Quick Start

Allen-Bradley

Micro800 Programmable Controllers: Getting Started with Motion Control Using a Simulated Axis

Catalog Numbers Bulletin 2080-LC30, 2080-LC50

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

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About This Publication

This quick start is designed to provide instructions for implementing a motion control project using Connected Components Workbench™ software and a Micro830™/Micro850™ programmable logic controller (PLC). It makes use of a sample project to illustrate the basic steps that a user needs to perform to use the motion control feature in Micro830 and Micro850 controllers.

To assist in the design and installation of your system, refer to the Micro830 and Micro850 Programmable Controllers User Manual, publication 2080-UM002.

The beginning of each chapter contains the following information. Read these sections carefully before beginning work in each chapter.

- **Before You Begin** – This section lists the steps that must be completed and decisions that must be made before starting that chapter. The chapters in this quick start do not have to be completed in the order in which they appear, but this section defines the minimum amount of preparation required before completing the current chapter.
- **What You Need** – This section lists the tools that are required to complete the steps in the current chapter. This includes, but is not limited to, hardware and software.
- **Follow These Steps** – This illustrates the steps in the current chapter and identifies which steps are required to complete the examples using specific networks.

Audience

To be able to use the motion control feature effectively, you need to be familiar with programming in function block diagram, structured text, and ladder programming.

This quick start works hand-in-hand with Micro830 and Micro850 Programmable Controllers User Manual, publication 2080-UM002.

Required Software

To complete this quick start, the following software is required:

- **Connected Components Workbench revision 2 and later**

  Connected Components Workbench is the main programming software for Micro800 systems. It provides a choice of IEC 61131-3 programming languages (ladder diagram, function block diagram, structured text) with user defined function block support that optimizes machine control.

  You will need the Connected Components Workbench software to configure your axis parameters, write your motion control function block programs, execute your function blocks, and monitor your axis status.

Additional Resources

Resource	Description
Micro830 and Micro850 User Manual, publication 2080-UM002	A detailed description of how to install and use your Micro830 and Micro850 programmable controller and expansion I/O system.
Micro800 Programmable Controller External AC Power Supply Installation Instructions, publication 2080-IN001	Information on wiring and installing the optional AC power supply.
Kinetix 3 Motion Control Indexing Application, publication CC-QS025	Quick start instructions designed to provide instructions for implementing a Kinetix® 3 component-class drive motion control indexing application by using Connected Components Workbench software and a Micro830 programmable logic controller (PLC).
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	More information on proper wiring and grounding techniques.
Connected Components Workbench Online Help	Online Help that provides a description of the different elements of the Connected Components Workbench software.

Table of Contents

Chapter 4

Wire Your Controller for Motion Control

Chapter 5

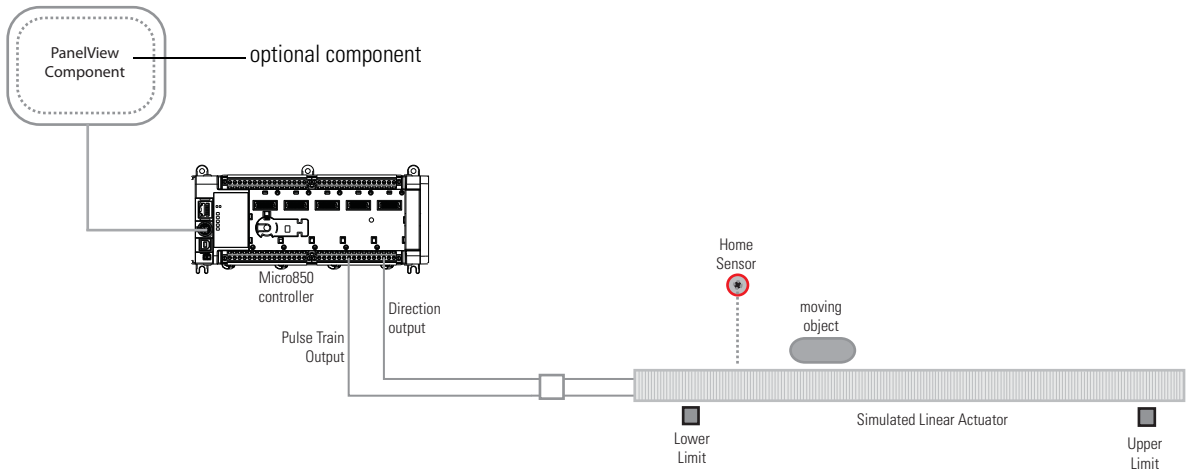
Execute Your Motion Control Function Blocks

Overview of Sample Project

This quick start instruction serves to enable users to the use the motion control feature on Micro830 and Micro850 controllers. It uses a sample simulation program to familiarize the user with motion control instructions and related parameter and wiring configurations. In particular, this project lets the user enable an axis, home an axis, move an axis, and use touch probe to capture current position in a simulated environment.

The project uses the minimum components to use motion control. It does not require a servo drive. The PTO output is wired directly to the high speed counter input. It makes use of high speed counter inputs to count the pulse train output (PTO) for the current position.

The following diagram illustrates how this project simulates motion control. The elements of this project are shown in the following diagram.



TIP HSC wiring for PTO feedback is not shown and is for simulation purposes only.

Download the Simulation Project

You can also download the code for the complete simulation project from the following link:

http://www.rockwellautomation.com/go/scmicro800

The downloadable code includes an optional PanelView Component (PVc) program, which allows the user to easily update and monitor different axis parameters through a PVc screen.

If you opt not to use a PanelView Component, use the Connected Components Workbench software to toggle variable input values and trigger motion instructions. Axis monitoring can also be done through the same software through the Axis Monitor feature.

To get started, check that your Micro800 controller supports motion control.

Hardware and Software Compatibility

The motion control feature on Micro830 and Micro850 controller is implemented through Pulse Train Outputs (PTOs) and motion axes, which are summarized in the following table.

PTO and Motion Axis Support on Micro830 and Micro850 Controllers

Controller	PTO (built-in)	Number of Axes Supported
10/16 Points 2080-LC30-10QVB 2080-LC30-16QVB	1	1
24 Points 2080-LC30-24QVB 2080-LC30-24QBB 2080-LC50-24QVB 2080-LC50-24QBB	2	2
48 Points 2080-LC30-48QVB 2080-LC30-48QBB 2080-LC50-48QVB 2080-LC50-48QBB	3	3

IMPORTANT **Software and Firmware Requirements**

- For programming, motion control is supported on Connected Components Workbench software revision 2 and later.
- Micro830 controllers require firmware revision 2 and later.

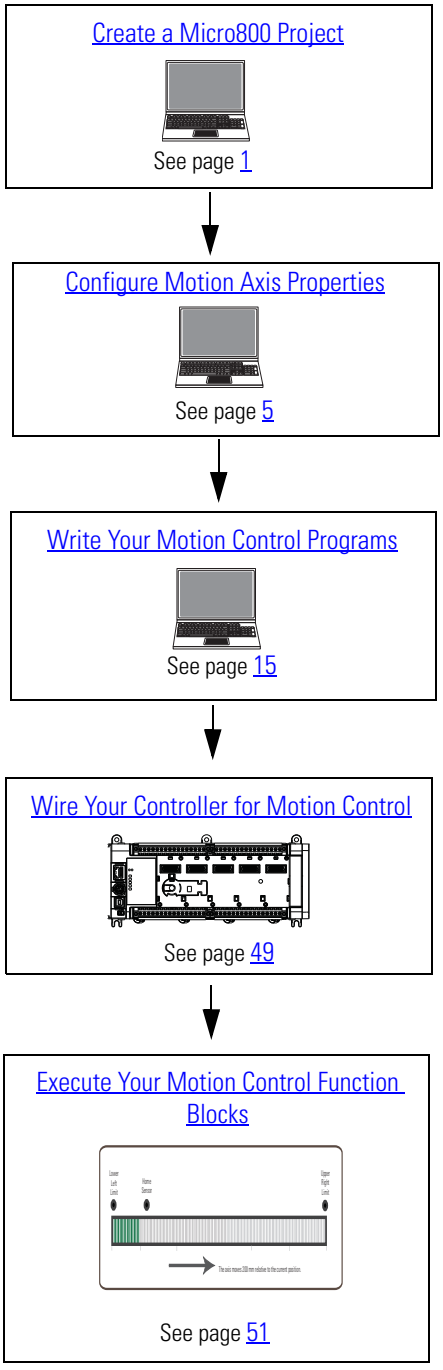
ATTENTION: To use the Micro800 motion control feature effectively, users need to have a basic understanding of the following:

- PTO components and parameters
  See the Micro830 and Micro850 User Manual, publication 2080-UM002, for a general overview of Motion components and their relationships.
- Programming and working with elements in the Connected Components Workbench software
  The user needs to have a working knowledge of ladder diagram, structured text, or function block diagram programming to be able to work with motion function blocks, variables, and axis configuration parameters.

ATTENTION: To learn more about Connected Components Workbench and detailed descriptions of the variables for the Motion Function Blocks, you can refer to Connected Components Workbench Online Help that comes with your Connected Components Workbench installation.

Follow These Steps

The major subsections for this quick start project are outlined in the following flowchart. Follow the steps under each subsection to become familiar with the required procedure to configure your controller and set up a simulation project for motion control.



Notes:

Create a Micro800 Project

Introduction

In this chapter, you will create a sample Micro830/Micro850 controller project through the Connected Components Workbench.

Before You Begin

Ensure that you have Connected Components Workbench revision 2 properly installed.

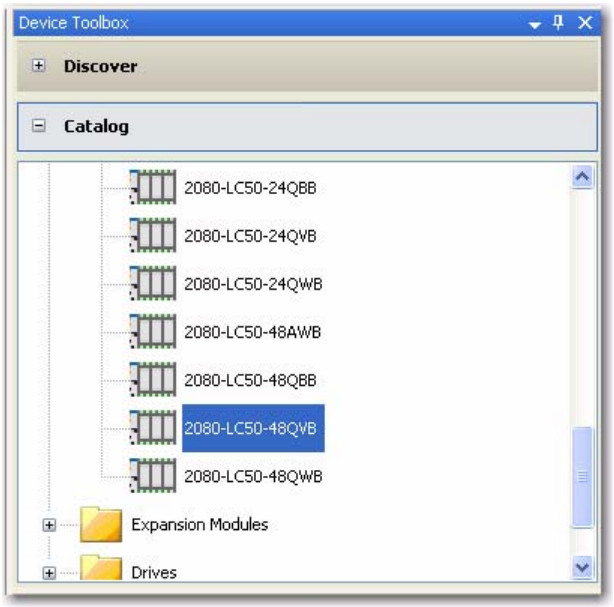
What You Need

- Connected Components Workbench revision 2 or later
- Firmware revision 2 and later for Micro830 controllers

Create a Micro800 Project in Connected Components Workbench

Launch the Connected Components Workbench software.

1. On the Device Toolbox, expand the list of Controllers by clicking the + sign.



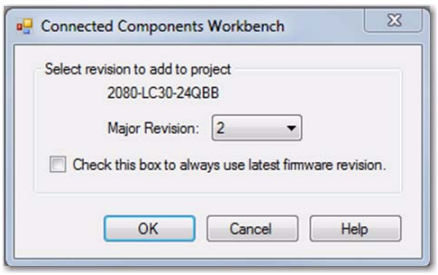
TIP If your controller is online, use the Discover feature to automatically discover your controller.

IMPORTANT Make sure that your controller is one of the following compatible controllers:

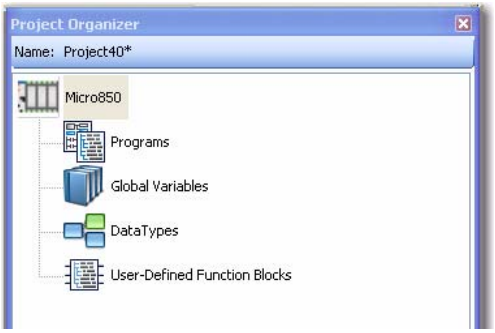
- 2080-LC30-24QBB
- 2080-LC30-24QVB
- 2080-LC30-48QBB
- 2080-LC30-48QVB
- 2080-LC50-24QBB
- 2080-LC50-24QVB
- 2080-LC50-48QBB
- 2080-LC50-48QVB

IMPORTANT Motion control on Micro830 controllers require firmware revision 2 or later.

2. Select major revision 2 when manually adding a Micro830 controller.

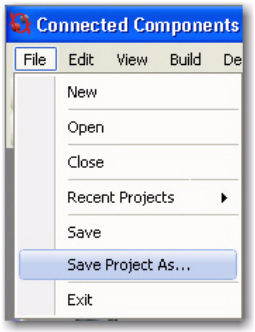


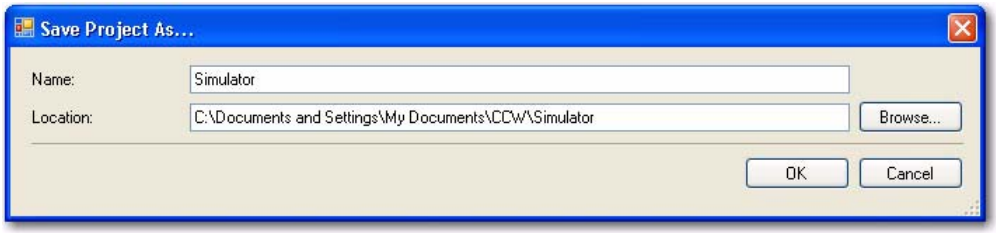
3. Drag your controller onto the Project Organizer pane.



4. Go to File → Save Project As. Then, provide a project name for your project.

5. Click OK.





TIP **Optional PanelView Component Program**

This simulation project can also include a PanelView Component program to allow for easier monitoring and toggling of axis parameter values through a PVc screen. The code for this optional program is downloadable from the following link, along with the complete code for this project:

http://www.rockwellautomation.com/go/scmicro800

Notes:

Configure Motion Axis Properties

Introduction

In this chapter, you will configure the axis parameters through Connected Components Workbench.

Before You Begin

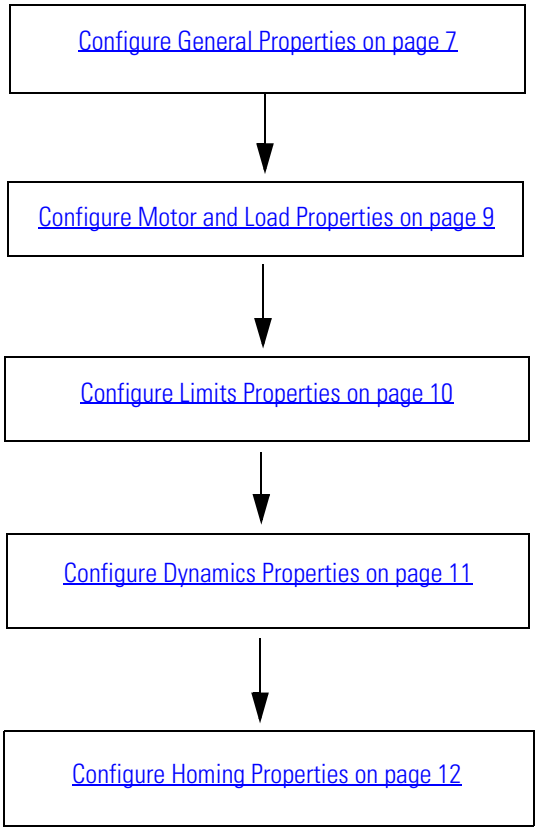
Acquire a basic understanding of the different motion axis parameters by referring to the Micro830 and Micro850 Programmable Controllers User Manual, publication 2080-UM002 and/or the Connected Components Workbench Online Help.

What You Need

- Connected Components Workbench revision 2 or later
- Firmware revision 2 and later for Micro830 controllers

Follow These Steps

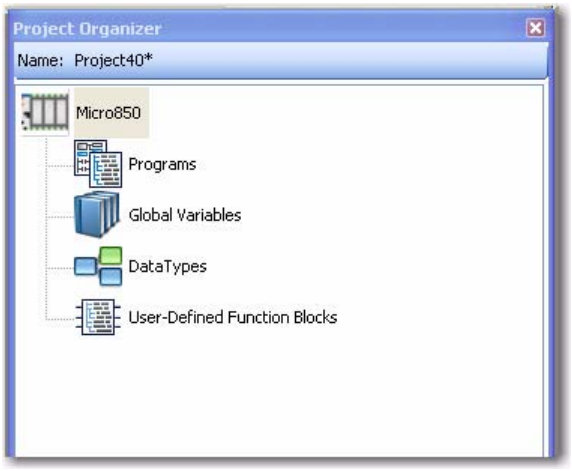
To configure your axis, follow these steps.



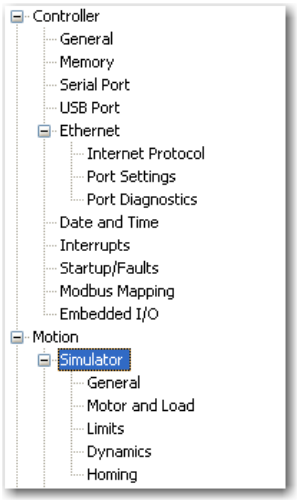
Configure General Properties

Launch the Connected Components Workbench software.

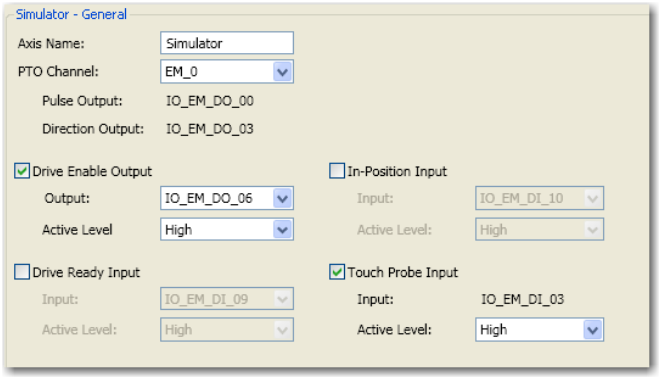
1. Open the project you have created in the previous chapter.
2. On the Project Organizer pane, double-click the controller name to bring up the Device Properties pane.



3. Under the Controller properties tree, go to Motion. Right-click <New Axis> and choose Create.
4. Provide the name "Simulator" for the axis. Alternatively, you can press F2 to name the axis.



5. Click General to bring up the General properties tab.



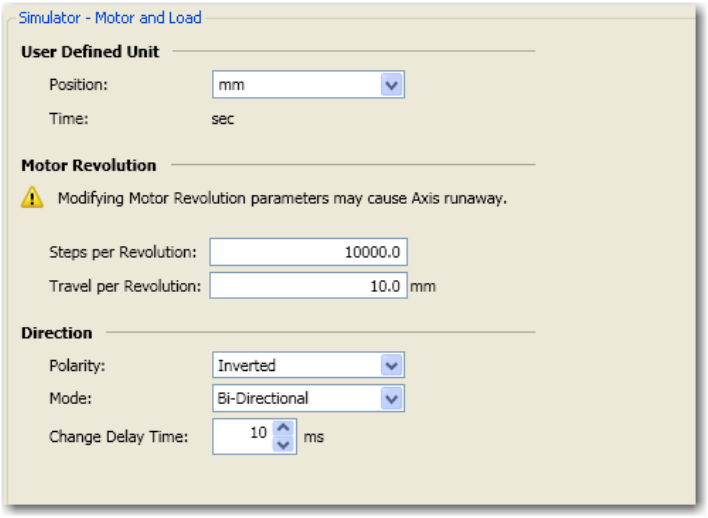
6. Configure the general properties as shown in the table.

General Properties Parameters

Parameter	Value
Axis Name	Simulator
PTO Channel	EM_0
Enable Drive Enable Output	*Tick option box to enable*
Drive Enable Output	IO_EM_DO_06
Drive Enable Output Active Level	High
Enable Touch Probe Input	*Tick option box to enable*
Touch Probe Input	IO_EM_DI_03
Touch Probe Input Active Level	High

Configure Motor and Load Properties

1. On the Controller Configuration tree, under Motion, click Motor and Load to bring up the Motor and Load tab.



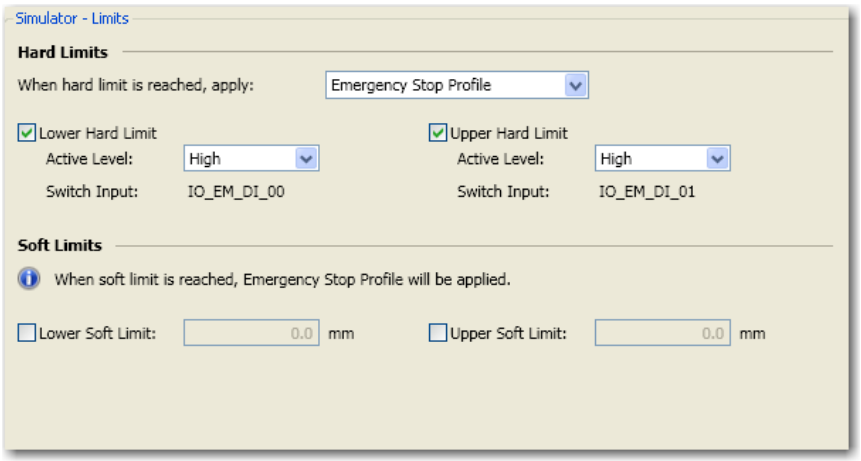
2. Configure Motor and Load parameters as follows.

Motor and Load Properties

Parameter	Value
Position	mm
Steps per revolution	10000
Travel per revolution	10 mm
Polarity	Inverted
Mode	Bi-directional
Change delay time	10 ms

Configure Limits Properties

1. On the Controller Configuration tree, under Motion, click Limits to bring up the Limits properties tab.



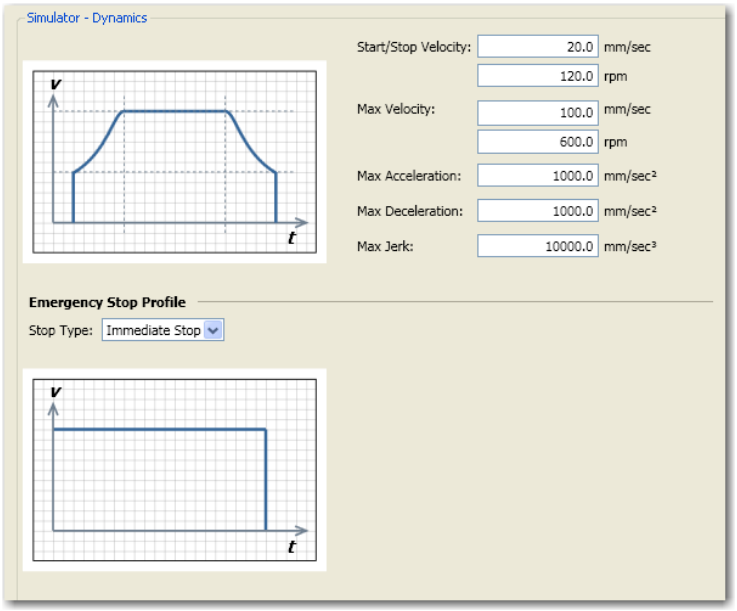
2. Configure Limits parameters as shown in the table.

