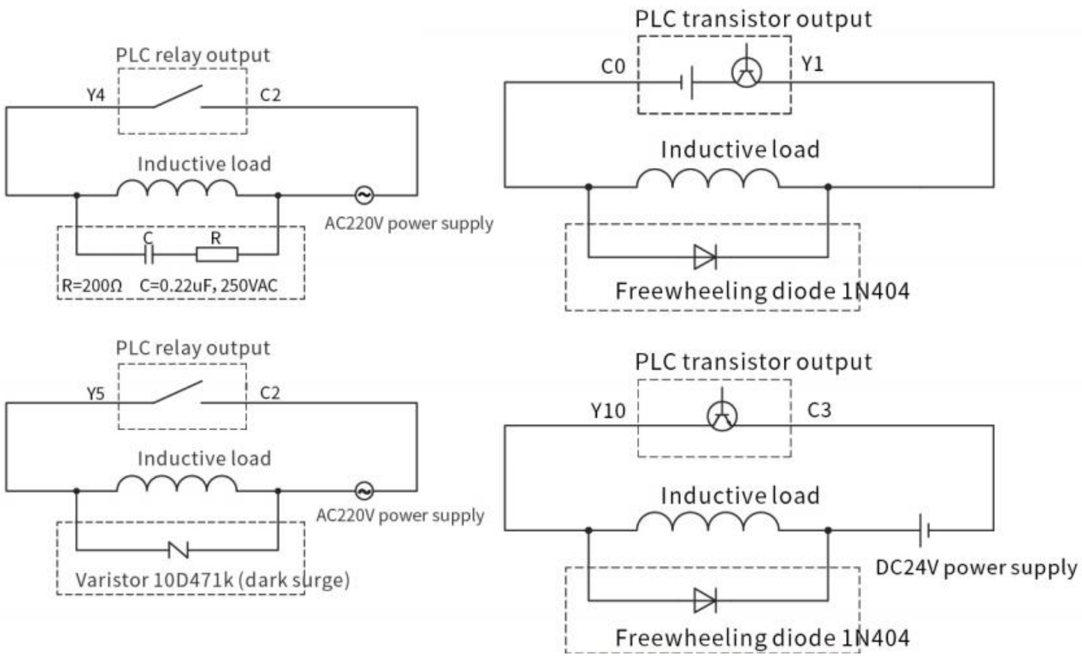


Relay output equivalent circuit Transistor output equivalent circuit

❖ Relay output: The output terminals are divided into several groups, each group is electrically isolated, and the output contacts of different groups are connected to different power supply circuits. COM can be connected to the positive or negative pole.

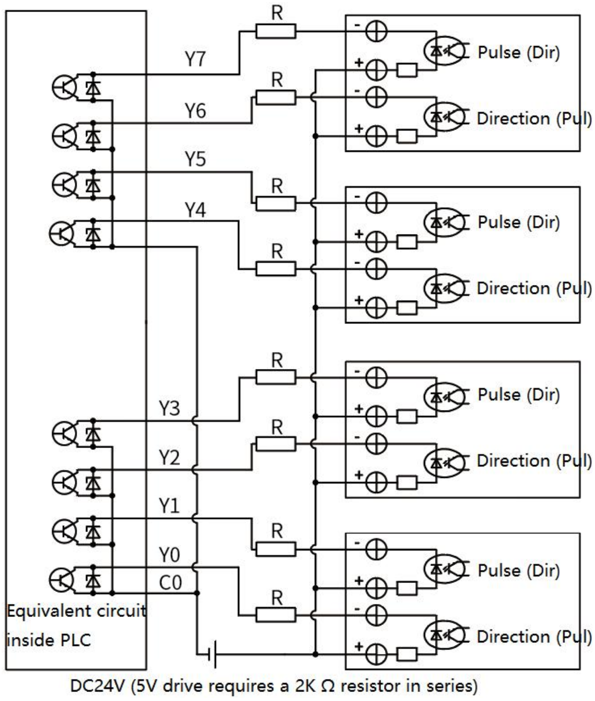
❖ Transistor output: The output terminals are divided into several groups, each group is electrically isolated, and the output contacts of different groups can be connected to different power supply circuits; transistor output can only be used for DC24V load circuits. The output wiring method is NPN, COM common cathode.

❖ When the inductive load is connected to the AC circuit, the external circuit should consider the RC transient voltage absorption circuit; for the load of the DC circuit, the freewheeling diode should be added, as shown in the following figure:



Schematic diagram of inductive load absorption circuit

❖ The wiring of stepper or servo motor is shown in Figure 11. The default pulse point of L01S series transistor output PLC is Y0-Y3, and the direction can be customized. As shown in the figure below. Note: 5V drive requires a 2KΩ resistor in series with DC24V.



Pulse output wiring diagram

Part 2 The soft element number

2.1 List of Soft Component Numbers

Component name	content		
Input and output relays			
Input relay	X000～X037	40points	The numbering of software components is an 8-digit number The total input and output are 80 points
Output Relay	Y000～Y037	40points	
Auxiliary relay			
Generally used	M0~M383	384points	
EEPROM retention	M384~M1535	1152points	
Generally used	M1536~M7679	6144points	
Special use	M8000~M8511	512points	
state			
Initial state (EEPROM hold)	S0～S9	10 点	
EEPROM retention	S10～S999	990 点	
Generally used	S1000～S4095	3096 点	
Timer (ON delay timer)			
100ms	T0～T199	200 points	0.1 to 3276.7 seconds
10ms※1	T200～T245	46 points	0.01 to 327.67 seconds
1ms cumulative type (EEPROM retention)	T246～T249	4 points	0.001 to 32.767 seconds
100ms cumulative type (EEPROM retention)	T250～T255	6 points	0.1 to 3276.7 seconds
1ms	T256～T319	64 points	0.001 to 32.767 seconds
counter			
Usually using up counting (16 bits)	C0～C15	16 points	Counter from 0 to 32767
EEPROM keeps count up (16 bits)	C16～C199	184 points	Counter from 0 to 32767
Usually using bidirectional (32-bit)	C200～C219	20points	-Counter from 2147483648 to+2147483647
EEPROM maintains bidirectional (32-bit)	C220～C234	15 points	-Counter from 2147483648 to+2147483647
High-speed counter			
Single phase single count input bidirectional (32-bit) (EEPROM hold)	C235～C245	-Counter from 2147483648 to+2147483647 Software counter Single phase: up to 6 channels, maximum frequency 100KHz Dual phase: 2 channels 100KHz	
Single phase dual counting input dual direction (32-bit) (EEPROM hold)	C246～C250		

Dual phase dual counting input dual direction (32-bit) (EEPROM hold)	C251～C255		
Data register (32 bits when used in pairs)			
Generally used (16 bits)	D0～D127	128 points	
EEPROM retention (16 bits)	D128～D7999	7872 points	
Special purpose (16 bits)	D8000～D8511	512 points	
Address changing (16 bits)	V0～V7,Z0～Z7	16 points	
pointer			
Used for JUMP and CALL branches	P0～P255 P0～P1280	256 points 1281 points (26232 and above versions)	CJ instruction and CALL instruction are used
Input interrupt	I0□□～I5□□	6 points	
timer interrupt	I6□□～I8□□	3 points	
Counter interrupt	I010～I060	6 points	
Nesting			
For main control purposes	N0～N7	8 points	Used for MC instructions
constant			
Decimal number (K)	16 bits	-32,768～+32,767	
	32 Bit	-2,147,483,648～+2,147,483,647	
Hexadecimal number (H)	16 bits	0000～FFFF	
	32 Bit	00000000～FFFFFFFF	
Real number (E)	32 Bit	-1.0×2128～-1.0×2-126,0,1.0×2-126～1.0×2128 It can be expressed in decimal point and exponential form	

※1：10ms timer will be affected by the scanning cycle. If the scanning cycle is 12ms, the timer will execute once every 12ms.

Part 3 Special Relays and Registers

3.1 Special relay numbers and contents

Serial number	Content	Remark	Serial number	Content	Remark
M8000	Normally closed when RUN		M8224	C224 increase/decrease counting action	ON: Decrease action OFF: Increase action
M8001	RUN is always on		M8225	C225 increase/decrease counting action	
M8002	After RUN, the output is ON for one scan cycle.		M8226	C226 increase/decrease counting action	
M8003	After RUN, the output is OFF for one scan cycle.		M8227	C227 increase/decrease counting action	
M8011	Oscillates with a period of 10ms		M8228	Start the hand wheel function [This model is not currently supported]	
M8012	Oscillates with a period of 100ms		M8229	C229 increase/decrease counting action	
M8013	Oscillates with a period of 1s		M8230	C230 increase/decrease counting action	
M8014	Oscillates with a period of 1 minute		M8231	C231 increase/decrease counting action	
M8020	Zero Flag		M8232	C232 increase/decrease counting action	
M8021	Borrow sign		M8233	C233 increase/decrease counting action	
M8022	Carry flag		M8234	C234 increase/decrease counting action	
M8024	Specify BMOV direction		M8235	C235 increase/decrease counting action	ON: Decrease action OFF: Increase action
M8028	Allow interrupts during instruction execution		M8236	C236 increase/decrease counting action	
M8029	Instruction execution end flag		M8237	C237 increase/decrease counting action	
M8031	Clear all non-volatile memory		M8238	C238 increase/decrease counting action	
M8032	Keep all memory cleared		M8239	C239 increase/decrease counting action	
M8033	Memory hold stop		M8240	C240 increase/decrease counting action	

Serial number	Content	Remark	Serial number	Content	Remark
M8034	Disable all output		M8241	C241 increase/decrease counting action	
M8035	Force RUN mode		M8242	C242 increase/decrease counting action	
M8036	Forced RUN instruction		M8243	C243 increase/decrease counting action	
M8037	Forced STOP instruction		M8244	C244 increase/decrease counting action	
M8045	Disable reset of all outputs		M8245	C245 increase/decrease counting action	
M8046	STL Status Action		M8246	C246 increase/decrease counting action	
M8047	STL control is effective		M8247	C247 increase/decrease counting action	
M8048	Signal alarm action		M8248	C248 increase/decrease counting action	
M8049	Signal alarm is effective		M8249	C249 increase/decrease counting action	
M8050	Input interrupt (I00 port disabled)		M8250	C250 increase/decrease counting action	ON: Decrease action OFF: Increase action
M8051	Input interrupt (I10 port disabled)		M8251	C251 increase/decrease counting action	
M8052	Input interrupt (I20 port disabled)		M8252	C252 increase/decrease counting action	
M8053	Input interrupt (I30 port disabled)		M8253	C253 increase/decrease counting action	
M8054	Input interrupt (I40 port disabled)		M8254	C254 increase/decrease counting action	
M8055	Input interrupt (I50 port disabled)		M8255	C255 increase/decrease counting action	
M8056	Timer interrupt (I6 port disabled)		M8340	The first pulse operation monitoring	
M8057	Timer interrupt (I7 port disabled)		M8342	Interpolation mode flag	
M8058	Timer interrupt (I8 port disabled)		M8343	Interpolation mode flag	This model is not currently supported
M8059	Counter interrupt disable		M8344	Interpolation relative/absolute coordinate flag	
M8060	I/O composition error		M8348	Interpolation clockwise and	

Serial number	Content	Remark	Serial number	Content	Remark
				counterclockwise flag	
M8061	PLC hardware error		M8341	Y000 clear signal output function is effective	
M8062	Serial communication error 0		M8342	Y000 specifies the origin return direction	
M8063	Serial communication error 1		M8343	Y000 forward limit	
M8064	Parameter error		M8344	Y000 reverse limit	
M8065	Syntax Error		M8345	Y000 Near-point DOG signal logic inversion	
M8066	Loop Error		M8346	Y000 zero signal logic inversion	
M8067	Operation error		M8347	Y000 interrupt signal logic inversion	
M8068	Operation error latch		M8348	Y000 positioning command is driving	
M8069	I/O bus detection		M8349	The first pulse stop position	
M8075	Sampling trace preparation start instruction		M8350	Second pulse operation monitoring	
M8076	Sampling trace execution start instruction		M8351	Y001 Clear signal output function is valid	
M8077	Sampling and tracking execution of temporary control		M8352	Y001 specifies the origin return direction	
M8078	Sampling tracking execution end temporary control		M8353	Y001 forward limit	
M8079	Sampling Tracking System Area		M8354	Y001 reverse limit	
M8120	Not available		M8355	Y001 Near-point DOG signal logic inversion	
M8121	RS/RS2 command sends the standby flag	serial port 2, refer to Section 8.2	M8356	Y001 zero signal logic inversion	
M8122	RS/RS2 command send request		M8357	Y001 interrupt signal logic inversion	
M8123	RS/RS2 instruction receiving end flag		M8358	Y001 positioning command is driving	
M8124	RS/RS2 command data receiving		M8359	Second pulse stop position	
M8125	MODBUS and Mitsubishi function activation flag		M8360	The third pulse operation monitoring	
M8128	RD3A/WR3A receives the		M8361	Y002 Clear signal output	

Serial number	Content	Remark	Serial number	Content	Remark
	correct flag			function is valid	
M8129	RD3A/WR3A communication timeout flag		M8362	Y002 specifies the origin return direction	
M8151	Fifth pulse operation temporary control	This model is not currently supported	M8363	Y002 forward limit	
M8152	The sixth pulse operation temporary control		M8364	Y002 reverse limit	
M8153	The seventh pulse operation temporary control		M8365	Y002 Near-point DOG signal logic inversion	
M8154	Eighth pulse operation temporary control		M8366	Y002 zero signal logic inversion	
M8160	XCH's SWAP function		M8367	Y002 interrupt signal logic inversion	
M8161	8-bit processing mode		M8368	Y002 positioning command is driving	
M8170	Input X000 pulse capture		M8369	The third pulse stop position	
M8171	Input X001 pulse capture		M8370	Fourth pulse operation monitoring	
M8172	Input X002 pulse capture		M8371	Y003 Clear signal output function is valid	
M8173	Input X003 pulse capture		M8372	Y003 specifies the origin return direction	
M8174	Input X004 pulse capture		M8373	Y003 forward limit	
M8175	Input X005 pulse capture		M8374	Y003 reverse limit	
M8176	Input X006 pulse capture		M8375	Y003 Near-point DOG signal logic inversion	
M8177	Input X007 pulse capture		M8376	Y003 zero signal logic inversion	
M8192	Programming port protocol and other protocols enable flag	Serial port 3	M8377	Y003 interrupt signal logic inversion	
M8196	Programming port protocol and other protocols enable flag	Serial Port 2	M8378	Y003 positioning command is driving	
M8198	C251, C252, C254 4-fold frequency mark		M8379	The fourth pulse stop position	
M8199	C253 4x frequency mark		M8396	C254 function corresponds to the input phase	Refer to Section 6.1
M8200	C200 increase/decrease counting action	ON: Decrease action	M8401	RS2 command sends the standby flag	serial port 3, refer to Section 8.3
M8201	C201 increase/decrease		M8402	RS2 command send request	

Serial number	Content	Remark	Serial number	Content	Remark
	counting action	OFF: Increase action			
M8202	C202 increase/decrease counting action		M8403	RS2 instruction reception end flag	
M8203	C203 increase/decrease counting action		M8404	RS2 command data receiving	
M8204	C204 increase/decrease counting action		M8405	RS2 command data set ready flag	
M8205	C205 increase/decrease counting action		M8408	RD3A/WR3A reception completion flag	
M8206	C206 increase/decrease counting action		M8409	RD3A/WR3A communication timeout flag	
M8207	C207 increase/decrease counting action		M8421	RS2 command sends the standby flag	This model is not currently supported
M8208	C208 increase/decrease counting action		M8422	RS2 command send request	
M8209	C209 increase/decrease counting action		M8423	RS2 instruction receiving end flag	
M8210	C210 increase/decrease counting action		M8424	RS2 command data receiving	
M8211	C211 increase/decrease counting action		M8425	RS2 command data sending completion flag	
M8212	C212 increase/decrease counting action		M8426	RS instruction master-slave and multi-machine mode flag	
M8213	C213 increase/decrease counting action		M8427	CAN data standard frame and extended frame flag	
M8214	C214 increase/decrease counting action		M8428	CAN communication MODBUS response correct flag	
M8215	C215 increase/decrease counting action		M8429	Communication timeout	
M8216	C216 increase/decrease counting action		M8432	Interpolation mode flag	This model is not currently supported
M8217	C217 increase/decrease counting action		M8433	Interpolation mode flag	
M8218	C218 increase/decrease counting action		M8434	Interpolation relative/absolute coordinate flag	
M8219	C219 increase/decrease counting action		M8435	Interpolation clockwise and counterclockwise flag	
M8220	C220 increase/decrease		M8450	The fifth pulse stop position	This model

Serial number	Content	Remark	Serial number	Content	Remark
	counting action				is not currently supported
M8221	C221 increase/decrease counting action		M8451	The sixth pulse stop position	
M8222	C222 increase/decrease counting action		M8452	The seventh pulse stop position	
M8223	C223 increase/decrease counting action		M8453	The eighth pulse stop position	

3.2 Special register numbers and contents

Serial number	Content	Remark	Serial number	Content	Remark
D8000	Watchdog Timer		D8148	Pulse acceleration and deceleration time from the fifth to the eighth	Reserve This model is not currently supported
D8001	PLC type and system version		D8160	The eighth position pulse quantity [Reserved This model is not currently supported]	Low
D8002	PLC memory capacity	8...8K steps; when the number is above 16K steps, D8002=8, and D8102 will be 16 or 32 accordingly.	D8161		High
D8003	Memory Type	10H: PLC built-in memory	D8169	Restricted access status	
D8010	Scan Current Value		D8182	Contents of the Z1 register	
D8011	Minimum scan time		D8183	Contents of the V1 register	
D8012	Maximum scan time		D8184	Contents of the Z2 register	
D8013	Second		D8185	Contents of the V2 register	
D8014	point		D8186	Contents of the Z3 register	
D8015	hour		D8187	Contents of the V3 register	
D8016	day		D8188	Contents of the Z4 register	
D8017	moon		D8189	Contents of the V4 register	
D8018	Year		D8190	Contents of the Z5 register	
D8019	Week		D8191	Contents of the V5 register	
D8020	Input filter adjustment		D8192	Contents of the Z6 register	
D8030	AD0 analog input value		D8193	Contents of register V6	
D8031	AD1 analog input value		D8194	Contents of the Z7 register	
D8032	AD2 analog input value		D8195	Contents of the V7 register	
D8033	AD3 analog input value		D8268	Reserve This model is not currently supported	
D8034	AD4 analog input value		D8269		
D8035	AD5 analog input value		D8278	Reserve This model is not currently supported	
D8036	AD6 analog input value		D8279		
D8037	AD7 analog input value		D8340	The first position pulse	Low
D8038	AD8 analog input value	Reserved, not	D8341		High

D8039	AD9 analog input value	supported yet	D8342	Y0 deviation speed initial value: 0	
D8040	AD10 analog input value		D8343	The maximum speed of the first pulse	Low
D8041	AD11 analog input value		D8344		High
D8042	AD12 analog input value		D8345	Y0 creep speed initial value: 1000	
D8043	AD13 analog input value		D8346	Y0 origin return speed initial value: 50000	Low
D8044	AD14 analog input value		D8347		High
D8045	AD15 analog input value		D8348	The first pulse acceleration time	
D8050	DA0 analog output value		D8349	The first pulse deceleration time	
D8051	DA1 analog output value		D8350	The second position pulse	Low
D8052	DA2 analog output value		D8351		High
D8053	DA3 analog output value	Reserved, not supported yet	D8352	Y1 deviation speed initial value: 0	
D8054	DA4 analog output value		D8353	The second pulse maximum speed	Low
D8055	DA5 analog output value		D8354		High
D8056	DA6 analog output value		D8355	Y1 creep speed initial value: 1000	
D8057	DA7 analog output value		D8356	Y1 origin return speed initial value: 50000	Low
D8058	DA is the current position setting	Refer to 5.2	D8357		High
D8059	Constant scan time		D8358	Second pulse acceleration time	
D8074	X0 rising edge ring counter value [1/6μs unit]	Low	D8359	Second pulse deceleration time	
D8075		High	D8360	The third position pulse	Low
D8076	X0 falling edge ring counter value [1/6μs unit]	Low	D8361		High
D8077		High	D8362	Y2 deviation speed initial value: 0	
D8078	X0 pulse width/pulse period [10μs unit]	Low	D8363	The third pulse maximum speed	Low
D8079		High	D8364		High
D8080	X1 rising edge ring counter value [1/6μs unit]	Low	D8365	Y2 crawling speed initial value: 1000	
D8081		High	D8366	Y2 origin return speed initial value: 50000	Low
D8082	X1 falling edge ring counter value [1/6μs unit]	Low	D8367		High
D8083		High	D8368	The third pulse acceleration time	
D8084	X1 pulse width/pulse period [10μs unit]	Low	D8369	The third pulse deceleration time	
D8085		High	D8370	The fourth position pulse	Low

D8086	X3 rising edge ring counter value [1/6μs unit]	Low	D8371		High
D8087		High	D8372	Y3 deviation speed initial value: 0	
D8088	X3 falling edge ring counter value [1/6μs unit]	Low	D8373	Maximum speed of the fourth pulse	Low
D8089		High	D8374		High
D8090	X3 pulse width/pulse period [10μs unit]	Low	D8375	Y3 crawling speed (Initial value: 1000)	
D8091		High	D8376	Y3 origin return speed (Initial value: 50000)	Low
D8092	X4 rising edge ring counter value [1/6μs unit]	Low	D8377		High
D8093		High	D8378	Fourth pulse acceleration time	
D8094	X4 falling edge ring counter value [1/6μs unit]	Low	D8379	Fourth pulse deceleration time	
D8095		High	D8395	Network settings feature flags	Reserved, this model is not currently supported
D8096	X4 pulse width/pulse period [10μs unit]	Low	D8397	ADPRW command serial port location	Refer to Section 8.2
D8097		High	D8398	0~2147483647 (1ms)	
D8101	PLC type and system version		D8399	incrementing action ring count	
D8102	PLC memory capacity	16...16K steps	D8400	Modbus RTU protocol communication parameters	serial port 3, refer to Section 8.3
D8108	Number of special module connections	Reserved, this model is not currently supported	D8401	Communication Mode	
D8109	The Y number where the output refresh error occurred		D8406	Interval cycle number	
D8120	Communication parameters of Modbus RTU protocol	serial port 2, refer to Section 8.2	D8409	Timeout	
D8121	Master and slave station numbers		D8410	RS2 header 1, 2 <initial value: STX>	
D8122	RS command sends the remaining points of data		D8411	RS2 header 3, 4	
D8123	Monitoring of RS instruction receiving points		D8412	RS2 tail 1, 2 <initial value: ETX>	
D8124	RS command header <initial value: STX>		D8413	RS2 tail 3, 4	
D8125	RS command end <initial		D8414	Master and slave station	

	value: ETX>			numbers	
D8126	The value of serial port 2 is 0 when using ADPRW instruction		D8415	RS2 receives the summation result	
D8126	Serial port 2 interval cycle number		D8416	RS2 sends summation	
D8127	Specify the starting number of the slave computer communication request	serial port 2, refer to Section 8.2	D8420	Communication parameters	Reserved, this model is not currently supported
D8128	Specify the number of data requested by the lower computer for communication		D8421	Communication Mode	
D8129	Set timeout		D8426	Interval cycle number	
D8140	The fifth position pulse	Reserved, this model is not currently supported	D8429	Timeout	
D8141			D8430	RS2 header 1, 2 <initial value: STX>	
D8142	The sixth position pulse		D8431	RS2 header 3, 4	
D8143			D8432	RS2 tail 1, 2 <initial value: ETX>	
D8144	The seventh position pulse		D8433	RS2 tail 3, 4	
D8145			D8434	RS2 receives and sums received data	
D8146	Maximum speed of the fifth to eighth pulses		D8435	RS2 receives the summation result	
D8147			D8436	RS2 sends summation	

