PLC Programming Manual

CONTENTS

I. Programming Tools

GXWorks2 or GX-Developer, FXCPU series, model FX3U.

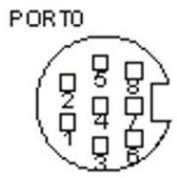
II. Program capacity

The system maximum program capacity is 32K programs and does not support reading and writing soft component comments.

III. Computer connection

Honyee 10/20 series PLC connect PC with mini D-8P (PORT 0) and mini USB port (PORT 1). 3U series PLC connect PC with mini D-8P (PORT 0). HC043B all-in-one connects PC with DB9 male socket (PORT 0) and mini USB port (PORT 0). HC070B all-in-one connects PC with DB9 male socket (PORT 0). Mini D-8P and DB9 connectors are RS232 interfaces, and PLC has a built-in USB to serial port function. When connecting to a computer, you need to ensure that the driver for the connection cable is correctly installed, and you can see the corresponding serial port number in the computer device manager.

Table 3-1 Mini D-8P communication port pin definition



Pin	Name	Description
1	VCC_+5V	5V power supply
7, 8	GND	Grounding
4	RXD	RS232 data receive
5	TXD	RS232 data send
2, 3, 6	Retain	No pins are defined, user wiring is prohibited

IV.Soft components

1. Retention range

The component can be configured to retain a range. Configuration method: programming software, parameter - soft component setting; in addition, D components add a fixed retain range; ① D512~D7999

2. Component T (timer)

The PLC timer is described as follows:

Component	Name	Number	Remark
T	Timer	320 points	T0-T199[100mS]
			T200-T245[10mS]
			T246-T249[1mS cumulative type]
			T250-T255[100mS cumulative type]
			T256-T287[1Sec]
			T288-T319[1Min]

3. Component C (counter)

The built-in high-speed counter configuration is shown in the following table.

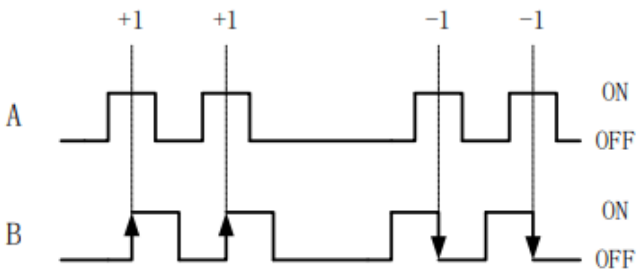
High-speed counter configuration table

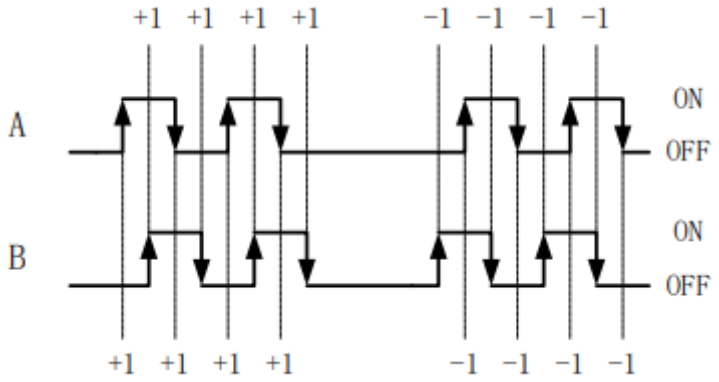
Input point Counter		**X0**	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**	**Maximum frequency KHz**		
										30 series	**20 series**	**10 series**
Single-phase single-ended counting input mode	C235	Inc / Dec								100	50	
	C236		Inc / Dec									
	C237			Inc / Dec							10	
	C238				Inc / Dec							
	C239					Inc / Dec						
	C240						Inc / Dec					
	C241	Inc / Dec	Reset								10	
	C242			Inc / Dec	Reset							
	C243					Inc / Dec	Reset					
	C244 OP							Inc / Dec				
	C244	Inc / Dec	Reset					start up				
	C245 OP								Inc / Dec			
	C245			Inc / Dec	Reset				start up			
Single-phase increment and decremen	C246	Inc	Reduce							100	50	
	C247	Inc	Reduce	Reset							10	
	C248 OP				Inc	Reduce					10	
	C248				Inc	Reduce	Reset					
	C249	Inc	Reduce	Reset				start up				

t counting input mode	C250				Inc	Reduce	Reset		start up		
Dual-phase counting input mode	C251	Phase A	Phase B							50	30
	C252	Phase A	Phase B	Reset							5
	C253 OP				Phase A	Phase B					
	C253				Phase A	Phase B	Reset				
	C254 OP							Phase A	Phase B		
	C254	Phase A	Phase B	Reset				start up			
	C255 OP			Phase A			Phase B				
	C255				Phase A	Phase B	Reset		start up		

The high-speed counter performs actions based on specific inputs as shown in the table above, and high-speed actions based on interrupt processing. The counting action is independent of the PLC scan cycle.

This type of counter is a 32 -bit increment/ decrement counter. According to different increment/ decrement switching methods, it can be divided into the following four types:

Counting method	Counting action
Single-phase single-ended counting input	According to the ON/OFF of M8235~M8245, C235 ~ C245 respectively count decrement/ increment.
Single-phase up and down counting input	Corresponding to the action of the increment-count input or decrement-count input, the counter C246 ~ C250 automatically increases / decreases the count. The channel corresponds to the current counting direction of the counter. When OFF, it is increment count, and when ON, it is decrement count.
Dual-phase counting input	M8100~M8102 is set to OFF, counters C251 ~ C255 automatically increase or decrease counts according to the bi-phase input. M8251~M8255 can know the current counting direction of the corresponding counter. When OFF, it is increment count, and when ON, it is decrement count. The counting direction is defined as follows: 

Dual-phase quadruple frequency counting input	M8100~M8102 is set to ON , counters C251 ~ C255 automatically increase or decrease counts at four times the frequency according to the dual-phase input. M8251~M8255 can know the current counting direction of the corresponding counter. When OFF , it is increment count, and when ON , it is decrement count. The counting direction is defined as follows: 

Relationship between high-speed counter and auxiliary relay

a. Special auxiliary relay number for increment/ decrement counting switching

Type	Counter number	Increment/ Decrement setting
Single-phase single-ended counting input	C235	M8235
	C236	M8236
	C237	M8237
	C238	M8238
	C239	M8239
	C240	M8240
	C241	M8241
	C242	M8242
	C243	M8243
	C244	M8244
	C245	M8245

b. Special auxiliary relay number for counting direction monitoring

Type	Counter number	Increase / decrease monitor
Single-phase increment and decrement counting input	C246	M8246
	C247	M8247
	C248	M8248
	C249	M8249
	C250	M8250
Dual-phase counting input	C251	M8251
	C252	M8252
	C253	M8253
	C254	M8254
	C255	M8255

c. Special auxiliary relay number for quadruple frequency switching

Type	Counter number	Quadruple frequency setting
Dual-phase	C251	M8100
	C252	M8100

counting input	C253	M8101
	C253OP	M8101
	C254	M8100
	C254OP	M8102
	C255	M8101

d. OP counter enables special auxiliary relay number

Type	Counter number	OP count enable setting
Single phase counting	C244OP	M8105
	C245OP	M8106
	C248OP	M8107
Dual-phase count	C253OP	M8107
	C254OP	M8108

V. System running

The main program ends with the END or FEND instruction.

1. Subroutines

The system supports 64 subroutines.

2. Interrupt program

All interrupts are described below:

Interrupt type	Interrupt number	Prohibit mark	Description
External input interrupt (X004~X007)	000	M8050	Corresponding to the falling edge interrupt of X000
	001	M8050	Corresponding to the rising edge interrupt of X000
	100	M8051	Corresponding to the falling edge interrupt of X001
	101	M8051	Corresponding to the rising edge interrupt of X001
	200	M8052	Corresponding to the falling edge interrupt of X002
	201	M8052	Corresponding to the rising edge interrupt of X002
	300	M8053	Corresponding to the falling edge interrupt of X003
	301	M8053	Corresponding to the rising edge interrupt of X003

	400	M8054	Corresponding to the falling edge interrupt of X004
	401	M8054	Corresponding to the rising edge interrupt of X004
	500	M8055	Corresponding to the falling edge interrupt of X005
	501	M8055	Corresponding to the rising edge interrupt of X005
	600	M8076	Corresponding to the falling edge interrupt of X006
	601	M8076	Corresponding to the rising edge interrupt of X006
	700	M8077	Corresponding to the falling edge interrupt of X007
	701	M8077	Corresponding to the rising edge interrupt of X007
Timer interrupt	6xx	M8056	Timer 1 : Timer time corresponding to xxms
	7xx	M8057	Timer 2 : Timer time corresponding to xxms
	8xx	M8058	Timer 3 : Timer time corresponding to xxms
High-speed counting interrupt	10	M8059	High-speed counting interrupt 1
	20	M8059	High speed counting interrupt 2
	30	M8059	High speed counting interrupt 3
	40	M8059	High speed counting interrupt 4
	50	M8059	High speed counting interrupt 5

VI.Communication function

All protocols support read and write operations on the corresponding soft components of the PLC .

1. FX programming protocol

All communication ports support FX programming protocol by default, and the serial port configuration is 9600-7-E-1. The baud rate can be modified through special registers.

Bit0	length 1 : 8 bits , 0 : 7 bits	Bit8	Start character enable

Bit1	Verification enable	00: No parity, 01: Odd parity, 11: Even parity	Bit9	End character enable	
Bit2	Verification method		Bit10	RS instruction automatic CRC check enable	
Bit3	Stop bit length 1: 2 bits, 0: 1 bit		Bit11~13	Protocol	0: FX protocol, 1: Free port protocol 2: MODBUS slave, 3: MODBUS master 4: N2N slave, 5: N2N master
Bit4~7	Baud rate	5: 1200 6: 2400 7: 4800 8: 9600 9: 19200 A: 38400 B: 57600 C:115200	Bit14~15	COM selection	0: Serial port 1 1: Serial port 2 2: Serial port 0 3 : Serial port 3

Note: The communication port selection is only applicable to D8120. Use the M8002 driver format change.

2. Free Protocol

PORT1 and PORT2 support free communication protocol. By sending and receiving commands via RS2 and RS communication, it can easily communicate with the instrument.

Address	Name	Actions and functions	R/W	20 series	10 series	30 series
M8121	RS serial port 1 sends waiting flag	Send Wait Set	R/W	√	√	√
M8122	RS serial port 1 sends enable flag		R/W	√	√	√
M8123	RS serial port 1 receiving completion flag	Receive completed	R/W	√	√	√
M8401	RS2 serial port 1 sends waiting flag	Send Wait Set	R/W	√	√	√
M8402	RS2 serial port 1 send enable flag		R/W	√	√	√
M8403	RS2 serial port 1 receiving completion flag	Receive completed	R/W	√	√	√

RS: FX free port send and receive instructions

Ladder diagram: RS S m D n	Applicable models	**10/ 20/ 30 series**
	Impact flag	
Instruction List: **RCV** (*S1*) (*D*) (*S2*)	Step length	**7**

Operands	Type	Applicable soft components														Address Indexing
S	WORD	D	V												R	
M	INT	constant	KnX	KnY	Knm	KnS	KnLM		D	SD	C	T	V	Z	R	
D	WORD	D	V												R	
n	INT	constant	KnX	KnY	Knm	KnS	KnLM		D	SD	C	T	V	Z	R	

a. Operand description

S: The starting address for storing the sent data m : The number of bytes sent

D: The starting address for storing received data n : The maximum number of bytes received

b. Function description

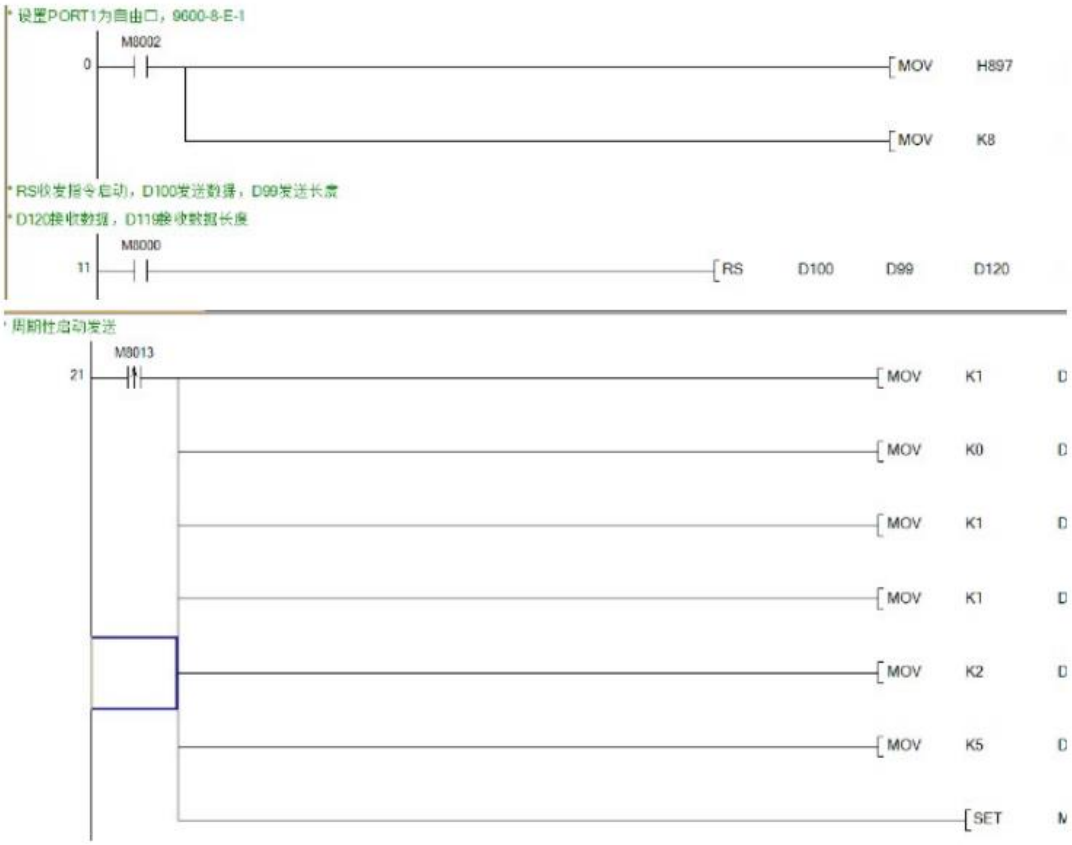
When the power flow is on and the communication conditions are met, data is sent and received according to the address specified by the user. The communication channel is specified as PORT1 .

c. Precautions

① Communication frame size: The communication frame is different depending on the type of component (D or V) selected. The end character of the receiving frame does not exceed D7999 or V63.

