Allen-Bradley

ControlLogix SynchLink Module

1756-SYNCH

User Manual

Rockwell Automation

What is the 1756-SYNCH module?

This chapter describes the ControlLogix SynchLink module. It also describes what you must know and do before using the SynchLink module.

Table 1.1

What is the ControlLogix SynchLink Module?

A ControlLogix SynchLink module, through the use of fiber optic communication technology, allows you to implement:

- time synchronization
- distributed motion control
- coordinated drive control

based on the ControlLogix and PowerFlex 700S platforms. In distributed control system, the SynchLink module broadcasts reference data and synchronizes time from a single ControlLogix chassis to multiple other chassis at a high speed.

What Data Does the SynchLink Module Transfer?

The SynchLink module transfers multiple types of reference data between chassis, including:

- Produced axis data for chassis to chassis remote axis control
- High speed drive reference data for chassis to drive control
- General control information that requires transfer at a high speed and in a synchronized manner

Why Synchronize Time Between Chassis?

In synchronizing time between chassis, the SynchLink module allows you to:

- share motion data from chassis to chassis because a consistent time reference is available among chassis for interpolation of velocity and position data.
- timestamp I/O in multiple chassis and have a common time reference with which to compare the timestamps.

For more information on how the SynchLink module impacts the time references between ControlLogix chassis, see Chapter 2, Time Synchronization in the ControlLogix System.

What Are Some of the Features Available On the ControlLogix SynchLink Module?

The following are some of the features available on the ControlLogix SynchLink module:

- Support of multiple SynchLink system configurations - Star, daisy chain and ring

  For more information on these functions, see Chapter 2, Time Synchronization in the ControlLogix System.

  For more information on how to configure the module with RSLogix 5000, see Chapter 5, Configuring the SynchLink Module.

- Removal and insertion under power (RIUP) - This system feature allows you to remove and insert the module while power is applied. For more information on RIUP, see page 1-6.
- Communication of remote axis data in a timely and deterministic manner
- Communication of direct and buffered data
- Class I Division 2, UL, CSA, and CE Agency Certification

Connecting a SynchLink Module to a SynchLink System

ControlLogix SynchLink modules mount in a ControlLogix chassis and connects to other SynchLink node through a fiber optic cable system.

For more information on the available fiber optic cables, see Table 1.2.

Table 1.2 Fiber Optic Cables Available with the 1756-SYNCH Module

Catalog number:	Cable length	Cables per box:
1403-CF001	1m (3.28ft)	2
1403-CF003	3m (9.84ft)	
1403-CF005	5m (16.4ft)	
1403-CF010	10m (32.8ft)	1
1403-CF020	20m (65.6ft)	
1403-CF050	50m (164ft)	
1403-CF100	100m (328ft)	
1403-CF250	250m (820ft)	

When you install the SynchLink module in a Star Configuration, you need to use hubs as well as fiber optic cables. A hub is a combination of one base block with up to four splitter blocks. A bypass switch block is also available for use in the daisy chain configuration. For more information on the Star Configuration, see 2-6.

For more information the hub components available for use with the SynchLink module, see Table 1.3

Table 1.3 Hub Components Available with the 1756-SYNCH Module

Catalog Number:	Hub Type:
1751-SLBA	SynchLink Fiber Base Block
1751-SL4SP	SynchLink Fiber 4-Port Splitter Block
1751-SLBP	SynchLink Fiber Bypass Switch Block

For more information on SynchLink fiber optic cable systems, see The SynchLink Design Guide, publication 1756-TD008.

Time Synchronization in the ControlLogix System

This chapter describes how the ControlLogix SynchLink module fits in the ControlLogix system.

Table 2.1

Before you can fully understand how the SynchLink module can be used in a distributed ControlLogix system, you should understand how a ControlLogix application works without SynchLink. See the ControlLogix System User Manual, publication 1756-UM001 for a detailed description of the ControlLogix system.

IMPORTANT

In RSLogix 5000, v13 or greater, you can use a 1756-SYNCH module in a remote chassis without a ControlLogix controller and still provide a CST value for the chassis. I/O modules (e.g., 1756-IH16ISOE) can use the CST value when generating timestamps.

For SynchLink systems that use RSLogix 5000, v12 or earlier, you cannot use a 1756-SYNCH module to synchronize I/O timestamps in a remote chassis without first installing a ControlLogix controller in that chassis.

Using the Coordinated System Time (CST)

The Coordinated System Time (CST) is the clocking mechanism used to achieve time synchronization in a ControlLogix chassis. The ControlLogix Coordinated System Time (CST) clock is a 64-bit clock on the backplane of the ControlLogix chassis. It has a 1µS resolution and is used as the main time reference for all modules plugged into a chassis backplane.

For more information on how the ControlLogix CST affects the operation of other ControlLogix products, see the ControlLogix System User Manual, publication 1756-UM001.

Time Synchronization in a Distributed Control System

The same CST mechanism described above is also used to synchronize ControlLogix chassis in a distributed control system. In such a system, SynchLink transfers the CST value from the CST Master chassis to CST Slave chassis.

Each chassis must be equipped with a SynchLink module and, depending on what version of RSLogix 5000 the system is using, each chassis may or may not require that a controller reside in remote chassis. This distributed control system is identified as a SynchLink system.

The 1756-SYNCH module provides synchronization of CSTs between ControlLogix chassis provides with no more than +/-5µs drift between chassis.

Time Synchronization in the SynchLink System

Time synchronization within a SynchLink system is required to:

- transfer a CST value from the CST Master chassis to CST Slave chassis.
- transfer motion and drive control data.
- support time synchronization between ControlLogix chassis and non-ControlLogix products (e.g. PowerFlex 700S products).

