Application Technique

Original Instructions

Integrated Motion on EtherNet/IP Networks for PowerFlex 755T Products with TotalFORCE Control

Catalog Numbers 20G, 20J

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc., is prohibited.

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.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

These labels may also be on or inside the equipment to provide specific precautions.

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.

ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

The following icon may appear in the text of this document.

Identifies information that is useful and can help to make a process easier to do or easier to understand.

Overview

This Application Technique describes how to configure PowerFlex® 755T products with TotalFORCE® Control in different integrated motion axis modes by using the Studio 5000 Logix Designer® software.

This manual includes these configuration examples:

- Configure a PowerFlex 755TS drive for Integrated Motion on EtherNet/IP™. This module includes an associated axis that controls an induction (asynchronous) motor in frequency control mode.
- Configure a PowerFlex 755TS drive for Integrated Motion on EtherNet/IP with a Safe Torque Off (STO) option module (cat. no. 20-750-S3). This module includes an associated axis that controls an induction (asynchronous) motor in position control mode. The 20-750-S3 module provides networked STO capability.

For a list of parameter to motion attributes and CIP™ motion enhanced attributes, see the PowerFlex Drives with TotalFORCE Control Parameters Reference Data, publication 750-RD101.

See the Knowledgebase article PowerFlex 755Tx CIP Motion Frequently Asked Questions (QA75447) for the difference in the configuration of PowerFlex 755 Integrated Motion on EtherNet/IP module versus a PowerFlex 755TS Integrated Motion on EtherNet/IP module.

IMPORTANT	When a PowerFlex drive is used in Integrated Motion on EtherNet/IP mode, the Logix controller and Logix Designer application are the exclusive owners of the drive (the same as Kinetix® drives). A human interface module (HIM) or other drive software applications cannot be used to control the drive or change the configuration settings. These applications can only be used to monitor the drive.

Before You Begin

Before you can configure a drive in the Logix Designer application, you must create a controller project with a connection to the EtherNet/IP network.

Keep these considerations in mind when creating your motion project.

- For a Motion and Safety application, you must add a GuardLogix® integrated safety controller.
- For all communication modules, use the firmware revision is compatible with the firmware revision of your controller. See the release notes for the firmware revision of your controller.
- The electronic keying feature automatically compares the expected module, as shown in the configuration tree, to the physical module before communication begins.

ATTENTION: When configuring communication and PowerFlex drive modules in motion or safety applications, set electronic keying to either Exact Match or Compatible Keying. Never use Disable Keying with motion or safety applications.

  For more information about electronic keying, see the Electronic Keying in Logix 5000™ Control Systems Application Technique, publication LOGIX-AT001.
- Time synchronization supports highly distributed applications that require a time stamp, recorded sequence of events, distributed motion control, and increased control coordination. All controllers and communication modules must have time synchronization enabled for applications that use Integrated Motion on the EtherNet/IP network.

For detailed information on configuring a controller or Ethernet/IP adapter, see the publications that are listed in the Additional Resources on page 107.

Software and Drive Firmware Requirements

To configure your Integrated Motion on EtherNet/IP network motion application, you need the following software and drive firmware:

- Logix Designer application, version 36.01 or later
- FactoryTalk® Linx (installed with the Logix Designer application, version 36.01) or RSLinx® Classic software, version 3.51.00 or later
- For PowerFlex drives with TotalFORCE Control:
  - PowerFlex 755 and 755T Drives Integrated Motion Add-on Profile, version 32.01 or later (separate download from the Product Compatibility and Download Center)
  - PowerFlex 755TL, 755TR, 755TM, or 755TS firmware revision 13.002 or later

Download Firmware, AOP, EDS, and Other Files

Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes from the Product Compatibility and Download Center at rok.auto/pcdc.

Controller, Motor, and Option Module Compatibility

To create an Integrated Motion on EtherNet/IP system, you need the following:

- A Logix 5000 controller with a connection to the EtherNet/IP network, either via an embedded Ethernet port or an Ethernet communication module (See Table 1). A safety controller is required for motion and safety applications. Table 1 lists the compatible controllers for a PowerFlex drive with TotalFORCE Control integrated motion on EtherNet/IP application.
- A compatible asynchronous induction motor. Rockwell Automation motors with catalog numbers 8720SM-, HPK-, and MMA- can be used in motion applications.

Table 1 lists the required controllers and PowerFlex option modules by the type of motor control and safety application.

Table 1 - Required Controllers and Option Modules for Motor Control and Safety Applications

Motor Control and Safety Application	Controller	Controller Cat. No.	PowerFlex Option Module	Option Module Cat. No.(1)
Frequency Control	CompactLogix™ 5370 Compact GuardLogix 5370 CompactLogix 5380 CompactLogix 5480 Compact GuardLogix 5380 ControlLogix® 5570 GuardLogix 5570 ControlLogix 5580 GuardLogix 5580	5069-L3*x*ERM*x* 5069-L3*x*ERMS*x* 5069-L3*xx*ERM*x* 5069-L3*xx*ERMS*x* 1756-L7*x* 1756-L7S*x* 1756-L8*x* 1756-L8S*x*	—	—
Position, Torque, and Velocity(2) Control			Universal Feedback	20-750-UFB-1 or 20-750-UFB-1-XT
			Single Incremental Encoder	20-750-ENC-1 or 20-750-ENC-1-XT
			Dual Incremental Encoder	20-750-DENC-1 or 20-750-DENC-1-XT
Hardwired Safe Torque Off (STO)(3)			Safe Torque Off	20-750-S or 20-750-S-XT
Integrated STO	Compact GuardLogix 5370 Compact GuardLogix 5380 GuardLogix 5570 GuardLogix 5580	5069-L3*x*ERM*x* 5069-L3*x*ERMS*x* 5069-L3*xx*ERM*x* 5069-L3*xx*ERMS*x*	Integrated Safe Torque Off	20-750-S3 or 20-750-S3-XT
Safely-limited Speed	Compact GuardLogix 5380 GuardLogix 5580	5069-L3*x*ERM*x* 5069-L3*x*ERMS*x* 5069-L3*xx*ERM*x* 5069-L3*xx*ERMS*x*	Integrated Safety Functions	20-750-S4 or 20-750-S4-XT

(1) 'XT' in the catalog number indicates that the safety option module includes enhanced corrosive gas protection.
(2) Position and Torque control require a feedback device. Velocity control can be used with or without a feedback device.
(3) Hardwired STO does not require a GuardLogix or Compact GuardLogix controller.

Table 2 lists the compatible PowerFlex feedback and safety option modules and valid ports for PowerFlex drives in Integrated Motion on EtherNet/IP applications. All feedback and safety option modules that are listed in the table can be installed in the control pod together. For a complete list of option modules and catalog numbers that can be used with PowerFlex products, see the Knowledgebase article PowerFlex 755Tx CIP Motion Frequently Asked Questions (QA75447). For PowerFlex option module installation and wiring instructions, see the PowerFlex 750-Series I/O, Feedback, and Power Option Modules Instructions, publication 750-IN111.

Table 2 - Compatible PowerFlex Feedback and Safety Option Modules and Ports

Option	Module	Catalog Number	Valid Ports
Feedback	Single Incremental Encoder	20-750-ENC-1 or 20-750-ENC-1-XT	4...8
	Dual Incremental Encoder	20-750-DENC-1 or 20-750-DENC-1-XT	
	Universal Feedback	20-750-UFB-1 or 20-750-UFB-1-XT(1)	4...6
Safety	Safe Torque Off, or	20-750-S or 20-750-S-XT	4...8
	Integrated Safe Torque Off, or Integrated Safety Functions	20-750-S3 or 20-750-S3-XT 20-750-S4 or 20-750-S4-XT(2)	4...6

(1) To configure PowerFlex 755T products for CIP motion homing applications, the Universal Feedback option module is required.
(2) When feedback is used, this safety option module requires that you use a 20-750-DENC-1, 20-750-DENC-1-XT, 20-750-UFB-1, or 20-750-UFB-1-XT option module only.

Configure the Drive for Integrated Motion on EtherNet/IP Mode

For control pod access procedures, see the appropriate manual:

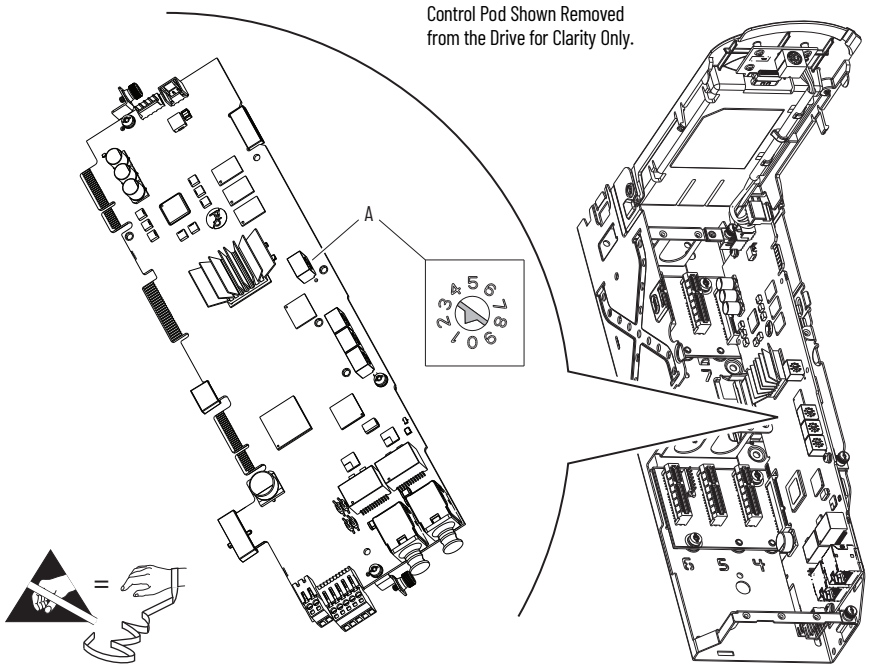
- PowerFlex 750-Series Products with TotalFORCE Control Hardware Service Manual, publication 750-TG100
- PowerFlex 750TS-Series Products with TotalFORCE Control Hardware Service Manual, publication 750-TG101

Follow these steps to configure the drive for integrated motion on EtherNet/IP mode.

1. Remove power from the drive.
2. Access the drive control pod.
3. Open the HIM cradle.
4. Set the control selector (A in Figure 1) on the main control circuit board to 1 (integrated motion on EtherNet/IP mode).

Control selector positions 2...9 are reserved for future use.

Figure 1 - PowerFlex 755T Products Main Control Circuit Board



5. For the programming mode change to take effect, apply power to the drive.

   When installed in a PowerFlex 755TS drive configured for integrated motion on EtherNet/IP mode, the HIM displays "PowerFlex 755TS, CIP Motion Mode."

IMPORTANT	When the programming mode is switched between I/O mode and integrated motion on EtherNet/IP mode and the drive is power cycled, all parameters are reset to their default value.

Configure a PowerFlex 755TS Drive for Frequency Control on EtherNet/IP

Complete these steps to configure your PowerFlex 755TS drive for a frequency control application.

IMPORTANT Before you begin, verify that you have completed the steps in Configure the Drive for Integrated Motion on EtherNet/IP Mode on page 5.

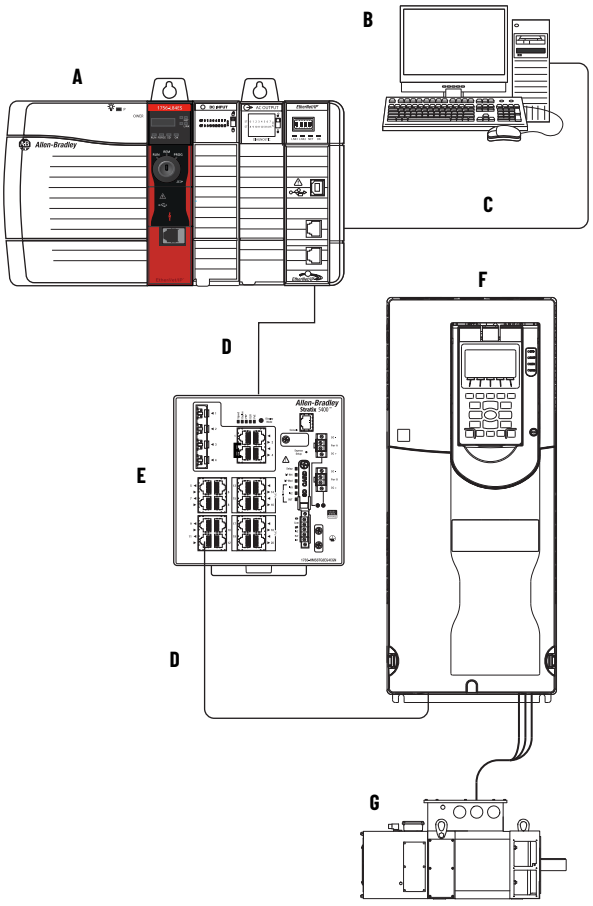
This example includes these devices:

- GuardLogix 5580 controller with a 1756-EN2TR Ethernet communication module
- PowerFlex 755TS drive with embedded Ethernet port
- 1783-HMx Stratix® 5400 Ethernet managed switch
- Induction (asynchronous) motor

Rockwell Automation motors with catalog numbers 8720SM-, HPK-, and MMA- can be used in motion applications.

Figure 2 on page 6 shows a typical PowerFlex drive in Integrated Motion on EtherNet/IP system installation.

Figure 2 - PowerFlex Drives in Integrated Motion on EtherNet/IP System Installation Example



Item	Description
A	GuardLogix 5580 controller with Bulletin 1756 EtherNet/IP module
B	Logix Designer application
C	ControlLogix controller programming network
D	1585J-M8CBJM-*x* Ethernet (shielded) cable

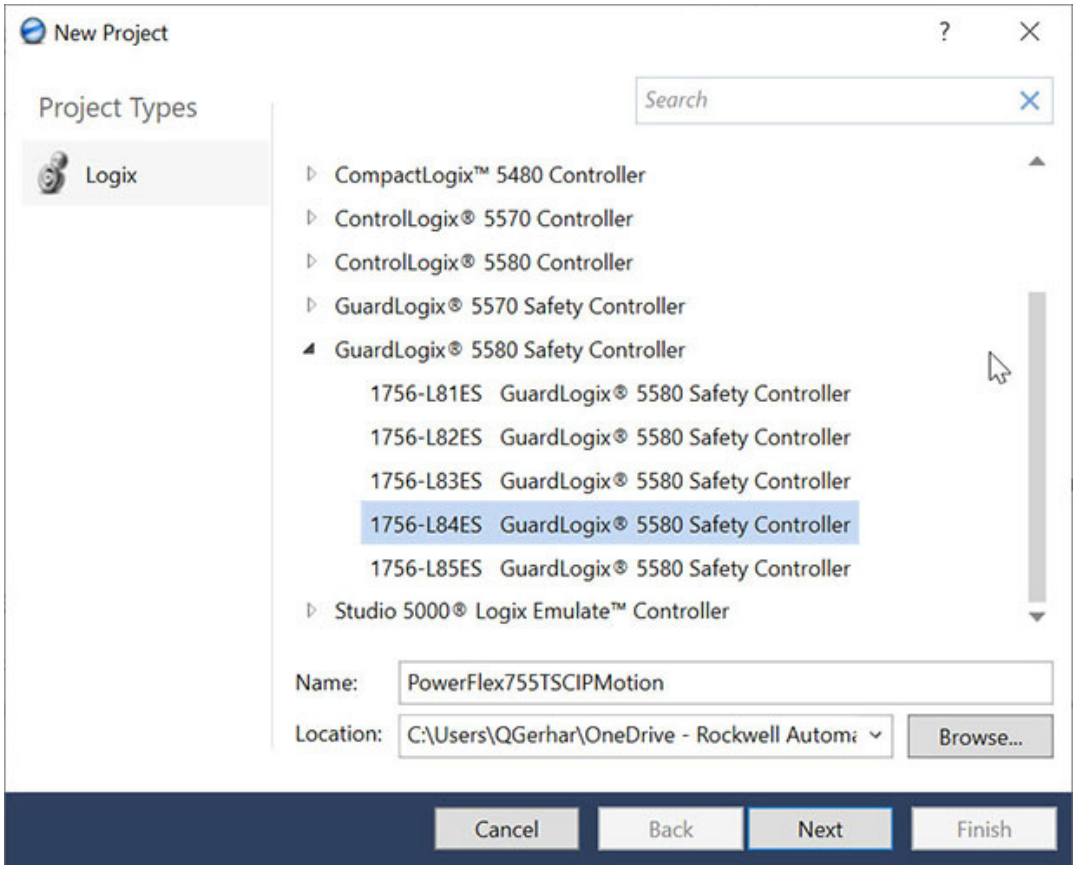
Item	Description
E	Stratix 5400 Ethernet managed switch
F	PowerFlex 755TS drive
G	Induction (asynchronous) motor

Create Your Controller Project

Follow these steps to start up your Logix Designer application and create a project.

1. Apply power to your controller and open your Logix Designer application.
2. From the Create menu, choose New Project.
   The New Project dialog box appears.

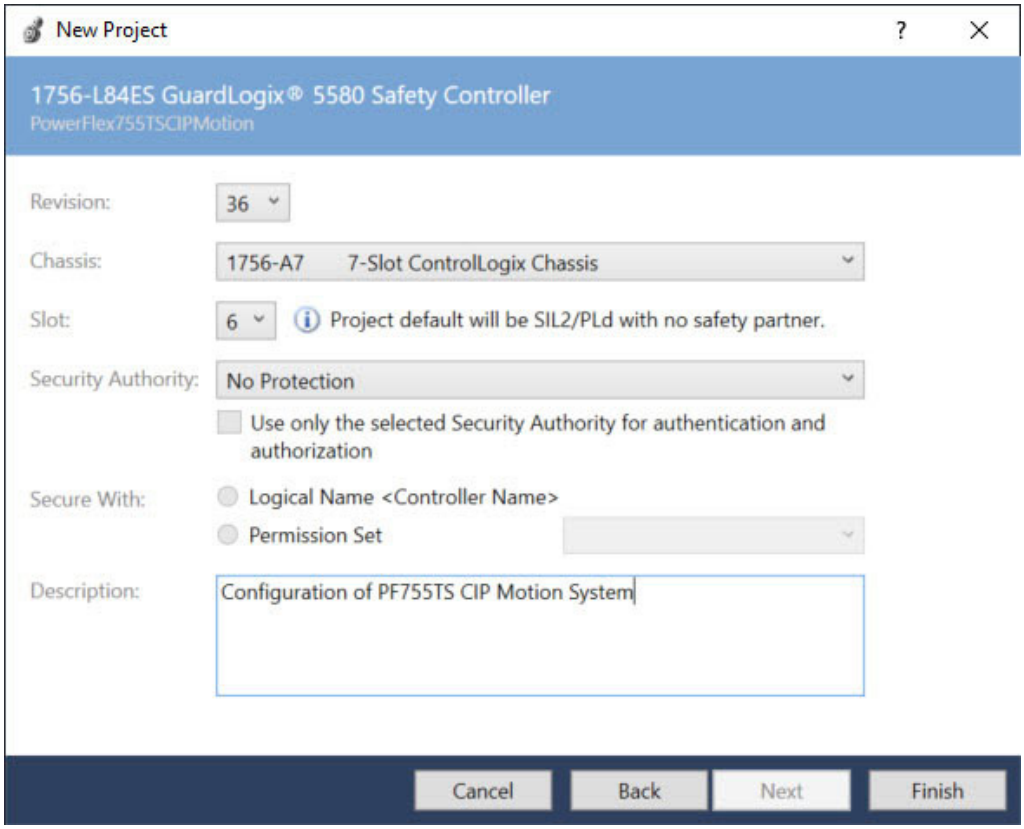
Figure 3 - New Project Dialog Box



3. Expand the Logix 5000 controller family and select your controller. This example uses a 1756-L84ES GuardLogix 5580 Safety Controller.
4. Type the Name of your project. This example uses PowerFlex755TSCIPMotion.
5. Click Next.

The New Project dialog box appears.

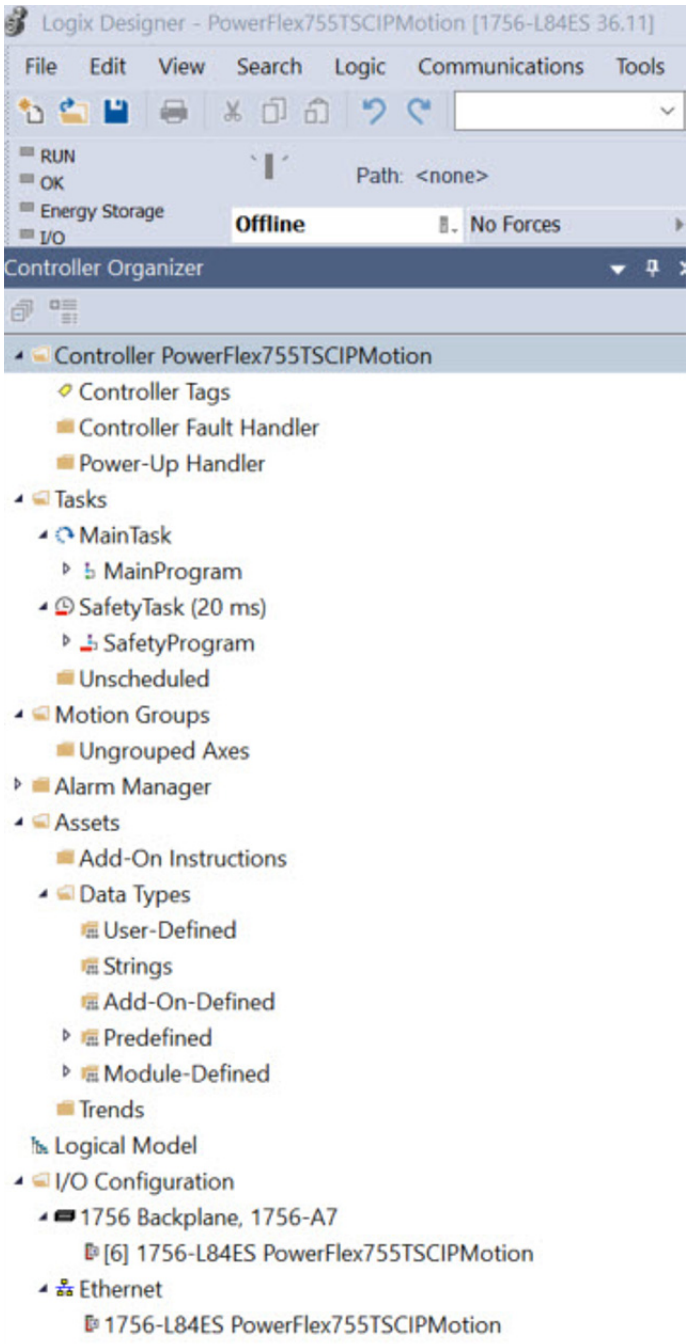
Figure 4 - New Project Dialog Box



6. Choose the controller Revision.
7. Choose the applicable Slot where the safety controller is installed in the chassis. Slot 6 is used in this example.
8. Click Finish.

The new controller appears in the Controller Organizer below the I/O Configuration folder.

Figure 5 - Controller Organizer

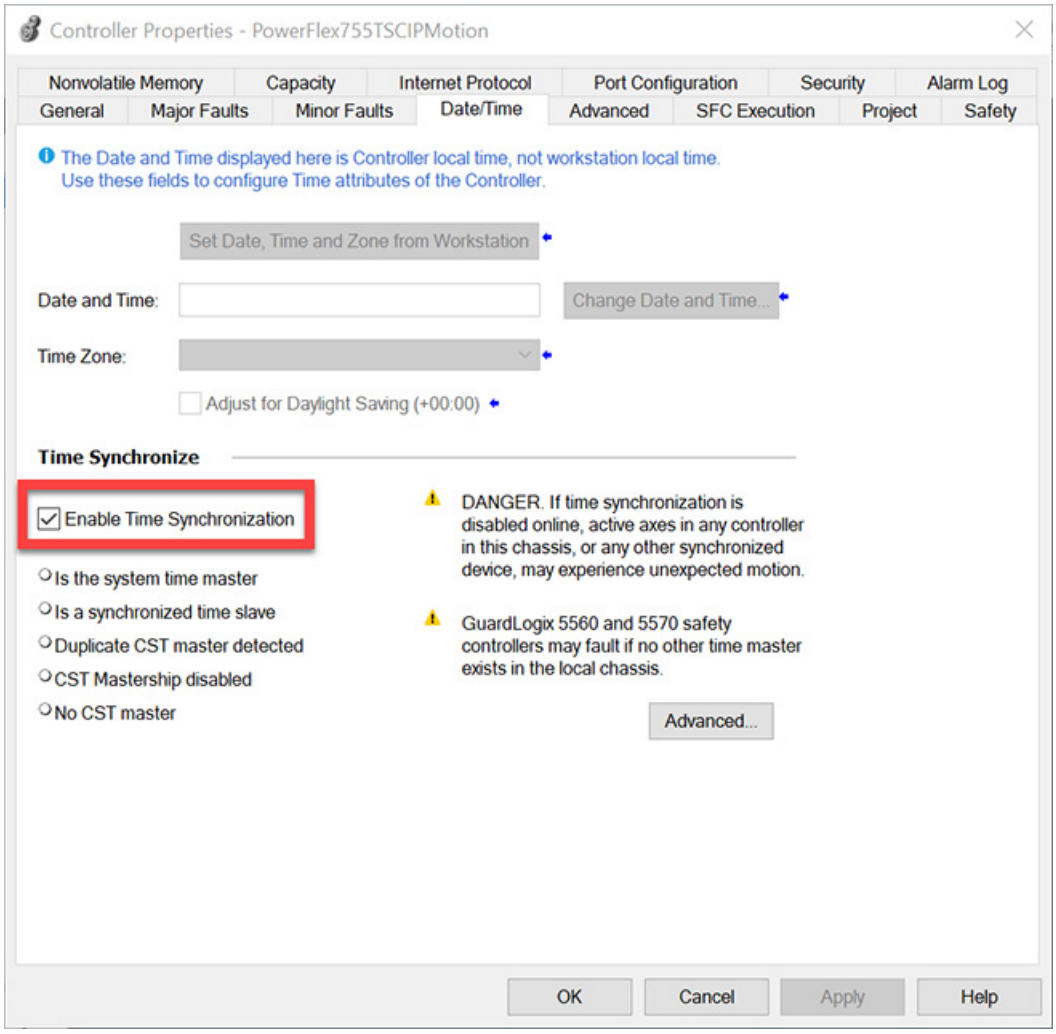


Configure Time Synchronization

Integrated motion on EtherNet/IP applications require precise motion control. Therefore, the Time Synchronization feature must be enabled in the controller properties dialog box, which allows the controller to use the time stamp function of positions and registrations.

1. Open the controller properties.
2. Choose the Date/Time tab.

Figure 6 - Controller Properties Dialog Box - Date/Time Tab



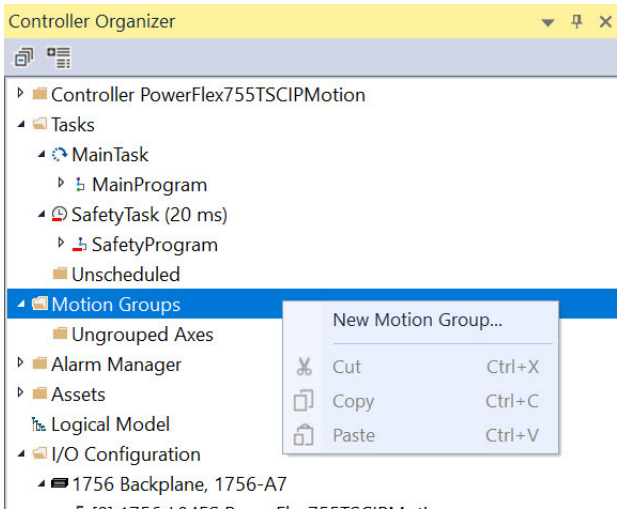
3. Below Time Synchronization, select Enable Time Synchronization.
4. To save your changes, click Apply.
5. Click OK.

Configure a Motion Group

Follow theses steps to create your motion group.

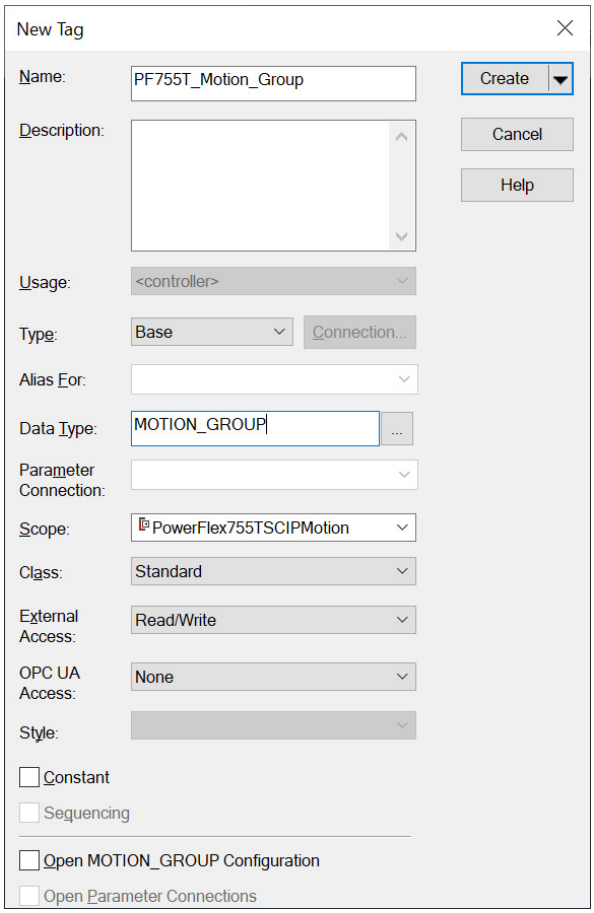
1. In the Controller Organizer, right-click Motion Groups and choose New Motion Group.

Figure 7 - New Motion Group



The New Tag dialog box appears.

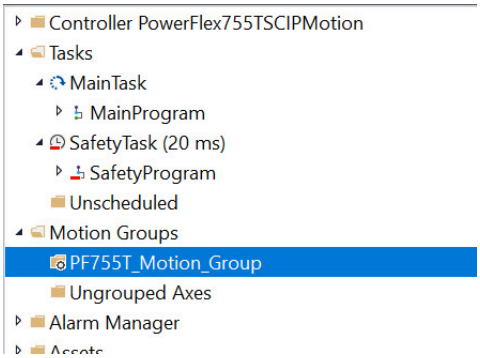
Figure 8 - New Tag Dialog Box - Create Group



2. Type a Name for the group. PF755T_Motion_Group is used in this example.
3. Click Create.

The new motion group is added to Motion Groups in the controller organizer.

Figure 9 - Controller Organizer - Motion Groups



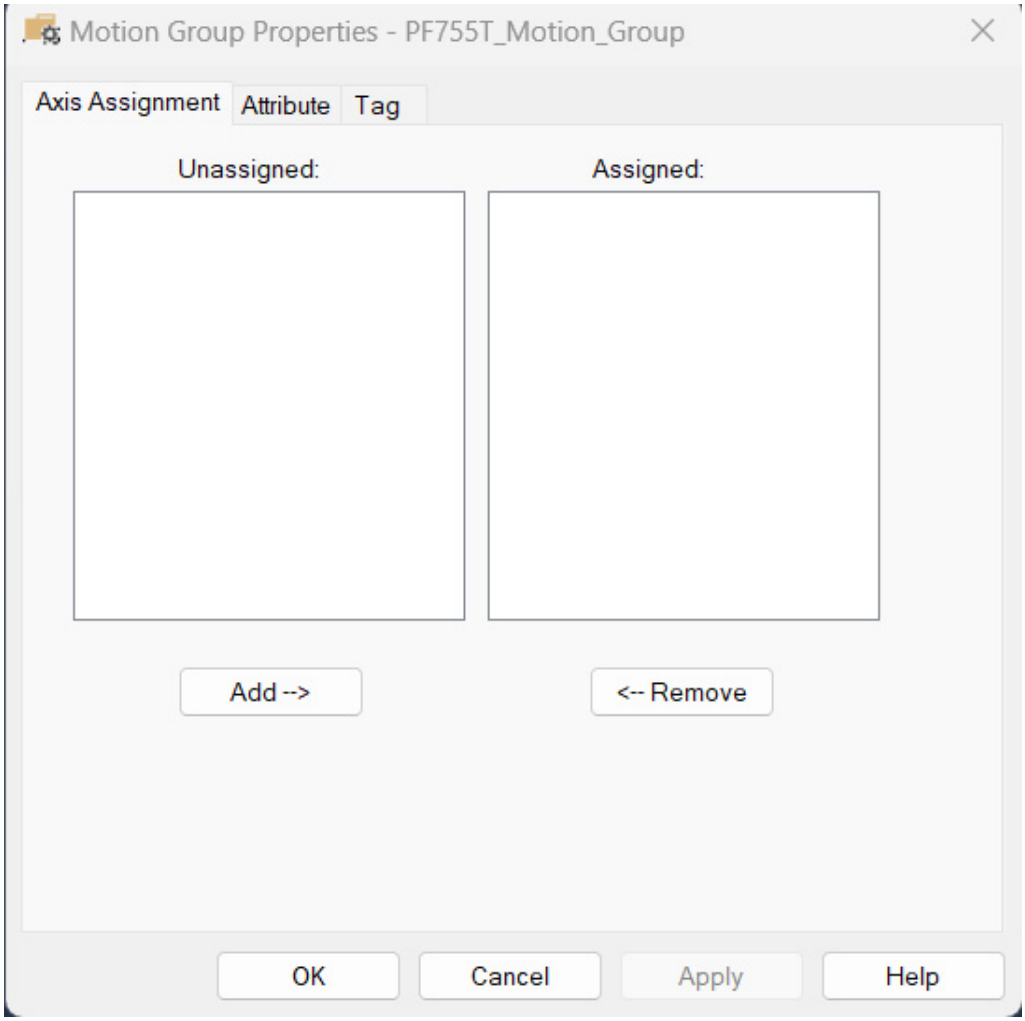
Configure the Motion Group Coarse Update Period

A combination of the type of controller and the number of axes determines the coarse update period. PowerFlex 755T products require a coarse update period of no less than 1 ms. Follow these steps to configure the coarse update rate for the motion group.

1. In the Controller Organizer, right-click your motion group and select Properties.

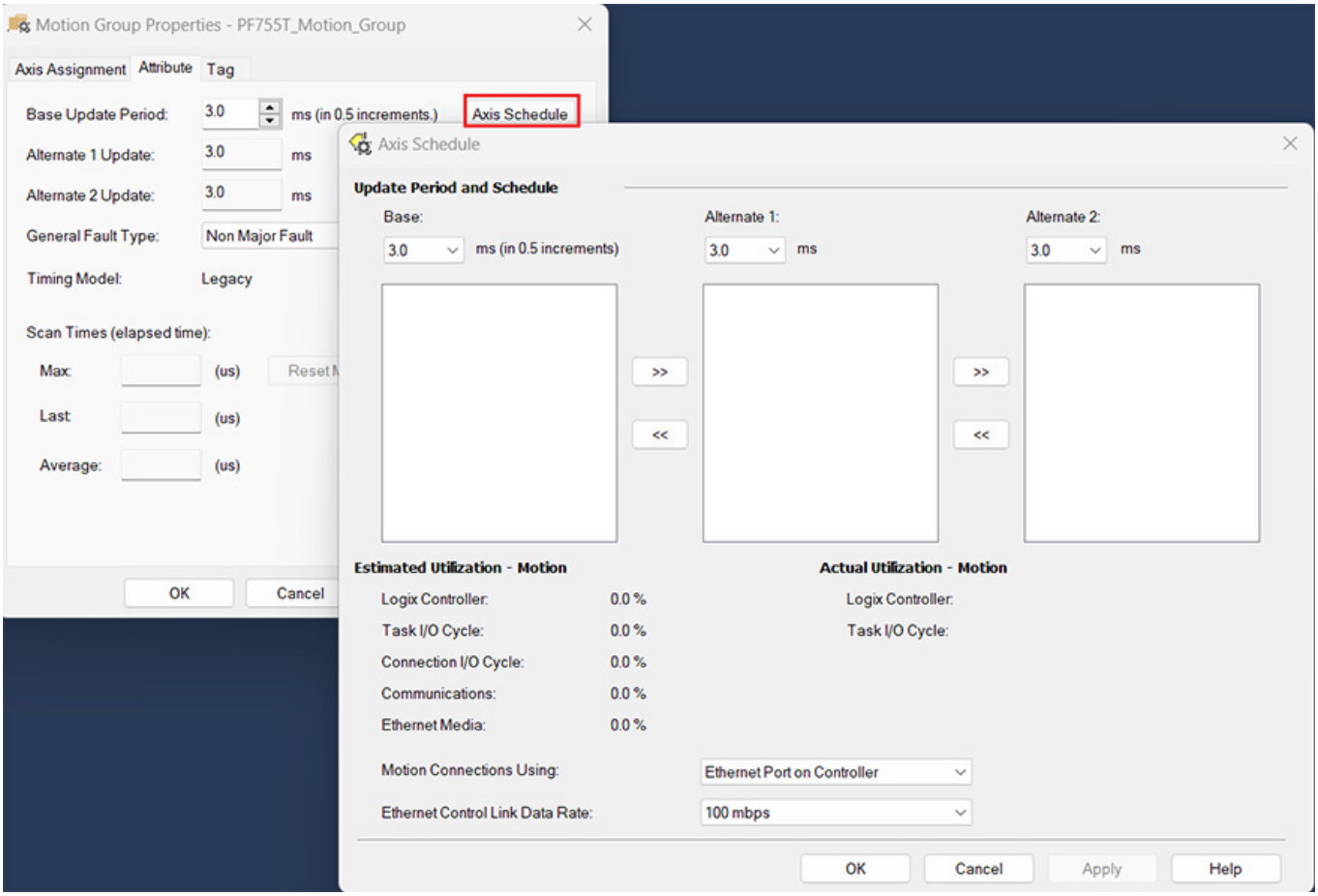
   The Motion Group Properties dialog box appears.

Figure 10 - Motion Group Properties Dialog Box - Axis Assignment



2. Select the Attribute tab and click Axis Schedule.

Figure 11 - Motion Group Properties Dialog Box - Axis Assignment



You can configure settings for a coarse update rate and use multiplexing to have various Axis CIP Drives update a multiple of the base update rate.

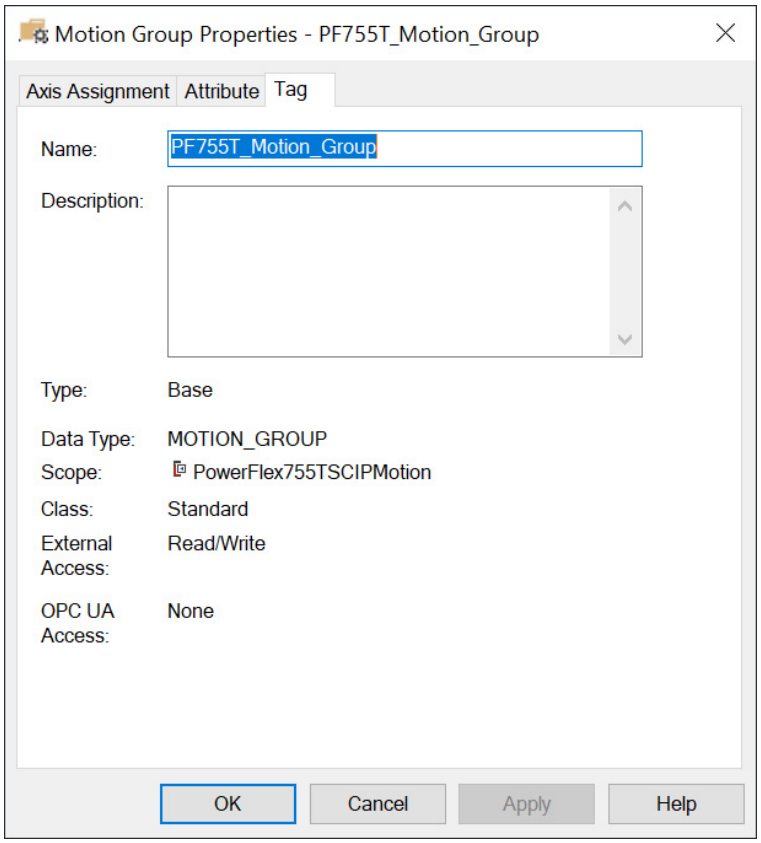
3. Make the appropriate settings for your application.

Mode	Minimum Update Rate
Coarse Update Period	1 ms
Position Loop	1024 µs
Velocity Loop	250 µs
Torque Loop	125 µs

4. Click OK.

5. Select the Tag tab.

Figure 12 - Motion Group Properties Dialog Box - Tag Tab



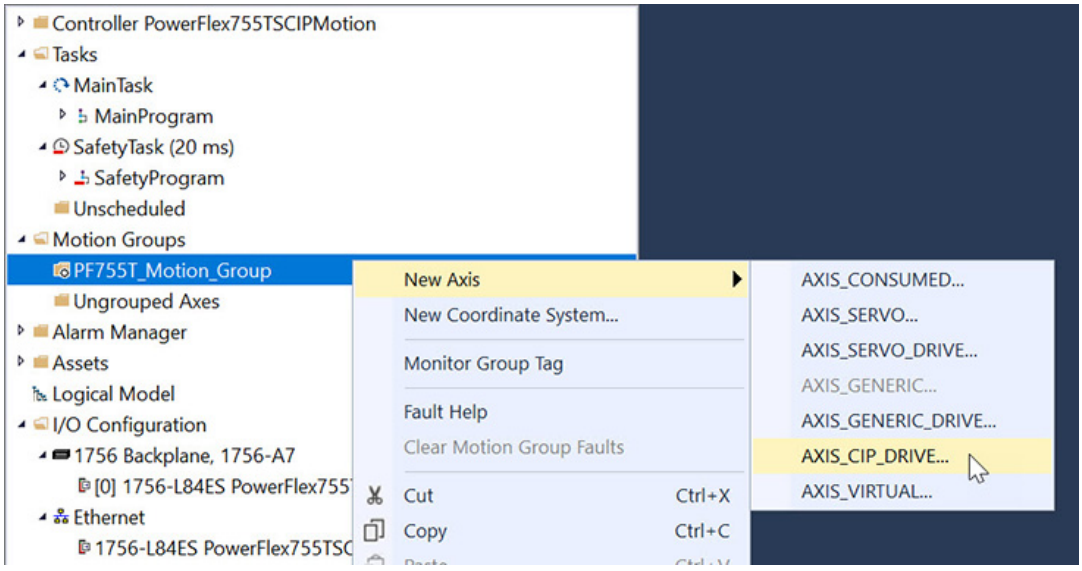
6. Type a Description for the motion group (optional).
7. Click OK.

Create an Associated Axis

Follow these steps to create an associated axis for your PowerFlex 755TS drive.

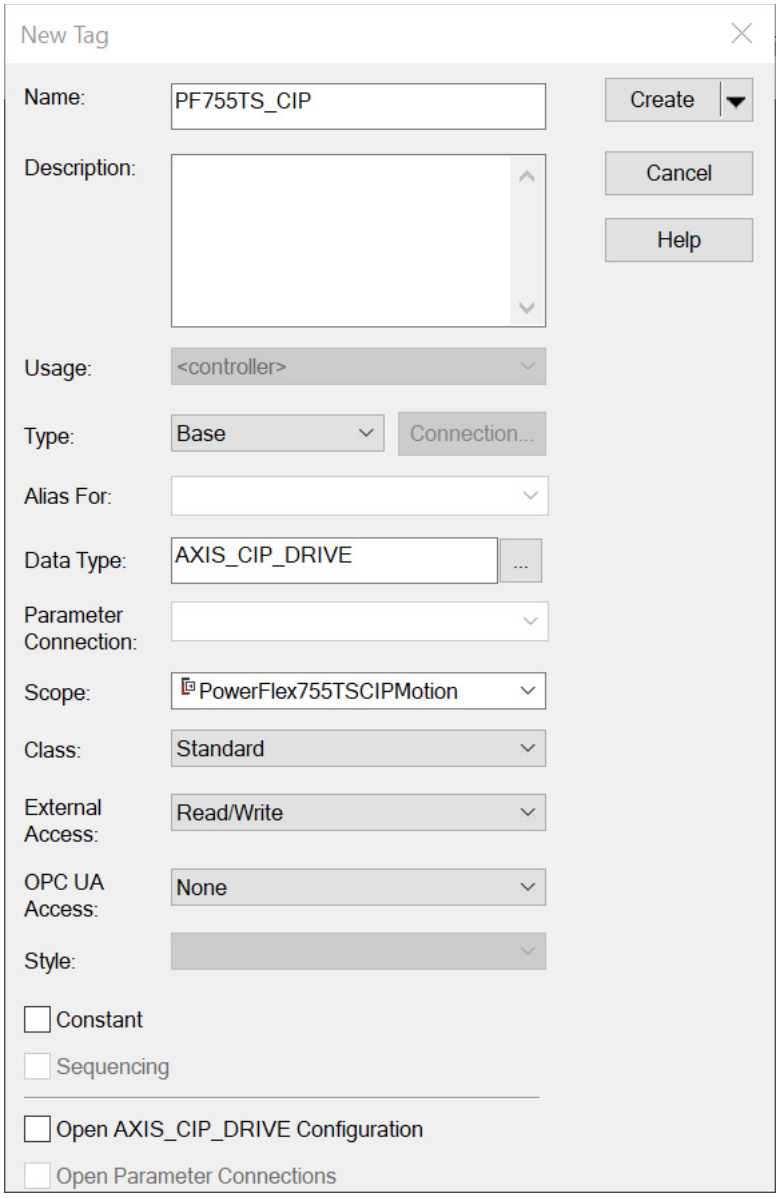
1. In the Controller Organizer, right-click your motion group (PF755T_Motion_Group in this example) and choose New Axis > AXIS_CIP_DRIVE.

Figure 13 - Create New Axis



The New Tag dialog box appears.

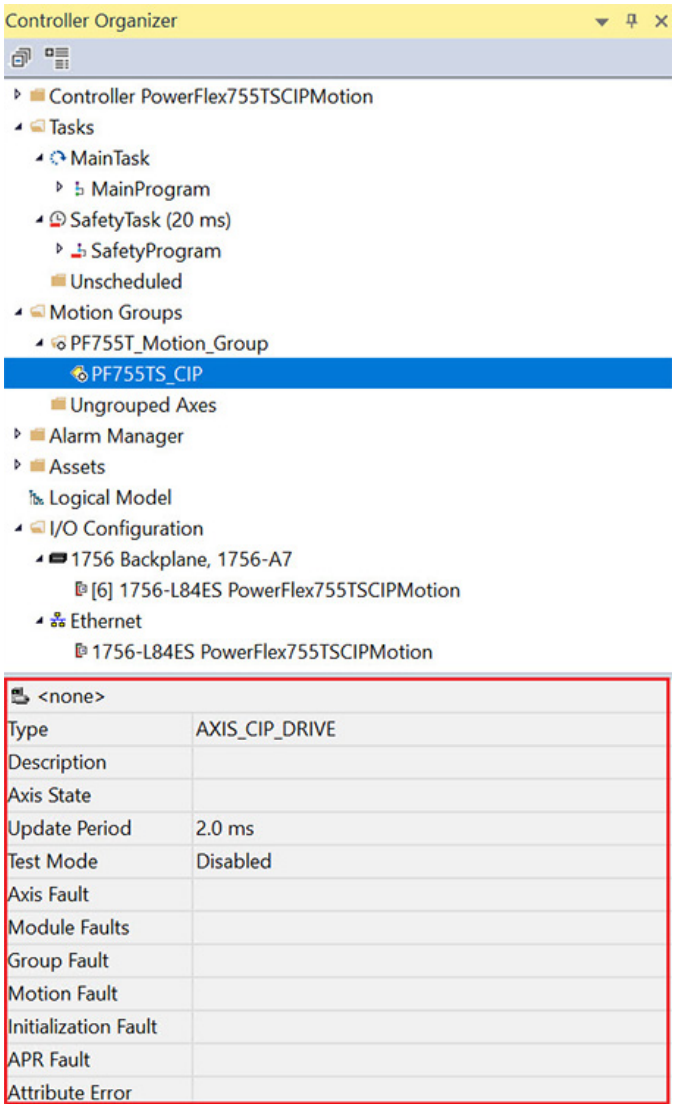
Figure 14 - New Tag Dialog Box - Axis CIP Drive



2. Type a Name for your motion axis. PF755TS_CIP is used in this example.
3. Click Create.

In the Controller Organizer, the axis is added to your motion group. At the bottom of the Controller Organizer, you can view the status of the axis in the quick view pane.

Figure 15 - Controller Organizer - Quick View Pane

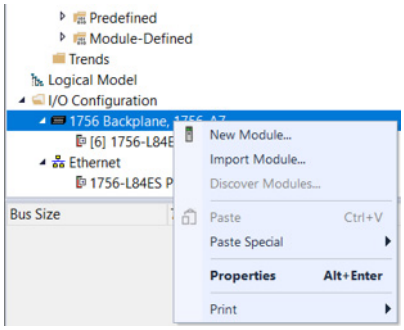


Add the EtherNet/IP Bridge Module to the Controller Chassis Backplane

Follow these steps to add an EtherNet/IP bridge module to the backplane. A 1756-EN2TR module is used in this example.