Part 4 Function Instruction List

4.1 List of basic logic instructions

Instruction	Name	Function	Available software	Execution speed (us)	Step
General Instructions:					
LD	Pick	Normally open contact logic operation starts	X, Y, M, S, T, C	0.24(0.56)	1~3
LDI	Negation	Normally closed contact logic operation starts	X, Y, M, S, T, C	0.24(0.56)	1~3
AND	and	Normally open contacts in series	X, Y, M, S, T, C	0.24(0.56)	1~3
ANI	With reverse	Normally closed contacts in series	X, Y, M, S, T, C	0.24(0.56)	1~3
OR	Or pulse rising edge	Normally open contacts in parallel	X, Y, M, S, T, C	0.24(0.56)	1~3
ORI	or reverse	Normally closed contacts in parallel	X, Y, M, S, T, C	0.24(0.56)	1~3
ANB	Block and	Series connection of circuit blocks	-	0.24	1~3
ORB	Block or	Parallel connection of circuit blocks	-	0.24	1~3
MPS	Push	Store on stack	-	0.24	1~3
MRD	Reading the stack	Read the stack (pointer does not move)	-	0.24	1
MPP	Pop	Pop the stack	-	0.24	1
Output instructions:					
OUT	Output	Coil drive	Y, M, S	0.24(0.56)	1~3
SET	Set	Action hold (ON)	Y, M, S	0.24(0.56)	1~3
RST	Reset	Contact or register clear	Y, M, S, T, C, D, E, F	0.24(0.56)	3
Timers, counters:					
TMR	Timer	16-bit timer	TK or TD	9.6	4
CNT	counter	16-bit counter	CK or CD (16 bits)	12.8	4
DCNT	Double word counter	32-bit counter	CK or CD (32 bits)	14.3	6
Master control instructions:					
MC	Master	Connection circle instructions for common series points	N0~N7	5.6	3
MCR	Master reset	Elimination instructions for	N0~N7	5.7	3

		common concatenation points			
Rising edge/falling edge detection instructions:					
LDP	Take the rising edge of the pulse	Detect rising edge and start calculation	X, Y, M, S, T, C	0.56(0.88)	3
LDF	Take the falling edge of the pulse	Detection of falling edge starts calculation	X, Y, M, S, T, C	0.56(0.88)	3
ANDP	With pulse rising edge	Series connection for detecting rising edge	X, Y, M, S, T, C	0.56(0.88)	3
ANDF	With the pulse falling edge	Series connection for falling edge detection	X, Y, M, S, T, C	0.56(0.88)	3
ORP	Or pulse rising edge	Parallel connection for detecting rising edge	X, Y, M, S, T, C	0.56(0.88)	3
ORF	Or pulse falling edge	Parallel connection for detecting falling edge	X, Y, M, S, T, C	0.56(0.88)	3
Rising/falling edge output instructions:					
PLS	pulse	Rising edge differential output	Y.M.	9.92	3
PLF	Falling edge pulse	Falling edge differential output	Y.M.	10.16	3
End instruction:					
END	Finish	Program ends and input and output and returns to the beginning	-	0.24	1
Other instructions:					
NOP	No Operation	No Action	-	0.16	1
INV	Negation	Inversion of operation results	-	0.24	1
P	pointer	pointer	P0~P255	-	1
I	Interrupt input pointer	Interrupt input pointer	I □□□	-	1
MEP	MEP	Turn on when rising edge	-		
MEF	MEF	Turn on at falling edge	-		
Step ladder instructions:					
STL	start	The program jumps to the secondary bus	S	0.56	1
RET	return	The program returns to the main bus	-	0.24	1

4.2 Application instructions [in order of instruction type]

Comparison table with Mitsubishi FX3G PLC instructions

17 types of application instructions as follows .

1	Data transfer instructions
2	Data conversion instructions
3	Comparison Instructions
4	Four arithmetic instructions
5	Logical operation instructions
6	Special function instructions
7	Loop Instructions
8	Shift Instructions
9	Data processing commands
10	String processing instructions

11	Program flow control instructions
12	I/O refresh instructions
13	Clock Control Instructions
14	Pulse output positioning command
15	Serial communication instructions
16	Special function unit/module control instructions
17	Other convenient commands

1. Data transfer instructions

instruction	FNC No.	Function	support instruction
MOV	1 2	Teleport	★
SMOV	1 3	Bit Shift	★
CML	1 4	Reverse transmission	★
BMOV	1 5	Batch Transfer	★
FMOV	1 6	Multicast	★
PRUN	81	Octal bit transmission	★
XC	1 7	exchange	★
SWAP	1 47	Swap high and low bytes	★
EMOV	112	Binary floating point data transmission	★
HCMOV	1 89	High-speed counter transmission	

2. Data conversion instructions

instruction	FNC No.	Function	support instruction
BCD	18	BCD Conversion	★
BIN	19	BIN Conversion	★
GRY	170	Gray code conversion	★
GBIN	171	Gray code inverse conversion	★
FLT	49	Conversion from BIN integer to binary floating point number	★
INT	129	Conversion from binary floating point to BIN integer	★
EBCD	118	Conversion from binary floating point to decimal floating point	★
EBIN	119	Conversion from decimal floating point to binary floating point	★
RAD	136	Conversion from binary floating point angle to radians	★
DEG	1 37	Conversion of binary floating point radians to degrees	★

3. Comparison instructions

instruction	FNC No.	Function	support instruction
LD=	224	Contact comparison LD (S1) = (S2)	★
LD>	225	Contact comparison LD (S1)>(S2)	★
LD<	226	Contact comparison LD (S1) < (S2)	★
LD<>	228	Contact comparison LD (S1)≠(S2)	★
LD<=	229	Contact comparison LD (S1) ≦ (S2)	★
LD>=	23 0	Contact comparison LD (S1) ≧ (S2)	★
AND=	23 2	Contact comparison AND (S1)=(S2)	★
AND>	23 3	Contact comparison AND (S1)>(S2)	★
AND<	23 4	Contact comparison AND (S1)<(S2)	★
AND<>	23 6	Contact comparison AND (S1)≠(S2)	★
AND<=	23 7	Contact comparison AND (S1)≦(S2)	★
AND>=	23 8	Contact comparison AND (S1)≧(S2)	★
OR=	24 0	Contact comparison OR (S1)=(S2)	★
OR>	24 1	Contact comparison OR (S1)>(S2)	★
OR<	24 2	Contact comparison OR (S1) < (S2)	★
OR<>	24 4	Contact comparison OR (S1)≠(S2)	★
OR<=	24 5	Contact comparison OR (S1)≦(S2)	★
OR>=	24 6	Contact comparison OR (S1)≧(S2)	★
CMP	1 0	Compare	★
ZCP	1 1	Interval comparison	★
ECMP	1 10	Binary floating point comparison	★
EZCP	1 11	Binary floating point number interval comparison	★
HSCS	5 3	Comparison set (for high-speed counter)	★
HSCR	5 4	Comparison reset (for high-speed counter)	★
HSZ	5 5	Section comparison (for high-speed counter)	★
HSCT	280	Tabular comparison of high-speed counters	★

4. Arithmetic instructions

instruction	FNC No.	Function	support instruction
ADD	20	BIN addition operation	★
SUB	twenty one	BIN subtraction	★
MUL	twenty two	BIN multiplication	★
DIV	twenty three	BIN division operation	★
EADD	120	Binary floating point addition	★
ESUB	121	Binary floating point subtraction	★
EMUL	122	Binary floating point multiplication	★
EDIV	123	Binary floating point division operation	★
BK+	192	Addition of data blocks	★
BK-	193	Subtraction of data blocks	★
INC	twenty four	BIN plus one	★
DEC	25	BIN minus one	★

BKCMP =	194	Data block comparison (S1) = (S2)	★
BKCMP >	195	Data block comparison (S1) > (S2)	★
BKCMP <	196	Data block comparison (S1) < (S2)	★
BKCMP <>	197	Data block comparison (S1) ≠ (S2)	★
BKCMP <=	198	Data block comparison (S1) ≦ (S2)	★
BKCMP >=	199	Data block comparison (S1) ≧ (S2)	★

5. Logical operation instructions

instruction	FNC No.	Function	support instruction
WAND	26	Logical AND	★
WOR	2 7	Logical OR	★
WXOR	28	Logical XOR	★

6. Special function instructions

instruction	FNC No.	Function	support instruction
SQR	48	BIN square root operation	★
ESQR	127	Binary floating point square root operation	★
EXP	124	Binary floating point exponentiation	★
LOGE	125	Binary floating point natural logarithm operation	★
LOG10	126	Common logarithmic operations for binary floating point numbers	★
SIN	130	Binary floating point SIN operation	★
COS	131	Binary floating point COS operation	★
TAN	132	Binary floating point TAN operation	★
ASIN	133	Binary floating point SIN-1 operation	★
ACOS	134	Binary floating point COS-1 operation	★
ATAN	135	Binary floating point TAN-1 operation	★
RND	184	Generate random numbers	★

7. Loop instruction

instruction	FNC No.	Function	support instruction
ROR	30	Circular right shift	★
ROL	31	Circular left shift	★
RCR	32	Rotate right with carry	★
RCL	33	Rotate left with carry	★

8. Shift instruction

instruction	FNC No.	Function	support instruction
SFTR	34	Bit shift right	★
SFTL	35	Bit Shift Left	★
SFR	213	16-bit data n-bit right shift (with carry)	★
SFL	214	16-bit data n-bit left shift (with carry)	★
WSFR	36	Word right	★
WSFL	37	Word left	★
SFWR	38	Shift write [First-in-first-out/first-in-last-out control]	★
SFRD	39	Shift read [for first-in first-out control]	★
POP	212	Read the last entered data [first in, last out control]	★

9. Data Processing Orders

instruction	FNC No.	Function	support instruction
ZRST	40	Batch reset	★
DECO	41	Decoding	★
ENCO	42	coding	★
MEAN	45	average value	★
WSUM	140	Calculate the total value of the data	★
SUM	43	ON digits	★
BON	44	Determine the ON position	★
NEG	29	Complement	★
ENEG	128	Binary floating point sign flip	★
WTOB	141	Byte-based data separation	★
BTOW	142	Byte-based data combination	★
UNI	143	4-bit combination of 16-bit data	★
DIS	144	4-bit separation of 16-bit data	★
CCD	84	Check code	★
CRC	188	CRC calculation	
LIMIT	256	Upper and lower limit control	★
BAND	257	Dead zone control	★
ZONE	258	Zone Control	★
SCL	259	Coordinate setting	★

		(coordinate data of each point)	
SCL2	269	Coordinate setting 2 (X/Y coordinate data)	★
SORT	69	Data Arrangement	★
SORT2	149	Data Arrangement 2	★
SER	61	Data Retrieval	★
FDEL	210	Deleting data from a table	★
FINS	211	Inserting data into the data table	★

11. Program flow control instructions 12. I/O refresh instructions

instruction	FNC No.	Function	support instruction
CJ	00	Conditional Jumps	★
CALL	01	Subroutine call	★
SRET	02	Subroutine returns	★
IRET	03	Interrupt return	★
EI	04	Enable interrupts	★
DI	05	Disable interrupts	★
FEND	06	End of main program	★
FOR	08	Start of loop range	★
NEXT	09	End of loop range	★

12. I/O refresh instructions

instruction	FNC No.	Function	support instruction
REF	50	Input and output refresh	★
REFF	51	Input refresh (with filter setting)	★

10. String processing instructions

instruction	FNC No.	Function	support instruction
ESTR	116	Binary floating point number → string conversion	/
EVAL	117	String → binary floating point conversion	★
STR	200	BIN to string conversion	★
VAL	201	String → BIN conversion	★
DABIN	260	Conversion from decimal ASCII to BIN	★
BINDA	261	BIN → Decimal ASCII conversion	★
ASCI	82	HEX → ASCII conversion	★
HEX	83	ASCII → HEX conversion	★
$MOV	209	String transmission	★
$+	202	String combination	★
LEN	203	Detect the length of the string	★
RIGH	204	Start taking from the right side of the string	★
LEFT	205	Start taking from the left side of the string	★
MIDR	206	Any extraction from a string	★
MIDW	207	Any replacement in a string	★
INSTR	208	String search	★
COMRD	182	Read out the comment data of the device	

13. Clock control instruction

instruction	FNC No.	function	support instruction
TCMP	160	Comparison of Clock Data	★
TZCP	161	Interval comparison of clock data	★
TADD	162	Addition operation of clock data	★
TSUB	163	Subtraction operation of clock data	★
TRD	166	Read clock data	★
TWR	167	Write clock data	★
HTOS	164	Second conversion of [hour, minute, second] data	★
STOH	165	Conversion of [hour, minute, second] data in seconds	★

14.Pulse output • positioning instruction

instruction	FNC No.	function	support instruction
ABS	155	Read the current ABS value	
DSZR	150	Origin regression with DOG search	★
ZRN	156	Origin regression	★
TBL	152	Table setting positioning	
DVIT	151	Interrupt positioning	/
DRVI	158	Relative positioning	★
DRVA	159	Absolute positioning	★
PLSV	157	Variable speed pulse output	★
PLSY	57	pulse output	★
PLSR	59	Pulse output with acceleration and deceleration	★

15. Serial communication instructions

instruction	FNC No.	function	support instruction
RS	80	Transmission of serial data	★
R(S2)	87	Serial data transmission 2	★
IVCK	270	Operation monitoring of frequency converter	
IVDR	271	Operation control of frequency converter	
IVRD	272	Read the parameters of the frequency converter	
IVWR	273	Write the parameters of the frequency converter	
IVBWR	274	Batch write parameters of frequency converter	
IVMC	275	Multiple commands for the frequency converter	
ADPRW	276	MODBUS read/write	★

16. Special functional unit/module control instructions

instruction	FNC No.	function	support instruction
FROM	78	BFM readout	★
TO	79	BFM writing	★
RD3A	176	Readout of analog module	★
WR3A	177	Writing of analog module	★
RBFM	278	BFM segmentation readout	
WBFM	279	BFM split write	

17. Other convenient instructions

instruction	FNC No.	function	support instruction
WDT	07	watchdog	★
ALT	66	Alternating output	★
ANS	46	Signal alarm setting	★
ANR	47	Signal alarm reset	★
HOUR	169	Chronograph	★
RAMP	67	RAMP	★
SPD	56	pulse density	★
PWM	58	Pulse Width Modulation	★
DUTY	186	Send timed pulses	
PID	88	PID operation	★
ZPUSH	102	Batch saving of index registers	★
ZPOP	103	Recovery of index register	★
TTMR	64	Teaching Timer	★
STMR	65	Special Timer	★
ABSD	62	Cam sequential control absolute mode	
INCD	63	Cam sequential control relative mode	
ROTC	68	Rotating worktable control	
IST	60	Initialization status	★
MTR	52	Matrix Input	/
TKY	70	Number key input	★
HKY	71	Hexadecimal numeric key input	★
DSW	72	Digital Switch	★
SEGD	73	7-segment decoder	★
SEGL	74	7SEG time-division display	
ARWS	75	Arrow switch	
ASC	76	Input of ASCII data	
PR	77	ASCII code printing	
VRRD	85	Potentiometer reading	
VRSC	86	Potentiometer scale	

For detailed instructions, please refer to "Coolmay Full Series PLC Instruction Programming Manual"

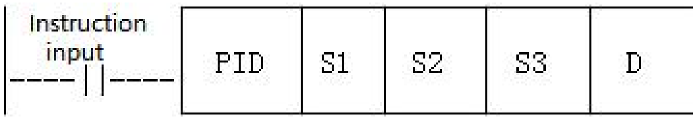
4.3 Special Instruction Usage

4.3.1 PID instruction

1. Overview: This instruction is used to execute PID control to change the output value according to the change of input.

2. PID instruction format and parameter description .

Instruction format:

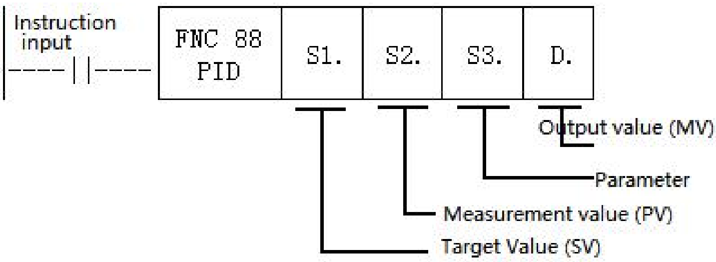


Parameter Description:

Operand Type	content	Data Types	Word software
S1.	Data register number to store the target value (SV)	BIN16 bits	D
S2.	Data register number for storing measured value (PV)	BIN16 bits	D
S3.	Data register number to save the parameter	BIN16 bits	D
D.	Data register number to store output value (MV)	BIN16 bits	D

3. Function and action description

16-bit operation (PID): After setting the target value S1., measured value S2., and parameters S3~S3+6 in the execution program, the operation result (MV) is saved in the output value D. every sampling time S3.



Setting Project

Setting Project		content	Occupied points
S1.	Target value (SV)	Set the target value (SV) PID instruction does not change the setting content	1 point
S2.	Measured value (PV)	Input value for PID operation.	1 point

S3.	parameter	Auto-tuning: Step response method a) Action setting (ACT): When bit1, bit2, and bit5 are all "0", 25 soft points are occupied starting from the start soft element specified in S3. b) Action setting (ACT): When bit1, bit2, and bit5 are all "0", 20 soft points are occupied starting from the start soft element specified in S3.	25:20
D.	Output value (MV)	Self-tuning: Please set the step output value on the user side before driving with the step response method. During the self-tuning process, the MV output cannot be changed on the PID instruction side.	1 point

Parameters S3.~S3.+28 list

Setting Project		Setting content	Remark
S3.	Sampling time (Ts)	1~32767(ms)	A value shorter than the operation cycle cannot be executed
S3.+1	Action Setting (ACT) bit3	0~32767	= 1, in learning state = 0 , it means PID learning is completed and enters the temperature control state
S3.+2	Input filter constant (α)	0~99(%)	0 means no input filtering
S3.+3	Proportional gain (KD)	Unsigned 32 bits	
S3.+5	Integration time (TD)	Unsigned 32 bits	0 is treated as ∞ (no integration)
S3.+7	Differential gain (TD)	Unsigned 32 bits	No differential gain at 0
S3.+9	Current Status	0~32767	=2 , indicating that it is in learning state = 3, indicating that it is in the learning initialization state = 4, indicating that it is in temperature control state = 8, indicating that it is in the temperature control initialization state
S3.+10	Self-tuning heating status	0~32767	= 0, indicating heating state = 1, indicating that it is in cooling state
S3.+11	Over temperature times	0~32767	Indicates the number of times the target temperature has been exceeded
S3.+12	Equal amplitude oscillation observation position	0~32767	Observe whether the waveform during the learning process is within the set error range.
S3.+13	Upper amplitude difference	Unsigned 32 bits	The difference between the highest temperature rise and the set temperature during the learning process
S3.+15	Lower amplitude difference	Unsigned 32 bits	the lowest temperature and the set temperature during the learning process
S3.+17	Zero crossing times	0~32767	In the learning state, it can be set according to the environment to filter data anomalies caused by fluctuations
S3.+18	Error Code	0~32767	During the learning process, the error is 11 when it is in the second waveform, and the error is 12 when it is in the third waveform.
S3.+19	Heating capacity	0~32767	The amount of heat used for learning and calculation during the learning process (not writable)
S3.+20	Peak temperature	Unsigned 32 bits	The highest temperature that rises during the learning process, used as outmax and outmin during

			temperature control
S3.+22	Valley temperature	Unsigned 32 bits	The lowest temperature that drops during the learning process. The temperature control is used as the target value.
S3.+24	Large control belt	0~32767	Difference range for integral separation (proportional suppression) during temperature control
S3.+25	Small control belt	0~32767	The difference range used for the first stage of integration (cooling coefficient) intervention during temperature control
S3.+26	Fine control belt	0~32767	The difference range used for PID temperature control during temperature control
S3.+27	Temperature drop coefficient	0~32767	Intervention coefficient for large control band
S3.+28	Full power equivalent	0~32767	Maximum output power during temperature control
S3.+29	First-order proportional suppression	0~32767	Intervention coefficient for small control band interval
S3.+30	Secondary proportional suppression	0~32767	Not used yet
S3.+31	Equal amplitude error	0~32767	Used to determine the error range of equal-amplitude waveforms during learning
S3.+32	Initial equivalent	0~32767	Initial learning power
S3.+33	PID Number	0~32767	Corresponding PID instruction number (for multiple PIDs to coexist)
S3.+34	Low Zero Times	0~32767	The number of times the temperature control target is exceeded is used as the control cycle during temperature control.
S3.+35	Temperature control P value	Unsigned 32 bits	Temperature control is used as the P value for calculation
S3.+37	Temperature control I value	Unsigned 32 bits	Temperature control is used as the I value for calculation
S3.+39	Temperature control D value	Unsigned 32 bits	Temperature control is used as the D value for calculation
S3.+41	KU Value	Unsigned 32 bits	The amount of computation during learning

4. Operation steps

initialization:

1. S3.+2 is the action setting.
   S3.+2 = 16: PID self-learning
   S3.+2 = 0: PID self-tuning temperature control
2. Outside the large control band (S3.+48), the integral does not intervene. Within the small control band (S3.+50), the integral intervenes. The fine control band (S3.+52) is finely

controlled, and the integral suppresses the output.

3. The cooling coefficient (S3.+54) is placed between the small control band and the large control band to control the output coefficient

4. The proportional suppression ratio (S3.+58) is set to the coefficient of the control output outside the large control band.

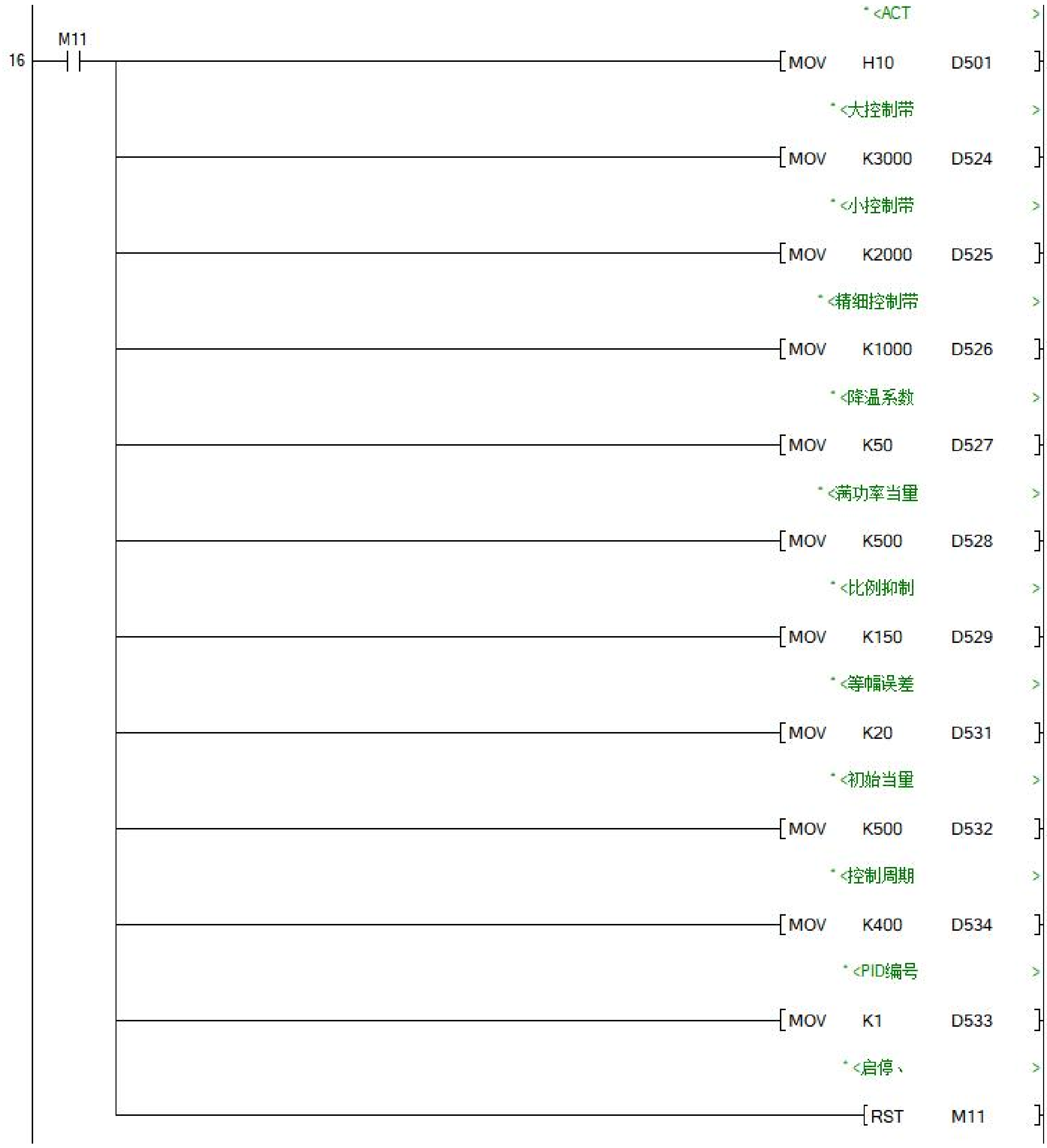
5. Full power (S3.+56) to set PWM cycle

6. The conditions for successful learning of equal amplitude error (S3.+62) are inversely proportional to the control effect.

