User Manual

Allen-Bradley

ControlLogix Data Highway Plus-Remote I/O Communication Interface Module

Catalog Numbers 1756-DHRIO, 1756-DHRIOXT

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

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

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

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

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

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

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

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

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

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

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

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

This manual contains new and updated information. Changes throughout this revision are marked by change bars, as shown to the right of this paragraph.

New and Updated Information

This table contains the changes made to this revision.

Topic	Page
Added references to 1756-DHRIOXT module	Throughout document
Added Installation chapter	37
Added hazardous information warnings and attentions to Installation chapter	37-40
Added references to Studio 5000	Throughout document

Notes:

Chapter 5

Messaging Between PLC-5 and SLC 5/04 Controllers

Chapter 6

Messaging Between PLC-5 or SLC 5/04 Controllers and ControlLogix Controllers

Chapter 7

Messaging Between ControlLogix Controllers and PLC-5 or SLC 5/04 Controllers

Chapter 8

Messaging Between ControlLogix Controllers

Chapter 9

Using the 1756-DHRIO and 1756-DHRIOXT Modules in Remote I/O Applications

Appendix B

Application Guidelines and Tips

Index

Purpose of This Manual

This manual describes how to understand, configure, and troubleshoot your ControlLogix® Data Highway Plus™ Remote I/O (1756-DHRIO) communication interface module and ControlLogix Data Highway Plus Remote I/O extreme temperature communication interface module.

This manual also provides step-by-step procedures on how to:

- use the 1756-DHRIO and 1756-DHRIOXT modules to send DH+™ messages between ControlLogix controllers, PLC and SLC controllers in DH+ applications.
- connect ControlLogix controllers to remote I/O and send block transfers via the 1756-DHRIO and 1756-DHRIOXT module.

Throughout this manual, we describe ControlLogix systems that use the 1756-DHRIO and 1756-DHRIOXT modules and ControlLogix controllers. Multiple ControlLogix controllers are available. The examples contained in this manual do not call out catalog numbers for ControlLogix controllers. Whenever a controller is shown, any of the controllers apply.

Studio 5000 Environment

The Studio 5000 Automation Engineering & Design Environment™ combines engineering and design elements into a common environment. The first element in the Studio 5000® environment is the Studio 5000 Logix Designer™ application. The Logix Designer application is the rebranding of RSLogix™ 5000 software and continues to be the product to program Logix5000™ controllers for discrete, process, batch, motion, safety, and drive-based solutions.

The Studio 5000 environment is the foundation for the future of Rockwell Automation® engineering design tools and capabilities. This environment is the one place for design engineers to develop all elements of their control system.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
ControlLogix Controllers Selection Guide, publication 1756-SG001	Provides information and specifications for ControlLogix controllers
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

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

About the Module

What This Chapter Contains

This chapter describes the 1756-DHRIO and 1756-DHRIOXT modules and what you must know and do before you begin to use it.

What the Module Does

The Data Highway Plus/RIO module supports the following types of communication:

- Data Highway Plus™ (DH+) Messaging
- Control and Information Protocol (CIP) Messaging
- Remote I/O

You can send messages between devices on DH+ networks and devices on other networks such as ControlNet, Ethernet, or other DH+ networks.

A 1756-DHRIO channel functions as a scanner by using remote I/O functionality. The module transfers discrete and block-transfer data with remote I/O devices. This module enables connection to multiple remote I/O adapters.

Routing Limitations

The modules can route a message through as many as four communication networks and three chassis. This limit applies to only the routing of a message and not to the total number of networks or chassis in a system.

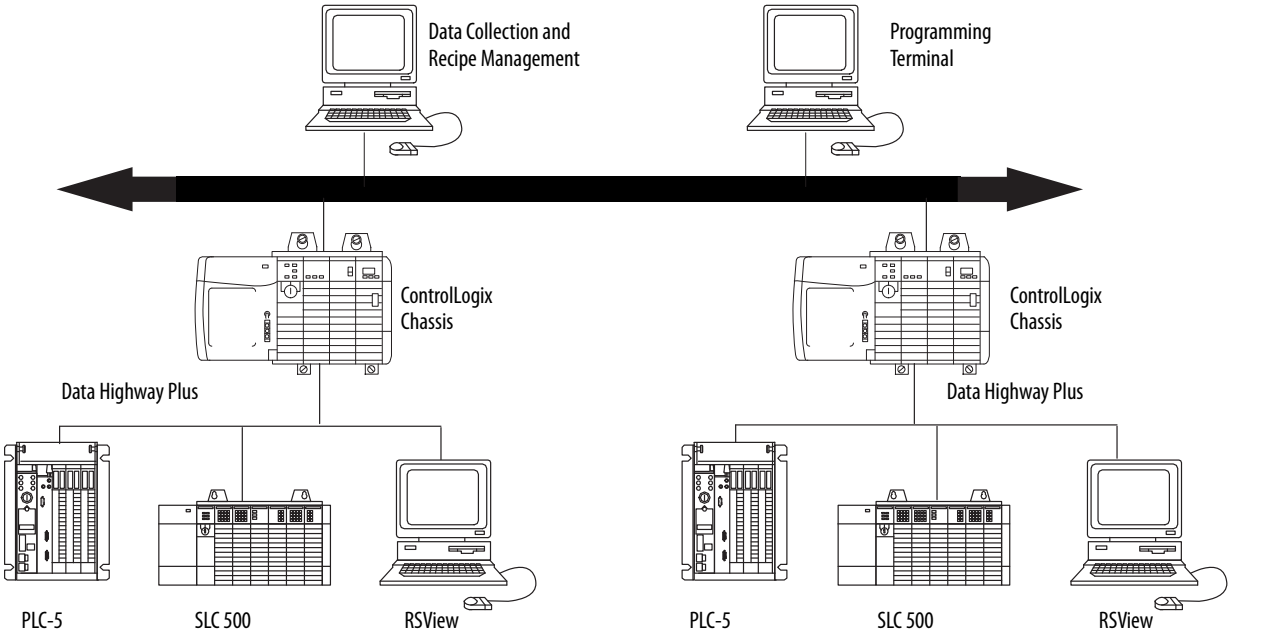
DH+ and CIP Messaging

The modules allow an information exchange between devices, such as ControlLogix controllers, PLC and SLC controllers.

With these modules, you can exchange information in any of the following scenarios:

- Between PLC or SLC controllers on different networks
- Between the ControlLogix controllers and a PLC or SLC controller on different networks
- Between ControlLogix controllers on different networks

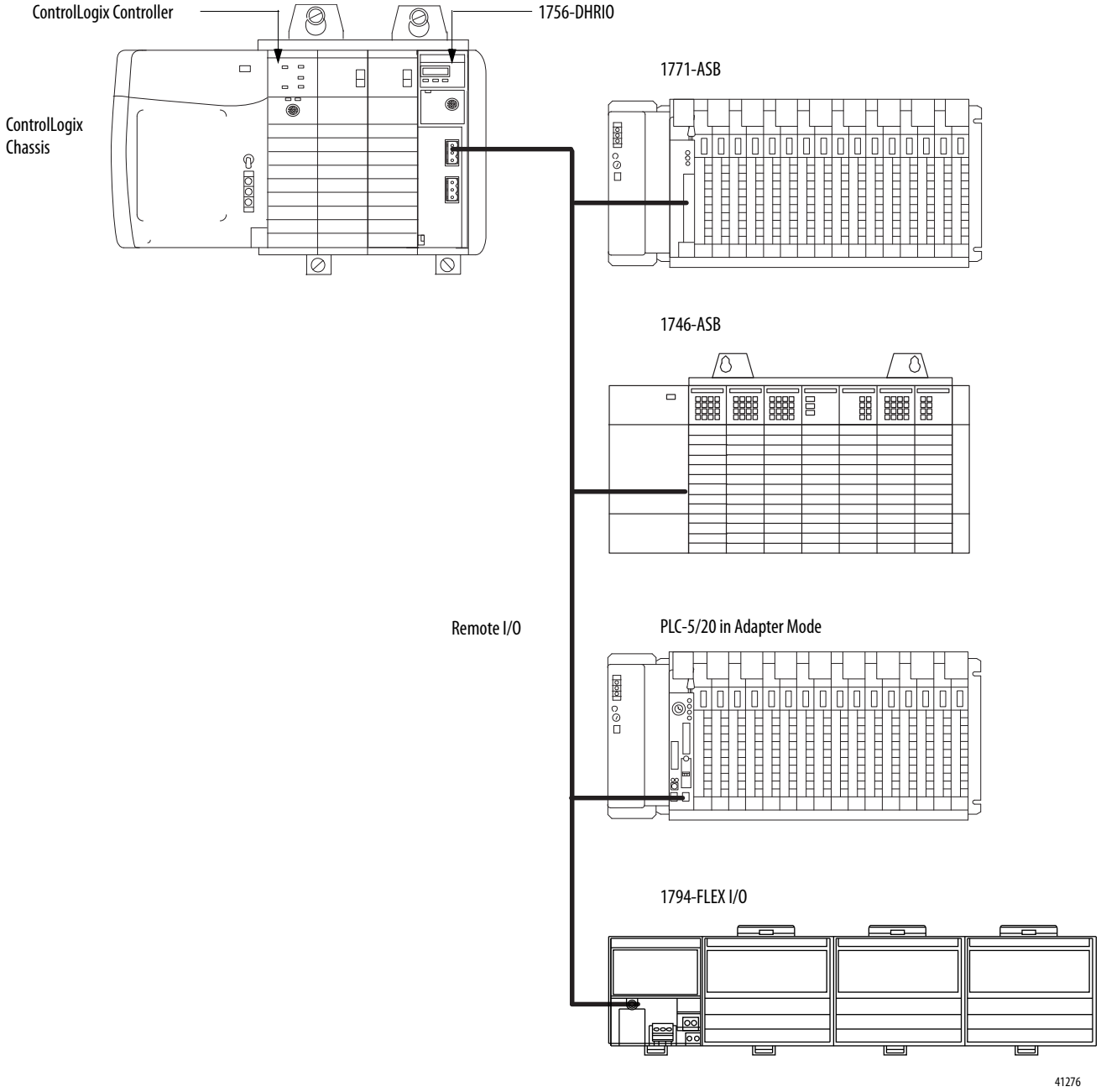
The figure shows an example system. Two ControlLogix chassis link Data Highway Plus networks. Communication between PLC-5® programmable controllers on different networks is accomplished in the same manner used for communication within a network.



Remote I/O

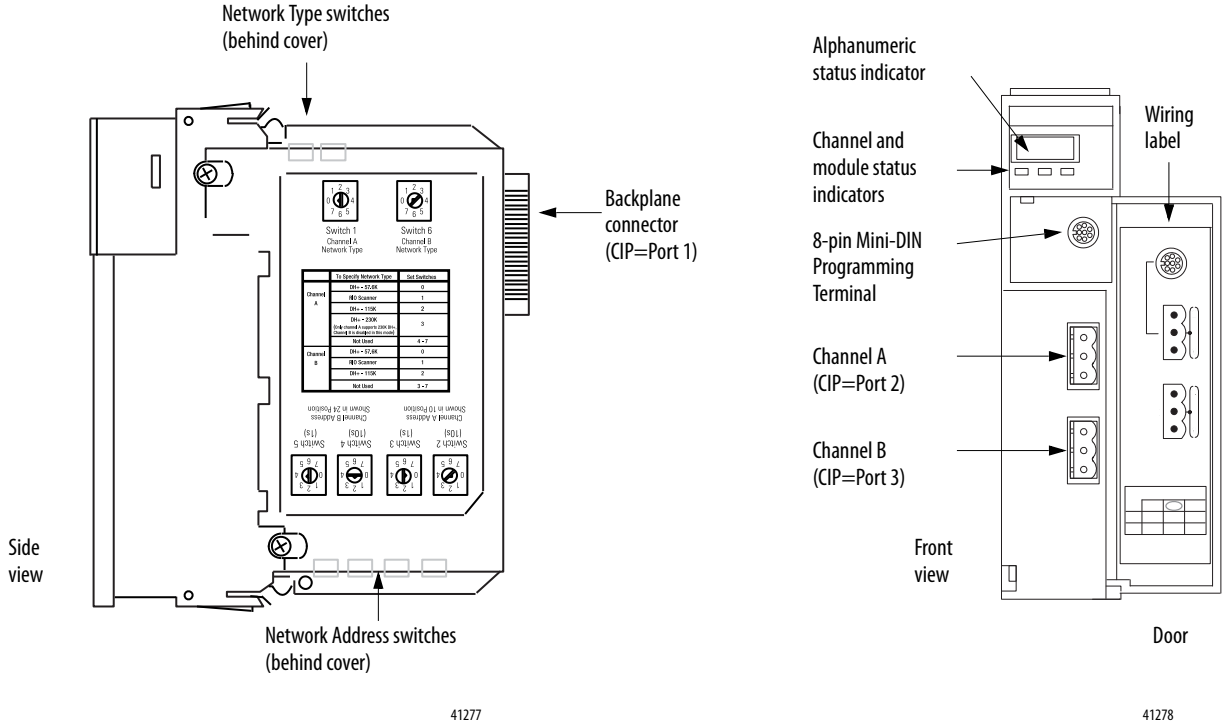
When a channel on the module is configured for Remote I/O, the module acts as a scanner for the remote I/O network. The ControlLogix controller communicates to the module's remote I/O scanner to send and receive the I/O on the remote I/O network.

The figure shows an example system.



Module Features

The figure shows the external features of the 1756-DHRIO and 1756-DHRIOXT modules.



Other module features include the following:

- Routing table that enables DH+ devices to use the modules and ControlLogix chassis to access other networks
- Routing communication to and from other modules
- No limit on number of modules per chassis, to the total number of available slots and the capabilities of the power supply
- Can be removed and inserted under power without disrupting power to other modules in the chassis

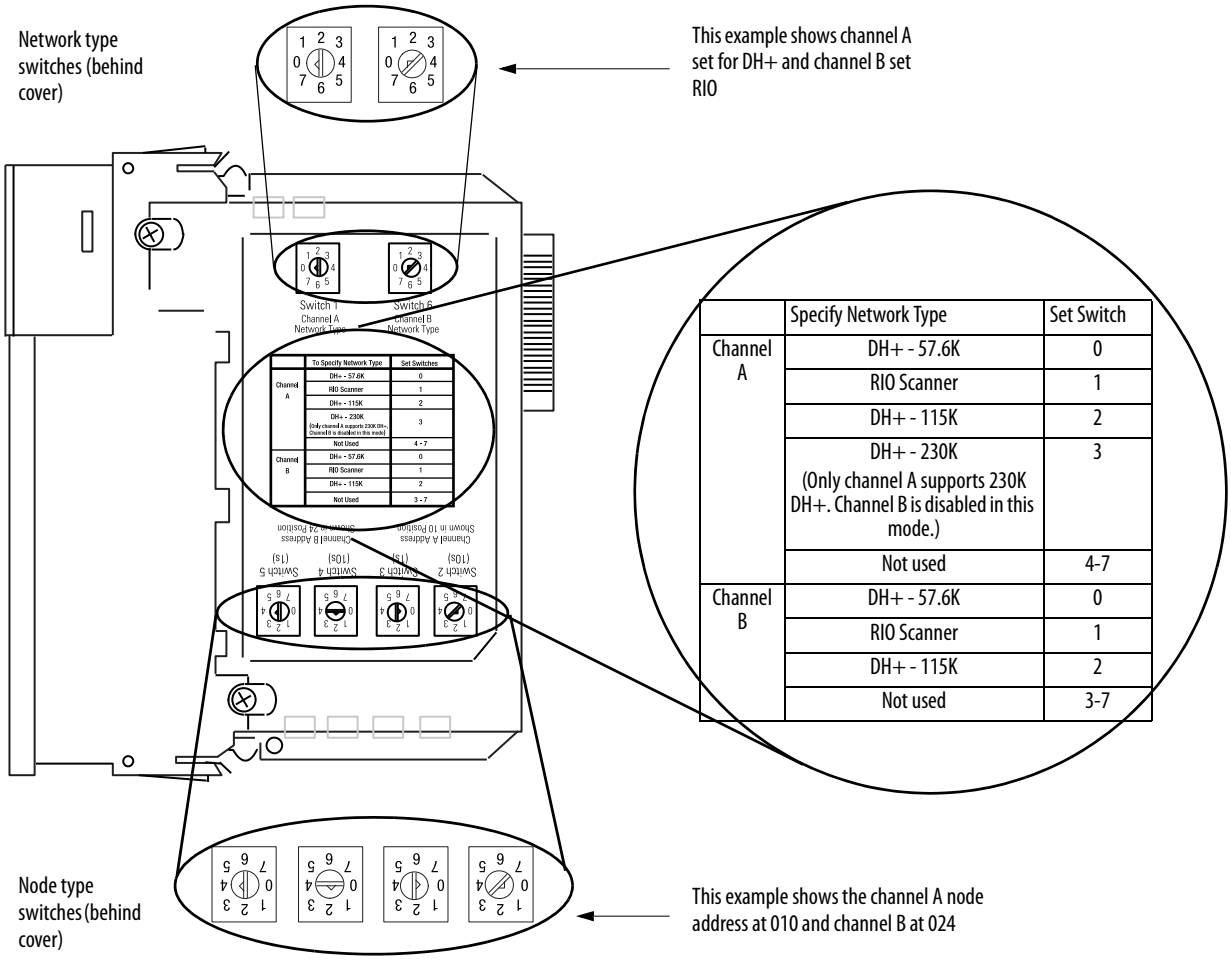
Configure Switches

Before installing the module, you must set the network type switches for DH+ or RIO, depending on your application. For a channel configured as DH+, you must also select a node address within the range of 00-77. Node addresses are set and displayed in octal.

IMPORTANT If your module uses the 230k DH+ network (that is Channel A switch set to 3), Channel B is disabled.

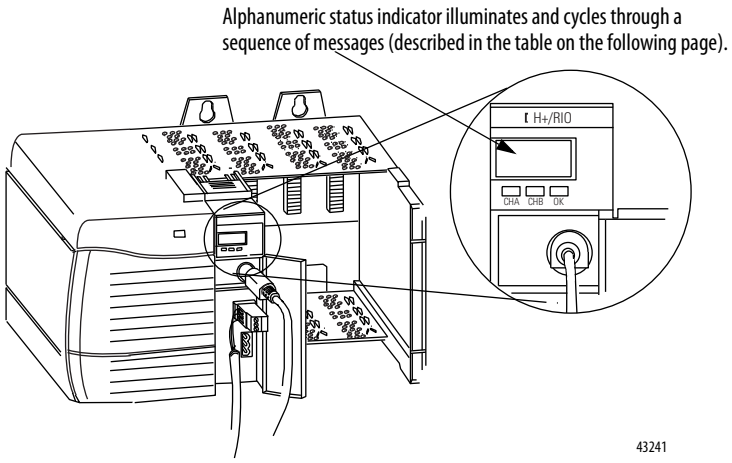
Also, node address switches do not apply if you are using remote I/O.

Set the network type and node address switches as shown in the Figure.



	Specify Network Type	Set Switch
Channel A	DH+ - 57.6K	0
	RIO Scanner	1
	DH+ - 115K	2
	DH+ - 230K (Only channel A supports 230K DH+. Channel B is disabled in this mode.)	3
	Not used	4-7
Channel B	DH+ - 57.6K	0
	RIO Scanner	1
	DH+ - 115K	2
	Not used	3-7

Alphanumeric Indicators



At power-up the module's alphanumeric display begins a cycle through the following sequences.

- Channel A and the network used for channel A - DH+ or RIO
- Channel A node address, if used for DH+
- Channel A status
- Channel B and the network used for channel B - DH+ or RIO
- Channel B node address, if used for DH+
- Channel B status

This sequence runs continuously during normal module operation.

EXAMPLE For example, if your module uses the following:

- Channel A for DH+ with node address 14
- Channel B for RIO

and the channels are operating properly, you see the following sequence:

- A DH, A#14, A OK, B IO, SCAN, B OK

For a detailed list of the status and error messages that can be displayed across the alphanumeric indicators, and for troubleshooting information, see Chapter 13.

Prevent Electrostatic Discharge

The Data Highway Plus module is sensitive to electrostatic discharge.

ATTENTION: 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.
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe packaging when not in use.

Removal and Insertion Under Power

You can install or remove the module while chassis power is applied if you observe the following precautions.

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

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

Notes:

Using the Data Highway Plus Network

This chapter describes the basics of Data Highway Plus (DH+) and the operation of a DH+ network.

What Is Data Highway Plus?

On the most basic level, Data Highway Plus is a wire or cable and a protocol that connects computers and peripheral devices so that they can communicate. The wire used for a network is called the network medium.

A DH+ link transfers data between ControlLogix controllers, PLC and SLC controllers, and other devices that use the DH+ network. These devices are called stations. You can connect a maximum of 32 stations to one DH+ link.

Link Design

When you design your DH+ link, use good design practices, including laying out the link before installation. We also recommend you consider the following when designing your DH+ link:

- All performance requirements
- Maintenance
- Possible future changes to the link

Use a1770-CD (Belden 9463) cable to connect your 1756-DHRIO module to DH+. Use a Belden 89463 cable to connect your 1756-DHRIOXT module to DH+. Connect a DH+ network by using a daisy chain or trunk line/drop line configuration.

Trunk Line/Drop Line Considerations

When using a trunk line/drop line configuration, use 1770-SC station connectors and follow these cable-length guidelines:

- trunk line-cable length - depends on the communication rate of the link
- drop-cable length - 30.4 m (100 cable-ft.)

Verify that your system's design plans specify cable lengths within allowable measurements.

IMPORTANT The maximum cable length for DH+ depends on the transmission rate. Configure all devices on a DH+ link to communicate at the same transmission rate.

For daisy chain configurations, use the following table to determine the available total cable length.

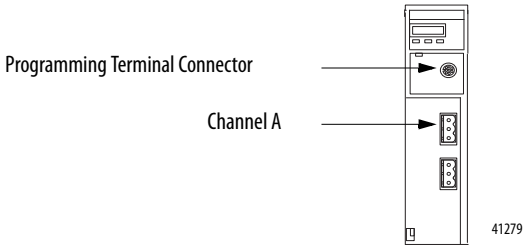
A DH+ link using this communication rate:	Cannot exceed this cable length:
57.6 kbps	3,048m (10,000 ft)
115.2 kbps	1524m (5,000ft)
230.4 kbps	762m (2,500 ft)

For proper operation, terminate the ends of a DH+ link by using the external resistors shipped with the module. The following table lists the resistors you can use with each communication rate.

If your DH+ I/O link operates at:	Use this resistor rating:
57.6 kbps	150 Ω
115.2 kbps	150 Ω
230 kbps	82 Ω

Programming Terminal Port

The programming terminal connector is the same physical link as Channel A.



IMPORTANT When configuring the module switches, remember the programming terminal connector can be used only if Channel A is set for DH+.

Connect Devices to the DH+ Network

The following table lists the devices you can connect to a DH+ link.

To:	You can use:	Cat. No.:	Required Cables[1]:
Connect PLC-3 family processors to DH+	Scanner Communication Adapter Module	1775-S5	1770-CD or Belden 89463
		1775-SR5	
Connect PLC-5 family processors to DH+	Classic and Enhanced PLC-5 processors using on-board DH+ ports	1785-Series	1770-CD or Belden 89463
	ControlNet and EtherNet PLC-5 processors using on-board DH+ ports		
Connect SLCs to DH+	SLC 5/04 Controller	1747-Series	1770-CD or Belden 89463
Connect PI systems to DH+	Resource Manager Module	5130-RM1	1770-CD or Belden 89463
	Resource Manager Module	5130-RM2	
	Data Highway/Data Highway Plus Communication Interface Module	5130-KA	
Perform data transmission, management, and local network diagnostics over DH+ network	KTX Communication Interface Card	1784-KTX	1770-CD or Belden 89463
Perform data transmission, management, and local network diagnostics over DH+ network	KTXD Communication Interface Card	1784-KTXD	1770-CD or Belden 89463
Add memory, storage, and I/O capabilities to computers through DH+	PCMK Communication Card	1784-PCMK	PCM6/B cable assembly
Connect other SLC controllers to DH+	SLC 5/04	1747-Series	1770-CD or Belden 89463
Connect AutoMax to DH+	AutoMax DH+ Interface	57C-442	1770-CD or Belden 89463

(1) Use 1770-CD for 1756-DHRIO modules and Belden 89463 for 1756-DHRIOXT modules.

Application Guidelines

Consider the following application guidelines when configuring a DH+ link for your system:

- Minimize the number of DH+ nodes to achieve acceptable response times. Keep in mind the size and frequency of messages exchanged between devices.
- Limit the number of stations on your network when you are trying to achieve the fastest control response time. Establish separate DH+ networks to bring-on additional stations.
- Do not add or remove stations from the network during machine or process operation. If the network token resides with a device that is removed, the token can be lost to the rest of the network. The network is automatically reestablished, but it could take several seconds. Control is unreliable or interrupted during this time.
- When possible, do not program controllers online during machine or process operation. This could result in long bursts of DH+ activity, increasing response time.
- When possible, add a separate DH+ link for programming processors to keep effects of the programming terminal from the process DH+ link.

Two Methods of Communication Over a DH+ Network

The 1756-DHRIO and 1756-DHRIOXT modules act as a bridge for two methods of communication. These methods are:

- DH+ Messaging
- Control and Information Protocol (CIP) Messaging

The following table lists the devices that support each communication method.

Type of communication:	Devices and Software supporting this type:
DH+ messaging	PLC-3 PLC-5 PLC-5/250 SLC 500 ControlLogix controllers RSLinx software Interchange software
Control and Information Protocol (CIP) messaging	ControlLogix controller Studio 5000 environment

Use DH+ Messaging

DH+ Messaging offers the following benefits:

- You can send messages between devices on the same link.
- You can send messages between devices on different links.
- It is compatible with many Rockwell Automation® modules.

DH+ messaging is divided into two types:

- Local DH+ Messaging - See page 25
- Remote DH+ Messaging - See page 28

Before you can design a control system to meet your application needs, be aware of the difference between Local DH+ Messaging and Remote DH+ Messaging.

Local DH+ Messaging

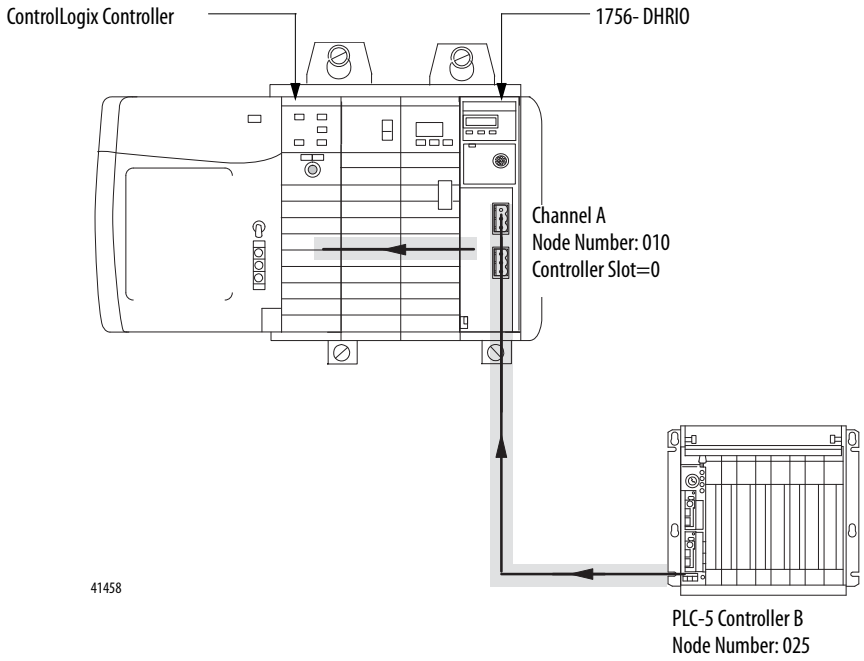
Devices use local DH+ messaging to communicate between devices on the same physical link. A device that uses local DH+ messaging must:

- generate local DH+ packets.
- support local DH+ protocol.
- send and receive messages.

A local DH+ message sent on a DH+ network has only enough address information to get the message to a target node on the same DH+ network.

The example in the following figure shows a PLC-5 controller sending a message to port A on the 1756-DHRIO and 1756-DHRIOXT modules. Because the

controller slot for port A is configured to “0”, the message is forwarded to the ControlLogix controller in slot 0.



Receiving Local DH+ Messages on DH+

Because a local DH+ message has only enough address information to get the message to a target node on the same DH+ network, the 1756-DHRIO and 1756-DHRIOXT modules that receive this message cannot identify where to send the message. The 1756-DHRIO and 1756-DHRIOXT modules use the *Controller Slot* configuration parameter to send the message to the local controller.

You must use RSLinx software to configure the controller slot. For more information on setting the controller slot, see page 51.

Some messages, called PCCC commands, are not sent to the controller slot. In this case, the 1756-DHRIO and 1756-DHRIOXT modules generate a response to the message. For a complete list of these messages, see Appendix B.

Local DH+ messaging **does not** require a populated routing table. Local DH+ messaging **does** require a default (that is a properly emptied) or an applied (that is a properly populated and saved) routing table, and a default or applied controller slot for each channel configured for DH+. For more information on routing tables, see Chapter 3,

IMPORTANT	Local DH+ Messaging can target only one ControlLogix controller per DH+ channel. The ControlLogix controller must reside in the same chassis as the 1756-DHRIO and 1756-DHRIOXT modules receiving the message.

Sending Local DH+ Messages on DH+

If a 1756-DHRIO channel receives a DH+ message with a destination link ID=0 from a ControlLogix controller in the same chassis, the module sends the message as a local DH+ message.

IMPORTANT The target of the DH+ message must be on the same DH+ link as the 1756-DHRIO and 1756-DHRIOXT modules sending the message. Also, the ControlLogix controller must reside in the same chassis as the 1756-DHRIO and 1756-DHRIOXT modules sending the message on DH+.

Limitations of Local DH+ Messaging

When using Local DH+ Messaging, you must remember:

- The DH+ message contains only a node ID for a node on the DH+ network.
- A local DH+ message sent to the node ID of a port on the 1756-DHRIO and 1756-DHRIOXT modules is forwarded to one user-configured controller slot.
- Messages on one DH+ network cannot be routed to other networks.

Routing Error in Local DH+ Messaging

If the module has a problem with routing a DH+ message, it can return a response with an error status of D0 hex. A PLC-5 displays this error as D000 hex when monitoring the message instruction. If you receive this error message, perform the following actions:

- Check your message instruction to make sure a destination node was entered.
- Check your default slot configuration to make sure that it matches the location of the ControlLogix controller in the chassis.
- Make sure power is applied to the module.

Programming Message Block Instructions in a Controller for Local DH+ Messaging

Before programming your message block instructions in your controller, you must:

- Determine which links send and receive DH+ Local messages.
- Draw a network to make sure you meet the design requirements for Local DH+ messages.

- Assign DH+ node numbers.
- Use the Studio 5000 environment to enter the controller slot or execute the default for the controller slot for each channel configured for DH+.

IMPORTANT These configuration steps must be done for each 1756-DHRIO or 1756-DHRIOXT in the your system.

Remote DH+ Messaging

Devices use remote DH+ messaging to communicate between devices on physically separate networks. A device that uses remote DH+ messaging must be able to perform the following:

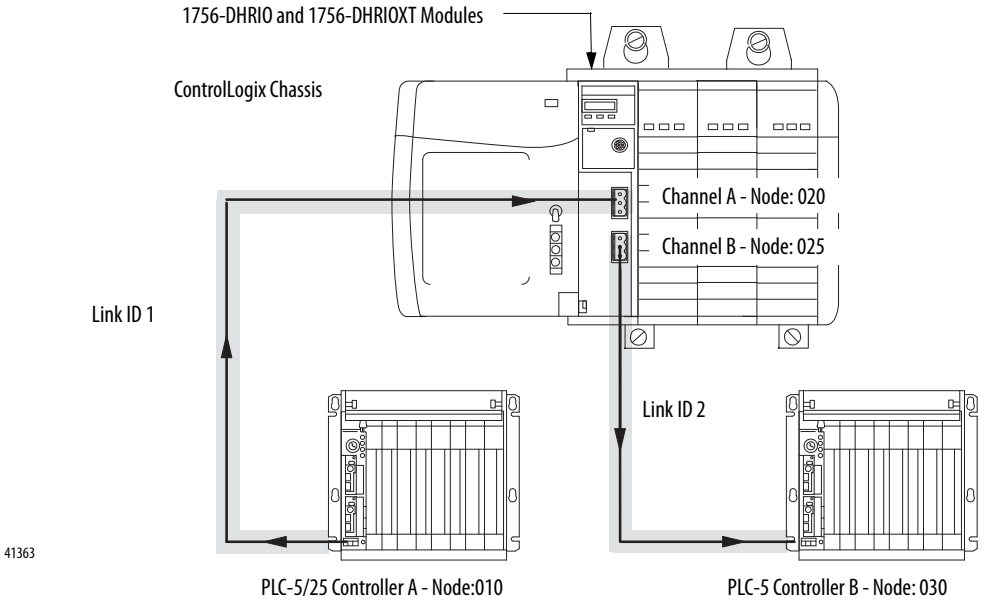
- Generate Remote DH+ packets.
- Support Remote DH+ protocol.
- Send and receive messages.

Use remote DH+ messaging when the following conditions apply:

- The message originating device or the message target device is one of the devices listed in the table on page 25.
- A DH+ link is in the message's path from originator to target.
- The message originating device and the message target device are on separate networks or the message target is in a ControlLogix chassis and multiple ControlLogix controller targets are in the chassis.

The following figure shows an example of remote DH+ messaging between PLC processor A and PLC processor B. In this example, the following information must be included in the remote DH+ message routing message instruction:

- local DH+ node = 020
- destination link ID = 2
- remote DH+ node = 030



Link IDs

To use remote DH+ messaging, each network that is an originating network or target network requires a unique link ID. The modules require these link IDs to be decimal values between 1-199. Each DH+ channel on a 1756-DHRIO or 1756-DHRIOXT module requires its own unique link ID.

The message originates on the source network. The destination network is the message's target network. This applies to all source and destination networks, including DH+, ControlNet, Ethernet and a ControlLogix chassis.

IMPORTANT For remote DH+ messaging, the ControlLogix chassis is considered a separate, independent network. Therefore, a system of 1 DH+ network and one ControlLogix chassis is a two-link system.

The ControlLogix chassis is **required** to be a separate, independent link for DH+ messaging if multiple message target ControlLogix controllers are in a ControlLogix chassis.

Routing Tables in Remote DH+ Messaging

The modules contain a routing table that you define for your application. The routing table contains information used to steer remote DH+ messages through the system to 'remote' nodes on separate networks. By using the routing table, the

1756-DHRIO and 1756-DHRIOXT modules enable devices, such as PLC-5s, to use “DH+ Remote Addressing” for messaging.

You must use RSLinx to configure your routing table. For more information on routing tables, see page 46

Programming Message Block Instructions in a Controller for Remote DH+ Messaging

Before programming your message block instructions in your controller, you must perform the following:

- Determine which links will send and receive remote DH++ messaging.
- Draw a network to make sure you meet the design requirements for remote DH+ messaging.

If you are using remote DH+ messaging, you must also perform the following:

- Assign link numbers. The numbers must be a decimal value between 1-199. ControlLogix chassis can also be assigned link IDs. Remember that the programming terminal and channel A are the same physical link.
- Assign DH+ node numbers.
- Use RSLinx software to load routing tables into each 1756-DHRIO and 1756-DHRIOXT module.

When using remote DH+ messaging, you must include the following in the message instruction:

- Destination link ID - A user-defined number representing a network in your system.
- Remote node or slot - The node or slot on the remote network with which you want to communicate.

If the message originates on DH+, you must also include:

- local DH+ node - The node on your local DH+ network capable of routing the message.

If the message originates on Ethernet or ControlNet networks or ControlLogix controllers, you must also include a CIP path to the first 1756-DHRIO and 1756-DHRIOXT modules.

Limitations of Remote DH+ Messaging

Remote DH+ Messages are encapsulated in CIP messages and sent on CIP connections when they are sent across ControlNet, Ethernet, and the ControlLogix chassis backplane. Resource limits are associated with CIP on the

1756-DHRIO and 1756-DHRIOXT modules, although this is transparent to the user.

The 1756-DHRIO and 1756-DHRIOXT modules support a total of 32 CIP connections per DH+ channel. These connections are made when devices want to send a DH+ message out of a 1756-DHRIO or 1756-DHRIOXT module's DH+ channel and are made by the 1756-DHRIO or 1756-DHRIOXT module when it receives DH+ message traffic. The 1756-DHRIO and 1756-DHRIOXT modules recover connections if they are not being used.

Because of the various paths involved, the 1756-DHRIO and 1756-DHRIOXT modules respond to 'out of connections' in one of the following ways:

- The 1756-DHRIO and 1756-DHRIOXT modules can generate a Routing Error on DH+ for DH+ message requests if no connections are available.
- The Message Originator can generate an Application Timeout if a remote 1756-DHRIO or 1756-DHRIOXT module has no connections available for a DH+ Message response.
- The Message Originator can receive an 'out of connections' error if the path from the Originator to the 1756-DHRIO or 1756-DHRIOXT module is ControlLogix chassis, ControlNet or Ethernet.

Routing Errors in Remote DH+ Messaging

If the 1756-DHRIO and 1756-DHRIOXT modules have a problem with routing a Remote DH+ Message, they can return a response with an error status of D0 hex. A PLC-5 displays this error as D000 hex when monitoring the message instruction. If you receive this error message, perform the following actions:

- Check your message instruction to make sure a gateway node, link ID and destination node were entered.
- Check your routing table in each DH+ module that the message passes through.
- Make sure all 1756-DHRIO and 1756-DHRIOXT modules are connected and powered-up.

Configuration Information in DH+ Messaging

When you are using DH+ messaging, you must use the default configuration or write configuration for your application.

