WS3U-JK Series PLC Control Board User Manual

ins1560001--V1.12

Applicable to the following models:

WS3U-40MR-JK

WS3U-40MT-JK

WS3U-40MRT-JK

WS3U-48MR-JK

WS3U-48MT-JK

WS3U-48MRT-JK

WS3U-64MR-JK

WS3U-64MT-JK

WS3U-64MRT-JK

Catalogue

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Chapter 1 Product Overview

1.1 Product Overview

Download and Communication:

- Supports 1 channel RS232 and 1 channel RS485 (2-channel RS485 optional for 64-point models), with three communication ports. It can communicate with programming software simultaneously. Download speed ranges from 9.6Kbps to 115.2Kbps. Programming, downloading, debugging and monitoring are available via Mitsubishi GX Developer or GX Works2 (monitoring write-in is not supported).
- The three communication ports can connect with HMI at the same time. Select FX3U protocol, communication parameters: 19200,7,E,1.
- 1-channel CAN communication is optional, with up to 320 channels (not available for 40-point models), without occupying RS485 and RS232 ports.

Power supply :

- Adopts DC 24V power supply; static current is 40mA when all output relays are off; starting current shall be more than 1A.

Analog input/output:

- Default: 4 channels, 0 – 10 V (40 points). Maximum 10 analog inputs (48 or 64 points).
- The 48 – 64 channels feature 10 analog input channels (AD0 – AD5) with 0 – 10 V input and adjustable to 0–20 mA range; AD6–AD9 provide 4 temperature input channels using NTC 10 K resistors (-40 to 150 °C) or NTC 50 K resistors (-40 to 209°C).
- 2-channel analog output, 0 – 10 V
- The device offers optional weighing function for channels 1, with E+ and E-, S+ and S-four-wire interfaces (40-point support is unavailable).

The excitation voltage is 5V, and the signal voltage range is-20mV to +20mV.

High-speed input/output:

- Default high-speed input configuration: 6 channels, X0/100K, X1-X5/10K (X0 and X1 support bipolar 100K).

Maximum selectable options: 6 channels, X0 X3/100K, X1 X2 X4 X5/10K (X0 X1 and X3 X4 can be used as a dual-phase 100K).

- High-speed output: Y0-Y5 200 kHz; Y6-Y7 100 kHz

Encryption :

- When the keyword is set to 8 characters and the value is 12345678, the super encryption feature activates, completely disabling the program's upload function. Changing the password will erase the program entirely, effectively preventing all commercially available password cracking software.
- Available in multiple models with wide application scenarios, and supports bulk customization of products.

Indication Light Description：

- Power indicator (PWR): Always on
- Operation indicator (RUN): Flickering
- Error indicator (ERR): Flickers for minor faults; remains on for severe faults. When the error indicator lights up, you can use the "Diagnostic" function in the programming software to retrieve the error code and troubleshoot by referring to the error code table.

1.2 User Notice

Safety Guide

This manual contains precautions to ensure personal safety, as well as to protect this product and connected equipment. These precautions are highlighted with warning triangles in the manual and marked by hazard levels as follows. For matters not specified herein, comply with basic electrical operation specifications.

Attention

1. Indicates that improper operation may result in death or serious personal injury, as well as severe property loss.

2. Indicates that improper operation may lead to unintended consequences or abnormal status, and cause property damage.

Usage Guidelines

To ensure personal safety and proper equipment operation, please strictly adhere to the following precautions during equipment setup, installation, operation, and maintenance.

1. Only operators with adequate electrical knowledge are permitted to install and operate the equipment. This includes commissioning, grounding, and labeling of circuits, equipment, and systems in accordance with established safety protocols and standards.

2. When using this device in combination with other equipment, operators must verify that the electrical specifications are compatible; otherwise, equipment failure or other damages may occur.

3. Before programming the equipment, please read this manual carefully and proceed with

programming only after fully understanding its contents. For questions regarding software usage and programming, refer to the relevant manuals.

4. The examples listed in this manual or other technical documents are for users' understanding and reference only; they should not be used directly for commercial purposes.

Disclaimer

We have verified that the contents of this manual match the described hardware and software. Since errors are difficult to completely avoid, we cannot guarantee perfect consistency. We regularly review the data in the manual and make necessary corrections during subsequent edits. We welcome your valuable feedback.

1.3 Essential Parameter

Model	Outer shell dimensions : L*W*H (mm)	Opening size L*W (mm)	Download speed	Memory capacity	Enter point	Output Point	Output Type	Output current	Load	Counting	Pulse output	Analog Input	Analog Outpu	485	232	CAN	Weighing	Clock	Shell
FX3U-40MR-JK	151*106.2	144.8*72.6	9.6-115.2Kb	32000步	24	16	Relay	3A	24V/220V	2/100K default 6/100K optional	None	2AD 0-10V	2DA 0-10V	Route 1	Route 1	None	None	√	None
FX3U-40MT-JK	151*106.2	144.8*72.6	9.6-115.2Kb	32000步	24	16	Transistor	0.5A	24V	2/100K default 6/100K optional	6/200K 2/100K	2AD 0-10V	2DA 0-10V	Route 1	Route 1	None	None	√	None
FX3U-40MRT-JK	151*106.2	144.8*72.6	9.6-115.2Kb	32000步	24	16	Transistor*8 Relay*8	Transistor 0.5A relay 3A	24V/220V	2/100K default 6/100K optional	6/200K 2/100K	2AD 0-10V	2DA 0-10V	Route 1	Route 1	None	None	√	None
FX3U-48MR-JK	196*105.6	188.4*72.8	9.6-115.2Kb	32000步	24	24	Relay	3A	24V/220V	2/100K default 6/100K optional	None	6AD 0-10V adjustable to 0-20mA 4-channel NTC NTC10K (-40 to 150°C) or NTC50K (-40 to 210°C)	2DA 0-10V	Route 1	Route 1	Select Channel	Select Channel	√	None
FX3U-48MT-JK	196*105.6	188.4*72.8	9.6-115.2Kb	32000步	24	24	Transistor	0.5A	24V	2/100K default 6/100K optional	6/200K 2/100K		2DA 0-10V	Route 1	Route 1	Select Channel	Select Channel	√	None
FX3U-48MRT-JK	196*105.6	188.4*72.8	9.6-115.2Kb	32000步	24	24	Transistor*8 Relay*16	Transistor 0.5A Relay 3A	24V/220V	2/100K default 6/100K optional	6/200K 2/100K		2DA 0-10V	Route 1	Route 1	Select Channel	Select Channel	√	None
FX3U-64MR-JK	245*102*30	233*91	9.6-115.2Kb	32000步	32	32	Relay	3A	24V/220V	2/100K default 6/100K optional	None		2DA 0-10V	Route 2	Route 1	Select Channel	Select Channel	√	None
FX3U-64MT-JK	245*102*30	233*91	9.6-115.2Kb	32000步	32	32	Transistor	0.5A	24V	2/100K default 6/100K optional	6/200K 2/100K		2DA 0-10V	Route 2	Route 1	Select Channel	Select Channel	√	None
FX3U-64MRT-JK	245*102*30	233*91	9.6-115.2Kb	32000步	32	32	Transistor*8 Relay*24	Relay 3A Transistor 0.5A	24V/220V	2/100K default 6/100K optional	6/200K 2/100K		2DA 0-10V	Route 2	Route 1	Select Channel	Select Channel	√	None

Figure 1-1

*1: All models are equipped with 2 high-speed inputs by default, expandable up to 6 channels. Refer to the chapter of High-speed Input Description for detailed parameters.

*2: The default analog input signal of all models is 0-10V, switchable to 0-20mA. AD6 to AD9 support NTC10K temperature probe (-40~150℃) / NTC50K temperature probe (-40~210℃).

*3: 48-point to 64-point models can be optionally fitted with 1 CAN port. It supports register sharing between PLC hosts, similar to N:N network. Please refer to CAN Sharing Mode Description for operation instructions.

*4: 48-point to 64-point models can be added with 1 weighing interface. Please refer to Weighing Acquisition Description respectively for usage.

1.3 Usage Environment and Installation Method

- To prevent overheating inside the device, install it in wall-mounted mode. Reserve sufficient space at the top and bottom for heat dissipation.

- Keep a clearance of more than 50 mm between the PLC main unit and other equipment or structures. Keep away from high-voltage cables, high-voltage devices and power equipment as much as possible.

- Avoid dusty, oily and corrosive environments; take electrostatic protection measures (do not directly touch the circuit on the circuit board with hands).

- Fix and install with rubber isolation pillars.

Chapter 2 Product Display

2.1.Main product hardware specifications (using the WS3U-48MR-JK as an example)

