Connecting SLC Systems as Remote I/O to PLC-5 Processors

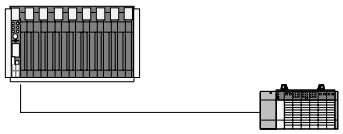
Introduction

This document combines available PLC® and SLC™ documentation to show you how you can communicate between these two types of systems over the remote I/O link.

Note: You can configure the communication modules described in this chapter to work with SLC 5/03™ and SLC 5/04™ processors or with a 1747-SN scanner.

remote I/O link

using a 1747-DCM
using a 1747-ASB
using a 1747-SN

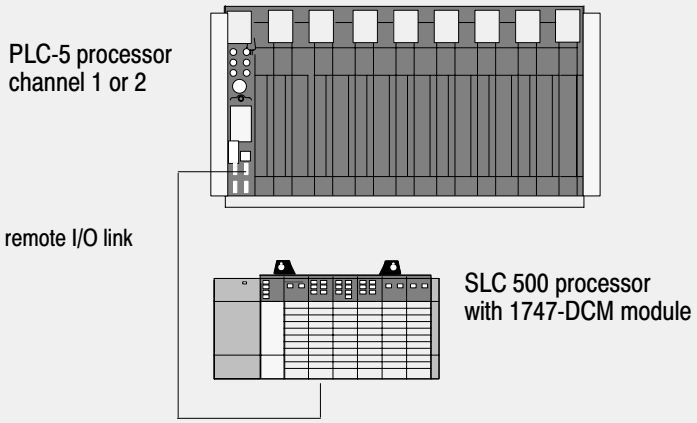


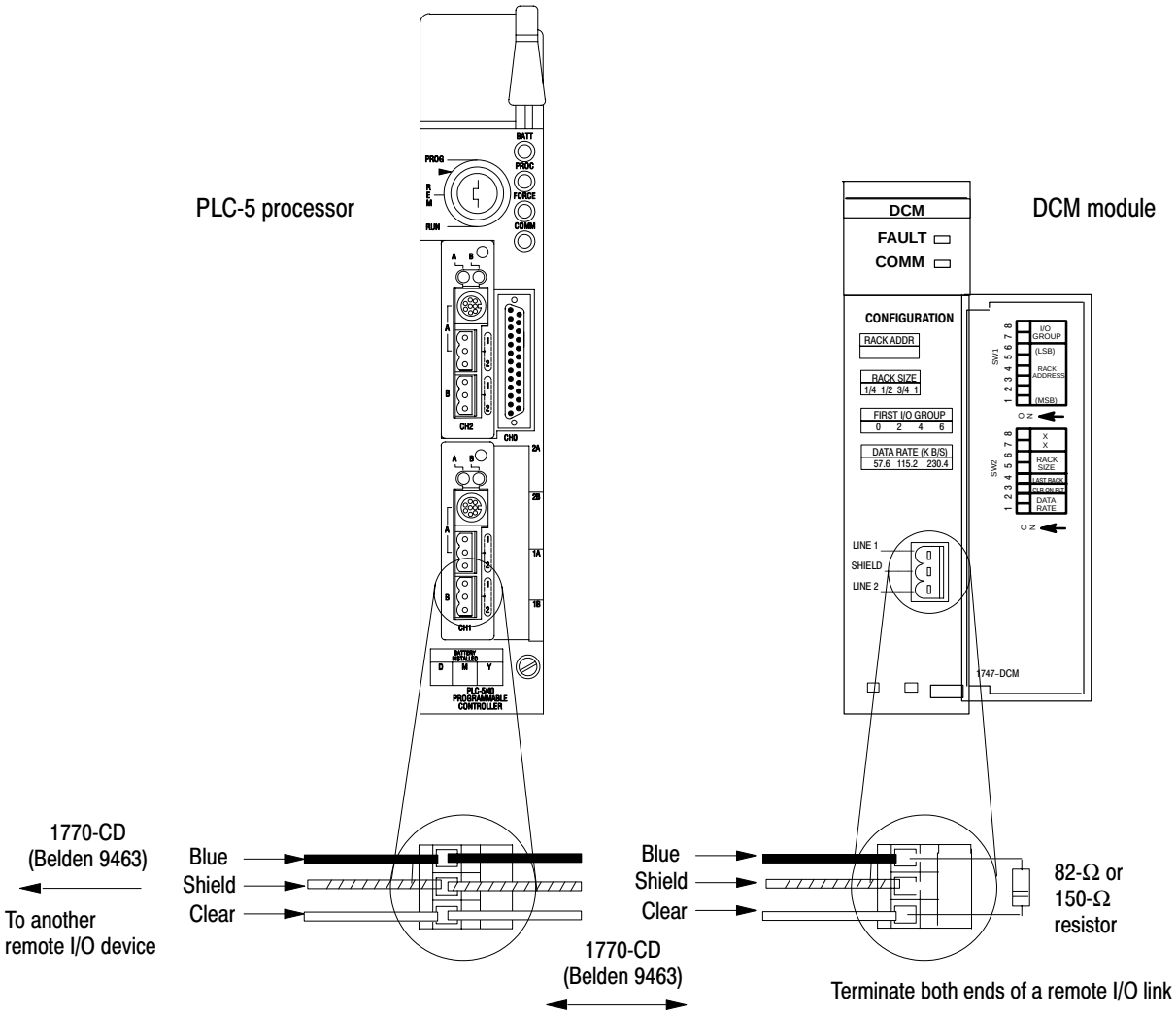
This information is in addition to the user documentation for the processors and communication modules discussed here. You should already have a solid understanding of how to use these processors. Each section in this document lists additional documentation you can refer to for detailed information.

This document is one of a larger set of reference materials to help you better use your PLC-5® processor. The 1785-6.8.*x* series of documents provides individual documents for different applications. This reference set is continually expanding, so see your Allen-Bradley sales representative or distributor for an up-to-date list of available reference documents.

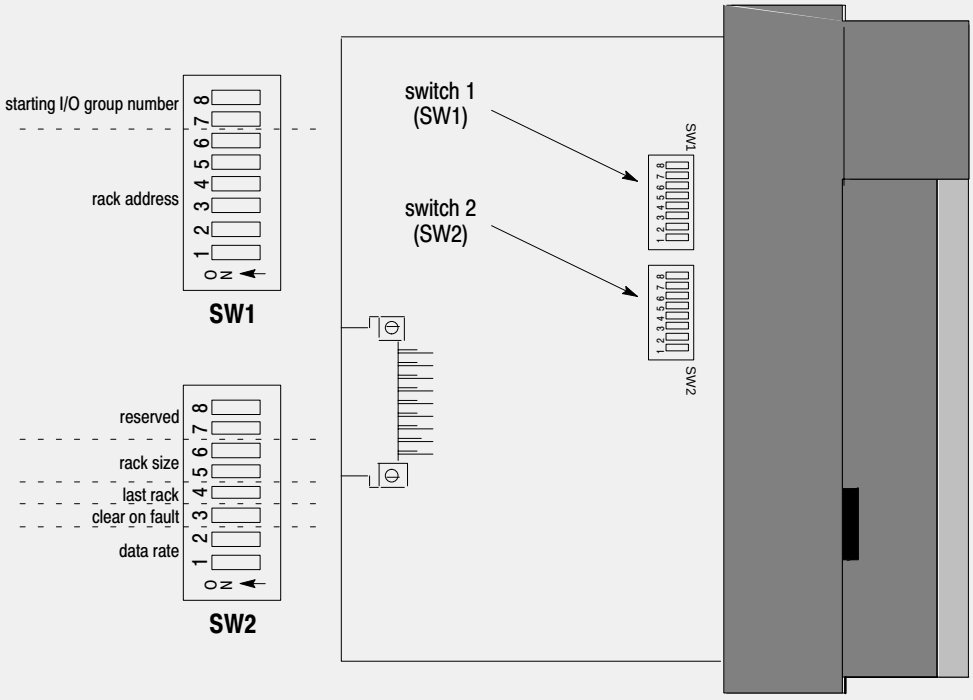
Connecting the remote I/O

Using the 1747-DCM Direct Communications Module





1747-DCM module configurations



Application requirements

Use 1770-CD (or Belden 9463) cable. Connect a remote I/O network using a daisy-chain configuration.