② When shutting down, reception is suspended.

d. Example



① The routine is send a frame of data every 1s. Using serial port 1 to send the following data:

01	00	01	01	02

② When the power flow is on, RS instruction will continue to be valid. After receiving the data, use D0 to receive the data count.

e. Special registers

Send enable flag, this bit enables the RS instruction to start sending when the power flow is on. This bit is automatically cleared after the instruction starts sending.

Receive completion flag: When receiving is completed, the receive completion flag is set, and reset after the user program finishes processing the data, starting the next frame reception.

Idle flag: When the serial port has no communication task, it is set and can be used as a communication detection bit.

Start character: can be set in the system block.

End character: can be set in the system block.

Timeout: starts from the last character received and can be set in the system block.

Total number of characters: The total number of characters received in the current frame.

Serial port	Start character	End character	Overtime time	Total number of characters
1	D8124	D8125	D8129	D8123

Serial port	Send enable flag	Receive completion flag	Idle flag
1	M8122	M8123	M8120

RS2: FX Free port send and receive commands

Ladder diagram: ⊣⊢ ⊣⊢[**RS** ***S*** ***m*** ***D*** ***n*** ***n1***]	Applicable models	**10/ 20/ 30 series**
	Impact flag	
Instruction List: **RCV** (***S1***) (***D***) (***S2***)	Step length	**7**

Operands	Type	Applicable software														Address indexing
S	WORD	D	V												R	
M	INT	constant	KnX	KnY	KnM	KnS	KnLM		D	SD	C	T	V	Z	R	
D	WORD	D	V												R	
n	INT	constant	KnX	KnY	KnM	KnS	KnLM		D	SD	C	T	V	Z	R	
n	INT	constant														

a. Operand Description

S: The starting address for storing the sent data

m: The number of bytes sent

D: The starting address for storing received data

n: The maximum number of bytes received

n1: Communication channel

b. Function Description

① When the power flow is on and the communication conditions are met, data is sent and received according to the address specified by the user.

② When the current communication port is a serial port, the programming method is the same as the RS instruction.

③ When the current communication port is CANbus interface, the format of sending and receiving data is:

[S+1, S]	S+2	S+3	S+4	…	S+8	S+9
CAN_ID	Data0	Data1	Data2	…	Data6	Data7
[D+1,D]	D+2	D+3	D+4	…	D+8	D+9

c. Precautions

① Communication frame size: The communication frame size depends on the type of component (D or V) selected. The end character of the received frame shall not exceed D7999 or V63 .

② When shutting down, reception is suspended.

d. Special registers

Send enable flag, this bit enables the RS2 instruction to start sending. This bit is automatically cleared after the instruction starts sending.

Receive completion flag: When receiving is completed, the receive completion flag is set, and reset after the user program finishes processing the data, starting the next frame reception.

Idle flag: When the serial port has no communication task, it is set and can be used as a communication detection bit.

- Start character: can be set in the system block.
- End character: can be set in the system block.
- Timeout: starts from the last character received and can be set in the system block.
- Total number of characters: The total number of characters received in the current frame

Serial port	Start character	End character	Overtime time	Total number of characters
0	D8210	D8212	D8209	D8204
1	D8410	D8412	D8409	D8404
2	D8430	D8432	D8429	D8424
3	D8230	D8232	D8229	D8224

Serial port	Send enable flag	Receive completion flag	Idle flag
0	M8192	M8193	M8190
1	M8402	M8403	M8400
2	M8422	M8423	M8420
3	M8412	M8413	M8410

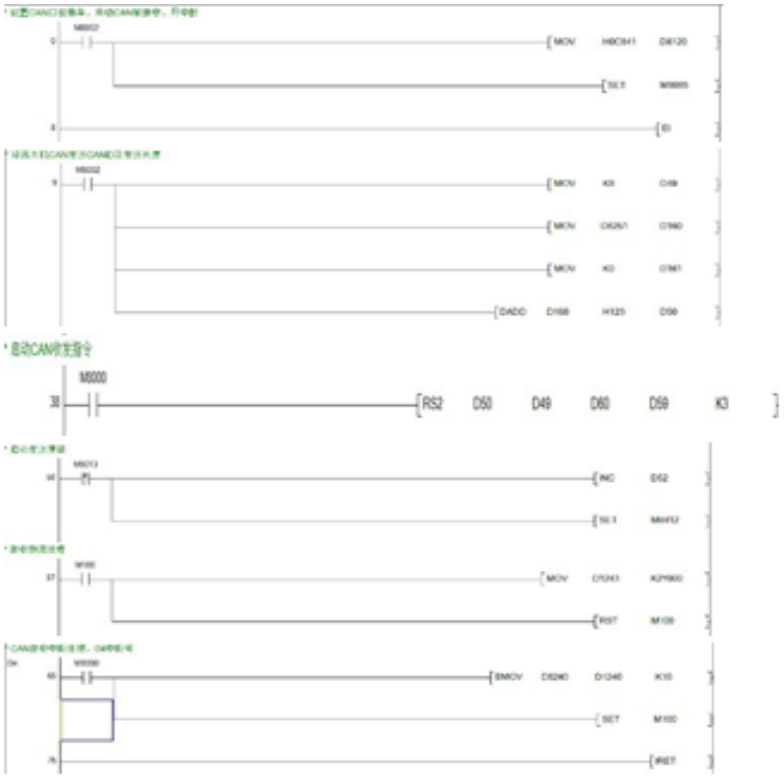
e. Examples

① The routine is sending a frame of data every 1s. Using CAN to send the following data:

[S+1, S]	S+2	S+3	S+4	…	S+8	S+9
CAN_ID	Data0	Data1	Data2	…	Data6	Data7
H123	Self-add	0	0	0	0	0

② When the power flow is on, RS2 instructions will remain in effect.

③ The received data is cached to D1240~D1249 through the CAN frame reception interrupt processing, and M100 is set. The main program processes the data according to the M100 status.



3. MODBUS Ethernet Master Protocol

The Ethernet host supports MODBUS TCP master communication function and uses FROM/TO instructions for slave read and write functions.

① Set the host IP address, D8220~D8233

② 2. Set D8234 as needed to configure the number of MODBUS master channels, MODBUS slave channels, and FXPro&MC channels. For example:
D8234 = H0161
MODBUS master channel number = 6
MODBUS slave channel number = 1
FXPro&MC channel number = 1

③ Configure the corresponding slave information according to the number of MODBUS master station channels. Each master station channel is connected to a MODBUS slave station, and up to 6 slave stations can be configured.

④ Set M8075 to complete the setting;

⑤ After the setting is successful, the corresponding flags of M8092~M8097 are set.

⑥ Use FROM/TO master station instructions to read and write slave stations.

Address	Name	R/W	20 series	10 series	30 series
M8075	D8220~D8234 are assigned, set M8075 to	R/W	√	√	√

	initialize the Ethernet				
M8092	Ethernet channel 1 configuration success flag	R/W	√	√	√
M8093	Ethernet channel 2 configuration success flag	R/W	√	√	√
M8094	Ethernet channel 3 configuration success flag	R/W	√	√	√
M8095	Ethernet channel 4 configuration success flag	R/W	√	√	√
M8096	Ethernet channel 5 configuration success flag	R/W	√	√	√
M8097	Ethernet channel 6 configuration success flag	R/W	√	√	√
D8220~D8233	For Ethernet IP address configuration, please refer to the appendix.	R/W	√	√	√
D8234	Ethernet protocol configuration	R/W	√	√	√

	B	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	H					MODBUS TCP master channels				MODBUS TCP slave channels				FxPro&MC Channels			
						PLC can control the number of MODBUS slave				Can access the number of PLC MODBUS TCP master				Can access the PLC programming software and the number of MC touch screens			

Mapping table of MODBUS slave address and slave IP address:

Function	Channel 1 parameters	Channel 2 parameters	Channel 3 parameters	Channel 4 parameters	Channel 5 parameters	Channel 6 parameters
Slave station number	D7900	D7905	D7910	D7915	D7920	D7925
Slave IP1	D7901	D7906	D7911	D7916	D7921	D7926
Slave IP2	D7902	D7907	D7912	D7917	D7922	D7927
Slave IP3	D7903	D7908	D7913	D7918	D7923	D7928
Slave IP4	D7904	D7909	D7914	D7919	D7924	D7929

4. MODBUS serial port master protocol

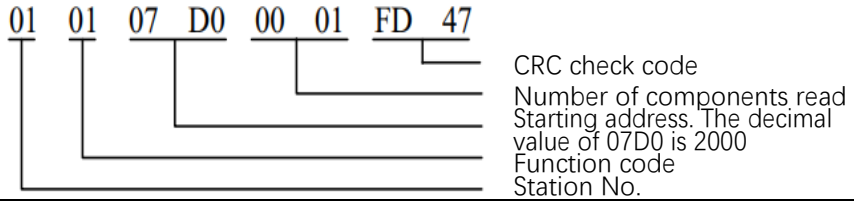
PORT1 and PORT2 support MODBUS RTU master communication protocol; through MODBUS master instructions, it can easily communicate with the inverter, temperature control and instrument.

Address	Name	R/W	20 series	10 series	30 series
D8400	Serial port 1 communication format setting	R/W	√	√	√
D8401	Serial port 1 protocol setting. H11: MODBUS slave. H1: MODBUS master	R/W	√	√	√
D8409	Serial port 1 communication timeout	R/W	√	√	√
D8411	Serial port 1 communication interval	R/W	√	√	√
D8414	Serial port 1 MODBUS slave number	R/W	√	√	√

D8063	Serial port 1 MODBUS communication error code	R/W	√	√	√
M8403	Serial port 1 MODBUS communication success flag	R/W	√	√	√
M8063	Serial port 1 MODBUS communication error flag	R/W	√	√	√
D8420	Serial port 2 communication format setting	R/W	√	√	√
D8421	Serial port 2 protocol setting, H11: MODBUS slave, H1: MODBUS master	R/W	√	√	√
D8429	Serial port 2 communication timeout	R/W	√	√	√
D8431	Serial port 2 communication interval	R/W	√	√	√
D8434	Serial port 2 MODBUS slave number	R/W	√	√	√
D8438	Serial port 2 MODBUS communication error code	R/W	√	√	√
M8423	Serial port 2 MODBUS communication success mark	R/W	√	√	√
M8428	Serial port 2 MODBUS communication error flag	R/W	√	√	√

5. Modbus protocol address table

Element	Type	Physical components	3U protocol address	Function code (decimal)	Notes
Y	Bit Components	Y0~Y377	H3300~H33FF	01, 05, 15	
X	Bit Components	X0~X377	H3400~H34FF	01, 05, 15 02	
M	Bit Components	M0~M4095	H0~H1DFF	01, 05, 15	
SM	Bit Components	SM0 to SM511	H1E00~H1FFF	01, 05, 15	
S	Bit Components	S0~S1023	H2000~H2FFF	01, 05, 15	
T	Bit Components	T0~T511	H3000~H31FF	01, 05, 15	Status of T component
C	Bit Components	C0~C306	H3200~H32FF	01, 05, 15	Status of C component
D	Word component	D0~D7999	H0~H1F3F	03, 04, 06, 16	
SD	Word component	SD0~SD511	H1F40~H213F	03, 04, 06, 16	
T	Word component	T0~T511	HA140~A33F	03, 04, 06, 16	Current value of T component
C	Word component	C0~C199	HA340~HA407	03, 04, 06, 16	Current value of C component (WORD)

C	Double word components	C200~C255	HA408~HA477	03, 04, 16	Current value of the C component (DWORD)
R	Word component	R0~R32767	H2140~HA13F	03, 04, 06, 16	
	Note: The protocol address is the address used in data transmission. The protocol address corresponds to the logical address of Modicon data. The protocol address starts from 0, and the logical address of Modicon data starts from 1, that is, the protocol address + 1 = the logical address of Modicon data. For example: the protocol address of T464 is 2000, and its corresponding logical address of Modicon data is 0: 2001. In practice, the reading and writing of T464 is completed through the protocol address. For example, the read frame of T464 component (sent by the master station):  				

6. MODBUS master commands

RD3A: MODBUS single register read instruction

Ladder diagram:										Applicable models									10/ 20/ 30	
										Impact flag										
Instruction List: **RD3A** (*S1*) (*S2*) (*D*)										Step length									9	
Operands	Type	Applicable software																		Address indexing
S1	INT	constant								D										
S2	INT	constant								D										
D	INT									D										√

a. Operand Description

S1: MODBUS slave station number

S2: MODBUS slave register address D: Command read and save component address

b. Function Description

Loop from S1 slave, read S2 register to D element.

