Allen-Bradley

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

1756-DHRIO

User Manual

Rockwell Automation

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

ATTENTION

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

IMPORTANT

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

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Introduction

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

Updated Information

The following changes were made in this release of the manual:

- The manual has been reorganized to keep specific information together.
  - DH+ information (e.g. description of DH+ operation, software usage in DH+ applications, DH+ examples) is grouped together in Chapters 2 through 8.
  - Remote I/O and block transfer information is grouped together in Chapters 9 through 13.

  For a full description of the manual's organization, see Table Preface.1 on page Preface-2 or the Table of Contents.

- The description of how to use software with 1756-DHRIO module is expanded, as follows:
  - Chapter 3 explains Using Programming Software in DH+ Applications.
  - Chapter 9 explains Using RSLogix 5000 in Remote I/O and Block Transfer Applications.

- Appendix C, Application Guidelines and Tips, has been included in the manual to assist you in improving the performance of your 1756-DHRIO module.

Notes:

Purpose of This Manual

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

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

- use the 1756-DHRIO module to send DH+ messages between ControlLogix controllers, PLCs and SLCs in DH+ applications.

  and

- connect ControlLogix controllers to remote I/O and send block transfers via the 1756-DHRIO module.

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

For a complete list of ControlLogix controllers, and a description of each, see the ControlLogix Selection Guide, publication 1756-SG001.

Who Should Use This Manual

This manual is intended for those individuals who program applications that use 1756-DHRIO modules, such as:

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

We assume you have a good understanding of the Data Highway Plus protocol and Remote I/O. This user manual contains a brief description of Data Highway Plus in Chapter 2 and a brief description of Remote I/O in Chapters 10 & 11.

Information Found in This Manual

This manual is broken into three parts:

- General module information - Chapters 1 and 14, Appendices A to C
- DH+ information - Chapters 2 to 8
- Remote I/O and Block Transfer Information - Chapters 9 to 13

Table Preface.1 lists the information that is available in each section of this manual.

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	Chapter 3	Using Programming Software in DH+ Applications
	Chapter 4	Messaging Between PLC-5s and SLC-5/04s
	Chapter 5	Messaging Between PLC-5s or SLC5/04s and ControlLogix Controllers
	Chapter 6	Messaging Between ControlLogix Controllers and PLC-5s or SLC-5/04s
	Chapter 7	Messaging Between ControlLogix Controllers
Remote I/O and Block Transfer Information	Chapter 8	Using the 1756-DHRIO Module in Remote I/O Applications
	Chapter 9	Using RSLogix 5000 in Remote I/O and Block Transfer Applications
	Chapter 10	Connecting a ControlLogix Controller to Remote I/O
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1756-DHRIO Module Description

What This Chapter Contains

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

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Routing Limitations	1-2
Module Features	1-4
Preventing Electrostatic Discharge	1-7
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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.

Using the remote I/O functionality, a 1756-DHRIO channel functions as a scanner. The module transfers discrete and block-transfer data with remote I/O devices. This module allows connection to multiple remote I/O adapters.

Routing Limitations

The 1756-DHRIO module can route a message through up to four communications networks and three chassis. This limit applies only to the routing of a message and not to the total number of networks or chassis in a system.

DH+ and CIP Messaging

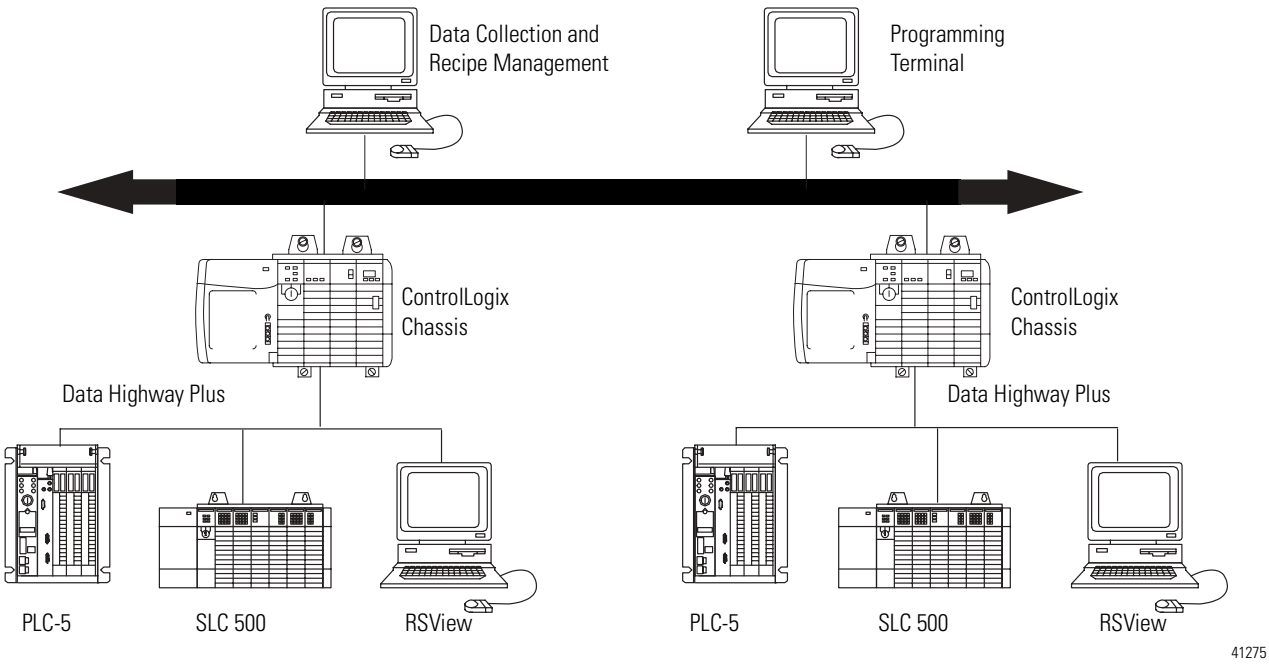
The 1756-DHRIO module allows an information exchange between devices, such as ControlLogix controllers, PLCs and SLCs.

With the 1756-DHRIO module, you may exchange information in any of the following scenarios:

- between PLCs/SLCs on different networks
- between the ControlLogix controllers and a PLC/SLC on different networks
- between ControlLogix controllers on different networks

Figure 1.1 shows an example system. Two ControlLogix chassis link existing 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.

Figure 1.1

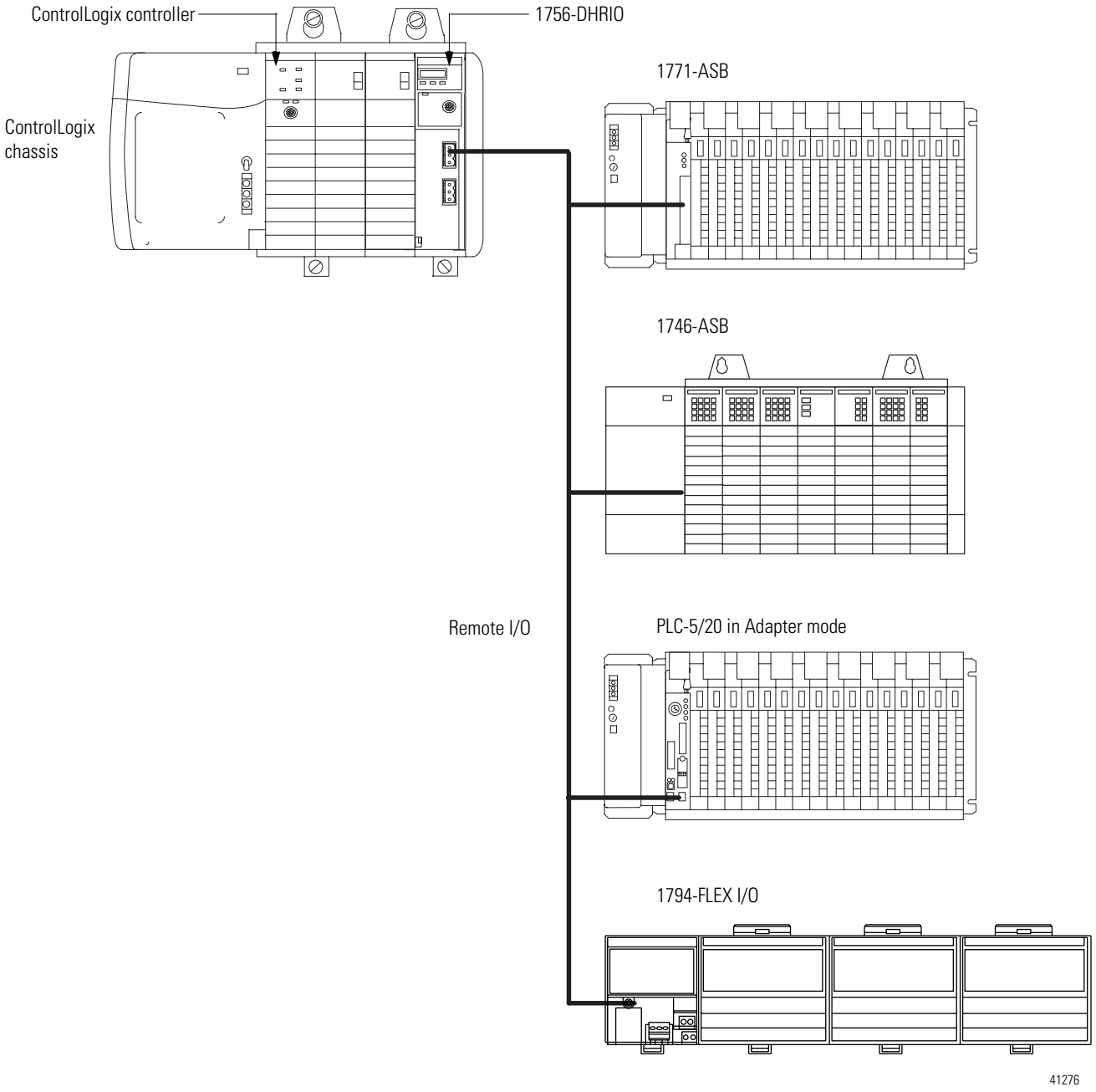


Remote I/O

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.

Figure 1.2 shows an example system.

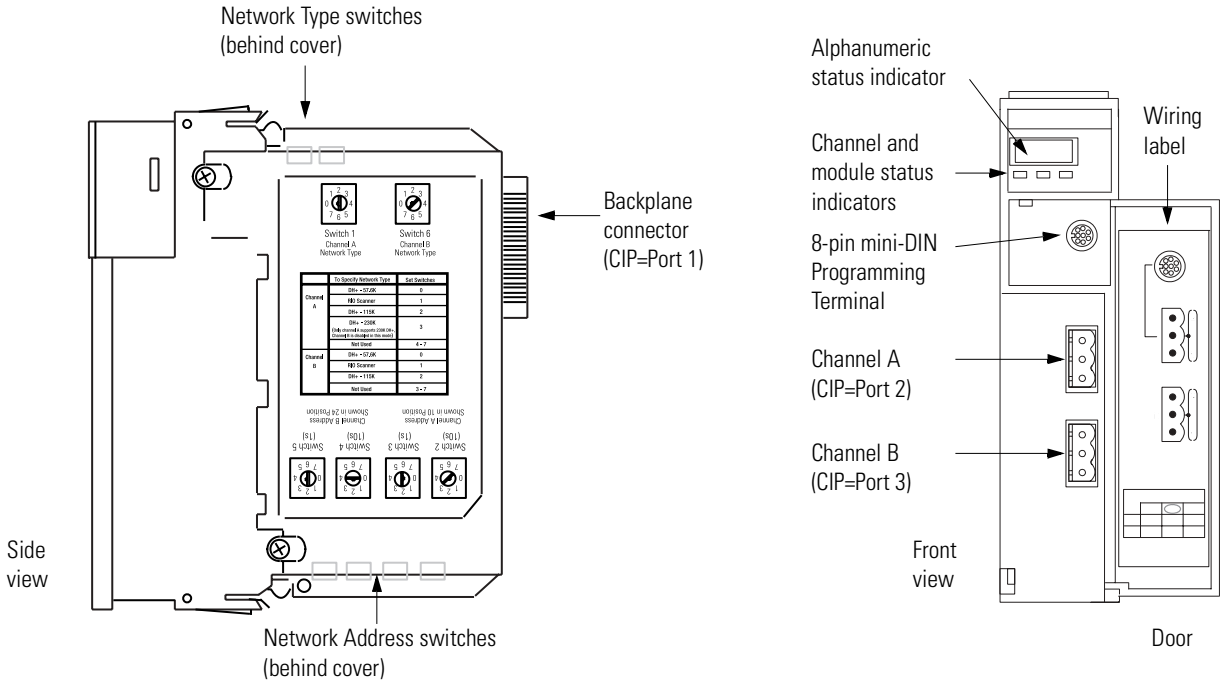
Figure 1.2



Module Features

Figure 1.3 shows the external features of the 1756-DHRIO module.

Figure 1.3



Other module features include:

- routing table that allows DH+ devices to use the 1756-DHRIO module and ControlLogix chassis to access other networks
- routing communications to and from other modules
- no limit on number of modules per chassis, up to the 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

Setting Switches

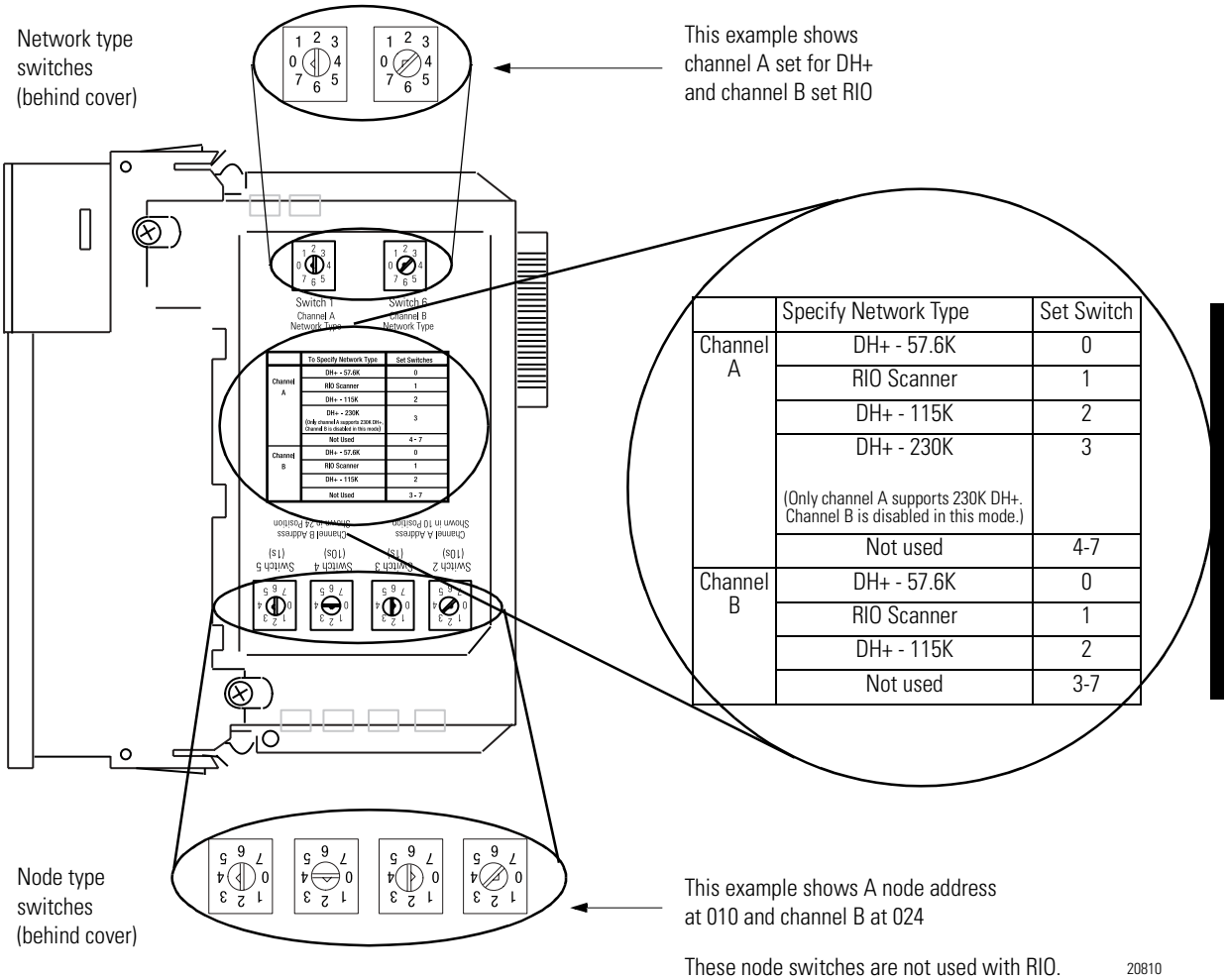
Before installing the module, you must set the network type switches for DH+ or RIO, depending on your application. For a channel configured as DH+, you must also select a node address within the range of 00-77. Node addresses are set and displayed in octal.

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

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

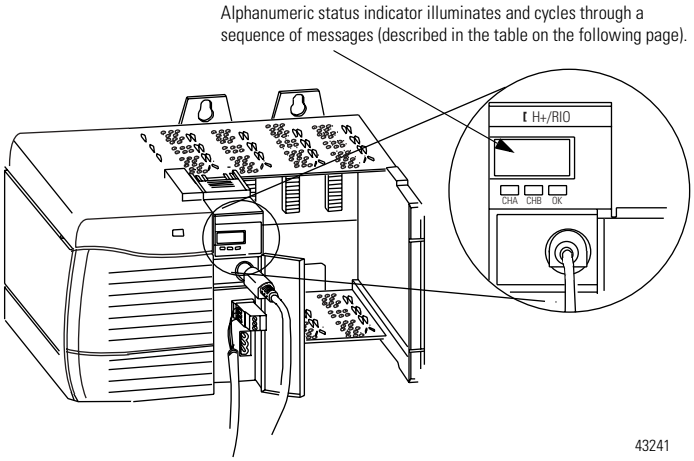
Set the network type and node address switches as in Figure 1.4.

Figure 1.4



	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 may display across the alphanumeric indicators, and for troubleshooting information, see Chapter 12, Troubleshooting the 1756-DHRIO Module.

Preventing 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.
- If available, use a static-safe workstation.
- When not in use, store the equipment in appropriate static-safe packaging.

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 both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

Chapter Summary and What's Next

In this chapter, you read a description of the 1756-DHRIO module. Chapter 2 describes Using the Data Highway Plus Network.

Using the Data Highway Plus Network

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

For information about	See page
What is Data Highway Plus?	2-1
Connecting Devices to the DH+ Network	2-4
Two Methods of Communication Over DH+	2-6
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Configuration Information in DH+ Messaging	2-14
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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, PLCs, SLCs, and other devices that use the DH+ network. These devices are called stations. You can connect a maximum of 32 stations to a single DH+ link.

Link Design

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

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

Use 1770-CD (Belden 9463) cable to connect your module to DH+. Connect a DH+ network 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.)

For more information about designing trunk line/drop line configurations, see the Data Highway/Data Highway Plus/Data Highway II/ Data Highway-485 Cable Installation Manual, publication 1770-6.2.2.

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 Table 2.1 to determine the available total cable length.

Table 2.1
Choosing the Correct 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 **both** ends of a DH+ link by using the external resistors shipped with the 1756-DHRIO. Table 2.2 lists the resistors you can use with each communication rate.

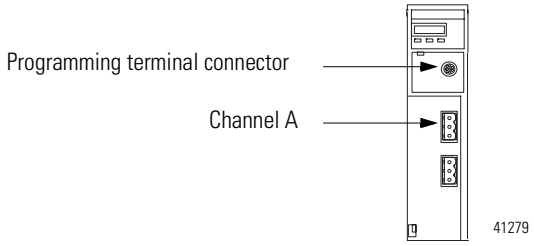
Table 2.2
Choosing the Correct Resistor Rating

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

Programming Terminal Port

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

Figure 2.1



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

Connecting Devices to the DH+ Network

Table 2.3 lists the devices you can connect to a DH+ link.

Table 2.3
Selecting Devices You Can Connect

To:	You can use:	Catalog Number:	Required Cables:
Connect PLC-3 family processors to DH+	Scanner Communication Adapter Module	1775-S5	1770-CD
		1775-SR5	
Connect PLC-5 family processors to DH+	Classic and Enhanced PLC-5 processors using on-board DH+ ports	1785-Series	1770-CD
	ControlNet and EtherNet PLC-5 processors using on-board DH+ ports		
Connect SLCs to DH+	SLC-5/04 Processor	1747-Series	1770-CD
Connect AutoMax to DH+	AutoMax DH+ Interface	57C-442	1770-CD
Connect PI systems to DH+	Resource Manager Module	5130-RM1	1770-CD
	Resource Manager Module	5130-RM2	
	Data Highway/Data Highway Plus Communication Interface Module	5130-KA	
Connect IBM XT or AT compatible computers to DH+	Data Highway Plus XT/AT Interface Module	1784-KT	1770-CD
Perform data transmission, management, and local network diagnostics over DH+ network	KTX Communication Interface Card	1784-KTX	1770-CD
Perform data transmission, management, and local network diagnostics over DH+ network	KTXD Communication Interface Card	1784-KTXD	1770-CD
Add memory, storage, and I/O capabilities to computers through DH+	PCMK Communication Card	1784-PCMK	PCM6/B cable assembly
Connect other SLCs to DH+	SLC-5/04	1747-Series	1770-CD
Connect AutoMax to DH+	AutoMax DH+ Interface	57C-442	1770-CD

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 may be lost to the rest of the network. The network is automatically reestablished, but it could take several seconds. Control would be 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 DH+

The 1756-DHRIO module acts as a bridge for two methods of communication. These methods are:

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

Table 2.4 lists the devices that support each communication method.

Table 2.4
Types of Communication on the 1756-DHRIO module

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

Using 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 existing Allen-Bradley modules.

DH+ messaging is divided into two types:

- Local DH+ Messaging - See page 2-7
- Remote DH+ Messaging - See page 2-10

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

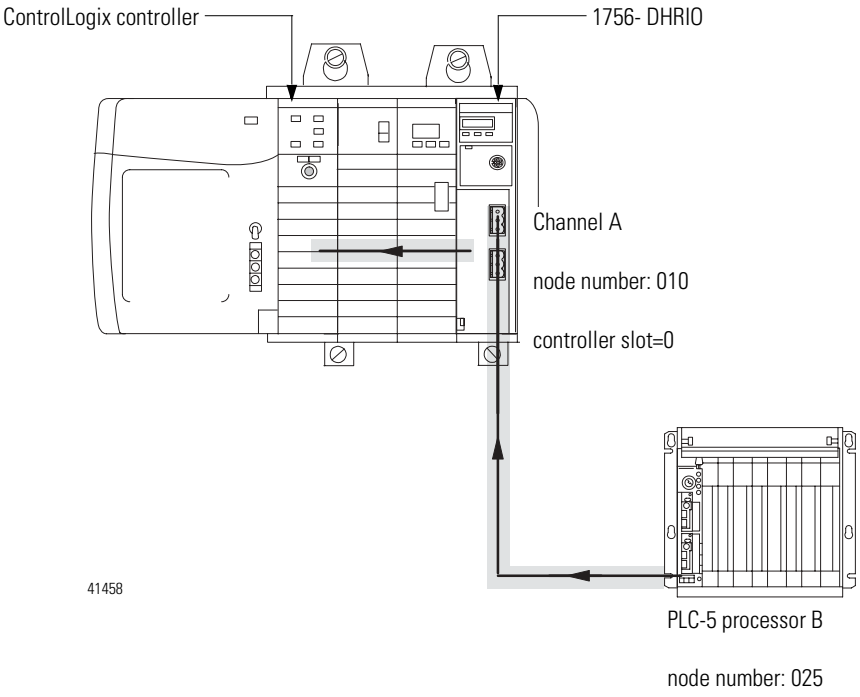
Devices use local DH+ messaging to communicate between devices on the same physical link. A device that uses local DH+ messaging must:

- 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 Figure 2.2 shows a PLC-5 sending a message to port A on the 1756-DHRIO module. Because the controller slot for port A is configured to “0”, the message is forwarded to the ControlLogix controller in slot 0.

Figure 2.2



Receiving Local DH+ Messages on DH+

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

You must use RSLinx to configure the Controller Slot. For more information on Setting the Controller Slot, see page 3-7.

There are some messages called PCCC commands that are not sent to the controller slot. In this case, the 1756-DHRIO module generates a response to the message. For a complete list of these messages, see Appendix B, PCCC Commands Supported by the Data Highway Plus Module.

Local DH+ messaging **does not** require a populated routing table. Local DH+ messaging **does** require a default (i.e. a properly emptied) or an applied (i.e. 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, Using Programming Software in DH+ Applications

IMPORTANT Local DH+ Messaging can only target one ControlLogix controller per DH+ channel. The ControlLogix controller must reside in the same chassis as the 1756-DHRIO module 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 module sending the message. Also, the ControlLogix controller must reside in the same chassis as the 1756-DHRIO module 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 the1756-DHRIO module is forwarded to a single user-configured controller slot.
- Messages on one DH+ network cannot be routed to other networks.

Routing Error in Local DH+ Messaging

If the 1756-DHRIO has a problem with routing a DH+ message, it may 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, take the following actions:

- check your message instruction to make sure a valid 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 the 1756-DHRIO is powered-up.

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 RSLogix 5000 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 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:

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

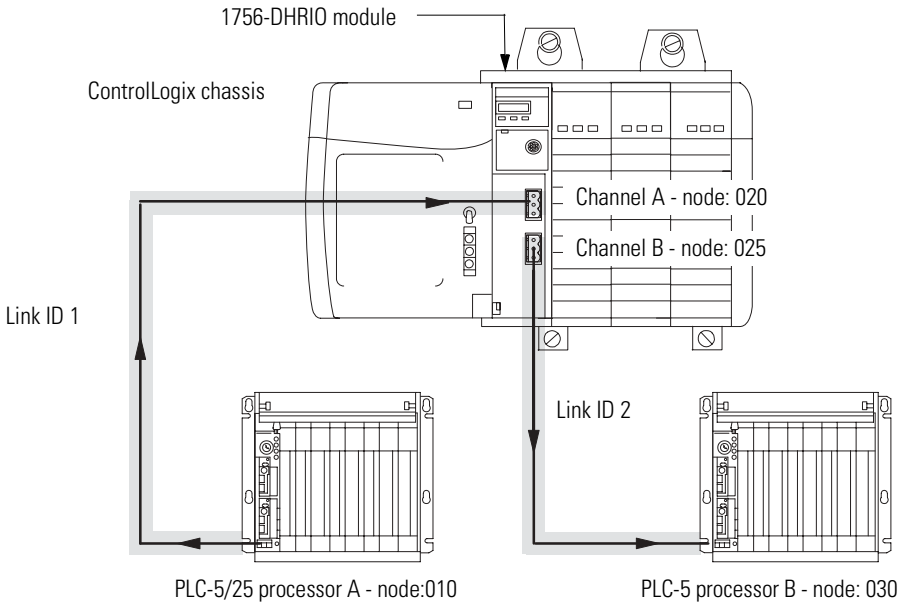
Remote DH+ messaging should be used when:

- the message originating device or the message target device is one of the devices listed in Table 2.3 on page 2-4.
- there is a DH+ link 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 there is more than one ControlLogix controller target in the chassis.

Figure 2.3 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

Figure 2.3



Link IDs

To use remote DH+ messaging, each network that is an originating network or target network must have a unique link ID. The 1756-DHRIO module requires these link IDs to be decimal values between 1-199. Each DH+ channel on a 1756-DHRIO must have 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 should be 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 there is more than one message target ControlLogix controller in a ControlLogix chassis.

Routing Tables in Remote DH+ Messaging

The 1756-DHRIO module contains 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 located on separate networks. By using the routing table, the 1756-DHRIO allows existing 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 Creating the Routing Table on page 3-5.

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

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

- 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:

- assign link numbers. The numbers must be a decimal value between 1-199. ControlLogix chassis may also be assigned link IDs. Remember that the programming terminal and channel A are the same physical link.
- assign DH+ node numbers.
- use RSLinx to load routing tables into each 1756-DHRIO 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, ControlNet or ControlLogix, you must also include a CIP path to the first 1756-DHRIO module.

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. Although this is transparent to the user, there are resource limits associated with CIP on the 1756-DHRIO module.

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

Because of the various paths involved, the 1756-DHRIO module responds to 'out of connections' in one of the following ways:

- The 1756-DHRIO module may generate a Routing Error on DH+ for DH+ message requests if there are no connections available.
- The Message Originator may generate an Application Timeout (see page 3-10) if a remote 1756-DHRIO module has no connections available for a DH+ Message response.
- The Message Originator may receive an 'out of connections' error if the path from the Originator to the 1756-DHRIO module is ControlLogix chassis, ControlNet or Ethernet.

Routing Errors in Remote DH+ Messaging

If the 1756-DHRIO module has a problem with routing a Remote DH+ Message, it may 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, take the following actions:

- Check your message instruction to make sure a valid 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 modules are connected and powered-up.

Configuration Information in DH+ Messaging

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

The following configuration information is stored in the non-volatile (NVS) memory on your 1756-DHRIO module when you apply configuration using RSLogix 5000:

- Any routing table that may 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 Creating the Routing Table on page 3-5.
- 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
- Slot number of the module
- Chassis serial number

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

Generating Configuration Faults

When you insert a 1756-DHRIO 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 module generates a configuration fault.

For a complete listing of the configuration faults that may be displayed on your 1756-DHRIO module, see Chapter 12, Troubleshooting the 1756-DHRIO Module.

Application Timeout

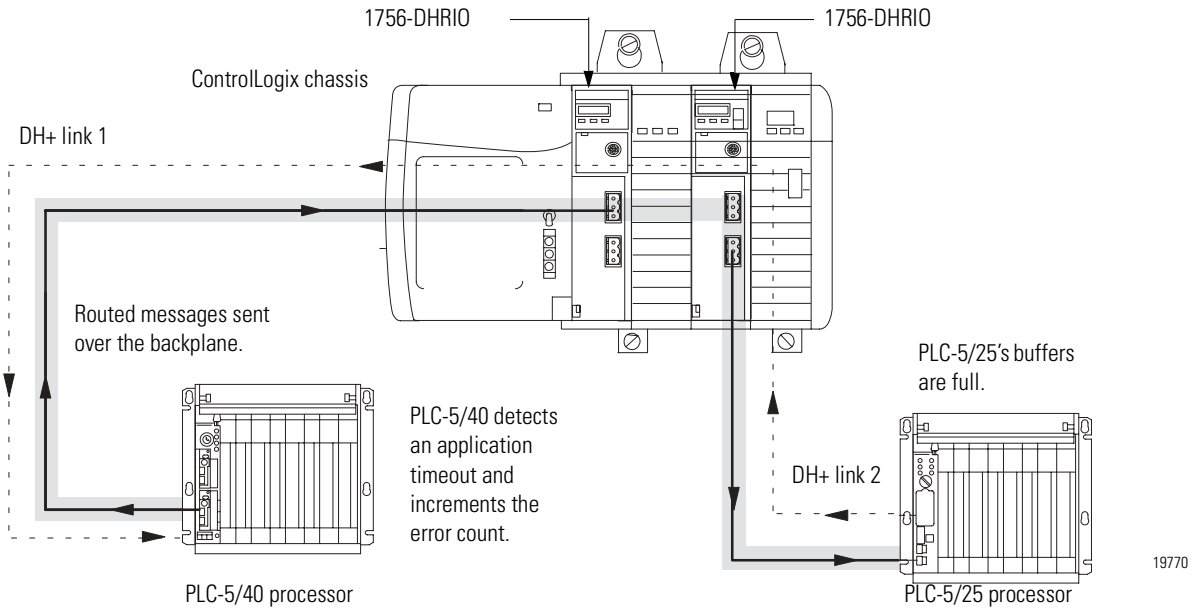
When an error occurs while sending a message to a remote link, it appears to the sending station as an application timeout because error messages are not routed back. When an error occurs during routing, it may be dropped.

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. Figure 2.4 shows an example of an application timeout.

Figure 2.4



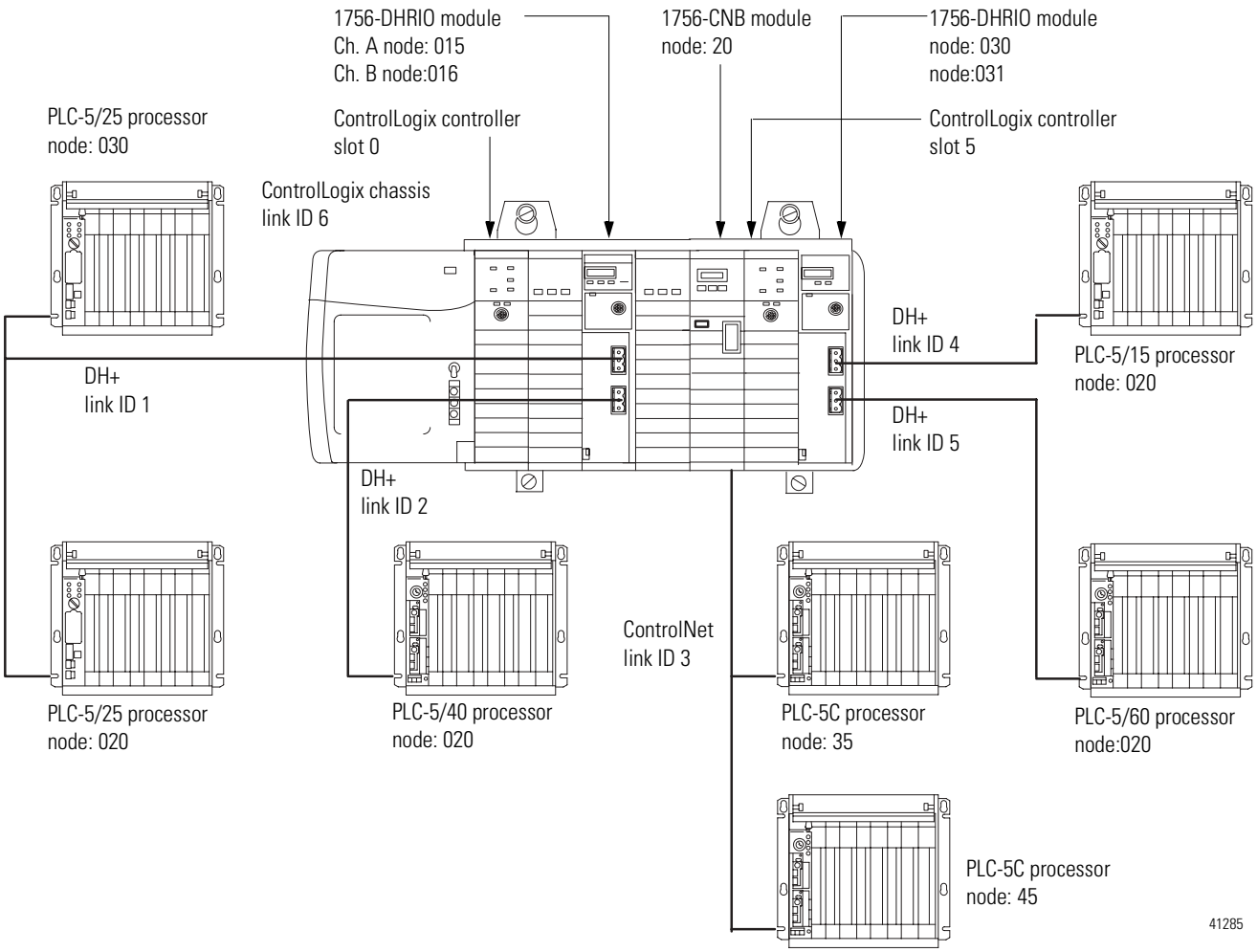
Example DH+ Routing Configuration

The figure below shows an example DH+ routing configuration.

Node numbers on DH+ are given in octal. Node numbers on ControlNet 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 must have unique node numbers. You must assign the node numbers.

Figure 2.5



Using Control and Information Protocol (CIP) Messaging

Control and Information Protocol (CIP) is the communications 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 a different 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 all 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 3, Using Programming Software in DH+ Applications.

