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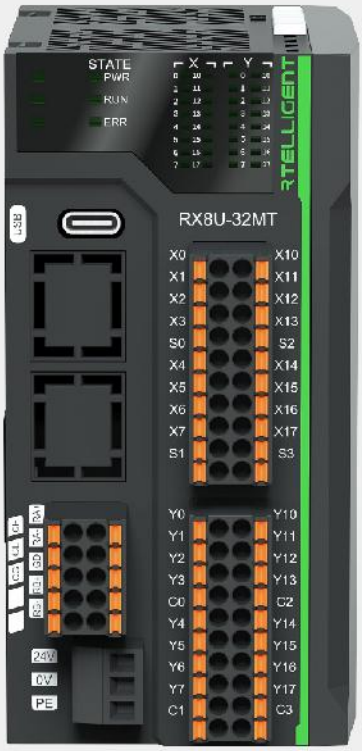
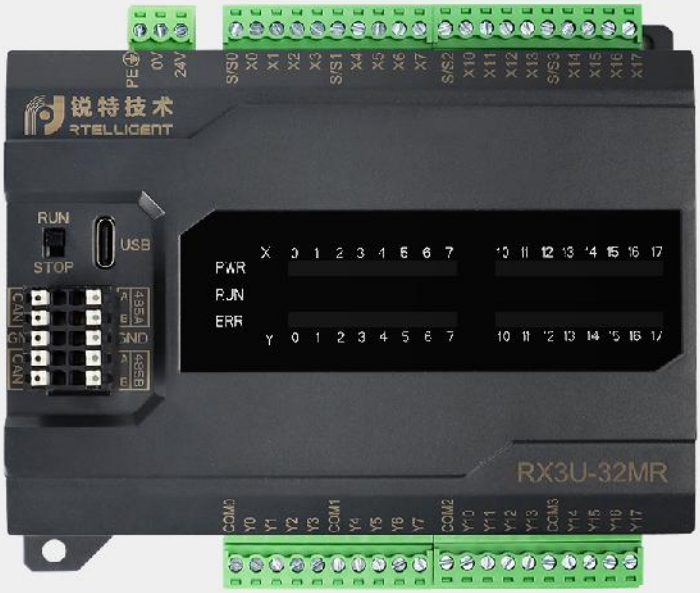
Leading the Way with Intelligent Motion Control





RX Series PLC User Manual

Shenzhen Rtelligent Technology Co.,Ltd

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Preface

Thank you for purchasing and using Rtelligent RX series PLC controller! The RX series controller is a compact programmable logic controller (PLC) developed by Rtelligent. Its instruction set is fully compatible with Mitsubishi's FX3U series controllers. It supports 3 to 8 channels of high-speed pulse output (up to 200kHz), 6 channels of 60kHz single-phase high-speed counting, or 2 channels of 30kHz AB-phase high-speed counting.

This manual serves as a comprehensive guide for using Rtelligent RX series controllers. Before operating the product, please read this manual carefully and ensure full understanding of its contents before proceeding with wiring, programming, and debugging. Only personnel with sufficient electrical knowledge should perform wiring, programming, and debugging operations. Prior to use, verify that the product meets your requirements and safety standards. If you encounter any uncertainties during operation, please consult our technical support team for assistance.

As part of our ongoing commitment to improving PLC controllers, Rtelligent reserves the right to modify product documentation without prior notice.

Revision History

Date	Revised Version	Description
2023.06	V1.00	Initial Release
2023.07	V1.01	Added CAN Function Description
2025.02	V1.1	Integrated RX Series

Content

Safety Precautions

- **WARNING**

1. Before installing the controller, ensure all external power supplies are disconnected. Failure to do so may result in electric shock.

2. Do not touch terminals while power is applied. Never perform wiring, disconnection, or modifications on live terminals—risk of electric shock.

3. Use the product only within the environmental specifications described in this manual. Prohibited environments: high humidity, extreme temperatures, dust, smoke, conductive/combustible/corrosive gases, excessive vibration or shock. Non-compliance may cause electric shock, fire, malfunction, or damage.

4. Design an external safety circuit to ensure system safety in case of controller failure. Without it, malfunctions or critical failures may occur.

5. Connect only DC24V power to the dedicated power terminals. Incorrect voltage will damage the controller.

6. Keep control wiring and power cables at least 10cm apart. Bundling them together may cause malfunctions or damage.

7. Avoid direct contact with conductive components—risk of malfunction or failure.

8. Mount the product on a flat surface using: DIN46277 rail or M3 screws. Improper installation may cause malfunctions or damage.

9. When drilling screw holes, ensure no metal shavings or wire fragments enter the casing—risk of malfunction.

10. Always power off before connecting/disconnecting: expansion modules, batteries, or external devices. Live operation may cause malfunctions.

11. Use 2mm² wires for Class-3 grounding (IEC 61131-2). Never share grounding with high-power systems—risk of failure or damage.

12. Securely tighten terminal screws to prevent exposed conductors from contacting adjacent terminals/wires—risk of short circuits.

13. Stop the controller before editing programs. Live edits may cause unintended operation.

14. Do not disassemble or modify the product—unauthorized tampering voids warranties and may cause damage.

15. Disconnect power before plugging/unplugging cables. Live cable handling may damage ports or cause malfunctions.

16. Never alter the product—risk of injury or mechanical failure.

17. Dispose of the product as industrial waste or per local environmental regulations.

- **Receiving Inspection Checklist**

Check Item	Description
Model Number Accuracy	Verify that the delivered product matches your ordered model number by checking the controller's label.
Physical Integrity	Inspect the packaging and product for any signs of damage during transit. If any defects or missing components are found, immediately contact our company or your supplier.

1 Product Information

1.1 Product Features

RX Series Programmable Logic Controller (PLC) offers the following advanced features:

1. High Integration. Built-in 16-channel digital input and 16-channel digital output (sink/source configurable).
2. Easy Programming Connectivity. Integrated Type-C programming port (no proprietary cable required).
3. The controller features two independent RS485 interfaces, each configurable as: MODBUS RTU Master (for centralized control) and MODBUS RTU Slave (for device networking)
4. Built-in CAN interface for industrial network integration.
5. The transistor model supports 3-8 channels of high-speed pulse output (up to 200kHz), featuring variable/constant-speed single-axis control and interpolation capabilities.
6. Supports 6 channels of 60kHz single-phase high-speed counting, or 2 channels of 30kHz AB-phase (quadrature) high-speed counting.
7. Non-volatile data storage eliminates battery backup concerns, ensuring permanent data retention.
8. Expandable with up to 8 Rtelligent RE Series I/O modules for flexible system scaling.
9. Fully compatible with Mitsubishi programming software GX Developer 8.86 and GX Works2.
10. Instruction set compatible with Mitsubishi FX3U series, with enhanced execution speed.
11. Tool-less wiring with pluggable terminal blocks for effortless installation.
12. Quick installation with dual mounting options: standard DIN35 rail (35mm width) or M3 screw fixation.

1.2 Product Model Explanation

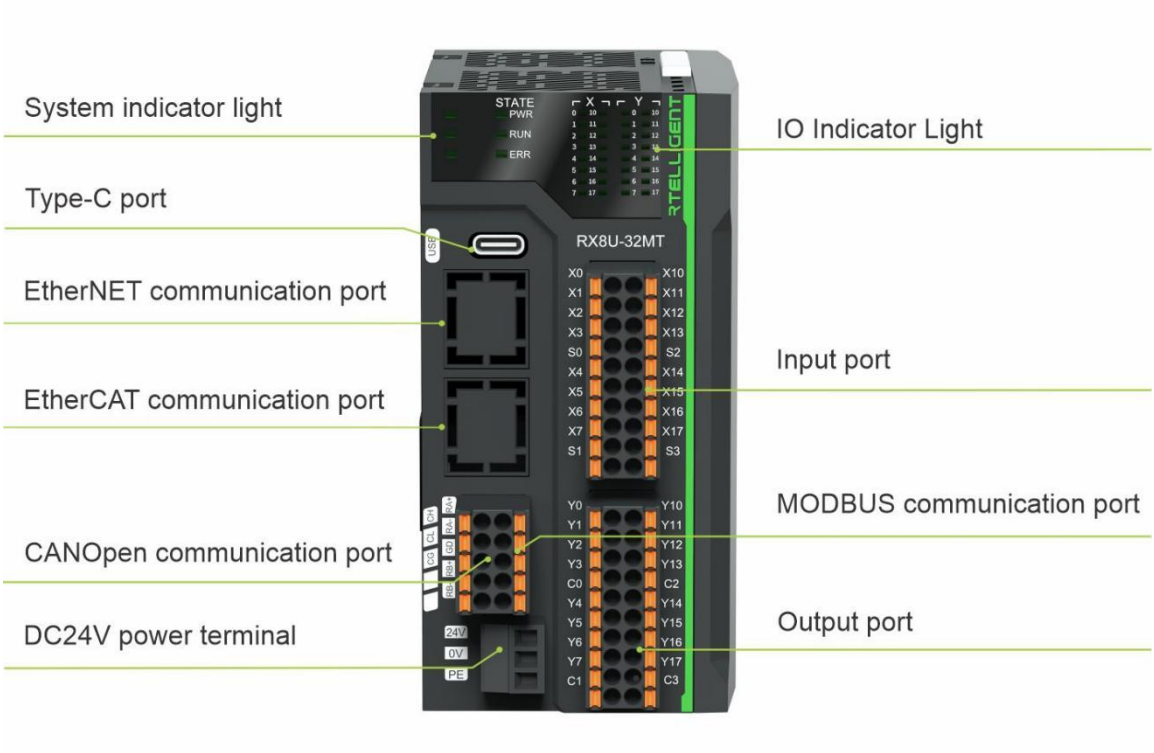
RX3U - 32 M T

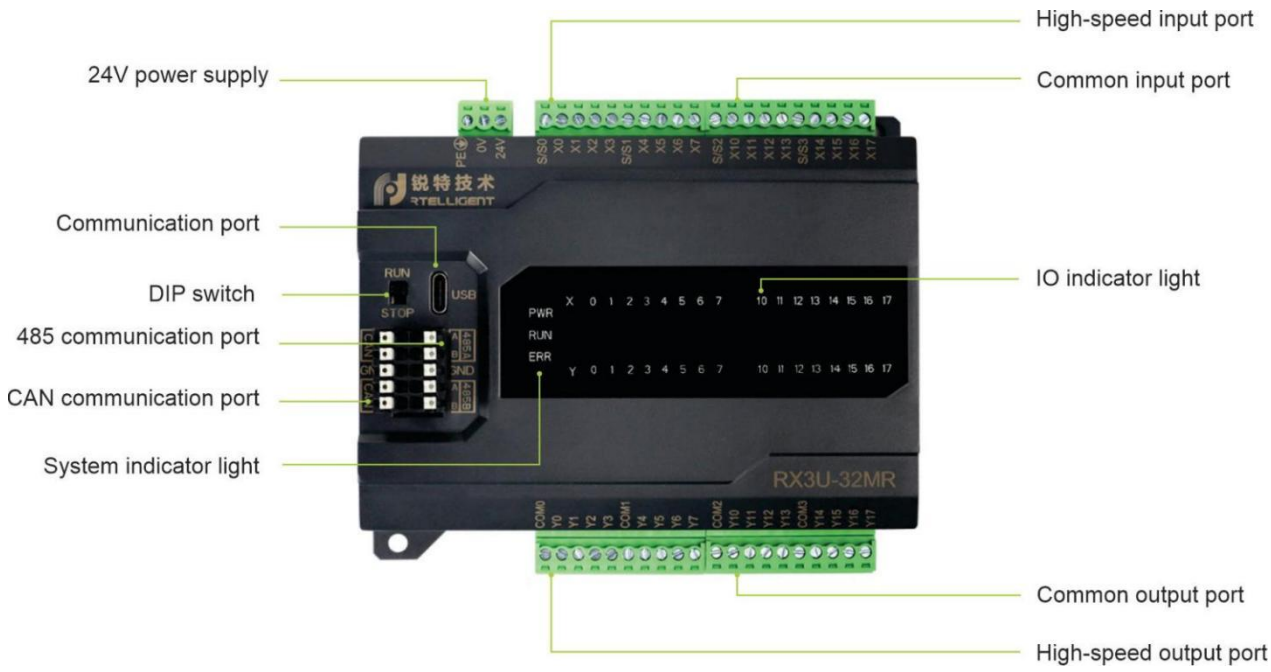
① ② ③ ④

① Product series RX3U: 3 Axis RX8U: 8 Axis	③ Module type General master controller module
② Input and output points Input and output points total 32 points	④ Output type R: Relay output T: Transistor output

1.3 Port Configuration

1.3.1 RX Series PLC Port





NO.	Port Type	Interface Label	Definition	LED Color	Description
1	Status Indicators	PWR	Power Normal	Green-Yellow	●Steedy on： Power supply normal ●Off: Power failure
		RUN	Normal Operation	Green-Yellow	●Steedy on: User program executing ●Off: Program stopped
		ERR	System Error	Red	●Off: No critical error ●Steedy on: Critical fault detected
2	I/O Indicators	IN/OUT	I/O Status	Green-Yellow	●Steedy on: Input/Output activated ●Off: I/O inactive
3	DIP Switch	RUN/STOP	Run/Stop Control	-	-
4	RS485 PORT1	485A+	RS485 Signal+	-	-
		485A-	RS485 Signal-	-	-
		GND	RS485 Ground	-	RS485PORT1 shared with PORT2
	RS485 PORT2	485B+	RS485 Signal+	-	-
		485B-	RS485 Signal-	-	-
	CAN	CANL	CAN Low	-	-
		CANH	CAN High	-	-
		CGND	CAN Ground	-	-
5	Power Interface	+24V	DC24V Positive	-	-
		0V	DC24V Negative	-	-

1.4 Product Specifications

1.4.1 General Specifications

Parameter	Specification
Working Environment	
Operating Temperature	0℃~55℃
Humidity	5%~95%（non-condensing）
Altitude	-1000m~+2000m
Air Quality	Dustproof, non-corrosive, low salt mist/humidity/dust， SO2<0.5ppm，RH <60%, non-condensing H2S<0.1ppm，RH <60%, non-condensing
Insulation Voltage	≥500V DC, 2MΩ minimum
Noise Immunity	Withstands 1000Vp-p noise pulse (1μs width) for 1 minute
Storage Temperature	-25~70℃
Overall Dimensions(Unit:mm)	See Section 2.3
Mounting Dimensions	See Section 2.4
Installation Method	The unit can be mounted using either M3 screws or directly onto a standard DIN35 rail (35mm width).
Grounding（FG）	Class-3 Grounding (Independent ground, must not share with high-power systems)※1

※1 For grounding, use either a dedicated ground or shared ground connection, but avoid common ground (with high-power systems). Refer to Appendix 13.1 for Class-3 grounding specifications.

1.4.2 Performance Specifications

Performance Item	Specification
User Program Capacity	16K steps (maximum)
Program Execution Mode	Cyclic scan operation
Programming Methods	Instruction list + Ladder diagram (dual support)
Power-off Retention	FlashROM storage (permanent data retention, no battery required)

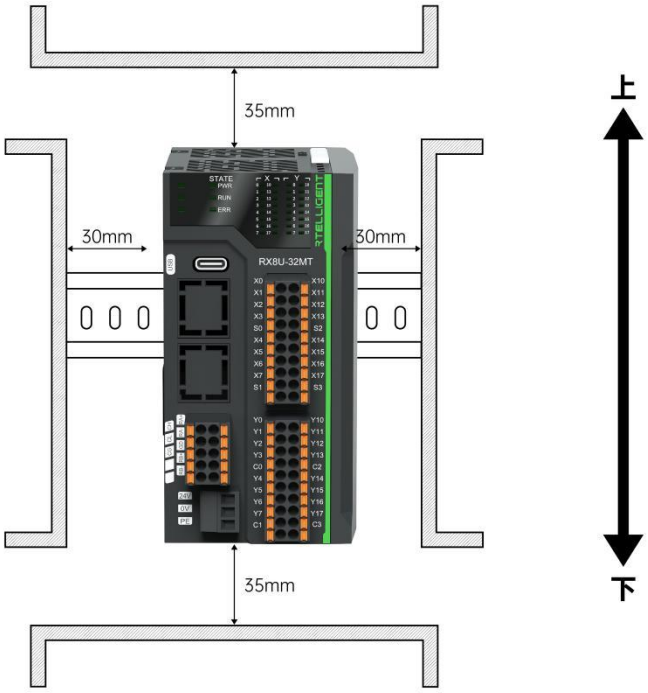
1.5 Soft Device Address Table

<table>
<tr><th>Device</th><th colspan="8">Content</th></tr>
<tr><td rowspan="10">Soft Device Allocation and Power-off Retention</td><td rowspan="2">M</td><td colspan="2">General Purpose (Non-retentive)</td><td colspan="2">Retentive (Battery-backed)</td><td>General Purpose (Non-retentive)</td><td colspan="2">Special Function</td></tr>
<tr><td colspan="2">M0-M499
500 points</td><td colspan="2">M500-M1023
524 points</td><td>M1024-M7679
6656 points</td><td colspan="2">M8000-M8511
512 points</td></tr>
<tr><td rowspan="2">S</td><td colspan="2">General Purpose (Non-retentive)</td><td colspan="2">Retentive (Battery-backed)</td><td colspan="3">General Purpose (Non-retentive)</td></tr>
<tr><td colspan="2">S0-S499
500 points</td><td colspan="2">S500-S999
500 points</td><td colspan="3">S1000-S4095
3096 points</td></tr>
<tr><td rowspan="2">T</td><td colspan="2">100ms Timer
0.1-3276.7s</td><td>10ms Type
0.01-327.67s</td><td>1ms Accumulative Timer 0.001-32.767s</td><td>100ms Accumulative Timer
0.1-3276.7s</td><td colspan="2">1ms timer
0.001-32.767s</td></tr>
<tr><td colspan="2">T0-T199
200 points</td><td>T200-T245
46 points</td><td>T246-T249
4 points</td><td>T250-T255
6 points</td><td colspan="2">T256-T511
256 points</td></tr>
<tr><td rowspan="3">C</td><td colspan="2">16-bit Up Counter (0~32,767 counts)</td><td colspan="3">32-bit Up Counter
-2,147,483,648~+2,147,483,647</td><td colspan="2">High-speed Counter</td></tr>
<tr><td>Non-retentive</td><td>Retentive</td><td colspan="2">Non-retentive</td><td>Retentive</td><td colspan="2">Retentive</td></tr>
<tr><td>C0-C99
100 points</td><td>C100-C199
100 points</td><td colspan="2">C200-C219
20 points</td><td>C220-C234
15 points</td><td colspan="2">C235-C25
21 points</td></tr>
<tr><td rowspan="2">D</td><td colspan="2">General Purpose (Non-retentive)</td><td colspan="2">Battery-backed (Retentive)</td><td>General Purpose (Non-retentive)</td><td colspan="2">Special Function</td></tr>
<tr><td colspan="2">D0-D199
200 Word</td><td colspan="2">D200-D2199
2000 Word</td><td>D2200-D7999
5800 Word</td><td colspan="2">D8000-D8511
512 Word</td></tr>
<tr><td>Internal Coil X</td><td colspan="8">256 points（X0-X377）</td></tr>
<tr><td>Internal Coil Y</td><td colspan="8">256 points（X0-X377）</td></tr>
<tr><td>Pointer</td><td colspan="8">support</td></tr>
</table>

2 Mechanical Installation

2.1 Installation Position Requirements

This product is designed for horizontal mounting orientation. The cooling system relies on natural convection for heat dissipation. To ensure proper ventilation and maintain sufficient wiring space, minimum clearances must be maintained around the unit as illustrated in the diagram below.



Warning: If high-temperature heat source equipment (e.g., heaters, transformers, high-power resistors) is present near this product, a minimum clearance of 100mm must be maintained between this product and the heat source.

2.2 Installation Precautions

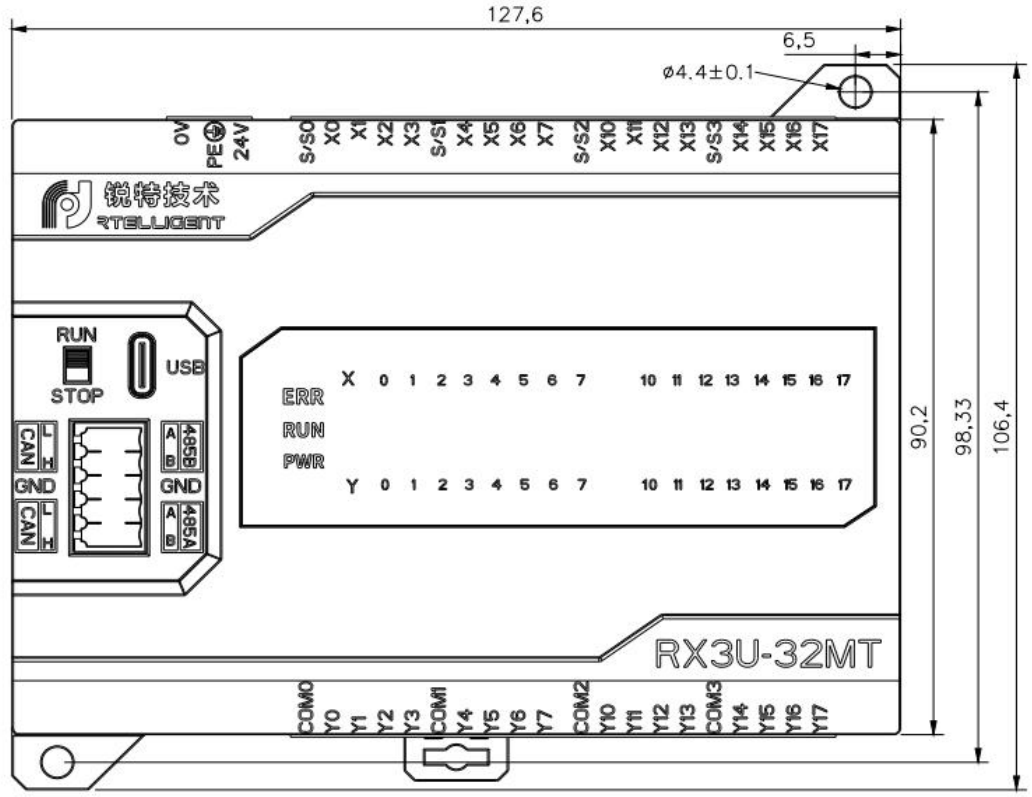
Before installing or removing the main unit/module, ensure all power supplies are disconnected and locked out (LOTO).

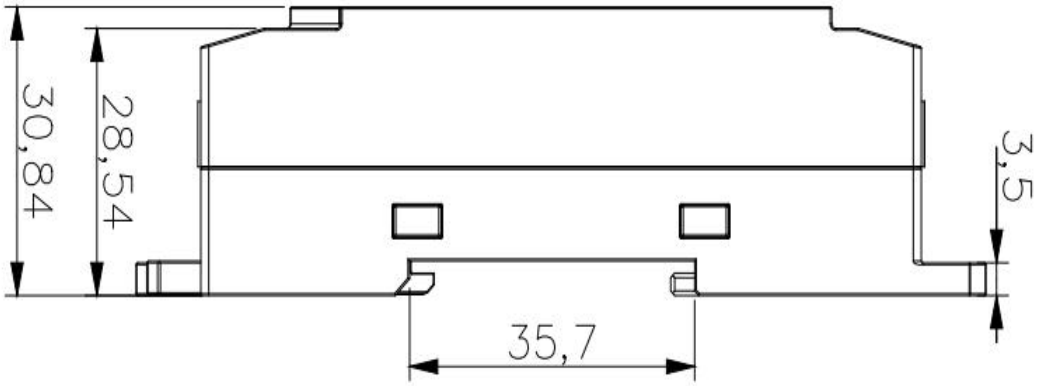
- Never hot-swap modules to avoid system reboots, data loss, or hardware damage.

- Do not drop or subject the main unit/module housing or terminals to impact to prevent equipment damage.