WR3A: MODBUS single register write instruction

Ladder diagram:	Applicable models	**10/ 20/ 30 series**

[FROM (S1) (S2) (D) (S3)]										Impact flag					
Instruction list: **WR3A** (*S1*) (*S2*) (*D*) (*S3*)										Step length				**9**	
Operands	Type	Applicable soft components													Address indexing
S1	INT	constant							D						
S2	INT	constant							D						
D	INT	constant							D						√

a. Operand Description

S1: MODBUS slave station number

S2: MODBUS slave register address

D: Command write save register

b. Function Description

The D component data is written into S1 slave station S2 register in a loop.

MODBUS single word read function, function code: 0x03.

FROM: MODBUS data read instruction

Ladder diagram: [FROM (S1) (S2) (D) (S3)]																Applicable models	**20/ 30 series**
																Impact flag	
Instruction List: **FROM** (*S1*) (*S2*) (*D*) (*S3*)																Step length	**9**
Operands	Type	Applicable soft components															Address indexing
S1	INT	constant															
S2	INT	constant															
D	INT								D				V	R			√
S3	INT	constant															

a. Operand Description

S1: MODBUS read parameters, Hpsse: p —— serial port number; ss —— slave address; e —— address type (0: word component, 1 : bit component, 4 : single word 04 function code)

S2: MODBUS slave data start address

D: Command read save element start address

S3: Command read number

b. Function Description

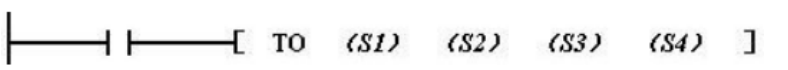
① Through serial port 2, read 1 word of data from the specified address 8192 (word element) of the specified slave station 17, and store it in the word elements starting from D200.

FROM H2110 K8192 D200 K1

② When the serial port number = 0xF , the MODBUS TCP master function is used , which is only supported by the Ethernet host.

TO: MODBUS data write instruction

	Applicable	**20/ 30 series**

Ladder diagram: 	models	
	Impact flag	
Instruction list: **TO** (***S1***) (***S2***) (***S3***) (***S4***)	Step length	**9**

Operands	Type	Applicable soft components												Address indexing
S1	INT	constant												
S2	INT	constant												
S3	INT								D			V	R	√
S4	INT	constant												

a. Operand description

S1: MODBUS read parameters, Hpsse: p —— serial port number; ss —— slave address; e —— address type (0 : word component, 1 : bit component)

S2: MODBUS slave data starting address

D: Instruction write data element starting address

S3: Instruction write number

b. Function description

① Through the serial port p, write S3 words of data starting from the specified address S2 (element type e) of the specified slave station (station number is ss), and the data is stored in the S3 word elements starting from D.

② When the serial port number = 0xF, the MODBUS TCP master function is used, which is only supported by the Ethernet host.

7. Application Instructions

ZRN instruction

Ladder diagram: 	Applicable models	**10/ 20/ 30 series**
	Impact flag	Zero flag Carry flag Borrow flag
Instruction list: **ZRN** (***S1***) (***S2***) (***S3***) (***D***)	Step length	**11**

Operands	Type	Applicable soft components														Address indexing
S1	DINT	constant	KnX	KnY	KnM	KnS	KnLM	KnSM	D	SD	C		V		R	√
S2	DINT	constant	KnX	KnY	KnM	KnS	KnLM	KnSM	D	SD	C		V		R	√
S3	BOOL		X	Y	M	S										
D1	BOOL			Y												

a. Operand Description

S1: Origin return speed. Specify the speed at the start of origin return, 10 ~ 100000 (Hz).

S2: Creep speed. Specifies a relatively low speed after the near-point signal (DOG) turns ON .

S3: Near-point signal. Specifies the near-point signal input X element.

When specifying an input element other than a relay (X), the origin position will be affected by the PLC operation cycle, which will cause the offset to increase.

D: High-speed pulse output starting address

b. Function Description

When the M8341 clear signal is valid, the servo drive is issued a clear signal; if the clear signal specifies a component that is valid (M8464), the clear component number is specified by D8464; otherwise, the default is as follows:

Pulse	4 axes or lower	6 axes or above
Y0	Y10	Y20
Y1	Y11	Y21
Y2	Y12	Y22
…		

c. Precautions

① Since the origin return instruction ZRN does not have the function of automatically searching for the near point signal, the origin return operation must be started from a point farther than the front end of the near point detection device.

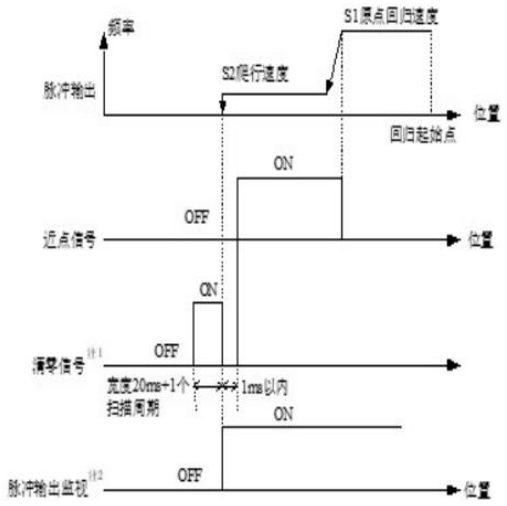
② During the origin return process, the current value register value will move in the decreasing direction.

③ When using this instruction, please pay attention to the settings of D8342 (the minimum speed when the instruction is executed, that is, the default base frequency), D8343 and D8344 (the maximum speed when the instruction is executed), D8348 (the acceleration time when executing the positioning instruction), and D8349 (the deceleration time when executing the positioning instruction).

④ When the frequency speed input in the instruction is greater than the value of D8343 and D8344, it will also cause abnormal output.

⑤ The origin return instruction ZRN starts the origin return at the return speed, changes to the creeping speed after the origin rising edge, and stops the instruction at the origin falling edge to complete the return; if the creeping speed is zero, the origin signal stops immediately at the rising edge to complete the return.

d. Timing diagram



DSZR instruction

Ladder diagram:	Applicable	**10/ 20/ 30 series**

⊣⊢ ⊣⊢[DSZR *(S1)* *(S2)* *(D1)* *(D2)*]	models	
	Impact flag	Zero flag Carry flag Borrow flag
Instruction List: **DSZR** ***(S1) (S2) (D1) (D2)***	Step Length	**9**

Operands	Type	Applicable soft components													Address indexing
S1	BOOL		X	Y	M	S									
S2	BOOL		X												
D1	BOOL			Y											
D2	BOOL			Y	M	S									

a. Operand Description

S1: Specify the soft element number of the input proximity signal (DOG). When specifying the input soft element, the offset of the origin position will increase due to the influence of the programmable controller operation cycle.

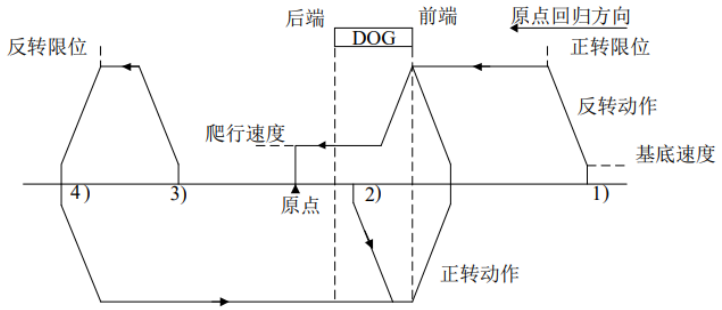
S2: Specify the soft element number of the input zero signal. Range: X0 ~X7 .

D1: Specify the pulse number of the output pulse.

D2: Specify the output object number of the rotation direction signal.

b. Function description

The origin return command using the near point signal and the zero point signal is allowed. There are forward limit and reverse limit designed. The origin return action is different due to the different origin return positions. A clear signal is sent after the command is completed.



➢ When the starting position is before passing DOG:

① By executing the origin return command, the origin return operation starts.

② Start moving in the origin return direction at the origin return speed.

③ Once the front end of the dog is detected, it starts to slow down to a crawling speed.

④ After detecting the back end of the DOG, stop when the first zero signal is detected.

➢ When the starting position is within DOG:

① By executing the origin return command, the origin return operation starts.

② Start moving in the direction opposite to the origin return direction at the origin return speed.

③ After detecting the front end of the DOG, the vehicle decelerates and stops. (Leaves the DOG)

④ Start moving in the origin return direction at the origin return speed. (DOG again)

⑤ As soon as the front end of the DOG is detected it starts to slow down to a crawling

speed.

⑥ After detecting the back end of the DOG, it stops when the first zero signal is detected.

➢ The start position is when the near point signal is OFF (after passing DOG)

① By executing the origin return command, the origin return operation starts.

② Start moving in the origin return direction at the origin return speed.

③ When the reverse limit is detected, the machine decelerates and stops.

④ Start moving in the opposite direction of the origin return at the origin return speed.

⑤ Detection of DOG The front end decelerates and stops (detection (leaving) D O G) .

⑥ Start moving in the origin return direction at the origin return speed.

⑦ DOG is detected At the front end of the vehicle, it starts to slow down to a crawling speed.

⑧ Detection of DOG After the back end of the circuit, it stops when the first zero signal is detected.

➢ The starting position is at the limit switch position (forward limit or reverse limit):

① The origin return operation starts with the origin return command.

② Start moving in the direction opposite to the origin return direction at the origin return speed.

③ Detection of DOG The front end of the dog slows down and stops. (Detect (leave) DOG)

④ Start moving in the origin return direction at the origin return speed.

⑤ (Enter DOG again .)

⑥ DOG is detected At the front end of the vehicle, it starts to slow down to a crawling speed.

⑦ Detection of DOG After the back end of the circuit, it stops when the first zero signal is detected

c. Precautions

① Please pay attention to the driving time of the command.

② High-speed instructions, envelope instructions, and positioning instructions can use the high-speed pulse port to output high-speed pulses. Please be careful not to use these instructions for high-speed output on the same high-speed port at the same time.

③ The lowest frequency of the output pulse frequency that can actually be output is determined by the following formula:
The minimum frequency of the output pulse frequency = sqrt〔Maximum speed ÷ (2/ deceleration time)

④ For the output pulse frequency, even if a value lower than the above calculation result is specified, the frequency of the calculated value will still be output. The frequency of the initial acceleration and the final deceleration part cannot be lower than the above calculation result. If the maximum speed is lower than the above calculation result, no pulse will be output.

⑤ The creeping speed should be greater than zero and less than one tenth of the maximum speed.

⑥ When the near-point signal and the zero-point signal are designated as the same input point, different functions are implemented according to M8098 (DSZR homing mode). When M8098 is not set, DSZR stops when it leaves the rear end of the DOG; when M8098 is set, DSZR leaves the rear end of the DOG and moves in the reverse direction to the

forward direction, and stops when it reaches the rear end of the DOG.

d. Example

The parameters such as maximum speed, base speed, acceleration/deceleration time, origin return speed, creeping speed, etc. can use the default values or be reset by assigning values to soft components.

SPD : Frequency measurement instruction

Ladder diagram: ⊣⊢ ⊢[SPD (S1) (S2) (D)]																Applicable models	10/ 20/ 30 series	
																Impact flag		
Instruction List: **SPD** (***S1***) (***S2***) (***D***)																Step length	**7(SPD)**	**13(DSPD)**
Operands	Type	Applicable software																Address Indexing
S1	BOOL		X															
S2	WORD	constant	KnX	KnY	KnM	KnS	KnLM	KnSM	D	SD	C	T	V	Z	R			√
D	WORD								D				V		R			√

a. Operand description

S1: Input point, setting range: X0 ~ X5

S2: Unit time of input point detection, in ms, operand S2>0

D: Detection pulse data storage unit, when the count exceeds 65535, automatic overflow processing

	SPD	DSPD
Counting results	D	(D+1, D)
Count present value	D1	(D+3, D+2)
operation hours	D2	(D+5, D+4)
Pulse interval (μs)	(D+4, D+3)	(D+7, D+6)

b. Function description

Detect the number of pulses input to X0 ~ X5 within the specified time (ms) and store the result in the specified soft element unit.

c. Precautions

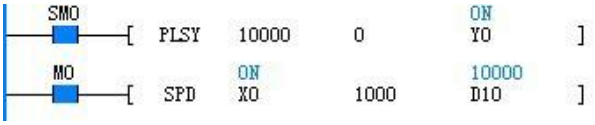
① There is a hardware conflict between SPD and HCNT, external input interrupt, and pulse capture.

② The input points of SPD can only be X0~X5, and other input points are not supported.

③ The maximum pulse input frequency of SPD is 10kHz. If it exceeds 10kHz, there may be errors in the detection.

