Allen-Bradley

ControlLogix SynchLink Module

1756-SYNCH

User Manual

Rockwell Automation

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of these products must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards. In no event will Allen-Bradley be responsible or liable for indirect or consequential damage resulting from the use or application of these products.

Any illustrations, charts, sample programs, and layout examples shown in this publication are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this publication, notes may be used to make you aware of safety considerations. The following annotations and their accompanying statements help you to identify a potential hazard, avoid a potential hazard, and recognize the consequences of a potential hazard:

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.

IMPORTANT

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

ATTENTION

Environment and Enclosure

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 meters without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as "open type" equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure. Also, see the appropriate sections in this publication, as well as the Allen-Bradley publication 1770-4.1 ("Industrial Automation Wiring and Grounding Guidelines"), for additional installation requirements pertaining to this equipment.

Rockwell Automation Support

Rockwell Automation offers support services worldwide, with over 75 sales/support offices, 512 authorized distributors and 260 authorized systems integrators located throughout the United States alone, as well as Rockwell Automation representatives in every major country in the world.

Local Product Support

Contact your local Rockwell Automation representative for:

- sales and order support
- product technical training
- warranty support
- support service agreements

Technical Product Assistance

If you need to contact Rockwell Automation for technical assistance, please review the troubleshooting information first. If the problem persists, then call your local Rockwell Automation representative.

Your Questions or Comments on this Manual

If you find a problem with this manual, please notify us of it on the enclosed How Are We Doing form.

About This Preface

This preface describes how to use this manual. The following table describes what this preface contains and its location.

For information about:	See page:
Who Should Use This Manual	Preface-1
Purpose of This Manual	Preface-1
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Who Should Use This Manual

You must be able to program and operate an Allen-Bradley Control**Logix**™ Logix controller and ControlLogix I/O modules to efficiently use your SynchLink™ module.

We assume that you know how to do this in this manual. If you do not, refer to Related Documentation, before you attempt to use this module.

IMPORTANT

SynchLink should be used in conjunction with a standard control network, such as ControlNet or Ethernet. A standard network is used for general control interlocking and transfer of diagnostic data across the system.

SynchLink does not function as a standard control network (e.g. it broadcasts data in a unidirectional manner).

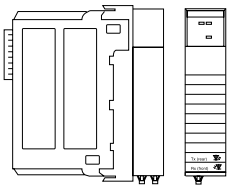
Purpose of This Manual

This manual describes how to install, configure, and troubleshoot your ControlLogix SynchLink module.

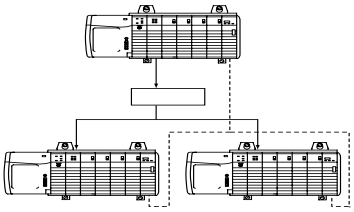
What This Manual Contains

This user manual contains the following sections:

Chapter 1 - What is the 1756-SYNCH module?
Description of the SynchLink module

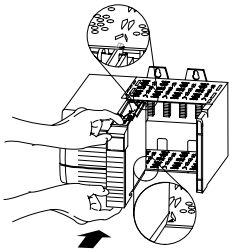


Chapter 2 - Time Synchronization in the ControlLogix System
Description of how the SynchLink module synchronizes time in the ControlLogix system

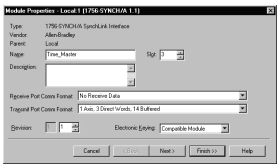


Chapter 3 - SynchLink Module Features
Description of the SynchLink module certifications and general features

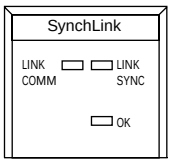
Chapter 4 - Installing the SynchLink Module
Description of how to install the SynchLink module and connect the fiber optic cable



Chapter 5 - Configuring the SynchLink Module
Description of how to configure the SynchLink module with RSLogix 5000

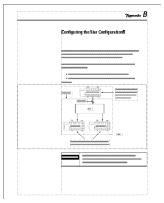


Chapter 6 - Troubleshooting the SynchLink Module
Description of how to troubleshoot the SynchLink module



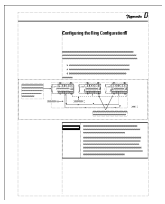
Appendix A - Specifications
Listing of the SynchLink module specifications

Appendix B - Configuring the Star Configuration
Example of how to configure the SynchLink Star Configuration



Appendix C - Configuring the Daisy Chain Configuration
Example of how to configure the SynchLink Daisy Chain Configuration

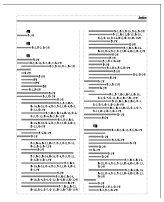
Appendix D - Configuring the Ring Configuration
Example of how to configure the SynchLink Ring Configuration



Appendix E - Software Configuration Tags
Complete list of all the input and output data tags

Glossary
Glossary of terms used with the SynchLink module

Index
Index of terms and concepts explained thoughout this user manual



Related Products and Documentation

The following table lists related ControlLogix products and documentation:

Table Preface.A
Related Documentation

Catalog number:	Document title:	Pub. number:
1756-SYNCH	ControlLogix SynchLink Module Installation Instructions	1756-IN575
1756-A4, -A7, -A10, -A13	ControlLogix Chassis Installation Instructions	1756-IN080B
1756-PA72, -PB72	ControlLogix Power Supply Installation Instructions	1756-5.67
1756-PA75, -PB75	ControlLogix Power Supply Installation Instructions	1756-5.78
1756-Series	ControlLogix Module Installation Instructions (Each module has separate installation document.)	Multiple 1756-IN numbers
1756-Series	ControlLogix System User Manual	1756-UM001
Multiple numbers	SynchLink Design Guide	1756-TD008
1751-SLBA	SynchLink Base Block Installation Instructions	1751-IN001
1751-SL4SP	SynchLink 4-port Splitter Block Installation Instructions	1751-IN002
1751-SLBP	SynchLink Bypass Switch Block Installation Instructions	1751-IN003
1756-DM	ControlLogix Drive Module Installation Instructions	1756-IN577
1756-DM	ControlLogix Drive Module User Manual	1756-UM522
	PowerFlex 700S User Manual	20D-UM001

If you need more information on these products, contact your local Allen-Bradley integrator or sales office for assistance. For more information on the documentation, refer to the Allen-Bradley Publication Index, publication SD499.

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What is the 1756-SYNCH module?

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Glossary

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What is the 1756-SYNCH module?

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

For information on:	See page:
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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 1-7.
- 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.A.

Table 1.A
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)	2
1403-CF005	5m (16.4ft)	2
1403-CF010	10m (32.8ft)	1
1403-CF020	20m (65.6ft)	1
1403-CF050	50m (164ft)	1
1403-CF100	100m (328ft)	1
1403-CF250	250m (820ft)	1

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 page 2-8.

For more information the hub components available for use with the SynchLink module, see Table 1.B

Table 1.B
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.

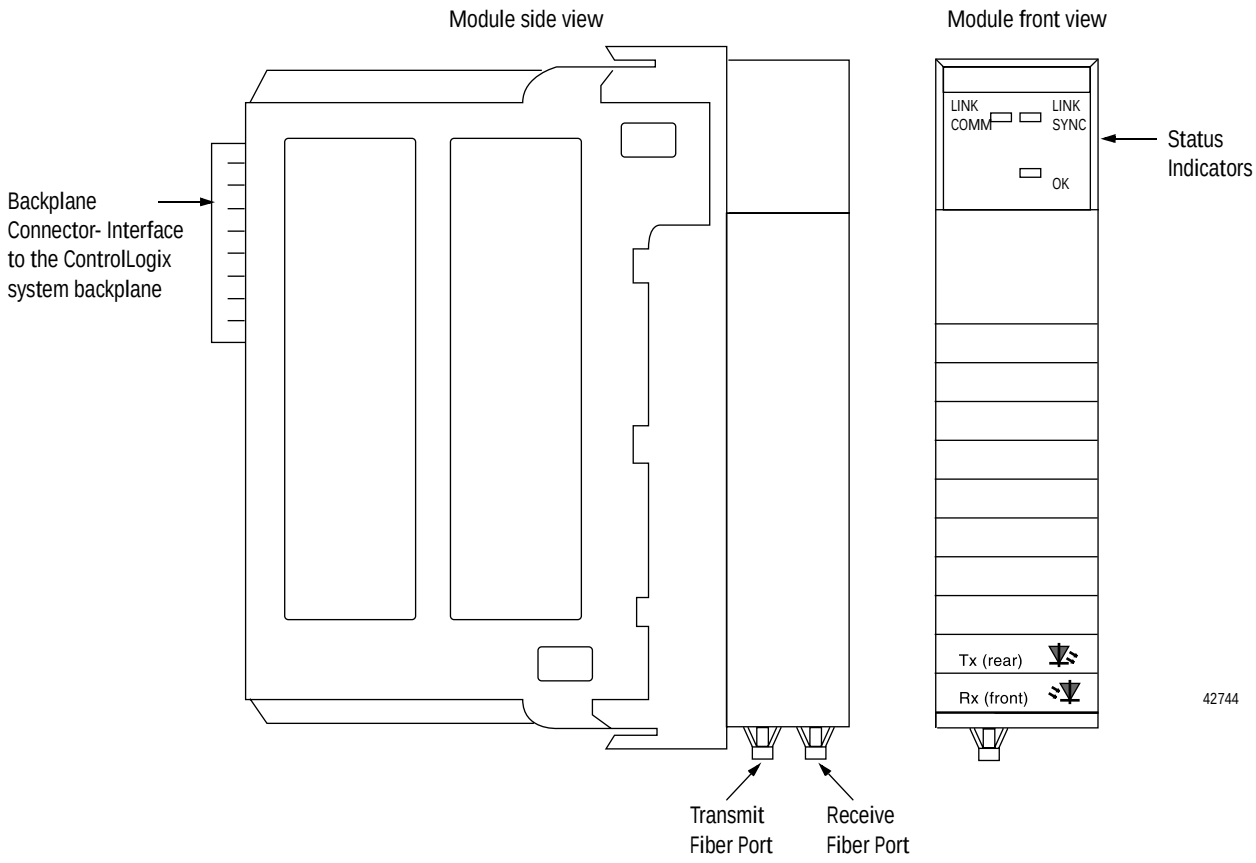
Before you install and use your module you should have already:

- installed and grounded a 1756 chassis and power supply. For more information, refer to the publications listed in Table 1.C.

Table 1.C
Chassis and Power Supply Documentation

Catalog number:	Document title:	Pub. number:
1756-A4, -A7, -A10, -A13	ControlLogix Chassis Installation Instructions	1756-IN080
1756-PA72, -PB72	ControlLogix Power Supply Installation Instructions	1756-5.67
1756-PA75, -PB75	ControlLogix Power Supply Installation Instructions	1756-5.78
1756-PA75R/A, -PB75R/A	ControlLogix Redundant Power Supply Installation Instructions	1756-IN573

Physical Features of the ControlLogix SynchLink Module



Backplane Connector - The backplane connector connects the module to the ControlLogix chassis backplane.

Status Indicators - The status indicators display the module's communications and SynchLink system status.

Transmit Fiber Port - The transmit fiber port allows connection (via fiber optic cables) to other SynchLink modules so the module can send data.

Receive Fiber Port - The receive fiber port allows connection (via fiber optic cables) to other SynchLink modules so the module can receive data.

Using Module Identification and Status Information

Each ControlLogix SynchLink module maintains specific identification information that separates it from all other modules. This information assists you in tracking all the components of your system.

For example, you can track module identification information to be aware of exactly what modules are located in any ControlLogix rack at any time. While retrieving module identity, you can also retrieve the module's status.

Each module maintains the following information:

Table 1.D
Module Identification and Status Information

Module Identification:	Description:
Product Type	Module's product type, such as Digital I/O or Analog I/O module
Catalog Code	Module's catalog number
Major Revision	Module's major revision number
Minor Revision	Module's minor revision number

Table 1.D
Module Identification and Status Information

Module Identification:	Description:
Status	Module's status. Returns the following information: • Controller ownership (if any) • Whether module has been configured • Device Specific Status, such as: – Self-Test – Flash update in progress – Communications fault – Not owned (outputs in program mode) – Internal fault (need flash update) – Run mode • Minor recoverable fault • Minor unrecoverable fault • Major recoverable fault • Major unrecoverable fault
Vendor ID	Module manufacturer vendor, for example Allen-Bradley
Serial Number	Module serial number
Length of ASCII Text String	Number of characters in module's text string
ASCII Text String	Number of characters in module's text string

IMPORTANT You must use the WHO service in the RSLinx software to retrieve this information. For more information on how to retrieve module identification information, see the RSLinx online help.

Preventing Electrostatic Discharge

This module is sensitive to electrostatic discharge.

ATTENTION

Preventing Electrostatic Discharge

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- If available, use a static-safe workstation.
- When not in use, store the equipment in appropriate static-safe packaging.

Removal and Insertion Under Power

These modules are designed to be installed or removed while chassis power is applied.

WARNING

When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

Chapter Summary and What's Next

In this chapter, you learned about the ControlLogix SynchLink module. For information about Time Synchronization in the ControlLogix System, see Chapter 2.

Time Synchronization in the ControlLogix System

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

For information on:	See page:
Using the Coordinated System Time (CST)	2-2
Time Synchronization in a Distributed Control System	2-2
Time Synchronization in the SynchLink System	2-2
How Do the CST Clock and SynchLink Node Clock Work Together?	2-5
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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 Part of this chapter describes the differences between ControlLogix systems that do and do not use the SynchLink module. In systems that use the SynchLink module, a Logix controller must reside in every chassis that contains a SynchLink module.

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. This distributed control system is identified as a SynchLink system.

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.

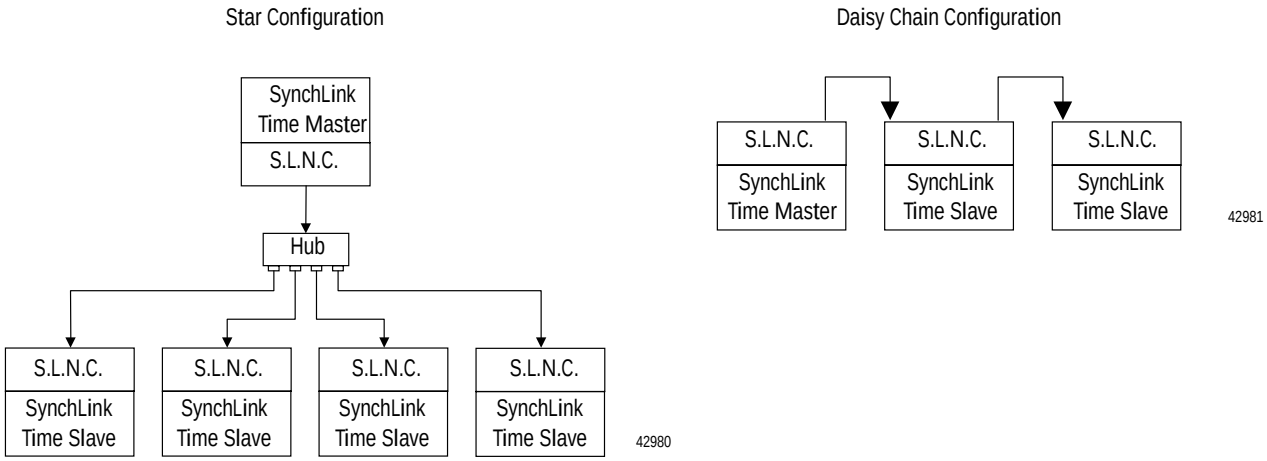
SynchLink Node Clock

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.

Since SynchLink is a unidirectional, broadcasting mechanism, the master is always placed at the beginning of a SynchLink system, regardless of topology, as shown in Figure 2.1.

Figure 2.1



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

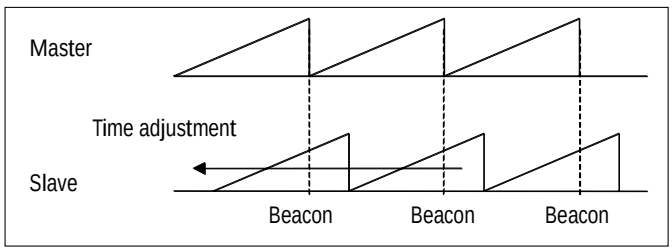
System Synchronization

When a SynchLink system is initialized, the individual SynchLink nodes power-up at separate times and the individual SynchLink node clocks begin to count at arbitrary points in time. When this occurs, the system is not yet synchronized. As the master node clock counts, it reaches a point where it rolls over and goes back to zero.

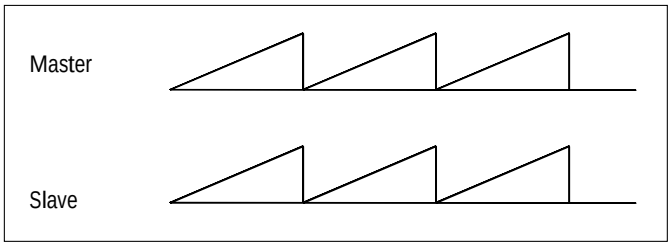
When the rollover occurs, the SynchLink master transmits a beacon signal to the SynchLink time slaves; the beacon is included in the control field of the transmitted message. When the SynchLink Time Slave receives the first message with the beacon signal, it begins to adjust the 1 microsecond time base of its node clock to synchronize with the master clock. This process can be gradual or immediate, depending on the product implementation.

Figure 2.2

Initial Start-Up

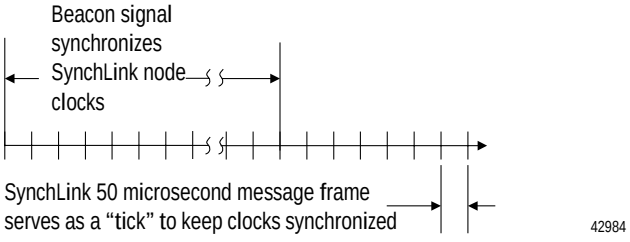


Synchronized Operation



After a SynchLink Time Slave is synchronized with the Time Master, each SynchLink frame that is transmitted serves as a 50µS “tick” (or mark) used for the periodic adjustment of its clock’s 1µS time base. This process provides highly accurate results.

Figure 2.3



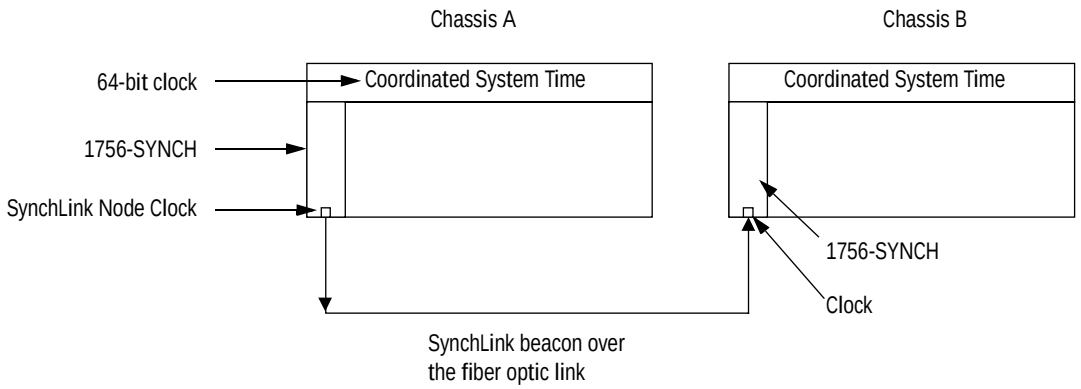
How Do the CST Clock and SynchLink Node Clock Work Together?

As stated earlier, the ControlLogix Coordinated System Time clock (CST) is a 64-bit clock on the ControlLogix backplane. It is used as the main time reference for all modules plugged into a ControlLogix chassis. The SynchLink node clock is used to establish the time reference on the SynchLink fiber.

Figure 2.4 illustrates how the SynchLink node clock and the CST time reference are coordinated in a system. In this example, the SynchLink modules in chassis A & B synchronize the CST clock in chassis B with the CST reference in chassis A.

Chassis A is the Time Master for the system. When the SynchLink module strobes the beacon signal onto the fiber optic link, it also transmits the CST time reference value that tells the downstream node what time it is as the beacon occurs. The downstream chassis receives the CST time reference and synchronizes its time with the CST reference value on the beacon signal.

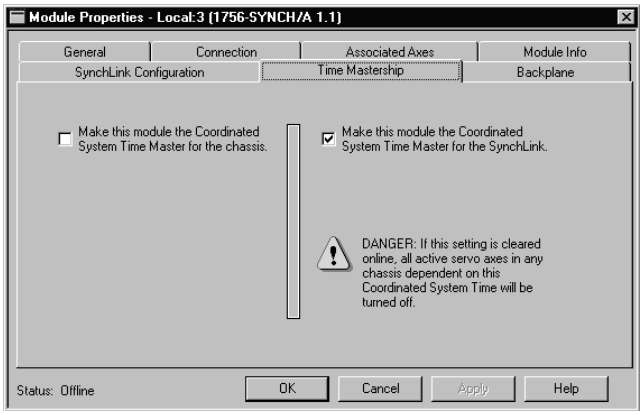
Figure 2.4



Configuring Time Mastership Functionality

In the example shown in Figure 2.4, you configure time mastership for the system when initially configuring the module. In the “Module Properties” software screens, the “Time Mastership” tab offers you the option to select the 1756-SYNCH module as the CST Time Master for the chassis, or, the Time Master on SynchLink. For any SynchLink system, there can only be one Time Master for the entire system. All other connected devices must be time slaves.

Use the following RSLogix 5000 configuration screen to establish time mastership in Chassis A of Figure 2.4:

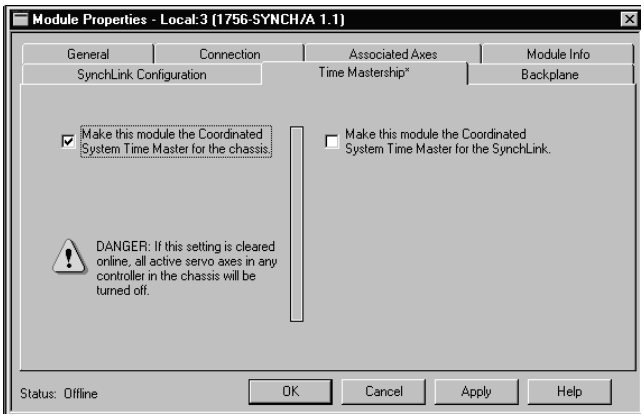


By checking the *Make this module the Coordinated System Time Master for the SynchLink* box, you:

- establish the SynchLink node clock on this module as the SynchLink Time Master.
- establish the chassis as the CST Time Master on SynchLink.

For more information on configuring your SynchLink modules, see Chapter 5.

You use the following RSLogix 5000 configuration screen to establish a Time Slave in Chassis B of Figure 2.4:



By checking the *Make this module the Coordinated System Time Master for the chassis* box, you:

- establish the SynchLink module as a Time Slave on SynchLink.
- establish the module as the CST Time Master of the local chassis.

The selection shown above (i.e. *Make this module the Coordinated System Time Master for the chassis*) is also optional for the CST Time Master chassis. If this selection is NOT selected in the Time Master chassis, another module on the backplane MUST be selected as the CST backplane master in order to allow the master chassis to have a CST reference value. Other modules that could be CST time masters are ControlLogix controllers and other 1756-SYNCH modules. Only one CST master can exist in a chassis at one time.

For more information on configuring your SynchLink modules, see Chapter 5.

What are the SynchLink Configurations?

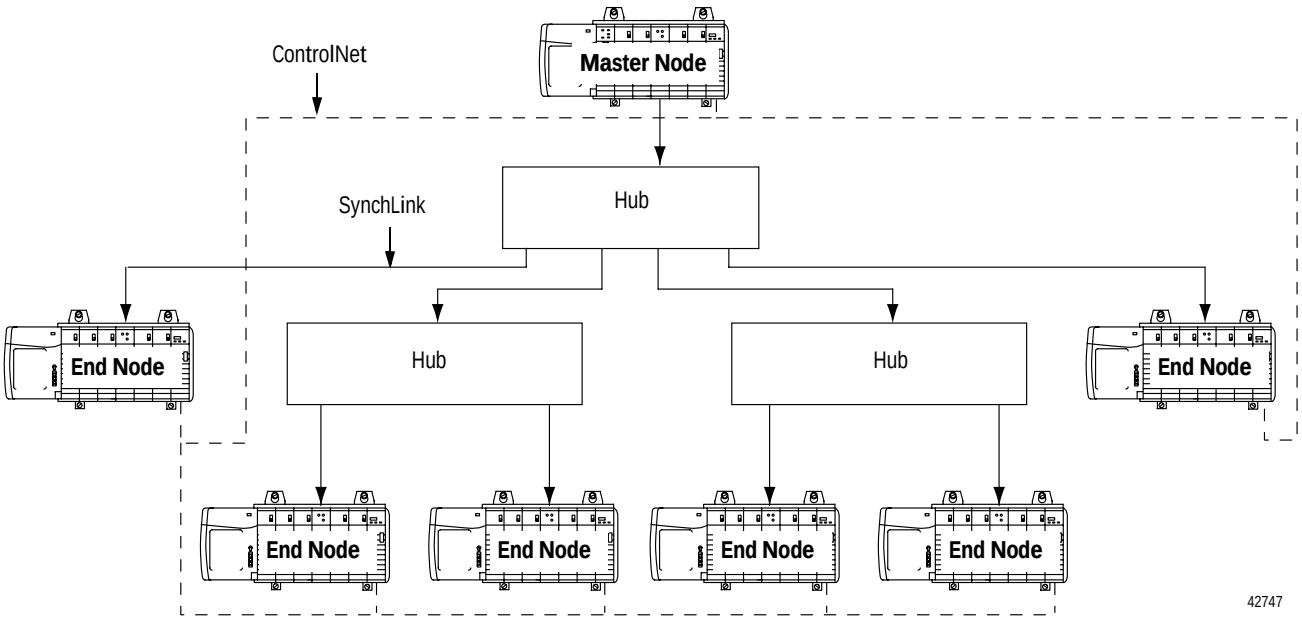
SynchLink communications are a unidirectional data transfer from one SynchLink node to another. Each configuration starts with a single Master Node. The SynchLink network can be configured in the following ways.

- Star Configuration
- Daisy Chain Configuration
- Ring Configuration

Do not mix the configurations (i.e. begin in the star configuration and change to the daisy chain configuration). Examples of these configurations are shown in the following sections.

Star Configuration

The star configuration transfers data from a Master Node through Hubs to End Nodes.



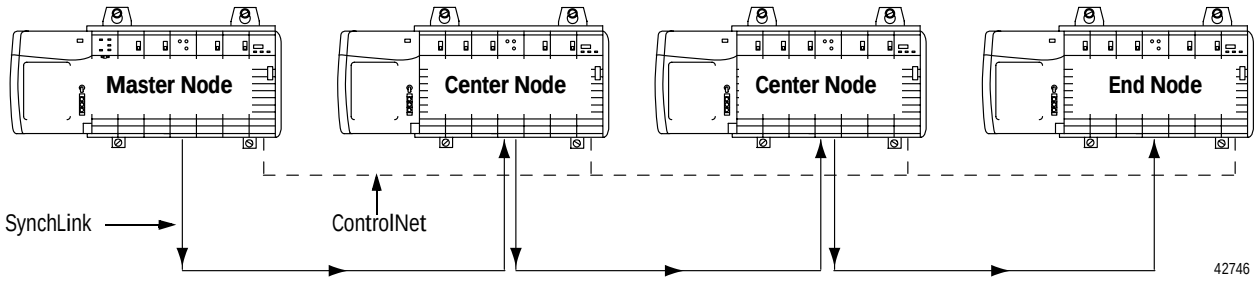
IMPORTANT The star configuration supports 2 layers of hubs with up to 16 end nodes connected to each hub.

A maximum of 257 SynchLink modules (including the Master Node) can be connected in the star configuration.

For an example of how to configure a Star configuration, see Appendix B.

Daisy Chain Configuration

In the daisy chain configuration, the SynchLink network starts at the Master Node and ends at an End Node. You can include Center Nodes (shown in Figure) in the configuration as needed.



IMPORTANT In the daisy chain configuration, you can use a maximum of 10 nodes, including the master and end nodes.

Also, the only difference between Center and End Nodes is their physical location.

In the **daisy chain** configuration the time synchronization process is more complicated than in the star. It's based on the following rules.

- Each node enable its transmitter right after it has received the first message from the upstream node.
- Each node can generate and transmit the beacon signal regardless of whether it has received one or not.
- Each node is a Time Slave of its upstream node and will attempt to synchronize with it.

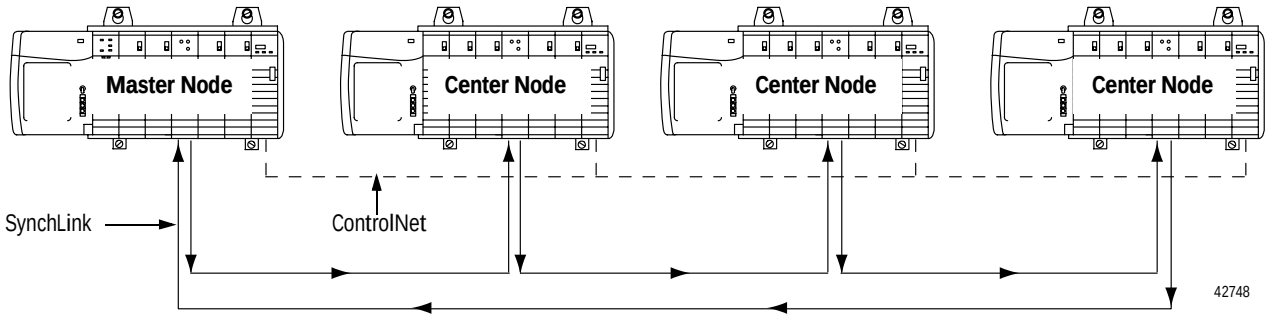
The Master node must be set as the SL Time Master. Its node clock is the SynchLink system clock. After power-up, the Master node begins to transmit a message every 50µS. As soon as the node connected to it receives the first of these messages, it begins to send messages to its downstream node. Eventually, all center nodes are transmitting messages.

As soon as a node receives the first message with the beacon signal, it starts to synchronize its node clock with the upstream node clock. The node connected to the Master, is the first to synchronize its clock with the SynchLink system clock. This process then propagates down the daisy chain until all nodes are synchronized with the Master.

For an example of how to configure a Daisy Chain configuration, see Appendix C.

Ring Configuration

The ring configuration is a permutation of the daisy chain configuration. In the ring chain configuration, the SynchLink network starts and ends at the Master Node. You can include Center Nodes (shown in Figure) in the configuration as needed.



IMPORTANT In the ring chain configuration, you can use a maximum of 10 nodes.

For an example of how to configure a Ring configuration, see Appendix D.

Cable Usage

You must use fiber optic cable to connect SynchLink modules in all configurations. For more information on choosing the correct cable lengths for your application, see the SynchLink System Overview, publication .

Chapter Summary and What's Next

In this chapter, you learned how the ControlLogix SynchLink module fits into the ControlLogix system. For more information on SynchLink Module Features, see Chapter 3.

Notes:

SynchLink Module Features

This chapter describes the ControlLogix SynchLink module features.

For information on:	See page:
General Module Features	3-1
Configurable Module Features	3-4
Chapter Summary and What's Next	3-16

General module features are features (e.g. Removal and Insertion Under Power) that are supported on the module regardless of configuration and application.

Configurable module features are features (e.g. Communications Format) that can be configured to work differently in various SynchLink applications.

General Module Features

The following general module features are available with the ControlLogix SynchLink module:

- Removal and Insertion Under Power (RIUP)
- Module Fault Reporting
- Fully Software Configurable
- LED Status Information
- Class I Division 2 Certification
- Agency Certification

Removal and Insertion Under Power (RIUP)

All ControlLogix SynchLink modules may be removed and inserted from the chassis while power is applied. This feature allows greater availability of the overall control system because, while the module is being removed or inserted, there is no additional disruption to the rest of the controlled process.

