COOLMAY

CX3G/FX3GC PLC

Programming manual

(Difference comparing with Mitsubishi FX3G)

V22.21

Content

1. Overview

1.1 COOLMAY CX3G PLC has the following advantages:

◆Powerful, compatible with FX3G/FX3U/FX3S PLC, high processing speed.(supports Ladder diagram and SFC language, does not support structured programming/labels).

◆Upper computer programming software compatible with Works 2/GX Developer8.86

◆Military level 32 bit CPU adopted, which is faster and more adapted to industrial environment of high electromagnetic interference.

◆Special encryption, prevent illegal reading thoroughly. 8-bit encryption, 12345678 as password can thoroughly prevent reading of ladder logic program.

◆Clock supported, rechargeable battery adopted.

◆With two PLC programming ports. CX3G PLC has one MiniB USB port with faster downloading speed; one Rs232 programming port with 8 mouse hole sockets.FX3GC PLC has one MiniB USB port with faster downloading speed; one Rs422 programming port with 8 mouse hole sockets.

◆Support Mitsubishi programming port protocol/Modbus protocol/Rs protocol/BD board protocol,easily achieve PLC communication with plc and other devices.

CX3G-16M/24M/32M/48M PLC is with 2 com ports. Default is with 2 RS485, or customized as 1 RS485+1 RS232, or 1RS485+ 1 CAN port, or 1RS232 + 1 CAN port.

CX3G-34M/64M/80M PLC is with 3 com ports. Default is with 2 RS485,or customized as 1 RS485+1 RS232,CAN port is optional for connecting HMI,VFD and other equipment.

For FX3GC-30M, 1 Rs485 can be added;

For FX3GC-16M, com ports/ analog can be added, at most 2 Rs485+1 CAN port+6AD4DA can be added; or 1 Rs485+1 CAN port+8AD4DA can be added; or 1 RS485 +8AD6DA can be added, or 2 RS485 +1 CAN port can be added.

◆High speed counter, regular as single phase 6 channels 60KHz or AB(Z) phase 2 channels 30KHz+ AB phase 1 channel 5KHz.

◆High speed pulse, regular as 8 channels Y0-Y3 in 100KHz,Y4-Y7 in 10KHz.(Among them CX3G-16M high-speed pulse gauge 8 way 10KHz);

Note: High speed counter+High speed pulse should be less 480KHz.

◆Support multiple types analog individually or mixed ones for analog output and input. Precision of AD/DA is 12bit.Temperature/current/voltage for input. current/voltage for output.

For CX3G PLC, at most 16DI/8DO. For FX3GC-16M, com ports/ analog can be added, at most 2 Rs485+1 CAN port+6AD/4DA can be added; or 1 Rs485+1 CAN port+8AD/4DA can be added; or 1 RS485+8AD/6DA can be added or 2 RS485+ 1 CAN port can be added.

◆Up to 40DI/40DO for CX3G PLC, up to 16DI/16DO for FX3GC PLC. Relay/transistor or mixed relay and transistor for output.

◆Convenient for wiring. CX3G adopts 5.00mm pluggable terminals. FX3GC adopts 3.5mm pluggable terminals.

◆Easy installation. DIN-Rail (35mm width) installation and fixed hole installation.

◆Flexible, can be customized accordingly.

1.2 Models of CX3G PLC

Models	CX3G-16M	CX3G-24M	CX3G-32M	CX3G-48M	CX3G-34M	CX3G-64M	CX3G-80M
Image							
Dimension	65*90*36mm	130*90*36mm		200*90*36mm		290*90*36mm	
Cutout size	57*99mm	122*99mm		192*99mm		282*99mm	
Installation	Fixed hole installation and DIN-Rail (35mm)						
Digital I/O	8DI/8DO	12DI/12DO	16DI/16DO	24DI/24DO	18DI/16DO	32DI/32DO	40DI/40DO
I/O level	MT Output: NPN MR output: NO contact Input: Passive NPN, public terminal isolated						
Output type and load	Relay MR/transistor MT/mixed output MRT Transistor MT output load 0.5A/point, 0.8A/4 points COM, 1.6A/8 points COM; MOS tube output load 2A/point, 4A/4 points COM; Relay output load is 2A/point, 4A/4 points COM, 5A/8 points COM, 5A/12 points COM.						
High speed counting	Normally 6 single-phase 60KHz or 2 AB(Z) phases 30KHz + AB phase 1 5KHz;						
High speed pulse	Up to 8 channels. Y0-Y3 is 100KHz, Y4-Y7is 10KHz. (CX3G-16M, can make 8channels 10KHz) High-speed counting + high-speed pulse total output can not exceed 480KHz						
Analog I/O	AI：0-10V/4-20mA/0-20mA/PT100/PT1000 /NTC10K/NTC50K/NTC100K /EKJST thermcouple (support negative temperature).						
	AO：0-10V/0-5V/0-20mA/4-20mA or mixed ones						
	Null	8AD/4DA 6AD/4DA	2AD/2DA 2DA	8AD/4DA	12AD/8DA	16AD/8DA	4AD/4DA
COM port	Two programming port(1 Mini B type USB port，faster downloading speed；1 Rs232，Interface terminal is mouse female port with 8 holes)						
	The total number of COM ports is 2. The default is 2 RS485; Or customized as 1 RS485, 1 RS232; Or customized as 1 RS485, 1 CAN (2.0A/B); Or customized as 1 RS232, 1 CAN (2.0A/B). **CX3G-48M can add ethernet port.**				The total number of COM ports is 3. The default 2 RS485; Or customized as 1 RS485, 1 RS232; Optional CAN (2.0A/B). **CX3G-34M can add ethernet port.**		
Programming software	Compatible with WORKS 2 / GX Developer8.86						

Regular models：CX3G-16MT/MR/MRT(-485/232) CX3G-24MT/MR/MRT(-6AD4DA -485/232)
CX3G-32MT/MR/MRT(-2AD -485/232) CX3G-34MT/MR/MRT(-12AD8DA -485/232)
CX3G-48MT/MR/MRT(-8AD4DA -485/232) CX3G-64MT/MR/MRT(-16AD8DA -485/232)
CX3G-80MT/MR/MRT(-4AD4DA -485/232)
*If the analog input of CX3G-24M is 8AD, the maximum digital input is 10DI
*If the analog quantity of CX3G-32M is 2AD 2DA, the maximum digital quantity is 16DI 14DO
Detailed info. refer to： COOLMAY CX3G PLC Programming Manual CX3G PLC user manual
Support interruption,linear and arc interpolated,PID and modify parameters automatically; with capacity of 32K step program, 32K holding register while power off.

1.3 Models of FX3GC PLC

Artical	FX3GC-16M Communication/analog extension module can be added	FX3GC-30M(-485)	FX3GC-32M
Image			
Dimension	90*60*32mm		
Installation	Fixed hole installation and DIN-Rail (35mm）		
Digital I/O	Up to 8DI/8DO	Up to 16DI/14DO	Up to 16DI/16DO
I/0 level	MT Output: NPN MR output: NO contact Input: Passive NPN, public terminal isolated		
Output type and load	Relay MR/transistor MT/mixed output MRT Transistor MT output load 0.5A/point, 0.8A/4 points COM, 1.6A/8 points COM; MOS tube output load 2A/point, 4A/4 points COM; Relay output load is 2A/point, 4A/4 points COM, 5A/8 points COM, 5A/12 points COM.		
High-speed counting	Conventional 6 single-phase 60 KHz or 2 B(Z) phase 30KHz+1 AB phase 5KHz		
High-speed pulse output	Up to 8 channels. Y0-Y3 is 100KHz, Y4-Y7is 10KHz. Customized 8 channels 10-100KHz; High-speed counting + high-speed pulse total output can not exceed 480KHz		
Analog I/O	AI：0-10V/4-20mA/0-20mA/PT100/PT1000/K type thermocouple /NTC10K/NTC50K/NTC100K etc.		
	AO：0-10V/0-5V/0-20mA/4-20mA or mixed ones		
	Analog extension module can be added	NULL	
COM port	2 programming port(1 Mini-B type USB port，faster downloading speed；1 Rs422 (MR) or 1RS232 (MT),Interface terminal is 8 holes mouse female port)		
	Rs485/CAN extension module can be added	Optional 1 RS485	NULL
Software	Compatible with WORKS 2 / GX Developer8.86		

Regular models: FX3GC-16/32MT/MR/MRT
FX3GC-30MT/MR/MRT(-485)

Detailed info. refer to：CX3G FX3GC PLC Programming Manual FX3GC User Manual

Support interruption、linear and arc interpolated、PID and modify parameters automatically; with capacity of 32K step program, 32K holding register while power off.

Extension module can add at most 2 RS485,1 CAN port,6AD4DA,
Or 1 RS485,1 CAN port,8AD4DA,
Or 1RS485,8AD8DA,
Or 2 RS485,1 CAN port.

2. Soft element

2.1 Soft element table

Name	Contents		
I/O relay			
Input relay	X000~X047	40points	Soft element number is octal
Output relay	Y000~Y047	40points	Total 80points for I/O
Auxiliary relay			
General	M0~M383	384 points	
EEPROM hold	M384~M1535	1152 points	
General*1	M1536~M7679*2	6144 points	
Special*3	M8000~M8511	512 points	
Status			
Initial state (EEPROM hold)	S0～S9	10 points	
EEPROM hold	S10～S899	890 points	
General*1	S1000～S4095	3096 points	
Timer (ON delay timer)			
100ms	T0～T191	200 points	0.1～3,276.7s
10ms	T200～T245	46 points	0.01～327.67s
1ms accumulative (EEPROM hold)	T246～T249	4 points	0.001～32.767s
100ms accumulative (EEPROM hold)	T250～T255	6 points	0.1～3,276.7s
1ms	T256～T319	64 points	0.001~32.767s
Counter			
General up counter (16bit)	C0～C15	16 points	0～32,767 counter
EEPROM hold up counter (16 bit)	C16～C199	184 points	0～32,767counter
General bi-direction (32 bit)	C200～C219	20 points	-2,147,483,648～+2,147,483,647 counter
EEPROM hold bi-direction (32 bit)	C220～C234	15 points	-2,147,483,648～+2,147,483,647 counter
High-speed counter			
Single-phase single counter input Bi-direction (32 bit) (EEPROM hold)	C235～C245	-2,147,483,648～+2,147,483,647 Counter Software counter Single phase：at most 6 channel, 60kHz Double phase：1 times frequency:at most 2-3 channels 30KHz; M8198 is 4 times frequency sign of C251. 4 times frequency:at most 2-3 channels，24KHz,M8199 is 4 times frequency sign of C253.	
Single-phase double counter input Bi-direction (32 bit) (EEPROM hold)	C246～C250		
Double –phase double counter input Bi-direction (32 bit)(EEPROM hold)	C251～C255		
Data register(32 bit when using in pair)			

General(16bit)	D0～D127	128 points	
EEPROM hold (16 bit)	D128～D7999	7872 points	
Special (16 bit)	D8000～D8511	512 points	
Index (16 bit)	V0～V7,Z0～Z7	16 points	
Extended register·extended file register			
Extended register(16 bit)	R0～R22999	23000points Maintain when power off not supported	
	R23000～R23999	1000points for system internal	
Pointer			
JUMP、CALL branch	P0～P255 P0～P1280	256 points 1281 points(26232 and above)	CJ instruct、CALL instruct
Input interrupt	I0□□～I5□□	6points	
Timer interrupt	I6□□～I8□□	3points	
Counter interrupt	I010～I060	6points	
Nest			
Master control	N0～N7	8points	MC instruct
Constant			
Decimal (K)	16 bit	-32,768～+32,767	
	32 bit	-2,147,483,648～+2,147,483,647	
Hexadecimal (H)	16 bit	0000～FFFF	
	32 bit	00000000～FFFFFFFF	
Real number(E)*3	32 bit	-1.0×2128～-1.0×2-126,0,1.0×2-126～1.0×2128 Can be in the form of a decimal point and index	

*1: The 10ms timer will be affected by the scan cycle. If the scan period is 12ms, the timer becomes 12ms and is executed once.

3. Special relay and register

3.1 Special relay number and content

Num	Content	Remarks	Num	Content	Remarks
M8000	In RUN,Normally closed		M8224	C224 Increase/decrease counting action	
M8001	In RUN,Normally open		M8225	C225 Increase/decrease counting action	
M8002	After RUN, Output a scan cycle ON		M8226	C226 Increase/decrease counting action	
M8003	After RUN, Output a scan cycle OFF		M8227	C227 Increase/decrease counting action	
M8011	Oscillating in 10ms cycle		M8228	Handwheel function enablement	
M8012	Oscillating in 100ms cycle		M8229	C229 Increase/decrease counting action	ON:decrease action OFF:increase action
M8013	Oscillating in 1s cycle		M8230	C230 Increase/decrease counting action	
M8014	Oscillating in 1min cycle		M8231	C231 Increase/decrease counting action	
M8020	Zero flag		M8232	C232 Increase/decrease counting action	
M8021	Borrowing flag		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	
M8028	During instruction execution,allow interrupt		M8236	C236 Increase/decrease counting action	
M8029	Instruction execution end flag		M8237	C237 Increase/decrease counting action	
M8031	Non-retentive memory is cleared		M8238	C238 Increase/decrease counting action	ON:decrease action OFF:increase action
M8032	Retentive memory is cleared		M8239	C239 Increase/decrease counting action	
M8033	Memory retention stop		M8240	C240 Increase/decrease counting action	
M8034	Prohibit all output		M8241	C241 Increase/decrease counting action	
M8035	Forced RUN mode		M8242	C242 Increase/decrease counting action	
M8036	Force RUN command		M8243	C243 Increase/decrease counting	

Num	Content	Remarks	Num	Content	Remarks
				action	
M8037	Force STOP command		M8244	C244 Increase/decrease counting action	
M8045	Prohibit reset of all outputs		M8245	C245 Increase/decrease counting action	
M8046	STL state action		M8246	C246 Increase/decrease counting action	
M8047	STL temporary 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 is prohibited)		M8250	C250 Increase/decrease counting action	ON:decrease action
M8051	Input interrupt (I10 is prohibited)		M8251	C251 Increase/decrease counting action	OFF:increase action
M8052	Input interrupt (I20 is prohibited)		M8252	C252 Increase/decrease counting action	
M8053	Input interrupt (I30 is prohibited)		M8253	C253 Increase/decrease counting action	
M8054	Input interrupt (I40 is prohibited)		M8254	C254 Increase/decrease counting action	
M8055	Input interrupt (I50 is prohibited)		M8255	C255 Increase/decrease counting action	
M8056	Timer interrupt (I6 is prohibited)		M8340	1st pulse operation temporary control	
M8057	Timer interrupt (I7 is prohibited)		M8342	Interpolation mode	26233 and lower version
M8058	Timer interrupt (I8 is prohibited)		M8343	Interpolation mode	
M8059	Counter interrupt is prohibited		M8344	Interpolation relative/absolute coordinate	
M8060	I/O Constitute error		M8348	Interpolation counterclockwise	
M8061	PLC hardware error		M8341	Y000 clear signal output function is valid	26234 and higher version
M8062	Serial communication error 0		M8342	Y000 specify the origin return direction	
M8063	Serial communication error 1		M8343	Y000 forward limit	
M8064	Parameter error		M8344	Y000 reverse limit	
M8065	Grammatical 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	

Num	Content	Remarks	Num	Content	Remarks
M8068	Operation error latch		M8348	Y000 positioning command driver	
M8069	I/O bus detection		M8349	1st pulse stop	
M8075	Sample tracking preparation start command		M8350	2nd pulse operation temporary control	
M8076	Sample tracking execution start command		M8351	Y001 clear signal output function is valid	
M8077	Sampling and tracking execution temporary control		M8352	Y001 specify the origin return direction	
M8078	Sample tracking execution end temporary control		M8353	Y001 forward limit	
M8079	Sampling tracking system area		M8354	Y001 reverse limit	
M8120	Can't use		M8355	Y001 near-point DOG signal logic inversion	
M8121	RS/RS2 command sends standby	Serial Port 2 refer to chapter 8.2	M8356	Y001 zero signal logic inversion	
M8122	RS/RS2 command to send request		M8357	Y001 interrupt signal logic inversion	
M8123	RS/RS2 command reception end		M8358	Y001 positioning command driver	
M8124	RS/RS2 command data in reception		M8359	2nd pulse stop	
M8125	MODBUS and Mitsubishi function enablement		M8360	3rd pulse operation temporary control	
M8128	RD3A/WR3A Receive correct		M8361	Y002 clear signal output function is valid	
M8129	RD3A/WR3A communication timeout		M8362	Y002 specify the origin return direction	
M8151	5th pulse operation temporary control		M8363	Y002 forward limit	
M8152	6th pulse operation temporary control		M8364	Y002 reverse limit	
M8153	7th pulse operation temporary control		M8365	Y002 near-point DOG signal logic inversion	
M8154	8th 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	26234 and higher version	M8368	Y002 positioning command driver	
M8170	Input X000 pulse capture		M8369	3rd pulse stop	
M8171	Input X001 pulse capture		M8370	4th pulse operation temporary control	
M8172	Input X002 pulse capture		M8371	Y003 clear signal output function is valid	

Num	Content	Remarks	Num	Content	Remarks
M8173	Input X003 pulse capture		M8372	Y003 specify the origin return direction	
M8174	Input X004 pulse capture		M8373	Y003 forward limit	
M8175	Input X005 pulse capture		M8374	Y003 forward 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 protocol enablement	Serial port3	M8377	Y003 interrupt signal logic inversion	
M8196	Programming port protocol and other protocol enablement	Serial port2	M8378	Y003 positioning command driver	
M8198	4 times frequency of C251/C252		M8379	4th pulse stop	
M8199	4 times frequency of C253/C255		M8396	C254 function corresponds to input phase	Refer to chapter 6.1
M8200	C200 Increase/decrease counting action	ON:decrease action OFF:increase action	M8401	RS2 command sends standby	Serial port 3 Refer to chapter 8.3
M8201	C201 Increase/decrease counting action		M8402	RS2 command to send request	
M8202	C202 Increase/decrease counting action		M8403	RS2 command reception end	
M8203	C203 Increase/decrease counting action		M8404	RS2 command data in reception	
M8204	C204 Increase/decrease counting action		M8405	RS2 command data setting ready	
M8205	C205 Increase/decrease counting action		M8408	RD3A/WR3A Receive Completed	
M8206	C206 Increase/decrease counting action		M8409	RD3A/WR3A communication timeout	
M8207	C207 Increase/decrease counting action		M8421	RS2 command sends standby	CAN communication Refer to chapter 8.5
M8208	C208 Increase/decrease counting action		M8422	RS2 command to send request	
M8209	C209 Increase/decrease counting action		M8423	RS2 command reception end	
M8210	C210 Increase/decrease counting action		M8424	RS2 command data in reception	
M8211	C211 Increase/decrease counting action		M8425	RS2 command data send completed	
M8212	C212 Increase/decrease counting action		M8426	RS command master-slave and multi-machine mode	
M8213	C213 Increase/decrease counting action		M8427	CAN data standard frame and extended frame	

Num	Content	Remarks	Num	Content	Remarks
M8214	C214 Increase/decrease counting action		M8428	CAN communication MODBUS response correct	
M8215	C215 Increase/decrease counting action		M8429	Communication timeout	
M8216	C216 Increase/decrease counting action		M8432	Interpolation mode	26235 and higher version
M8217	C217 Increase/decrease counting action		M8433	Interpolation mode	
M8218	C218 Increase/decrease counting action		M8434	Interpolation relative/absolute coordinate	
M8219	C219 Increase/decrease counting action		M8435	Interpolation counterclockwise	
M8220	C220 Increase/decrease counting action		M8450	5th pulse stop	
M8221	C221 Increase/decrease counting action		M8451	6th pulse stop	
M8222	C222 Increase/decrease counting action		M8452	7th pulse stop	
M8223	C223 Increase/decrease counting action		M8453	8th pulse stop	

3.2 Special register number and content

Num	Content	Remarks	Num	Content	Remarks
D8000	Watchdog timer		D8148	5th- 8th pulse acceleration and deceleration time	
D8001	PLC type and system version	Main version number	D8160		Low
D8002	PLC memory capacity	2...2K steps； 4...4K steps； 8...8K steps； When 16K steps and above, D8002=8,D8102 is corresponded to 16,32,64	D8161	8th position pulse amount	High
D8003	Memory type	10H:Programmable controller built-in memory	D8169	Restrict access status	
D8010	Scan current value		D8182	Z1 Register contents	
D8011	Scan time minimum		D8183	V1 Register contents	
D8012	Scan time maximum		D8184	Z2 Register contents	

Num	Content	Remarks	Num	Content	Remarks
D8013	Second		D8185	V2 Register contents	
D8014	Minute		D8186	Z3 Register contents	
D8015	Hour		D8187	V3 Register contents	
D8016	Date		D8188	Z4 Register contents	
D8017	Month		D8189	V4 Register contents	
D8018	Year		D8190	Z5 Register contents	
D8019	Week		D8191	V5 Register contents	
D8020	Input filter adjustment (0-60ms) initial 10		D8192	Z6 Register contents	
D8030	AD0 analog input value		D8193	V6 Register contents	
D8031	AD1 analog input value		D8194	Z7 Register contents	
D8032	AD2 analog input value		D8195	V7 Register contents	
D8033	AD3 analog input value		D8268	Customize PWM 0~3 division factor	Value range:840~16800000
D8034	AD4 analog input value		D8269		
D8035	AD5 analog input value		D8278	Customize PWM 4~7 division factor	
D8036	AD6 analog input value		D8279		
D8037	AD7 analog input value		D8340	1st position pulse amount	Low
D8038	AD8 analog input value		D8341		High
D8039	AD9 analog input value		D8342	Y0 deviation speed Initial value:0	
D8040	AD10 analog input value		D8343	1st pulse maximum speed	Low
D8041	AD11 analog input value		D8344		High
D8042	AD12 analog input value		D8345	Y0 crawling 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	1st pulse acceleration time	
D8050	DA0 analog output value		D8349	1st pulse deceleration time	
D8051	DA1 analog output value		D8350	2nd position pulse amount	Low
D8052	DA2 analog output value		D8351		High
D8053	DA3 analog output value		D8352	Y1 deviation speed Initial value:0	
D8054	DA4 analog output value		D8353	2nd pulse maximum speed	Low
D8055	DA5 analog output value		D8354		High
D8056	DA6 analog output value		D8355	Y1 crawling speed Initial value: 1000	
D8057	DA7 analog output value		D8356	Y1 Origin return speed Initial value:50000	Low
D8058	When DA is current,Bit setting	Refer to 5.2	D8357		High
D8059	Constant scan time		D8358	2nd pulse acceleration time	
D8074	X0 Rising edge ring counter value	Low	D8359	2nd pulse deceleration time	
D8075	[1/6μs unit]	High	D8360	3rd position pulse amount	Low

Num	Content	Remarks	Num	Content	Remarks
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	3rd 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	3rd pulse acceleration time	
D8084	X1 pulse width / pulse period [10μs unit]	Low	D8369	3rd pulse deceleration time	
D8085		High	D8370	4th position pulse amount	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	4th pulse maximum speed	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	4th pulse acceleration time	
D8094	X4 falling edge ring counter value [1/6μs unit]	Low	D8379	4th pulse deceleration time	
D8095		High	D8395	Network setting function	Refer to chapter 8.6
D8096	X4 pulse width / pulse period [10μs unit]	Low	D8397	ADPRW command serial port position	Refer to chapter 8.2
D8097		High	D8398	0~2147483647(1ms) Ring count for incremental actions	
D8101	PLC type and system version	Secondary version number	D8399		
D8102	PLC memory capacity	16...16K steps	D8400	Modbus RTU protocol Communication parameters	Serial port3 Refer to chapter 8.3
D8108	Number of special modules connected		D8401	Communication mode	
D8109	Y number of output refresh error		D8406	Number of intervals	
D8120	Modbus RTU protocol Communication parameters	Serial port2 Refer to chapter 2.11	D8409	overtime time	
D8121	Master and slave station number		D8410	RS2 header 1, 2 <initial value: STX>	
D8122	RS command to send data remaining points		D8411	RS2 header 3, 4	

Num	Content	Remarks	Num	Content	Remarks
D8123	RS command to receive points monitoring		D8412	RS2 trailer 1, 2 <initial value: ETX>	
D8124	RS header <initial value: STX>		D8413	RS2 trailer 3, 4	
D8125	RS trailer <initial value: ETX>		D8414	Master and slave station number	
D8126	When the serial port 2 uses the ADPRW command, the value is 0.	26232 and lower	D8415	RS2 receives the summation calculation result	
D8126	Serial port 2 interval period number	26232 and higher	D8416	RS2 sends summation	
D8127	Specify the starting number of the communication request of the lower computer	Serial port2 Refer to chapter 2.11	D8420	Communication parameters	CAN communication Refer to chapter 8.6
D8128	Specify the number of data requested by the lower computer communication		D8421	Communication mode	
D8129	Set timeout		D8426	Number of intervals	
D8140	5th position pulse amount	Low	D8429	overtime time	
D8141		High	D8430	RS2 header 1, 2 <initial value: STX>	
D8142	6th position pulse amount	Low	D8431	RS2 header 3, 4	
D8143		High	D8432	RS2 trailer 1, 2 <initial value: ETX>	
D8144	7th position pulse amount	Low	D8433	RS2 trailer 3, 4	
D8145		High	D8434	RS2 receives the summation receive data	
D8146	5th -8th pulse max speed	Low	D8435	RS2 receives the summation calculation result	
D8147		High	D8436	RS2 sends summation	

Specific functions please refer to "Coolmay PLC Instruction Programming Manual V21.31"

4. Function Instructions

4.1 List of basic logic instructions

Mnemonic	Name	Features	Available devices
LD	take	Normally open contact logic operation starts	X,Y,M,S,D□.b,T,C
LDI	Negate	Normally closed contact logic operation starts	X,Y,M,S,D□.b,T,C
LDP	Take the rising edge of the pulse	Start of operation to detect rising edge	X,Y,M,S,D□.b,T,C
LDF	Take the falling edge of the pulse	Start of operation to detect falling edge	X,Y,M,S,D□.b,T,C
AND	versus	Series of normally open contacts	X,Y,M,S,D□.b,T,C
ANI	With reverse	Series of normally closed contacts	X,Y,M,S,D□.b,T,C
ANDP	With pulse rising edge	Detect rising edge series connection	X,Y,M,S,D□.b,T,C
ANDF	With the falling edge of the pulse	Series connection detection of falling edges	X,Y,M,S,D□.b,T,C
OR	Or pulse rising edge	Normally open contacts in parallel	X,Y,M,S,D□.b,T,C
ORI	Or reverse	Normally closed contacts in parallel	X,Y,M,S,D□.b,T,C
ORP	Or pulse rising edge	Parallel connection detecting rising edge	X,Y,M,S,D□.b,T,C
ORF	Or pulse falling edge	Parallel connection to detect falling edge	X,Y,M,S,D□.b,T,C
ANB	Block with	Series connection of circuit blocks	-
ORB	Block or	Parallel connection of circuit blocks	-
MPS	Push stack	Push onto the stack	-
MRD	Read stack	Read stack	-
MPP	Unstack	Pop the stack	-
INV	Negate	Inversion of operation result	-
MEP	M.E.P	Conduction on rising edge	-
MEF	M..EF	Conduction on falling edge	-
OUT	Output	Coil drive	Y,M,S,D□.b,T,C
SET	Position	Movement retention	Y,M,S,D□.b
RST	Reset	Clear action keeps, register cleared	Y,M,S,D□.b,T,C, D,R,V,Z
PLS	pulse	Differential output on rising edge	Y,M
PLF	Falling edge pulse	Differential output on falling edge	Y,M
MC	Master	Connection circle command for common series point	Y,M
MCR	Master reset	Instruction to eliminate common series point	-
NOP	No operation	No action	-
END	End	End of the program and I/O and return to the beginning	-

4.2 Applied instructions【Sequence is according to instruct variety】

(Contrast with MITSUBISHI)

Applied instruction can be divided into the following 18 kinds.