The SynchLink Node Clock is integral to all devices that contain the SynchLink circuitry. It is the clocking mechanism on the fiber optic side of the SynchLink system. This clock has a resolution of 1µS.

During system configuration, you establish one SynchLink node clock as the master system clock on the SynchLink fiber. By design, the ControlLogix chassis that is configured as the SynchLink master also acts as the CST master of the system. In this manner, one SynchLink node acts as a Time Master for the entire system. This chapter gives more detail on how this functionality is accomplished.

Multiple Rockwell Automation products can be synchronized with SynchLink. In addition to the SynchLink module, the PowerFlex 700S and the 1756-DMxxx series products (both used for drive control) also use SynchLink to achieve drive to drive synchronization. While all of these products maintain interoperability, not all SynchLink features are incorporated into every product that uses SynchLink; the 1756-SYNCH module, however, uses all of the SynchLink features.

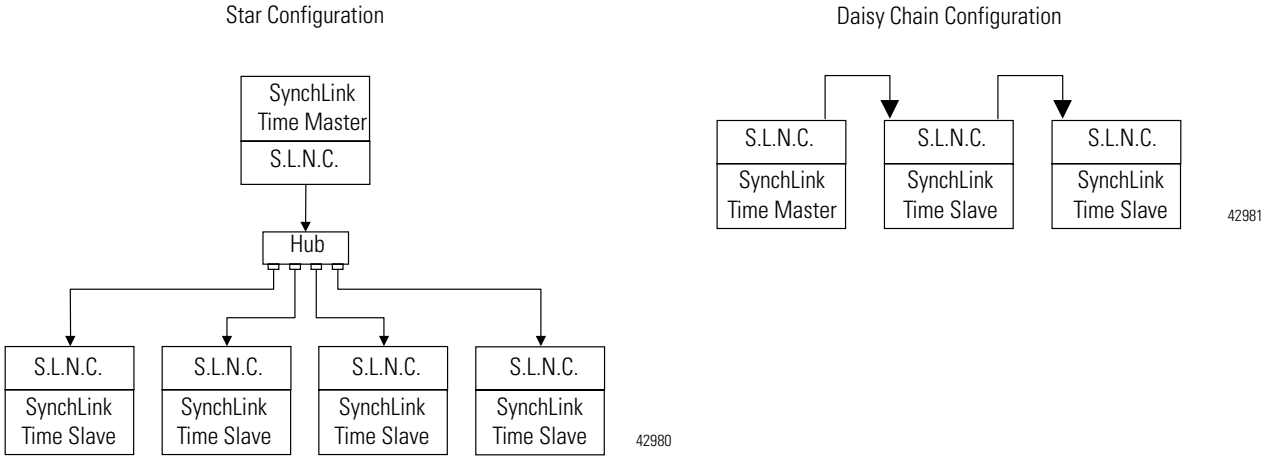
SynchLink Node Clock

The SynchLink node clock is integral to the SynchLink circuit design. Any product incorporating SynchLink incorporates the SynchLink node clock as a base-line requirement. The SynchLink node clock has a 1μS resolution and is synchronized from node to node when the SynchLink system is configured.

SynchLink uses a Time Master-Slave mechanism to achieve time synchronization. During system configuration, you configure one SynchLink node as the Time Master and all other nodes as Time Slaves. The SynchLink node that is configured as Time Master becomes the system clock for the entire SynchLink system. As such, the SynchLink Time Master broadcasts its time reference to the SynchLink Time Slaves which adjust their node clocks to be in phase with the master clock.

Because SynchLink is a unidirectional, broadcasting mechanism, the master is always placed at the beginning of SynchLink systems using the star or daisy chain configurations.

Figure 2.1



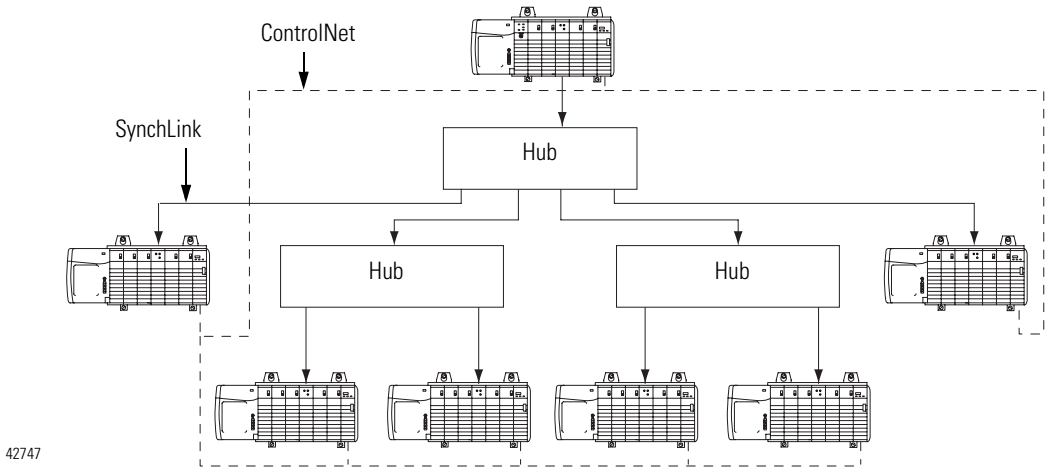
S.L.N.C. = SynchLink Node Clock

Choose a SynchLink Configuration

You must use one of the following SynchLink configurations:

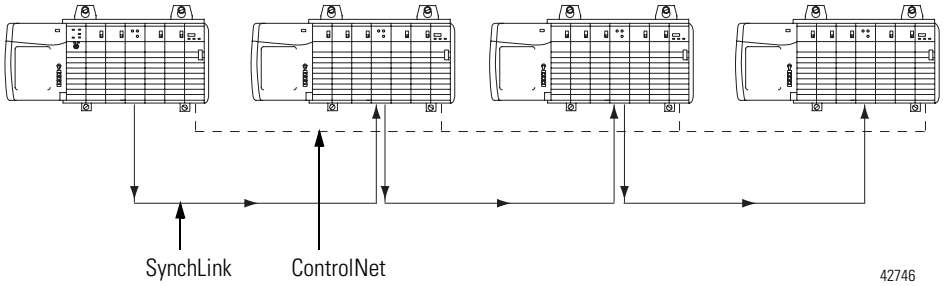
Star Configuration - See Appendix B for an example.