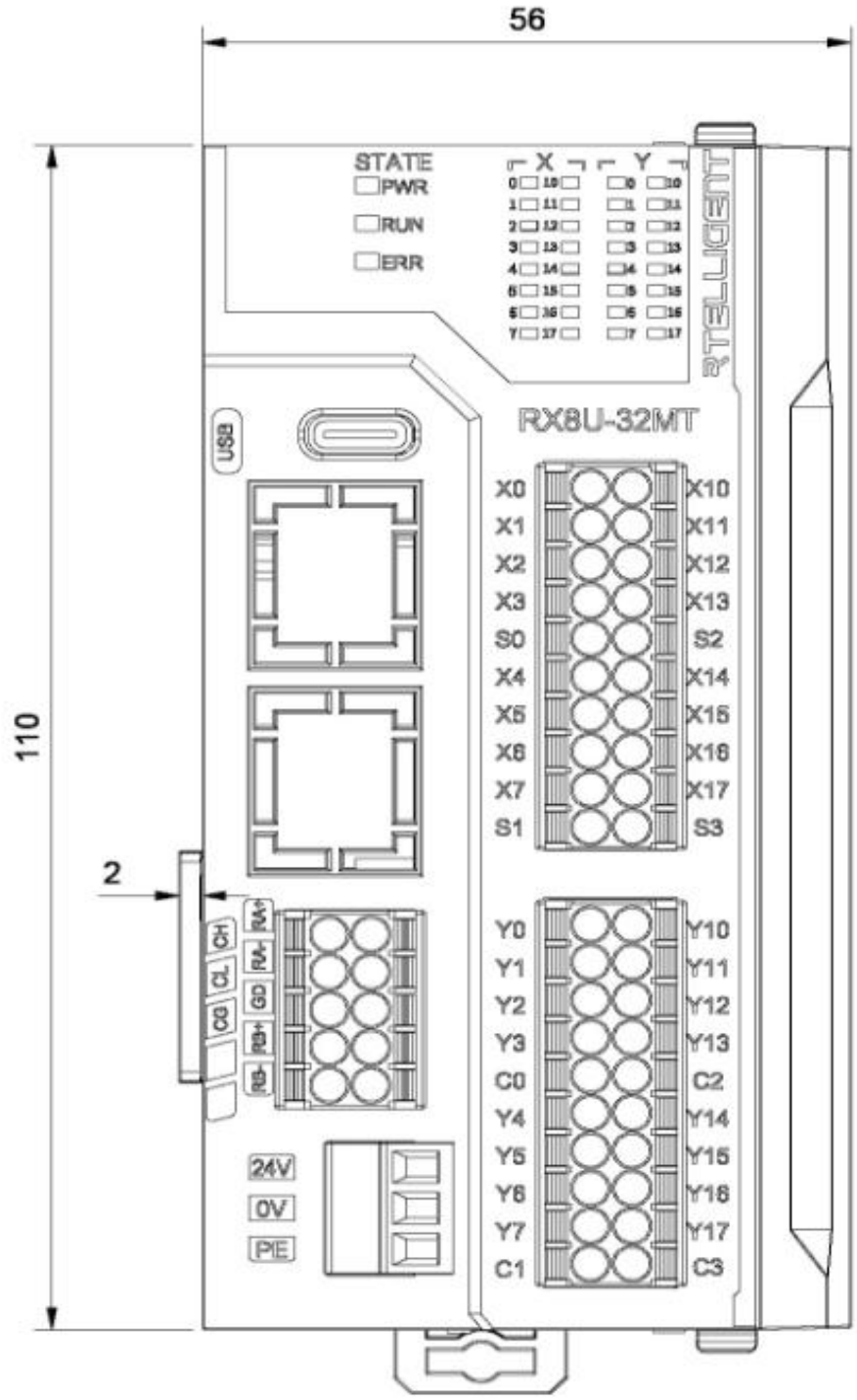
2.3 Controller Dimensional Drawing

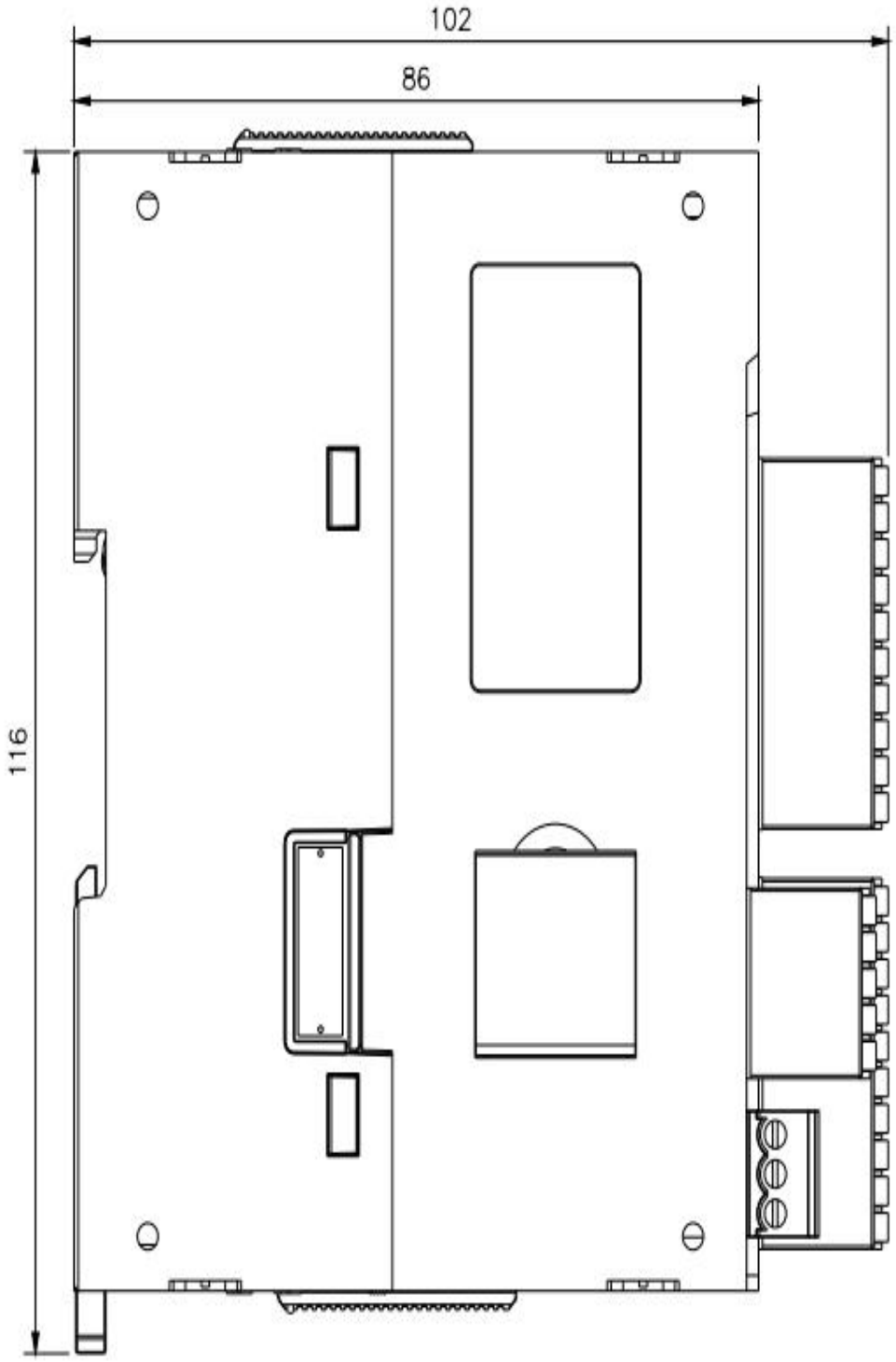
2.3.1 RX3U Dimensional Drawing





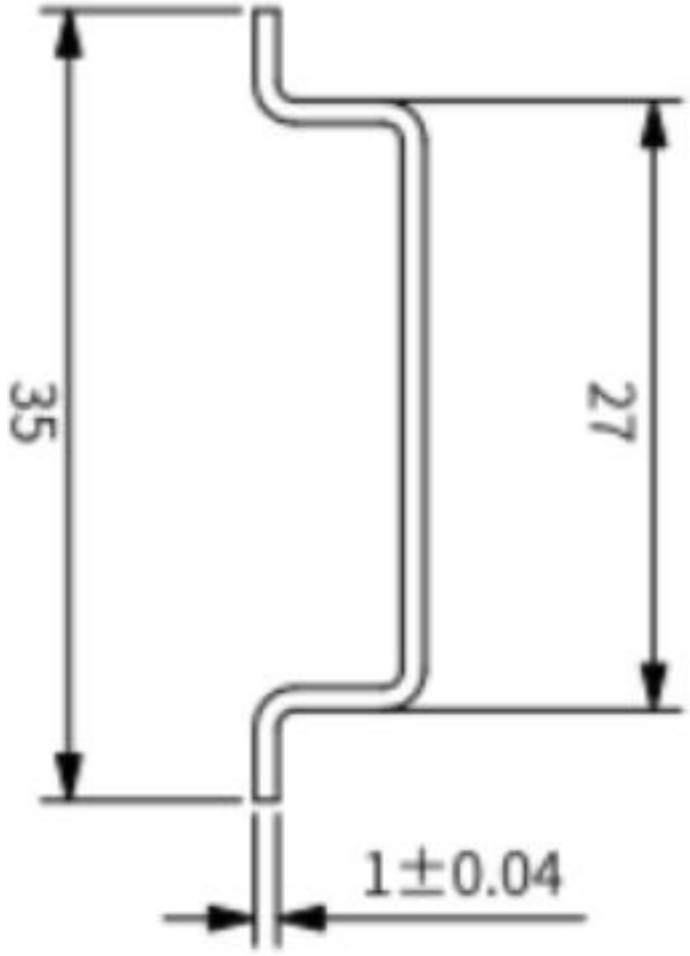
2.3.2 RX8U Dimensional Drawing




102
86
116

2.4 Installation Method

Installation requires DIN rail compliant with IEC 60715 standard (35mm width, 1mm thickness), with dimensional details shown in the diagram (unit: mm).



3 Electrical Parameters

3.1 Electrical Parameter Description

Item	Parameter	
Power Supply Input Voltage	DC 24V (Operating range: 20.4~28.8V)	
Digital Input Specifications	RX3U-32MR	RX3U-32MT,RX8U-32MT
Digital Input Points	16-point bipolar input (High-speed input points X0, X1, X3, X4, X5, X6, X7 can only be common anode)	
Isolation Method	Optocoupler	
Input Impedance	2.4KΩ	
ON Condition	High-speed: >5.8mA/24V, Standard: >9.9mA/24V	
OFF Condition	High-speed: <4.5mA/19V, Standard: <4mA/17V	
Filtering	Configurable (0~60ms, default: 10ms)	
High-Speed Counting	6x single-phase 60kHz or 2x AB-phase 30kHz	
Input Type	Sink/Source (S/S to 24V = NPN, S/S to GND = PNP) *High-speed counting only supports S/S to 24V*	
Isolation	Field-to-logic group isolation: 500V AC for 1 minute	
Digital Output Specifications	RX3U-32MR	RX3U-32MT,RX8U-32MT
Output Points	16 relay outputs	16 NPN outputs
Max. Current	2A/point	0.5A/point
Voltage Range	DC/AC24V~220V	DC24V
Electrical Isolation	Mechanical relay	Optocoupler
ON Response Time	~10ms	High-speed: 10μs; Others: 0.5ms
Output Type	NO dry contact (COM = +/-)	NPN low-side (COM = GND)

3.2 Wiring Specifications

3.2.1 Power Wiring Specifications

Terminal No.	Wiring Requirements
1	DC 24V+ (Positive)
2	DC 24V- (Negative)
3	PE

3.2.2 I/O Input Terminal Signal Definitions

Left/Upper Signal	Left/Upper Terminal	Right/Lower Terminal	Right/Lower Signal
X0 Signal Input	1A	1B	X10 Signal Input
X1 Signal Input	2A	2B	X11 Signal Input
X2 Signal Input	3A	3B	X12 Signal Input
X3 Signal Input	4A	4B	X13 Signal Input
SS0 Input Common	5A	5B	SS2 Input Common
X4 Signal Input	6A	6B	X14 Signal Input
X5 Signal Input	7A	7B	X15 Signal Input
X6 Signal Input	8A	8B	X16 Signal Input
X7 Signal Input	9A	9B	X17 Signal Input
SS1 Input Common	10A	10B	SS3 Input Common

3.2.3 I/O Output Terminal Signal Definition

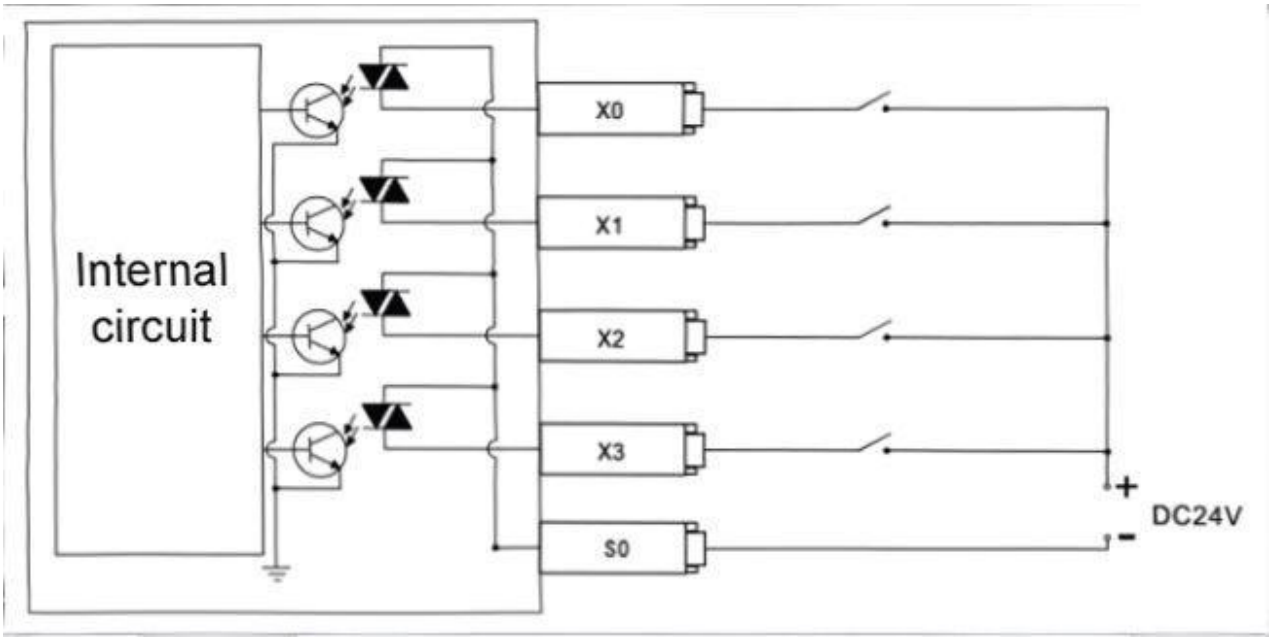
Left/Upper Signal	Left/Upper Terminal	Right/Lower Terminal	Right/Lower Signal
Y0 Signal Output	1A	1B	Y10 Signal Output
Y1 Signal Output	2A	2B	Y11 Signal Output
Y2 Signal Output	3A	3B	Y12 Signal Output
Y3 Signal Output	4A	4B	Y13 Signal Output
COM0 Output Common	5A	5B	COM2 Output Common
Y4 Signal Output	6A	6B	Y14 Signal Output
Y5 Signal Output	7A	7B	Y15 Signal Output
Y6 Signal Output	8A	8B	Y16 Signal Output
Y7 Signal Output	9A	9B	Y17 Signal Output
COM1Output Common	10A	10B	COM3 Output Common

3.2.4 RS485 & CAN Terminal Signal Definition

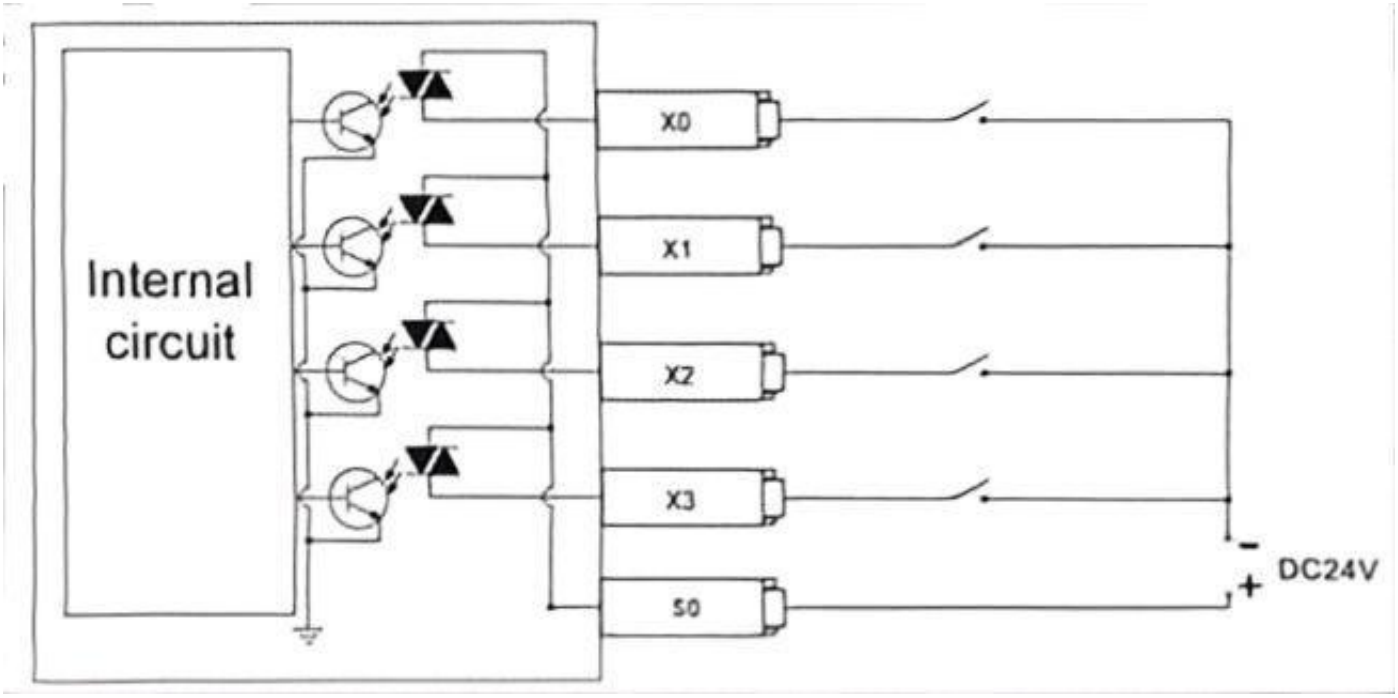
Left Terminal	Left Signal	Right Signal	Right Terminal
1A	CAN-H	485A+	1B
2A	CAN-L	485A-	2B
3A	CGND	GND	3B
4A	Reserved	485B+	4B
5A	Reserved	485B-	5B

3.3 I/O Wiring Diagrams

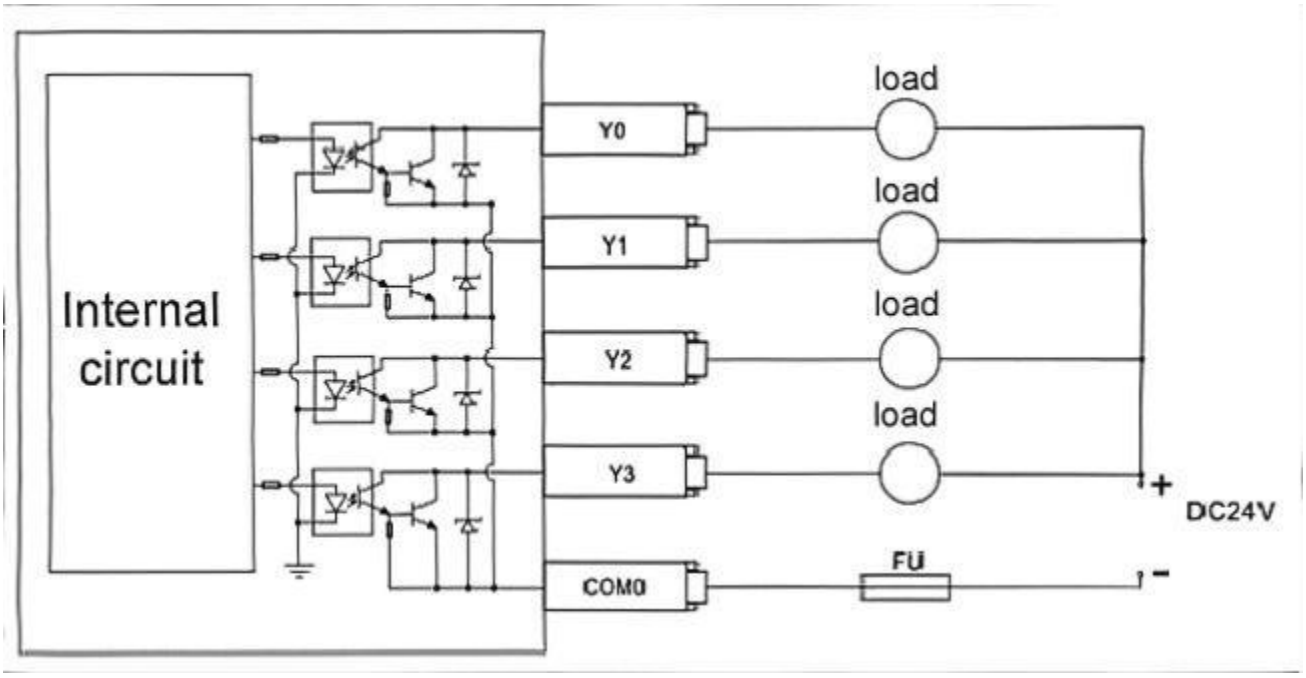
3.3.1 Sinking (NPN) Digital Input Wiring



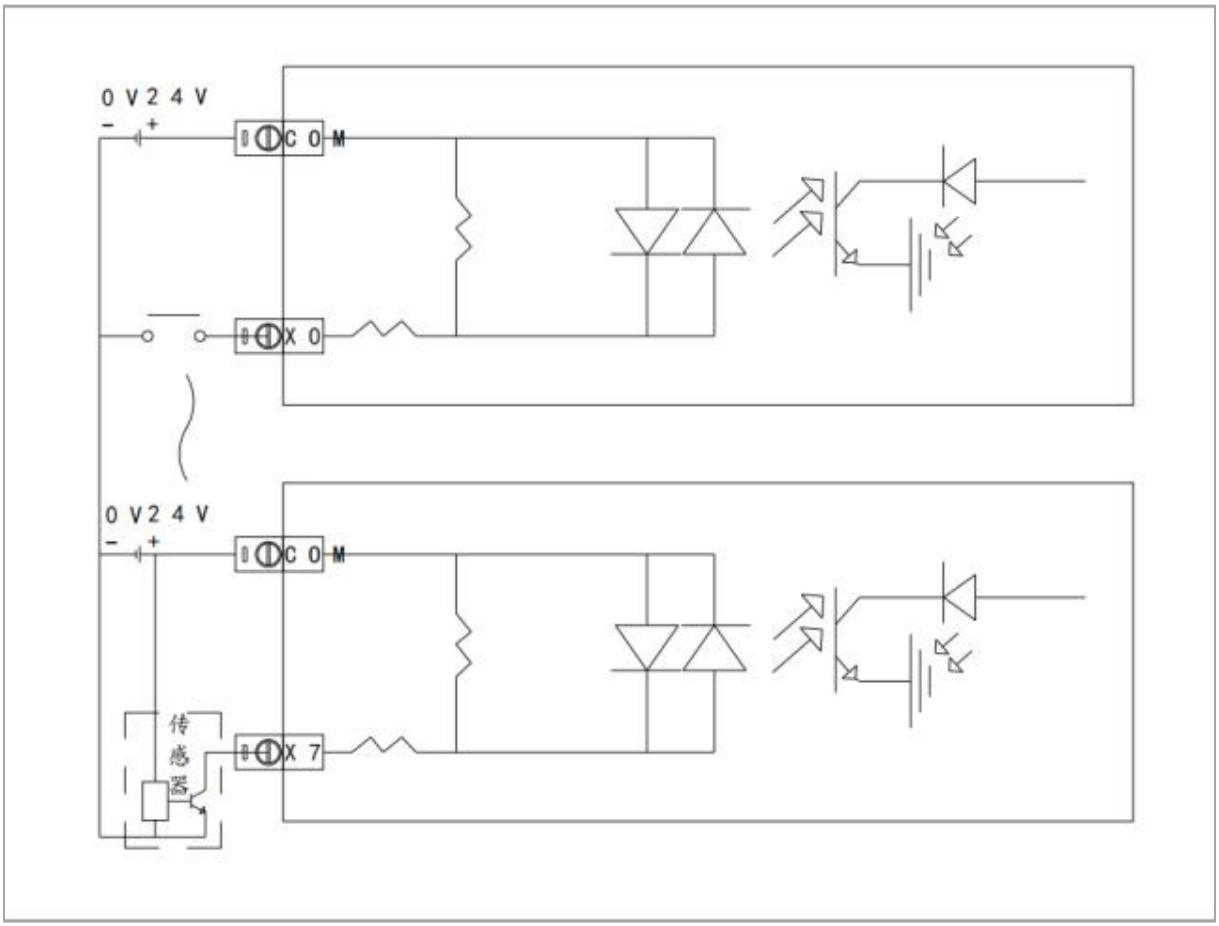
3.3.2 Sourcing (PNP) Digital Input Wiring



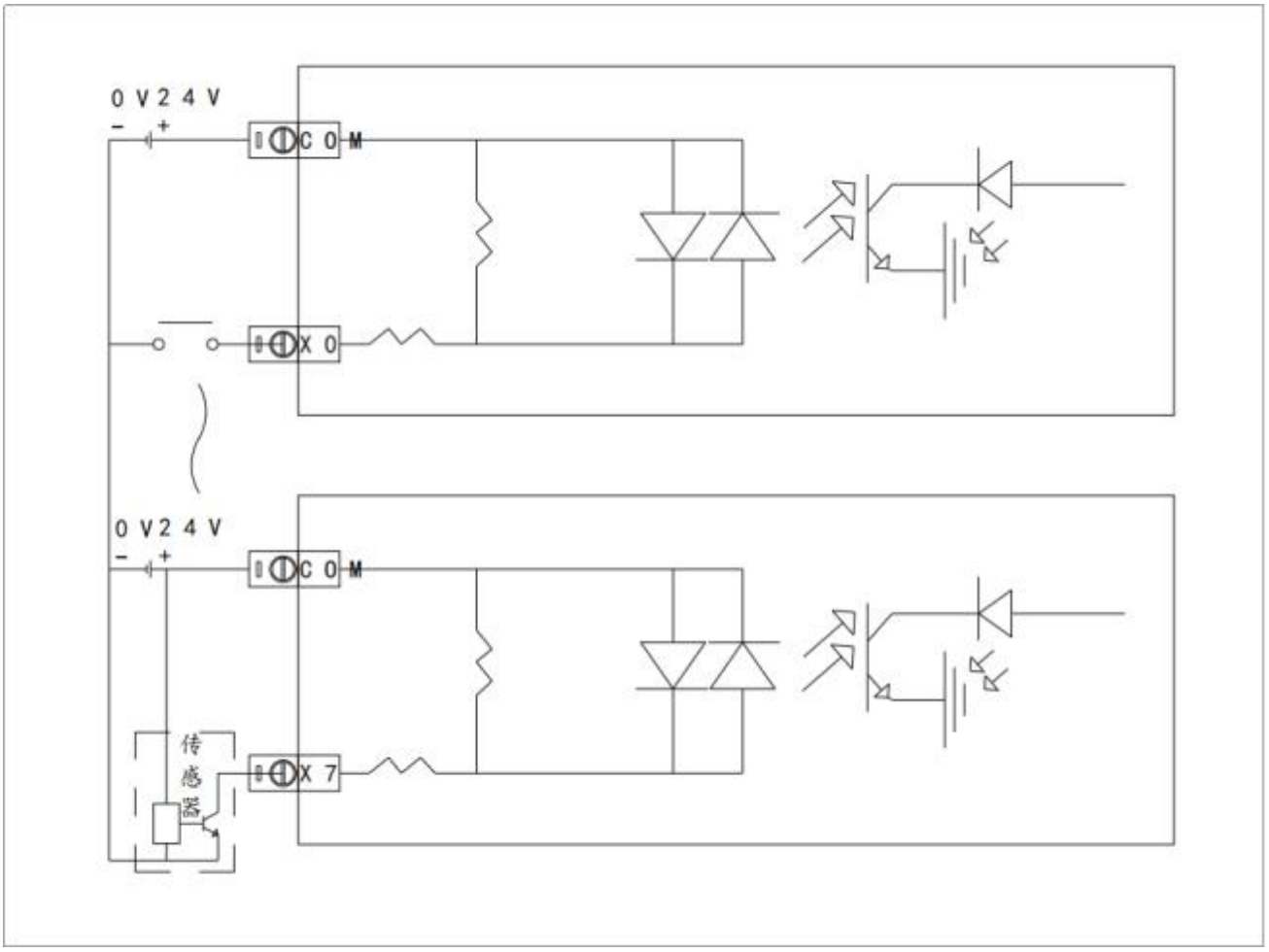
3.3.3 Digital Output Terminal Wiring



3.3.4 Digital Input Internal Schematic Diagram



3.3.5 Digital Output Internal Schematic Diagram



4 Product Operation, Debugging, and Maintenance

This chapter details the workflow for RX-series PLCs, covering operation, debugging, and maintenance procedures from initial programming to field deployment.

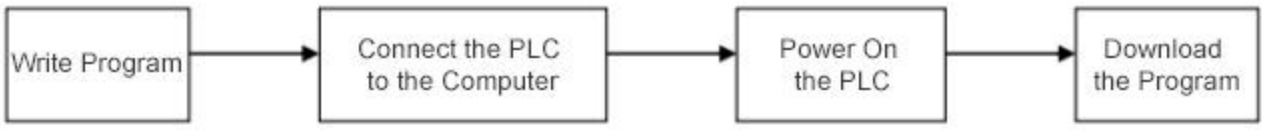
4.1 Operation and Debugging

4.1.1 Product Inspection

Upon receiving the product, first check that all I/O terminals are intact and no components are missing. Typically, you can directly connect the power cable for initial testing - the PWR and RUN indicators should remain steadily lit during normal operation.

4.1.2 Program Writing and Downloading

After confirming the product is in good condition, you can proceed to program the PLC. The programming is done on a personal computer, and the completed program can then be downloaded to the PLC. The general operational steps are as follows:



4.1.3 Program Debugging

Under normal circumstances the PLC operates properly, but if program errors are detected, the running PLC requires reprogramming.

1. Connect the PLC to a PC using a programming cable.
2. Upload the current program from the PLC to the PC for analysis.
3. Modify the program as needed and save the modified program with a new version number for traceability.

4. Pause PLC operation and download the updated program to the PLC.
5. Use Ladder Monitoring or Free Monitoring to verify correct operation.
6. If issues persist, repeat steps 3 – 5 until the system meets requirements.

4.1.4 PLC Status Indicators

1. During normal PLC operation, the PWR and RUN indicators should remain steadily lit.
2. A continuously illuminated ERR indicator indicates a PLC runtime error --promptly correct the program.
3. If the PWR indicator is off, check the power supply wiring for issues.

4.2 Routine Maintenance

4.2.1 Periodic Inspection

Although PLCs are designed for high interference resistance and stability, regular inspection and maintenance are essential. Key checks include:

1. Ensure I/O terminals and power terminals are secure (no looseness).
2. Inspect RS-485/Ethernet ports for physical damage or corrosion.
3. Verify PWR, RUN, and I/O LEDs illuminate correctly during operation.
4. Clean external dust with a dry, anti-static brush and not use compressed air (may push dust inside).

Please always maintain the PLC's operating and storage environment within the standards specified in this chapter.

4.2.2 Battery Replacement

The PLC contains no components that rapidly degrade its lifespan, except the backup battery if the Real-Time Clock (RTC) is used.

1. Battery Lifespan is typically 3 – 5 years
2. Replace the battery promptly when its voltage drops below the threshold
3. Power on the PLC immediately after battery replacement to prevent battery depletion

5 Supported Instructions

The Rtelligent RX Series PLC controllers are fully instruction-set compatible with Mitsubishi FX3U Series programmable logic controllers. For more detailed specifications, please refer to the relevant documentation.

