



Home to Torque-level Example

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About This Publication

This application note explains how to use the Home to Torque-level sequence in RSLogix 5000 software, version 16, and the considerations required when using this homing method. This document provides an example for a typical homing program routine. The example shown does not claim to be complete and does not apply to any specific application.

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://literature.rockwellautomation.com>) 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.





In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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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.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you to identify a hazard, avoid a hazard, and recognize the consequences.
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.

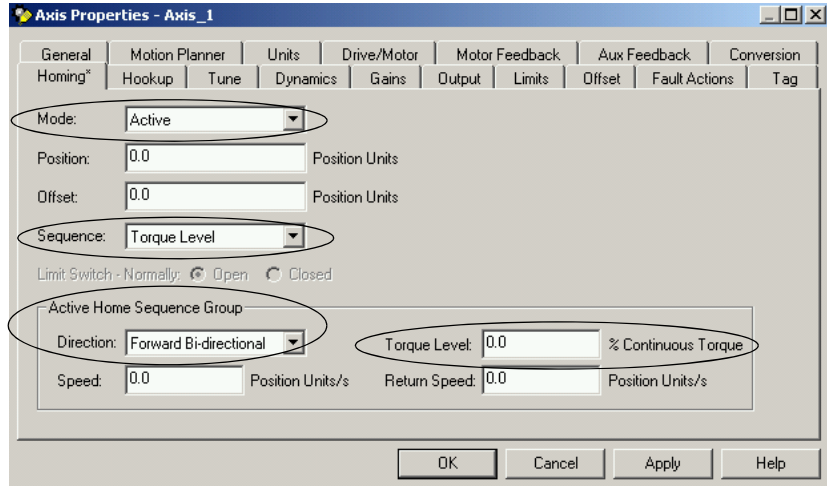
About Home to Torque-level Homing

Home to torque-level homing is a process that references a known position by monitoring torque while driving an axis into a mechanical hard-stop. Once the actual torque level reaches or exceeds a specified torque level for a set time of 500 ms, a status flag is set in the controller.

IMPORTANT

Because the process of home to torque-level requires axis motion, the axis homing mode must be configured as Active.

Axis Properties - Homing Tab



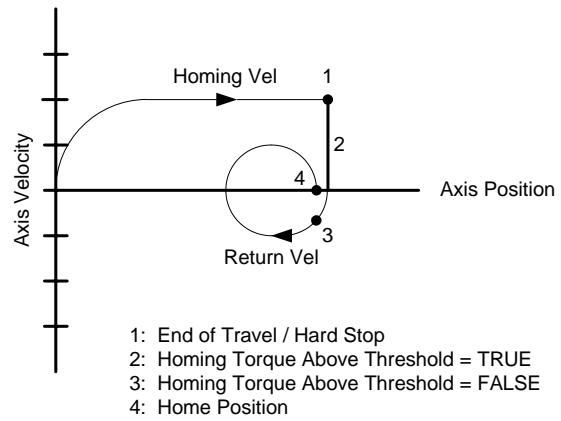
Torque-level Homing

Sequence Type	Description
Torque Level	Sets the Home Position after the output torque reaches the Torque Level value, reverses direction, and moves until the Homing Torque Above Threshold bit is low and the status bit sets.
Torque Level - Marker	Sets the Home Position after the output torque reaches the Torque Level value, reverses direction, and encounters an encoder marker.

