COOLMAY

EX3G PLC/HMI All in one

Programming manual

(plc part: Difference comparing with Mitsubishi FX3G)

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V9.81

Content

1. Overview

1.1 EX3G PLC/HMI Allin one Main Advantage:

◆Powerful, compatible with FX3G/FX3U/FX3S PLC, high processing speed.

◆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.

◆Default With one HMI Downloading port, two PLC programming ports: one MiniB USB port with faster downloading speed;　one Rs232 programming port with 8 mouse hole sockets.

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

◆EX3G-70KH/100HA,PLC is optional to add 1 rs485 or 2rs485(one of rs485 is changed from default rs232)/CAN/ethernet (which can't exist to hmi ethernet port)/WIFI(which will occupy default rs232port)；

HMI is optional to add 1RS232 or RS485/ethernet (which can't exist to plc ethernet port);

43HB(HA)/43(50)KH(A) PLC is optional to add 2 RS485；HMI is optional to add 1 RS232,used for external hmi and inverters.

◆High speed counter.regularly single phase 6 channels 60KHz/ AB(Z) Phase 2 channels 60KHz + AB phase 1 channel 10KHz. EX3G-43HB regularly single phase 8 10KHz；

◆High speed pulse, regular as 8 channels Y0-Y3 in 100KHz,Y4-Y7 in 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.

EX3G-70KH/100HA is up to 16AD/8DA，EX3G-43HB(HA)/43(50)KH is up to 4AD/2DA.Precision of AD/DA is 12bit.Temperature/current/voltage for input. current/voltage for output.

◆EX3G-70KH/100HA is up to 30DI/30DO(MR:28 at most)，DO is optional to choose MR(max:5A)/MT(max:500mA)or mixed MRT；EX3G-43HB(HA)/43(50)KH is up to 12DI/12DO，DO is optional to choose MR(max:5A)/MT(max:2A).

◆Convenient for wiring, adopting 3.81mm pluggable terminals.

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

◆32K steps program capacity, 32k registers of hold on when power off, support interrupt,linear&circular interpolation,PID and self-tuning,high powerful.

◆Flexible, can be customized accordingly.

1.2 Specification

Artical	EX3G-43HB-24M	EX3G-43(50)KH-24M	EX3G-70KH	EX3G-100HA
Image				
Dimension	134*102*30mm	150*93*32mm	226*163*35.6mm	275*194*36mm
Cutout size	119*93mm	143*86mm	218*153mm	261*180mm
Power Consumption	4-6W	4-6W/5-7W	6-7W	6-8W
Features	Support Interrupt,linear arc interpolation,PID auto-tuning,32k program capacity, 32k retentive register			
HMI				
Display	60K colors			
Display size	97*56mm	97*56/108*65mm	154*87mm	222*133mm
Resolution（pixels）	480*272	43KH：480*272 50KH：800*480	70KH:800*480	1024*600
RAM	32MB	64MB		128MB
ROM	128MB			
Operation system	without system	WINCE 5.0		WINCE 7.0
CPU	ARM9 216MHz	ARM9 400MHz		CORTEX A8 720MHz-1GHz;
COM port	1 TP download port	1 TP download port,1 USB 2.0 port		
	1 RS232 optional		1 RS485 or RS232 optional Can't coexist with PLC ethernet port	
Software	CoolMayHMI V5.**(newest vesion pls see Http://coolmay.net)			
PLC				
Digital I/O	Up to12DI/12DO		Up to 30DI/30DO(At most 28 relay outputs)	
I/O level	MT Output: NPN MR output: NO contact Input: Passive NPN, public terminal isolated			
Output type	MR/MOS Maximum load: MOS is 2A; MR is 5A		MR/MT/MRT Maximum load: MT is 500mA; MR is 5A	
High-speed counting	Single phase 6channel 10KHz or AB(Z) 3 channel 10KHz	Normally 6 single phase 60KHz Or 2channel AB(Z) phase 60KHz+AB phase 1 channel 10KHz；		
High-speed pulse	8 channel 10KHz	8channels,Y0-Y3 is 100KHz，Y4-Y7 is 10KHz； Note: High speed counter+High speed pulse should be less 480KHz.		
Analog I/O	Analog input type is EKSTJ type thermocouple (supports negative temperature) / PT100 / PT1000 / NTC10K / NTC50K / NTC100K / 0 ~ 10V/0~5V/0~20mA/4~20mA or mix type and other special specifications		Analog input type is EKSTJ type thermocouple (supports negative temperature) / PT100 / PT1000 / NTC10K / NTC50K / NTC100K / -5V ~ 5V / -10V ~ 10V / 0 ~ 10V/0~5V/0~20mA/4~20mA or mix type and other special specifications	
	AO: 0-10V/0-5V/0-20mA/4-20mA or mixed			
	At most 4AD/2DA		At most 16AD/8DA	
COM port	2 programming ports（1 MiniB type USB port,faster downloading speed；1 Rs232 port）			
	2 RS485 optional		1 rs485 or 2rs485(one of rs485 is changed from default rs232)/CAN(2.0A/B)/ethernet (which can't exist to hmi ethernet port)/WIFI(which will occupy default rs232port) optional	
Software	Compatible with Mitsubishi GX Developer8.86 and WORKS 2			

Regular models：EX3G-43HB/43KH/50KH-16MR/24MR/24MT(-4AD2DA-485P/232H)
EX3G-70KH100HA-16MR/24MR/44MT/44MRT(-16AD8DA-485P/232H)
*EX3G-70HA/100HA: If with 30DI/30DO,the maximum analogs are 5AD/2DA;If with 24DI/20DO,the maximum analogs are 16AD/8DA； Detailed info.refer to：《Coolmay HMI/PLC All-in-on Programming Manual》 《HMI/PLC All-in-one User Manual》 《CoolMay HMI User Manual》 《EX3G PLC/HMI Programming Manual》 《EX3G PLC/HMI User Manual》

1.3 Hardware description

1.3.1 EX3G-43HA/HB structure description and dimension
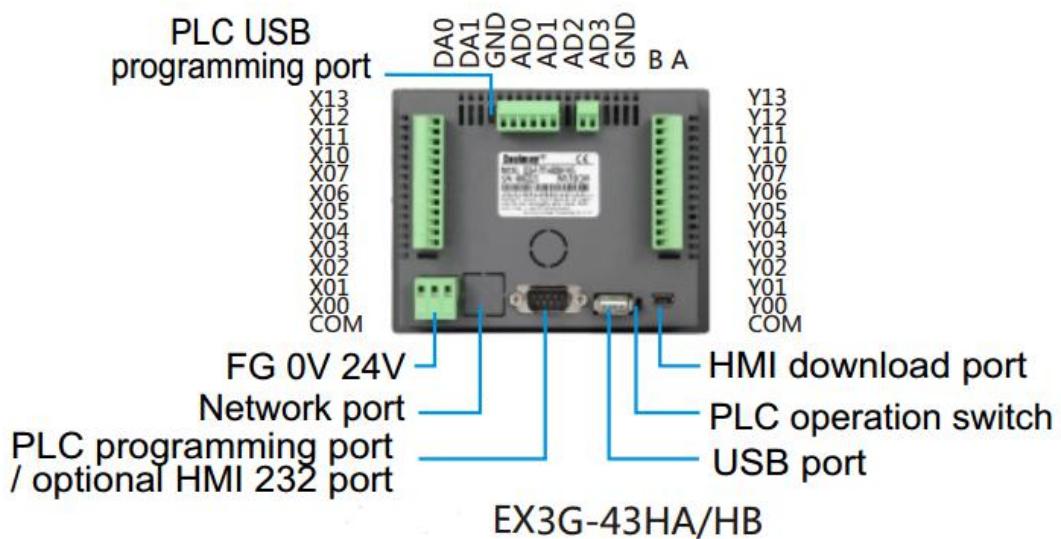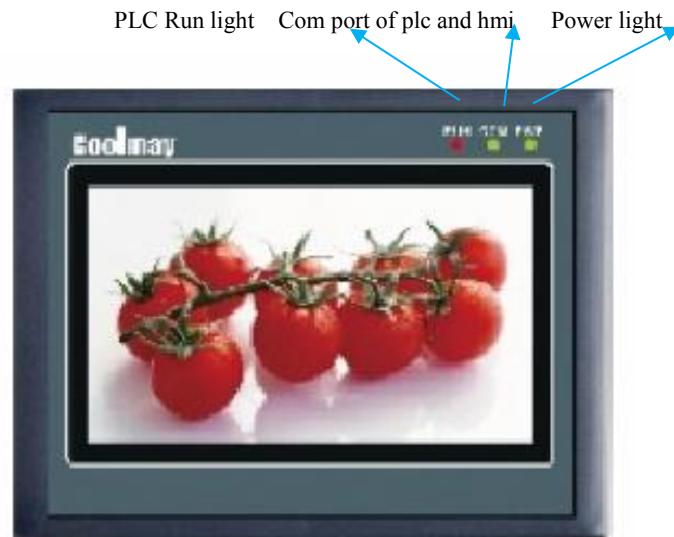
* Dimension(mm)：134*102*30
* Cutout size(mm)： 119*93
* Installation: Clip installation
* Display size(mm): 97*56

1.3.2 EX3G-43(50)KH structure description and dimension

PLC Run light   Com port of plc and hmi   Power light

PLC USB programming port

DA0 DA1 GND AD0 AD1 AD2 AD3 GND B A

X13 X12 X11 X10 X07 X06 X05 X04 X03 X02 X01 X00 COM

Y13 Y12 Y11 Y10 Y07 Y06 Y05 Y04 Y03 Y02 Y01 Y00 COM

FG 0V 24V
Network port
PLC programming port / optional HMI 232 port

PLC Operation switch
HMI download port
USB port

EX3G-43KHB/50KHB
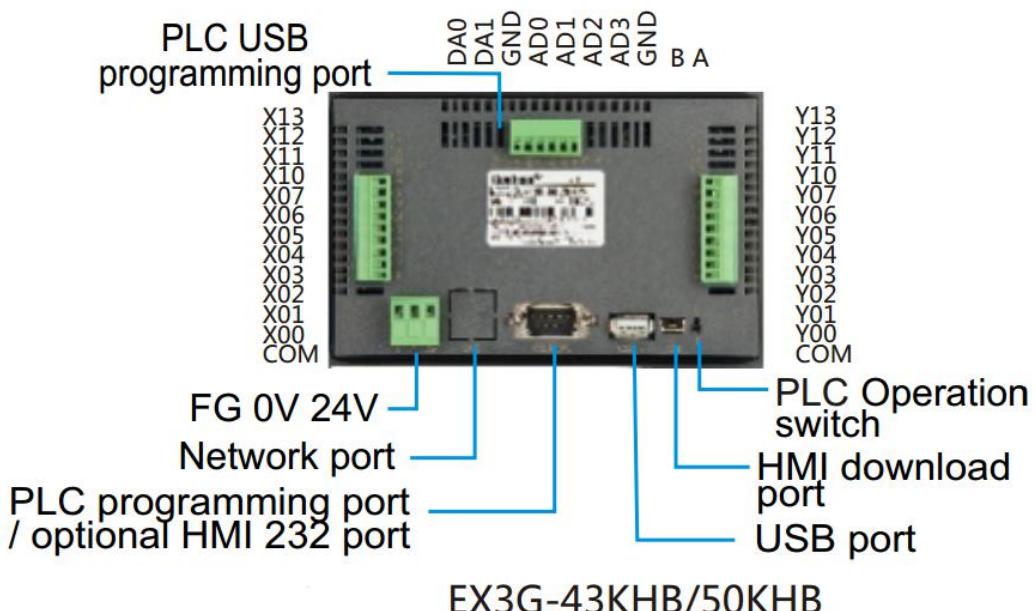
* Dimension(mm)：150*93*32
* Cutout size(mm)：143*86
* Installation:　Clip installation
* Display size(mm):　EX3G-43KH:97*56
　　　　　　　　　　EX3G-50KH:108*65

1.3.3 EX3G-70KH structure description and dimension

PLC Run light   Com port of plc and hmi   Power light

PLC USB programming port   Operation switch

X27 X26 X25 X24 X23 X22 X21 X20 X17 X16 X15 X14 X13 X12 X11 X10 COM X07 X06 X05 X04 X03 X02 X01 X00 COM

Y23 Y22 Y21 Y20 COM4 Y17 Y16 Y15 Y14 COM3 Y13 Y12 Y11 Y10 COM2 Y07 Y06 Y05 Y04 COM1 Y03 Y02 Y01 Y00 COM0

USB port
HMI download port
Network port (optional)
HMI optional RS232/RS485

FG 0V 24V

PLC programming port
(optional RS232/RS485)

EX3G-70KHA/KHB

* Dimension(mm)：226*163*35.6
* Cutout size(mm)： 218*153
* Installation: Clip installation
* Display size(mm): 154*87

1.3.4 EX3G-100HA structure description and dimension

PLC Run light   Com port of plc and hmi   Power light

PLC USB programming port   Operation switch

USB port
HMI download port
Network port (optional)

FG 0V 24V
PLC programming port
(optional RS232/RS485)
HMI optional RS232/RS485
EX3G-100HA/HB
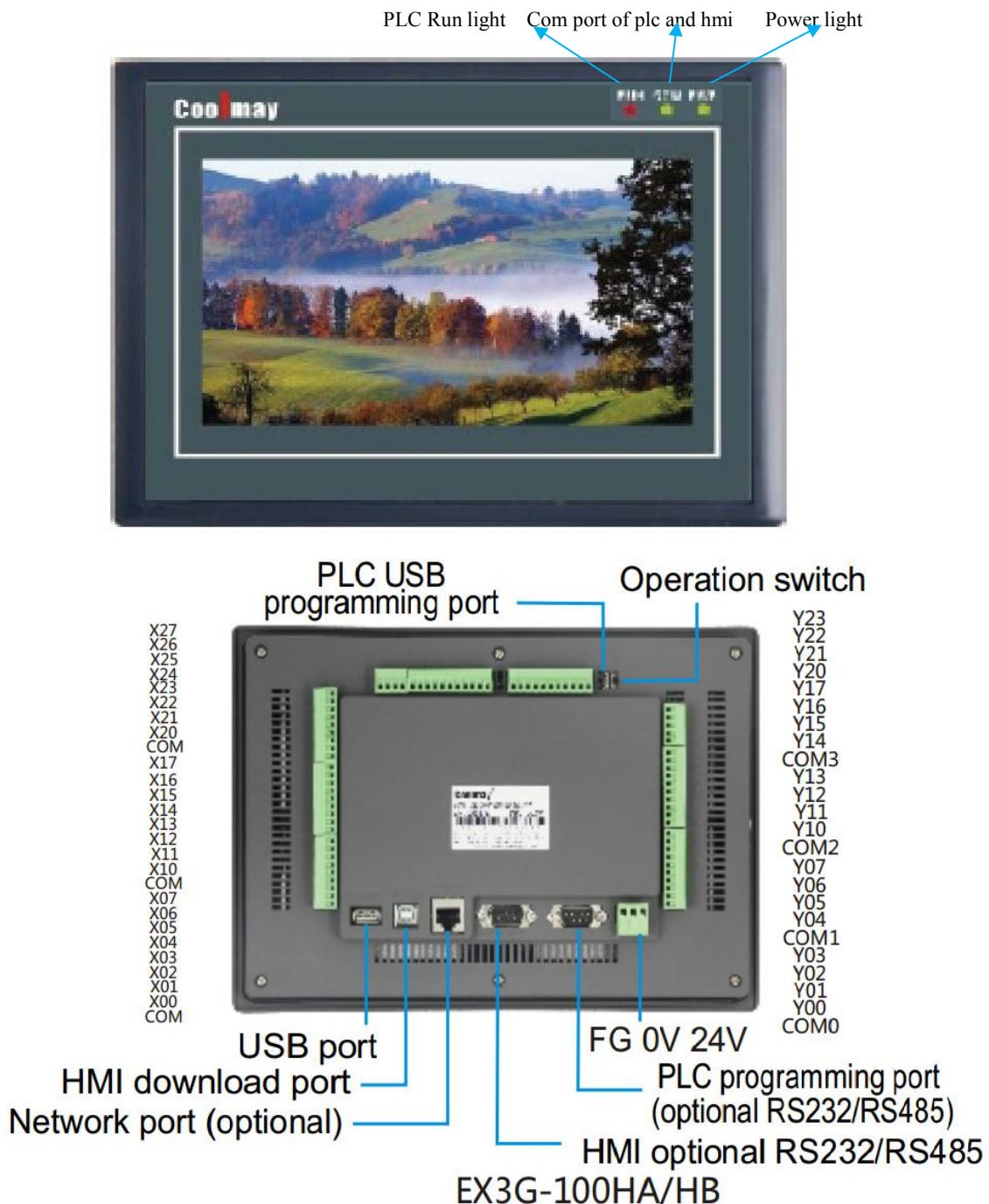
* Dimension(mm)：275*194*36
* Cutout size(mm)：261*180
* Installation: Clip installation
* Display size(mm): 222*133

1.3.5 Introduction of each interface and indicator

POWER: Power indicator, connected to the power light

RUN: PLC running status indicator. This light is on when the PLC is running.

COM: touch screen and PLC communication status indicator, when the two communicate, the light is on

Power terminal: The positive and negative terminals of the DC24V switching power supply are respectively connected to the DC24V and 0V of the power supply terminal.

PLC programming port: two PLC programming ports (MiniB type usb port / RS232), PLC program can be downloaded through 232 programming line or USB cable download

Touch screen programming port: download touch screen configuration program

USB interface: mainly can be directly inserted into the U disk of the file system FAT 32, can also be inserted into the mouse.

For other hardware information, refer to "EX3G Series HMI/PLC All-in-One User Manual"

2. PLC

2.1 PLC Programming notice

The PLC is compatible with GX 8.86/Works 2 and below. If you use other versions of the software,

incompatibility may occur.