The following configuration information is stored in the nonvolatile (NVS) memory on your 1756-DHRIO and 1756-DHRIOXT modules when you apply configuration by using the Studio 5000 environment:

- Any routing table that can be needed to send DH+ messages through the module. - This information must be applied to the module's configuration separately from other information. Use RSLinx to apply the routing table. For more information on routing tables, see page49.
- Controller slot for each DH+ channel - This information must be applied to the module's configuration separately from other information. For more information on setting the controller slot, see page 51.
- Slot number of the module
- Chassis serial number

IMPORTANT If you restore defaults with Studio 5000 environment, the slot number and chassis serial number are stored in the 1756-DHRIO and 1756-DHRIOXT module's nonvolatile memory, but no routing table is used and the controller slot for the DH+ channels is set to 0.

Generate Configuration Faults

When you insert a 1756-DHRIO or 1756-DHRIOXT module in a ControlLogix chassis, the configuration information stored in the module's NVS memory is compared to the slot and serial number of the chassis it is entering. If any information does not match, the 1756-DHRIO or1756-DHRIOXT module generates a configuration fault.

For a complete listing of the configuration faults that can be displayed on your 1756-DHRIO and 1756-DHRIOXT modules, see Chapter 13.

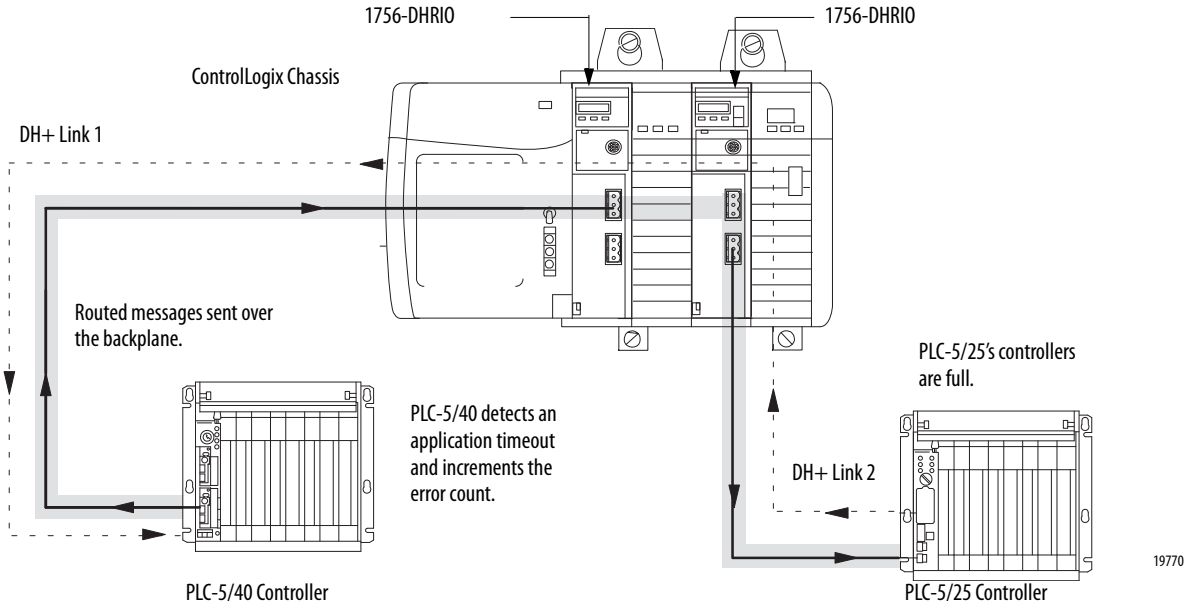
Application Timeout

When an error occurs while sending a message to a remote link, it appears to the sending station as an application timeout because error messages are not routed back. When an error occurs during routing, it can be dropped.

For example, if a PLC 5/40 processor sends a message to a PLC processor, and the PLC-5/25 processor's buffers are full, three things happen:

- The PLC-5/25 processor refuses the message because the buffers are full.
- When no reply is received, the originator detects an application timeout.
- The originator increments its error count.

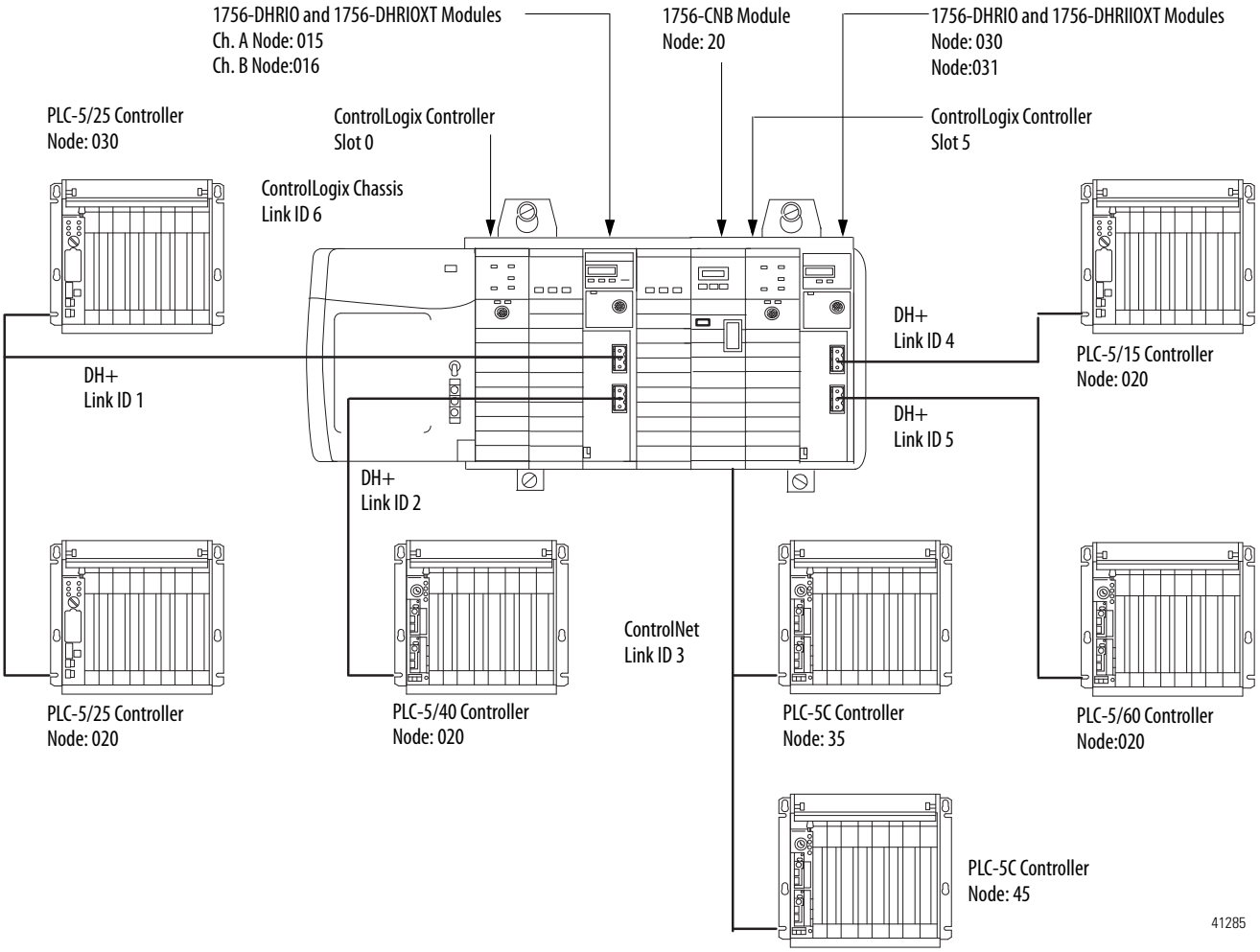
The PLC-5/40 processor can retry to send the message later. The following figure shows an example of an application timeout.



Example DH+ Routing Configuration

The following figure shows an example DH+ routing configuration.

Node numbers on DH+ are given in octal. Node numbers on ControlNet network and slot numbers in ControlLogix chassis are given in decimal. Links IDs for all networks are given in decimal.



IMPORTANT Some devices in the figure have the same node number because they are on different networks. Devices on the same network require unique node numbers. You must assign the node numbers.

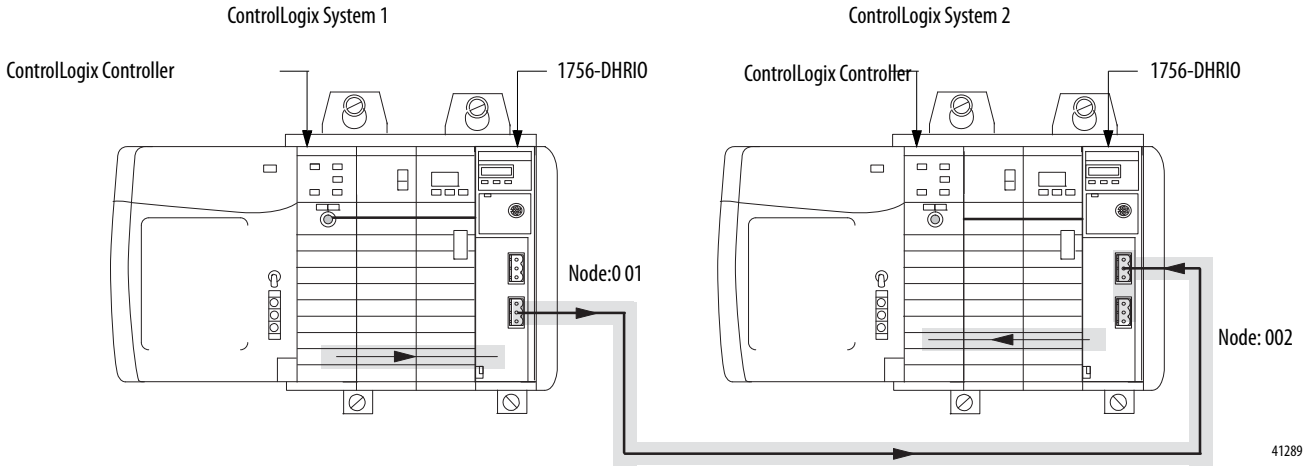
Use Control and Information Protocol (CIP) Messaging

Control and Information Protocol (CIP) is the communication mechanism on ControlLogix chassis, ControlNet network and Ethernet with the Encapsulation Protocol (EPIC) protocol.

Like DH+ messaging, CIP supports communication between devices on the same link and physically separate links. However, CIP Messaging uses another method to route messages than DH+ Messaging.

CIP uses a "relative path" concept for routing messaging. Because the message itself, or the connection the message is sent on, contains the information required to route the message, CIP messages do not require any routing table or link IDs. For more information on paths, see Chapter 4.

Devices such as ControlLogix devices, devices that use the ControlNet network, and devices that use EPIC protocol on Ethernet support this new type of communication.



IMPORTANT Your 1756-DHRIO and 1756-DHRIOXT modules support bridging CIP messaging over a DH+ link. However, your 1756-DHRIO and 1756-DHRIOXT modules do not support bridging CIP I/O data from a ControlLogix controller to a 1756-I/O module.

The message originator, target, and all modules and links between them must support CIP to send a message by using CIP protocol.

Limitations of CIP Messaging

The 1756-DHRIO and 1756-DHRIOXT modules support 32 connections per DH+ channel. A total of 5 of the connections can be CIP connections. These 5 count against the 32 connections. So if a 1756-DHRIO or 1756-DHRIOXT module used 30 connections for DH+ Message Routing, it can use only 2 connections to bridge a CIP message through the module on that channel.

Notes:

Installing the Modules

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

ATTENTION: Environment and Enclosure

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

This equipment is not intended for use in residential environments and may not provide adequate protection to radio communication services in such environments.

This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA or be approved for the application if nonmetallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see the following:

- Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, for additional installation requirements.
- NEMA 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by enclosures.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations.	Informations sur l'utilisation de cet équipement en environnements dangereux.
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.
WARNING: EXPLOSION HAZARD - • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous.	**AVERTISSEMENT:** RISQUE D'EXPLOSION – • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

European Hazardous Location Approval

The following applies when the product bears the Ex Marking.

This equipment is intended for use in potentially explosive atmospheres as defined by European Union Directive 94/9/EC and has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of Category 3 equipment intended for use in Zone 2 potentially explosive atmospheres, given in Annex II to this Directive.

Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 60079-15 and EN 60079-0.

ATTENTION: This equipment is not resistant to sunlight or other sources of UV radiation.

WARNING:

- This equipment shall be mounted in an ATEX-certified enclosure with a minimum ingress protection rating of at least IP54 (as defined in EN 60529) and used in an environment of not more than Pollution Degree 2 (as defined in EN 60664-1) when applied in Zone 2 environments. The enclosure must have a tool-removable cover or door.
- This equipment shall be used within its specified ratings defined by Rockwell Automation.
- Provision shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 140% of the rated voltage when applied in Zone 2 environments.
- This equipment must only be used with ATEX certified Rockwell Automation backplanes.
- Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
- Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.

ATTENTION: Prevent 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:

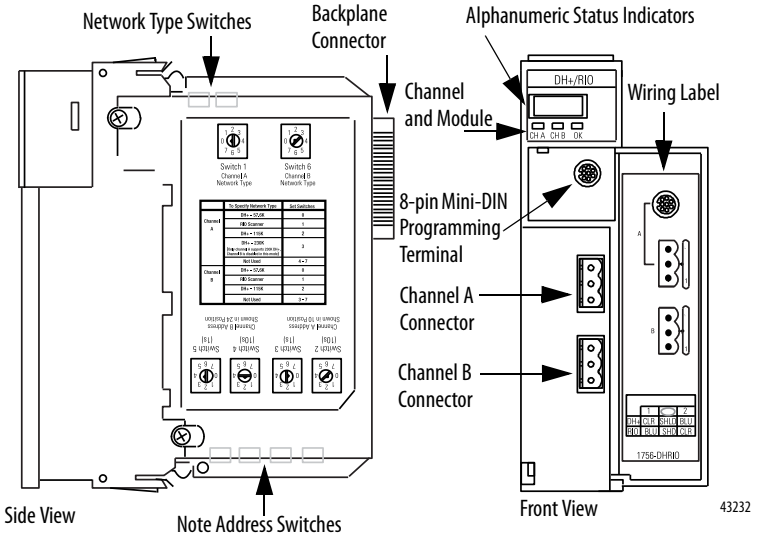
- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe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

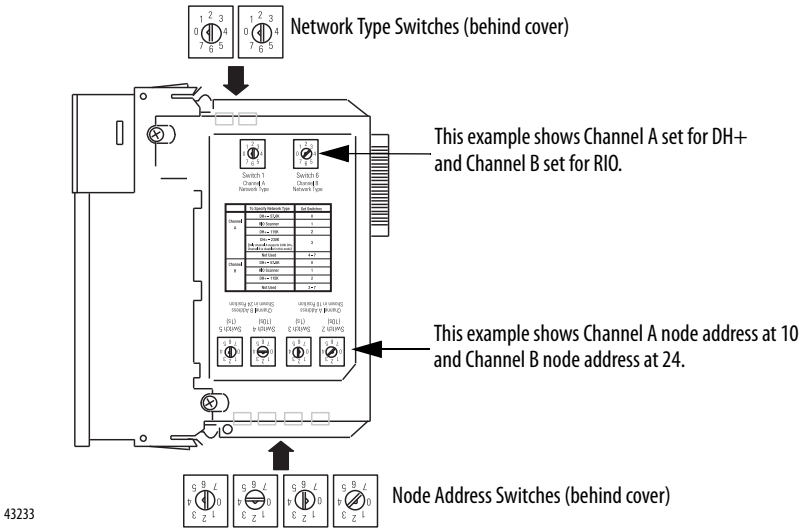
Before You Begin

Follow these procedures before installing the module.

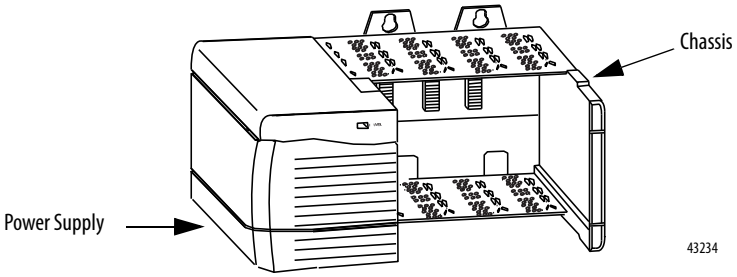
ATTENTION: If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

1. Identify the module features, as shown.





2. Install and connect a ControlLogix chassis and power supply.



3. Set the network type switches for each channel.

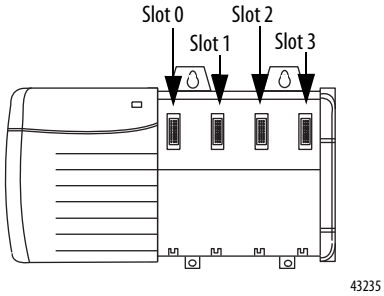
If the network type is DH+, you must also set the node address switches for that channel.

IMPORTANT If you are using the remote I/O network, do not set node address switches.

For each channel, you can select a node address within the range of 00...77.

4. Determine module slot location.

This example shows chassis slot numbering in a 4-slot chassis. Slot 0 is the first slot and is the left most slot in the rack (the first slot to the right of the power supply). You can use any size ControlLogix chassis and install the module in any slot.

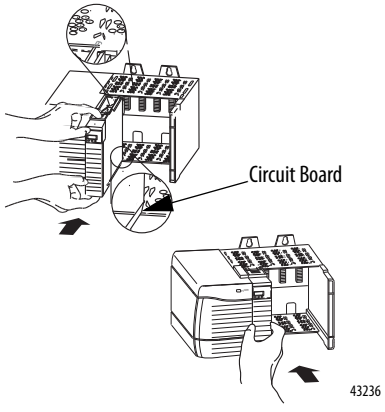


You can use multiple 1756-DHRIO or 1756-DHRIOXT modules in the same chassis.

Install the Module

Follow these steps to install the module.

1. Align the circuit board wit the top and bottom guides in the chassis.
2. Slide the module into the chassis.
3. Make sure the module backplane connector properly connects to the chassis backplane.



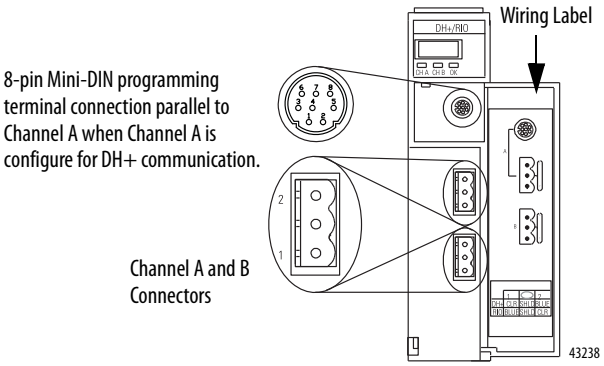
If you are replacing a module with an identical one, and you want to resume identical system operation, you must install the new module in the same slot.

Wire the Module

Wire the connectors for the module channels.

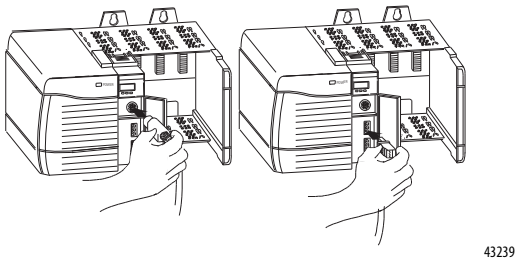
WARNING: If you connect or disconnect the communications cable with power applied to this module or any device on the network, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.



Pin Assignments for Channel A and B Connectors			
DH+		**Remote I/O**	
Pin Numbers	**Description**	**Pin Number**	**Description**
1	Clear	1	Blue
	Shield		Shield
	Blue	2	Clear

4. Connect the module to the programming terminal and Data Highway Plus or remote I/O network.



WARNING: The local programming terminal port is intended for temporary use only and must not be connected or disconnected unless the area is assured to be nonhazardous.

For hazardous locations, use the following Rockwell Automation cable for the programming terminal connection: 1784-U2DHP.

5. Apply chassis power.
6. Check power supply and module status.

Network Connectors and Cable

The following network connectors and cable are available for the modules.

Parts	Requirements
DH-RIO/DH+	Belden 9463 twinaxial
DH-RIOXT/DH+	Belden 89463 twinaxial
Programming (nonhazardous)	1784-CP
Programming (hazardous)	1784-U2DHP

Notes:

Using Programming Software in DH+ Applications

What This Chapter Contains

This chapter describes how to use programming software with your 1756-DHRIO and 1756-DHRIOXT modules in DH+ applications, including a brief discussion of how to use each. For more information on these software, see the online help in each.

Select the Correct Software

The programming software you need is dependent on what products you are using with the 1756-DHRIO and 1756-DHRIOXT modules. The following table explains what software is needed for your application.

If you are using this product with the 1756-DHRIO module to read/write data in a DH+ application:	You must use this software:
PLC controllers	RSLinx® RSLogix 5
SLC controllers	RSLinx RSLogix500
ControlLogix controllers	RSLinx Studio 5000 environment

Use RSLinx to Create a Routing Table

DH+ protocols do not use the Control and Information Protocol (CIP), the communication protocol used in the ControlLogix architecture. The 1756-DHRIO and 1756-DHRIOXT modules are the transition point from the DH+ network to ControlLogix. In this capacity, the 1756-DHRIO and 1756-DHRIOXT modules serve as the DH+ message source and require a full message route, or path, to deliver the message. A routing table, using link IDs and node addresses, provides the full path.

What Is a Routing Table?

Before you can create a routing table for your 1756-DHRIO and 1756-DHRIOXT modules, you must assign link IDs to all networks (including ENET and CNET) that route information through the module. Link IDs are numbers from 1...199.

DH+ module addressing provides the link IDs and node addresses. The routing table translates link IDs and node address information into path, or routing, information. Thus, the routing table specifies a 'map' to other links in the system. Routing tables are configured at each node to build accurate connections.

ControlLogix supports Pyramid Integrator (PI) routing and is backward-compatible with DH+ products. The architecture also provides newer routing protocols that are designed to make it easier to maintain a system. The 1756-DHRIO and 1756-DHRIOXT modules, as the transition points between the ControlLogix architecture and the DH+ network, enable ControlLogix to use new protocols while maintaining the option of backward-compatibility with DH+ products.

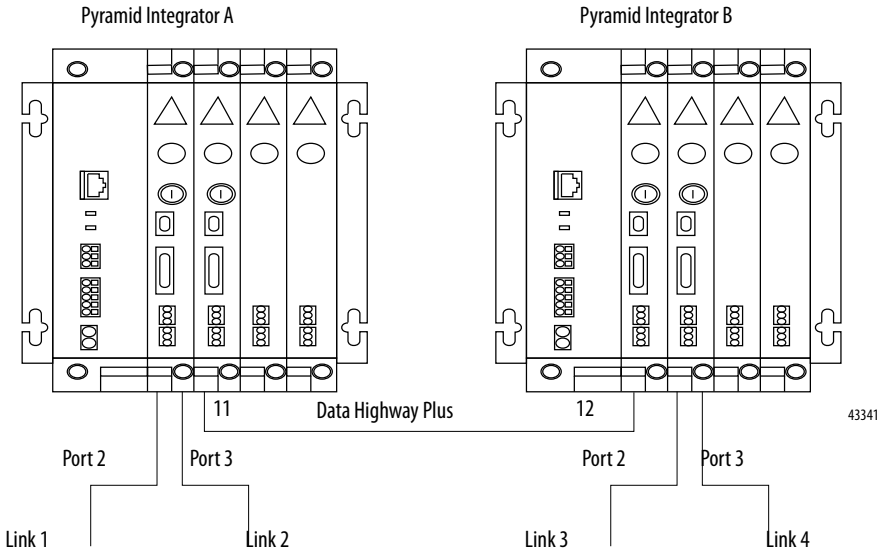
Pyramid Integrator Emulation

Each Pyramid Integrator chassis has a routing table in it that tells the chassis where each DH+ link is in relation to that chassis. The routing table uses a *link ID* to identify each link. You must enter a port for each link that is local to that chassis and a bridge address for each link that is remote from that chassis.

Each bridge can have a list of link IDs that are accessible through that bridge. A bridge can be any device that supports the Pyramid Integrator style of routing, including the following:

- Pyramid Integrator
- ControlLogix chassis
- WinLinx Gateway
- RSLinx workstation hosting DDE topics or applications that accept unsolicited messages

For example, the Pyramid Integrator system shown in the following figure uses the routing tables described in the following tables.



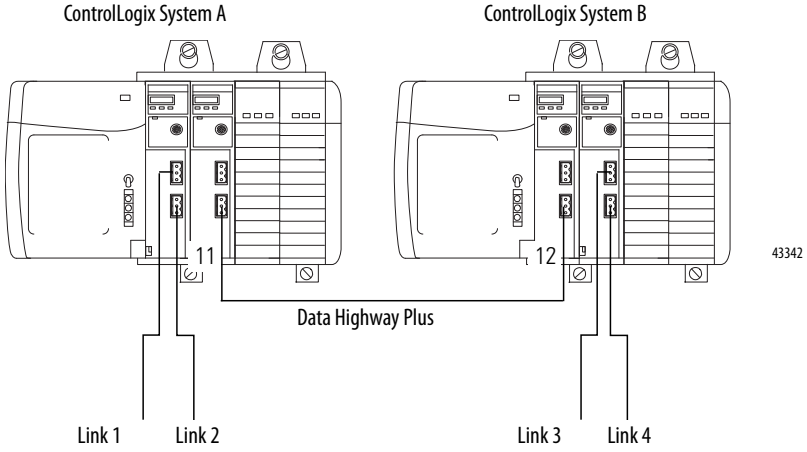
System A Routing Table

Link ID	Module and Port	Type	Bridge
1	1KA-2	Local	NA
2	1KA-3	Local	NA
3	2KA-2	Remote	12
4	2KA-3	Remote	12

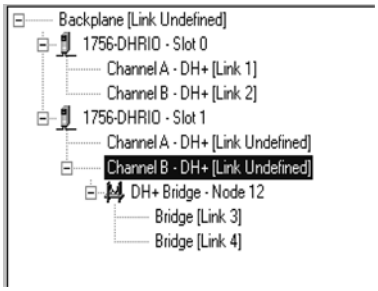
System B Routing Table

Link ID	Module and Port	Type	Bridge
1	1KA-2	Remote	11
2	1KA-3	Remote	11
3	2KA-2	Local	NA
4	2KA-3	Local	NA

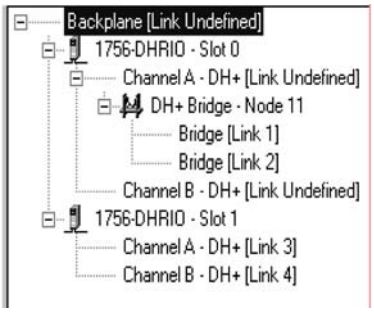
An equivalent routing (via the DH+ network) with ControlLogix is shown in the following figure.



ControlLogix System A routing table in RSLinx software



ControlLogix System B routing table in RSLinx software



ControlLogix Routing

In the ControlLogix system, you complete the same tasks as in Pyramid Integrator Emulation; however, the presentation is graphical instead of tabular.

The ControlLogix routing protocols use CIP, a message-based protocol that implements a relative path to send a message from the source device in a system to the destination device. In this way, the source device in a networks system contains the path information that steers the message along the proper route to reach its destination. Because the source device holds this information, other devices along the path simply pass this information; they do not need to store it. ControlLogix routing has two significant benefits:

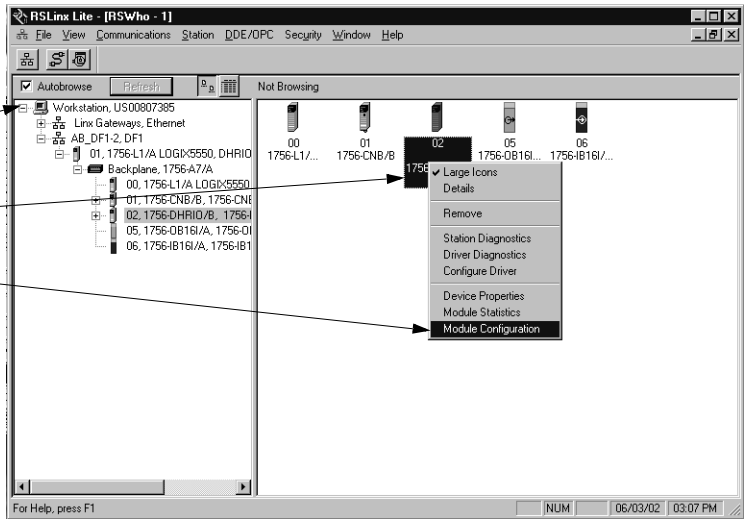
- You do not need to configure routing tables in the *bridging* module, greatly simplifying maintenance and module replacement.
- You maintain full control over the route taken by each message, enabling you to select alternative paths for the same end device.

Create the Routing Table

To create a routing table for your application, follow these steps:

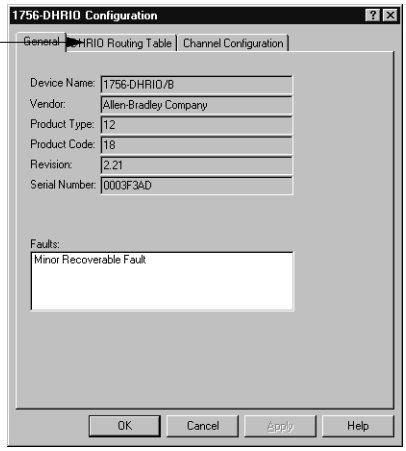
1. Start RSLinx.
2. Browse the network.
3. Use the left-side navigation bar to see your DH+ application, as shown in the following example.

1. Expand the configuration tree until your application appears on the right side of the dialog box.
2. Right-click the 1756-DHRIO or 1756-DHRIOXT module's icon to see the menu.
3. Click Module Configuration.



4. When the 1756-DHRIO Configuration pop-up appears, select the DHRIO Routing Table tab.

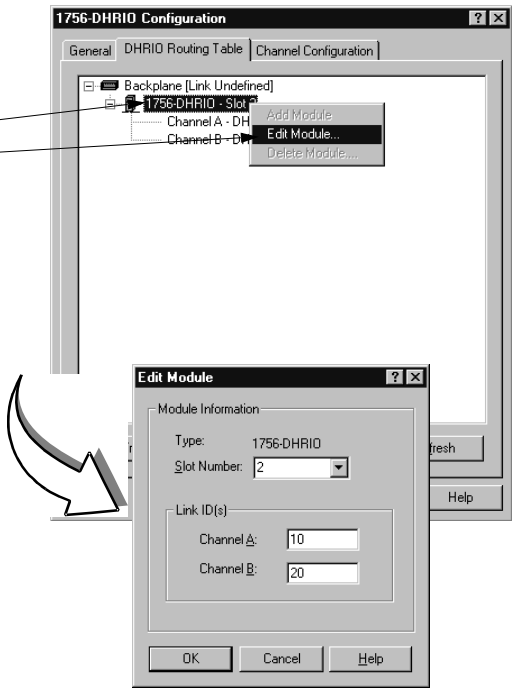
DHRIO Routing Tab



You must use RSLinx software to build the routing table based on the 1756-DHRIO and 1756-DHRIOXT modules in the ControlLogix chassis. Each link ID (that is chassis backplane, channels A and B of any 1756-DHRIO and 1756-DHRIOXT modules in the chassis) is initially undefined.

5. You must assign link IDs, as shown below.

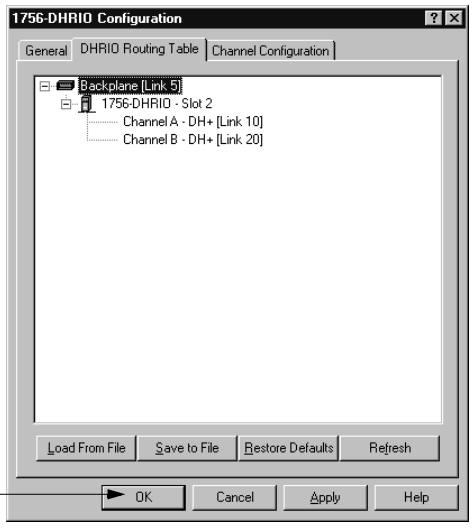
1. Right-click the 1756-DHRIO module to see the menu.
2. Click Edit Module.



IMPORTANT Keep track of your Link ID assignments. You need the Link ID values when you send messages via Studio 5000 environment software.

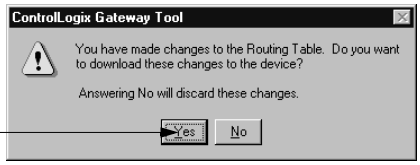
6. To assign a Link ID for the chassis backplane, follow the procedure described in step 5. When you are finished assigning Link IDs, your dialog box will look similar to the one below.

Click OK.



The software prompts you to download routing table changes.

Click OK.

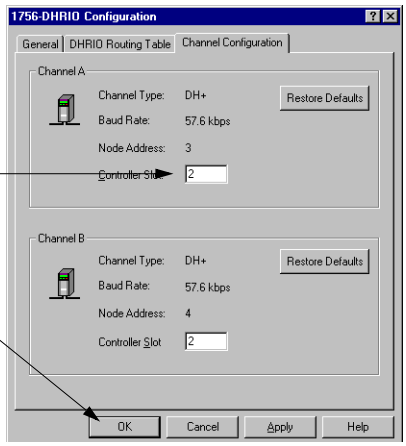


When the routing table is downloaded, RSLinx returns to the Browsing screen. This completes the routing table creation process.

Configure the Controller Slot

The Controller Slot is the physical location of a ControlLogix controller in a DH+ application. The default setting is slot 0. If necessary, use the Channel Configuration tab to change the Controller Slot number.

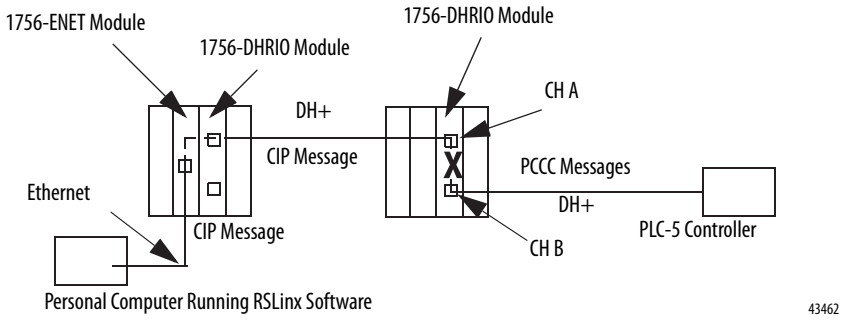
1. Change the Controller slot.
2. Click OK.



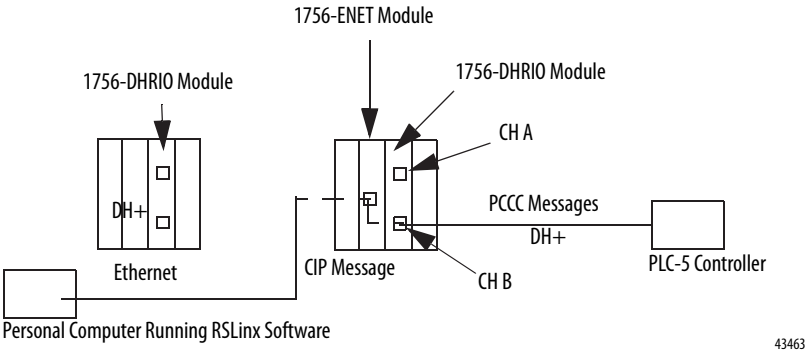
Use RSLinx Software to Send Control and Information Protocol Messages

The 1756-DHRIO and 1756-DHRIOXT modules cannot receive Control and Information Protocol (CIP) messages on one of its DH+ channels to send the messages as Programmable Controller Communication Command (PCCC) messages out of its second DH+ channel.

RSLinx software uses the CIP protocol when it sends messages via Ethernet or ControlNet networks. Therefore, it cannot route an RSWho message from an 1756-ENET module to one 1756-DHRIO or1756-DHRIOXT module, to channel A of a second 1756-DHRIO or 1756-DHRIOXT module in a second chassis, and out of channel B of the second 1756-DHRIO or1756-DHRIOXT module (see the X in the following figure).



To do this, use the 1756-ENET module to connect to a second ControlLogix chassis that contains the second 1756-DHRIO or 1756-DHRIOXT module, as shown in the following figure.



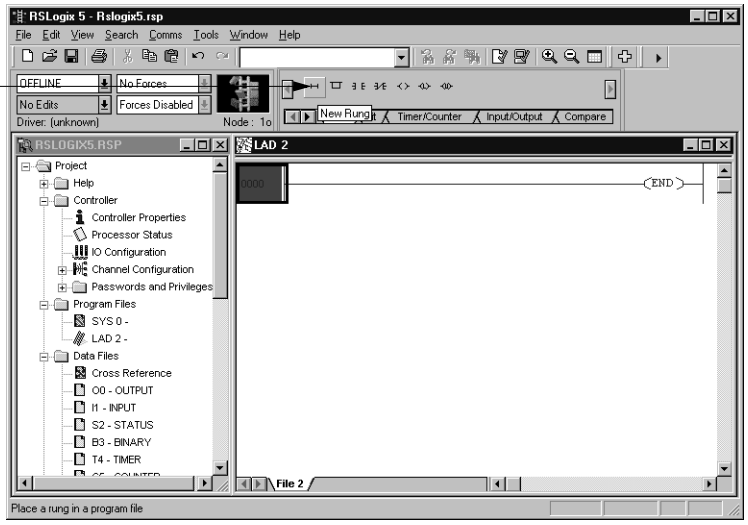
Use RSLogix 5

RSLogix 5 software is required to send read/write message instructions from PLC-5s in DH+ applications. To send messages, follow these steps:

IMPORTANT This section offers a brief description of how to send a message via RSLogix 5 software. For a full description of how to use the software, see the online help.