5.1 Basic Logic Instructions

Instruction	Function	Supported
LD	Start with normally open contact	★
LDI	Start with normally closed contact	★
LDP	Start with detecting rising edge	★
LDF	Start with detecting falling edge	★
AND	Series normally open contact	★
ANI	Series normally closed contact	★
ANDP	Series rising edge detection	★
ANDF	Series falling edge detection	★
OR	Parallel normally open contact	★
ORI	Parallel normally closed contact	★
ORP	Parallel rising edge detection	★
ORF	Parallel falling edge detection	★
ANB	Series connection of circuit blocks	★
ORB	Parallel connection of circuit blocks	★
MPS	Push to stack	★

MRD	Read from stack	★
MPP	Pop from stack	★
INV	Invert operation result	★
MEP	Rising Edge Trigger	★
MEF	Falling Edge Trigger	★
OUT	Coil Drive	★
SET	Retain ON state	★
RST	Clear retained state and reset data registers	★
PLS	Pulse output (rising edge)	★
PLF	Pulse output (falling edge)	★
MC	Master Control Contact Instruction	★
MCR	Master Control Reset (MCR) Instruction	★
NOP	No operation	★
END	Program End with I/O Refresh and Return to Start	★

5.2 Data Transfer Instructions

Instruction	Function	Supported
MOV	Move	★
SMOV	Shift Move	★
CML	Complement Move	★
BMOV	Block Move	★
FMOV	Fill Move	★
PRUN	Octal-Based I/O Mapping	★
XCH	Swap	★
SWAP	High/Low Byte Swap	★
EMOV	Binary Floating-Point Transfer	★
HCMOV	High-Speed Counter Transfer	★

5.3 Data Conversion Instructions

Instruction	Function	Supported
BCD	Binary → BCD	★
BIN	BCD → Binary	★
GRY	Conversion of Gray Code	★
GBIN	Converse Conversion of Gray Code	★
FLT	BIN Integer → Binary Floating-Point Conversion	★
INT	Binary Floating-Point → BIN Integer Conversion	★
EBCD	Binary Floating-Point → Decimal Floating-Point Conversion	★
EBIN	Decimal Floating-Point → Binary Floating-Point Conversion	★
RAD	Binary Floating-Point Angle → Radian Conversion	★
DEG	Binary Floating-Point Radian → Angle Conversion	★

5.4 Comparison Instructions

Instruction	Function	Supported
LD=	Contact Signal Comparison LD（S1）=（S2）	★
LD>	Contact Signal Comparison LD（S1）>（S2）	★
LD<	Contact Signal Comparison LD（S1）<（S2）	★
LD<>	Contact Signal Comparison LD（S1）≠（S2）	★
LD<=	Contact Signal Comparison LD（S1）≦（S2）	★
LD>=	Contact Signal Comparison LD（S1）≧（S2）	★
AND=	Contact Signal Comparison AND（S1）=（S2）	★
AND>	Contact Signal Comparison AND（S1）>（S2）	★
AND<	Contact Signal Comparison AND（S1）<（S2）	★
AND<>	Contact Signal Comparison AND（S1）≠（S2）	★
AND<=	Contact Signal Comparison AND（S1）≦（S2）	★
AND>=	Contact Signal Comparison AND（S1）≧（S2）	★
OR=	Contact Signal Comparison OR（S1）=（S2）	★
OR>	Contact Signal Comparison OR（S1）>（S2）	★
OR<	Contact Signal Comparison OR（S1）<（S2）	★
OR<>	Contact Signal Comparison OR（S1）≠（S2）	★
OR<=	Contact Signal Comparison OR（S1）≦（S2）	★
OR>=	Contact Signal Comparison OR（S1）≧（S2）	★
CMP	Comparison	★

ZCP	Range Comparison	★
ECMP	Binary Float Comparison	★
EZCP	Binary Floating-Point Range Comparison	★
HSCS	Comparison-triggered Set (High-Speed Counter)	★
HSCR	Comparison-triggered Reset (High-Speed Counter)	★
HSZ	Range Comparison (High-Speed Counter)	★
HSCT	Table Comparison (High-Speed Counter)	★
BKCMP=	Data Block Comparison（S1）=（S2）	★
BKCMP>	Data Block Comparison（S1）>（S2）	★
BKCMP<	Data Block Comparison（S1）<（S2）	★
BKCMP<>	Data Block Comparison（S1）≠（S2）	★
BKCMP<=	Data Block Comparison（S1）≦（S2）	★
BKCMP>=	Data Block Comparison（S1）≧（S2）	★

5.5 Arithmetic Operation Instructions

Instruction	Function	Supported
ADD	BIN Addition	★
SUB	BIN Subtraction	★
MUL	BIN Multiplication	★
DIV	BIN Division	★
EADD	Binary Floating-Point Addition	★
ESUB	Binary Floating-Point Subtraction	★
EMUL	Binary Floating-Point Multiplication	★
EDIV	Binary Floating-Point Division	★
BK+	Data Block Addition	★
BK-	Data Block Subtraction	★
INC	BIN Increment	★
DEC	BIN Decrement	★

5.6 Logical Operation Instructions

Instruction	Function	Supported
WAND	Word AND	★
WOR	Word OR	★
WXOR	Word XOR	★

5.7 Special Function Instructions

Instruction	Function	Supported
SQR	BIN Square Root	★
ESQR	Floating-Point Square Root	★
EXP	Binary Floating-Point Exponential Operation	★
LOGE	Binary Floating-Point Natural Logarithm Operation	★
LOG10	Binary Floating-Point Common Logarithm Operation	★
SIN	Binary Floating-Point Sine Operation	★
COS	Binary Floating-Point Cosine Operation	★
TAN	Binary Floating-Point Tangent Operation	★
ASIN	Binary Floating-Point Arcsine Operation	★
ACOS	Binary Floating-Point Arccosine Operation	★
ATAN	Binary Floating-Point Arctangent Operation	★
RND	Random Number Generation	★

5.8 Rotation Instructions

Instruction	Function	Supported
ROR	Rotate Right	★
ROL	Rotate Left	★
RCR	Rotate Right with Carry	★
RCL	Rotate Left with Carry	★

5.9 Shift Instructions

Instruction	Function	Supported
SFTR	Bit Shift Right	★
SFTL	Bit Shift Left	★
SFR	16-bit data Shift Right with Carry	★
SFL	16-bit data Shift Left with Carry	★
WSFR	Word Shift Right	★
WSFL	Word Shift Left	★
SFWR	Shift Write (FIFO/LIFO Control)	★
SFRD	Shift Read (FIFO Control)	★
POP	Pop Data (LIFO Control)	★

5.10 Data Processing Instructions

Instruction	Function	Supported
ZRST	Zone Reset	★
DECO	Decode	★
ENCO	Encode	★
MEAN	Mean Value	★
WSUM	Weighted Sum	★
SUM	Sum ON Bits	★
BON	Bit ON Check	★
NEG	Two's Complement	★
ENEG	Float Sign Invert	★

WTOB	Split Word to Byte	★
BTOW	Combine Byte to Word	★
UNI	Combines four 4-bit nibbles into 16-bit	★
DIS	Splits 16-bit into four 4-bit nibbles	★
CCD	Check Code	★
CRC	CRC Calculation	★
LIMIT	Limit Control	★
BAND	Deadband Control	★
ZONE	Zone Control	★
SCL	Linear interpolation (single-axis)	★
SCL2	XY coordinate mapping	★
SORT	Descending Sort	
SORT2	Descending Sort 2	
SER	Data Search	★
FDEL	Table File Delete	★
FINS	Table File Insert	★

5.11 String Processing Instructions

Instruction	Function	Supported
LEFT	Extracts characters from the start of a string	★
MIDR	Extracts substring from any position	★
MIDW	Replaces substring at any position	★
INSTR	Finds substring position	★
COMRD	Reads soft element comments	

5.12 Program Flow Control Instructions

Instruction	Function	Supported
CJ	Conditional Jump	★
CALL	Subroutine Call	★
SRET	Subroutine Return	★
IRET	Interrupt Return	★
EI	Enable Interrupts	★
DI	Disable Interrupts	★
FEND	Main Program End	★
FOR	Loop Start	★
NEXT	Loop End	★

5.13 I/O Refresh Instructions

Instruction	Function	Supported
REF	Immediate I/O Refresh	★
REFF	Input Refresh with Filter	★

5.14 Clock Control Instructions

Instruction	Function	Supported
TCMP	Time Compare	★
TZCP	Time Zone Compare	★
TADD	Time Addition	★
TSUB	Time Subtraction	★
TRD	Time Read	★
TWR	Time Write	★
HTOS	Hour-to-Seconds	★
STOH	Seconds-to-Hour	★

5.15 Pulse Output & Positioning Instructions

Instruction	Function	Supported
ABS	Read Absolute Position	
DSZR	Dog Search Origin Return	★
ZRN	Origin Return	★
TBL	Table Positioning	
DVIT	Interrupt Positioning	
DRVI	Relative Positioning	★
DRVA	Absolute Positioning	★
PLSV	Variable-Speed Pulse Output	★
PLSY	Fixed-Speed Pulse Output	★
PLSR	Accel/Decel Pulse Output	★

5.16 Serial Communication Instructions

Instruction	Function	Supported
RS	Serial Data Transmission	★
RS2	Enhanced Serial Data Transmission	★
IVCK	Inverter Status Check	
IVDR	Inverter Control	
IVRD	Read Inverter Parameter	
IVWR	Write Inverter Parameters	
IVBWR	Batch Write Inverter Parameters	
IVMC	Multi-Command Inverter Control	
ADPRW	MODBUS Read/Write	★

5.17 Special Function Module Control Instructions

Instruction	Function	Supported
FROM	Read BFM	
TO	Write BFM	
RD3A	Read Analog Module	
WR3A	Write Analog Module	
RBFM	Partial BFM Read	
WBFM	Partial BFM Write	

5.18 Extended Register / Extended File Register Control Instructions

Instruction	Function	Supported
LOADR	Load Extended File Register	
SAVER	Save Extended File Register	
RWER	Rewrite Extended File Register	
INITR	Initialize Extended Register	
INITER	Initialize Extended File Register	
LOGR	Login to Extended Register	

5.19 Other Convenient Commands

Instruction	Function	Supported
WDT	Watchdog Timer	★
ALT	Alternate Output	★
ANS	Annunciator Set	★
ANR	Annunciator Reset	★
HOUR	Hour Meter	★
RAMP	Ramp Signal	★
SPD	Pulse Density	★
PWM	Pulse Width Modulation	★
DUTY	Timed Pulse	★
PID	PID loop calculations	★
ZPUSH	Index Register Batch Save	★
ZPOP	Index Register Restore	★
TTMR	Teaching Timer	
STMR	Special Timer	★
ABSD	Absolute Cam Control	
INCD	Incremental Cam Control	
ROTC	Rotary Table Control	
IST	Initial State	
MTR	Matrix Input	★

TKY	Ten-Key Input	★
HKY	Hex Key Input	
DSW	Digital Switch	
SEGD	7-Segment Decoder	★
SEGL	7-Segment Time Division	
ARWS	Arrow Switch	
ASC	ASCII Input	★
PR	ASCII Print	
VRRD	Potentiometer Read	
VRSC	Potentiometer Scale	

6 Timer [T] Operation

A timer is a soft component that counts up clock pulses (1ms, 10ms, or 100ms) in the programmable controller. When the accumulated value reaches the specified setpoint, the output contact activates.

The setpoint can be specified in either of the following ways:

Constant (K): A fixed value directly set in the program memory.

Indirect specification (D): Dynamically set via the contents of a data register (D).

6.1 Timer Numbering

100ms Type 0.1~3276.7s	10ms Type 0.01~327.67s	1ms Accumulative Type 0.001~32.767s	100ms Accumulative Type 0.1~3276.7s	1ms Type 0.001~32.767s
T0-T199 （200 points）	T200-T245 （46 points）	T246-T249 （4 points, retentive）	T250-T255 （6 points, retentive）	T256-T511 （256 points）

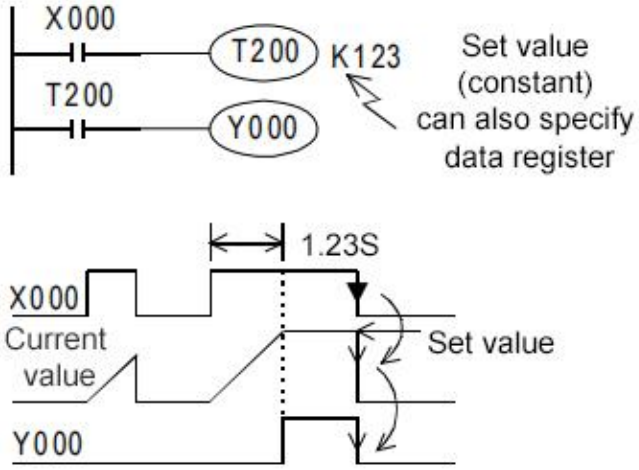
The numbering of timers (T) is as shown in the table below. (Numbers are assigned in decimal format).

Timer numbers that are not used as timers can also be utilized as data registers for numerical storage.

In the RX series programmable controllers, the accumulated value of retentive timers is backed up via EEPROM memory for power failure retention.

6.2 Timer Functions and Operation Examples

6.2.1 General Purpose Timers



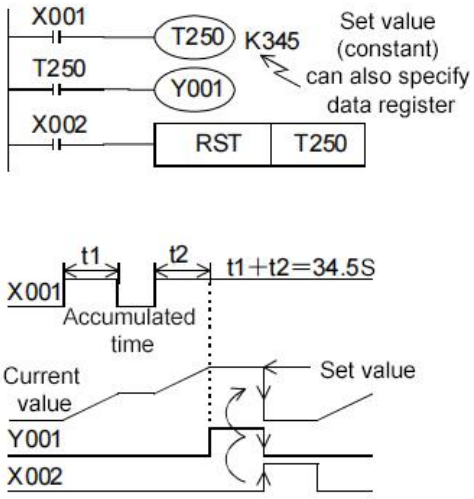
When the driving input X000 for timer coil T200 turns ON, the current value counter of T200 begins incrementing by 10ms clock pulses. Once the accumulated value reaches the preset value K123, the timer's output contact triggers.

That is, the output contact activates 1.23 seconds (10ms × 123 = 1.23s) after the coil is energized.

Reset Conditions:

The driving input X000 turns OFF, or A power loss occurs, the output contact returns to its default state upon reset.

6.2.2 Accumulative Timers



When the driving input X001 for retentive timer coil T250 is ON, the current value counter of T250 increments using 100ms clock pulses. Upon reaching the preset value K345, the timer's output contact activates.

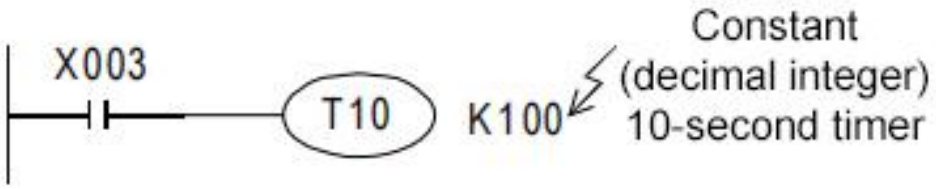
During the counting process, even if input X001 turns OFF or a power outage occurs, counting can resume from the current value when operation restarts. The total accumulated operation time is 34.5 seconds.

When reset input X002 turns ON, the timer will be reset and its output contact will also reset.

6.3 Timer Setting Methods

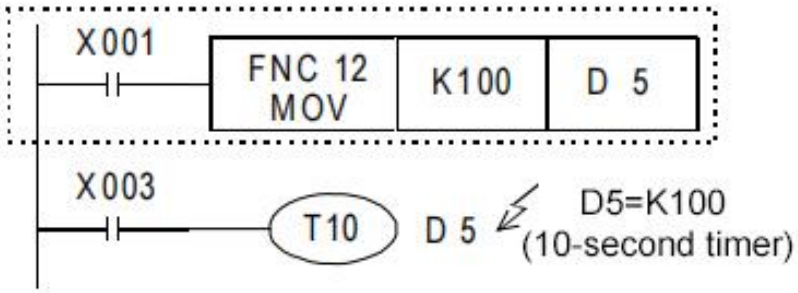
6.3.1 Constant (K) Specification

T10 is a timer with 100ms (0.1s) time base. When the constant is set to 100, the timer will operate for 0.1s × 100 = 10s.



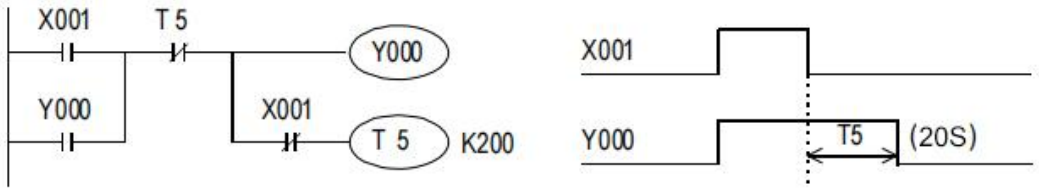
6.3.2 Indirect Specification (D)

The content of the indirectly specified data register can be either written in advance in the program or input through devices such as digital switches.

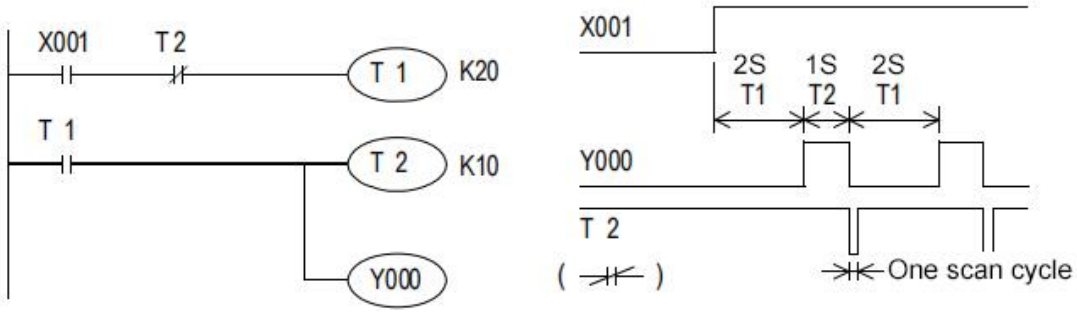


6.4 Programming Example [Off-Delay Timer, Flashing Function]

Off-Delay Timer



Flashing Function



7 Counter [C] Usage

7.1 Counter Numbering

Counter numbers (C) are allocated as shown in the table below (assigned in decimal format).

16-bit Up Counter 0~32767 counts		32-bit Up/Down Counter -2,147,483,648~2,147,483,647 counts	
General Purpose	Retentive (Power-off Protected)	General Purpose	Retentive (Power-off Protected)
C0-C99(100 points)	C100-C199(100 points)	C200-C219(20 points)	C220-C234(15 points)

7.2 Counter Characteristics

The features of 16-bit counters and 32-bit counters are as follows. They can be selected and used according to different operating conditions such as counting direction switching and counting range.

Item	16-bit Counter	32-bit Counter
Counting Direction	Up-count only	Up/Down count (switchable)
Set Value	1-32767	-2,147,483,648~2,147,483,647
Setting Method	Constant K or data register	Same, but requires register pairs (2 pieces)
Current Value Behavior	Stops after reaching set value	Continues changing (circular counting)
Output Contact	Maintains after reaching value	Maintains (up-count)/Resets (down-count)
Reset Operation	RST command zeros current value and resets contact	
Current Value Register	16-bit	32-bit

7.3 Related Soft Elements (Up/Down Count Specification) [32-bit Counters]

The counting direction is controlled by special auxiliary relays:

When ON: Counts down (decrement)

When OFF: Counts up (increment)

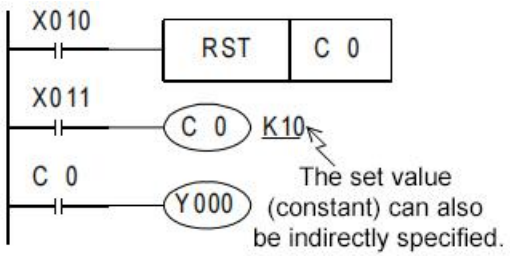
Counter Number	Direction Control	Counter Number	Direction Control	Counter Number	Direction Control
C200	M8200	C212	M8212	C224	M8224
C201	M8201	C213	M8213	C225	M8225
C202	M8202	C214	M8214	C226	M8226
C203	M8203	C215	M8215	C227	M8227
C204	M8204	C216	M8216	C228	M8228
C205	M8205	C217	M8217	C229	M8229
C206	M8206	C218	M8218	C230	M8230
C207	M8207	C219	M8219	C231	M8231
C208	M8208	C220	M8220	C232	M8232
C209	M8209	C221	M8221	C233	M8233
C210	M8210	C222	M8222	C234	M8234
C211	M8211	C223	M8223		

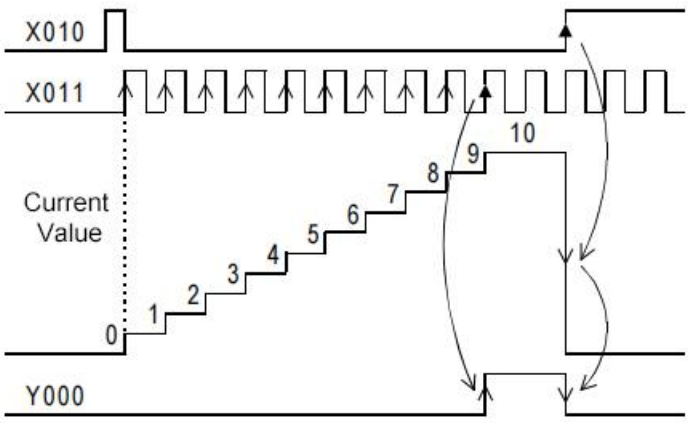
7.4 Function and Operation Examples

7.4.1 16-bit Counters (General Purpose/Power-Off Retentive)

1. When the count input X011 activates, each activation of the CO coil increments the counter's current value. On the 10th activation of the coil instruction, the output contact triggers. After this point, even if the count input X011 activates again, the counter's current value will no longer change.

2. When reset input X010 turns ON, executing the RST command will: Clear the counter's current value to 0. Reset the output contact.





7.4.2 32-bit Up/Down Counters (General Purpose/Power-Off Retentive)

1.For counter C△△△, it operates as a down counter when M8△△△ is driven (ON), and functions as an up counter when not driven (OFF) (refer to previous page).

2.When using count input X014 to drive the C200 coil, the counter can perform both increment and decrement counting

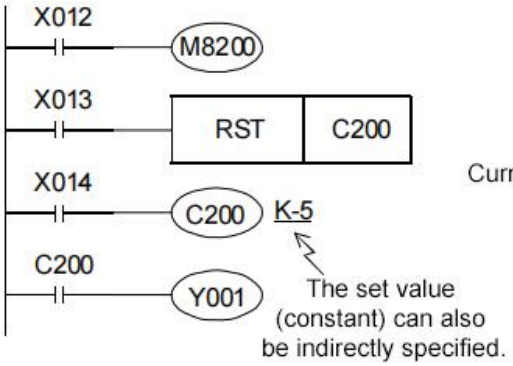
3.The output contact is SET (ON) when the current value changes from -6 → -5.

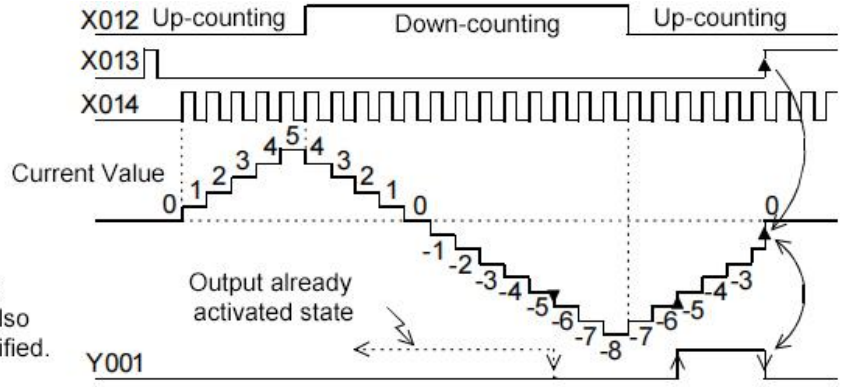
The output contact is RESET (OFF) when the current value changes from -5 → -6.

4. When X013 turns ON, executing the RST command will:

Reset the current value to 0.

Turn OFF the output contact.



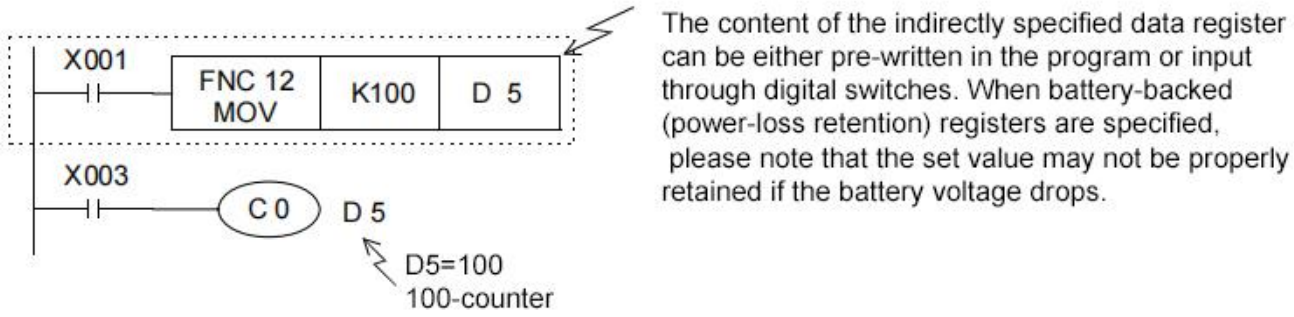


7.5 Setting Value Specification Methods

7.5.1 16-bit Counters

1.Constant Specification (K)

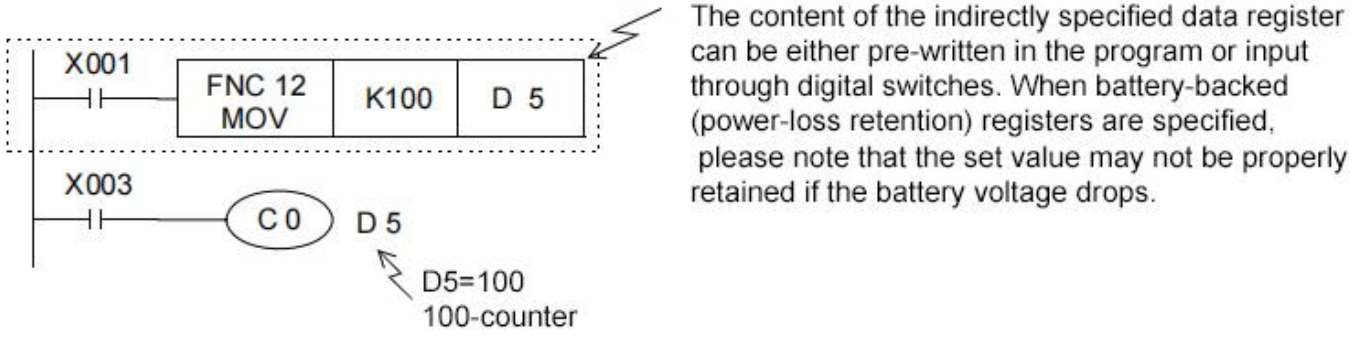
2.Indirect Specification (D)



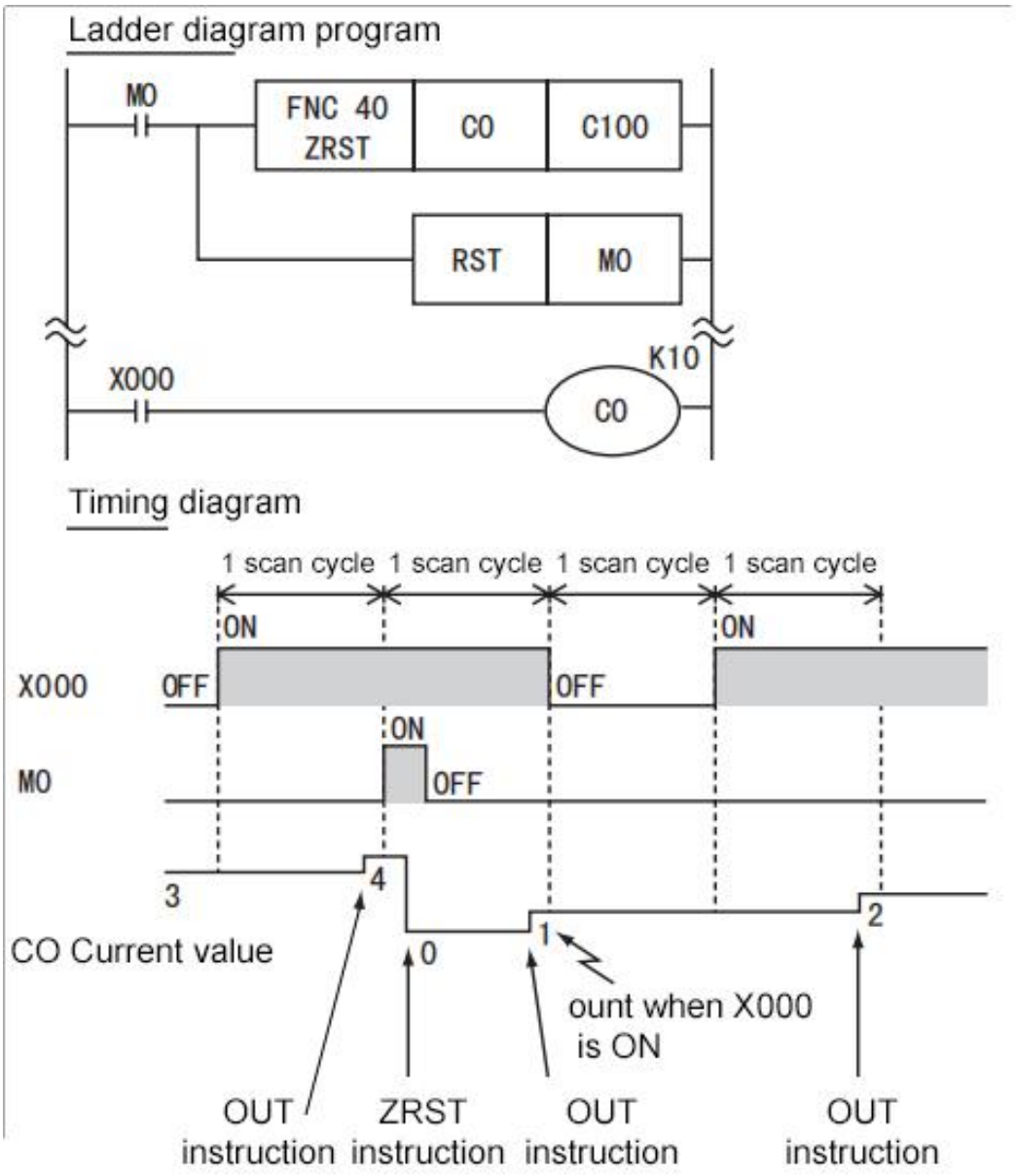
7.5.2 32-bit Counters

1. Constant Specification (K)

2. Indirect Specification (D)



7.6 Programming Examples



The ZRST instruction resets both the current values and contact states of T and C coils.

