Allen-Bradley

ControlLogix® Redundancy System

1756-CNB/D, 1756-CNBR/D, 1756-ENBT, 1756-EWEB, 1756-L55, 1756-L55M12, 1756-L55M13, 1756-L55M14, 1756-L55M16, 1756-L55M22, 1756-L55M23, 1756-L55M24, 1756-L61, 1756-L62, 1756-L63, 1757-SRM

User Manual

Rockwell Automation

Important User Information

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

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

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

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

WARNING

Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

IMPORTANT

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

ATTENTION

Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you:

- identify a hazard
- avoid a hazard
- recognize the consequence

SHOCK HAZARD

Labels may be located on or inside the drive to alert people that dangerous voltage may be present.

BURN HAZARD

Labels may be located on or inside the drive to alert people that surfaces may be dangerous temperatures.

Introduction

This release of this document contains new and updated information. To find new and updated information, look for change bars, as shown next to this paragraph.

Updated Information

The document contains the following changes:

For this new or updated information:	See:
Miscellaneous updates that show EtherNet/IP	Chapter 1
IP address swapping of EtherNet/IP modules in a redundant chassis	Chapter 1
List of features not supported: event tasks, inhibited tasks, read/write from/to CF card, motion control	Chapter 1
1756-EWEB modules in a redundant chassis	Chapters 1 and 2
Guidelines for an EtherNet/IP network	Chapters 1 and 2
ControlLogix5561, 5562, 5563 controller in a redundant chassis	Chapters 1 and 2
Operator interfaces—RSLinx Enterprise software 3.0 lets you use local ENBT and EWEB modules	Chapters 1 and 2
Operator interfaces—if you don't want a bump, use ControlNet	Chapters 1 and 2
Up to 2 ControlLogix5555 controllers in the same redundant chassis	Chapters 1 and 2
Choose IP addresses	Chapter 2
How an EtherNet/IP module handles a cable break	Chapter 2
Additional considerations: • Switchover always triggers an event task in a remote, non-redundant controller. • Simultaneous branch delays the execution of a higher priority task.	Chapter 2
Install an EtherNet/IP Web Server module	Chapter 3
Configure the IP address of an EtherNet/IP module	Chapter 3
Configure a 1757-SRM module—new chapter that includes: • Check your revision of the SRM configuration tool • Set the clock of an SRM	Chapter 4
Schedule ControlNet networks—moved to different chapter	Chapter 5
Finalize All Edits in Program	Chapter 5
New guideline for minimum scan time	Chapter 5
More ways to lower scan time:	Chapter 5
Condition logic to run after a switchover	Chapter 5
Alias topics	Appendix A
Simultaneous Power of Redundant Chassis Pair May Bump Another Redundant Chassis Pair Off the EtherNet/IP Network	Chapter 6

For this new or updated information:	See:
SRM event log: • How to interpret • How to export	Chapter 6
NVS store: • Updated procedure • Store to nvs fails with CNB > 75%	Chapter 6
If You Have Series B ControlNet Bridge Modules	Appendix D

Purpose of this Manual

This manual guides the design, development, and implementation of a redundancy system for a ControlLogix® controller.

Who Should Use this Manual

This manual is intended for those individuals who design and develop applications that use ControlLogix controllers, such as:

- software engineers
- control engineers
- application engineers
- instrumentation technicians

When to Use This Manual

Use this manual throughout the life-cycle of a redundancy system:

- design
- installation
- configuration
- programming
- testing
- maintenance and troubleshooting

How to Use this Manual

This manual is divided into the basic tasks that you perform during the design, development, and implementation of a ControlLogix redundancy system.

- Each chapter covers a task.
- The tasks are organized in the sequence that you will typically perform them.

As you use this manual, you will see some text that is formatted differently from the rest of the text:

Text that is:	Identifies:	For example:	Means:
Italic	the actual name of an item that you see on your screen or in an example	Right-click *User-Defined* ...	Right-click on the item that is named User-Defined.
`courier`	information that you must supply based on your application (a variable)	Right-click `name_of_program` ...	You must identify the specific program in your application. Typically, it is a name or variable that you have defined.
enclosed in brackets	a keyboard key	Press [Enter].	Press the Enter key.

Notes:

Chapter 1

ControlLogix® Redundancy Overview

Chapter 2

Design the System

Chapter 3

Install the System

Chapter 4

Configure the System Redundancy Module

Configure and Program the Controller

Chapter 5

Chapter 6

Maintain and Troubleshoot the System

Appendix A

Set Up EtherNet/IP Communication Across Subnets

Appendix B

Convert an Existing System to Redundancy

Appendix C

Attributes of the Redundancy Object

Appendix D

If You Have Series B ControlNet Bridge Modules

ControlLogix® Redundancy Overview

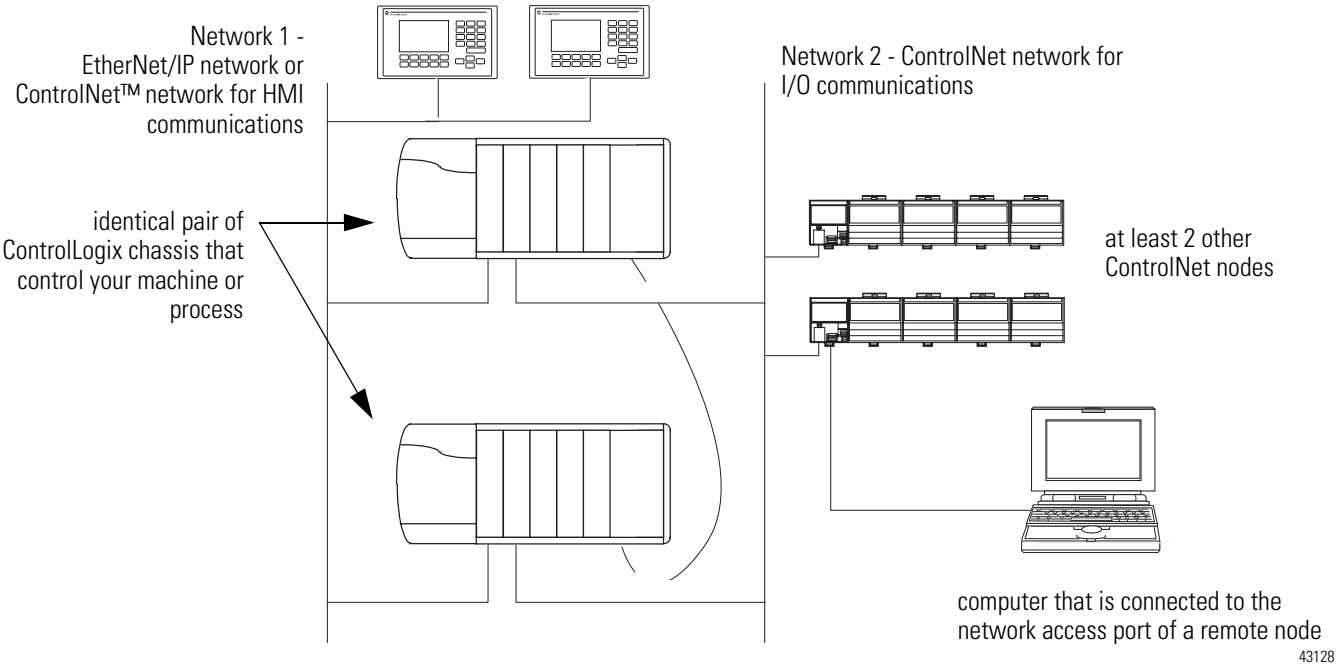
What's in this chapter?

This chapter gives you an overview of the ControlLogix redundancy system, including terms that we commonly use. It also answers some common questions about a ControlLogix redundancy system.

What are the main parts of a redundant system?

The ControlLogix redundancy system uses an identical pair of ControlLogix chassis to keep your machine or process running if a problem occurs with a controller.

The following diagram shows the layout of a simple redundant set-up.



Redundancy requires no additional programming. It is transparent to any devices that you connect over an EtherNet/IP or ControlNet™ network. It uses 1757-SRM modules to maintain communication between the pair of redundant chassis.

In a redundant system, the following terms describe the relationship between the two redundant chassis:

Term:	Description:
primary controller	The controller that is currently controlling the machine or process.
primary chassis	The chassis that contains the primary controller or controllers.
secondary controller	The controller that is standing by to take control of the machine or process. A secondary controller always resides in a different chassis than the primary controller.
secondary chassis	The chassis that contains the secondary controller or controllers.
switchover	Transfer of control from the primary controller to the secondary controller. After a switchover, the controller that takes control becomes the primary controller. Its partner controller (the controller that was previously the primary controller) becomes the secondary controller.

How do I assign the primary chassis?

In a pair of redundant chassis, the first chassis that you turn on becomes the primary chassis. When you turn on power to the secondary chassis, that chassis synchronizes itself with the primary chassis.

What causes a switch from one controller to another?

When a failure occurs in any of the components of the primary chassis, control switches to the secondary controller. A switchover occurs for any of the following reasons:

- any of the following situations IN THE PRIMARY CHASSIS:
  - loss of power
  - major fault of the controller
  - removal, insertion, or failure of any module in the primary chassis
  - break or disconnection of a ControlNet tap or ethernet cable
- command from the primary controller
- command from RSLinx® software

Can I use a network access port?

To connect a device to the network access port (NAP) of a 1756-CNB/D or 1756-CNBR/D module, use a NAP that is outside of a redundant chassis.

IMPORTANT

Use of the Network Access Port (NAP)

DO NOT connect any device to the network access port (NAP) of a 1756-CNB/D or -CNBR/D module in a redundant chassis.

- If you connect a device to the NAP of a CNB module in a redundant chassis, a switchover will fail to occur if the CNB module is disconnected from the network. While the CNB module is disconnected from the network, the controller will be unable to control any I/O devices through that CNB module.
- If you connect a workstation to the NAP of a CNB module in a redundant chassis, the workstation will be unable to go online after a switchover.

To connect a device to a ControlNet network via a NAP, use a NAP that is outside of a redundant chassis.

Do I see a bump in outputs during a switchover?

Depending on how you organize your RSLogix™ 5000 project, outputs may or may not experience a change in state (bump) during a switchover:

- During the switchover, outputs that you control by the highest priority task experience a bump-less switchover. (i.e., Outputs don't revert to a previous state.)
- Outputs in lower priority tasks MAY experience a change of state.

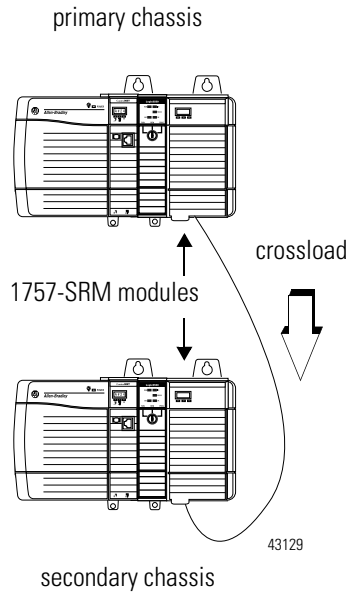
The switchover time of a redundant system depends on the type of failure and the network update time (NUT) of the ControlNet network. For a NUT of 10 ms, the switchover time is approximately 80 ms to 220 ms.

How does the second controller stay up to date?

To take over control, the secondary controller requires the same project as the primary controller. It also requires up-to-date tag values.

The following terms describe the process of communication between the two controllers.

Term:	Description:
crossload	The transfer of any or all of the contents of the primary controller to the secondary controller. This could be updated tag values, force values, online edits, or any other information about the project. A crossload happens initially when the chassis synchronize and then repeatedly as the primary controller executes its logic.
synchronize	The process that readies a secondary chassis to take over control if a failure occurs in the primary chassis. During synchronization, the 1757-SRM modules check that the partner modules in the redundant chassis pair are compatible with each other. The SRM modules also provide the path for crossloading (transferring) the content of the primary controller to the secondary controller. Synchronization happens when you turn on power to the secondary chassis. It also happens after a switchover once you fix the cause of the switchover.
synchronized	The secondary chassis is ready to take over control if a failure happens in the primary chassis.
disqualified	The secondary chassis isn't synchronized with the primary chassis. If a secondary chassis is disqualified, it can't take over control of the machine or process. You also have the option of manually disqualifying a secondary chassis.
qualify	Same as synchronize
qualified	Same as synchronized



The 1757-SRM modules keep communication between the primary and secondary chassis.

- You don't download the project to the secondary controller. While the secondary controller is synchronizing with the primary controller, the 1757-SRM modules automatically let the primary controller transfer the project to the secondary controller.
- Once the secondary controller is synchronized, the 1757-SRM modules keep the controller synchronized by providing the path for crossloading any changes that occur in the primary controller. These changes include:
  - online edits
  - force values
  - changes to properties
  - changes to data
  - results of logic execution

What if I make online edits?

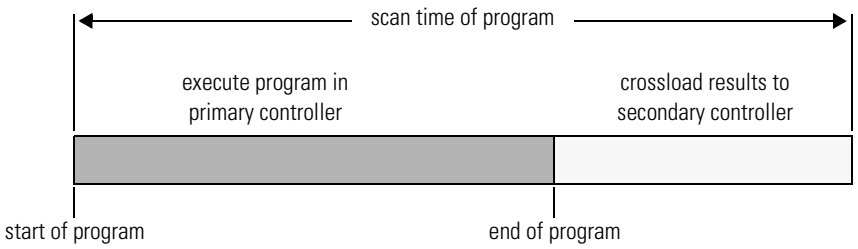
Online edits automatically crossload to the secondary controller. They become inactive if a switchover happens before you assemble them into the project. This stops a mistake from faulting both the old and new primary controllers.

Suppose you test an online edit and it causes the controller to fault. In that case, a switchover happens. The new primary controller automatically untests the edits and goes back to the original code.

You have the option to keep the edits active after a switchover (at the risk of faulting both controllers).

Does my scan time increase?

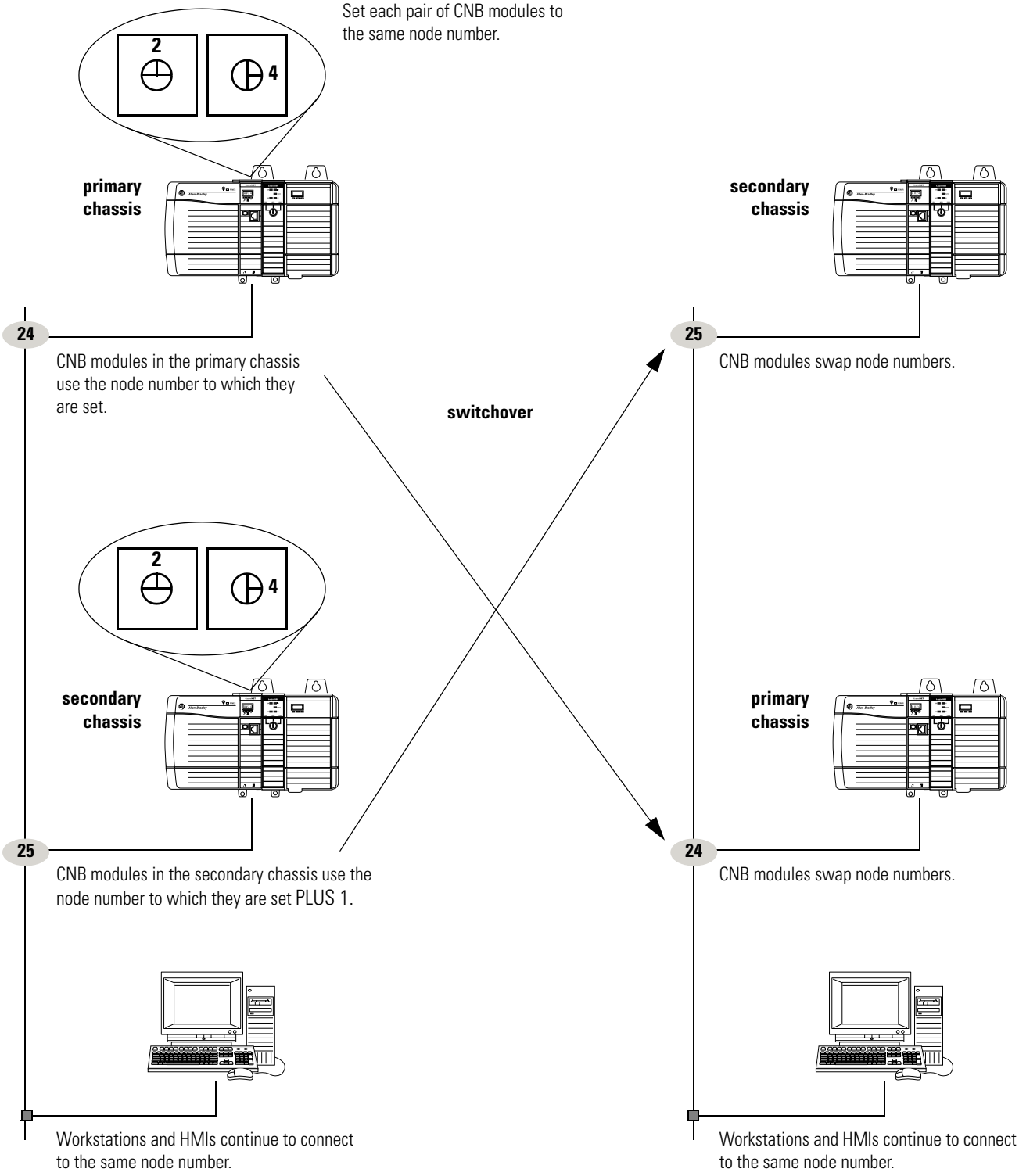
At the end of each program, the primary controller pauses its execution to crossload the result of any output instruction that executed in the program. This results in an increased program scan time for a synchronized redundancy system.



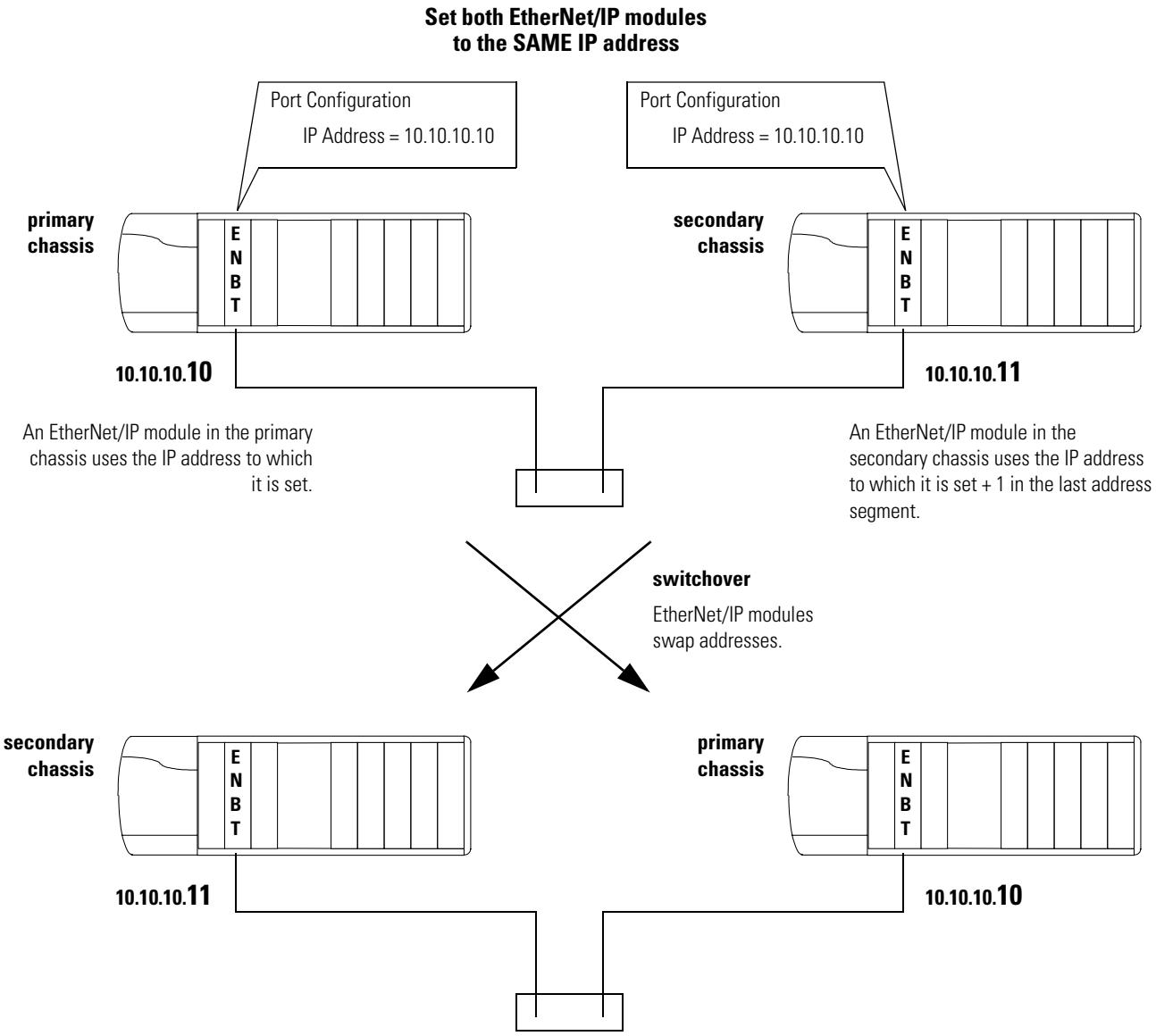
What happens to network addresses during a switchover?

Each CNB, ENBT, or EWEB module in a redundant chassis shares a pair of network addresses with its partner in the other chassis.

If you have a ControlNet network



If you have an EtherNet/IP network



What can't I do with a redundant system?

Don't use any of these features in a ControlLogix redundancy system:

- any of these modules in the local chassis (redundant chassis pair):
  - I/O
  - 1756-DHRIO
  - 1756-DNB
- event task
- inhibit a task
- store data on a CompactFlash card via the controller. It's OK to store a project on a CompactFlash card. See page 6-28.
- motion control. That means don't use any of these modules:
  - 1756-HYD02
  - 1756-L60M03SE
  - 1756-M02AE
  - 1756-M02AS
  - 1756-M03SE
  - 1756-M08SE
  - 1756-M16SE

Quick Start Checklists

The following checklists provide a summary of the criteria for a successful ControlLogix redundancy system. See the remaining chapters for more information on each parameter.

System Lay-Out

Parameter:	Criteria:	See page:
❑ **1. ControlNet networks**	• ControlNet™ networks are the primary networks for the system. • OK to bridge to devices on other networks, such as DeviceNet™, Universal Remote I/O, and DH+™ networks. • Networks follow the guidelines in Logix5000 Controllers Design Considerations, publication 1756-RM094.	2-2, 2-5

❑ **2. I/O Placement**	• All I/O modules in remote chassis or DIN rails (no I/O in the local chassis)
	• All I/O in ONLY the following locations:
	  • same ControlNet network as the redundant controllers (no bridging)
	  • DeviceNet™ network (via a 1756-DNB module in a remote chassis)
	  • universal remote I/O network (via a 1756-DHRIO module in a remote chassis)
		2-2, 2-5

❑ **3. ControlNet network update times**	• NUTs ≤90 ms • NUTs ≤specified relationship to each other	2-9
❑ **4. Number of ControlNet nodes**	At least 2 nodes on each network in addition to the CNBs in the redundant chassis (I.e., Each ControlNet network has at least 4 nodes.)	2-9
❑ **5. ControlNet node assignments**	• Non-redundant nodes use the lowest node numbers • CNB modules in the redundant chassis set close to the SMAX. • 2 consecutive node addresses for each set of partner CNB modules (one in each chassis) • Switches of each partner CNB module set to the same node address	1-6, 2-9
❑ **6. Network Access Ports**	No devices connected to the network access ports of CNB modules in the redundant chassis	2-2
❑ **7. EtherNet/IP networks**	EtherNet/IP networks are ONLY for HMIs, workstations, and messaging (NO control of I/O). NO EtherNet/IP network for: • control of I/O • peer interlocking (produced and consumed tags)	2-2, 2-12

Redundant Chassis Configuration

Parameter:	Criteria:	See page:
❑ **1. Chassis size**	Same size chassis for each pair of redundant chassis.	2-3

❑ **2. Chassis lay-out**	• Only the following modules in each redundant chassis (NO other modules):
	  • controllers
	  • ControlNet modules
	  • EtherNet/IP modules
	  • System redundancy module (needs 2 slots)
	• Each chassis within a redundant pair looks the same:
	  • Identical modules (same catalog number, series, revision, and memory size)
	  • Same slot assignments
		2-3

❑ **3. System redundancy modules**	1757-SRM module: • 1 in each redundant chassis • Needs 2 slots • Needs 1757-SRCx cable (1, 3, 10, 50, and 100 meter lengths)	2-3, 2-4

❑ **4. Controllers**	ControlLogix5555, ControlLogix5561, ControlLogix5562, or ControlLogix5563 controllers
	• Which type of controller do you want to use?
	  • If ControlLogix5555, then 1 or 2 controllers in EACH redundant chassis.
	  • If ControlLogix5561, ControlLogix5562, or ControlLogix5563, then ONLY 1 controller in EACH redundant chassis.
	• Same type of controller throughout the chassis.
	• Enough memory for 2 copies of all data.
	• 7 connections for redundancy
		2-3

❑ **5. ControlNet modules**	1756-CNB/D or 1756-CNBR/D module or modules: • CPU usage ≤75% • CNB modules have the same keeper information • ≤5 CNB modules. See also parameter 6 below.	2-3, 6-6, 6-24

❑ **6. EtherNet/IP modules**	1756-ENBT or 1756-EWEB modules:
	• Which modules do you want to use?
	  • If 1756-ENBT, catalog revision greater than or equal to E01 (E01, E02, …, F01, etc.). See the label on the side of the module or its box.
	  • If 1756-EWEB, any catalog revision
	• Up to 2 EtherNet/IP modules in each redundant chassis, within these limits:
		2-3, 2-12

If you have	Use up to
1 ControlNet module	2 EtherNet/IP modules
2 ControlNet modules	2 EtherNet/IP modules
3 ControlNet modules	2 EtherNet/IP modules
4 ControlNet modules	1 EtherNet/IP module
5 ControlNet modules	no EtherNet/IP modules
Don't use more than 5 ControlNet modules.	

RSLogix™ 5000 Project

Parameter:	Criteria:	See page:
❑ **1. Number of projects**	Only one RSLogix 5000 project for the pair of redundant controllers. The project automatically crossloads to the secondary controller when the secondary controller synchronizes with the primary controller.	5-1
❑ **2. Controller properties**	• ControlLogix5555, ControlLogix5561, ControlLogix5562, or ControlLogix5563 controller • Redundancy enabled	5-5
❑ **3. Task structure**	• Only one task at the highest priority • If more than one task, all tasks periodic	5-7, 5-12, 6-20
❑ **4. I/O**	• Outputs that require a bumpless switchover are in the highest priority task • Requested packet interval (RPI) less than or equal to 375 milliseconds. (Larger RPIs may produce a bump at switchover.).	5-7
❑ **5. Task watchdog time**	Watchdog time ≥ (2 * *maximum_scan_time*) + 100 ms where: *Maximum_scan_time* is the maximum scan time for the entire task when the secondary controller is synchronized.	5-35
❑ **6. Minimizing scan time**	• A few large programs instead of a lot of small programs • NO unused tags • Arrays and user-defined data types instead of individual tags • User-defined data types as compact as possible • Code as compact as possible • Code runs only when you need it • Data grouped by how often you need it • DINT tags instead of SINT or INT tags	5-12
❑ **7. Data integrity**	Special treatment for: • Bit Shift Left (BSL) and Bit Shift Right (BSR) instructions • FIFO Unload (FFU) instructions • Logic that is scan-dependant	5-18
❑ **8. Produced and consumed tags**	If you want a controller in another chassis to consume a tag from the redundant controller, use a comm format of None. In the I/O configuration of the consuming controller, select a comm format of None for the remote CNB module (the CNB that is physically in the redundant chassis).	5-7
❑ **9. Message (MSG) instructions**	For any MSG instruction from a controller in another chassis to a redundant controller, cache the connection.	5-7

Operator Interface Terminals

<table>
<tr><th>Parameter:</th><th>For any of these operator interfaces:</th><th>Criteria:</th><th>See page:</th></tr>
<tr><td rowspan="4">❑ 1. EtherNet/IP network</td><td>PanelView™ Standard terminal</td><td>Same as a non-redundant system</td><td rowspan="4">2-2, 2-6, 2-12</td></tr>
<tr><td>• PanelView Plus™ terminal
• VersaView™ industrial computer running a Windows® CE operating system</td><td>• Use RSLinx Enterprise software revision 3.0 or later.
• Set aside connections for EACH PanelView Plus or VersaView CE terminal:
<table><tr><th>In this module</th><th>Set aside</th></tr><tr><td>controller</td><td>5 connections</td></tr><tr><td>CNB</td><td>5 connections</td></tr><tr><td>ENBT</td><td>5 connections</td></tr><tr><td>EWEB</td><td>5 connections</td></tr></table></td></tr>
<tr><td>RSView® Supervisory Edition software with RSLinx Enterprise software</td><td>• Use RSLinx Enterprise software revision 3.0 or later.
• Use IP swapping.
• Keep the HMI and both redundant chassis on the same subnet.</td></tr>
<tr><td>• RSView Supervisory Edition software with RSLinx 2.x software
• RSView 32 software
• Any other HMI client software that uses RSLinx 2.x software</td><td>Limit the number of RSLinx servers that a controller uses to 1 (ideal) to 3 (maximum).</td></tr>
<tr><td rowspan="3">❑ 2. ControlNet network</td><td>• PanelView™ Standard terminal
• PanelView 1000e/1400e terminal</td><td>Do your terminals use unscheduled communication?
• YES — Use ≤4 terminals per controller.
• NO — Use the number of terminals that you need.</td><td rowspan="3">2-2, 2-6, 2-9</td></tr>
<tr><td>• PanelView Plus™ terminal
• VersaView™ industrial computer running a Windows® CE operating system</td><td>Set aside connections for EACH PanelView Plus or VersaView CE terminal:
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</table>

Design the System

Use this chapter to design a redundancy system for a ControlLogix controller

How to Use this Chapter

To design your system, complete the following tasks:

Lay Out the System

Figure 2.1 ControlLogix redundancy requirements and recommendations

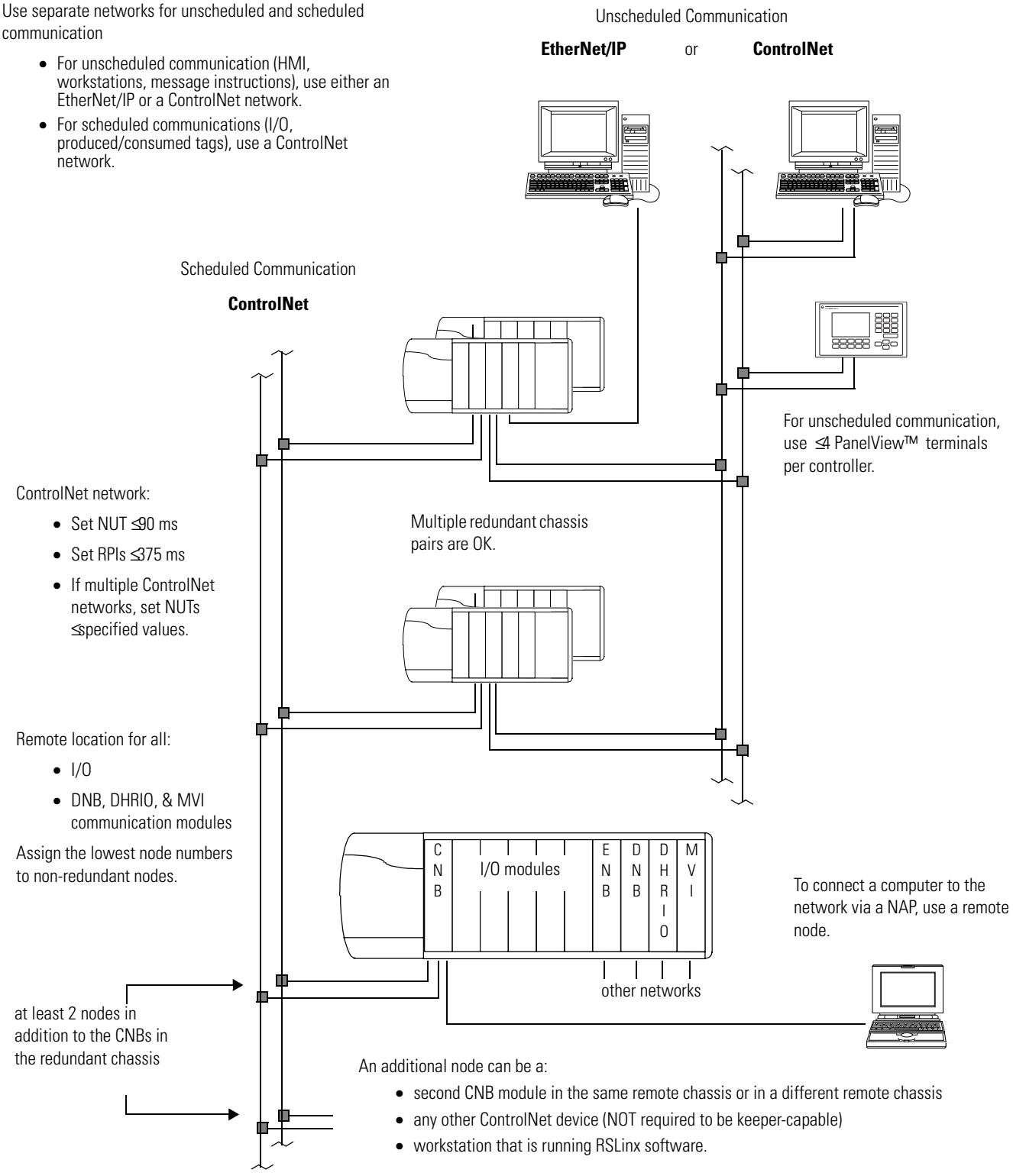
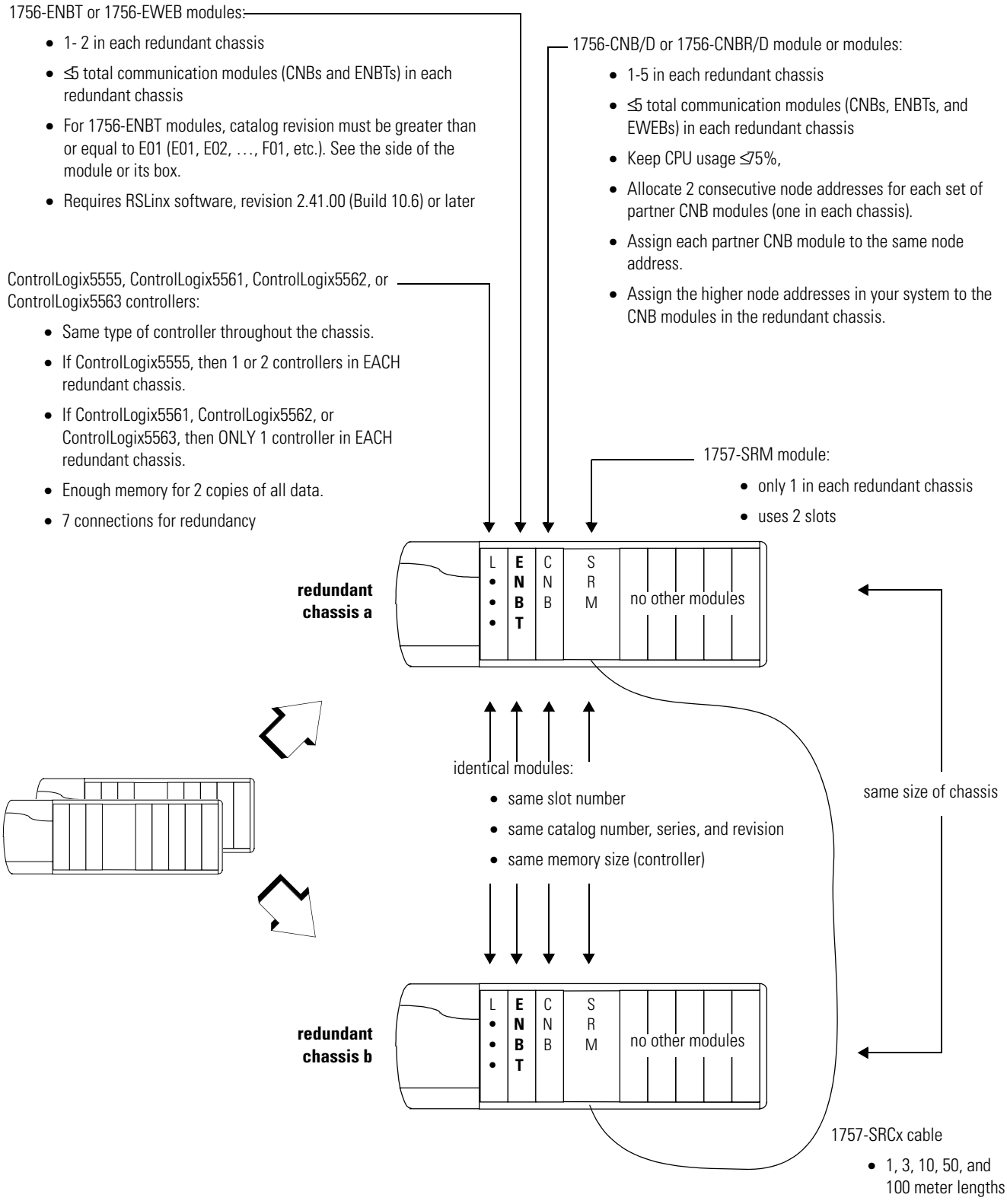
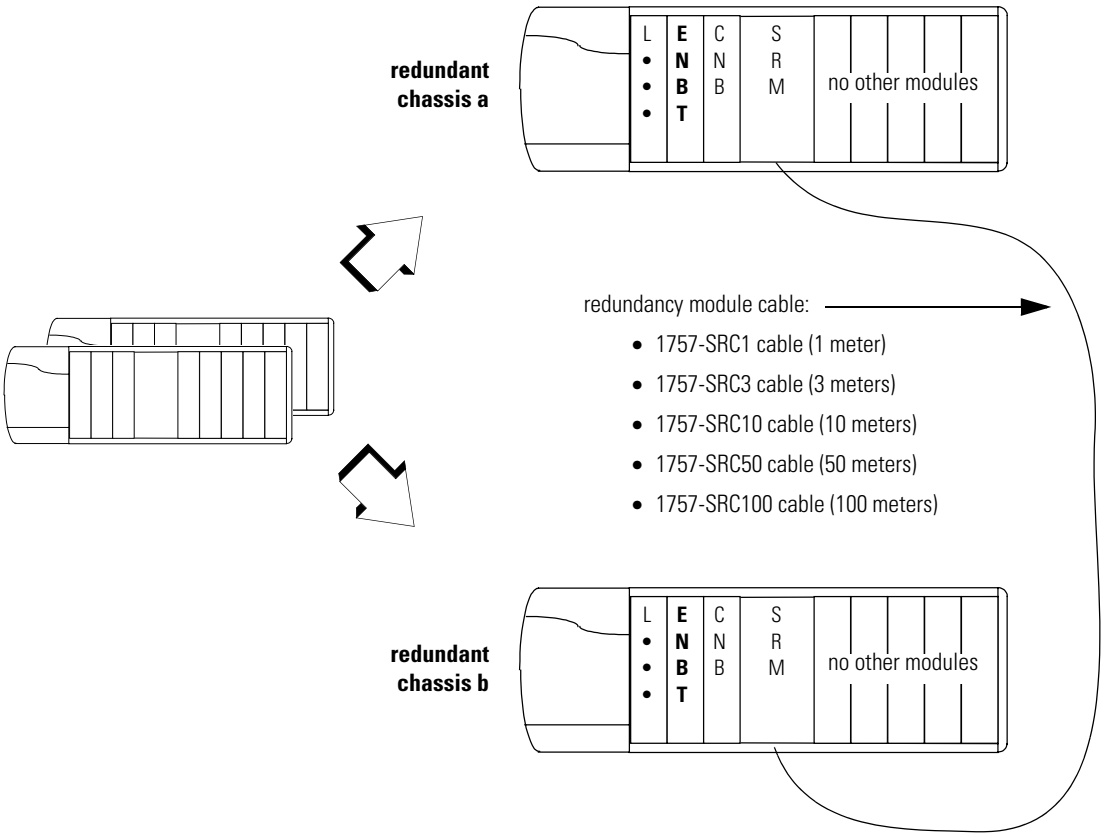


Figure 2.2 ControlLogix redundancy requirements and recommendations (Continued)



Place the Pair of Redundant Chassis

The standard redundancy module cables let you place your pair of redundant chassis (primary and secondary) up to 100 meters apart.