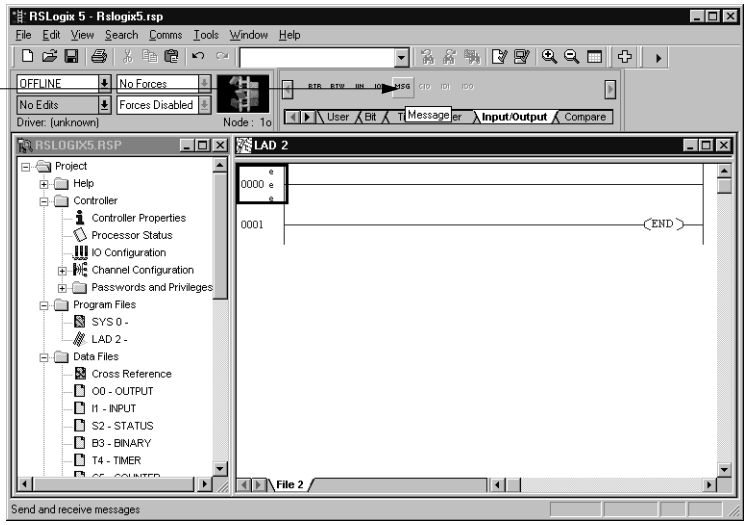
1. Start the RSLogix 5 software.
2. Begin a new project or open a project.
3. Add a rung to the ladder logic portion of the project.

Click here to add a rung.



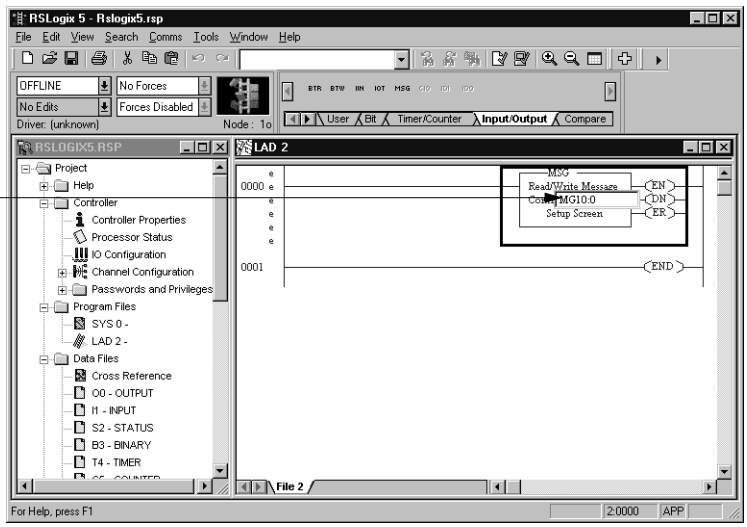
4. Add a message instruction (MSG) to the new rung.

Click here to add a MSG.



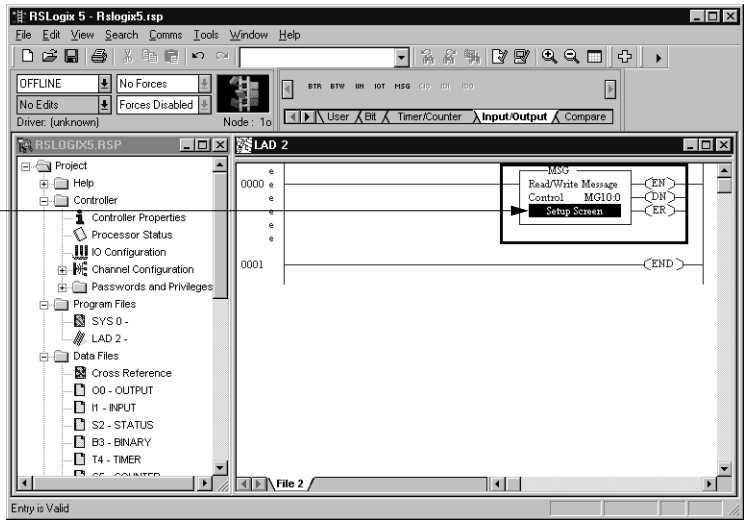
5. Change the MSG instruction Control.

Type the new Control value here. This example uses a Control of MG10:0.



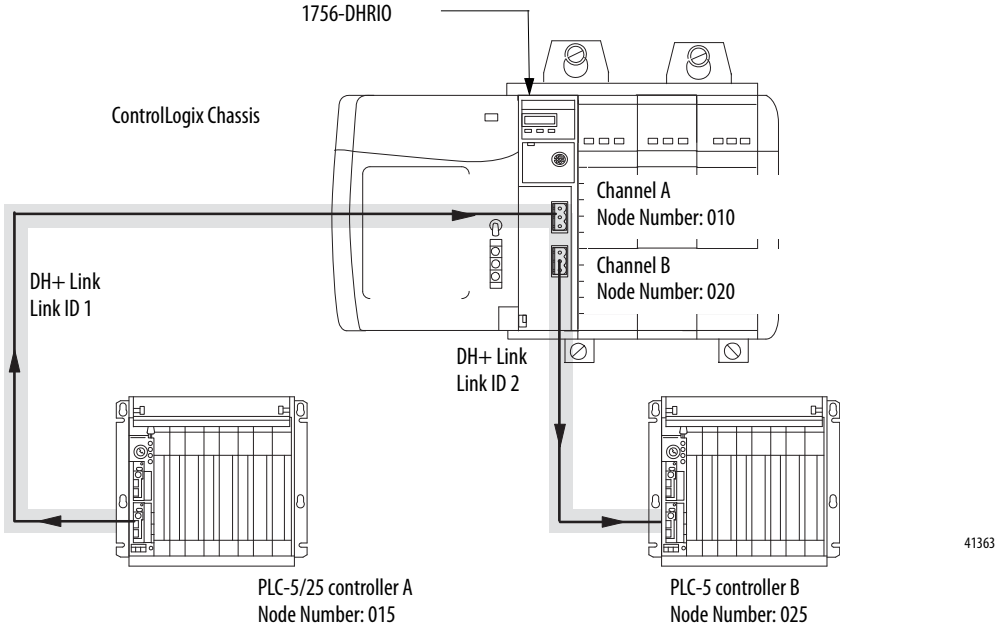
6. Configure the MSG instruction on the Setup dialog box.

Double-click Setup Screen to access the message instruction dialog box.



Studio 5000 Environment DH+ Application Example

The following figure shows an example DH+ application where PLC-5/25 processor A writes data, via a message instruction and the 1756-DHRIO or 1756-DHRIOXT module, to PLC-5 processor B.



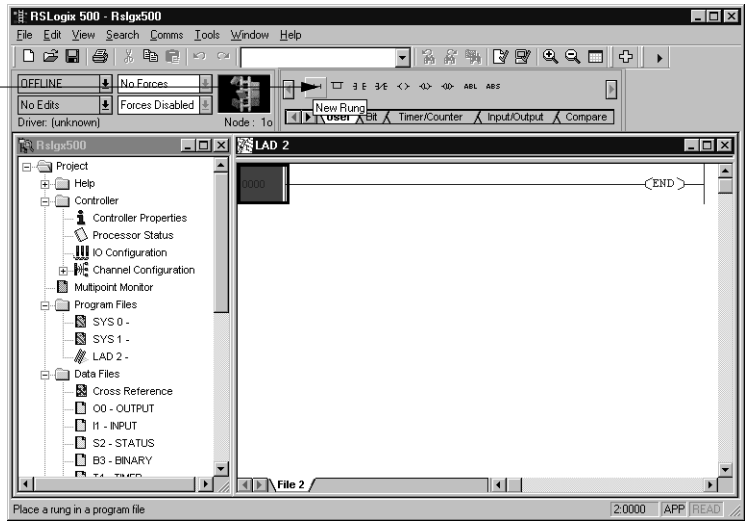
Use RSLogix 500

RSLogix 500 software is required to send read/write message instructions from SLC-500s in DH+ applications. To send messages, follow these steps:

IMPORTANT This section offers a brief description of how to send a message via RSLogix 500 software. For a full description of how to use the software, see the online help.

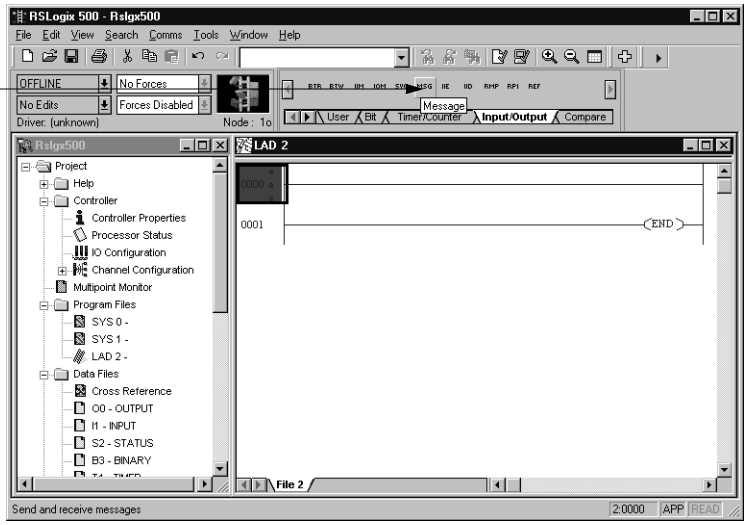
1. Start the RSLogix 500 software.
2. Begin a new project or open a project.
3. Add a rung to the ladder logic portion of the project.

Click here to add a rung.



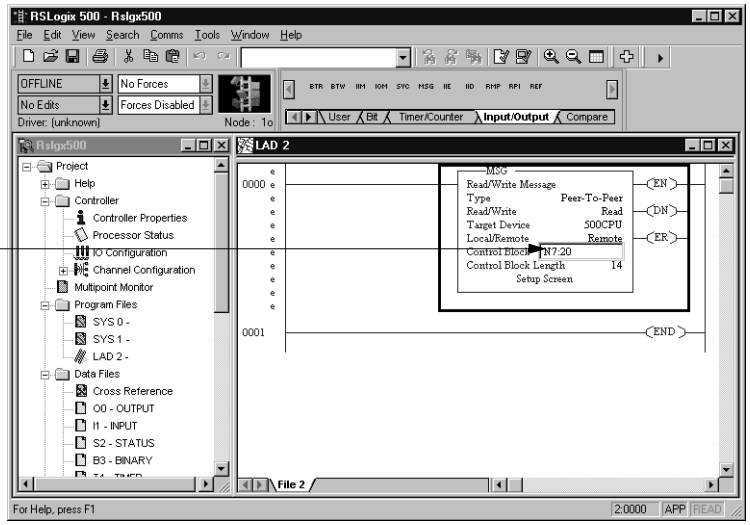
4. Add a message instruction (MSG) to the new rung.

Click here to add a MSG.



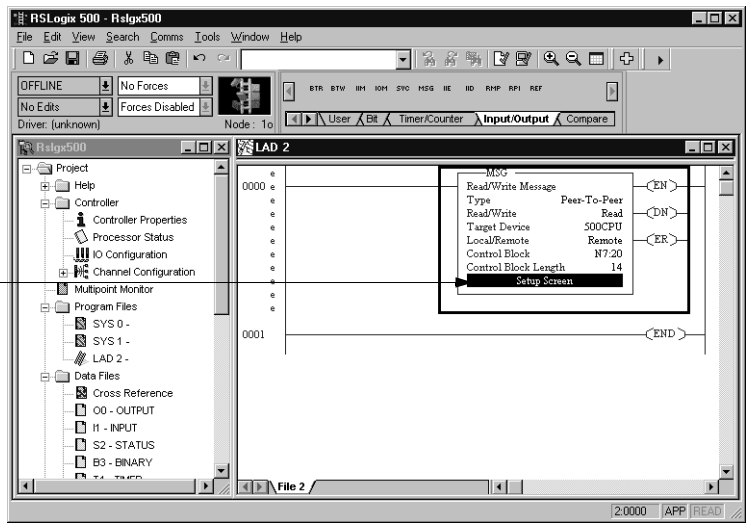
5. Change the MSG instruction Control.

Type the new Control value here. This example uses a Control of N7:20.



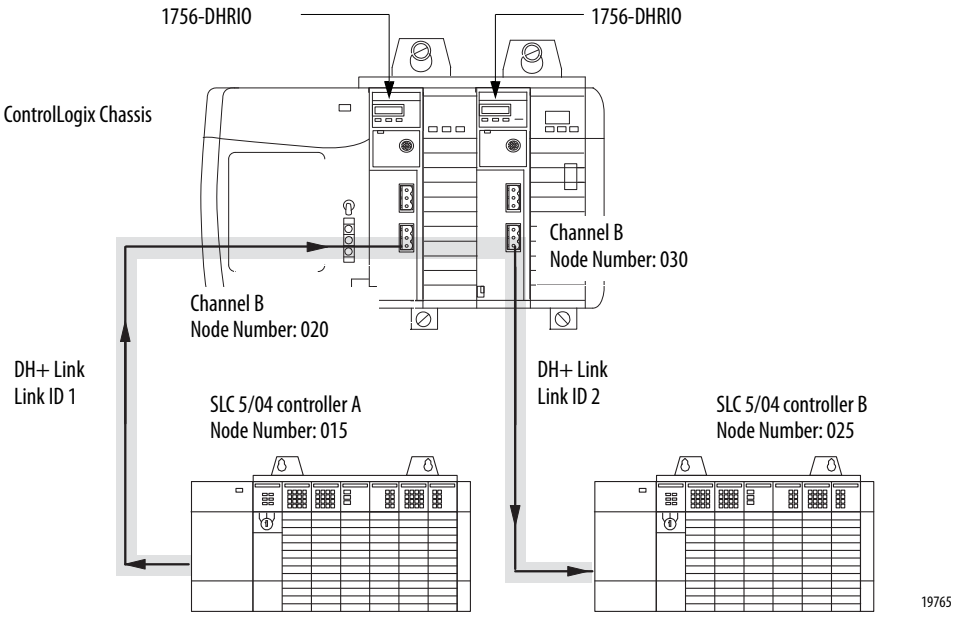
6. Configure the MSG instruction on the Setup dialog box.

Double-click Setup Screen.



RSLogix 500 DH+ Application Example

The following figure shows an example DH+ application that includes SLC-5 processors using the 1756-DHRIO and 1756-DHRIOXT modules to write message instructions.



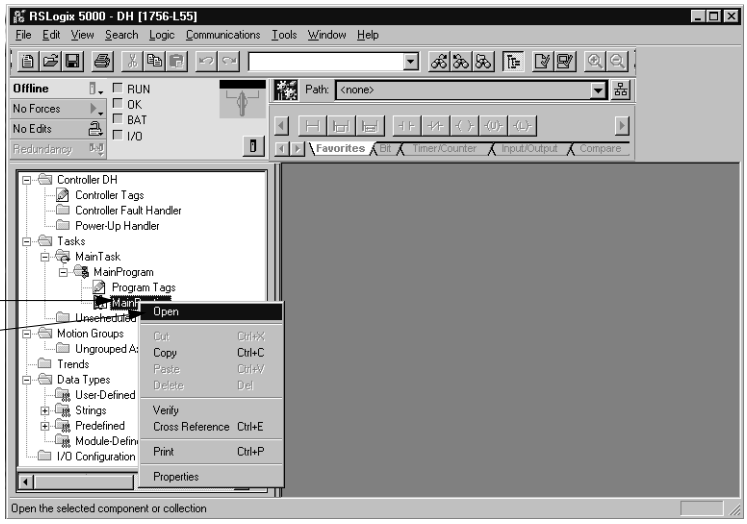
Use the Studio 5000 Environment

The Studio 5000 environment is required to send read/write message instructions from a ControlLogix controller in DH+ applications. To send messages, follow these steps:

IMPORTANT You are not required to add the 1756-DHRIO or 1756-DHRIOXT module to the Controller Organizer to send message instructions from a ControlLogix controller in a DH+ application.

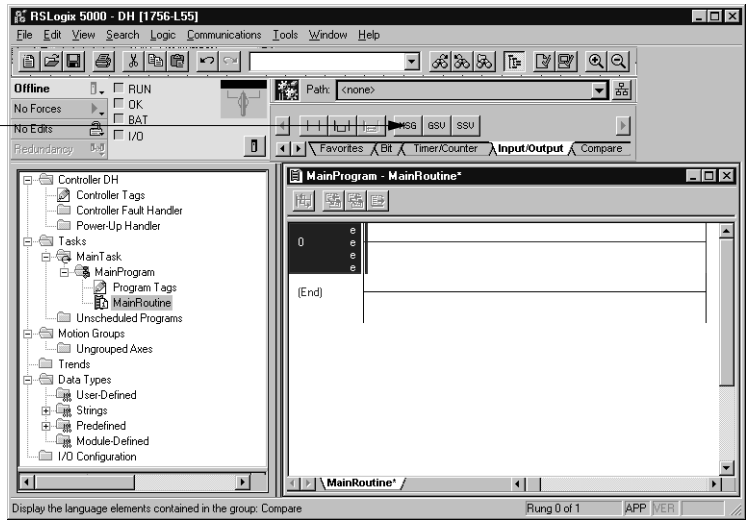
1. Start the Studio 5000 environment.
2. Begin a new project or open a project.
3. Add a message instruction (MSG) to the new rung of ladder logic.

1. Right-click Main Routine to see the menu.
2. Click Open.



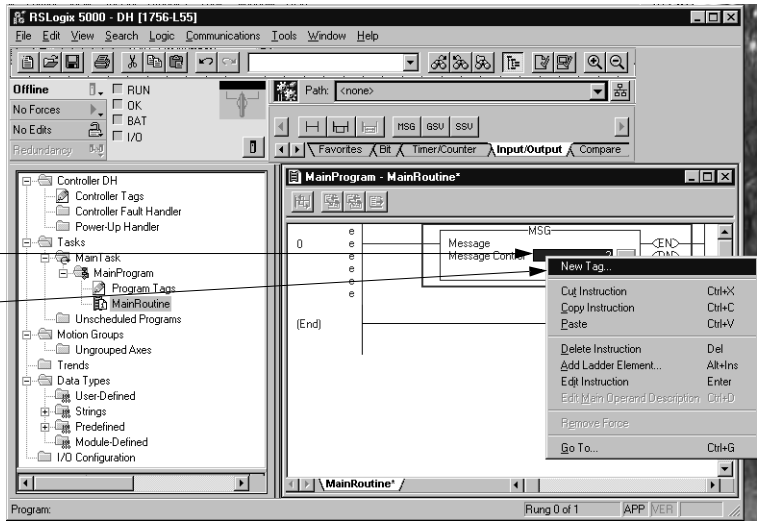
4. Add a message instruction (MSG) to the new ladder logic rung that appears.

Click the MSG button.



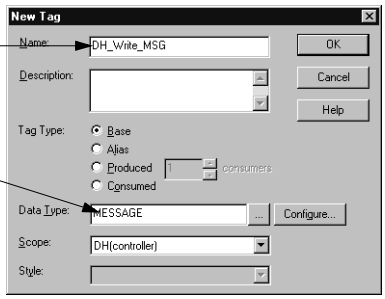
5. Add a new tag to the MSG instruction.

1. Right-click the question mark (?) the menu.
2. Click New Tag.



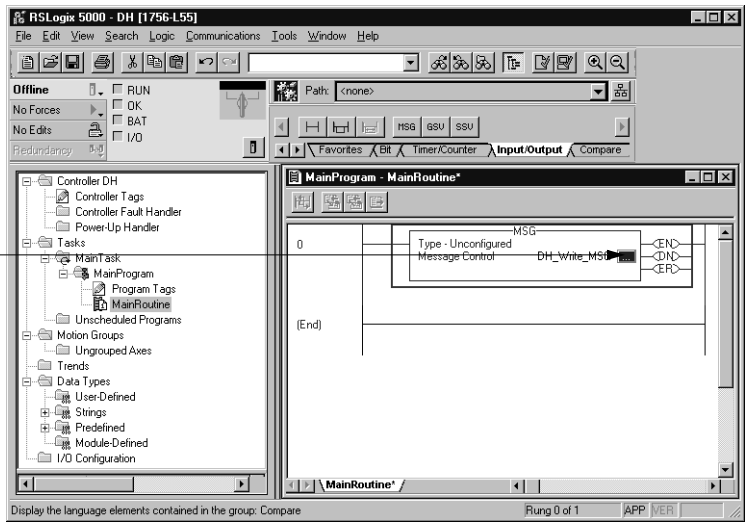
6. Name and define the new tag.

1. Name the tag.
2. Make sure this tag is of the MESSAGE type.



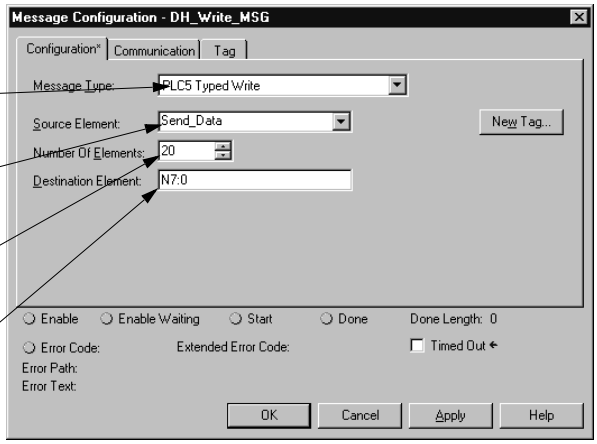
7. Access the message type configuration and communication parameters.

Double-click the ellipsis (. . .) button.



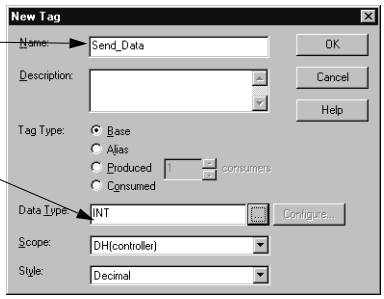
8. Change the message configuration.

1. Choose the Message Type from the pull-down list.
2. Choose the Source Element from the pull-down list if the tag exists. If the tag does not exist, use the New Tag feature (shown below) to create it.
3. Type the Number of Elements being written.
4. Type the Destination Element. In this example, the Destination Element is a PLC-5 data table.



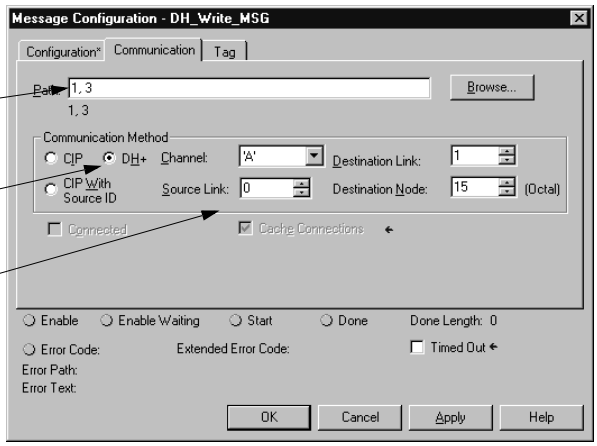
If you create a Tag, you must:

1. Name the tag.
2. Make sure the Data Type is Integer (INT).



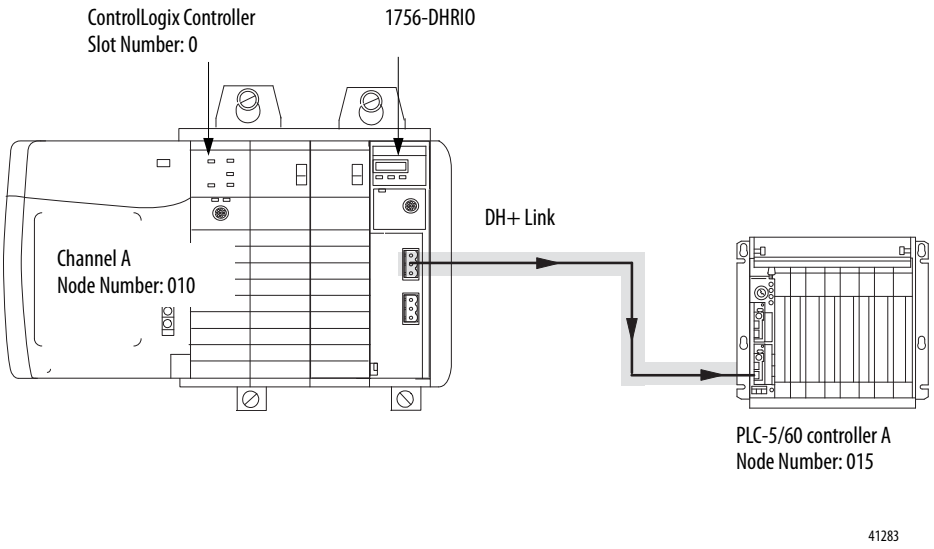
9. Set the communication path for the message instruction.

1. Set the path. For DH+ applications, the number order must match the ControlLogix chassis backplane (1) and the slot number of the local 1756-DHRIO and 1756-DHRIOXT modules.
2. Select the DH+ Communication Method.
3. Enter the information from the routing table for this module.

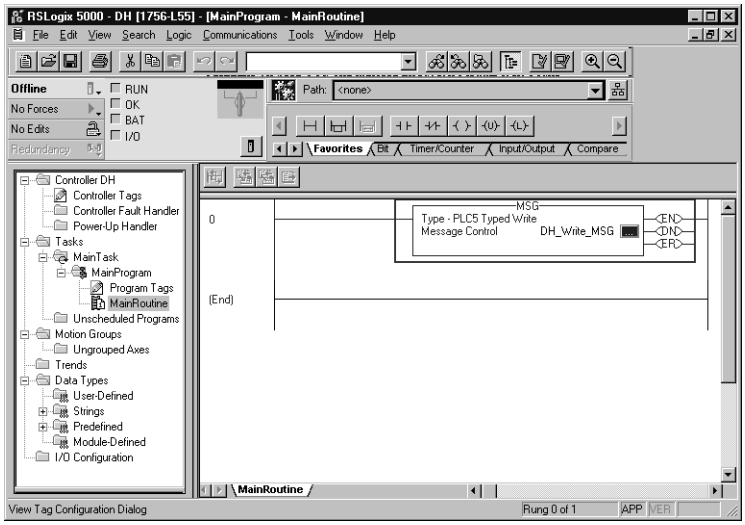


Studio 5000 Environment DH+ Application Example

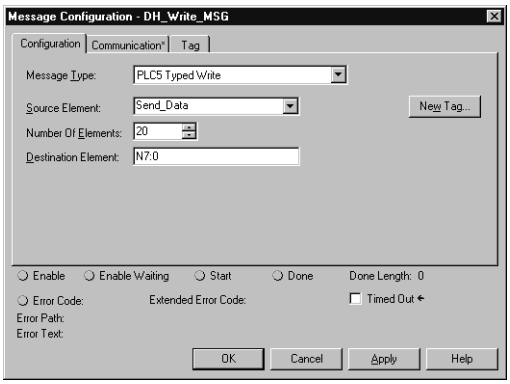
The following figure shows an example DH+ application that includes a ControlLogix controller using the 1756-DHRIO and 1756-DHRIOXT modules to write message instructions.



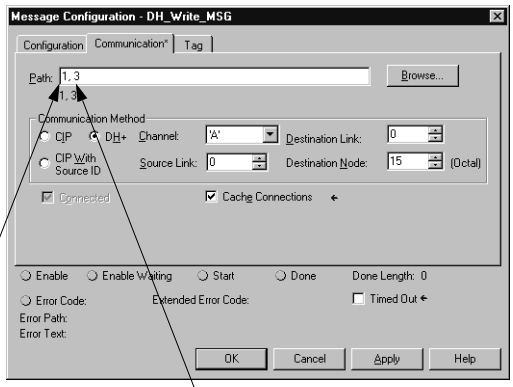
For this example, you must follow the basic steps described beginning on page 58. The message instruction's ladder logic's rung and configuration and communication parameters will match the ones shown below.



Configuration Pop-Up Dialog Box



Communication Pop-Up Dialog Box



1 represents the ControlLogix backplane (as the message leaves the ControlLogix controller)

3 represents the location of the 1756-DHRIO module (that is slot 3)

Define Connection Paths

You can configure a connection path when configuring controller-to-controller communication or workstation-to-controller communication. The connection path starts with the controller or the communication card in the workstation.

The following steps construct a communication path:

1. Separate the number or address entered in each step with a comma. All numbers are in decimal by default. You can enter any number, other than an Ethernet IP address, in another base by using the IEC-1131 prefix (8# for octal, 16# for hexadecimal). Ethernet IP addresses are decimal numbers separated by periods.
2. To construct the path, you enter one or more *path segments* that lead to the controller. Each path segment takes you from one module to another module over the ControlBus backplane or over a DH+, ControlNet, or Ethernet networks.

   You can have a maximum of 8 paths leading to the controller.

Each *path segment* contains two numbers: x,y

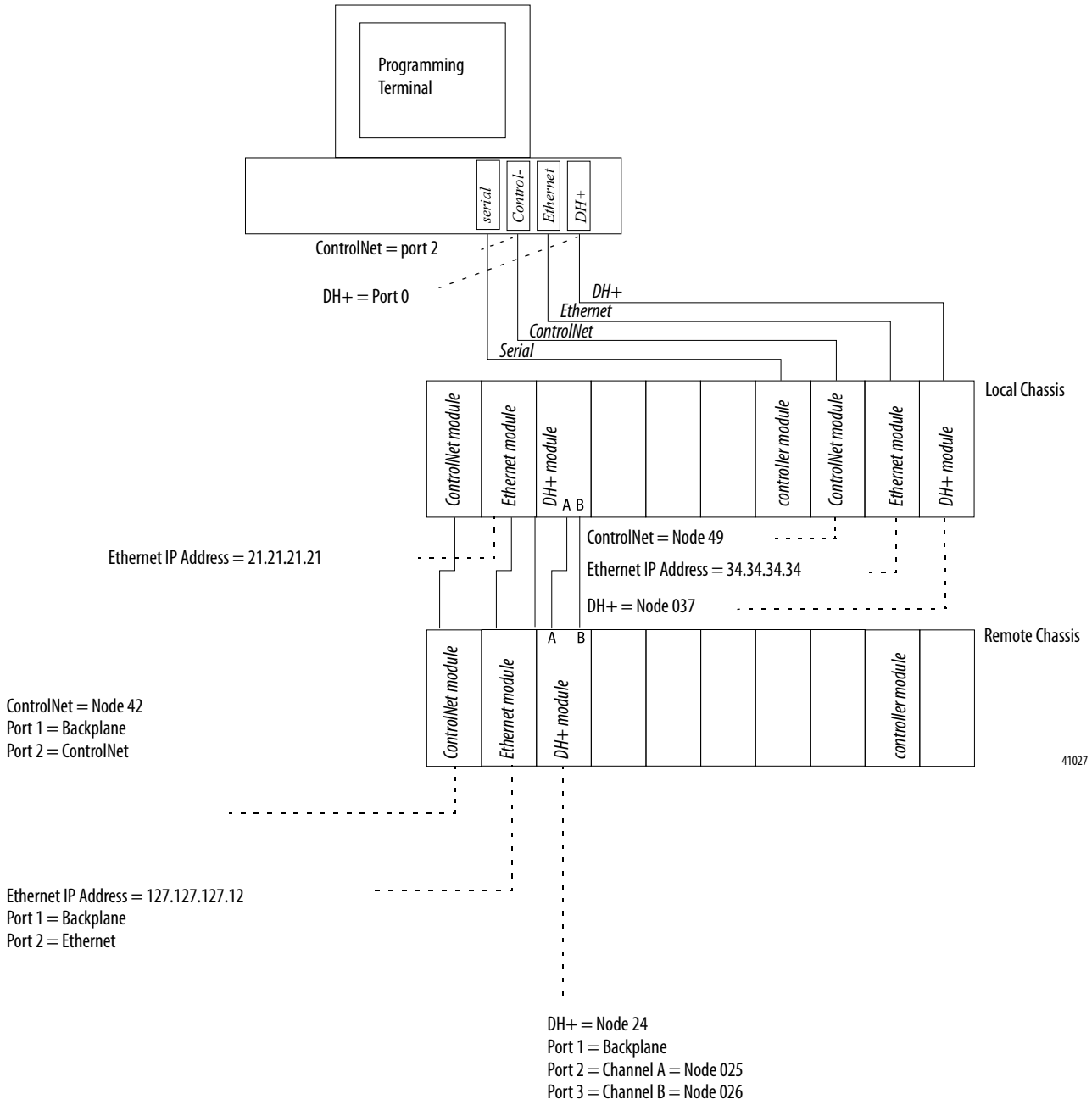
Where:

This	Is
x	number of the type of port you use to exit from the module you are at: 0 DH+ port from a KT card 1 backplane from any 1756 module 2 RS232 port from a 1756-L1 controller 2 ControlNet port from a KTC card or a 1756-CNB module 2 Ethernet port from a 1756-ENET module 2 DH+ port over channel A from a 1756-DHRIO or 1756-DHRIOXT module 3 DH+ port over channel B from a 1756-DHRIO or 1756-DHRIOXT module
,	separates the first number and second number of the path segment
y	address of the module you are going to For — Address means: ControlBus backplane — slot number (0-16 decimal) DF1 network — station address (0-254) ControlNet network — node number (1-99 decimal) DH+ network — node number (0-77 octal) Ethernet network — IP address (four decimal numbers separated by periods)

If you have multiple path segments, you must also separate each path segment with a comma (,).

Connection path examples

The following examples are based on this system:



Network	Example	Description
serial	Programming terminal to controller module in logical rack. Use DF1 Upload logic from local controller (controller is directly connected to the programming terminal).	Configure DF1 driver. Leave connection path blank.
	Programming terminal to controller module in remote rack. Use DF1 (connected to controller in local rack) Use ControlNet to bridge to remote chassis.	Configure the DF1 driver. Enter connection path: 1,0,2,42,1,9 1 = backplane port of the ControlLogix controller in slot 6 of the local chassis 0 = slot number of the 1756-CNB module in the local chassis 2 = ControlNet port of the 1756-CNB module in slot 0 of the local chassis 42 = ControlNet node of the 1756-CNB module in slot 0 of the remote chassis 1 = backplane port of the 1756-CNB module in slot 0 of the remote chassis 9 = slot number of the controller in the remote chassis
ControlNet	Programming terminal to controller module in remote chassis. Use ControlNet throughout the system.	Configure the ControlNet driver. Enter connection path: 2, 49, 1, 0, 2, 42, 1, 9 2 = ControlNet port of the KTC communication card in the workstation 49 = ControlNet node of the 1756-CNB module in slot 7 of the local chassis 1 = backplane port of the 1756-CNB module in slot 7 of the local chassis 0 = slot number of the 1756-CNB module in the local chassis 2 = ControlNet port of the 1756-CNB module in slot 0 of the local chassis 42 = ControlNet node of the 1756-CNB module in slot 0 of the remote chassis 1 = backplane port of the 1756-CNB module in slot 0 of the remote chassis 9 = slot number of the controller in the remote chassis
Ethernet	Programming terminal to controller module in remote rack. **IMPORTANT**: Connection path excludes path segment from Ethernet card in programming terminal to Ethernet module in local chassis because Ethernet driver is configured for the Ethernet module in the local chassis. Bridge across Ethernet	Configure the Ethernet driver. Enter connection path: 1, 1, 2, 127.127.127.12, 1, 9 1 = backplane port of the 1756-ENET module in slot 8 of the local chassis 1 = slot number of the other 1756-ENET module in the local chassis 2 = Ethernet port of the 1756-ENET module in slot 1 of the local chassis 127.127.127.12 = IP address of the 1756-ENET module in the remote chassis 1 = backplane port of the 1756-ENET module in slot 1 of the remote chassis 9 = slot number of the controller in the remote chassis

Network	Example	Description
DH+	Program the controller in slot 9 of the remote chassis. Go from DH+ to the local chassis. Bridge to the remote chassis over ControlNet.	Configure the DH+ driver. Enter connection path: 0, 8#37, 1, 0, 2, 42, 1, 9 0 = DH+ port of the KT communication card in the workstation 8#37 = octal DH+ node of the 1756-DHRIO or 1756-DHRIOXT module in slot 9 of the local chassis 1 = backplane port of the 1756-DHRIO or 1756-DHRIOXT module in slot 9 of the local chassis 0 = slot number of the 1756-CNB module in the local chassis 2 = ControlNet port of the 1756-CNB module in slot 0 of the local chassis 42 = ControlNet node of the 1756-CNB module in slot 0 of the remote chassis 1 = backplane port of the 1756-CNB module in slot 0 of the remote chassis 9 = slot number of the controller in the remote chassis
	Program the controller in slot 9 of the remote chassis. Go from DH+ to the local chassis. Bridge across DH+ to the remote controller.	Configure the DH+ driver. Enter connection path: 0, 8#37, 1, 2, 3, 8#24, 1, 9 0 = DH+ port of the KT communication card in the workstation 8#37 = octal DH+ node of the 1756-DHRIO or 1756-DHRIOXT module in slot 9 of the local chassis 1 = backplane port of the 1756-DHRIO or 1756-DHRIOXT module in slot 9 of the local chassis 2 = slot number of the other 1756-DHRIO or 1756-DHRIOXT module in the local chassis 3 = Channel B of the 1756-DHRIO or 1756-DHRIOXT module in slot 2 of the local chassis, configured for DH+ 8#24 = DH+ node of the 1756-DHRIO or 1756-DHRIOXT module in slot 2 of the remote chassis 1 = backplane port of the 1756-DHRIO or 1756-DHRIOXT module in slot 2 of the remote chassis 9 = slot number of the controller in the remote chassis
ControlNet Ethernet DH+	Use several network connections across different network bridges: • DF1 (connected to controller module in local rack) • ControlNet to the remote chassis • Ethernet back to the local chassis • DH+ back to the remote chassis	Configure the DF1 driver (to handle worst case performance) Enter connection path: 1, 0, 2, 42, 1, 1, 2, 21.21.21.21, 1, 2, 2, 8#25, 1, 9 1 = backplane port of the ControlLogix controller in slot 6 of the local chassis 0 = slot number of the 1756-CNB module in the local chassis 2 = ControlNet port of the 1756-CNB module in slot 0 of the local chassis 42 = ControlNet node of the 1756-CNB module in slot 0 of the remote chassis 1 = backplane port of the 1756-CNB module in slot 0 of the remote chassis 1 = slot number of the 1756-ENET module in the remote chassis 2 = Ethernet port of the 1756-ENET module in slot 1 of the remote chassis 21.21.21.21 = IP address of the 1756-ENET module in slot 1 of the local chassis 1 = backplane port of the 1756-ENET module in slot 1 of the local chassis 2 = slot number of the 1756-DHRIO or 1756-DHRIOXT module in the local chassis 2 = Channel A of the 1756-DHRIO or 1756-DHRIOXT module in slot 2 of the local chassis, configured for DH+ 8#25 = DH+ node of the 1756-DHRIO or 1756-DHRIOXT module in slot 2 of the remote chassis 1 = backplane port of the 1756DHRIO or 1756-DHRIOXT module in slot 2 of the remote chassis 9 = slot number of the controller in the remote chassis

Messaging Between PLC-5 and SLC 5/04 Controllers

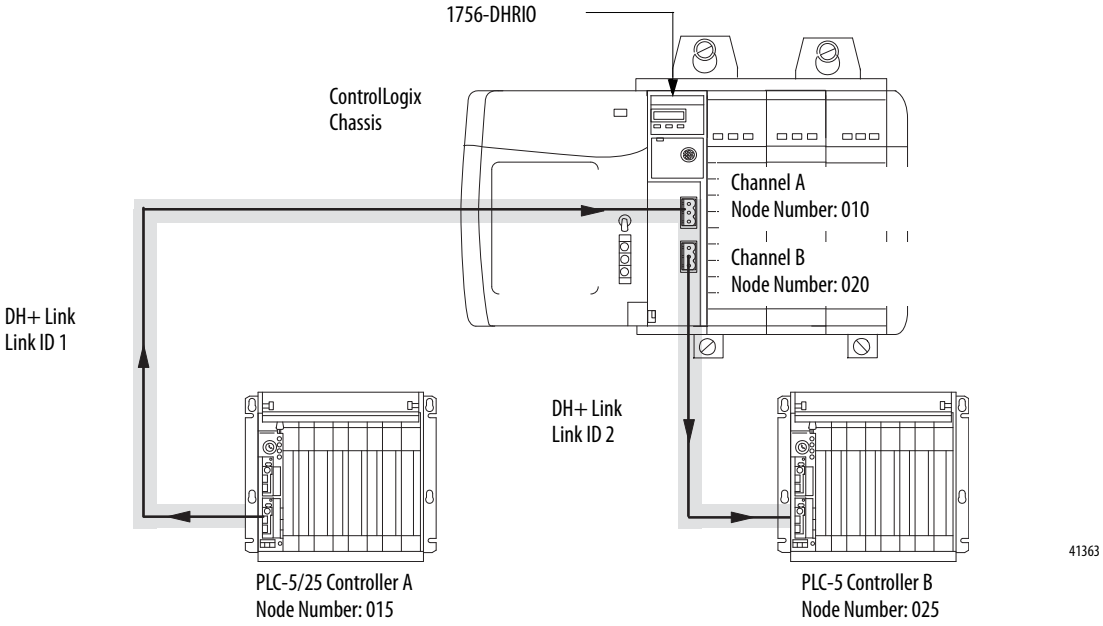
This chapter describes how to use DH+ messaging between PLC-5 and SLC 5/04 controllers.