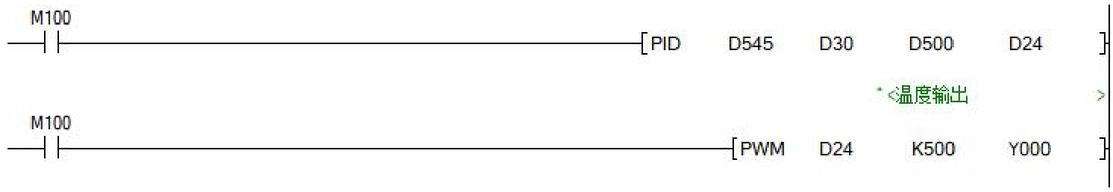
7. Initial equivalent (S3.+64) sets the initial output pulse width

5. Examples

Initialization configuration:



Analog control:



4.3.2 SPD instruction

1. Overview: Pulse frequency detection instruction: An instruction that uses interrupt input to count input pulses within a specified time **.**

2. SPD instruction format and parameter description .

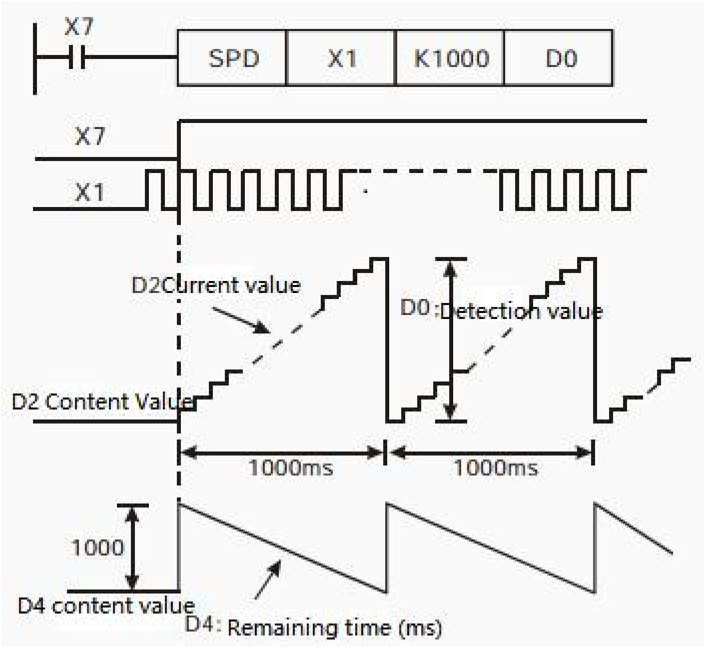
type	instruction	External pulse input	Receive pulse time	Test results
D	**SPD**	**S 1.**	**S2.**	**D.**

- 16-bit operation (SPD): The pulses of input **S1** are counted only within **S2.** × 1ms , the measured value is saved **in D.** , the current value is saved in **D.** +1, and the remaining time is saved in **D.** +2 (ms).

By repeating this operation, the pulse density (i.e., a value proportional to the rotational speed) can be obtained in the measured value **D.**

- **D.** It occupies 5 registers, **D. +1** and **D.** are the previous pulse detection values, **D. +3 and D. + 2** are the current pulse accumulation values, and **D. + 4 shows** the remaining timing time, which can reach a maximum of 32,767ms **.**
- SPD specifies 7 ports, i.e. **S1 .=** X0 - X7. There is no limit on the number of times the command can be run, and all ports can be collected at the same time.

- Program Example
  - When X7=On, D2 calculates the high-speed pulse input by X1, and automatically stops calculating after 1000ms, and the result is stored in D0.
  - When the 1000ms timing is completed, the content of D2 is cleared to 0. When X7 is turned on again, D2 starts counting again.


X7
SPD
X1
K1000
D0
X7
X1
D2Current value
D0:Detection value
D2 Content Value
1000ms
1000ms
1000
D4 content value
D4: Remaining time (ms)

Part 5 Analog Usage

5.1 Analog Input

The L01S series PLC can select up to 8 analog inputs with an accuracy of 1 to 2 bits . When in use, you can directly read the register value corresponding to each analog input.

5.1.1 Analog type

Input signal type	Range	Register reading value	Resolution	Accuracy Total range	Remark
K-type thermocouple	-240～1370℃	-2400～13700	0.1℃	1%	Thermocouple type should be ungrounded
T-type thermocouple	-240～400℃	-2400～4000	0.1℃	1%	
S-type thermocouple	-50～1690℃	-500～16900	0.1℃	1%	
J-type thermocouple	-120～1200℃	-1200～12000	0.1℃	1%	
Type E Thermocouple	-110～730℃	-1100～7300	0.1℃	1%	
PT100	-200～800℃	-2000～8000	0.1℃	1%	
Thermistor NTC10K	-30～210℃	-300～2100	0.1℃	1%	The default value of B is 3435
Voltage analog Type1	0-10V	0 ～ 4000	2.5mV	1%	
Voltage analog Type2	-10-10V	-4000～4000	0.3mV	1%	
Current analog Type1	0～20mA	0 ～ 4000	5uA	1%	
Current analog Type2	4～20mA	0 ～ 4000	4uA	1%	

5.1.2 Reading analog input

Supports FROM instruction or register direct reading. For example: FROM K0 K0 D400 K 2 reads 2 analog inputs, 0~10V.

Register direct reading: D[8030]~D[8037] are the output values of the corresponding type settings , channel switch **D8114** ;

Serial number	Register reading value	Channel switch register
AD0	D8030	Start when D8114.0~D8114.7=1
AD1	D8031	
AD2	D8032	
AD3 (Cold end when thermocouple is selected)	D8033	

AD4	D8034	
AD5	D8035	
AD6	D8036	
AD7	D8037	

5.1.3 Analog input sampling

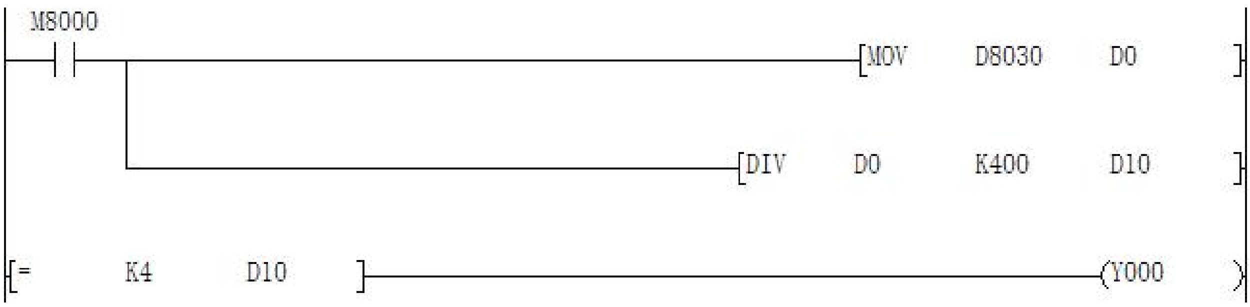
D8073 is the number of sampling cycles : range 0-7 , default = 7; after modification, restart will take effect. That is, if D8073 = 1, a PLC scan cycle will sample once and change the value of the analog input once.

D8100 is the number of filter cycles: range 0-32767, default = 5.

5.1.4 Example of analog input

The following is an example of collecting the voltage analog AD0 of the integrated machine.

The program reads the value as follows:



Connect the signal end of the voltage sensor to the AD0 input of the PLC, and the other end to the GND of the analog input port. When the PLC is running, the value of the data register D8030 corresponding to AD0 will be transferred to D0, and the value of D0 will be divided and placed in D10. The result is that D10 is the actual voltage input value. In the ladder diagram, the value of D8030 can also be divided directly.

Note: When the input is temperature, the actual analog value = register reading/10;

When the input is 0-10V analog, the actual analog value = register reading/400;

When the input is 0-20mA analog, the actual analog value = register reading/200;

When the input is 4-20mA analog, the actual analog value = register reading/250+4.

5.2 Analog output

The analog output setting value range is 0~ 4000 , with an accuracy of 12 bits . Supports TO instruction or register direct assignment operation;

Use TO K0 K0 D500 K2 instruction to output 2 analog quantities 0~10V or 0~20mA.

Register direct assignment operation: D8050~D805 1 .

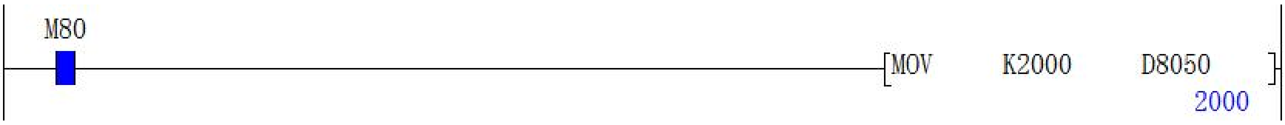
When the analog output is current, the bit of D8058 needs to be set: by default, when

D8058.0~D8058.1 = 0 , it means 0~20mA; when D8058.0~D8058.1 = 1 , it means 4~20mA.

	Analog output	Setting	illustrate
DA0	D8050	0-4000	If it is not 0, the DA conversion is
DA1	D8051	0-4000	

For example:

The following figure shows the 0-10V voltage analog output.



At this time, use a multimeter to check the voltage at the DA0 terminal, that is, connect the red pen of the multimeter to the DA0 terminal and the black pen to the GND terminal, and see that the multimeter displays a 5V voltage value.

Part 6 High-speed counting and interruption function application

6.1 Built-in high-speed counter input allocation table

High speed counters are divided into hardware high-speed counters and software high-speed counters (hardware high-speed counters have fast counting speed and high accuracy, while software high-speed counters have slightly lower speed and low speed). Simultaneously using multiple high-speed counters requires reducing the counting frequency.

If high-speed counting interrupt is used, the high-speed counting setting device cannot be used and cannot be reused.

Input X000~X007 can be used for high-speed counters, input interrupts, pulse capture, as well as SPD, ZRN, DSZR commands and general-purpose inputs. Therefore, do not reuse the input terminals.

High speed counting conventional single-phase 6-channel 100KHz or AB phase 2-channel 100KHz; Among them, the dual phase dual counting input defaults to 1x.

Counter type	Counter number	Input Allocation							
		X000	**X001**	X002	**X003**	**X004**	X005	X006	X007
Single phase single counting input	C235(100K)	U/D							
	C236(10K)		U/D(软)						
	C237(10K)			U/D(软)					
	C238(100K)				U/D				
	C239(10K)					U/D(软)			
	C240(10K)						U/D		
	C241	U/D	R						
	C242			U/D	R				
	C243								
	C244	U/D	R					S	
	C245			U/D	R				S
Single phase dual counting input	C246	U	D						
	C247	U	D	R					
	C248				U	D	R		
	C249	U	D	R				S	
	C250				U	D	R		S
Dual phase dual counting input	C251(100K)	A	B						
	C252	A	B	R					
	C253(100K)				A	B	R		
	C254	A	B	R				S	
	C255				A	B	R		S

U: Counting input D: Counting input A: A-phase input B: B-phase input R: External reset input S: External start input

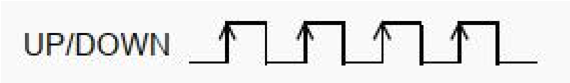
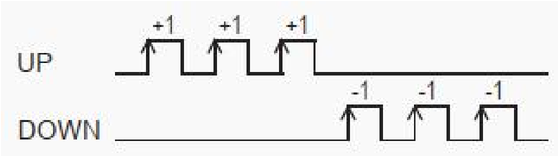
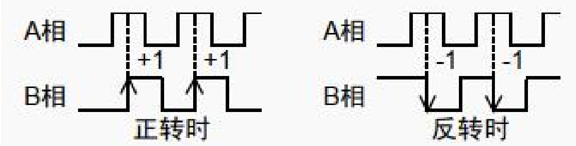
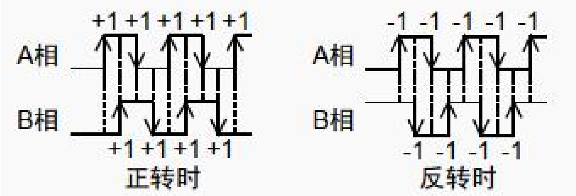
Single phase: software counting 4 channels, maximum frequency 10KHz; Hardware count up to 2 channels, maximum frequency 100KHz

Dual phase: 1x frequency: up to 2 channels, maximum frequency 100KHz;

4th harmonic: up to 2 channels, maximum frequency 100KHz;

M8198 is the 4th harmonic symbol of C251, C252, and C254; M8199 is the 4th harmonic symbol of C253 and C255.

Other notes

<table>
<tr><th colspan="2"></th><th>Input signal form</th><th>Counting direction</th></tr>
<tr><td colspan="2">Single phase single counting input</td><td>
</td><td>Use the ON/OFF of M8235-M8245 to specify whether to increase or decrease the count.
ON: Countdown
OFF: Increase Count</td></tr>
<tr><td colspan="2">Single phase dual counting input</td><td>
</td><td>As shown in the left figure, increase or decrease the count.
The counting direction can be set through M8246 to M8250.
ON: Countdown
OFF: Increase Count</td></tr>
<tr><td rowspan="2">Dual-phase dual-counting input</td><td>1x</td><td>
</td><td rowspan="2">As shown in the left figure, the counting is automatically increased or decreased based on the input state changes of phase A/phase B.
The counting direction can be set through M8251 to M8255.
ON: Countdown
OFF: Increase Count</td></tr>
<tr><td>4x</td><td>
</td></tr>
</table>

[Tips: The 1st and 4th harmonics of a high-speed counter refer to the way the counter records pulse signals.

1x refers to the high-speed counter recording a data when the encoder generates a complete pulse.

The fourth harmonic is to record the rising and falling edges of the two high-speed outputs A/B as a complete pulse. This method can record 3/4 more high-speed pulse values than 1x under the same encoder conditions, thereby improving control accuracy (resolution accuracy). In short, in the 4th harmonic mode, the counter counts each rising and falling edge of the pulse signal, resulting in more count values for the same number of physical pulses.

The main difference between the two lies in counting efficiency and accuracy. The 1st harmonic counting is simple and direct, while the 4th harmonic improves the accuracy and resolution of counting by capturing the changes in pulse signals in more detail.]

6.2 Related software components

1. Single-phase single-count input counter increase/decrease count switching

type	Counter number	Specified software	Up count	Down count
Single-phase single-count input	**C235**	**M8235**	OFF	ON
	C236	**M8236**		
	C237	**M8237**		
	C238	**M8238**		
	C239	**M8239**		
	C240	**M8240**		
	C241	**M8241**		
	C242	**M8242**		
	C243	**M8243**		
	C244	**M8244**		
	C245	**M8245**		

2.Monitoring the increase/decrease counting direction of single-phase dual-count and dual-phase dual-count input counters

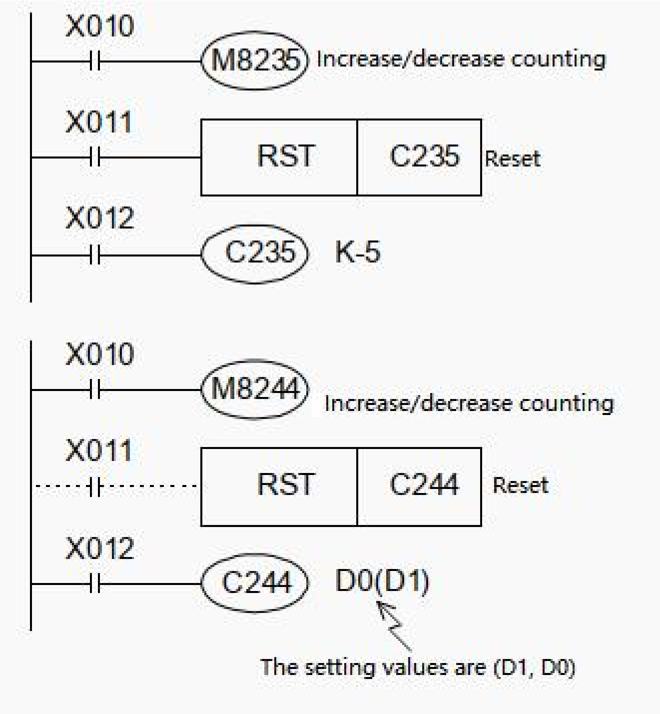
type	Counter number	Specified software	Up count	Down count
Single-phase dual-count input	**C246**	**M8246**	OFF	ON
	C247	**M8247**		
	C248	**M8248**		
	C249	**M8249**		
	C250	**M8250**		
Two-phase two-count input	**C251**	**M8251**		
	C252	**M8252**		
	C253	**M8253**		
	C25 4	**M8254**		
	C25 5	**M8255**		

3. High-speed counter function switching

Component name	name	content
M8198	Function switching software	1x/4x switching soft element for C251, C252, C254
M8199		1x/4x switching soft element for C253 and C255

6.3 Use of High-speed Counter

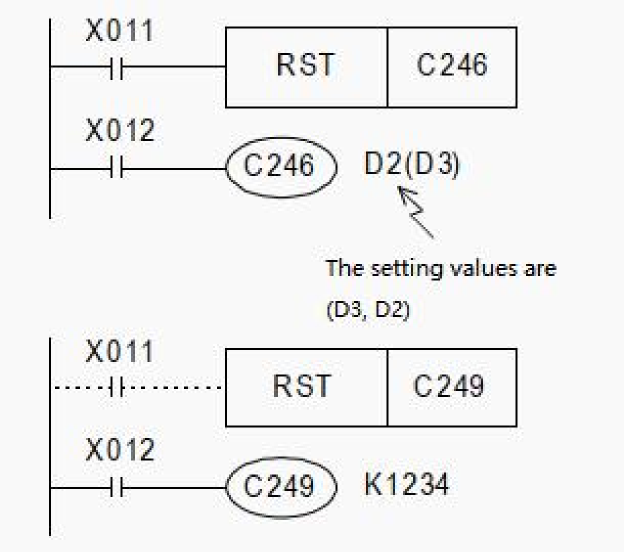
1. Single-phase single-count input



- C235 counts the OFF → ON of input X000 when X012 is ON.
- When X011 is ON, execute the RST instruction, and C235 will be reset.
- By adjusting the ON/OFF of M8235~M8245, the counters C235~C245 can be varied between decreasing/increasing counts.

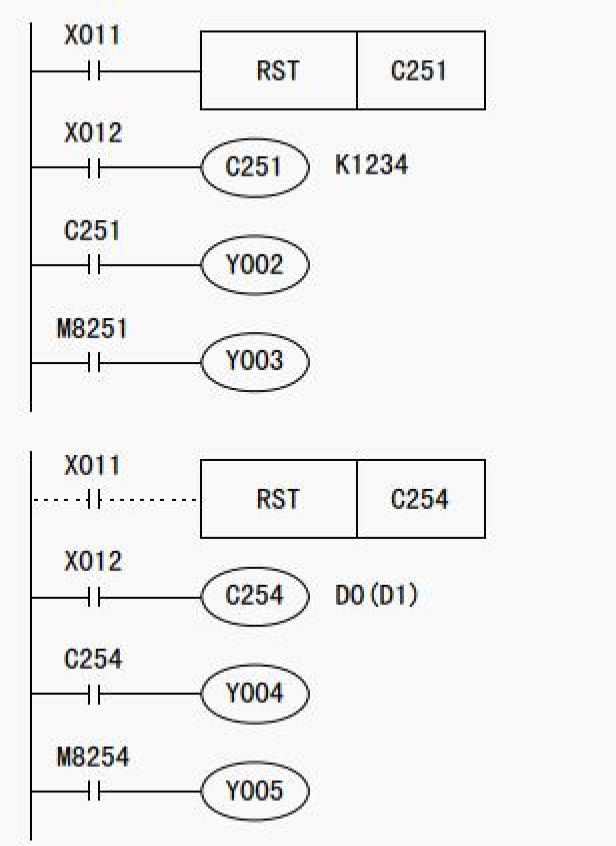
- C244 starts counting immediately after X012 reaches ON and input X006 changes to ON. The count input is X000, and in this example, the set value is the content of the indirectly specified data register (D1, DO).
- As shown in the figure, X011 can be used to reset the program, but closing X001 will also immediately reset it. So there is no need for such a program.
- By adjusting the ON/OFF of M8235~M8245, the counters C235~C245 can be varied between decreasing/increasing counts

2. Single-phase dual-count input



- When X012 is ON, if the input X000 changes from OFF to ON, C246 counts up; if the input X001 changes from OFF to ON, C246 counts down.
- The counting actions of C246 to C250 can be monitored through the ON/OFF actions of M8246 to M8250. (ON: Countdown; OFF: Increase Count)
- When X012 is ON, if X006 is ON, C249 immediately starts counting.
- The count up input is X000, and the count down input is X001.
- As shown in the left figure, X011 can be used to reset the program, but X002 will be reset immediately when it is closed. So there is no need for such a program.
- The counting actions of C246 to C250 can be monitored through the ON/OFF actions of M8246 to M8250.
- ON: down counter
- OFF: Increase Count

3. Dual-phase dual-count input



- When X012 is ON, C251 counts the actions of input X000 (phase A) and X001 (phase B) through interrupts.
- X011 is ON, execute RST instruction, and C251 will be reset at this time.
- If the current value exceeds the set value, Y002 is ON, and if it changes within the range below the set value, it is OFF.
- Y003 is turned on (off) and off (on) according to the counting direction.

- When X012 is ON, if X006 is ON, immediately start counting C254. The input for this count is X000 (phase A) and X001 (phase B).
- In addition to resetting the program using X011, C254 can also be reset immediately when X002 is turned on.
- When the current value exceeds the set value (D1, D0), Y004 will act, and when it changes within the range below the set value, it will be OFF.
- Y005 is ON (decrease) and OFF (increase) according to the counting direction.

6.4 Interrupt Application

Statement : The priority of interrupt pointer I is input interrupt, timer interrupt, and high-speed counter interrupt.

6.4.1 Input Interrupt

X0~X5 input terminals is triggered on the rising or falling edge, the processing of the special hardware design circuit in the PLC host will not be affected by the scan cycle. It will immediately interrupt the currently executing program and jump to the specified interrupt insertion subroutine pointer I00□(X0), I10□(X1), I20□(X2), I30□(X3), I40□(X4), I50□(X5) for execution. When the IRET instruction is executed, it will return to the original position and continue to execute.