Although there is no disruption to other devices when the SynchLink module is removed and inserted from the chassis while power is applied, the removal and insertion will break communications between SynchLink modules and will impact the performance of the SynchLink system.

Removing and reinserting the SynchLink module under power also impacts overall system performance and operation because the ControlLogix chassis are no longer synchronized. Depending on the application, removing and reinserting the SynchLink module under power may cause significant changes to an application, including the possibility of a system E-Stop (emergency stop).

Because of its impact on other chassis, the removal of a SynchLink module while under power may cause personal injury or property damage.

WARNING

When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

Module Fault Reporting

ControlLogix SynchLink modules provide both hardware and software indication when a module fault has occurred. Each module's LED fault indicator and RSLogix 5000 will graphically display this fault and include a fault message describing the nature of the fault.

This feature allows you to determine how your module has been affected and what action should be taken to resume normal operation.

Fully Software Configurable

The RSLogix 5000 software uses a custom, easily understood interface to write configuration. All module features are enabled or disabled through the I/O configuration portion of the software.

You can also use the software to interrogate any module in the system to retrieve

- serial number
- revision information
- catalog number
- vendor identification
- error/fault information

By eliminating such tasks as setting hardware switches and jumpers, the software makes module configuration easier and more reliable.

LED Status Information

The ControlLogix SynchLink module has LED indicators on the front of the module that allow you to check the module health and operational status.

The following status can be checked with the LED indicators:

- SynchLink and ControlLogix backplane status
- Module health status

For examples of LED indicators, see page 6-1.

Class I Division 2 Certification

The ControlLogix SynchLink module is certified for use in nonhazardous locations as well as Class I, Division 2 hazardous Locations containing gas groups A, B, C, and D. This equipment may be used as a component of a control system which is certified to operate in hazardous locations.

WARNING

When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Agency Certification

When the SynchLink module is marked appropriately, the following agency certifications apply:

- UL Listed Industrial Control Equipment
- CSA Certified Process Control Equipment
- CSA Certified for Class I, Division 2 Hazardous Locations

Configurable Module Features

The following SynchLink module features are configurable via RSLogix 5000:

- Communications Format
- Electronic Keying
- Requested Packet Interval
- SynchLink Transmitted Axes
- Transmitted Direct Words
- CST and SynchLink Mastership

Each of these features is described in this section, including information on which RSLogix 5000 configuration screen should be used to configure the feature. For an overview of the entire configuration process, see Chapter 5, Configuring the SynchLink Module. For configuration examples, see the following appendices B (Configuring the Star Configuration), C (Configuring the Daisy Chain Configuration), and D (Configuring the Ring Configuration).

Communications Format

The communications format defines the connection between the owner-controller and the module (i.e. determines what type of data is transferred between them). The SynchLink module can receive and transmit data and, therefore, uses a Receive Port Communications Format and Transmit Port Communications Format.

SynchLink messages that are structured as six 32-bit words; the words are divided into three types:

- Direct - Data delivered in a single message. A SynchLink message can contain a maximum of four direct data words; each word is 32 bits in length. Direct data can be automatically forwarded to the next node in the daisy chain and ring configurations.

  Direct data is typically only used in a daisy chain configuration.

- Buffered - Data that exceeds the four word limit of a direct data transfer. Buffered data is appropriately segmented at the transmitting module and reassembled at the receiving module. Buffered data cannot be automatically forwarded to the next node in the daisy chain and ring configurations.

- Axis data - Motion data used by the motion planner in the controller. The 1756-SYNCH module can consume an Axis tag from a controller and pass it over SynchLink. A controller in another chassis can then consume axis tags passed over SynchLink from the 1756-SYNCH module in that chassis. This data is not automatically forwarded in a Daisy Chain.

Module-Defined Data Tags

When you create a module, module-defined data types and tags are created in the RSLogix 5000 programming software. These tags allow you to access the Input and Output Data of the module via the controller's ladder logic, if necessary

The types of tags created vary, depending on which communications format you choose when creating a module. There are two types of tags:

- Input Data Tags
- Output Data Tags

For a complete listing of all the module-defined data tags available on your SynchLink module, see Appendix E.

Multiple Port Communications Formats in Single Module

You must set a communications format for receiving data (Receive Port Communications Format) and transmitting data (Transmit Port Communications Format) in each SynchLink module.

The following requirements apply to communication format choices:

- If a SynchLink module does not receive data (e.g. a SynchLink Time Master in a star or daisy chain configuration), you must choose the *No Receive Data* Receive Port communication format.
- If a SynchLink module does not transmit data (e.g. an end node), you must choose the *No Transmit Data* Transmit Port communications format.
- The receive communication format for any SynchLink module that receives data (i.e. is not the SynchLink Time Master) must match the transmit communications format of the upstream node in the system. For example, if the Time Master SynchLink module uses a *2 Axis* Transmit Port communication format, the SynchLink module physically connected to the Time Master must use a *2 Axis* Receive Port communications format.

IMPORTANT

The receive and transmit on the same module do not have to match.

Also, once the module is created, the communications format cannot be changed. The module must be deleted and recreated.

Internal Scan on SynchLink Module

Every 500µS, the SynchLink module scans its internal hardware and captures a "snapshot" of the data there. This data is then sent to the local owner-controller. But, depending on the communications formats chosen during module configuration, data types are transmitted between SynchLink nodes (via the fiber optic cable) at various rates and may be transmitted multiple times between the 500µS snapshots.

IMPORTANT

The transfer rate times listed in Table 3.A and Table 3.B only represent the rate at which data is passed between SynchLink modules over the fiber optic cable.

Although the data is passed over the fiber optic cable at various rates, depending on the communications format choices, the **owner-controllers** in each local chassis only **receive the data** after the local SynchLink module's internal scan **every 500µS**.

The SynchLink module updates its receive and transmit buffers once every 500µS. Because direct data can be passed through from node to node once every 50µS, up to 10 nodes can be updated with direct data in a single 500µS SynchLink scan. Pass-through functionality only applies to direct data in a daisy chain configuration, though; axis data and buffered data cannot be passed through. Instead, these data types require the intervention of the local controller to move data along. For this reason, it is **not recommended** that a daisy chain configuration be used when distributing axis data among multiple axis in a distributed control system.

For more information on the available Receive Port and Transmit Port communication formats, see Table 3.A.

Table 3.A
SynchLink Module Communications Formats

Receive Port Communications Format	Transfer Rate (across the fiber optic cable) for Each Data Type:
1 Axis, 3 Direct Words, 14 Buffered	Axis Data - Updated every 500µS Direct Data - Updated every 50µS Buffered Data - Updated every 500µS
2 Axis	Axis Data - Updated every 250µS
2 Axis, 3 Direct Words	Axis Data - Updated every 500µS Direct Data - Updated every 50µS
2 Direct Words, 18 Buffered	Direct Data - Updated every 50µS Buffered Data - Updated every 250µS
4 Direct Words, 18 Buffered	Direct Data - Updated every 50µS Buffered Data - Updated every 500µS
4 Direct Words, 8 Buffered	Direct Data - Updated every 50µS Buffered Data - Updated every 250µS
No Receive Data	No data updated in this format

Table 3.B
SynchLink Module Communications Formats

Transmit Port Communications Format	Transfer Rate (across the fiber optic cable) for Each Data Type:
1 Axis, 3 Direct Words, 14 Buffered	Axis Data - Updated every 500µS Direct Data - Updated every 50µS Buffered Data - Updated every 500µS
2 Axis	Axis Data - Updated every 250µS
2 Axis, 3 Direct Words	Axis Data - Updated every 500µS Direct Data - Updated every 50µS
2 Direct Words, 18 Buffered	Direct Data - Updated every 50µS Buffered Data - Updated every 250µS
4 Direct Words, 18 Buffered	Direct Data - Updated every 50µS Buffered Data - Updated every 500µS
4 Direct Words, 8 Buffered	Direct Data - Updated every 50µS Buffered Data - Updated every 250µS
Listen Only, No Transmit Data	No data updated in this format
No Transmit Data	No data updated in this format

Electronic Keying

Instead of plastic mechanical backplane keys, electronic keying allows the ControlLogix system to control what modules belong in the various slots of a configured system.

During module configuration, you must choose one of the following keying options for your SynchLink module:

- Exact Match
- Compatible Match
- Disable Keying

When the controller attempts to connect to and configure a SynchLink module (e.g. after program download), the module compares the following parameters before allowing the connection and configuration to be accepted:

- Vendor
- Product Type
- Catalog Number
- Major Revision
- Minor Revision

The comparison is made between the keying information present in the SynchLink module and the keying information in the controller's program. This feature can prevent the inadvertent operation of a control system with the wrong module in the wrong slot.

Exact Match

All of the parameters listed above must match or the inserted module will reject a connection to the controller.

Compatible Match

The Compatible Match mode allows a SynchLink module to determine whether it can emulate the module defined in the configuration sent from the controller.

With ControlLogix SynchLink modules, the module can emulate older revisions. The module will accept the configuration if the controller's major.minor revision is less than or equal to the physical module's revision.

For example, if the configuration contains a major.minor revision of 2.7, the module inserted into the slot must have minor revision of 2.7 or higher for a connection to be made.

TIP

We recommend using Compatible Match whenever possible. Remember, though, the module will only work to the level of the configuration.

For example, if a slot is configured for a module with major.minor revision of 2.7 and you insert a module with a major.minor revision of 3.1, the module works at the 2.7 level despite having been previously upgraded.

If possible, we suggest you make sure configuration is updated to match the revision levels of all SynchLink modules. Failure to do so may not prevent the application from working but may defeat the purpose of upgrading your modules' revision levels.

Disable Keying

The inserted module attempts to accept a connection to the controller regardless of its type.

ATTENTION

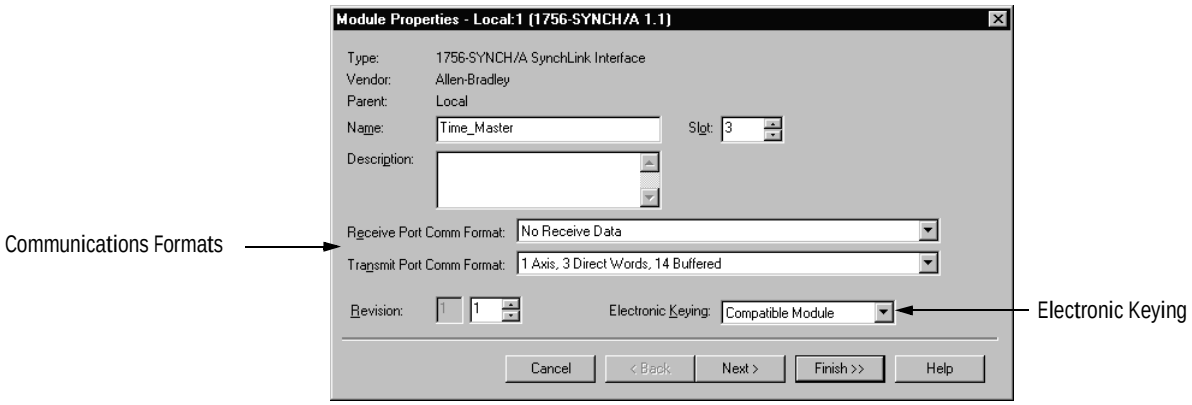
Be extremely cautious when using the disable keying option; if used incorrectly, this option can lead to personal injury or death, property damage or economic loss.

If keying is disabled, a controller makes a connection with most modules of the same type as that used in the slot configuration.

A controller will not establish a connection if any of the following conditions exist, even if keying is disabled:

- The slot is configured for one module type (e.g. digital input module) and a module of another type (e.g. SynchLink module) is inserted in the slot.
- The module inserted into the slot cannot accept some portion of the configuration. This case should not arise if the slot is configured for a SynchLink module and one is inserted.

The Communications Format and Electronic Keying features are configured on the following screen.



Requested Packet Interval

The Requested Packet Interval (RPI) is a configurable parameter that defines when the module multicasts its data onto the local chassis backplane. In the SynchLink module, though, the RPI's role is dictated by the data the SynchLink transfers.

Axis Data

The RPI does not have an effect on produced or consumed axis data. In a distributed motion control application, the coarse planner update establishes the timing of the axis data updates from the producing controller to the consuming 1756-SYNCH module in the master chassis. Likewise, in the slave chassis, the RPI parameter does not affect the delivery of the axis data to the consuming processor. This data is produced at the coarse update rate established in the master chassis.

Buffered, Direct and Diagnostic Data - RPI Effect on Input Data (to the controller)

The RPI is one of two mechanisms available through the 1756-SYNCH module to update the module's input data onto the backplane. Input data is transferred from the SynchLink module to its owner-controller at the rate defined in the RPI.

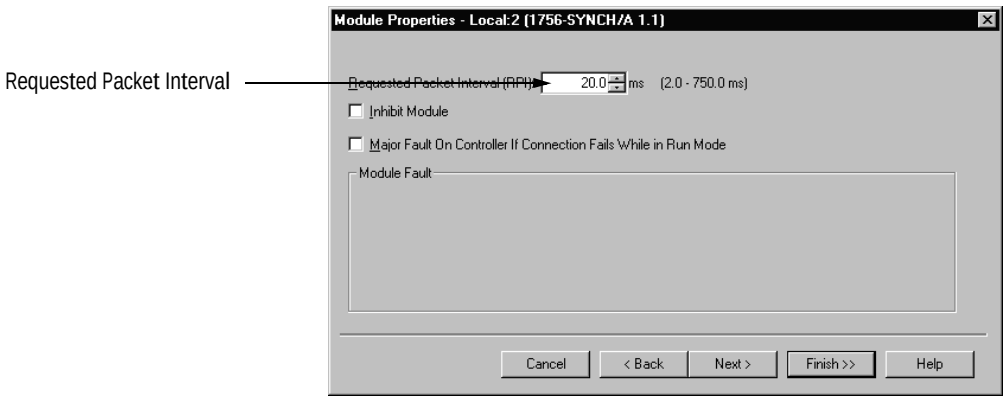
In addition to the RPI, Change of State (COS) functionality also causes the module to produce its data to the consuming controller whenever the values of the data changes. The RPI timer is asynchronous to the COS functionality. Both cause the module to produce data when triggered.

Buffered, Direct and Diagnostic Data - RPI Effect on Output Data (from the controller)

As a producing controller writes data to the 1756-SYNCH module, the output data is placed in a local buffer until the next RPI reset occurs. When the RPI timer expires, the output data is moved from the controller's local buffer to the 1756-SYNCH module.

The RPI timer is asynchronous to the program execution. Therefore, a worst case update to the SynchLink module can be calculated by adding the program execution time to the RPI timer setting, as configured by the user.

The SynchLink module **minimum RPI** = 2.0mS. The RPI is configured on the following screen:

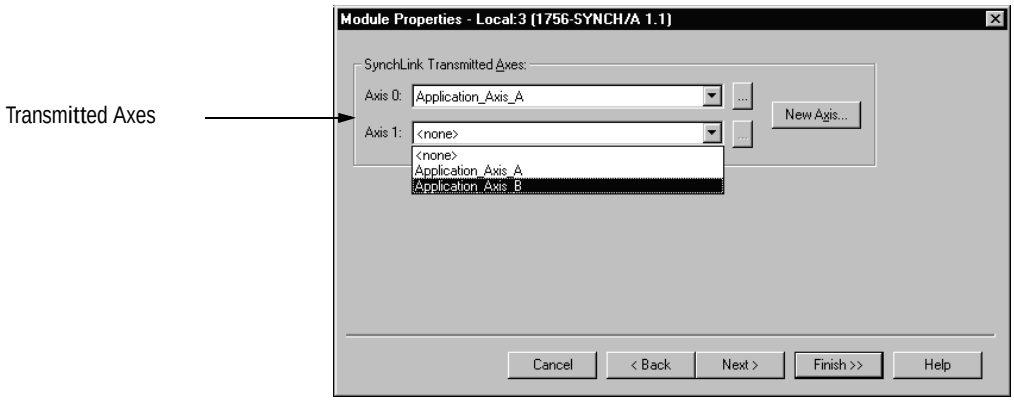


SynchLink Transmitted Axes

Most applications using the ControlLogix SynchLink module use it for Remote Axis Control. You can use the SynchLink module to produce axes from a master chassis and broadcast the data to other chassis. The module can produce and consume two axes (i.e. Axis 0 & Axis 1).

Slave chassis consume the broadcast axis data and redistribute it to their local motion planners (i.e. the Logix controller in their local chassis). With this configuration, you can control multiple axes synchronously throughout the system.

The SynchLink Transmitted Axes are configured on the following screen:



For an example configuration that uses Remote Axis Data, see Appendix B, Configuring the Star Configuration.

IMPORTANT

This manual assumes you know how to set-up axis data tags for the data the controller in the Time Master chassis produces; this manual does not intend to explain how to plan the motion portion of your application as that is a controller function.

If you do not know how to set-up remote axis data tags and account for them in the motion portion of your application, see the ControlLogix Motion Module Setup & Configuration User Manual, publication 1756-6.5.16.

Transmitted Direct Words

The SynchLink module can transmit data from the following direct word sources:

- Output Direct Words (0-3)
- Received Direct Words (0-3)
- Multiplier

In initial configuration, you can choose the Transmitted Direct Words, but you must use ladder logic to move data to those locations in data type tags. For more information on the data tags, see Appendix E.

Direct Words

Direct words are data delivered in a single message. A SynchLink message can contain a maximum of four direct data words; each word is 32 bits in length. Direct data can be automatically forwarded to the next node in the daisy chain configuration.

Multiplier

The Multiplier multiplies one Direct Word on the receive port by the value in the local tag "Local:x:O.Multiplier" before transmitting it out the transmit port. This is useful when your application requires fine adjustments to the direct word between SynchLink nodes.

EXAMPLE If the Direct Word 0 passes process status on and the local controller in the downstream chassis identifies a change in the process, you can use the multiplier to change the value of the direct word before passing it on to the next processor.

Although you can configure the multiplier for any of the Direct Words, it can only be used with one Direct Word at a time.

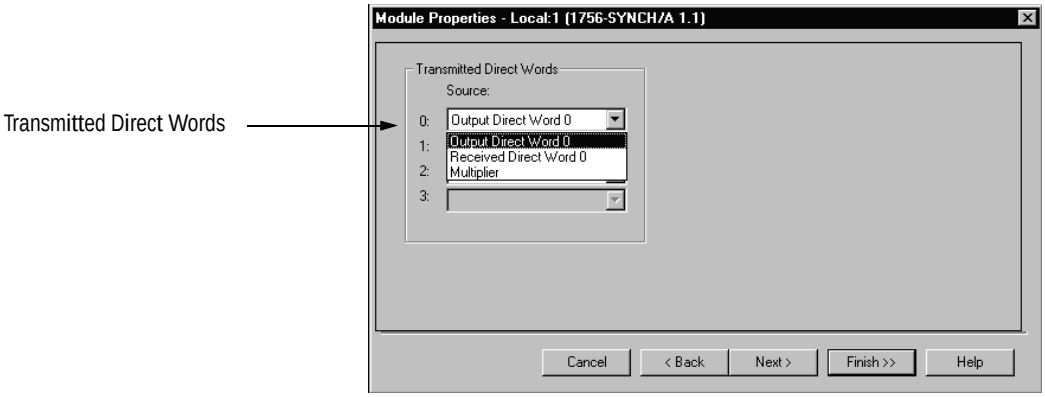
The multiplier can only transmit the same word it received (i.e. this feature does not allow your module to receive direct word 0 and transmit it as direct word 1). The multiplier is limited to 16 bits; any value used in the multipler larger than 65535 is truncated to 16 bits, and a multiplier overflow error (described below) is reported by the Synchlink module. Make sure any data that is passed onto the Output word is less than 65535 else you receive incorrect output data.

Mutiplier Overflow

The Multiplier Overflow bit is a data tag (Local.x.I.SynchLinkMultiplier Overflow) that exceeds the maximum multiplier value of 65535. This value is reported back to you through the input data tags.

IMPORTANT If you want to pass a Multiplier Overflow value (received from an upstream node) to a third node downstream but not multiple the direct word data transmitted to the downstream node, you must use a Multiplier value = 1.

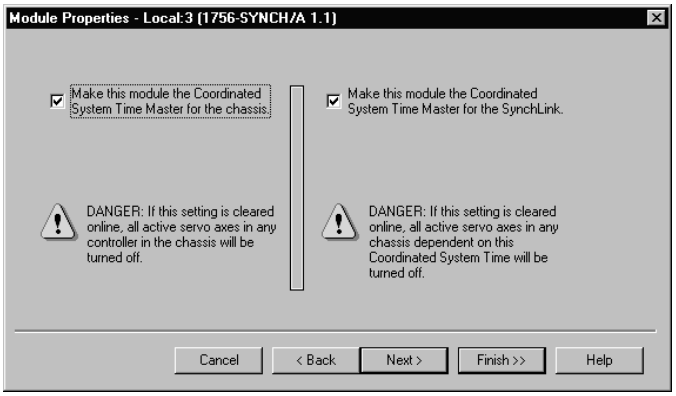
The Transmitted Direct Words are configured on the following screen:



CST and SynchLink Mastership

The SynchLink module can be configured for multiple mastership and slave roles in respect to the Coordinated System Time and the SynchLink. For more information on these roles, see Chapter 2, Time Synchronization in the ControlLogix System.

Time mastership is configured on the following screen.



Chapter Summary and What's Next

In this chapter, you learned about the ControlLogix SynchLink module features. For information about Installing the SynchLink Module, see Chapter 4.

Installing the SynchLink Module

This chapter describes how to install the ControlLogix SynchLink module.

For information on:	See page:
Noting the Power Requirements	4-1
Installing the Module	4-2
Connecting the Fiber Optic Cable	4-3
Removing the Module	4-4
Chapter Summary and What's Next	4-5

Noting the Power Requirements

This module receives power from the 1756 chassis power supply and requires 2 sources of power from the backplane:

- 1200mA at 5.1V dc
- 3mA at 24V dc

Add this current/power value (6.19W) to the requirements of all other modules in the chassis to prevent overloading the power supply.

Installing the Module

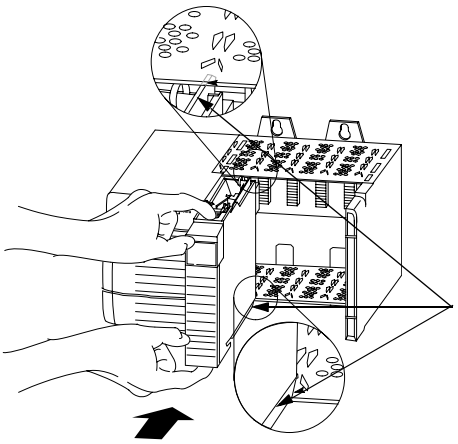
You can install or remove the module while chassis power is applied.

WARNING

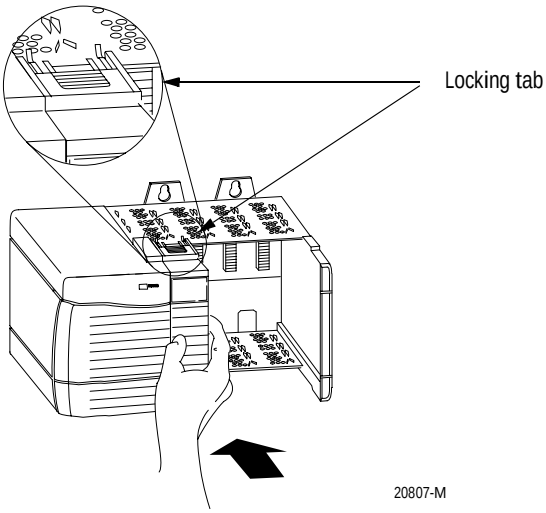
When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

1. Align the circuit board with the top and bottom chassis guides.



2. Slide the module into the chassis until the module locking tabs ‘click’.



Connecting the Fiber Optic Cable

Your 1756-SYNCH module has two ports for fiber optic cables. The front port is used to receive data, and the rear port is used to transmit data.

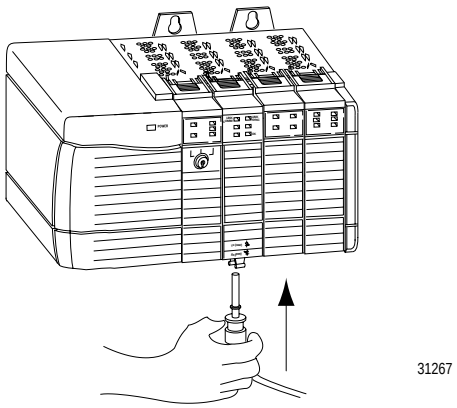
1. Remove the plugs from the ports at the bottom of the module.

TIP

Keep the plugs that were removed to connect the fiber optic cables. When the cables are disconnected, you can reinsert the plugs into the ports to protect them.

2. Connect the fiber optic cables as shown below.

Figure 4.1



ATTENTION

Do not look directly into the fiber ports or fiber cables. Light levels may cause damage to eyesight. The SynchLink module is a Class 1 LED product.

Table 4.A lists the possible connections that might be made to your 1756-SYNCH module and where to connect the fiber optic cable.

Table 4.A
Making Fiber Optic Cable Connections to the 1756-SYNCH Module

If your 1756-SYNCH module is configured to:	Make this fiber optic cable connection:
transmit data only	Connect the fiber optic cable to the rear port. The other end of the cable should be connected to a device receiving data over the SynchLink from your 1756-SYNCH module.
receive data only	Connect the fiber optic cable to the front port. The other end of the cable should be connected to a device transmitting data to your 1756-SYNCH module over the SynchLink.
transmit and receive data	1. Connect the fiber optic cable going to (i.e. transmitting the data to) a module receiving the data to the front port. 2. Connect the fiber optic cable coming from (i.e. receiving the data from) a module transmitting data to the rear port.

This completes installation. Use the next section to remove your SynchLink module if necessary.

Removing the Module

ATTENTION

Before you remove the module, you must disconnect the fiber optic cables.

1. Pull the fiber optic cable out of the connection port.

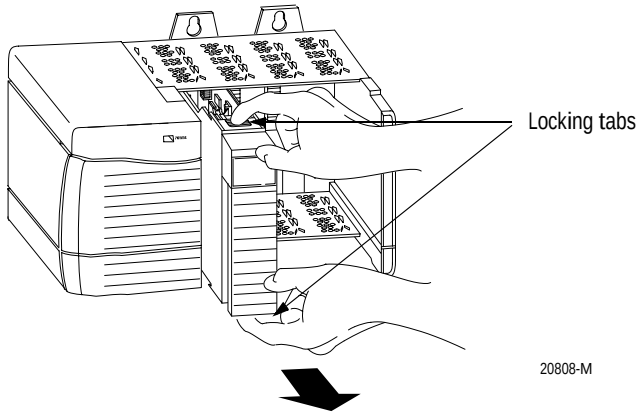
TIP

If you kept the plugs that were removed to connect the fiber optic cables, reinsert them to protect the ports.

2. Push in the top and bottom locking tabs.

3. Pull the module out of the chassis as shown.

Figure 4.2



Chapter Summary and What's Next

In this chapter, you learned how to install the ControlLogix SynchLink module. For information about Configuring the SynchLink Module, see Chapter 5.

Notes:

Configuring the SynchLink Module

This chapter describes how to configure the ControlLogix SynchLink module using RSLogix 5000 programming software.

For information on:	See page:
Overview of the Configuration Process	5-2
Choose a SynchLink Configuration	5-3
Chapter Summary and What's Next	5-10

You must configure your module upon installation. The module will not work until it has been configured.

This chapter offers a configuration overview and the three available ControlLogix SynchLink configurations. For specific examples of each configuration, see the following:

- Star Configuration - Appendix B - This example shows a configuration using Remote Axis Data.
- Daisy Chain Configuration - Appendix C
- Ring Configuration - Appendix D

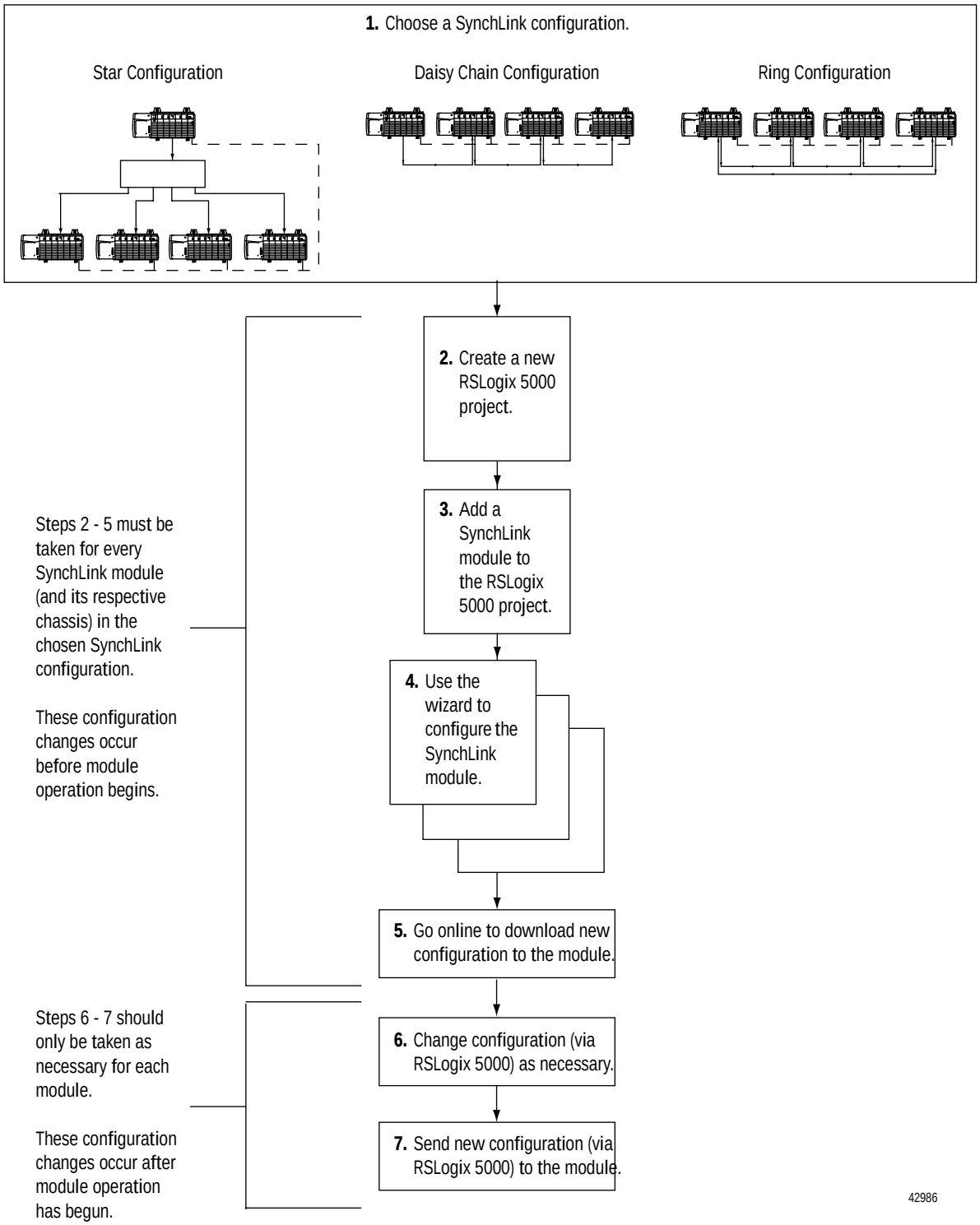
RSLogix 5000 Configuration Software

Use RSLogix 5000 to write configuration for your SynchLink module. You must write configuration for each module because module position in the SynchLink system affects configuration. For example, if a SynchLink module is the Time Master for the system, it must be configured as such.