IMPORTANT The examples use PLC-5 and SLC 5/04 controllers to send DH+ messages. In each case, the use of these devices is strictly for example purposes and not an indication of restrictions on the 1756-DHRIO and 1756-DHRIOXT modules. Examples using PLC-5 controllers could, in fact, use SLC 5/04 controllers and examples using SLC 5/04 controllers could use PLC-5 controllers.

DH+ Messaging: PLC-5 Controllers with One 1756-DHRIO

This application sends a DH+ message from PLC-5 controller A through a 1756-DHRIO module to PLC-5 controller B. Remote DH+ messaging is required to send the message.

The following figure illustrates the steps you must follow in this application.

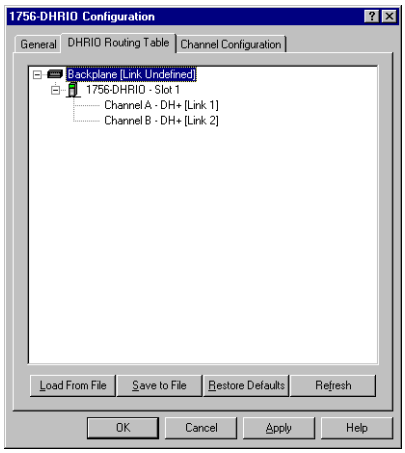


Configure the Module Switches

In this example, Channel A and Channel B on the 1756-DHRIO and 1756-DHRIOXT modules must be set for DH+.

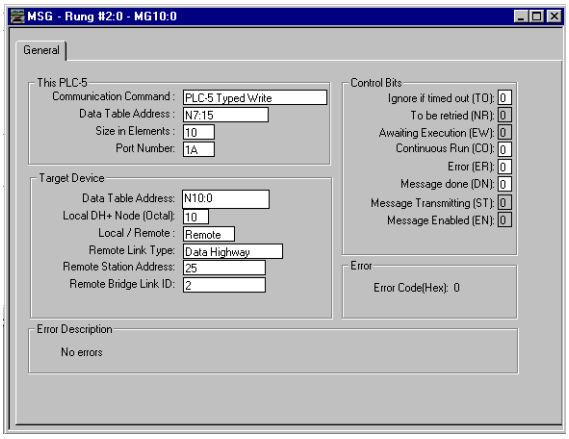
Configure a Routing Table for the 1756-DHRIO Module

Use RSLinx to configure a routing table for the modules as shown in the following figure.



Configure Message Instructions

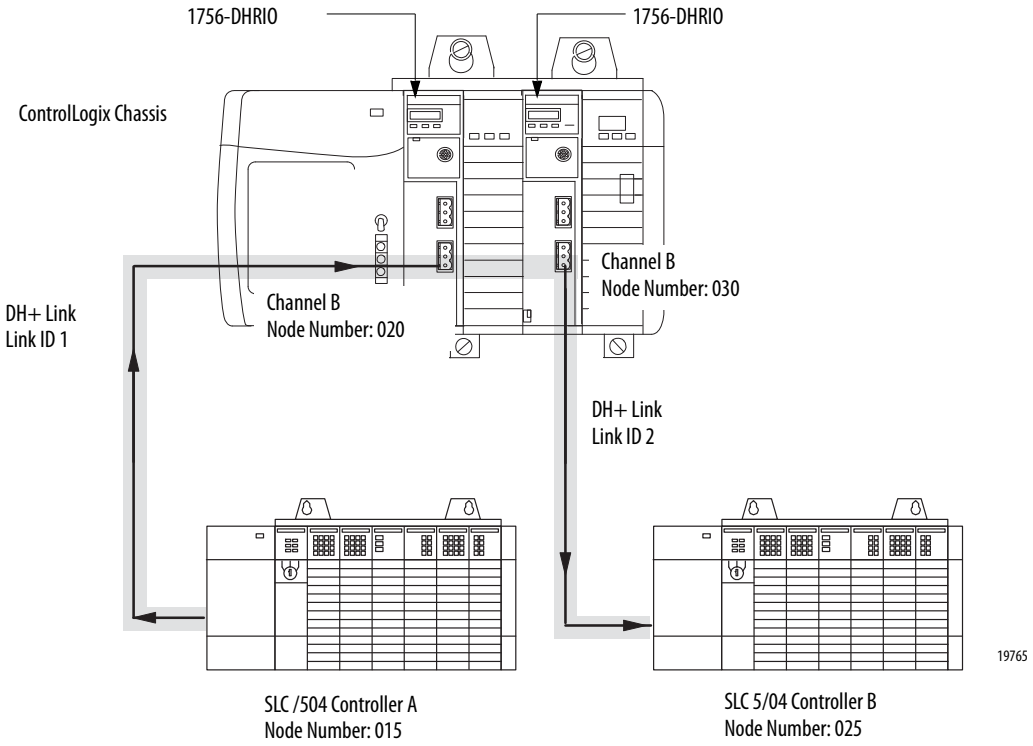
Use RSLogix 5 to configure the remote PLC-5 message instructions being sent to ControlLogix controller B. The following figure shows message instruction for this example.



DH+ Messaging: SLC 5/04 Controllers with Two Modules in One ControlLogix Chassis

This application sends a DH+ message from SLC 5/04 controller A through two 1756-DHRIO or 1756-DHRIOXT modules in the same chassis to SLC 5/04 controller B. Remote DH+ messaging is required to send the message.

The following figure illustrates the steps you must use in this application.

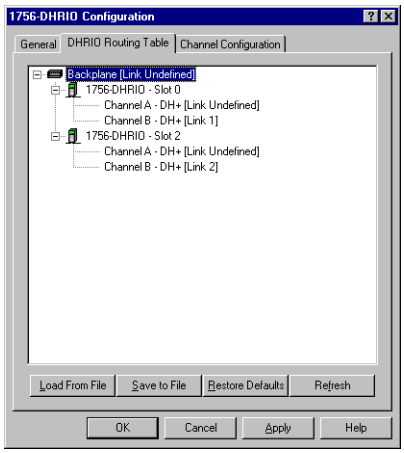


Configure the Module Switches

In this application, Channel B on the 1756-DHRIO and 1756-DHRIOXT modules must be set for DH+.

Configure a Routing Table for the 1756-DHRIO Modules

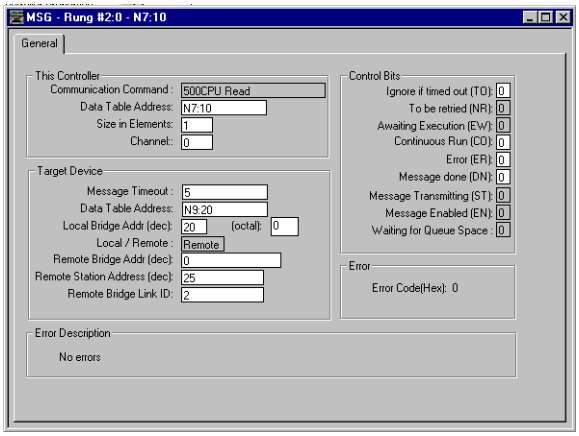
Use RSLinx to configure a routing table for the 1756-DHRIO and 1756-DHRIOXT modules. The following figure shows the routing table for this example.



TIP Because the 1756-DHRIO and 1756-DHRIOXT modules are in the same chassis, you must configure only one of the two routing tables and apply it to the modules.

Configure Message Instructions

Use RSLogix 500 software to configure the SLC-500 controller message instructions, as shown in the following figure.

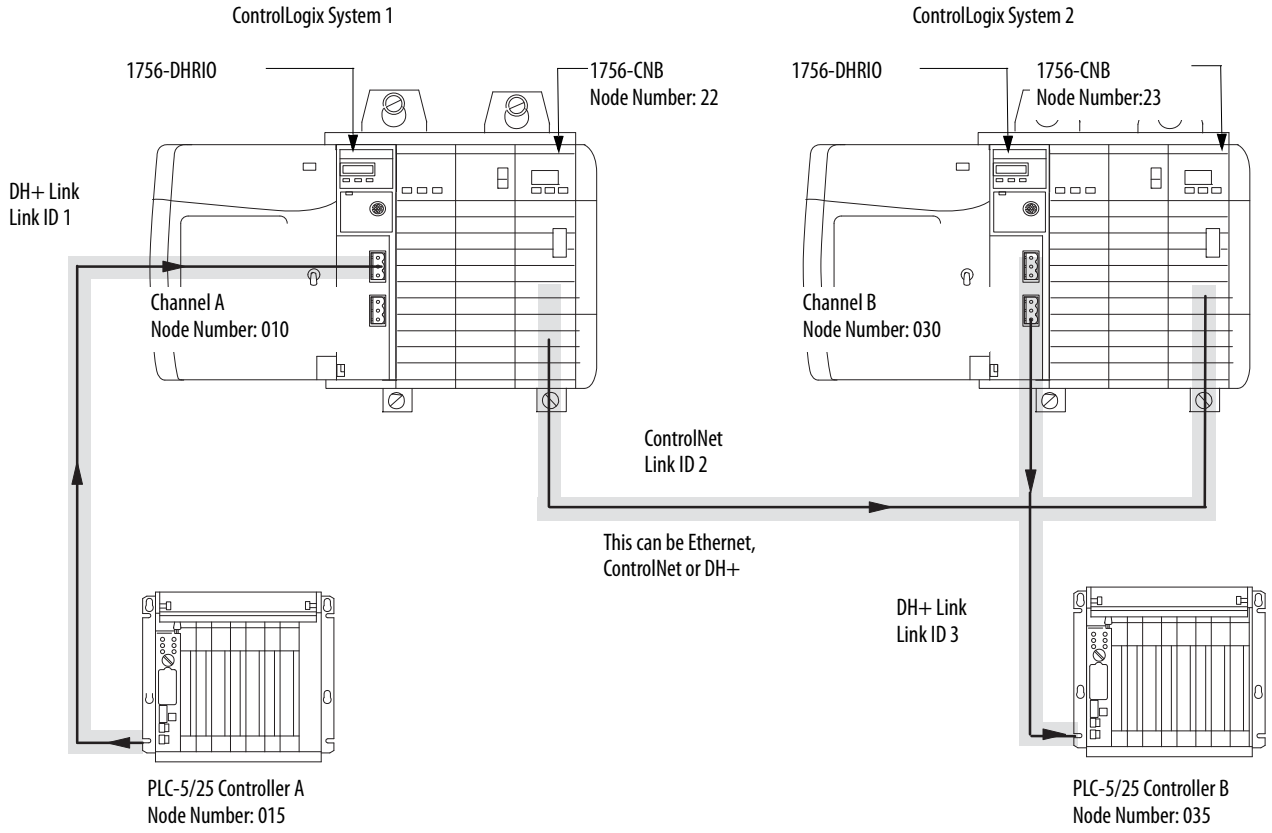


IMPORTANT RSLogix 500 software displays Nodes and link IDs in decimal. Also, in this application, a remote bridge address is not required.

DH+ Messaging: PLC-5 Controllers with Multiple ControlLogix Chassis

This application sends a DH+ message from PLC-5 controller A through 1756-DHRIO and 1756-DHRIOXT modules in separate chassis over ControlNet to PLC-5 controller B. Remote DH+ messaging is required to send the message.

The following figure illustrates the steps you must use in this application.

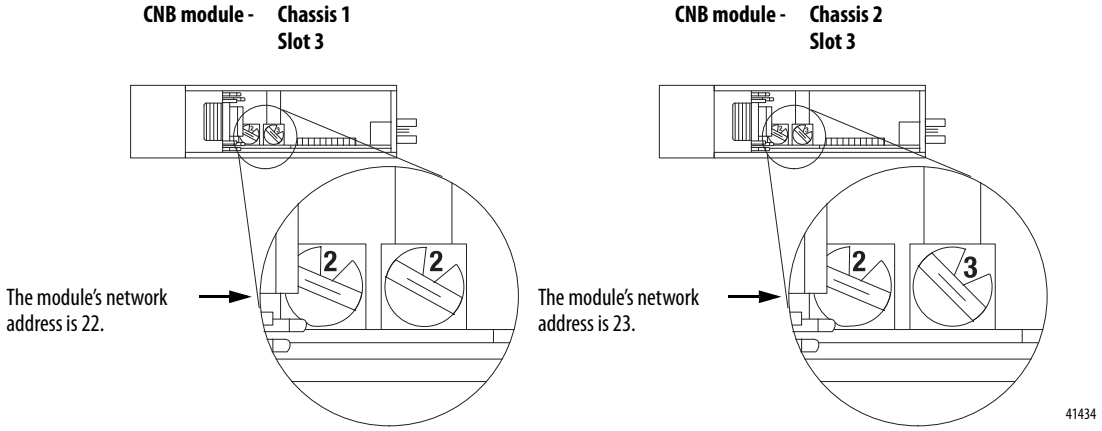


Configure the Module Switches

In this application, you must set switches on the 1756-DHRIO and 1756-DHRIOXT modules for DH+ and the switches on the 1756-CNB modules to Node addresses 22 for the 1756-CNB module in system number 1 and 23 for the 1756-CNB module in system number 2.

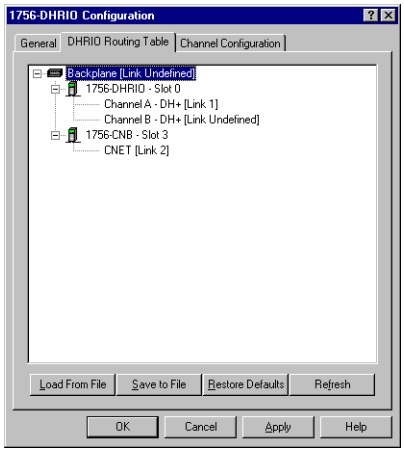
IMPORTANT The switches on the 1756-CNB modules must match the information in the module routing tables.

Set the channels on the 1756-CNB module as shown in the following figure.

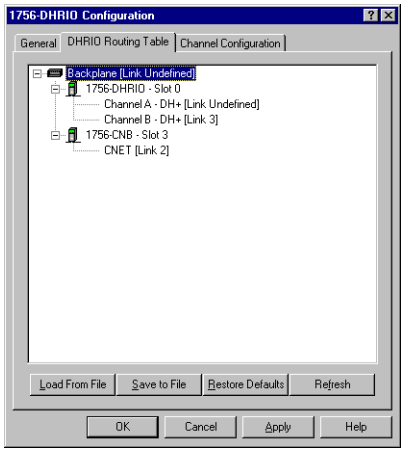


Configure Routing Tables for the Modules

You must configure routing tables for each 1756-DHRIO and 1756-DHRIOXT module in this example. The following figure shows the routing table for the 1756-DHRIO and 1756-DHRIOXT modules in ControlLogix system number 1 this example.

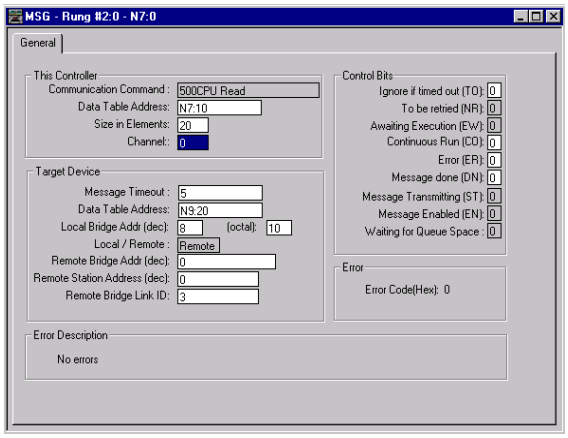


The following figure shows the routing table for the 1756-DHRIO and 1756-DHRIOXT modules in ControlLogix system number 2 this example.



Configure Message Instructions

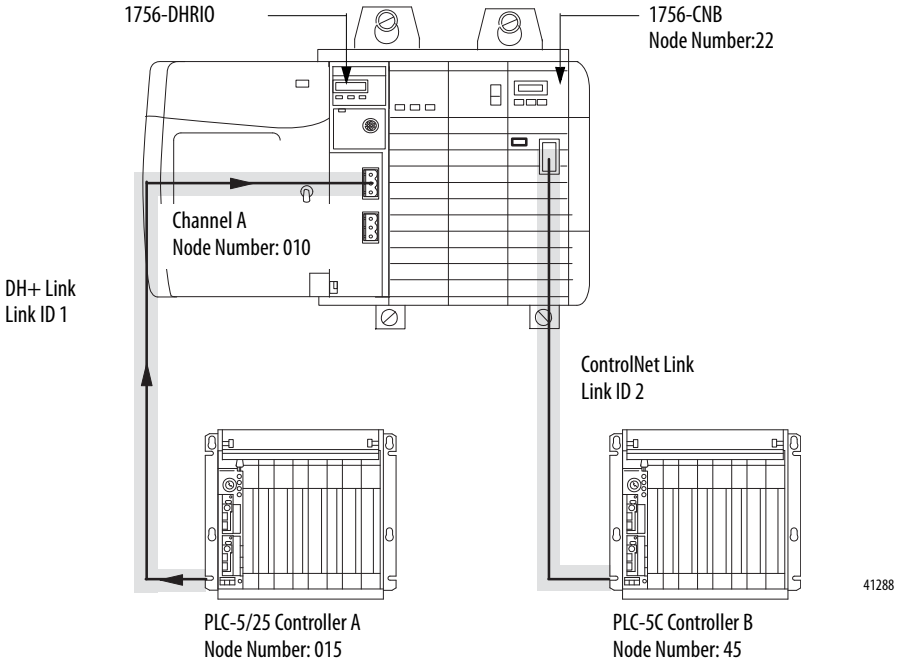
Use RSLogix 5 software to configure the remote PLC-5 message instructions being sent to ControlLogix controller B, as shown in the following figure.



DH+ Messaging: PLC-5 to PLC-5/C Controllers on the ControlNet Network

This application sends a DH+ message from PLC-5 controller A through 1756-DHRIO and 1756-CNB modules to PLC-5C controller B on the ControlNet network. Remote DH+ messaging is required to send the message.

The following figure illustrates the steps you must use in this application.

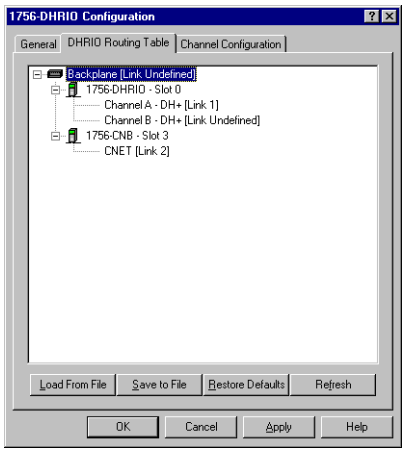


Configure the Module Switches

In this application, you must set switches on the 1756-DHRIO and 1756-DHRIOXT modules for DH+ and the switches on the 1756-CNB module to Node address 22.

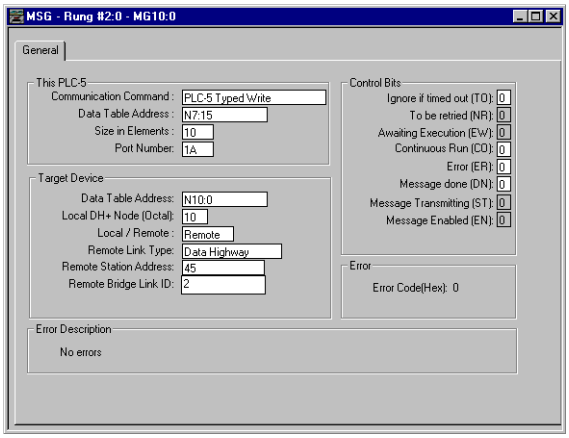
Configure a Routing Table for the 1756-DHRIO Module

Use RSLinx to configure a routing table for the modules. The following figure shows the routing table for this example.



Configure Message Instructions

Use RSLogix 5 software to configure the remote PLC-5 controller message instructions being sent to ControlLogix controller B. The following figure shows a message instruction for this example.



Messaging Between PLC-5 or SLC 5/04 Controllers and ControlLogix Controllers

What This Chapter Contains

This chapter describes how to use DH+ messaging between PLC-5 or SLC 5/04 controllers and a ControlLogix controller.

IMPORTANT The examples use PLC-5 and SLC 5/04 controllers to send DH+ network messages. In each case, the use of these devices is strictly for example purposes and not an indication of restrictions on the 1756-DHRIO and 1756-DHRIXOT modules.

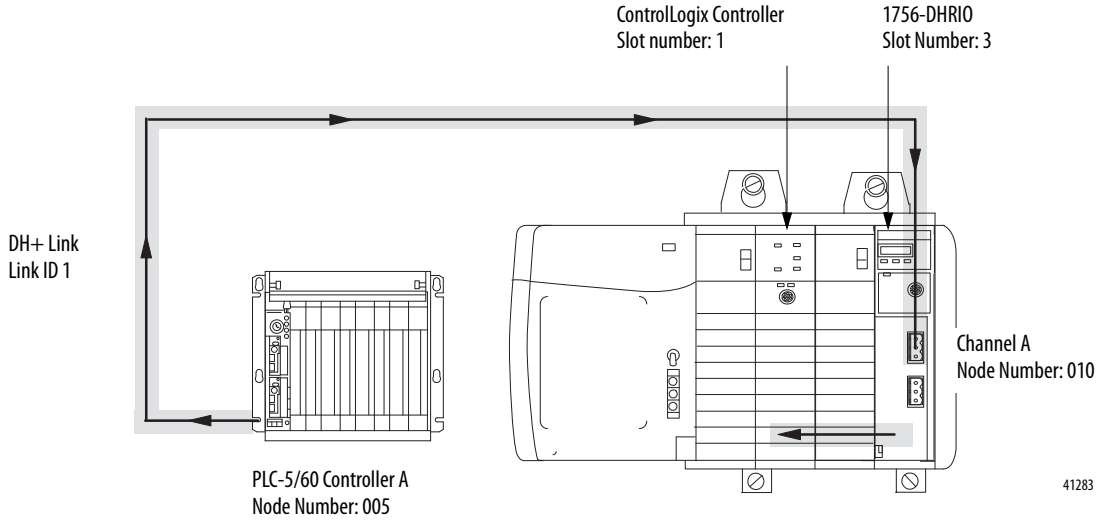
Examples using PLC-5 controllers could, in fact, use SLC 5/04 controllers and examples using SLC 5/04 controllers could use PLC-5 controllers.

DH+ Messaging: PLC-5 Controllers to One ControlLogix Controller with One ControlLogix Chassis

This application sends a DH+ message from PLC-5/60 controller A through a 1756-DHRIO or 1756-DHRIOXT module to ControlLogix controller B. Local DH+ messaging can be used to send the message.

IMPORTANT Local DH+ messaging can send only DH+ messages to one ControlLogix controller per DH+ channel. See the application on page 83 if you want to send DH+ messages to multiple ControlLogix controllers in the chassis.

The following figure illustrates the steps you must use in this application.



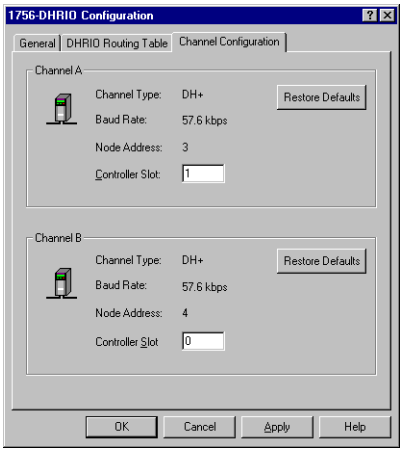
IMPORTANT For this application, the 1756-DHRIO and 1756-DHRIOXT modules need only a controller slot programmed if the ControlLogix controller is not in the default slot (0) of the ControlLogix chassis.

Configure the Module Switches

In this example, Channel A on the 1756-DHRIO and 1756-DHRIOXT modules must be set for DH+.

Configure a Controller Slot for the 1756-DHRIO Module

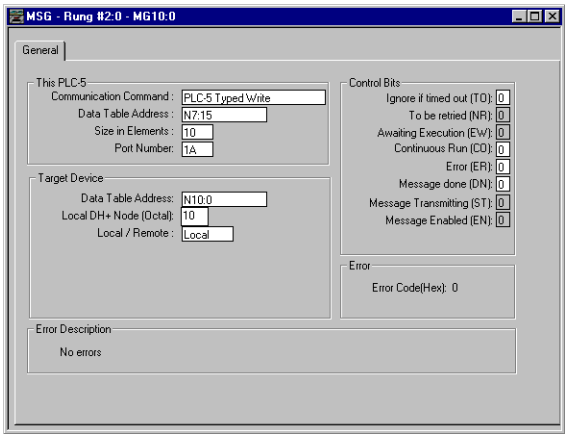
In this example, the controller is not in the default slot (slot 0) of the ControlLogix chassis. You must use RSLinx software to configure a controller slot for the 1756-DHRIO and 1756-DHRIOXT modules as shown in the following figure.



IMPORTANT Controller slot values for the other channel, if it is configured for DH+, are applied or restored to default values. In this example, controller values applied to the channel not used for DH+ messaging do not matter, but failure to enter a value generates a configuration fault for that channel.

Configure Message Instructions

You must use RSLogix 5 software to configure the PLC-5 message instructions. The following figure shows a message instruction necessary for this example.



IMPORTANT

If the ControlLogix controller in this example is the destination of a PCCC-typed message, you must remember the following:

- When a PLC5, SLC500, PLC5/250, PLC3, or PLC2 sends a message to a controller on ControlLogix, a mapping table is needed to be configured in the Studio 5000 environment.
- In the Logic tab on the tool bar select Map PLC or SLC Messages
- The file number must be an integer type. Just write the file number in the box. The whole file in the PLC or SLC controller will be used starting with word 0.
- A tag must be created beforehand to accept the data with the proper number of array elements.
- The destination tag in the PLC or SLC message is the file number configured at the word level.

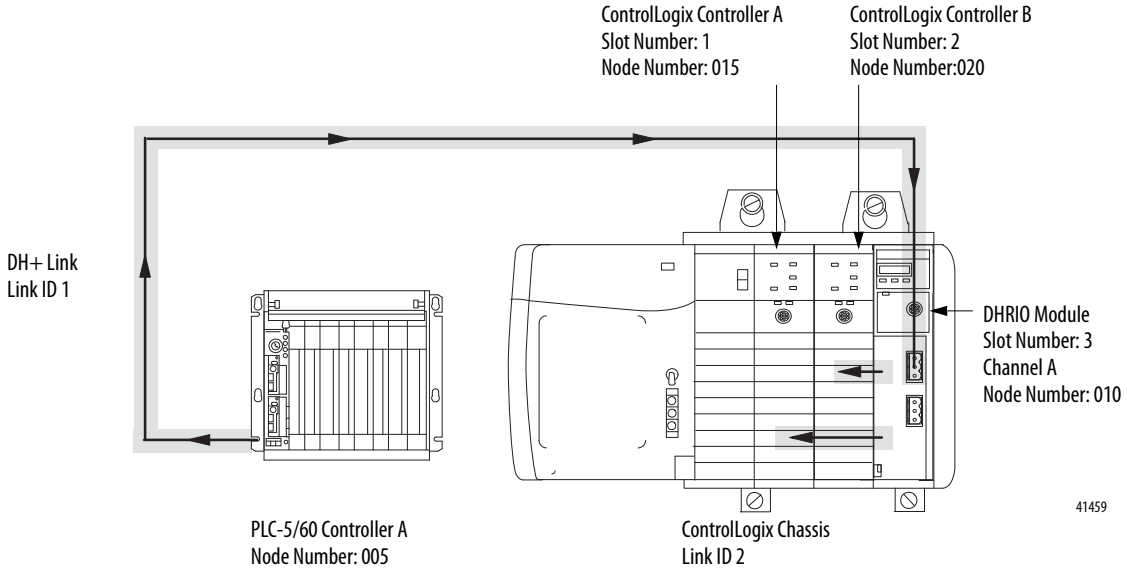
DH+ Messaging: PLC-5 to Multiple ControlLogix Controllers in One ControlLogix Chassis

This application sends a DH+ message from PLC-5/60 controller A through a 1756-DHRIO and 1756-DHRIOXT modules to multiple ControlLogix controllers.

IMPORTANT In this example, we use local and remote DH+ messaging to send DH+ messages. Local DH+ messaging is used to send a message to ControlLogix controller A. This processor must be configured as the controller slot.

Remote DH+ messaging is used to send a message to ControlLogix controller B. Separate message instructions must be configured in RSLogix 5 software for each ControlLogix controller.

The following figure illustrates the steps you must use in this application.

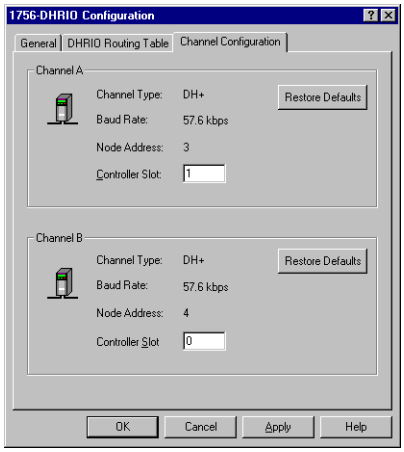


Configure the Module Switches

In this example, Channel A on the 1756-DHRIO and 1756-DHRIOXT modules must be set for DH+.

Configure a Controller Slot for the Module

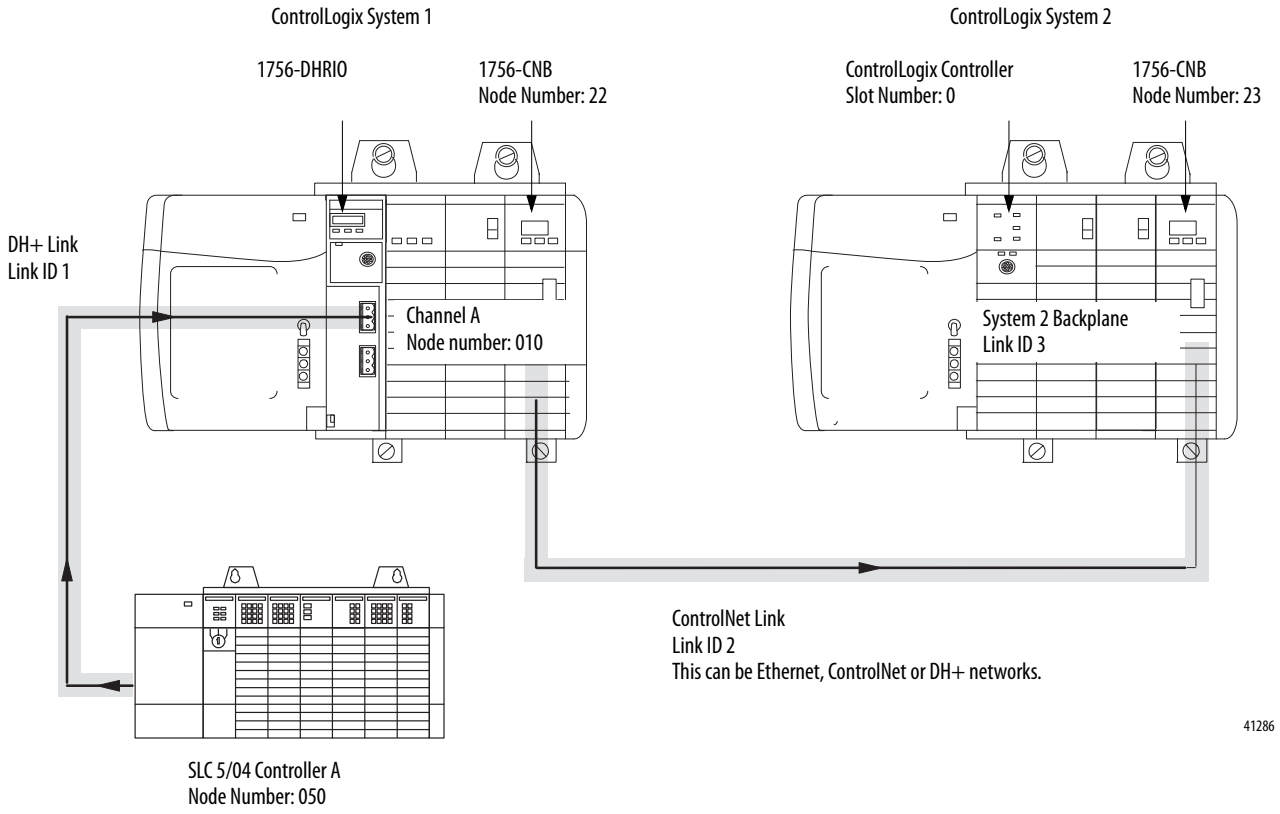
In this example, the controller is not in the default slot (slot 0) of the ControlLogix chassis. You must use RSLinx software to configure a controller slot for the 1756-DHRIO and 1756-DHRIOXT modules. The following figure shows the controller slot necessary for this example.



DH+ Messaging: SLC 5/04 to a ControlLogix Controller with Multiple ControlLogix Chassis

This application sends a DH+ message from SLC 5/04 controller A through a 1756-DHRIO or 1756-DHRIOXT module in ControlLogix system number 1 to a 1756-DHRIO or 1756-DHRIOXT module in ControlLogix system number 2 to ControlLogix controller B. Remote DH+ messaging is required to send the message.

The following figure illustrates the steps you must use in this application.



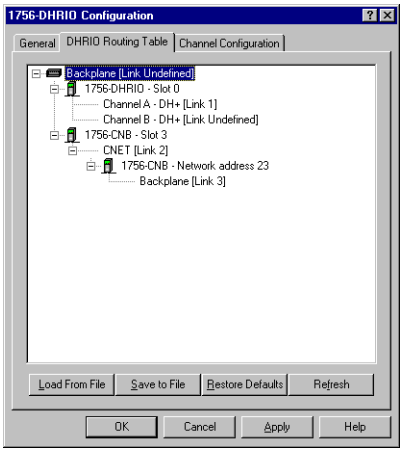
Configure the Module Switches

In this application, you must set switches on the 1756-DHRIO and 1756-DHRIOXT modules for DH+ and the switches on the 1756-CNB modules to the correct node addresses. The 1756-CNB module in system number 1 uses node address 22 and the 1756-CNB module in system number 2 uses node address 23.

IMPORTANT The switches on the 1756-CNB modules must match the information in the 1756-DHRIO routing table.

