

2.0 Editing Programs

This chapter describes how to use the Editor to edit programs offline. See chapter 5 for information about editing programs online.

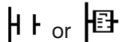

2.1 Starting a Rung

The first step in entering ladder logic is inserting the first instruction in the rung. Place the first instruction of a rung against the left power rail.

All rungs are aligned against the left power rail.

To start a rung

- Step 1. Click on the Ladder Language toolbar button that accesses the group of instructions you need.
An instruction palette appears.
- Step 2. Point to the instruction you want to insert, and press and hold the left mouse button.
- Step 3. While holding down the mouse button, drag the instruction into the program area and next to the left power rail. While you are dragging the instruction, the cursor changes to indicate whether you can drop the instruction and where it will be placed. Instructions

destined for the left power rail will look like  or 

- Step 4. When the instruction is where you want to place it, release the left mouse button, dropping the instruction into place.

IMPORTANT

You must place the first instruction of a rung so that it attaches to the left power rail to start a rung. If you place it anywhere else in the program window, you must then cut, paste, or drag to connect it to the power rail. You cannot draw a wire to connect it to the left power rail.

Tip

If you frequently use a particular instruction on a toolbar palette, you may want to turn the toolbar palette on. Once a toolbar palette is on, just point to the instruction you want to insert, and press and hold the left mouse button to drag the instruction from the palette.

2.1.1 Defining the Horizontal and Vertical Grid Limits Per Rung

You can define limits for the size of the grid used by the Editor to lay out each rung. This lets you make sure that your program printouts fit on your preferred page size without the rungs being split up.

Relay instructions occupy a grid space of 1 x 1. More complex instructions occupy at least 3 units horizontally by 2 to 8 units vertically.

The default grid size per rung is 40 horizontal units by 24 vertical units, which is also the maximum grid size per rung.

The Editor lets you place instructions outside the grid limits. Rungs that exceed either limit cause a warning to be displayed during a verify operation. The limits you set are checked only when you perform a verify operation.

To define the horizontal and vertical grid limits per rung

- Step 1. From the Tools menu, choose Options. A tabbed dialog box is displayed.
- Step 2. From the General tab, locate the Per Rung Instruction Grid group box.
- Step 3. Enter the desired values for the Horizontal and Vertical fields. The Editor uses these new values for all subsequent programs you open.
- Step 4. Click OK to accept the new grid size.

2.1.2 Turning the Grid On and Off

Use the grid to help you see where instructions will be placed and where you can draw wires. You can select whether to display the grid used by the Editor to lay out rungs. The grid is displayed using + symbols.

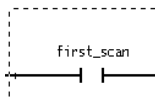
To turn the grid on or off from the View menu


- From the View menu, choose Grid.

2.2 Selecting Rungs

Before you can copy, cut, or move a rung, you must first select it. You can select a rung by doing any of the following:

- Click on or near the rung number.
or
- Click on the rung description text (when displayed).
or
- Draw a selection box around the entire rung. A selection box is a dotted-line rectangle like this:



A selected rung looks like this: 

Tip

If rung numbers are not displayed, you can still select the rung by clicking in the rung status area next to the rung.

To select a rung by drawing a selection box

- Step 1. Think of the rung you want as being enclosed in a box, and position the pointer on the white space at either the top or bottom “corners.”
- Step 2. Press the left mouse button. The cursor changes to +.
- Step 3. Draw a selection box around the rung by moving the mouse diagonally across the rung. You cannot draw a selection box to encompass more than one rung.

Tip

If the rung you are selecting extends beyond the screen display, you can scroll the screen to display the remaining rung logic by extending the selection box against any side of the program window.

- Step 4. Once the rung is enclosed in the box, release the mouse button. The rung is now selected.

To select multiple, contiguous rungs by dragging the mouse

Press and hold the mouse button in the rung status area, and drag the mouse in either direction (up or down) to select additional rungs.

To select multiple, contiguous rungs by selecting the first and last rung

- Step 1. Select a rung.
- Step 2. Scroll the screen as necessary to display the last rung you want to select.
- Step 3. Hold down SHIFT and select the last rung by clicking in the rung status area next to the rung.

To select all the rungs in a program

- From the Edit menu, choose Select All
 - or
- Press CTRL+A
 - or
- From the program window pop-up menu, choose Select All.

2.3 Entering Rung Descriptions

Rung descriptions help you document the program's logic so that others can understand the function of each rung and help make troubleshooting easier. Rung descriptions can contain a maximum of 16 lines, with each line containing a maximum of 80 characters of text.

You must turn on rung descriptions to view them in the program.