④ The input pulse frequency of the SPD must refer to the total pulse frequency input and output requirements of the system

d. Examples

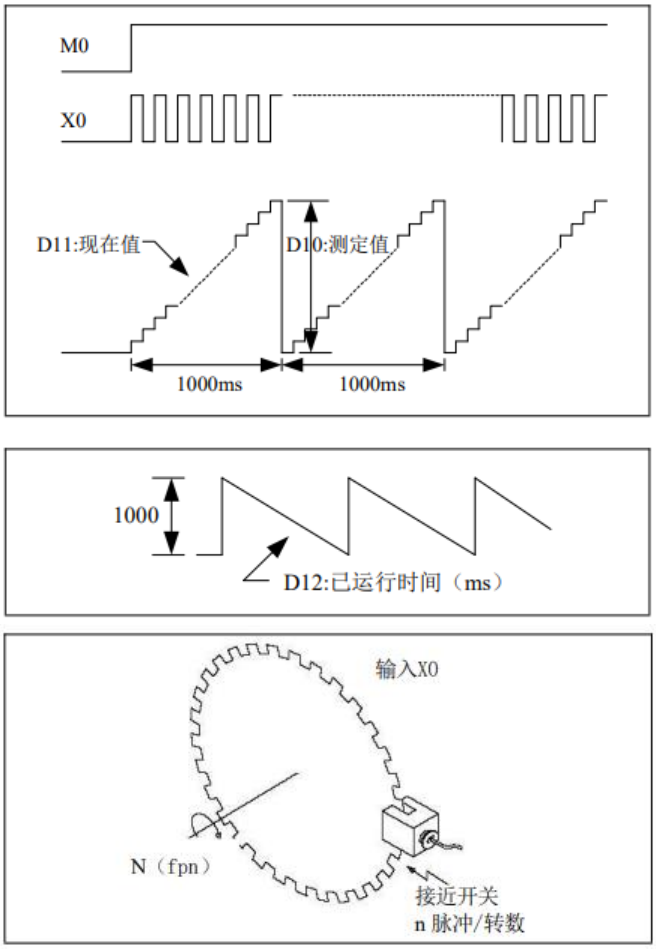


LD SM0

PLSY 10000 0 Y0 LD M0

SPD X0 1000 D10

The timing operations of the program operation instance are as follows:



① When M0 is ON, the input pulse specified by X0 is counted within 1000ms, and the counting result is saved in the storage unit of D10, where D11 is the current value of the count within 1000ms, D12 is the running time within 1000ms, and D13/D14 is the pulse interval (unit: microseconds).

② The data of D10 is proportional to the rotation speed in the above figure.

③ Each OFF→ON count of X0 is saved in D10 every 1000ms.

HSZ: Synchronous follow command

Ladder diagram	Applicable models	
	Impact flag	Zero flag Carry flag Borrow flag
Instruction List: **DSZ** （***Dz***） （***Dn***） （**Cm**） （***Yi***）	Step length	**17**

Operands	Type	Application soft components													Address Indexing
Dz	DINT								D						
Dn	DINT								D						
Cm	DINT			Y							C				
Yi	BOOL			Y											

a. Operand Description

Dz: Synchronous follow-up parameter

Dn: Electronic gear ratio, electronic gear numerator (Dn/Dn+1), electronic gear denominator (Dn+2/Dn+3), range: 1/10000~10000.

Cm: Output point number or high-speed counter number corresponding to the spindle pulse signal. Range: Y0~Y7, C235~C255.

Yi: Output point number corresponding to the slave axis pulse signal, direction Dz+7.

b. Functional description

① When M8135 is set, DHSZ is defined as a follow instruction; when M8135 is not set, DHSZ is a general instruction;

② Dz, defines the follow control mode

0: Electronic gear mode, the slave axis follows the master axis with the electronic gear ratio

2: Interval follow mode

4: Electronic cam mode

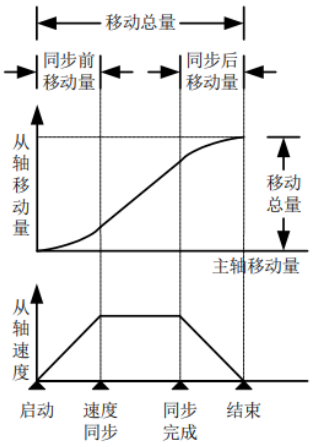
- Range follow function

Element D	Content
Dz +8/ Dz +9	Interval following starting position
Dz +10/ Dz +11	Interval following end position
Dz +12	Follow times

- Electronic cam following function

Element D	Content
Dz +8	Color code input X number
Dz +9	Number of cache data
Dz+10/Dz+11	Total number of pulses of the spindle in the following process (fixed length)
Dz+12/Dz+13	The number of pulses of the spindle during acceleration
Dz+14/Dz+15	The number of pulses that the spindle runs during the synchronization phase
Dz+16/Dz+17	The number of pulses of the spindle during deceleration (follow cut)
Dz+18/Dz+19	Number of pulses of the main axis during the slave axis reversing process (follow cut)
Dz+20/Dz+21	Speed of slave axis returning to starting position
Dz+22/Dz+23	Color mark offset position (number of spindle pulses)
Dz+24/Dz+25	Single cycle pulse number of slave axis (flying cut)
Dz+26~Dz+49	Cache retention

✓ This instruction electronic cam mode realizes the simple synchronization function of dual-axis motion. The slave axis measures and follows the speed and position of the master axis. The master axis can be the high-speed output port of this module or the high-speed input port.



Tempo Sync

- ✓ As shown in the figure above, after this instruction is started, the slave axis starts from a stationary state and follows the main axis after a period of acceleration and deceleration. When the main axis outputs the specified pulse number DZ+12/DZ+13, the slave axis accelerates to the same speed as the main axis and starts uniform speed synchronization. When the main axis outputs the specified pulse number DZ+14/DZ+15, the uniform speed synchronization ends, the main axis outputs the specified pulse number DZ+10/DZ+11, the slave axis completes the deceleration stop, and the slave axis stops.
- ✓ When the spindle is defined as an input axis, specify operand S1 as C235 to C255.
- ✓ When the driving energy flow of the instruction is turned on
  After the instruction is driven, the main axis outputs the specified DZ+4/DZ+5 position, and the slave axis starts running.
- ✓ The direction signal of the output axis is specified by Dz+7, and the ON/OFF state of the direction signal is changed when the following process returns.

③ Follow parameter table:

Element D	Content
Dz	Follow-up mode
Dz +1	Bit0：0-follow-cut mode；1-flying-cut mode； Bit4：0-fixed length；1—color mark Bit5：0-rising edge of color mark，1-falling edge of color mark Bit 8：Sync flag valid
Dz +2	Number of pulses to be compensated
Dz +3	Pulse compensation time
Dz +4/ Dz +5	Starting spindle position
Dz+6	Synchronous mark M address
Dz+7	Slave axis direction signal

c. Precautions

Please be careful not to use multiple high-speed instructions, envelope instructions or positioning instructions on the same high-speed port at the same time.

FLWR : Interpolation instruction

Ladder diagram:	Applicable models	10/ 20/ 30 series
FLWR (S) (D1) (D2) (D3) (D4)	Impact flag	Zero flag Carry flag Borrow flag
Instruction List: **FLWR (S) (D1) (D2) (D3) (D4)**	Step length	**12**

Operands	Type	Application soft components													Address Indexing
S	WORD								D						
D1	BOOL			Y											
D2	WORD								D						
D3	WORD								D						
D4	WORD								D						

a. Operand description

S: interpolation parameter

D1: X- axis pulse signal

D2: Interpolation position parameter starting address

D3: Interpolation speed parameter starting address

D4: Interpolation axis number

b. Function description

① Move to the target position along a straight line trajectory at the specified vector speed

② S interpolation parameter definition

Instruction	Interpolation mode	Acceleration type	Position mode
B15~12	B11~8	B7~4	B3~0
H0: Straight line	/	H0: pulse + direction H1: positive and negative pulse H2: AB phase pulse	H0: Absolute H1: Relative
H1: CW H2: CCW	H0: Radius H1: Center H2 passing point		

③ D1 pulse signal

D1: X -axis pulse signal, Y0 or Y1

④ D2 interpolation position parameter

S(B15~B8)	D2	D2+2	D2+4	D2+6
H00	X- axis target	Y- axis target	/	/
H10/H20	X- axis target	Y- axis target	Radius	
H11/H21	X- axis target	Y- axis target	Center X	Center Y
H12/H22	X- axis target	Y- axis target	After X	After Y

⑤ D3 interpolation speed parameters

D3+0/ D3+1: Base speed, greater than or equal to 1000

D3+2/D3_3: Running speed, greater than or equal to base speed, less than the system maximum speed

D3+4: Acceleration and deceleration time (ms)

D3+5: Y-axis pulse signal, cannot be Y0/Y1

D3+6: X-axis direction signal

D3+7: Y - axis direction signal

⑥ D4 interpolation axis number: HxxLA

L: bit4~7, continuous linear interpolation segment number, 0~1 is 1 segment;

A: bit0~3, number of interpolation axes, where

- In incremental mode, the track target uses a relative address, which refers to the moving distance of the X and Y axes from the current position to the target.
- In the absolute value mode, the trajectory target applies an absolute address, which refers to the absolute position coordinates of the target position on the X and Y axes.

c. Precautions

① The direction output ports corresponding to the two output axis pulse ports in the instruction must be used in groups.

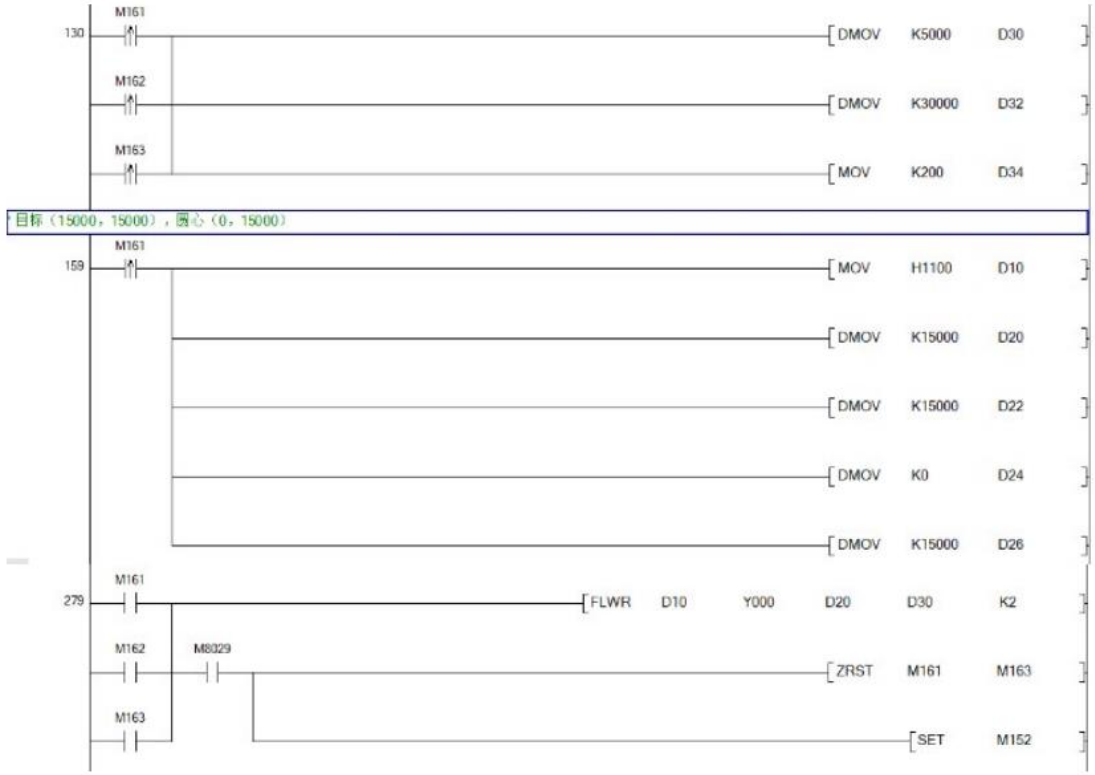
② The moving distance of each axis does not exceed 16,777,215 pulses each time.

③ In radius mode, positive radius realizes small circle arc interpolation.

④ Specify the passing point mode and determine CW/CCW based on the current position, target position, and passing point position.