If you need more than 100 meters between chassis…

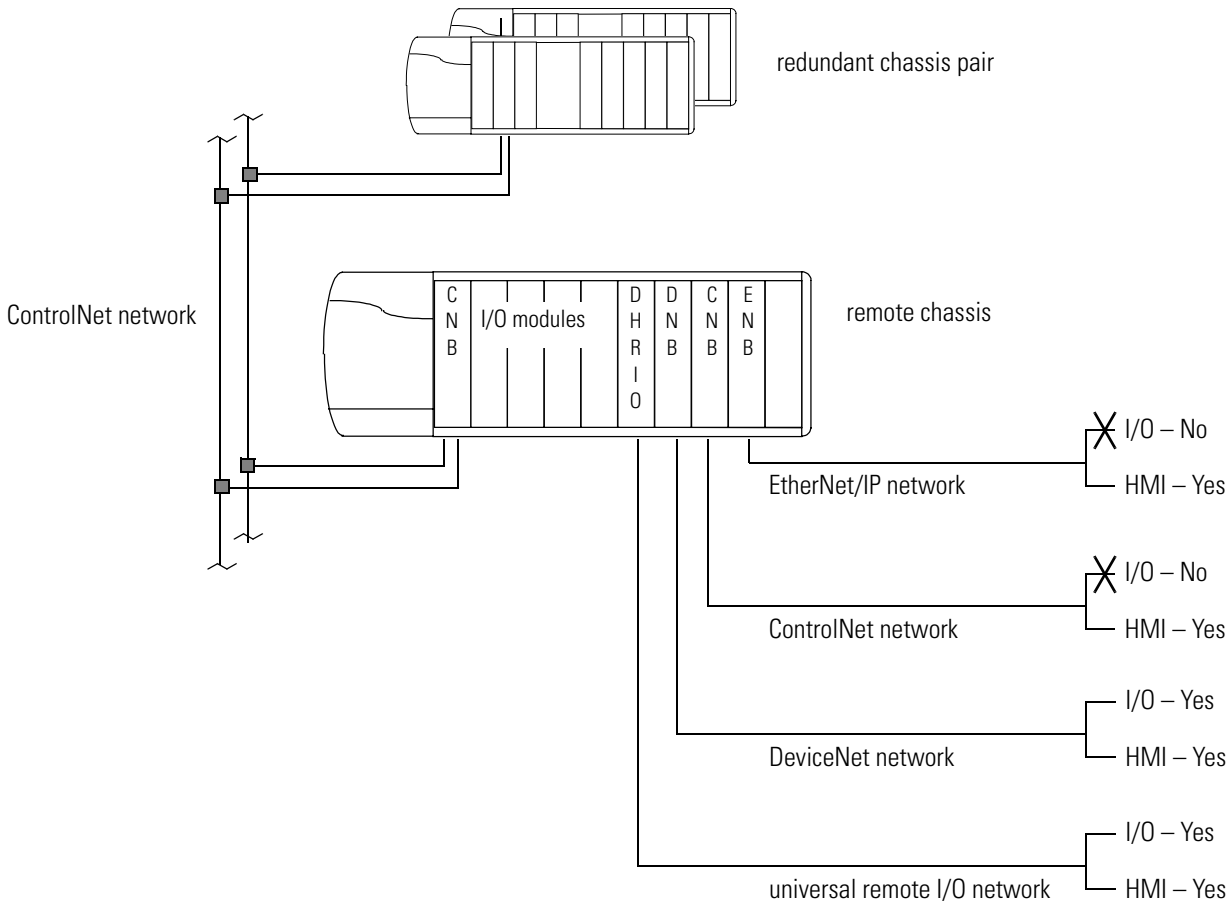
If you need more than 100 meters of distance between the primary and secondary controller chassis, use your own custom fiber optic cable. For a custom cable, follow these rules:

1. Keep total light loss through the cable less than or equal to 7dB.
2. Keep total length less than or equal to 4 km.
3. Use high quality 62.5/125 micron multi-mode fiber-optic cable.
4. Use professionally installed SC-style connectors to connect to the 1757-SRM modules.

Place the I/O

In a ControlLogix redundancy system, place all I/O in ONLY the following locations:

- ✔ same ControlNet network as the redundant controllers (no bridging to I/O modules on another ControlNet network)
- ✔ DeviceNet network
- ✔ universal remote I/O network



Place Operator Interface Terminals

For operator interface terminals, stay within these limitations:

<table>
<tr><th>For this network</th><th>And any of these operator interfaces</th><th>Follow these guidelines</th></tr>
<tr><td rowspan="5">EtherNet/IP network</td><td>PanelView™ Standard terminal</td><td>Same as a non-redundant system</td></tr>
<tr><td>• PanelView Plus™ terminal
• VersaView™ industrial computer running a Windows® CE operating system</td><td>• Use RSLinx Enterprise software revision 3.0 or later.
• Set aside connections for EACH PanelView Plus or VersaView CE terminal:
<table><tr><th>In this module</th><th>Set aside</th></tr><tr><td>controller</td><td>5 connections</td></tr><tr><td>CNB</td><td>5 connections</td></tr><tr><td>ENBT</td><td>5 connections</td></tr><tr><td>EWEB</td><td>5 connections</td></tr></table></td></tr>
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<table><tr><th>In this module</th><th>Set aside</th></tr><tr><td>controller</td><td>5 connections</td></tr><tr><td>CNB</td><td>5 connections</td></tr></table></td></tr>
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<tr><td></td></tr>
</table>

Add Additional Redundant Components

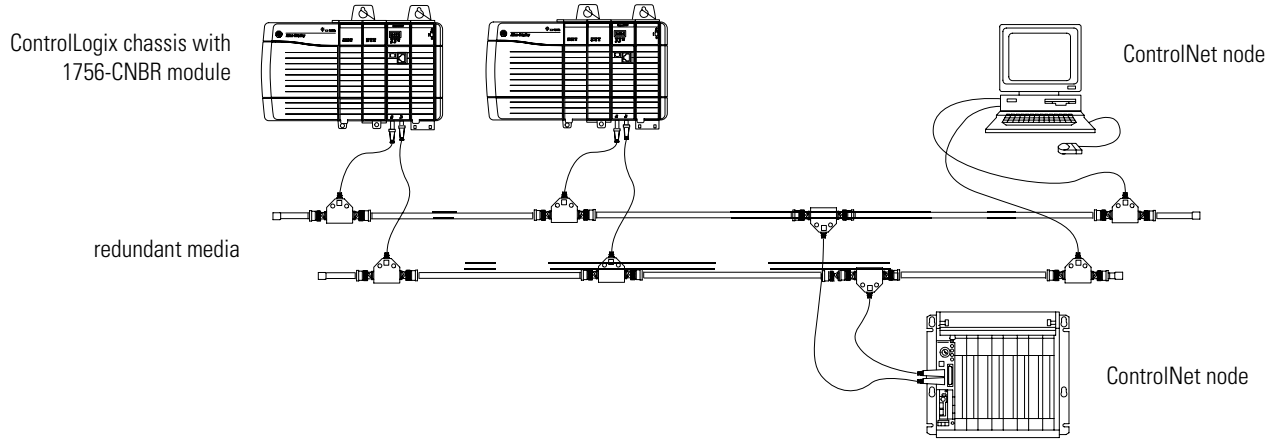
In addition to using redundant pairs of controllers, you have the option of adding the following redundant components to your system:

- Redundant ControlNet Media
- Redundant Power Supplies

Redundant ControlNet Media

Redundant ControlNet media prevents a loss of communication if a trunkline or tap is severed or disconnected. It uses the following components:

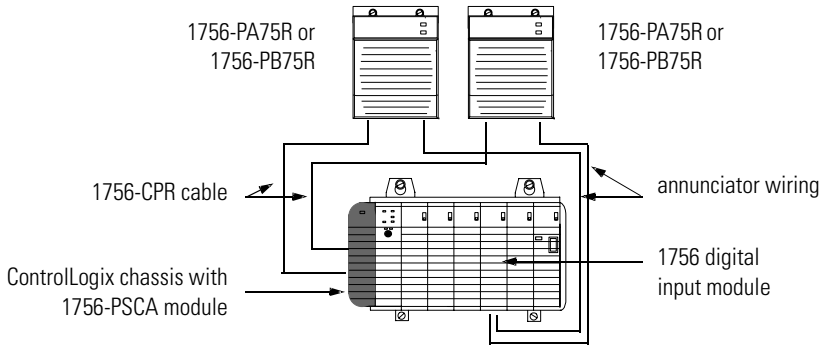
- 1756-CNBR ControlNet modules
- two identical ControlNet links



Redundant Power Supplies

Redundant power supplies let you maintain power to a ControlLogix chassis if a power supply fails. Redundant power supplies use the following hardware:

- two redundant power supplies, any combination of 1756-PA75R and 1756-PB75R
- 1756-PSCA chassis adapter module, in place of the standard power supply
- two 1756-CPR cables to connect the power supplies to the 1756-PSCA adapter
- user-supplied annunciator wiring to connect the power supplies to the input modules, if needed



Check Connection Requirements

Make sure that you set aside 7 connections in each redundant controller for redundancy communication:

- 2 connections for the SRM
- 5 connections for the partner controller

Plan the ControlNet Networks

Follow these guidelines as you plan your ControlNet networks:

Guideline	Details
1. Make sure that your network has at least 2 nodes plus the redundant chassis pair.	An additional node can be a: • second CNB module in the same remote chassis or in a different remote chassis • any other ControlNet device • workstation that is running RSLinx software. If your ControlNet network contains only one node other than the redundant chassis pair, that node will drop its connections during a switchover. This may cause the outputs of that node to change state during the switchover.
2. Give the lowest ControlNet addresses to I/O chassis and other remotely-located chassis.	Don't give the lowest addresses to the redundant chassis pair. If you give the lowest address to a CNB module in the redundant chassis pair: • On a switchover, you may temporarily lose communication with I/O modules, produced tags, and consumed tags. • If you remove the CNB module from the primary chassis while chassis power is on, you may temporarily lose communication with I/O modules, produced tags, and consumed tags. • If every ControlNet node powers down at the same time (e.g., a plant-wide power loss), you may have to cycle the power to the primary chassis to restore communication.
3. Set aside 2 consecutive ControlNet addresses for each pair of redundant chassis (e.g., nodes 3 and 4).	• If each redundant chassis has multiple CNB modules, set aside a pair of node numbers for each pair of CNB modules (one in each chassis). • Do not configure any other device on the ControlNet network for either of these addresses. For example, if you allocated nodes 3 and 4 for the redundant chassis, then no other device should use those node numbers.

Table 2.1 Use this worksheet to record the slot number and node numbers for each pair of CNB modules.

Pair of CNB modules (one in each redundant chassis)	Slot and node numbers		
	Slot #	**Primary node #**	**Secondary node # (primary node # + 1)**
1st pair of CNB modules			
2nd pair of CNB modules			
3rd pair of CNB modules			
4th pair of CNB modules			
5th pair of CNB modules			

Guideline | **Details**

4. Know that the switchover time depends on the NUT of the ControlNet network.

Use the network update time (NUT) of the ControlNet network to estimate how long it takes your system to switchover:

If	And the NUT is	Then the switchover time is
the chassis loses power or a module fails	6 ms or less	60 ms
	7 ms or more	5 (*NUT*) + MAX (2 (*NUT*), 30)
a CNB module can't communicate with any other node	⇒	14 (*NUT*) + MAX (2 (*NUT*), 30) + 50

Example 1

The chassis loses power and the NUT = 4 ms. In that case, the switchover time is approximately 60 ms.

Example 2

The chassis loses power and the NUT = 10 ms. In that case, the switchover time is approximately 80 ms.

Example 3

You unplug the CNB from the network and the NUT = 10 ms. In that case, the switchover time is approximately 220 ms.

5. Use a NUT that is less than or equal to 90 milliseconds.

If you use a larger network update time (NUT), the controller could lose its connection with a module during a switchover. This could cause outputs to change state.

6. Do the redundant chassis use more than 1 ControlNet network?

- YES — See Table 2.2 on page 2-11.
- NO — Skip this guideline.

The NUT of each network must be within the values indicated in Table 2.2. If you use a larger network update time (NUT), the controller could lose its connection with a module during a switchover. This could cause outputs to change state.

Example

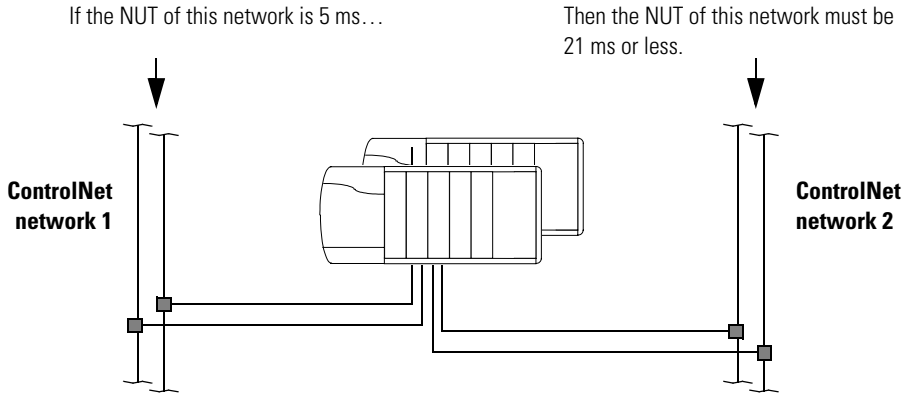


Table 2.2 NUTs for multiple ControlNet networks

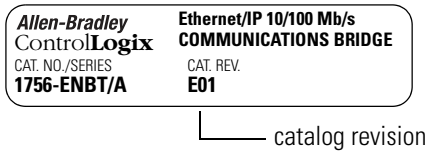
If the smallest NUT on a network is (ms):	Then the largest NUT on any other network must be less than or equal to (ms):
2	15
3	17
4	19
5	21
6	23
7	25
8	27
9	29
10	31
11	33
12	35
13	37
14	39
15	41
16	43
17	46
18	48
19	50

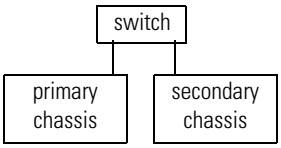
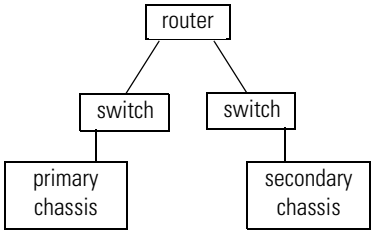
Table 2.2 NUTs for multiple ControlNet networks (Continued)

If the smallest NUT on a network is (ms):	Then the largest NUT on any other network must be less than or equal to (ms):
20	52
21	55
22	57
23	59
24	62
25	64
26	66
27	68
28	71
29	73
30	75
31	78
32	80
33	82
34	84
35	87
36	89
37 - 90	90

Plan the EtherNet/IP Networks

Follow these guidelines as you plan your EtherNet/IP networks:

Guideline	Details
1. Use EtherNet/IP ONLY for HMIs, workstations, and messaging.	In a redundant system, use an EtherNet/IP network ONLY for HMI, workstation, and message communication. DON'T use an EtherNet/IP network for: • control of I/O modules • peer interlocking (produced and consumed tags) **Important**: RSLogix 5000 software lets you set up and download a project that tries to use an EtherNet/IP network for I/O, produced tags, or consumed tags. Those communications don't work however.
2. Are communication delays OK during a switchover? • If YES, then continue with EtherNet/IP. • If NO, then use ControlNet.	Communication stops over an EtherNet/IP network with your controllers and HMIs during a switchover. • You won't be able to communicate with them for up to a minute. • The actual delay depends on your network topology. If you need bumpless communication, use a ControlNet network.
3. If you need a redundant network, use ControlNet.	2 EtherNet/IP modules in same chassis DOESN'T give you redundant EtherNet/IP communication. A switchover still happens if one of the modules fails, a cable breaks, etc. See How an EtherNet/IP module handles a cable break on page 2-14.
4. Make sure that your ENBT modules are catalog revision E01 or later. 	To use a 1756-ENBT module in a redundant controller chassis, make sure the catalog revision of the module is greater than or equal to E01 (E01, E02, …, F01, etc.). • To find the catalog revision, look at the label on the side of the module or box. • If you use an older ENBT module, your secondary chassis won't synchronize.

Guideline	Details	
5. Decide how to handle IP addresses.	**If BOTH redundant chassis are on**	**Then**
	same subnet 	Use IP swapping. During a switchover the primary and secondary modules swap IP addresses. This lets you use the same IP address regardless of which chassis is primary. See the next guideline for details.
	different subnets 	You MUST change to the new primary address after a switchover. Use ControlLogix Redundancy Alias Topic Switcher software to do this. See Appendix A.
6. If you're using IP swapping, give the same IP address to the primary module and its partner.	A. Give the SAME IP address, subnet mask, and gateway address to BOTH modules in the redundant pair. B. Leave the next highest IP address open for the secondary module. **For example** Set the primary and secondary modules to 10.10.10.10 Leave this open for the secondary 10.10.10.11 The module in the secondary chassis automatically uses the IP address of the primary + 1.	

Use this worksheet for IP swapping

Pair of ENBT or EWEB modules (one in each redundant chassis)	Slot #	Configuration			
		Primary IP address	Secondary IP address (primary address + 1)	Subnet mask	Gateway address
1st pair of ENBT or EWEB modules					
2nd pair of ENBT or EWEB modules					

How an EtherNet/IP module handles a cable break

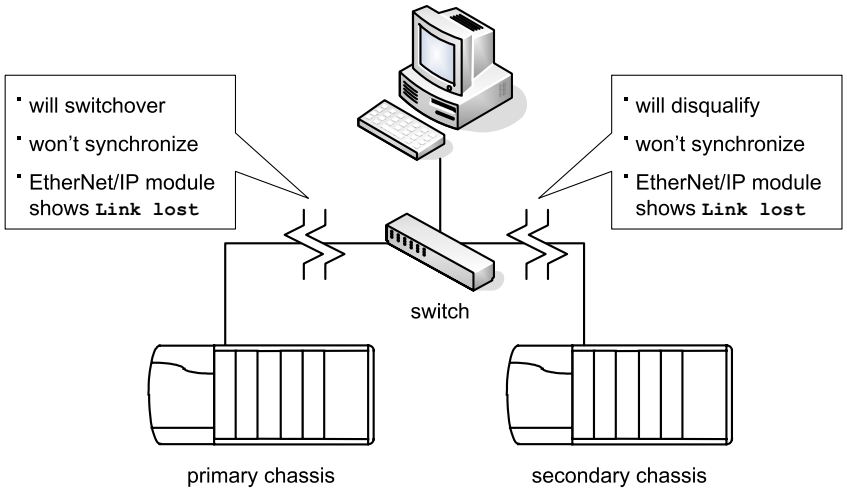
An EtherNet/IP module looks for a carrier signal only from the closest switch. It doesn't know the health of the network beyond that point. Data doesn't have to be flowing.

If the EtherNet/IP module:

- Gets the carrier signal — It considers the network as OK.
- Doesn't get the carrier signal — It shows `Link lost`.

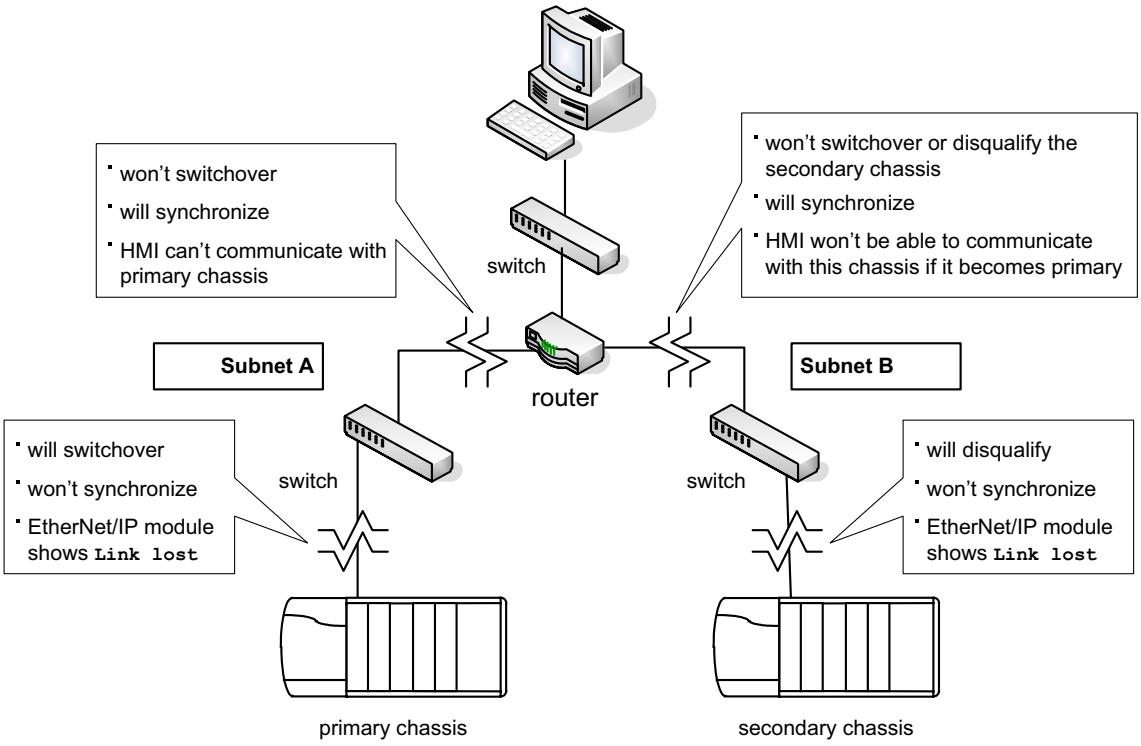
one switch

one subnet



several switches

several subnets



Additional Considerations

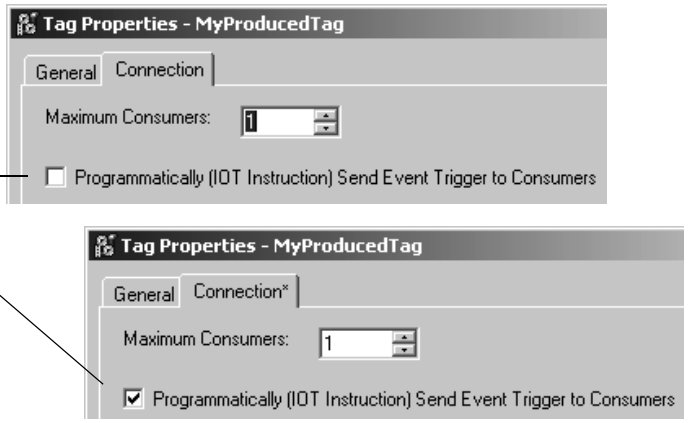
Switchover *Always* Triggers an Event Task in a Remote, Non-Redundant Controller

A switchover triggers an event task under the following combination of circumstances:

- The event task is in non-redundant controller. (An Event task is *not* permitted in a redundant controller.)
- A redundant controller triggers the event task via a produced tag.

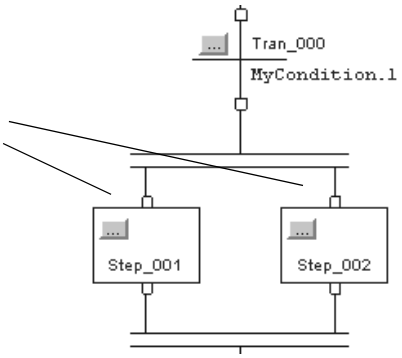
This occurs regardless of how you configure the produced tag.

Both configurations always trigger an event task during a switchover.



Simultaneous Branch Delays the Execution of a Higher Priority Task

In an SFC, each path of a simultaneous branch delays the execution of a higher priority task by up to 25 µs.



Notes:

Install the System

When to Use this Chapter

Use this chapter to install the hardware of your ControlLogix redundancy system.

How to Use this Chapter

To install your system, complete the following tasks:

Preliminary Information

IMPORTANT

Use of the Network Access Port (NAP)

DO NOT connect any device to the network access port (NAP) of a 1756-CNB/D or 1756-CNBR/D module in a redundant chassis.

- If you connect a device to the NAP of a CNB module in a redundant chassis, a switchover will fail to occur if the CNB module is disconnected from the network. While the CNB module is disconnected from the network, the controller will be unable to control any I/O devices through that CNB module.
- If you connect a workstation to the NAP of a CNB module in a redundant chassis, the workstation will be unable to go online after a switchover.

To connect a device to a ControlNet network via a NAP, use a NAP that is outside of a redundant chassis.

This chapter provides the sequence of tasks and the critical actions for the successful installation of your ControlLogix redundancy system. It DOES NOT replace the installation instructions for the components of the system. As you install your system, refer to the following publications:

Install this component:	According to this publication:
1756-A4, -A7, -A10, -A13, or -A17 chassis	*ControlLogix Chassis Installation Instructions*, publication 1756-IN080
1756-PA72 or -PB72 power supply	*ControlLogix Power Supplies Installation Instructions*, publication 1756-5.67
1756-PA75 or -PB75 power supply	*ControlLogix Power Supplies Installation Instructions*, publication 1756-5.78
ControlLogix controller	*ControlLogix Controller and Memory Board Installation Instructions*, publication 1756-IN101
1756-CNB/D or -CNBR/D module	*ControlLogix ControlNet Bridge Installation Instructions*, publication 1756-IN571
1756-ENBT module	*ControlLogix EtherNet/IP Bridge Module Installation Instructions*, publication 1756-IN019
1756-EWEB module	*EtherNet/IP Web Server Module Installation Instructions*, publication 1756-IN588
1757-SRM module	*ProcessLogix/ControlLogix System Redundancy Module Installation Instructions*, publication 1757-IN092

Installation instructions provide important information, such as detailed installation steps, safety considerations, enclosure requirements, and hazardous location information.

Before you install the system, review the following guidelines for safe handling of ControlLogix components:

WARNING

When you insert or remove a 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 a module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

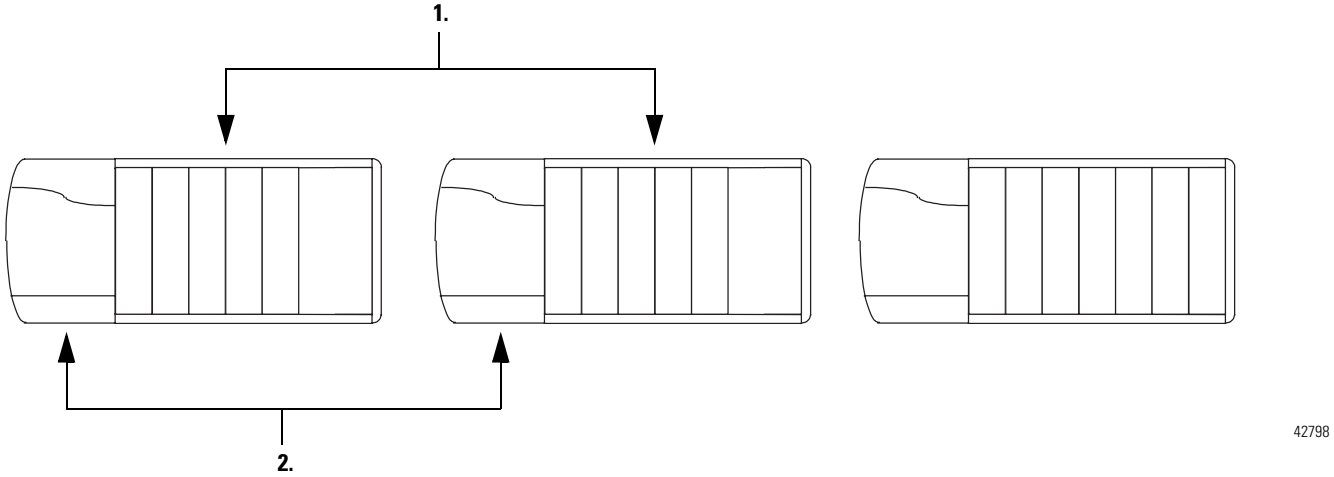
ATTENTION

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.

Install the Chassis for the Controllers



1. Install the two ControlLogix chassis that will contain the controllers (i.e., the redundant chassis):

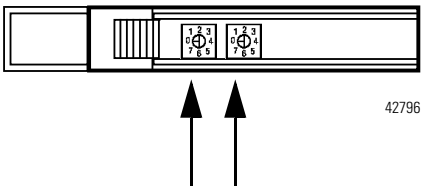
   - Place the chassis within the length of your 1757-SRCx cable.
   - Install each chassis according to the *ControlLogix Chassis Installation Instructions*, publication 1756-IN080.
   - If you are converting an existing system that contains local I/O modules, you still need two additional chassis. In a redundant system, you must place all I/O modules outside the redundant chassis pair.

2. For each chassis, install a ControlLogix power supply according to the corresponding installation instructions:

Install this power supply:	According to this publication:
1756-PA72	*ControlLogix Power Supplies Installation Instructions,* publication 1756-5.67
1756-PB72	
1756-PA75	ControlLogix Power Supplies Installation Instructions, publication 1756-5.78
1756-PB75	

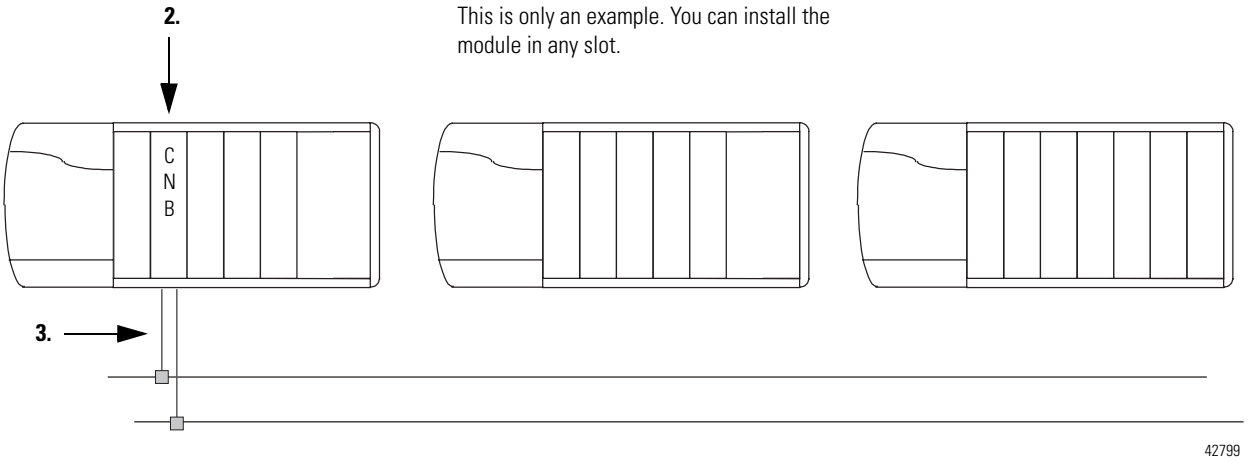
Install Modules in the First Redundant Chassis

IMPORTANT Set the rotary switches of the 1756-CNB/D or 1756-CNBR/D modules for both redundant chassis to the same node address.



1. Set the rotary switches of each of the 1756-CNB/D or 1756-CNBR/D modules to the primary node number from Table 2.1 on page 2-9.

   For example, if you allocated nodes 3 and 4 for the redundant chassis, set both CNB modules to node 3.