When the X000 driving contact is ON in the program, the counter will restart counting after the ZRST instruction is executed.

8 Usage of High-Speed Counters

8.1 Types of High-Speed Counters

The PLC main unit has built-in 32-bit up/down high-speed counters with three counting modes:

Single-phase single-input counting,single-phase dual-input counting,dual-phase dual-input counting

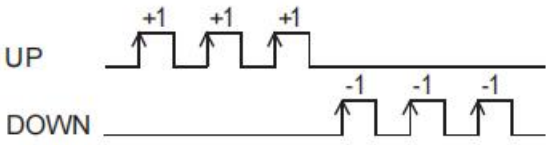
These counters support:

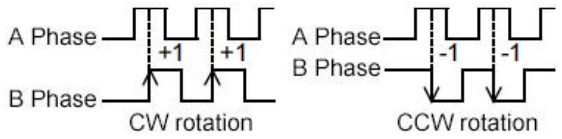
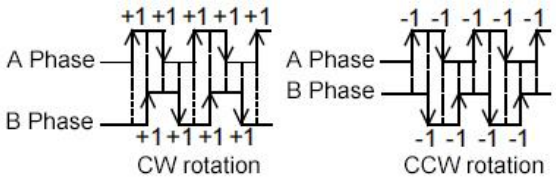
External reset input terminal (optional)

External start input terminal (counting enable control)

8.2 Input Signal Formats for High-Speed Counters

The following illustrates the counter types and their corresponding input signal waveforms:

Type	Input Mode	Counting Direction
Single-Phase Single-Input		The counting direction (increment/decrement) is determined by the ON/OFF status of M8235～M8245. ON: Decrement counting OFF: Increment counting
Single-Phase Dual-Input		As shown in the left diagram, increment or decrement counting is performed. The counting direction can be set via M8246～M8250. ON: Decrement counting OFF: Increment counting

Dual-Phase Dual-Input	1× multiplier		As shown in the left diagram, the counter automatically performs increment or decrement counting based on the input state changes of Phase A/Phase B. The counting direction can be set via M8251～M8255. ON: Decrement counting OFF: Increment counting
	4× multiplier		

8.3 Built-in High-Speed Counter Input Allocation Table

Counter Type	Counter Number	Input Point Allocation							
		X000	X001	X002	X003	X004	X005	X006	X007
Single-Phase Single 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 Dual Input	C246	U	D						
	C247	U	D	R					
	C248				U	D	R		
	C249	U	D	R				S	
	C250				U	D	R		S
Dual-Phase Dual Input	C251	A	B						
	C252	A	B	R					
	C253				A	B	R		
	C254							A	B
	C255				A	B	R		S

U: Up-count input

D: Down-count input

A: AB phase A-phase input

B: AB phase B-phase input

R: External reset input

S: External start input

Single-phase: Maximum 6 channels, maximum frequency 60kHz

AB (Z) phase: 2 channels at 30kHz + 1 channel at 10kHz (C254)

8.4 Related Software Components

8.4.1 Counting Direction Control for Single-Phase Single-Input Counter

Type	Counter Number	Designation Component	Up-Counting	Down-Counting
Single-Phase Single Input	C235	M8235	OFF	ON
	C236	M8236		
	C237	M8237		
	C238	M8238		
	C239	M8239		
	C240	M8240		
	C241	M8241		
	C242	M8242		
	C243	M8243		
	C244	M8244		
	C245	M8245		

8.4.2 Counting Direction Monitoring for Single-Phase Dual-Input and Dual-Phase Dual-Input Counters

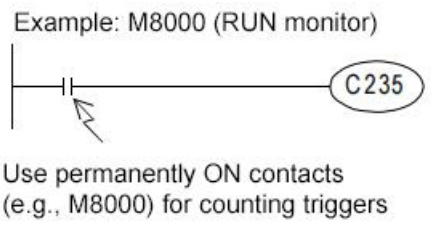
Type	Counter Number	Monitoring Component	OFF	ON
Single-Phase Dual Input	C246	M8246	Up-counting	Down-counting
	C247	M8247		
	C248	M8248		
	C249	M8249		
	C250	M8250		
Dual-Phase Dual Input	C251	M8251		
	C252	M8252		
	C253	M8253		
	C254	M8254		
	C255	M8255		

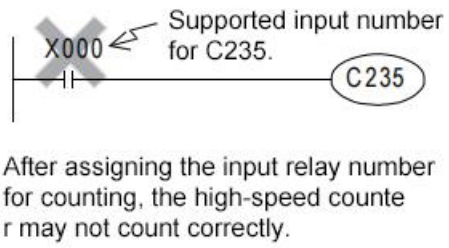
8.4.3 Function Switching for High-Speed Counters

Soft Element No.	Name	Description
M8388	High-speed counter function control contact	General function switching
M8392	Function selection register	For C248 & C253: Function switching soft elements
M8198		For C251, C252 & C254: 1×/4× multiplier switching soft elements
M8199		For C253, C255 & C253(OP): 1×/4× multiplier switching soft elements

8.5 High-Speed Counter Usage Examples and Precautions

1. For the coil driving contact of high-speed counters, always use a permanently ON contact during high-speed counting operations.





2. When using mechanical switches (such as toggle switches) for high-speed counter operation, counting errors may occur due to contact bounce. Please take note.

3. The input filter for the main unit input terminals used with high-speed counters is automatically set to 5μs (X000, X001, X003, X004) or 50μs (X002, X005). Therefore, there is no need to use the REFF instruction or special data register D8020 (input filter adjustment). Additionally, input relays not used for high-speed counter inputs maintain a 10ms filter (default value).

4. Signals input to high-speed counters must not exceed the response frequency. If signals beyond this frequency are input, it may cause WDT errors and prevent normal parallel link operation.

5. When using the RST instruction to reset a high-speed counter, the counter cannot resume counting until the RST instruction driving contact turns OFF.

9 High-Speed Pulse Output & Positioning Function Usage

9.1 High-Speed Pulse Output & Positioning Features

1. Rtelligent RX3U Series PLC (Transistor Type)

- Supports 3 channels (Y0-Y2) of 150kHz high-speed pulse output
- Capable of constant-speed and variable-speed pulse output

3. Rtelligent RX8U Series PLC (Transistor Type)

- Supports 4 channels (Y0-Y3) of 200kHz and 4 channels (Y4-Y7) of 60kHz pulse output
- Capable of constant-speed, variable-speed pulse output, and linear interpolation

3. Supported Instructions

- PLSY (Constant-speed pulse output)
- PLSR(Acceleration/deceleration pulse output)
- PLSV (Variable-speed pulse output with direction control)
- DRVI (Relative positioning)
- DRVA (Absolute positioning)
- ZRN (Origin return)
- DSZR (DOG-search origin return)

4. Compatibility

- Mitsubishi FX3U pulse programs can be used without modification on RX series PLCs.

9.2 Output Point Allocation

Model Name	RX8U-32MT	RX3U-32MT	RX3U-32MR
Pulse Signal (Pulse Output)	Y000~Y007	Y000~Y002	Not Supported high speed output
Direction Signal (Rotation Direction)	All Output Points	All Output Points	
Clear Signal (Zero Signal)	Not Supported	Not Supported	

9.3 High-Speed Pulse Output Specifications

Model Name	RX8U-32MT	RX3U-32MT
Control Axes	8 independent axes	3 independent axes
Output Type	Transistor	
Output Mode	Pulse + Direction	
Max Frequency	200KHz	150KHz
Acceleration Control	Trapezoidal acceleration/deceleration	
Control Unit	Pulse	
Positioning Range	-2,147,483,648~+2,147,483,647	
Additional Features	Pulse output available from general-purpose outputs (Y000~Y007)	Pulse output available from general-purpose outputs (Y000~Y002)

9.4 Related Soft Component List

9.4.1 Special Auxiliary Relay List

Soft Component No.				Name	Attribute	Applicable Instructions
Y000	Y001	Y002	Y003			
M8029				Instruction Completion Flag	Read only	PLSY/PLSR/DSZR/DVIT/ZRN/DRVI/DRVA
M8340	M8350	M8360	M8370	Pulse Output Monitor (BUSY/READY)	Read only	PLSY/PLSR/DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
M8341	M8351	M8361	M8371	Zero Signal Output Function Enable	Read/Write	DSZR/ZRN
M8342	M8352	M8362	M8372	Origin Return Direction Setting	Read/Write	DSZR
M8343	M8353	M8363	M8373	Forward Rotation Limit	Read/Write	PLSY/PLSR/DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
M8344	M8354	M8364	M8373	Reverse Rotation Limit	Read/Write	PLSY/PLSR/DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
M8345	M8355	M8365	M8375	Near-point Signal Logic Inversion	Read/Write	DSZR
M8346	M8356	M8366	M8376	Zero-point Signal Logic Inversion	Read/Write	DSZR
M8347	M8357	M8367	M8377	Interrupt Signal Logic Inversion	Read/Write	DVIT
M8348	M8358	M8368	M8378	Positioning Instruction in Progress	Read only	PLSY/PWM/PLSR/DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
M8349	M8359	M8369	M8379	Pulse Stop Bit	Read/Write	PLSY/PLSR/DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
M8460	M8461	M8462	M8472	User Interrupt Input Instruction	Read/Write	DVIT
M8464	M8465	M8466	M8467	Zero Signal Soft Component Assignment Enable	Read/Write	DSZR/ZRN

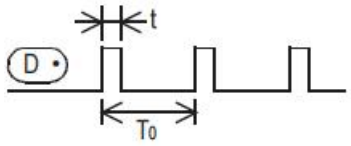
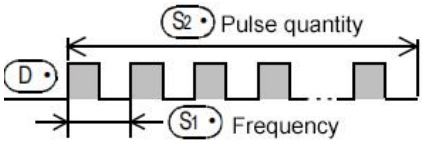
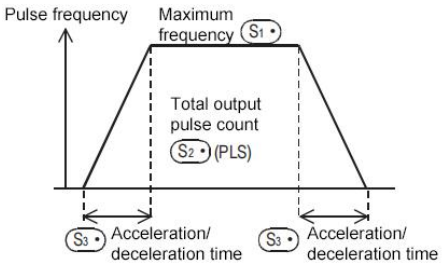
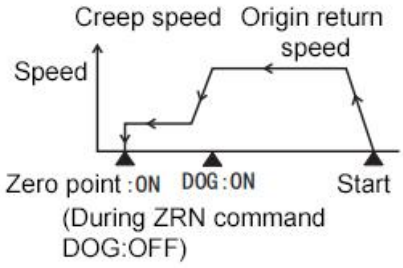
Soft Component No.				Name	Attribute	Applicable Instructions
Y004	Y005	Y006	Y007			
M8029				Instruction Completion Flag	Read-Only	PLSY/PLSR/DSZR/DVIT/ZRN/DRVI/DRVA
M8151	M8152	M8153	M8154	Pulse Output Monitor (BUSY/READY)	Read-Only	PLSY/PLSR/DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
M8450	M8451	M8452	M8453	Pulse Stop Bit	Read-Only	PLSY/PLSR/DSZR/DVIT/ZRN/PLSV/DRVI/DRVA

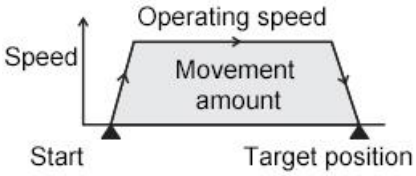
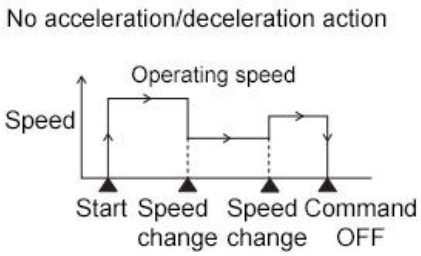
9.4.2 Special Data Registers

Register No.				Name	Data Length	Default Value	Related Instructions
Y000	Y001	Y002	Y003				
D8336				Interrupt Input Assignment	16 bit	0	DVIT
D8340	D8350	D8360	D8370	Position pulse amount [PUL] (low word)	32 bit	0	DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
D8341	D8351	D8361	D8371	Position pulse amount [PUL] (high word)			
D8342	D8352	D8362	D8372	Base speed [Hz]	16 bit	0	DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
D8343	D8353	D8363	D8373	Maximum speed [Hz] (low word)	32 bit	100,000	DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
D8344	D8354	D8364	D8374	Maximum speed [Hz] (high word)			
D8345	D8355	D8365	D8375	Creep speed [Hz]	16 bit	1,000	DSZR
D8346	D835	D8366	D8376	Origin return speed [Hz] (low word)	32 bit	50,000	DSZR

D8347	D8357	D8367	D8377	Origin return speed [Hz] (high word)			
D8348	D8358	D8368	D8378	Acceleration time [ms]	16 bit	100	DSZR/DVIT/ZRN/ PLSV/DRVI/DRVA
D8349	D8359	D8369	D8379	Deceleration time [ms]	16 bit	100	DSZR/DVIT/ZRN/ PLSV/DRVI/DRVA
D8464	D8465	D8466	D8467	Clear signal Soft element assignment	16 bit	0	DSZR/ZRN
Register No.				**Name**	**Data Length**	**Default Value**	**Related Instructions**
Y004	**Y005**	**Y006**	**Y007**				
D8140	D8142	D8144	D8160	Position pulse count [PUL] (lower word)	32 bit	0	DSZR/DVIT/ZRN/ PLSV/DRVI/DRVA
D8141	D8143	D8145	D8161	Position pulse count [PUL] (upper word)			
D8148				Acceleration/deceleration time [ms]	16 bit	100	DSZR/DVIT/ZRN/ PLSV/DRVI/DRVA
D8146				Maximum speed [Hz] (lower word)	32 bit	100,000	DSZR/DVIT/ZRN/PLSV/DRVI/DRVA
D8147				Maximum speed [Hz] (upper word)			

9.5 Built-in Pulse Output and Positioning Instruction Reference

Pulse Width Modulation		Action	Description
PWM Instruction	Pulse Width Modulation		When the PWM instruction is executed, it outputs pulses with the specified cycle time and ON duration.
Pulse Instructions		**Action**	**Description**
PLSY instruction	Pulse Output		The PLSY instruction outputs a pulse train with specified frequency and pulse count when executed.
PLSR instruction	Pulse Output with Acceleration/ Deceleration		The PLSR instruction outputs pulses with specified maximum frequency, performs acceleration/deceleration over the specified milliseconds duration, and generates the specified number of pulses.
Positioning Instructions		**Action**	**Description**
Mechanical Origin Return			
DSZR instruction	Origin Return with DOG Search		The DSZR/ZRN instructions initiate mechanical origin return operation at the specified home return speed. When the DOG sensor turns ON, the speed decelerates to creep speed. The operation stops upon zero signal input to complete origin return (when using ZRN instruction, stopping occurs when DOG sensor turns OFF).
ZRN instruction	Standard Origin Return		

<table>
<tr><th colspan="4">Relative/Absolute Positioning</th></tr>
<tr><td>DRVI instruction</td><td>Relative Positioning</td><td rowspan="2"> 
</td><td rowspan="2">The DRVI/DRVA instructions begin motion at the operating speed and stop at the target position.</td></tr>
<tr><td>DRVA instruction</td><td>Absolute Positioning</td></tr>
<tr><th colspan="4">Variable Speed Operation</th></tr>
<tr><td>PLSV instruction</td><td>Variable Pulse Output (PLSV)</td><td> 
</td><td>The PLSV instruction operates at the specified running speed. If the running speed changes, it adjusts to the newly specified speed. Pulse output stops when the PLSV instruction turns OFF.</td></tr>
</table>

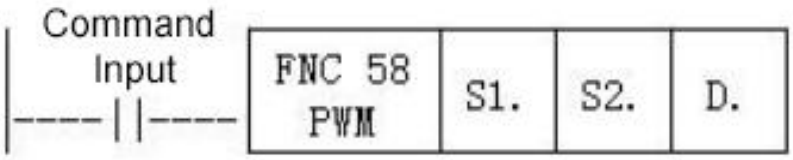
9.6 PWM/Pulse Width Modulation Instruction

9.6.1 PWM Instruction Overview

This instruction outputs pulses with specified cycle time and ON duration.

9.6.2 PWM Instruction Format and Parameters

1. Instruction Format



2. Parameter Description

Operand Type	Content	Data Type	Word Soft Elements	Value Range
S1.	Pulse width (ms) data or word soft element number storing the data	BIN16 bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	0-32767 ms
S2.	Cycle time (ms) data or word soft element number storing the data	BIN16 bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	0-32767 ms
D.	Pulse output Y number	BIN16 bit	Y0-Y7	Y0-Y7

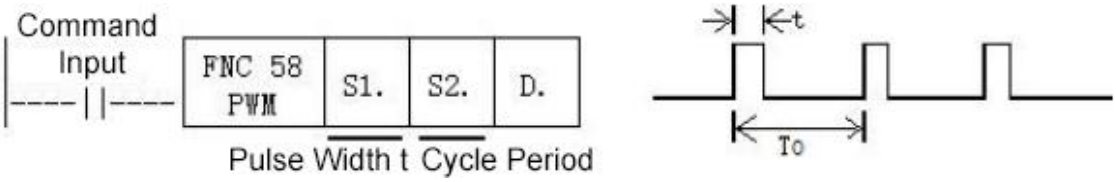
9.6.3 PWM Function and Operation Description

1. 16-bit PWM Instruction Function:

Outputs pulses from [D] with:

- ON pulse width = [S1] (ms)

- Cycle period = [S2] (ms)

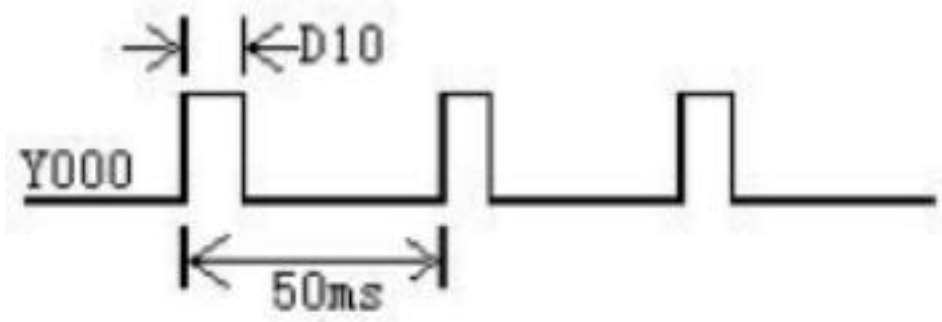


2. Key Notes:

- The values for pulse width (S1) and cycle (S2) must satisfy S1 ≦ S2.
- When the instruction input is OFF, output [D] will also be OFF.
- Do not modify the pulse output mode setting during pulse generation.
- Valid [D] outputs are limited to transistor outputs Y000, Y001, Y002 on the base unit.

9.6.4 PWM Programming Example

In the following program, when the content of D10 varies between 0–50, the average output of Y000 will range from 0–100%.



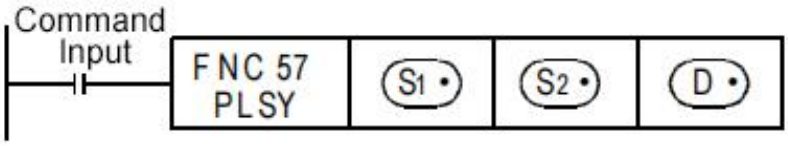
9.7 PLSY / Pulse Output Instruction

9.7.1 PLSY Instruction Overview

This instruction outputs pulses with specified frequency and pulse count.

9.7.2 PLSY Instruction Format and Parameters

1. Instruction Format:



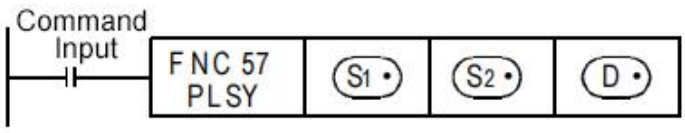
2. Parameter Description:

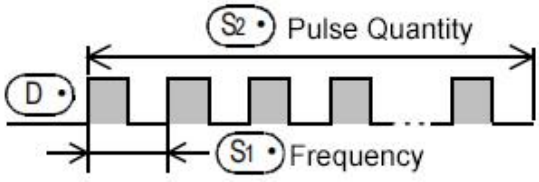
Operand Type	Description	Data Type	Word Soft Elements	Value Range
S1.	Pulse frequency (Hz)	BIN16/32 bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	16-bit operation: 1–32,767 Hz 32-bit operation: 1–150,000 Hz
S2.	Number of output pulses	BIN16/32 bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	16-bit operation: 1–32,767 pulses 32-bit operation: 1–2,147,483,647 pulses
D.	Pulse output Y number	BIN16/32 bit	Y0-Y7	Y0-Y7

9.7.3 PLSY Function and Operation Description

1. 16-bit PLSY Instruction Function:

Outputs [S2] pulses at frequency [S1 Hz] from output terminal [D].



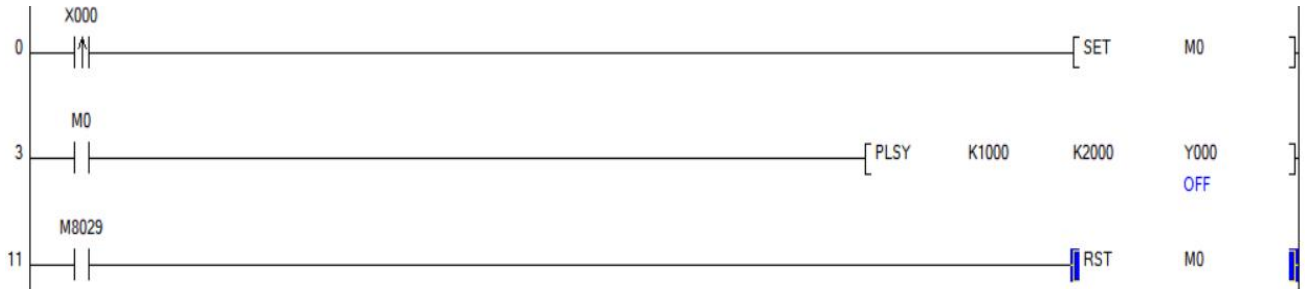


2. Key Notes:

- When modifying the value of a word device during instruction execution, the instruction behavior changes as follows: if the data in S1 is changed, the output frequency will immediately update accordingly; if S2 is modified, the changes will take effect from the next instruction execution cycle.
- When using the transistor output of the base unit, set the output frequency below 150,000Hz. Operating loads with pulse frequencies exceeding 150,000Hz may sometimes cause PLC malfunctions. Additionally, do not set the output frequency to 0.
- The pulse ON/OFF duty cycle is internally fixed at 50% by the PLC, though some frequencies may not maintain exactly 50% due to output circuit characteristics.
- Only the base unit's transistor outputs Y000, Y001, and Y002 are valid as assignable soft elements in D.

9.7.4 PLSY Programming Example

When X0 detects a rising edge, output 2000 pulses at 1000Hz from Y0.



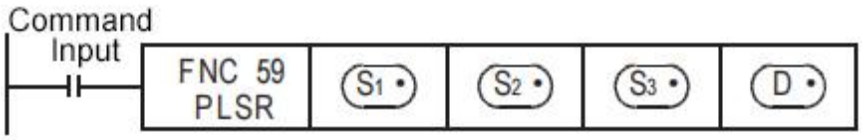
9.8 PLSR / Acceleration-Deceleration Pulse Output Instruction

9.8.1 PLSR Instruction Overview

This instruction outputs pulses with specified maximum frequency and pulse count, featuring acceleration/deceleration control.

9.8.2 PLSR Instruction Format and Parameters

1.Instruction Format:



2.Parameter Description:

Operand Type	Description	Data Type	Word Soft Elements	Value Range
S1.	Maximum frequency (Hz)	BIN16/32 bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	16-bit operation: 1–32,767 Hz 32-bit operation: 1–150,000 Hz
S2.	Total pulse count	BIN16/32 bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	16-bit operation: 1–32,767 pulses 32-bit operation: 1–2,147,483,647 pulses
S3.	Acceleration/deceleration time (ms)	BIN16/32 bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	50-5000ms
D.	Output terminal (Y0-Y7)	BIN16/32 bit	Y0-Y7	Y0-Y7

9.8.3 PLSR Function and Operation Description

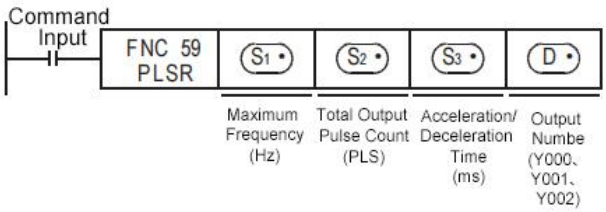
1.16-bit PLSR Instruction Function:

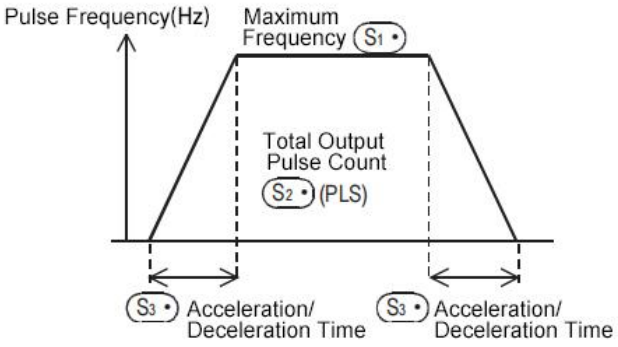
Outputs pulses from [D] with:

- Maximum frequency = [S1] Hz

- Acceleration/deceleration time = [S3] ms

- Total pulse count = [S2]





2. Key Notes

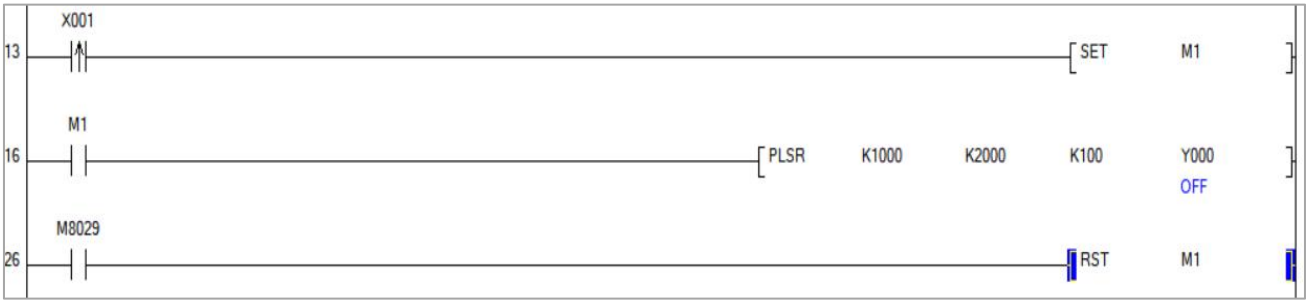
- When using the transistor output of the basic unit, set the output frequency below 150,000Hz. Operating loads with pulse frequencies exceeding 150,000Hz may cause the programmable controller to malfunction. Additionally, do not set the output frequency to 0.
- The ON/OFF duty cycle of pulses is internally fixed at 50% in the programmable controller, though some frequencies may not maintain exactly 50% due to output circuit characteristics.
- Only the basic unit's transistor outputs Y000, Y001, and Y002 are valid as assignable soft elements in D.

