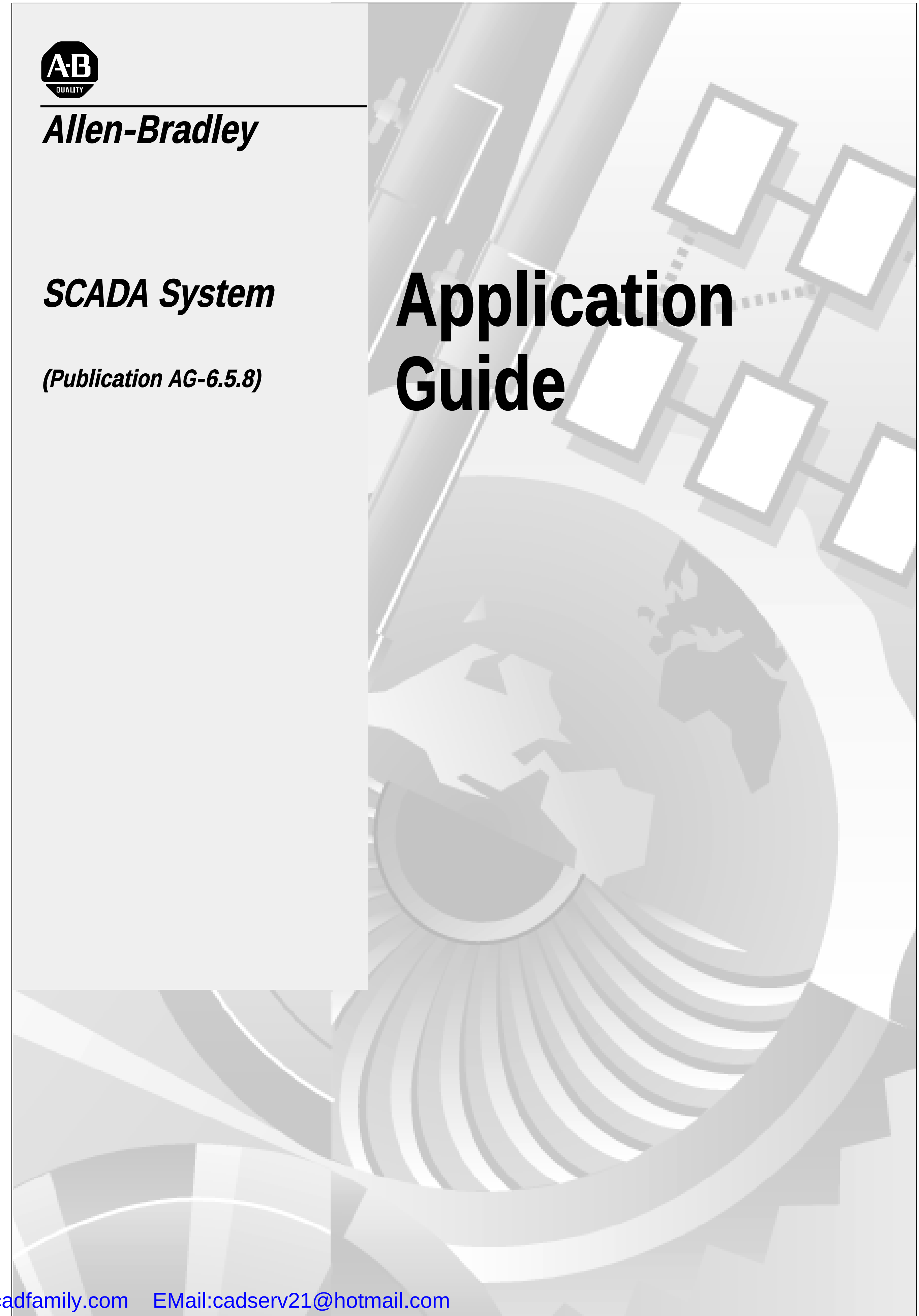
Allen-Bradley

SCADA System

(Publication AG-6.5.8)

Application Guide



Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI–1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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

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

Attention statements help you to:

- identify a hazard
- avoid the hazard
- recognize the consequences

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

Introduction

This document has been revised since the June 1996 printing. Changes to this document are so extensive, that it is impractical to mark every change with a revision bar in the margin of the page. The purpose of this section is to outline the changes in the SCADA Application Guide.

Scope of Changes

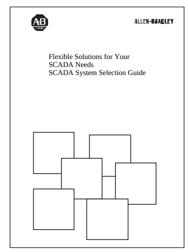
This SCADA Application Guide represents the latest developments in Allen-Bradley hardware and software, and includes the most recent third-party supplier information as it relates to SCADA applications.

Changes incorporated in this document include:

- The updating of the enhanced PLC-5 chapter (Chapter 2), including new screen captures from RSLogix 5 and messaging details.
- The restructuring of the SLC 5/03, 5/04 chapter (Chapter 4) to include the SLC 5/05, new screen captures from RSLogix 500 and messaging details.
- The addition of a MicroLogix chapter, (Chapter 6) which details the use of MicroLogix controllers in SCADA applications.
- The addition of a Logix5550 chapter, (Chapter 7) which details the use of the Logix5550 controller in SCADA applications.
- Updated third-party modem documentation (Chapter 8).
- The addition of a RSLinx chapter, which details the configuration of the RSLinx DF1 Polling Master and DF1 Slave drivers for use in SCADA applications.
- The addition of an appendix (Appendix E) which provides detailed examples of messaging ladder logic that is typical to SCADA applications.

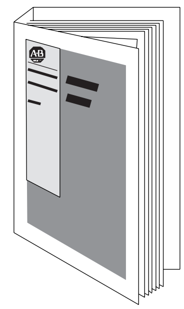
What SCADA Information Is Available?

Two principle SCADA documents are available:



SCADA System Selection Guide
Publication AG-2.1

- Presents A-B capabilities for SCADA applications
- Guides you through choosing SCADA system components



SCADA System Application Guide
Publication AG-6.5.8 (this manual)

- Describes how to configure A-B products and third-party modems
- Describes how to send messages
- Gives application samples

Audience

We designed this document for individuals who are configuring a SCADA system or are answering configuration questions. This document assumes you know how to:

- handle, install, and operate the products referenced in this document
- install, navigate through, and use the software products referenced in this document
- prepare cables, if necessary

Book Overview

Design

- **chapter 1** Designing Communication

Configure

- **chapter 2** Configuring Enhanced PLC-5 Processors
- **chapter 3** Configuring Classic PLC-5 Processors with 1785-KE Modules
- **chapter 4** Configuring SLC-5/03,5/04 and 5/05 Processors
- **chapter 5** Configuring SLC 500 Processors with 1747-KE Interface Modules
- **chapter 6** Configuring MicroLogix Controllers
- **chapter 7** Configuring Logix5550 Processors
- **chapter 8** Configuring Modems
- **chapter 9** Configuring RSLinx 2.0 Software for DF1 Half-duplex Communications

Apply

- **chapter 10** Using Dial-up Telephone Communication
- **chapter 11** Remotely Programming PLC-5 and SLC 500 Processors

Reference

- **appendix A** Modem Cable Reference
- **appendix B** Basic DF1 Protocol Troubleshooting
- **appendix C** Third-Party Supplier Contact Information
- **appendix D** Worksheets
- **appendix E** Sample Ladder Logic
- **Glossary**

Terms

We use these terms frequently in this book:

Term:	Definition:
Classic PLC–5 processor	A collective name used to refer to PLC–5/10, –5/12, –5/15, and –5/25 processors.
Enhanced PLC–5 processor	A collective name used to refer to PLC–5/11, –5/20, –5/30, –5/40, –5/60, and PLC–5/80 processors.
Ethernet PLC–5 processor	A collective name used to refer to PLC–5/20E, –5/40E, and –5/80E processors.
master station	A device (programmable controller with I/O modules or a workstation) that sends data to and collects data from devices connected on a point-to-multipoint, half-duplex network.
slave station	A device (programmable controller with I/O modules) that is located in a remote site away from the master station and that controls I/O points at the remote site. A slave station accepts commands from and can send data (if capable) to a master station via a telemetry network.

See the Glossary for other definitions.

Conventions

This section explains the following conventions:

- addresses
- identifying where you are within the manual

Addresses

These values:	Are represented like:
octal	X_8
decimal	X_{10}

Related Publications

Use these manuals as necessary::

Title:	Publication Number:
Automation Systems Catalog	
Enhanced and Ethernet PLC–5 Programmable Controllers User Manual	1785–6.5.12
Classic PLC–5™ Family Programmable Controllers Hardware Installation Manual	1785–6.6.1
1785 PLC–5 Family Programmable Controllers Quick Reference	1785–7.1
PLC–5 Instruction Set Reference Manual	1785–6.1
1785–KE DH+ Communications Interface Module User Manual	1785–6.5.2
SLC 500™ and MicroLogix™ 1000 Instruction Set Reference Manual	1747–6.15
SLC 500 Modular Hardware Style Installation and Operation Manual	1747–6.2
DH–485/RS232C Interface Module User Manual	1747–6.12
MicroLogix™ 1000 Programmable Controllers Users Manual	1761-6.3
Logix5550 Controller User Manual	1756-6.5.12
Logix5550 Controller Programming Manual	1756-6.4.1

Chapter 1

Designing Communication

Chapter 2

Configuring Enhanced PLC-5 Processors

Chapter 3

Configuring Classic PLC-5 Processors with 1785-KE Modules

Chapter 4

Configuring SLC 5/03, 5/04 and 5/05 Processors

Chapter 5

Configuring SLC 500™ Processors with 1747-KE Interface Modules

Chapter 6

Configuring MicroLogix Controllers

Chapter 7

Configuring Logix5550 Controllers

Chapter 8

Configuring Modems

Chapter 9

Configuring RSLinx Software for DF1Half-Duplex Communications

Chapter 10

Using Dial-up Telephone Communication

Chapter 11

Remotely Programming PLC-5, SLC 500 and MicroLogix 1000 Processors

Appendix A

Appendix B

Appendix C

Appendix D

Appendix E

Designing Communication

Use This Chapter . . .

... to choose a communication method and design a communication scheme for getting information to and from slave stations. Use this chapter along with the configuration chapters of the devices in your SCADA system to help you make design and configuration choices.

While designing your communication scheme, consider these application requirements:

- responsiveness
- determinism
- cost
- efficiency

Keep in mind the factors that affect communication are a result of the protocol you are using, whether half-duplex or full-duplex.

Choosing a Polling Mode for DF1 Half-Duplex Master

A master station can be configured to communicate with slave stations in either Message-based polling mode or Standard polling mode. The pros and cons of each polling mode are described below.

Message-Based Polling Mode

Message-based polling mode is best used in networks when communication with the slave stations is not time critical and where the user needs to be able to limit when and how often the master station communicates with each slave station. It is ***not*** recommended for larger systems that require time critical communication between the master and all the slave stations, or for systems where slave station-initiated messages are going to be used.

With Message-Based polling mode, the only time a master station communicates with a slave station is when a message (MSG) instruction in ladder logic is triggered to that particular slave station's address. This polling mode gives the user complete control (through ladder logic) over when and how often to communicate with each slave station.

If multiple MSG instructions are triggered "simultaneously," they will be executed in order, one at a time, to completion (i.e., the first MSG queued up will be transmitted and completed to done or error before the next queued up MSG is transmitted). Any time a message is triggered to a slave station that can't respond (for instance, if its modem fails), the message will go through retries and timeouts that will slow down the execution of all the other queued up messages. The minimum time to message to every responding slave station increases linearly with the number of slave stations that can't respond.

If the Message-based selection is "*don't allow* slaves to initiate messages," then even if a slave station triggers and queues up a MSG instruction in its ladder logic, the master station will not process it. This mode is similar to how a master/slave network based on Modbus protocol would work, since Modbus slave stations cannot ever initiate a message.

If the Message-based selection is "*allow* slaves to initiate messages," when a slave station initiates a message to the master station *(polled report by exception messaging*) or to another slave station *(slave-to-slave messaging)*, the MSG command packet will remain in that slave station's transmit queue until the master station triggers its own MSG command packet to it (which could be seconds, minutes or hours later, depending on the master's ladder logic).

Standard Polling Mode

Standard polling mode is *strongly* recommended for larger systems that require time critical communication between the master and all the slave stations, or for any system where slave station-initiated messages are going to be used (this includes slave programming over the network, since this uses the same mechanism that slave-to-slave messaging uses). The Active Node Table "automatically" keeps track of which slaves are (and are not) communicating. Standard polling mode should *not* be used in cases where the user needs to be able to limit when and how often the master station communicates with each slave station.

Standard polling mode causes the master station to continuously send one or more 4-byte poll packets to each slave station address configured by the user in the poll list(s) in round robin fashion – as soon as the end of the polling list is reached, the master station immediately goes back and starts polling slave stations from the top of the polling list over again. This is independent and asynchronous to any MSG instructions that might be triggered in the master station ladder logic. In fact, this polling continues even while the master station is in program mode!

When a MSG instruction is triggered while the master station is in run mode, the master station will transmit the message packet just after it finishes polling the current slave station in the poll list and before it starts polling the next slave station in the poll list (no matter where in the poll list it is currently at). If multiple MSG instructions have been triggered "simultaneously," at least four message packets may be sent out between two slave station polls. Each of these messages will have an opportunity to complete when the master polls the slave station that was addressed in the message packet as it comes to it in the poll list.

If each of the transmitted message packets is addressed to a different slave station, the order of completion will be based upon which slave station address comes up next in the poll list, not the order that the MSG instructions were executed and transmitted in.

When a slave station receives a poll packet from the master station, if it has one or more message packets queued up to transmit (either replies to a command received earlier or MSG commands triggered locally in ladder logic), the slave station will transmit the first message packet in the transmit queue.

If the standard mode selection is "*single* message per poll scan," then the master station will then go to the next station in the poll list. If the standard mode selection is "*multiple* messages per poll scan," the master station will continue to poll this slave station until its transmit queue is empty.

The master station “knows” the slave station has no message packets queued up to transmit when the slave station responds to the master poll packet with a 2-byte poll response.

Every time a slave station responds or doesn’t respond to its poll packet, the master station “automatically” updates its active node list (again, even if it’s in program mode). In this list, one bit is assigned to each possible slave station address (0-254). If a slave station doesn’t respond when it is polled, its active node list bit is cleared. If it does respond when it is polled, its active node bit is set. Besides being an excellent online troubleshooting tool, two common uses of the active node list are to report good/bad communication status for all slave stations to an operator interface connected to the master station for monitoring, alarming and logging purposes, and to precondition MSG instructions to each particular slave.

This second use is based on the supposition that if a slave station didn’t respond the last time it was polled (which was just a few seconds ago, if that long), then chances are it won’t be able to receive and respond to a MSG instruction now, and so it would most likely just end up going through the maximum number of retries and timeouts before completing in error (which slows down both the poll scan and any other messaging going on). Using this technique, the minimum time to message to every responding slave station actually *decreases* as the number of slave stations that can’t respond *increases*.

Important: In order to remotely monitor and program the slave stations over the half-duplex network while the master station is configured for Standard polling mode, the programming computer DF1 slave driver (typically Rockwell Software WINLINX or RSLinx) station address must be included in the master station poll list.

Standard polling mode should *not* be used in cases where the user needs to be able to limit when and how often the master station communicates with each slave station.

About Polled Report-by-Exception

Polled report-by-exception lets a slave station initiate data transfer to its master station, freeing the master station from having to constantly read blocks of data from each slave station to determine if any slave input or data changes have occurred. Instead, through user programming, the slave station monitors its own inputs for a change of state or data, which triggers a block of data to be written to the master station when the master station polls the slave.

If your SCADA application is time-critical and any two or more of the following apply, then you can benefit from polled report-by-exception messaging:

- communication channel is slow (2400 bps or less)
- average number of words of data to monitor in each slave station is greater than five
- number of slave stations is greater than ten

About Slave-to-Slave Messaging

Most SCADA half-duplex protocols do not allow one slave station to talk to another slave station, except through special application-specific code, which requires processing overhead in the master station. However, Allen-Bradley's DF1 half-duplex protocol implements slave-to-slave communications as a feature of the protocol within the master station, without any additional application code or extra processing overhead.

If one slave station has a message to send to another, it simply includes the destination slave station's address in the message instruction's destination field in place of the master station's address when responding to a poll. The master station checks the destination station address in every packet header it receives from any slave station. If the address does not match its own station address, the entire message is forwarded back onto the telemetry network to the appropriate slave station, without any further processing.

Addressing Tips

Each station on the network including the master station must have a unique address. The address range is $0\text{-}254_{10}$ (376_8), so you can have a maximum of 254 stations on a single telemetry network. Station address 255_{10} (377_8) is the broadcast address, which you cannot select as a station's individual address.

A remote programming terminal station address should be reserved, even if remote programming is not considered a requirement initially. This address will need to be periodically polled, even though it will remain on the inactive poll list unless a remote programming terminal is online. See chapter 11 for more information.

SLC 500™ and MicroLogix 1000 Processor Addressing Considerations

When a SLC 5/02™ or MicroLogix 1000 slave station issues a PLC-2®-type message to a PLC-5® master station, the message's destination in the PLC-5 processor's data table is an integer file with the file number equal to the SLC 500 or MicroLogix 1000 processor station address.

An address lower than 9 may interfere with a PLC-5 processor master station since files 0-8 are usually left in their default configuration; file 9 is often used by programmers for the I/O list. Station address 255_{10} is the broadcast address. So, assign addresses between 10_{10}-254_{10}.

When using a SLC 5/03, 5/04 or 5/05 processor as a master station, the poll list configuration consists of a contiguous block of addresses. Therefore, assign slave station addresses in a contiguous block in order to avoid polling for nonexistent slave stations.

SLC 500 Processors with a 1747-KE Module Addressing Considerations

Since you can have up to 254 devices on a half-duplex network and 31 devices on a DH-485 network, to allow 255 DH-485 nodes requires using a group number. This parameter defines the address group of the SLC 500 half-duplex address. Each address group can consist of 32 addresses.

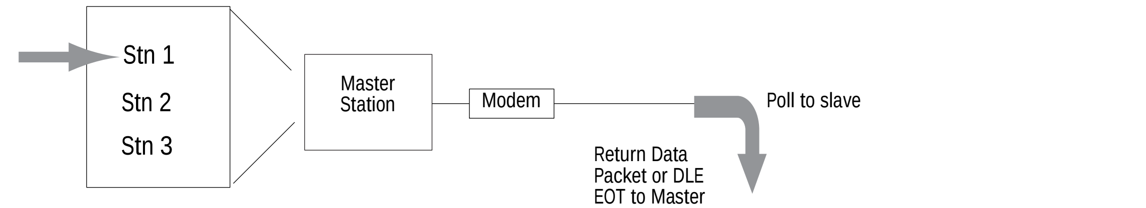
The address of the SLC 500 processor is determined with the following formula: (32*G)+A, where G is the "group number" (0-7) and A is the DH-485 node address of the SLC 500 processor.

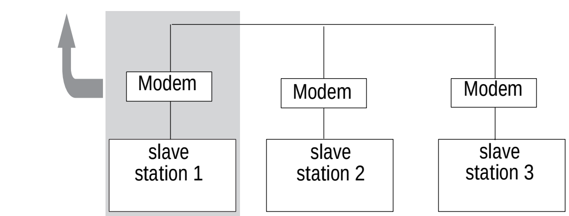
One station address within each group of size 32 must be reserved for any 1747-KE modules configured with that group number. A second address within each group should also be reserved for local DH-485 programming terminals. These 16 addresses (two per group) should never have to be polled by the master station.

Communication Scheme Design Using Standard-Mode

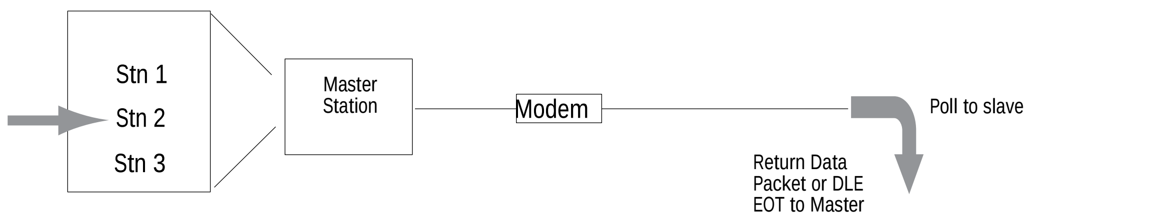
Standard-communication mode for an Allen-Bradley master station uses centralized polling to gather data from slave stations. A master station using this communication technique asks (polls) individual slave stations if they have any information to send. All stations on the link "hear" the master station's requests, but only the slave station to which a request is addressed replies. PLC-5, Logix5550 and RSLinx master stations poll slave stations based on an ordered list (polling list) configured by the system designer. SLC 5/03, 5/04 and 5/05 master stations poll slave stations sequentially in a range of addresses configured by the system designer. Figure 1.1 shows how a slave station gets polled and how it responds.

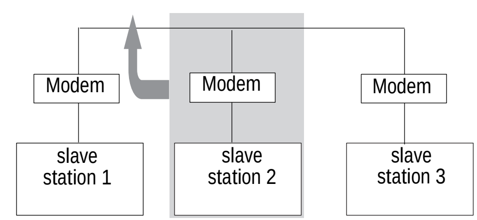
Figure 1.1
A master station polls the slave stations in the order the slave stations appear on the list. slave stations send either a data packet or a packet indicating that the station has no data to send.





1. Master station polls a slave station for data.
2. If the slave station has data to send, then it sends a data packet. If there is no data to send then it sends an end of transmission packet (DLE EOT).





3. Master station polls the next slave station for data.
4. If the slave station has data to send, then it sends a data packet. If there is no data to send then it sends an end of transmission packet (DLE EOT).
5. Master station continues to poll each slave station in the polling list. When the end of the list is reached, the master station then moves back to the beginning of the list and starts the polling sequence over again.

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When the master station is configured for standard-communication mode, you do not need to program any master-station message instructions to communicate with slave stations. Communication with slave stations occurs by the master station sending polling packets to slave stations. You only need message instructions when you want the master station to write data to or read data from a location within a slave station's data table.

To help you understand:	See:
standard-communication mode	Figure 1.2
how a master station requests data	Figure 1.3

Figure 1.2
Use this machine state diagram to help you understand *standard-communication* mode.