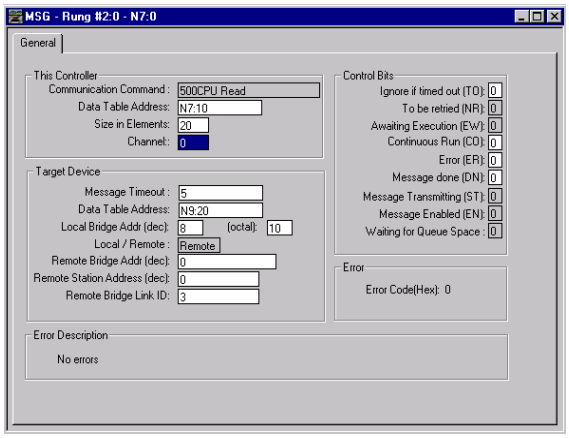
Configure a Routing Table for the Module

Use RSLinx software to configure a routing table for the 1756-DHRIO and 1756-DHRIOXT modules. The following figure shows the routing table necessary for this example.



Configure Message Instructions

Use RSLogix 500 software to configure the SLC-500 controller message instructions. The following figure shows a message instruction necessary for this example.



IMPORTANT RSLogix 500 software displays nodes and link IDs in decimal. Also, in this application, a remote bridge address is not required.

Notes:

Messaging Between ControlLogix Controllers and PLC-5 or SLC 5/04 Controllers

What This Chapter Contains

This chapter describes how to use DH+ messaging between a ControlLogix controller and PLC or SLC controller.

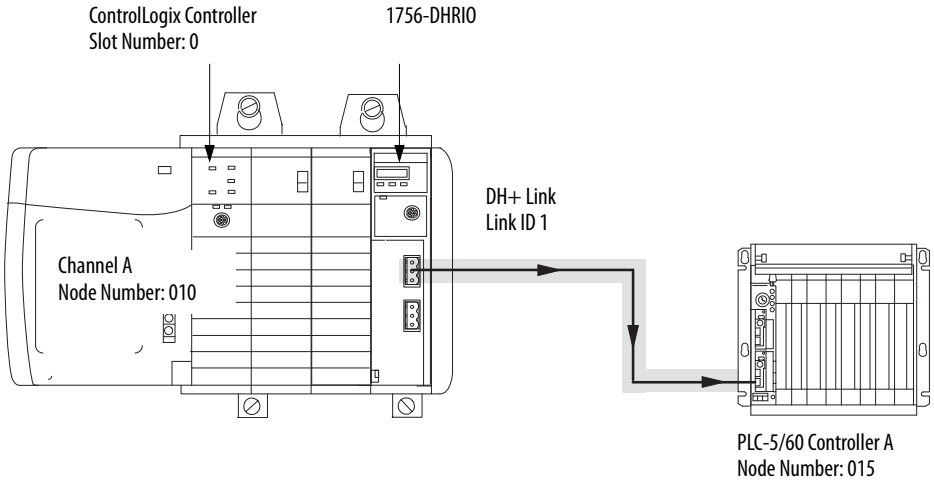
IMPORTANT The examples use PLC-5 and SLC 5/04 controllers to send DH+ messages. In each case, the use of these devices is strictly for example purposes and not an indication of restrictions on the 1756-DHRIO and 1756-DHRIOXT modules.

Examples using PLC-5 controllers could, in fact, use SLC 5/04 controllers and examples using SLC 5/04 controllers could use PLC-5 controllers.

Local DH+ Messaging: ControlLogix Controller in One Chassis to a PLC-5

This application sends a DH+ message from a ControlLogix controller A through a 1756-DHRIO or 1756-DHRIOXT module to a PLC-5 controller B on a DH+ link. Local DH+ messaging can be used to send the message. In this case, local DH+ messaging is used.

The following figure illustrates the steps you must use in this application.



IMPORTANT When you are using local DH+ messaging between a ControlLogix controller and a PLC controller, you **do not need** a routing table. The default setting on the module out of the box is to have no routing table configured.

However, if a routing table is programmed, verify it is programmed correctly or a configuration fault can occur.

Also, controller slot values for channels that are configured for DH+ are applied or restored to default value, by using the software tabs. Failure to enter the correct value generates a configuration fault for that channel.

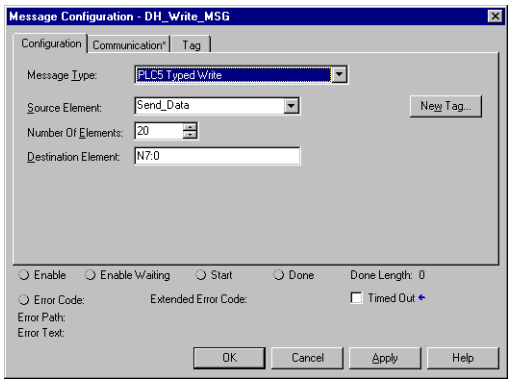
Configure the Module Switches

In this application, channel A on the 1756-DHRIO and 1756-DHRIOXT modules must be set for DH+.

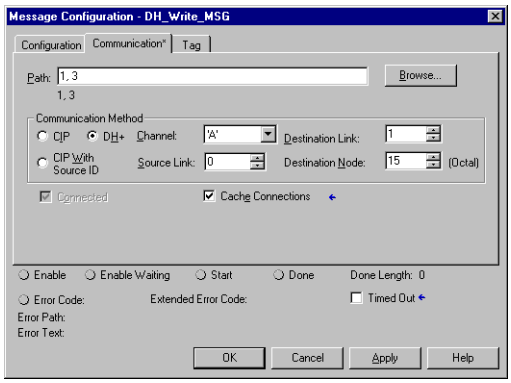
Configure Message Instructions

Use the Studio 5000 environment to configure the ControlLogix controller message instructions. The following figure shows the message instruction tabs necessary for this example.

Configuration Tab



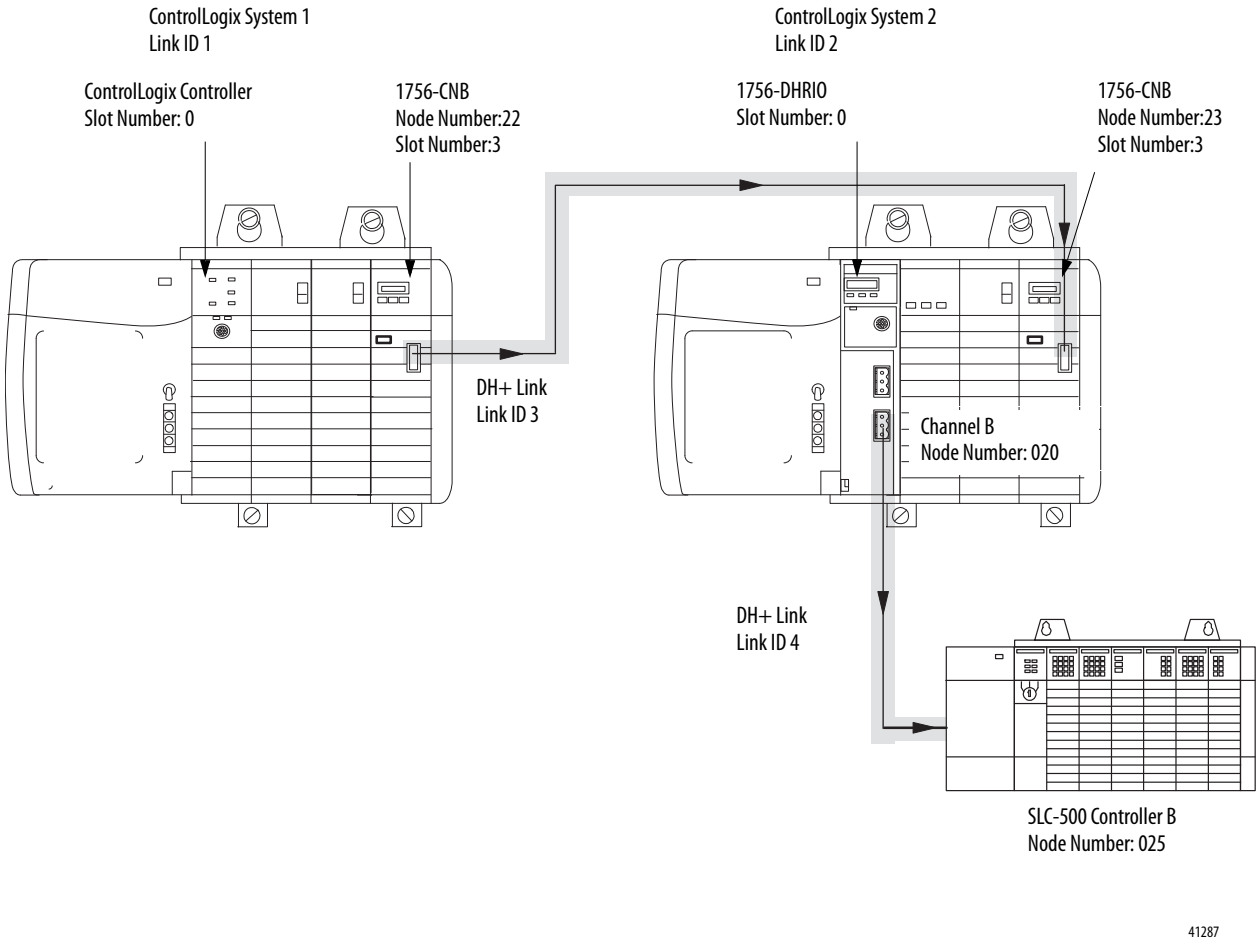
Communication Tab



DH+ Messaging: ControlLogix Controller to a SLC 5/04 Controller over ControlNet and DH+ Networks

This application sends a DH+ message from ControlLogix controller A to SLC 5/04 controller B over ControlNet and DH+ networks. Remote DH+ messaging is used to send the message in this application.

The following figure illustrates the steps you must use in this application.



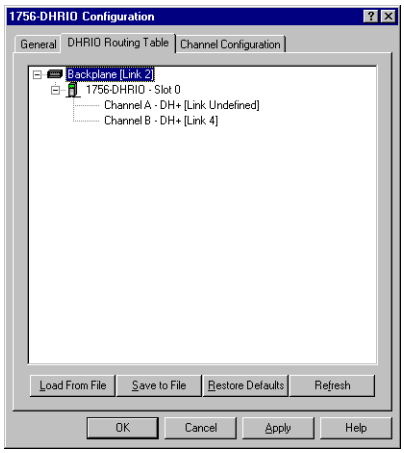
Configure the Module Switches

In this application, you must set switches on the 1756-DHRIO and 1756-DHRIOXT modules for DH+ and the switches on the 1756-CNB modules to the correct node addresses. The 1756-CNB module in system number 1 uses node address 22 and the 1756-CNB module in system number 2 uses node address 23.

IMPORTANT The switches on the 1756-CNB modules must match the information in the 1756-DHRIO routing table.

Configure a Routing Table for the Module

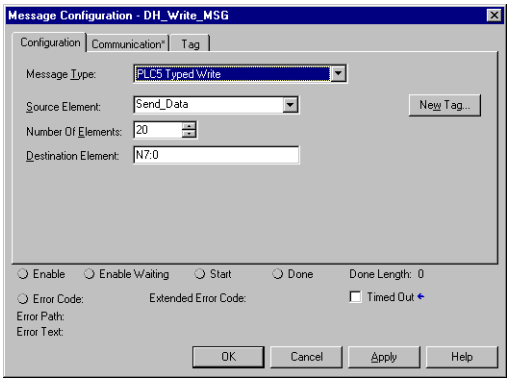
Use RSLinx software to configure a routing table for the 1756-DHRIO and 1756-DHRIOXT modules in ControlLogix system number 2. The following figure shows the routing table necessary for this example.



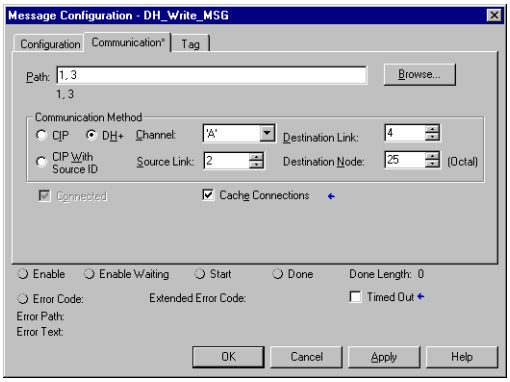
Configure Message Instructions

Use the Studio 5000 environment to configure the ControlLogix controller message instructions. The following figure shows the message instruction tabs necessary for this example.

Configuration Tab



Communication Tab



Messaging Between ControlLogix Controllers

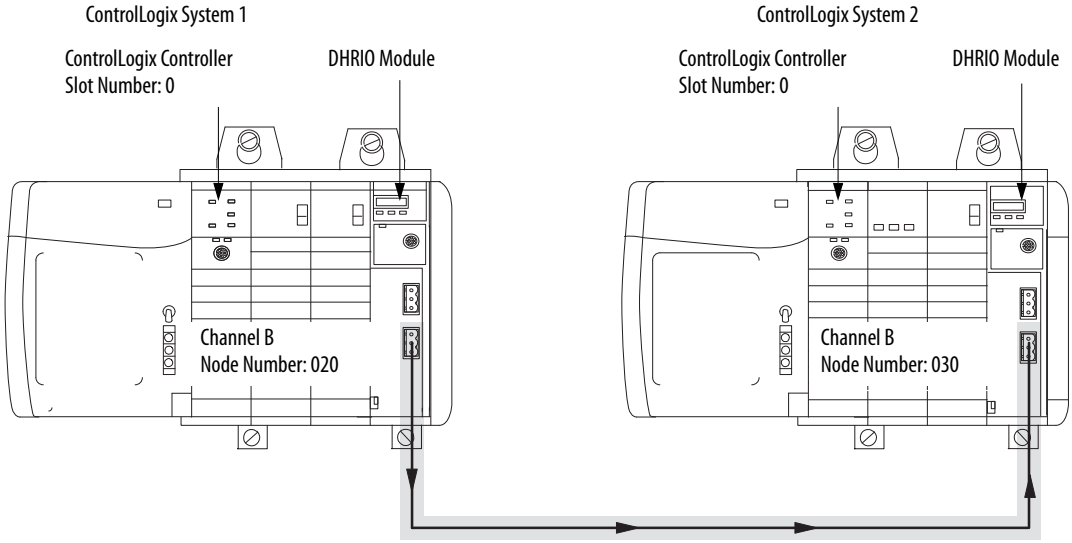
What This Chapter Contains

This chapter describes how to use Control and Information Protocol (CIP) messaging between ControlLogix controllers with the1756-DHRIO and 1756-DHRIOXT modules.

Each of the following examples explains what steps you must take to perform the described operations.

CIP Messaging Between ControlLogix Controllers over One Link

This application sends a CIP message from ControlLogix controller A through a 1756-DHRIO or 1756-DHRIOXT module to ControlLogix controller B controller B. The following figure illustrates the steps you must use in this application.



41419

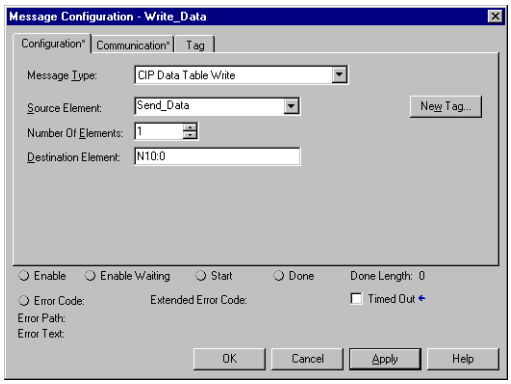
Configure the Module Switches

In this application, Channel B on the 1756-DHRIO and 1756-DHRIOXT modules must be set for DH+.

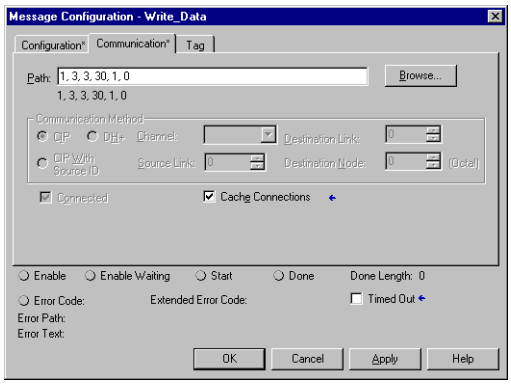
Configure Message Instructions

Use the Studio 5000 environment to configure the ControlLogix controller message instructions. The following figure shows the message instructions necessary for this example.

Configuration Tab



Communication Tab

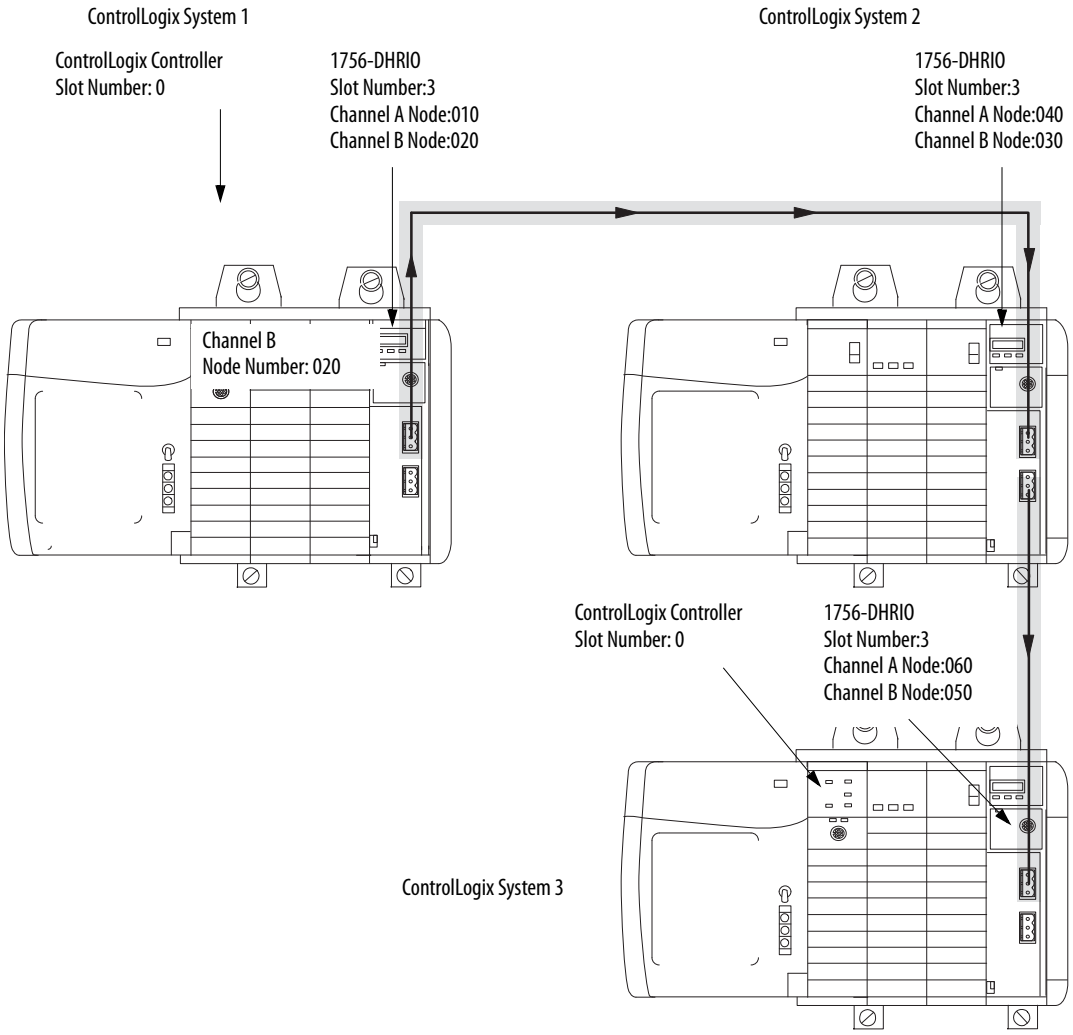


IMPORTANT When you are using the 1756-DHRIO for CIP messaging, no link ID numbers are present. You must use an explicit message path.

CIP Message Routing Between ControlLogix Controllers over Two Links

This application sends a CIP message from ControlLogix controller A through a 1756-DHRIO of 1756-DHRIOXT module to ControlLogix controller B controller B over two links.

The following figure illustrates the steps you must use in this application.



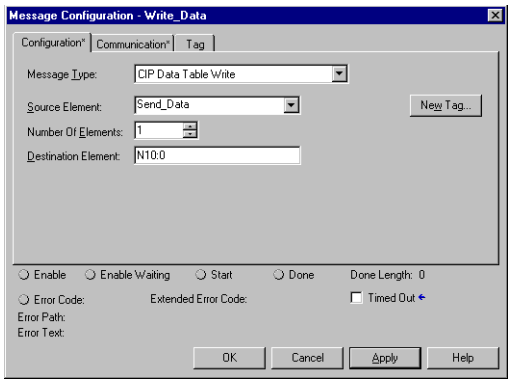
Configure the Module Switches

In this application, Channel A on the first and last 1756-DHRIO or 1756-DHRIOXT modules must be set for DH+. The channels on the second 1756-DHRIO or 1756-DHRIOXT module must be set for DH+.

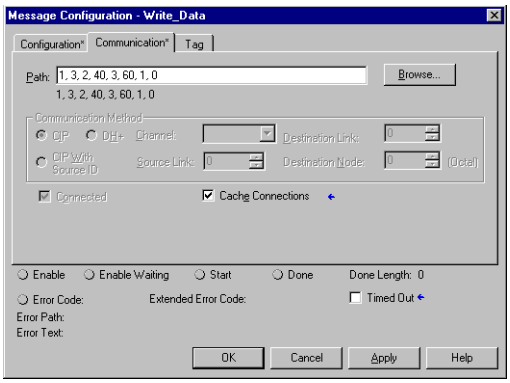
Configure Message Instructions

Use the Studio 5000 environment to configure the ControlLogix controller message instructions. The following figure shows the message instructions necessary for this example.

Configuration Tab



Communication Tab



IMPORTANT When you are using the 1756-DHRIO for CIP messaging, no link ID numbers are present. You must use an explicit message path.

Using the 1756-DHRIO and 1756-DHRIOXT Modules in Remote I/O Applications

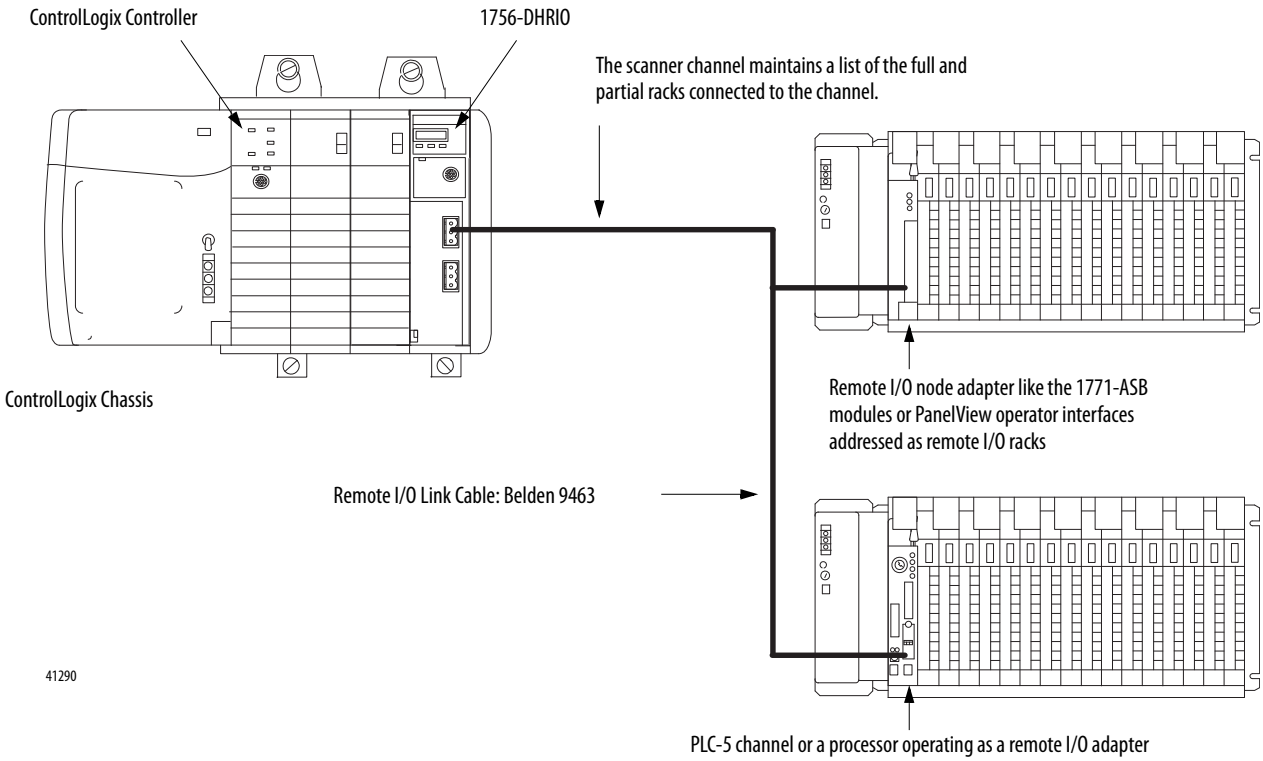
What This Chapter Contains

This chapter describes the basic procedures of using the 1756-DHRIO and 1756-DHRIOXT modules in remote I/O scanner mode and configuring a remote I/O network.

Introduction to Remote I/O

The remote I/O system lets you control I/O devices that are not in the controller's chassis. A 1756-DHRIO channel, configured as a remote I/O scanner, transfers discrete and block-transfer data between a ControlLogix controller and remote I/O devices.

The following figure shows an example of a remote I/O system.



Follow these steps when setting up a remote I/O system:

1. Configure the remote I/O adapter.
2. Layout the remote I/O network cable.
3. Connect the remote I/O network cable.
4. Configure the scanner channel.

Select Devices that You Can Connect

The following table lists some of the devices you can use on a remote I/O network as an adapter.

Category	Product	Cat. No.
Other Processors (in adapter mode)	enhanced PLC-5 processors	1785-LxxB
	Ethernet PLC-5 processors	1785-LxxE
	ControlNet PLC-5 processor	1785-LxxC
	VMEbus PLC-5 processors	1785-VxxB
	extended-local PLC-5 processors	1785-LxxL
	classic PLC-5 processors	1785-LTx
To Remote I/O	SLC 500 Remote I/O Adapter Module	1747-ASB
	1791 Block I/O	1791 series
	Remote I/O Adapter Module	1771-ASB
	1-Slot I/O Chassis with Integral Power Supply and Adapter	1771-AM1
	2-Slot I/O Chassis with Integral Power Supply and Adapter	1771-AM2
	Direct Communication Module	1771-DCM
Operator Interfaces	DL40 Dataliner	2706-xxxx
	RediPANEL	2705-xxx
	PanelView Terminal	2711-xxx
Drives	Remote I/O Adapter for 1336 AC Industrial Drives	1336-RIO
	Remote I/O Adapter for 1395 AC Industrial Drives	1395-NA

Design a Remote I/O Network

Designing a remote I/O network requires applying network and cable design guidelines.

Network Design Guidelines

Follow these rules as you design a remote I/O network:

- All devices connected to a remote I/O network must communicate by using the same communication rate. The following rates are available for remote I/O:
  - 57.6kbps
  - 115.2kbps
  - 230.4kbps
- Assign unique partial and full racks to each channel used in remote I/O scanner mode. The channels of a 1756-DHRIO or 1756-DHRIOXT module cannot scan the same partial or full rack address. For example, to reduce the possibility of a conflict, you may have channel A communicate to racks 00...37 octal and channel B communicate to 40...77 octal, or have channel A communicate to even rack numbers while channel B communicates to odd rack numbers.
- A channel can have a maximum of 32 rack numbers and a maximum of 32 physical devices connected to it.

Cable Design Guidelines

Follow these cable design guidelines in your remote I/O network:

- Specify a 1770-CD (Belden 9463) cable for 1756-DHRIO modules.
- Specify a Belden 89463 cable for 1756-DHRIOXT modules.
- Connect a remote I/O network by using a daisy chain or trunk line/drop line configuration.
- Verify that your system's design plans specify cable lengths within allowable measurements.

IMPORTANT The maximum cable length for remote I/O depends on the transmission rate. Configure all devices on a remote I/O network to communicate at the same transmission rate.

Trunk Line/Drop Line Considerations

When using a trunk line/drop line configuration, use 1770-SC station connectors and follow these cable-length guidelines:

- The trunk line-cable length depends on the communication rate of the link.
- The drop-cable length uses a maximum of 30.4 m (100 cable-ft.).

For daisy chain configurations, use the following table to determine the total cable length you can use.

A remote I/O network using this communication rate:	Cannot exceed this cable length:
57.6 kbps	3,048m (10,000 ft)
115.2 kbps	1,524m (5,000 ft)
230.4 kbps	762m (2,500 ft)

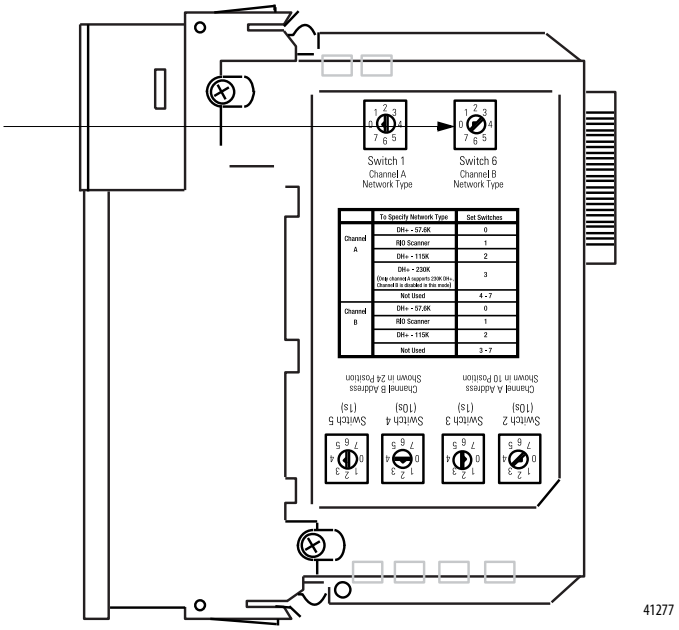
For proper operation, terminate the ends of a remote I/O network by using the external resistors shipped with the 1756-DHRIO and 1756-DHRIOXT modules. Selecting a 150W or a 82W terminator determines how many devices you can connect on one remote I/O network.

If your remote I/O network:	Use this resistor rating:	The maximum number of physical devices you can connect on the network:	The maximum number of racks you can scan on the network:
does not contain any of the devices listed in the row below, regardless of communication rate	82Ω	32	32
contains any of the following: • 1771-AS • 1771-ASB/A • 1771-ASB/B • 1771-DCM • 1771-AF	150Ω	16	16
operates at 57.6kbps or 115.2kbps, and the network does not support more than 16 physical devices			

Module Operation in a Remote I/O Application

The 1756-DHRIO and 1756-DHRIOXT modules provide two configurable channels that can send and receive messages over DH+ or scan remote I/O devices. You must set the rotary switches on the module to use the 1756-DHRIO or 1756-DHRIOXT module in a remote I/O application.

Set the channel you want to use for Remote I/O to 1.



IMPORTANT If you require a channel to be configured for DH+, use Channel A. By doing so, you can connect your programming terminal to the connector on the front of the module and communicate to devices on the network. If only one channel is needed for RIO, use Channel B.

When a channel is configured for remote I/O, the 1756-DHRIO and 1756-DHRIOXT modules are designed to function as remote I/O scanners for a ControlLogix controller. In this case, the following occurs:

- I/O data is exchanged between the 1756-DHRIO or1756-DHRIOXT modules and remote I/O adapters on the remote I/O link.
- I/O data is exchanged between the 1756-DHRIOor1756-DHRIOXT module and the ControlLogix controller.

Exchange I/O Data Between the Module and Adapters

I/O data is exchanged between the 1756-DHRIO or 1756-DHRIOXT module and adapters on the remote I/O link based on a list of adapters generated in the Studio 5000 environment.

The ControlLogix controller, as the 1756-DHRIO or1756-DHRIOXT module's owner-controller, downloads this list, along with the remote I/O baud rate, to the 1756-DHRIO or1756-DHRIOXT module. The 1756-DHRIO or 1756-DHRIOXT module scans each adapter (exchange I/O data) in the list in a round-robin fashion.

Exchange I/O Data Between the Module and the ControlLogix Controller

I/O data and status are exchanged between the 1756-DHRIO or 1756-DHRIOXT module and the ControlLogix controller through the producer/consumer model used by the ControlLogix system.

Multiple connections are established between the 1756-DHRIO or 1756-DHRIOXT module and the ControlLogix controller. These connections can be classified in two categories. In the first category, connections are established between the 1756-DHRIO or 1756-DHRIOXT module and the ControlLogix controller for each adapter on the remote I/O link. I/O data is exchanged on these connections.

In the second category, a connection is established between the supervisor of the remote I/O on the 1756-DHRIO or 1756-DHRIOXT module (the supervisor is the internal remote I/O scanner on the module) and the ControlLogix controller. Remote I/O scanner status is exchanged on this connection. In this case, the data exchange is bidirectional. The 1756-DHRIO or 1756-DHRIOXT module reports status on the remote I/O scanner, and the ControlLogix controller maintains ownership of the 1756-DHRIO or1756-DHRIOXT module.

IMPORTANT Only one ControlLogix controller can communicate with and own the remote I/O channels on a 1756-DHRIO or 1756-DHRIOXT module.

I/O Configuration Tree in Studio 5000 Environment Controller Organizer

The I/O configuration tree in the Studio 5000 environment Controller Organizer specifies the connections to the 1756-DHRIO or 1756-DHRIOXT module and generates the adapter list of the 1756-DHRIO or 1756-DHRIOXT modules to scan.

The 1756-DHRIO and 1756-DHRIOXT modules entry in the I/O configuration tree specifies the status connection between the scanner function on the 1756-DHRIO or 1756-DHRIXOT module and the ControlLogix controller.

The adapter entries under the 1756-DHRIO and 1756-DHRIOXT modules in the I/O configuration tree specify the connections between the ControlLogix controller and the 1756-DHRIO or 1756-DHRIOXT module for each adapter's data.

TIP Enter a 1756-DHRIO or 1756-DHRIOXT module into the I/O configuration tree only if at least one of the module's channels is configured for remote I/O.

Remote I/O Scanner Status

A connection is used to exchange remote I/O scanner status as described previously. The data from the 1756-DHRIO or 1756-DHRIOXT module contains the current state of the channels (A/B) that are configured for remote I/O. The data from the ControlLogix controller represents an update used by the 1756-DHRIO or 1756-DHRIOXT module to maintain ownership.

This data exchange is continually updated and is responsible for maintaining module awareness in the system.

Adapter Module I/O

The 1756-DHRIO and 1756-DHRIOXT modules scan the remote I/O devices as they appear in the ControlLogix controller's controller organizer. The entries in the organizer represent logical adapters. The physical adapter modules on remote I/O can act as several racks. This depends on the addressing mode of the physical adapter and chassis. The Studio 5000 environment enables four choices for the adapter modules:

- 1747 Remote I/O adapter
- 1771 Remote I/O adapter
- 1794 Remote I/O adapter
- Generic Remote I/O adapter

Each entry includes the following:

- rack address - values are 00-77 octal
- starting group - can start in slot 0, 2, 4, or 6
- rack size - can be 1/4, 1/2, 3/4 or full rack

IMPORTANT Each choice determines what type of adapter is present on the remote I/O network. However, they all behave the same in the ControlLogix system. When online, the 1756-DHRIO and 1756-DHRIOXT modules cannot tell which adapter is connected to the remote I/O network.

The 1756-DHRIO and 1756-DHRIOXT modules consume the adapter output data sent by the ControlLogix controller on the connection created when you add remote I/O devices in the Studio 5000 environment.

The owner-controller produces the output data at the RPI; this output data production is not tied to the scan time of the controller's program. The remote I/O scanner sends output data to the remote I/O adapters at a rate dependent on the number of adapters on the channel and the baud rate used.

The 1756-DHRIO and 1756-DHRIOXT modules produce the rack input data received in the adapter response immediately after the remote I/O adapter response is received. The owner-controller receives the data directly into the data buffer created by the software. The frequency at which the input data is produced depends upon the number of adapters on the channel and the baud rate used.

Configure the Data Exchange Rate Between the Modules and a Controller

The following sections describe the process of setting the Requested Packet Interval (RPI) for data exchanges between the 1756-DHRIO or 1756-DHRIOXT module and the ControlLogix controller. An RPI must be set for the remote I/O scanner status connection and each adapter connection.

Requested Packet Interval (RPI)

This interval specifies the rate at which the 1756-DHRIO or 1756-DHRIOXT module and the ControlLogix controller produce data. The time ranges from 3...750 ms and is sent to the module with all other configuration parameters. When the specified time frame elapses, the 1756-DHRIO module and the ControlLogix controller produce data for each other.

RIO Scanner Status Update Rate with the Module in a Local Chassis

When a module resides in the same chassis as the owner controller, the RPI affects how and when the module produces link status and consumes the controller status. The rate at which the status is exchanged is equal to the RPI.

RIO Scanner Status Update Rate with the Module in a Remote Chassis

If a module physically resides in a chassis other than that of its owner-controller (that is a remote chassis connected via ControlNet), the rate at which the status is exchanged is equal to the RPI + 2 x [Network Update Time (NUT)].

TIP To maximize notification of the module status, we recommend setting the 1756-DHRIO and 1756-DHRIOXT modules' RPI value equal to the RPI used in the adapter connections.