When the PLC program is downloaded, there is a prompt error: Cannot specify the com port,

GX 8.86 software: Online - Transfer settings change com port;

Works 2: All targets - Change the com port in all connected targets;

If communication error occurs, cable is abnormal If prompted, remove it by powering off, detecting the cable,

detecting whether the power is normal, or replacing the computer.

In the Works 2 software version, choose the figure : (Note: the label is forbidden)
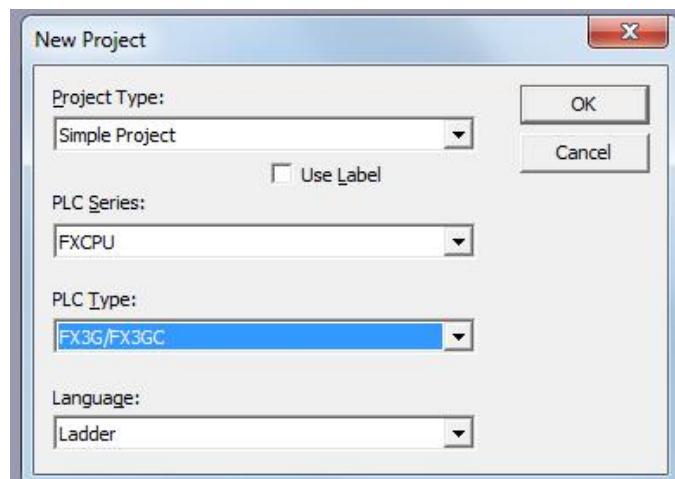
2.2 Soft element table

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	
Signal Alert (EEPROM hold)	S900～S999	100 points	
General*1	S1000～S4095	3096 points	
Timer (ON delay timer)			
100ms	T0～T191	200 points	0.1～3,276.7s
10ms ※1	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 double counter input Bi-direction (32 bit) (EEPROM hold)	C246～C250	Single phase：at most 6 channel, 60kHz Double phase：double frequency：at most 2-3 channels，60KHz	
Double－phase double counter input Bi-direction (32 bit)(EEPROM hold)	C251～C255	M8198 is 4 times frequency sign of C251. Quad frequency：at most 2-3 channels，24kHz M8199 is 4 times　frequency sign of C253.	

Name		Contents	
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	I10□□～I60□□	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.

2.3 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	C228 Increase/decrease counting action	
M8012	Oscillating in 100ms cycle		M8229	C229 Increase/decrease counting action	ON:decrease action
M8013	Oscillating in 1s cycle		M8230	C230 Increase/decrease counting action	OFF:increase 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	
M8032	Retentive memory is cleared		M8239	C239 Increase/decrease counting action	ON:decrease action
M8033	Memory retention stop		M8240	C240 Increase/decrease counting action	OFF:increase 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 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 effective control		M8247	C247 Increase/decrease counting action	
M8048	Signal alarm action		M8248	C248 Increase/decrease counting action	ON:decrease action
M8049	Signal alarm is effective		M8249	C249 Increase/decrease counting action	OFF:increase action
M8050	Input interrupt (I00 is prohibited)		M8250	C250 Increase/decrease counting action	

Num	Content	Remarks	Num	Content	Remarks
M8051	Input interrupt (I10 is prohibited)		M8251	C251 Increase/decrease counting 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 monitoring	
M8057	Timer interrupt (I7 is prohibited)		M8342	Interpolation mode	
M8058	Timer interrupt (I8 is prohibited)		M8343	Interpolation mode	26233 and lower version
M8059	Counter interrupt is prohibited		M8344	Interpolation relative/absolute coordinate	
M8060	I/O Constitute error		M8348	Interpolation counterclockwise	26233and lower version
M8061	PLC hardware error		M8341	Y000 clear signal output function is valid	
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	26234 and higher version
M8066	Loop error		M8346	Y000 zero signal logic inversion	
M8067	Operation error		M8347	Y000 interrupt signal logic inversion	
M8068	Operation error latch		M8348	Y000 positioning command driver	
M8069	I/O bus detection		M8349	1st pulse stop	
M8075	Sample tracking preparation start command		M8350	2nd pulse operation monitoring	
M8076	Sample tracking execution start command		M8351	Y001 clear signal output function is valid	
M8077	Sample tracking execution		M8352	Y001 specify the origin return direction	
M8078	Sample tracking execution end 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		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	Serial Port 2 refer to chapter 2.11	M8359	2nd pulse stop	
M8125	MODBUS and Mitsubishi function enablement		M8360	3rd pulse operation monitoring	
M8128	RD3A/WR3A Receive Completed		M8361	Y002 clear signal output function is valid	
M8129	RD3A/WR3A communication timeout		M8362	Y002 specify the origin return direction	

Num	Content	Remarks	Num	Content	Remarks
M8151	5th pulse operation monitoring		M8363	Y002 forward limit	
M8152	6th pulse operation monitoring		M8364	Y002 reverse limit	
M8153	7th pulse operation monitoring		M8365	Y002 near-point DOG signal logic inversion	
M8154	8th pulse operation monitoring		M8366	Y002 zero signal logic inversion	
M8160	XCH's SWAP function		M8367	Y002 interrupt signal logic inversion	
M8161	8-bit processing mode	Software 26234 and higher	M8368	Y002 positioning command driver	
M8170	Input X000 pulse capture		M8369	3rd pulse stop	
M8171	Input X001 pulse capture		M8370	4th pulse operation monitoring	
M8172	Input X002 pulse capture		M8371	Y003 clear signal output function is valid	
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, C254		M8379	4th pulse stop	
M8199	4 times frequency of C253		M8396	C254 function corresponds to input phase	Refer to chapter 2.9.1
M8200	C200 Increase/decrease counting action		M8401	RS2 command sends standby	
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	ON:decrease action OFF:increase action	M8404	RS2 command data in reception	Serial port 3 Refer to chapter 2.11.2
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

Num	Content	Remarks	Num	Content	Remarks
M8208	C208 Increase/decrease counting action		M8422	RS2 command to send request	Refer to chapter 2.11.4
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	
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	
M8217	C217 Increase/decrease counting action		M8433	Interpolation mode	26235 and higher version
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	

2.4 Special register number and content

Num	Content	Remarks	Num	Content	Remarks
D8000	Watchdog timer		D8146		Low
D8001	PLC type and system version	Main version number	D8147	5th -8th pulse max speed	High
D8002	PLC memory capacity	2...2K steps；4...4K steps；	D8148	5th- 8th pulse acceleration and deceleration time	

Num	Content	Remarks	Num	Content	Remarks
		8...8K steps; When 16K steps and above, D8002=8,D8102 is corresponded to 16,32,64			
D8003	Memory type	10H:Programmable controller built-in memory	D8160	8th position pulse amount	Low
D8010	Scan current value		D8161		High
D8011	Scan time minimum		D8169	Restrict access status	
D8012	Scan time maximum		D8182	Z1 Register contents	
D8013	Second		D8183	V1 Register contents	
D8014	Minute		D8184	Z2 Register contents	
D8015	Hour		D8185	V2 Register contents	
D8016	Date		D8186	Z3 Register contents	
D8017	Month		D8187	V3 Register contents	
D8018	Year		D8188	Z4 Register contents	
D8019	Week		D8189	V4 Register contents	
D8020	Input filter adjustment (0-60ms) initial 10		D8190	Z5 Register contents	
D8030	AD0 analog input value		D8191	V5 Register contents	
D8031	AD1 analog input value		D8192	Z6 Register contents	
D8032	AD2 analog input value		D8193	V6 Register contents	
D8033	AD3 analog input value		D8194	Z7 Register contents	
D8034	AD4 analog input value		D8195	V7 Register contents	
D8035	AD5 analog input value		D8340	1st position pulse amount	Low
D8036	AD6 analog input value		D8341		High
D8037	AD7 analog input value		D8342	Y0 deviation speed Initial value:0	
D8038	AD8 analog input value		D8343	1st pulse maximum speed	Low
D8039	AD9 analog input value		D8344		High
D8040	AD10 analog input value		D8345	Y0 crawling speed Initial value: 1000	
D8041	AD11 analog input value		D8346	Y0 Origin return speed	Low
D8042	AD12 analog input value		D8347	Initial value:50000	High
D8043	AD13 analog input value		D8348	1st pulse acceleration time	
D8044	AD14 analog input value		D8349	1st pulse deceleration time	
D8045	AD15 analog input value		D8350	2nd position pulse amount	Low
D8050	DA0 analog output value		D8351		High
D8051	DA1 analog output value		D8352	Y1 deviation speed	

Num	Content	Remarks	Num	Content	Remarks
				Initial value:0	
D8052	DA2 analog output value		D8353	2nd pulse maximum speed	Low
D8053	DA3 analog output value		D8354		High
D8054	DA4 analog output value		D8355	Y1 crawling speed Initial value: 1000	
D8055	DA5 analog output value		D8356	Y1 Origin return speed	Low
D8056	DA6 analog output value		D8357	Initial value:50000	High
D8057	DA7 analog output value		D8358	2nd pulse acceleration time	
D8058	When DA is current,Bit setting	Refer to 2.7	D8359	2nd pulse deceleration time	
D8059	Constant scan time		D8360	3rd position pulse amount	Low
D8074	X0 Rising edge ring counter value [1/6μs unit]	Low	D8361		High
D8075		High	D8362	Y2 deviation speed Initial value:0	
D8076	X0 falling edge ring counter value [1/6μs unit]	Low	D8363	3rd pulse maximum speed	Low
D8077		High	D8364		High
D8078	X0 pulse width / pulse period [10μs unit]	Low	D8365	Y2 crawling speed Initial value: 1000	
D8079		High	D8366	Y2 Origin return speed	Low
D8080	X1 Rising edge ring counter value [1/6μs unit]	Low	D8367	Initial value:50000	High
D8081		High	D8368	3rd pulse acceleration time	
D8082	X1 falling edge ring counter value [1/6μs unit]	Low	D8369	3rd pulse deceleration time	
D8083		High	D8370	4th position pulse amount	Low
D8084	X1 pulse width / pulse period [10μs unit]	Low	D8371		High
D8085		High	D8372	Y3 deviation speed Initial value:0	
D8086	X3 Rising edge ring counter value [1/6μs unit]	Low	D8373	4th pulse maximum speed	Low
D8087		High	D8374		High
D8088	X3 falling edge ring counter value [1/6μs unit]	Low	D8375	Y3 crawling speed Initial value:1000	
D8089		High	D8376	Y3 Origin return speed	Low
D8090	X3 pulse width / pulse period [10μs unit]	Low	D8377	Initial value:50000	High
D8091		High	D8378	4th pulse acceleration time	
D8092	X4 Rising edge ring counter value [1/6μs unit]	Low	D8379	4th pulse deceleration time	
D8093		High	D8395	Network setting function	Refer to chapter 2.12
D8094	X4 falling edge ring counter value [1/6μs unit]	Low	D8397	ADPRW command serial port position	Refer to chapter 2.11.1
D8095		High	D8398	0~2147483647(1ms) Ring count for incremental actions	Low
D8096	X4 pulse width / pulse period [10μs unit]	Low	D8399		Low
D8097		High	D8400	Modbus RTU protocol Communication parameters	Serial port3 Refer to

Num	Content	Remarks	Num	Content	Remarks
D8101	PLC type and system version	Secondary version number	D8401	Communication mode	chapter 2.11.2
D8102	PLC memory capacity	16...16K steps	D8406	Number of intervals	
D8108	Number of special modules connected		D8409	overtime time	
D8109	Y number of output refresh error		D8410	RS2 header 1, 2 <initial value: STX>	
D8120	Modbus RTU protocol Communication parameters	Serial port2 Refer to chapter 2.11	D8411	RS2 header 3, 4	
D8121	Master and slave station number		D8412	RS2 trailer 1, 2 <initial value: ETX>	
D8122	RS command to send data remaining points		D8413	RS2 trailer 3, 4	
D8123	RS command to receive points monitoring		D8414	Master and slave station number	
D8124	RS header <initial value: STX>		D8415	RS2 receives the summation calculation result	
D8125	RS trailer <initial value: ETX>		D8416	RS2 sends summation	
D8126	When the serial port 2 uses the ADPRW command, the value is 0.	26232 lower	D8420	Communication parameters	CAN communication Refer to chapter 2.11.4
D8126	Serial port 2 interval period number	26232 and higher	D8421	Communication mode	
D8127	Specify the starting number of the communication request of the lower computer	Serial port2 Refer to chapter 2.11	D8426	Number of intervals	
D8128	Specify the number of data requested by the lower computer communication		D8429	overtime time	
D8129	Set timeout		D8430	RS2 header 1, 2 <initial value: STX>	
D8140	5th position pulse amount	Low	D8431	RS2 header 3, 4	
D8141		High	D8432	RS2 trailer 1, 2 <initial value: ETX>	
D8142	6th position pulse amount	Low	D8433	RS2 trailer 3, 4	
D8143		High	D8434	RS2 receives the summation receive data	
D8144	7th position pulse amount	Low	D8435	RS2 receives the summation calculation result	
D8145		High	D8436	RS2 sends summation	

Special relay and register not supported

※ Special relay not supported

M8004~M8010，

M8015~M8019，

M8024~M8027，

M8030，

M8038~M8039,

M8040~M8044，

M8060~M8074，

M8084~M8119，

M8130~M8159，

M8161~M8169，

M8178~M8191，

M8256~M8339,

M8370~M8395，

M8430~M8511.

※ special register not supported

D8004~D8009，

D8042~D8067，

D8069~D8073，

D8105~D8119，

D8150~D8168，

D8200~D8329，

D8468~D8511.

Specific functions please refer to 《Mitsubishi FX3G programming manual》

2.5 Applied instructions【Sequence is according to instruct variety】

(Contrast with MITSUBISHI FX3G PLC)

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	Shift instruction
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)	★

Mnemonic	FNC No.	Function	Support
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	★

2.6 Analog input

This section refers to the software version query, the version number is stored in the special register D8001, D8101, if necessary, please query the value of D8001.

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.

2.6.1 Analog input (temperature)

Below table for software version 26210

Input signal	Range	Register value	Resolution	Accuracy (Total Measuring range)
K-type thermocouple	0～1100℃	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	0～1100℃	Room temperature ～11000	0.1℃	1%
K-type thermocouple (Negative temp)	-210～1200℃	-2100～12000	0.1℃	1%
T-type thermocouple	0～420℃	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 higher

Input signal	Range	Register value	Resolution	Accuracy (Total Measuring range)
K-type thermocouple	0～1100℃	Room temperature ～11000	0.1℃	1%
K-type thermocouple (Negative temp)	-210～1200℃	-2100～12000	0.1℃	1%
T-type thermocouple	0～420℃	Room temperature ～4200	0.1℃	1%
T-type thermocouple (Negative temp)	-210～420℃	-2100～4200	0.1℃	1%
S-type thermocouple	0～1710℃	Room temperature ～17100	0.1℃	1%
S-type thermocouple (Negative temp)	-26～1710℃	-260～17100	0.1℃	1%
J-type thermocouple	0～800℃	Room temperature ～8000	0.1℃	1%
J-type thermocouple (Negative temp)	-90～950℃	-900～9500	0.1℃	1%
E-type thermocouple	0～600℃	Room temperature ～6000	0.1℃	1%
E-type thermocouple (Negative temp)	-110～730℃	-1100～7300	0.1℃	1%
PT100/PT1000	-200～500℃	-2000～5000	0.1℃	1%

NTC50K/100K	-48～210℃	-480～2100	0.1℃	1%
NTC10K	-48～110℃	-480～1100	0.1℃	1%
Voltage	0～10V/0-5V/ -10～10V/-5～5V	0～4000	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.

2.6.2 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.

K type thermocouple (1~4 channel) are in the 4 registers from R23680, the 5th is temperature compensation, R23684 reveals the environment temperature. The below keep the same, that is to say that read thermocouple (6~16 channels) are the 11 registers from R23685

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

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

Other types of registers read values are shown below table:

NO	PT100	NTC10K	0~10V/0-5V/0~20mA	4~20mA
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,<3.8mA,value is 32760,which is the disconnection value.

2.6.3 Analog input reading 2   (for Main software version 26220)

Thermocouple K (negative temperature), T type, T type (negative temperature) register read values are shown as below table:

No	K type(negative temperature)	T type	T type(negative temperature)
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

2.6.4 Analog input reading 3   (for Main software version 26230 and higher)

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

The register is directly read: D[8030]~D[8045] is the output value set for the corresponding type, the constant scan time is changed to D8059, and it is started by M8039 (version 26232 and above);

NO	Register Value
AD0	D8030
AD1	D8031
AD2	D8032
AD3	D8033
AD4 (environment temp)	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. You can do 16 channels without the thermocouple type.

Tthermistor NTC is shown as below table:

NO	Register Value
AD0	R23660
AD1	R23661
AD2	R23662
AD3	R23663
AD4	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).

R23980 starts with a negative temperature amplification. The default is 4633 (temporarily only have negative temperature amplification).

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

2.6.5 Analog input sampling

Filtering cycles=(R23600~R23615)* PLC scanning time, if R23600=1, One PLC scan cycle sample one time and change the 1st analog input 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), data can't be equal to or less than 0;
D8073 is smoothing filter coefficients of all analog input, range: 0~999

2.6.6 Demo example

Below is an example of EX3G 1 channel temperature analog AD0 acquisition. The program reads the values as follows:
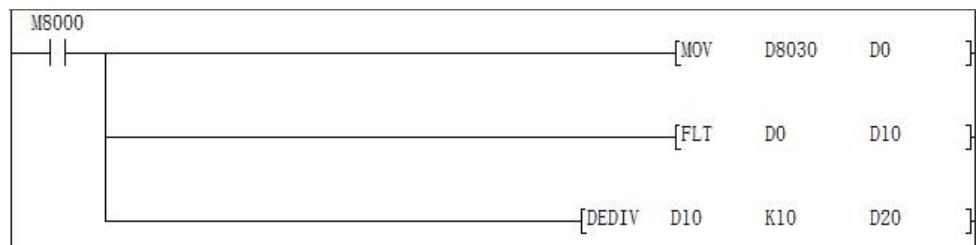
Connect the signal terminal of the temperature sensor to the AD0 input of the PLC and the other end to the GND of the analog input port.