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

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

Installing a 1747-DCM module

The installation procedures for the DCM module are the same as for any other discrete I/O or specialty module in a 1746 chassis.

You must attach a 1/2-watt terminating resistor across line 1 and line 2 of the connectors at each end (scanner and last physical device) of the network. The scanner cannot be the end device. The size of the resistor depends on the baud rate and extended node capability.

Baud rate:		Terminating resistor size:
using extended node capability	all baud rates	82Ω 1/2 watt
not using extended node capability	57.6K	150Ω 1/2 watt
	115.2K	150Ω 1/2 watt
	230.4K	82Ω 1/2 watt

Communicating over a remote I/O link

The Direct Communications Module (DCM) links the SLC processor to a PLC processor for distributed processing. The DCM acts as a remote I/O adapter on a remote I/O link. Information is transferred between the local PLC processor and the remote DCM module during each remote I/O scan. The number of DCM modules that a PLC processor can supervise depends on the number of racks the processor supports and the rack size of the DCM. The SLC fixed processor with a 1746-A2 expansion slot can support one DCM module; the SLC modular processors can support multiple DCM modules.

The DCM module can be configured for:

1/4 rack = 2 words (1 remote I/O word and 1 status word)
1/2 rack = 4 words (3 remote I/O words and 1 status word)
3/4 rack = 6 words (5 remote I/O words and 1 status word)
full rack = 8 words (7 remote I/O words and 1 status word)

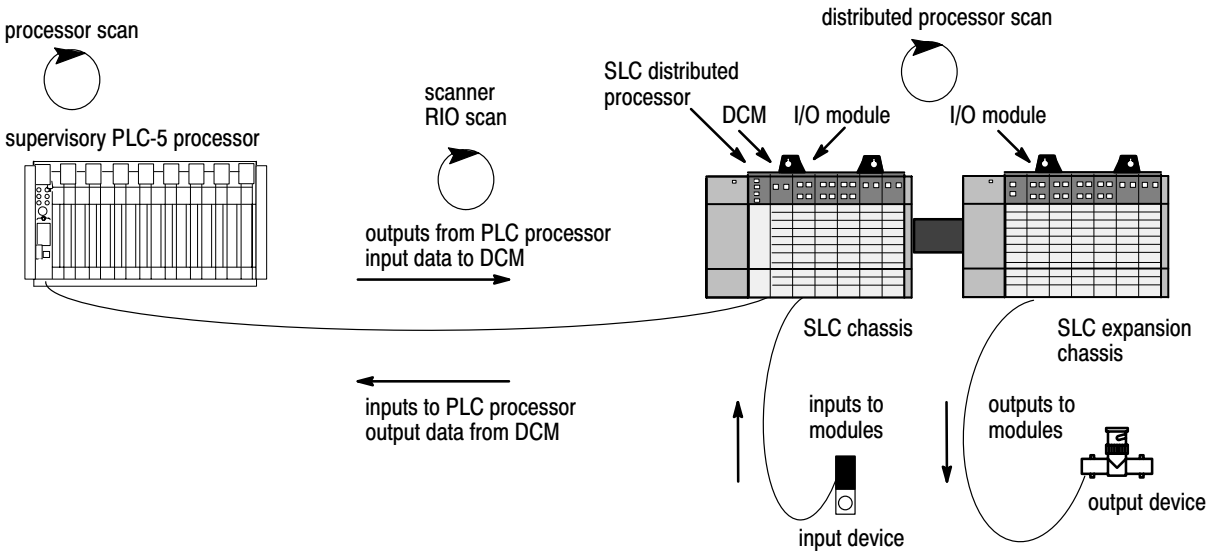
How data is exchanged between the PLC-5 scanner and the DCM module

Information is transferred between the PLC-5 scanner channel and the DCM module every remote I/O scan. Remote I/O scans are asynchronous to the processor scan. The DCM module provides word integrity on all words transferred via the SLC backplane.

The supervisory PLC-5 processors communicates with the DCM module through a PLC-5 channel configured as a scanner. The DCM module does not scan the I/O in its local I/O chassis, rather it passes the supervisory data to its SLC processor.

In the DCM module, outputs from the SLC output image table are inputs to the PLC-5 processor input image table. Likewise, outputs from the PLC-5 processor output image table are inputs to the SLC input image table.

The following diagram shows the communication flow between a PLC-5 scanner and the DCM module.



What is the status word?

The first word of the DCM input and output image table is the status word. The status word indicates the status of communication and data between the PLC-5 scanner and the DCM module.

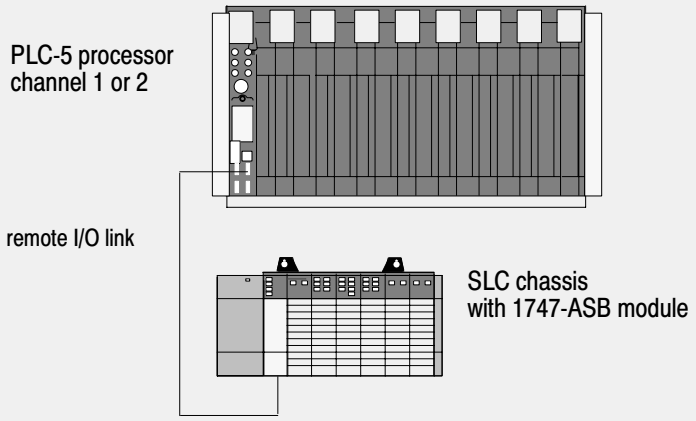
Whenever any of the status word bits (except the User Status Flag bit) are set, it indicates that a condition occurred in your logic program which might require inspection. If this happens, you would normally want to inhibit some outputs by using a ladder logic instruction. Use an Examine If Open (XIO) instruction to examine the Logical OR bit (word 0, bit 8 for an SLC processor; word 0, bit 10 for a PLC-5 processor).