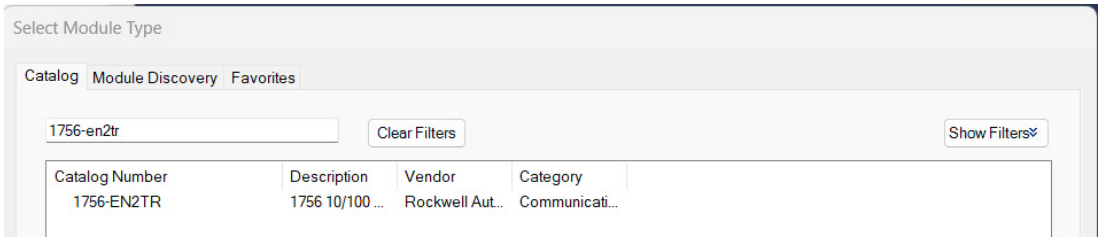
1. In the Controller Organizer, below I/O Configuration, right-click the 1756 Backplane and choose New Module.

Figure 16 - Create New Module



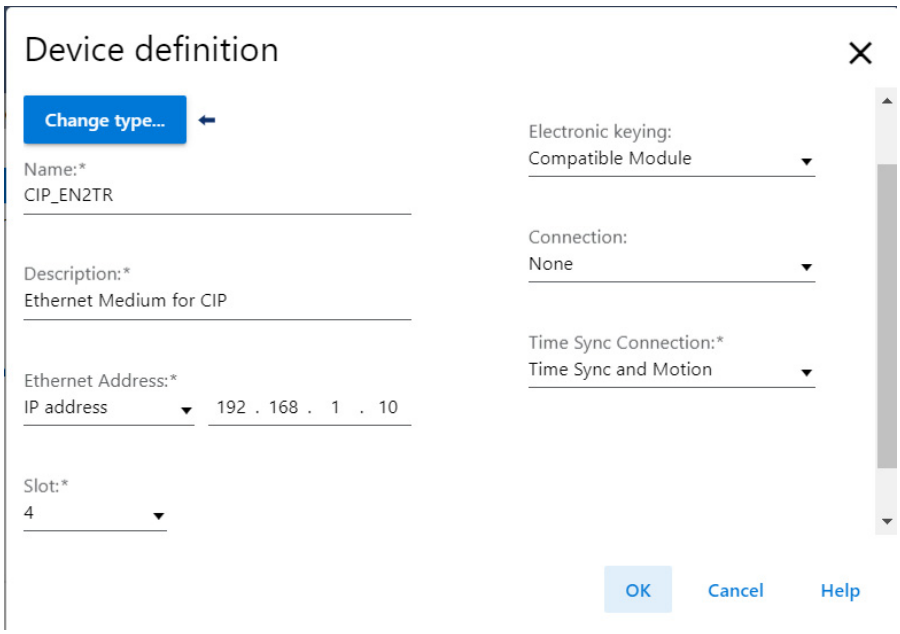
The Select Module Type dialog box appears.

Figure 17 - Select Module Type Dialog Box



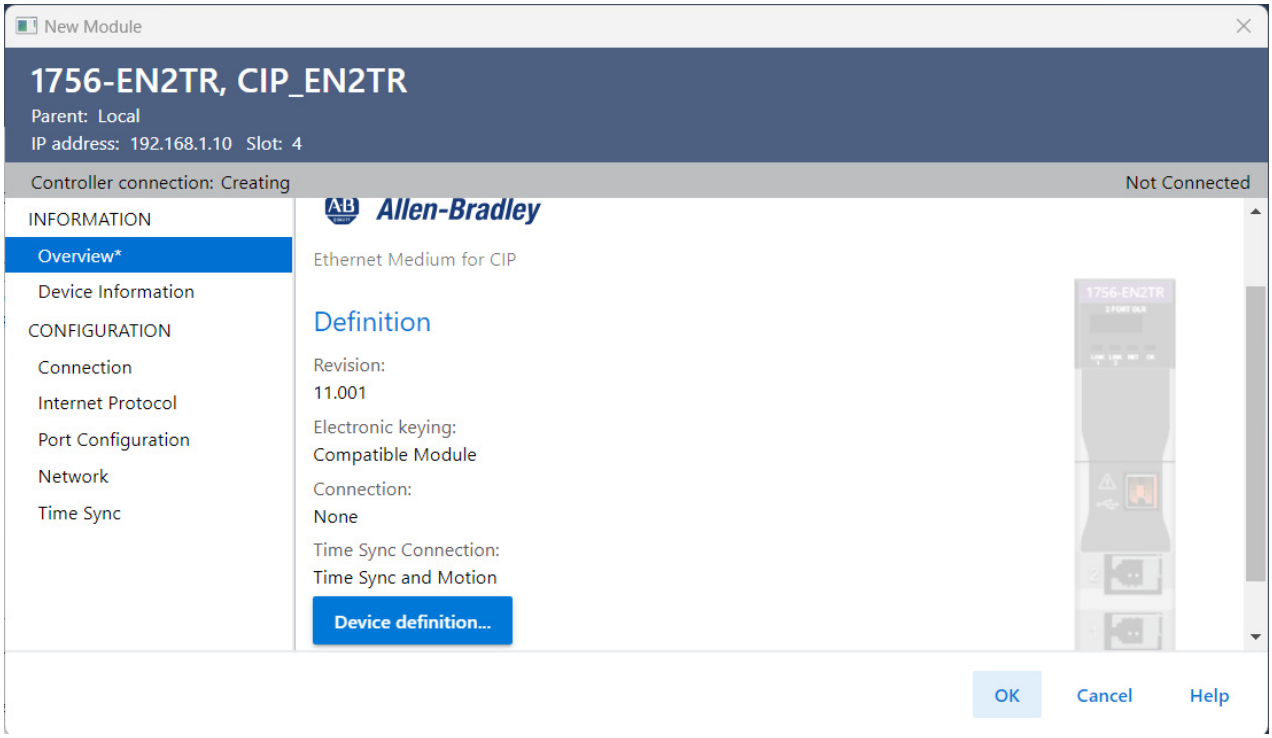
2. In the filter box, type the module catalog number. 1756-EN2TR is used in this example.
3. Below the Catalog Number, choose your EtherNet/IP bridge module.
4. Click Create.
   The Device Definition dialog box appears.

Figure 18 - Device Definition Dialog Box



5. Type a Name for the module. CIP_EN2TR is used in this example.
6. Type a Description for the module.
7. Choose the appropriate Ethernet Address option and type the IP address for the module, when applicable.
8. Choose the appropriate chassis Slot.
9. In Time Sync Connection, choose Time Sync and Motion.
10. Click OK.
    The New Module dialog box appears.

Figure 19 - New Module Dialog Box



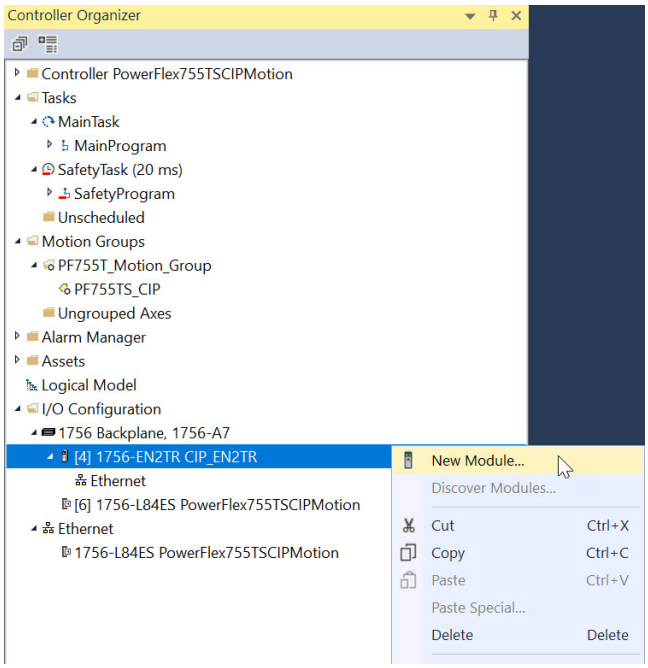
11. To save your changes, click OK.
    The EtherNet/IP bridge module appears below the Backplane in the Controller Organizer.

Add the PowerFlex Drive to Your EtherNet/IP Network

Follow these steps to add the PowerFlex 755TS drive to your EtherNet/IP network.

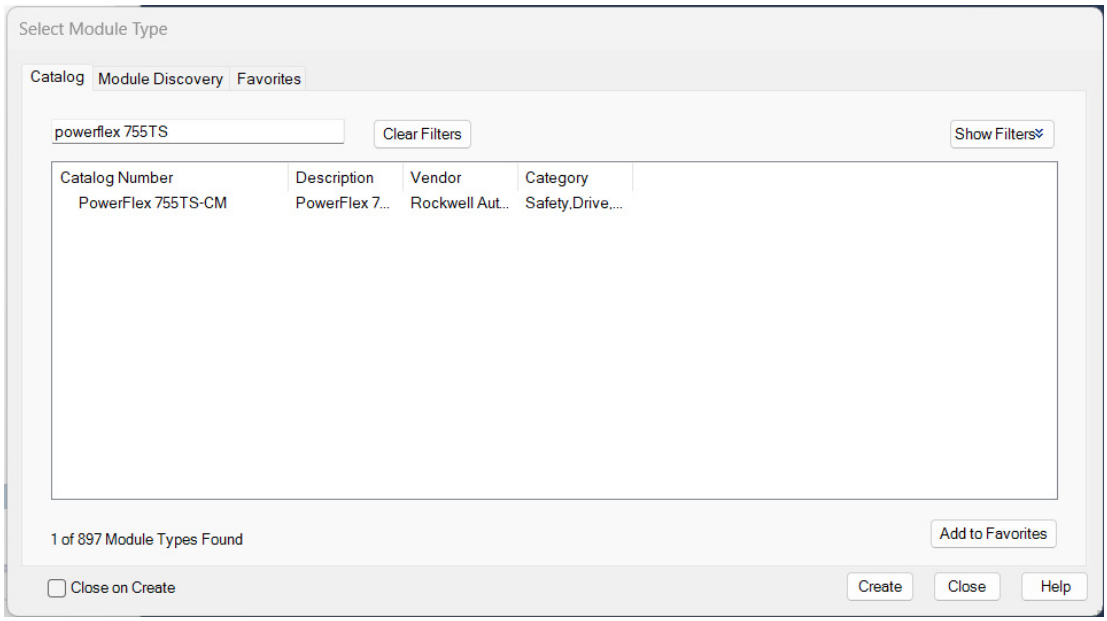
1. In the Controller Organizer, right-click your EtherNet/IP bridge module and choose New Module. 1756-EN2TR CIP_EN2TR is used in this example.

Figure 20 - Controller Organizer - Add New Module



The Select Module Type dialog box appears.

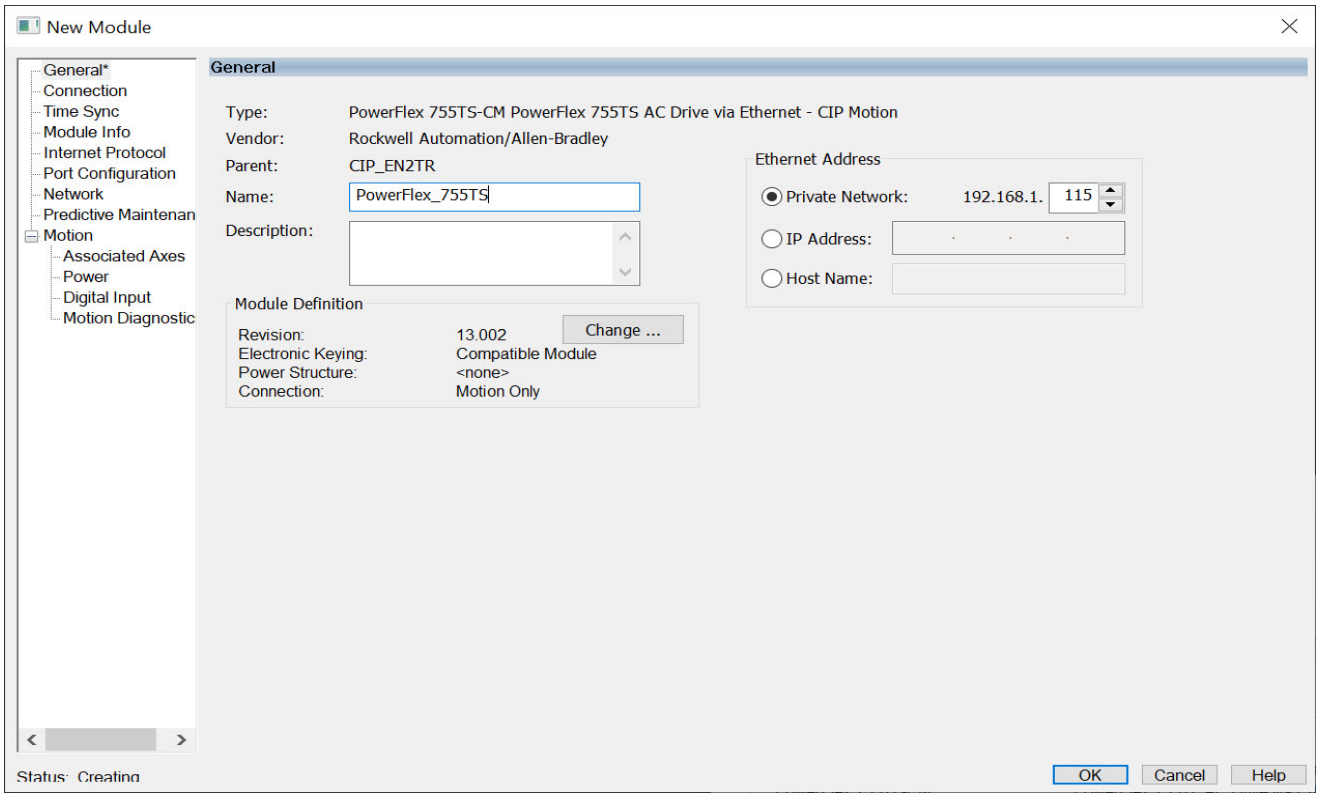
Figure 21 - Select Module Type Dialog Box



2. In the filter box, type PowerFlex 755TS.
3. Below Catalog Number, choose PowerFlex 755TS-CM.
4. Click Create.

The New Module dialog box appears.

Figure 22 - New Module Dialog Box



5. Type a Name for the drive. PowerFlex_755TS is used in this example.
6. Type a Description for the drive (optional).
7. Choose the appropriate Ethernet Address option and type the IP address for the drive.
8. To save your configuration, click OK.

Complete the Module Definition for Your Drive

The Match Drive feature allows you to connect to a physical drive and upload data from the drive to these module fields:

- Revision (major revision only)
- Drive Rating
- Special Type
- Catalog

You can find this data on the nameplate that is on your drive. Or, if your drive is not available, you can find this data in the PowerFlex 750TS-Series Products with TotalFORCE Control Technical Data, publication 750-TD104.

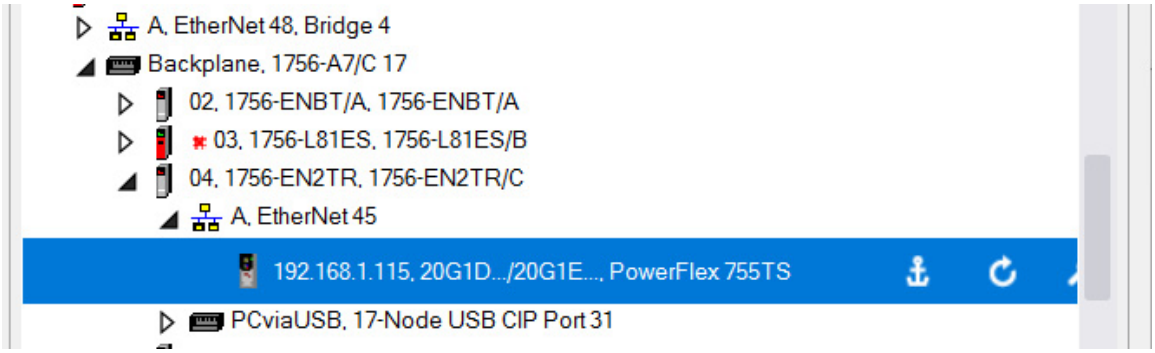
You can use the Match Drive feature if the following are true:

- Your drive is offline with the controller
- The drive control power is energized
- The drive is in Integrated Motion on EtherNet/IP mode
- The drive Ethernet address is configured and the drive is active on the network

Follow these steps to complete the module definition for your PowerFlex drive.

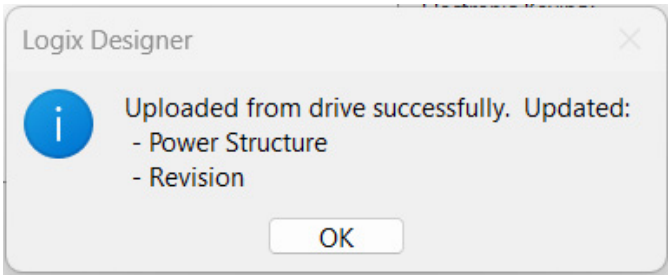
1. In the Controller Organizer, right-click your PowerFlex 755TS drive and choose Properties. PowerFlex_755TS is used in this example.
2. If your drive is installed and is online, and the Ethernet address is configured, complete steps a...e, or continue with step 3.
   a. On the General page, click Change (see Figure 22 on page 20 for location).
   b. In the Module Definition dialog box, click Match Drive (see Figure 25 on page 22 for location).
   c. In the Upload - Path Selection dialog box, navigate to and choose your drive.

Figure 23 - Upload - Path Selection Dialog Box



   d. Click Continue.
   A message box appears to indicate that the upload was successful.

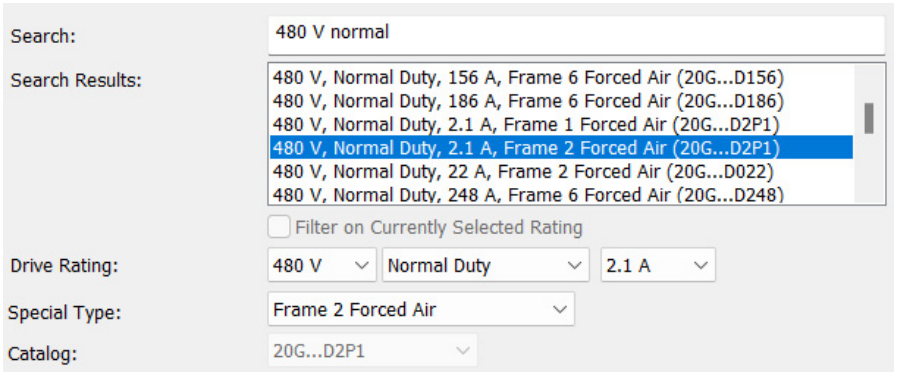
Figure 24 - Match Drive Results



   e. Click OK.
   The Revision (major revision only), Drive Rating, Special Type, and Catalog data is uploaded from the drive to the module definition.
3. Complete the drive module definition:

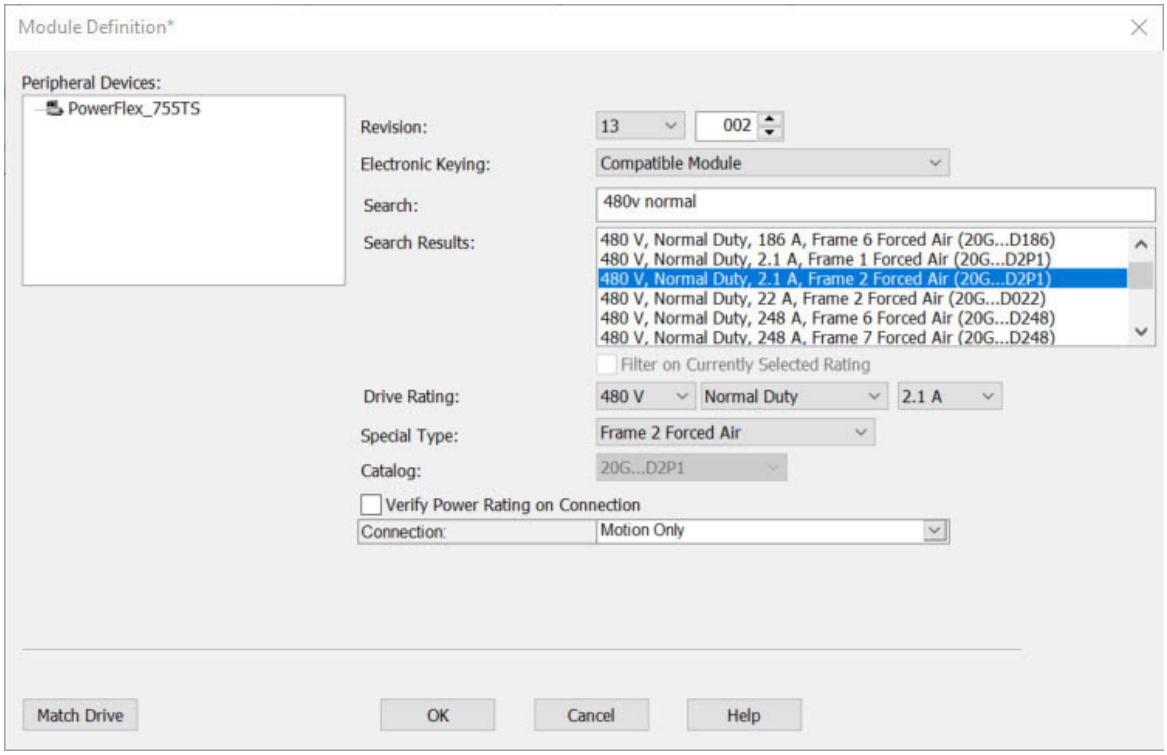
You can complete the Drive Rating fields by using one of these methods:

- Type a portion of the power rating in the Search field and choose the applicable rating from Search Results.



- Choose the applicable voltage, duty, and amp ratings from the Drive Rating fields.

Figure 25 - Module Definition Dialog Box



This example does not use any peripheral devices.

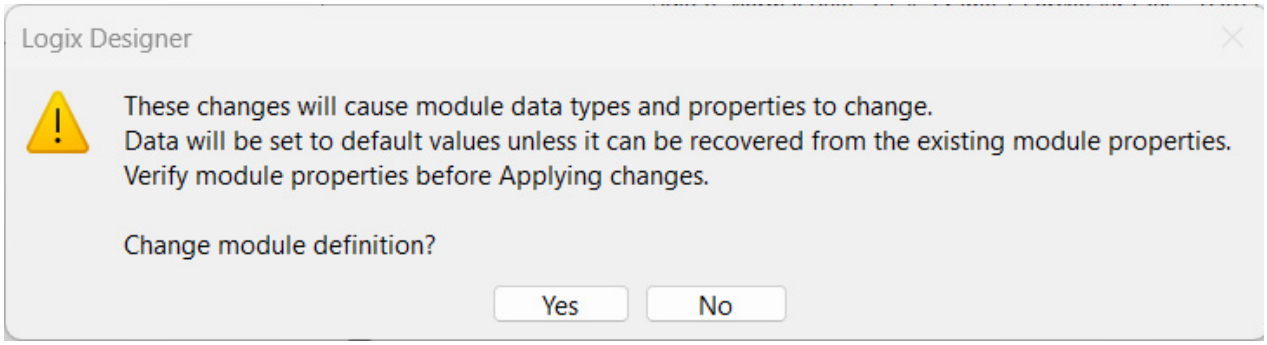
Table 3 - Module Definition Properties

Property	Description
Revision	Select the major and minor firmware revision (must be 13.002 or later).
Electronic Keying	Selects the type of electronic keying that is used for the drive (enabled when the drive is offline only). Keying is a feature that reduces the possibility that you use the wrong device in a control system. Electronic Keying lets you verify that communication occurs only with an installed device that matches the expected device type and revision. The available options are: • Exact Match • Compatible Module • Disable Keying (not available for use with a safety option module)
Search	Type the drive power rating (voltage, duty, and current) to view possible selections in Search Results.
Search Results	Select the search result that matches the desired drive rating, special type, and catalog number of the drive.
Filter on Currently Selected Rating	Select to filter the Drive Rating, Special Type, and Catalog selections.
Drive Rating	Select the voltage class, normal duty, heavy duty, or light duty, and current rating of the drive.
Special Type	Select the drive frame size and cooling type (based on the selected drive rating). Not available for all drive ratings.
Catalog	Drive catalog number (based on the selected drive rating). Not available for all drive ratings.
Verify Power Rating on Connection	Select to verify that the drive rating selections on this page match the drive to which you are connecting. If this box is selected and the physical drive rating does not match the drive rating selected on this page, an error occurs and the connection fails.
Connection	Select the type of controller and drive communication type. The available options are: • Motion Only - This controller manages the motion connections. Another controller that has a Safety Only connection to the drive manages the integrated safety connection. • Safety Only - This controller manages the integrated safety connection. Another controller manages the motion connections. An integrated safety connection can only be made from a GuardLogix 5580 or Compact GuardLogix 5380 controller. Because the safety function is controlled in this axis only, a motion drive axis does not appear in the motion group. • Motion and Safety - This controller manages the motion and integrated safety connections. A Motion and Safety connection can only be made from a GuardLogix 5580 or Compact GuardLogix 5380 controller. This example uses this selection.

4. Click OK.

A message appears to identify that changes have been made to the module properties.

Figure 26 - Change Module Definition Message



5. To accept the changes and complete the module definition, click Yes.
   The Module Properties dialog box appears.
6. To save your drive module, click Save.

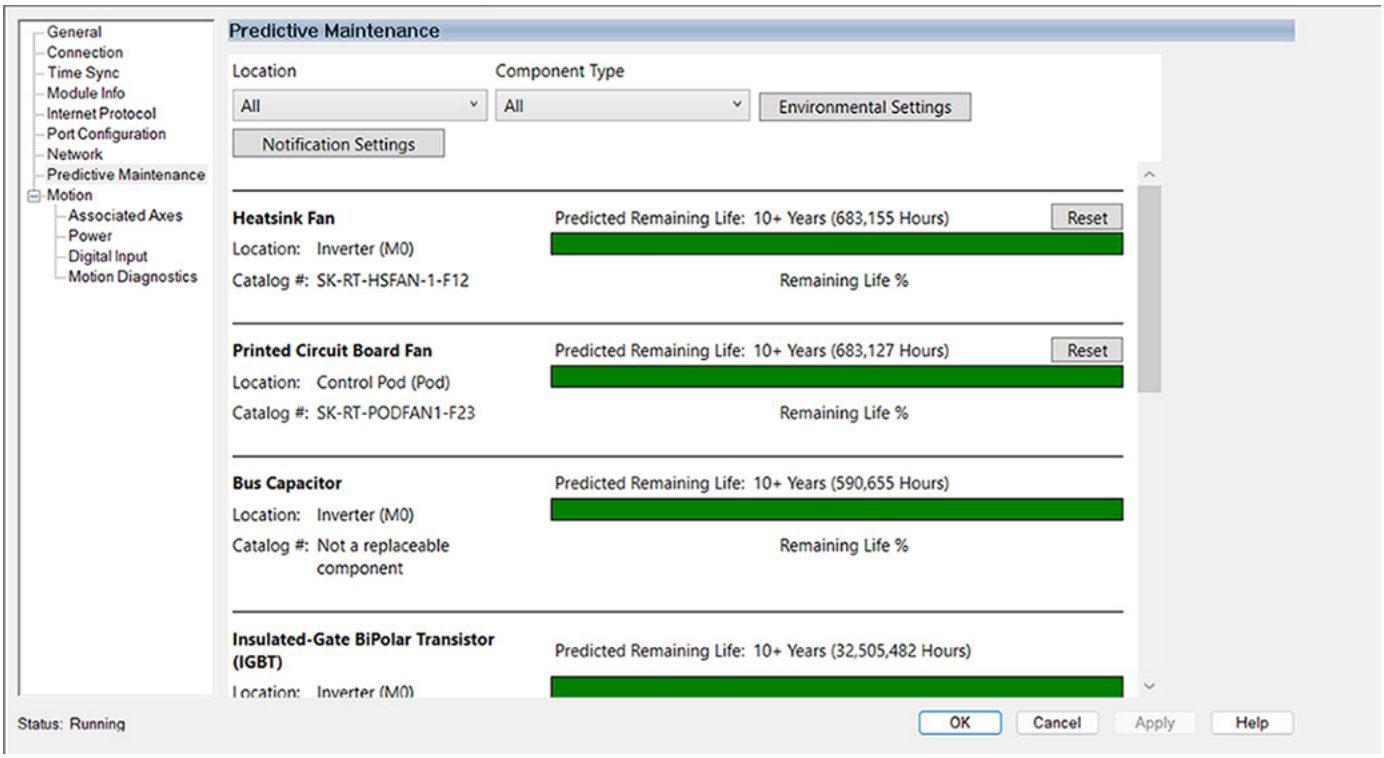
Set Up Predictive Maintenance

Use the Predictive Maintenance page to monitor and reset the estimated life of components in your PowerFlex 755T product with TotalFORCE Control. The controller must be online with the drive to view the status of predicted remaining life of components.

Follow these steps to complete the predictive maintenance configuration for your PowerFlex drive module.

1. From the Controller Organizer, open your drive module.
2. Select the Predictive Maintenance category.

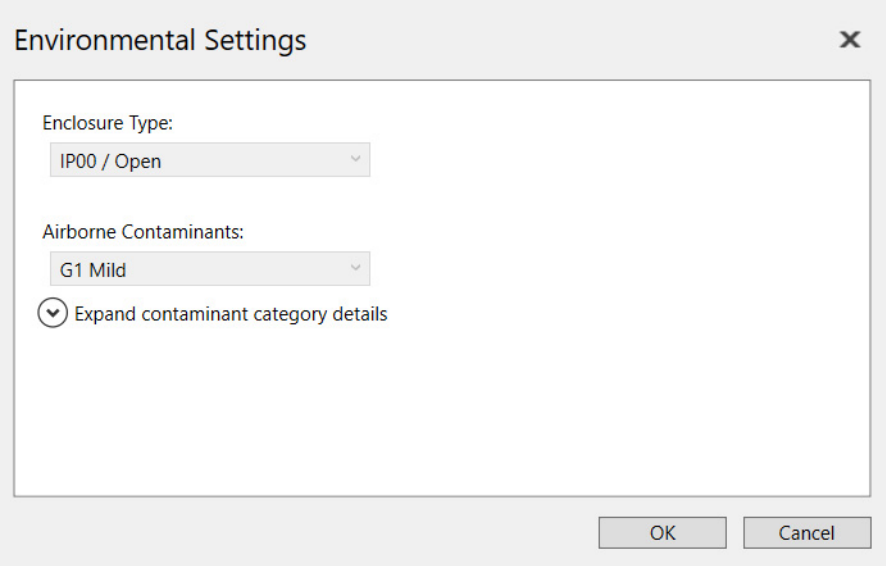
Figure 27 - Module Properties Dialog Box - Predictive Maintenance Category (Drive Online)



3. To configure the environmental settings, click Environmental Settings.

The Environmental Settings dialog box appears.

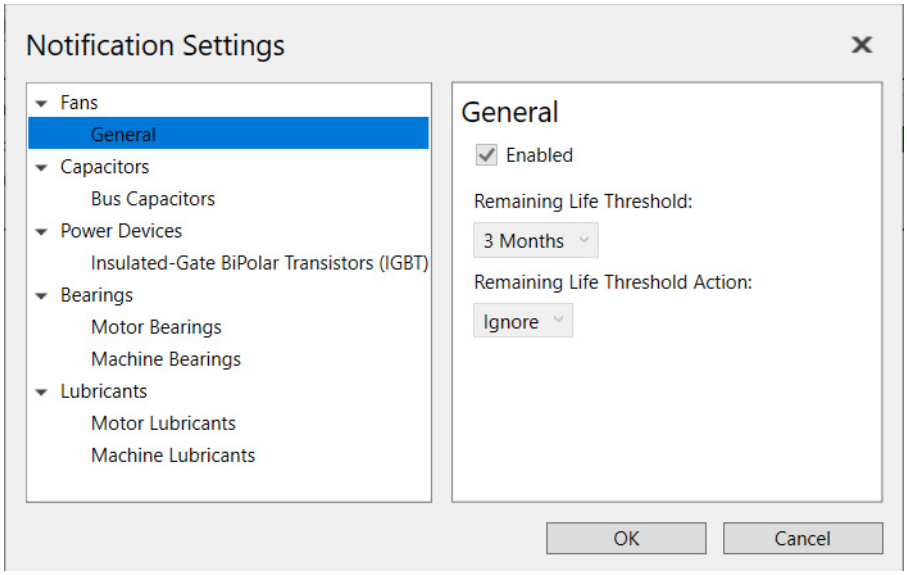
Figure 28 - Environmental Settings Dialog Box



4. To configure your environmental settings, complete steps a...c.
   a. Select the Enclosure Type for your product. Available options are:
      - P00 / Open
      - IP20-21 /Type 1
      - IP54 / Type 12
   b. Select the applicable Airborne Contaminants category for your product installation site. The selections classify the airborne contaminants in the installation environment, per ISA 71.04 standard with an additional category (GX+). Available options are:
      - G1 Mild - An environment sufficiently well-controlled such that corrosion is not a factor in determining equipment reliability.
      - G2 Moderate - An environment in which the effects of corrosion are measurable and can be a factor in determining equipment reliability.
      - G3 Harsh - An environment in which there is a high probability that a corrosive attack can occur. These harsh levels should prompt further evaluation resulting in environmental controls or specially designed and packaged equipment.
      - GX Severe - An environment in which only specially designed and packaged equipment would be expected to survive. Specifications for equipment in this class are a matter of negotiation between user and supplier.
   c. Click OK.
5. Click Notification Settings.

The Notification Settings dialog box appears.

Figure 29 - Notification Settings Dialog Box



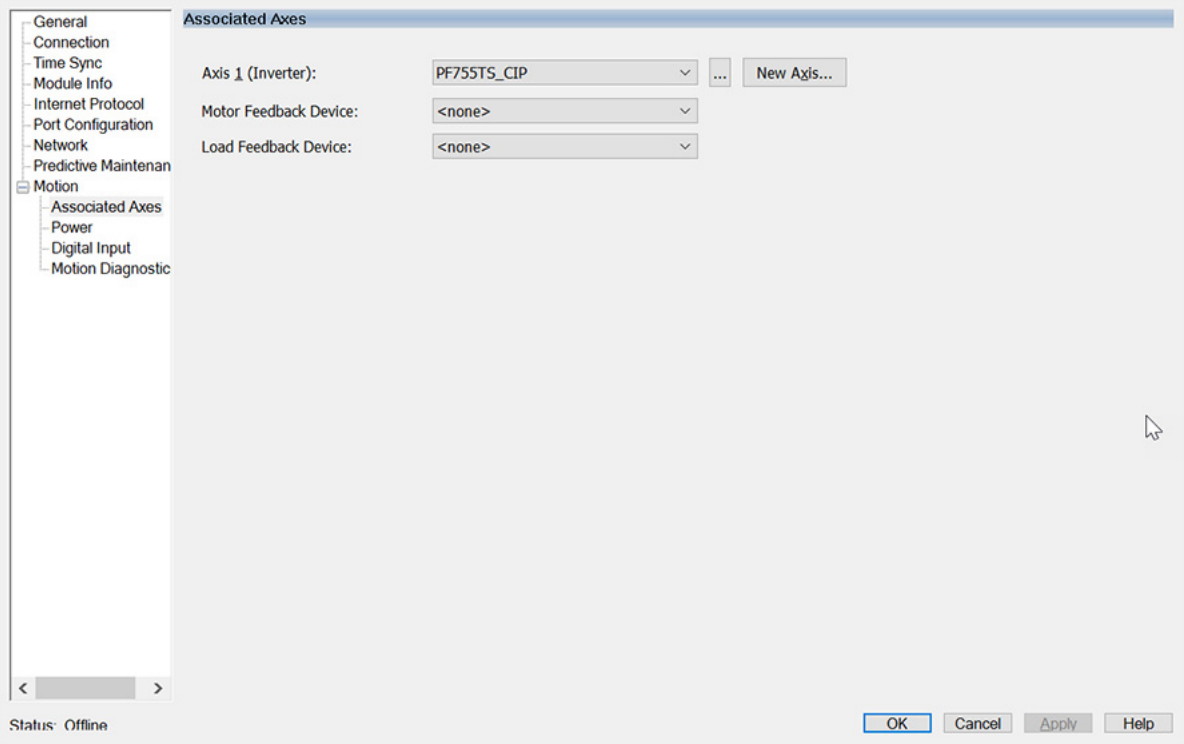
6. To configure your notification settings, complete steps a...g.
   a. In the selection list, choose the component or group of components for which you want to configure notification settings.
   b. If present, click Enabled to enable notifications for a non-drive component.
   c. In Remaining Life Threshold, select the time at which you want a notification to occur.
   d. From Remaining Life Threshold Action, select the type of notification action that you want to occur when the remaining life threshold is reached.
   e. For non-drive components, type the maximum number of hours of the components expected life in User Defined Maximum Life.
   f. Repeat steps a...e for each renewal component or component group you want to configure.
   g. Click OK.
7. To save your changes, in the Module Properties dialog box, click Apply.

Assign the Associated Axis

Follow these steps to create an associated axis for your PowerFlex 755TS drive.

1. Expand the Motion category and select Associated Axes.

Figure 30 - Module Properties Dialog Box - Associated Axes Category



2. In Axis 1, select your axis. PF755TS_CIP is used in this example.
   There is no Motor Feedback Device or Load Feedback Device because the axis is configured for frequency control.

Your CIP axis is now assigned to the drive module.

Review the Power Settings

Review the power configuration for your PowerFlex drive.

1. Below the Motion category, select Power.

   Configure the power settings for your application. Configuration changes to this page can be made if a switching frequency or bus overvoltage issue occurs. See Table 4 for available power settings. In this example, the settings remain set to the default values.

Figure 31 - Module Properties Dialog Box - Power Category

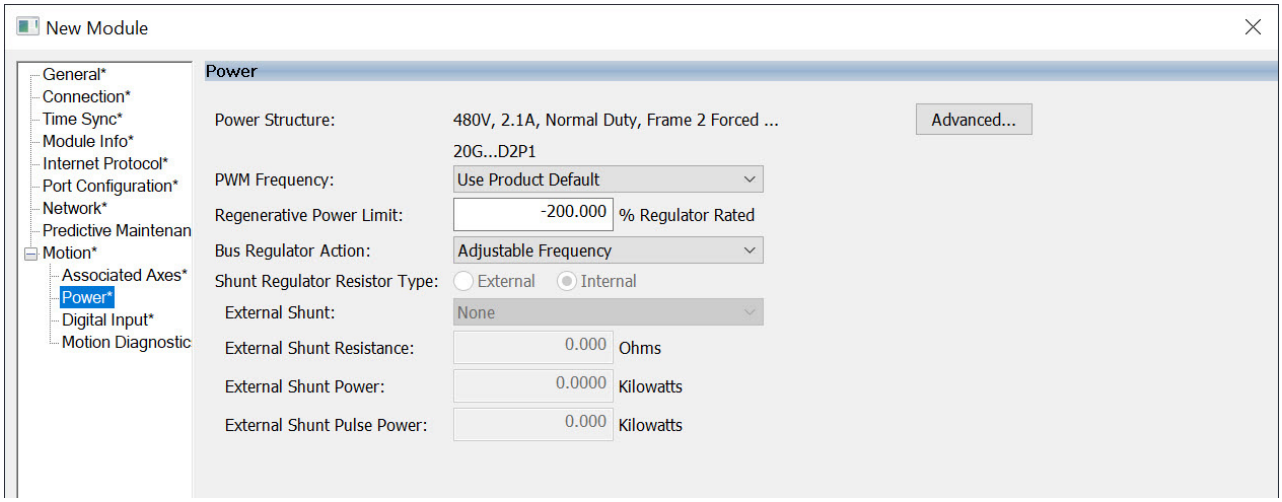


Table 4 - Power Settings

Attribute	Settings	Description
Power Structure	From the Module Definition	The drive voltage class, normal duty, heavy duty, or light duty, and current rating.
PWM Frequency	Use Product Default (default) 1.333 kHz[1] 2 kHz 4 kHz 8 kHz 12 kHz	The value sets the carrier frequency for the pulse-width modulation (PWM) output to the motor.
Regenerative Power Limit	-800.00...0.00 (Default -200.00)	This limit is the amount of energy that the drive allows during regeneration. If an external regenerative power supply or shunt (dynamic brake) resistor is used, it is recommended that this value is set to -200.0%. **IMPORTANT:** If this value is set too low, the ability of the drive to stop a motor is limited.
Bus Regulator Action[2]	Disabled	Disables the internal shunt resistor and external shunt option.
	Shunt Regulator	Enables the internal and external shunt options.
	Adjustable Frequency (default)	This selection allows the drive to either change the torque limits or ramp rate of the velocity to control the DC bus voltage. This option is not recommended for positioning applications because it overrides the velocity and the system can overshoot or not stop.
	Shunt then Adjustable Frequency	This selection allows the Shunt resistor to absorb as much energy as it is designed for, then transitions to adjustable frequency control if the limit of the resistor has been reached.
	Adjustable Frequency then Shunt	This selection allows for adjustable frequency control of the DC bus. If adjustable frequency control cannot maintain the DC bus within limits, the shunt resistor is activated.
	Use Product Default	Uses the default setting for the product.
Shunt Regulator Resistor Type	Internal	Enables the internal shunt (the external shunt option is disabled).
	External	Enables the external shunt (the internal shunt option is disabled).
External Shunt Resistance	The type of drive determines the valid values.	Specifies the external shunt resistance in Ohms. Available only if the External Shunt is set to Custom.
External Shunt Power		Specifies the external shunt power in Kilowatts. Available only if the External Shunt is set to Custom.
External Shunt Pulse		Specifies the external shunt pulse power in Kilowatt-seconds. Available only if the External Shunt is set to Custom.

(1) 1.333 kHz option is valid for PowerFlex 755TL, 755TR, and 755TM products only.
(2) Disabled and Adjustable Frequency are the only valid Bus Regulator Action options for PowerFlex 755TL, 755TR, and 755TM products.

2. To save your changes, click Apply.

Review the Digital Inputs

Review the digital inputs for your PowerFlex drive.

1. In the Axis Properties for the drive, select the Digital Input category.

   The settings on this page remain set to the default values. Digital input 0 on the main control circuit board terminal block (TB1) can be used as a dedicated hardware enable when the enable jumper is removed from the board. See the Main Control Circuit Board section in the PowerFlex 755TS Products with TotalFORCE Control Installation Instructions, publication 750-IN119, for details.

   See Table 5 for available digital input settings.

Figure 32 - Module Properties Dialog Box - Digital Input Category

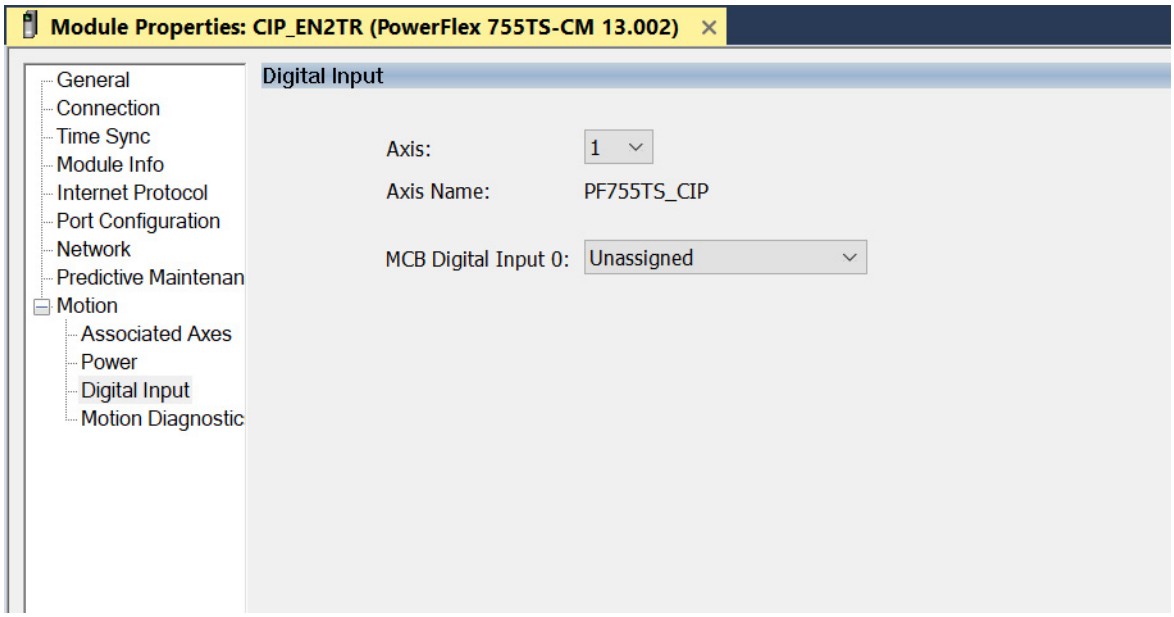


Table 5 - Digital Input Settings

Attribute	Settings	Description
MCB Digital Input 0	Unassigned	This digital input on the main control circuit board is unassigned.
	Enable	24V DC or 120V AC control power is applied to digital input 0 on the main control circuit board as a condition to enable the drive.

2. To save your changes, click Apply.
3. Click OK.

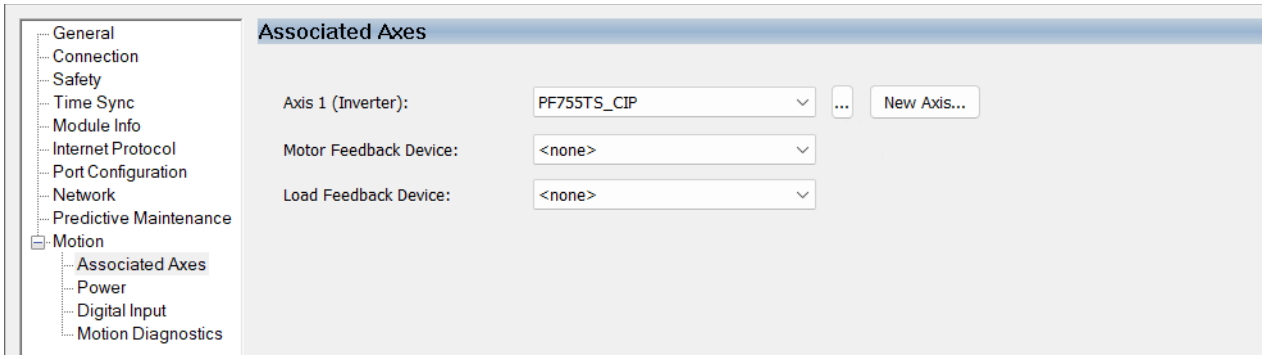
You have completed the drive configuration and created the associated axis for the drive.

Configure Frequency Control

Follow these steps to configure frequency control for your Axis CIP Drive.

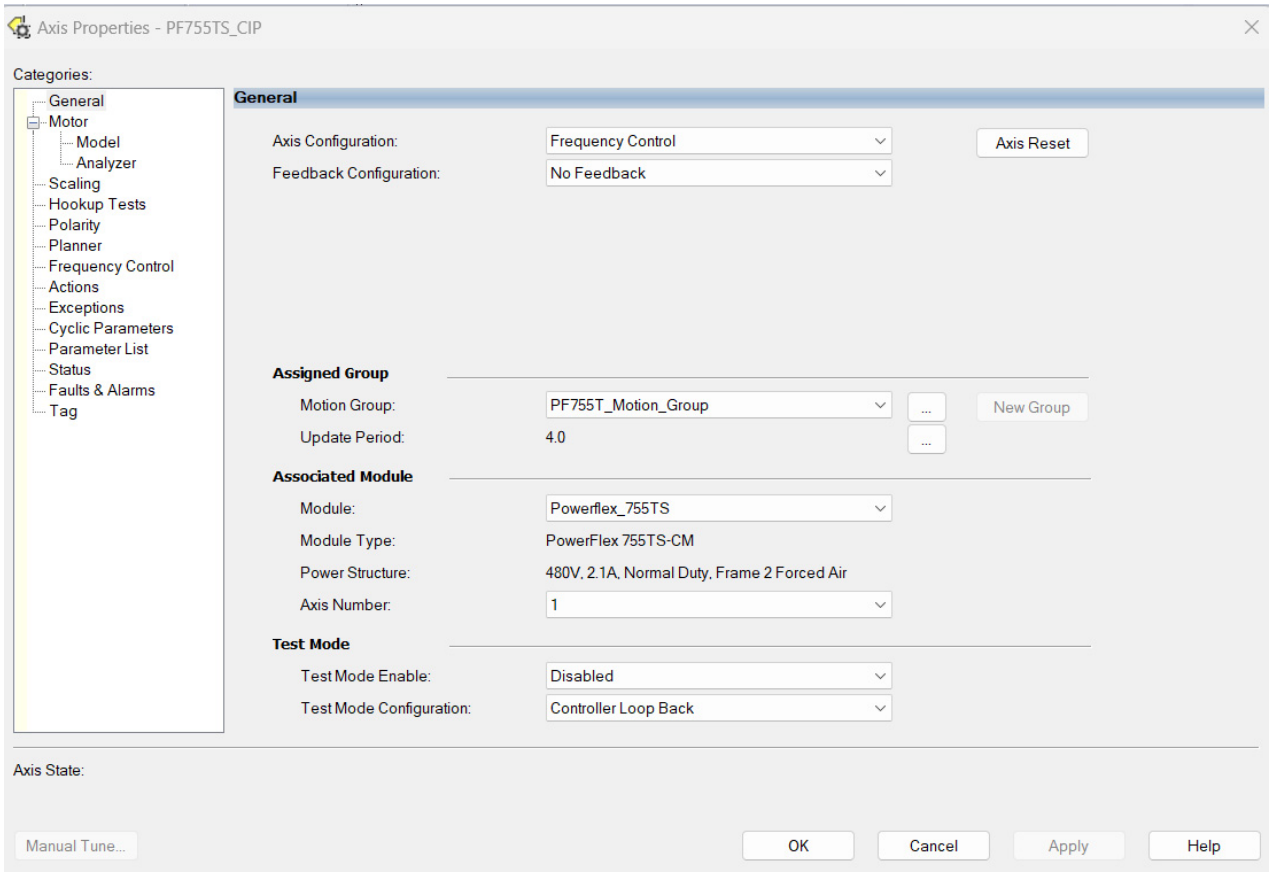
1. Below the Motion category, select Associated Axes.
2. To the left of New Axis, click the ellipsis (...).