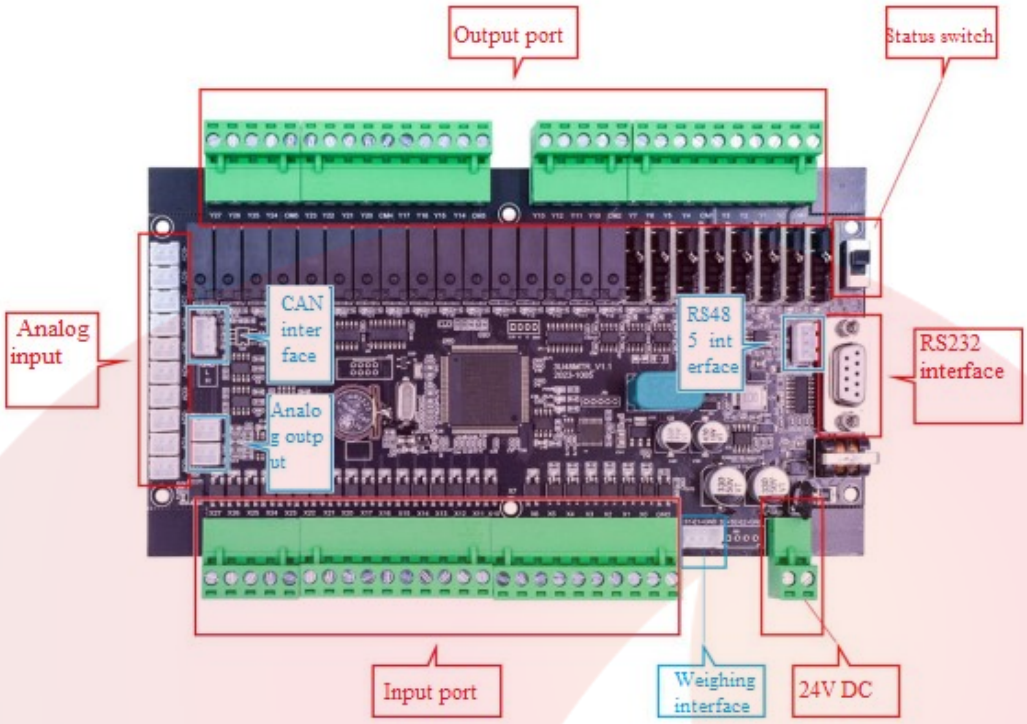

Figure 2-1

2.2.Front view of the product

WS3U-40MR-JK

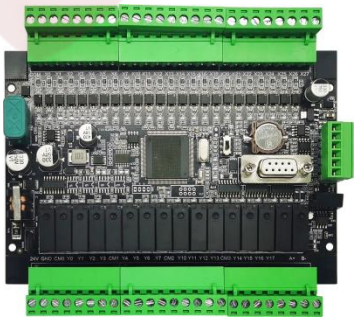

Figure 2-2

WS3U-40MT-JK

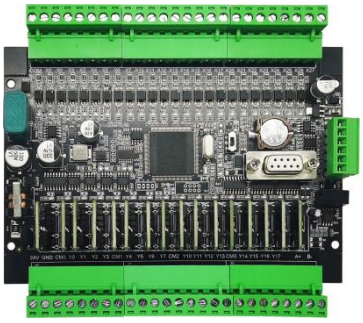

Figure 2-3

WS3U-40MRT-JK

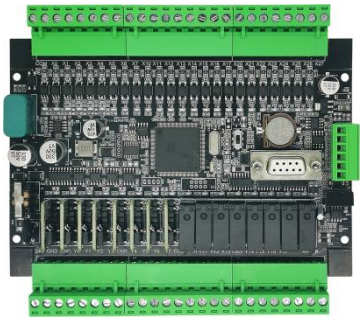

Figure 2-4

WS3U-48MR-JK

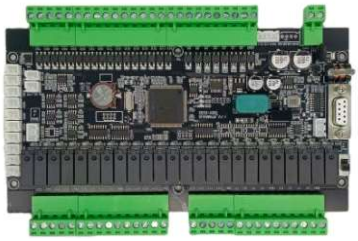

Figure 2-5

WS3U-48MT-JK

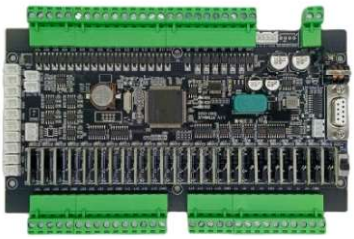

Figure 2-6

WS3U-48MRT-JK

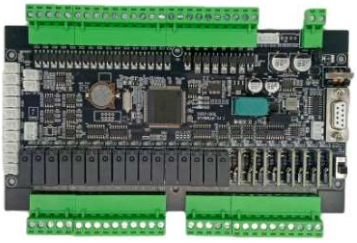

Figure 2-7

WS3U-64MR-JK

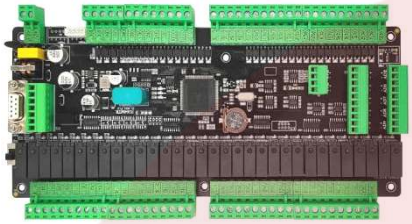

Figure 2-8

WS3U-64MT-JK

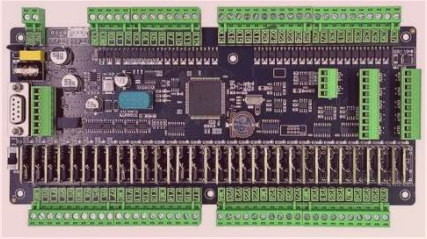

Figure 2-9

WS3U-64MRT-JK

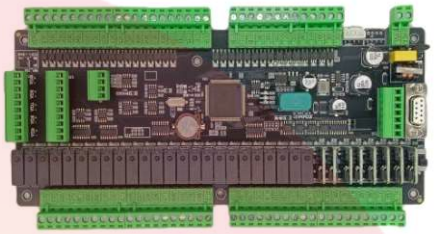

Figure 2-10

Chapter 3 Electrical Design Reference

3.1 Power Supply and Power Consumption

Powered by a DC 24V supply;

Under conditions where none of the output relays are activated, the static current is 40 mA;

Each activated relay increases the current by approximately 9 mA. For example, when all 3U-64MR output relays are fully activated, the current reaches 320 mA (7.5 W).

Note：Select a switching power supply with minimal ripple for power delivery. When the circuit is subject to strong interference, ensure appropriate filtering is applied using suitable filters.

3.2 CAN Communication Port Description

Function Description

1. Register sharing mode, similar to an N:N network.

Registration Sharing Mode Description

1. In register sharing mode, you can configure 1 master and up to 32 slaves (range: 1 – 32), with each station sharing up to 32 registers (range: 1 – 32).

2. The master or slave device can perform read/write operations on registers shared locally, and read operations on registers shared with other stations. (Each device shares a specific register address range; see the table below for details.)

3. In CAN register sharing mode, the communication baud rate is configurable: 20K, 50K, 80K, 100K, 125K, 200K, 250K, 400K, 500K, 600K, 800K, 1000K. If an unsupported baud rate is set, the system will automatically default to 250K.

4. The addresses of the master and slave hosts must not be duplicated; otherwise, fault codes 6373 and 6374 will be reported.

CAN Speed and distance(reference.)

Baud rate	Distance-m	Min line diameter-mm2	Max slave
50Kbps	500	0.7	32
100Kbps	250	0.5	32
125Kbps	150	0.5	32
250Kbps	80	0.3	32
500Kbps	40	0.3	32
1000Kbps	15	0.3	18

**Connect the host and the farthest slave device to the 120R terminal matching resistor.

Special Relay and Register Description

Host		Remark
M8150	CAN work permit	
M8149	Communication overtime mark	If mark on, please make it OFF manually in the program.
D8149	Communication overtime	1=1ms, default 50ms
D8150	Address configuration	0 for Host
D8151	Guest quantity	1-32; default 8
D8152	share register quantity	1-32; default 8
D8153	Communication baud rate	20K-1000K; default 250K
D8196	No Communication slave	1-16

D8197	No Communication slave	17-32
D8198	total No Communication slave	1-16
D8199	total No Communication slave	17-32
D8200	Max time to slave Communication	1=1ms

Guest		Remark
M8150	CAN work permit	
M8149	Communication overtime mark	If mark on, please make it OFF manually in the program.
D8149	Communication overtime	1=1ms, default 50ms
D8150	Address settings	Set range 1-32
D8152	Share register quantity	1-32; default 8
D8153	Communication baud rate	20K-1000K;default 250K
D8196	No Communication slave	1-16
D8197	No Communication slave	17-32
D8198	Total No Communication slave	1-16
D8199	Total No Communication slave	17-32
D8200	Max time to host Communication	1=1ms

Instruction

1. D8196 and D8197: Slave communication failure flags are automatically reset every 500ms.
2. D8198 and D8199: Summary of slaves with communication failure. Slaves that have ever failed to communicate after power-on will not be automatically reset during PLC operation.
3. After setting the parameters of the registers related to the CAN communication port, power cycle the PLC for the new parameters to take effect.
4. For the communication timeout setting of the master and slaves, it is recommended that the slave's D8149 be 10ms longer than the master's D8149.
5. The number of shared registers (D8152) must be set the same on both the master and slaves.

D8196、D8197and D8198、D8199 instruction

	b0	b1	b2	b3	b4	b5	b6	b7	b8	b9	b10	b11	b12	b13	b14	b15
D8196 D8198	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
D8197 D8199	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

Instruction

1. When the corresponding bit in the above register is 1, it indicates that the corresponding slave is offline or has a communication error.
2. D8198 and D8199 are the summary of slaves that have ever been offline after the master powers on. They are reset after the master is powered off.

Master/ Slave Shared Register (D8150) List

D8150	Start	End	Definition	D8150	Start	End	Definition
0	D1000-D1031		Host share register	17	D1544-D1575		NO.17 Slave share register
1	D1032-D1063		NO.1 Slave share register	18	D1576-D1607		NO.18 Slave share register
2	D1064-D1095		NO.2 Slave share register	19	D1608-D1639		NO.19 Slave share register
3	D1096-D1127		NO.3 Slave share register	20	D1640-D1671		NO.20 Slave share register
4	D1128-D1159		NO.4 Slave share register	21	D1672-D1703		NO.21 Slave share register
5	D1160-D1191		NO.5 Slave share register	22	D1704-D1735		NO.22 Slave share register
6	D1192-D1223		NO.6 Slave share register	23	D1736-D1767		NO.23 Slave share register
7	D1224-D1255		NO.7 Slave share	24	D1768-D1799		NO.24 Slave share

		register			register
8	D1256-D1287	NO.8 Slave share register	25	D1800-D1831	NO.25 Slave share register
9	D1288-D1319	NO.9 Slave share register	26	D1832-D1863	NO.26 Slave share register
10	D1320-D1351	NO.10 Slave share register	27	D1864-D1895	NO.27 Slave share register
11	D1352-D1383	NO.11 Slave share register	28	D1896-D1927	NO.28 Slave share register
12	D1384-D1415	NO.12 Slave share register	29	D1928-D1959	NO.29 Slave share register
13	D1416-D1447	NO.13 Slave share register	30	D1960-D1991	NO.30 Slave share register
14	D1448-D1479	NO.14 Slave share register	31	D1992-D2023	NO.31 Slave share register
15	D1480-D1511	NO.15 Slave share register	32	D2024-D2055	NO.32 Slave share register
16	D1512-D1543	NO.16 Slave share register			

Instruction

1. The starting address of shared registers for all devices is fixed, and the ending address is determined by D8152.
2. All devices can perform read/write operations on their own shared registers, and only read operations on other devices' registers.
That is, each device can write up to 1*32=32 registers in the network;
and read up to (1+32)*32=1056 registers.

3.3 485 Communication Port Description

1. The RS485-1/RS485-2 communication ports are programmed with the default protocol: communication parameters: 19200,7, E, 1.

2. Adjust the values on the D8400/D8420 to select the MODBUS-RTU protocol, RS Free Port protocol (RS485-1), or RS2 Free Port protocol (RS485-2), and configure the corresponding communication parameters. (When the PLC is idle, switch to the programming port protocol.) For fault detection details, refer to the "Fault Code List."