To enter a rung description in the program window

- Step 1. Make sure Rung Descriptions are turned on.
- Step 2. Select the rung to which you want to add or edit a description. The rung description field, which is a dotted line box, is displayed above the rung. For more information, see section 2.2.
- Step 3. Click in the rung description field and enter the description.

Tips

- Start a new line by pressing CTRL+ENTER.
- Move around in the rung description field by using the mouse, HOME, END and the arrow keys. Delete text by using BACKSPACE or DELETE.
- You can also cut, copy, and paste text in rung descriptions. See the AutoMax Ladder Editor and Enhanced Ladder Editor help file for more information.

To enter a rung description in the Rung Properties dialog box

- Step 1. Select the rung to which you want to add or edit a rung description. For more information, see section 2.2.
- Step 2. From the File menu, choose Properties.
- Step 3. In the Rung Description field, type in the description.
- Step 4. Click OK to add the description.

Tip

You can also access the Rung Properties dialog box from the pop-up menu. Select the rung or point to it. Then, click the right mouse button and choose Properties from the pop-up menu.

2.4 Inserting Instructions into a Rung

Build a rung by using the mouse to drag and drop instructions from an instruction palette and connect them together by drawing wires. The program area is like a blank canvas—you drag instructions from the instruction palettes and drop them in the program area. But first, you must start a rung by dragging an instruction from an instruction palette and dropping it very near the left power rail. To help make inserting instructions easier, the insert cursor indicates when and in which direction you can drop an instruction. See section 2.1 for more information on starting a rung.

When dropped into the rung, the instructions indicate where you can attach another instruction or wire. Contact instructions have connections on either side, but coil instructions can only connect to another instruction on the left side.

For instruction blocks like ADD, you can connect other instructions to the longer lines. These longer lines attach to Boolean input and output parameters.

An inserted instruction belongs to the rung above it if the newly inserted instruction does not start a rung.

To insert instructions into a rung

- Step 1. Click on the Ladder Language toolbar button that accesses the instruction palette you want to use.
The instruction palette appears.
- Step 2. Point to the instruction you want to insert.
- Step 3. Press and hold the left mouse button while dragging the instruction into the program area.
- Step 4. When the pointer is where you want the upper-left corner of the instruction to be, release the left mouse button, dropping the instruction into place.

If you drop an instruction very near another, the newly-placed instruction automatically connects to the one adjacent to it. Similarly, you can insert an instruction between two instructions by simply dragging it between the existing two.

Tip

If you frequently use the instruction on a toolbar palette, you may want to turn the toolbar palette on. See “Turning the Toolbars and Palettes On and Off” in Appendix A.

Tip

If you delete or cut the first instruction of a rung, the left power rail connection stays, indicating that you can insert a new instruction. Insert the new instruction to the right of the left power rail connector.

Tip

You can move or copy one or more instructions from one rung and insert them into another rung. See “Moving Instructions” and “Copying Instructions” in the AutoMAX Ladder Editor online help.

2.5 Connecting Instructions (Drawing Wires)

Connect instructions when you want to create branches (parallel logic) or to connect two or more instructions together that were placed too far apart for them to connect automatically. Connect instructions by drawing wires.

You can use the grid markers to help you determine where instructions will be placed and where you can draw wires.

To connect instructions

Step 1. Place the cursor near a connection point for an instruction. For relay logic, the connection point is either the left side (for coils) or both sides (for contacts). For block instructions, the connection points are the free ends of the long lines.

When the cursor is near a connection point, it changes to include a pencil:



Step 2. Press and hold the left mouse button. The cursor changes to a pencil.

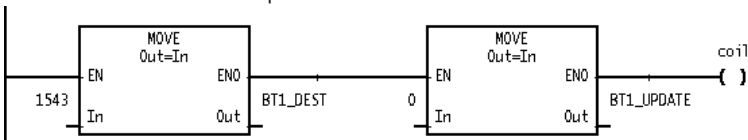
Step 3. Draw the wire by moving the mouse towards the instruction to which you want to connect. You can draw a continuous wire to connect instructions in a branch and the coils at the end of the rung. A dotted line indicates where the wire will be placed.

Step 4. When you reach the destination connection point, release the mouse button.

The wire is drawn to connect the instructions.

2.6 Connecting Multiple Instructions by Using the ENO Output Bit

Quickly build a rung by connecting a relay instruction or a Boolean input of an instruction to the ENO output parameter of an instruction block. For example:



The Boolean input parameter's or relay instruction's state is linked to that of the ENO output parameter.

