FINGER CNC

Open Design Infinite Possibilities

PLC_A Designer

User Manual

Version No: F202507PA-EN

Guangzhou Finger Technology Co., Ltd

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1. Introduction

1.1. Revision History

Modification Date	Note
20250702	Initial Draft

1.2. About FINGER CNC

Guangzhou Finger Technology Co., Ltd. aims to develop high-performance open CNC systems that simplify automation development and make machine tool automation easily accessible. As one of China's high-performance controller manufacturers, Finger Technology focuses on customer needs, continuously pushing the boundaries of technological R&D to gradually form a comprehensive ecosystem of key automation technologies, providing customers with complete solutions and convenient services. We have established complete, professional, and efficient sales and service channels across various regions in China.

Finger Technology is dedicated to the R&D and production of CNC systems, motion controllers, edge computing controllers, Open CNC development platforms, CAD/CAM technologies, machine vision technologies, robotic control technologies, and industrial IoT technologies. Our industry-leading Open CNC development platform simplifies the customization of machinery and creates unique product value for our customers. Finger Technology proposes the integration of six core embedded technologies (motion control, HMI, PLC, machine vision, CAD/CAM, IoT) as part of our integrated product solutions,

providing customers with optimal automation solutions. We have accumulated extensive product experience and customer base in industries such as turning and milling centers, grinding machines, spring machines, tool machines, woodworking machinery, winding machines, spinning machines, pipe bending machines, and 3C electronics, continuously striving for excellence.

In the field of high-speed and high-precision, Finger Technology conducts in-depth research on various high-performance motion control algorithms, widely applicable to different industry needs. Especially in multi-axis linkage interpolation, RTCP five-axis linkage control, multi-axis multi-channel control, electronic cam, winding, and tension control technologies, we provide customers with a wider range of solutions.

Focusing on customer needs, emphasizing results, pursuing excellence in innovation, and respecting talent have been the core principles and values of Finger Technology since its inception. We remain dedicated to these principles, diligently advancing and consistently developing reliable, user-friendly automation products. By extending the Open CNC concept to customer endpoints, we create exclusive value for our clients.

2.FINGER A Series PLC Designer Introduction

2.1 FINGER A Series PLC Designer Introduction

The Programmable Logic Controller System, commonly known as PLC (Programmable Logic Controller), is also referred to as MLC (Machine Logic Controller). Its role is to control the logic program for mechanical interfaces and COUNTC interface signals, essentially managing the flow sequence of input/output signals (I/O Signals) to control machine operations.

The PLC system replaces hardware wiring with software, providing several advantages, including simplified hardware logic circuits and configurable signal addresses. Depending

on different logic circuit requirements, the software allows for the creation of various ladder diagram circuits, enabling users to control COUNTC and mechanical interface signals.

PLC is part of the FINGER CNC system program. Although FINGER provides standard ladder diagrams, the operations of different machines can vary significantly, meaning these ladder diagrams often need to be modified or new ones created to meet the specific needs of each machine. FINGER CNC provides a ladder diagram editing software (PLC Editor) to modify or create ladder diagrams.

This software allows for graphical input to build ladder diagram programs, eliminating the need for users to learn and memorize ladder diagram instructions. Under this PLC system, not only can I/O signal logic control such as AND and OR operations be performed, but also timer, counter, logic, arithmetic, and comparison functions, which can be used for designing and controlling mechanisms such as tool changing on a lathe.

This manual provides instructions on how to use the FINGER A Series PLC Designer (Windows version).

The FINGER A Series PLC Designer provides the following 5 functions:

1. Edit (EDIT) Function – Used to edit the ladder diagram.
2. Compile (COMPILE) Function – Compiles the ladder diagram into a PLC program.
3. Print (PRINT) Function – Prints the ladder diagram for inspection.
4. Download (DOWNLOAD) Function – Downloads the compiled PLC file to the COUNTC system.
5. Online Monitor Function – Connects to the PLC and allows real-time monitoring of the operating status.。

2.2 Configuration Requirements

The minimum system requirements for this software are:

- CPU: P4 (1.4G)
- RAM: 256MB
- At least 10MB of hard disk space (C: drive)
- Operating System: Windows XP / VISTA / 7 / 10

The recommended system configuration is:

- CPU: P4 (1.7G)
- RAM: 512MB
- At least 40MB of hard disk space (C: drive)
- Operating System: Windows XP / VISTA / 7 / 10

2.3 Installing FINGER A Series PLC Designer

Follow the steps below to install FINGER A Series PLC Designer:

1. Open the FINGER A Series PLC Designer.exe installation package.
2. Install the software to the specified path.

2.4 Uninstalling FINGER A Series PLC Designer

- In the Windows "Control Panel", run "Add or Remove Programs".
- Find **FINGER A Series PLC Designer** and click **OK** to uninstall.

2.5 Resources of FINGER A Series PLC Designer

The signals (Bits) used between the FINGER CNC, PLC, and machine tools are introduced as follows:

I/O Signals	Address Range	Meaning
I	0 ~ 1024	Input signals transmitted to the PLC from the machine tool or external equipment.
O	0 ~ 1024	Output signals sent from the PLC to the machine tool or external equipment.
C	0 ~ 1024	Command signals sent from the PLC to the CNC controller.
S	0 ~ 1024	Status signals sent from the CNC controller to the PLC.
A	0 ~ 8091	Auxiliary signals used internally within the PLC.
Timer	0 ~ 1024	Timers: units of 0.05 seconds, 0.1 seconds, and 1 second.
Counter	0 ~ 1024	Counters: Up (counting upwards) and Down (counting down), setting, Ring-up (upward cyclic counting), Ring-Down (downward cyclic counting).
Register	0 ~ 9999	Buffers defined by the user.
User	0 ~ 9999	Variables defined by the user.
Sys	0~29999	System Planning
MCM	0~9999	System Planning
BUS	0~9999	System Planning
ComUser	0~9999	Variables defined by the user
ComSys	10000~59999	System Planning
ComReg	60000~69999	Variables defined by the user
ComMCM	70000~79999	System Planning

3.FINGER A Series PLC Designer Operation

3.1 Starting and Exiting

After installing FINGER A Series PLC Designer, you need to start the program before using the functions it provides. After finishing your work, exit the program promptly to release the system resources it occupies.

3.1.1 Starting FINGER A Series PLC Designer

You can start FINGER A Series PLC Designer using one of the following methods:

- Click the "Start" button in the lower-left corner of the Windows interface, then choose the "Programs" command from the pop-up menu, and select the "FINGER A Series PLC Designer" command from the submenu.
- Double-click the FINGER A Series PLC Designer icon on the desktop.
- Directly double-click the HLD ladder diagram file.

3.1.2 Exiting FINGER A Series PLC Designer

Once you're sure you no longer need to use FINGER A Series PLC Designer, click the "Close" button on the right side of the title bar or select "Exit" from the software's "File" menu to exit FINGER A Series PLC Designer.

3.2 FINGER A Series PLC Designer Work Environment

The user interface of FINGER A Series PLC Designer is composed of several sections, as shown in Figure 2-1. These include the title bar, menu bar, standard toolbar, drawing toolbar, and drawing area.