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:
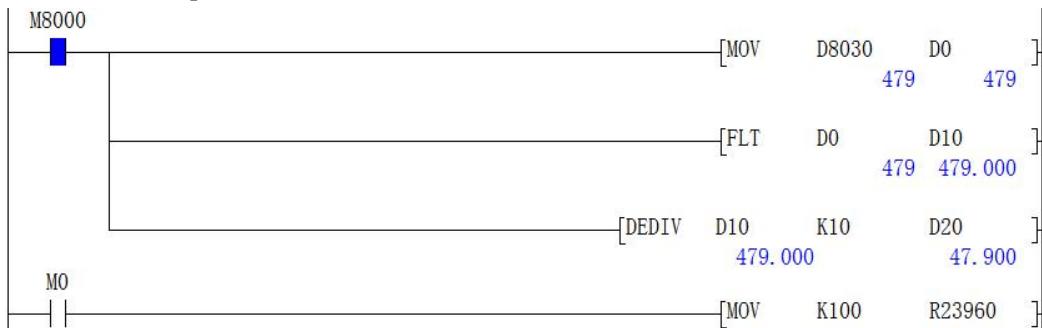
If the current temperature is 37.9℃,the actual test is 47.9 ° C, the error is 10 ° C, you need to modify the size correction register, show as below:
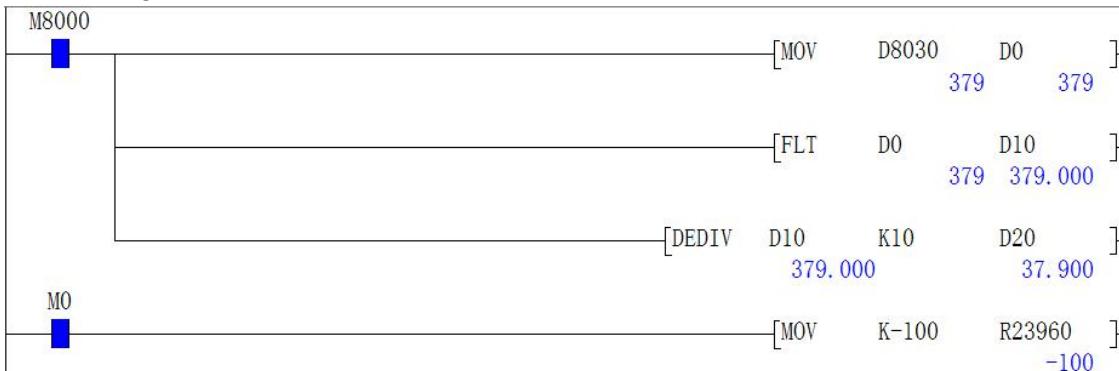
In the above figure, when M0 is closed, the value -100 is transmitted to the correction register R23960, and now you can see that the value of the actual measured temperature D20 is close to the actual temperature which is 37.9 ℃.

2.7 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.

	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	

Example：Below shows the 0-10V voltage analog output.
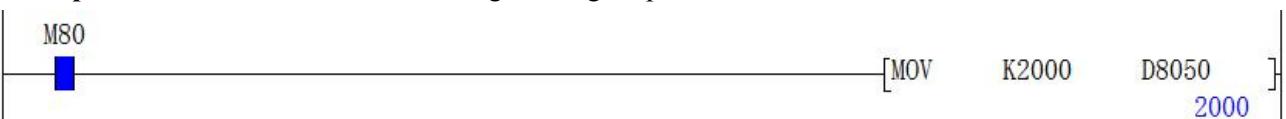
At this point, use a multimeter to check the voltage of the DA0 terminal, that is, the multimeter's red pen is connected to the DA0 terminal, and the black pen is connected to the GND terminal. The multimeter is displaying 5V voltage value.

2.8 PID instruction

Detailed information please refer to <Mitsubishi FX3G Programming Manual>

The self-tuning method in the PID instruction has only a step response mode. The step value is S0+22.

2.9.Application of high speed counter

2.9.1Assignment table of built-in high speed counter

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		
	C248(OP)*1				U	D			
	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		
	C253(OP)*1				A	B			
	C254(OP)*1							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(Z) phase: 2 times frequency: 2 channels 60KHz+1 way 10KHz;

4 times frequency: 2 channels 24KHz; M8198 is C251 4 times frequency signal;M8199 is
C253 4 times frequency signal.

* High speed input C254:

When M8396=0, the original C254 is AB phase corresponded to X3 X4.

When M8396=1, C254 changes to AB phase corresponded to X6 X7.

2.10.Application of high speed pulse

2.10.1 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).
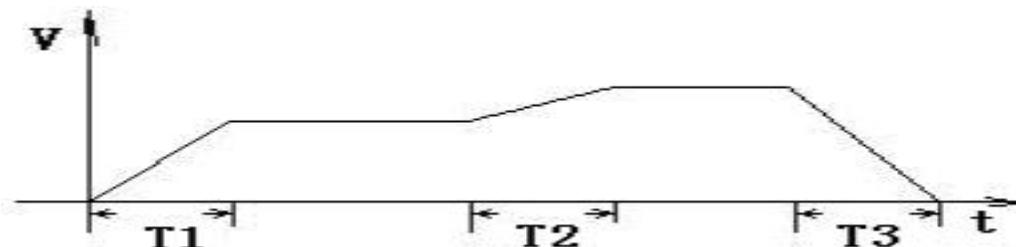
Acceleration/deceleration time T calculation= (target speed-current speed) * acceleration/deceleration time/maximum speed.

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.

2.10.2 Circular interpolation

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

26233 Version and lower		
Interpolation mode	M8343	M8342
Line Interpolation	0	1
Center interpolation	1	0
Radius interpolation	1	1

26235 Version and higher		
Interpolation mode	M8343	M8342
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: (No interpolation function in 26234 version)

26233 Version and lower	
Clockwise	**M8348=0**
Counterclockwise	**M8348=1**
Relative position	**M8344=0**
Absolute position	**M8344=1**

26235 Version and higher	
Clockwise	**M8348=0**
Counterclockwise	**M8348=1**
Relative position	**M8344=0**
Absolute position	**M8344=1**

M8348=0，clockwise； M8348=1，anticlockwise.

M8344=0，relative position； M8344=1，absolute position.

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:

instruction input				
----||---- DPLSR	S.	S.+2	S.+4	D.
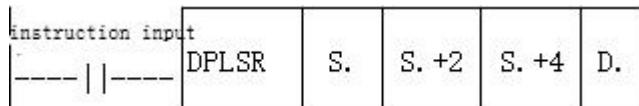
S.　　 represents the pulse frequency, that is, the speed of the interpolation motion.

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 Y0 is supported), and the default Y1 is another axis.

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.
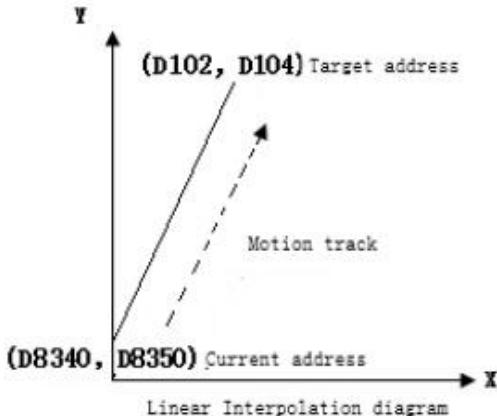
Linear Interpolation diagram

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.
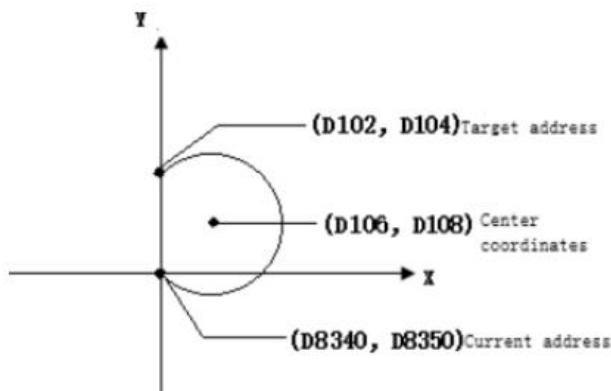
Center Interpolation diagram

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.

Radius Interpolation diagram

Raius Interpolation diagram 2
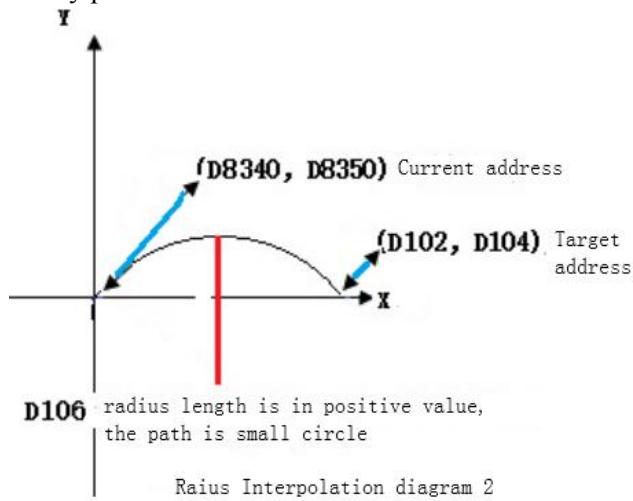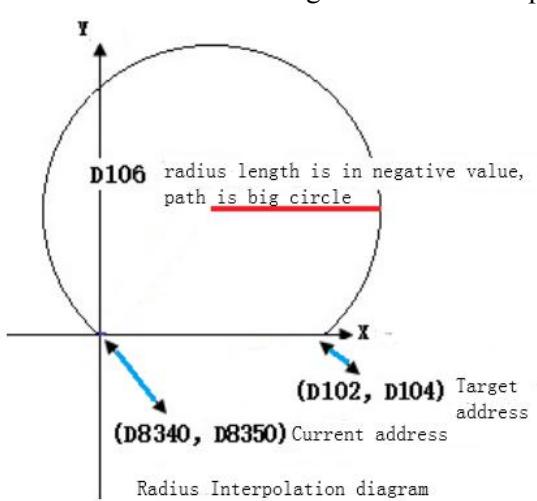
2.10.3 Continuous interpolation function

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.

Command input ‖	DPLSR	S1.	S2.	S2.+2	D.
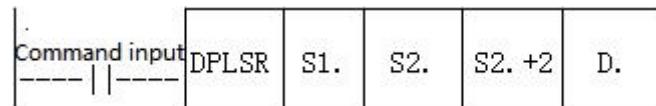
Operand Description: All use 32-bit registers.

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 (currently only supporte Y0), 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 shown :

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 below:

Program as below :


```
M8002
 ┤├                                          ─[DMOV    K0        D8340    ]
                                              D8340 is current X coordinate position

                                             ─[DMOV    K0        D8350    ]
                                              D8350 is current X coordinate position

                                             ─[DMOV    K300      D100     ]
                                              D100 Set the pulse frequency, ie speed

                                             ─[DMOV    K500      D102     ]
                                              D102 is first paragraph straight line X
                                              target position
                                             ─[DMOV    K1000     D104     ]
                                              D104 is first paragraph straight line Y
                                              target position
                                             ─[DMOV    H251      D110     ]
                                              D110 is  first linear interpolation
                                              control method

                                             ─[DMOV    K1000     D112     ]
                                              D112 set first arc X-axis target position

                                             ─[DMOV    K1500     D114     ]
                                              D114 set first arc Y-axis target position

                                             ─[DMOV    K1000     D116     ]
                                              D116 set first arc center X coordinate

                                             ─[DMOV    K1000     D118     ]
                                              D118 set first arc center Y coordinate

                                             ─[DMOV    H202      D120     ]
                                              D120 is first circular interpolation
                                              control mode 202
                                             ─[DMOV    K500      D122     ]
                                              D122 set the second arc X-axis
                                              target position
                                             ─[DMOV    K1000     D124     ]
                                              D124 set the second arc Y-
                                              axis target position
                                             ─[DMOV    K500      D126     ]
                                              D126 set the second arc radius length

                               ─[DMOV    H0AAAAA203        D130     ]
                                D130 is second circular arc
                                interpolation control mode 203
M8002
 ┤├                                                    ─[SET     M8436    ]
M10
 ┤├                          ─[DPLSR  D100   D102   D104   Y000   ]
```

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2.11 PLC Communication port instructions

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

2.11.1 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.

2.11.1.1 RD3A/WR3A command function and action description:
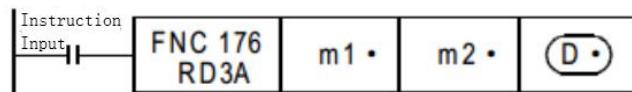
Read slave data (RD3A)：

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

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, 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)
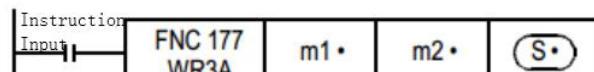
Write data to the slave (WR3A):

WR3A originally referred to the analog modules write.

For CoolMay PLC, the WR3A instruction corresponds to Modbus's 06 and 10 functions.

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. 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. 10: 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.

2.11.1.2 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 ：

Command input	ADPRW	S.	S1.	S2.	S3.	D.
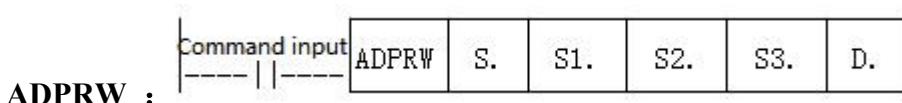
S. indicates the station number of the slave device to be read and written, the range is 0-247;
S1. indicates the function code (that is, the functions NO 01-06, 15, and 16);
S2. The function parameter corresponding to each function code (the operand indicates the MODBUS start address when the function 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.

2.11.1.3 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		

2.11.1.4 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		

2.11.1.5 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

2.11.2 Serial port 2: RS485(A B)

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
RS port protocol	M8196=1 M8125=0	M8192=1	-	
RS sending mark	M8122=1	M8402=1	M8422=1	Need manual reset
RS sending completion mark	-	-	M8425	Need manual reset
RS receiving completion mark	M8123	M8403	M8423	Need manual reset
RS receiving process mark	M8124	M8404	M8424	Data is receiving
RS 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
RS command end operation settings	0	1	2	
MODBUS RTU function	M8196=1 M8125=1	M8192=1	-	
RD3A\WR3A receiving completion mark	M8128	M8408	M8428	Need manual reset
RD3A\WR3A communication over-time mark	M8129	M8409	M8429	Need manual reset
ADPRW command completion	M8029	M8029	M8029	Command execution end mark

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
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 higher 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 maintain power failure).

M8125: the activation flag of using MODBUS and the original Mitsubishi function.

M8122: Send flag (this bit needs to be set 1 when using the RS instruction).

M8123: Communication completion flag (communication completion flag when using RS command, needs to be reset by hand).

M8161: 8-bit/16-bit mode distinguishing flag for RS/RS2 instruction (used in version 26230 and above, always in 8-bit mode in versions 26210 and 26220)

M8128: Communication completion flag (valid when using RD3A and WR3A for MODBUS communication, needs to be reset by hand).

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

D8120: Save the communication parameters of the Modbus RTU protocol, and the highest bit of the communication parameters must be set to E.

D8121: Save the host or slave station number.

D8129: RD3A and WR3A time-out period. (Unit: ms. Better not over 100ms while setting).

D8126: When using the serial port 2 in the ADPRW instruction, set D8126 to 0. (Main version 26232 or lower)

D8126: Interval period. Default as 10 times. (Main version 26232 or higher.)

D8397: When using the serial port 2 in the ADPRW instruction, set D8397 to 0. (Main version 26232 and higher version)

Support RS,WR3A,RD3A,ADPRW, Can be set in parameter zone，correspond to serial port 2。Parameter zone settings are valid only for this channel. Invalid for serial port 3.