Figure 33 - Module Properties Dialog Box - Associated Axes Category



The Axis Properties dialog box for the PF755TS_CIP axis appears.

Figure 34 - Axis Properties Dialog Box - General Category (Frequency Control)



3. On the General page, in Axis Configuration, select Frequency Control.

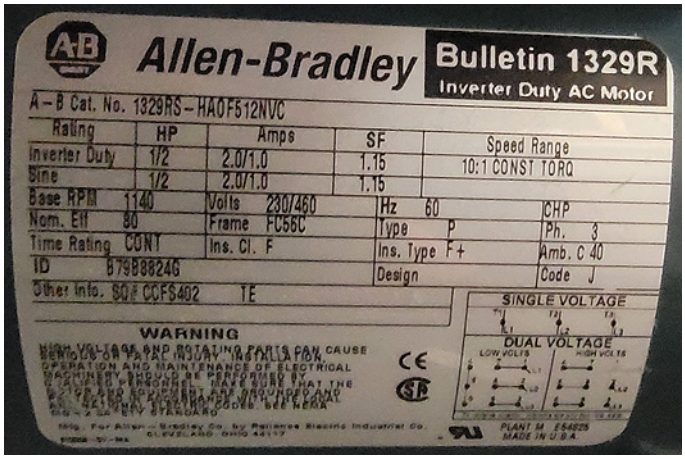
Add a Motor

In the Motor category of the drive module, there are two methods to add motor data:

- Nameplate Datasheet is used for manual entry of the applicable motor data from a motor datasheet or nameplate.
- Catalog Number is used for any Rockwell Automation manufactured induction motor or a custom motor file (CMF) for other motors, if available. When the Catalog Number selection is used, all motor characteristic data is loaded in the Axis CIP Drive structure and then downloaded to the drive.

The PowerFlex 755TS drive module that is created for this procedure was sized according to the motor data nameplate available. Therefore, this example uses the Nameplate Datasheet selection.

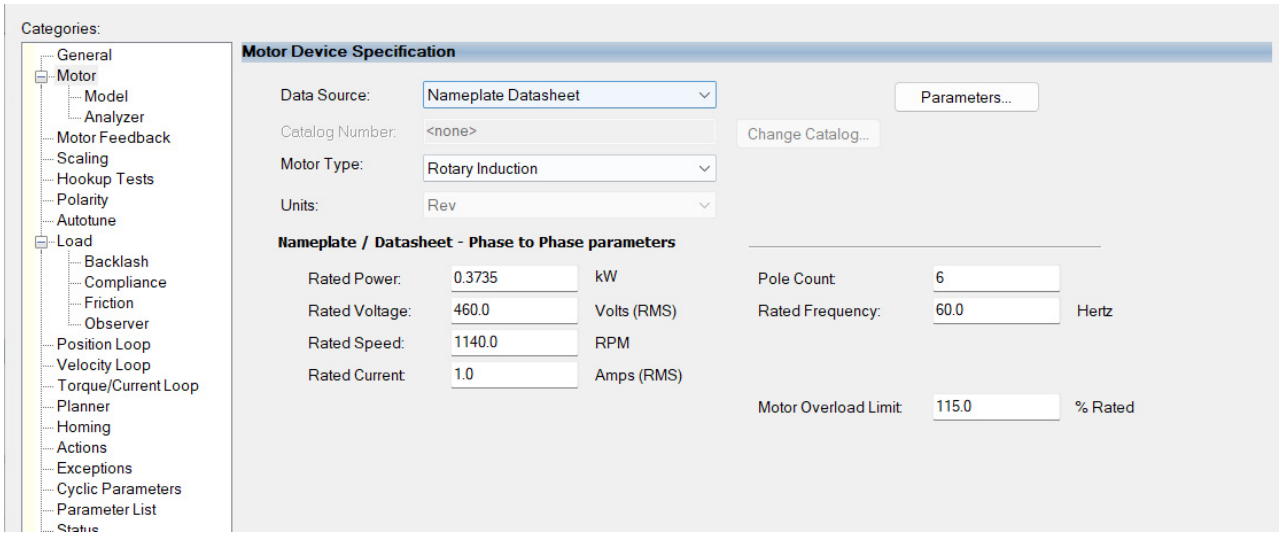
Figure 35 - Motor Data Nameplate Example



Follow these steps to add your motor to the drive module properties.

1. In the Axis Properties for the drive, select the Motor category.

Figure 36 - Axis Properties Dialog Box - Motor Category



2. In Data Source, select Nameplate Datasheet.
3. In Motor Type, select Rotary Induction.

4. Complete the Nameplate / Datasheet data by using the motor performance datasheet or the motor nameplate data. Use Figure 35 to identify and complete the fields on the Motor Device Specification page, as identified in this table.

Motor Data Entry

Data Nameplate Property	Data Nameplate Data	Motor Device Specifications Field
HP	0.5 HP x 0.747 W = 0.3735 kW	Rated Power
Amps (Inverter Duty)	2.0 (230V) /1.0 (460V)	Rated Current
SF (Service Factor)	SF x 100 = 115.0%	Motor Overload Limit
Base RPM	1140	Rated Speed (always use asynchronous speed)
Volts	230/460	Rated Volts
Hz	60	Rated Frequency
(See step 5)	6	Poles

5. If the motor nameplate excludes the motor poles, use this calculation:

   Motor Poles = 120 x Frequency / Rated Speed (at rated torque) + Slip Speed

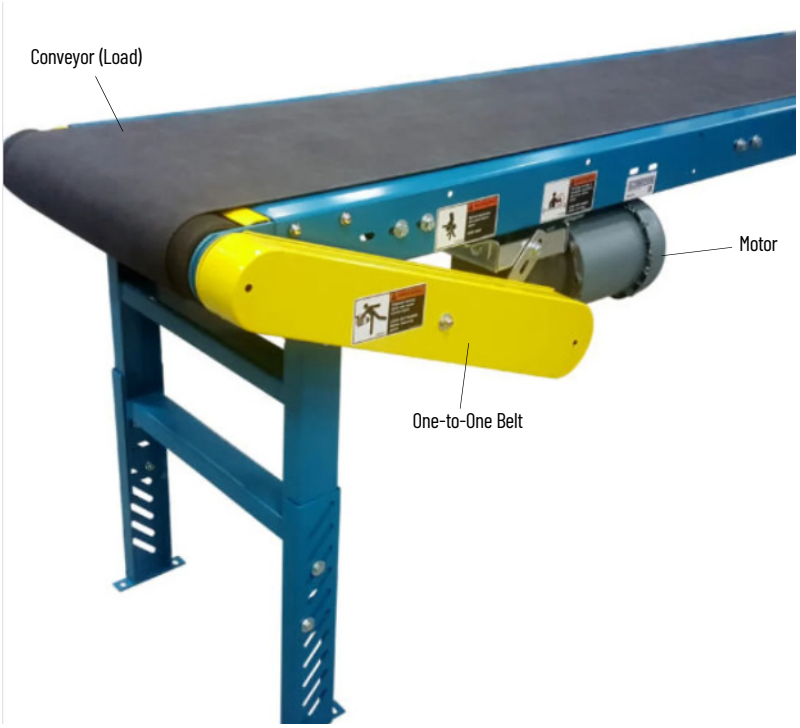
6. To save your settings, click Apply.

Set Up Scaling

The motor scaling depends on the type of connection between the motor and the load. This example uses Direct Coupled Rotary.

Direct Coupled Rotary is used for a load that is directly coupled to a rotary induction motor. In this case, motor-to-load scaling is typically 1:1.

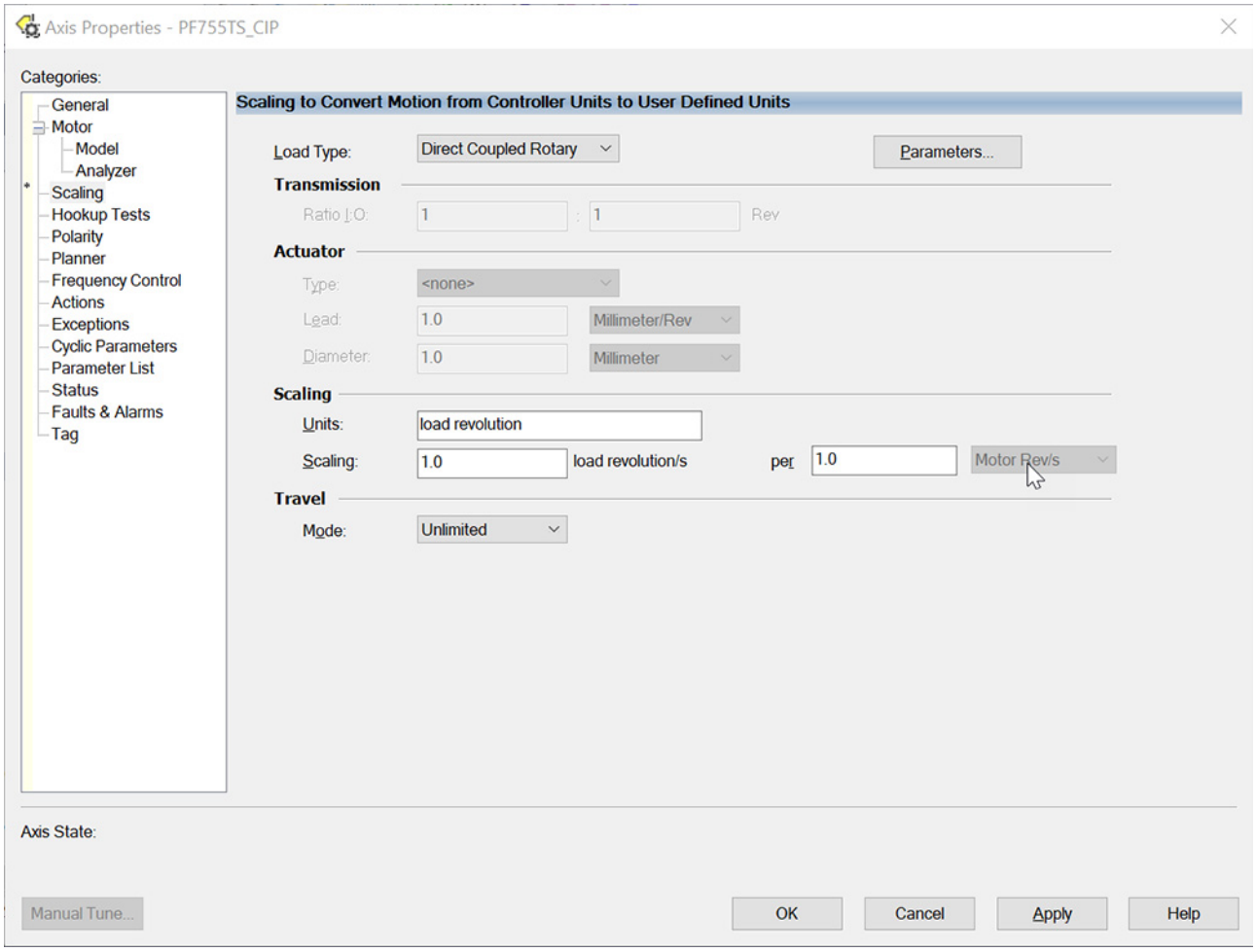
Figure 37 - Direct Coupled Rotary Motor-to-Load Example



Follow these steps to configure scaling for your application.

1. In the Axis Properties for the drive, select the Scaling category.

Figure 38 - Axis Properties Dialog Box - Scaling Category



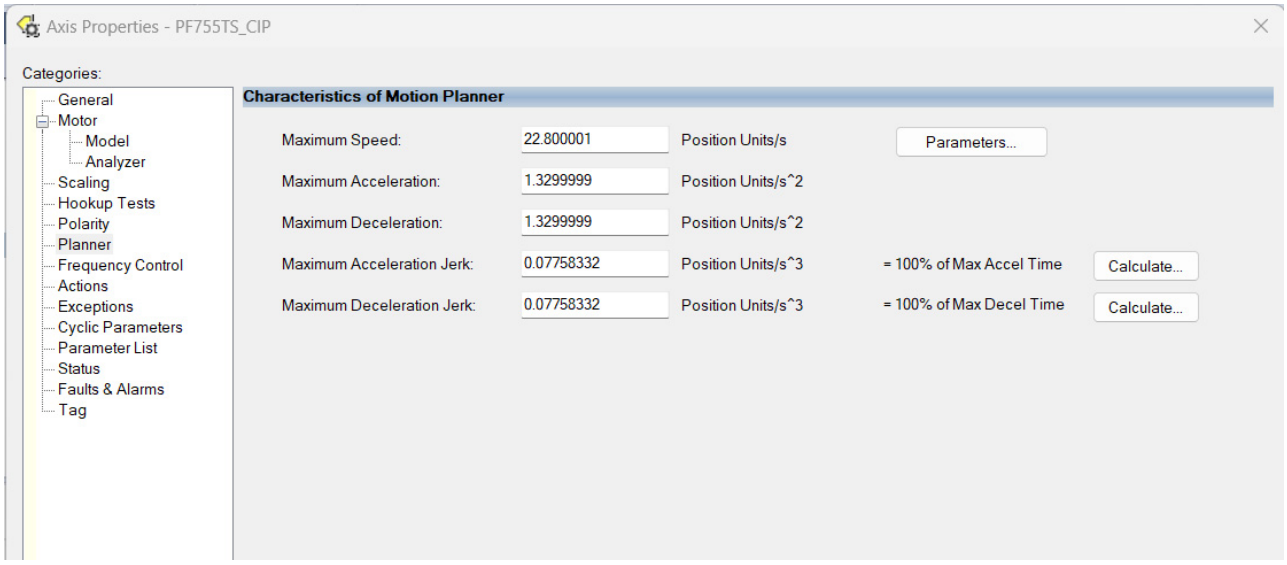
2. In Load Type, select the appropriate type of connection between the motor and load.

   If the load is not directly coupled to the motor, uses a gearbox for example, select a Load Type of Rotary Transmission.

3. Below Scaling, in Units, type the units applicable to your application. This example uses "load revolution," which determines a scaling requirement of load revolutions to motor revolutions.
4. Type the Scaling units applicable to your application:
   - For direct-coupled rotary loads, use 1:1 scaling.
   - For non-direct rotary loads (transmissions), use a scaling applicable to the transmission system (gearbox or reduction method ratio).

The scaling affects the overall system torque, speed, acceleration, and jerk parameters, as shown in this example of the Planner category for the associated drive axis.

Figure 39 - Axis Properties Dialog Box - Planner Category (Direct Coupled Rotary Example)



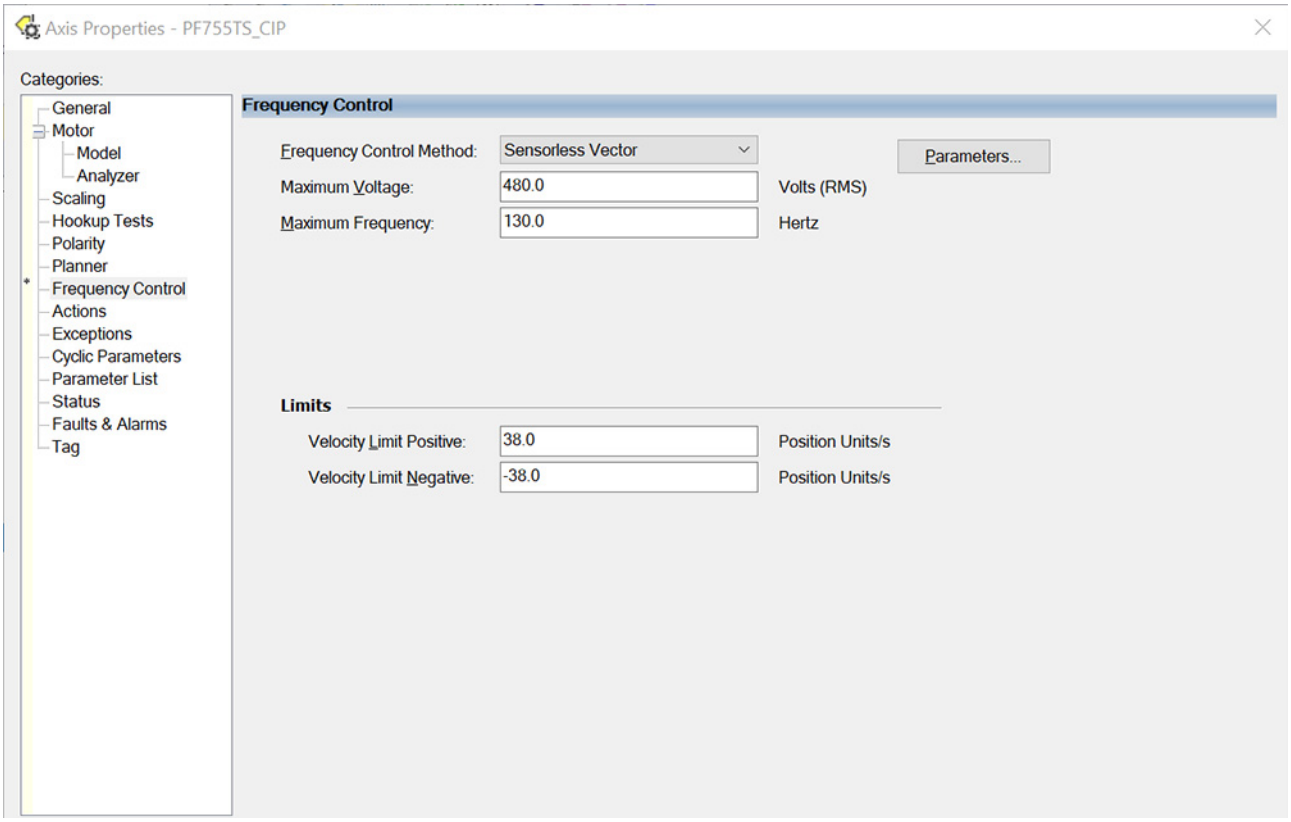
Refine the Frequency Control Configuration

PowerFlex 755T products support basic Volts/Hertz (V/Hz), Fan/Pump Volts/Hertz, Sensorless Vector Control, and Sensorless Vector Control Economy frequency control methods.

Follow these steps to refine the frequency control configuration.

1. In the Axis Properties for the drive, select the Frequency Control category.

Figure 40 - Axis Properties Dialog Box - Frequency Control Category



The Frequency Control Method defaults to Sensorless Vector motor control.

2. If your application requires a different motor control, in Frequency Control Method, select the appropriate option. This example uses Sensorless Vector Control.
3. If necessary, you can change the following values to meet your control loop application needs:
   - Maximum Voltage - The highest voltage the drive outputs to the motor
   - Maximum Frequency - The frequency that corresponds with the voltage in parameter 10:421 [Maximum Voltage]. This determines the frequency where Voltage Limiting begins.
   - Velocity Limit Positive - The positive velocity limit for velocity reference commands.
   - Velocity Limit Negative - The negative velocity limit for velocity reference commands.
4. To save your changes, click Apply.

You have successfully completed the PowerFlex 755TS drive frequency control configuration.

Calibrate and Test the Axis

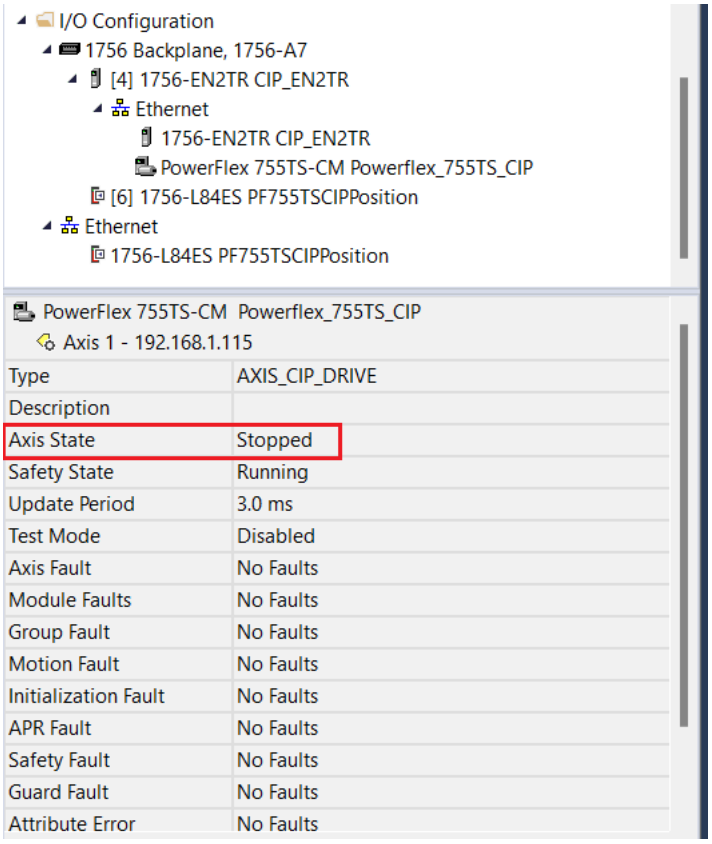
We recommend that you download the configuration to the controller to calibrate and test the drive module configuration and Axis CIP Drive axis.

ATTENTION: These tests can actively move the axis even with the controller in remote Program mode:
- Before you complete the tests, make sure no one is in the way of the axis.
- Changing the motor or feedback after performing the Hookup Test can result in an axis-runaway condition when the drive is enabled.
- To avoid personal injury or damage to equipment, you must remove the load from each axis as uncontrolled motion can occur when an axis with an integral motor brake is released during the test.

Follow these steps to calibrate and test the axis.

1. Download the program to the controller from the Logix Designer application.
2. Verify that the Axis CIP Drive is in the Stopped state.
   - See the Drive Module Exceptions and Stop Actions on page 93 section to understand communication and converter/inverter faults.
   - To run the Calibration test, if you have already completed the system programming of motion instructions per the application, make sure that the controller is in Remote Program mode and code is not running so that the instructions do not interfere with the calibration test.

Figure 41 - Axis CIP Drive Stopped State



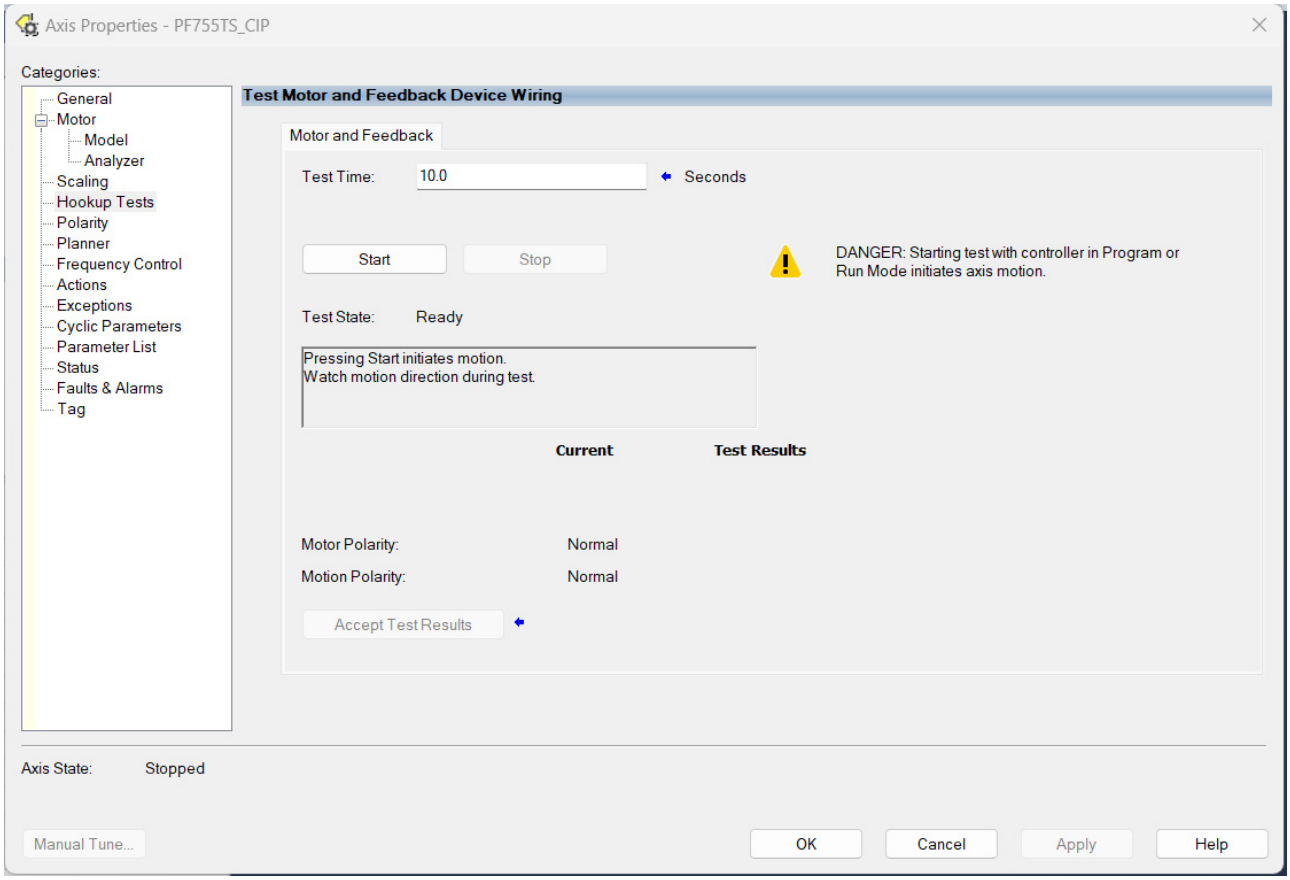
Run the Hookup Test

Use the Hookup test to set the motor polarity based on your observation of the direction of rotation. The motor and feedback test initiates the drive current loop output and monitors the feedback direction. Follow these steps to run the motor and feedback direction test.

The motion direction can also be tested and configured in the Polarity category.

1. Select the Hookup Tests category.

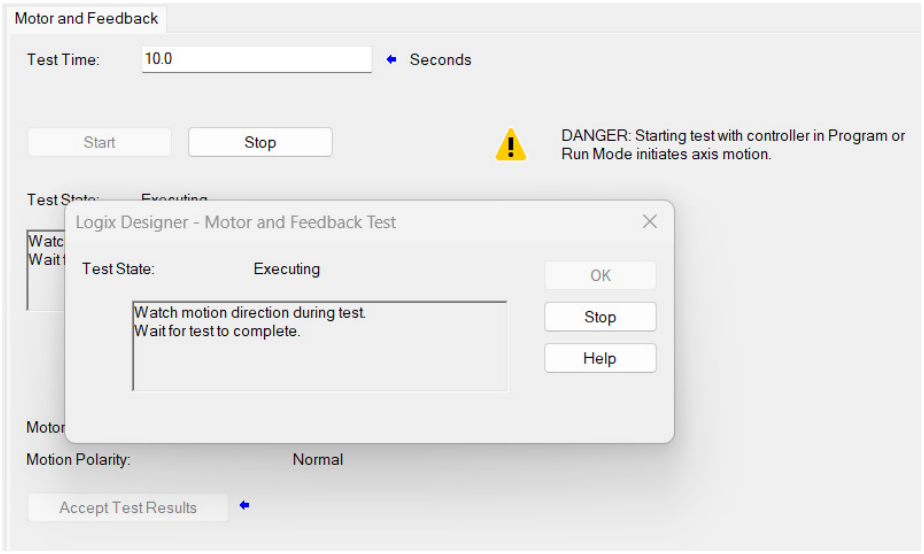
Figure 42 - Axis Properties Dialog Box - Hookup Tests



2. Configure the desired Test Time. This example uses 10.0 seconds.
3. Click Start and observe the direction of motor rotation.

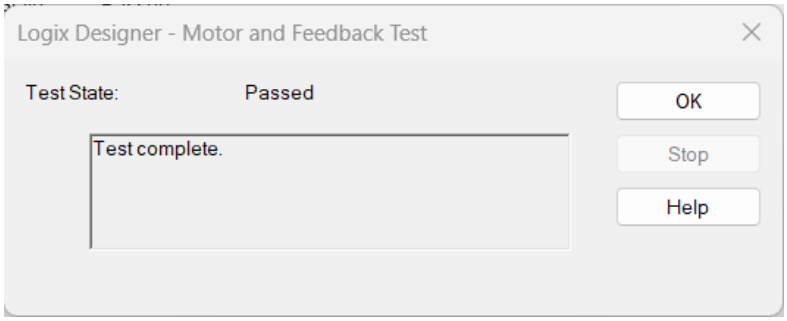
The Motor and Feedback Test message box appears to indicate the test has been executed and provides the status of the test.

Figure 43 - Hookup Test Execution Message



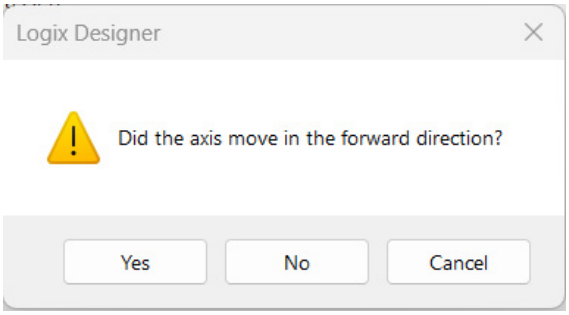
The drive runs the motor in current mode and rotates the motor for 10 seconds before the test completes.

Figure 44 - Hookup Test Complete Message



4. Click OK.
   A message box appears to allow you to verify whether the axis moved in the forward direction.

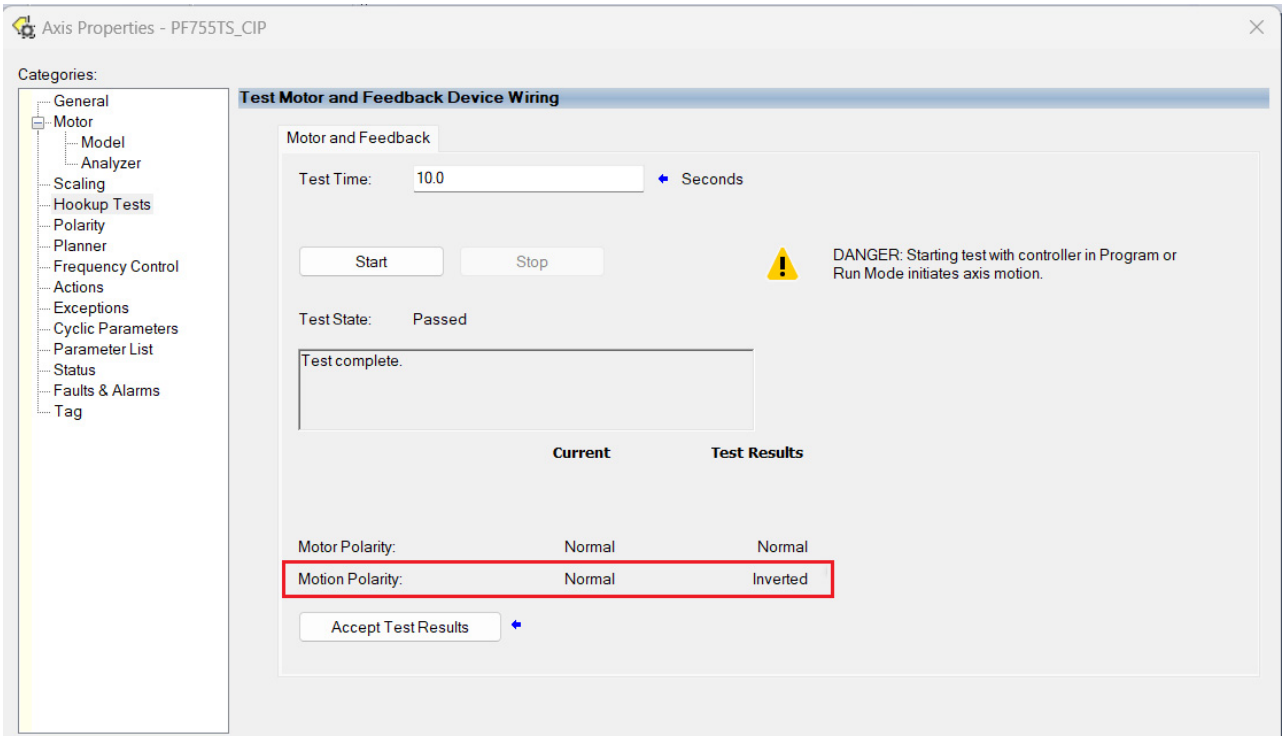
Figure 45 - Direction Test Message



5. Choose Yes or No based on your application need:
   - If the observed motor rotation was in the forward direction that is intended for your application, select Yes. For example, the observed motor rotation is the intended direction for a Motion Axis Jog command of 10 revolutions/second.
   - If the observed motor rotation was not in the forward direction that is intended for your application, select No. In this case, the Motion Polarity changes from Normal to Inverted as shown in Figure 46 on page 37.

The Axis Properties Hookup Test page appears.

Figure 46 - Axis Properties Dialog Box - Motion Polarity Set to Inverted



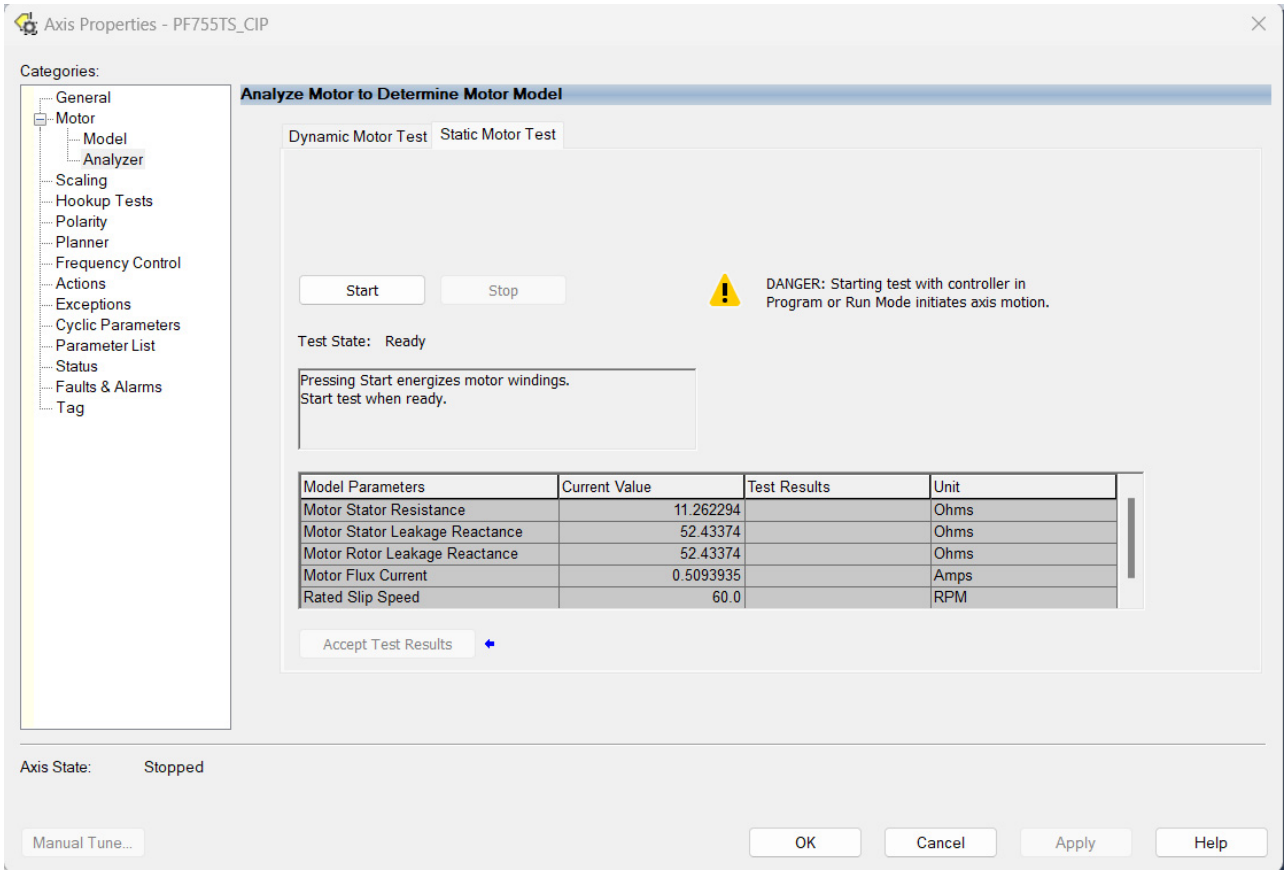
6. Click Accept Test Results.

Complete the hookup test to determine the motion polarity of a new or a replacement motor.

If you run the Hookup test again, it uses the original calibration direction. You must use Motion Direct or programming commands to see the difference in the motor direction.

7. In the Drive Module Axis Properties, expand the Motor category and choose Analyzer.
   The Static Motor test measures the actual motor stator resistance and calculates the other four motor model parameters.

Figure 47 - Axis Properties Dialog Box - Analyzer Category



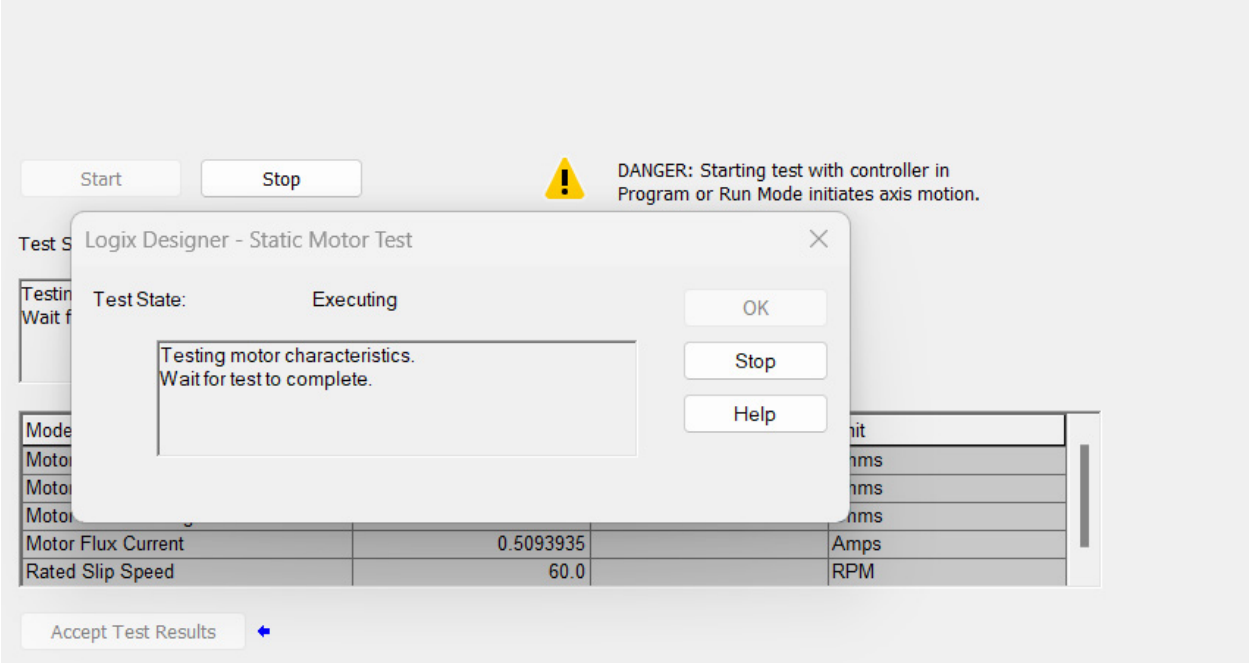
8. Select Static Motor Test.

A static test applies control power to the drive but does not cause motor rotation. Therefore, the motor can remain connected to the load.

9. Click Start.

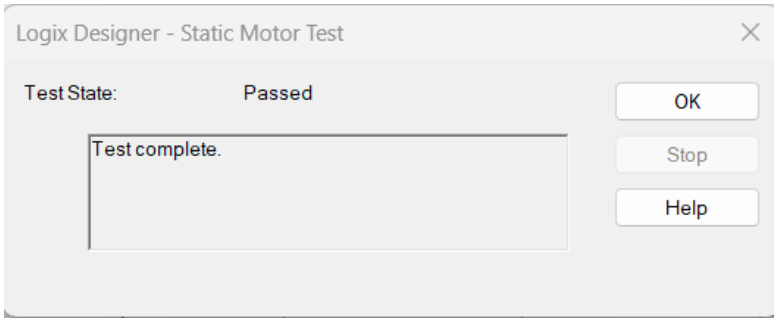
   Control power is applied to the drive and the Static Motor Test message box appears to indicate the test has been executed and provides the status of the test.

Figure 48 - Static Motor Test Execution Message



When the test has been completed, the Test complete message appears in the Static Motor Test message box.

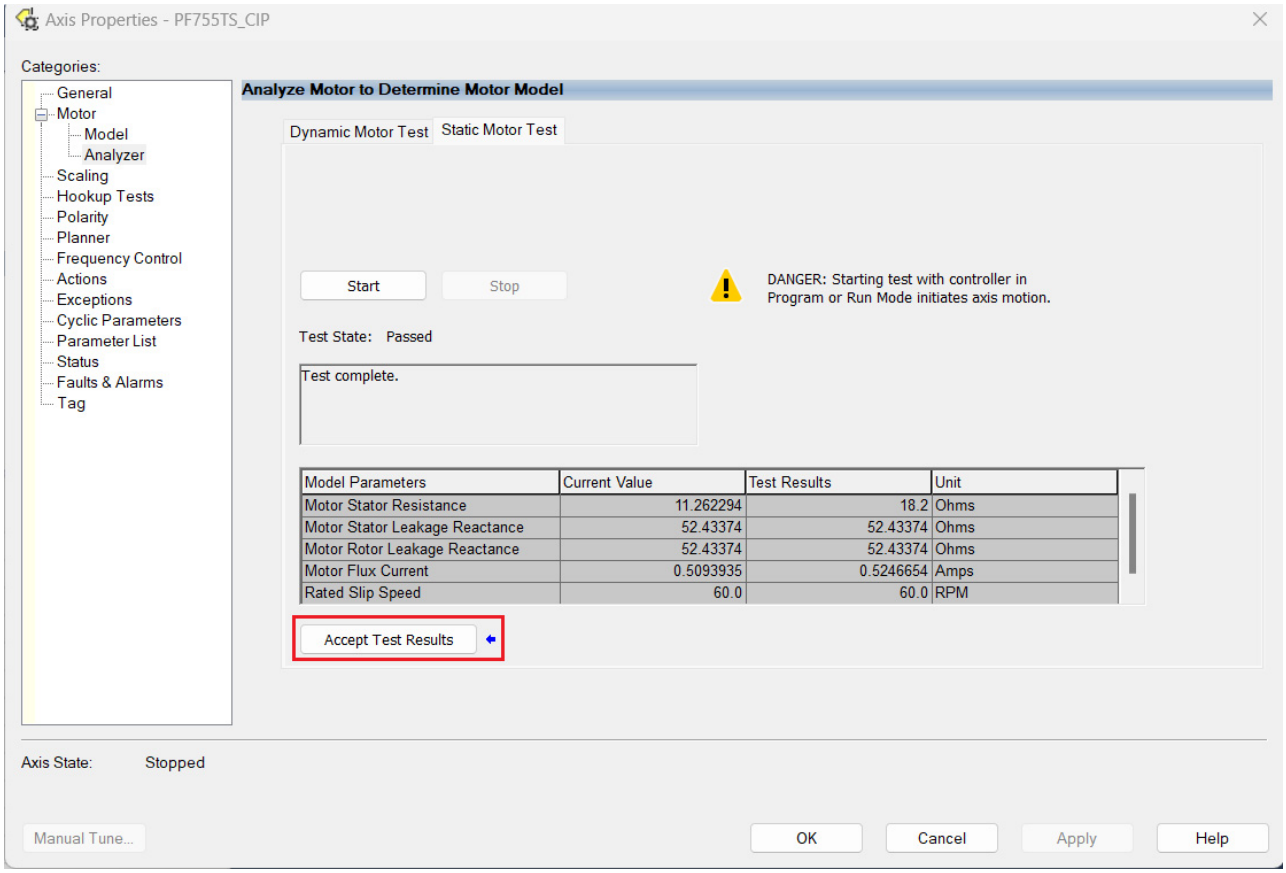
Figure 49 - Static Motor Test Complete Message



10. Click OK.

The test data populates the model parameters on the Analyzer page.

Figure 50 - Axis Properties Dialog Box - Analyzer Category



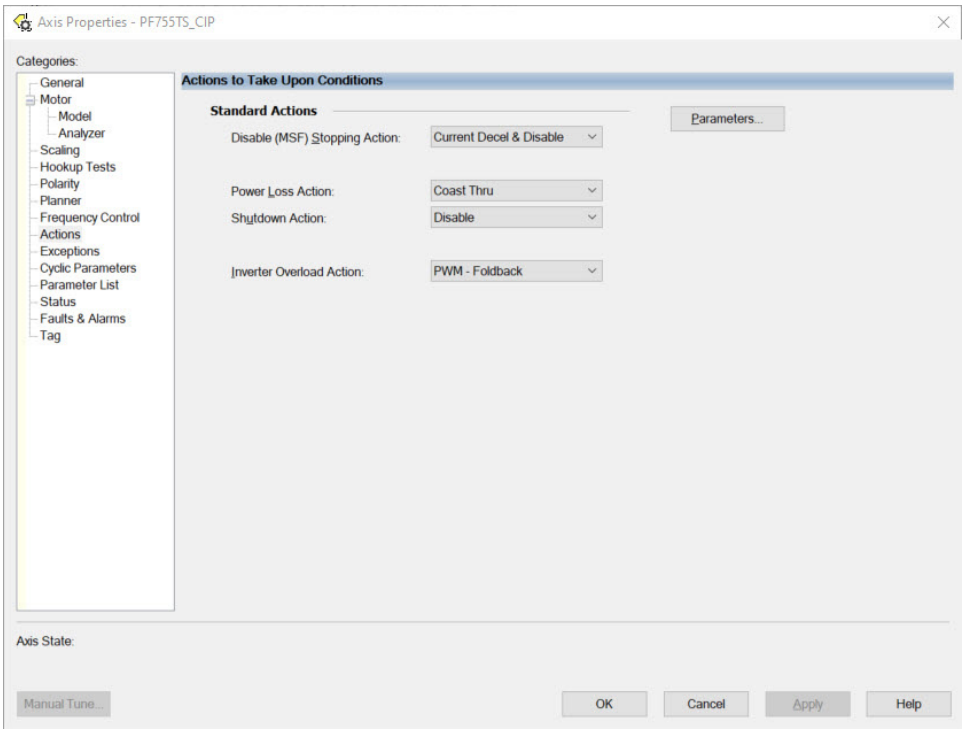
11. To accept the test results, below the Model Parameters, click Accept Test Results.
    A Dynamic Motor Test is recommended unless the motor cannot be uncoupled from the drive.

Configure Actions for Drive Conditions

Follow these steps to configure the drive's response to specific actions. For a list of condition codes and stopping actions, see Drive Module Exceptions and Stop Actions on page 93.