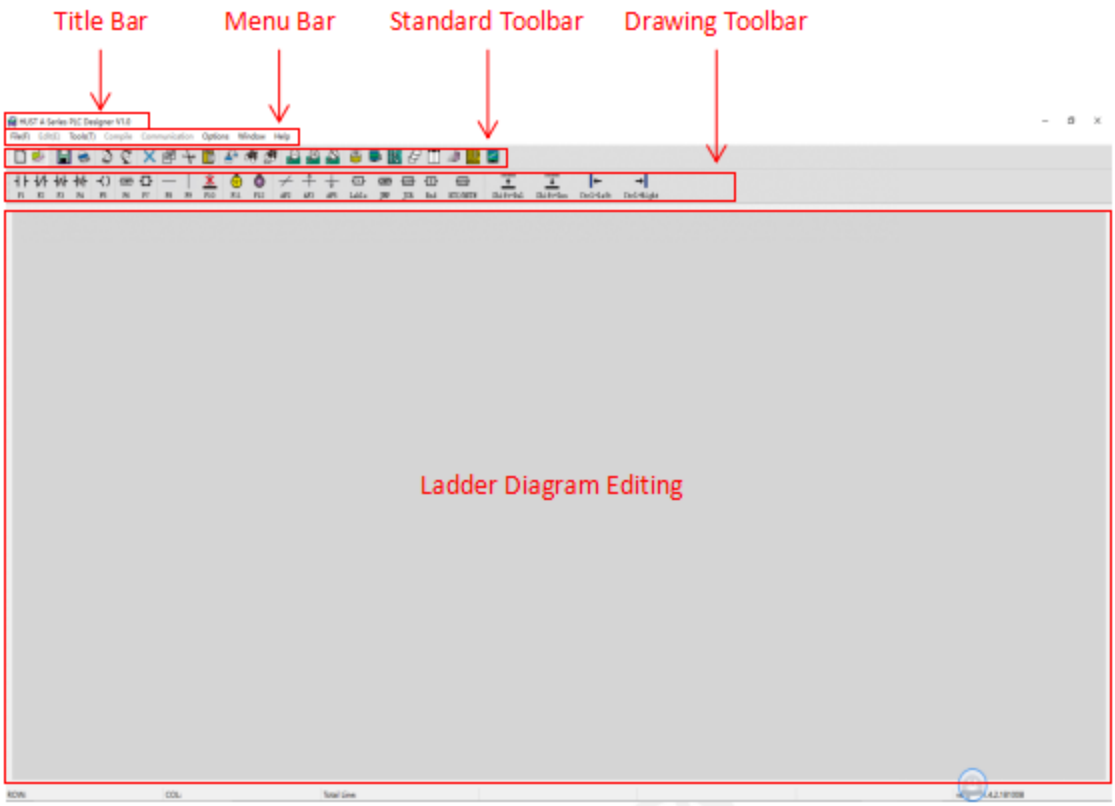


Figure: User Interface

3.2.1 Title Bar

The title bar of FINGER A Series PLC Designer is located at the top of the workspace. It displays the program control icons and the name of the currently edited graphic file.

3.2.2 Menu Bar

The menu bar is located just below the title bar and contains the main commands of the software. FINGER A Series PLC Designer has 7 main menu items, as shown in Figure 2-2.

Figure: Menu Bar

Clicking on any menu will display the corresponding dropdown menu. Simply clicking on an option will execute the corresponding command.

- File -- File Menu

Allows you to create a new LAD file, open an existing LAD file, save the LAD file, close the document, print the ladder diagram, and adjust print settings, etc.

- Edit -- Edit Menu

Allows you to redo, undo the previous action, select an entire row, undo the row selection, delete, copy, cut, paste, search, insert a blank line, delete a line, etc.

- Tools -- Tools Menu

Provides drawing tools for operations in the drawing area. Specific functions can be found in the drawing toolbar.

- Compile -- Compile Menu

Compiles and generates the .PLC file to be imported into COUNTC. The CRF file is a parts list for the ladder diagram, showing the I/O/C/S/A/Timer/Counter points used in each line and their components.

- Communication -- Transfer Menu

Includes PLC file download and online monitoring functions.

- Options -- Options Menu

Configures RS232 communication parameters or network communication parameters.

- Window --- Window Menu

When multiple documents are opened, this allows you to cascade, tile horizontally, or tile vertically.

- Help --- Help Menu

Provides help features and version information for the system.

3.2.3 Standard Toolbar

The standard toolbar is located below the menu bar and displays some commonly used

commands of FINGER A Series PLC Designer in the form of icon buttons, as shown in Figure 2-3. The names and functions of the standard toolbar icons are listed in Table 2-1.

Figure 2-3 Standard Toolbar

Table 2-1 Standard Toolbar Icons and Functions

Icon	Name	Shortcut Key	Main Function
	New	CTRL+N	Create a new graphic file
	Open	CTRL+O	Open an existing graphic file
	Save	CTRL+S	Save the graphic file to disk
	Print	CTRL+P	Configure device and media settings, then print the graphic
	Undo	CTRL+Z	Undo the last drawing operation
	Redo	CTRL+ALT+Z	Redo the last undone drawing operation
	Delete	DEL	Delete the selected graphic
	Copy	CTRL+C	Copy the graphic file to clipboard
	Cut	CTRL+X	Cut the graphic file to clipboard
	Paste	CTRL+V	Paste clipboard content to the current cursor position
	Jump	NULL	Navigate to a specified line
	Search	CTRL+F	Find specified components, variables, labels, etc.
	Replace		Replace found components

	Zoom Out		Dynamically zoom out the window
	Zoom In		Dynamically zoom in the window
	Restore		Restore the window to its initial size
	Compile		Compile and generate PLC file
	Download		Download PLC file to COUNTC
	Online Monitor		Monitor the ladder diagram's runtime status online
	Tile Windows Horizontally		Tile editing windows horizontally
	Tile Windows Vertically		Tile editing windows vertically
	Help		Display help documentation
	Show Comments		Show/hide component comments
	Device Table		View I/O/C/S/A/Timer/Counter/Var./Reg. information

3.2.4 Drawing Toolbar

By default, the drawing toolbar is located below the standard toolbar and displays drawing commands in the form of icon buttons, as shown in Figure 2-4.

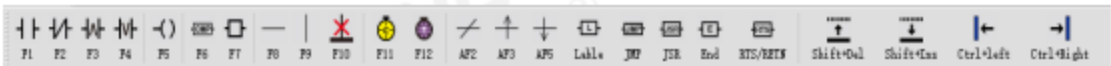


Figure: Drawing Toolbar

Table 2-2 Drawing Toolbar Icons and Functions

Icon	Shortcut Key	Shortcut Key

	F1	Normally Open Contact drawing tool
	F2	Normally Closed Contact drawing tool
	F3	Falling Edge Trigger
	F4	Rising Edge Trigger
	F5	Output Coil
	F6	Comparison Function
	F7	Function Block
	F8	Draw Horizontal Connection Line
	F9	Draw Vertical Connection Line
	F10	Delete Vertical Connection Line
	F11	Create New Counter
	F12	Create New Timer
	ALT+F2	Condition Inversion
	ALT+F3	Condition Rising Edge
	ALT+F5	Condition Falling Edge
		Subroutine Label
		Jump to Subroutine Label
		Jump to Subroutine Label
		End Label
		End Label
	Shift+del	Delete Current Editing Line

	Shift+ins	Insert Blank Line at Current Position
	Ctrl+left	Shift Left
	Ctrl+right	Shift Right

3.3 FINGER A Series PLC Designer Operations

3.3.1 Create New File

FINGER A Series PLC Designer creates new files using a default graphic template.

Select 【File】→【New】 or click the standard toolbar icon to open the "Select Template" dialog (Figure 1-7).

Enter a "Project Name", select the FINGER PLC template, and click 【OK】 to enter the workspace.。

3.3.2 Open File

- To open a saved LAD file, select the 【File】|【OPEN】 command or click the button on the toolbar. The "Open" dialog box shown in Figure 2-7 will appear. In the dialog box, first select the file type as LAD, then choose a file and click the Open button to load the specified file.
- FINGER A Series PLC Designer allows opening multiple documents simultaneously, and supports copying and pasting between documents.
- If the file type is "FINGER LAD files (*.HLD)", the opened file is a Windows version file format edited and saved by this software.
- If the file type is "FINGER LAD files (*.LAD)", the opened file is in the DOS version LAD file format.