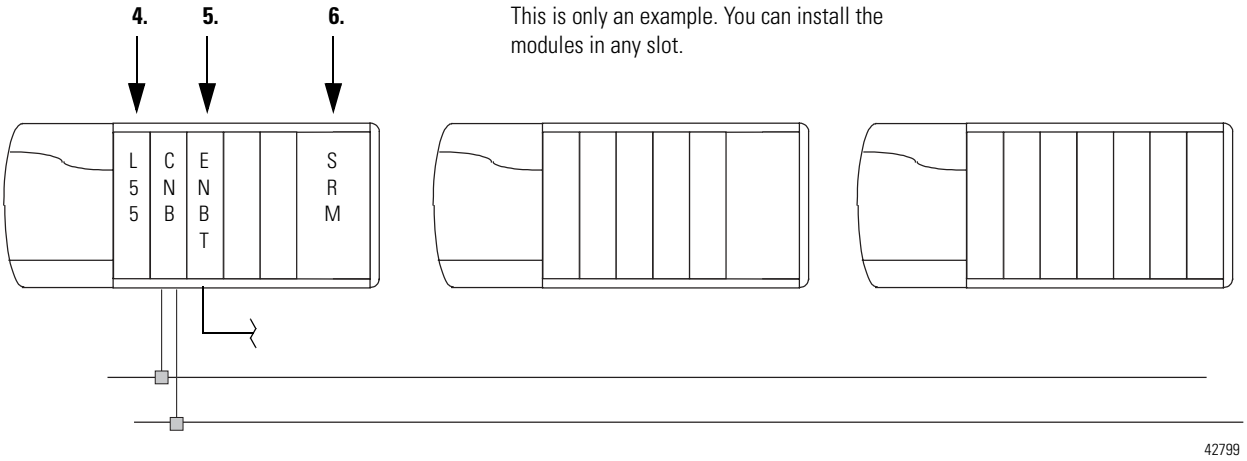
2. Install a 1756-CNB/D or 1756-CNBR/D module. See *ControlLogix ControlNet Bridge Installation Instructions*, publication 1756-IN571.

WARNING

If you connect or disconnect the communications cable with power applied to this module or any device on the network, 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.

3. Connect the CNB module to the ControlNet network.

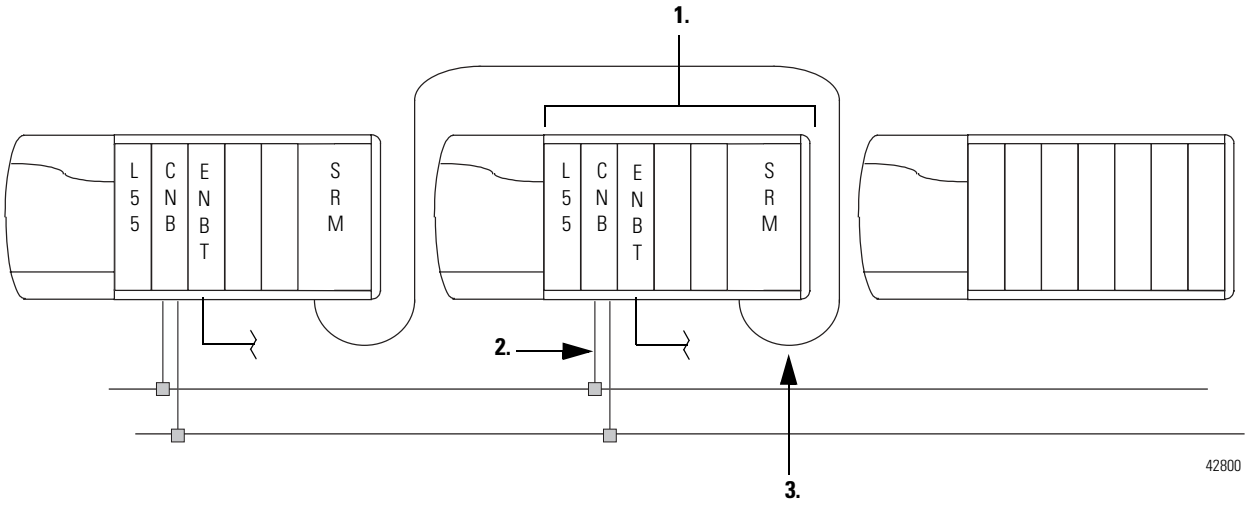


4. Install the controller or controllers. See *ControlLogix Controller and Memory Board Installation Instructions*, publication 1756-IN101.

5. Install the 1756-ENBT or 1756-EWEB module or modules (2 max.), if required. Connect each module to an ethernet switch.

6. Install the 1757-SRM module. See *ProcessLogix/ControlLogix System Redundancy Module Installation Instructions*, publication 1757-IN092.

Install Modules in the Second Redundant Chassis



IMPORTANT

- The modules in each redundant chassis must match each other slot-by-slot.
- Set the rotary switches of the 1756-CNB/D or 1756-CNBR/D modules for both redundant chassis to the same node address.

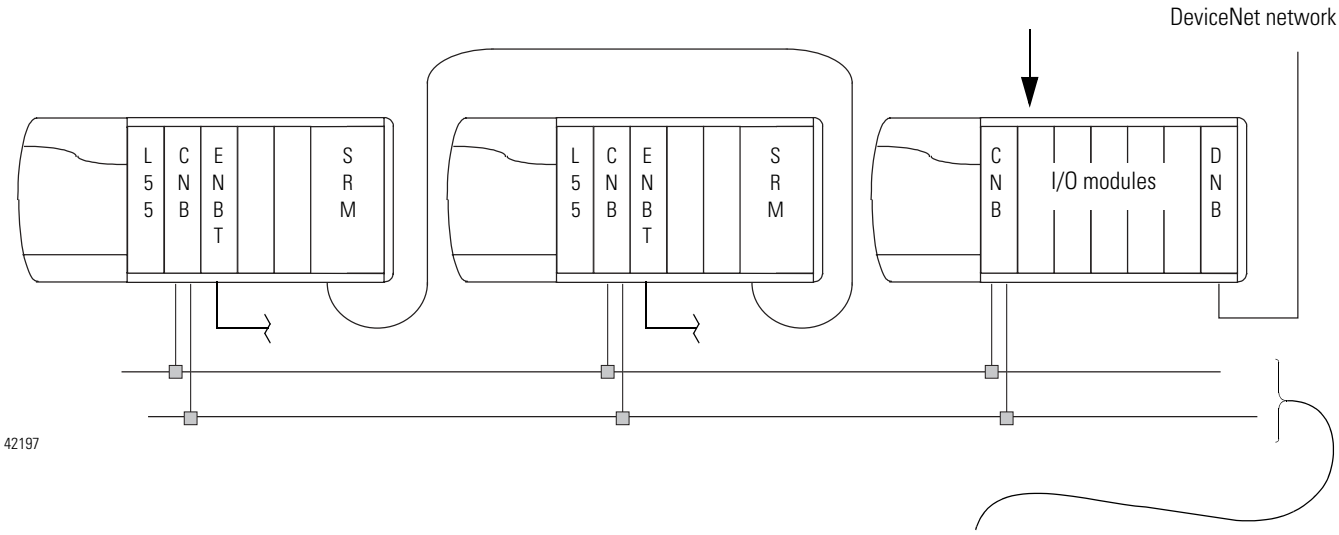
1. For each module in the first redundant chassis, install an identical module into the same slot of the second redundant chassis.

2. Connect the CNB, ENBT, and EWEB modules to their respective networks.

3. Connect one of the following fiber optic cables to the 1757-SRM modules:
   - 1757-SRC1
   - 1757-SRC3
   - 1757-SRC10
   - 1757-SRC50
   - 1757-SRC100

Install the Remote Chassis or Rails

You must install all I/O modules and additional types of communication modules in remote chassis or on DIN rails. The following example shows a remote 1756 chassis. You can use any type of chassis or device that you can connect to the ControlNet network.



You must have at least 2 other nodes in addition to the redundant chassis pair. See "Lay Out the System" on page 2-2.

IMPORTANT If you connect the workstation to the network via a network access port on a CNB module, use a CNB module in a remote chassis. This lets a switchover occur after the failure of a ControlNet tap of a primary chassis.

As you install the chassis, follow these guidelines:

- Do not assign any device to the address of the CNB modules in the redundant chassis plus one.

  For example, if you set the rotary switches of the CNB modules in the redundant chassis to node 11, no other device should use node 12.

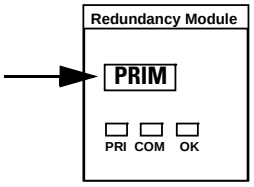
- Use a remote chassis for communication modules such as:
  - 1756-ENET
  - 1756-DHRIO
  - 1756-MVI
  - 1756-DNB

Configure the EtherNet/IP Modules

To use an EtherNet/IP module, give it an IP address, subnet mask, and gateway address:

Step	Details
1. Before you begin.	A. Do these things if you haven't already: ❑ Install and connect both 1757-SRM modules. ❑ Get the IP address, subnet mask, and gateway address for each EtherNet/IP module. See *Plan the EtherNet/IP Networks* on page 2-12. B. Do you know how to configure an EtherNet/IP module in a non-redundant system? • If NO, then continue with step C. • If YES, then go to step 2. C. Get the following publication: *EtherNet/IP Modules in Logix5000 Control Systems*, publication ENET-UM001 You'll use that publication when you configure each module.
2. Configure the EtherNet/IP modules in the first chassis.	A. Turn on the power to ONLY ONE of the redundant chassis. For example, if both chassis are on, turn off one of them. B. Configure the EtherNet/IP module in the chassis that is on. C. Do you see the IP address on the front of the module? • If NO, then return to step B. • If YES, then continue with step D. D. Repeat steps 2B and 2C for each EtherNet/IP module in THIS chassis.
3. Configure the EtherNet/IP modules in the second chassis.	A. Turn off the chassis that you just configured. B. Turn on the other chassis. C. Configure the EtherNet/IP module in the chassis that is on. D. Do you see the IP address on the front of the module? • If NO, then return to step C. • If YES, then continue with step E. E. Repeat steps 3C and 3D for each EtherNet/IP module in THIS chassis.

Flash the Modules



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1. Turn on the power to one of the redundant chassis.
2. Wait for the 1757-SRM module to display PRIM.
3. Flash upgrade each module in the chassis with a compatible revision of firmware.
   - See the *ControlFLASH Firmware Upgrade Kit User Manual*, publication 1756-6.5.6.
   - To find the chassis in RSLinx software, look for the node number or IP address that you see on the front of the communication module.
4. Turn off the power to the chassis.
5. Turn on the power to the second redundant chassis.
6. Wait for the 1757-SRM module to display PRIM.
7. Flash upgrade each module in the chassis with a compatible revision of firmware. Use the same revisions that you used for the first redundant chassis.

Check Your Installation

Purpose

To make sure that your redundant chassis are able to synchronize

When

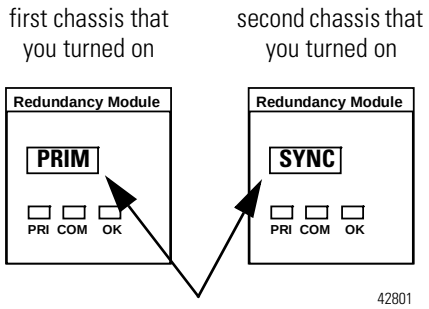
Do this procedure after you:

- Install your system
- Configure the communication modules
- Update firmware

Actions

1. Turn on the chassis power to the partner (secondary) chassis.

2. Wait for the 1757-SRM module to complete its power-up cycle.
- The SRM module takes 1 to 3 minutes to power-up.
- It may also take several minutes to synchronize the secondary controller.



3. Does 1 of the 1757-SRM modules show PRIM and the other module show SYNC?
- YES — Stop. Your system is synchronized.
- NO — There is a problem. Your system isn't synchronized. Go to step 4.

4. Make sure that the Auto-Synchronization option of the SRMs is set to *Always*. For help, see Chapter 4.

5. Does 1 of the 1757-SRM modules show PRIM and the other module show SYNC?
- YES — Stop. Your system is synchronized.
- NO — Go to Troubleshoot a Failure to Synchronize on page 6-5.

Notes:

Configure the System Redundancy Module

Purpose of this Chapter

This chapter shows how to set or change the configuration of a 1757-SRM module. The SRM module controls the synchronization and switchover of your redundancy system.

When to Use this Chapter

Use this chapter:

- After you install your system
- When you want to change how the SRM supports your system
- After both redundant chassis get power back after a power loss

How to Use this Chapter

Use this chapter as follows:

If	Do this	On page
you just installed your system	Open the SRM Configuration Tool	4-2
	Check the Revision of Your SRM Configuration Tool	4-4
	Set the Clock of the SRM	4-6
	Test a Switchover	4-8
you want to change how the SRM supports your system	Change the Auto-Synchronization Option	4-10
	Change the Program Control Option	4-12
both redundancy chassis lost power	Set the Clock of the SRM	4-6

Open the SRM Configuration Tool

Purpose

To open the 1757-SRM System Redundancy Module configuration tool

When

Do this procedure when you need to do actions such as:

- Set the clock of the SRM
- Test a switchover
- Troubleshoot your system
- Store or load a project using nonvolatile memory
- Update firmware

Before you begin

You get the 1757-SRM System Redundancy Module configuration tool as part of RSLinx software. RSLinx software automatically installs the SRM configuration tool. You don't have to do anything to install the tool.

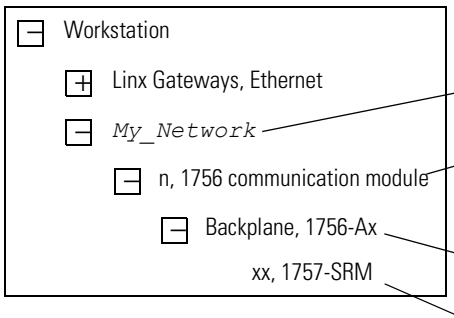
IMPORTANT

Check your revision of the SRM configuration tool when you open it for the first time.

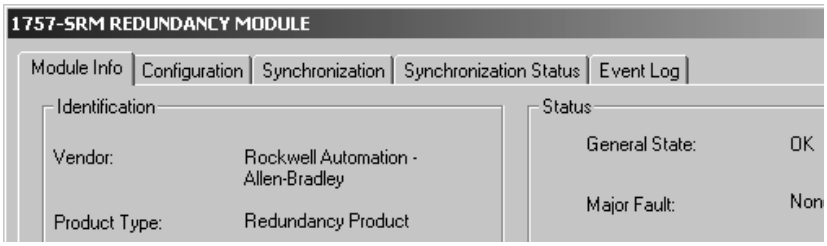
- The revision of tool that you get depends on your revision of RSLinx software.
- Some revisions of the SRM configuration tool aren't compatible with some revisions of a ControlLogix Redundancy system.

The next section shows you how to see if your revision of the SRM configuration tool is right for your redundancy system.

Actions



1. Start RSLinx software.
2. From the *Communications* menu, choose *RSWho*.
3. Double-click your network to open it.
4. Double-click the communication module in the primary chassis to show the backplane.
5. Double-click the backplane to see its modules.
6. Right-click the 1757-SRM module and select *Module Configuration*.



What to do next

IMPORTANT Make sure that you check the revision of your SRM configuration tool before you use it. Later revisions of the SRM configuration tool aren't compatible with earlier revisions of ControlLogix redundancy systems. See *Check the Revision of Your SRM Configuration Tool* on page 4-4.

Check the Revision of Your SRM Configuration Tool

Purpose

To make sure that you are using the right revision of the SRM configuration tool for your ControlLogix redundancy system.

IMPORTANT

Make sure that you check the revision of your SRM configuration tool.

- Revision 2.6 is compatible only with revision 13.x or later ControlLogix redundancy systems.
- You'll cause the 1757-SRM module to fault if you use revision 2.6 of the tool with an revision 11.x or earlier redundancy systems.

When

Do this procedure when you:

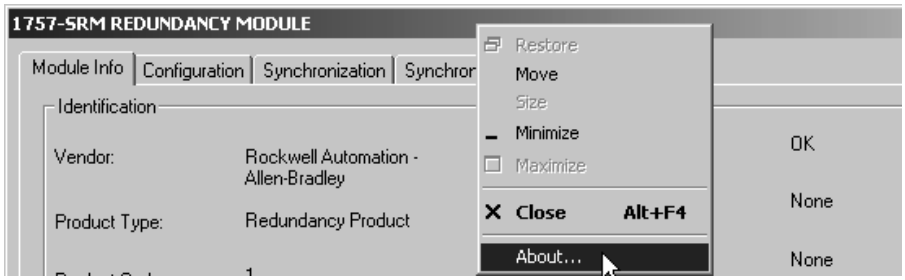
- Use the SRM configuration tool for the first time
- Connect to a different ControlLogix redundancy system for the first time
- Update the firmware of your ControlLogix redundancy system

Before you begin

RSLinx software automatically installs the SRM configuration tool. Use the following table to see which revision of the tool that you get:

If you install	Then you get
RSLinx software revision 2.42	SRM configuration tool revision 2.5
RSLinx software revision 2.43	SRM configuration tool revision 2.6

Actions

Action	Details
1. Choose which revision to use.	Do you connect your computer to ControlLogix redundancy systems revision 11.x or earlier? • YES — Use revision 2.5 of the SRM Configuration Tool. DON'T use revision 2.6. • NO — Use revision 2.6 of the SRM Configuration Tool. Revision 2.6 is compatible only with revision 13.x or later ControlLogix redundancy systems. You'll cause the 1757-SRM module to fault if you use revision 2.6 of the tool with an revision 11.x or earlier redundancy systems. Keep in mind that some features are available only in revision 2.6 or later of the configuration tool.
2. See which revision you have.	A. Open the SRM configuration tool if you haven't already done so. B. Right-click the title bar of the configuration tool and choose *About…* 
3. Change your revision	If you need a different revision of the SRM configuration tool, see Knowledgebase document G92234770. To access Rockwell Automation's Knowledgebase, go to http://support.rockwellautomation.com **Important**: The SRM configuration tool lets you install only 1 revision on your computer at the same time. To change the revision, remove the revision that you installed earlier.

Set the Clock of the SRM

Purpose

To set clock of the 1757-SRM module

When

Do this procedure:

- After you install your system
- After any power-loss to both chassis

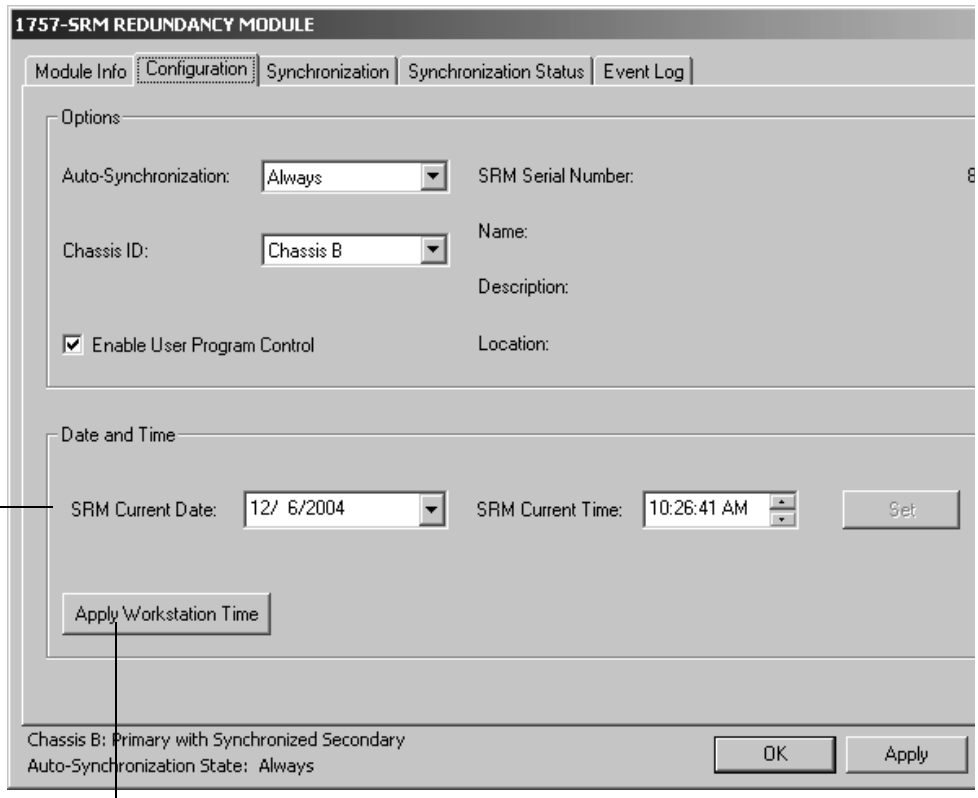
Before you begin

The SRM uses its clock to log the time when significant events happen. Keep these things in mind about the SRM's clock:

- You set the clock of only the primary SRM. The secondary SRM sets its clock to the clock of the primary SRM.
- The SRM doesn't have a battery to keep its clock running. The clock stops when you turn off power to the SRM.
- When you turn on power to the SRM, the primary SRM sets its clock equal to the most recent event in its event log.
- To see when the secondary SRM powered up, look in its event log. Look for *WCT time change (> 1 second)* event.
- An SRM with a firmware revision 3.37 or earlier doesn't log its power down time. If only one of the chassis powers down, use the event log of the other chassis to see when it happened. Look for *The partner RM screamed* event. See Interpret the SRM Event Log on page 6-10.

Actions

Action	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*.
2. Set the clock.	A. Click the *Configuration* tab.



B. Do you want to set the clock of the SRM to the clock of your computer?

If	Then
YES	Choose *Apply Workstation Time* and then *Yes*.
NO	1. Change the date or time. 2. Choose *Set* and then *Yes*.

C. Choose *OK*.

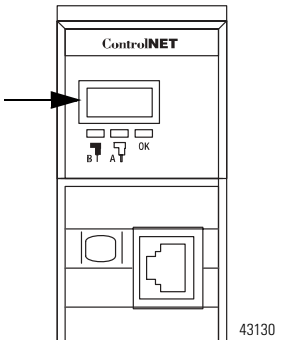
Test a Switchover

Purpose

To use RSLinx software to manually initiate a switchover.

When

Do this procedure after you've synchronized your system and want to test a switchover.



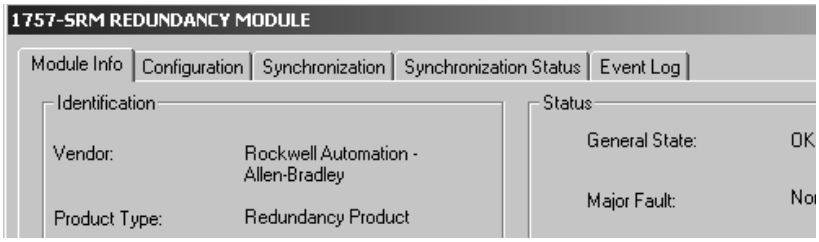
Before You Begin

The CNB modules in the new primary chassis show the synchronization progress after a switchover. Typically, the modules show the following sequence:

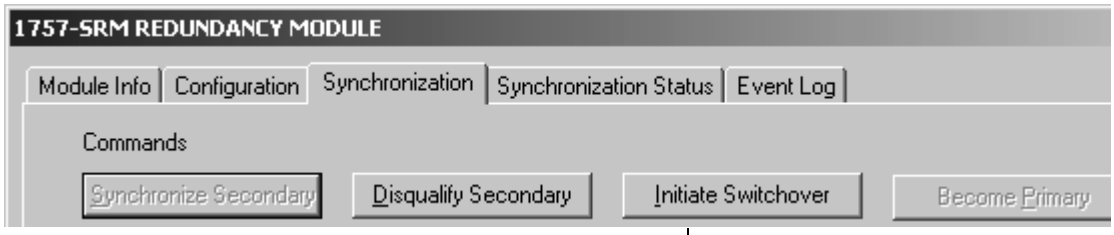
PwNS ⇒	*PwDS* ⇒	*PwQg* ⇒	*PwQS*
primary with no secondary	primary with disqualified secondary	primary with synchronizing (qualifying) secondary	primary with synchronized (qualified) secondary

Actions

Action	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*.



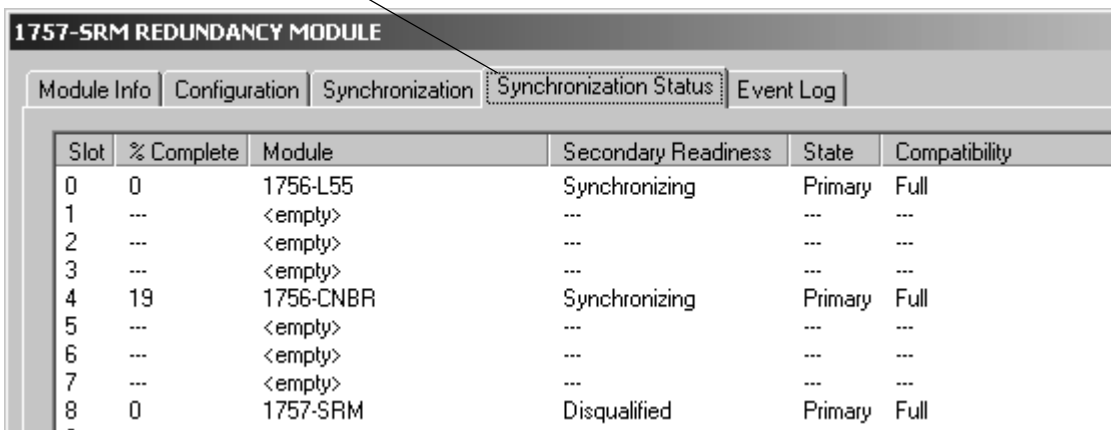
Action	Details
2. Start a switchover.	A. Click the *Synchronization* tab.



B. Choose *Initiate Switchover* and then choose *Yes* to continue.

3. Monitor the synchronization progress.

A. Click the *Synchronization Status* tab.

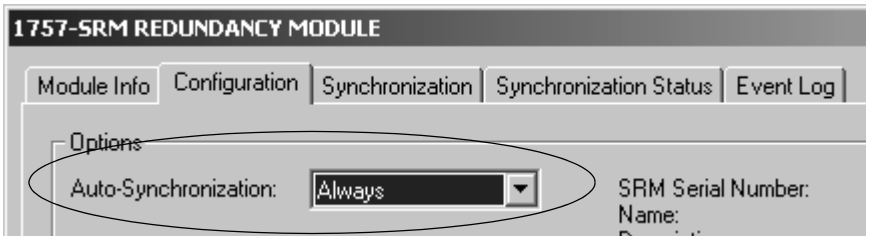


Slot	% Complete	Module	Secondary Readiness	State	Compatibility
0	0	1756-L55	Synchronizing	Primary	Full
1	---	<empty>	---	---	---
2	---	<empty>	---	---	---
3	---	<empty>	---	---	---
4	19	1756-CNBR	Synchronizing	Primary	Full
5	---	<empty>	---	---	---
6	---	<empty>	---	---	---
7	---	<empty>	---	---	---
8	0	1757-SRM	Disqualified	Primary	Full

If the controller contains a large project, the system may spend some time synchronizing the secondary controller.

B. If the *Secondary Readiness* remains *Disqualified*:

- Make sure the Auto-Synchronization option = Always.



- See "Troubleshoot a Failure to Synchronize" on page 6-5.

Change the Auto-Synchronization Option

Purpose

To change when the 1757-SRM module tries to synchronize the controllers

When

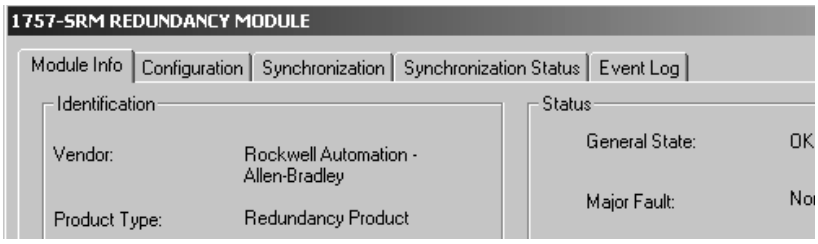
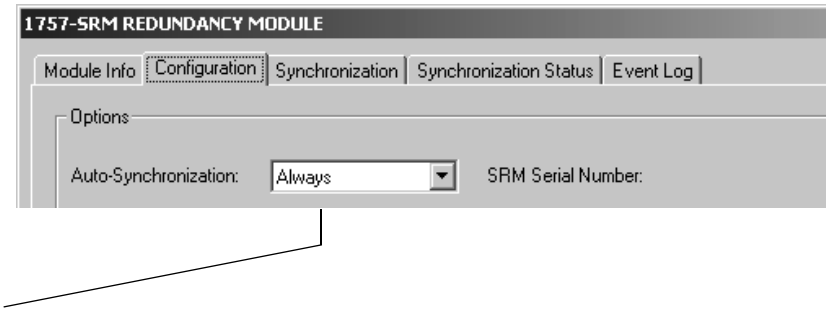
Do this procedure when:

- Your system isn't synchronizing.
- You don't want the system to crossload your changes.

Actions

Action	Details
1. Decide when you want the system to synchronize.	Do you plan to manually disqualify a chassis so you can make changes? • NO — Choose Always • YES — Choose Conditional **Notes**:

If you choose:	Then:
Conditional	The SRM keeps the synchronization command that you give it. If you: • Synchronize the secondary — the SRM always tries to keep the controllers synchronized. • Disqualify the secondary — the SRM keeps the controller unsynchronized (disqualified). It doesn't crossload changes.
Never	The controllers won't try to synchronize, but you can still manually synchronize the controllers.

Action	Details
2. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*. 
3. Set the auto-synchronization option.	A. Click the *Configuration* tab.  B. Select the *Auto-Synchronization* option. C. Choose *Apply* and then *Yes* to continue. D. Choose *OK*.

Change the Program Control Option

Purpose

To let the controller send a message to the 1757-SRM module or block the controller from sending a message to the 1757-SRM module

When

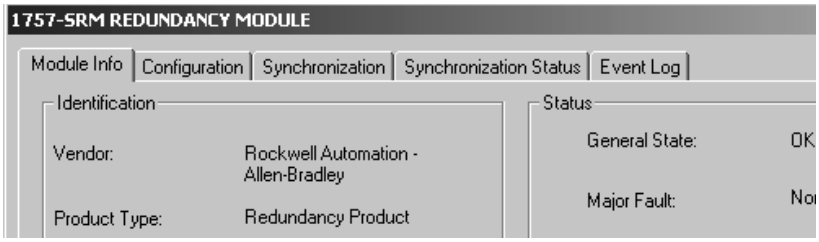
Do this procedure when you:

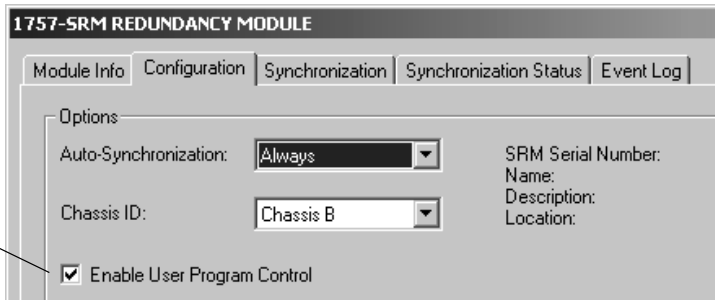
- Initially configure the SRM
- Decide to send the SRM a message from the controller

Before you begin

See page 5-28 for a list of messages that a controller can send to an SRM module.

Actions

Action	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*. 

Action	Details
2. Set the program control option.	A. Click the *Configuration* tab. B. Do you want to let a controller send a message to the SRM? • YES — Check the *Enable User Program Control* check box. • NO — Uncheck the *Enable User Program Control* check box.  C. Choose *Apply* and then *Yes* to continue. D. Choose *OK*.

Notes:

Configure and Program the Controller

When to Use this Chapter

After you have installed your system, use this chapter to configure and program the controller for redundancy.

IMPORTANT Create and maintain only one RSLogix 5000 project for the pair of redundant controllers. When you download the project to the primary controller, the project automatically crossloads to the secondary controller.

How to Use this Chapter

To configure and program your controller, complete the following tasks:

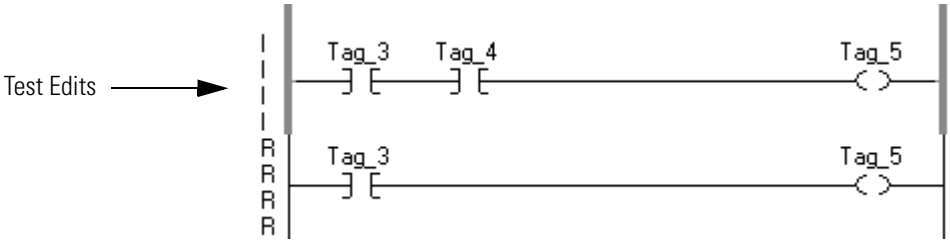
Plan for Online Edits

Before you do any online edits:

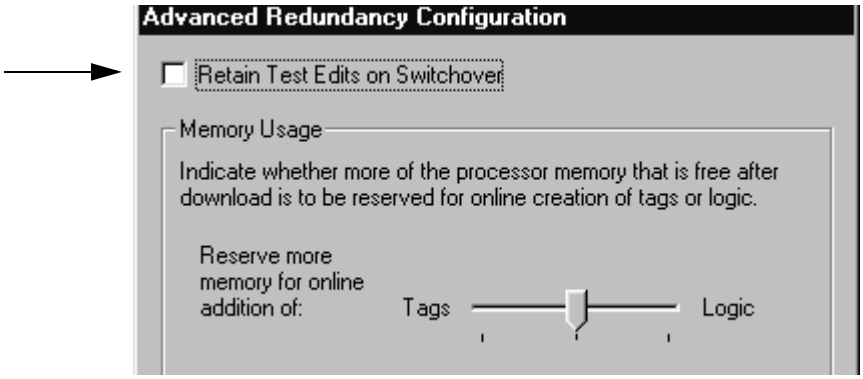
- ❑ Decide if you want to keep test edits after a switchover
- ❑ Be aware that finalizing all edits removes your original logic
- ❑ Decide how you want to set aside unused memory

Decide if you want to keep test edits after a switchover

When you edit your logic while online with the controller, it is possible for those edits to fault the controller and cause a switchover.



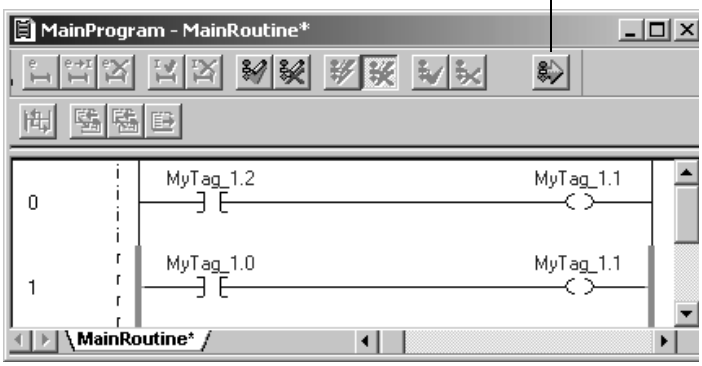
If the test edits fault the primary controller, it is likely they will fault the secondary controller as well. To prevent this from occurring, any test edits are deactivated (untested) during a switchover. As an option, you can keep the edits active after a switchover:



If you want to:	Then:
prevent an incorrect online edit from faulting both the primary and secondary controller	Do not retain test edits (default setting).
keep test edits active during a switchover (at the risk of faulting both controllers)	Retain test edits.

Be aware that finalizing all edits removes your original logic

Finalize All Edits in Program

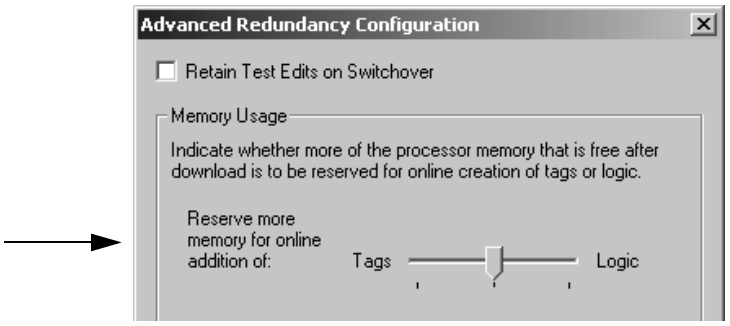


The controller removes the original logic when you finalize all edits in a program. If your changes cause a major fault and a switchover, the new primary controller also faults. That's because there's NO original logic to go back to. (I.e., The new primary can't untest the edits.)

This happens even if you set the controller to untest edits on a switchover.

Decide how you want to set aside unused memory

IMPORTANT We recommend that you leave the Memory Usage slider in the middle (default).



When the secondary controller gets crossload data, it first buffers tag data in a quarantine section of memory. When it has all of the data and knows it is valid, it moves the data into the main memory area. That is why a redundant controller requires twice as much memory for tags as a non-redundant controller.

The controller sets up the quarantine area at the time of download:

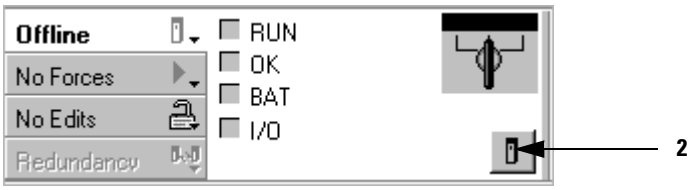
- The controller divides its memory into two sections:
  - tags, including a quarantine area
  - logic
- The controller also divides its unused memory. It reserves a specific amount for tags that you create while online. The rest for logic.