Configure the Baud Rate

The rate of I/O data exchange is directly related to the configured remote I/O scanner baud rate. Your 1756-DHRIO and 1756-DHRIOXT modules allow the following baud rates:

- 57.6Kbaud
- 115.2Kbaud
- 230.4Kbaud

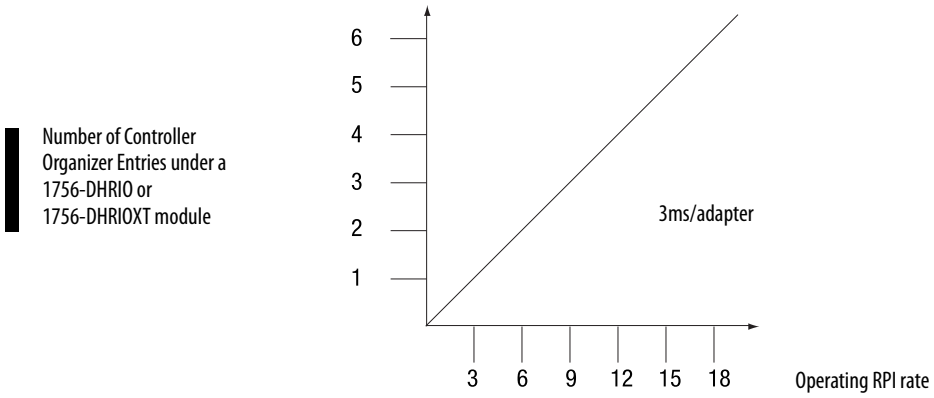
The remote I/O scanner scan each remote I/O adapter at the following rates:

- 8ms/adapter @ 57.6Kbaud
- 5ms/adapter @ 115.2Kbaud
- 3ms/adapter @ 230.4Kbaud

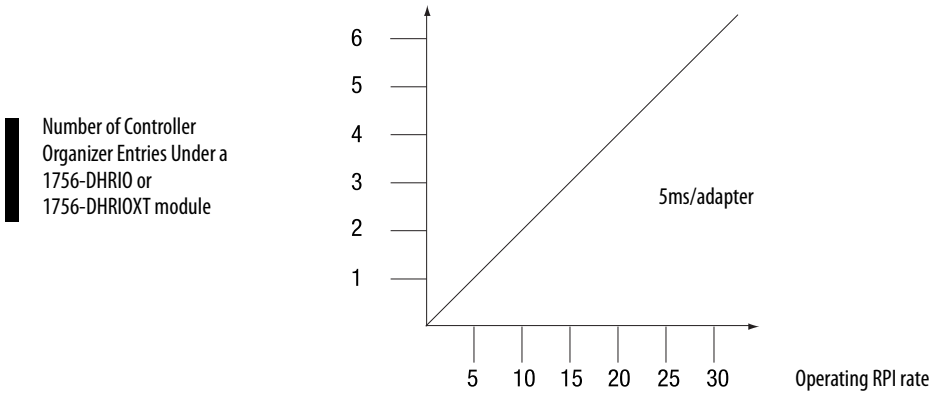
To determine the RPI for all Controller Organizer entries, use the graphs in the following figure.

The following graphs provide the minimum RPI for the baud rates. Rates faster than those specified do not provide greater data throughput.

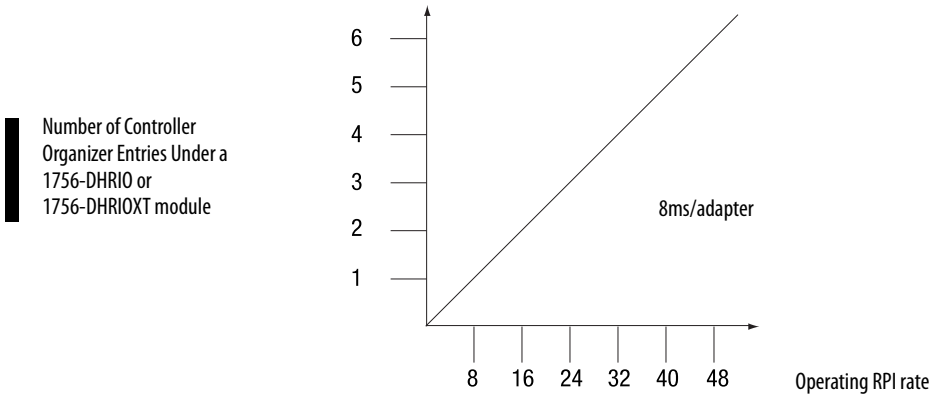
Adapter Update Rates for Remote I/O at 230.4Kbaud Rate



Adapter Update Rates for Remote I/O at 115.2Kbaud Rate



Adapter Update Rates for Remote I/O at 57.6Kbaud Rate



Remote I/O Scanner Fault Notification

A 1756-DHRIO or 1756-DHRIOXT module using one of its channels for remote I/O has a connection open between the module and its owner-controller. The remote I/O scanner status is continually being exchanged over this connection. This continuous data exchange is responsible for maintaining module awareness in the system.

If at any time this continuous data exchange is interrupted for a time that is four times the RPI, the ControlLogix controller drops the current remote I/O scanner configuration and terminates communication with the adapters on the remote I/O network. The channel configured for remote I/O scanner goes offline and waits for new configuration data before beginning communication with the remote I/O network.

The ControlLogix controller also performs one of the following scenarios:

- ControlLogix controller faults, if the 1756-DHRIO module has been configured for a major fault to occur on the controller if communication fails.
- ControlLogix controller does not fault, if the 1756-DHRIO or 1756-DHRIOXT module has not been configured for a major fault to occur if communication fails. In this case, the ControlLogix controller repeatedly attempts to reestablish communication with the 1756-DHRIO or 1756-DHRIOXT module.

TIP The update rate for the data exchange is set to go at the minimum RPI set for the data flow between the ControlLogix controller and the remote I/O adapters. This guarantees the scanner quickly terminates remote I/O network communication if the 1756-DHRIO or 1756-DHRIOXT module loses data flow from the ControlLogix controller.

Remote I/O Adapter Failure Notification

The speed at which the ControlLogix controller is notified that a remote I/O adapter faulted is directly related to the RPI. The fault, known as a connection timeout, occurs at four times the RPI. For example, if the RPI is set at 25 ms and a fault occurs, the ControlLogix controller is not notified for 100 ms.

A remote I/O adapter fault notification occurs whenever the communication between the remote I/O scanner (Channel A or B) and a remote I/O adapter is interrupted or the communication between the 1756-DHRIO or 1756-DHRIOXT module and the ControlLogix controller is interrupted.

The Studio 5000 environment alerts you to a rack fault in at least one of the following ways:

- nonzero condition in the *Rack Status* tag in the tag editor
- fault icon appears in the controller organizer
- connections page displays the fault type

Inhibit the Module Connections

When the inhibit bit is set for the 1756-DHRIO or 1756-DHRIOXT module, the connection between the ControlLogix controller and the 1756-DHRIO or 1756-DHRIOXT module is terminated.

Although the 1756-DHRIO or 1756-DHRIOXT module connection is inhibited, the DHRIO scanner (Channel A or B) changes to program mode and continues to scan the remote I/O adapters on the remote I/O network. When inhibited, a 1756-DHRIO or 1756-DHRIOXT module accepts configuration from any ControlLogix controller in the control system.

The 1756-DHRIO or 1756-DHRIOXT module connection can be inhibited on the module properties connection tab of the Studio 5000 environment.

Inhibit an Remote I/O Connector Adapter

When the inhibit bit is set for a remote I/O adapter connection, the connection between the ControlLogix controller and the remote I/O adapter is terminated.

In this case, the 1756-DHRIO or 1756-DHRIOXT scanner (Channel A or B) continues to scan the remote I/O rack on the remote I/O network and switches the affected chassis of I/O into program mode. Only the ControlLogix controller that initiated the configuration of the 1756-DHRIO or 1756-DHRIOXT module can reestablish communication with the inhibited remote I/O adapter.

RIO rack connections can be inhibited on the module properties connection dialog box of the Studio 5000 environment.

Increased Remote I/O System Throughput

Because of the unique design of the 1756-DHRIO or 1756-DHRIOXT module system, performance can be greatly enhanced by splitting the remote I/O adapters across the channels. An example of a simple system has the following devices:

- Rack 1 - Starting Quarter 0 - Size Full
- Rack 2 - Starting Quarter 0 - Size Full

If the racks are placed on the same channel at a baud rate of 230.4Kbaud, the minimum RPI between the 1756-DHRIO or 1756-DHRIOXT module and the remote I/O adapters is 6 ms. If the racks are split between channel A and channel B, the update rate can be decreased to 4.5 ms.

The following algorithms are used to calculate various update rates:

@ 230.4Kbaud Update Rate = 3 ms*(number of racks [channel A or B]) + 1/2*3 ms*(number of racks [channel A or B])

@ 115.2Kbaud Update Rate = 5 ms*(number of racks [channel A or B]) + 1/2*5 ms*(number of racks [channel A or B])

@ 57.6Kbaud Update Rate = 8 ms*(number of racks [channel A or B]) + 1/2*8 ms*(number of racks [channel A or B])

Using the Studio 5000 Environment in Remote I /O and Block Transfer Applications

What This Chapter Contains

This chapter describes how to use the Studio 5000 environment with your 1756-DHRIO and 1756-DHRIOXT modules in remote I/O and block transfer applications. For more information on Studio 5000 environment, see the online help.

Use the Studio 5000 Environment in Module Remote I/O Applications

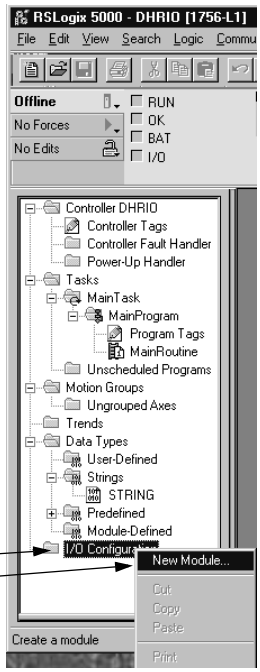
When you use the 1756-DHRIO or 1756-DHRIOXT module for remote I/O, you must follow these basic steps:

IMPORTANT When using the 1756-DHRIO or 1756-DHRIOXT module in remote I/O mode on channels A & B, a remote I/O node cannot be duplicated. Channel A's nodes must all be unique to B's nodes.

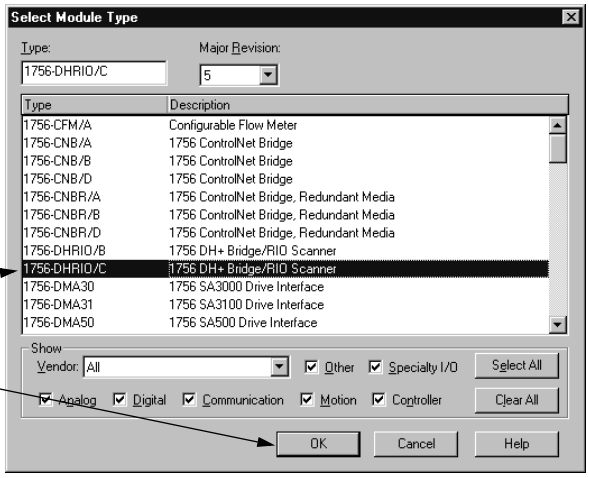
1. Add the 1756-DHRIO or 1756-DHRIOXT module to the project.
2. Configure the 1756-DHRIO or 1756-DHRIOXT module, including setting the channels for Remote I/O.
3. Add a remote I/O adapter to the project.
4. Configure the remote I/O adapter.
5. Download the project to the controller.
6. Begin application operation (that is go online).
7. If necessary, change the configuration for all modules and adapters in the project.

Add the Module

After you start the Studio 5000 environment and create a project, you must create a 1756-DHRIO or 1756-DHRIOXT module.



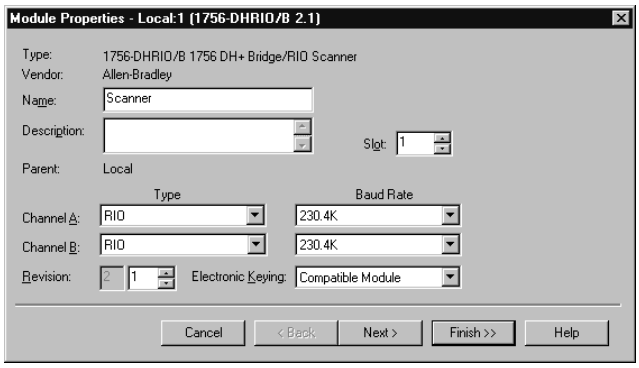
1. Right-click I/O configuration.
2. Click New Module.

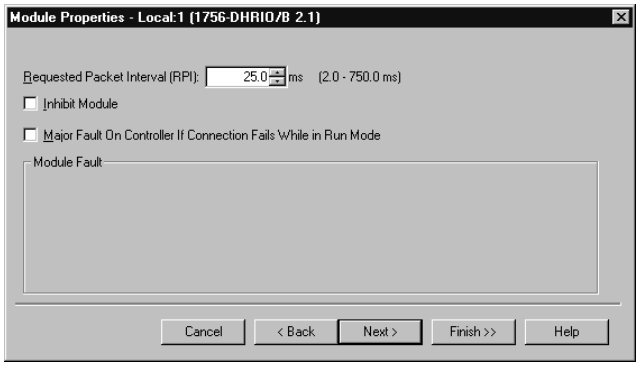


3. Select the module.
4. Click OK.

Configure the Module

Configure the newly added 1756-DHRIO or 1756-DHRIOXT module in the wizard dialog boxes that appear. The following table describes the configurable parameters that appear on the wizard dialog boxes.



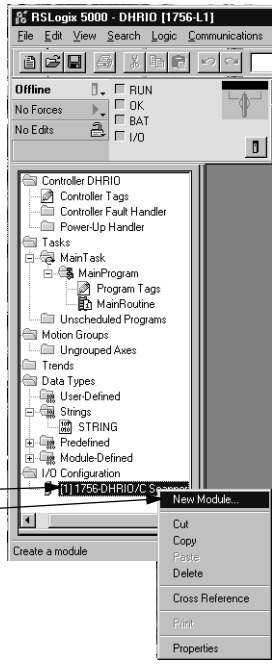


Naming Screen (first screen):	**Parameter:**	**Definition:**
	Name	Module name. This field is required.
	Description	Optional description of the module.
	Slot	Location of module in the chassis.
	Type	Application for each module channel. This field must be changed to RIO.
	Baud Rate	Rate of communication at which the 1756-DHRIO module scans the remote I/O. Available options are: • 57.6K bps • 115.2K bps • 230.4K bps
	Revision	Minor revision of the 1756-DHRIO or 1756-DHRIOXT module.
	Electronic Keying	Parameter that determines if the controller that owns the 1756-DHRIO or 1756-DHRIOXT module establishes a connection with the module. The options are: • Compatible Module - Controller attempts to establish a connection with any module in this slot that can emulate the configuration being sent from the controller. • Disable Keying - Controller attempts to establish a connection to the module regardless of its type. This option is not recommended. • Exact Match - Controller only attempts to establish a connection with the module if it matches the configuration parameters being sent from the controller.
Requested Packet Interval Screen (second screen):	**Parameter:**	**Definition:**
	Requested Packet Interval	User-defined rate (2…750ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that lets you configure a 1756-DHRIO or 1756-DHRIOXT module but prevent it from communicating with the controller. In this case, the controller does not establish a connection until the module is uninhibited.
	Major Fault on Controller if Connection Fails in Run Mode	Use this feature to choose whether a major fault occurs on the controller if the connection between the controller and the 1756-DHRIO or 1756-DHRIOXT module fails.

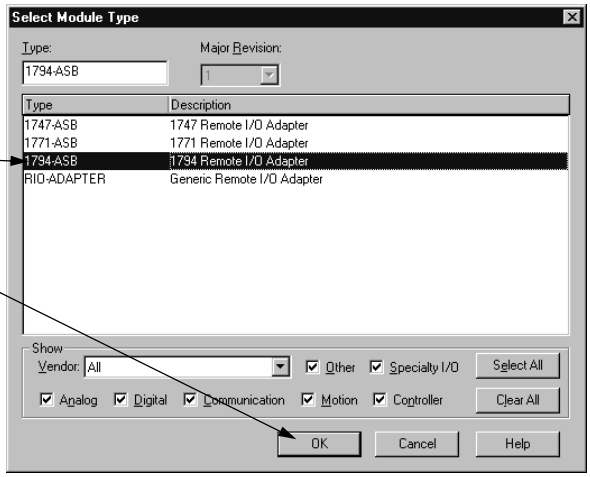
Add the Remote I/O Adapter

Add the remote I/O adapter to your project.

1. Right-click the module.
2. Click New Module.

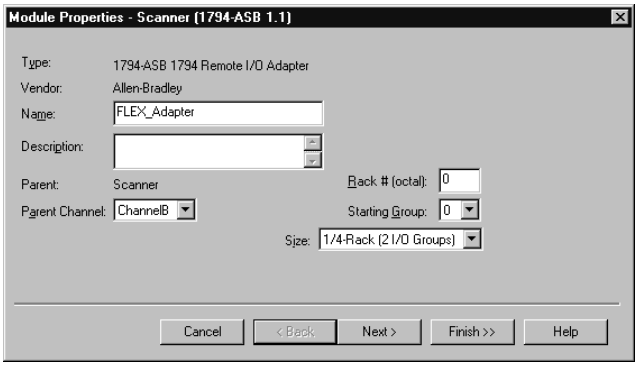


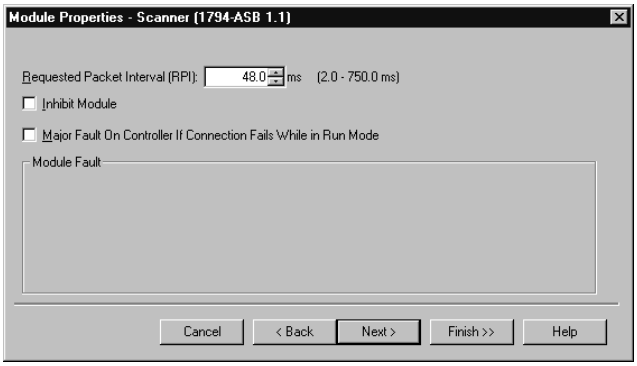
3. Select the adapter.
4. Click OK.



Configure the Remote I/O Adapter

Configure the newly added remote I/O adapter in the wizard dialog boxes that appear. The following figures show a 1794-ASB remote adapter. However, the parameters described in the following table apply to all remote I/O adapters that can be connected to the 1756-DHRIO and 1756-DHRIOXT modules.



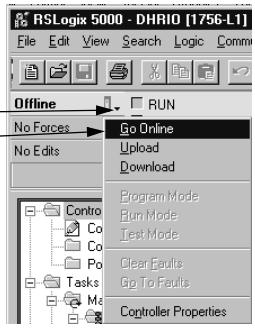


Naming Screen (first screen):	**Parameter:**	**Definition:**
	Name	Module name. This field is required.
	Description	Optional description of the module.
	Parent Channel	1756-DHRIO or 1756-DHRIOXT module channel to which this adapter is connected.
	Rack Number (#)	Remote I/O rack number (in octal from 0-76)
	Starting Group	First word of input/output from a given rack begins at group 0, 2, 4, or 6. For example, a system of 2 racks and 4 words of I/O can be: • Rack 12, st grp 2, size 1/4 • Rack 12, st grp 6, size 1/4
	Size	Words of data are available for the given rack, including: • 1/4 rack = 2 words of input and 2 words of output • 1/2 rack = 4 words of input and 4 words of output • 3/4 rack = 6 words of input and 6 words of output • Full rack = 8 words of input and 8 words of output
Requested Packet Interval Screen (second screen):	**Parameter:**	**Definition:**
	Requested Packet Interval	User-defined rate (2…750ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that lets you configure the remote I/O adapter module but prevent it from communicating with the controller. In this case, the controller does not establish a connection until the adapter is uninhibited.
	Major Fault on Controller if Connection Fails in Run Mode	Use this feature to choose whether a major fault occurs on the controller if the connection between the controller and the 1756-DHRIO or 1756-DHRIOXT module fails.

Download the Project to the Controller

After you write all configuration for your project, you must download the configuration to the controller.

1. Click the menu.
2. Click Go Online.



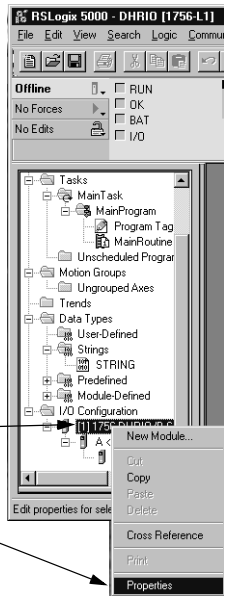
Edit Configuration

After you complete configuration for a project, you can review and change your choices. Changes can be made while the project is online (also known as Dynamic Reconfiguration) or offline.

IMPORTANT Although you can change configuration while a project is online, you must go offline to add or delete modules and adapters to or from the project.

The following figure shows how to access a module's properties.

1. Right-click the module.
2. Click Properties.



The naming page appears for the module on which you must change configuration.

Use the Studio 5000 Environment in 1756-DHRIO Module Block Transfer Applications

The Studio 5000 environment automatically allocates a portion of a controller's memory for the data collected in remote I/O applications. In block transfer applications, however, the data transferred between the controller and the remote modules (for example, analog or specialty I/O modules) is greater than the software can allocate memory for. You must generate tags (that is space in the controller's memory) for the data transferred. This section explains how to configure a block transfer application.

The process for block transfers with the 1756-DHRIO and 1756-DHRIOXT modules is similar to the process for remote I/O, except that block transfer applications require several additional steps, including the use of a message instruction to read data from or write data.

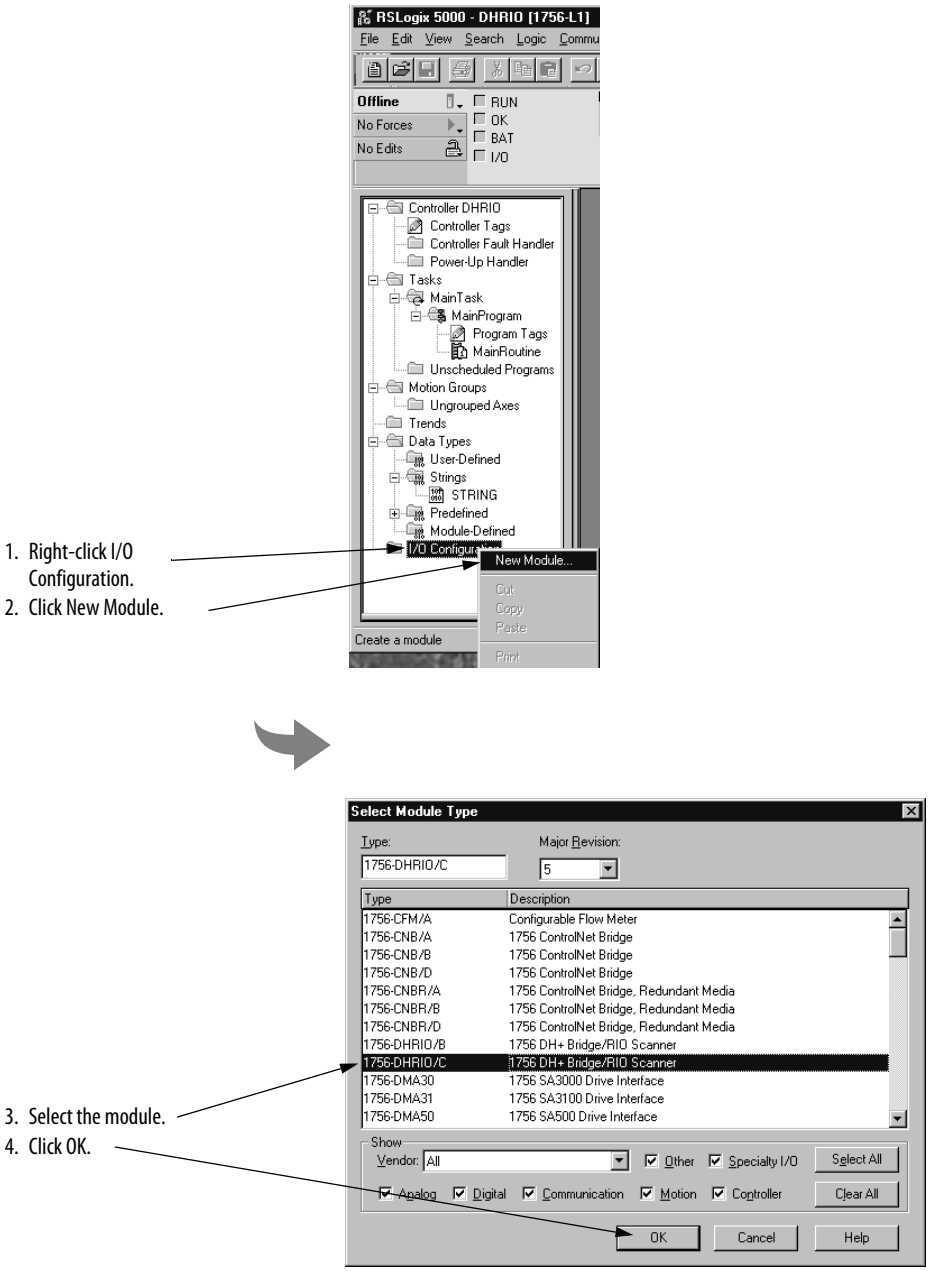
When you use the 1756-DHRIO or 1756-DHRIOXT module for block transfers, you must follow these basic steps:

1. Add the 1756-DHRIO or 1756-DHRIOXT module to the project.

2. Configure the 1756-DHRIO or 1756-DHRIOXT module, including setting the channels for Remote I/O.
3. Add a remote I/O adapter to the project.
4. Configure the remote I/O adapter.
5. Add remote I/O modules to the project.
6. Configure remote I/O modules.
7. Configure the Block Transfer (Read or Write) message instruction in the project's ladder logic.
8. Download the project to the controller.
9. Begin application operation (that is go online).
10. If necessary, change the configuration for all modules and adapters in the project.

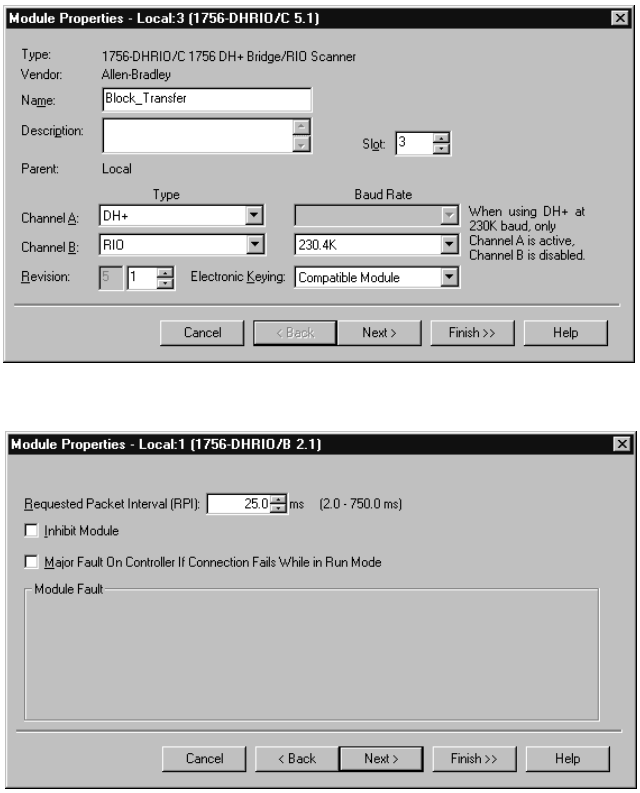
Add the 1756-DHRIO or 1756-DHRIOXT Module

After you start the Studio 5000 environment and create a project, you must create a 1756-DHRIO or 1756-DHRIOXT module.



Configure the Module

Configure the newly added 1756-DHRIO or 1756-DHRIOXT module in the wizard dialog boxes that appear. The following table describes the configurable parameters that appear on the wizard dialog boxes.

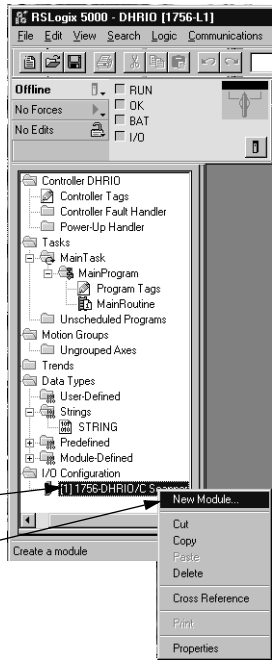


Naming Screen (first screen):	**Parameter:**	**Definition:**
	Name	Module name. This field is required.
	Description	Optional description of the module.
	Slot	Location of module in the chassis.
	Type	Application for each module channel. This field must be changed to RIO.
	Baud Rate	Rate of communication at which the 1756-DHRIO or 1756-DHRIOXT module scans the remote I/O. Available options are: • 57.6K bps • 115.2K bps • 230.4K bps
	Revision	Minor revision of the 1756-DHRIO or 1756-DHRIOXT module.
	Electronic Keying	Parameter that determines if the controller that owns the 1756-DHRIO or 1756-DHRIOXT module establishes a connection with the module. The options are: • Compatible Module - Controller attempts to establish a connection with any module in this slot that can emulate the configuration being sent from the controller. • Disable Keying - Controller attempts to establish a connection to the module regardless of its type. This option is not recommended. • Exact Match - Controller only attempts to establish a connection with the module if it matches the configuration parameters being sent from the controller.
Requested Packet Interval Screen (second screen):	**Parameter:**	**Definition:**
	Requested Packet Interval	User-defined rate (2…750ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that lets you configure a 1756-DHRIO or 1756-DHRIOXT module but prevent it from communicating with the controller. In this case, the controller does not establish a connection until the module is uninhibited.
	Major Fault on Controller if Connection Fails in Run Mode	Use this feature to choose whether a major fault occurs on the controller if the connection between the controller and the 1756-DHRIO or 1756-DHRIOXT module fails.

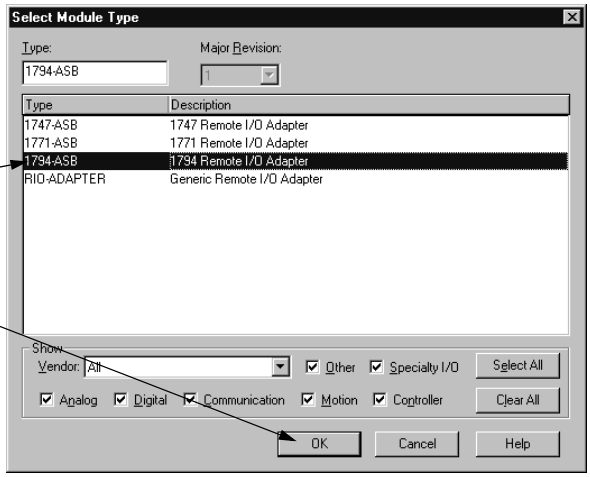
Add the Remote I/O Adapter

Add the remote I/O adapter to your project.

1. Right-click the 1756-DHRIO or 1756-DHRIOXT module.
2. Click New Module.

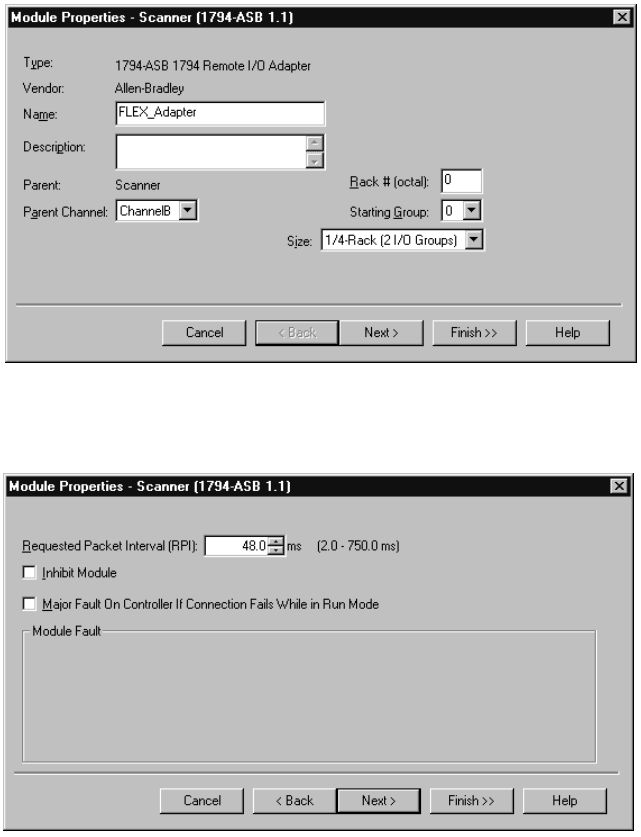


3. Select the adapter. In this example, we use the 1794-ASB adapter.
4. Click OK.



Configure the Remote I/O Adapter

Configure the newly added 1794-ASB remote I/O adapter in the wizard dialog boxes that appear. The following table describes the configurable parameters that appear on the wizard dialog boxes. However, the parameters described in the following table apply to all remote I/O adapters that can be connected to the 1756-DHRIO or 1756-DHRIOXT module.

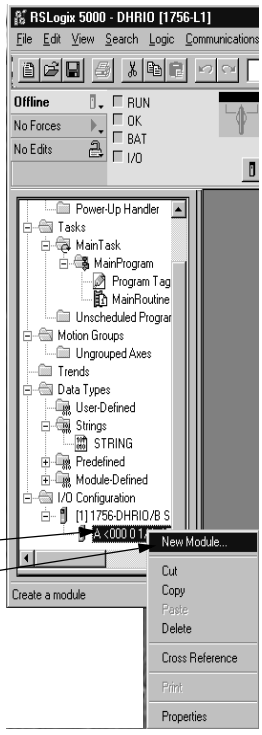


Naming Screen (first screen):	**Parameter:**	**Definition:**
	Name	Module name. This field is required.
	Description	Optional description of the module.
	Parent Channel	1756-DHRIO or 1756-DHRIOXT module channel to which this adapter is connected.
	Rack Number (#)	Remote I/O rack number (in octal from 0…76)
	Starting Group	First word of input/output from a given rack begins at group 0, 2, 4, or 6. For example, a system of 2 racks and 4 words of I/O can be: • Rack 12, st grp 2, size 1/4 • Rack 12, st grp 6, size 1/4
	Size	Words of data are available for the given rack, including: • 1/4 rack = 2 words of input and 2 words of output • 1/2 rack = 4 words of input and 4 words of output • 3/4 rack = 6 words of input and 6 words of output • Full rack = 8 words of input and 8 words of output
Requested Packet Interval Screen (second screen):	**Parameter:**	**Definition:**
	Requested Packet Interval	User-defined rate (2…750ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that lets you configure the remote I/O adapter module but prevent it from communicating with the controller. In this case, the controller does not establish a connection until the adapter is uninhibited.
	Major Fault on Controller if Connection Fails in Run Mode	Use this feature to choose whether a major fault occurs on the controller if the connection between the controller and the 1756-DHRIO or 1756-DHRIOXT module fails.

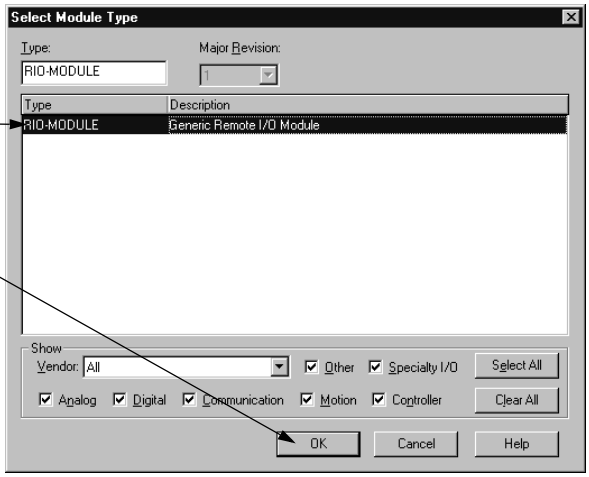
Add the Remote I/O Modules

Add the remote I/O modules to your project.

1. Right-click the remote I/O adapter.
2. Click New Module.

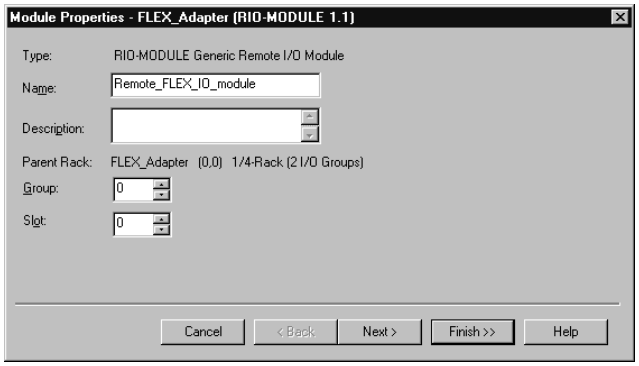


3. Select the RIO-MODULE.
4. Click OK.



Configure the Remote I/O Modules

Configure the newly added remote I/O modules.