1. In the Axis Properties for the drive, select the Actions category.

Figure 51 - Axis Properties Dialog Box - Action Category



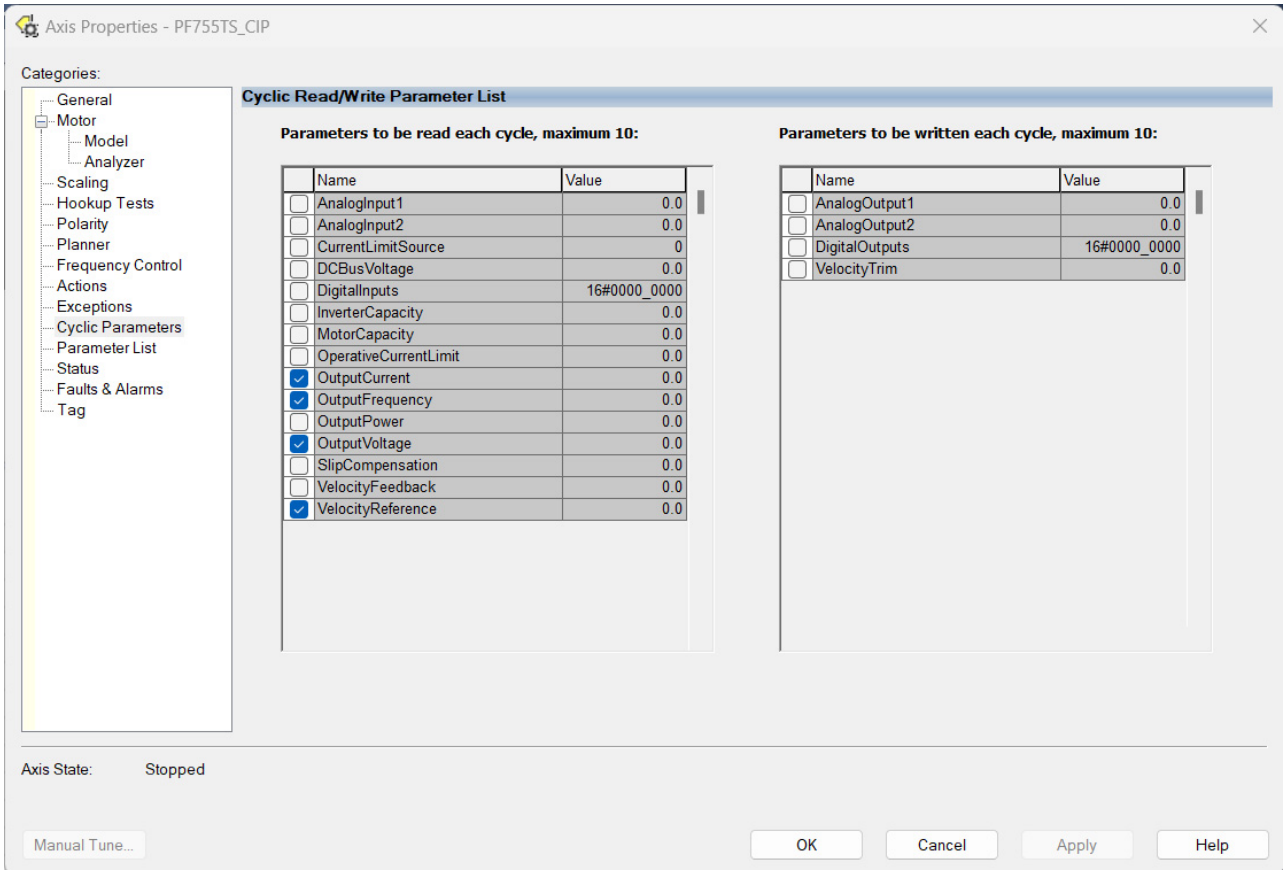
2. Configure the following stopping actions for your application.
3. In Standard Actions choose from these options:
   - Disable (MSF) Stopping Action - Selects the stop action for the motor. The available options depend on the Axis Configuration.
   - Inverter Overload Action - Specifies the inverter overload action for the motor. This field is optional.

Run Motion Direct Commands

It is recommended that you run the motor by using motion direct commands and observe the motor speed, current, and voltage by using the cyclic parameters. Or you can use the RSTrend® application to collect trend data to evaluate.

1. In Axis Properties, select the Cyclic Parameters category.

Figure 52 - Axis Properties Dialog Box - Cyclic Parameter Category



2. Select these parameters:
   - OutputCurrent
   - OutputFrequency
   - OutputVoltage
   - VelocityReference

   Up to 10 parameters can be read in each cycle.
3. To configure the parameters for the next read cycle, click Apply. Do not close this window.

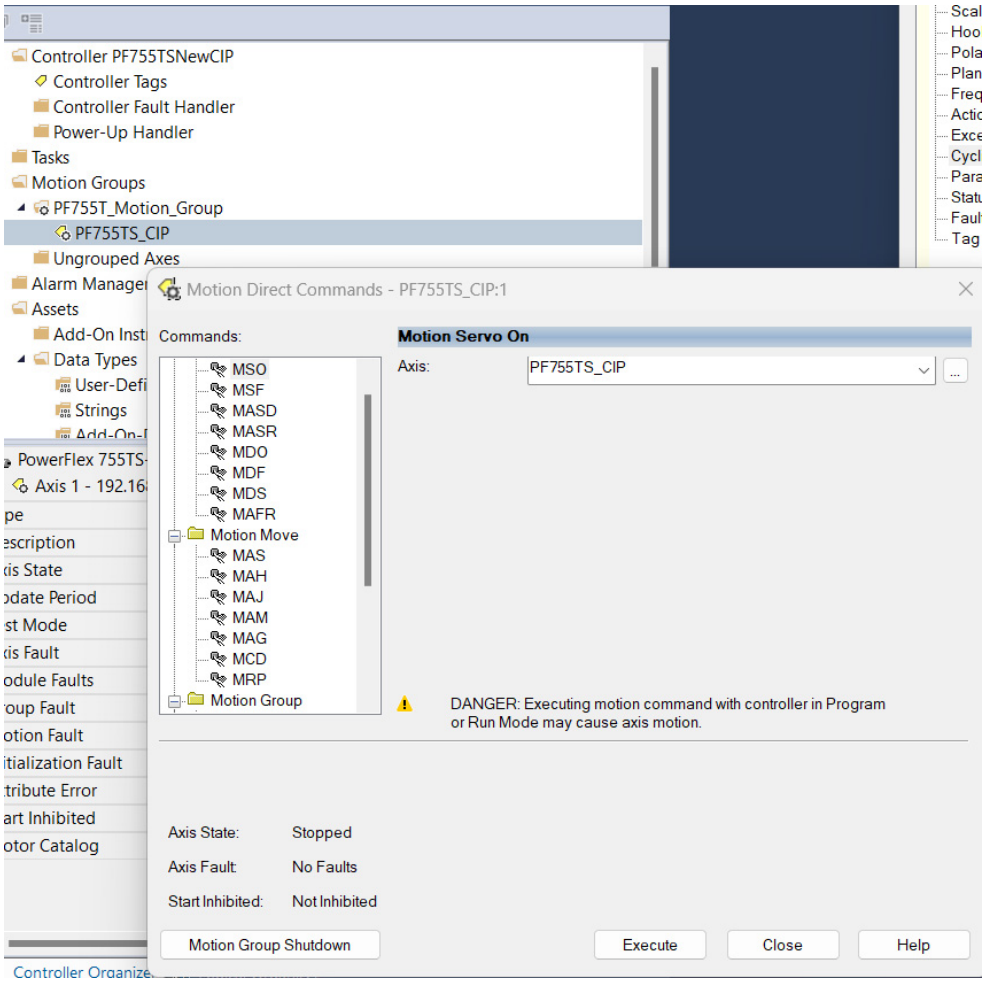
   Use of motion direct commands can show the correct drive-to-motor performance.

ATTENTION: The motion direct commands cause motor rotation that can damage connected equipment. Before you issue motion direct commands, uncouple the motor from the equipment.

4. In The Controller Organizer, below your Motion Group, right-click your axis to choose Motion Direct Commands. PF755TS_CIP is used in this example.

   The Motion Direct Commands dialog box appears.

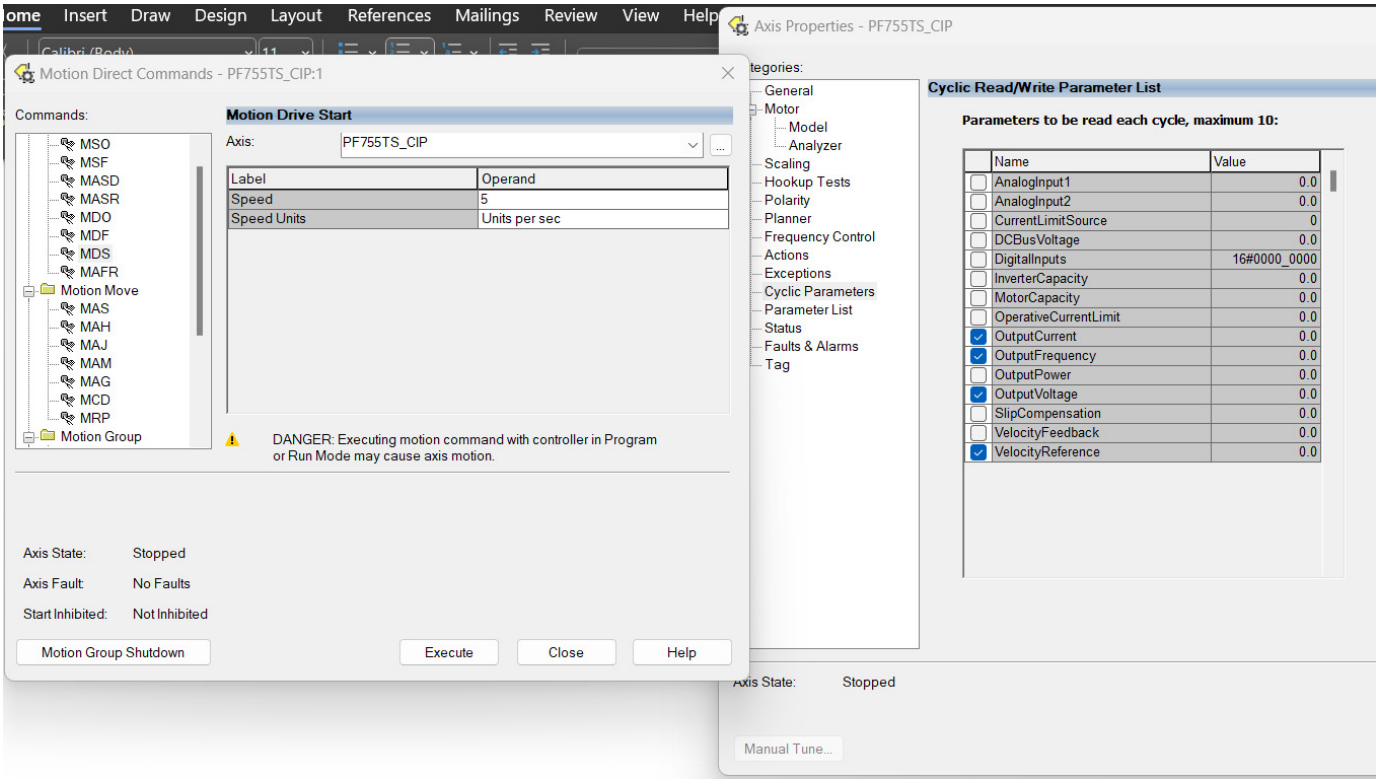
Figure 53 - Motion Direct Commands



5. Below Commands, select MDS.

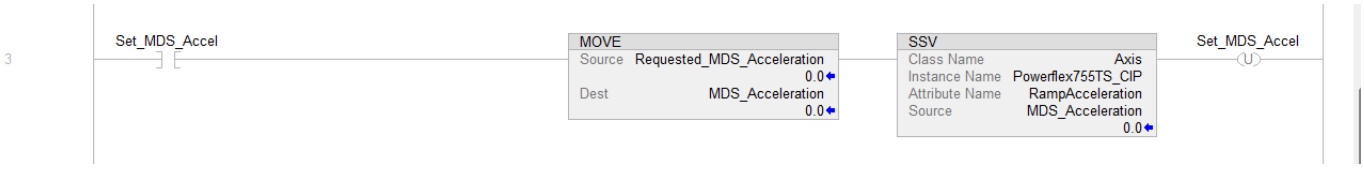
The direct drive command, Motion Drive Start (MDS), starts the drive and issues a velocity reference. This command causes the drive to modulate and rotate the motor at a set rate of speed. This example uses five revolutions/second.

Figure 54 - MDS Motion Direct Command



(Optional) The default acceleration and deceleration or jerk is configured in the Planner category. To set a different rate of acceleration or deceleration or jerk, use a Set System Value (SSV) instruction to change the value as required by the application. For an example, see Figure 55.

Figure 55 - Example SSV Acceleration Instruction



For SSV and Get System Value (GSV) instruction information, see the Logix 5000 Controllers Motion Instructions Reference Manual, publication MOTION-RM002.

For more information, see the Knowledgebase article RSLogix 5000 / Studio 5000: SSV and GSV mechanism with CIP Motion (QA54803).

6. Before you continue, verify the following:
   - The Motion Direct Command and Cyclic Parameter windows are open as shown in Figure 54.
   - The axis status shown in the lower, left corner of the Motion Direct Command dialog box appear as follows:
     - Axis State: Stopped
     - Axis Fault: No Faults
     - Start Inhibited: Not Inhibited
7. Type a value of 5 in the Speed field.
8. Verify Units per sec in the Speed Units field.

9. Click Execute.
   All four Cyclic Read parameters are checked for instantaneous Read values. Or, you can use a time-based trend in the RSTrend application.
10. Evaluate the Cyclic Parameters while the motor is running.
11. In the Motion Direct Commands dialog box, below Commands, select Motion Servo Off (MSF).
12. To stop the drive and motor, click Execute.

You have successfully configured your Integrated Motion on EtherNet/IP frequency control application.

Configure a PowerFlex 755TS Drive for Position Control and Integrated Safety on EtherNet/IP

Complete these steps to configure your PowerFlex 755TS drive for a position control application with integrated safety on EtherNet/IP.

IMPORTANT Before you begin, verify that you have completed the steps in Configure the Drive for Integrated Motion on EtherNet/IP Mode on page 5.

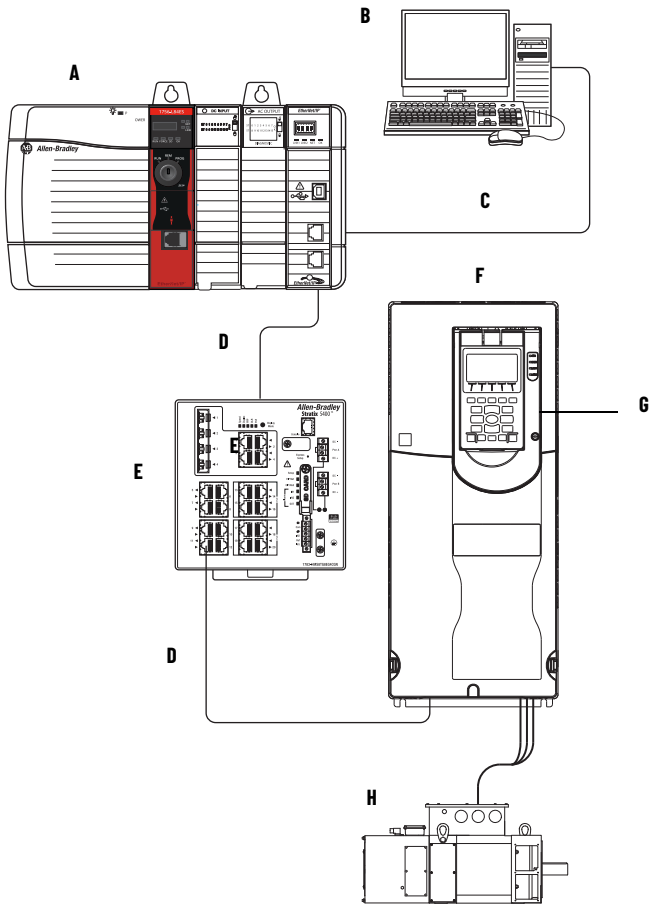
This example includes these devices:

- GuardLogix 5580 controller with a 1756-EN2TR Ethernet communication module
- 1783-HM*x* Stratix 5400 Ethernet managed switch
- PowerFlex 755TS drive with embedded Ethernet port
- PowerFlex 750-Series Integrated Safe Torque Off option module (20-750-S3)
- PowerFlex 750-Series Universal Feedback option module (20-750-UFB-1)
- PowerFlex 750-Series 24V DC 22-Series I/O option module (20-750-2262C-2R)
- Induction (asynchronous) motor

Rockwell Automation catalog numbers 8720SM-, HPK-, and MMA- are examples of motors that can be used with motion applications.

Figure 56 shows a typical PowerFlex drive in Integrated Motion on EtherNet/IP and integrated-safety system installation.

Figure 56 - PowerFlex Drives in Integrated Motion on EtherNet/IP and Integrated Safety System Installation Example



Item	Description
A	GuardLogix 5580 controller with Bulletin 1756 EtherNet/IP module
B	Logix Designer application
C	ControlLogix controller programming network
D	1585J-M8CBJM-*x* Ethernet (shielded) cable

Item	Description
E	Stratix 5400 Ethernet managed switch
F	PowerFlex 755TS drive
G	PowerFlex 750-Series option modules installed in control pod
H	Induction (asynchronous) motor

Application Overview

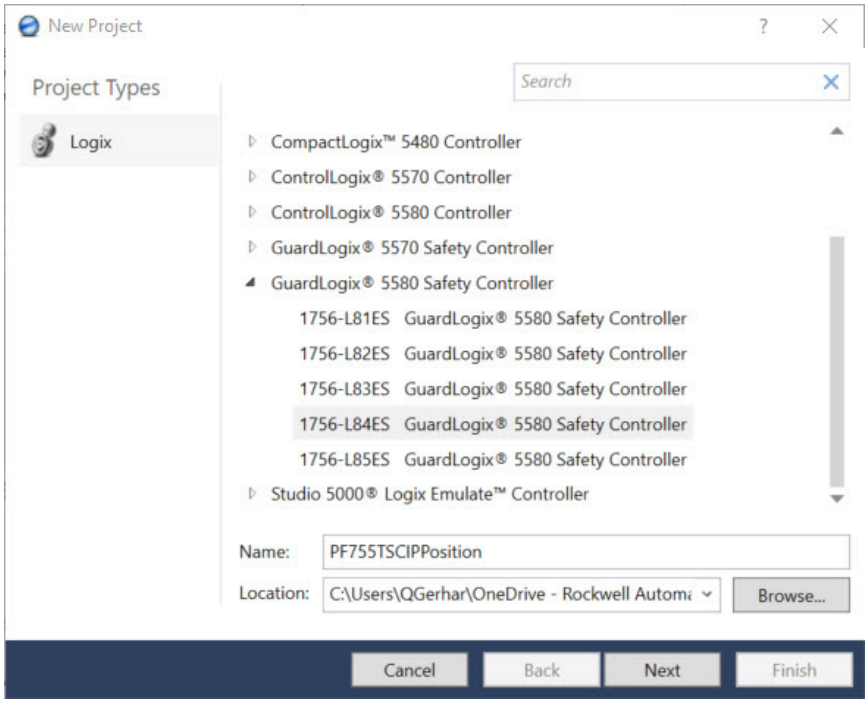
This section provides procedures to configure and calibrate an unloaded motor (no gearbox or load connected to the motor shaft) for a position loop application. When the initial configuration and calibration tests are complete, procedures for scaling a rotary knife are provided as an example of a common position control application.

Create Your Controller Project

Follow these steps to start up your Logix Designer application and create a project.

1. Apply power to your controller and open your Logix Designer application.
2. From the Create menu, choose New Project.
   The New Project dialog box appears.

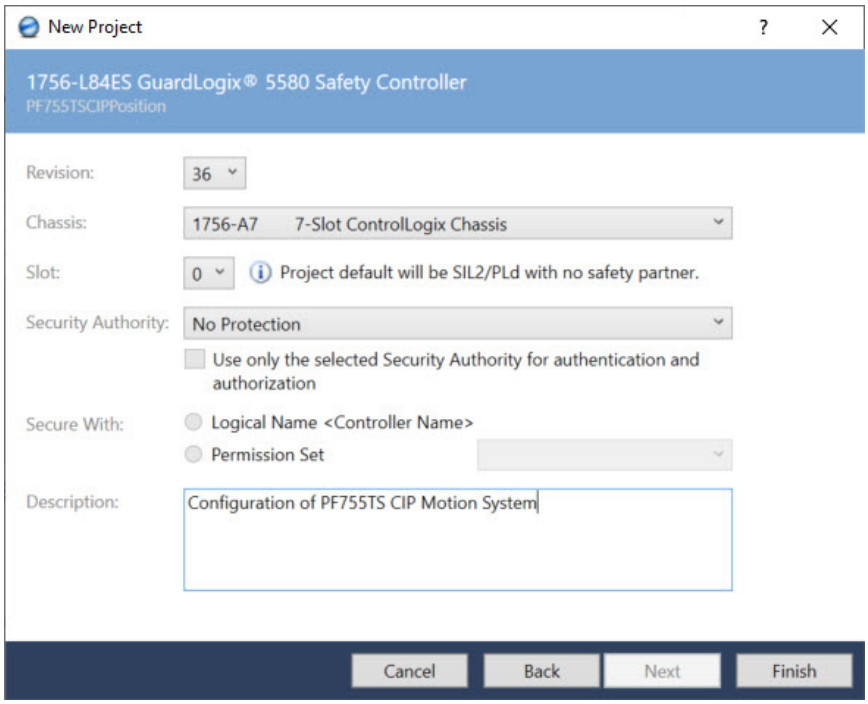
Figure 57 - New Project Dialog Box



3. Expand the Logix 5000 controller family and select your controller. This example uses a 1756-L84ES GuardLogix 5580 Safety Controller.
4. Type the Name of your project. This example uses PF755TSCIPPostion.
5. Click Next.

The New Project dialog box appears.

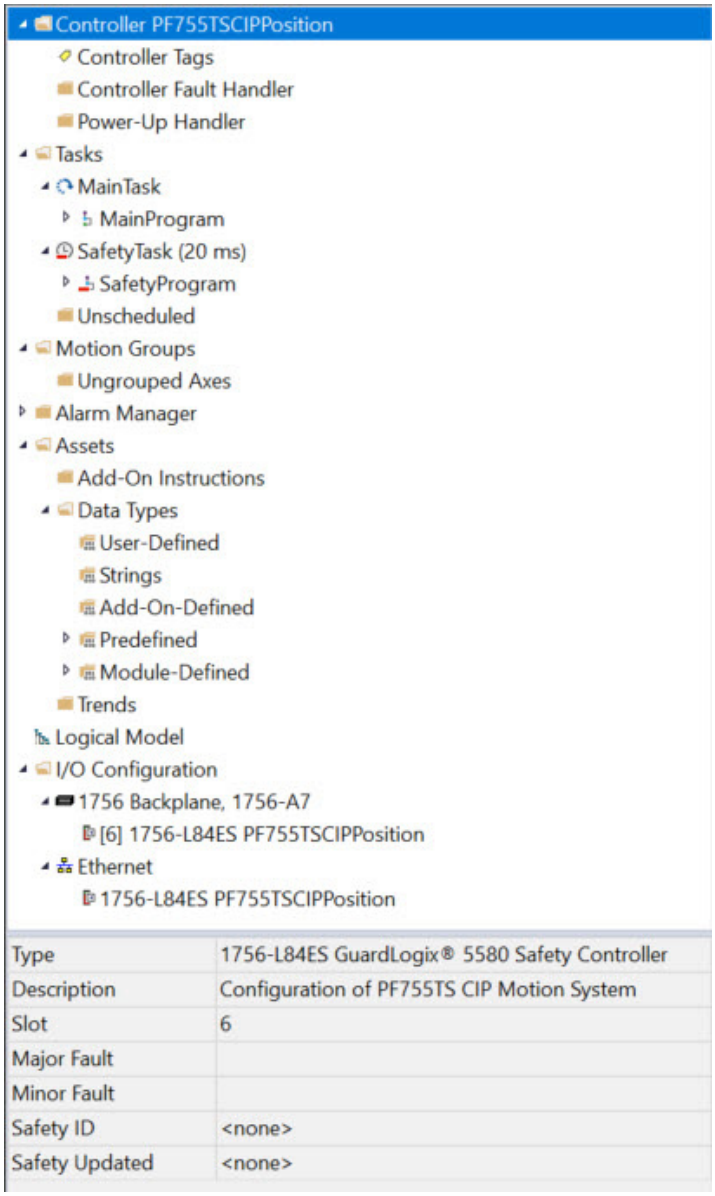
Figure 58 - New Project Dialog Box



6. Choose the controller Revision.
7. Choose the applicable Slot where the safety controller is installed in the chassis. Slot 6 is used in this example.
8. Click Finish.

The new controller appears in the Controller Organizer below the I/O Configuration folder.

Figure 59 - Controller Organizer

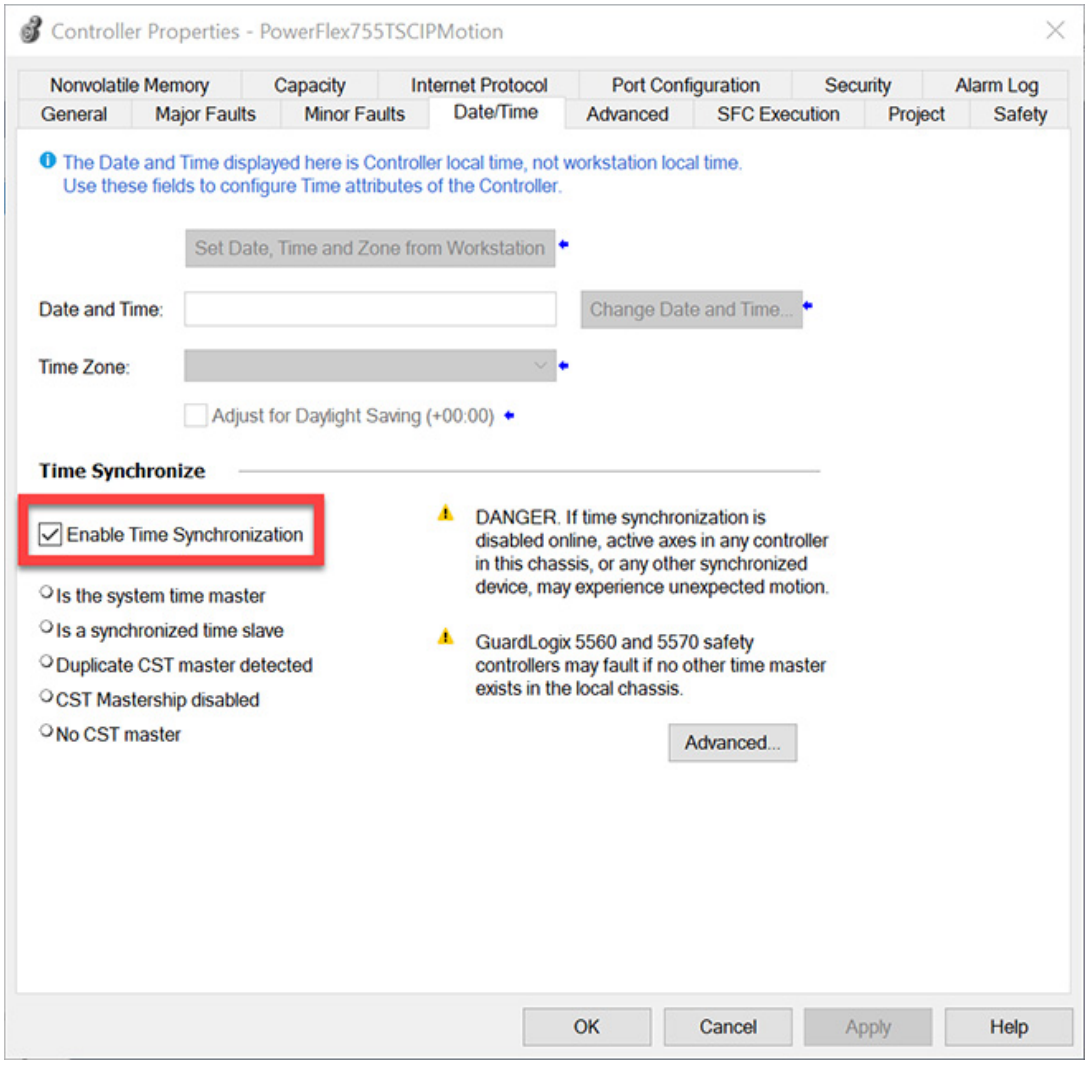


Configure Time Synchronization

Integrated motion on EtherNet/IP applications require precise motion control. Therefore, the Time Synchronization feature must be enabled in the controller properties dialog box, which allows the controller to use the time stamp function of positions and registrations.

1. Open the controller properties.
2. Choose the Date/Time tab.

Figure 60 - Controller Properties Dialog Box - Date/Time Tab



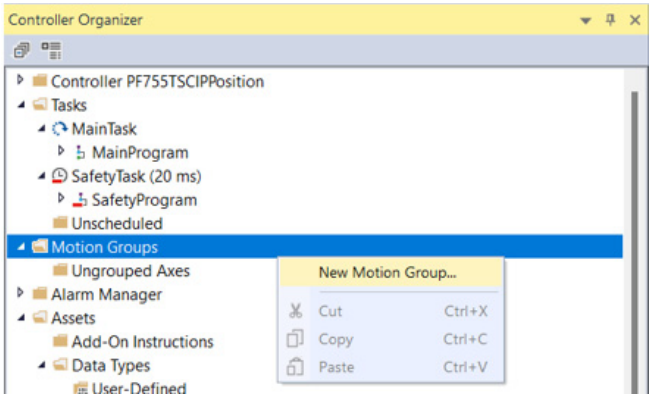
3. Below Time Synchronization, select Enable Time Synchronization.
4. To save your changes, click Apply.
5. Click OK.

Configure a Motion Group

Follow theses steps to create your motion group.

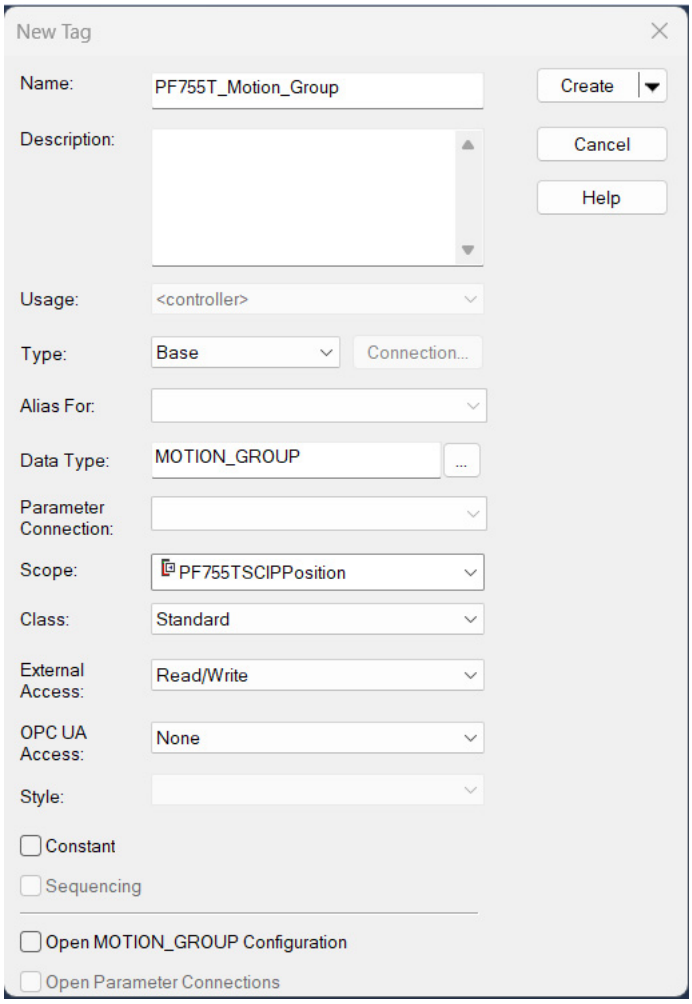
1. In the Controller Organizer, right-click Motion Groups and choose New Motion Group.

Figure 61 - New Motion Group



The New Tag dialog box appears.

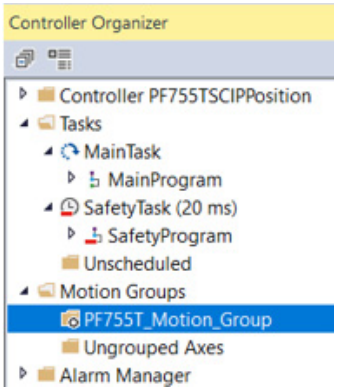
Figure 62 - New Tag Dialog Box - Create Group



2. Type a Name for the group. PF755T_Motion_Group is used in this example.
3. Click Create.

The new motion group is added to Motion Groups in the controller organizer.

Figure 63 - Controller Organizer - Motion Groups

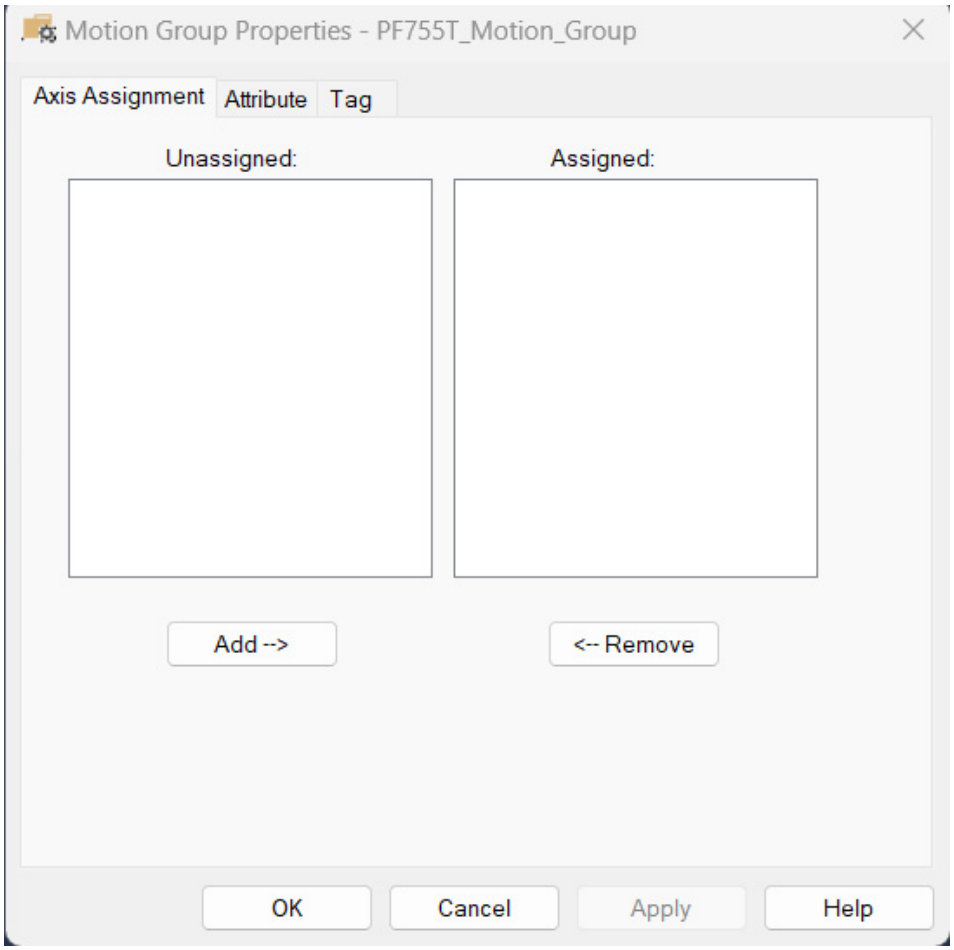


Configure the Motion Group Coarse Update Period

A combination of the type of controller and the number of axes determines the coarse update period. PowerFlex 755T products require a coarse update period of no less than 1 ms. Follow these steps to configure the coarse update rate for the motion group.

1. In the Controller Organizer, right-click your motion group and select Properties.
   The Motion Group Properties dialog box appears.

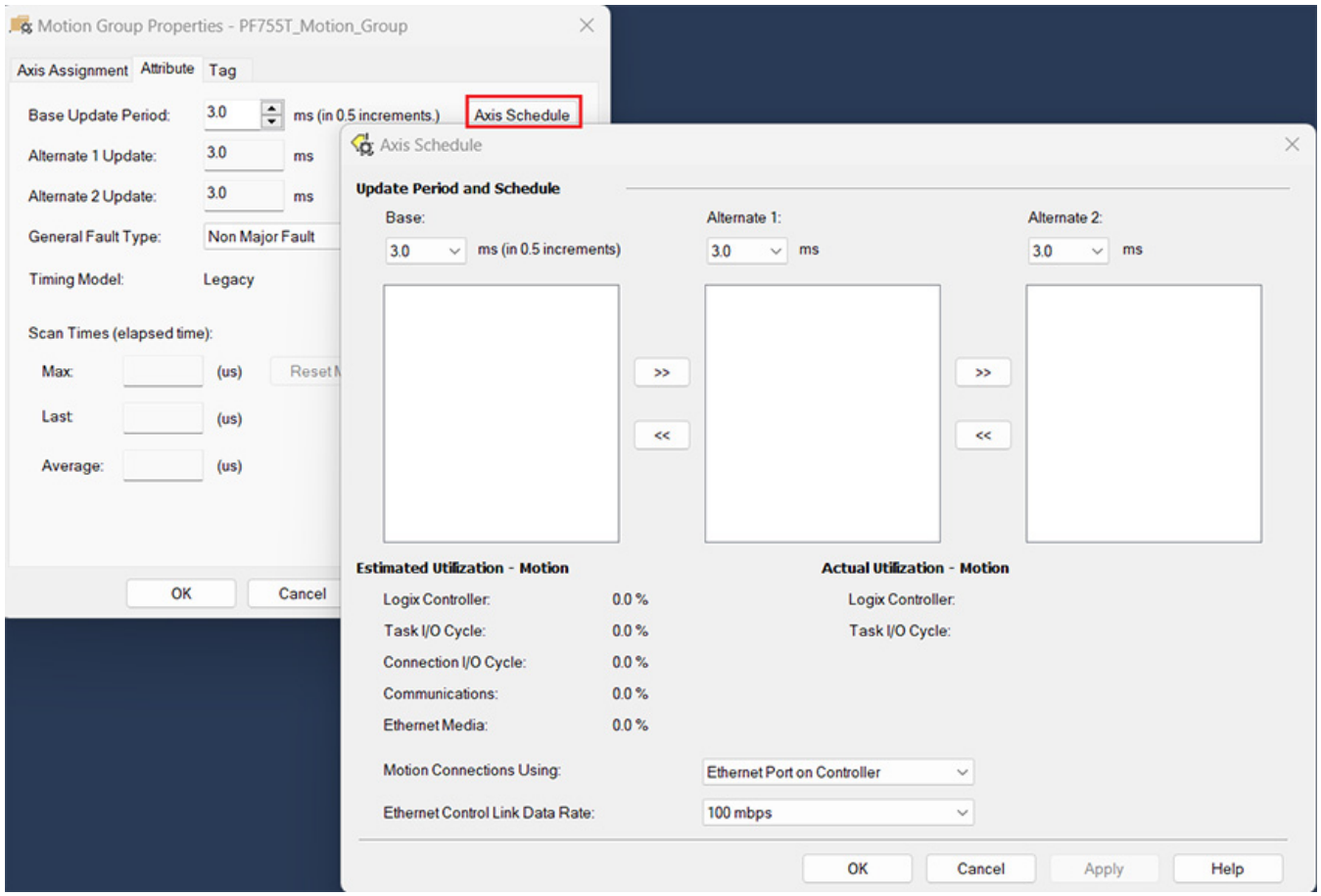
Figure 64 - Motion Group Properties Dialog Box - Axis Assignment



2. Select the Attribute tab and click Axis Schedule.

   You can configure settings for a coarse update rate and use multiplexing to have various Axis CIP Drives update a multiple of the base update rate.

Figure 65 - Motion Group Properties Dialog Box - Axis Assignment



   You can configure settings for a coarse update rate and use multiplexing to have various Axis CIP Drives update a multiple of the base update rate.

3. Make the appropriate settings for your application.

Mode	Minimum Update Rate
Coarse Update Period	1 ms
Position Loop	1024 µs
Velocity Loop	250 µs
Torque Loop	125 µs

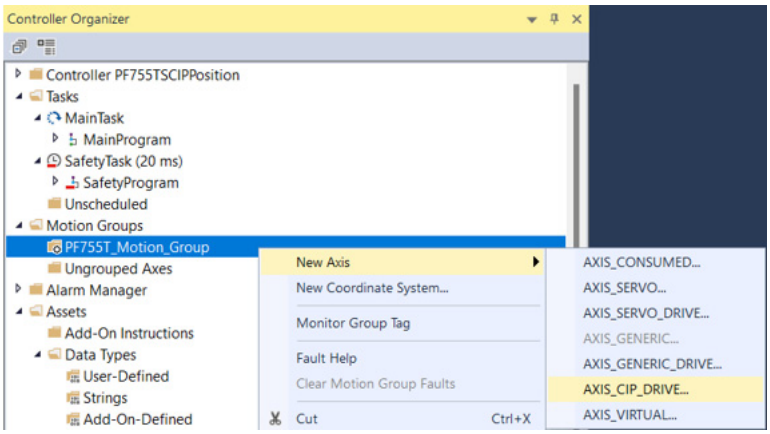
4. Click OK.

Create an Associated Axis

Follow these steps to create an associated axis for your PowerFlex 755TS drive.

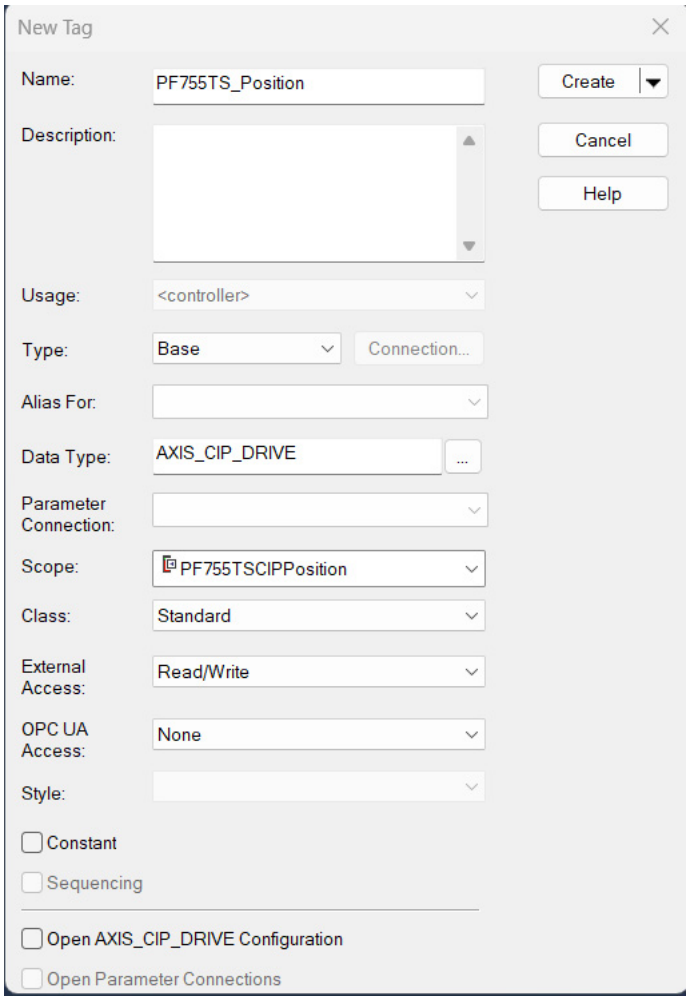
1. In the Controller Organizer, right-click your motion group (PF755T_Motion_Group in this example) and choose New Axis > AXIS_CIP_DRIVE.

Figure 66 - Create New Axis



The New Tag dialog box appears.

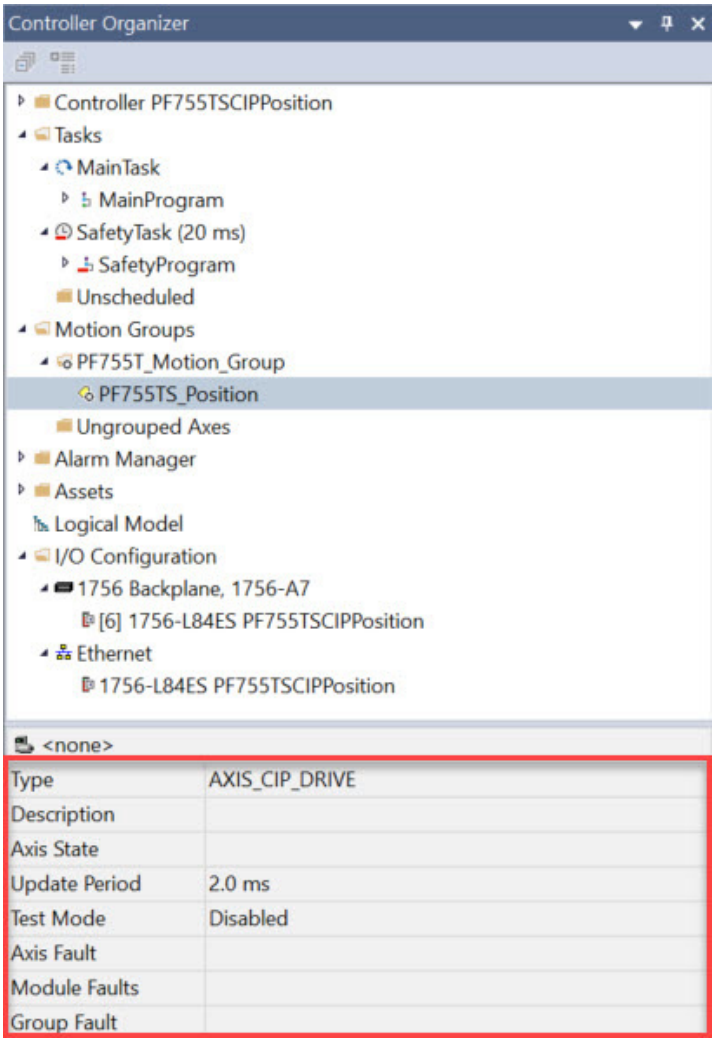
Figure 67 - New Tag Dialog Box - Axis CIP Drive



2. Type a Name for your motion axis. PF755TS_Position is used in this example.
3. Click Create.

In the Controller Organizer, the axis is added to your motion group. At the bottom of the Controller Organizer, you can view the status of the axis in the quick view pane.

Figure 68 - Controller Organizer - Quick View Pane

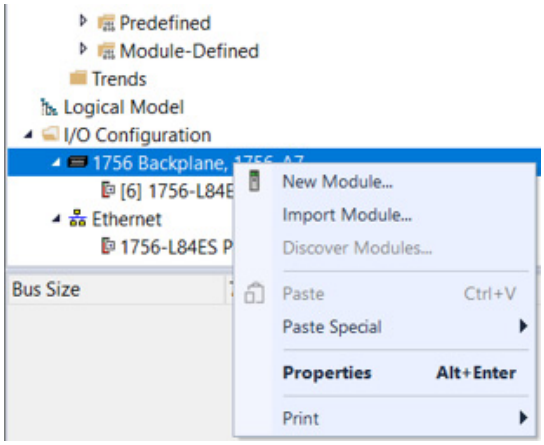


Add the EtherNet/IP Bridge Module to the Controller Chassis Backplane

Follow these steps to add an EtherNet/IP bridge module to the backplane. A 1756-EN2TR module is used in this example.

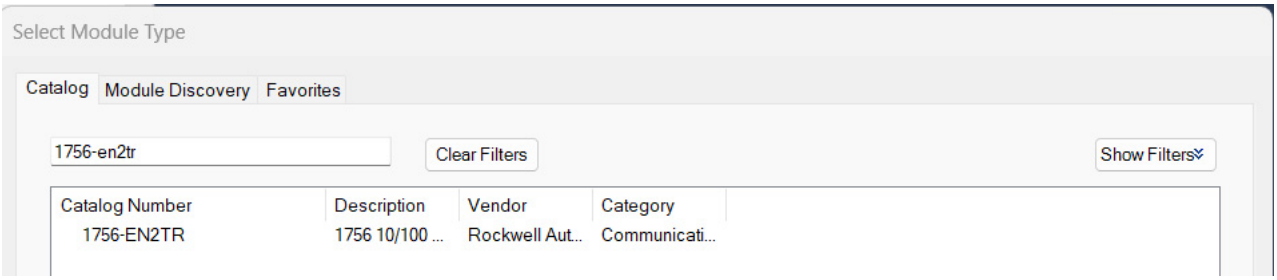
1. In the Controller Organizer, below I/O Configuration, right-click the 1756 Backplane and choose New Module.

Figure 69 - Create New Module



The Select Module Type dialog box appears.