RS485-1 RS Command (RS Protocol-Free Communication): Description of Special M Relay and Special D Register Functions

Bit	Function	Bit	Function
M8401	RS command transmitting mark	M8402	RS command transmitting request mark
M8403	RS command receiving finish mark	M8409	Communication overtime mark
M8161	8/16 bit process mode(ON-8 bit; OFF-16 bit)		
D8400	Protocol chosen and Communication parameter setting	D8402	RS command data transmitting left
D8403	RS command receiving quantity	D8409	RS command overtime setting(1=10ms)
D8419	Communication port executing protocol mark		

RS485-1 RS2 Command (RS2 Protocol-Free Communication): Description of Special M Relay and Special D Register Functions

Bit	Function	Bit	Function
M8421	RS2 command transmitting mark	M8422	RS command transmitting request mark
M8423	RS2 command receiving finish mark	M8429	Communication overtime mark
D8420	Protocol chosen and Communication parameter setting	D8422	RS2 command data transmitting left
D8423	RS2 command receiving quantity	D8429	RS2 command overtime setting(1=10ms)
D8439	Communication port executing protocol mark		

D8400（RS485-1）/D8420（RS485-2）Parameter Setting

Bit	Name	Content	
		0(bit=0FF)	1(bit=0N)
bit0	Length	7 bit*1	8 bit
bit1 bit2	Parity	bit2 bit1 (0 0)- No Check (0 1)- ODD (1 1)-EVEN	
bit3	Stop	1 bit	2 bit
bit4 bit5 bit6 bit7	Speed	bit7 bit6 bit5 bit4 (0 0 1 1): 300 (0 1 0 0): 600 (0 1 0 1): 1200 (0 1 1 0): 2400 (0 1 1 1): 4800	bit7 bit6 bit5 bit4 (1 0 0 0):9600 (1 0 0 1):19200 (1 0 1 0):38400 (1 0 1 1):57600 (1 1 0 1):115200
bit8~bit11	Forbidden	Set 0	
bit12 bit13 bit14		bit14 bit13 bit12 (0 0 0):FX program port protocol (0 0 1):RS non-protocol Communication (RS485-1 dedicated) (0 1 0):RS2 无 protocol Communication (RS485-2 dedicated) (0 1 1):MODBUS - RTU protocol(D8401/D8421 set host and slave)	
bit15	Forbidden	Set 0	

Description of function codes supported by the MODBUS-RTU master slave protocol

Function	Command	Soft component type	
		Bit component	Byte component
Bit read command	1(H1), 2(H2)	X, Y, M, S, T, C, special M	-
Bit write command	5(H5)	Y, M, S, T, C, special M	

Register read command	3(H3), 4(H4)	X, Y, M, S, T, C, special M	D, T, C, special D
Register write command	6(H6)	Y, M, S, T, C, special M	D, T, C, special D
Multi register write command	16(H10)	Y, M, S, T, C, special M	D, T, C, special D

Note: 1. The maximum data length for APRW read and write operations is 520; exceeding this limit triggers fault codes 6343 or 6363.

2. Use register read bits: a single register reads the status of 16 bit elements.

3. Use register write bits: A single register can modify the state of 16-bit elements.

RS485-1/RS485-2 ADPRW Command (MODBUS-RTU Protocol): Special M Relay Function Description

RS485-1	RS485-2	Name	Valid	Content	Type
M8410		RS485-1/2 use ADPRW command switch	Host	OFF:RS485-1 use ADPRW command. ON:RS485-2 use ADPRW command.	R/W
M8029		Command execution end	Host	OFF:command not executed or command execution not end. ON:command execution done	R
M8401	M8421	In MODBUS communication	Host	Set to ON in MODBUS communication.	R
M8402	M8422	MODBUS Communication error	Host/Slave	MODBUS Communication error setting ON.	R
M8403	M8423	MODBUS Communication error lock	Host/Slave	MODBUS Communication error setting ON.	R
M8408	M8428	Retry	Host	Guest no response timely, Host transmits retry and set ON	R
M8409	M8429	Overtime	Host	Response overtime setting ON.	R

R: read only

R/W: read/write

RS485-1/RS485-2 ADPRW Command (MODBUS-RTU Protocol): Description of the Special D Register Function

RS485-1	RS485-2	Name	Valid	Content	Type
D8400	D8420	Protocol chosen and Communication parameter set	Host/Slave	Set Communication format	R/W
D8401	D8421	MODBUS protocol chosen	Host/Slave	Value HO to choose MODBUS Host protocol; Value in H10(K16)to choose MODBUS slave protocol	R/W
D8402	D8422	Communication error code	Host/Slave	In MODBUS Communication latest error code stored	R
D8403	D8423	Error content	Host/Slave	Latest error content be stored.	R
D8404	D8424	Communication error step	Host	First error in ADPRW command step code stored	R
D8407	D8427	Communication step code	Host	MODBUS Communication in ADPRW command step code stored(command not executed, 0 stored). last execution ADPRW Command step code kept.	R
D8408	D8428	Current retry times	Host	Guest no response overtime, Communication retry, and current times be stored	R
D8409	D8429	Guest response overtime	Host	Host transmits request, and slave not response. Then host resend the text, or judge the overtime wrong from setting(D8412,D8432). then end this command. Set scope:0～32767,1=10ms. If set 0, 3s means overtime.	R/W
D8410	D8431	Transmitting delay	Host/Slave	Delay after receiving the data and return the data setting scope:0～16382,1=1ms, default:10ms	R/W

D8412	D8432	Retry times	Host	Guest not response in setting time. Then host send text unit the retry times. The command ends the handling for overtime error. Setting scope:0～20[times] Set value more than 20, retry times 20.	R/W
D8414	D8434	Guest station code	Guest	Store slave code, scope: 1～247.	R/W
D8063	D8438	Serial Communication error code	Host/Slave	Communication error occurs, it store the corresponding error code same to the one in MODBUS Communication .	R
D8419	D8439	Movement way display	Host/Slave	0-FX program port Communication 4-RS command 5-RS2 command 19-MODBUS Communication Host 29-MODBUS Communication slave	R

R: read only

R/W: read/write

RS485-1/RS485-2 MODBUS-RTU Slave Protocol Software Component Address Description

MODBUS - RTU slave bit component address.		PLC bit component address
Only red	Read/write	
0x0000～0x1DFF	0x0000～0x1DFF	M0～M7679
0x1E00～0x1FFF	0x1E00～0x1FFF	M8000～M8511
0x0000～0x2FFF	0x0000～0x2FFF	S0～S4095
0x3000～0x31FF	0x3000～0x31FF	TS0～TS511
0x3200～0x32FF	0x3200～0x32FF	CS0～CS255
0x3300～0x33FF	0x3300～0x33FF	Y0～Y377
0x3400～0x34FF	-	X0～X377

MODBUS - RTU Guest word component address		PLC word component address
Only red	Read/write	
0x0000～0x1F3F	0x0000～0x1F3F	D0～D7999
0x1F40～0x213F	0x1F40～0x213F	D8000～D8511
0xA140～0xA33F	0xA140～0xA33F	TN0～TN511
0xA340～0xA407	0xA340～0xA407	CN0～CN199
0xA408～0xA477	0xA408～0xA477	CN200～CN255(32-bit)
0xA478～0xA657	0xA478～0xA657	M0～M7679
0xA658～0xA677	0xA658～0xA677	M8000～M8511
0xA678～0xA777	0xA678～0xA777	S0～S4095
0xA778～0xA797	0xA778～0xA797	TS0～TS511
0xA798～0xA7A7	0xA798～0xA7A7	CS0～CS255
0xA7A8～0xA7B7	0xA7A8～0xA7B7	Y0～Y377
0xA7B8～0xA7C7	-	X0～X377

3.4 High-speed Input Instructions

1. Maximum response frequency of C251, C252, C254 (AB phase): 100KHz;

2. Maximum response frequency of C253, C255 (AB phase): 100KHz;

3. Maximum response frequency of C235, C241, C244, C238 (single-phase): 100KHz;

4. Maximum response frequency of other high-speed counters: 10KHz;

5. AB-phase high-speed counters support 2-frequency multiplication and 4-frequency multiplication (the setting is valid only within the current OUT drive cycle):

(1) When M8196 is ON, the counting pulses of C251, C252 and C254 are doubled;

(2) When M8197 is ON, the counting pulses of C253 and C255 are doubled;

(3) When M8198 is ON, the counting pulses of C251, C252 and C254 are quadrupled;

(4) When M8199 is ON, the counting pulses of C253 and C255 are quadrupled;

Example: If an AB-phase encoder is used with 1000 pulses per revolution. Without frequency multiplication, the counter counts 1000 per revolution. With 2-frequency multiplication enabled, the counter counts 2000 per revolution. With 4-frequency multiplication enabled, the counter counts 4000 per revolution.

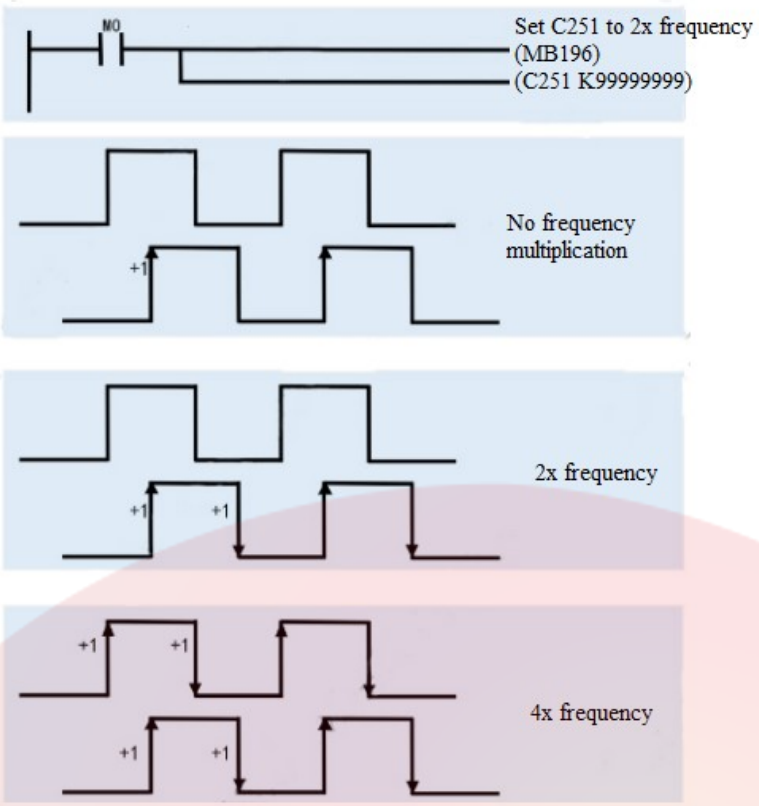

Figure 3-1

The inputs X000-X007 correspond to the high-speed counter numbers listed in the table below. These inputs cannot be reused by the high-speed counters.