Overview of the Configuration Process

Figure 5.1 shows an overview of the configuration process:

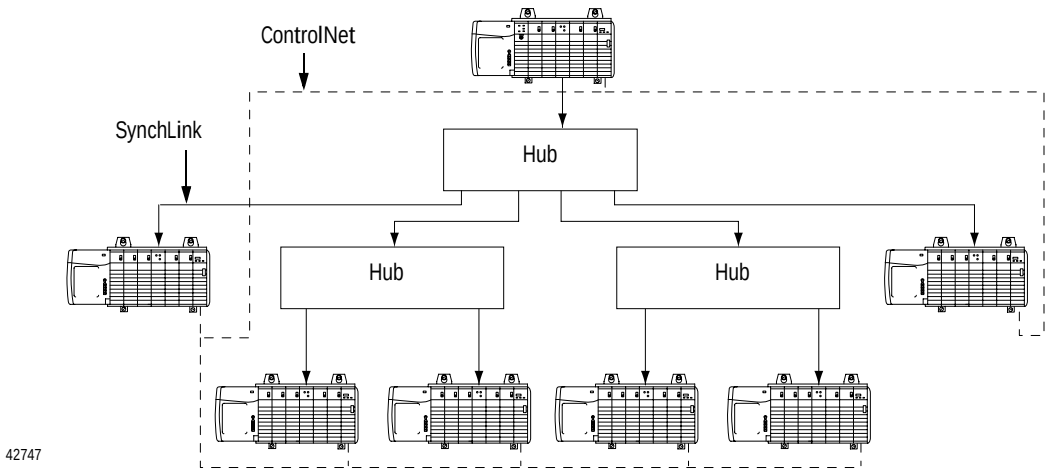
Figure 5.1



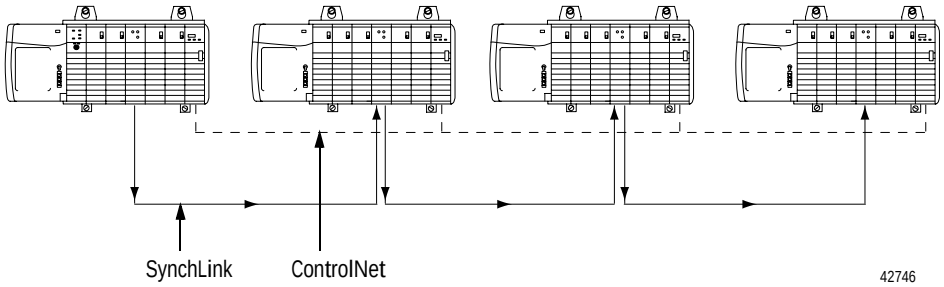
Choose a SynchLink Configuration

You must use one of the following SynchLink configurations:

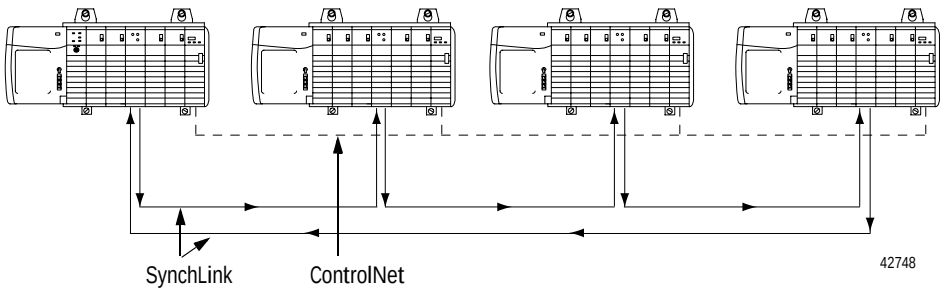
Star Configuration - See Appendix B for an example.



Daisy Chain Configuration - See Appendix C for an example.



Ring Configuration - See Appendix D for an example.



Create a New RSLogix 5000 Project

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

Choose a New project from the File menu.

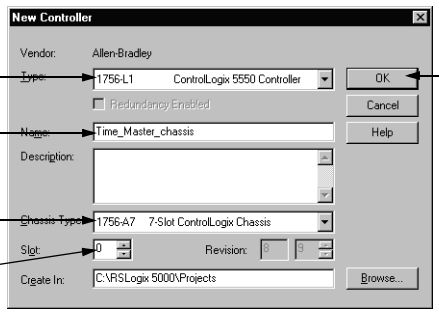
2. Name the controller.

A. This controller is a 1756-L1.

B. This controller is named Time_Master_chassis.

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

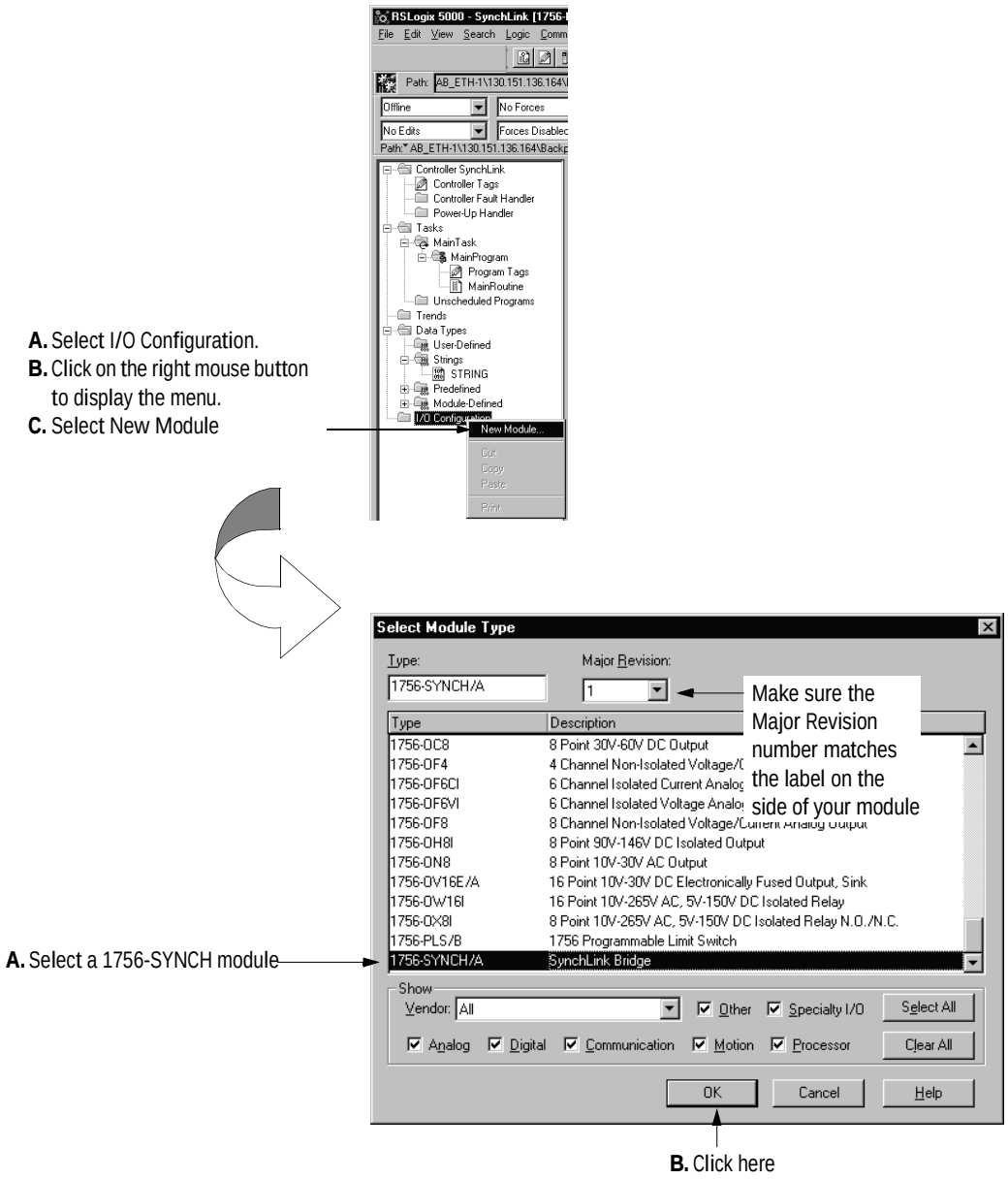
D. The controller slot number is 0.



E. Click here to use the new controller.

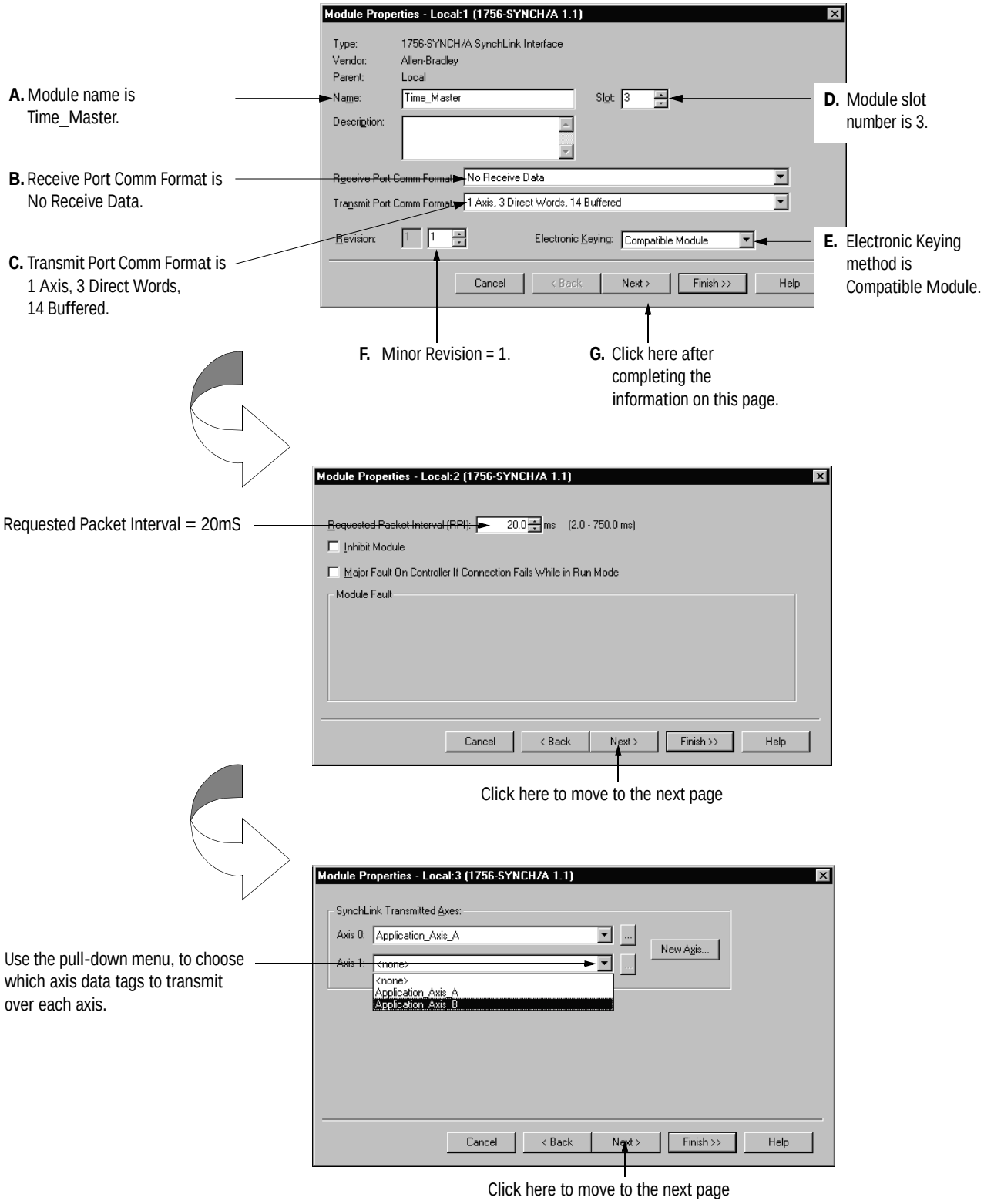
Add a SynchLink Module

1. Select a SynchLink module as shown below.

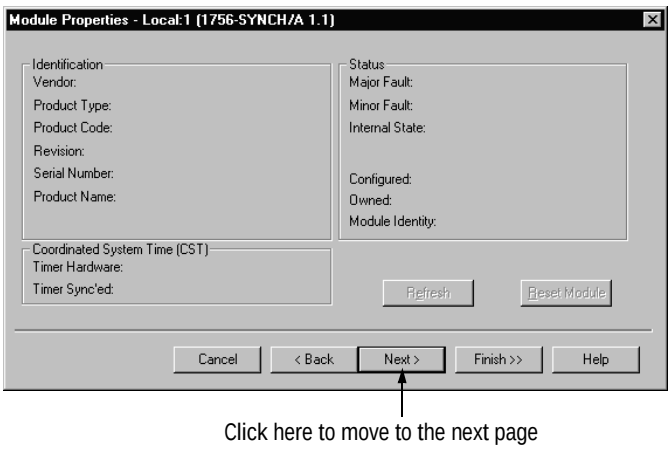


Configure the SynchLink Module

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

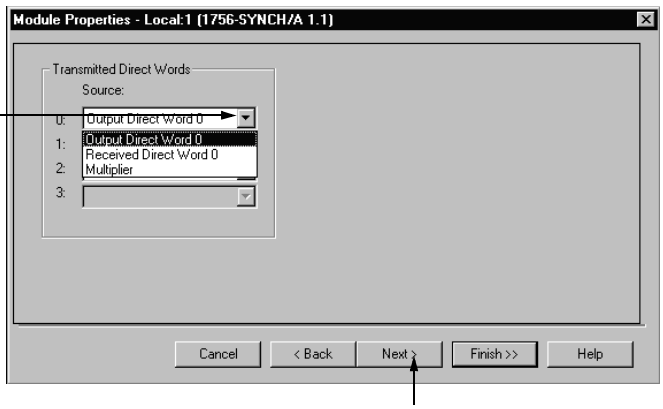


The Module Identification page is blank during initial configuration.



Click here to move to the next page

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

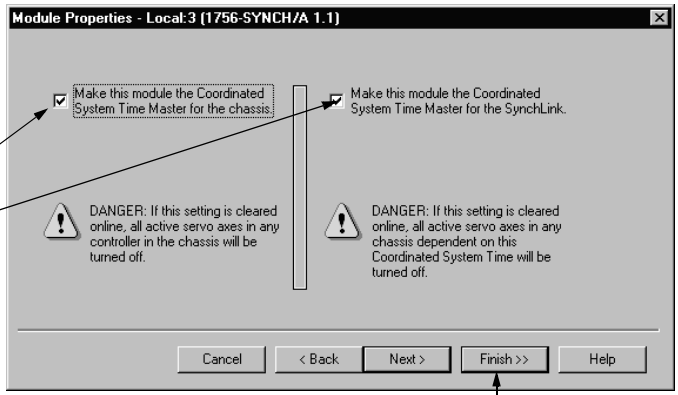


Click here to move to the next page

The example module is configured as the Time Master for:

- the chassis - optional
- the SynchLink - required

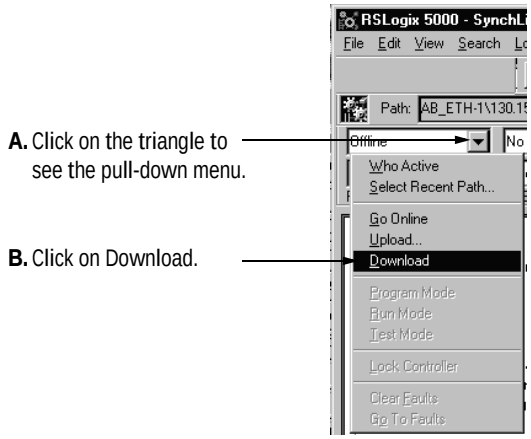
IMPORTANT: In this configuration, the SynchLink module must be the Time Master of the SynchLink, but it is not required to be the Time Master of the chassis. If the module is not the Time Master of the chassis, it receives the CST timer value from the chassis backplane.
For more information on Time Mastership, see Chapter 2.



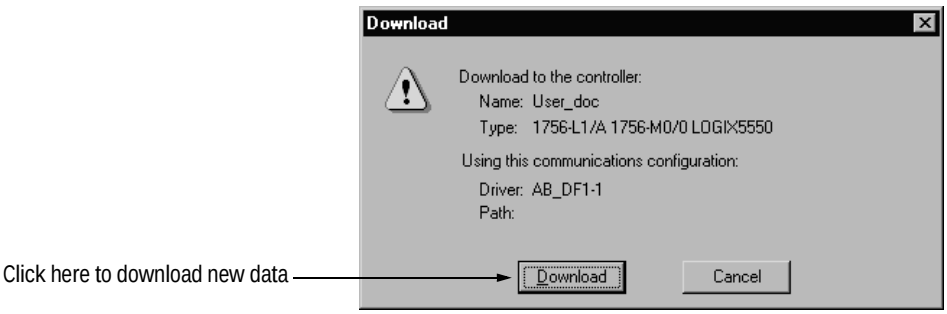
Click here to finish configuration.

Download Configuration

Download the configuration data.



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

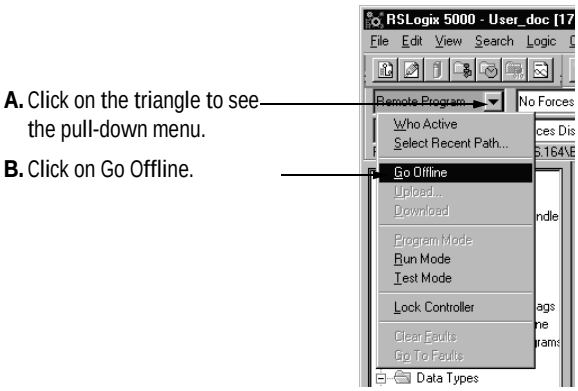


This completes the download process.

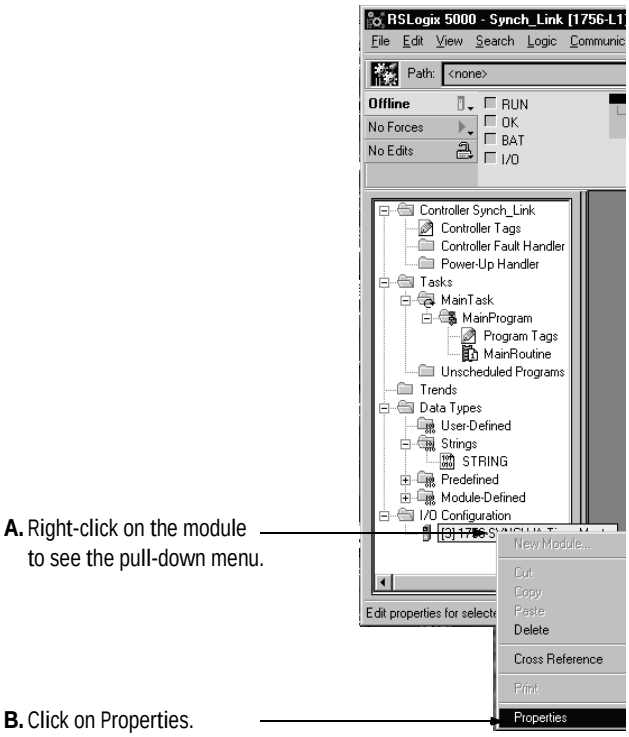
Changing Configuration After Module Operation Has Begun

You change configuration for your SynchLink module after operation has begun, but you must go offline first. Follow these steps to change the SynchLink module configuration:

1. Go offline.



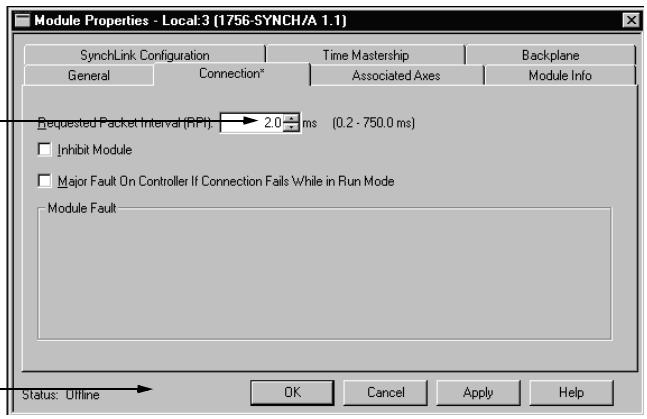
2. Access the module properties in RSLogix 5000.



3. Make the necessary changes.

A. In this example, the Connection tab was accessed to change the RPI.

B. Click on OK to make the changes..



Chapter Summary and What's Next

In this chapter, you learned about the general configuration process. For specific configuration examples, see:

- Appendix B - Star Configuration with Remote Axis Data
- Appendix C - Daisy Chain Configuration
- Appendix D - Ring Configuration

For information on Troubleshooting the SynchLink Module, see Chapter 6.

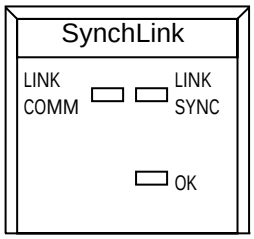
Troubleshooting the SynchLink Module

This chapter describes how to troubleshoot the ControlLogix SynchLink module.

For information on:	See page:
Using the Status Indicators	6-1
Using RSLogix 5000 to Troubleshoot the Module	6-3
Chapter Summary and What's Next	6-11

Using the Status Indicators

The SynchLink module uses status indicators to show SynchLink and communications status (red/green) and a bi-colored LED for module "OK" (red/green).



During power up, an indicator test is done and the following occurs:

- The "OK" indicator turns red for 1 second and then turns to flashing green if it has passed the self-test.

Use Table 6.A to troubleshoot your module.

Table 6.A
Troubleshooting the 1756-SYNCH Module

LED indicators:	This display:	Means:	Take this action:
COMM	Steady green light	The module is configured and operating properly.	None
COMM	Off	1. The module is not powered. 2. The module is not configured. 3. The module is configured to receive data from SynchLink but did not receive it in the last scan. 4. The module is configured to transmit on SynchLink but has not enabled its transmitter. 5. The Transmit and Receive communications formats do not match between linked modules.	1. Power the module. 2. Configure the module. 3. Check fiber connections and diagnostic counter for errors. If the problem persists, replace the cable or module. 4. Make sure configuration is complete and downloaded. If the problem persists, replace the module. 5. In RSLogix 5000, make sure communications formats match between linked modules.
SYNC	Steady green light	The module is the Time Master or a time relay and synchronization is complete.	None
SYNC	Flashing green light	1. The module is configured as a time relay from chassis backplane to SynchLink but is not synchronized with a CST master on the backplane. 2. The module is configured as a time relay from SynchLink to chassis backplane but has not synchronized with the upstream device.	1. Establish a CST master on the backplane. 2. Check configuration and make sure all modules in the system are properly connected and online.

Table 6.A
Troubleshooting the 1756-SYNCH Module

LED indicators:	This display:	Means:	Take this action:
SYNC	Flashing red light	1. The module is configured as the CST Time Master and has detected another CST Time Master. 2. The configuration information received from SynchLink does not match the module's configuration. 3. The module is configured as Time Master on SynchLink and has received time information from another Time Master on SynchLink.	1. Check configuration throughout the system and verify there is only one CST Time Master. 2. Check configuration of this module and all upstream SynchLink devices. 3. Check configuration for all modules in the system to make sure only one is the SynchLink Time Master.
SYNC	Off	1. The module is not powered. 2. The module is not configured as Time Master or time relay.	1. Power the module. 2. Configure the module for its proper function.
OK	Steady green light	The module is operating properly.	None
OK	Flashing green light	The module is powered and ready for operation but has not received configuration.	Configure the module.
OK	Steady red light	The module has experienced an unrecoverable error.	Replace the module.
OK	Flashing red light	A flash upgrade is in process.	Wait for upgrade to finish. New application code may be needed afterward.
OK	Off	The module is not powered.	Power the module, if needed.

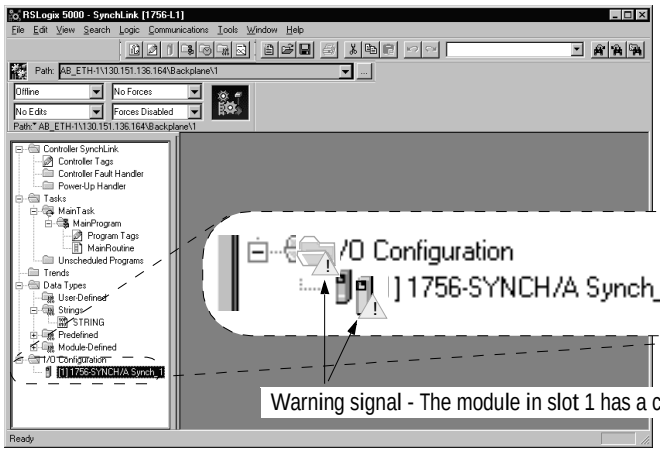
Using RSLogix 5000 to Troubleshoot the Module

In addition to the LED display on the module, RSLogix 5000 alerts you to fault conditions. You are alerted in the following ways:

- Warning signal on the main screen next to the module-This occurs when the connection to the module is broken
- Notification in the Tag Editor - General module faults are also reported in the Tag Editor.
- Status on the Module Info Page

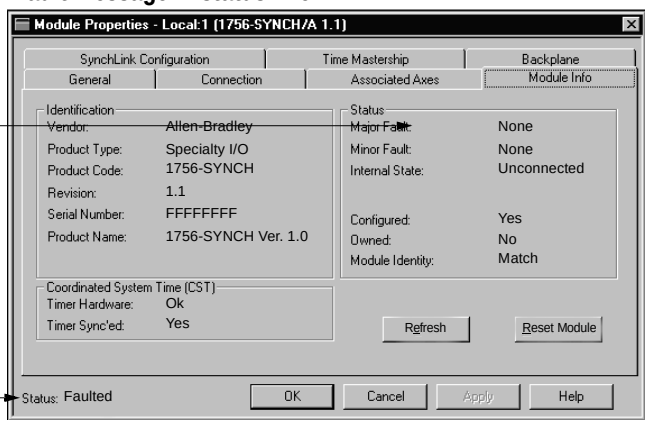
The screens below display fault notification in RSLogix 5000.

Warning signal on main screen



Warning icon when a communications fault occurs or if the module is inhibited

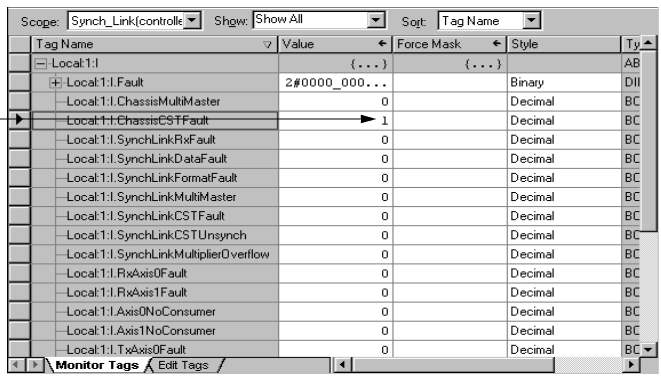
Fault message in status line



Status section lists Major and Minor Faults and the Internal State of the module

Status line provides information on the connection to the module

Notification in Tag Editor

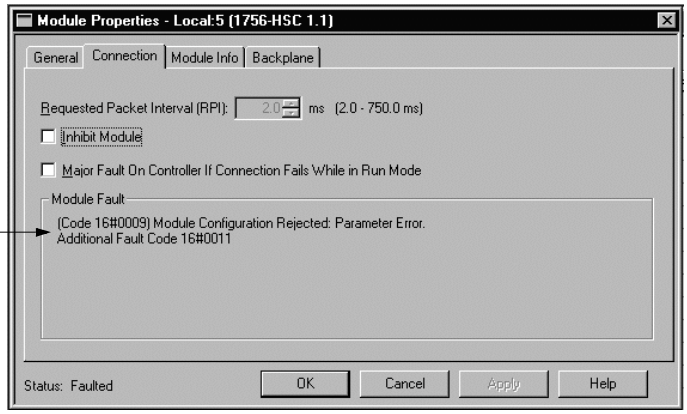


A value of 1 shows a fault for this input point.

IMPORTANT: If all input fault bits are set to 1, the controller cannot connect to the module. In this case, the use the Connection tab in the RSLogix 5000 properties wizard (see page 6-5) to determine the problem. Also, the RSLogix 5000 online help offers a definition of all fault bits.

Determining Fault Type

When you are monitoring a module's configuration properties in RSLogix 5000 and receive a Communications fault message, the Connection page lists the type of fault.



The fault type is listed here
In this example, Error 16#0011 means Counter 0 was set to an invalid Operational Mode

For a detailed listing of the possible faults, their causes and suggested solutions, see Module Table Faults in the online help.

Using Diagnostic Counters

The 1756-SYNCH module uses diagnostic counters; the counters contain additional information about the module. See Table 6.B for more information on the SynchLink module diagnostic counters. This information must be used in the Destination field of the Configuration pop-up screen (page 6-9).

For more information on how to access the diagnostic counter information, see page 6-7.

Table 6.B
SynchLink Module Diagnostic Counters

Name:	Description:	Data Type	Attribute ID:	Possible Values:
Status	Status of this device on the SynchLink system	DINT	1	This counter lists the status of the following bits (0 = bit is not faulted, 1 = bit is faulted): • Bit 0 - Reserved (default =0) • Bit 1 - Reserved (default =0) • Bit 2 - Receive fault. No data has been received from the upstream device. • Bit 3 - Data Fault. The upstream device is in the idle state. • Bit 4 - Data Comm Format Mismatch Fault. The communications format of data received from the upstream device does not match this device's receive port communications format. • Bit 5 – Duplicate SynchLink Time Master Fault – This device is configured to be SynchLink Time Master but has received a CST update from another Time Master • Bit 6 – CST Drifting – CST synchronization with SynchLink was not verified at last beacon but was verified within last 6 beacon updates • Bit 7 – CST Synchronization Fault – The device CST is not synchronized with SynchLink. • Bit 8 – Multiplier Overflow Fault – The output of the multiplier exceeded 16 bits • Bit 9 – Axis 0 Receive Fault – The device is configured to receive Axis 0, but Axis 0 was not received from the SynchLink system. • Bit 10 – Axis 1 Receive Fault – The device is configured to receive Axis 1, but Axis 1 was not received from the SynchLink system. • Bit 11 – Axis 0 Unclaimed Fault – Axis 0 was received from the SynchLink system but was not consumed by the local controller. • Bit 12 - Axis 1 Unclaimed Fault – Axis 1 was received from the SynchLink system but was not consumed by the local controller. • Bit 13 – Axis 0 Transmit Fault – The device is configured to transmit Axis 0, but Axis 0 was not produced by the local controller. • Bit 14 – Axis 1 Transmit Fault – The device is configured to transmit Axis 1, but Axis 1 was not produced by the local controller. • Bit 15 – SynchLink Revision Fault – The SynchLink revision was received but the data is not compatible with the receiving module's revision. • Bits 16 to 31 – Unused (Default = 0)
CRC Error Counter	Number of CRC errors detected on the SynchLink system since power-up or last reset service	DINT	2	0 to 2^{32} - 1

Table 6.B
SynchLink Module Diagnostic Counters

Name:	Description:	Data Type	Attribute ID:	Possible Values:
Framing Error Counter	Number of framing errors detected on SynchLink since powerup or last reset service	DINT	3	0 to 2^{32} - 1
Incomplete Package Error Counter	Number of incomplete package errors detected on SynchLink since powerup or last reset service	DINT	4	0 to 2^{32} - 1
SynchLink Revision	Revision of SynchLink supported	DINT	5	Bits 0 to 15 - Minor Revision Bits 16 to 31 - Major Revision

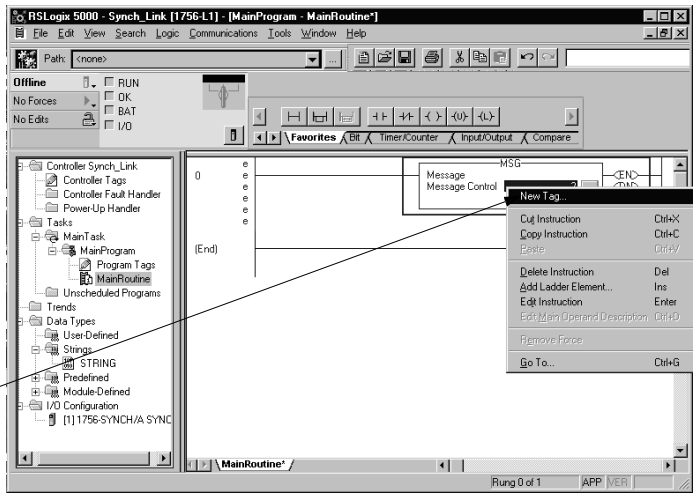
Message Instructions

To retrieve and reset the SynchLink diagnostic counter information, you must use a message instruction in ladder logic and a CIP message. This ladder logic is written in the Main Routine section of RSLogix 5000.