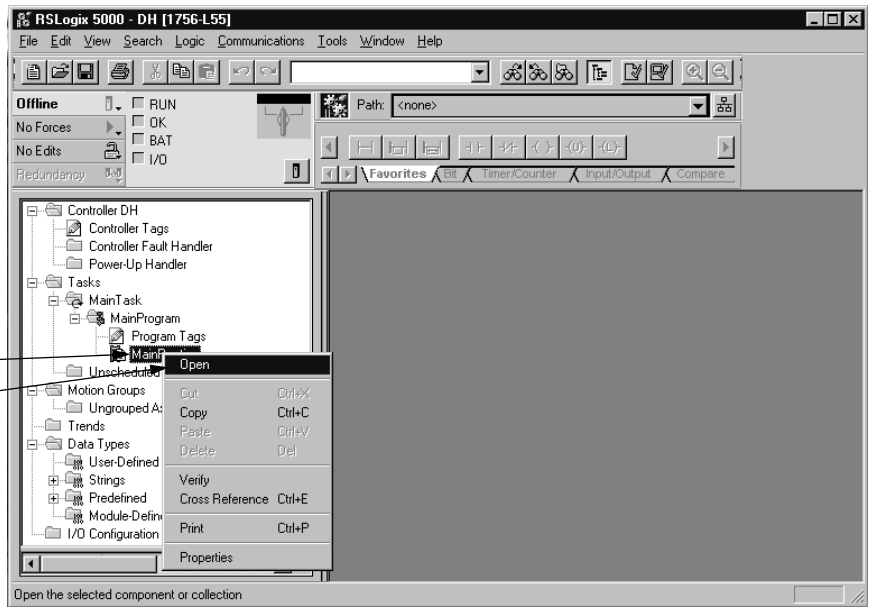


Naming Screen (first screen):	Parameter:	Definition:
	Name	Module name. This field is required.
	Description	Optional description of the module.
	Group	Determines what group on the module provides the first word of I/O data. This selection is affected by the parent module's configuration. For example, if the parent module's size = 1/2 rack (4 I/O groups), this module's configuration offers the option of starting with group 0, 1, 2 or 3.
	Slot	Location of the remote I/O module.

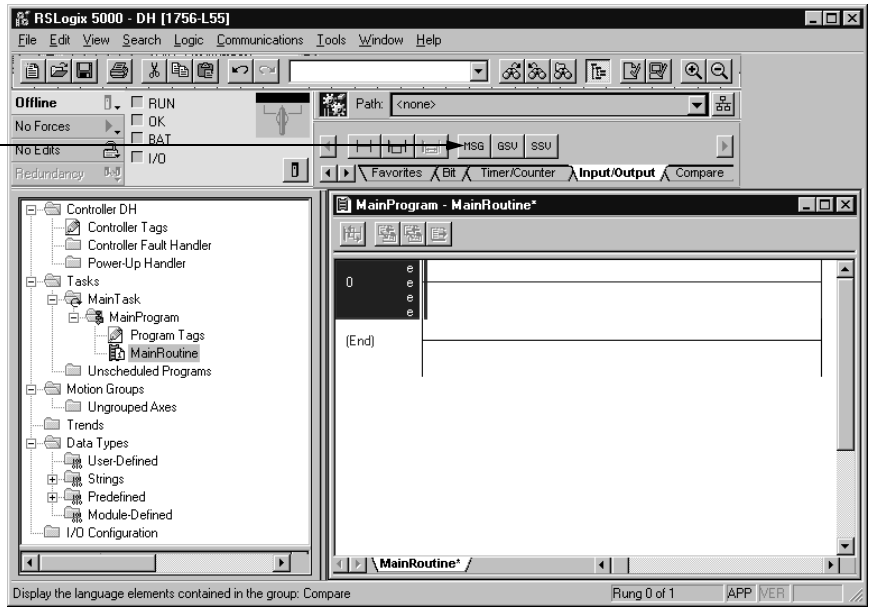
Create a Block Transfer (Read or Write) Message Instruction

After you add all modules to the block transfer project, you must write message instructions to transfer data between the controller and the remote I/O modules. Follow these steps:

1. Access the project's Main Routine of ladder logic.

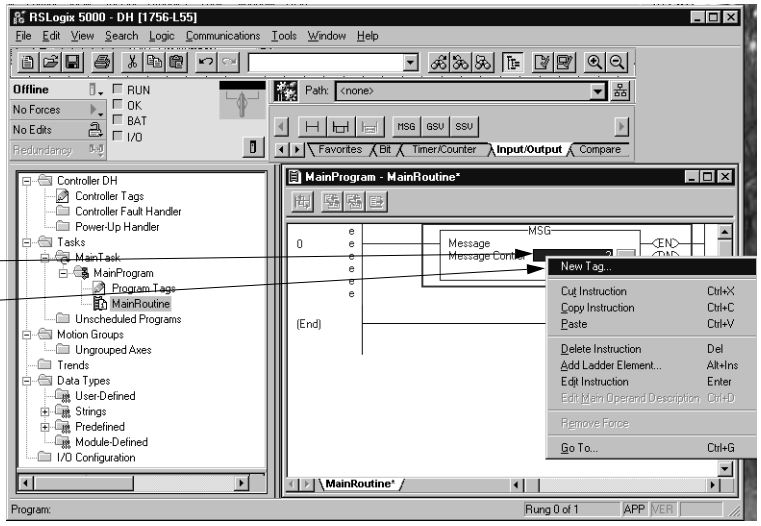


2. Add a message instruction.



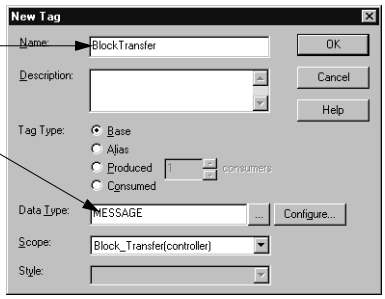
3. Add a new tag to the MSG instruction.

1. Right-click the question mark (?) in the menu.
2. Click New Tag.



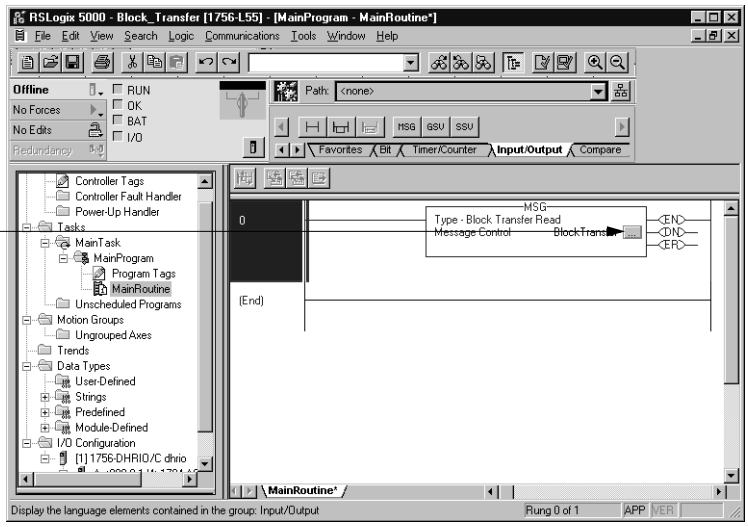
4. Name and define the new tag.

1. Name the tag.
2. Make sure this tag is of the MESSAGE type.



5. Access the message type configuration and communication parameters.

Double-click the ellipsis (. . .) button.

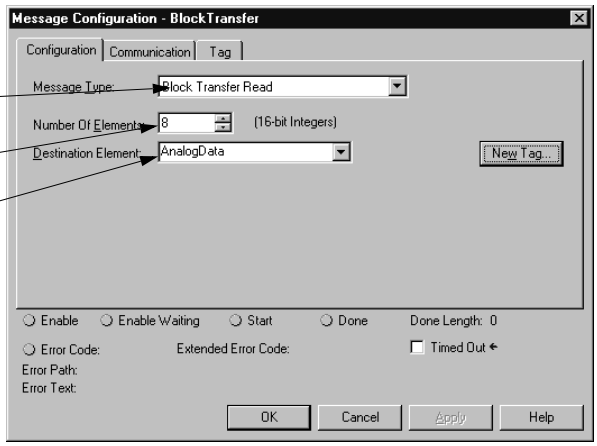


To create **Block Transfer Read** messages, see step 6. To create **Block Transfer Write** messages, see step 8.

6. Change the message configuration. In this step, we create a Block Transfer Read (that is the controller uses the message instruction to read data from remote module inputs) message. For an example of creating a Block Transfer Write message, see step 8.

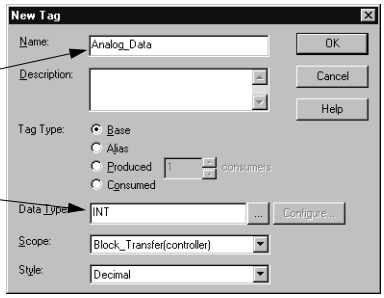
1. Choose the Message Type from the pull-down list.
2. Type the Number of Elements being written.
3. Specify the Destination Element. You can:
   - Choose an element from the pull-down (that is browse to the tag)

     or
   - Use the New Tag button to create the tag where data is read from on the remote module.



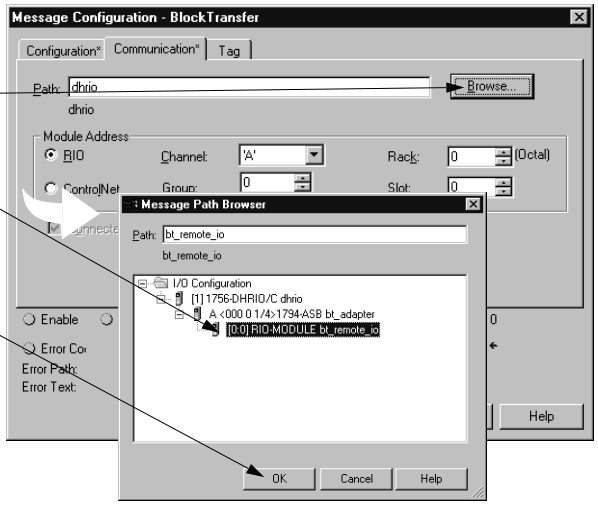
If you create a Tag, you must:

1. Name the tag.
2. Make sure the Data Type is Integer (INT).



7. Set the communication path for the message instruction.

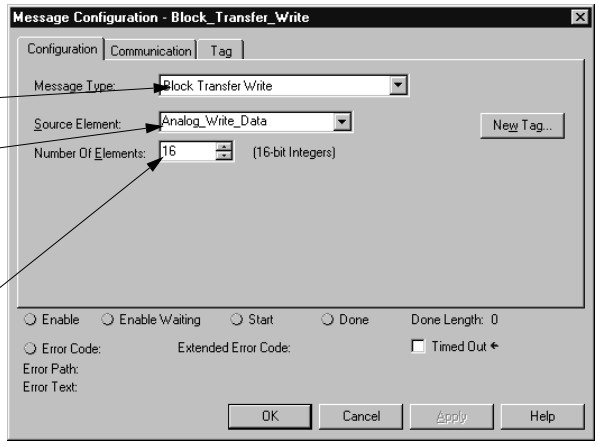
1. Use the Browse button to select the path.
2. Select the destination module for the message instruction.
3. Click OK.



8. To create a Block Transfer Write message, change the message configuration as shown below.

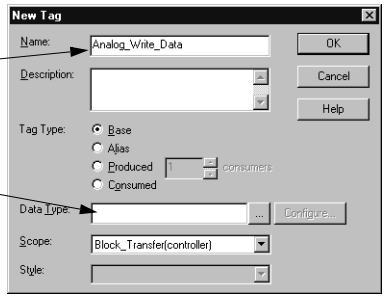
1. Choose the Message Type from the pull-down list.
2. Specify the Source Element. You can:
   - Choose an element from the pull-down (that is browse to the tag)

     or
   - Use the New Tag button to create the tag where data is written to on the remote module.
3. Type the Number of Elements being written.



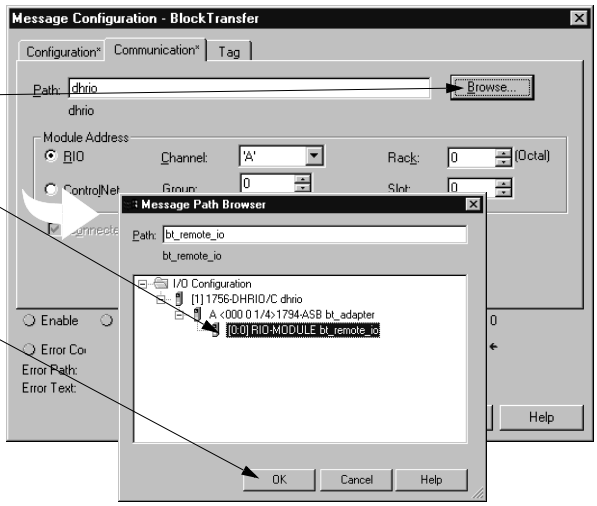
If you create a Tag, you must:

1. Name the tag.
2. Make sure the Data Type is Integer (INT).



9. Set the communication path for the message instruction.

1. Use the Browse button to select the path.
2. Select the destination module for the message instruction.
3. Click OK.



Notes:

Connecting a ControlLogix Controller to Remote I/O

What This Chapter Contains

This chapter describes how to use the 1756-DHRIO and 1756-DHRIOXT modules in remote I/O scanner mode to connect a ControlLogix controller to remote I/O.

IMPORTANT

In these examples, only channel B is configured as a remote I/O scanner. You can configure the channels as remote I/O scanners simultaneously if necessary.

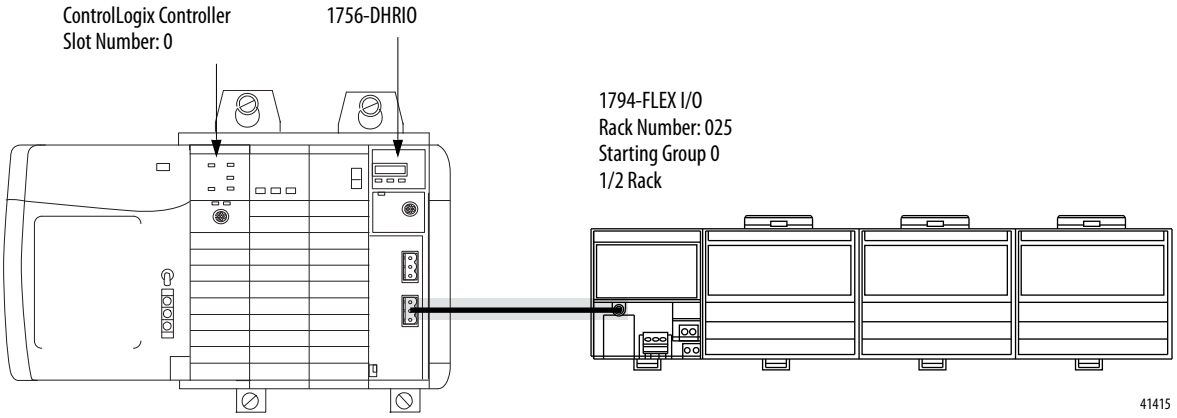
If only one channel is configured as a remote I/O scanner, we recommend you use channel B. If you configure channel A as a remote I/O scanner, you cannot use the programming terminal on the front of the 1756-DHRIO and 1756-DHRIOXT modules for DH+ access.

Also, throughout this chapter, we show sample configuration dialog boxes with each example. Configuration information is dependent on your application needs.

Scan Remote FLEX Adapters through One 1756-DHRIO or 1756-DHRIOXT Module in a Local 1756-Chassis

In this application, a ControlLogix controller controls remote I/O modules through a 1756-DHRIO or 1756-DHRIOXT module in the local chassis.

The following figure illustrates the steps you follow to use this application.

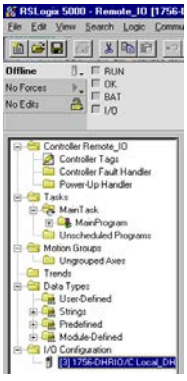


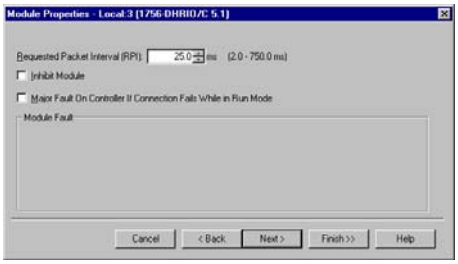
Configure the Module Switches

In this application, channel B on the 1756-DHRIO or 1756-DHRIOXT module must be set for RIO. Channel A can be used for remote I/O or DH+, regardless of the usage assigned to channel B.

Configure the Module

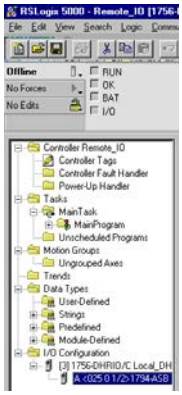
Use the Studio 5000 environment to configure the 1756-DHRIO or 1756-DHRIOXT module. The following figure shows some sample configuration dialog boxes for the 1756-DHRIO or 1756-DHRIOXT module in this example.

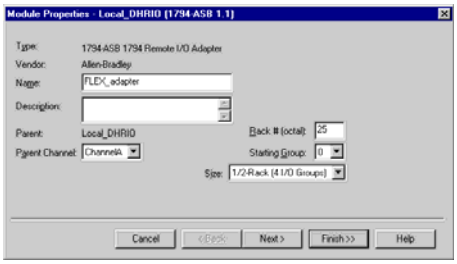


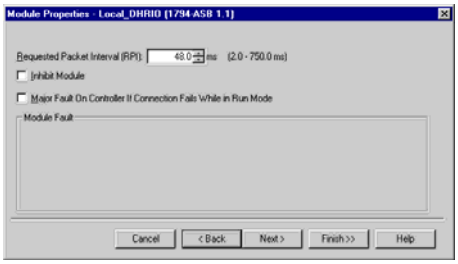


Configure the FLEX Adapter

Use the Studio 5000 environment to configure the FLEX adapter. The following figure shows some sample configuration dialog boxes for the FLEX adapter in this example.



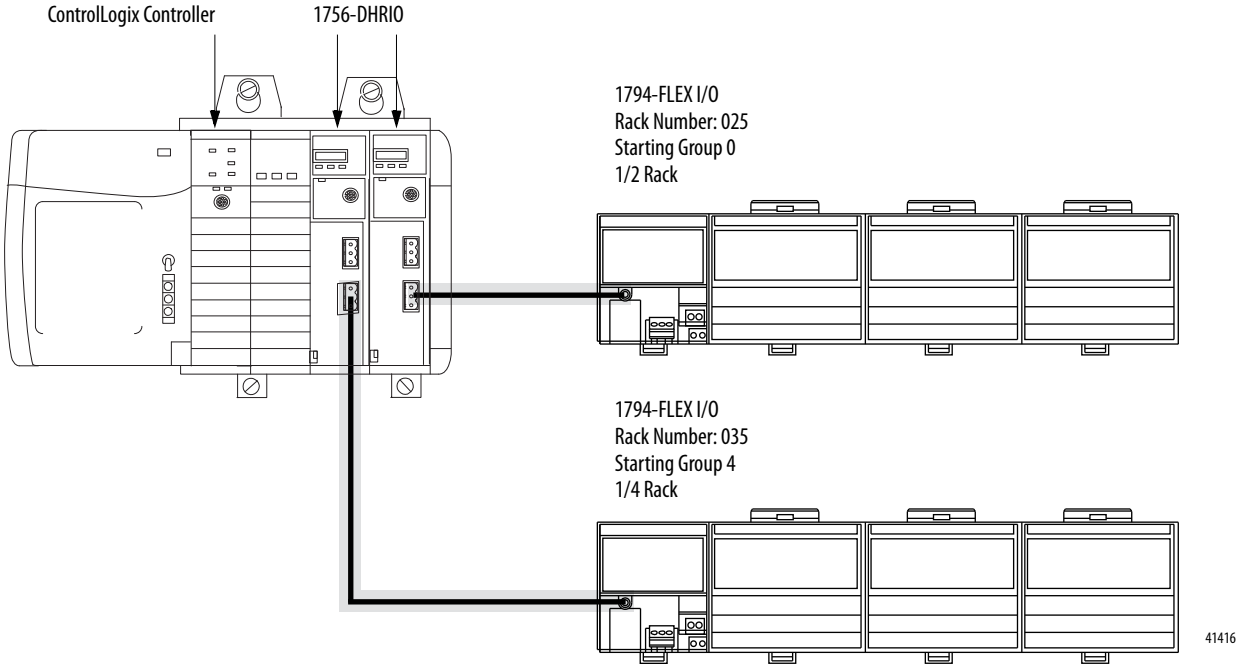




Scan Remote FLEX Adapters through Multiple 1756-DHRIO or 1756-DHRIOXT Modules in a Local Chassis

In this application, a ControlLogix controller scans multiple FLEX remote I/O adapters through multiple 1756-DHRIO or 1756-DHRIOXT modules in the local chassis.

The following figure illustrates the steps you must use in this example.

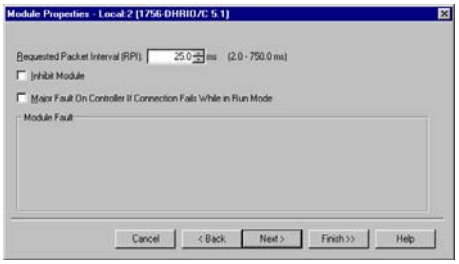


Configure the Module Switches

In this application, channel B on the 1756-DHRIO and 1756-DHRIOXT module must be set for RIO. Channel A can be used for remote I/O or DH+, regardless of the usage assigned to channel B.

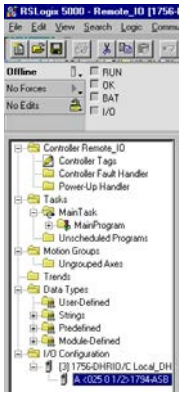
Configure the First Module

Use the Studio 5000 environment to configure the 1756-DHRIO or 1756-DHRIOXT module. The following figure shows some sample configuration dialog boxes for the first 1756-DHRIO or 1756-DHRIOXT module in this example.



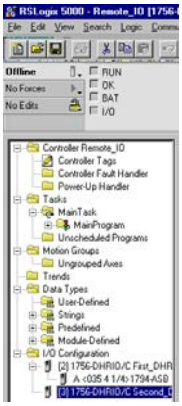
Configure the First FLEX Adapter

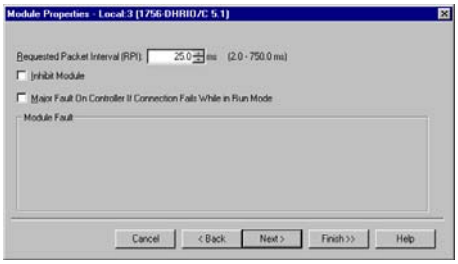
Use the Studio 5000 environment to configure the first FLEX adapter. The following figure shows some sample configuration dialog boxes for the first FLEX adapter in this example.



Configure the Second Module

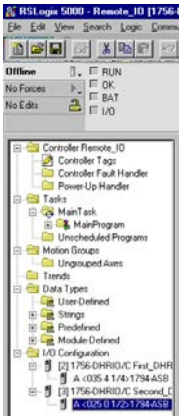
Use the Studio 5000 environment to configure the second 1756-DHRIO or 1756-DHRIOXT module. The following figure shows some sample configuration dialog boxes for the second 1756-DHRIO or 1756-DHRIOXT module in this example.

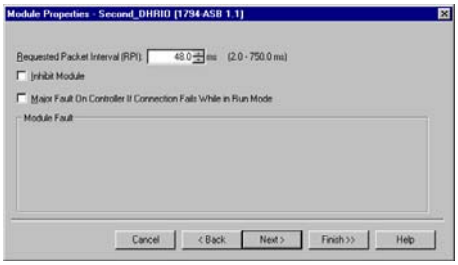




Configure the Second FLEX Adapter

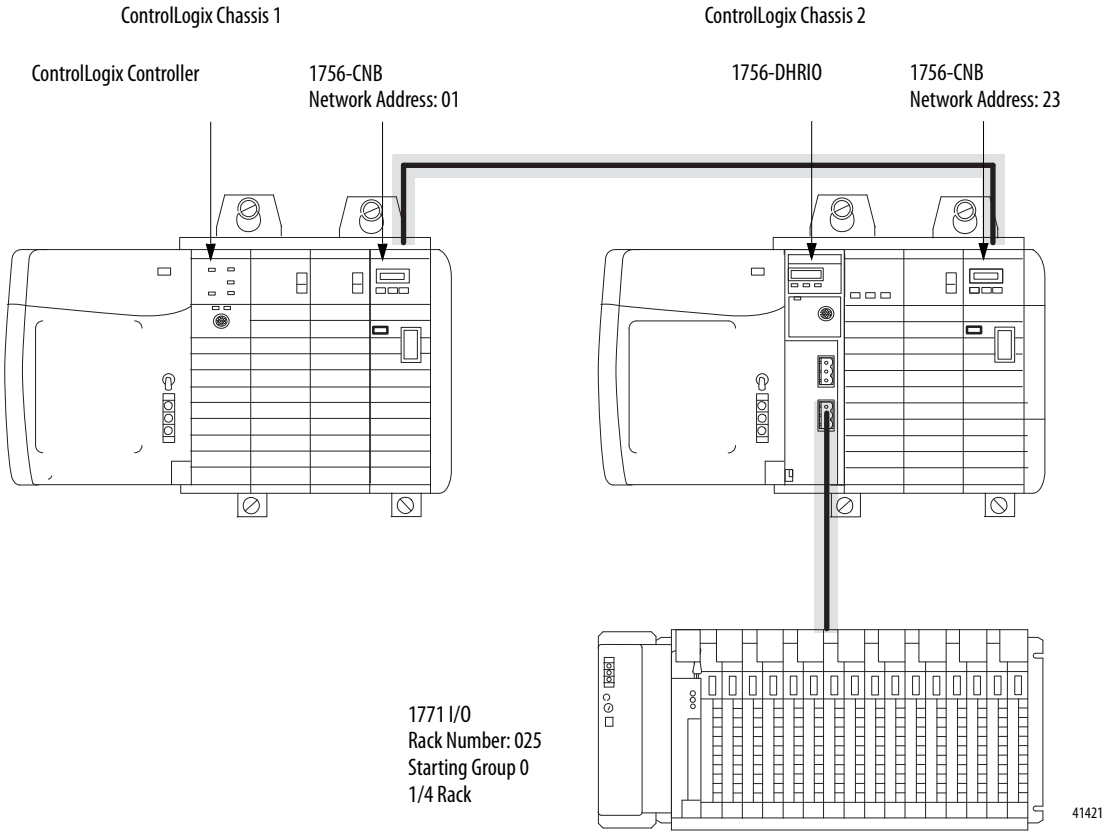
Use the Studio 5000 environment to configure the second FLEX adapter. The following figure shows some sample configuration dialog boxes for the second FLEX adapter in this example.





Scan 1771 Remote I/O Adapters through a 1756-DHRIO or 1756-DHRIOXT Module in a Remote Chassis

In this application, a ControlLogix controller scans remote FLEX I/O modules through a 1756-DHRIO or 1756-DHRIOXT module in a remote chassis over a ControlNet network. The following figure illustrates the steps you follow to use this application.



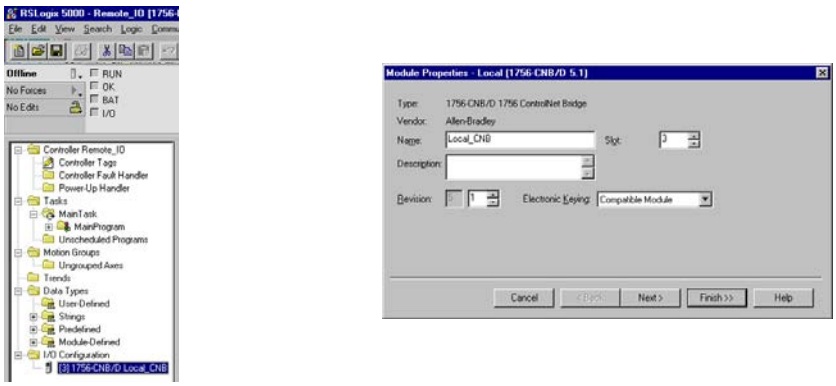
Configure the 1756-DHRIO or 1756-DHRIOXT Module Switches

In this application, channel B on the 1756-DHRIO or 1756-DHRIOXT module must be set for RIO. Channel A can be used for remote I/O or DH+, regardless of the usage assigned to channel B.

Configure the switches on the 1756-CNB modules to the correct node addresses. The 1756-CNB module in system number 1 uses node address 01 and the 1756-CNB module in system number 2 uses node address 23.

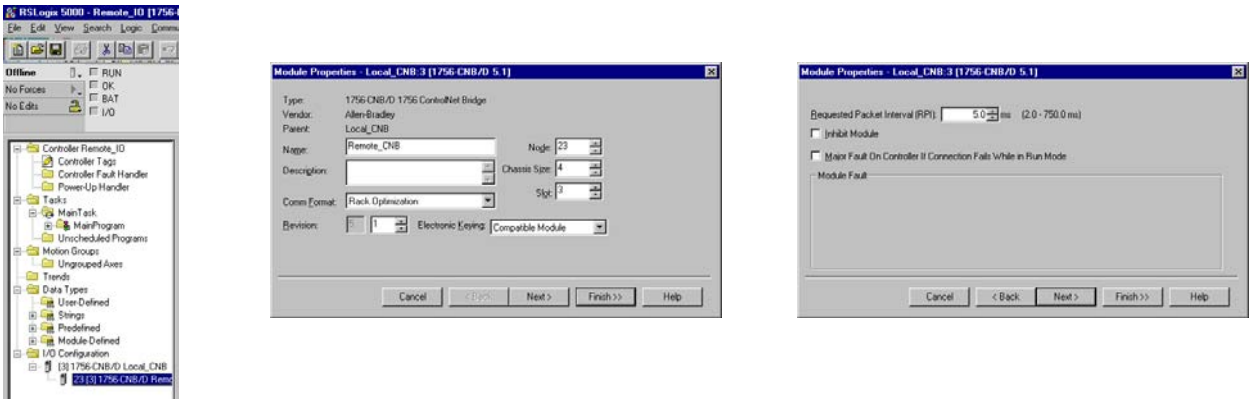
Configure First 1756-CNB Module

Use the Studio 5000 environment to configure the 1756-CNB module. The following figure shows some sample configuration dialog boxes for the first 1756-CNB module in this example.



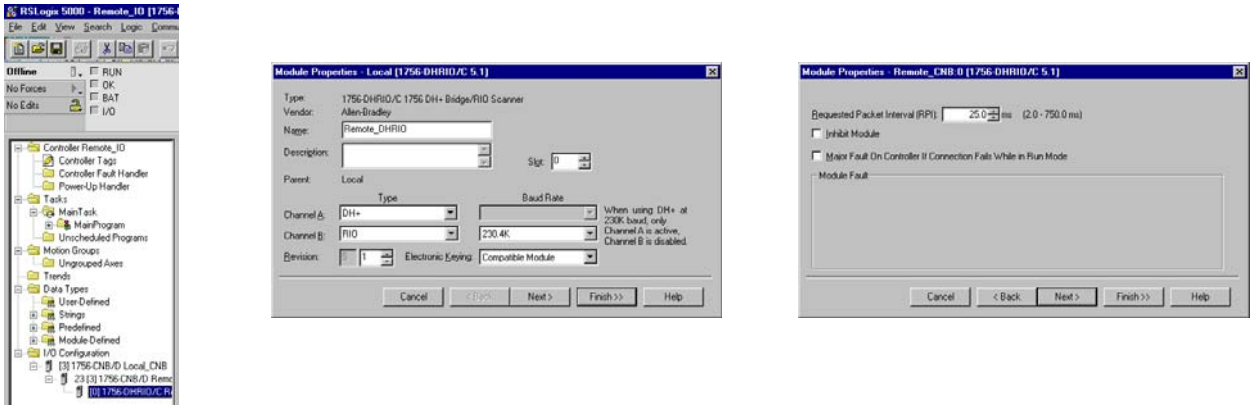
Configure the Second 1756-CNB Module

Use the Studio 5000 environment to configure the 1756-CNB module. The following figure shows some sample configuration dialog boxes for the second 1756-CNB module in this example.



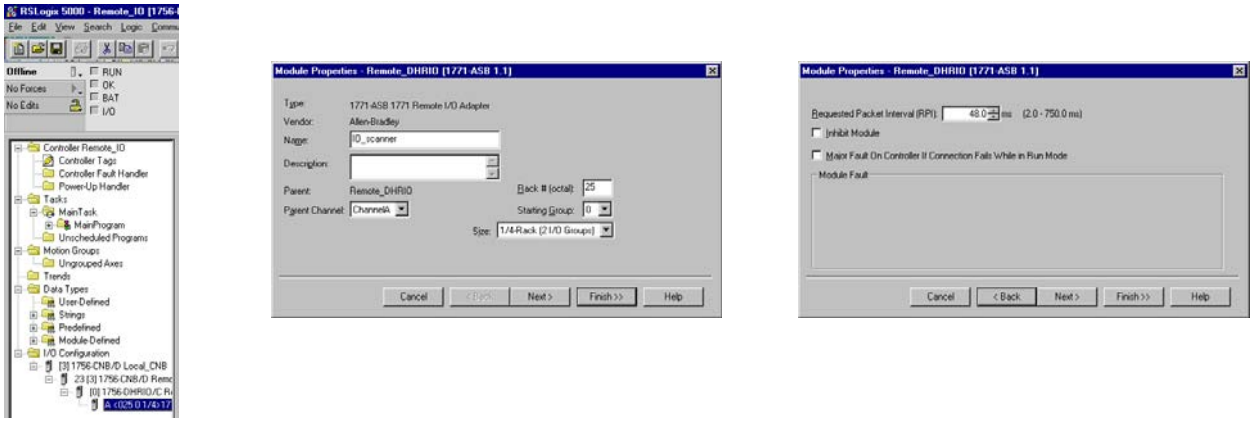
Configure the 1756-DHRIO or 1756-DHRIOXT Module

Use the Studio 5000 environment to configure the 1756-DHRIO or 1756-DHRIOXT module. The following figure shows some sample configuration dialog boxes for the 1756-DHRIO or 1756-DHRIOXT module in this example.



Configure the 1771-ASB Adapter

Use the Studio 5000 environment to configure the 1771-ASB adapter. The following figure shows some sample configuration dialog boxes for the 1771-ASB adapter in this example.



Run RSNetWorx Software

You must run RSNetWorx™ software for this application to begin operation. For more information on how to run RSNetWorx software, see the online help for that software.

Notes:

Block Transfers with the 1756-DHRIO or 1756-DHRIOXT Module

What This Chapter Contains

This chapter describes how to use the 1756-DHRIO or 1756-DHRIOXT module to connect a ControlLogix controller to a remote I/O Block Transfer (BT) module.

The 1756-DHRIO and 1756-DHRIOXT modules support sending block transfer (BT) data and discrete I/O to the ControlLogix controller. This data exchange transfers up to 64 words of data to/from a selected I/O module.

The BT data exchange is message-based (that is a message instruction in the Ladder Logic program of the ControlLogix controller must be used to initiate the BT request). In the case of digital I/O modules, simply by entering the adapter in the ControlLogix controller organizer, data is transferred without requiring instructions.

The process for completing block transfers on remote I/O remains consistent with all adapters products. The remote I/O network characteristics defined for the PLC-5 remote I/O scanner are the same for the 1756-DHRIO remote I/O scanner.

Block Transfer Fault Notification

The message timeout for the BT message is fixed at 4.5 seconds. This timeout is a ControlLogix network response timeout associated with the connection established between the 1756-DHRIO or 1756-DHRIOXT module and the ControlLogix controller. The primary timeout for the BT response is remote I/O network based. This timeout occurs in 4 seconds if the I/O module fails to respond to the BT message.

Block Transfer 'Pass-Through' Messages

DH+ 'Block Transfer (BT) Pass-Through' messages are DH+ (PCCC) messages sent to an remote I/O channel, where it causes an remote I/O Block Transfer.

To target a DH+ 'BT Pass-Through' message to an remote I/O channel on a 1756-DHRIO or 1756-DHRIOXT module, the final destination of the DH+ message must be the 1756-DHRIO or 1756-DHRIOXT module with the remote I/O channel.

In the case of Local DH+ Messaging, the bridging 1756-DHRIO or 1756-DHRIOXT module must have its default slot configured to match the location (slot) of the final destination 1756-DHRIO or 1756-DHRIOXT module (module with the remote I/O channel).

In the case of Remote DH+ Messaging, the destination link ID and destination node of the DH+ message must be set to the final destination 1756-DHRIO or 1756-DHRIOXT module (module with the remote I/O channel).

For example, if the target is an remote I/O channel on a 1756-DHRIO or 1756-DHRIOXT module in slot 5 of a ControlLogix chassis and remote DH+ messaging is used, the destination link ID is set to the ControlLogix chassis link ID and the remote destination node is set to 5.

IMPORTANT To send DH+ 'Pass-Through' messages to a 1756-DHRIO or 1756-DHRIOXT module, the module must be configured with a routing table, as described in Chapter 2, even if the channels are configured for remote I/O.

Block Transfer Examples

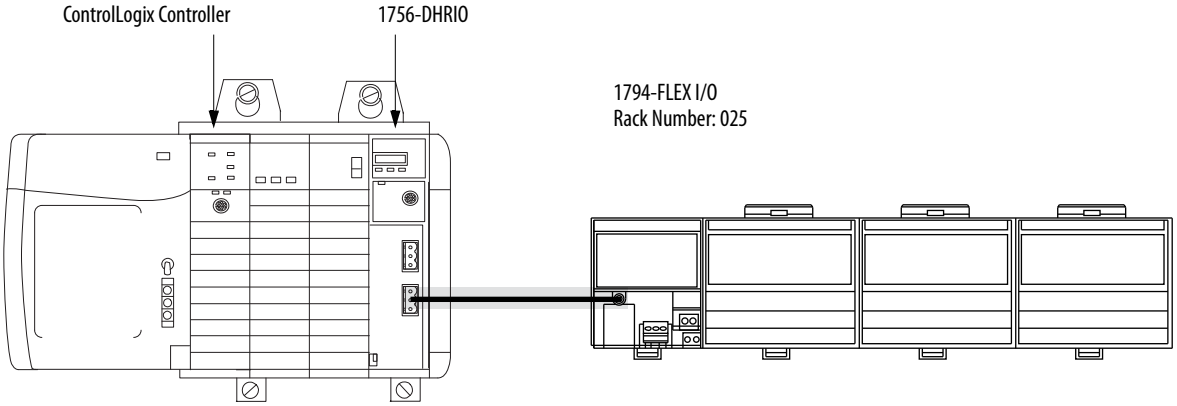
IMPORTANT In the examples in this chapter, only channel B is connected to remote I/O. You can connect the channels to remote I/O simultaneously if necessary.