Figure 5.2



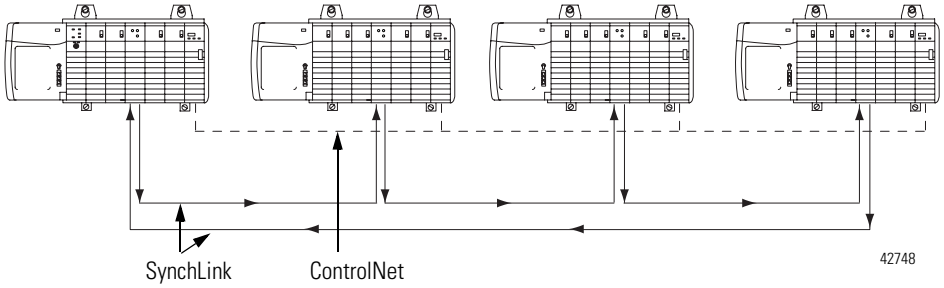
Daisy Chain Configuration - See Appendix for an example.

Figure 5.3



Ring Configuration - See Appendix D for an example.

Figure 5.4



Creating a New Module

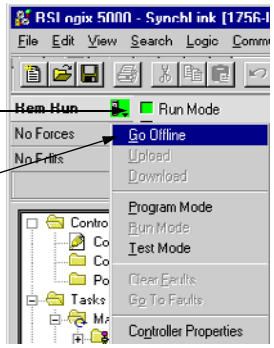
After you have started RSLogix 5000 and created a processor, you must create a new module. The wizard allows you to create a new module and configure it.

IMPORTANT You must be offline when you create a new module.

1. If your application is online, go offline.

A. Click on the triangle to see the pull-down menu.

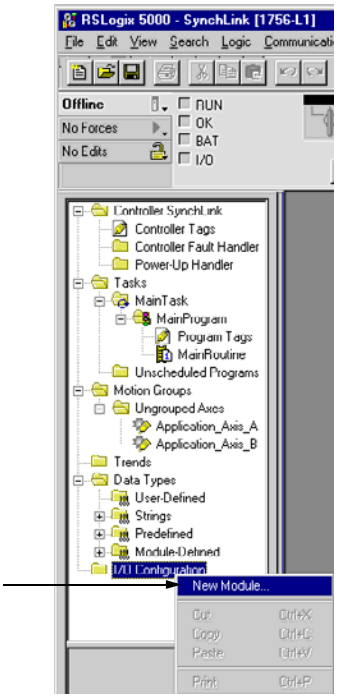
B. Click on Go Offline.



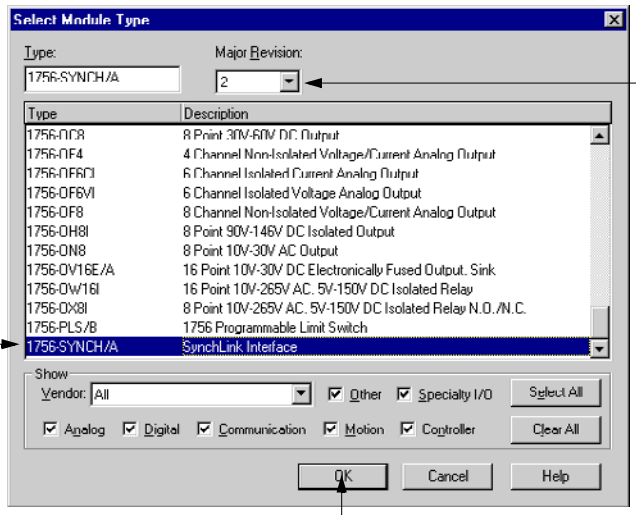
2. Access the Select Module Type screen.

A. Right-click on I/O Configuration.

B. Select New Module.



3. Select the module type.

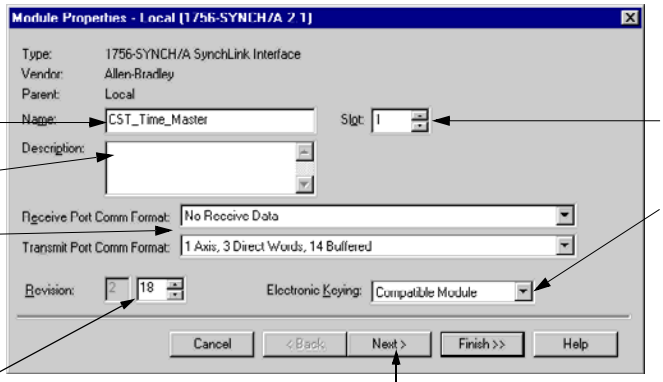


A. Select a module.

B. Make sure the Major Revision number matches the label on the side of your module

C. Select a module.

4. Begin configuration on the naming screen.



A. Name the module.

B. Type a description (optional).

C. Choose a Communications Format for the receive and transmit ports. A detailed explanation of this field is provided on page 3-6.

