

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

Catalog Numbers 1756-DHRIO, 1756-DHRIOXT





Allen-Bradley • Rockwell Software

## **Important User Information**

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

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

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

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

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

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

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

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

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

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



**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.



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

Allen-Bradley, ControlLogix, Data Highway Plus (DH+), Rockwell Software, Rockwell Automation, Studio 5000, Studio 5000 Automation Engineering & Design Environment, and Studio 5000 Logix Designer are trademarks of Rockwell Automation, Inc.

Trademarks not belonging to Rockwell Automation are property of their respective companies.

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

## New and Updated Information

This table contains the changes made to this revision.

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

## Notes:

Purpose of This Manual11Studio 5000 Environment12

	Additional Resources	12
	Chapter 1	
About the Module	What This Chapter Contains	13
	What the Module Does	13
	Routing Limitations	14
	DH+ and CIP Messaging	14
	Remote I/O	15
	Module Features	16
	Configure Switches	17
	Alphanumeric Indicators	18
	Prevent Electrostatic Discharge	19
	Removal and Insertion Under Power	19
	Chapter 2	
Using the Data Highway Plus	What Is Data Highway Plus?	21
Network	Link Design.	22
	Trunk Line/Drop Line Considerations	22
	Programming Terminal Port	23
	Connect Devices to the DH+ Network	23
	Application Guidelines	24
	Two Methods of Communication Over a DH+ Network	25
	Use DH+ Messaging	25
	Local DH+ Messaging	25
	Remote DH+ Messaging	28
	Configuration Information in DH+ Messaging	32
	Generate Configuration Faults	32
	Application Timeout	33
	Example DH+ Routing Configuration	34
	Use Control and Information Protocol (CIP) Messaging	35
	Limitations of CIP Messaging	35
	Chapter 3	
Installing the Modules	Before You Begin	40
5	Install the Module	41
	Wire the Module	42
	Network Connectors and Cable	43
	Chapter 4	
Ilsing Programming Software in DH+	What This Chapter Contains	45
Annlications	Select the Correct Software	45
איראוינמנוטווא	Use RSLinx to Create a Routing Table	46
		10

Preface

What Is a Routing Table?	46
Pyramid Integrator Emulation	46
ControlLogix Routing	48
Create the Routing Table	49
Configure the Controller Slot	51
Use RSLinx Software to Send Control and Information	
Protocol Messages	51
Use RSLogix 5	52
Studio 5000 Environment DH+ Application Example	54
Use RSLogix 500	55
RSLogix 500 DH+ Application Example	57
Use the Studio 5000 Environment	58
Studio 5000 Environment DH+ Application Example	61
Define Connection Paths	63
Connection path examples	64

## Chapter 5

DH   Messaging BIC 5 Controllers with One 1756 DHBIO	68
$C = \frac{1}{10000000000000000000000000000000000$	00
Configure the Module Switches.	68
Configure a Routing Table for the 1756-DHRIO Module	68
Configure Message Instructions	69
DH+ Messaging: SLC 5/04 Controllers with Two Modules in One	
ControlLogix Chassis	70
Configure the Module Switches	71
Configure a Routing Table for the 1756-DHRIO Modules	71
Configure Message Instructions	72
DH+ Messaging: PLC-5 Controllers with Multiple	
ControlLogix Chassis	73
Configure the Module Switches	74
Configure Routing Tables for the Modules	75
Configure Message Instructions	76
DH+ Messaging: PLC-5 to PLC-5/C Controllers on the ControlNet	
Network.	77
Configure the Module Switches	78
Configure a Routing Table for the 1756-DHRIO Module	78
Configure Message Instructions	78
5 5	

## Chapter 6

What This Chapter Contains 79
DH+ Messaging: PLC-5 Controllers to One ControlLogix Controller
with One ControlLogix Chassis
Configure the Module Switches
Configure a Controller Slot for the 1756-DHRIO Module 81
Configure Message Instructions
DH+ Messaging: PLC-5 to Multiple ControlLogix Controllers in One
ControlLogix Chassis

# Messaging Between PLC-5 and SLC 5/04 Controllers

## Controllers and ControlLogix D Controllers w

Messaging Between PLC-5 or SLC 5/04

Configure the Module Switches	84
Configure a Controller Slot for the Module	84
DH+ Messaging: SLC 5/04 to a ControlLogix Controller with	
Multiple ControlLogix Chassis	85
Configure the Module Switches	86
Configure a Routing Table for the Module	86
Configure Message Instructions	87

## Chapter 7

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

Messaging Between ControlLogix

Controllers

Controllers

What This Chapter Contains	89
Local DH+ Messaging: ControlLogix Controller	
in One Chassis to a PLC-5	90
Configure the Module Switches	91
Configure Message Instructions	91
DH+ Messaging: ControlLogix Controller to a SLC 5/04 Controller	
over ControlNet and DH+ Networks	92
Configure the Module Switches	93
Configure a Routing Table for the Module	93
Configure Message Instructions	94

## Chapter 8

What This Chapter Contains	95
CIP Messaging Between ControlLogix Controllers over One Link	95
Configure the Module Switches	96
Configure Message Instructions	96
CIP Message Routing Between ControlLogix	
Controllers over Two Links	97
Configure the Module Switches	98
Configure Message Instructions	98

## Chapter 9

Using the 1756-DHRIO and	What This Chapter Contains	. 99
1756-DHRIOXT Modules in Remote I/O	Introduction to Remote I/O	100
Annlications	Select Devices that You Can Connect.	101
Applications	Design a Remote I/O Network	102
	Network Design Guidelines	102
	Cable Design Guidelines	102
	Trunk Line/Drop Line Considerations	103
	Module Operation in a Remote I/O Application	104
	Exchange I/O Data Between the Module and Adapters	105
	Exchange I/O Data Between the Module and the ControlLogix	
	Controller	105
	I/O Configuration Tree in Studio 5000 Environment Controller	
	Organizer	105
	Remote I/O Scanner Status	106
	Adapter Module I/O	107

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

## Chapter 11

Connecting a ControlLogix Controller to Remote I/O

Configure the Data Exchange Rate Between the Modules
and a Controller 108
Requested Packet Interval (RPI) 108
RIO Scanner Status Update Rate with the Module
in a Local Chassis
RIO Scanner Status Update Rate with the Module
in a Remote Chassis
Configure the Baud Rate 108
Remote I/O Scanner Fault Notification 110
Remote I/O Adapter Failure Notification 111
Inhibit the Module Connections 111
Inhibit an Remote I/O Connector Adapter 111
Increased Remote I/O System Throughput 112

## Chapter 10

What This Chapter Contains 113
Use the Studio 5000 Environment in
Module Remote I/O Applications 113
Add the Module
Configure the Module 115
Add the Remote I/O Adapter 117
Configure the Remote I/O Adapter 118
Download the Project to the Controller 119
Edit Configuration 120
Use the Studio 5000 Environment in 1756-DHRIO
Module Block Transfer Applications 120
Add the 1756-DHRIO or 1756-DHRIOXT Module 122
Configure the Module 123
Add the Remote I/O Adapter 125
Configure the Remote I/O Adapter 126
Add the Remote I/O Modules 128
Configure the Remote I/O Modules 129
Create a Block Transfer (Read or Write) Message Instruction 130

What This Chapter Contains	135
Scan Remote FLEX Adapters through One 1756-DHRIO or	
1756-DHRIOXT Module in a Local 1756-Chassis	136
Configure the Module Switches	136
Configure the Module	136
Configure the FLEX Adapter	137
Scan Remote FLEX Adapters through Multiple 1756-DHRIO or	
1756-DHRIOXT Modules in a Local Chassis	138
Configure the Module Switches	138
Configure the First Module	139
Configure the First FLEX Adapter	139

Configure the Second Module 1	40
Configure the Second FLEX Adapter 1	40
Scan 1771 Remote I/O Adapters through a 1756-DHRIO or	
1756-DHRIOXT Module in a Remote Chassis 1	41
Configure the 1756-DHRIO or 1756-DHRIOXT	
Module Switches 1	41
Configure First 1756-CNB Module 1	42
Configure the Second 1756-CNB Module 1	42
Configure the 1756-DHRIO or 1756-DHRIOXT Module 1	43
Configure the 1771-ASB Adapter 1	43
Run RSNetWorx Software 1	43

## Chapter 12

What This Chapter Contains	145
Block Transfer Fault Notification	145
Block Transfer 'Pass-Through' Messages	146
Block Transfer Examples.	146
Block Transfers to Remote FLEX I/O Modules through	
a 1756-DHRIO or 1756-DHRIOXT Module in a Local Chassis	147
Configure the Module Switches	147
Configure the 1756-DHRIO or 1756-DHRIOXT Module	147
Configure the FLEX Adapter	148
Configure the Block Transfer Module	148
Configure Message Instruction	149
Block Transfers to Remote 1771-ASB I/O Modules through a	
1756-DHRIO or 1756-DHRIOXT Module in a Remote Chassis	150
Configure the Module Switches	150
Configure the First 1756-CNB Module	151
Configure the Second 1756-CNB Module	151
Configure the 1756-DHRIO or 1756-DHRIOXT Module	152
Configure the 1771-ASB Adapter	152

## Chapter 13

What This Chapter Contains	153
Check Power Supply and Module Status	153
Status Indicators	154
Minimizing False Received Frame with Bad CRC Messages	156

## Appendix A

What This Appendix Contains 1	57
Echo 1	57
ID Host and Status 1	58
Read DH+ Diagnostic Counters 1	60
Reset DH+ Diagnostic Counters 1	61

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

Troubleshooting the Module

PCCC Commands Supported by the Data Highway Plus Module

Application Guidelines and Tips

## Appendix B

Index

## **Purpose of This Manual**

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

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

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

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

## Studio 5000 Environment

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



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

## **Additional Resources**

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

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

You can view or download publications at

<u>http://www.rockwellautomation.com/literature/</u>. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

## **About the Module**

## What This Chapter Contains

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

Торіс	Page
What the Module Does	13
Routing Limitations	14
Module Features	16
Prevent Electrostatic Discharge	19
Removal and Insertion Under Power	19

## What the Module Does

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

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

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

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

## **Routing Limitations**

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

## **DH+ and CIP Messaging**

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

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

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

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



### Remote I/O

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

The figure shows an example system.



## **Module Features**

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



Other module features include the following:

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

## **Configure Switches**

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

IMPORTANT

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

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

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



### **Alphanumeric Indicators**

Alphanumeric status indicator illuminates and cycles through a sequence of messages (described in the table on the following page).



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

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

This sequence runs continuously during normal module operation.

EXAMPLE	For example, if your module uses the following:
	Channel A for DH+ with node address 14
	Channel B for RIO
	and the channels are operating properly, you see the following sequence:
	• A DH, A#14, A OK, B IO, SCAN, B OK

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

## Prevent Electrostatic Discharge

The Data Highway Plus module is sensitive to electrostatic discharge.



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

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

# Removal and Insertion Under Power

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



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

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

## Notes:

## **Using the Data Highway Plus Network**

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

Торіс	Page
What Is Data Highway Plus?	21
Connect Devices to the DH+ Network	23
Two Methods of Communication Over a DH+ Network	25
Use DH+ Messaging	25
Configuration Information in DH+ Messaging	32
Application Timeout	33
Example DH+ Routing Configuration	34
Use Control and Information Protocol (CIP) Messaging	35

## What Is Data Highway Plus?

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

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

### Link Design

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

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

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

### Trunk Line/Drop Line Considerations

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

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

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

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

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

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

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

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

## **Programming Terminal Port**

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



## Connect Devices to the DH+ Network

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

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

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

### **Application Guidelines**

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

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

## Two Methods of Communication Over a DH+ Network

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

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

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

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

### Use DH+ Messaging

DH+ Messaging offers the following benefits:

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

DH+ messaging is divided into two types:

- Local DH+ Messaging See page <u>25</u>
- <u>Remote DH+ Messaging</u> See page <u>28</u>

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

### Local DH+ Messaging

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

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

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

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

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



### Receiving Local DH+ Messages on DH+

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

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

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

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

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

### Sending Local DH+ Messages on DH+

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

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

### Limitations of Local DH+ Messaging

When using Local DH+ Messaging, you must remember:

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

### *Routing Error in Local DH+ Messaging*

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

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

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

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

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

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

IMPORTANTThese configuration steps must be done for each 1756-DHRIO or<br/>1756-DHRIOXT in the your system.