The ENO output parameter for an instruction follows the state of that instruction's EN input parameter unless an error occurs. When an error occurs within an instruction, the ENO output parameter is set according to the pre-defined variable `ERROR_ENO`. Because the default value of `ERROR_ENO` is false, instructions connected to the ENO output are disabled when an error occurs in the instruction block containing the ENO output. Should you want to continue evaluating and executing the logic connected to an ENO output, set the variable `ERROR_ENO` true.

2.7 Selecting Instructions

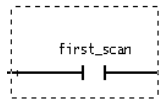
Before you can copy, cut, clear, or move an instruction, you must first select it.

To select an instruction

- Click on any part of the instruction such as the instruction itself, a variable used in the instruction, or the description.

or

- Draw a selection box around the instruction. A selection box is a dotted-line rectangle like this:



A selected instruction looks like this:



To select an instruction by drawing a selection box

- Step 1. Think of the instruction you want to select as being enclosed in a box and position the pointer on the white space at either the top or bottom “corners.”
- Step 2. Press the left mouse button. The cursor changes to +.
- Step 3. Draw a selection box around the instruction by moving the mouse diagonally across the instruction. Once the instruction is enclosed in the box, release the mouse button. The instruction is now selected.

To select multiple, contiguous instructions by drawing a selection box

- Draw a selection box to encompass the instructions you want to select. You can only select instructions that belong to the same rung.

or

- Step 1. Select an instruction.
- Step 2. While pressing SHIFT, place the mouse pointer on the selected instruction and press the left mouse button. A selection box appears.
- Step 3. While holding down the mouse button, drag the selection box to encompass the instructions that you want to select.

Tip

If the instructions you are selecting extend beyond where they are displayed on the screen, you can scroll the screen to display the remaining instructions by extending the selection box against any side of the program window.

2.8 About Instruction Properties

The Instruction Properties dialog box contains two tabs:

Use this tab:	For:
Instruction Info	<ul style="list-style-type: none">● changing the instruction's type● viewing the variable names used in the instruction's input and output parameters
Variables	<ul style="list-style-type: none">● viewing the variables used in the instruction● entering a variable description● changing variable's data type, scope, initialization, and display format● specifying a maximum array index

To access Instruction Properties from the File menu

- Step 1. Select an instruction.
- Step 2. From the File menu, choose Properties. The Instruction Properties dialog box is displayed.

To access Instruction Properties from the pop-up menu

- Step 1. Point to the instruction, and press the right mouse button.
- Step 2. From the pop-up menu, choose Properties. The Instruction Properties dialog box is displayed.


To display the variable properties tab, choose Variables. To display information about the instructions, choose Instruction Info. Quickly toggle between the two tabs by using CTRL+TAB.

2.9 Changing an Instruction Type

You can change an instruction to another compatible instruction without having to re-enter the variable names for the parameters. This feature helps reduce the time required to make logic changes.

Compatible instructions are those with the same basic function and/or the same number of inputs and outputs. For example, you can change an NOI instruction to a NCI instruction because these instructions are compatible relay input instructions. Conversely, you cannot change an NOI instruction to a CO or an ADD instruction because these instructions are not compatible.

To change an instruction type by using Find and Replace

- Step 1. Click on .
The Find dialog box is displayed.
- Step 2. In the Objects group box, choose Instruction.
- Step 3. In the Find Instruction list box, choose the instruction for which you want to search. This list only displays those instructions that are compatible with the selected instruction.
- Step 4. Choose Find.
The Editor searches the program for the instruction you specified.
- Step 5. Choose the Replace button.
- Step 6. In the Replace Instruction list box, choose the instruction that you want to use in place of the instruction you are searching for. This list only displays those instructions that are compatible with the selected instruction.
- Step 7. Choose Replace to replace the current instruction with the new one or Replace All to replace all occurrences of an instruction with another.

To change an instruction type by using its Instruction Properties

- Step 1. Select the instruction you want to change.
- Step 2. From the File menu, choose Properties.
- Step 3. Choose the Instruction Info tab.
- Step 4. From the Type list box, choose the instruction type that you want to use in place of the selected instruction. This list only displays those instructions that are compatible with the selected instruction.
- Step 5. Click OK to accept the change.

Tip

You can also access the Instruction Info tab from the pop-up menu. Point to the instruction that you want to change, press the right mouse button, and choose Properties from the pop-up menu.

Tip

You can also change the information about the variables used in the instruction. Simply choose the Variables tab or press CTRL+TAB to display the Variable Properties.

Tip

To select the instruction and access the pop-up menu, place the mouse pointer over the instruction and click the right mouse button.