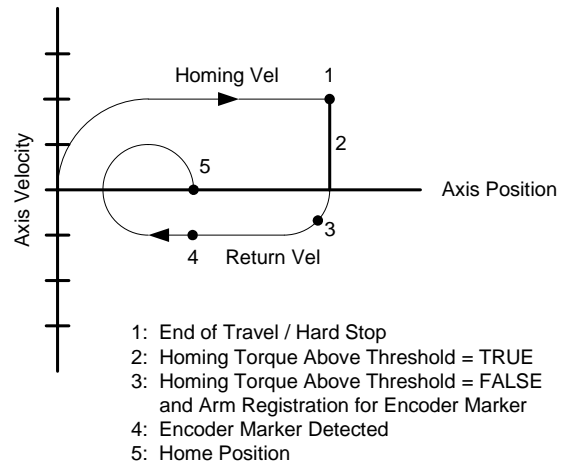
When either the Torque Level or Torque Level - Marker homing option is selected on the Homing tab, the Torque Level field is activated in the Active Home Sequence Group. The units for this field are a percentage of the continuous torque of the motor (% Continuous Torque) limited by the drive-rated current/motor-rated current ratio. This number is interpreted in the drive as an absolute value and the range is 0...TorqueLimitPositive value.

Forward Bi-directional and Reverse Bi-directional are the only options for the Direction field when Torque Level or Torque Level - Marker homing sequence is selected. Uni-directional homing is not possible, because the Home to Torque-level sequence relies on a mechanical hard-stop.

Position/Velocity Diagram for Torque-level Homing



Position/Velocity Diagram for Torque-level - Marker Homing



Drive Bipolar Torque Limit Adjustment

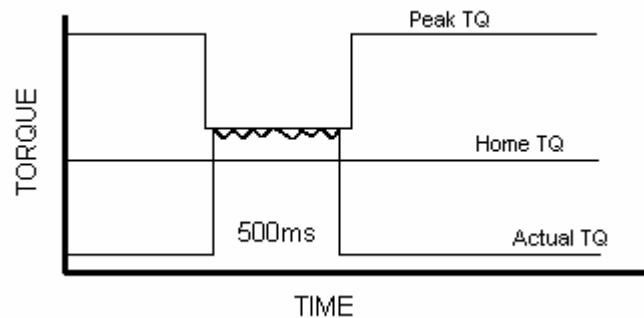
When homing an axis to a mechanical hard-stop, set the Home Torque-level value above the torque value required to move the system, but low enough not to cause problems with the system mechanics. As part of the process of homing to a torque limit, limit the Peak Torque value to a level 10% above the Home Torque value to reduce the stresses on the mechanics and to eliminate the chance of an over-current fault.

IMPORTANT

The 10% value is an estimated starting point. This value may need adjustment based on the application requirements.

Limit the Peak Torque value before issuing the homing instruction (MAH) and reset the Peak Torque field to the original value after homing completes.

Bipolar Torque Limit Adjustment



Disable Soft Overtravel Limit

If the application requires the use of soft-overtravel limits (Limits tab) to safeguard the system mechanics, the Soft Travel Limits must be disabled for the axis to home. The Soft Travel Limits must be disabled through programming to prevent a fault from occurring during the homing operation, but re-enabled after homing completes.

IMPORTANT

Those responsible for the application must determine when it is safe and appropriate to disable soft-overtravel checking.

Ladder Code Example

This example shows how to adjust the peak torque limit and disable the soft-overtravel limit checking when homing to a torque limit. The code uses a state model methodology in which each rung of code needs to complete successfully before moving to the next rung.

IMPORTANT

Since the home to torque-level sequence relies on the mechanical end of travel for operation, Uni-directional homing is not possible. You must choose between Forward Bi-directional or Reverse Bi-directional.

Rung 11 of the ladder code checks to make sure that the axis position, after homing, is within the Soft Travel Limits before re-enabling soft-overtravel limit checking. In this example a 1.15 cm Offset move is configured in the Homing tab and that is the final home position. The 0.5 cm is within the Soft Travel Limits set on the Limits tab.