You configure how to reserve unused memory between tags and logic. You do this online in program mode.

If you plan to:	Then:	Notes:
WHILE ONLINE, create roughly the same amount of new tags and new logic	Leave the default setting.	
WHILE ONLINE, create a relatively large amount of new tags but a much smaller amount of new logic	Drag to slider toward *Tags*.	Avoid setting the slider all the way to *Tags*: • You will be unable to perform online edits. • OPC communications may error or fail.
WHILE ONLINE, create a relatively large amount of new logic but a much smaller amount of new tags	Drag to slider toward *Logic*.	Avoid setting the slider all the way to *Logic*; you will be unable to create tags while online.

Configure a Controller for Redundancy

1. Open or create the RSLogix 5000™ project.



2. On the Online toolbar, click the controller button.

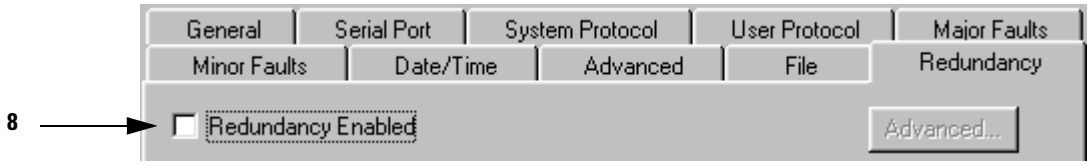
3. Does the *General* tab show your type of controller?
   - If NO, go to step 4.
   - If YES, go to step 7.

4. Click the *Change Type* button.

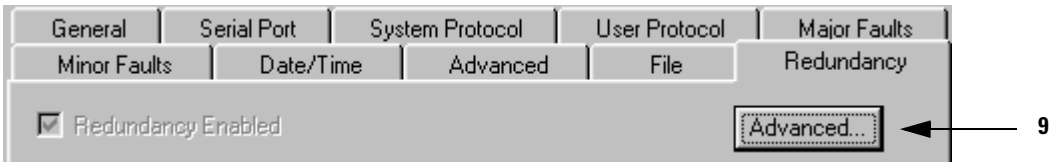
5. Select your controller.

6. Choose *OK*.

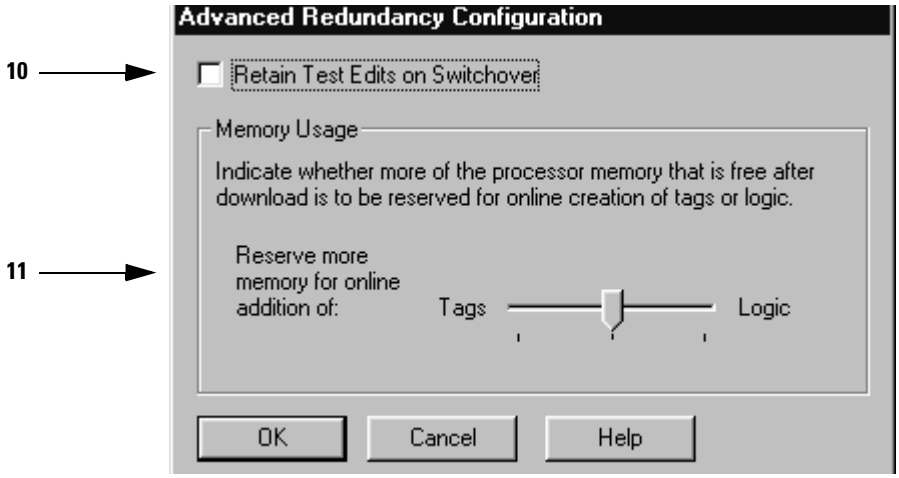
7. Click the *Redundancy* tab.



8. Select the *Redundancy Enabled* check box.



9. Click the *Advanced* button.



10. We recommend that you leave this check box cleared (unchecked). This prevents an incorrect online edit from faulting both the primary and secondary controller.

If you want any test edits to remain active during a switchover (at the risk of faulting both controllers), then check this check box.

11. We recommend that you leave the Memory Usage slider in the middle (default).

12. Choose OK

13. To close the Controller Properties dialog box, choose OK

Configure Communications

A redundant system requires some specific configuration choices for successful communications. Use this section for guidance on how to configure the following elements for redundancy:

- ❑ Configure I/O
- ❑ Configure Produced Tags
- ❑ Configure Message (MSG) Instructions
- ❑ Configure Tags for an HMI

Configure I/O

IMPORTANT For each module in your system, make sure that the requested packet interval (RPI) is less than or equal to 375 milliseconds. If you use a larger RPI, the controller could lose its connection with the module during a switchover. This could cause outputs to change state.

For any outputs that require a bumpless switchover:

- Put those outputs in the highest priority task.
- Configure only that task at the highest priority.

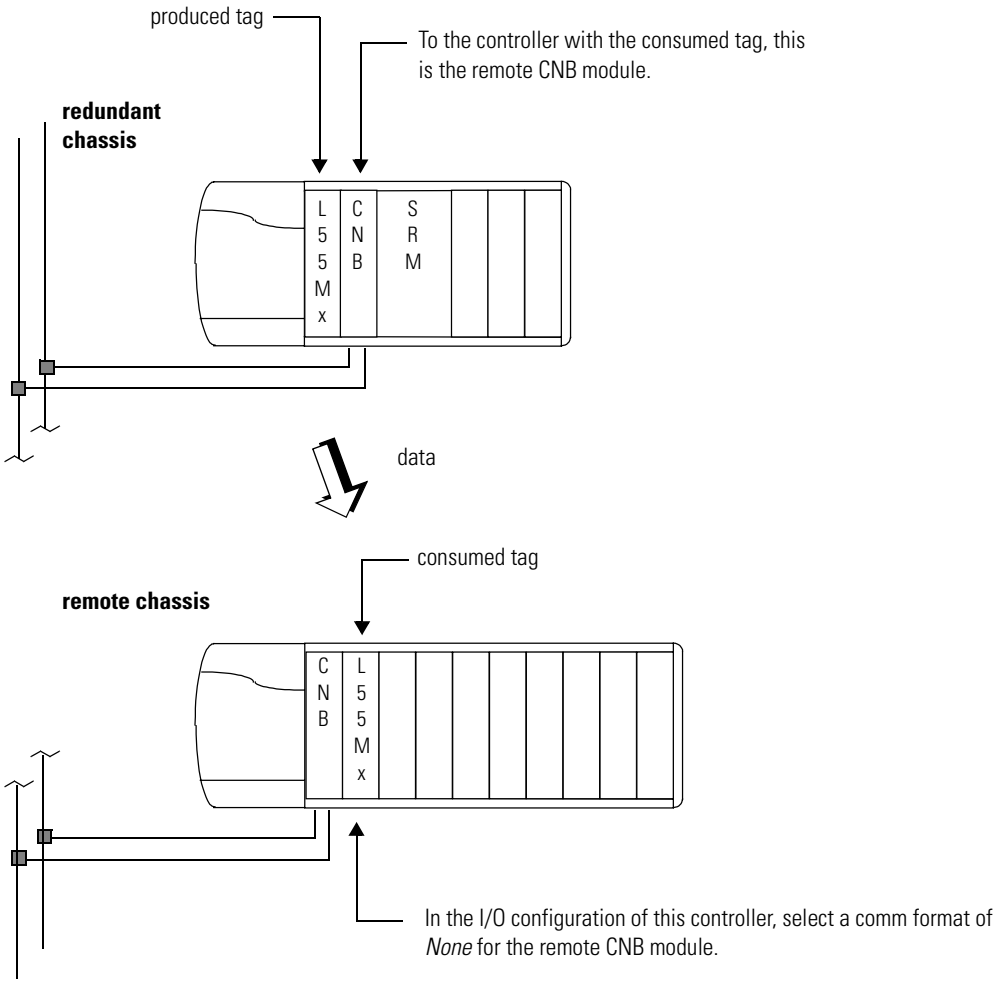
Configure Produced Tags

IMPORTANT During a switchover, the connection for tags that are consumed FROM a redundant controller may time out.

- The data DOES NOT update.
- The logic acts on the last data that it received.

After the switchover, the connection reestablishes and the data begins to update again.

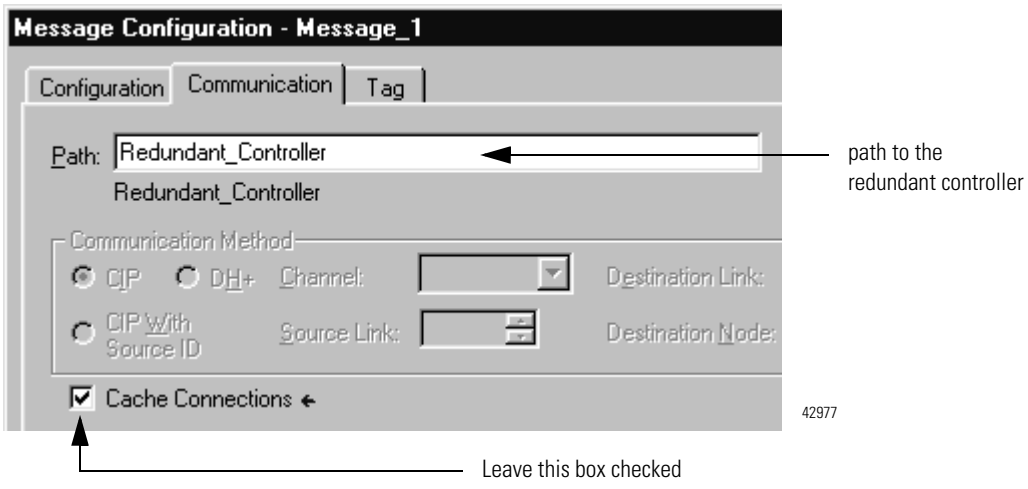
If you want a controller in another chassis to consume a tag from the redundant controller, use a comm format of *None*. In the I/O configuration of the consuming controller, select a comm format of *None* for the remote CNB module (the CNB that is physically in the redundant chassis).



Configure Message (MSG) Instructions

If the MSG instruction is:	Then:
from a redundant controller	In a redundant controller, any MSG instruction that is in progress during a switchover experiences an error. (The ER bit of the instruction turns on.) After the switchover, normal communication resumes.
to a redundant controller	For any MSG instruction from a controller in another chassis to a redundant controller, cache the connection:

Properties of the Message to the Redundant Controller



Configure Tags for an HMI

If you plan to monitor tags directly in the secondary controller (not typical), monitor from no more than 3 devices through a CNB module.

You can monitor tags in a secondary controller ONLY via:

- RSLogix 5000 software
- Any method that DOES NOT try to create OPC optimized packets. Only a primary controller can create an OPC optimized packet.

Estimate the Crossload Time of a Program

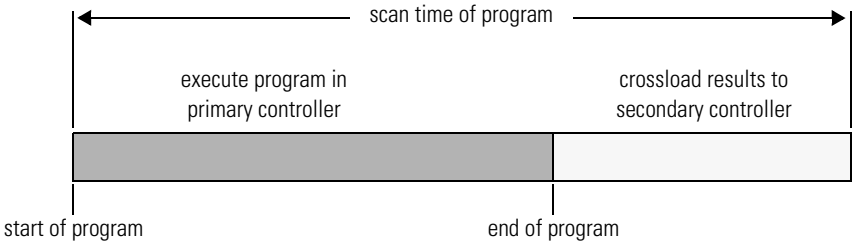
Purpose

To estimate the crossload time of a program in a redundant controller

When

Do this procedure when you want to see how much time your project spends or will spend on crossloading data.

Before you begin

Consideration	Details
The controller crossloads data at the end of every program.	The primary controller stops at the end of every program to crossload fresh data to the secondary controller. This keeps the secondary controller up-to-date and ready to take over. It also increases the scan time when compared to a non-redundant system. 
The crossload time depends on how much data changed.	The length of time for the crossload depends on the how much data the primary controller has to crossload: • The primary controller crossloads any tag to which an instruction wrote a value (even the same value) since the last crossload. • Crossloading also requires a small amount of overhead time to tell the secondary controller which program the primary controller is executing.
In a redundant system, a ControlLogix5561, 5562, or 5563 controller is up to 30% faster than a ControlLogix5555 controller.	The scan time improvement of ControlLogix5561, 5562, and 5563 controllers is less in a redundant system is than in a non-redundant system. • Even though the ControlLogix5561, 5562, and 5563 controllers execute logic faster, they must still crossload data. • Given the same project and redundant system, a ControlLogix5561, 5562, or 5563 controller is up to 30% faster than a ControlLogix5555 controller.

Actions

Action	Details
1. Get the size of your crossload data.	Use a Get System Value (GSV) instruction to read the REDUNDANCY object.

For this information	Get this attribute	Data Type	Description
• size of the last crossload • size of the last crossload if you had a secondary chassis	LastDataTransfer Size	DINT	This attribute gives the size of data that was or would have been crossloaded in the last scan. • The size in DINTs (4-byte words). • You must configure the controller for redundancy. • You don't need a secondary chassis. Is there a synchronized secondary chassis? • YES — This gives number of DINTs that was crossloaded in the last scan. • NO — This gives number of DINTs that would have been crossloaded in the last scan.
• size of the biggest crossload • size of the biggest crossload if you had a secondary chassis	MaxDataTransfer Size	DINT	This attribute gives the biggest size of the LastDataTransfer Size attribute. • The size in DINTs (4-byte words). • You must configure the controller for redundancy. • You don't need a secondary chassis. • To reset this value, use an SSV instruction with a Source value of 0. Is there a synchronized secondary chassis? • YES — This gives biggest number of DINTs that was crossloaded. • NO — This gives biggest number of DINTs that would have been crossloaded.

See *Logix5000 Controllers General Instructions Reference Manual*, publication 1756-RM003, for more information on the GSV and SSV instructions.

2. Estimate the crossload time.

Which controller do you have?

- If ControlLogix5555, then crossload time = (0.0015 ms * `DINTs`) + 1 ms overhead
- If ControlLogix5561, then crossload time = (0.0013 ms * `DINTs`) + 1 ms overhead
- If ControlLogix5562, then crossload time = (0.0013 ms * `DINTs`) + 1 ms overhead
- If ControlLogix5563, then crossload time = (0.0013 ms * `DINTs`) + 1 ms overhead

where `DINTs` is the size of tag data to be crossloaded, measured in 4-byte words.

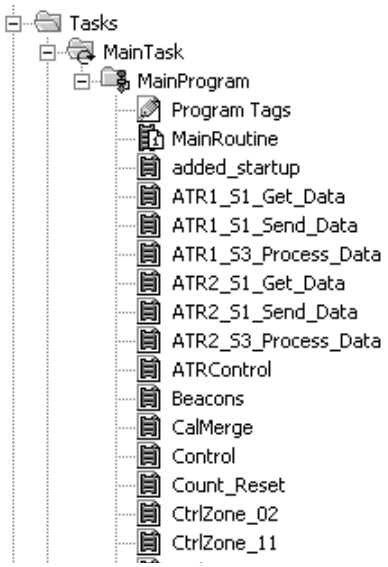
Minimize Scan Time

To minimize the scan time of your project, follow these guidelines:

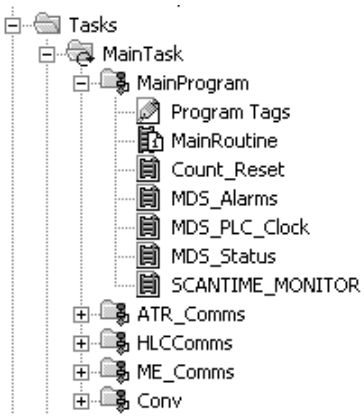
IMPORTANT Don't try to get the scan time of a ControlLogix redundancy project down below about 20 milliseconds. At very low scan times, crossload data becomes a bigger performance burden. This burden limits the minimum scan time.

Step	Details
1. Use a few large programs instead of a lot of small programs.	The controller stops at the end of every program to crossload data. So the more programs that you have, the more the controller stops to crossload. And it often ends up crossloading the same data many times. To cut down the number of crossloads: A. Use only one or a few programs. B. Divide each program into whatever number of routines makes the most sense. A routine doesn't cause a crossload. C. Use the main routine of each program to call the other routines of the program. D. If you want to use several tasks for different scan periods, put only one program in each task. Remember that each program adds a crossload. So use only one or a few tasks.

This is better



Than this



Step	Details
2. Delete unused tags.	This reduces the size of the tag database. A smaller database takes less time to crossload. To delete unused tags: A. Open one of the tags folders. B. Click the *Edit Tags* tab. C. From the *Show* list, select *Unused*.  D. From the *Edit* menu, choose *Select All*. E. Press the [Delete] key.
3. Use arrays and user-defined data types instead of individual tags.	When you create a tag, the controller ALWAYS sets aside AT LEAST 4 bytes (32 bits) of memory. The controller does this even if the tag needs only 1 bit. When you create an array or a user-defined data type, the controller packs smaller data types into 4-byte (32-bit) words. This means the controller has less data to crossload. **This array of 32 BOOLs takes only 4-bytes.** Tag Name / Alias For / Base Tag / Type ⊞-Bool_Array / / / BOOL[32] The controller crossloads only 4 bytes. **These 3 BOOL tags take 12 bytes total (3 tags x 4 bytes/tag = 12 bytes).** Tag Name / Alias For / Base Tag / Type Bool_Tag_1 / / / BOOL Bool_Tag_2 / / / BOOL Bool_Tag_3 / / / BOOL The controller crossloads all 12 bytes. Arrays and user-defined data types help you the most with BOOL tags. But also use them for your SINT, INT, DINT, REAL, COUNTER, and TIMER tags.

Step	Details
4. If you've already created individual tags, change them to aliases.	If you've already created individual tags, change them to aliases for elements of an array. Your logic points to the aliases. The controller crossloads the base array.

A. Create an array.

B. Change each individual tag to an alias for an element in the array.

Tag Name	Alias For	Base Tag	Type
⊞-Bool_Array			BOOL[32]
Bool_Tag_1	Bool_Array[0]	Bool_Array[0]	BOOL
Bool_Tag_2	Bool_Array[1]	Bool_Array[1]	BOOL
Bool_Tag_3	Bool_Array[2]	Bool_Array[2]	BOOL

C. Keep pointing your logic to the individual tag names.

5. Keep your user-defined data types as compact as possible.

Put like data types together when you lay out a user-defined data type:

- Put all the BOOLs together.
- Put all the SINTs together.
- Put all the INTs together.

This is better

This data type takes 12 bytes. The BOOLs are together.

Members: Data Type Size: 12 byte(s)

	Name	Data Type	Style	Description
	Bool_1	BOOL	Decimal	
	Bool_2	BOOL	Decimal	
	Bool_3	BOOL	Decimal	
	Dint_1	DINT	Decimal	
	Dint_2	DINT	Decimal	
*				

Than this

This data type takes 20 bytes. The BOOLs are spread out.

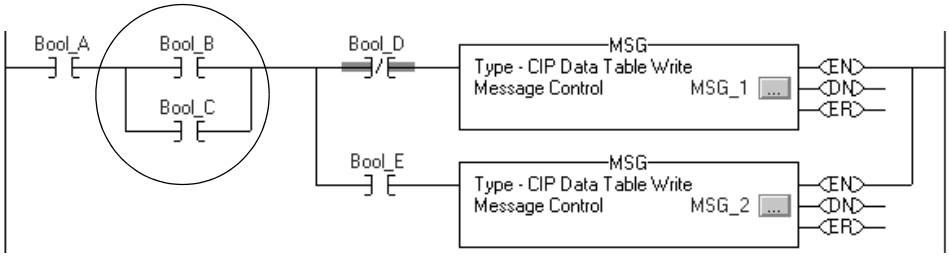
Members: Data Type Size: 20 byte(s)

	Name	Data Type	Style	Description
	Bool_1	BOOL	Decimal	
	Dint_1	DINT	Decimal	
	Bool_2	BOOL	Decimal	
	Dint_2	DINT	Decimal	
	Bool_3	BOOL	Decimal	
*				

Step	Details
6. Keep your code as compact as possible.	Avoid checking the same conditions many times, if possible. Each instruction adds scan time to your controller.

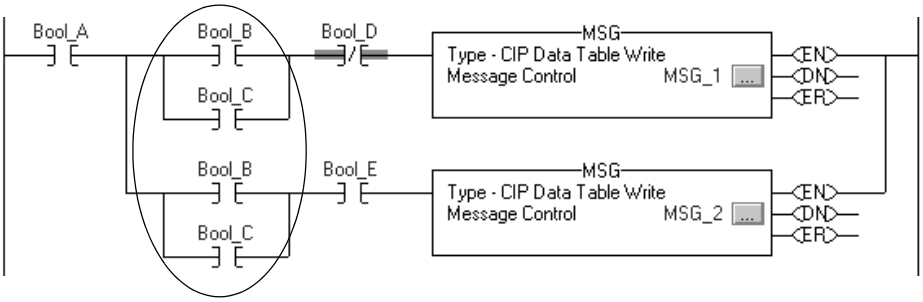
This is better

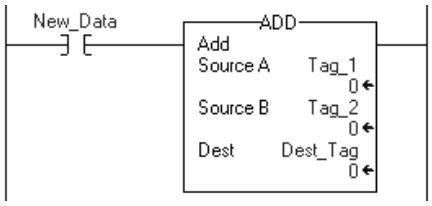
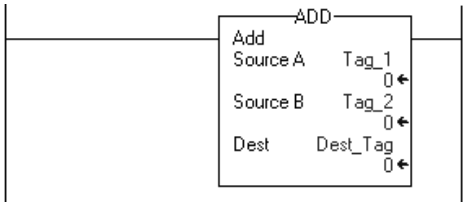
This rung checks *Bool_B* and *Bool_C* only once each scan.

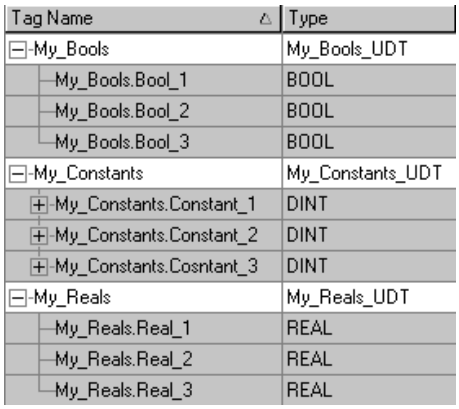
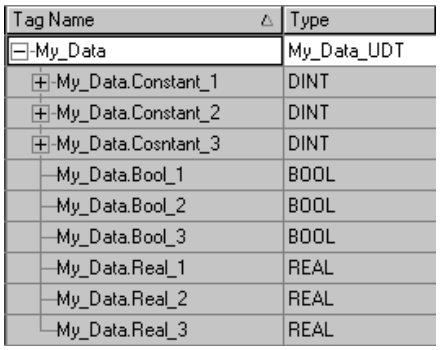


Than this

This rung checks *Bool_B* and *Bool_C* twice each scan. 1 or 2 instructions don't add much scan time. But if you do this often, the extra instructions add up to a much longer scan time.



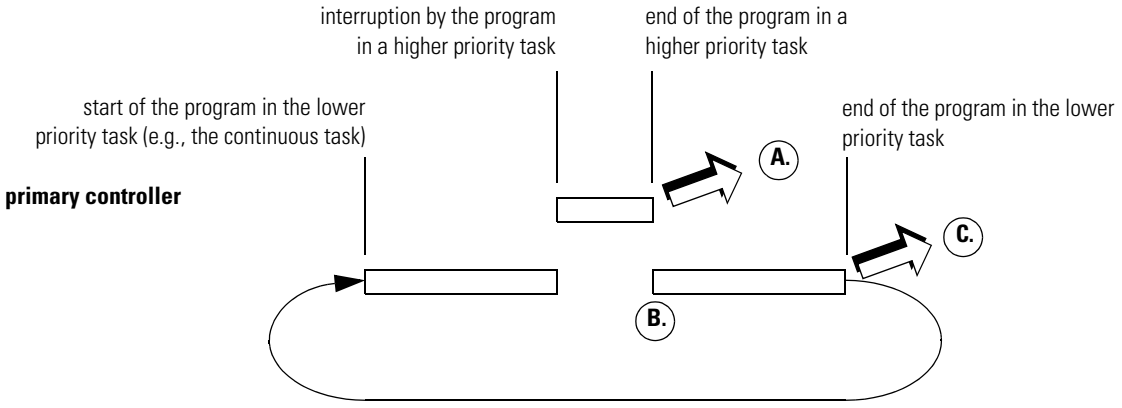
Step	Details
7. Execute code only when you need it.	The controller crossloads a tag anytime an instruction writes a value to the tag. This happens even if the value stays the same: • Many instructions write a value whenever they run. For example, instructions such as OTL, OTU, and many instructions with Destination operands write a value each time the rung-condition-in is true. • Whenever an instruction writes a value, the controller marks the value for the next crossload. This occurs even if the instruction wrote the same value that was previously in the tag. If you execute an instruction only when you need to, you reduce the amount of crossload data. This reduces scan time. To limit the execution of an instruction: • Make a rung false when you don't need to execute its instructions. • Divide your logic into subroutines and call each subroutine only when needed. • Run non-critical code every few scans instead of every scan. **This is better** The ADD instruction runs only when the controller gets new data (*New_Data* = on). And *Dest_Tag* crossloads only when the ADD instruction produces a new value.  **Than this** The ADD instruction writes the sum of *Tag_1* + *Tag_2* to *Dest_Tag* each time the rung executes. The controller crossloads *Dest_Tag* every scan, even if *Tag_1* and *Tag_2* stay the same. 

Step	Details
8. Group your data by how often you need it.	To update the secondary controller, the primary controller divides its memory into blocks of 256 bytes. Anytime an instruction writes a value, the primary controller crossloads the entire block that contained the value. For example, if your logic writes only 1 BOOL value to a block, the controller crossloads the entire block (256 bytes). To keep your crossload time down, group your data by how often you need it. Suppose that you have some DINTs that you use only as constants to initialize your logic. You have some BOOLs that you update every scan. And you have some REALs that you update every second. **This is better** One user-defined data type for the BOOLs. The controller crossloads these 4 bytes every scan. One user-defined data type for the DINTs. The controller crossloads these 12 bytes only once. One user-defined data type for the REALs. The controller crossloads these 12 bytes every second.  **Than this** One user-defined data type for all the data. The controller crossloads these 28 bytes every scan. 
9. Use DINT tags instead of SINT or INT tags	To keep your logic as efficient as possible, use the DINT data type instead of the SINT or INT data types. A ControlLogix controller usually works with 32-bit values (DINTs or REALs). If you use a SINT or INT value: • The controller usually changes a SINT or INT value to a DINT or REAL value before it uses the value. • If the destination is a SINT or INT tag, the controller usually changes the value back to a SINT or INT value. • You don't have to program the controller to change values to or from SINTs or INTs. The controller does it automatically. But it takes extra execution time and memory.

Maintain the Integrity of Your Data During a Switchover

The redundancy system guarantees a bumpless switchover for any logic in the highest priority task. In some cases, a switchover may make lower priority tasks repeat part of their scan. This has to do with how data crossloads from the primary controller to the secondary controller.

As the primary controller executes its logic, it updates the secondary controller at the end of every program.

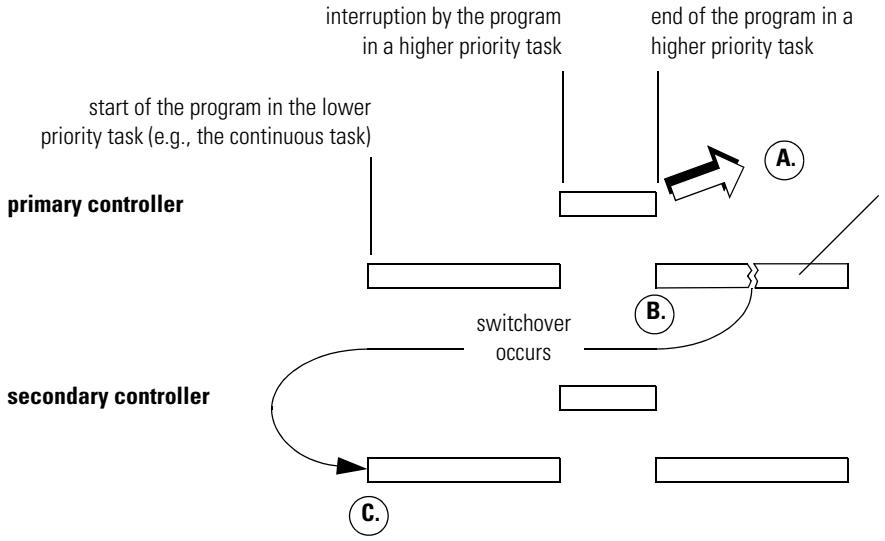


A. The following data is sent to the secondary controller:
- data from the program in the higher priority task
- data from the first part of the program in the lower priority task

B. Execution returns to the program in the lower priority task.

C. Data from the second part of the program in the lower priority task is sent to the secondary controller.

When a switchover interrupts the execution of the primary controller, the secondary controller re-executes an interrupted program from the beginning of the program.



A. The following data is sent to the secondary controller:
- data from the program in the higher priority task
- data from the first part of the program in the lower priority task

B. Execution returns to the program in the lower priority task.

C. The secondary controller:
- starts the scan at the beginning of the program that was in progress in the primary controller at the time of the switchover
- uses the data from the last update

In this example, the secondary controller starts the scan with an image of the data as it was DURING the last scan of the primary controller.

To find places in your logic that might repeat its scan after a switchover:

- ❑ Look for Array Shift Instructions
- ❑ Look for Logic That is Scan-Dependant
- ❑ Take Preventative Actions

Look for Array Shift Instructions

The following instructions might corrupt your data during a switchover:

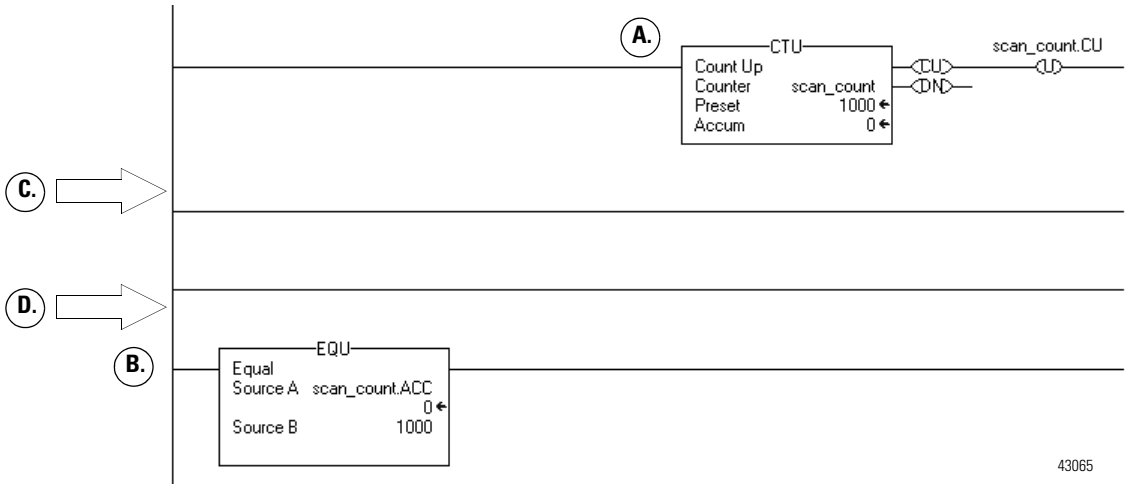
- BSL
- BSR
- FFU

Because these instructions shift data within an array, an interruption by a higher priority task and a subsequent switchover leaves the data with an incomplete shift:

- If a higher priority task interrupts one of these instructions, the partially-shifted array values are sent to the secondary controller.
- If a switchover occurs before the instruction completes its execution, data remains only partially shifted.
- The secondary controller starts its execution at the beginning of the program, When it reaches the instruction, it shifts the data again.

Look for Logic That is Scan-Dependant

A rung that must read the output of another rung during the same scan might miss a scan during a switchover. For example:



A. The CTU instruction counts each scan.

B. The EQU instruction uses the count of each scan (*scan_count.ACC*).

C. If a higher priority task interrupts the logic, the value of *scan_count.ACC* is sent to the secondary controller at the end of the program in the higher priority task.

D. If a switchover occurs before the EQU instruction, the secondary controller starts its execution at the beginning of the program. The EQU instruction misses the last value of *scan_count.ACC*.

Take Preventative Actions

If you find a place in your logic that might be susceptible to an upset during a switchover, take one of the following preventative actions:

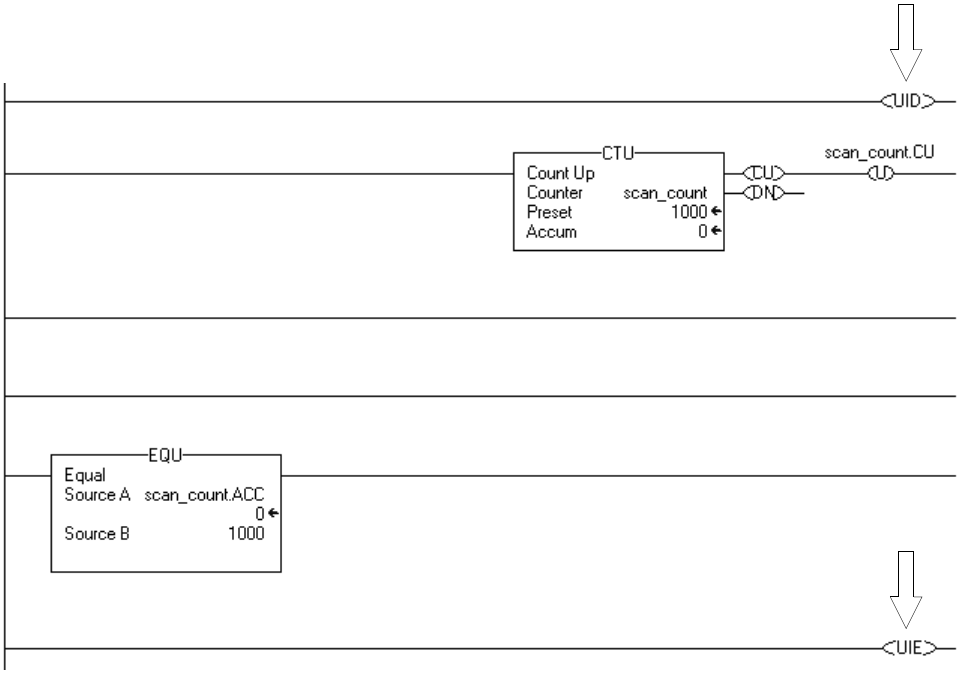
1. Place Susceptible Logic in the Highest Priority Task
2. If the logic must remain in a lower priority task, take one of the following actions:
   - Use UID and UIE Instruction Pairs
   - Buffer Critical Data

Place Susceptible Logic in the Highest Priority Task

- This prevents the controller from sending any data to the secondary controller until the program finishes.
- If a switchover occurs during the program, the secondary controller repeats the scan using the same starting data.

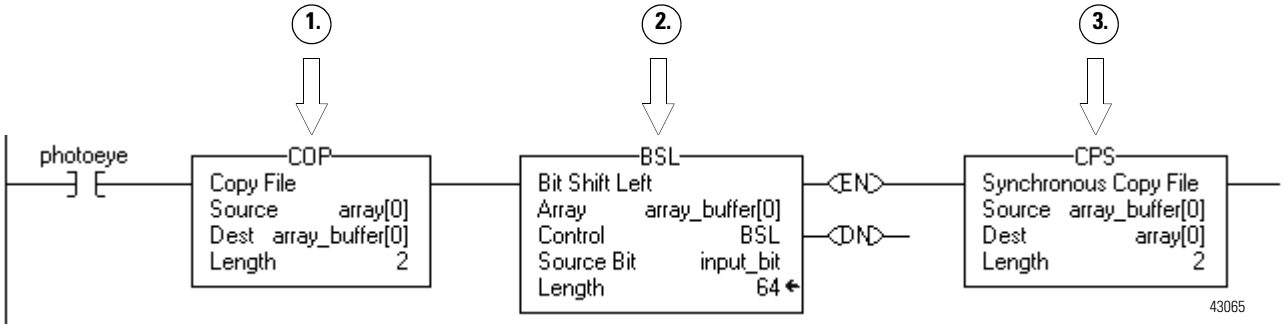
Use UID and UIE Instruction Pairs

Bound critical rungs with UID and UIE instruction pairs. This prevents the higher priority task form interrupting the scan-dependent logic, as shown below:



Buffer Critical Data

The following example shows the use of a buffer together with a BSL instruction.