9.8.4 PLSR Programming Example

On X1 rising edge, outputs 2000 pulses from Y0 with:

- Max frequency: 1000Hz

- Acceleration time: 100ms



9.9 DSZR / Origin Return with DOG Search Instruction

9.9.1 DSZR Instruction Overview

An instruction that performs origin return to align the mechanical position with the current value register in the programmable controller. Compared to the ZRN instruction, DSZR additionally supports:

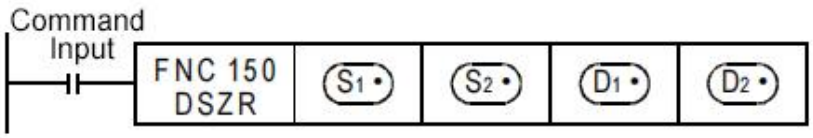
1.DOG search function

2.Origin return using both near-point DOG and zero-point signals

3.Shared input point for DOG and zero signals

9.9.2 DSZR Instruction Format and Parameters

1.Instruction Format



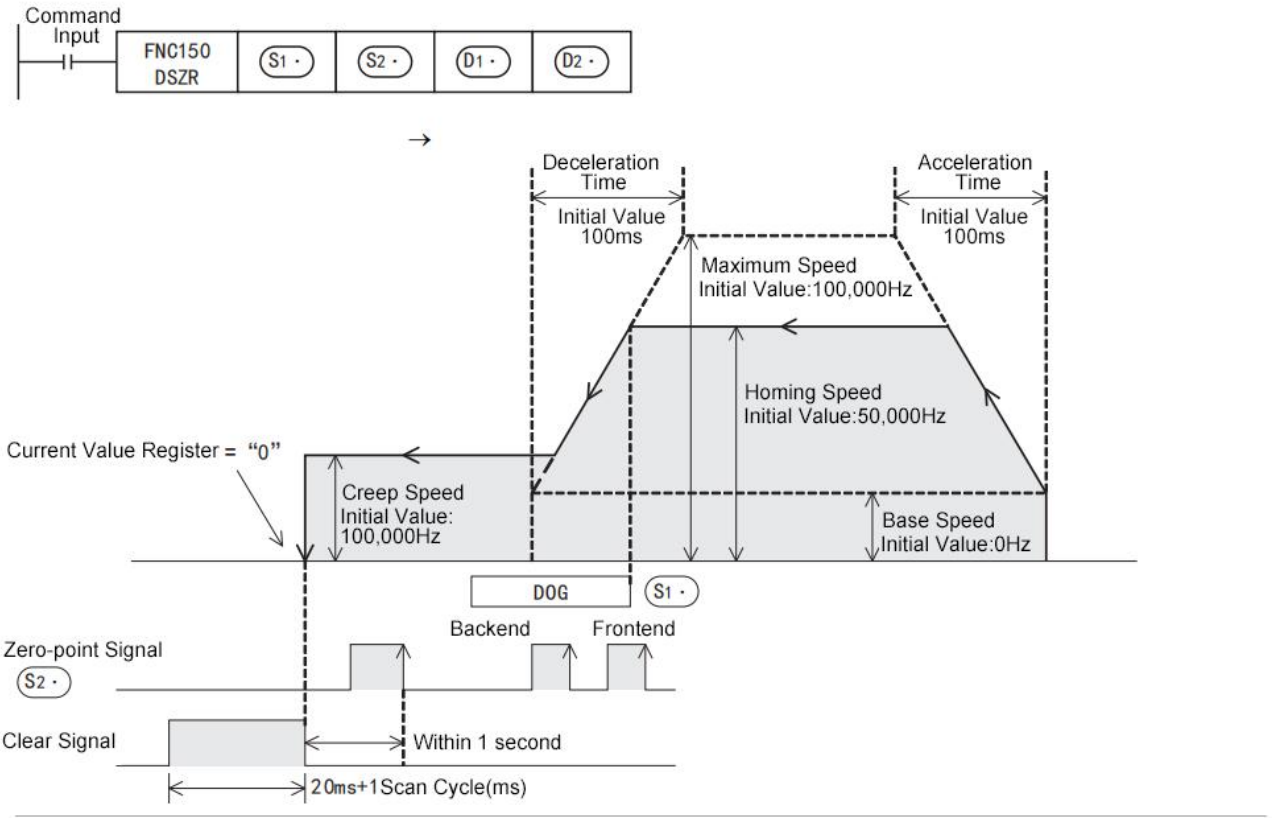
2. Instruction Parameters

Parameter	Description	Data Type	Valid Operands	Value Range
S1.	Near-point signal (DOG)	BIN16 bit	X0-X17	X0-X17
S2.	Zero-point signal	BIN16 bit	X0-X17	X0-X17
D1.	Pulse output terminal	BIN16 bit	Y0-Y7	Y0-Y7
D2.	Rotation direction signal	BIN16 bit	Y0-Y17	Y0-Y17

9.9.3 DSZR Function and Operation Description

1. DSZR Instruction Function:

2. The instruction outputs pulses from [D1] and rotation direction signals from [D2], using [S1] as the near-point (DOG) signal and [S2] as the zero-point signal, to perform origin return that aligns the mechanical position with the current value register in the programmable controller.



3. S1: Specify the soft component number for the near-point signal (DOG) input.

4. The logic state of the near-point signal (DOG) is determined by the ON/OFF status of the near-point signal logic inversion flag (see table below).

Pulse Output Soft Element	Near-point Signal Logic Inversion Flag	Function
D1.=Y000	M8345	OFF: Positive logic (DOG signal is ON when input is ON) ON: Negative logic (DOG signal is ON when input is OFF)
D1.=Y001	M8355	
D1.=Y002	M8365	
D1.=Y003	M8375	

5. The detection (leading edge/trailing edge) of the near-point signal (DOG) is affected by the input filter and the scan cycle of the sequence program. Ensure there is at least one scan cycle between the DOG trailing edge and the zero-point signal turning ON.

6. In S2, specify the input number (X000-X017) for the zero-point signal input.

7. The logic of this zero-point signal is determined by the ON/OFF state of the zero-point signal logic inversion flag (see table below).

Note: If the same input is specified for both the near-point signal and zero-point signal, the zero-point signal logic will follow the near-point signal (DOG) logic instead of the soft element below. In this case, the operation will be similar to the ZRN instruction, where the zero-point signal is not used, and the operation is performed based on the leading and trailing edges of the near-point signal (DOG). Refer to point 4 for the operation details.

Pulse Output Soft Element	Zero Signal Logic Inversion Flag	Description
D1.＝Y000	M8346	OFF: Positive logic (Zero signal is ON when input is ON) ON: Negative logic (Zero signal is ON when input is OFF)
D1.＝Y001	M8356	
D1.＝Y002	M8366	
D1.＝Y003	M8376	

1. In D1, specify the pulse output terminal number (Y000-Y003).

2. In D2, specify the soft element number for the rotation direction signal output.

3. For RX series programmable controllers:

The rotation direction signal must use transistor output.

The rotation direction corresponds to the ON/OFF state of the specified soft element in D2, as shown in the table below.

Important: Do not manually control the output specified in D2 during instruction execution.

D2 Soft Element State	Rotation Direction (Current Value Change)
ON	Forward rotation (Pulse output from D1 increases current value)
OFF	Reverse rotation (Pulse output from D1 decreases current value)

4. Origin Return Direction Control

The origin return direction is specified by the ON/OFF state of the direction control flags in the table below:

Pulse Output Soft Element	Origin Return Direction Flag	Description
D1.=Y000	M8342	ON: Forward direction origin return OFF: Reverse direction origin return
D1.=Y001	M8352	
D1.=Y002	M8362	
D1.=Y003	M8372	

5. Clear Signal Output

This instruction includes a function to output a clear signal after stopping at the origin position. To output a clear signal during the origin return operation, set the clear signal output enable flag (see table below) to ON. If the clear signal soft element assignment enable flag is ON, a designated soft element can be used to specify the clear signal (output Y) for the pulse output terminal associated with the supported soft element.

Pulse Output Soft Element	Clear Signal Output Active Flag Status	Clear Signal Soft Element Enable Flag Status	Clear Signal Soft Element Assignment Register
D1. =Y000	M8341=ON	M8464=ON	D8464
D1. =Y001	M8351=ON	M8465=ON	D8465
D1. =Y002	M8361=ON	M8466=ON	D8466
D1. =Y003	M8371=ON	M8467=ON	D8467

6. Origin Return Speed

The origin return speed is specified by the soft elements in the table below. However, the relationship base speed ≤ origin return speed ≤ maximum speed must be observed. If the origin return speed exceeds the maximum speed, the system will operate at the maximum speed.

Pulse Output Soft Element	Base Speed	Homing Speed	Maximum Speed	Initial Value
D1. =Y000	D8342	D8347, D8346	D8344, D8343	50, 000 (Hz)
D1. =Y001	D8352	D8357, D8356	D8354, D8353	
D1. =Y002	D8362	D8367, D8366	D8364, D8363	
D1. =Y003	D8372	D8377, D8376	D8374, D8373	

7. Creep Speed

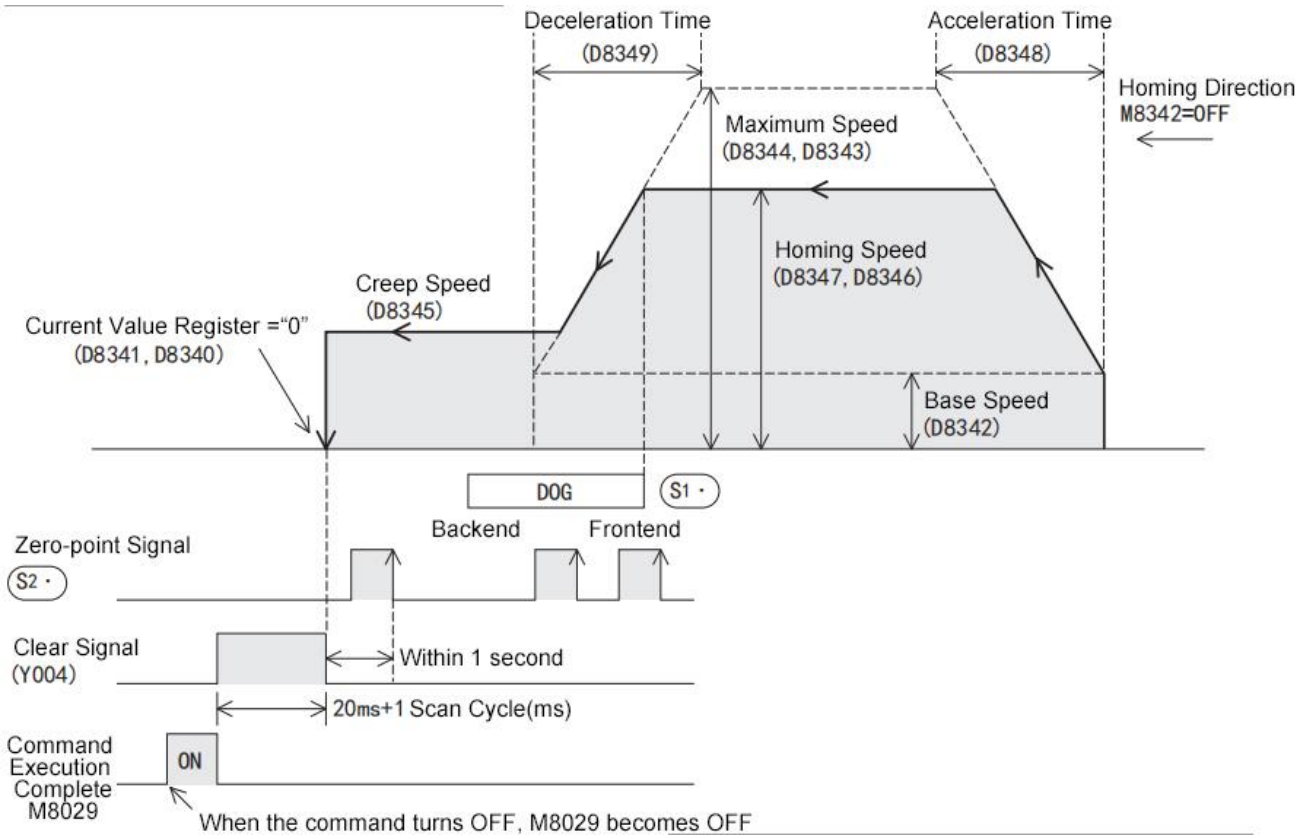
Pulse Output Soft Element	Base Speed	Creep Speed	Maximum Speed	Initial Value
D1• =Y000	D8342	D8345	D8344, D8343	1, 000(Hz)
D1• =Y001	D8352	D8355	D8354, D8353	
D1• =Y002	D8362	D8365	D8364, D8363	
D1• =Y003	D8372	D8375	D8374, D8373	

The creep speed is specified by the soft elements in the table below. However, the relationship base speed ≤ creep speed ≤ maximum speed must be observed.

Origin Return Operation

Taking pulse output terminal Y000 as an example, the origin return operation is described below. For Y001/Y002/Y003, replace relevant flags according to the output number used.

1. The origin return direction is specified by the ON/OFF state of the direction designation flag (M8342).
2. The DSZR instruction is executed to perform origin return
3. Moving in the direction specified by M8342 at the speed set in the origin return speed registers (D8347, D8346).
4. When the designated near-point signal (DOG) turns ON, deceleration begins until reaching the creep speed (D8345).
5. After the DOG signal changes from ON to OFF, if the designated zero-point signal is detected changing from OFF to ON, pulse output stops immediately. When the near-point and zero-point signals share the same input, the operation follows ZRN instruction behavior - pulse output stops immediately at the DOG signal's OFF transition without using the zero signal.
6. With the clear signal output function (M8341) enabled (ON), the clear signal (Y004) activates within 1ms after detecting the zero signal's OFF→ON transition and remains ON for "20ms + 1 scan cycle".
7. The current value registers (D8341, D8340) are cleared to 0
8. The instruction completion flag (M8029) turns ON to conclude the origin return operation.



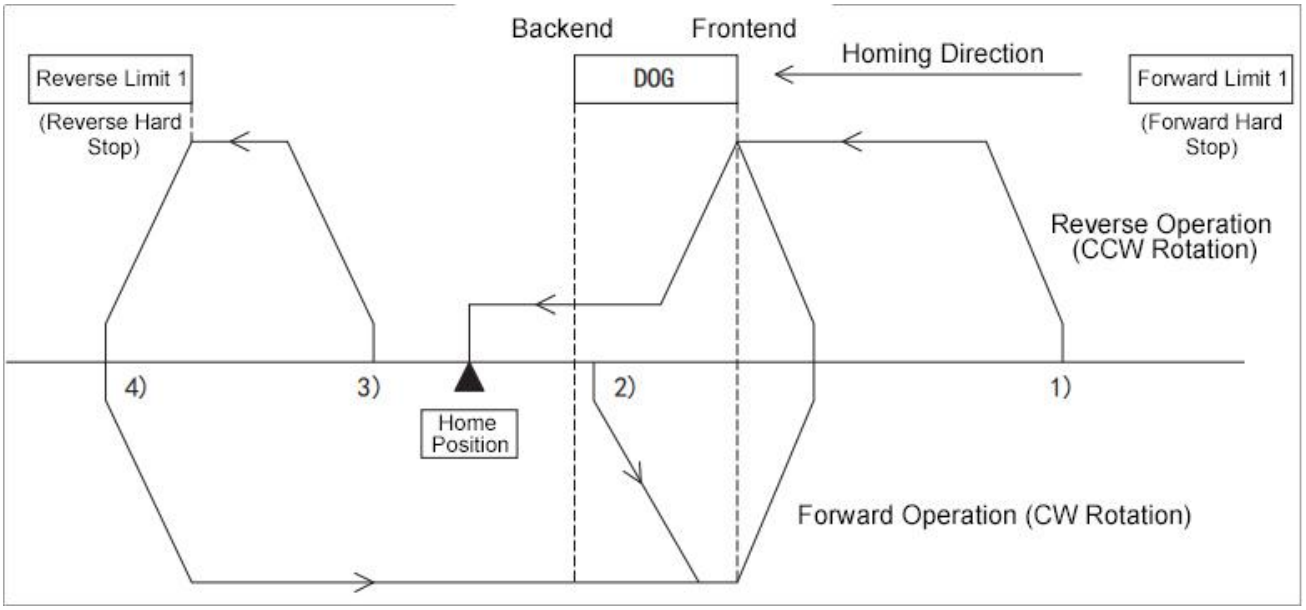
■ The above description applies when the near-point signal logic inversion flag (M8345) is OFF.

If M8345 is ON, interpret all "ON" states as "OFF" and "OFF" as "ON" for the DOG signal.

■ The above description applies when the zero-point signal logic inversion flag (M8346) is OFF.

If M8346 is ON, interpret all "ON" states as "OFF" and "OFF" as "ON" for the zero-point signal.

DOG Search Function



When forward/reverse limit switches are configured, origin return with DOG search is executed. The operation varies based on the starting position:

1. Starting Position Before Passing DOG

- Execute origin return instruction to begin operation.
- Move toward origin at origin return speed.
- Upon detecting DOG leading edge, decelerate to creep speed.
- After detecting DOG trailing edge, stop at the first zero signal.

2. Starting Position Inside DOG Zone

- Execute origin return instruction.
- Move opposite to origin direction at origin return speed.
- Decelerate and stop after detecting DOG leading edge (exiting DOG).
- Reverse direction and move toward origin (re-entering DOG).
- Decelerate to creep speed upon detecting DOG leading edge.
- Stop at first zero signal after DOG trailing edge.

3. Starting Position After Passing DOG (DOG OFF)

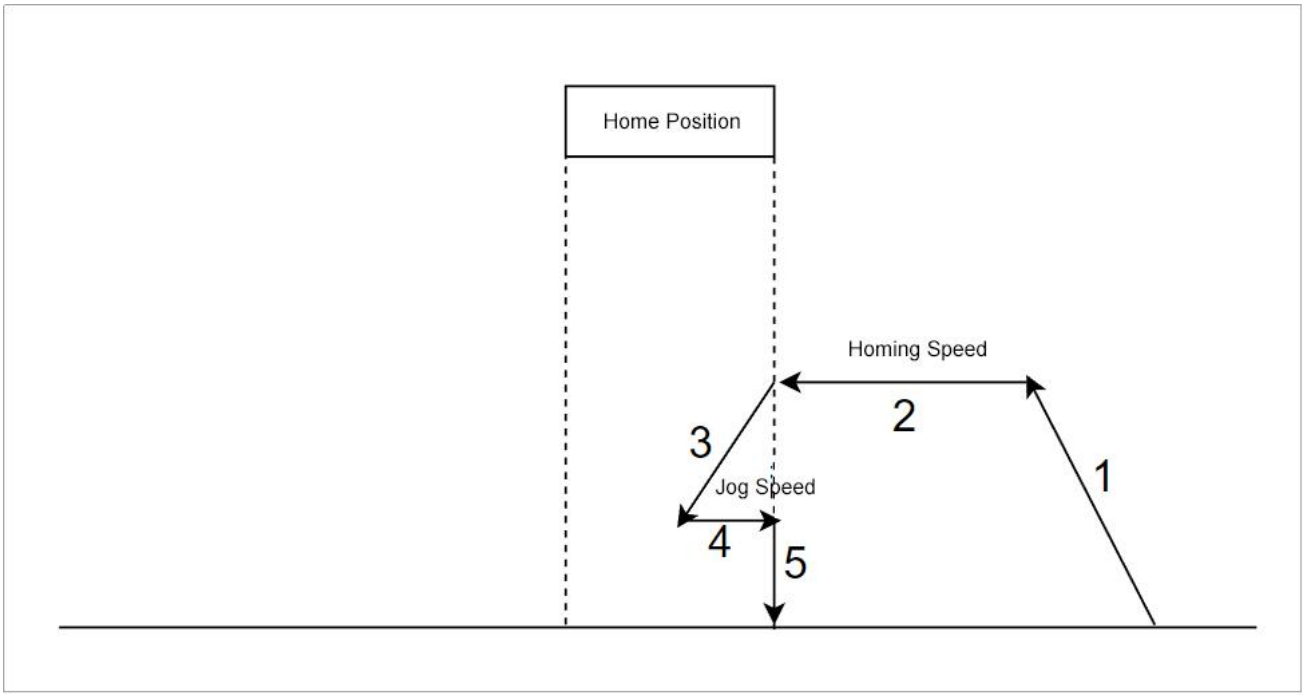
- Execute origin return instruction.
- Move toward origin at origin return speed.
- Decelerate and stop upon hitting reverse limit switch.
- Reverse direction and move away from origin.
- Stop after detecting DOG leading edge (exiting DOG).
- Move toward origin again (re-entering DOG).
- Decelerate to creep speed at DOG leading edge.
- Stop at first zero signal after DOG trailing edge.

4. Limit Switch Active During Origin Return

If origin-direction limit switch (forward/reverse limit 1) is ON:

- Execute origin return instruction.
- Move opposite to origin direction at origin return speed.
- Stop after detecting DOG leading edge (exiting DOG).
- Move toward origin (re-entering DOG).
- Decelerate to creep speed at DOG leading edge.
- Stop at first zero signal after DOG trailing edge.

DSZR Operation with Shared DOG/Zero Signal Input



1. Starting Position at Origin Signal (Signal ON)

- Move in the opposite direction of origin return at creep speed.
- Stop upon detecting the falling edge (OFF transition) of the signal.

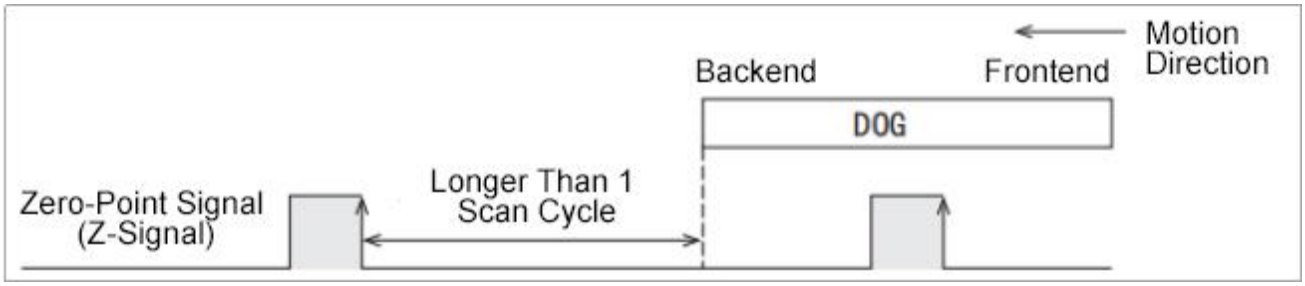
2. Starting Position Outside Origin Signal (Signal OFF)

- Execute the DSZR instruction to begin origin return.
- Move toward origin at origin return speed.
- Upon detecting the rising edge (ON transition) of the signal:
- Decelerate to creep speed.
- Reverse direction (away from origin).
- Stop upon detecting the falling edge (OFF transition).

9.9.4 DSZR Critical Usage Notes

1. The detection of the near-point signal (DOG) leading/trailing edges is affected by both the input filter and the scan cycle of the sequence program. Ensure at least one full scan cycle elapses between the DOG trailing edge and the zero-point signal turning ON.

2. Since the servo motor's zero-point signal is being used, precisely align the timing relationship between the DOG trailing edge and zero-point signal. For fine adjustments of the origin position, physically reposition the near-point signal (DOG) sensor.



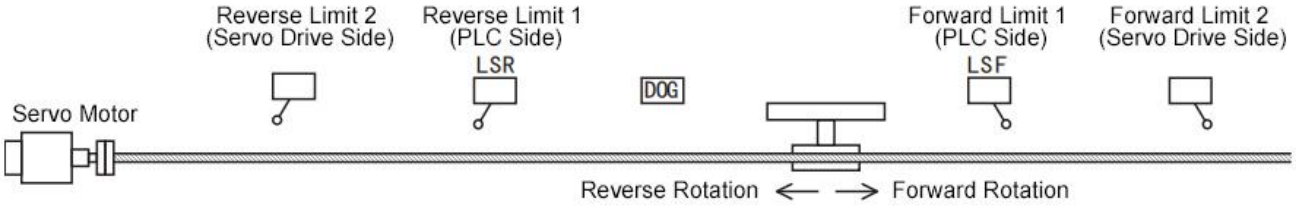
3. When designing the near-point signal (DOG), ensure sufficient ON duration to allow complete deceleration to creep speed.

4. This instruction begins deceleration to creep speed at the DOG leading edge, and stops either at the "DOG trailing edge" or when "the first zero signal is detected after the DOG trailing edge", while clearing the current value register.

5. If the system fails to decelerate to creep speed before the DOG trailing edge, it will cause stopping position deviation.

6. The near-point signal (DOG) must be positioned between the forward limit 1 (LSR) and reverse limit 1 (LSR).

7. If the near-point signal (DOG), reverse limit 1 (LSR), and forward limit 1 (LSF) are not arranged as shown in the following diagram, the desired operation may not be performed.



8. The input signals designated for near-point signals and zero-point signals cannot be used simultaneously for the following purposes:

- High-speed counters
- Input interrupts
- Pulse catch
- SPD instruction
- DVIT instruction
- ZRN instruction

9. Set the creep speed sufficiently slow. Since the origin return instruction stops without deceleration braking, excessive creep speed may cause stopping position deviation due to inertia.

10. If operand values are modified during instruction execution, the changes will not affect the current operation. To apply changes, first turn OFF the instruction contact, then turn it ON again.

11. If the instruction driving contact turns OFF during origin return, the system will decelerate to a stop.

12. In this case, the instruction completion flag M8029 will not turn ON.

13. When the pulse output monitor (BUSY/READY) is ON, positioning instructions (including PLSR, PLSY) using that output cannot be executed.

Additionally, even if the instruction driving contact is OFF, do not execute positioning instructions (including PLSR/PLSY) specifying the same output number while the pulse output monitor (BUSY/READY) remains ON.

9.10 ZRN / Origin Return Instruction Usage

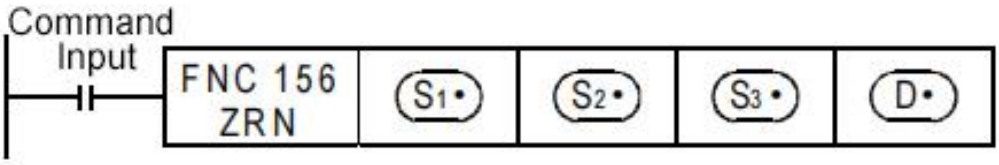
9.10.1 ZRN Instruction Overview

An instruction that performs origin return to align the mechanical position with the current value register in the programmable controller.

When DOG search function is required, please use the DSZR instruction.

9.10.2 ZRN Instruction Format and Parameter Description

1.Instruction Format



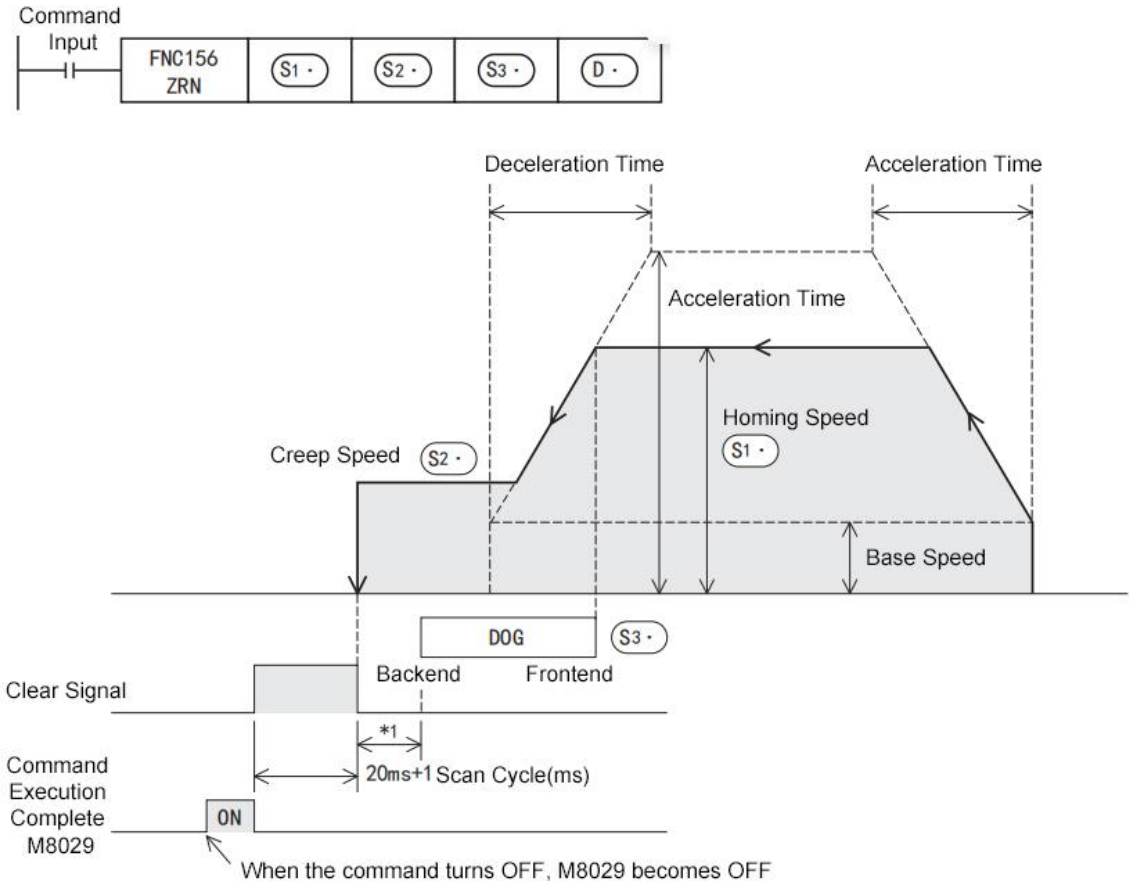
2.Parameter Description

Parameter	Description	Data Type	Valid Operands	Value Range
S1.	Origin return starting speed	BIN16/32 bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	16-bit: 10-32,767 Hz 32-bit: 10-150,000 Hz
S2.	Creep speed	BIN16/32 bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	10-32,767Hz
S3.	Near-point signal (DOG) input	BIN16/32 bit	X0-X17	X0-X17
D.	Pulse output destination	BIN16/32 bit	Y0-Y7	Y0-Y7

9.10.3 ZRN Function and Operation Description

1.ZRN Instruction Function:

Outputs pulses from [D],Uses [S1] as the initial speed for origin return,Uses [S2] as the creep speed,Uses [S3] as the near-point input signal (DOG).Performs origin return to align the mechanical position with the current value register in the programmable controller



- Specify the origin return speed in S1.
- If the set origin return speed exceeds the maximum speed, the system will operate at the maximum speed.

Data Type	Setting Range
16-bit instruction	10-32,767(Hz)
32-bit instruction	10～150,000(Hz)

The origin return speeds specified in the following table are not applicable.