List of Tags Used

Tag Name	Data Type	Description
Saved_FaultConfig	DINT	Storage location for FaultConfigurationBits (motion attributes) Bit 0 = soft-overtravel limit checking
Clear_SoftOT_Mask	DINT	Set to -2. This masks the off soft-overtravel enable bit without changing the other bits in the configuration.
Temp_FaultConfig	DINT	Temporary hold word for FaultConfigurableBits
SoftOT_Disabled	BOOL	Soft-overtravel checking disabled status bit
Saved_TQLim_Bipolar	REAL	Storage location for Peak Torque (TorqueLimitBipolar)
HomeTQ_Level	REAL	Home Torque Level from the Home tab in Axis Properties
Temp_TQLim_Bipolar	REAL	Temporary Peak Torque for Homing (10% higher than Home Torque Limit)
Axis_01_MI.MAH	MOTION_INSTRUCTION	Control for MAH instruction (using a UDT)
Positive_Overtravel	REAL	Max. Positive Soft-overtravel value
Negative_Overtravel	REAL	Max. Negative Soft-overtravel value
Saved_PosErrorTol	REAL	Storage location for Actual Position Error value
Temp_PosErrorTol	REAL	Temporary Position Error value for Homing

Axis Properties - Homing Tab

Axis Properties - AXIS_01

General | Motion Planner | Units | Drive/Motor | Motor Feedback | Aux Feedback | Conversion
Homing | Hookup | Tune | Dynamics | Gains | Output | Limits | Offset | Fault Actions | Tag

Mode:

Position: cm

Offset: cm

Sequence:

Limit Switch - Normally: Open Closed

Active Home Sequence Group

Direction: Torque Level: % Continuous Torque

Speed: cm/s Return Speed: cm/s

OK Cancel Apply Help

Axis Properties - Limits Tab

Axis Properties - AXIS_01

General | Motion Planner | Units | Drive/Motor | Motor Feedback | Aux Feedback | Conversion
Homing | Hookup | Tune | Dynamics | Gains | Output | Limits | Offset | Fault Actions | Tag