### Remote DH+ Messaging

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

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

Use remote DH+ messaging when the following conditions apply:

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

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

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



41363

### Link IDs

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

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

IMPORTANT	For remote DH+ messaging, the ControlLogix chassis is considered a separate, independent network. Therefore, a system of 1 DH+ network and one ControlLogix chassis is a two-link system.
	The ControlLogix chassis is <b>required</b> to be a separate, independent link for DH+ messaging if multiple message target ControlLogix controllers are in a ControlLogix chassis.

### *Routing Tables in Remote DH+ Messaging*

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

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

You must use RSLinx to configure your routing table. For more information on routing tables, see page  $\frac{46}{2}$ 

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

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

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

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

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

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

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

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

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

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

### *Limitations of Remote DH+ Messaging*

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

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

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

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

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

### *Routing Errors in Remote DH+ Messaging*

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

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

# Configuration Information in DH+ Messaging

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

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

- Any routing table that can be needed to send DH+ messages through the module. This information must be applied to the module's configuration separately from other information. Use RSLinx to apply the routing table. For more information on routing tables, see page<u>49</u>.
- Controller slot for each DH+ channel This information must be applied to the module's configuration separately from other information. For more information on setting the controller slot, see page <u>51</u>.
- Slot number of the module
- Chassis serial number

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

### **Generate Configuration Faults**

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

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

## **Application Timeout**

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

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

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

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



# Example DH+ Routing Configuration

The following figure shows an example DH+ routing configuration.

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



on different networks. Devices on the same network require unique numbers. You must assign the node numbers.

## Use Control and Information Protocol (CIP) Messaging

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

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

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

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.



IMPORTANTYour 1756-DHRIO and 1756-DHRIOXT modules support bridging CIP<br/>messaging over a DH+ link. However, your 1756-DHRIO and 1756-DHRIOXT<br/>modules do not support bridging CIP I/O data from a ControlLogix<br/>controller to a 1756-I/O module.The message originator, target, and all modules and links between them

must support CIP to send a message by using CIP protocol.

### **Limitations of CIP Messaging**

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

## Notes:
# **Installing the Modules**

Торіс	Page
Before You Begin	40
Install the Module	41
Wire the Module	42
Network Connectors and Cable	43

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



#### **ATTENTION: Environment and Enclosure**

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

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

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

In addition to this publication, see the following:

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

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

be changed in an area known to be nonhazardous.

# • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

#### **European Hazardous Location Approval**

#### The following applies when the product bears the Ex Marking.

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

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

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



#### **ATTENTION: Prevent Electrostatic Discharge**

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

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

# **Before You Begin**

Follow these procedures before installing the module.



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

1. Identify the module features, as shown.



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



3. Set the network type switches for each channel.

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

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

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

4. Determine module slot location.

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



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

**Install the Module** 

Follow these steps to install the module.

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



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

# Wire the Module

Wire the connectors for the module channels.



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

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



Piı	n A	lssi	ignmen	ts for	Channel	A and B	Connectors	
-----	-----	------	--------	--------	---------	---------	------------	--

DH+		Remote I/O		
Pin Numbers	Description	Pin Number	Description	
1	Clear	1	Blue	
	Shield		Shield	
	Blue	2	Clear	

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





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

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

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

# Network Connectors and Cable

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

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

# Notes:

# Using Programming Software in DH+ Applications

# What This Chapter Contains

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

Topic:	Page
Use RSLinx to Create a Routing Table	46
Use RSLinx Software to Send Control and Information Protocol Messages	51
Use RSLogix 5	52
Use RSLogix 500	55
Use the Studio 5000 Environment	58
Define Connection Paths	63

# Select the Correct Software

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

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

# Use RSLinx to Create a Routing Table

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

#### What Is a Routing Table?

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

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

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

#### **Pyramid Integrator Emulation**

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

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

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



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

#### **System A Routing Table**

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

#### System B Routing Table

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



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

#### **ControlLogix Routing**

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

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

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

### **Create the Routing Table**

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

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



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

	1756-DHRIO Configuration		
DHRIO Routing Tab ———	General HRID Routing Table Channel Configuration		
	Device Name: 1756-DHRIG//8 Vendot: Allen-Bradley Company Product Type: 12 Product Code: 18		
	Hevision: 2.21 Serial Number: 0003F34D		
	Faults: Minor Recoverable Fault		
	OK Cancel Arrity Help		

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

<ol> <li>Right-click the 1756-DHRIO module to see the menu.</li> <li>Click Edit Module.</li> </ol>	1756-DHRID Configuration     ? ×       General     DHRID Routing Table     Channel Configuration       Backplane [Link Undefined]        Channel A - DH     Add Module       Channel B - DH     Edd Module       Delete Module     Delete Module
	Edit Module     ? ×       Module Information     Type:     1756-DHRIO       Slot Number:     ?     *       Link ID(s)     *     *       Channel A:     10     *       Channel B:     ?0     *       OK     Cancel     Help

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

# IMPORTANT

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

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



Click OK.

The software prompts you to download routing table changes.



Click OK.

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

#### **Configure the Controller Slot**

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

	1756-DHRIO Configuration General DHRIO Routing Table Channel Configuration	? ×
	Channel A Channel Type: DH+ Restore Defa Baud Rate: 57.6 kbps	aults
1. Change the Controller ——— slot.	Node Address: 3	
2. Click OK.	Channel B Channel Type: DH+ Restore Defa Baud Rate: 57.6 kbps	aults
	Node Address: 4 Controller Stot 2	
	OK Cancel Apply	Help

### Use RSLinx Software to Send Control and Information Protocol Messages

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

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



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



### **Use RSLogix 5**

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

IMPORTANTThis section offers a brief description of how to send a message via<br/>RSLogix 5 software. For a full description of how to use the software, see<br/>the online help.

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



1	
	*# RSLogix 5 - Rslogix5.rsp 📃 🗖 🗖
	Eile Edit View Search Comms Iools Window Help
	□ ☞ 문 ● ※ ħ № ♥ ♀ ● →
Click here to add	
a MSG.	No Edits Forces Disabled B Forces D For
	Driver: [unknown] Node: 10
	R RSLOGIX5.RSP EX KLAD 2
	P-S Project
	Controller Properties 0001
	- D Processor Status
	IO Configuration
	⊕ ₩ Channel Configuration
	Passwords and Privileges
	Program Files
	SYS0.
	B3-BINARY

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

5. Change the MSG instruction Control.



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



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

#### Studio 5000 Environment DH+ Application Example

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

41363



Rockwell Automation Publication 1756-UM514C-EN-P - June 2014

### **Use RSLogix 500**

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

IMPORTANTThis section offers a brief description of how to send a message via<br/>RSLogix 500 software. For a full description of how to use the software, see<br/>the online help.

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



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



of N7:20.

- 법 RSLogix 500 Rslgx500 \_ 🗆 × <u>S</u>earch <u>I</u>ools Window Help • % % 🕅 🕑 🔍 🔍 🗗 🔸 BTR BTW IIM IOM SINC MSG IIE IID RMP OFFLINE ▲ No Forces \* Node: 1o RPI REI ▶ No Edits 🛃 Forces Disabled 🛃 User & Bit & Timer/Counter > Input/Output & Compare Driver: (unknown) - □ × 添LAD 2 🙀 Rsigx: - (Π X ⊡- 🔄 Project i - 🦳 Help **^** (EN) Read/Write Message 0000 Peer-To-Peer Read 500CPU <u>Remote</u> 20 Type Read/Write Target Device Local/Remote Controlle (DN) Controller Properties -(ER) Type the new Control Local/Remote Control Block Length Setup Screen IO Configuration
   Grannel Configuration 14 e e e e value here. This example uses a Control (END) 0001 / LAD 2 -Data Files 00 - OUTPUT File 2 • 2:0000 APP RE For Help, press F1
- 5. Change the MSG instruction Control.

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



#### **RSLogix 500 DH+ Application Example**

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



19765

# Use the Studio 5000 Environment

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

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

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



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



- N RSLogix 5000 DH [1756-L55] Ele Edit View Search Logic Communications Iools Window Help - 🗆 × - <u>\*\*</u>\*\* • • • • • • Offline Path: <none> - \* L\$-No Forces H Harl Harl Miss GSU SSU
   Favorites (Bit ( Timer/Counter Input/Output Compare No Edits Controller DH
  Controller Tags
  Controller Fault Handler
  Controller Fault Handler
  Tasks
  MainTask
  GMainTask
  GMainTask \_ 🗆 × 🗎 MainProgram - MainRoutine\* 雨 雪易 🖻 MSG -Message Message Conter e e 0 1. Right-click the question mark (?) the a 🕅 e New Tag. Source State Stress Stres menu. Ctrl+X Ctrl+C Cut Instruction ē 2. Click New Tag. Copy Instruction (End) Ctrl+V Delete Instruction Add Ladder Element. Edit Instruction Edit Main Operand D Del Alt+Ins Enter <u>G</u>o To.. Ctrl+G 1/0 Configuration --MainRoutine\* / न • Rung 0 of 1 APP VER Program
- 5. Add a new tag to the MSG instruction.

6. Name and define the new tag.

	New Tag	2	1
1. Name the tag	Name:	DH_Write_MSG OK	
2. Make sure this tag is of the	Description:	Cancel	
MESSAGE type.		- Help	
	Tag Type:		
		C Alias	
		C Produced 1 Consumers	
	<u> </u>	C Consumed	
	Data <u>T</u> ype:	MESSAGE Configure	
	Scope:	DH(controller)	
	Style:	7	

7. Access the message type configuration and communication parameters.

	器 RSLogix 5000 - DH [1756-L55]	
	<u>File Edit View Search Logic Communications</u>	Iools Window Help
		<u>- 2825 - 29</u>
	Offline . FRUN	Path: <none></none>
	No Edits	
	Redundancy 0-0	Favorites (Bit ( Timer/Counter ) Input/Output ( Compare
Double-click the ellipsis () button	Controller DH Controller Tags Controller Tags Pover-Up Handler Tasks GMainPogram Program Tags Program Tags MainPoulain Molion Groups Molion Groups Molion Groups Data Types Data Types Predsined Module Defined Module Defined Discretioned to contained in the monor	Image: Control     Image: Control       Image: Contro     Image: Contro<

8. Change the message configuration.

	Message Configuration - DH_Write_MSG
	Configuration* Communication Tag
<ol> <li>Choose the Message Type from the</li></ol>	Message Type: PLC5 Typed Write Source Element: Send_Data Number Of Elements: 20 Destination Element: N7:0
written.	
4. Type the Destination Element. In this example, the Destination Element is a PLC-5 data table.	Error Code: Extended Error Code:      Timed Dut      Error Path:     Error Text:
	OK Cancel Apply Help

- If you create a Tag, you must: New Tag X 1. Name the tag. Name Send\_Data OK 2. Make sure the Data Type is Integer 4 Description Cancel (INT). Help Tag Type: • Base Alias Produced Consumed Data Type IN Scope: • DH(controller) Style • Decimal
  - 9. Set the communication path for the message instruction.