D. Make sure the Minor Revision number matches the label on the side of your module.

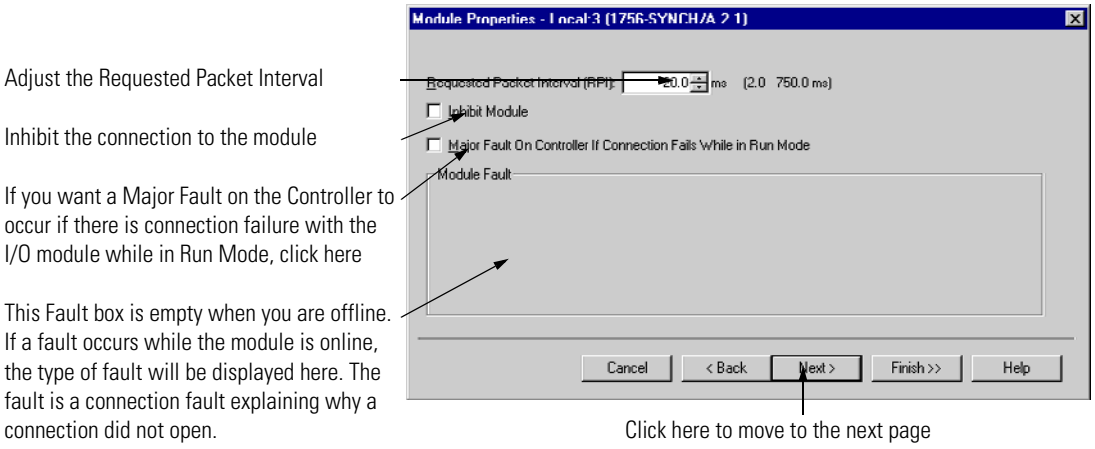
E. Set your module's slot.

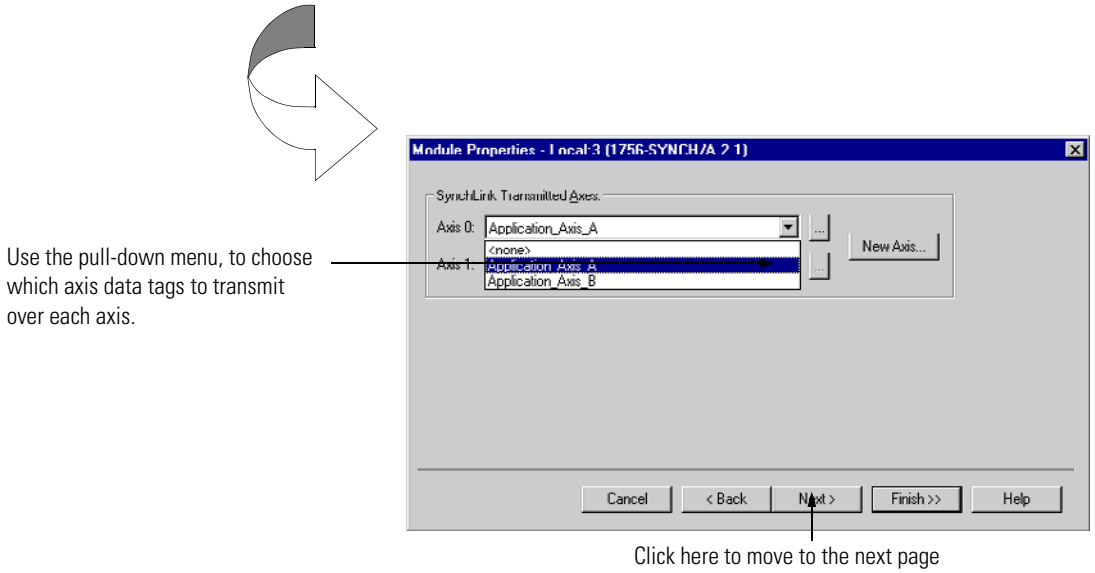
F. Choose an Electronic Keying method. A detailed explanation of this field is provided on the next page 3-11.

G. When you are finished on this page, click here.

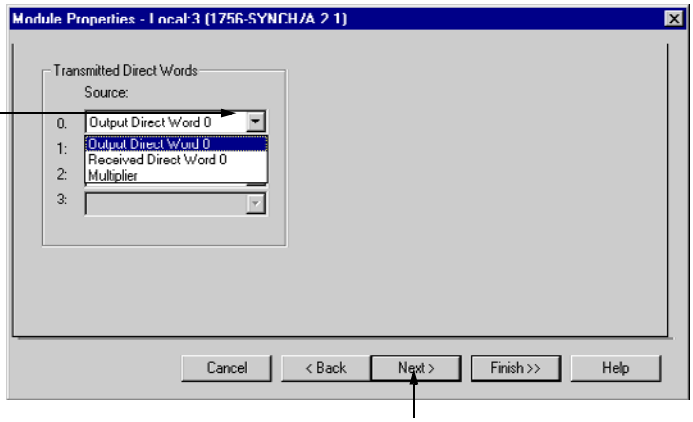
5. When you click on Next, you see the series of wizard screens that enable you to configure the module.

   Although each screen maintains importance during online monitoring, some of the screens that appear during this initial module configuration process are blank. They are not shown here.





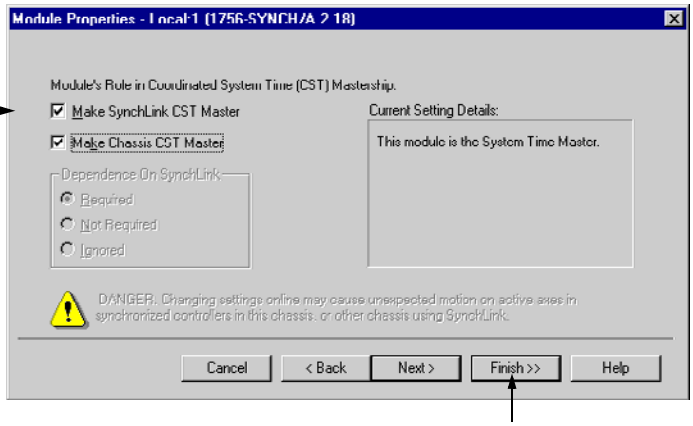
Use the pull-down menus to choose which direct words are transmitted.