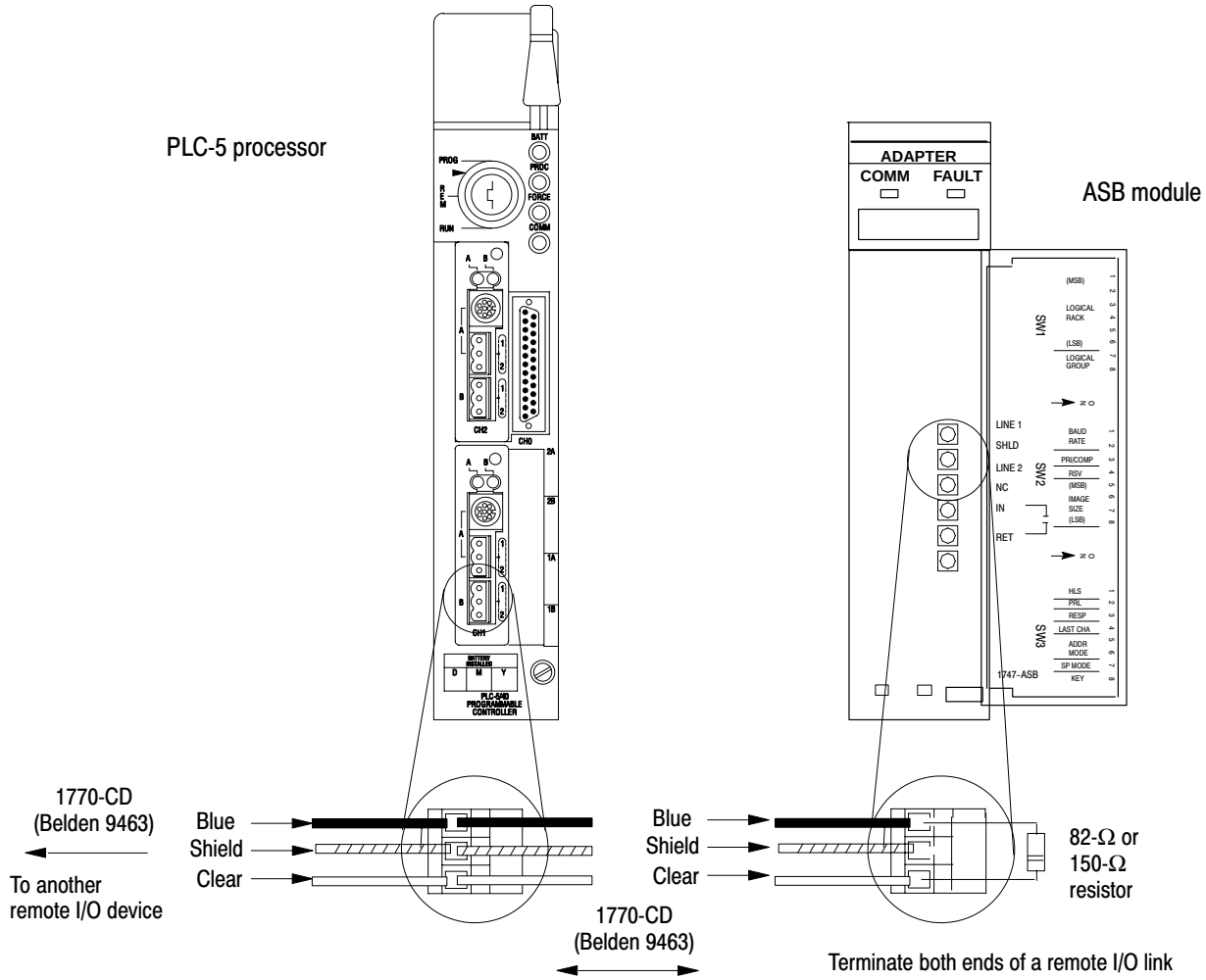
Additional documentation

- 1747-NM007 Direct Communication Module User Manual

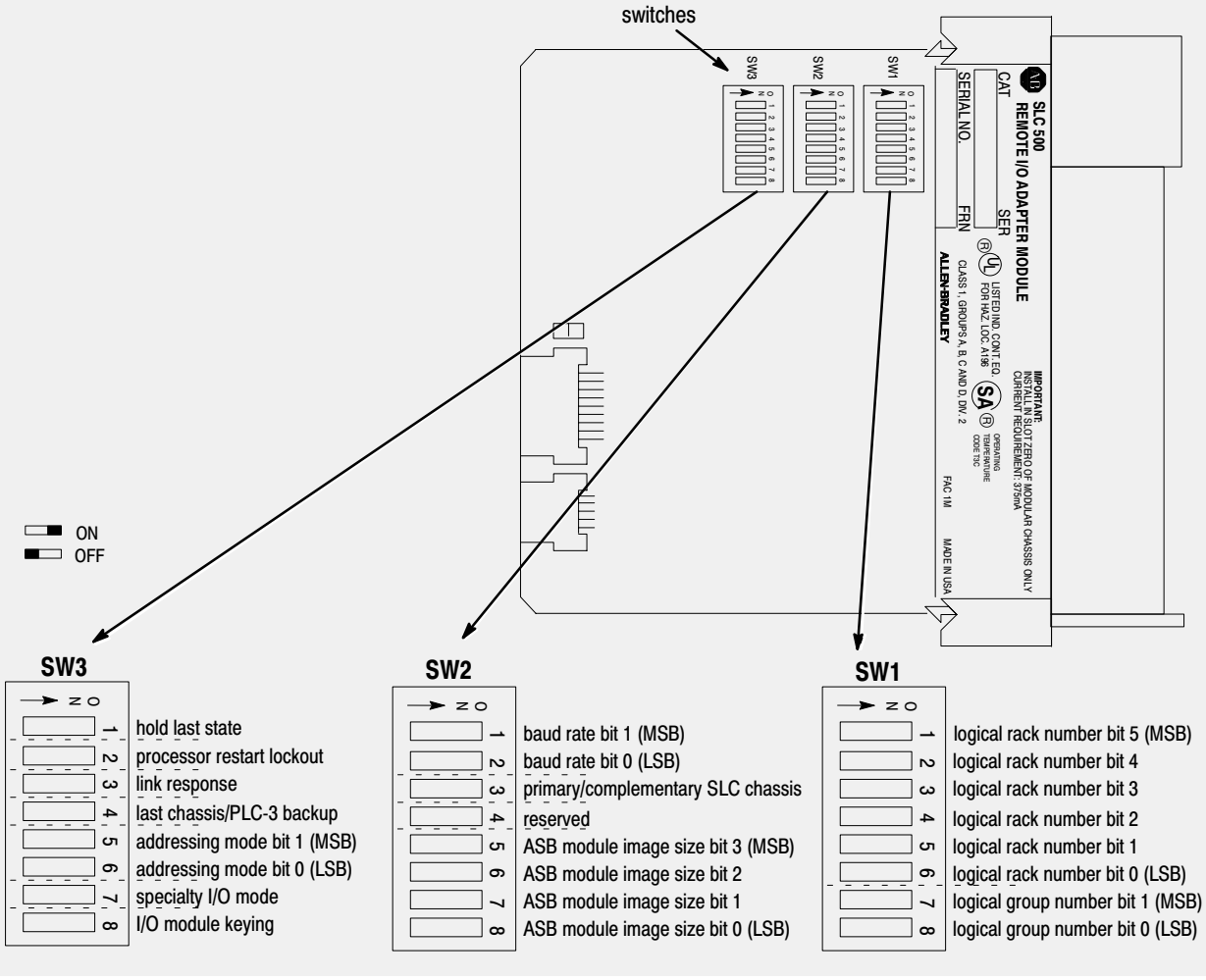
Connecting the remote I/O

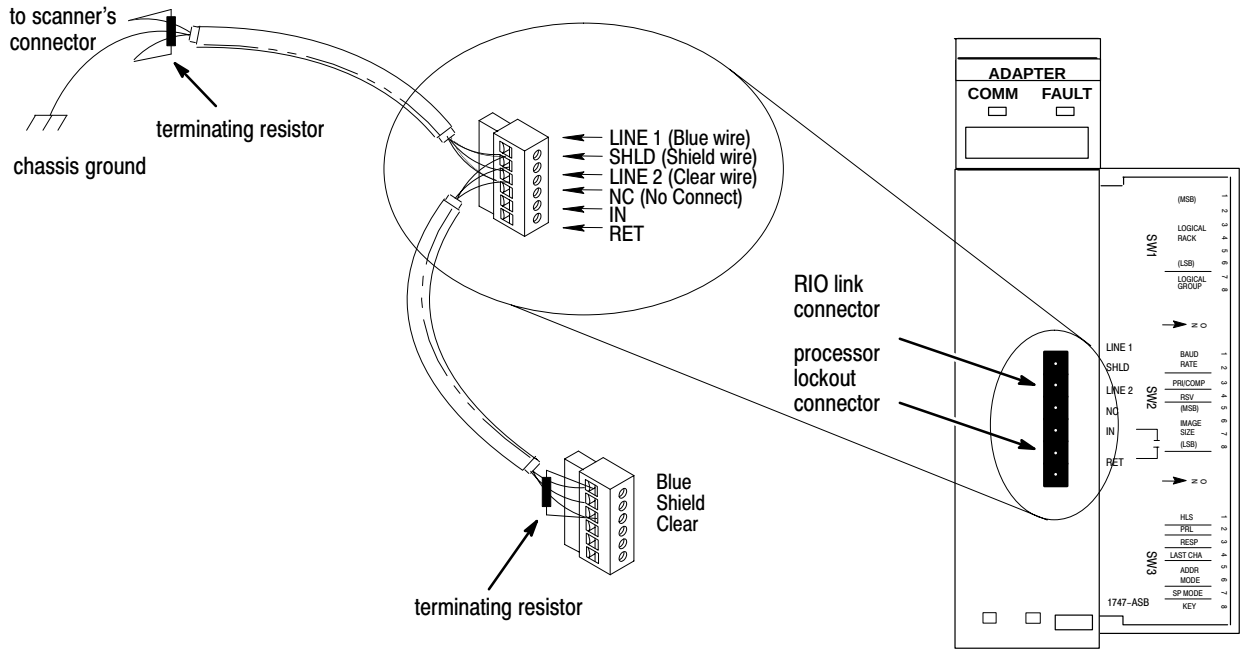
Using the 1747-ASB Remote I/O Adapter Module





1747-ASB module configurations





Application requirements

Use 1770-CD (or Belden 9463) cable. Connect a remote I/O network using a daisy-chain configuration.

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

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

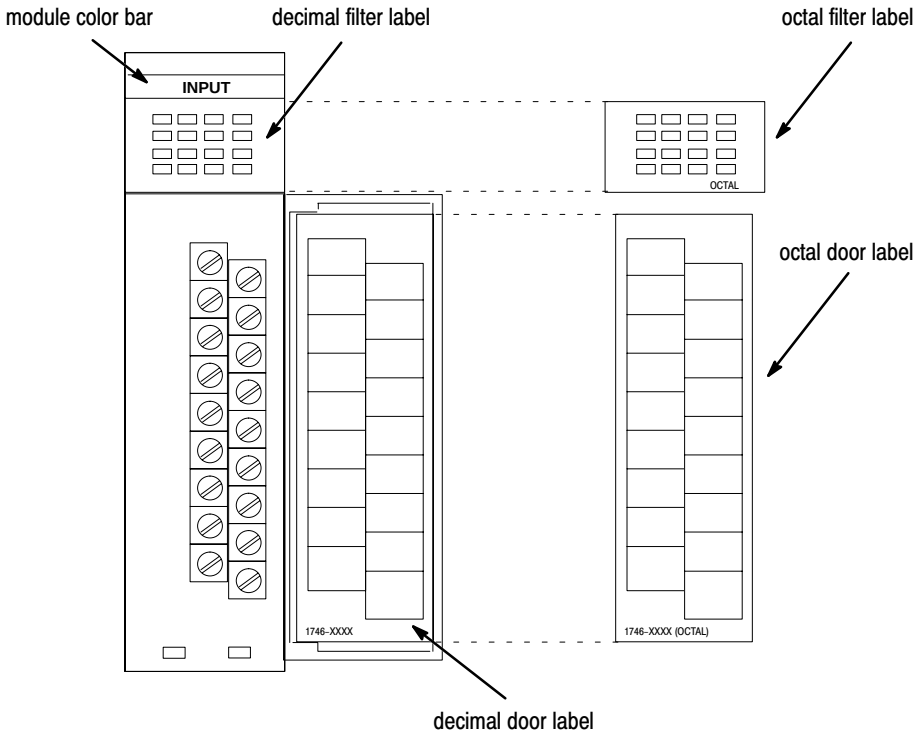
Installing a 1747-ASB module

The total number of adapters allowed on a remote I/O link are:

- 32 if the scanner and all adapters on the remote I/O link have extended node capability
- 16 if the scanner or any adapter does not have extended node capability