	Message Configuration - DH_Write_MSG
	Configuration* Communication Tag
1. Set the path. For DH+ applications, the	Pater 1, 3 Browse
number order must match the	1,3
ControlLogix chassis backplane (1) and	Communication Method
the slot number of the local 1756-DHRIO	O LIP O DH+ Enannet: A Destination Link:
and 1756-DHRIOXT modules.	C CIP With Source Link: 0 🚖 Destination Node: 15 🖆 (Octal)
2. Select the DH+ Communication	Connected Cache Connections
Method.	
3. Enter the information from the routing	
table for this module.	
	○ Enable ○ Enable Waiting ○ Start ○ Done Done Length: 0
	O Error Code: Extended Error Code: ☐ Timed Out ←
	Error Path: Error Text:

#### Studio 5000 Environment DH+ Application Example

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



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

Image: Stopping S	utine)
Predundance     Image: Controller Tags       Controller Tags     Image: Controller Tags       Image: Controller Tags     Image: Controller Tags   <	writes (LET ( Imer/Counter ( Input/Colput ( Compare
View Tag Configuration Dialog	INTERNAL STATE ST

#### **Configuration Pop-Up Dialog Box**

#### lessage Configuration - DH\_Write\_MSG × Configuration Communication\* Tag PLC5 Typed Write ¥ Message <u>T</u>ype: Send\_Data -Source Element: Ne<u>w</u> Tag... \* Number Of Elements: 20 Destination Element: N7:0 ⊖ Enable ⊖ Enable Waiting 🔿 Start O Done Done Length: 0 O Error Code: Extended Error Code: 🔲 Timed Out 🗲 Error Path: Error Text: OK Cancel Apply Help

1 represents the ControlLogix backplane (as the message leaves the ControlLogix controller) **Communication Pop-Up Dialog Box** 



Rockwell Automation Publication 1756-UM514C-EN-P - June 2014

# **Define Connection Paths**

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

The following steps construct a communication path:

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

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

Each path segment contains two numbers: x,y

Where:

This	ls	
X	number of the type of port you	use to exit from the module you are at:
	0 DH+ port from a KT car	d
	1 backplane from any 175	56 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 17	56-ENET module
	2 DH+ port over channel	A from a 1756-DHRIO or 1756-DHRIOXT module
	3 DH+ port over channel	B from a 1756-DHRIO or 1756-DHRIOXT module
,	separates the first number and	l second number of the path segment
у	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:

Port 3 = Channel B = Node 026

Network	Example	Description
serial	Programming terminal to controller module in logical	Configure DF1 driver.
	rack.	Leave connection path blank.
	Use DF1	
	Upload logic from local controller (controller is directly connected to the programming terminal).	
	Programming terminal to controller module in remote	Configure the DF1 driver.
	rack.	Enter connection path: 1,0,2,42,1,9
	Use DF1 (connected to controller in local rack)	1 = backplane port of the ControlLogix controller in slot 6 of the local chassis
	Use ControlNet to bridge to remote 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	Configure the ControlNet driver.
	chassis.	Enter connection path: 2, 49, 1, 0, 2, 42, 1, 9
	Use ControlNet throughout the system.	2 = ControlNet port of the KTC communication card in the workstation
		49 = ControlNet node of the 1756-CNB module in slot 7 of the local chassis
		1 = backplane port of the 1756-CNB module in slot 7 of the local chassis
		0 = slot number of the 1756-CNB module in the local chassis
		2 = ControlNet port of the 1756-CNB module in slot 0 of the local chassis
		42 = ControlNet node of the 1756-CNB module in slot 0 of the remote chassis
		1 = backplane port of the 1756-CNB module in slot 0 of the remote chassis
		9 = slot number of the controller in the remote chassis
Ethernet	Programming terminal to controller module in remote	Configure the Ethernet driver.
	rack.	Enter connection path: 1, 1, 2, 127.127.127.12, 1, 9
	<b>IMPORTANT</b> : Connection path excludes path segment	1 = backplane port of the 1756-ENET module in slot 8 of the local chassis
	module in local chassis because Ethernet driver is	1 = slot number of the other 1756-ENET module in the local chassis
	configured for the Ethernet module in the local chassis.	2 = Ethernet port of the 1756-ENET module in slot 1 of the local chassis
	Bridge across Ethernet	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.	Configure the DH+ driver.
	Go from DH+ to the local chassis.	Enter connection path: 0, 8#37, 1, 0, 2, 42, 1, 9
	Bridge to the remote chassis over ControlNet.	0 = DH+ port of the KT communication card in the workstation
		8#37 = octal DH+ node of the 1756-DHRIO or 1756-DHRIOXT module in slot 9 of the local chassis
		1 = backplane port of the 1756-DHRIO or 1756-DHRIOXT module in slot 9 of the local chassis
		0 = slot number of the 1756-CNB module in the local chassis
		2 = ControlNet port of the 1756-CNB module in slot 0 of the local chassis
		42 = ControlNet node of the 1756-CNB module in slot 0 of the remote chassis
		1 = backplane port of the 1756-CNB module in slot 0 of the remote chassis
		9 = slot number of the controller in the remote chassis
	Program the controller in slot 9 of the remote chassis.	Configure the DH+ driver.
	Go from DH+ to the local chassis.	Enter connection path: 0, 8#37, 1, 2, 3, 8#24, 1, 9
	Bridge across DH+ to the remote controller.	0 = DH+ port of the KT communication card in the workstation
		8#37 = octal DH+ node of the 1756-DHRIO or 1756-DHRIOXT module in slot 9 of the local chassis
		1 = backplane port of the 1756-DHRIO or 1756-DHRIOXT module in slot 9 of the local chassis
		2 = slot number of the other 1756-DHRIO or 1756-DHRIOXT module in the local chassis
		3 = Channel B of the 1756-DHRIO or 1756-DHRIOXT module in slot 2 of the local chassis, configured for DH+
		8#24 = DH+ node of the 1756-DHRIO or 1756-DHRIOXT module in slot 2 of the remote chassis
		1 = backplane port of the 1756-DHRIO or 1756-DHRIOXT module in slot 2 of the remote chassis
		9 = slot number of the controller in the remote chassis
ControlNet	Use several network connections across different network	Configure the DF1 driver (to handle worst case performance)
Ethernet	bridges:	Enter connection path: 1, 0, 2, 42, 1, 1, 2, 21.21.21.21, 1, 2, 2, 8#25, 1, 9
DH+	• DFT (connected to controller module in local rack)	1 = backplane port of the ControlLogix controller in slot 6 of the local chassis
	ControlNet to the remote chassis	0 = slot number of the 1756-CNB module in the local chassis
	Ethernet back to the local chassis	2 = ControlNet port of the 1756-CNB module in slot 0 of the local chassis
	DH+ back to the remote chassis	42 = ControlNet node of the 1756-CNB module in slot 0 of the remote chassis
		1 = backplane port of the 1756-CNB module in slot 0 of the remote chassis
		1 = slot number of the 1756-ENET module in the remote chassis
		2 = Ethernet port of the 1756-ENET module in slot 1 of the remote chassis
		21.21.21.21 = IP address of the 1756-ENET module in slot 1 of the local chassis
		1 = backplane port of the 1756-ENET module in slot 1 of the local chassis
		2 = slot number of the 1756-DHRIO or 1756-DHRIOXT module in the local chassis
		2 = Channel A of the 1756-DHRIO or 1756-DHRIOXT module in slot 2 of the local chassis, configured for DH+
		8#25 = DH+ node of the 1756-DHRIO or 1756-DHRIOXT module in slot 2 of the remote chassis
		1 = backplane port of the 1756DHRIO or 1756-DHRIOXT module in slot 2 of the remote chassis
		9 = slot number of the controller in the remote chassis

# Messaging Between PLC-5 and SLC 5/04 Controllers

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

Торіс	Page
DH+ Messaging: PLC-5 Controllers with One 1756-DHRIO	68
DH+ Messaging: SLC 5/04 Controllers with Two Modules in One ControlLogix Chassis	70
DH+ Messaging: PLC-5 Controllers with Multiple ControlLogix Chassis	73
DH+ Messaging: PLC-5 to PLC-5/C Controllers on the ControlNet Network	77

IMPORTANT

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

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

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

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



#### **Configure the Module Switches**

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

#### Configure a Routing Table for the 1756-DHRIO Module

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



# **Configure Message Instructions**

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

Instructor Communication Command: [ Data Table Address: Size in Elements: Port Number [ Target Device Data Table Address: Local DH+ Node (Dotal): Local J H+ Node (Dotal): Local J Hemote: Remote Link Type: Remote Bridge Link ID: [	PLC-5 Typed Write N7:15 10 11 10 10 Remote Data Highwey 25 2	Control bits     Control bits     To be retried (NR) [0]     Awaiting Executions [EwY] [0]     Continuous Run (C0) [0]     Error (ER) [0]     Message Control (DN) [0]     Message Erransmitting (ST) [0]     Message Erransmitting (ST) [0]     Error     Error     Error Code(Hex) [0]
Error Description		

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

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

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



#### **Configure the Module Switches**

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

#### Configure a Routing Table for the 1756-DHRIO Modules

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



TIP

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

#### **Configure Message Instructions**

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

eneral This Controller Communication Command : Data Table Address: Size in Elements: Channel: Target Device Message Timeout : Data Table Address: Local Bridge Addr (dec) Remote Bridge Addr (dec) Remote Bridge Link ID:	500CPU Read N7.10 1 0 5 5 20 (octa): 0 Remote 0 25 2 2	Control Bits Ignore if timed out (T0) ① Availing Execution (EW) ① Continuous Run (C0) ② Error (ER) ① Message Cons(DN) ① Message Transmitting (ST) ② Message Enabled (EN) ① Waiting for Queue Space : ③ Error Error Code(Hex): ①
Error Description No errors		

#### IMPORTANT

RSLogix 500 software displays Nodes and link IDs in decimal. Also, in this application, a remote bridge address is not required.
## DH+ Messaging: PLC-5 Controllers with Multiple ControlLogix Chassis

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

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



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

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



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

### **Configure Routing Tables for the Modules**

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



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

1756-DHF	310 Configuration	? ×
General	DHRIO Routing Table Channel Configuration	
	Bockslone [Link Undefined] ☐ 17560HRI0 - Siot 0 Channel 8 - DH+ [Link 3] ☐ 1756CNB - Siot 3 CNET [Link 2]	
Load	From File Save to File Restore Defaults Refresh	] [
	OK Cancel Apply Hei	p

## **Configure Message Instructions**

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

This Controller Communication Command : Data Table Address: Size in Elements: Channel: Target Device Message Timeout : Data Table Address: Local Arlenge Addr (dec): Local / Remote : Remote Bridge Address (dec): Remote Bridge Link (De	500CPU Read N7:10 20 5 N9:20 8 (octal) 10 Remote 0 0 3	Control Bits Ignore 4 timed out [T0] ① To be retried (NR) ② Awaing Execution [EW] ③ Emor(ER) ③ Message done [DN] ③ Message framitting [ST] ③ Message framitting [ST] ③ Massage Enabled [EN] ③ Waiting for Queue Space : ③ Einor Error Code(Hex): ③
Error Description		

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

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

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



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

### Configure a Routing Table for the 1756-DHRIO Module

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

1756-DHF	10 Configuration	? ×
General	DHRIO Routing Table Channel Configuration	
	Backplane [Link Undefined]           ① T756 DHRID - Slot 0           Charnel 8 - DH+ [Link 1]           Charnel 8 - DH+ [Link Undefined]           ① 1756 CN8 - Slot 3           O CNET [Link 2]	
Load	From File Save to File Restore Defaults Refresh	
	OK Cancel Apply Hel	p

### **Configure Message Instructions**

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

The PLC5     Communication Command: PLC5 Tog     Data Table Address: N7.15     Size in Elements: 10     Port Number: 1A     Target Device     Data Table Address: N10:0     Local DH+ Node (Octal)     Local / Remote: Remote     Remote Link Type: Data High     Remote Bridge Link ID: 2	Control Bits To be retried (11) [0] To be retried (11) [0] Awaiing Execution (EW) [0] Continuous Run (20) [0] Error (ER) [0] Message den (EN) [0] Message Enabled (EN) [0] Error Error Error Code(Hex): 0
rror Description No errors	

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

## What This Chapter Contains

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

Торіс	Page
DH+ Messaging: PLC-5 Controllers to One ControlLogix Controller with One ControlLogix Chassis	80
DH+ Messaging: PLC-5 to Multiple ControlLogix Controllers in One ControlLogix Chassis	83
DH+ Messaging: SLC 5/04 to a ControlLogix Controller with Multiple ControlLogix Chassis	85

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

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

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

IMPORTANT

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



default slot (0) of the ControlLogix chassis.