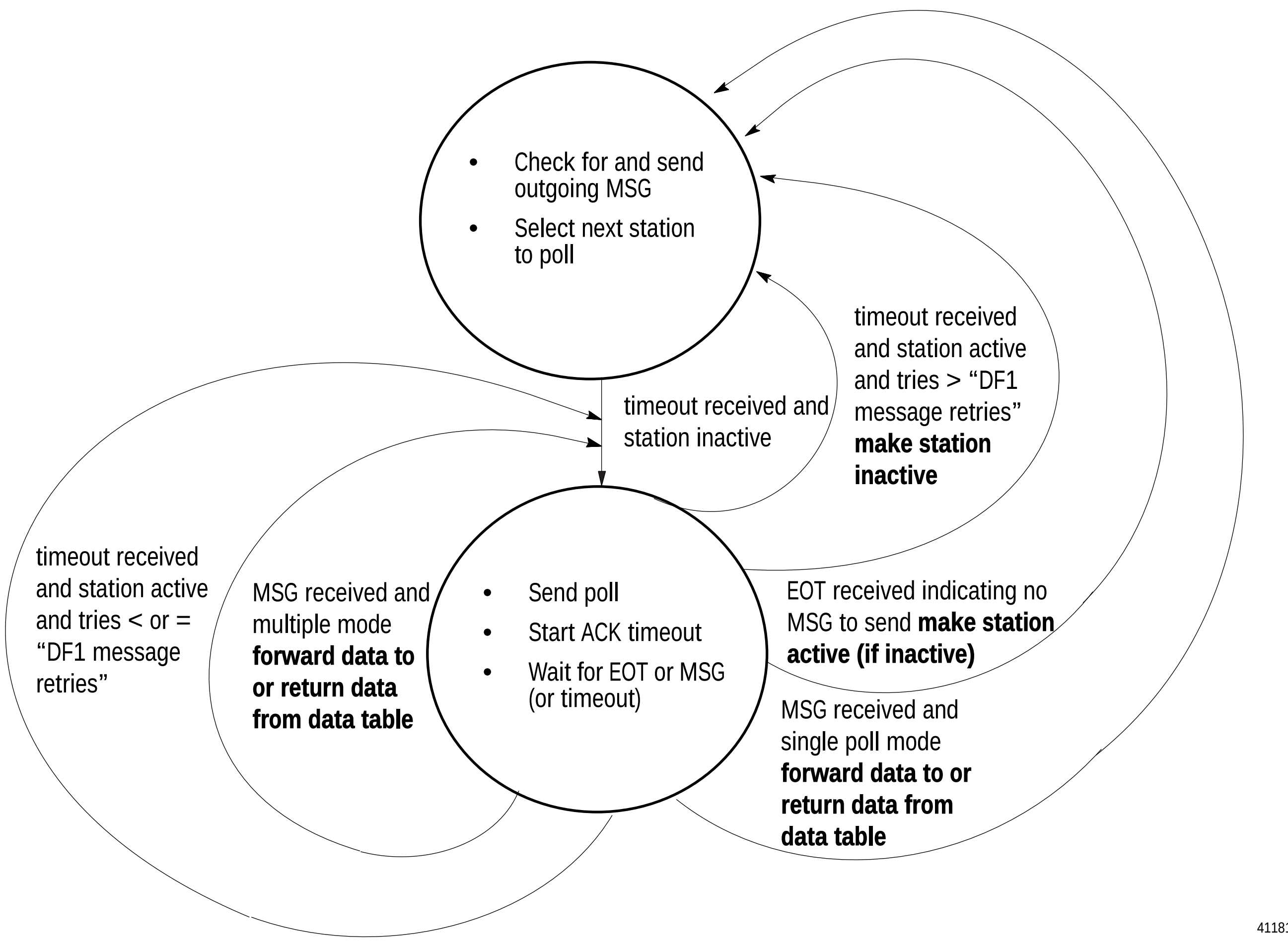
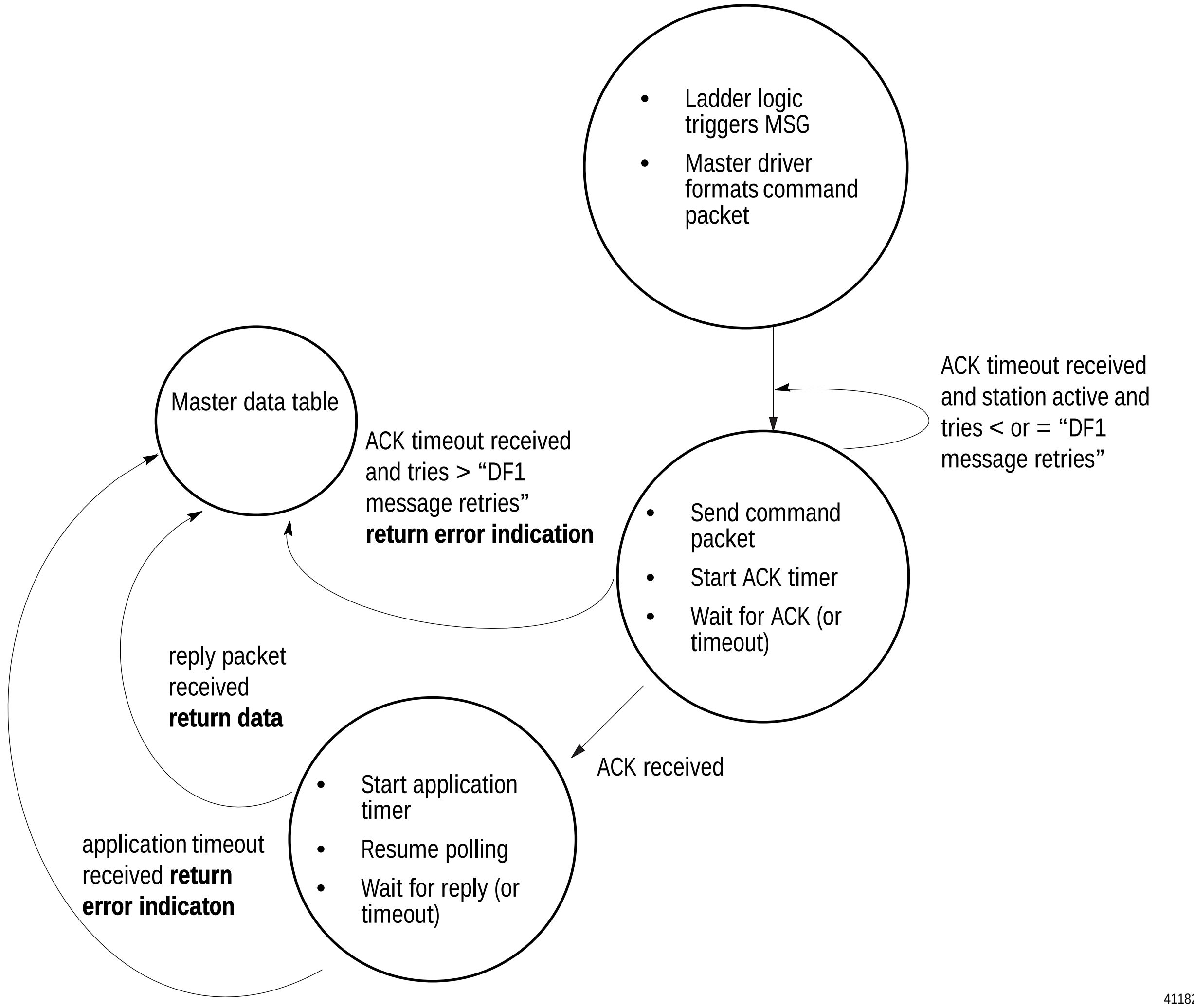


Figure 1.3
Use this machine state diagram to help you understand how a device requests data transfer (read or write request) via DF1 half-duplex protocol.



To design a communication scheme using standard-communication mode, you must do the following:

- design a polling scheme
- plan for timing issues

Designing a Polling Scheme

Each master station in a SCADA application must have a polling scheme configured. To design a polling scheme, do the following:

- choose the type of scheme best suited for your application
- optimize your polling scheme to obtain the best efficiency

The master station you are using determines the type of polling choices you have; however, A-B master stations offer similar choices, such as:

- normal and priority polling lists
- ability to poll a slave station:
  - once per occurrence in the poll list (single)
  - until it has no more messages to send (multiple)

Choosing Normal or Priority Polling Lists

slave stations listed in a priority poll list are polled more frequently than those listed in the normal poll list. Place the slave stations that you need information from more frequently in a priority poll list.

Within each poll list, slave stations are assigned a status, which is either active or inactive. A slave station becomes inactive when it does not respond to a master station's poll packet after the configured number of retries.

If your master station is a Logix5550 or PLC-5, you can use application logic to reorder the polling lists and priority while the application logic is executing.

Figure 1.4 and Figure 1.5 show how normal and priority lists relate to one another.

Figure 1.4
The master station scans slave stations in a set sequence.

1. Scans all stations in the active priority poll file
2. Scans one station in the inactive priority poll file
3. Scans stations in the active normal poll file based on the normal poll group size, which you specify during configuration. For example, if the group size were 3, then three stations would be polled in the normal file before the master continues to the next step in the sequence
4. Scans one station in the inactive normal poll file after all stations in the active normal list have been polled.

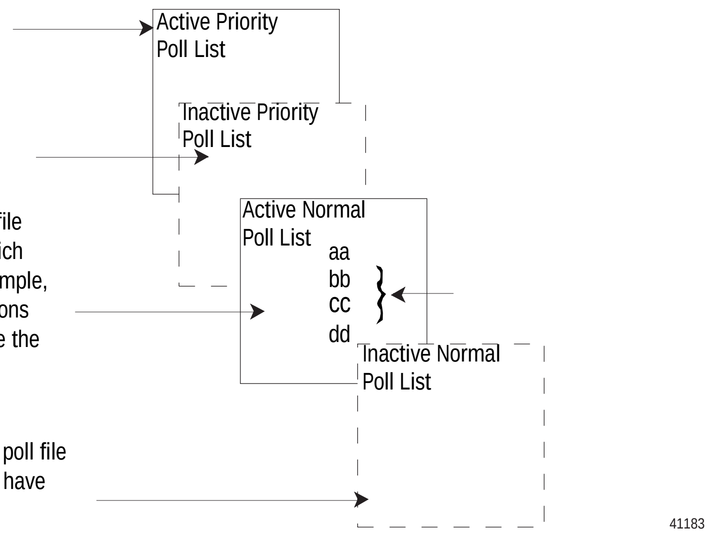
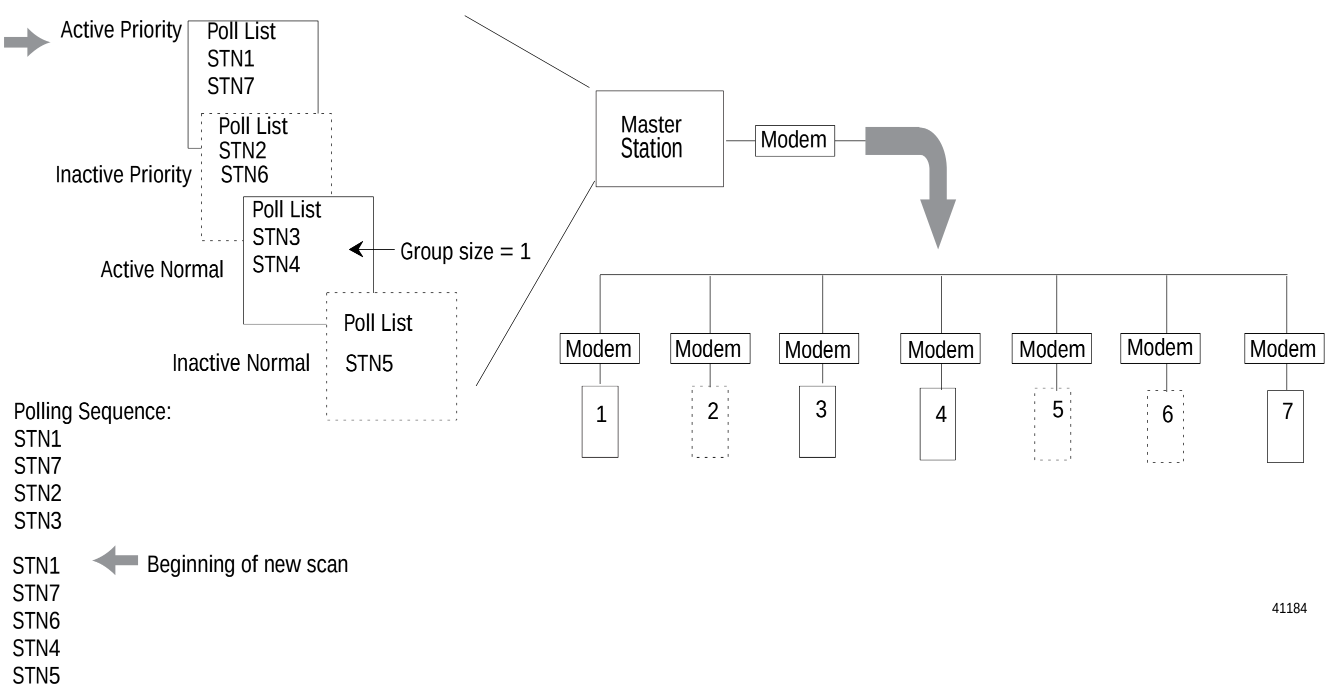


Figure 1.5
Here is how the polling sequence applies to an application.



Choosing Single or Multiple Message Transfer
Depending on your application's requirement, you can choose the number of messages you want to receive from a slave station during its turn.

If you want to receive:	Choose:
only one message from a slave station per poll per a station's turn Choose this method only if it is critical to keep the poll list scan time to a minimum.	single transfer
as many messages from the slave station as it has in its queue	multiple transfer

Planning for Timing Issues

Two types of timing categories exist:

- protocol timers, which specify how long a master station will wait to "hear" from a slave station
- Request to send (RTS) timers, which you can use to make sure the modem is ready to accept data or has passed on the data

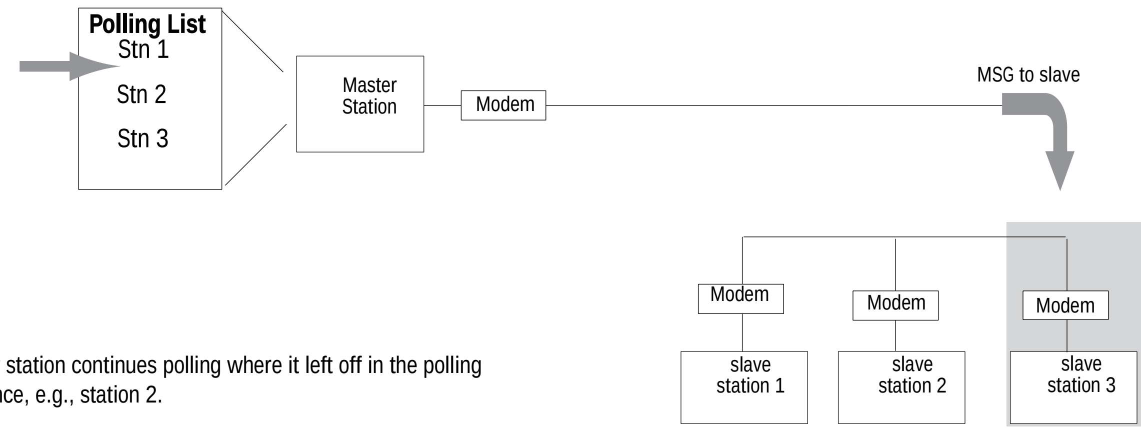
Set and adjust these timing values as necessary for your application. Set your RTS times based on the communication media and modem you are using.

Design Considerations

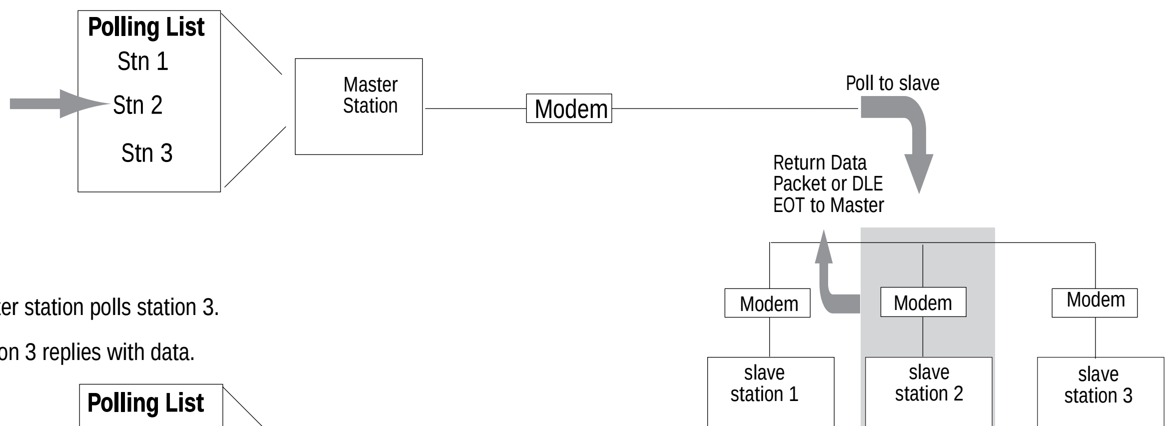
- Define a polling list type to use (normal or priority).
- Define a station list.
- Use Figure 1.6 to help understand how the MSGs are handled using standard communication.

Figure 1.6
Use this figure to help you understand the effect sending MSGs has on Logix5550, PLC-5 and SLC 500 polling.

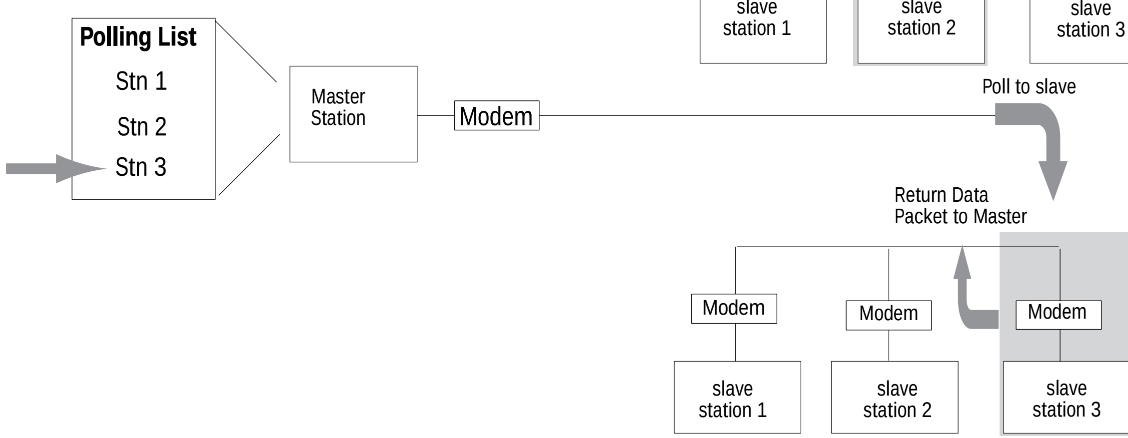
1. Polled station 1; ready to poll station 2.
2. MSG sent to station 3 (MSG was waiting in queue).



3. Master station continues polling where it left off in the polling sequence, e.g., station 2.



4. Master station polls station 3.
5. Station 3 replies with data.

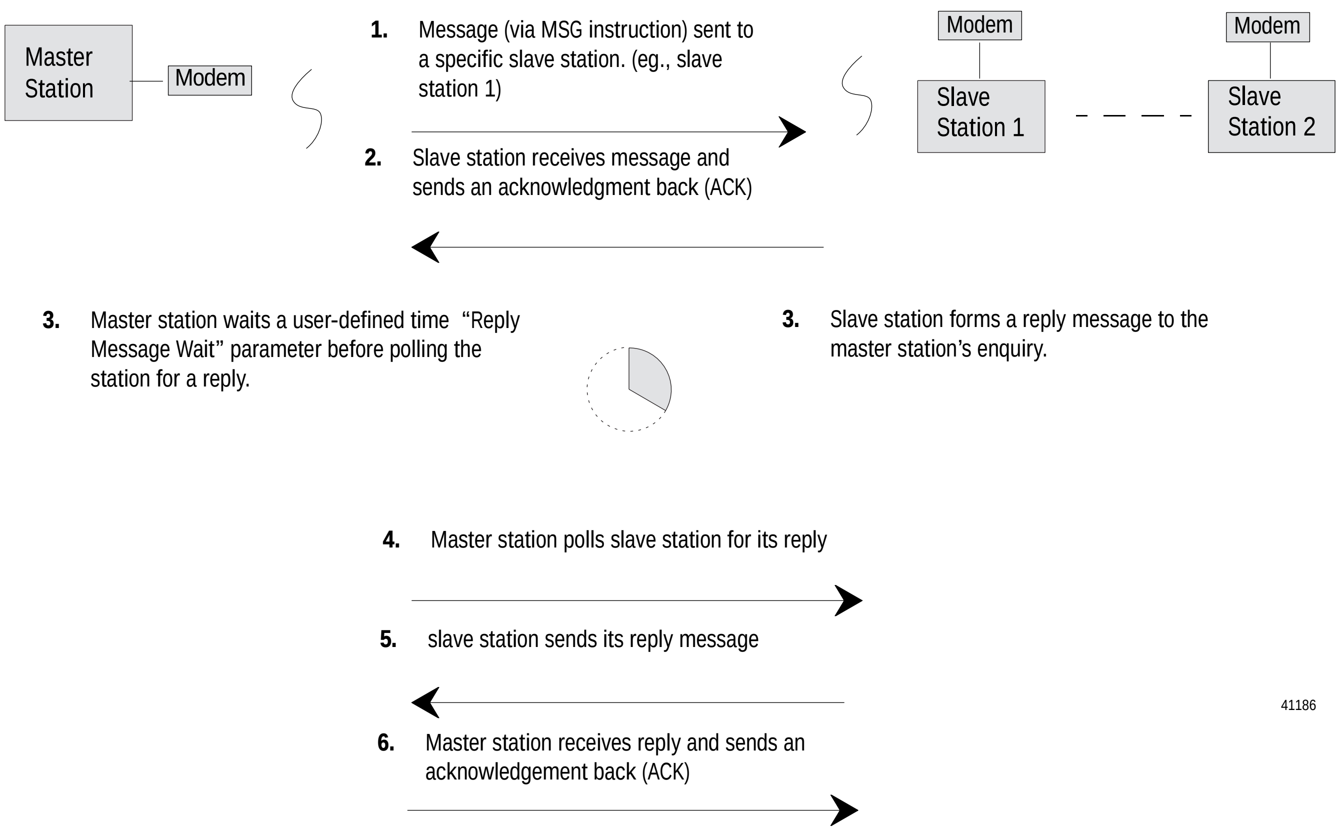


6. Master station returns to beginning of the poll list.

Communication Scheme Design Using Message-based Mode

In message-based communication mode, the master station sends solicited messages (messages programmed via ladder logic) to a specific slave station when the master requires information. In this mode, the communication link is inactive until the master station has a message to send to a slave station. Figure 1.7 explains the communication sequence that occurs.