2.11.2.1 Mitsubishi programming port protocol

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

2.11.2.2 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 0A 0D (stored in D8124, D8125 separately)

For the Mitsubishi protocol, the D8120 only needs to set 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：
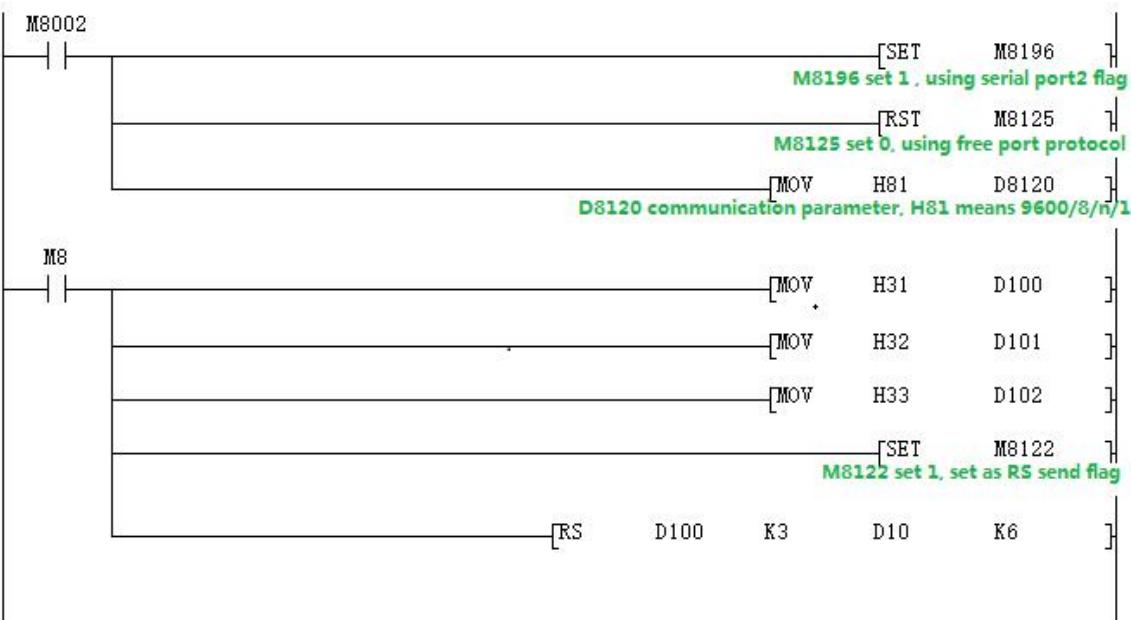
Use the serial port tool by serial port 2 to monitor the data obtained is
[2017:11:01:10:49:16][receive]31 32 33

2.11.2.3 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	
b9	Set 0
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 2. 11. 1. 1):
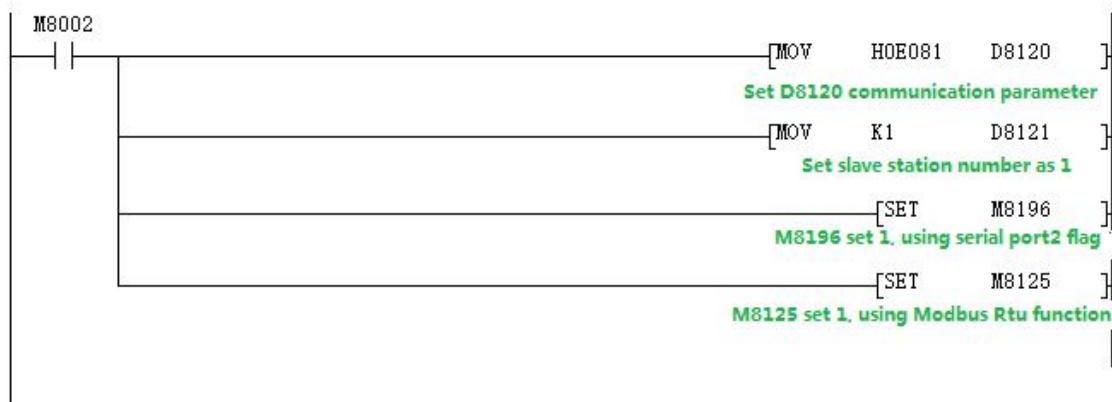
Slave program:

Master program:
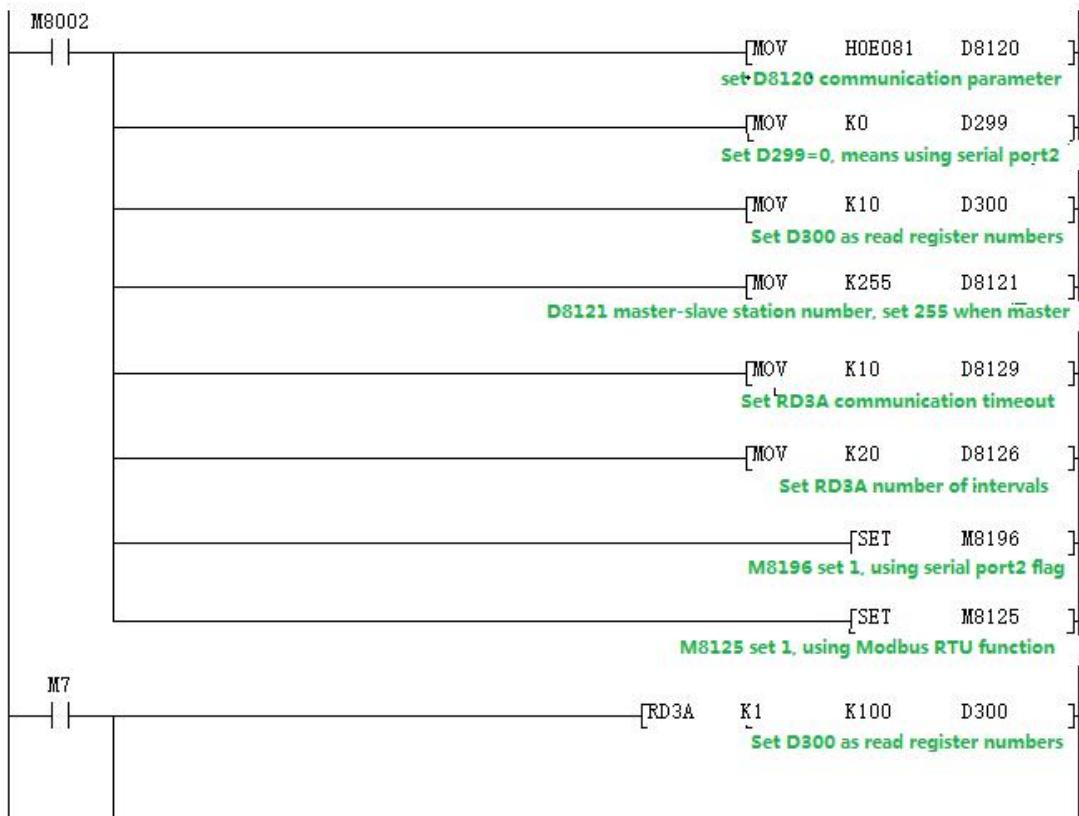
Program explanation:

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 2. 11. 1. 1):
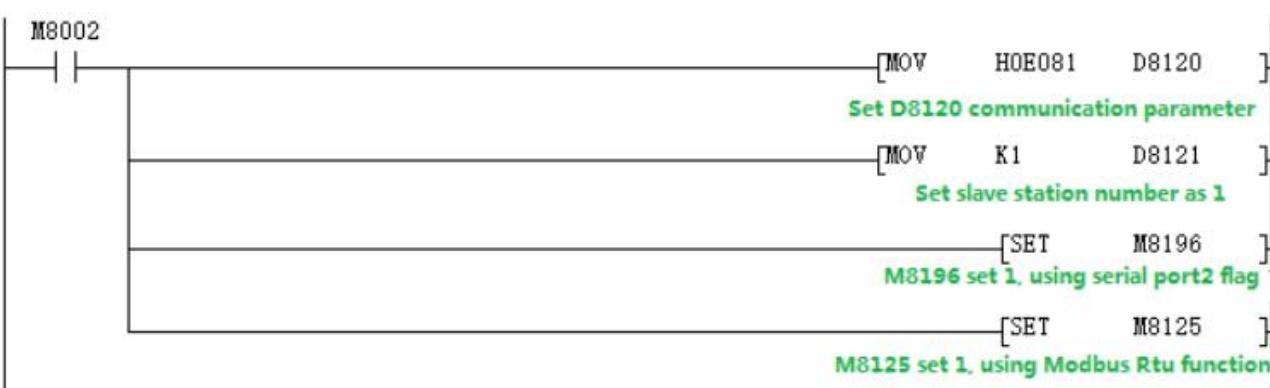
Slave program:
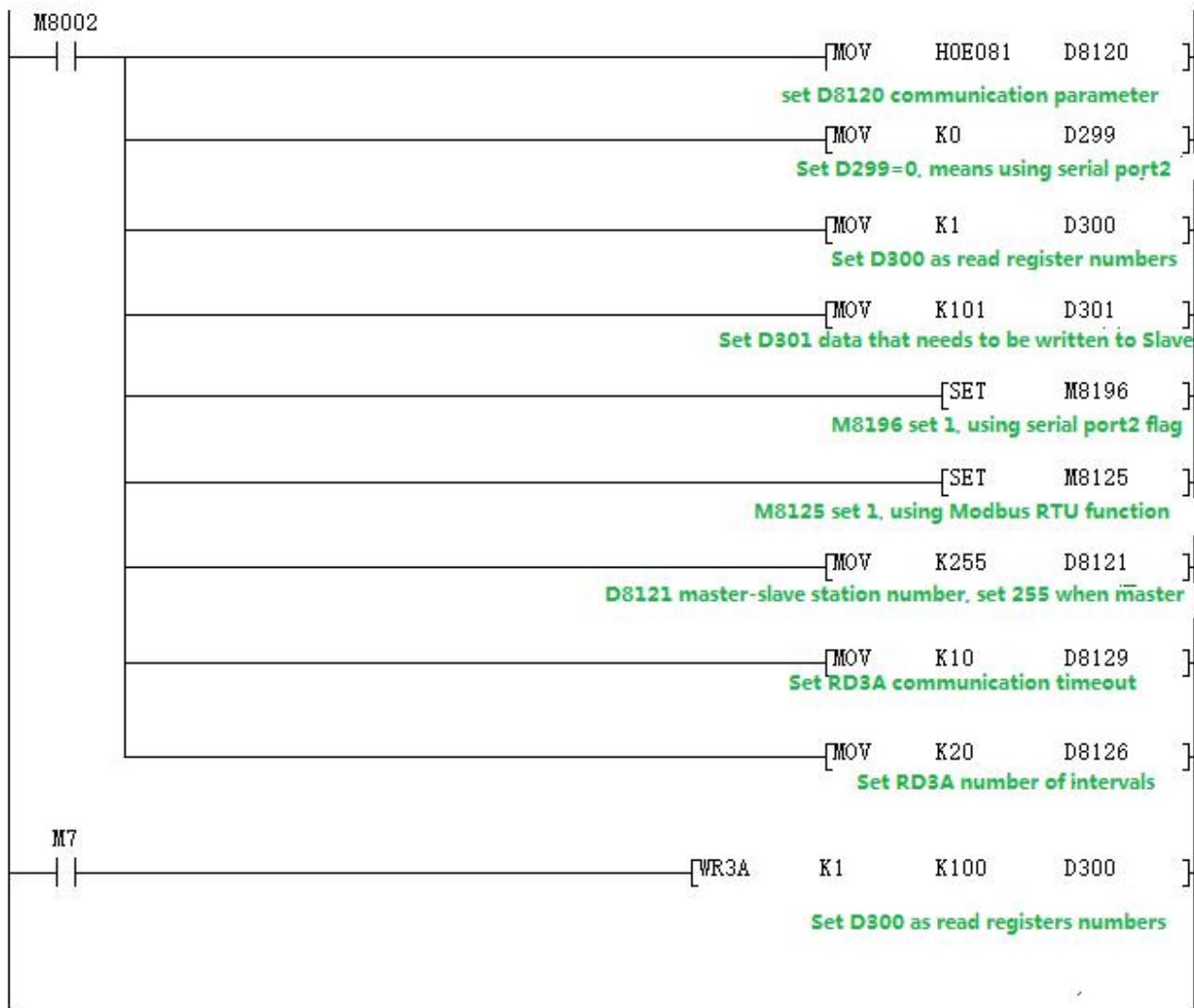
Master program:

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

2.11.2.4 MODBUS RTU ADPRW command

03 function code hold register output. **(refer to 2. 11. 1. 2):**

Master program:
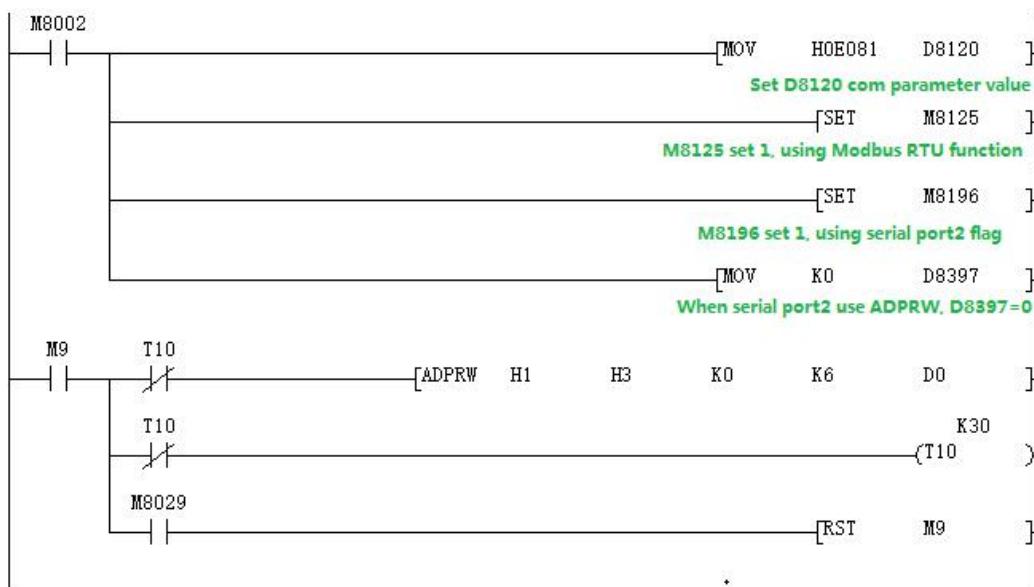
Slave program:
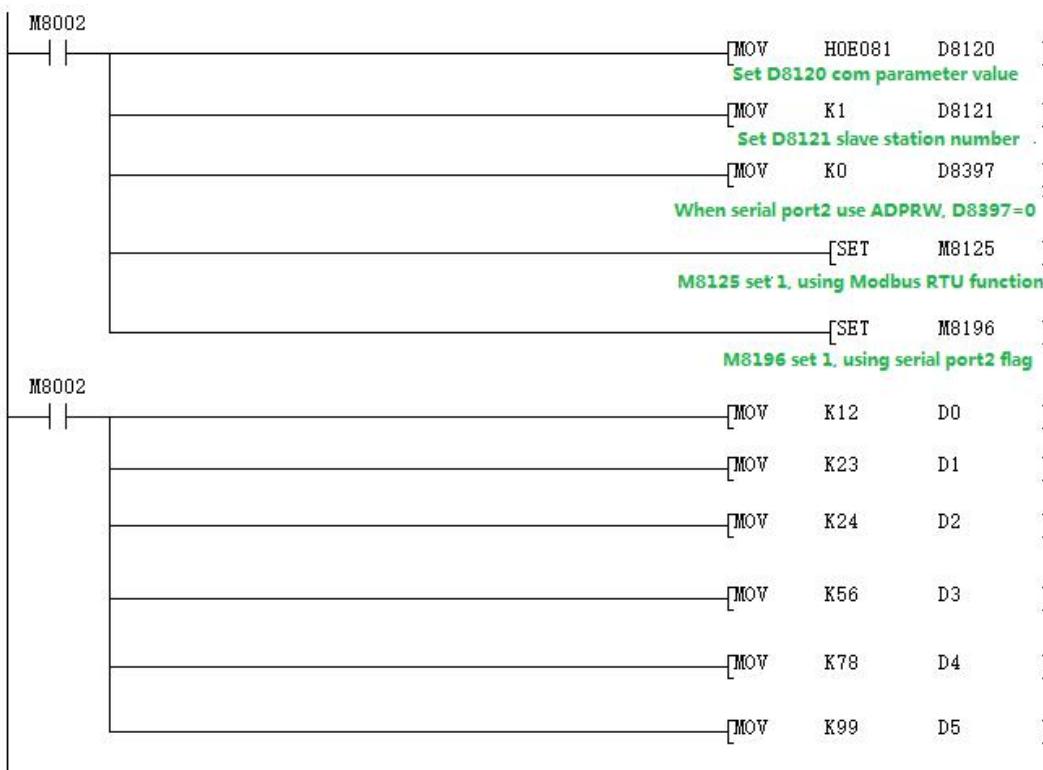
Use the serial port tool to monitor serial port 2 for below data:

[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

2.11.2.5 Modbus ASCII Protocol

When used as Modbus ASCII protocol,specific parameter setting pls refer 2. 11. 2. 3,Only the 12th bit of D8120 is set differently,checking D8120 parameter setting in section 2. 11. 2. 3.

Master program：

```
M8002
 | |--------------------------------------------[MOV    H0F081   D8120  ]
                                                 D8120 communication parameters, F refers to MODBUS ASCII
                                                 function
                                             ---[MOV    K0       D299   ]
                                                 D299=0,using serial port 2
                                             ---[MOV    K100     D300   ]
                                                 Set D300 to the read registers numbers
                                             ---[MOV    K255     D8121  ]
                                                 D8121 master and slave station number, the master must
                                                 be set to 255
                                             ---[MOV    K10      D8129  ]
                                                 D8129 set communication timeout time when RD3A
                                             ---[MOV    K10      D8126  ]
                                                 D8126 set interval circles numbers when RD3A
                                             ---[SET             M8196  ]
                                                 M8196=1,using serial port 2
                                             ---[SET             M8125  ]
                                                 M8125=1, using MODBUS RTU
M800
 | |------------------------------------[RD3A   K1      D10      D300   ]
                                                 Set D300 as read registers numbers
```

Slave program：

```
M8002
 | |--------------------------------------------[MOV    H0F081   D8120  ]
                                                 D8120 communication parameters, F refers to MODBUS ASCII
                                                 function
                                             ---[MOV    K1       D8121  ]
                                                 M8121=1,slave station number is 1
                                             ---[SET             M8196  ]
                                                 M8196=1,using serial port 2
                                             ---[SET             M8125  ]
                                                 M8125=1, using MODBUS RTU
M8000
 | |--------------------------------------------[MOV    K35      D100   ]
                                             ---[MOV    K36      D101   ]
                                             ---[MOV    K37      D102   ]
```

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.

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

Support Mitsubishi programming port protocol,RS2 protocol and MODBUS 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
RS port protocol	M8196=1 M8125=0	M8192=1	-	
RS sending mark	M8122=1	M8402=1	M8422=1	Need manual reset
RS sending completion mark	-	-	M8425	Need manual reset
RS receiving completion mark	M8123	M8403	M8423	Need manual reset
RS receiving process mark	M8124	M8404	M8424	Data is receiving
RS 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
RS command end operation settings	0	1	2	
MODBUS RTU function	M8196=1 M8125=1	M8192=1	-	
RD3A\WR3A receiving completion mark	M8128	M8408	M8428	Need manual reset
RD3A\WR3A communication over-time mark	M8129	M8409	M8429	Need manual 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
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 flag of using programming port protocol and other protocol (Main version 26232 and higher, modified to not maintain power failure).