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

### Configure a Controller Slot for the 1756-DHRIO Module

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



#### IMPORTANT

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

## **Configure Message Instructions**

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

	Ine PLL-5 Communication Command: PLC-5 Typed With Data Table Address: N7:15 Size in Elements: 10 Port Number: 1A Target Device Data Table Address: N10:0 Local DH+ Node (Octal): 10 Local / Remote: Local	e Control sits I gnore if timed out (T0) ① To be retried (NR) ① Awaiting Execution (EW) ① Continuous Run (C0) ① Error (ER) ① Message Transmitting (ST) ① Message Transmitting (ST) ② Error Error Code(Hex): ①
--	---	--

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

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

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

In this example, we use local and remote DH+ messaging to send DH+ IMPORTANT messages. Local DH+ messaging is used to send a message to ControlLogix controller A. This processor must be configured as the controller slot. Remote DH+ messaging is used to send a message to ControlLogix controller B. Separate message instructions must be configured in RSLogix 5 software for each ControlLogix controller.



DH+Link Link ID 1

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

### **Configure a Controller Slot for the Module**

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



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

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

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



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

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

### Configure a Routing Table for the Module

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



## **Configure Message Instructions**

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

🔀 MSG - Rung #2:0 - N7:0	_ 🗆 ×
General	1
This Controller       500CPU Read         Data Table Address       11/210         Size in Elements:       20         Channet:       0         Target Device       Message Timeout:         Message Timeout:       5         Data Table Address:       19/20         Local Bridge Address:       10         Local Bridge Address:       (ect)         Remote Bridge Address:       (ect)         Remote Station Address (dec)       0         Remote Station Link ID:       3	Control Bits [groue if limed out (TO); 0 To be retited (NR); 0 Awaiting Execution (EW); 0 Continuous Run (CO); 0 Error (ER); 0 Message done (DN); 0 Message Chabled (EN); 0 Wessage Enabled (EN); 0 Waiting for Queue Space : 0 Error Error Code(Hex); 0
Error Description	

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

## Notes:

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

## What This Chapter Contains

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

Торіс	Page
Local DH+ Messaging: ControlLogix Controller in One Chassis to a PLC-5	90
DH+ Messaging: ControlLogix Controller to a SLC 5/04 Controller over ControlNet and DH+ Networks	92

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

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

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

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



41284

IMPORTANT	When you are using local DH+ messaging between a ControlLogix controller and a PLC controller, you <b>do not need</b> a routing table. The default setting on the module out of the box is to have no routing table configured.
	However, if a routing table is programmed, verify it is programmed correctly or a configuration fault can occur.
	Also, controller slot values for channels that are configured for DH+ are applied or restored to default value, by using the software tabs. Failure to enter the correct value generates a configuration fault for that channel.

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

## **Configure Message Instructions**

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

**Configuration Tab** 

**Communication Tab** 

Configuration Communication* T	ag		
Message <u>Type</u> : PLC5 Type	d Write	F	
Source Element: Send_Data	•		Ne <u>w</u> Tag
Number Of Elements: 20	3		
Destination Element: N7:0			
) Enable () Enable Waiting	⊖ Start ⊖ Do	ne Done Length: (	
) Enable 🔾 Enable Waiting ): Error Code: Extended	◯ Start ◯ Do 1 Firm Code:	ne Done Length: I	) }
) Enable ◯ Enable Waiting ) Error Code: Extender ror Path: ror Text:	⊖ Start ⊖ Do d Error Code:	ne Done Length: I	) •

Message Configuration	- DH_Write_MSG		×
Configuration Communi	cation* Tag		
Path: 1,3			<u>B</u> rowse
Communication Metho CIP ⊙ D <u>H</u> +	d <u>C</u> hannel: 'A'	Destination Link	e 1 芸
C CIP With Source ID	Source Link: 0	Destination Not	de: 15 🔅 (Octal)
Connected	🔽 Cach <u>e</u> (	Connections 🔶	
O Enable O Enable	Waiting 🔾 Start	O Done [	)one Length: 0
<ul> <li>Error Code:</li> <li>Error Path:</li> <li>Error Text:</li> </ul>	Extended Error Code:	1	Timed Out 🕈
	OK	Cancel	Apply Help

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

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

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



41287

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

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

### **Configure a Routing Table for the Module**

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



## **Configure Message Instructions**

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

#### **Configuration Tab**

Message Configuratio	n - DH_Wri	te_MSG			×
Configuration Commu	nication*   T	ag			
Message <u>T</u> ype:	PLC5 Type	ed Write	•	]	
Source Element:	Send_Data	i	-		Ne <u>w</u> Tag
Number Of Elements:	20	÷			
Destination Element:	N7:0				
0.5.11.0.5.11	5.2.11	0.00	0.0	<u> </u>	
⊖ Enable ⊖ Enabl	e waiting	⊖ start	O Done	Done Lengtr	r: U
O Error Code:	Extende	d Error Code:		Timed O	ut 🗲
Error Path: Error Text:					
		OK	Cancel	Apply	Help

#### **Communication Tab**

Message Configuration - DH_Write_MSG	×
Configuration Communication* Tag	
Path: 1, 3 1, 3	Browse
Communication Method C CIP ● DH+ @hannet A C CIP With Source ID Source Link: 2 ===================================	Destination Link:     4
Connected 🔽 Cache C	ionnections 🔶
⊖ Enable ⊖ Enable Waiting ⊖ Start	🔾 Done 🛛 Done Length: 0
O Error Code: Extended Error Code: Error Path: Error Text:	Timed Out +
OK	Cancel <u>Apply</u> Help

## **Messaging Between ControlLogix Controllers**

## What This Chapter Contains

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

Торіс	Page
CIP Messaging Between ControlLogix Controllers over One Link	95
CIP Message Routing Between ControlLogix Controllers over Two Links	97

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

## CIP Messaging Between ControlLogix Controllers over One Link

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



41419

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

## **Configure Message Instructions**

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

**Configuration Tab** 

~		
Comm	unication	Tah
COLLIN	unicación	IUD

Message Configuration - Write_Data	Message Configuration - Write_Data
Configuration* Communication* Tag Message Type: CIP Data Table Write Source Element: Send_Data Number Of Element: 1 Destination Element: N10.0	Configuration*       Communication*       Tag         Patr.       1.3.3.30.1.0       Browse         1.3.3.3.0.1.0       Communication Method       Communication Method         © CP       C D±+       Drannet       Destination Link:         © COP       Connected       Image: Connections       Connected
○ Enable     ○ Enable Waiting     ○ Start     ○ Done     Done     Length: 0       ○ Error Code:     □ Timed Out ◆       Error Path:       Error Text:         ○K     Cancel     Apply     Help	○ Enable     ○ Enable Waiting     ○ Start     ○ Done Length: 0       ○ Error Code:     Error Code:     □ Timed Dut ◆       Error Path:     Error Text:

IMPORTANT

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

## CIP Message Routing Between ControlLogix Controllers over Two Links

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

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



41420

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

### **Configure Message Instructions**

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

Configuration* Com	munication"   1   CIP Data T	ag ] able Write		<b>.</b>		1	
Source Element:	Send_Data		¥		Ne <u>w</u> Tag	1	
Number Of Element	: 1 <u>-</u>	-					
	Luce e						
Destination Element	N10:0						
Destination Element	N10:0						
Destination Element	N10:0						
Destination Element	: N10:0	O Start	O Done	Done Length	r. 0		
Destination Element	: N10:0 ble Waiting Extender	) Start d Error Code:	) Done	Done Length	r: 0 .t.€		

Configuration* Communica	tion* Tag		
Path: 1.3.2.40.3.60.1.	0		Browse
1, 3, 2, 40, 3, 60, 1,	0		
Communication Method-	annel:	Destination	Link: 0 👘
C CIP With Source ID Source ID	urce Link: 0	- Destination	Node: 0 🔆 (Octal
M Ugrmected	♥ Lachg		
	aiting 🔿 Start	O Done	Done Length: 0
○ Enable ○ Enable Wa			
<ul> <li>Enable</li> <li>Error Code:</li> <li>Error Path:</li> <li>Error Text:</li> </ul>	Extended Error Code:		🔲 Timed Out 🗲

**Communication Tab** 

IMPORTANT

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

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

## What This Chapter Contains

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

Topic	Page
Introduction to Remote I/O	100
Select Devices that You Can Connect	101
Design a Remote I/O Network	102
Module Operation in a Remote I/O Application	104
Remote I/O Scanner Status	106
Adapter Module I/O	107
Configure the Data Exchange Rate Between the Modules and a Controller	108
Remote I/O Scanner Fault Notification	110
Remote I/O Adapter Failure Notification	111
Inhibit the Module Connections	111
Inhibit an Remote I/O Connector Adapter	111
Increased Remote I/O System Throughput	112

## Introduction to Remote I/O

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

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



PLC-5 channel or a processor operating as a remote I/O adapter

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

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

## Select Devices that You Can Connect

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

Category	Product	Cat. No.
Other Processors	enhanced PLC-5 processors	1785-LxxB
(in adapter mode)	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-ххх
	PanelView Terminal	2711-ххх
Drives	Remote I/O Adapter for 1336 AC Industrial Drives	1336-RIO
	Remote I/O Adapter for 1395 AC Industrial Drives	1395-NA

**Design a Remote I/O Network** Designing a remote I/O network requires applying network and cable design guidelines.

### Network Design Guidelines

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

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

### **Cable Design Guidelines**

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

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

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

### **Trunk Line/Drop Line Considerations**

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

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

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

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

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

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

# Module Operation in a Remote I/O Application

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



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

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

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

### Exchange I/O Data Between the Module and Adapters

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

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

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

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

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

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

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

## I/O Configuration Tree in Studio 5000 Environment Controller Organizer

The I/O configuration tree in the Studio 5000 environment Controller Organizer specifies the connections to the 1756-DHRIO or 1756-DHRIOXT module and generates the adapter list of the 1756-DHRIO or 1756-DHRIOXT modules to scan. The 1756-DHRIO and 1756-DHRIOXT modules entry in the I/O configuration tree specifies the status connection between the scanner function on the 1756-DHRIO or 1756-DHRIXOT module and the ControlLogix controller.

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

TIP

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

## Remote I/O Scanner Status

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

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

## Adapter Module I/O

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

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

Each entry includes the following:

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

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

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

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

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

## Configure the Data Exchange Rate Between the Modules and a Controller

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

### Requested Packet Interval (RPI)

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

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

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

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

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

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

### **Configure the Baud Rate**

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

- 57.6Kbaud
- 115.2Kbaud
- 230.4Kbaud

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

- 8ms/adapter @ 57.6Kbaud
- 5ms/adapter @ 115.2Kbaud
- 3ms/adapter @ 230.4Kbaud
To determine the RPI for all Controller Organizer entries, use the graphs in the following figure.

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

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



8

16 24 32 40 48

41463

**Operating RPI rate** 

# Remote I/O Scanner Fault Notification

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

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

The ControlLogix controller also performs one of the following scenarios:

- ControlLogix controller faults, if the 1756-DHRIO module has been configured for a major fault to occur on the controller if communication fails.
- ControlLogix controller does not fault, if the 1756-DHRIO or 1756-DHRIOXT module has not been configured for a major fault to occur if communication fails. In this case, the ControlLogix controller repeatedly attempts to reestablish communication with the 1756-DHRIO or 1756-DHRIOXT module.
- TIP
- The update rate for the data exchange is set to go at the minimum RPI set for the data flow between the ControlLogix controller and the remote I/O adapters. This guarantees the scanner quickly terminates remote I/O network communication if the 1756-DHRIO or 1756-DHRIOXT module loses data flow from the ControlLogix controller.