Pulse Output Soft Element	Homing Speed
(D•) =Y000	D8347, D8346
(D•) =Y001	D8357, D8356
(D•) =Y002	D8367, D8366
(D•) =Y003	D8377, D8376

- S2: Specify creep speed (10-32,767 Hz)
- S3: Assign the near-point signal (DOG) input (non-contact input)
- Deceleration to creep speed begins when DOG changes from OFF→ON.Origin return completes when DOG changes from ON→OFF
- Designate pulse output terminal (Y000-Y002)
- Origin Return Direction

In this instruction, the origin return direction defaults to the reverse direction (during origin return, the current value register decrements).

For origin return in the forward direction, programmatically control the rotation direction signal output (Y) as follows:

a)Set rotation direction signal (Y□□□) ON

b)Refresh output using REF instruction

c)Execute ZRN instruction

d)Reset direction signal (Y□□□) using M8029 (completion flag)

- Clear Signal Output

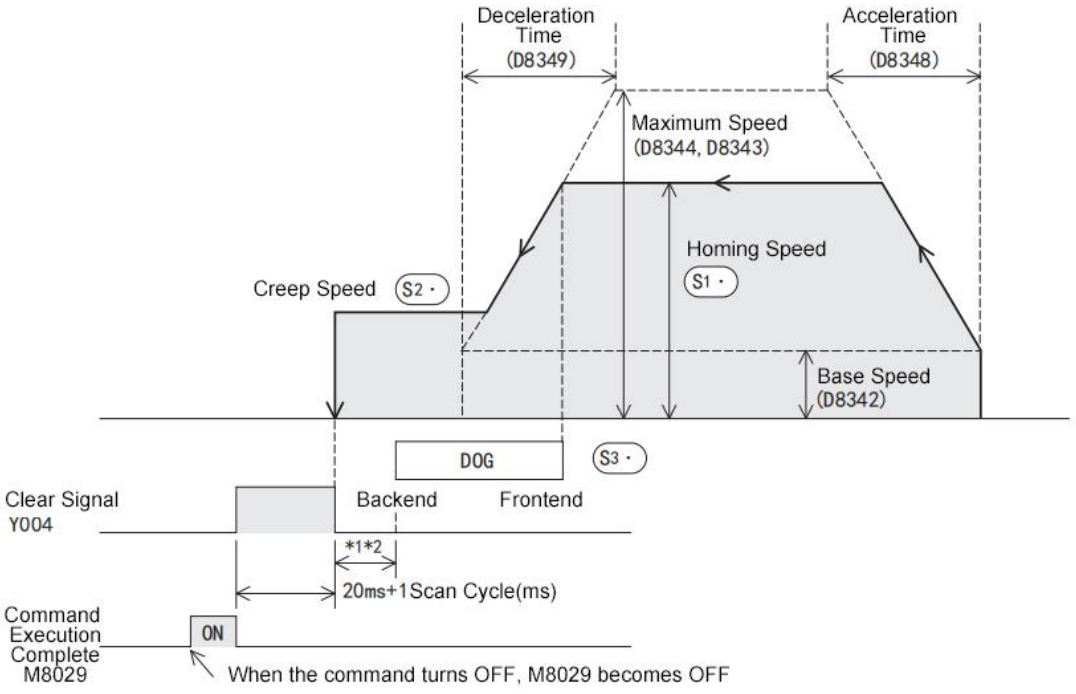
Pulse Output Soft Element	Clear Signal Output Active Flag Status	Clear Signal Soft Element Enable Flag Status	Clear Signal Soft Element Assignment Register
(D•) =Y000	M8341=ON	M8464=ON	D8464
(D•) =Y001	M8351=ON	M8465=ON	D8465
(D•) =Y002	M8361=ON	M8466=ON	D8466
(D•) =Y003	M8371=ON	M8467=ON	D8467

The instruction features a zero-point signal output function after stopping at the origin position. When the zero-point signal soft element designation enable flag is ON, you can use the designated soft element to specify the zero-point signal (output Y) for the pulse output terminal that corresponds with the supported soft element.

2. Origin Return Operation

Taking pulse output terminal Y000 as an example, the origin return operation is described below. For Y001/Y002, replace relevant flags (special auxiliary relays/data registers) accordingly.

- The origin return is executed using the ZRN instruction
- Moving at the origin return speed specified in S1.
- When the near-point signal (DOG) specified in S3 turns ON, deceleration begins until reaching the creep speed specified in S2.
- After the DOG signal in S3 changes from ON to OFF, pulse output stops immediately.
- When the clear signal output function (M8341) is enabled (ON), the clear signal (Y004) activates within 1ms after the DOG signal's ON→OFF transition and remains ON for "20ms plus one scan cycle".
- The current value registers (D8341, D8340) are cleared to 0
- The instruction completion flag turns ON to conclude the origin return operation.



9.10.4 Important Notes for ZRN Instruction Usage

1. The near-point signal (DOG) must be assigned to inputs X000-X017 on the base unit, with its stop positioning accuracy being affected by both the input filter response time and the sequence program's scan cycle.

2. Restricted DOG Signal Assignments (X000-X005)

When using X000-X005 as DOG signals, do not simultaneously use these inputs for:

- High-speed counters
- Input interrupts
- Pulse catch
- SPD instructions
- DSZR instructions
- DVIT instructions

3.When designing the near-point signal (DOG), ensure sufficient ON duration to allow complete deceleration to creep speed. The instruction begins deceleration at the DOG leading edge and stops at the trailing edge while clearing the current value register. Failure to reach creep speed before the DOG trailing edge will cause stopping position deviation.

4.Set the creep speed sufficiently slow - since the origin return instruction stops without deceleration braking, excessive creep speed leads to position drift due to inertia.

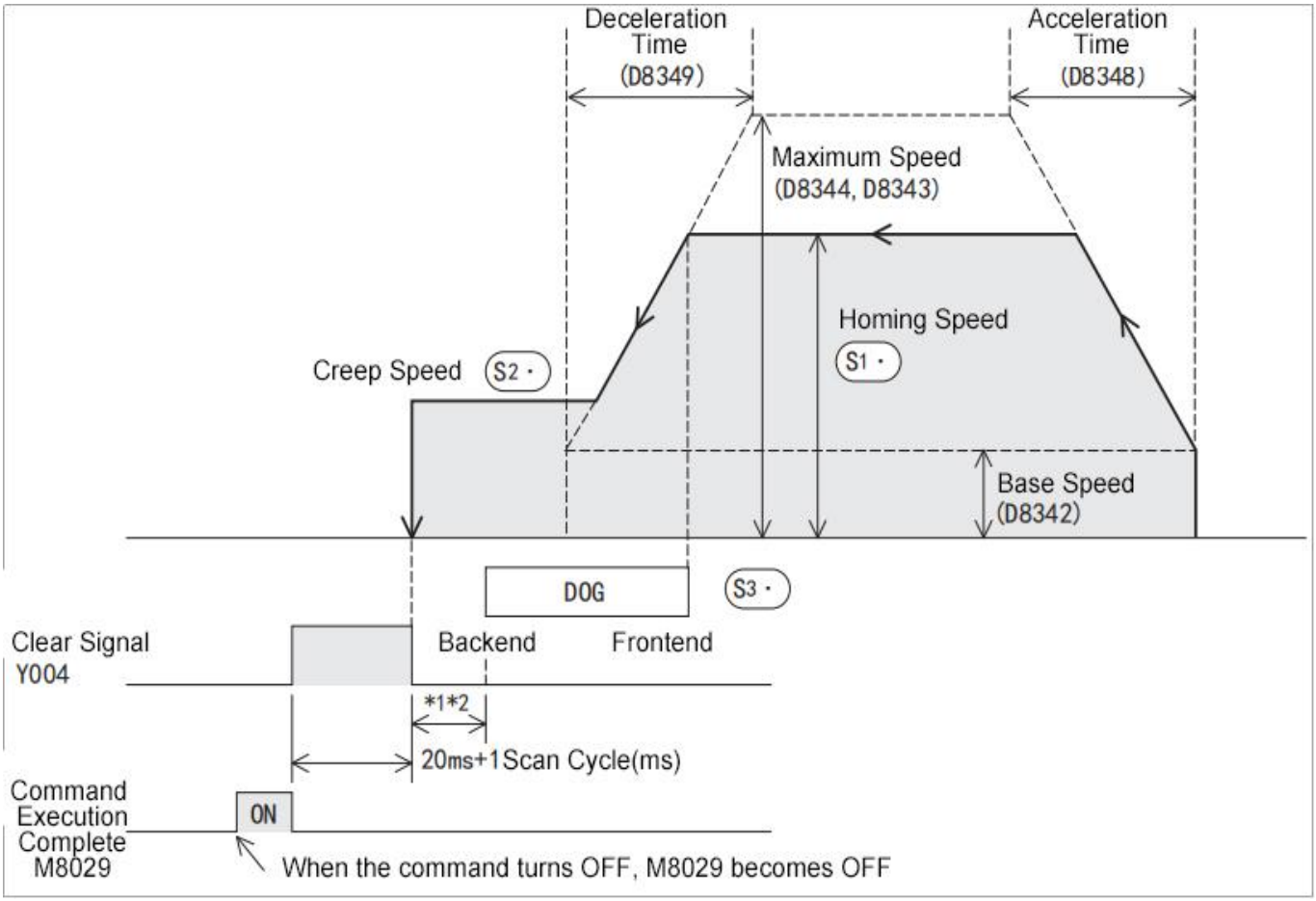
5.As the DOG search function is unsupported, always initiate origin return from the DOG's leading edge (use DSZR instruction when DOG search is required).

6.For servo motor applications lacking zero-signal support, physically adjust the DOG sensor position for origin fine-tuning.

7.If the instruction driving contact turns OFF during origin return, decelerated stopping occurs without activating completion flag M8029.

8.When the pulse output monitor (BUSY/READY) is ON, positioning instructions (including PLSR/PLSY) using that output cannot execute.

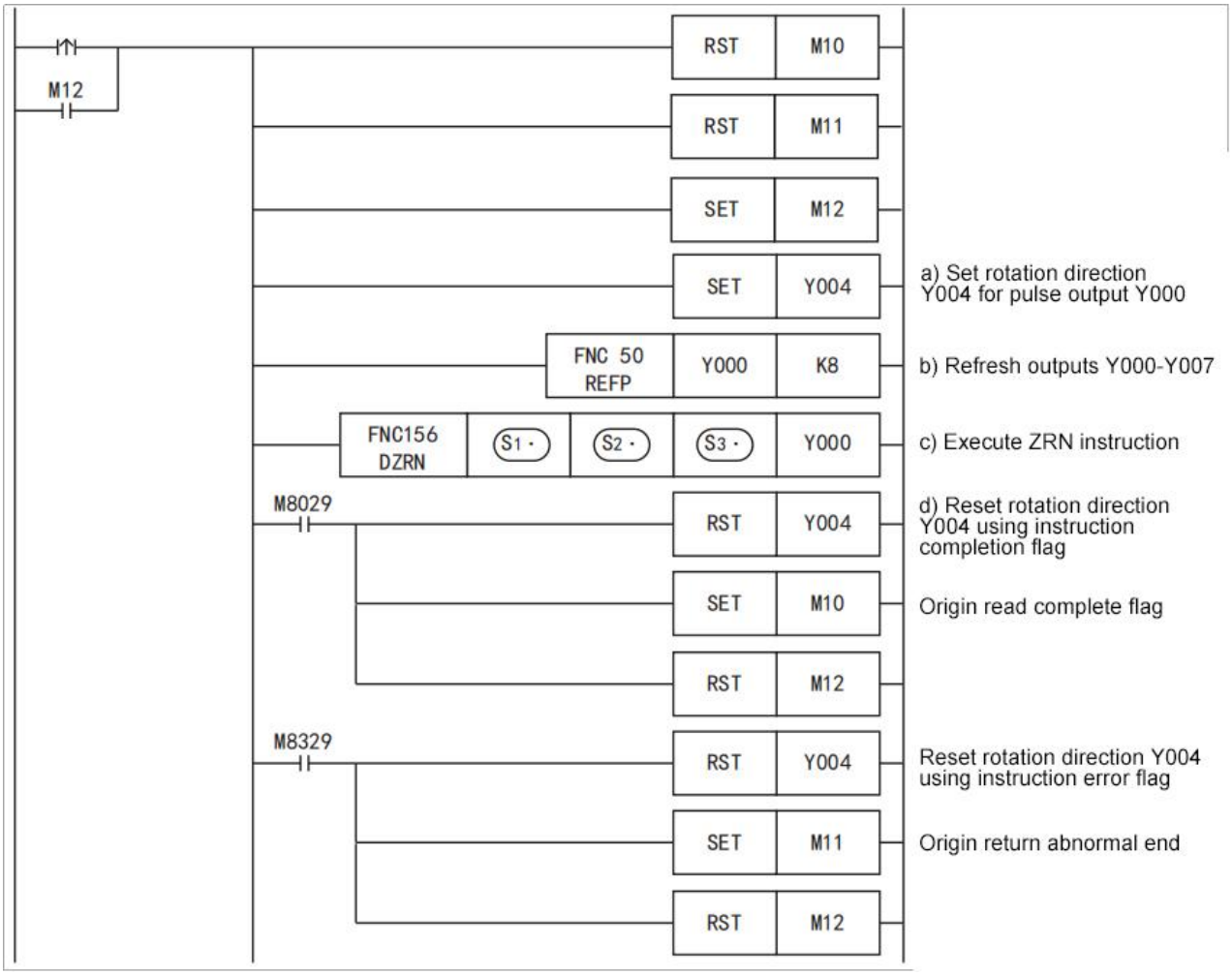
Furthermore, even with the instruction contact OFF, avoid executing positioning instructions for the same output number while BUSY/READY remains ON.



9.10.5 ZRN Instruction Programming Example

Example Configuration:Pulse output terminal: Y000.

Rotation direction signal: Y004



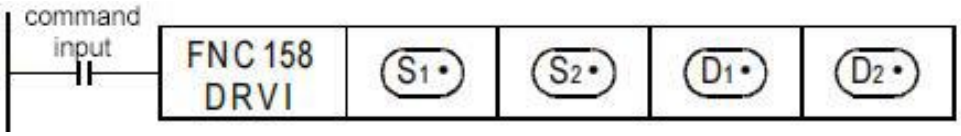
9.11 DRVI/Relative Positioning Instruction Usage Instructions

9.11.1 DRVI Command Summary

Executing single-speed positioning commands using relative drive mode. The method of specifying the movement distance from the current position using positive/negative signs is also known as incremental (relative) drive mode

9.11.2 DRVI Commands Format and Parameter Explanation

1. Commands format



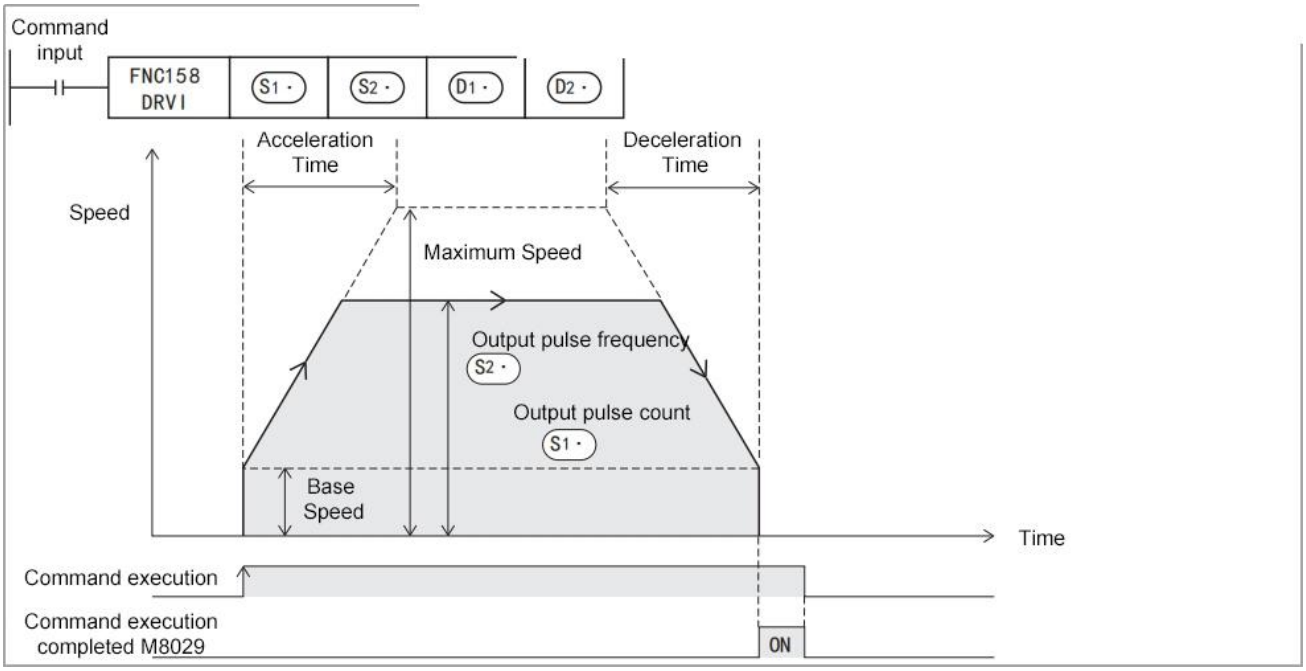
2. Parameter explanation

Type of operands	Content	Data type	Soft component	Data range
S1.	Output pulse count (relative address)	BIN16/32bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	During 16-bit operation, it is -32,768 to +32,767 (except 0) During 32-bit operation, it is -999,999 to +999,999 (except 0)
S2.	Output pulse frequency	BIN16/32bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	16-bit operation ranges from 10 to 32,767 (Hz) 32-bit operation ranges from 10 to 150,000 (Hz)
D1.	Output pulse's output Y number	BIN16/32bit	Y0-Y7	Y0-Y7
D2.	Output Y number indicating the rotation direction	BIN16/32 bit	Y0-Y7	Y0-Y17

9.11.3 DRVI Function and Operation Description

DRVI Command function：

This is a single-speed positioning command using relative driving. By specifying the movement distance from the current position with positive/negative signs, it is called incremental (relative) driving mode.



1. In S1., specify the number of output pulses (relative address value).

2. In S2., specify the output pulse frequency.

3. In D1., specify the output numbers of the output pulses Y000 to Y002.

4. In D2., specify the soft component number of the output rotation direction signal.

The rotation direction and the ON/OFF status of the specified soft component are shown in the table below. However, during the execution of this command, please do not control the output specified by D2.

ON/OFF status of the soft component specified ir (D2•)	Rotation direction (adjustment of current value)
ON	When the value of the output pulse count specified in (S1•) is a positive number, it rotates forward Forward: The pulse output of (D1•) increases the current value。
OFF	When the value of the output pulse number specifiedin in (S1•) negative, it rotates reverse. Reverse :The pulse output of (D1•) decreases the current value。

9.11.4 Key Points for Using DRVI

1. During the execution of the command, even if the content of the operand is changed, it will not be reflected in the current operation. It will only take effect during the next command-driven process.

2. During the command execution process, when the driving contact is OFF, the deceleration stop occurs. And at this time, the command execution end flag M8029 does not act.

3. When the limit flag (forward or reverse rotation) of the action direction is activated, the deceleration stop occurs.

4. When the monitoring (BUSY/READY) of the pulse output is ON, the positioning commands (including PLSR, PLSY) using this output cannot be executed.

Furthermore, even if the command-driven contact is set to OFF, during the monitoring (BUSY/READY) of the pulse output being ON, please do not execute the positioning commands (including PLSR/PLSY) that are specified for the same output number.

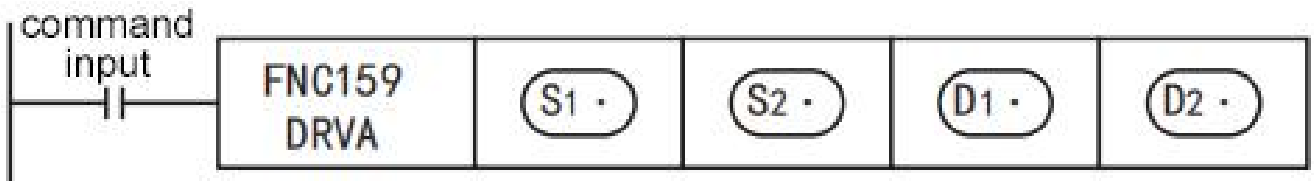
9.12 DRVA/Absolute Positioning Command Usage Instructions

9.12.1 DRVA Command Summary

Execute the single-speed positioning command in an absolute driving mode. In this mode, the movement distance starting from the origin (zero point) is specified, also known as the absolute driving mode.

9.12.2 DRVA Commands Format and Parameter Explanation

1. Commands format



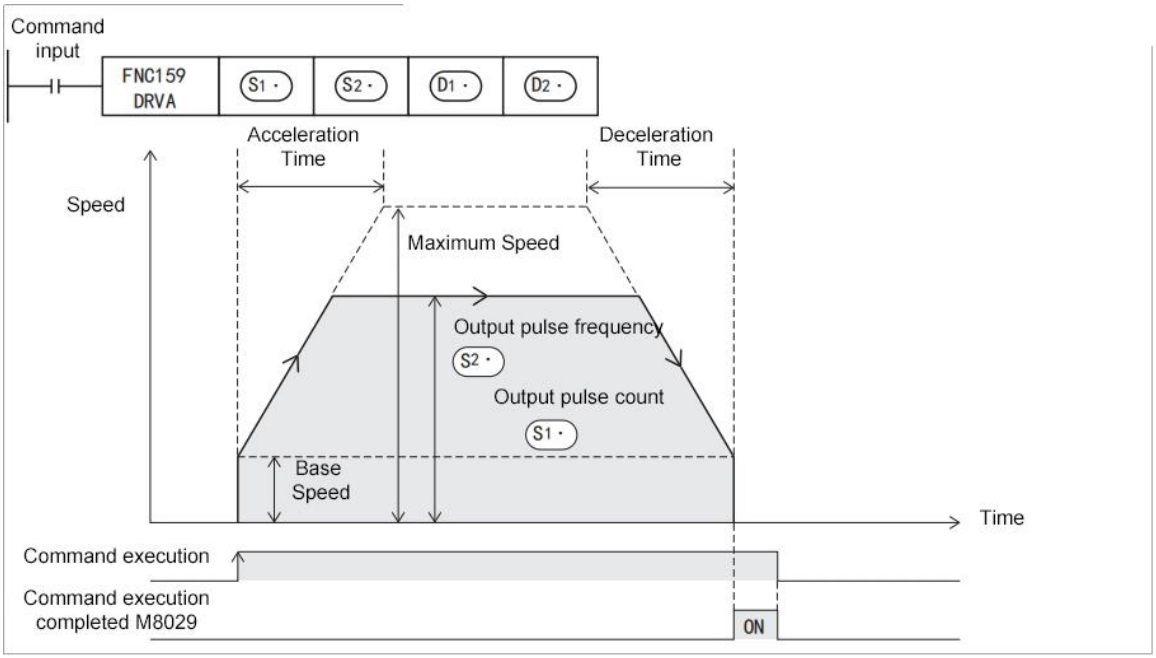
2. Parameter explanation

Type of operands	Content	Data type	Soft components	Data range
S1.	Output pulse count (relative address)	BIN16/32bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	During 16-bit operation, it is -32,768 to +32,767 (except 0) During 32-bit operation, it is -999,999 to +999,999 (except 0)
S2.	Output pulse frequency	BIN16/32bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	16-bit operation ranges from 10 to 32,767 (Hz) 32-bit operation ranges from 10 to 150,000 (Hz)
D1.	Output pulse's output Y number	BIN16/32bit	Y0-Y7	Y0-Y7
D2.	Output Y number indicating the rotation direction	BIN16/32bit	Y0-Y7	Y0-Y17

9.12.3 DRVA Function and Operation Description

DRVA Command function：

This is a single-speed positioning command using absolute drive. It uses the distance specification method starting from the origin (0 point), also known as the absolute drive method.



1. In S1., specify the number of output pulses (absolute address value).

2. In S2., specify the output pulse frequency.

3. In D1., specify the output numbers of the output pulses Y000 to Y002.

4. In D2., specify the soft component number of the output rotation direction signal.

The rotation direction and the ON/OFF status of the specified soft component are shown in the table below. However, during the execution of this command, please do not control the output specified by D2.

ON/OFF status of the soft component specified in (D2•)	Rotation direction (adjustment of current value)	
ON	Forward: The pulse output of (D1•) increases the current value.	Forward or reverse operation is determined by the relationship between the number of output pulses specified by (S•) (absolute address) and the size of the current value register.
OFF	Reverse :The pulse output of (D1•) decreases the current value.	

9.12.4 Key Points for Using DRVA

1. During the execution of the command, even if the content of the operand is changed, it will not be reflected in the current operation. It will only take effect during the next command-driven process.

2. During the command execution process, when the driving contact is OFF, the deceleration stop occurs. And at this time, the command execution end flag M8029 does not act.

3. When the limit flag (forward or reverse rotation) of the action direction is activated, the deceleration stop occurs.

4. When the monitoring (BUSY/READY) of the pulse output is ON, the positioning commands (including PLSR, PLSY) using this output cannot be executed.

Furthermore, even if the command-driven contact is set to OFF, during the monitoring (BUSY/READY) of the pulse output being ON, please do not execute the positioning commands (including PLSR/PLSY) that are specified for the same output number.

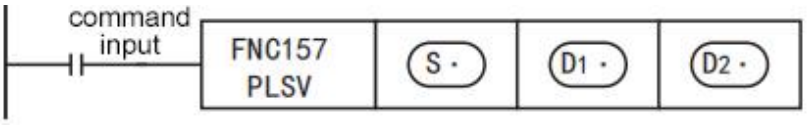
9.13 PLSV//Variable Speed Pulse Output Instruction Usage Instructions

9.13.1 PLSV Command Summary

This is the command for generating variable-speed pulses with rotational direction.

9.13.2 PLSV Commands Format and Parameter Explanation

1. Commands format



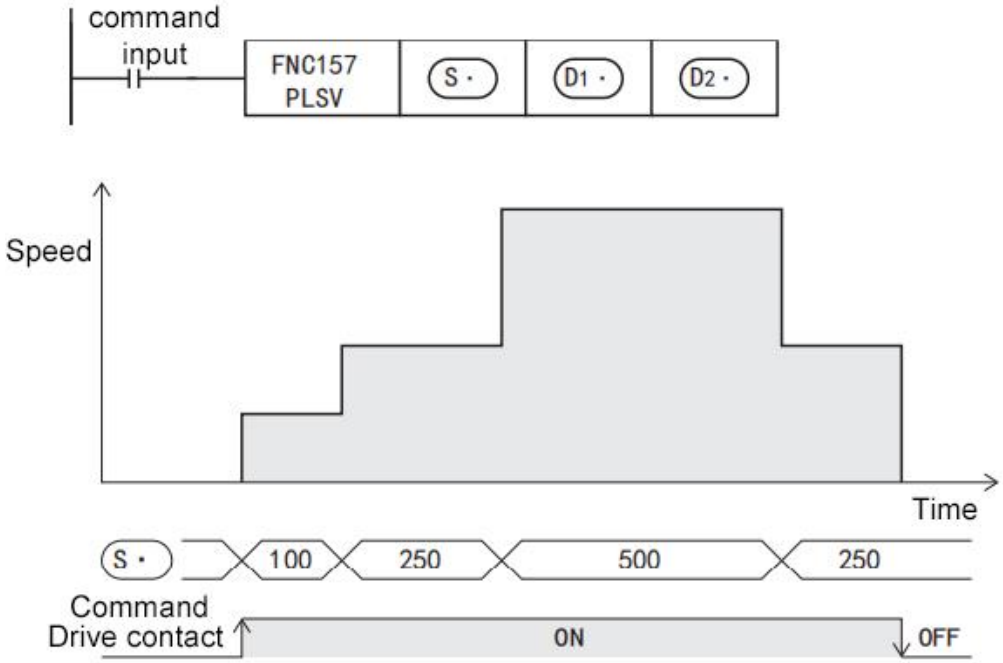
2. Parameter explanation

Type of operands	Content	Data type	Soft components	Data range
S.	The number of the soft component for outputting the pulse frequency	BIN16/32bit	KnX、KnY、KnM、KnS、T、C、D、V、Z、K、H	During 16-bit operation, -32,768 - 32,767 (Hz); During 32-bit operation, -150,000 - 150,000 (Hz). (except 0)
D1.	Output pulse's output Y number	BIN16/32bit	Y0-Y7	Y0-Y7
D2.	Output Y number indicating the rotation direction	BIN16/32bit	Y0-Y17	Y0-Y17

9.13.3 PLSV Function and Operation Description

PLSV Command function：

This command is a variable-speed pulse output command with rotational direction output. In the variable-speed pulse output (PLSV) command, there is no acceleration or deceleration action.



1. In S., specify the number of output pulses.Even during the pulse output process, the output pulse frequency can be changed at will. However, there is no acceleration or deceleration action.

2. In D1., specify the output numbers of the output pulses Y000 to Y002.

3. In D2., specify the soft component number of the output rotation direction signal.

The rotation direction and the ON/OFF status of the specified soft component are shown in the table below. However, during the execution of this command, please do not control the output specified by D2.