External interrupt pointer insertion prohibition flag signal:

Corresponding port	Flag signal (Cleared when switching from RUN to STOP)	Functional Description	Remark
X0	M8050	External interrupt insertion I00□ Disable	□ is 0 or 1 [0=falling edge interrupt; 1=rising edge interrupt]
X1	M8051	External interrupt insert I 1 0□ Disable	
X2	M8052	External interrupt insertion I 2 0□ Disable	
X3	M8053	External interrupt insertion I 3 0□ Disable	
X4	M8054	External interrupt insertion I 4 0□ Disable	
X5	M8055	External interrupt insertion I 5 0□ Disable	

Note: All interrupt priorities: The last interrupt has the highest priority. The last interrupt will terminate the executing program or the previous interrupt, and will resume execution of the previous program after execution.

Input X000~ X005 is used for high-speed counter, input interrupt, pulse capture, SPD, DSZR, ZRN instructions and general input. Therefore, do not reuse input terminals.

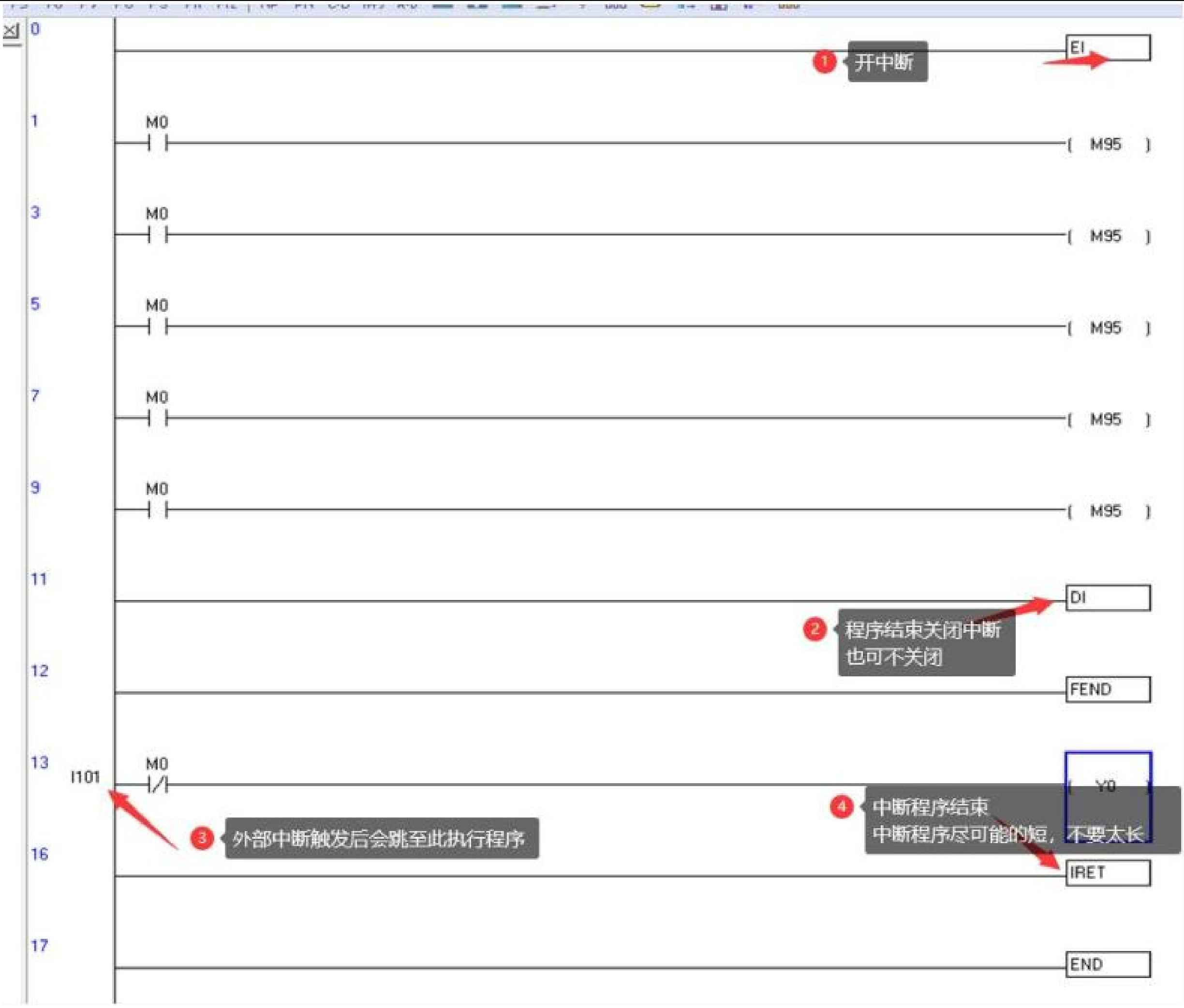
The rising edge interrupt and falling edge interrupt of the same input such as I001 and I000 cannot be programmed at the same time.

Program example:

The program first turns on the interrupt enable EI, and the time period from EI to DI allows the external X1 rising edge to trigger an interrupt.

When X1 is ON during the interrupt time period, the program jumps to the interrupt number I101 to execute program Y0, which is ON.

Because this interrupt is a pulse edge interrupt, the I101 segment will not be polled and executed. After the interrupt program is executed, it will jump to the breakpoint of the main program and continue to run the main program.



6.4.2 Timer Interrupt

Add timer interrupt T timer I602~I699, I702~I799, I 805~I899. 3 points, the time is not affected by the scan cycle time.

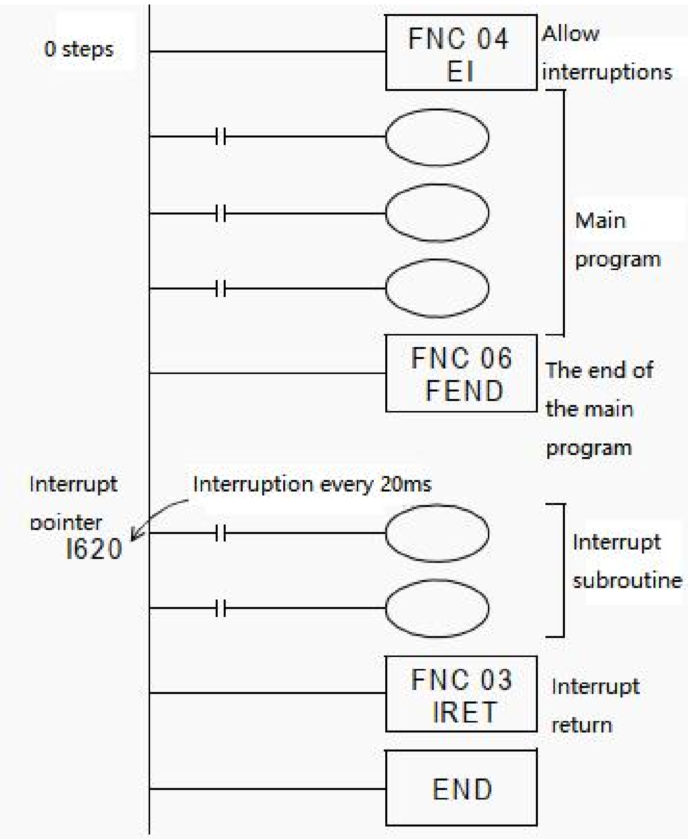
It is suitable for situations where the main program operation cycle is long, a specific program needs to be processed at high speed, or a program needs to be executed at a certain interval during sequential control operation.

Flag signal (Cleared when switching from RUN to STOP)	Functional Description	Remark
M8056	I600 ~ I699 prohibited	Time base = 1ms
M8057	I 7 00 ~ I 7 99 Prohibited	
M8058	I 8 00 ~ I 8 99 Prohibited	

Note: All interrupt priorities: The last interrupt has the highest priority. The last interrupt will terminate the executing program or the previous interrupt, and will resume execution of the previous program after execution.

When there are multiple timer interrupt subroutines, for example: I620, I730, I850, I6=20ms, I7=30ms, I8=50ms. When the scan cycle is greater than 50ms, only I6 will be executed (I6 has the highest priority). Improper time setting will cause interrupt reentry.

Basic procedure:



●After the EI instruction, the timer interrupt becomes valid.
●In addition, when there is no prohibition interval that requires timer interruption,
●There is no need to write DI (disable interrupt instruction).

●FEND represents the end of the main program.
●The interrupt subroutine must be written after FEND.

●Execute interrupt subroutine every 20ms.
●Use the IRET instruction to return to the main program.

6.4.3 High-speed counter interrupt

high-speed counter interrupt address is 010, 020, 030, 040, 050, 060. Used together with the comparison set instruction of DHSCS, the interrupt program is executed when the current value of the high-speed counter reaches the specified value.

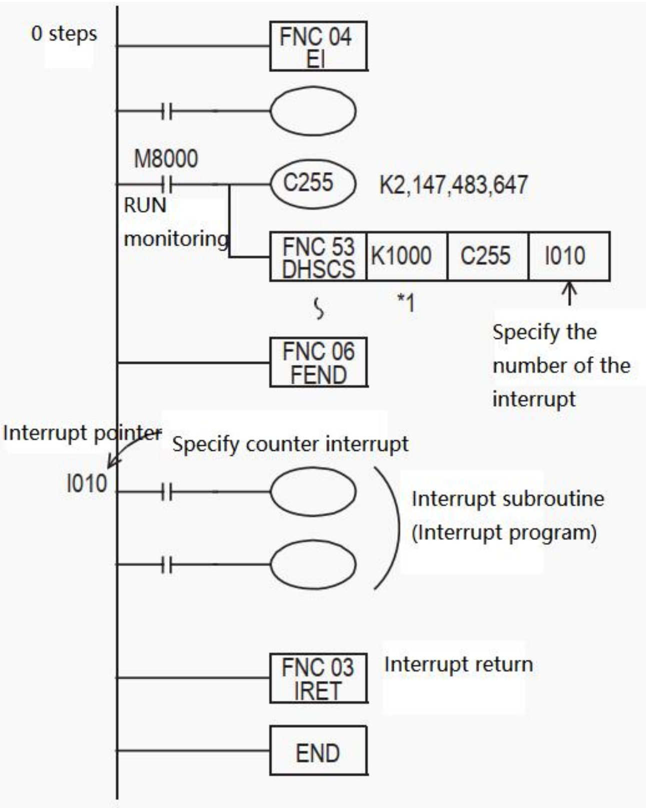
When only the ON/OFF output relay (Y) and auxiliary relay (M) are controlled according to the current value of the high-speed counter, programming can be easily performed using the DHSCS (FNC 53), DHSCR (FNC 54), and DHSZ (FNC 55) instructions.

Flag signal	Functional Description
M8059	Disable interrupt I1 0 10
	Disable interrupt I1 02 0
	Disable interrupt I1 03 0
	Disable interrupt I1 04 0
	Disable interrupt I1 05 0
	Disable interrupt I1 06 0

Note:
1) Duplicate pointer numbers
Pointer numbers cannot be reused.
2) Disabling interrupts
When the special auxiliary relay M8059 is turned ON in the program, all counter interrupts are

disabled.

Basic procedure:



main program

Allow interrupts after EI (FNC 04) instruction

Describe the main program.

Drive the coil of the high-speed counter in DHSCS (FNC 53)

Specify interrupt pointer in instruction

When the current value of C255 changes from 999 to 1000,

Execute interrupt subroutine

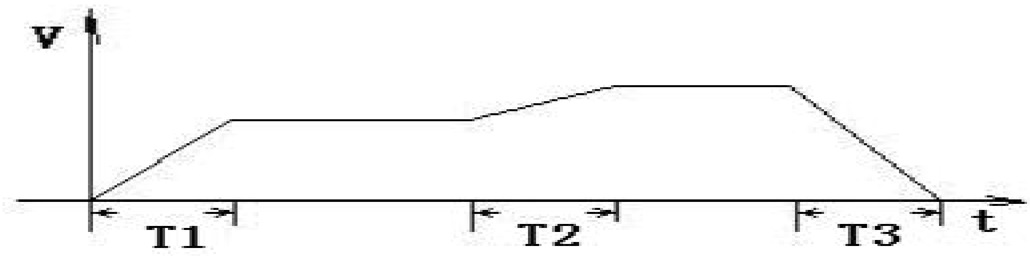
For an example of using interrupt programs, please refer to the input interrupt mentioned above

Part 7 High-speed pulse output application

7.1 High-speed pulse output

Note: When using the Y1, Y3 high-speed pulse output channels, the X4, X5, X6, and X7 hard high-speed counting functions cannot be used, and vice versa.

Gumei L01S series PLC high-speed pulse output conventional 4 channels, 100K Hz. Support variable speed, the initial/final speed of start/stop is 0, the chart is as follows:



Acceleration and deceleration time T calculation: (target speed --- current speed) * acceleration and deceleration time / maximum speed

For example: target speed = 50000, current speed = 20000, acceleration time 100 (ms), maximum speed = 100000, T = 30ms.

1. The relevant auxiliary relays are as follows:

Soft component number				name	property	Object directives	Remark
Y000	Y001	Y002	Y003				
M8029				Instruction execution end flag	Read-only	PLSY/PLSR/DSZR/ ZRN/PLSV/DRVI/DRVA, etc.	
M8329				Instruction execution abnormal end flag	Read-only	PLSY/PLSR/DSZR/ ZRN/PLSV/DRVI/DRVA	
M8338				Acceleration and deceleration action	Readable and writable	PLSV	This model is not currently supported
M8340	M8350	M8360	M8370	Pulse output monitoring (BUSY/READY)	Read-only	PLSY/PLSR/DSZR/ ZRN/PLSV/DRVI/DRVA	
M8341	M8351	M8361	M8371	Clear signal output function is effective	Readable and writable	DSZR/ZRN	This model is not

M8342	M8352	M8362	M8372	Origin return direction specification	Readable and writable	DR	currently supported
M8343	M8353	M8363	M8373	Forward limit	Readable and writable	PLSY/PLSR/DSZR/ ZRN/PLSV/DRVI/DRVA	
M8344	M8354	M8364	M8374	Reversal Limit	Readable and writable		
M8345	M8355	M8365	M8375	Proximity signal logic inversion	Readable and writable	DR	This model is not currently supported
M8346	M8356	M8366	M8376	Zero signal logic inversion	Readable and writable	DR	
M8348	M8358	M8368	M8378	Positioning command driving	Read-only	PLSY/PWM/PLSR/DSZR/ ZRN/PLSV/DRVI/DRVA	
M8349	M8359	M8369	M8379	Pulse stop command	Readable and writable	PLSY/PLSR/DSZR / ZRN/PLSV/DRVI/DRVA	
M8464	M8465	M8466	M8467	Clear signal device designation function is effective	Readable and writable	DSZR/ZRN	This model is not currently supported

2. The relevant data registers are as follows:

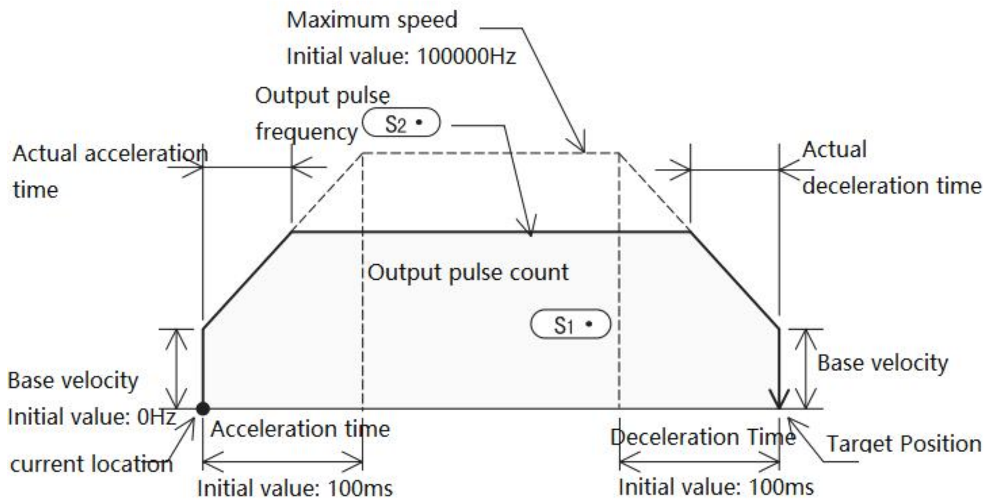
Soft component number								name	Data length	Initial Value	Object directives	Remark
Y000		Y001		Y002		Y003						
D8336								Interrupt input assignment	16-bit	one	DVIT	This model is not currently supported
D8340	Low	D8350	Low	D8360	Low	D8370	Low	Current value register [PLS]	32-bit	0	DSZR/ZRN/ PLSV/DRVI/ DRVA	
D8341	High	D8351	High	D8361	High	D8371	High					
D8342		D8352		D8362		D8372		Base speed	16-bit	0	DSZR/ZRN/ PLSV/DRVI/	Less than

								[Hz]			DRVA	1/10 of the maximum speed
D8343	Low	D8353	Low	D8363	Low	D8373	Low	Maximum speed [Hz]	32-bit	100,000	DSZR/ZRN/PLSV/DRVI/DRVA	
D8344	High	D8354	High	D8364	High	D8374	High					
D8345		D8355		D8365		D8375		Crawling speed [Hz]	16-bit	1000	DR	
D8346	Low	D8356	Low	D8366	Low	D8376	Low	Origin return speed [Hz]	32-bit	50,000	DR	
D8347	High	D8357	High	D8367	High	D8377	High					
D8348		D8358		D8368		D8378		Acceleration time [ms]	16-bit	100 ms	DSZR/ZRN/PLSV/DRVI/DRVA	50～5,000(ms)
D8349		D8359		D8369		D8379		Deceleration time [ms]	16-bit	100 ms	DSZR/ZRN/PLSV/DRVI/DRVA	
D8464		D8465		D8466		D8467		Clear signal device designation	16-bit	one	DSZR/ZRN	This model is not currently supported

7.2 Related instructions

1.Relative positioning (DRVI instruction), absolute positioning (DRVA instruction)

In these instructions, in addition to the output pulse frequency specified by the operand of the instruction, there are also setting items such as the maximum speed, base speed, acceleration time, deceleration time, etc. specified by the relevant soft components.



Instruction introduction:

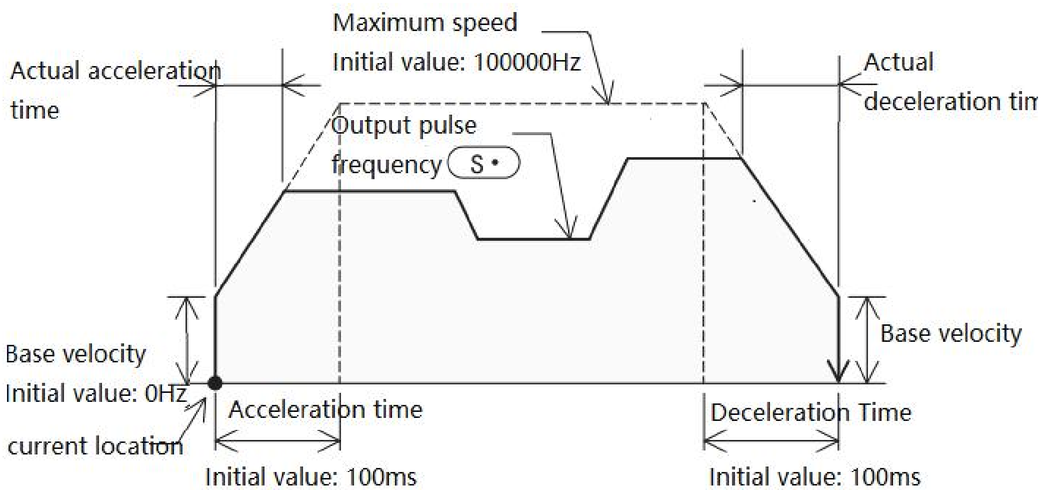
instruction	Operands	Setting range 16 bit (Hz)	Setting range 32 bit (Hz)	Instruction Format
DRVI	S2.	10～32767	10～200,000	DRVI S1• S2• D1• D2•
DRVA	S2.	10～32767	10～200,000	DRVA S1• S2• D1• D2•

2. Variable speed pulse output (PLSV) instruction

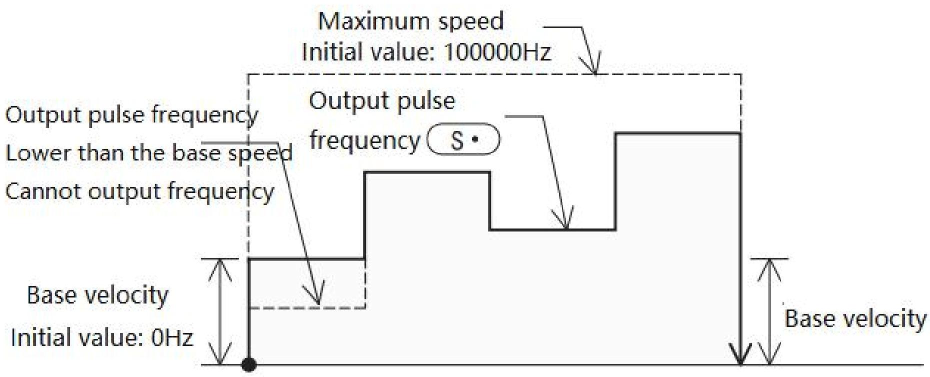
In the variable speed pulse output (PLSV) instruction, in addition to the output pulse frequency specified by the instruction operand, there are also setting items such as the maximum and base speeds, acceleration time, and deceleration time specified by related soft components.

However, the acceleration time and deceleration time are only valid when the acceleration and deceleration are in action (M8338=ON).

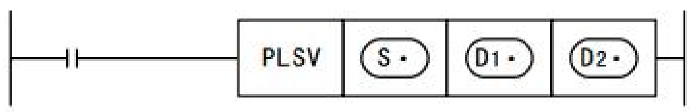
1) During acceleration and deceleration (M8338=ON)



2) No acceleration/deceleration action (M8338=OFF)

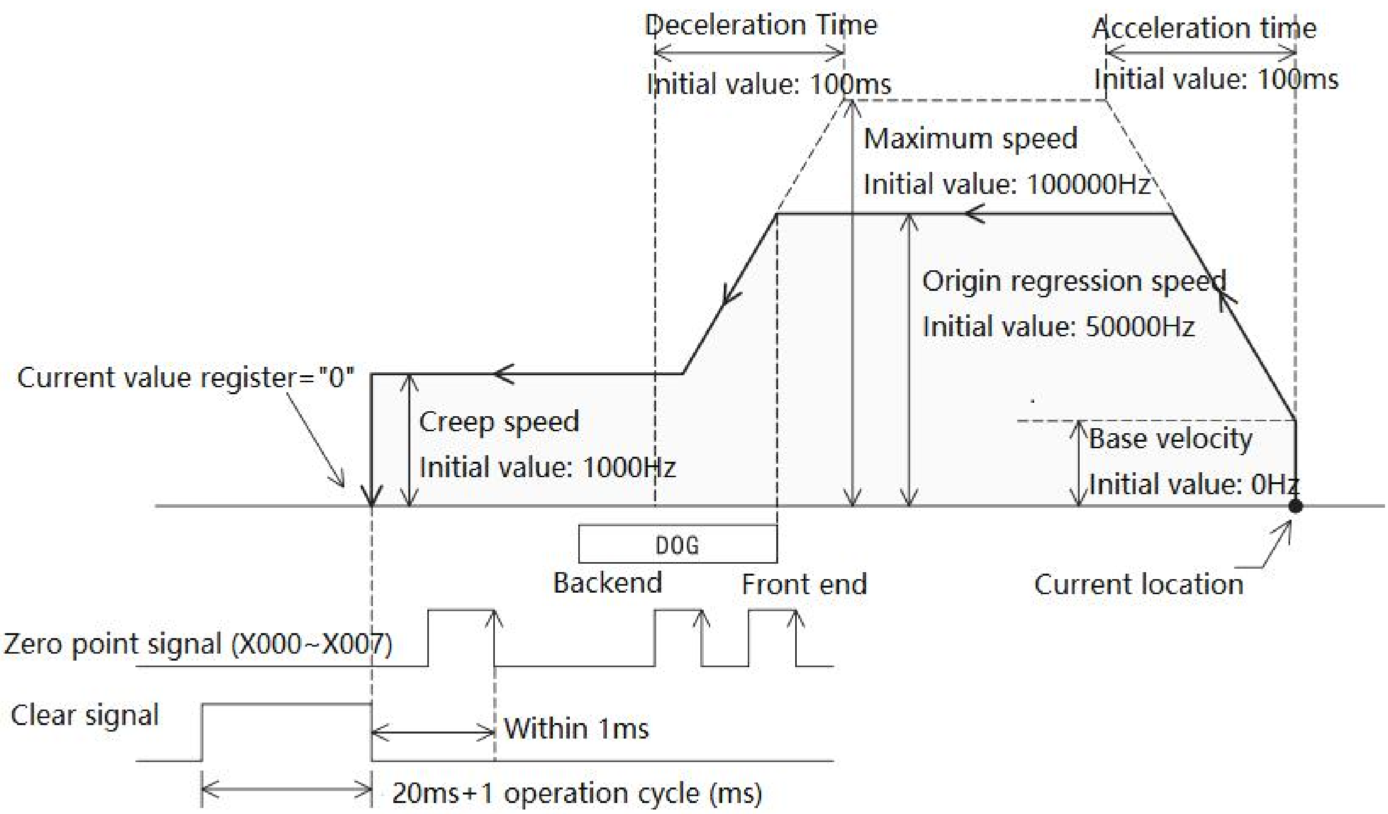


Instruction introduction:

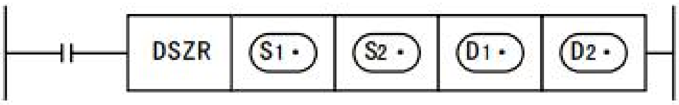
instruction	Operands	Setting range		Instruction Format
		16 bit (Hz)	32 bit (Hz)	
PLSV	S.	-32768～-1, +1～32767	-200,000～-1, +1～200,000	

3. Home point return with DOG search (DSZR) instruction

This instruction has setting items such as maximum speed, base speed, acceleration time, deceleration time, origin return speed, creeping speed, etc. specified by related software .