M8402：Send flag (use when RS2 instruction)。

M8403：Communication completion flag (communication completion flag when using RS instruction, needs to be reset by hand).

M8408：Communication completion flag (valid when using RD3A and WR3A for MODBUS communication, needs to be reset by hand).

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

M8161：8-bit/16-bit mode distinguishing flag for RS/RS2 instruction (used in version 26230 and above, always in 8-bit mode in versions 26210 and 26220)

D8400：Save the communication parameters of the Modbus RTU protocol

D8401：Save the communication mode of serial port 3. D8401=H11 represents PLC as Slave；D8401=H1 represents PLC as Master;D8401=H0 represents the RS free communication mode.

D8414：Save the host or slave station number.

D8126：When using the serial port 3 in the ADPRW instruction, set D8126 to 1. (26232 version lower)

D8397：When using the serial port 3 in the ADPRW instruction, set D8397 to 1. (26232 version and higher)

Support RS2,WR3A,RD3A,ADPRW instructions,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
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

2.11.3.1 Mitsubishi programming protocol

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

2.11.3.2 Free port protocol

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

Program example:
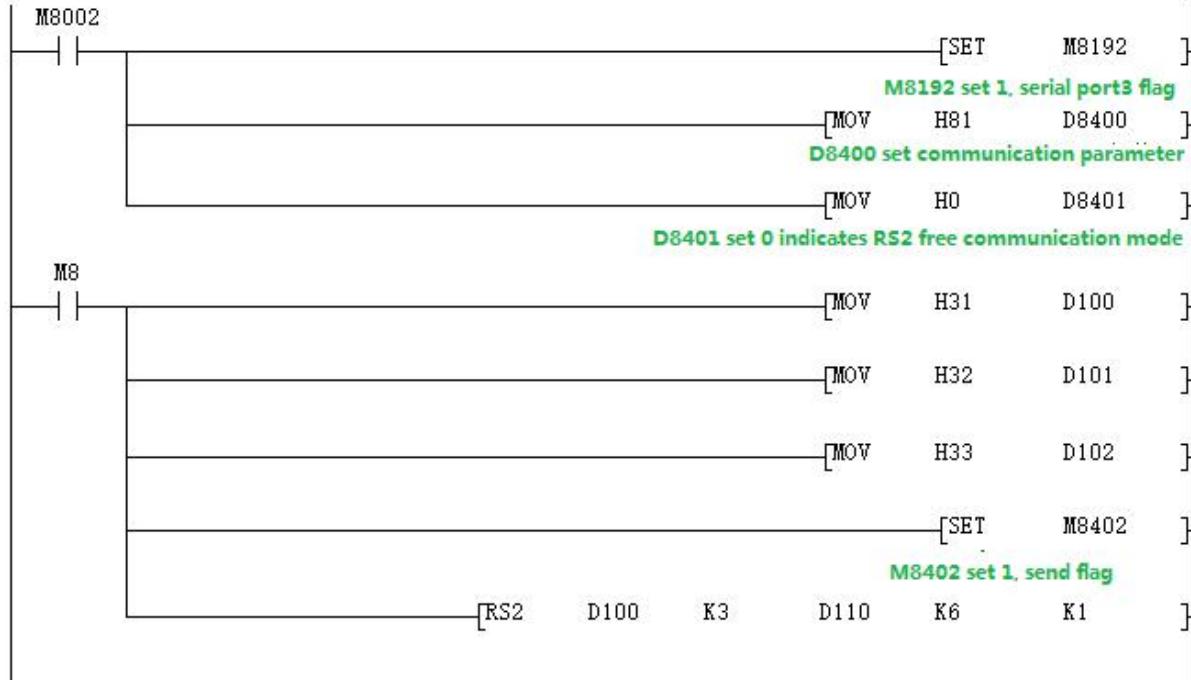
Use the serial port tool to monitor serial port 3 for data:[2017:11:01:11:49:16][receive]37 38 39
Last parameter of RS2 instruction =0: serial port 2;

　　　　　　　　　　　　　=1: Serial port 3;

　　　　　　　　　　　　　=2: CAN.

2.11.3.3 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 <mark>2. 11. 1. 1</mark>):

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 2. 11. 1. 1):

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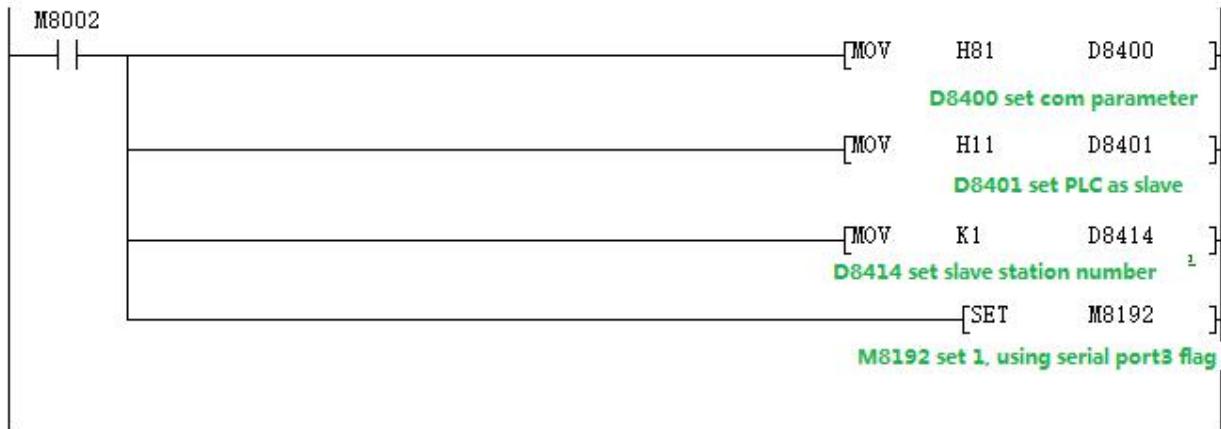
Master program
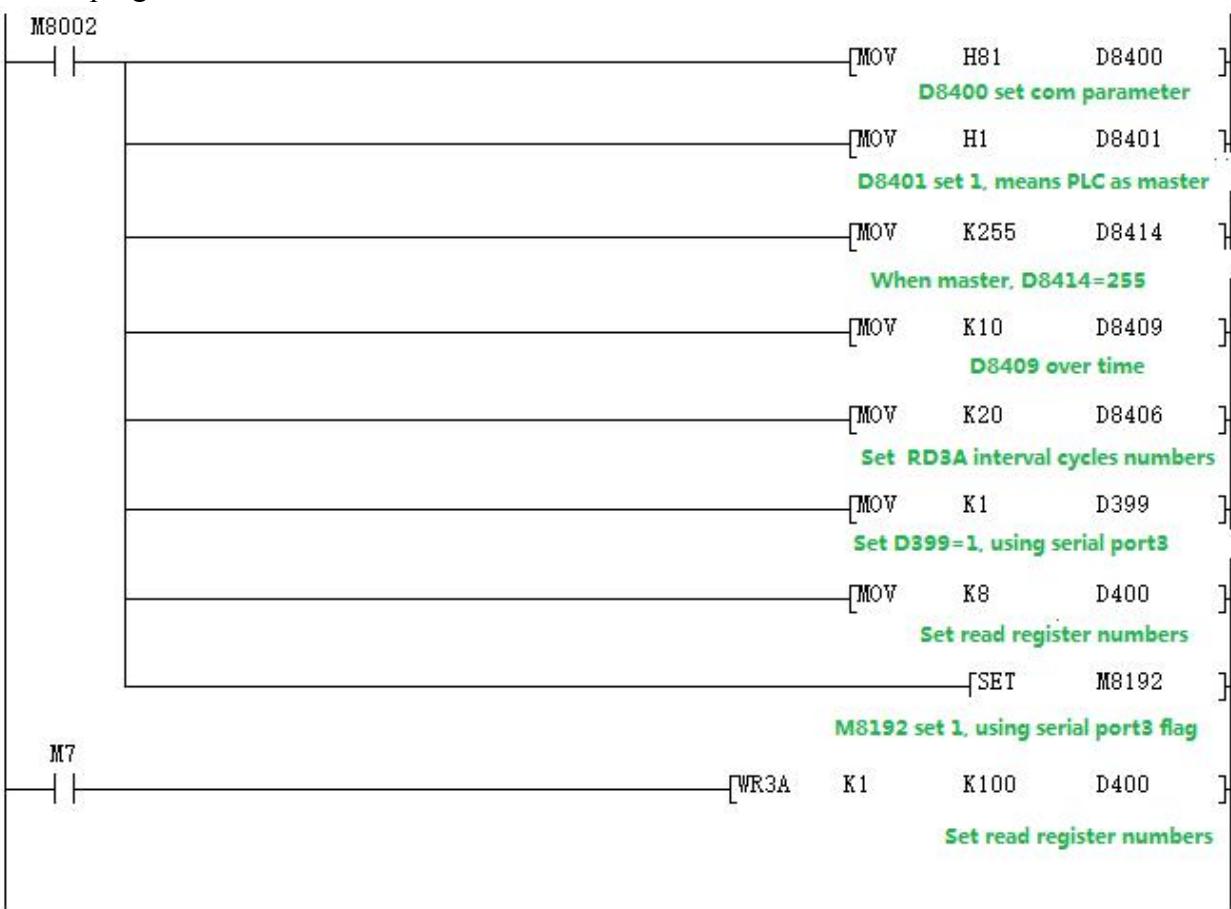
Use the serial port tool to monitor serial port 3 for below data:

[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

2.11.3.4 MODBUS RTU ADPRW Command

04 register input readout. **Program Example (Refer to 2.11.1.2):**

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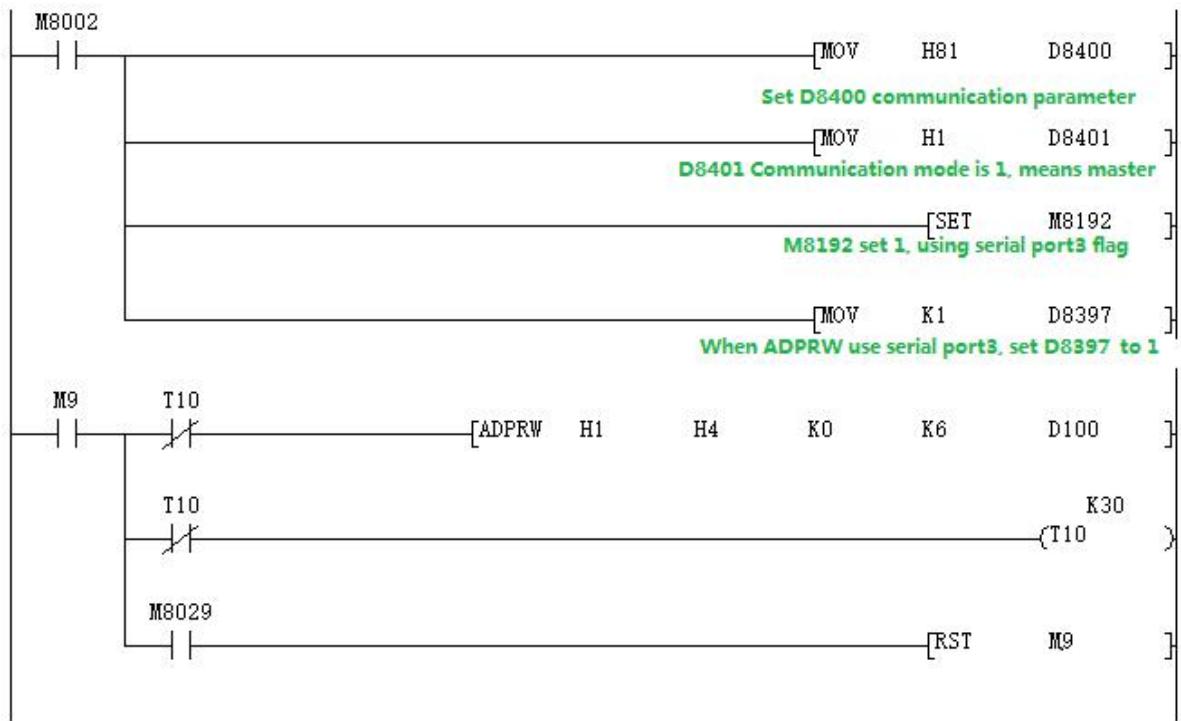
Slave program
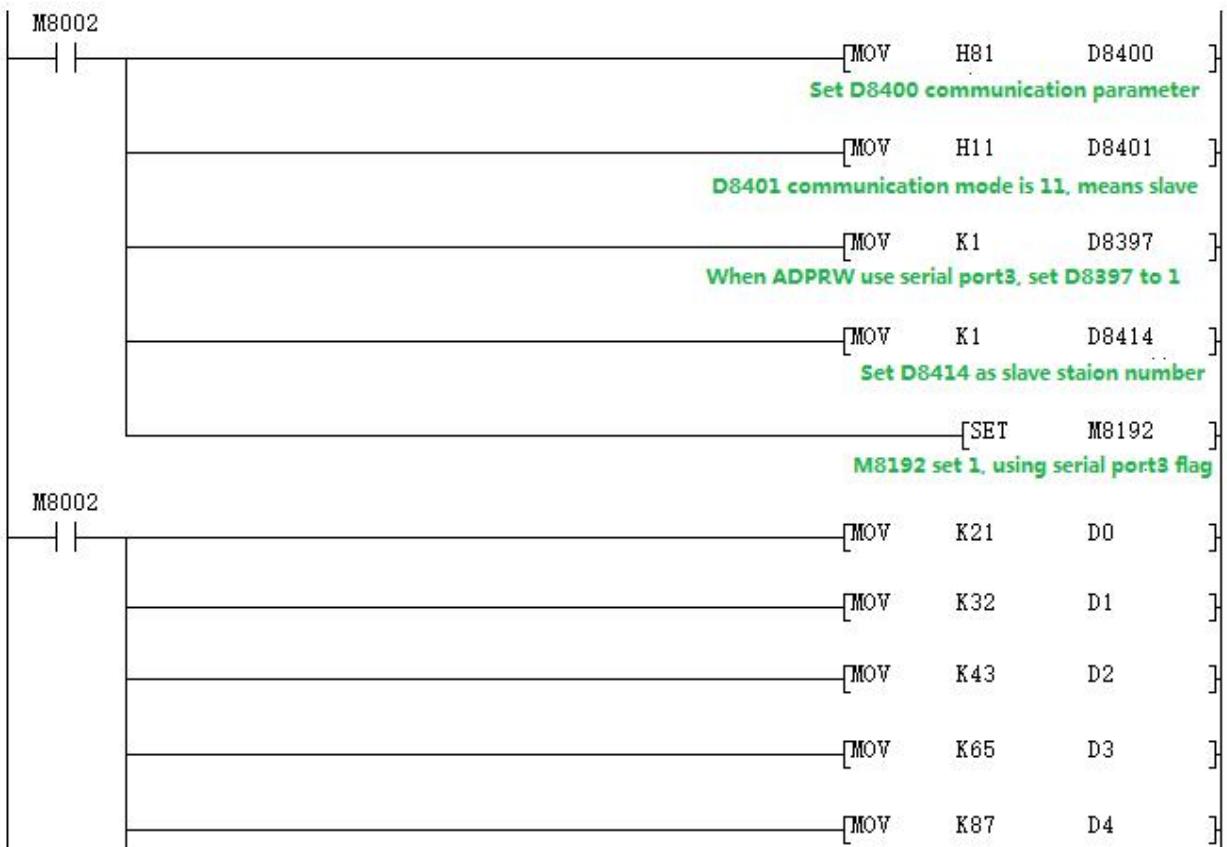
Use the serial port tool to monitor serial port 3 for below data:

[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

2.11.3.5 Modbus ASCII Function

When used as Modbus ASCII protocol,specific parameter setting pls refer to 2. 11. 3,Only the 8th bit of D8401 is set differently,checking D8120 parameter setting in section 2. 11. 3.

Master program：
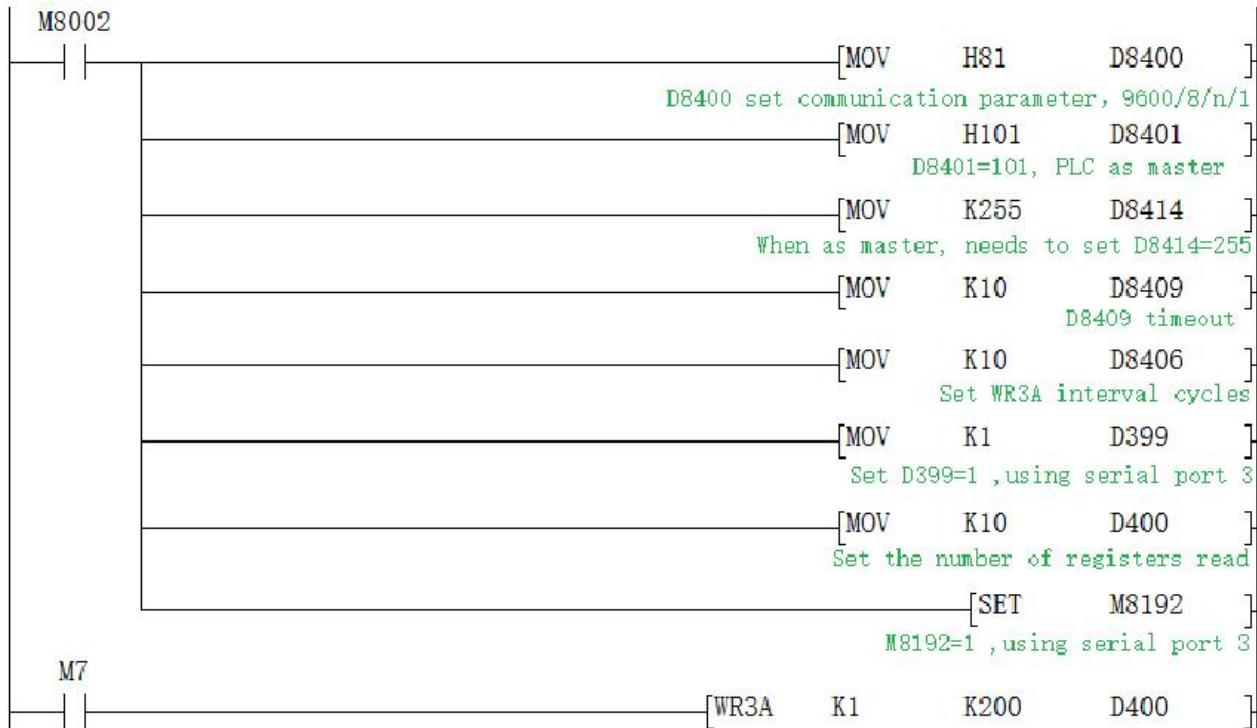
Slave program：

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

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

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

2.11.4 CAN communication port

Support RS2 protocol and MODBUS RTU protocol. (Note: The PLC must be disconnected (at least 15 seconds) after the CAN port is set.)