Double-click here to enter the Main Routine

After adding a message instruction to a rung, you must create a tag for the message instruction

1 Right-click on the question mark (?) to see this pull-down menu.
2 Click here to Create a New Tag.



Fill in the following information when the New Tag pop-up screen appears:

IMPORTANT We suggest you name the tag to indicate what module service the message instruction is sending. For example, the message instruction below is used to retrieve diagnostic counters, and the tag is named to reflect this.

Name the tag here.

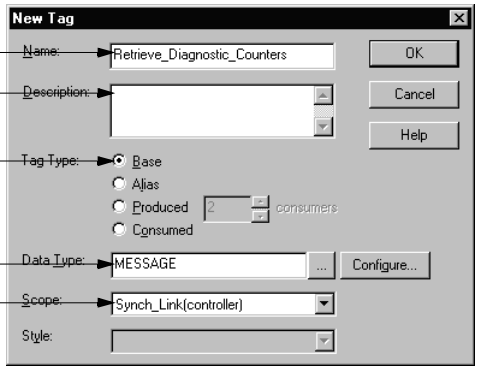
Enter an optional description here.

Choose the **Base** Tag Type here.

Choose the **Message** Data Type here.

Choose the **Controller** Scope here.

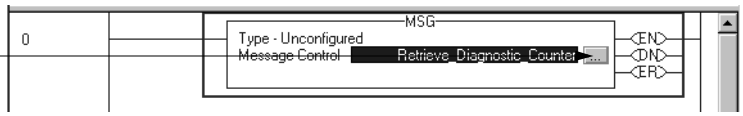
IMPORTANT: Message tags can only be created with the Controller Scope.



Message Configuration

After creating a new tag, you must enter message configuration.

Click here to see the message configuration pop-up screens



Enter message configuration on the following screens:

- Configuration Pop-Up Screen
- Communication Pop-Up Screen

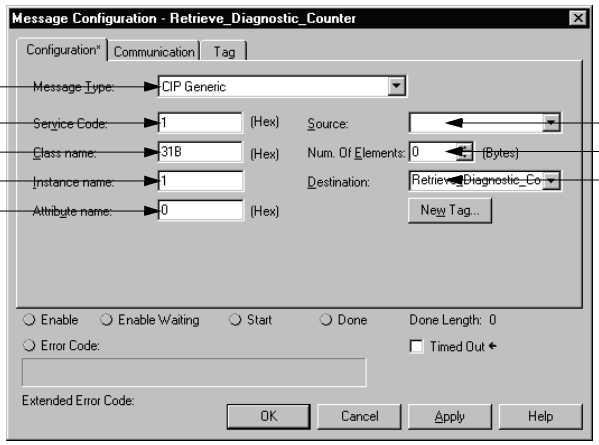
A description of the purpose and set-up of each screen follows.

Configuration Pop-Up Screen

This pop-up screen provides information on what module service to perform and where to perform it. For example, you must use this screen to retrieve diagnostic counters (module service) from the 1756-SYNCH module (where to perform service).

Message Type is CIP Generic

Service Code is 1
Class Name is 31B
Instance Name is 1
Attribute name is 0



There is no Source.
Number of Elements is 0
Destination is a tag of type DINT [5].
IMPORTANT: The data contained in this DINT is described in Table 6.B.

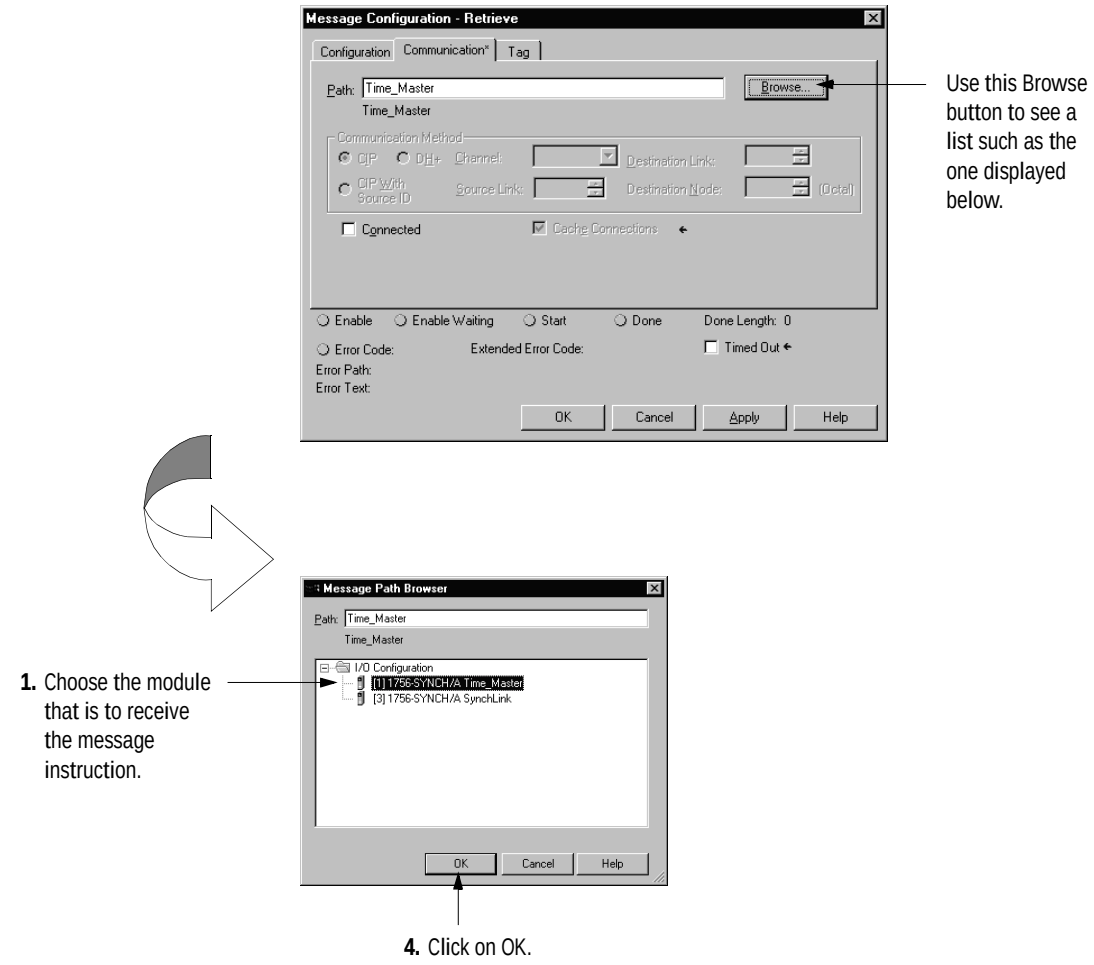
Communication Pop-Up Screen

This pop-up screen provides information on the path of the message instruction. For example, the slot number of a 1756-SYNCH module distinguishes exactly which module a message is designated for.

IMPORTANT

Use the Browse button to see a list of the I/O modules in the system. You choose a path when you choose a module from the list.

You must name an I/O module during initial module configuration to choose a path for your message instruction.



Retrieving and Resetting Diagnostic Counters

You can use the diagnostic counters to recognize a problem with your 1756-SYNCH module. After correcting a problem, though, you may want to reset the counters for future use. The counters are also reset via message instructions and a CIP message.

1. Create a message instruction, as described on page 6-7.

2. Use the values listed in on the Configuration Pop-Up Screen to retrieve or reset the counters.

Table 6.C
Configuration Pop-Up Screen Values Required to Reset SynchLink Module Diagnostic Counters

Field:	Value to Retrieve the Counter:	Value to Reset the Counter:
Message Type	CIP Generic	CIP Generic
Service Code	5	5
Class	31B	31B
Instance	1	1
Attribute	0	0
Source	NA	NA
Source Length	0	0
Destination	Retrieve Diagnostic Counters	NA

Chapter Summary and What's Next

In this chapter, you learned how to troubleshoot the ControlLogix SynchLink module. For information on the module specifications, see Appendix A.

Notes:

Specifications

General Specifications	
Module Location	1756 ControlLogix chassis
Backplane Current	1200mA @ 5.1V dc & 3mA @ 24V dc
Maximum Power Dissipation	6.19W
Thermal Dissipation	21.1 BTU/hr
Connecting Cable Fiber Type Fiber Termination Type Assemblies Maximum Length Minimum Length	 200/230 micron Hard Clad Silica (HCS), Versalink V-System Order assemblies from Rockwell Automation under catalog 1403-CFxxx (xxx=length in meters) or from Lucent Technologies Specialty Fiber Technologies Division 300m 1m
Operating Wavelength	650nm (red)
SynchLink Data Rate	5Mbps
Baud Rate	5Mbaud
Type of Communication	Synchronous
Frame Parameters	3 Flags - 3 bytes Control field - 1 byte Data field - 24 bytes CRC field - 2 bytes
Frame Period	50µs
Indicators	Green and red indicators for operation, status and diagnostics
Environmental Conditions Operating Temperature Storage Temperature Relative Humidity Shock Operating Non-operating Vibration	 0 to 60°C (32 to 140°F) -40 to 85°C (-40 to 185°F) 5 to 95% noncondensing 30g peak acceleration, 11(± 1ms) pulse width 50g peak acceleration, 11(± 1ms) pulse width Tested 2g @ 10-500Hz per IEC 68-2-6
Agency Certification (when product or packaging is marked)	Listed Industrial Control Equipment Certified Process Control Equipment Certified Class I, Division 2, Group A, B, C, D Marked for all applicable directives Marked for all applicable acts N223

Notes:

Configuring the Star Configuration

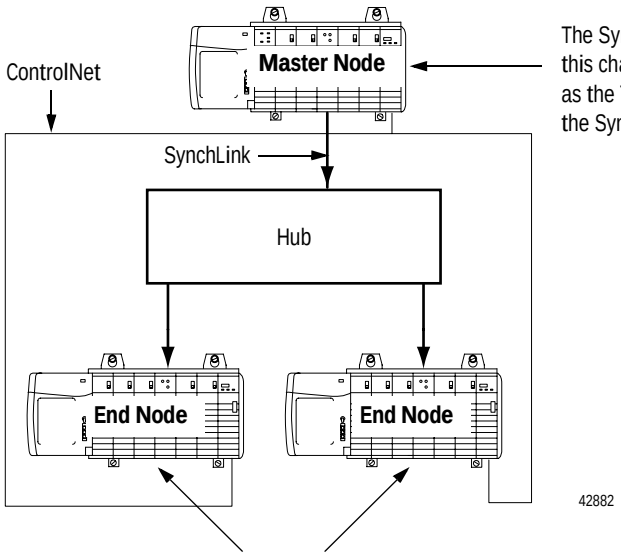
This appendix describes how to configure the ControlLogix SynchLink module in a Star configuration using remote axis control. In this example configuration, the following occurs:

- The controller in the Time Master chassis produces axis data.
- The axis data is transmitted via SynchLink modules to each Time Slave chassis.
- The controller in each Time Slave chassis consumes the axis data.

The system's physical configuration is shown in Figure B.1. In this configuration, you must:

- configure the Master Node in an RSLogix 5000 project.
- configure each End Node in separate RSLogix 5000 projects.

Figure B.1



Using Remote Axis Control

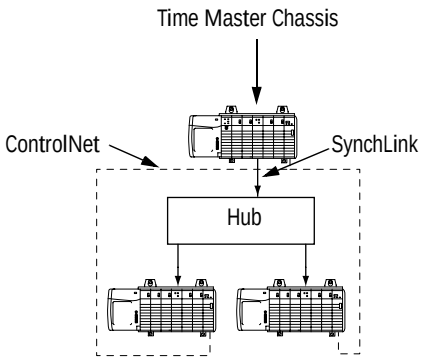
Most applications using the ControlLogix SynchLink module use it for Remote Axis Control. You can use the SynchLink module to produce axes from a master chassis and broadcast the data to other chassis.

Slave chassis consume the broadcast axis data and redistribute it to their local motion planners (i.e. the Logix controller in their local chassis). With this configuration, you can control multiple axes synchronously throughout the system.

IMPORTANT

This example assumes you have already set-up axis data tags for the data the controller in the Time Master chassis produces; this manual does not intend to explain how to plan the motion portion of your application as that is a controller function.

If you do not know how to set-up remote axis data tags and account for them in the motion portion of your application, see the ControlLogix Motion Module Setup & Configuration User Manual, publication 1756-6.5.16.



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.

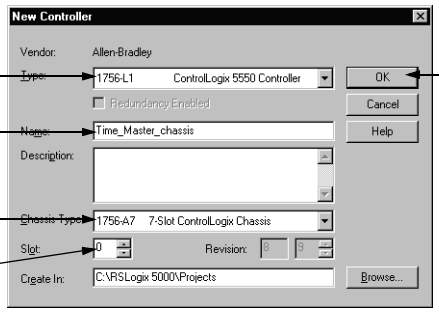
2. Name the controller.

A. This controller is a 1756-L1.

B. This controller is named Time_Master_chassis.

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

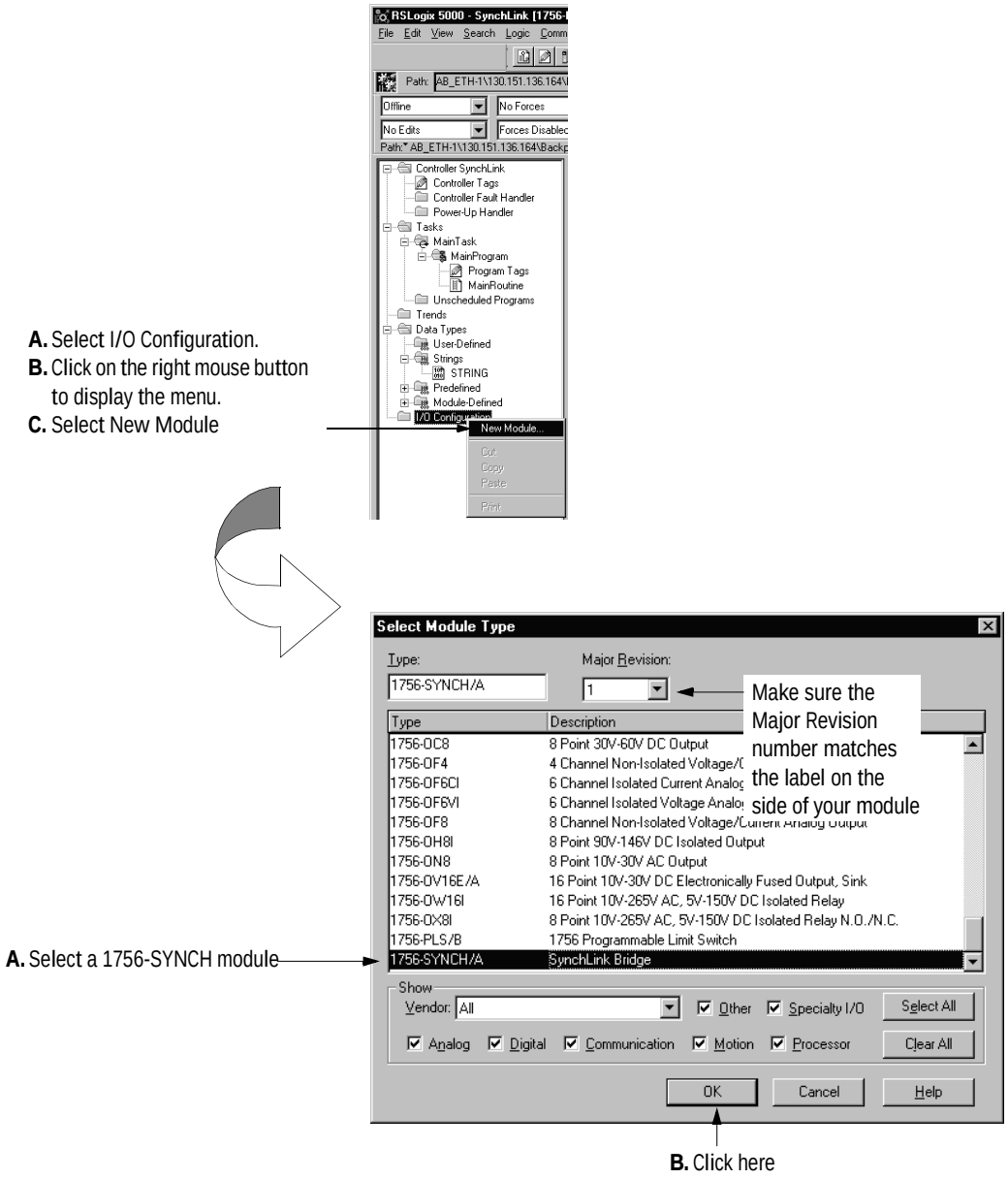
D. The controller slot number is 0.



E. Click here to use the new controller.

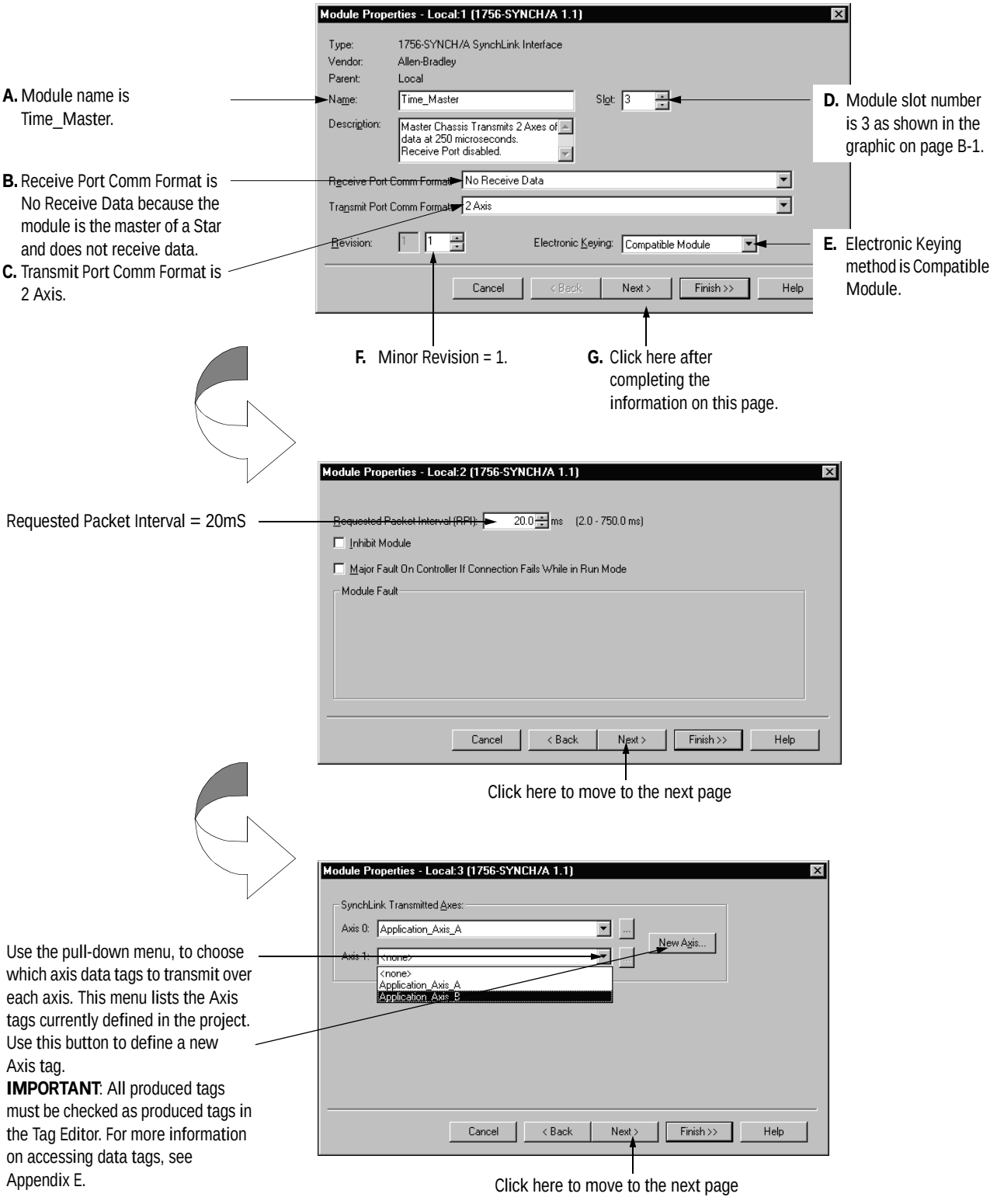
Add a SynchLink Module

1. Select a SynchLink module as shown below.

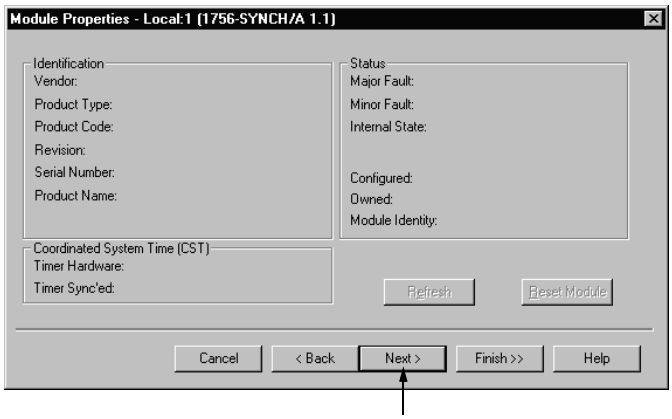


Configure the SynchLink Module

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

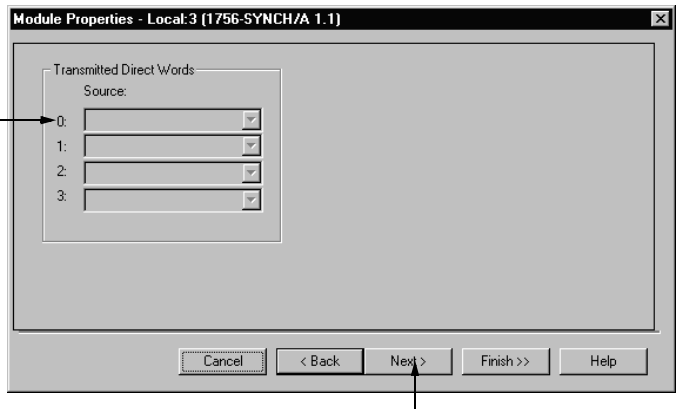


The Module Identification page is blank during initial configuration.



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.

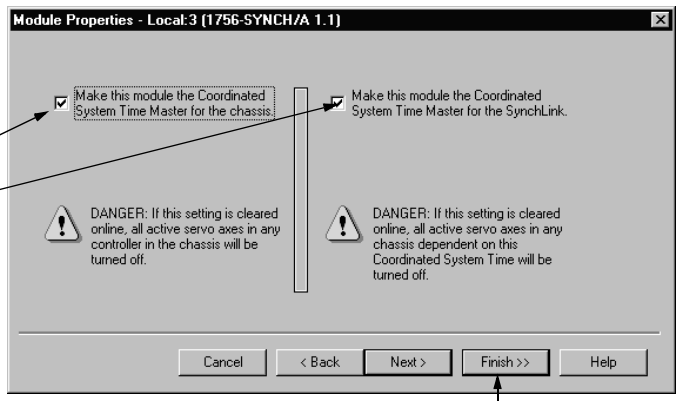


Click here to move to the next page

The module is configured as the Time Master for:

- the chassis - optional
- the SynchLink - required

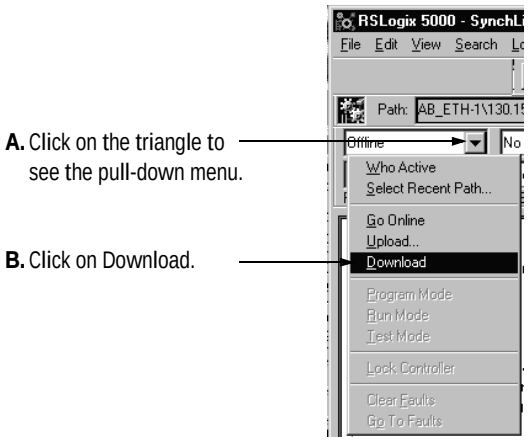
IMPORTANT: In this configuration, the SynchLink module must be the Time Master of the SynchLink, but it is not required to be the Time Master of the chassis. If the module is not the Time Master of the chassis, it receives the CST timer value from the chassis backplane.



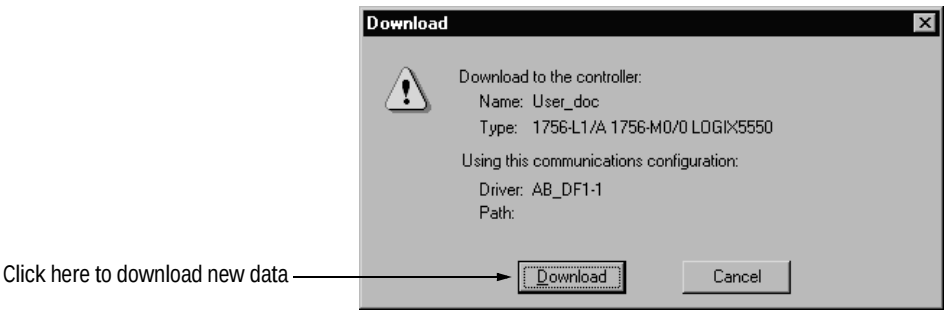
Click here to finish configuration.

Download Configuration

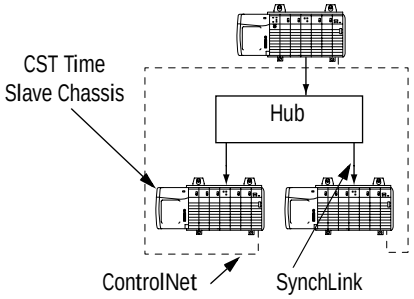
Download the configuration data.



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



This completes the download process.



Configure Time Slave Chassis - End Node

You must complete the following tasks to configure the first time slave 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
  - Set the module as the CST Time Master for the chassis
- Create Axis Data Tags
- 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.

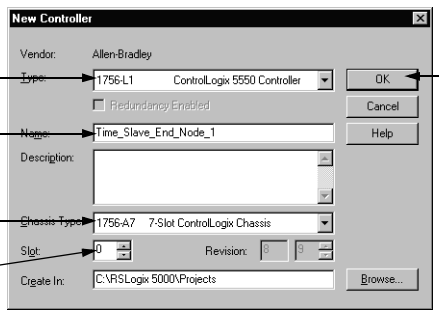
2. Name the controller.

A. The controller is a 1756-L1.

B. The controller is named Time_Slave_End_Node_1.

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

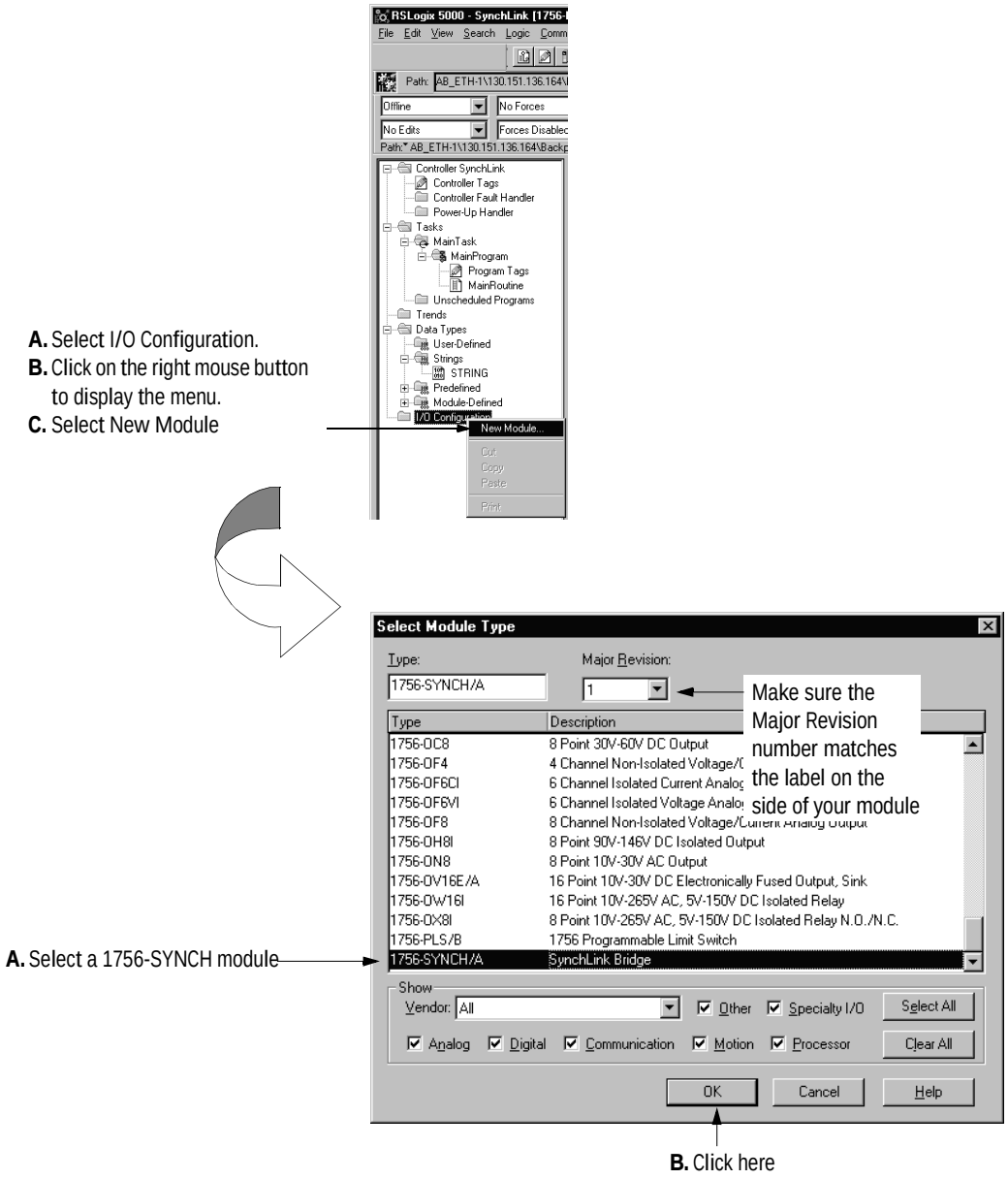
D. The controller's slot location is 0.