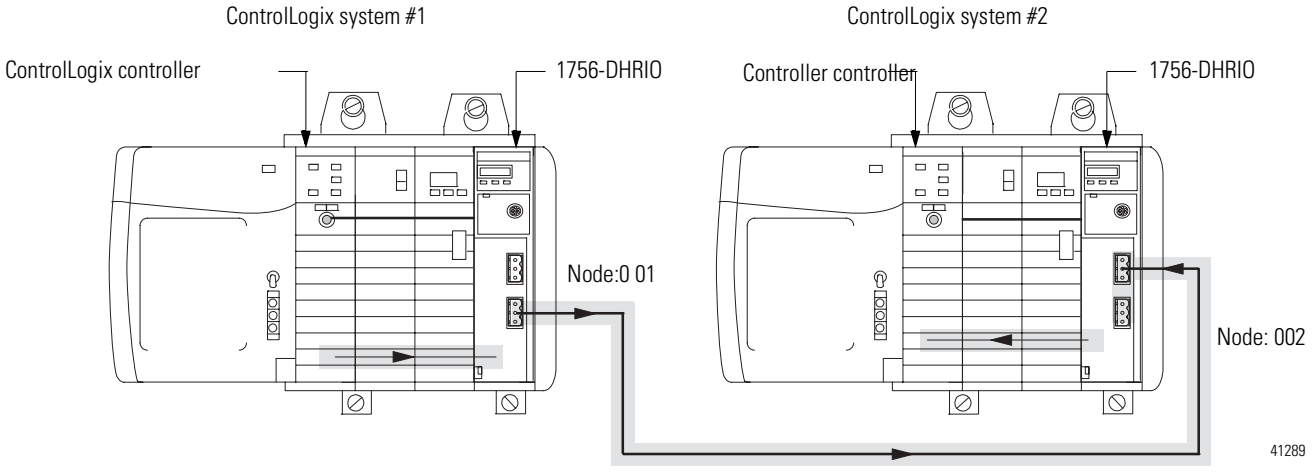
Devices such as ControlLogix devices, devices that use the ControlNet network, and devices that use EPIC protocol on Ethernet support this new type of communication.

IMPORTANT

Your 1756-DHRIO module supports bridging CIP messaging over a DH+ link. However, your 1756-DHRIO module does not support bridging CIP I/O data from a ControlLogix controller to an 1756-I/O module.

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

Figure 2.6



Limitations of CIP Messaging

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

Chapter Summary and What's Next

In this chapter, you read about the basics of using Data Highway Plus. Chapter 3 describes Using Programming Software in DH+ Applications.

Using Programming Software in DH+ Applications

Using This Chapter

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

For information about:	See page
Using RSLinx to Create a Routing Table	3-2
Using RSLinx Software to Send Control and Information Protocol Messages	3-8
Using RSLogix 5	3-9
Using RSLogix 500	3-12
Using RSLogix 5000	3-15
Defining Connection Paths	3-20
Connection path examples	3-21

Choosing the Correct Software

The programming software you need is dependent on what products you are using with the 1756-DHRIO module. Table 3.1 explains what software is needed for your application.

Table 3.1
Software Needed for 1756-DHRIO Applications

If you are using this product with the 1756-DHRIO module to read/write data in a DH+ application:	You must use this software:
PLCs	RSLinx RSLogix 5
SLCs	RSLinx RSLogix500
ControlLogix Controllers	RSLinx RSLogix 5000

Using 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 module is the transition point from the DH+ network to ControlLogix. In this capacity, the 1756-DHRIO module serves as the DH+ message source and requires 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 module, you must assign link IDs to all networks (including ENET and CNET) that route information through the module. Link IDs are numbers from 1 to 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 set up at each node to build accurate connections.

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

- 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 Figure 3.1 uses the routing tables described in Table 3.2 (system A) and Table 3.3 (system B).

Figure 3.1

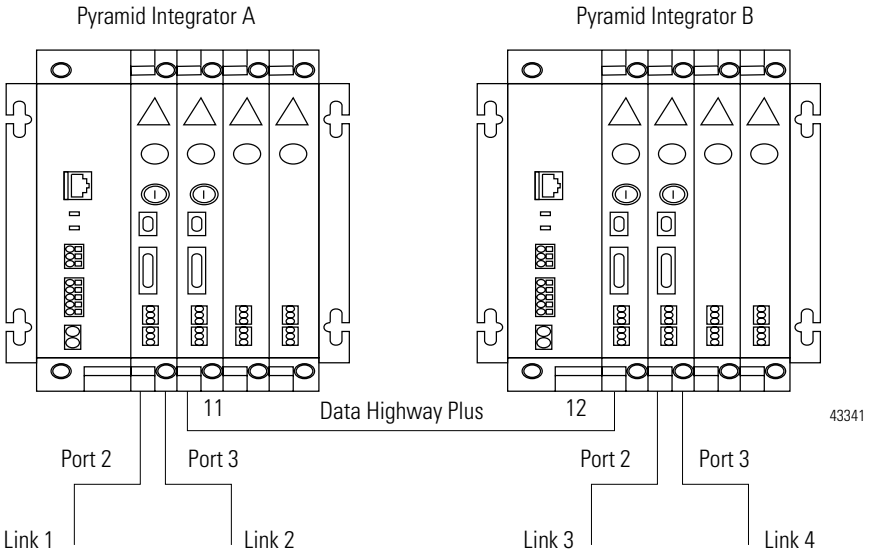


Table 3.2
System A Routing Table

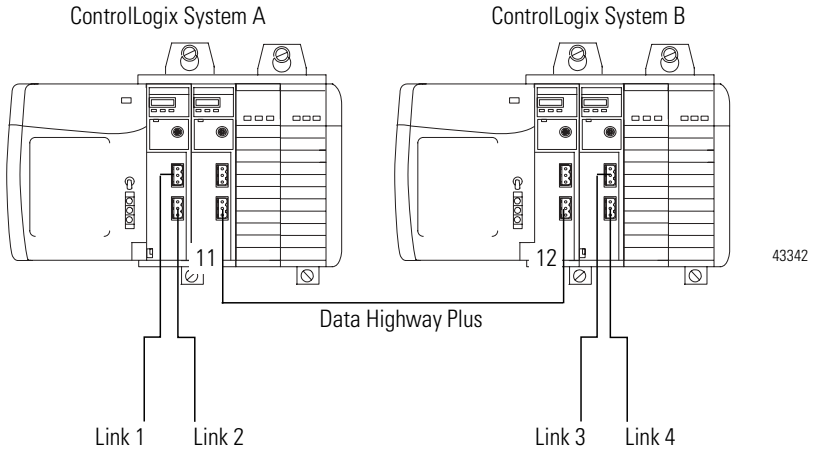
Link ID	Module and Port	Type	Bridge
1	1KA-2	Local	NA
2	1KA-3	Local	NA
3	2KA-2	Remote	12
4	2KA-3	Remote	12

Table 3.3
System B Routing Table

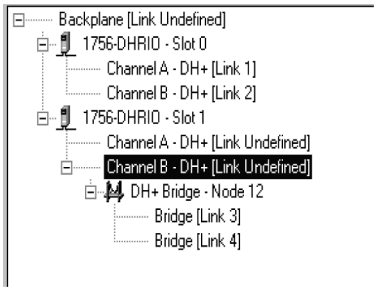
Link ID	Module and Port	Type	Bridge
1	1KA-2	Remote	11
2	1KA-3	Remote	11
3	2KA-2	Local	NA
4	2KA-3	Local	NA

An equivalent routing (via the DH+ network) with ControlLogix is shown in Figure 3.2

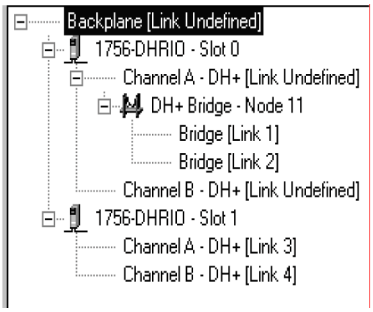
Figure 3.2



ControlLogix System A routing table in RSLinx



ControlLogix System B routing table in RSLinx



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. Since 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.

Creating the Routing Table

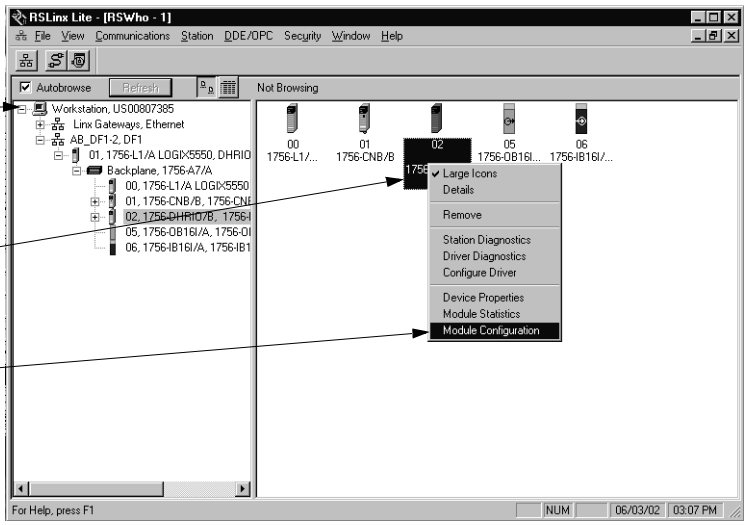
To create a routing table for your application, follow these steps:

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

A. Expand the configuration tree until your application appears on the right side of the screen.

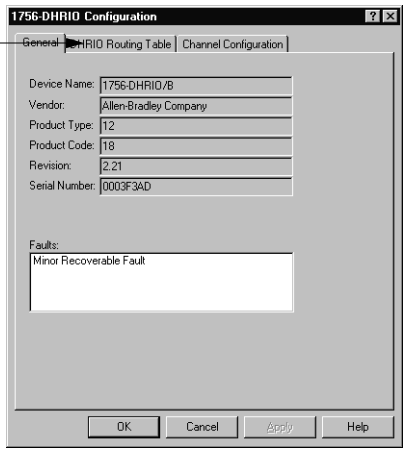
B. Right-click on the 1756-DHRIO module icon to see the menu.

C. Click on Module Configuration.



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

DHRIO Routing Tab

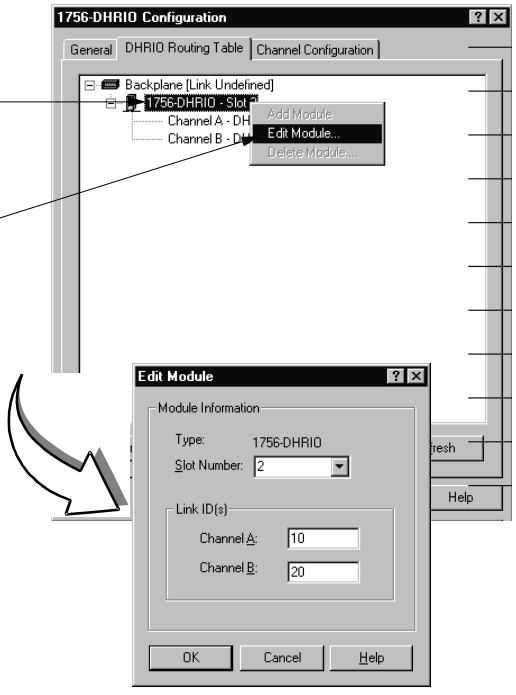


You must use RSLinx to build the routing table based on the 1756-DHRIO modules in the ControlLogix chassis. Each link ID (i.e. chassis backplane, channels A and B of any 1756-DHRIO module in the chassis) is initially undefined.

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

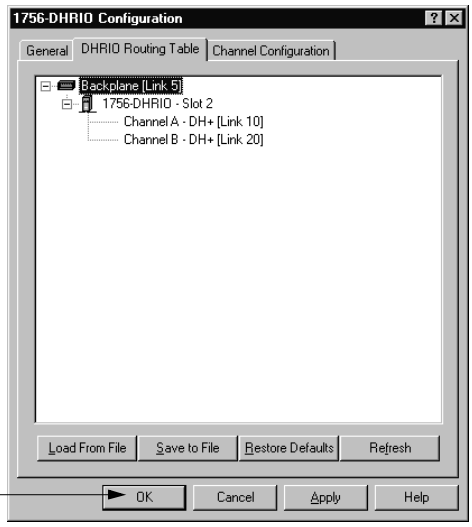
A. Right-click on the 1756-DHRIO module to see the menu.

B. Click on Edit Module.



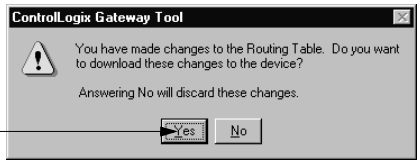
IMPORTANT Keep track of your Link ID assignments. You need the Link ID values when you send messages via RSLogix 5, RSLogix 500 and RSLogix 5000.

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 screen should look similar to the one below.



Click on OK.

The software prompts you to download routing table changes.

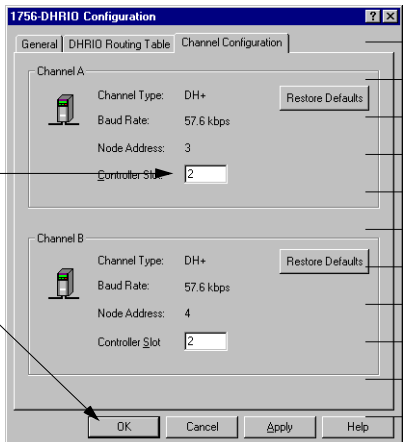


Click on OK.

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

Setting 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.



A. Change the Controller slot.

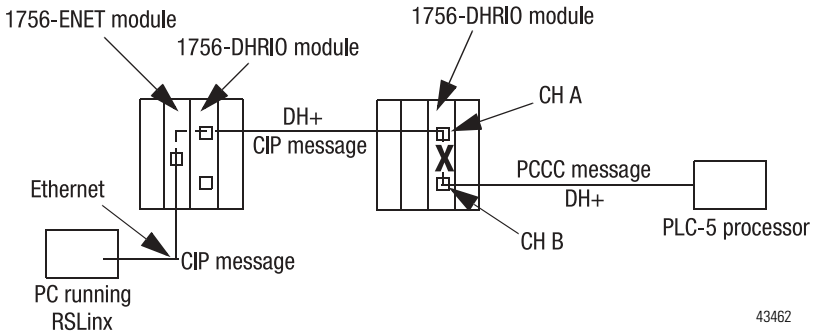
B. Click on OK.

Using RSLinx Software to Send Control and Information Protocol Messages

The 1756-DHRIO module 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.

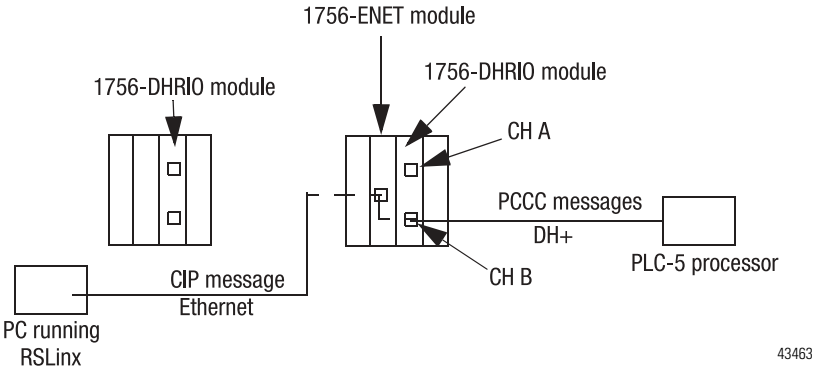
RSLinx uses the CIP protocol when it sends messages via EtherNet or ControlNet. Therefore, it cannot route an RSWho message from a 1756-ENET module to one 1756-DHRIO module, to channel A of a second 1756-DHRIO module in a second chassis, and then out of channel B of the second 1756-DHRIO module (see the X in Figure 3.3).

Figure 3.3



To do this, use the 1756-ENET module to connect to a second ControlLogix chassis that contains the second 1756-DHRIO module, as shown in Figure 3.4.

Figure 3.4



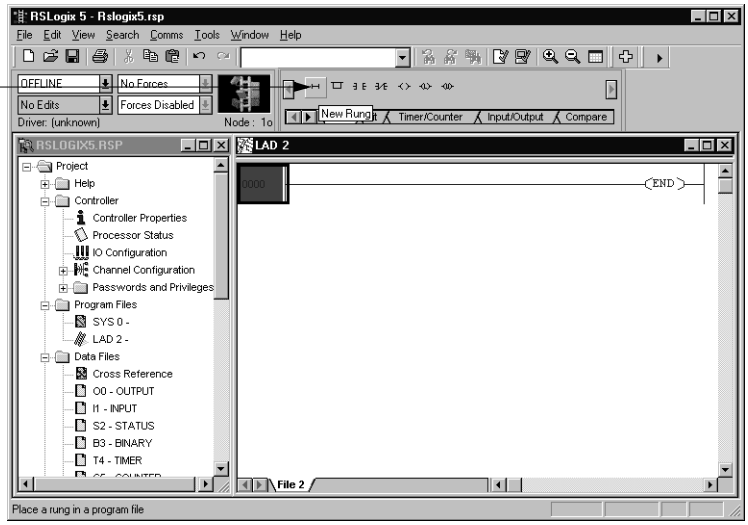
Using RSLogix 5

RSLogix 5 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. For a full description of how to use the software, see the online help.

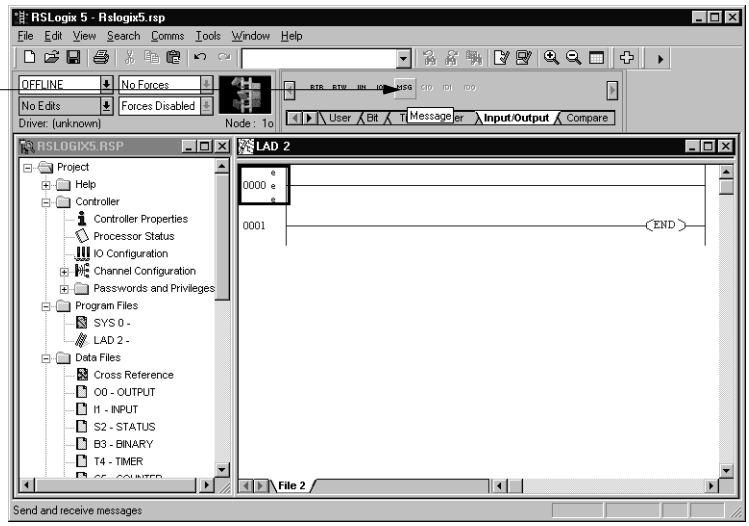
1. Start the RSLogix 5 software.
2. Begin a new project or open an existing project.
3. Add a rung to the ladder logic portion of the project.

Click here to add a rung.



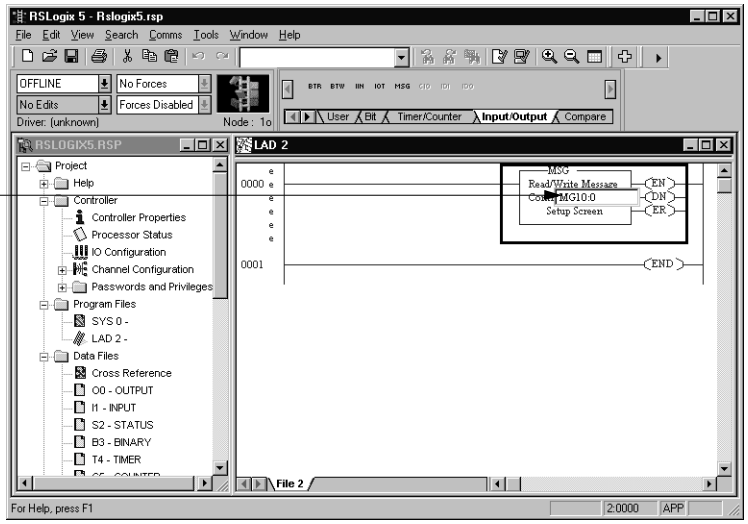
4. Add a message instruction (MSG) to the new rung.

Click here to add a MSG.



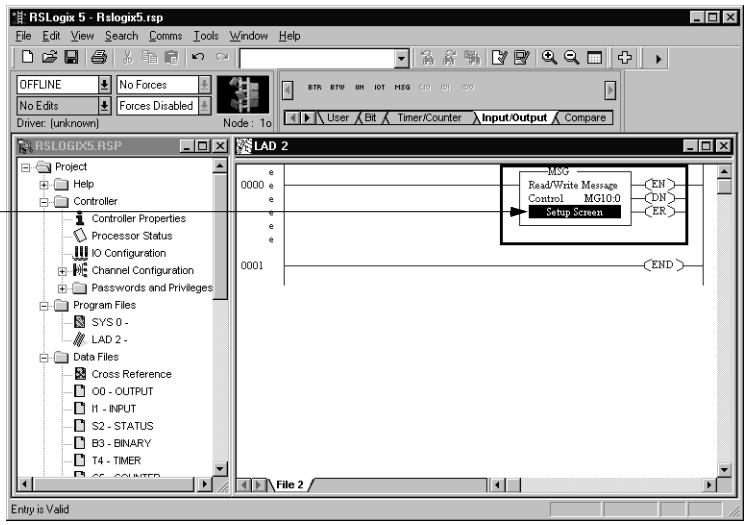
5. Change the MSG instruction Control.

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



6. Configure the MSG instruction on the set-up screen.

Double-click on Setup Screen to access the message instruction screen. An example of the screen is shown in the RSLogix 5 DH+ Application Example on page 3-11.

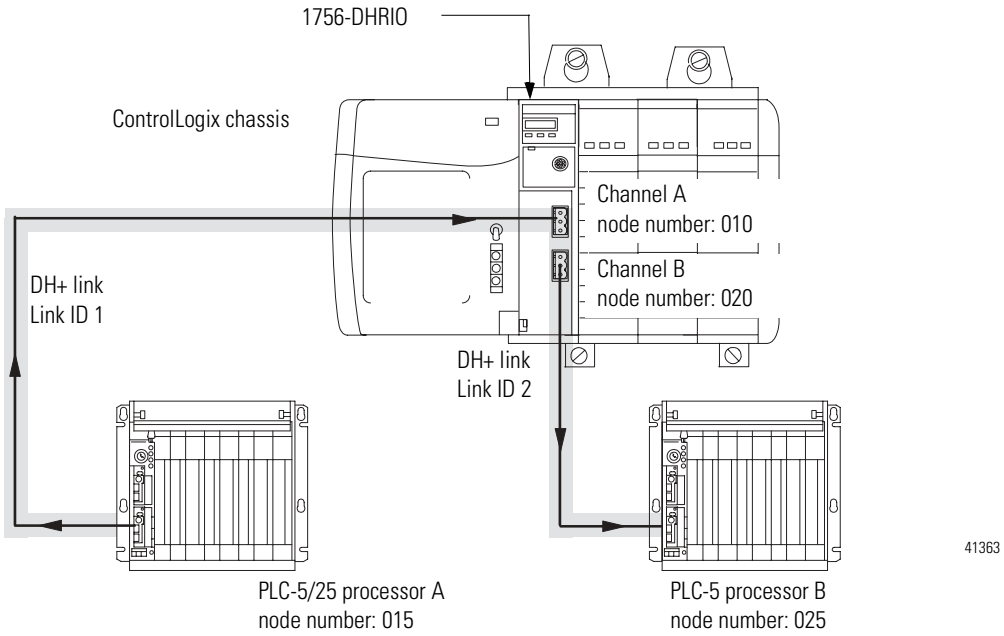


This completes creating a MSG instruction in RSLogix 5. For more information on how to the use the software, see the online help.

RSLogix 5 DH+ Application Example

Figure 3.5 shows an example DH+ application where PLC-5/25 processor A writes data, via a message instruction and the 1756-DHRIO module, to PLC-5 processor B.

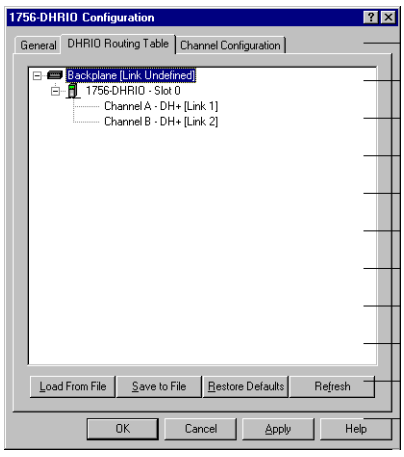
Figure 3.5



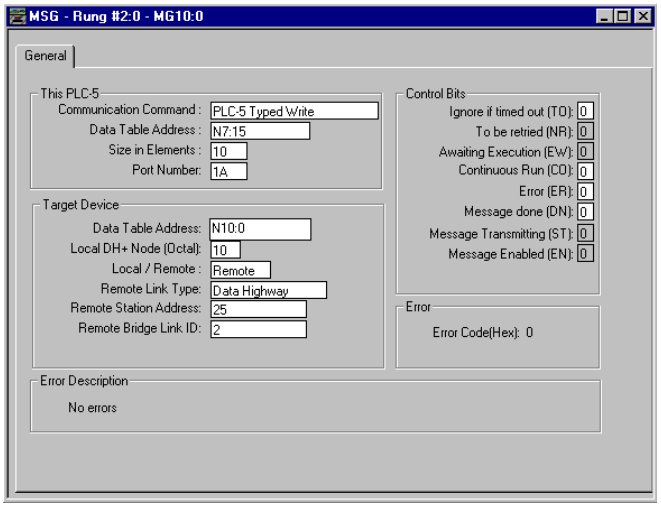
For this example, you must configure a routing table in RSLinx as described in the steps beginning on page 3-5 and then use RSLogix 5 to complete the message instruction as described in the steps beginning on page 3-9. Figure 3.6 shows the screens needed to complete the example.

Figure 3.6

Routing table



RSLogix 5 message instruction



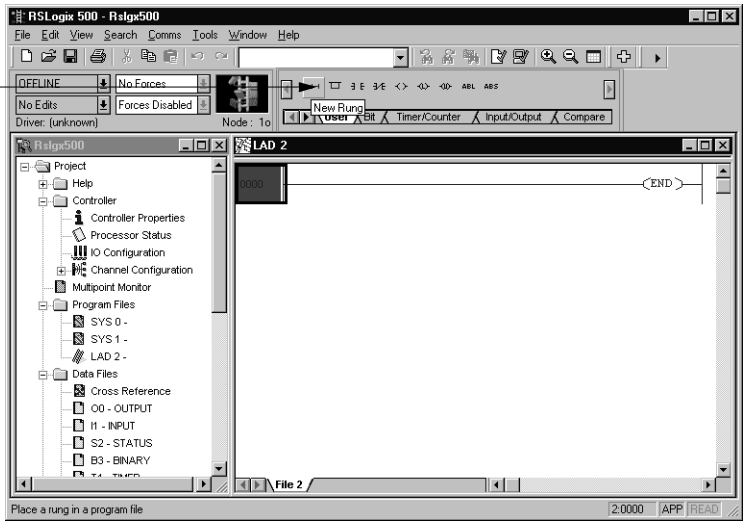
Using RSLogix 500

RSLogix 500 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. For a full description of how to use the software, see the online help.

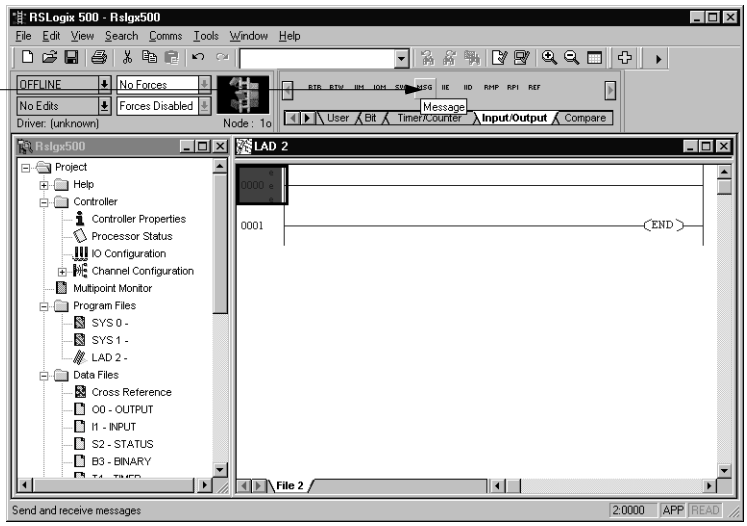
1. Start the RSLogix 500 software.
2. Begin a new project or open an existing project.
3. Add a rung to the ladder logic portion of the project.

Click here to add a rung.



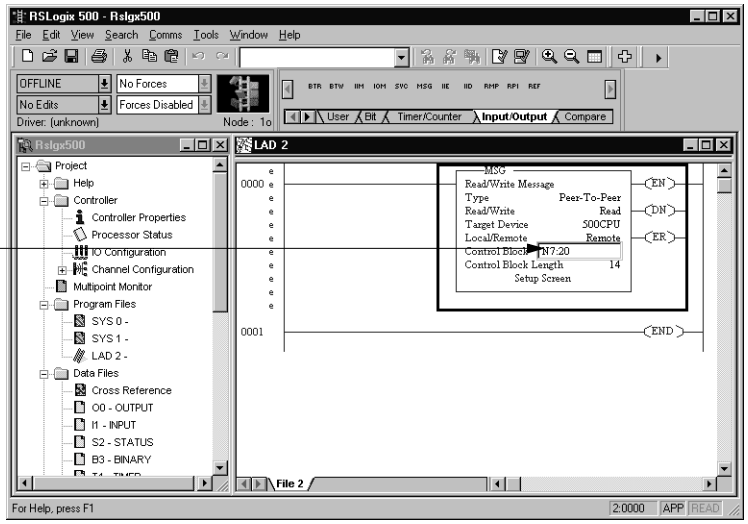
4. Add a message instruction (MSG) to the new rung.

Click here to add a MSG.



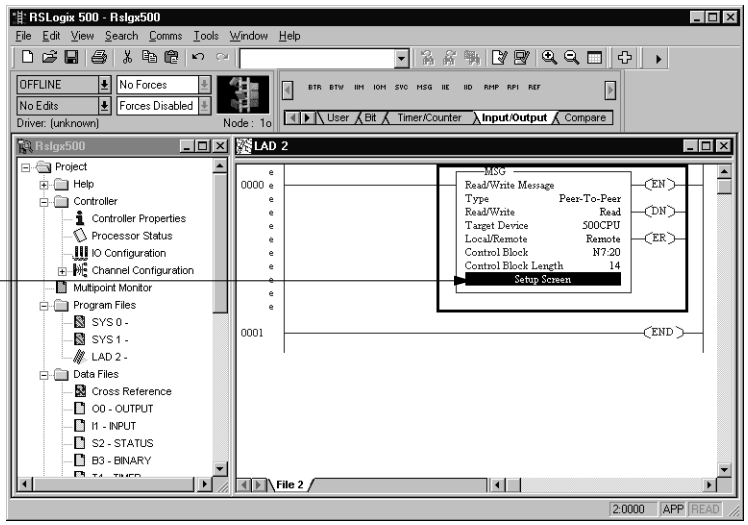
5. Change the MSG instruction Control.

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



6. Configure the MSG instruction on the set-up screen.

Double-click on Setup Screen to access the screen shown below.

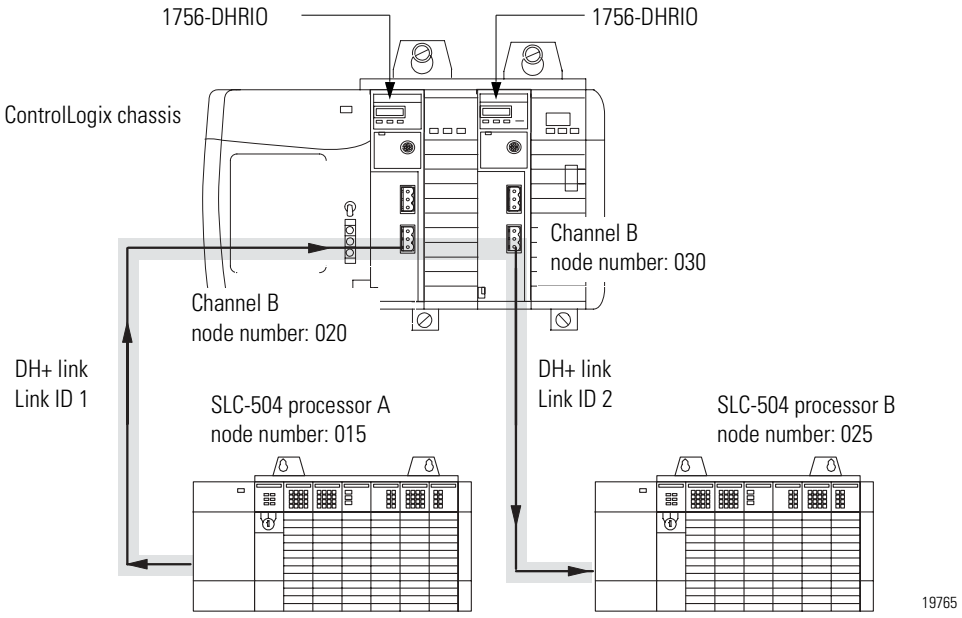


This completes creating a MSG instruction in RSLogix 500. For more information on how to the use the software, see the online help.

RSLogix 500 DH+ Application Example

Figure 3.5 shows an example DH+ application that includes SLC-5s using the 1756-DHRIO module to write message instructions.

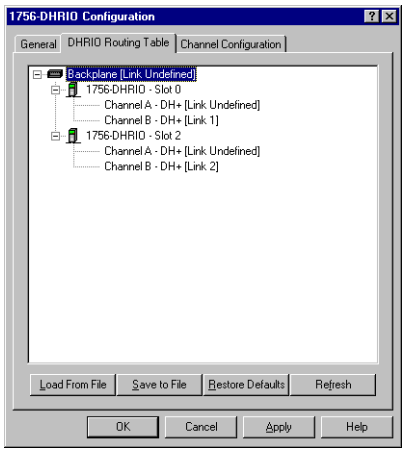
Figure 3.7



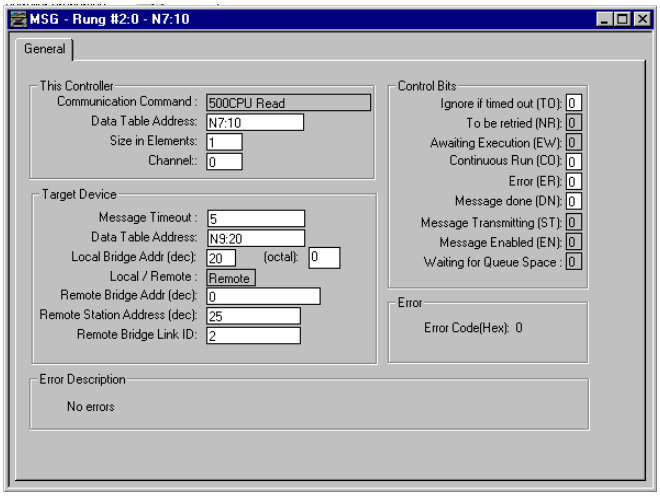
For this example, you must configure a routing table in RSLinx as described in the steps beginning on page 3-5 and then use RSLogix 500 to complete the message instructions as described on page 3-12. Figure 3.8 shows the screens needed to complete the example.

Figure 3.8

Routing table



RSLogix 500 message instruction



Using RSLogix 5000

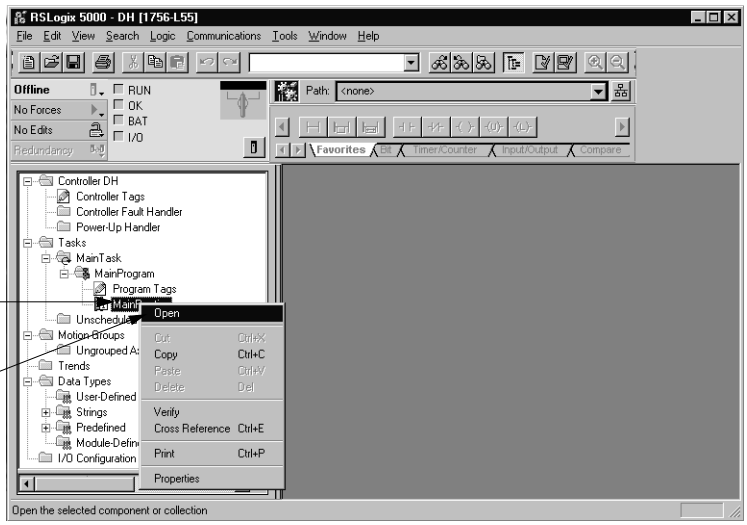
RSLogix 5000 is required to send read/write message instructions from a ControlLogix controller in DH+ applications. To send messages, follow these steps:

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

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

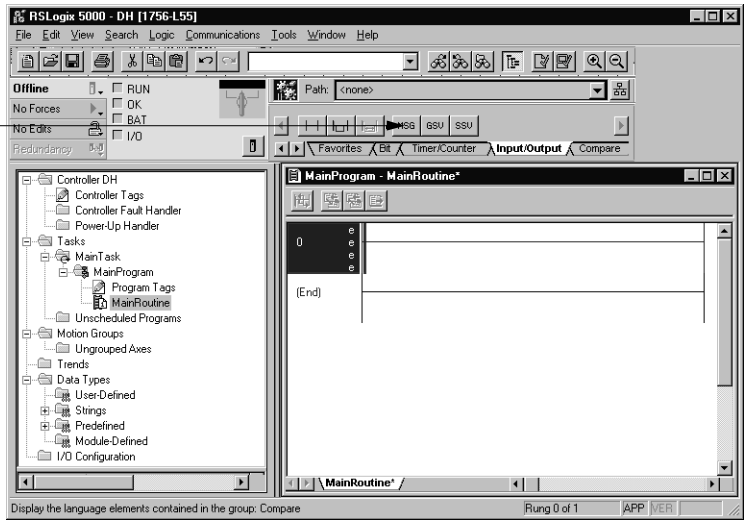
A. Right-click on Main Routine to see the menu.