Remote I/O Adapter Failure Notification	<ul> <li>The speed at which the ControlLogix controller is notified that a remote I/O adapter faulted is directly related to the RPI. The fault, known as a connection timeout, occurs at four times the RPI. For example, if the RPI is set at 25 ms and a fault occurs, the ControlLogix controller is not notified for 100 ms.</li> <li>A remote I/O adapter fault notification occurs whenever the communication between the remote I/O scanner (Channel A or B) and a remote I/O adapter is interrupted or the communication between the 1756-DHRIO or 1756-DHRIOXT module and the ControlLogix controller is interrupted.</li> <li>The Studio 5000 environment alerts you to a rack fault in at least one of the following ways: <ul> <li>nonzero condition in the <i>Rack Status</i> tag in the tag editor</li> <li>fault icon appears in the controller organizer</li> <li>connections page displays the fault type</li> </ul> </li> </ul>
Inhibit the Module Connections	When the inhibit bit is set for the 1756-DHRIO or 1756-DHRIOXT module, the connection between the ControlLogix controller and the 1756-DHRIO or 1756-DHRIOXT module is terminated. Although the 1756-DHRIO or 1756-DHRIOXT module connection is inhibited, the DHRIO scanner (Channel A or B) changes to program mode and continues to scan the remote I/O adapters on the remote I/O network. When inhibited, a 1756-DHRIO or 1756-DHRIOXT module accepts configuration from any ControlLogix controller in the control system. The 1756-DHRIO or 1756-DHRIOXT module connection can be inhibited on the module properties connection tab of the Studio 5000 environment.
Inhibit an Remote I/O Connector Adapter	When the inhibit bit is set for a remote I/O adapter connection, the connection between the ControlLogix controller and the remote I/O adapter is terminated. In this case, the 1756-DHRIO or 1756-DHRIOXT scanner (Channel A or B) continues to scan the remote I/O rack on the remote I/O network and switches the affected chassis of I/O into program mode. Only the ControlLogix controller that initiated the configuration of the 1756-DHRIO or 1756-DHRIOXT module can reestablish communication with the inhibited remote I/O adapter. RIO rack connections can be inhibited on the module properties connection dialog box of the Studio 5000 environment.

# Increased Remote I/O System Throughput

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

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

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

The following algorithms are used to calculate various update rates:

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

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

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

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

## What This Chapter Contains

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

Торіс	Page
Use the Studio 5000 Environment in Module Remote I/O Applications	113
Use the Studio 5000 Environment in 1756-DHRIO Module Block Transfer Applications	120

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

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

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

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

#### Add the Module

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



## **Configure the Module**

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

Module Prop	erties - Local:1 (1756-DHRIO/B 2.1)	X
Type: Vendor:	1756-DHRIO/B 1756 DH+ Bridge/RIO Scanner Allen-Bradley	
Na <u>m</u> e:	Scanner	
Description:	Sigt 1	
Parent:	Local	
	Type Baud Rate	
Channel <u>A</u> :	RIO 230.4K	
Channel <u>B</u> :	RIO 230.4K 💌	
<u>R</u> evision:	2 1 Electronic Keying: Compatible Module	
	Cancel <back next=""> Finish&gt;&gt; Help</back>	

<u>R</u> equested Packet I	nterval (RPI):	25.0 🛨 ms	(2.0 - 750.0 ms)		
🔲 Inhibit Module					
🔲 <u>M</u> ajor Fault On C	ontroller If Connec	tion Fails While i	in Run Mode		
Module Fault					

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.
	Туре	Application for each module channel. This field must be changed to RIO.
	Baud Rate	Rate of communication at which the 1756-DHRIO module scans the remote I/O. Available options are: 57.6K bps 115.2K bps 230.4K bps
	Revision	Minor revision of the 1756-DHRIO or 1756-DHRIOXT module.
	Electronic Keying	<ul> <li>Parameter that determines if the controller that owns the 1756-DHRIO or 1756-DHRIOXT module establishes a connection with the module. The options are: <ul> <li>Compatible Module - Controller attempts to establish a connection with any module in this slot that can emulate the configuration being sent from the controller.</li> <li>Disable Keying - Controller attempts to establish a connection to the module regardless of its type. This option is not recommended.</li> <li>Exact Match - Controller only attempts to establish a connection with the module if it matches the configuration parameters being sent from the controller.</li> </ul> </li> </ul>
Requested Packet	Parameter:	Definition:
(second screen):	Requested Packet Interval	User-defined rate (2750ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that lets you configure a 1756-DHRIO or 1756-DHRIOXT module but prevent it from communicating with the controller. In this case, the controller does not establish a connection until the module is uninhibited.
	Major Fault on Controller if Connection Fails in Run Mode	Use this feature to choose whether a major fault occurs on the controller if the connection between the controller and the 1756-DHRIO or 1756-DHRIOXT module fails.

## Add the Remote I/O Adapter

Add the remote I/O adapter to your project.



## Configure the Remote I/O Adapter

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

LIDO:	
Type.	1794-ASB 1794 Remote I/O Adapter
Vendor:	Allen-Bradley
Na <u>m</u> e:	FLEX_Adapter
Description:	× · · · · · · · · · · · · · · · · · · ·
Parent:	Scanner <u>R</u> ack # (octal): 0
Parent Channel:	ChannelB 💌 Starting <u>G</u> roup: 0 💌
	Size: 1/4-Back (21/D Groups)
	dier. In Frider (Einis Groups)
	Cancel < Black Next > Finish >> Help
odule Propertio <u>R</u> equested Pack Inhibit Modul	es - Scanner (1794-ASB 1.1) et Interval (RPI): 48.0 === ms (2.0 - 750.0 ms) e
odule Propertif Bequested Pack I Inhibit Modul Major Fault 0	es - Scanner <b>(1794-ASB 1.1)</b> et Interval (RPI): 48.0 == ms (2.0 - 750.0 ms) e in Controller If Connection Fails While in Run Mode
odule Propertion	es - Scanner (1794-ASB 1.1) et Interval (RPI): 48.0 == ms (2.0 - 750.0 ms) e n Controller If Connection Fails While in Run Mode
odule Propertii <u>R</u> equested Pack Inhibit Modul Major Fault O - Module Fault -	es - Scanner (1794-ASB 1.1) et Interval (RPI): 48.0 <sup></sup> ms (2.0 - 750.0 ms) e In Controller If Connection Fails While in Run Mode
odule Properti Bequested Pack Inhibit Modul Major Fault O Module Fault –	es - Scanner (1794-ASB 1.1) et Interval (RPI): 48.0 <sup></sup>
odule Propertit Bequested Pack Inhibit Modul Major Fault O Module Fault -	es - Scanner <b>(1794-ASB 1.1)</b> et Interval (RPI): 48.0 <sup>-++</sup> / <sub>-+</sub> ms (2.0 - 750.0 ms) e In Controller If Connection Fails While in Run Mode
odule Propertii Requested Pack I Inhibit Moduli Major Fault O Module Fault —	es - Scanner (1794-ASB 1.1) et Interval (RPI): 48.0 🚔 ms (2.0 - 750.0 ms) e n Controller If Connection Fails While in Run Mode
odule Properti Bequested Pack □ Inhibit Modul □ Major Fault 0 - Module Fault	es - Scanner (1794-ASB 1.1) et Interval (RPI): 48.0금 ms (2.0 - 750.0 ms) e in Controller If Connection Fails While in Run Mode
<mark>Bequested Pack ☐ Inhibit Modul <b>☐ Major Fault O</b> - Module Fault —</mark>	et Interval (RPI): 48.0 = ms (2.0 - 750.0 ms) e in Controller If Connection Fails While in Run Mode

Naming Screen (first screen):	Parameter:	Definition:
	Name	Module name. This field is required.
	Description	Optional description of the module.
	Parent Channel	1756-DHRIO or 1756-DHRIOXT module channel to which this adapter is connected.
	Rack Number (#)	Remote I/O rack number (in octal from 0-76)
	Starting Group	<ul> <li>First word of input/output from a given rack begins at group 0, 2, 4, or 6. For example, a system of 2 racks and 4 words of I/O can be:</li> <li>Rack 12, st grp 2, size 1/4</li> <li>Rack 12, st grp 6, size 1/4</li> </ul>
	Size	<ul> <li>Words of data are available for the given rack, including:</li> <li>1/4 rack = 2 words of input and 2 words of output</li> <li>1/2 rack = 4 words of input and 4 words of output</li> <li>3/4 rack = 6 words of input and 6 words of output</li> <li>Full rack = 8 words of input and 8 words of output</li> </ul>
Requested Packet	Parameter:	Definition:
interval Screen (second screen):	Requested Packet Interval	User-defined rate (2750ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that lets you configure the remote I/O adapter module but prevent it from communicating with the controller. In this case, the controller does not establish a connection until the adapter is uninhibited.
	Major Fault on Controller if Connection Fails in Run Mode	Use this feature to choose whether a major fault occurs on the controller if the connection between the controller and the 1756-DHRIO or 1756-DHRIOXT module fails.

## Download the Project to the Controller

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



#### **Edit Configuration**

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

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

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



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

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

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

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

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

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

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

#### Add the 1756-DHRIO or 1756-DHRIOXT Module

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



## **Configure the Module**

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

Module Prop	erties - Local:3 (1756-DHRIO/C 5.1)	X
Type: Vendor:	1756-DHRID/C 1756 DH+ Bridge/RIO Scanner Allen-Bradley	
Na <u>m</u> e:	Block_Transfer	
Descri <u>p</u> tion:	Sigt 3 🗮	
Parent:	Local	
	Type Baud Rate	
Channel <u>A</u> :	DH+ When using DH+ at 230K baud, only	
Channel <u>B</u> :	RIO 230.4K Channel A is active, Channel B is disabled	
<u>R</u> evision:	5 1 - Electronic Keying: Compatible Module	
	Cancel K Back Next > Finish >> Help	

<u>R</u> equested Pack	et Interval (RPI):	25.0 <u>+</u> ms (i	2.0 - 750.0 ms)	
🔲 Inhibit Modul	3			
🔲 <u>M</u> ajor Fault O	n Controller If Connec	tion Fails While in	Run Mode	
Module Fault				

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.
	Туре	Application for each module channel. This field must be changed to RIO.
	Baud Rate	Rate of communication at which the 1756-DHRIO or 1756-DHRIOXT module scans the remote I/O. Available options are: • 57.6K bps • 115.2K bps • 230.4K bps
	Revision	Minor revision of the 1756-DHRIO or 1756-DHRIOXT module.
	Electronic Keying	<ul> <li>Parameter that determines if the controller that owns the 1756-DHRIO or 1756-DHRIOXT module establishes a connection with the module. The options are:</li> <li>Compatible Module - Controller attempts to establish a connection with any module in this slot that can emulate the configuration being sent from the controller.</li> <li>Disable Keying - Controller attempts to establish a connection to the module regardless of its type. This option is not recommended.</li> <li>Exact Match - Controller only attempts to establish a connection with the module if it matches the configuration parameters being sent from the controller.</li> </ul>
Requested Packet	Parameter:	Definition:
Interval Screen (second screen):	Requested Packet Interval	User-defined rate $(2750$ ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that lets you configure a 1756-DHRIO or 1756-DHRIOXT module but prevent it from communicating with the controller. In this case, the controller does not establish a connection until the module is uninhibited.
	Major Fault on Controller if Connection Fails in Run Mode	Use this feature to choose whether a major fault occurs on the controller if the connection between the controller and the 1756-DHRIO or 1756-DHRIOXT module fails.

## Add the Remote I/O Adapter

Add the remote I/O adapter to your project.