Limits Properties

Parameter	Value
When hard limits is reached, apply	Emergency Stop Profile
Lower Hard Limit	*Tick option box to enable*
Lower Hard Limit Active Level	High
Upper Hard Limit	*Tick option box to enable*
Upper Hard Limit Active Level	High

Configure Dynamics Properties

1. Under Motion, click Dynamics to bring up the Dynamics properties tab.



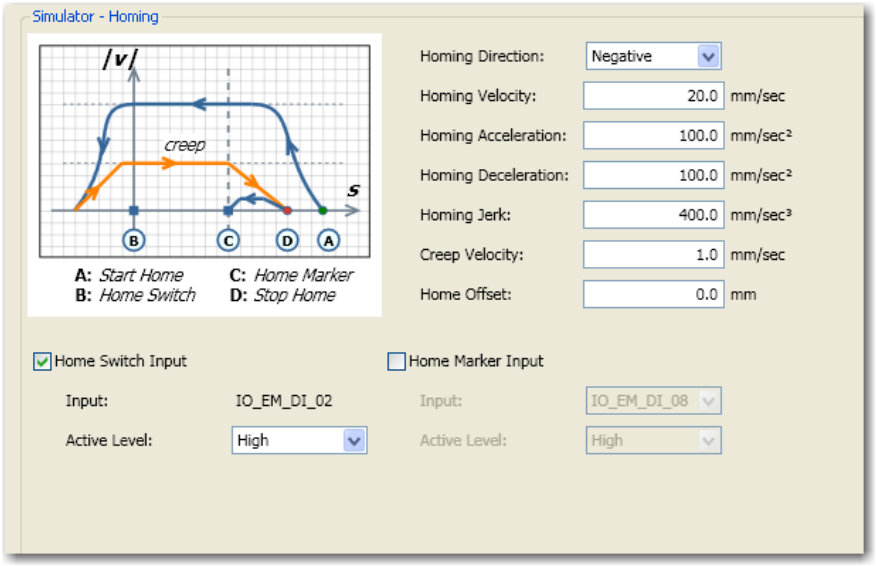
2. Configure Dynamics parameters as shown in the table.

Dynamics Properties

Parameter	Value
Start/Stop Velocity	20.0 mm/sec 120.0 rpm
Max Velocity	100.0 mm/sec 600.0 rpm
Max Acceleration	1000 mm/sec^2
Max Deceleration	1000 mm/sec^2
Max Jerk	10000 mm/sec^3

Configure Homing Properties

1. Under Motion, click Homing to bring up the Homing properties tab.

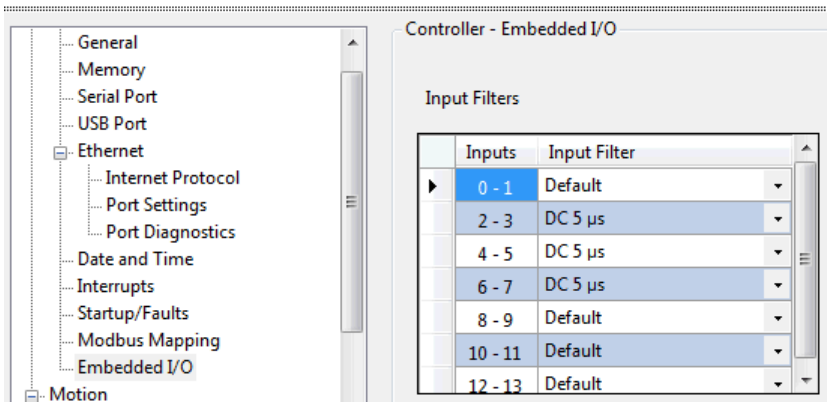


2. Configure homing parameters as shown in the table.

Parameter	Value
Homing Direction	Negative
Homing Velocity	20 mm/sec
Homing Acceleration	100 mm/sec^2
Homing Deceleration	100 mm/sec^2
Homing Jerk	400 mm/sec^3
Creep Velocity	1.0 mm/sec
Home Offset	0.0 mm
Home Switch Input	*Tick option box to enable*
Home Switch Input Active Level	High

Configure Embedded I/O Properties

Go to Controller Properties → Embedded I/O, and update the input filter values as shown below.



Input filters are configured so that high speed pulse from the PTO is properly captured. When High Speed Counters and Touch Probe are used, input filters need to be configured to match the high speed input.

Notes:

Write Your Motion Control Programs

Introduction

In this chapter, you will write movement function block programs that will allow you to control the movement profile of your axis.

Before You Begin

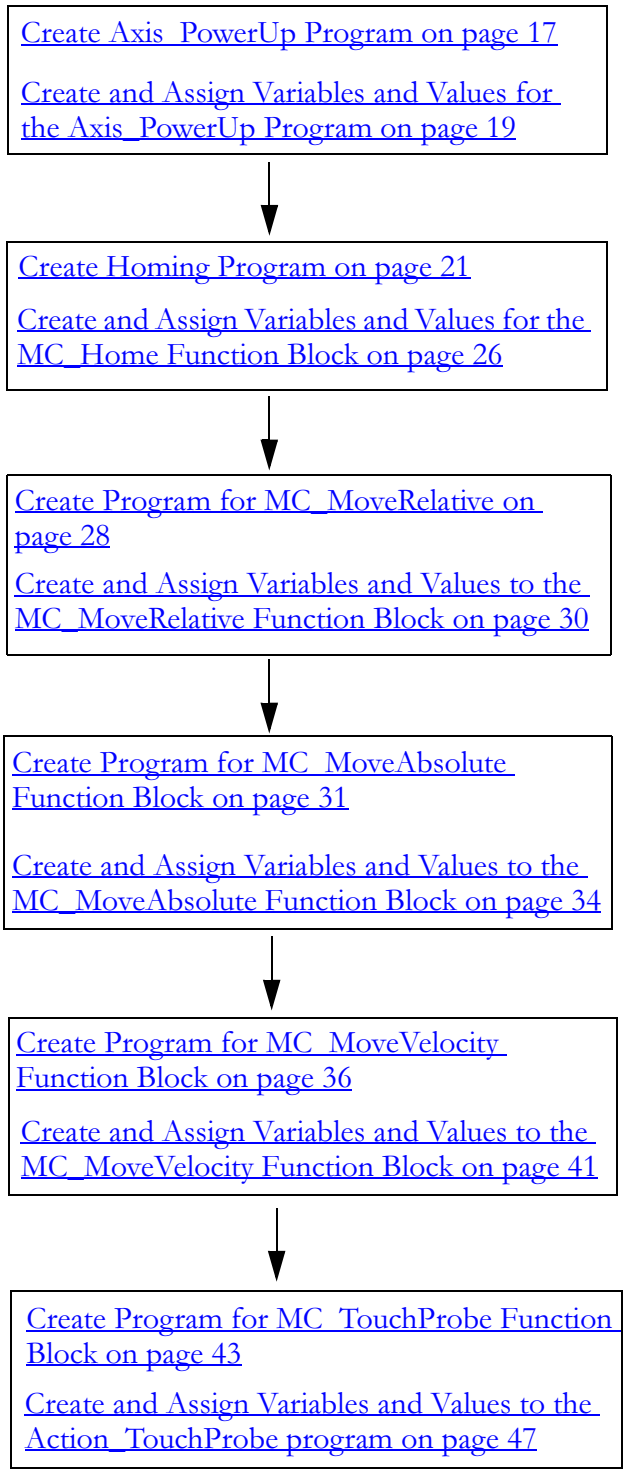
Learn about motion control function blocks by referring to the Micro830 and Micro850 Programmable Controllers User Manual, publication 2080-UM002, and the Connected Components Workbench Online Help.

What You Need

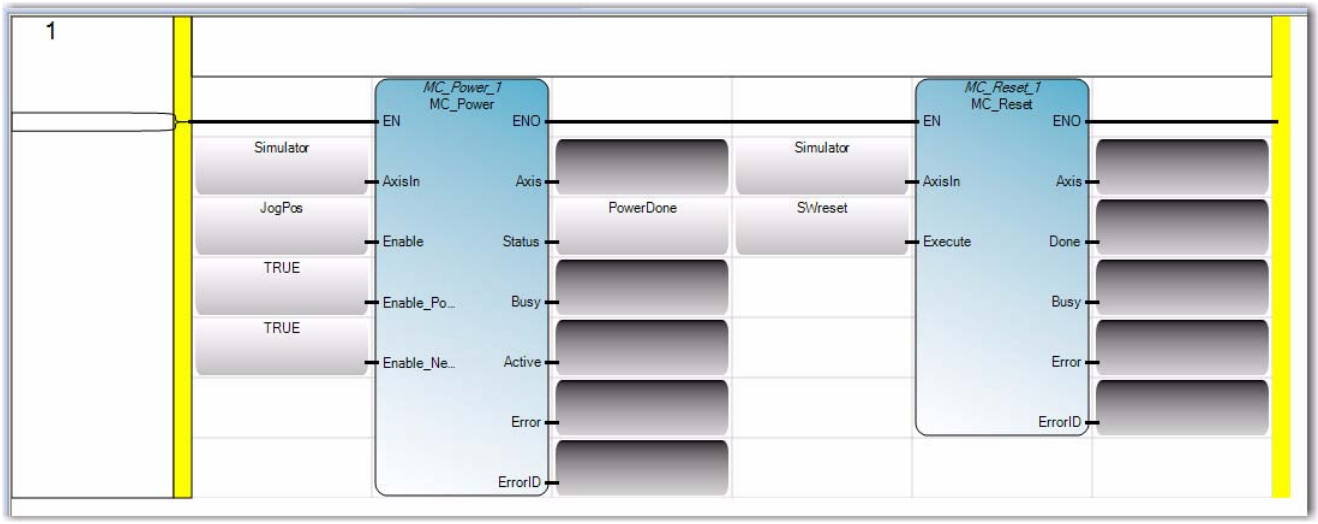
- Connected Components Workbench revision 2 or later
- Firmware revision 2 and later for Micro830 controllers

Follow These Steps

To write your motion control function blocks, follow these steps.



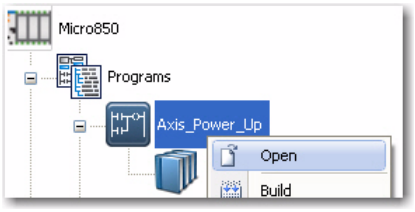
Create Axis_PowerUp Program



1. Open the project for your controller in Connected Components Workbench.

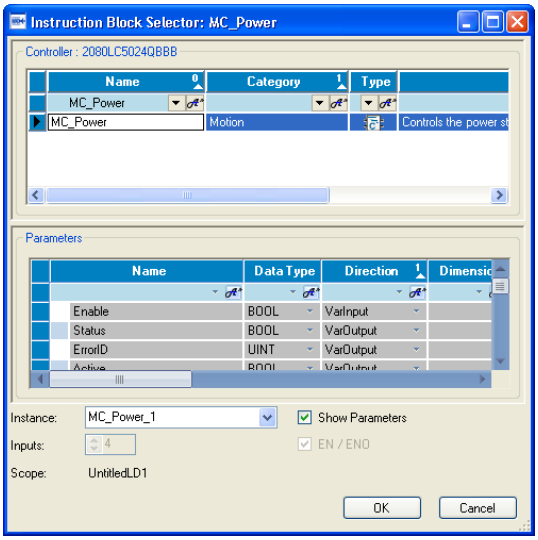
2. On the Project Organizer pane, right-click Programs, select Add New LD: Ladder Diagram. Press F2 to rename the program to Axis_PowerUp. Press Enter.

3. Right-click Axis_PowerUp program, choose Open.

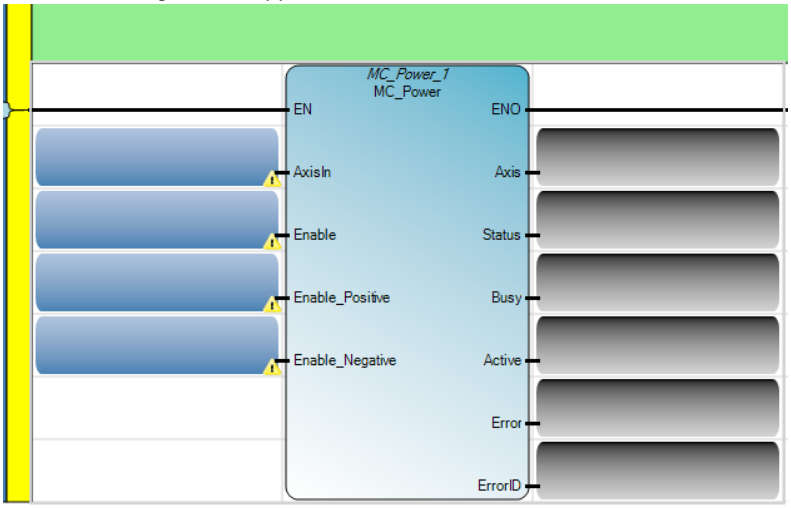


4. From the Toolbox, double-click Block to add it to the rung. Alternatively, you can drag and drop Block onto the rung. Your ladder rung should appear as shown.

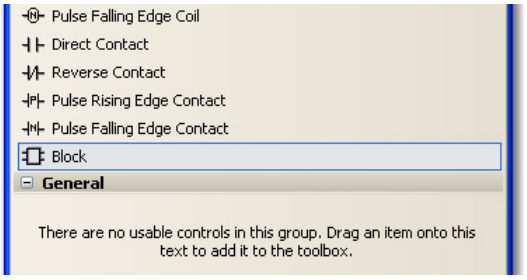
5. On the Instruction Block Selector window that appears, type MC_Power on the default entry field to filter the MC_Power function block. Choose MC_Power. Click OK.



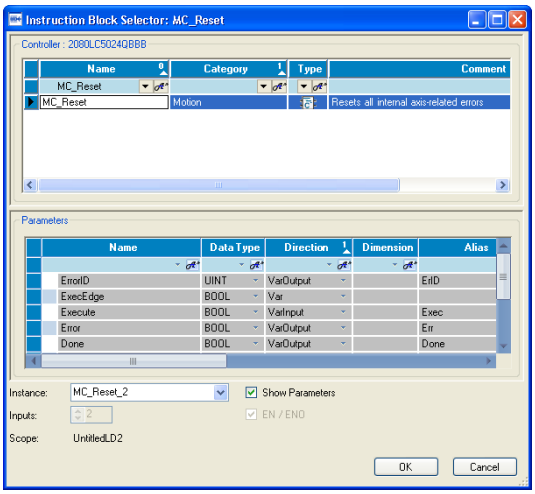
Your ladder rung should appear as follows.



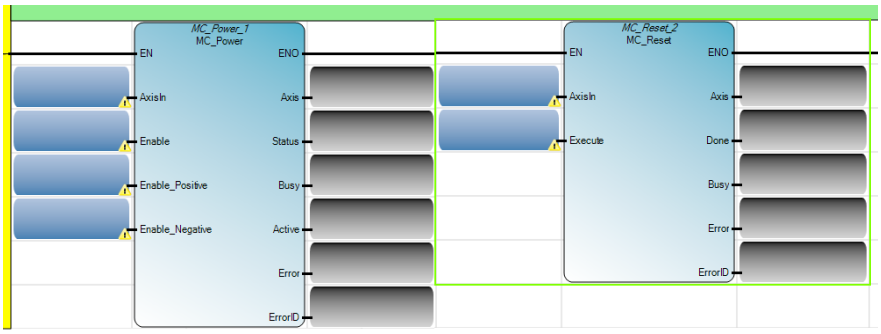
6. From the Toolbox, double-click Block to add it to the rung. Alternatively, you can drag and drop Block onto the rung.



7. On the Instruction Block Selector window that appears, type MC_Reset on the default entry field. Choose MC_Reset and click OK.



Your ladder rung should appear as follows.



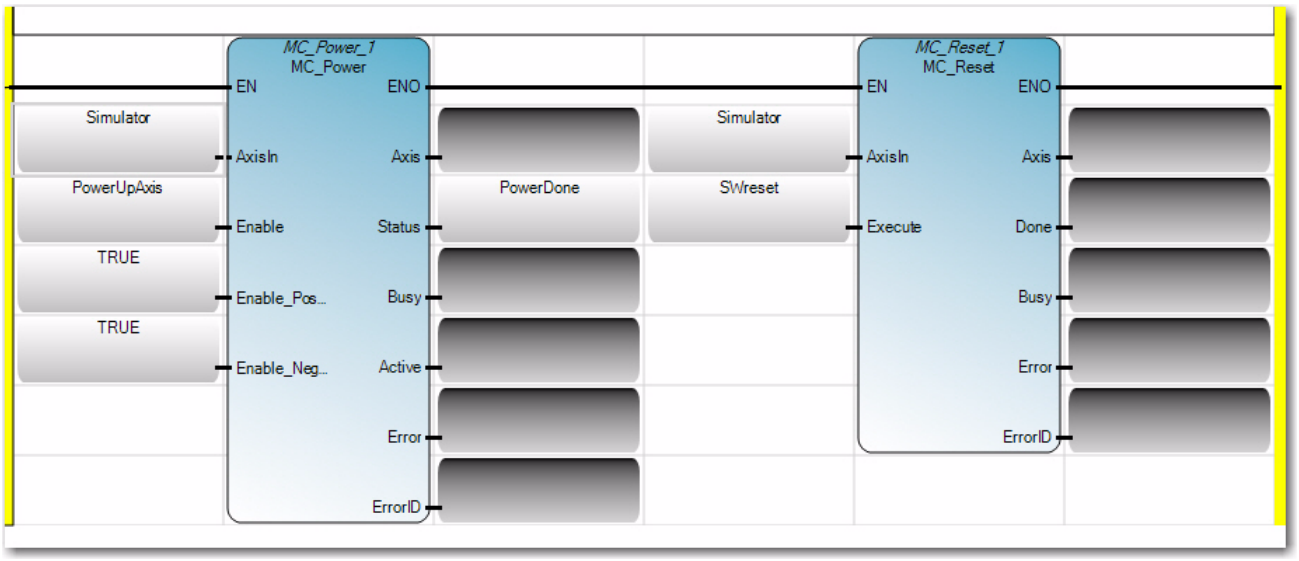
Create and Assign Variables and Values for the Axis_PowerUp Program

1. On the Project Organizer pane, double-click Global Variables to bring up the Variables window. Add the following variables with these corresponding data types and initial values.

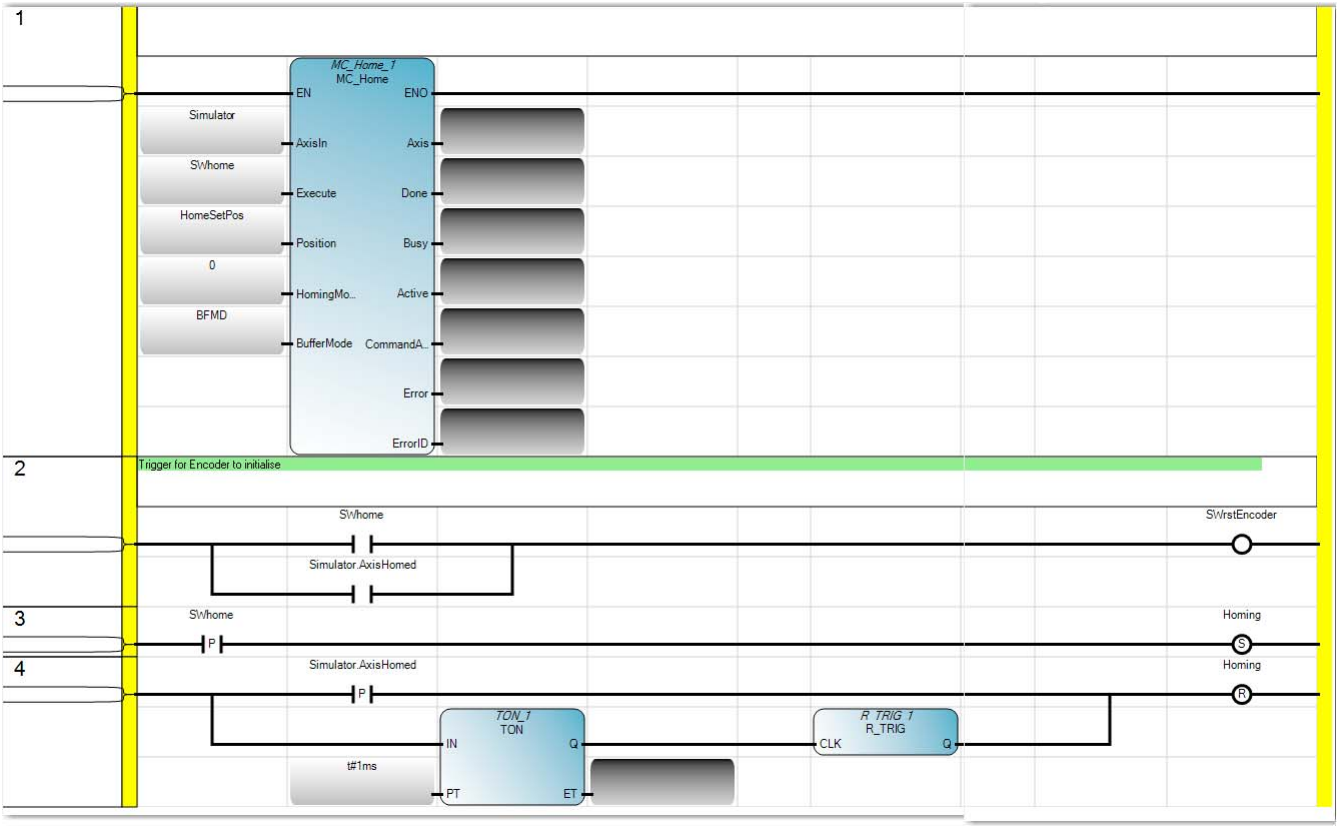
Variables and Initial Values for Axis_PowerUp Program

Variable Name	Data Type	Initial Value
Simulator	AXIS_REF	
PowerUpAxis	BOOL	TRUE
PowerDone	BOOL	
SWReset	BOOL	False

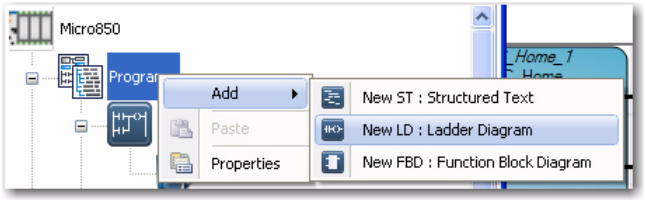
2. Assign the variables to the function block elements as shown.



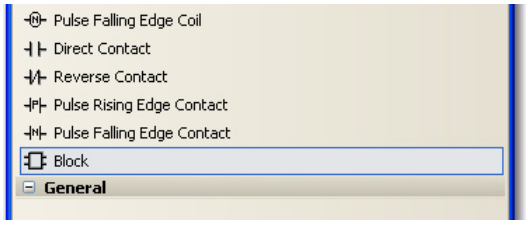
Create Homing Program



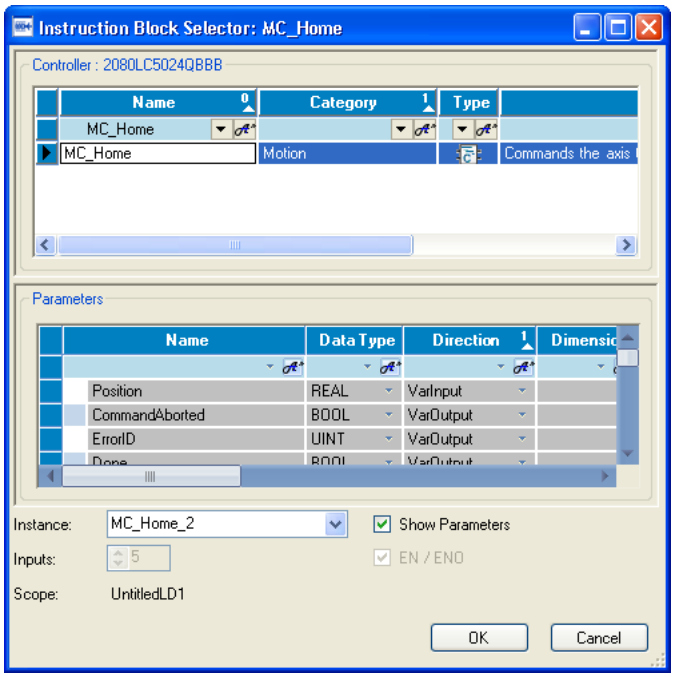
1. Click Programs, select Add → New LD: Ladder Diagram. Press F2 and rename the program to Action_Homing.