B. Click on Open.



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

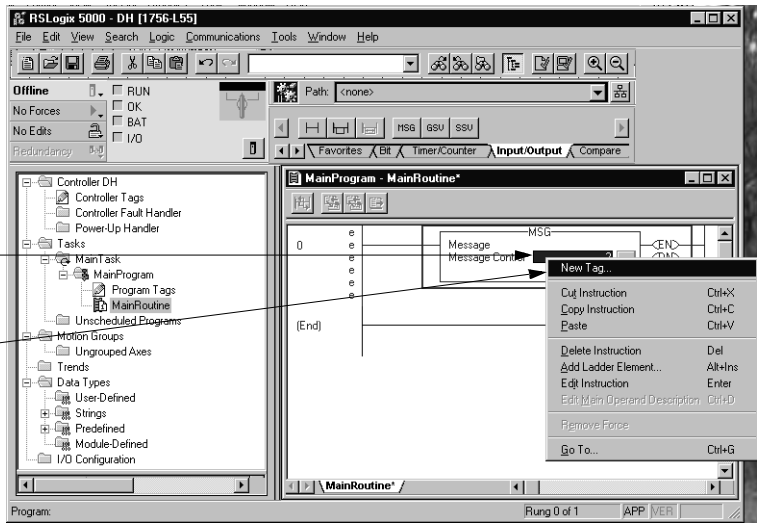
Click on the MSG button.



5. Add a new tag to the MSG instruction.

A. Right-click on the question mark (?) the menu.

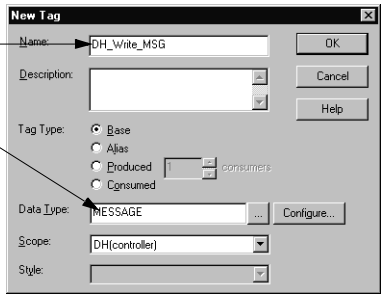
B. Click on New Tag.



6. Name and define the new tag.

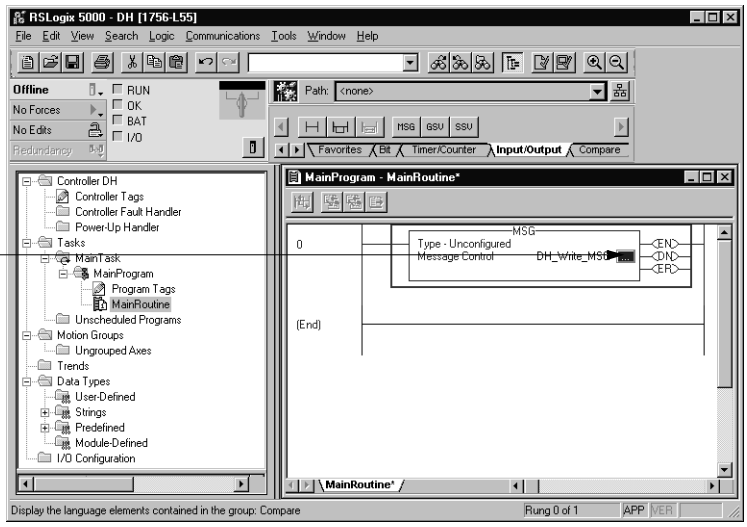
A. Name the tag.

B. Make sure this tag is of the MESSAGE type.

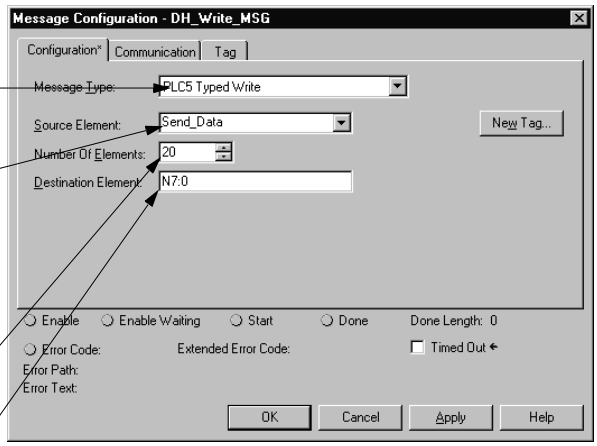


7. Access the message type configuration and communication parameters.

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



8. Change the message configuration.



A. Choose the Message Type from the pull-down list.

B. Choose the Source Element from the pull-down list if the tag already exists.
If the tag does not exist, use the New Tag feature (shown below) to create it.

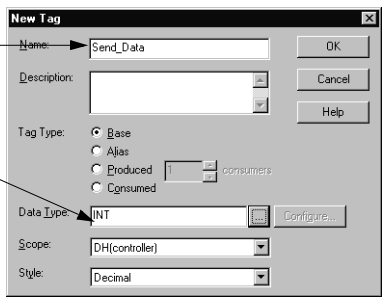
C. Type the Number of Elements being written.

D. Type the Destination Element. In this example, the Destination Element is a PLC-5 data table.

If you create a New Tag, you must:

A. Name the tag.

B. Make sure the Data Type is Integer (INT).

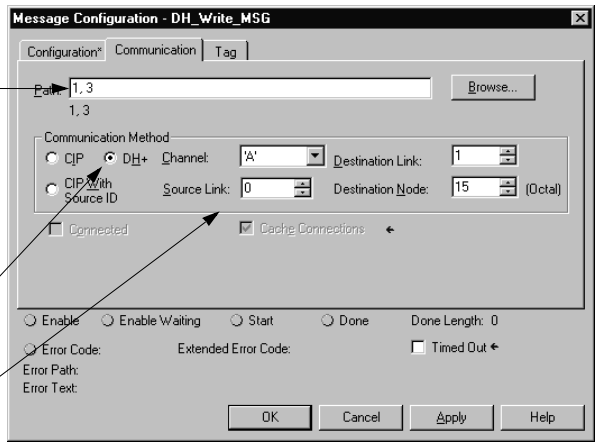


9. Set the communication path for the message instruction. For more information, see Defining Connection Paths on page 3-20.

A. 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 module.

B. Choose the DH+ Communication Method.

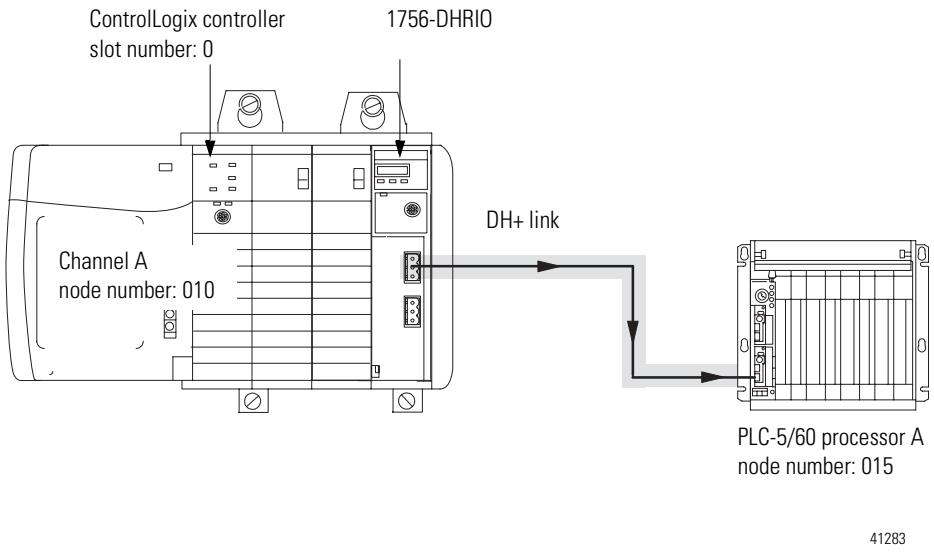
C. Fill in the appropriate information from the routing table for this module.



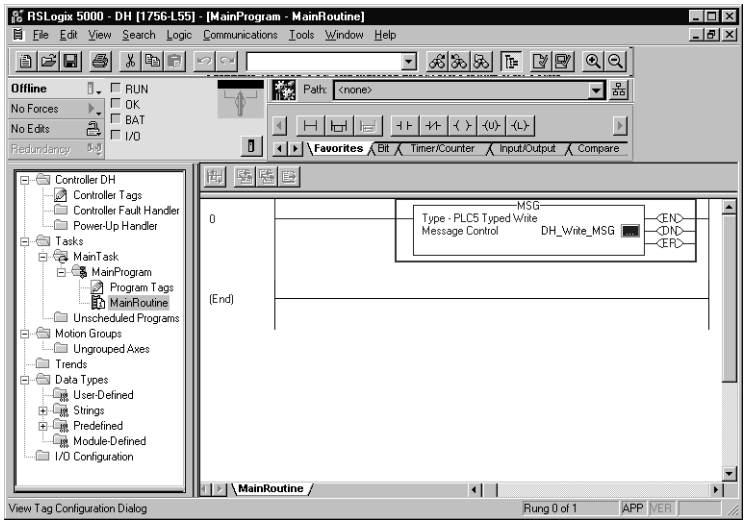
RSLogix 5000 DH+ Application Example

Figure 3.9 shows an example DH+ application that include a ControlLogix controller using the 1756-DHRIO module to write message instructions.

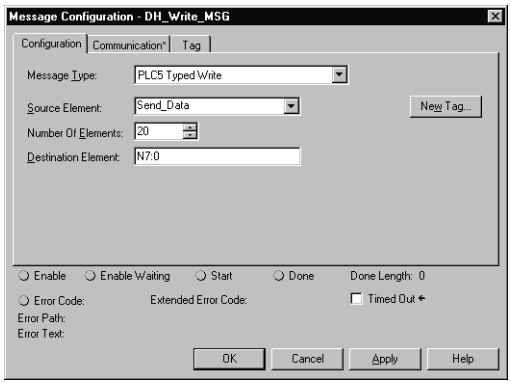
Figure 3.9



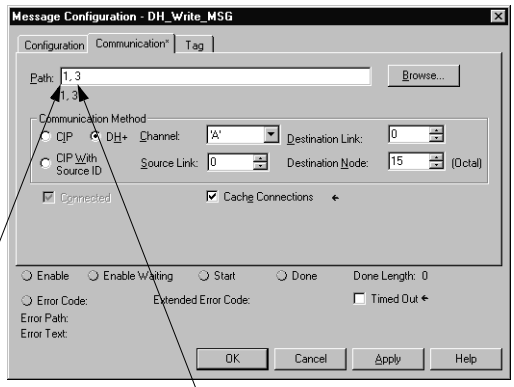
For this example, you need to follow the basic steps described beginning on page 3-15. The message instruction's ladder logic's rung and configuration and communication parameters should match the ones shown below.



Configuration Pop-Up Screen



Communication Pop-Up Screen



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

3 represents the location of the 1756-DHRIO module (i.e. slot 3)

Defining Connection Paths

You may have to configure a connection path when configuring controller-to-controller communication or workstation-to-controller communication. The connection path starts with the controller or the communications 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 always 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

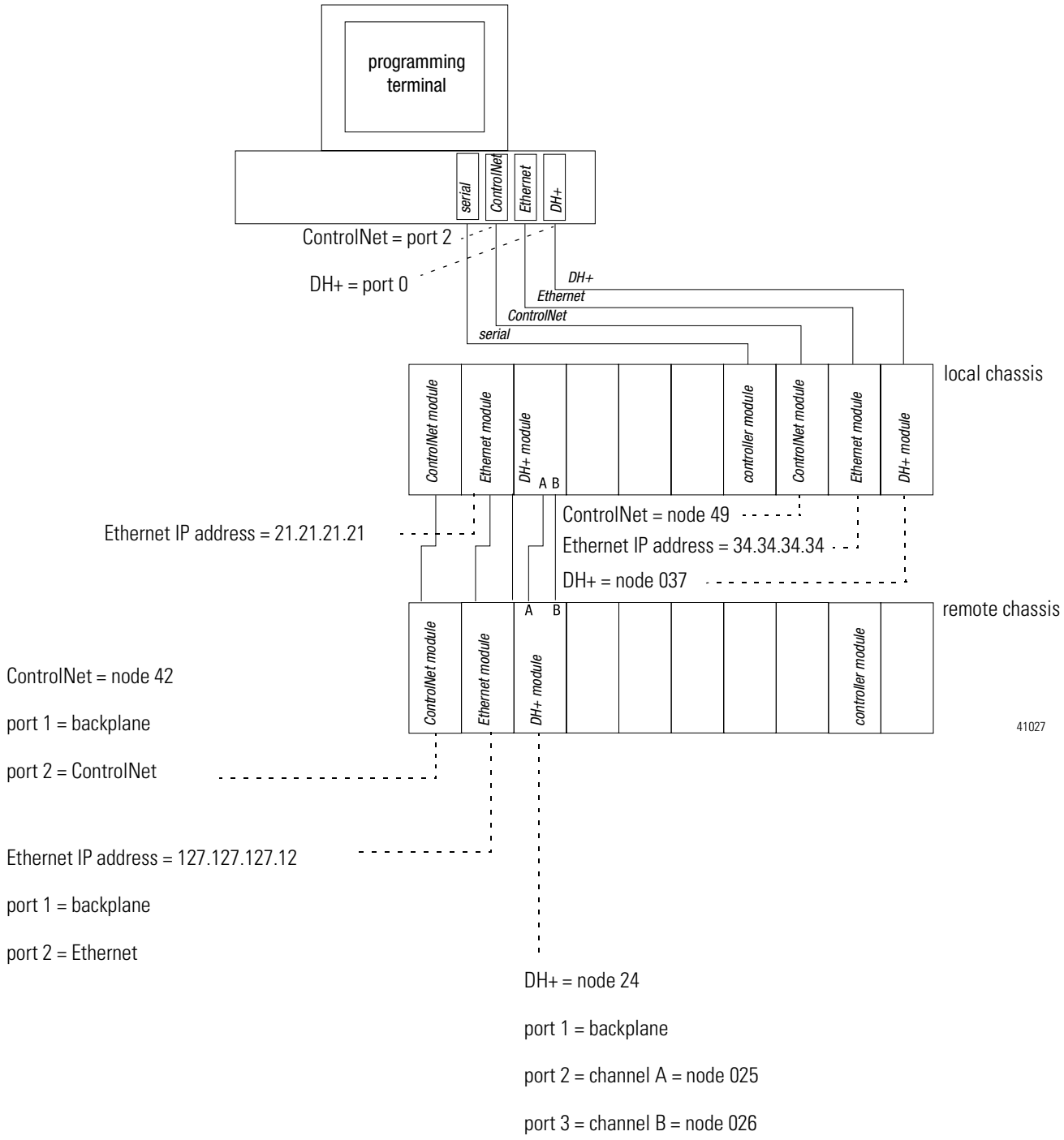
Where:

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 module 3 DH+ port over channel B from a 1756-DHRIO 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 communications 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 does not include path segment from Ethernet card in programming terminal to Ethernet module in local chassis because Ethernet driver is configured for the Ethernet module already 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 communications card in the workstation 8#37 = octal DH+ node of the 1756-DHRIO module in slot 9 of the local chassis 1 = backplane port of the 1756-DHRIO 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 communications card in the workstation 8#37 = octal DH+ node of the 1756-DHRIO module in slot 9 of the local chassis 1 = backplane port of the 1756-DHRIO module in slot 9 of the local chassis 2 = slot number of the other 1756-DHRIO module in the local chassis 3 = Channel B of the 1756-DHRIO module in slot 2 of the local chassis, configured for DH+ 8#24 = DH+ node of the 1756-DHRIO module in slot 2 of the remote chassis 1 = backplane port of the 1756-DHRIO 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 module in the local chassis 2 = Channel A of the 1756-DHRIO module in slot 2 of the local chassis, configured for DH+ 8#25 = DH+ node of the 1756-DHRIO module in slot 2 of the remote chassis 1 = backplane port of the 1756DHRIO in slot 2 of the remote chassis 9 = slot number of the controller in the remote chassis

Chapter Summary and What's Next

In this chapter, you read about using programming software in DH+ applications. Chapter 4 explains Messaging Between PLC-5s and SLC-5/04s.

Messaging Between PLC-5s and SLC-5/04s

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

For information about using	See page
DH+ Messaging: PLC-5s With One 1756-DHRIO	4-2
DH+ Messaging: SLC-5/04s With Two 1756-DHRIOs in One ControlLogix Chassis	4-5
DH+ Messaging: PLC-5s With Multiple ControlLogix Chassis	4-8
DH+ Messaging: PLC-5 to PLC-5/C on ControlNet	4-12

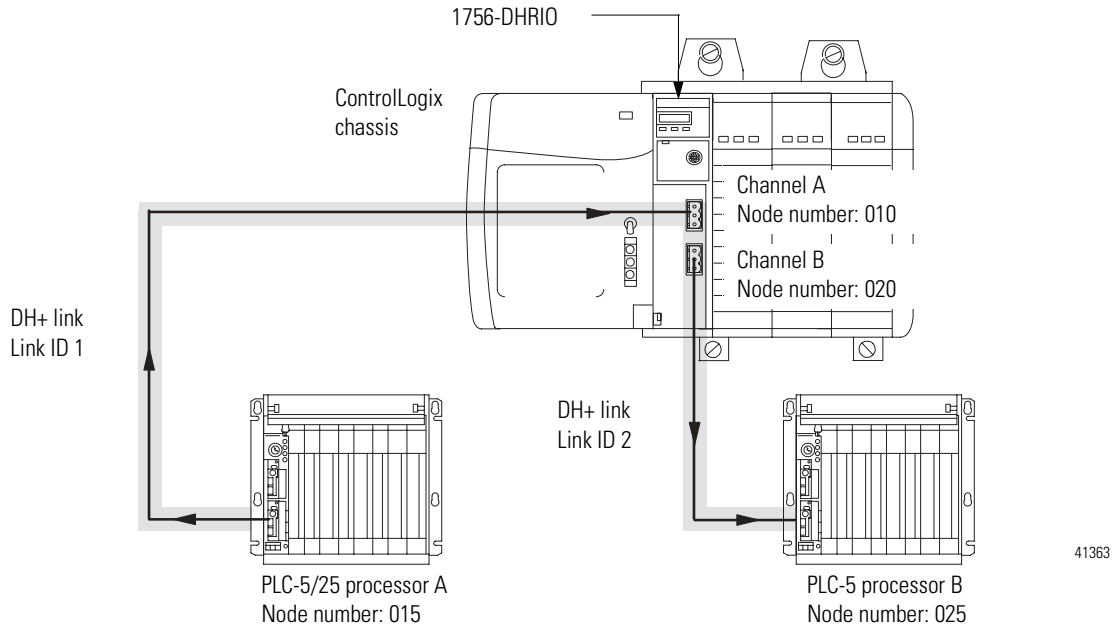
IMPORTANT The examples use PLC-5s and SLC-5/04s to send DH+ messages. In each case, the use of these devices is strictly for example purposes and not an indication of restrictions on the 1756-DHRIO module. Examples using PLC-5s could, in fact, use SLC-5/04s and examples using SLC-5/04s could use PLC-5s.

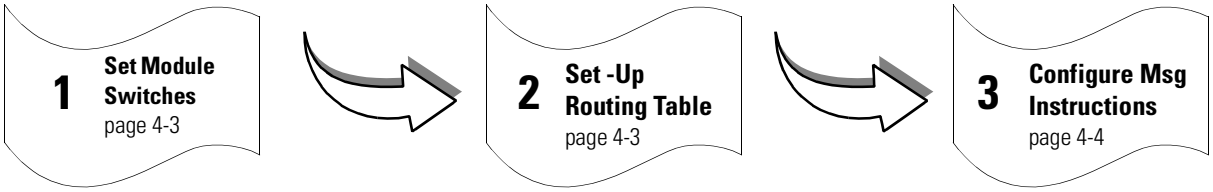
DH+ Messaging: PLC-5s With One 1756-DHRIO

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

Figure 4.1 illustrates the steps you must follow in this application:

Figure 4.1





1

Set the Module Switches

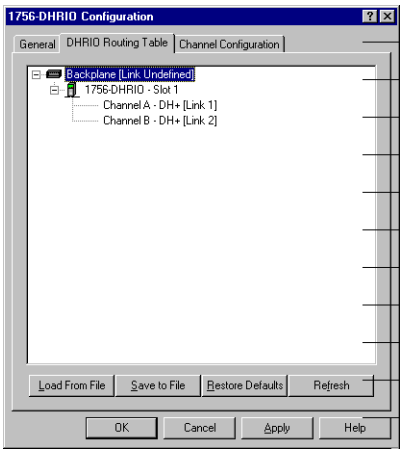
In this example, both Channel A and Channel B on the 1756-DHRIO module must be set for DH+. For more information on setting switches, see page 1-5.

2

Set-Up a Routing Table for the 1756-DHRIO Module

Use RSLinx to set-up a routing table for the 1756-DHRIO module. Figure 4.2 shows the routing table for this example.

Figure 4.2



For more information on how to set-up a routing table, see page 3-5 or the RSLinx online help.

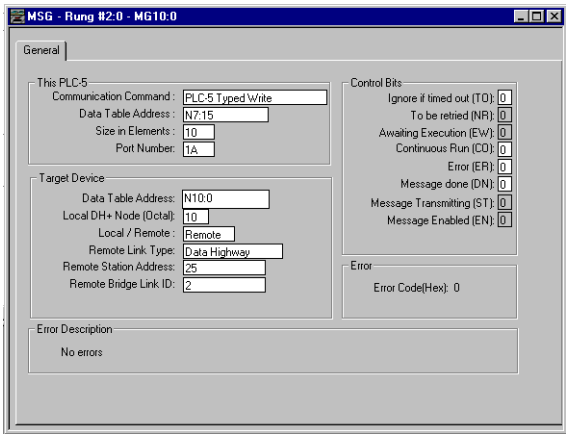
3

See PLC-5 Instruction set reference, publication 1785-6.1

Configure Message Instructions

Use RSLogix 5 to configure the remote PLC-5 message instructions being sent to ControlLogix controller B. Figure 4.3 shows message instruction for this example.

Figure 4.3



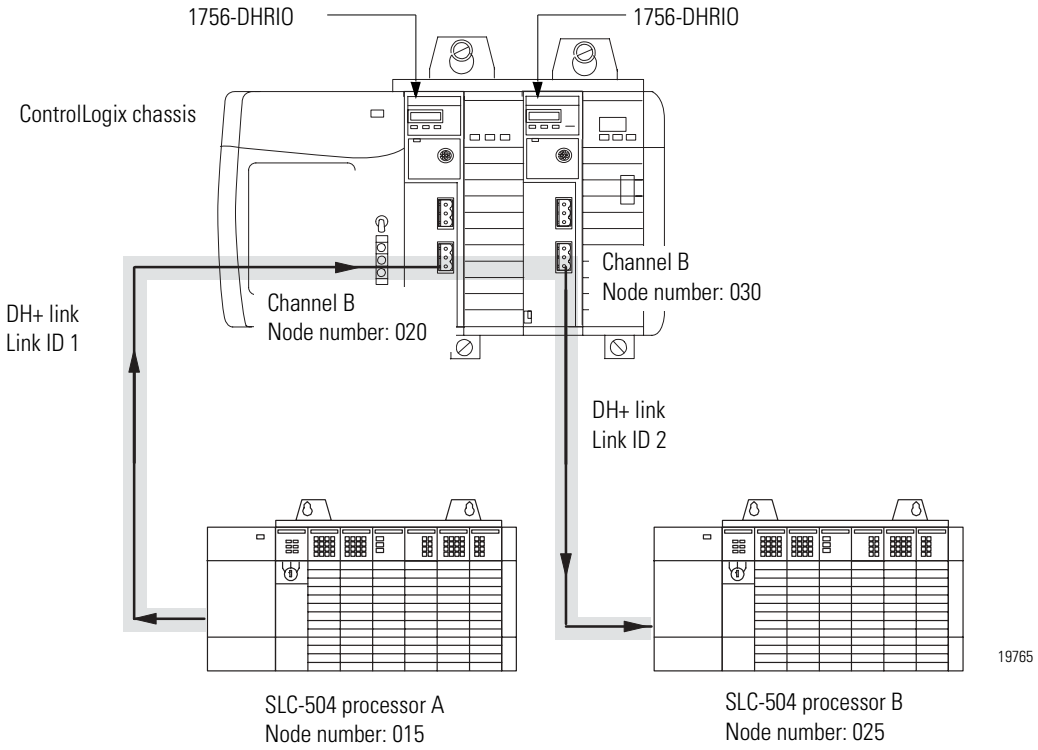
For more information on how to configure message instructions using RSLogix 5, see page 3-9 or the RSLogix 5 online help.

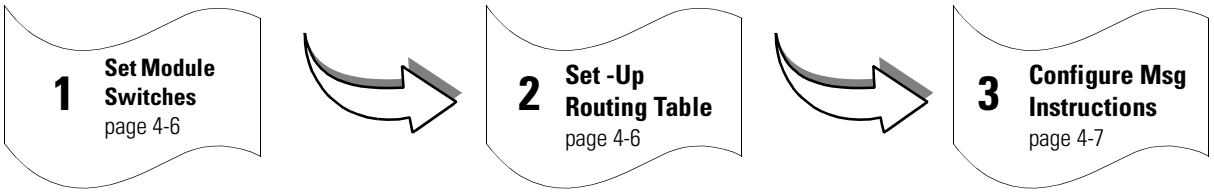
DH+ Messaging: SLC-5/04s With Two 1756-DHRIOs in One ControlLogix Chassis

This application sends a DH+ message from SLC-504 processor A through two 1756-DHRIO modules in the same chassis to SLC-5/04 processor B. Remote DH+ messaging is required to send the message.

Figure 4.4 illustrates the steps you must use in this application:

Figure 4.4





1

Set the Module Switches

In this application, Channel B on both 1756-DHRIO modules must be set for DH+. For more information on setting switches on the 1756-DHRIO module, see page 1-5.

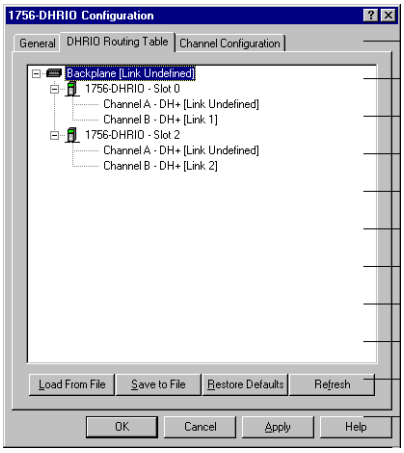
2

Set-Up a Routing Table for the 1756-DHRIO Modules

Use RSLinx to set-up a routing table for the 1756-DHRIO module. Figure 4.5 shows the routing table for this example.

TIP Because both 1756-DHRIO modules are in the same chassis, you only need to set-up one of the two routing tables and apply it to both modules.

Figure 4.5



For more information on how to set-up a routing table, see page 3-5 or the RSLinx online help.

3

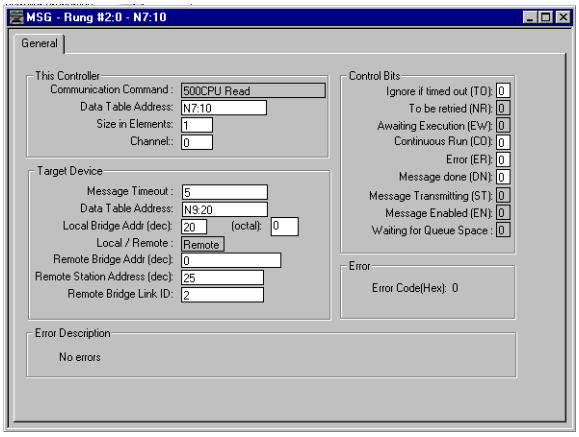
See SLC-500 Instruction Set Reference, publication 1747-6.15

Configure Message Instructions

Use RSLogix 500 to configure the SLC-500 message instructions. Figure 4.6 shows a message instruction for this example.

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

Figure 4.6



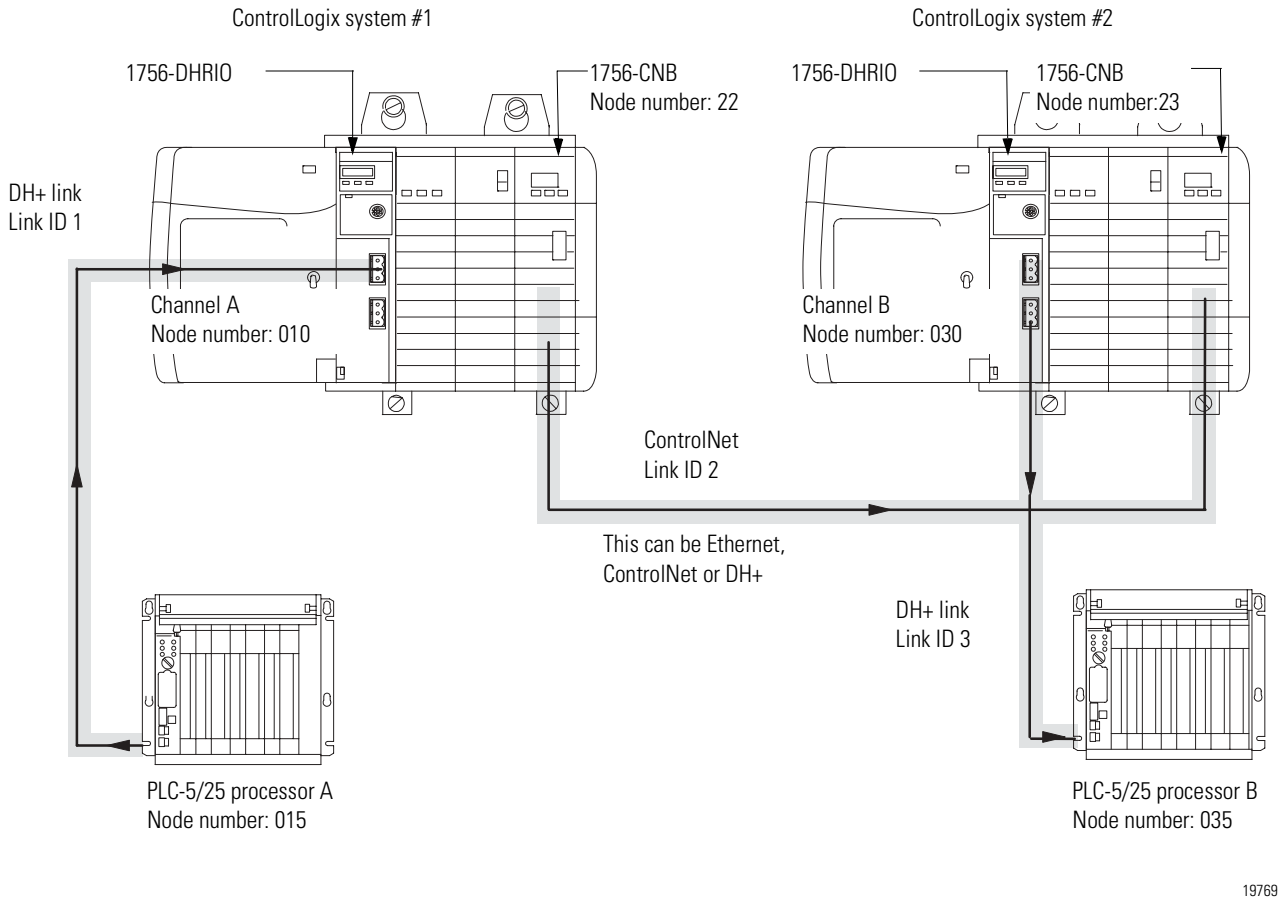
For more information on how to configure message instructions using the RSLogix 500 software, see page 3-12 or the RSLogix 500 online help.

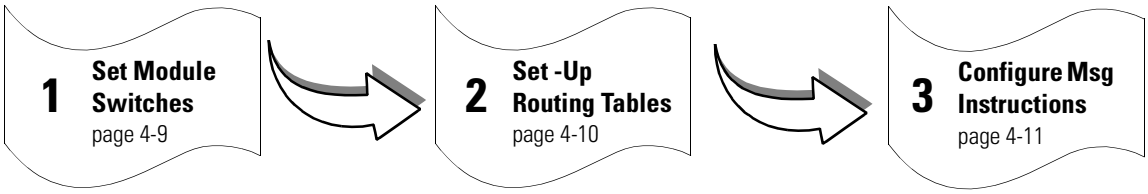
DH+ Messaging: PLC-5s With Multiple ControlLogix Chassis

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

Figure 4.7 illustrates the steps you must use in this application:

Figure 4.7





1

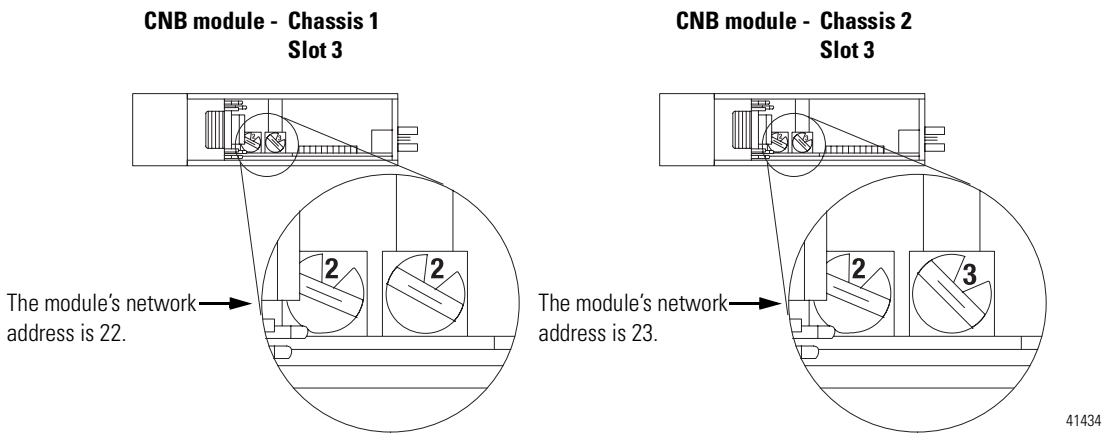
Set the Module Switches

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

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

Set the channels on the 1756-CNB module as shown in Figure 4.8. For more information on setting switches on the 1756-DHRIO module, see page 1-5.

Figure 4.8



2

Set-Up Routing Tables for the 1756-DHRIO Modules

You must set up routing tables for each 1756-DHRIO module in this example. Figure 4.9 shows the routing table for the 1756-DHRIO module in ControlLogix system #1 this example.

Figure 4.9

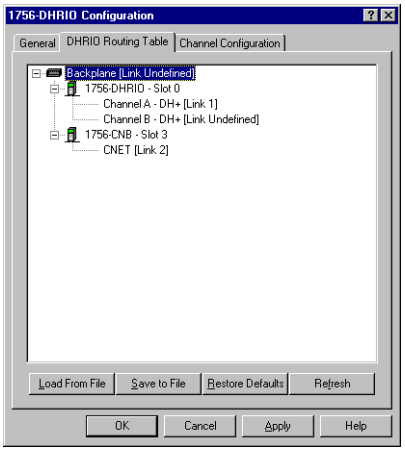
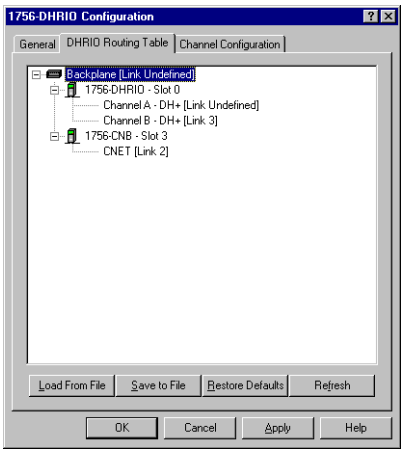


Figure 4.10 shows the routing table for the 1756-DHRIO module in ControlLogix system #2 this example.