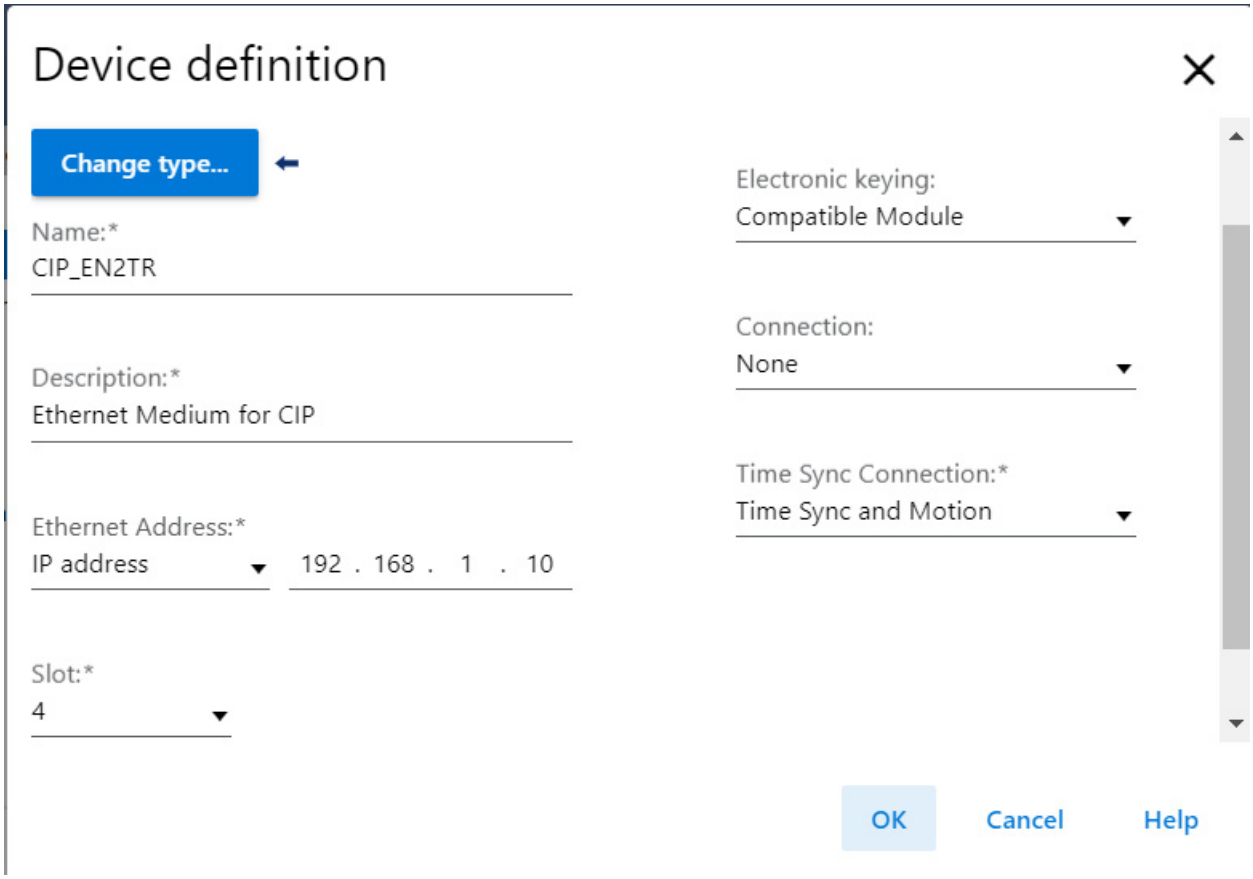
Figure 70 - Select Module Type Dialog Box



2. In the filter box, type the module catalog number. 1756-EN2TR is used in this example.
3. Below the Catalog Number, choose your EtherNet/IP bridge module.
4. Click Create.

The Device Definition dialog box appears.

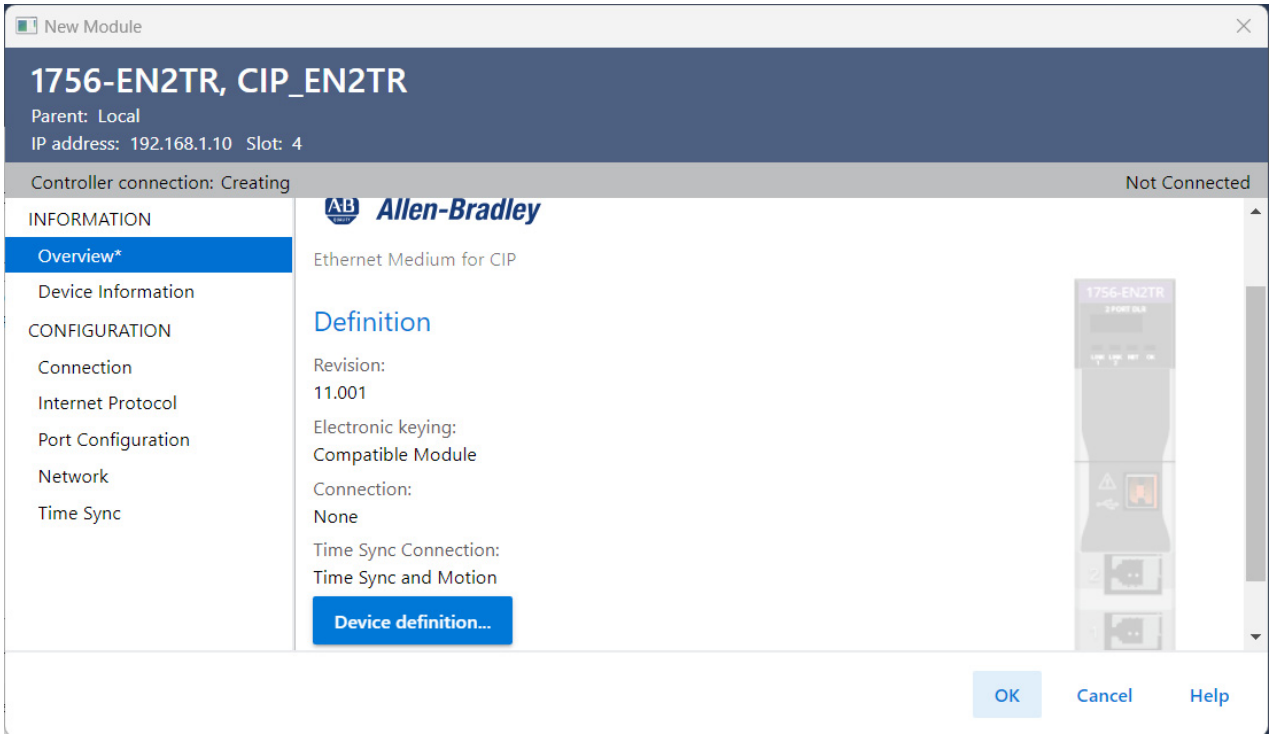
Figure 71 - Device Definition Dialog Box



5. Type a Name for the module. CIP_EN2TR is used in this example.
6. Type a Description for the module.
7. Choose the appropriate Ethernet Address option and type the IP address for the module, when applicable.
8. Choose the appropriate chassis Slot.
9. In Time Sync Connection, choose Time Sync and Motion.
10. Click OK.

The New Module dialog box appears.

Figure 72 - New Module Dialog Box



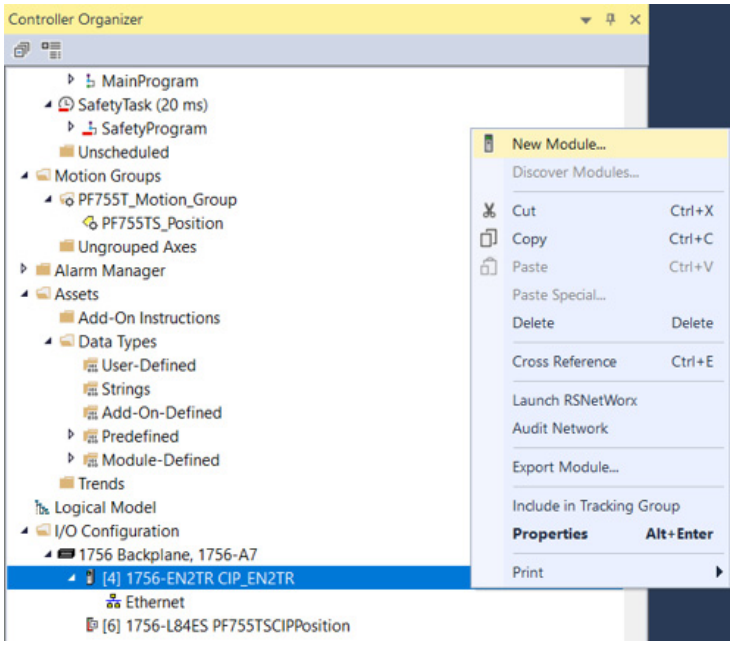
11. Click OK.
    The EtherNet/IP bridge module appears below the Backplane in the Controller Organizer.

Add the PowerFlex Drive to Your EtherNet/IP Network

Follow these steps to add the PowerFlex 755TS drive to your EtherNet/IP network.

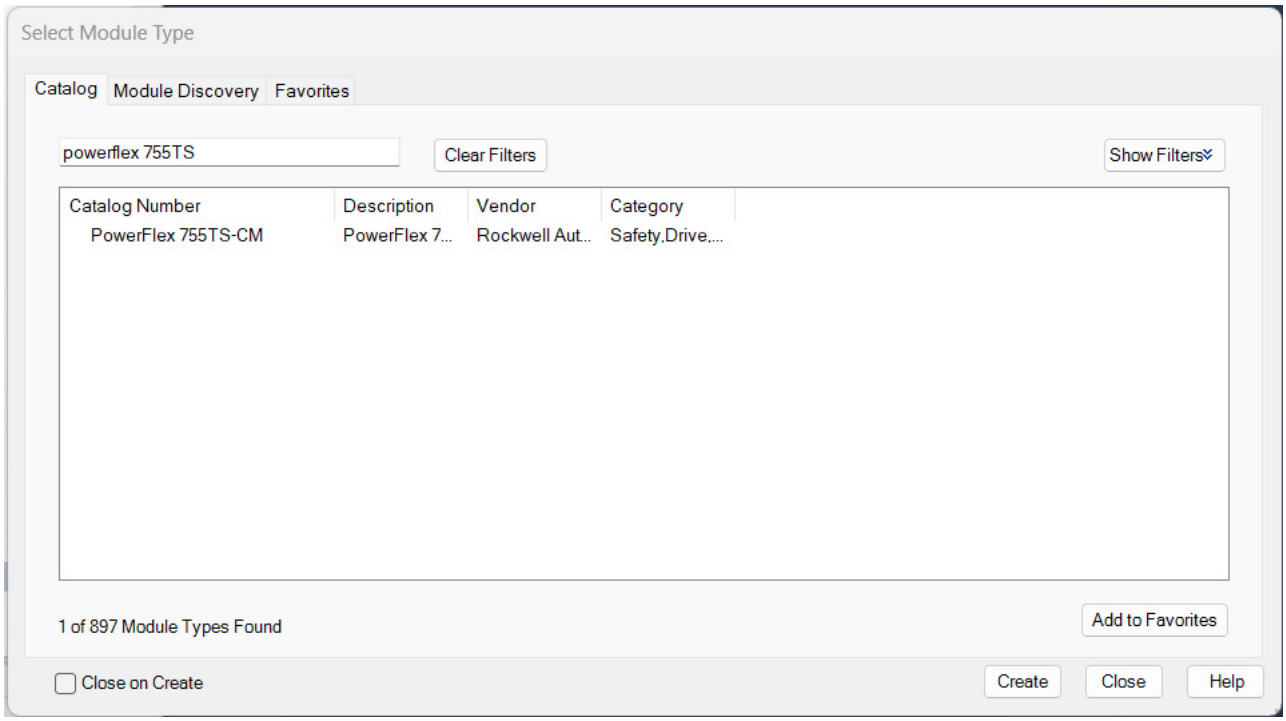
1. In the Controller Organizer, right-click your EtherNet/IP bridge module and choose New Module. 1756-EN2TR CIP_EN2TR is used in this example.

Figure 73 - Controller Organizer - Add New Module



The Select Module Type dialog box appears.

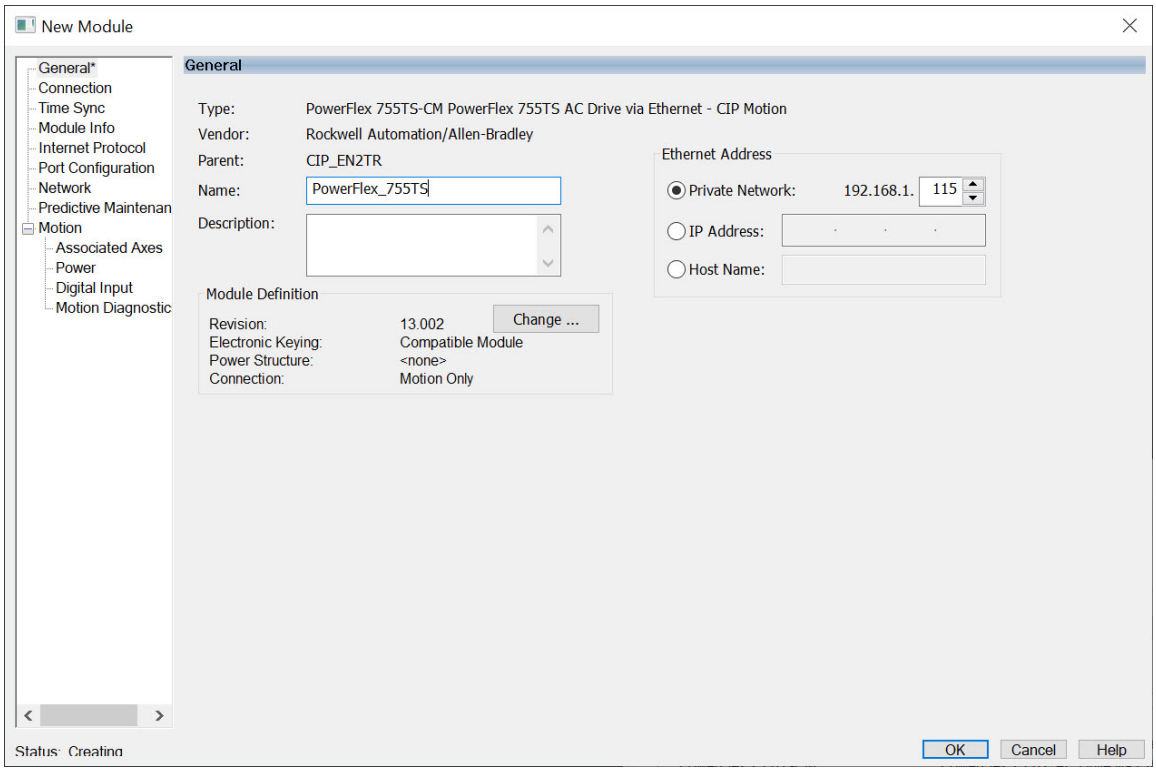
Figure 74 - Select Module Type Dialog Box



2. In the filter box, type PowerFlex 755TS.
3. Below Catalog Number, choose PowerFlex 755TS-CM.
4. Click Create.

The New Module dialog box appears.

Figure 75 - New Module Dialog Box



5. Type a Name for the drive. PowerFlex 755TS is used in this example.
6. Type a Description for the drive (optional).
7. Choose the appropriate Ethernet Address option and type the IP address for the drive.
8. To save your configuration, click OK.

Complete the Module Definition for Your Drive

The Match Drive feature allows you to connect to a physical drive and upload data from the drive to these module fields:

- Revision (major revision only)
- Drive Rating
- Special Type
- Catalog

You can find this data on the nameplate that is on your drive. Or, if your drive is not available, you can find this data in the PowerFlex 750TS-Series Products with TotalFORCE Control Technical Data, publication 750-TD104.

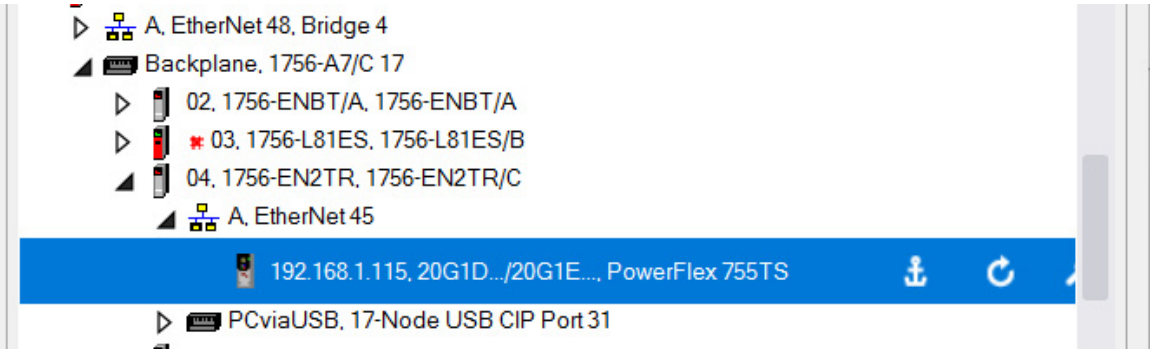
You can use the Match Drive feature if the following are true:

- Your drive is offline with the controller
- The drive control power is energized
- The drive is in Integrated Motion on EtherNet/IP mode
- The drive Ethernet address is configured and the drive is active on the network

Follow these steps to complete the module definition for your PowerFlex drive.

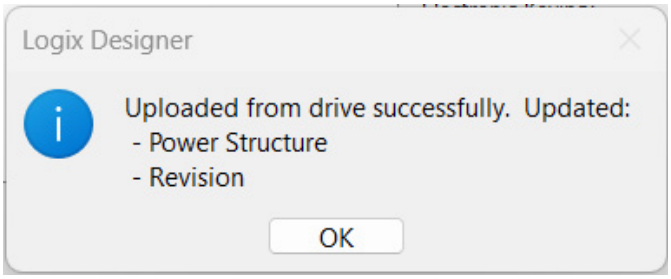
1. In the Controller Organizer, right-click your PowerFlex 755TS drive and choose Properties. PowerFlex_755TS is used in this example.
2. If your drive is installed and is online, and the Ethernet address is configured, complete steps a...e, or continue with step 3.
   a. On the General page, click Change.
   b. In the Module Definition dialog box, click Match Drive (see Figure 78 on page 62 for location).
   c. In the Upload - Path Selection dialog box, navigate to and choose your drive.

Figure 76 - Upload - Path Selection Dialog Box



   d. Click Continue.
   A message box appears to indicate that the upload was successful.

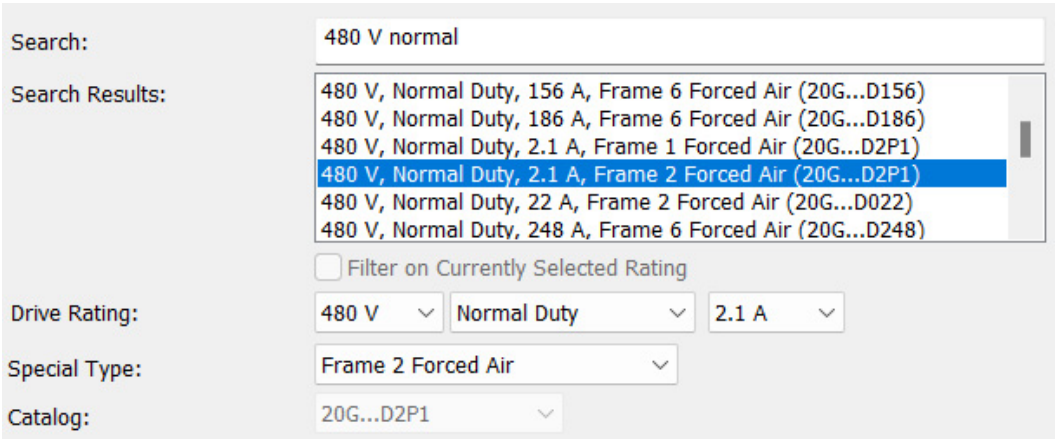
Figure 77 - Match Drive Results



   e. Click OK.
   The Revision (major revision only), Drive Rating, Special Type, and Catalog data is uploaded from the drive to the module definition.
3. Complete the drive module definition:

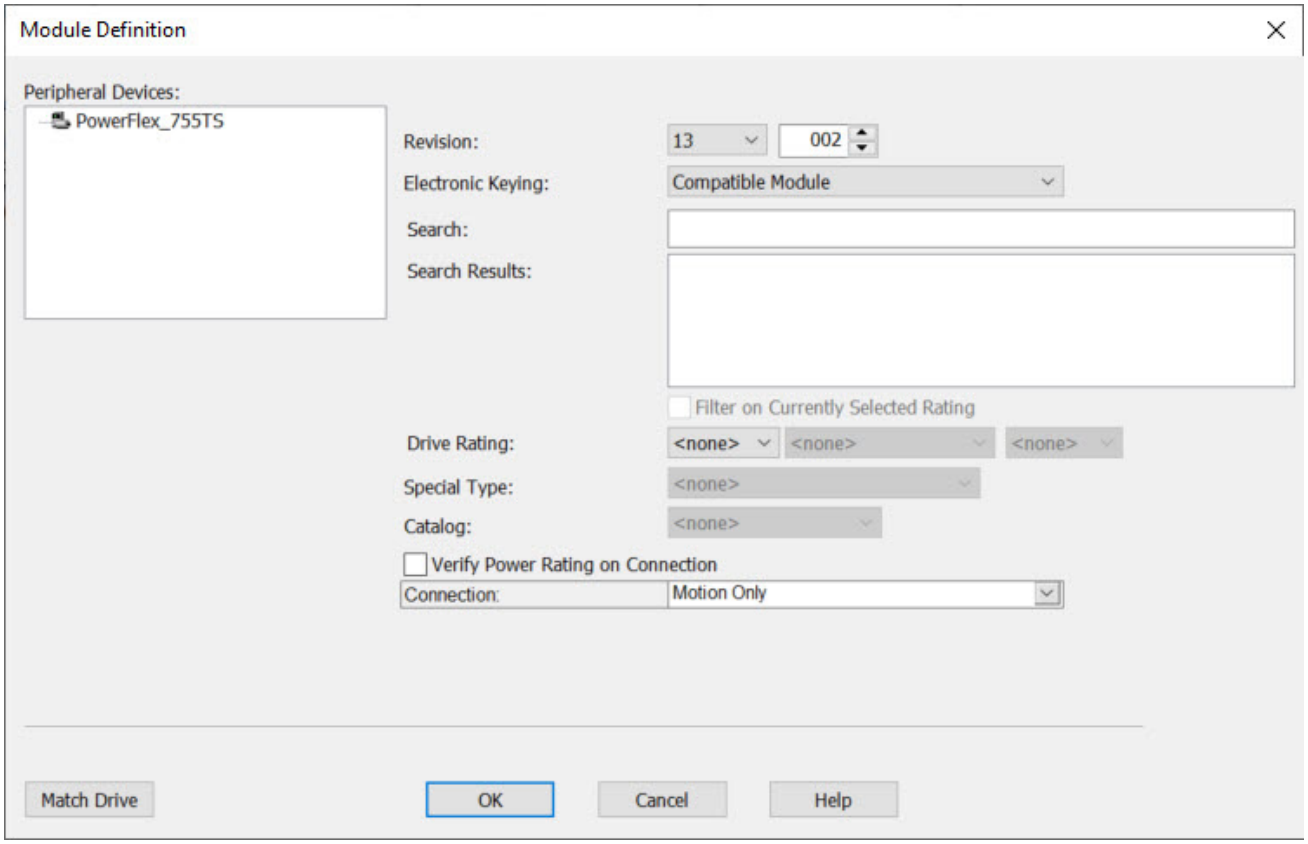
You can complete the Drive Rating fields by using one of these methods:

- Type a portion of the power rating in the Search field and choose the applicable rating from Search Results.



- Choose the applicable voltage, duty, and amp ratings from the Drive Rating fields.

Figure 78 - Module Definition Dialog Box



Peripheral devices are added in the next section. See the PowerFlex 750-Series I/O, Feedback, and Power Option Modules Installation Instructions, publication 750-IN111, for information on option modules compatible with PowerFlex 755T products.

Table 6 - Module Definition Properties

Property	Description
Revision	Select the major and minor firmware revision (must be 13.002 or later).
Electronic Keying	Selects the type of electronic keying that is used for the drive (enabled when the drive is offline only). Keying is a feature that reduces the possibility that you use the wrong device in a control system. Electronic Keying lets you verify that communication occurs only with an installed device that matches the expected device type and revision. The available options are: • Exact Match • Compatible Module • Disable Keying (not available for use with a safety option module)
Search	Type the drive power rating (voltage, duty, and current) to view possible selections in Search Results.
Search Results	Select the search result that matches the desired drive rating, special type, and catalog number of the drive.
Filter on Currently Selected Rating	Select to filter the Drive Rating, Special Type, and Catalog selections.
Drive Rating	Select the voltage class, normal duty, heavy duty, or light duty, and current rating of the drive.
Special Type	Select the drive frame size and cooling type (based on the selected drive rating). Not available for all drive ratings.
Catalog	Drive catalog number (based on the selected drive rating). Not available for all drive ratings.
Verify Power Rating on Connection	Select to verify that the drive rating selections on this page match the drive to which you are connecting. If this box is selected and the physical drive rating does not match the drive rating selections on this page, an error occurs and the connection fails.
Connection	Select the type of controller and drive communication type. The available options are: • Motion Only - This controller manages the motion connections. Another controller that has a Safety Only connection to the drive manages the integrated safety connection. • Safety Only - This controller manages the integrated safety connection. Another controller manages the motion connections. An integrated safety connection can only be made from a GuardLogix 5580 or Compact GuardLogix 5380 controller. Because the safety function is controlled in this axis only, a motion drive axis does not appear in the motion group. • Motion and Safety - This controller manages the motion and integrated safety connections. A Motion and Safety connection can only be made from a GuardLogix 5580 or Compact GuardLogix 5380 controller. This example uses this selection.

Add Peripheral Devices to the Drive

This application example uses position control with Integrated Safety on EtherNet/IP application. Therefore, these option modules are added to the drive to enable input/output functions, motor feedback, and safety devices.

- 20-750-UFB-1 - Universal Feedback option module
- 20-750-S3 - Integrated Safe Torque Off option module
- 20-750-2262C-2R - 24V DC 22-Series I/O option module with two analog inputs, two Analog outputs, six digital inputs, and two relay outputs

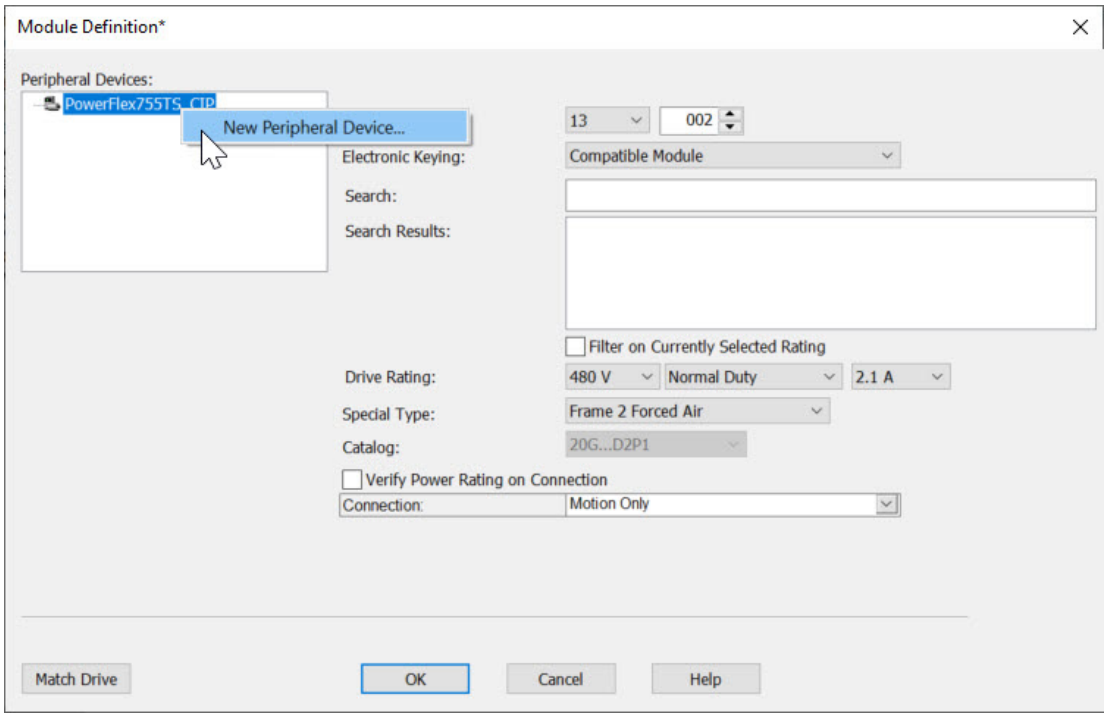
For compatible option modules and valid ports, see Controller, Motor, and Option Module Compatibility on page 4. Also, for a list of compatible option modules and ports, see the Knowledgebase article PowerFlex 755Tx CIP Motion Frequently Asked Questions (QA75447).

The peripheral devices added to the drive module definition must be installed in the drive.

Follow these steps to add the peripheral devices (option modules) to the drive.

1. On the General page, click Change.
   The Module Definition dialog box appears.

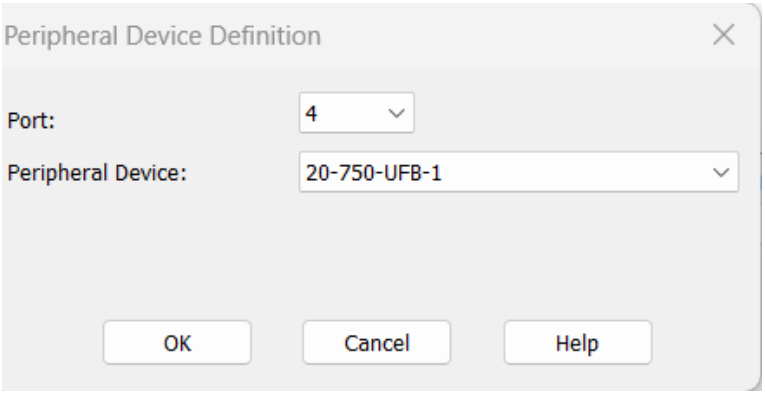
Figure 79 - Module Definition Dialog Box



2. Below Peripheral Devices, right-click the drive name and choose New Peripheral Device.

The Peripheral Device Definition dialog box appears.

Figure 80 - Peripheral Device Definition Dialog Box Example



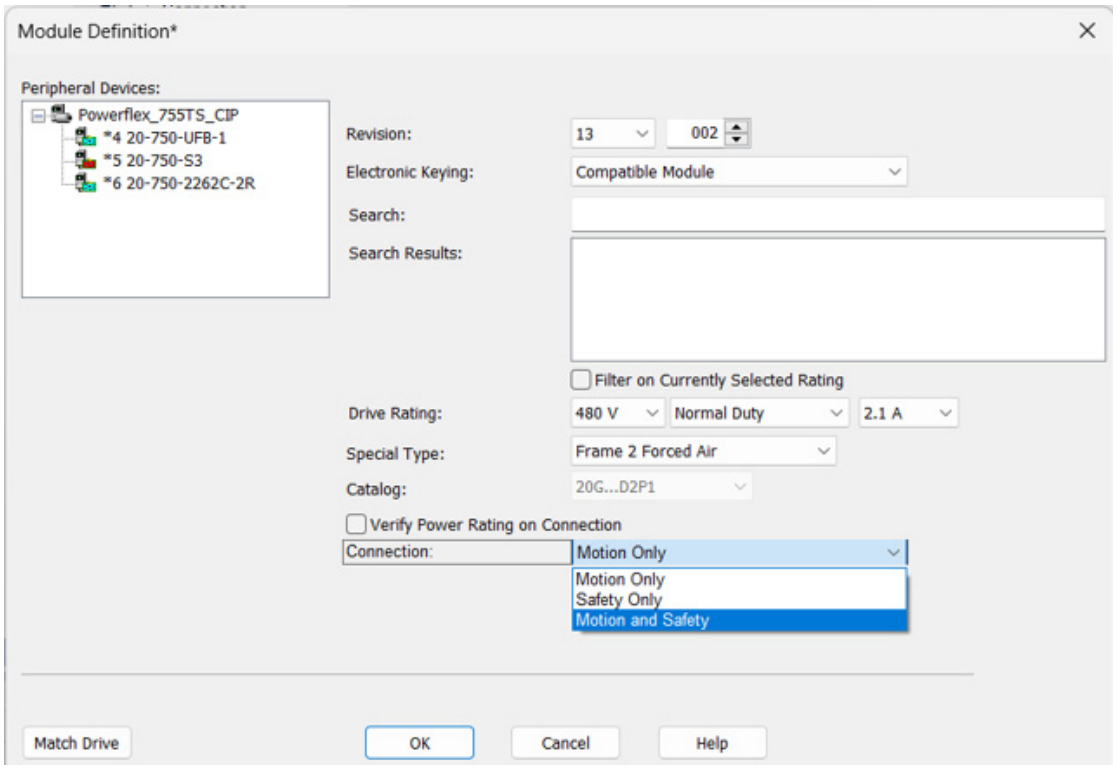
3. For each peripheral device (option module), complete steps a...c.
   a. Choose the applicable Port.
   b. Choose the applicable Peripheral Device.
   c. Click OK.

   This example uses these ports and peripheral devices:

Port	Peripheral Device Catalog Number
4	20-750-UFB-1
5	20-750-S3
6	20-750-2262C-2R

4. At the bottom of the Module Definition dialog box, in Connection, choose Motion and Safety.

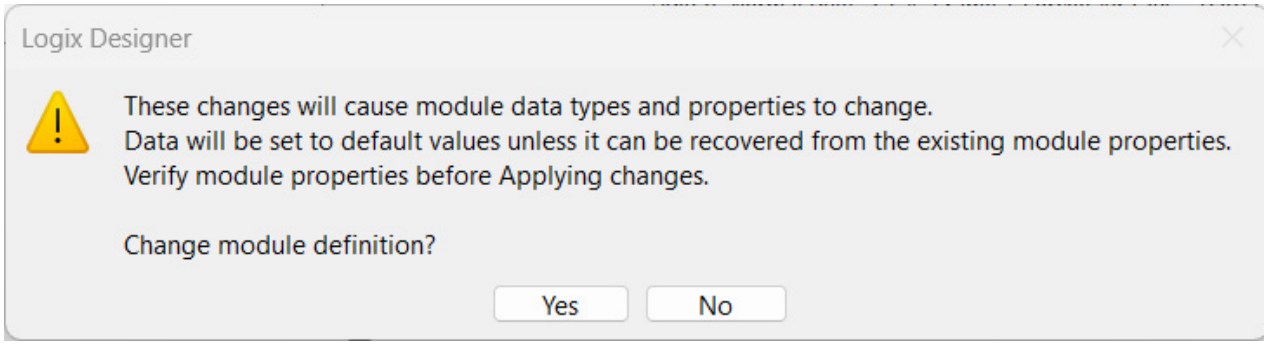
Figure 81 - Module Definition Dialog Box - Connection Type



5. Click OK.

A message appears to identify that changes have been made to the module properties.

Figure 82 - Change Module Definition Message



6. To accept the changes and complete the module definition, click Yes.
   The Module Properties dialog box appears.
7. To save your drive module, click Save.

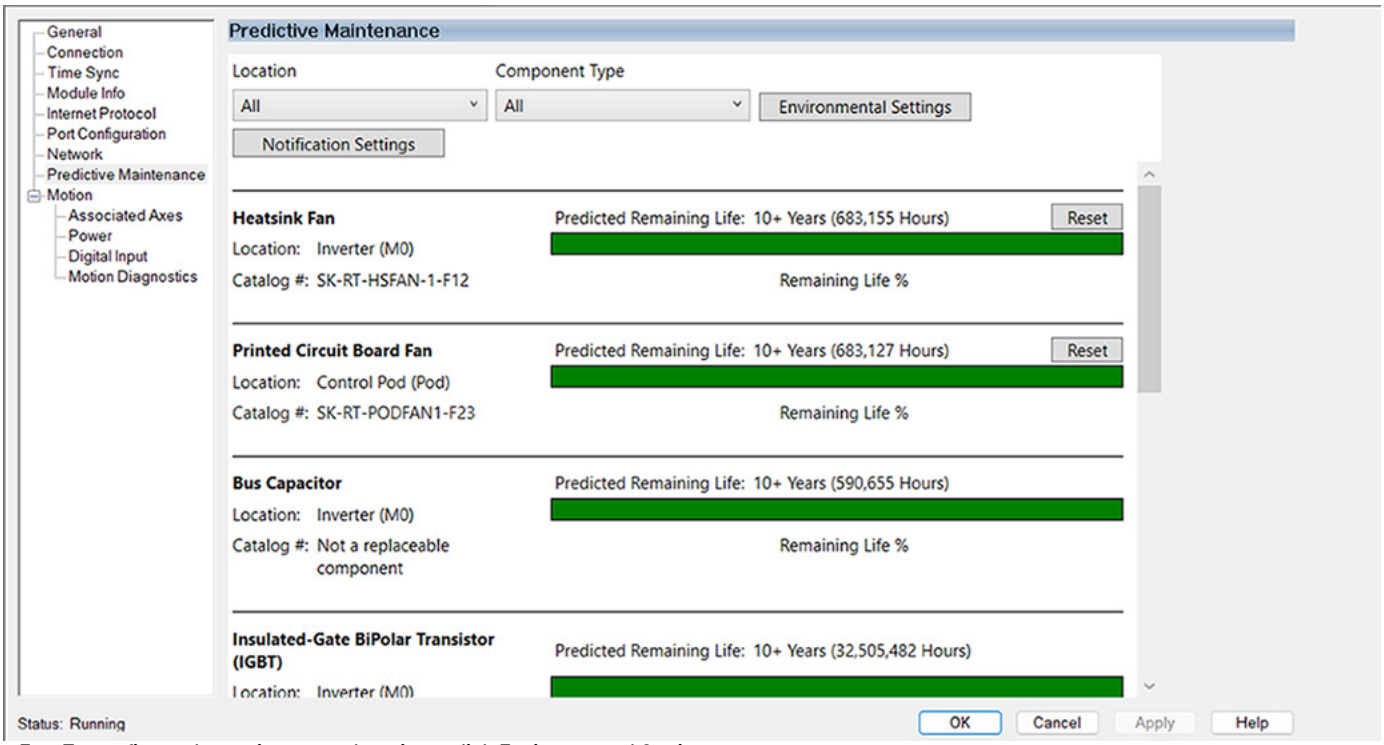
Set Up Predictive Maintenance

Use the Predictive Maintenance page to monitor and reset the estimated life of components in your PowerFlex 755T products with TotalFORCE Control. The controller must be online with the drive to view the status of predicted remaining life of components.

Follow these steps to complete the predictive maintenance configuration for your PowerFlex drive module.

1. Open your drive module.
2. Select the Predictive Maintenance category.

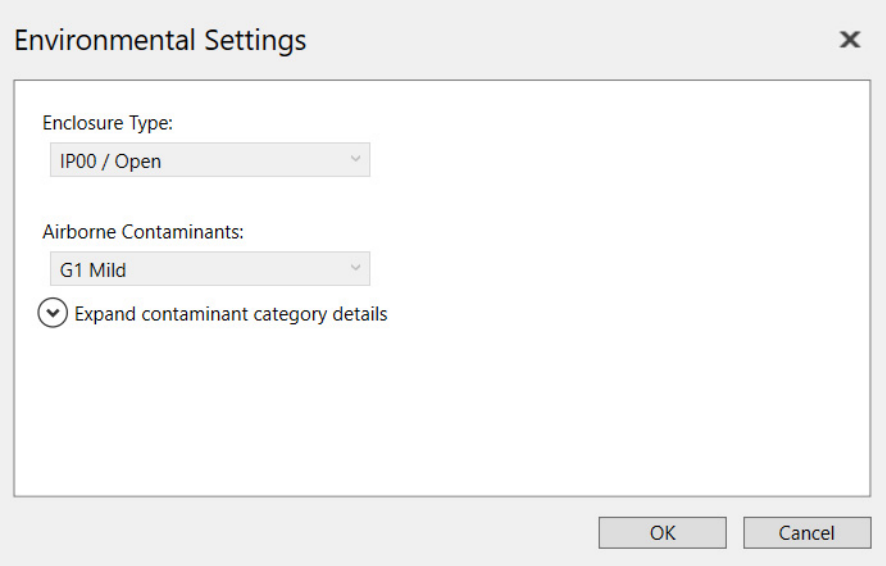
Figure 83 - Module Properties Dialog Box - Predictive Maintenance Category (Drive Online)



3. To configure the environmental settings, click Environmental Settings.

The Environmental Settings dialog box appears.

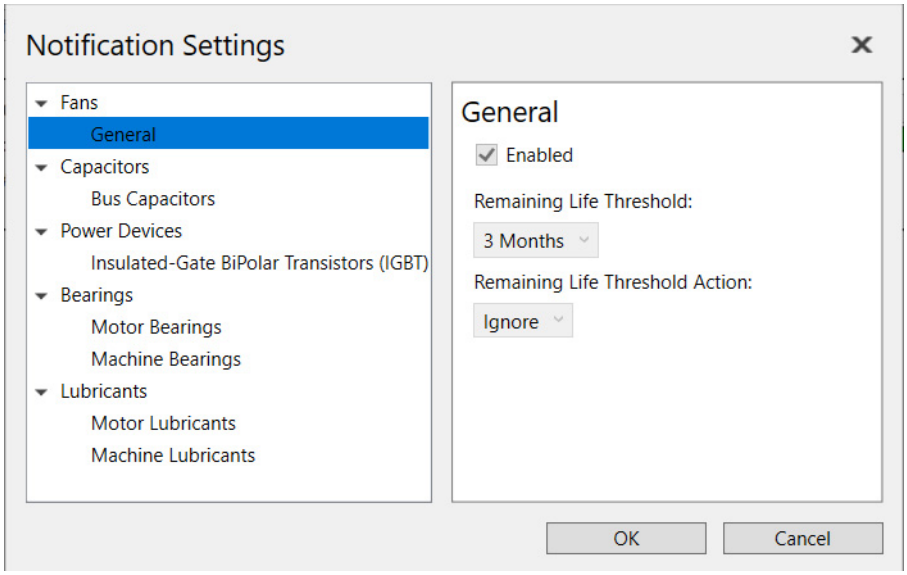
Figure 84 - Environmental Settings Dialog Box



4. To configure your environmental settings, complete steps a...c.
   a. Select the Enclosure Type for your product. Available options are:
      - P00 / Open
      - IP20-21 /Type 1
      - IP54 / Type 12
   b. Select the applicable Airborne Contaminants category for your product installation site. The selections classify the airborne contaminants in the installation environment, per ISA 71.04 standard with an additional category (GX+). Available options are:
      - G1 Mild - An environment sufficiently well-controlled such that corrosion is not a factor in determining equipment reliability.
      - G2 Moderate - An environment in which the effects of corrosion are measurable and can be a factor in determining equipment reliability.
      - G3 Harsh - An environment in which there is a high probability that a corrosive attack can occur. These harsh levels should prompt further evaluation resulting in environmental controls or specially designed and packaged equipment.
      - GX Severe - An environment in which only specially designed and packaged equipment would be expected to survive. Specifications for equipment in this class are a matter of negotiation between user and supplier.
   c. Click OK.

5. Click Notification Settings.
   The Notification Settings dialog box appears.

Figure 85 - Notification Settings Dialog Box



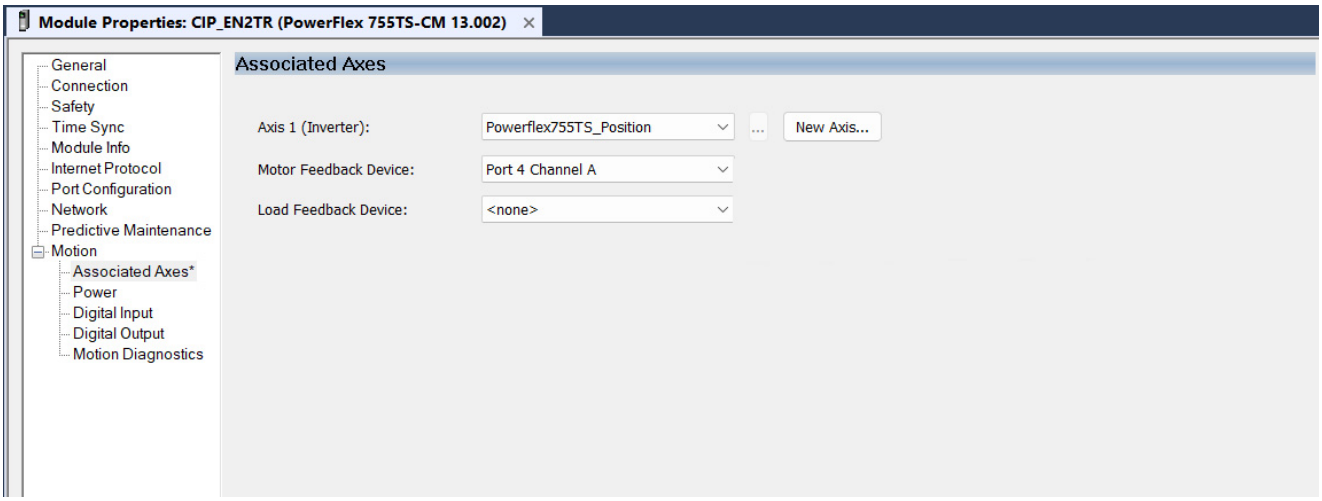
6. To configure your notification settings, complete steps a...g.
   a. In the selection list, choose the component or group of components for which you want to configure notification settings.
   b. If present, click Enabled to enable notifications for a non-drive component.
   c. In Remaining Life Threshold, select the time at which you want a notification to occur.
   d. From Remaining Life Threshold Action, select the type of notification action that you want to occur when the remaining life threshold is reached.
   e. For non-drive components, type the maximum number of hours of the components expected life in User Defined Maximum Life.
   f. Repeat steps a...e for each renewal component or component group you want to configure.
   g. Click OK.
7. To save your changes, in the Module Properties dialog box, click Apply.

Assign the Associated Axes Settings

Follow these steps to configure the motion associated axes settings for your drive module.

1. Below the Motion category, select Associated Axes.

Figure 86 - Module Properties Dialog Box - Associated Axes



2. In Axis 1 (Inverter), choose your drive. PF755TS_Position is used in this example.
3. In Motor Feedback Device, choose the port and channel for your feedback option module. This example uses a Universal Feedback option module (20-750-UFB-1) in port 4.
4. To save your changes, in the Module Properties dialog box, click Apply.

Review the Power Settings

Review the power configuration for your PowerFlex drive.

1. Below the Motion category, select Power.

   Configure the power settings for your application. Configuration changes to this page can be made if a switching frequency or bus overvoltage issue occurs. See Table 7 for available power settings. In this example, the settings remain set to the default values.

Figure 87 - Module Properties Dialog Box - Power Category

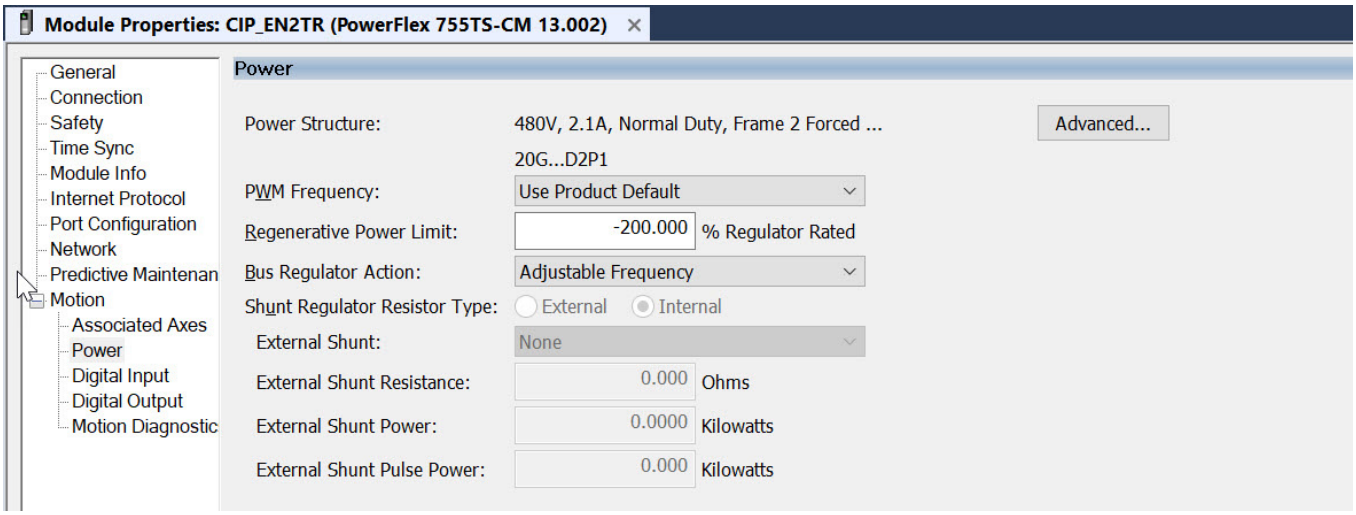


Table 7 - Power Settings

Attribute	Settings	Description
Power Structure	From the Module Definition	The drive voltage class, normal duty, heavy duty, or light duty, and current rating.
PWM Frequency	1.333 kHz(1) 2 kHz (Default) 4 kHz 8 kHz 12 kHz Use Product Default	The value sets the carrier frequency for the pulse-width modulation (PWM) output to the motor.
Regenerative Power Limit	-800.00...0.00 (Default -50.00)	This limit is the amount of energy that the drive allows during regeneration. If an external regenerative power supply or shunt (dynamic brake) resistor is used, it is recommended that this value is set to -200.0%. **IMPORTANT:** If this value is set too low, the ability of the drive to stop a motor is limited.
Bus Regulator Action(2)	Disabled	Disables the internal shunt resistor and external shunt option.
	Shunt Regulator	Enables the internal and external shunt options.
	Adjustable Frequency (default)	This selection allows the drive to either change the torque limits or ramp rate of the velocity to control the DC bus voltage. This option is not recommended for positioning applications because it overrides the velocity and the system can overshoot or not stop.
	Shunt then Adjustable Frequency	This selection allows the Shunt resistor to absorb as much energy as it is designed for, then transitions to adjustable frequency control if the limit of the resistor has been reached.
	Adjustable Frequency then Shunt	This selection allows for adjustable frequency control of the DC bus. If adjustable frequency control cannot maintain the DC bus within limits, the shunt resistor is activated.
	Use Product Default	Uses the default setting for the product.
Shunt Regulator Resistor Type	Internal	Enables the internal shunt (the external shunt option is disabled).
	External	Enables the external shunt (the internal shunt option is disabled).
External Shunt Resistance	The type of drive determines the valid values.	Specifies the external shunt resistance in Ohms. Available only if the External Shunt is set to Custom.
External Shunt Power		Specifies the external shunt power in Kilowatts. Available only if the External Shunt is set to Custom.
External Shunt Pulse		Specifies the external shunt pulse power in Kilowatt-seconds. Available only if the External Shunt is set to Custom.