F. Click here to use the new controller.

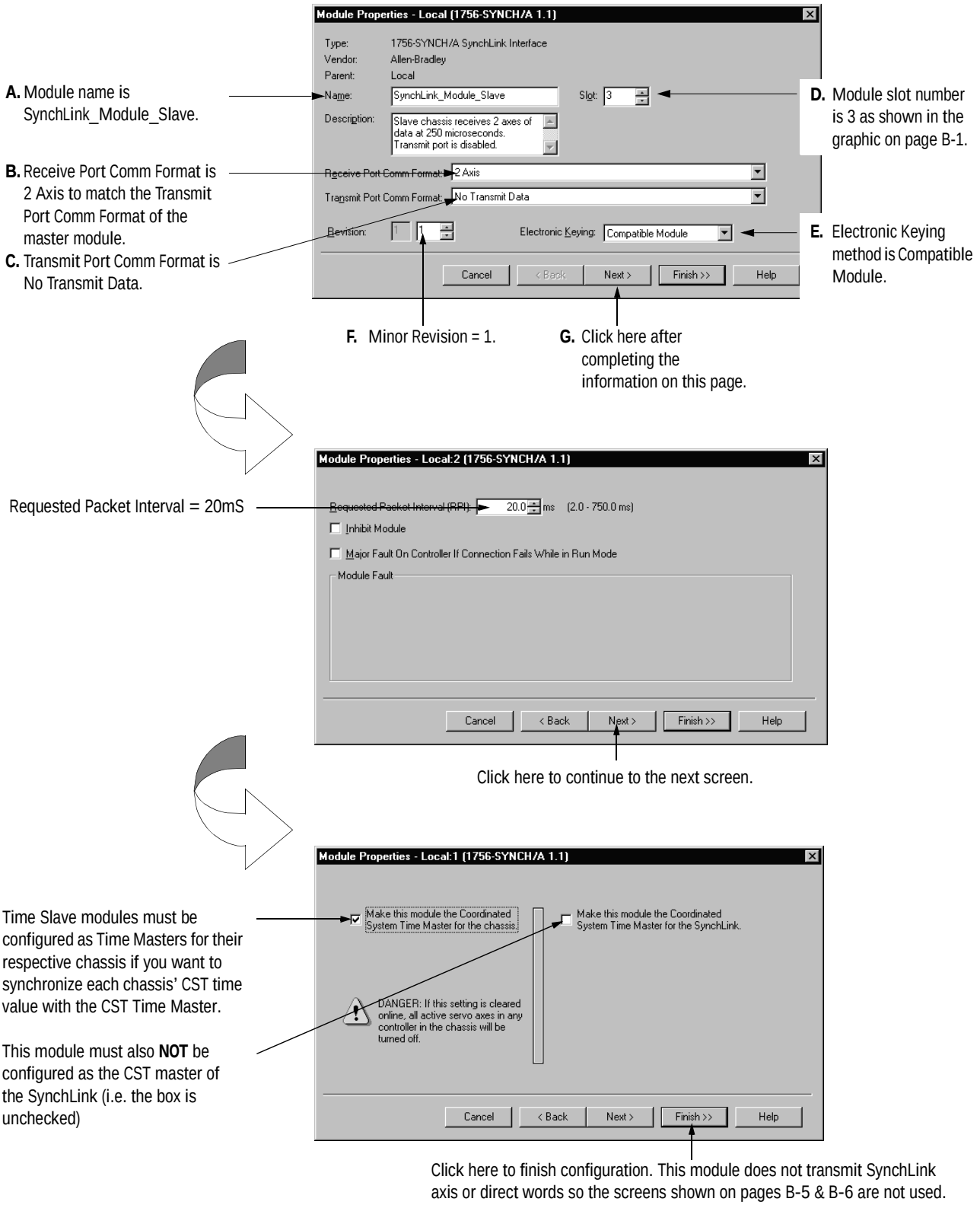
Add a SynchLink Module

1. Select a SynchLink module as shown below.



Configure the SynchLink Module

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

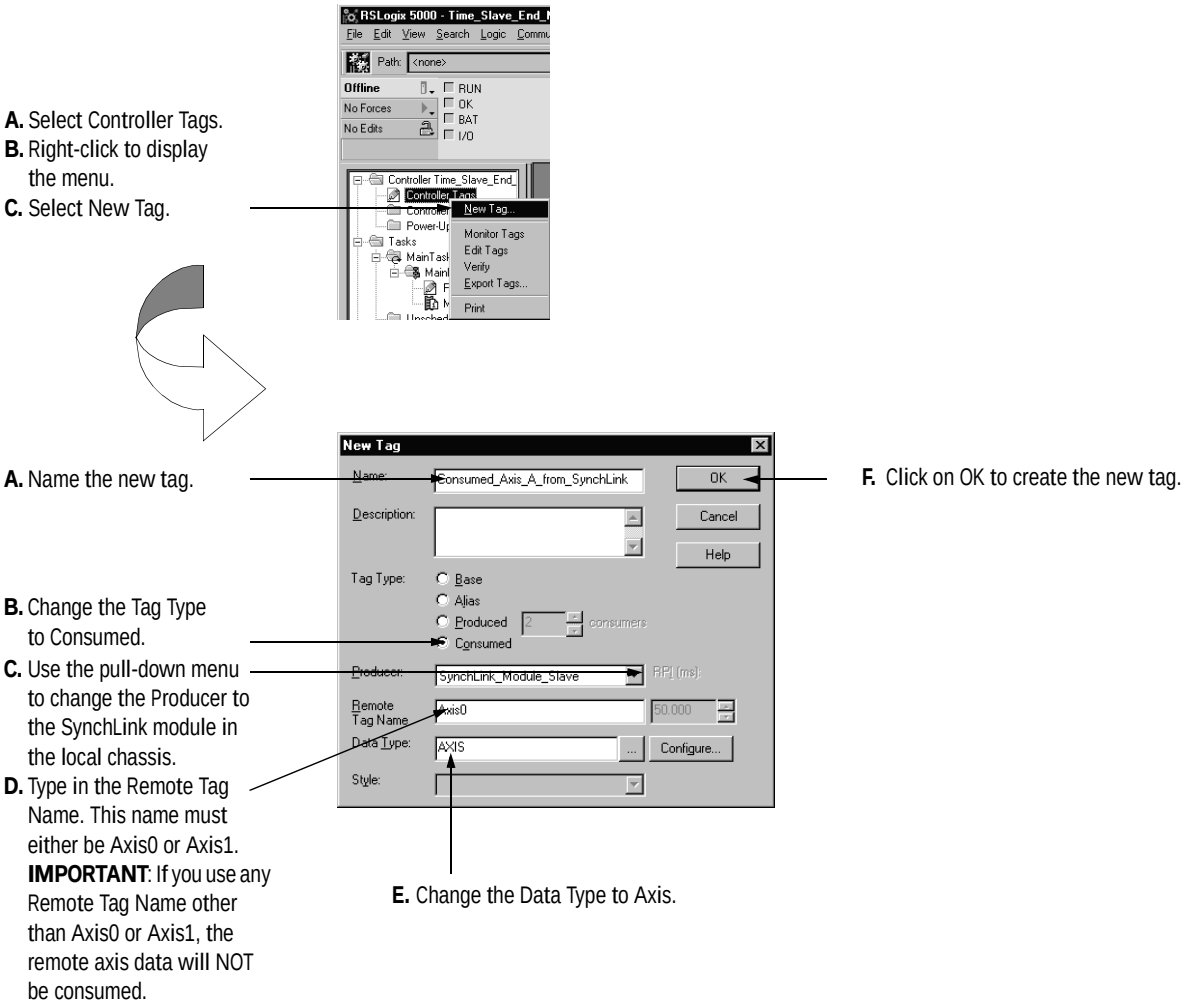


Create Axis Data Tags

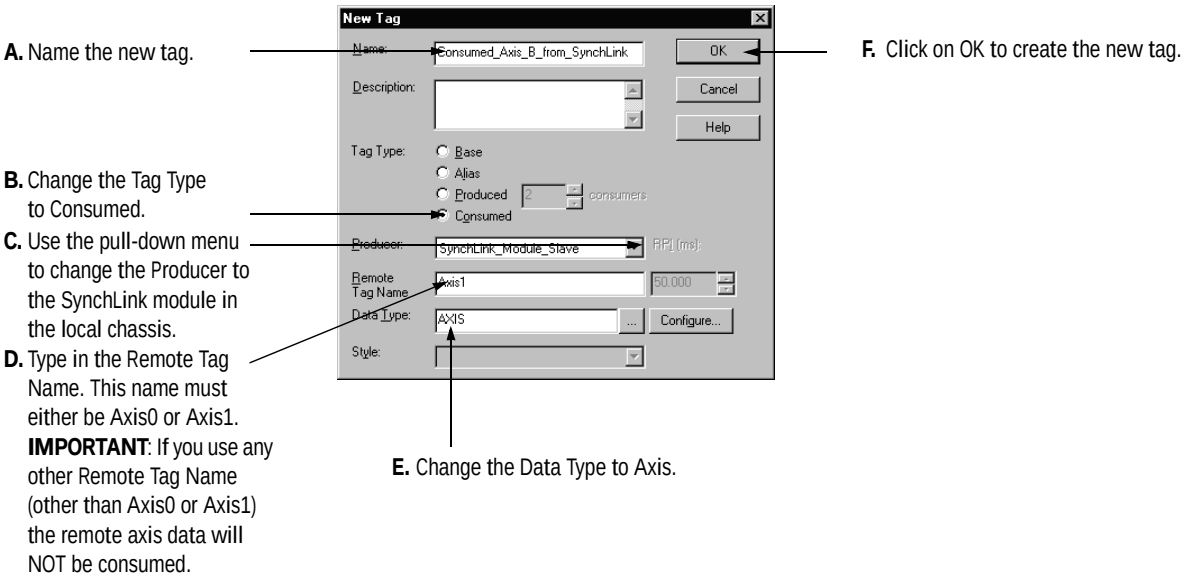
You must create axis data tags for the controller in this chassis to consume. The axis data is originally produced in the Time Master chassis and broadcast to SynchLink modules in other chassis over the fiber optic cable. SynchLink modules in each Time Slave chassis then consume the data from the cable and produce it in the local chassis. The owner controller in their local chassis consumes the data from the local SynchLink module.

Follow these steps to create axis data tags in the consuming chassis:

1. Create a New Tag for Axis 0.

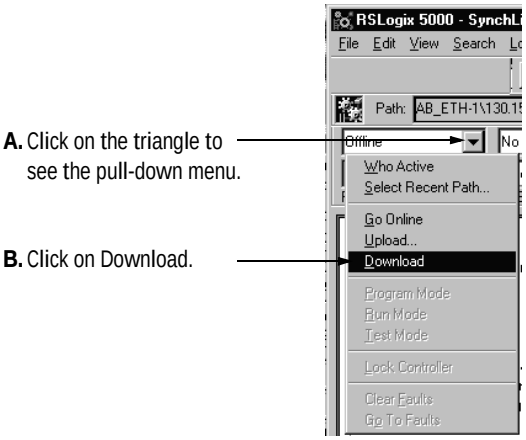


2. Create a new tag for Axis 1. The tag should look like the example below.

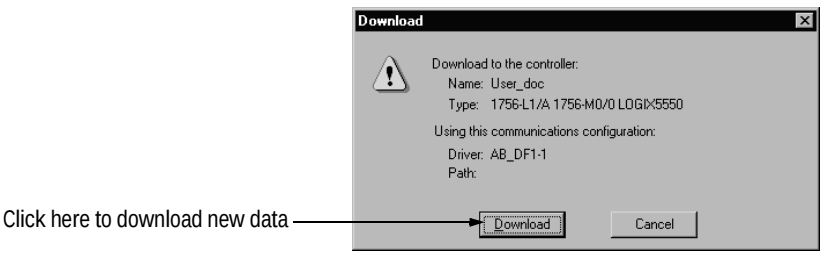


Download Configuration

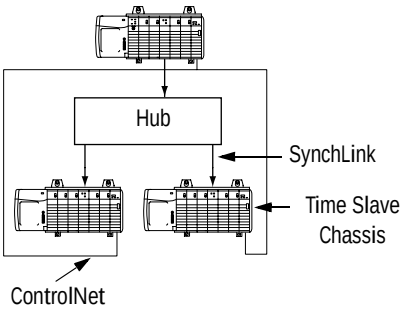
Download the configuration data.



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



This completes the download process.



Configure Time Slave Chassis - End Node

You must complete the following tasks to configure the second CST Time Slave chassis. This set of tasks is exactly the same as those described on page B-8 for the first End Node but are repeated here.

- 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
  - Set the module as the CST Time Master for the chassis
- Create Axis Data Tags
- 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.

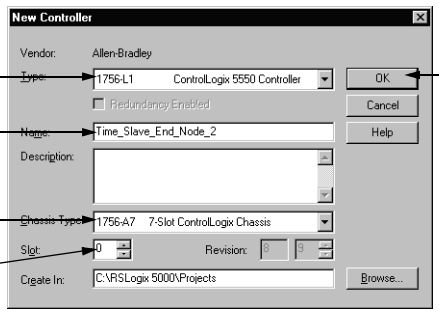
2. Name the controller.

A. The controller is a 1756-L1.

B. The controller is named Time_Slave_End_Node_2.

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

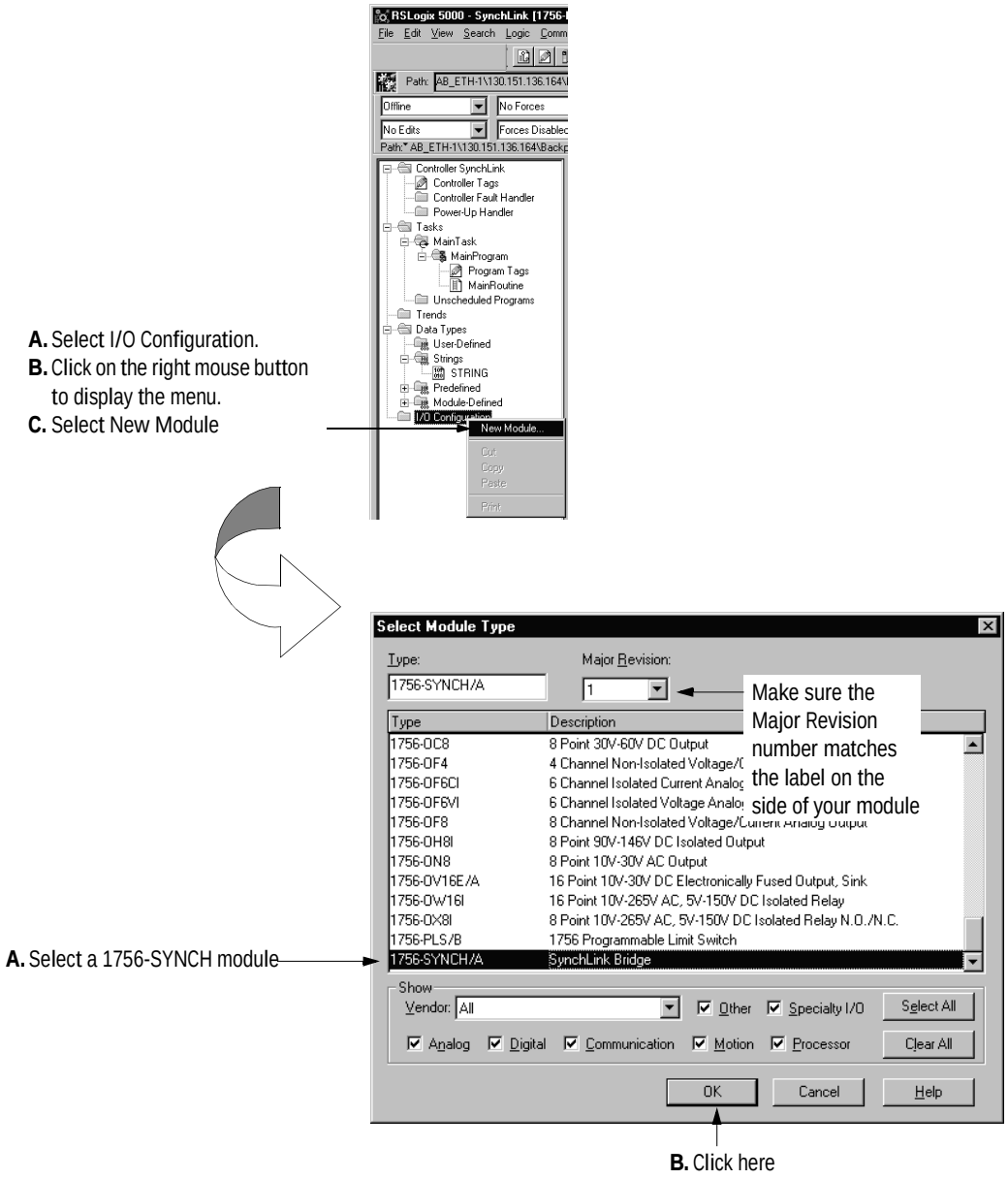
D. The controller's slot location is 0.



F. Click here to use the new controller.

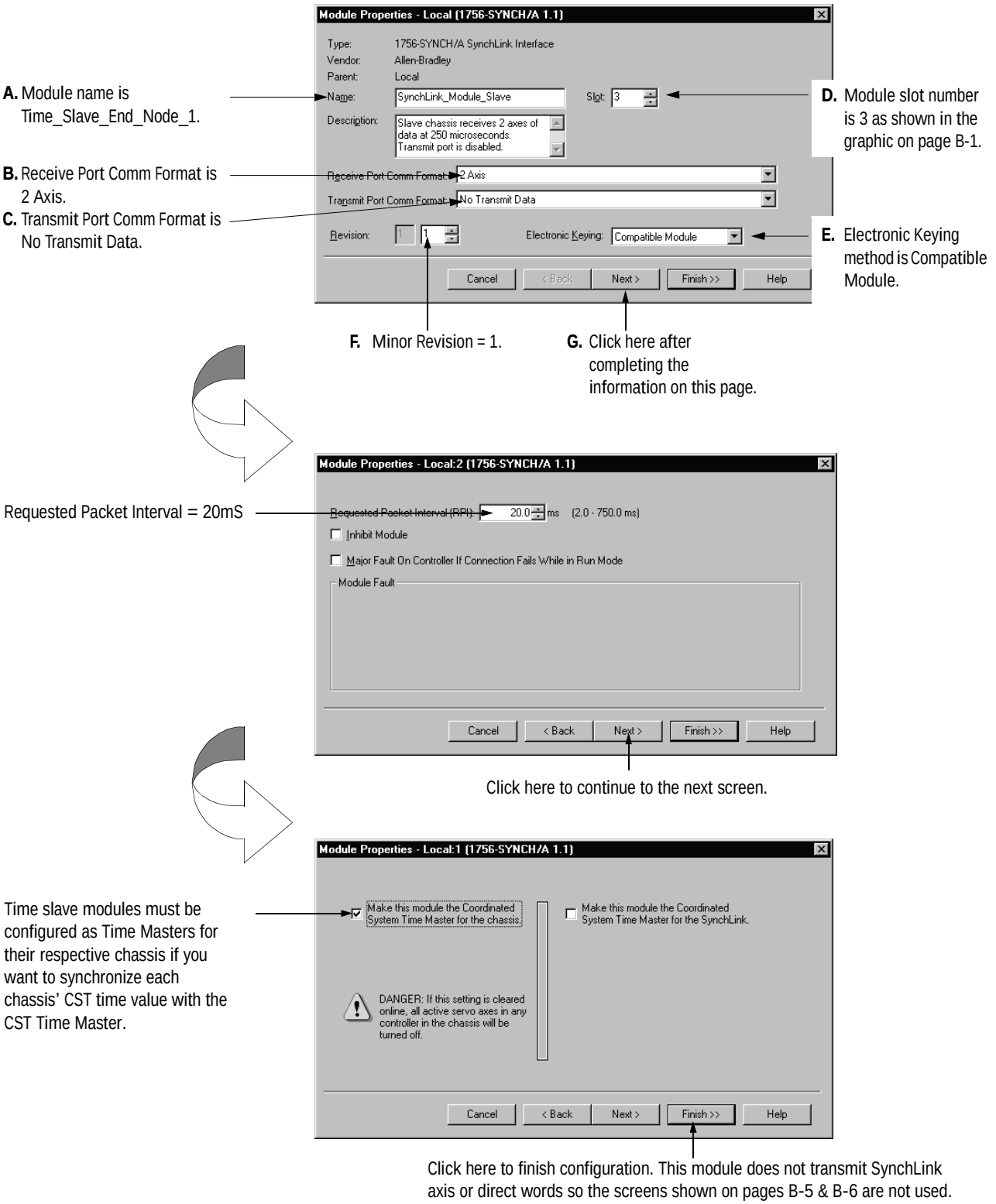
Add a SynchLink Module

1. Select a SynchLink module as shown below.



Configure the SynchLink Module

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

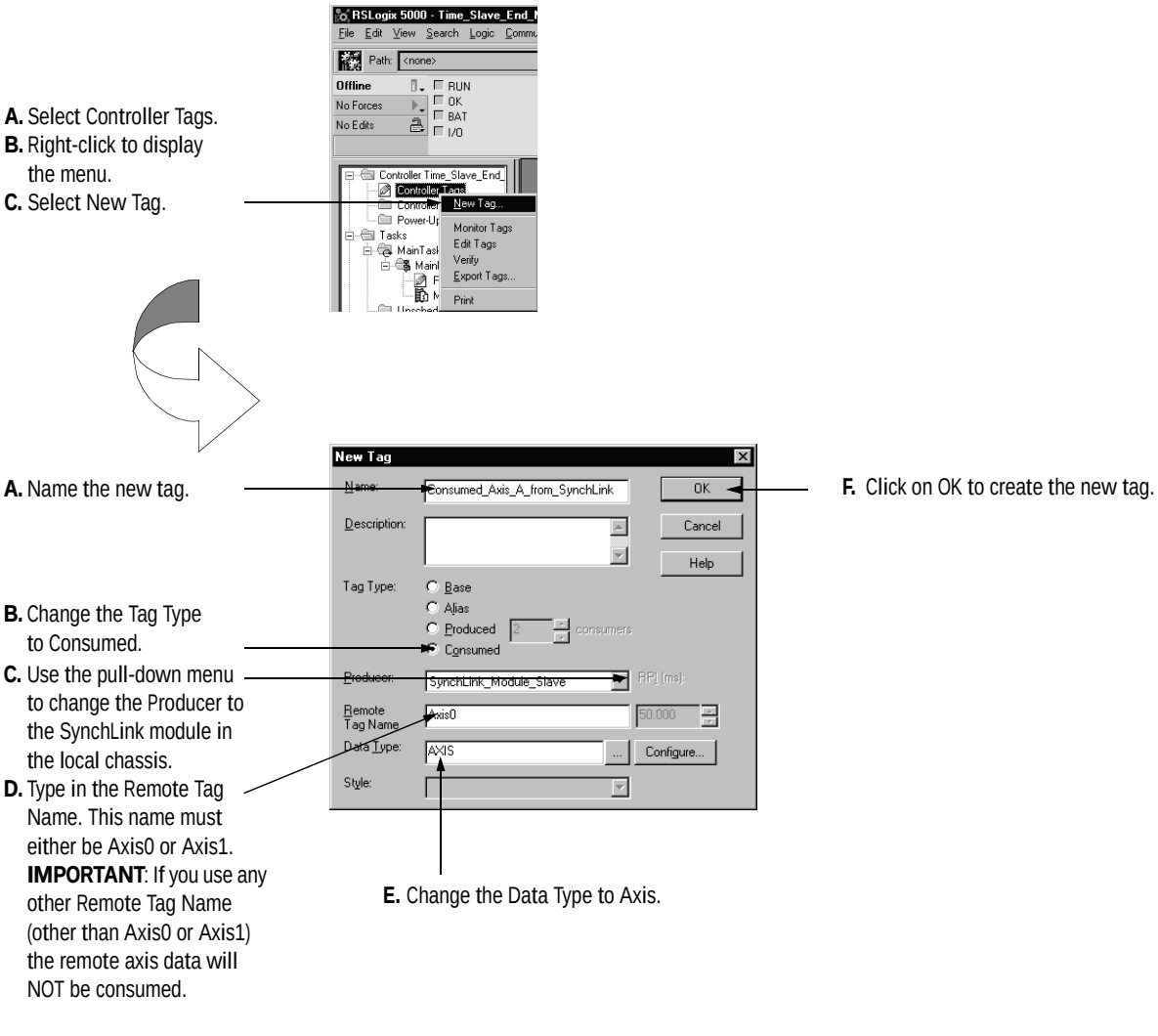


Create Axis Data Tags

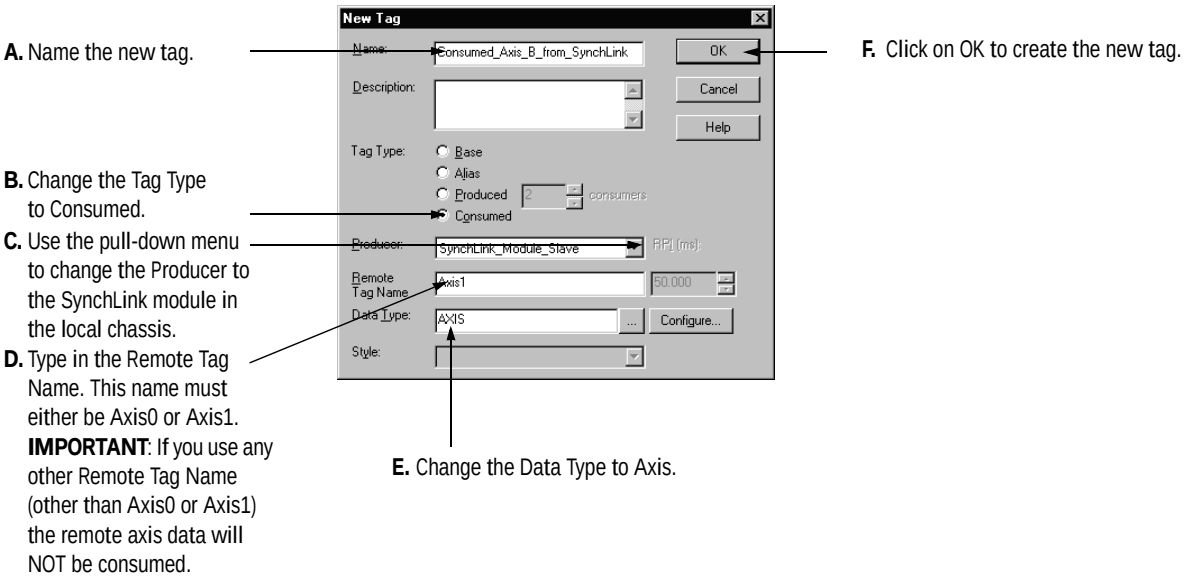
You must create axis data tags for the controller in this chassis to consume. The axis data is originally produced in the Time Master chassis and broadcast to SynchLink modules in other chassis over the fiber optic cable. SynchLink modules in each Time Slave chassis then consume the data from the cable and produce it in the local chassis. The owner controller in their local chassis consumes the data from the local SynchLink module.

Follow these steps to create axis data tags in the consuming chassis:

1. Create a New Tag for Axis 1.

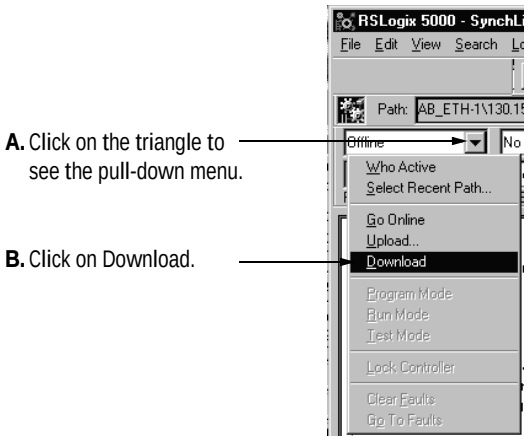


2. Create a new tag for Axis 1. The tag should look like the example below.

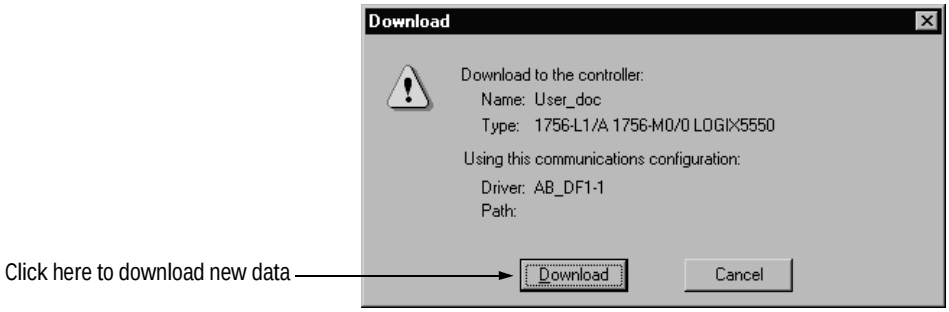


Download Configuration

Download the configuration data.



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



This completes the download process.

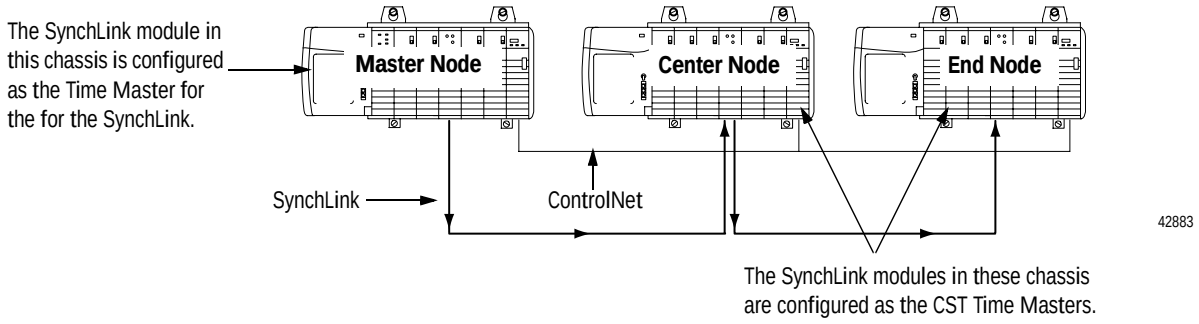
When all the chassis in the Star Configuration are configured and operating online (i.e. configuration was downloaded) the chassis synchronize with the CST Time Master.

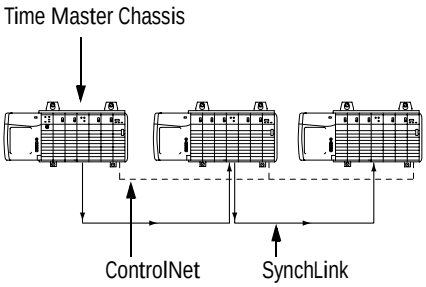
Configuring the Daisy Chain Configuration

This appendix provides a sample configuration for a SynchLink system using the Daisy Chain Configuration. The system's physical configuration is shown in Figure C.1. In this configuration, you must:

- configure the Master Node in an RSLogix 5000 project.
- configure the Center Node in an RSLogix 5000 project.
- configure the End Node in an RSLogix 5000 project.

Figure C.1





Configure Time Master Chassis - Master Node

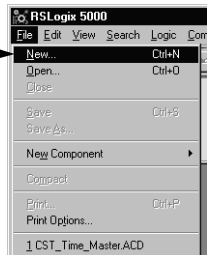
You must complete the following tasks to configure the time master chassis.

- 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.



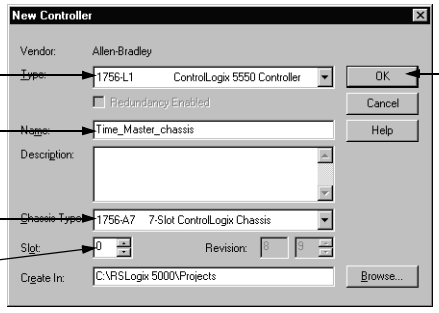
2. Name the controller.

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.