⑤ Please be careful not to use multiple high-speed instructions, envelope instructions, or positioning instructions on the same high-speed port at the same time.

d. Example



VII. Appendix 1 Special Auxiliary Relays

1. Run flag

Address	Name	Actions and functions	R/W	20	10	30
M8000	PLC operation status flag		R/W	√	√	√
M8002	PLC first cycle flag		R/W	√	√	√
M8029	Instruction completion flag	Set when a multi-cycle complex instruction is completed; reset if not completed.	R	√	√	√
M8030	No battery operation mode	When this bit is set to 1, the battery voltage error and real-time clock error will not be reported if the system battery fails.	R/W	√	√	√

2. Interrupt flag

Address	Name	Actions and functions	R/W	20	10	30
M8050	Input interrupt X00 disabled	I000, I001 interrupt disable	R/W	√	√	√
M8051	Input interrupt X01 disabled	I100, I101 interrupt disable	R/W	√	√	√
M8052	Input interrupt X02 disabled	I200, I201 interrupt disable	R/W	√	√	√
M8053	Input interrupt X03 disabled	I300, I301 interrupt disable	R/W	√	√	√
M8054	Input interrupt X04 disabled	I400, I401 interrupt disable	R/W	√	√	√
M8055	Input interrupt X05 disabled	I500, I501 interrupt disable	R/W	√	√	√
M8056	Timer 0 interrupt disabled	I600 interrupt is disabled, the period is displayed in D8056 (ms), the period is greater than 2ms	R/W	√	√	√
M8057	Timer 0 interrupt disabled	I700 interrupt is disabled, the period is displayed in D8057 (ms), the period is greater than 2ms	R/W	√	√	√
M8058	Timer 0 interrupt disabled	I800 interrupt disabled, cycle displayed in D8058 (ms)	R/W	√	√	√
M8059	High-speed counting interrupt disabled	I10/I20/I30/I40/I50/I60 interrupts are disabled, DHSCS instruction is used	R/W	√	√	√
M8076	Input interrupt X06 disabled	I600, I601 interrupt disable	R/W	√	√	√
M8077	Input interrupt X07 disabled	I700, I701 interrupt disable	R/W	√	√	√
M8078	PORT2 character reception enable	I33 interrupt enable	R/W	√	√	√
M8085	CAN0 frame reception enable	I34 interrupt enable	R/W	√	√	√
M8086	CAN0 frame	I35 interrupt enable	R/W	√	√	√

	reception enable					
M8087	PORT0 character reception enable	I31 interrupt enable	R/W	√	√	√
M8088	PORT1 character reception enable	I32 interrupt enable	R/W	√	√	√

3. Error flag

Address	Name	Actions and functions	R/W	20	10	30
M8062	Serial port 0 communication error flag		R/W	√	√	√
M8063	Serial port 1 communication error flag		R/W	√	√	√

4. Other system flag

Address	Name	Actions and functions	R/W	20	10	30
M8083	Positioning command fast deceleration enable	After setting, the positioning instruction decelerates quickly	R/W	√	√	√
M8084	PWM specifies the microsecond parameter to enable	After setting, the parameter unit of PWM instruction changes to microseconds	R/W	√	√	√
M8074	Positioning real-time speed change enable	DDRVA/DDRVI real-time speed change enable	R/W	√	√	√
M8075	ETH address latch enable	=1 Ethernet IP address latch start, automatically reset after latch	R/W	√	√	√
M8079	RAMP time mode enable	=1 RAMP instruction outputs a ramp wave with a 1S time base	R/W	√	√	√
M8089	M element mapping X address enable	After setting, use the value of D8089 to start address mapping	R/W	√	√	√

5. High speed counting

Address	Name	R/W	20	10	30
M8100	X0 counter 4 times frequency switching enable	R/W	√	√	√
M8101	X3 counter 4 times frequency switching enable	R/W	√	√	√
M8102	X6 counter 4 times frequency switching enable	R/W	√	√	√
M8104	Counter reset signal logic inversion enable	R/W	√	√	√
M8105	C244 counter OP enable	R/W	√	√	√
M8106	C245 counter OP enable	R/W	√	√	√
M8107	C248 , C253 counter OP enable	R/W	√	√	√
M8108	C254 counter OP enable	R/W	√	√	√

6. Expandable BD card

Address	Name	Actions and functions	R/W	20	10	30
M8110	Analog input 1 mode	0: Voltage, current input 10V---2000/ 20mA---1000 1: PT100 temperature input	R/W	√	√	√
M8111	Analog input 2 mode		R/W	√	√	√
M8112	Analog input 3 mode		R/W	√	√	√
M8113	Analog input 4 mode		R/W	√	√	√
M8114	Analog output 1 mode	0: voltage output 1: current output	R/W	√	√	√
M8115	Analog digital range setting	0: 0~2000 1: 0~4000	R/W	√	√	√
M8116	Digital quantity 1	4EX-BD: As digital input sign 4EY-BD: Enable as digital output	R/W	√	√	√
M8117	Digital quantity 2		R/W	√	√	√
M8118	Digital quantity 3		R/W	√	√	√
M8119	Digital quantity 4		R/W	√	√	√

7. Freeport (RS instruction)

Address	Name	Actions and functions	R/W	20	10	30
M8121	Serial port 1 sends the waiting flag	Send wait set	R/W	√	√	√
M8122	Serial port 1 sends enable flag		R/W	√	√	√
M8123	Serial port 1 receiving completion flag	Receive completed	R/W	√	√	√
M8124	Serial port command PORT1 enable	Set 1: RS/ADPRW instruction uses PORT1	R/W	√	√	√
M8125	Serial port command PORT2 enable	Set 1: RS/ADRPW instruction uses PORT2	R/W	√	√	√

8. High speed output

Address	Name	Actions and functions	R/W	20	10	30
M8140	Instruction CLR signal output effective	When this bit is set, the CLR signal is output after returning to the original state.	R/W	√	√	√
M8147	Y000 pulse output monitoring (busy/ready)	When there is pulse output, set	R	√	√	√
M8148	Y001 pulse output monitoring (busy/ready)	When there is pulse output, set	R	√	√	√
M8098	DSZR homing mode	it is ON , if the DOG and near-point signals are the same, it stops at the rear end of the DOG .	R/W	√	√	√
M8338	PLSV Progressive Frequency Variable	it is ON , the frequency changes gradually and rapidly.	R/W	√	√	√

M8149	PLSV variable frequency progressive prohibition	it is ON , the frequency is changed during operation and gradual changes are prohibited.	R/W	√	√	√

9. Free serial port 1 (RS2 command)

Address	Name	Actions and functions	R/W	20	10	30
M8191	Serial port 0 sends the waiting flag	Send Wait Set	R/W	√	√	√
M8192	Serial port 0 send enable flag		R/W	√	√	√
M8193	Serial port 0 receiving completion flag	Receive completed	R/W	√	√	√

10. Enhanced positioning 1

Address	Name	Function	R/W	20	10	30
M8336	Interrupt input function designation effective	Y0 and Y1 are applicable to DVIT. When the interrupt input designation function is not used, Y0 corresponds to the interrupt of X0, and Y1 corresponds to the interrupt of X1; when the designation is used, the bit is set, and then each 4 bits of the corresponding D8336 corresponds to the input of each output (Y).	R/W	√	√	√
M8338	Acceleration and deceleration enable	0: PLSV command direct speed change 1: PLSV command acceleration and deceleration	R/W	√	√	√
M8340	Y000 pulse output monitoring (busy/ready)	When there is pulse output, set	R	√	√	√
M8341	Clear signal specifies the component efficient	The corresponding value in D8464 is Y (N), which indicates the clear signal. If not specified, Y0 is Y10, and DSZR is applicable.	R/W	√	√	√
M8342	Origin return direction	Y0 for DSZR	R/W	√	√	√
M8343	Forward limit	Y0 is suitable for DSZR/DVIT	R/W	√	√	√
M8344	Reversal limit	Y0 is suitable for DSZR/DVIT	R/W	√	√	√
M8345	Proximity signal logic inversion	Y0 for DSZR	R/W	√	√	√
M8346	Zero signal	Y0 for DSZR	R/W	√	√	√

	logic inversion					
M8347	Interrupt signal logic inversion	Y0 applies to DVIT	R/W	√	√	√
M8348	Positioning command driving	Y0 is suitable for DSZR/DVIT	R/W	√	√	√
M8349	Pulse output stop command	When this bit is set, the Y000 pulse will be disabled.	R/W	√	√	√
M8350	Y001 pulse output monitoring (busy/ready)	When there is pulse output, set	R	√	√	√
M8351	Clear signal specifies the component efficient	The corresponding value in D8465 is Y (N), which indicates the clear signal. If not specified, Y1 is Y11, and DSZR is applicable.	R/W	√	√	√
M8352	Origin return direction	Y1 for DSZR	R/W	√	√	√
M8353	Forward limit	Y1 for DSZR/DVIT	R/W	√	√	√
M8354	Reversal limit	Y1 for DSZR/DVIT	R/W	√	√	√
M8355	Proximity signal logic inversion	Y1 for DSZR	R/W	√	√	√
M8356	Zero signal logic inversion	Y1 for DSZR	R/W	√	√	√
M8357	Interrupt signal logic inversion	Y1 Applicable to DVIT	R/W	√	√	√
M8358	Positioning command driving	Y1 for DSZR/DVIT	R/W	√	√	√
M8359	Pulse output stop command	When this bit is set, the Y001 pulse will be disabled.	R/W	√	√	√
M8360	Y002 pulse output monitoring (busy/ready)	When there is pulse output, set	R	√	√	√
M8361	Clear signal specifies the component efficient	corresponding value in D8466 is Y (N), which indicates a clear signal and does not indicate Rule Y2 is Y12, applicable DSZR	R/W	√	√	√
M8362	Origin return direction	Y2 for DSZR	R/W	√	√	√
M8363	Forward limit	Y2 for DSZR/DVIT	R/W	√	√	√
M8364	Reversal limit	Y2 for DSZR/DVIT	R/W	√	√	√
M8365	Proximity signal logic inversion	Y2 for DSZR	R/W	√	√	√
M8366	Zero signal logic inversion	Y2 for DSZR	R/W	√	√	√

M8367	Interrupt signal logic inversion	Y2 Applicable DVIT	R/W	√	√	√
M8368	Positioning command driving	Y2 for DSZR/DVIT	R/W	√	√	√
M8369	Pulse output stop command	When this bit is set, the Y002 pulse will be disabled.	R/W	√	√	√
M8370	Y003 pulse output monitoring (busy/ready)	When there is pulse output, set	R			√
M8371	Clear signal specifies the component efficient	The corresponding value in D8467 is Y (N), which indicates the clear signal. If not specified, Y3 is Y13, and DSZR is applicable.	R/W			√
M8372	Origin return direction	Y3 for DSZR	R/W			√
M8373	Forward limit	Y3 for DSZR/DVIT	R/W			√
M8374	Reversal limit	Y3 for DSZR/DVIT	R/W			√
M8375	Proximity signal logic inversion	Y3 for DSZR	R/W			√
M8376	Zero signal logic inversion	Y3 for DSZR	R/W			√
M8377	Interrupt signal logic inversion	Y3 Applicable DVIT	R/W			√
M8378	Positioning command driving	Y3 for DSZR/DVIT	R/W			√
M8379	Pulse output stop command	When this bit is set, the Y003 pulse will be disabled.	R/W			√
M8380	Y004 pulse output monitoring (busy/ready)	When there is pulse output, set	R			√
M8381	Clear signal specifies the component efficient	The corresponding value in D8468 is Y (N), which indicates the clear signal. If not specified, Y4 is Y14, and DSZR is applicable.	R/W			√
M8382	Origin return direction	Y4 for DSZR	R/W			√
M8383	Forward limit	Y4 for DSZR/DVIT	R/W			√
M8384	Reversal limit	Y4 for DSZR/DVIT	R/W			√
M8385	Proximity signal logic inversion	Y4 for DSZR	R/W			√
M8386	Zero signal logic inversion	Y4 for DSZR	R/W			√
M8387	Interrupt	Y4 applies to DVIT	R/W			√

	signal logic inversion					
M8388	Positioning command driving	Y4 for DSZR/DVIT	R/W			√
M8389	Pulse output stop command	When this bit is set, the Y004 pulse will be disabled.	R/W			√
M8390	Y005 pulse output monitoring (busy/ready)	When there is pulse output, set	R			√
M8391	Clear signal specifies the component efficient	The corresponding value in D8469 is Y (N), which indicates the clear signal. If not specified, Y5 is Y15, and DSZR is applicable.	R/W			√
M8392	Origin return direction	Y5 for DSZR	R/W			√
M8393	Forward limit	Y5 for DSZR/DVIT	R/W			√
M8394	Reversal limit	Y5 for DSZR/DVIT	R/W			√
M8395	Proximity signal logic inversion	Y5 for DSZR	R/W			√
M8396	Zero signal logic inversion	Y5 for DSZR	R/W			√
M8397	Interrupt signal logic inversion	Y5 for DVIT	R/W			√
M8398	Positioning command driving	Y5 for DSZR/DVIT	R/W			√
M8399	Pulse output stop command	When this bit is set, the Y005 pulse will be disabled.	R/W			√

11. Free serial port 2 (RS2 command)

Address	Name	Actions and functions	R/W	20	10	30
M8401	Serial port 1 sends the waiting flag	Send wait set	R/W	√	√	√
M8402	Serial port 1 sends enable flag		R/W	√	√	√
M8403	Serial port 1 receiving completion flag	Receive completed	R/W	√	√	√
M8421	Serial port 2 sends the waiting flag	Send wait set	R/W	√	√	√
M8422	Serial port 2 sends enable flag		R/W	√	√	√
M8423	Serial port 2 receiving completion flag	Receive completed	R/W	√	√	√
M8428	Serial port 2 error flag	Serial port 2 error flag, also applies to MODBUS master station commands	R/W	√	√	√
M8411	Serial port 3 sends the waiting flag	Send wait set	R/W	√	√	√
M8412	Serial port 3 sends		R/W	√	√	√

	enable flag					
M8413	Serial port 3 receiving completion flag	Receive completed	R/W	√	√	√
M8418	Serial port 3 error flag	Serial port 3 error flag, also used with MODBUS master command	R/W	√	√	√