When the high-speed input point is not used as a pulse input terminal for the high-speed counters, they can serve as general inputs.

Input end	Single phase single counting input										
	C235	C236	C237	C238	C239	C240	C241	C242	C243	C244	C245
Type	H/W	S/W	S/W	H/W	S/W	S/W	H/W	S/W	S/W	H/W	S/W
X000	U/D						U/D			U/D	
X001		U/D					R			R	
X002			U/D					U/D			U/D
X003				U/D				R			R
X004					U/D				U/D		
X005						U/D			R		
X006										S	
X007											S

Input end	Single phase single counting input					dual phase dual counting input				
	C246	C247	C248	C249	C250	C251	C252	C253	C254	C255
Type	S/W	S/W	S/W	S/W	S/W	H/W	H/W	H/W	H/W	H/W
X000	U	U		U		A	A		A	
X001	D	D		D		B	B		B	
X002		R		R			R		R	
X003			U		U			A		A
X004			D		D			B		B
X005			R		R			R		R
X006				S					S	
X007					S					S

H/W: Hardware counter S/W: Software counter U: Up-count input D: Down-count input
A: Phase A input B: Phase B input R: Reset input S: Start-count input

Inputs X000–X007 cannot be reused.For example: If C251 is used, X000 and X001 will be occupied.Therefore, C235, C236, C244, C247, C249, C252, C254, the interrupt pointers I00/I01, and the corresponding SPD instructions cannot be used repeatedly.

Pulse Capture Function Description

1. Supports pulse capture functionality for X0-X5, corresponding to: X0-M8170, X1-M8171, X2-M8172, X3-M8173, X4-M8174, X5-M8175;

2. To use the pulse capture function, an EI instruction must be executed first.

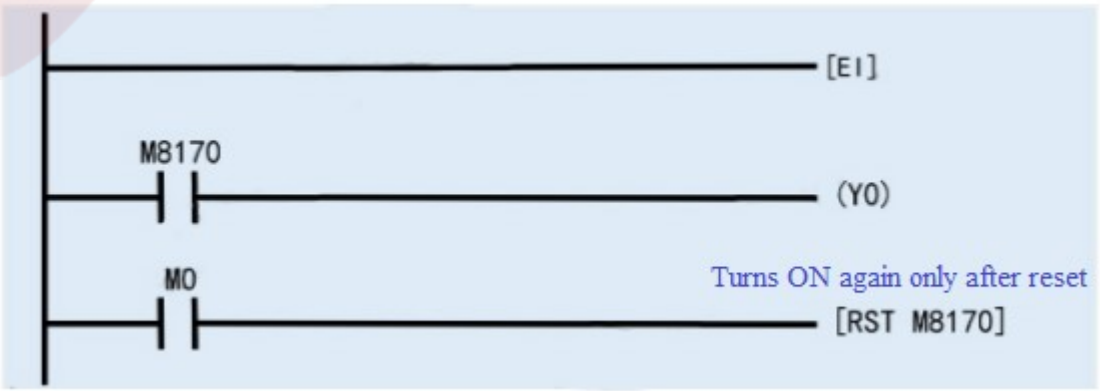

Figure 3-2

Instructions for Using the DHSCS, DHSCR, and DHSZ Commands

1. Number of simultaneous executions for the three high-speed comparison instructions: 2 times for the X0 hardware counter, 2 times for the X3 hardware counter, and 4 times for other software counters

(exceeding fault code 6705).

2. When using a hardware high-speed counter for comparison, the response frequency remains unchanged. While DHSCS and DHSCR perform real-time comparisons, the interval comparison in DHSZ hardware occurs not in real time but approximately every 5 microseconds.

3. When using a hardware high-speed counter, the comparison result is output only after the DHSCS, DHSCR, or DHSZ drivers are activated; 4. When using a software high-speed counter, the comparison is performed only when the high-speed counter receives an input signal.

Interrupt Description

1. Supports input interrupts for X0-X5.

2. Does not support input interrupt delayed execution (D8393 function)

3.5 High-Speed Output Description

High-speed Output Description

1.Y0, Y1, Y2, Y3, Y4, and Y5 have a maximum output frequency of 200 kHz, while Y6 and Y7 have a maximum output frequency of 100 kHz, allowing simultaneous output;

2.all Y0 – Y7 support enhanced PWM commands.

Special M Relay Specifications

Special M relay code								Usage	Type	command
Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7			
M8029								Command execution end mark	R	PLSY/PLSR/DSZR/DVIT/ZRN/DRVI/DRVA
M8329								Command abnormal end mark		PLSY/PLSR/DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
M8336								Input interruption end, assigned function valid	R/W	DVIT

M8338								PLSV command +/- speed valid		PLSV
M8340	M8350	M8360	N8370	M8440	M8450	M8470	M8480	Pulse output mark	R	PLSY/PLSR/DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
M8341	M8351	M8361	M8371	M8441	M8451	M8471	M8481	Signal zero output valid	R/W	DSZR/ZRN
M8342	M8352	M8362	M8372	M8442	M8452	M8472	M8482	Original point returned direction assigned.		DSZR
M8343	M8353	M8363	N8373	M8443	M8453	M8473	M8483	Forward rotation limit		PLSY/PLSR/DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
M8344	M8354	M8364	M8374	M8444	M8454	M8474	M8484	Reverse rotation limit		
M8345	M8355	M8365	M8375	M8445	M8455	M8475	M8485	Near point signal logic reverse		DSZR
M8346	M8356	M8366	M8376	M8446	M8456	M8476	M8486	zero point signal logic reverse		
M8347	M8357	M8367	M8377	M8447	M8457	M8477	M8487	Interruption signal logic reverse		DVIT
M8348	M8358	M8368	M8378	M8448	M8458	M8478	M8488	Location command drive mark	R	PLSY/PWM/PLSR/ DSZR/DVIT/ZRN/ PLSV/DRVI/DRVA

M8349	M8359	M8369	M8379	M8449	M8459	M8479	M8489	Pulse stop command	R/W	PLSY/PLSR/DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
M8460	M8461	M8462	M8463	M8152	M8153	M8154	M8155	User end input command		DVIT
M8464	M8465	M8466	M8467	M8156	M8157	M8158	M8159	Signal setting soft component assigned function valid.		DSZR/ZRN

R: Read-only;

R/W: Read/Write.

*1: When the specified function of the reset signal soft component is invalid, reset signals Y0-Y10, Y1-Y11, Y2-Y12, Y3-Y13, Y4-Y14, Y5-Y15, Y6-Y16, and Y7-Y17 are cleared.

Special D Register Description

Special D register code								Usage	Bit	Default value	Command
Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7				
D8336				D8337				End input assignment	16 bit	0	DVIT
D8340	D8350	D8360	D8370	D8440	D8450	D8470	D8480	Current location register	32 bit	0	DSZR/DVIT/ZRN/DSZR/PLSV/DRVI/DRVA
D8341	D8351	D8361	D8371	D8441	D8451	D8471	D8481				
D8342	D8352	D8362	D8372	D8442	D8452	D8472	D8482	Basic speed	16 bit	0	
D8343	D8353	D8363	D8373	D8443	D8453	D8473	D8483	Highest speed	32 bit	100000	
D8344	D8354	D8364	D8374	D8444	D8454	D8474	D8484				

D8345	D8355	D8365	D8375	D8445	D8455	D8475	D8485	Crawl speed	16 bit	1000	DSZR
D8346	D8356	D8366	D8376	D8446	D8456	D8476	D8486	Original point returned speed	32 bit	50000	
D8347	D8357	D8367	D8377	D8447	D8457	D8477	D8487				
D8348	D8358	D8368	D8378	D8448	D8458	D8478	D8488	Accelerated time	16 bit	100	DSZR/DVIT/ ZRN/PLSV*1 DRVI/DRVA
D8349	D8359	D8369	D8379	D8449	D8459	D8479	D8489	Decelerated time	16 bit	100	
D8464	D8465	D8466	D8467	D8156	D8157	D8158	D8159	Signal resetting software component assigned	16 bit	0	DSZR/ZRN
D8140	D8142	D8144	D8146	D8170	D8172	D8174	D8176	Pulse value register	32 bit	0	PLSY/PLSR *2
D8141	D8143	D8145	D8147	D8171	D8173	D8175	D8177				

*1: The M8338 must be set to ON for the PLSV acceleration and deceleration functions to be effective;

*2: This pulse is generated when using PLSY or PLSR commands, and its cumulative output corresponds to the designated register.

PWM Usage Instructions

The Y0-Y7 ports are enhanced PWM commands;

1. S1: PWM output frequency. The maximum frequency is 200KHz for Y0-Y5 and 10KHz for Y6-Y7. The higher the frequency, the greater the duty cycle error.
2. S2: PWM output duty cycle. The range 0-1000 corresponds to 0%-100.0%. If out of range, error code 6706 will be reported.
3. D: Specified PWM output channel. Supported channels are Y0-Y7.

3.6 Analog Input Description

Analog input command RD3A

AD0-AD5:0-10V，

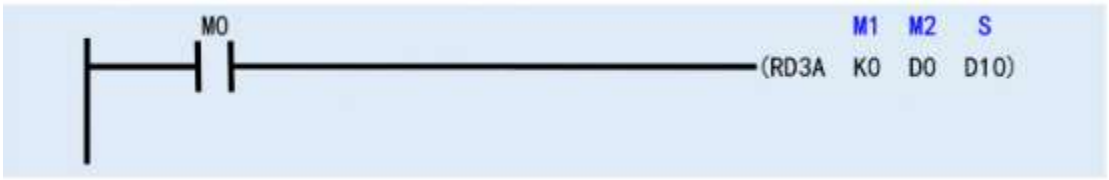

Figure 3-3

1.M1: Specifies the analog input channel number. If the value exceeds the PLC's maximum channel number, error code 6711 will be reported.