Hard Travel Limits

Soft Travel Limits

Maximum Positive: cm

Maximum Negative: cm

Position Error Tolerance: cm

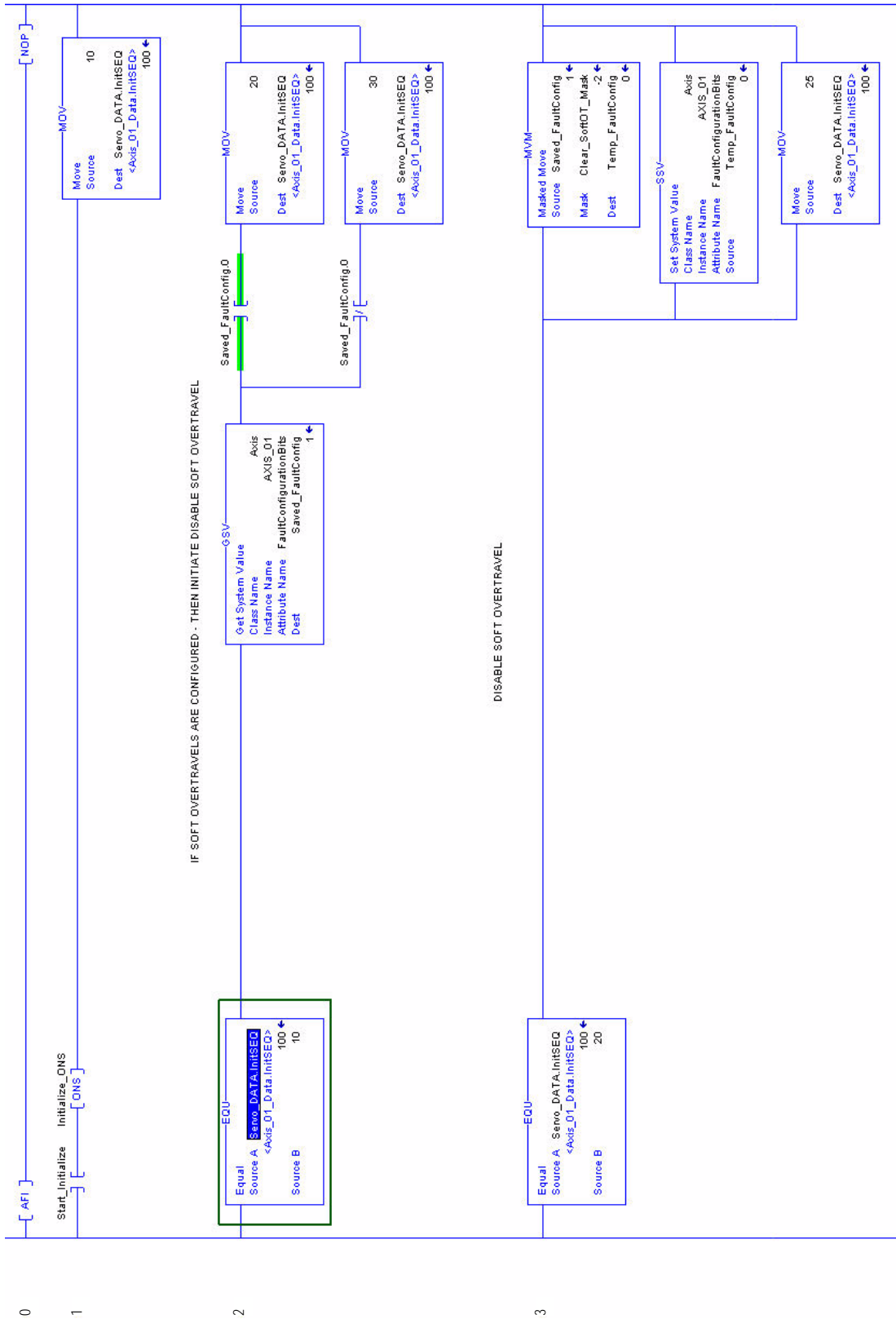
Position Lock Tolerance: cm

Peak Torque/Force Limit: % Rated

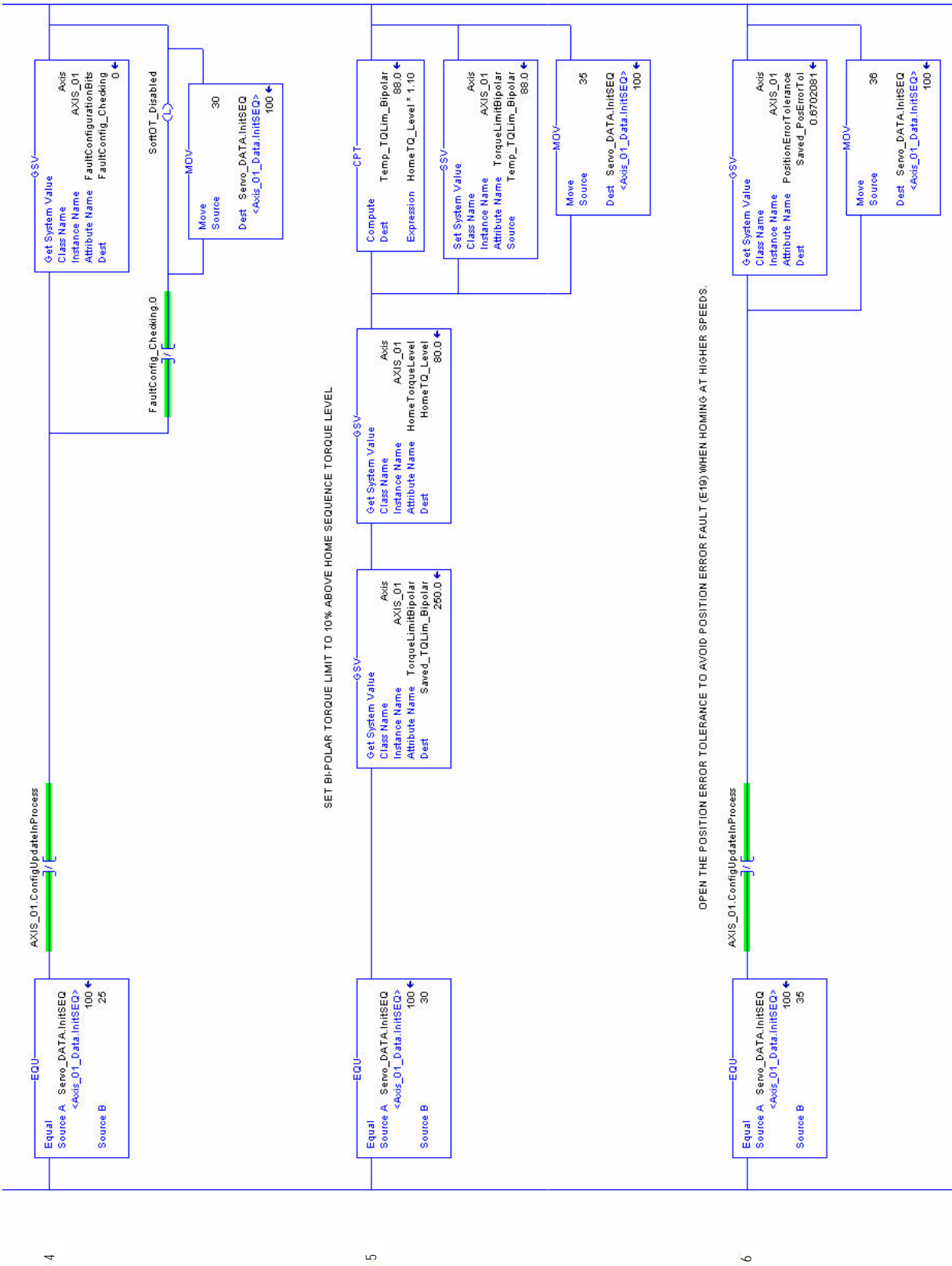
Continuous Torque/Force Limit: % Rated

OK Cancel Apply Help

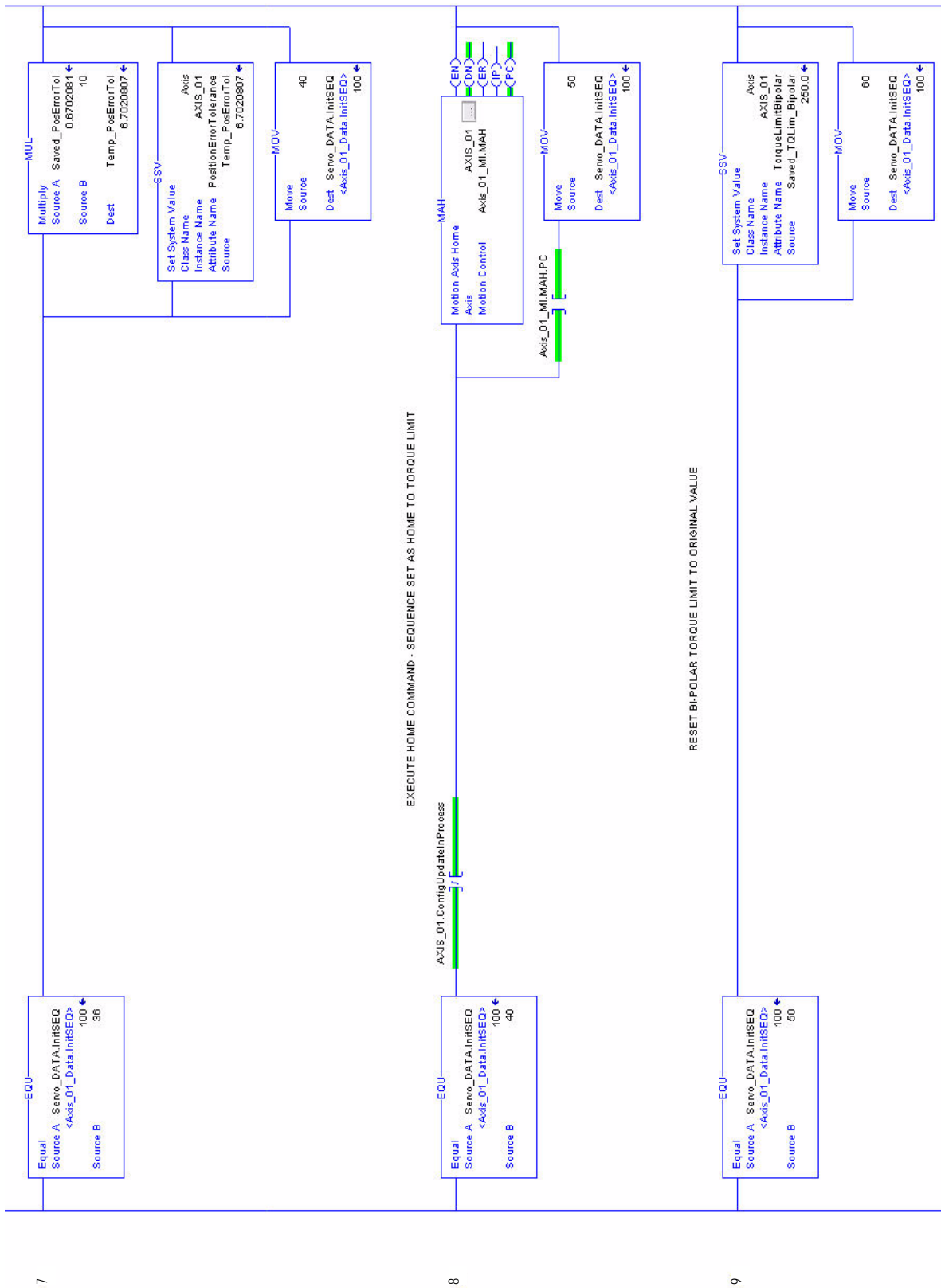
Ladder Code Example



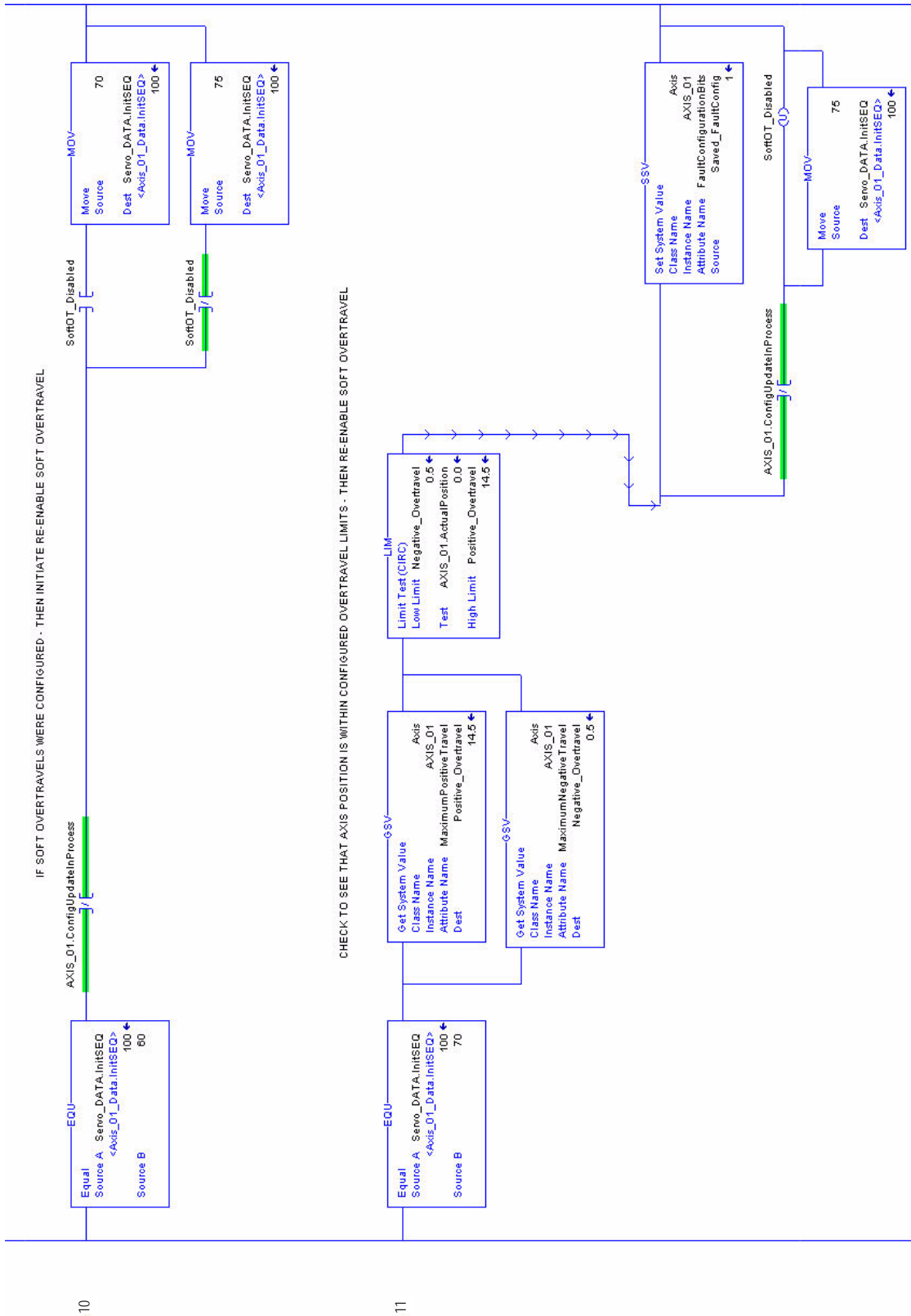
Ladder Code Example, continued



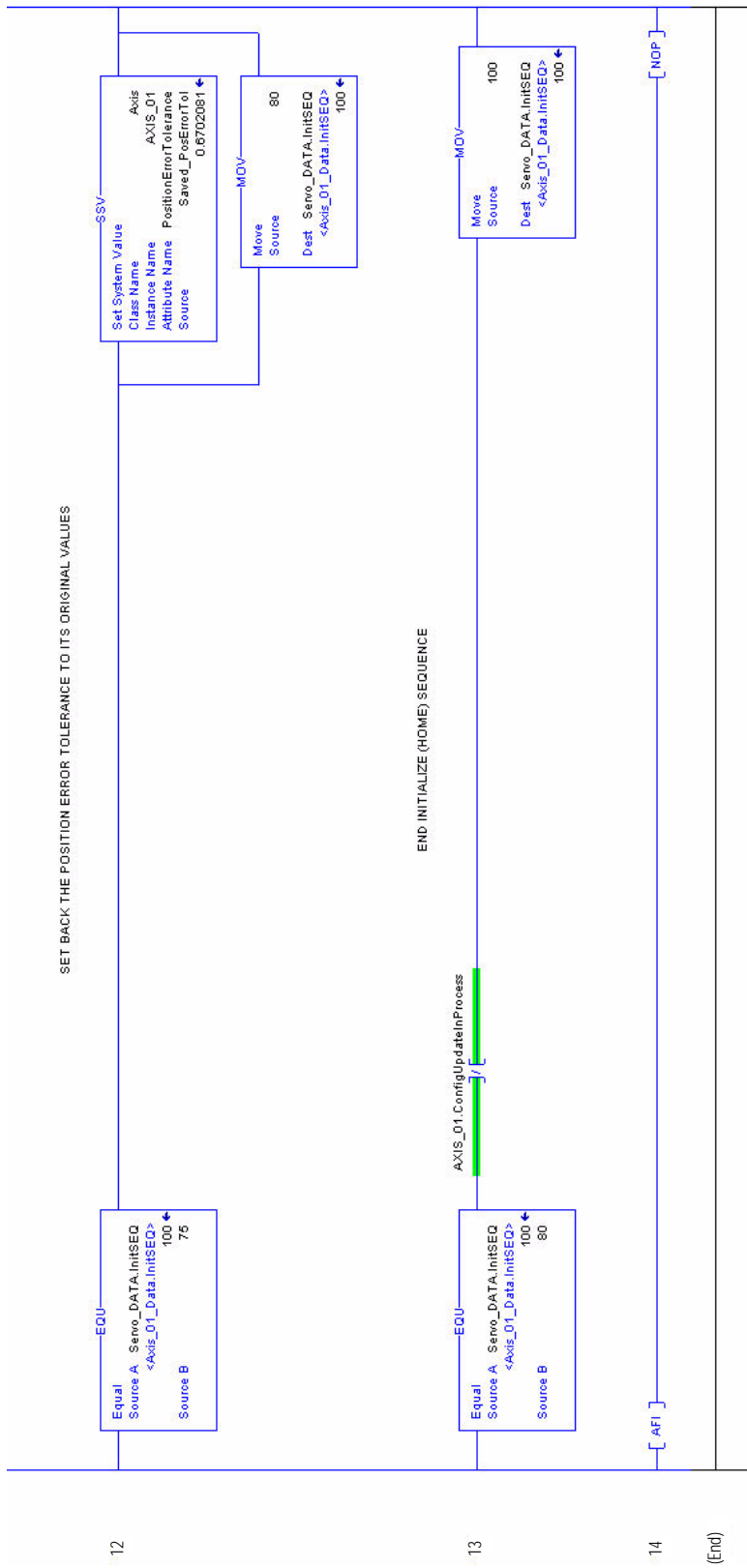
Ladder Code Example, continued



Ladder Code Example, continued



Ladder Code Example, continued



Potential for Position Error Fault