Using the octal label kit

The octal filter and door label **must** be used when working with a PLC processor as a master.

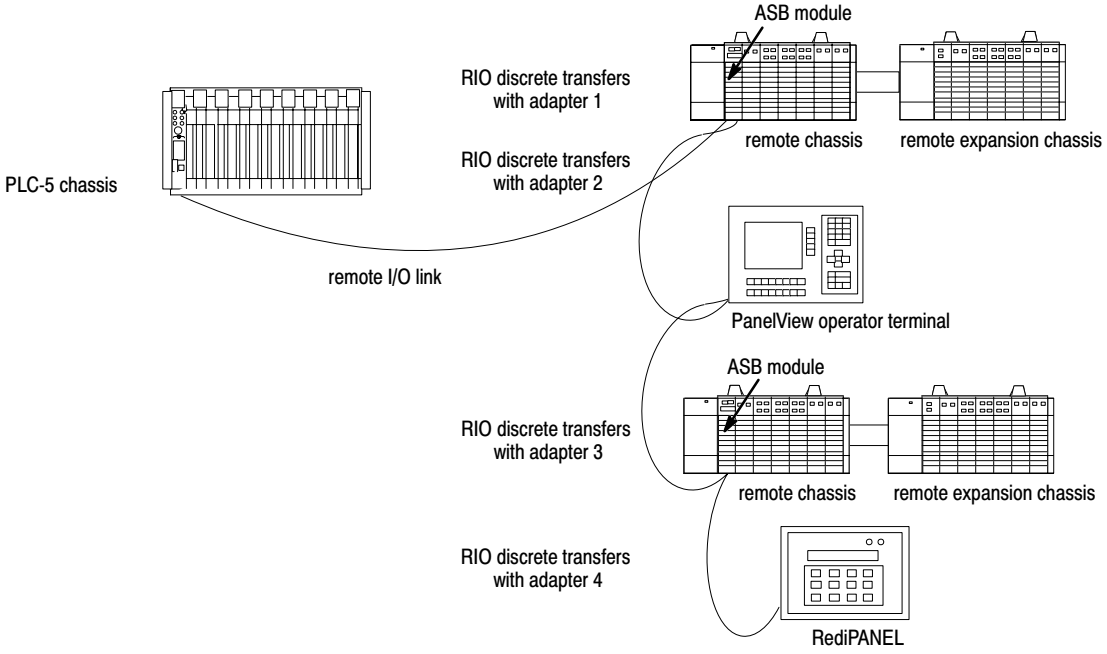


Communicating over a remote I/O link

The Remote I/O Adapter module is a single-slot, RIO communication link module. It occupies the first slot (slot 0) of a 1746 remote chassis, where the SLC processor normally resides.

The 1747-ASB module is an adapter on the remote I/O link and the master of the remote chassis and remote expansion chassis it is installed in. Remote expansion chassis are optional. The 1747-ASB module acts as a gateway between the PLC-5 scanner and the I/O modules residing in the remote chassis and remote expansion chassis. The 1747-ASB module maps the image of the I/O modules in its remote chassis and remote expansion chassis directly to the PLC-5 scanner.