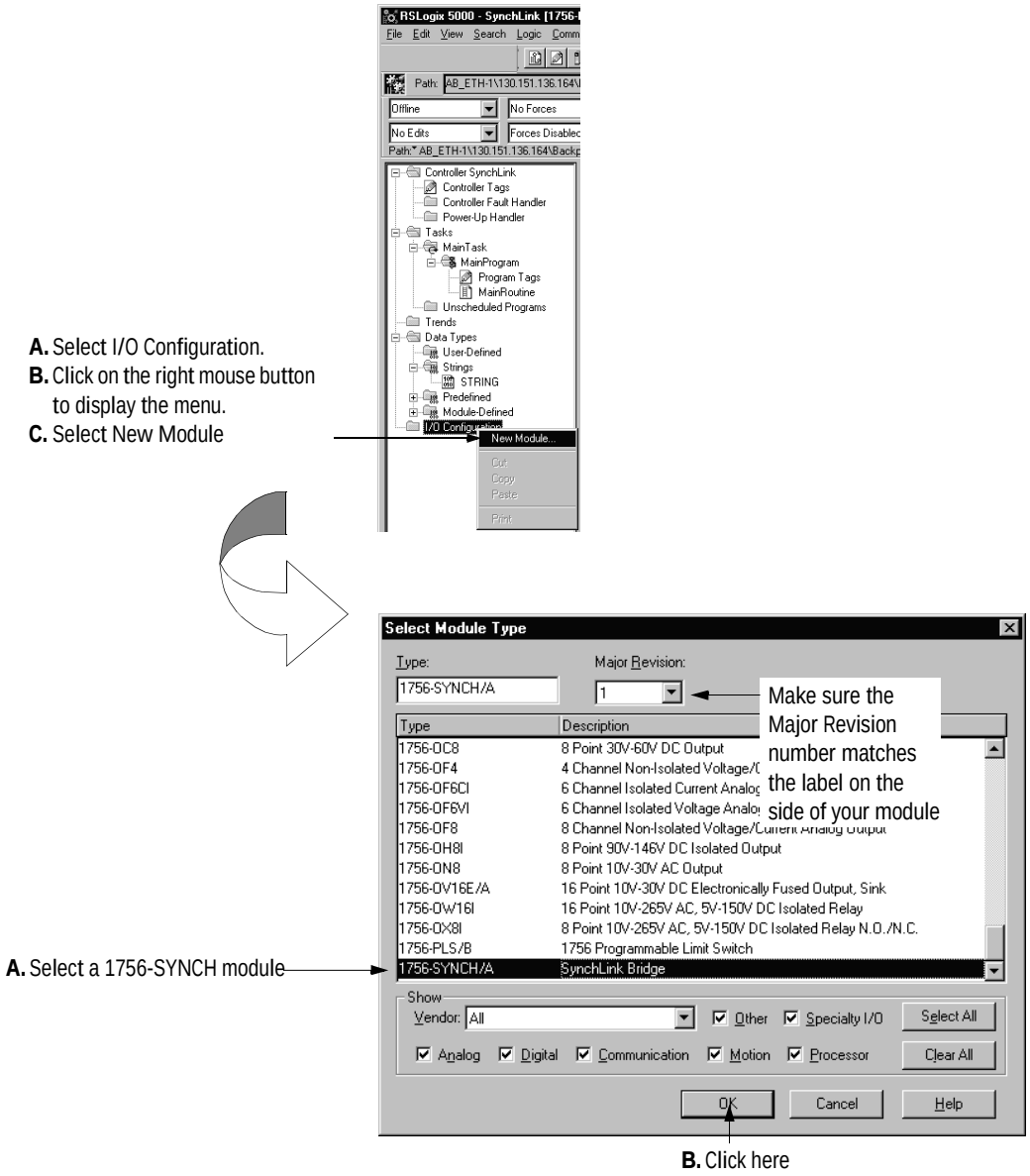
D. The controller slot number is 0.



E. Click here to use the new controller.

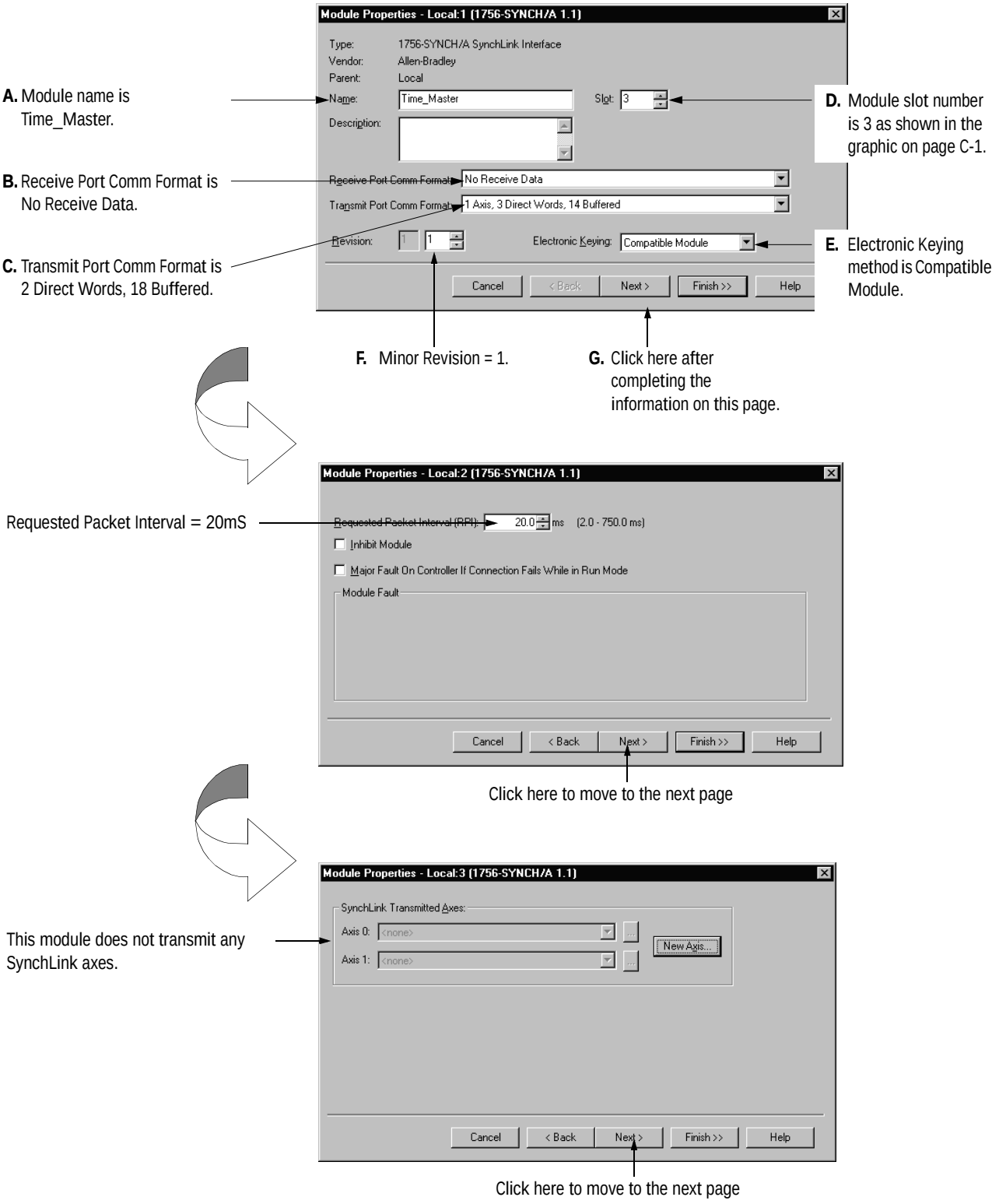
Add a SynchLink Module

1. Select a SynchLink module as shown below.

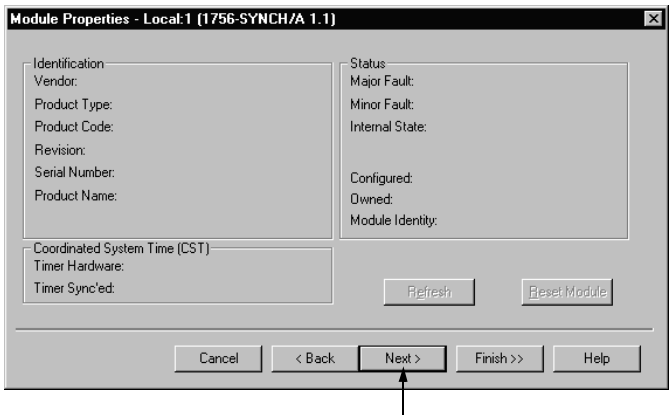


Configure the SynchLink Module

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

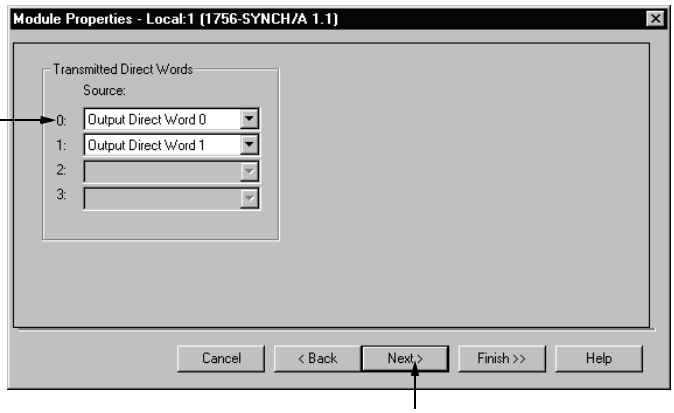


The Module Identification page is blank during initial configuration.



Click here to move to the next page

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

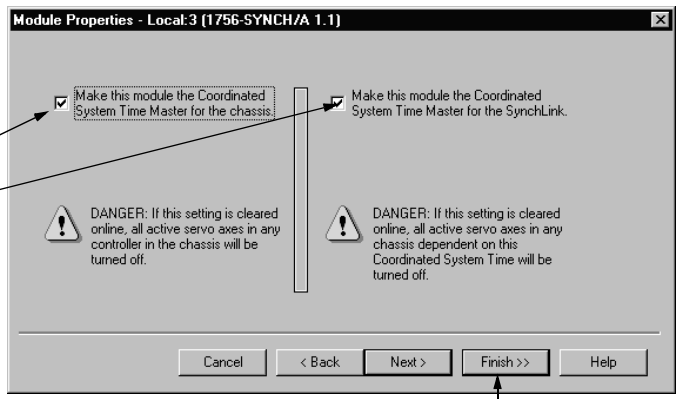


Click here to move to the next page

The module is configured as the Time Master for:

- the chassis - optional
- the SynchLink - required

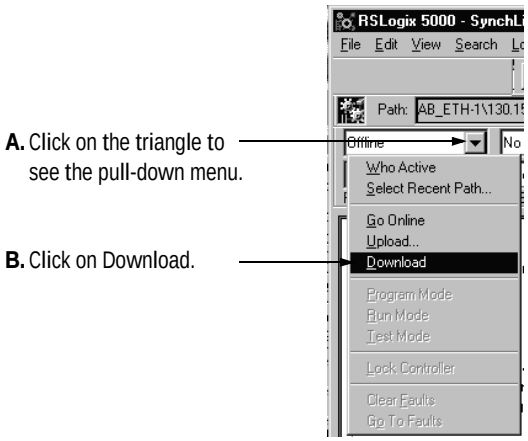
IMPORTANT: In this configuration, the SynchLink module must be the Time Master of the SynchLink, but it is not required to be the Time Master of the chassis. If the module is not the Time Master of the chassis, it receives the CST timer value from the chassis backplane.



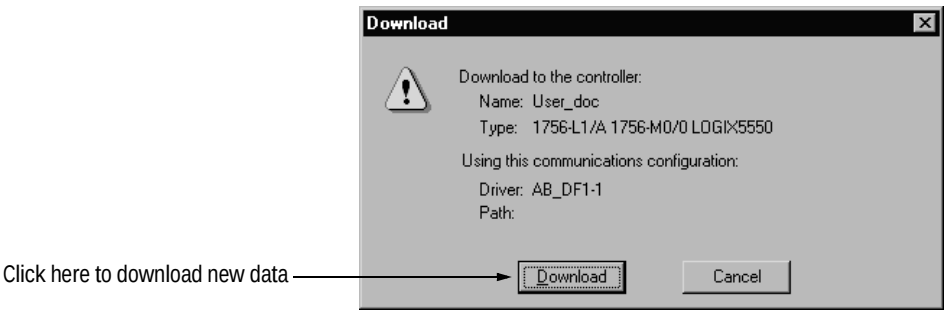
Click here to finish configuration.

Download Configuration

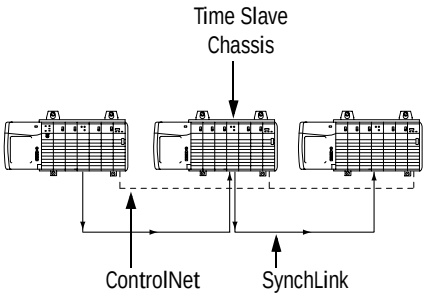
Download the configuration data.



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



This completes the download process.



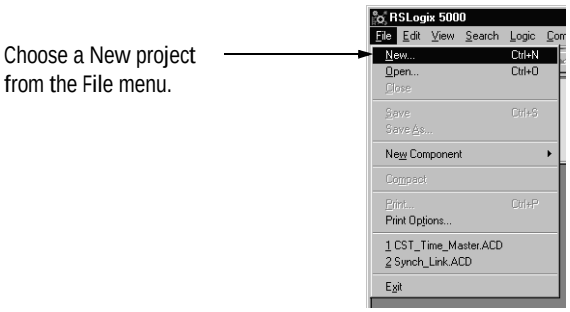
Configure Time Slave Chassis - Center Node

You must complete the following tasks to configure the first time slave chassis.

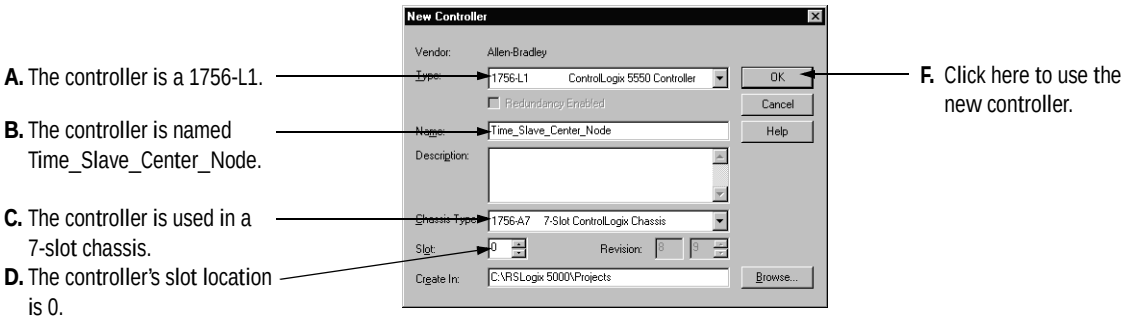
- Create a New RSLogix 5000 Project
- Add a SynchLink Module
- Configure the SynchLink Module
  - Name the module
  - Choose a receive communications format
  - Choose a transmit communications format
  - Choose an electronic keying option
  - Set the RPI
  - Make the module the CST Time Master for the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

Create a New RSLogix 5000 Project

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

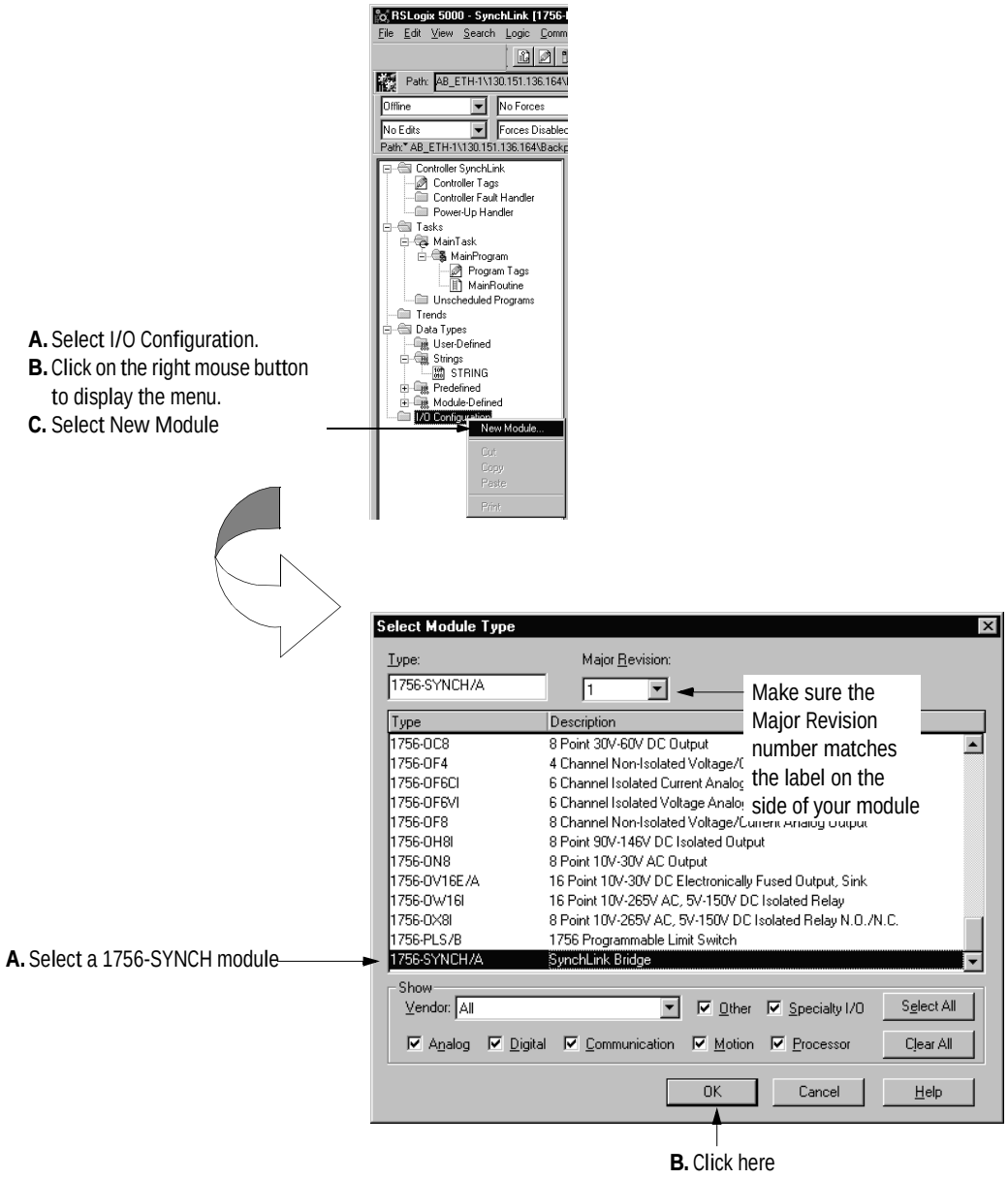


2. Name the controller.



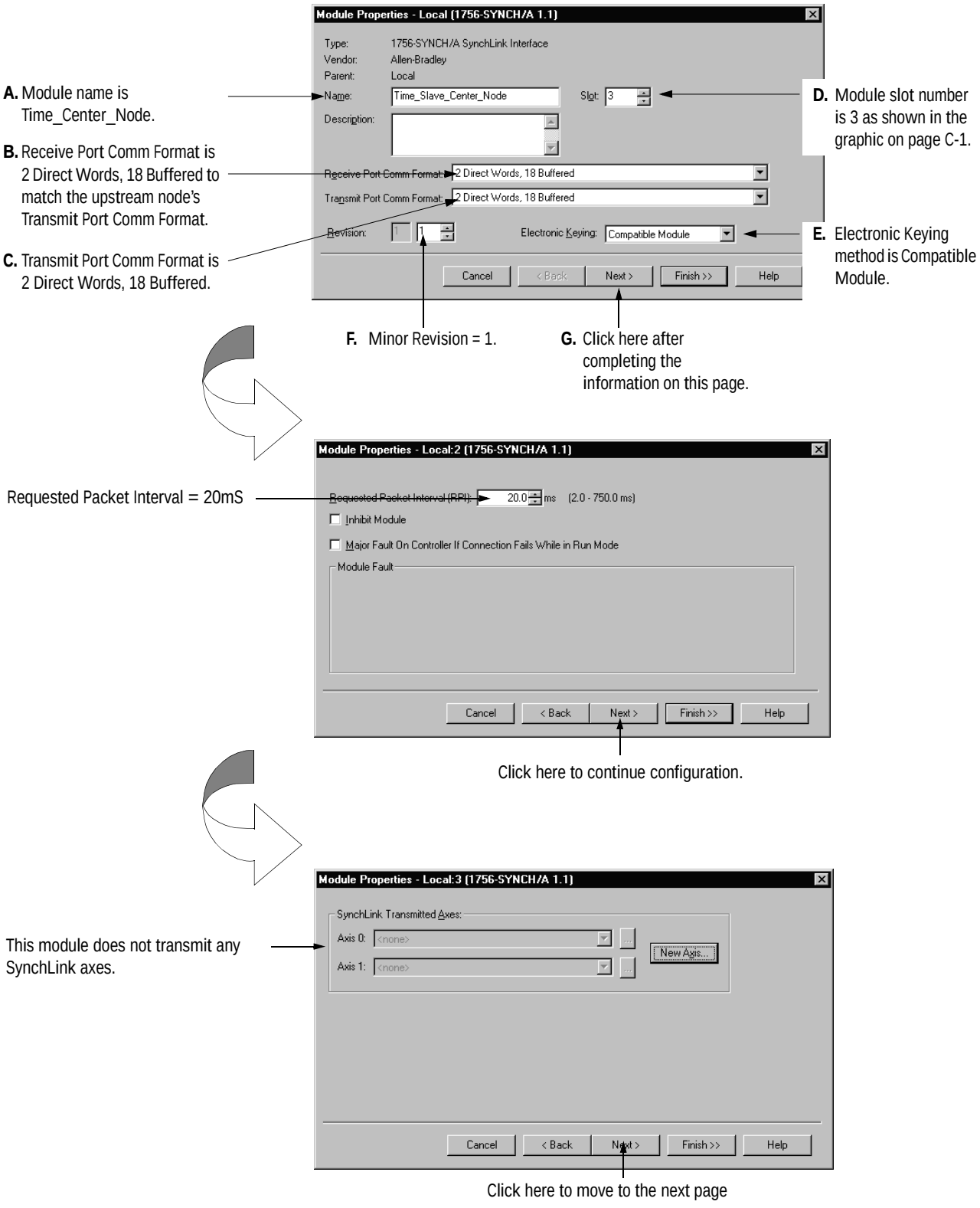
Add a SynchLink Module

1. Select a SynchLink module as shown below.

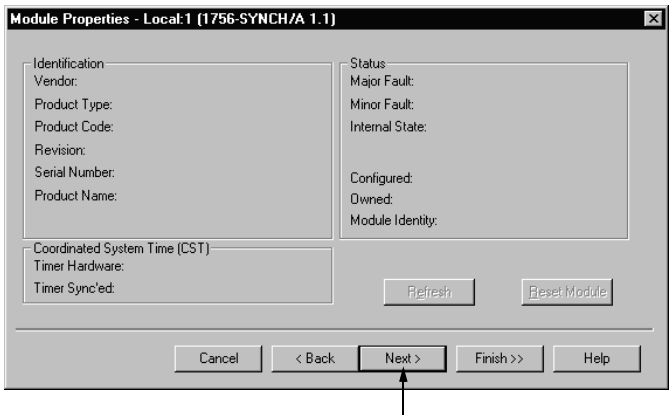


Configure the SynchLink Module

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

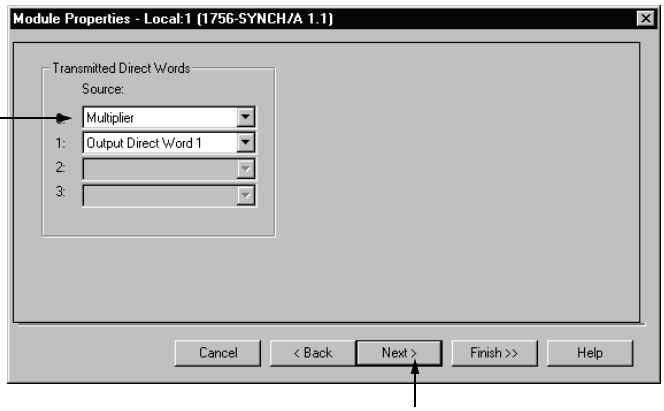


The Module Identification page is blank during initial configuration.



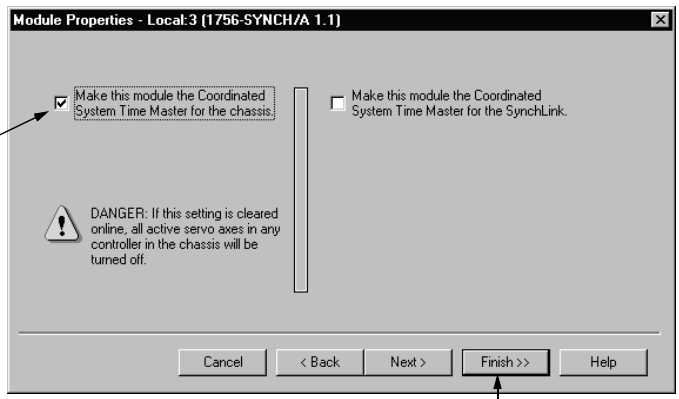
Click here to move to the next page

The module transmits 2 Direct Words, as specified in the transmit port communications format. The first Direct Word transmits the Multiplier value specifed in the Local:x:O.Multiplier data tag.



Click here to move to the next page

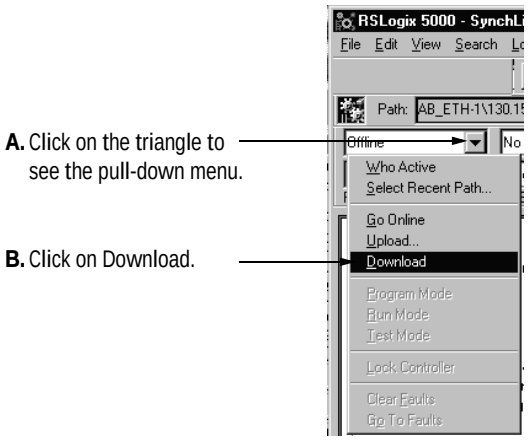
Time slave modules must be configured as Time Masters for their respective chassis if you want to synchronize the CST value in the local chassis with the system CST Time Master.



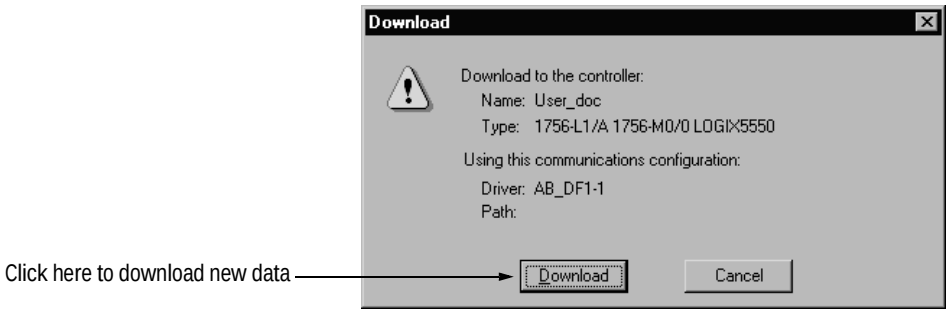
Click here to finish configuration.

Download Configuration

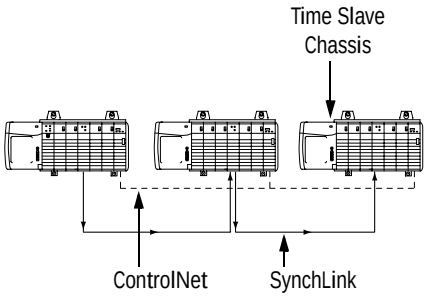
Download the configuration data.



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



This completes the download process.



Configure Time Slave Chassis - End Node

You must complete the following tasks to configure the second Time Slave 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
  - Make the module the CST Time Master for the chassis
- 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.

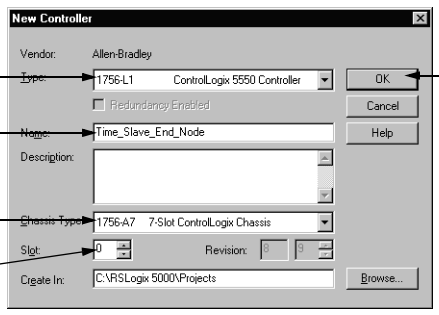
2. Name the controller.

A. The controller is a 1756-L1.

B. The controller is named Time_Slave_End_Node.

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

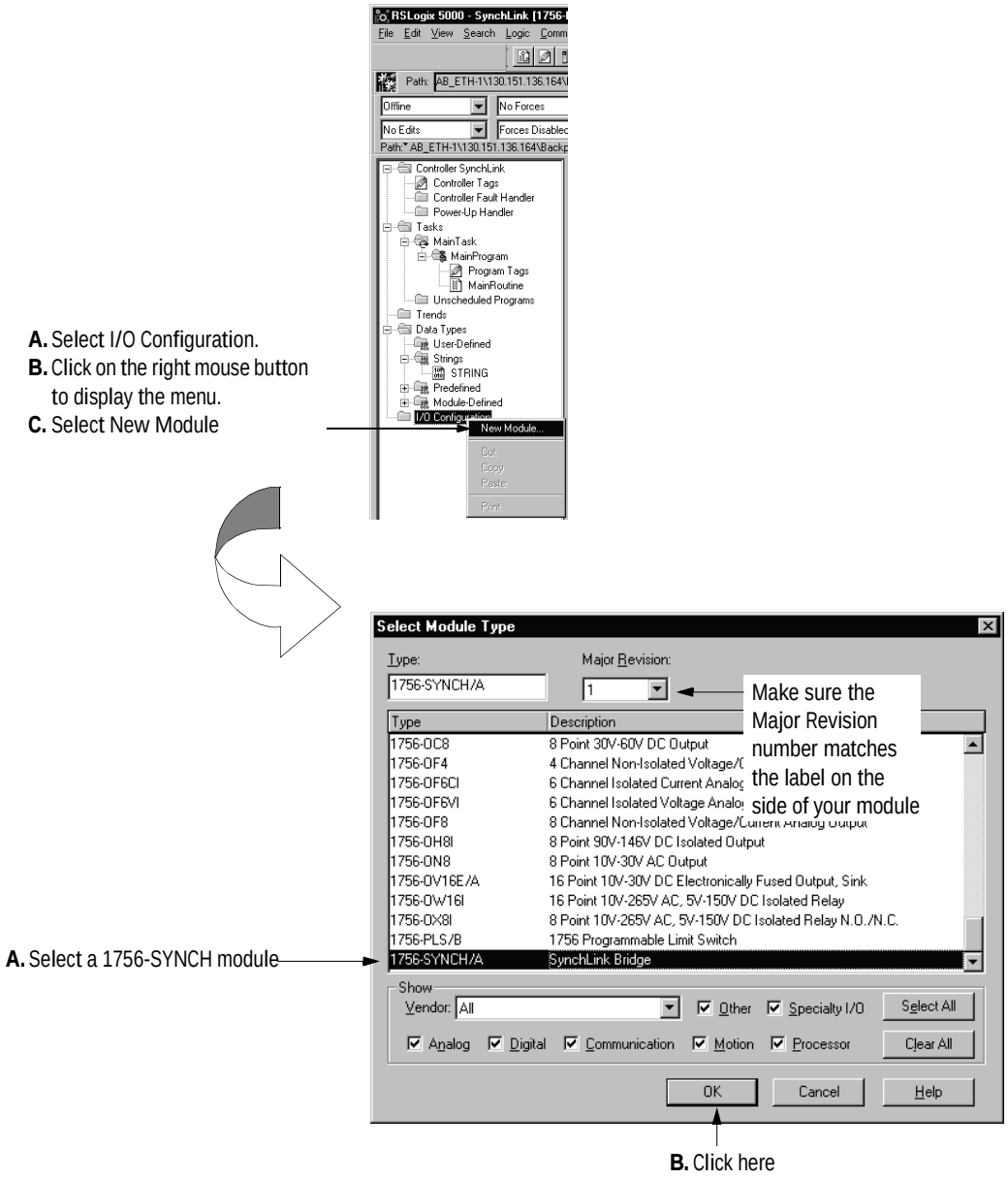
D. The controller's slot location is 0.