## Configure the Remote I/O Adapter

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

Туре:	1794-ASB 1794 Remote I/O Adapter
Vendor:	Allen-Bradley
Va <u>m</u> e:	FLEX_Adapter
Descri <u>p</u> tion:	
Parent:	Scanner <u>R</u> ack # (octal): 0
P <u>a</u> rent Channel:	ChannelB 💌 Starting <u>G</u> roup: 0 💌
	Size: 1/4-Rack (21/0 Groups) 💌
	Cancel < Back Next > Finish >> Help
<b>dule Properti</b> <u>1</u> equested Pack	es - Scanner (1794-ASB 1.1) et Interval (RPI): 48.0 🚋 ms (2.0 - 750.0 ms) e
dule Properti 3equested Pack 1 Inhibit Modul Major Fault O	et Interval (RPI): 48.0 🚎 ms (2.0 - 750.0 ms) e n Controller If Connection Fails While in Run Mode
d <b>ule Propertii</b> }equested Pack ] Inhibit Modul <u>M</u> ajor Fault O - Module Fault —	et Interval (RPI): 48.0 🚎 ms (2.0 - 750.0 ms) e n Controller If Connection Fails While in Run Mode
dule Propertit }equested Pack hhibit Modul hajor Fault O Module Fault —	et Interval (RPI): 48.0 🚎 ms (2.0 - 750.0 ms) e n Controller If Connection Fails While in Run Mode
odule Propertit Requested Pack Inhibit Modul Major Fault O - Module Fault —	es - Scanner (1794-ASB 1.1) et Interval (RPI): 48.0 🚎 ms (2.0 - 750.0 ms) e n Controller If Connection Fails While in Run Mode
dule Propertia Bequested Pack Inhibit Modul Mojor Fault O Module Fault —	es - Scanner (1794-ASB 1.1) et Interval (RPI): 48.0 🚎 ms (2.0 - 750.0 ms) e n Controller If Connection Fails While in Run Mode
dule Properti Bequested Pack Inhibit Modul Major Fault D	et Interval (RPI): 48.0 ms (2.0 - 750.0 ms) e n Controller If Connection Fails While in Run Mode
dule Properti 3equested Pack 1 Inhibit Modul Major Fault 0 Module Fault -	es - Scanner (1794-ASB 1.1) et Interval (RPI): 48.0 = ms (2.0 - 750.0 ms) e n Controller If Connection Fails While in Run Mode
dule Properti Gequested Pack Inhibit Modul Major Fault O Module Fault	et Interval (RPI): 48.0 mm (2.0 - 750.0 ms) e n Controller If Connection Fails While in Run Mode

Naming Screen (first screen):	Parameter:	Definition:
	Name	Module name. This field is required.
	Description	Optional description of the module.
	Parent Channel	1756-DHRIO or 1756-DHRIOXT module channel to which this adapter is connected.
	Rack Number (#)	Remote I/O rack number (in octal from 076)
	Starting Group	<ul> <li>First word of input/output from a given rack begins at group 0, 2, 4, or 6. For example, a system of 2 racks and 4 words of I/O can be:</li> <li>Rack 12, st grp 2, size 1/4</li> <li>Rack 12, st grp 6, size 1/4</li> </ul>
	Size	<ul> <li>Words of data are available for the given rack, including:</li> <li>1/4 rack = 2 words of input and 2 words of output</li> <li>1/2 rack = 4 words of input and 4 words of output</li> <li>3/4 rack = 6 words of input and 6 words of output</li> <li>Full rack = 8 words of input and 8 words of output</li> </ul>
Requested Packet	Parameter:	Definition:
Interval Screen (second screen):	Requested Packet Interval	User-defined rate (2750ms) that determines the rate at which the module scans data from the remote I/O.
	Inhibit Module	Feature that lets you configure the remote I/O adapter module but prevent it from communicating with the controller. In this case, the controller does not establish a connection until the adapter is uninhibited.
	Major Fault on Controller if Connection Fails in Run Mode	Use this feature to choose whether a major fault occurs on the controller if the connection between the controller and the 1756-DHRIO or 1756-DHRIOXT module fails.

#### Add the Remote I/O Modules

Add the remote I/O modules to your project.



# Configure the Remote I/O Modules

Configure the newly added remote I/O modules.

ties - FLEX_Adapter (RIO-MODULE 1.1)
RID-MODULE Generic Remote I/O Module
Remote_FLEX_I0_module
FLEX_Adapter (0,0) 1/4-Rack (21/0 Groups)
0 *
Cancel < Back. Next > Finish >> Help

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

#### Create a Block Transfer (Read or Write) Message Instruction

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

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



3. Add a new tag to the MSG instruction.

	& RSLogix 5000 - DH [1756-L55]		
	Eile Edit <u>V</u> iew <u>S</u> earch Logic <u>Communications</u> <u>Tools</u> <u>Wi</u> ndow <u>H</u> elp		
		- <u>&amp;&amp;&amp;</u> -	18 22
	Offline	Path: <none></none>	- *
	No Edits A		Þ
	Redundancy by	Favorites (Bit ( Timer/Counter ) Input/Out	put Compare
	Controller DH	MainProgram - MainRoutine*	
	Controller Fault Handler		
1. Dight disk the question $mark(2)$ in	Tasks	0 e Message	
	A A A A A A A A A A A A A A A A A A A	e Message Conter	New Tag
the menu.	Program Tage	e	Cut Instruction Ctrl+X
2. Click New Tag.	MainBoutine		Copy Instruction Ctrl+C
	🗊 🕾 Motion Groups	(End)	Easte Uti+V
	Ungrouped Axes		Delete Instruction Del Add Ladder Element Altains
			Edit Instruction Enter
	E-Com Predefined		
	Module-Defined		<u>G</u> o To Ctrl+G
		MainRoutine* /	
	Program:	Run	g 0 of 1 APP VER

**4.** Name and define the new tag.

	New Tag		×
1. Name the tag.	Name:	BlockTransfer	OK
2. Make sure this tag is of the MESSAGE	Description:	<u> </u>	Cancel
type.		V	Help
	Tag Type:	<u>Base</u>	
		C Alias	
		C Produced 1 Consumers	
		C Consumed	
	Data <u>T</u> ype:	MESSAGE	Configure
	Scope:	Block_Transfer(controller)	
	Style:	7	

5. Access the message type configuration and communication parameters.

	背 RSLogix 5000 - Block_Transfer [*	1756-L55] - [MainProgram - Mainf	Routine*]	_ 🗆 ×
	i Eile Edit ⊻iew Search Logic C	Communications <u>T</u> ools <u>W</u> indow <u>H</u> e	əlp	_ 8 ×
		20	- <u>222</u>	Q.
Double-click the ellipsis () button.	Image: Second	Image: Second	Solution     Solution	
	III 1756-DHRIO/C dhrio	MainRoutine* /	Russ 0 of 1	

To create **Block Transfer Read** messages, see <u>step 6</u>. To create **Block Transfer** Write messages, see <u>step 8</u>.

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

	Message Configuration - BlockTransfer	×
	Configuration Communication Tag	
<ol> <li>Choose the Message Type from the pull-down list.</li> <li>Type the Number of Elements being written.</li> <li>Specify the Destination Element. You can:         <ul> <li>Choose an element from the pull- down (that is browse to the tag)</li> </ul> </li> </ol>	Message Type: Flock Transfer Read	New Tag)
or • Use the New Tag button to create the tag where data is read from on the remote module.	Cancel	Ine Length: 0 Timed Out +



7. Set the communication path for the message instruction.

1	Message Configuration - BlockTransfer
	Configuration* Communication* Tag
<ol> <li>Use the Browse button to select the path.</li> <li>Select the destination module for the message instruction.</li> <li>Click OK.</li> </ol>	Path: dhrio dhrio Module Address Module Address Path: dhrio Module Address Path: dhrine Module Address Path: dhrine Slot ControlNet Forum Path: dhrine Path:

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

	Message Configuration - Block_Transfer_Write
	Configuration Communication Tag
1. Choose the Message Type from the pull-down list.	Message Type:     ■       Source Element:
<ul> <li>Choose an element from the pull- down (that is browse to the tag)</li> </ul>	Number Of Elements: 16 🚔 (16-bit Integers)
or • Use the New Tag button to create	
the tag where data is written to on the remote module.	│ ◯ Enable ◯ Enable Waiting ◯ Start ◯ Done Done Length: 0
3. Type the Number of Elements being written.	⊖ Error Code: Extended Error Code:      □ Timed Out ← Error Path: Error Text:
	OK Cancel Apply Help

	New Tag
If you create a Tag, you must: 1. Name the tag. 2. Make sure the Data Type is Integer (INT).	Name: Analog_Wite_Data DK Description: Cancel Tag Type: © Base © Agas © Broduced Consumers
	C Contigue  Deta Jope:  Scope:  Block_Transfer(controller)  Style:

9. Set the communication path for the message instruction.



## Notes:

# Connecting a ControlLogix Controller to Remote I/O

# What This Chapter Contains

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

Торіс	Page
Scan Remote FLEX Adapters through One 1756-DHRIO or 1756-DHRIOXT Module in a Local 1756-Chassis	136
Scan Remote FLEX Adapters through Multiple 1756-DHRIO or 1756-DHRIOXT Modules in a Local Chassis	138
Scan 1771 Remote I/O Adapters through a 1756-DHRIO or 1756-DHRIOXT Module in a Remote Chassis	141

IMPORTANT	In these examples, only channel B is configured as a remote I/O scanner. You can configure the channels as remote I/O scanners simultaneously if necessary.
	If only one channel is configured as a remote I/O scanner, we recommend you use channel B. If you configure channel A as a remote I/O scanner, you cannot use the programming terminal on the front of the 1756-DHRIO and 1756-DHRIOXT modules for DH+ access.
	Also, throughout this chapter, we show sample configuration dialog boxes with each example. Configuration information is dependent on your application needs.

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

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

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



## **Configure the Module Switches**

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

## **Configure the Module**

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

line 0. E RUN	Module Properties - Local (1756-DHRI07C 5.1)	Module Properties - Local 3 (1756 DHB10/C 5.1)
Forces P DK Edit Bat Controller Tagi Controller Tagi	Type:         1756-DHHID/C 1755 DH+ Bidge/RID Scanner           Vendo::         Allen-Stradey           Nage:         Locol_DHRID           Description:         Image: Image           Stat:         3	Bequested Packet Interval (RPI) 250 곳 es. (20-750.0 m) 『 Inhibit Module 『 Mays Fault Dontroller II Connection Falls While in Bun Mode
Consider / aur Hander Power (U) Handler Carlos Carlos Main Task. Carlos Main Task. Carlos Main Groups Motion Groups Motion Groups Motion Groups	Parent Local Type Baud Rate Untern Long DH+ of Strenge Billion Deemel Billion Berkion: Deemel Billion Electronic (Seying Compatible Module	Module Fault
Trends Toda Types Typ	Cancel CB055 Nexts Finishiss Hep	Cancel (Back Next> Finith>>> Help

## **Configure the FLEX Adapter**

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



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

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

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



## **Configure the Module Switches**

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

## **Configure the First Module**

& RSLogix 5000 - Remote\_10 [1756-1

ST RSL onix 5000 - Rende 10 117564

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

Ele Edit Vew Search Logic Comm.		
Diffine D. FRUN No Forces F. FOK No Edits A FUC	Module Properties - Local (1756 DHBID/C 5 1)         32           Type:         1756 DHBID/C 1756 DH+ Bidge/RID Scanner           Vendor         Alm-Bradley           Mines         Fare INHOID	Module Properties = Local 2 (1756 0HRI0/C 5 1) X
	Decorption	Indian Koada     In Controller II Connection Fails While in Run Mode     Module Fault     Module Fault
Alicia Groups     Ungrouped Aves     Ungrouped Aves     Trends     Outra Types     Outra Type     Out	Berlaion Electorie Keying Computer Module Cancel Cancel Heb	Cancel CBack Next> Finish>>> Help

## **Configure the First FLEX Adapter**

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

te Edit View Search Logic Commu		
Iffline 0. E RUN	Module Properties - First_DHRI0 (1794-AS8 1.1)	Module Properties - First_DHRID (1794-ASB 1.1)
lo Edita BAT lo Edita BAT BAT BAT BAT BAT BAT BAT BAT	1 som     1754 ACGB 1758 Remote I/O Adapter       Verdoz:     Allen-Bladky       Nage:     Г.E.C., adapter_1       Description:	Becuented Packet Interval (RP)
- ST trends - St Dut Types - St Dut Configuration	Cancel (EVX Next) Frain(>>> Heb	Cancel <back next=""> Finith&gt;&gt;&gt; Heb</back>

🏽 RSLogix 5000 - Remote\_10 [1756-0

e 10 11756-

#### **Configure the Second Module**

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

Hilline D. F D(N) to Faces F. E OK DAT to E dis BAT F 1/0 Controller Remote, ID Controller Fages Controller Fages	Module Properties - Local (1256-DHRID/C.5.1)	Module Properties - Local 3 (1756 OHRID/C 5.1) 문 Bequested Packet Interval (PPI) [250 곳 es (20-750.0 ms) 다 [phibit Module 다 Maior Fault On Connection Fails While in Flun Mode
Power-Up Handler     Tasks     G MainTask     G MainTask     G MainTask     G MainTask     G MainTask     G Groups     Unscheduled Pograms     G Motion Groups     Ungrouped Aves	Parent         Type         Baud Rate           Overnel &         DH+         Image: Channel &         DH+ at 2000 baud, only 20	
Trends     Trends	Cancel Cancel Frish. Heb	Carcel <back next=""> Finith&gt;&gt; Hep</back>