1	Data move instructions
2	Data conversion instructions
3	Comparison instructions
4	Arithmetic operation instructions
5	Logical operation instructions
6	Special function instructions
7	Rotate instructions
8	Data operation instructions
9	Data operation instructions
10	Character string operation instructions
11	Program flow control instructions
12	I/O refresh instructions
13	Real time clock control instructions
14	Pulse output/positioning control instructions
15	Serial communication
16	Special block/unit control instructions
17	Extension register/extension file register control instructions
18	Other handy instruct

1. Data move instructions

Mnemonic	FNC No.	Function	Support
MOV	12	Move	★
SMOV	13	Shift Move	★
CML	14	Compliment	★
BMOV	15	Block Move	★
FMOV	16	Fill Move	★
PRUN	81	Parallel Run (Octal Mode)	★
XCH	17	Exchange	★
SWAP	147	Byte Swap	★
EMOV	112	Floating Point Move	★
HCMOV	189	High Speed Counter Move	★

2. Data conversion instructions

Mnemonic	FNC No.	Function	Support
BCD	18	Conversion to Binary Coded Decimal	★
BIN	19	Conversion to Binary	★
GRY	170	Decimal to Gray Code Conversion	★
GBIN	171	Gray Code to Decimal Conversion	★
FLT	49	Conversion to Floating Point	★
INT	129	Floating Point to Integer Conversion	★
EBCD	118	Floating Point to Scientific Notation	★

		Conversion	
EBIN	119	Scientific Notation to Floating Point Conversion	★
RAD	136	Floating Point Degree to Radian Conversion	★
DEG	137	Floating Point Radian to degree Conversion	★

3. Comparison instructions

Mnemonic	FNC No.	Function	Support
LD=	224	Contact compare LD (S1)=(S2)	★
LD>	225	Contact compare LD (S1)>(S2)	★
LD<	226	Contact compare LD (S1)<(S2)	★
LD<>	228	Contact compare LD (S1)≠(S2)	★
LD<=	229	Contact compare LD (S1)≦(S2)	★
LD>=	230	Contact compare LD (S1)≧(S2)	★
AND=	232	Contact compare AND (S1)=(S2)	★
AND>	233	Contact compare AND (S1)>(S2)	★
AND<	234	Contact compare AND (S1)<(S2)	★
AND<>	236	Contact compare AND (S1)≠(S2)	★
AND<=	237	Contact compare AND (S1)≦(S2)	★
AND>=	238	Contact compare AND (S1)≧(S2)	★
OR=	240	Contact compare OR (S1)=(S2)	★
OR>	241	Contact compare OR (S1)>(S2)	★
OR<	242	Contact compare OR (S1)<(S2)	★
OR<>	244	Contact compare OR (S1)≠(S2)	★
OR<=	245	Contact compare OR (S1)≦(S2)	★
OR>=	246	Contact compare OR (S1)≧(S2)	★
CMP	10	Compare	★
ZCP	11	Zone Compare	★
ECMP	110	Floating Point Compare	★
EZCP	111	Floating Point Zone Compare	★
HSCS	53	High speed counter set	★
HSCR	54	High speed counter reset	★
HSZ	55	High Speed Counter Zone Compare	★
HSCT	280	High speed counter table compare	★
BKCMP=	194	Block compare (S1)=(S2)	★
BKCMP>	195	Block compare (S1)>(S2)	★
BKCMP<	196	Block compare (S1)<(S2)	★
BKCMP<>	197	Block compare (S1)≠(S2)	★
BKCMP<=	198	Block compare (S1)≦(S2)	★
BKCMP>=	199	Block compare (S1)≧(S2)	★

4. Arithmetic operation instructions

Mnemonic	FNC No.	Function	Support
ADD	20	Addition	★
SUB	21	Subtraction	★
MUL	22	Multiplication	★
DIV	23	Division	★
EADD	120	Floating Point Addition	★
ESUB	121	Floating Point Subtraction	★
EMUL	122	Floating Point Multiplication	★
EDIV	123	Floating Point Division	★
BK+	192	Block Data Addition	★
BK-	193	Block Data Subtraction	★
INC	24	Increase	★
DEC	25	Decrement	★

5. Logical operation instructions

Mnemonic	FNC No.	Function	Support
WAND	26	Word AND	★
WOR	27	Word OR	★
WXOR	28	Word Exclusive OR	★

6. Special function instructions

Mnemonic	FNC No.	Function	Support
SQR	48	Square Root	★
ESQR	127	Floating Point Square Root	★
EXP	124	Floating Point Exponent	★
LOGE	125	Floating Point Natural Logarithm	★
LOG10	126	Floating Point Common Logarithm	★
SIN	130	Floating Point Sine	★
COS	131	Floating Point Cosine	★
TAN	132	Floating Point Tangent	★
ASIN	133	Floating Point Arc Sine	★
ACOS	134	Floating Point Arc Cosine	★
ATAN	135	Floating Point Arc Tangent	★
RND	184	Random Number Generation	★

7. Rotate instructions

Mnemonic	FNC No.	Function	Support
ROR	30	Rotation Right	★
ROL	31	Rotation Left	★
RCR	32	Rotation right With Carry	★
RCL	33	Rotation Left with Carry	★

8. Shift instructions

Mnemonic	FNC No.	Function	Support
SFTR	34	Bit Shift Right	★
SFTL	35	Bit Shift Left	★
SFR	213	Bit Shift Right with Carry	★
SFL	214	Bit Shift Left with Carry	★
WSFR	36	Word Shift Right	★
WSFL	37	Word Shift left	★
SFWR	38	Shift Write [FIFO/FILO Control]	★
SFRD	39	Shift Read [FIFO Control]	★
POP	212	Shift Last Data Read [FILO Control]	★

9. Data operation instructions

Mnemonic	FNC No.	Function	Support
ZRST	40	Zone Reset	★
DECO	41	Decode	★
ENCO	42	Encode	★
MEAN	45	Mean	★
WSUM	140	Sum of Word Data	★
SUM	43	Sum of Active Bits	★
BON	44	Check Specified Bit Status	★
NEG	29	Negation	★
ENEG	128	Floating Point Negation	★
WTOB	141	WORD to BYTE	★
BTOW	142	BYTE to WORD	★
UNI	143	4-bit Linking of Word Data	★
DIS	144	4-bit Grouping of Word Data	★
CCD	84	Check Code	★
CRC	188	Cyclic Redundancy Check	★
LIMIT	256	Limit Control	★
BAND	257	Dead Band Control	★
ZONE	258	Zone control	★
SCL	259	Scaling (Coordinate by Point Data)	★
SCL2	269	Scaling 2 (Coordinate by X/Y Data)	★
SORT	69	Sort Tabulated Data	★
SORT2	149	Sort Tabulated Data 2	★
SER	61	Search a Data Stack	★
FDEL	210	Deleting Data from Tables	★
FINS	211	Inserting Data to Tables	★

10. String processing instruction

Mnemonic	FNC No.	Function	Support
ESTR	116	Floating Point to Character String Conversion	★
EVAL	117	Character String to Floating Point Conversion	★
STR	200	BIN to Character String Conversion	★
VAL	201	Character String to BIN Conversion	★
DABIN	260	Decimal ASCII to BIN Conversion	★
BINDA	261	BIN to Decimal ASCII Conversion	★
ASCI	82	Hexadecimal to ASCII Conversion	★
HEX	83	ASCII to Hexadecimal Conversion	★
$MOV	209	Character String Transfer	★
$+	202	Link Character Strings	★
LEN	203	Character String Length Detection	★
RIGH	204	Extracting Character String Data From the Right	★
LEFT	205	Extracting Character String Data from the Left	★
MIDR	206	Random Selection of Character Strings	★
MIDW	207	Random Replacement of Character Strings	★
INSTR	208	Character string search	★
COMRD	182	Read Device Comment Data	★

11. Program flow control instructions

Mnemonic	FNC No.	Function	Support
CJ	00	Conditional Jump	★
CALL	01	Call Subroutine	★
SRET	02	Subroutine Return	★
IRET	03	Interrupt Return	★
EI	04	Enable Interrupt	★
DI	05	Disable Interrupt	★
FEND	06	Main Routine Program End	★
FOR	08	Start a FOR/NEXT Loop	★
NEXT	09	End a FOR/NEXT Loop	★

12. I/O refresh instructions

Mnemonic	FNC No.	Function	Support
REF	50	Refresh	★
REFF	51	Refresh and Filter Adjust	★

13. Real time clock control instructions

Mnemonic	FNC No.	Function	Support
TCMP	160	RTC Data Compare	★
TZCP	161	RTC Data Zone Compare	★
TADD	162	RTC Data Addition	★
TSUB	163	RTC Data Subtraction	★

TRD	166	Read RTC data	★
TWR	167	Set RTC data	★
HTOS	164	Hour to Second Conversion	★
STOH	165	Second to Hour Conversion	★

14. Pulse output/positioning control instruction

Mnemonic	FNC No.	Function	Support
ABS	155	Absolute Current Value Read	★
DSZR	150	DOG Search Zero Return	★
ZRN	156	Zero Return	★
TBL	152	Batch Data Positioning Mode	★
DVIT	151	Interrupt Positioning	★
DRVI	158	Drive to Increment	★
DRVA	159	Drive to Absolute	★
PLSV	157	Variable Speed Pulse Output	★
PLSY	57	Pulse Y Output	★
PLSR	59	Acceleration/Deceleration Setup	★

15. Serial communication instructions

Mnemonic	FNC No.	Function	Support
RS	80	Serial Communication	★
R(S2)	87	Serial Communication 2	★
IVCK	270	Inverter Status Check	
IVDR	271	Inverter Drive	
IVRD	272	Inverter Parameter Read	
IVWR	273	Inverter Parameter Write	
IVBWR	274	Inverter Parameter Block Write	
IVMC	275	Inverter multiple command	
ADPRW	276	MODBUS read and write	★

16. Special block/unit control instructions

Mnemonic	FNC No.	Function	Support
FROM	78	Read From a Special Function Block	★
TO	79	Write To a Special Function Block	★
RD3A	176	Read form Dedicated Analog Block	★
WR3A	177	Write to Dedicated Analog Block	★
RBFM	278	Divided BFM Read	
WBFM	279	Divided BFM Write	

17. Extension register/extension file register control instructions

Mnemonic	FNC No.	Function	Support
LOADR	290	Load From ER	
SAVER	291	Save to ER	

RWER	294	Rewrite to ER	
INITR	292	Initialize R and ER	
INITER	295	Initialize ER	
LOGR	293	Logging R and ER	

18. Other handy instructions

Mnemonic	FNC No.	Function	Support
WDT	07	Watchdog Timer Refresh	★
ALT	66	Alternate State	★
ANS	46	Timed Annunciator Set	★
ANR	47	Annunciator Reset	★
HOUR	169	Hour Meter	★
RAMP	67	Ramp Variable Value	★
SPD	56	Speed Detection	★
PWM	58	Pulse Width Modulation	★
DUTY	186	Timing Pulse Generation	★
PID	88	PID Control Loop	★
ZPUSH	102	Batch Store of Index Register	★
ZPOP	103	Batch POP of Index Register	★
TTMR	64	Teaching timer	★
STMR	65	Special timer	★
ABSD	62	Absolute Drum Sequencer	★
INCD	63	Incremental Drum Sequencer	★
ROTC	68	Rotary Table Control	★
IST	60	Initial state	★
MTR	52	Input Matrix	★
TKY	70	Ten Key Input	★
HKY	71	Hexadecimal Input	★
DSW	72	Digital switch (thumbwheel input)	★
SEGD	73	Seven Segment Decoder	★
SEGL	74	Seven Segment With Latch	★
ARWS	75	Arrow Switch	★
ASC	76	ASCII code data input	★
PR	77	Print (ASCII Code)	★
VRRD	85	Volume Read	★
VRSC	86	Volume Scale	★

5. Application of analog

This section refers to the software version query, the version number is stored in the special register D8001, if necessary, please query the value of D8001.

5.1 Analog input

Input precision of coolmay CX3G/FX3GC PLC and EX3G plc hmi all-in-one is 12-bit, directly read the corresponded register value of each analog while using.

Environment temperature is only used in thermocouple type.

When Analog input is NTC10K, B value is 3435.

5.1.1 Analog input (temperature)

Below table for software version 26210

Input signal	Range	Register value	Resolution	Accuracy (Total Measuring range)
K-type thermocouple	Room temperature～1100℃	Room temperature ～11000	0.1℃	1%
PT100	-200～350℃	-2000～3500	0.1℃	1%
NTC10K	-48～210℃	-480～2100	0.1℃	1%
Voltage	0～10V/0-5V	0～4000	2.5mV	1%
Current Type1	0～20mA	0～4000	5uA	1%
Current Type2	4～20mA	0～4000	4uA	1%

Below table for software version 26220

Input signal	Range	Register value	Resolution	Accuracy (Total Measuring range)
K-type thermocouple	Room temperature～1100℃	Room temperature ～11000	0.1℃	1%
K-type thermocouple (Negative temp)	-210～1200℃	-2100～12000	0.1℃	1%
T-type thermocouple	Room temperature～420℃	Room temperature ～4200	0.1℃	1%
T-type thermocouple (Negative temp)	-210～420℃	-2100～4200	0.1℃	1%
PT100/PT1000	-200～350℃	-2000～3500	0.1℃	1%
NTC	-48～210℃	-480～2100	0.1℃	1%

Voltage	0～10V/0-5V	0～4000	2.5mV	1%
Current Type1	0～20mA	0～4000	5uA	1%
Current Type2	4～20mA	0～4000	4uA	1%

Below table for software version 26230 and above

Input signal	**Range**	**Register value**	**Resolution**	**Accuracy (Total Measuring range)**	**Remark**
K-type thermocouple	Room temperature～1100℃	Room temperature～11000	0.1℃	1%	Non-grounded wiring is required for thermocouple type
K-type thermocouple (Negative temp)	-230～1370℃	-2300～13700	0.1℃	1%	
T-type thermocouple	Room temperature～400℃	Room temperature～4000	0.1℃	1%	
T-type thermocouple (Negative temp)	-230～400℃	-2300～4000	0.1℃	1%	
S-type thermocouple	Room temperature～1690℃	Room temperature～16900	0.1℃	1%	
S-type thermocouple (Negative temp)	-40～1690℃	-400～16900	0.1℃	1%	
J-type thermocouple	Room temperature～800℃	Room temperature～8000	0.1℃	1%	
J-type thermocouple (Negative temp)	-90～950℃	-900～9500	0.1℃	1%	
E-type thermocouple	Room temperature～600℃	Room temperature～6000	0.1℃	1%	
S-type thermocouple (Negative temp)	-110～730℃	-1100～7300	0.1℃	1%	
PT100/PT1000	-200～500℃	-2000～5000	0.1℃	1%	
NTC50K/100K (B value defaults to 3435)	-48～210℃	-480～2100	0.1℃	1%	

NTC10K (B value defaults to 3435)	-48～110℃	-480～1100	0.1℃	1%	
Voltage	0～10V/0-5V	0～4000	2.5mV	1%	
Negative Voltage	-10～10V/-5～5V	0～4000	5mV/2.5mV	1%	
Current Type1	0～20mA	0～4000	5uA	1%	
Current Type2	4～20mA	0～4000	4uA	1%	

The transmitter which is integrated inside PLC is one of the above table or mixed ones, it is up to customers's need when ordering.

5.1.2 Analog input reading 1 (for software version 26210 and 26220)

Support FROM instruction or register directly read. Such as: FROM K0 K0 D400 K16, read out 16 analog input, 0-10V.

The K-type thermocouple registers read values are shown in the following table:

NO	Register Value
AD0	R23680
AD1	R23681
AD2	R23682
AD3	R23683
AD4 (Environment temperature)	R23684
AD5	R23685
AD6	R23686
AD7	R23687
AD8	R23688
AD9	R23689
AD10	R23690
AD11	R23691
AD12	R23692
AD13	R23693
AD14	R23694
AD15	R23695

A decimal points should be retained for temperature. Namely 182=18.2℃.

Other types of read values are as the following table:

NO	PT100 register read value	NTC10K register read value	0~10V/0-5V or 0~20mA register read value	4~20mA register read value
AD0	R23640	R23660	D8030	R23620

AD1	R23641	R23661	D8031	R23621
AD2	R23642	R23662	D8032	R23622
AD3	R23643	R23663	D8033	R23623
AD4	R23644	R23664	D8034	R23624
AD5	R23645	R23665	D8035	R23625
AD6	R23646	R23666	D8036	R23626
AD7	R23647	R23667	D8037	R23627
AD8	R23648	R23668	D8038	R23628
AD9	R23649	R23669	D8039	R23629
AD10	R23650	R23670	D8040	R23630
AD11	R23651	R23671	D8041	R23631
AD12	R23652	R23672	D8042	R23632
AD13	R23653	R23673	D8043	R23633
AD14	R23654	R23674	D8044	R23634
AD15	R23655	R23675	D8045	R23635

When 4-20mA type, Registers read less than 3.8mA, the value is 32760, that is break value.

5.1.3 Analog input reading 2 (for software version 26220)

Thermocouple K-type (negative temperature), T-type, T-type (negative temperature) register read value are as the table below.

NO	K-type (negative temperature) register read value	T-type register read value	T-type (negative temperature) register read value
AD0	R23720	R23700	R23740
AD1	R23721	R23701	R23741
AD2	R23722	R23702	R23742
AD3	R23723	R23703	R23743
AD4 (Environment temperature)	R23724	R23704	R23744
AD5	R23725	R23705	R23745
AD6	R23726	R23706	R23746
AD7	R23727	R23707	R23747
AD8	R23728	R23708	R23748
AD9	R23729	R23709	R23749
AD10	R23730	R23710	R23750
AD11	R23731	R23711	R23751
AD12	R23732	R23712	R23752
AD13	R23733	R23713	R23753
AD14	R23734	R23714	R23754
AD15	R23735	R23715	R23755

5.1.4 Analog input reading 3 (for software version 26230 and above)

Support FROM instructions or register read directly. Such as: FROM K0 K0 D400 K16 read 16 analog input, 0~10V.

The analog input of current, voltage, PT type and thermocouple type directly reads the register: D[8030]~D[8045]. Constant scan time changed to D8059, started by M8039 (version 26232 and higher).

NO	Register Value
AD0	D8030
AD1	D8031
AD2	D8032
AD3	D8033
AD4 (Environment temperature)	D8034
AD5	D8035
AD6	D8036
AD7	D8037
AD8	D8038
AD9	D8039
AD10	D8040
AD11	D8041
AD12	D8042
AD13	D8043
AD14	D8044
AD15	D8045

When the analog input has a thermocouple type, it can only do up to 15 channels, of which AD4 is the ambient temperature of the thermocouple. 16 channels are possible without the thermocouple type.

The value of the thermistor NTC is read in the 16th registers starting at R23660.

NO.	Register value
AD0	R23660
AD1	R23661
AD2	R23662
AD3	R23663
AD4 (Environment temperature)	R23664
AD5	R23665
AD6	R23666
AD7	R23667
AD8	R23668
AD9	R23669

AD10	R23670
AD11	R23671
AD12	R23672
AD13	R23673
AD14	R23674
AD15	R23675

R23960 starts with a zero correction value and default is 0 (Namely, size correction).

The 16 registers starting from R23620 are 0~10V or 0~20mA corresponding values, that is, real-time sampled values.

5.1.5 Analog input sampling

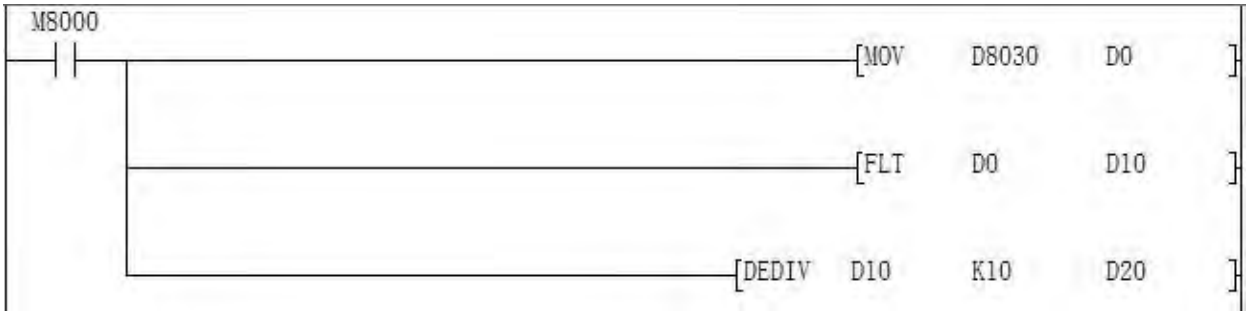
Filtering cycles=(R23600~R23615)* PLC scanning time, if R23600=1, sample one time each scan circle and change the 1st analog value for one time. The larger R23600~R23615 value is, the result is more stable.

R23600~R23615 is filtering cycles, default is 100 (Range 2~20000);

D8073 is smoothing filter coefficients of all analog input, range: 0~999

5.1.6 Analog input program example:

Below is an example of the CX3G 1 channel temperature analog AD0 acquisition. The program reads the values as follows:



Connect the signal terminal of the temperature sensor to the AD0 input of the PLC and the other end to the GND of the analog input port.

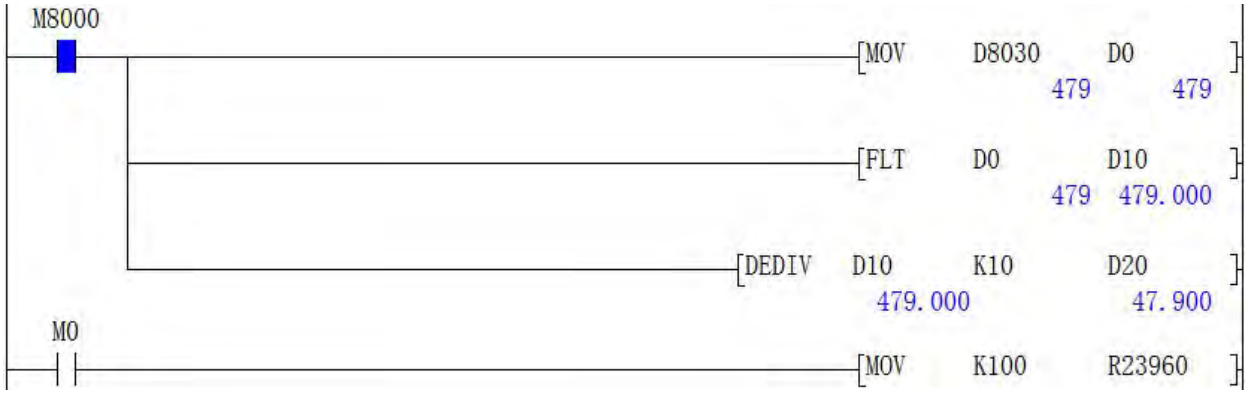
When the PLC is running, the value of the data register D8030 corresponding to AD0 will be transmitted to D0, the value of D0 will be put into D10 after floating point operation,

and then the floating point number division operation will be performed on D10, and then operation result will be put into D20, the result D20 is the actual Temperature value.