2.10 Assigning Variables and Constants to Ladder Instruction Parameters

Each instruction includes at least one input or output parameter. The more complex instructions contain parameters for multiple non-Boolean inputs and outputs. Each parameter has a variable name field in which you enter the variable name or constant that you want to assign to the parameter.

To help make assigning variables to instruction parameters easier and faster, variables are automatically assigned a default data type and scope when they are first entered. The default type is that most likely to be used by the instruction. For example, the default type for a variable name entered for a relay instruction is Boolean. But for a JMP, the default type is label. For most block instructions, the default type for input and output parameters is integer.

When you enter an element-indexed variable, a default maximum array index is automatically assigned, which you can later change in the Variable Properties.

The scope of the variable is determined by the case of the first letter of the variable name you type. If the letter is upper case, the variable defaults to being a global variable. If the letter is lower case, the variable defaults to being a local variable.

To assign variables or constants to ladder instruction parameters

- Step 1. Select the instruction for which you want to assign variables. The variable name field appears as a dotted-line box.
- Step 2. Click in this dotted-line box. The outline becomes solid and a vertical text cursor appears.
- Step 3. Type in the variable name or a constant you want to use following the naming conventions of the Editor. See the reference information for the instruction you are programming for more information about the allowable variable types. The scope of a variable can be either global or local. When you first enter a variable, its scope is defined based on the case of the first letter you type. An upper case letter defines the variable to be global. A lower case letter defines it to be local. See section 2.15 for more information about a variable's scope.

Tip

If the variable has not been used before, a default data type and scope is automatically assigned. If the variable is an array, the maximum array index defaults to the value you entered as the element of the variable. For example, if you entered `part[5]` the value of 5 would be entered into the Maximum Array Index field of the Variable Properties.

If the element-index of an array is a variable, the Maximum Array Index field contains a value of 1.

Tip

If the variable has been used before, you can save typing by using Variable Smart-Matching. See section 2.12 for more information about Variable Smart-Matching.

Tip

To enter hexadecimal constants:

- End hexadecimal constants with an “h” or “H”.
For example: 607H
- If the hexadecimal constant begins with a letter, enter a leading 0 before the value.
For example: 0A607H
- If the most significant bit of the hexadecimal constant is set and the constant is fewer than 8 digits, sign-extend it with “F’s” into an 8-digit hexadecimal value.
For example: Enter 9C40H as 0FFFF9C40H

The Editor converts a hexadecimal value to a decimal constant, except for the logical and Masked Move instructions.

2.11 Entering Variable Descriptions

Variable descriptions help you document variables used in instructions. Each variable can have its own description; however, the description applies to simple or array variables and not to indexed variable names. For example, the description displayed for the variable `TANK.fill` would be for the variable `TANK`.

The descriptions can contain a maximum of 40 characters.

You must turn on variable descriptions to view them.

To enter a variable description by clicking into the variable description field above a variable

- Step 1. Make sure that the variable descriptions are turned on.
- Step 2. Select the instruction.
- Step 3. Click in the variable description field above the variable for which you want to enter a description. When selected, the variable description field is outlined by a solid border.
- Step 4. Enter a description containing a maximum of 40 characters.

Tip

A shortcut to entering a variable description is to click twice on the variable name and press TAB to advance to the variable description field. Enter a maximum of 40 characters of text.

To enter a variable description by using the Variables tab in the Instruction Properties dialog box

- Step 1. Select the instruction that contains the variables you want to document.
- Step 2. From the File menu, choose Properties. The Instruction Property dialog box is displayed.
- Step 3. Choose the Variables tab. The Variables Properties box is displayed.
- Step 4. In the Name list box, choose the variable you want to document.
- Step 5. Click on the Description field, and type in the description.
- Step 6. Click OK to add the description.

Tip

You can also access the Variable Properties dialog box from the pop-up menu. Point to the instruction containing the variables to which you want to add or edit a description, press the right mouse button, and choose Properties from the pop-up menu.

Tip

Move around in the name field by using the mouse, HOME, END, and arrow keys. Delete text by using BACKSPACE or DELETE.

Tip

To select the instruction and access the pop-up menu, place the mouse pointer over the instruction and click the right mouse button.

2.12 Using Variable Smart-Matching

Variable smart-matching is an option you can use to help you enter variable names in less time. The Editor maintains an alphabetical and case-sensitive list of variables you have used. When this option is on and you begin entering letters in the variable name field, the first variable name in the Editor's list that matches the first letter or letters you have typed appears in the variable name field. For example, if you have previously used the variables "pump" and "packet" and you type the letter "p" in a variable name, the word "packet" is inserted into the variable name field. If "packet" is the variable name you want, you can stop typing. If you had typed a "P," global variables (which begin with an uppercase P) would have been offered by the Variable Smart-Matching option.