F. Click here to use the new controller.

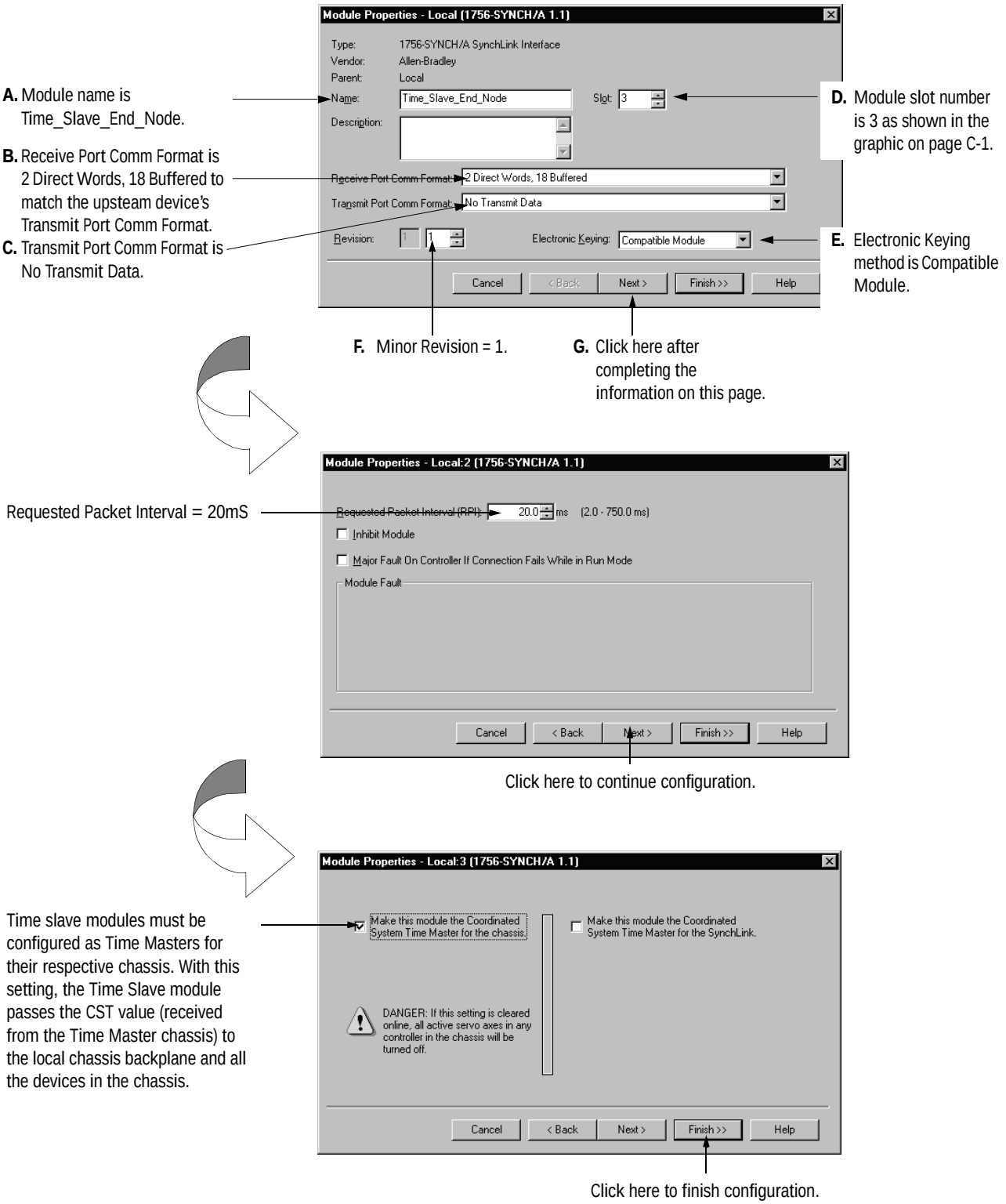
Add a SynchLink Module

1. Select a SynchLink module as shown below.

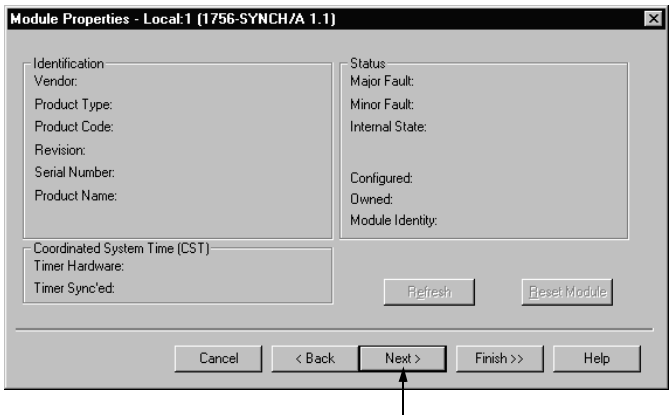


Configure the SynchLink Module

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

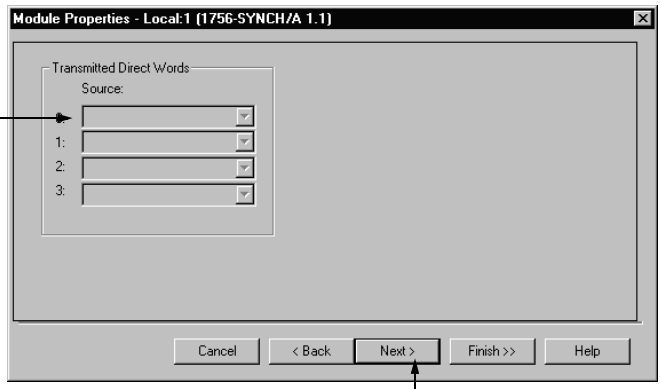


The Module Identification page is blank during initial configuration.



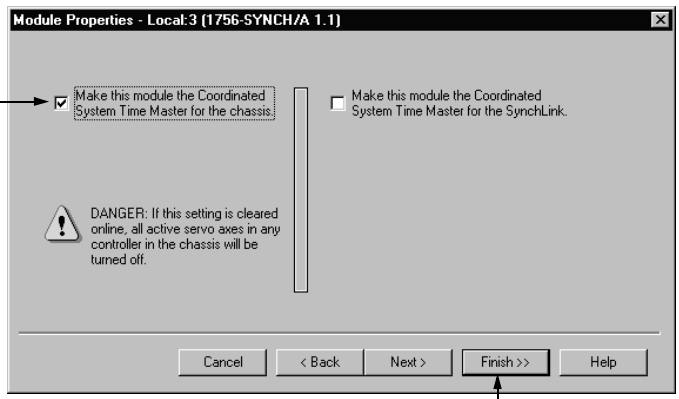
Click here to move to the next page

As the end node in the Daisy Chain configuration, this module does not transmit any Direct Words.



Click here to move to the next page

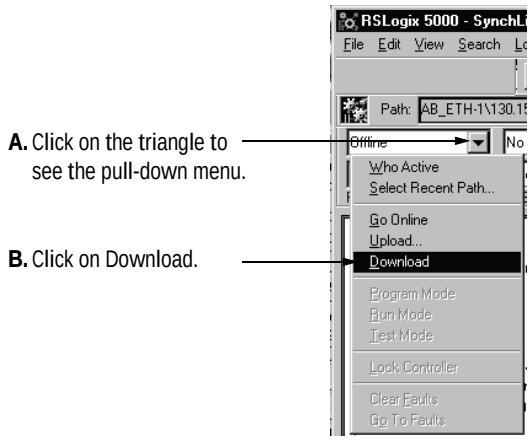
Time slave modules must be configured as Time Masters for their respective chassis if you want to synchronize the CST value in the local chassis with the system CST Time Master.



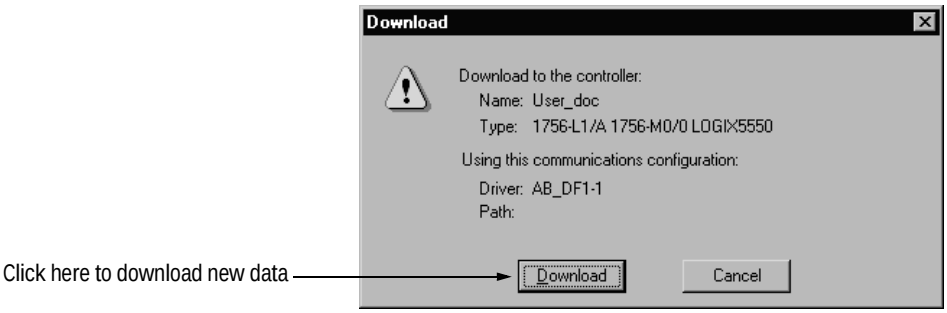
Click here to finish configuration.

Download Configuration

Download the configuration data.



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



This completes the download process.

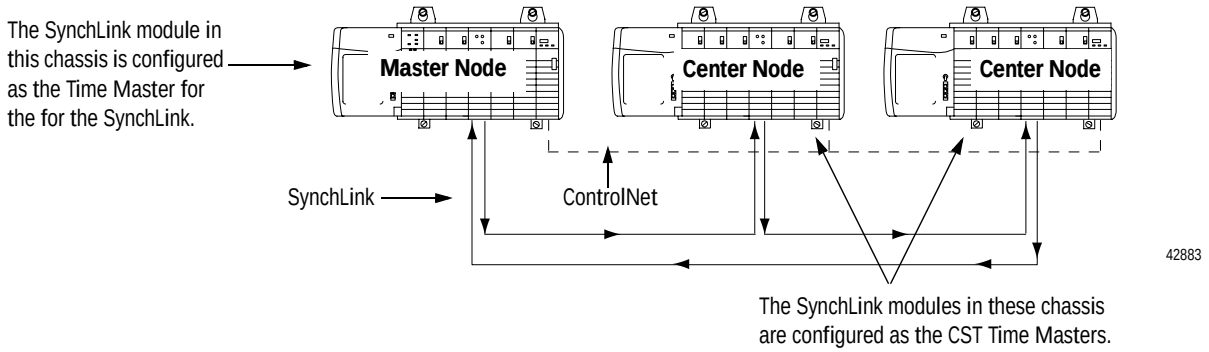
When all the chassis in the Daisy Chain Configuration are configured and operating online (i.e. configuration was downloaded) the chassis synchronize with the CST Time Master.

Configuring the Ring Configuration

This appendix provides a sample configuration for a SynchLink system using the Ring Configuration. The system's physical configuration is shown in Figure D.1. In this configuration, you must:

- configure the Master Node in an RSLogix 5000 project.
- configure the Center Node in an RSLogix 5000 project.
- configure the End Node in an RSLogix 5000 project.

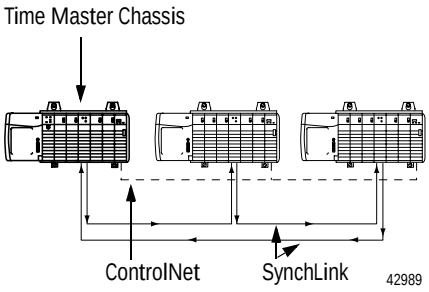
Figure D.1



IMPORTANT

You can use a maximum of 10 nodes in the Ring configuration. In this configuration, you must configure all chassis that are Time Slave chassis on SynchLink as CST Time Master for the local chassis.

Also, in the Star and Daisy Chain configurations, the Master Node does not receive data. But in the Ring configuration, the Master Node receives data from the End Node. Make sure the Master Node's receive port communications format matches the End Node's transmit port communications format.



Configure Time Master Chassis - Master Node

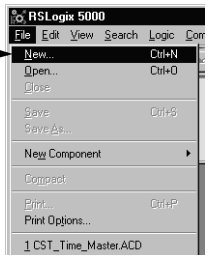
You must complete the following tasks to configure the time master chassis.

- 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 CST 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.



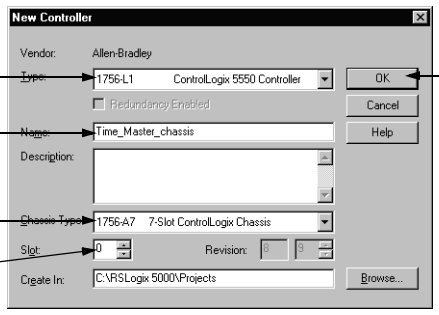
2. Name the controller.

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.

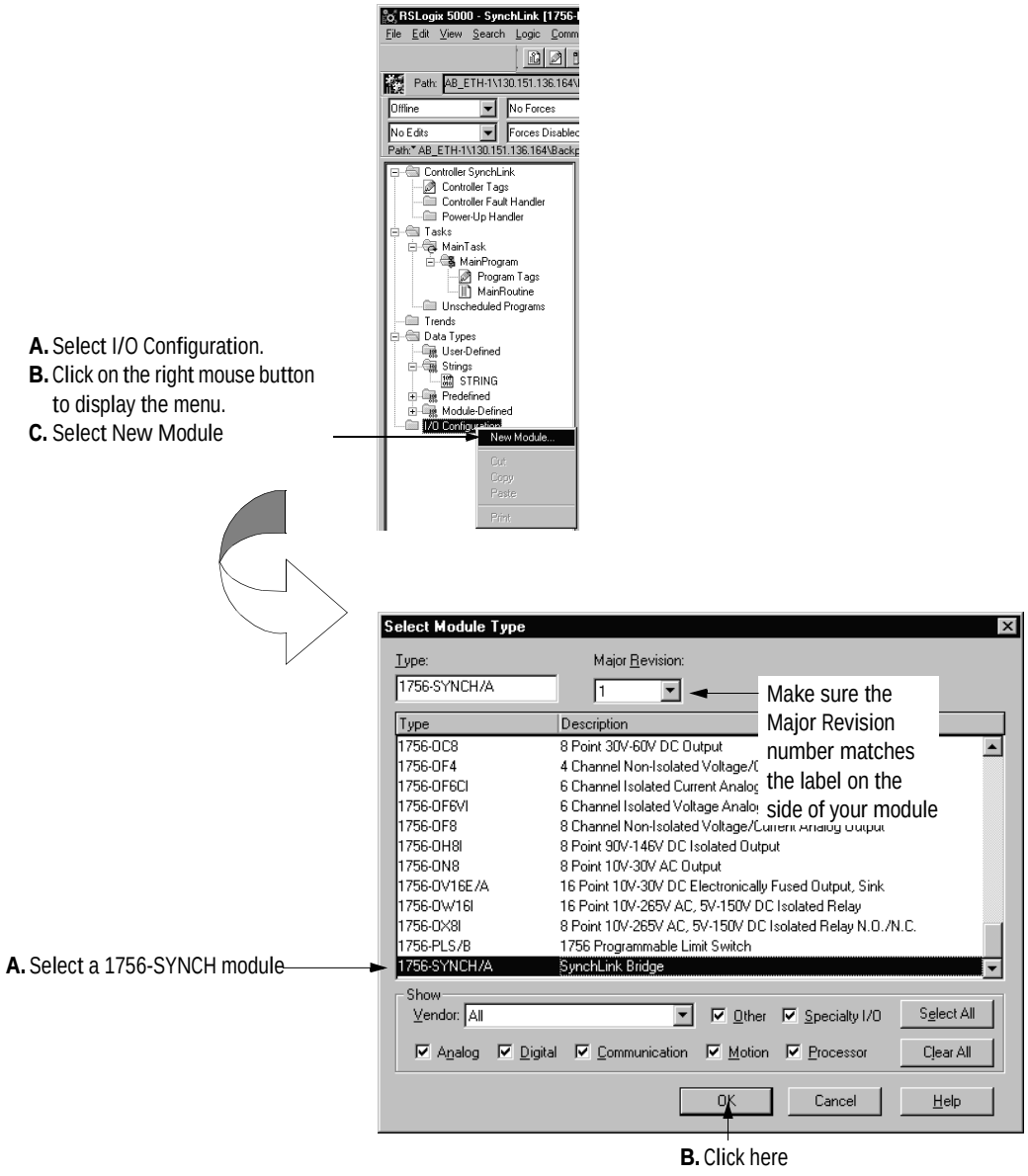
D. The controller slot number is 0.



E. Click here to use the new controller.

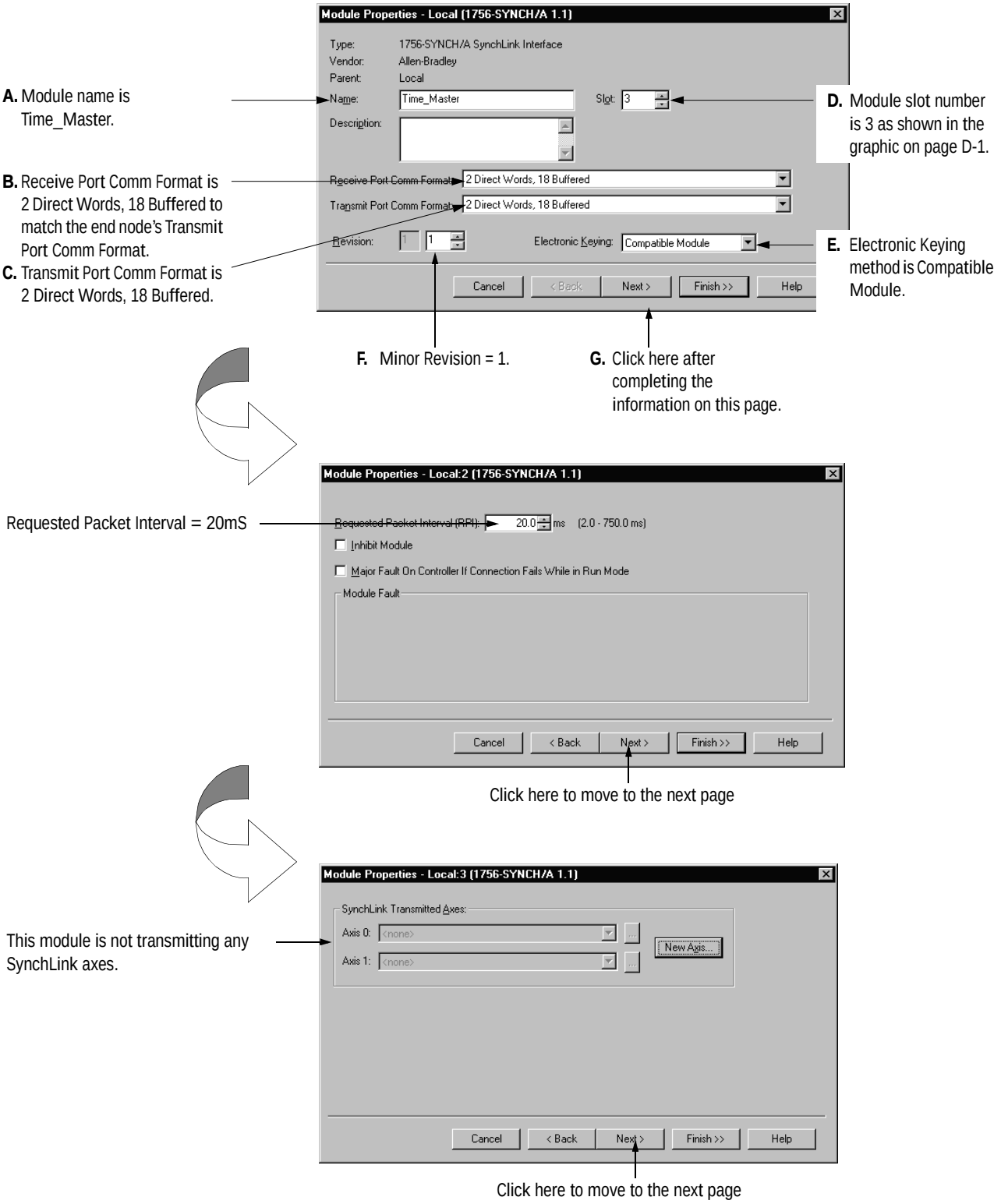
Add a SynchLink Module

1. Select a SynchLink module as shown below.

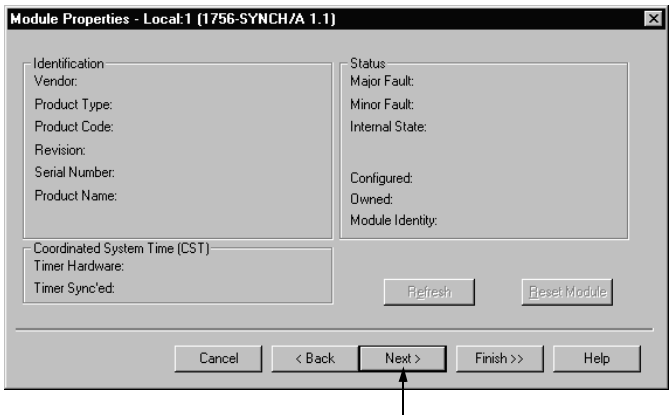


Configure the SynchLink Module

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

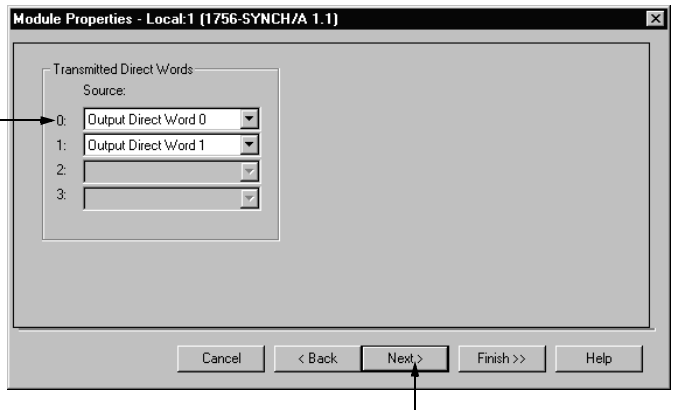


The Module Identification page is blank during initial configuration.



Click here to move to the next page

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

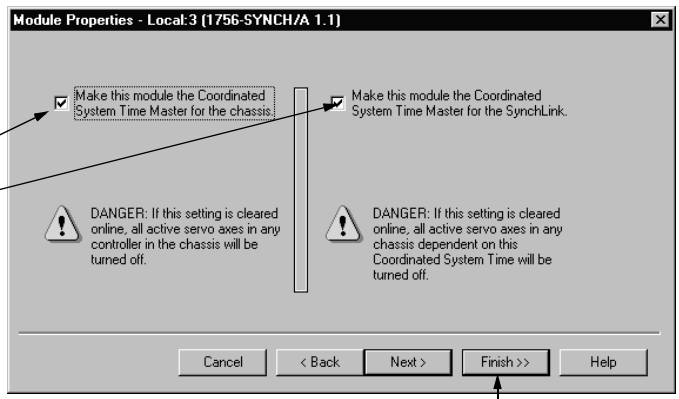


Click here to move to the next page

The module is configured as the Time Master for:

- the chassis - optional
- the SynchLink - required

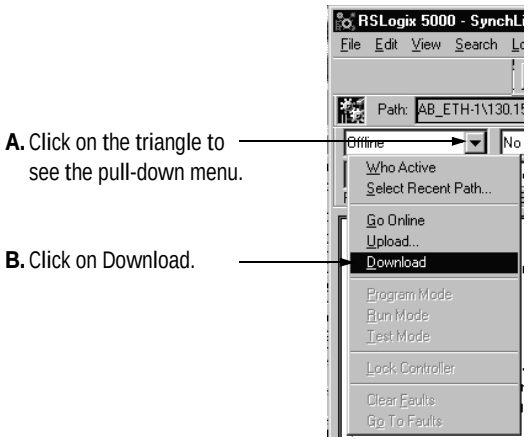
IMPORTANT: In this configuration, the SynchLink module must be the Time Master of the SynchLink, but it is not required to be the Time Master of the chassis. If the module is not the Time Master of the chassis, it receives the CST timer value from the chassis backplane.



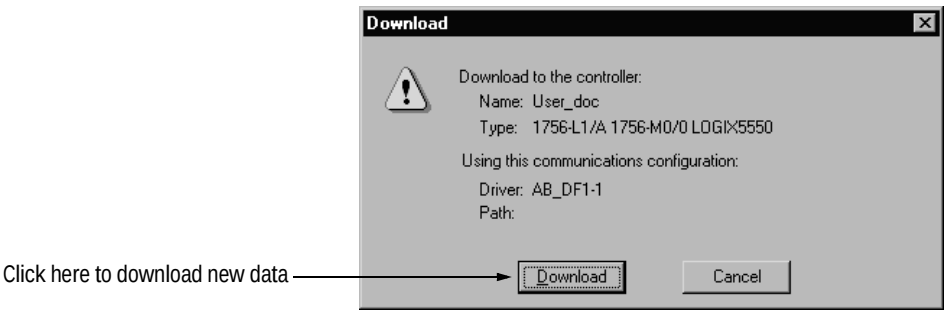
Click here to finish configuration.

Download Configuration

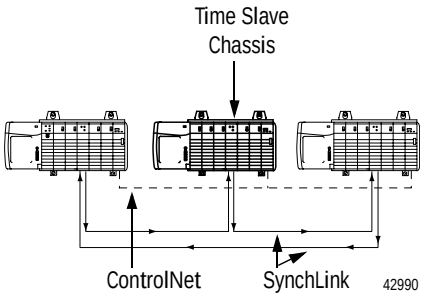
Download the configuration data.



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



This completes the download process.



Configure Time Slave Chassis - Center Node

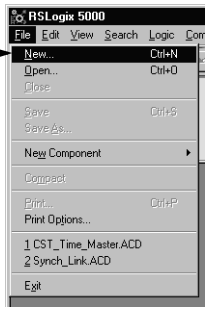
You must complete the following tasks to configure the first time slave chassis.

- 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
  - Make the module the CST Time Master for the chassis
- 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.



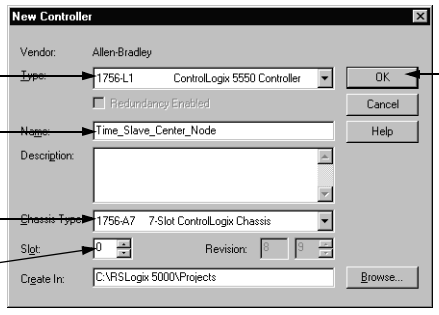
2. Name the controller.

A. The controller is a 1756-L1.

B. The controller is named Time_Slave_Center_Node.

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

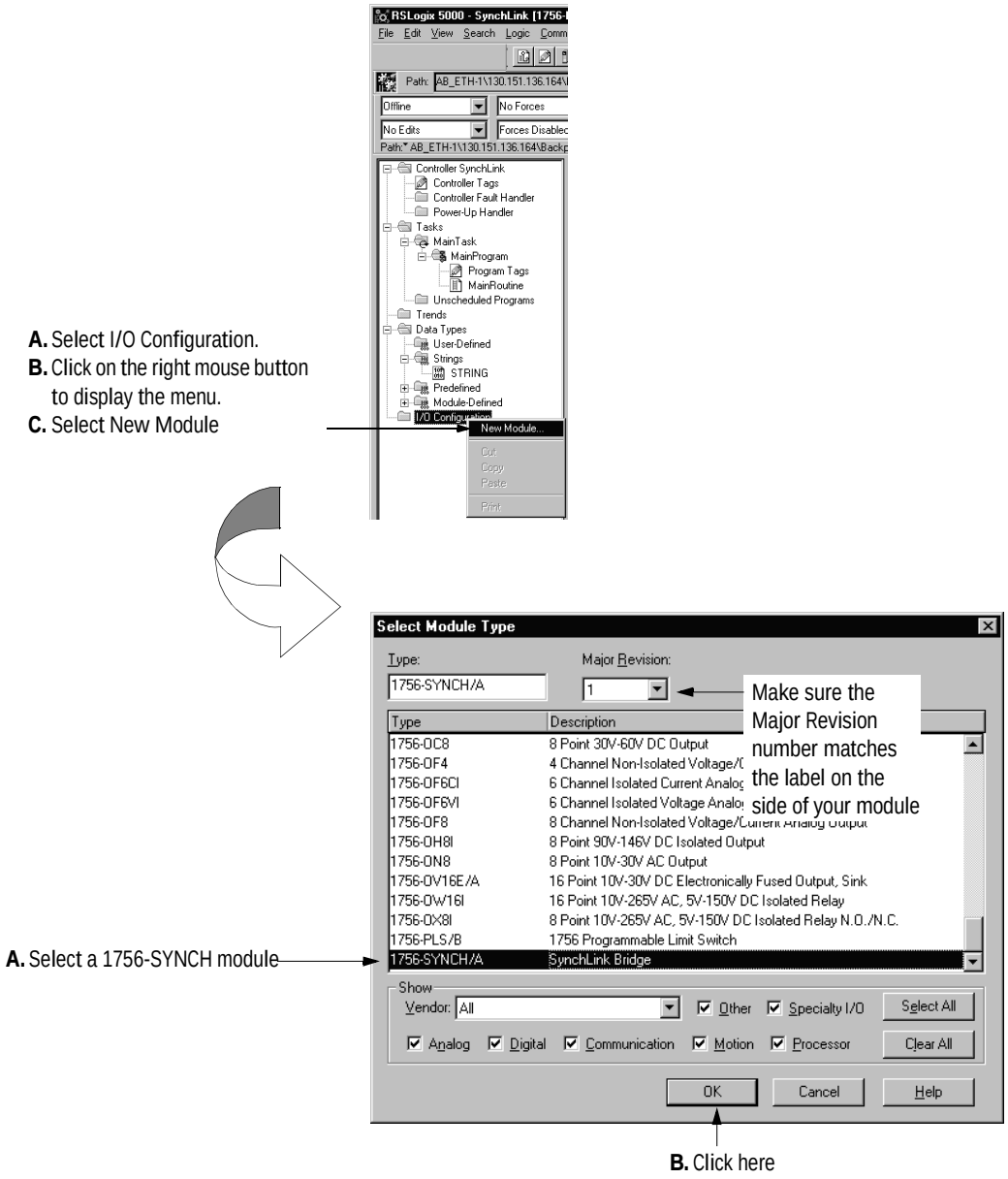
D. The controller's slot location is 0.