2.M2: Analog input range limit registers. M2 is the upper range limit, M2+1 is the lower range limit, and M2+2 is the first-order lag filter coefficient (range: 0–128; the larger the coefficient, the greater the lag; recommended setting: 50). Only D registers can be assigned to M2, M2+1, and M2+2; specifying other data types will trigger error code 6711.

3.S: Specifies the data collected from the AD port.

Example Explanation

The principle of the example program is as follows: When M0 is activated, analog data from port AD0 is sampled and stored in D10. The displayed voltage or current value is determined by the upper range register D0 and the lower range register D1.

For example:

(1) D0=1000, D1=0; AD0 input range: 0–10 V. When the input is 5 V, D10 equals 500.

(2) D0=0, D1=0; AD0 input range: 0–20 mA. When the input is 5 mA, D10 equals 1024.

(3) D0=1000, D1=-1000; AD0 input range: 0–10 V. When the input is 6 V, D10 equals 200.

When both upper and lower ranges are set to 0, the AD data range is 0-4095;
If the upper range setting value is less than or equal to the lower range setting value (and not both set to 0 at the same time), error code 6711 will be reported.

Figure 3-4

3.7 Analog Output Description

Analog output command WR3A

Figure 3-5

1. M1: Specifies the analog output channel number; if it exceeds the PLC's maximum number of channels, error code 6712 will be reported.

2. M2: Analog output range limit registers - M2 is the upper limit value, M2+1 is the lower limit value; only D registers can be specified; specifying other data will trigger error code 6712.

3. S: Specifies the data output from the DA interface.

Example Explanation

The principle of the example program is as follows: When M0 is activated, port DA0 outputs the voltage or current value corresponding to the data in D10. The specific output value is determined by the upper range register D0 and the lower range register D1.

For example:

(1) D0=1000, D1=0, DA0 output range 0–10 V; when an output of 5 V is required, the D10 data is 500;

(2) D0=0, D1=0, DA0 output range 0–20 mA; when an output of 5 mA is required, the D10 data is 1024;

(3) D0=1000, D1=-1000, DA0 output range 0–10 V; when an output of 6 V is required, the D10 data is 200;

When both upper and lower ranges are set to 0, the DA data range is 0-4095;
If the upper range setting value is less than or equal to the lower range setting value (and not both set to 0 at the same time), error code 6712 will be reported;
If the DA output set value is not within the range set by D0 and D1, error code 6712 will be reported.

Figure 3-5

3.8 Temperature Measurement Instructions

NTC10K/NTC50K Temperature Measurement Instructions

AD6-AD9 are temperature acquisition ports for NTC10K/NTC50K thermistors (B value 3950K). The switching between NTC10K and NTC50K is determined by specific bits of the D8009 chip. The temperature measurement range for NTC10K is-40° C to 150℃, while that for NTC50K is-40℃ to 210℃

	D8009									
bit 位	bit0	bit1	bit2	bit3	bit4	bit5	bit6	bit7	bit8	bit9
AD port	ADO	AD1	AD2	AD3	AD4	AD5	AD6	AD7	AD8	AD9
NTC10K	0	0	0	0	0	0	0	0	0	0
NTC50K	1	1	1	1	1	1	1	1	1	1

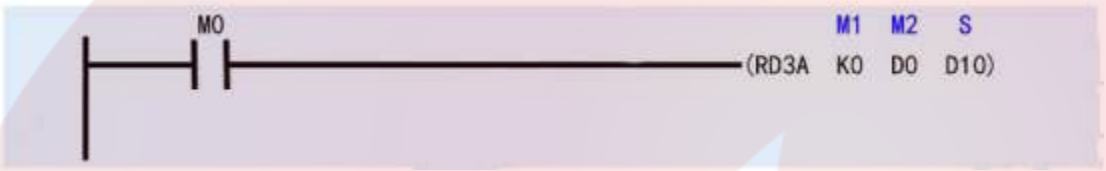

Figure 3-6

Share the RD3A instruction with analog inputs

1.M1: Assign the temperature input channel number. Error code 6711 will be triggered if exceeding the maximum channel number of the PLC.

2.M2: Temperature input range register. M2 stands for the upper limit, M2+1 for the lower limit, and M2+2 for the first-order lag filter coefficient (0-128; the larger the value, the stronger the lag, 50 is recommended). Only D registers are available for M2, M2+1 and M2+2. Any other assignment will trigger error code 6711. The values of range registers are fixed. Both upper and lower limit values shall be set to 0; otherwise, abnormal temperature data will occur.

3.S: Designate the data of temperature input port.

Example Explanation：

The principle of the example program is as follows: When M0 is activated, temperature data from port AD 0 is acquired and stored in D10. For example:

(1) When D0 = 0 and D1 = 0, and AD0 uses an NTC10K sensor with a temperature of 98.5°C, the D10 value is 985;

(2) When D0 = 0 and D1 = 0, and AD0 uses an NTC10K sensor with a temperature of-23.8°C, the D10 value is-238;

(3) When D0 = 0 and D1 = 0, and AD0 uses an NTC50K sensor with a temperature of 203.4°C, the D10 value is 2034.

Both the upper and lower ranges must be set to 0 at the same time, otherwise the temperature data will be inaccurate;
The actual temperature is obtained by adding one decimal place to the data collected by the temperature acquisition port. For example, if the data is 1234, the temperature is 123.4°C.

Figure 3-7

3.9 Weighing and Collection Instructions

Weighing Interface Description

1. Supports a four-pin interface: Power positive E+, power negative E-, signal positive S+, signal negative S-;
2. Excitation voltage: 5 V;
3. Signal voltage range: -20 mV to +20 mV;
4. 4. Data acquisition frequency: 10 Hz.

Weighing Interface 1: Special M Relay and Special D Register			
M8120	Enable the weighing data collection function	M8121	An error occurred during weight measurement and data acquisition; perform manual reset.
D8116	Filter frequency (3–32, default 12)	D8120	Original data from the weighing sensor, 32 bits

The aforementioned special relays and special registers are all power-loss-holding types.

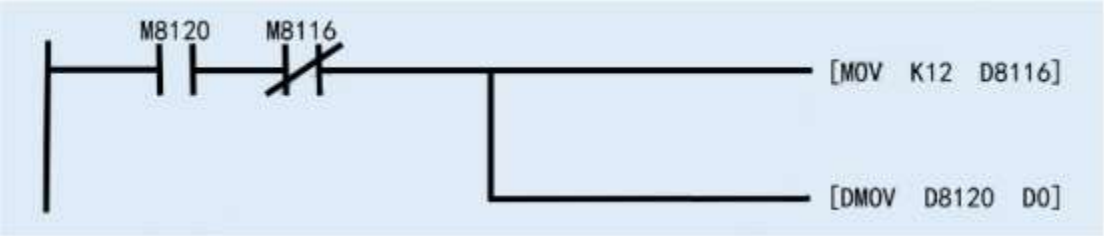

Figure 3-8

Example Explanation：

The operating principle of the sample program is as follows: When the M8120 is powered on, the Weight Acquisition Port 1 begins collecting raw data from the weight sensor and transmitting it to the D0

register—a 32-bit register. If the weight acquisition port fails, the data collection function stops.

3.10 PID Instruction Description

PID instruction format (Incremental PID)

Figure 3-9

1. The PID instruction is used to call the PID calculation routine;

2. Before the PID calculation begins, use the MOV instruction to pre-load the parameter setpoints (see table below) into the corresponding data registers;

3. If using data registers with power-off retention, there is no need to re-load the values;

4. If the target operand [D] has power-off retention, use the normally open contact of the initialization pulse M8002 to reset it.

PID Function Selection			
Address	Function		Explanation
S1	Set value SV		
S2	Feedback value (PV)		
S3	Dwell time （TS）		Set the range from 1 to 32767 (ms), which must be greater than the PLC program scan cycle.
S3+1	functioning pattern ACT	bit0	0: Direct Action; 1: Reverse Action;
		bit1	0: No alarm for input change; 1: Alarm for input change is valid;
		bit2	0: No output change alarm; 1: Output change alarm is active—do not set bit2 and bit5 to ON simultaneously.
		bit3	Reserve: set to 0;
		bit4	Reserve: set to 0;
		bit5	0: No upper or lower limit setting for output values; 1: Upper and lower limit settings for output values are valid—bit2 and bit5 should not be set to ON simultaneously.
		bit6~bit15	Reserve: set to 0;

Direct Action:The larger the difference that the feedback value is lower than the set value, the higher the output value.Typical application: heating system realized by controlling the on-off time of heating wire;

Reverse Action:The larger the difference that the feedback value is higher than the set value, the higher the output value.Typical application: cooling system realized by controlling fan speed.

<table>
<tr><td colspan="4">Incremental PID</td></tr>
<tr><td>Address</td><td>Name</td><td>Range</td><td>Content</td></tr>
<tr><td>S3+2</td><td>KP</td><td>0~32767(%)</td><td>2 times PV difference*ratio increase=output value ratio</td></tr>
<tr><td>S3+3</td><td>KI</td><td>0~32767(%)</td><td>(Difference between PV and SV)*integral increase=output value integral</td></tr>
<tr><td>S3+4</td><td>KD</td><td>0~32767(%)</td><td>PV change predication value*differential increase=output value differential part</td></tr>
<tr><td>S3+(5~11)</td><td colspan="3">For test only, not for program</td></tr>
<tr><td rowspan="2">S3+12</td><td>Input variation(increase)</td><td rowspan="2">0~32767</td><td rowspan="3"><ACT> bit1=1 valid</td></tr>
<tr><td>Alarm SV</td></tr>
<tr><td rowspan="2">S3+13</td><td>Input variation(decrease)</td><td rowspan="2">0~32767</td></tr>
<tr><td>Alarm set value</td></tr>
<tr><td rowspan="2">S3+14</td><td>Output variation(increase)</td><td>0~32767</td><td><ACT> bit2=0,bit5=1 valid</td></tr>
<tr><td>Alarm set value</td><td>-32768~32767</td><td><ACT> bit2=1,bit5=0 valid</td></tr>
<tr><td rowspan="2">S3+15</td><td>Output variation(decrease)</td><td>0~32767</td><td><ACT> bit2=0,bit5=1 valid</td></tr>
<tr><td>Alarm set value</td><td>-32768~32767</td><td><ACT> bit2=1, bit5=0 valid</td></tr>
<tr><td rowspan="5">S3+16</td><td rowspan="5">Alarm output</td><td colspan="2">Bit0 output variation(increase) overflow</td></tr>
<tr><td colspan="2">Bit1 output variation(decrease) overflow</td></tr>
<tr><td colspan="2">bit2 output variation(increase) overflow</td></tr>
<tr><td colspan="2">bit3 output variation(decrease) overflow</td></tr>
<tr><td colspan="2"><ACT>bit1=1or bit2=1 valid</td></tr>
<tr><td>S3+(17～28)</td><td colspan="3">For test only, not for program</td></tr>
</table>

PID instructions can be executed multiple times simultaneously, but the D register occupied by each PID instruction cannot be reused.