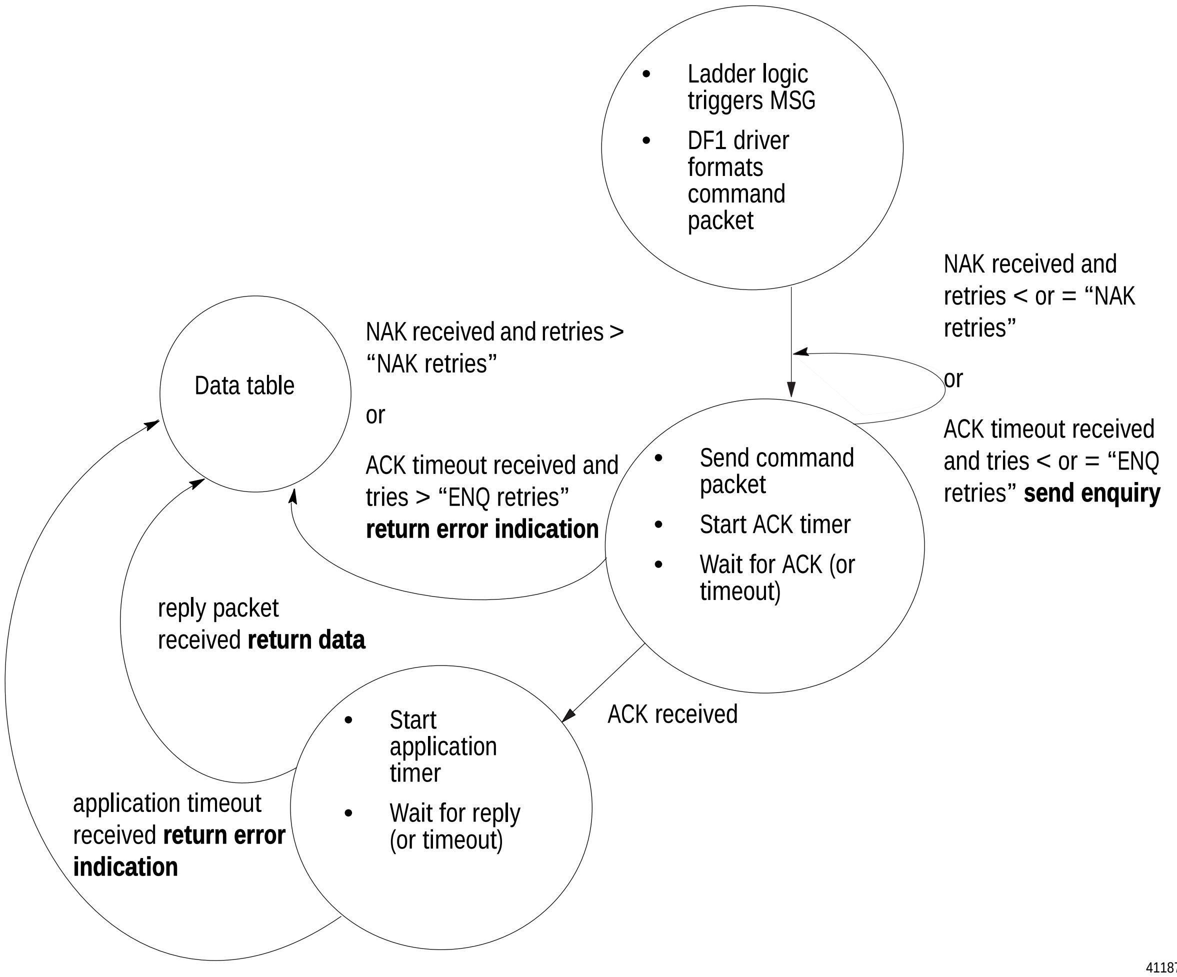
Figure 1.7
Use this figure to help you understand message-based communication.



Designing Communication for Full-Duplex Protocol

When designing communication using DF1 full-duplex protocol, you must specify some timers and counters that control the communication between a transmitting station and a receiving station. Consider the type of link media you are using to help you determine the best values for the timer and counters. For example, you can expect a message being sent over a satellite link to take longer than one being sent over a telephone leased-line link. Figure 1.8 shows the communication sequence for DF1 full-duplex protocol.

Figure 1.8
Use this machine state diagram to help you understand a device requests data transfer (read or write request) via DF1 full-duplex protocol.



What to Do Next?

Make sure you:

- choose the communication method best suited for your application
- make initial configuration choices for the communication method you have chosen
- use this chapter as a reference as you configure the devices in your SCADA system

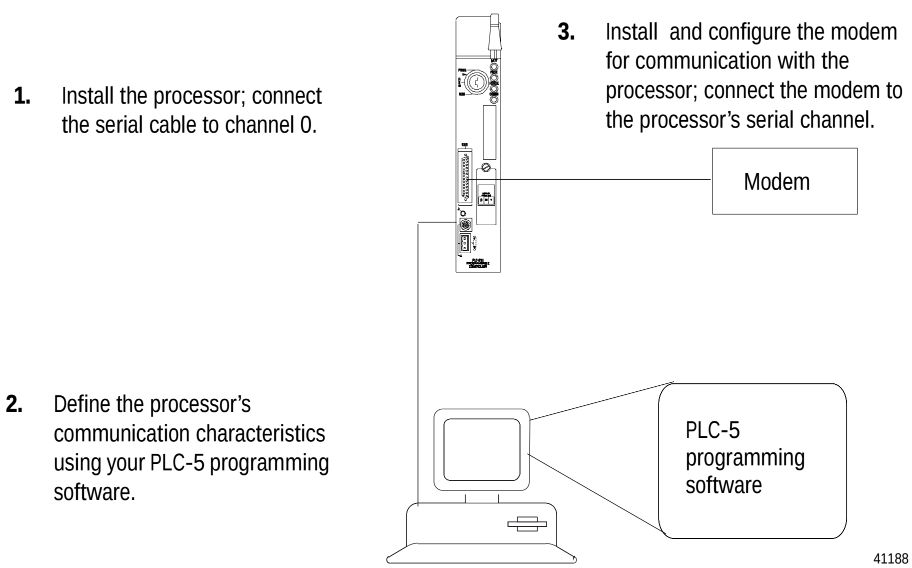
Configuring Enhanced PLC-5 Processors

Use This Chapter…

… to help you set up an Enhanced PLC-5 processor as a master station, as a slave station, or as a station on a point-to-point link.

Overview

To configure an Enhanced PLC-5 processor, perform these tasks:



Installing the Processor

Before installing the processor, set the processor switch assemblies.

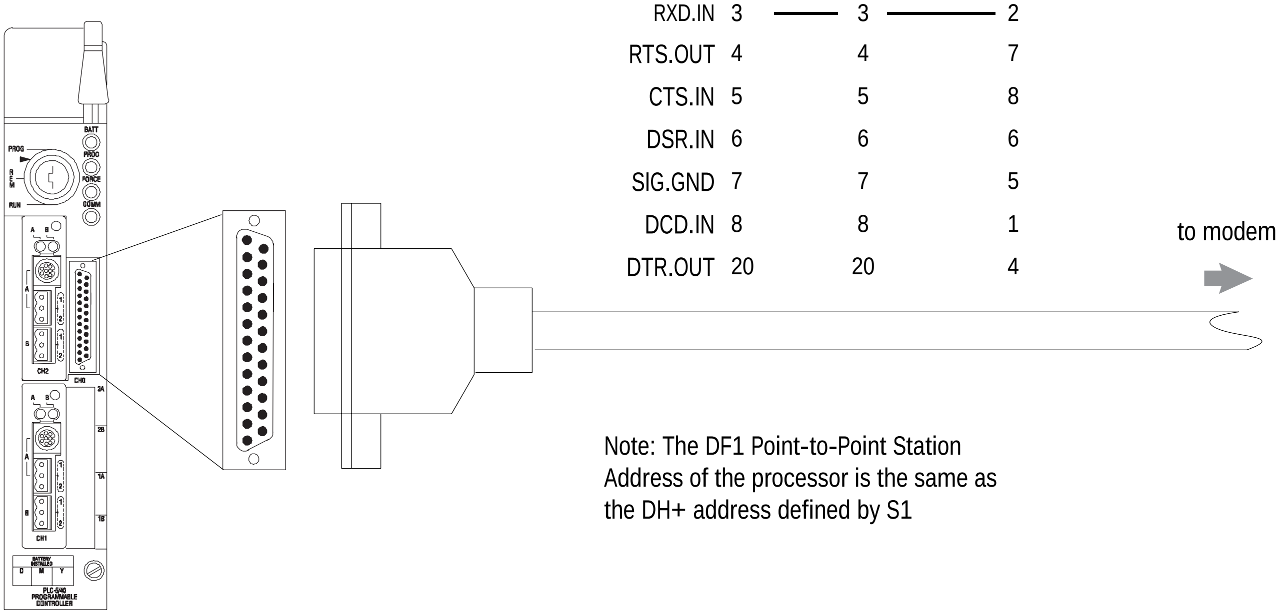
Define:	By setting switch assembly:
DH+ and DF1 point-to-point station address	S1
RS-232 as the electrical interface for the serial port	S2

For details about installing the processor, see the Enhanced PLC-5 Programmable Controllers Quick Start, publication 1785-10.4.

For cable pinouts, see Figure 2.1 or Appendix A-2.

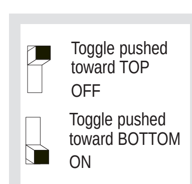
Figure 2.1
Enhanced PLC-5 Serial Port Pin Assignments and S2 Settings.

25-pin male		25-pin	9-pin
C. GND	1	1	NC
TXD.OUT	2	2	3
RXD.IN	3	3	2
RTS.OUT	4	4	7
CTS.IN	5	5	8
DSR.IN	6	6	6
SIG.GND	7	7	5
DCD.IN	8	8	1
DTR.OUT	20	20	4



Note: The DF1 Point-to-Point Station Address of the processor is the same as the DH+ address defined by S1

To Specify:	Set Switches: 1	2	3	4	5	6	7	8	9	10
RS-232C	ON	ON	ON	OFF	OFF	ON	ON	OFF	ON	OFF



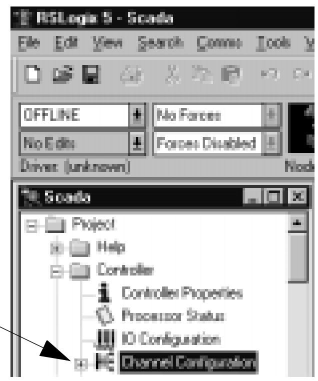
41189

Configuring a DF1 Half-Duplex Standard Mode Master Station

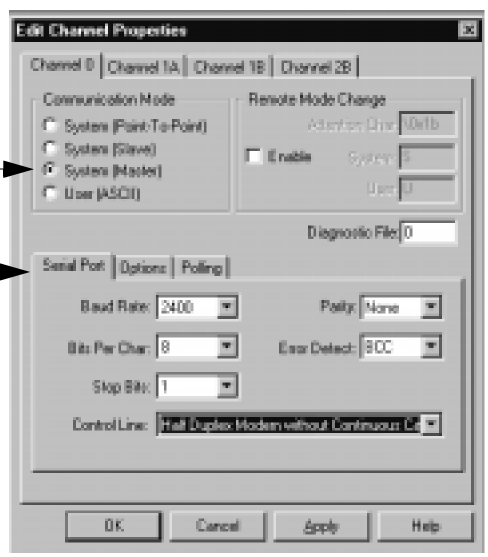
Choose standard-communication mode if you want to query slave stations for information based upon user-configured polling lists. This mode is used most often in point-to-multipoint configurations because it allows polled report-by-exception (page 1-4), slave-to-slave messaging (page 1-5) and slave programming over the telemetry network (chapter 11) to be implemented. In addition, in this mode the master station maintains an active node table which allows an MMI or programming terminal to immediately identify which slave nodes can currently communicate and which nodes cannot.

To configure the processor for a master station using standard communication, place the processor into program mode and do the following using your RSLogix 5 software:

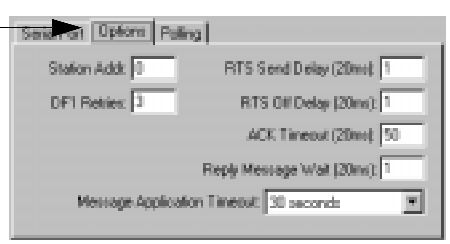
Double-click on the Channel Configuration file to bring up the Edit Channel Configuration interface.



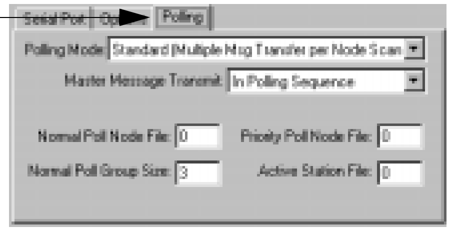
1. On the Channel 0 tab, choose System (Master) for your Communication Mode.
2. Configure the Serial Port, Options, and Polling parameters according to Table 2.A.



3. Configure Options parameters according to Table 2.A .



4. Configure the Polling parameters according to Table 2.A.
5. When all parameters are set, click OK.
6. Create station lists (page 2-7).



Define the Communication Driver Characteristics

Use Table 2.A to help you understand the communication parameters you need to specify on the Channel Configuration screen for standard-communication mode.

Use Worksheet 2.1 (Appendix D-4) for an example configuration and to record your station's configuration.

Table 2.A
Define these communication parameters for a PLC-5 master station using standard-communication mode to talk to slave stations.

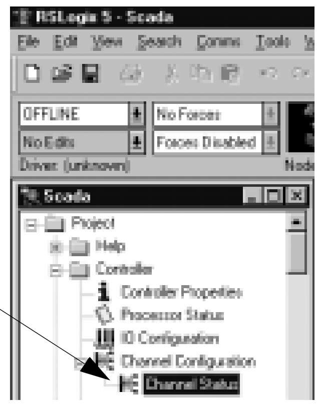
RSLogix 5 Tab:	Parameter:	Selections:
Channel 0	Diagnostic File	Select an unused integer file to store channel status information. You must define a diagnostic file in order to be able to view channel 0 status. See Table 2.B on page 2-6 for description of what is in this file.
	Remote Mode Change	Check enable remote mode change if you want to switch the configuration of the channel during runtime. Leave the parameter set at the default (unchecked) if you are not using this feature.
	Mode Attention Character	Select a character that will signal a remote mode change. Leave the parameter set at the default if you are not using remote mode change.
	System Mode Character	Select a character that will signal the channel to switch into system mode. Leave the parameter set at the default if you are not using remote mode change.
	User Mode Character	Select a character that will signal the channel to switch into user mode. Leave the parameter set at the default if you are not using remote mode change.
Serial Port	Baud Rate	Select a communication rate that all devices in your system support. Configure all devices in the system for the same communication rate.
	Bits Per Character	Match the number of bits per character to the devices with which you are communicating
	Stop Bits	Match the number of stop bits to the devices with which you are communicating.
	Control Line	This parameter defines the mode in which the master driver operates. Choose a method appropriate for your system's configuration: • If you are not using a modem, choose NO HANDSHAKING. • If the master modem is full duplex and the slave modem is full-duplex, choose FULL-DUPLEX MODEM. • If all the modems in the system are half-duplex, choose HALF-DUPLEX MODEM WITHOUT CONTINUOUS CARRIER.

RSLogix 5 Tab:	Parameter:	Selections:
Serial Port	Error Detect	With this selection, you choose how the processor checks the accuracy of each DF1 packet transmission. BCC: This algorithm provides a medium level of data security. It cannot detect: • transposition of bytes during transmission of a packet • the insertion or deletion of data values of zero within a packet CRC: This algorithm provides a higher level of data security. Select an error detection method that all devices in your system support. When possible, choose CRC.
Options	Station Address	Define the octal address of the processor on the DF1 half-duplex link. Each station on a link must have a unique address. Choose an address between 0 and 376_8. Station address 377_8 is the broadcast address, which you cannot select as a station's individual address.
	DF1 Retries	Defines the number of times a master station retries either a message before the master station declares the message undeliverable, or poll packet to an active station before the master station declares that station to now be inactive.
	RTS Send Delay	RTS send delay is the amount of time in 20 millisecond increments that elapses between the assertion of the RTS signal and the beginning of the message transmission. This time allows the modem to prepare to transmit the message. The Clear to Send (CTS) signal must be high for transmission to occur.
	RTS Off Delay	RTS off delay is the amount of time in 20 millisecond increments that elapses between the end of the message transmission and the de-assertion of the RTS signal. This time delay is a buffer to make sure that the modem has transmitted the message but should normally be left at zero.
	ACK Timeout	Define the amount of time in 20 millisecond increments that you want the processor to wait for an acknowledgment from a slave station to its transmitted message before the processor retries the message or the message errors out.
	Reply Message Wait	Define the amount of time in 20 millisecond increments that the master station will wait after receiving an ACK (to a master-initiated message) before polling the slave station for a reply. Choose a time that is, at minimum, equal to the longest time that a slave station needs to format a reply packet. This is typically the maximum scan time of the slave station **Note:** This field is only valid if the polling mode field is configured to be MESSAGE BASED.
	MSG Application Timeout	Define the number of 30 second increments within which the reply message must be received before the error bit is set on the message. The timer starts when the ACK is received.
Polling	Polling Mode	If you want to receive: • only one message from a slave station per its turn, choose STANDARD (SINGLE MESSAGE TRANSFER PER NODE SCAN) Choose this method only if it is critical to keep the poll list scan time to a minimum. • as many messages from a slave station as it has, choose STANDARD (MULTIPLE MESSAGE TRANSFER PER NODE SCAN)
	Master Message Transmit	If you want the master station to: • send all of the master station-initiated MSG instructions to the slave stations before polling the next slave station in the poll list, choose Between Station Polls This method makes certain that master station-initiated messages are sent in a timely and regular manner (after every slave station poll). • only send master station-initiated MSG instructions when the master's station number appears in the polling sequence; choose In Poll Sequence With this method, sending master station-initiated messages are dependent upon where and how often the master station appears in the poll list. To achieve the same goal as the Between Station Polls method, the master-station's address would have to appear after every slave-station's address.

RSLogix 5 Tab:	Parameter:	Selections:
Polling	Normal Poll Node File	Enter an unused integer file that will store the addresses of the slave stations you want in the normal poll list.
	Normal Poll Group Size	Enter the quantity of active stations located in the normal poll list that you want polled during a scan through the normal poll list before returning to the priority poll list.
	Priority Poll Node File	Enter an unused integer file that will store the addresses of the slave stations you want in the priority poll list.
	Active Station File	Enter an unused binary file that will store the status of all the stations in your network configuration. The file stores one station address per bit. 0 = inactive; 1 = active.

Displaying System (Master) Channel Status

To display Channel Status, double click on Channel Status, which is located within Channel Configuration.



To access the various channels from the Channel status screen, click on the tabs. Descriptions of the status screen fields can be found in Table 2.B.

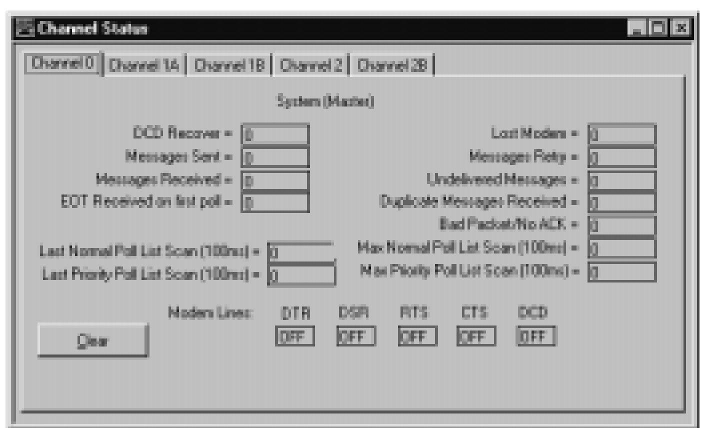


Table 2.B Descriptions of System Mode DF1 Master Channel Status Fields

Status Field:	Location	Description
Clear		Clear counters for all channels by clicking on Clear button
DCD Recover	word 11	Displays the number of times the processor detects the DCD handshaking line has gone low to high.
Lost Modem	word 12	Displays the number of times that the modem lost bit (S:17/5) has gone low to high.
Messages Sent	word 1	Displays the number of messages sent by the processor (including message retry).

Status Field:	Location	Description
Messages Received	word 2	Displays the number of messages the processor received with no error.
Undelivered Messages	word 3	Displays the number of messages that were sent by the processor but not received by the destination device.
Messages Retry	word 4	Displays the number of messages resent.
Duplicate Mesages Received	word 9	Displays the number of times the processor received a message packet identical to the previous message packet.
EOT Received on First Poll	word 8	Displays the number of times the Master received an EOT in response to the first poll of a station.
Bad Packet / No ACK	word 7	Displays the number of incorrect data packets that the processor has received.
Last Normal Poll List Scan (100 ms)	word 5	The time it took to complete the previous scan of the normal station poll list.
Max Normal Poll List Scan (100 ms)	word 6	The maximum time taken to complete a scan of the normal station poll list.
Last Priority Poll List Scan (100 ms)	word 10	The time it took to complete the previous scan of the priority station poll list.
Max Priority Poll List Scan (100 ms)	word 13	The maximum time taken to complete a scan of the priority station poll list.
DTR (Data Terminal Read)	word 0; bit 4	Displays the status of the DTR handshaking line (asserted by the processor).
DCD (Data Carrier Detect)	word 0; bit 3	Displays the status of the DCD handshaking line (received by the processor).
DSR (Data Set Ready)	word 0; bit 2	Displays the status of the DSR handshaking line (received by the processor).
RTS (Request to Send)	word 0; bit 1	Displays the status of the RTS handshaking line (asserted by the processor).
CTS (Clear to Send)	word 0; bit 0	Displays the status of the CTS handshaking line (received by the processor).

Create Station Lists

After defining your polling files and group size, create station lists by entering the station address of each slave station into either the normal poll file or priority poll file of the PLC-5 data table. Place each station address in an individual word in a poll file (normal and priority) starting at word 2.

The normal and priority poll file layout is as follows:

This word in a poll file:	Contains this information:
word 0	total number of stations to be polled (for a list)
word 1	the address location (poll offset) of the station currently being polled (as long as all configured stations are active) For example: a value of 1 means the station address stored in word 2 is being polled, 2 means the address stored in word 3 is being polled, etc. This word is automatically updated by the master station as a new slave station is polled.
word 2 through word *xx*	the slave station address in the order that the stations should be polled Store one station address in each word.