(1) 1.333 kHz option is valid for PowerFlex 755TL, 755TR 755TR, and 755TM products only.
(2) Disabled and Adjustable Frequency are the only valid Bus Regulator Action options for PowerFlex 755TL, 755TR, and 755TM products.

2. To save your changes, click Apply.
3. Click OK.

Review the Inputs and Outputs

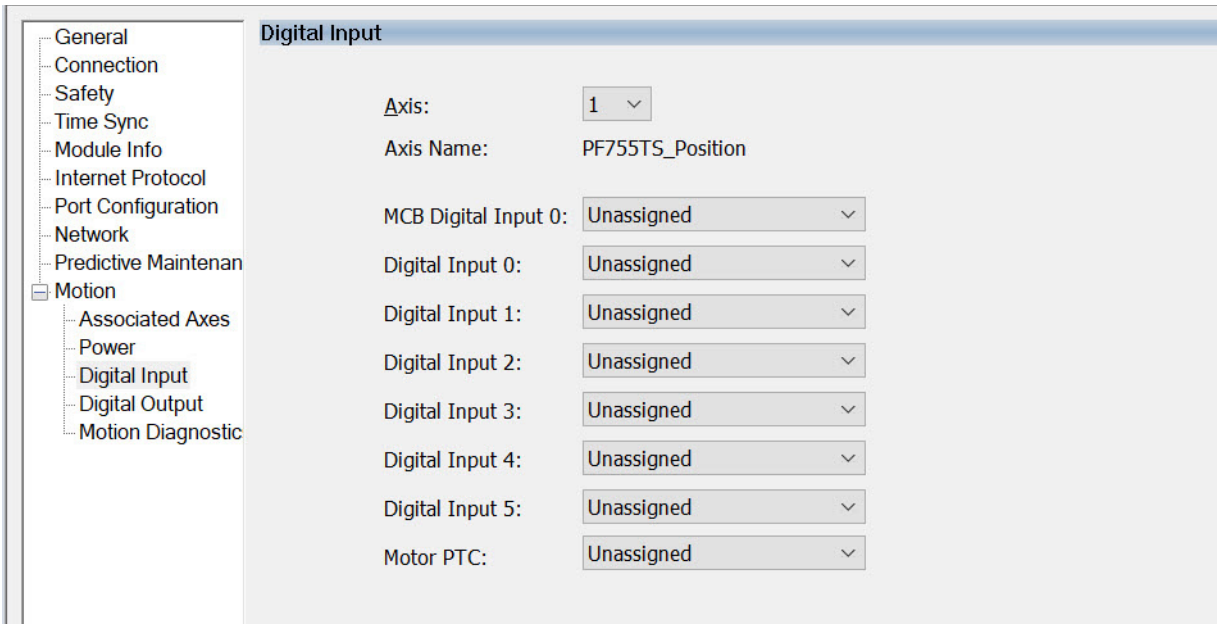
When an I/O option module is installed in the drive, any digital inputs or outputs should be configured in the Digital Input and Digital Output categories. In position control applications, the digital inputs can be used for the Hardware Overtravel functions.

In this example, a 20-750-2262C-2R option module is used. No machine transmission for these digital inputs/outputs is used, but a general digital input is used to request a Motion Servo On (MSO) command later in the configuration.

Review the digital inputs for your PowerFlex drive.

1. In the Axis Properties for the drive, select the Digital Input category.

Figure 88 - Module Properties Dialog Box - Digital Input Category



The settings on this page remain set to the default values.

Digital input 0 on the main control circuit board terminal block (TB1) can be used as a dedicated hardware enable when the enable jumper is removed from the board. See the Main Control Circuit Board section in the PowerFlex 755TS Products with TotalFORCE Control Installation Instructions, publication 750-IN119, for details. See Table 8 for available digital input settings.

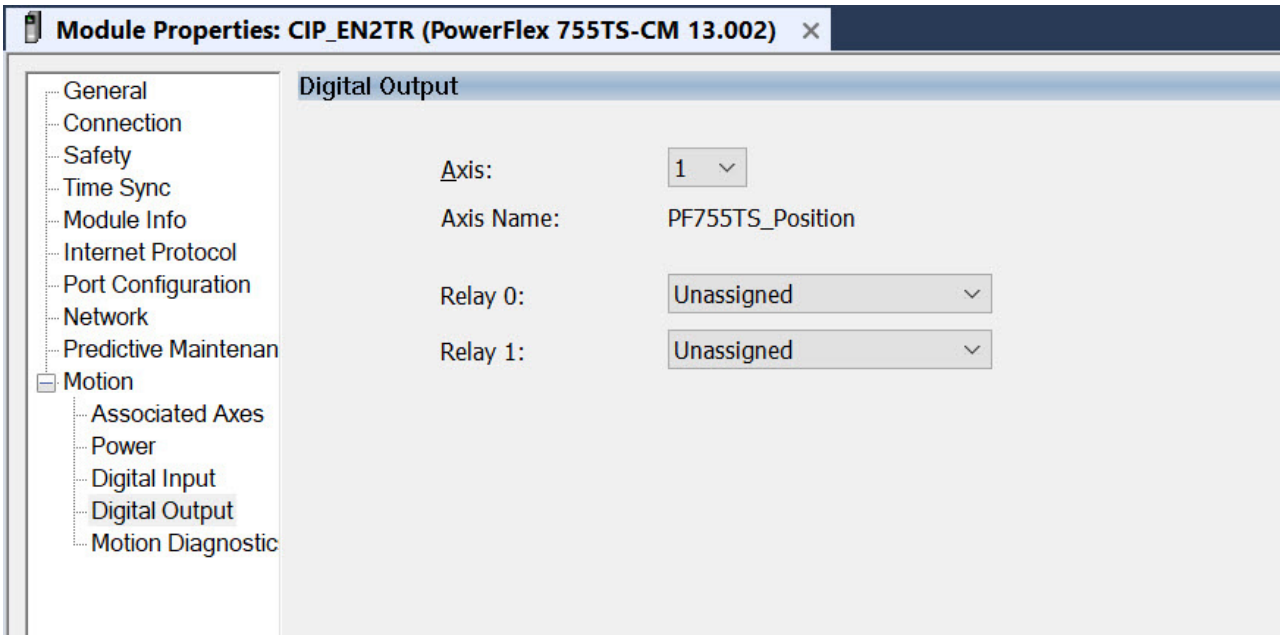
Table 8 - Digital Input Settings

Attribute	Settings	Description
MCB Digital Input 0	Unassigned	This digital input on the main control circuit board is unassigned.
	Enable	24V DC control power is applied to digital input 0 on the main control circuit board as a condition to enable the drive.
Digital Input 0 Digital Input 1, Digital Input 2 Digital Input 4 Digital Input 5[1]	Unassigned	The digital input is unassigned.
	Enable	24V DC control power is applied to this digital input (1...5) as a condition to enable the drive.
	Positive Overtravel	The positive limit switch (normally closed contact) inputs for each axis require 24V DC (nominal).
	Negative Overtravel	The negative limit switch (normally closed contact) inputs for each axis require 24V DC (nominal).
	Regeneration OK	In the active state, the inverters can be enabled. An inactive state indicates that the bus supply unit is not ready to supply DC bus power. The inverters cannot be enabled.
	Pre-Charge OK	This feature extends the precharge input monitoring capability to the drive in integrated motion. The event processing is as follows: 1. If the configured Pre-charge OK Input becomes inactive and the drive is in the Stopped state, the drive enters the precharge state. 2. If the configured Pre-charge OK input becomes inactive and the drive is in the Running state, the drive generates the Converter Pre-charge Input Deactivated exception and performs a Fault Coast Stop.
Motor PTC	Unassigned	The motor PTC input is unassigned.
	Motor Thermostat OK	Motor thermostat input functionality is provided through the motor thermostat input (PTC) on the 22-Series I/O modules when in Integrated Motion on EtherNet/IP mode. The functionality is the same as the motor thermostat functionality in parameter mode. When the PTC input resistance transitions from low to high at the design temperature, the drive issues a motor over temperature fault, 18 [Motor PTC Trip]. The functionality supports the current motor thermostat range for status trip and reset in parameter mode. However, this functionality is not suitable for Allen-Bradley MPL and MPM motors due to the varying hardware capacities and thermostat ranges of the Kinetix and 22-Series I/O modules.

(1) The number of digital inputs available depends on the I/O option module installed. 11-Series I/O option modules provide up to three digital inputs. 22-Series I/O option modules provide up to five digital inputs.

2. Select the Digital Output category.

Figure 89 - Module Properties Dialog Box - Digital Output Category



The settings on this page remain set to the default values.

Table 9 - Digital Output Settings

Attribute	Settings	Description
Relay 0 Relay 1	Unassigned	The output is unassigned.
	Contactor Enable	The operation of this output is tied to fault processing in the drive. The drive de-energizes the Contactor Enable output when an exception causes the axis to go to the 'shut down' state. Note: This configuration is only valid when an axillary power supply is used for control power with PowerFlex 755TS Frames 1...7 drives.

3. To save your changes, click Apply.
4. Click OK.

You have completed the hardware configuration for your drive. The next task is to configure the position control requirements.

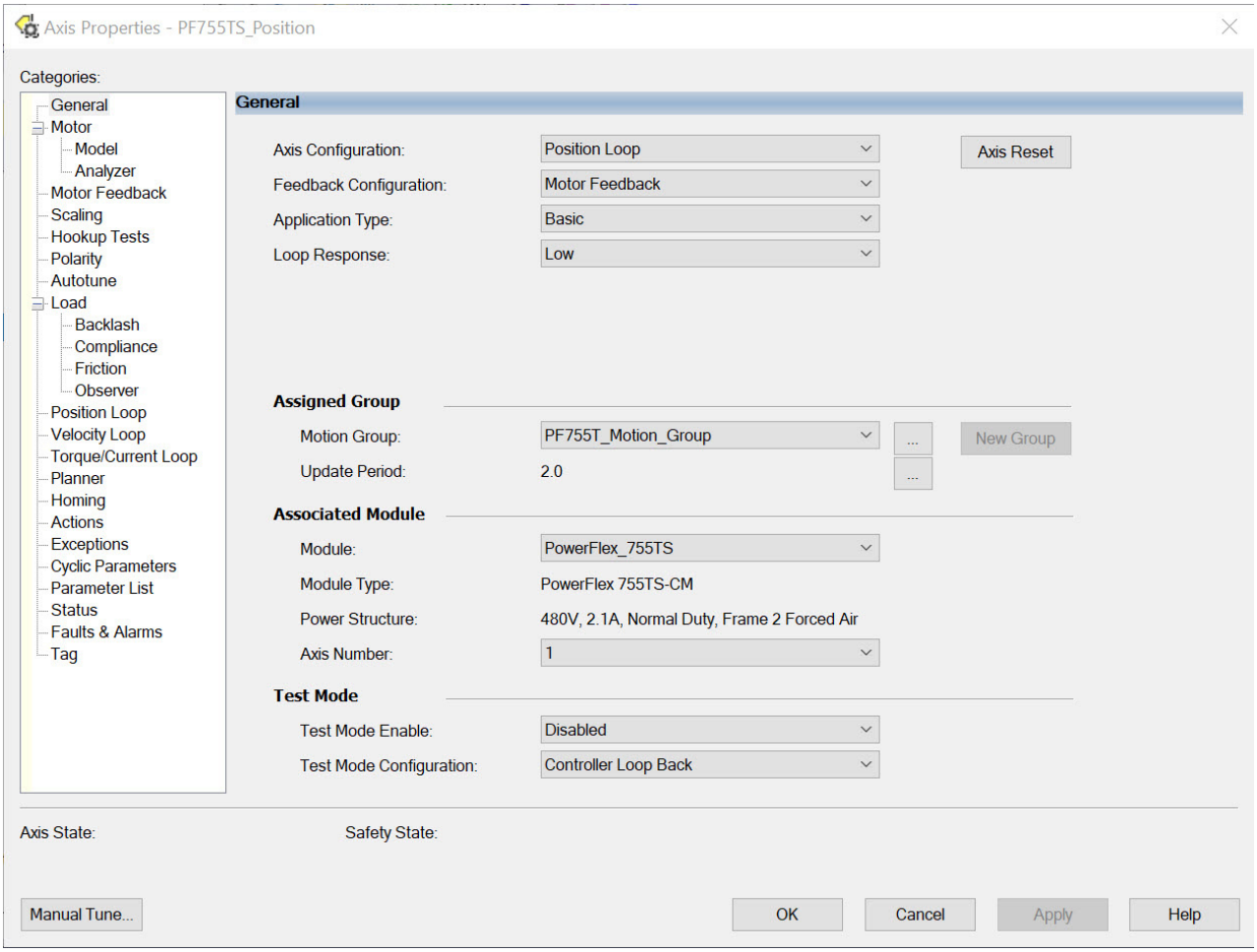
Verify Your Position Control Settings

Follow these steps to review and verify your position control settings.

1. In the Controller Organizer, expand your motion group (PF755T_Motion_Group in this example), right-click the assigned axis (PF755TS_Position in this example), and choose Properties.

   The Axis Properties dialog box appears.

Figure 90 - Axis Properties Dialog Box - General Tab



2. For this example, the default Axis Configuration setting for Position Loop and the default Feedback Configuration for Motor Feedback are used and no action is needed.

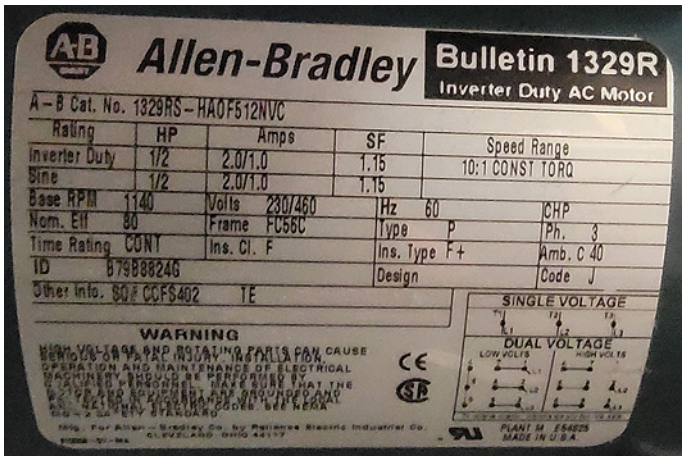
Add a Motor

In the Motor category of the drive module, there are two methods to add motor data:

- Nameplate Datasheet is used for manual entry of the applicable motor data from a motor datasheet or nameplate.
- Catalog Number is used for any Rockwell Automation manufactured induction motor or a custom motor file (CMF) for other motors, if available. When the Catalog Number selection is used, all motor characteristic data is loaded in the Axis CIP Drive structure and then downloaded to the drive.

The PowerFlex 755TS drive module that is created for this procedure was sized according to the motor data nameplate available. Therefore, this example uses the Nameplate Datasheet selection.

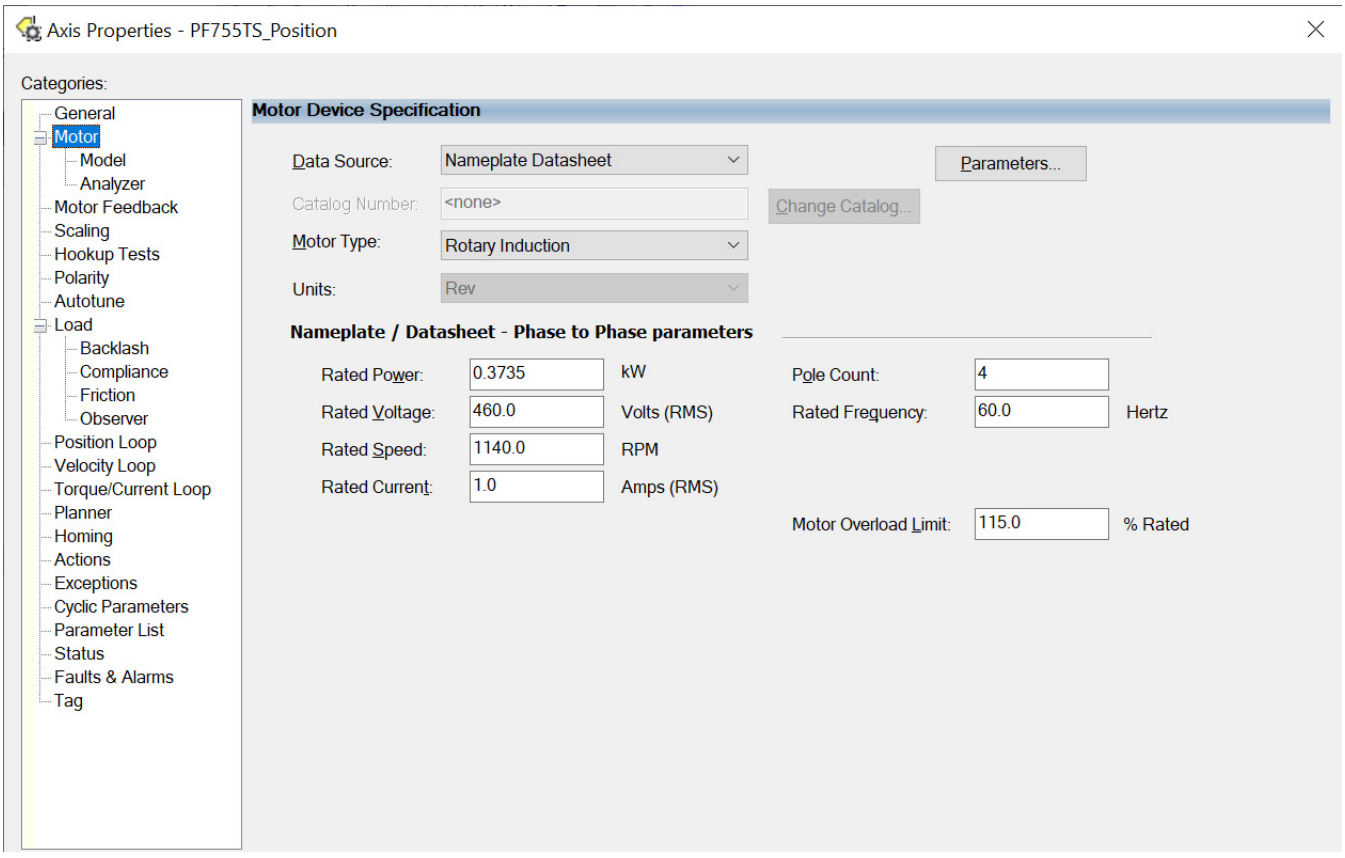
Figure 91 - Motor Data Nameplate Example



Follow these steps to add your motor to the drive module properties.

1. In the Axis Properties for the drive, select the Motor category.

Figure 92 - Axis Properties Dialog Box - Motor Category



2. In Data Source, select Nameplate Datasheet.
3. In Motor Type, select Rotary Induction.
4. Complete the Nameplate / Datasheet data by using the motor performance datasheet or the motor nameplate data. Use Figure 35 to identify and complete the fields on the Motor Device Specification page, as identified in this table.

Motor Data Entry

Data Nameplate Property	Data Nameplate Data	Motor Device Specifications Field
HP	0.5 HP x 0.747 W = 0.3735 kW	Rated Power
Amps (Inverter Duty)	2.0 (230V) /**1.0** (460V)	Rated Current
SF (Service Factor)	SF x 100 = 115.0%	Motor Overload Limit
Base RPM	1140	Rated Speed (always use asynchronous speed)
Volts	230/**460**	Rated Volts
Hz	60	Rated Frequency
(See step 5)	6	Poles

5. If the motor nameplate excludes the motor poles, use this calculation:

   Motor Poles = 120 x Frequency / Rated Speed (at rated torque) + Slip Speed

6. To save your settings, click Apply.

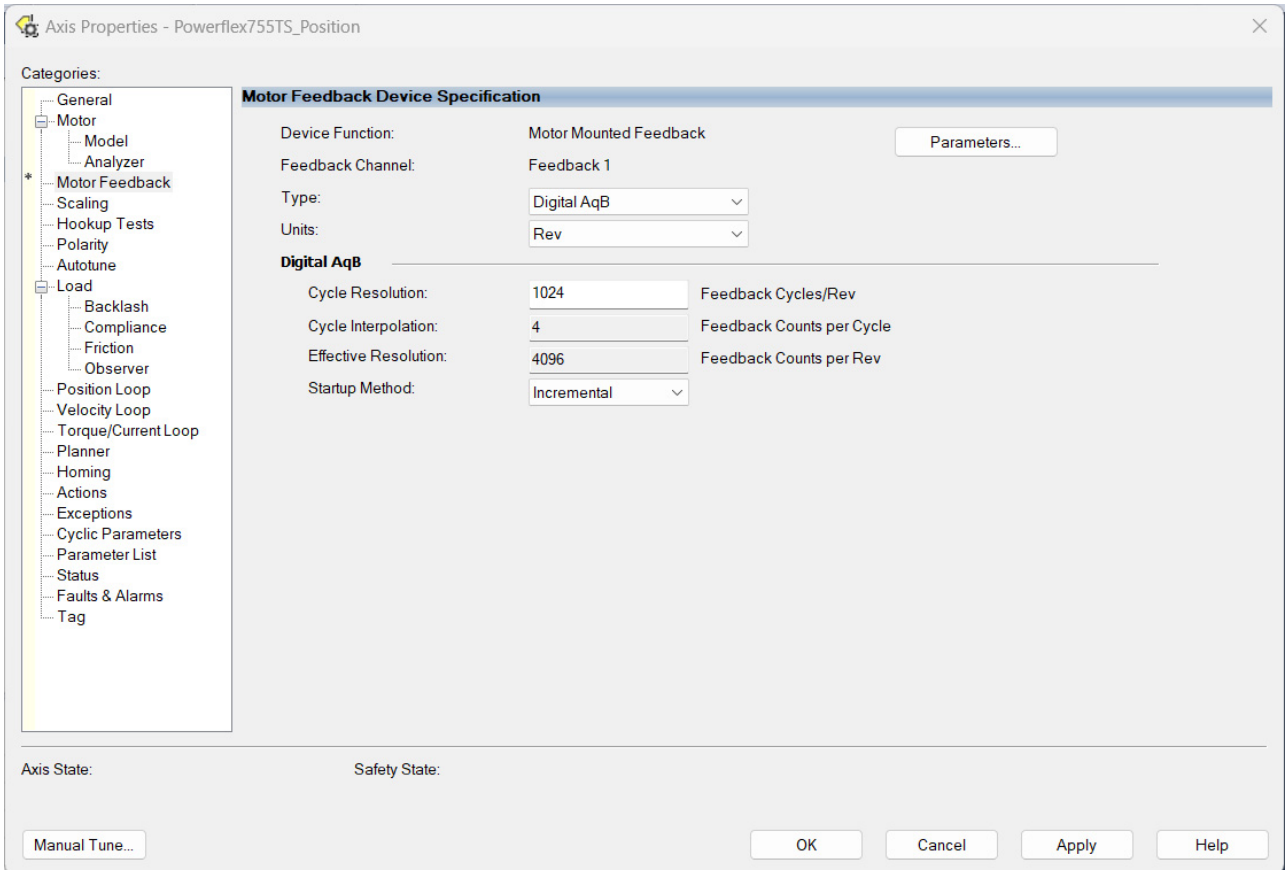
Configure Motor Feedback

Feedback channel attributes that are associated with the Motor Feedback dialog box are designated as Feedback 1.

Follow these steps to configure your motor feedback settings.

1. In the Axis Properties for the drive, select the Motor Feedback category.

Figure 93 - Axis Properties Dialog Box - Motor Category



2. Configure the available settings by using the information in this table.

Motor Feedback Settings

Setting	Description
Type	The type of feedback available depends on the axis and feedback configurations. Some examples include: • Not specified • Digital AqB (used in this example) • EnDat Sine/Cosine • EnDat Digital • Hiperface DSL • Sine Cosine • SSI Digital • SSI Sine/Cosine • Stahl SSI
Units	• Rev for Rotary motors If you specified a motor on the Motor page, the value is automatically set.
Cycle Resolution	Enter the cycle resolution for the feedback device.
Cycle Interpolation	Enter the cycle interpolation for the feedback device.
Effective Resolution	Configures or displays the effective resolution of the feedback device. This value is calculated by multiplying the Cycle Resolution with the Cycle Interpolation.
Startup Method	Determines how the device applies the feedback count value during drive startup. Choose from the following: • Incremental - The device zeros the feedback count accumulator at power-up. • Absolute - The device initializes the feedback count accumulator at power-up to the absolute feedback position value read from the feedback device. • Digital AqB and Sine/Cosine Feedback Types do not support Absolute startup.

3. To save your settings, click Apply.

Update Motor Load and Motion Values

We recommend that you use the load observer and adaptive tuning features instead of manually tuning the application. These features are available in the load section of the axis properties. For more information or guidance on these features, refer to the 'Load Observer' and 'Adaptive Tuning' sections in the PowerFlex 755T Vector Tuning Application Technique, publication 750-AT006.

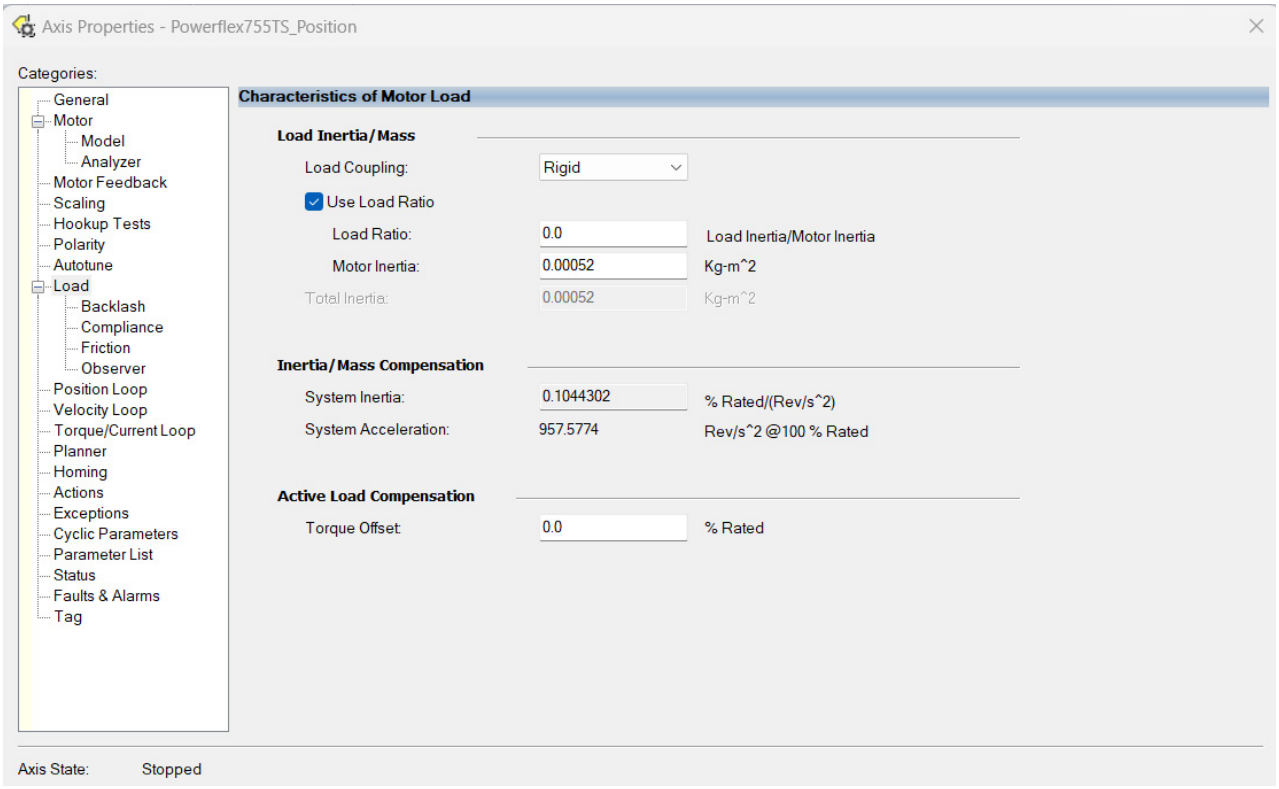
The motor load and motion settings are set to default values. Follow these steps to configure the appropriate settings for your application.

1. In the Axis Properties, select the Load category.

   The Load category contains the characteristics of the motor load. It is recommended that you add or estimate the motor inertia (Total Inertia) to set the system inertia to the correct value. The motor rotor inertia is typically available in any motor electrical/mechanical technical specification.

   The Total Inertia value that is shown in this example is based on a technical specification. Also, this motor power and density are based on a similar, high-performance induction motor. Note that the system inertia changes considerably.

Figure 94 - Axis Properties Dialog Box - Load Category



2. Update the Load values for your motor and application accordingly.

Table 10 - Motor Load Characteristics

Attribute	Description
Load Coupling	Lets you control how tightly the system is physically coupled. Your choices are the following: • Rigid (default) • Compliant Load Coupling appears dimmed when the axis is Servo On.
Use Load Ratio	Allows you to manually enter the Load Ratio and Motor Inertia to calculate the Total Inertia.
Load Ratio	The value of the Load Ratio attribute represents the ratio of the load inertia or mass to the motor inertia, or mass.
Motor Inertia	The Motor Inertia attribute is a float that specifies the unloaded inertia of a rotary motor.
Total Inertia	Total Inertia represents the combined inertia of the rotary motor and load in engineering units.

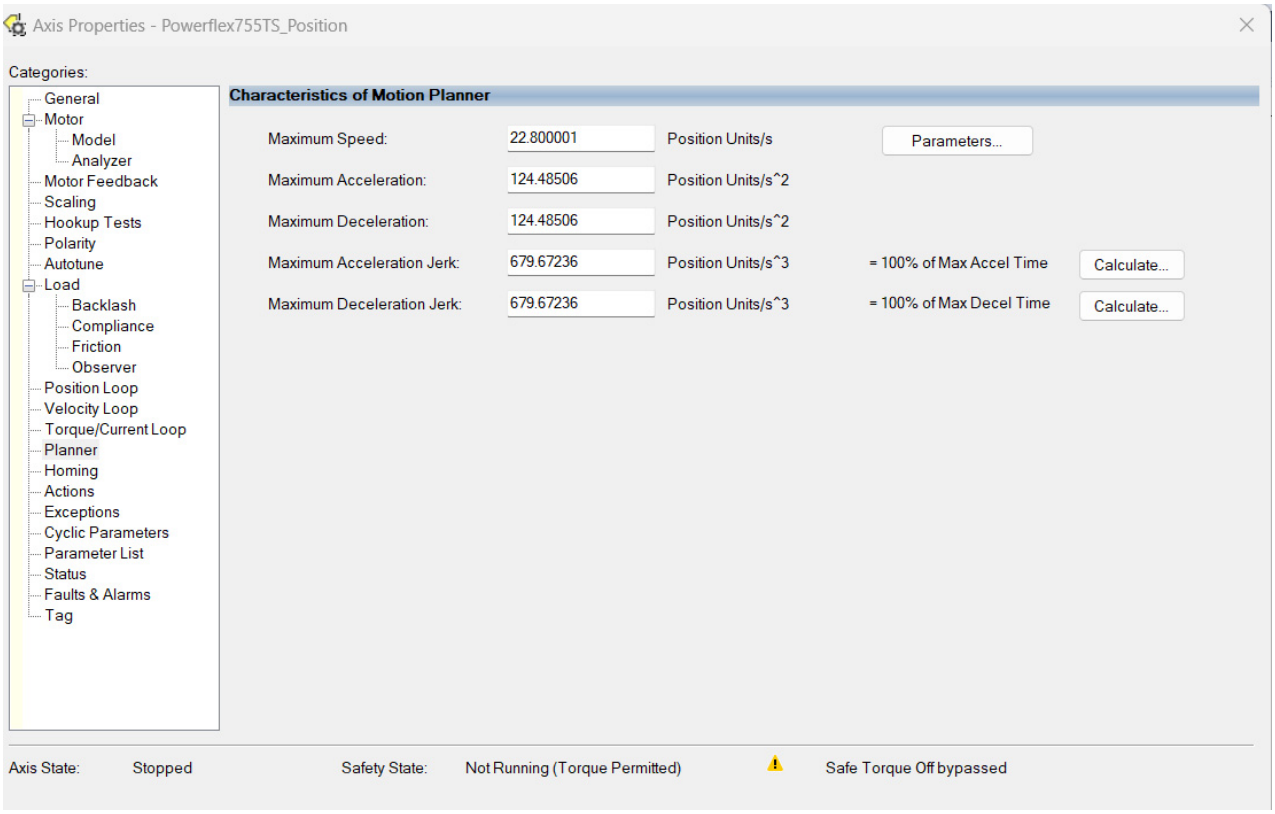
Table 10 - Motor Load Characteristics (Continued)

Attribute	Description
System Inertia	The torque or force-scaling gain value converts commanded acceleration into equivalent rated torque/force. Properly set, this value represents the total system inertia or mass. System Inertia is a read-only field that is based on Total Inertia. The software recalculates System Acceleration anytime the dependent attributes change: • If the data Source is Motor Catalog Number, the System Acceleration value is read directly from the motion database. • If the data Source is Nameplate data sheet, the System Acceleration value is calculated. • If the Data Source is Drive NV or Motor NV, this field is blank.
System Acceleration	System Inertia is recalculated anytime the System Acceleration changes: • System Inertia = 0, if System Acceleration = 0 • System Inertia = 1/System Acceleration • Units are Rev/s^2 @100% Rated
Torque Offset	The Torque Offset attribute provides a torque bias when performing closed-loop control.

Note that these changes initiate updates to the attributes in the Axis CIP Drive - Planner category, such as acceleration, deceleration, and jerk because they relate to the system inertia that affects the motor output.

3. Select the Planner category.

Figure 95 - Axis Properties Dialog Box - Planner Category



4. Update the values for your application accordingly.

Table 11 - Motion Planner Characteristics

Attribute	Description
Maximum Speed	The value of the Maximum Speed attribute that is used by various motion instructions to determine the steady-state speed of the axis.
Maximum Acceleration and Maximum Deceleration	The Maximum Acceleration and Maximum Deceleration values frequently used by motion instructions, for example, MAJ, MAM, and MCD, to determine the acceleration/deceleration rate to apply to the axis.
Maximum Acceleration and Maximum Deceleration Jerk	The Maximum Acceleration and Maximum Deceleration jerk values frequently used by motion instructions, for example, MAJ, MAM, and MCD, to determine the acceleration/deceleration rate to apply to the axis.

5. To save your changes, click Apply.

Also, for further calibration techniques, see the Knowledgebase article PowerFlex 755Tx CIP Motion Frequently Asked Questions (QA75447).

Calibration and Startup Tests

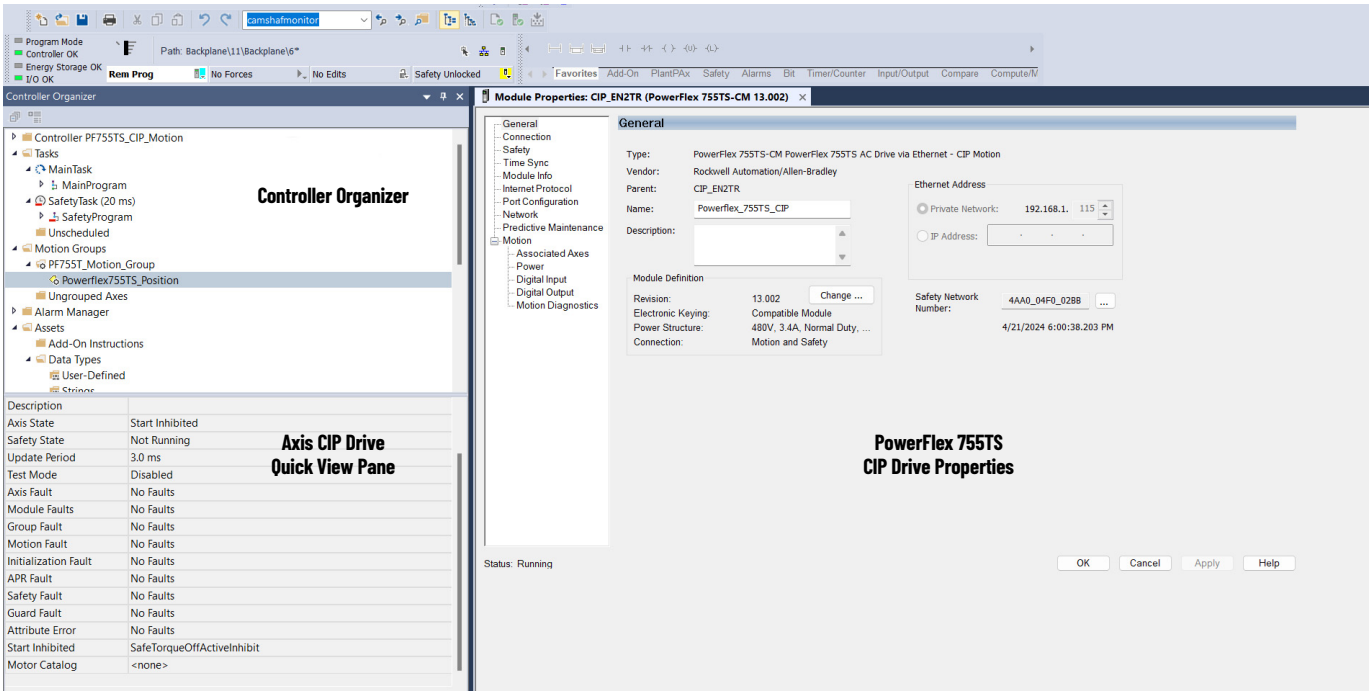
Consider these conditions before you complete the tests in this section:

- The controller is set to remote program mode. In this mode, CIP motion and safety commands are not executed.
- The load is disconnected from the motor. Therefore, no gearbox or transmission is connected currently. Running these tests without a load helps ensure that the CIP motion function executes properly before scaling and programmed code can cause possible application implementation issues.
- The intent of these tests is to rotate the motor shaft one revolution, forward and backward, and monitor tags and trends to verify test data, and observe the physical motor rotation. Additional procedures for flux vector tuning are provided at the end of these test procedures.

The Axis CIP Drive Quick View Pane shown in Figure 96 indicates the "health" of the Motion Planner.

- To execute motion commands and motor movement for normal operation, the Axis State or the Axis CIP State must be in a 'Stopped' state.
- Note that during these tests the GuardLogix safety commands are not executed. You can write GuardLogix safety commands to execute the STO enable, but STO bypass is used during these tests. STO bypass is used during maintenance and startup modes only. GuardLogix safety code is used for normal operation.

Figure 96 - Logix Designer Application - Axis CIP Drive

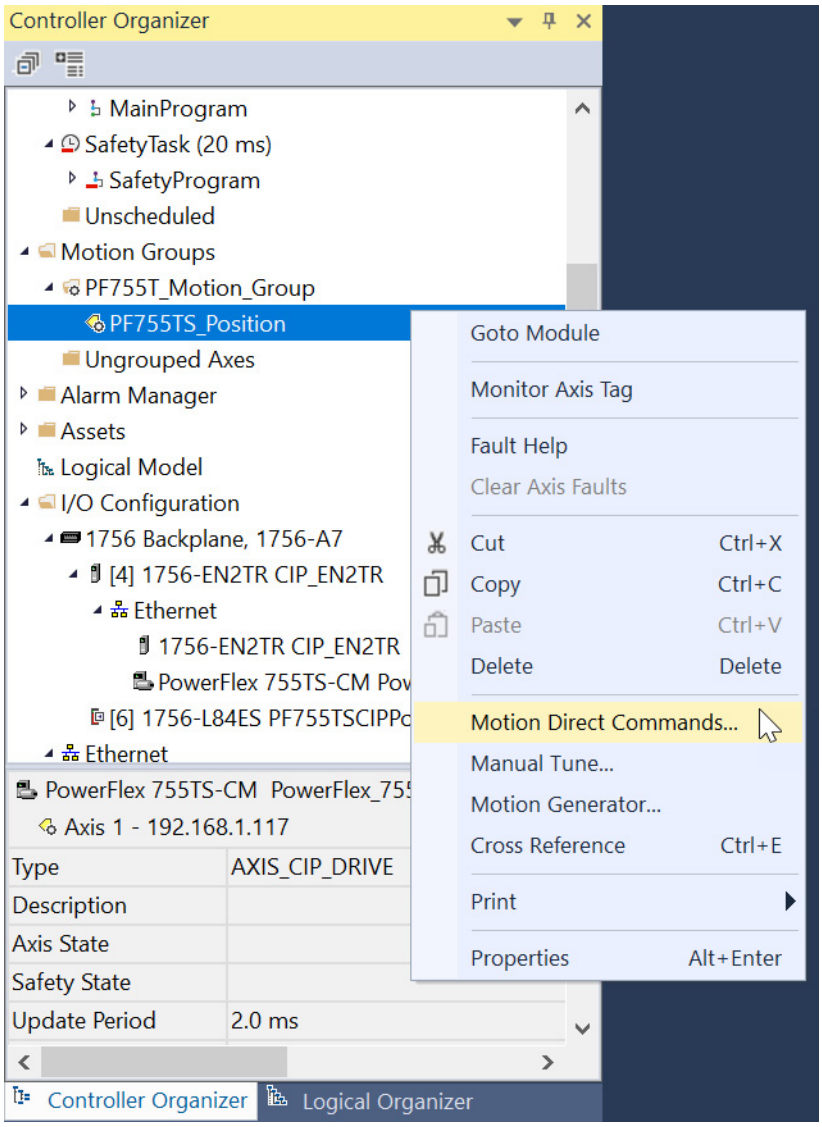


We recommend that you download the configuration to the controller to calibrate and test the drive module configuration and Axis CIP Drive axis.

Follow these steps to calibrate and start up your position control configuration.

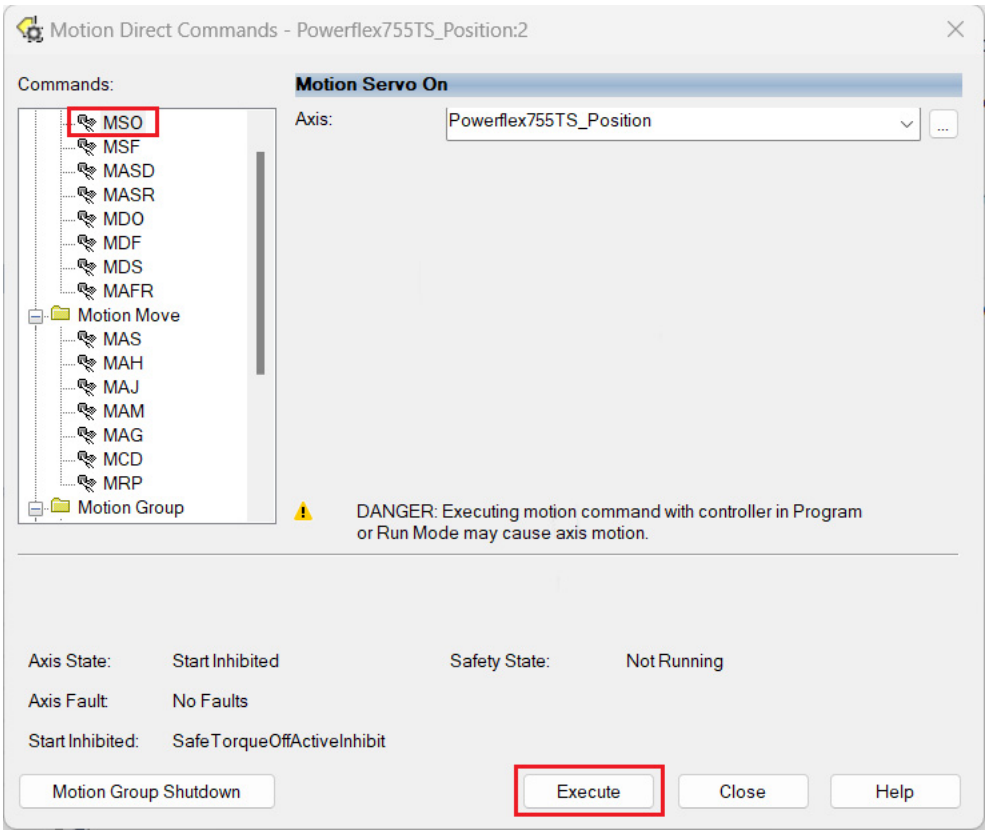
1. Download the program to the controller from the Logix Designer application.
2. In the controller organizer, right-click your Axis CIP Drive and choose Motion Direct Commands. PowerFlex755TS_Position is used in this example.

Figure 97 - Controller Organizer - Motion Direct Command



The Motion Direct Commands dialog box appears.

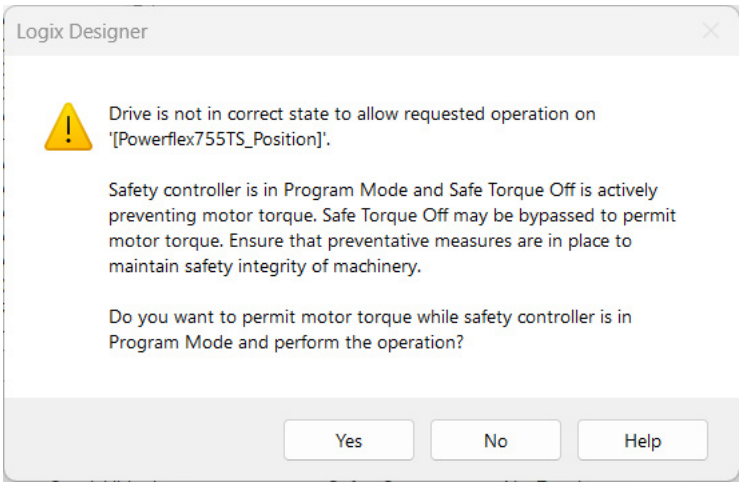
Figure 98 - Motion Direct Commands Dialog Box



3. Verify that the correct Axis is selected. PowerFlex755TS_Position is used in this example.
4. In the Commands list, choose MSO.
   Execution of the MSO (Motion Servo On) command places the axis in Safety bypass mode.
5. Click Execute.
   A message box appears to indicate that the drive is not in the correct state to run the command.

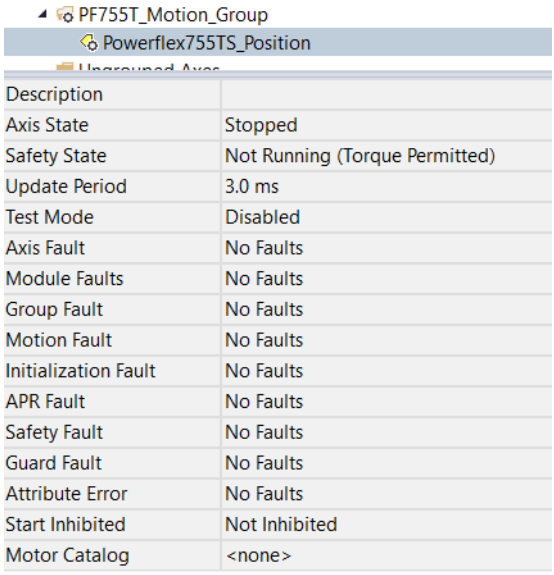
ATTENTION: The safety controller is in Program Mode and Safe Torque Off is actively preventing motor torque. Safe Torque Off can be bypassed to permit motor torque. Be sure that preventative measures are in place to maintain safety integrity of the machine.

Figure 99 - Safe Torque Off Bypass Message



6. To permit motor torque while the safety controller is in Program Mode, click Yes.
   The CIP Axis Drive Safety State is set to Not Running (Torque Permitted).