## **Configure the Second FLEX Adapter**

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

ie Edit Vew Search Logic Comm.		
Hime	Module Properties - Secured_DHFII0 (1/24 ASB 1-1)     Image: T384 ASB 1784 Remote I/O Adapter       Vendoc     Alen-Braday       Nage:     TLC%, odgeter_2       Denciption:     Image: TLC%, odgeter_2       Parent:     Second_DHFII0       Parent:     Second_DHFII0       Parent:     Second_DHFII0       Statise gloop:     Image: T2/Resk (41/0 Groupe)	Module Properties - Secured_DHHID (1794.ASB 3.1)     Image: Comparison of the comparison of th

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

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



#### Configure the 1756-DHRIO or 1756-DHRIOXT Module Switches

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

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

#### **Configure First 1756-CNB Module**

oux 5000 - Remote 10 11756-

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

Offine PLAN Renote D Controller Face Plane Pla	Module Properties - Local (1756 CMB/0 5.1)
Innois	Concel (Dynk Next) Finals) Heb

## Configure the Second 1756-CNB Module

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

RSLogix 5000 - Remote_10 [1756-		
e Edit View Search Logic Commu		
fline ], E RUN	Module Properties - Local_CN8:3 [1756-CN8/D 5.1]	Module Properties - Local_CN8:3 (1756-CN8/0.5.1)
Forces by EOK Edes BAT F 1/0	Type: 1756 CNB/0 1756 ControlNet Bidge Viendor: Allerification Parent: Local_CNB Director CNB	Bequested Packet Interval (RPI) 50 글 mu (20 - 750.0 mu)
	Nage Prevol Cros Nage 13 Decoglare Data Stor 4 Stor 2 Stor 4	Majar Fault On Controller II Connection Fails While in Run Mode     Moduler Fault
MainTask     Break MainTask     Break MainProgram     Unscheduled Programs	Comer Comer (Frick Uptracionan Electronic Keylers Comparible Module	
Motion Groups     Ungrouped Axes     Trends		
Cata Types	Cancel Cases Next> Finish>> Heb	Cancel <back next=""> Finish&gt;&gt; Help</back>
Grand Presented     Grand Module Defined     Grand Module Defined		
E 1311756-CNB/D Local CNB		



E I III

#### Configure the 1756-DHRIO or 1756-DHRIOXT Module

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

Ele Edit View Search Logic Commu		
Diffue C A Host C C C C C C C C C C C C C C C C C C C	Module Propertiers - Local (1256-0H8ID/C-5-1)         20           Type         1766-0H8ID/C-1795-0H4-Bidge/RID Scanner           Vender         AderDitadey           *         Commerce Control	Module Properties - Remote_CNB 0 (1756 DHB10/C 5 1)
Controller Renote, [0     Controller Renote, [0     Controller Tags     Controller Fault Handler     Torks     Tarks     Renote (]p Handler     Renote (]p	Nage: preside_Dremot	Initial Mode     Mode In Connection Fails While in Run Mode     Mode Fault
Motion Groups     Motion Groups     Log Ungrouped Axes     Tends     Motion Groups     Log Ungrouped Axes     Tends     Motion Groups     MotionGroups	Bevision: Cancel Concostile Module Concostile Module Concostile Module Concostile Module Cancel Cancel News Finishass Help	Cancel <back next=""> Finish&gt;&gt;&gt; Heb</back>

& RSLogix 5000 - Remote\_10 [1756-

& RSLogix 5000 - Remote\_10 [1756-

#### Configure the 1771-ASB Adapter

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

ie For New Teacy Folic Found		
		11-0-1-0 Describes Describe D1010 (1971 400 5-1)
Controller Renote, ID     Controller Renote, ID     Controller Renote, ID     Controller Tags     Con	Tape     T21 ASB 1771 Rewale (0/ Adapter       Vendor:     Alen-Budday       Nage:     0. jconner       Description	Becausing Packet Interval (RPI)     ▲ 6 0 → mc     (2.0 - 750.0 mc)       Image Fault On Controller II Connection Fails While in Run Mode       Module Fault       Cancel     < Back
E Contra value		

#### Run RSNetWorx Software

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

# Notes:
# Block Transfers with the 1756-DHRIO or 1756-DHRIOXT Module

## What This Chapter Contains

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

Торіс	Page
Block Transfers to Remote FLEX I/O Modules through a 1756- DHRIO or 1756-DHRIOXT Module in a Local Chassis	147
Block Transfers to Remote 1771-ASB I/O Modules through a 1756-DHRIO or 1756-DHRIOXT Module in a Remote Chassis	150

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

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

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

## Block Transfer Fault Notification

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

Block Transfer 'Pass-Through' Messages	DH+ 'Block Transfer (BT) Pass-Through' messages are DH+ (PCCC) messages sent to an remote I/O channel, where it causes an remote I/O Block Transfer.			
	To target a DH+ 1756-DHRIO or message must be remote I/O chan	'BT Pass-Through' message to an remote I/O channel on a r 1756-DHRIOXT module, the final destination of the DH+ the 1756-DHRIO or 1756-DHRIOXT module with the nel.		
	In the case of Local DH+ Messaging, the bridging 1756-DHRIO or 1756-DHRIOXT module must have its default slot configured to match the location (slot) of the final destination 1756-DHRIO or 1756-DHRIOXT module (module with the remote I/O channel).			
	In the case of Remote DH+ Messaging, the destination link ID and destination node of the DH+ message must be set to the final destination 1756-DHRIO or 1756-DHRIOXT module (module with the remote I/O channel).			
	For example, if the target is an remote I/O channel on a 1756-DHRIO or 1756-DHRIOXT module in slot 5 of a ControlLogix chassis and remote DH+ messaging is used, the destination link ID is set to the ControlLogix chassis link ID and the remote destination node is set to 5.			
	IMPORTANT	To send DH+ 'Pass-Through' messages to a 1756-DHRIO or 1756-DHRIOXT module, the module must be configured with a routing table, as described in Chapter 2, even if the channels are configured for remote I/O.		
Block Transfer Examples				
	IMPORTANT	In the examples in this chapter, only channel B is connected to remote I/O. You can connect the channels to remote I/O simultaneously if necessary. If only one channel is connected to remote I/O, it is recommended that you use channel B. If you connect channel A to remote I/O, you cannot use the programming terminal on the front of the 1756-DHRIO or 1756-DHRIOXT module.		

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

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

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



#### **Configure the Module Switches**

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

#### Configure the 1756-DHRIO or 1756-DHRIOXT Module

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

	Module Properties - Local (1756.0HRIO/C 5.1)	Module Properties - Local 3 (1756 DHRIO/C 5-1)
o Edia → Dia Haritania DEdia → Dia Haritania Controler Fasiliander Controler Fasiliander Power Up Handler → Tanke → Tanke → ManiTask. → ManiTask. → ManiTask. → ManiTask.	Type: 1756-DHFRID/C 1756-DH+B Bidge/RID Scanner Vendor: Allen-Bladley Natter: Local_DHRID Description:	Becuested Packet Interval (RPI). 230 g m (2.0 - 750.0 m) [Initial Module Module Fault On Controller II Connection Fails While in Bun Mode Module Fault
Call Ungrouped Aves → Trends → Data Types → Bata Types → Call Sear Defined → Call Sear Defined → Call Deduced → Call Aves Defined → Call / Configuration	Eleman    1 = Lectron Exercise Module  Cancel Concuste Module  Finish >> Help	Cancel < Back Next > Finish >> Help

\* 5000 - DH [1756-L55]\*

## **Configure the FLEX Adapter**

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

Image:	
Offline         Image: Text of the state of the sta	
No Faces         ↓         □ 0.*           To Edits         ▲         □ D         1794 4/38 1794 Remote 1/0 Adapter           To Edits         ▲         □ D         Vendo:         Alter-Biadlay           Vendo:         Alter-Biadlay         □ pikkit Module         □ pikkit Module	X
Consider Total     Consider	reih >>Heb

#### **Configure the Block Transfer Module**

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



Type:	RID-MODULE Generic Remote I/O Module
Name	Block_Tsansfer_Module
Description	3
Parent Back	FLEX adapter (25.0) 1/2 Back (4 1/0 Groups)
Group	0
Sigt	0 =

## **Configure Message Instruction**

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

#### Configuration Tab

Message Configuratio	n - BlockTransfer			×
Configuration* Comm	unication* Tag			
Message <u>T</u> ype:	Block Transfer Read		-	
Number Of Elements:	8 👘 (16-bit Inte	egers)		
Destination Element:	AnalogData	-	Nev	v Tag
	a h failing 🔿 Chad	O Dana	Dena Lanathu O	
	ewaiting Ustait	O Done		
Error Code:	Extended Error Code:		📘 Timed Out 🗲	
Error Text:				
	OK	Cancel		Help

Message Configuratio	n - BlockT	ransfer				×	C
Configuration* Comm	unication*	Tag					
Path: Local_DHRI0 Local_DHRI0					<u>B</u> rowse.		
Module Address	<u>C</u> hannel:	'B'		Rac <u>k</u> :	25 📫	(Octal)	
C Contro <u>I</u> Net	<u>G</u> roup:	0		Slo <u>t</u> :	0 *	1	
Connected		🔽 Cach <u>e</u> (	Connections	٠			
O Enable O Enabl	e Waiting	O Start	🔾 Done	Done	e Length: 0		1
<ul> <li>Error Code:</li> <li>Error Path:</li> <li>Error Text:</li> </ul>	Extend	ed Error Code:		T	imed Out 🗲		
		OK	Cance	I ,	Apply	Help	J

#### Communication Tab

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

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



## **Configure the Module Switches**

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

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

#### **Configure the First 1756-CNB Module**

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

RSLogis 5000 - Resola_10 117564       Enr Edit Verw Search Logic Comm       Image: Image	
Ittime I o Grades No Edit Control Remote_IO Control Remote_IO Co	Modele Properties - Local (1256 CNB/0 5.1)     E       Type:     1756 CNB/0 1756 Controller Bedge       Vendo:     Allendinder       Nege:     Local (CNB)       Descriptor
Constantial Spece     Constantial Specee     Constantial Specee	Cancel Class Nexts Frankiss Help

#### **Configure the Second 1756-CNB Module**

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

warrodix anon - wemone_in (isae-		
ie Edit View Search Logic Commu		
fline ]. E BUN	Module Properties - Local_CNB:3 (1756-CNB/D 5.1)	Module Properties - Local_CN8:3 (1756-CN8/0 5.1)
o Edita A	Type: 1756-CH8/O 1756 ControlNet Bidge Vendo: Altern®tadley Patent Local_CH8	Bequested Packet Interval (RPI) 50 ∰ m (2.0 - 750.0 m)
Controller Remote_ID     Controller Tegs     Controller Tegs     Controller Fouk Handler     Power-Up Handler	Nage Premote_CN8 Nage [23 ag Cenception	Major Fault On Controller II Connection Falls While in Run Mode     Module Fault
Electronic Tasks Electr	Conne Format Rack Optimization Territory	
Motion Groups     Ungrouped Axes     Trends     Provide Trends		
Gener User Defined     Gener Strings     Gener Strings	Cancel Class Next > Finish >> Help	Cancel <back next=""> Finith&gt;&gt;&gt; Heb</back>
Module Defined		

is 5000 - Remote\_10 [1756-

f

#### Configure the 1756-DHRIO or 1756-DHRIOXT Module

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



#### Configure the 1771-ASB Adapter

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

te Fox Xiew Testou Fodic Founier		
1 <b>2 2</b> 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		
Iffline 🛛 🗧 BUN	Module Properties Remote_DHBI0 (1271 ASB 1.1)	Module Properties - Remote_DHBI0 [1771-AS8 1.1]
© Gonze L C CK. C Cartoler Flencke_ID Controler Teacte Controler Teacte Control Control Control Control Control Control Control Control Control Control Control Control Control Control Control Control Control	Tgtr 1771 ASB 1771 Remote I/O Adapter Vendo: Alen-Buiday Noge 0, scenner Descriptor Parent: Remote_Diriftio Bok # (octa); 25 Parent: Descriptor Pgred Channel: [Channels ] Sjot: [1/4Rack (21/0 Groups)]	Bequented Packet Interval (RPI): 460 m (2.0 - 750.0 m)  // johid Module // May Fast On Controller II Connection Fails While in Run Mode // Module Faul
Trends     Trends     Surgers     UserDefined     Dimedified     ModuleDefined	Cancel (195 Next) Fraithty Help	Carcel Clack Next> Frish>>> Hep
1/0 Configuration		

# **Troubleshooting the Module**

## What This Chapter Contains

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

Торіс	Page
Check Power Supply and Module Status	153
Status Indicators	154
Minimizing False Received Frame with Bad CRC Messages	156

## Check Power Supply and Module Status

On power-up, three events occur simultaneously:

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

This sequence runs continuously during normal module operation.