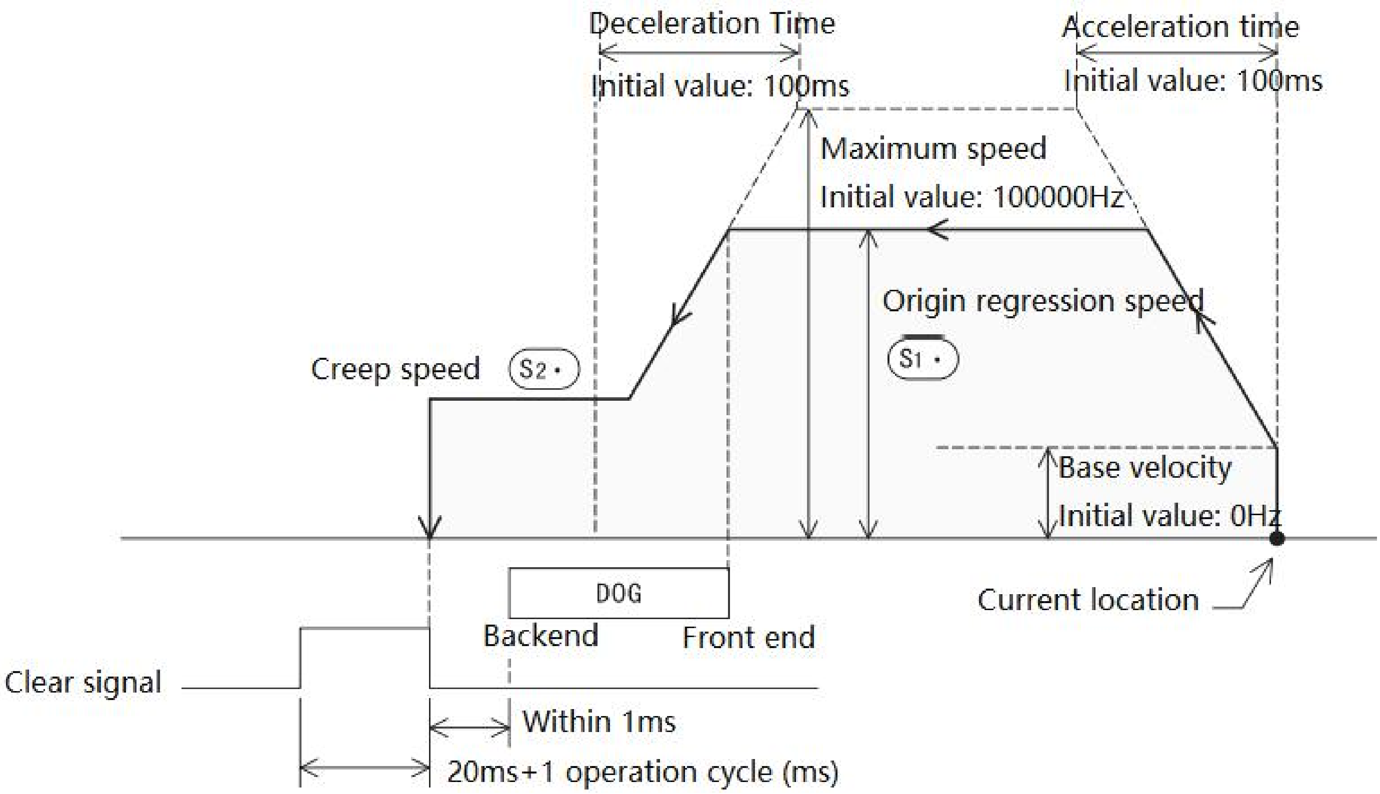


Instruction introduction:

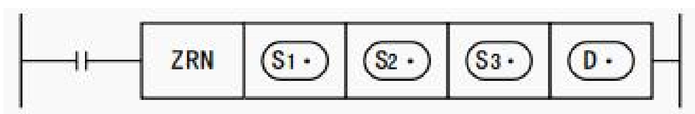
instruction	Operands	Setting range		Instruction Format
		16 bit (Hz)	32 bit (Hz)	
DR	D1. (Y0~Y3)	10～200,000 Initial value: 50000		

4. Origin return (ZRN) instruction

In this instruction, in addition to the origin return speed and creep speed specified by the instruction operands, there are also setting items such as maximum speed, base speed, acceleration time, deceleration time, etc. specified by related soft components.



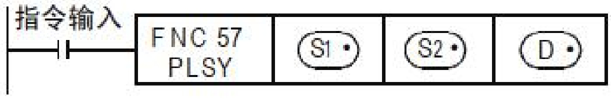
Instruction introduction:

instruction	Operands	Setting range		Instruction Format
		16 bit (Hz)	32 bit (Hz)	
ZRN	S1.	10～32767	10～200,000	

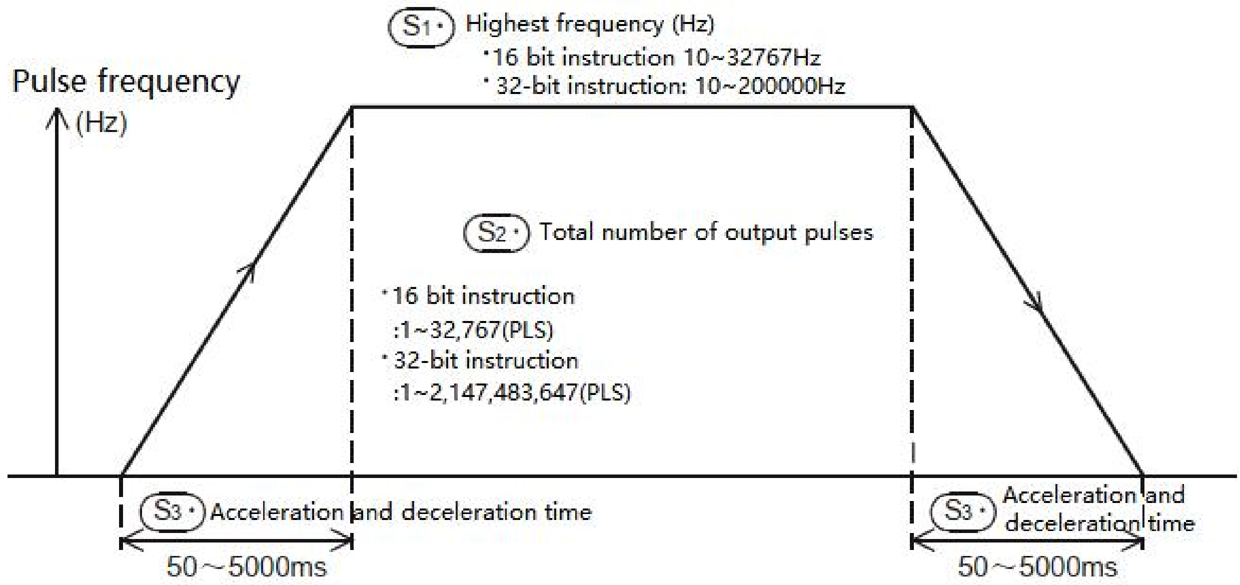
5. Pulse output PLSY instruction

Instruction introduction: Output S1. pulse trains with frequency S2. from output Y [D.] **.**

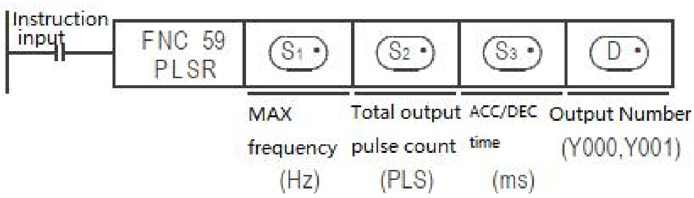
instructi	Operan	Frequency setting range	Instruction Format

on	ds	16 bit (Hz)	32 bit (Hz)	
PLSY	D. (Y0~Y3)	10～32767	10～200,000	

6. Pulse output PLSR instruction with acceleration and deceleration



Instruction description: Output pulses from output Y [D.] with a maximum frequency of S1., perform deceleration in S3. ms, and the number of output pulses is only S2 **.**

instruction	Operands	Frequency setting range		Instruction Format
		16 bit (Hz)	32 bit (Hz)	
PLSR	D. (Y0~Y3)	10～32767	10～200,000	

❖ Note: For detailed usage of the above instructions, please refer to "Coolmay Full Series PLC Instruction Programming Manual"

7.3 Pulse Width Modulation PWM

1. Overview: This instruction is used to specify the pulse output of the pulse cycle and ON time.

2. PWM instruction format and parameter description.

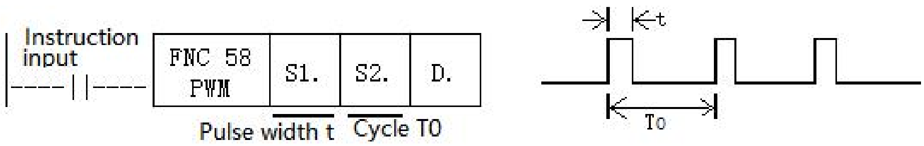
Instruction format:

Parameter Description:

Operand Type	content	Data Types	Word software element	Value range	Remark
S1.	Pulse output width	BIN16 bits	KnX, KnY, KnM, KnS, T, C, D, E, F, K, H	0~32767ms	S1≤S2
S2.	Pulse output period	BIN16 bits	KnX, KnY, KnM, KnS, T, C, D, E, F, K, H	1~32767ms	
D.	Output pulse soft element (Y) number	BIN16 bits	Y0-Y3	Y0-Y3	5~100KHz

3. Function and action description

16-bit operation (pwm): Outputs a pulse with an ON pulse width of [S1.ms] in units of period [S2.ms].



Points to note

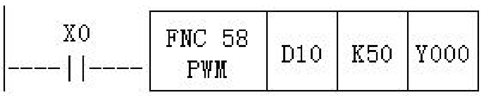
- ❖ Y is transistor output type.
- ❖ The values of pulse width S1. and period S2. need to be set to S1.≦S2.
- ❖ When the command input is OFF, the output from D is also OFF.
- ❖ Output control is performed using an interrupt processing method that is not affected by the sequence program (operation cycle).
- ❖ Do not operate the pulse output mode setting switch while the pulse is being emitted.

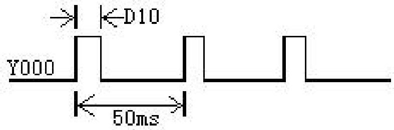
4. Description of related registers

Component name	name	content
M8473	Pulse output signal inversion	PWM command Y0 Pulse output signal inversion Default: OFF
M8474		PWM command Y1 pulse output signal inversion Default: OFF

M8475		PWM command Y2 pulse output signal inversion Default: OFF
M8476		PWM command Y3 Pulse output signal inversion Default: OFF
D8473	Time Unit	Y0 Pulse output unit time switching, default value 2; 0=10us 1=10us 2=1ms 3=10ms
D8474		Y1 Pulse output unit time switching, default value 2; 0=10us 1=10us 2=1ms 3=10ms
D8475		Y2 pulse output unit time switching, default value 2; 0=10us 1=10us 2=1ms 3=10ms
D8476		Y3 pulse output unit time switching, default value 2; 0=10us 1=10us 2=1ms 3=10ms

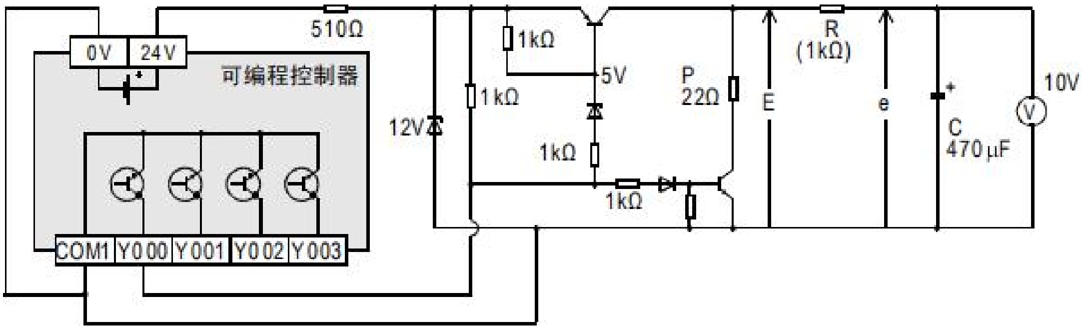
5. Program Example





In this example, the data range of D10 is changed between 0 and 50, and the average output of Y0 is 0 to 100%. If the data of D10 is greater than 50, an error will occur.

Example of a smoothing loop



R >> P

t = R(K Ω)* C(μ F) = 470ms >>T0

τ of the filter is extremely large compared to the pulse period T0.

Δe in the average output current e is approximately $\frac{\Delta e}{e} \leqq \frac{T0}{\tau}$

6. Special instructions

1) Supports 4 channels from Y0 to Y3 (please select transistor MT output);

2) There is no limit on pulse width and period, both are in milliseconds (ms) .

Part 8 Coolmay L01S Series PLC Communication User Manual

The L01S series PLCs are equipped with a programming port (RS232) and two RS485 ports to meet the needs of users for connecting to several types of devices.

8.1 MODBUS instruction explanation and communication address

When PLC is used as the host, it supports ADPRW instruction, RD3A instruction, and WR3A instruction. This section explains these three instructions.

8.1.1 Read /write data instruction function and action description

Modbus data reading:

RD3A	m1.	m2.	D.

In Cool may In PLC, the RD3A instruction corresponds to Modbus function 03.

m1 indicates the station number of the slave device being read, ranging from 1 to 247;

m2 indicates the first address number of the read data in the slave device;

D. indicates the number of registers read, ranging from 1 to 125 (1 to 45 for Modbus ASCII) . The read data is saved in **D.** +1, **D.** +2 **, etc. of the host in sequence** .

D. -1 address value must be set (=0: serial port 2; =1: serial port 3;)

Modbus data writing:

WR3A	m1.	m2.	S.

In CoolMayPLC, the WR3A instruction corresponds to Modbus function 06 and function 10.

m1 indicates the station number of the slave device being written, ranging from 1 to 247.

m2 indicates the first address number of the register to be written in the slave device;

S. indicates the number of registers to be written, ranging from 1 to 123 (1 to 45 for Modbus ASCII) . The data to be written is saved in the host **S.** +1, **S.** +2 **, etc.** in sequence.

S = 1, the WR3A instruction corresponds to Modbus function 06;

S= 2-123 , the WR3A instruction corresponds to Modbus function No. 10;

S .-1 Address value must be set (=0: serial port 2; =1: serial port 3;)

8.1.2 ADPRW instruction function and action description

following functions of MODBUS RTU :

Function 01: Read coil status, obtain the current status (ON/OFF) of a group of logic coils, range 1-512

Function 02: Read input status, obtain the current status (ON/OFF) of a set of switch inputs, range 1-512

Function 03: Read holding registers, obtain the current binary value in one or more holding registers, ranging from 1 to 125

Function 04: Get the current binary value in one or more input registers, ranging from 1 to 125

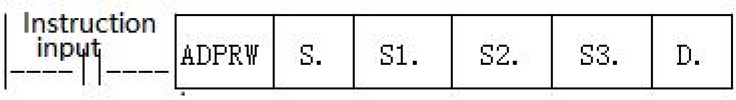
Function 05: Forced single coil, forced on/off state of a logic coil (write bit), range 1

Function 06: Load a specific binary value into a holding register (write register), range 1

0F : Force multiple coils, force a series of continuous logic coils to be on or off (write multiple bits), range 1-1968

10 : Preset multiple registers, load specific binary values into a series of consecutive holding registers (write multiple registers), range 1-125

ADPRW :



S. indicates the station number of the slave device being read or written , ranging from 1 to 247;

S1. Indicates the function code (i.e. the functions 01-06, 15, and 16 written above) ;

S2. Function parameters corresponding to each function code (for example, in case of function 01, the operand represents the MODBUS start address);

S3. Function parameters corresponding to each function code (for example, when the function is 01, the operand represents the number of access points, and when the function is 05, the parameter is fixed to 0);

D. Indicates the starting position of the data storage soft element.

8.1.3 ADPRW instruction function parameters

Operands / Function	S1. Function code	S2. MODBUS address/sub-function code	S3. Access points/sub-function data	D. Data storage software starts
Coil readout	1H	MODBUS address: 0000H~FFFFH	Access points: 1~2000	Read target device DRMYS
Input Readout	2H	MODBUS address: 0000H~FFFFH	Access points: 1~2000	Read target device DRMYS
Holding register read	3H	MODBUS address: 0000H~FFFFH	Access points: 1~125	Read target device DR
Input register read	4H	MODBUS address: 0000H~FFFFH	Access points: 1~125	Read target device DR
Single coil write	5H	MODBUS address: 0000H~FFFFH	0 (fixed)	Write target soft element DRXYMS 0 = bit OFF 1 = bit ON
Single Register Write	6H	MODBUS address: 0000H~FFFFH	0 (fixed)	Write target device DR
Batch coil writing	FH	MODBUS address: 0000H~FFFFH	Access points: 1~1968	Write target device DRXYMS

Batch Register Write	10H	MODBUS address: 0000H~FFFFH	Access points: 1~123	Write target device DR

8.1.4Soft component communication address number

Word soft element:

MODBUS software		PLC software
Input register (read only)	Holding register (read/write)	
-	0x0000～0x1F3F	D0～D7999
-	0x1F40～0x213F	D8000～D8511
-	0x2140～0x7EFF	R0～R23999
-	0x7F00～0xA13F	Unused address
-	0xA140～0xA27F	TN0～TN319
-	0xA280～0xA33F	Unused address
-	0xA340～0xA407	CN0～CN199
-	0xA408～0xA477	CN200～CN255
-	0xA478～0xA657	M0～M7679
-	0xA658～0xA677	M8000～M8511
-	0xA678～0xA777	S0～S4095
-	0xA778～0xA78B	TS0～TS319
-	0xA78C～0xA797	Unused address
-	0xA798～0xA7A7	CS0～CS255
-	0xA7A8～0xA7AF	Y0～Y177
0xA7B0～0xA7B7	-	Unused address
0xA7B8～0xA7BF	-	X0～X177
An error will occur when accessing an unused address. CN200 to 255 is a 32-bit counter.		

Bit soft element:

MODBUS software		PLC software
Input (read only)	Coil (read/write)	
-	0x0000～0x1DFF	M0～M7679
-	0x1E00～0x1FFF	M8000～M8511
-	0x2000～0x2FFF	S0～S4095
-	0x3000～0x313F	TS0～TS319
-	0x3140～0x31FF	Unused address
-	0x3200～0x32FF	CS0～CS255
-	0x3300～0x337F	Y0～Y177
0x3380～0x33FF	-	Unused address
0x3400～0x347F	-	X0～X177
An error occurs when accessing an unused address		

8.2 Serial port 2: RS485 (AB)

Support Mitsubishi programming port protocol, Mitsubishi BD protocol, Freeport RS protocol and MODBUS RTU protocol;

The special relays and special registers involved in this serial port are as follows:

Functional Description	Serial port 2 (A/B)	Serial port 3 (A1/B1)	Remark
Mitsubishi programming port protocol	M8196=0	M8192=0	Power off does not hold
Freeport protocol function	M8196=1 M8125=0	M8192=1	
RS/RS2 send flag	M8122=1	M8402=1	
RS/RS2 send completion flag	-	-	Manual reset required
RS/RS2 receiving end flag	M8123	M8403	Manual reset required
RS/RS2 receiving process flag	M8124	M8404	Data is being received
RS/RS2 instruction 8-bit/16-bit switching	M8161	M8161	
RS2 instruction end operand setting	-	1	
MODBUS Functionality	M8196=1 M8125=1	M8192=1	
RD3A/WR3A receives the correct flag	M8128	M8408	Automatic reset
RD3A/WR3A communication timeout flag	M8129	M8409	Automatic reset
ADPRW instruction completion flag	M8029	M8029	Instruction execution end flag
Communication parameters	D8120	D8400	
Communication Mode	-	D8401	
Master and slave station number	D8121	D8414	
RD3A/WR3A timeout	D8129	D8409	The unit is milliseconds. For detailed settings, see the explanation.
RD3A/WR3A interval cycle number	D8126	D8406	
RD3A/WR3A last operand	0	1	

-1			
Set when ADPRW instruction is used	D8397=0	D8397=1	

M8196: Enable flag for using programming port protocol and other protocols.

M8125: Enable the use of MODBUS and the original Mitsubishi function.

M8122: RS instruction sending flag (this position needs to be set to 1 when used, and it will be automatically reset after sending).

M8123: RS instruction receiving end flag, needs to be reset manually.

M8124: RS instruction data is being received.

M8161: 8-bit/16-bit mode flag for RS instruction.

M8128: RD3A / WR3A receives the correct flag.

M8129: RD3A/WR3A communication timeout flag (when communication times out, this flag turns ON).

M8029: Communication completion flag (communication completion flag when using ADPRW instruction, needs to be reset manually) .

D8120: Save the communication parameters of the Modbus RTU protocol. See the figure below for specific settings.

D8121: Save the host or slave station number. (When acting as a host, this value must be set to the maximum value of K255)

D8129: RD3A and WR3A timeout. (Unit: milliseconds, recommended setting: when the communication rate is greater than or equal to 9600, D8129 is set to 10~20; when the communication rate is less than 9600, D8129 is set to 20~50;)

D8126: Interval cycle number. Default = 10 (times).

D8397: When using serial port 2 for ADPRW instruction, D8397 needs to be set to 0.

Support RS, WR3A, RD3A, ADPRW instructions. Can be set in the parameter area, corresponding to serial port 2. Parameter area settings are only valid for this channel. Not valid for serial port 3.

8.2.1 Mitsubishi programming port protocol

When used as Mitsubishi programming port protocol: set M8196=0.