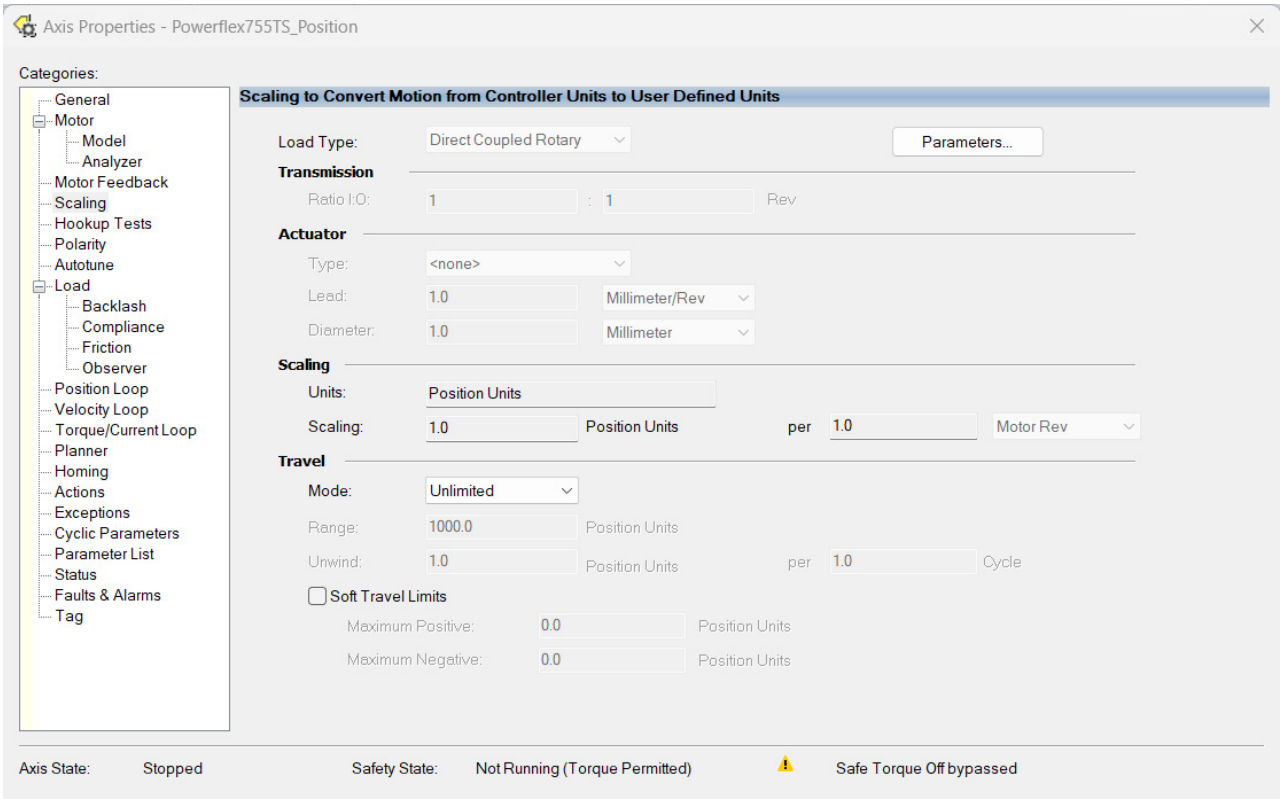
Figure 100 - CIP Axis State - Torque Permitted



Description	
Axis State	Stopped
Safety State	Not Running (Torque Permitted)
Update Period	3.0 ms
Test Mode	Disabled
Axis Fault	No Faults
Module Faults	No Faults
Group Fault	No Faults
Motion Fault	No Faults
Initialization Fault	No Faults
APR Fault	No Faults
Safety Fault	No Faults
Guard Fault	No Faults
Attribute Error	No Faults
Start Inhibited	Not Inhibited
Motor Catalog	<none>

7. In the Axis Properties for the drive, select the Scaling category.

Figure 101 - Axis Properties Dialog Box - Scaling Category



8. Verify that the all values are set to the default values. For example, a Direct Coupled Rotary scaling configuration is set to 1.0 to 1.0 (one motor revolution equals one load revolution).

The Axis State and Safety States are identified at the bottom of the Axis Properties dialog box.

Run the Hookup Tests

Use the Hookup tests to set the motor and feedback polarity based on your observation of the direction of motor rotation. The motor feedback test initiates the drive current loop output and monitors the feedback direction. Follow these steps to run the motor feedback direction test.

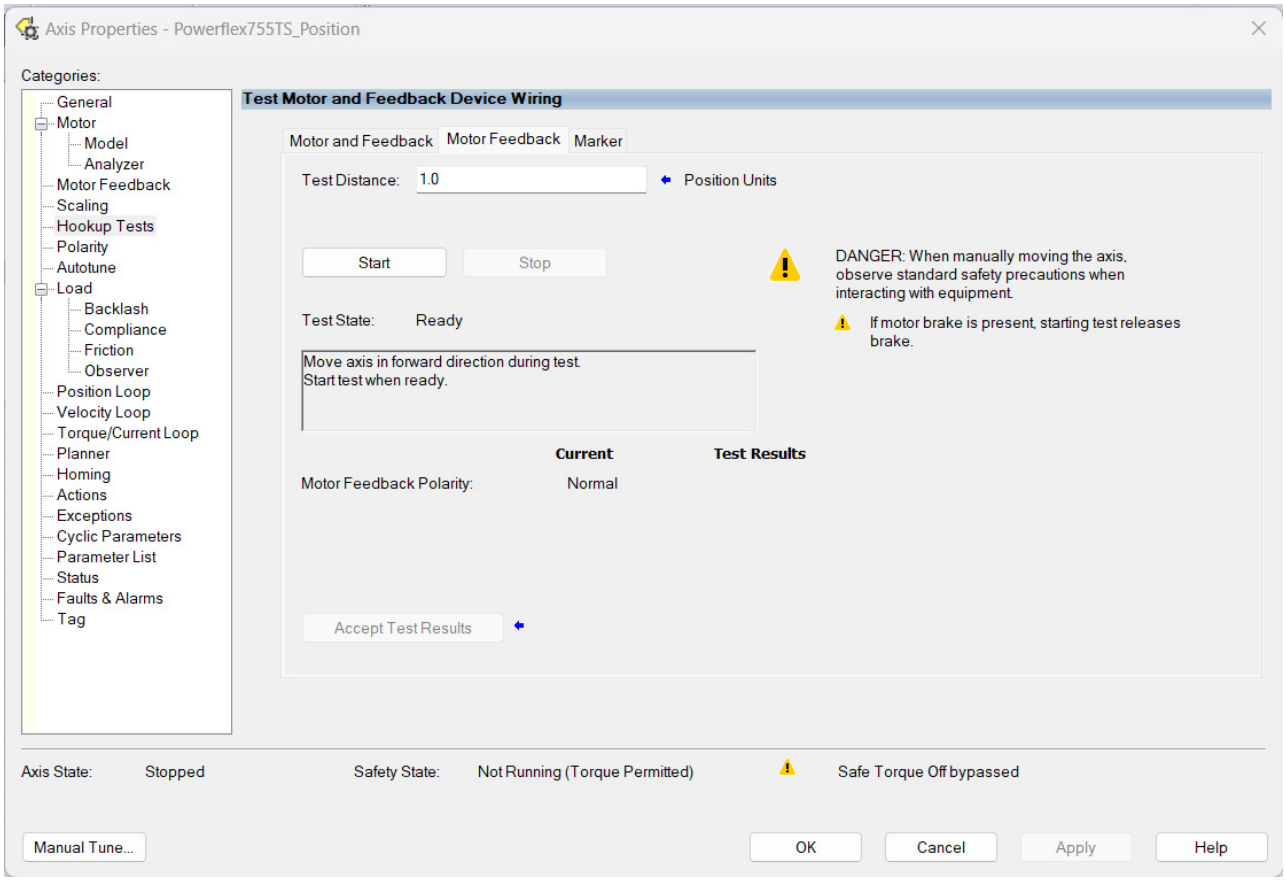
ATTENTION: These tests can actively move the axis even with the controller in remote Program mode:
- Before you complete the tests, make sure no one is in the way of the axis.
- Changing the motor or feedback after performing the Hookup Test can result in an axis-runaway condition when the drive is enabled.
- To avoid personal injury or damage to equipment, you must remove the load from each axis as uncontrolled motion can occur when an axis with an integral motor brake is released during the test.

This test requires that you manually rotate the motor shaft.

1. Select the Hookup Tests category.
2. Select the Motor Feedback tab.

   This tests the polarity of the motor feedback.

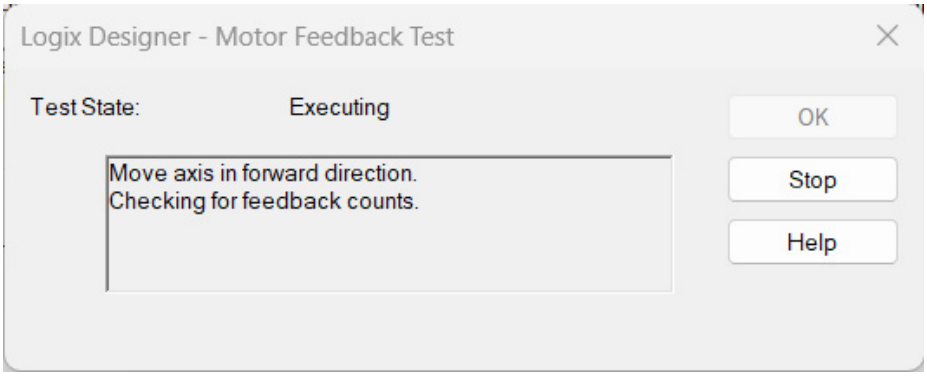
Figure 102 - Axis Properties Dialog Box - Hookup Tests Category



3. Enter the Test Distance in position units. 1.0 is recommended for one motor revolution, or a value that is measurable or observable for your application.
4. Click Start.

The Motor Feedback Test message box appears to indicate the test has been executed and provides the status of the test. This example identifies that the application is awaiting feedback and motor shaft movement.

Figure 103 - Motor Feedback Test Execution Message

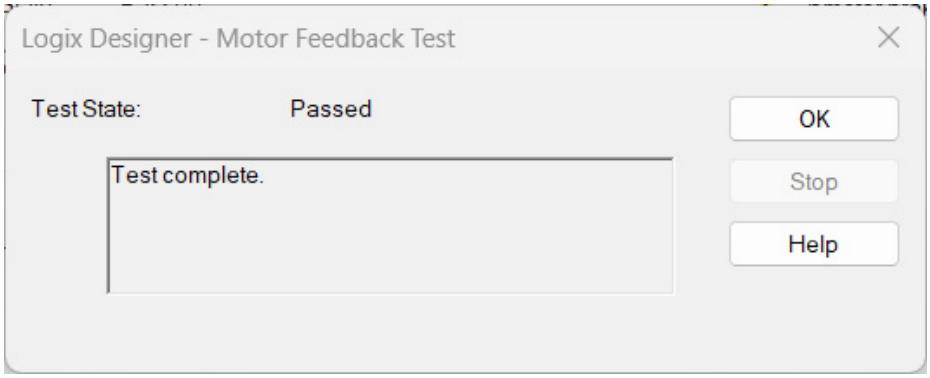


5. Rotate the motor one revolution manually.

   When the motor has been rotated one revolution, the test completes.

   If the test fails, see the Knowledgebase article PowerFlex 755Tx CIP Motion Frequently Asked Questions (QA75447) for troubleshooting recommendations.

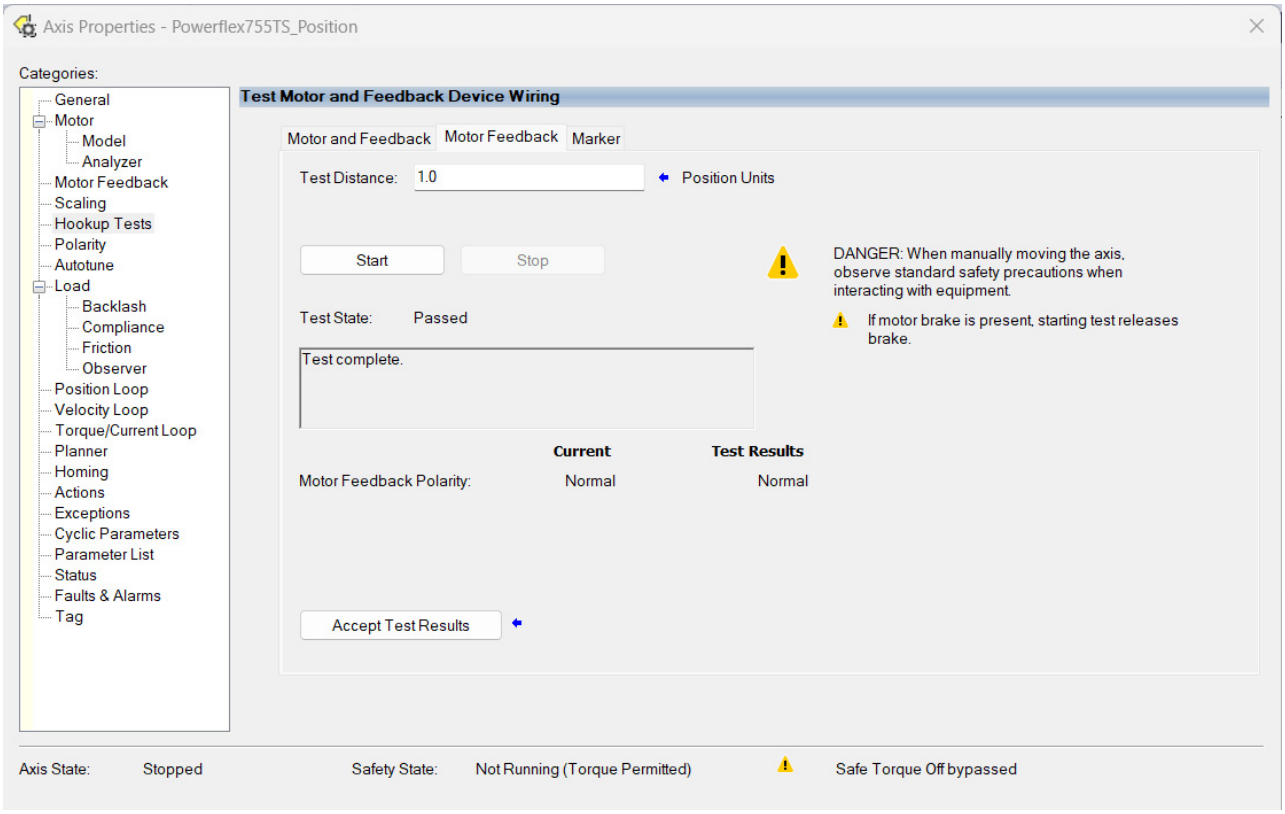
Figure 104 - Motor Feedback Test Complete Message



6. Click OK.

The Test State changes to Passed and the status indicates that the test is complete.

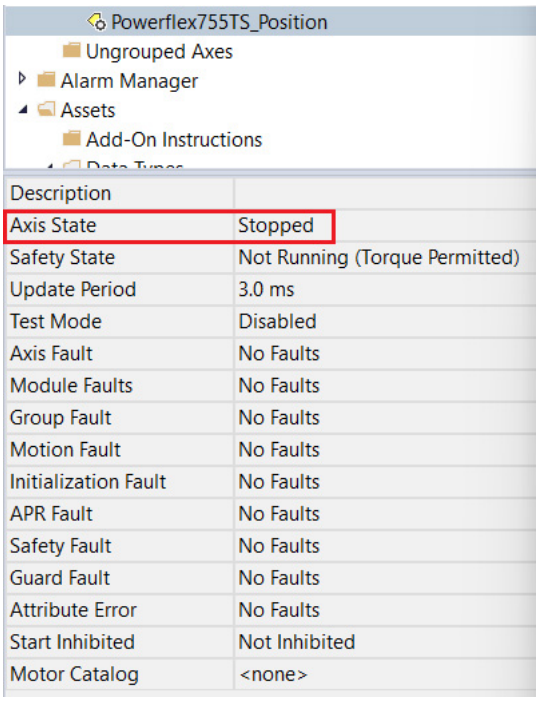
Figure 105 - Axis Properties Dialog Box - Motor Feedback Test Complete



7. To complete the Motor Feedback test, click Accept Test Results.

The Axis State in the Axis CIP Drive Quick View Pane is Stopped. This state changes to 'Testing' when you run a calibration test.

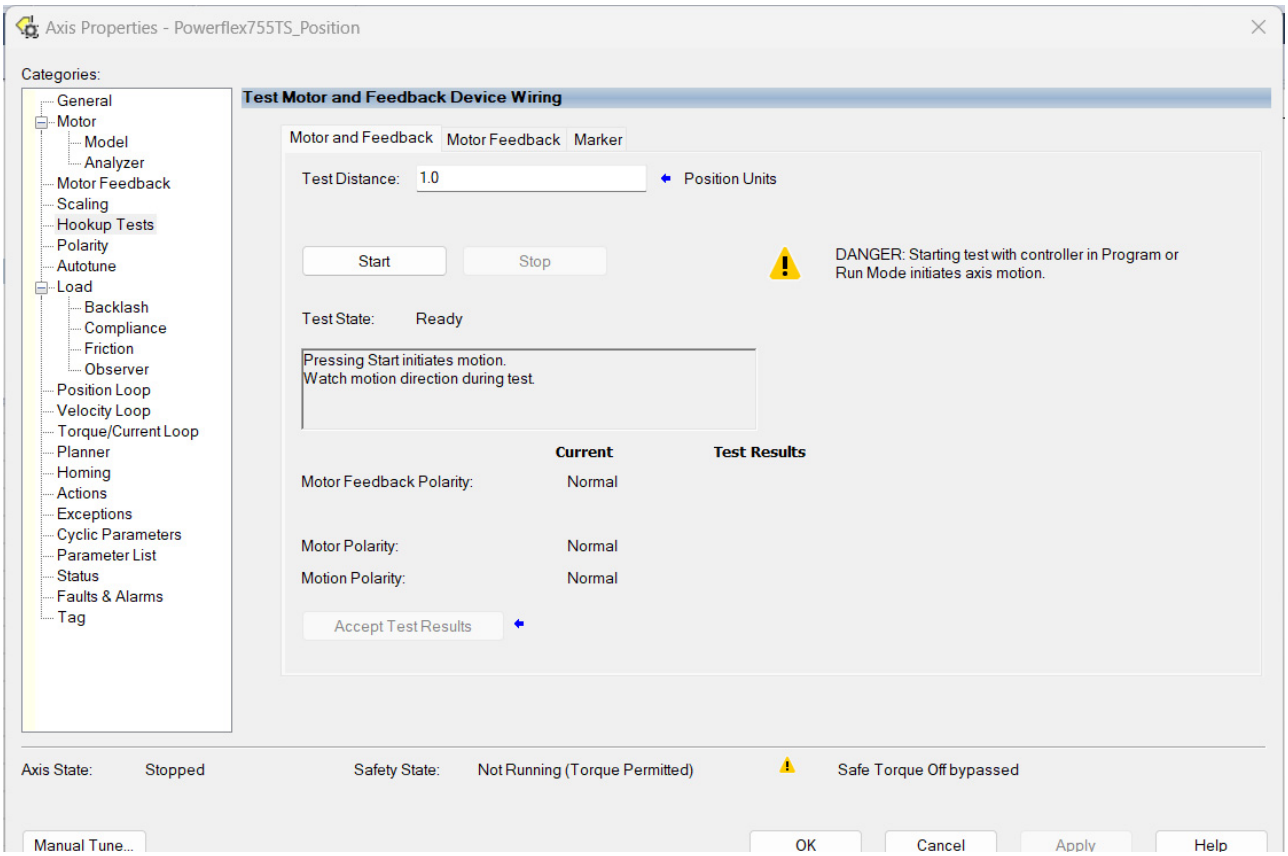
Figure 106 - Axis State



8. Select the Motor and Feedback tab.
   This tests the polarity of the motor, motion, load, and motor feedback based on your observation of the motor rotation direction.

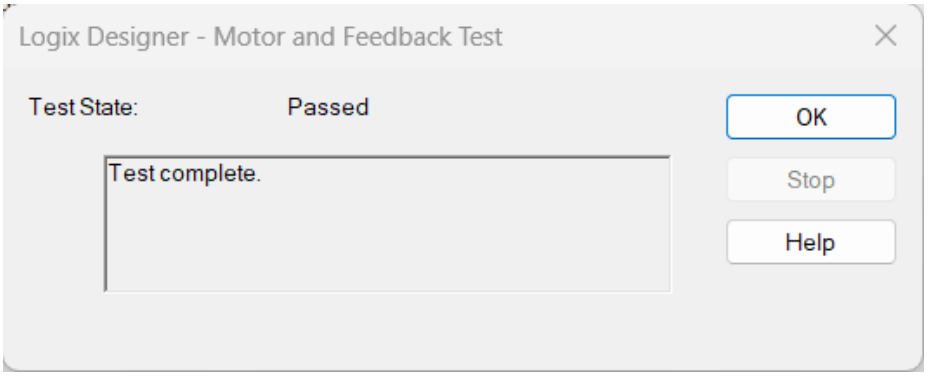
   When the test is complete, you can view the <Axis Name>.ActualPosition tag in the controller tags dialog box to see the revolutions increment and to observe the measured distance of movement.

Figure 107 - Axis Properties Dialog Box - Motor and Feedback Tab



9. Click Start and observe the motor rotation direction.
   The Motor and Feedback Test message box appears to indicate the test has been executed and provides the status of the test.

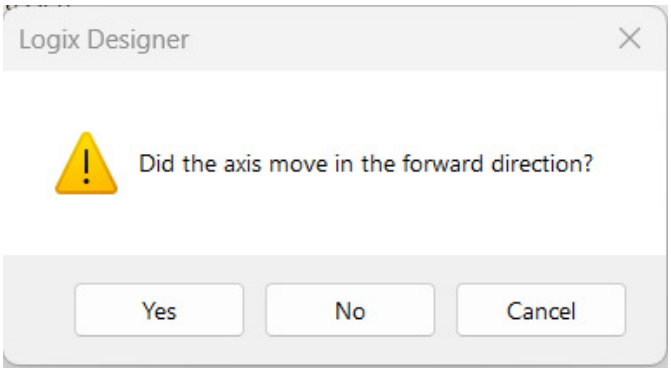
Figure 108 - Motor Feedback Test Execution Message



10. When the test completes, click OK.

A message box appears where you verify whether the axis moved in the forward direction.

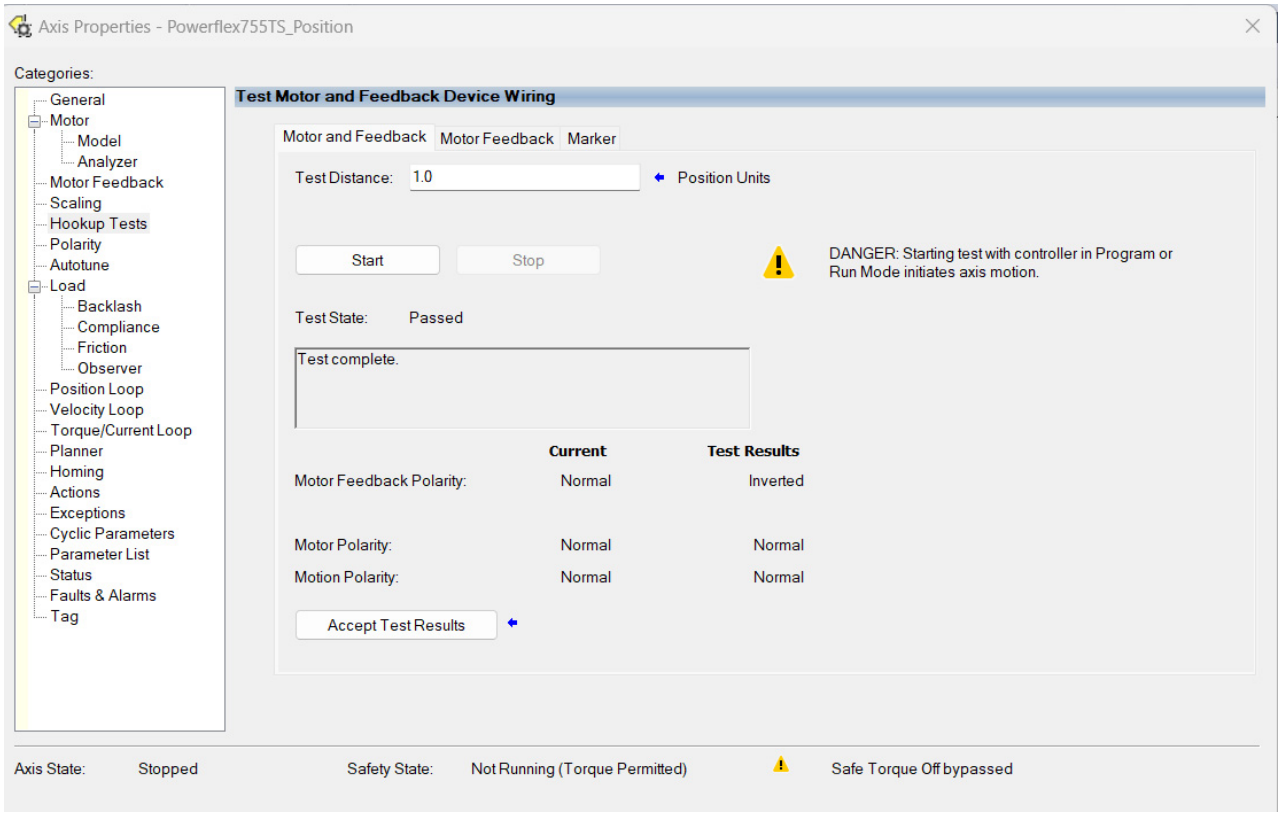
Figure 109 - Test Direction Message



11. Choose Yes or No based on your application need:
    - If the observed motor rotation was in the forward direction intended for your application, select Yes. For example, the observed motor rotation is the intended direction for a Motion Axis Jog command of 10 revolutions/second.
    - If the observed motor rotation was not in the forward direction intended for your application, select No. In this case, the Motion Polarity changes from Normal to Inverted.

To obtain the initial configuration and identify the correct direction for motor rotation that is applicable to the application, run the Motor and Feedback test once only.

Figure 110 - Axis Properties Dialog Box - Motor and Feedback Test Complete



12. To complete the Motor and Feedback test, click Accept Test Results.

Run the Motor Model Test

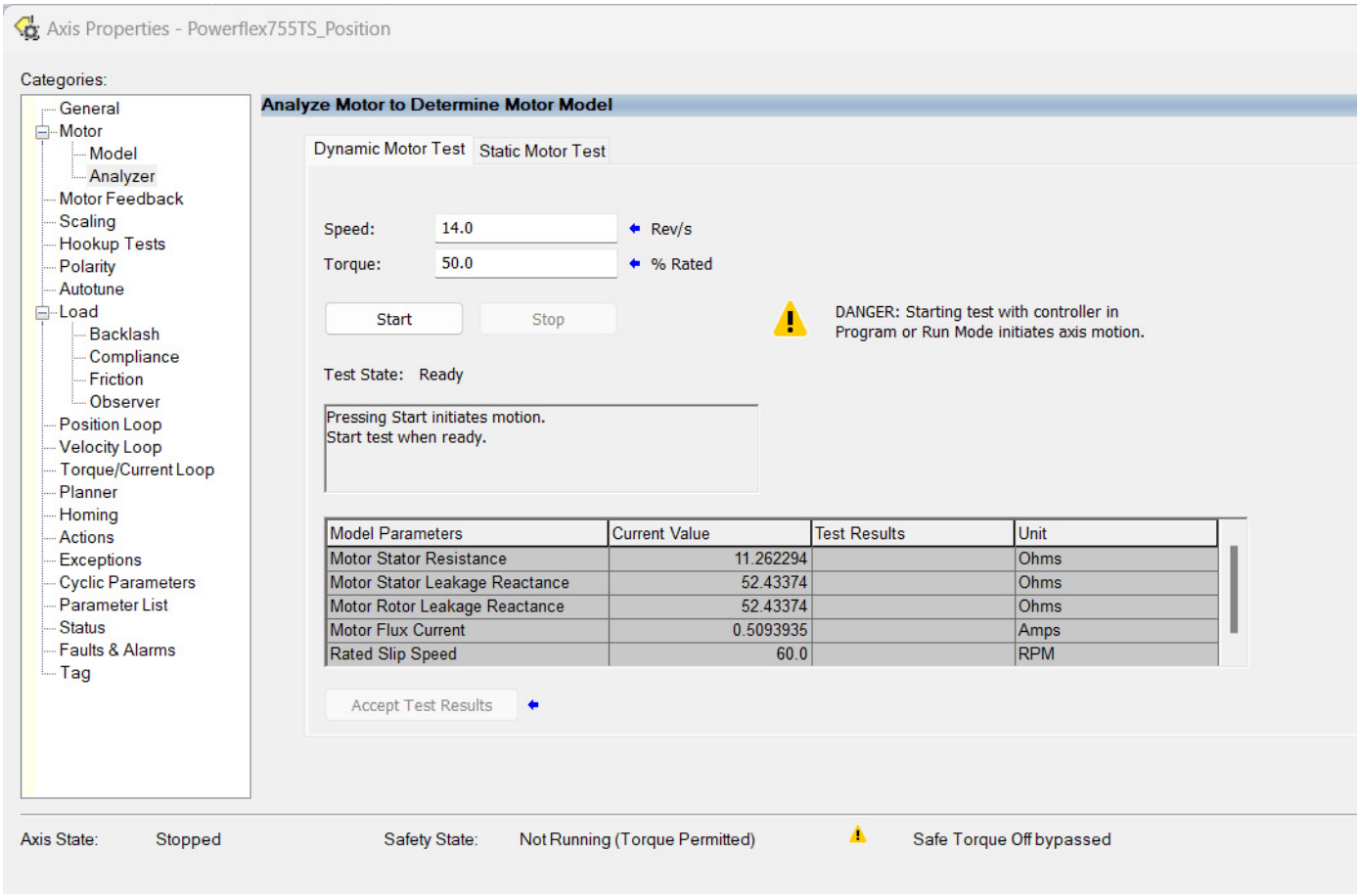
The Dynamic Motor Test is the most accurate method to evaluate the Axis CIP Drive motor model parameter configuration.

The Hookup Tests are run before the Dynamic Motor Test to help ensure that the motor polarity and feedback are correct for this test.

Follow these steps to run the dynamic motor test.

1. In the Axis Properties dialog box, choose the Analyzer category.

Figure 111 - Axis Properties Dialog Box - Analyzer Category



ATTENTION: This test can actively move the axis even with the controller in remote Program mode:
- Before you complete the test, make sure no one is in the way of the axis.
- To avoid personal injury or damage to equipment, you must remove the load from each axis as uncontrolled motion can occur when an axis with an integral motor brake is released during the test.

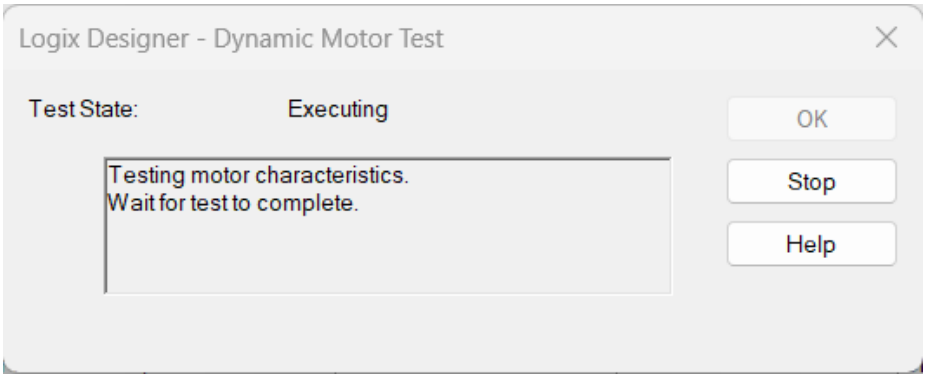
2. On the Dynamic Motor Test tab, review the Speed and Torque configuration values.

   It is recommended that you run the dynamic motor test with no load and at 75% of motor base speed.

3. Click Start.

Control power is applied to the drive and the Dynamic Motor Test message box appears to indicate the test has been executed and provides the status of the test.

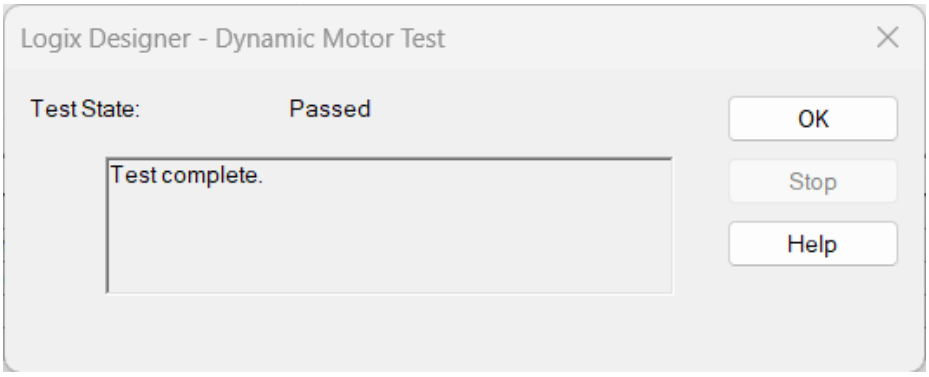
Figure 112 - Dynamic Motor Test Message



A message appears to indicate when the test is complete.

If the test fails or other issues occur, see the Knowledgebase article PowerFlex 755Tx CIP Motion Frequently Asked Questions (QA75447) for troubleshooting recommendations.

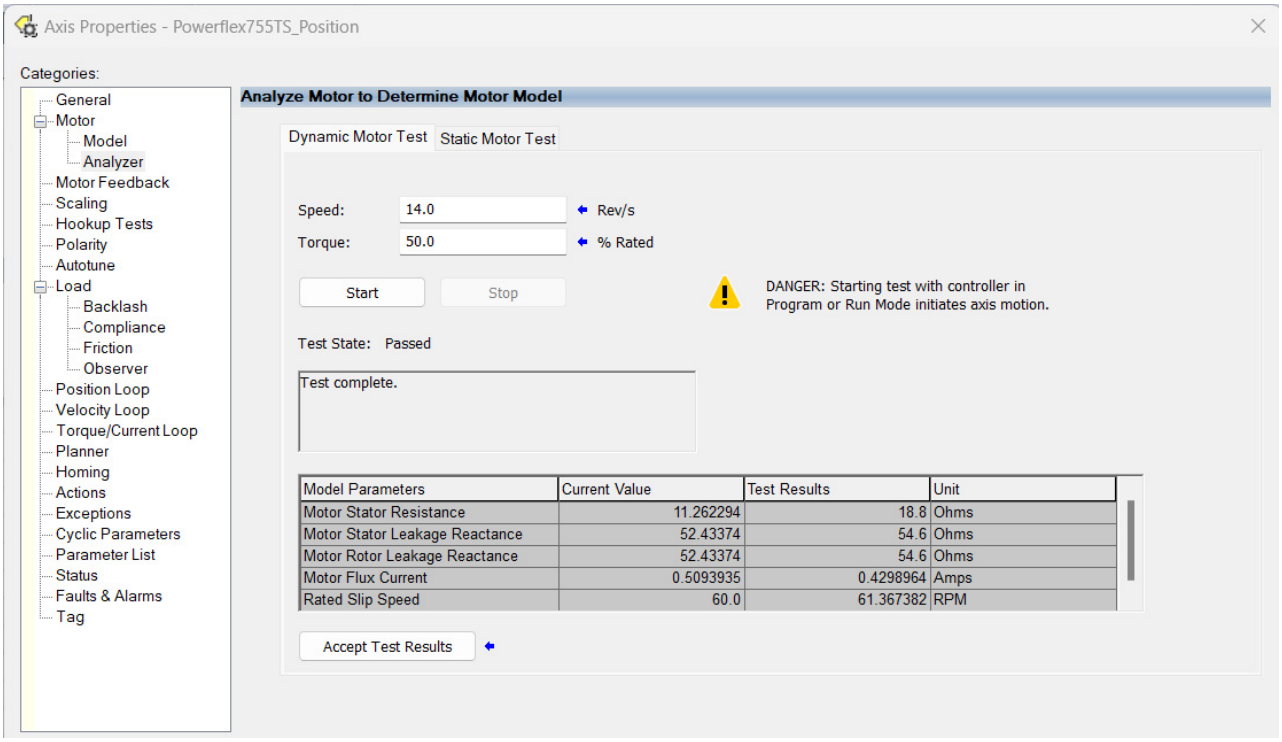
Figure 113 - Dynamic Motor Test Complete



4. Click OK.

The test results are critical for motor voltage and current operation.

Figure 114 - Axis Properties Dialog Box - Dynamic Motor Test Complete

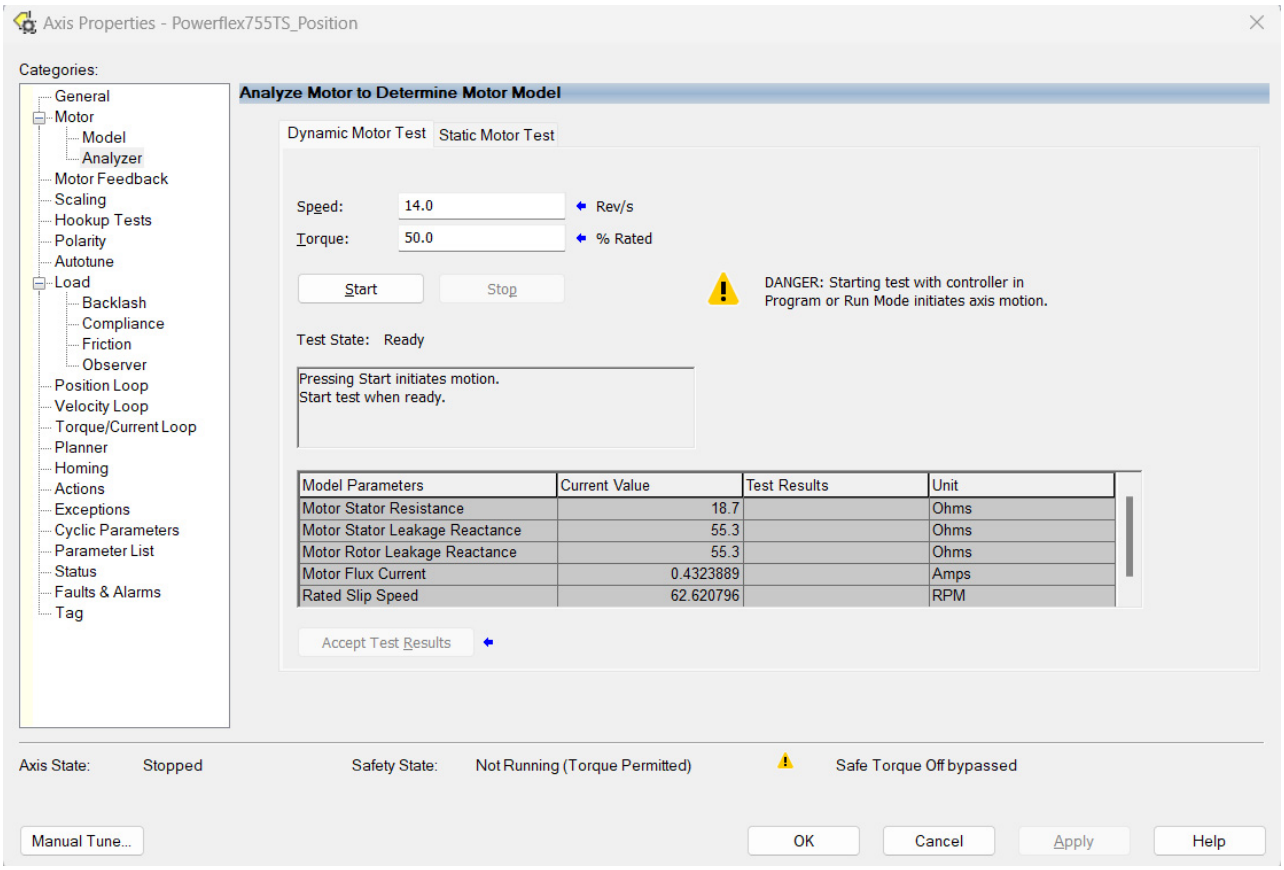


5. To complete the Dynamic Motor test, click Accept Test Results.

You do not need to run the Static Motor Test, as the Dynamic Motor Test provides a much more accurate resulting configuration. The Static Motor Test can be used in cases where machine movement or friction, or other application requirements, can cause issues.

The test results are automatically saved to the project.

Figure 115 - Axis Properties Dialog Box - Test Results

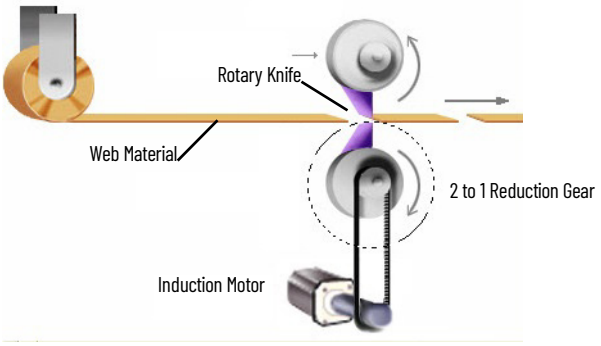


You have successfully configured your Integrated Motion on EtherNet/IP position control application.

Update Scaling Values for a Rotary Knife Application Example (Optional)

The rotary knife is a common industrial application that is used to cut a web of material into smaller lengths, without stopping the line. In this way, the main web production process is not interrupted by a start and stop indexing motion, allowing machine productivity to be maximized.

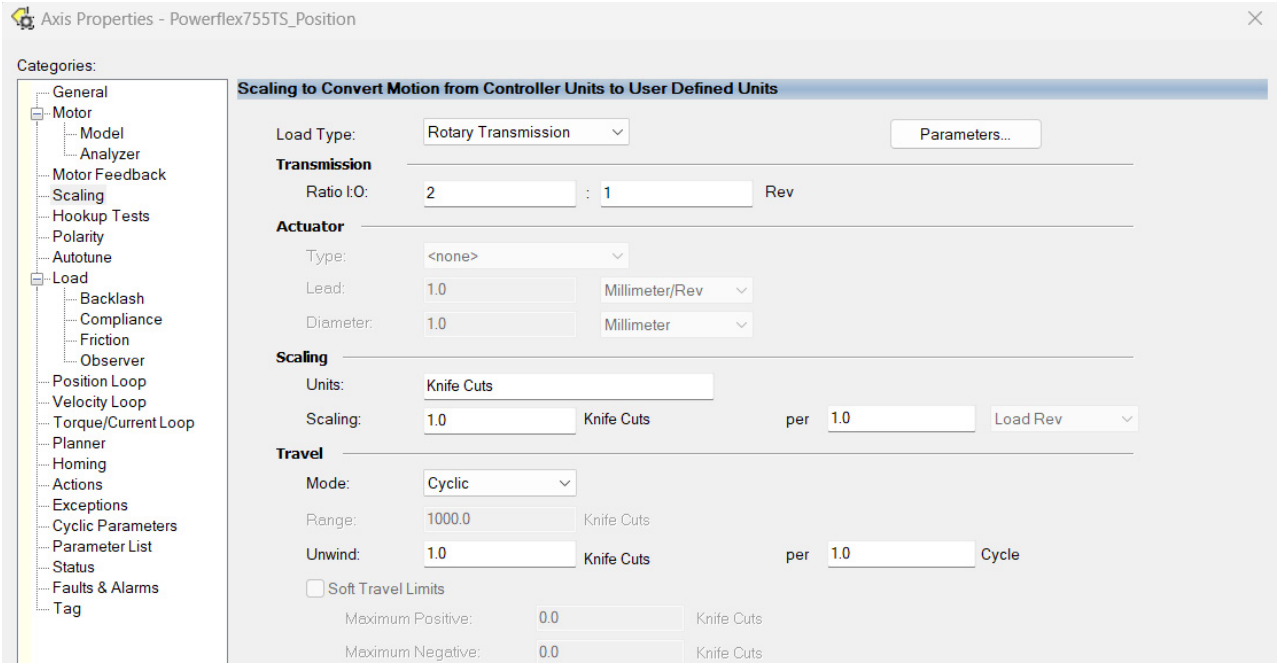
Figure 116 - Rotary Knife Application Example



In this instance, the induction motor uses closed-loop feedback to precisely control the 2-to-1 gear reduction to the rotary knife motion. Proper scaling is important to the successful configuration of an application where a one-to-one motor to load transmission is not used.

1. In the Axis Properties dialog box, select the Scaling category.

Figure 117 - Axis Properties Dialog Box - Scaling Category



2. Set the scaling Load Type to Rotary Transmission.
3. Set the Transmission Ratio I:O to 2 motor (input) revolutions to 1 load (output) revolution.
4. Enter the Scaling Units used for the application. This example uses Knife Cuts to reflect a programmed Motion Axis Move.
5. Set the Scaling to 1.0 (Knife Cut) per 1.0 (Load Rev). With these settings, one knife-blade cut of the material occurs at the output of the gearbox.
6. To reset the position counter to one knife cut for each load revolution cycle, set the Travel Mode to Cyclic.

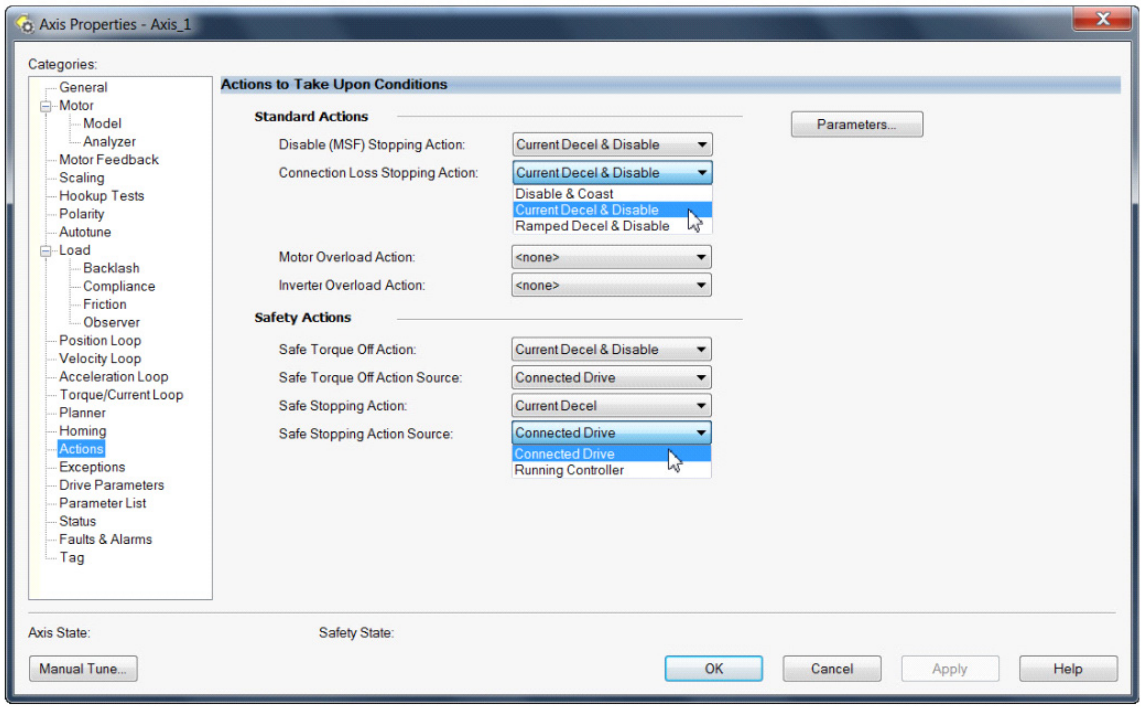
For more information on program control and Logix motion instruction sets, see the Logix 5000 Controllers Motion Instructions Reference Manual, publication MOTION-RM002.

Configure Actions for Drive Conditions

Follow these steps to configure the drive's response to specific actions. For a list of condition codes and stopping actions, see Drive Module Exceptions and Stop Actions on page 93.

1. In the Axis Properties for the drive, select the Actions category.

Figure 118 - Axis Properties Dialog Box - Action Category



2. Configure the following stopping actions for your application.
3. In Standard Actions choose from these options:

Attribute	Description
Disable (MSF) Stopping Action	Selects the stop action for the motor. The available options depend on the Axis Configuration.
Connection Loss Stopping Action	Specifies the stopping method applied to the motor when it detects a loss of connection.
Motor Overload Action	Specifies the motor overload action for the motor. This field is optional.
Inverter Overload Action	Specifies the inverter overload action for the motor. This field is optional.

4. From Safety Actions, choose from these options:

Attribute	Description
Safe Torque Off Action	Specifies the stopping action that is executed in response to a STO Activation. This selection is only valid when 'Safe Torque Off Action Source' is set to 'Connected Drive.'
Safe Torque Off Action Source	Specifies which controller or drive product is responsible for initiating and performing the stop action that is specified in the 'Safe Torque Off Action' attribute.
Safe Stopping Action	Specifies the stopping action that is executed in response to a Safe Stop Activation. This selection is only valid when 'Safe Stopping Action Source' is set to 'Connected Drive.'
Safe Stopping Action Source	Specifies which controller or drive product is responsible for initiating and performing the stop action that is specified in the 'Safe Stopping Action' attribute.

Drive Module Exceptions and Stop Actions

This section explains how system exceptions and the corresponding fault actions are managed in a closed-loop, Integrated Motion on EtherNet/IP application with a CompactLogix controller and PowerFlex 755TL/TR/TM product or PowerFlex 755TS drive.