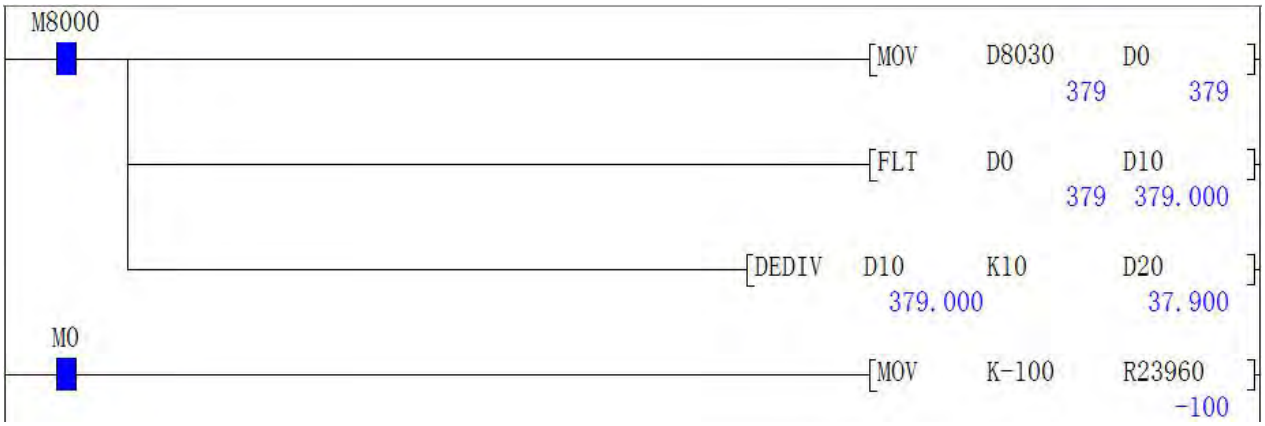
In the ladder diagram, you can also directly divide the value of D8030.

Note: When the input is 0-10V analog, the actual analog value = register reading / 400;
When the input is temperature, the actual temperature value = register reading/10;
When the input is 0-20mA analog, the actual analog value = register reading / 200;
When the input is 4-20 mA analog, the actual analog value = register reading / 250 + 4.

The analog correction is corrected for the size. The following figure is an example of correcting the AD0 temperature after acquisition:



If the current temperature is 37.9℃,the actual test is 47.9 ° C, the error is 10 ° C, you need to modify the size correction register, show as below:



In the above figure, when M0 is closed, the value -100 is transmitted to the correction register R23960, and now you can see that the value of the actual measured temperature D20 is close to the actual temperature which is 37.9 °C.

5.2 Analog output

Analog output range 0~4000, precision is 12 bit. Support TO instruction or register assignment operation directly.

Adopts TO K0 K0 D500 K8, 8 channels 0~10V or 0~20mA analog output.

Register assignment operation directly: D8050~D8057.

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

When the default D8058.0~D8058.7=0, it means 0~20mA; when D8058.0~D8058.7=1, it means 4~20mA.

For example:

	DA register	Range	Output type
DA0	D8050	0-4000	When D8058.0~D8058.7=0 Means 0~20mA； When D8058.0~D8058.7=1 Means 4~20mA.
DA1	D8051	0-4000	
DA2	D8052	0-4000	
DA3	D8053	0-4000	

DA4	D8054	0-4000	
DA5	D8055	0-4000	
DA6	D8056	0-4000	
DA7	D8057	0-4000	

Below shows the 0-10V voltage analog output.

At this point, use a multimeter to check the voltage of the DA0 terminal, that is, the multimeter's red pen is connected to the DA0 terminal, and the black pen is connected to the GND terminal. The multimeter is displaying 5V voltage value.

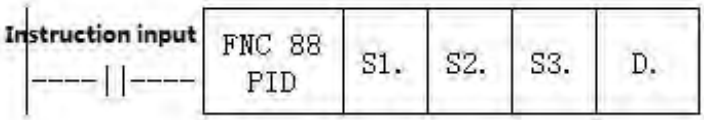
5.3 PID Instruction

5.3.1 Outline

This command is used to perform PID control that changes the output value according to the amount of change in the input.

5.3.2 PID instruction format and parameter description

Instruction format:：

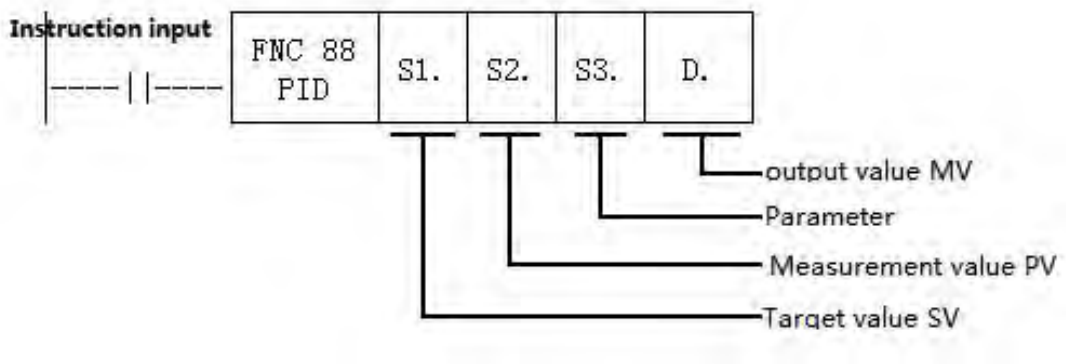


Parameter Description：

Operand Type	Content	Data Type	Word software component
S1.	Save data register number of the target value (SV)	BIN16 bit	D,R
S2.	Save data register number of the measured value (PV)	BIN16 bit	D,R
S3.	Save the data register number of the parameter	BIN16 bit	D,R
D.	Save data register number of the output register (MV)	BIN16 bit	D,R

5.3.3 Function and action description

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



Setting item

Setting item		Content	Occupied points
S1.	Target value(SV)	Set target value (SV) PID instruction does not change the setting contents	1 point
S2.	Measured value(PV)	The input value of the PID operation	1 point
S3.	Parameter	Auto-tuning: step response method a) ACT setting：when bit1,bit2,bit5 are all not "0",occupy 25points Soft Component starting from the Initial Soft Component specified in S3. b) ACT setting： when bit1,bit2,bit5 are all "0",occupy 20points Soft Component starting from the Initial Soft Component specified in S3.	25 points 20 points
D.	Output value (MV)	Auto-tuning: step response method Set the step output value on the user side before the instruction is driven. During the auto-tuning process, the MV output cannot be changed on the side of the PID instruction.	1 point

Parameter list S3.~S3.+28

Setting item			Setting content	Remark
S3.	Sampling time(Ts)		1~32767(ms)	Value shorter than the calculation period can’t be run
S3.+1	ACT	bit0	0: positive action; 1: reverse action.	Action direction (ACT)
		bit1	0: No input change alarm; 1: Input change amount alarm is valid.	
		bit2	0: No output change alarm; 1: Output change amount alarm is valid.	Do not turn ON bit2 and bit5 at the same time
		bit3	Can't use	
		bit4	0: Auto-tuning doesn’t work; 1: Perform auto-tuning.	

		bit5	0: No output value upper and lower limit setting; 1: The output value upper and lower limits are valid.	Do not turn ON bit2 and bit5 at the same time
		bit6	0: Step response method.	Auto-tuning mode
		bit7~bit15	Can't use	
S3.+2	Input filter constant (α)		0~99(%)	0 means no input filtering
S3.+3	Proportional gain ()		1~32767(%)	
S3.+4	Integration time()		0~32767(*100ms)	0 means as ∞ processing (no points)
S3.+5	Differential gain ()		0~100(%)	0 means no derivative gain
S3.+6	Derivative time ()		0~32767(*10ms)	0 means no differential processing
S3.+7 ... S3.+19	PID operation internal processing occupied, please do not change the data.			
S3.+20*1	Input change amount (increase side) alarm set value		0~32767	(ACT): Valid when S3.+1 bit1=1
S3.+21*1	Input change amount (decrease side) alarm set value		0~32767	(ACT): Valid when S3.+1 bit1=1
S3.+22*1	Output change amount (increase side) alarm set value		0~32767	(ACT): Valid when S3.+1 bit2=1，bit5=0
	Output upper limit set value		-32768~32767	(ACT): Valid when S3.+1 bit2=0，bit5=1
S3.+23*1	Output change amount (decrease side) alarm set value		0~32767	(ACT): Valid when S3.+1 bit2=1，bit5=0
	Output lower limit set value		-32768~32767	(ACT): Valid when S3.+1 bit2=0，bit5=1
S3.+24*1	Alarm output	bit0	0: The input change amount (increase side) does not overflow; 1: Input change amount (increase side) overflow.	(ACT): Valid when S3.+1 bit1=1 or bit2=1
		bit1	0: The input change amount (reduction side) does not overflow; 1: Input change amount (reduction side) overflow.	
		bit2	0: The output change amount (increase side) does not	

			overflow; 1: Output change amount (increase side) overflow.	
		bit3	0: The output change amount (reduction side) does not overflow; 1: Output change amount (reduction side) overflow.	

*1: When S3+1 action setting (ACT) bit1=1, bit2=1 or bit5=1, S3+20~24 is occupied.

5.3.4 Notice

When using multiple instructions： It can be executed multiple times at the same time (the number of loops is not limited), but note that the S3 and D devices used in the operation cannot be repeated.

Occupied points of parameter S3. : Step response method

1) ACT setting：when bit1,bit2,bit5 are all not "0",occupy 25points Soft Component starting from the Initial Soft Component specified in S3.

2) ACT setting：when bit1,bit2,bit5 are all "0",occupy 20points Soft Component starting from the Initial Soft Component specified in S3.

Step response mode: The self-tuning mode in the PID instruction has only a step response mode, and the step value is S0+22, which is the upper limit value.

When specifying the soft component in the power failure holding area： If D. is specified in the program to hold the data register in the power failure, needs to clear the specified register at the time of program start-up.

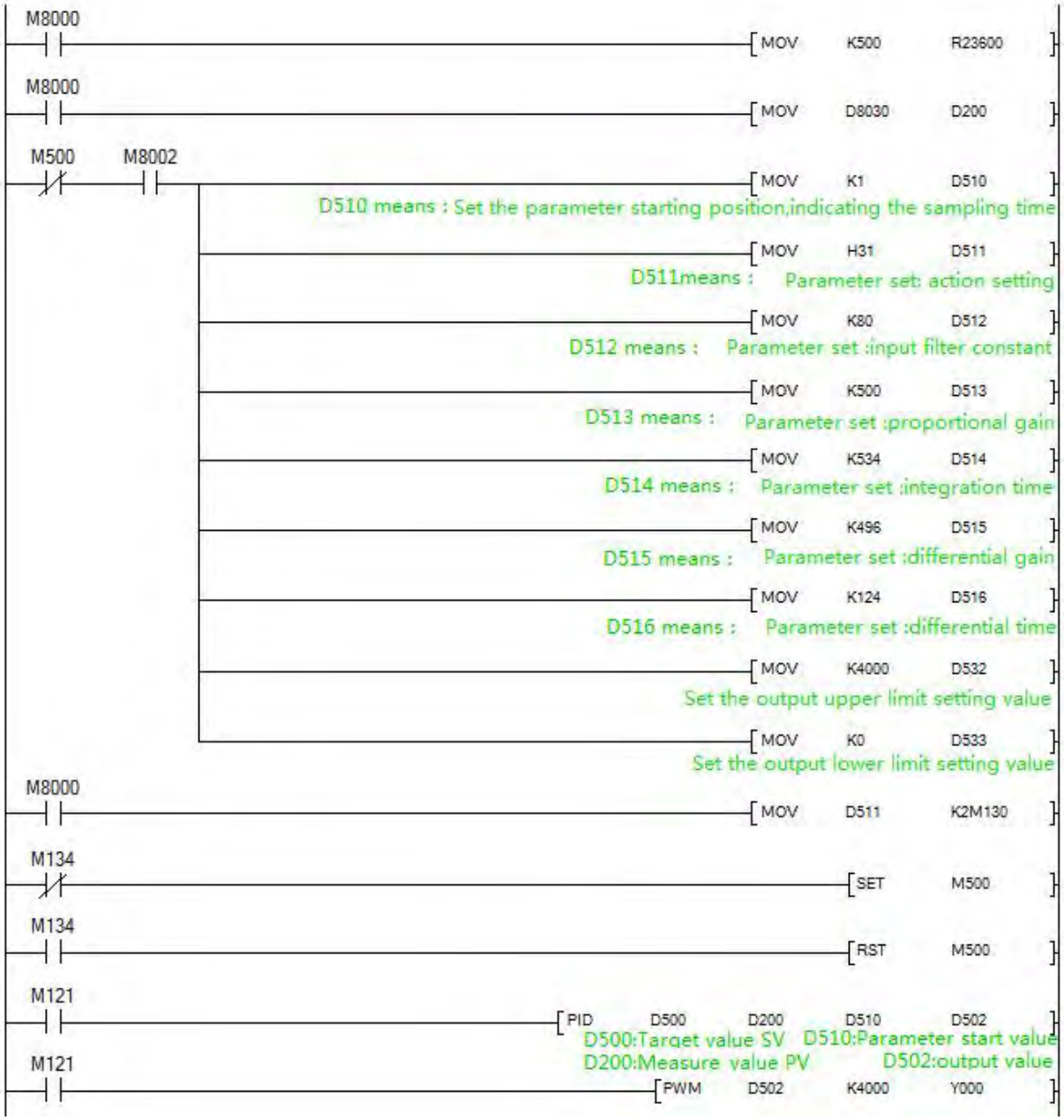
Action flag：(version number is viewed in D8001)

version below 26232，bit 0=0 of S3+1 is positive action，bit0=0 is reverse action;；

version in and after 26232,bit 0=0 of S3+1 is a positive action, and bit0=1 is a reverse action;

When heating, is reverse action.

5.3.5 Example


M8000
MOV K500 R23600
M8000
MOV D8030 D200
M500 M8002
MOV K1 D510
D510 means : Set the parameter starting position,indicating the sampling time
MOV H31 D511
D511means : Parameter set: action setting
MOV K80 D512
D512 means : Parameter set :input filter constant
MOV K500 D513
D513 means : Parameter set :proportional gain
MOV K534 D514
D514 means : Parameter set :integration time
MOV K496 D515
D515 means : Parameter set :differential gain
MOV K124 D516
D516 means : Parameter set :differential time
MOV K4000 D532
Set the output upper limit setting value
MOV K0 D533
Set the output lower limit setting value
M8000
MOV D511 K2M130
M134
SET M500
M134
RST M500
M121
PID D500 D200 D510 D502
D500:Target value SV D510:Parameter start value
D200:Measure value PV D502:output value
M121
PWM D502 K4000 Y000

6. Application of high speed counter

6.1 Assignment table of built-in high speed counter

For 3G series PLC, high speed counter is default as single phase 6 channels 60KHz, or AB(Z) phase 2 channels 60KHz+AB phase 1 channel 10KHz; Among them,AB phase double counter input is default as 1 times frequency.

Counter type	No.	Input assignment							
		X000	X001	X002	X003	X004	X005	X006	X007
Single phase single counter input	C235	U/D							
	C236		U/D						
	C237			U/D					
	C238				U/D				
	C239					U/D			
	C240						U/D		
	C241	U/D	R						
	C242			U/D	R				
	C243					U/D	R		
	C244	U/D	R					S	
	C245			U/D	R				S
Single phase double counter input	C246	U	D						
	C247	U	D	R					
	C248				U	D	R		
	C249	U	D	R				S	
	C250				U	D	R		S
AB phase double counter input	C251	A	B						
	C252	A	B	R					
	C253				A	B	R		
	C254							A	B
	C255				A	B	R		S

U: up counter D: down counter
A: A phase input B:B phase input
R: External reset input S: External start input

Single phase: at most 6 channels, max frequency is 60KHz
AB phase: 1 times frequency: 2 channels 30KHz + 1 channel 5KHz;
4 times frequency: at most 2 channels, max frequency is 24KHz;

6.2 Related device

1.For switching up/down counting of Single phase single counter

Type	Counter number	Designated device	Up counting	Down counting
Single phase single counter 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.For monitoring the up/down counting direction of Single phase double counter and AB phase double counter

Type	Counter number	Designated device	Up counting	Down counting
Single phase double counter input	C246	M8246	OFF	ON
	C247	M8247		
	C248	M8248		
	C249	M8249		
	C250	M8250		
AB phase double counter input	C251	M8251		
	C252	M8252		
	C253	M8253		
	C254	M8254		
	C255	M8255		

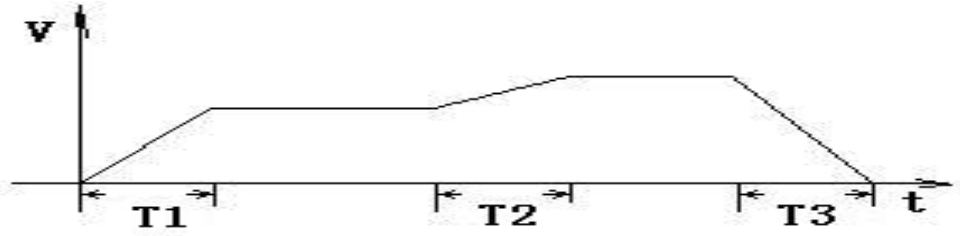
3.For High-speed counter function switching

Device name	Name	Content
M8198	Function switching device	1 times/4 times switching device for C251/C252
M8199		1 times/4 times switching device for C253/C255

7. Application of high speed pulse

7.1 high speed pulse output

Coolmay CX3G default has 8 channels high speed pulse, Y0-Y3 each 100KHz, Y4-Y7 each 10KHz,variable speed supported, the initial/final speed of start/stop is 0, diagram as below: (take accelerate and decelerate time D8148 as an example).



Acceleration/deceleration time T calculation= (target speed-current speed) * acceleration/deceleration time÷maximum speed.
For example, target speed = 50000, current speed = 20000, acceleration time 100 (ms), maximum speed = 100,000, T = 30 ms.
CX3G: 8 channels of pulse, the last 4 channels of acceleration and deceleration = D8148, the maximum speed is D8146, D8147.
PLSY, ZRN, PLSV, DRVI, DRVA, DVIT, DSZR, only Y0-Y3 supports DVIT (interrupt positioning), DSZR (originary return with DOG search) instructions.

Pulse point / Function Description	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
Pulse operation monitoring	M8340	M8350	M8360	M8370	M8151	M8152	M8153	M8154
Position pulse（32bit）	D8340 D8341	D8350 D8351	D8360 D8361	D8370 D8371	D8140 D8141	D8142 D8143	D8144 D8145	D8160 D8161
accelerate / decelerate time	D8348 D8349	D8358 D8359	D8368 D8369	D8378 D8379	D8148	D8148	D8148	D8148
Pulse stop bit	M8349	M8359	M8369	M8379	M8450	M8451	M8452	M8453
Maximum speed	D8343 D8344	D8353 D8354	D8363 D8364	D8373 D8374	D8146 D8147	D8146 D8147	D8146 D8147	D8146 D8147

The original FX3G pulse program can be used directly.
All the instruction support 8 channels pulse, except DVIT、DSZR which support 4 channels.

7.2 Circular interpolation

7.2.1 Normal interpolation function

The special flags when setting the interpolation route are as shown in the following table: (26234 version has no interpolation function)

26233 version and above		
Interpolation mode	**M8343**	**M8342**
Line Interpolation	0	1
Center interpolation	1	0
Radius interpolation	1	1

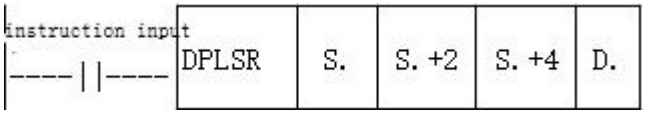
26235 version and above		
Interpolation mode	**M8433**	**M8432**
Line Interpolation	0	1
Center interpolation	1	0
Radius interpolation	1	1

The direction and coordinates of the center and radius interpolation are as shown in the following table: (26234 version has no interpolation function)

26233 version and above	
Clockwise	M8348 = 0
Anticlockwise	M8348 = 1
Relative coordinate	M8344 = 0
Absolute coordinate	M8344 = 1

26235 version and above	
Clockwise	M8435 = 0
Anticlockwise	M8435 = 1
Relative coordinate	M8434 = 0
Absolute coordinate	M8434 = 1

D8340 shows the current address of X axis，D8350 shows the current address of Y axis。
In CoolMay 3G PLC，interpolation motion still adopts DPLSR for pulse output.



Description of the Operand:

S.　represents the pulse frequency, that is, the speed of the interpolation motion.
S.+2　represents the X-axis target address.
S.+4　represents the Y-axis target address.
D.:　Specify the Y number with pulse output (Currently only supports Y0, the corresponding direction is Y4; Y1 is another axis, the corresponding direction is Y5).
X axis: Y0 pulse, Y4 direction
Y axis: Y1 pulse, Y5 direction

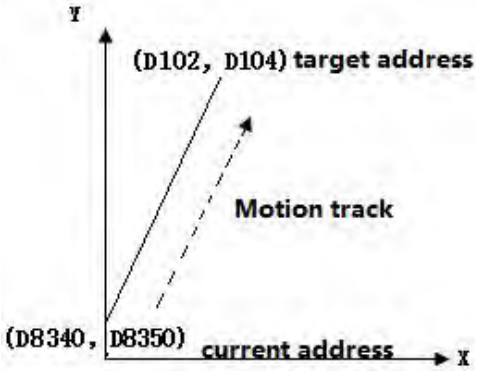
In the center interpolation mode:

S.+6　represents the center X coordinate address.
S.+8　represents the center Y coordinate address.

In radius interpolation mode:

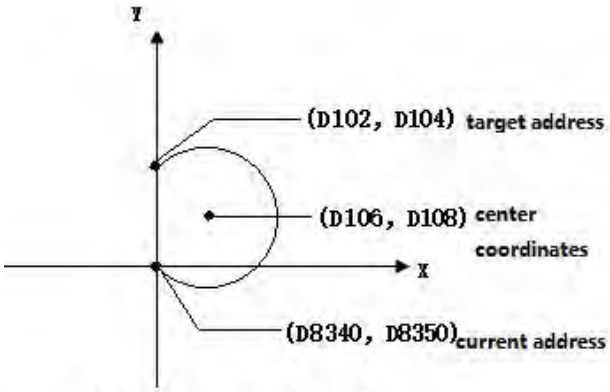
S.+6　represents the radius length. When it is positive, the path is a small circle; when it is a negative value, the path is a large circle.

For example: DPLSR D100 D102 D104 Y000
In the linear interpolation: D100 speed, D102 is the X-axis target address, and D104 is the Y-axis target address.Y0 and Y1 respectively pulse the X-axis and Y-axis.



Linear Interpolation diagram

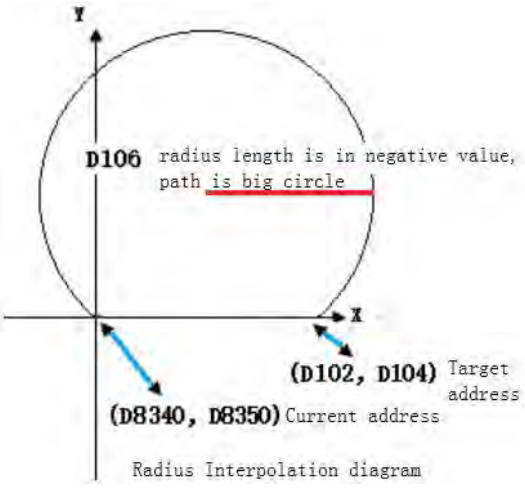
In the Center interpolation: D100 speed, D102 is the X-axis target address, D104 is the Y-axis target address, and D106 is the center X address. D108 is the center Y address. Y0 and Y1 respectively pulse the X-axis and Y-axis.



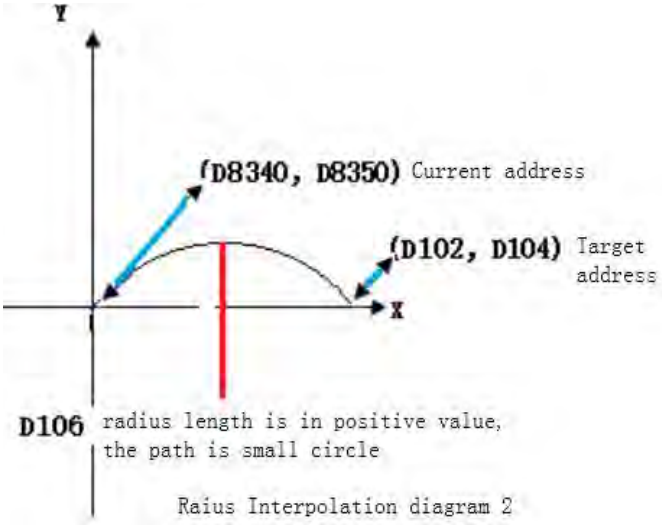
Center Interpolation Diagram

Note 1: The current address of X and Y must be on the same circle as the destination address.
Note 2: When the current address coincides with the target address, it indicates that the motion track is a full circle.