8.2.2 Mitsubishi BD Agreement

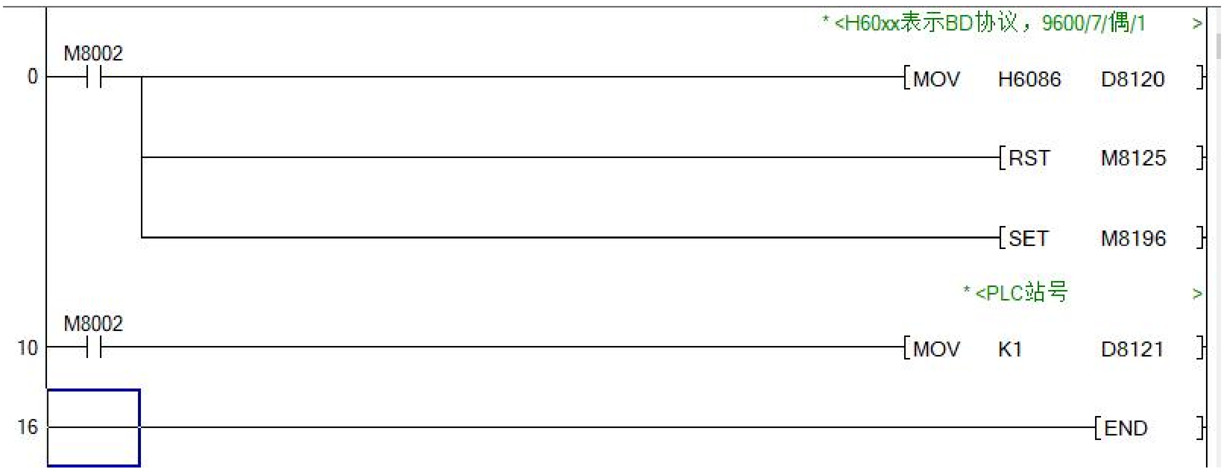
as Mitsubishi BD protocol function: set M8196=1, M8125=0; D8120 is set as communication parameter, and D8121 is set as slave station number. For example, set D8120=H 6086 , D8121=H1 (communication parameter is 9600/ 7 / E /1, slave station number is 1).

D8120 parameter settings

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

b0	Data length 0: 7 bits 1: 8 bits
b1 b2	Parity (b2, b1) 00: None; 01: Odd; 11: Even
b3	Stop bit 0:1 bit 1:2 bit
b4 b5 b6 b7	Baud rate (b7, b6, b5, b4) (0100): 600bps (0101): 1200bps (0110): 2400bps (0111): 4800bps (1000): 9600bps (1001): 19200bps (1010): 38400bps (1011): 57600bps (1101): 115200bps
b8	Setting 0
b9	
b10	
b11	
b12	Setting 0
b13	Setup 1
b14	Setup 1
b15	Setting 0

Example of PLC as slave program:



The touch screen sets the BD protocol master station to communicate with the PLC.

8.2.3 Freeport protocol functions and examples

as Mitsubishi free port protocol function: set M8196=1, M8125=0;

The difference between Mitsubishi protocol 1 and protocol 4 is that there are end characters 0A 0D (stored in D8124 D8125 respectively)

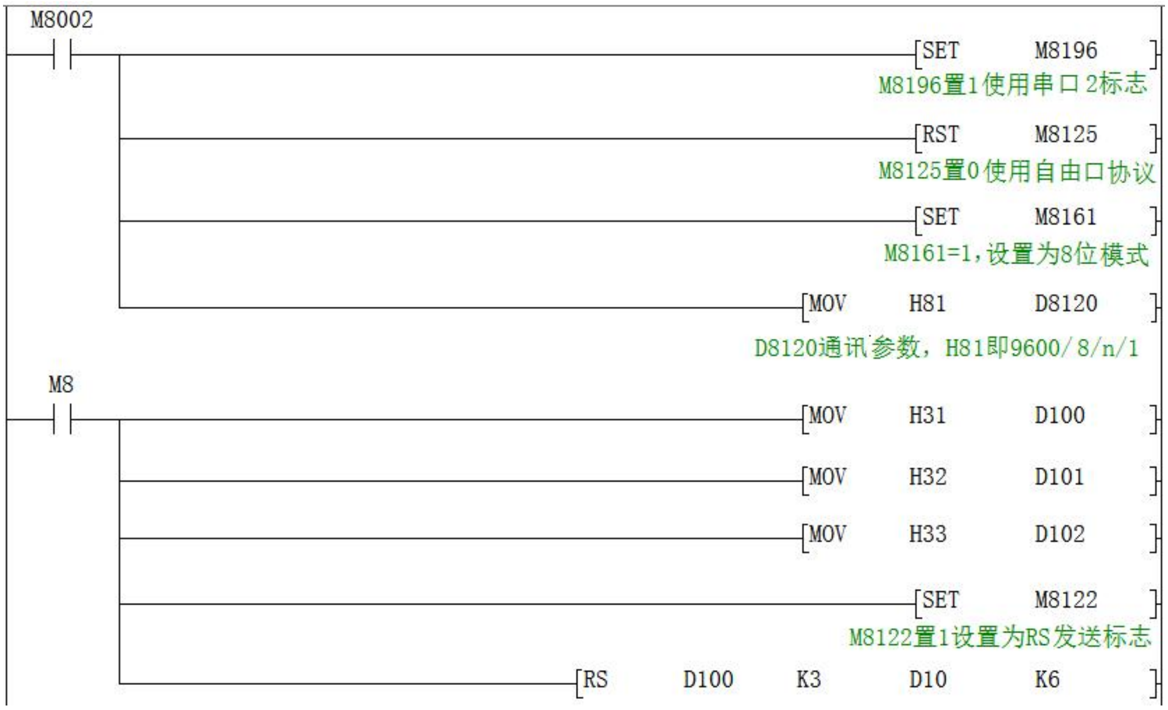
When using Mitsubishi Freeport protocol, RS instruction is supported, and D8120 only needs to set the value of the lower 8 bits

b7	b6	b5	b4	b3	b2	b1	b0

b0	Data length 0: 7 bits 1: 8 bits

b1 b2	Parity (b2, b1) 00: None; 01: Odd; 11: Even
b3	Stop bit 0:1 bit 1:2 bit
b4 b5 b6 b7	Baud rate (b7, b6, b5, b4) (0100): 600bps (0101): 1200bps (0110): 2400bps (0111): 4800bps (1000): 9600bps (1001): 19200bps (1010): 38400bps (1011): 57600bps (1101): 115200bps

Program example:



The data obtained by using the serial port tool to monitor serial port 2 is: [2019 :11:01:10:49:16][Receive]31 32 33

8.2.4 Modbus RTU protocol

When used as Modbus RTU protocol: set M8196=1, M8125=1; set D8120 as communication parameter, and set D8121 as slave station number. For example, set D8120=HE081, D8121=H1 (communication parameter is 9600/8/n/1, slave station number is 1).

D8120 parameter settings

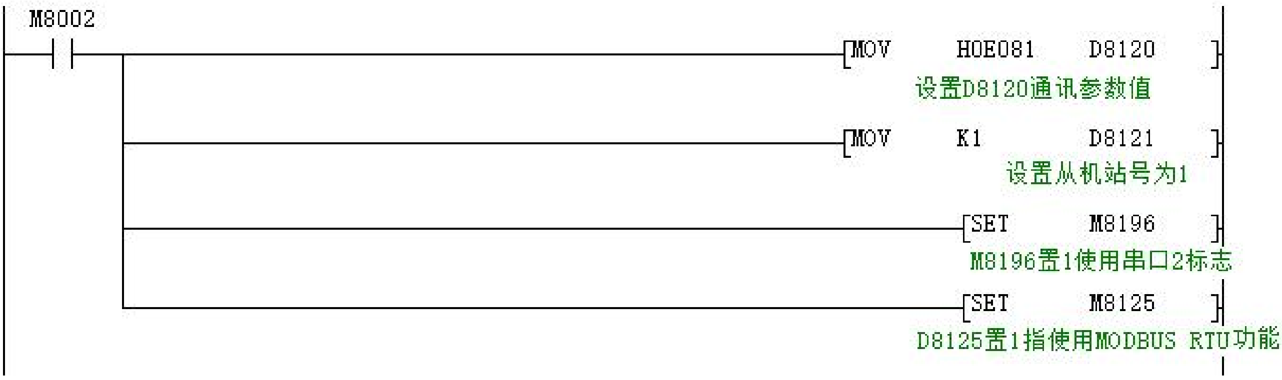
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

b0	Data length 0: 7 bits 1: 8 bits
b1 b2	Parity (b2, b1) 00: None; 01: Odd; 11: Even

b3	Stop bit 0:1 bit 1:2 bit
b4 b5 b6 b7	Baud rate (b7, b6, b5, b4) (0100): 600bps (0101): 1200bps (0110): 2400bps (0111): 4800bps (1000): 9600bps (1001): 19200bps (1010): 38400bps (1011): 57600bps (1101): 115200bps
b8	Setting 0
b9	
b10	
b11	
b12	RTU/ASCII mode setting 0:RTU 1:ASCII
b13	Setup 1
b14	Setup 1
b15	Setup 1

RD3A program example (for detailed instructions, refer to Chapter 8.1.1) :

Slave program:



Host program:

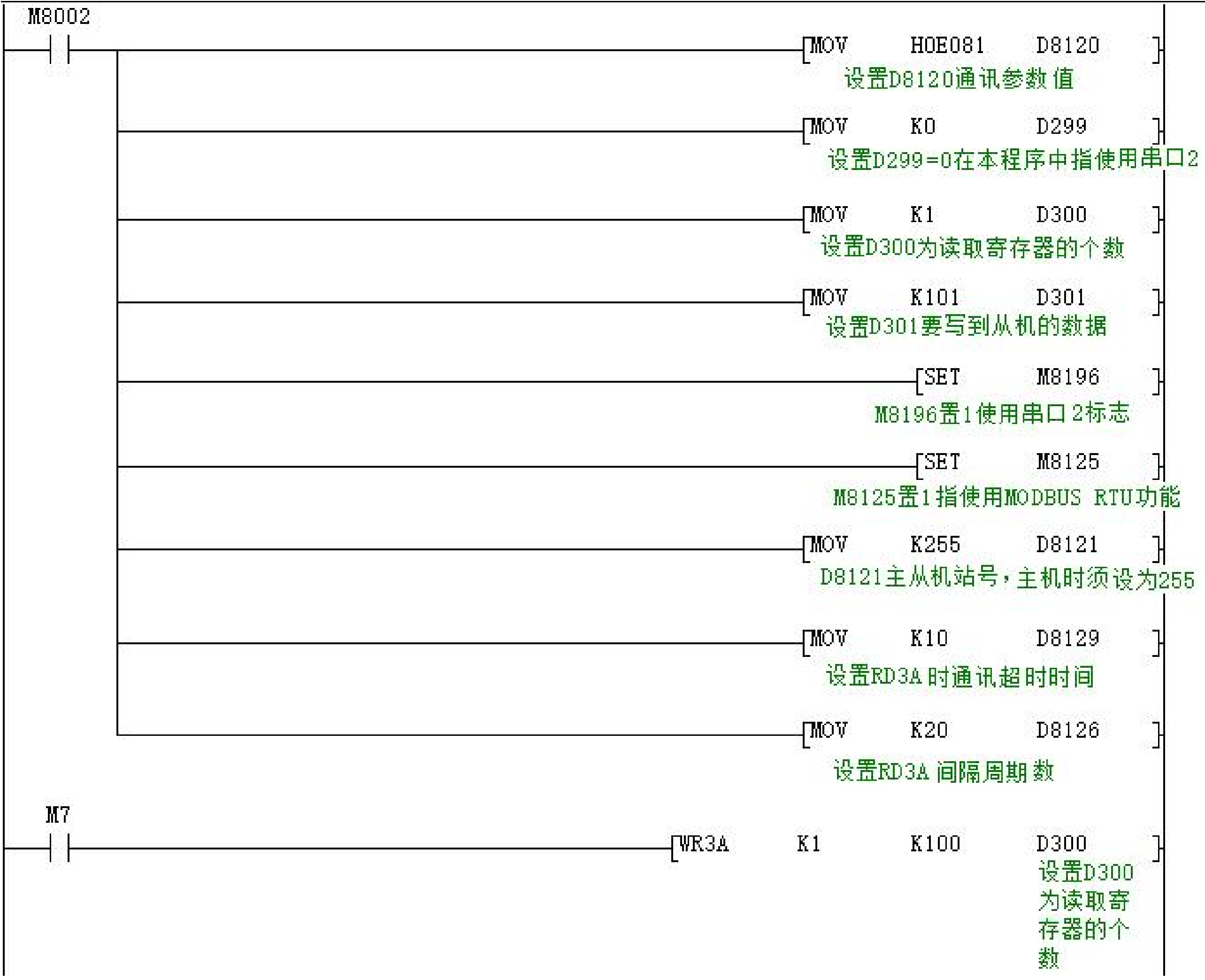
Program Explanation:

D300 stores the number of registers read, which means reading 10 data. When using serial port 2, D. -1 , D299 must be set to 0.

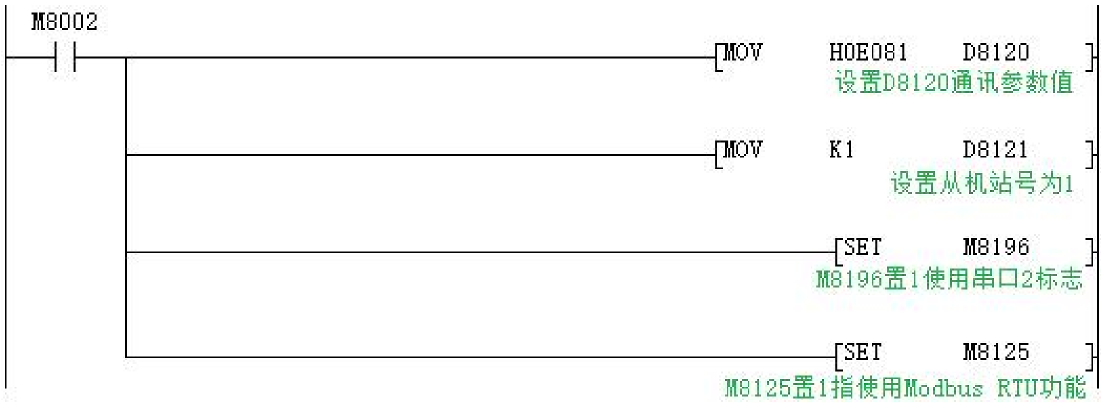
The program indicates that 10 data in registers D100-D109 in the PLC of slave station 1 are read and saved in registers D301-D310 of the master station PLC.

WR3A program example (for detailed instructions, refer to Chapter 8.1.1) :

Host program:



Slave program:



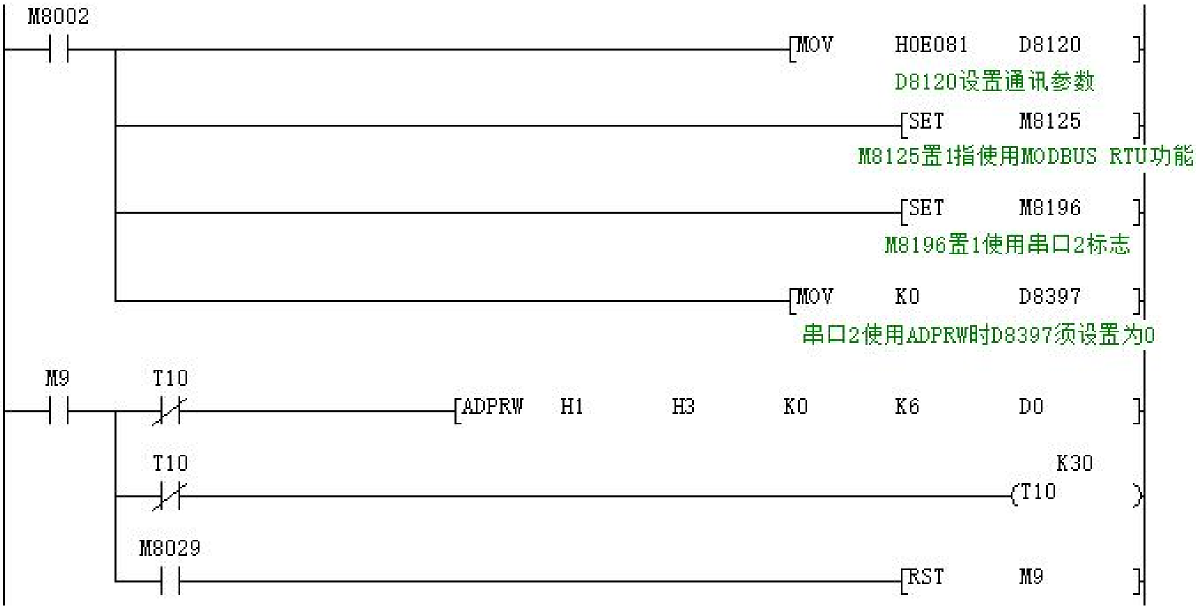
Program Explanation:

The program indicates that one data of register D301 in the master station PLC is written to the PLC of slave station 1 and saved in register D100 of the slave station PLC.

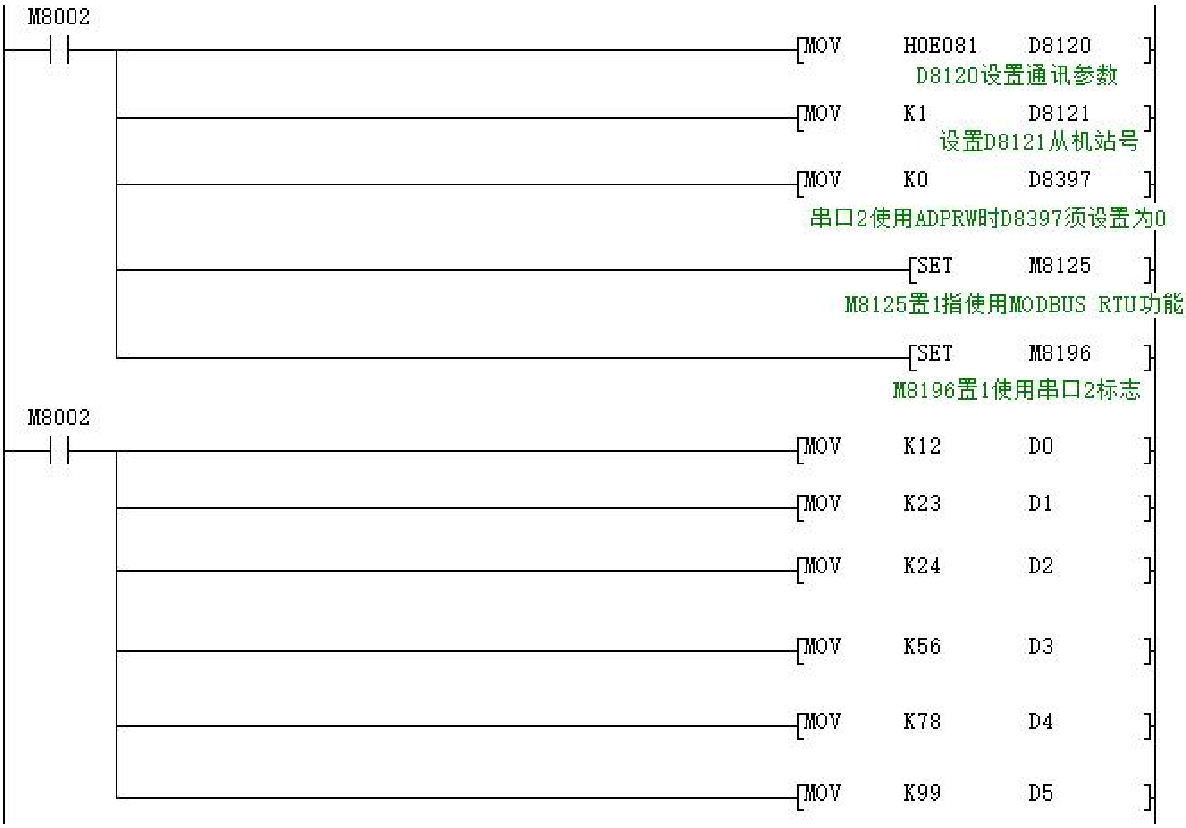
8.2.5 Modbus RTU function ADPRW instruction

03 Function code holding register output program example **(for detailed instruction introduction, refer to chapter 8.1.2)**

Host program:



Slave Program



Use the serial port tool to monitor serial port 2 to get the following data:

[2017:11:01:17:48:54][Receive]01 03 00 00 00 06 C5 C8

[2017:11:01:17:48:54][Receive]01 03 0C 00 0C 00 17 00 22 00 38 00 4E 00 63 C4 29

8.2.6 Modbus ASCII protocol

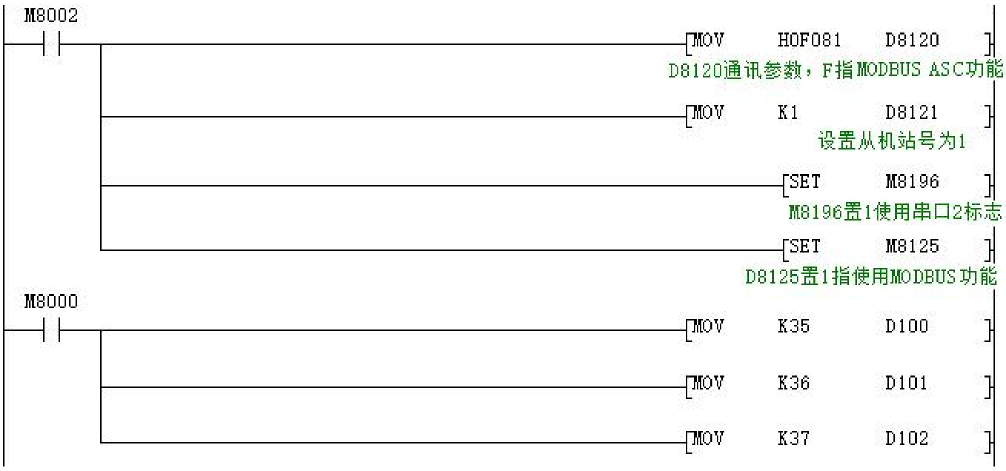
When used as Modbus ASCII protocol: The specific parameter settings are the same as 8.2.3 , except that the 12th bit of D8120 is different. For specific settings, refer to the introduction of D8120 parameter settings in section 8.2.3 .

Note: When using modbus ASCII protocol, ADPRW instruction is not supported.

Program example :

Host program:

Slave program:



The data display of host D300~D303 before and after the program is executed is shown in the figure below.