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
RS2 functions	M8196=1 M8125=0	M8192=1	-	
RS2 sending mark	M8122=1	M8402=1	M8422=1	Need manual reset
RS2 sending completion mark	-	-	M8425	Need manual reset
RS2 receiving completion mark	M8123	M8403	M8423	Need manual reset
RS2 receiving process mark	M8124	M8404	M8424	Data is receiving
RS 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	0	1	2	
MODBUS RTU function	M8196=1 M8125=1	M8192=1	-	
RD3A\WR3A receiving completion mark	M8128	M8408	M8428	Need manual reset
RD3A\WR3A communication over-time mark	M8129	M8409	M8429	Need manual 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 time-out period	D8129	D8409	D8429	Unit: ms
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	

The special relays and registers related are as below.

Special relay involved: M8426,M8422,M8424,M8425.

Special register involved: D8420,D8421,D8126,D8397(version in 26232 and above),D8440,D8442.

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 and needs manual reset.

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.

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 setting

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

2.11.4.1 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：
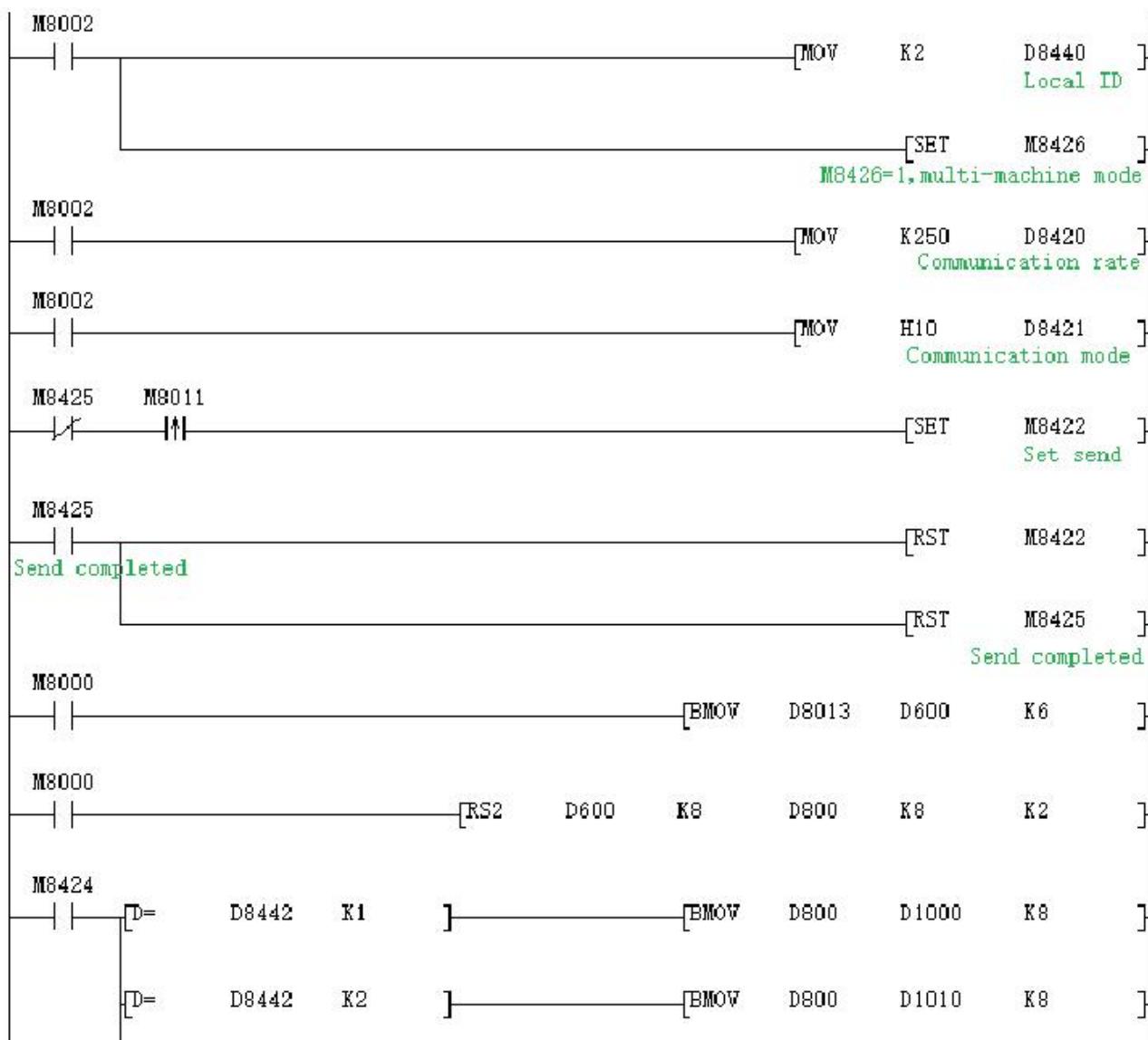
RS2 command last parameter =0: Serial port 2；

=1: Serial port 3；

=2: CAN.

2.11.4.2 Modbus RTU Function RD3A/WR3A command

RD3A Program Example (refer to 2.11.1.1)：

Master Program:

```
    M8002
   ──┤├──                                                      ─[RST      M8426    ]
                                                  M8426=0,master-slave mode
    M8002
   ──┤├──────────────────────────────────────────────[MOV    K250      D8420    ]
                                          D8420 indicates that the communication rate is 250K
          ├──────────────────────────────────────────[MOV    H1        D8421    ]
                                                    D8421=1, PLC as master
          └──────────────────────────────────────────[MOV    K16       D8429    ]
                                    D8429 is the communication timeout,6 larger than the slave station
    M8002
   ──┤├──────────────────────────────────────────────[MOV    K2        D299     ]
          └──────────────────────────────────────────[MOV    K16       D300     ]
                                          Set the number of data to be read from the slave
    M8000
   ──┤├──────────────────────────────────[RD3A     K1       K501      D300     ]
                   Read 16 data starting from the slave station D501 with the station number
                   1,store in the 16 registers starting from the master station D301.
```

Slave Program:

```
    M8002
   ──┤├──────────────────────────────────────────────[MOV    K1        D8434    ]
                                          M8434=1,slave station number is 1
          └──────────────────────────────────────────[RST      M8426    ]
                                                  M8426=0,master-slave mode
    M8002
   ──┤├──────────────────────────────────────────────[MOV    K250      D8420    ]
                                          D8420 indicates that the communication rate is 250K
          ├──────────────────────────────────────────[MOV    H11       D8421    ]
                                                    D8421=11, PLC as slave
          └──────────────────────────────────────────[MOV    K300      D500     ]
    M8013
   ──┤↑├─────────────────────────────────────────────[DEC      D500     ]
   [=    K200     D500     ]──────────────────────────[MOV    K300      D500     ]
    M8000
   ──┤├──────────────────────────────────────[FMOV    D500     D501      K16      ]
```

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 2.11.1.1)：

Master Program:
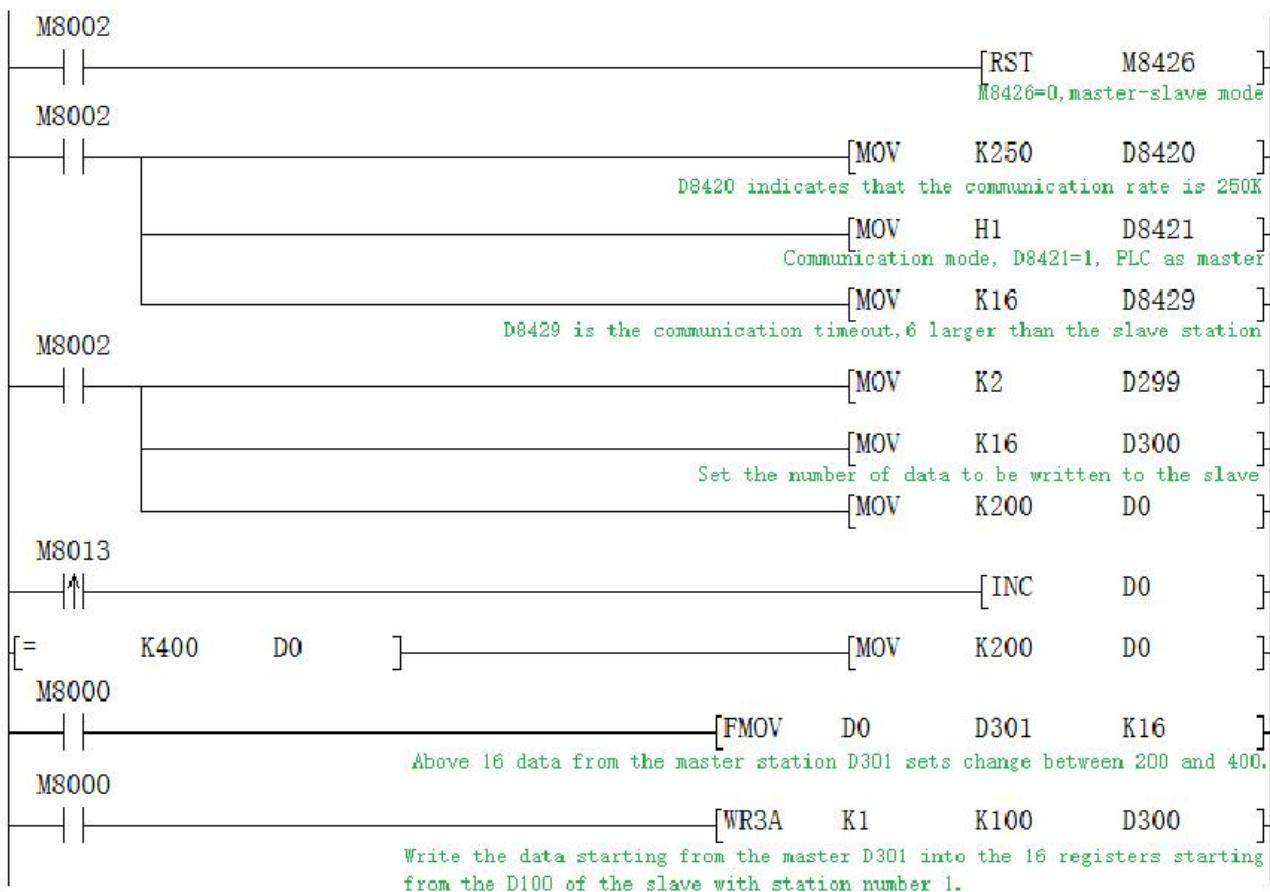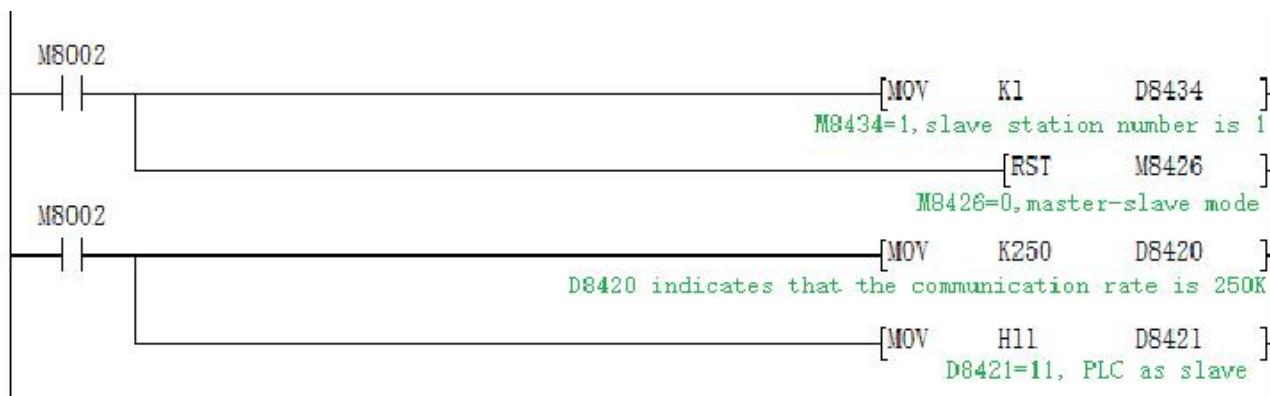
Slave Program:

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.

2.11.4.3 Modbus RTU Function ADPRW command

01 input register **ADPRW program example (refer to 2.11.1.2)**

Master Program:

```
M8002
 ┤├                                                    ─[RST     M8426    ]
                                                          Master-slave mode
M8002
 ┤├                                              ─[MOV    K250     D8420    ]
                                                          Communication rate
                                                ─[MOV    H1       D8421    ]
                              Communication mode, D8421=1, PLC as master
                                                ─[MOV    K16      D8429    ]
                                                   D8429 timeout, Set D8429=16ms
M8002
 ┤├                                              ─[MOV    K2       D8397    ]
                                                    D8397=2,using CAN communication
M800
 ┤├                            ─[ADPRW   H1      H1      H0      K4      D0      ]
```

Slave Program:

```
M8002
 ┤├                                              ─[MOV    K1       D8434    ]
                                                          Slave station number
                                                ─[RST     M8426    ]
                                                          Master-slave mode
M8002
 ┤├                                              ─[MOV    K250     D8420    ]
                                                          Communication rate
                                                ─[MOV    H11      D8421    ]
                              Communication mode, D8421=11, PLC as slave
M8002
 ┤├                                              ─[MOV    K15      K1M0     ]
```

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.

2.11.5 Network communication

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	
Switch mark between	D8395	

Mitsubishi functions and MODBUS		
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_UPD Slave

      D8395=2：MODBUS_UPD 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 InfoPacketSend. (26235 and higher version)

R23816 is MODBUS InfoPacketReceive. (26235 and higher version)

2.11.5.1 Modbus RTU Function RD3A/WR3A command

RD3A Program Example (refer to 2. 11. 1. 1):

Master Program:

Slave Program:

```
M8002
 ─┤├──┬──────────────────────────────────────────[MOV    H0C0A8    R23800 ]
     │                                                   Router address 1
     │
     ├──────────────────────────────────────────[MOV    H101      R23801 ]
     │                                                   Router address 2
     │
     ├──────────────────────────────────────────[MOV    H0FFFF    R23802 ]
     │                                                   Subnet mask 1
     │
     ├──────────────────────────────────────────[MOV    H0FF00    R23803 ]
     │                                                   Subnet mask 2
     │
     ├──────────────────────────────────────────[MOV    H0C0A8    R23807 ]
     │                                                   Local IP 1
     │
     ├──────────────────────────────────────────[MOV    H179      R23808 ]
     │                                                   Local IP 2
     │
     ├──────────────────────────────────────────────[SET    M8197 ]
     │                                              Write network information
     │
     └──────────────────────────────────────────[MOV    K1        D8395 ]
           D8395=1,PLC is UDP communication slave
```
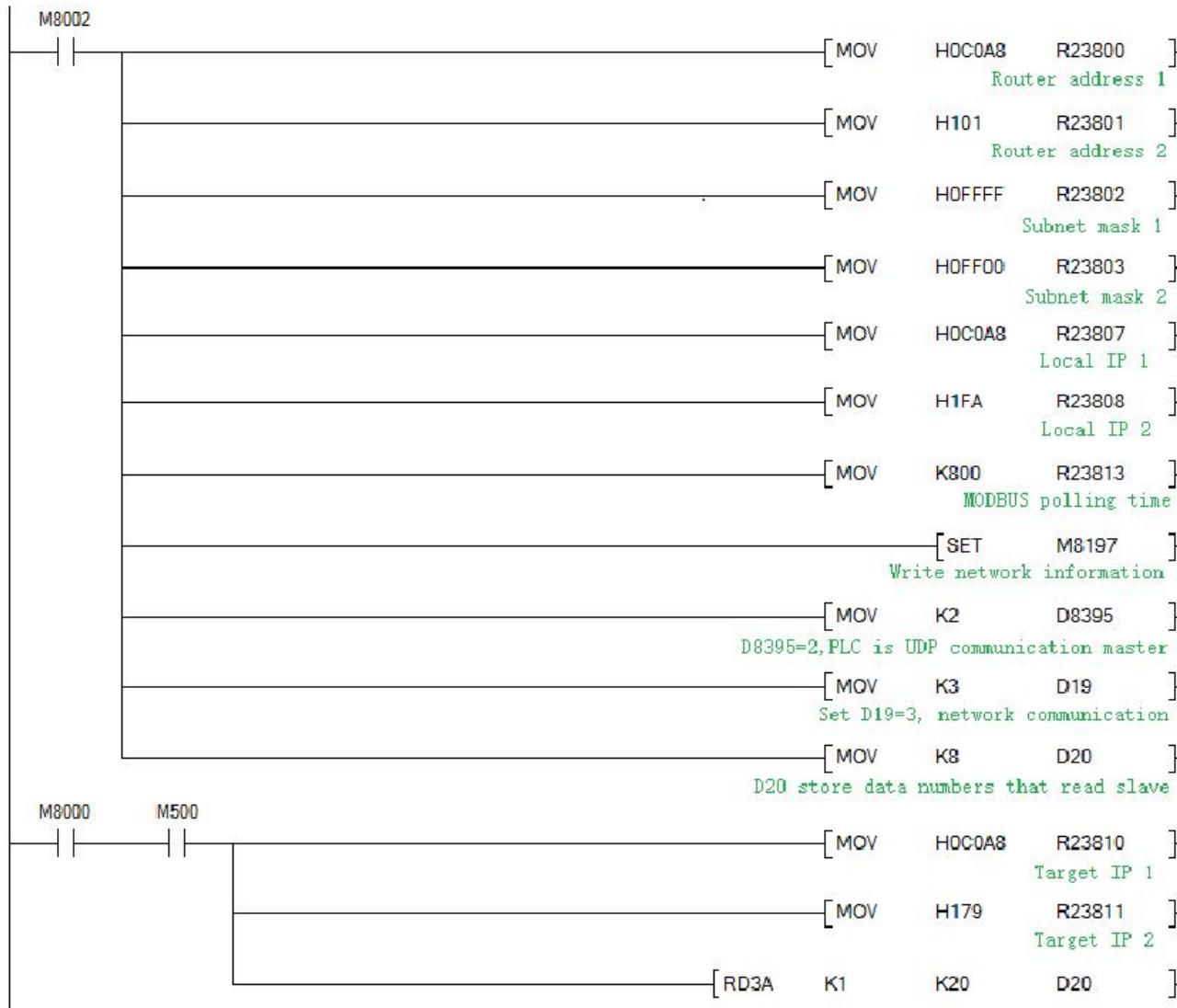
2.12 Difference between EX3G and EX2N PLC/HMI All in one