12. Enhanced positioning function 2

Address	Name	Function	R/W	20	10	30
M8470	Y006 pulse output monitoring (busy/ready)	When there is pulse output, set	R			√
M8471	Clear signal specifies the component efficient	The corresponding value in D8462 is Y (N), which indicates the clear signal. If not specified, Y6 is Y16, and DSZR is applicable.	R/W			√
M8472	Origin return direction	Y6 for DSZR	R/W			√
M8473	Forward limit	Y6 is suitable for DSZR/DVIT	R/W			√
M8474	Reversal limit	Y6 is suitable for DSZR/DVIT	R/W			√
M8475	Proximity signal logic inversion	Y6 for DSZR	R/W			√
M8476	Zero signal logic inversion	Y6 for DSZR	R/W			√
M8477	Interrupt signal logic inversion	Y6 is suitable for DVIT	R/W			√
M8478	Positioning command driving	Y6 is suitable for DSZR/DVIT	R/W			√
M8479	Pulse output stop command	When this bit is set, the Y006 pulse will be disabled.	R/W			√
M8480	Y007 pulse output monitoring (busy/ready)	When there is pulse output, set	R			√
M8481	Clear signal specifies the component efficient	The corresponding value in D8463 is Y (N), which indicates the clear signal. If not specified, Y7 is Y17, and DSZR is applicable.	R/W			√
M8482	Origin return direction	Y7 for DSZR	R/W			√
M8483	Forward limit	Y7 for DSZR/DVIT	R/W			√
M8484	Reversal limit	Y7 for DSZR/DVIT	R/W			√
M8485	Proximity signal logic inversion	Y7 for DSZR	R/W			√
M8486	Zero signal logic	Y7 for DSZR	R/W			√

	inversion					
M8487	Interrupt signal logic inversion	Y7 is suitable for DVIT	R/W			√
M8488	Positioning command driving	Y7 for DSZR/DVIT	R/W			√
M8489	Pulse output stop command	When this bit is set, the Y007 pulse will be disabled.	R/W			√

13. MODBUS slave address mapping

Address	Name	Function	R/W	20	10	30
M8509	Mitsubishi protocol address	After setting, use Mitsubishi MODBUS address mapping	R/W	√	√	√
M8510	Honyee protocol address	After setting, use Honyee MODBUS address mapping	R/W	√	√	√
M8511	Emerson Protocol Address	When set, use the Emerson MODBUS address mapping	R/W	√	√	√

VIII. Appendix 2 Special Auxiliary Registers

1. PLC system parameters

Address	Name	R/W	20	10	30
D8000	Software to check the door time, unit ms	R	√	√	√
D8001	PLC type + software version number 24XYZ 24086 —— 24: PLC type FX3U/FX3UC, 086 main version number: 0.86	R	√	√	√
D8002	Program capacity, unit: K steps	R	√	√	√
D8004	System error codes	R	√	√	√
D8010	System current scan time	R	√	√	√
D8011	System minimum scan time	R	√	√	√
D8012	System maximum scan time	R	√	√	√
D8013	System clock - seconds	R/W	√	√	√
D8014	System clock - minute	R/W	√	√	√
D8015	System clock - hour	R/W	√	√	√
D8016	System clock - day	R/W	√	√	√
D8017	System clock - month	R/W	√	√	√
D8018	System clock - year, default 0~99; after writing 2000, 2000~2099	R/W	√	√	√
D8019	System clock - date	R/W	√	√	√
D8021	Software sub-version number	R	√	√	√
D8030	Potentiometer 1 scale, 0~255	R	√	√	√
D8031	Potentiometer 1 scale, 0~255	R	√	√	√
D8032	Communication delay time, unit: ms	R/W	√	√	√
D8056	Timer interrupt 0 setting period, unit ms	R/W	√	√	√
D8057	Timer interrupt 1 setting cycle, unit: ms	R/W	√	√	√
D8058	Timer interrupt 2 setting cycle, unit: ms	R/W	√	√	√
D8089	Mapping of M element to X element, B15~12: mapping octal group number	R/W	√	√	√

	B11~0: mapping M element starting address				

2. Analog input

Address	Name	R/W	20	10	30
D8108	Integrated analog value average points	R/W	√	√	√
D8109	9- channel analog, 9th analog sampling value	R	√	√	√
D8110	Channel 1 analog sampling value	R	√	√	√
D8111	Channel 2 analog sampling value	R	√	√	√
D8112	Channel 3 analog sampling value	R	√	√	√
D8113	Channel 4 analog sampling value	R	√	√	√
D8114	Analog output value of channel 1	R/W	√	√	√
D8115	Analog output value of channel 2	R/W	√	√	√
D8116	Channel 5 analog sampling value	R	√	√	√
D8117	Channel 6 analog sampling value	R	√	√	√
D8118	Channel 7 analog sampling value	R	√	√	√
D8119	Channel 8 analog sampling value	R	√	√	√

3. Serial port configuration (RS)

Address	Name	R/W	20	10	30
D8120	Serial port 0~3 settings	R/W	√	√	√
D8121	RS instruction address	R/W	√	√	√
D8124	RS start character value	R/W	√	√	√
D8125	RS end character value	R/W	√	√	√
D8129	RS command timeout	R/W	√	√	√

4. Serial port 0 configuration

Address	Name	R/W	20	10	30
D8200	Serial port 0 communication format setting	R/W	√	√	√
D8201	Serial port 0 protocol setting, H11: MODBUS slave, H1: MODBUS master	R/W	√	√	√
D8209	Serial port 0 communication timeout	R/W	√	√	√
D8211	Serial port 0 communication interval	R/W	√	√	√
D8212	Serial port 0 communication MODBUS retry times	R/W	√	√	√
D8214	Serial port 0 MODBUS slave number	R/W	√	√	√

5. Ethernet parameter settings

Address	Name	R/W	20	10	30
D8220	MODBUS_TCP slave address	R/W	√	√	√
D8221	Ethernet IP address setting	R/W	√	√	√
D8222		R/W	√	√	√
D8223		R/W	√	√	√
D8224		R/W	√	√	√
D8225	Ethernet subnet mask settings	R/W	√	√	√
D8226		R/W	√	√	√
D8227		R/W	√	√	√
D8228		R/W	√	√	√
D8229	Ethernet Gateway Settings	R/W	√	√	√
D8230		R/W	√	√	√
D8231		R/W	√	√	√
D8232		R/W	√	√	√
D8233	UDP port number	R/W	√	√	√
D8234	Ethernet protocol configuration	R/W	√	√	√

Note: M8075 Ethernet parameter modification enable bit, automatically reset after Ethernet parameters are modified.

6. Serial port 3 configuration

Address	Name	R/W	20	10	30
D8220	Serial port 3 communication format setting	R/W	√	√	√
D8221	Serial port 3 protocol setting, H11: MODBUS slave, H1: MODBUS master	R/W	√	√	√
D8229	Serial port 3 communication timeout	R/W	√	√	√
D8231	Serial port 3 communication interval	R/W	√	√	√
D8232	Serial port 3 communication MODBUS retry times	R/W	√	√	√
D8234	Serial port 3 MODBUS slave number	R/W	√	√	√

7. CAN communication configuration

Address	Name	R/W	20	10	30
D8240	CAN receive buffer start address, D8240~D8250	R/W	√	√	√
D8251	CAN station number	R/W	√	√	√
D8252	CAN command timeout	R/W	√	√	√

D8253	CAN command retry times	R/W	√	√	√

8. Input and output switching configuration

Address	Name	R/W	20	10	30
D8300	Input point switch 0, the upper 8 bits of actual input are mapped to the lower 8 bits of X element	R/W	√	√	√
D8301	Input point switch 1, the upper 8 bits of actual input are mapped to the lower 8 bits of X element	R/W	√	√	√
D8302	Output point switch 0, the high 8- bit Y element controls the low 8- bit actual output	R/W	√	√	√
D8303	Output point switching 1, the high 8- bit Y element controls the low 8- bit actual output	R/W	√	√	√

9. Enhanced positioning instruction 1

Address	Name		R/W	20	10	30
D8335	Positioning instruction reserved		R	√	√	√
D8336	Specify Y0~Y3 interrupt input signal		R/W	√	√	√
D8337	Specify Y4~Y7 interrupt input signal		R/W			√
D8338	Y0~Y3 interpolation configuration		R/W	√	√	√
D8339	Y4~Y7 interpolation configuration		R/W			√
D8340	Low	Y0 maximum speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (10 to 100000)	R/W	√	√	√
D8341	High		R/W	√	√	√
D8342	Y0 base speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (less than 1/10 of the maximum speed)		R/W	√	√	√
D8343	Low	Y0 maximum speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (10 to 100000)	R/W	√	√	√
D8344	High		R/W	√	√	√
D8345	Y0 creeping speed, suitable for DSZR		R/W	√		√
D8346	Low	Y0 origin return speed, suitable for DSZR	R/W	√	√	√
D8347	High		R/W	√	√	√
D8348	Y0 acceleration time (unit: ms)		R/W	√	√	√
D8349	Y0 deceleration time (unit: ms)		R/W	√	√	√
D8464	Y0 specifies the clear input signal		R/W	√	√	√
D8350	Low	Y1 outputs the current value data register of the positioning instruction	R/W	√	√	√
D8351	High		R/W	√	√	√
D8352	Y1 base speed when executing ZRN, PLSV, DRVI,		R/W	√	√	√

	DRVA, DSZR, DVIT instructions (less than 1/10 of the maximum speed)					
D8353	Low	Y1 maximum speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (10 to 100000)	R/W	√	√	√
D8354	High		R/W	√	√	√
D8355	Y1 creeping speed, suitable for DSZR		R/W	√		√
D8356	Low	Y1 origin return speed, suitable for DSZR	R/W	√	√	√
D8357	High		R/W	√	√	√
D8358	Y1 acceleration time (unit: ms)		R/W	√	√	√
D8359	Y1 deceleration time (unit: ms)		R/W	√	√	√
D8465	Y1 specifies the clear input signal		R/W	√	√	√
D8360	Low	Y2 outputs the current value data register of the positioning instruction	R/W	√	√	√
D8361	High		R/W	√	√	√
D8362	Y2 Base speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (less than 1/10 of the maximum speed)		R/W	√	√	√
D8363	Low	Y2 maximum speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (10 to 100000)	R/W	√	√	√
D8364	High		R/W	√	√	√
D8365	Y2 creeping speed, suitable for DSZR		R/W	√		√
D8366	Low	Y2 origin return speed, suitable for DSZR	R/W	√	√	√
D8367	High		R/W	√	√	√
D8368	Y2 acceleration time (unit: ms)		R/W	√	√	√
D8369	Y2 deceleration time (unit: ms)		R/W	√	√	√
D8466	Y2 specifies the clear input signal		R/W	√	√	√
D8370	Low	Y3 outputs the current value data register of the positioning instruction	R/W			√
D8371	High		R/W			√
D8372	Y3 Base speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions		R/W			√

	Speed (less than 1/10 of the maximum speed)					
D8373	Low	Y3 maximum speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (10 to 100000)	R/W			√
D8374	High		R/W			√
D8375	Y3 creeping speed, suitable for DSZR		R/W			√
D8376	Low	Y3 origin return speed, suitable for DSZR	R/W			√
D8377	High		R/W			√
D8378	Y3 acceleration time (unit: ms)		R/W			√
D8379	Y3 deceleration time (unit: ms)		R/W			√
D8467	Y3 specifies the clear input signal		R/W			√
D8380	Low	Y4 outputs the current value data register of the positioning instruction	R/W			√
D8381	High		R/W			√
D8382	Y4 base speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (less than 1/10 of the maximum speed)		R/W			√
D8383	Low	Y4 maximum speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (10 to 100000)	R/W			√
D8384	High		R/W			√
D8385	Y4 creeping speed, suitable for DSZR		R/W			√
D8386	Low	Y4 origin return speed, suitable for DSZR	R/W			√
D8387	High		R/W			√
D8388	Y4 acceleration time (unit: ms)		R/W			√
D8389	Y4 deceleration time (unit: ms)		R/W			√
D8468	Y4 specifies the clear input signal		R/W			√

D8390	Low	Y5 outputs the current value data register of the positioning instruction	R/W			√
D8391	High		R/W			√
D8392	Y5 Base speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (less than 1/10 of the maximum speed)		R/W			√
D8393	Low	Y5 Maximum speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (10 to 100000)	R/W			√
D8394	High		R/W			√
D8395	Y5 creeping speed, suitable for DSZR		R/W			√
D8396	Low	Y5 origin return speed, suitable for DSZR	R/W			√
D8397	High		R/W			√
D8398	Y5 acceleration time (unit: ms)		R/W			√
D8399	Y5 deceleration time (unit: ms)		R/W			√
D8469	Y5 specifies the clear input signal		R/W			√

Note: Configuration code (D8338/D8339) definition

Component	B15~B12-Y3	B11~B8-Y2	B7~B4-Y1	B3~B0-Y0
D8338	Bit0/4/8/12: 0: Absolute position, 1: Relative position Bit1/5/9/13: 0: Trapezoidal acceleration/deceleration, 1: S-shaped acceleration/deceleration Bit2/6/10/14: 0: Negative direction low level, 1: Negative direction high level			
Component	B15~B12-Y7	B11~B8-Y6	B7~B4-Y5	B3~B0-Y4
D8339	Bit0/4/8/12: 0: Absolute position, 1: Relative position Bit1/5/9/13: 0: Trapezoidal acceleration/deceleration, 1: S-shaped acceleration/deceleration Bit2/6/10/14: 0: Negative direction low level, 1: Negative direction high level			