If variable smart-matching displays a variable name that you only want to use part of, you must delete the extra characters by pressing BACKSPACE or DELETE.

To turn the Variable Smart-Matching option on and off

- Step 1. From the Tools menu, choose Options. The Option dialog box is displayed.
- Step 2. Choose the General tab and locate the Miscellaneous group box.
- Step 3. Choose the Variable Smart-Matching option. This setting applies to all subsequent editing sessions.
- Step 4. Click OK to accept the new setting.

To scroll through the available variable names that match the character(s) you have typed

- To advance, press CTRL and the down arrow.
- To move backward through the matching variable names, press CTRL and the up arrow.

The Variable Smart-Matching option provides matches to each part of an element-indexed and/or bit-indexed variable. Enter the element-index or bit-index delimiter and the first letter or letters of the element or bit name. Then, scroll through the variable name choices offered. The choices offered by the variable smart-matching option are determined by how many letters you type in.

Tip

- To append onto a variable name picked from the variable smart-match choices, make sure the variable name is not selected before continuing to type.
- To re-initialize smart-matching, delete characters (by using BACKSPACE), and re-type one or more.

Tip

If you type a question mark (?) as the first letter of a variable name, the Editor automatically smart-matches on the first variable in your variable list.

2.13 Selecting Variable Names

Before you can copy, cut, or clear a variable name you must first select it.

To select a variable

- Step 1. Select the instruction that contains the variable you want to edit. The variable name fields appear as dotted-line boxes.
- Step 2. Click the dotted-line box. The outline becomes a solid box and the text is selected.

2.14 Changing a Variable's Data Type

When you enter a variable name in an instruction's input or output parameter, a default data type is assigned based on the instruction type. If you want to change a variable's data type to something other than the default, you can change it by using the Variable Properties tab.

IMPORTANT

Changing the properties of a variable affects the variable, not just a particular instance in which it is used. For example, if you change the data type of a variable from timer to integer and that variable happens to be used in a TON instruction, this integer variable will no longer be allowed within the instruction.

To change the data type for a variable

- Step 1. Select the instruction containing the variable whose data type you want to change.
- Step 2. From the File menu or the pop-up menu, choose Properties. The Instruction Properties dialog box is displayed.
- Step 3. Choose the Variables tab. The Variable Properties tab is displayed.
- Step 4. If the name of the variable you want is not displayed in the Name field, use the list box to scroll through a list and choose it. The Variable Properties dialog box for that variable is displayed.
- Step 5. Using the Type list box, choose the data type for the variable.
- Step 6. Click OK to accept the change.

Tip

Integer variables default to a 16-bit integer. If you want the variable to be a double integer (32-bits), you must change its type to double integer.

Tip

Quickly toggle between the Instruction Info and Variables tabs by using CTRL+TAB.

Tip

To select the instruction and access the pop-up menu, place the mouse pointer over the instruction and click the right mouse button.

2.15 Changing a Variable's Scope

The scope of a variable can be either global or local. When you first enter a variable, its scope is defined based on the case of the first letter you type. An upper case letter defines the variable to be global. A lower case letter defines it to be local. You can change a variable's scope by using the Variable Properties tab.

Compound variables (element-indexed or bit-indexed variable names) are treated as separate variables with their own properties, including scope. For example: TANK.fill is a compound variable. TANK is a global variable and fill is a local variable. For element-indexed and bit-indexed variables using a number as the index, the scope of the variable is determined by the named variable. For example, the scope of the variable TANK.31 would be determined by TANK, which would appear in the variable list. If the variable were TANK.31, only TANK would appear in the variable list and have a scope.

IMPORTANT

Changing the properties of a variable affects the variable and not just a particular instance in which it is used. If you change a variable's scope, the change applies to every instance where that variable is used.

To change a variable's scope

- Step 1. Select the instruction containing the variable whose scope you want to change.
- Step 2. Access its Instruction Properties by choosing Properties from either the File menu or the pop-up menu. The Instruction Properties dialog box is displayed.
- Step 3. Choose the Variables tab. The Variable Properties tab is displayed.
- Step 4. If the name of the variable you want is not displayed in the Name field, use the list box to scroll through and choose it. The Variable Properties tab for that variable is displayed.
- Step 5. Click on either the Global or the Local option. The variable name changes to be either all upper case or lower case, depending on which option you chose.
- Step 6. Click OK to accept the change.

Tip

Quickly toggle between the Instruction Info and Variables tabs by using CTRL+TAB.

Tip

To select the instruction and access the pop-up menu, place the mouse pointer over the instruction and click the right mouse button.