Series Difference	EX2N series HMI/PLC all in one	EX3G series HMI/PLC all in one
Size difference		
Cutout size	EX2N-43H series is the same as the EX3G-43HB series ,Dimension：134*102*30mm，Cutout：119*93mm； EX2N-43KH/50KH is the same as EX3G-43(50)KH series，Dimension：150*93*32mm，Cutout：143*86mm； EX2N-100HA series is the same as EX3G-100HA series，Dimension：275*194*36mm，Cutout：261*180mm； EX2N-70H series Dimension：212*148*40mm，Cutout：194*138mm； EX3G-70KH series Dimension：226*163*35.6mm，Cutout：218*153mm。	
HMI		
Resolution	EX2N-43H/43KH：480*272 EX2N-50KH/70H：800*480 EX2N-70H/100HA:1024*600	EX3G-43HB/43KH：480*272 EX3G-50KH/70KH：800*480 EX3G-70KH/100HA:1024*600
RAM	H/KH：64MB;HA(S)：128MB	43HB:32MB 43(50)KH:64MB 43HA/43(50)/70KH/100HA:128MB

CPU	H/KH series ARM9 core 400MHz	HB:ARM9 core 216MHz KH:ARM9 core 400MHz
COM	Optional communication port supports the Mitsubishi programming port protocol/MODBUS protocol/RS protocol. EX2N-43H/43KH/50KH Optional 1 RS232, optional audio, no optional network port; EX2N-70H /100HA optional 1 RS232 or 1 RS485,Optional network port and audio.	The optional communication port supports the Mitsubishi programming port protocol/MODBUS protocol/RS protocol. EX3G-43HB/43(50)KH can be equipped with 1 RS232. No optional network port; The EX3G-70KH/100HA can be equipped with one 232 or one 485, and the optional network port (can not coexist with the PLC network port).
PLC		
Instruction operation time	About 30ns/basic instruction；About 200ns（8K steps about 25ms）/application instruction	0.42μs/basic instructions; 1.6μs/application instructions
Digital input	Active NPN (common terminal connect with negative)	Passive NPN, common side isolation
PLC type	Compatible with Mitsubishi FX2N	Compatible with Mitsubishi FX3G
PLC programming software	Compatible with Works 2/GX Developer8.52	Compatible with Works 2/GX Developer 8.86 version
Write mode	write when run is not supported	Support RUN write, modify the program more convenient and fast
PLC programming port	DB9 port RS232 programming port	It comes with two PLC programming ports (Mini B type USB port and RS232 port), USB programming port download can reach 115200bps, USB programming port download speed can reach 12Mbps.
COM port	Optional communication port supports the Mitsubishi programming port protocol/MODBUS protocol/RS protocol. EX2N-43H/43KH50KH can be optionally equipped with one RS485; EX2N-70H/100HA can be equipped with one RS232 or one RS485.	The optional communication port supports Mitsubishi programming port protocol/MODBUS protocol/RS protocol/BD board protocol, which facilitates PLC interconnection and communication with external devices. EX3G-43HB/EX3G-43(50)KH series can be equipped with 2 485; EX3G-70KH/100HA can be equipped with 1 485 or 2 485 (optional 2 485, one of them) 485 is changed from the default 232 special), optional CAN port, network port (and touch screen network port

	8K steps	32K steps
		can not coexist), optional WIFI (will occupy the default 232 port).
Program Capacity	8K steps	32K steps
Auxiliary register range	[M0~M499] 500 points General; [M500~M1535] 1036 points Keep in; [M8000~M8255] 256 points Special.	[M0~M383] 384 points General; [M384~M1535] 1152 points to keep in; [M1536~M7679] 6144 points General; [M8000～M8511] 512 points Special.
Data register range	[D0~D199] 200 points General; [D200~D999] 800 points Keep in ; [D8000-D8255] 256 points Special.	[D0~D127] 128 points General; [D128~D7999] 7872 points to keep in; File register [R0~R23999] 24000 points to keep; [D8000-D8511] 512 points Special.
Status register range	[S0~S9] 10 points Initial status; [S10~S499] 490 points General; [S500~S999] 500 points keep in.	[S0-S9] 10 points for initial state; [S10~S999] 990 points to keep in use; [S1000~S4095] 3096 points Generally used.
Timer range	[T0~T199] 200 points 100ms General; [T200~T245] 46 points 10ms General; [T246~249] 4 points 1ms, General; [T250~T255] 6 points 100ms Cumulative keep in.	[T0~T199] 200 points 100ms is general; [T200~T245] 46 points 10ms for general use; [T246~T249] 4 points 1ms cumulatively used; [T250~T255] 6 points 100ms cumulatively used; [T256~T319] 64 points 1ms Normal use.
Counter range	[C0~C99] 100 points Generally 16 bits; [C100~C199] 100 points Power outage remains 16 bits; [C200~C234] 35 points Power outage remains 32 bits.	[C0~C15] 16 points, generally 16 bits; [C16~C199] 184 points, power failure to maintain 16 places; [C200~C219] 20 points, generally 32 bits; [C220~C234] 15 points Power failure to maintain 32 bits.
Pointer, interrupt	[P0~P127] 128 points JUMP CALL.	[P0~P255] 256 points JUMP CALL; [P0~P1280] 1281 points JUMP CALL (26232 and above); Input interrupt 6 points I0□□~I5□□; The timer is interrupted by 3 points I6□□~I8□□.
DI/DO	Up to 24DI/20DO, at most 18 relay can be available.	Supports up to 30DI/30DO and up to 28 MR. Note: When the switch quantity reaches 30DI/30DO, the analog quantity can be up to 5AD/2DA; when the switch quantity is 24DI/20 DO, the analog quantity can be up to 16AD/ 8DA.
DO type and load	Relay MR(Maximum load: 5A)/Transistor MT(Maximum load:500mA)/Mixed output MRT.	EX3G-43H/HB/EX3G-43(50)KH series optional Relay MR (maximum load 5A) / MOS tube

		(maximum load 2A) EX3G-70KH/100HA optional relay MR (maximum load 5A) / Transistor MT (maximum load 500mA) / mixed output MRT.
Analog	Support multiple analog input and output, single or mixed, at most 20AD/8DA, analog input precision 12 bit, output 10 bit. Analog input is read the value of special registers, analog output is to reset standard bit ON and then value special registers. AD type：EK thermocouple /S thermocouple /J thermocouple / PT100 / PT1000 /NTC10K/ NTC50K/NTC100K /0-20mA /4-20mA /0- 10V /0-5V DA type: 0-10V/0-5V /0-20mA	Support multiple channels of various types of analog single or mixed input and output, a single device up to 16 in 8 out, analog input and output accuracy 12 bits. The CX3G analog input read supports direct read registers, and can also use the FROM instruction. The analog output supports direct register assignment or the TO instruction. Analog input type: EKSTJ type thermocouple (can support negative temperature) / PT100/PT1000/NTC10K/NTC50K/NTC100 K/0-10V/0-5V/0-20mA/4-20mA or hybrid and other special specifications; EX3G-70KHA(S)/100HA all-in-one supports -5V~5V And -10V~10V voltage input. Analog output type: 0-10V/0-5V/0-20mA/4-20mA or hybrid type optional.
High speed counter	Regularly with 2 channels single or AB phase 10Khz high speed counter. At most 6 channels single phase（4　10-100K,2 5-10K）or 3 channels AB phase (2 10-100K,1　5-10K）or 3 ABZ phase （1 10-100K,2 5-10K). Fixed double frequency.	EX3G-43HB single phase 6 channel 10KHz or AB (Z) phase 3 channel 0KHz. Conventional single-phase 6 channel 60KHz or AB(Z) phase 2 channel 60KHz+1 channel 10KHz.
Pulse	Regularly 4 channels 20Kpulse，Y0/Y1/Y6/Y7, at most can be customized to 5channel 20-200K. Acceleration and deceleration is the same register.	The conventional 8 channel Y0-Y3 is 100KHz, and the Y4-Y7 is 10KHz; Acceleration and deceleration independent, high-speed counting + high-speed pulse total transmission can not exceed 480KHz.
Supported instructions	Compatible with most instructs of FX2N , position instruct and　floating points of 3U（123 instructs in total）.EI and high speed compare not supported. PID supported, adjust automatically not supported, users need to modify parameters by hand.	Support interrupt, support linear arc interpolation, support high-speed instruction such as high-speed set reset, PID support auto-tuning (only step response mode is supported), support for index multi-point transfer instruction/binary floating-point number transfer, Gray code conversion, binary Floating point angle arc conversion, data block addition and subtraction, cam matrix, digital tube command, etc. (More than 76 instructions supported by CX2N).

3. HMI

3.1 HMI program software user introduction

3.1.1HMI Program software installation

Coolmay HMI program software, compatible with XP/WIN7/WIN8/WIN10 system. If it can not be installed for use, pls try by replacing another computer, re-installing the system, and higher user rights. Among them, The WIN7 system must change the user account control settings to never notify, WIN8 system, WIN10 system must turn off the digital signature to reduce trouble.

Installation: Double-click "CoolMayHMI V*.** .exe"   and follow the prompts to click Next.
Note: If it is not the latest version, please ask the customer service or enter the official website of Shenzhen Coolmay Technology Co., Ltd. "www.coolmay.net".

3.1.2 New build HMI program

1,Double click , then Click [New], or click the icon in the toolbar, or use the defaulted hotkey Ctrl+N.

2,Set parameter
EX3G-43HA/43HB/43KH/43KHA select MT6043H(480*272)；
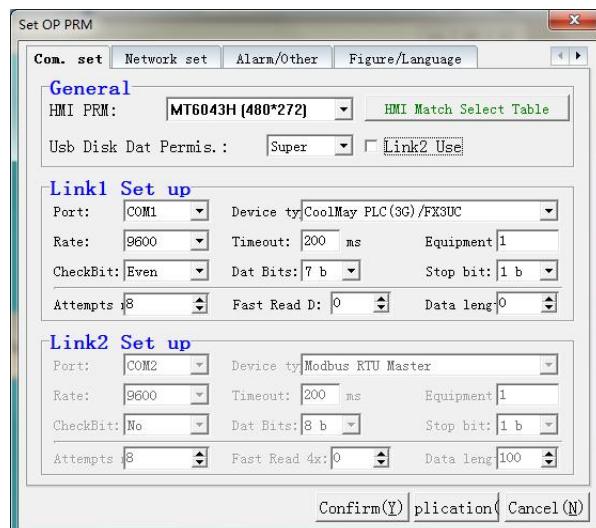
EX3G-50KH/50KHA/70KHAS select MT6070H(800*480)；
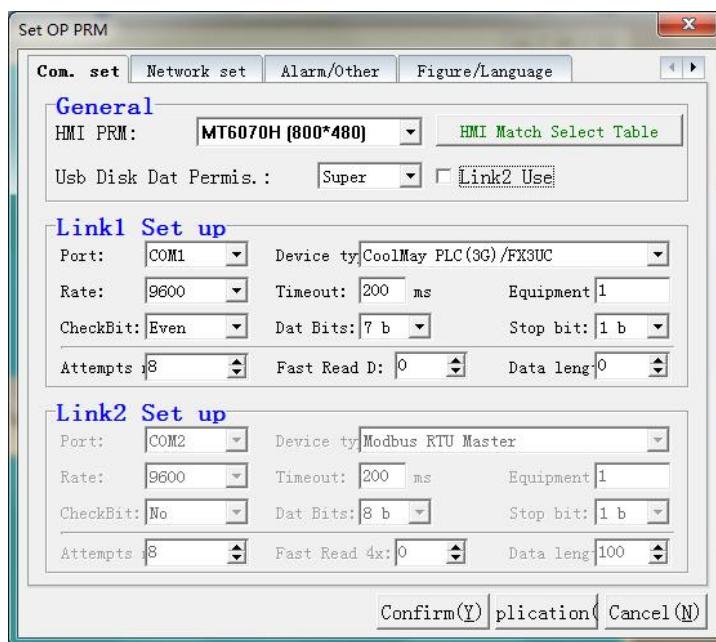
EX3G-70KHA/100HA select MT6100HA(1024*600)；
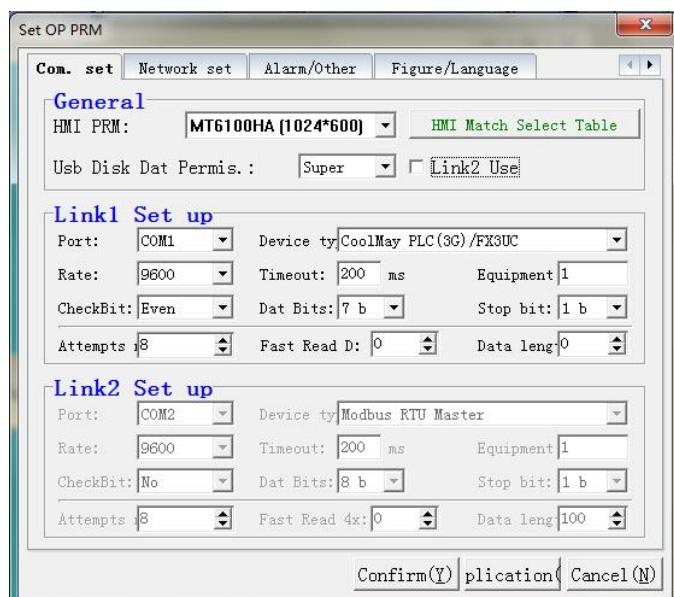
3.2 HMI Display download