In the radius interpolation: D100 speed, D102 is the X-axis target address, D104 is the Y-axis target address, and D106 is the radius length. Y0 and Y1 respectively pulse the X-axis and Y-axis.(The example below is clockwise, i.e. M8435=0)



Radius Interpolation diagram



Raius Interpolation diagram 2

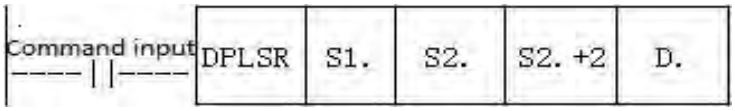
7.2.2 Continuous interpolation function

M8436 is the flag for the normal interpolation mode and continuous interpolation mode.

M8436=0: regular interpolation mode;

M8436=1: continuous interpolation mode;

In CoolMay 3G PLC 26236 and higher version, continuous interpolation motion uses DPLSR for pulse output.



Operand Description: All use 32-bit registers.

S1. indicates the pulse frequency, that is, the speed of the interpolation motion.

S2. indicates the X-axis target address.

S2.+2 indicates the Y-axis target address.

In the center mode: S2.+4 and S2.+6 indicates the Center coordinates.

In radius mode: S2.+4 indicates the radius length, and S2.+6 ignores and unused.

S2.+4 positive value: the path is a small circle;

S2.+4 negative value: the path is a big circle.

S2.+8 is the control register.

D.: Specify the Y number with pulse output (only Y0 supported), and the default Y1 is another axis.

In continuous interpolation mode, M8432~M8435 are determined by the 5th parameter (ie S.+10).

The function description of each bit of the 32-bit register S2.+8 is as follows:

32bit position	b31~b28	b27~b24	b23~b20	b19~b16	b15~b12	b11~b8	b7~b4	b3~b0
Function	Continuous interpolation execution and stop Flag position					Position mode	Interpolation direction	Interpolation mode

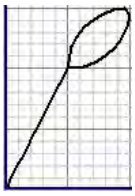
When S2.+8 is used, it is expressed in hexadecimal. The bit values of each group are as below:

b3~b0	=1： linear mode interpolation =2： center mode interpolation =3： radius mode interpolation
b7~b4	=0： clockwise rotation =1： counterclockwise rotation = any other value： linear mode
b11~b8	=1： relative position =2： absolute position
b31~b12	=00000： continuous interpolation execution =AAAAA： continuous interpolation stop

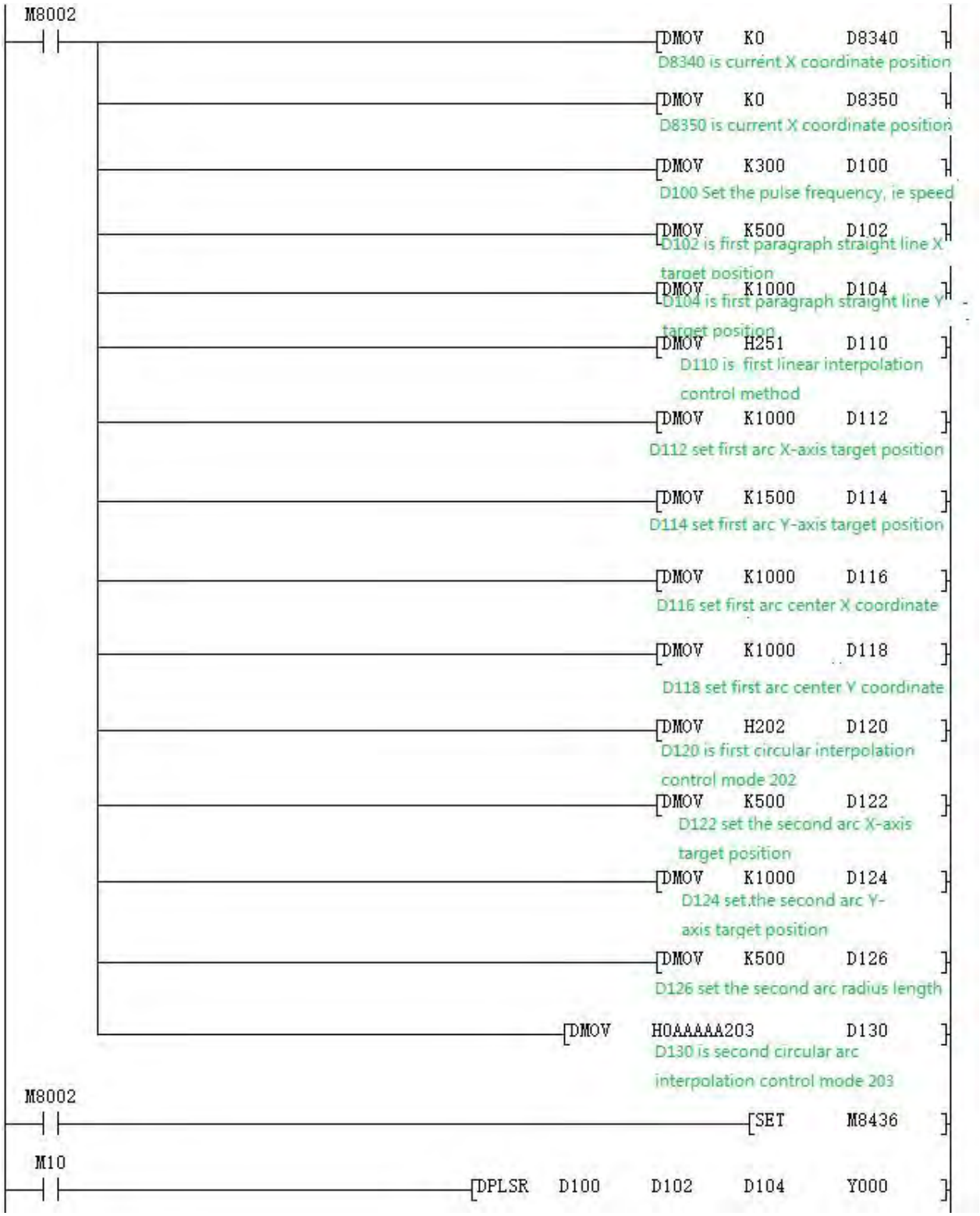
PS: When using linear mode interpolation, b7~b4 is ignored and can be set to any value from 2~F.

S1. and S2. may be set discontinuous. For example, S1.=D100, S2.=D120.

S2. Must be consecutive with the next four 32-bit registers. For example, it must be set to D102, D104, D106, D108, D110.

For example: draw a line and two arcs, as shown: 

Program as below :



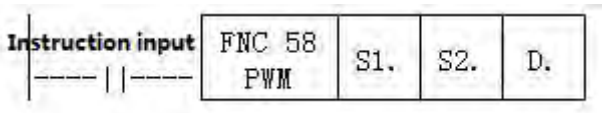
7.3 Pulse width modulation (PWM)

7.3.1 Outline

This instruction is used to specify the pulse period and pulse output of the ON time.

7.3.2 PWM instruction format and parameter description.

Instruction format：

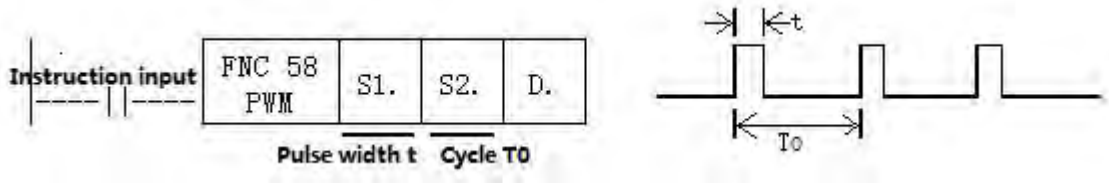


Parameter description：

Operand type	Content	Data type	Word software component	Range
S1.	Word soft component numbers of Pulse width (ms) data or saving data	BIN 16 bit	KnX, KnY, KnM, KnS, T, C, D, R, V, Z, K, H	0~32767ms
S2.	Word soft component numbers of Period (ms) data or saving data	BIN 16 bit	KnX, KnY, KnM, KnS, T, C, D, R, V, Z, K,H	1~32767ms
D.	Soft component (Y) numbers of Output pulse	BIN 16 bit	Y	Y0-Y3(5~100KHz) Y4-Y7(5~10KHz)

7.3.3 Function and action description

16-bit operation (PWM):Pulse output in units of period [S2.ms],Its ON pulse width is [S1.ms].



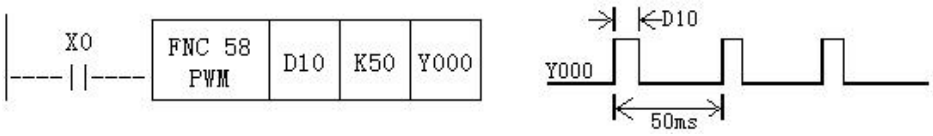
Notes.

Value of the pulse width S1. and the period S2. should be set: S1.≦S2.。

When instruction input is OFF, Output from D. is also OFF.

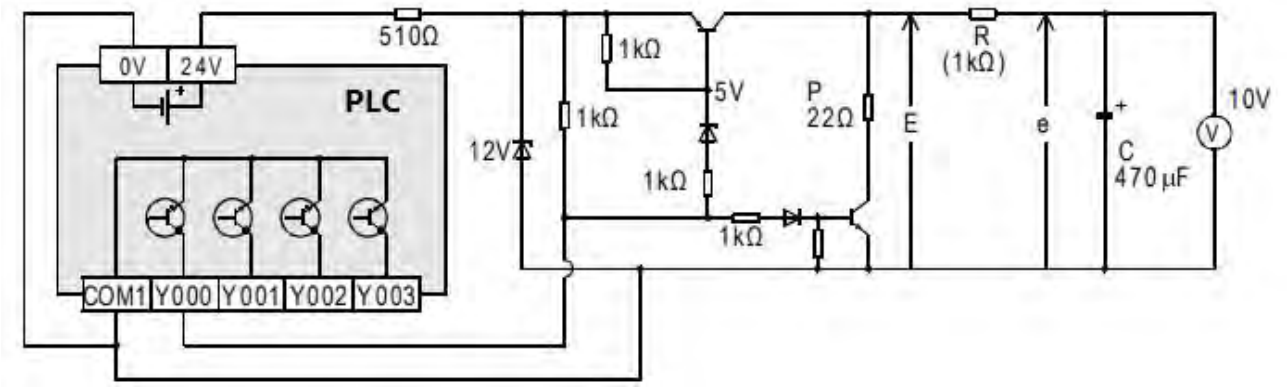
Do not operate the setting switch of the pulse output mode during pulse emission.

7.3.4 Program Example



In this example, the data range of D10 is changed from 0 to 50, and the average output of Y0 is 0 to 100%. If D10 data >50, it will be wrong.

Example for smooth loop



R >> P

t = R(KΩ)* C(μF) = 470ms >>T0

Compared to the pulse period T0,the time constant τ of the filter is a very large value.

The fluctuation value Δe of average output current e is approximately $\frac{\Delta e}{e} \leqq \frac{T0}{\tau}$

7.3.5 Special Note

Conventional PWM

1) Support a total of 8 channels Y0-Y7 (please select transistor MT output);

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

Special customized PWM -- as Analog output

The following parameters are required for model selection:

1) the output voltage of the required PWM;

2) the output frequency of the required PWM;

3) Confirm the numbers of customized PWM, up to 8 PWMs. (depending on analog outputs that customer make).

4) Whether the customized PWM coexists with other analog. (If the product is separately equipped with analog, the analog output terminals DA0~DA3 are a group, and DA4~DA7 are a group. When custom PWM of 3G series products, Only when the output frequency is 21KHz,it can be used with other analog group.).

Special customized PWM -- Output frequency setting

When special customize PWM,don't need to use the PWM instruction. You only need to set the special register and then turn on the hardware.

The special registers used for each analog, check below table:

Analog output address	DA0	DA1	DA2	DA3	DA4	DA5	DA6	DA7
Duty cycle setting	D8050	D8051	D8052	D8053	D8054	D8055	D8056	D8057
PWM frequency division coefficient setting (32 bits)	D8268	D8268	D8268	D8268	D8278	D8278	D8278	D8278

V26235-1 and later versions are used as follows:

D8050 to D8057: the corresponding duty cycle, the value range is 0~4000, each 1 is 0.025%, and the total corresponds to 0~100%;

D8268 and D8278: the value range is 1~100000Hz (32 bits);

D8050 to D8057 ≦ D8268 and D8278

When D8268 and D8278 are powered on, the default setting is 21000Hz, and the power is not maintained. Program assignment is required when using.

7.4 Hand wheel pulse function

The hand wheel pulse generator is commonly known as the electronic hand wheel and hand wheel.

It is mainly used for setting the teaching origin of the teaching CNC machine in the CNC machine tool, stepping fine-tuning in manual mode, and interrupting insertion during processing. Widely used in CNC engraving and milling machines, CNC milling machines, CNC lathes, machining centers, CNC wire cutting machine tools, CNC EDM machine tools, printing equipment, textile machinery and other fields.

Coolmay 3G series PLC supports the handwheel function (only supports the servo motor, does not support the stepper motor). With the cooperation of the 3G PLC, the handwheel is used to

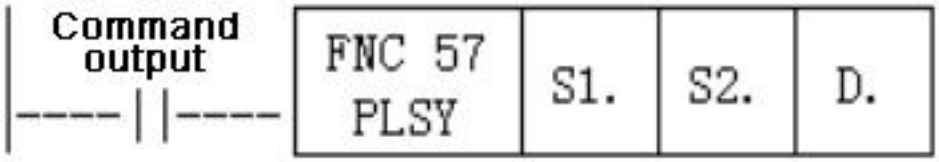
control the motor rotation, and the handwheel can rotate one pulse, and the motor also rotates the corresponding one. Number of pulses.

Special sign

M8228: Turn ON to enable the hand wheel function (the original C228 function is not used for now)

Instruction format and parameter description when using the hand wheel.

Instruction format

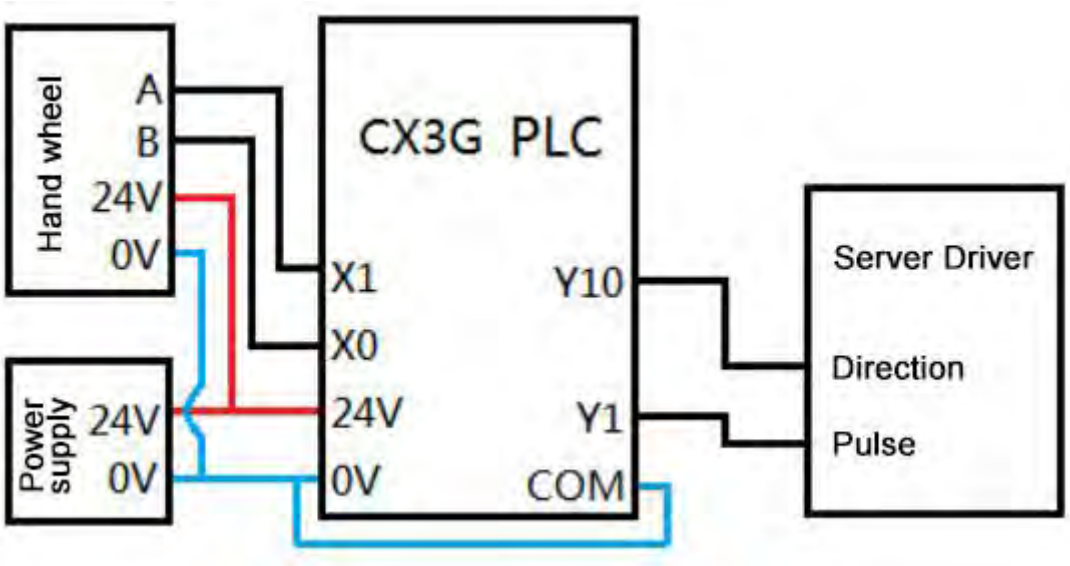


Parameter Description:

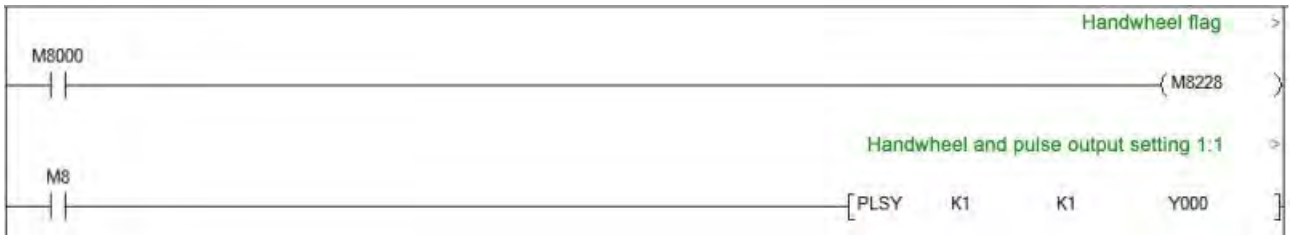
Operand type	content	type of data	Word software
S1.	Set the numerator of the input to output ratio	BIN16 digits	K,D
S2.	Set the denominator of the input to output ratio	BIN16 digits	K,D
D.	Output pulse device (Y) number	BIN16 digits	pulse：Y0-Y5 Corresponding direction： Y10-Y15

PS: When setting S1. and S2., S1. must be an integer multiple of S2. If it is 1:1, it means that the hand wheel rotates one pulse and the motor rotates one pulse; if it is an integer multiple of n, it means that the hand wheel rotates one pulse and the motor rotates n pulses;

The hand wheel connection is shown below:



The hand wheel function program is shown below:



This program is 1:1 pulse output, that is, how many the hand wheel rotates, then how many pulse Y0 will output.

8. Coolmay CX3G PLC Communication Instructions

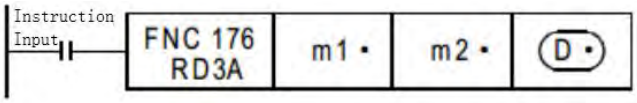
CX3G PLC has default RS232 programming port, and two communication ports (Rs232 or Rs485) can be added. Meanwhile, CANbus is also optional.

8.1 MODBUS instruction interpretation and communication address

PLC, when as master, support ADPRW command,RD3A command,WR3A command,this section will give you detailed description about these commands.

8.1.1 RD3A/WR3A command function and action description:

Read slave data (RD3A)



For CoolMay PLC, the RD3A instruction corresponds to Modbus's No. 03 function.
In the instruction,

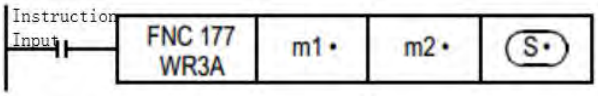
m1 represents the station number of the read slave device,range:1-247;

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

D represents the number of registers read, range: 1-125(When Modbus ASCII,range is1-45; When CAN communication,range is 1-90), and the read data is sequentially stored in the host D.+1, D.+2.

D-1 address value must be set to (=0: serial port 2; =1: serial port 3; =2: CAN; =3: Modbus TCP/IP)

Write data to the slave (WR3A):



WR3A originally referred to the analog modules write.
For CoolMay PLC, the WR3A instruction corresponds to Modbus's 06 and 10 functions.
In the instruction,

m1 represents the station number of the slave device to be written, range :1-247.

m2 represents the first address number of the write register in the slave device;

S represents the numbers of registers to be written, ranging:1-123(When Modbus ASCII,range is1-45; When CAN communication,range is 1-90). The data to be written is sequentially stored in the host S.+1, S.+2.

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

S=2-123, the WR3A instruction corresponds to the Modbus 10 function.

S.-1 address value must be set to (=0: serial port 2; =1: serial port 3; =2: CAN; =3: Modbus TCP/IP)

RD3A and WR3A only support the below MODBUS functions:

Function No. 03: Read holding register and takes the current binary value range of 1-125 in one or more holding registers.
Function No. 06: Load the specific binary value into a holding register (write register) ,range:1.
Function No. 16: Preset multiple registers, load specific binary values into a series of consecutive holding registers (write multiple registers),range:1-123.
Note! For 26231 below version The RD3A and WR3A must be triggered with a rising edge. For

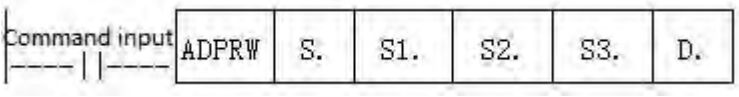
26231 and above,it can be triggered by the normal signal.

8.1.2 ADPRW command function and action description:

ADPRW instruction supports all functions of the MODBUS RTU.

No. 01: Read coil status and get the current status (ON/OFF) of a group of logic coils, range 1-512
No. 02: Read the input status and get the current status (ON/OFF) of a group of switch inputs, range 1-512
No. 03: Read the retentive register and get the current binary value in one or more retentive registers, ranging from 1-125
No. 04: Get the current binary value in one or more input registers, range 1-125
No. 05: Force a single coil to force the on/off state (write bit) of a logic coil, range 1
No. 06: Load specific binary values into a retentive register (write register), range 1
No. 0F: Force multiple coils, forcibly open and close a series of continuous logic coils (write multiple bits), range 1-1968
No. 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 to be read and written, the range is 0-247;
S1. indicates the function code (that is, the functions NO 01-06, 15, and 16);
S2. The function parameter corresponding to each function code (the operand indicates the MODBUS start address when the function is 01);
S3. The function parameters corresponding to each function code (the operand indicates the number of access points when the function is 01, and the parameter is fixed to 0 when the 05 function is used);
D. indicates the starting position of the data storage device.

8.1.3 Bit device Communication address number

MODBUS device		CX3G/FX3GC device
Input (readout dedicated)	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 CN200～255 is a 32- bit counter		

8.1.4 Word device Communication address number

MODBUS device		CX3G/FX3GC device
Input register (readout dedicated)	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 occurs when accessing an unused address CN200～255 is a 32-bit counter		

8.1.5 ADPRW Command function parameter

Operand function	S1. Function code	S2. MODBUS address/subfunction code	S3. Access points/subfunction data	D. Data storage device start
Coil readout	1H	MODBUS Address：0000H~FFFFH	Access points：1~2000	Read object device D.R.M.Y.S
Input readout	2H	MODBUS Address：0000H~FFFFH	Access points：1~2000	Read object device D.R.M.Y.S
Holding register readout	3H	MODBUS Address：0000H~FFFFH	Access points：1~125	Read object device D.R
Input register readout	4H	MODBUS Address：0000H~FFFFH	Access points：1~125	Read object device D.R

Single coil write	5H	MODBUS Address：0000H~FFFFH	0(Fix)	Write object device D.R.X.Y.M.S 0=OFF 1=ON
Single register write	6H	MODBUS Address：0000H~FFFFH	0(Fix)	Write object device D.R
Bulk coil writing	FH	MODBUS Address：0000H~FFFFH	Access points：1~1968	Write object device D.R.X.Y.M.S
Bulk register write	10H	MODBUS Address：0000H~FFFFH	Access points：1~123	Write object device D.R

8.2 Serial port 1: RS232(PLC programming port)

Support Mitsubishi programming port protocol；Can be used to download PLC program or communicate with devices which support MITSUBISHI programming port protocol.

8.3 Serial port 2: RS485(A B)/RS232

Support MITSUBISHI programming port protocol,Mitsubishi BD board protocol,free port protocol and MODBUS RTU protocol.

The special relays and registers related to this serial port are as below.

Functions	Serial port 2(A/B)	Serial port 3(A1/B1)	CAN(H/L)	Remark
Mitsubishi programming port protocol	M8196=0	M8192=0	-	26232 or higher version: power lost can not be retentive
Freeport protocol function	M8196=1 M8125=0	M8192=1	-	
RS/RS2 sending mark	M8122=1	M8402=1	M8422=1	
RS/RS2 sending completion mark	-	-	M8425	Need to reset manually
RS/RS2 receiving completion mark	M8123	M8403	M8423	Need to reset manually
RS/RS2 receiving process mark	M8124	M8404	M8424	Data is receiving
RS/RS2 command 8/16 bits differentiation mark	M8161	M8161	M8161	
RS command CAN master-slave mark	-	-	M8426	M8426=0 master-slave mode, M8426=1 multi-device mode

RS2 command end operation settings	-	1	2	
MODBUS function	M8196=1 M8125=1	M8192=1	-	
RD3A/WR3A Receive correct mark	M8128	M8408	M8428	Automatic reset
RD3A\WR3A communication over-time mark	M8129	M8409	M8429	Automatic reset
ADPRW command completion mark	M8029	M8029	M8029	Command execution end mark
Communication parameters	D8120	D8400	D8420	
Communication mode	-	D8401	D8421	
Master-slave station number	D8121	D8414	D8434 D8440 D8442	D8434: CAN slave station NO D8440/D8442: multi-device mode ID NO
RD3A/WR3A overtime	D8129	D8409	D8429	Unit: ms (detailed setting,refer to explanation)
RD3A/WR3A interval period	D8126	D8406	D8426	Main version 26232 or higher version
RD3A\WR3A end operation -1	0	1	2	
ADPRW command settings	D8126=0	D8126=1	D8126=2	Main version 26232 or lower version
ADPRW command settings	D8397=0	D8397=1	D8397=2	Main version 26232 or higher version
CAN data frame	-	-	M8427	

M8196: the activation flag of using programming port protocol and other protocol (Main version 26232 and higher, modified to “not hold when power failure”).
M8125: the activation flag of using MODBUS and the original Mitsubishi function.
M8122: RS sending flag (this bit needs to be set 1 when using the RS instruction, and it will automatically reset after sending).
M8123: RS receiving completion flag (need to reset manually).
M8124: RS command data is being received.
M8161: 8-bit/16-bit mode flag of RS instruction (used in 26230 and above versions, fixed 8-bit mode in 26210/26220 version)
M8128: RD3A / WR3A receive the correct flag.
M8129:RD3A/WR3A communication over-time flag. (when communication is over-time, flag is ON)
M8029: Communication completion flag (communication completion flag when using ADPRW instruction, needs to be reset by hand).