Figure 4.10



For more information on how to set-up a routing table, see page 3-5 or the RSLinx online help.

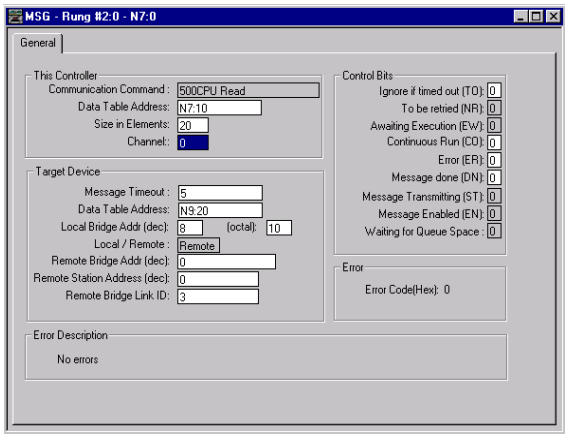
3

See SLC-500 Instruction Set Reference, publication 1747-6.15

Configure Message Instructions

Use RSLogix 5 to configure the remote PLC-5 message instructions being sent to ControlLogix controller B. Figure 4.11 shows a message instruction for this example.

Figure 4.11



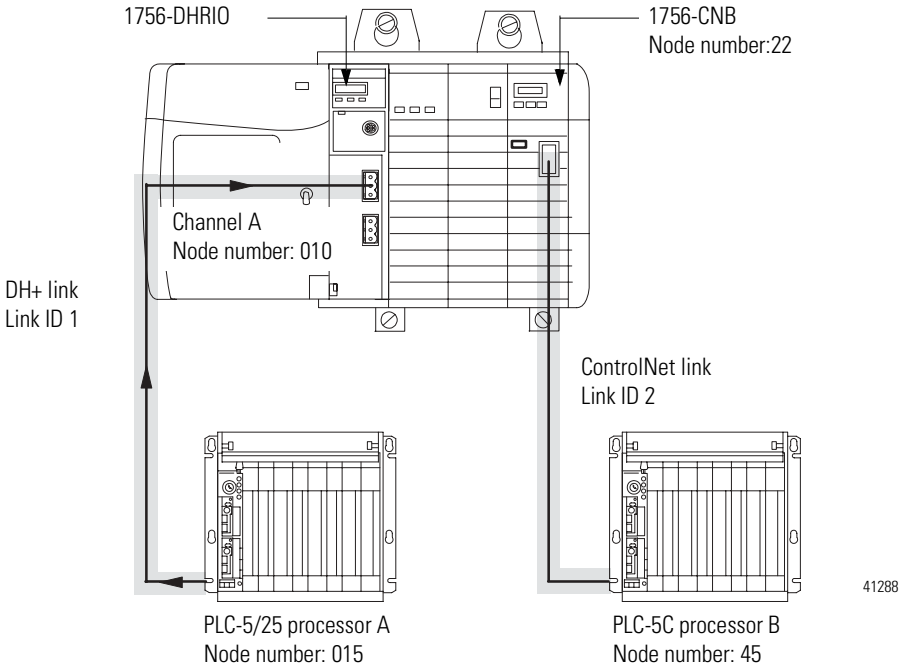
For more information on how to configure message instructions using RSLogix 5, see page 3-9 or the RSLogix 5 online help.

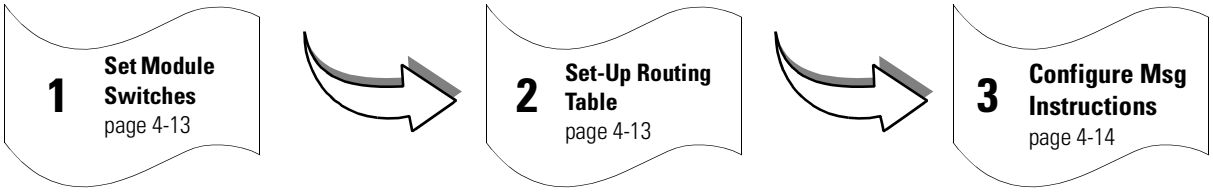
DH+ Messaging: PLC-5 to PLC-5/C on ControlNet

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

Figure 4.12 illustrates the steps you must use in this application:

Figure 4.12





1

Set the Module Switches

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

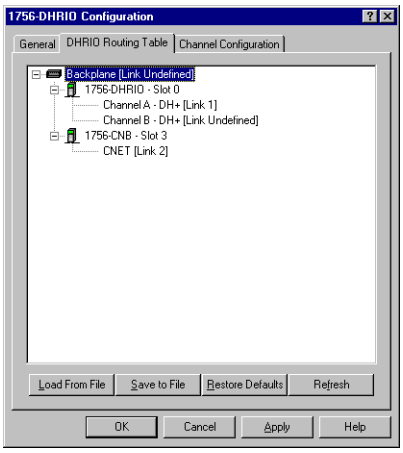
For more information on setting switches on the 1756-DHRIO module, see page 1-5. For more information on setting the switches on the 1756-CNB module, see page 4-9.

2

Set-Up a Routing Table for the 1756-DHRIO Module

Use RSLinx to set-up a routing table for the 1756-DHRIO module. Figure 4.13 shows the routing table for this example.

Figure 4.13



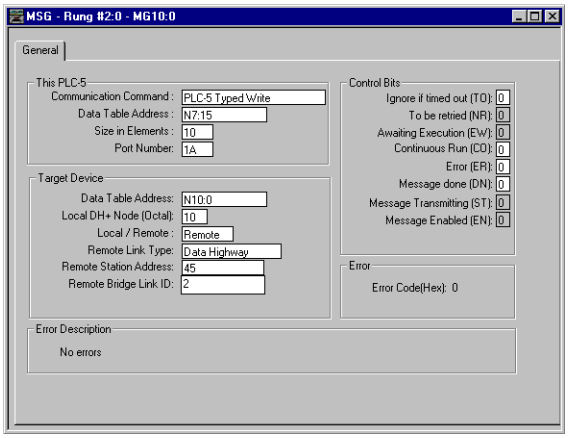
3

See SLC-500 Instruction Set Reference, publication 1747-6.15

Configure Message Instructions

Use RSLogix 5 to configure the remote PLC-5 message instructions being sent to ControlLogix controller B. Figure 4.14 shows a message instruction for this example.

Figure 4.14



For more information on how to configure message instructions using RSLogix 5, see page 3-9 or the RSLogix 5 online help.

Chapter Summary and What's Next

In this chapter, you read about using messaging between PLCs and SLCs. Chapter 5 describes Messaging Between PLC-5s or SLC5/04s and ControlLogix Controllers.

Messaging Between PLC-5s or SLC5/04s and ControlLogix Controllers

What This Chapter Contains

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

For information about using	See page
DH+ Messaging: PLC-5 to One ControlLogix Controller With One ControlLogix Chassis	5-2
DH+ Messaging: PLC-5 to Multiple ControlLogix Controllers in One ControlLogix Chassis	5-5
DH+ Messaging: SLC-5/04 to a ControlLogix Controller With Multiple ControlLogix Chassis	5-9

IMPORTANT

The examples use PLC-5s and SLC-5/04s 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 module.

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

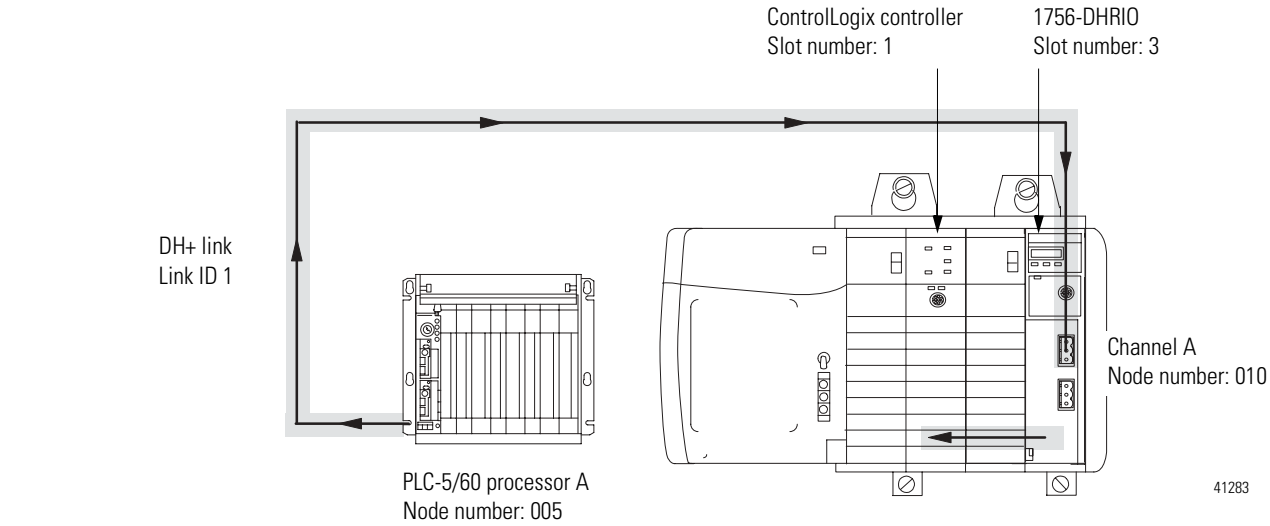
DH+ Messaging: PLC-5 to One ControlLogix Controller With One ControlLogix Chassis

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

IMPORTANT Local DH+ messaging can only send DH+ messages to one ControlLogix controller per DH+ channel. See the application on page 5-5 if you want to send DH+ messages to multiple ControlLogix controllers in the chassis.

Figure 5.1 illustrates the steps you must use in this application:

Figure 5.1



IMPORTANT For this application, the 1756-DHRIO module only needs a controller slot programmed if the ControlLogix controller is not located in the default slot (0) of the ControlLogix chassis.

1

Set the Module Switches

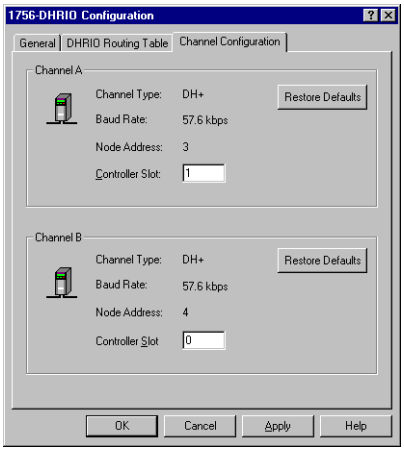
In this example, Channel A on the 1756-DHRIO module must be set for DH+. For more information on setting switches on the 1756-DHRIO module, see page 1-5.

2

Set-Up a Controller Slot for the 1756-DHRIO Module

In this example, the controller is not located in the default slot (slot 0) of the ControlLogix chassis. You must use RSLinx to set-up a controller slot for the 1756-DHRIO module as shown in Figure 5.2.

Figure 5.2



For more information on how to set-up a controller slot, see page 3-7 or the RSLinx online help

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

3

See PLC-5 Instruction set reference, publication 1785-6.1

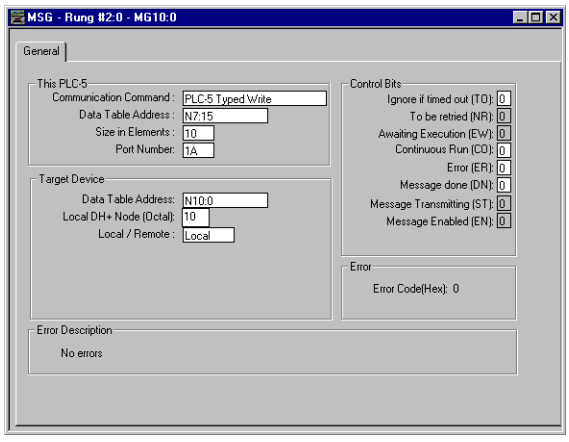
Configure Message Instructions

You must use RSLogix 5 to configure the PLC-5 message instructions. Figure 5.3 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 RSLogix5000 program application.
- In the Logic tab on the tool bar select Map PLC/SLC Messages
- The file number must be an integer type. Just write the file number in the box. The whole file in the PLC/SLC will be used starting with word 0.
- A tag must be created before hand to accept the data with the proper number of array elements.
- The destination tag in the PLC/SLC message would be the file number configured at the word level.

Figure 5.3



For more information on how to configure message instructions using RSLogix 5, see page 3-9 or the RSLogix 5 online help.

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

This application sends a DH+ message from PLC-5/60 processor A through a 1756-DHRIO module to multiple ControlLogix controllers.

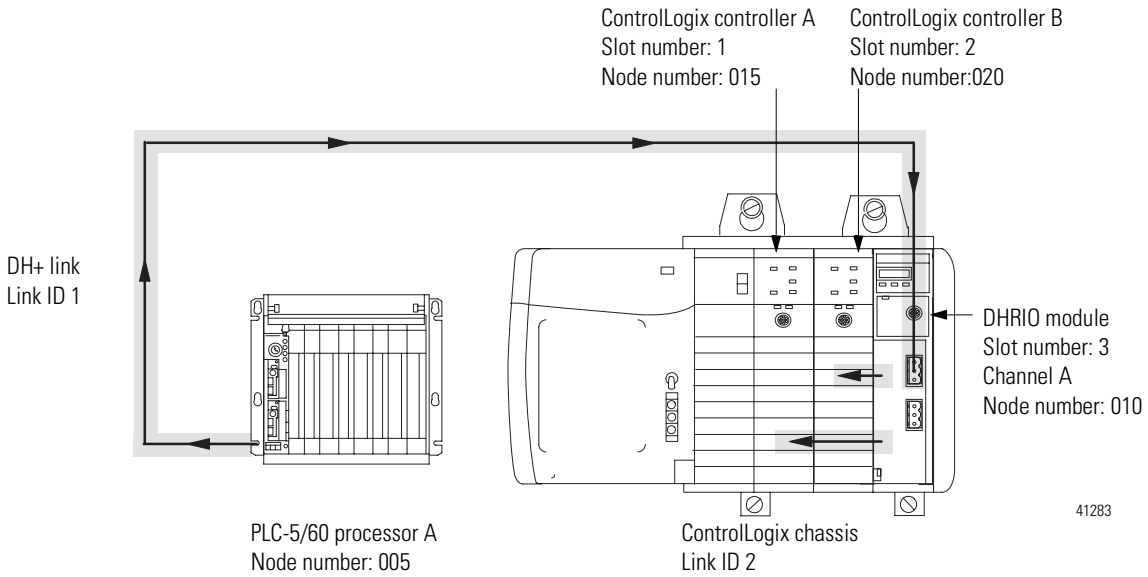
IMPORTANT

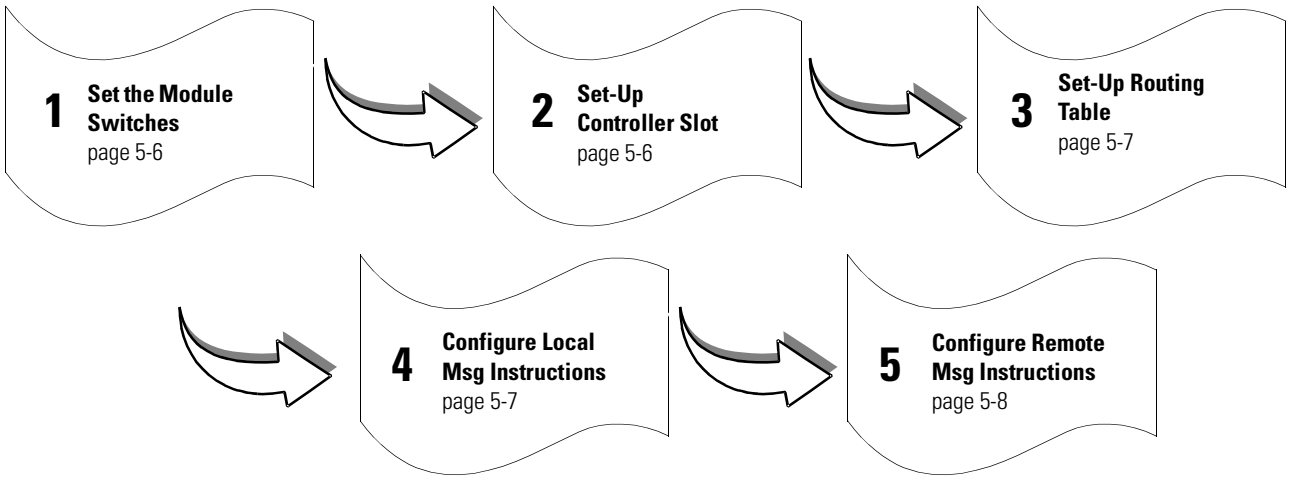
In this example, we use both local and remote DH+ messaging to send DH+ messages. Local DH+ messaging is used to send a message to ControlLogix controller A. (This processor must be configured as the controller slot, see Step 2.)

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

Figure 5.4 illustrates the steps you must use in this application:

Figure 5.4





1

Set the Module Switches

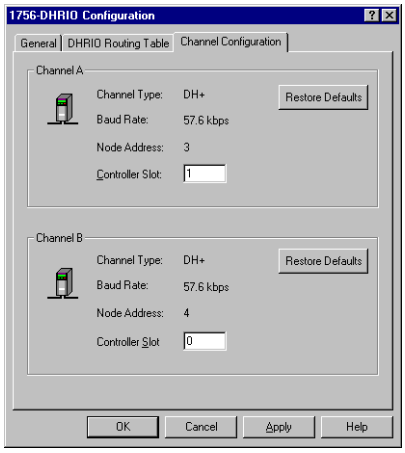
In this example, Channel A on the 1756-DHRIO module must be set for DH+. For more information on setting switches on the 1756-DHRIO module, see page 1-5.

2

Set-Up a Controller Slot for the 1756-DHRIO Module

In this example, the controller is not located in the default slot (slot 0) of the ControlLogix chassis. You must use RSLinx to set-up a controller slot for the 1756-DHRIO module. Figure 5.5 shows the controller slot necessary for this example.

Figure 5.5



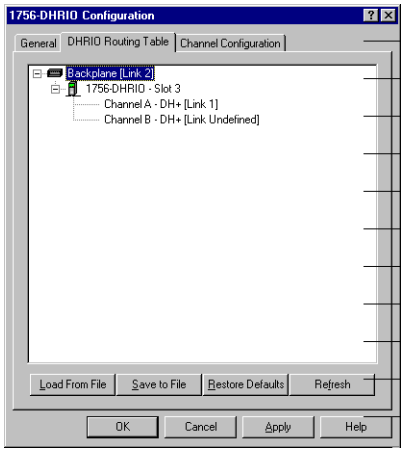
For more information on how to set-up a controller slot, see page 3-7 or the RSLinx online help.

3

Set-Up a Routing Table for the 1756-DHRIO Module

Use RSLinx to set-up a routing table for the 1756-DHRIO module. Figure 5.6 shows the routing table necessary for this example.

Figure 5.6



For more information on how to set-up a routing table, see page 3-5 or the RSLinx online help.

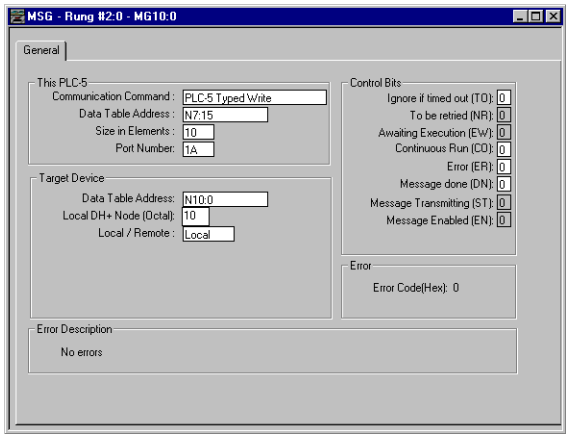
4

Configure Local Message Instructions

Use RSLogix 5 to configure the local PLC-5 message instructions being sent to ControlLogix controller A in the controller slot. Figure 5.7 shows the local message instruction necessary for this example.

PLC-5 Instruction Set Reference, publication 1785-6.1

Figure 5.7



For more information on how to configure message instructions using RSLogix 5, see page 3-9 or the RSLogix 5 online help.

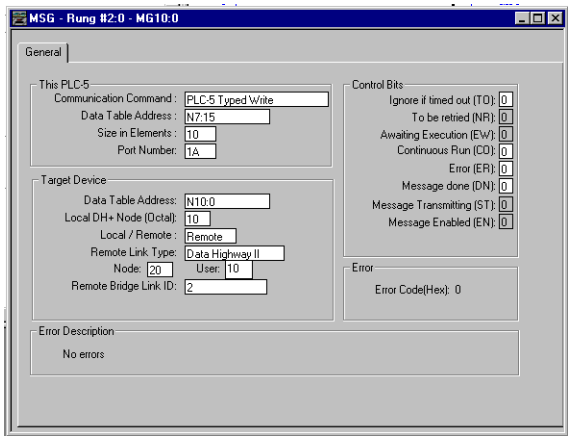
5

PLC-5 Instruction Set Reference, publication 1785-6.1

Configure Remote Message Instructions

Use RSLogix 5 to configure the remote PLC-5 message instructions being sent to ControlLogix controller B. Figure 5.8 shows a remote message instruction necessary for this example.

Figure 5.8



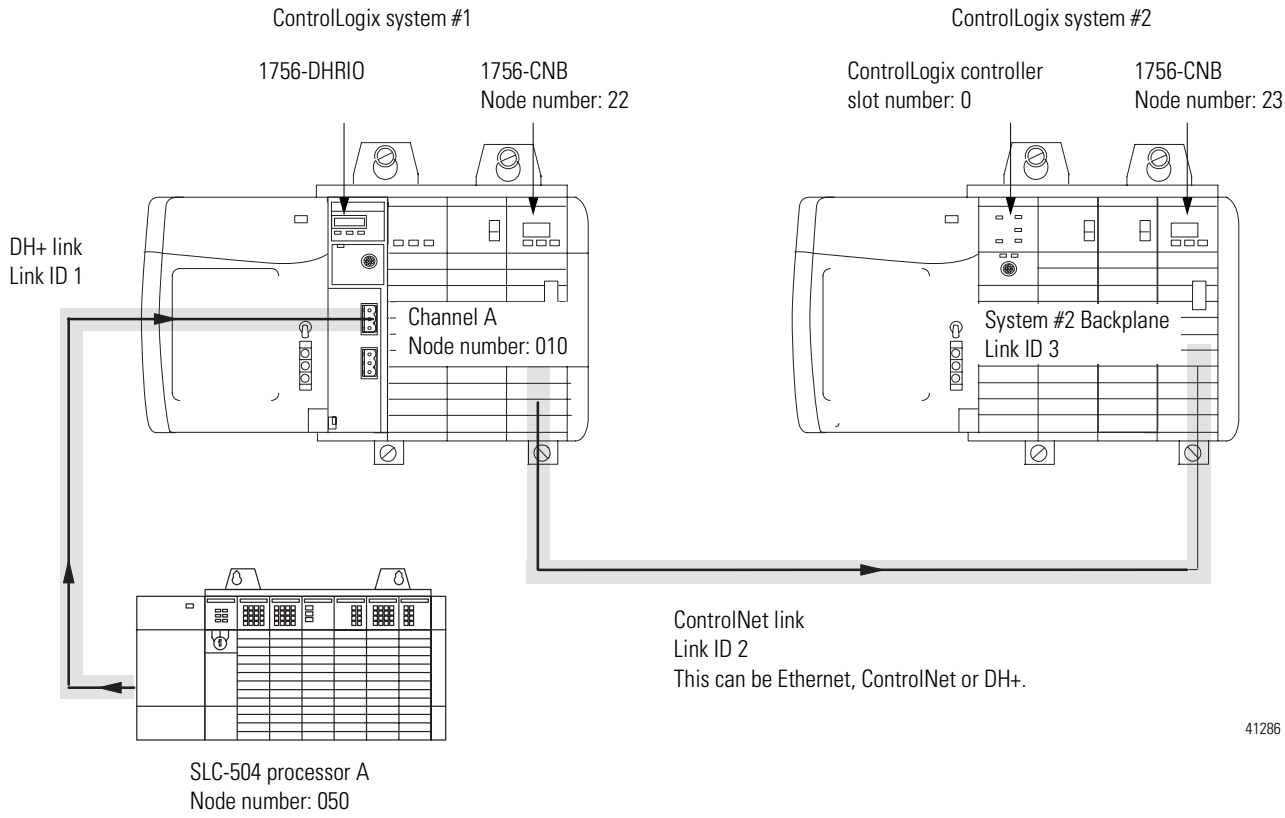
For more information on how to configure message instructions using RSLogix 5, see page 3-9 or the RSLogix 5 online help.

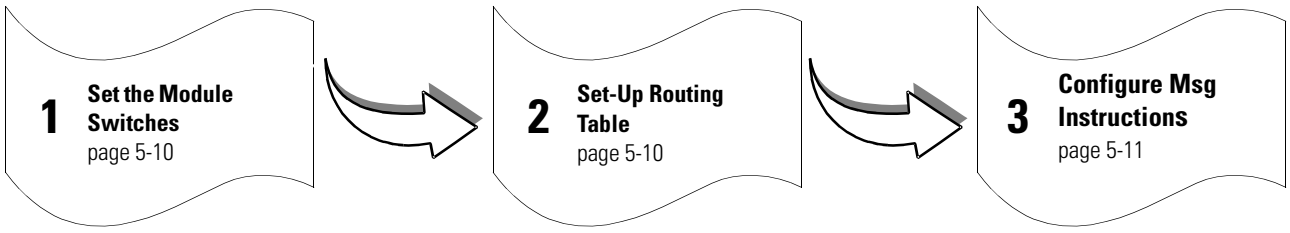
DH+ Messaging: SLC-5/04 to a ControlLogix Controller With Multiple ControlLogix Chassis

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

Figure 5.9 illustrates the steps you must use in this application:

Figure 5.9





1

Set the Module Switches

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

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

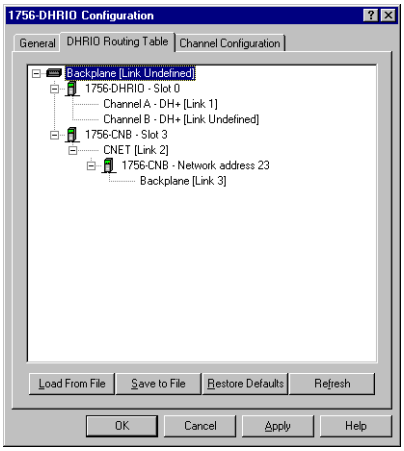
For more information on setting switches on the 1756-DHRIO module, see page 1-5. For more information on setting the switches on the 1756-CNB module, see page 4-9.

2

Set-Up a Routing Table for the 1756-DHRIO Module

Use RSLinx to set-up a routing table for the 1756-DHRIO module. Figure 5.10 shows the routing table necessary for this example.

Figure 5.10



For more information on how to set-up a routing table, see page 3-5 or the RSLinx online help.

3

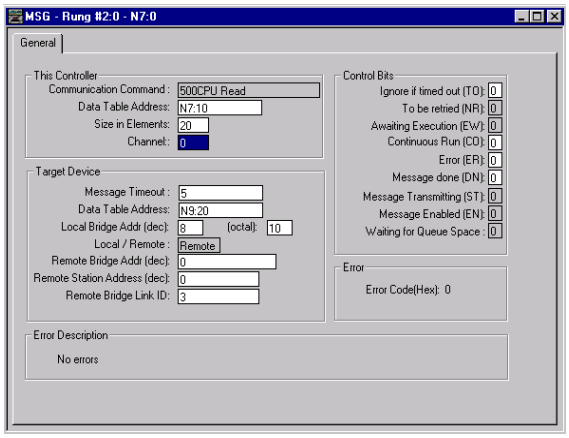
See PLC-5 Instruction Set Reference, publication 1785-6.1

Configure Message Instructions

Use RSLogix 500 to configure the SLC-500 message instructions. Figure 5.11 shows a message instruction necessary for this example.

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

Figure 5.11



For more information on how to configure message instructions using the RSLogix 500 software, see page 3-9 or the RSLogix 500 online help.

Chapter Summary and What's Next

In this chapter, you read about Messaging Between PLC-5s or SLC5/04s and ControlLogix Controllers. Chapter 6 describes Messaging Between ControlLogix Controllers and PLC-5s or SLC-5/04s.

Notes:

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

What This Chapter Contains

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

For information about using	See page
Local DH+ Messaging: ControlLogix Controller in a Single Chassis to a PLC-5	6-2
DH+ Messaging: ControlLogix Controller to a SLC-5/04 Over ControlNet and DH+	6-4

IMPORTANT

The examples use PLC-5s and SLC-5/04s 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 module.

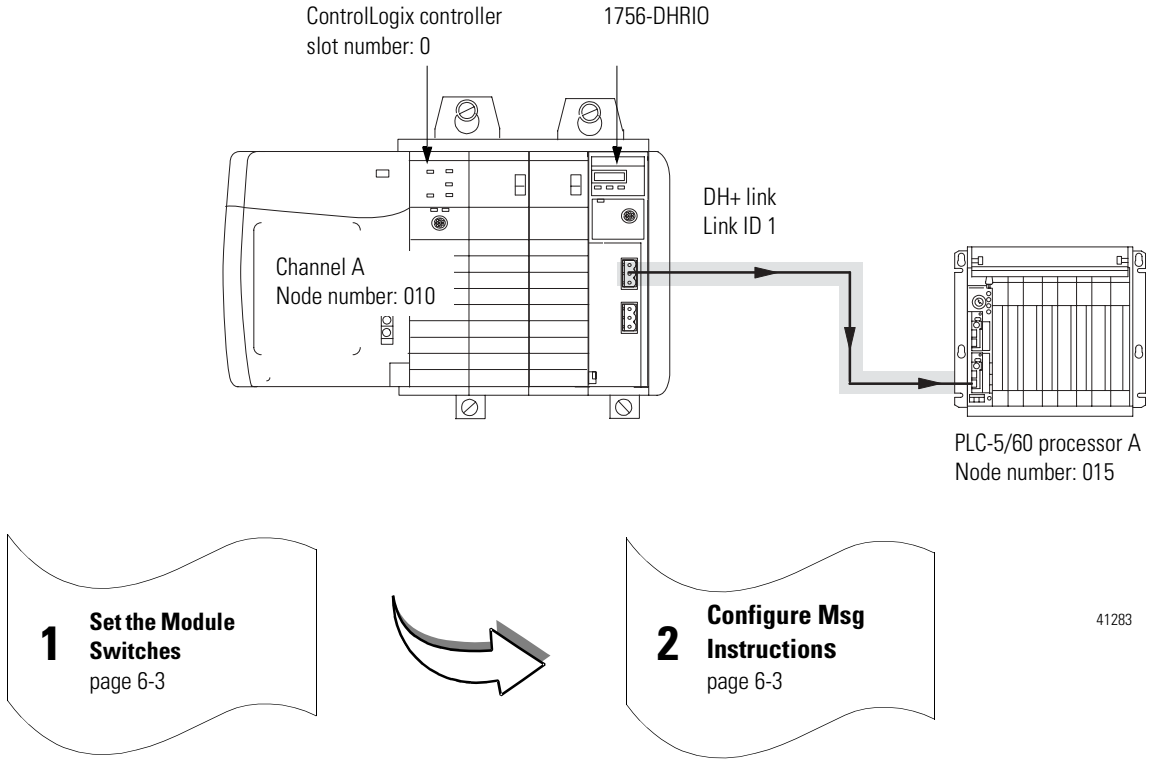
Examples using PLC-5s could, in fact, use SLC-504s and examples using SLC-5/04s could use PLC-5s.

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

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

Figure 6.1 illustrates the steps you must use in this application:

Figure 6.1



IMPORTANT

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

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

Also, controller slot values for channels configured for DH+ should be applied or restored to default value, using the appropriate software tabs. Failure to enter the correct value will generate a configuration fault for that channel.

1

Set the Module Switches

In this application, channel A on the 1756-DHRIO module must be set for DH+. For more information on setting switches on the 1756-DHRIO module, see page 1-5.

2

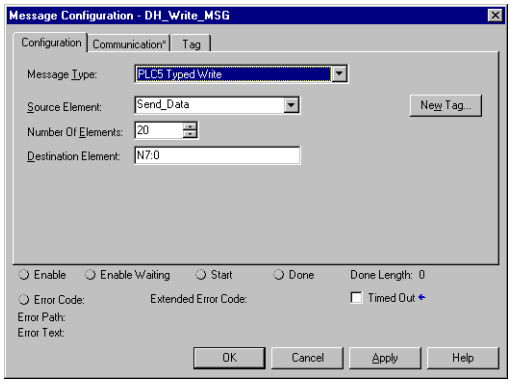
Configure Message Instructions

See Logix5000 Controllers General Instructions Reference Manual, publication 1756-RM003

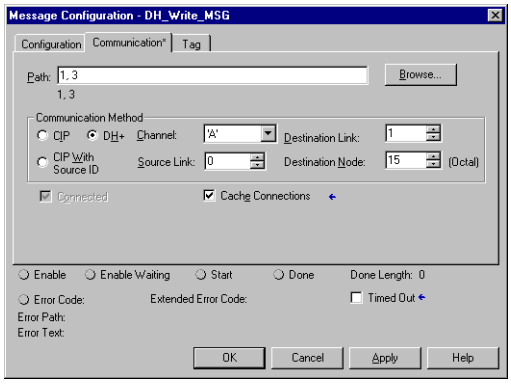
Use RSLogix 5000 to configure the ControlLogix controller message instructions. Figure 6.2 shows the message instruction tabs necessary for this example.

Figure 6.2

Configuration tab



Communication tab



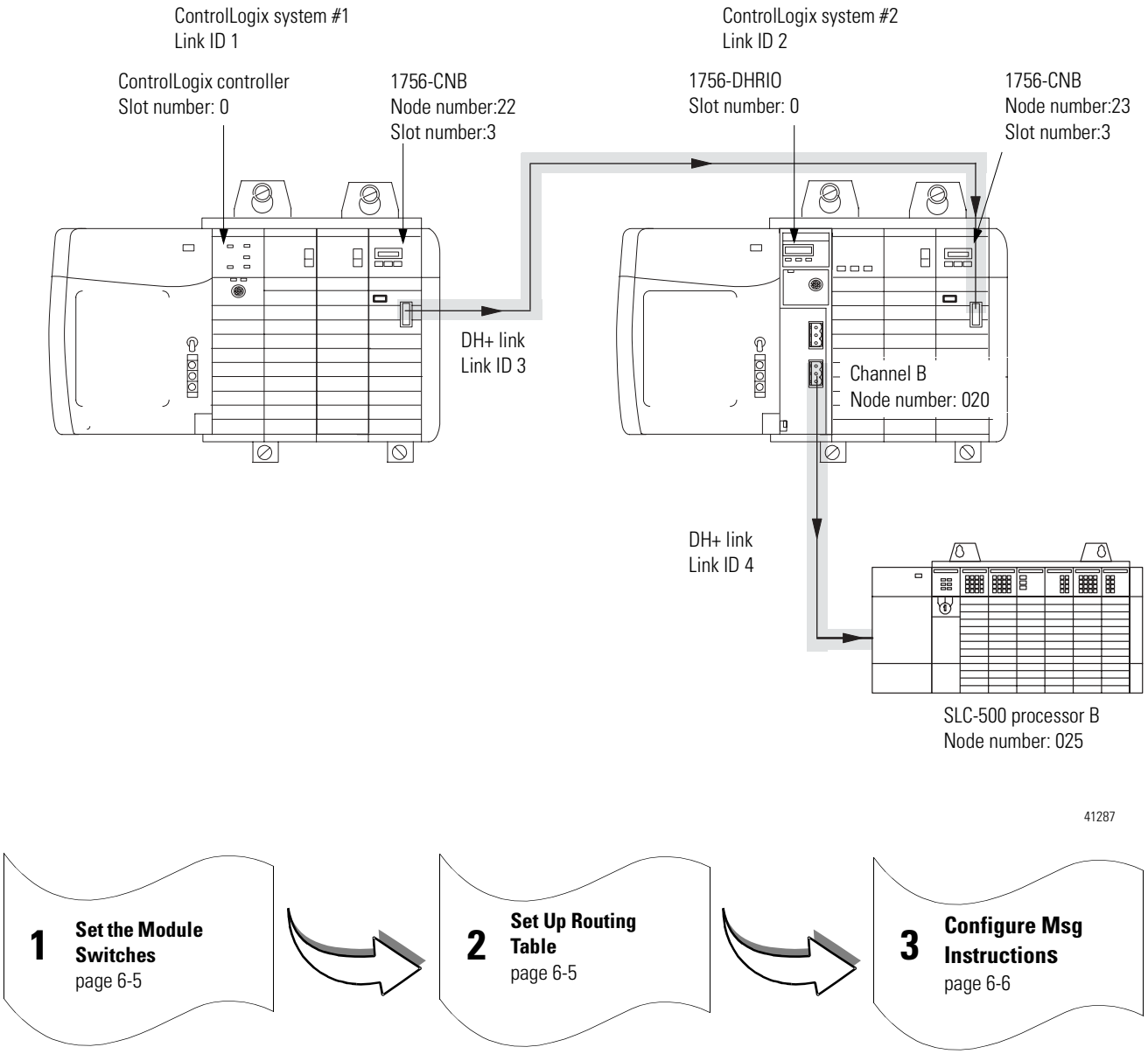
For more information on how to configure message instructions using RSLogix 5000, see page 3-15 or the RSLogix 5000 online help.