3.2.1 Online download step (USB download line download)

1. After saving the program, click "application" --- "compile" in the software (shortcut F5)
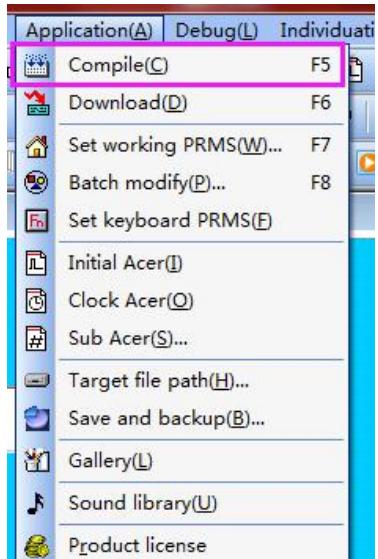
After compiling, it will prompt to create the target file successfully;
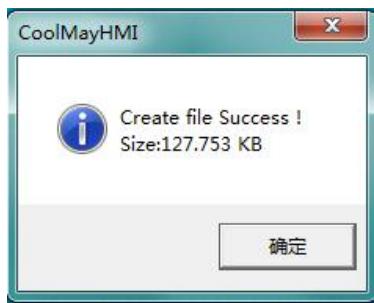
2. Under the target file path (view the default disk in the software application---target file path, the default is on the C drive)
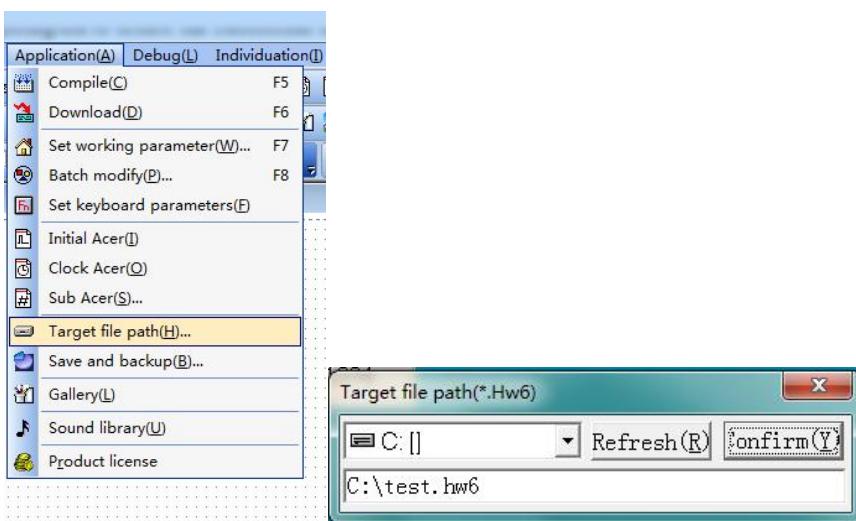
Confirm that the C drive has generated a file with the same file name and the same name as .hw6, as shown in the test program". hw6"
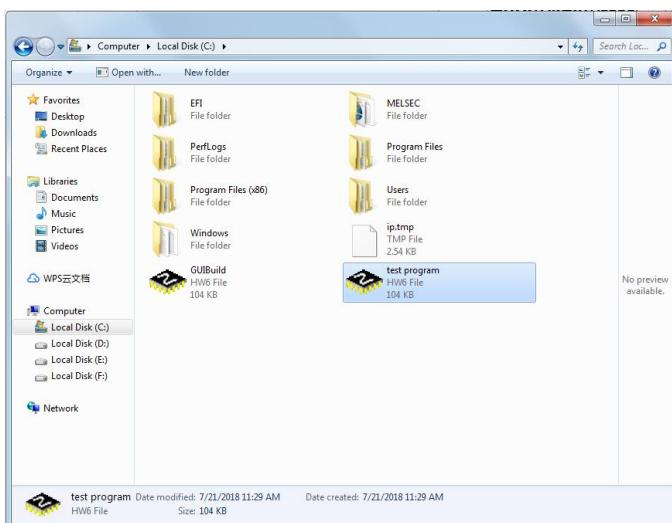
3. Click "Application"--"Download".
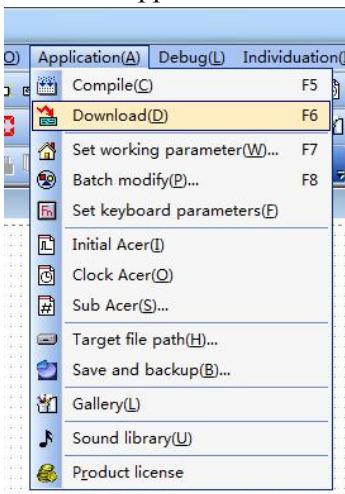
4.The download window pops up, the HMI connection is OK, the IP setting is OK, wait for the download command prompt, and then click download;
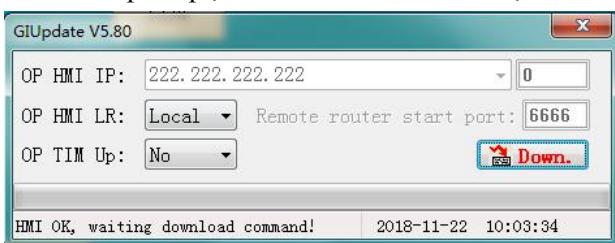
5.The download will complete and the update will be successful.
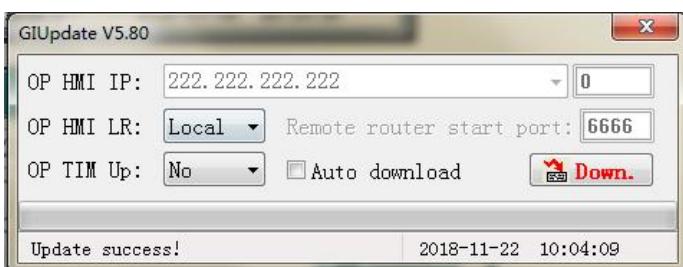
3.2.2 U disk download step (43HB series don't support)

1. After saving the program, compile the program (shortcut F5);
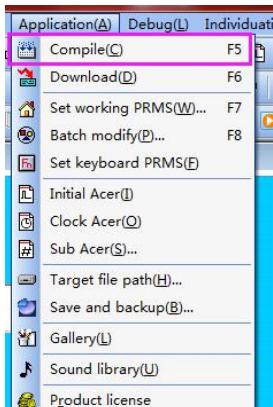
2. Under the target file path (view the default disk in the software application---target file path, the default is on the C drive)
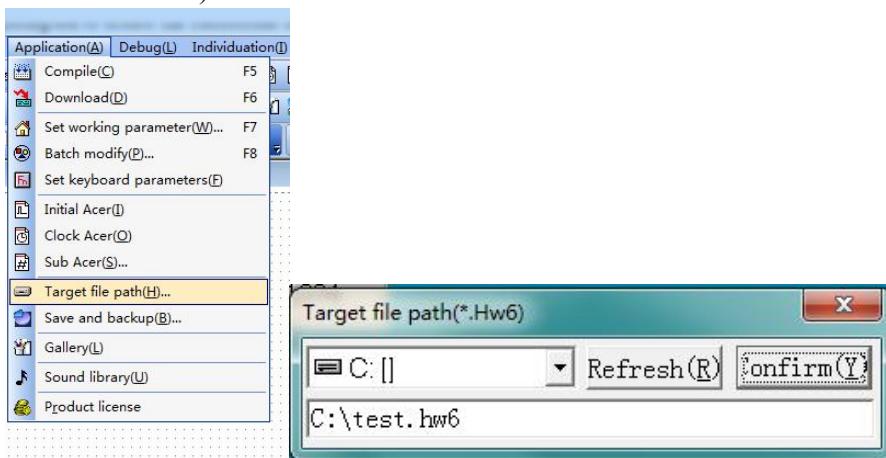
Find the file generated in C disk, which name is ".hw6" and same as program file.
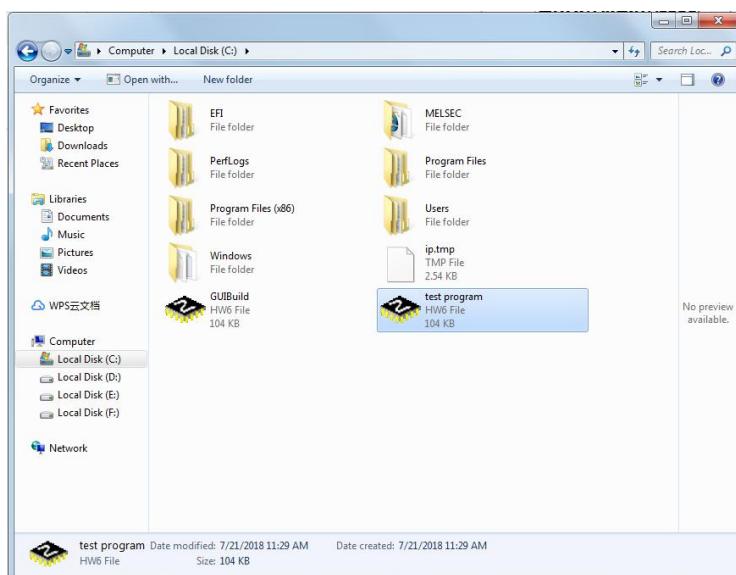
3. Copy the .hw6 file in the target file path to the USB flash drive;

4. Insert the USB flash drive into the usb port of the product - the USB setting screen will pop up;

5. Click "Update *.hw6 file", enter the corresponding level password , the default super password is 12345678, the default normal password is empty (direct confirmation);

if you changed the password, you need to enter the corresponding correct password;
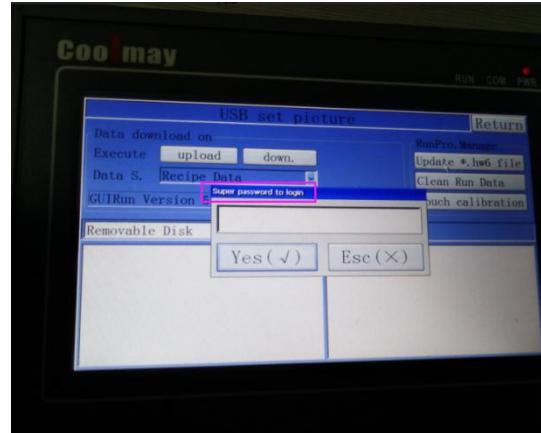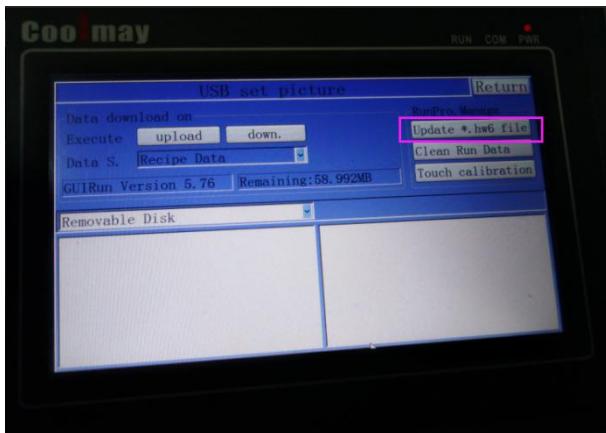
After confirming, find the ".HW6" file in the lower right corner. After double-clicking, the confirmation box will pop up. The progress bar will be updated automatically.

3.3 Introduction when HMI is with com port for MODBUS RTU protocol

3.3.1 HMI as master

Note: When the HMI is used as a Master with one slave, the communication port can be set to COM2 in Link1 or Link2 settings (Optional RS485 or RS232 for HMI, multiple slaves not available for RS232), and COM1 is used for communicating HMI of all-in-one to PLC of all-in-one.

1.HMI as master and connect to only one slave settings:

1) Open "Application --- Setting OP Parameters --- Communication Settings"

   link2 settings are as below:

   Communication port : COM2

   Device Type: Modbus RTU Slave

   Communication speed, communication timeout, check bit, data bit, stop bit: according to your own communication needs, , the master and salve must be set as the same.

   Device ID : The slave number to be read.
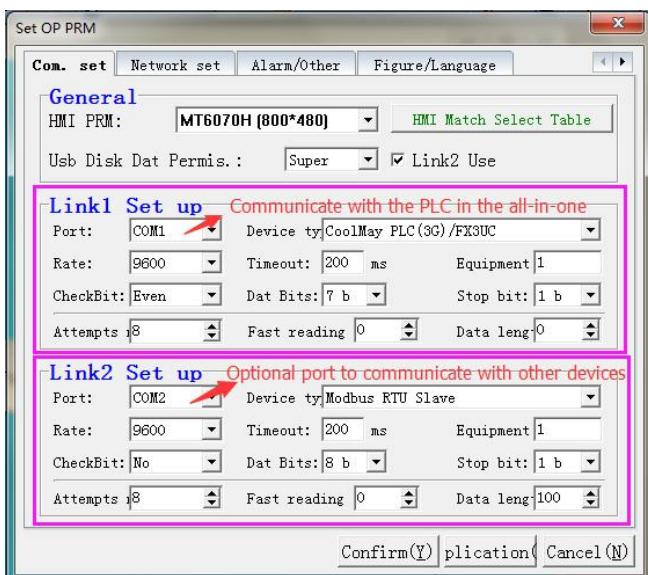
2) Communication Parameter setting: Open "Application --- Setting OP --- Network Settings"

Controller ID Address Mode: Select the default standard mode

2.HMI as mater and connect to multi-slaves setting:

Note: When the HMI is used as the Master with multiple slaves, the communication port must be set to COM2 in the Link1 setting (HMI optional RS485). In the Link2 setting, the communication port is changed to COM1 for communicating HMI of all-in-one to PLC of all-in-one.

1) In communication parameters setting,Open "Application --- Setting OP parameters --- Communication settings"

Settings in the link1 are as follows:

Communication port: COM2.

Device type: Modbus RTU Slave.

Communication speed, communication timeout, check bit, data bit, stop bit: according to their own communication needs, the master and salve must be set as the same.
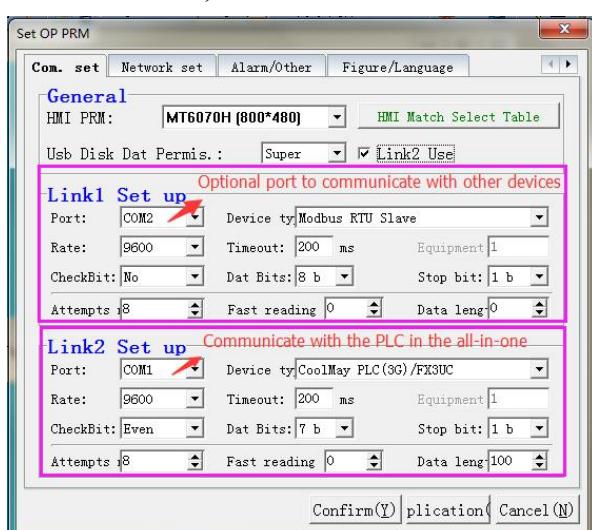
2) In Communication Parameter Settings, Open "Application --- Set Working Parameters --- Network Settings" .

Controller ID Address Mode: Select Extended Mode.

Extended communication ID switching interval: The default is 35ms, which can be adjusted according to actual communication.

Extended Mode Start ID: The default is 1, which is the first slave station number of the connected slave.

Each ID address register number: 100-30000 range can be set according to the actual register range setting of each slave.

The following figure shows:

the HMI is connected with multiple slaves, the first slave station number is from 1.

Number of each ID address register set 1000 When 4x0-4x999 indicates the address register of slave 0-999, 4x1000-4x1999 indicates 0-999 of slave 2.The register address, 4x2000-4x2999, represents register address 0-999 of slave 3... and so on.
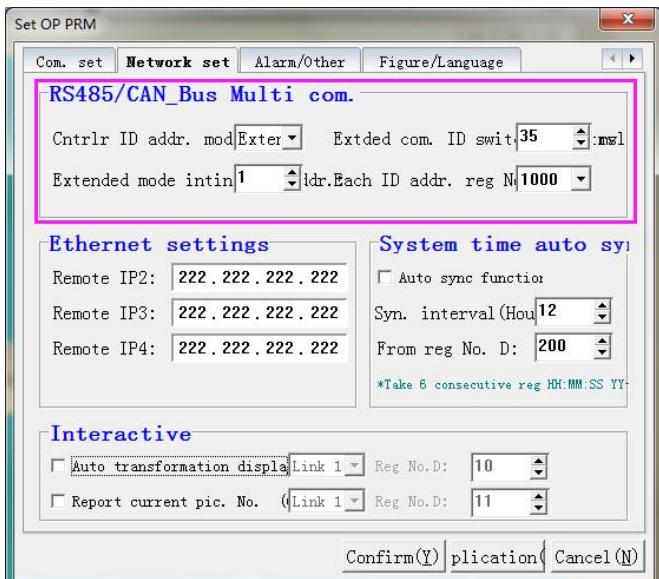

3.3.2 HMI as slave

<mark>Note: When the HMI is used as a slave, the communication port can be set to COM2 in Link1 or Link2 settings (Optional RS485 or RS232 for HMI), and COM1 is used for communicating HMI of all-in-one to PLC of all-in-one.</mark>

1. Communication parameter setting,   Open "Application --- Set OP Parameters --- Communication Settings"

link1 or link2 settings are as below:

Device Type: Modbus RTU Slave

Communication speed, communication timeout, check bit, data bit, stop bit: according to your own communication needs, , the master and salve must be set as the same.
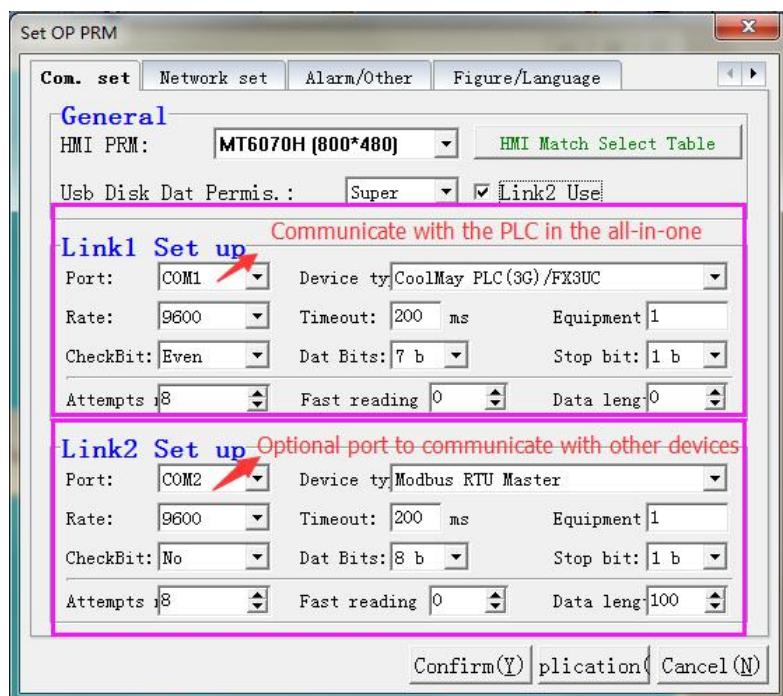
2. station number setting

1) Put a function key on the HMI program and jump to the 255 system menu page, and then compile and download the program to the HMI.

  As shown below:
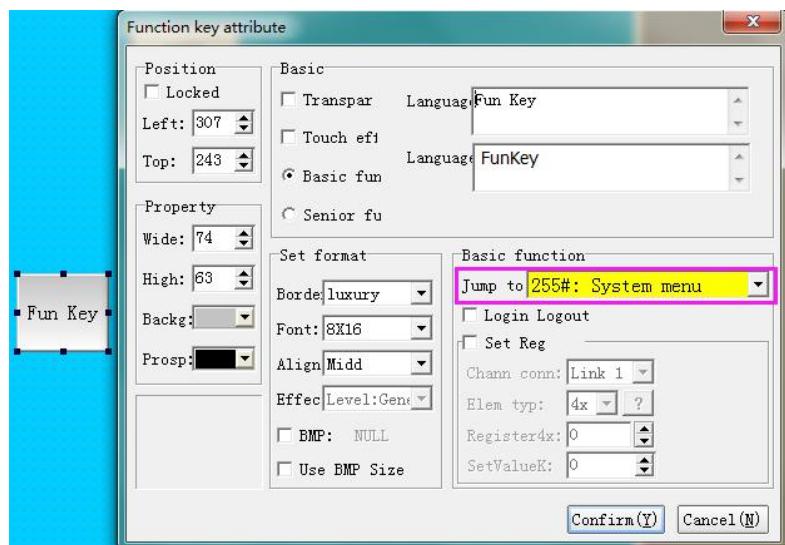
3.4 Other HMI usage.

please refer to CoolMay HMI User Manual,CoolMay HMI Programming Manual