Output data is sent from the PLC-5 scanner to the 1747-ASB module across the remote I/O link. This data is automatically transferred to the output modules across the chassis backplane by the 1747-ASB module. Inputs from the input modules are collected via the backplane by the 1747-ASB module and sent back to the PLC-5 scanner across the remote I/O link. You don't need to program the 1747-ASB module.



Using the processor restart lockout

SW3 switch 2 determines whether your system automatically resumes RIO link communications with the scanner when:

- link communications are temporarily interrupted. For example, by removing and replacing the RIO connector.
- the 1747-ASB module is inhibited and re-enabled.

Processor Restart Lockout DIP Switch Settings

When in the OFF position (lock processor out) and communications are restored, the 1747-ASB module does not respond to any communication commands until 1747-ASB module terminals IN and RET are momentarily shorted together. Processor restart lockout prevents RIO link communications (by locking out the scanner and processor) and does not let the 1747-ASB module exchange any I/O data or respond to any RIO commands, such as reset commands.

RIO link communications can be restarted by:

- momentarily shorting pins 5 and 6 together
- cycling power on any chassis controlled by the 1747-ASB module

While in the ON position, the 1747-ASB module always attempts to restart communications with the scanner if RIO link communications are interrupted or if the 1747-ASB module is inhibited and re-enabled. While in the ON position, the 1747-ASB module does not respond if terminals 5 and 6 are shorted together.

The 1747-ASB module is shipped from the factory with the default position ON (automatic restart).

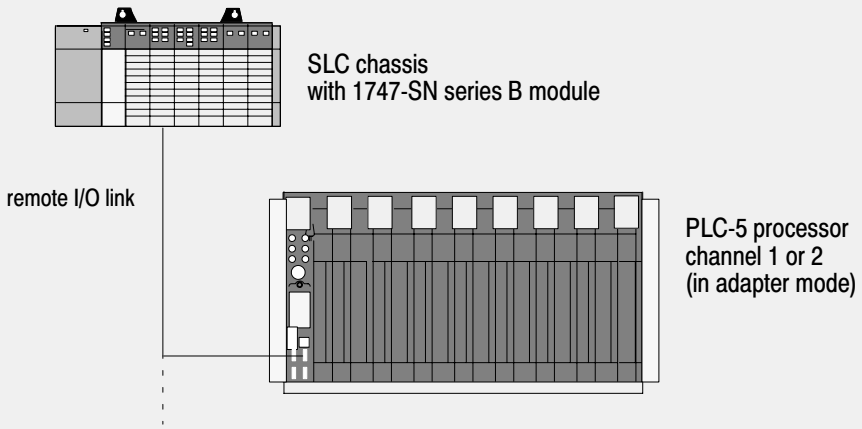
ATTENTION: Cycling power on any chassis removes the processor restart lockout condition.