1. The COP instruction moves the data into a buffer array.
2. The BSL instruction uses the data in the buffer. If a switchover occurs, the source data (*array* tag) remains unaffected.
3. The CPS instruction updates *array* tag. Since higher priority tasks cannot interrupt a CPS instruction, the instruction keeps the integrity of the data.

Get the Status of Your Redundancy System

Purpose

To write code that gets the status of your redundancy system

When

Do this procedure when you want to:

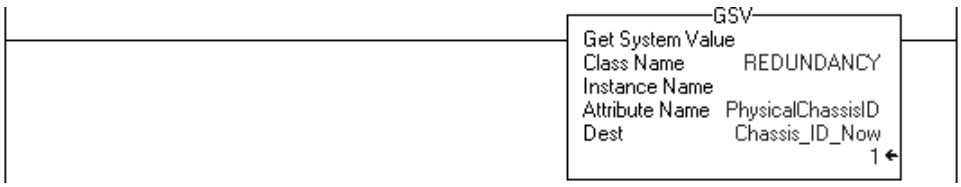
- show the status of your system on an HMI screen
- condition your code to execute based on the status of your system
- get diagnostic information to troubleshoot your system

Actions

Use a Get System Value (GSV) instruction to read the attributes of the REDUNDANCY object. See Appendix C for a list of attributes.

Example 1: Ladder diagram

Get the ID of the primary chassis. That's always the chassis that runs the code.
Store the ID in the *Chassis_ID_Now* tag. *Chassis_ID_Now* is a DINT.



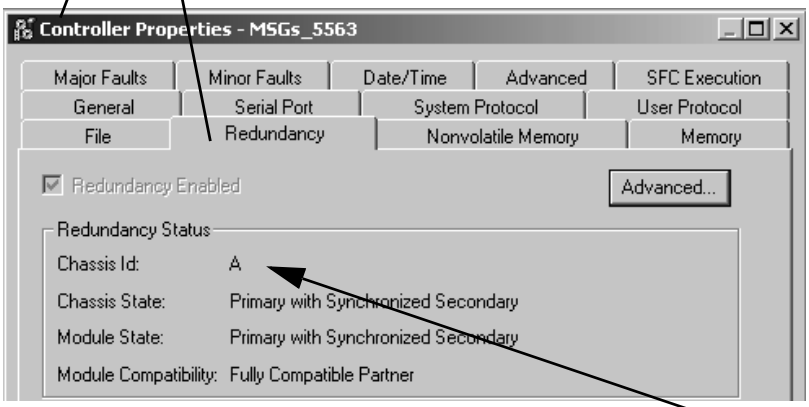
Example 2: Structured text

```
//Get the ID of the primary chassis.
//That's always the chassis that runs the code.
//Store the ID in Chassis_ID_Now. Chassis_ID_Now is a DINT.
GSV(REDUNDANCY,,PhysicalChassisID,Chassis_ID_Now);
```

Check your work

Use the Redundancy tab of the Controller Properties window to check your code for some of the attributes. It doesn't show all the attributes, but it shows the more common attributes.

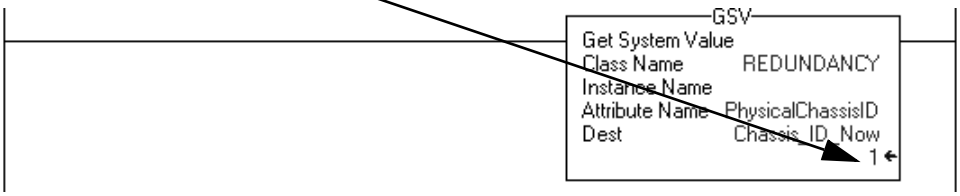
1. Download and run your project.
2. Open the Controller Properties window.
3. Click the Redundancy tab.



4. Compare the Redundancy tab with your code.

   For example, for the chassis ID:

   - A = 1
   - B = 2



For more information

For more information on	See
Attributes of the REDUNDANCY object	Appendix C
GSV and SSV instructions	*Logix5000 Controllers General Instructions Reference Manual*, publication 1756-RM003

Condition Logic to Run After a Switchover

Purpose

To condition a section of your logic to run after a switchover

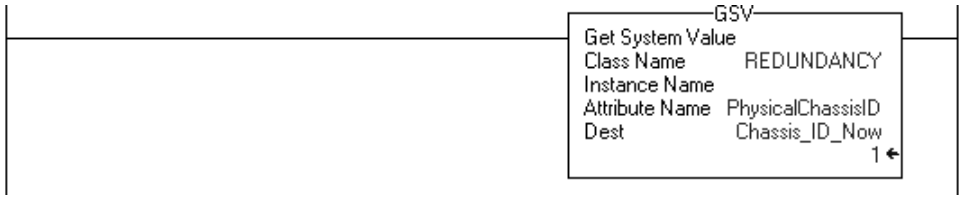
When

Follow these examples when you have logic that you want to run if a switchover happens.

Example 1: Ladder diagram

Get the ID of the primary chassis. That's always the chassis that runs the code.
Store the ID in the *Chassis_ID_Now* tag.

Chassis_ID_Now — DINT.



If this is the first scan then

Set the last value of the chassis ID = the ID of this chassis.

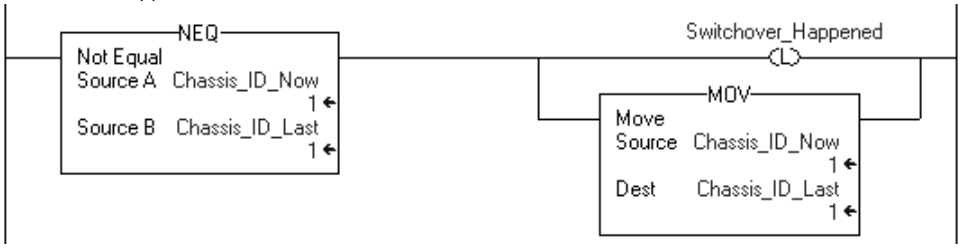
Chassis_ID_Last — DINT.

If the chassis ID changes, a switchover happened. If a switchover happens, then

Turn on the *Switchover_Happened* bit.

Set the last value of the chassis ID = the ID of this chassis.

Switchover_Happened — BOOL.



Continued on next page

If Switchover_Happened = on, then

Execute the instructions that you want to execute after a switchover.

Turn off the *Switchover_Happened* bit.

Example 2: Structured text

```
comment ——  //Get the ID of the primary chassis.
comment ——  //That's always the chassis that runs the code.
comment ——  //Store the ID in Chassis_ID_Now.
comment ——  //Chassis_ID_Now -- DINT.
code ——     GSV(REDUNDANCY,,PhysicalChassisID,Chassis_ID_Now);

            //If this is the first scan
            //Then set the last value of the chassis ID = the ID of this chassis
            //Chassis_ID_Last -- DINT.

            If S:FS then
                Chassis_ID_Last := Chassis_ID_Now;
            End_If;

            //If the chassis ID changes, a switchover happened.
            //If a switchover happens then
            //Turn on the Switchover_Happened bit.
            //Set the last value of the chassis ID = the ID of this chassis
            //Switchover_Happened -- BOOL

            If Chassis_ID_Now <> Chassis_ID_Last then
                Switchover_Happened := 1;
                Chassis_ID_Last := Chassis_ID_Now;
            End_If;

            //If Switchover_Happened = on
            //Then
            //Execute the instructions that you want to execute after a switchover.
            //Turn off the Switchover_Happened bit.

            If Switchover_Happened then
                Put your statements here.
                Switchover_Happened := 0;
            End_If;
```

Send a Message to the SRM

Purpose

Use this procedure to let your logic initiate actions in the SRM.

When

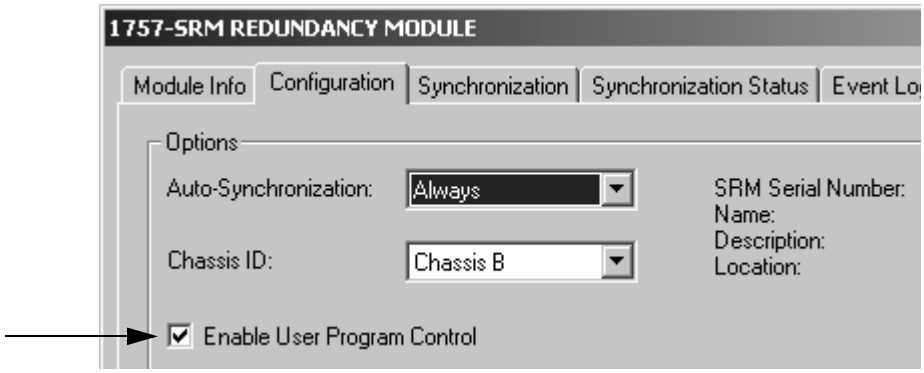
Do this procedure when you want your logic to:

- initiate a switchover
- disqualify the secondary controller
- synchronize the secondary controller
- set the clock of the SRM module

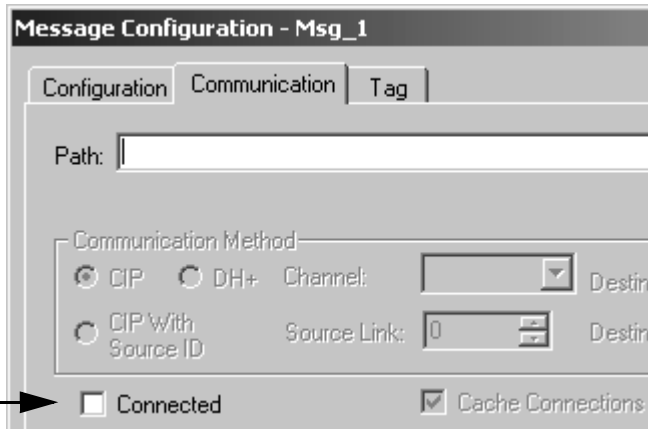
Before you begin

Before you send a message to an SRM, make sure that:

- The SRM is configured for program control.



- The message is unconnected.



Leave the *Connected* check box clear (unchecked).

Actions

Use the following table to configure a message to an SRM module.

Table 5.1 How to configure a message to an SRM

If you want to:	On this tab:	For this item:	Type or select:
initiate a switchover	Configuration	Message Type	*CIP Generic*
		Service Code	4e
		Class name	bf
		Instance name	1
		Attribute name	leave blank
		Source	DINT tag with a value of 1
		Num. Of Elements	4
		Destination	leave blank
	Communication	Path	1, `slot_number` where: `slot_number` is the left-hand slot number of the 1757-SRM module.
		Connected check box.	Leave the *Connected* check box clear (unchecked). You can send only unconnected messages to a 1757-SRM module.
disqualify the secondary controller	Configuration	Message Type	*CIP Generic*
		Service Code	4d
		Class name	bf
		Instance name	1
		Attribute name	leave blank
		Source	DINT tag with a value of 1
		Num. Of Elements	4
		Destination	leave blank
	Communication	Path	1, `slot_number` where: `slot_number` is the left-hand slot number of the 1757-SRM module.
		Connected check box.	Leave the *Connected* check box clear (unchecked). You can send only unconnected messages to a 1757-SRM module.

Table 5.1 How to configure a message to an SRM (Continued)

If you want to:	On this tab:	For this item:	Type or select:
synchronize the secondary controller	Configuration	Message Type	*CIP Generic*
		Service Code	4c
		Class name	bf
		Instance name	1
		Attribute name	leave blank
		Source	DINT tag with a value of 1
		Num. Of Elements	4
		Destination	leave blank
	Communication	Path	1, *slot_number* where: *slot_number* is the left-hand slot number of the 1757-SRM module.
		Connected check box.	Leave the *Connected* check box clear (unchecked). You can send only unconnected messages to a 1757-SRM module.
set the clock of the SRM module	Configuration	Message Type	*CIP Generic*
		Service Code	10
		Class name	8b
		Instance name	1
		Attribute name	1
		Source	*WallClockTime[0]* where: *WallClockTime* is a DINT[2] array that stores the CurrentValue of the WALLCLOCKTIME object.
		Num. Of Elements	8
		Destination	leave blank
	Communication	Path	1, *slot_number* where: *slot_number* is the left-hand slot number of the 1757-SRM module.
		Connected check box.	Leave the *Connected* check box clear (unchecked). You can send only unconnected messages to a 1757-SRM module.

Download the Project to the Primary Controller

You only have to download the project to the primary controller. When the secondary controller is synchronized, the system automatically crossloads the project to the secondary controller.

IMPORTANT If the secondary chassis becomes disqualified after you download the project, make sure that you:

- configured the project for the right type of controller
- enabled redundancy

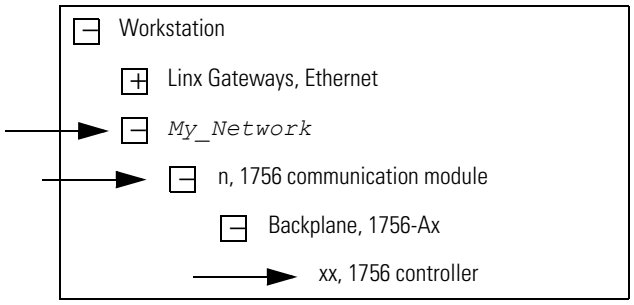
See "Plan for Online Edits" on page 5-2.

1. Open or create the RSLogix 5000™ project for the controller.
2. From the *File* menu, choose *Save*.
3. From the *Communications* menu, choose *Who Active*.
4. Browse to the controller in the primary chassis.

A. Open a branch in one of these ways:
   - Double-click it.
   - Click its + sign.
   - Select it and press the → key.

B. Find the primary chassis. Its communication module uses the address that you gave it.

C. Find the controller.



5. Select the controller and choose *Download*.

   A confirmation box opens.

6. Choose *Download*.

Schedule the ControlNet Networks

IMPORTANT Before you schedule a ControlNet network, turn on the power to both redundant chassis. If you schedule a ControlNet network while the secondary chassis is off, the keeper signature of a CNB module may not match its partner, and the secondary chassis will fail to synchronize.

Use the following procedures to schedule your network:

- ❑ Schedule a New Network
- ❑ Update the Schedule of an Existing Network
- ❑ Check the Keepers
- ❑ Save the Project for Each Controller

Schedule a New Network

1. Turn on the power to each chassis.
2. Start RSNetworx™ for ControlNet™ software.
3. From the *File* menu, choose *New*.
4. From the *Network* menu, choose *Online*.
5. Select your ControlNet network and choose *OK*.
6. Select the *Edits Enabled* check box.
7. From the *Network* menu, choose *Properties*.
8. From the *Network Parameters* tab, type or select the following parameters:

In this box:	Specify:
Network Update Time	repetitive time interval in which data is sent over the ControlNet network
Max Scheduled Address	greatest node number to use scheduled communications on the network
Max Unscheduled Address	greatest node number that you will use on the network
Media Redundancy	channels in use
Network Name	name for the network

9. choose *OK*.

10. From the *Network* menu, choose *Single Pass Browse*.
11. From the *File* menu, choose *Save*.
12. Type a name for the file that stores the network configuration, then choose *Save*.
13. Select the *Optimize and re-write Schedule for all Connections* button (default) and choose *OK*.

Update the Schedule of an Existing Network

1. Turn on the power to each chassis.
2. Start RSNetworx for ControlNet software.
3. From the *File* menu, choose *Open*.
4. Select the file for the network and choose *Open*.
5. From the *Network* menu, choose *Online*.
6. Select the *Edits Enabled* check box.
7. From the *Network* menu, choose *Properties*.
8. From the *Network Parameters* tab, update the following parameters:

In this box:	Specify:
Max Scheduled Address	greatest node number to use scheduled communications on the network
Max Unscheduled Address	greatest node number that you will use on the network

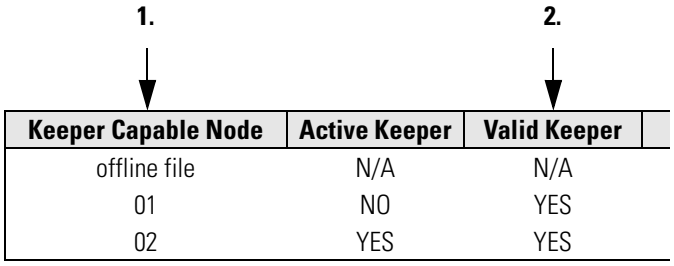
9. choose *OK*.
10. From the *Network* menu, choose *Single Pass Browse*.
11. From the *File* menu, choose *Save*.
12. Select the *Optimize and re-write Schedule for all Connections* button (default) and choose *OK*.

Check the Keepers

On a ControlNet network, each keeper must:

- be able to take over the keeper duties if the current keeper drops off the network
- use the same configuration (signature) regardless of which keeper comes online first after a major network disturbance (cable short, system power cycle, etc.)

After you schedule your ControlNet networks:



1. Make sure the network shows all keeper capable nodes.
2. Make sure that each node is a valid keeper.

For more information, see "Update a Keeper Signature" on page 6-6.

Save the Project for Each Controller

After your schedule your ControlNet networks, save the online project of each controller. This lets you download a project in the future without having to reschedule the networks.

For each controller (redundant and non-redundant) on a ControlNet network:

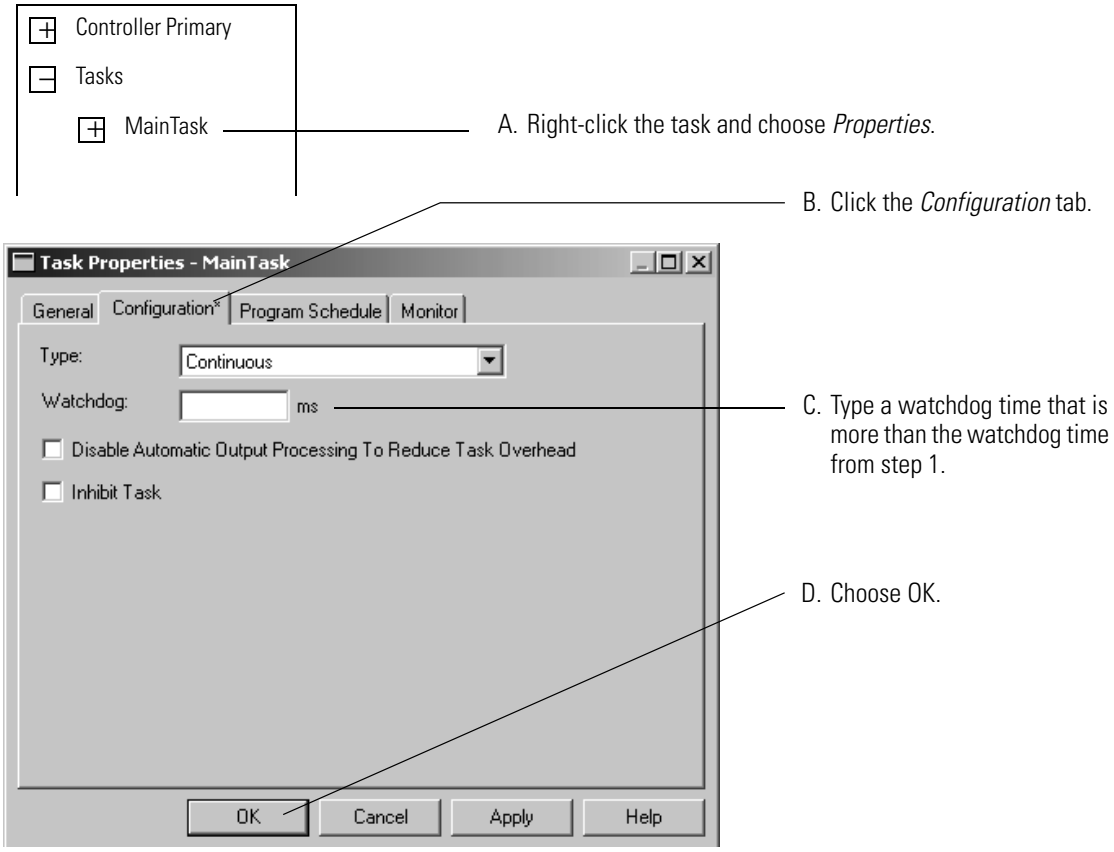
1. Go online to the controller.
2. Save the project.

Set the Task Watchdog Times

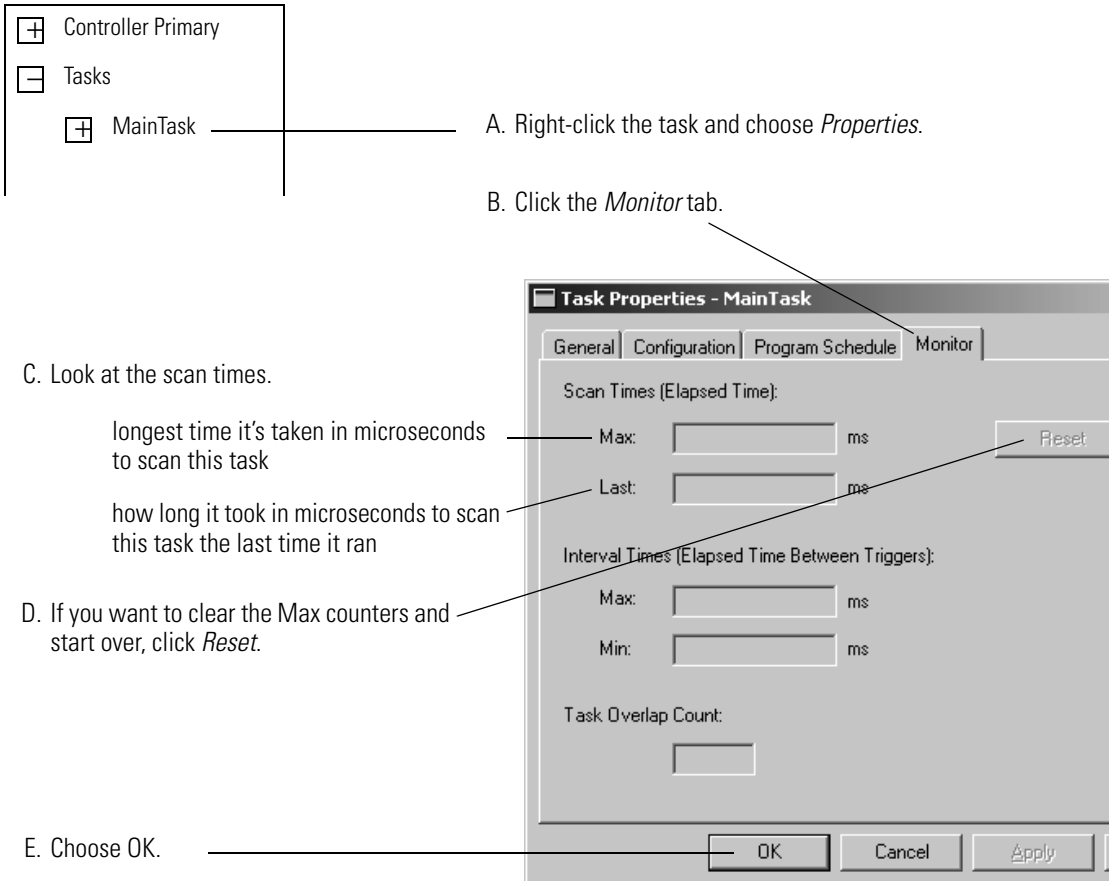
You must give a redundant controller bigger watchdog times than a non-redundant controller.

- After a switchover, the secondary controller starts the scan at the beginning of the program that was running in the primary controller at the time of the switchover.
- The watchdog timer for the task that has the program, however, is not reset.
- A major fault happens (type 6, code 1) if you don't give the watchdog timer enough time for a complete rescan of the program.

Step	Details
1. Estimate the smallest watchdog time for your task.	Use the following formula to estimate the smallest watchdog time for a task: Smallest watchdog time = (2 * *maximum_scan_time*) + 100 ms where: *Maximum_scan_time* is the maximum scan time for the entire task when the secondary controller is synchronized.
2. Set the estimated watchdog time for a task,	



Step	Details
3. Determine the real scan time of a task.	Do the following steps while the controller is running.



4. See if the watchdog time is big enough.	A. Calculate the smallest watchdog time for your task using the real scan time of the task: Smallest watchdog time = (2 * *maximum_scan_time*) + 100 ms B. Is your watchdog time more than the smallest watchdog time from step 4A above? • YES — Stop. Your watchdog time is OK. • NO — Repeat step 2 and enter a new watchdog time.

Maintain and Troubleshoot the System

When to Use this Chapter

This chapter gives you a variety of procedures to help you commission, maintain, and troubleshoot your redundancy system.

Simultaneous Power of Redundant Chassis Pair May Bump Another Redundant Chassis Pair Off the EtherNet/IP Network	Under the following *combination* of conditions (all must apply), duplicate IP addresses on your EtherNet/IP network will cause you to lose communication with a redundant chassis pair over that EtherNet/IP network: • You have multiple pairs of redundant chassis on the same EtherNet/IP network. For example, pair 1 and pair 2. • The IP addresses of one pair of redundant chassis is the same as another pair of redundant chassis. For example, pair 1 = 10.10.10.10 and pair 2 = 10.10.10.10. • A redundant chassis pair with the conflict (both chassis that make up the pair) simultaneously powers up. For example, both chassis of pair 2 power up at the same time. When this occurs the newly powered up chassis use the IP address. The redundant chassis pair that was previously communicating at that IP address stops communicating on the network. For example, when pair 2 powers up at 10.10.10.10, pair 1 stops communicating on the network.

How to Use this Chapter

If you want to:	Then see this section:	Which starts on page:
• find the cause of an unplanned switchover • find why your secondary chassis became disqualified	Find the Cause of a Switchover or Disqualification	6-3
find why the secondary controller fails to synchronize	Troubleshoot a Failure to Synchronize	6-5
see if the keeper signature of a CNB module is stopping the secondary chassis from synchronizing	Update a Keeper Signature	6-6
see if a computer is stopping the secondary chassis from synchronizing	See If an Edit Session Is in Progress	6-8
look through a log of events to see why your system switched over or failed to synchronize	Interpret the SRM Event Log	6-10
export specific events from the SRM event log and view them in software such as Microsoft® Excel	Export the SRM Event Log	6-16
initiate the synchronization process	Manually Synchronize the Chassis	6-19
• determine why it takes a very long time to synchronize the secondary controller • determine why communication with your HMIs is very slow	Optimize Communication	6-20

If you want to:	Then see this section:	Which starts on page:
• determine why OPC communication has errored or failed • determine why you are unable to create tags or edit logic while online	Check the Allocation of Unused Memory	6-24
• determine the CPU usage of a CNB module • reduce the CPU usage of a CNB module	Adjust CNB Usage	6-24
• store a project to the nonvolatile memory of a controller in a redundant system • load a project into the controller from the nonvolatile memory of the controller	Store or Load a Project Using Nonvolatile Memory	6-28
change the revision of a module while minimizing the time your system is off	Update a Module	6-30

Find the Cause of a Switchover or Disqualification

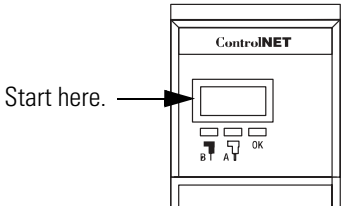
Purpose

Use this procedure to find and fix the cause of an unplanned switchover or loss of synchronization.

When

Do this procedure when:

- An unplanned switchover happens.
- A chassis that was synchronized becomes disqualified.



Actions

1. Do the 1756-CNB/D or 1756-CNBR/D modules in the PRIMARY chassis show PwQS?
   - YES — Go to Interpret the SRM Event Log on page 6-10.
   - NO — Go to step 2.
2. Does ANY module in the PRIMARY chassis show PwNS?
   - YES — Go to step 3.
   - NO — Go to step 6.
3. Use this table to troubleshoot the SECONDARY chassis.

If the secondary chassis	And each communication module in the primary chassis	And a secondary communication module has a	Then
has power	has a matching partner in the secondary chassis	Red OK light	Replace the module.
		Green OK light	Check the 1757-SRC cable for a proper connection.
	doesn't have a matching partner in the secondary chassis	⇒	Install a matching module.
doesn't have power	⇒		Restore the power.

4. Wait several minutes for the system to try to synchronize.

5. What do the CNB modules in the PRIMARY chassis show?
   - PwQS — Stop. Your system is synchronized.
   - PwDS — Go to step 6.

6. Use this table to troubleshoot the SECONDARY chassis.

If the SRM module has a:	And a secondary CNB module:	And a secondary controller has a:	Then:
Green OK LED	doesn't show *NET ERR*	Flashing Red OK light	Clear the major fault of the controller. **Note**: It's possible that you have to clear the fault on both the primary and secondary controllers.
		Solid Red OK light	A. Cycle the power to the chassis. B. If the OK light remains solid red, replace the controller and flash the controller with the appropriate revision of firmware.
		Solid Green OK light	Go to step 7.
	shows *NET ERR*	⇒	Check all ControlNet taps, connectors, and terminators for proper connections.
Red OK LED	⇒		A. Cycle the power to the chassis. B. If the OK light of the SRM module remains solid red, contact your local distributor or Rockwell Automation representative.

7. Wait several minutes for the system to try to synchronize.

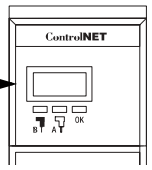
8. Do the CNB modules in the PRIMARY chassis show PwQS?
   - YES — Stop. Your system is synchronized.
   - NO — Go to Troubleshoot a Failure to Synchronize on page 6-5.

Troubleshoot a Failure to Synchronize

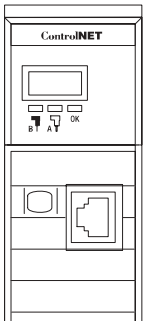
IMPORTANT

- If the steps in this section DON'T correct the situation, check the usage of the CNB modules. See "Adjust CNB Usage" on page 6-24.
- If the chassis still doesn't synchronize, try to manually synchronize it. See "Manually Synchronize the Chassis" on page 6-19.

1. Look at the 1756-CNB/D or 1756-CNBR/D modules in the PRIMARY chassis:

Front panel:	If:	It means:	So do this:
Primary CNB Look here. → 	PwQS	Primary with Synchronized (Qualified) Secondary	STOP! The redundant chassis are synchronized.
	PwDS	Primary with Disqualified Secondary	Go to step 2. A problem exists. The redundant chassis are not synchronized.
	PwNS	Primary with No Secondary	

2. Look at the CNB modules in the SECONDARY chassis.

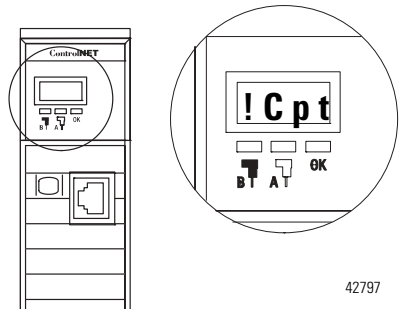
Front panel:	If the display shows:	Then:	So check the following:
Secondary CNB 	!Cpt	The CNB modules in the primary and secondary chassis don't match in some way.	1. All CNB modules in each redundant chassis are series D modules. 2. Each CNB module has a partner in the same slot in the other redundant chassis. 3. Each pair of CNB modules (one in each chassis) is set to the same node address. 4. Each module has compatible firmware. 5. All CNB modules in each redundant chassis are valid keepers. See "Update a Keeper Signature" on page 6-6.
	CMPT	Some module other than this CNB module doesn't match between the primary and secondary chassis.	1. Each module has a partner in the same slot in the other redundant chassis. 2. Each pair of controllers (one in each chassis) has the same memory board (e.g., 1756-L55M14). 3. Each module has compatible firmware. 4. The RSLogix 5000 project is configured for the right type of controller and redundancy is enabled. See "Configure a Controller for Redundancy" on page 5-5. 5. The Module Configuration window for the 1757-SRM module does not list any reasons for the failure to synchronize. See "See If an Edit Session Is in Progress"on page 6-8.
	DUPL NODE	More than one device on your ControlNet network is using the same node number.	1. No other device on the ControlNet network is set to the address of the CNB modules PLUS ONE. For example, if the CNB modules are set to 3, no other device should be set to 4. 2. The 1757-SRCx cable is connected to both SRM modules.
	NET ERR	The ControlNet media is not completely connected.	All ControlNet taps, connectors, and terminators are connected.

Update a Keeper Signature

Purpose

To see if the keeper signature of a CNB module is stopping the secondary chassis from synchronizing

Secondary



When

Do this procedure when your secondary chassis won't synchronize and its CNB modules show !CPT.

Before you begin

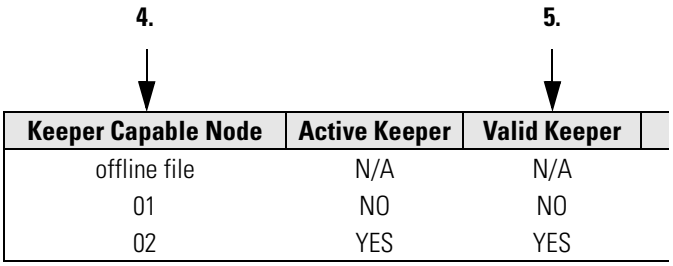
The secondary chassis won't synchronize if the keeper signature of a CNB module doesn't match its partner. This happens if you schedule the ControlNet network while the secondary chassis is off or if the CNB module was previously configured in a different network.

Actions

1. Start RSNetWorx for ControlNet software.
2. Has this network been scheduled before?

If:	Then:
No	A. From the *File* menu, select *New*. B. From the *Network* menu, select *Online*. C. Select your ControlNet network and choose *OK*.
Yes	A. From the *File* menu, select *Open*. B. Select the file for the network and choose *Open*. C. From the *Network* menu, select *Online*.

3. From the *Network* menu, choose *Keeper Status*.



4. Make sure the list contains all your keeper capable nodes. This includes the CNB modules in the secondary chassis.

5. Make sure that each node has a valid keeper signature.

If the Valid Keeper column shows:	Then:
YES	The node has a valid keeper signature.
NO	Select the node and choose *Update Keeper*.

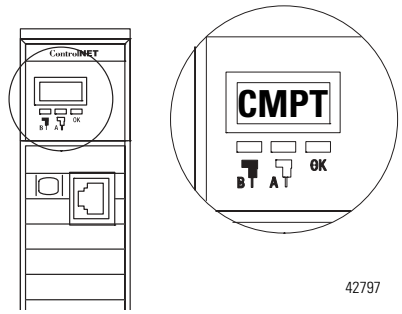
6. Choose *Close*.

See If an Edit Session Is in Progress

Purpose

To see if a computer is stopping the secondary chassis from synchronizing

Secondary

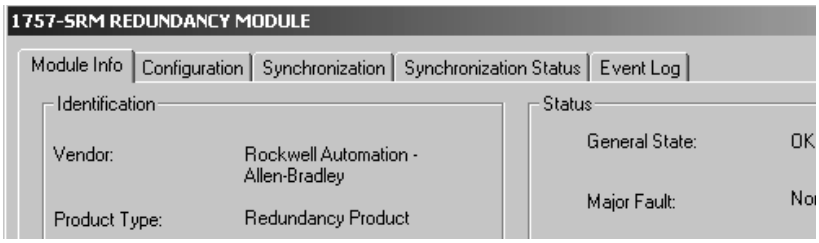


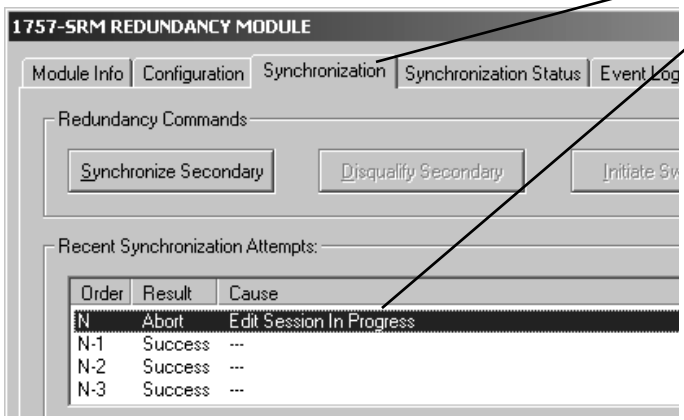
When

Do this procedure when your secondary chassis won't synchronize and the CNB modules in the secondary chassis show `CMPT`.

Actions

Actions	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*.