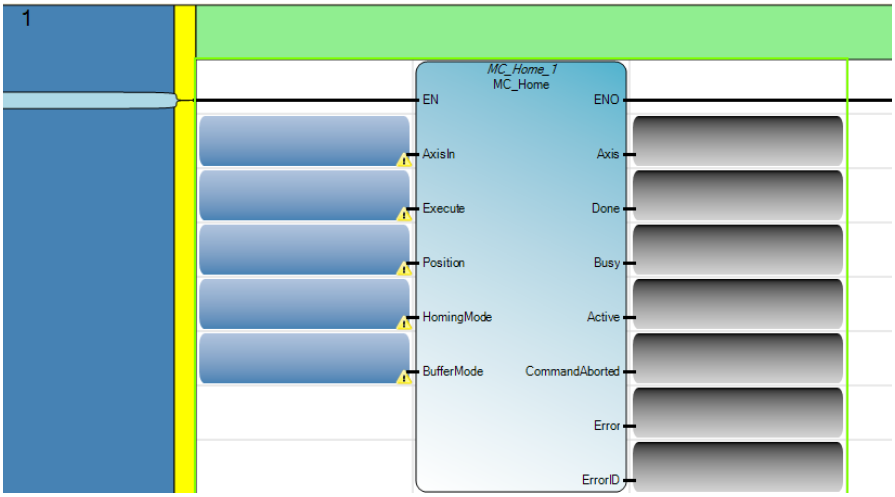
2. From the Toolbox, double-click Block to add it to the rung. Alternatively, you can drag and drop Block onto the rung.



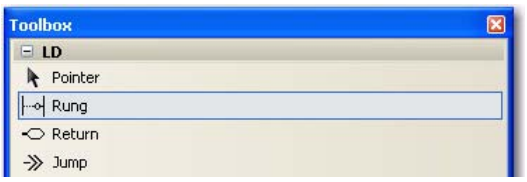
3. On the Instruction Block Selector window that appears, type MC_Home on the default entry field to filter out MC_Home.



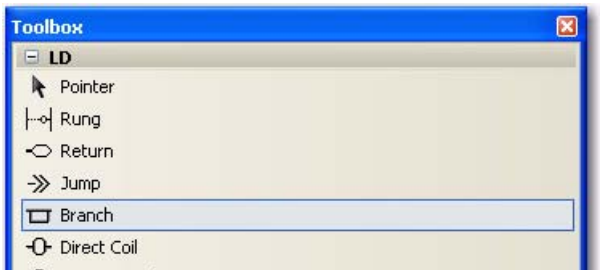
4. Choose MC_Home. Click OK. Your ladder rung should appear as follows.



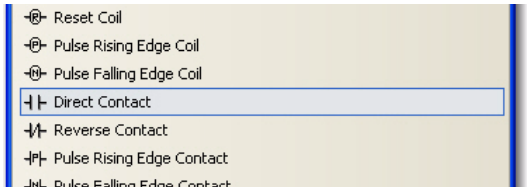
5. Create a second rung. From the Toolbox, select Rung and drag it onto the space just below the first rung.



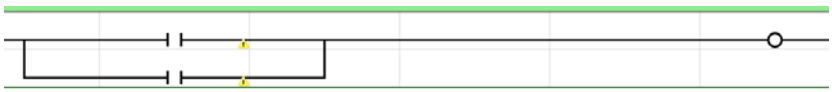
6. Select Branch from the Toolbox and drag it onto the second rung.



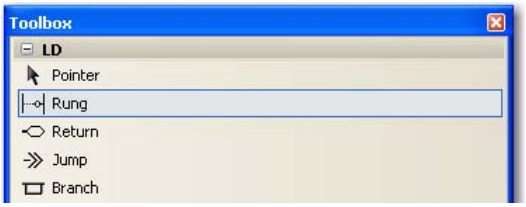
7. Select Direct Contact from the Toolbox and drag it onto the second rung as shown.



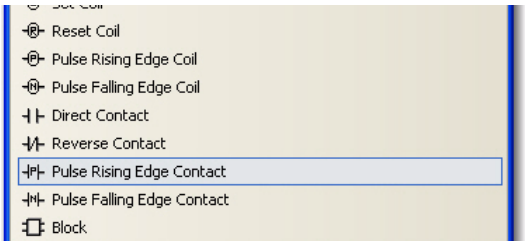
8. Select Direct Contact from the Toolbox and drag it onto the branch on the second rung as shown.



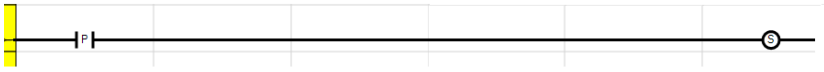
9. Create a third rung. From the Toolbox, select rung and drag it onto the space just below the second rung.



10. Select Pulse Rising Edge Direct Contact from the Toolbox and drag it onto the third rung.

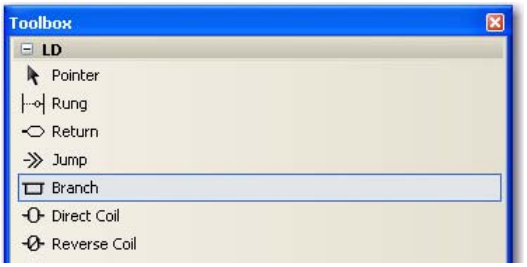


11. Select Set Coil from the Toolbox and drag it onto the third rung. Your third rung should appear as follows.

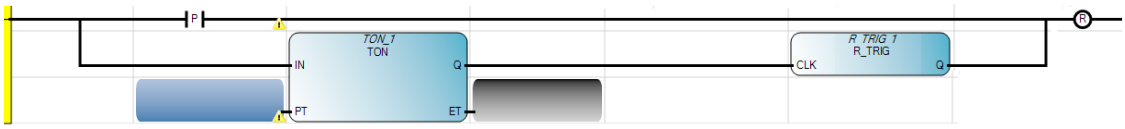


12. Create a fourth rung. From the Toolbox, select rung and drag it onto the space just below the third rung.

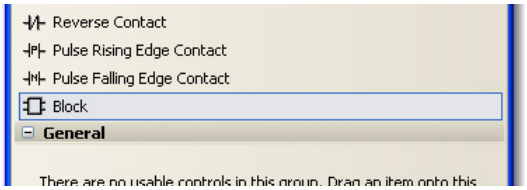
13. Select Branch from the Toolbox and drag it onto the fourth rung.



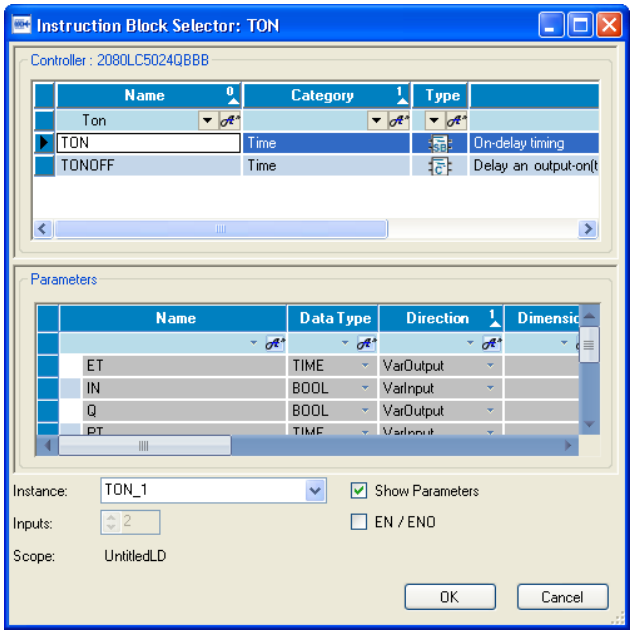
14. Select Pulse Rising Edge Direct Contact from the Toolbox and drag it onto the fourth rung as shown.



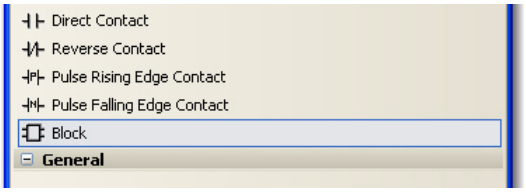
15. Select Block from the Toolbox and drag it onto the branch on fourth rung as shown.



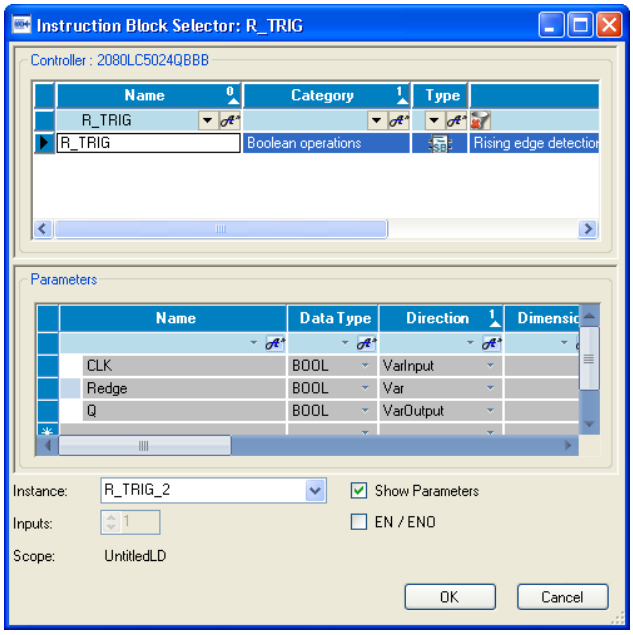
16. On the Instruction Block Selector window that appears, type TON to filter out the TON function block. Choose TON. Click OK



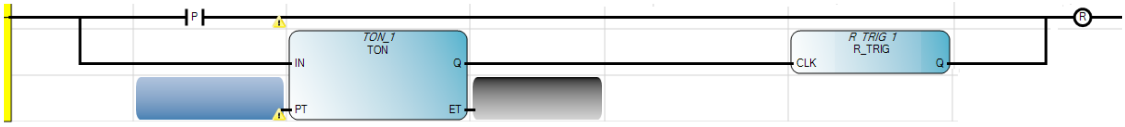
17. Select Block from the Toolbox and drag it onto the branch on the fourth rung as shown.



18. On the Instruction Block Selector window that appears, type R_TRIG to filter out the R_TRIG function block. Choose R_TRIG. Click OK



19. Select Reset Coil from the Toolbox and drag it onto the fourth rung as shown.

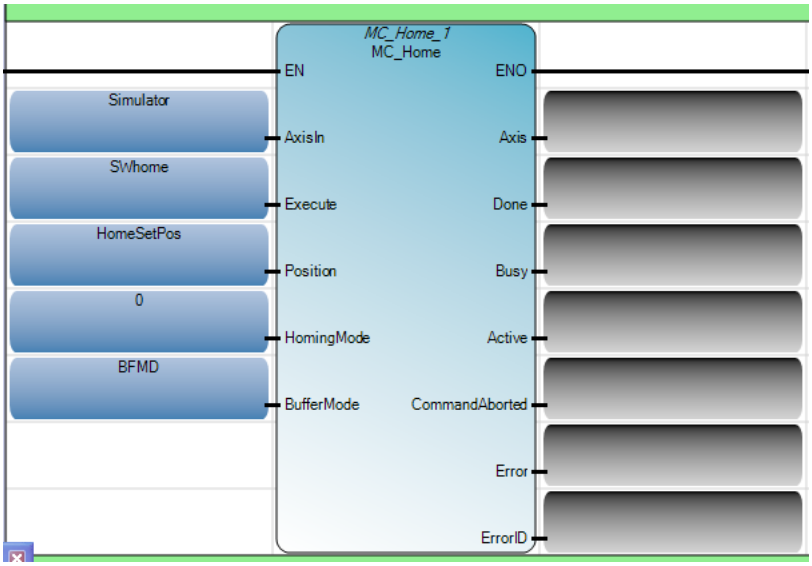


Create and Assign Variables and Values for the MC_Home Function Block

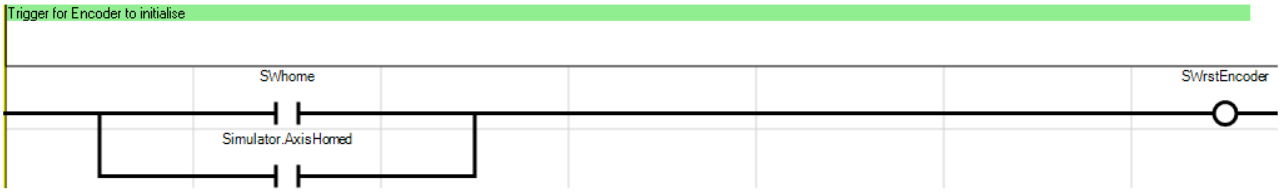
1. Create the following Global Variables with the data types and initial values (if any) as shown in the table.

Variable Name	Data Type	Initial Value
SWHome	BOOL	
HomeSetPos	Real	110
BFMD	SInt	
t#1ms	time	
Simulator.AxisHomed	BOOL	
SWrstEncoder	BOOL	

2. On the first rung, assign the variables for the MC_Home function block elements as shown.

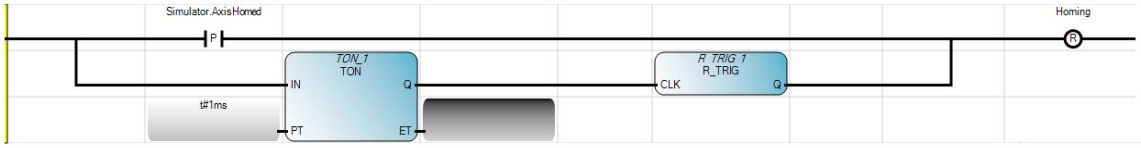


3. On the second rung, assign the variables as shown below.

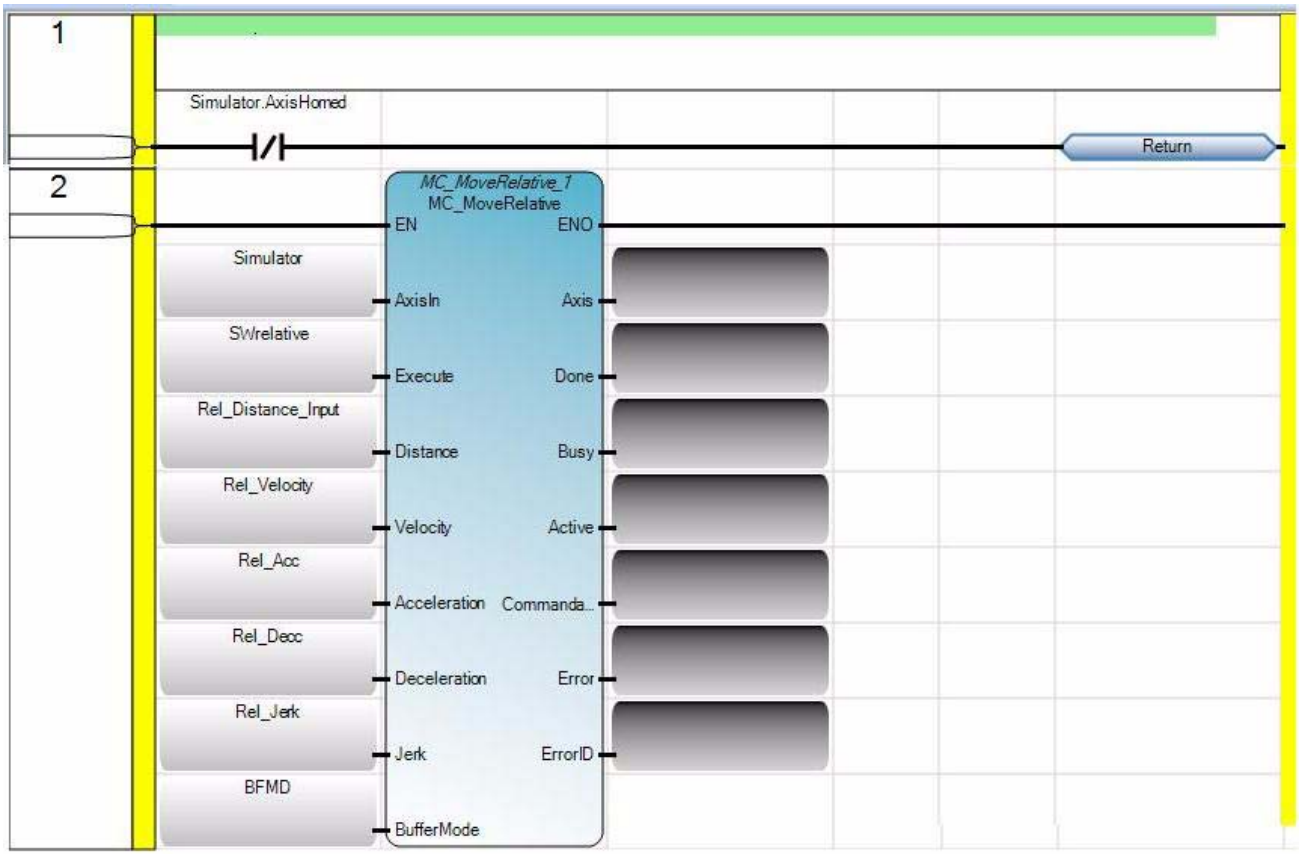


4. On the third rung, assign the variables as shown below.

5. On the fourth rung, assign the variables as shown below.

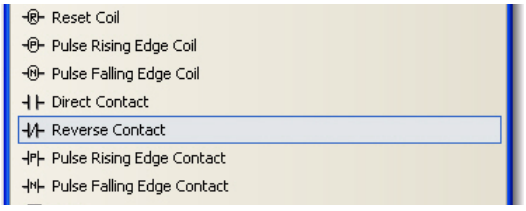


Create Program for MC_MoveRelative

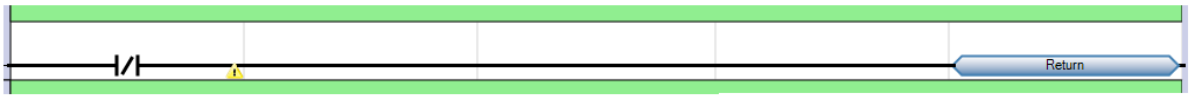


1. Click Programs, select Add → New LD: Ladder Diagram. Press F2 and rename the program to Action_MoveRelative.

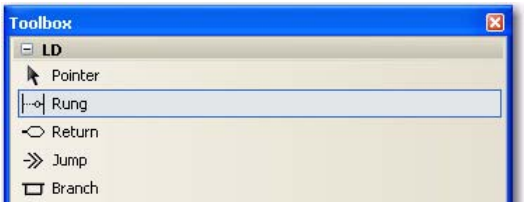
2. From the Toolbox, select Reverse Contact and drag and drop it onto the rung.



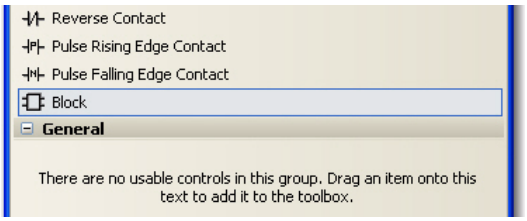
3. From the Toolbox, select Return and drag and drop it onto the rung.
   Your first ladder rung should appear as shown.



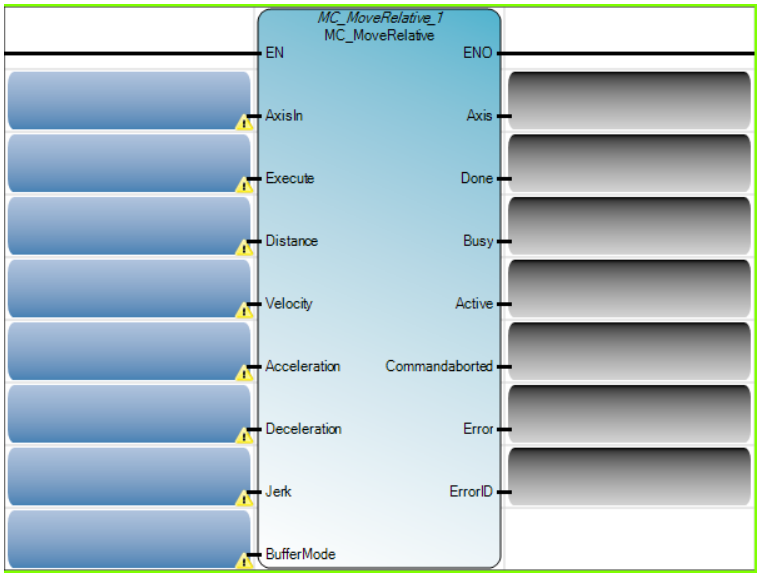
4. Create a second rung. From the Toolbox, select Rung and drag and drop it just below the first rung.



5. From the Toolbox, select Block and drag and drop it onto the second rung.



6. On the Instruction Block Selector window that appears, type MC_MoveRelative to filter out the MC_MoveRelative function block. Choose MC_MoveRelative. Click OK. Your second rung should appear as shown.