ON/OFF status of the soft component specified ir (D2·)	Rotation direction (adjustment of current value)
ON	When the value of the output pulse count specified in (S1·) is a positive number, it rotates forward Forward: The pulse output of (D1·) increases the current value。
OFF	When the value of the output pulse number specifiedin in (S1·) negative, it rotates reverse. Reverse :The pulse output of (D1·) decreases the current value。

9.13.4 Key Points for Using PLSV

- During the pulse output process, if the output pulse frequency is changed to "KO", the pulse output of the programmable controller will immediately stop. When outputting again, please start from the condition where the flag (BUSY/READY) in the pulse output is OFF, and wait for more than one operation cycle before setting (changing) the output pulse frequency to a value other than KO.
- During the pulse output process, please do not change the sign of the output pulse frequency. If you want to change it, first set the output pulse frequency to "KO", then after the deceleration stop, set the time for the motor to fully stop, and then change the sign of the output pulse frequency. If the sign of the output pulse frequency is changed during the pulse output process, it may damage the machinery due to the following actions.

  1)Stop the pulse output.

  2) The flag (BUSY/READY) in the pulse output is OFF. (The pulse output has stopped, but the motor has not immediately stopped.)

  3)It operates according to the specified frequency and rotation direction in the output pulse frequency.
- During the pulse output process, if the command-driven contact is turned off, the operation will immediately stop. Moreover, the flag M8029 for indicating the end of command execution does not function.
- When the limit flag for the direction of movement (forward or reverse) is activated, the operation will immediately stop.
- When the monitoring (BUSY/READY) status of the pulse output is ON, the positioning instructions (including PLSR and PLSY) using this output cannot be executed. Furthermore, even if the command-driven contact is set to OFF, during the monitoring (BUSY/READY) of the pulse output being ON, please do not execute the positioning instructions (including PLSR/PLSY) that are specified for the same output number.
- After the instruction execution is completed, the output of the rotation direction signal turns off.

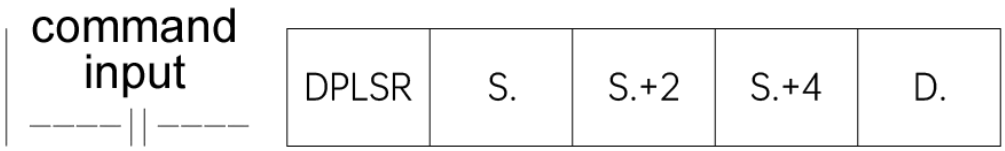
9.14 The use of interpolation function

1、The special flag settings for setting the interpolation route are as shown in the following table：

Interpolation method	M8432	M8433
line interpolation	1	0
Circular interpolation	0	1

relative coordinates	M8434=0
absolute coordinate	M8434=1
Clockwise	M8435=0
Counterclockwise	M8435=1

2、In the RX8U PLC, interpolation motion uses DPLSR for pulse output.



Operand Description：

S.Indicates the pulse frequency, that is, the speed of the interpolation movement

S.+2 Indicates the target address on the X-axis

S.+4 Indicates the target address on the Y-axis

D.:Specify the Y number with pulse output

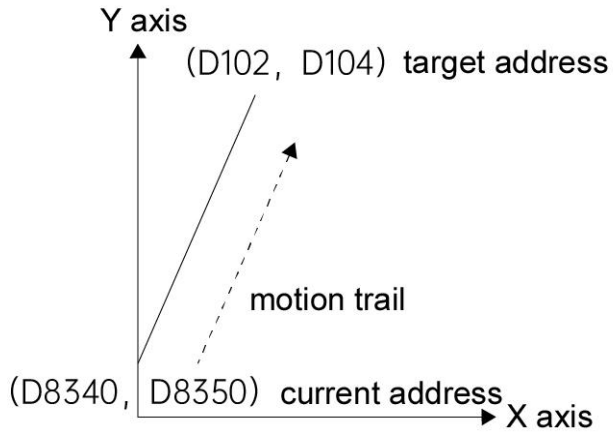
In circular interpolation mode:

S.+6 represents the X-axis coordinate address of the circle center.

S.+8 represents the Y-axis coordinate address of the circle center.

Interpolation currently only supports Y0/Y1, where Y0 corresponds to the direction Y10, and Y1 corresponds to the direction Y11.

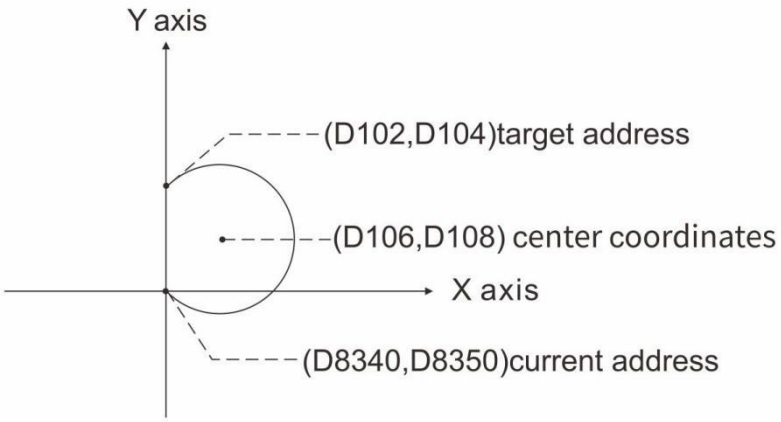
For example: DPLSR D100 D102 D104 Y000 (at this time, M8435 = 0)



Straight-line interpolation diagram

During linear interpolation: D100 represents the speed, D102 is the target address for the X-axis, and D104 is the target address for the Y-axis.

Y0 and Y1 respectively send pulses to the X-axis and Y-axis.



Circular interpolation diagram

During circular interpolation: D100 is the speed, D102 is the target address for the X-axis, D104 is the target address for the Y-axis,

D106 is the center X address, D108 is the center Y address.

Y0 and Y1 send pulses to the X-axis and Y-axis respectively.

10 Explanation of MODBUS Communication Function

10.1 Overview of MODBUS Communication Functionality

The RX series PLC controller body is equipped with two RS485 interfaces. Each RS485 interface can be independently configured as a MODBUS RTU master or MODBUS RTU slave for operation. One MODBUS master can control up to 32 slave stations. The maximum transmission speed corresponds to 115.2 kbps.

10.2 List of Related Soft Components

10.2.1 Special Data Registers

As shown on the following page：

The special data registers used in MODBUS communication are shown in the following table.

Special Data Registers		Name	Effective station	Content	R/W
Channel 1	Channel 2				
D8400	D8420	Communi-cation format setting	Master station/ Slave station	Set the communication format. Note: For detailed information on the communication format, please refer to Section 10.2.2.	R、W

<table>
<tr>
<td>D8401</td>
<td>D8421</td>
<td>Protocols</td>
<td>Master station/ Slave station</td>
<td>Select the channel to be used and set the master station/slave station.
<table>
<tr><td rowspan="2">bit</td><td rowspan="2">name</td><td colspan="2">contents</td></tr>
<tr><td>0（bit＝OFF）</td><td>1 (bit＝ON)</td></tr>
<tr><td>b0</td><td>Select the agreement</td><td>Other communication protocols</td><td>MODBUS protocols</td></tr>
<tr><td>b1-b3</td><td>unusable</td><td></td><td></td></tr>
<tr><td>b4</td><td>Master station / Slave station settings</td><td>MODBUS main station</td><td>MODUS slave station</td></tr>
<tr><td>b5-b7</td><td>unusable</td><td></td><td></td></tr>
<tr><td>B8</td><td>RTU/ASCII mode setting</td><td>RTU</td><td>ASCII</td></tr>
<tr><td>b9-b15</td><td>unusable</td><td></td><td></td></tr>
</table>
Note:If the MODBUS master station is set, and both bits of D8401b0 (Channel 1) and D8421b0 (Channel 2) are ON, then Channel 1 takes priority and becomes effective, while Channel 2 will be invalid.</td>
<td>R、W</td>
</tr>
<tr>
<td>D8402</td>
<td>D8422</td>
<td>Communication error code</td>
<td>Main station/ slave station</td>
<td>The latest error code that occurs during MODBUS communication will be stored.</td>
<td>R、W</td>
</tr>
<tr>
<td>D8408</td>
<td>D8428</td>
<td>The current number of retry</td>
<td>Main station</td>
<td>When communication is retried due to a timeout in the station response, the current retry count will be stored.</td>
<td>R</td>
</tr>
</table>

D8409	D8429	Response timeout from the station	Main station	After the main station sends the request, if the slave station does not respond within the set time, the main station will resend the text again, or if the retry times (D8412, D8432) set are reached, it will be judged as a timeout error and the processing of this instruction will be ended. The setting range is: 0 - 32767 [ms]. When the value is 0, 3 seconds is considered as a timeout. Note: This value can be changed before executing each instruction.	R、W
D8412	D8432	Retry times	Main station	If the slave station fails to respond within the time set in the slave station response timeout, the master station will send a text until the set number of retries is reached. After that, the command processing will end due to a timeout error. Setting range: 0 - 20 [times] If a value above 20 is set, the retry count will be 20.	R、W
D8414	D8434	Slave Station Local Address	Slave station	Store the slave station number of this station. Setting range: 1 to 247. Note: If a value outside the setting range is detected during initialization, this setting will be invalid and the slave station will not respond to any requests.	R、W

Note: R: Reading W: Writing

10.2.2 MODBUS Communication Settings

The software components used in the communication settings are as follows.

When using the communication port (channel 1), set D8400. When using the communication port (channel 2), set D8420.

1. D8400、D8420（Communication format）

Set the values in the communication format to make communication settings such as data length, parity, and baud rate.

The content of the communication format is shown in the table below.

Bit	Name	Content	
		0 (bit=OFF)	1 (bit=ON)
b0	Data Length *1	7 bits	8 bits
b1 b2	Parity	b2、b1 (0, 0) : None (0, 1) : Odd (1, 1) :Even	
b3	Stop Bits	1bits	2bits
b4 b5 b6 b7	Baud Rate (bps)	b7, b6, b5, b4 (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 (1, 0, 0, 0) :9600 b7, b6, b5, b4 (1, 0, 0, 1) :19200 (1, 0, 1, 0) :38400 (1, 0, 1, 1) :57600 (1, 1, 0, 0) : Not available (1, 1, 0, 1) :115200	
b8～b11	Not available	-	-
b12	Hardware Type	RS-232C	RS-485
b13～b15	Not available	-	-

*In the RTU mode, please set the data length to 8 bits. Setting it to 7 bits may cause data corruption.

10.2.3 Special Auxiliary Relay

The special auxiliary relays used in MODBUS communication are as shown in the following table.

Special auxiliary relay		Name	Effective station	Content	R/W
Channel 1	Channel 2				
M8411		Set the flag for Modbus communication parameters	Master station / Slave station	Used in the MODBUS communication settings.	R、W
M8029		Instruction execution completed	Master station	The ADPRW instruction is set to ON after its execution.Clearing reasons: 1) Power ON 2) STOP → RUN 3) When another instruction (including other ADPRW instructions) using M8029 is being executed	R
M8401	M8421	In MODBUS communication	Master station	In MODBUS communication, the flag is set to ON. This flag is active from the start of the instruction execution until the end of the instruction execution. The reason for clearing: 1) Power ON 2) STOP → RUN	R
M8402	M8422	MODBUS communication in error	Master station / Slave station	Set to ON when there is a MODBUS communication error. Clearing reason: 1) Power ON 2) STOP → RUN 3) When executing the next ADPRW instruction	R
M8403 M8063	M8423 M8438	MODBUS communication Error latch	Master station / Slave station	Once there is a MODBUS communication error, it will be set to ON. Clearing reason: 1) Power ON 2) STOP → RUN	R
M8408	M8428	Retry occurred	Master station	When the slave station fails to respond in time, it is set to ON during the period when the master station sends a retry. Clearing reason: 1) Power ON 2) STOP → RUN 3) When executing the next ADPRW instruction If the slave station responds to the retry sent, this flag bit will not be ON.	R

M8409	M8429	Timeout occurred	Master station	Response timeout has been set to ON. Clearing reason: 1) Power ON 2) STOP → RUN 3) When executing the next ADPRW instruction. Note: If the retry count is more than 1 time, the error flag will not be ON until the retry count reaches the set limit caused by timeout, etc.	R

Note: R: Reading W: Writing

10.3 MODBUS Master Station Function

10.3.1 List of MODBUS Master Station Functions

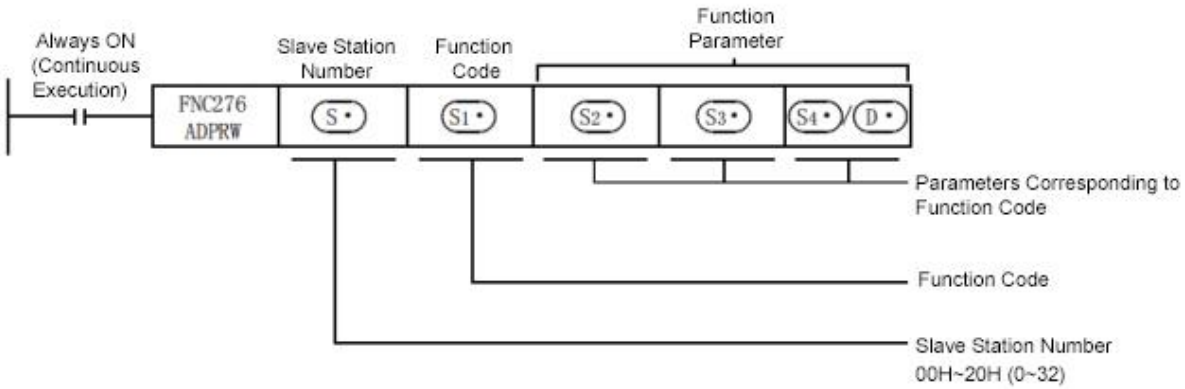
Function code	Function name	Details
0x01	Coil read	Coil read (Multi points supported)
0x02	Discrete input read	input read (Multi points supported)
0x03	Holding register read	Holding register read (Multi points supported)
0x04	Input register read	Input register read(Multi points supported)
0x05	Single coil write	Single coil write(Single point only)
0x06	Single holding register write	holding register write(Single point only)
0x0F	Multiple coil write	Multi-point coil write
0x10	Multiple holding register write	Multi-point holding register write

10.3.2 ADPRW/MODBUS Read/Write Instructions

1. ADPRW Instruction Summary

This is the instruction used for communication (data reading/writing) with the slave station corresponding to the MODBUS master station. The function code S. operates on the slave station S. according to parameters S2., S3., S4./D.. When broadcasting, please specify 0 in the station number of the slave station.

2. Instruction Format



3. Parameters Setting

Operand Type	Content	Data Type
(S•)	Slave ID	16-bit Binary
(S1•)	Function code	16-bit Binary
(S2•)	Function parameters corresponding to the function code	16-bit Binary
(S3•)	Function parameters corresponding to the function code	16-bit Binary
(S4•) / (D•)	Function parameters corresponding to the function code	Bit/16-bit

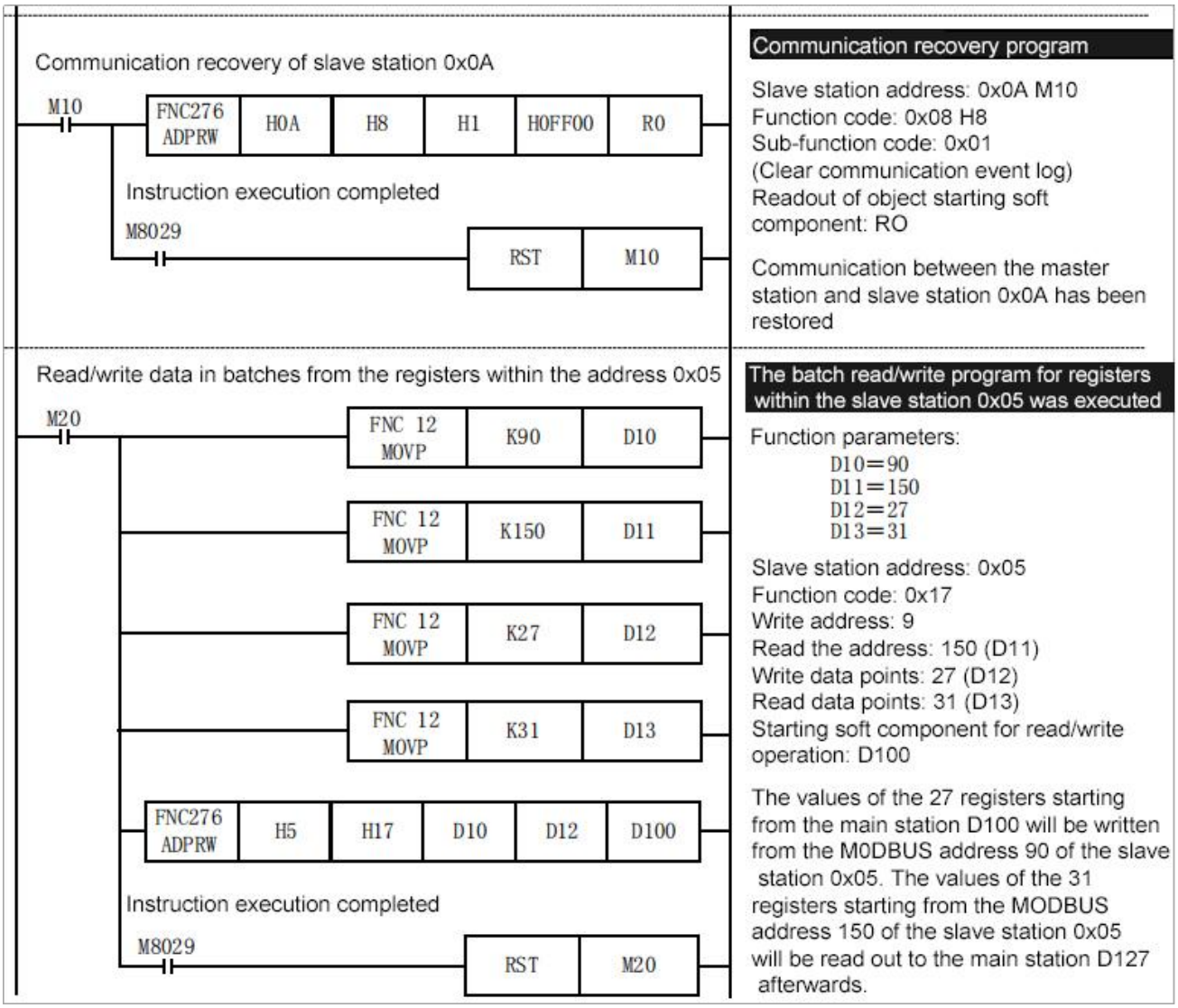
10.3.3 ADPRW Instruction function code and function parameters

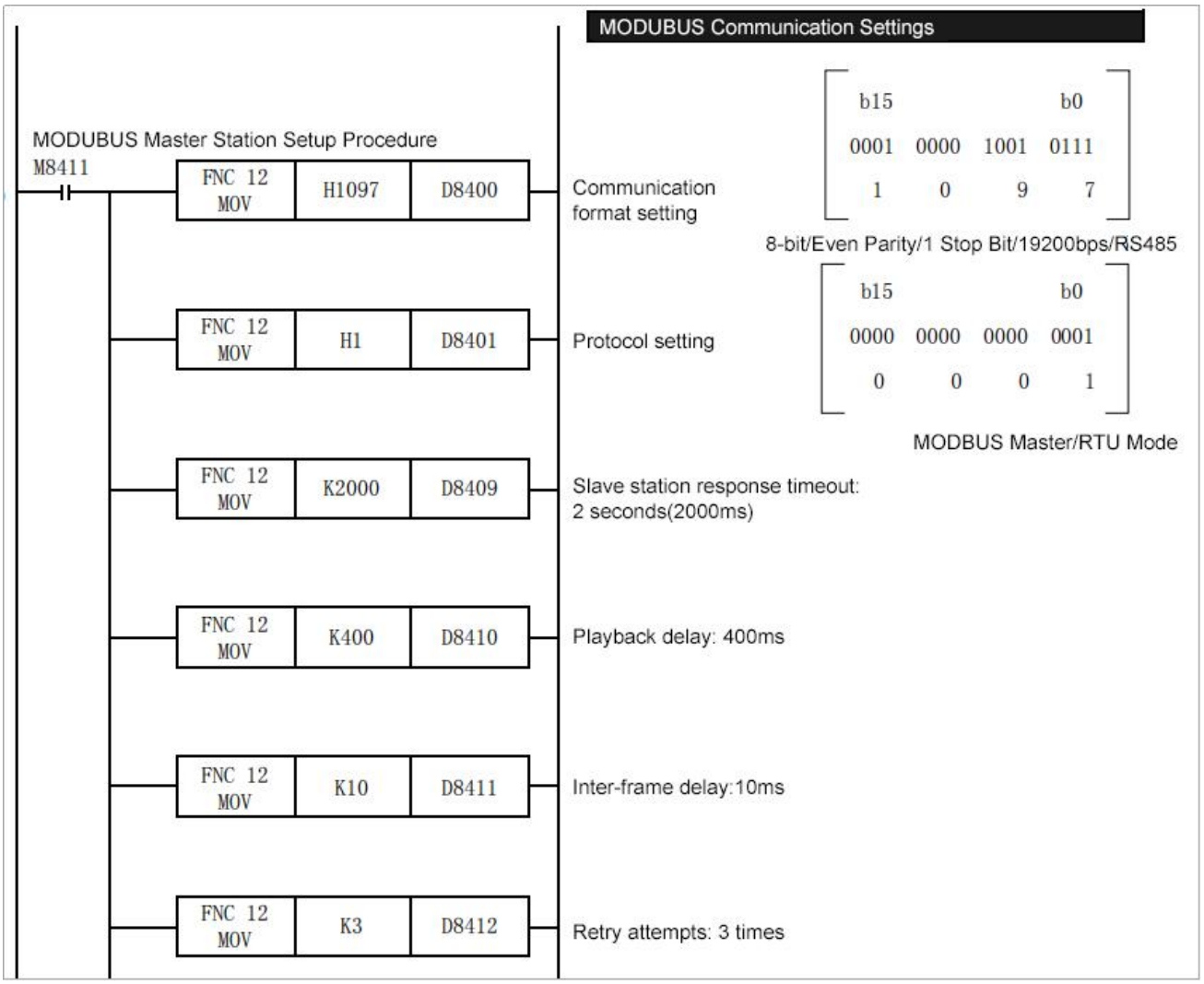
The required function parameters for each function code are shown in the table below.

(S1•)	(S2•)	(S3•)	(S4•) / (D•)
1H coil reading	MODUBUS address 0000H~FFFFH	Access point count:1~2000	Read the object's soft component (starting address) Target soft component: D • M • Y • S Occupied points: ((S3•) +15) ÷16
2H Input Readout	MODUBUS address 0000H~FFFFH	Access point count:1~2000	Read the object's soft component (starting address) Target soft component: D • M • Y • S Occupied points: ((S3•) +15) ÷16
3H Maintain register readout	MODUBUS address 0000H~FFFFH	Access point count:1~125	Read the object's soft component (starting address) Target soft component: D Occupied points: (S3•)
4H input register readout	MODUBUS address 0000H~FFFFH	Access point count:1~125	Read the object's soft component (starting address) Target soft component: D Occupied points: (S3•)
5H Coil writing	MODUBUS address 0000H~FFFFH	0 (fixed)	Write to object software component (starting address) Target soft component: D • K • H • X • Y • M • S Occupied points: 1点
6H Register write-in	MODUBUS address 0000H~FFFFH	0 (fixed)	Write to object software component (starting address) Target soft component: D • K • H Occupied points: 1点
FH Batch coil writing	MODUBUS address 0000H~FFFFH	Access point count:1~1968	Write to object software component (starting address) Target soft component: D • K • H • M • X • Y • S Occupied points: ((S3•) +15) ÷16
10H Batch Register write-in	MODUBUS address 0000H~FFFFH	Access point count:1~123	Write to object software component (starting address) Target soft component: D • K • H Occupied points: (S3•)

10.3.4 MODBUS Main Station's Procedures

The program for reading/writing soft components from the master station to the slave station is as follows.




MODUBUS Communication Settings
MODUBUS Master Station Setup Procedure
M8411
FNC 12 MOV
H1097
D8400
Communication format setting
b15 b0
0001 0000 1001 0111
1 0 9 7
8-bit/Even Parity/1 Stop Bit/19200bps/RS485
FNC 12 MOV
H1
D8401
Protocol setting
b15 b0
0000 0000 0000 0001
0 0 0 1
MODBUS Master/RTU Mode
FNC 12 MOV
K2000
D8409
Slave station response timeout:
2 seconds(2000ms)
FNC 12 MOV
K400
D8410
Playback delay: 400ms
FNC 12 MOV
K10
D8411
Inter-frame delay:10ms
FNC 12 MOV
K3
D8412
Retry attempts: 3 times

10.4 MODBUS Slave Station Function

10.4.1 List of MODBUS Slave Station Functions

Function code	Function name	Detail
0x01	Coil read	Coil read (Multi points supported)
0x02	Discrete input read	input read (Multi points supported)
0x03	Holding register read	Holding register read (Multi points supported)
0x04	Input register read	Input register read(Multi points supported)
0x05	Single coil write	Single coil write(Single point only)
0x06	Single holding register write	holding register write(Single point only)
0x0F	Multiple coil write	Multi-point coil write
0x10	Multiple holding register write	Multi-point holding register write

10.4.2 Allocation of Soft Elements for MODBUS Slave Station (Initial Values)

The initial values for the allocation of MODBUS soft components for the bit and word soft elements of the RX programmable controller are as follows.

Soft components for the bit:

MODBUS Soft Elements		RX3U Soft Elements
Input (Read-Only)	Coil (Read/Write)	
0x0000～0x1DFF	0x0000～0x1DFF	M0～M7679
0x1E00～0x1FFF	0x1E00～0x1FFF	M8000～M8511
0x2000～0x2FFF	0x2000～0x2FFF	S0～S4095
0x3000～0x31FF	0x3000～0x31FF	TS0～TS511
0x3200～0x32FF	0x3200～0x32FF	CS0～CS255
0x3300～0x33FF	0x3300～0x33FF	Y0～Y377
0x3400～0x34FF	–	X0～X377

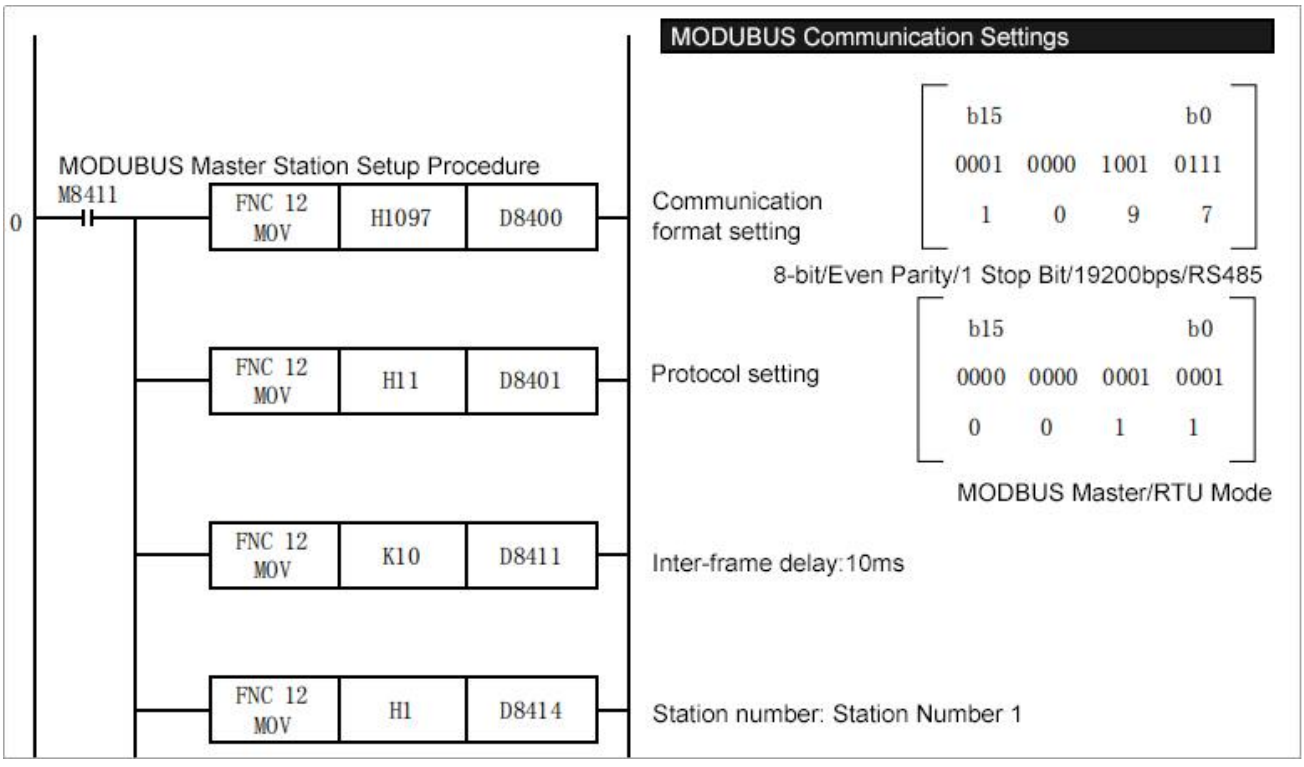
Soft components for the word:

MODBUS Soft Elements		RX3U Soft Elements
Input (Read-Only)	Coil (Read/Write)	
0x0000～0x1F3F	0x0000～0x1F3F	D0～D7999
0x1F40～0x213F	0x1F40～0x213F	D8000～D8511
0x2140～0xA13F	0x2140～0xA13F	R0～R32767
0xA140～0xA33F	0xA140～0xA33F	TN0～TN511
0xA340～0xA407	0xA340～0xA407	CN0～CN199
0xA408～0xA477	0xA408～0xA477	CN200～CN255*1
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

*1. CN200~CN255 is 32-bit Counters.