D8120: The detailed communication parameter settings of saving Modbus RTU protocol are seen as below.
D8121: Save the host or slave station number. (It must be set as max. K255 as master)
D8126: When using the serial port 2 in the ADPRW instruction, set D8126 to 0. (26232 or lower version)
D8126: Interval period. Default as 10 times. (26232 or higher version uses this register.)
D8129: RD3A and WR3A timeout period. (The unit is milliseconds, it is recommended to set: when the communication rate setting is greater than or equal to 9600, D8129 is set to 10~20; when the communication rate setting is less than 9600, D8129 is set to 20~50;)
D8397: When using the serial port 2 in the ADPRW instruction, set D8397 to 0. (26232 and higher version)

Support RS, WR3A, RD3A, ADPRW instructions. Can be set in the parameter zone, corresponding to serial port 2. The parameter zone settings are only valid for this channel. It is invalid for serial port 3.

8.3.1 Mitsubishi programming port protocol

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

8.3.2 Mitsubishi BD Protocol

When used as the Mitsubishi BD protocol function: set M8196=1, M8125=0; D8120 is set as the communication parameter, and D8121 is set as the slave station number. For example, set D8120=H6086, D8121=H1 (communication parameter is 9600/7/E/1, slave station number is 1).

D8120 parameter setting

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 bits
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 b9 b10 b11	Set 0
b12	Set 0
b13	Set 1
b14	Set 1

b15	Set 0

Example of PLC as slave program:

HMI can communicate with PLC by setting BD protocol master station.

8.3.3 Free port protocol function and example

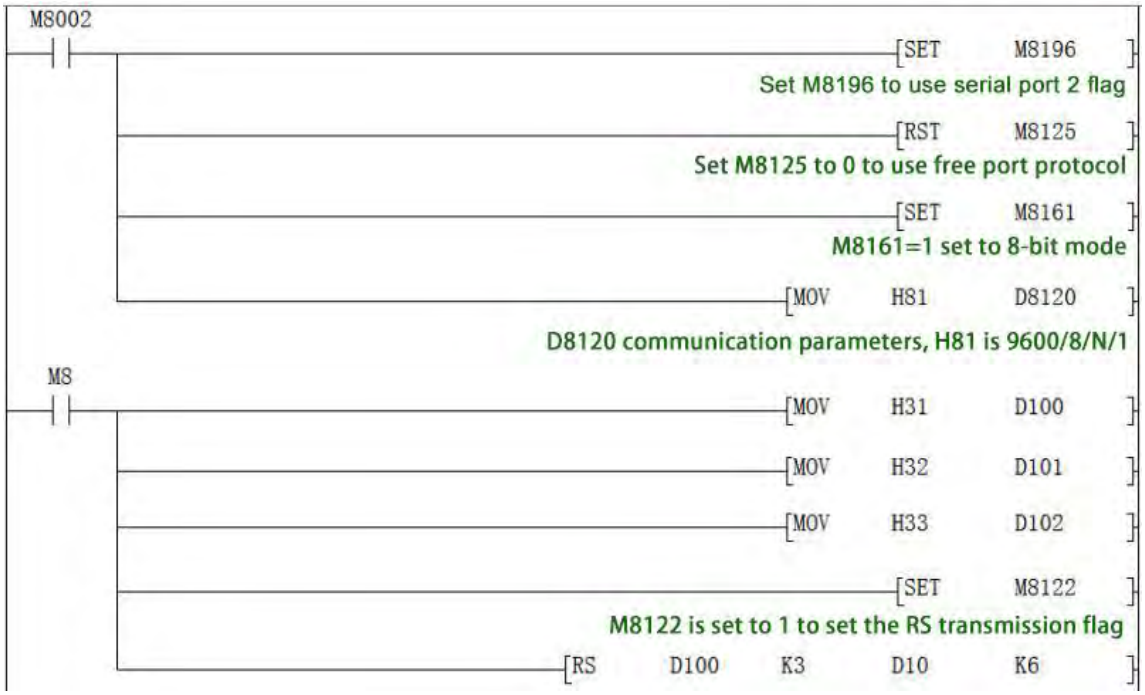
When used as Mitsubishi free port protocol: set M8196=1，M8125=0； the difference between Mitsubishi protocol 1 and protocol 4 is with end mark OA OD (stored in D8124, D8125 separately)

For Mitsubishi Freeport Protocol, RS instruction is supported, the 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 1:8bits
b1 b2	Odd and Even (b2,b1) 00: None 01: Odd 02: Even
b3	Stop bit 0: 1 bit 1: 2 bits
b4 b5 b6 b7	BPS rate (b7,b6,b5,b4) (0100):600bps (0101):1200bps (0110):2400bps (0111):4800bps (1000):9600bps (1001):19200bps (1010):38400bps (1011):57600bps (1101):115200bps

Demo program：



Use the serial port tool by serial port 2 to monitor the data obtained is
[2017:11:01:10:49:16][receive]31 32 33

8.3.4 Modbus RTU Protocol

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

D8120 Parameter set

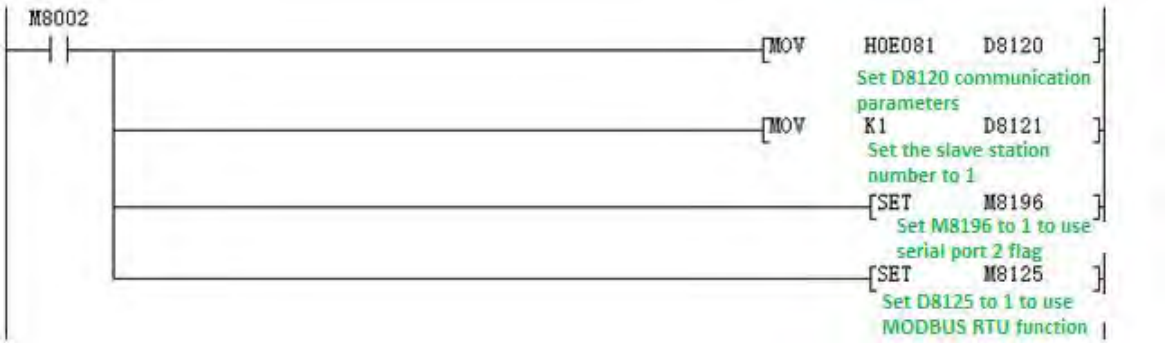
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

Bit number	Content
b0	Data length 0:7 bit 1:8 bit
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

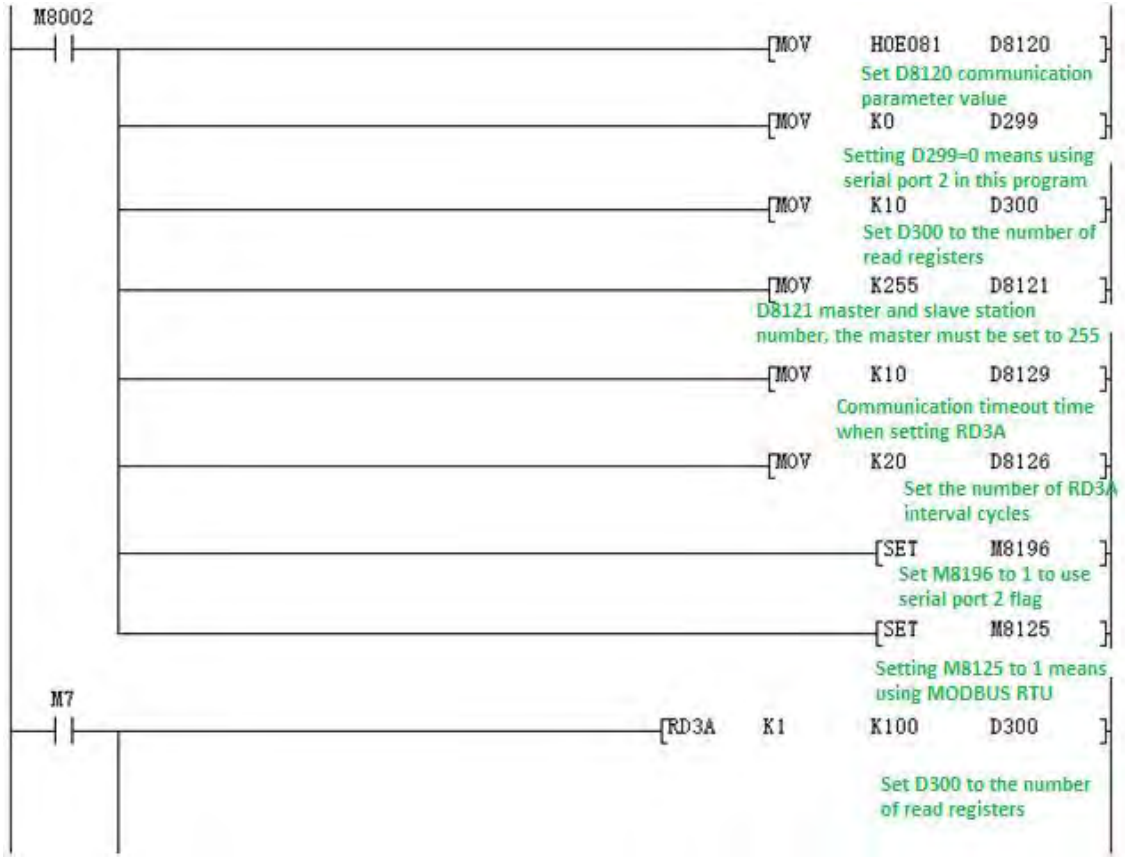
	0111:4800bps 1000:9600bps 1001:19200bps 1010:38400bps 1011:57600bps 1100:115200bps
b8	Set 0
b9	
b10	
b11	
b12	RTU/ASCII Mode Selection 0:RTU 1:ASCII
b13	Set 1
b14	Set 1
b15	Set 1

RD3A Program example (refer to 8.1.1):

Slave program:



Master program:



Program explanation:

D300 saves the numbers of registers read, which means that 10 data is read.

D299 must be set to 0.

This program represents that 10 data of the registers D100-D109 in the PLC with the slave station 1 are read and stored in the registers D301-D310 of the master station PLC.

Use the serial port tool to monitor the results:

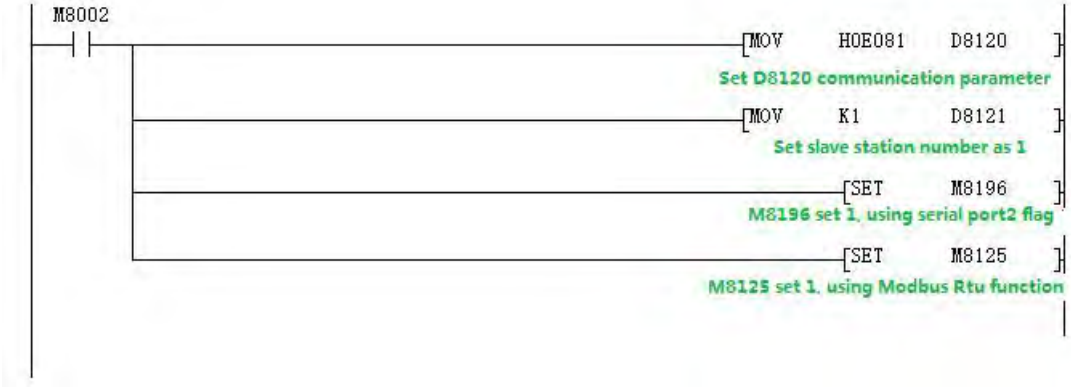
[2017:07:05:17:41:20][receive]01 03 00 64 00 0A 84 12

[2017:07:05:17:41:20][receive]01 03 14 00 6F 00 DE 01 4D 01 BC 02 2B 02 9A 03 09 03 78 03 E7 00 00 7D 69

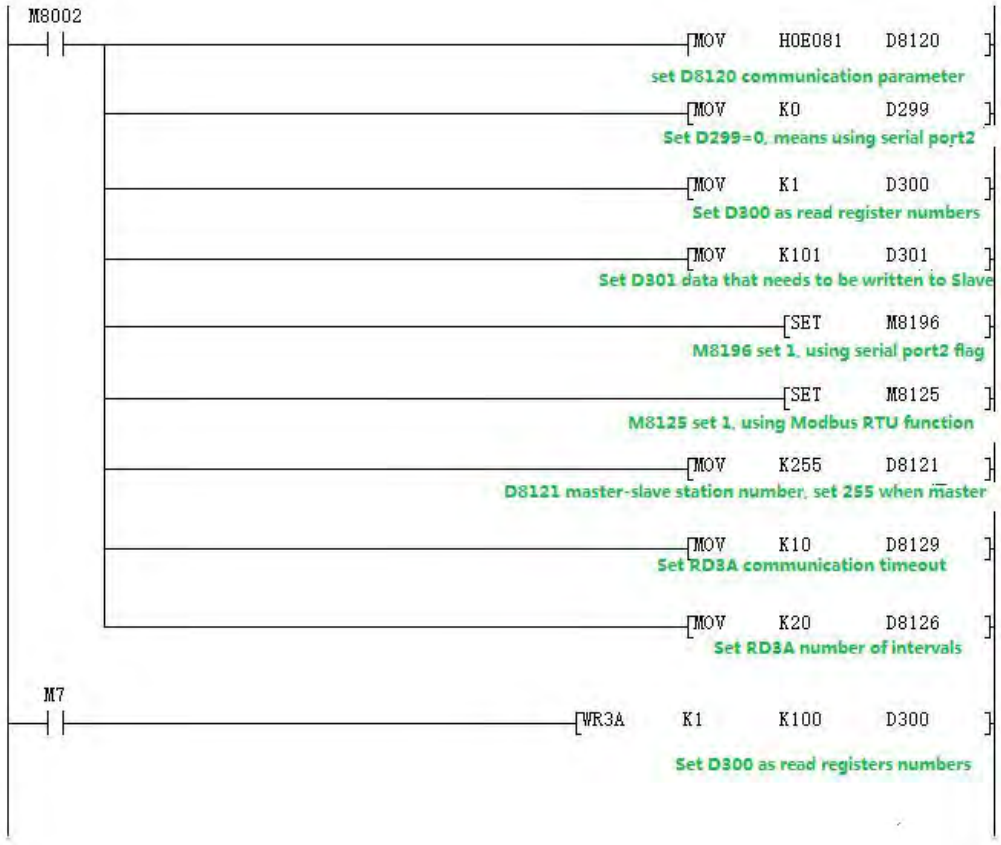
(This example sets the data of the slave D100-D109 to 111-999).

WR3A Program example (refer to 8.1.1):

Slave program:



Master program:



Program explanation:

This program represents that 1 data of the register D301 in the master PLC is written to the PLC in Slave 1, and is stored in the register D100 of the slave PLC.

Use the serial port tool to monitor the results:

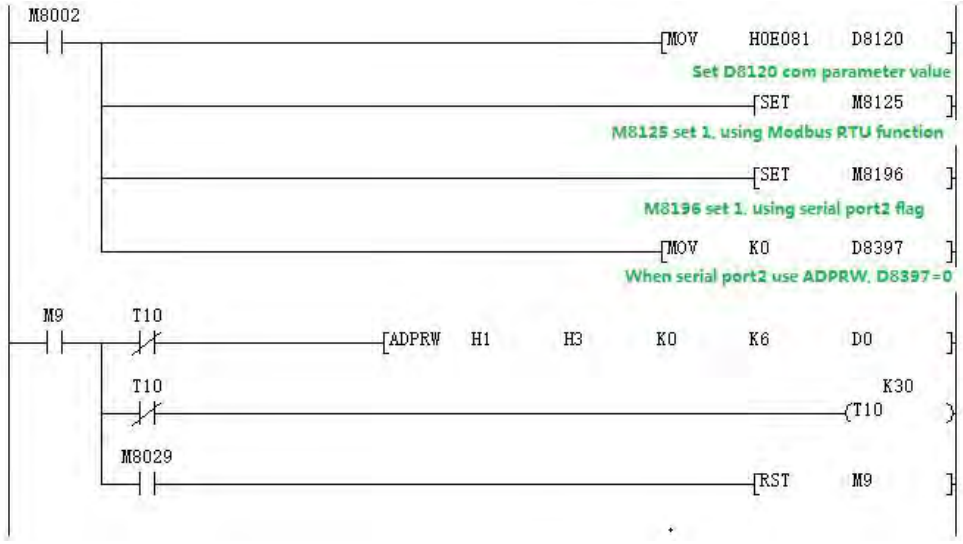
[2017:10:31:16:47:22][receive]01 06 00 64 00 6F 88 39

[2017:10:31:16:47:22][receive]01 06 00 64 00 6F 88 39

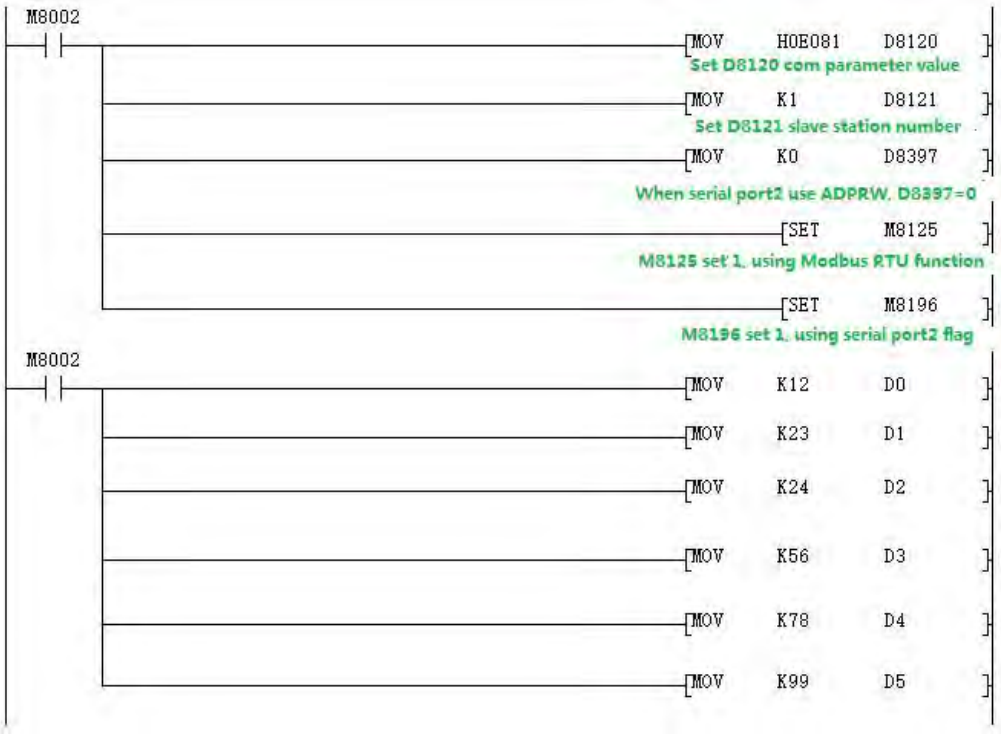
8.3.5 MODBUS RTU ADPRW command

03 function code hold register output. **(refer to 8.1.2):**

Master program:



Slave program:



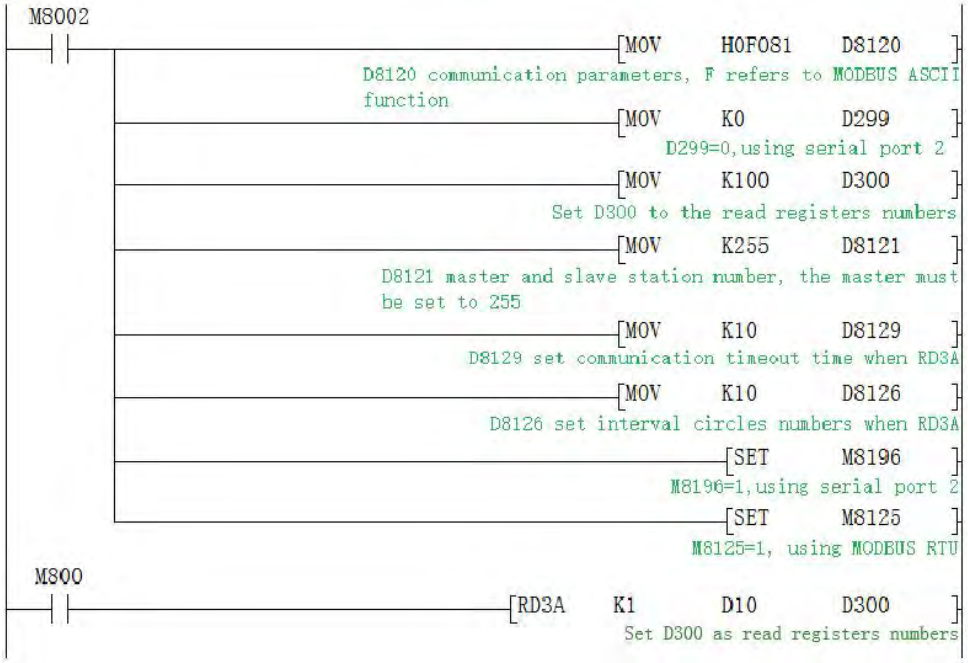
Use the serial port tool to monitor serial port 2 for below data:
[2017:11:01:17:48:54][receive]01 03 00 00 00 06 C5 C8
[2017:11:01:17:48:54][receive]01 03 0C 00 0C 00 17 00 22 00 38 00 4E 00 63 C4 29

8.3.6 Modbus ASCII Protocol

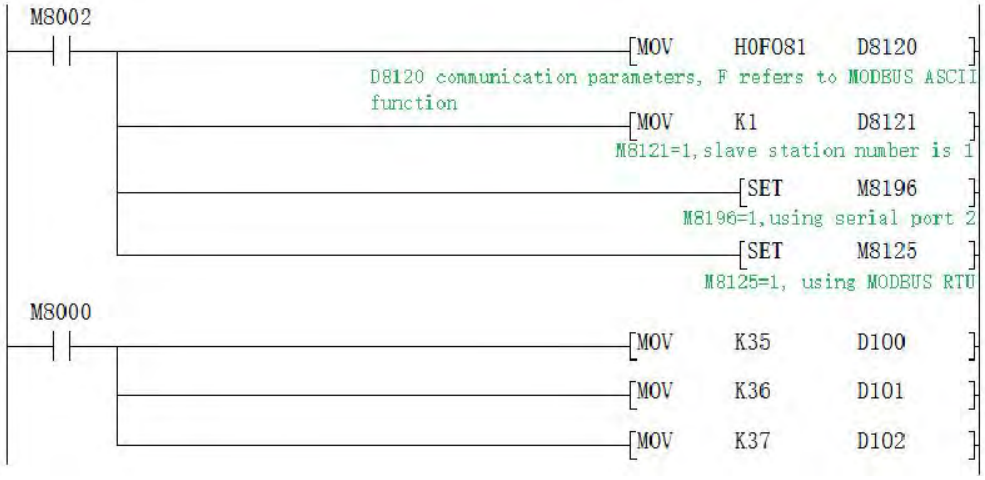
When used as Modbus ASCII protocol,specific parameter setting pls refer to 8.3.3,Only the 12th bit of D8120 is set differently,checking D8120 parameter setting in section 8.3.3.

Note: In modbus ASCII protocol, ADPRW command is not supported.

Master program：



Slave program：



Data of the Master D300~D303 before and after the program execution is showed as below.

Soft components	+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

Monitor D300-D301 data before the master M7 turns on.

Soft components	+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

Monitor D300-D301 data after the master M7 turns on.

8.4 Serial port 3:RS485(A1 B1)

Support Mitsubishi programming port protocol,RS2 protocol and MODBUS RTU protocol.
The special relays and registers related to this serial port are as below.