When executing a torque limit homing procedure there is potential for a Position Error fault. As mentioned earlier, for the home to torque limit to complete, the output torque to the motor must reach (or exceed) the specified torque level for a set time of 500 ms. During this time the axis is against the mechanical hard-stop, and following error is increasing in the position loop. If the Position Error Tolerance value is exceeded before completion of the homing instruction, a Position Error fault (E19) will result.

There are two ways to limit the occurrence of an E19.

- Set the Position Error Tolerance value on the Limits tab of the Axis Properties to a value high enough to eliminate a fault from occurring.
- Modify the Position Error Tolerance value via an SSV instruction similar to the method used in code above to change the Bipolar Torque Limit.

TIP

The second method is preferred since it temporarily sets Position Error Tolerance to a value appropriate for homing to a mechanical hard-stop and then resets it to the original value set in the Axis Properties dialog box.

Rung 6 of the ladder code opens the Position Error window. This allows the Homing to complete without causing a Position Error fault. The original value is reset after Homing completes.

Additional Resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
Kinetix 2000 Multi-axis Servo Drive Release Note, publication 2093-RN001	Enhancements, known anomalies, and restrictions for your Kinetix 2000 drive firmware used with RSLogix 5000 software, version 16.
Kinetix 6000 Multi-axis Servo Drive Release Note, publication 2094-RN007	Enhancements, known anomalies, and restrictions for your Kinetix 6000 drive firmware used with RSLogix 5000 software, version 16.
Kinetix 7000 High Power Servo Drive Release Note, publication 2099-RN002	Enhancements, known anomalies, and restrictions for your Kinetix 7000 drive firmware used with RSLogix 5000 software, version 16.
Motion Modules in Logix5000 Control Systems User Manual, publication LOGIX-UM002	Information on configuring and troubleshooting your ControlLogix and CompactLogix SERCOS interface modules, and using the home to torque-level sequence.

You can view or download publications at <http://literature.rockwellautomation.com>. To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.

Notes:

Notes:

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At <http://support.rockwellautomation.com>, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://support.rockwellautomation.com>.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned:

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

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Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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