Setting of PID parameters (Incremental PID)

1. There are four main parameters to set for PID control: TS, Kp, Ki, and Kd;

2. A smaller TS value allows for a more immediate response to changes in the feedback value; however, an excessively small TS value increases the computational load on the PLC, and if there is little change between two feedback values, the PID output will also remain largely unchanged. The appropriate TS value must be selected based on the specific project requirements.

3. The functions of the three control modes: P (Proportional), I (Integral), and D (Derivative):

(1) The proportional component is related to the difference between two consecutive feedback values. As long as a difference exists, the proportional component promptly generates a control action proportional to that difference, characterized by its responsiveness.

(2) The action of the integral term is related to the magnitude of the difference between the current setpoint and the feedback value. As long as this difference is not zero,

the output will continue to be generated due to the integral action until the difference disappears, at which point the integral term ceases to produce an output.

(3) The derivative term anticipates changes based on the rate of change of the difference between the setpoint and the feedback value, providing a larger corrective action in advance.

The derivative term reflects the trend of system changes.

3.11 Product wiring diagram

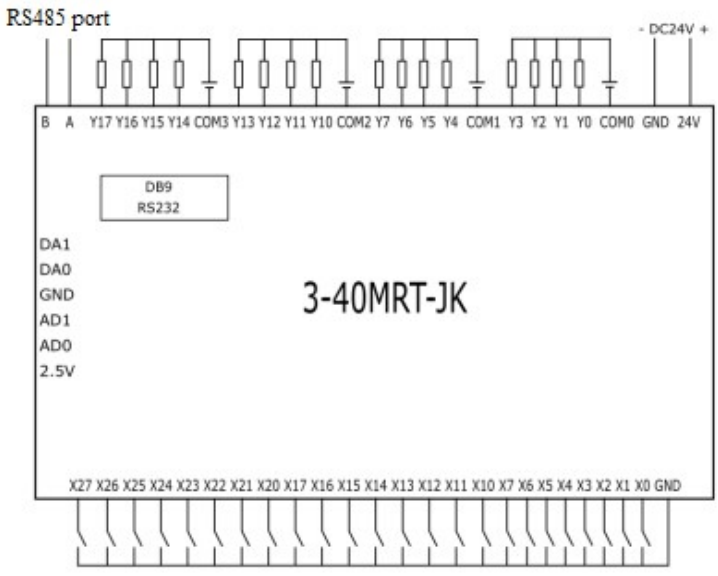

Figure 3-10

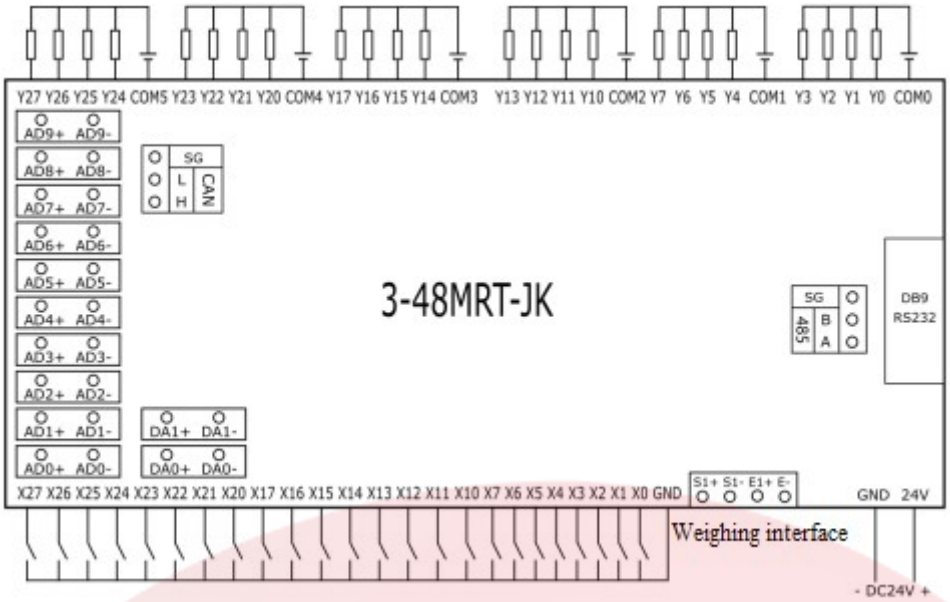

Figure 3-11

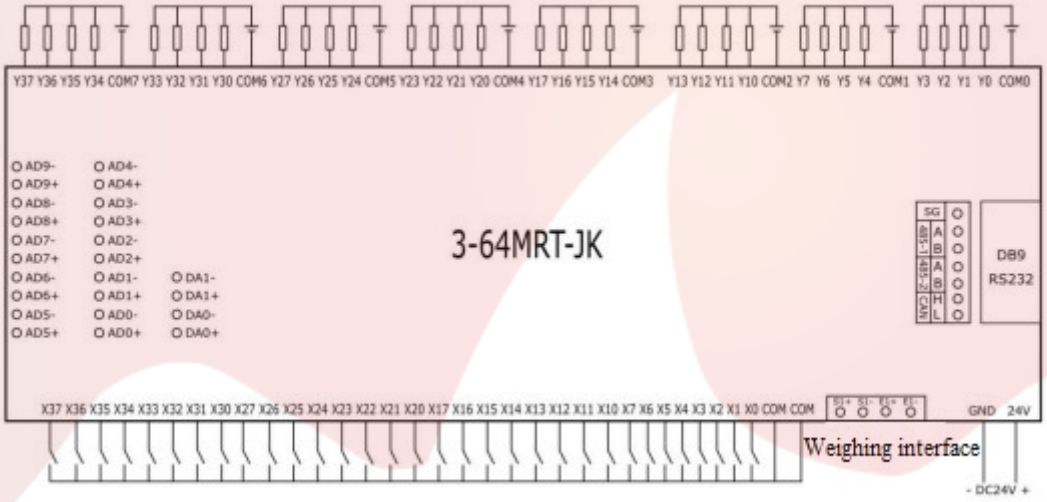

Figure 3-12

Chapter 4 Programming Reference

4.1 Application Environment

1. GX Developer (compatible with XP and Windows 7 32-bit systems)
2. GX Works2 (compatible with Windows 7 64-bit, Windows 8, and Windows 10 systems)

4.2.Assignment of component numbers and functional overview

Range of internal soft components

M auxiliary relay	General use	M0~M499 500 point	
	Keep use	M500~M7679 7180 point	
	Special use	M8000~M8511 512 point	
S status relay	Initialization	S0~S9 10 point	
	General use	S10~S499 490 point	
	Keep use	S500~S899 400 point	
	Signal alarm	S900~S999 100 point(keep)	
	Keep use	S1000-S4095 3096 point	
T timer	100ms general use	T0~T199 200 point	
	10ms general use	T200~T245 46 point	
	Cumulative usage: 1 ms	T246~T249 4 point	
	Cumulative usage: 100 ms	T250~T255 6 point	
	1ms general use	T256~T511 256 point	
C counter	16 bit incremental counter	General use	C00~C99 100 point
		Keep use	C100~C199 100 point
	32-bit increment decrement counter	General use	C200~C219 20 point
		Keep use	C220~C234 15 point
		For high-speed maintenance use	C235~C255 20 point
D register	General use	D0~D199 200 point	

	Keep use	D200~D7999 7800 point	
	Special use	D8000-D8511 512 point	
V.Z address change register	V0~V7. Z0~Z7 16 point		
Nested pointer	Host control	N0~N7 8 point	
	Jump out, slave program use	P0~P4095 4096 point	
	Outer end	I0□□ ~I5□□ 6 point	
	Counter end	I010~ I060 6 point	
Constant	K (Decimal)	16 bit : -32768~32767	32 bit:-2147483648~ 2147483647
	H (hexadecimal)	16 bit : 0~FFFF	32 bit: 0~FFFFFFFF
	E (real number-Float point)	$-1.0x2^{*128}$ ~$-1.0x2^{-126}$, 0, $1.0x2^{-126}$ ~$1.0x2^{128}$	

M Special Register

Bit	Function	Bit	Function
M8000	Run Monitoring Contact	M8001	Run Monitoring Reverse Contact
M8002	Initial pulse contact	M8003	Initial pulse reverse contact
M8004	Error indication contact	M8005	
M8006		M8008	
M8011	10ms clock pulse	M8012	100ms clock pulse
M8013	1-second clock pulse	M8014	1-minute clock pulse
M8015	Set the clock	M8016	The clock shows stopped
M8017	Correct the time to ±30 seconds	M8018	There is a real-time clock indicator
M8019	Clock Error Flag	M8020	Zero mark
M8021	Borrow flag	M8022	Carry flag
M8024	BMOV transmission direction	M8029	Instruction Execution Completion Flag
M8031	Power-off data erase	M8032	Power-off data clearing

M8034	Prohibit all outputs	M8039	Constant scanning mode
M8040	STL prohibits transfer	M8046	STL movement
M8047	Effective STL monitoring	M8048	S900 and S999 are in the ‘on’ state
M8049	Signal alarm is effective	M8050	I0□□Interrupt prohibited
M8051	I1□□Interrupt prohibited	M8052	I2□□Interrupt prohibited
M8053	I3□□Interrupt prohibited	M8054	I4□□Interrupt prohibited
M8055	I5□□Interrupt prohibited	M8059	I010. I020. I030. I040. I050. I060 Counting Interrupt Disabled
M8118		M8120	Weighing function 1 activated
M8121	Weighing function 1 error, cannot automatically reset	M8122	Weighing function 2 activated
M8123	Weighing function 2 error, cannot automatically reset	M8124	Weighing function 3 activated
M8125	Weighing function 3 error, cannot automatically reset	M8126	Weighing function 4 activated
M8127	Weighing function 4 error, cannot automatically reset	M8129	
M8139	HSS、HSCR. HSZ. HSCTHigh-speed counter comparison instruction is being executed	M8149	CAN communication timeout flag
M8150	CAN Working Flag Permitted	M8152	User interrupted input command Y4
M8153	User interrupted input command Y5	M8154	User interrupted input command Y6
M8155	User interrupted input command Y7	M8161	16-bit/8-bit switching flag, RS command valid
M8168	SMOV instruction HEX processing function	M8170	X0 pulse capture
M8171	X1 pulse capture	M8172	x2 pulse capture
M8173	X3 pulse capture	M8174	X4 pulse capture
M8175	X5 pulse capture	M8196	Double frequency markers for C251, C252, and C254
M8197	Double frequency flag for C253 and C255	M8198	C251. The 4x frequency marker of C252 C254
M8199	Quadruple frequency flag of C253 and C255	M8200-M8234	Counting direction setting for C200-0234