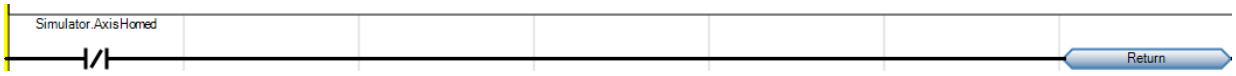
Create and Assign Variables and Values to the MC_MoveRelative Function Block

1. Create the following Global Variables with these data types and initial values.

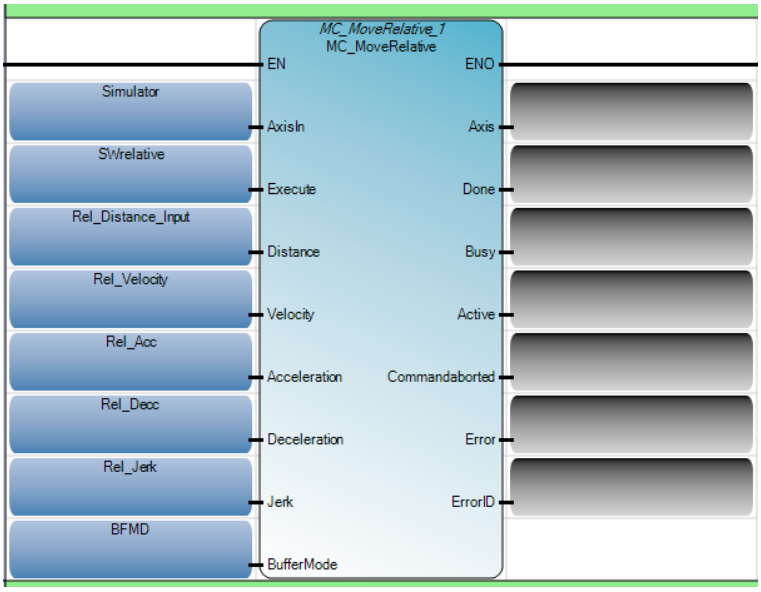
Name	Data Type	Initial Value
	REAL	
Rel_Acc	REAL	1000.0
Rel_Decc	REAL	1000.0
Rel_Distance_Input	REAL	
Rel_Jerk	REAL	10000.0
Rel_Velocity	REAL	100.0

Name	Data Type	Initial Value
SWrelative	BOOL	

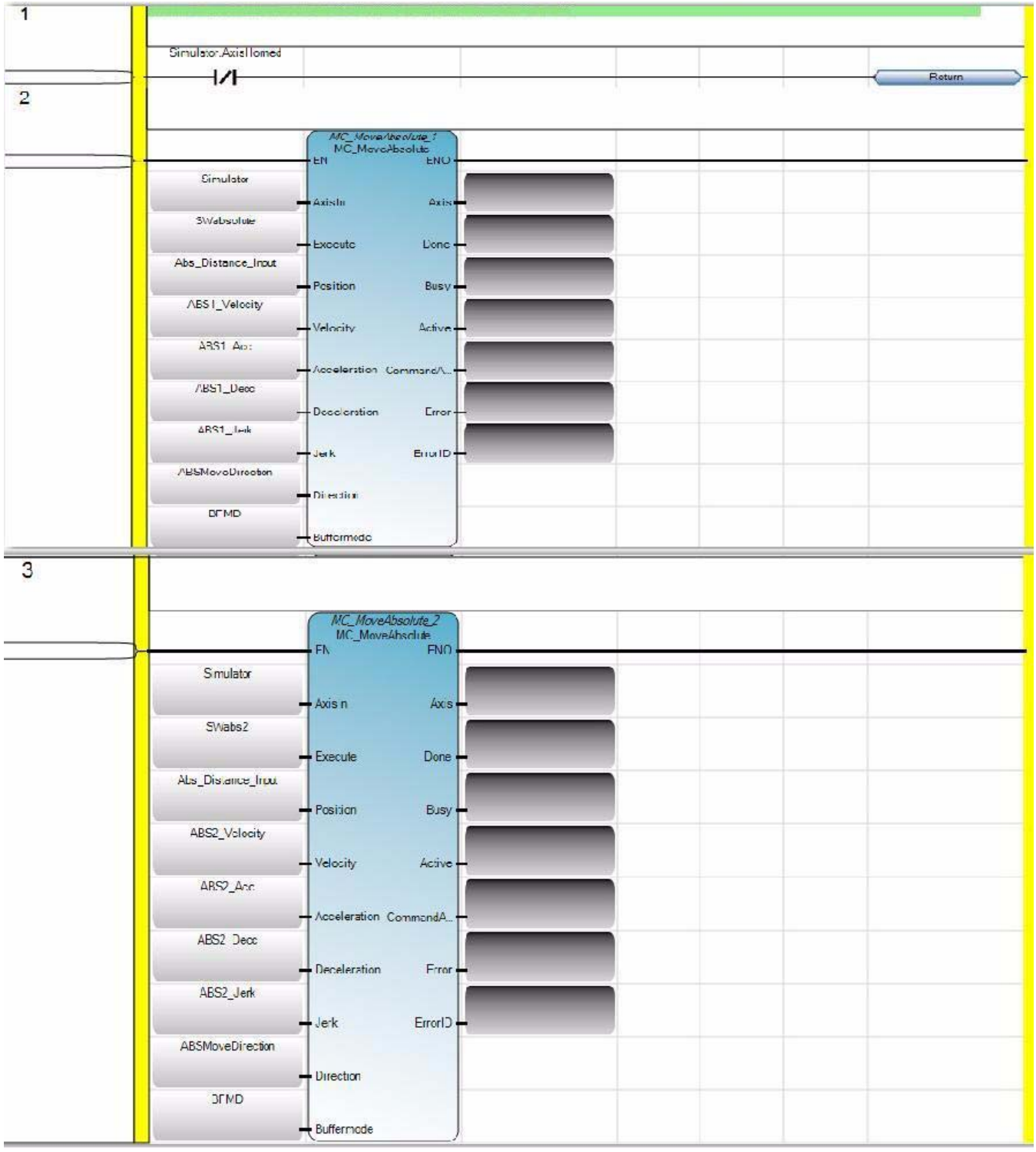
2. On the first rung, assign the variables as shown.



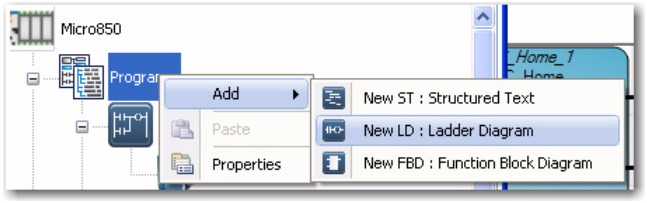
3. On the second rung, assign the variables as shown in the picture.



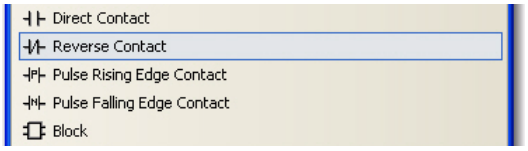
Create Program for MC_MoveAbsolute Function Block



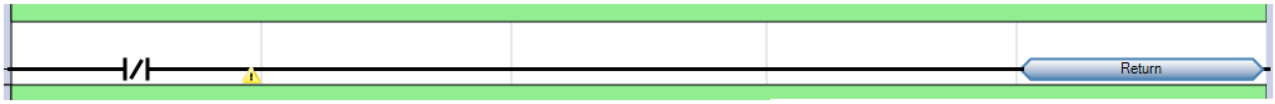
1. Click Programs, select Add → New LD: Ladder Diagram. Press F2 and rename the program to Action_MoveAbsolute.



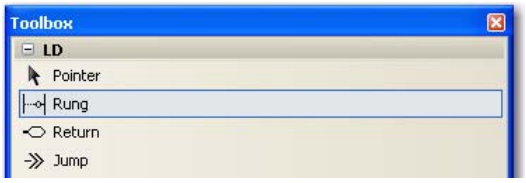
2. From the Toolbox, select Reverse Contact and drag and drop it onto the rung.



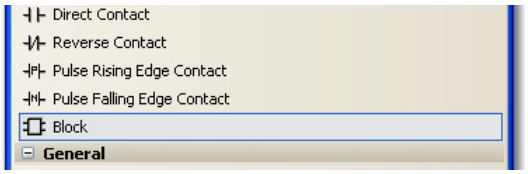
3. From the Toolbox, select Return and drag and drop it onto the rung.
Your first ladder rung should appear as shown.



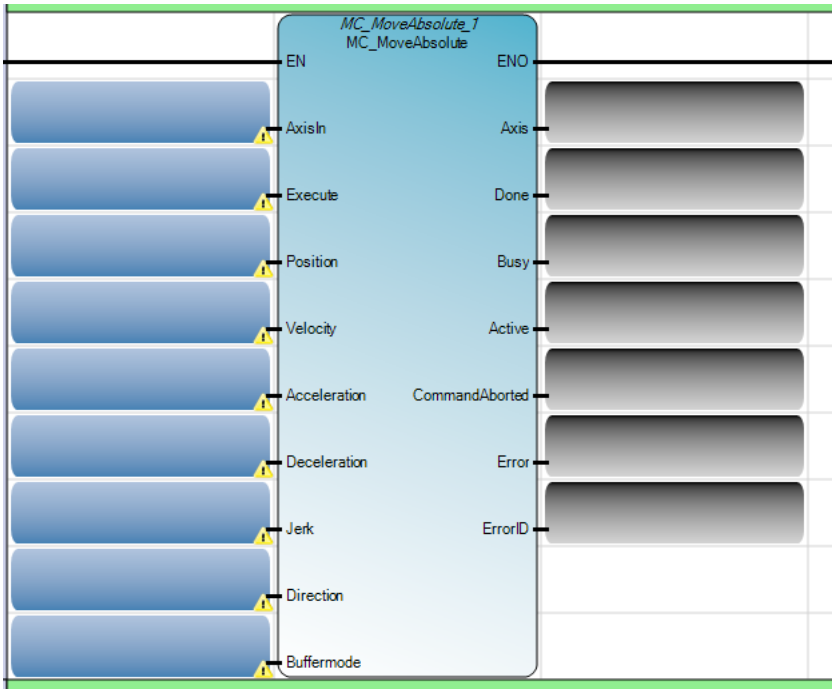
4. Create a second rung. From the Toolbox, select Rung and drag and drop it just below the first rung.



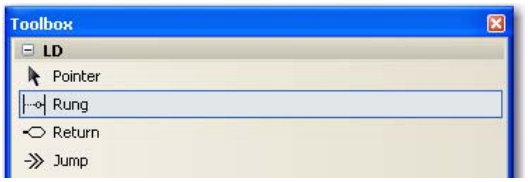
5. From the Toolbox, select Block and drag and drop it onto the second rung.



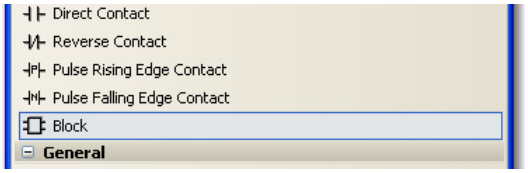
6. On the Instruction Block Selector window that appears, type MC_MoveAbsolute to filter out the MC_MoveAbsolute function block. Choose MC_MoveAbsolute. Click OK. Your second rung should appear as shown in the picture.



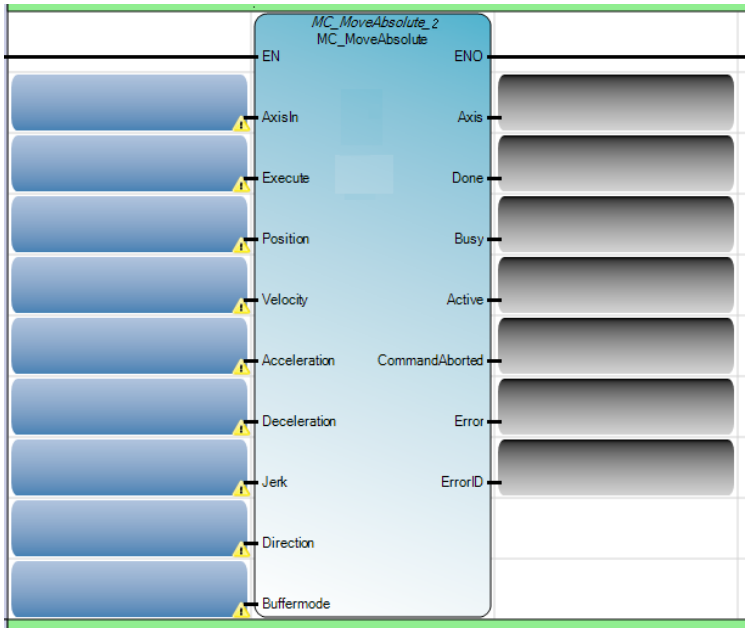
7. Create a third rung. From the Toolbox, select Rung and drag and drop it just below the second rung.



8. From the Toolbox, select Block and drag and drop it onto the third rung.



9. On the Instruction Block Selector window that appears, type MC_MoveAbsolute to filter out the MC_MoveAbsolute function block. Choose MC_MoveAbsolute. Click OK. Your third rung should appear as shown in the picture.



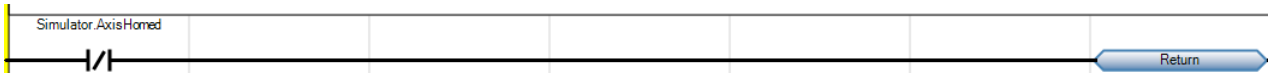
Create and Assign Variables and Values to the MC_MoveAbsolute Function Block

1. Create the following Global Variables with these data types and initial values.

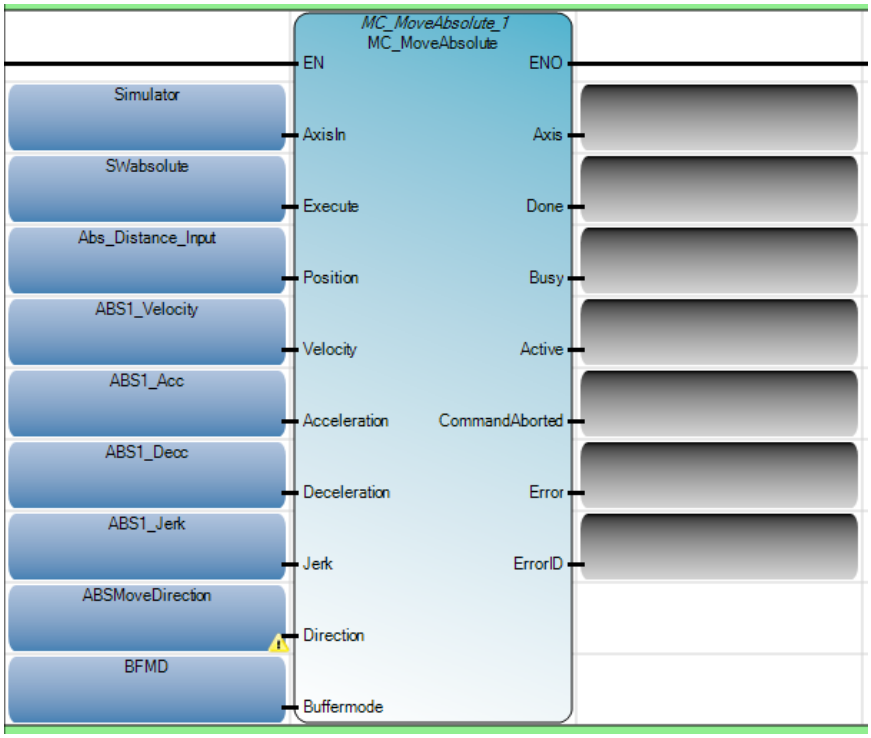
Name	Data Type	Initial Value
SWabs2	BOOL	
ABS1_Velocity	REAL	100.0
ABS1_Acc	REAL	1000.0
ABS1_Decc	REAL	1000.0
ABS1_Jerk	REAL	10000.0
ABS2_Velocity	REAL	100.0
ABS2_Acc	REAL	1000.0
ABS2_Decc	REAL	1000.0
ABS2_Jerk	REAL	10000.0

Name	Data Type	Initial Value
SWabsolute	BOOL	
Abs_Distance_Input	REAL	

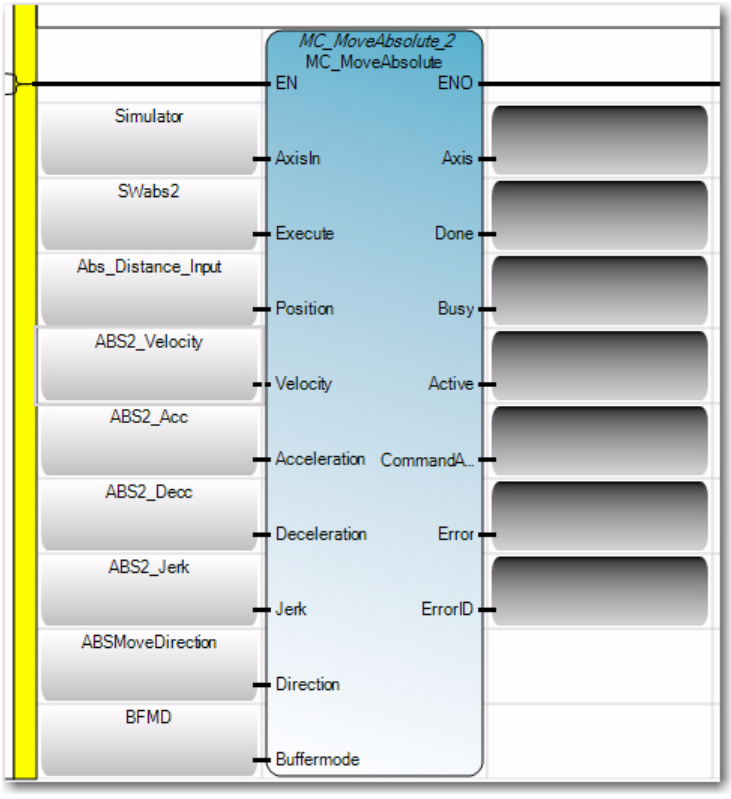
2. On the first rung, assign the variables as shown.



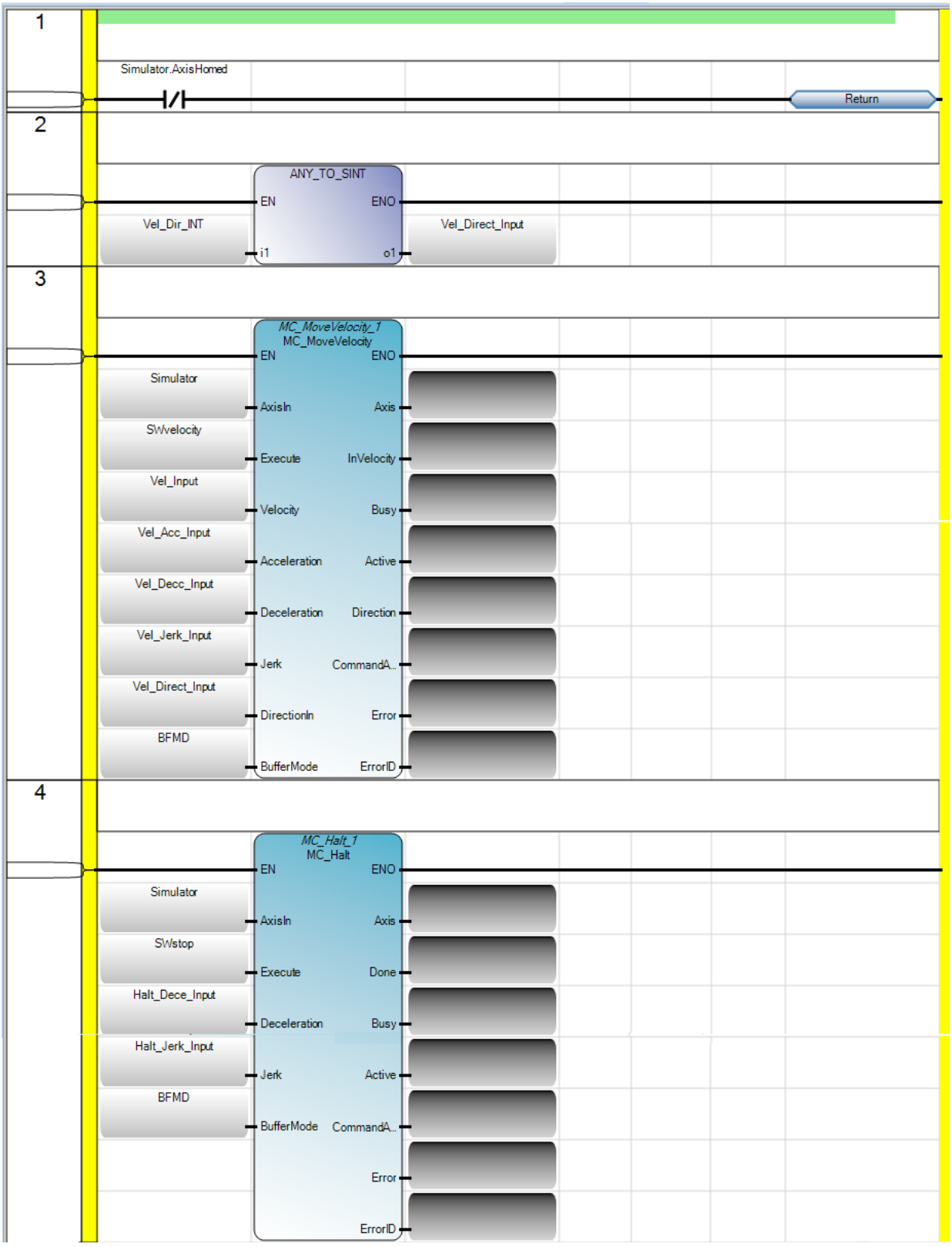
3. On the second rung, assign the variables as shown.



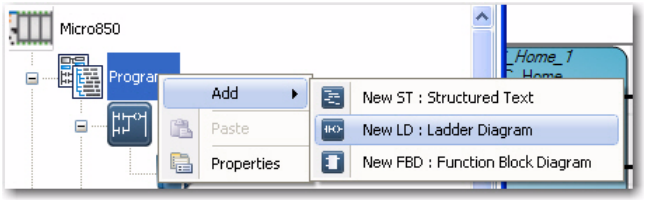
4. On the third rung, assign the variables as shown.



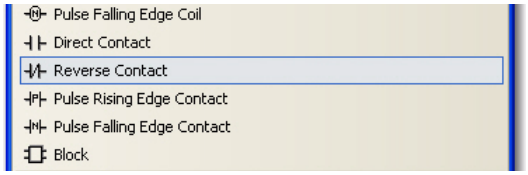
Create Program for MC_MoveVelocity Function Block



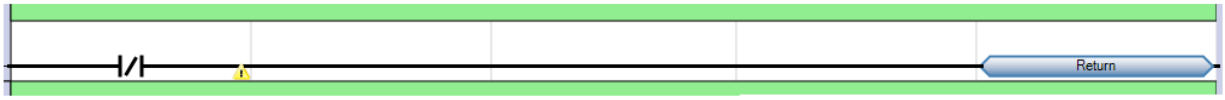
1. Click Programs, select Add → New LD: Ladder Diagram. Press F2 and rename the program to Action_MoveVelocity.



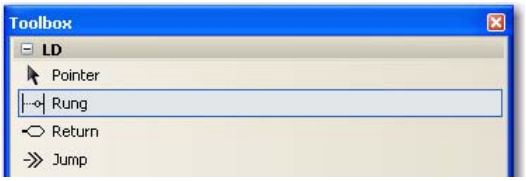
2. From the Toolbox, select Reverse Contact and drag and drop it onto the rung.



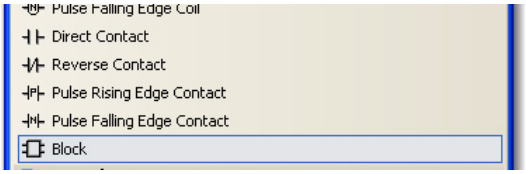
3. From the Toolbox, select Return and drag and drop it onto the rung. The first rung should appear as shown.



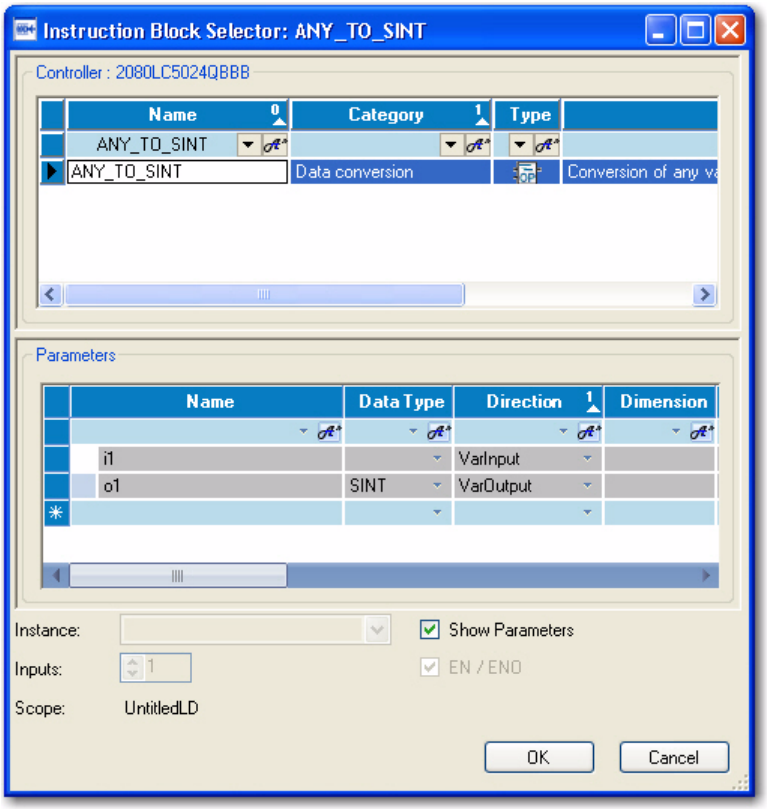
4. Create a second rung. From the Toolbox, select Rung and drag and drop it onto the space just below the first rung.



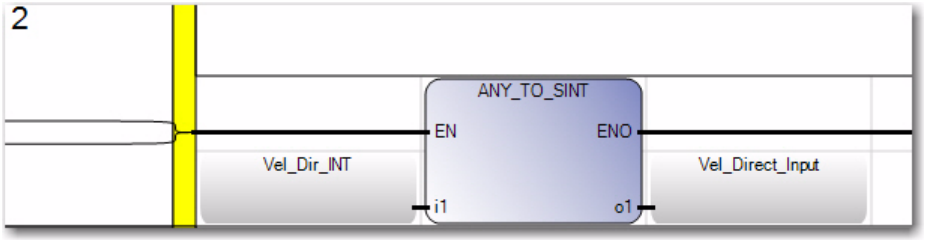
5. From the Toolbox, select Block and drag and drop it onto the second rung.