DH+ Messaging: ControlLogix Controller to a SLC-5/04 Over ControlNet and DH+

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

Figure 6.3 illustrates the steps you must use in this application:

Figure 6.3



1

Set the Module Switches

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

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

For more information on setting switches on the 1756-DHRIO module, see page 1-5. For more information on setting the switches on the 1756-CNB module, see page 4-9.

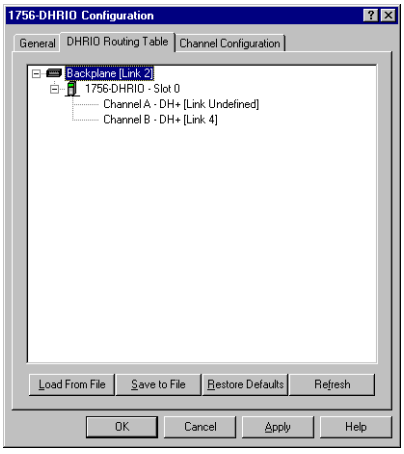
2

Remote DH+ Messaging described on page 2-10

Set-Up a Routing Table for the 1756-DHRIO Module

Use RSLinx to set-up a routing table for the 1756-DHRIO module in ControlLogix system #2. Figure 6.4 shows the routing table necessary for this example.

Figure 6.4



For more information on how to set-up a routing table, see page 3-5 or the RSLinx online help.

3

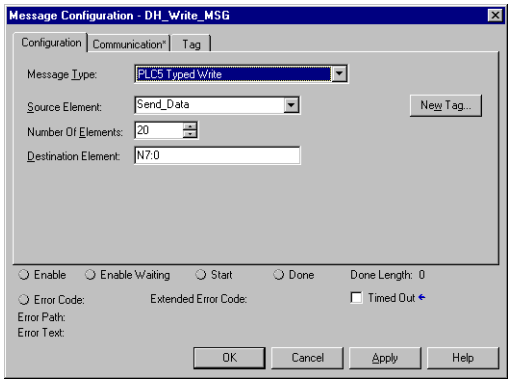
See Logix5000 Controllers General Instructions Reference Manual, publication 1756-RM003

Configure Message Instructions

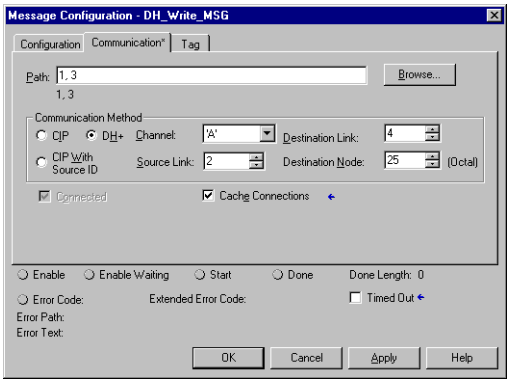
Use RSLogix 5000 to configure the ControlLogix controller message instructions. Figure 6.5 shows the message instruction tabs necessary for this example.

Figure 6.5

Configuration tab



Communication tab



For more information on how to configure message instructions using RSLogix 5000, see page 3-15 or the RSLogix 5000 online help.

Chapter Summary and What's Next

In this chapter, you learned about messaging between ControlLogix controllers and PLCs or SLCs. Chapter 7 describes Messaging Between ControlLogix Controllers.

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 module.

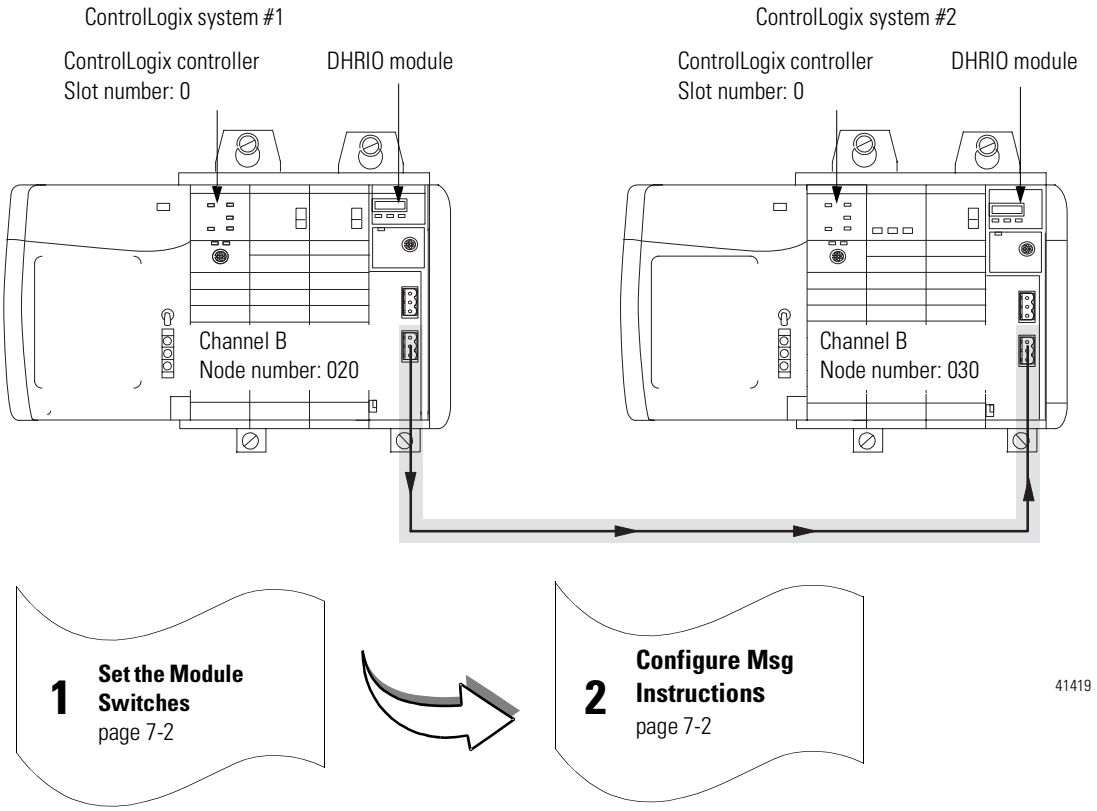
For information about using	See page
CIP Messaging Between ControlLogix Controllers Over One Link	7-1
CIP Message Routing Between ControlLogix Controllers Over Two Links	7-3

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 module to ControlLogix controller B controller B. Figure 7.1 illustrates the steps you must use in this application:

Figure 7.1



1

Set the Module Switches

In this application, Channel B on both 1756-DHRIO modules must be set for DH+. For more information on setting switches on the 1756-DHRIO module, see page 1-5.

2

Configure Message Instructions

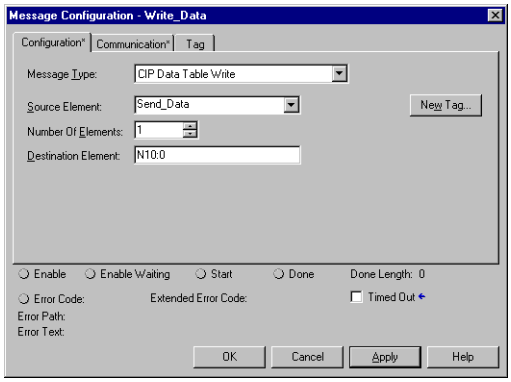
See Logix5000 Controllers General Instructions Reference Manual, publication 1756-RM003

Use RSLogix 5000 to configure the ControlLogix controller message instructions. Figure 7.2 shows the message instructions necessary for this example.

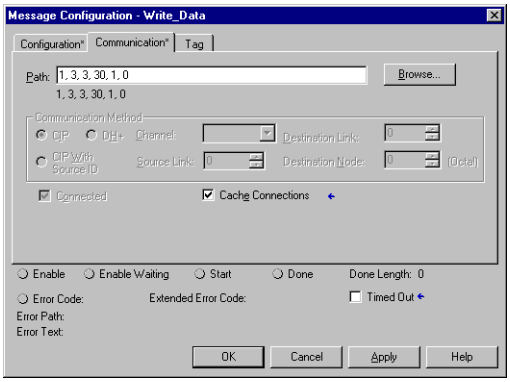
IMPORTANT When you are using the 1756-DHRIO for CIP messaging, there are no link ID numbers. You must use an explicit message path. For more information on determining the path, see page 3-20.

Figure 7.2

Configuration tab



Communication tab



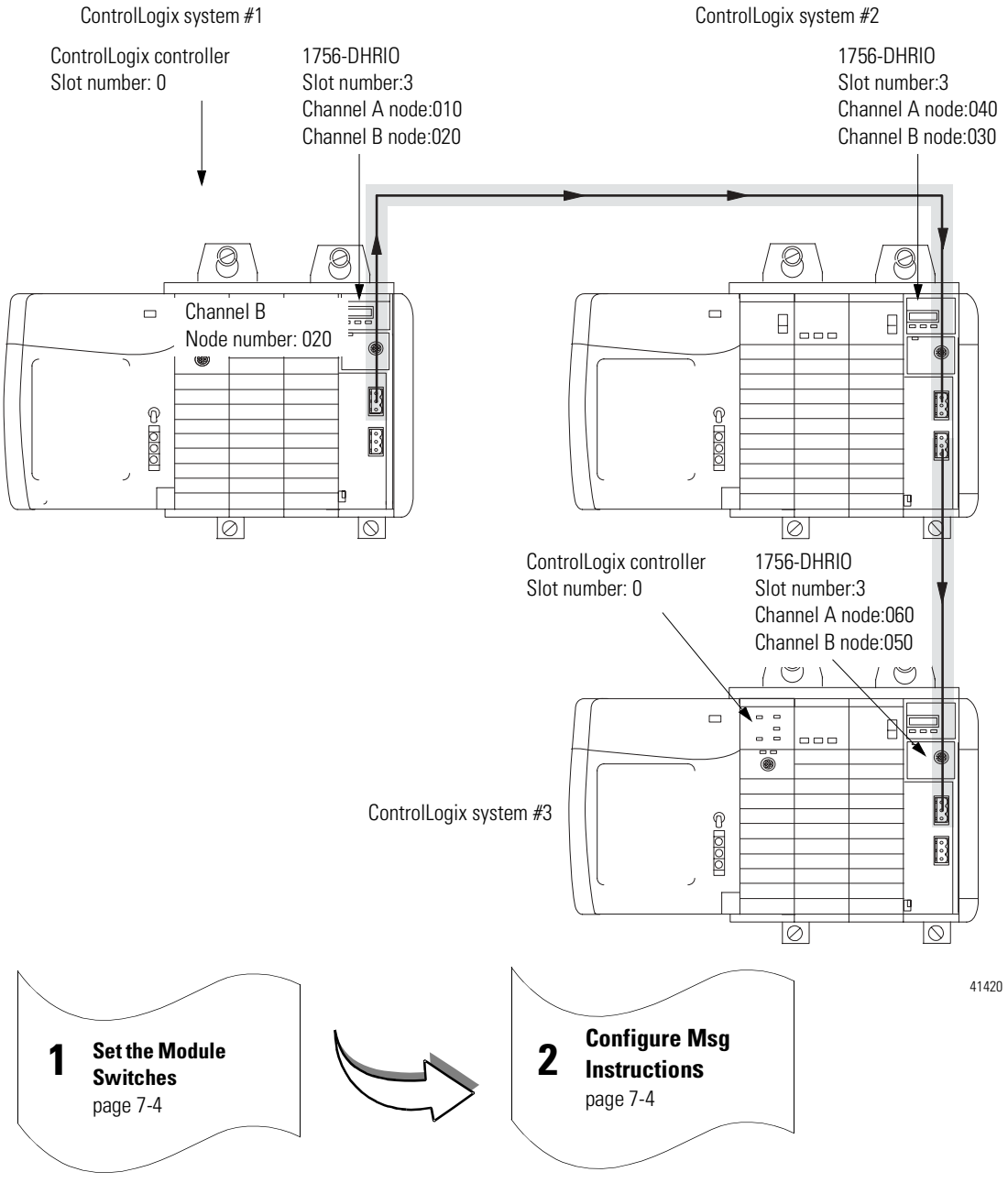
For more information on how to configure message instructions using RSLogix5000, see page 3-15 or the RSLogix 5000 online help.

CIP Message Routing Between ControlLogix Controllers Over Two Links

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

Figure 7.3 illustrates the steps you must use in this application:

Figure 7.3



1

Set the Module Switches

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

For more information on setting switches on the 1756-DHRIO module, see page 1-5.

2

See Logix5000 Controllers General Instructions Reference Manual, publication 1756-RM003

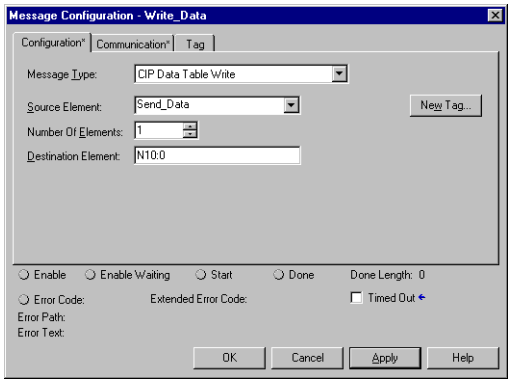
Configure Message Instructions

Use RSLogix 5000 to configure the ControlLogix controller message instructions. Figure 7.2 shows the message instructions necessary for this example.

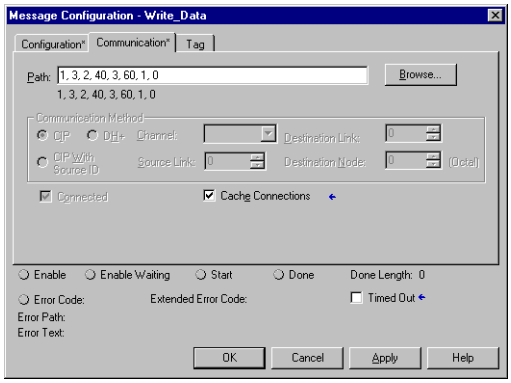
IMPORTANT When you are using the 1756-DHRIO for CIP messaging, there are no link ID numbers. You must use an explicit message path. For more information on determining the path, see page 3-20.

Figure 7.4

Configuration tab



Communication tab



For more information on how to configure message instructions using RSLogix5000, see page 3-15 or the RSLogix 5000 online help.

Chapter Summary and What's Next

In this chapter, you learned about messaging between ControlLogix controllers. Chapter 8 describes the Using the 1756-DHRIO Module in Remote I/O Applications.

Using the 1756-DHRIO Module in Remote I/O Applications

What This Chapter Contains

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

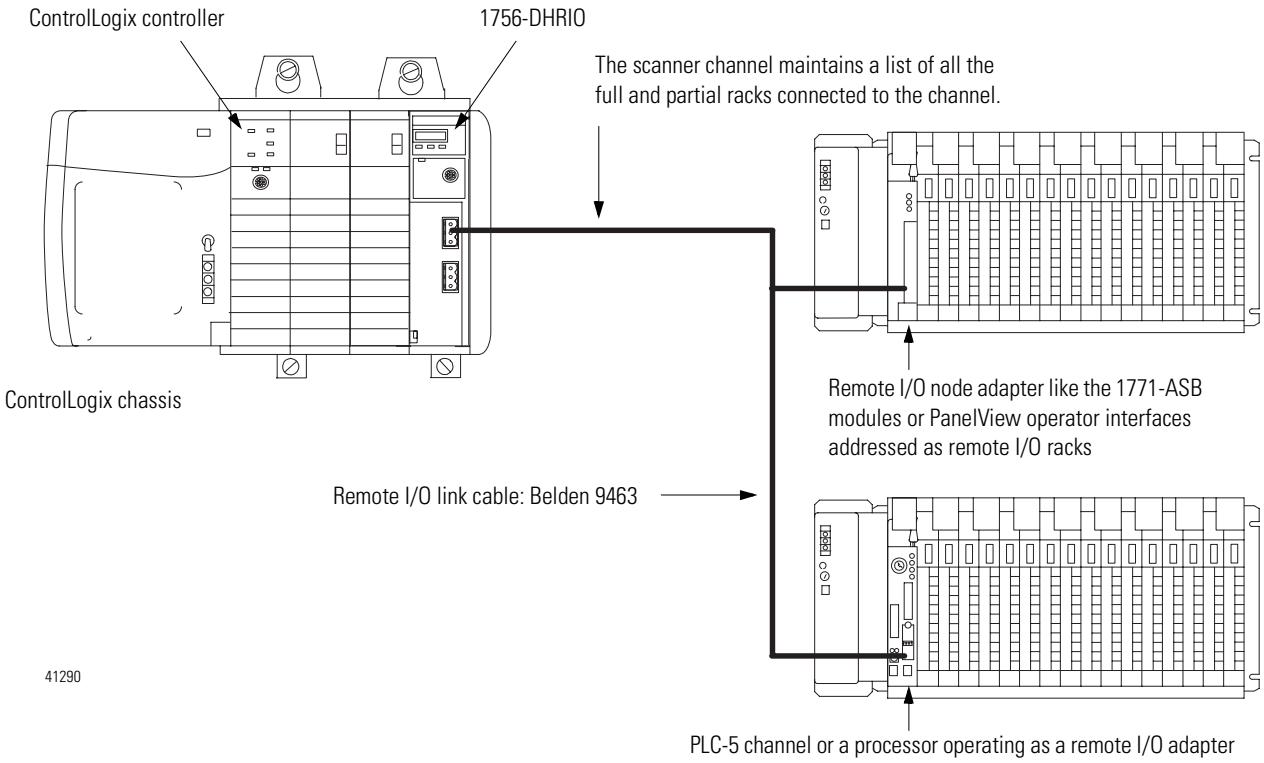
For information about using	See page
Introduction to Remote I/O	8-2
Selecting Devices That You Can Connect	8-3
Designing a Remote I/O Network	8-4
1756-DHRIO Module Operation in a Remote I/O Application	8-7
Remote I/O Scanner Status	8-9
Adapter Module I/O	8-10
Setting the Data Exchange Rate Between the 1756-DHRIO Module and a Controller	8-11
Remote I/O Scanner Fault Notification	8-16
Remote I/O Adapter Failure Notification	8-17
Inhibiting the 1756-DHRIO Module Connections	8-17
Inhibiting an Remote I/O Connector Adapter	8-17
Increased Remote I/O System Throughput	8-18

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.

Figure 8.1 shows an example of a remote I/O system.

Figure 8.1



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.

Selecting Devices That You Can Connect

Table 8.1 lists some of the devices you can use on a remote I/O network as an adapter:

Table 8.1
Devices You Can Connect to a Remote I/O Network

Category:	Product:	Catalog number:
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

Designing a Remote I/O Network

Designing a remote I/O network requires applying:

- Network Design Guidelines
- Cable Design Guidelines

Network Design Guidelines

Keep these rules in mind as you design a remote I/O network:

- All devices connected to a remote I/O network must communicate 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. Both channels of a 1756-DHRIO module cannot scan the same partial or full rack address. Both module channels can communicate to 00-37 octal or 40-77 octal, but each channel can only communicate with address in one of the ranges at a time.
- 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 1770-CD (Belden 9463) cable.
- Connect a remote I/O network 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 more information about designing trunk line/ drop line configurations, see the Data Highway/Data Highway Plus/Data Highway II/ Data Highway-485 Cable Installation Manual, publication 1770-6.2.2.

For daisy chain configurations, use Table 8.2 to determine the total cable length you can use.

Table 8.2
Determining Cable Length

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 **both** ends of a remote I/O network by using the external resistors shipped with the 1756-DHRIO module. Selecting either a 150W or a 82W terminator determines how many devices you can connect on a single remote I/O network.

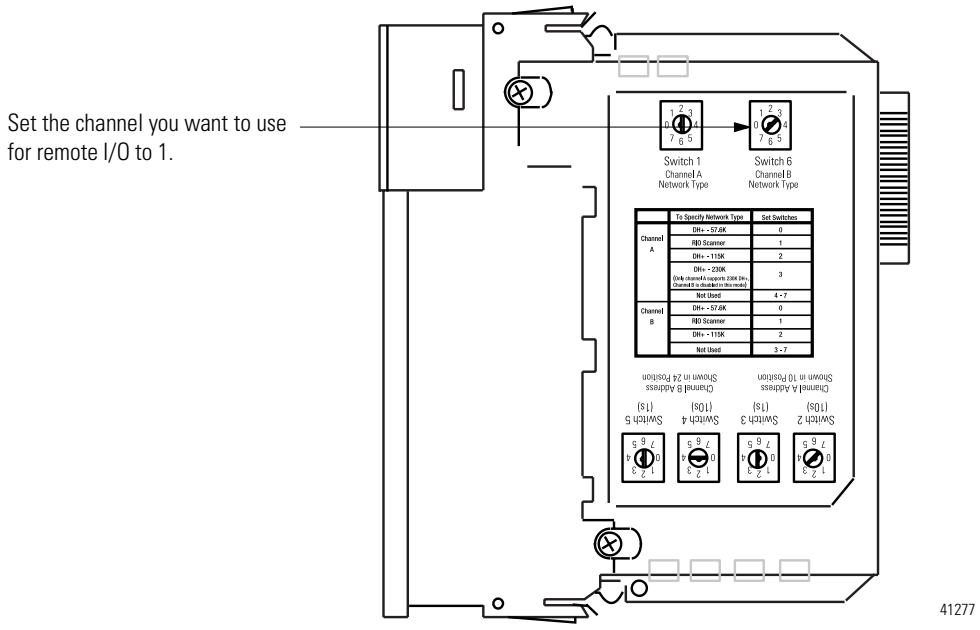
Table 8.3
Determining Resistor Rating and the Number of Devices Connected on Your Network

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 Footnote 1, 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			

1756-DHRIO Module Operation in a Remote I/O Application

The 1756-DHRIO module provides two configurable channels that can either 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 module in a remote I/O application.

Figure 8.2



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 module is designed to function as an remote I/O scanner for a ControlLogix controller. In this case, the following occurs:

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

Exchanging I/O Data Between the 1756-DHRIO Module and Adapters

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

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

Exchanging I/O Data Between the 1756-DHRIO Module and the ControlLogix Controller

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

Multiple connections are established between the 1756-DHRIO module and the ControlLogix controller. These connections can be classified in two categories. In the first category, connections are established between the 1756-DHRIO 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 module (The supervisor is the remote I/O scanner located internally 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 module reports status on the remote I/O scanner, and the ControlLogix controller maintains ownership of the 1756-DHRIO module.

IMPORTANT Only 1 ControlLogix controller can communicate with and own the remote I/O channels on a 1756-DHRIO module.

I/O Configuration Tree in RSLogix 5000 Controller Organizer

The I/O configuration tree in the RSLogix 5000 Controller Organizer specifies the connections to the 1756-DHRIO module, in addition to generating the adapter list of the 1756-DHRIO module to scan.

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

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

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

For more information on how to use the RSLogix 5000 Controller Organizer, and the software in general, in remote I/O applications, see Chapter 9, Using RSLogix 5000 in Remote I/O and Block Transfer Applications or the RSLogix 5000 online help.

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 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 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 module scans 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 may act as several racks. This depends on the addressing mode of the physical adapter and chassis.

RSLogix 5000 allows 4 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 module cannot tell which specific adapter is connected to the remote I/O network.

The 1756-DHRIO module consumes the adapter output data sent by the ControlLogix controller on the connection created when you add remote I/O devices in RSLogix 5000.

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 module produces 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.

Setting the Data Exchange Rate Between the 1756-DHRIO Module and a Controller

The following sections describe the process of setting the Requested Packet Interval (RPI) for data exchanges between the 1756-DHRIO module and the ControlLogix controller. An RPI must be set for both 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 module and the ControlLogix controller produce data. The time ranges from 3mS to 750mS 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 1756-DHRIO 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 1756-DHRIO Module in a Remote Chassis

If a module physically resides in a chassis other than that of its owner-controller (i.e. 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 module's RPI value equal to the RPI used in the adapter connections.

Setting 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 module allows 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:

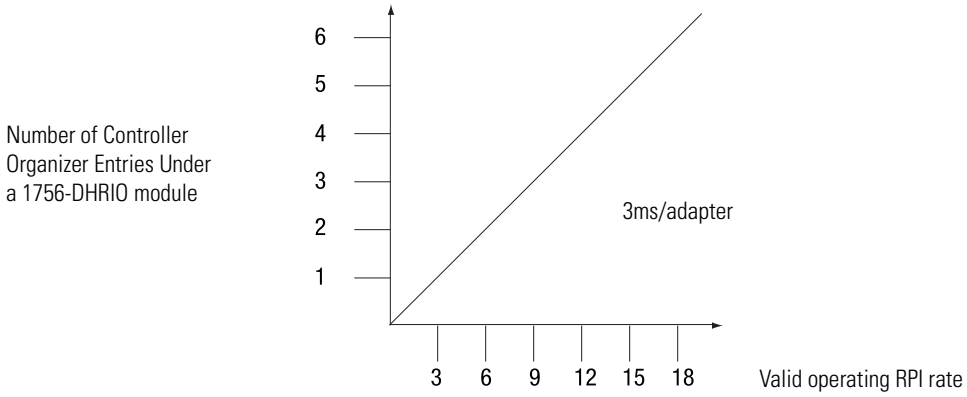
- 8ms/adapter @ 57.6Kbaud
- 5ms/adapter @ 115.2Kbaud
- 3ms/adapter @ 230.4Kbaud

To determine the RPI for all Controller Organizer entries, use the graphs in Figure 8.3.

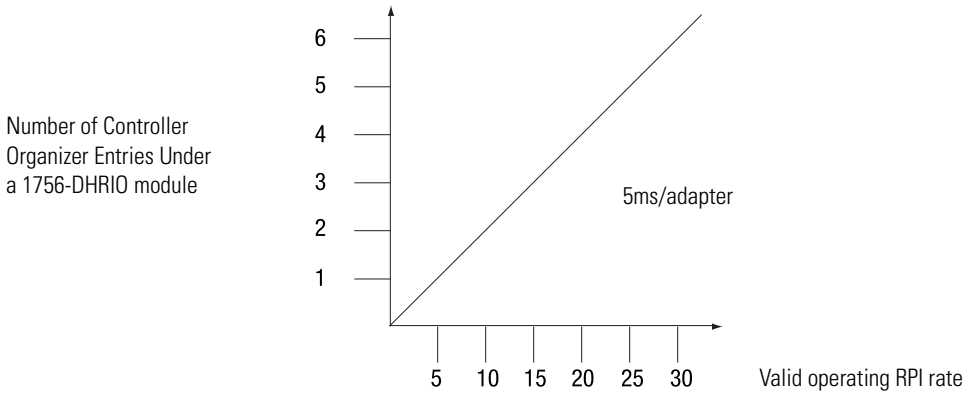
The graphs in Figure 8.3 provide the minimum RPI for the different baud rates. Rates faster than those specified do not provide greater data throughput.

Figure 8.3
Adapter Update Rates

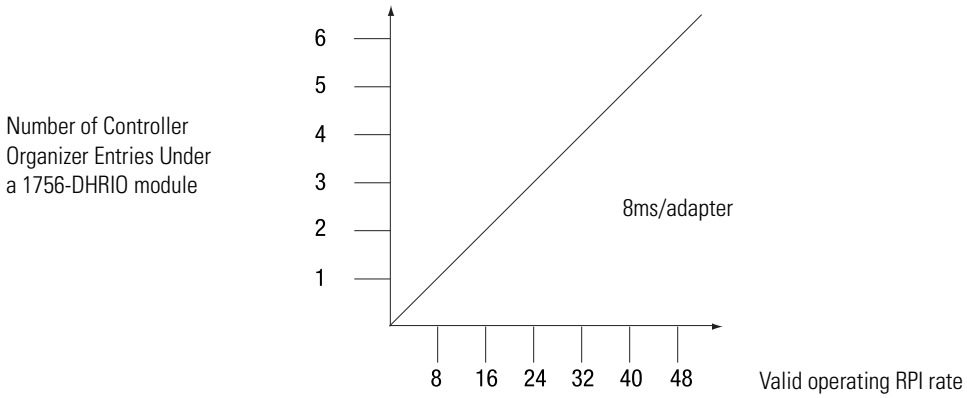
Adapter Update Rates for Remote I/O at 230.4Kbaud Rate



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



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



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Adapter Module I/O Update Rate with the 1756-DHRIO Module in the Local Chassis

When the 1756-DHRIO module resides in the same chassis as the owner-controller, updated output data (refreshed to new values via the control program) is delivered to the adapter module at:

RPI + scan rate per adapter * number of adapters

Where the RPI is equal to the value determined from the graphs on page 10-6, and scan rate per adapter=3ms @ 230.4K, 5ms @115.2K, or 8ms @57.6K.

The updated input data is delivered to the ControlLogix controller at:

Scan rate per adapter * number of adapters

The update rate for an adapter module (i.e. the rate at which I/O data is produced/consumed between the owner-controller and the 1756-DHRIO module) is:

RPI + 2[Scan rate per adapter * number of adapters]

This is a turnaround calculation for an output to input in the same rack.

When you include block transfers, the update rate for an adapter module is:

RPI + 2(Scan rate per adapter * number of adapters) + (Scan rate per adapter * total number of adapters with BT modules in them)

Adapter Module I/O Update Rate with the 1756-DHRIO Module in the Remote Chassis

When the 1756-DHRIO module resides in the remote chassis from the owner-controller, updated output data (refreshed to new values via the control program) is delivered to the adapter module at:

RPI + (scan rate per adapter * number of adapters) + 2(NUT)

The updated input data is delivered to the ControlLogix controller at:

(scan rate per adapter * number of adapters) + 2(NUT)

The update rate for an adapter module (i.e. the rate at which I/O data is produced/consumed between the owner-controller and the 1756-DHRIO module) is:

RPI + 2(scan rate per adapter * number of adapters) + 4(NUT)

This is a turnaround calculation for an output to input in the same rack.

When you include block transfers, the update rate for an adapter module is:

RPI + 2(scan rate per adapter * number of adapters) + (Scan rate per adapter * total number of adapters with BT modules in them) + 4(NUT)

Remote I/O Scanner Fault Notification

A 1756-DHRIO 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 4 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 module has not been configured for a major fault to occur if communication fails. In this case, the ControlLogix controller repeatedly attempts to reestablish communications with the 1756-DHRIO module.

TIP The update rate for the data exchange should be 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 communications if the 1756-DHRIO 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 has faulted is directly related to the RPI. The fault, known as a connection timeout, occurs at 4 times the RPI. For example, if the RPI is set at 25ms and a fault occurs, the ControlLogix controller is not notified for 100ms. For more information on connection timeouts, see page 2-15.

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 module and the ControlLogix controller is interrupted.

RSLogix 5000 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

Inhibiting the 1756-DHRIO Module Connections

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

Although the 1756-DHRIO 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 module accepts configuration from any ControlLogix controller in the control system.

The 1756-DHRIO connection can be inhibited on the module properties connection tab of RSLogix5000.

Inhibiting 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 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 module can reestablish communications with the inhibited remote I/O adapter.

RIO rack connections can be inhibited on the module properties connection screen of RSLogix 5000.

Increased Remote I/O System Throughput

Because of the unique design of the 1756-DHRIO module system, performance may be greatly enhanced by splitting the remote I/O adapters across both 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 both racks are placed on the same channel at a baud rate of 230.4Kbaud, the minimum RPI between the 1756-DHRIO module and the remote I/O adapters would be 6mS. If the racks are split between channel A and channel B, the update rate can be decreased to 4.5mS.

The following algorithms are used to calculate various update rates:

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

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

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

Chapter Summary and What's Next

In this chapter, you learned about the basics of using remote I/O. Chapter 9 describes Using RSLogix 5000 in Remote I/O and Block Transfer Applications.

Using RSLogix 5000 in Remote I/O and Block Transfer Applications

Using This Chapter

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

For information about:	See page
Using RSLogix 5000 in 1756-DHRIO Module Remote I/O Applications	9-1
Using RSLogix 5000 in 1756-DHRIO Module Block Transfer Applications	9-9

Using RSLogix 5000 in 1756-DHRIO Module Remote I/O Applications

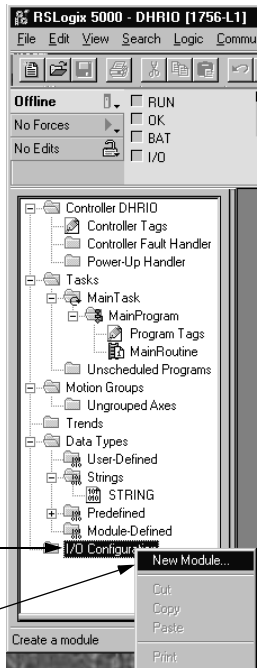
When you use the 1756-DHRIO module for remote I/O, you must follow these basic steps:

IMPORTANT When using the 1756-DHRIO 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 module to the project.
2. Configure the 1756-DHRIO module, including setting the appropriate 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 (i.e. go online).
7. If necessary, change the configuration for all modules and adapters in the project.

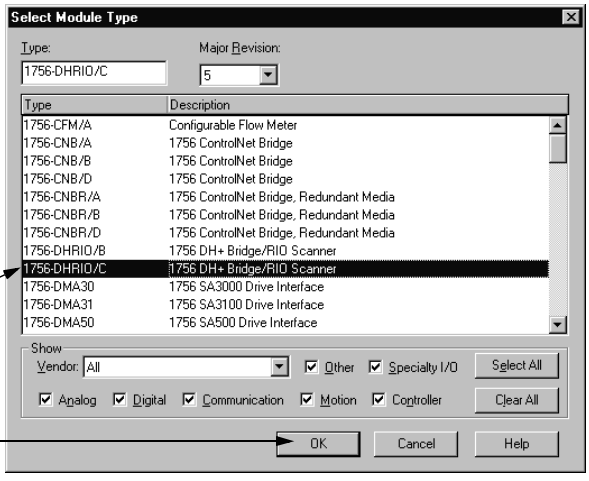
Adding the 1756-DHRIO Module

After you start RSLogix 5000 and create a new project, you must create a new 1756-DHRIO module.



A. Right-click on I/O Configuration.

B. Click on New Module.



C. Choose the 1756-DHRIO module.

D. Click here.

Configuring the 1756-DHRIO Module

Configure the newly added 1756-DHRIO module in the wizard screens that appear. Table 9.1 describes the configurable parameters that appear on the wizard screens.