软元件	+F E D C	+B A 9 8	+7 6 5 4	+3 2 1 0	
D300	0 0 0 0	0 0 0 0	0 0 0 0	0 0 1 1	3
D301	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D302	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D303	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0

主机M7导通前监控D300-D301的数据

软元件	+F E D C	+B A 9 8	+7 6 5 4	+3 2 1 0	
D300	0 0 0 0	0 0 0 0	0 0 0 0	0 0 1 1	3
D301	0 0 0 0	0 0 0 0	0 0 1 0	0 0 1 1	35
D302	0 0 0 0	0 0 0 0	0 0 1 0	0 1 0 0	36
D303	0 0 0 0	0 0 0 0	0 0 1 0	0 1 0 1	37
D304	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0

M7导通后D300-D303的数据

8.2.7 Freeport protocol functions and examples

as Mitsubishi free port protocol function: set M8196=1, M8125=0;

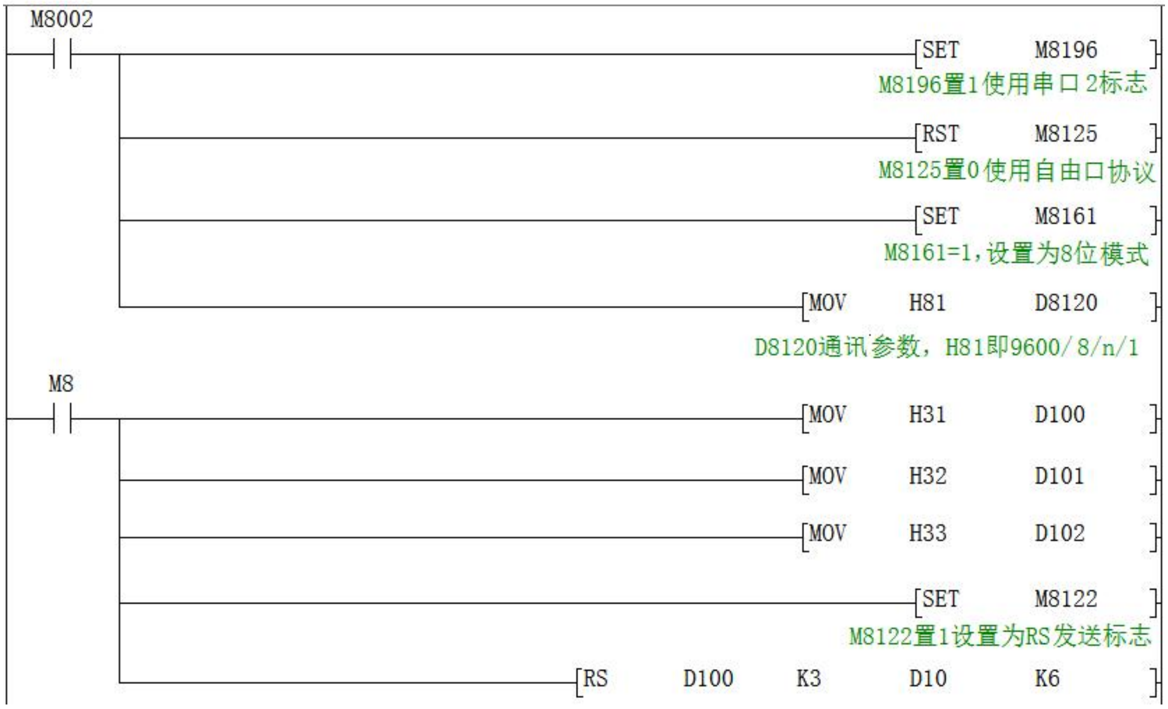
The difference between Mitsubishi protocol 1 and protocol 4 is that there are end characters 0A 0D (stored in D8124 D8125 respectively)

When using Mitsubishi Freeport protocol, RS instruction is supported, and D8120 only needs to set the value of the lower 8 bits

b7	b6	b5	b4	b3	b2	b1	b0

b0	Data length 0: 7 bits 1: 8 bits
b1 b2	Parity (b2, b1) 00: None; 01: Odd; 11: Even
b3	Stop bit 0:1 bit 1:2 bit
b4 b5 b6 b7	Baud rate (b7, b6, b5, b4) (0100): 600bps (0101): 1200bps (0110): 2400bps (0111): 4800bps (1000): 9600bps (1001): 19200bps (1010): 38400bps (1011): 57600bps (1101): 115200bps

Program example:



The data obtained by using the serial port tool to monitor serial port 2 is: [201 9 :11:01:10:49:16][Receive]31 32 33

8.3 Serial port 3: RS485 (A1 B1)/RS232

Support Mitsubishi programming port protocol, RS2 protocol and MODBUS RTU protocol

The special relays and special registers involved in this serial port are as follows:

Functional Description	Serial port 2 (A/B)	Serial port 3 (A1/B1)	Remark
Mitsubishi programming port	M8196=0	M8192=0	26232 version and above will not maintain after power off
Freeport protocol function	M8196=1 M8125=0	M8192=1	
RS/RS2 send flag	M8122=1	M8402=1	
RS/RS2 send completion flag	-	-	Manual reset required
RS/RS2 receiving end flag	M8123	M8403	Manual reset required
RS/RS2 receiving process flag	M8124	M8404	Data is being received
RS/RS2 instruction 8/16 bit switching	M8161	M8161	
RS2 instruction end operand setting	-	1	
MODBUS Functionality	M8196=1 M8125=1	M8192=1	

RD3A/WR3A receives the correct flag	M8128	M8408	Automatic reset
RD3A/WR3A communication timeout flag	M8129	M8409	Automatic reset
ADPRW instruction completion flag	M8029	M8029	Instruction execution end flag
Communication parameters	D8120	D8400	
Communication Mode	-	D8401	
Master and slave station numbers	D8121	D8414	
RD3A/WR3A timeout	D8129	D8409	The unit is milliseconds. For detailed settings, see the explanation.
RD3A/WR3A interval cycle number	D8126	D8406	
RD3A/WR3A last operand -1	0	1	
Set when ADPRW instruction is used	D8397=0	D8397=1	

M8192: Enable flag for using programming port protocol and other protocols.

M8402: Sending flag (used for RS2 instruction).

M8403: Communication completion flag (communication completion flag when using RS2 instruction, needs to be reset manually).

M8404: Data receiving.

M8408: Communication completion flag (valid when using RD3A and WR3A for MODBUS communication).

M8409: Communication timeout.

M8029: Communication completion flag (communication completion flag when using ADPRW instruction, needs to be reset manually) .

M8161: 8-bit/16-bit mode distinction flag for RS/RS2 instructions.

D8400: Save the communication parameters of Modbus RTU protocol.

D8401: Save the communication mode of serial port 3.

D8401=H0 indicates RS 2 free communication mode.

In Modbus RTU mode: D8401=H11 indicates that the PLC is a slave station; D8401=H1 indicates that the PLC is a master station.

In Modbus ASCII mode: D8401 = H1 1 1 indicates that the PLC is a slave station; D8401 = H 10 1 indicates that the PLC is a master station.

D8406: Interval cycle number. Default = 12 (times).

D8409: Timeout time. (Unit: milliseconds. Recommended settings: When the communication rate is greater than or equal to 9600, D8409 is set to 10~20; when the communication rate is less than 9600, D8409 is set to 20~50.)

D8414: Save the host or slave station number. (When acting as a host, this value must be set to the maximum value of K255)

D8397: When using the ADPRW instruction, use serial port 3 and set D8397 to 1.

Support RS2, WR3A, RD3A, ADPRW instructions. Can be set in the parameter area, corresponding to serial port 3. Parameter area settings are only valid for this channel. Not valid for serial port 2.

D8400 communication parameter format setting

b0	Data length 0: 7 bits 1: 8 bits
b1 b2	Parity (b2, b1) 00: None 01: Odd 11: Even
b3	Stop bit 0:1 bit 1:2 bit
b4 b5 b6 b7	Baud rate (b7, b6, b5, b4) 0100: 600bps 0101: 1200bps 0110: 2400bps 0111: 4800bps 1000: 9600bps 1001: 19200bps
b8~b15	Cannot be used, set to 0

D8401 Communication parameter format setting

b0	Select protocol 0: other communication protocols 1: MODBUS protocol
b1~b3	Cannot be used, set to 0
b4	Master/slave station setting 0: MODBUS master station 1: MODBUS slave station
b5~b7	Cannot be used, set to 0
b8	RTU/ASCII mode setting 0:RTU 1:ASCII
b9~b15	Cannot be used, set to 0

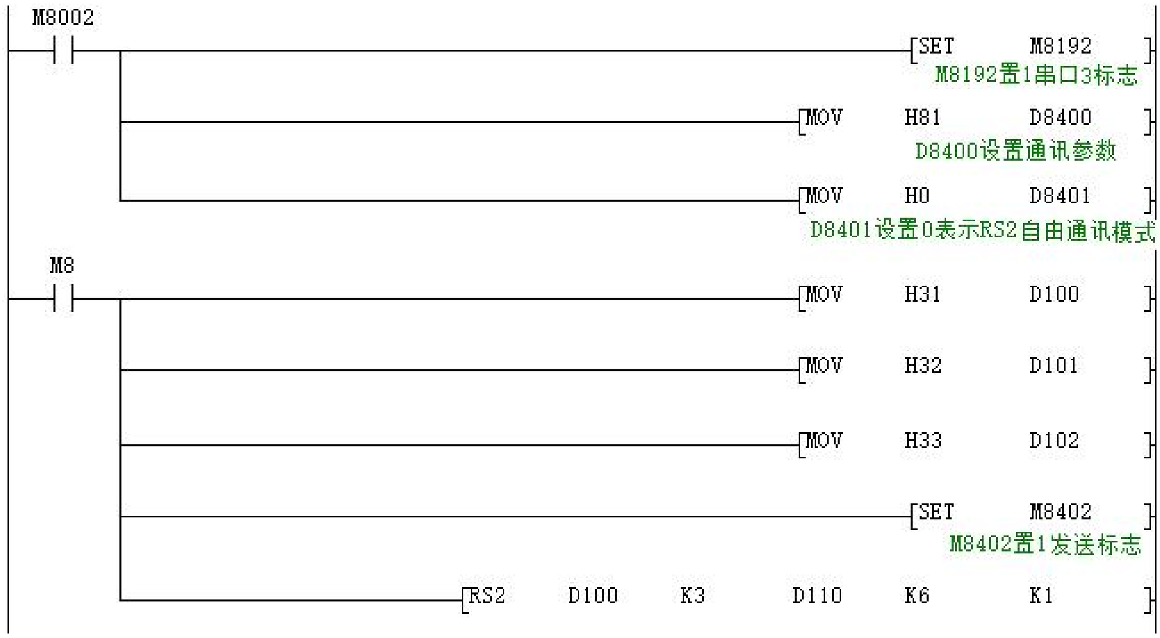
8.3.1 Mitsubishi programming port protocol

as Mitsubishi programming port protocol: set M8192=0.

8.3.2 Freeport protocol function

as Mitsubishi free port protocol function: set M8192=1, M8402=1;

Program example:



The data obtained by using the serial port tool to monitor serial port 3 is: [2017:11:01:1 1 :49:16][Receive]3 1 3 2 3 3

RS2 instruction last parameter =1: Serial port 3.

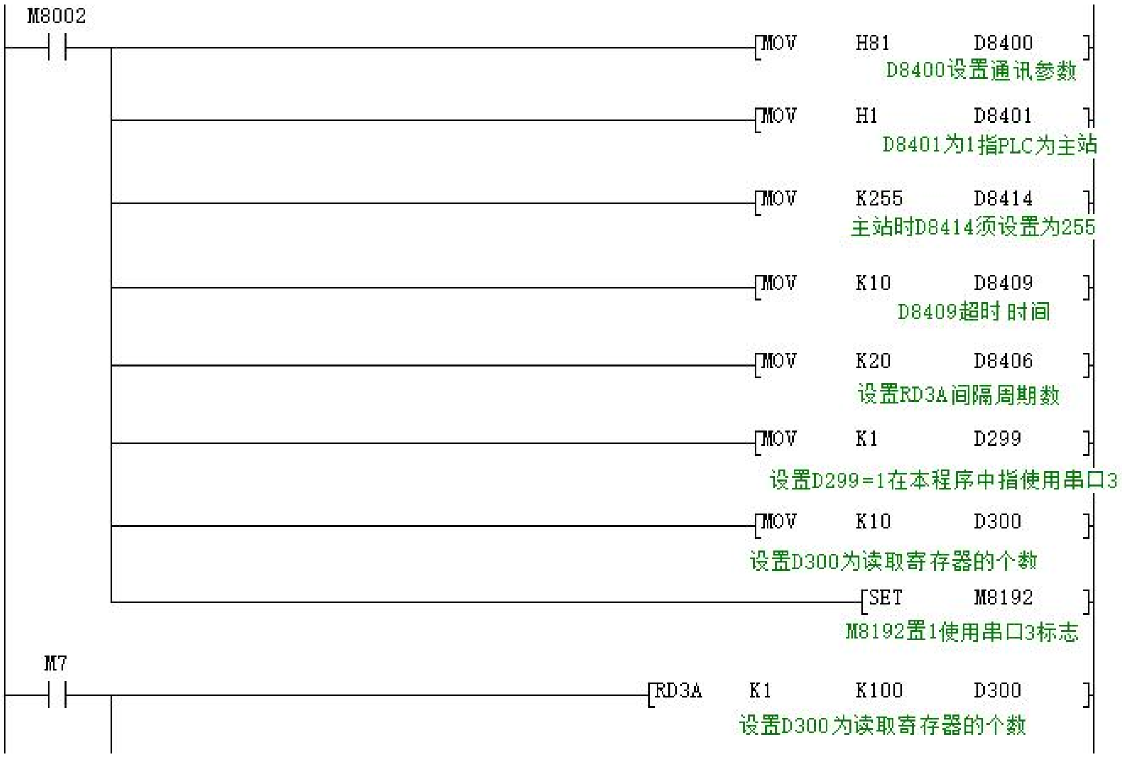
8.3.3 Modbus RTU function RD3A/WR3A instructions

When used as Modbus RTU protocol: set M8192=1; D8400 is set as communication parameters, and D8414 is set as the master-slave station number.

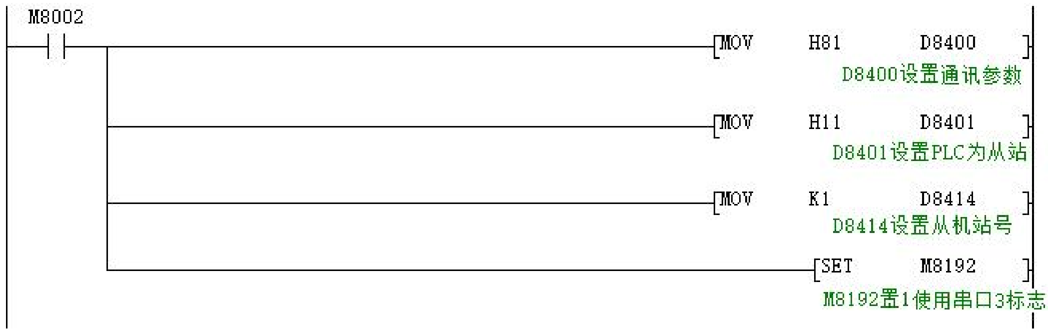
For example, set D8400=H81, D8414=K1 (communication parameters are 9600/8/n/1, slave station number is 1).

RD3A program example (for detailed instructions, refer to Chapter 8.1.1) :

Host program:



Slave program:



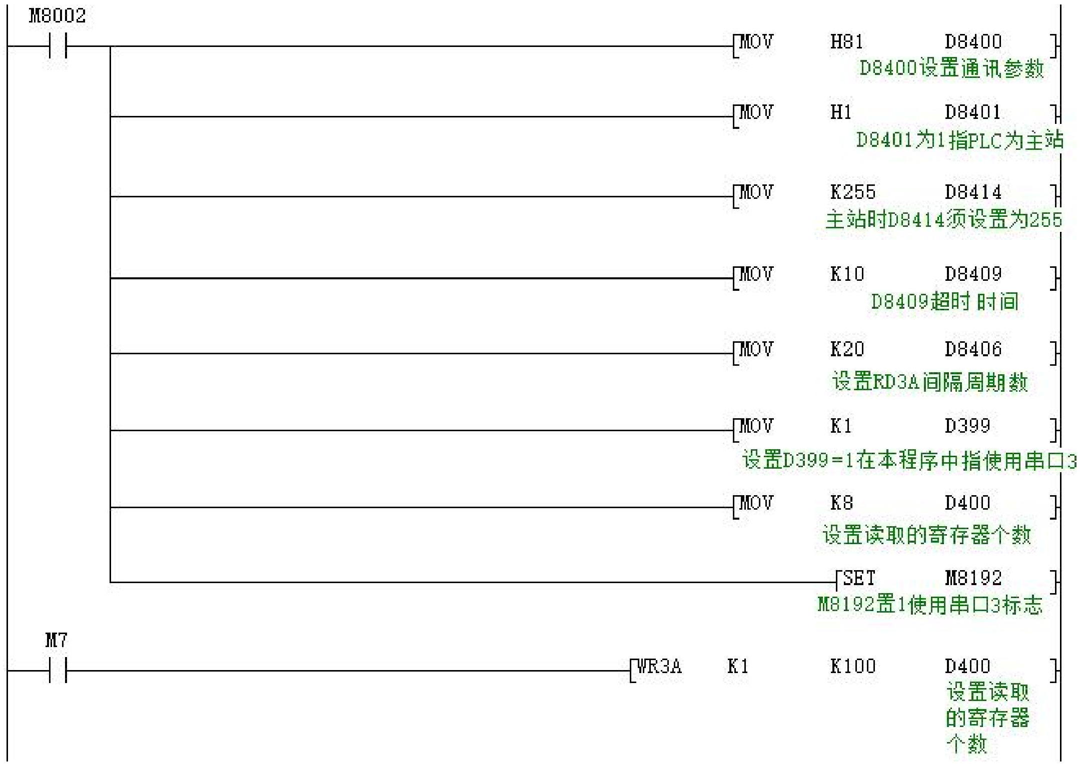
Use the serial port tool to monitor the serial port 3 data and get the following results:

[2017:11:01:09:00:11][Receive]01 03 00 64 00 0A 84 12

[2017:11:01:09:00:11][Receive]01 03 14 00 42 00 4D 00 58 00 58 00 63 00 37 00 2C 00 21 00 16 00 0B 9F C7

WR3A program example (for detailed instructions, refer to Chapter 8.1.1) :

Host program:



Slave program:

Use the serial port tool to monitor the serial port 3 data and get the following results:

[2017:11:01:09:25:20][Receive]01 10 00 64 00 08 10 00 0B 00 16 00 21 00 2C 00 37 00 42 00 4D 00 58 D1 6C

[2017:11:01:09:25:20][Receive]01 10 00 64 00 08 10 00 0B 00 16 00 21 00 2C 00 37 00 42 00 4D 00 58 D1 6C

8.3.4 Modbus RTU function ADPRW instruction

04 Input register readout program example **(for detailed instruction introduction, refer to chapter 8.1.2)**

Host Program

Slave Program

Use the serial port tool to monitor the serial port 3 data and get the following results:

[2017:11:01:17:38:34][Receive]01 04 00 00 00 06 70 08

[2017:11:01:17:38:34][Receive]01 04 0C 00 15 00 20 00 2B 00 41 00 57 00 00 5F A7

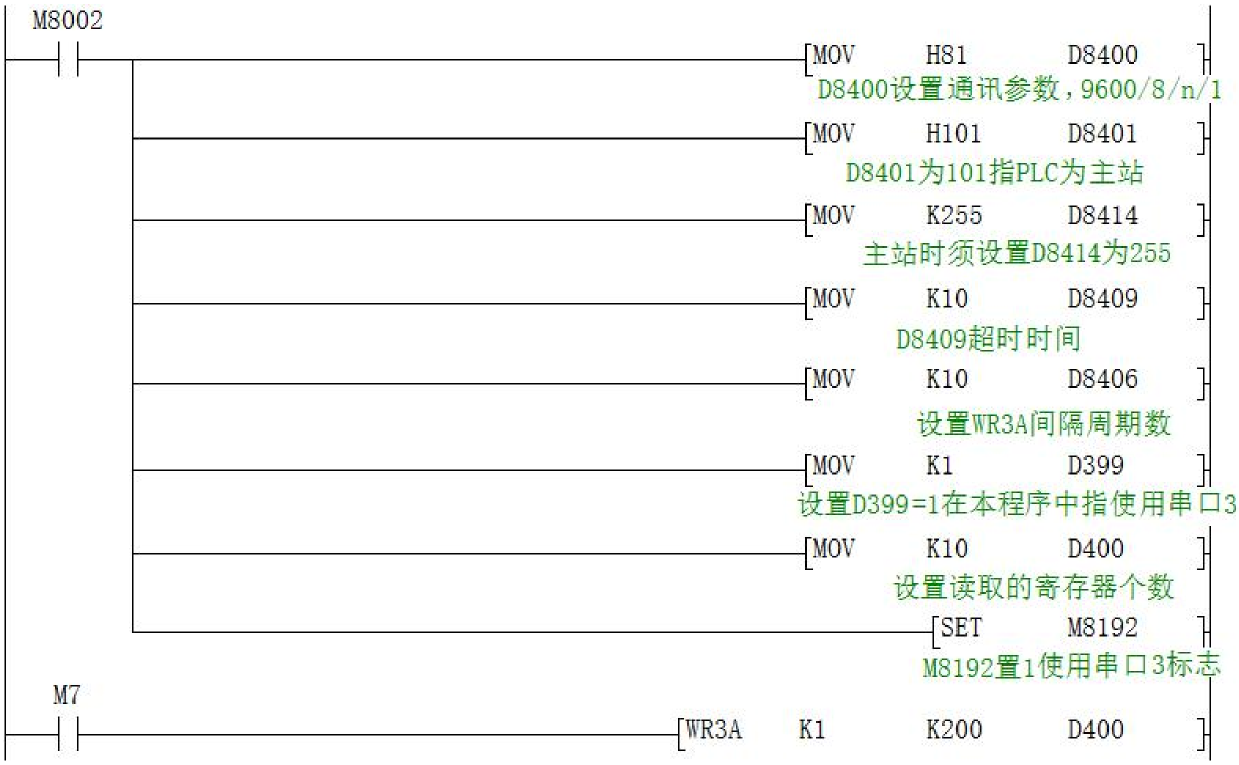
8.3.5 Modbus ASCII Function

When used as Modbus ASCII protocol: The specific parameter settings are the same as 8.3 , only the 8th bit of D8401 is different. For specific settings, refer to the introduction of D8401 parameter settings .

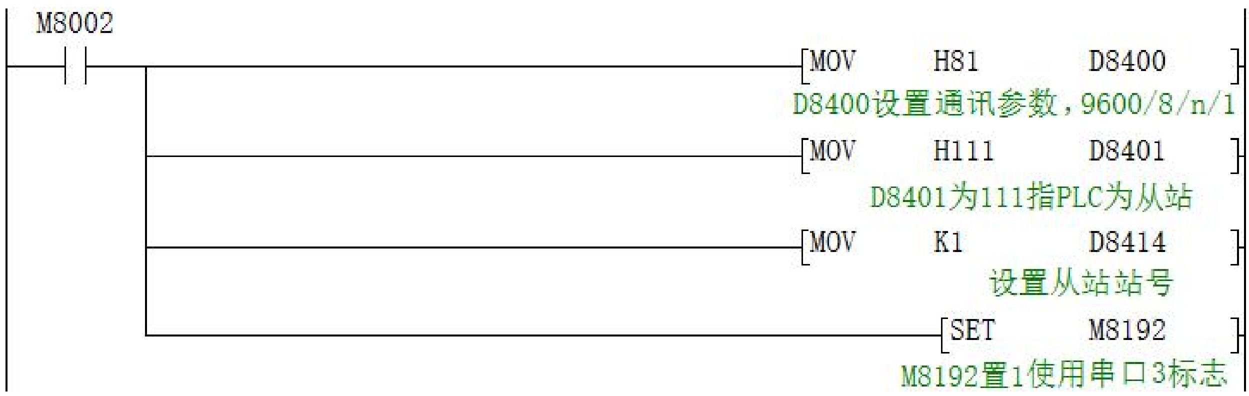
Note: When using modbus ASCII protocol, ADPRW instruction is not supported.

Program example :

Host program:



Slave program:



The data display of slave D100~D109 before and after the program is executed is shown in the figure below.