F. Click here to use the new controller.

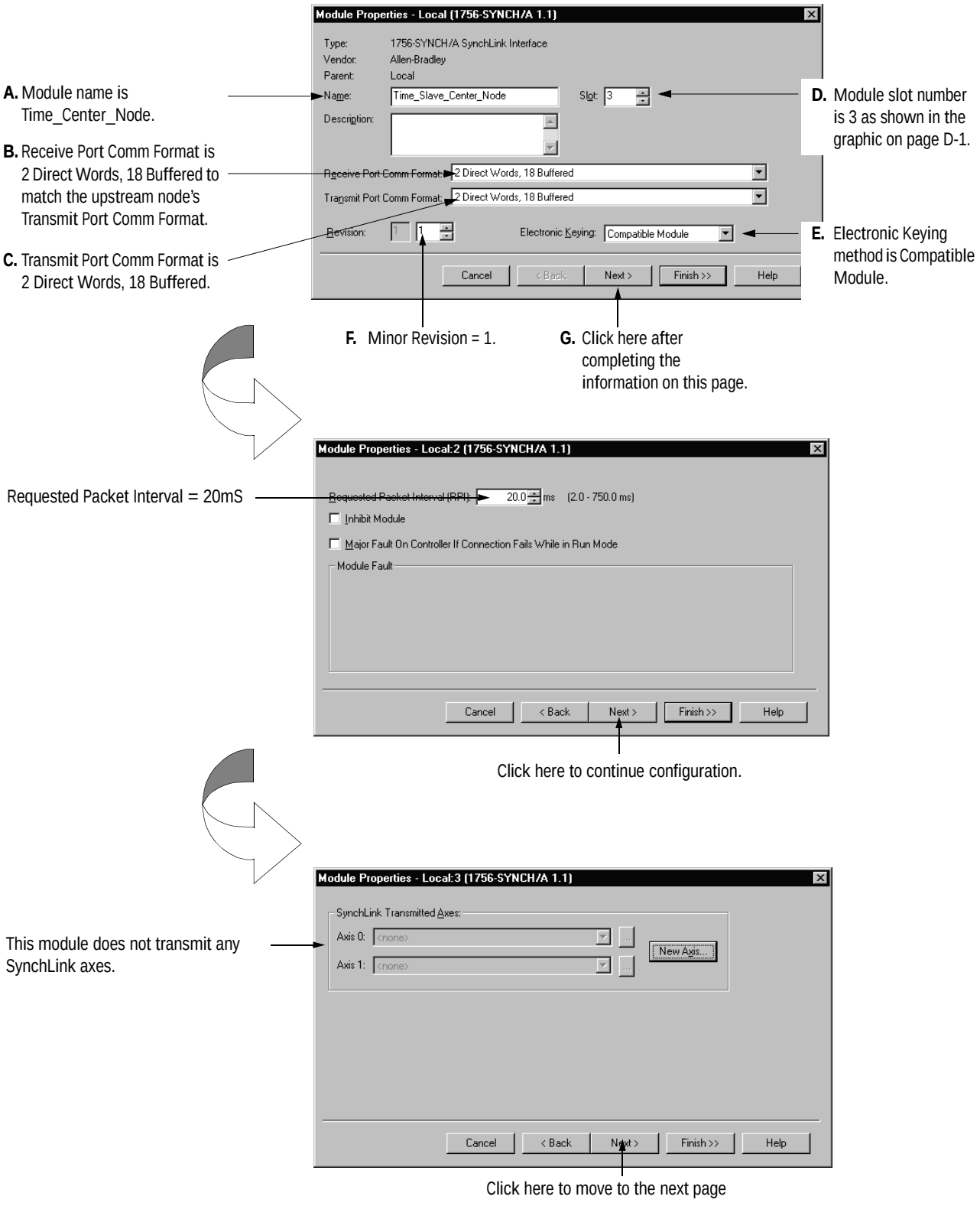
Add a SynchLink Module

1. Select a SynchLink module as shown below.

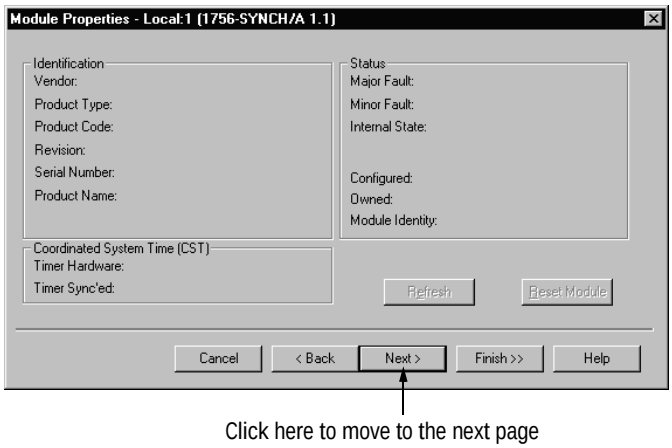


Configure the SynchLink Module

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

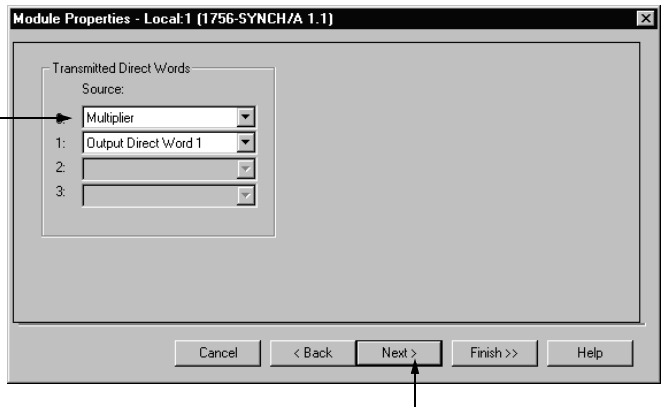


The Module Identification page is blank during initial configuration.



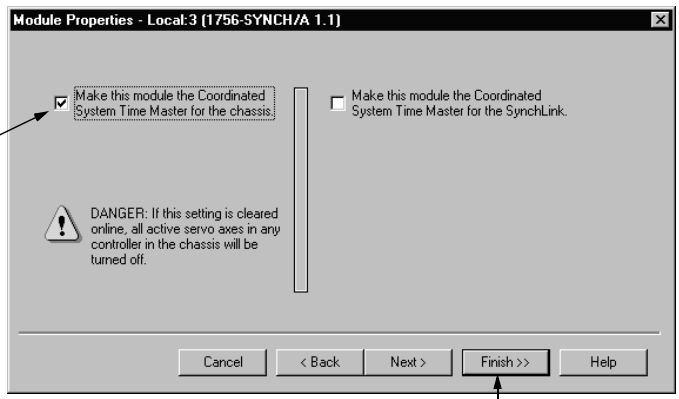
Click here to move to the next page

The module transmits 2 Direct Words, as specified in the transmit port communications format. The first Direct Word transmits the Multiplier value specifed in the Local:x:O.Multiplier data tag.



Click here to move to the next page

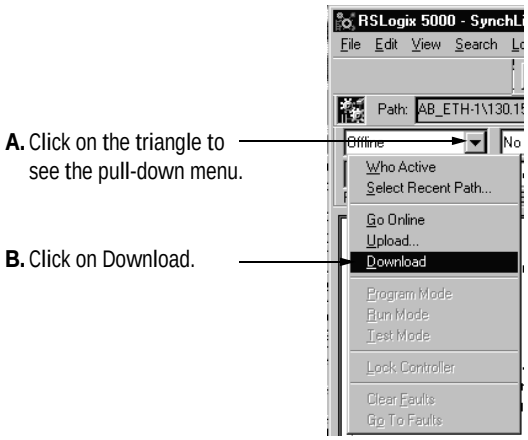
Time slave modules must be configured as Time Masters for their respective chassis if you want to synchronize the CST value in the local chassis with the system CST Time Master.



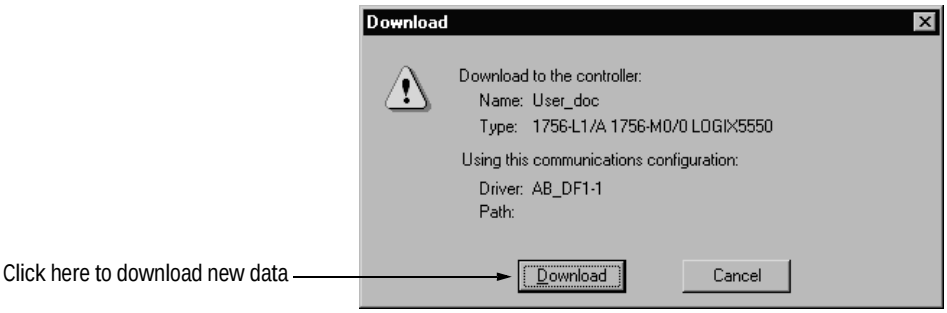
Click here to finish configuration.

Download Configuration

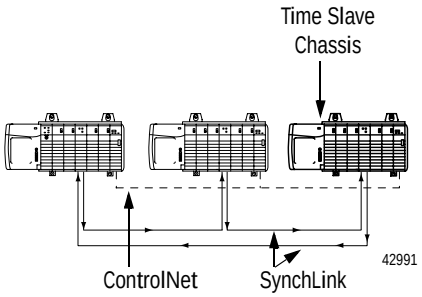
Download the configuration data.



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



This completes the download process.



Configure Time Slave Chassis - End Node

You must complete the following tasks to configure the second Time Slave 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
  - Make the module the CST Time Master for the chassis
- 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.

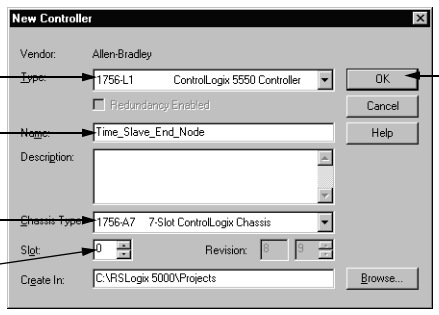
2. Name the controller.

A. The controller is a 1756-L1.

B. The controller is named Time_Slave_End_Node.

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

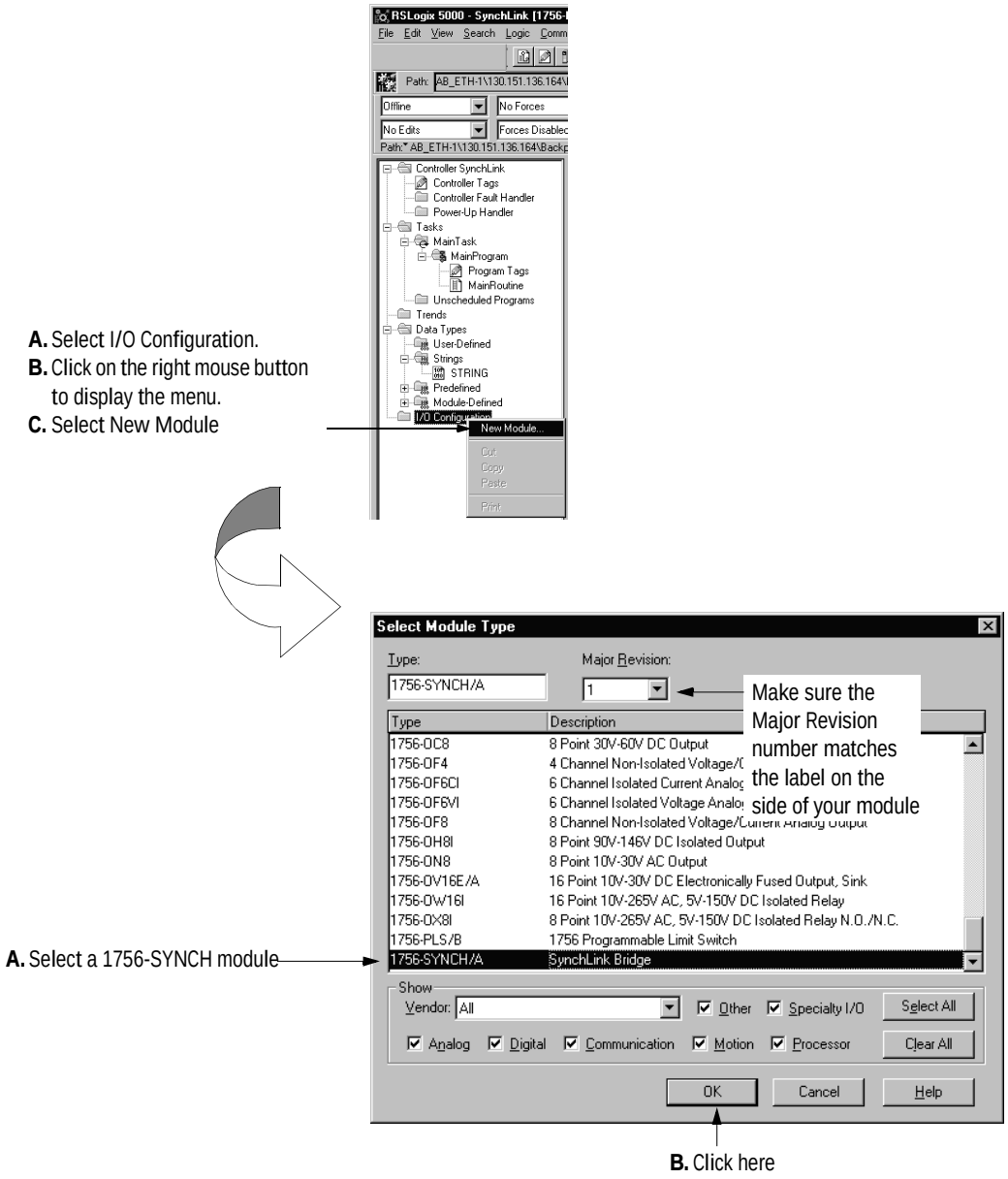
D. The controller's slot location is 0.



F. Click here to use the new controller.

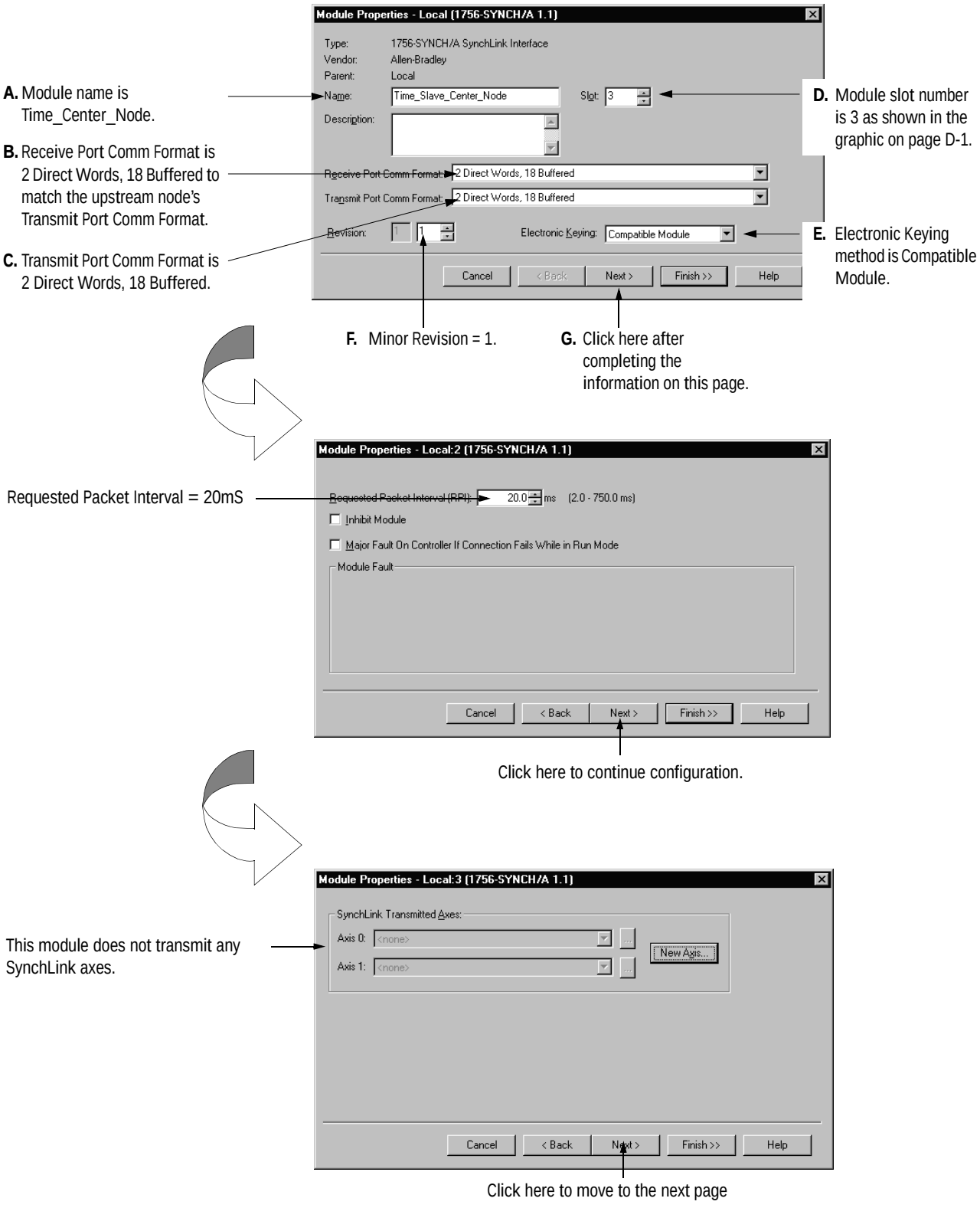
Add a SynchLink Module

1. Select a SynchLink module as shown below.

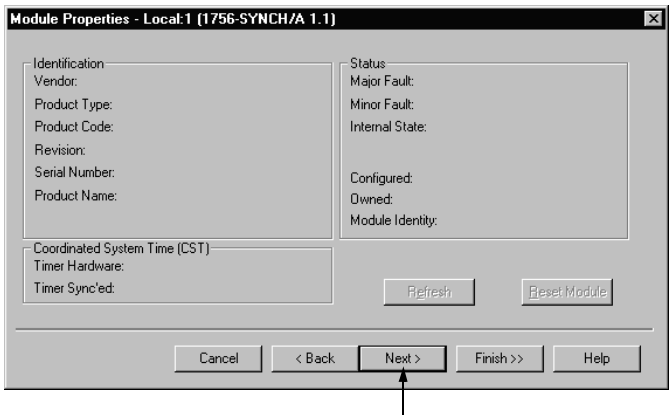


Configure the SynchLink Module

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

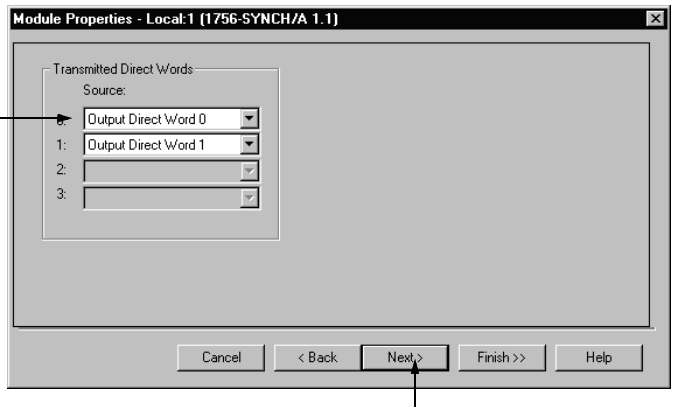


The Module Identification page is blank during initial configuration.



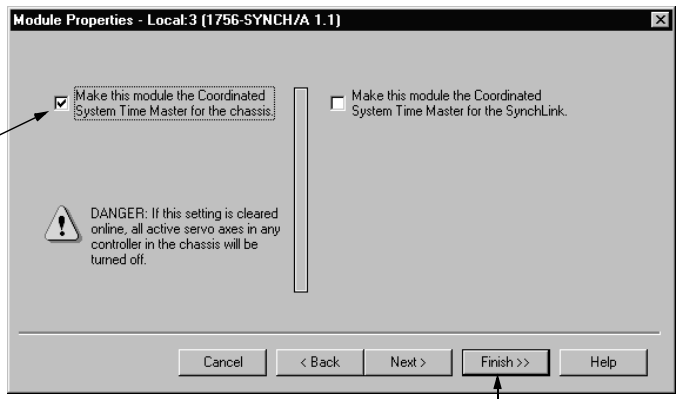
Click here to move to the next page

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



Click here to move to the next page

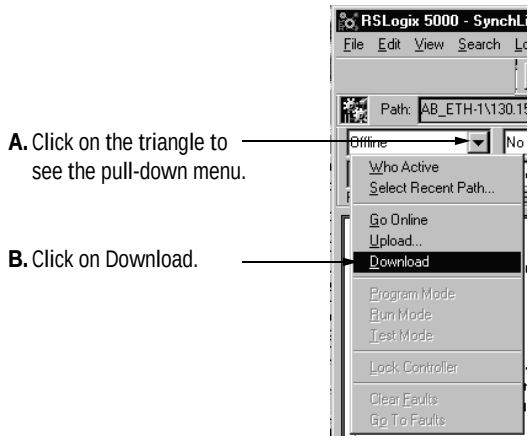
Time slave modules must be configured as Time Masters for their respective chassis if you want to synchronize the CST value in the local chassis with the system CST Time Master.



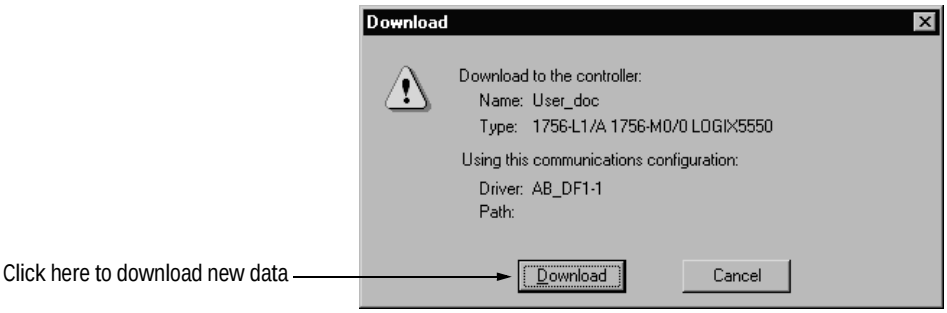
Click here to finish configuration.

Download Configuration

Download the configuration data.



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



This completes the download process.

When all the chassis in the Ring Configuration are configured and operating online (i.e. configuration was downloaded) the chassis synchronize with the CST Time Master.

Software Configuration Tags

IMPORTANT Although this appendix presents the option of changing a module's configuration through the Tag Editor of RSLogix 5000, we suggest that you use the module's properties tabs to change configuration when possible.

When you create a module, module-defined data types and tags are created in the RSLogix 5000 programming software. These Tags allow you to access the Input and Output Data of the module via the controller's ladder logic.

The types of tags created vary, depending on which communications format you choose when creating a module. There are two types of tags:

- Input Data Tags
- Output Data Tags

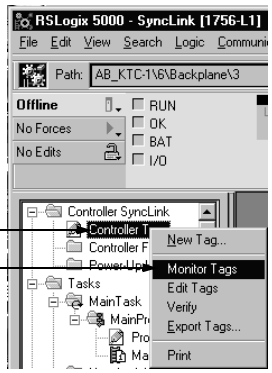
This appendix lists all the tags of each type, but the tags created by RSLogix 5000 varies according to the communications format chosen during initial module configuration.

Accessing the Tags

When you access tags, you have two options. You can:

- monitor tags - option allows you to view tags and change their values
- edit tags - option allows you to add or delete tags but not change values

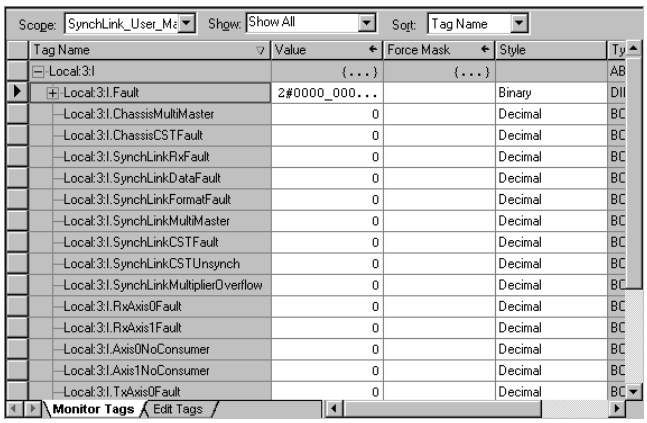
A. Right-click on Controller Tags.
B. Select Monitor Tags.



You can view tags here.

Click on the data type (input or output) you want to see.

Information is listed for each input and output data type.



Input Data Tags

Table E.1 lists the input data tags available on your ìSynchLink module.

Table E.1
Input Data Tags

Name (x = module's chassis slot location):	Type:	Definition:
Local.x.I.Fault	DINT	
Local.x.I.ChassisMultiMaster	BOOL	0 = The chassis has no CST master or one CST master 1 = This module is configured to be CST master, but another module is active as CST master.
Local.x.I.ChassisCSTFault	BOOL	0 = Chassis CST value is not faulted. 1 = Chassis CST value is faulted.
Local.x.I.SynchLinkRxFault	BOOL	0 = The module's receive port is functioning properly. 1 = A fault has occurred on the module's receive port.
Local.x.I.SynchLinkDataFault	BOOL	0 = Either no data received from upstream module (see other faulty bits) or upstream device not in idle state 1 = Upstream device producing data for this module is in the idle state
Local.x.I.SynchLinkFormatFault	BOOL	0 = The module's communications formats are properly configured. 1 = This modules receive port communications format does not match the upstream module's transmit port communications format
Local.x.I.SynchLinkMultiMaster	BOOL	0 = One node is configured as the master of the SynchLink . 1 = Multiple nodes are configured as the master of the SynchLink.
Local.x.I.SynchLinkCSTFault	BOOL	0 = Valid CST data received from upstream module or CST data not required 1 = This module configured to relay CST from SynchLink to Chassis and valid CST data not received from upstream module
Local.x.I.SynchLinkCSTUnsynch	BOOL	0 = The module's CST value is either synchronized with the rest of the system or is configured so that synchronization is not required. 1 = The module is configured to synchronize its CST value with the rest of the system but the synchronization has not occurred.
Local.x.I.SynchLinkMultiplierOverflow	BOOL	This field only shows a value if the result of Multiplier (i.e. Local.x.O.Multiplier) exceeds 16 bits. This value here is the excess over 16 bits of data.
Local.x.I.RxAxis0Fault	BOOL	0 = The module's receive port is either receiving Axis0 data or is not configured to receive such data. 1 = This module is configured to transmit Axis0 data but is not receiving Axis0 data from local processor
Local.x.I.RxAxis1Fault	BOOL	0 = The module's receive port is either receiving Axis1 data or is not configured to receive such data. 1 = This module is configured to transmit Axis1 data but is not receiving Axis0 data from local processor
Local.x.I.Axis0NoConsumer	BOOL	0 = Another device is consuming the Axis0 data this module is producing or this module is not configured to produce Axis0 data. 1 = No device is configured to consume the Axis0 data this module produces.

Table E.1
Input Data Tags

Name (x = module's chassis slot location):	Type:	Definition:
Local.x.I.Axis1NoConsumer	BOOL	0 = Another device is consuming the Axis1 data this module is producing or this module is not configured to produce Axis1 data. 1 = No device is configured to consume the Axis1 data this module produces.
Local.x.I.TxAxis0Fault	BOOL	0 = The module's transmit port is transmitting Axis0 data or is not configured to transmit such data. 1 = The module is configured to transmit Axis0 data but is experiencing a fault on that port.
Local.x.I.TxAxis1Fault	BOOL	0 = The module's transmit port is transmitting Axis0 data or is not configured to transmit such data. 1 = The module is configured to transmit Axis0 data but is experiencing a fault on that port.
Local.x.I.DirectData[0] through Local.x.I.DirectData[3]	DINT	These 4 fields vary according to the data contained the first direct word the module receives.
Local.x.I.BufferedData[0] through Local.x.I.BufferedData[17]	DINT	These 18 fields vary according to the data contained the first buffered word the module receives.
Local.x.I.MultiplierProduct	DINT	The product of the Multiplier and the selected Direct Word.

Output Data Tags

Table E.2 lists the output data tags available on your SynchLink module.

Table E.2
Output Data Tags

Name (x = module's chassis slot location):	Type:	Definition:
Local.x.O.DirectData[0] through Local.x.O.DirectData[3]	DINT	These fields contain the data that this module will transmit in the direct data word if configured to transmit output direct words. The module can transmit up to 4 output direct words.
Local.x.O.BufferedData[0] through Local.x.O.BufferedData[17]	DINT	These fields contain the data that this module will transmit in the buffered data words. The module can transmit up to 18 buffered data words.
Local.x.O.Multiplier	REAL	Coeeficient applied in multiplier feature, restricted to 0.5 to 2.0

Buffered data

Data exchanged between SynchLink nodes. The data is appropriately segmented at the transmitting module and reassembled at the receiving module. Buffered data cannot be automatically forwarded to the next node in the daisy chain configuration.

Center node

A node in the SynchLink Daisy Chain or Ring configuration that receives data and transmits data.

Communications format

Format that defines the type of information transferred between an I/O module and its owner controller. This format also defines the tags created for each I/O module.

Compatible match

An electronic keying protection mode that requires the physical module and the module configured in the software to match according to vendor, catalog number and major revision. In this case, the minor revision of the module must be greater than or equal to that of the configured slot.

Connection

The communication mechanism from the controller to another module in the control system.

Coordinated system time (CST)

Timer value that is used in:

- all modules in a single ControlLogix chassis

  or

- all ControlLogix chassis in a distributed control system.

The SynchLink system can synchronize this timer value across chassis.

Daisy chain configuration

SynchLink configuration that begins with a master node and ends at an end node. Center nodes may be used between the master and end in this configuration.

Direct data

Data delivered in a single message. A SynchLink message can allocate a maximum of four words. Direct data can be automatically forwarded to the next node in the daisy chain configuration.

Disable keying

Option that turns off all electronic keying to the module. Requires no attributes of the physical module and the module configured in the software to match.

Download

The process of transferring the contents of a project on the workstation into the controller.

Electronic keying

A system feature which makes sure that the physical module attributes are consistent with what was configured in the software.

Exact match

An electronic keying protection mode that requires the physical module and the module configured in the software to match identically, according to vendor, catalog number, major revision and minor revision.

Field side

Interface between user field wiring and I/O module.

End node

A node in SynchLink Star and Daisy chain configurations that only receives data.

Inhibit

A ControlLogix process that allows you to configure a SynchLink module but prevent it from communicating with the owner controller. In this case, the controller does not establish a connection.

Hub

Distribution unit in the star configuration that consists of a single base block and up to 4 splitter blocks. Unidirectional data passes through the hub.

Listen-only connection

An I/O connection that allows a controller to monitor I/O module data without owning the module.

Major revision

A module revision that is updated any time there is a functional change to the module resulting in an interface change with software.

Master node

A node in any SynchLink configuration that serves as the time master and begins the SynchLink system.

Minor revision

A module revision that is updated any time there is a change to the module that does not affect its function or software user interface (e.g. bug fix).

Owner controller

The controller that creates and stores the primary configuration and communication connection to a module.

Receive port communications format

The communications format used in a ControlLogix SynchLink module for all data the module receives.

Remote axis data

Motion data used by the motion planner in the controller. The 1756-SYNCH module can consume an Axis tag from a controller and pass it over SynchLink. A controller in another chassis can then consume axis tags passed over SynchLink from the 1756-SYNCH module in that chassis.

Removal and insertion under power (RIUP)

A ControlLogix feature that allows a user to install or remove a module while power is applied.

Requested packet interval (RPI)

A configurable parameter which defines when the module will multicast data.

Ring Configuration

SynchLink configuration that begins with the master node. Unidirectional data passes from the master node to up to nine other nodes and then back to the master node.

RSLogix 5000

The programming software for any ControlLogix system.

Star configuration

A SynchLink topology where a hub is the physical center of the link, and SynchLink nodes are connected to the hub. Each node has its own direct, dedicated line to the hub. The hub acts as a multi-port repeater and contains one receive and up to 16 transmit ports. The Producer/Master node transmitter is connected to the hub receiver. The receiver of each of the Consumer/Slave nodes is connected to an appropriate hub transmitter. The Producer/Master node transmitter and Consumer/Slave node transmitters are not connected. Messages transmitted by the Producer/Master node are retransmitted (repeated) simultaneously to all Consumer/Slave nodes.

SynchLink

A unidirectional fiber optic communications link that provides time synchronization and data broadcasting. These functions are used for distributed motion and coordinated drive control systems based on ControlLogix and PowerFlex™ 700S products.

Synchronize

A process where multiple devices operate at the same time or maintain a matching time reference.

Time master

A device (e.g. SynchLink module) that is configured to establish the time reference for a ControlLogix chassis or SynchLink system.

Time relay

A device that is configured to pass a time reference between a chassis backplane and a SynchLink fiber.

Time slave

A device (e.g. SynchLink module) that is configured to receive the time reference from the CST Time Master (located in a ControlLogix chassis) or upstream node in a SynchLink system.

Timestamp

A ControlLogix process that stamps a change in input data with a time reference of when the change occurred.

Transmit port communications format

The communications format used in a ControlLogix SynchLink module for all data the module transmits.

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