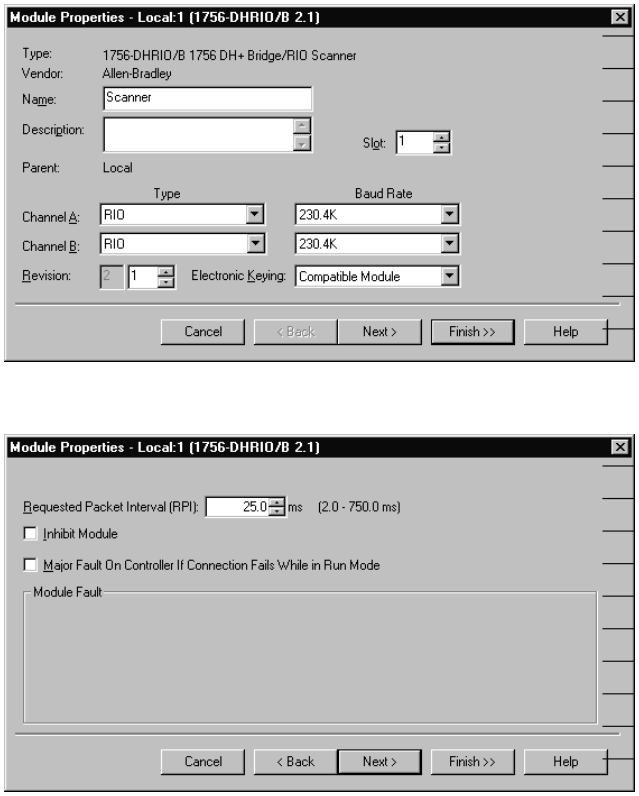
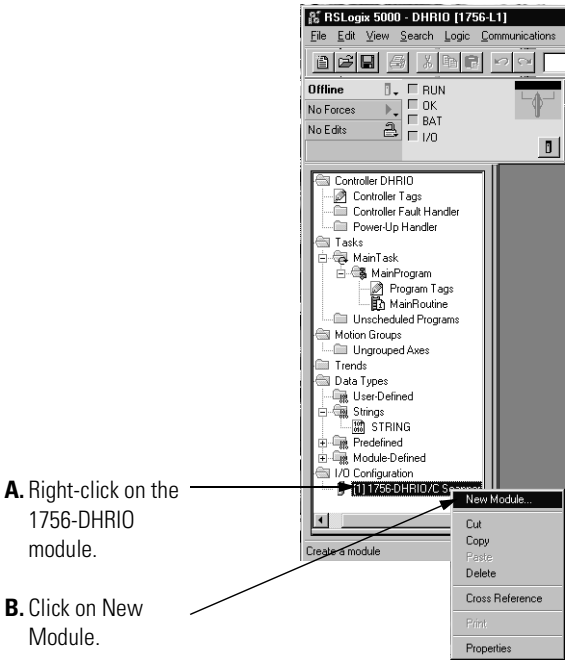


Table 9.1
1756-DHRIO Module Configurable Parameters

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 module.
	Electronic Keying	Parameter that determines if the controller that owns the 1756-DHRIO module will establish a connection with the module. The options are: • Compatible Module - Controller will attempt 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 will only attempt to establish a connection with the module if it exactly matches the configuration parameters being sent from the controller.
Requested Packet Interval Screen (second screen):	**Parameter:**	**Definition:**
	Requested Packet Interval	User-defined rate (2ms - 750ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that allows you to configure a 1756-DHRIO 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 module fails.

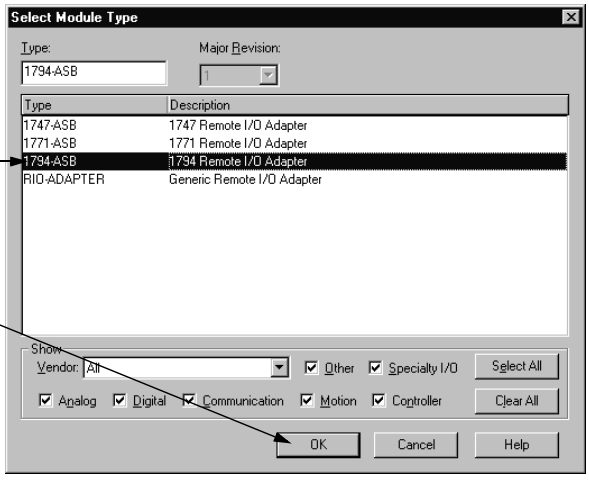
Adding the Remote I/O Adapter

Add the remote I/O adapter to your project.



A. Right-click on the 1756-DHRIO module.

B. Click on New Module.

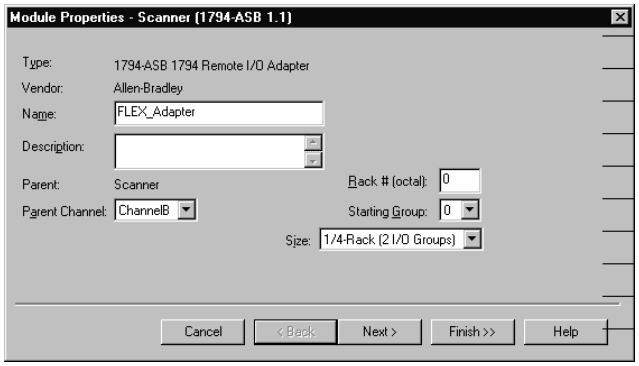


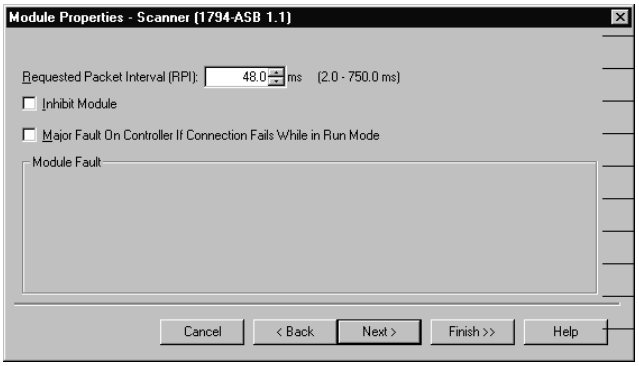
C. Choose the appropriate adapter.

D. Click here.

Configuring the Remote I/O Adapter

Configure the newly added remote I/O adapter in the wizard screens that appear. Table 9.2 on page 9-7 describes the configurable parameters that appear on the wizard screens.





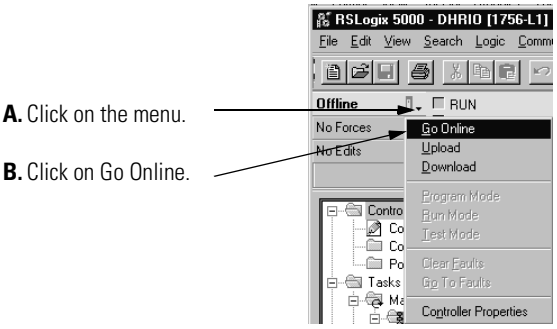
The screens on page 9-6 show a 1794-ASB remote I/O adapter. However, the parameters described in Table 9.2 apply to all remote I/O adapters that can be connected to the 1756-DHRIO module.

Table 9.2
1756-DHRIO Module Configurable Parameters

Naming Screen (first screen):	**Parameter:**	**Definition:**
	Name	Module name. This field is required.
	Description	Optional description of the module.
	Parent Channel	1756-DHRIO 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 either group 0, 2, 4, or 6. For example, a system of 2 racks and 4 words of I/O may 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 (2ms - 750ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that allows you to 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 module fails.

Downloading the Project to the Controller

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



A. Click on the menu.

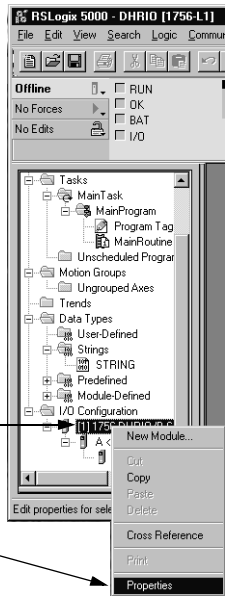
B. Click on Go Online.

Editing Configuration

After you have completed 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 screen below shows how to access a module's properties.



A. Right-click on the appropriate module.

B. Click on Properties.

The naming page appears for the module on which you need to change configuration. For more information on changing configuration, the RSLogix 5000 online help.

Using RSLogix 5000 in 1756-DHRIO Module Block Transfer Applications

RSLogix 5000 automatically generates 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 remotely-located modules (e.g. analog or specialty I/O modules) is greater than the software can allocate memory for. You must generate tags (i.e. space in the controller's memory) for the data transferred. This section explains how to configure a block transfer application.

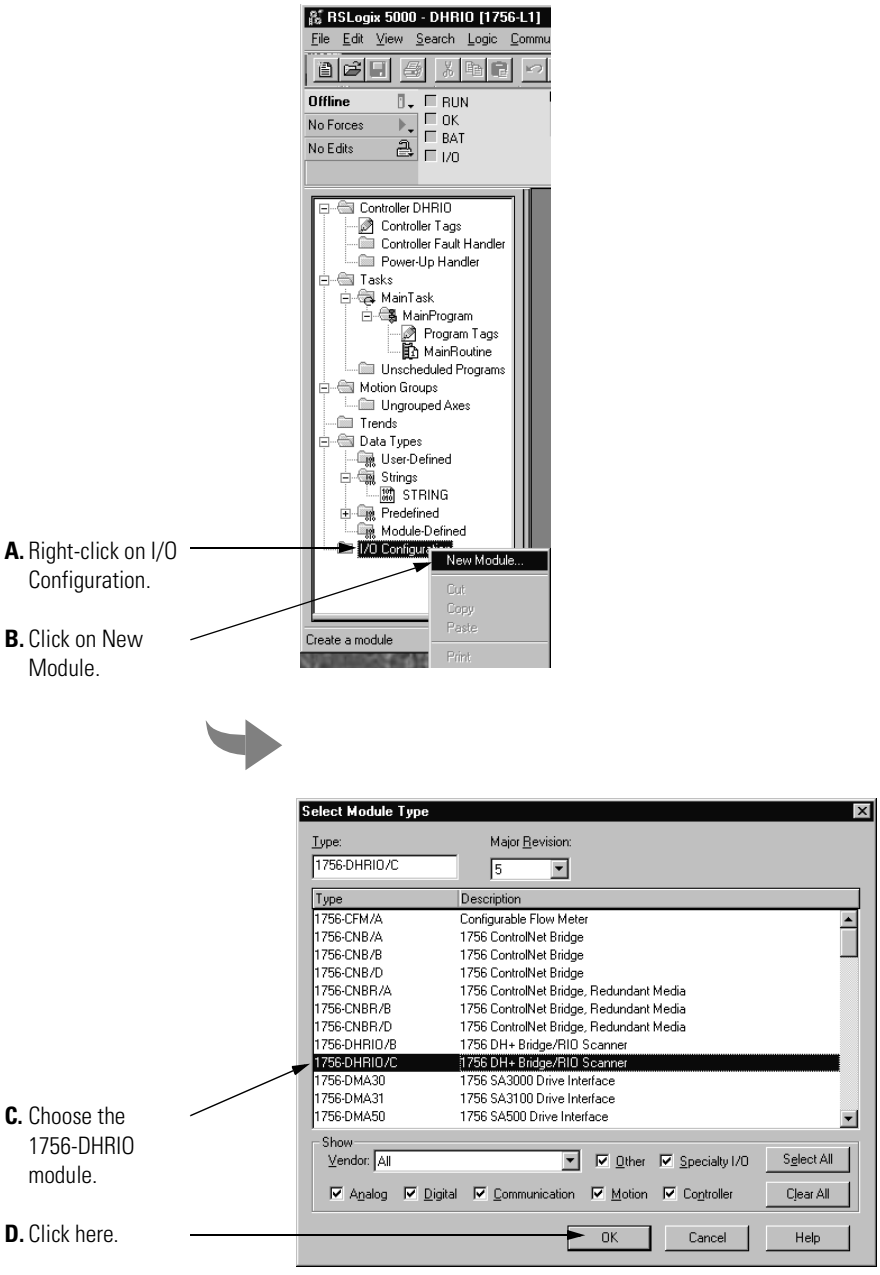
The process for block transfers with the 1756-DHRIO module is similar to the process for remote I/O, except that block transfer applications require several additional steps, including the use of a message instruction to read data from or write data.

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

1. Add the 1756-DHRIO module to the project.
2. Configure the 1756-DHRIO module, including setting the appropriate 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. Set up 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 (i.e. go online).
10. If necessary, change the configuration for all modules and adapters in the project.

Adding the 1756-DHRIO Module

After you start RSLogix 5000 and create a new project, you must create a new 1756-DHRIO module.



Configuring the 1756-DHRIO Module

Configure the newly added 1756-DHRIO module in the wizard screens that appear. Table 9.3 describes the configurable parameters that appear on the wizard screens.

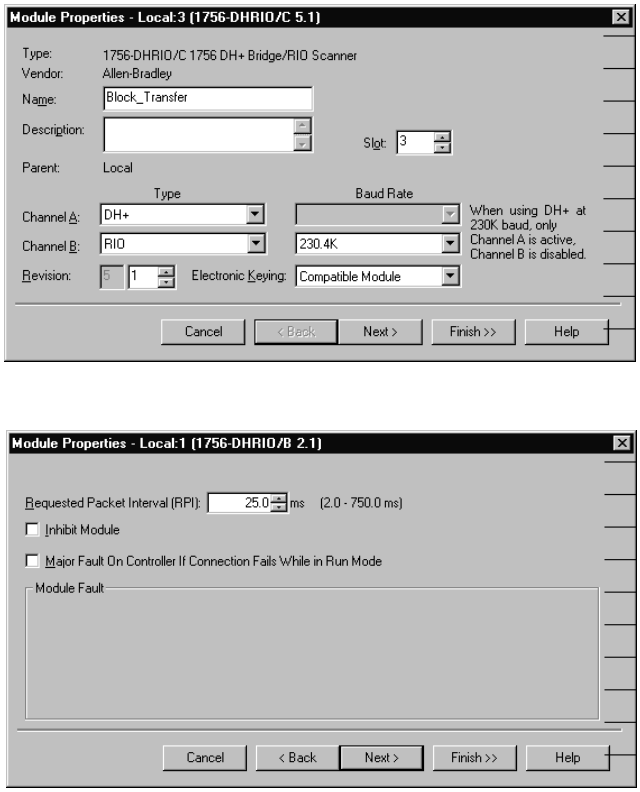
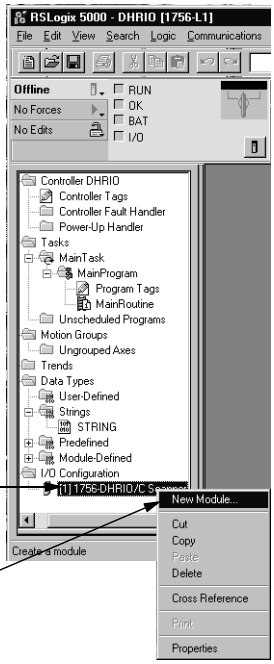


Table 9.3
1756-DHRIO Module Configurable Parameters

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 module.
	Electronic Keying	Parameter that determines if the controller that owns the 1756-DHRIO module will establish a connection with the module. The options are: • Compatible Module - Controller will attempt 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 will only attempt to establish a connection with the module if it exactly matches the configuration parameters being sent from the controller.
Requested Packet Interval Screen (second screen):	**Parameter:**	**Definition:**
	Requested Packet Interval	User-defined rate (2ms - 750ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that allows you to configure a 1756-DHRIO 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 module fails.

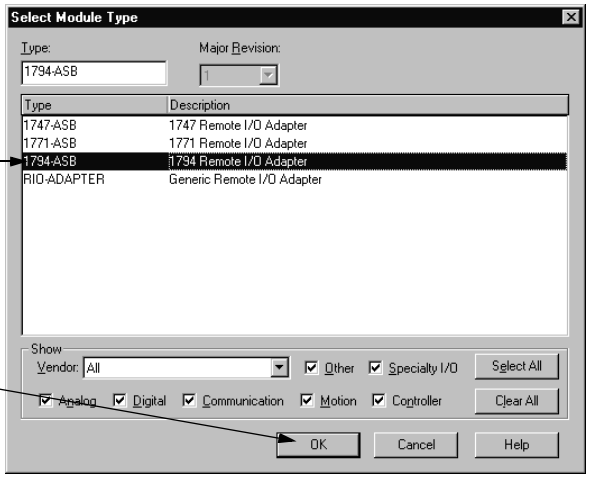
Adding the Remote I/O Adapter

Add the remote I/O adapter to your project.



A. Right-click on the 1756-DHRIO module.

B. Click on New Module.

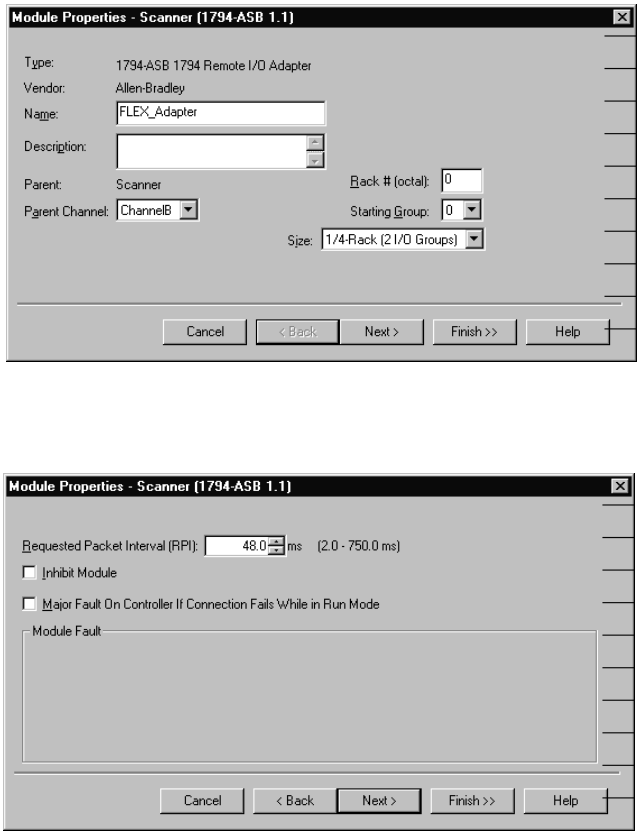


C. Choose the appropriate adapter. In this example, we use the 1794-ASB adapter.

D. Click here.

Configuring the Remote I/O Adapter

Configure the newly added remote I/O adapter in the wizard screens that appear. Table 9.2 on page 9-7 describes the configurable parameters that appear on the wizard screens.



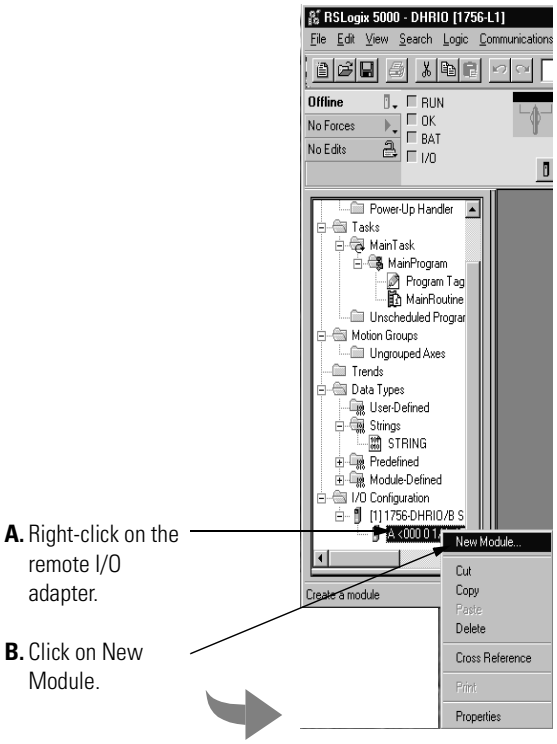
The screens on page 9-6 show a 1794-ASB remote I/O adapter. However, the parameters described in Table 9.2 apply to all remote I/O adapters that can be connected to the 1756-DHRIO module.

Table 9.4
1756-DHRIO Module Configurable Parameters

Naming Screen (first screen):	**Parameter:**	**Definition:**
	Name	Module name. This field is required.
	Description	Optional description of the module.
	Parent Channel	1756-DHRIO 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 either group 0, 2, 4, or 6. For example, a system of 2 racks and 4 words of I/O may 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 (2ms - 750ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that allows you to 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 module fails.

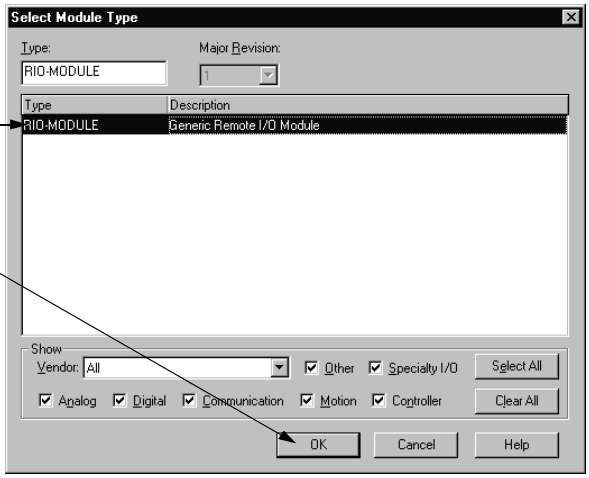
Adding the Remote I/O Modules

Add the remote I/O modules to your project.



A. Right-click on the remote I/O adapter.

B. Click on New Module.



C. Choose the RIO-MODULE.

D. Click here.

Configuring the Remote I/O Modules

Configure the newly added remote I/O modules in the wizard screen that appears.

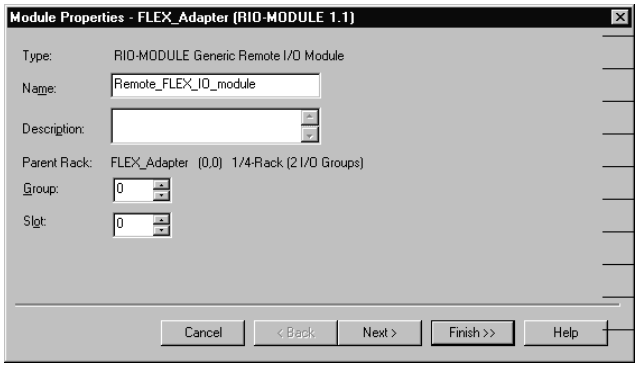


Table 9.5 describes the configurable parameters that appear on the wizard screens.

Table 9.5
1756-DHRIO Module Configurable Parameters

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.

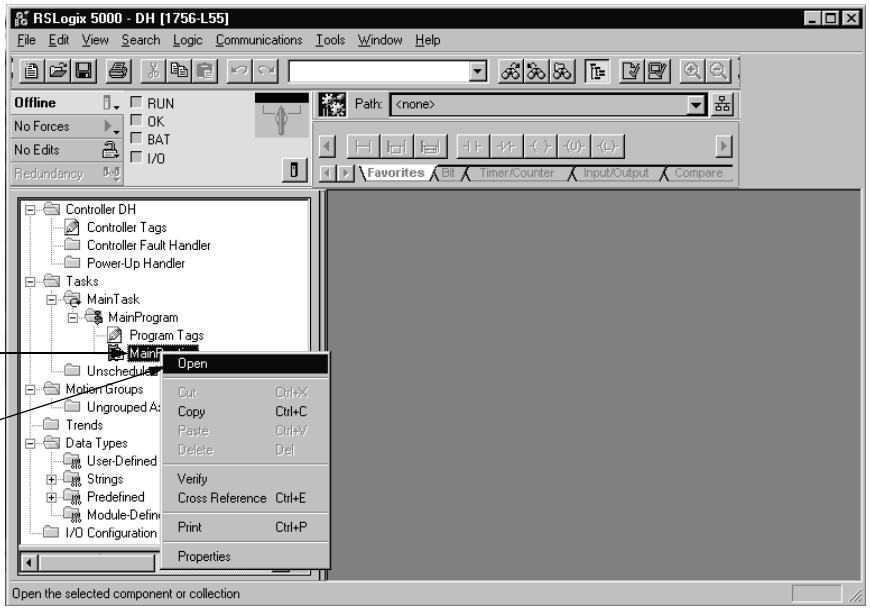
Creating a Block Transfer (Read or Write) Message Instruction

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.

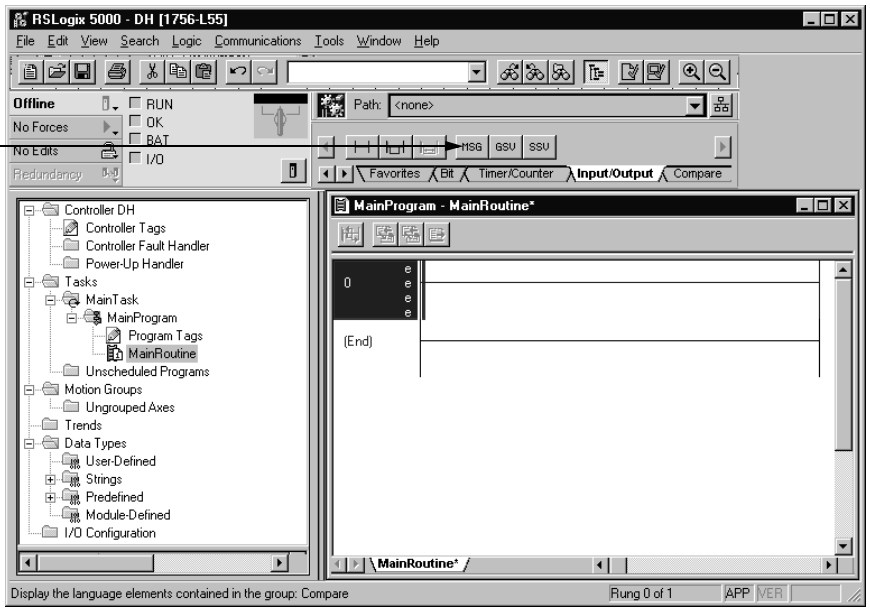
A. Right-click on Main Routine.

B. Click on Open.



2. Add a message instruction.

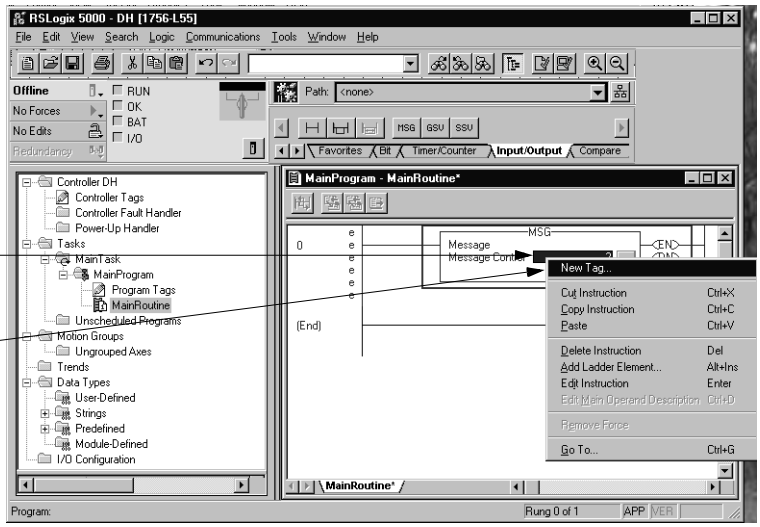
Click on MSG.



3. Add a new tag to the MSG instruction.

A. Right-click on the question mark (?) the menu.

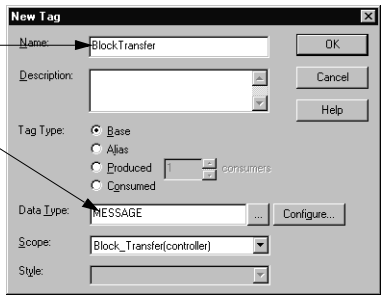
B. Click on New Tag.



4. Name and define the new tag.

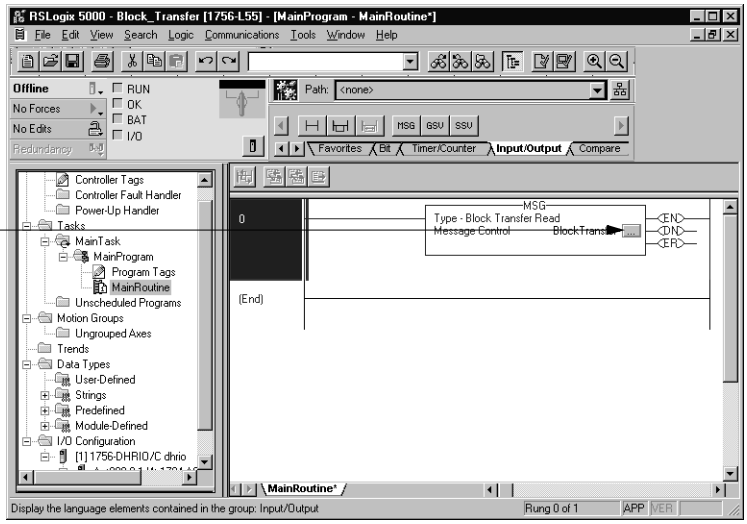
A. Name the tag.

B. Make sure this tag is of the MESSAGE type.



5. Access the message type configuration and communication parameters.

Double-click on 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 (i.e. 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

A. Choose the Message Type from the pull-down list.

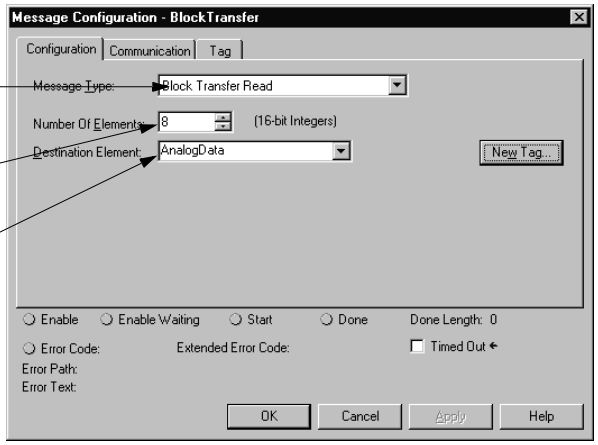
B. Type the Number of Elements being written.

C. Specify the Destination Element. You can:

- Choose an element from the pull-down (i.e. browse to the tag)

or

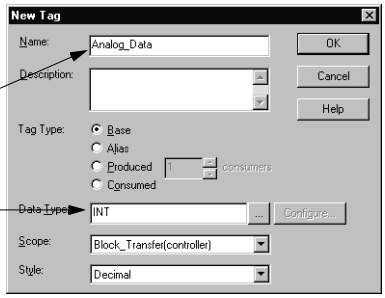
- Use the New Tag button to create the tag where data is read from on the remote module.



If you create a New Tag, you must:

A. Name the tag.

B. Make sure the Data Type is Integer (INT).

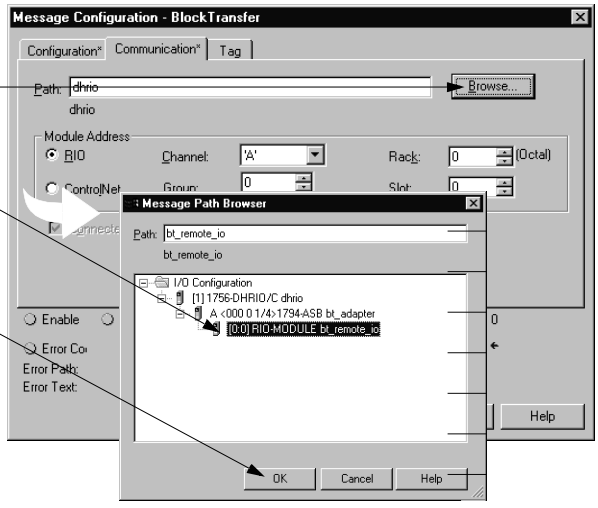


7. Set the communication path for the message instruction.

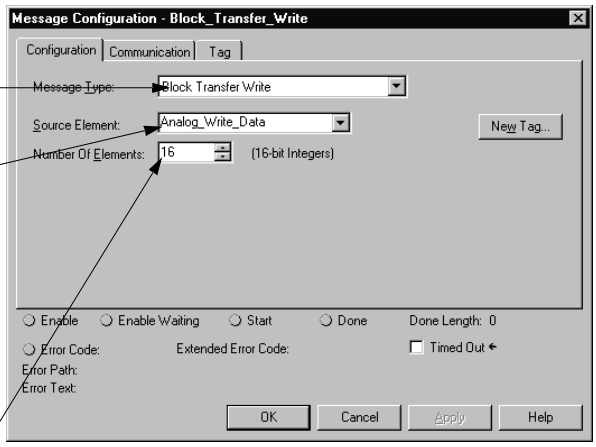
A. Use the Browse button to choose the path.

B. Choose the destination module for the message instruction.

C. Click on OK.



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



A. Choose the Message Type from the pull-down list.

B. Specify the Source Element. You can:

- Choose an element from the pull-down (i.e. browse to the tag)

or

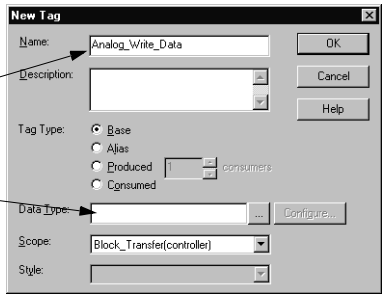
- Use the New Tag button to create the tag where data is written to on the remote module.

C. Type the Number of Elements being written.

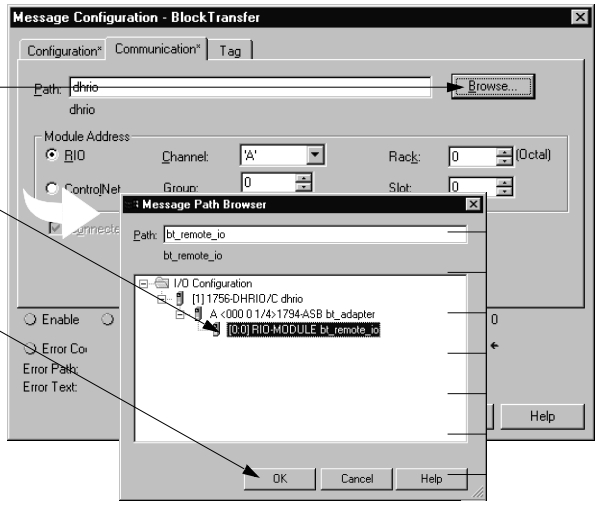
If you create a New Tag, you must:

A. Name the tag.

B. Make sure the Data Type is Integer (INT).



9. Set the communication path for the message instruction.



A. Use the Browse button to choose the path.

B. Choose the destination module for the message instruction.

C. Click on OK.

Chapter Summary and What's Next

In this chapter, you read about using RSLogix 5000 in remote I/O and block transfer applications. Chapter 10 explains Connecting a ControlLogix Controller to Remote I/O.

Connecting a ControlLogix Controller to Remote I/O

What This Chapter Contains

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

For information about using	See page
Scanning Remote FLEX Adapters Through a Single 1756-DHRIO Module in a Local 1756-Chassis	10-2
Scanning Remote FLEX Adapters Through Multiple 1756-DHRIO Modules in a Local Chassis	10-4
Scanning 1771 Remote I/O Adapters Through a 1756-DHRIO in a Remote Chassis	10-8

IMPORTANT

In these examples, only channel B is configured as a remote I/O scanner. You can configure both 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 module for DH+ access.

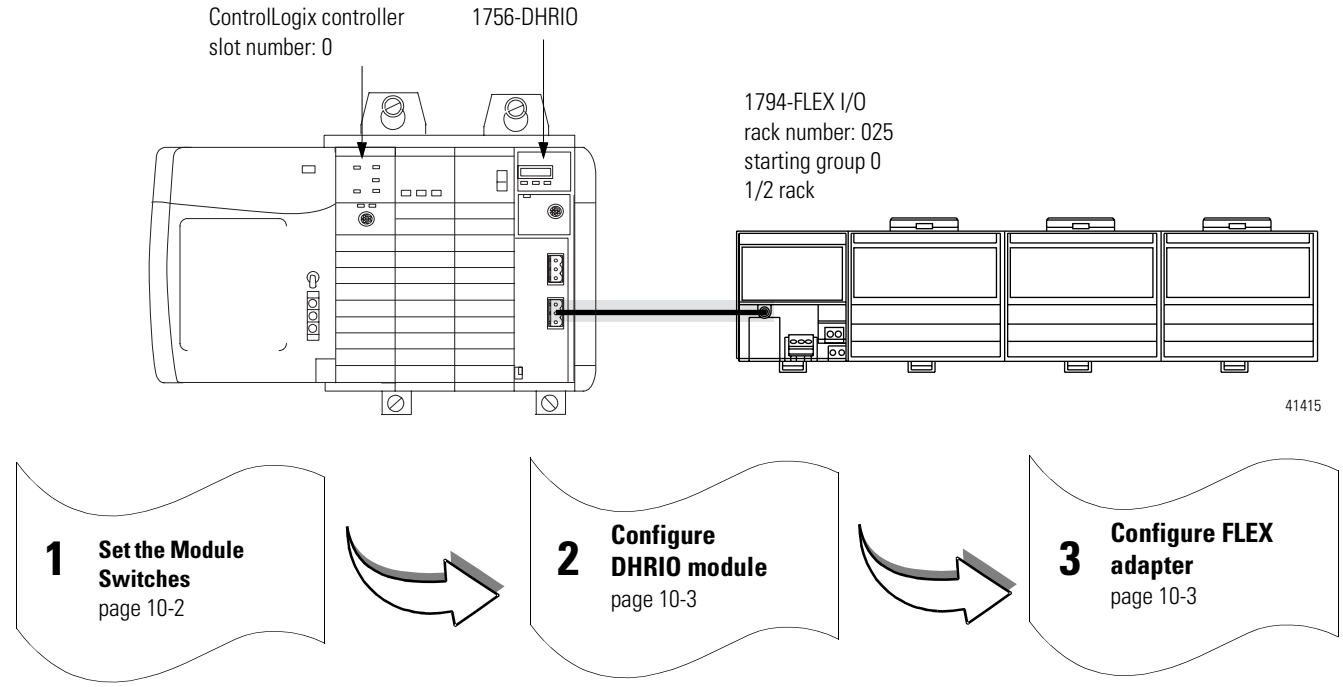
Also, throughout this chapter, we show sample configuration screens with each example. Specific configuration information is dependent on your application needs.