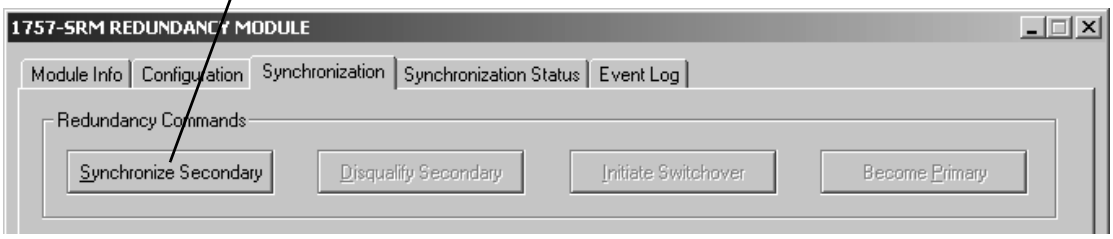
Actions	Details
2. Check the recent synchronization attempts.	 A. Click the *Synchronization* tab. B. Do you see *Edit Session In Progress* under *Recent Synchronization Attempts*? • YES — Go to step 3. • NO — An edit session didn't stop synchronization. Return to Troubleshoot a Failure to Synchronize on page 6-5.

3. Look for the reason.

If	Then
Another computer is editing the project in the controller.	Stop the edit session.
The project contains test edits.	Untest the edits.
The *Nonvolatile Memory Load/Store* dialog box of the controller is open.	Close the *Nonvolatile Memory Load/Store* dialog box.
You tried to synchronize the chassis while downloading a project at the same time.	Wait for the download to finish.

4. Manually synchronize the chassis.

Choose *Synchronize Secondary* and then *Yes* — continue with synchronization.



Interpret the SRM Event Log

Purpose

Use this procedure to look through a log of events to see why your system switched over or failed to synchronize.

When

Do this procedure when:

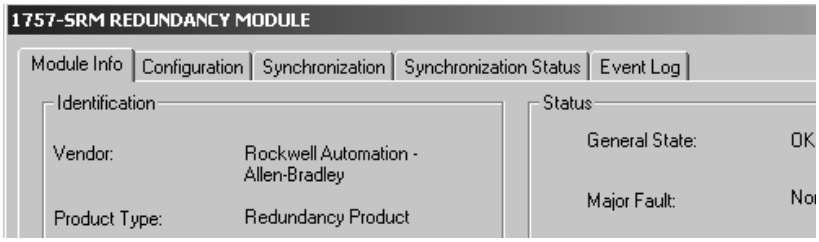
- A switchover happens but your system synchronizes again.
- You've already tried to use the hardware lights to find why your system won't synchronize.

Before You Begin

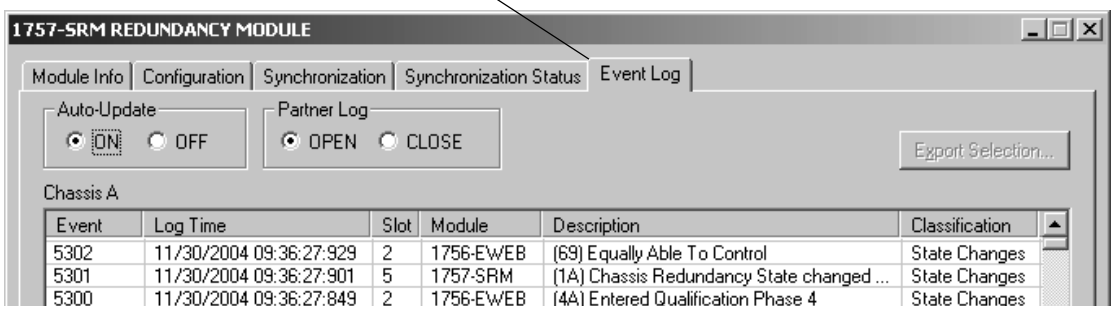
The clock of the SRM is accurate only if you:

- Initially set it after you installed your system
- Reset it after any power-loss to both chassis.

Actions

Actions	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*. 

Actions	Details
2. Go to the event log.	Click the *Event Log* tab.



3. Look through the events of the SECONDARY chassis for a large change in log times.

A. Start with the secondary chassis.

- The lower list is the secondary chassis.
- The cause of the switchover probably happened to secondary chassis while it was the primary chassis.

B. Look for a change of months, days, or hours between the log times of events.

- Sometimes the difference is only minutes.
- The SRM logs only significant events. It doesn't log events while your system is running normally.

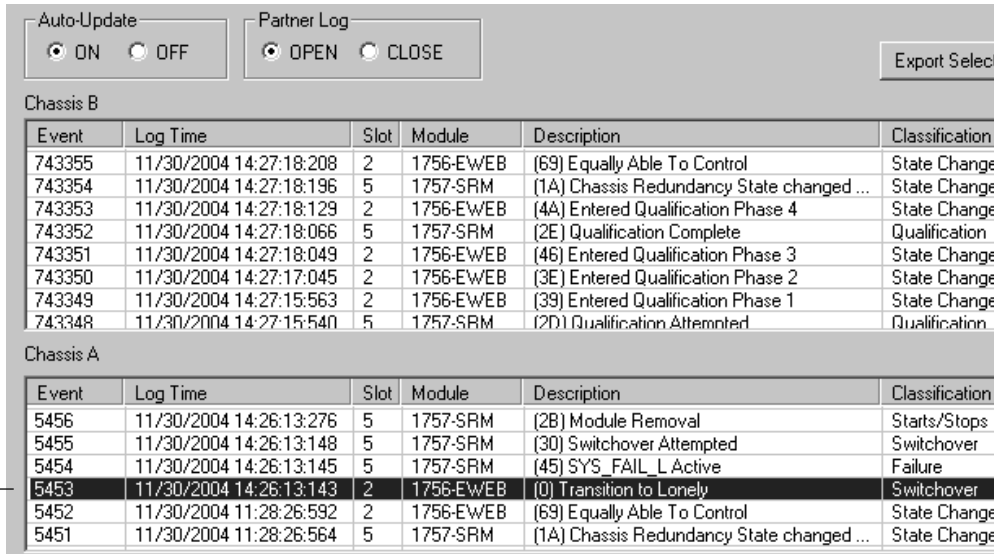
C. Use the slot and module columns to find the module that caused the event.

D. Go to Interpret SRM events on page 6-13 to interpret the description.

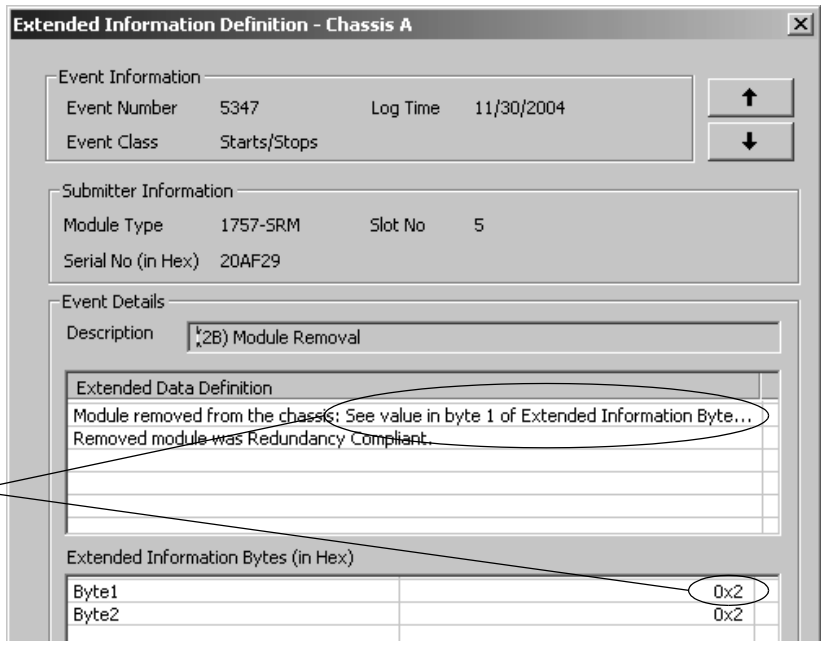
Example

Here's a large change in the log time.

The slot, module, and description columns show that the 1756-EWEB module in slot 2 went lonely. That usually means it lost its connection to the network.



Actions	Details
4. Double-click and event for more information.	A. Double-click an event to see if it gives more information. The Extended Information Definition dialog opens. B. Click *OK* when you're done to close the Extended Information Definition dialog. **Example**

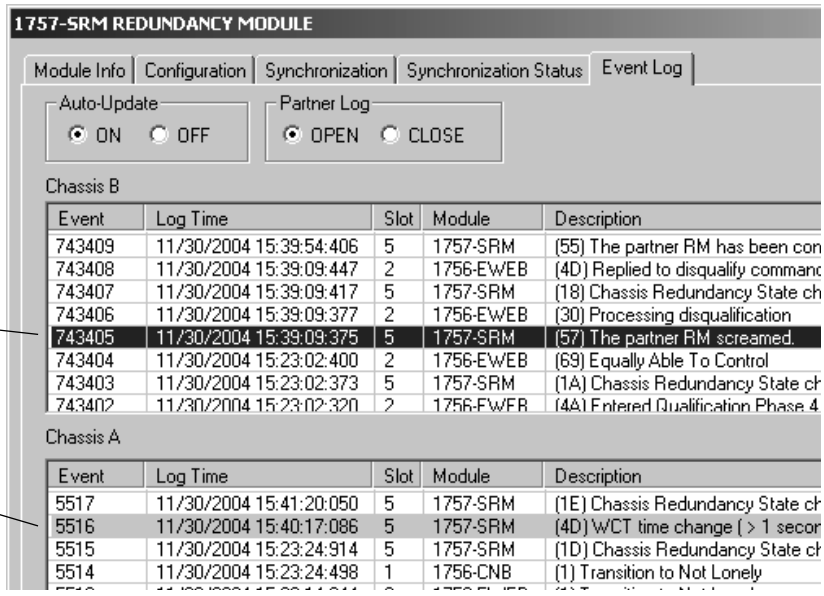


Someone removed the module for slot 2. Or the module failed.

Actions	Details
5. If the secondary log doesn't show the cause, look at the primary log.	Sometimes you have to use both logs to find out what happened. **Example**

A. The secondary log shows that something happened around 15:40. But it's not clear just what happened.

B. The primary log shows that around that time the partner SRM screamed. That means it lost power.



Interpret SRM events

Use this table to interpret the events that you see in the event log of the SRM.

Event description	Meaning
Autoqualification Trigger	Something happened that caused your system to try and synchronize again. Double-click the event to see what happened.
Blank Memories Rule	A check to choose a primary chassis if both chassis power up at the same time. Suppose that the controllers in one chassis don't have projects while the controllers in the other chassis do have projects. In that case, the other chassis becomes primary.
Chassis Modules Rule	A check to choose a primary chassis if both chassis power up at the same time. Suppose that one chassis has more modules than the other chassis. In that case, the chassis with the most modules gets the first chance to become primary. It becomes primary as long as the other chassis isn't more able to control the system.
Chassis Redundancy State changed to…	The chassis changed to a different redundancy state. • PwQS — Primary with qualified (synchronized) secondary partner • QSwP — Qualified (synchronized) secondary with primary partner • DSwP — Disqualified secondary with primary partner • DSwNP — Disqualified secondary with no partner • PwDS — Primary with disqualified secondary partner • PwNS — Primary with no secondary partner
Crossloading Error	A module isn't able to get some information to its partner.
Disqualified Secondaries Rule	A check to choose a primary chassis if both chassis power up at the same time. Suppose that the modules in one of the chassis powered down in a disqualified secondary state. In that case, the other chassis becomes primary.
Failed Modules Rule	A check to choose a primary chassis if both chassis power up at the same time. Suppose that a module in one of the chassis is faulted but its partner module in the other chassis isn't faulted. In that case, the other chassis becomes primary.
Firmware Error	The SRM has a problem.
Module Insertion	The SRM now sees the module on the backplane. This means the module has either just powered-up, just been put into the chassis, or just finished resetting. Double-click the event to see the slot number of the module.
Module Removal	The SRM no longer sees a module on the backplane. This means that the module either experienced a nonrecoverable fault, was removed from the chassis, or was reset. Double-click the event to see the slot number of the module.
Modules Chassis State Rule	A check to choose a primary chassis if both chassis power up at the same time. Suppose that the modules in one chassis are already in a primary state. In that case, that chassis becomes primary.
NRC Modules Rule	A check to choose a primary chassis if both chassis power up at the same time. NRC stands for non-redundancy compliant. Suppose that a module in one of the chassis doesn't support redundancy and all the modules in the other chassis do support redundancy. In that case, the other chassis becomes primary.

Event description	Meaning
Partner not on same CNet link	A primary CNB isn't able to communicate with the secondary CNB over the ControlNet network. This means there is either: • A network problem such as noise, a poor connection, or a problem with the termination. • The secondary CNB isn't connected to network.
Powerdown Time Rule	A check to choose a primary chassis if both chassis power up at the same time. If the two chassis powered down more than one second apart, the last chassis to power down gets the first chance at being primary.
Program Fault	A controller has a major fault.
SRM OS Error	The SRM has a problem.
SRM Serial Number Rule	A check to choose a primary chassis if both chassis power up at the same time. This is the final tie-breaker. The SRM with the lower serial number gets the first chance to become primary. It becomes primary as long as the other chassis isn't more able to control the system.
Standby Secondaries Rule	A check to choose a primary chassis if both chassis power up at the same time. Since standby isn't available yet, this check always ends in a tie.
SYS_FAIL_L Active	A module has a nonrecoverable fault or lost its connection to the network. When that happens, the SYS_FAIL signal becomes true. The backplane of the chassis has a SYS_FAIL signal. Each module in the chassis uses this signal to indicate a problem: • The signal is normally false (inactive), which means that all modules in the chassis are OK. • A module turns the SYS_FAIL signal true (active) when the module has a nonrecoverable fault or it losses its connection to the network. Look for later events to find out what happened: • If you see a Module Removal event shortly afterward, then a module has a nonrecoverable fault. Double-click the Module Removal event to see the slot number of the module. The SYS_FAIL signal may stay true until you cycle power or remove the faulted module. • If you see a SYS_FAIL_L Inactive event within a few hundred milliseconds, then a cable is probably disconnected or broken. A communication module pulses the SYS_FAIL signal when the module loses its connection to the network. Look for a Transition to Lonely event to see which module lost its connection.
The partner RM has been connected	The partner SRM powered up or become connected by the fiber-optic cable.
The partner RM screamed	The partner SRM lost power, has a non-recoverable fault, or was removed. An SRM has circuits that hold power long enough for it to send a message to its partner over the fiber-optic interconnect cable. The SRM sends the message even after you remove it from the chassis. This message is called a scream. The scream lets the partner SRM tell the difference between a broken fiber-optic interconnect cable and the power loss or removal of the primary SRM. • If the fiber optic cable breaks, then there isn't a switchover. • If the SRM loses power or is removed, then there is a switchover.

Event description	Meaning
Transition to Lonely	A communication module doesn't see any other devices on its network. This usually means that the network cable of the module is disconnected or broken. The event log shows Transition to Not Lonely when you reconnect the cable.
Unknown Event	The SRM configuration tool doesn't have a description for the event.
WCT time change (> 1 second)	The clock of the SRM changed. This happens when you: • Use the SRM configuration tool to set the clock. • Connect the SRM to another SRM that is already primary. The SRM sets its clock to the clock of the primary SRM.

Export the SRM Event Log

Purpose

Use this procedure to export specific events from the SRM event log to a CSV or TXT file.

When

Do this procedure when you want to:

- look at the event log in spreadsheet software such as Microsoft Excel®
- send the event log to someone else

Before you begin

The SRM configuration tool lets you export events from both the primary and the secondary chassis at the same time.

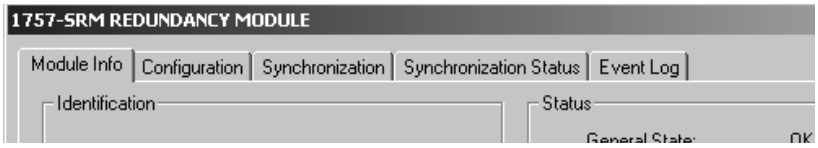
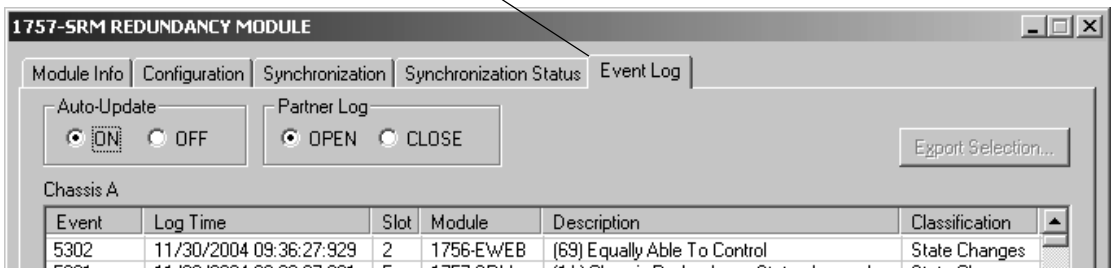
Chassis ID	Event	Log Time	Slot	Module	Description
Chassis B	743584	12/2/2004 16:02:27:055	2	1756-EWEB	(69) Equally Able To Control
Chassis B	743583	12/2/2004 16:02:27:050	5	1757-SRM	(1A) Chassis Redundancy State ch
Chassis B	743582	12/2/2004 16:02:26:967	2	1756-EWEB	(4A) Entered Qualification Phase 4
Chassis B	743581	12/2/2004 16:02:26:917	5	1757-SRM	(2E) Qualification Complete
Chassis A	5720	12/3/2004 14:18:43:894	5	1757-SRM	(C) Port2 Communication error
Chassis A	5719	12/2/2004 16:02:27:052	5	1757-SRM	(1E) Chassis Redundancy State ch

IMPORTANT

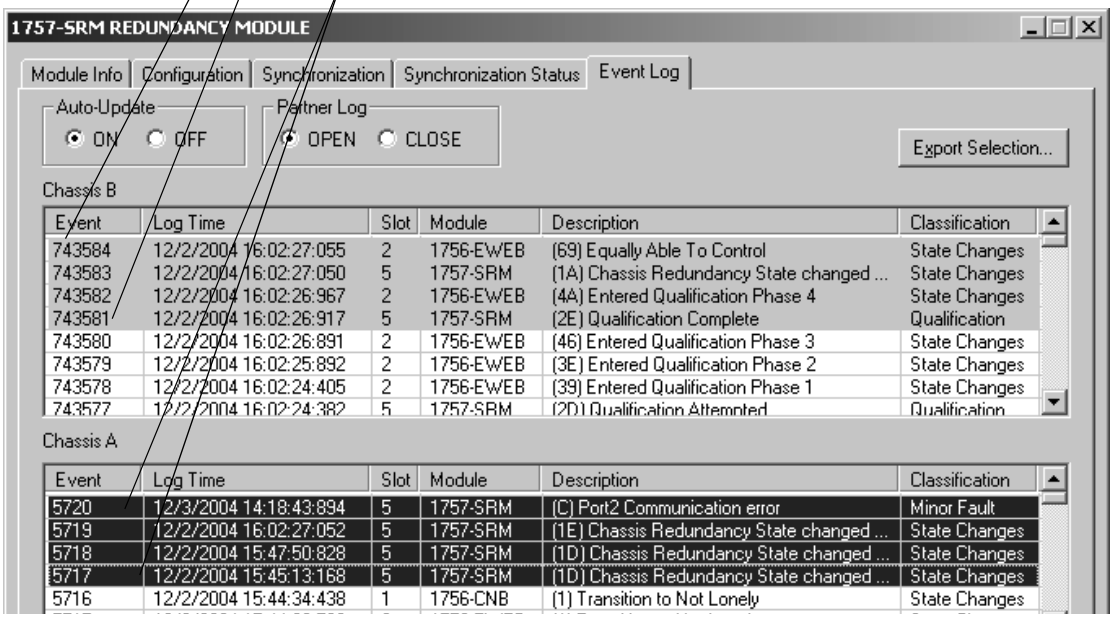
When you send event logs to Rockwell Automation:

- Send events from both the primary and secondary chassis.
- Include all events from the latest event to the last event when you knew that the chassis were in a good state.

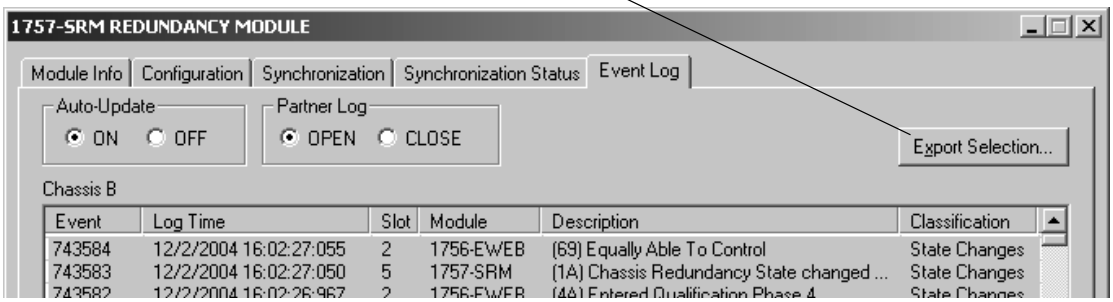
Actions

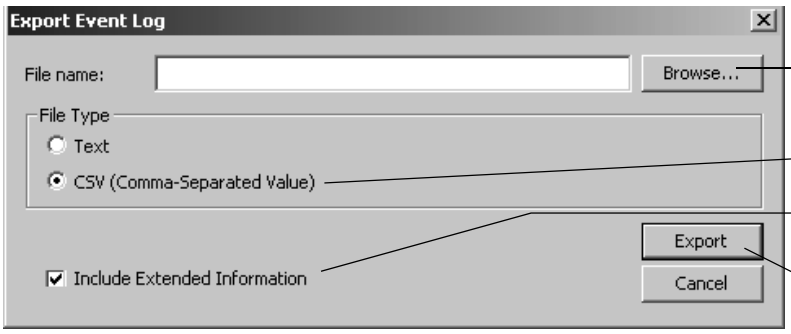
Actions	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*. 
2. Go to the event log.	Click the *Event Log* tab. 

Actions	Details
3. Select the events that you want to export.	A. Click the first event that you want to export from the primary chassis. B. Press and hold the [Shift] key and then click the last event that you want to export from the primary chassis. C. Repeat steps 3A and 3B for the secondary chassis.



4. Export your selection.	A. Choose *Export Selection*.





B. Click the Browse button and choose a location and name for the export file.

C. Choose *CSV (Comma-Separated Value)*.

D. Select the *Include Extended Information* check box.

E. Choose *Export*.

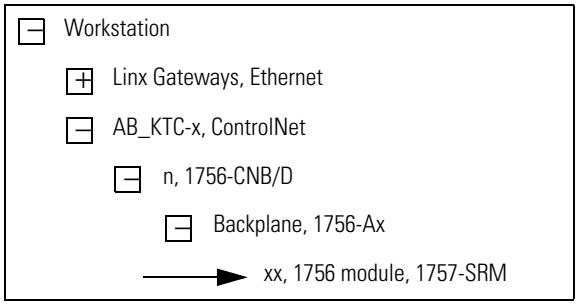
Manually Synchronize the Chassis

After a switchover, you may have to manually synchronize the chassis because either:

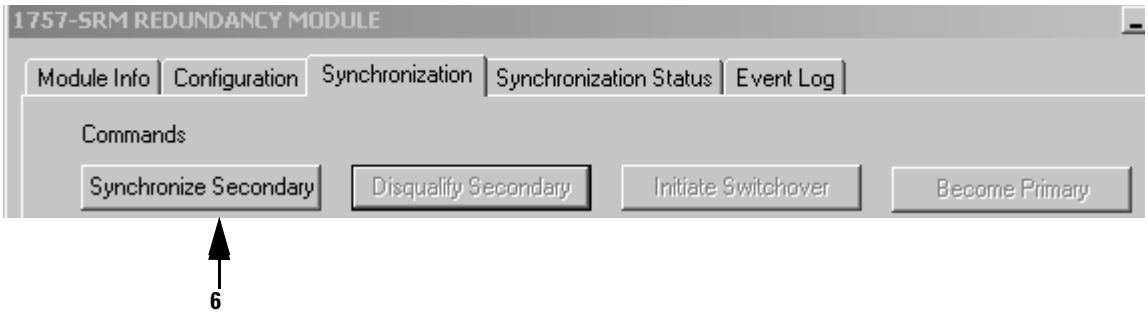
- The *Auto-Synchronization* option is NOT set to *Always*.
- The chassis failed to synchronize.

To manually synchronize the chassis:

1. Display RSLinx software.
2. From the *Communications* menu, choose *RSWho*.
3. Expand the network until you see the 1757-SRM module in the primary chassis.

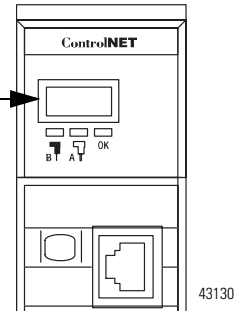


4. Right-click the 1757-SRM module and select *Module Configuration*.
5. Click the *Synchronization* tab.



6. Choose *Synchronize Secondary* and then choose *Yes* to confirm.
7. Choose *OK*.

8. In the primary chassis, what do the CNB modules display?

Front Panel:	If you see:	Which means:	Then:
Look here. 	PwQg	Primary with Synchronizing (Qualifying) Secondary	• Synchronization is in progress. • Continue waiting. It may take several minutes to synchronize the secondary chassis.
	PwQS	Primary with Synchronized (Qualified) Secondary	• The secondary chassis is synchronized. • Skip the remaining steps in this section.
	PwDS	Primary with Disqualified Secondary	• The secondary chassis is NOT synchronized. • Go to step 9.

9. Cycle power to the secondary chassis.

10. If the CNB module in the primary chassis fails to display *PwQS,* see "Troubleshoot a Failure to Synchronize" on page 6-5.

Optimize Communication

If it takes too long to synchronize the secondary chassis or update your HMI, there may not be enough controller time for unscheduled communication. In general, unscheduled communication is any type of communication that you DO NOT configure through the I/O configuration folder of the controller:

This type of communication:	Is:
update I/O data (not including block-transfers)	scheduled communication
produce or consume tags	
communicate with programming devices (e.g., RSLogix 5000 software)	unscheduled communication
communicate with HMI devices	
execute Message (MSG) instructions, including block-transfers	
respond to messages from other controllers	
synchronize the secondary controller of a redundant system	
re-establish and monitor I/O connections (such as Removal and Insertion Under Power conditions); this DOES NOT include normal I/O updates that occur during the execution of logic.	
bridge communications from the serial port of the controller to other ControlLogix devices via the ControlLogix backplane	

To improve the speed of unscheduled communication:

If your RSLogix 5000 project contains:	Then:	See page:
only a continuous task and no other tasks (This is the default task configuration.)	Choose a Greater System Overhead Time Slice	6-21
more than one task (i.e., at least 1 periodic task)	Make All Your Tasks Periodic	6-23

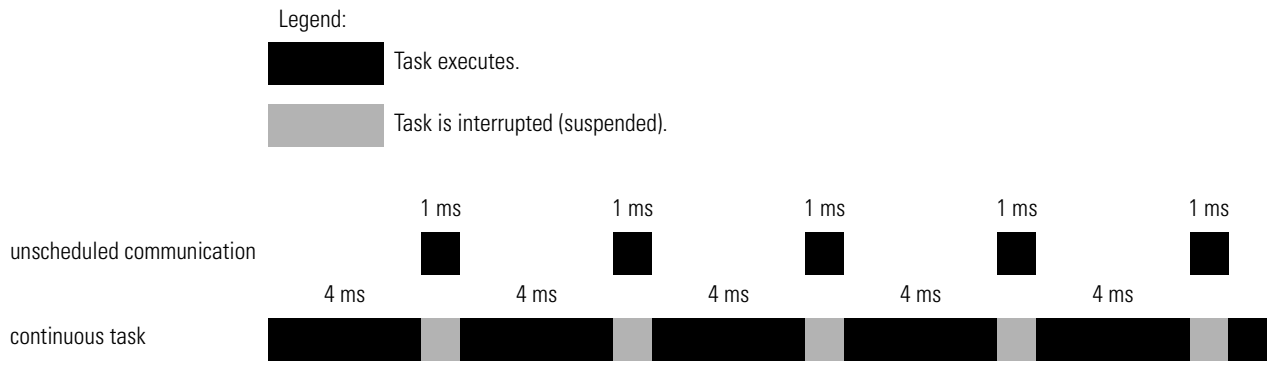
Choose a Greater System Overhead Time Slice

The system overhead time slice specifies the percentage of time (excluding the time for periodic tasks) that the controller devotes to unscheduled communication. The controller performs unscheduled communication for up to 1 ms at a time and then resumes the continuous task.

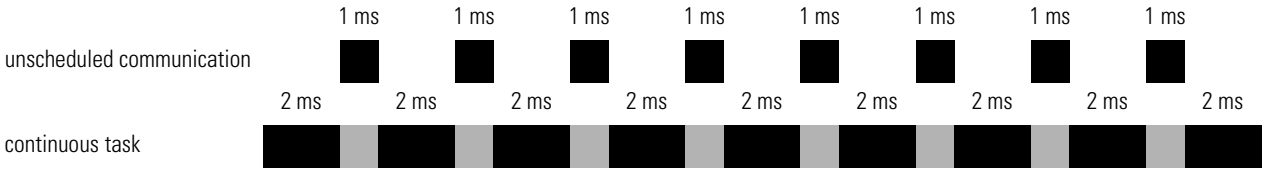
The following table shows the ratio between the continuous task and unscheduled communication at various system overhead time slices:

At this time slice:	The continuous tasks runs for:	And unscheduled communication occurs for up to:
10%	9 ms	1 ms
20%	4 ms	1 ms
33%	2 ms	1 ms
50%	1 ms	1 ms

At a system overhead time slice of 20 % (default), unscheduled communication occurs every 4 ms of continuous task time for 1 ms.

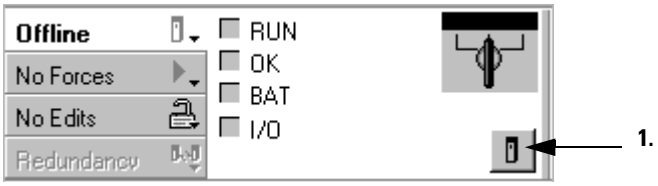


If you increase the system overhead time slice to 33 %, unscheduled communication occurs every 2 ms of continuous task time for 1 ms.

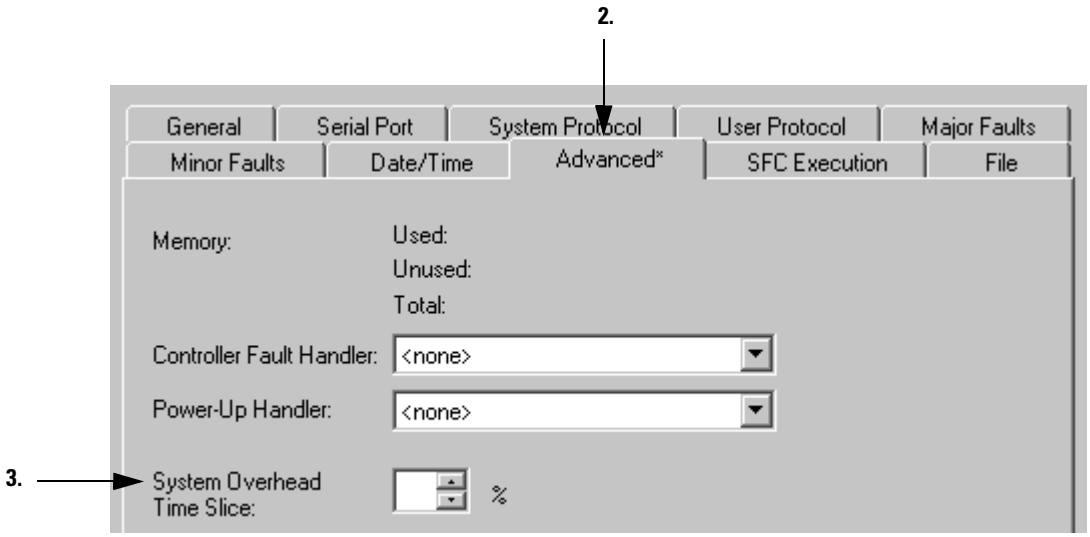


Enter a System Overhead Time Slice

To change the system overhead time slice:

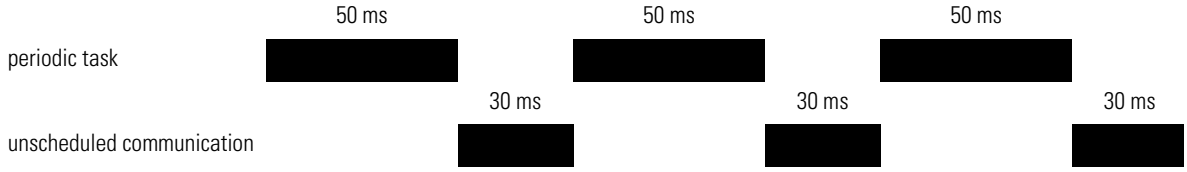


1. On the Online toolbar, click controller properties button.
2. Click the *Advanced* tab.



3. Type or select a value for the system overhead time slice.
4. Choose OK

Make All Your Tasks Periodic

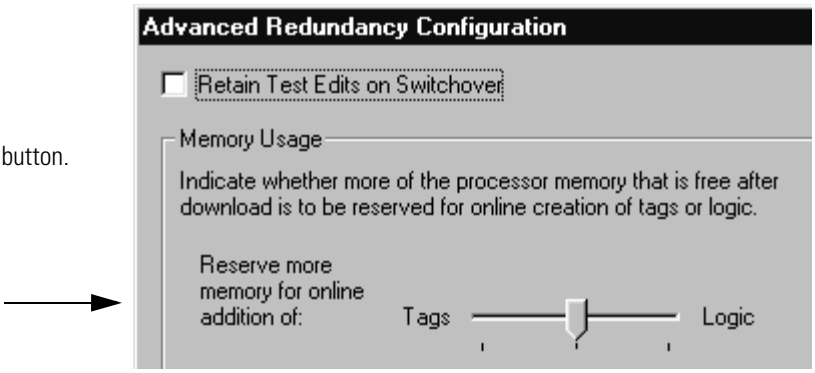
Actions	Details
1. If you have more than one task, make them all periodic tasks.	If the controller contains only a periodic task or tasks, the system overhead time slice value has no effect. Unscheduled communication happens whenever a periodic task is not running. Example Suppose your task takes 50 ms to execute and you configure its period to 80 ms. In that case, the controller has 30 ms out of every 80 ms for unscheduled communication. 
2. Follow these guidelines to set the periods of the tasks.	If you have multiple tasks, make sure that: 1. The execution time of a highest priority task is significantly less than its period. 2. The total execution time of all your tasks is significantly less than the period of the lowest priority tasks. This generally leaves enough time for unscheduled communication. For example, in this configuration of tasks: **Task:** / **Priority:** / **Execution time:** / **Rate** 1 / higher / 20 ms / 80 ms 2 / lower / 30 ms / 100 ms total execution time: 50 ms 1. The execution time of the highest priority task (Task 1) is significantly less than its period (20 ms is less than 80 ms). 2. The total execution time of all tasks is significantly less than the period of the lowest priority task (50 ms is less than 100 ms).
3. Tune the periods of the tasks.	Adjust the periods of the tasks as needed to get the best trade-off between executing your logic and servicing unscheduled communication.
4. Look for overlaps.	Look at the *Monitor* tab of the properties of the task to see if overlaps are happening. An overlap happens if the period of a task is less than its scan time. If you see overlaps, increase the period of the task.

Check the Allocation of Unused Memory

The controller reserves a specific amount of its unused memory for tags and the rest for logic. Depending on how you configure the memory usage, you might not have memory for the required operation.

To display this dialog box:

1. Choose *Edit* ⇒*Controller Properties*.
2. On the *Redundancy* tab, choose the *Advanced* button.



If:	Then:	Important:
• You are unable to perform online edits. • OPC communications error or fail.	Make sure the slider is NOT all the way to *Tags*.	You are able to change this setting only while: • offline • online in program mode
You are unable to create tags while online.	Make sure the slider is NOT all the way to *Logic*.	

Adjust CNB Usage

For each CNB module in a redundant chassis, keep CPU usage to less than 75 percent.

- Each redundant CNB module needs enough additional processing time for redundancy operations.
- At peak operations such as synchronization, redundancy uses an additional 8 percent (approximately) of the CPU of the CNB module.
- A total CPU usage that is higher than 75 percent may prevent a secondary chassis from synchronizing after a switchover.