To place a station address in a poll file, do the following:

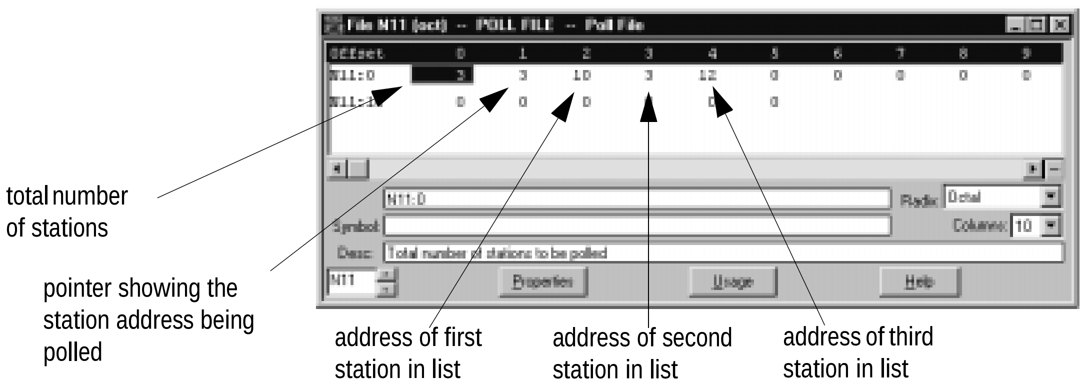
1. Access the PLC-5 data table.
2. Specify the address of the integer file that is either the normal poll file or priority poll file (e.g., If the normal poll file is N11, then you specify N11:0).
3. Enter the station addresses of the slave stations you want in the poll list starting at word 2. Put them in the order you want them polled.

Important: PLC-5 station addresses are octal addresses. The poll files are integer files. To properly enter PLC-5 station addresses in a poll file, you must either:

- change the radix of the file to octal
- convert the PLC-5 octal station addresses to decimal

Figure 2.2 is an example of a station list containing three stations: octal addresses 10, 3, and 12. Station 12 is being polled.

Figure 2.2
Example Station List



Monitor Active Stations

To see what stations are active, view the active station file. Each bit in the file represents a station on the link. The stations are numbered in order as a continuous bit-stream file starting with the first bit in the first word (Figure 2.3).

Figure 2.3
Example Active Station File

Address	15 Data 0	
B11:0	1111 1111 1111 1111	← Remote station 0
B11:1	1111 1111 1111 1111	← Remote station 16_{10}
B11:2	1111 1111 1111 1111	

For PLC-5 processors, note the following:

Starting with these PLC-5 firmware revisions:	This is what you will see:
Series E/Revision B Series D/Revision C Series C/Revision L Series B/Revision M Series A/Revision M	At power-up or after reconfiguration, the master station assumes that all slave stations are **inactive** (bit=0).
For all prior firmware revisions	At power-up or after reconfiguration, the master station assumes that all slave stations are **active** (bit=1) and the station displays inactive only after it fails to respond to a poll packet.

Configuring a DF1 Half-Duplex Message-based Mode Master Station

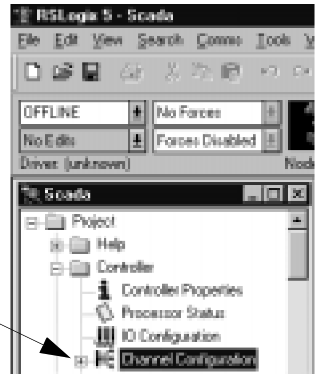
Choose message-based communication mode if you want to use MSG instructions in user programming to communicate with one station at a time. If your application uses satellite transmission or public switched telephone network transmission, consider choosing message-based. Communication to a slave station can be initiated on an as-needed basis.

Also choose message-based mode when a redundant PLC-5 system is being used as a master station. Connect both PLC-5 processor serial ports to the master station modem through an RS-232 modem splitter and precondition all MSG instructions with the Primary Processor status bit.

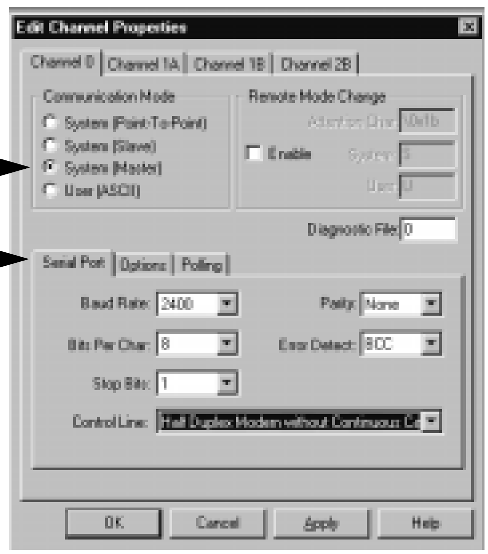
With message-based mode, you do not have an active station file that you can use to monitor station status. Also, you cannot implement slave-to-slave messaging or slave programming over the telemetry network.

To configure the processor for a master station using message-based communication, place the processor in program mode and do the following using RSLogix 5:

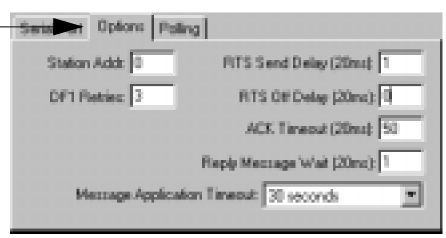
Double-click on the Channel Configuration file to bring up the Edit Channel Configuration interface.



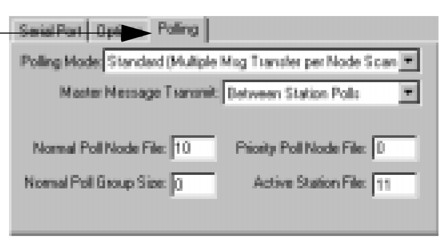
1. On the Channel 0 tab, choose System (Master) for your Communication Mode.
2. Configure the Serial Port, Options, and Polling parameters according to Table 2.C.



3. Configure Options parameters according to Table 2.C.



4. Configure the Polling parameters according to Table 2.C.
5. When all parameters are set, click OK.



Use Table 2.C to help you understand the communication parameters you need to specify on the Channel Configuration screen.

Use Worksheet 2.2 (Appendix D-5) for an example configuration and to record your station's configuration.

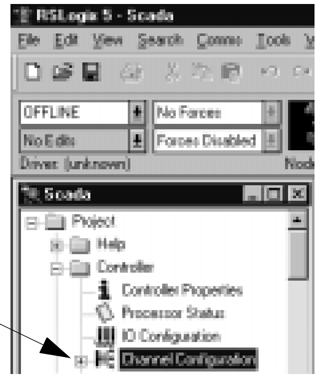
Table 2.C
Define these communication parameters for a PLC-5 master station using message-based communication mode to talk to slave stations.

RSLogix 5 Tab:	Parameter:	Selections:
Channel 0	Diagnostic File	Select an unused integer file to store channel status information. You must define a diagnostic file in order to be able to view channel 0 status. See Table 2.B on page 2-6 for description of what's in this file.
	Remote Mode Change	Check enable remote mode change if you want to switch the configuration of the channel during runtime. Leave the parameter set at the default (uncheck) if you are not using this feature.
	Mode Attention Character	Select a character that will signal a remote mode change. Leave the parameter set at the default if you are not using remote mode change.
	System Mode Character	Select a character that will signal the channel to switch into system mode. Leave the parameter set at the default if you are not using remote mode change.
	User Mode Character	Select a character that will signal the channel to switch into user mode. Leave the parameter set at the default if you are not using remote mode change.
Serial Port	Baud Rate	Select a communication rate that all devices in your system support. Configure all devices in the system for the same communication rate.
	Bits Per Character	Match the numbers of bits per character to the devices with which you are communicating.
	Stop Bits	Match the number of stop bits to the devices with which you are communicating.
Serial Port	Control Line	This parameter defines the mode in which the master driver operates. Choose a method appropriate for your system's configuration: • If you are not using a modem, choose NO HANDSHAKING. • If the master modem is full duplex and the slave modem is full-duplex, choose FULL-DUPLEX MODEM. • If all the modems in the system are half-duplex, choose HALF-DUPLEX MODEM WITHOUT CONTINUOUS CARRIER.
	Parity	Parity provides additional message packet error detection. To implement even parity checking, choose Even. To implement no parity checking, choose None.
	Error Detect	With this selection, you choose how the processor checks the accuracy of each DF1 packet transmission. BCC: This algorithm provides a medium level of data security. It cannot detect: • transposition of bytes during transmission of a packet • the insertion or deletion of data values of zero within a packet CRC: This algorithm provides a higher level of data security. Select an error detection method that all devices in your system support. When possible, choose CRC.

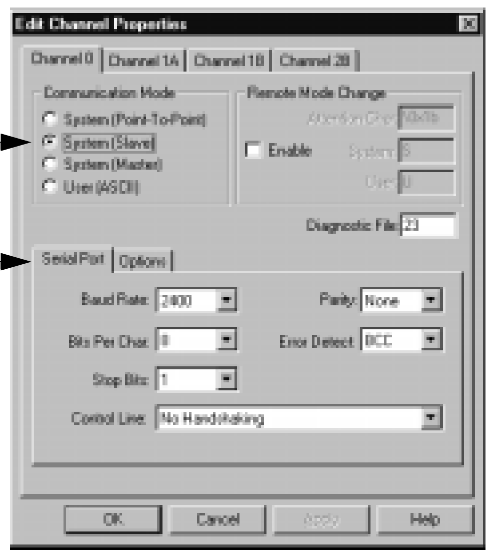
RSLogix 5 Tab:	Parameter:	Selections:
Options	Station Address	Define the octal address of the processor on the DF1 half-duplex link. Each station on a link must have a unique address. Choose an address between 0 and 376_8. Station address 377_8 is the broadcast address, which you cannot select as a station's individual address.
	DF1 Retries	Define the number of times a master station retries either a message before the master station declares the message undeliverable, or a poll packet to an active station before the master station declares tht station to be inactive.
	RTS Send Delay	RTS send delay is the amount of time in 20 millisecond increments that elapses between the assertion of the RTS signal and the beginning of the message transmission. This time allows the modem to prepare to transmit the message. The Clear to Send (CTS) signal must be high for transmission to occur.
	RTS Off Delay	RTS off delay is the amount of time in 20 millisecond increments that elapses between the end of the message transmission and the de-assertion of the RTS signal. This time delay is a buffer to ensure that the modem has transmitted the message but should normally be left at zero.
	ACK Timeout	Define the amount of time in 20 millisecond increments that you want the processor to wait for an acknowledgment from a slave station to its transmitted message before retrying. This timeout value is also used for the poll response timeout.
	Reply Message Wait	Define the amount of time in 20 millisecond increments that the master station will wait after receiving an ACK (to a master-initiated message) before polling the slave station for a reply. Choose a time that is, at minimum, equal to the longest time that a slave station needs to format a reply packet. This is typically the maximum scan time of the slave station.
	MSG Application Timeout	The application timeout of the message is the number of 30 second increments within which the reply message must be received before the error bit is set on the message. The timer starts when the ACK is received.
Polling	Polling Mode	If you want to: • accept unsolicited messages from slave stations, choose MESSAGE BASED (ALLOW SLAVE TO INITIATE MESSAGES) Slave station-initiated messages are acknowledged and processed after all master station-initiated (solicited) messages. **Note:** Slave stations can only send messages when they are polled. If the message-based master station never sends a slave station a message, the master station will never send the slave station a poll. Therefore, to regularly obtain a slave station-initiated message from a slave station, you should choose to use standard communications mode instead. • ignore unsolicited messages from slave stations, choose MESSAGE BASED (DO NOT ALLOW SLAVES TO INITIATE MESSAGES) Slave station-initiated messages are acknowledged and discarded. The master station acknowledges the slave station-initiated message so that the slave station removes the message from its transmit queue, which allows the next packet slated for transmission into the transmit queue.

Configuring the Processor as a Slave Station

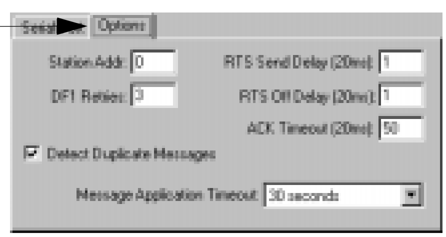
To configure the processor as a slave station, place the processor in program mode and do the following using your programming software:



Double-click on the Channel Configuration file to bring up the Edit Channel Configuration interface.



1. On the Channel 0 tab, choose System (Slave) for your Communication Mode
2. Configure the Serial Port parameters according to Table 2.D.



3. Configure the Options parameters according to Table 2.D.
4. When all parameters are set, click OK.

Use Table 2.D to help you understand the communication parameters you need to specify on the Channel Configuration screen.

Use Worksheet 2.3 (Appendix D-6) for an example configuration and to record your station's configuration.

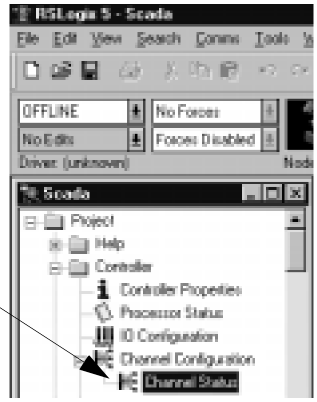
Table 2.D
Define these communication parameters when configuring a PLC-5 slave station.

RSLogix 5 Tab:	Parameter:	Selections:
Channel 0	Diagnostic File	Select an unused integer file to store channel status information. You must define a diagnostic file in order to be able to view channel 0 status. See Table 2.E on page 2-16 for a description of what this file contains.
	Remote Mode Change Enable	Check enable remote mode change if you want to switch the configuration of the channel during runtime. Leave the parameter set at the default (unchecked) if you are not using this feature.
	Mode Attention Character	Select a character that will signal a remote mode change. Leave the parameter set at the default if you are not using remote mode change.
	System Mode Character	Select a character that will signal the channel to switch into system mode. Leave the parameter set at the default (unchecked) if you are not using remote mode change.
	User Mode Character	Select a character that will signal the channel to switch into user mode. Leave the parameter set at the default if you are not using remote mode change.
Serial Port	Baud Rate	Select a communication rate that all devices in your system support. Configure all devices in the system for the same communication rate.
	Bits Per Character	Match the number of bits per character to the devices with which you are communicating.
	Stop Bits	Match the number of stop bits to the devices with which you are communicating.
	Control Line	This parameter defines the mode in which the slave station driver operates. Choose a method appropriate for your system's configuration: • If you are not using a modem, choose NO HANDSHAKING. • If the master modem is full duplex and transmits a constant carrier and the slave modem is half-duplex, choose HALF-DUPLEX MODEM WITH CONTINUOUS CARRIER. • If all the modems in the system are half-duplex, choose HALF-DUPLEX MODEM WITHOUT CONTINUOUS CARRIER.
	Parity	Parity provides additional message packet error detection. To implement even parity checking, choose Even. To implement no parity checking, choose None.
Serial Port	Error Detect	With this selection, you choose how the processor checks the accuracy of each DF1 packet transmission. BCC: This algorithm provides a medium level of data security. It cannot detect: • transposition of bytes during transmission of a packet • the insertion or deletion of data values of zero within a packet CRC: This algorithm provides a higher level of data security. Select an error detection method that all devices in your system support. When possible, choose CRC.

RSLogix 5 Tab:	Parameter:	Selections:
Options	Station Address	Define the octal address of the the processor on the DF1 half-duplex link. Each station on a link must have a unique address. Choose an address between 0 and 376_8. Station address 377_8 is the broadcast address, which you cannot select as a station's individual address.
	DF1 Retries	The number of times a slave station retries a message before the slave station declares the message undeliverable.
	RTS Send Delay	RTS send delay is the amount of time in 20 millisecond increments that elapses between the assertion of the RTS signal and the beginning of the message transmission. This time allows the modem to prepare to transmit the message. The CTS (Clear-to-Send) signal must be high for transmission to occur.
	RTS Off Delay	RTS off delay is the amount of time in 20 millisecond increments that elapses between the end of the message transmission and the de-assertion of the RTS signal. This time delay is a buffer to make sure that the modem has transmitted the message but should normally be left at zero.
	ACK Timeout	Define the amount of time in 20 millisecond increments that you want the processor to wait for an acknowledgment from the master station to its transmitted message.
	Detect Duplicate Messages	Duplicate packet detection lets the PLC-5 processor detect if it has received a message that is a duplicate of its most recent message from the master station. If you choose detect duplicate messages, the processor will acknowledge (ACK) the message but will not act on it since it has already performed the message's task when it received the command from the first message. If you want to detect duplicate packets and discard them, check this parameter. If you want to accept duplicate packets and execute them, leave this parameter unchecked.
	MSG Application Timeout	Define the number of 30 second increments within which the reply message must be received before the error bit is set on the message. The timer starts when the ACK is received.

Displaying Slave System Channel Status

To display Channel Status, double click on Channel Status, which is located within Channel Configuration.



To access the various channels from the Channel status screen, click on the tabs. Descriptions of the status screen fields can be found in Table 2.E.

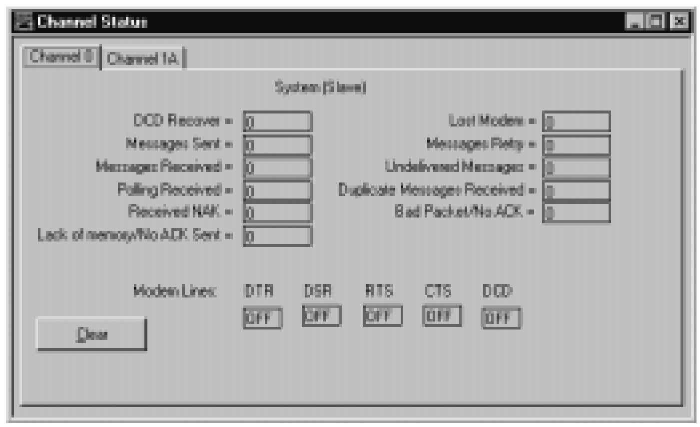


Table 2.E Descriptions of System Mode DF1 Slave Channel Status Fields

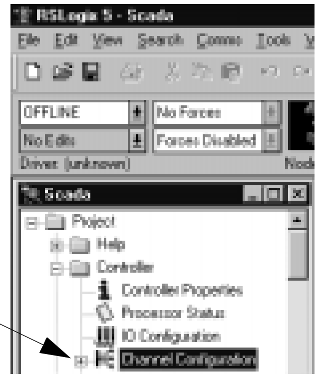
Status Field	Diagnostic File Location	Definition
DCD Recover	word 11	The number of times the processor detects the DCD handshaking line has gone low to high
Messages Sent	word 1	The total number of DF1 messages sent by the processor (including message retries)
Messages Received	word 2	The number of messages received with no errors
Polling Received	word 6	The number of master poll packets received by the processor
Received NAK	word 5	The number of NAKs received by the processor
Lack of Memory/No ACK Sent	word 8	The number of times the processor could not receive a message because it did not have available memory
Lost Modem	word 12	The number of times the lost modem bit has gone low to high
Messages Retry	word 4	The number of message retries sent by the processor
Undelivered Messages	word 3	The number of messages that were sent by the processor but not acknowledged by the destination device
Duplicate Messages Received	word 9	The number of times the processor received a message packet identical to the previous message packet

Status Field	Diagnostic File Location	Definition
Bad Packet/No ACK	word 7	The number of incorrect data packets received by the processor for which a no ACK was returned
DTR (Data Terminal Ready)	word 0;bit 4	The status of the DTR handshaking line (asserted by the processor)
DSR (Data Set Ready)	word 0;bit 2	The status of the DSR handshaking line (received by the processor)
RTS (Request to Send)	word 0;bit 1	The status of the RTS handshaking line (asserted by the processor)
CTS (Clear to Send)	word 0;bit 0	The status of the CTS handshaking line (received by the processor)
DCD (Carrier Detect)	word 0;bit 3	The status of the DCD handshaking line (received by the processor)

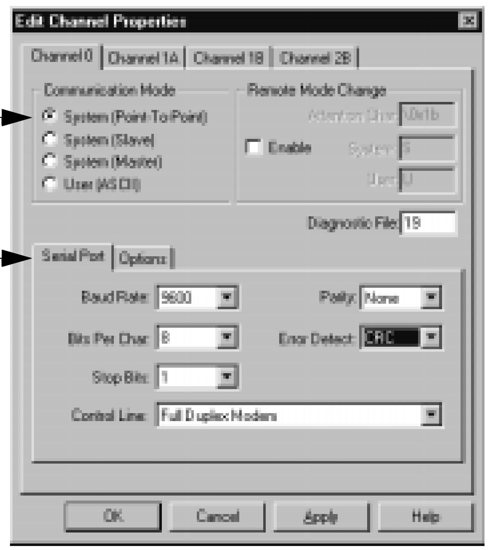
Configuring the Processor as a Station on a Point-to-Point Link

To configure the processor as a station on a point-to-point link, place the processor in program mode and do the following using your programming software:

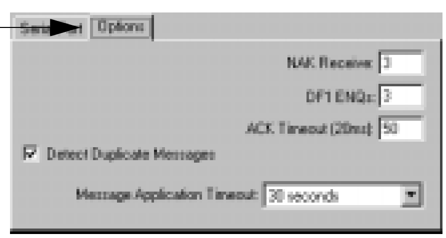
Double-click on the Channel Configuration file to bring up the Edit Channel Configuration interface.



1. On the Channel 0 tab, choose System (Point-to-Point) for your Communication Mode.
2. Configure the Serial Port parameters according to Table 2.F.



3. Configure the Options parameters according to Table 2.F.
4. When all parameters are set, click OK.



Use Table 2.F to help you understand the screen parameters you need to specify on the Channel Configuration screen.

Use Worksheet 2.4 (Appendix D-7) for an example configuration and to record your station's configuration.

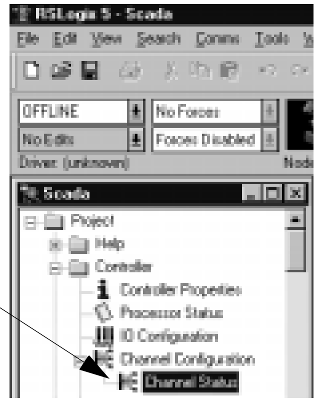
Table 2.F
Define these parameters when using the PLC-5 processor as a device on a point-to-point link.