Note: When opening a DOS-version LAD file, the system will prompt a Save As window during the save operation, requiring a new file name to be entered.

3.3.3 Save File

- While working on a file, it is recommended to frequently save your work. This helps prevent loss of diagrams and data in case of power failure or other unexpected incidents. The default file extension is .HLD.。
- To save a file: select the【File】|【Save】command or directly click the Save button on the standard toolbar. The system will save the currently edited and named diagram using the original file name to disk.
- Note: If the current file being edited is a DOS version file (with the .LAD extension), the system will prompt a Save As window during the save operation and ask you to enter a new file name. (For details, see section "2.3.4 Save As Another Name/Format").

3.3.4 Save As

- If you need to change the current file name or save format, select the 【Save As】command from the【File】menu. A dialog box will pop up. Choose the file type under "Save as type" and enter a file name to save.
- When the file type is "FINGER LAD files (*.HLD)", the file will be saved in the Windows version format.
- When the file type is "FINGER LAD files (*.LAD)", the file will be saved in the DOS version format.

3.3.5 Print

Select 【File】→【Print】 to open the print settings dialog. Configure the printer and click Print.

3.4 Ladder Diagram Editing

- The ladder diagram editing is done using the mouse. Select the component tool to edit from the toolbar, then click on an empty area (or horizontal line) in the editing area to open the parameter editing window, where you can set the properties of each component. If the clicked area already contains a component, no action will be performed.
- Double-click on a component to open the parameter editing window, where the component's parameters will be displayed. After modifying the parameters, click OK or press the Enter key to apply the changes to the component.
- Press the ESC key during the editing operation to cancel the current edit.
- In the parameter editing window, the numeric value next to the parameter input field indicates the allowed input range for that parameter. If the entered value exceeds the allowed range, it will automatically be adjusted to the maximum value. The 'Comment' field in the parameter editing window allows you to input comment information.

3.4.1 Relay Normally Open / Normally Closed Node

Select the block, then click or press F3 to open the dialog box shown in Figure 2-10 for setting the parameters of the relay normally open contact. After setting the parameters, click OK. If selected, a normally open contact will be drawn; if not, a normally closed contact will be drawn.

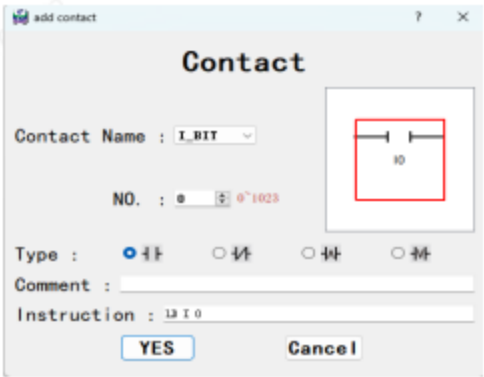
The types and ranges for the normally open / normally closed nodes are as follows:

I_BIT Normally Open/Closed Node: Range 0~1023

O_BIT Normally Open/Closed Node: Range 0~1023

C_BIT Normally Open/Closed Node: Range 0~1023

S_BIT Normally Open/Closed Node: Range 0~1023



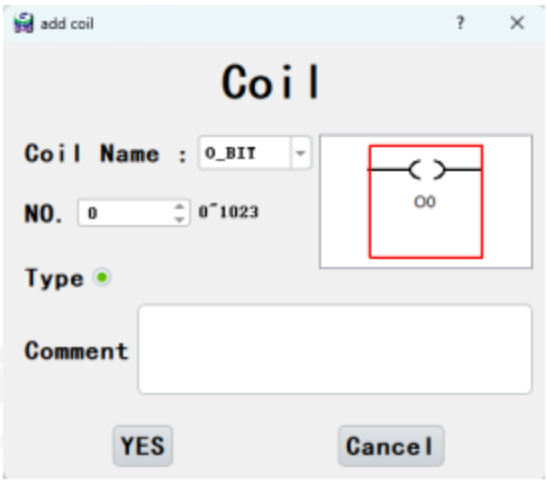
A_BIT Normally Open/Closed Node: Range 0~8191

COUNTER Normally Open/Closed Node: Range 0~1023

TIMER Normally Open/Closed Node: Range 0~1023

3.4.2 Output Coil

After selecting the block, click -() and press F4 to open the dialog box shown in Figure 2-11 for setting the parameters of the output coil. Then click OK.



-( ): Relay Outputs Include

O_BIT Output Point

C_BIT Output Point

A_BIT Output Point

Example↓:

When the input signal I0001 is ON, the output signal O0005 is activated;

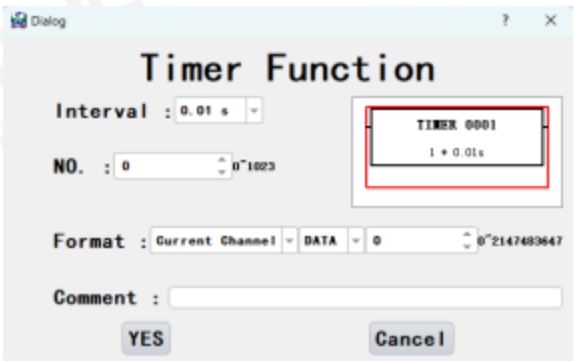
When the input signal I0001 is OFF, the output signal O0005 is deactivated.

Input Signal: I0001 

Output Signal: O0005 

3.4.3 Timer

After selecting the block  , click or press F11 to open Figure 2-12 for setting the parameters of the timer. Then click OK.



Current Channel: Refers to the channel currently used by the PLC

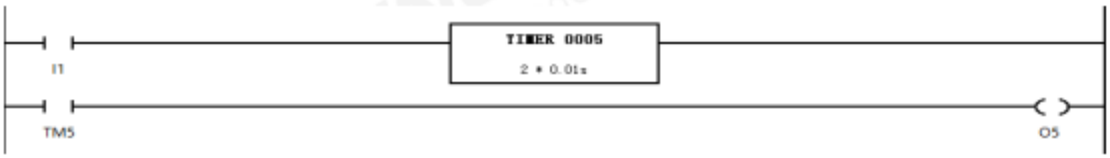
Channel 1: Channel 1 is used by the PLC

Channel 2: Channel 2 is used by the PLC

Note: The channel settings below are the same.

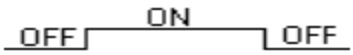
Interval: Represents the interval time with a unit of seconds (S). The following 4 options are available: 0.01S, 0.05S, 0.1S, and 1S.

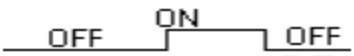
As shown in the figure↓:

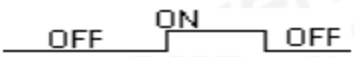


When the input signal I0001 is ON for 0.02S (0.01*2=0.02), the timer TM0005 is activated;

When the input signal I0001 is OFF, TM0005 is immediately deactivated.

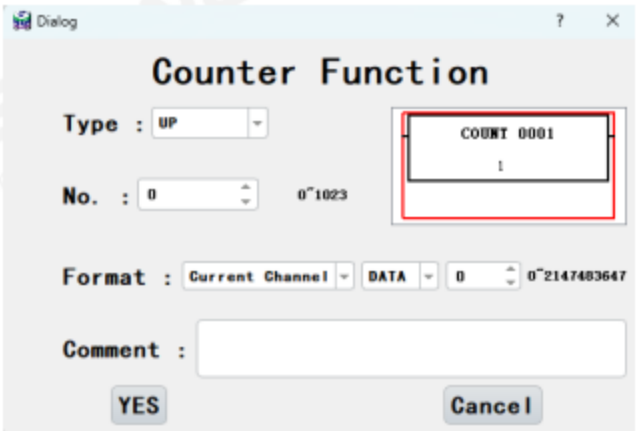
Input Signal: I1 

Output Signal: TM5 

Output Signal: O5 

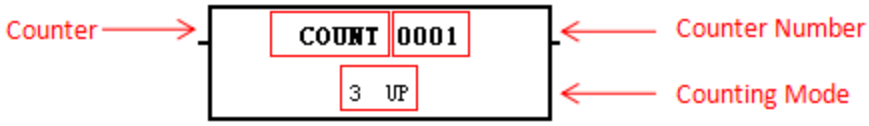
3.4.4 Counter

After selecting the block, click  or press F12 to open the dialog box shown in Figure 2-13 for setting the parameters of the counter. Then click OK.