Functions	Serial port 2(A/B)	Serial port 3(A1/B1)	CAN(H/L)	Remark
Mitsubishi programming port	M8196=0	M8192=0	-	26232 or higher version: power lost can not be retentive
Freeport protocol function	M8196=1 M8125=0	M8192=1	-	
RS/RS2 sending mark	M8122=1	M8402=1	M8422=1	
RS/RS2 sending completion mark	-	-	M8425	Need to reset manually
RS/RS2 receiving completion mark	M8123	M8403	M8423	Need to reset manually
RS/RS2 receiving process mark	M8124	M8404	M8424	Data is receiving
RS/RS2 command 8/16 bits differentiation mark	M8161	M8161	M8161	
RS2 command CAN master-slave mark	-	-	M8426	M8426=0 master-slave mode, M8426=1 multi-device mode
RS2 command end operation settings	-	1	2	
MODBUS function	M8196=1 M8125=1	M8192=1	-	
RD3A/WR3A Receive correct mark	M8128	M8408	M8428	Automatic reset
RD3A\WR3A communication over-time mark	M8129	M8409	M8429	Automatic reset
ADPRW command completion mark	M8029	M8029	M8029	Command execution end mark
Communication parameters	D8120	D8400	D8420	
Communication mode	-	D8401	D8421	
Master-slave station number	D8121	D8414	D8434 D8440 D8442	D8434:CAN slave station Number D8440\D8442 multi-device mode ID Number
RD3A/WR3A overtime	D8129	D8409	D8429	Unit: ms (detailed setting,refer to explanation)
RD3A/WR3A interval period	D8126	D8406	D8426	26232 or higher version
RD3A/WR3A end operation -1	0	1	2	
ADPRW command settings	D8126=0	D8126=1	D8126=2	26232 or lower version
ADPRW command settings	D8397=0	D8397=1	D8397=2	26232 or higher version
CAN data frame	-	-	M8427	

M8192: the activation mark of using programming port protocol and other protocol. (26232 and higher version is power lost not retentive).
M8402: Send mark (use when RS2 command).

M8403: Communication completion mark (communication completion flag when using RS command, needs manual reset).
M8404: Data is receiving.
M8408: Communication completion mak (Valid while using ADPRW command).
M8409: Communication time out.
M8029: Communication completion mark (communication completion mark while using ADPRW instruction and needs manual reset).
M8161: 8-bit/16-bit mode distinguishing mark for RS/RS2 command (version 26230 and above, always in 8-bit mode)
D8400: Save the communication parameters of the Modbus RTU protocol
D8401:Save the communication mode of serial port 3.

D8401=H0 represents the RS free communication mode.

When Modbus RTU: D8401=H11 represents PLC as Slave. D8401=H1 represents PLC as Master.
When Modbus ASCII: D8401=H111represents PLC as Slave； D8401=H101represents PLC as Master.
D8406: Interval period. Default as 12 times.
D8409: overtime time. (The unit is milliseconds, it is recommended to set: when the communication rate is greater than or equal to 9600, D8409 is set to 10~20; when the communication rate is set to less than 9600, D8409 is set to 20~50;)
D8414: Save the master or slave station number (The value mast be set as max K255 as master).
D8126: When using the serial port 3 in the ADPRW instruction, set D8126 to 1. (26232 or lower version)
D8397: When using the serial port 3 in the ADPRW instruction, set D8397 to 1. (26232 and higher version)
Support RS2,WR3A,RD3A,ADPRW commands. Can be set in parameter zone, correspond to serial port 3. Parameter zone settings are valid only for this channel. Invalid for serial port 2.

D8400 Parameter set

Bit number	Content
b0	Data length 0:7 bit 1:8 bit
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 1100: Not use 1101:115200bps
b8-b15	Unavailable, Set 0

D8401 Parameter set

b0	Select protocol 0: Other communication protocol 1: MODBUS protocol
b1~b3	Unavailable, Set 0
b4	Master/Slave setting 0: MODBUS Master 1: MODBUS Slave
b5~b7	Unavailable, Set 0
b8	RTU/ASCII Mode selection 0:RTU 1:ASCII
b9~b15	Unavailable, Set 0

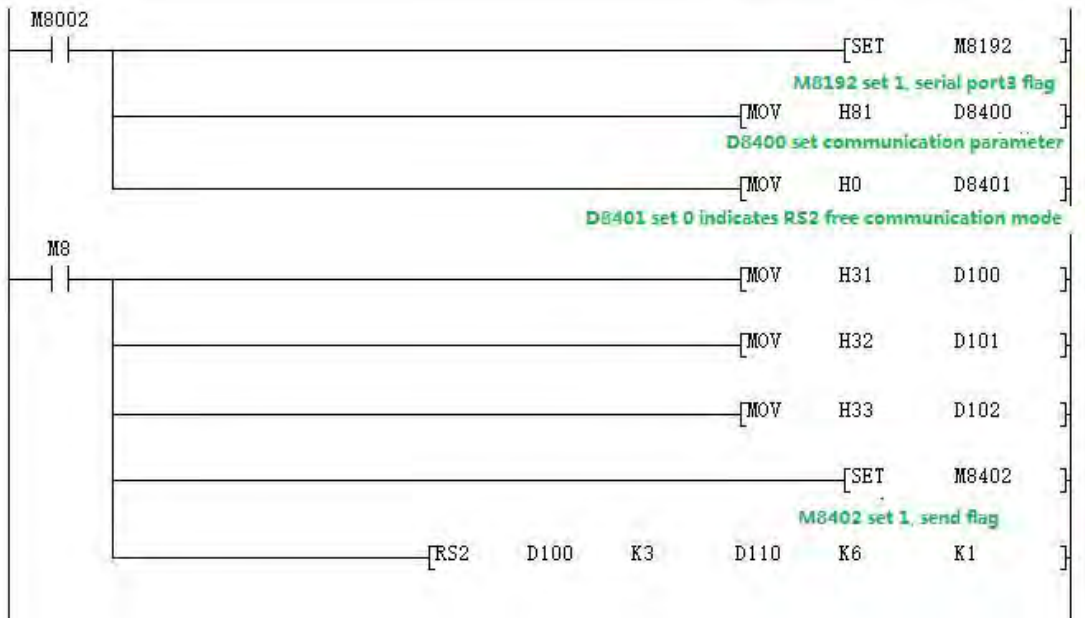
8.4.1 Mitsubishi programming protocol

When using as mitsubishi programming port protocol: set M8192=0.

8.4.2 Free port protocol function

When using as mitsubishi free port protocol: set M8192=1, M8402=1;

Program example:



Use the serial port tool to monitor serial port 3 for data:[2017:11:01:11:49:16][receive]31 32 33
Last parameter of RS2 instruction =1: Serial port 3;
=2: CAN.

8.4.3 Modbus RTU protocol RD3A/WR3A command

Used as MOdbus RTU： set M8192=1; set D8400 as communication parameters, set D8414 s as master slave station no. For example: D8400=H81，D414=K1（communications parameter as 9600/8/n/1,slave station number is 1）

RD3A Program Example (Refer to 8.1.1):

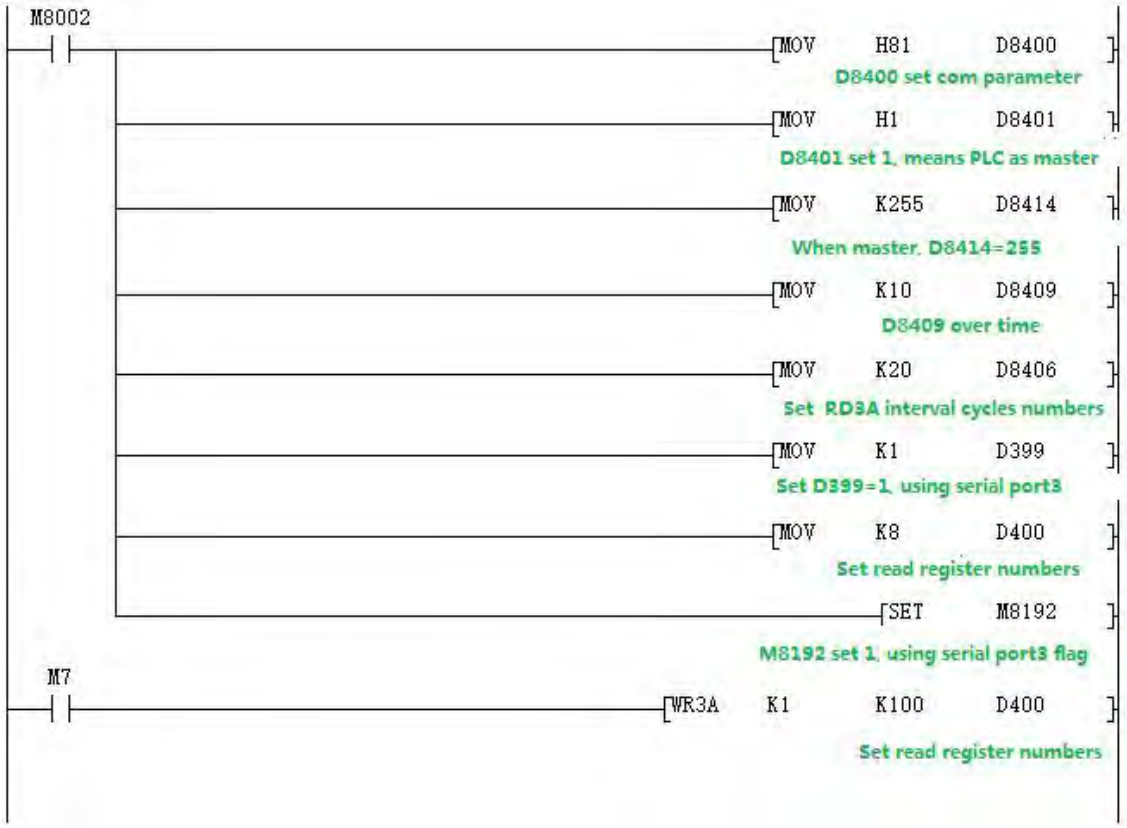
Slave program：

Master program：

Use the serial port tool to monitor serial port 3 for below data:
[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 (Refer to 8.1.1):
Slave program

Master program



Use the serial port tool to monitor serial port 3 for below data:

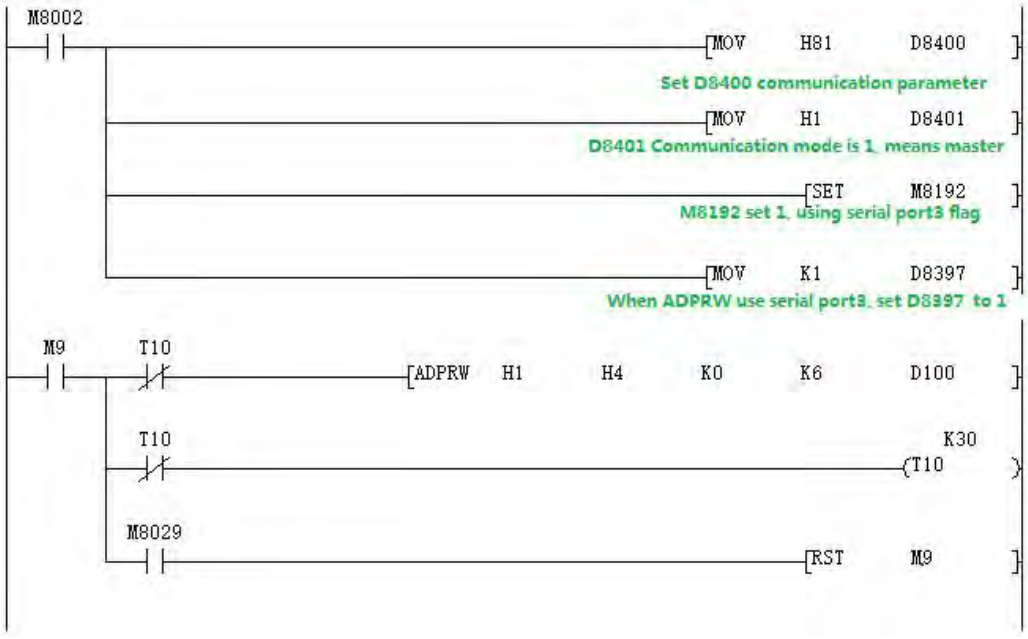
[2017:11:01:09:25:20][receive]01 10 00 64 00 08 10 00 0B 00 16 00 21 00 2C 00 37 00 42 00 4D 00 58 D1 6C

[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

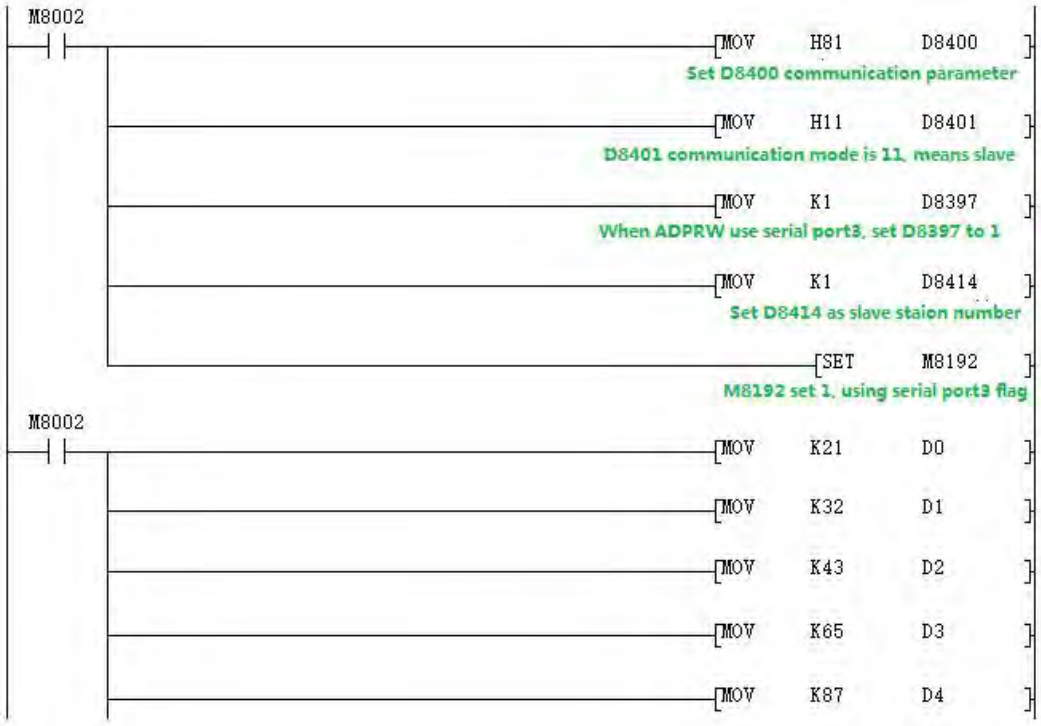
8.4.4 MODBUS RTU ADPRW Command

04 register input readout. **Program Example (Refer to 8.1.2):**

Master program



Slave program



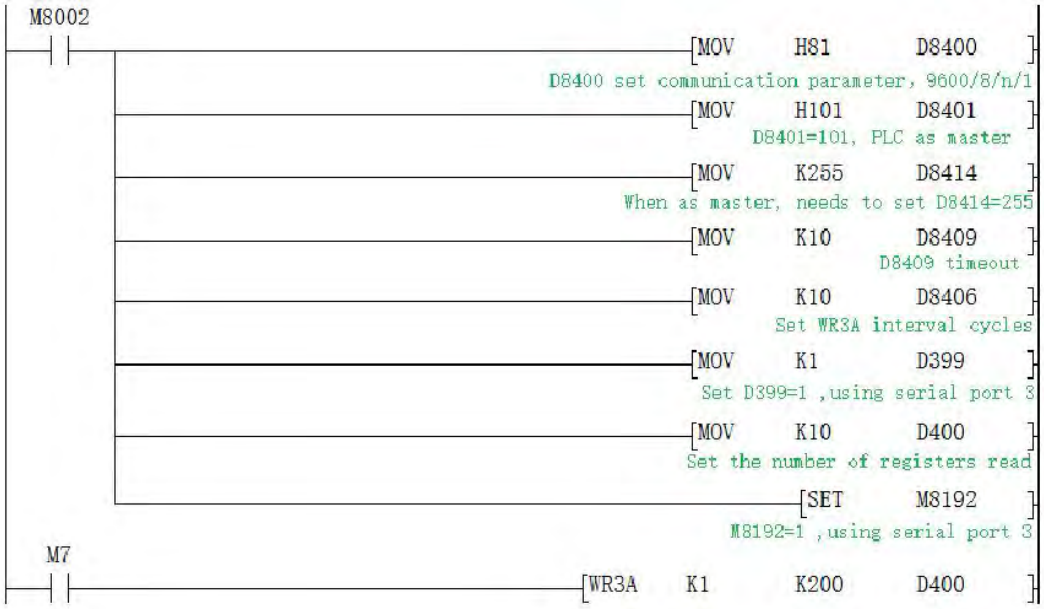
Use the serial port tool to monitor serial port 3 for below data:
[2017:11:01:17:38:34][receive]01 04 00 00 00 06 70 08
[2017:11:01:17:38:34][receive]01 04 0C 00 15 00 20 00 2B 00 41 00 57 00 00 5F A7

8.4.5 Modbus ASCII Function

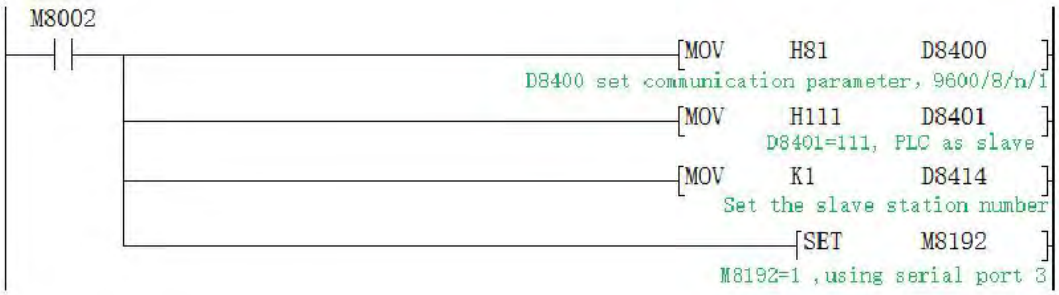
When used as Modbus ASCII protocol,specific parameter setting pls refer to 8.4.3,Only the 8th bit of D8401 is set differently,checking D8120 parameter setting in section 8.4.3.

Note: In modbus ASCII protocol, ADPRW command is not supported.

Master program：



Slave program：



Data of the Slave D100~D109 before and after the program execution is showed as below

Soft components	+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

Monitor D100~D109 data before the master M7 turns on.

Soft components	+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

Monitor D100~D109 data after the master M7 turns on.

8.5 CAN communication port

Support RS2 protocol and MODBUS RTU protocol
The special relays and registers related are as below.

Functions	Serial port 2(A/B)	Serial port 3(A1/B1)	CAN(H/L)	Remark
Programming port	M8196=0	M8192=0	-	26232 or higher version: power lost

				can not be retentive
Freeport protocol function	M8196=1 M8125=0	M8192=1	-	
RS/RS2 sending mark	M8122=1	M8402=1	M8422=1	
RS/RS2 sending completion mark	-	-	M8425	Need to reset manually
RS/RS2 receiving completion mark	M8123	M8403	M8423	Need to reset manually
RS/RS2 receiving process mark	M8124	M8404	M8424	Data is receiving
RS/RS2 command 8/16 bits differentiation mark	M8161	M8161	M8161	
RS2 command CAN master-slave mark	-	-	M8426	M8426=0 master-slave mode, M8426=1 multi-device mode
RS2 command end operation settings	-	1	2	
MODBUS function	M8196=1 M8125=1	M8192=1	-	
RD3A/WR3A Receive correct mark	M8128	M8408	M8428	Automatic reset
RD3A/WR3A communication over-time mark	M8129	M8409	M8429	Automatic reset
ADPRW command completion mark	M8029	M8029	M8029	Command execution end mark
Communication parameters	D8120	D8400	D8420	
Communication mode	-	D8401	D8421	
Master-slave station number	D8121	D8414	D8434 D8440 D8442	D8434:CAN slave station number D8440/D8442 multi-device mode ID number
RD3A/WR3A time-out period	D8129	D8409	D8429	Unit: ms, see explanation for detailed settings
RD3A/WR3A interval period	D8126	D8406	D8426	26232 or higher version
RD3A\WR3A end operation -1	0	1	2	
ADPRW command settings	D8126=0	D8126=1	D8126=2	26232 or lower version
ADPRW command settings	D8397=0	D8397=1	D8397=2	26232 or higher version
CAN data frame	-	-	M8427	

M8422: Send data and needs manual reset.

M8423: Date receiving completion.

M8424: Data is under receiving.

M8425: The transmission is completed and needs manual reset.

M8426: Switch between multi-machine mode and master-slave mode

M8426=1: CAN is in multi-machine mode, there is no master-slave division, and it can transmit up to 8 bytes of data.

M8426=0: CAN is the master-slave mode. There must be one master on the bus line,

which is similar to the MODBUS function.

M8427: =0 means setting as CAN2.OB extension frame. =1 means setting as CAN2.OA standard frame.

M8428: Set as ON while right response of MODBUS communication

M8429: Communication times out.

D8420： Communication parameters.

D8420: The 0th to 9th bits are CAN baud rate, 1K~1023K. The default is 500.

Supported baud rate:5 10 15 20 25 40 50 62 80 100 125 200 250 400 500 666 800 1000.

D8421: Communication protocol and description of master-slave station.

RS2 command: Setting as D8421=H10, which means RS protocol.

RD3A, WR3A, ADPRW command: D8421=H1 is master station, D8421=H10 is slave station.

D8126: When using the ADPRW instruction, set the D8126 to 2 when using CAN. (lower than 26232 version)

D8397: When using the ADPRW instruction, set the D8397 to 2 when using CAN. (versions 26232 and above)

D8426: Interval period. Default as 12 times.

D8429: Time-out period.(The unit is milliseconds, it is recommended to set: when the communication rate setting is greater than or equal to 9600, D8429 is set to 10~20; when the communication rate setting is less than 9600, D8429 is set to 20~50; when using RD3A and WR3A, the master timeout setting is about that of the slave The timeout time is about 6);

D8434: Slave station number.

D8440: Save the local ID number (slave station number).

D8442: When multiplexed, save the slave ID number (the slave what data is read).

D8421 Parameter set

b0	Select protocol 0: Other communication protocol 1: MODBUS protocol
b1~b3	Unavailable, Set 0
b4	Master/Slave setting 0: MODBUS Master 1: MODBUS Slave
b5~b7	Unavailable, Set 0
b8	RTU/ASCII Mode selection 0:RTU 1:ASCII
b9~b15	Unavailable, Set 0

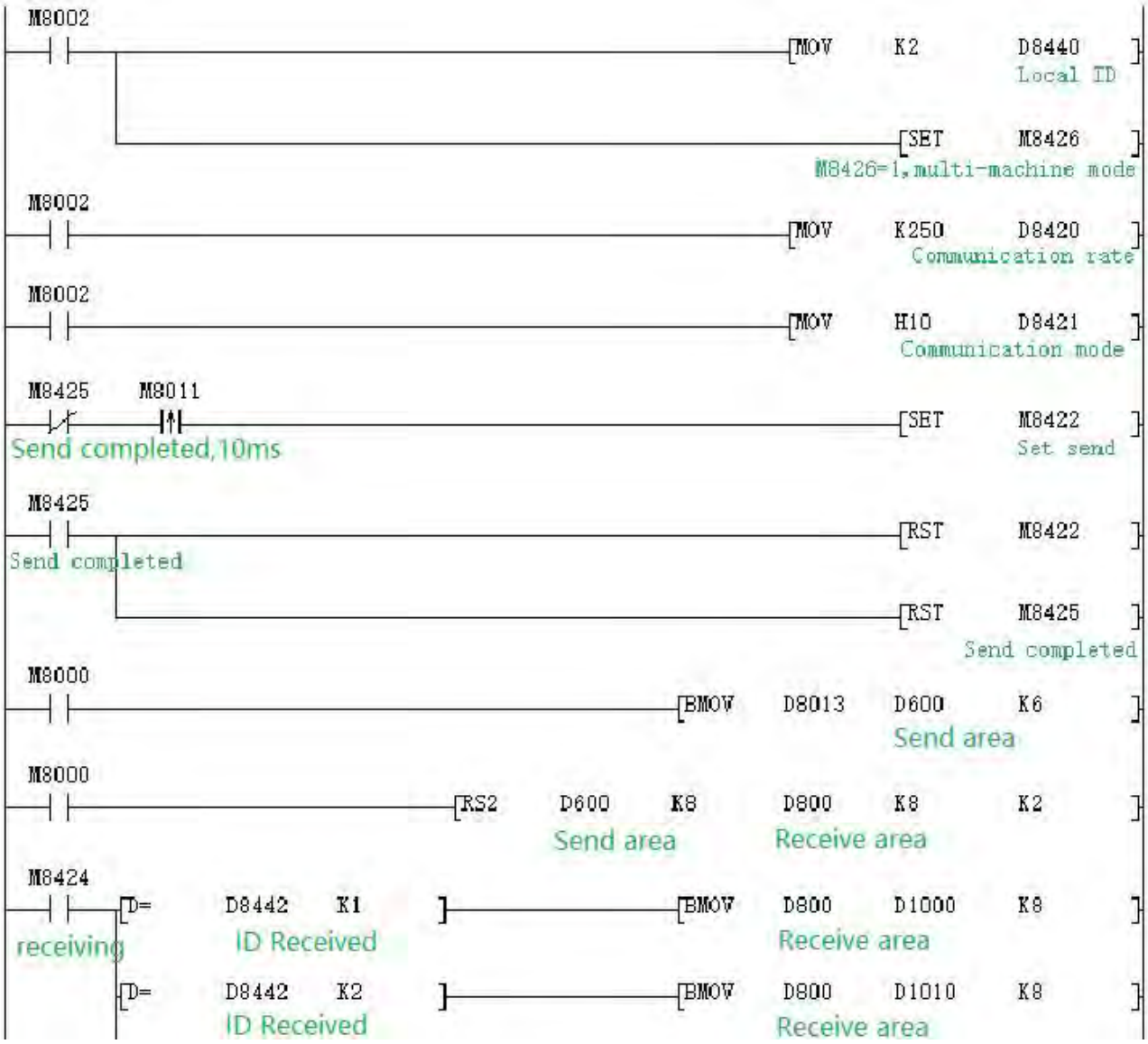
8.5.1 Free port protocol function

When use RS2 command , multiple channels can be interconnected, and each communicated PLC can be distinguished by an ID number.