RSLogix 5 Tab:	Parameter:	Selections:
Channel 0	Diagnostic File	Select an unused integer file that you want to use to store channel status information. You must define a diagnostic file in order to be able to view channel 0 status. See Table 2.G on page 2-20 for a description of what this file contains
	Remote Mode Change	Enable remote mode change if you want to switch the configuration of the channel during runtime. Leave the parameter set at the default if you are not using remote mode change.
	Mode Attention Character	Select a character that will signal a remote mode change. Leave the parameter set at the default if you are not using remote mode change.
	System Mode Character	Select a character that will signal the channel to switch into system mode. Leave the parameter set at the default if you are not using remote mode change.
	User Mode Character	Select a character that will signal the channel to switch into user mode. Leave the parameter set at the default if you are not using remote mode change.
Serial Port	Baud Rate	Select a communication rate that all devices in your system support. Configure all devices in the system for the same communication rate.
	Bits Per Character	Match the number of bits per character to the device with which you are communicating.
	Stop Bits	Match the number of stop bits to the device with which you are communicating.
	Control Line	This parameter defines the mode in which the driver operates. Choose a method appropriate for your system's configuration: • If you are not using a modem, choose NO HANDSHAKING. • If you are using a full-duplex modem, choose FULL-DUPLEX.
	Parity	Parity provides additional message packet error detection. To implement even parity checking, choose Even. To implement no parity checking, choose None.
Options	NAK Receive	Define the number of NAKs the processor can receive in response to a transmitted message before the station declares the message undeliverable.
	DF1 ENQs	Define the number of enquiries (ENQs) that you want the processor to send after an ACK timeout occurs before the station declares the message undeliverable.
	ACK Timeout	Define the amount of time in 20 millisecond increments you want the processor to wait for an acknowledgment from a station to its transmitted message.
Options	Detect Duplicate Messages	Duplicate Packet Detection lets the PLC-5 processor detect if it has received a message that is a duplicate of its most recent message from another station. If you choose detect duplicate messages, the processor will acknowledge (ACK) the message but will not act on it since it has already performed the message's task when it received the command from the first message. If you want to detect duplicate packets and discard them, check this parameter. If you want to accept duplicate packets, and execute them, leave this parameter unchecked.
	MSG Application Timeout	Define the number of 30 second increments within which the reply message must be received before the error bit is set on the message. The timer starts when the ladder program first initiates the message and is restarted if/when the ACK is received.
	Error Detect	With this selection you choose how the processor checks the accuracy of each DF1 packet transmission. BCC: This algorithm provides a medium level of data security. It cannot detect: • transposition of bytes during transmission of a packet • the insertion or deletion of data values of zero within a packet CRC: This algorithm provides a higher level of data security. Select an error detection method that all devices in your system support. When possible, choose CRC.

Important: The station address in the point-to-point driver is determined by the DH+ address defined by switch assembly S1.

Displaying Point-to-Point System Channel Status

To display Channel Status, double click on Channel Status, which is located within Channel Configuration.



To access the various channels from the Channel status screen, click on the tabs. Descriptions of the status screen fields can be found in Table 2.G.

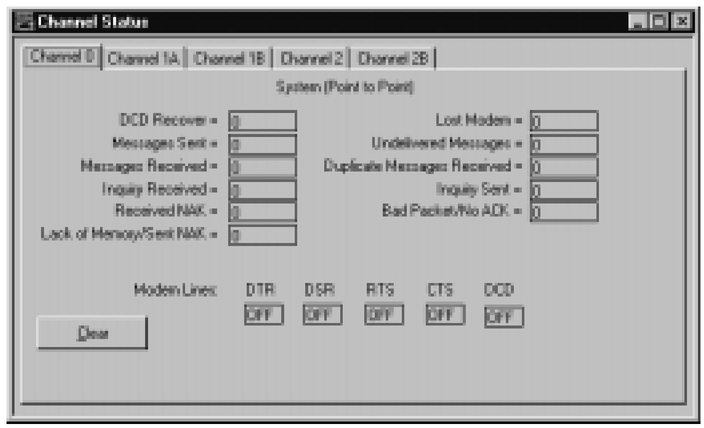
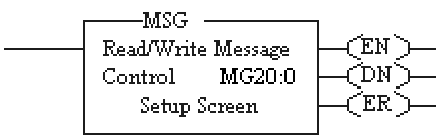


Table 2.G Descriptions of System (Point-to-Point) Channel Status Fields

Status Field	Diagnostic File Location	Definition
DCD Recover	word 11	The number of times the processor detects the DCD handshaking line has gone low to high
Messages Sent	word 1	The total number of DF1 messages sent by the processor (including message retries)
Messages Received	word 2	The number of messages received with no errors
Inquiry Received	word 6	The number of master poll packets received by the processor
Received NAK	word 5	The number of NAKs received by the processor
Lack of Memory/Sent NAK	word 8	The number of times the processor could not receive a message because it did not have available memory
Lost Modem	word 12	The number of times the lost modem bit has gone low to high
Undelivered Messages	word 3	The number of messages that were sent by the processor but not acknowledged by the destination device
Duplicate Messages Received	word 9	The number of times the processor received a message packet identical to the previous message packet
Inquiry Sent	word 4	The number of ENQs sent by the processor

Status Field	Diagnostic File Location	Definition
Bad Packet/No ACK	word 7	The number of incorrect data packets received by the processor for which a NAK was returned
DTR (Data Terminal Ready)	word 0;bit 4	The status of the DTR handshaking line (asserted by the processor)
DSR (Data Set Ready)	word 0;bit 2	The status of the DSR handshaking line (received by the processor)
RTS (Request to Send)	word 0;bit 1	The status of the RTS handshaking line (asserted by the processor)
CTS (Clear to Send)	word 0;bit 0	The status of the CTS handshaking line (received by the processor)
DCD (Carrier Detect)	word 0;bit 3	The status of the DCD handshaking line (received by the processor)

Messaging



For:	See Page:
examples	2-21
list of considerations	2-23

Messaging can occur between:

- a master station and a slave station
- a slave station and its master station (See “Polled Report-by-Exception”)
- slave stations or between two processors connected via a point-to-point link

Master Station to Slave Station

A PLC-5 master station communicates with the slave stations that are connected to it via modems in a point-to-multipoint configuration. A master station sends a slave station messages to receive status or issue commands. For sample messaging ladder logic, see Appendix E-8.

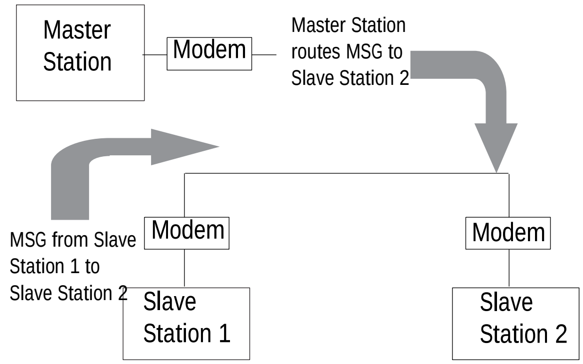
Polled Report-by-Exception

Slave stations can gather information from the I/O points they are responsible for and can send any anomalous readings to the master station. To do this, write ladder logic in the slave station to monitor certain conditions and send the data in a MSG instruction to the master station. Figure 2.5 is an example MSG instruction and control block that a PLC-5 processor in a slave station can send to a PLC-5 master station. For sample messsaging ladder logic when using a PLC-5 as a slave, see Appendix E-12.

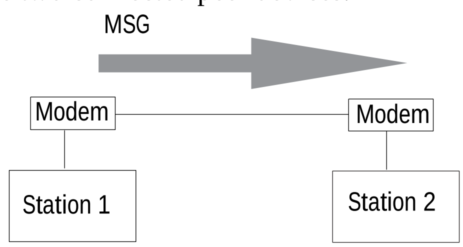
Processor-to-Processor

A processor-to-processor message can be two types:

- In a point-to-multipoint configuration, the messaging would be between slave stations; the master station automatically routes the message.



- In a point-to-point configuration, the messaging would be between the two connected peer devices.



The configuration of the network (point-to-multipoint vs. point-to-point) and the configuration of the station (master, slave, or peer) does not affect how you configure a MSG instruction. That is, a MSG instruction being sent between two PLC-5 slave stations is configured the same as a MSG instruction between two PLC-5 processors connected point-to-point, which is configured the same as a MSG instruction between a PLC-5 master station and a PLC-5 slave station. See Figure 2.4 through Figure 2.7 for example MSG control blocks.

Considerations When Configuring MSG Control Blocks

Keep these considerations in mind when configuring messages between a PLC-5 and SLC 500 or MicroLogix 1000 processors.

The following table lists which PLC-5 processors (series and revision) you can use with the MSG instruction to transfer data from/to a PLC-5 processor to/from any SLC 500 processor or MicroLogix 1000 in SLC native mode.

Processor Series/Revision:	Processors:
Series A / revision M	PLC-5/40, -5/40L, -5,60, -5/60L
Series A / revision J	PLC-5/30
Series A / revision H	PLC-5/11, -5/20
Series B / revision J	PLC-5/40, -5/40L, -5/60, -5/60L
Series C / revision G	PLC-5/11, -5/20, -5/20E, -5/30, -5/40, -5/40L, -5/V40, -5/V40L, -5/40E, -5/60, -5/60L, -5/80, -5/80E, -5/V80, -5/20C, -5/40C, -5/80C
Series D / all	PLC-5/11, -5/20, -5/20E, -5/30, -5/40, -5/40L, -5/V40, -5/V40L, -5/40E, -5/60, -5/60L, -5/80, -5/80E, -5/V80, -5/20C, -5/40C, -5/80C
Series E / all	PLC-5/11, -5/20, -5/20E, -5/30, -5/40, -5/40L, -5/V40, -5/V40L, -5/40E, -5/60, -5/60L, -5/80, -5/80E, -5/V80, -5/20C, -5/40C, -5/80C

- Since all SLC 5/05, 5/04 and 5/03 processors with operating system 301 or higher can respond to (and initiate) PLC-5 native mode message commands, all PLC-5 processors can transfer data between their data tables and the data table of these particular SLC processors (except for the I/O image table) as if they were messaging with another PLC-5 processor.
- In a single instruction, the maximum amount of words you can read from or write to through channel 0 is as follows:
    - SLC 500, 5/01, 5/02, and MicroLogix 1000 processor, 41 words
    - SLC 5/03, 5/04, and 5/05 processor, 103 words

When configuring messages between a PLC-5 and Logix5550 processor, use the PLC-5 typed read and write commands and enclose the name of the Logix5550 tag in double quotes. This is called logical ASCII addressing.

Example MSG Control Blocks

Figure 2.4
This is an example of a PLC-5 read MSG to another PLC-5 (or SLC 5/03, 5/04, 5/05, or Logix5550) processor.

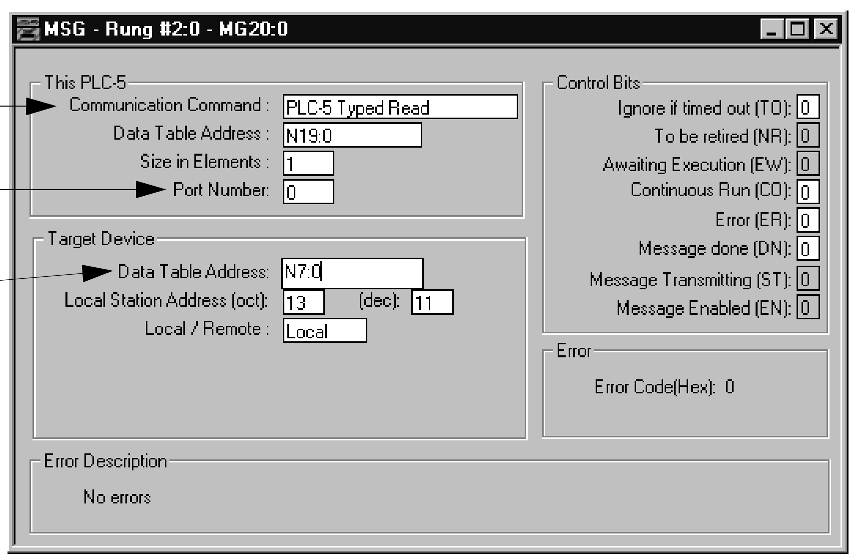
Ladder Rung

Control Block

MSG being sent to another PLC-5 processor.

MSG being sent out channel 0 (must use MG file type).

If the destination were a Logix5550 processor, then the address could also be entered as "tagname".



This MSG example tells this (master) PLC-5 to read the information from PLC-5 (slave) station 13_8's, location N7:0 and place the information in file N19:0 (master).

Figure 2.5
This is an example of a PLC-5 write MSG to another PLC-5 (or SLC 5/03, 5/04, 5/05, or Logix5550) processor.

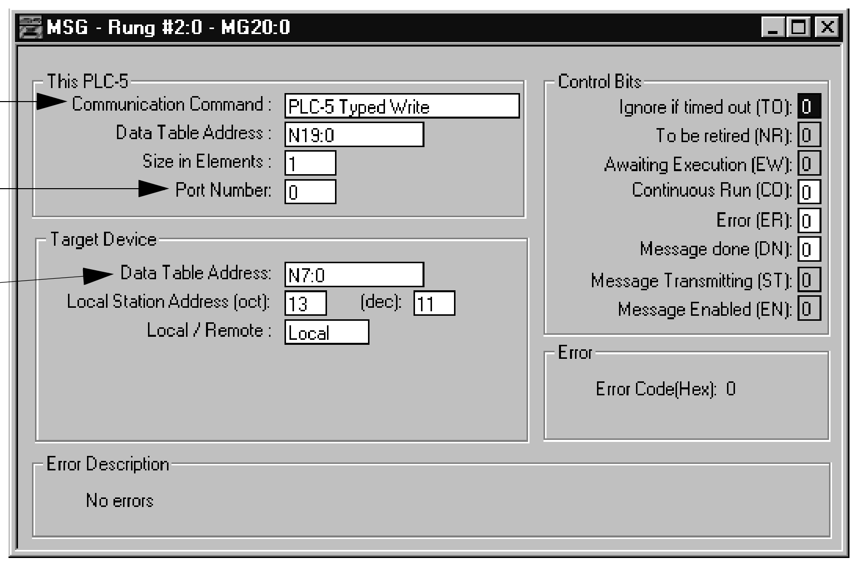
Ladder Rung

Control Block

MSG being sent to another PLC-5 processor.

MSG being sent out channel 0 (must use MG file type).

If the destination were a Logix5550 processor, then the address could also be entered as “tagname”.



This MSG example tells this (master) PLC-5 to write the information from its file N19:0 through its serial port (channel 0) to the PLC-5 (slave) station 13_8. The data’s destination is N7:0 of the PLC-5 (slave) station.

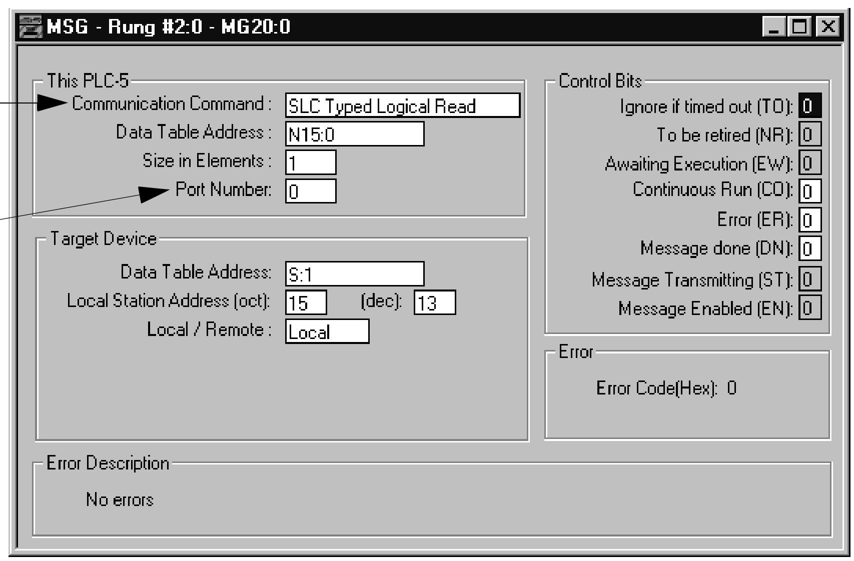
Figure 2.6
This is an example of a PLC-5 read MSG to a SLC 500 processor.

Ladder Rung

Control Block

MSG being sent to an SLC 500 or MicroLogix 1000 processor.

MSG being sent out channel 0 (must use MG file type).



This MSG example tells this PLC-5 (master) to read the information from SLC 500 (slave) 13_{10} (15_8) S:1 and place the information in its N15:0 file.

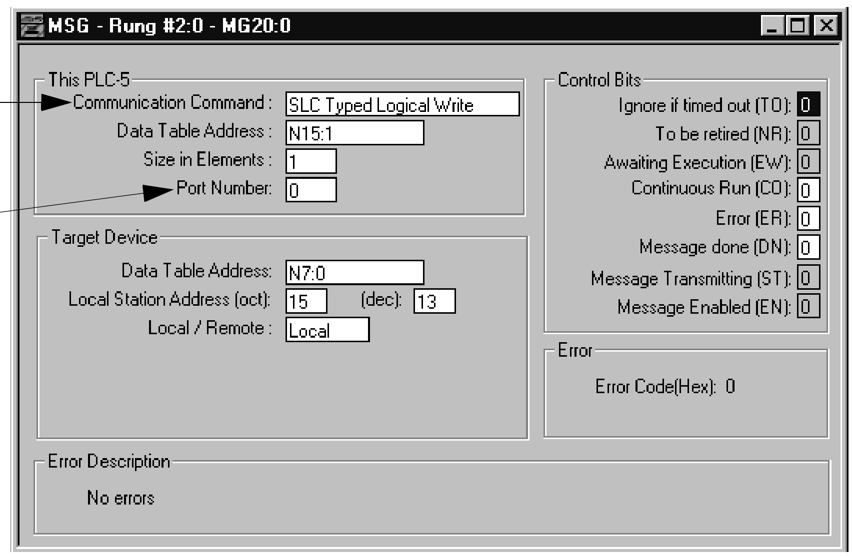
Figure 2.7
This is an example of a PLC-5 Write MSG to a SLC 500 processor.

Ladder Rung

Control Block

MSG being sent to an SLC 500 or MicroLogix 1000 processor.

MSG being sent out channel 0 (must use MG file type).



This MSG example tells the PLC-5 master station to write the information from its N15:1 through its serial port (channel 0) to the SLC 500 slave station 13_{10} (15_8). The data's destination is N7:0 of the SLC 500 slave station.

Notes

Configuring Classic PLC-5 Processors with 1785-KE Modules

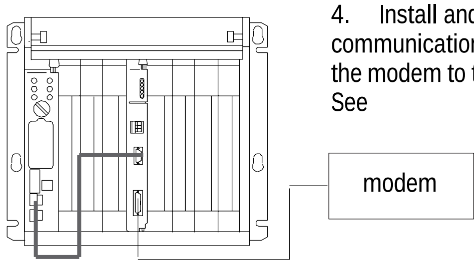
Use This Chapter. . .

… to help you set up a Classic PLC-5 processor, with the 1785-KE Data Highway Plus™ Communication Interface Module, as a remote station.

Overview

To configure a Classic PLC-5 remote station, perform these tasks:

1. Install the processor



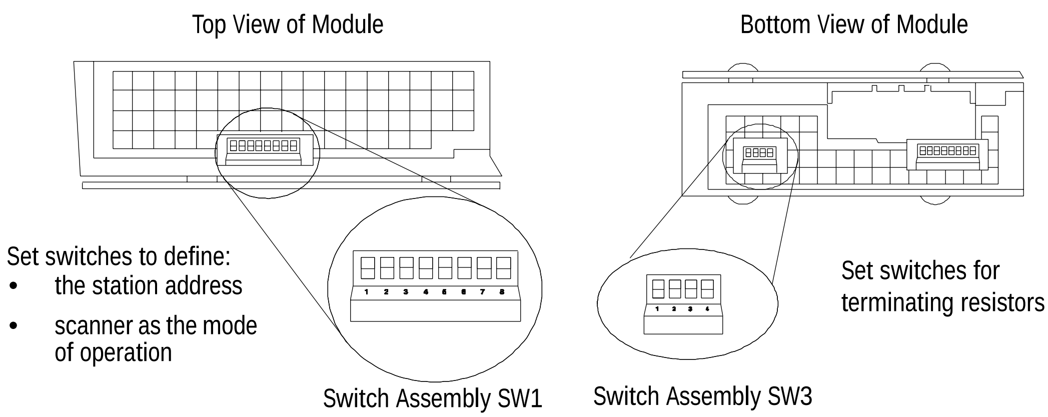
Installing the Processor

Before installing the processor, set the switch assemblies.

Specify:	By setting switch assembly:
DH+ station address of the processor scanner as the processor mode	SW1
terminating resistors for remote I/O and DH+ links	SW3

For more information:

About:	See:
setting switches	1785 PLC-5 Family Programmable Controllers Hardware Installation Manual, publication 1785-6.6.1
installing the processor	1785 PLC-5 Family Programmable Controllers Hardware Installation Manual, publication 1785-6.6.1



See the 1785 PLC-5 Family Programmable Controllers Hardware Installation Manual, publication 1785-6.6.1, for the settings.

Configuring and Installing the 1785-KE Module

Configure each 1785-KE being used with a Classic PLC-5 processor in the network according to the following:

	Configuration Selections		Switch Settings	
	For:	**Choose:**	**Set switch**	**To:**
Switch Assembly SW1	Protocol	half-duplex	1	on
	Error check	CRC	2	on
	Parity	none	3	on
	Embedded responses	no	4	on
	Duplicate message	ignore	5	on
	Handshaking signals	use	6	on
	Diagnostic command	execute		
Switch Assembly SW2	Station address When the module is in remote mode, do not poll this address.	7 (Set all 1785-KE modules for the same address (if on different DH+s). The address should be one that is not used by any remote station.) *7 in this example*	1	0
			2	on
			3	on
			4	on
			5	on
			6	off
			7	off
			8	off
Switch Assembly SW3	DH+ Communication Rate	57.6 K	1	on
	RS-232 Communication Rate	9600 (must match the modem's rate) *9600 in this example*	2	on
			3	off
			4	on
			5	on
	Addressing mode	remote	6	off
Switch Assembly SW4	Reserved		1-4	off

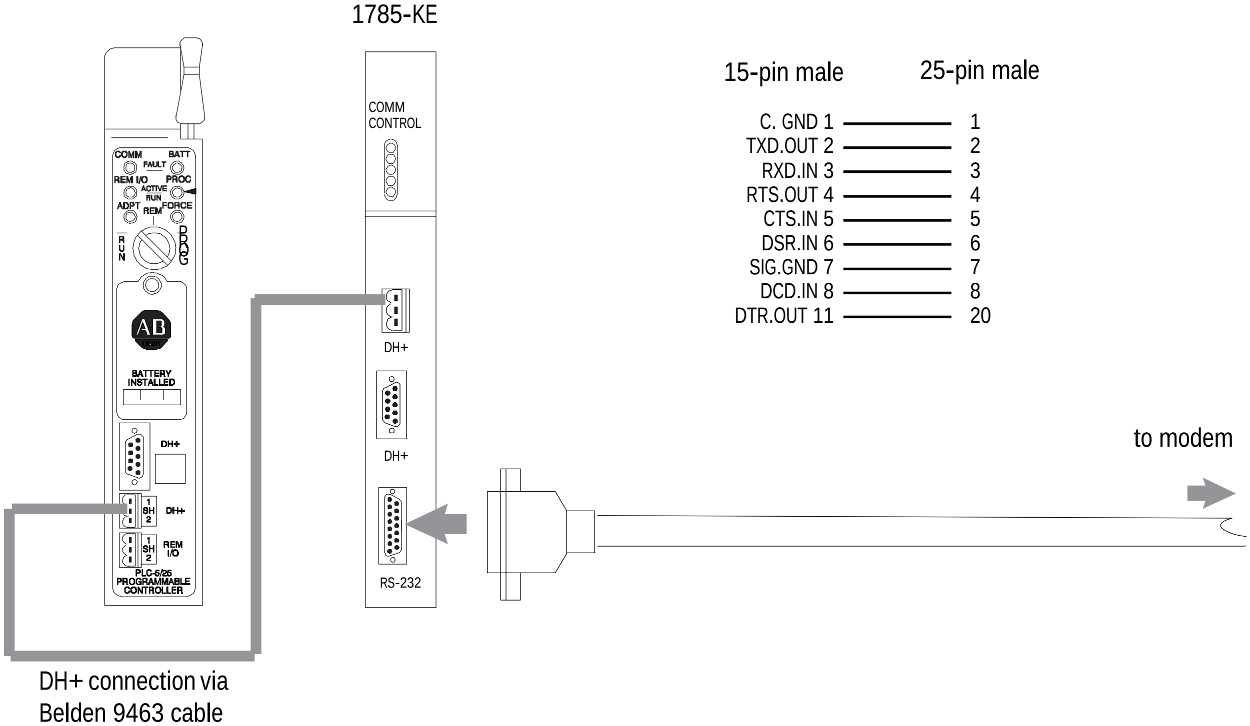
Record your configurations on Worksheet 3.1 (page 9-9).