- **Up — Up Counter**

Counts upward, and when the counter value reaches the set value, the output becomes ON, and the counter retains this value.



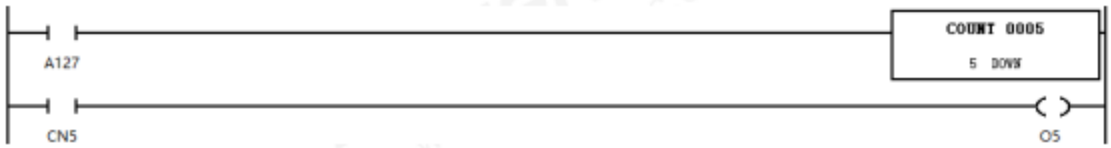
Example:

The counter COUNT5 counts the number of times A0127 is ON. After A0127 is ON 6 times, the value of COUNT5 reaches 6, and COUNT5 output becomes ON, corresponding to the node COUNT5 ON, so O5 becomes ON.

- **Down — Down Counter**

Counts downward, and when the counter value reaches 0 from the set value, the output becomes ON, and the counter retains this value.

Example:

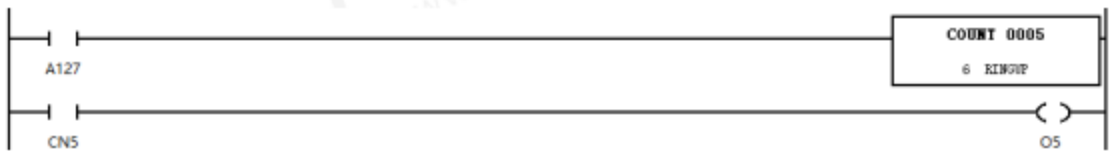


The counter COUNT5 starts counting downward from 5. When COUNT5 reaches 0, i.e., after A127 is ON 5 times, COUNT5 outputs ON, so O5 becomes ON.

- **Ringup — Up Ring Counter**

Counts upward, and when the counter value reaches the set value, the output becomes ON. The counter then automatically resets to 0 and begins counting upward again, while the output signal turns OFF.

Example:



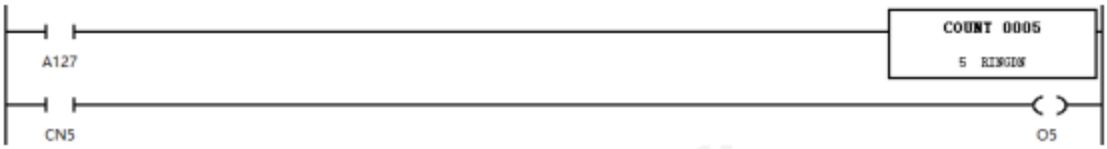
The counter COUNT5 counts the number of times A0127 is ON. When A0127 is ON 6

times, the value of COUNT5 reaches 6, COUNT5 outputs ON, and O5 becomes ON. The counter then resets to 0 and starts counting upward again, COUNT5 turns OFF, and O5 becomes OFF. When A0127 is ON 6 more times and COUNT5 again reaches 6, COUNT5 outputs ON, and O5 becomes ON.

- **Ringdown — Down Ring Counter**

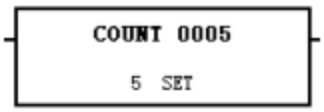
Counts downward, and when the counter value reaches 0 from the set value, the output becomes ON. The counter then automatically resets to the set value and begins counting downward again, while the output signal turns OFF.

Example:



The counter COUNT0005 counts the number of times A0127 is ON. When A0127 is ON 5 times, the value of COUNT5 reaches 0, COUNT5 outputs ON, and O5 becomes ON. The counter then resets to 5 and starts counting downward again, COUNT5 turns OFF, and O5 becomes OFF. When A0127 is ON 5 more times and COUNT5 again reaches 0, COUNT5 outputs ON, and O5 becomes ON.

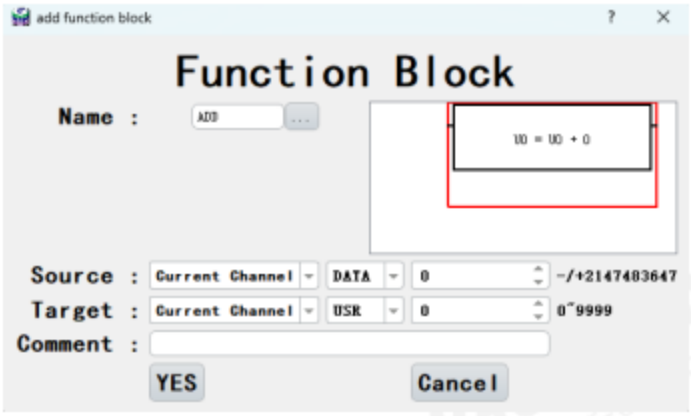
- **Set — Counter Value Setting: Sets the value of the counter.**



Meaning: Set the value of COUNT5 to 5, i.e., COUNT5 = 5.

3.4.5 Function Block

After selecting the block, click or press F7 to open the dialog box shown in the figure, where you can set the parameters for the function block.



The available function blocks are listed in the following table:

Arithmetic Operations		Trigonometric Functions		Data Transfer		Bitwise Operations	
SUB	Subtraction	TAN	Tangent	MOV	Assignment	XOR	XOR
SQR	Square Root	SIN	Sine	BLKSET	Block Setting	TST1	Bitwise AND Result is True
MUL	Multiplication	COS	Cosine	BLKMOV	Block Transfer	TST0	Bitwise AND Result is False
MOD	Modulo	ATAN	Arctangent			OR	OR
DIV	Division					NOT	NOT
ADD	Addition					BTST	Bit Test
						BSET	Bit Set
						BCLR	Bit Clear
						ASR	Arithmetic Right Shift

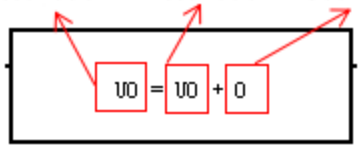
						ASL	Arithmetic Left Shift
						AND	AND

3.4.5.1 Arithmetic Operations

- **ADD (Addition)**

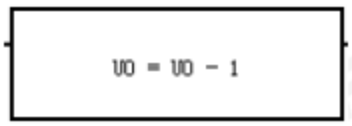
Destination = Destination + Source

Destination = Destination + Source



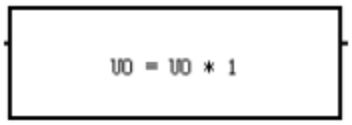
- **SUB (Subtraction)**

Destination＝Destination－Source



- **MUL (Multiplication)**

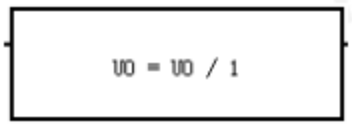
Destination＝Destination×Source



Note: For MUL operation, if the multiplication result exceeds 2^31, the result will be 0.