Click here to move to the next page

Set the 1756-SYNCH module's role in Coordinated System Time (CST) Mastership.

For more information on Time Mastership, see CST and SynchLink Mastership on page 3-18.

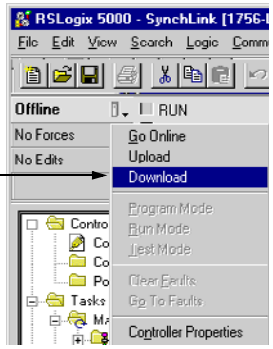


Click here to finish configuration.

Downloading New Configuration Data

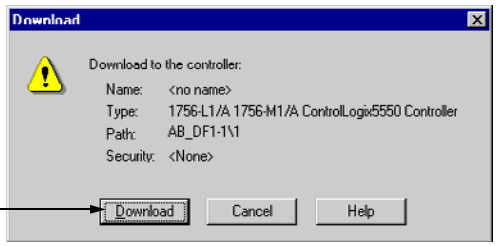
After you have changed the configuration data for a module, the change does not actually take affect until you download the new program which contains that information. This downloads the entire program to the controller overwriting any existing programs.

Pull down this menu and click here to download the new data



RSLogix 5000 verifies the download process with this pop-up screen.

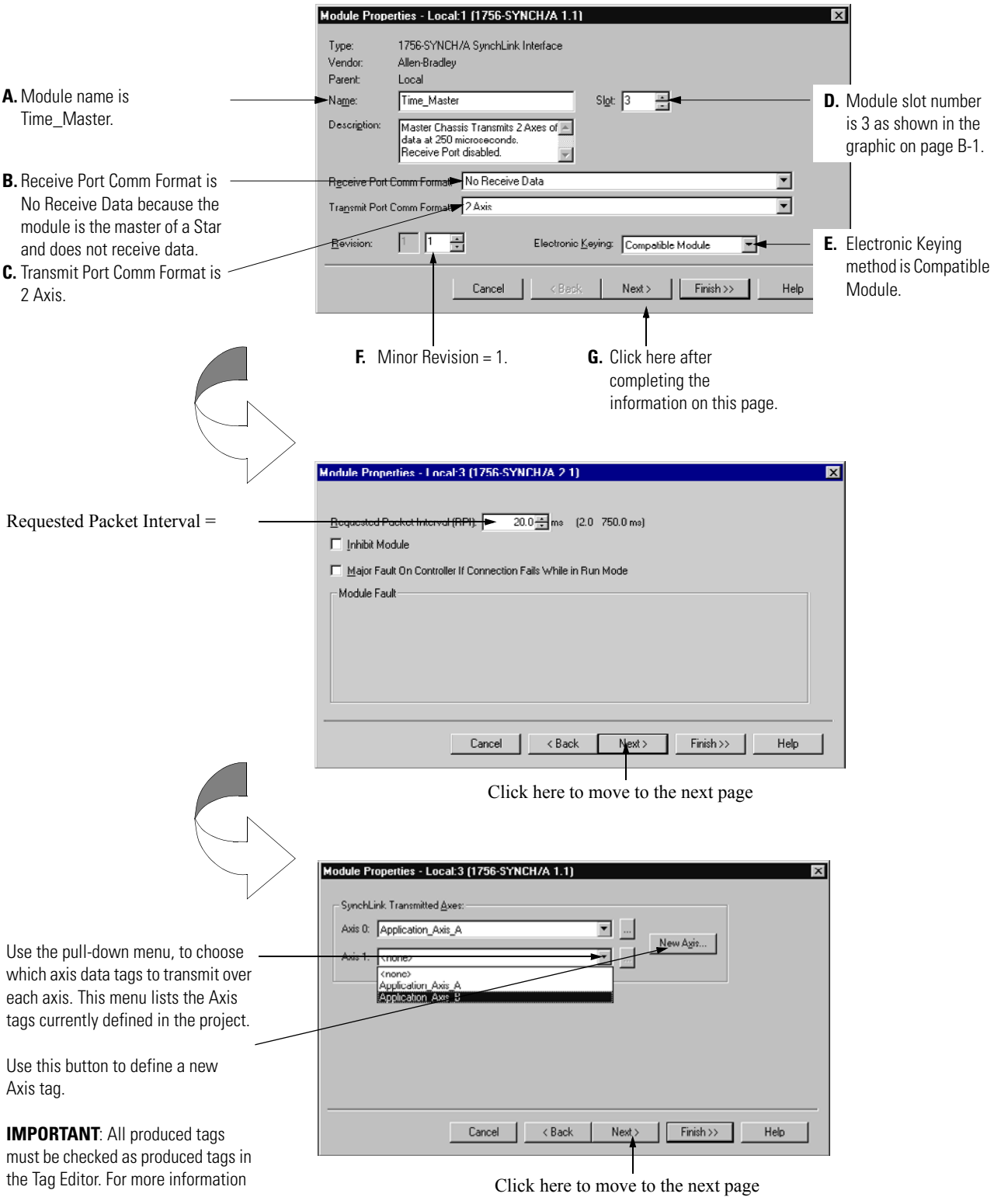
Click here to download new data



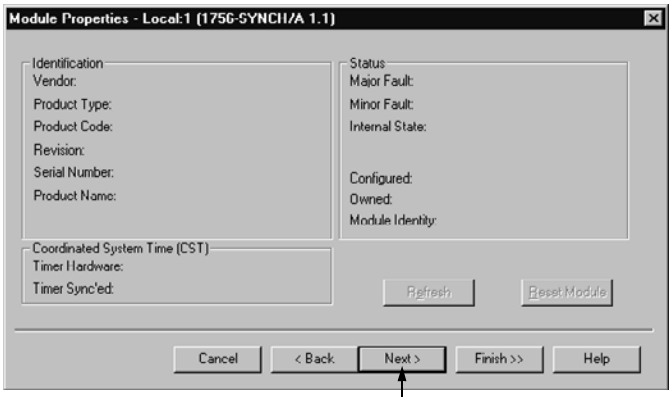
This completes the download process.