M8235-M8345	Counting direction setting for C235-C245	M8346-M8255	Counting direction flag of C246-0255
M8329	Command execution parazacco spilurus subsp. spilurus often termination marker	M8330	DUTY designated timing clock output 1
M8331	DUTY specifies the output 2 of the timing clock	M8332	DUTY specifies the output of the timing clock 3
M8333	DUTY designated timing clock output 4	M8334	DUTY specifies the output of the timing clock 5
M8336	Interrupt input specified function is valid	M8338	PLSV command acceleration/deceleration operation valid
M8340-M8349	High-speed output Y0 function	M8350-M8359	High-speed output Y1 function
M8360-M8369	High-speed output Y2 function	M8370-M8379	High-speed output Y3 function
M8440-M8449	High-speed output Y4 function	M8450-M8459	High-speed output Y5 function
M8470-M8479	High-speed output Y6 function	M8480-M8489	High-speed output Y7 function
M8401-M8409	Communication port RS485-1 function	M8410	Communication port RS485-2/RS485-2 switches using the ADPRW instruction
M8421-M8429	Communication port RS485-2 function	M8460	User interrupted input command Y0
M8461	User interrupted input command Y1	M8462	User interrupted input command Y2
M8463	User interrupted input command Y3	M8464	DSZR, ZRN command Y0 clear signal command is valid
M8465	DSZR, ZRN command Y1 clear signal command is valid	M8466	DSZR, ZRN command Y2 clear signal command is valid
M8467	DSZR, ZRN command Y3 clear signal command is valid		

D Special Register

Bit	Function	Bit	Function
D8000	Watchdog timer setting value (default 200)	D8009	AD□ NTC10K/NTC50K temperature acquisition switching

D8010	Scan time current value (0.1ms)	D8011	Minimum scan time (0.1 ms)
D8012	Maximum scanning time (0.1 s)	D8013	RTC clock second
D8014	RTC Clock Interval	D8015	RTC clock time
D8016	RTC Clock Day	D8017	RTC Clock Month
D8018	RTC Clock Year	D8019	RTC Clock Week
D8020	X0-X17 filter coefficients (set range: 0–60 ms, default: 10)	D8021	The filtering coefficient for X20-X77 (set value: 1–60 ms; default: 10)
D8028	Content of the Z0 address register	D8029	Content of the V0 address register
D8039	Constant scan time (unit: 1 ms, default: 0)	D8040	First activity STL state
D8041	Second activity STL state	D8042	The 3th activity STL state
D8043	The 4th activity STL state	D8044	The 5th activity STL state
D8045	The 6th activity STL state	D8046	The 7th activity STL state
D8047	The 8th activity STL state	D8048	
D8049	Minimum Active STL State	D8116	Weigh function 1 filter count
D8117	Weigh function 2 filter count	D8118	Weigh function 3 filter count
D8119	Weigh function 4 filter count	D8120	Weighting function 1 data low bit
D8121	Weighing function 1 data high bit	D8122	Weighting function 2 data low bit
D8123	Weighing function 2 data high bit	D8124	Weighting function 3 data low bit
D8125	Weighing function 3 data high bit	D8126	Weighting function 4 data low bit
D8127	Weighing function 4 data high bit	D8139	HSCS, HSCR, HSZ, HSCT instruction count in command execution (cannot exceed 4)
D8140	Y0 pulse output count register (32-bit)	D8142	Y1 pulse output count register (32-bit)
D8144	Y2 pulse output count register (32-bit)	D8146	Y3 pulse output count register (32-bit)
D8149	CAN master/slave communication timeout period (1=1ms)	D8150	Master/Slave Station Number (0~32)
D8151	Number of slave devices (1~32, default: 8)	D8152	Number of shared registers (1~32, default: 8)
D8153	CAM communication baud rate (20-1000k, default: 250K)	D8156	DSZR and ZRN instructions designate Y4 as the signal element for clearing.
D8157	DSZR and ZRN instructions designate Y5 as the signal element for clearing.	D8158	DSZR and ZRN instructions designate Y6 as the signal element for clearing.

D8159	DSZR and ZRN instructions designate Y7 as the signal element for clearing.	D8170	Y4 pulse output count register (32-bit)
D8172	Y5 pulse output count register (32-bit)	D8174	Y6 pulse output count register (32-bit)
D8176	Y7 pulse output count register (32-bit)	D8182	Z1 index register content
D8183	V1 index register content	D8184	Z2 index register content
D8185	V2 index register content	D8186	Z3 index register content
D8187	V3 index register content	D8188	Z4 index register content
D8189	V4 index register content	D8190	Z5 index register content
D8191	V5 index register content	D8192	Z6 index register content

D Special Register

Bit	Function	Bit	Function
D8193	V6 index register content	D8194	Z7 index register content
D8195	V7 index register content	D8196	CAN communication failure in slave devices 1~16
D8197	CAN communication failure in slave devices 17~32	D8198	Summary of 16 slave devices with failed CAN communication
D8199	Summary of Slave Devices 17~32 with CAN Communication Failure	D8310	Random number (32-bit) V
D8330	DUTY instruction timed clock output 1 scan counter	D8331	DUTY instruction timed clock output 2 scan counter
D8332	DUTY instruction timed clock output 3 scan count counter	D8333	DUTY instruction timed clock output 4 scan count counter
D8334	DUTY instruction timed clock output 5 scan count counter	D8336	DVIT interrupt input specifies Y0-Y3
D8337	DVIT interrupt input specifies Y4-Y7	D8340-D8349	High-speed output Y0 register
D8350-D8359	High-speed output Y1 register	D8360-D8369	High-speed output Y2 register
D8370-D8379	High-speed output Y3 register	D8400-D8419	Communication port RS485-1 function
D8420-D8439	Communication port RS485-2 function	D8440-D8449	High-speed output Y4 register
D8450-D8459	High-speed output Y5 register	D8470-D8479	High-speed output Y6 register

D8480-D8489	High-speed output Y7 register	D8464	DSZR, ZRN instructions designate Y0 as the clearing signal component.
D8465	DSZR and ZRN instructions designate Y1 as the clear signal component.	D8466	DSZR and ZRN instructions designate the Y2 clear signal component.
D8467	DSZR and ZRN instructions designate the Y3 clear signal component.		

4.3 Basic instructions (all supported)

LD LDI LDP LDF AND ANI ANDP ANDF ANDB OR ORI ORP ORF ORB MPS
MRD MPP MC MCR INV PLS PLF OUT SET RST NOP MEP MEF END STL(Maximum 8-way branching） RET

4.4 Application Instructions

Sort	Function Number	Command	Function	Note
Process flow	0	CJ	Conditional Jump	
	1	CALL	Subroutine call	
	2	SRET	Subroutine Return	
	3	IRET	Interrupt return	
	4	El	Interrupt flag	
	5	DI	Power off	
	6	FEND	Main program ended	
	7	WDT	Watchdog timer refresh	
	8	FOR	Loop area begins	
	9	NEXT	Loop zone termination	
Transmission and Comparison	10	CMP	Comparison	
	11	ZCP	Regional comparison	
	12	MOV	Transmission	
	13	SMOV	Bit traffic	
	14	CML	Reverse transmission	
	15	BMOV	Simultaneous transmission	
	16	FMOV	Multicast	

	17	XCH	Exchange	
	18	BCD	BCD conversion	
	19	BIN	BIN conversion	
Four fundamental logical operations	20	ADD	BIN Addition	
	21	SUB	BIN Subtraction	
	22	MUL	BIN Multiplication	
	23	DIV	BIN Division	
	24	INC	BIN Add 1	
	25	DEC	BIN Minus 1	
	26	WAND	Logical word and	
	27	WOR	Logical character or	
	28	WXOR	Logical XOR	
	29	NEG	Complement code	
Circular shift	30	ROR	Right turn	
	31	ROL	Left turn	
	32	RCR	Rotate right with carry	
	33	RCL	Rotate left with carry	
	34	SFTR	Right shift	
	35	SFTL	Left shift	
	36	WSFR	Word right	
	37	WSFL	Word left	
	38	SFWR	Move write	
	39	SFRD	Move read	
Data processing	40	ZRST	Zone reset	
	41	DECO	Decode	
	42	ENCO	Encode	
	43	SUM	Number of digits in ON	
	44	BON	ON position judgment	
	45	MEAN	Average value	
	46	ANS	Signal alarm set	
	47	ANR	Signal alarm reset	
	48	SQR	Square root calculation	
	49	FLT	BIN integer - binary float point transform	
High-speed	50	REF	Input output refresh	

processing	53	HSCS	Comparison set	
	54	HSCR	Comparison reset	
	55	HSZ	Zone comparison	
	56	SPD	Input pulse density	Using the SPD instruction to switch to other high-speed input functions requires clearing the utetheisa kong PLC program.
	57	PLSY	Pulse output	
	58	PWM	Pulse modulation output	For the usage of enhanced PWM instructions, please refer to the "Enhanced PWM User Manual" for detailed explanations.
	59	PLSR	Increase and decrease pulse output	
Convenient instruction	61	SER	Data inquire	
	62	ABSD	Cam control absolute way	
	63	INCD	Cam control relative way	
	64	TIMR	Teach timer	
	65	STMR	Special timer	
	66	ALT	Alternate output	
	67	RAMP	Slope signal	
	69	SORT	Data sequence	
Peripheral instruction I/O	73	SEGD	7 segment decode	
Peripheral device SER	80	RS	Serial data transmit	
	81	PRUN	8-bit data transfer	
	82	ASCI	HEX-ASCII conversion	
	83	HEX	ASCII - HEX conversion	
	84	CCD	Verification code	
	87	RS2	Serial data transmit 2	
	88	PID	PID calculation	For the usage of PID, please refer to the "PID Instruction Manual" for detailed explanations.
Data transmission 2	102	ZPUSH	Address change register bulk storage	