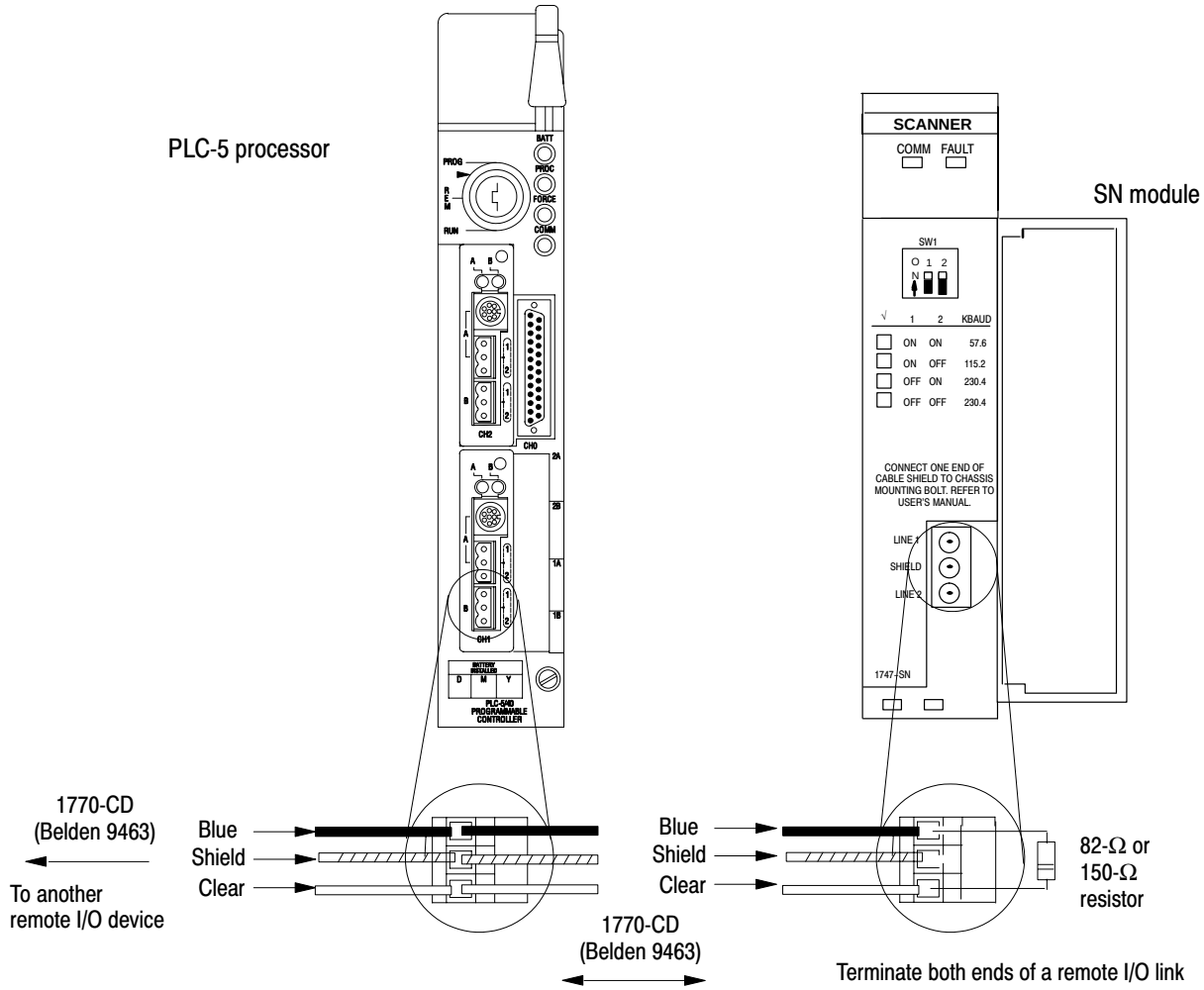
Additional documentation

- 1747-6.13 Remote I/O Adapter Module User Manual

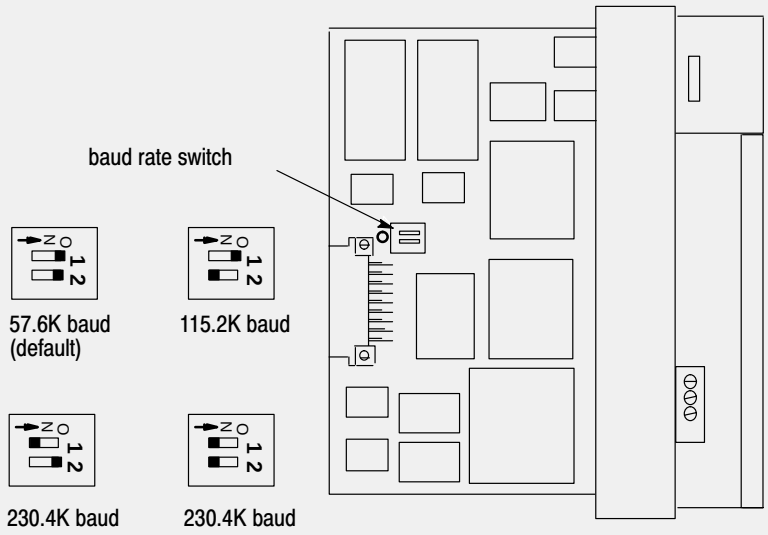
Connecting the remote I/O

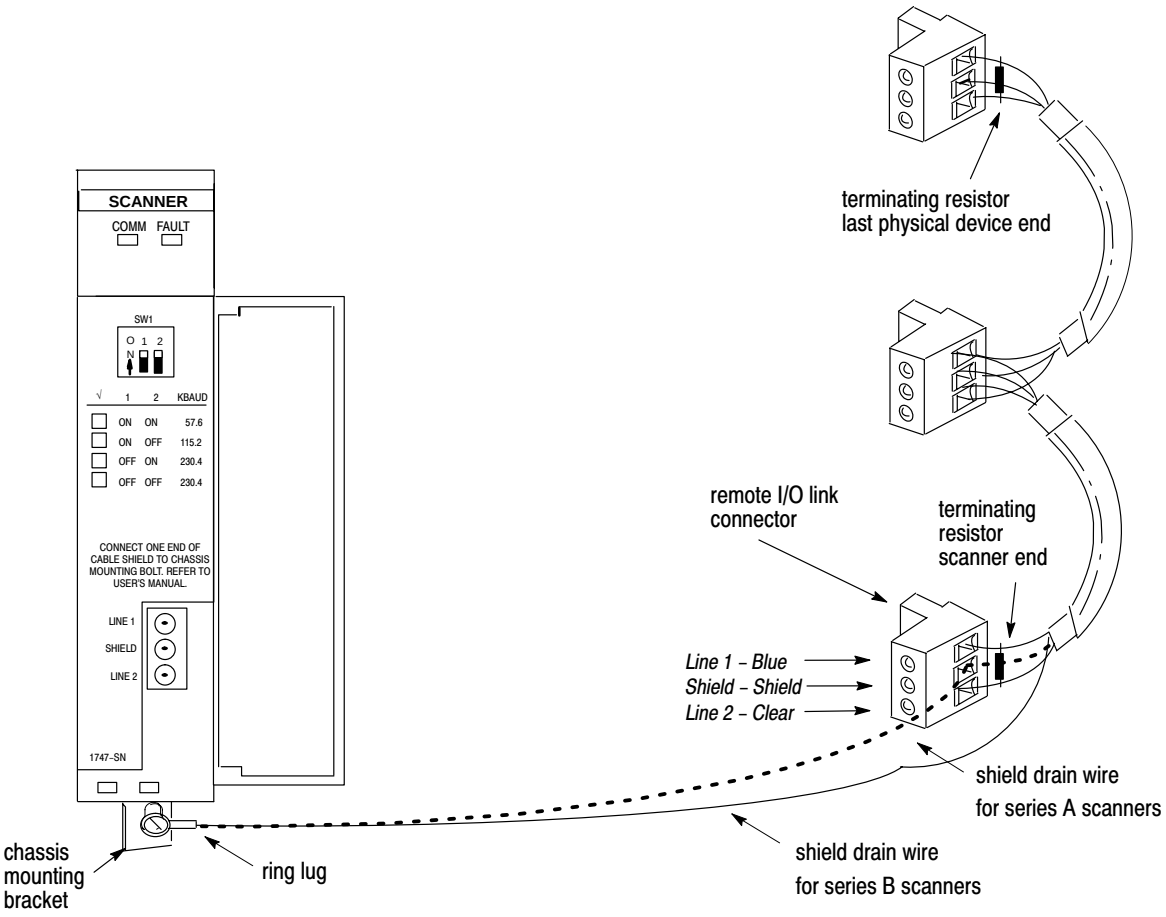
Using the 1747-SN Remote I/O Scanner Module





1747-SN module configurations





Application requirements

Use 1770-CD (or Belden 9463) cable. Connect a remote I/O network using a daisy-chain configuration. There are no restrictions governing the space between each device, provided the maximum cable distance (Belden 9463) is not exceeded.

A 1/2 watt terminating resistor (included with the module) must be attached across line 1 and line 2 of the connectors at *each* end (scanner and *last* physical device) of the remote I/O link. The value of the resistor depends on the baud rate and extended node capability, as shown in the table that follows.

Important: To use extended node capability, all devices on the remote I/O link must support it.

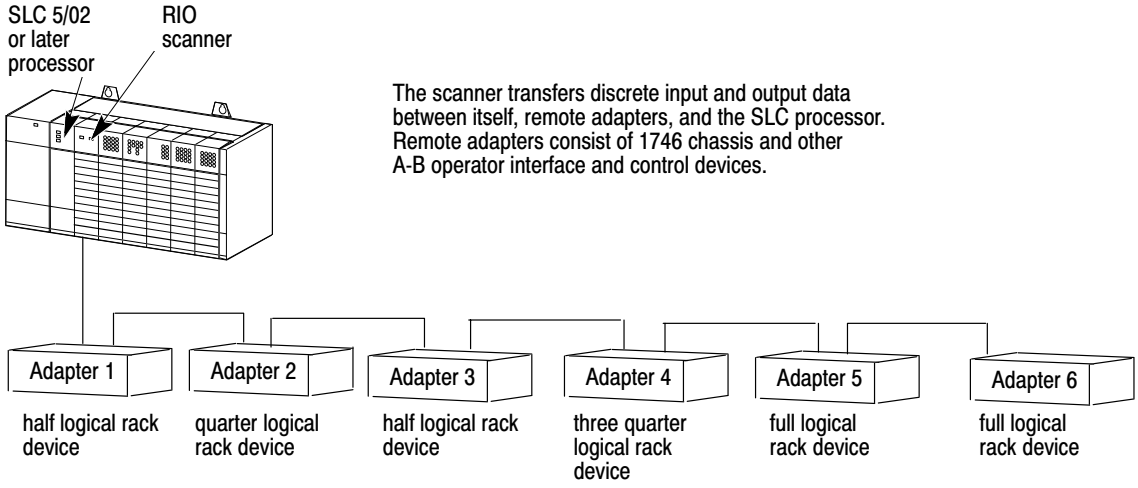
	Baud rate:	Terminating resistor size:	Maximum cable distance: (Belden 9463)
Using extended node capability	all baud rates	82Ω 1/2 Watt gray–red–black–gold	3048 meters (10,000 feet) at 57.6K baud 1524 meters (5,000 feet) at 115.2K baud 762 meters (2,500 feet) at 230.4K baud
Not using extended node capability	57.6K baud	150Ω 1/2 Watt brown–green–brown–gold	3048 meters (10,000 feet)
	115.2K baud	150Ω 1/2 Watt brown–green–brown–gold	1524 meters (5,000 feet)
	230.4K baud	82Ω 1/2 Watt gray–red–black–gold	762 meters (2,500 feet)

Communicating over a remote I/O link

The remote I/O scanner is a single-slot, remote I/O communication module. It occupies the any slot other than the first slot (where the SLC processor resides) of a 1746 chassis.