D8440 saves the local ID number, D8442 saves the ID number of the PLC where the data is read in; ID number uses 32 bits registers, but the setting can only use 29 bits, that is, the upper 3 bits have

no effect.
Up to 8 lengths of data can be sent when using RS2 command.

Program example：



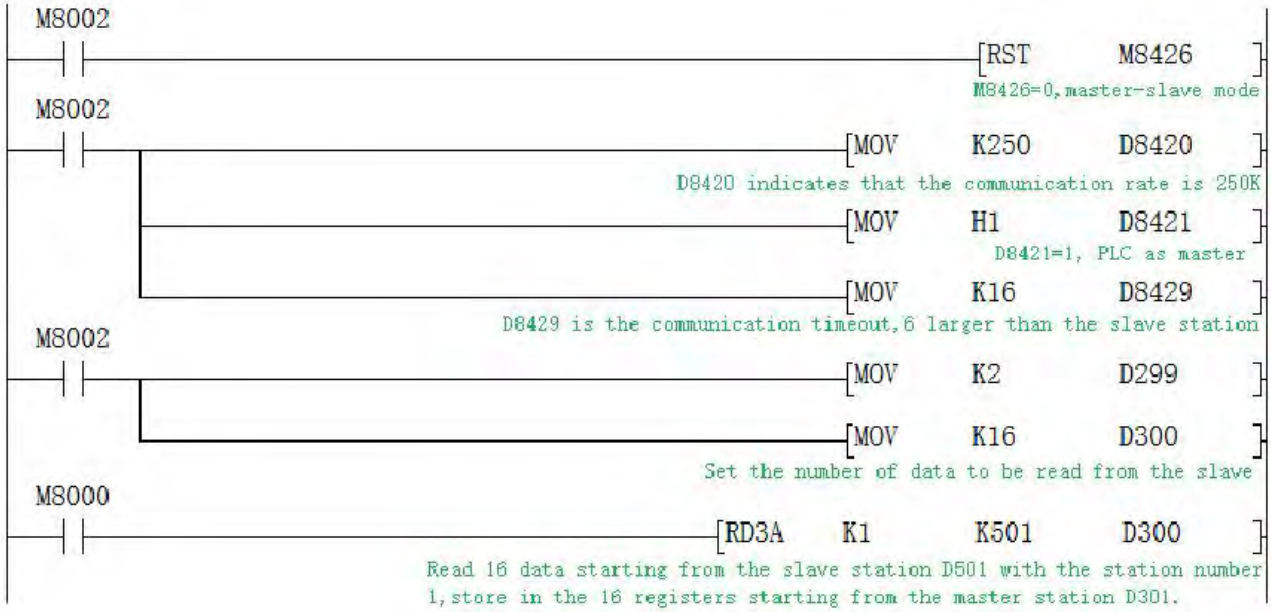
RS2 command last parameter =1: Serial port 3；

=2: CAN.

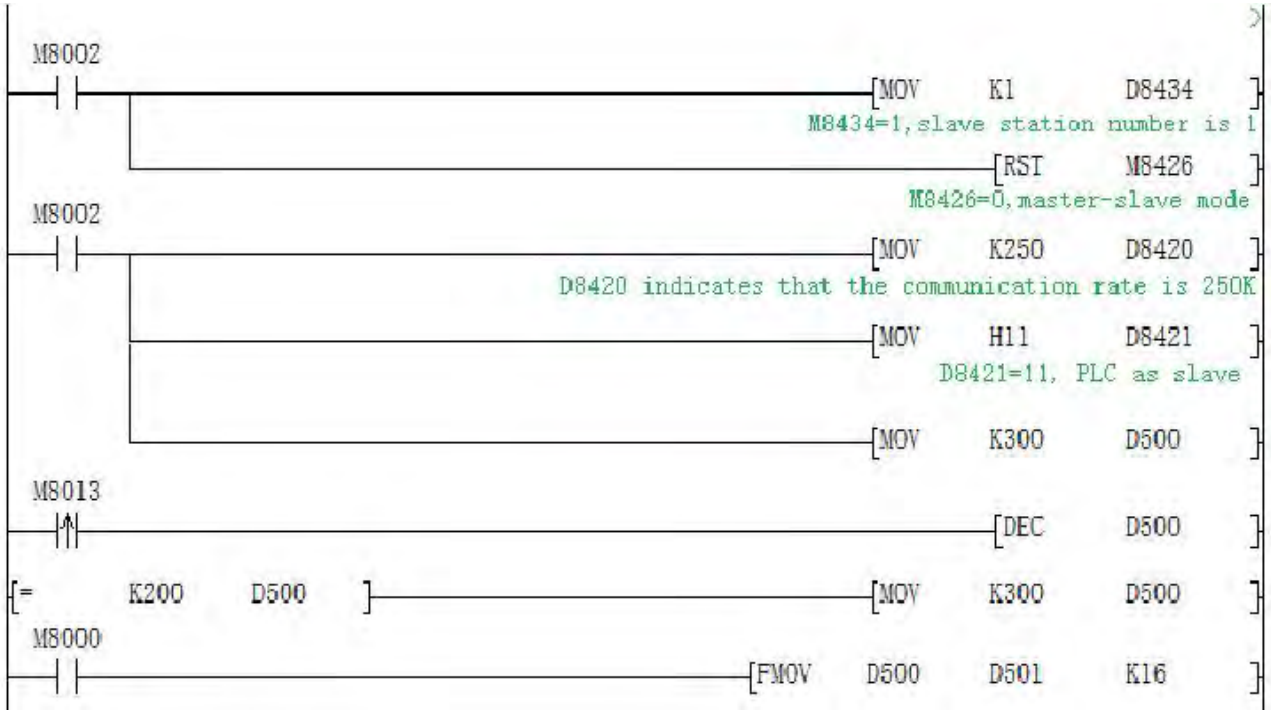
8.5.2 Modbus RTU Function RD3A/WR3A command

RD3A Program Example (refer to 8.1.1)：

Master Program:



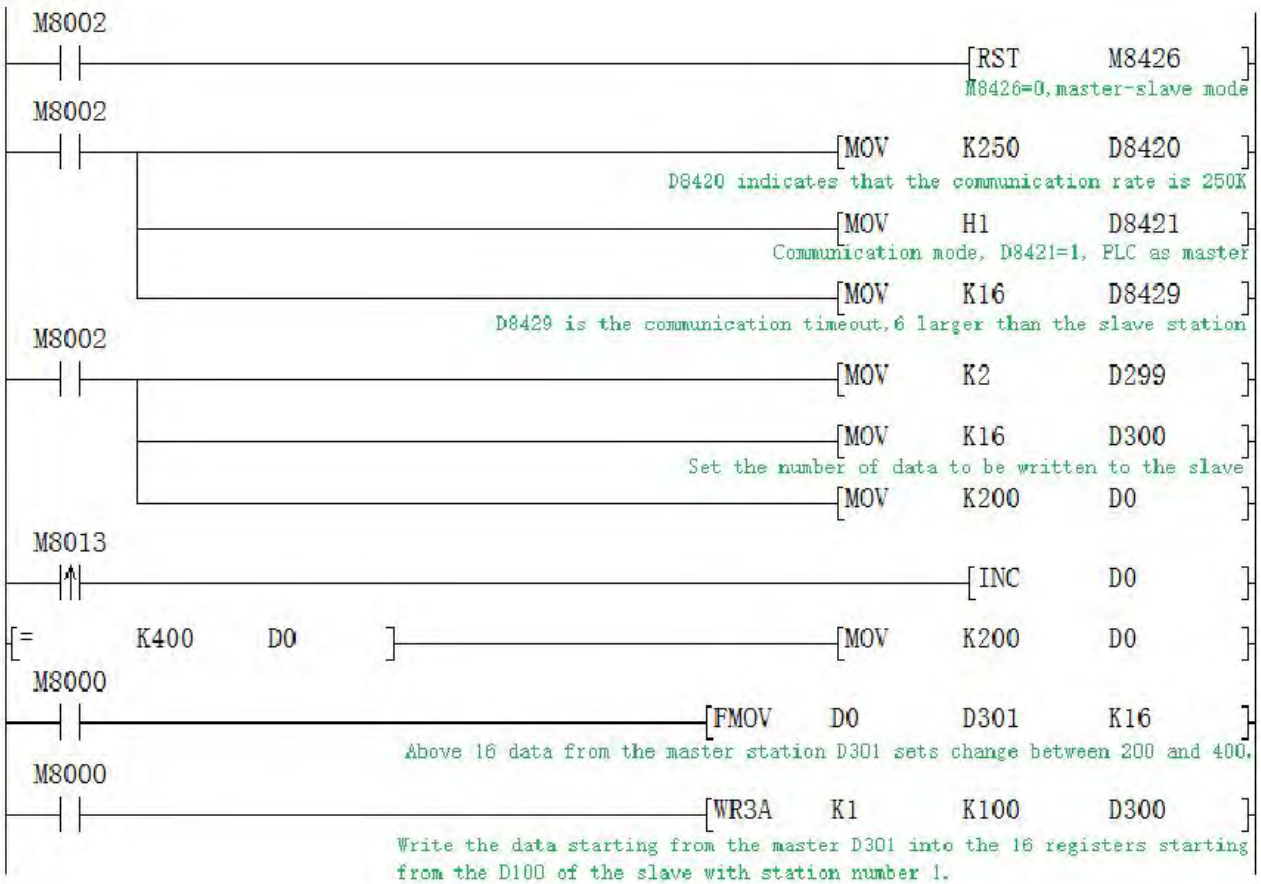
Slave Program:



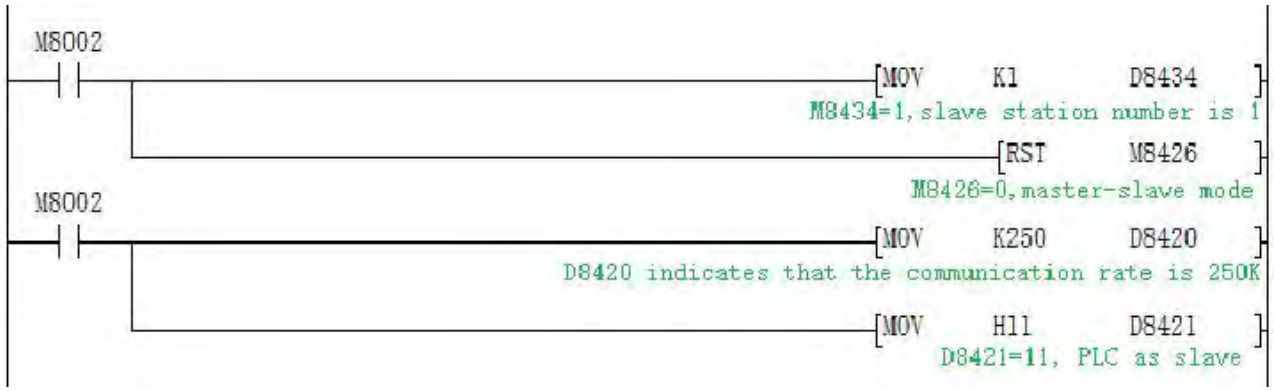
Monitoring the Master station program, the master station 16 data of D301-D316 change between 300-200 at a rate of minus 1 per second.

WR3A Program Example (refer to 8.1.1):

Master Program:



Slave Program:

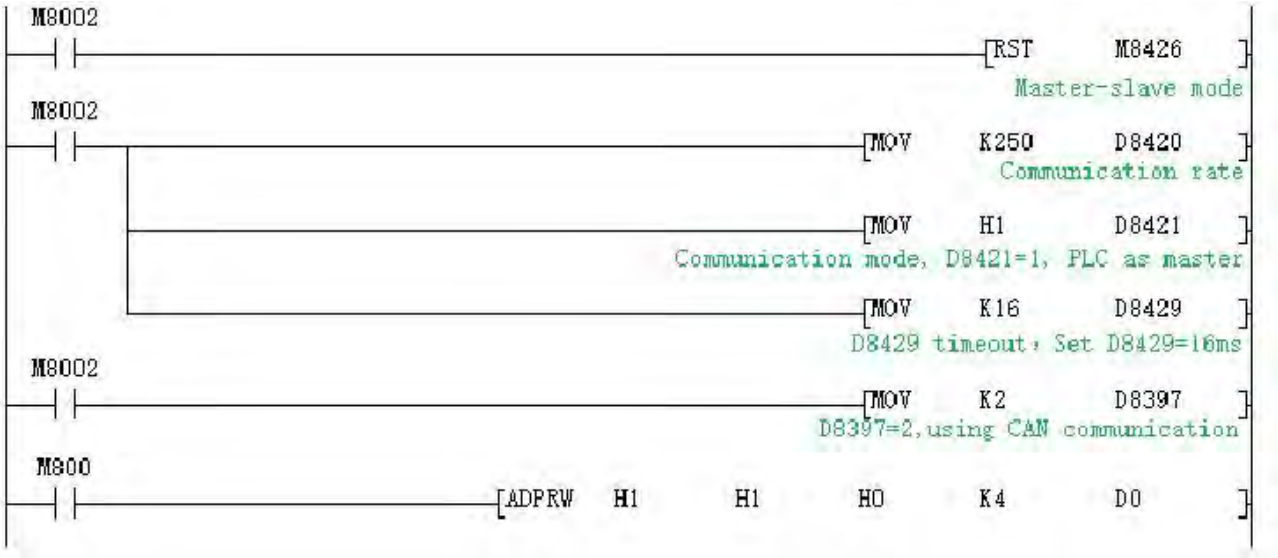


Monitoring the Slave station program, the slave station 16 data of D100-D115 change between 200-400 at a rate of plus 1 per second.

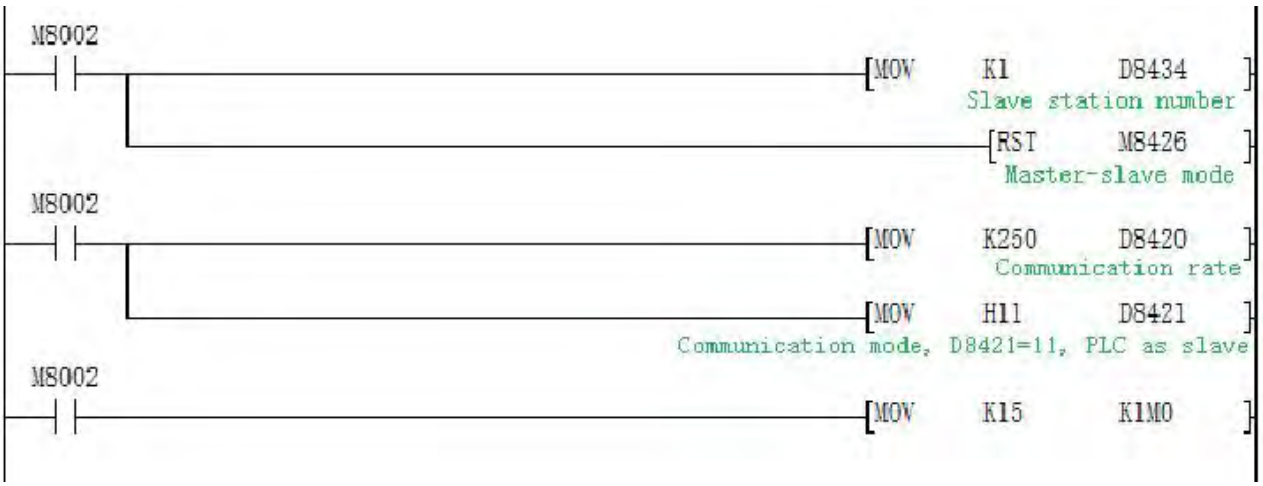
8.5.3 Modbus RTU Function ADPRW command

01 input register **ADPRW program example (refer to 8.1.2)**

Master Program:



Slave Program:



CAN port of the the PLC communicates with the CAN port of the slave PLC, and reads from the 4 bits M0~M3 of the slave PLC to the D0 of the master PLC.

8.6 Network communication

Support Mitsubishi MC protocol, modbus TCP/UDP protocol and EtherNet/IP protocol.

Automatically detect the network after power-on. M8193=1 when there is a network chip, network preparation.

Special relays, registers and registers that IP addresses used are as below.

Functions	Network	Remark
Network preparation	M8193	
Write network address	M8197	26232 or higher version
MODBUS time out	M8062	
IP address conflict	M8063	

Automatically obtain current IP address	M8324	26238 or higher version
Switch mark between Mitsubishi functions and MODBUS	D8395	
ADPRW command settings	D8397=3	
Router address	R23800 R23801	
Mask address	R23802 R23803	
MAC address	R23804~R23806	
Local IP address	R23807 R23808	
Target IP address	R23810 R23811	
Terminal	R23812	Default as 502
RD3A/WR3A command cycling times	R23813	
MODBUS time-out period	R23814	
Send Packets numbers	R23815	26235 and higher version
Receive Packets numbers	R23816	26235 and higher version

M8193：=1 Represents that there is a network chip, network preparation

M8197：=1 Write network address, automatic reset (Not support 26231 version, you can write the above parameters and then restart).

M8062：=1 Represents MODBUS timeout, MODBUS_TCP is used.

M8063：=1 Represents IP address is conflict.

D8395：Switch between Mitsubishi function and MODBUS_TCP

D8395=0：Mitsubishi function

D8395=1：MODBUS_UDP Slave

D8395=2：MODBUS_UDP Master

D8395=3：MODBUS_TCP Slave

D8395=4：MODBUS_TCP Master

D8397：While using ADPRW command, it needs to set D8397 to 3 when using MODBUS_TCP.(26232 and higher version)

R23800,23801 is the router address. Default:192 .168. 1 .1. Namely R23800=0XC0A8，R23801=0X0101.

R23802,23803 is the mask address，Default:0 .0. 0 .0. Namely R23802=0，R23803=0。

R23804~23806 is the MAC address,is generated by the system, basically no duplication,can also be set. Note: MAC addresses on the same network cannot be duplicated, otherwise communication will be abnormal.

R23807，R23808 is the local IP address. Default:192 .168. 1 .250.Namely R23807=0XC0A8，R23808=0X01FA.

R23810,R23811 is the MODBUS target IP，

R23812 Port default =502

R23813 default=100 (Cycle numbers) is the WR3A RD3A sequential execution interval.

R23814 default=20（200ms), is the MODBUS timeout setting, only retry twice, each time = (R23814 * 5) ms.

R23815 is MODBUS transmission packets numbers. (26235 and higher version).
R23816 is MODBUS receive packets numbers. (26235 and higher version).

8.6.1 MITSUBISHI MC protocol

Note: a. MC protocol and cloud configuration background can coexist, even when MC protocol is used, it can also be connected with Coolamy Cloud background.

b. When the MC protocol is used, the default port is 5556.

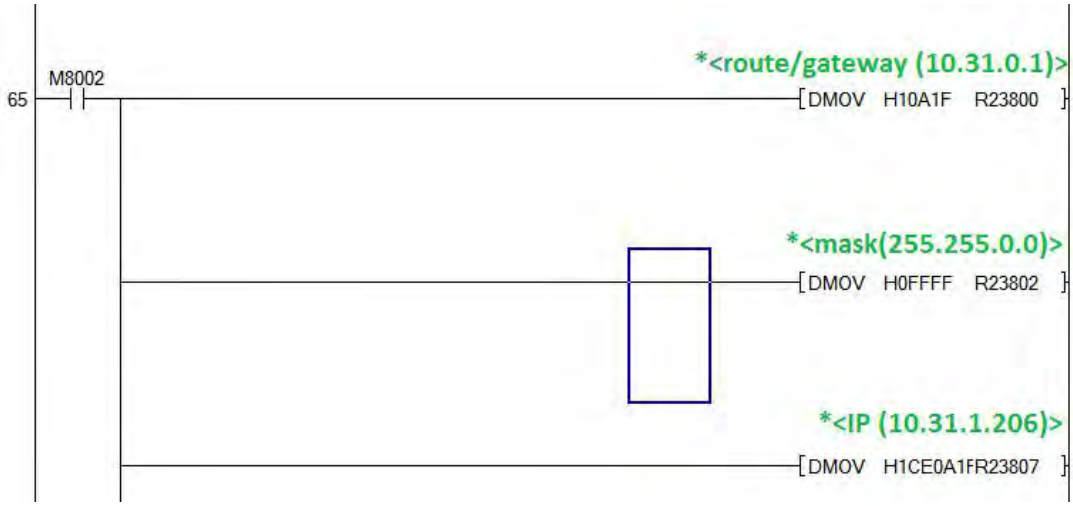
c. When the communication is unsuccessful, check whether the IP of the PLC and HMI is correct (ensure the same network segment), whether the IP of the HMI remote access is correct, whether the HMI protocol is selected correctly, and whether the network cable is connected correctly.

1. Set the IP address of the PLC

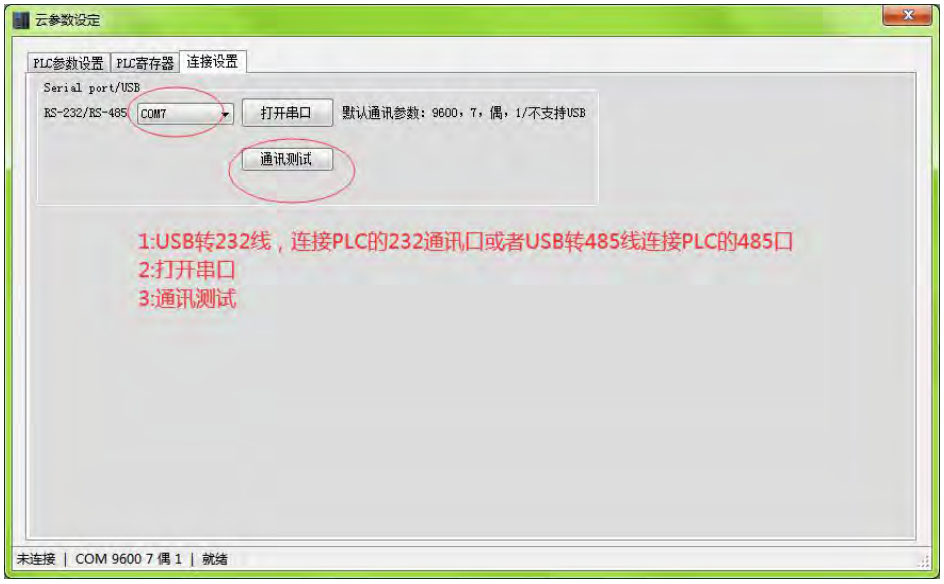
a. Automatic acquisition: M8324 is set when M8002 is powered on

b. Manual settings:

Method 1:
Write directly to the IP register
Router address: R23800 R23801; default 192.168.1.1. That is, R23800=0XC0A8, R23801=0X0101.
Subnet mask: R23802 R23803; default 0 .0. 0 .0. That is, R23802=0, R23803=0.
IP address: R23807 R23808; the default is 192.168.1.250, that is, R23807=0XC0A8, R23808=0X01FA.