The routine of the MODBUS slave station

The program for setting parameters of the slave station is as follows.

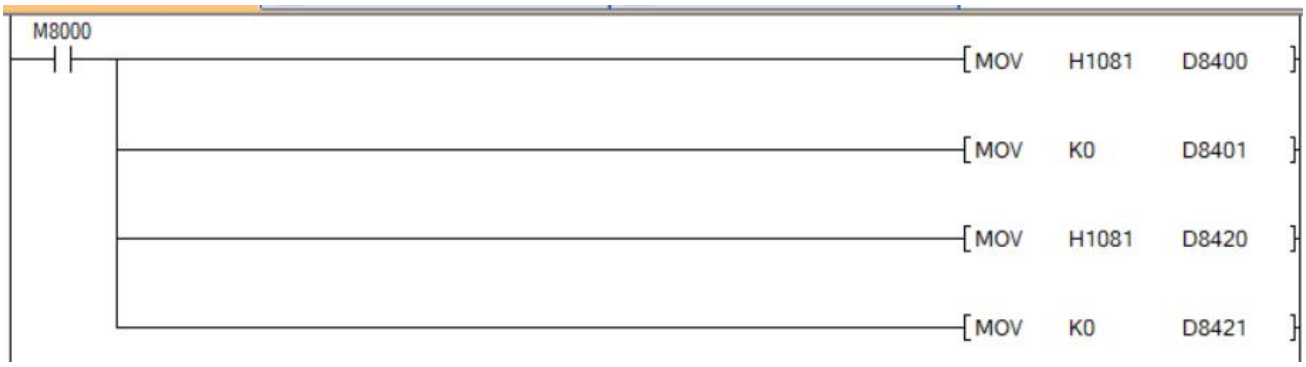


10.5 Programming Interface Protocol Communication

The two RS485 channels of the RX series PLC controller both support Mitsubishi programming port protocol communication. When using the programming port protocol communication, it is necessary to set D8401 (Channel 1) or D8421 (Channel 2) to 0. The communication format setting is the same as MODBUS, and set D8400 (Channel 1) or D8420 (Channel 2).

It is worth noting that if the special register for the communication format setting is 0, then the default is a communication format of 9600 baud rate, 1 stop bit, 8 data bits, and no parity check.

Programming port protocol communication routine



11 Function Instructions for CAN Communication

11.1 Overview of CAN Communication Function

The RX series PLC controller body is equipped with a CAN interface (CAH/CAL), which can send data frames using the RS2 command. The sent data frames are all standard frames (11-bit ID) and support sending SDO of CANopen. It can also be configured with a CANopen driver.

11.2 List of Relevant Software Components

Function description	CAN(H/L)	Remark
CAN function enabled	M8500=1	
RS2 transmission flag	M8502=1	Enable transmission
RS2 transmission completion flag	M8503	Manual reset required
RS2 reception end flag	M8504	Manual reset required
RS2 reception process flag	M8505	Data is being received
RS2 instruction sending CANoepn command	M8501=1	Send a 2-byte driver enable command or other commands to facilitate the one-time completion of driver configuration
Communication parameters	D8500	0-9 are CAN baud rates, 1K-1023K. Default 250
Master-slave station number	D8503 D8504	Local ID setting: D8503Store received data frame ID: D8504
Frame interval	D8502	Default 1ms

1. The maximum single transmission is 128 bytes.
2. Support sending the CANoepn command SDO. This can be done either by using the RS2 instruction to customize the sending process, or by directly enabling M8426 to send the SDO at once, thereby completing the driver configuration.

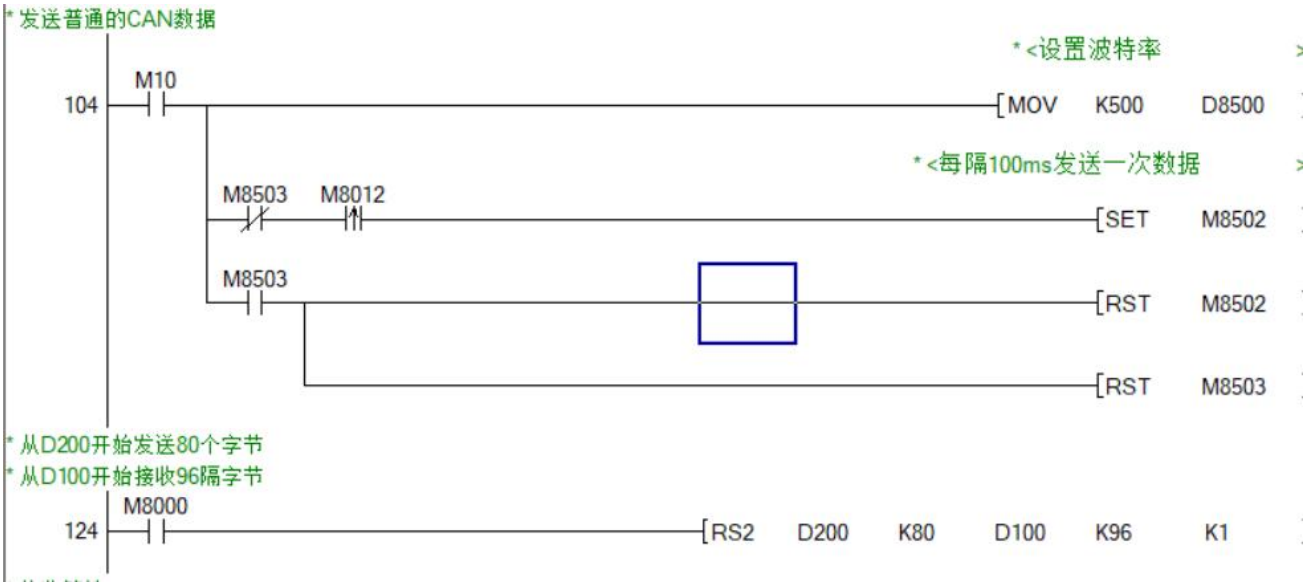
3. In the program, the baud rate can be changed via D8500 or the local ID can be modified through D8503.

11.3 Program example

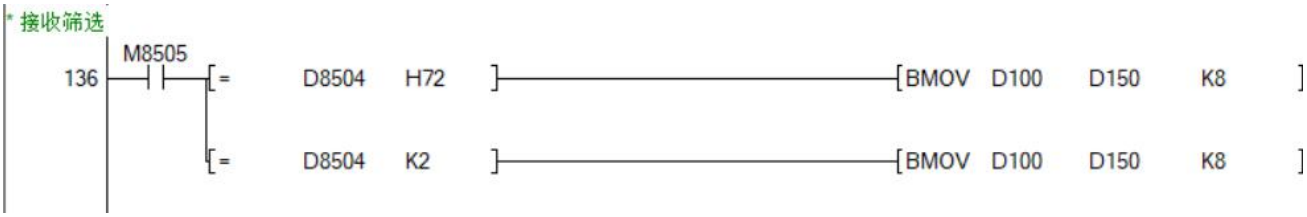
11.3.1 CAN Function

1. Initialization of the CAN function

2. Normal data frame communication of CAN



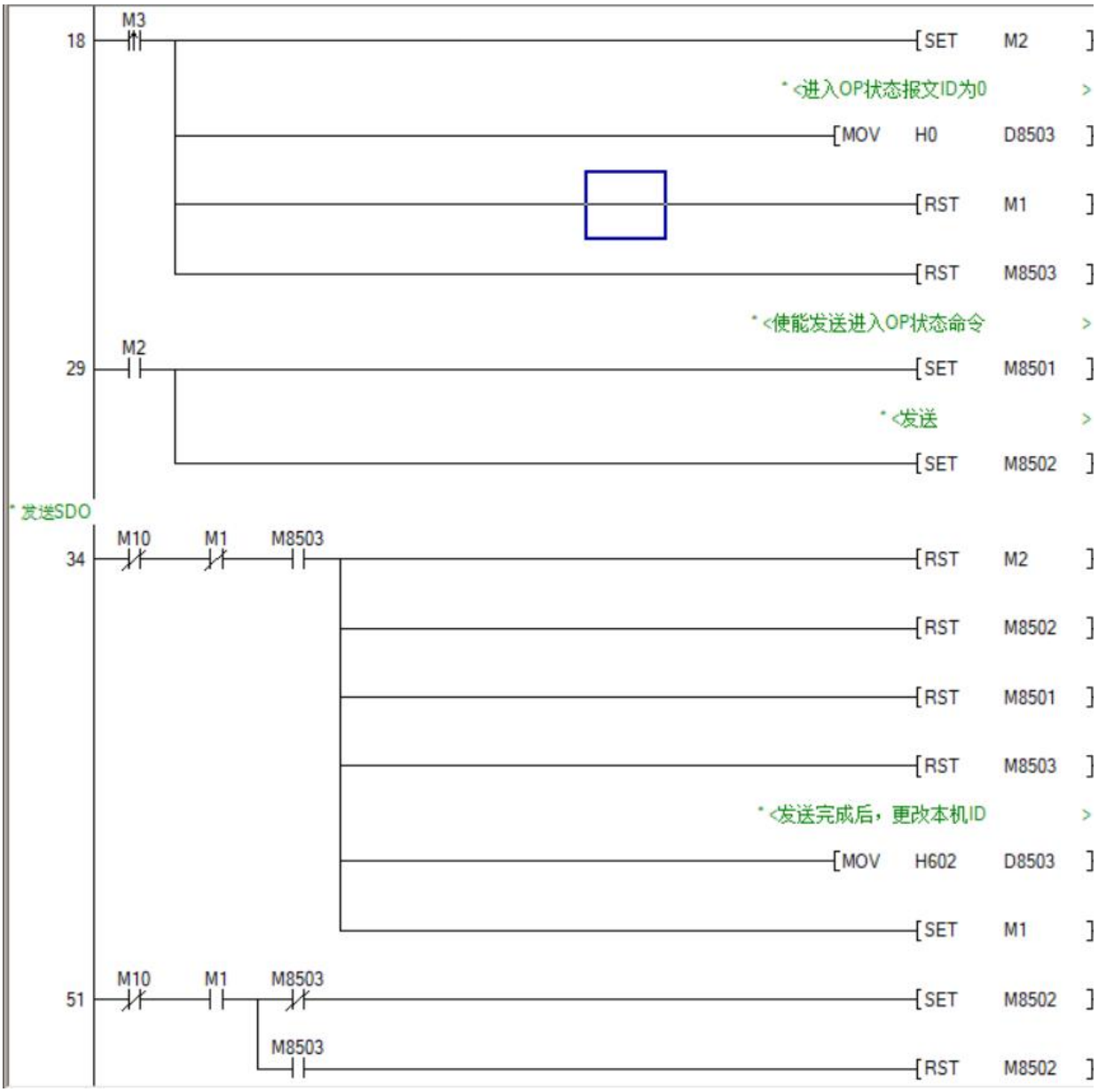
11.3.2 Identification of the CAN received data frame ID



3. Send SDO command

Change the local node ID via D8503. Perform an SDO transmission upon each rising edge of M3.In the sample program, the drive enable command is sent first, followed by configuration information.Prior to sending commands, parameters can be written to the transmission area specified in the RS2 instruction.

Data returned by the drive will be saved in the reception area specified in the RS2 instruction.


18
M3
SET M2
*<进入OP状态报文ID为0
MOV H0 D8503
RST M1
RST M8503
*<使能发送进入OP状态命令
29
M2
SET M8501
*<发送
SET M8502
*发送SDO
34
M10
M1
M8503
RST M2
RST M8502
RST M8501
RST M8503
*<发送完成后，更改本机ID
MOV H602 D8503
SET M1
51
M10
M1
M8503
SET M8502
M8503
RST M8502

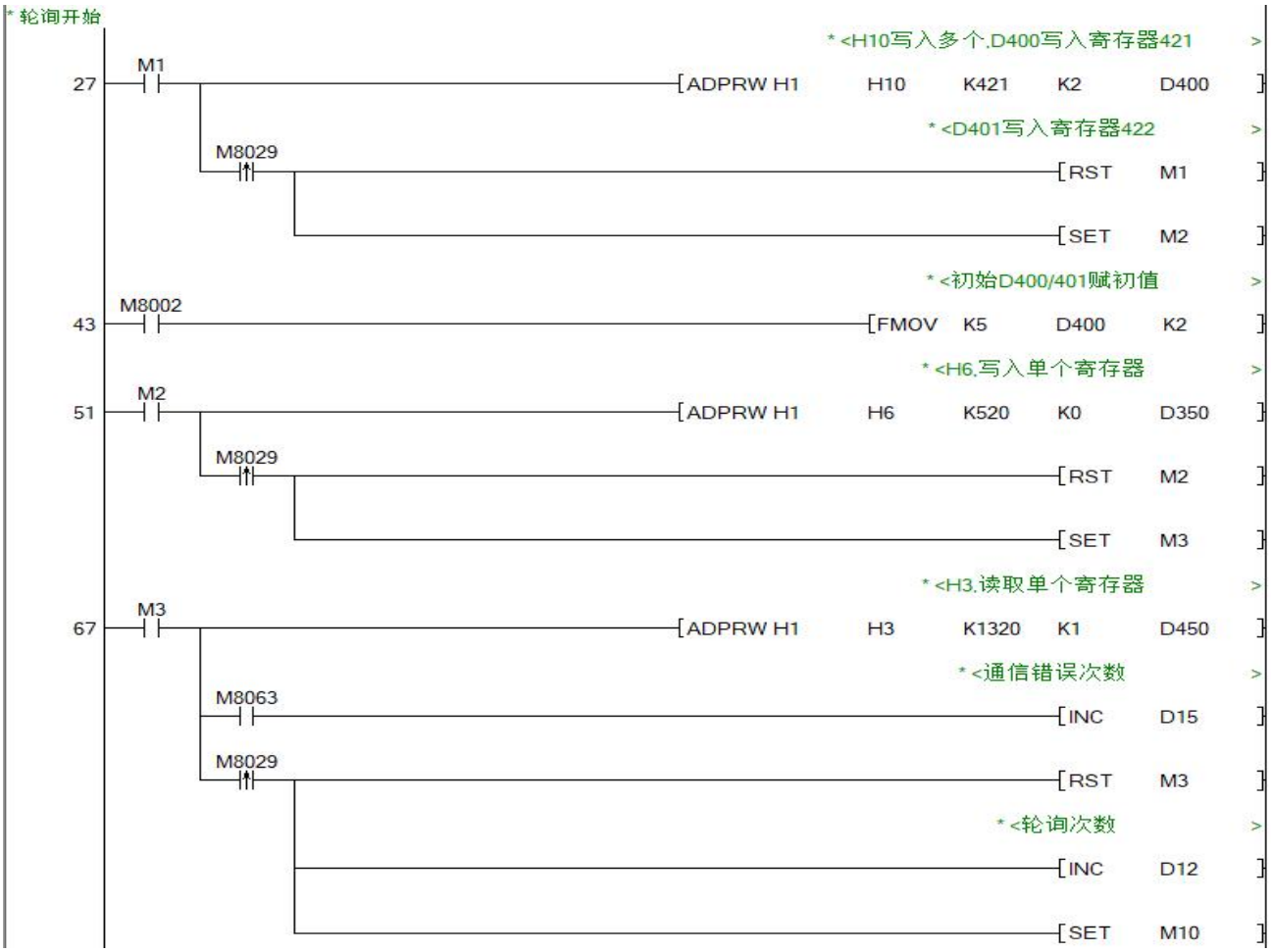
12 Application Cases

12.1 MODBUS function

The PLC has two 485 interfaces, which can function as either the master station or the slave station. The master and slave roles can be changed at will.

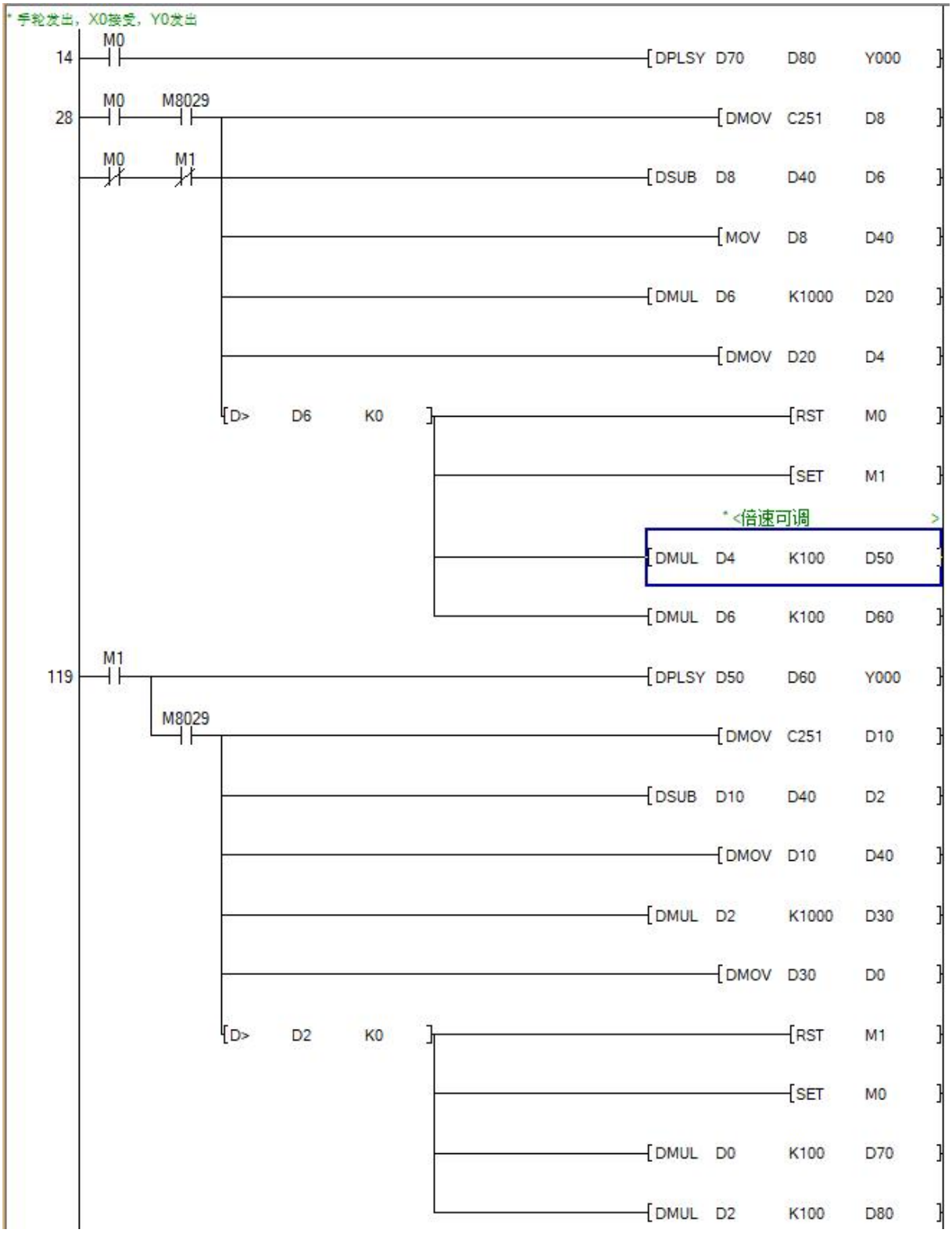
Here, A1/B1 is set as the master station, while A2/B2 is the slave station. The slave station address is 1.

The following demonstrates the use of function codes 0X10, 0X06, 0X03 to conduct communication with the slave station using ADPRW. M8029 is used to determine completion, and M8063 is used to determine read/write errors.


* 轮询开始
* <H10写入多个,D400写入寄存器421
27
M1
ADPRW H1 H10 K421 K2 D400
* <D401写入寄存器422
M8029
RST M1
SET M2
* <初始D400/401赋初值
43
M8002
FMOV K5 D400 K2
* <H6,写入单个寄存器
51
M2
ADPRW H1 H6 K520 K0 D350
M8029
RST M2
SET M3
* <H3,读取单个寄存器
67
M3
ADPRW H1 H3 K1320 K1 D450
* <通信错误次数
M8063
INC D15
M8029
RST M3
* <轮询次数
INC D12
SET M10

12.2 Handwheel function

The handwheel function is implemented programmatically, receiving pulse signals from Port X0 and outputting them through Port Y0. Flying shear synchronization can also be implemented.



12.3 PLC-PLC Communication

Slave Station Configuration：

Master Station Setup: Controls slave PLCs via RS485.

Output Control Mapping:

Energizing master Y20 energizes slave Y0

Energizing master Y37 energizes slave Y17

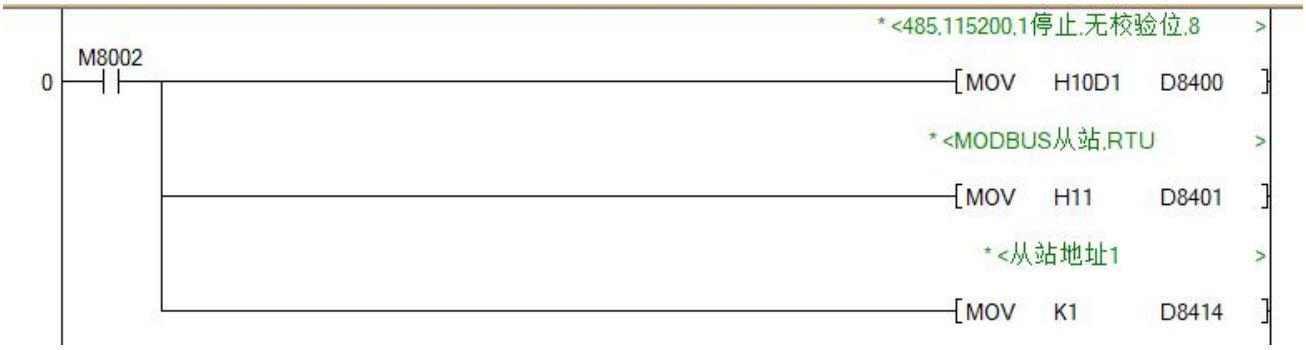
(Direct mapping: Master Y20 → Slave Y0 ... Master Y37 → Slave Y17)

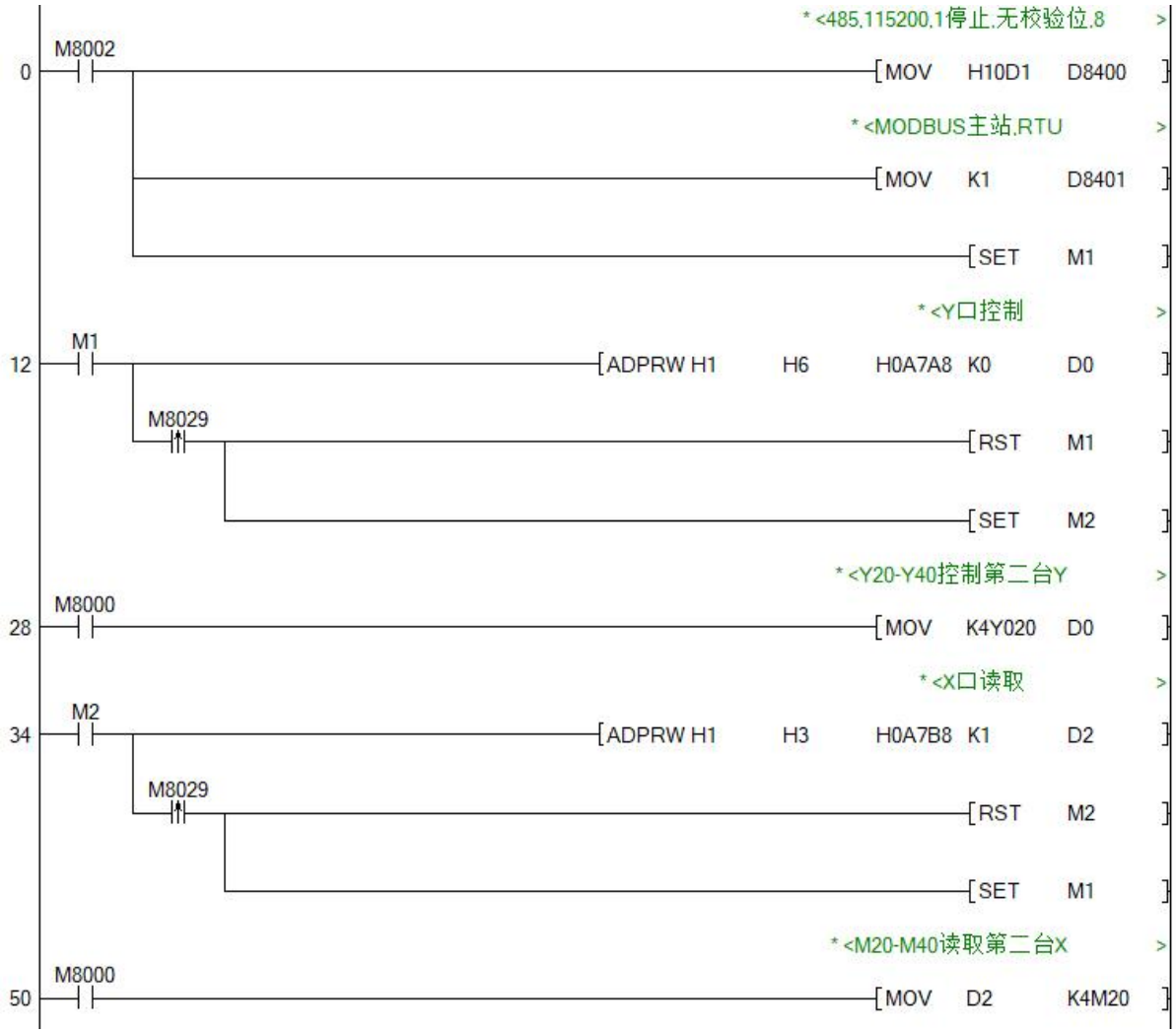
Input Signal Mapping:

Slave X0 status is read into master M20

Slave X17 status is read into master M37

(Direct mapping: Slave X0 → Master M20 ... Slave X17 → Master M37)




* <485,115200,1停止,无校验位,8 >
M8002
0
[MOV H10D1 D8400]
* <MODBUS主站,RTU >
[MOV K1 D8401]
[SET M1]
* <Y口控制 >
M1
12
[ADPRW H1 H6 H0A7A8 K0 D0]
M8029
[RST M1]
[SET M2]
* <Y20-Y40控制第二台Y >
M8000
28
[MOV K4Y020 D0]
* <X口读取 >
M2
34
[ADPRW H1 H3 H0A7B8 K1 D2]
M8029
[RST M2]
[SET M1]
* <M20-M40读取第二台X >
M8000
50
[MOV D2 K4M20]

13 Appendix

13.1 What do the three types of grounding in electricians mean?

The single point grounding methods for low-voltage electrical equipment can be divided into series single point grounding, parallel single point grounding, and multi branch single point grounding.

Series single point grounding: also known as the first grounding method. Grounding method: Connect the grounding terminals of multiple low-voltage electrical equipment to the same grounding wire near the equipment, and then connect it to the grounding device through this grounding wire. The benefits of this type of grounding are: saving manpower and material resources; The downside is that when there is an open circuit in the common grounding wire, if one device in the grounding system leaks electricity, it will cause voltage to appear on the shells of other devices, posing a threat to personnel safety.

Parallel single point grounding: also known as the second grounding method. Grounding method: Each grounding terminal of the equipment is connected to a grounding wire, and then these several wires are simultaneously connected to the grounding device. The advantage of this grounding method is that when one of the grounding devices in the grounding system experiences an open circuit, it will not cause voltage to the casing of other devices, which is beneficial for ensuring personal safety. The imperfection of this grounding method lies in the fact that if it is an electronic device or other highly sensitive electrical device to high-frequency interference, high-frequency interference from other devices (such as frequency converters, intermediate frequency furnaces, and other thyristor converter devices) will be connected from a common point, causing the equipment to work improperly.

Multi branch single point grounding: this is the third grounding method. Grounding method: Connect the grounding terminal of each device separately to the grounding device. The difference between the grounding method and the second grounding method is that the equipment has a separate grounding body (or alternatively, it is directly connected to the grounding device (or grounding source) closest to the grounding body, and the distance between each equipment on the electrical grounding circuit is relatively long (such as over 50 meters), which effectively avoids mutual electromagnetic interference between equipment. But this method is time-consuming, labor-intensive, and it may not be easy to obtain a separate grounding source.

In normal construction, if conditions permit, it is recommended to use the third grounding method. However, in fact, the second grounding method is commonly used for PLC grounding. As for electromagnetic interference, if there are multiple high-power frequency converters in the cabinet, a single-phase power filter can be installed at the front end of the PLC power supply.