Configure the SynchLink Module

1. Use the new module creation wizard as shown below.

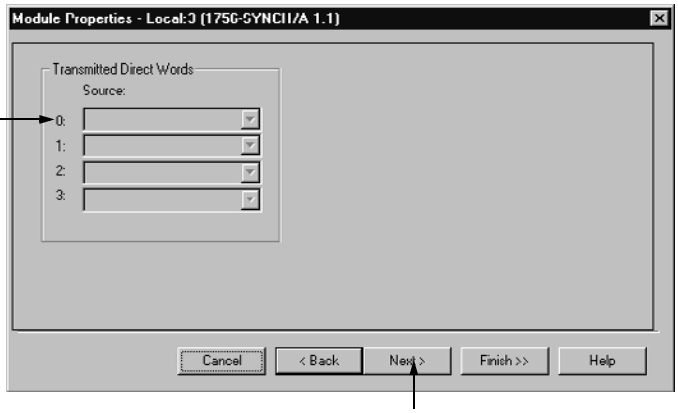


The Module Identification page is blank during initial



Click here to move to the next page

The module does not transmit any direct words because the Communications Format only calls for Axis data.

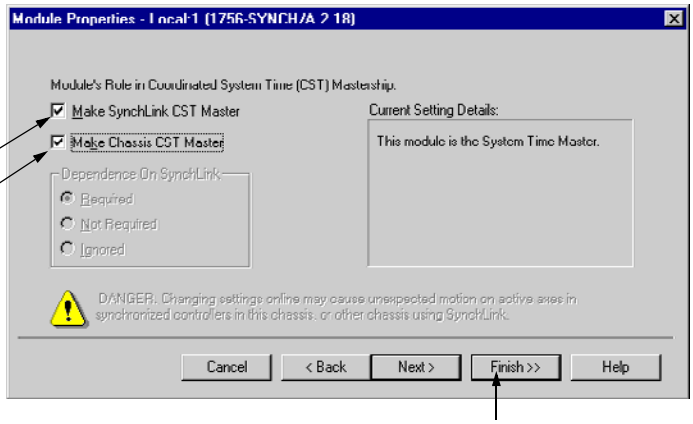


Click here to move to the next page

The module is configured as the Time Master for:

- the chassis - optional
- the SynchLink - required

IMPORTANT: In this configuration, the SynchLink module must be the Time Master of the SynchLink, but it is not required to be the Time Master of the chassis. If the module is not the Time Master of the chassis, it receives the CST timer value from the chassis backplane.

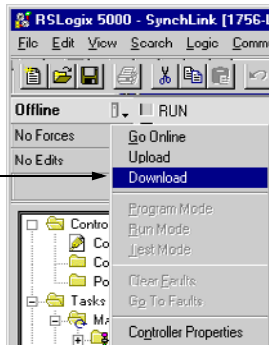


Click here to finish configuration.

Download Configuration

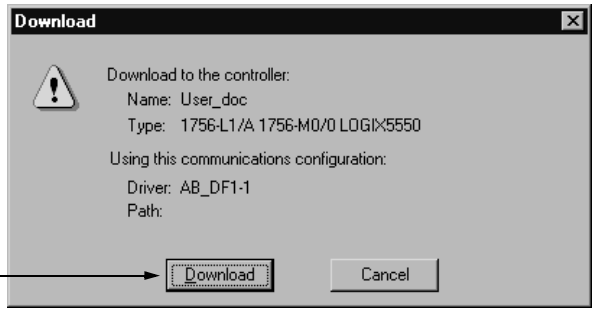
Download the configuration data.

Pull down this menu and click here to download the new data

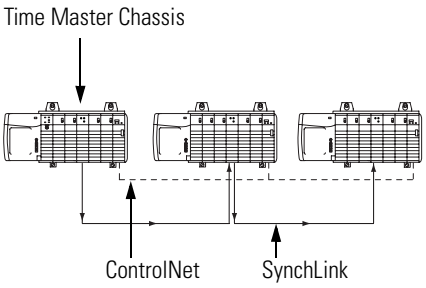


RSLogix 5000 verifies the download process with this pop-up screen.

Click here to download new



This completes the download process.



Configure Time Master Chassis - Master Node

You must complete the following tasks to configure the time master chassis.

- Create a New RSLogix 5000 Project
- Add a SynchLink Module
- Configure the SynchLink Module
  - Name the module
  - Choose a receive communications format
  - Choose a transmit communications format
  - Choose an electronic keying option
  - Set the RPI
  - Determine if the module is the CST Time Master for the chassis
  - Make the module the Time Master for the SynchLink
- Download Configuration

Create a New RSLogix 5000 Project

1. Use the File menu to create a new project.

Choose a New project from the File menu.

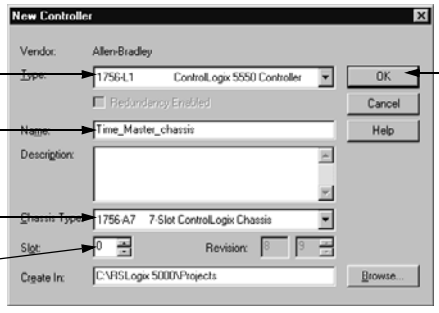
2. Name the controller.