10. Serial port 1-2 configuration

Address	Name	R/W	20	10	30
D8400	Serial port 1 communication format setting	R/W	√	√	√
D8401	Serial port 1 protocol setting H11: MODBUS slave H1: MODBUS master	R/W	√	√	√
D8403	Number of bytes received by serial port 1 command	R/W	√	√	√

D8409	Serial port 1 communication slave station response timeout	R/W	√	√	√
D8411	Serial port 1 communication interval	R/W	√	√	√
D8412	Serial port 1 communication MODBUS retry times	R/W	√	√	√
D8414	Serial port 1 MODBUS slave number	R/W	√	√	√
D8420	Serial port 2 communication format setting	R/W	√	√	√
D8421	Serial port 2 protocol setting H11: MODBUS slave H1: MODBUS master	R/W	√	√	√
D8423	Number of bytes received by serial port 2 command	R/W	√	√	√
D8429	Serial port 2 communication slave station response timeout	R/W	√	√	√
D8431	Serial port 2 communication interval	R/W	√	√	√
D8432	Serial port 2 communication MODBUS retry times	R/W	√	√	√
D8434	Serial port 2 MODBUS slave number	R/W	√	√	√

11. Enhanced positioning instruction 2

Address	Name		R/W	20	10	30
D8470	Low	Y6 outputs the current value data register of the positioning instruction	R/W			√
D8471	High		R/W			√
D8472	Y6 Base speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (less than 1/10 of the maximum speed)		R/W			√
D8473	Low	Y6 Maximum speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (10 to 100000)	R/W			√
D8474	High		R/W			√
D8475	Y6 creeping speed, suitable for DSZR		R/W			√
D8476	Low	Y6 origin return speed, suitable for DSZR	R/W			√
D8477	High		R/W			√
D8478	Y6 acceleration time (unit: ms)		R/W			√
D8479	Y6 deceleration time (unit: ms)		R/W			√
D8462	Y6 specifies the clear input signal		R/W			√
D8480	Low	Y7 outputs the current value data register of the positioning instruction	R/W			√
D8481	High		R/W			√
D8482	Y7 Base speed when executing ZRN, PLSV, DRVI, DRVA, DSZR, DVIT instructions (less than 1/10 of the maximum speed)		R/W			√
D8483	Low	Y7 Maximum speed when executing ZRN,	R/W			√

D8484	High	PLSV, DRVI, DRVA, DSZR, DVIT instructions (10 to 100000)	R/W			√
D8485	Y7 creeping speed, suitable for DSZR		R/W			√
D8486	Low	Y7 origin return speed, suitable for DSZR	R/W			√
D8487	High		R/W			√
D8488	Y7 acceleration time (unit: ms)		R/W			√
D8489	Y7 deceleration time (unit: ms)		R/W			√
D8463	Y7 specifies the clear input signal		R/W			√

12. System Parameters 2

Address	Name	R/W	10	20	30
D8499	Reserved, can be saved when power is off	R/W	√	√	√
D8500	Reserved, product version number	R	√	√	√
D8501	Y7 current pulse, locate the instruction position (step)	R	√	√	√
D8502	Y6 current pulse, locate the instruction position (step)	R	√	√	√
D8503	Y5 current pulse, locate the instruction position (step)	R	√	√	√
D8504	Y4 current pulse, locate the instruction position (step)	R	√	√	√
D8505	Y3 current pulse, locate the instruction position (step)	R	√	√	√
D8506	Y2 current pulse, locate the instruction position (step)	R	√	√	√
D8507	Y1 current pulse, locate the instruction position (step)	R	√	√	√
D8508	Y0 current pulse, locate the instruction position (step)	R	√	√	√
D8509	Non-standard code	R	√	√	√
D8510	PLC serial number (low order)	R	√	√	√
D8511	PLC serial number (high order)	R	√	√	√

13. Communication format setting

Bit0	Character length 1: 8 bits, 0: 7 bits		Bit8	Start character enable	
Bit1	Verification Enable	00: No parity, 01: Odd parity, 11: Even parity	Bit9	End character enable	
Bit2	Verification method		Bit10	RS instruction automatic CRC check enable	
Bit3	Stop bit length 1: 2 bits, 0: 1 bit		Bit11~13	Protocol	0: FX protocol, 1: Freeport protocol 2: MODBUS slave 3: MODBUS master 4: N2N slave 5: N2N master
Bit4~7	Baud rate	5: 1200 6: 2400 7: 4800 8: 9600	Bit14~15	COM port selection	0: Serial port 1 1: Serial port 2 2: Serial port 0

		9: 19200 A: 38400 B: 57600 C~F:115 200			3: Serial port 3

Note: Communication protocol and communication port selection are only valid for D8120, and use M8002 to change the drive format.

Data bit 8, stop bit 1, even parity: B0111 H7

Data bit 8, stop bit 2, no parity: B1001 H9

Data bit 8, stop bit 1, odd parity: B0011 H3

Data bit 8, stop bit 1, no parity: B0001 H1

Baud rate 19200, data bits 8, stop bits 1, even parity: H97

Baud rate 9600, data bit 8, stop bit 1, no parity: H81

Baud rate 9600, data bits 8, stop bits 2, no parity: H89

IX. Appendix III Application Instruction Set

Instruction		Instruction function description	Step length	Impact flag	10	20	30	Remark
Basic instructions	LD	Normally open contact instruction	1		√	√	√	
	LDI	Normal closed contact instruction	1		√	√	√	
	LDP	Get pulse rising edge	2		√	√	√	
	LDF	Get pulse rising edge	2		√	√	√	
	AND	Normal open contact and instruction	1		√	√	√	
	ANI	Normal closed contact and instruction	1		√	√	√	
	ANDP	And pulse rising edge	2		√	√	√	
	ANDF	And pulse rising edge	2		√	√	√	
	OR	Normal open contact or instruction	1		√	√	√	
	ORI	Normal closed contact or instruction	1		√	√	√	
	ORP	Or pulse rising edge	2		√	√	√	
	ORF	Or pulse rising edge	2		√	√	√	
	OUT	Coil output instruction	1		√	√	√	
	SET	Coil set instruction	1		√	√	√	
	RST	Coil clear instruction	1		√	√	√	
	ANB	Power flow block and instruction	1		√	√	√	
	ORB	Power flow block or instruction	1		√	√	√	
	INV	Power flow negation instruction	1		√	√	√	
	NOP	No operation instruction	1		√	√	√	
	MPS	Power flow into stack instruction	1		√	√	√	
	MRD	Power flow read stack instruction	1		√	√	√	
	MPP	Power flow out of stack instruction	1		√	√	√	
	MC	Master control instruction	3		√	√	√	
	MCR	Master control clear instruction	1		√	√	√	
	MEP/EU	Rising edge detection instruction	2		√	√	√	
	MEF/ED	Falling edge	2		√	√	√	

		detection instruction						
	PLS	Rising edge pulse output	2/3		√	√	√	
	PLF	Falling edge pulse output	2/3		√	√	√	
Program flow control instructions	CJ	Conditional jump instruction	3		√	√	√	
	CALL	User subroutine call	3		√	√	√	
	SRET	User subroutine return	1		√	√	√	
	CSRET	User subroutine conditional return	1		√	√	√	
	FEND	User main program end	1		√	√	√	
	CFEND	User main program conditional end	1		√	√	√	
	IRET	User interrupt subroutine return	1		√	√	√	
	CIRET	User interrupt subroutine conditional return	1		√	√	√	
	FOR	Loop instruction	3		√	√	√	
	NEXT	Loop return	1		√	√	√	
	WDT	User program watchdog clear	1		√	√	√	
	EI	Interrupt enable instruction	1		√	√	√	
	DI	Interrupt disable instruction	1		√	√	√	
SFC Instructions	STL	SFC status load instruction	3		√	√	√	
	SET Sxx	SFC state transfer	3		√	√	√	
	OUT Sxx	SFC state jump	3		√	√	√	
	RST Sxx	SFC status clear	3		√	√	√	
	RET	SFC program	1		√	√	√	
Data transfer instructions	MOV	Word data transfer instructions	5		√	√	√	
	DMOV	Double word data transfer instructions	7		√	√	√	
	EMOV	Floating point data transfer instructions	7		√	√	√	
	BMOV	Block data transfer instructions	7		√	√	√	
	SMOV	Bit Shift	11		√	√	√	Ver0.87.3
	SWAP	High and low byte swap instructions	3		√	√	√	
	XC	Word swap command	5		√	√	√	
	DXCH	Double word exchange instruction	7		√	√	√	
	FMOV	Data block fill instructions	7		√	√	√	

Data flow	DFMOV	Data block double word fill instruction	9		√	√	√	
	WSFR	String right shift instruction	9		√	√	√	
	WSFL	String left shift instruction	9		√	√	√	
	PUSH	Data push instruction	7	carry	√	√	√	
	SFWR/FIFO	First-in-first-out instruction	7	Zero	√	√	√	
	SFRD/LIFO	LIFO	7	Zero	√	√	√	
	ZPUSH	Index register batch save						
	ZPOP	Index register restore						
Integer/ long integer arithmetic instructions	ADD	Integer addition instructions	7	Zero, carry, borrow	√	√	√	
	DADD	Long integer addition instructions	10	Zero, carry, borrow	√	√	√	
	SUB	Integer subtraction instructions	7	Zero, carry, borrow	√	√	√	
	DSUB	Long Integer Subtraction Instructions	10	Zero, carry, borrow	√	√	√	
	INC	Integer increment instruction	3		√	√	√	
	DINC	Long integer increment instruction	4		√	√	√	
	DEC	Integer decrement instruction	3		√	√	√	
	DDEC	Long integer minus one instruction	4		√	√	√	
	MUL	Integer multiplication instructions	8		√	√	√	
	DMUL	Long integer multiplication instructions	10		√	√	√	
	DIV	Integer division instructions	7		√	√	√	
	DDIV	Long integer division instructions	10		√	√	√	
	VABS	Integer absolute value instructions	5		√	√	√	
	DVABS	Long integer absolute value instruction	7		√	√	√	
	NEG	Integer negation instruction	5		√	√	√	
	DNEG	Long integer negation instruction	7		√	√	√	
	SQT	Integer arithmetic square root instruction	5		√	√	√	
	DSQT	Long integer	7		√	√	√	

		arithmetic square root instruction						
	SUM	Integer accumulation instructions	8	Zero	√	√	√	
	DSUM	Long integer accumulation instructions	9	Zero	√	√	√	

Instruction		Instruction Function Description	Step length	Impact flag	10	20	30	Remark
Floating point arithmetic instructions	RADD	Floating point addition instructions	10	Zero, carry	√	√	√	
	RSUB	Floating point subtraction instructions	10	Zero, carry	√	√	√	
	RMUL	Floating point multiplication instructions	10	Zero, carry	√	√	√	
	RDIV	Floating point division instructions	10	Zero, carry	√	√	√	
	RBCD	Convert binary to decimal						
	RBIN	Convert decimal to binary						
	RVABS	Floating point absolute value instructions	7		√	√	√	
	RNEG	Floating point negation instruction	7		√	√	√	
	QT	Floating point arithmetic square root instruction	7	Zero	√	√	√	
	SIN	Floating point SIN instruction	7	Zero	√	√	√	
	COS	Floating point COS instruction	7	Zero	√	√	√	
	TAN	Floating point TAN instruction	7	Zero, carry	√	√	√	
	LN	Floating point natural logarithm instruction LN	7	Zero, carry	√	√	√	
	EXP	Floating point natural number power instruction EXP	7	Zero, carry	√	√	√	
	POWER	Floating point exponentiation instructions	10	Zero, carry	√	√	√	
	RSUM	Floating point accumulation instructions	9		√	√	√	
	ASIN	Floating point number SIN $^{-1}$ operation	7	Zero			√	
	ACOS	Floating point number COS $^{-1}$ Operation	7	Zero			√	
	ATAN	Floating point number TAN $^{-1}$ Operation	7	Zero			√	
	RAD	Floating point angle -> radians conversion	7	Zero			√	
	DEG	Floating point radians -> degrees conversion	7	Zero, carry			√	