- **DIV (Division)**

Destination＝Destination/Source

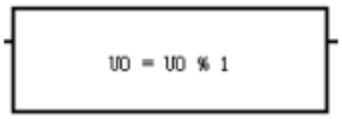


Note: In DIV division operation, when the dividend is 0, the division will not be performed, but it will not affect the function output following the node; when the dividend is very large,

the division result will be 0.

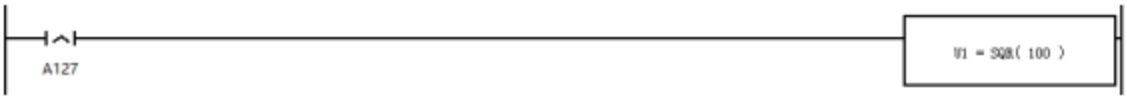
- **MOD (Modulo Operation)**

Destination = Destination % Source



- **SQR (Square Root)**

Destination=SQR(Source)



If U1 is set as SQR(100), after calculation U1 = 10.

Source: Same setting as ADD

Destination: Same setting as ADD

Note: In the SQR operation, if the radicand is a negative value, the square root operation will not be performed, but it will not affect the execution of functions following the node.

- **Trigonometric Functions**

This feature is currently under development.

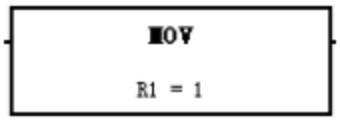
3.4.6 Data Transfer

- **MOV (Assignment)**

When the Destination is REG, Source can be REG, DATA, VAR, I_BIT, O_BIT, C_BIT, S_BIT, or A_BIT.

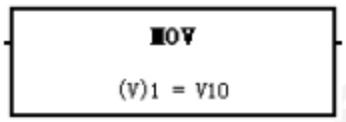
When Source is REG, DATA, or VAR, Destination = Source.

Example: Set the value of R1 to 1.

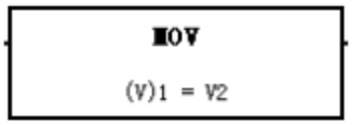


When Destination is (VAR/USR/REG...), Source can be VAR or (VAR), meaning the value of Source is placed into the address specified by VAR.

For example: Place the value in V10 into the address specified by V1. If V10 = 10, V1 = 2, and V2 = 3 before execution, after execution V2 = 10.



For example: Transfer the value from the address specified by V2 to the address specified by V1. If before execution V3 = 10, V1 = 2, and V2 = 3, after execution V2 = 10.



Note: For MOV() assigning values to addresses, and the relationship between variable types and channels, please refer to the A6 Application Manual (Section 12.1.5 Variable Indirect Addressing).

- **BLOCKMOV (Continuous Block Transfer)**

The value of Source is the starting variable for the transfer, and the value of Destination is the starting variable for placement. The number of variables to transfer is specified by Sys10122.

Source: Same settings as ADD

Destination: Same settings as ADD

Example:

Set Sys10122 = 10, V20 = 20, V10 = 100. When A127 is ON, variables #20 to #29 will be transferred to variables #100 to #109, i.e., #100 = #20, #101 = #21, #102 = #22 … #109 = #29.

Note: When the source is DATA, all corresponding destination addresses are set to the

same value specified by DATA.

For example, when using indirect addressing, the transferred variables are stored by default in #USR.

- **BLOCKSET (Continuous Block Setting)**

The value of Destination is the starting variable to be set, and Source is the value to set. The number of variables to be set is specified by Sys10122.

Source: Same setting as ADD

Destination: Same setting as ADD

Note: When using (USR), (MCM), (SYS), (REG), (BUS), (COM), or (VAR), absolute addressing is used. For example, if (REG)100=20, the indexed address is V20.

Example:

Set Sys10122 = 10, R10 = 20, R0 = 100. When A127 is ON, variables R20 to R29 will all be set to 100.

Set Sys10122 = 10, R20 = 100. When A127 is ON, variables V100 to V109 will all be set to 50.

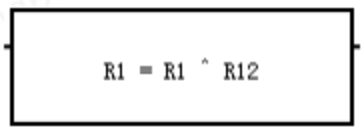
3.4.7 Bitwise Operations

- **XOR (Logical Exclusive OR Operation)**

Destination = Destination XOR Source

Source: Same settings as ADD

Destination: Same settings as ADD



Example:

Before execution:

R0001=104 → (0000 0000 0000 0000 0000 0000 0110 1000)

R0012=9 → (0000 0000 0000 0000 0000 0000 0000 1001)

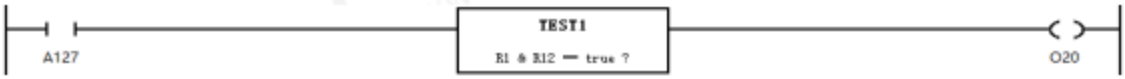
After executing XOR:

R0001=97 → (0000 0000 0000 0000 0000 0000 0110 0001)

- **TEST1 (Logical AND Result is True)**

Determines whether the result of the logical AND between Destination and Source is not equal to 0. If the result is not 0, the output is turned ON.

Example:



When A127 is ON, the logical AND operation is executed. If the result is not 0, O0005 is turned ON.

Before execution:

R0012=6 → (0000 0000 0000 0000 0000 0000 0000 0110)

R0001=20 → (0000 0000 0000 0000 0000 0000 0001 0100)

The result of the logical AND operation is 4 → (0000 0000 0000 0000 0000 0000 0000 0100)

Therefore, O20 is turned ON.

Before execution:

R0012=6 → (0000 0000 0000 0000 0000 0000 0000 0110)

R0001=16 → (0000 0000 0000 0000 0000 0000 0001 0000)

The result of the logical AND operation is 0 → (0000 0000 0000 0000 0000 0000 0000 0000)

Therefore, O20 is not turned ON.

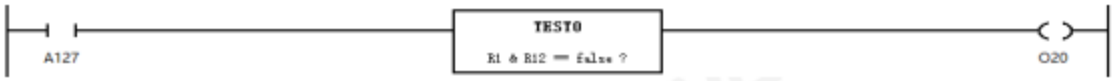
- **TEST0 (Logical AND Result is False)**

Determines whether the result of the logical AND operation between Destination and Source is equal to 0. If the result is 0, the output is turned ON.

Source: Same setting as ADD

Destination: Same setting as ADD

Example:



When A127 is ON, the logical AND operation is executed. If the result is 0, O0005 is turned ON.

Before execution:

R0012=6 → (0000 0000 0000 0000 0000 0000 0000 0110)

R0001=20 → (0000 0000 0000 0000 0000 0000 0001 0100)

The result of the logical AND operation is 4 → (0000 0000 0000 0000 0000 0000 0000 0100)

Therefore, O20 is not turned ON.

Before execution:

R12=6 → (0000 0000 0000 0000 0000 0000 0000 0110)

R1=16 → (0000 0000 0000 0000 0000 0000 0001 0000)

The result of the logical AND operation is 0 → (0000 0000 0000 0000 0000 0000 0000 0000)

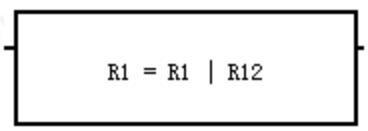
Therefore, O20 is turned ON.