The remote I/O scanner enables communication between an SLC processor (SLC 5/02 or later) and remotely located (3,048 meters [10,000 feet] maximum) 1746 I/O chassis and other remote I/O compatible device (such a PLC-5 processor in adapter mode or a 1771-ASB remote I/O scanner module).

The scanner can transfer a maximum of 4 logical racks of discrete data on the remote I/O link. The scanner provides discrete I/O and block-transfer (series B or later). You can configure any combination of quarter, half, three quarter, or full logical rack devices.



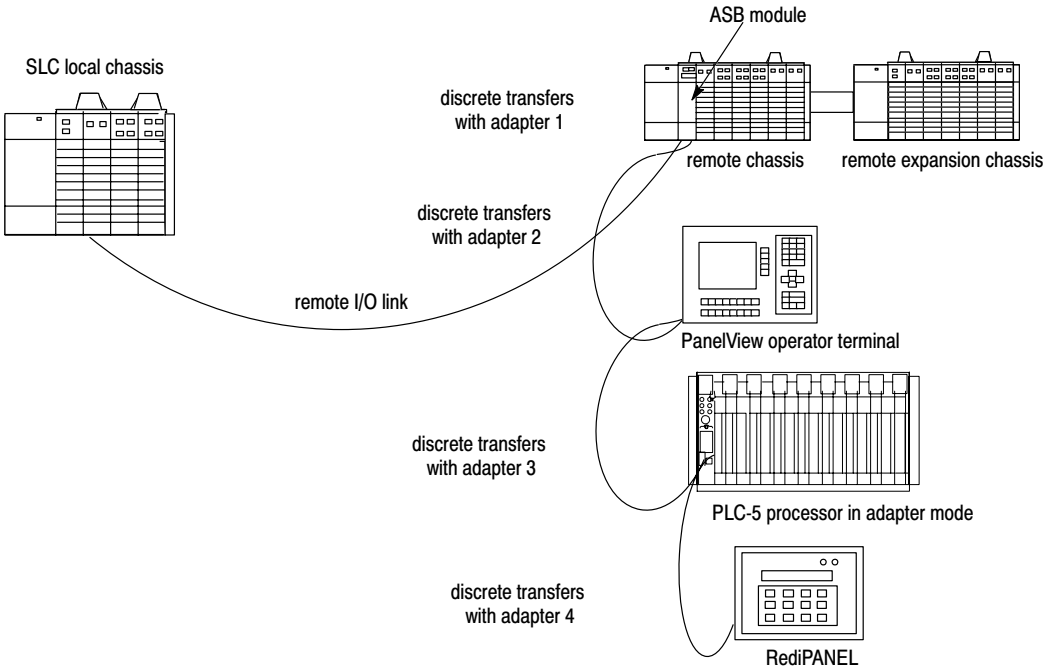
The SLC processor transfers the scanner's 4 logical racks (32 input image and 32 output image words) of discrete remote I/O image data into the SLC input and output image files. You can adjust the size of the scanner input and output image file when you configure the SLC system so that the scanner only transfers the discrete I/O data your application program requires. Use the confiGuration file (G file) to configure the starting remote I/O address and image size of each remote I/O adapter device connected to the scanner.

Important: The SLC 500 processor (SLC 5/02 or higher) supports multiple scanners in its local I/O chassis. The maximum number is dependent on the following:

- backplane power requirements (power-supply dependent)
- SLC 500 processor I/O data table limit (4,096 I/O)
- processor memory to support the application (SLC 500 processor dependent)

How the scanner scans remote I/O

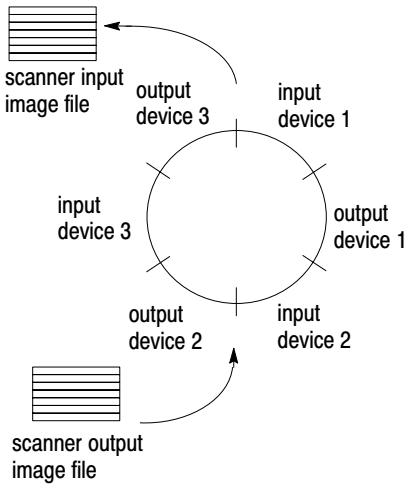
The scanner communicates with each logical device in a sequential fashion. First, the scanner initiates communication with a device by sending output data to the device. The device then responds by sending its input data back to the scanner. This is a discrete I/O transfer. After the scanner completes its discrete I/O transfer with the last configured network device, it begins another discrete I/O transfer with the first device.



The scanner transfers discrete I/O on a logical device basis not on an adapter basis. A logical device is a full logical rack or portion of a logical rack assigned to an adapter.

RIO Scanner Scan

The scanner updates its input image file each time it scans a logical device.



Configuring complementary I/O

The 1747-SN scanner supports complementary I/O. To use complementary I/O, you need two adapters that support complementary I/O. Configure one adapter as a primary chassis and configure the other adapter as a complementary chassis. There must be an input module in the primary chassis and an output module in the same slot of the complementary chassis. This enables total use of the scanner's 32 input and 32 output word image for I/O addressing of up to 1024 discrete points.

Primary and complementary chassis cannot have the same logical rack number. The logical rack numbers must be assigned to the primary and complementary racks as shown below:

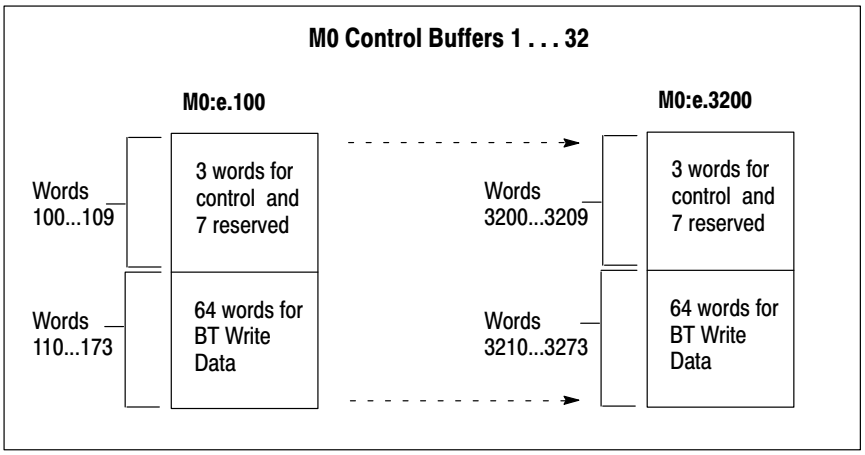
Primary chassis logical rack number:	Complementary chassis logical rack number:	
	decimal	octal
0	8	10_8
1	9	11_8
2	10	12_8
3	11	13_8

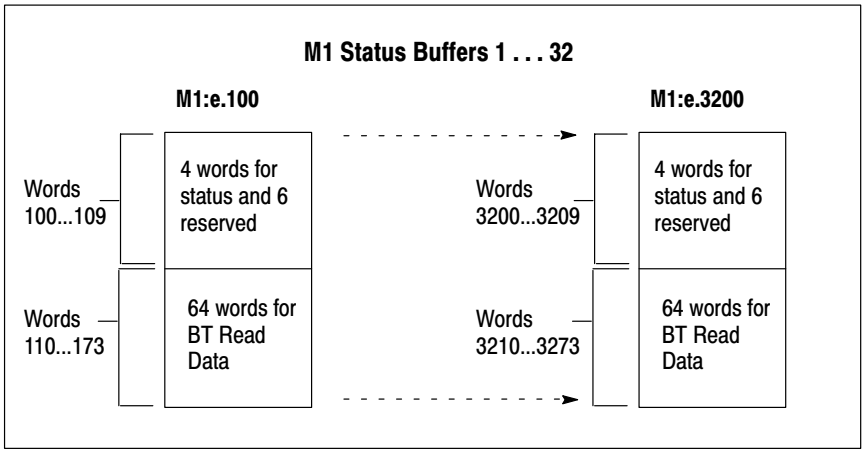
Sending block-transfers

The remote I/O scanner performs block-transfers through control/status buffers that you allocate in the scanner's M0 and M1 files. For BTWs, the M0 BT buffer contains BTW control data and BTW data, while a corresponding M1 BT buffer contains only BTW status information. For BTRs, the M0 BT buffer contains only BTR control data, while a corresponding M1 BT buffer contains BTR status information and BTR data. Block transfers occur asynchronous to remote I/O link discrete transfers. Block-transfers occur as RIO scan time allows – discrete I/O transfers have first priority.