	LOG	Common logarithmic operations for floating point numbers	7	Zero, carry			√	
Word/ Double-word logical operations	WAND	Words and instructions	7		√	√	√	
	DWAND	Double words and instructions	10		√	√	√	
	WOR	Word or command	7		√	√	√	
	DWOR	Double word or instruction	10		√	√	√	
	WXOR	Word XOR instruction	7		√	√	√	
	DWXOR	Double word XOR instruction	10		√	√	√	
	WINV	Word negation instruction	5		√	√	√	
	DWINV	Double word negation instruction	7		√	√	√	
Bit shift and rotate instructions	ROR	16 -bit Rotate Right Instruction	7	carry	√	√	√	
	DROR	32 -bit Rotate Right Instruction	9	carry	√	√	√	
	ROL	16 -bit Rotate Left Instruction	7	carry	√	√	√	
	DROL	32 -bit Rotate Left Instruction	9	carry	√	√	√	
	RCR	16 -bit carry-in right shift instruction	7	carry	√	√	√	
	DRCR	32 -bit carry right shift instruction	9	carry	√	√	√	
	RCL	16 -bit carry-rotate left instruction	7	carry	√	√	√	
	DRCL	32 -bit carry-rotate left instruction	9	carry	√	√	√	
	SHR	16 -bit right shift instruction	7		√	√	√	
	DSHR	32 -bit right shift instruction	9		√	√	√	
	SHL	16 -bit left shift instruction	7		√	√	√	
	DSHL	32 -bit left shift instruction	9		√	√	√	
	SFTL	Bit string left shift instruction	9		√	√	√	
	SFTR	Bit string right shift instruction	9		√	√	√	
	WSFL	Bit string left shift instruction	9		√	√	√	
	WSFR	Bit string right shift instruction	9		√	√	√	
Enhanced row processing instructions	DECO	Decoding instructions	5		√	√	√	
	ENCO	Encoding instructions	5		√	√	√	
	BITS	ON bit count instruction in word	5		√	√	√	
	DBITS	Double word ON bit counting instruction	6		√	√	√	
	ZRST	Bulk bit clear	5		√	√	√	

		instruction						
	BON	ON bit judgment instruction	7		√	√	√	

Instruction		Instruction function description	Step length	Impact flag	10	20	30	Remark
High-speed I/O instruction	HCNT	High-speed counter drive instruction	7		√	√	√	
	DHSCS	High-speed counting comparison setting instruction	10		√	√	√	
	DHSCR	High-speed counting comparison reset instruction	10		√	√	√	
	DHSCI	High-speed counting comparison interrupt trigger instruction	10		√	√	√	
	DZD	High-speed counting interval comparison instruction	13		√	√	√	
	DHST	High-speed counting table comparison instructions	10		√	√	√	
	DHSP	High-speed counting table comparison pulse output	10		√	√	√	
	SPD	SPD frequency measurement instruction	7		√	√	√	
	DHCMOV	High-speed counting transmission	13		√	√	√	Ver 0.87.7
	PLSY	Count pulse output instruction	9		√	√	√	
	PLSR	With acceleration and deceleration counting pulse output instructions	10		√	√	√	
	PWM	PWM pulse output instruction	7		√	√	√	
Control calculation instructions	PID	PID function instructions	9		√	√	√	
	RAMP	Ramp signal output instruction	12		√	√	√	
	TRIANGLE	Triangle wave signal output instruction	12		√	√	√	
	HACKLE	Sawtooth wave signal output instruction	12		√	√	√	
	IST	Initialization state						
	ABSD	Cam sequence absolute control instruction	9	Zero, carry, borrow	√	√	√	
	DABSD	Cam sequence absolute control instruction	11	Zero, carry, borrow	√	√	√	
	INCD	Cam sequence relative control instructions	11	Zero, carry, borrow	√	√	√	
	TTMR	Teaching timer	5		√	√	√	
	STMR	Special timer	5					

	ALT	Alternate output command	3		√	√	√	
	ROTC	Rotary table control						
	SORT	Data Sorting	11		√	√	√	
	SORT2	Data Sorting						
Peripheral instructions	FROM	Special module BFM read instruction	9		√	√	√	
	DFROM	Special module BFM double word read instruction	10		√	√	√	
	TO	Special module BF word write instruction	9		√	√	√	
	DTO	Special module BFM double word write instruction	10		√	√	√	
	VRRD	Read analog potentiometer value instruction	5		√	√	√	
	REFF	Set input filter constant command	3		√	√	√	
	REF	I/O immediate refresh command	5		√	√	√	
	PR	Printing instructions						
	TKY	Numeric key input						
	HKY	Hexadecimal number input						
	DSW	Digital Switches	9		√	√	√	
	SEGD	7- segment decoder	5		√	√	√	
	SEGL	7 SEG hour and minute display	7		√	√	√	
	PRUN	Octal bit transmission	5		√	√	√	
	VRSC	Potentiometer scale						
	ARWS	Arrow switch						
Positioning instructions	ABS	Current instruction fetch						
	ZRN	Origin return command	11		√	√	√	
	PLSV	Variable speed pulse output command	8		√	√	√	
	DRVI	Relative position control instructions	11		√	√	√	
	DRVA	Absolute position control command	11		√	√	√	
	DR	With DOG search origin return instruction	9	Zero, carry, borrow	√	√	√	
	DVIT	Interrupt positioning	11	Zero, carry, borrow	√	√	√	
	TBL	Table setting positioning instructions						

Instruction		Instruction function description	Step length	Impact flag	10	20	30	Remark
Real-time clock instructions	TRD	Real-time clock read instruction	3		√	√	√	
	TWR	Real-time clock write instruction	3		√	√	√	
	TADD	Clock plus instruction	7	Zero, carry	√	√	√	
	TSUB	Clock down instruction	7	Zero, Borrow	√	√	√	
	HOUR	Chronograph instructions	8		√	√	√	
	HTOS	[Hour, minute, second] data conversion to seconds	5		√	√	√	
	STOH	Seconds data [hour, minute, sec]	5		√	√	√	
Compare contact instructions	LD=	Integer comparison LD= instruction	5		√	√	√	
	LDD=	Long integer comparison LD= instruction	7		√	√	√	
	LD>	Integer comparison LD= instruction	5		√	√	√	
	LDD>	Long integer comparison LD> instruction	7		√	√	√	
	LD>=	Integer comparison LD>= instruction	5		√	√	√	
	LDD>=	Long integer comparison LD>= instruction	7		√	√	√	
	LD<	Integer comparison LD< instruction	5		√	√	√	
	LDD<	Long integer comparison LD< instruction	7		√	√	√	
	LD<=	Integer comparison LD<= instruction	5		√	√	√	
	LDD<=	Long integer comparison LD<= instruction	7		√	√	√	
	LD<>	Integer comparison LD<> instruction	5		√	√	√	
	LDD<>	Long integer comparison LD<> instruction	7		√	√	√	
	AND=	Integer comparison AND= instruction	5		√	√	√	
	ANDD=	Long integer comparison AND= instruction	7		√	√	√	
	AND>	Integer comparison AND> instruction	5		√	√	√	
	ANDD>	Long integer comparison AND> instruction	7		√	√	√	

	AND>=	Integer comparison AND>= instruction	5		√	√	√	
	ANDD>=	Long integer comparison AND>= instruction	7		√	√	√	
	AND<	Integer comparison AND< instruction	5		√	√	√	
	ANDD<	Long integer comparison AND< instruction	7		√	√	√	
	AND<=	Integer comparison AND<= instruction	5		√	√	√	
	ANDD<=	Long integer comparison AND<= instruction	7		√	√	√	
Compare contact instructions	AND<>	Integer comparison AND<> instruction	5		√	√	√	
	ANDD<>	Long integer comparison AND<> instruction	7		√	√	√	
	OR=	Integer comparison OR= instruction	5		√	√	√	
	ORD=	Long integer comparison OR= instruction	7		√	√	√	
	OR>	Integer comparison OR> instruction	5		√	√	√	
	ORD>	Long integer comparison OR> instruction	7		√	√	√	
	OR>=	Integer comparison OR>= instruction	5		√	√	√	
	ORD>=	Long integer comparison OR>= instruction	7		√	√	√	
	OR<	Integer comparison OR< instruction	5		√	√	√	
	ORD<	Long integer comparison OR< instruction	7		√	√	√	
	OR<=	Integer comparison OR<= instruction	5		√	√	√	
	ORD<=	Long integer comparison OR<= instruction	7		√	√	√	
	OR<>	Integer comparison OR<> instruction	5		√	√	√	
	ORD<>	Long integer comparison OR<> instruction	7		√	√	√	
	CMP	Integer compare set instructions	7		√ *	√ *	√	
	DCMP	Long integer comparison set instruction	9		√ *	√ *	√	
	ECMP	Floating point comparison set instruction	9		√ *	√ *	√	
	CML	Reverse transfer command	5		√	√	√	

	ZCP	Interval comparison	9		√	√	√	
Numeric conversion	ITD	Integer to Double Integer Instructions	6		√	√	√	

Instruction		Instruction function description	Step length	Impact flag	10	20	30	Remark
Instruction	DTI	Double Integer to Integer Instructions	6		√	√	√	
	FLT	Integer to floating point instructions	6		√	√	√	
	DFLT	Long integer to floating point conversion instructions	7		√	√	√	
	INT	Floating point to integer conversion instructions	6	Zero, carry, borrow	√	√	√	
	DINT	Floating point conversion long integer instruction	7	Zero, carry, borrow	√	√	√	
	BCD	Word conversion 16 -bit BCD code instruction	5		√	√	√	
	DBCD	Double word conversion 32 -bit BCD code instruction	7		√	√	√	
	BIN	16 - bit BCD code conversion word instruction	5		√	√	√	
	DBIN	32 -bit BCD code conversion double word instruction	7		√	√	√	
	GRY	Word conversion to 16 -bit Gray code instruction	5		√	√	√	
	DGRY	Double word conversion 32 -bit Gray code instruction	7		√	√	√	
	GBIN	16 -bit Gray code conversion word instruction	5		√	√	√	
	DGBIN	32 -bit Gray code conversion double word instruction	7		√	√	√	
	SEG	Word conversion 7 segment code	5		√	√	√	
	ASC	ASCII code conversion instructions	19		√	√	√	
	ITA	16 - bit hexadecimal number conversion to ASCII	7		√	√	√	
	ATI	ASCII code number conversion 16 - bit hexadecimal	7		√	√	√	
	LCNV	Engineering Conversion Instructions	9		√	√	√	
	RLCNV	Floating-point engineering	12		√	√	√	

		conversion instructions						
Word contact instruction	BLD	Word contact LD instruction	5		√	√	√	
	BLDI	Word bit contact LDI instruction	5		√	√	√	
	BAND	Word contact AND instruction	5		√	√	√	
	BANI	Word contact ANI instruction	5		√	√	√	
	BOR	Word contact OR instruction	5		√	√	√	
	BORI	Word contact ORI instruction	5		√	√	√	
	BSET	Word bit coil setting instruction	5		√	√	√	
	BRST	Word bit coil clear instruction	5		√	√	√	
	BOUT	Word coil output instruction	5		√	√	√	
Communication instructions	RS	Serial data transmission	13		√	√	√	
	RS2	Serial data transmission 2	13		√	√	√	
	ADPRW	Modbus master communication instructions	13		√	√	√	
Verify instruction	CCITT	CCITT verification instruction	7		√	√	√	
	CCD	CCD calibration instructions	7		√	√	√	
	CRC16	CRC16 check instruction	7		√	√	√	
	LRC	LRC check instruction	7		√	√	√	
Time Instructions	TCMP	Time comparison instructions	7		√	√	√	
	TZP	Time interval comparison instructions	7		√	√	√	
	TADD	Time addition instruction	7		√	√	√	
	TSUB	Time subtraction instruction	7		√	√	√	
Data processing instructions	MEAN	average value	7		√	√	√	
	WSUM	Calculate data and instructions	7		√	√	√	
	WTOB	Byte-based data separation	7		√	√	√	
	BTOW	Byte-based data combination	7		√	√	√	
	UNI	4-bit combination of 16-bit data	7		√	√	√	
	DIS	4-bit separation of 16-bit data	7		√	√	√	
	ANS	Signal alarm set	7		√	√	√	
	ANR	Signal alarm set	1		√	√	√	
	BKAD	Addition of data blocks	9		√	√	√	

Data block processing instructions	BKSUB	Subtraction of data blocks	9		√	√	√	
	BKCMP=,>,<,<>,<=,>=	Comparison of data blocks	9		√	√	√	
Data table processing instructions	LIMIT	Upper and lower limit control	9		√	√	√	
	BAND	Dead zone control	9		√	√	√	
	ZONE	Zone Control	9		√	√	√	
	SCL	Set coordinates	7		√	√	√	
	SCL2	Set coordinates	7		√	√	√	Ver 0.87.5
	IST	Initialization state	7					
	SER	Data Retrieval	9		√	√	√	
String processing instructions	STR	BIN to string	7		√	√	√	
	VAL	Convert string to BIN	7		√	√	√	
	STRADD	String concatenation	7		√	√	√	
	STRLEN	Check string length	5		√	√	√	
	STRRIGHT	Start reading from the right side of the string	7		√	√	√	
	STRLEFT	Start reading from the left side of the string	7		√	√	√	
	STRMIDR	Read any string	7		√	√	√	
	STRMIDW	Replace anything in a string	7		√	√	√	
	STRINSTR	String search	9		√	√	√	
	STRMOV	String transfer	5		√	√	√	
Extended file register instructions	LOADR	Read extended file register	5					
	SAVER	Batch write extended file registers	7					
	INITR	Extension register initialization	5					
	LOGR	Login to the extension register	11					
	INITER	Extension file register initialization	5					
Other instructions	RND	Generate random numbers	3		√	√	√	
	DUTY	Generate timing pulse	7		√	√	√	
	COMRD							
	HCMOV							
	RD3A		7		√	√	√	MODBUS Read
	WR3A		7		√	√	√	MODBUS WRITE

X. Appendix 4 Troubleshooting

1. The fault light flashes 4 times after being on, indicating that the power supply voltage is too low.

2. The fault light flashes periodically. Please check the fault table as below.

D8004	Description 1	Register	Numeric	Description 2
8065	System error	D8065	40	User program error
			41	Parameter block error
			42	Data block error
			43	Keep data from being lost
			45	POU file error
			65	Register out of range
8064	Runtime Error	D8064	64	Wrong parameter value
			69	Division by zero error
8067	Runtime Error	D8067	60	User program compilation error
			61	Watchdog timeout
			62	Wrong instruction
			63	Wrong component type
			68	Label Error