- **OR (Logical OR Operation)**

Destination = Destination OR Source

Source: Same setting as ADD

Destination: Same setting as ADD



Example:

Before execution:

R1＝104 → (0000 0000 0000 0000 0000 0000 0110 1000)

R12=9 → (0000 0000 0000 0000 0000 0000 0000 1001)

After executing OR:

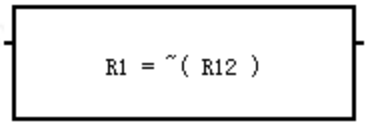
R1=105 → (0000 0000 0000 0000 0000 0000 0110 1001)

- **NOT (Logical NOT Operation)**

Destination = Destination NOT Source

Source: Same setting as ADD

Destination: Same setting as ADD



Before execution:

R0012=7 → (0000 0000 0000 0000 0000 0000 0000 0000 0000 0111)

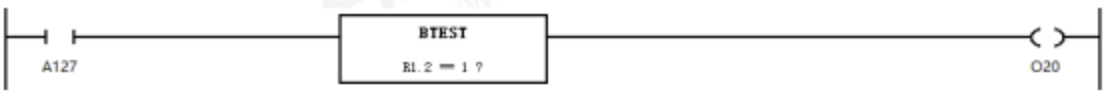
After executing NOT:

R0001=-8 → (1111 1111 1111 1111 1111 1111 1111 1111 1111 1000)

- **BTST (Bit Test: Check if Bit is 1)**

Checks whether the bit at position Source in Destination is 1. The least significant bit is bit 0.

Example:



When A127 is ON, check whether bit 2 of R0001 is 1. If it is, then O0020 is turned ON.

Before execution:

R0001=18 → (0000 0000 0000 0000 0000 0000 0001 0010)

Since bit 2 is 1, O20 is turned ON

Before execution:

R0001=1 → (0000 0000 0000 0000 0000 0000 0000 0001)

The bit at position 2 is 0, so O20 is not turned ON.

- **BTST (Bit Test: Check if Bit is 0)**

Checks whether the bit at position Source in Destination is 0. The least significant bit is bit 0.

Example:

When A127 is ON, check whether bit 2 of R0001 is 0. If it is, then O0020 is turned ON.

Before execution:

R0001=2 → (0000 0000 0000 0000 0000 0000 0000 0010)

The bit at position 2 is 1, so O20 is turned ON.

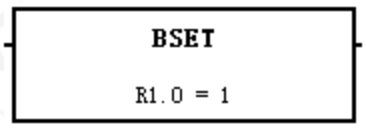
Before execution:

R0001=1 → (0000 0000 0000 0000 0000 0000 0000 0001)

The bit at position 2 is 0, so O20 is not turned ON.

- **BSET (Set Bit to 1)**

Sets the bit at position Source in Destination to 1. The least significant bit is bit 0.



Source: Same setting as ADD

Destination: Same setting as ADD

Before execution:

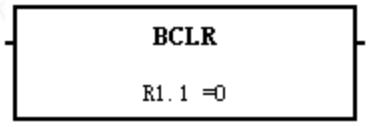
R1=2 → (0000 0000 0000 0000 0000 0000 0000 0010)

Setting bit 0 (currently 0) to 1 results in

R1's value becoming 3. → (0000 0000 0000 0000 0000 0000 0000 0011)

BCLR (Clear Bit to 0)

Sets the bit at position Source in Destination to 0. The least significant bit is bit 0.



Source: Same setting as ADD

Destination: Same setting as ADD

Before execution:

R0001=2 → (0000 0000 0000 0000 0000 0000 0000 0010)

Setting bit 1 to 0 results in

R0001's value becoming 2. → (0000 0000 0000 0000 0000 0000 0000 0010)

- **ASL (Arithmetic Shift Left)**

Destination＝Destination<<Source

Source: Same setting as ADD

Destination: Same setting as ADD

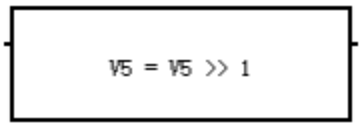
When V5＝3 → (0000 0000 0000 0000 0000 0000 0000 0011)

All values are shifted left by one bit,

Then V5＝6 → (0000 0000 0000 0000 0000 0000 0000 0110)

- ASR (Arithmetic Shift Right)

Destination＝Destination>>Source



When V5＝3 → (0000 0000 0000 0000 0000 0000 0000 0011)

All bits are shifted right by one position,

Then #5＝1 → (0000 0000 0000 0000 0000 0000 0000 0001)

Note: During the right shift, the vacant leftmost bits are filled with the original highest bit of the shifted value.

When BIT31 = 1, the newly filled bits are all 1.

When BIT31 = 0, the newly filled bits are all 0.

When V5=-1 → (1111 1111 1111 1111 1111 1111 1111 1111)

All bits are shifted right by one position (the new BIT31 is filled with the old BIT31),

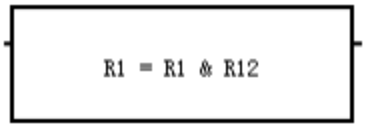
Then #5=-1 → (1111 1111 1111 1111 1111 1111 1111 1111)

- **AND (Logical AND Operation)**

Destination = Destination AND Source

Source: Same setting as ADD

Destination: Same setting as ADD



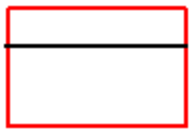
When R0001＝104 → (0000 0000 0000 0000 0000 0000 0110 1000)

When R0012=9 → (0000 0000 0000 0000 0000 0000 0000 1001)

After executing AND operation, R0001=8 → (0000 0000 0000 0000 0000 0000 0000 1000)

3.4.8 Draw Horizontal Connection Line

Select the block, then click F8 or press F8 to draw a horizontal connection line within the block, as shown in the figure.



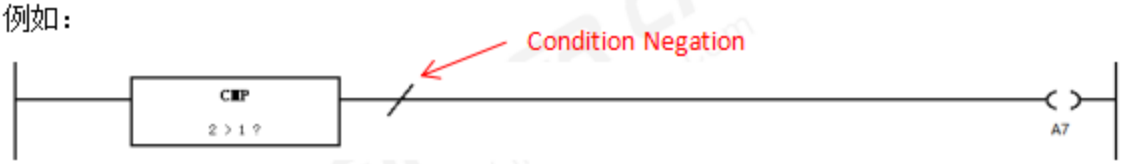
3.4.9 Draw Vertical Connection Line

Select the block, then click F9 or press F9 to draw a vertical connection line along the left edge of the block, as shown in the figure.

3.4.10 Condition Handling

Condition Negation 、Condition Rising Edge 、Condition Falling Edge

例如：



As shown in the figure above:

The CMP condition is 2 > 1. When 2 > 1 and “Condition Negation” is not applied, the circuit is connected.

When “Condition Negation” is applied, the circuit is not connected.

That is:

Condition Negation: Takes the inverse value when the condition is met.

Condition Rising Edge: Triggers a rising edge signal when the condition is met.

Condition Falling Edge: Triggers a falling edge signal when the condition is met.

The CMP condition is 2 > 1. When 2 > 1 and "Condition Negation" is not applied, the circuit is connected.

When "Condition Negation" is applied, the circuit is not connected.

That is:

Condition Negation: Takes the inverse value when the condition is met.

Condition Rising Edge: Triggers a rising edge signal when the condition is met.

Condition Falling Edge: Triggers a falling edge signal when the condition is met.

3.4.11 Label Definition

Subroutine Function Key

Label: Creates a Label subroutine.

Note: Labels cannot be created on an empty page; multiple Label subroutines cannot be added within the same program block.

JMP: Calls a Label subroutine; after execution, the program does not return to the calling point.

JSR: Calls a Label subroutine; after execution, the program returns to the calling point.

RTS/RETN: Marks the end of a Label subroutine definition.

3.4.12 END Marker (Required for Every PLC)

Select the block, then click 

on the drawing toolbar to draw the END marker on the current line, as shown in the figure.