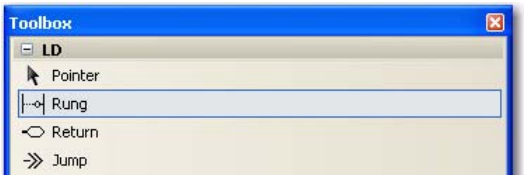
6. On the Instruction Block Selector window that appears, type ANY_TO_SINT to filter out the function block. Choose ANY_TO_SINT. Click OK.



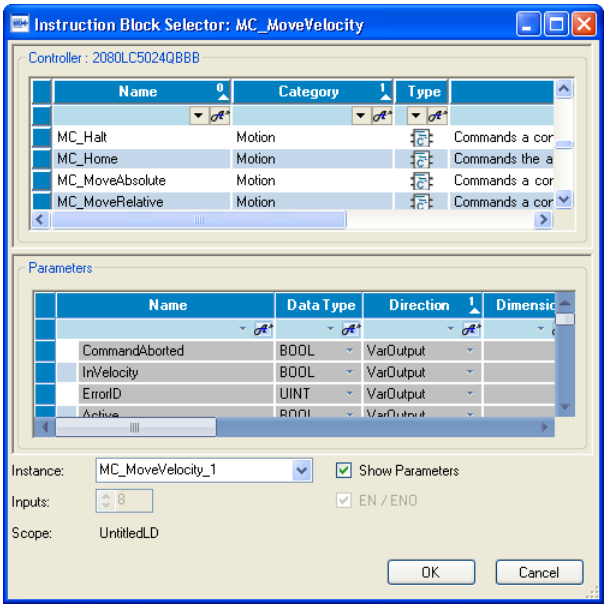
Your second rung should appear as follows:



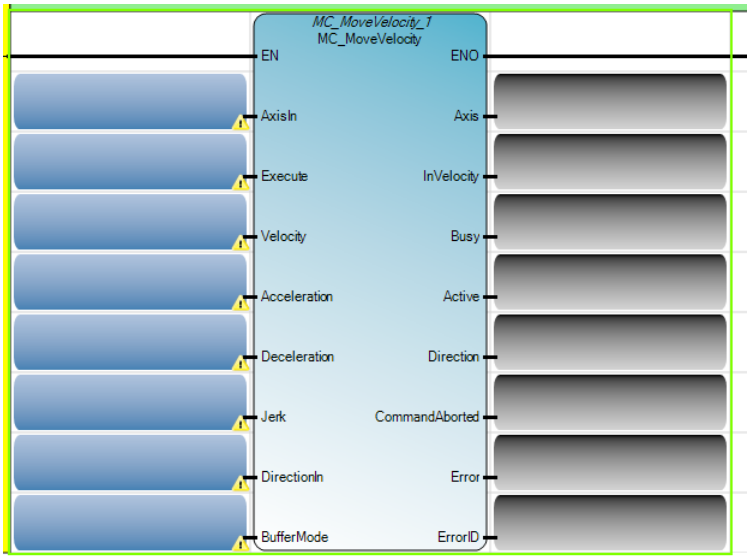
7. Create a third rung. From the Toolbox, select Rung and drag and drop it onto the space just below the second rung.



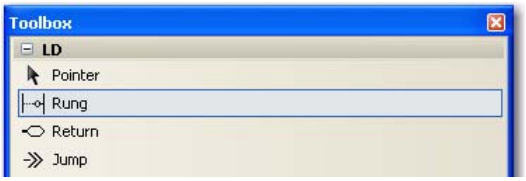
8. On the Instruction Block Selector window that appears, type MC_MoveVelocity to filter out the MC_MoveVelocity function block. Choose MC_MoveVelocity. Click OK.



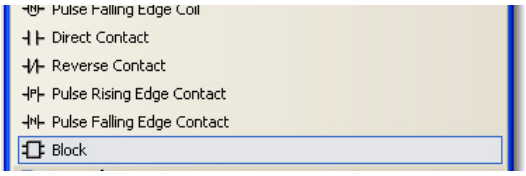
Your third rung should appear as follows:



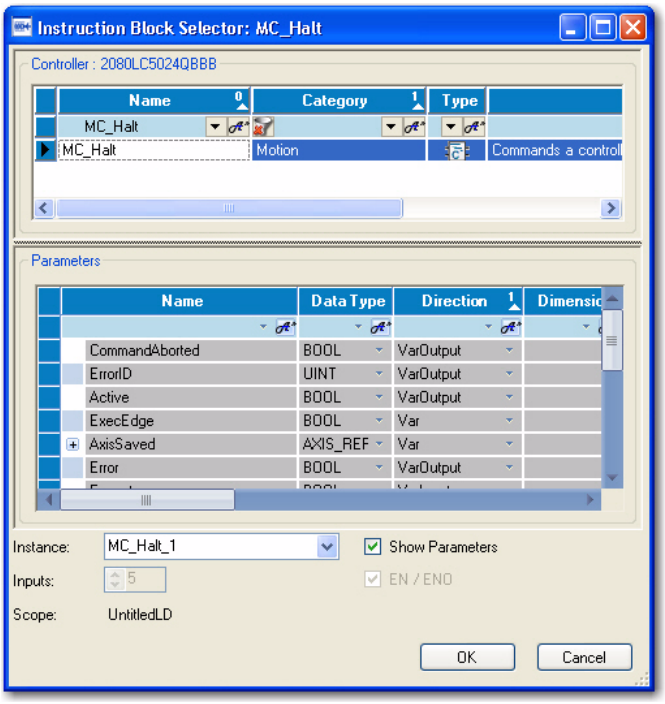
9. Create a fourth rung. From the Toolbox, select Rung and drag and drop it onto the space just below the second rung.



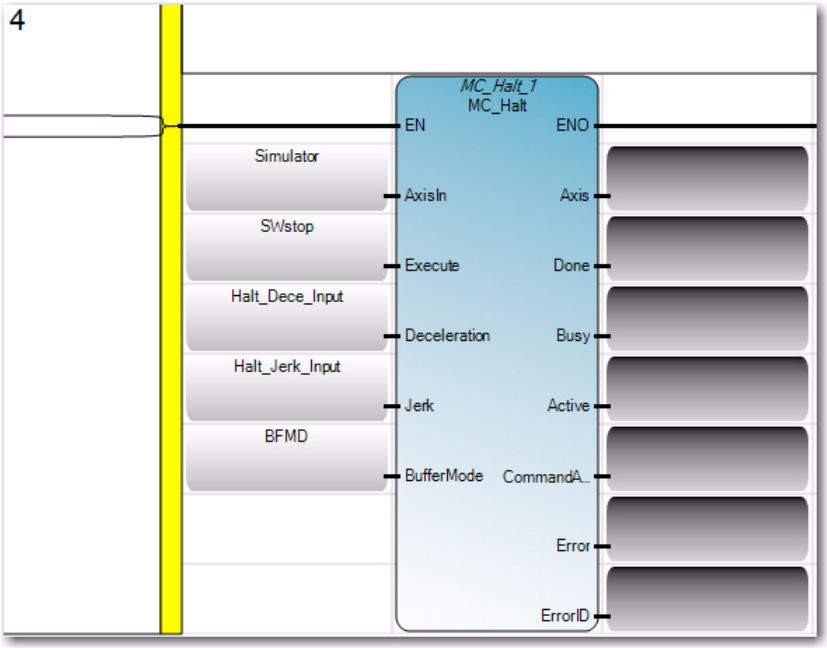
10. From the Toolbox, select Block and drag and drop it onto the fourth rung.



11. On the Instruction Block Selector window that appears, type MC_Halt to filter out the MC_Halt function block.
Choose MC_Halt.
Click OK.



Your fourth rung should appear as shown:

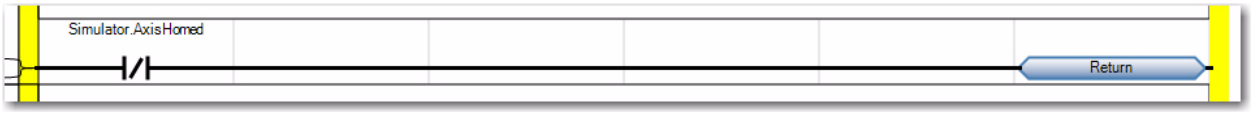


Create and Assign Variables and Values to the MC_MoveVelocity Function Block

1. Create the following Global variables with these data types and initial values.

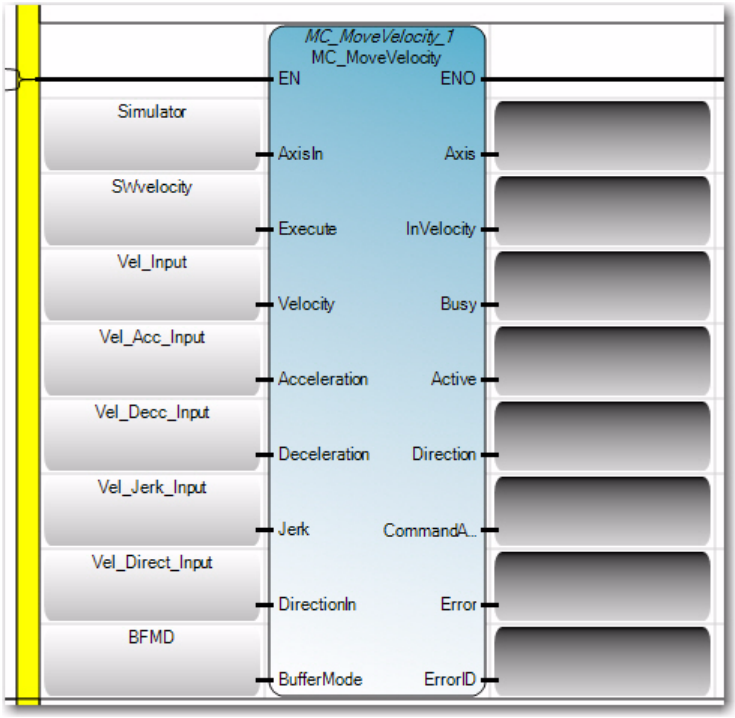
Name	Data Type	Initial Value
SWvelocity	BOOL	
Vel_Input	REAL	50.0
Vel_Direct_Input	SINT	1
Vel_Acc_Input	REAL	1000.0
Vel_Dir_INT	INT	
Vel_Decc_Input	REAL	1000.0
Vel_Jerk_Input	REAL	10000.0
Halt_Dece_Input	REAL	1000.0
Halt_Jerk_Input	REAL	10000.0

2. On the first rung, assign the variables as shown in the following picture.

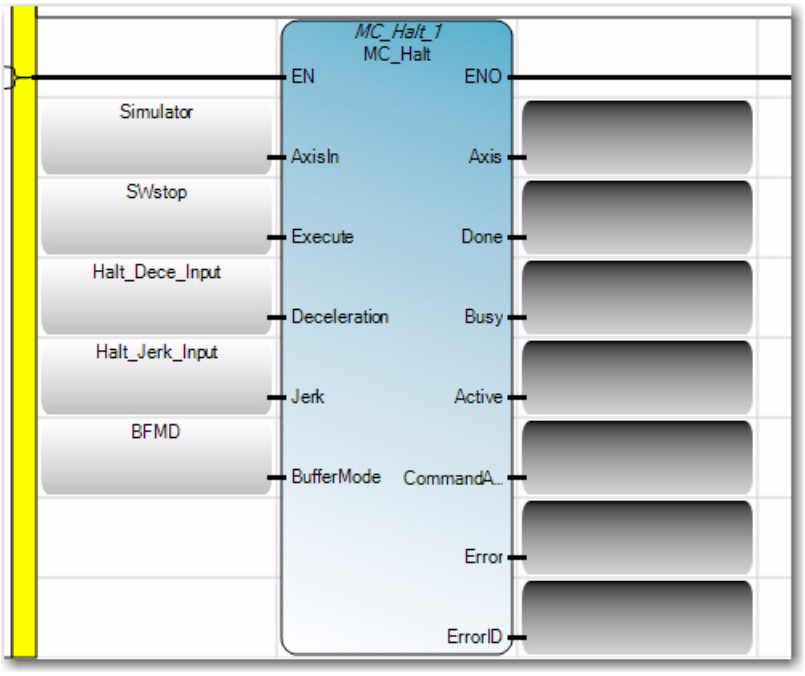


3. On the second rung, assign the variables as shown.

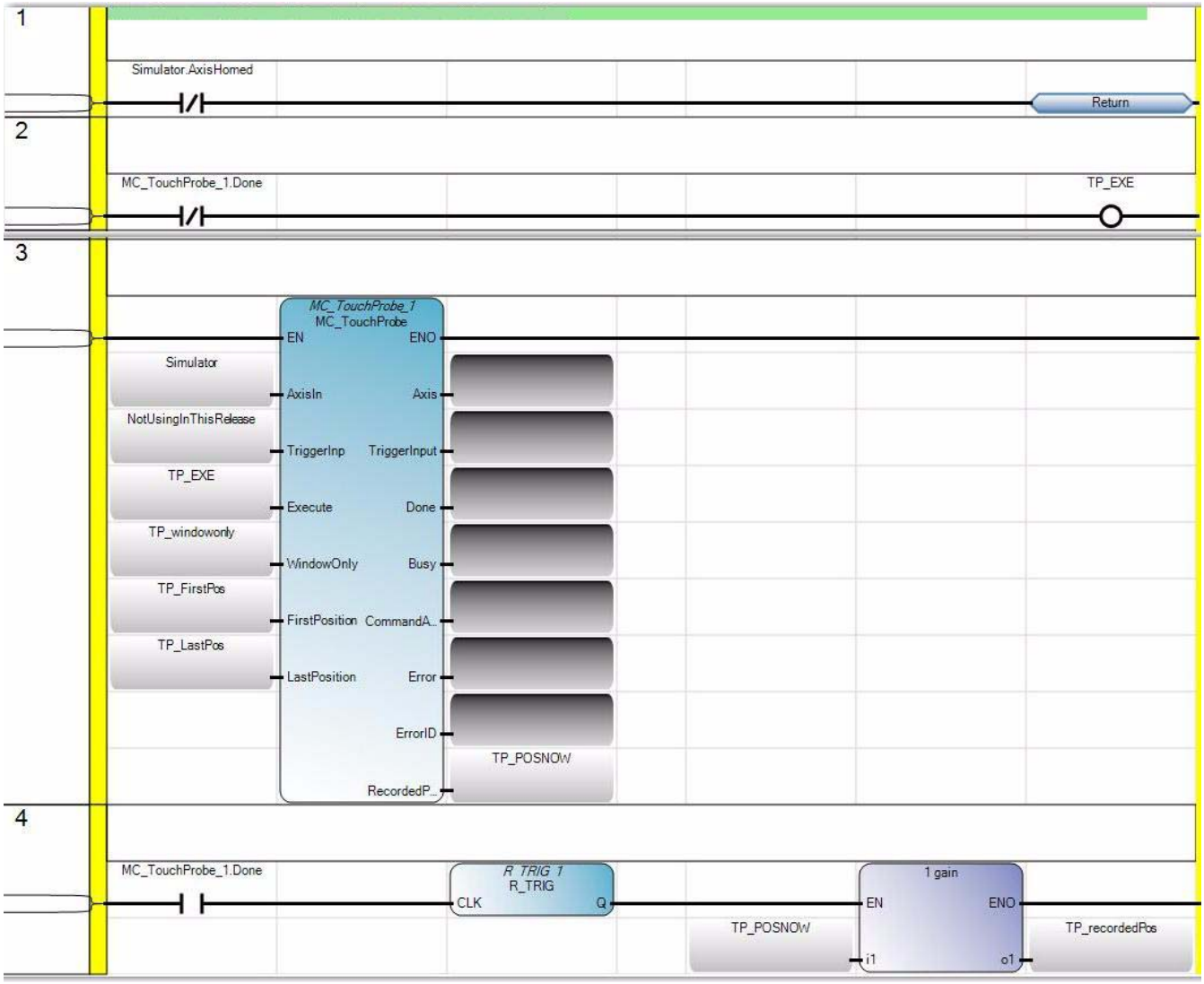
4. On the third rung, assign the variables as shown.



5. On the fourth rung, assign the variables as shown.

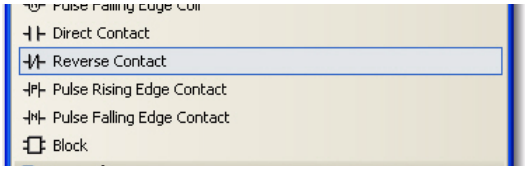


Create Program for MC_TouchProbe Function Block

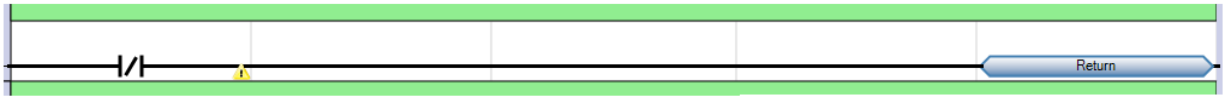


1. Click Programs, select Add → New LD: Ladder Diagram. Press F2 and rename the program to Action_TouchProbe.

2. From the Toolbox, select Reverse Contact and drag and drop it onto the rung.

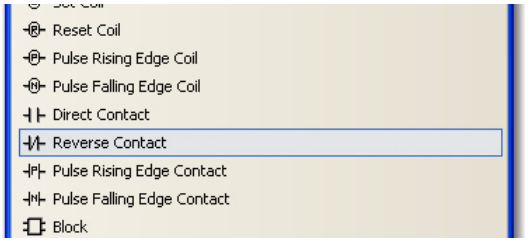


3. From the Toolbox, select Return and drag and drop it onto the rung.
   Your first ladder rung should appear as shown.

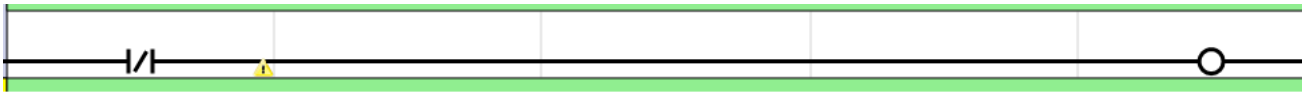


4. Create a second rung. From the Toolbox, select Rung and drag and drop it below the first rung.

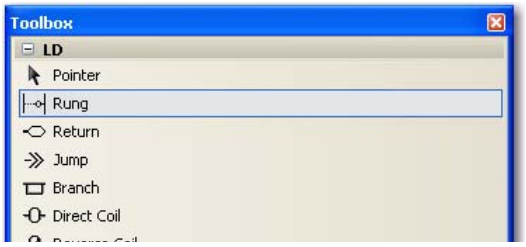
5. From the Toolbox, select Reverse Contact and drag and drop it onto the second rung.



6. From the Toolbox, select Direct Coil and drag and drop it onto the second rung.

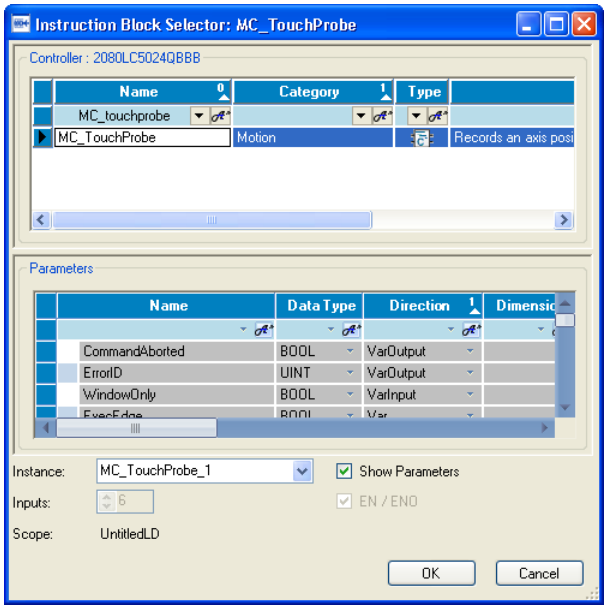


7. Create a third rung. From the Toolbox, select Rung and drag and drop it below the second rung.

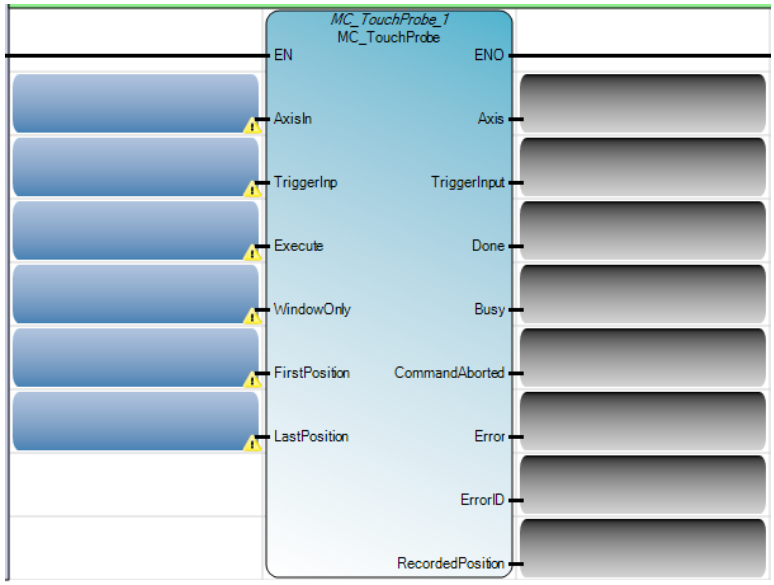


8. From the Toolbox, select Block and drag and drop it onto the third rung.

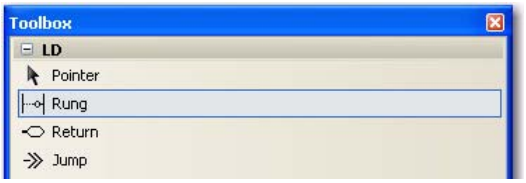
9. On the Instruction Block Selector window that appears, type MC_TouchProbe to filter out the MC_TouchProbe function block. Choose MC_TouchProbe. Click OK.



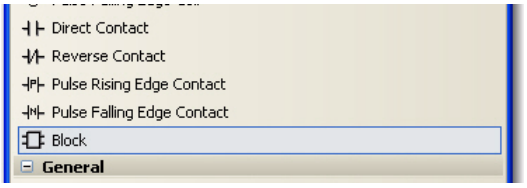
Your third rung should appear as shown.



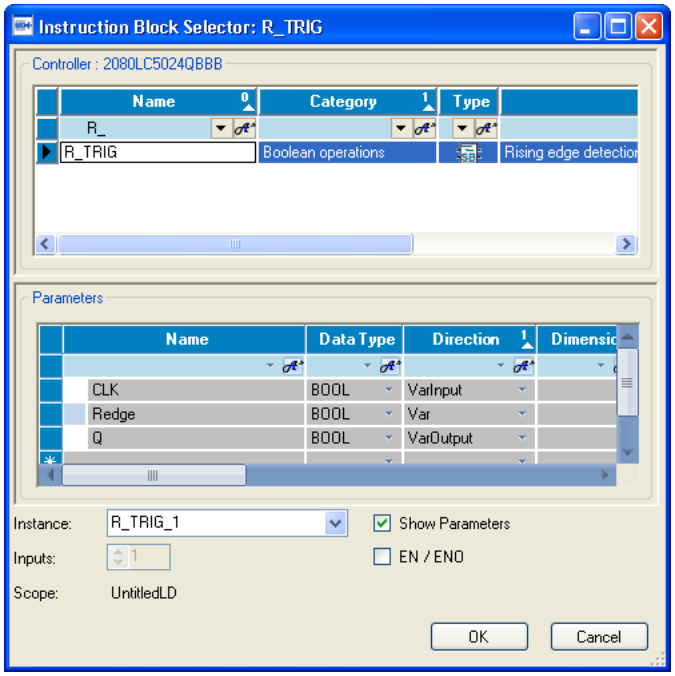
10. Create a fourth rung. From the Toolbox, select Rung and drag and drop it below the third rung.