Scanning Remote FLEX Adapters Through a Single 1756-DHRIO Module in a Local 1756-Chassis

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

Figure 10.1 illustrates the steps you follow to use this application:

Figure 10.1



1

Set the Module Switches

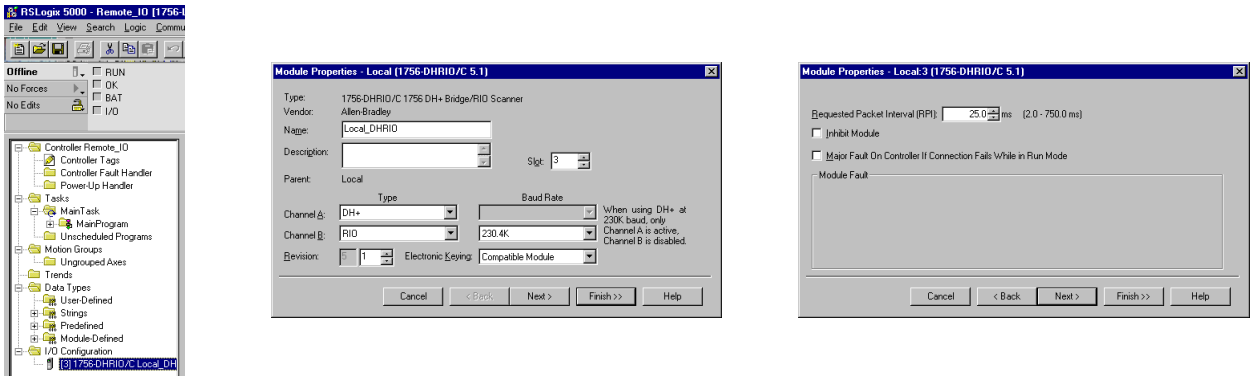
In this application, channel B on the 1756-DHRIO module must be set for RIO. Channel A can be used for remote I/O or DH+, regardless of the usage assigned to channel B. For more information on setting switches on the 1756-DHRIO module, see page 1-5.

2

Configure 1756-DHRIO Module

Use RSLogix 5000 to configure the 1756-DHRIO module. Figure 10.2 shows some sample configuration screens for the 1756-DHRIO module in this example.

Figure 10.2



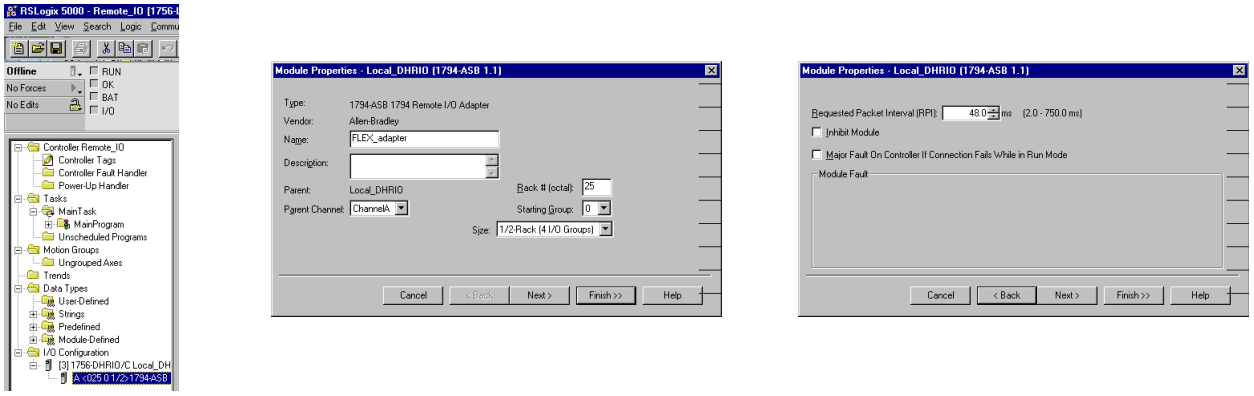
For more information on configuring a 1756-DHRIO module in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

3

Configure the FLEX Adapter

Use RSLogix 5000 to configure the FLEX adapter. Figure 10.3 shows some sample configuration screens for the FLEX adapter in this example.

Figure 10.3



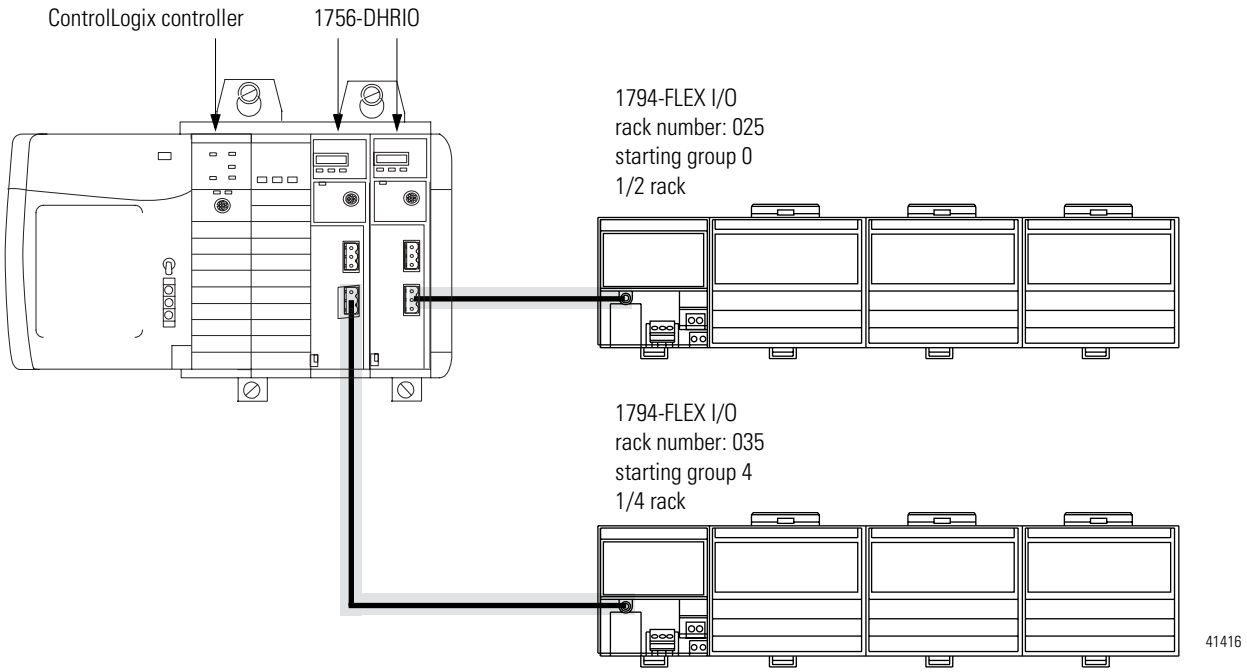
For more information on configuring a FLEX adapter in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

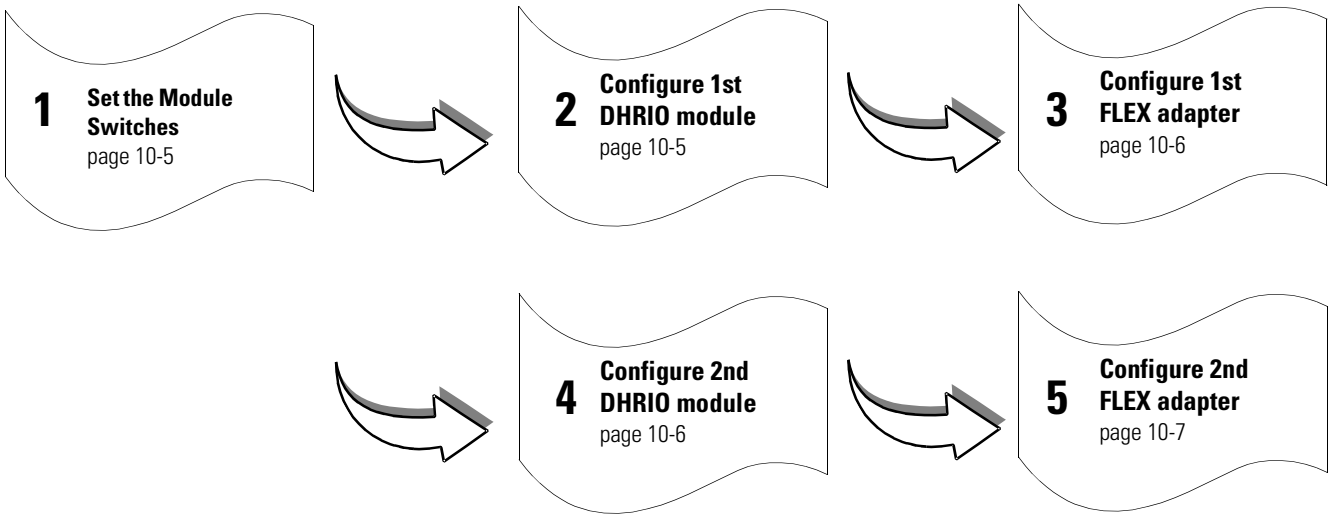
Scanning Remote FLEX Adapters Through Multiple 1756-DHRIO Modules in a Local Chassis

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

Figure 10.4 illustrates the steps you must use in this example:

Figure 10.4





1

Set the Module Switches

In this application, channel B on the 1756-DHRIO 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.

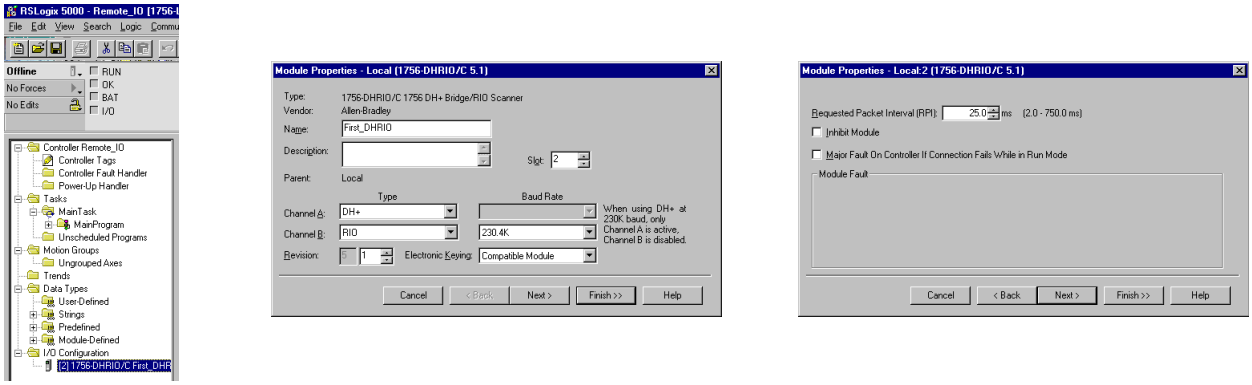
For more information on setting switches on the 1756-DHRIO module, see page 1-5.

2

Configure First 1756-DHRIO Module

Use RSLogix 5000 to configure the 1756-DHRIO module. Figure 10.5 shows some sample configuration screens for the first 1756-DHRIO module in this example.

Figure 10.5



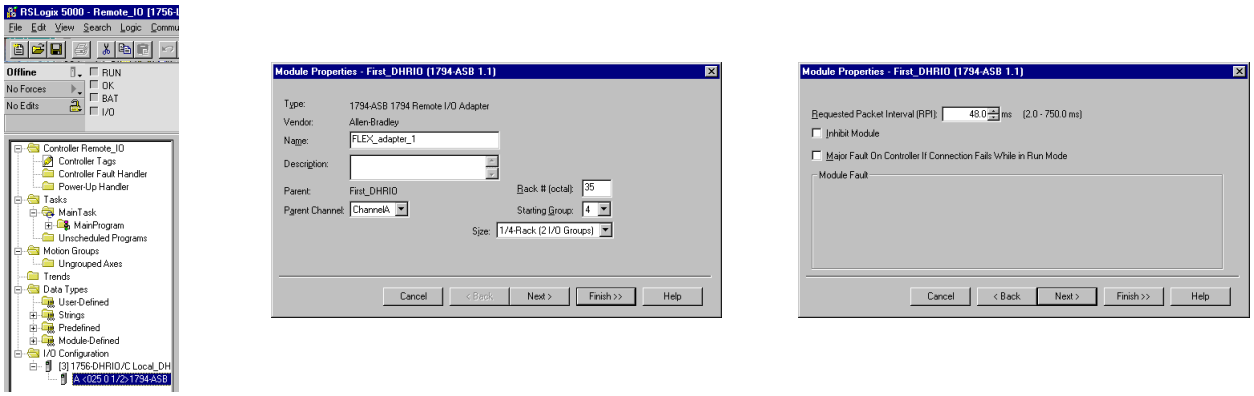
For more information on configuring a 1756-DHRIO module in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

3

Configure First FLEX Adapter

Use RSLogix 5000 to configure the first FLEX adapter. Figure 10.6 shows some sample configuration screens for the first FLEX adapter in this example.

Figure 10.6



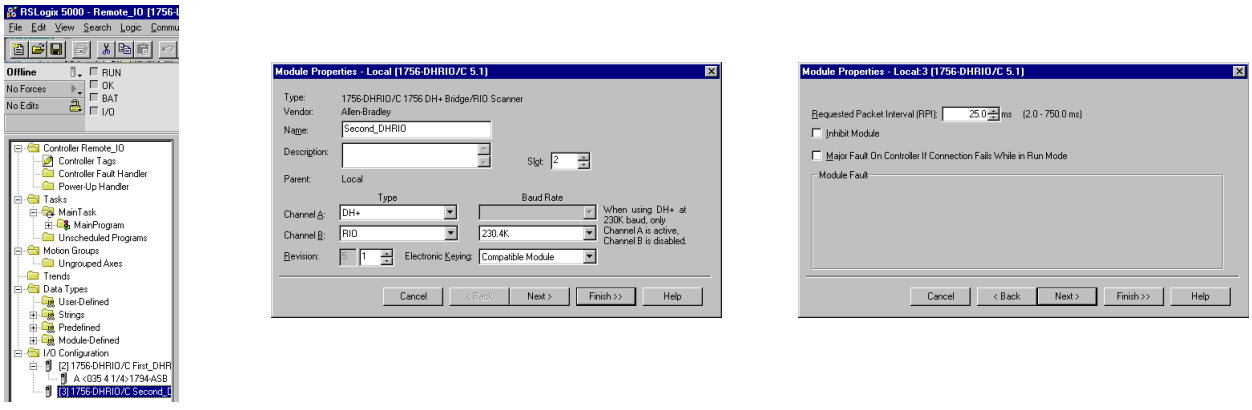
For more information on configuring a FLEX adapter in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

4

Configure Second 1756-DHRIO Module

Use RSLogix 5000 to configure the 1756-DHRIO module. Figure 10.7 shows some sample configuration screens for the second 1756-DHRIO module in this example.

Figure 10.7



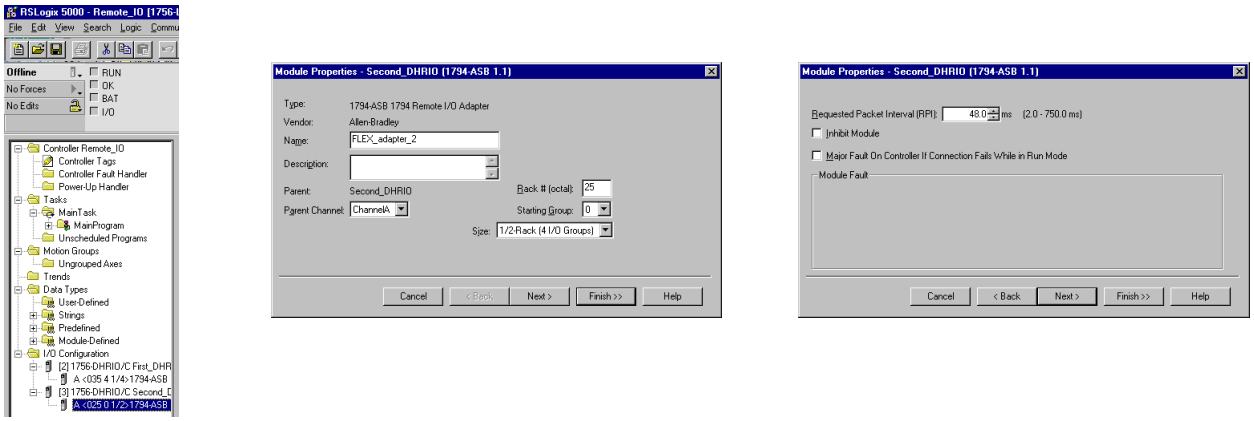
For more information on configuring a 1756-DHRIO module in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

5

Configure 2nd FLEX Adapter

Use RSLogix 5000 to configure the second FLEX adapter. Figure 10.8 shows some sample configuration screens for the second FLEX adapter in this example.

Figure 10.8

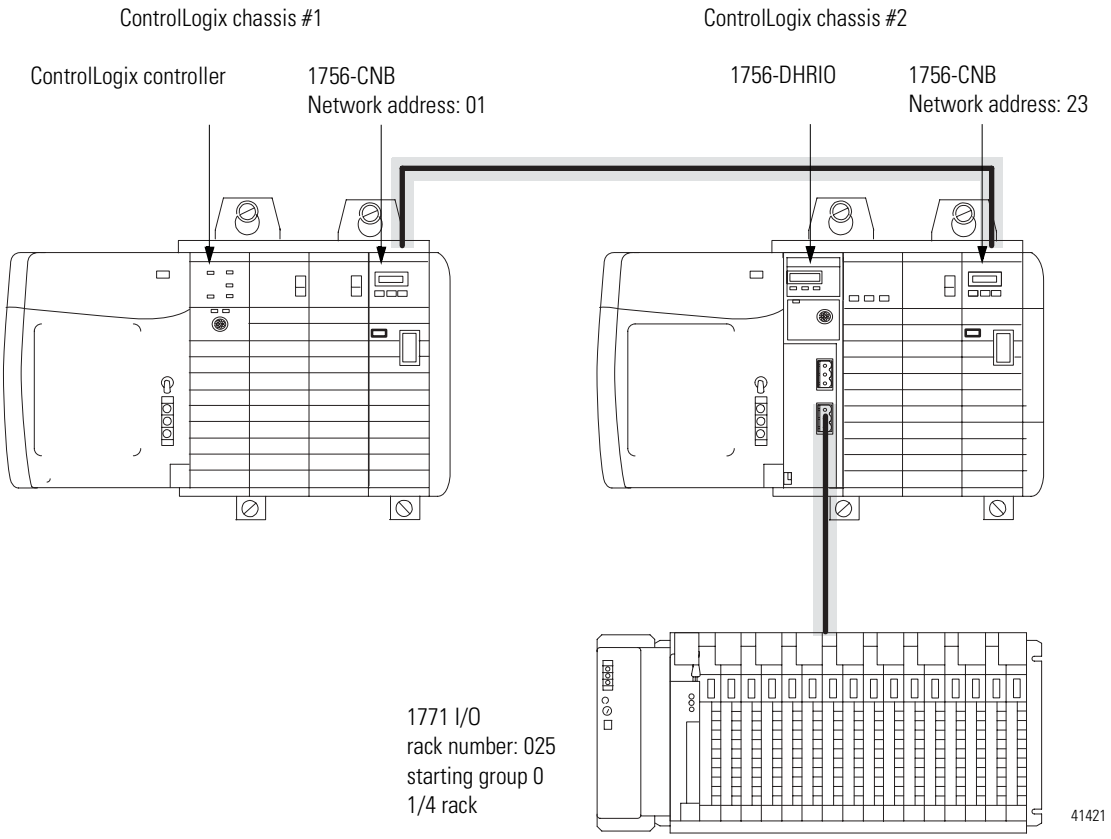


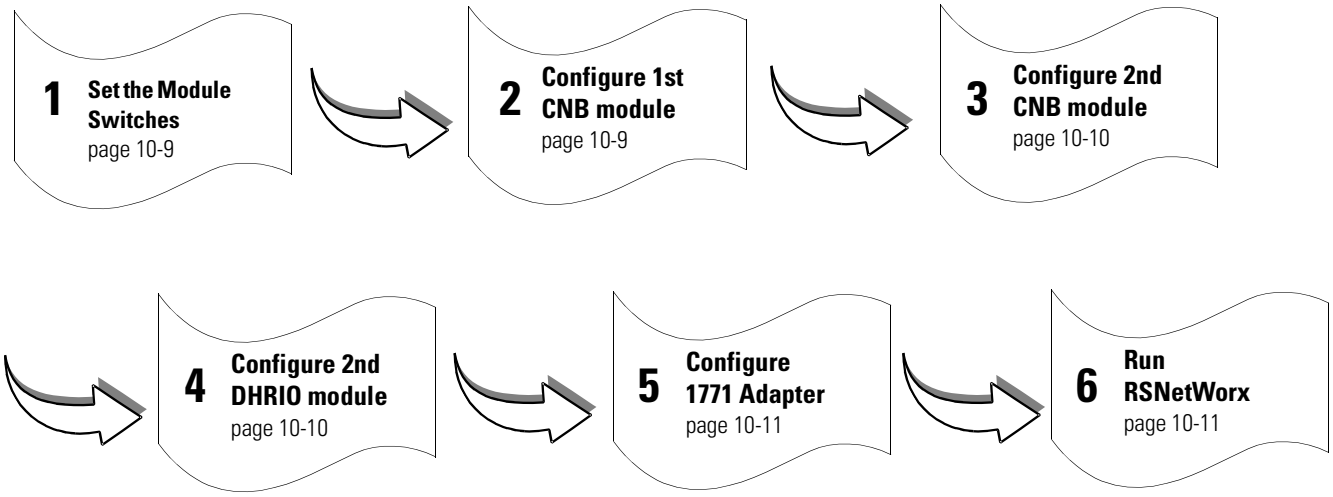
For more information on configuring a FLEX adapter in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

Scanning 1771 Remote I/O Adapters Through a 1756-DHRIO in a Remote Chassis

In this application, a ControlLogix controller scans remote FLEX I/O modules through a 1756-DHRIO module in a remote chassis over a ControlNet network. Figure 10.9 illustrates the steps you follow to use this application:

Figure 10.9





1

Set the Module Switches

In this application, channel B on the 1756-DHRIO 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. For more information on setting switches on the 1756-DHRIO module, see page 1-5.

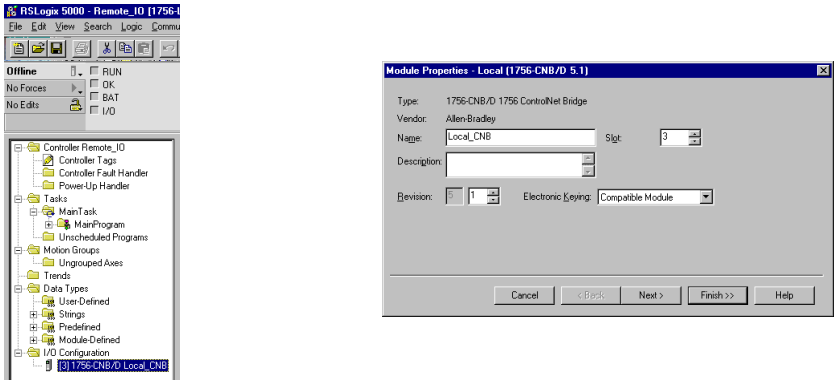
Set the switches on the 1756-CNB modules to the correct node addresses. The 1756-CNB module in system #1 uses node address 01 and the 1756-CNB module in system #2 uses node address 23. For more information on setting the switches on the 1756-CNB module, see page 4-9.

2

Configure First 1756-CNB Module

Use RSLogix 5000 to configure the 1756-CNB module. Figure 10.10 shows some sample configuration screens for the first 1756-CNB module in this example.

Figure 10.10



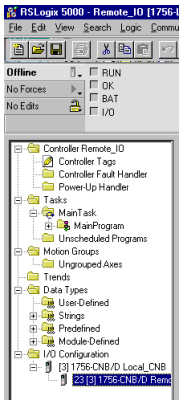
For more information on configuring a 1756-CNB module in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

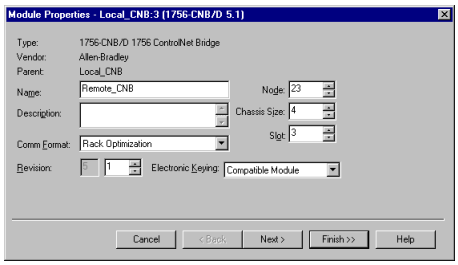
3

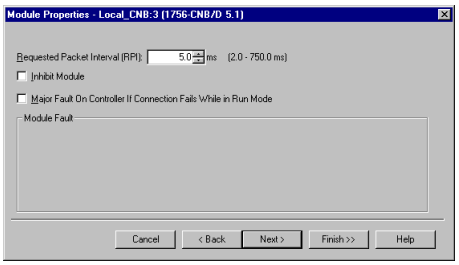
Configure Second 1756-CNB Module

Use RSLogix 5000 to configure the 1756-CNB module. Figure 10.11 shows some sample configuration screens for the second 1756-CNB module in this example.

Figure 10.11







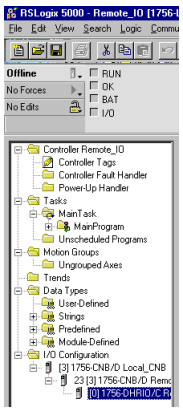
For more information on configuring a 1756-CNB module in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

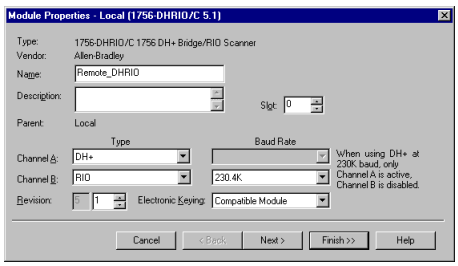
4

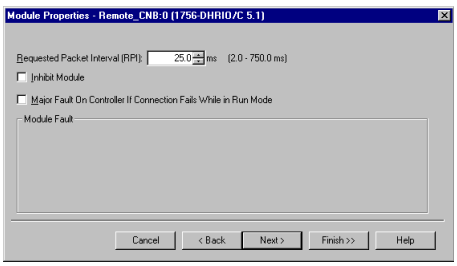
Configure 1756-DHRIO Module

Use RSLogix 5000 to configure the 1756-DHRIO module. Figure 10.12 shows some sample configuration screens for the 1756-DHRIO module in this example.

Figure 10.12







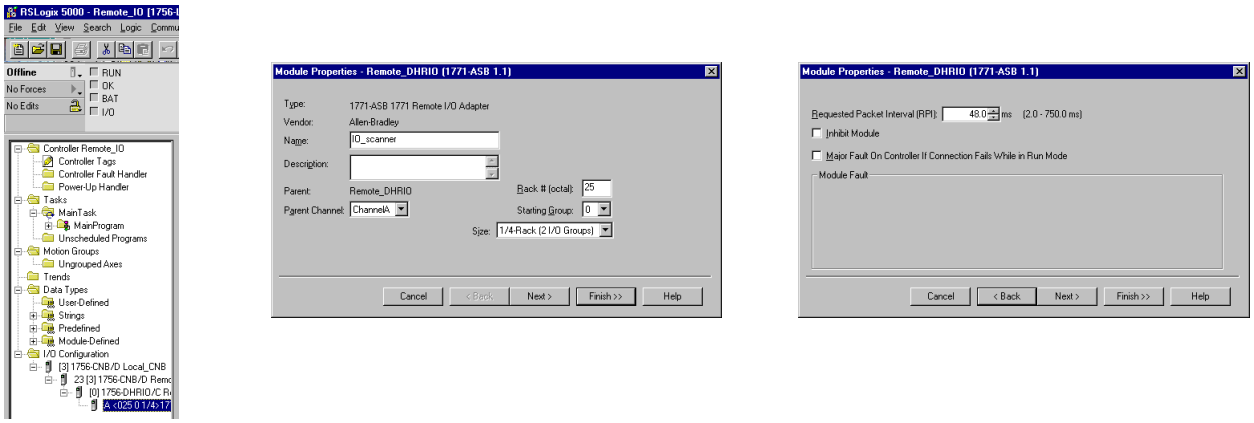
For more information on configuring a 1756-DHRIO module in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

5

Configure 1771-ASB Adapter

Use RSLogix 5000 to configure the 1771-ASB adapter. Figure 10.13 shows some sample configuration screens for the 1771-ASB adapter in this example.

Figure 10.13



For more information on configuring a 1771-ASB adapter in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

6

Run RSNetworx

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

Chapter Summary and What's Next

In this chapter, you learned about connecting a ControlLogix controller to remote I/O. Chapter 11 describes Block Transfers with the 1756-DHRIO Module.

Block Transfers with the 1756-DHRIO Module

What This Chapter Contains

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

For information about using	See page
Block Transfers to Remote FLEX I/O Modules Through a 1756-DHRIO in a Local Chassis	11-3
Block Transfers to Remote 1771-ASB I/O Modules Through a 1756-DHRIO in a Remote Chassis	11-7

In addition to discrete I/O, the 1756-DHRIO module supports sending block transfer (BT) data 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 (i.e. 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 specific instructions required.

The process for completing block transfers on remote I/O remains consistent with all adapters products. All 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 module and the ControlLogix controller. There is a primary timeout for the BT response that 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 specific 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 module, the final destination of the DH+ message must be the 1756-DHRIO module with the remote I/O channel.

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

For example, if the target is an remote I/O channel on a 1756-DHRIO 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 module, the module must be configured with a valid routing table, as described in Chapter 2, even if both 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 both channels to remote I/O simultaneously if necessary.

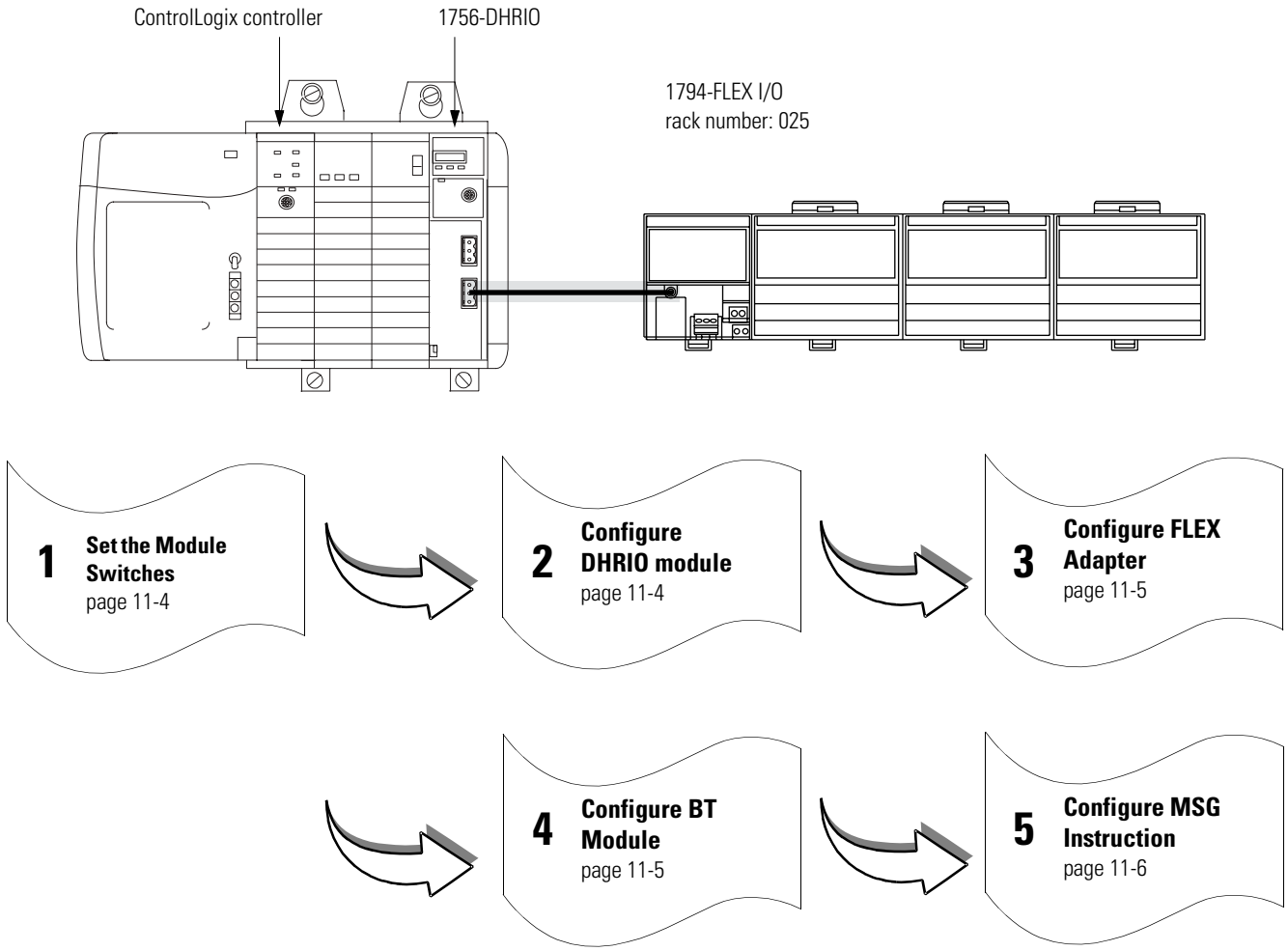
If only one channel is connected to remote I/O, it is recommended that you use channel B. If you connect channel A to remote I/O, you cannot use the programming terminal on the front of the 1756-DHRIO module.

Block Transfers to Remote FLEX I/O Modules Through a 1756-DHRIO in a Local Chassis

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

Figure 11.1 illustrates the steps you must use in this example:

Figure 11.1



1

Set the Module Switches

Channel B on the 1756-DHRIO 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.

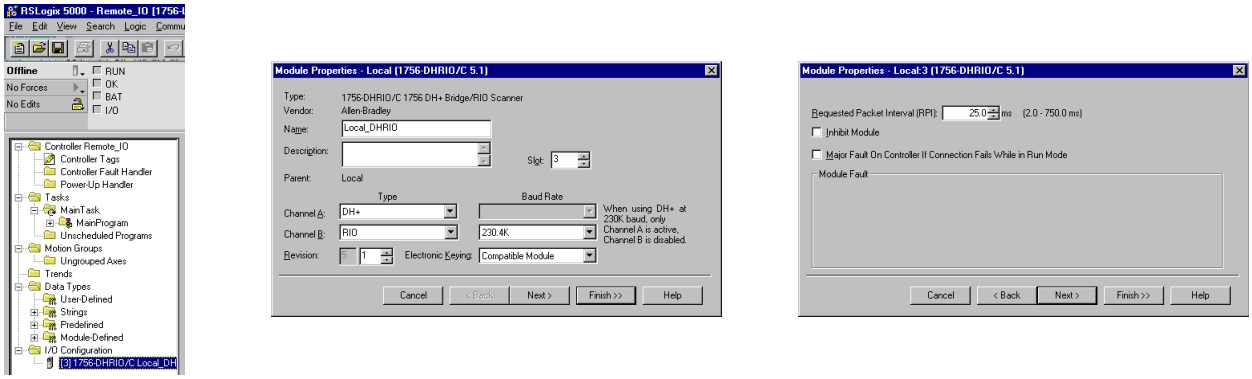
For more information on setting switches on the 1756-DHRIO module, see page 1-5.