3.4.13 Delete Vertical Connection Line

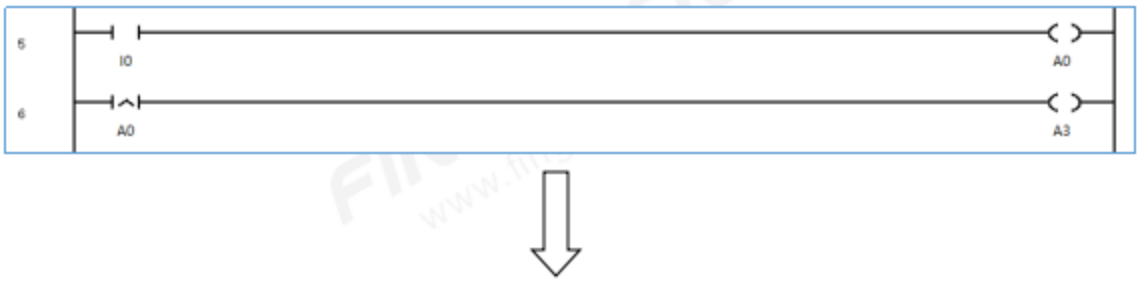
Select the block 

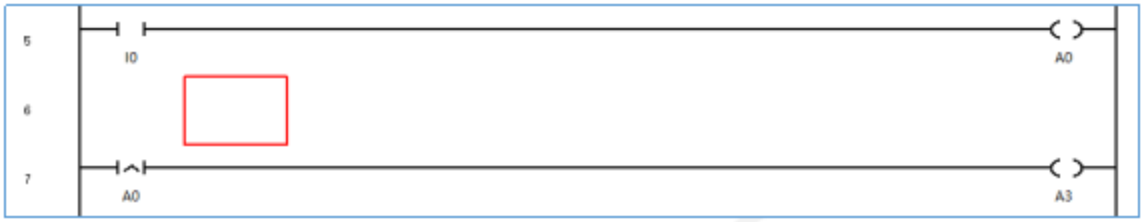
containing the vertical connection line, then click or press F10 to delete the vertical connection line, as shown in the figure.

3.4.14 Insert a Blank Line at the Current Editing Line

As shown in the figure, to insert a blank line at line 0006, select any block on that line, then click 

or press F12. Then a blank line will be inserted at line 0006.



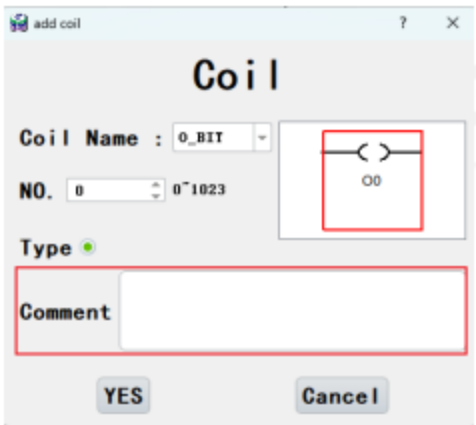


3.4.15 Delete Current Editing Line

As shown in the figure, to delete line 0004, select any block on that line, then click to delete line 0004. The figure illustrates the deletion of the current editing line.

3.4.16 Input and Modify Comment Information

Comment information can be entered in the comment section of the new component window.



You can use the  button on the standard toolbar to display comments on the working interface.

3.4.17 Copying Ladder Diagram

- **Select Multiple Components**

In the editing interface, click on a component, hold down the left mouse button, and drag the mouse (or click on one component, hold down the Shift key on the keyboard, move the mouse, and then click on another component. All components between these two will be selected).

- **Copy, Cut, Paste, and Delete**

1. After selecting a component, press the DEL key or click  to delete the selected component; press CTRL+C or click  to copy; press CTRL+X or click to cut.
2. Click on an empty area, press CTRL+V or click  , to paste the copied or cut components at the specified location. If the selected components are less than a full row, they will directly overwrite the specified position. If the selected components are a full row or multiple rows, an empty line will be automatically inserted, and the components will be placed over the inserted empty line.

3.4.18 Moving Components

 and  are used to move components left or right. If there is a component at the boundary in the direction of movement, a prompt will appear indicating that the component cannot be moved. Multiple components can be moved simultaneously.

3.5 Find and Replace

3.5.1 Find

1. The find function allows users to conveniently search for coils, Timer, Counter, FunctionBlock, Label definitions, and REG/VAR during editing. To search, press CTRL+F or click  on the toolbar to open the find interface. If a coil or FunctionBlock is selected when the find interface opens, the parameters of that component will be automatically filled in (for Function Block, the parameters corresponding to Source Param will be automatically filled in).
2. Click "Search Next" to find the next occurrence, continuing until the end of the ladder diagram. It will then return to the starting point of the diagram to continue searching.

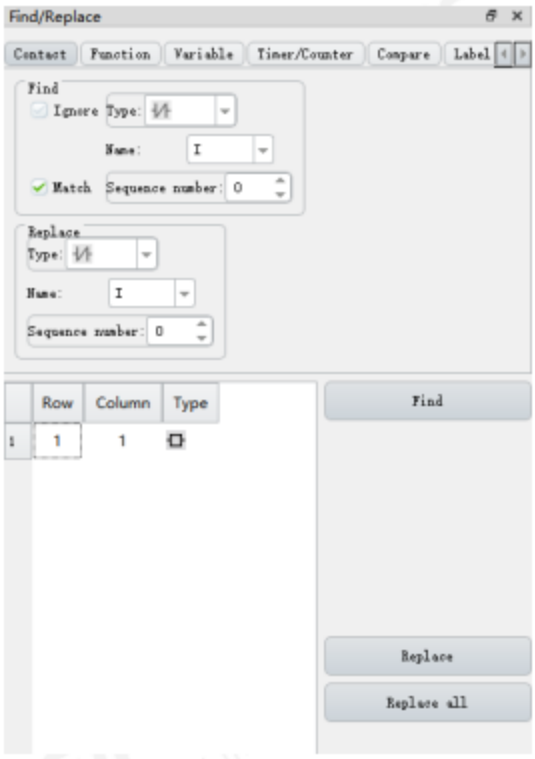


Figure: Search Interface

3.5.2 Replace

1. Open the Find interface. To replace a coil or REG/VAR in the ladder diagram, enter the parameter to be replaced in the "Find text" box, click "Replace" to replace one, or "Replace All" to replace all related parameters.

Replace Interface

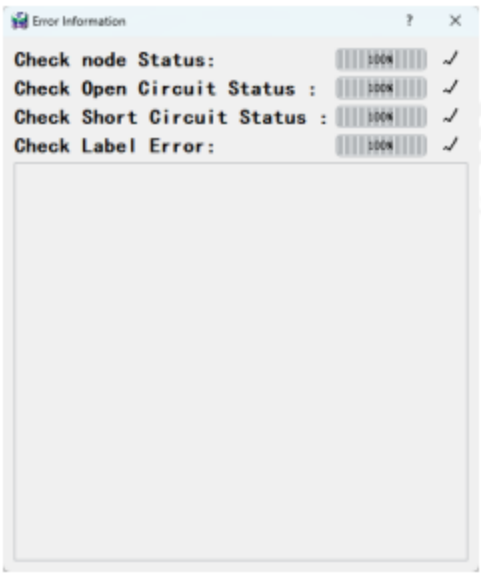
2. Before replacing, check whether the object to be replaced is used in the ladder diagram. If it is, a warning will appear, and the editor can decide whether to continue. For IOCSA coils, each coil can be replaced with any other IOCSA coil.
3. For Timer/Counter/Reg/Var, only parameters of the same type can be replaced. Since Timer/Counter/Reg correspond to system-reserved variables (Var 10000~...), when replacing these objects, the corresponding system variables will also be replaced. If a system variable is replaced, the corresponding Timer/Counter/Reg will also be replaced.。