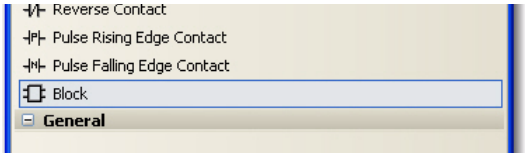
11. From the Toolbox, select Block and drag and drop it onto the fourth rung.



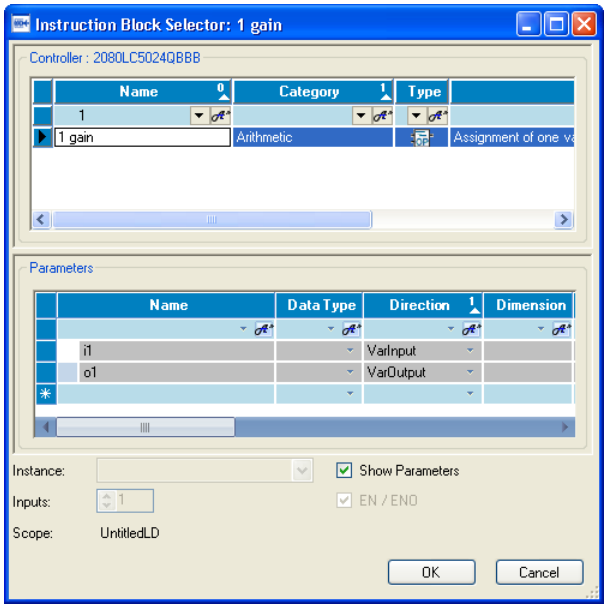
12. On the Instruction Block Selector window that appears, type R_TRIG to filter out the R_TRIG function block. Choose R_TRIG. Click OK.



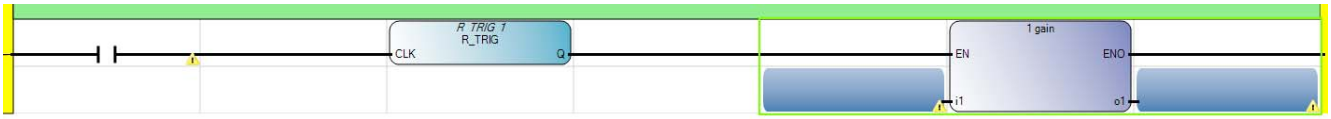
13. From the Toolbox, select Block and drag and drop it onto the fourth rung.



14. On the Instruction Block Selector window that appears, type 1 gain to filter out 1 gain. Choose 1 gain. Click OK.



Your fourth rung should appear as follows.

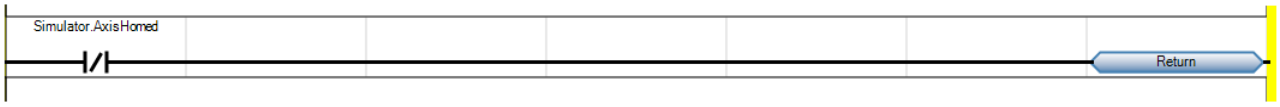


Create and Assign Variables and Values to the Action_TouchProbe program

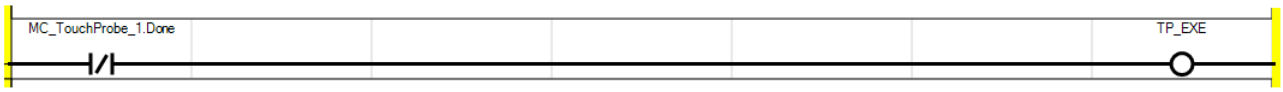
1. Create the following Global Variables with these data types and initial values.

Name	Data Type	Initial Value
TP_windowonly	BOOL	FALSE
TP_FirstPos	REAL	110.0
TP_LastPos	REAL	900.0
TP_recordedPos	REAL	

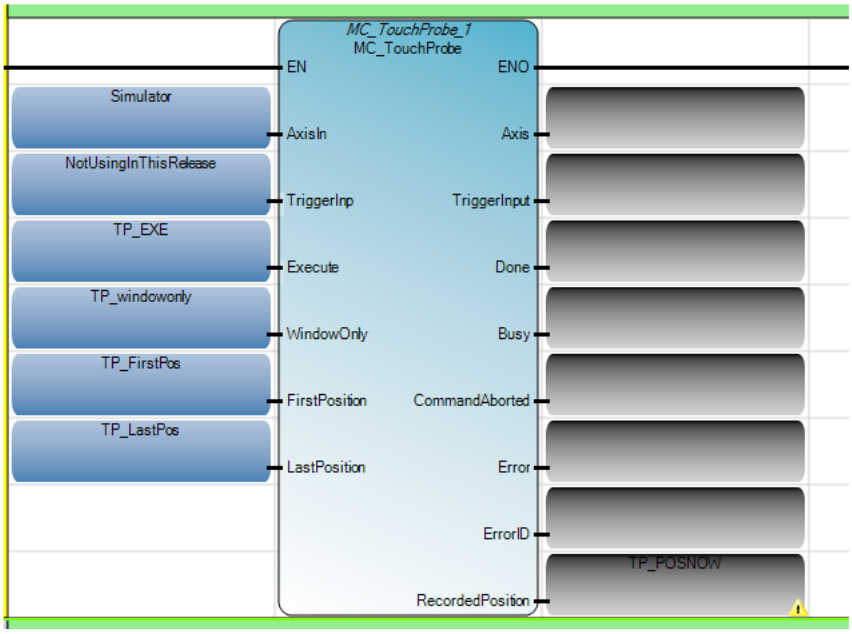
2. Assign variables to the elements on the first rung as shown.



3. Assign variables to the elements on the second rung as shown.



4. Assign variables to the elements on the third rung as shown.



5. Assign variables to the elements on the fourth rung as shown.

6. Save the program.

Build and Download Programs

After writing the programs, build and download the user program into the controller.

Wire Your Controller for Motion Control

Introduction

In this chapter, you will wire your controller based on the sample project wiring configuration.

IMPORTANT	The wiring diagram presented in this chapter serves the purpose of a simulation project only. To help you wire your controller to an actual servo drive for motion control, refer to the chapter, "Positioning with Embedded Pulse Train Outputs" in the Micro830 and Micro850 Programmable Controllers User Manual, 2080-UM002.

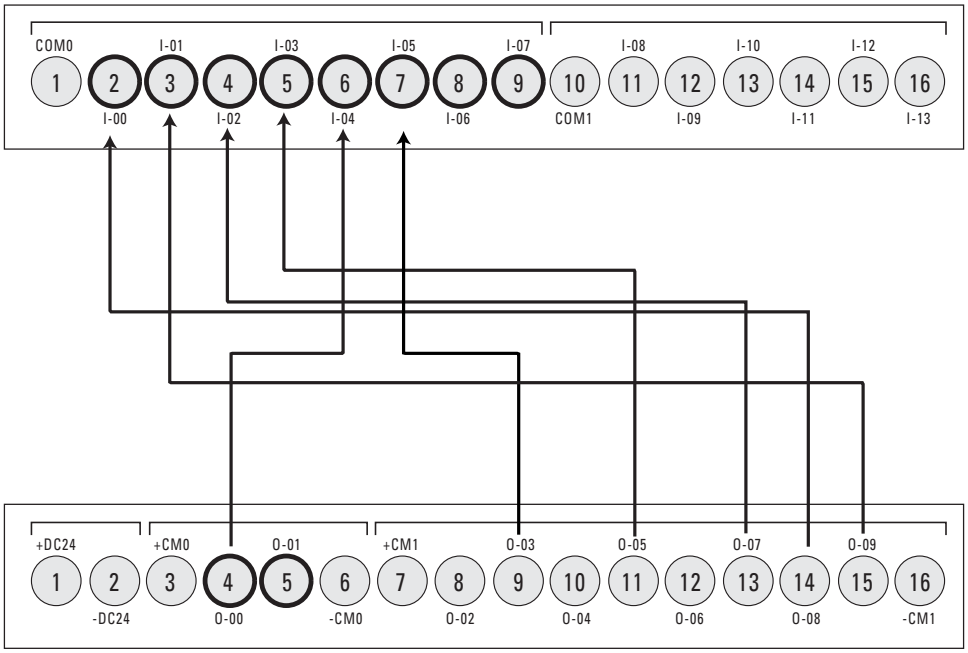
What You Need

- 2080-LC30-xxQVB, 2080-LC30-xxQBB, 2080-LC50-xxQBB, 2080-LC50-xxQVB controller
- PanelView Component (optional)

Wire the Controller

Wire the controller based on the wiring configuration indicated in the following drawing and table.

Input Terminal Block



Output Terminal Block

Input Channel	Logical Variable Name in Software	Description
2	_IO_EM_DI_00	Limit_L
3	_IO_EM_DI_01	Limit_R
4	_IO_EM_DI_02	Home
5	_IO_EM_DI_03	Probe
6	_IO_EM_DI_04	PTO0-IN
7	_IO_EM_DI_05	DIR0-IN
8	_IO_EM_DI_06	
9	_IO_EM_DI_07	
11	_IO_EM_DI_08	
12	_IO_EM_DI_09	DriverReady
13	_IO_EM_DI_10	
14	_IO_EM_DI_11	
15	_IO_EM_DI_12	
16	_IO_EM_DI_13	

Output Channel	Logical Variable Name in Software	Description
4	_IO_EM_DO_00	PTO0
5	_IO_EM_DO_01	
8	_IO_EM_DO_02	
9	_IO_EM_DO_03	DIR0
10	_IO_EM_DO_04	Driver Ready Sensor
11	_IO_EM_DO_05	Touch Probe Sensor
12	_IO_EM_DO_06	Drive Enable
13	_IO_EM_DO_07	Home Sensor
14	_IO_EM_DO_08	L Limit Sensor
15	_IO_EM_DO_09	R Limit Sensor

Execute Your Motion Control Function Blocks

Introduction

In this chapter, you will use the different motion function blocks to control the movement and direction of the axis. At the end of the chapter, you should be more familiar with the movement function blocks and their operation.

Before You Begin

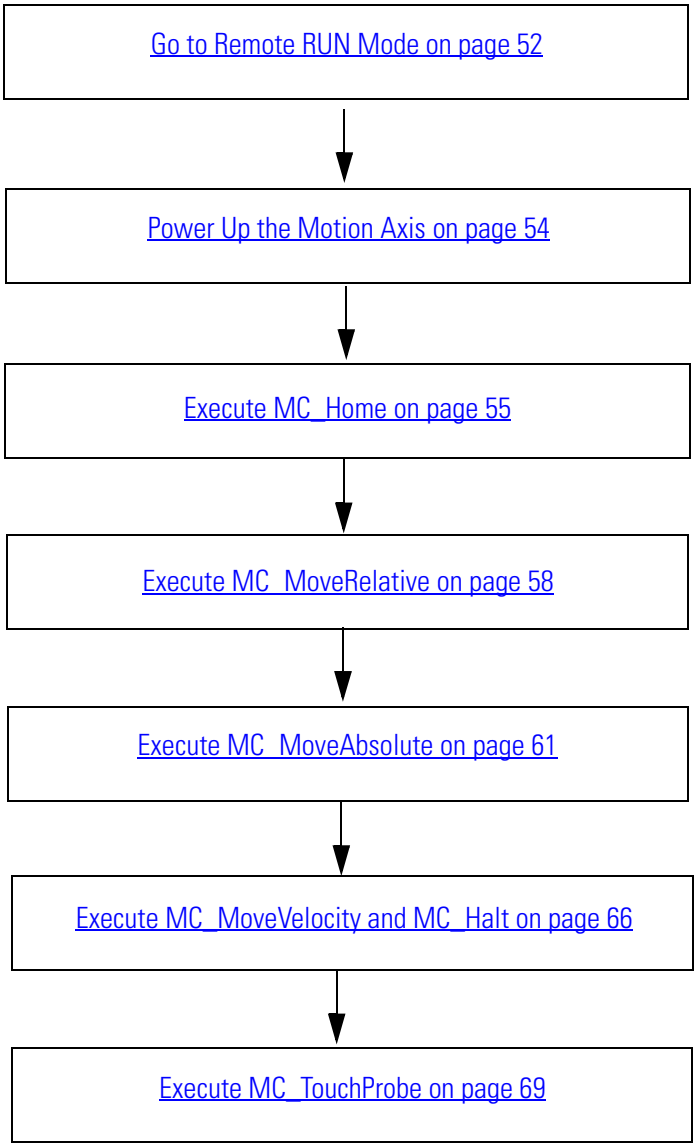
Familiarize yourself with the motion control function blocks by referring to the Micro830 and Micro850 Programmable Controllers User Manual, publication 2080-UM002 and/or the Connected Components Workbench Online Help.

What You Need

- Connected Components Workbench revision 2 or later
- Firmware revision 2 and later for Micro830 controllers

Follow These Steps

To execute the motion function blocks, perform the following steps.

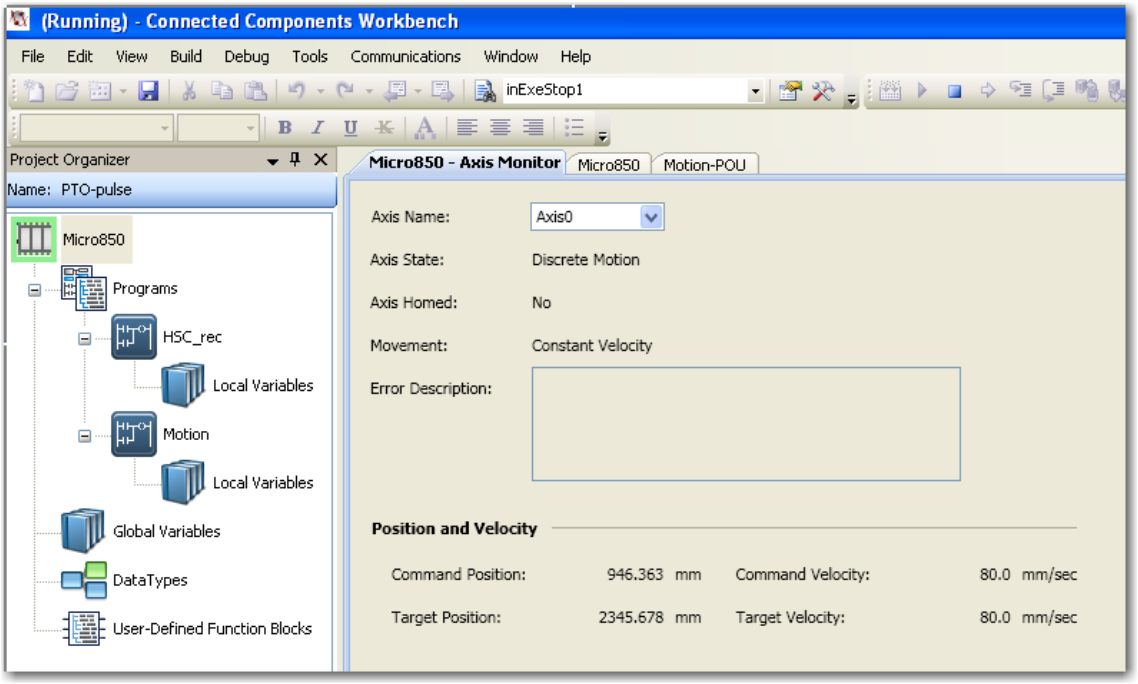


Go to Remote RUN Mode

Before you execute your motion control function blocks, go to Remote RUN mode, and enable Debug mode through the Connected Components Workbench software.

Axis Monitoring

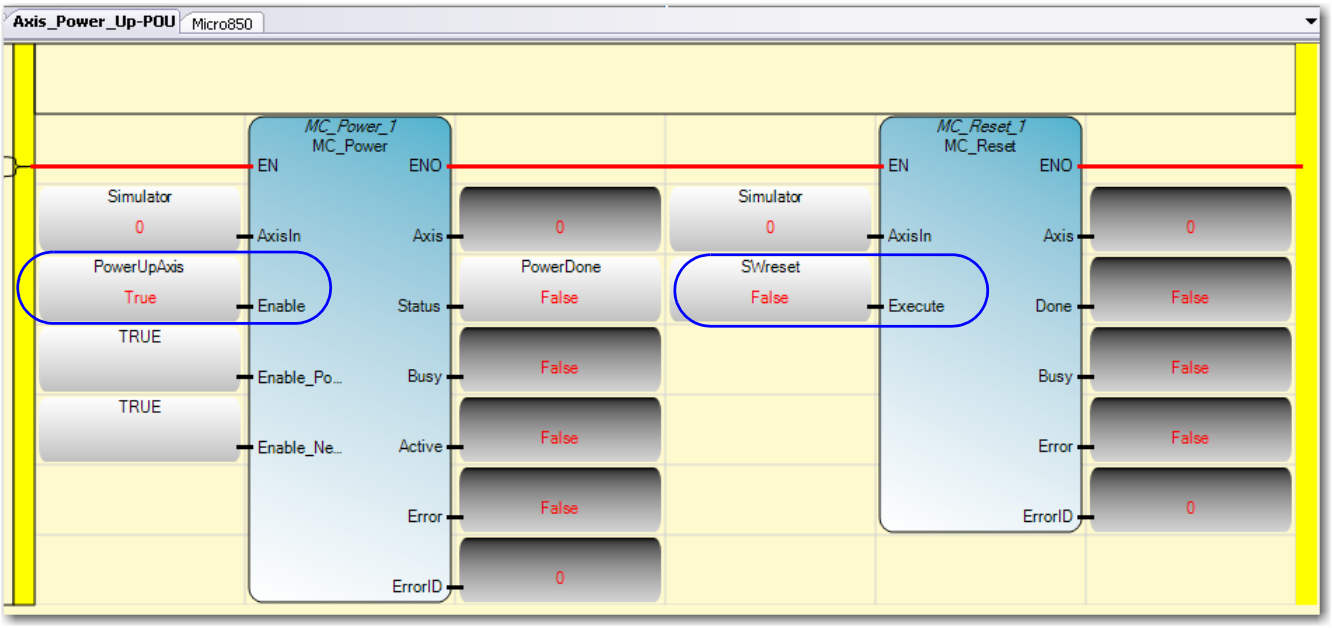
Note that while in DEBUG mode, you can always check the status of your axis and access diagnostic information through the Axis Monitor feature in Connected Components Workbench.



Power Up the Motion Axis

The MC_Power function block controls the power stage of the axis, whether ON or OFF. The MC_Reset function block transitions the axis state from ErrorStop to StandStill by resetting all internal axis-related errors. The outputs of the function block instances are not changed.

The Axis_PowerUp variable has an initial value of TRUE so the axis powers up as soon as the controller enters RUN mode. When the axis is powered up, the DriveEnable output is TRUE.



The SWReset variable is set to initial value of False so that the MC_Reset function block does not execute until thePanelView Component sets it to True (or SWReset is set to True in Debug mode in Connected Components Workbench using the Variable Monitor). Setting the SWReset variable to True clears any errors.

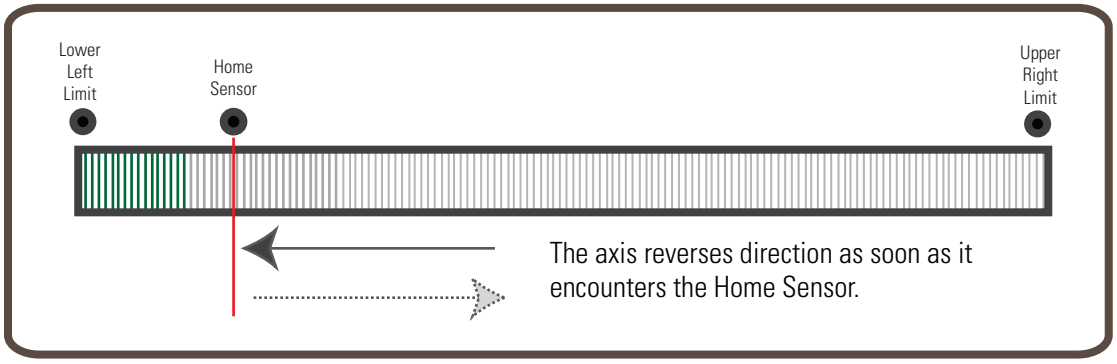
To use this sample project with the PanelView Component, you can download the PanelView Component program code for the project from the following link:

http://www.rockwellautomation.com/go/scmicro800

Execute MC_Home

The MC_Home function block commands the axis to perform the "search home" sequence. The Home Sensor is connected to the configured Home Switch input (see Configure Homing Properties on page 12 for the configuration).

For this simulation, the initial position is initialized to 300 mm so that when the homing sequence starts in the negative direction, the axis moves to the left until the Home Sensor is reached. The axis then reverses direction and creeps back until the Home Sensor is encountered again and the Home Sensor input transitions from True to False. The negative edge is used to mark the Home position.



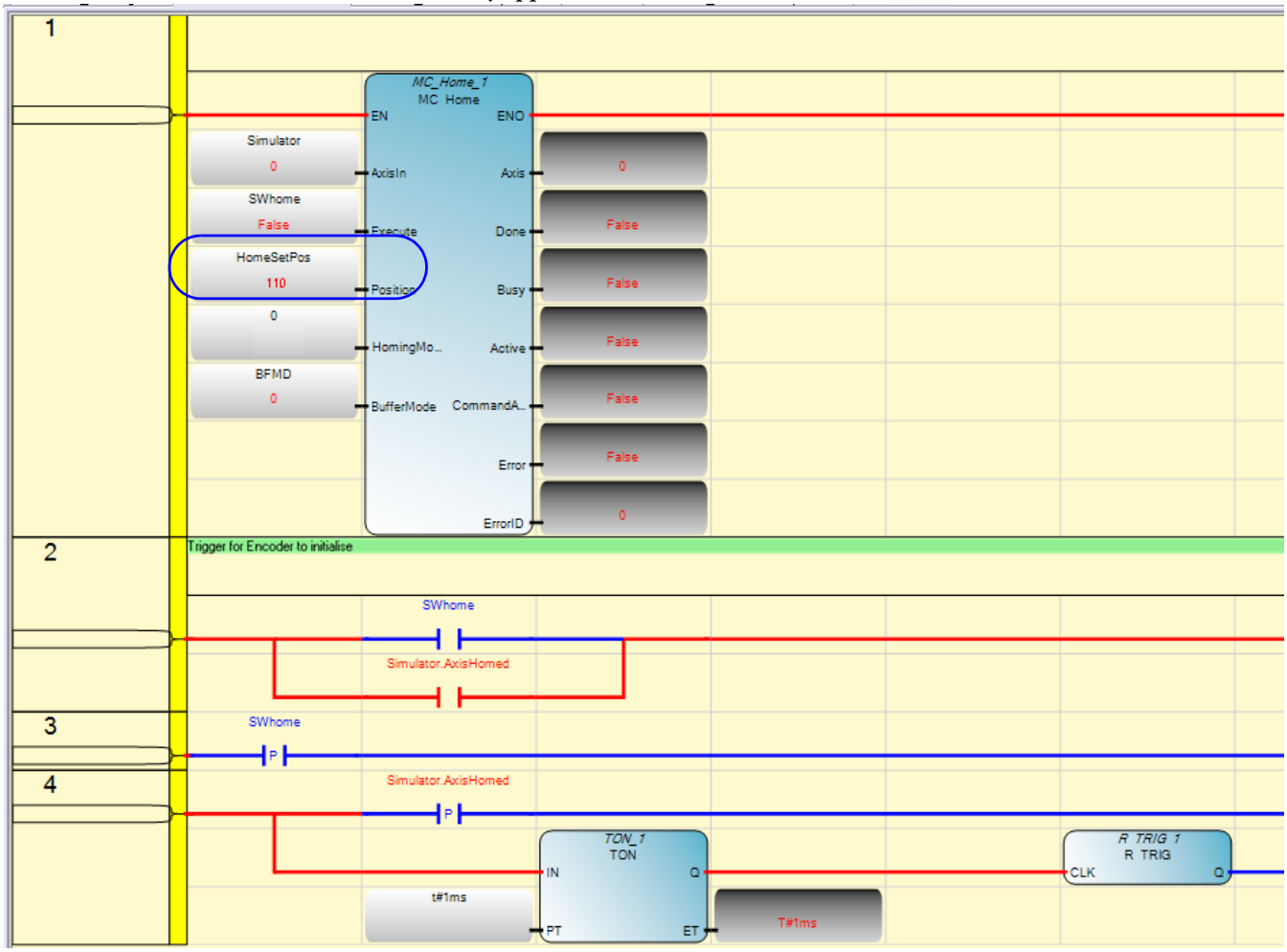
The following sequence describes the homing method used in this simulation project:

1. Moving part moves to its left side (in negative direction);
2. When home switch is detected, the moving part decelerates to a stop;
3. Moving part moves back (in positive direction) in creep velocity to detect Home Switch On → Off edge.
4. Once Home Switch On → Off is detected, record the position as mechanical home position, and decelerate to stop;
5. Move to the configured home position (the mechanical home position recorded during moving back sequence, plus the home offset configured in axis configuration in Connected Components Workbench.