M7导通前D100-D109数据

软元件	+F E D C	+B A 9 8	+7 6 5 4	+3 2 1 0	
D100	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D101	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D102	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D103	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D104	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D105	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D106	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D107	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D108	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D109	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0
D110	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0

M7导通后D00-D109数据被写入

软元件	+F E D C	+B A 9 8	+7 6 5 4	+3 2 1 0	
D100	0 0 0 0	0 0 0 0	0 0 0 0	1 0 1 1	11
D101	0 0 0 0	0 0 0 0	0 0 0 0	1 0 1 1	11
D102	0 0 0 0	0 0 0 0	0 0 0 0	1 0 1 1	11
D103	0 0 0 0	0 0 0 0	0 0 0 0	1 0 1 1	11
D104	0 0 0 0	0 0 0 0	0 0 0 0	1 0 1 1	11
D105	0 0 0 0	0 0 0 0	0 0 0 0	1 0 1 1	11
D106	0 0 0 0	0 0 0 0	0 0 0 0	1 0 1 1	11
D107	0 0 0 0	0 0 0 0	0 0 0 0	1 0 1 1	11
D108	0 0 0 0	0 0 0 0	0 0 0 0	1 0 1 1	11
D109	0 0 0 0	0 0 0 0	0 0 0 0	1 0 1 1	11
D110	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0

Part 9 Host/Module Hardware Identification and Address Assignment

The L01S series PLC host can expand the switch quantity and analog quantity according to customer needs. This chapter introduces the hardware identification and address allocation of the host to the expansion module.

9.1Extension module type view

The type and function of the expansion module can be viewed through the following registers:

<table>
<tr><th>register</th><th>Functional Description</th><th>Module type definition</th><th>Remark</th></tr>
<tr><td>D8108</td><td>Number of expansion modules</td><td rowspan="16">0 : Switch input (reserved)
1: Analog input (4AD)
2: Switch output (reserved)
3: Analog output (4DA)
4: Mixed switch quantity (8 input and 8 output)
5: Mixed switch quantity (16 input and 16 output)
6: Mixed analog (4 inputs and 2 outputs)
7: 4RTD
8: 4TC
9: 4NTC
10: 2LC
11: Switch quantity 8 input
12: Switch quantity 16 input
13: Switch quantity 32 input
14: Switch quantity 8 outputs
15: Switch quantity 16 output
16: Switch quantity 32 outputs
48: 1-axis positioning module
49: 2-axis positioning module
50: 4-axis positioning module</td><td></td></tr>
<tr><td>D8260</td><td>The first and second expansion module types</td><td rowspan="15">The lower 8 bits of the register indicate the type of the first expansion module, and the upper 8 bits indicate the type of the second expansion module;
If the value of D8260 is H0504, then the types of the first and second expansion modules are mixed switch quantity (8 inputs and 8 outputs) and mixed switch quantity (16 inputs and 16 outputs) respectively.</td></tr>
<tr><td>D8261</td><td>3rd and 4th expansion module types</td></tr>
<tr><td>D8262</td><td>5th and 6th expansion module types</td></tr>
<tr><td>D8263</td><td>7th and 8th expansion module types</td></tr>
<tr><td>D8264</td><td>9th and 10th expansion module types</td></tr>
<tr><td>D8265</td><td>1st 1 , 12th expansion module type</td></tr>
<tr><td>D8266</td><td>13th and 14th expansion module types</td></tr>
<tr><td>D8267</td><td>1st 5th and 16th expansion module types</td></tr>
<tr><td>D8268</td><td>1st 7th and 18th expansion module types</td></tr>
<tr><td>D8269</td><td>19th and 20th expansion module types</td></tr>
<tr><td>D8270</td><td>21 , 22 expansion module types</td></tr>
<tr><td>D8271</td><td>23. 24 Extension module types</td></tr>
<tr><td>D8272</td><td>25th , 26th expansion module type</td></tr>
<tr><td>D8273</td><td>27 , 28 expansion module types</td></tr>
<tr><td>D8274</td><td>29th and 30th expansion module types</td></tr>
</table>

D8275	31 , 32 expansion module types		

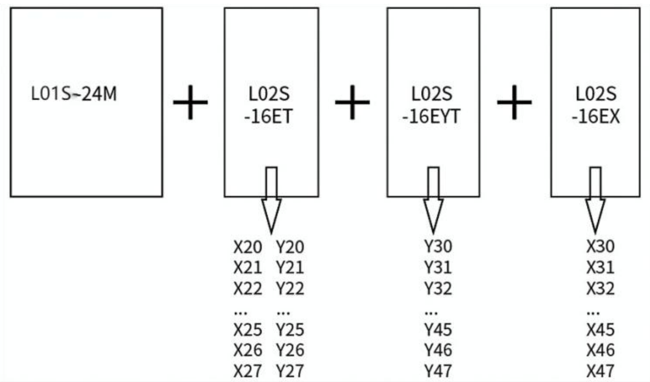
9.2 Address assignment of switch input and output modules

When the host detects the expansion of switch input and output, it will automatically sort from left to right starting from X20 or Y20.

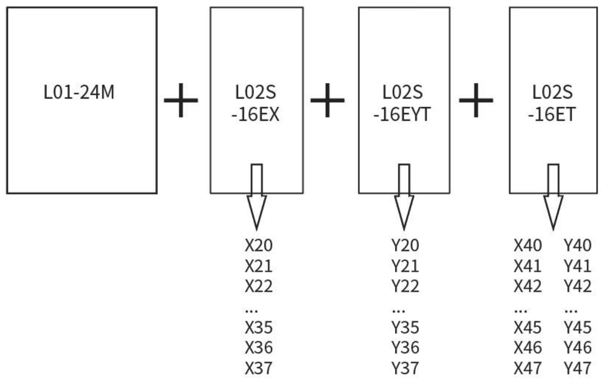
Take the host L01S-24M, switch input module L02S-16EX, switch output module L02S-16EYT, and mixed switch L02S-16ET as examples.

Note: When the order of expansion modules is different, the address assignments are also different.

The addresses of each expansion module in order are shown in the figure below:



The addresses of each expansion module in sorting 2 are shown in the figure below:



9.3 Reading analog input and output modules

9.3.1 Module register definition

Register Number	Function	Data Types	access	default value
0	Module Type	16-bit	R	Hardware Type
1	Module version number	16-bit	R	
2	CH0--AD/DA value	16-bit	R	
3	CH 1 --AD/DA value	16-bit	R/W	
4	CH 2 --AD/DA value	16-bit	R/W	
5	CH 3 --AD/DA value	16-bit	R/W	
6	CH 4 --DA value (4AD2DA)	16-bit	R/W	
7	CH 5 --DA value (4AD2DA)	16-bit	R/W	
8	CH0 Humidity	16-bit	R/W	When it is not RTD type, the default value is 0xFFFF
9	CH1 Humidity	16-bit	R/W	When it is not RTD type,

				the default value is 0xFFFF
11	TC type cold junction temperature	16-bit	R/W	In TC type, the default is 25℃ when no cold end is connected. In non-TC type, the default is 0xFFFF
13	CH0--AD original value (24-bit precision)	32-bit	R	0x0-0xFFFFFF
15	CH1--AD original value (24-bit precision)	32-bit	R	0x0-0xFFFFFF
17	CH2--AD original value (24-bit precision)	32-bit	R	0x0-0xFFFFFF
18	CH3--AD original value (24-bit precision)	32-bit	R	0x0-0xFFFFFF
19	CH0--Type	16-bit	R/W	Default value 0
20	CH1--Type	16-bit	R/W	Default value 0
twenty one	CH2--Type	16-bit	R/W	Default value 0
twenty two	CH3--Type	16-bit	R/W	Default value 0
twenty three	CH4--Type (4AD2DA)	16-bit	R/W	DA default value 0 Non-DA default value 0xFFFF
twenty four	CH5--Type (4AD2DA)	16-bit	R/W	DA default value 0 Non-DA default value 0xFFFF
25	CH0--coefficient	32-bit	R/W	
27	CH1--Coefficient	32-bit	R/W	
29	CH2--Coefficient	32-bit	R/W	
31	CH3--Coefficient	32-bit	R/W	
41	Control Word =1: Calibration =7707: Save type, coefficient =2: Restore default values 3: Zero point correction value calibration	16-bit	R/W	When executing, it is the command value, and becomes 255 after execution.

Use the FROM and TO instructions to operate the module's CR register to execute functions.

AD module calibration method:

AD: 4-channel AD connected to 10V standard signal

PT100: Connect all 250R resistors

TC: All input 64.13mv

NTC: All connected to 75KΩ resistor

The CR29 register is set to 1, calibrated, the coefficient is automatically calculated, and the self-reset coefficient is K255; monitor whether the CR21-CR27 data changes, CR29 is set to 7707, and the parameters are saved. This can only be saved once.

9.3.2 Extended analog module types

Extended analog module input type:

Input signal type	Range	Register reading value	Resolution	Accuracy Total range	Remark
K-type thermocouple	-240～1370℃	-2400～13700	0.1℃	1%	Thermocouple type should be ungrounded
T-type thermocouple	-240～400℃	-2400～4000	0.1℃	1%	
S-type thermocouple	-50～1690℃	-500～16900	0.1℃	1%	
J-type thermocouple	-120～1200℃	-1200～12000	0.1℃	1%	
Type E Thermocouple	-110～730℃	-1100～7300	0.1℃	1%	
PT100	-200～800℃	-2000～8000	0.1℃	1%	
Thermistor NTC10K	-30～210℃	-300～2100	0.1℃	1%	The default value of B is 3435
Voltage analog Type1	0-10V	0～32000	0.3mV	1%	
Voltage analog Type2	-10-10V	-32000～32000	0.3mV	1%	
Current analog Type1	0～20mA	0～32000	0.6uA	1%	
Current analog Type2	4～20mA	0～32000	0.5uA	1%	

The type of analog input needs to be set. For specific settings, refer to the table below:

serial number	Reading Values	Representation Type	Remark
CR17-CR20	0	-10~10V (or 0~20mA); NTC (3435); K-type thermocouple; PT100【Break value: -200】	Different types of wiring methods
CR17-CR20	1	4~20mA; [Break value: 32767] 2~10V	When it is greater than 4mA, there will be digital value. When it is less than 4mA, it is considered disconnected.
CR17-CR20	5	E-type thermocouple [Broken wire value: 1357]	When the thermocouple is not connected, the default value is the disconnection value.
CR17-CR20	7	T-type thermocouple [Broken wire value: 385]	

CR17-CR20	9	S-type thermocouple [Broken wire value: 1730]	When the cold end is not connected, the default value is 25℃
CR17-CR20	11	J-type thermocouple [Broken wire value: 1187]	

Extended analog module output type:

Number Read Value	Output signal type	Range	Setting value range	Resolution	Remark
0	Voltage analog	0-10V	0～32000	0.3mV	The wiring methods for current and
1	Current analog Type2	4～20mA	0～32000	0.5uA	
2	Current analog Type1	0～20mA	0～32000	0.6uA	

9.3.3 Example of extended analog reading and writing

Note:

The communication between the master control and the module is to write the module data and then read it after the ladder diagram END.

When using each module FROM and TO instructions, multiple instructions cannot be executed simultaneously (one FROM and one TO are allowed to be executed simultaneously).

type	instruction	The location of the	The module	Storage start	The length of the
D	**FROM**	**m 1**	**m 2**	**D**	**n**

m 1 : The number of the expansion module, that is, the position of the module.

m 2 : The number of the expansion module to be read, that is, the register number defined in 9.3.1 Module Register .

D : Stores the starting address of the read data . **n** : The number of data records read at one time.

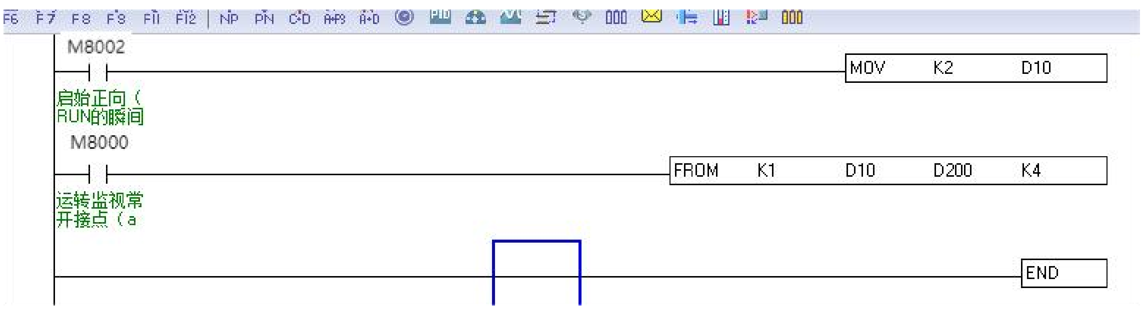
type	instruction	The location of the	The module	Data source start	The length of the
D	**TO**	**m 1**	**m 2**	**S**	**n**

m 1 : The number of the expansion module, that is, the position of the module.

m 2 : The number of the expansion module to be written , that is, the register number defined in 9.3.1 Module Register .

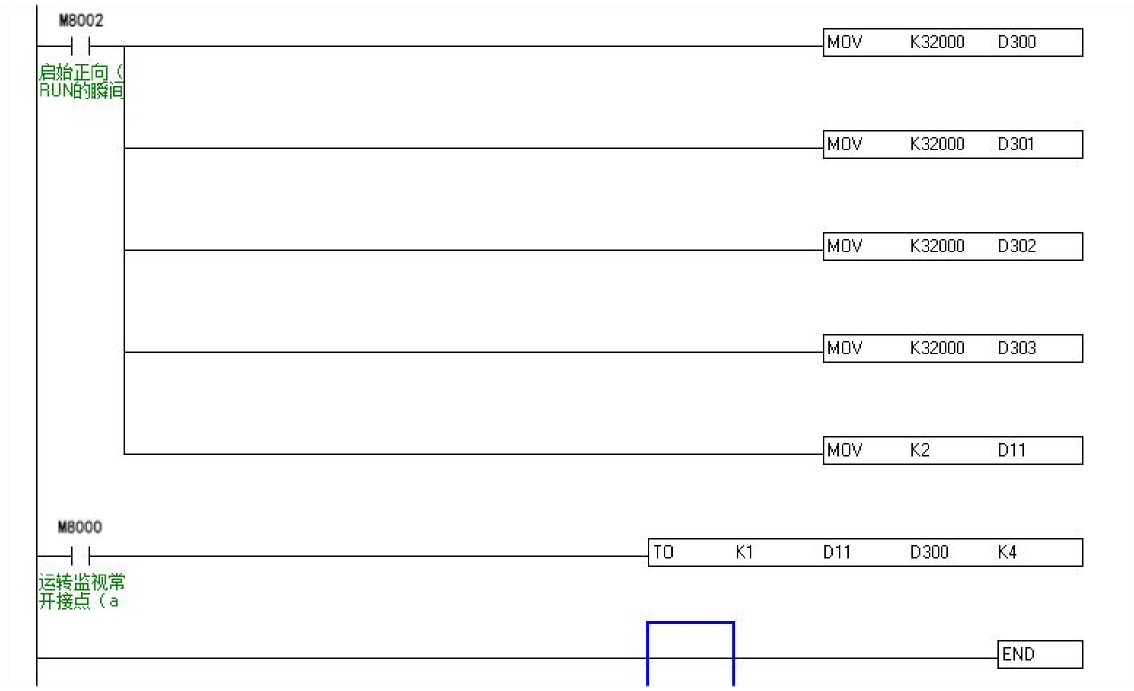
S : Stores the starting address of the data source to be written . **n** : The number of data records written at one time .

Example 1 : Get the AD value of CH0-CH3



FROM reads the four AD values of the first module channel CH0-CH3 (numbered K2-K5) and stores them in D200-D203.

Example 2 : CH0-CH3 output 10V voltage



The DA value to be output is preset to 10V, that is, the value is K32000 in register D300-D303, and the TO instruction is written to the channels CH0-CH3 (numbered K2-K5) of the first module.

9.4 Axis Control Module Extension Instructions

The L01S series host can expand 2 axis control modules (8 channels 100K Hz), which do not occupy IO points. The host and the module read through the FROM instruction and write to the module through the TO instruction.

9.4.1 Axis module description

1. Corresponding interface function

aisle	Pulse port	Direction port	Zero	limit
CH0	Y0	Y1	X0	X1
CH1	Y2	Y3	X2	X3
CH2	Y4	Y5	X4	X5
CH3	Y6	Y7	X6	X7

2. Axis module address

Address Number	Functional Description	property	Remark
0	Module Type Number Register	R	

1	Software version number register	R	0x4514
2	Axis 0 acceleration and deceleration time setting	R/W	100
3	Axis 1 acceleration and deceleration time setting	R/W	100
4	Axis 2 acceleration and deceleration time setting	R/W	100
5	Axis 3 acceleration and deceleration time setting	R/W	100
6	Axis Control Registers Bit0: ON Axis 0 is running Bit1: ON Axis 1 running Bit2: ON Axis 2 running Bit3: ON Axis 3 is running Bit4: ON axis 0 emergency stop Bit5: ON Axis 1 emergency stop Bit6: ON Axis 2 emergency stop Bit7: ON Axis 3 emergency stop Bit8: ON axis 0 clear positioning completion flag CR47 bit0=0 Bit9: ON axis 1 clears the positioning completion flag CR47 bit1=0 Bit10: ON axis 2 clears positioning completion flag CR47 bit2=0 Bit11: ON axis 3 clear positioning completion flag CR47 bit3=0	R/W	0
7	Axis operation mode register Axis 0 Bit0-Bit3: = 0: absolute positioning , = 1: relative positioning , = 4: origin return Axis 1 Bit4-Bit7: = 0: absolute positioning, = 1: relative positioning, = 4: origin return Axis 2 Bit8-Bit11: = 0: Absolute positioning, = 1: Relative positioning, = 4: Origin return Axis 3 Bit12-Bit15: = 0: Absolute positioning, = 1: Relative positioning, = 4: Origin return	R/W	0
8	Axis 0 target position PPU	R/W	0
10	Axis 0 Target speed HZ	R/W	0
12	Axis 1 target position PPU	R/W	0
14	Axis 1 Target speed HZ	R/W	0
16	Axis 2 target position PPU	R/W	0
18	Axis 2 target speed HZ	R/W	0
20	Axis 3 target position PPU	R/W	0
twenty two	Axis 3 target speed HZ	R/W	0
twenty four	All axes return to origin at high speed	R/W	0
26	All axes return to origin at low speed	R/W	0
27	Axis movement direction Bit0: CH0 axis motion reverse flag Bit1: CH1 axis movement reverse flag Bit2: CH2 axis movement reverse flag Bit3: CH3 axis movement reverse flag	R/W	0

	Axis zero return direction Bit 4 : CH0 axis = 0: fixed negative direction, = 1: automatic direction determination Bit 5 : CH1 axis = 0: fixed negative direction, = 1: automatic direction determination Bit 6 : CH2 axis = 0: fixed negative direction, = 1: automatic direction determination Bit7 : CH3 axis = 0: fixed negative direction, = 1: automatic direction determination Acceleration and deceleration curve Bit8: CH0 axis trapezoidal and S-shaped acceleration and deceleration switch, the default is trapezoidal acceleration and deceleration Bit9: CH1 axis trapezoidal and S-shaped acceleration and deceleration switch, default is trapezoidal acceleration and deceleration Bit10: CH2 axis trapezoidal and S-shaped acceleration and deceleration switch, the default is trapezoidal acceleration and deceleration Bit11: CH3 axis trapezoidal and S-shaped acceleration and deceleration switch, the default is trapezoidal acceleration and deceleration Backlash compensation positive and negative selection Bit 12 : CH0 axis = 0: positive compensation, = 1: negative compensation Bit 13 : CH1 axis = 0: positive compensation, = 1: negative compensation Bit 14 : CH2 axis = 0: positive compensation, = 1: negative compensation Bit15: CH3 axis = 0: forward compensation, = 1: reverse compensation		
33	Axis 0 position backlash compensation	R/W	0
34	Axis 1 position backlash compensation	R/W	0
35	Axis 2 position gap compensation	R/W	0
36	Axis 3 position gap compensation	R/W	0
37	Axis 0 speed lower limit	R/W	100
38	Axis 1 speed lower limit	R/W	100
39	Axis 2 speed lower limit	R/W	100
40	Axis 3 speed lower limit	R/W	100
41	Axis homing mode register Axis 0 : Bit 0-Bit 3, Axis 1 : Bit 4 -Bit 7, Axis 2 : Bit 8 -Bit 11, Axis 3: Bit 12 -Bit 15 = 0: Low speed after detecting ORG ON, and stop after ORG OFF.	R/W	0

	= 1: Reverse low speed when ORG ON is detected, and stops after ORG OFF. = 2: Check limit ON and then reverse to find ORG ON, reverse to ORG OFF and stop.		
42	Axis status: bit1 =1 Axis 0 command is being executed, =0 command is being stopped Axis status: bit2 =1 Axis 1 command is being executed, =0 The command is stopped Axis status: bit2 =1 Axis 2 command is being executed, =0 Command is stopped Axis status: bit3 =1 Axis 3 command is being executed, =0 Command is stopped	R/W	0
43	Axis in place: bit0 =1 Axis 0 is in place, =0 is not in place or the axis is moving or stopped Axis in place: bit1 =1 Axis 1 is in place, =0 is not in place or the axis is moving or stopped Axis in place: bit2 =1 Axis 2 is in place, =0 is not in place or the axis is moving or stopped Axis in place: bit3 =1 Axis 3 is in place, =0 is not in place or the axis is moving or stopped	R/W	0
44	Axis 0 Current position	R/W	0
56	Axis 1 Current position	R/W	0
48	Axis 2 Current position	R/W	0
50	Axis 3 Current position	R/W	0

9.4.2 Axis module example

The communication between the master control and the module is to write the module data and then read it after the ladder diagram END.

When using the positioning module, you cannot rely solely on judging the positioning completion flag to execute the next positioning function. This is because when positioning at a short distance, there is a delay when reading and writing the module and the module status cannot be updated in real time (the PLC module refresh method can be adjusted). You need to use the TO instruction to clear the positioning completion flag first, and then determine whether the positioning is completed when executing positioning. When using FROM and TO instructions, multiple FROM and TO instructions cannot be executed at the same time. Multiple FROM and TO instructions can only start one FORM or TO instruction (one FROM and one TO are allowed to be executed at the same time).

type	instruction	The module number	The module	Starting	Data length
D	**FROM**	**m 1**	**m 2**	**D**	**n**

m 1 : The number of the expansion module, that is, the position of the module.

m 2: The number of the expansion module to be read, that is, the module address number in the above table .

D: Stores the starting address of the read data .

n : The number of data records read at one time.

type	instruction	The module number	The module	Starting	Data length
D	**TO**	**m 1**	**m 2**	**S**	**n**

m 1 : The number of the expansion module, that is, the position of the module.

m 2: The number of the expansion module to be written , that is, the module address number in the above table .

S : Stores the starting address of the data source to be written .

n : The number of data records written at one time .

Example: The ladder diagram realizes 2,000,000 pulses in forward rotation and 2,000,000 pulses in reverse rotation: 《 Axis Module--FX 》

Appendix Version Change History

date	Changed version	Changes
2024-03	V24.31	◆ First version released
2024-04	V24.41	◆ Add model ◆ Other typos and data corrections
2024-05	V24.51	◆ Modify 6.1 built-in high-speed counter input allocation table ◆ Modify 6.2.4 High-speed counter interrupt ◆ Modify 7.1 High-speed pulse output
2024-07	V24.71	◆ Remove unsupported features
2024-09	V24.91	◆ Modify 1.3 L01S series host brief description ◆ Modify 1.5 L01S series host hardware information introduction - wiring instructions ◆ Added the fifth part of analog quantity description (the fifth part of special instruction usage in the previous version was changed to 4.3 Special instruction usage) ◆ Added Part 9
2024-10	V24.101	◆ Unified model L01S
2024-12	V24.121	◆ Modify technical content to be compatible with FX
2025-02	V25.21	◆ Modify 1.3 L01S series host brief description ◆ Modify high-speed counter parameters, etc. ◆ Modify 4.2 Application Instructions [Order by Instruction Type] Some instructions are not supported
2025-05	V25.51	◆ Modify 1.1 Coolmay L01S PLC's main advantages and functional features ◆ Modify 1.3 L01S series host simple instructions ◆ Modification of 1.4 L01S series host programming precautions ◆ Modify 2.1 Software Component Number List ◆ Modify the input allocation table of the built-in high-speed counter in 6.1