You can reconfigure the module's parameters if additional requirements are necessary.

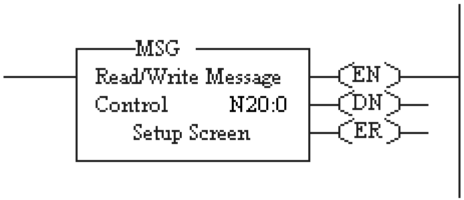
For more information about:	See:
setting switches installing the module	1785-KE DH+ Communications Interface Module User Manual, publication 1785-6.5.2
module to modem cable	Connecting the Processor and 1785-KE Module (page 3-4) appendix A

Connecting the Processor and 1785-KE Module

The processor and 1785-KE module communicate with each other over a DH+ link. Use a length of Belden 9463 cable to connect the processor and the 1785-KE module.



Messaging



For:	See page:
list of considerations	3-6
examples	3-6

Messaging can occur between:

- a remote station and its master station (See "Polled Report-by-Exception")
- remote stations or between two processors connected via a point-to-point link

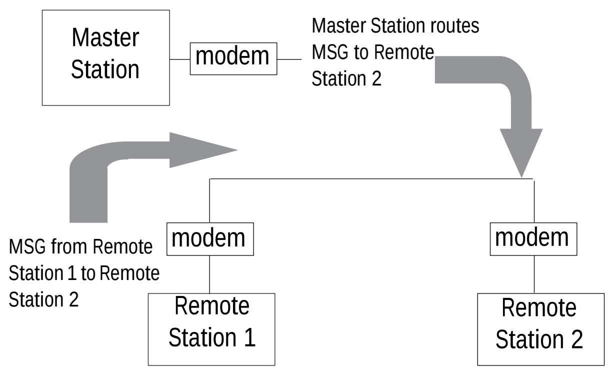
Polled Report-by-Exception

Remote stations can gather information from the I/O points they are responsible for and send any anomalous readings to the master station. To do this, write logic in the remote station's processor to monitor certain conditions and send the data in a MSG instruction to the master station. Figure 3.2 is an example MSG instruction and control block that a Classic PLC-5 processor in a remote station can send to a PLC-5 master station.

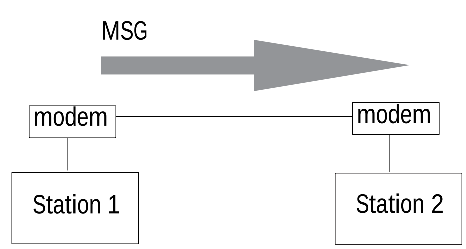
Processor-to-Processor

A processor-to-processor message can be two types:

- In a point-to-multipoint configuration, the messaging is between remote stations; the master station routes the message.



- In a point-to-point configuration, the messaging would be between the two devices connected together.



The 1785-KE module acts as bridge between the Classic PLC-5 processor and the other stations on the telemetry network. Generally, use remote MSGs to read data from and write data to another processor.

Considerations When Configuring MSG Control Blocks

Keep these considerations in mind when configuring messages between a Classic PLC-5 and a SLC 5/02, 5/03, 5/04 or 5/05 processor.

- If you are sending messages between a PLC-5 processor and SLC 5/02 processor, then set S:2/8 in the SLC 5/02 status file to 1. This bit is the CIF (Common Interface File) Addressing Mode selection bit and lets the SLC 5/02 processor accept "byte-offsets" from a PLC-5 processor.
- You cannot access words 0-7 or directly access 100_8-107_8 (64_{10}-71_{10}) in a SLC 5/02 Common Interface File from a PLC-5 processor.
- Since all SLC 5/04 and 5/05 processors and SLC 5/03 processors with operating system 301 or higher can respond to (and initiate) PLC-5 native mode message commands, all PLC-5 processors can transfer data between their data tables and the data table of these particular SLC processors (except for the I/O image table) as if they were messaging with another PLC-5 processor.
- In a single instruction, the maximum amount of words you can read from or write to as follows:
  - SLC 5/02 processor: 41 words
  - SLC 5/03, 5/04, 5/05 processor: 103 words

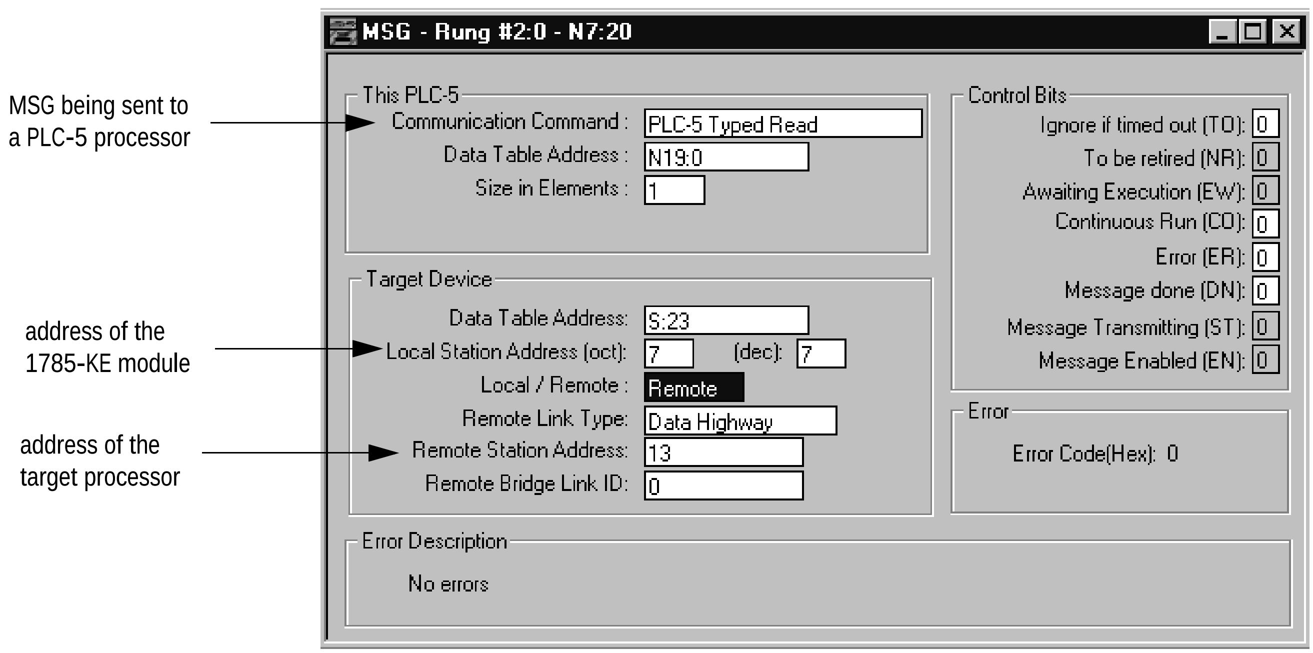
Example MSG Control Blocks

Application:	See:	Page:
Classic PLC-5 read message to another PLC-5 processor	Figure 3.1	3-8
Classic PLC-5 write message to another PLC-5 processor	Figure 3.2	3-9
Classic PLC-5 read message to a SLC 5/02 processor	Figure 3.3	3-10
Classic PLC-5 write message to a SLC 5/02 processor	Figure 3.4	3-11

Figure 3.1
This is an example of a Classic PLC-5 read MSG to another PLC-5 processor.

ladder rung

setup screen (remote message)

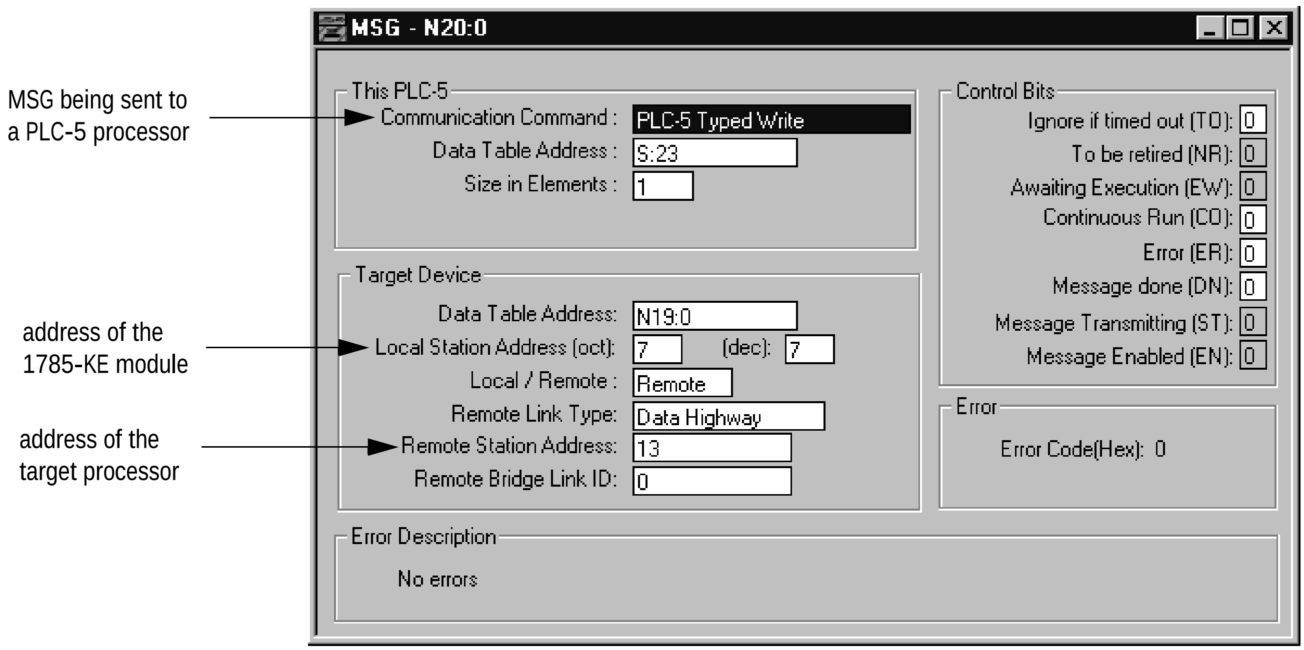


This MSG example tells the Classic PLC-5 remote station to read the information from the PLC-5 master station's (13_8.) S:23 and place the information in remote station file N19:0.

Figure 3.2
This is an example of a Classic PLC-5 write MSG to another PLC-5 processor.

ladder rung

setup screen (remote message)

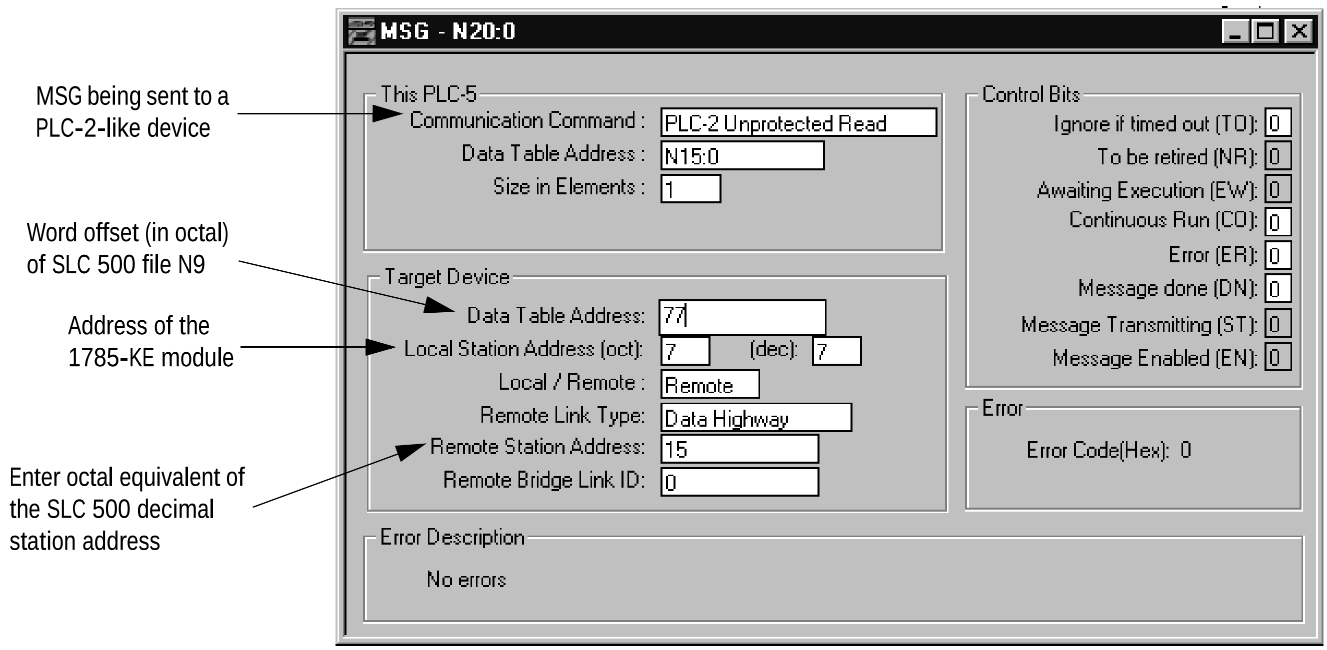


This MSG example tells the Classic PLC-5 remote station to write the information from its S:23 to PLC-5 master station (13_8.) file N19:0.

Figure 3.3
This is an example of a Classic PLC-5 read MSG to a SLC 5/02 processor.

ladder rung

setup screen (remote message)



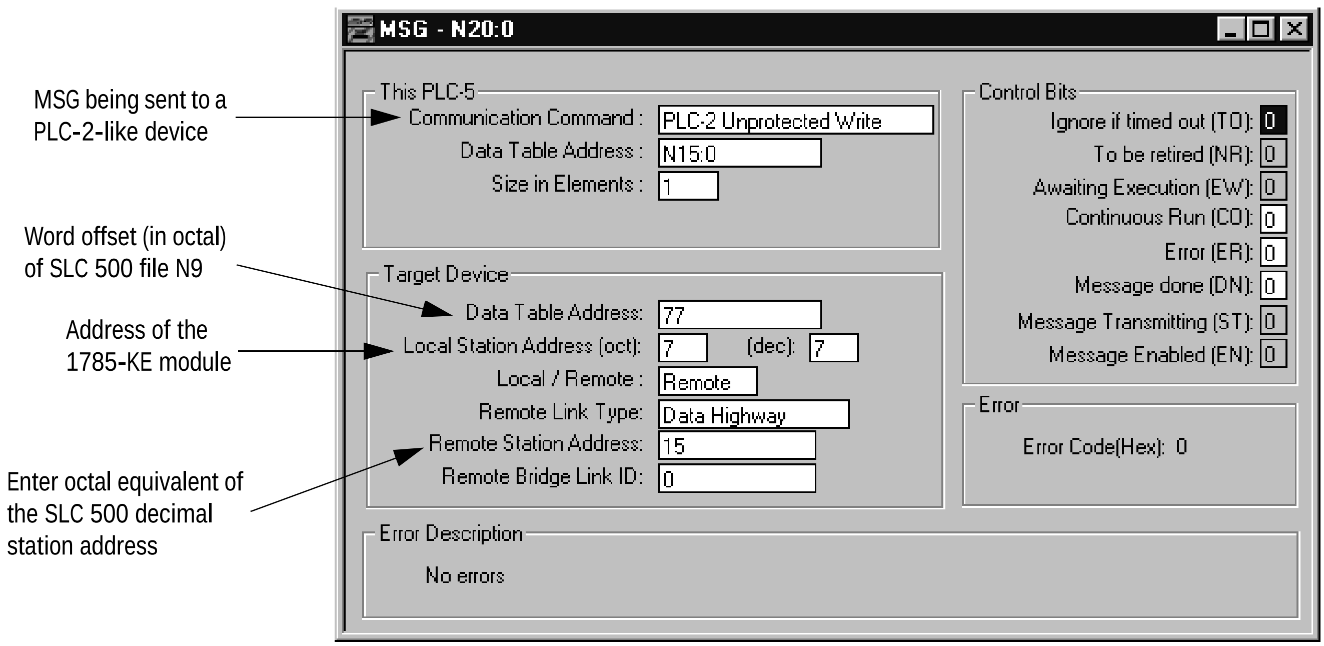
This MSG example tells the Classic PLC-5 processor to read the information from SLC 500 remote station 13_{10} (15_8) common interface file N9, offset 77_8 (63_{10}) and place the information in its N15:0 file.

Set S:2/8 in SLC 5/02 status file to 1. This bit is the Common Interface File (CIF) Addressing Mode selection bit that allows the SLC 5/02 processor to accept “byte-offsets” from a PLC-5 processor.

Figure 3.4
This is an example of a Classic PLC-5 write MSG to a SLC 5/02 processor.

ladder rung

setup screen (remote message)



This MSG example tells the Classic PLC-5 processor to write the information from its N15:0 to SLC 500 remote station 13_{10} (15_8)., The information is to be written to offset 77_8 (63_{10}) in the SLC common interface file N9.

Set S:2/8 in SLC 5/02 status file to 1. This bit is the Common Interface File (CIF) Addressing Mode selection bit that allows the SLC 5/02 processor to accept "byte-offsets" from a PLC-5 processor.

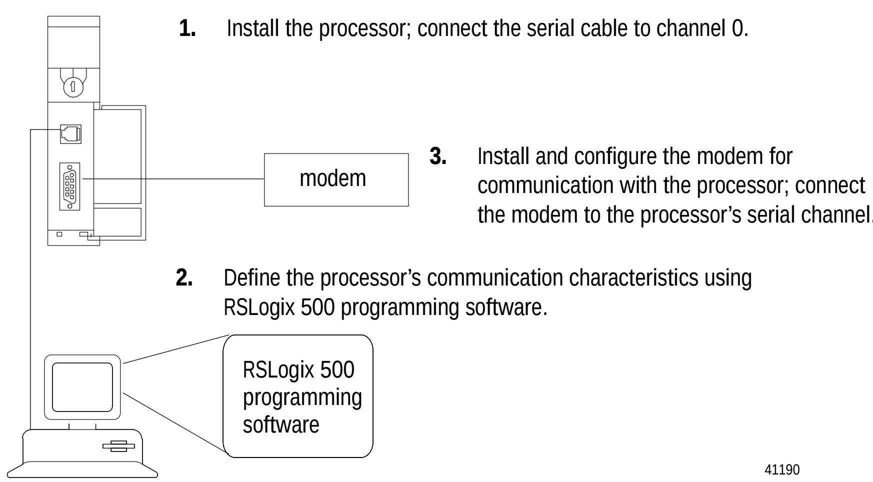
Configuring SLC 5/03, 5/04, and 5/05 Processors

Use This Chapter…

…to help you set up a SLC 5/03, 5/04, or 5/05 processor as a master station, as a slave station, or as a station on a point-to-point link.

Overview

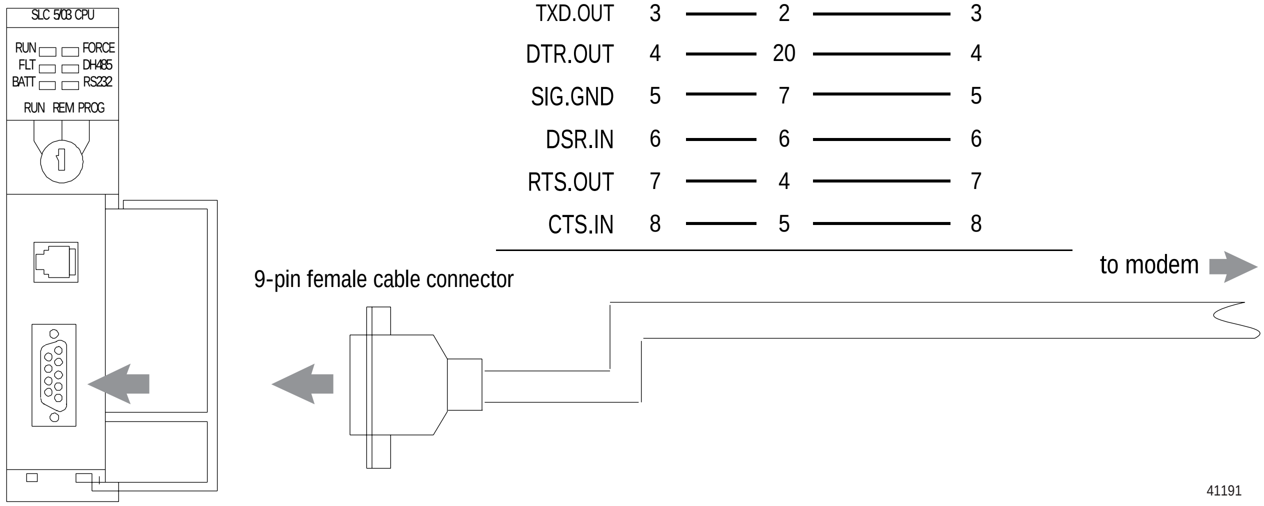
To configure a SLC 5/03, 5/04, or 5/05 processor, perform these tasks:



Installing the Processor

For details about installing the processor into an I/O chassis, see the SLC 500 Modular Hardware Style Installation and Operation Manual, publication 1747-6.2. Cable pinouts are shown in each example configuration as well as in Appendix A.