The function block completes at "StandStill" if the homing sequence is successful.

MC_Home can only be aborted by the function blocks MC_Stop or MC_Power. Any abort attempt from other moving function blocks will result in function block failure with Error ID = MC_FB_ERR_STATE. However, homing operation is not interrupted, and can be executed as usual.

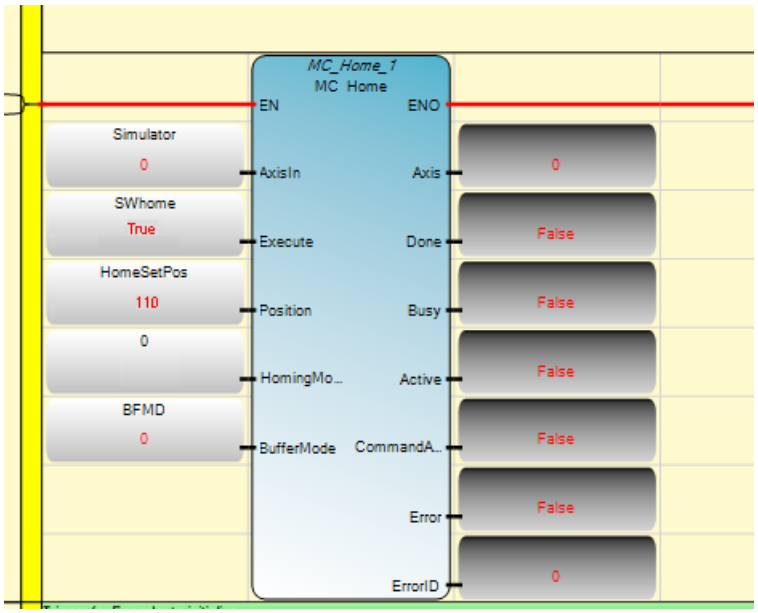
The MC_Home function block should initially appear as follows.



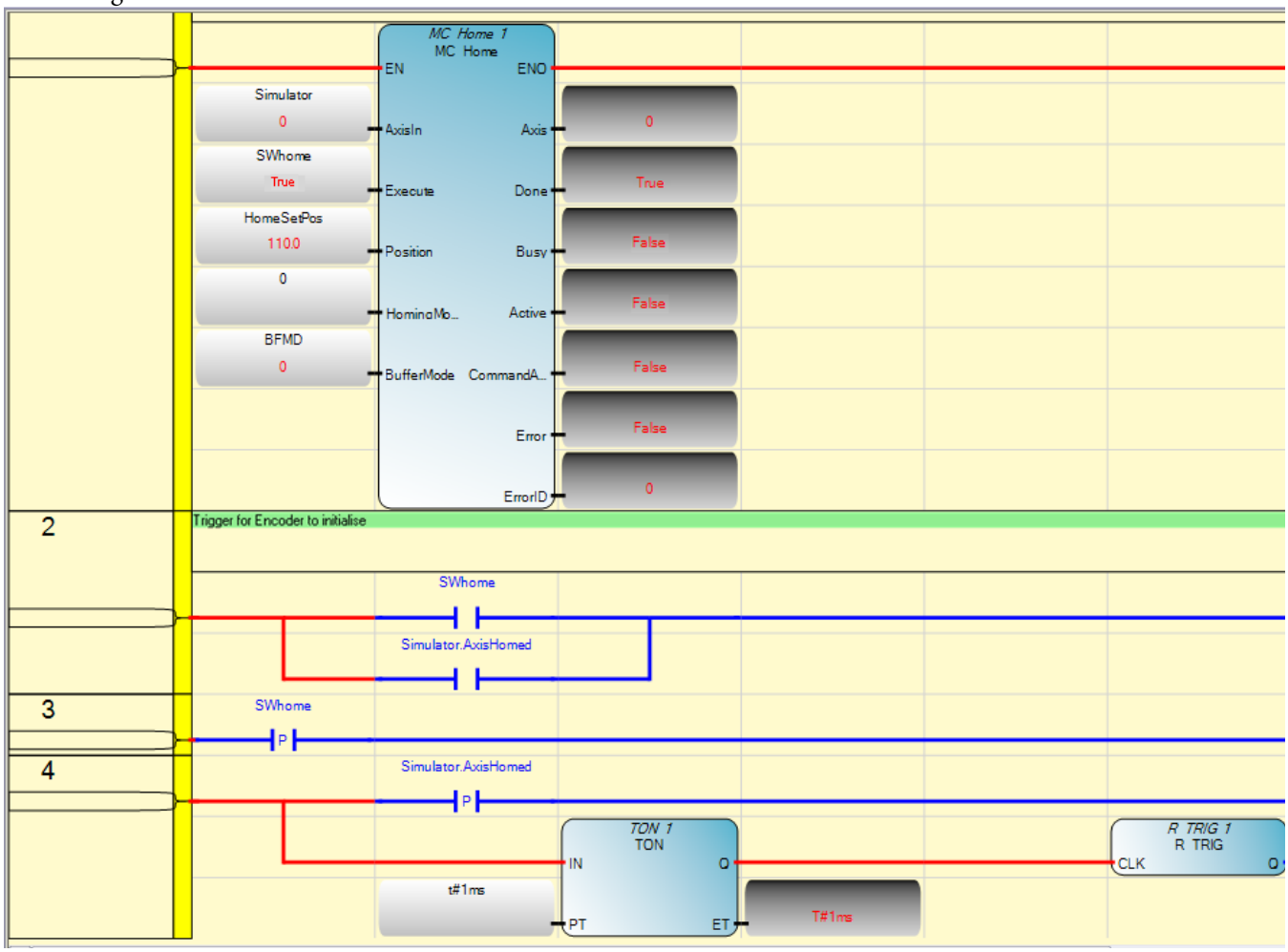
1. Set the SWHome variable input to True to trigger the MC_Home function block.

   When the Homing sequence is complete with no error, the Done output will be True and the Home position will be set to 110 mm.

   (The Home Sensor is at position 100 mm and the width of the pulse is 10 mm.)

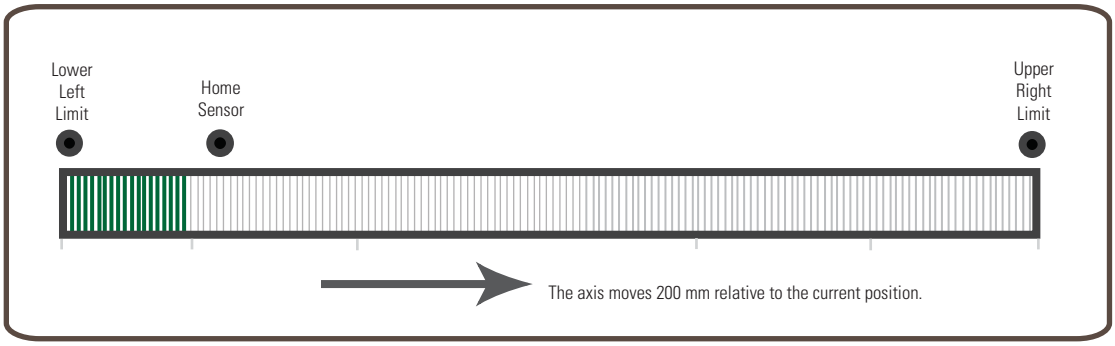


After execution, the MC_Home function block should appear as shown. When SWHome becomes False, the Done and Error bits gets cleared.

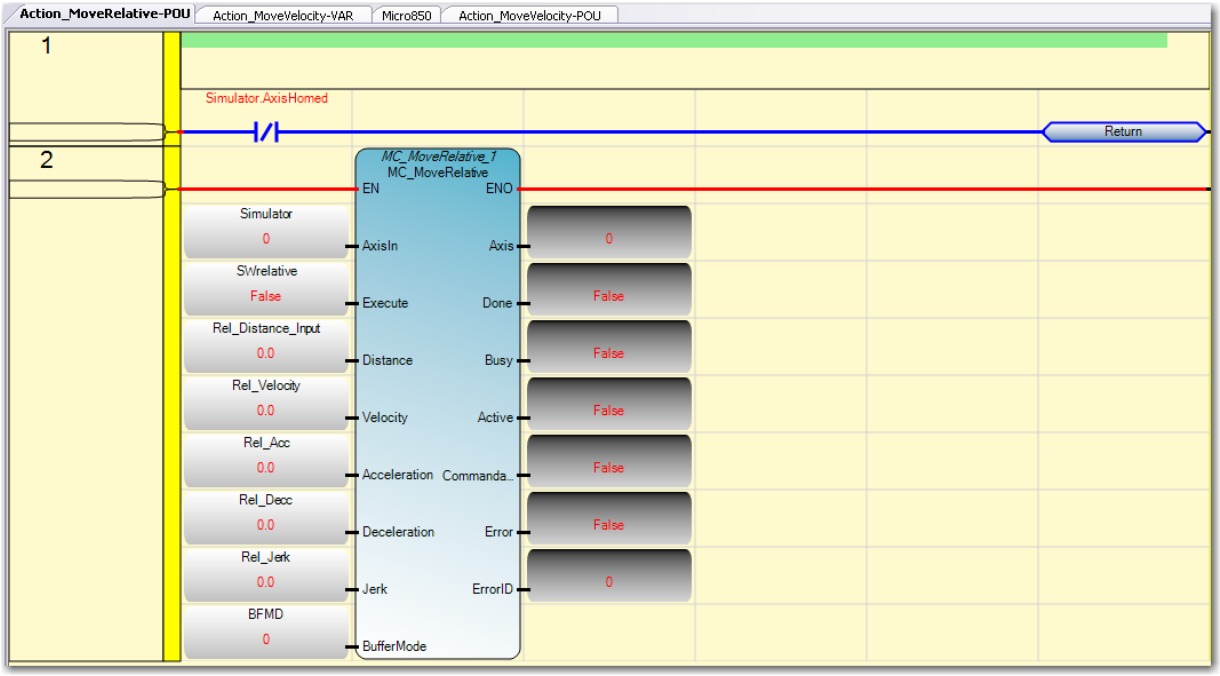


Execute MC_MoveRelative

The MC_MoveRelative function block commands an axis of a specified distance relative to the current position at the time of the execution.

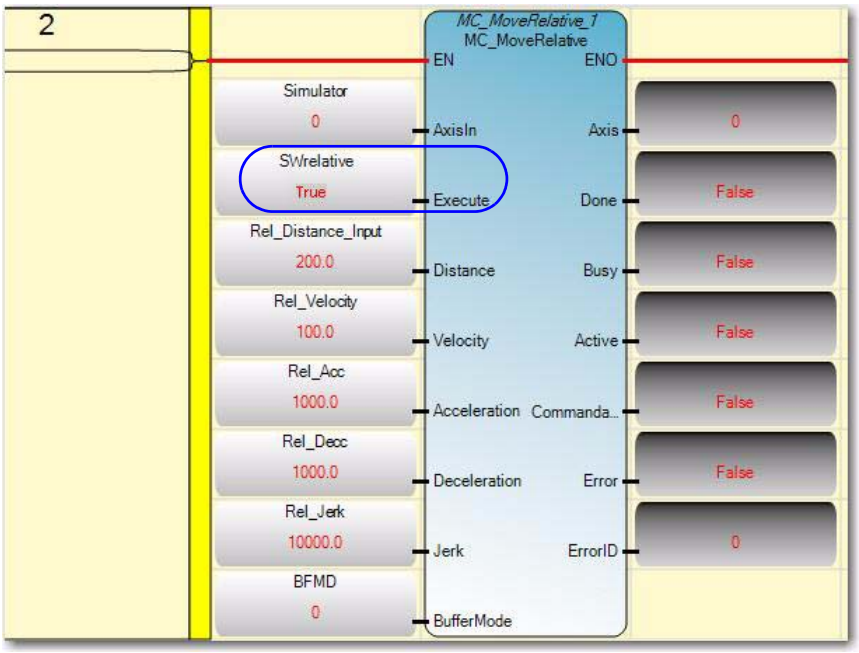


In this section, you will use the MC_MoveRelative function block to move your axis towards a positive or negative direction. The initial state of your MC_MoveRelative program (that is, before execution) is shown below.



Before execution, the value of inputs such as distance, velocity, acceleration, jerk, deceleration, and buffer mode is 0. Execute is False as the application has not been run yet. Outputs such as Done, Busy, Active, CommandAborted, Error, are False.

1. Update the values of the input variables as shown and set SWRelative to True to trigger the MC_MoveRelative function block.

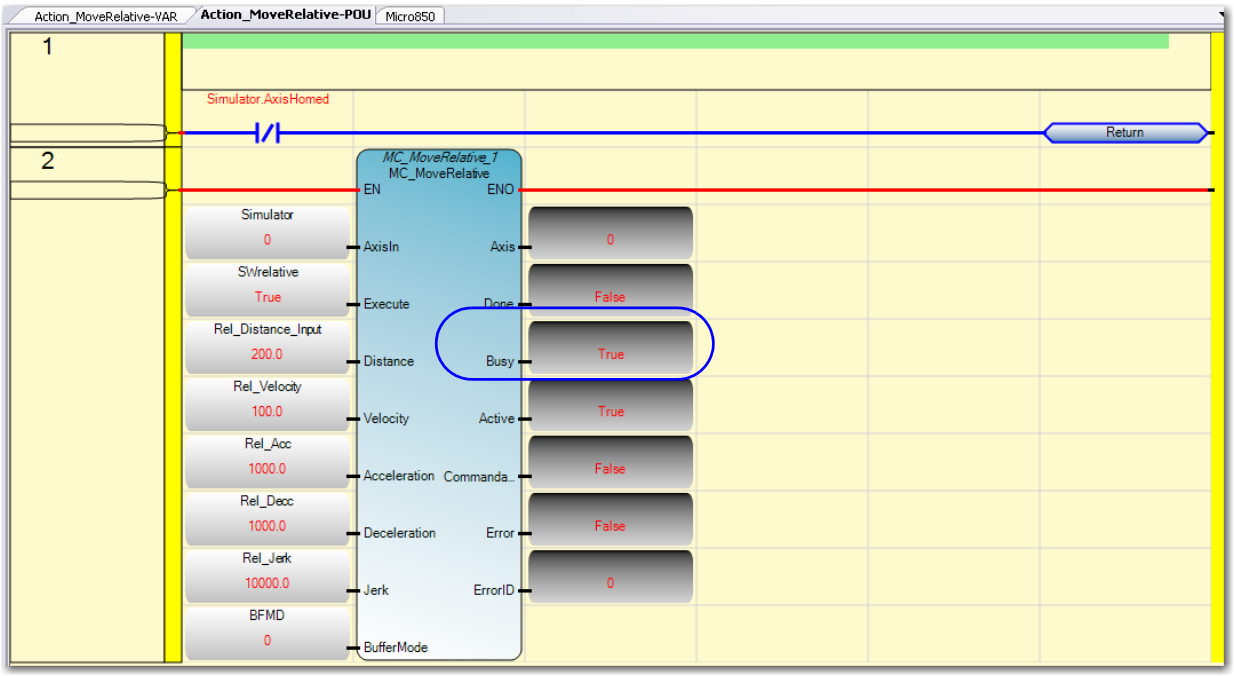


These values move your axis to a positive (right) direction by a distance of 200 mm, relative to the initial distance input (which is 0). The axis moves at a velocity of 100 mm/sec^2, an acceleration of 1000 mm/sec^3, and deceleration of 10000 mm/sec^3.

IMPORTANT	Deceleration or acceleration inputs should have a positive value. If deceleration or acceleration is set to be a non-positive value, an error is reported.

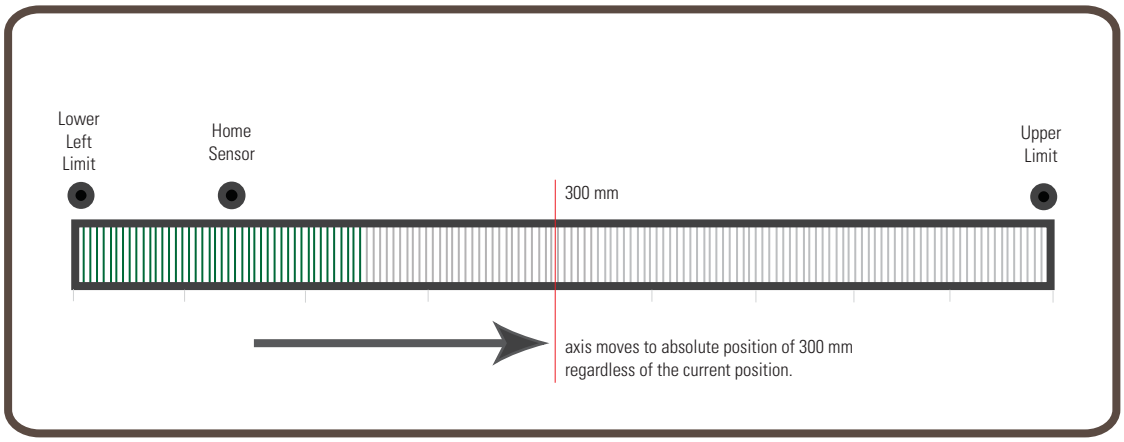
IMPORTANT	The Jerk input should have a non-negative value. If Jerk is set to be a negative value, error will be reported. If maximum jerk is configured as zero in Connected Components Workbench motion configuration, all jerk parameters for the motion function block has to be configured as zero. Otherwise, the function block reports an error.

While the axis is moving, note the Busy output is True.



Execute MC_MoveAbsolute

The MC_MoveAbsolute function block allows you to command an axis to a specified absolute position at the rate of Velocity, Acceleration, Deceleration, and Jerk inputs specified.



TIP For MC_MoveAbsolute, direction input is ignored.

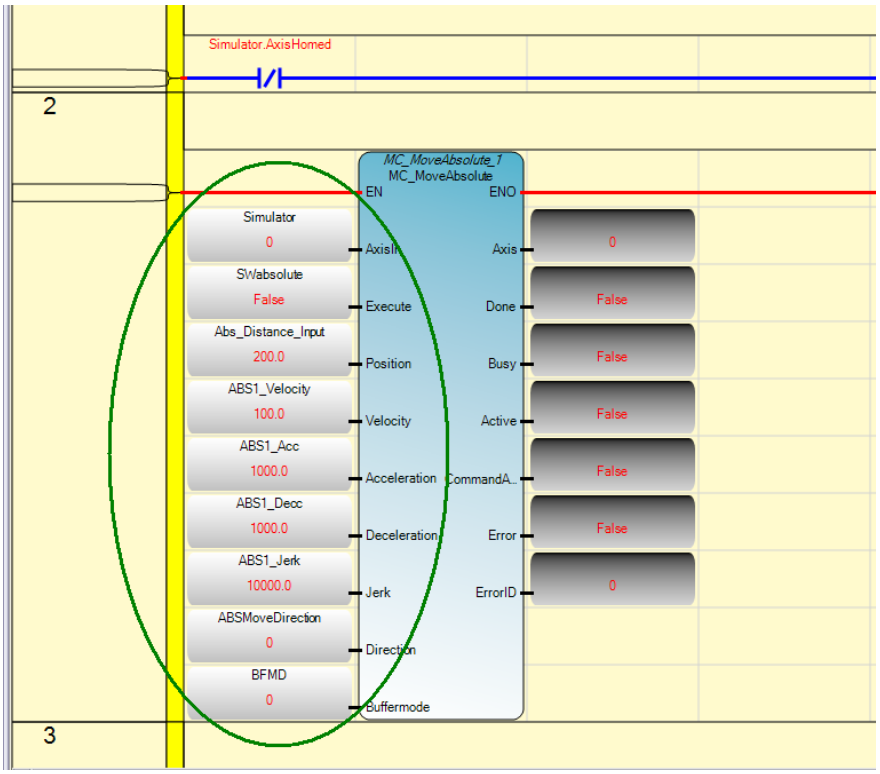
IMPORTANT For MC_MoveAbsolute function block, the position input is the absolute location commanded to the axis. For MC_MoveRelative, the distance input is the relative location (considering current axis position is 0) from current position.

IMPORTANT Absolute move requires that the axis be homed. It is a move to a known position within the coordinate system, regardless of distance and direction. Position can be negative or positive value.

IMPORTANT Velocity can be a signed value. Users are advised to use positive velocity.

For MC_MoveRelative and MC_MoveAbsolute function blocks the absolute value of the velocity is used. Velocity input does not need to be reached if Jerk input is equal to 0.

2. Specify a distance value of 200 mm.[1] Then, set the SWAbsolute variable to True to trigger the function block.



The objective is to move the axis to an absolute position of 200 mm at the end of execution, regardless of the initial value of the position input. The move will be at the velocity rate of 100 mm/sec^2, acceleration rate of 1000 mm/sec^3, deceleration rate of 1000 mm/sec^3, and jerk rate of 10000 mm/sec^3.

TIP For MC_MoveAbsolute, direction input is ignored.

IMPORTANT Deceleration or acceleration inputs should have a positive value. If deceleration or acceleration is set to be a non-positive value, an error will be reported.

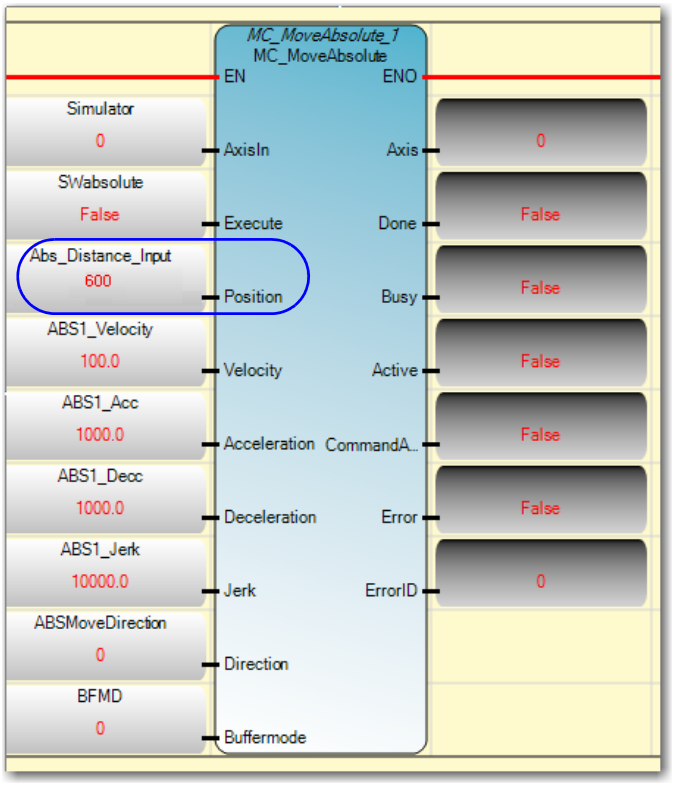
IMPORTANT The Jerk input should have a non-negative value. If Jerk is set to be a negative value, error will be reported.