A total of 32 block-transfer control/status buffers exist in the M0 (output/control) and the M1 (input/status) files. Block-transfer buffers consist of:

- 3 BT control words in an M0 file BT buffer
- 4 BT status words in an M1 file BT buffer
- 64 words of BTW data in an M0 file and 64 words of BTR data in an M1 file





You use an M0 file BT control buffer to initiate a BT. The corresponding M1 file displays the status of the block transfer.

BT buffers reside on 100 word boundaries in the M0/M1 files starting at word 100. For example, BT buffer 1 resides at M0:e.100 and M1:e.100; BT buffer 2 resides at M0:e.200 and M1:e.200; while BT buffer 16 resides at M0:e.1600 and M1:e.1600. The “e” in these examples refers to the physical chassis slot number in which the scanner resides.

All block transfer buffers (M0 and M1) are cleared (set to zero) either when the RIO scanner goes through a power cycle or when the SLC processor commands the scanner to change mode from Program to Test mode, Program to Run mode, or Test to Run mode.

Application considerations when using block-transfers

Below are points to consider when implementing block-transfer operations:

- The minimum amount of scanner image that can be assigned to a device on the RIO link is 1/4 logical rack in the G file configuration. This allows up to four separate devices per logical rack. Each device could have a maximum of four block-transfers configured to it. Thus, up to 16 BTRs and/or 16 BTWs could be assigned to each logical rack.
- If a block-transfer device is a 1747-ASB remote I/O adapter, then multiple SLC 500 modules (such as analog modules) could be scanned by the 1747-ASB and the data block transferred to the 1747-SN scanner. Since the remote I/O network handles one block-transfer request per logical rack at a time, there will be a delay before all devices in the 1747-ASB rack can be accessed.
- Inhibiting a device on the remote I/O network (via control words M0:e.8...11) precludes that device from block-transfer operations. Trying to initiate a block-transfer to an inhibited device results in an error reply. The scanner cancels a block-transfer that is in progress if it detects that the device is inhibited. Because of the asynchronous nature of inhibiting a device that has a block-transfer in progress, the reply may indicate either a successful completion or an error. In either case, the SLC control program must still clear the Enable flag.
- All M0 and M1 BT buffers are cleared (set to all zeros) after a power cycle and when the SLC processor goes from Program to Run mode, Program to Test mode, or Test to Run mode.

When using complementary I/O, if you configure a complementary device to use more I/O image space than an associated primary device, then block-transfers can only be performed to locations in the complementary device that have associated I/O image space in the primary device. For example, if a primary device is 1/2 logical rack and a complementary device is a full logical rack, block-transfers can be performed only in the first 1/2 logical rack of the complementary device.

Setting up a block-transfer

Follow the steps below to set up your scanner and SLC control program for either BTWs or BTRs.

1. You must increase the size of the M0 and M1 files in an offline programming-software session. The size depends on the number of block-transfer buffers your applications requires. Setting the buffers to maximum size (3300) does not affect system performance. However, addressing M-files in your SLC control program **does** affect system performance.
2. Set the control flags in M0:e.*x*00. Where *x* = block-transfer buffer number. See the tables below for read/write settings.

If you want to transfer data:	Use:	Do this to the M0:e.x00/7 file :
to the scanner from the adapter	BTR (block-transfer read)	Set the bit to 1 to specify a read operation
from the scanner to the adapter	BTW (block-transfer write)	Set the bit to 0 to specify a write operation.

3. Specify the length of the data you wish to block-transfer in word M0:e.x01. The maximum length is 64 words.
4. Specify the device's logical rack, group, and slot in word M0:e.x02.
5. Set your SLC control program to set the EN bit.

Block-transfer status bits

The tables below provide a quick reference for block transfer status and control bits. In the tables, x = the block transfer file.

This bit:	Is set:
Enable waiting EW M1:e.x00/10	when the scanner first detects EN being set. The EW bit gets reset when the EN flag resets.
Error ER M1:e.x00/12	when the scanner detects that the block transfer failed. The ER bit is reset when the EN flag resets.
Done DN M1:e.x00/13	at completion of the block transfer, if the data is valid. The DN bit is reset when the EN flag resets.
Start ST M1:e.x00/14	when the scanner "schedules" the BT for the adapter. The data transfers may not start for some time. The ST bit is reset when the EN flag resets.

Block-transfer control bits

This bit:	Is set:
Read-write RW M0:e.x00/7	by the SLC control program. A 0 indicates a write operation; a 1 indicates a read operation.
Timeout TO M0:e.x00/8	if you leave the timeout bit reset. The scanner repeatedly tries to send a block-transfer request to an unresponsive module for four seconds before setting the ER bit. if you set the TO bit through the SLC program the scanner attempts to cancel the BT request.
Enable EN M0:e.x00/15	by the SLC control program to initiate a BT request.

Additional documentation

- 1747-6.6 Remote I/O Scanner Module User Manual

PLC, PLC-2, PLC-5, SLC, SLC 5/02, SLC 5/03, and SLC 5/04 are trademarks of Allen-Bradley Company, Inc.

Rockwell *Automation*

Allen-Bradley

Allen-Bradley, a Rockwell Automation Business, has been helping its customers improve productivity and quality for more than 90 years. We design, manufacture and support a broad range of automation products worldwide. They include logic processors, power and motion control devices, operator interfaces, sensors and a variety of software. Rockwell is one of the worlds leading technology companies.

Worldwide representation.

Argentina • Australia • Austria • Bahrain • Belgium • Brazil • Bulgaria • Canada • Chile • China, PRC • Colombia • Costa Rica • Croatia • Cyprus • Czech Republic • Denmark • Ecuador • Egypt • El Salvador • Finland • France • Germany • Greece • Guatemala • Honduras • Hong Kong • Hungary • Iceland • India • Indonesia • Ireland • Israel • Italy • Jamaica • Japan • Jordan • Korea • Kuwait • Lebanon • Malaysia • Mexico • Netherlands • New Zealand • Norway • Pakistan • Peru • Philippines • Poland • Portugal • Puerto Rico • Qatar • Romania • Russia–CIS • Saudi Arabia • Singapore • Slovakia • Slovenia • South Africa, Republic • Spain • Sweden • Switzerland • Taiwan • Thailand • Turkey • United Arab Emirates • United Kingdom • United States • Uruguay • Venezuela • Yugoslavia

Allen-Bradley Headquarters, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414 382-2000 Fax: (1) 414 382-4444

1785-6.8.10 March 1996

955124-11

Copyright 1996 Allen-Bradley Company, Inc. Printed in USA