EXAMPLE	For example, if your module uses the following:
	Channel A for DH+ with node address 14
	Channel B for RIO
	and the channels are operating properly, you see the following sequence:
	• A DH, A#14, A OK, B IO, SCAN, B OK

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

## **Status Indicators**

The following figure and tables describe the module status indicators.



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

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

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

#### Alphanumeric Indicator Status Message - Data Highway Plus

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

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

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

#### Rockwell Automation Publication 1756-UM514C-EN-P - June 2014

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

## Minimizing False Received Frame with Bad CRC Messages

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

Received Frame with Bad CRC

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

# PCCC Commands Supported by the Data Highway Plus Module

## **What This Appendix Contains**

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

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

#### Echo

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

CMD = 06h, FNC = 00

#### **ID Host and Status**

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

CMD = 06h, FNC = 03

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

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

Byte	Description			
10	Options - Port	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	Port A - Node Address		
12	Port B - Node	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 Numb	per / Name (In ASCII)	•	
	1756-DHRIO/>	where x is the Series letter with a	a space after the Series letter	

#### **Read DH+ Diagnostic Counters**

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

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

CMD = 06h, FNC = 01

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

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

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

## **Reset DH+ Diagnostic Counters**

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

CMD = 06h, FNC = 07

# Notes:

# **Application Guidelines and Tips**

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

Торіс	Page
Cached and Uncached Connections	163
ControlLogix Controller Constraints	164
Message Manager	165
Messages Between a ControlLogix Controller and PLC Devices	165
RPI Configuration Settings	165
RPI Formula without Block Transfer Modules	166
Increase the Unconnected Message Buffer Limit	166
Remote I/O Performance: ControlLogix Controllers versus PLC-5 Controllers	168
DH+ Baud Rate Comparison	169

## Cached and Uncached Connections

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

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

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

- <u>Cached Connections</u>
- <u>Uncached Connections</u>

#### **Cached Connections**

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

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

#### **Uncached Connections**

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

When using the ControlLogix controllers, remember the following constraints:

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

For more information on increasing the unconnected message buffer limit, see page 166.

- A DH+ or remote I/O message can take a total of two connections in the UCB. One connection is used for the forward open and one connection is used for the reply.
- Cached connections are separate from the UCB number.

## ControlLogix Controller Constraints

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

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

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

Message Manager	Even though the unconnected message buffer can be increased to 40, the best throughput performance is attained when only 5 messages are enabled in a ControlLogix controller at one time. One simple method of managing your messages is to enable five messages, wait for all five to complete and than enable another set of five messages. Repeat the process as needed until all required message completed.
Messages Between a ControlLogix Controller and PLC Devices	For more information on the 1756-DHRIO or 1756-DHRIOXT module's performance when messages are sent between a ControlLogix controller and PLC devices, see the Rockwell Automation Knowledge Base. The database can be accessed from the following location:

https://rockwellautomation.custhelp.com/

## **RPI Configuration Settings**

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

## RPI Formula without Block Transfer Modules

#### **Digital Modules**

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

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

#### **Worst Case Scenario**

This formula is for a worst case scenario.

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

## Increase the Unconnected Message Buffer Limit

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

https://rockwellautomation.custhelp.com/

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

#### **Increase Unconnected Message Buffer Configuration**

Configure the message as shown below

essage Configu	mation - BU	FFER			
Message <u>T</u> ype:	CIP Generic	>		]	
Ser <u>v</u> ice Code:	4	(Hex)	<u>S</u> ource:	source_buff[0]	•
<u>C</u> lass name:	304	(Hex)	Num. Of <u>E</u> lements	: 18 📑 (Byb	es)
Instance name:	1		Destination:	dest_buff[0]	*
Attrib <u>u</u> te name:		(Hex)		Ne <u>w</u> Tag	
) Enable () Ena ) Error Code:	able Waiting	🔾 Start	) Done	Done Length: 6 ☐ Timed Out ←	
xtended Error Code:					

## **Increase Unconnected Message Buffer Source Data**

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

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

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

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



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



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.

Block Transfer Write Messages per Second

## **DH+ Baud Rate Comparison**

**Messages per Second** 

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



PLC-5/60 processor

#### **Use Cached Connections**

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



Number of Nodes (that is number of messages)

Rockwell Automation Publication 1756-UM514C-EN-P - June 2014

**Messages per Second** 

#### **Use Uncached Connections**

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



Number of Nodes (that is number of messages)

# Maintain PCCC Message Sequences

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

#### Numerics

1756-DHRIO module description 13-19

#### A

Alphanumeric indicators 18 Application guidelines 163-170 For a data highway plus (DH+) network 24 For a remote I/O network 102-103 Application timeouts In data highway plus (DH+) messaging 33

#### В

Baud rates Available on the 1756-DHRIO module 102, 108-109 Cached vs uncached connections 169-170 Setting in Studio 5000 116, 124 Block transfers 145-152 Examples 147-152 Fault notification 145 Pass-through messages 146

#### C

Cached connections 163-164, 169 Communication Baud rates for remote I/O 102 Control and information protocol (CIP) messaging 13, 14, 35 Data highway plus (DH+) messaging 13, 14, 67-78 Remote I/O 13, 15, 99-112 Requested packet interval (RPI) 108 Types supported by the 1756-DHRIO module 13, 25-35 Using multiple networks 13 Configuration Controller slot 51, 81, 84 Data highway plus (DH+) messaging 32 Requested packet interval (RPI) 165-166 Setting baud rates 116, 124 Setting electronic keying 116, 124 Setting the requested packet interval (RPI) 116, 119, 124, 127 Using software in block transfer applications 120-133, 147-149, 151-152 Using software in data highway plus (DH+) applications 45-66 Using software in remote I/O applications 113-120, 136, 139-140, 142-143 **Connection paths** In data highway plus (DH+) messaging 63-65 Connections Cached 163-164, 169 Uncached 163-164, 170 **Control and information protocol (CIP)** messaging 13, 25, 35 Controller slot 51, 81, 84

Controllers

Constraints 164 Using with the 1756-DHRIO 11

#### D

Data highway plus (DH+) messaging 13, 14, 25-34 **Application timeouts 33 Configuration 32** Connections paths 63-65 Controller slot 51 Example 14, 26, 29, 33, 34 Local 25-28 Messages between ControlLogix controllers 95-98 Messages between ControlLogix controllers and PLC-5 or SLC 5/04 controllers 89-94 Messages between PLC-5 and SLC 5/04 controllers 67-78 Messages between PLC-5 or SLC 5/04 controllers and ControlLogix controllers 79-87 Remote messaging 28-31 Using software 45-66 Data highway plus (DH+) network 21-35 Application guidelines 24 Connecting devices to the network 23 Definition 21 Link design 22 Trunk line/drop line considerations 22

## Ε

Echo command 157 Electronic keying Setting in Studio 5000 116, 124 Electrostatic discharge (ESD) Preventing 19

#### F

Fault notification

When the fault occurs during block transfers 145 When the remote I/O adapter faults 111 When the remote I/O scanner faults 110 Features of the 1756-DHRIO module 16-18 Alphanumeric indicators 18 Programming terminal port 23 Switches 17

#### I

ID host and status 158-159 Increasing the unconnected message buffer limit 166-167 Inhibiting the 1756-DHRIO module connections 111, 116, 119, 124, 127 Inhibiting the remote I/O connections 111

#### K

Keying

Setting electronic keying in Studio 5000 116, 124

#### L

Limitations **Controller constraints 164** Increasing the unconnected message buffer limit 166-167 Of local data highway plus (DH+) messaging 27 Of remote data highway plus (DH+) messaging 30 Routing limitations for messages sent via the 1756-DHRIO module 14 Link design On a data highway plus (DH+) network 22 Link IDs 72 For remote data highway plus (DH+) messaging 29, 50 Local data highway plus (DH+) messaging 25-28 Limitations 27 Programming message block instructions in a controller 27 **Receiving messages 26** Routing errors 27 Sending messages 27

#### М

Message instructions Block transfer application example 130-133 RSLogix 5 69, 76, 78, 82 RSLogix 500 72, 87 Studio 5000 91, 94, 96, 98 Messaging

> Control and information protocol (CIP) 35 Data highway plus (DH+) 13, 14, 67-78 Increasing the unconnected message buffer limit 166-167

#### Ν

Networks

Definition of the data highway plus (DH+) network 21 Using multiple networks with the 1756-DHRIO module 13 Using the data highway plus (DH+) network 21-35

#### Ρ

Pass-through messages With block transfers 146

#### Paths

In data highway plus (DH+) messaging 63-65 PCCC commands 157-161 Echo 157 ID host and status 158-159 Read DH+ diagnostic counters 160-161 Reset DH+ diagnostic counters 161 Preventing electrostatic discharge (ESD) 19 Programming terminal port 23 Pyramid integrator As related to routing tables 46

#### R

Read DH+ diagnostic counter command 160-161 Remote data highway plus (DH+) messaging 28-31 Limitations 30 Link IDs 29 Programming message block instructions in a controller 30 Routing errors 31 Using routing tables 29 Remote I/O communication 13, 15, 99-112, 135-143 Available adapter modules 107 Cable design guidelines 102–103 Designing a remote I/O network 102-103 Devices that can be connected to a remote I/O network 101 Exhanging data between the 1756-DHRIO module and adapters 105 Exhanging data between the 1756-DHRIO module and ControlLogix controllers 105 Network design guidelines 102 Requested packet interval (RPI) 108 Trunk line/drop line considerations 103 **Remote I/O connection** ControlLogix vs PLC-5 performance 168 **Removal and insertion under power (RIUP)** 19 Requested packet interval (RPI) 108, 116, 119, 124, 127, 165-166 Reset DH+ diagnostic counters command 161 **Routing errors** In local data highway plus (DH+) messaging 27 In remote data highway plus (DH+) messaging 31 **Routing limitations** For messages sent via the 1756-DHRIO module 14 Routing tables 46-51 Definition 46 Example 47-48 In data highway plus (DH+) messaging 68, 71, 75, 78, 86, 93 In remote data highway plus (DH+) messaging 29 Pyramid integrator 46

#### RSLinx

Creating routing tables 46, 49-51 Routing table example 68, 71, 75, 78, 86, 93 Setting the controller slot 51 Using in data highway plus (DH+) applications 45

#### **RSLogix 5**

Using in data highway plus (DH+) messaging 45, 52-54, 69, 76, 78, 82

#### RSLogix 500

Using in data highway plus (DH+) messaging 45, 55-57, 72, 87

#### S

#### Software

In block transfer applications 120-133, 147-149, 151-152 In data highway plus (DH+) applications 45-66 In remote I/O applications 113-120, 136, 139-140, 142-143 RSLogix 5 52-54, 69, 76, 78, 82 RSLogix 500 55-57, 72, 87 Setting the controller slot 51 Studio 5000 58-61, 91, 94, 96, 98 Studio 5000 Increasing the unconnected message buffers 167 Setting baud rates 116, 124 Setting electronic keying 116, 124 Setting the requested packet interval (RPI) 116, 119, 124, 127 Using in block transfer applications 120-133, 147-149, 151-152 Using in data highway plus (DH+) messaging 45, 58-61, 91, 94, 96, 98 Using in remote I/O applications 113-120, 136, 139-140, 142-143 Switches Setting on the 1756-DHRIO module 17

#### T

Troubleshooting 153-156 Power supply and module status 153-155 Trunk line/drop line considerations In a data highway plus (DH+) network 22 In a remote I/O network 103

#### U

Uncached connections 163-164, 170

## **Rockwell Automation Support**

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

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

#### **Installation Assistance**

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

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

#### **New Product Satisfaction Return**

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

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

## **Documentation Feedback**

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

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

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

#### www.rockwellautomation.com

#### Power, Control and Information Solutions Headquarters

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