A. The controller is a 1756-L1.

B. The controller is named Time_Master_chassis.

C. The controller is used in a 7-slot chassis.

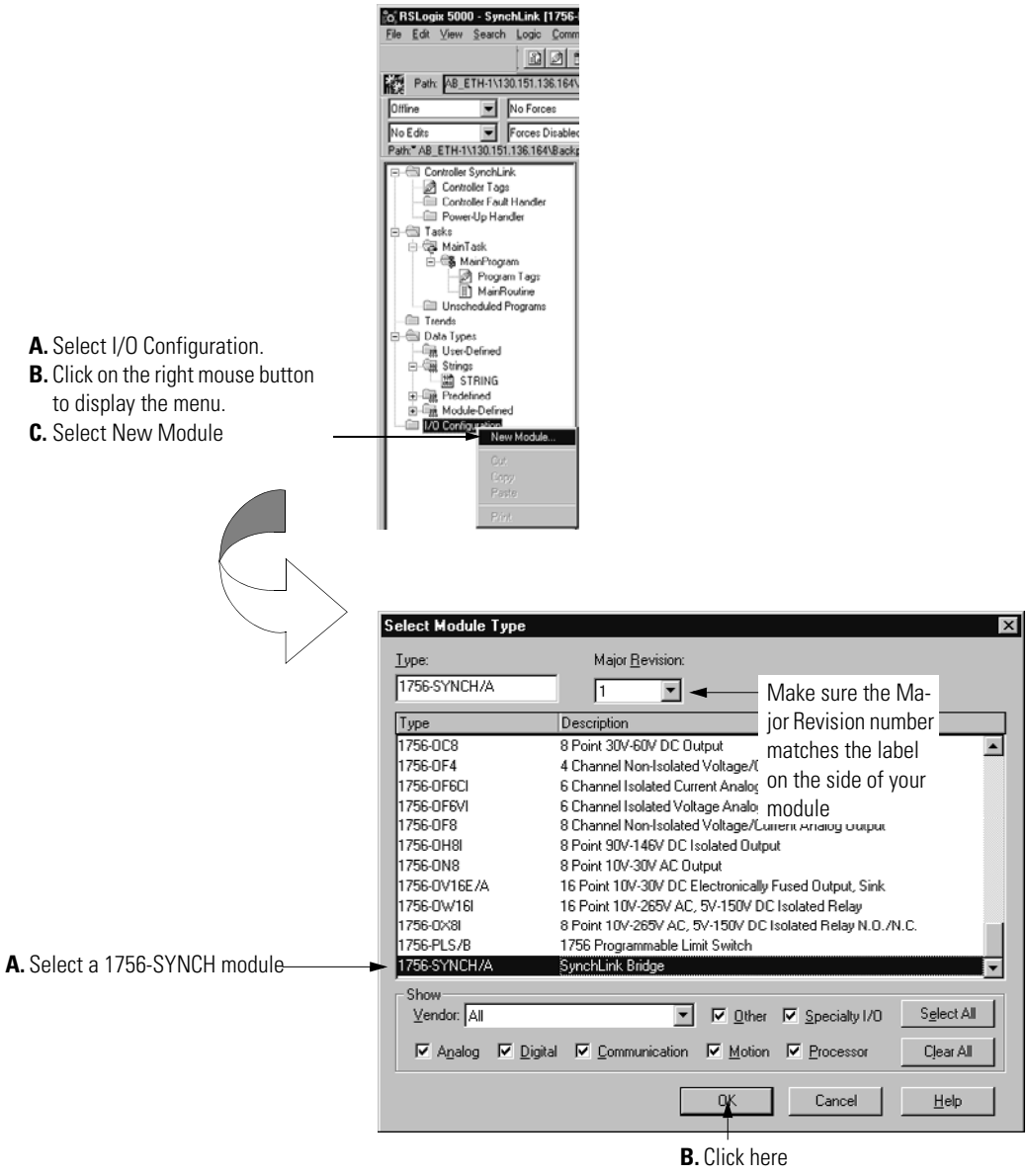
D. The controller slot number is 0.