9-pin female		25-pin	9-pin
DCD.IN	1	8	1
RXD.IN	2	3	2
TXD.OUT	3	2	3
DTR.OUT	4	20	4
SIG.GND	5	7	5
DSR.IN	6	6	6
RTS.OUT	7	4	7
CTS.IN	8	5	8



Using Modems that Support DF1 Communication Protocols

The types of modems that you can use with SLC processors include dial-up phone modems, leased-line modems, radio modems and line drivers. For point-to-point full-duplex modem connections, use DF1 full-duplex protocol. For point-to-multipoint modem connections, use DF1 half-duplex master and slave protocols. In this case, one (and only one) of the other devices must be configured for DF1 half-duplex master protocol.

Important: Do not attempt to use DH-485 protocol through modems under any circumstance.

Dial-up Phone Modems

Dial-up phone line modems support point-to-point full-duplex communications. Normally, an SLC processor on the initiating or receiving end of the dial-up connection, will be configured for DF1 full-duplex protocol with the control line parameter set for “Full-Duplex Modem.” See page 4-4 for details on the operation of the RS-232 modem control signals when “Full-Duplex Modem” is selected. See chapter 11 for further details on using SLC processors in dial-up modem applications.

When an SLC processor is the initiator of the dial-up connection, use one of the ASCII write instructions to send out the “AT” dial-up string (for example ATDT 555-1212). The status file modem lost bit (S:5/14) provides the feedback that the connection has been successfully made. To hang up the connection, use the ASCII AHL instruction to temporarily lower the DTR signal.

Leased-Line Modems

Leased-line modems are used with dedicated phone lines that are typically leased from the local phone company. The dedicated lines may be point-to-point topology supporting full-duplex communications between two modems or in a point-to-multipoint topology supporting half-duplex communications between three or more modems. In the point-to-point topology, configure the SLC processor for DF1 full-duplex protocol with the control line parameter set to “Full-Duplex Modem.” In the point-to-multipoint topology, configure the SLC processors for DF1 half-duplex master or slave protocol with the control parameter set to “Half-Duplex Modem without Continuous Carrier.” See page 4-5 for details on the operation of the RS-232 modem control signals when “Half-Duplex Modem without Continuous Carrier” is selected.

Radio Modems

Radio modems may be implemented in a point-to-point topology supporting either half-duplex or full-duplex communications, or in a point-to-multipoint topology supporting half-duplex communications between three or more modems. In the point-to-point topology using full-duplex radio modems, configure the SLC processors for DF1 full-duplex protocol. In the point-to-multipoint topology using half-duplex radio modems, configure the SLC processors for DF1 half-duplex master or slave protocol. If these radio modems require RTS/CTS handshaking, configure the control line parameter to “Half-Duplex Modem without Continuous Carrier.”

Line Drivers

Line drivers, also called short-haul modems, do not actually modulate the serial data, but rather condition the electrical signals to operate reliably over long transmission distances (up to several miles). Allen-Bradley’s AIC+ Advanced Interface Converter is a line driver that converts an RS-232 electrical signal into an RS-485 electrical signal, increasing the signal transmission distance from 50 to 4000 feet. In a point-to-point line driver topology, configure the SLC processor for DF1 full-duplex protocol. In a point-to-multipoint line driver topology, configure the SLC processors for DF1 half-duplex master or slave protocol. If these line drivers require RTS/CTS handshaking, configure the control line parameter to “Half-Duplex Modem without Continuous Carrier.”

Modem Control Line Operation

The following explains the operation of the SLC 5/03, 5/04 and 5/05 processors when you configure the RS-232 channel for the following applications.

DF1 Full-Duplex

When configured for DF1 full-duplex, the following control line operation takes effect:

No Handshaking Selected

DTR is always active (high) and RTS is always inactive (low). *Receptions and transmissions take place regardless of the states of DSR, CTS, or DCD inputs.* Only make this selection when the SLC 5/03, 5/04 and 5/05 processors are directly connected to another device that does not require handshaking signals.

Full-Duplex Modem Selected

DTR and RTS are always active except:

- If DSR goes inactive, both DTR and RTS are dropped for 1 to 2 seconds, then reactivated. The modem lost bit (S:5/14) is turned on immediately. While DSR is inactive, the state of DCD is ignored. Neither receptions nor transmissions are performed.
- If DCD goes inactive while DSR is active, then receptions are not allowed. If DCD remains inactive for 9 to 10 seconds, DTR is set inactive. At this point, the modem lost bit is also set. If DSR remains active, DTR is raised again in 5 to 6 seconds.

Reception requires DSR and DCD to be active. Transmission requires all three inputs (CTS, DCD, and DSR) to be active. Whenever DSR and DCD are both active, the modem lost bit is reset.

DF1 Half-Duplex Slave

When configured for DF1 half-duplex slave, the following control line operation takes effect:

No Handshaking Selected

DTR is always active and RTS is always inactive. *Receptions and transmissions take place regardless of the states of DSR, CTS, or DCD inputs.* Only make this selection when the processor is directly connected to another device that does not require handshaking signals.

Half-Duplex Modem with Continuous Carrier Selected

DTR is always active and RTS is only activated during transmissions (and any programmed delays before or after transmissions). The handling of DCD and DSR are exactly the same as with Full-Duplex Modem. *Reception requires DSR and DCD to be active. Transmissions require CTS, DCD and DSR to be active.* Whenever DSR and DCD are both active, the modem lost bit is reset.

Half-Duplex Modem without Continuous Carrier Selected

This is exactly the same as Half-Duplex Modem with Continuous Carrier except monitoring of DCD is not performed. *DCD is still required for receptions, but is not required for transmissions. Transmissions still require CTS and DSR.* Whenever DSR is active, the modem lost bit is reset.

DF1 Half Duplex Master

When configuring for DF1 half-duplex master, the following control line operation takes effect:

No Handshaking Selected

DTR is always active and RTS is always inactive. *Receptions and transmissions take place regardless of the states of DSR, CTS, or DCD inputs.* Only make this selection when the processor is directly connected to another device that does not require handshaking signals.

Full-Duplex Modem Selected

DTR and RTS are always active except at the following times:

- If DSR goes inactive, both DTR and RTS are dropped for 1 to 2 seconds then reactivated. The modem lost bit (S:5/14) is turned on immediately. While DSR is inactive, the state of DCD is ignored. Neither receptions nor transmissions are performed.
- If DCD goes inactive while DSR is active, then receptions are not allowed. If DCD remains inactive for 9 to 10 seconds, then DTR is set inactive. At this point, the modem lost bit is also set. If DSR remains active, then DTR is raised again in 5 to 6 seconds.

Reception requires DSR and DCD to be active. Transmission requires all three inputs (CTS, DCD, and DSR) to be active. Whenever DSR and DCD are both active, the modem lost bit is reset.

Half-Duplex Modem without Continuous Carrier Selected

DTR is always active and RTS is only active during transmissions (and any programmed delays before and after transmissions). The processor does not monitor DCD.

If DSR goes inactive, RTS is dropped. The modem lost bit (S:5/14) is turned on immediately. While DSR is inactive, neither receptions nor transmissions are performed.

Reception requires DSR to be active. Transmission requires two inputs, CTS and DSR, to be active. Whenever DSR is active, the modem lost bit is reset.

Configuring DF1 Half-Duplex Channel 0 Parameters

RTS Send Delay and RTS Off Delay

Through your programming software, the parameters RTS Send Delay and RTS Off Delay give you the ability to set how long RTS is on prior to transmission, as well as how long to keep it on after transmission is complete. These parameters only apply when you select half-duplex modem with or without continuous carrier. For maximum communication throughput, leave these parameters at zero.

For use with half-duplex modems that require extra time to turnaround or key-up their transmitter even after they have activated CTS, the RTS Send Delay specifies (in 20 millisecond increments) the amount of delay time after activating RTS to wait before checking to see if CTS has been activated by the modem. If CTS is not yet active, RTS remains active, and as long as CTS is activated within one second, the transmission occurs. After one second, if CTS is still not activated, then RTS is set inactive and the transmission is aborted.

For modems that do not supply a CTS signal but still require RTS to be raised prior to transmission, jumper RTS to CTS and use the shortest delay possible without losing reliable operation.

If an RTS Send Delay of 0 is selected, then transmission starts as soon as CTS is activated. If CTS does not go active within one second after RTS is raised, RTS is set inactive and the transmission is aborted.

Certain modems will drop their carrier link when RTS is set inactive even though the transmission has not quite been finished. The RTS Off Delay parameter specifies in 20 millisecond increments the delay between when the last serial character is sent to the modem and when RTS is deactivated. This gives the modem extra time to transmit the last character of a packet.

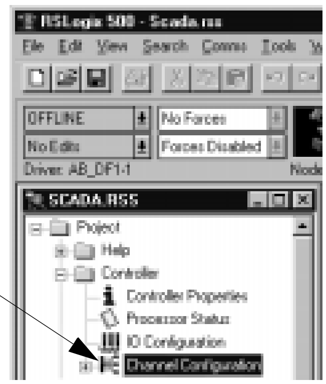
ATTENTION: For almost all modem applications, the RTS Off Delay should be left at 0. Never Select an RTS Off Delay that is greater than the RTS Send Delay in the other devices on the network, or you may incur two devices trying to transmit simultaneously

Configuring a Standard-Mode DF1 Half-Duplex Master Station

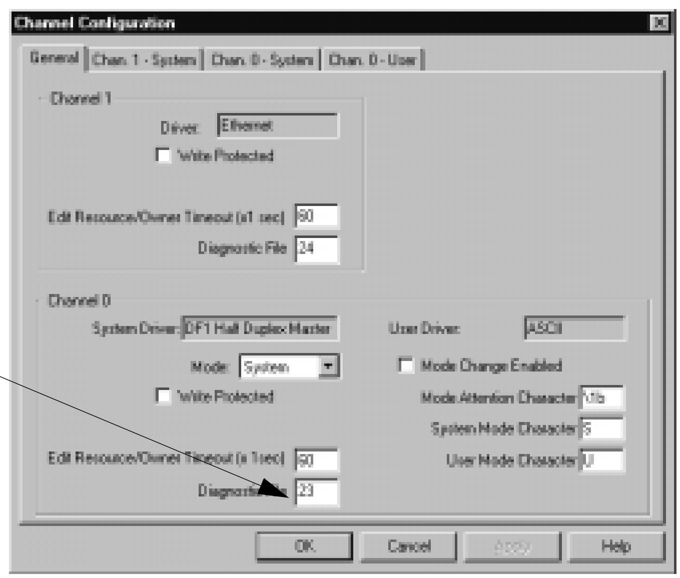
Choose standard mode if you want to query slave stations for information based upon user-configured polling ranges. This mode is used most often in point-to-multipoint configurations.

To configure the processor for a master station using standard communication, place the processor into program mode and do the following using your programming software:

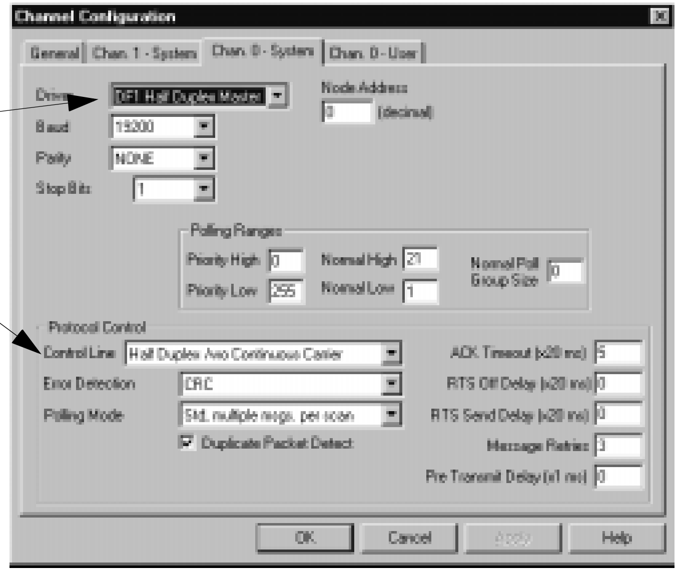
To bring up the Channel Configuration interface, double-click on the Channel Configuration icon.



Define the location of the diagnostic file used for Channel Status here. For Channel Status details, see page 4-14.



1. On the Channel 0 tab, choose DF1 Half-Duplex for your Driver.
2. Choose a Standard Polling Mode.
3. Configure the rest of the communication driver characteristics according to Table 4.A on page 4-8.



Use Worksheet 4.1 (page D-9) for an example configuration and to record your station's configuration.

Table 4.A
Define these parameters when configuring a SLC 5/03, 5/04, or 5/05 processor as a master station using standard-communication mode to talk to slave stations.

Tab:	Parameter:	Selections:
General	Diagnostic File	SLC 5/03 (OS 303 or higher), 5/04 (OS 402 or higher) and 5/05 only. Select an unused file to store channel status information. You must define a diagnostic file in order to be able to view channel 0 status. See Table 4.C on page 4-12 for a file description.
Channel 0 System	Baud Rate	Select a communication rate that all devices in your system support. Configure all devices in the system for the same communication rate.
	Parity	Parity provides additional message packet error detection. To implement even parity checking, choose Even. To implement no parity checking, choose None.
	Stop Bits	Match the number of stop bits to the device with which you are communicating.
	Node Address	A node address identifies the processor on the DF1 half-duplex link. Each station on a link must have a unique address. Choose an address between 0_{10} and 254_{10}. Node address255_{10} is the broadcast address, and cannot be selected as a station's individual address
	Control Line	This parameter defines the mode in which the driver operates. Choose a method appropriate for your system's configuration: • If you are not using a modem, choose NO HANDSHAKING. • If the master modem is full duplex, choose FULL-DUPLEX MODEM. • If all the modems in the system are half-duplex, choose HALF-DUPLEX WITHOUT CONTINUOUS CARRIER. See page 4-5 for a description of the control line operation settings.

Tab:	Parameter:	Selections:
Channel 0 System	Error Detection	With this selection, you choose the how the processor checks the accuracy of each DF1 packet transmission. BCC: This algorithm provides a medium level of data security. It cannot detect: • transposition of bytes during transmission of a packet • the insertion or deletion of data values of zero within a packet CRC: This algorithm provides a higher level of data security. Select an error detection method that all devices in your configuration can use. When possible, choose CRC.
	Polling Mode	If you want to receive: • only one message from a slave station per its turn, choose STANDARD (SINGLE MESSAGE TRANSFER PER NODE SCAN). Choose this method only if it is critical to keep the poll list scan time to a minimum. • as many messages from a slave station as it has, choose STANDARD (MULTIPLE MESSAGE TRANSFER PER NODE SCAN).
	Duplicate Packet Detect	Duplicate Detect lets the SLC detect if it has received a message that is a duplicate of its most recent message from another station. If you choose duplicate detect, the processor will acknowledge (ACK) the message but will not act on it since it has already performed the message's task when it received the command from the first message. If you want to detect duplicate packets and discard them, check this parameter. If you want to accept duplicate packets and execute them, leave this parameter unchecked.
	ACK Timeout	The amount of time in 20 millisecond increments that you want the processor to wait for an acknowledgment to the message it has sent before the processor retries the message or the message errors out. This timeout value is also used for the poll response timeout. See page 4-10 for recommendations to minimize this value.
	RTS Off Delay	Defines the amount of time in 20 millisecond increments that elapses between the end of the message transmission and the de-assertion of the RTS signal. This time delay is a buffer to make sure that the modem has transmitted the message but should normally be left at zero. See page 4-6 for further guidelines for setting this parameter.
	RTS Send Delay	Defines the amount of time in 20 millisecond increments that elapses between the assertion of the RTS signal and the beginning of the message transmission. This time allows the modem to prepare to transmit the message. The Clear-to-Send (CTS) signal must be high for transmission to occur. See page 4-6 for further guidelines for setting this parameter.
	Pre-Transmit Delay	Defines the amount of time in 1 millisecond increments that elapses between when the processor has a message to send and when it asserts the RTS signal.
	Message Retries	Defines the number of times a master station retries either: • a message before it declares the message undeliverable • or a poll packet to an active station before the master station declares that station to be inactive.
	Priority Polling Range – High	Select the last slave station address to priority poll.
	Priority Polling Range – Low	Select the first slave station address to priority poll. Entering 255 disables priority polling.
	Normal Polling Range – High	Select the last slave station address to normal poll.
	Normal Polling Range – Low	Select the first slave station address to normal poll. Entering 255 disables normal polling.
	Normal Poll Group Size	Enter the quantity of active stations located in the normal poll range that you want polled during a scan through the normal poll range before returning to the priority poll range. If no stations are configured in the Priority Polling Range, leave this parameter at 0.

Minimum DF1 Half-Duplex Master Channel 0 ACK Timeout

The governing timeout parameter to configure for a DF1 Half-Duplex Master is the channel 0 ACK Timeout. The ACK Timeout is the amount of time you want the processor to wait for an acknowledgment of its message transmissions. Set in 20 millisecond intervals, the value is the amount of time the master will wait for:

- an ACK to be returned by a slave when the master has just sent it a message, or
- a poll response or message to be returned by a slave when the master has just sent it a poll packet.

The timeout must be long enough that after the master has transmitted the last character of the poll packet, there is enough time for a slave to transmit (and the master receive) a maximum sized packet before the time expires.

To calculate the minimum ACK timeout, you must know:

- the modem baud rate
- maximum sized data packet (the maximum number of data words that a slave write command or read reply packet might contain)
- the RTS/CTS or “turnaround” delay of the slave modem
- the configured RTS Send Delay in the slave
- the program scan time of the slave

Determining Minimum Master ACK Timeout

To determine the minimum ACK Timeout, you must first calculate the transmission time by multiplying the maximum sized data packet for your processor by the modem rate in ms/byte. For an example we will assume an SLC 5/03 processor (103 data words or 224 bytes total packet size including overhead) and a 9600 bps modem, which transmits at approximately 1 ms/byte. Therefore, the message transmission time is 224ms. For approximate modem transmission rates, see the following table.

Table 4.B Approximate modem transmission rates

modem bps	approx. ms/byte
4800	2 ms/byte
9600	1 ms/byte
19200	.5 ms/byte

Next, you need to determine the average slave program scan time. In RSLogix 500, double click on the Processor Status icon and then locate Average on the Scan Times tab. For this example, lets assume an average slave program scan time of 20 ms. Remember, program scan time will vary by application.

Finally, you must determine the larger of two values, either the configured slave RTS Send Delay or the turnaround time of the slave modem. The RTS Send Delay time can be found by double-clicking on the slave's Channel Configuration icon and looking at the Chan. 0 System tab of the Channel Configuration screen. Note that the RTS Send Delay time is in intervals of 20 ms, so with a value of 3 in the box, the RTS Send Delay time would be 20 ms multiplied by 3. Using this value (60 ms) for our example, and assuming that the turnaround time of the modem is 50 ms (which will vary by modem) you would choose to use the RTS Send Delay time of 60 ms for your calculation.

Having determined the maximum message transmission time (224 ms), the average slave program scan time (20 ms) and the largest of either RTS Send Delay (60 ms) or the modem turnaround time, the minimum ACK timeout is simply the sum of these values.

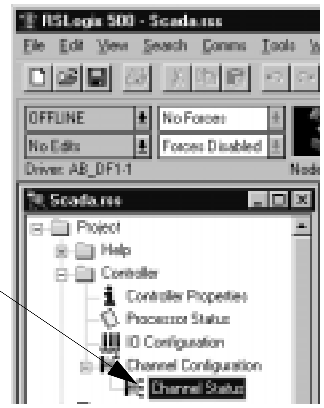
Use only the largest of these two values (RTS Send Delay, modem turnaround time)

Parameter	Example Values (in ms)
Max message transmission time	224
Average program scan time	20
RTS Send Delay	60
modem turnaround time	50
calculated ACK Timeout	304
round up to nearest 20 ms	320

DF1 Half-Duplex Master Channel Status

Channel Status data is stored in the diagnostic file defined on the Channel 0 Configuration screen. Table 4.C on page 4-12 explains information regarding the diagnostic counter data displayed.

Double-click on the Channel Status Icon Located beneath the Configuration icon to bring up the Channel Status screen.



See Table 4.C for details concerning the DF1 Half-Duplex Master Channel Status Screen.

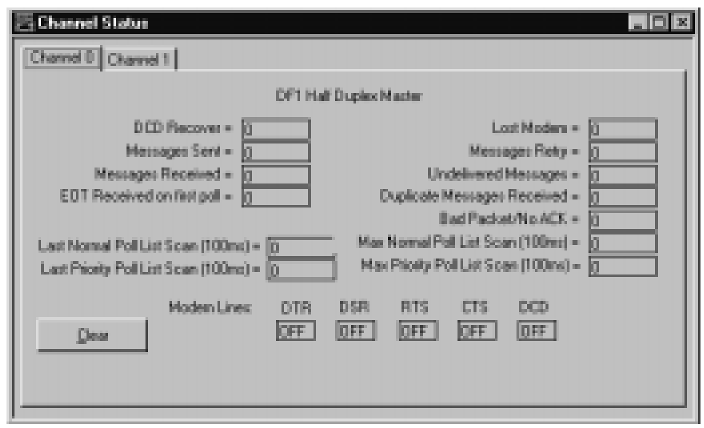


Table 4.C Understanding The DF1 Half-Duplex Master Status Screen Fields

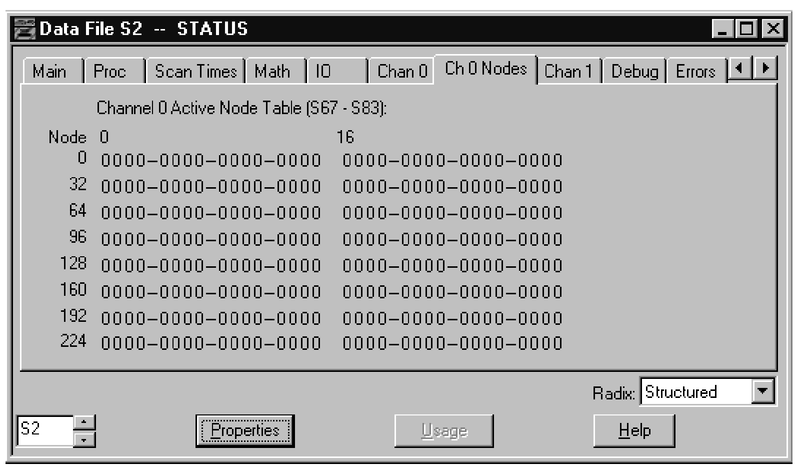
Status Field	Diagnostic File Location	Definition
DCD Recover	word 11	The number of times the processor detects the DCD handshaking line has gone low to high
Messages Sent	word 1	The total number of DF1 messages sent by the processor (including message retries)
Messages Received	word 2	The number of messages received with no errors
EOT Received on First Poll	word 8	Not implemented
Last Normal Poll List Scan	word 5	Time in 100 ms increments of last scan through Normal Poll List
Last Priority Poll List Scan	word 10	Time in 100 ms increments of last scan through Priority Poll List
Lost Modem	word 12	The number of times the lost modem bit has gone low to high
Message Retry	word 4	The number of message retries sent by the processor

Status Field	Diagnostic File Location	Definition
Undelivered Messages	word 3	The number of messages that were sent by the processor but not acknowledged by the destination device
Duplicate Messages Received	word 9	The number of times the processor received a message packet identical to the previous message packet
Bad Packet/No ACK	word 7	The number of incorrect data packets received by the processor for which no ACK was returned
Max Normal Poll List Scan	word 6	Maximum time in 100 ms increments to scan the Normal Poll List
Max Priority Poll List Scan	word 13	Maximum time in 100 ms increments to scan the Priority Poll List
DTR (Data Terminal Ready)	word 0;bit 4	The status of the DTR handshaking line (asserted by the processor)
DSR (Data Set Ready)	word 0;bit 2	The status of the DSR handshaking line (received by the processor)
RTS (Request to Send)	word 0;bit 1	The status of the RTS handshaking line (asserted by the processor)
CTS (Clear to Send)	word 0;bit 0	The status of the CTS handshaking line (received by the processor)
DCD (Data Carrier Detect)	word 0;bit 3	The status of the DCD handshaking line (received by the processor)

Monitor Active Stations

To see what stations are active, view the channel 0 active node table in the SLC 5/03, 5/04, or 5/05 processor status file (S:67/0-S:82/15). Each bit in the file represents a station on the link. The stations are numbered in order as a continuous bitstream file starting with the first bit in word S:67 (see Figure 4.1 below).