2

Configure the 1756-DHRIO Module

Use RSLogix 5000 to configure the 1756-DHRIO module. Figure 11.2 shows some sample configuration screens for the 1756-DHRIO module in this example.

Figure 11.2



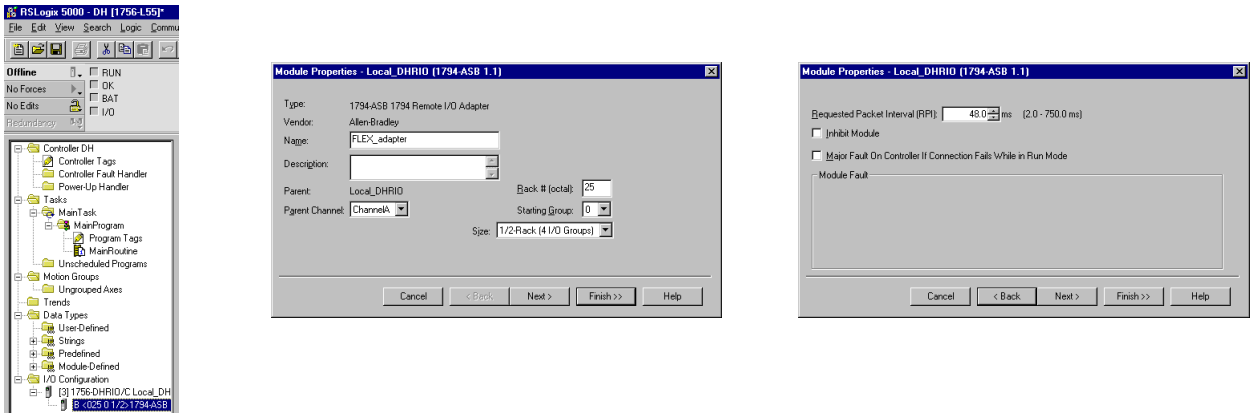
For more information on configuring a 1756-DHRIO module in a block transfer application, see Chapter 9, or the RSLogix 5000 online help.

3

Configure FLEX Adapter

Use RSLogix 5000 to configure the FLEX adapter. Figure 11.3 shows some sample configuration screens for the FLEX adapter in this example.

Figure 11.3



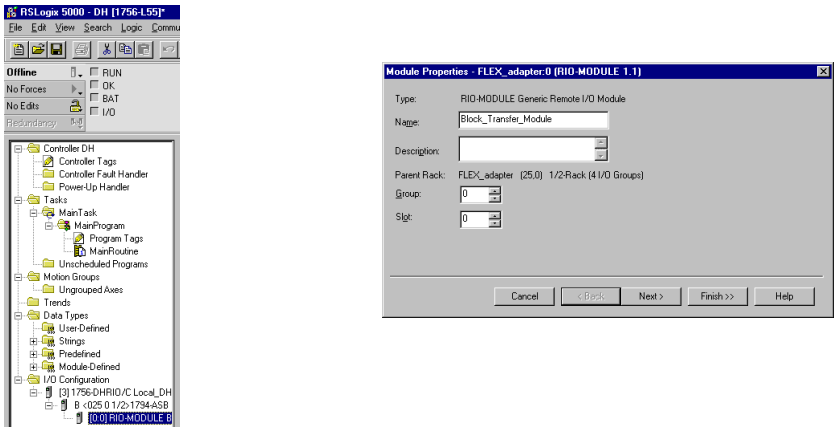
For more information on configuring a FLEX adapter in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

4

Configure Block Transfer Module

Use RSLogix 5000 to configure the Block Transfer module. Figure 11.4 shows some sample configuration screens for the Block Transfer module in this example.

Figure 11.4



For more information, see page 9-17 or the RSLogix 5000 online help.

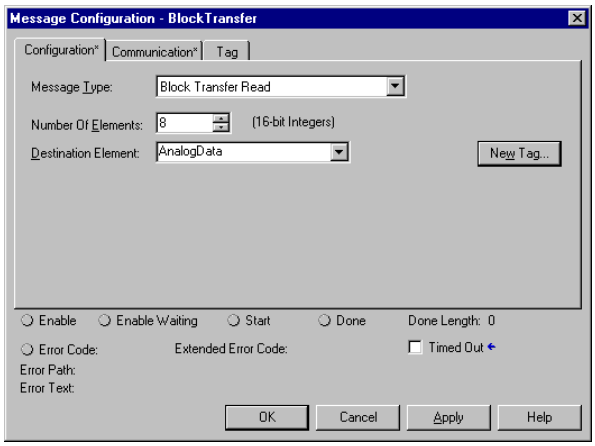
5

Configure Message Instruction

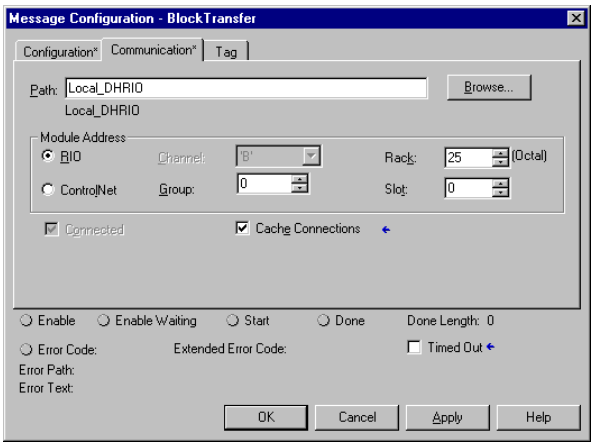
Use RSLogix 5000 to configure the block transfer message instructions. Figure 11.5 shows the message instruction tabs necessary for this example.

Figure 11.5

Configuration tab



Communication tab

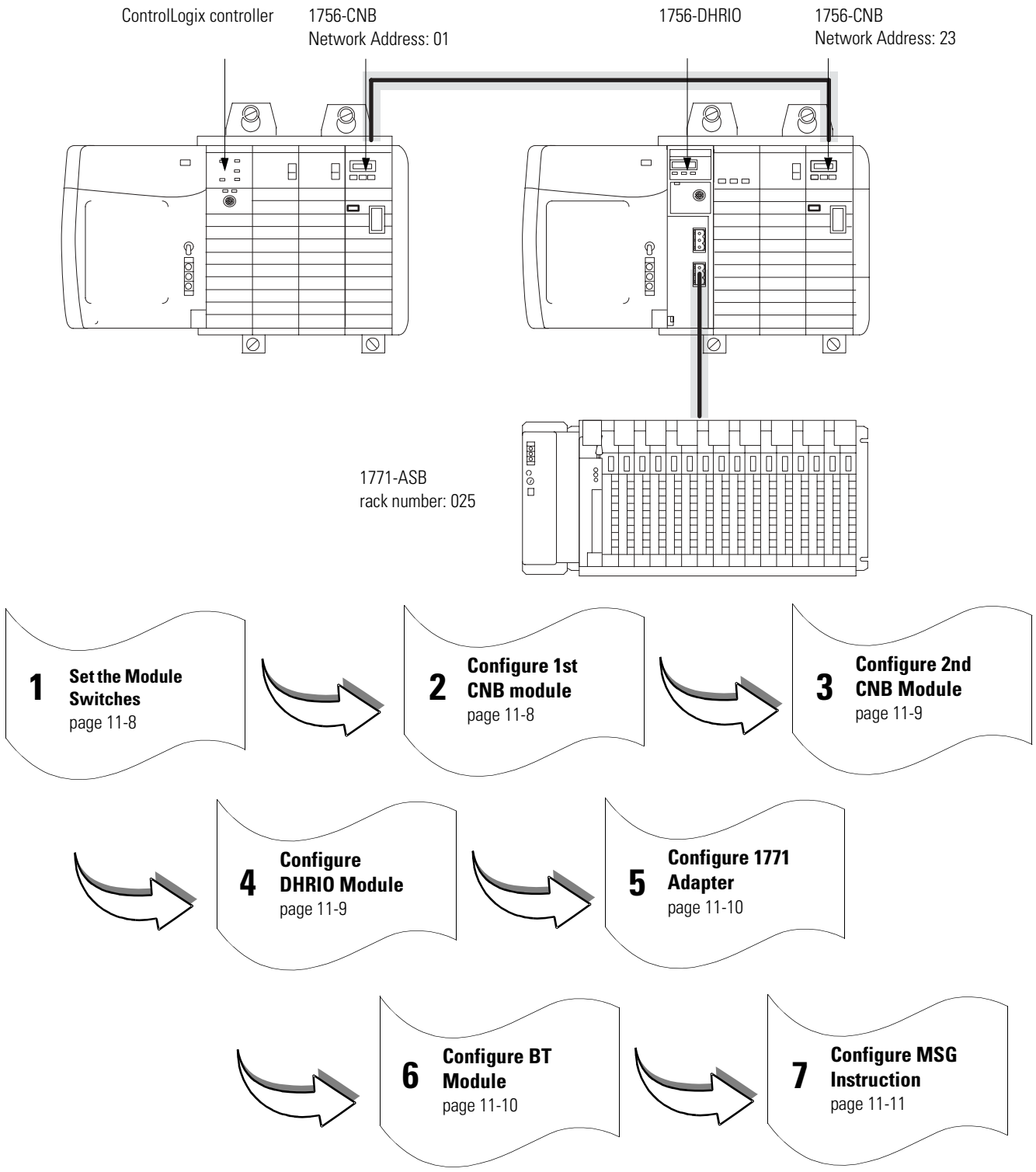


For more information on how to configure message instructions using RSLogix 5000, see page 9-18 or the RSLogix 5000 online help.

Block Transfers to Remote 1771-ASB I/O Modules Through a 1756-DHRIO in a Remote Chassis

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

Figure 11.6



1

Also described on page 1-5

Set the Module Switches

In this application, channel B on the 1756-DHRIO 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. For more information on setting switches on the 1756-DHRIO module, see page 1-5.

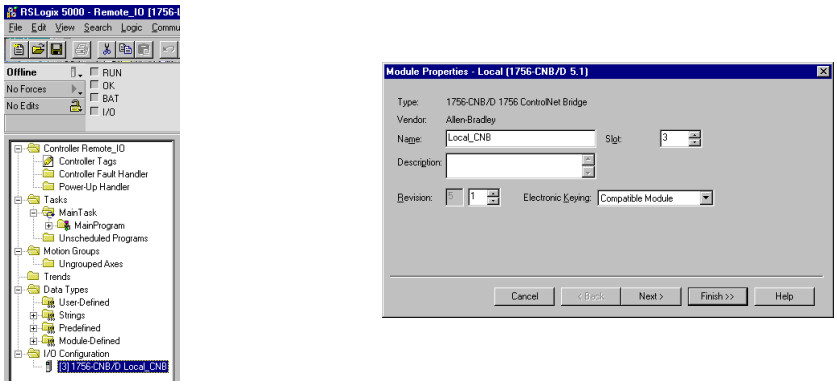
Set the switches on the 1756-CNB modules to the correct network addresses. The 1756-CNB module in system #1 uses network address 01 and the 1756-CNB module in system #2 uses network address 23. For more information on setting the switches on the 1756-CNB module, see page 4-9.

2

Configure First 1756-CNB Module

Use RSLogix 5000 to configure the 1756-CNB module. Figure 11.7 shows some sample configuration screens for the first 1756-CNB module in this example.

Figure 11.7



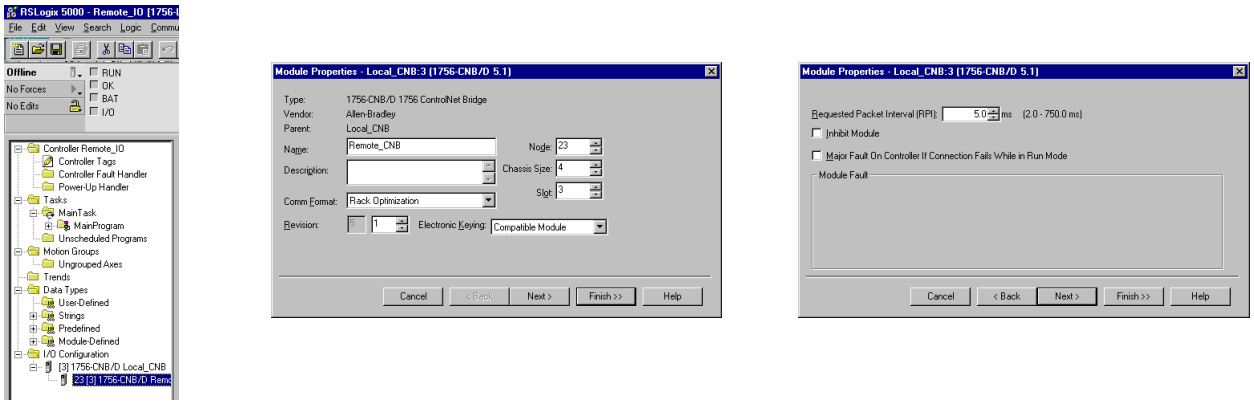
For more information on configuring a 1756-CNB module in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

3

Configure Second 1756-CNB Module

Use RSLogix 5000 to configure the 1756-CNB module. Figure 11.8 shows some sample configuration screens for the second 1756-CNB module in this example.

Figure 11.8



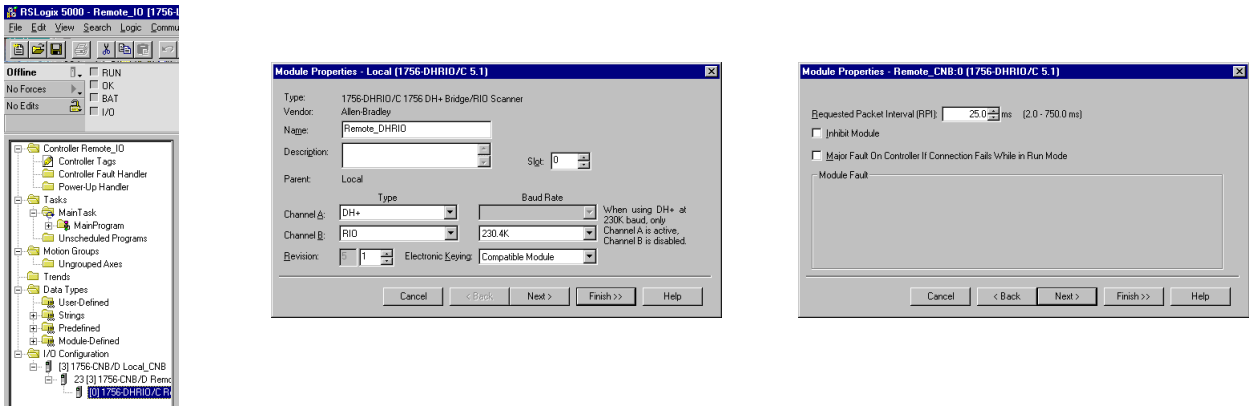
For more information on configuring a 1756-CNB module in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

4

Configure 1756-DHRIO Module

Use RSLogix 5000 to configure the 1756-DHRIO module. Figure 11.9 shows some sample configuration screens for the 1756-DHRIO module in this example.

Figure 11.9



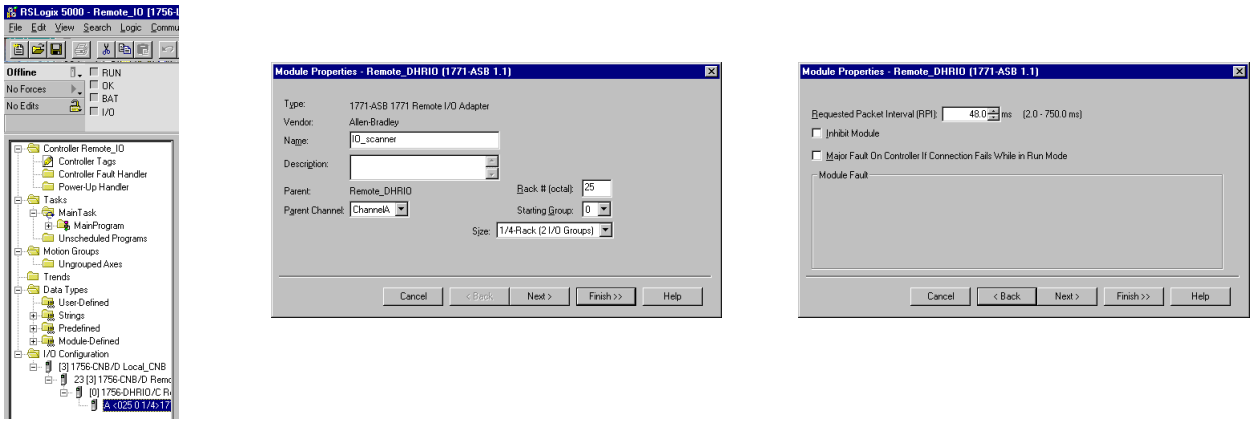
For more information on configuring a 1756-DHRIO module in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

5

Configure 1771-ASB Adapter

Use RSLogix 5000 to configure the 1771-ASB adapter. Figure 11.10 shows some sample configuration screens for the 1771-ASB adapter in this example.

Figure 11.10



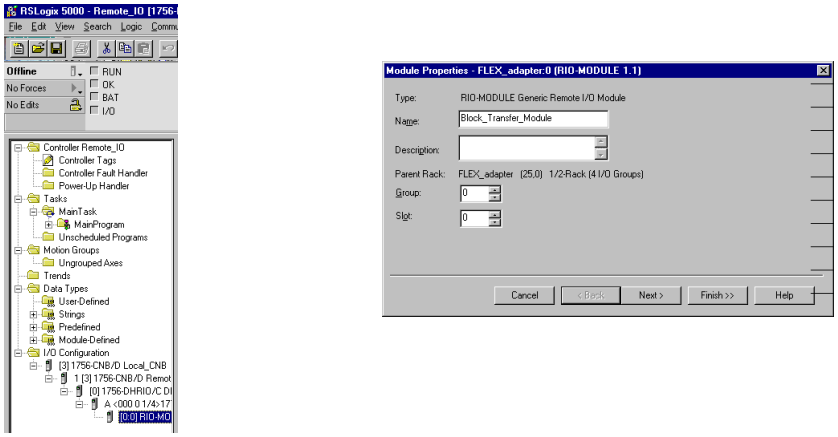
For more information on configuring a 1771-ASB adapter in a remote I/O application, see Chapter 9, or the RSLogix 5000 online help.

6

Configure Block Transfer Module

Use RSLogix 5000 to configure the Block Transfer module. Figure 11.11 shows some sample configuration screens for the Block Transfer module in this example.

Figure 11.11



For more information, see page 9-17 or the RSLogix 5000 online help.

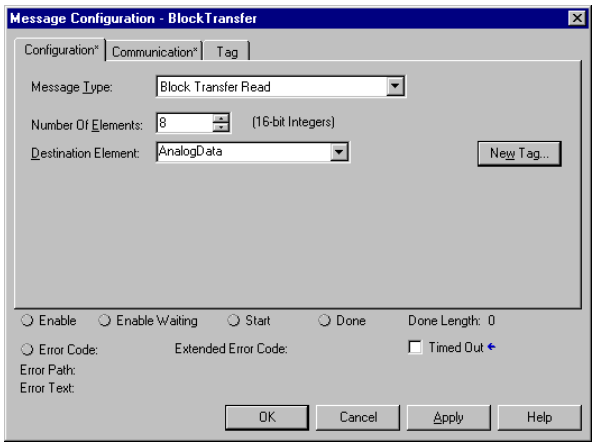
7

Configure Message Instruction

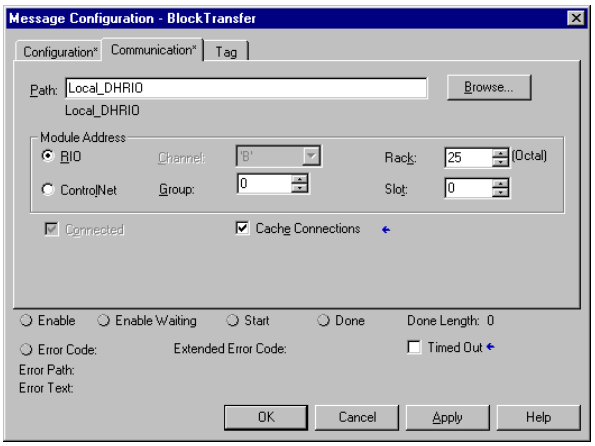
Use RSLogix 5000 to configure the block transfer message instructions. Figure 11.12 shows the message instruction tabs necessary for this example.

Figure 11.12

Configuration tab



Communication tab



For more information on how to configure message instructions using RSLogix 5000, see page 9-18 or the RSLogix 5000 online help.

Chapter Summary and What's Next

In this chapter, you learned about block transfer applications. Chapter 12 describes Troubleshooting the 1756-DHRIO Module.

Notes:

Troubleshooting the 1756-DHRIO Module

What This Chapter Contains

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

For information about using	See page
Checking Power Supply and Module Status	12-1
Interpreting the Alphanumeric Indicators	12-2
Interpreting the Status Indicators	12-3

Checking Power Supply and Module Status

On power-up, three events take place 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, then flashes green
- Power supply indicator shows solid green

If the alphanumeric indicator on the 1756-DHRIO module does not cycle through these messages on power-up, refer to the following table and to the Troubleshooting section that follows.

Table 12.1

If the POWER indicator is:	Power Supply Status is	Recommended Action:
Off	Not operating.	Turn power switch ON. Check power wiring connections. Check fuse.
On	Operating.	None, normal operation.

Interpreting the Alphanumeric Indicators

Your 1756-DHRIO module displays alphanumeric codes that provide diagnostic information about your module. The alphanumeric display flashes the codes at approximately 1 second intervals. The following table summarizes the codes.

Table 12.2
Interpreting the Alphanumeric Display

Code	Description	Recommended Action
Data Highway Plus		
OFF LINE	Data Highway Plus link is in STOP state.	Correct the configuration.
DUPL NODE	Data Highway Plus Duplicate node address.	Choose another node address and reset switches.
ONLY NODE	Only node on Data Highway Plus link.	Check the cables.
CNFG FALT	Incorrect DH+ routing table configuration. Incorrect Data Highway object configuration.	Correct the configuration. Verify the module is inserted in correct slot.
OK	Normal operation for that channel.	None.
LINK OFF	Channel B is disabled because Channel A is used for 230k operation.	None

Table 12.2
Interpreting the Alphanumeric Display

Code	Description	Recommended Action
Remote I/O		
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	None.

Interpreting the Status Indicators

The three LED status indicators on the module provide information about your module and the status of each channel. The following tables outline the indicator condition and the corresponding status, and explain what each condition means.

Table 12.3
Interpreting the OK Status Indicators

If the Module OK indicator is:	Module Status	Recommended 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	Reboot module. If red reoccurs, then replace module.
Red flashing	In major fault or configuration fault.	Check alphanumeric indicator and take action described in Table 12.2

Table 12.4
Interpreting the Channel Status Indicators

If the channel A or B indicator is:	in this channel mode:	then the channel status is:	take this action:
Off	All	Not on line.	Place channel on line.
Green	RIO scanner	Active remote I/O 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.	Reboot module. If red reoccurs, 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

A 1756-DHRIO module that communicates with a 1784-KT or 1784-PCMK communication card on its DH+ link may 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.

Chapter Summary and What's Next

In this chapter, you learned about troubleshooting your 1756-DHRIO module. Appendix A lists Specifications.

Specifications

Module Location	ControlLogix chassis
Maximum Backplane Current Load	850mA @ +5.1V dc and 1.7mA @ 24 V dc from I/O chassis backplane
Power Dissipation	4.5W maximum
Thermal Dissipation	15.4 BTU/hr maximum
Available Baud Rates	57.6Kbaud 115.2Kbaud 230.4Kbaud
Environmental Conditions:	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Shock	IEC60068-2-27: Test Ea (Unpackaged shock, ES#002) Operating 30g Non-operating 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 80MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz

EFT/B Immunity	IEC 61000-4-4: ±2kV at 5kHz on communications ports
Surge Transient Immunity	IEC 61000-4-5: ±2kV line-earth (CM) on shielded ports
Conducted RF Immunity	IEC 61000-4-6: 3Vrms with 1kHz sine-wave 80%AM from 10kHz to 80MHz 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Conductors:Wiring Category	Belden 9463 twinaxial 2[1]
Agency Certification (when product or packaging is marked)	UL — UL Listed Industrial Control Equipment CSA — CSA Certified Process Control Equipment CSA — CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations CE[2] — European Union 89/336/EEC EMC Directive, compliant with: EN 50081-2; Industrial Emissions EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity C-Tick[2] — Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[2] — European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n"

(1) Use this conductor category information for planning conductor routing as described in system level installation manual. Also refer to 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

(2) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

PCCC Commands Supported by the Data Highway Plus Module

What This Appendix Contains

This appendix describes PCCC commands that your 1756-DHRIO module can execute. The module executes these commands when received on one of its DH+ ports only under 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 will be executed directly by the 1756-DHRIO if the destination address is the 1756-DHRIO's DH+ node address.
- For DH+ messages with LSAP = 1 (remote), the diagnostic commands will be executed directly by the 1756-DHRIO if the DH+ message's network destination address is the network address of one of the DH+ ports on the 1756-DHRIO or if the DH+ message's network destination link ID is 0 and the network destination node is the 1756-DHRIO'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 allows you to 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:

Table B.1
ID Host and Status

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	
		etc.	
	Bits 4 - 7	1 = Major Revision 1	
		2 = Major Revision 2	
		etc.	
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	

Table B.1
ID Host and Status

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, and there is a space after the Series letter		

Read DH+ Diagnostic Counters

Diagnostic counters are bytes of information stored in RAM in you 1756-DHRIO 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:

Table B.2
DH+ Diagnostic Counters

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)

Table B.2
DH+ Diagnostic Counters

Byte	Description
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)
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 module's diagnostic counters, you may want to 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 module in DH+ and remote I/O applications.

For more information on:	See page:
Cached and Uncached Connections	C-1
ControlLogix Controller Constraints	C-2
Message Manager	C-3
Messages Between a ControlLogix Controller and PLC Devices	C-3
RPI Configuration Settings	C-3
RPI Formula without Block Transfer Modules	C-4
Increasing the Unconnected Message Buffer Limit	C-4
Remote I/O Performance: ControlLogix vs. PLC-5	C-6
DH+ Baud Rate Comparison	C-7

Cached and Uncached Connections

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

Up to 5 messages can be sent between points and be counted as 1 connection. When you read and write to the same module on remote I/O, however, you must interlock messages.

There are two types of connections in DH+ and remote I/O applications:

- Cached Connections
- Uncached Connections

Cached Connections

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

- When using cached connections, more than 1 message from identical points consume only 1 connection. In this case, ALL the identical point messages must be cached.
- Messages are completed much faster because the connection is already open.
- Can have up to 16 cached connections on remote I/O.
- With RSLogix 5000 version 10 and greater, you can have up to 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 only cache 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, you should 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 greater, 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 C-4.

- A DH+ or remote I/O message can take up to 2 connections in the UCB. 1 connection is used for the forward open and 1 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, you should manage the messages to make sure that only up to 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 up to 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 5 messages, wait for all 5 to complete and than enable another set of 5 messages. Repeat the process as needed until all required message completed.

Messages Between a ControlLogix Controller and PLC Devices

For more information on 1756-DHRIO 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:

http://support.rockwellautomation.com

RPI Configuration Settings

- Requested Packet Interrupt (RPI) setting on the 1756-DHRIO module is the time where the DHRIO module will send 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 should be 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 Only

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

- 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)

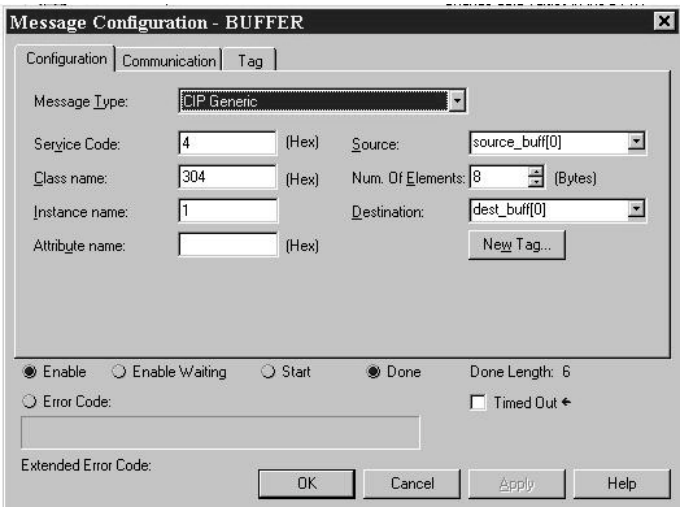
Increasing the Unconnected Message Buffer Limit

In addition to below, you can find more information on increasing the unconnected message buffer limit at the Rockwell Automation knowledge base at: http//support.rockwellautomation.com.

- With RSLogix5000 version 8.02 the Unconnected Message Buffer can be increased from the default value of 10 up to 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 set up as SINT type with 30 arrays.
- The communication path should be 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.

Increasing Unconnected Message Buffer Set-Up

Set up the message as shown below



Increasing 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 screen 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 vs. PLC-5

In Figure C.1, block transfer write messages are sent from a ControlLogix controller (via the 1756-DHRIO module) to a 1771-DCM over cached remote I/O connections.

Figure C.1

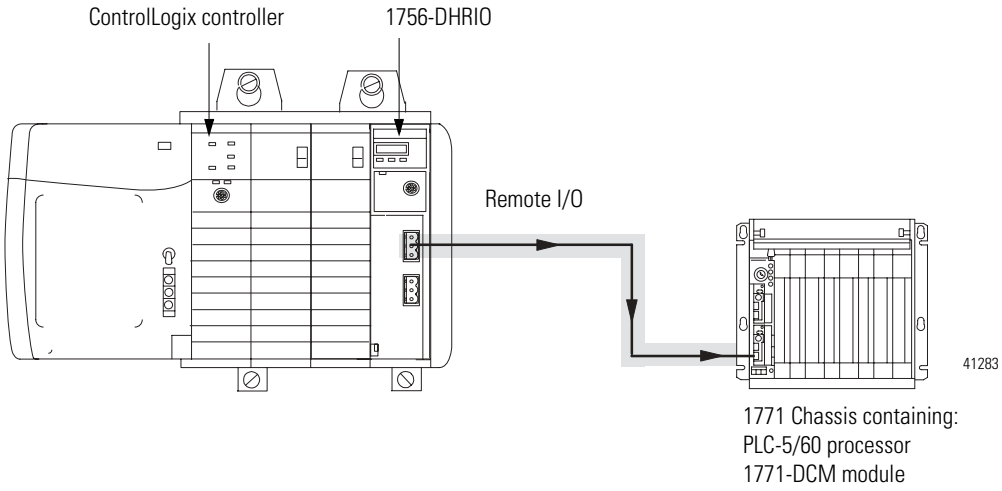
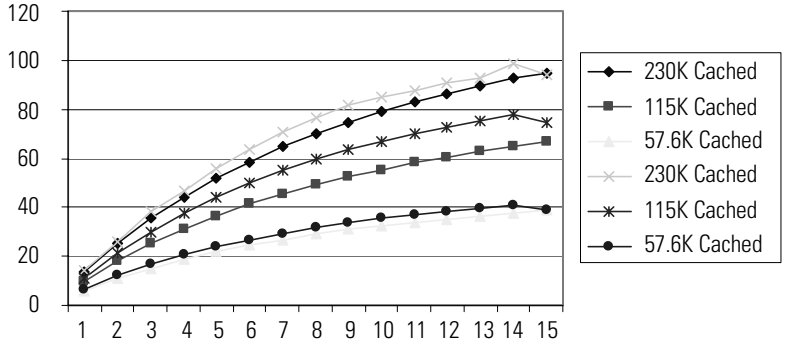


Figure C.2 illustrates the differences between using cached remote I/O connections with the 1771-DCM module and using PLC-5 connections with the 1771-DCM module.

Figure C.2



Block Transfer Write Messages per Second

Number of Nodes per Block Transfer Write Messages

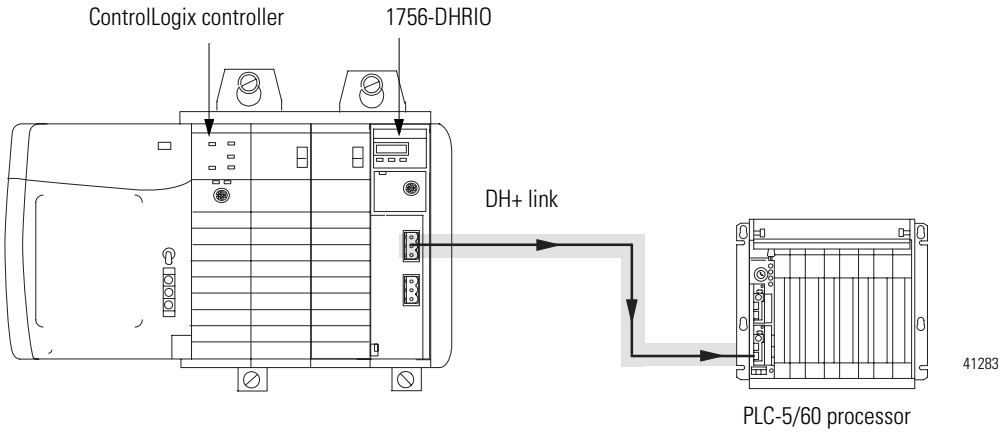
All 15 Block Transfer Write messages were on one channel.

Each Block Transfer Write message was 40 words in size.

DH+ Baud Rate Comparison

Figure C.3 shows an example where a ControlLogix controller sends messages to a PLC-5 via a 1756-DHRIO module. Performance differences exist if the connections are cached or uncached.

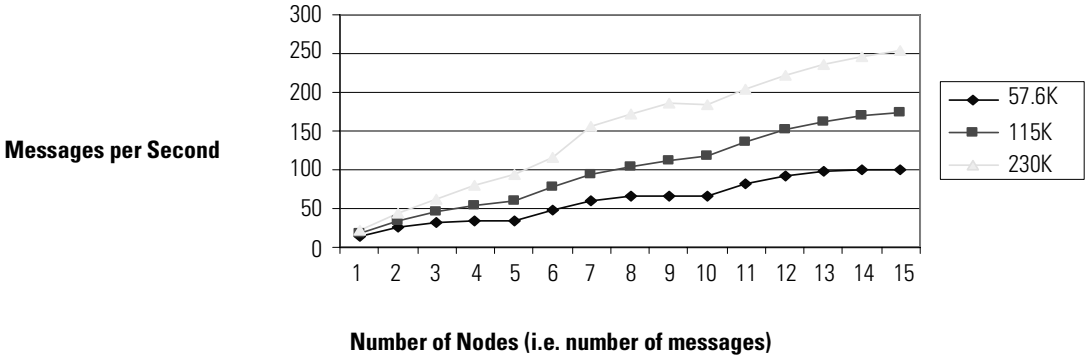
Figure C.3



Using Cached Connections

Figure C.4 illustrates the difference in messages per second available with cached connections for each DH+ baud rate.

Figure C.4

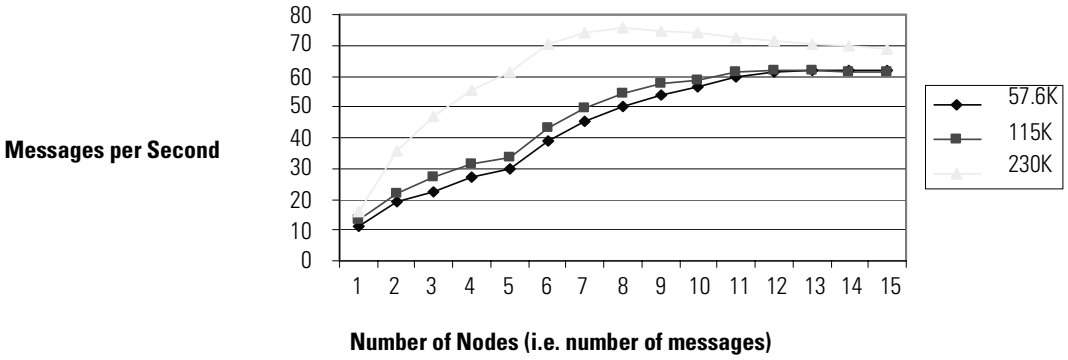


Version 5 of the 1756-DHRIO module added baud rates of 115.2K and 230.4K.

Using Uncached Connections

Figure C.5 illustrates the difference in messages per second available with uncached connections for each DH+ baud rate.

Figure C.5



Version 5 of the 1756-DHRIO module added baud rates of 115.2K and 230.4K.

Maintaining PCCC Message Sequences

The 1756-DHRIO module does 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.

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