4.Ladder Diagram Compilation and Download

4.1 Ladder Diagram Compilation

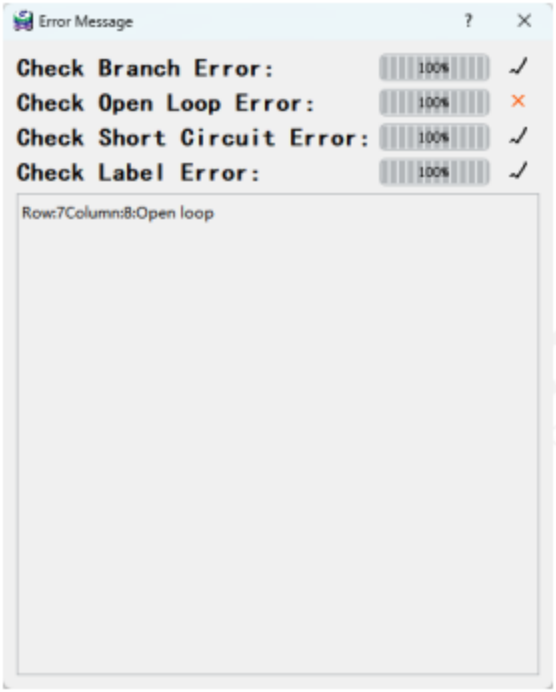
1. After editing the ladder diagram, compile it to generate the PLC file, which can then be downloaded to the CNC for execution.
2. When a file is opened, the menu item [Compile] | [Compile] and the button on the toolbar will become operable. Click with the mouse to compile the file.
3. If the current file is not saved, the system will save it first, then compile it.
4. The compiled file will have a .PLC extension.
5. If the compilation is error-free, the system will prompt that the compilation is successful.

Note: Before compiling, please make sure to save the changes to the PLC.



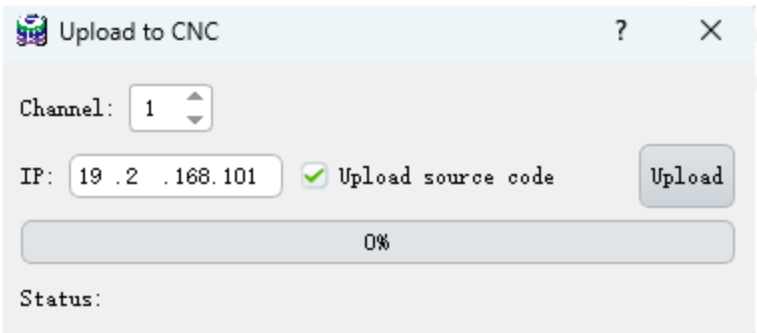
4.2 Ladder Diagram Compilation Error Messages

If there are errors in the file, error messages will be displayed during compilation. The error prompt is shown in the following image:



4.3 PLC File Download

1. After successful compilation, a file with the .PLC extension will be generated in the system working directory. It can be sent to the CNC via the Download function.
2.
3. Execute the [Communication] | [Download] menu item or click  on the toolbar to enter the PLC download interface.

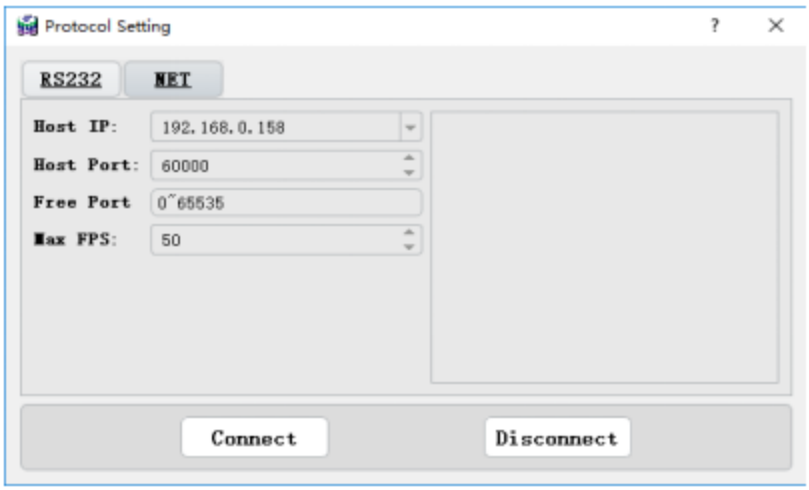


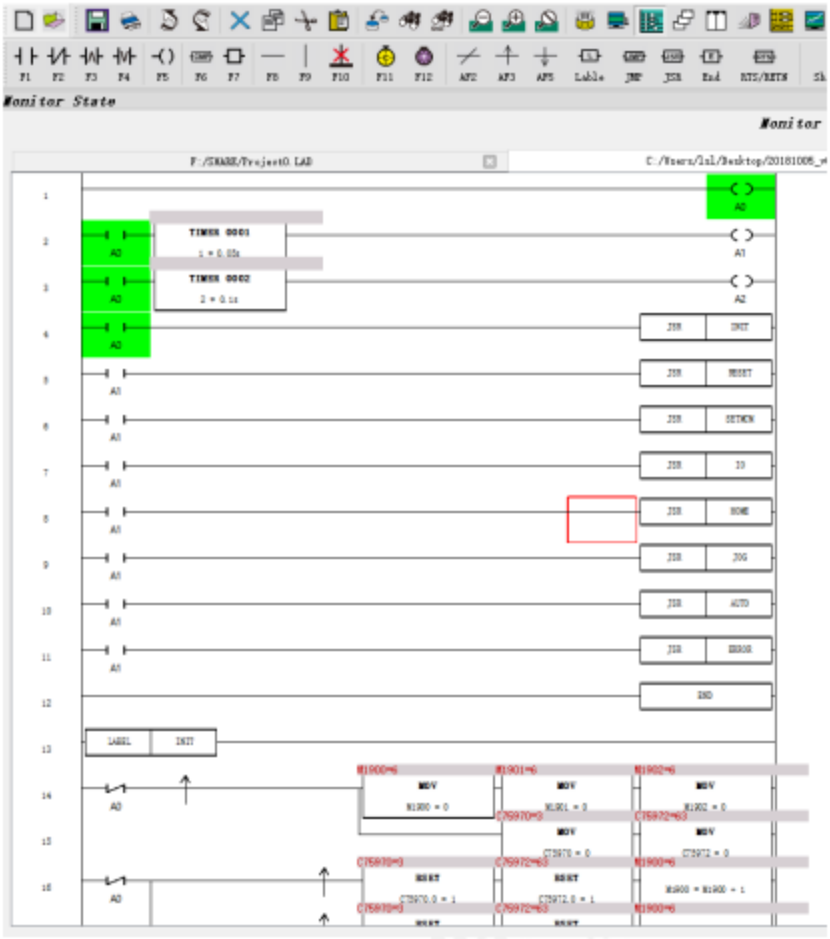
After selecting a PLC file to send, click the "Download" button to send the selected PLC file to the CNC. If there is a communication cable failure between the CNC controller, the corresponding error message will be displayed.

5.Ladder Diagram Online Monitoring (Online Monitor)

5.1 Starting Online Monitor

Execute the [Communication] | [Online monitor] menu item or click  on the toolbar to enter Online Monitor mode. When entering Online Monitor mode, the system checks whether the ladder diagram file running on the CNC matches the currently opened file. If they are not the same, a prompt will notify that the files are different.





5.2 Ladder Diagram Operation Status Display

After entering Online Monitor mode, the system communicates with the CNC. Based on the data returned from the CNC, output coils that are ON will be displayed in green.

Note: When a normally open coil is closed or a normally closed coil is opened, the coil will be displayed in green, indicating that the signal is ON.

5.3 Exiting Online Monitor Mode

Close the "Online Monitor" window displayed in the top-right corner of the screen.

Note: Before performing PLC file Download or Online Monitor, make sure to set the serial

port parameters in the [Options] | [Online Communication Settings] menu. For Net connections, use the IP address of the A6 controller.

6.Disclaimer

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