If only one channel is connected to remote I/O, it is recommended that you use channel B. If you connect channel A to remote I/O, you cannot use the programming terminal on the front of the 1756-DHRIO or 1756-DHRIOXT module.

Block Transfers to Remote FLEX I/O Modules through a 1756-DHRIO or 1756-DHRIOXT Module in a Local Chassis

This application enables a ControlLogix controller to initiate block transfers to remote FLEX I/O modules through a 1756-DHRIO or 1756-DHRIOXT module in the local chassis.

The following figure illustrates the steps you must use in this example.

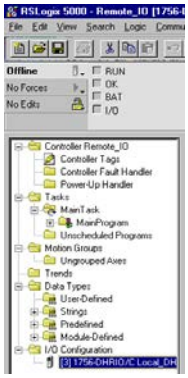


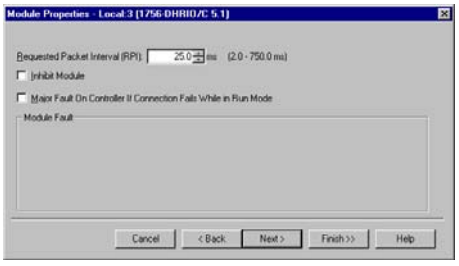
Configure the Module Switches

Channel B on the 1756-DHRIO or 1756-DHRIOXT module must be set for RIO. Channel A can be used for remote I/O or DH+, regardless of the usage assigned to channel B.

Configure the 1756-DHRIO or 1756-DHRIOXT Module

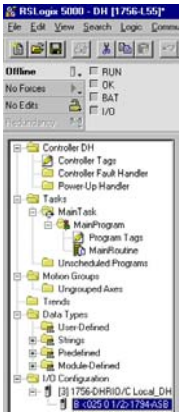
Use the Studio 5000 environment to configure the 1756-DHRIO or 1756-DHRIOXT module. The following figure shows some sample configuration dialog boxes for the 1756-DHRIO or 1756-DHRIOXT module in this example.

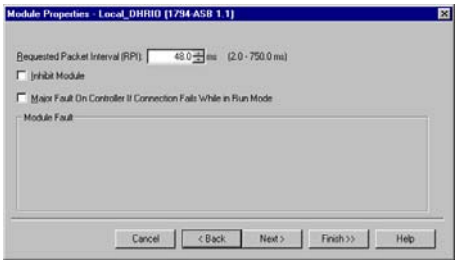




Configure the FLEX Adapter

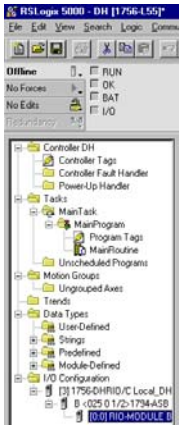
Use the Studio 5000 environment to configure the FLEX adapter. The following figure shows some sample configuration dialog boxes for the FLEX adapter in this example.

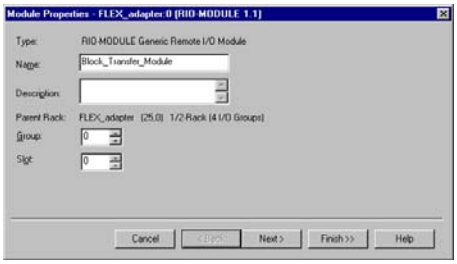




Configure the Block Transfer Module

Use the Studio 5000 environment to configure the Block Transfer module. The following figure shows some sample configuration dialog boxes for the Block Transfer module in this example.

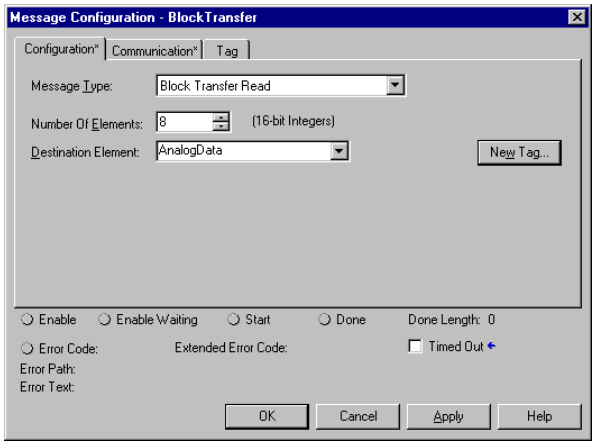




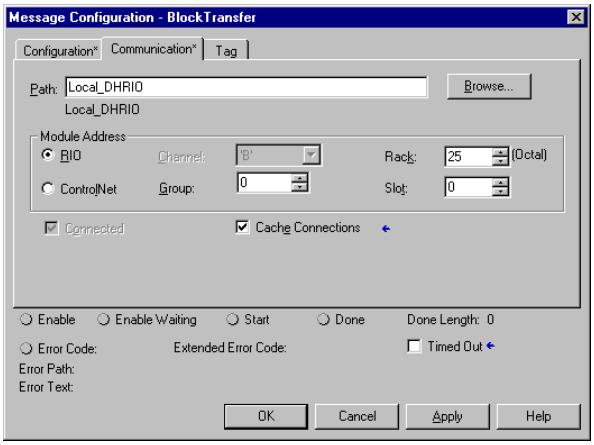
Configure Message Instruction

Use the Studio 5000 environment to configure the block transfer message instructions. The following figure shows the message instruction tabs necessary for this example.

Configuration Tab

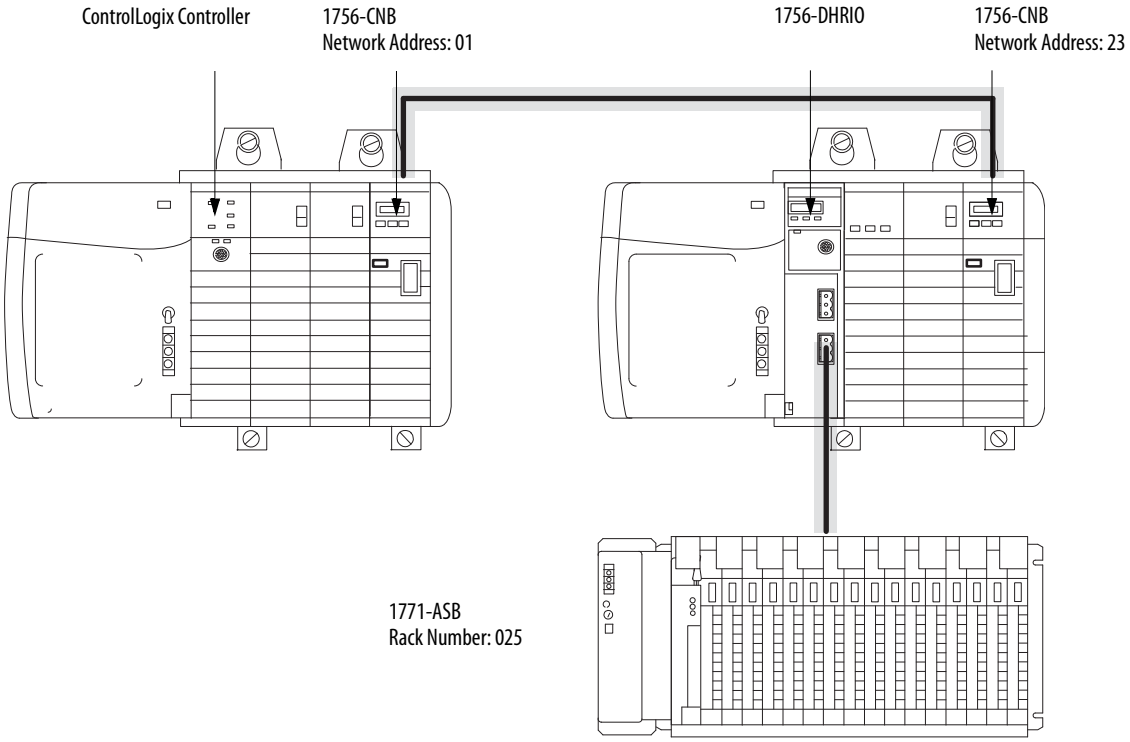


Communication Tab



Block Transfers to Remote 1771-ASB I/O Modules through a 1756-DHRIO or 1756-DHRIOXT Module in a Remote Chassis

This application enables a ControlLogix controller to write block transfers to remote 1771-ASB I/O modules through a 1756-DHRIO or 1756-DHRIOXT module in a remote chassis over a ControlNet link. The following diagram illustrates the steps you follow to use this application.



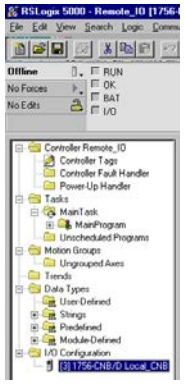
Configure the Module Switches

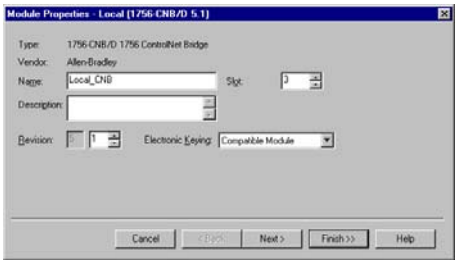
In this application, channel B on the 1756-DHRIO or 1756-DHRIOXT module must be set for RIO. Channel A can be used for remote I/O or DH+, regardless of the usage assigned to channel B.

Set the switches on the 1756-CNB modules to the correct network addresses. The 1756-CNB module in system number 1 uses network address 01 and the 1756-CNB module in system number 2 uses network address 23.

Configure the First 1756-CNB Module

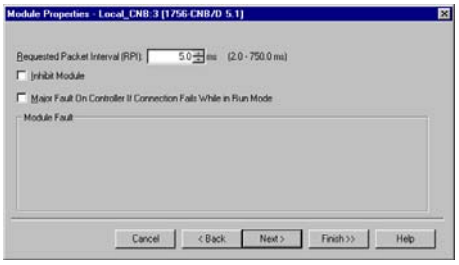
Use the Studio 5000 environment to configure the 1756-CNB module. The following figure shows some sample configuration dialog boxes for the first 1756-CNB module in this example.





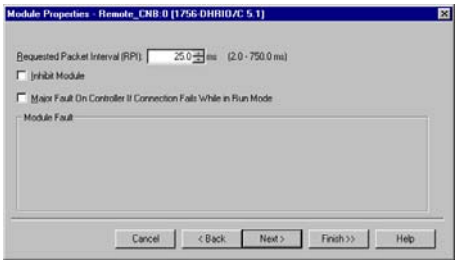
Configure the Second 1756-CNB Module

Use the Studio 5000 environment to configure the 1756-CNB module. The following figure shows some sample configuration dialog boxes for the second 1756-CNB module in this example.



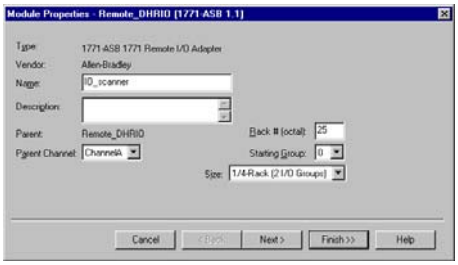
Configure the 1756-DHRIO or 1756-DHRIOXT Module

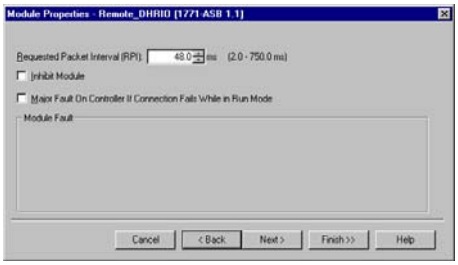
Use the Studio 5000 environment to configure the 1756-DHRIO or 1756-DHRIOXT module. The following figure shows some sample configuration dialog boxes for the 1756-DHRIO or 1756-DHRIOXT module in this example.



Configure the 1771-ASB Adapter

Use the Studio 5000 environment to configure the 1771-ASB adapter. The following figure shows some sample configuration dialog boxes for the 1771-ASB adapter in this example.





Troubleshooting the Module

What This Chapter Contains

This chapter describes your module's diagnostics and methods of troubleshooting your module.

Check Power Supply and Module Status

On power-up, three events occur simultaneously:

- Alphanumeric status indicator on the module illuminates and cycles through the following sequence of messages:
  - Channel A and the network used for channel A - DH+ or RIO
  - Channel A node address, if used for DH+
  - Channel A status
  - Channel B and the network used for channel B - DH+ or RIO
  - Channel B node address, if used for DH+
  - Channel B status

  This sequence runs continuously during normal module operation.

EXAMPLE For example, if your module uses the following:

- Channel A for DH+ with node address 14
- Channel B for RIO

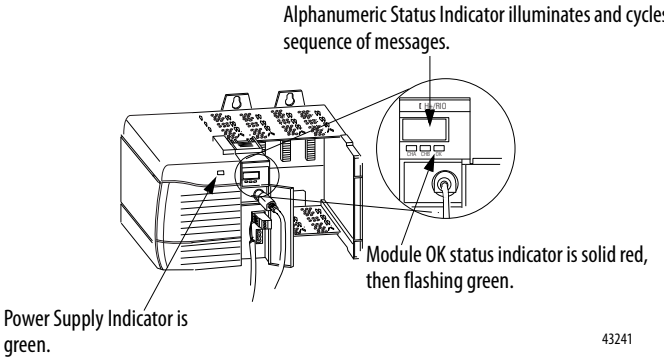
and the channels are operating properly, you see the following sequence:

- A DH, A#14, A OK, B IO, SCAN, B OK

- Module OK status indicator shows solid red and then flashes green
- Power supply indicator shows solid green

Status Indicators

The following figure and tables describe the module status indicators.



Data Highway Plus	
Sequence of display	**Where**
A DH A#xx xxxx	A is the channel (A or B) and DH indicates network type is DH+. xx is the channel's node address. xxxx is the channel's status message.
Remote I/O	
Sequence of display	**Where**
BIO SCAN xxxx	B is the channel (A or B) and IO indicates network type is Remote I/O. SCAN indicates scanner. xxxx is the channel's status message.

If after powerup, the alphanumeric indicator does not start cycling (or if it stops cycling) through these messages, see the following tables.

Power Supply Indicator		
If the power indicator is:	**Power supply is:**	**Take this action:**
Off	Not operating	Turn power switch ON. Check power wiring connections. Check fuse.
On	Operating	None; normal operation

Alphanumeric Indicator Status Message - Data Highway Plus		
If the alphanumeric indicator status message shows:	**Network status is:**	**Take this action:**
OFF LINE	Data Highway Plus link is in STOP state.	Correct the configuration.
DUPL NODE	Data Highway Plus Duplicate node address.	Select another node address and reset switches.
ONLY NODE	Only node on Data Highway Plus link.	Check cables.
CNFG FALT	Incorrect Data Highway Plus routing table configuration. Incorrect Data Highway object configuration.	Verify the module is inserted into the correct slot.
OK	Normal operation for that channel.	None.

Alphanumeric Indicator Status Message - Remote I/O		
If the OK indicator is:	**Module status is:**	**Take this action:**
MUTE LINK	No adapters found on remote I/O.	Add an adapter to the remote I/O network.
RACK OVER	Rack overlap on remote I/O.	Reconfigure remote I/O racks.
DUPL SCAN	Duplicate scanner on remote I/O.	Check remote I/O adapter settings.
MAX_ DEV_	Maximum devices exceeded on remote I/O.	Remove devices to meet limitations on remote I/O network.
CHAT LINK	Babble detected on remote I/O.	Check remote I/O device and network connections.
OFF_ LINE	Not trying to communicate.	None. Normal state if controller is not controlling remote I/O.
OK	Normal operation for that channel.	None.

Module Status - OK Indicator		
If the OK indicator is:	**Module status is:**	**Take this action:**
Off	Not operating.	Apply chassis power. Verify module is completely inserted into chassis and backplane.
Green flashing	Operating, but not routing messages and no controller transferring I/O.	None, if no messages are actively being routed through the module and no controller transferring I/O. To route messages or transfer I/O, use module default configuration or configure module.
Red, then Off	Performing self-test.	None, normal operation.
Green	Operating and routing messages.	Verify module configuration.
Red	In major fault.	Restart module. If red reoccurs, replace module.
Red flashing	In major fault or configuration fault.	Check alphanumeric indicator and take action described in Alphanumeric Indicator Status Message table.

Channel Status - Channel A and Channel B Indicators			
If the Channel A or B indicator is:	**In this channel mode:**	**Channel status is:**	**Take this action:**
Off	All	Not online.	Place channel online.
Green	RIO scanner	Active RIO link. All adapter modules are present and not faulted.	None, normal operation
	DH+	Operating.	None, normal operation.
Green flashing	RIO scanner	One or more nodes faulted or failed.	Check power at other racks.
	DH+	No other node on the network.	Check cables.
Red	All	Hardware fault.	Restart module. If red still on, replace module.
Red flashing	RIO scanner	Faulted adapters detected.	Check cables. Check power at other racks.
	DH+	Duplicate node detected.	Check node address.

Minimizing False Received Frame with Bad CRC Messages

1756-DHRIO and 1756-DHRIOXT modules that communicate with a 1784-KT or 1784-PCMK communication card on their DH+ link can receive the following error message:

Received Frame with Bad CRC

This error does not affect DH+ link operations. To minimize its occurrence, make sure that the DH+ link is terminated properly.

PCCC Commands Supported by the Data Highway Plus Module

What This Appendix Contains

This appendix describes PCCC commands that your 1756-DHRIO and 1756-DHRIOXT modules can execute. The module executes these commands when received on one of its DH+ ports under only the following conditions:

- The final destination address must be an address for the 1756-DHRIO.
- For DH+ messages with LSAP = 0 (local), the diagnostic commands are executed directly by the 1756-DHRIO or 1756-DHRIOXT module if the destination address is the 1module's DH+ node address.
- For DH+ messages with LSAP = 1 (remote), the diagnostic commands are executed directly by the 1756-DHRIO or 1756-DHRIOXT module if the DH+ message's network destination address is the network address of one of the DH+ ports on the 1756-DHRIO or 1756-DHRIOXT module, or if the DH+ message's network destination link ID is 0 and the network destination node is the module's DH+ port node address.
- For the first case of the remote message the Routing Table and DH+ ports must be configured

Echo

Any data sent in the echo command is returned in the echo reply.

CMD = 06h, FNC = 00

ID Host and Status

This command lets you check the location and status of the controlling intelligent device, such as a PLC-5, that is connected to the DHRIO network.

CMD = 06h, FNC = 03

The definition of the data returned is shown in the following table.

Byte	Description		
0	PLC Mode = 00		
1	Interface Type = 0xEE		
2	Interface Type Extension = 0x3D		
3	Processor Type Extension = 0x76		
4 - 5	Reserved		
6	Pointer to Diagnostic Counters (low byte) = 00		
7	Pointer to Diagnostic Counters (high byte) = 00		
8	Major and Minor Revision		
	Bits 0 - 3	1 = Minor Revision 1	
		2 = Minor Revision 2	
		and so forth	
	Bits 4 - 7	1 = Major Revision 1	
		2 = Major Revision 2	
		and so forth	
9	Options - Port A		
	Bits 0 - 1	Port A Type, where	00 = illegal
			01 = remote I/O
			10 = DH+
			11 = illegal
	Bits 2 - 3	Unused	
	Bits 4 - 5	Port A Baud Rate, where	00 = 57.6 Kb
			01 = 115 Kb
			10 = 230 Kb
			11 = illegal
	Bits 6 - 7	Unused	

Byte	Description		
10	Options - Port B		
	Bits 0 - 1	Port B Type, where	00 = illegal
			01 = remote I/O
			10 = DH+
			11 = disabled
	Bits 2 - 3	Unused	
	Bits 4 - 5	Port B Baud Rate, where	00 = 57.6 Kb
			01 = 115 Kb
			10 = 230 Kb
			11 = illegal
	Bits 6 - 7	Unused	
11	Port A - Node Address		
12	Port B - Node Address		
13	Port Type		
	Bits 0 - 2	Unused	set to 0
	Bit 3	Port A Type, where	0 = DH+
			1 = RIO
			2 - DH+ @ 230Kbaud
	Bits 4 - 6	Unused	set to 0
	Bit 7	Port B Type, where	0 = DH+
			1 = remote I/O
			2 = disabled
14 - 26	Bulletin Number / Name (In ASCII)		
	1756-DHRIO/x – where x is the Series letter with a space after the Series letter		

Read DH+ Diagnostic Counters

Diagnostic counters are bytes of information stored in RAM in your 1756-DHRIO or1756-DHRIOXT module. The counters occupy a block of the module's internal scratch RAM. Your module's counters wrap around to zero when they overflow.

Counters are used to record events that can be used in debugging and long-term reliability analysis. You must issue a **diagnostic read** to check the information in your module's counters.

CMD = 06h, FNC = 01

The definition of the data returned is shown in the following table.

Byte	Description
0	Received ACK/NAK with bad CRC
1	Timeout expired with no ACK received
2	Transmit retries exhausted
3	Received NAK (illegal protocol operation)
4	Received NAK (bad LSAP)
5	Received NAK (no memory)
6	Received ACK/NAK too short
7	Received ACK/NAK too long
8	Received something other than ACK/NAK
9	Token pass timeout
10	Token pass retries exhausted
11	Claim token sequence entered
12	Token claimed
13	Received frame with bad CRC
14	Transmitted NAK (illegal protocol operation)
15	Transmitted NAK (bad LSAP)
16	Transmitted NAK (no memory)
17	Received frame too short
18	Received frame too long
19	Received retransmission of a frame
20	Received frame aborted
21	Message successfully sent (low byte)
22	Message successfully sent (high byte)
23	Message successfully received (low byte)
24	Message successfully received (high byte)
25	Command successfully sent (low byte)
26	Command successfully sent (high byte)
27	Reply successfully received (low byte)

Byte	Description
28	Reply successfully received (high byte)
29	Command successfully received (low byte)
30	Command successfully received (high byte)
31	Reply successfully sent (low byte)
32	Reply successfully sent (high byte)
33	Reply could not be sent
34	Duplicate node detected
35	Duplicate token detected
36	Fatal out of memory
37	Underrun
38 - 127	Reserved / Read as 0
128	Number of Active Nodes
129 - 136	Active Node Table A bit table where the LSB of offset 129 represents node 00 and the MSB of offset 136 represents node 77 If bit = 0, the node is not present If bit = 1, the node is present

Reset DH+ Diagnostic Counters

After reading your 1756-DHRIO or 1756-DHRIOXT module's diagnostic counters, you can reset them back to zero to clear that block of your module's internal scratch RAM.

CMD = 06h, FNC = 07

Notes:

Application Guidelines and Tips

Use this appendix to better understand how to use your 1756-DHRIO and 1756-DHRIOXT modules in DH+ and remote I/O applications.

Cached and Uncached Connections

A connection is defined as a message from point A to point B. A ControlLogix controller can make a total of 250 connections. With RSLogix 5000 version 10 or later, the controller can cache a total of16 DH+ connections and 16 remote I/O connections. In RSLogix 5000 versions 9 and earlier, the controller can cache only remote I/O connections.

Up to five messages can be sent between points and be counted as one connection. When you read and write to the same module on remote I/O, however, you must interlock messages.

The two types of connections in DH+ and remote I/O applications are as follows:

- Cached Connections
- Uncached Connections

Cached Connections

A cached connection is connection between two points that remains open at all times. Remember the following:

- When using cached connections, multiple messages from identical points consume only one connection. In this case, the identical point messages must be cached.
- Messages are completed much faster because the connection is open.
- Can have a total of 16 cached connections on remote I/O.
- With Studio 5000 environment version 10 and later, you can have a total of 16 connections cached on DH+.
- If **more** than 16 connections are cached the messages perform like they were uncached. If you want all connections in your application to perform like cached connections, we recommend you cache only 16 connections.

Uncached Connections

An uncached connection is a connection between two points that opens only when a message is enabled and closes when the connection is completed. Uncached connections are not as fast as cached connections.

ControlLogix Controller Constraints

When using the ControlLogix controllers, remember the following constraints:

- The controller is limited by its unconnected buffers, including a default Unconnected Buffer (UCB) limit of 10.
- In RSLogix 5000 version 8 and later, you can increase the UCB limit to 40. However, for each UCB over 10, your application receives a penalty of 1K of I/O memory. For example, if you change the UCB limit to 25, your application loses 15K of I/O memory.

  For more information on increasing the unconnected message buffer limit, see page 166.
- A DH+ or remote I/O message can take a total of two connections in the UCB. One connection is used for the forward open and one connection is used for the reply.
- Cached connections are separate from the UCB number.

- We recommend that the number of uncached messages enabled in your application be no more than 50% of your UCB limit. For example, if you are using the 40 UCB limit, we recommend that no more than 20 uncached messages are enabled at once.

  If your application requires that more uncached messages are enabled than 50% of your UCB, manage the messages to make sure that only a total of 50% are enabled at any single time. For example, if your application uses the 10 UCB limit but requires 7 uncached messages, make sure only a total of 5 uncached messages are active at any time.

- If the message is giving error #301 that means the UCB is full

Message Manager

Even though the unconnected message buffer can be increased to 40, the best throughput performance is attained when only 5 messages are enabled in a ControlLogix controller at one time. One simple method of managing your messages is to enable five messages, wait for all five to complete and than enable another set of five messages. Repeat the process as needed until all required message completed.

Messages Between a ControlLogix Controller and PLC Devices

For more information on the 1756-DHRIO or 1756-DHRIOXT module's performance when messages are sent between a ControlLogix controller and PLC devices, see the Rockwell Automation Knowledge Base. The database can be accessed from the following location:

https://rockwellautomation.custhelp.com/

RPI Configuration Settings

- Requested Packet Interrupt (RPI) setting on the 1756-DHRIO and 1756-DHRIOXT modules is the time where the DHRIO module sends status information to the controller. It is not the time where data is transferred from the DHRIO to the controller.
- RPI setting for adapter modules are used to send discrete data from the adapter racks to the controller
- All adapter racks underneath the same channel of a DHRIO module are set to the same RPI time
- Block Transfer data is updated during the time slice period as specified in the ControlLogix controller

RPI Formula without Block Transfer Modules

Digital Modules

This formula is for a worst case scenario with only discrete modules.

- Scan Rate =
  - 3ms/adapter for 230.4K Baud
  - 5ms/adapter for 115.2K Baud
  - 8ms/adapter for 57.6K Baud
- Link Time = scan rate * (# of adapters)
- Recommended RPI = 0.5 * link time
- Maximum Update Time = RPI + 2 * (link time)

Worst Case Scenario

This formula is for a worst case scenario.

- Scan Rate =
  - 3ms/adapter for 230.4K Baud
  - 5ms/adapter for 115.2K Baud
  - 8ms/adapter for 57.6K Baud
- Link time = scan rate * (# of adapters + # of adapters with block transfer modules)
- Recommended RPI = 0.5 * link time
- Maximum Update Time = RPI + 2 * (link time)

Increase the Unconnected Message Buffer Limit

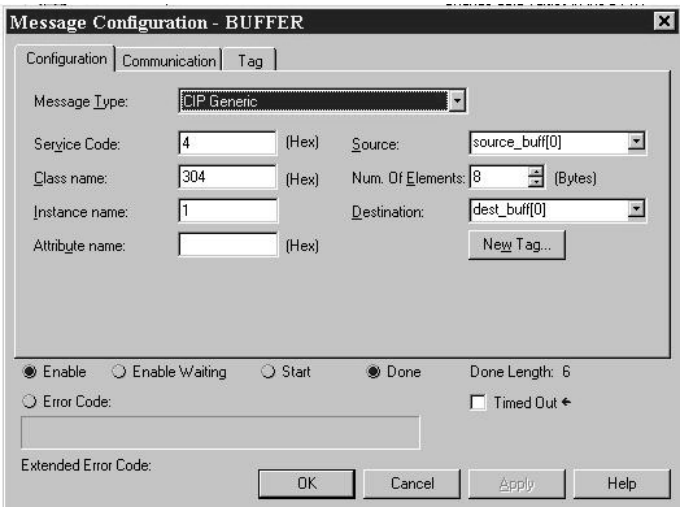
You can find more information on increasing the unconnected message buffer limit at the Rockwell Automation knowledge base at:

https://rockwellautomation.custhelp.com/

- With RSLogix 5000 version 8.02 the Unconnected Message Buffer can be increased from the default value of 10 to a total of 40 with a CIP Generic Message instruction.
- A penalty of 1K of I/O memory is consumed for each increase above 10
- A source and destination array must be configured. Each needs to be configured as SINT type with 30 arrays.
- The communication path is set to: 1, slot number of the controller.
- The CIP Generic message has to be enabled once, after that another CIP Generic message must be used to change the value.

Increase Unconnected Message Buffer Configuration

Configure the message as shown below



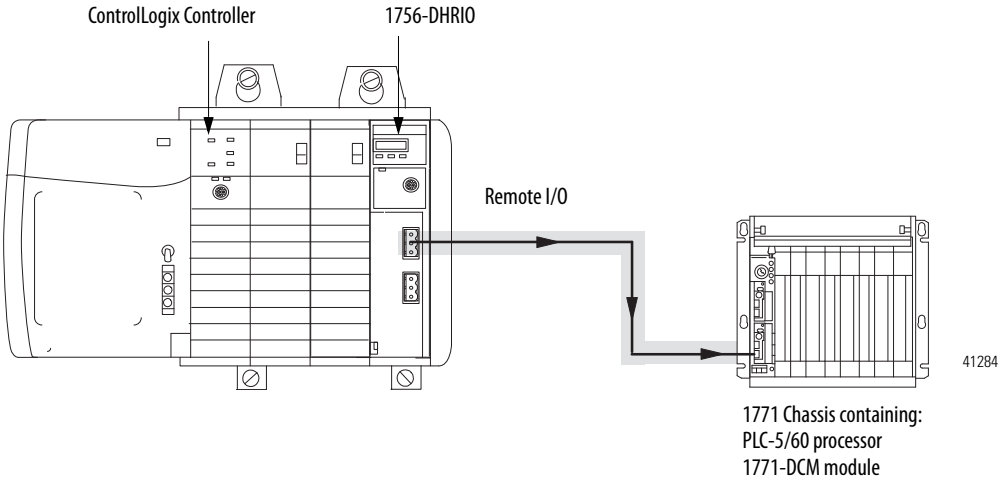
Increase Unconnected Message Buffer Source Data

The source array tag needs to have data manually placed into some of the locations. Set element #4 to the value desired of the UCB. The other values **cannot** be varied. The dialog box is shown below.

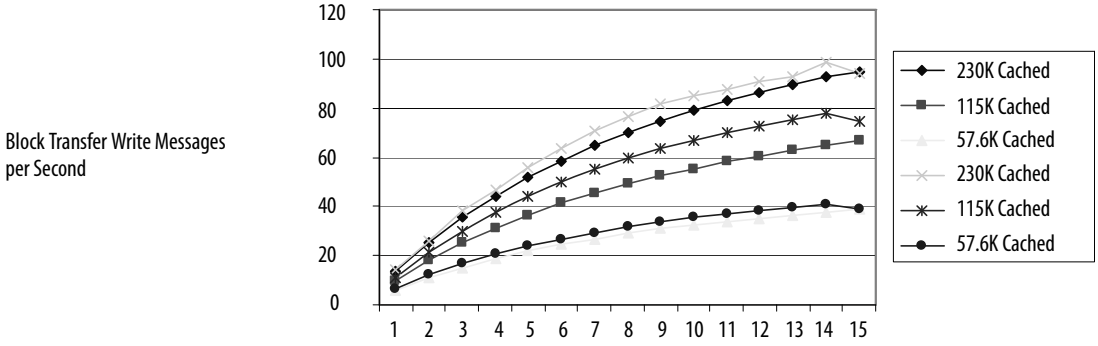
source_buff	{...}	{...}	Decimal	SINT[30]
source_buff[0]	1		Decimal	SINT
source_buff[1]	0		Decimal	SINT
source_buff[2]	17		Decimal	SINT
source_buff[3]	0		Decimal	SINT
source_buff[4]	32		Decimal	SINT
source_buff[5]	0		Decimal	SINT
source_buff[6]	0		Decimal	SINT
source_buff[7]	0		Decimal	SINT
source_buff[8]	0		Decimal	SINT
source_buff[9]	0		Decimal	SINT
source_buff[10]	0		Decimal	SINT
source_buff[11]	0		Decimal	SINT

Remote I/O Performance: ControlLogix Controllers versus PLC-5 Controllers

In the following figure, block transfer write messages are sent from a ControlLogix controller (via the 1756-DHRIO or 1756-DHRIOXT module) to a 1771-DCM over cached remote I/O connections.



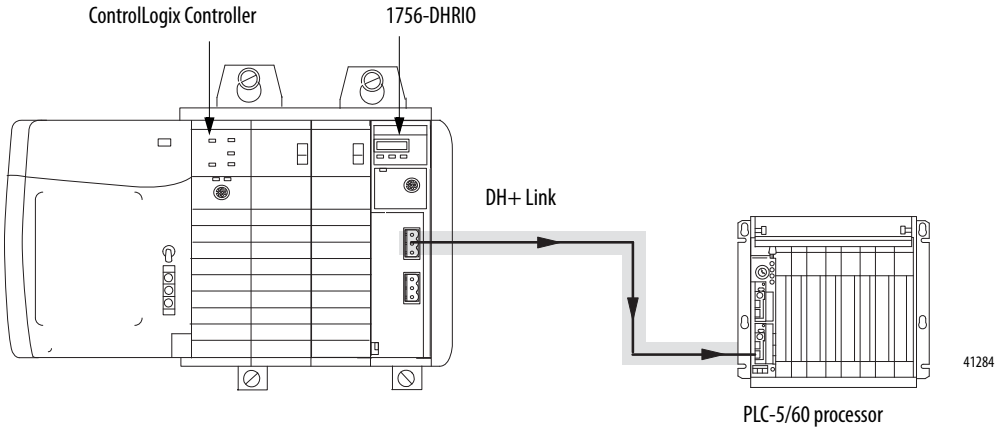
The following figure illustrates the differences between using cached remote I/O connections with the 1771-DCM module and using PLC-5 connections with the 1771-DCM module.



All 15 Block Transfer Write messages were on one channel.
Each Block Transfer Write message was 40 words in size.

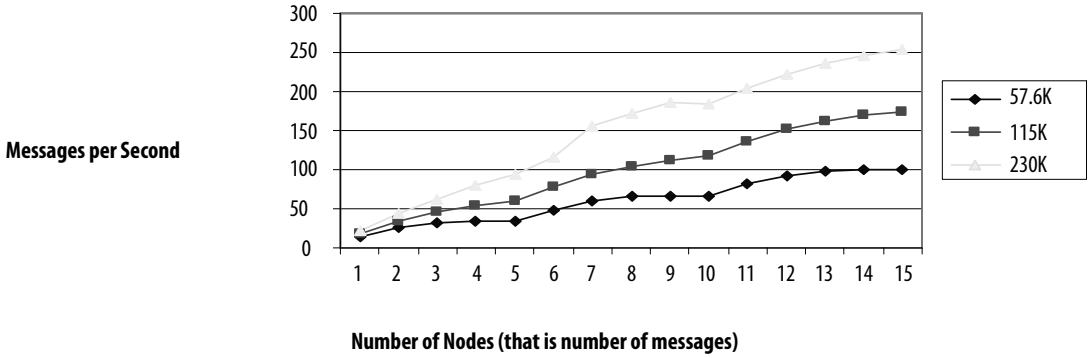
DH+ Baud Rate Comparison

The following figure shows an example where a ControlLogix controller sends messages to a PLC-5 via a 1756-DHRIO or 1756-DHRIOXT module. Performance differences exist if the connections are cached or uncached.



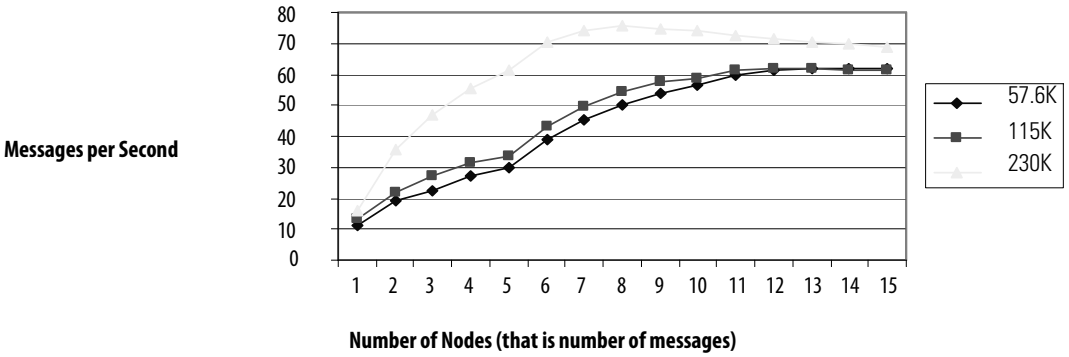
Use Cached Connections

The following figure illustrates the difference in messages per second available with cached connections for each DH+ baud rate.



Use Uncached Connections

The following figure illustrates the difference in messages per second available with uncached connections for each DH+ baud rate.



Maintain PCCC Message Sequences

The 1756-DHRIO and 1756-DHRIOXT modules do not necessarily send PCCC messages in the same order in which it receives them. To make sure of proper sequences, wait for the PCCC response to the initial PCCC message before you send another PCCC request.

Numerics

A

B

C

D

E

F

I

S

T

U

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support you can find technical and application notes, sample code, and links to software service packs. You can also visit our Support Center at https://rockwellautomation.custhelp.com/ for software updates, support chats and forums, technical information, FAQs, and to sign up for product notification updates.

In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/services/online-phone.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

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

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

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication RA-DU002, available at http://www.rockwellautomation.com/literature/.

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 1756-UM514C-EN-P - June 2014
Supersedes Publication 1756-UM514B-EN-P - February 2003