To reduce the CPU usage of a module, you have these options:

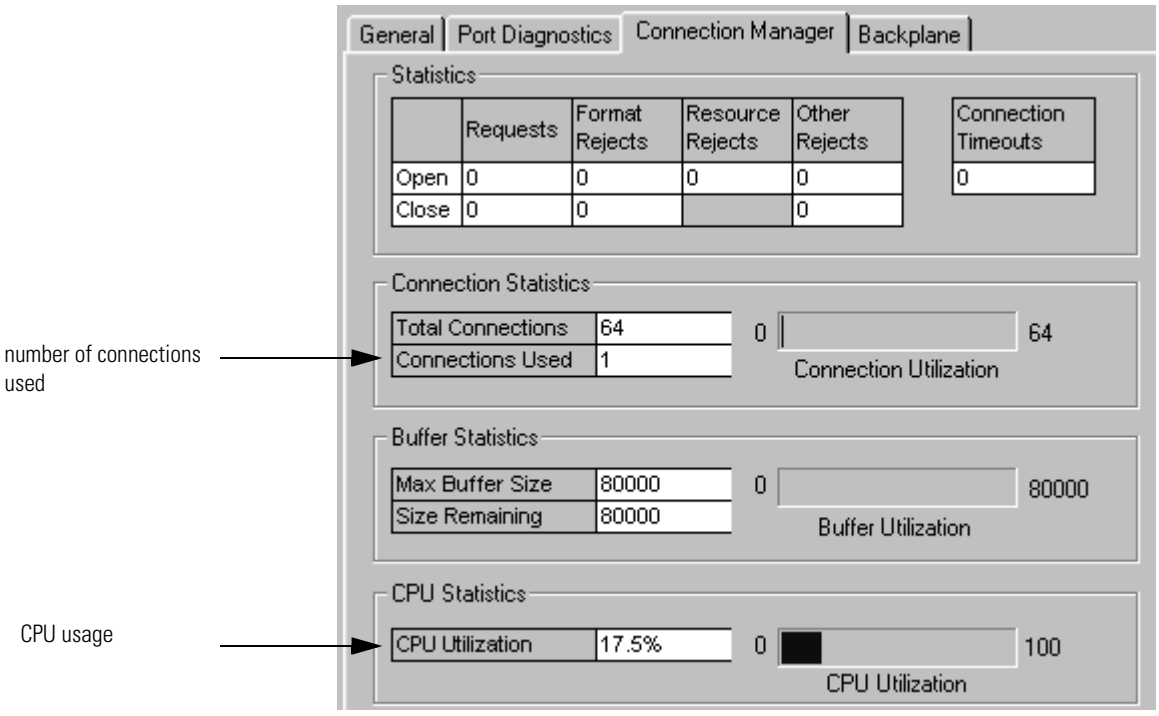
- Change the network update time (NUT) of the ControlNet network (Typically, increase the NUT to reduce the CPU usage of a CNB module.)
- Increase the requested packet interval (RPI) of your connections
- Reduce the number of connections to (through) the CNB
- Reduce the number of MSG instructions
- Add another CNB module to each redundant chassis

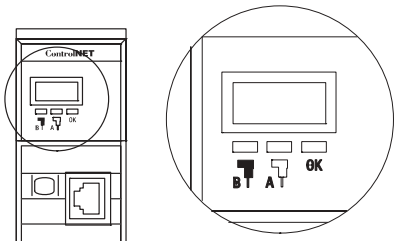
To get status information about a CNB module, you have these options:

- ❑ Use RSLinx Software
- ❑ Look at the Four Character Display
- ❑ Send a Message to the CNB Module

Use RSLinx Software

1. Start RSLinx software.
2. Expand a network until you see your CNB module.
3. Right-click the module and choose *Module Statistics*.
4. Click the *Connection Manager* tab.





Look at the Four Character Display

The four character display on the front of the 1756-CNB/D or -CNBR/D module, shows the following information:

For this information about a CNB module:	Display:	Where:
address of the module	A#*xx*	*xx* is the node address of the module.
percent of CPU usage	%C*xx*	*xx* is the percent of CPU usage. The range for the display is 00 - 99%.
number of open connections	nCxx	*xx* is the number of open connections that the module is using.
number of unconnected client buffers	Uc*xx*	*xx* is the number of unconnected client buffers that the module is using. You see this number only if the module is using 80% of its buffers or more. The module stops showing the number if the number drops below 50%.
number of unconnected server buffers	Us*xx*	*xx* is the number of unconnected server buffers that the module is using. You see this number only if the module is using 80% of its buffers or more. The module stops showing the number if the number drops below 50%.
state of the module's keeper function	Kp*xx*	*xx* is the state of the module's keeper function:

If *xx* is:	Then the module is:
Ai	active network keeper with either: • invalid keeper information or • keeper signature that does not match the keeper signature of the network
Av	active network keeper with: • valid keeper information • keeper signature that defines the keeper signature of the network
Ii	inactive network keeper with either: • invalid keeper information or • keeper signature that does not match the keeper signature of the network
Iv	inactive network keeper with valid keeper information that matches the keeper signature of the network
Oi	• powering up with invalid keeper information or • offline with invalid keeper information
Ov	• powering up with valid keeper information that may or may not match the keeper signature of the network or • offline with valid keeper information that may or may not match the keeper signature of the network

Continued on next page

For this information about a CNB module:	Display:	Where:
number of times that the bandwidth of the module was exceeded	Bx*nn*	*nn* is the number of times that the bandwidth of the module was exceeded (bandwidth exceeded error) since the module was turned off or reset. You see this number only if the number is more than zero.

Send a Message to the CNB Module

To use a Message (MSG) instruction to get the CPU usage of a CNB module, configure the MSG instruction as follows:

On this tab:	For this:	Type or select:
Configuration	Message Type	*CIP Generic*
	Service Type	*Custom*
	Service Code	4f
	Class	a1
	Instance	8
	Attribute	0
	Source Element	tag that uses a user-defined data type: **Members of the data type:** / **Name:** / **Data type:** / **Tag value:** offset / DINT / 0 size_returned / INT / 2
	Source Length	6
	Destination	INT tag in which to store the CPU usage of the CNB module (0 - 99%.)
Communication	Path	1, *slot_number* where: *slot_number* is the slot number of the CNB module.

Store or Load a Project Using Nonvolatile Memory

Nonvolatile memory lets you keep a copy of your project on the controller.

Term:	Description:
nonvolatile memory	Memory of the controller that retains its contents while the controller is without power or a battery.
store	To copy a project to the nonvolatile memory of the controller. This overwrites any project that is currently in the nonvolatile memory.
load	To copy a project from nonvolatile memory to the user memory (RAM) of the controller. This overwrites any project that is currently in the controller.

In a redundant system, you can store or load a project only while the secondary chassis is disqualified.

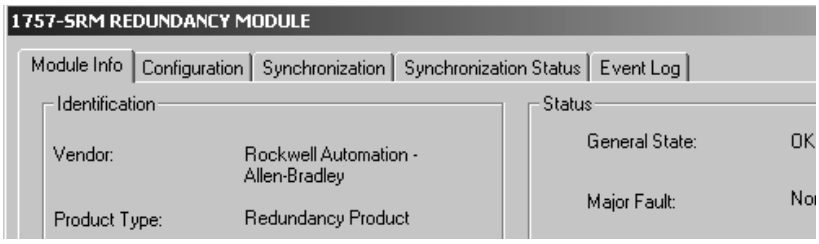
If you want to do this in a redundant system:	Do this:
Store a Project	**IMPORTANT**: If your computer is online with the controller over a ControlNet network, check the CPU usage of the CNB module. The CPU usage module must be less than about 75% for the store to work. 1. Put the primary controller in program mode (program or remote program). 2. Open the Module Configuration properties for one of the 1757-SRM modules. 3. Set the *Auto-Synchronization* option to *Conditional*. 4. Disqualify the secondary chassis. 5. Store the project that is in the primary controller. For step-by-step procedures on how to store a project, see *Logix5000 Controllers Common Procedures*, publication 1756-PM001. **Important**: DON'T go back online to the primary controller until you complete the rest of the steps in this procedure. 6. Go online to the secondary controller and store the project. 7. Return to the Module Configuration properties for one of the 1757-SRM modules. 8. Synchronize the controllers. 9. Set the *Auto-Synchronization* option to the desired option.
Load a Project—User Initiated	1. Disqualify the secondary chassis. 2. Go online to the primary controller. 3. In the primary controller, load the project. For step-by-step procedures on how to store a project, see *Logix5000 Controllers Common Procedures*, publication 1756-PM001. 4. Synchronize the controllers.

If you want to do this in a redundant system:	Do this:
Load a Project—On Power Up	This Load Image option works the same as in a non-redundant system. • The controller loads the project on power up. • The controller loads the project before it activates the redundancy feature.
Load a Project—On Corrupt Memory	This Load Image option works the same as in a non-redundant system. • The controller loads the project when the memory is empty or corrupt. • The controller loads the project before it activates the redundancy feature.

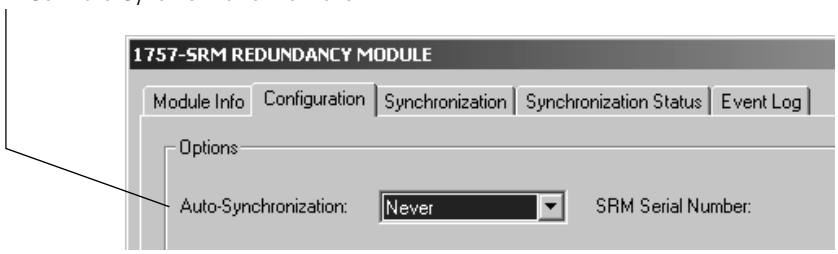
Update a Module

Use the following steps to upgrade the revision of your redundant modules. This procedure minimizes the time your process is down for the upgrade.

IMPORTANT DON'T connect your computer to the network access port on a CNB module in the primary chassis. You'll lose access to the network when you turn off power to the chassis.

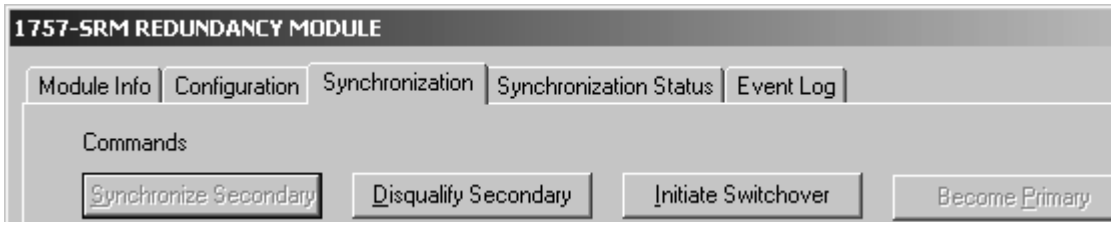
Step	Details
1. Upload and save the project.	A. Do you have an up-to-date copy of the project for the controller stored offline? • YES — Go to step 2. • NO — Continue with step B. B. Upload the project in the primary controller. C. Save the project.
2. Open the SRM configuration tool for the secondary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*. 

Step	Details
3. Disqualify the secondary chassis,	A. Click the *Configuration* tab. B. Set Auto-Synchronization to Never.



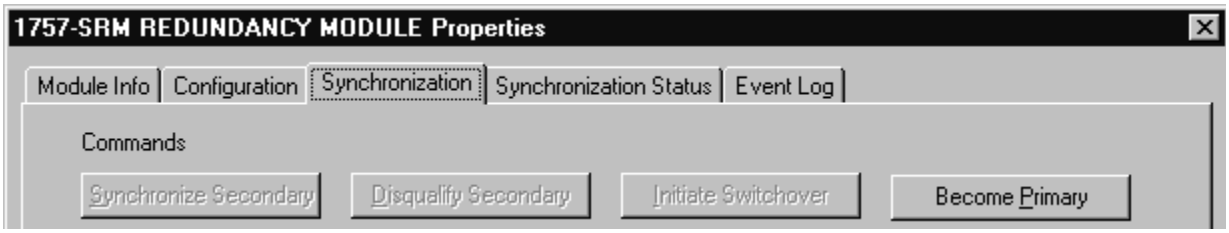
C. Choose *Apply* and then *Yes* to confirm.

D. Click the *Synchronization* tab.



E. Choose *Disqualify Secondary* and then *Yes* to confirm.

4. Upgrade the required firmware of the secondary chassis.	See the *ControlLogix Controller and Memory Board Installation Instructions*, publication 1756-IN101.
5. Make the secondary controller the new primary controller.	A. Start RSLogix 5000 software. B. Download the project to the secondary controller. C. When it is safe to stop the control of your system, change the primary controller to Program Mode. D. Turn off power to the primary chassis. E. Go to the 1757-SRM properties of the secondary chassis.



F. Choose *Become Primary*.

Step	Details
6. Clear the fault of the new primary controller.	A. In RSLogix 5000 software, go online to the new primary controller. B. The controller is faulted. When a disqualified secondary controller becomes a primary controller, the controller experiences a major fault. C. From the *Communications* menu, choose *Clear Faults*. D. To start control of the process, from the *Communications* menu, choose *Run Mode*.
7. Upgrade the other redundant chassis.	A. Turn on power to the other redundant chassis. B. Upgrade the required firmware of the chassis.
8. Change the Auto-Synchronization Option to *ALWAYS*.	A. Open the SRM configuration tool for the primary chassis. B. On the *Configuration* tab, change the *Auto-Synchronization* Option to *ALWAYS*. C. Choose *OK*.

Notes:

Set Up EtherNet/IP Communication Across Subnets

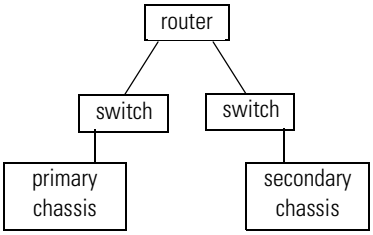
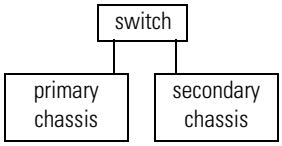
Purpose of This Chapter

To keep your HMIs and messages pointing to the primary chassis when you aren't using IP swapping

When to Use This Chapter

Use this chapter when:

- you want to use alias topics instead of IP swapping
- your primary and secondary chassis are on different EtherNet/IP subnets

If BOTH redundant chassis are on	Then
different subnets 	You MUST point your HMIs and messages to the new primary chassis after a switchover. Use this appendix to show you how.
same subnet 	Stop. Use IP swapping instead. This lets you use the same IP address regardless of which chassis is primary. See Chapter 2.

When your primary and secondary chassis are on different EtherNet/IP subnets, they keep their IP addresses during a switchover. This means that your HMIs and other controllers must be able to switch between the IP address of each redundant chassis.

How to Use This Chapter

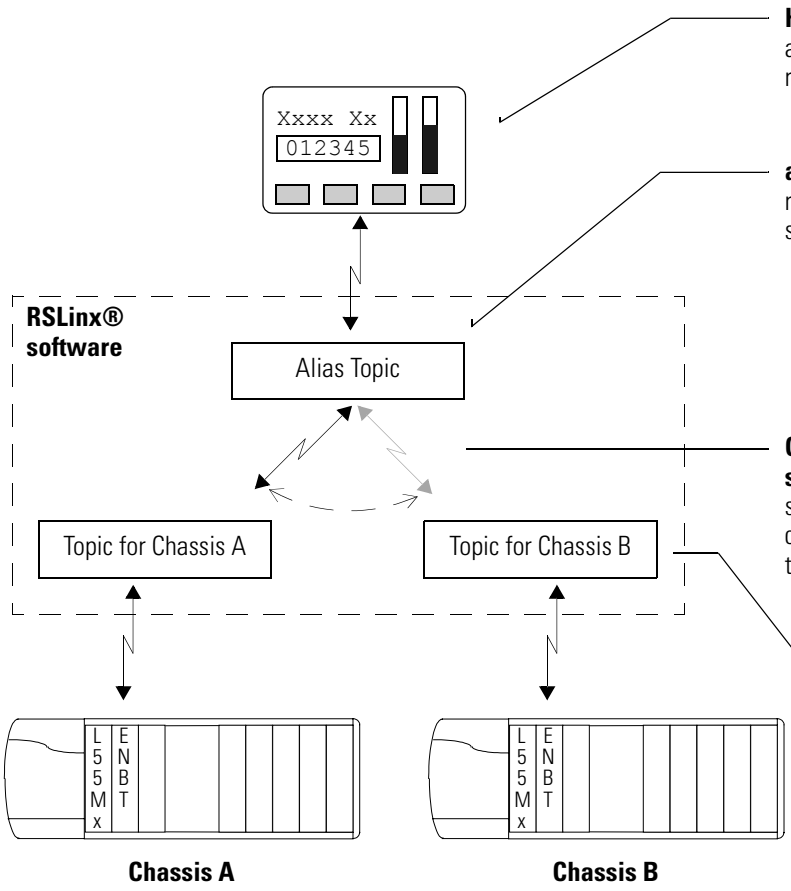
This chapter provides the following information:

Keep an HMI Communicating with the Primary Chassis

If you're NOT using IP swapping, your HMIs must point their communication to the new primary chassis after a switchover. The easiest way to do this is with the ControlLogix Redundancy Alias Topic Switcher software. Look for this software on the CD along with your firmware.

IMPORTANT To use the ControlLogix Redundancy Alias Topic Switcher software, your computer needs an activation file for RSLinx software. The activation file lets you perform DDE/OPC communication.

The ControlLogix Redundancy Alias Topic Switcher software works with RSLinx alias topics. Together they keep your HMI communicating with the primary controller after a switchover.



HMI tags – In your HMI project, each tag references an alias topic in RSLinx software. This lets RSLinx software re-direct communications to the appropriate chassis.

alias topic – In RSLinx software, an alias topic represents a flexible communication path to one of several controllers (topics).

- In a ControlLogix redundancy system, the alias topic points to the topic for the primary controller.
- When a switchover occurs, the alias topic points to the topic for the new primary controller.

ControlLogix Redundancy Alias Topic Switcher software – Automatically reads a value in RSLinx software to determine which controller is the primary controller. It then commands the alias topic to switch to the topic for that controller.

topic – In RSLinx software, a topic represents a specific path to a controller. Since each ENBT and EWEB module uses a unique IP address, you create a topic for the controller in each redundant chassis.

To keep your HMI communicating with the new primary chassis after a switchover:

Step:		See page:
❑	Install the ControlLogix Redundancy Alias Topic Switcher software	A-3
❑	Configure a driver to communicate with the primary and secondary EtherNet/IP modules	A-4
❑	Create a DDE/OPC topic for each controller	A-5
❑	Create an alias topic	A-6
❑	Set up the Alias Topic Switcher	A-7
❑	Address the alias topic in the HMI project	A-8

Install the ControlLogix Redundancy Alias Topic Switcher software

The ControlLogix Redundancy Alias Topic Switcher software maintains communication between your HMI project and the primary controller after a switchover.

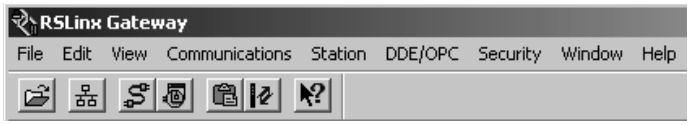
To install the Alias Topic Switcher software, use the *ControlLogix Redundancy Alias Topic Switcher.Exe* file. The file is located on the same CD as the firmware for your redundancy system.

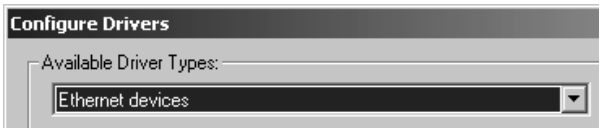
The Alias Topic Switcher software runs as a service. It starts automatically when you start your computer and shows up in the tool tray of your desktop.

ControlLogix Redundancy Alias Topic Switcher

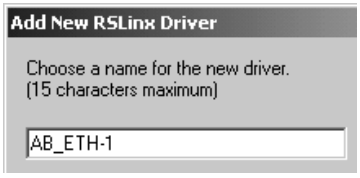
Configure a driver to communicate with the primary and secondary EtherNet/IP modules

1. Start RSLinx software.
2. Click  .



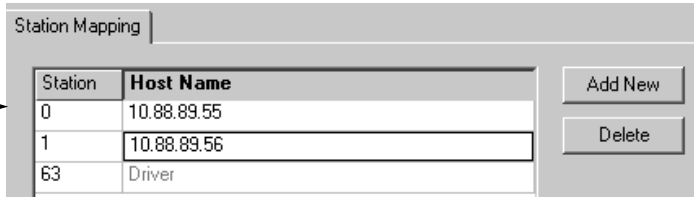


3. Select *Ethernet devices* and choose 



4. Accept the default name.

5. Type the IP address of each ENBT or EWEB module.

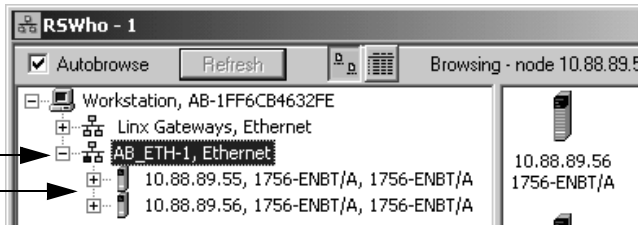


   To add another IP address, choose 

6. Choose 

and then 

7. Click  .

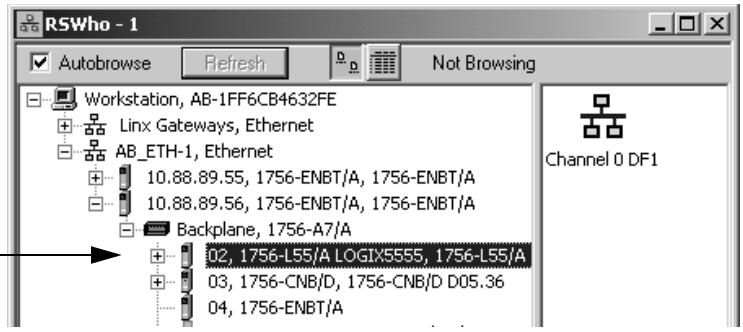


driver that you just added

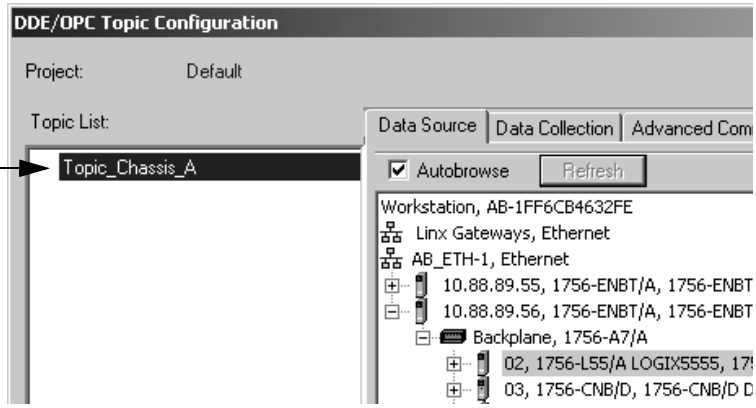
modules in the redundant chassis

Create a DDE/OPC topic for each controller

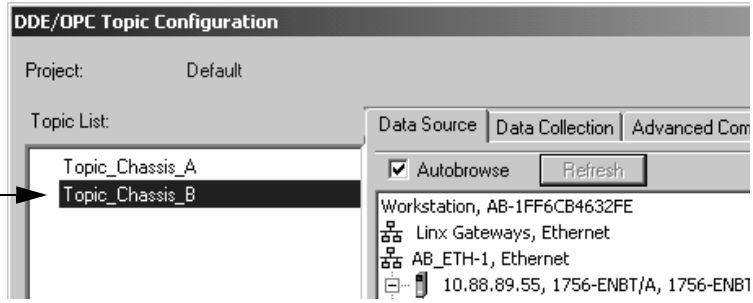
1. Browse to the controller in Chassis A.
2. Right-click the controller and choose *Configure New DDE/OPC Topic*.



3. Rename the topic to indicate that this is Chassis A.
4. Choose Done and then Yes (Yes—update topic.)

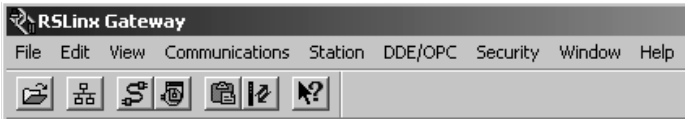


5. Create a topic for the controller in Chassis B.



Create an alias topic

1. In RSLinx software, choose *DDE/OPC* ⇒ *Alias Topic Configuration*.



2. Type a name for the alias topic that will communicate with this pair of redundant controllers

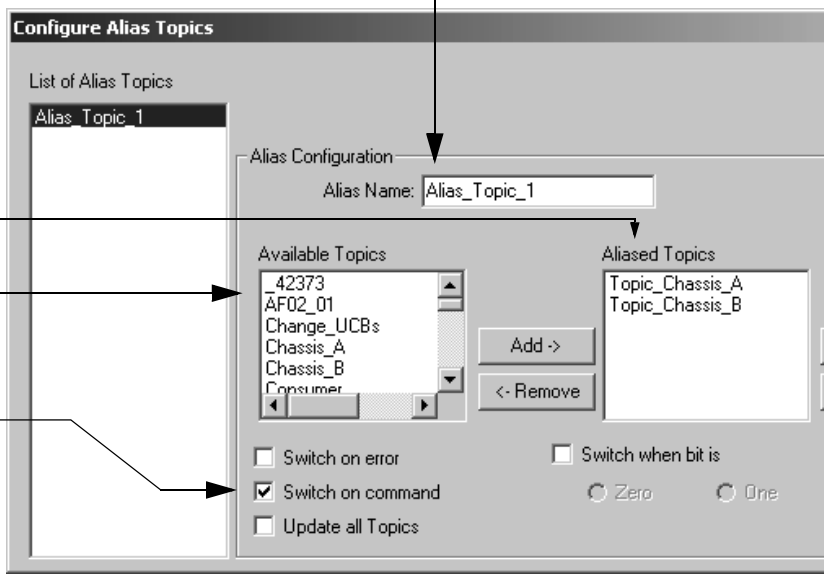
3. Add the topic for each redundant controller to the *Aliased Topics* list.

   To add a topic, select the topic and choose Add ->

4. Select (check) the *Switch on command* check box. Clear (uncheck) the remaining check boxes.

   This lets the ControlLogix Redundancy Alias Topic Switcher software control which topic the alias topic uses for communication.

5. Choose Save and then Close



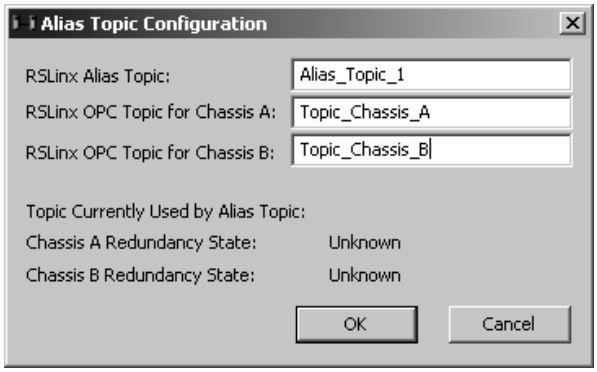
Set up the Alias Topic Switcher

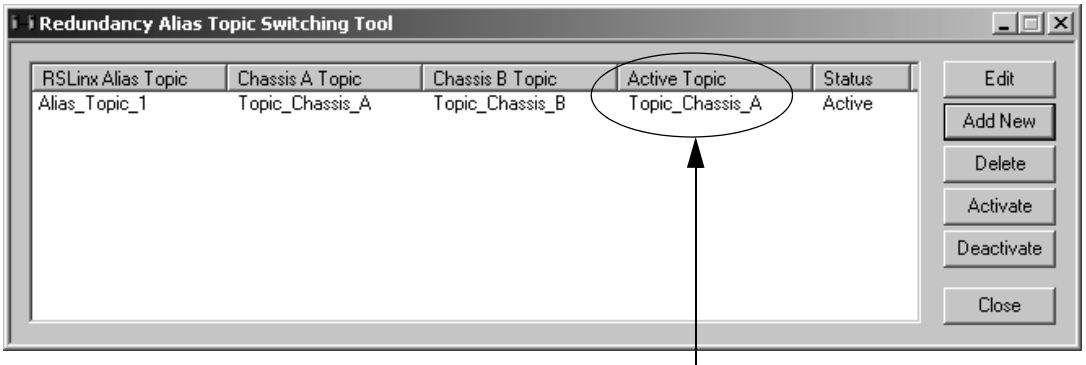
IMPORTANT If you start the Alias Topic Switcher software without access to an RSLinx activation file (i.e., without a version of RSLinx which supports OPC), the following error occurs:

0x80040112

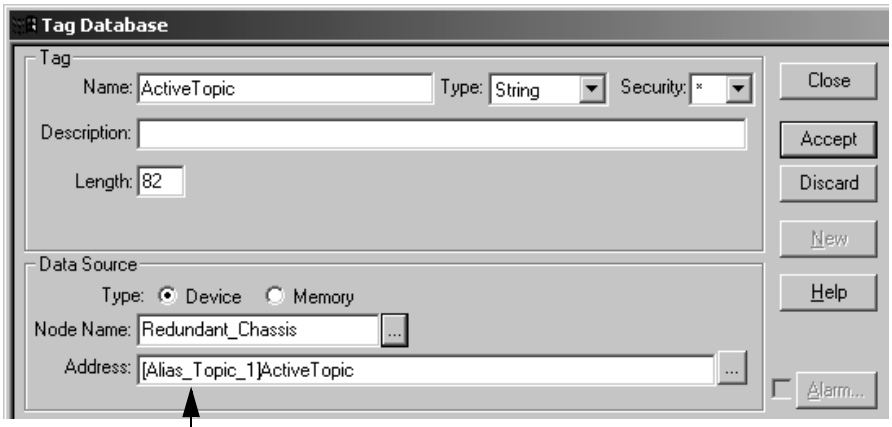
(The text for the message depends on your operating system.)

1. In the system tray, right-click the Redundancy Switch icon and choose *Open Alias Topic Switching Tool*.
2. In the *Redundancy Alias Topic Switching Tool* window, choose Add New
3. Type the topic names:
   a. alias topic
   b. topic for the controller in Chassis A
   c. topic for the controller in Chassis B
4. Choose OK





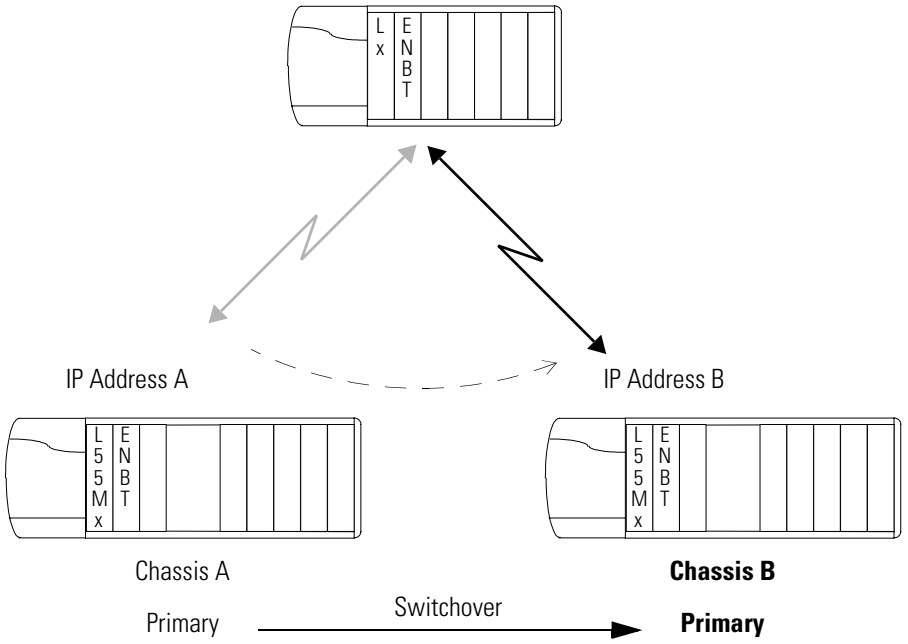
Address the alias topic in the HMI project



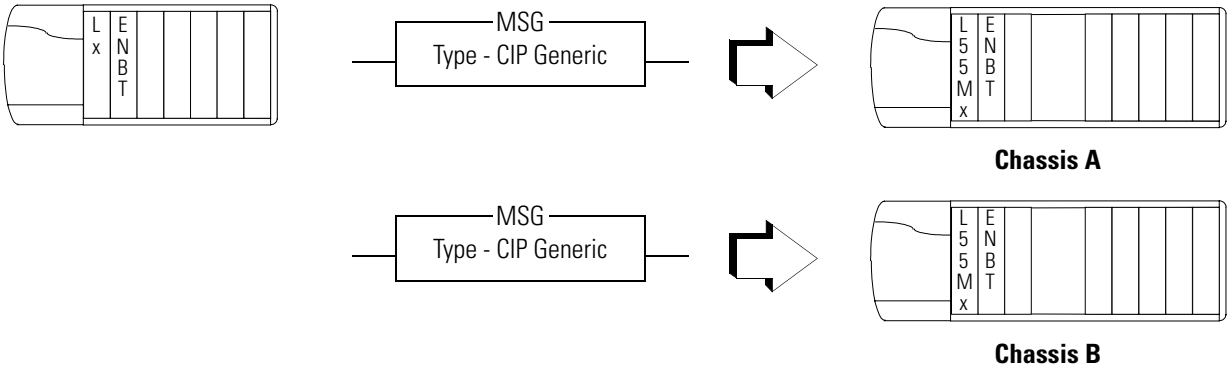
When you create tags for your HMI project, use the alias topic in the address of the tag.

Keep a Message Going to the Primary Chassis

If you're NOT using IP swapping, any controller that sends a message to a redundant chassis has to point to the new primary chassis after a switchover.



In this procedure, you use CIP Generic messages to see which chassis is primary. Then you send a Message (MSG) instruction to the primary controller.

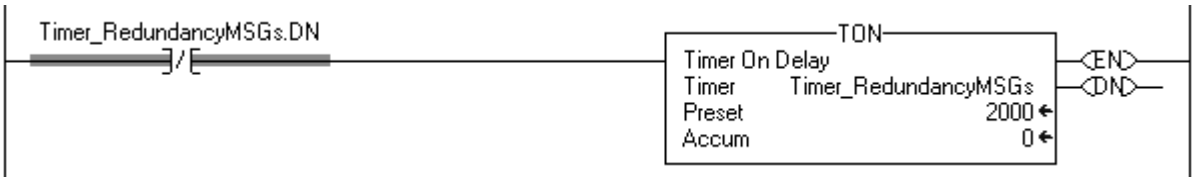


To keep a Message (MSG) instruction going to the new primary chassis after a switchover:

Step:	See page:
❑ Create a Periodic Trigger for the Messages	A-10
❑ Get the Redundancy State of Chassis A	A-11
❑ Get the Redundancy State of Chassis B	A-12
❑ Determine Which Chassis is Primary	A-13
❑ Send the Message to the Appropriate Controller	A-14

Create a Periodic Trigger for the Messages

Free-running timer that triggers the execution of MSG instructions. The timer runs for 2 seconds (2000 ms) and then resets and starts timing again. Every 2 seconds, *Timer_RedundancyMSGs.DN* = 1 for a single scan. The MSG instructions use this bit as one of their conditions for execution.

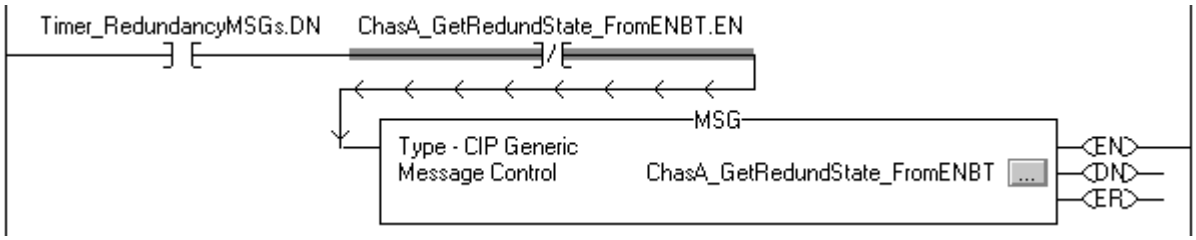


Tag Name	Description	Alias For	Data Type
Timer_RedundancyMSGs	Periodic trigger for the execution of MSG instructions. Triggers MSGs every 2s.		TIMER

Get the Redundancy State of Chassis A

If *Timer_RedundancyMSGs.DN* = 1 (2 seconds are up so execute the MSG instruction again)
And *ChasA_GetRedundState_FromENBT.EN* = 0 (The MSG instruction is not currently enabled.)
Then

Execute a MSG instruction that gets the redundancy state of Chassis A from the ENBT module in Chassis A. Store the value in *ChasA_RedundancyState* (data type = DINT).