In an Integrated Motion on EtherNet/IP application, the controller is the parent, or source, of motion commands. The PowerFlex 755TS CIP inverter (Axis CIP Drive) is the child, or recipient, of the motion commands and executes the corresponding actions. For example, in a Position Loop application, the controller issues the commands and the drive executes the on/off, move, jog, or more, actions.

To help ensure the correct data transfer and drive response, the controller and Axis CIP Drive must be configured properly. The Axis CIP Drive configuration that is contained in the controller maps the motion planner through the Motion Control Axis Object (MCAO). The controller tags are loaded into the Axis CIP Drive via the Motion Device Axis Object (MDAO). The motor type, feedback, and scaling attributes are configured in the inverter, which are critical for the Axis CIP Drive response and execution of the controller commands. The controller tags and specific attribute and instance definitions of the required or optional Axis CIP Drive functions are identified in the Integrated Motion on the EtherNet/IP Network User Manual, publication MOTION-RM003.

System exceptions and fault actions are also included in the data transfer between the controller and drive. When an exception occurs, the controller communicates to the drive, which annunciates the fault, such as S54 'Excessive Position Error.' The controller can also configure the CIP system response or the Axis CIP Drive response to a configurable fault condition for the faults that the system allows. The controller provides flexibility to change fault reaction.

By using the Logix Designer application, you can configure how the PowerFlex 755TS drive responds when a module exception/fault occurs. You can configure exception behavior in the Logix Designer application from the Axis Properties dialog box, Exceptions category. Controller exception actions are defined in Table 12.

Table 12 - Controller Exception Action Definitions

Exception Action	Definition
Ignore	The controller completely ignores the exception condition. For some exceptions that are fundamental to the operation of the planner, Ignore is not an available option.
Alarm	The drive module sets the associated bit in the Motion Alarm Status word, but does not otherwise affect axis behavior. Like Ignore, if the exception is so fundamental to the drive, Alarm is not an available option. When an exception action is set to Alarm, the Alarm goes away by itself when the exceptional condition has cleared.
Fault Status	Like Alarm, Fault Status instructs the controller to set the associated bit in the Motion Fault Status word, but does not otherwise affect axis behavior. However, unlike Alarm, an explicit Fault Reset is required to clear the fault once the exceptional condition has cleared. Like Ignore and Alarm, if the exception is so fundamental to the drive, Fault Status Only is not an available option.
Stop Planner	The controller sets the associated bit in the Motion Fault Status word and instructs the Motion Planner to perform a controlled stop of all planned motion at the configured maximum deceleration rate. An explicit Fault Reset is required to clear the fault once the exceptional condition has cleared. If the exception is so fundamental to the drive, Stop Planner is not an available option.
Disable	When the exception occurs, the associated bit in the Fault Status word is set and the axis comes to a stop by using the stopping action that is defined by the drive for the particular exception that occurred. If a fault occurs, there is no controller-based configuration to specify what the stopping action is. The stopping action is device dependent.
Shutdown	When the exception occurs, the drive brings the motor to a stop by using the stopping action defined by the drive (as in Stop Drive) and the power module is disabled. An explicit Shutdown Reset is required to restore the drive to operation.

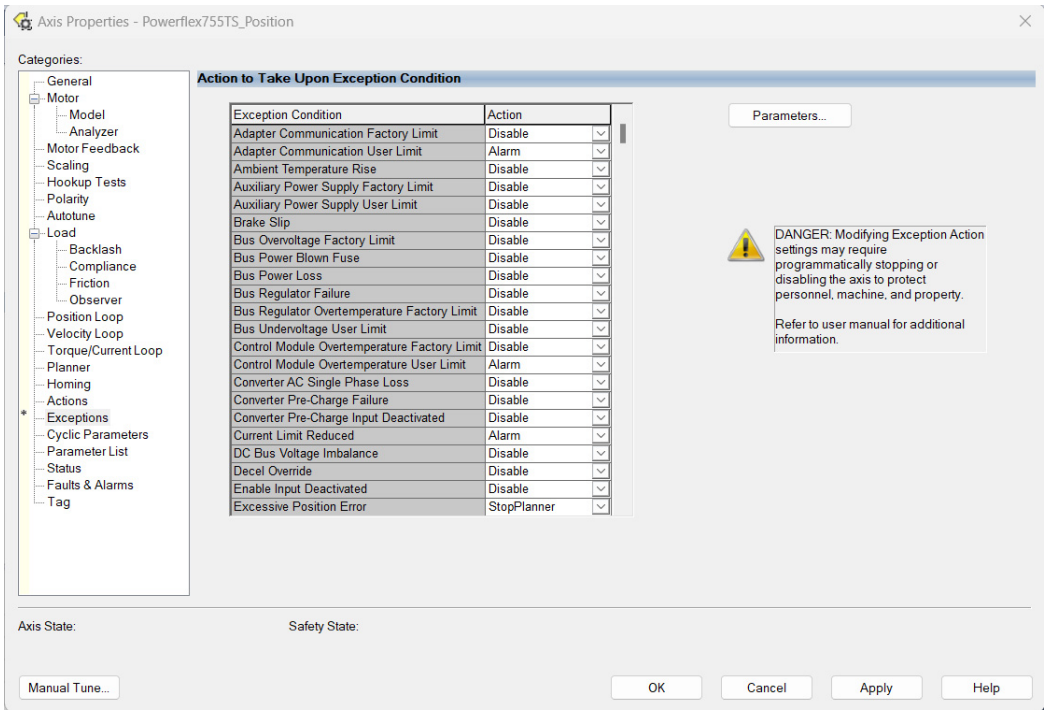
For example, an 'Excessive Position Error Fault' (S54) can be configured with one of these options to determine the PowerFlex 755TS CIP inverter response to the fault:

- Ignore
- Alarm
- Fault Status Only
- Stop Planner
- Disable
- Shutdown

Figure 119 provides an example of the exception condition options for a PowerFlex 755TS CIP inverter. For example, a 'Bus Overvoltage Factory Limit' fault (S36) can only be configured as a Major Fault with one of the following responses:

- Disable
- Shutdown

Figure 119 - Axis Properties - Exceptions Category



In summary, Ignore, Alarm, Fault Status Only, and Stop Planner are the controller-executed functions. The PowerFlex 755TS CIP inverter does not take any of these options as an action. These four controller exception options are communicated to the PowerFlex 755TS CIP inverter via the MDAO as Ignore, Alarm, or Minor Fault. The Minor Fault action can have either the Fault Status Only or Stop Planner options because the drive acknowledges the fault latching the same way, but the controller takes the exception action of latching the Fault Status Only bit or controlling the PowerFlex 755TS CIP inverter to a stop using the Axis CIP Drive planner deceleration rate only.

Therefore, Disable and Shutdown are executed in the PowerFlex 755TS CIP inverter as the best stopping action. The controller communication is also shut down when Shutdown is enabled and requires a Motion Axis Shutdown Reset (MASR) once the condition is corrected.

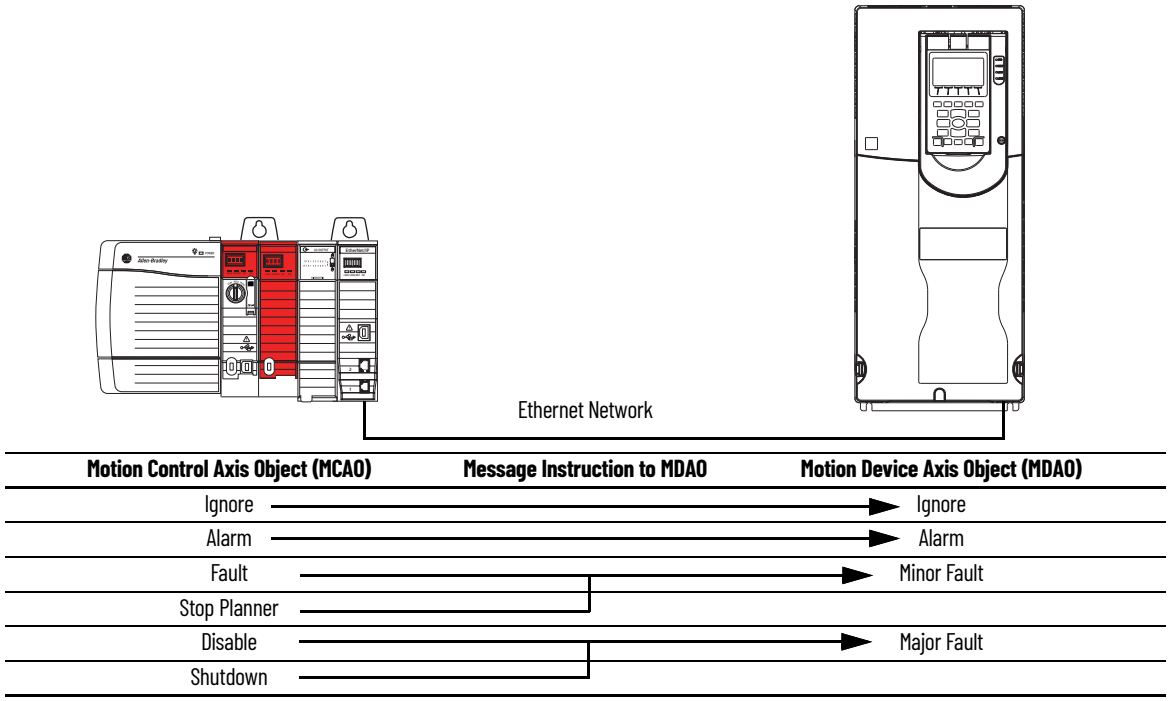
The PowerFlex 755TS drive supports fault actions for Ignore, Alarm, Minor Fault, and Major Fault as defined in Table 13.

Table 13 - PowerFlex 755TS Drive Module Exception Action Definitions

Exception Action	Definition
Ignore	The drive ignores the exception condition and no action is taken.
Alarm	Indicates that an exception condition exists. An alarm that is left unaddressed can stop the drive if the drive is running.
Minor Fault	If this type of fault occurs while the line side converter or motor side inverter is modulating, it allows modulation to continue. If it occurs while the line side converter or motor side inverter is not modulating, it prevents starting. It prevents starting until the fault is cleared. Note: Minor Fault corresponds to the "Fault" and "Stop Planner" controller exception actions that are listed in Table 12.
Major Fault	If this type of fault occurs while the line side converter or motor side inverter is modulating, it stops modulating. If it occurs while the line side converter or motor side inverter is not modulating, it prevents starting. It prevents starting until the fault is cleared. Note: Major Fault corresponds to the "Disable" and "Shutdown" controller exception actions that are listed in Table 12.

Figure 120 illustrates how exceptions are mapped between the MCAO and the MDAO.

Figure 120 - MCAO to DMAO Exception Communication



The controller exception set to 'Ignore' results in a PowerFlex 755TS CIP inverter to 'Ignore' the condition.

ATTENTION: The machine owner must consider any machine operation that can be affected when a fault condition is ignored.

An exception that is configured as 'Alarm' results in the PowerFlex 755TS CIP inverter to ignore the fault condition but set the 'Alarm' bit in the controller tags. The Alarm condition doesn't need a reset and clears when the condition is no longer present. For example, for an Excessive Position Error (S54), this tag is set but the PowerFlex 755TS CIP Inverter will not take any action. You must monitor this bit to determine the next best machine sequence based on fault annunciation.

Powerflex755TS_Position.ExcessivePositionErrorAlarm	0		Decimal	BOOL	Standard	

An exception configured as 'Fault Status Only' results in the PowerFlex 755TS CIP inverter not taking any action but the fault bit is set in the controller tags and in the drive CIP Axis Fault Display. For example, for an Excessive Position Error (S54), this tag is set. To clear this bit, the condition must be corrected and an Axis CIP Drive reset is required.

Powerflex755TS_Position.ExcessivePositionErrorFault	0		Decimal	BOOL	Standard	

An exception configured as 'Stop Planner' results in the PowerFlex 755TS CIP inverter not taking any action but the fault bit is set in the controller tags and in the drive CIP Axis Fault Display and the Planner deceleration is used to stop the motor.

An exception configured as 'Disable' results in the PowerFlex 755TS CIP inverter using the best stop action in the firmware and the exception is annunciated on the drive CIP Axis Fault Display. In this case, the fault condition must be corrected and a drive reset must be executed.

An exception configured as 'Shutdown' has the same results as 'Disable' with an additional Axis shutdown action. In this case, the fault condition must be corrected and an Axis CIP Drive shutdown reset must be executed.

Powerflex755TS_Position.ShutdownStatus	0		Decimal	BOOL	Standard

Table 14 describes the options that are used in the Exception Actions columns in Table 15 on page 96.

Table 14 - Exception Actions Column Options

Code	Description	Description
A	Available	This exception action can be configured for the corresponding condition.
I	Inverter only	This exception action can be configured for the corresponding condition only for inverters.
D	Default	This is the default exception action for the corresponding condition.
–	<blank>	This exception action cannot be configured for the corresponding condition.

Use Table 15 to identify and configure possible module exceptions and the drive's response to the exception.

Table 15 - Exception Codes and Descriptions

Exception Code	Exception Name	Exception Actions						Stop Action	Converter	Inverter
		Ignore	Alarm	Fault Status	Stop Planner	Disable	Shutdown			
S01	Motor Overcurrent	–	–	–	–	A	A	Disable and Coast	–	A
S03	Motor Overspeed Factory Limit	–	–	–	–	A	A	Disable and Coast	–	A
S04	Motor Overspeed User Limit	–	–	–	–	A	A	Disable and Coast	–	A
S05	Motor Overtemperature Factory Limit	–	–	–	–	A	A	Disable and Coast	–	A
S07	Motor Thermal Overload Factory Limit	–	–	–	–	A	A	Disable and Coast	–	A
S08	Motor Thermal Overload User Limit	A	D	A	A	A	A	Disable and Coast	–	A
S09	Motor Phase Loss	A	A	A	A	A	A	Disable and Coast	–	A
S10	Inverter Overcurrent	–	–	–	–	A	A	Disable and Coast	–	A
S11	Inverter Overtemperature Factory Limit	–	–	–	–	A	A	Disable and Coast	–	A
S12	Inverter Overtemperature User Limit	A	D	–	–	A	A	Disable and Coast	–	A
S13	Inverter Thermal Overload Factory Limit	–	–	–	–	A	A	Disable and Coast	–	A
S14	Inverter Thermal Overload User Limit	A	D	–	–	A	A	Disable and Coast	–	A
S15	Converter Overcurrent	–	–	–	–	A	A	Disable and Coast	A	–
S16	Converter Ground Current Factory Limit	–	–	–	–	A	A	Disable and Coast	A	–
S17	Converter Ground Current User Limit	A	D	–	–	A	A	Disable and Coast	A	–
S18	Converter Overtemperature Factory Limit	–	–	–	–	A	A	Disable and Coast	A	–
S19	Converter Overtemperature User Limit	A	D	–	–	A	A	Disable and Coast	A	–
S20	Converter Thermal Overload Factory Limit	–	–	–	–	A	A	Disable and Coast	A	–
S21	Converter Thermal Overload User Limit	A	D	–	–	A	A	Disable and Coast	A	–
S22	Converter AC Power Loss	–	–	–	–	A	A	Disable and Coast	A	–
S23	Converter AC Single Phase Loss	A	A	A	I	A	A	Disable and Coast	A	A
S25	Converter PreCharge Failure	–	–	–	–	A	A	Disable and Coast	A	A
S27	Bus Regulator Overtemperature Factory Limit	–	–	–	–	A	A	Disable and Coast	–	A
S31	Bus Regulator Failure	–	–	–	–	A	A	Disable and Coast	–	A
S34	Bus Undervoltage User Limit	A	A	A	A	A	A	Disable and Coast	–	A
S35	Bus Overvoltage Factory Limit	–	–	–	–	A	A	Disable and Coast	A	A
S37	Bus Power Loss	I	I	I	I	A	A	Disable and Coast	A	A
S38	Bus Power Blown Fuse	–	–	–	–	A	A	Disable and Coast	A	A
S45	Feedback Data Loss Factory Limit	–	–	–	–	A	A	Disable and Coast	–	A
S46	Feedback Data Loss User Limit	A	D			A	A	Disable and Coast	–	A
S47	Feedback Device Failure	–	–	–	–	A	A	Disable and Coast	–	A
S48	Sensor Failure	–	–	–	–	A	A	Disable and Coast	A	A
S49	Brake Slip	–	–	–	–	A	A	Disable and Coast	–	A
S50	Hardware Overtravel Positive	A	A	A	A	A	A	Current Decel and Disable	–	A
S51	Hardware Overtravel Negative	A	A	A	A	A	A	Current Decel and Disable	–	A
S54	Excessive Position Error	A	A	A	A	A	A	Disable and Coast	–	A
S55	Excessive Velocity Error	A	A	A	A	A	A	Disable and Coast	–	A
S56	Overtorque Limit	A	A	A	A	A	A	Disable and Coast	–	A
S57	Undertorque Limit	A	A	A	A	A	A	Disable and Coast	–	A
S59	Ambient Temperature Rise	A	A	A	I	A	A	Disable and Coast	A	A
S60	Illegal Control Mode	–	–	–	–	A	A	Disable and Coast	A	A

Table 15 - Exception Codes and Descriptions (Continued)

Exception Code	Exception Name	Exception Actions						Stop Action	Converter	Inverter
		Ignore	Alarm	Fault Status	Stop Planner	Disable	Shutdown			
S61	Enable Input Deactivated	–	–	–	–	A	A	Disable and Coast	A	A
S63	External Exception Input	–	D	–	–	A	A	Disable and Coast	A	A
S64	AC Line Overvoltage Factory Limit	A	A	A	–	A	A	Disable and Coast	A	–
S65	AC Line Overvoltage User Limit	A	A	A	–	A	A	Disable and Coast	A	–
S66	AC Line Undervoltage Factory Limit	A	A	A	–	A	A	Disable and Coast	A	–
S67	AC Line Undervoltage User Limit	A	D	A	–	A	A	Disable and Coast	A	–
S68	AC Line High Frequency Factory Limit	A	A	A	–	A	A	Disable and Coast	A	–
S69	AC Line High Frequency User Limit	A	D	A	–	A	A	Disable and Coast	A	–
S70	AC Line Low Frequency Factory Limit	A	A	A	–	A	A	Disable and Coast	A	–
S71	AC Line Low Frequency User Limit	A	A	A	–	A	A	Disable and Coast	A	–
S72	AC Line Voltage Unbalance	A	D	–	–	A	A	Disable and Coast	A	–
S73	AC Line Current Unbalance	A	D		–	A	A	Disable and Coast	A	–
S74	AC Line Voltage Sag	A	A	A	–	A	A	Disable and Coast	A	–
S75	AC Line Frequency Change	A	A	A	–	A	A	Disable and Coast	A	–
S76	AC Line Sync Loss	A	A	A	–	A	A	Disable and Coast	A	–
S80	Inverter Ground Current Factory Limit	–	–	–	–	A	A	Disable and Coast	–	A
S81	Inverter Ground Current User Limit	A	D	–	–	A	A	Disable and Coast	–	A
S82	Inverter Output Phase Short	–	–	–	–	A	A	Disable and Coast		A
S85	Auxiliary Power Supply Factory Limit	–	–	–	–	A	A	Disable and Coast	A	A
S86	Auxiliary Power Supply User Limit	A	D	–	–	A	A	Disable and Coast	A	A
M10	Control Module Overtemperature Factory Limit	–	–	–	–	A	A	Disable and Coast	A	A
M11	Control Module Overtemperature User Limit	A	D	–	–	A	A	Disable and Coast	A	A
M15	Regenerative Power Supply Failure	–	–	–	–	A	A	Disable and Coast	–	A
M16	PWM Frequency Reduced	A	D	A	A	A	A	Disable and Coast	–	A
M17	Current Limit Reduced	A	D	A	A	A	A	Disable and Coast	–	A
M19	Decel Override	A	A	A	–	A	A	Disable and Coast	–	A
M21	Motor Test Failure	–	–	–	–	A	A	Disable and Coast	–	A
M22	Hardware Configuration	–	–	–	–	A	A	Disable and Coast	A	A
M23	Firmware Change	–	–	–	–	A	A	Disable and Coast	A	A
M24	Converter PreCharge Input Deactivated	–	–	–	–	A	A	Disable and Coast		A
M26	Runtime Error	–	–	–	–	A	A	Disable and Coast	A	A
M30	AC Line Resonance Factory Limit	–	–	–	–	A	A	Disable and Coast	A	A
M31	AC Line Resonance User Limit	A	D	–	–	A	A	Disable and Coast	A	A
M40	Peripheral Hardware Factory Limit	–	–	–	–	A	A	Disable and Coast	A	A
M41	Peripheral Hardware User Limit	A	D	–	–	A	A	Disable and Coast	A	A
M42	Peripheral Over Temperature Factory Limit	–	–	–	–	A	A	Disable and Coast	A	A
M43	Peripheral Over Temperature User Limit	A	D	–	–	A	A	Disable and Coast	A	A
M44	Peripheral Under Temperature Factory Limit	–	–	–	–	A	A	Disable and Coast	A	A
M45	Peripheral Under Temperature User Limit	A	D	–	–	A	A	Disable and Coast	A	A
M46	Peripheral Communication Factory Limit	–	–	–	–	A	A	Disable and Coast	A	A
M47	Peripheral Communication User Limit	A	D	–	–	A	A	Disable and Coast	A	A
M50	Adapter Communication Factory Limit	–	–	–	–	A	A	Disable and Coast	A	A
M51	Adapter Communication User Limit	A	D	–	–	A	A	Disable and Coast	A	A
M54	AC Line Phase Reversal	A	D	–	–	A	A	Disable and Coast	A	
M55	Phase Thermal Imbalance	A	D	A	I	A	A	Disable and Coast	A	A
M56	DC Bus Voltage Imbalance[1]	A	D	A	I	A	A	Disable and Coast	A	A
M57	Predictive Maintenance	A	D	–	–	A	A	Disable and Coast	A	A
M63	Product Specific	A	D	–	–	A	A	Disable and Coast	A	A

(1) Not available for PowerFlex 755TS drives.

Optional and Enhanced Attributes

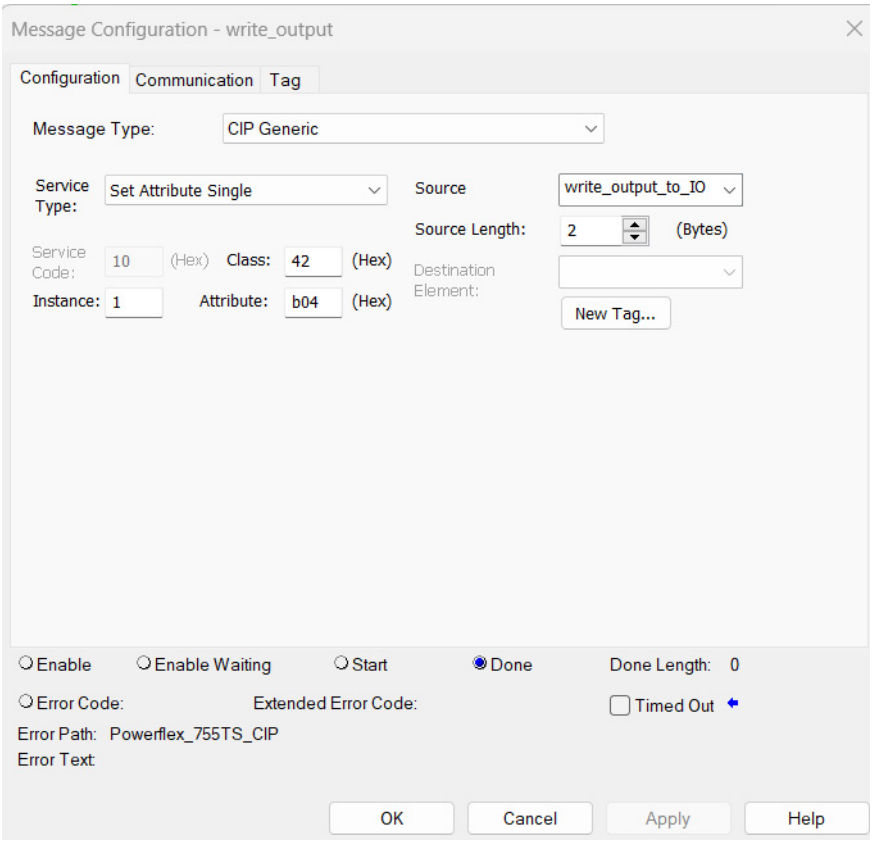
There are specific PowerFlex 755T CIP motion parameters that can be changed online. There are two methods to evaluate and change these parameters other than by changing the existing Axis CIP Drive module configuration.

One method you can use to change CIP motion parameters is optional attributes. A Set System Value (SSV) instruction allows configuration of drive parameters via optional attributes, dependent on the loop configuration. A Get System Value (GSV) instruction allows you to retrieve Axis CIP Drive parameters via optional attributes at any time, even when the Axis CIP State is Running. The list of available attributes accessible by SSV and GSV instructions are included in the Integrated Motion on the EtherNet/IP Network Reference Manual, publication MOTION-RM003, and the Knowledgebase article PowerFlex 755Tx CIP Motion Frequently Asked Questions (QA75447).

Figure 121 - Set System Value (SSV) Instruction Example

A second method that you can use to change CIP motion parameters is enhanced attributes. Enhanced attributes are accessed by using an MSG instruction in Logix Designer. To configure a message, create a message instruction in the controller logic and open the message properties.

Figure 122 - Message Configuration Dialog Box



- Message Type - Choose CIP Generic.
- Service Type or Service Code - Choose the source or enter the hex value for the service that is performed on the specified object. 10 (hex) for Set Attribute Single, or 0E (hex) for Get Attribute Single.
- Class - Enter the hex value for the type or class of object to which the service is sent. 42 (hex) for Motion Device Axis Object.
- Instance - Enter the instance of the object to which the service is sent. This example uses PowerFlex 755TS.
  - For a PowerFlex 755TS drive, Instance = 1
  - For a PowerFlex 755TL and 755TR drive and PowerFlex 755TM regenerative bus supply converter, Instance = 1
  - For a PowerFlex 755TL, 755TR, and 755TM common bus inverter, Instance = 2
- Attribute - Enter the hex value of the attribute of the object to which the service is sent.
- Source - Choose a local source tag that contains more service parameters and/or data that is sent with the set request. For a get request, this field appears dimmed.
- Source Length - Enter or choose the number of bytes of data from the source tag that is included with the set request. For a get request, this field appears dimmed.
- Destination Element - Choose a local destination tag to receive the result of a get request. For a set request, this field appears dimmed.

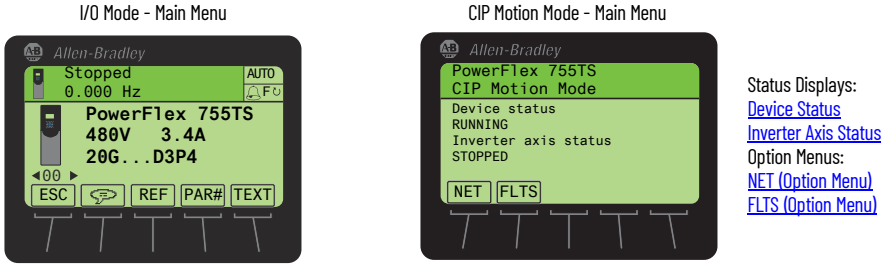
The Axis CIP Drive must be inhibited for any MSG instruction that is configured with Set Attribute Single. An MSG instruction that is configured with Get Attribute Single can occur when the Axis state is Stopped or Running. For more information, see the Knowledgebase article Programmatically Inhibit a Motion Axis.

For a list of parameter to motion attributes and CIP motion enhanced attributes, see the PowerFlex Drives with TotalFORCE Control Parameters Reference Data, publication 750-RD101.

Interpret the Human Interface Module (HIM) Display for CIP Motion Mode Versus I/O Mode

This document provides information on interpreting the differences in HIM indications between I/O mode and CIP motion mode and troubleshooting faults. Figure 123 shows the HIM main menu when the drive is in I/O mode versus the display after you have set the control selector on the main control circuit board to "1" - CIP motion mode. To configure your drive for CIP Motion mode, see Configure the Drive for Integrated Motion on EtherNet/IP Mode on page 5.

Figure 123 - HIM Indication - I/O Mode Versus CIP Motion Mode

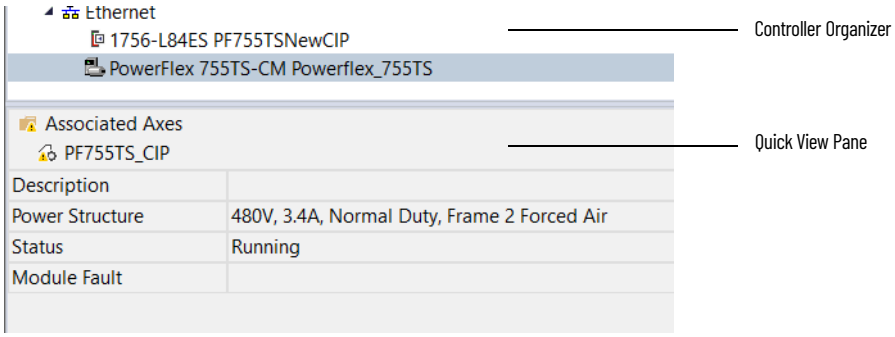


The CIP Motion mode Main menu displays Device status and Inverter status and provides access to the NET and FLTS option menus. The following sections describe the correlation between the information that is shown on the HIM and in the Logix Designer project.

Device Status

The 'Device Status' shown on the HIM is the corresponding Axis CIP Drive 'Status' in the controller organizer. This status identifies the CIP motion connection to the parent module via the Ethernet network.

Figure 124 - Controller Organizer - Axis CIP Drive Status

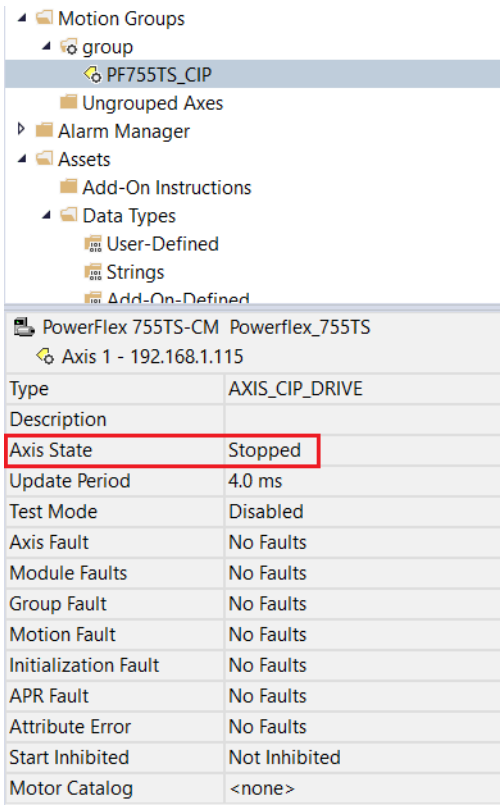


The Axis CIP Drive 'Status' shown in the controller organizer is equivalent to the module object 'EntryStatus' attribute in the controller. The 'Running" status indicates that all connections to the module (Axis CIP Drive) are established and data is successfully transferring. For more information on how to monitor the connection status of a PowerFlex drive via a ControlLogix or CompactLogix controller over an Ethernet network connection, see Knowledgebase article QA18642.

Inverter Axis Status

The 'Inverter axis status' shown on the HIM is also shown in the Axis State field in the Quick View pane for the inverter axis.

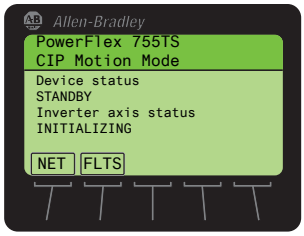
Figure 125 - Controller Organizer - Axis CIP Drive State



Troubleshooting Axis CIP Drive States

Figure 123 on page 100 shows an established I/O connection status 'Running' and the Axis CIP Drive state of 'Stopped'. Not all Axis CIP Drive systems reach a 'Stopped' state and the condition must be investigated. Figure 126 shows an I/O connection in the 'Standby' state and the Axis CIP drive state of 'Initializing'. In this example, the HIM alone isn't useful for determining what is wrong with the controller-to-drive configuration.

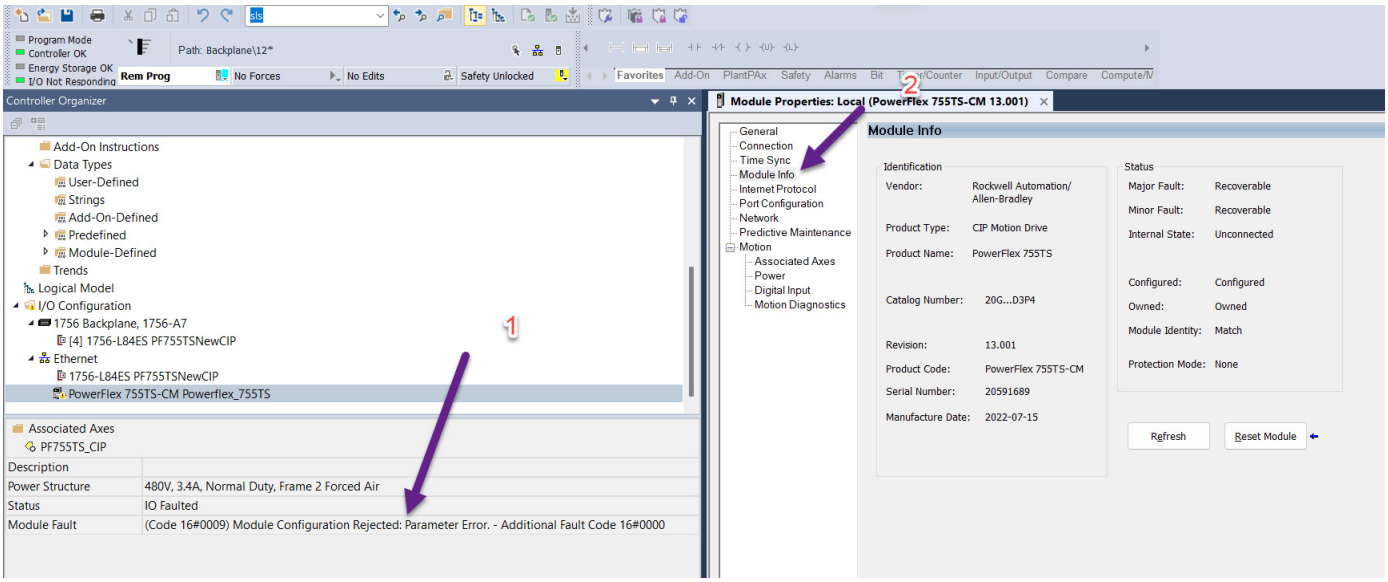
Figure 126 - CIP Motion Mode - Device Status 'Standby'



'Standby' indicates that the application configuration in the parent 1756-L84ES module that is connected to the drive does not match the Axis CIP Drive configuration. Because the configuration does not match, the controller and drive can't synchronize and establish a successful connection status. The easiest way to evaluate this mismatch is to go online with the controller and drive in your Studio 5000 project.

When the Device Status is not 'Running', check the controller I/O tree, where the PowerFlex 755TS CIP motion drive is configured.

Figure 127 - Quick View Pane and Drive Module Properties - Module Info Category



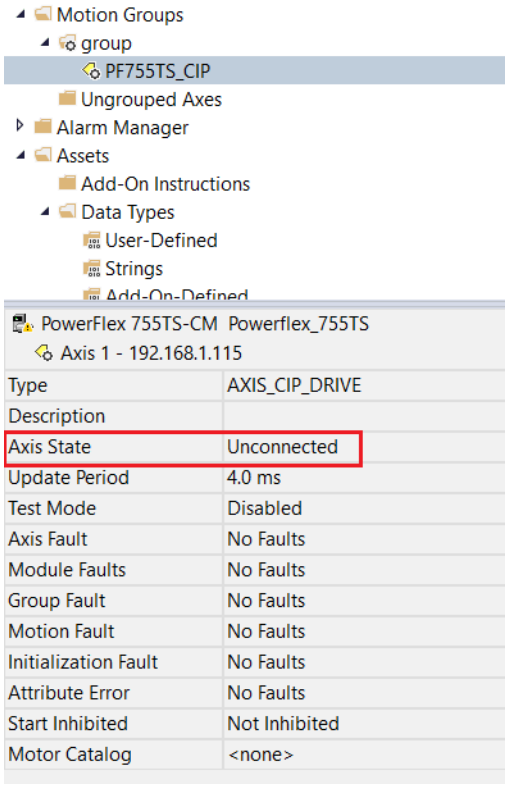
Review the Axis CIP Drive Status in the Quick View pane and the Module Info category in the drive Module Properties dialog box.

1. In the Axis CIP Drive Quick View pane, the Status field displays a fault message (IO Faulted in this example) and the Module Fault field displays a fault and/or error message.
2. Verify that the module configuration in the Module Properties dialog box and the physical drive configuration match.

In this example, this issue is that during a power-down a 20-750-UFB-1 board was installed and configured in port 5 of the control pod, but the drive module properties were not configured for the option module. Thus, a mismatch occurred, which must be corrected in the Axis CIP Drive configuration.

The motion group (PF755TS_CIP in this example) and Axis CIP Drive shows 'Unconnected' because the 1756-L84ES can't load the image in the drive due to a mismatch.

Figure 128 - Motion Group - Axis State



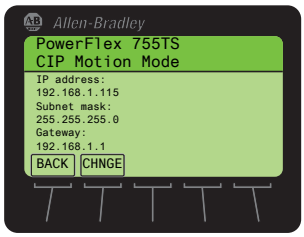
Once the 20-750-UFB-1 option module was added to the PowerFlex 755TS CIP Drive module configuration at Port 5 and the Axis CIP Drive motor feedback type added, the Device Status returns to 'Running' and the Inverter Axis Status to 'Stopped' as shown in Figure 123.

NET (Option Menu)

The Network screen lists the IP address, Subnet mask, and Gateway configured for the drive.

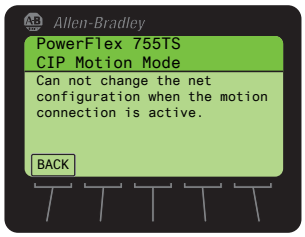
To view Ethernet timing statistics, on the CIP motion mode main menu, press 'NET'. This configuration can be changed in Logix Designer for the Axis CIP Drive module and the drive itself based on Ethernet.

Figure 129 - CIP Motion Mode - NET Screen



When the drive is in CIP Motion mode and a CIP motion connection is not active, you can change the Ethernet address from the HIM. To change the Ethernet address with the HIM, press the CHNGE option and enter the IP address. If you attempt to change the Ethernet address while a CIP Motion connection is active, the message shown in Figure 130 appears.

Figure 130 - CIP Motion Mode - CHNGE Message



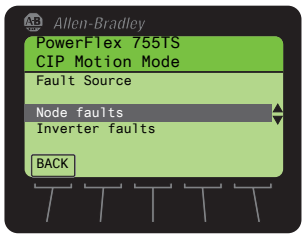
To return to the CIP Motion Mode main menu, press BACK, and then BACK again.

FLTS (Option Menu)

The Fault Source screen lists options for Node or Inverter faults.

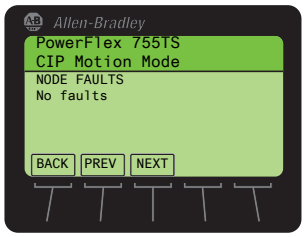
1. On the CIP Motion Mode main menu, to view any Node or Network faults or Inverter or Axis CIP Drive faults, press FLTS.

Figure 131 - CIP Motion Mode - FLTS Screen



2. To enter the Node faults screen, which displays faults that are related to the Axis CIP Drive node, press 5 on the HIM.

Figure 132 - CIP Motion Mode - NODE FAULTS Screen

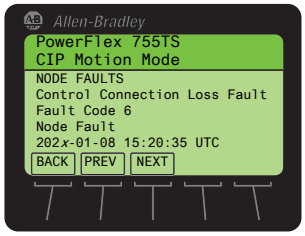


The Integrated Motion on the EtherNet/IP Network Reference Manual, publication MOTION-RM003, contains a complete list of Axis CIP Drive Node fault bits, such as 'Control Synch Fault'. Note that this is not a Device Status or I/O Connection fault, which are configuration faults. A Node fault is a network-related fault for an Axis CIP Drive.

Knowledgebase article QA39714, 'Troubleshooting Guide for Communication Faults on CIP Motion Systems', is a guide is intended for troubleshooting various communication faults that can occur on axes of Integrated Motion on EtherNet/IP.

A Node Fault can indicate many things as discussed in the Integrated Motion on the EtherNet/IP Network Reference Manual, publication MOTION-RM003. These are the module/node fault and alarm-related attributes that are associated with a Motion Control Axis. It could be a 'Control Synch Fault' or 'Module Connection Fault'.

Figure 133 - CIP Motion Mode - NODE FAULTS Screen



Note that the HIM display text for the fault code is limited. To view a more detailed fault code description, you must view the Axis CIP Drive status in the Logix Designer Quick View pane.

In the example in Figure 134, the motor data was not entered into the configured drive module before the project was downloaded.

Figure 134 - Axis CIP Drive Status

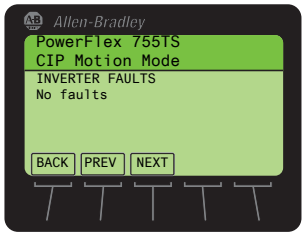
PowerFlex 755TS-CM PF755TS_CIP_Motion
Axis 1 - 192.168.1.115

Type	AXIS_CIP_DRIVE
Description	
Axis State	Faulted
Update Period	4.0 ms
Test Mode	Disabled
Axis Fault	ModuleFault, ConfigFault
Module Faults	ControlConnFault
Group Fault	No Faults
Motion Fault	No Faults
Initialization Fault	No Faults
APR Fault	No Faults
Attribute Error	MotorType - Invalid attribute value.
Start Inhibited	Not Inhibited
Motor Catalog	<none>

To return to the Fault Codes screen.

1. Press BACK.
2. To select the Inverter faults option, press  .
3. To enter the Inverter faults screen, press  .

Figure 135 - CIP Motion Mode - NODE FAULTS Screen

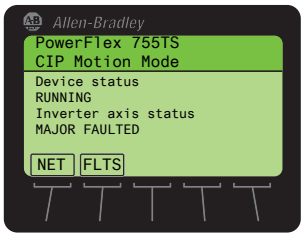


Troubleshoot an Inverter Axis Fault from the HIM

You can begin troubleshooting any inverter axis faults by starting on the HIM CIP Motion main menu.

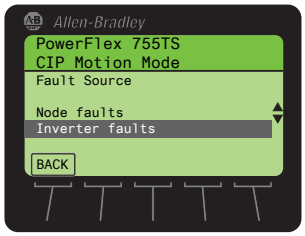
Note in this example that the Device status has not changed but there is a Major Fault in the Axis CIP Drive as shown in Figure 136.

Figure 136 - CIP Motion Mode - Main Menu



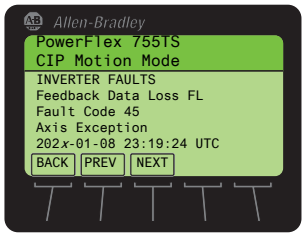
1. To view more details about the Inverter fault, press FLTS.
   The Fault Source screen displays.

Figure 137 - CIP Motion Mode - FLTS Screen



2. To select the Inverter faults option, press  .
3. To enter the Inverter faults screen, press  .

Figure 138 - CIP Motion Mode - INVERTER FAULTS Screen



A Feedback Data Loss Fault typically occurs when the motor feedback to the feedback option module, for example 20-750-UFB-1, is missing packets of data.

To correct this issue, reconnect the feedback cable to option module. You must reset the fault in Logix Designer. You can use code in your program to accomplish a reset as well.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation. You can view or download publications at rok.auto/literature.

Resource	Description
PowerFlex 750-Series Products with TotalFORCE Control Installation Instructions, publication 750-IN100	Provides the basic steps to install PowerFlex 755TL drives, PowerFlex 755TR drives, and PowerFlex 755TM bus supplies.
PowerFlex 750TS-Series Products with TotalFORCE Control Installation Instructions, publication 750-IN119	Provides the basic steps to install PowerFlex 755TS drives.
PowerFlex 750-Series I/O, Feedback, and Power Option Modules Installation, publication 750-IN111	Provides instructions to install and wire 750-Series option modules.
PowerFlex TotalFORCE Firmware Documentation Set: • PowerFlex Drives with TotalFORCE Control Programming Manual (firmware revision 10.xxx and later), publication 750-PM101 • PowerFlex Drives with TotalFORCE Control Parameters Reference Data, publication 750-RD101 • PowerFlex Drives with TotalFORCE Control Conditions Reference Data, publication 750-RD102	Provides detailed information for firmware revisions 10.xxx and later on: • I/O, control, and feedback options • Parameters and programming • Faults, alarms, and troubleshooting
PowerFlex 20-HIM-A6 and 20-HIM-C6S HIM (Human Interface Module) User Manual, publication 20HIM-UM001	Provides information about the enhanced PowerFlex 20-HIM-A6 and 20-HIM-C6S Human Interface Modules (HIM), and using them with PowerFlex 750-Series drives and PowerFlex 7-Class drives.
PowerFlex 750-Series Products with TotalFORCE Control Hardware Service Manual, publication 750-TG100	Provides detailed information on: • Preventive maintenance • Component testing • Hardware replacement procedures
PowerFlex 750TS-Series Products with TotalFORCE Control Hardware Service Manual, publication 750-TG101	
PowerFlex 750-Series Safe Torque Off Option Module User Manual, publication 750-UM002	This manual explains how the PowerFlex 750-Series Safe Torque Off option module can be used in Safety Integrity Level (SIL) 3, Performance Level [PLe], or Category (cat.) 3 applications.
PowerFlex 755/755T Integrated Safety - Safe Torque Off Option Module User Manual, publication 750-UM004	This user manual explains how to use PowerFlex 755 drives and PowerFlex 755T drive products in safety integrity level (SIL) 3, Performance Level (PL) PLe, Category (CAT) 3 applications.
PowerFlex 755/755T Integrated Safety Functions Option Module User Manual, publication 750-UM005	This user manual explains how to use PowerFlex 755 drives and PowerFlex 755T drive products in safety applications up to safety integrity level 3 (SIL 3), performance level e (PLe), category 4.
Integrated Motion on the EtherNet/IP Network Reference Manual, publication MOTION-RM003	Information on the AXIS_CIP_DRIVE attributes and the configuration software control modes and methods.
Integrated Motion on the EtherNet/IP Network Configuration and Startup User Manual, publication MOTION-UM003	Information on how to configure and troubleshoot your ControlLogix and CompactLogix EtherNet/IP network modules.
GuardLogix 5570 Controllers User Manual, publication 1756-UM022	Provides information on how to install, configure, program, and use ControlLogix controllers and GuardLogix® controllers in Studio 5000 Logix Designer projects.
GuardLogix 5580 Controllers User Manual, publication 1756-UM543	
Compact GuardLogix 5370 Controllers User Manual, publication 1769-UM022	Provides information on how to install, configure, program, and use CompactLogix and Compact GuardLogix controllers.
Compact GuardLogix 5380 Controllers User Manual, publication 5069-UM001	
GuardLogix 5570 and Compact GuardLogix 5370 Controller Systems Safety Reference Manual, publication 1756-RM099	Provides information on how to achieve and maintain Safety Integrity Level (SIL) and Performance Level (PL) safety application requirements for GuardLogix and Compact GuardLogix controllers.
GuardLogix 5580 and Compact GuardLogix 5380 Controller Systems Safety Reference Manual, publication 1756-RM012	
EtherNet/IP Network Devices User Manual, publication ENET-UM006	Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP network.
Ethernet Reference Manual, publication ENET-RM002	Describes basic Ethernet concepts, infrastructure components, and infrastructure features.
Scalable Time Distribution within a Converged Plantwide Ethernet Architecture Technical Data, publication ENET-TD016	Describes how to design and deploy Scalable Time Distribution technology throughout a plant-wide Industrial Automation and Control System (IACS) network infrastructure.
Motion Analyzer System Sizing and Selection Tool https://motionanalyzer.rockwellautomation.com/	Comprehensive motion application sizing tool used for analysis, optimization, selection, and validation of your Kinetix Motion Control system.
Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication SGI-1.1	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, Knowledgebase, and product notification updates.	rok.auto/support
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

Documentation Feedback

Your comments help us serve your documentation needs better. If you have any suggestions on how to improve our content, complete the form at rok.auto/docfeedback.

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.

Rockwell Otomasyon Ticaret A.Ş. Kar Plaza İş Merkezi E Blok Kat:6 34752, İçerenköy, İstanbul, Tel: +90 (216) 5698400 EEE Yönetmeliğine Uygundur

Connect with us.

rockwellautomation.com — expanding **human possibility**®

AMERICAS: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000
EUROPE/MIDDLE EAST/AFRICA: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2663 0600
ASIA PACIFIC: Rockwell Automation SEA Pte Ltd, 2 Corporation Road, #04-05, Main Lobby, Corporation Place, Singapore 618494, Tel: (65) 6510 6608
UNITED KINGDOM: Rockwell Automation Ltd., Pitfield, Kiln Farm, Milton Keynes, MK11 3DR, United Kingdom, Tel: (44)(1908) 838-800

Publication 750-AT007A-EN-P - June 2024