E. Click here to use the new controller.

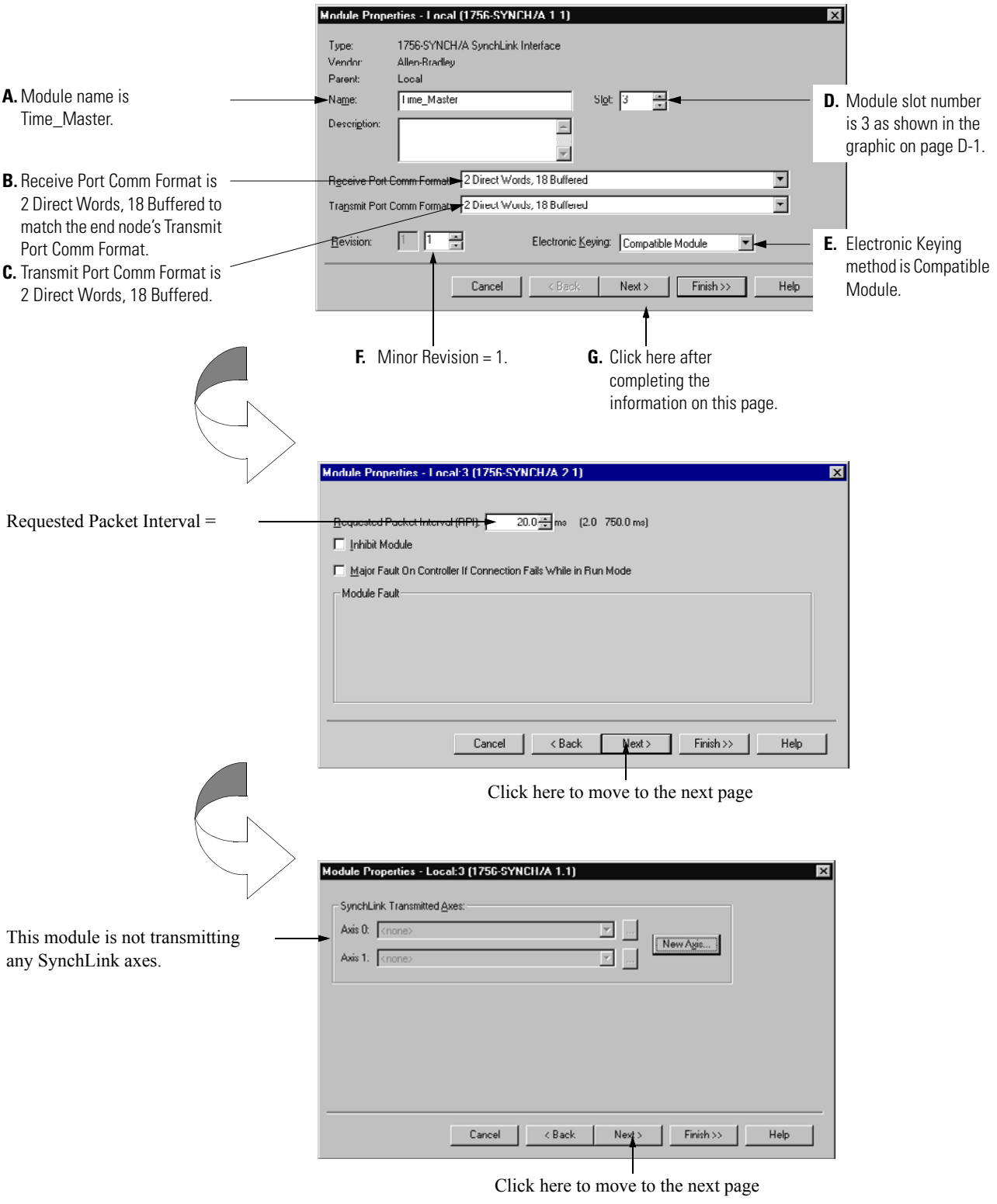
Add a SynchLink Module

1. Select a SynchLink module as shown below.

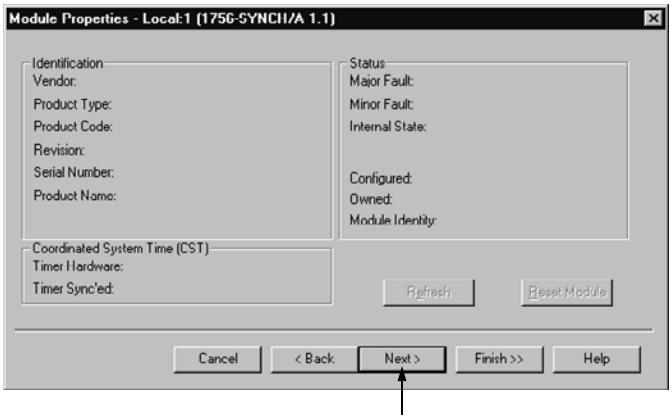


Configure the SynchLink Module

1. Use the new module creation wizard as shown below.



The Module Identification page is blank during initial



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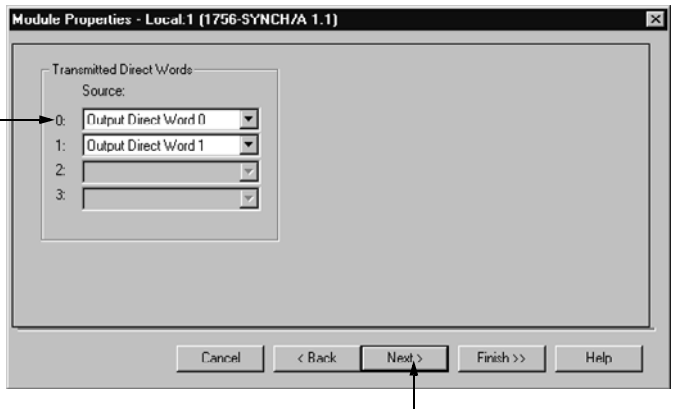
The module transmits 2 Direct Words, as specified in the transmit port communications format.

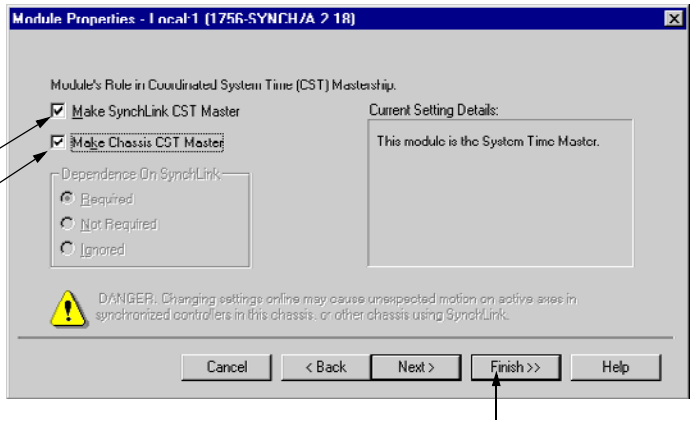


Click here to move to the next page

The module is configured as the Time Master for:

- the chassis - optional
- the SynchLink - required

IMPORTANT: In this configuration, the SynchLink module must be the Time Master of the SynchLink, but it is not required to be the Time Master of the chassis. If the module is not the Time Master of the chassis, it receives the CST timer value from the chassis backplane.



Click here to finish configuration.