If maximum jerk is configured as zero in Connected Components Workbench motion configuration, all jerk parameters for the motion function block has to be configured as zero. Otherwise, the function block reports an error.

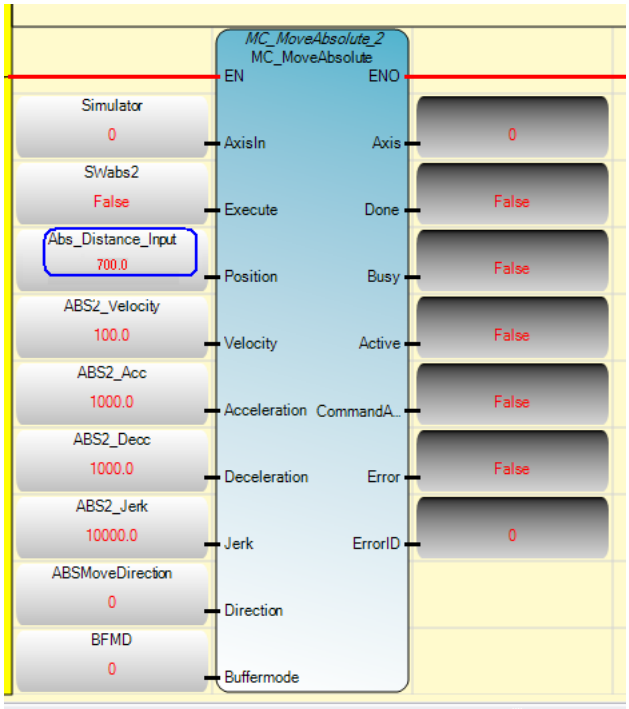
[1] The PanelView Component can be used to set the inputs and monitor the outputs. For non-PVc users, you can refer to the Connected Components Workbench to monitor the state of your outputs.

Abort a Movement Function Block

1. Set the MC_MoveAbsolute1 distance input to 600.



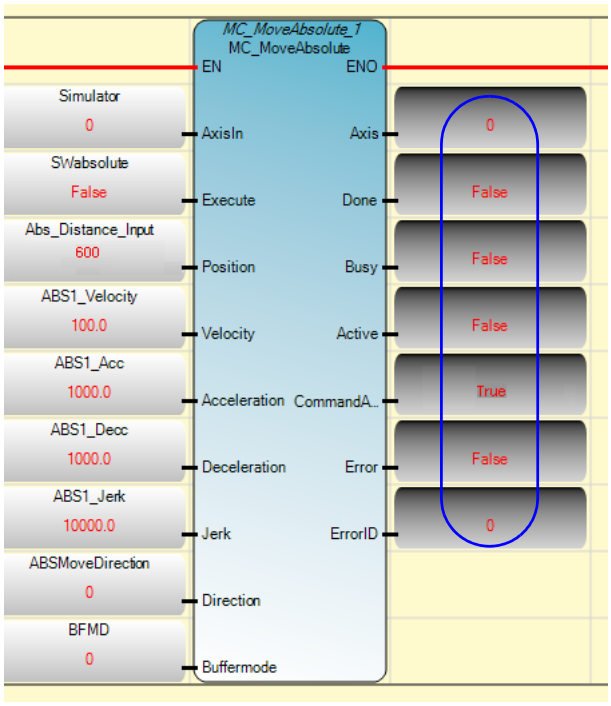
2. To perform an aborted move, set the MC_MoveAbsolute2 function block distance input to 700.



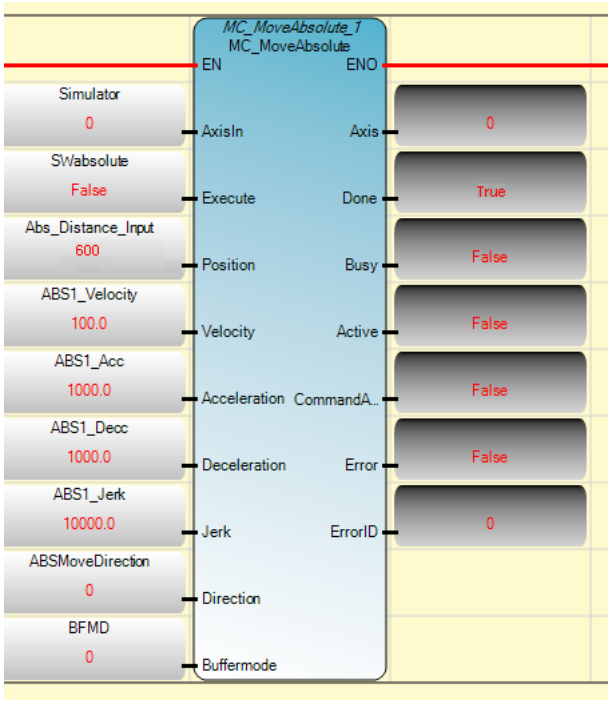
3. Trigger MC_MoveAbsolute1. Before the function block finishes executing, trigger MC_MoveAbsolute2. In this case, MC_MoveAbsolute2 will abort MC_MoveAbsolute1.

   Note that all MC_MoveAbsolute1 output bits will be set to False, while CommandAborted goes True.

   All output bits for the aborting function block MC_MoveAbsolute2 will be set to False, while Done output is True.

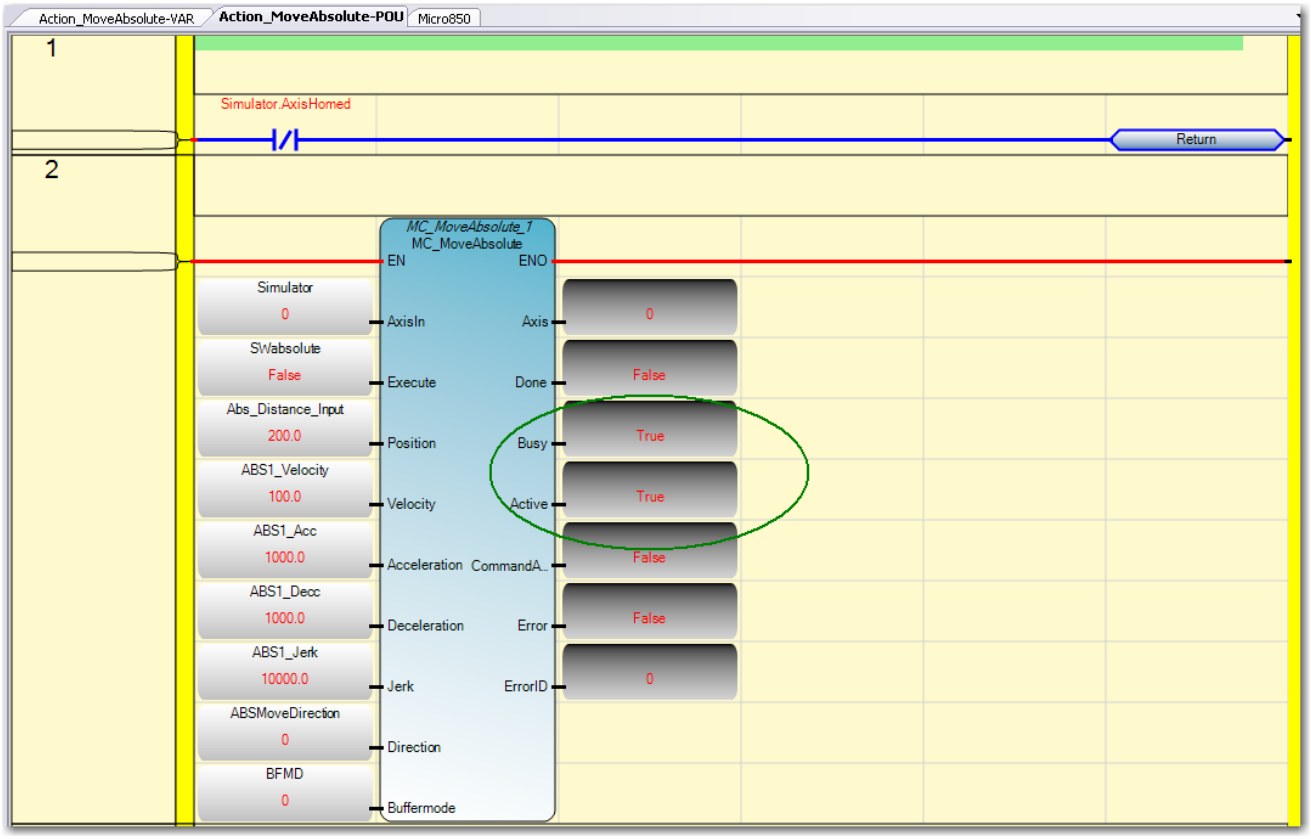


For the aborted function block MC_MoveAbsolute1, all output bits will be set to False, and CommandAborted is set to True.



For the aborting function block MC_MoveAbsolute1, all output bits will be set to False, and CommandAborted is set to True.

While executing, notice that outputs Busy and Active are True. After successful execution, Done should be True. If any error occurs during execution, the Error output will be True. You can check the status of your axis through the Axis Monitoring page of the Connected Components Workbench software.



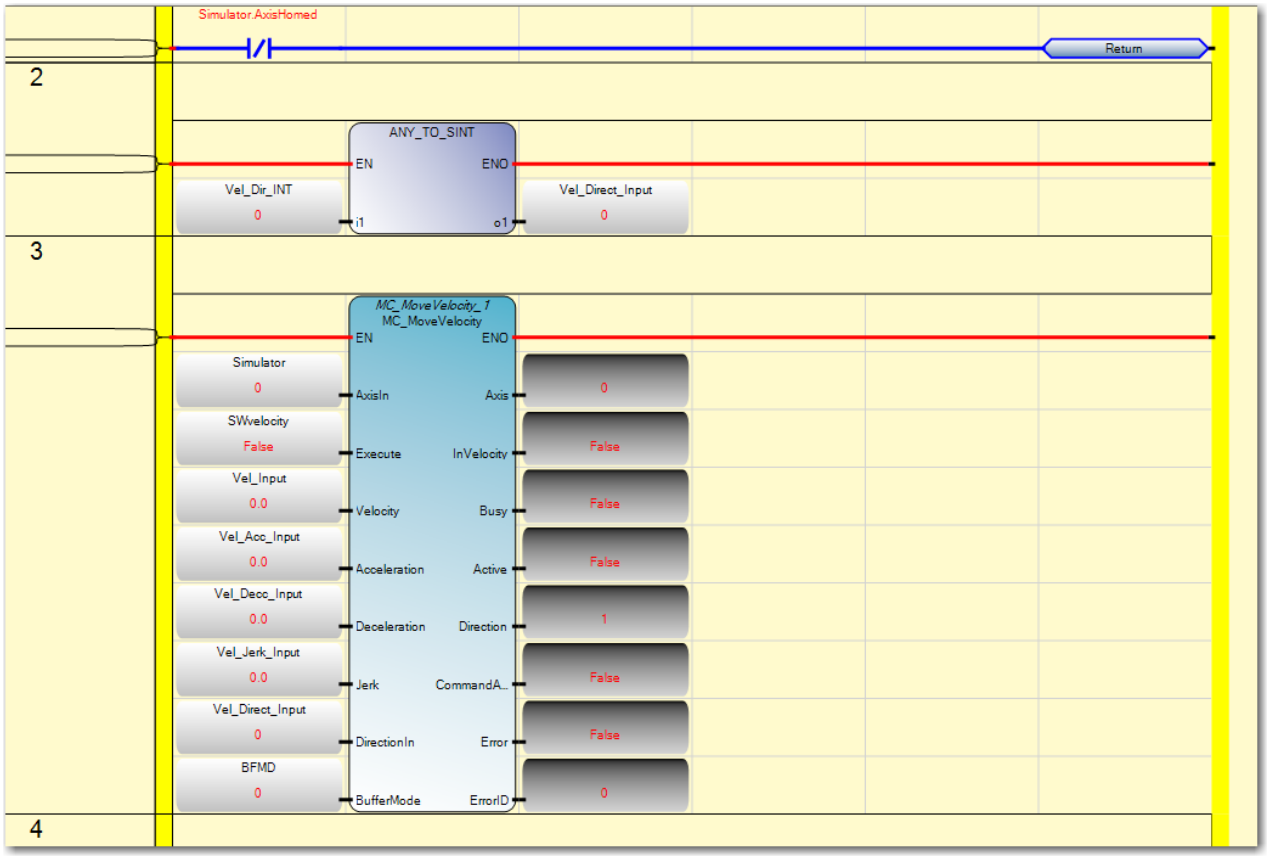
Execute MC_MoveVelocity and MC_Halt

The MC_MoveVelocity function block commands a never ending axis to move at a specified velocity until the hard or soft limit is reached.

TIP Velocity can be a signed value. Users are advised to use positive velocity.

Direction input for the MC_MoveVelocity function block can be used to define the direction of the move (that is, negative velocity x negative direction = positive velocity).

Before execution, the MC_MoveVelocity program should appear as shown.

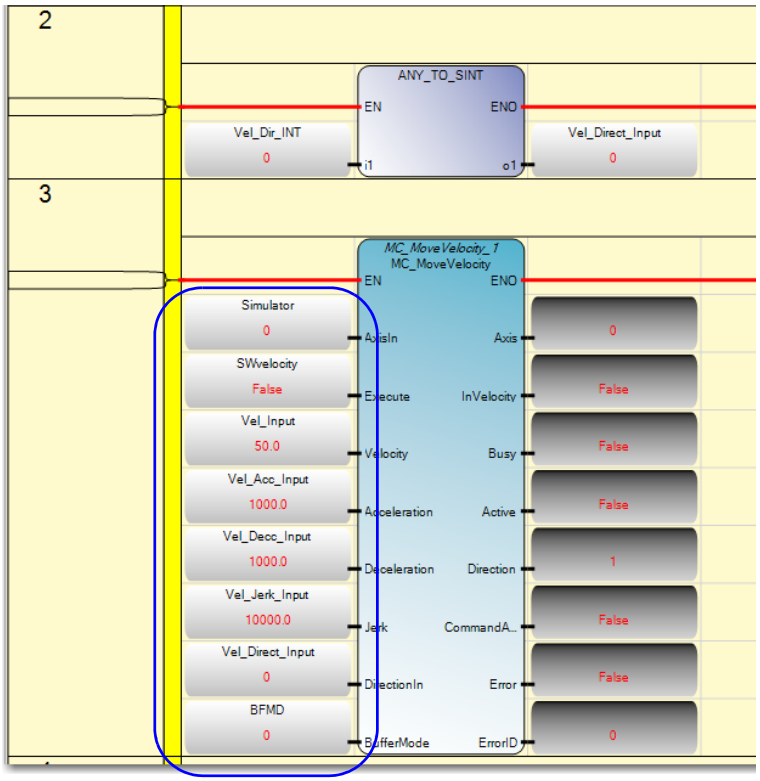


TIP For MC_MoveVelocity, direction input value can be 1 (positive direction), 0 (current direction) or -1 (negative direction).

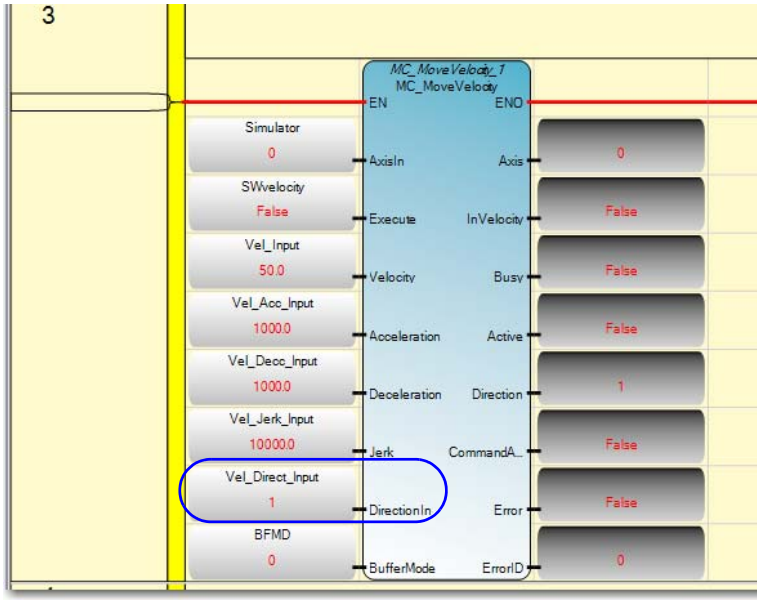
For any other value, only the sign is taken into consideration. For example, -3 denotes negative direction, +2 denotes positive direction, and so on.

For MC_MoveVelocity, the resulting sign of the product value derived from velocity x direction decides the motion direction, if the value is not 0. For example, if velocity x direction = +300, then direction is positive.

1. Update the MC_MoveVelocity input variables as shown.



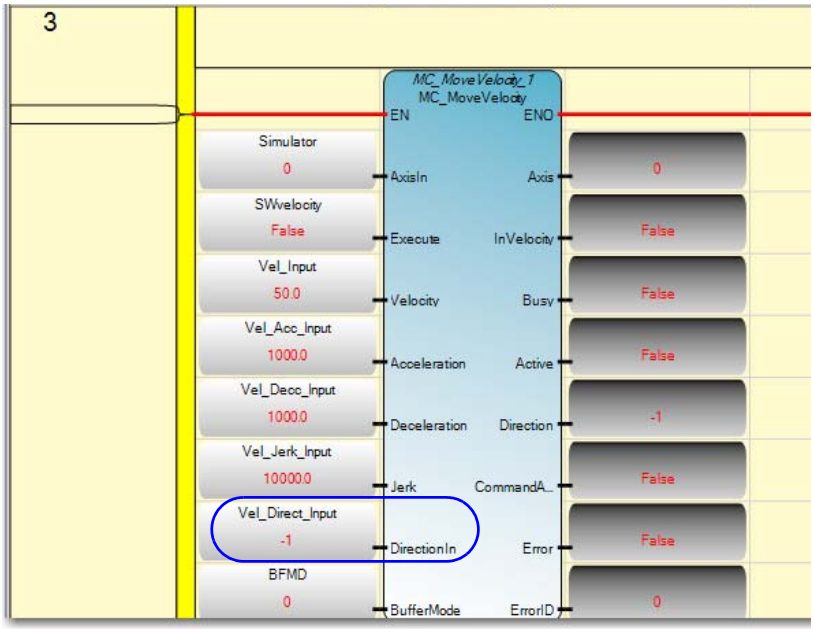
2. To move the axis to the right, set the direction input value to 1.



IMPORTANT	Once an axis is flagged with error, and the error ID is not zero, the user needs to reset the axis (using MC_Reset) before issuing any other movement function block.

IMPORTANT	The update for axis status is performed at the end of one program scan cycle, and the update is aligned with the update of Motion Axis status.

3. To move the axis to the left, set the direction input to -1.

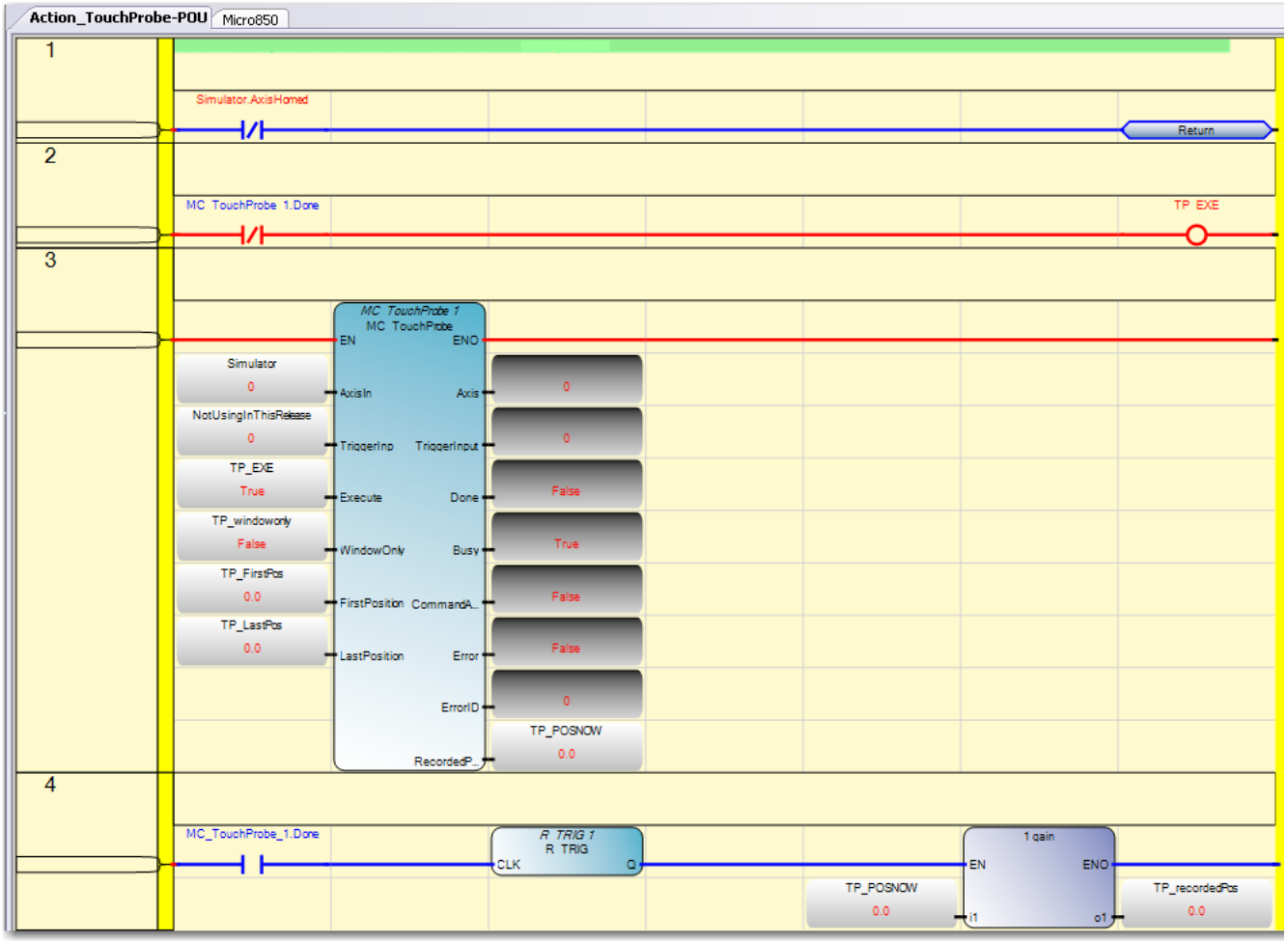


Execute MC_TouchProbe

The MC_TouchProbe function block records the current position when the touchprobe input becomes True. This function block is useful for registering the absolute position of the asynchronous object, for example, the registration mark of a film for a vertical form fill seal machine.

To record the current position while an axis is moving, set TP_EXE variable to True to trigger the function block. Then, you have to manually trigger the touchprobe input from the hardware.

To do so, refer to Wire the Controller on page 50. The output _IO_EM_DO_05 is connected to the touchprobe input. To trigger it, you can use Connected Components Workbench to force turn on _IO_EM_DO_05.



Implementing Motion Control in an Actual Environment

While this quickstart allowed you to become more familiar with the different motion control function blocks and enabled you to power up, home, and move a simulated axis, you will need to implement a different wiring configuration for an actual environment (that is, with a Servo drive, motor).

To do this, you need to refer to the following publications for wiring and supporting configuration information:

- Micro830 and Micro850 Programmable Controllers User Manual, 2080-UM002 (see the chapter, "Positioning with Embedded Pulse Train Outputs")
- Kinetix 3 Motion Control Indexing Application, CC-QS025

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