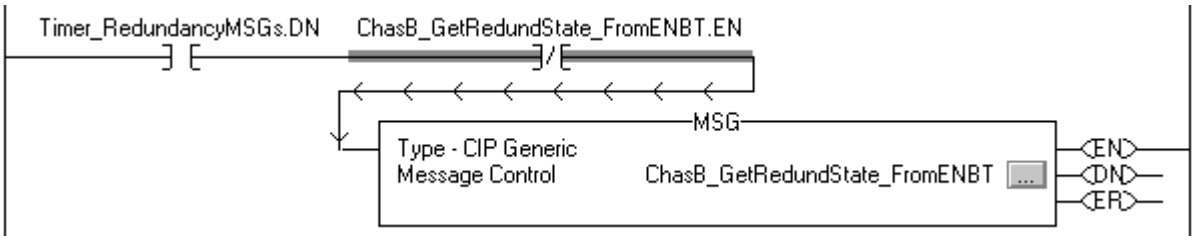
Tag Name	Description	Alias For	Data Type
Timer_RedundancyMSGs	Periodic trigger for the execution of MSG instructions. Triggers MSGs every 2s.		TIMER
ChasA_GetRedundState_FromENBT	Message instruction that gets the redundancy state of Chassis A		MESSAGE
ChasA_RedundancyState	Redundancy state of the Chassis A: 2 = PwQS 3 = PwDS 4 = PwNS		DINT

MSG parameter:	Value:
Message Type	CIP Generic
Service Type	Get Attribute Single
Service Code	e
Class	c0
Instance	1
Attribute	4
Source Element	
Source Length	
Destination	*ChasA_RedundancyState*
Path (Communication tab)	Specify the 1756-ENBT module in Chassis A. Use either of the following methods: • Add the module to the I/O configuration of the controller. Then use the *Browse* button on the *Communication* tab to identify the module. • Type the path using port numbers and addresses.

Get the Redundancy State of Chassis B

If *Timer_RedundancyMSGs.DN* = 1 (2 seconds are up so execute the MSG instruction again)
And *ChasB_GetRedundState_FromENBT.EN* = 0 (The MSG instruction is not currently enabled.)
Then

Execute a MSG instruction that gets the redundancy state of Chassis B from the ENBT module in Chassis B. Store the value in *ChasB_RedundancyState* (data type = DINT).



Tag Name	Description	Alias For	Data Type
Timer_RedundancyMSGs	Periodic trigger for the execution of MSG instructions. Triggers MSGs every 2s.		TIMER
ChasB_GetRedundState_FromENBT	Message instruction that gets the redundancy state of Chassis B		MESSAGE
ChasB_RedundancyState	Redundancy state of the Chassis B: 2 = PwQS 3 = PwDS 4 = PwNS		DINT

MSG parameter:	Value:
Message Type	CIP Generic
Service Type	Get Attribute Single
Service Code	e
Class	c0
Instance	1
Attribute	4
Source Element	
Source Length	
Destination	*ChasB_RedundancyState*
Path (Communication tab)	Specify the 1756-ENBT module in Chassis B. Use either of the following methods: • Add the module to the I/O configuration of the controller. Then use the *Browse* button on the *Communication* tab to identify the module. • Type the path using port numbers and addresses.

Determine Which Chassis is Primary

If *ChasA_RedundancyState* = 2, 3, or 4 then
ChasA_IsPrimary = 1. (Chassis A is the primary chassis.)

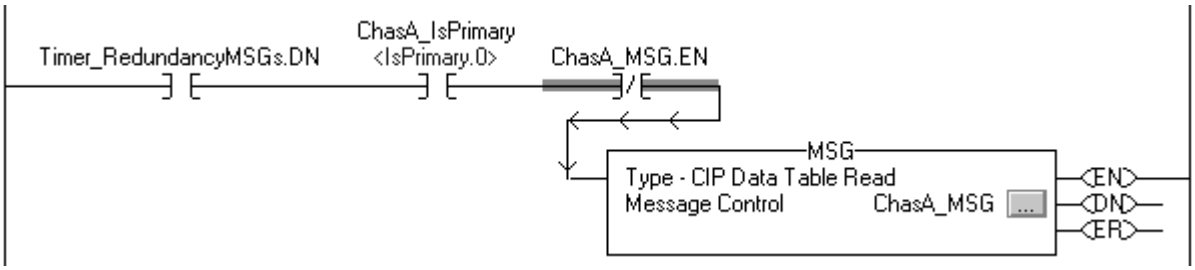
If *ChasB_RedundancyState* = 2, 3, or 4 then
ChasB_IsPrimary = 1. (Chassis B is the primary chassis.)

Tag Name	Description	Alias For	Data Type
ChasA_RedundancyState	Redundancy state of the Chassis A: 2 = PwQS 3 = PwDS 4 = PwNS		DINT
ChasB_RedundancyState	Redundancy state of the Chassis B 2 = PwQS 3 = PwDS 4 = PwNS		DINT
ChasA_IsPrimary	If set (1), then Chassis A is the primary chassis.	IsPrimary.0	BOOL
ChasB_IsPrimary	If set (1), then Chassis B is the primary chassis.	IsPrimary.1	BOOL
IsPrimary	Each bit represents the primary status for an individual chassis within a redundant chassis pair. 1 = primary. 0 = not primary. A single DINT tag for all the chassis uses less memory than a unique tag for each chassis.		DINT

Send the Message to the Appropriate Controller

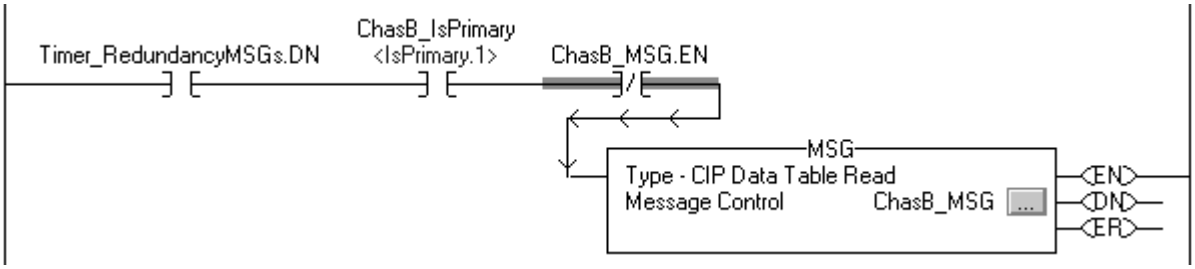
If *Timer_RedundancyMSGs.DN* = 1 (2 seconds are up.)
And *ChasA_IsPrimary* = 1. (Chassis A is the primary chassis.)
And *ChasA_MSG.EN = 0* (The message is not currently enabled.)
Then

Execute the MSG instruction for the controller in Chassis A.



If *Timer_RedundancyMSGs.DN* = 1 (2 seconds are up.)
And *ChasB_IsPrimary* = 1. (Chassis B is the primary chassis.)
And *ChasB_MSG.EN = 0* (The message is not currently enabled.)
Then

Execute the MSG instruction for the controller in Chassis B.



Tag Name	Description	Alias For	Data Type
ChasA_IsPrimary	If set (1), then Chassis A is the primary chassis.	IsPrimary.0	BOOL
ChasA_MSG	Message instruction that transfers data between this controller and the controller in redundant Chassis A		MESSAGE
ChasB_IsPrimary	If set (1), then Chassis B is the primary chassis.	IsPrimary.1	BOOL
ChasB_MSG	Message instruction that transfers data between this controller and the controller in redundant Chassis B		MESSAGE

Convert an Existing System to Redundancy

Introduction

If you are adding redundancy to an existing system, follow these guidelines:

- If you change the node number of a CNB module, you may affect messages, tags, or listen-only connections in other devices. Choose node numbers that have the least impact on existing communications.
- If your existing system contains local I/O modules, you still need two additional chassis.
  - A redundant system can use only I/O that is in a remote chassis (i.e., not in the same chassis as the controller).
  - We recommend that you move the existing 1756-L55Mxx controller from the original chassis and place it in a redundant chassis.
- Change any event tasks to periodic tasks. You can't use event tasks in a ControlLogix redundancy system.

Convert Local Modules to Remote Modules

If you are converting an existing system to a redundant system:

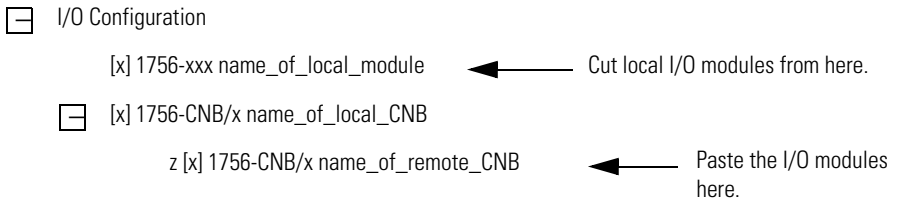
And the system:	Then:
contained only I/O modules that were not in the same chassis as the controller	You do not have to change the I/O configuration of the controller.
contained local I/O modules	Use the procedures in this section to convert the configuration of local modules to remote modules.

To convert a local module to a remote module:

- ❑ Re-Configure the Local I/O Modules
- ❑ Replace Local I/O Tags
- ❑ Replace any Aliases to Local I/O Tags

Re-Configure the Local I/O Modules

1. If you have not already done so, add the CNB module of the remote chassis to the I/O configuration of the controller. See the *ControlLogix System User Manual*, publication 1756-UM001.

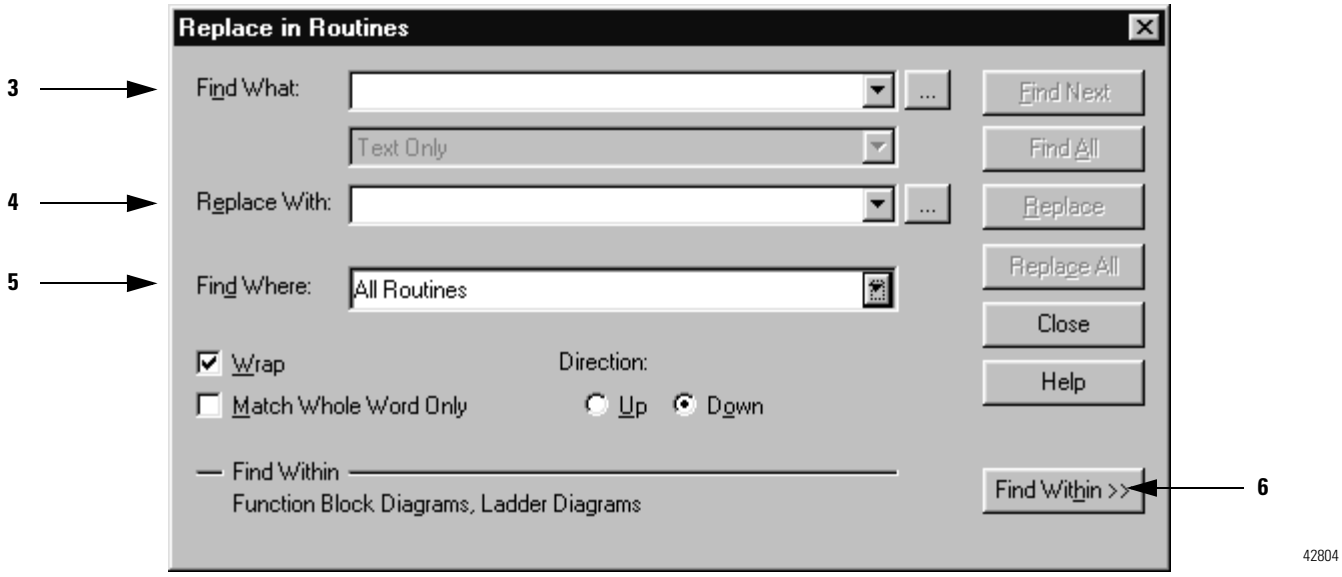


2. In the controller organizer, cut the modules from the local I/O configuration and paste them into the remote CNB module. Cut and paste the following modules:
   - I/O
   - 1756-DHRIO
   - 1756-DNB
   - 1756-ENET or -ENB
   - 1756-MVI

Replace Local I/O Tags

1. Open a routine. If a routine is already open, click within the routine to activate the window.

2. Press the *Ctrl* + *H* keys (replace).

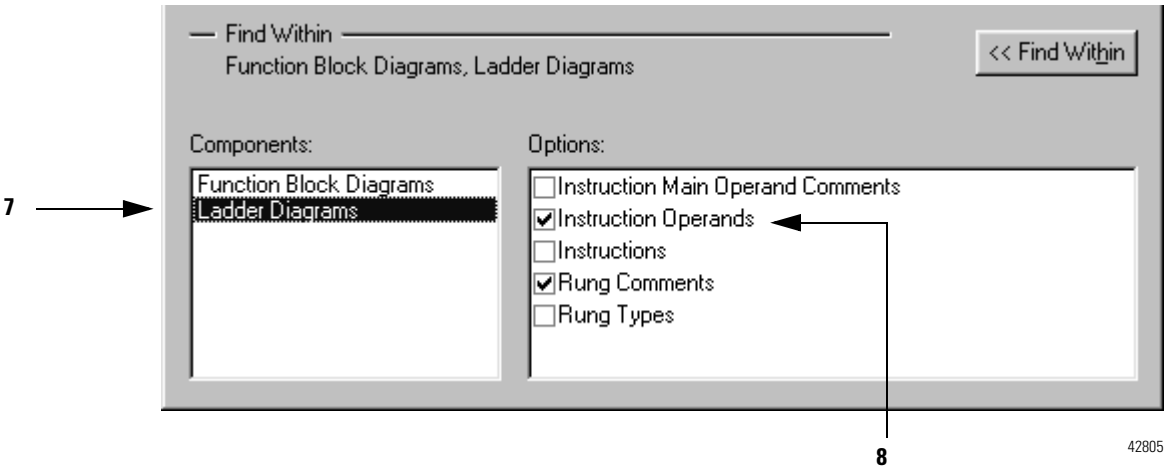


3. Type *Local*.

4. Type the name of the CNB module that is in the remote chassis.

5. Select *All Routines*.

6. Choose *Find Within* >>.



7. Select *Ladder Diagram*.

8. Check *Instruction Operands*.

9. Choose *Replace All*.

The Search Results tab displays the changes to the logic.

10. Choose *Close*.

The following example shows the results of replacing “Local” with “chassis_c”.

EXAMPLE

```
Replacing "Local" with "chassis_c"...


Searching through MainProgram - MainRoutine...
Replaced: Rung 0, XIC, Operand 0: XIC(Local:16:I.Data.0)
Replaced: Rung 0, OTE, Operand 0: OTE(Local:2:O.Data.0)
Replaced: Rung 1, XIC, Operand 0: XIC(Local:16:I.Data.1)
Replaced: Rung 1, OTE, Operand 0: OTE(Local:2:O.Data.1)
Replaced: Rung 2, XIC, Operand 0: XIC(Local:16:I.Data.2)
Replaced: Rung 2, OTE, Operand 0: OTE(Local:2:O.Data.2)
Replaced: Rung 8, OTE, Operand 0: OTE(Local:15:O.CommandRegister.Run)


Complete - 7 occurrence(s) found, 7 occurrence(s) replaced.
```

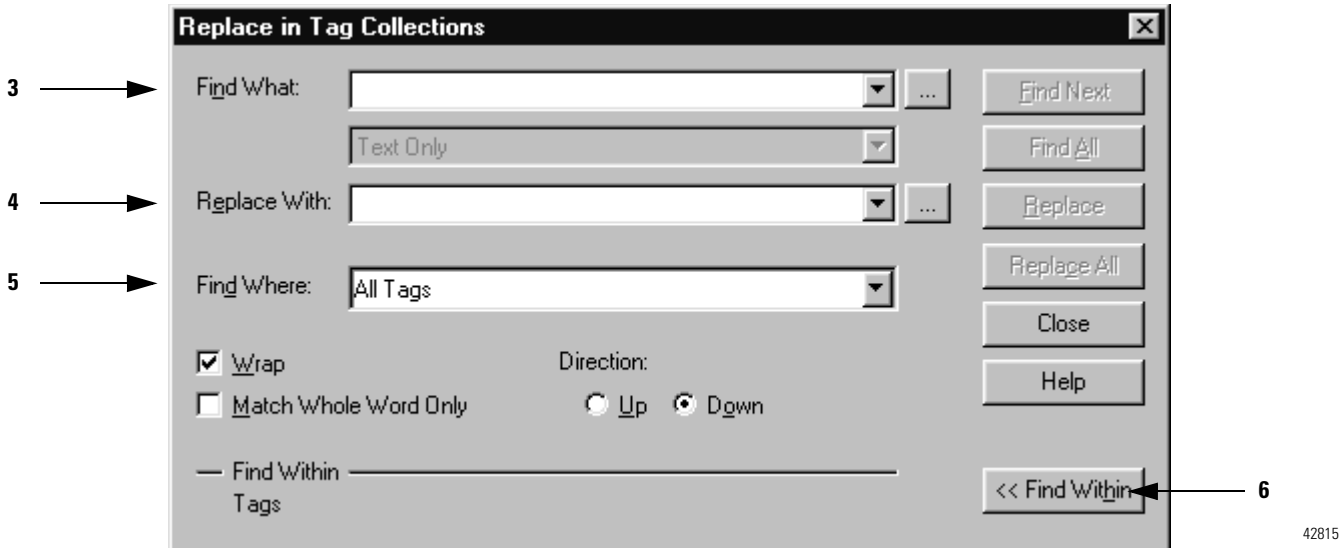
Replace any Aliases to Local I/O Tags

Are any of your tags an alias for an I/O device that was previously in a local chassis?

If:	Then:
Yes	Go to step 1.
No	Skip this procedure.

1. From the *Logic* menu, choose *Edit Tags*.

2. Press the *Ctrl* + *H* keys (replace).

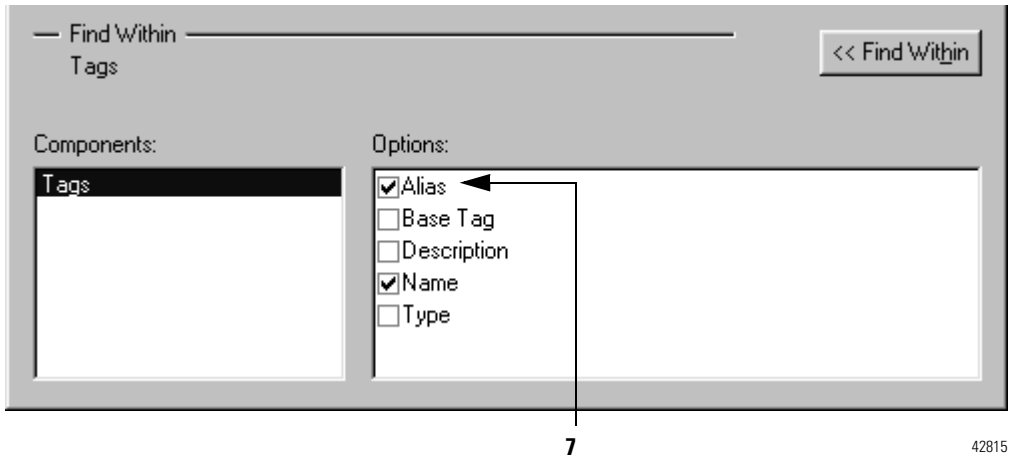


3. Type *Local*.

4. Type the name of the CNB module that is in the remote chassis.

5. Select *All Tags*.

6. Choose *Find Within* >>.



7. Check *Alias*.

8. Choose *Replace All*.

9. Choose *Close*.

Notes:

Attributes of the Redundancy Object

Use the REDUNDANCY object to get status information about your redundancy system.

For this information:	Get this attribute:	Data Type:	GSV/SSV:	Description:	
redundancy status of the entire chassis	ChassisRedundancy State	INT	GSV	**If:**	**Then:**
				16#1	power-up or undetermined
				16#2	primary with synchronized secondary
				16#3	primary with disqualified secondary
				16#4	primary with no secondary
redundancy state of the partner chassis	PartnerChassis RedundancyState	INT	GSV	**If:**	**Then:**
				16#8	synchronized secondary
				16#9	disqualified secondary with primary
				16#E	no partner
redundancy status of the controller	ModuleRedundancy State	INT	GSV	**If:**	**Then:**
				16#1	power-up or undetermined
				16#2	primary with synchronized secondary
				16#3	primary with disqualified secondary
				16#4	primary with no secondary
				16#6	primary with synchronizing secondary
redundancy state of the partner	PartnerModule RedundancyState	INT	GSV	**If:**	**Then:**
				16#7	synchronizing secondary
				16#8	synchronized secondary
				16#9	disqualified secondary with primary
				16#E	no partner
results of the compatibility checks with the partner controller	CompatibilityResults	INT	GSV	**If:**	**Then:**
				0	undetermined
				1	no compatible partner
				2	fully compatible partner

For this information:	Get this attribute:	Data Type:	GSV/SSV:	Description:	
status of the synchronization (qualification) process	Qualification InProgress	INT	GSV	**If:**	**Then:**
				-1	Synchronization (qualification) is not in progress.
				0	unsupported
				1 - 99	For modules that can measure their completion percentage, the percent of synchronization (qualification) that is complete.
				50	For modules that *cannot* measure their completion percentage, synchronization (qualification) is in progress.
				100	Synchronization (qualification) is complete.
keyswitch settings of the controller and its partner match or do not match	KeyswitchAlarm	DINT	GSV	**If:**	**Then:**
				0	one of the following: • The keyswitches match. • No partner is present.
				1	keyswitches do not match
position of the keyswitch of the partner	PartnerKeyswitch	DINT	GSV	**If:**	**Then the keyswitch is in:**
				0	unknown
				1	RUN
				2	PROG
				3	REM
status of the minor faults of the partner (if the ModuleRedundancyState indicates that a partner is present)	PartnerMinorFaults	DINT	GSV	**This bit:**	**Means this minor fault:**
				4	problem with an instruction (program)
				6	periodic task overlap (watchdog)
				9	problem with the serial port
				10	low battery

For this information:	Get this attribute:	Data Type:	GSV/SSV:	Description:	
mode of the partner	PartnerMode	DINT	GSV	**If:**	**Then:**
				16#0	power up
				16#1	program
				16#2	run
				16#3	test
				16#4	faulted
				16#5	run-to-program
				16#6	test-to-program
				16#7	program-to-run
				16#8	test-to-run
				16#9	run-to-test
				16#A	program-to-test
				16#B	into faulted
				16#C	faulted-to-program
In a pair of redundant chassis, identification of a specific chassis without regard to the state of the chassis.	PhysicalChassisID	INT	GSV	**If:**	**Then:**
				0	unknown
				1	Chassis A
				2	Chassis B
slot number of the 1757-SRM module in this chassis	SRMSlotNumber	INT	GSV		
• size of the last crossload • size of the last crossload if you had a secondary chassis	LastDataTransfer Size	DINT	GSV	This attribute gives the size of data that was or would have been crossloaded in the last scan. • The size in DINTs (4-byte words). • You must configure the controller for redundancy. • You don't need a secondary chassis. Is there a synchronized secondary chassis? • YES — This gives number of DINTs that was crossloaded in the last scan. • NO — This gives number of DINTs that would have been crossloaded in the last scan.	

For this information:	Get this attribute:	Data Type:	GSV/SSV:	Description:
• size of the biggest crossload • size of the biggest crossload if you had a secondary chassis	MaxDataTransfer Size	DINT	GSV SSV	This attribute gives the biggest size of the LastDataTransfer Size attribute. • The size in DINTs (4-byte words). • You must configure the controller for redundancy. • You don't need a secondary chassis. • To reset this value, use an SSV instruction with a Source value of 0. Is there a synchronized secondary chassis? • YES — This gives biggest number of DINTs that was crossloaded. • NO — This gives biggest number of DINTs that would have been crossloaded.

If You Have Series B ControlNet Bridge Modules

About This Appendix

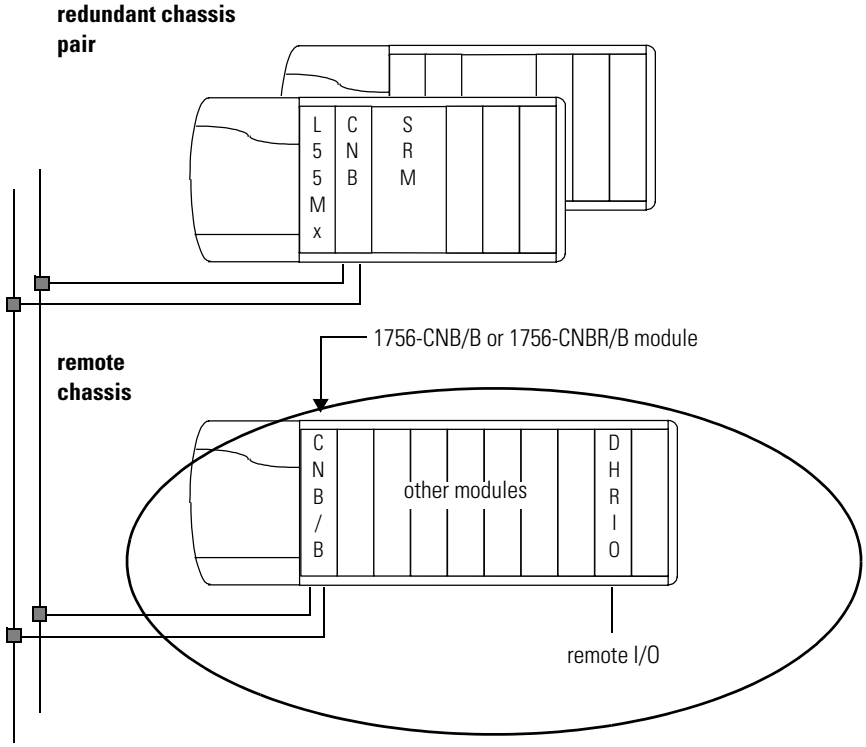
This appendix describes several situations that could happen if you use series B of a ControlNet Bridge module:

Communication Loss If You Bridge Through a Series B ControlNet Bridge Module

Situation

You could temporarily lose communication with a remote chassis if you use both these modules in the remote chassis:

- 1756-CNB/B or 1756-CNBR/B module
- 1756-DHRIO module that is connected to a remote I/O network.



On the first switchover after you download a project to the controller, you may temporarily lose communications with these devices.

The loss of communication happens on the first switchover after you download the project to the redundant controller.

- You lose communication with the remote chassis and any devices to which you were bridging via the chassis, such as the remote I/O modules.
- During the communication loss, the I/O modules go to their configured state for a communication fault.
- The communication loss is temporary. Communications restore themselves.

Prevention

To prevent this situation, use series D ControlNet Bridge modules.

Communication Could Stop If You Use a Series B ControlNet Bridge Module

Situation

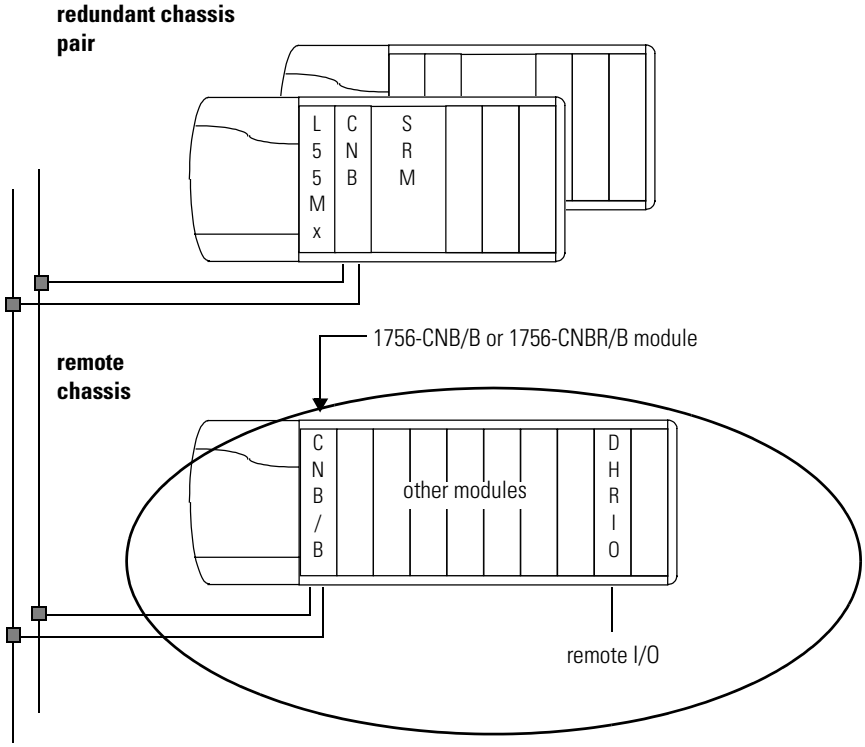
All communication on a ControlNet network could stop if the lowest node is a 1756-CNB/B or 1756-CNBR/B module. This happens if you unplug or break the tap of the module while it is turned on.

Corrective Action

If	Then
Tap of a series B ControlNet Bridge module becomes unplugged or broken.	1. Turn off the power to the module. 2. Replace the tap. 3. Turn on the power to the module.
Communication on the network stops because of an unplugged or broken tap.	Cycle power to each primary controller on the network.

Prevention

To prevent this situation, use series D ControlNet Bridge modules.

Restriction:	Description:
Communication Loss When Bridging Through a Series B ControlNet Bridge Module	You could temporarily lose communication with a remote chassis if you use both these modules in the chassis: • 1756-CNB/B or 1756-CNBR/B module • 1756-DHRIO module that is connected to a remote I/O network.  **On the first switchover after you download a project to the controller, you may temporarily lose communications with these devices.** The loss of communication occurs on the first switchover after you download the project to the redundant controller. • You lose communication with the remote chassis and any devices to which you were bridging via the chassis, such as the remote I/O modules. • During the communication loss, the I/O modules go to their configured state for a communication fault. • The communication loss is temporary. Communications restore themselves. To prevent this situation, use 1756-CNB/D or 1756-CNBR/D modules.

Restriction:	Description:
If the Lowest Node Is a 1756-CNB/B or -CNBR/B Module, Removing a Tap or Breaking a Cable Could Stop All Communications over the Network	If the lowest node on a ControlNet network is a 1756-CNB/B or 1756-CNBR/B module, all communications over the network could stop if: • A tap to the 1756-CNB/B or -CNBR/B module is disconnected or breaks and then is replaced while power is still applied to the 1756-CNB/B or -CNBR/B module If a tap to a 1756-CNB/B or -CNBR/B module becomes disconnected or broken, take these actions: 1. Turn off the power to the 1756-CNB/B or -CNBR/B module. 2. Replace the tap. If a communication failure occurs because of a disconnected or broken tap, cycle power to each primary controller on the network. To prevent this situation, use a 1756-CNB/D or -CNBR/D module as your lowest node on the network.

connection

A communication link between two devices, such as between a controller and an I/O module, PanelView terminal, or another controller. You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. Connections are allocations of resources that provide more reliable communications between devices than unconnected messages. See *direct connection*, *rack optimization connection*.

consumed tag

A tag that receives the data that is produced (broadcast) by another controller. Logix5000 controllers can produce and consume tags over an EtherNet/IP network, a ControlNet network, or a ControlLogix backplane. See *produced tag*.

crossload

The transfer of any or all of the contents of the primary controller to the secondary controller. This could be updated tag values, force values, online edits, or any other information about the project. A crossload happens initially when the chassis synchronize and then repeatedly as the primary controller executes its logic.

direct connection

A direct connection is a real-time, data transfer link between the controller and an I/O module. The controller maintains and monitors the connection between the controller and the I/O module. Any break in the connection, such as a module fault or the removal of a module while under power, causes the controller to set fault status bits in the data area associated with the module. See *connection*, *rack optimization connection*.

disqualified

The secondary chassis isn't synchronized with the primary chassis. If a secondary chassis is disqualified, it can't take over control of the machine or process. You also have the option of manually disqualifying a secondary chassis.

load

To copy a project from nonvolatile memory to the user memory (RAM) of the controller. This overwrites any project that is currently in the controller. See *nonvolatile memory, store.*

NAP

See *network access port (NAP)*.

network access port (NAP)

A port on a ControlNet device that lets you connect another device to a ControlNet network.

network update time (NUT)

The repetitive time interval in which data is sent over an EtherNet/IP or ControlNet network.

nonvolatile memory

Memory of the controller that retains its contents while the controller is without power or a battery. See *load*, *store*.

NUT

See *network update time (NUT)*.

primary chassis

The chassis that contains the primary controller.

primary controller

The controller that is currently controlling the machine or process.

produced tag

A tag that a controller is making available (broadcasting) for use by other controllers. See *consumed tag*.

qualified

See *synchronized*

qualify

See *synchronize*

rack optimization connection

For digital I/O modules, you can select rack optimization communication. A rack optimized connection consolidates connection usage between the controller and all the digital I/O modules on a rack (or DIN rail). Rather than having individual, direct connections for each I/O module, there is one connection for the entire rack (or DIN rail). See *connection, direct connection.*

requested packet interval (RPI)

When communicating over a network, this is the maximum amount of time between subsequent production of input data.

- Typically, this interval is configured in microseconds.
- The actual production of data is constrained to the largest multiple of the network update time that is smaller than the selected RPI.
- Use a binary multiple of the network update time (NUT). The binary multipliers are: 1, 2, 4, 8, 16, 32, 64, and 128.

  For example, if the NUT is 5 ms, use an RPI of 5, 10, 20, 40 ms, etc.

See *network update time (NUT).*

RPI

See *requested packet interval (RPI).*

secondary chassis

The chassis that contains the secondary controller.

secondary controller

The controller that is standing by to take control of the machine or process.

SMAX

In a ControlNet network, the maximum scheduled address. The greatest node number to use scheduled communications on a ControlNet network.

store

To copy a project to the nonvolatile memory of the controller. This overwrites any project that is currently in the nonvolatile memory. See *load, nonvolatile memory.*

switchover

Transfer of control from the primary controller to the secondary controller. After a switchover, the controller that takes control becomes the primary controller. Its partner controller (the controller that was previously the primary controller) becomes the secondary controller.

synchronize

The process that readies a secondary chassis to take over control if a failure occurs in the primary chassis. During synchronization, the 1757-SRM modules check that the partner modules in the redundant chassis pair are compatible with each other. The SRM modules also provide the path for crossloading (transferring) the content of the primary controller to the secondary controller.

Synchronization happens when you turn on power to the secondary chassis. It also happens after a switchover once you fix the cause of the switchover.

synchronized

The secondary chassis is ready to take over control if a failure happens in the primary chassis.

system overhead time slice

Specifies the percentage of time (excluding the time for periodic tasks) that the controller devotes to unscheduled communication. Unscheduled communication includes:

- communicate with programming and HMI devices (such as RSLogix 5000 software)
- respond to messages
- send messages, including block-transfers
- re-establish and monitor I/O connections (such as RIUP conditions); this *does not* include normal I/O communications that occur during program execution
- bridge communication from the serial port of the controller to other ControlLogix devices via the ControlLogix backplane
- synchronize the secondary controller of a redundant system

The controller performs unscheduled communication for up to 1 ms at a time. The following table shows the ratio between the continuous task and unscheduled communication at various system overhead time slices:

At this time slice:	The continuous tasks runs for:	And unscheduled communication occurs for up to:
10%	9 ms	1 ms
20%	4 ms	1 ms
33%	2 ms	1 ms
50%	1 ms	1 ms

UMAX

In a ControlNet network, the maximum unscheduled address. The greatest node number that you will use on a ControlNet network.

watchdog

Specifies how long a task can run before triggering a major fault.

- Each task has a watchdog timer that monitors the execution of the task.
- A watchdog time can range from 1 ms to 2,000,000 ms (2000 seconds). The default is 500 ms.
- The watchdog timer begins to time when the task is initiated and stops when all the programs within the task have executed.
- If the task takes longer than the watchdog time, a major fault occurs. The time includes interruptions by other tasks.

Notes:

Numerics

A

B

C

D

E

Q

R

S

T

U

W

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