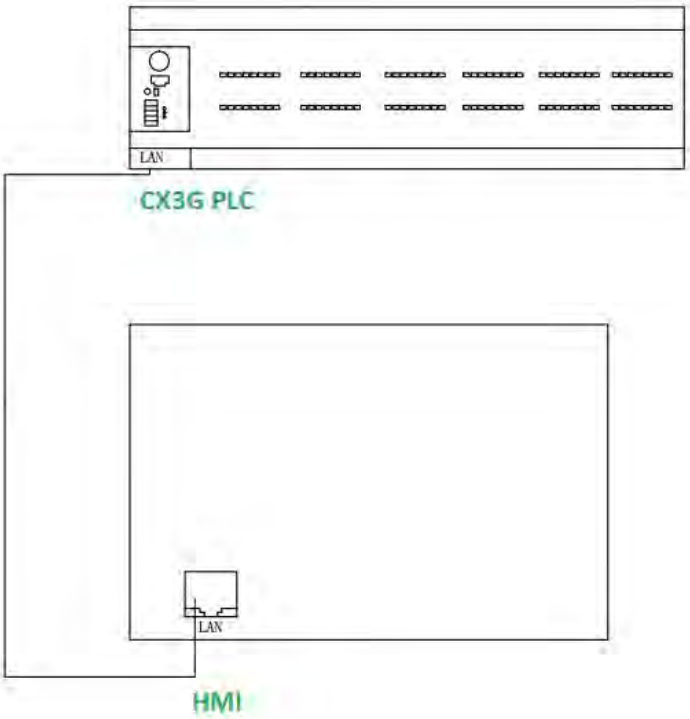


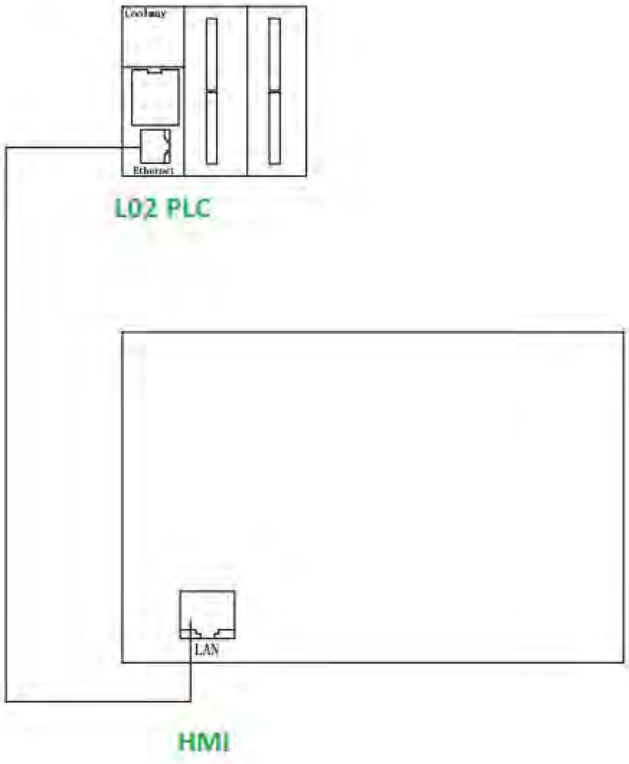
Method 2:
Use cloud parameter setting software (Cloudset.exe) to set



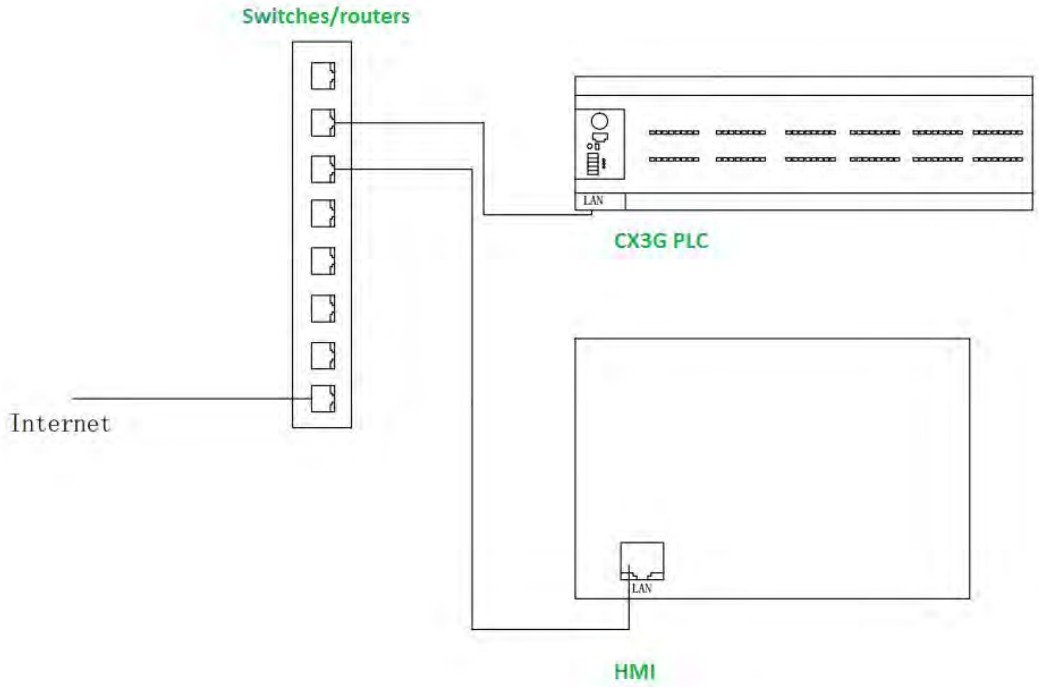
2. Diagram of network connection

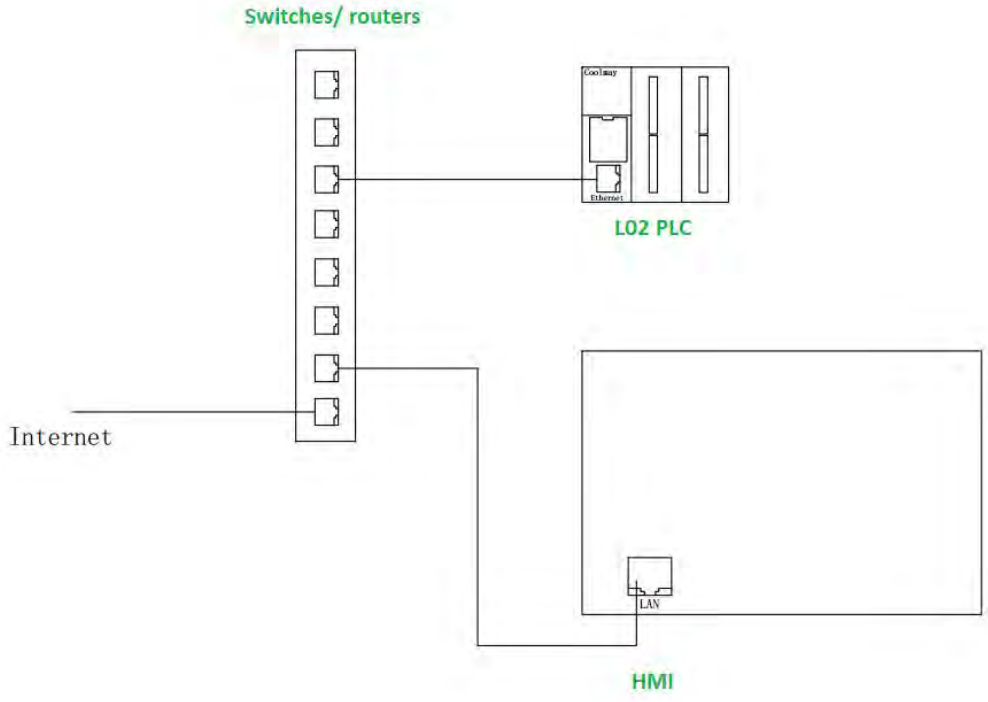
a. Without switching equipment





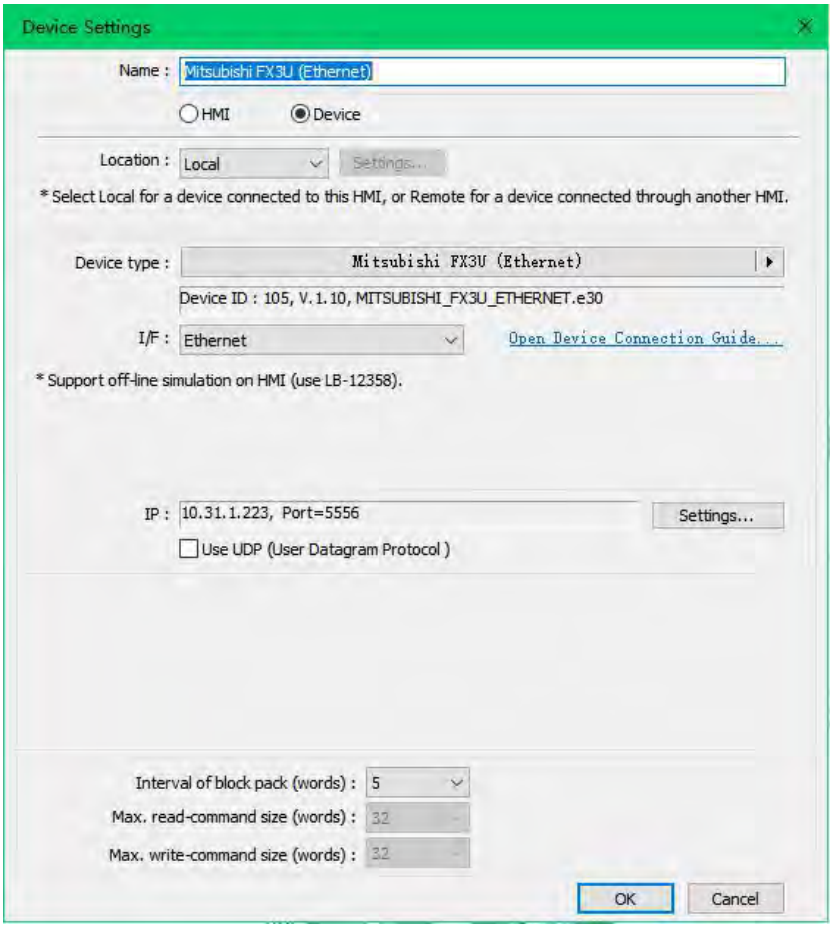
b. Through the switching equipment





3. HMI settings (different manufacturers have different HMI settings)

a. Weilun HMI protocol settings:

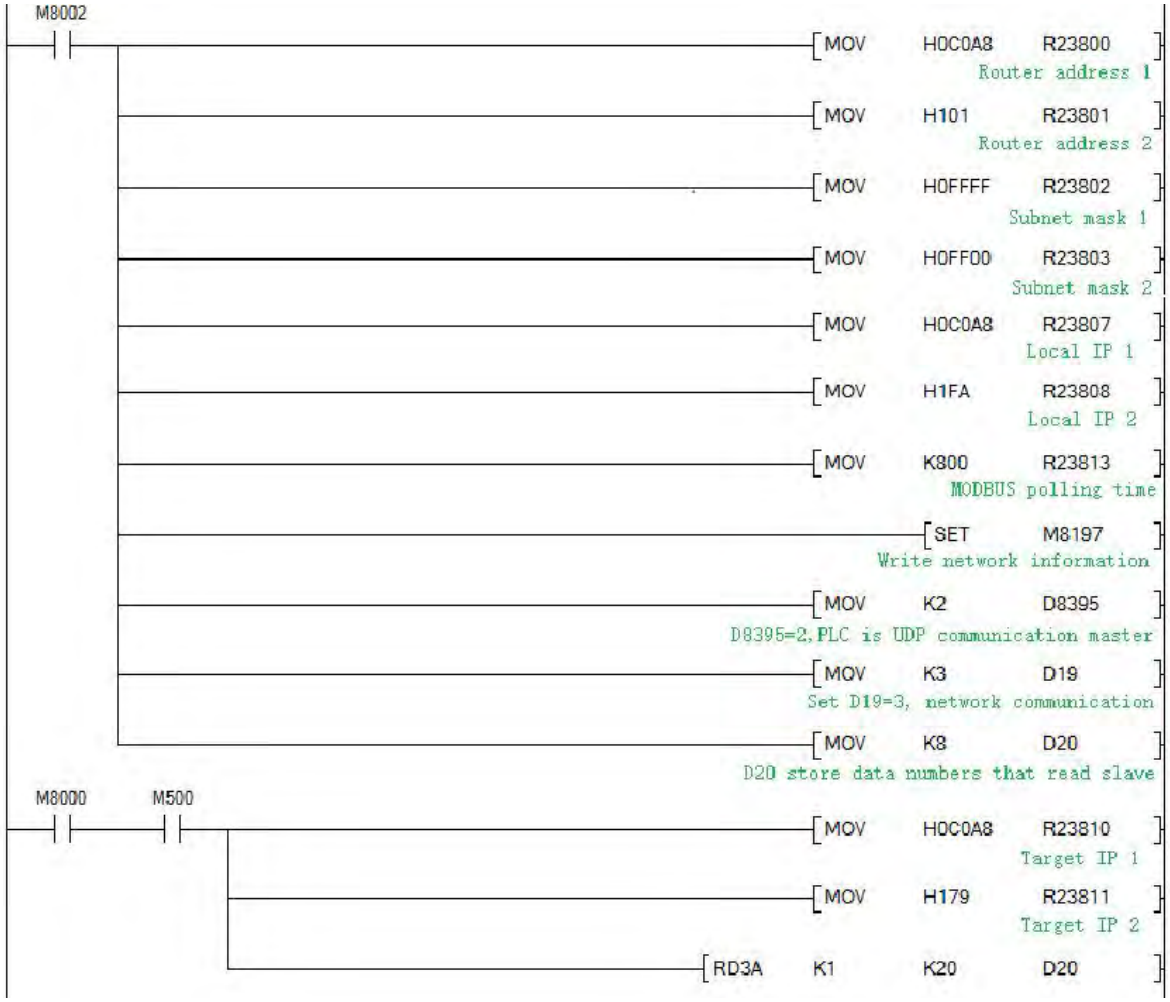


The settings in the above figure indicate that the HMI accesses the PLC whose IP is 10.31.1.223, and the port is 5556.

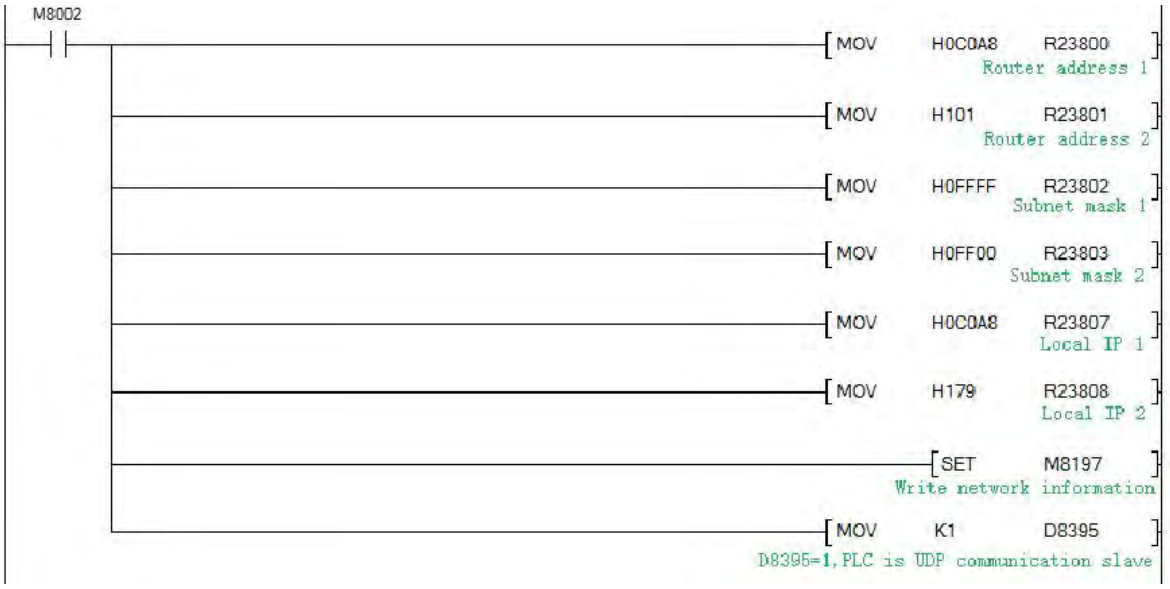
8.6.2 Modbus UDP function RD3A/WR3A command

RD3A Program Example (refer to 8.1.1):

Master Program:



Slave Program:



8.7 Network N:N communication

8.7.1 Related device content

1.N:N network setting device

Soft element	name	content	Set value
M8038	Parameter setting	Set the flag for communication parameters. It can also be used as a flag to confirm the presence of N:N network programs. Do not turn ON in the sequence program.	
D8176	Corresponding station number setting	N:N network setting station number when using. The master station is set to 0, and the slave station is set to 1 to 15. [Initial value: 0]	0~15
D8177	Slave total number setting	Set the total number of slave stations. No setting is required in the PLC of the slave station. [Initial value: 7]	1~15
D8178	Refresh Range setting	Select the mode of the number of device points to communicate with each other. No setting is required in the PLC of the slave station. [Initial value: 0]	0~2
D8394	Serial channel selection	=2：Serial port 2 =3：Serial port 3 =4：CAN	2~4

2. Components for judging N:N network errors

M8184~M8190, M8496~M8503: The data transmission sequence error flag of the slave station. When a data transmission sequence error occurs in each slave station, the corresponding flag bit turns ON.

Station No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Relay	M8184	M8185	M8186	M8187	M8188	M8189	M8190	M8496	M8497	M8498	M8499	M8500	M8501	M8502	M8503

3. Link device

It is a device for sending and receiving information between programmable controllers. The device number and the number of points used differ depending on the station number set in the corresponding station number setting and the mode set in the refresh range setting.

1) Mode 0 (D8178=0):

Station No	Station 0	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7
Word device (4 points each)	D0~D3	D10~ D13	D20~ D23	D30~ D33	D40~ D43	D50~ D53	D60~ D63	D70~ D73
Station No	**Station 8**	**Station 9**	**Station 10**	**Station 11**	**Station 12**	**Station 13**	**Station 14**	**Station 15**

Word device (4 points each)	D80~ D83	D90~ D93	D100~ D103	D110~ D113	D120~ D123	D130~ D133	D140~ D143	D150~ D153

2) Mode 1 (D8178=1):

Station No	Station 0	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7
Bit device (32 points each)	M1000~ M1031	M1064~ M1095	M1128~ M1159	M1192~ M1223	M1256~ M1287	M1320~ M1351	M1384~ M1415	M1448~ M1479
Word device (4 points each)	D0~D3	D10~ D13	D20~ D23	D30~ D33	D40~ D43	D50~ D53	D60~ D63	D70~ D73

Station No	Station 8	Station 9	Station 10	Station 11	Station 12	Station 13	Station 14	Station 15
Bit device (32 points each)	M1512~ M1543	M1576~ M1607	M1640~ M1671	M1704~ M1735	M1768~ M1799	M1832~ M1863	M1896~ M1927	M1960~ M1991
Word device (4 points each)）	D80~ D83	D90~ D93	D100~ D103	D110~ D113	D120~ D123	D130~ D133	D140~ D143	D150~ D153

3) Mode 2 (D8178=2):

Station No	Station 0	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7
Bit device (64 points each)	M1000~ M1063	M1064~ M1127	M1128~ M1191	M1192~ M1255	M1256~ M1319	M1320~ M1383	M1384~ M1447	M1448~ M1511
Word device (8 points each)	D0~D7	D10~ D17	D20~ D27	D30~ D37	D40~ D47	D50~ D57	D60~ D67	D70~ D77
Station No	**Station 8**	**Station 9**	**Station 10**	**Station 11**	**Station 12**	**Station 13**	**Station 14**	**Station 15**
Bit device (64 points each)	M1512~ M1575	M1576~ M1639	M1640~ M1703	M1704~ M1767	M1768~ M1831	M1832~ M1895	M1896~ M1959	M1960~ M2023

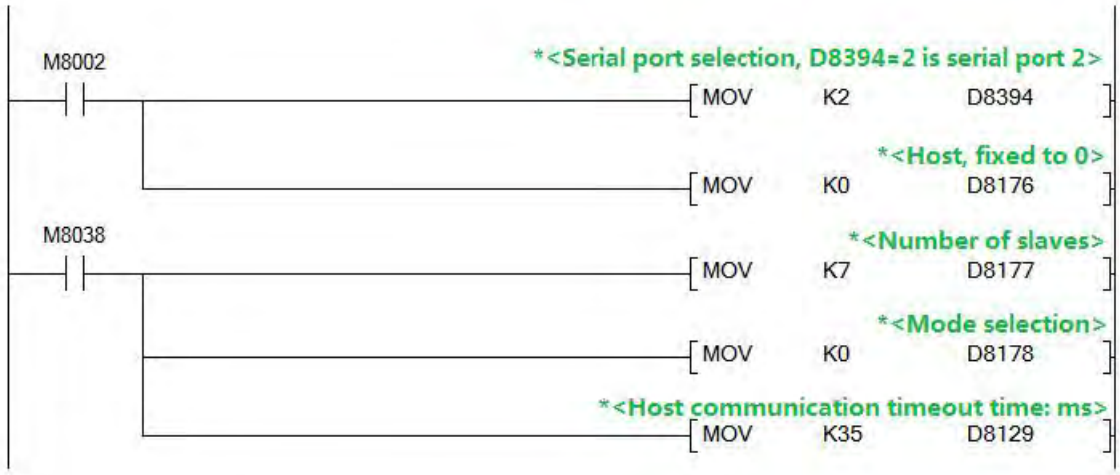
Word device (8 points each)	D80~ D87	D90~ D97	D100~ D107	D110~ D117	D120~ D127	D130~ D137	D140~ D147	D150~ D157

8.7.2 Program setting and description

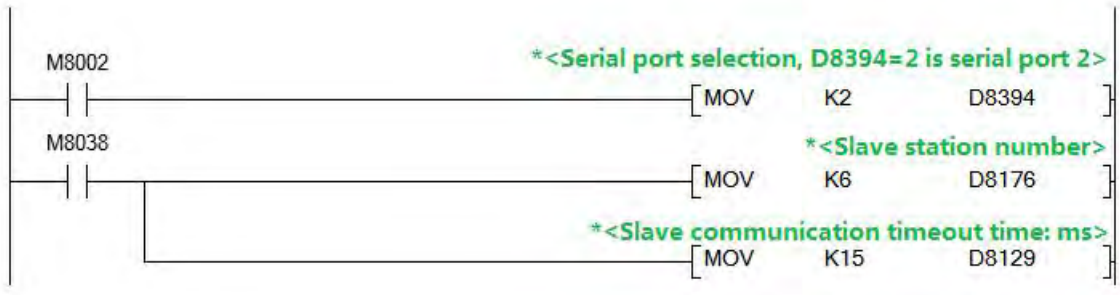
The program settings are as shown below. It is recommended to set the timeout wait register D8129/D8409/D8429 above 12. It is only necessary to set the corresponding special register to achieve the data sharing of the corresponding interval register and auxiliary relay. Channel M8184~M8190 and the rear 8 channels M8496~M8503, you can check the status of each slave, if there is no connection, turn ON

1. Serial port 2

Master program:



Slave program:

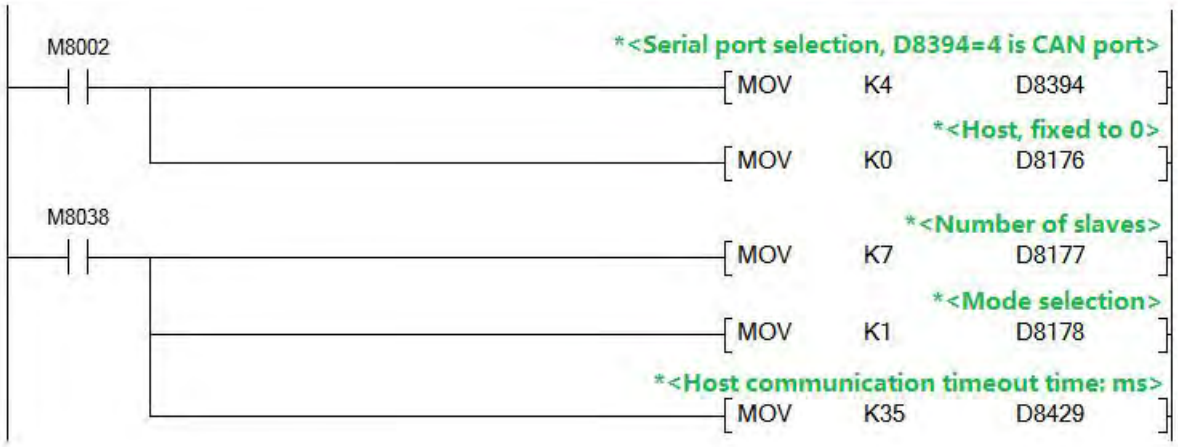


2. Serial port 3

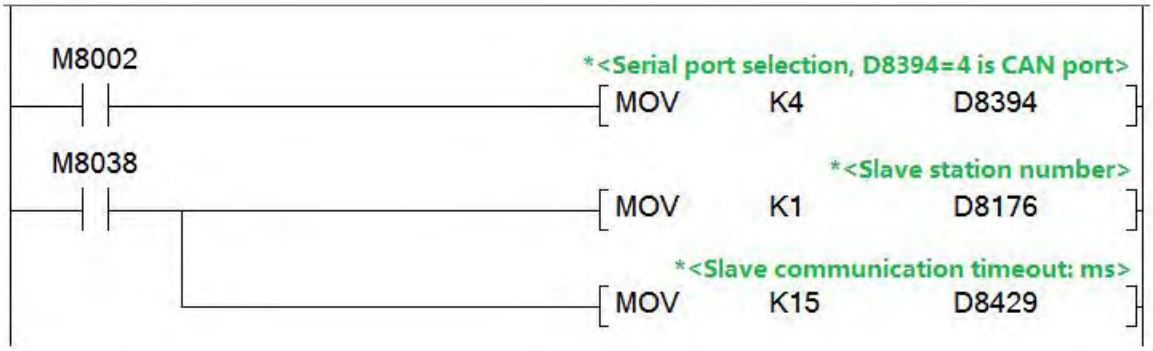
Such as serial port 2, only need the master and slave program to set D8394=3

3. CAN port

Master program:



Slave program:



Appendix Version Change Record

Date	Changed version	Change content
Jul. 2021	V21.71	◆ 8.6.1-- modify the modbus UDP title ◆ 8.7.1-- Modified serial port channel selection register D8394
Aug. 2021	V21.81	◆ 7.3.5 Special Note-- Changed the output frequency
Feb.2022	V22.21	◆ AB(Z) phase 2 channels 60KHz + AB phase 1 channel 10KHz changed to AB(Z) phase 2 channels 30KHz + AB phase 1 channel 5KHz ◆ 6.2 Related devices Added ◆ 8.3.2 Mitsubishi BD Protocol Added ◆ 8.6 Modified some parameters ◆ 8.6.1 Mitsubishi MC Protocol Added