	103	ZPOP	Address change register recovery	
Floating-point operations	110	ECMP	Binary float point comparison	
	111	EZCP	Binary float point zone comparison	
	112	EMOV	Binary float point data transmission	
	118	EBCD	Binary -Decimal float point transform	
	119	EBIN	Decimal- binary float point transform	
	120	EADD	Binary float point add	
	121	ESUB	Binary float point subtract	
	122	EMUL	Binary float point multiply	
	123	EDIV	Binary float point divide	
	124	EXP	Binary float point index calculation	
	125	LOGE	Binary float point Napier logarithm calculation	
	126	DLOG10	Binary float point common logarithm calculation	
	127	ESQR	Binary float point square root calculation	
	128	ENEG	Binary float point symbol rotary	
	129	INT	Binary float point-BIN transform	
	130	SIN	Float point SIN calculation	
	131	COS	Float point COS calculation	
	132	TAN	Float point TAN calculation	

	133	ASIN	Binary float point SIN-1 calculation	
	134	ACOS	Binary float point COS-1 calculation	
	135	ATAN	Binary float point TAN-1 calculation	
	136	RAD	Binary float point angle-radian transform	
	137	DEG	Binary float pointradian -angle transform	
Data processing	140	WSUM	Calculate the sum of data values	
	141	WTOB	Byte unit data isolation	
	142	BTOW	Byte unit data combination	
	143	UNI	16 bit data 4 bit combination	
	144	DIS	16 bit data 4 bit isolation	
	147	SWAP	Up&down byte exchange	
	149	SORT2	Data sequence 2	
positioning control	150	DSZR	DOG search original point return	
	156	ZRN	Original point return	
	157	PLSV	Variable pulse output	
	158	DRVI	Relative location	
	159	DRVA	Absolute location	
Clock operation	160	TCZP	Clock data zone comparison	
	161	TADD	Clock data add	
	162	TSUB	Clock data subtract	
	163	HTOS	Hour/min/sec data second transform	
	164	STOH	Second data Hour/min/sec transform	
	165	TRD	Clock data read	
	166	TWR	Clock data write	

	167	HOUR	Timer	
External device	170	GRY	Gray code transform	
	171	GBIN	Gray code reverse transform	
	176	RD3A	Analog module read	For analog input readings, please refer to the "Analog Description" section for detailed explanations.
	177	WR3A	Analog module write	Analog output, please refer to the "Analog Description" section for detailed instructions.
Other instructions	184	RND	Random data	
	188	CRC	CRC calculation	
	185	HCMOV	high-speed counter transmission	
	192	BK+	Data block add calculation	
	193	BK-	Data block subtract calculation	
	194	BKCMP=	Data block comparison(S1)=(S2)	
	195	BKCMP>	Comparison of data blocks (S1) > (S2)	
	196	BKCMP<	Comparison of data blocks (S1) < (S2)	
	197	BKCMP<>	Comparison of data blocks (S1)<> (S2)	
	198	BKCMP<=	Comparison of data blocks (S1) <= (S2)	
	199	BKCMP>=	Comparison of data blocks (S1) >= (S2)	
Data processing 3	210	FDEL	Data sheet data deletion	
	211	FINS	Data sheet data insertion	
	212	POP	Read left data	
	213	SFR	16 bit data n bit right move(carry bit)	
	214	SFL	16-bit data n-bit left shift	

			(carry bit)	
Contact comparison instruction	224	LD=	(S1)=(S2)	
	225	LD>	(S1)>(S2)	
	226	LD<	(S1)<(S2)	
	228	LD<>	(S1)≠(S2)	
	229	LD<=	(S1)<=(S2)	
	230	LD>=	(S1)>=(S2)	
	232	AND=	(S1)=(S2)	
	233	AND>	(S1)>(S2)	
	234	AND<	(S1)<(S2)	
	236	AND<>	(S1)≠(S2)	
	237	AND<=	(S1)<=(S2)	
	238	AND>=	(S1)>=(S2)	
	240	OR=	(S1)=(S2)	
	241	OR>	(S1)>(S2)	
	242	OR<	(S1)<(S2)	
	244	OR<>	(S1)≠(S2)	
	245	OR<=	(S1)<=(S2)	
	246	OR>=	(S1)>=(S2)	
Data table processing	256	LIMIT	Upper and lower limit position control	
	257	BAND	Dead zone control	
	258	ZONE	Zone control	
	259	SCL	Set coordinates (coordinate data of different points)	
	269	SCL2	Set coordinates 2 (X/Y coordinate data)	
	276	ADPRW	Modbus-RTU read/write	M8410:RS485-1/2 switched using ADPRW instruction

Chapter 5 Frequently Asked Questions and Solutions

5.1 Fault diagnosis

WS3U-JK Series Fault Diagnosis

Take GX Works 2 as an example

1：Click the top menu bar: "Diagnostics" → "PLC Diagnostics(P)"

2: On the PLC Diagnostics screen, view the error code and error program step in sequence.
3: Refer to the "WS3U-JK Series Error Code List" on the next page according to the error code to troubleshoot the error.

Figure 5-1

5.2 Fault Code List

Type	Fault code	Error content	Remark
PLC hardware fault M8061 (D8061) operation stopped	6101	Power-off data check error	Increase the power supply capacity and contact the manufacturer.
	6102	Data keep module check error 1	Contact the manufacturer
	6103	Data keep module check error 2	Contact the manufacturer
	6105	Monitor action(inner watchdog action)	Increase the set value of D8000 or check the program
	6106	Logic error	Check the program, contact the manufacturer
CAN expansion mode error M8062(D8062) operation continues	6206	Parameter check error	
	6209	Module QTY exceeded	Maximum 15
	6210	CAN Initialization error	
	6211	Receive expansion address wrong	
	6212	Receive data interfered	
	6213	Expansion back error mark	
	6214	Receive overtime mark	For details, refer to D8196 and D8197.

	6215	Receive illegal slave address	
	6216	Receive slave expansion function and host configuration nonconforming	
	6217	Guest address set repeat	
RS485-1/RS485-2 M8063(D8063) Run continue	6306	Receive data overtime	Check the communication line or the settings of D8400 and D8409.
	6308	D8400 baud rate exceeded scope	
	6309	D8400 choose 7 bit data, Do not choose no check	
	6310	Use RS, RS2command but DB400, D8420 no start	
	6314	D8420 baud rate exceeded scope	
	6315	D8420choose 7 bit data, Do not choose no check	
	6340	D8400 no start MODBUS Host function	RS485-1
	6341	MODBUS protocol ADPRW slave address error	
	6342	MODBUS protocol ADPRW function error	
	6343	MODBUS protocol ADPRW command length error	
	6344	MODBUS protocol receive data check error	
	6345	Receive data station code and command wrong	
	6346	Receive data overtime	
	6360	D8440 no start MODBUS Host function	RS485-2
	6361	MODBUS protocol ADPRW slave address error	
	6362	MODBUS protocol ADPRW function error	
	6363	MODBUS protocol ADPRW	

		command length error	
	6364	MODBUS protocol receive data check error	
	6365	Receive data station code and command wrong	
	6366	Receive data overtime	

Type	Fault code	Error content	Remark
CAN sharing mode error M8063(D8063) operation continues	6380	Initialization failed	CAN
	6381	The returned slave ID does not match the read ID.	
	6382	Reception length error	
	6383	Incomplete data received	
	6384	The slave device has the same ID	
	6385	Data reception timeout	
	6386	The hosts have identical IDs.	
Parameter error M8064 (D8064) operation stopped	6401	Program and number verification error	Malicious program modification or incomplete download;
			The internal program FLASH of the CPU is damaged;
	6409		Internal FLASH corruption.
Syntax error M8065 (D8065) operation halted	6504	Px or Ix or high-speed counter label duplication	
	6505	Component range exceeded	
	6506	Using unsupported instructions	
	6507	Incorrect labeling used (P63 was utilized)	
	6510	The serial number of MC is incorrect in size	
Circuit error M8066 (D8066) operation stopped	6603	Using MPS more than 12 times	
	6605	STL continuous usage count exceeds 9 times	
		Without using STL, RET appears	
	6606	The main program contains I (interrupt) IRET SRET	

		No IRET SRET in the program	
	6609	Other	
	6614	MPS is missing	
	6615	MPP is missing	
	6619	FOR NEXT includes I MC MCR IRET STL RST	
	6623	No MC instruction	
	6625	STL Sx consecutive usage count exceeds 9	
		STL Sx, Sx range is greater than S899	
	6626	The STL includes MC, MCR, SRET, I (Interrupt), and IRET	
	6627	No RET instruction after STL	
	6630	CALL SRET relationship is incorrect	
Operation error M8067 (D8067) operation continues	6701	CALL, CJ does not have an object	
	6706	Instruction component address or component value range exceeded	
	6710	SFWR(P) instruction element 1 is the same as element 2	
	6711	Analog AD input range setting error	
	6712	Analog DA output range or data setting error	
	6715	NTC resistor may be open circuit	Please connect the NTC resistor

5.3 This version does not support the command list.

Function Number	Directive	Function Number	Directive	Function Number	Directive	Function Number	Directive
51	REFF	52	MTR	60	IST	68	ROTC
70	TKY	71	HKY	72	DSW	74	SEGL
75	ARWS	76	ASC	77	PR	85	VRRD
86	VRSC	117	ESTR	151	DVIT	152	TBL

155	ABS	182	COMRD	200	STR	201	VAL
202	$+	203	LEN	204	RIGHT	205	LEFT
206	MIDR	207	MIDW	208	INSTR	209	$MOV
260	DABIN	261	BINDA	270	IVCK	271	IVDR
272	lVRD	273	IVWR	274	IVBWR	275	IVMC
278	RBFM	279	WBFM	280	HSCT	290	L0ADR
291	SAVER	292	INITR	293	LOGR	294	RWER
295	INITER	300	FLCRT	301	FLDEL	302	FLWR
303	FLRD	304	FLCMD	305	FLSTRD		

Chapter 6 Warranty Terms

6.1 Warranty period 12 months

The product comes with a one-year warranty period starting from the date of shipment. During the warranty period, our company will provide free repair services for the product.

6.2 Not covered under warranty

- Incorrect wiring, such as reversing the positive and negative terminals of the power supply.
- Exceeding the voltage range or environmental usage requirements.
- Unauthorized modification of internal components.