Figure 4.1
Example Active Node Table



At powerup or after reconfiguration, the master station assumes that all slave stations are inactive. A station is shown active only after it responds to a poll packet.

Configuring a Message-based Mode DF1 Half-Duplex Master Station

Choose message-based communication mode if you want to use MSG instructions in user programming to communicate with one station at a time. If your application uses satellite transmission or public switched telephone network transmission, consider choosing message-based. Communication to a slave station can be initiated on an as-needed basis.

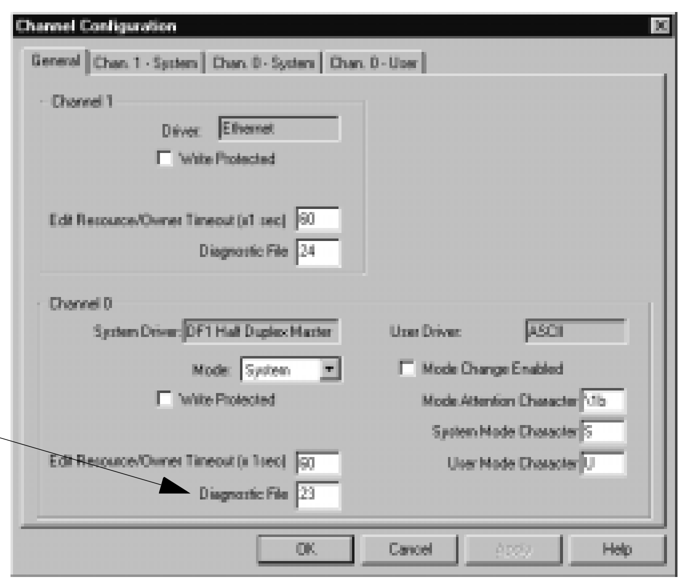
Message-based communication should also be used in redundant SLC master station systems implemented with the 1746-BSN backup communication module.

With message-based mode, you do not have an active node file that you can use to monitor station status. Also, you cannot implement slave station-to-slave station messaging or slave programming.

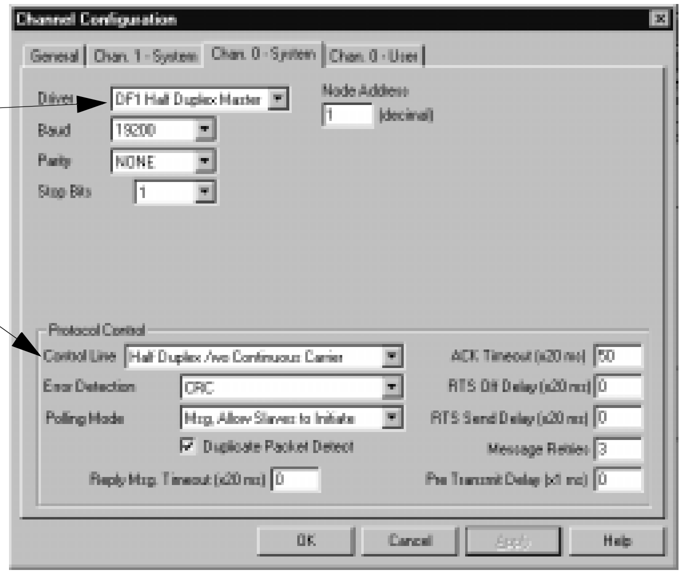
To configure the processor for a master station using message-based communication, place the processor in program mode and do the following using your programming software:

To bring up the Channel Configuration interface, double-click on the Channel Configuration icon.

Define the location of the diagnostic file used for Channel Status here. For Channel Status details, see page 4-14.



1. On the Channel 0 tab, choose DF1 Half-Duplex Master for your Driver.
2. Choose a Message-based Polling Mode.
3. Configure the communication driver characteristics according to Table 4.D.



Use Worksheet 4.2 (page D-10) for an example configuration and to record your station's configuration.

Table 4.D
Define these parameters when configuring a SLC 5/03, 5/04, or 5/05 processor as a master station using message-based communication mode to talk to slave stations.

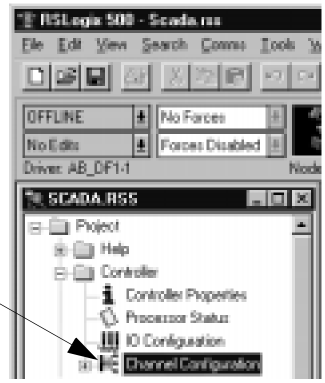
Tab:	Parameter:	Selections:
General	Diagnostic File	SLC 5/03 (OS 303 or higher), 5/04 (OS 402 or higher) and 5/05 only. Select an unused file (9-255) to store channel status information. You must define a diagnostic file in order to be able to view channel 0 status. See Table 4.C on page 4-12 for a file description.
Channel 0 System	Baud Rate	Select a communication rate that all devices in your system support. Configure all devices in the system for the same communication rate.
	Parity	Parity provides additional message packet error detection. To implement even parity checking, choose Even. To implement no parity checking, choose None.
	Stop Bits	Match the number of stop bits to the devices with which you are communicating.
	Node Address	A node address identifies the processor on the DF1 half-duplex link. Each station on a link must have a unique address. Choose an address between 0_{10} and 254_{10}. Node address255_{10} is the broadcast address, and cannot be selected as a station's individual address
	Control Line	This parameter defines the mode in which the driver operates. Choose a method appropriate for your system's configuration: • If you are not using a modem, choose NO HANDSHAKING. • If the master modem is full duplex, choose FULL-DUPLEX. • If all the modems in the system are half-duplex, choose HALF-DUPLEX WITHOUT CONTINUOUS CARRIER. See page 4-5 for descriptions of control line operation settings.

Tab:	Parameter:	Selections:
Channel 0 System	Error Detection	With this selection, you choose the how the processor checks the accuracy of each DF1 packet transmission. BCC: This algorithm provides a medium level of data security. It cannot detect: • transposition of bytes during transmission of a packet • the insertion or deletion of data values of zero within a packet CRC: This algorithm provides a higher level of data security. Select an error detection method that all devices in your configuration can use. When possible, choose CRC.
	Polling Mode	If you want to: • accept unsolicited messages from slave stations, choose MESSAGE BASED (ALLOW SLAVES TO INITIATE MESSAGES) Slave station-initiated messages are acknowledged and processed after all master station-initiated (solicited) messages. **Note:** Slave stations can only send messages when they are polled. If the message-based master station never sends a slave station a message, the master station will never send the slave station a poll. Therefore, to regularly obtain a slave station-initiated message from a slave station, you should choose to use standard communication mode instead. • ignore unsolicited messages from slave stations, choose MESSAGE BASED (DO NOT ALLOW SLAVES TO INITIATE MESSAGES) Slave station-initiated messages are acknowledged and discarded. The master station acknowledges the slave station-initiated message so that the slave station removes the message from its transmit queue, which allows the next packet slated for transmission into the transmit queue.
	Duplicate Packet Detect	Duplicate Detect lets the SLC detect if it has received a message that is a duplicate of its most recent message from another station. If you choose duplicate detect, the processor will acknowledge (ACK) the message but will not act on it since it has already performed the message's task when it received the command from the first message. If you want to detect duplicate packets and discard them, check this parameter. If you want to accept duplicate packets and execute them, leave this parameter unchecked.
	Reply Message Wait Time	Define the amount of time in 20 millisecond increments that the master station will wait after receiving an ACK (to a master-initiated message) before polling the slave station for a reply. Choose a time that is, at minimum, equal to the longest time that a slave station needs to format a reply packet. This would typically be the maximum scan time of the slave station.
	ACK Timeout	The amount of time in 20 millisecond increments that you want the processor to wait for an acknowledgment to the message it has sent before the processor retries the message or the message errors out. This timeout value is also used for the poll response timeout. See page 4-10 for recommendations to minimize this value.
	RTS Off Delay	Defines the amount of time in 20 millisecond increments that elapses between the end of the message transmission and the de-assertion of the RTS signal. This time delay is a buffer to make sure that the modem has transmitted the message but should normally be left at zero. See page 4-6 for further guidelines for setting this parameter.
	RTS Send Delay	Defines the amount of time in 20 millisecond increments that elapses between the assertion of the RTS signal and the beginning of the message transmission. This time allows the modem to prepare to transmit the message. The Clear-to-Send (CTS) signal must be high for transmission to occur.
	Pre-Transmit Delay	Defines the amount of time in 1 millisecond increments that elapses between when the processor has a message to send and when it asserts the RTS signal.
	Message Retries	Defines the number of times a master station retries a message before it declares the message undeliverable.

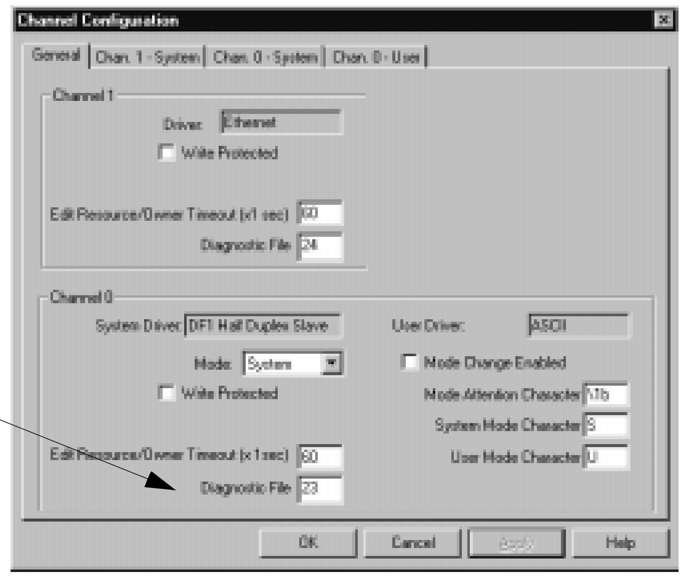
Configuring a Slave Station

To choose the processor as a slave station, do the following using your programming software:

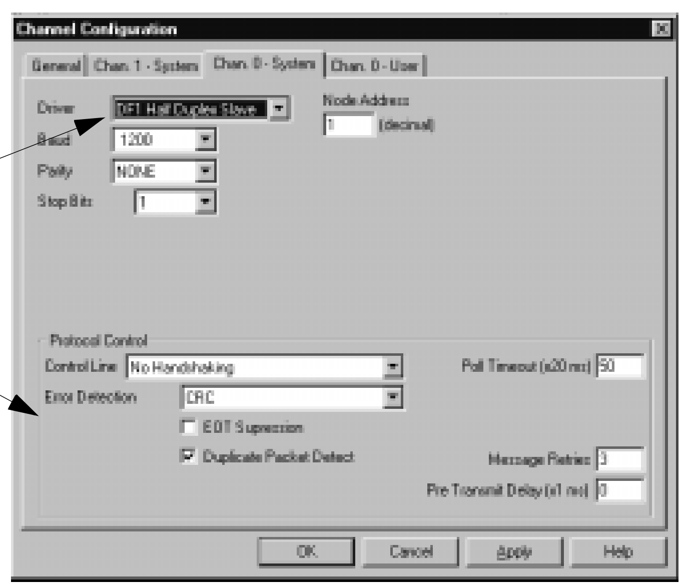
To bring up the Channel Configuration interface, double-click on the Channel Configuration icon.



Define the location of the diagnostic file used for Channel Status here. For Channel Status details, see page 4-20.



1. On the Channel 0 tab, choose DF1 Half-Duplex Slave for your Driver.
2. Configure the communication driver characteristics according to Table 4.E.



Use Worksheet 4.3 (page D-11) for an example configuration and to record your station's configuration.

Table 4.E
Define these parameters when configuring a SLC 5/03, 5/04, or 5/05 processor as a slave station.

Tab:	Parameter:	Selections:
General	Diagnostic File	SLC 5/03 (OS 303 or higher), 5/04 (OS 402 or higher) and 5/05 only. Select an unused file to store channel status information. You must define a diagnostic file in order to be able to view channel 0 status. See Table 4.F on page 4-20 for a file description.
Chan. 0 System	Baud Rate	Select a communication rate that all devices in your system support. Configure all devices in the system for the same communication rate.
	Parity	Parity provides additional message packet error detection. To implement even parity checking, choose Even. To implement no parity checking, choose None.
	Stop Bits	Match the number of stop bits to the device with which you are communicating.
	Node Address	A node address identifies the processor on the DF1 half-duplex link. Each station on a link must have a unique node address. Choose an address between 0_{10} and $254_{10.}$ Node address 255_{10} is the broadcast address, which you cannot select as a station's individual address.
	Control Line	This parameter defines the mode in which the driver operates. Choose a method appropriate for your system's configuration: • If you are not using a modem, choose NO HANDSHAKING. • If the master modem is full duplex and the slave modem is half-duplex, choose HALF-DUPLEX WITH CONTINUOUS CARRIER. • If all the modems in the system are half-duplex, choose HALF-DUPLEX WITHOUT CONTINUOUS CARRIER. See page 4-4 for descriptions of the control line operation settings.
	Error Detection	With this selection, you choose the how the processor checks the accuracy of each DF1 packet transmission. BCC: This algorithm provides a medium level of data security. It cannot detect: • transposition of bytes during transmission of a packet • the insertion or deletion of data values of zero within a packet CRC: This algorithm provides a higher level of data security. Select an error detection method that all devices in your configuration can use. When possible, choose CRC.
	Duplicate Packet Detect	Duplicate Detect lets the SLC detect if it has received a message that is a duplicate of its most recent message from the master station. If you choose duplicate detect, the processor will acknowledge (ACK) the message but will not act on it since it has already performed the message's task when it received the command from the first message. If you want to detect duplicate packets and discard them, check this parameter. If you want to accept duplicate packets and execute them, leave this parameter unchecked.
	Poll Timeout	The timer keeps track of how often the station is polled. If the station has a message to send, it starts a timer. If the poll timeout expires before the message timeout, which you specify in the MSG control block, the MSG error bit is set and the message is removed from the transmit queue. If the message timeout, which you specify in the MSG control block, expires before the poll timeout expires, the MSG error bit and MSG timeout bit are set. The poll timeout can be disabled by entering a zero. See page 4-19 for recommendations to minimize this value

Tab:	Parameter:	Selections:
Chan. 0 System	RTS Off Delay	Defines the amount of time in 20 millisecond increments that elapses between the end of the message transmission and the de-assertion of the RTS signal. This time delay is a buffer to make sure that the modem has transmitted the message, but should normally be left at zero. See page 4-6 for further guidelines for setting this parameter.
	RTS Send Delay	Defines the amount of time in 20 millisecond increments that elapses between the assertion of the RTS signal and the beginning of the message transmission. This time allows the modem to prepare to transmit the message. The Clear-to-Send (CTS) signal must be high for transmission to occur.See page 4-6 for further guidelines for setting this parameter.
	Message Retries	Defines the number of times a slave station resends its message to the master station before the slave station declares the message undeliverable.
	Pre-Transmit Delay	Defines the amount of time in 1 millisecond increments that elapses between when the processor has a message to send and when it asserts the RTS signal.
	EOT Suppression	If you want to minimize traffic on the network, you can choose to have the slave station not send EOT packets to the master station. When EOT packets are suppressed, the master station automatically assumes a slave station has no data to give if the slave station does not send a message packet as a response to a poll. A disadvantage of suppressing EOTs is that the master station cannot distinguish between an active station that has no data to transmit and an inactive station. A possible application for suppressing EOTs is the following: conserving power with a radio modem because the radio transmitter does not have to power-up to transmit a DLE EOT packet (”no data to give” packet). To suppress EOTs, check this parameter. To have the processor send EOTs, leave this parameter unchecked.

Configuring Channel 0 Poll Timeout

The Channel 0 Poll Timeout is only used when the DF1 half-duplex slave is initiating MSG instructions in ladder logic. This implies that the Master is most likely configured for Standard Polling Mode. The minimum Poll Timeout value is dependent on the maximum Master poll scan rate. Since the Master’s polling and the Slave’s triggering of a MSG instruction are asynchronous events, it is possible that in the instant just after the slave was polled, the MSG instruction gets triggered. This means the MSG instruction will remain queued-up for transmission until the Master has polled every other slave first. Therefore, the minimum Slave channel 0 Poll Timeout value is equal to the maximum Master poll scan rate rounded up to the next 20 ms increment.

Minimum Channel 0 Poll Timeout = (maximum Master scan poll rate)

DF1 Half-Duplex Slave Channel Status

Channel Status data is stored in the diagnostic file defined on the Channel 0 Configuration screen. Table 4.F on page 4-20 explains information regarding the diagnostic counter data displayed.

Double-click on the Channel Status Icon Located beneath the Configuration icon to bring up the Channel Status screen.

See Table 4.F for details concerning the DF1 Half-Duplex Slave Channel Status Screen.

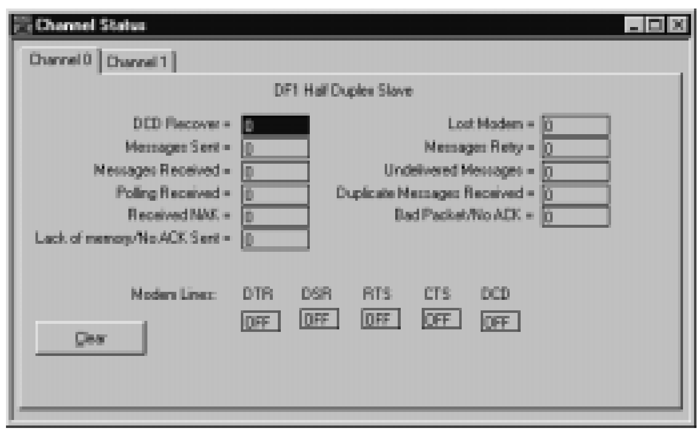


Table 4.F Understanding The DF1 Half-Duplex Slave Status Screen Fields

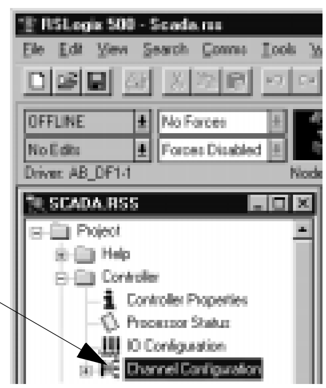
Status Field	Diagnostic File Location	Definition
DCD Recover	word 11	The number of times the processor detects the DCD handshaking line has gone low to high
Messages Sent	word 1	The total number of DF1 messages sent by the processor (including message retries)
Messages Received	word 2	The number of messages received with no errors
Polling Received	word 6	The number of master poll packets received by the processor
Received NAK	word 5	The number of NAKs received by the processor
Lack of Memory/No ACK Sent	word 8	The number of times the processor could not receive a message because it did not have available memory
Lost Modem	word 12	The number of times the lost modem bit has gone low to high
Messages Retry	word 4	The number of message retries sent by the processor

Status Field	Diagnostic File Location	Definition
Undelivered Messages	word 3	The number of messages that were sent by the processor but not acknowledged by the destination device
Duplicate Messages Received	word 9	The number of times the processor received a message packet identical to the previous message packet
Bad Packet/No ACK	word 7	The number of incorrect data packets received by the processor for which no ACK was returned
DTR (Data Terminal Ready)	word 0;bit 4	The status of the DTR handshaking line (asserted by the processor)
DSR (Data Set Ready)	word 0;bit 2	The status of the DSR handshaking line (received by the processor)
RTS (Request to Send)	word 0;bit 1	The status of the RTS handshaking line (asserted by the processor)
CTS (Clear to Send)	word 0;bit 0	The status of the CTS handshaking line (received by the processor)
DCD (Carrier Detect)	word 0;bit 3	The status of the DCD handshaking line (received by the processor)

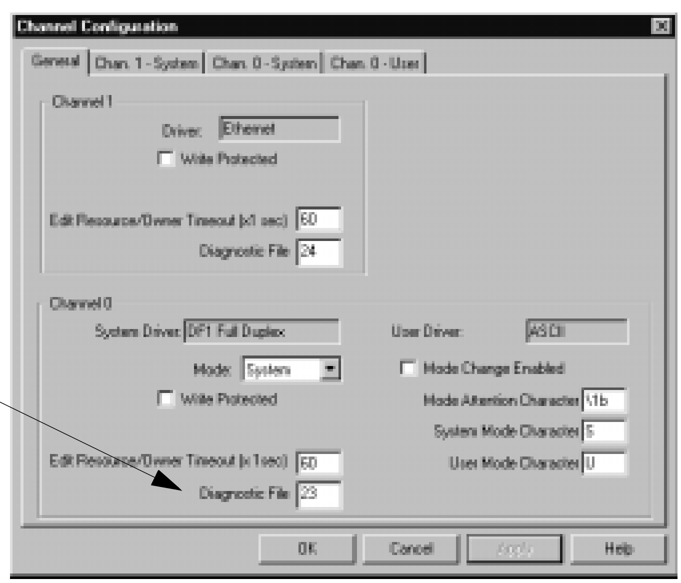
Configuring a Station on a Point-to-Point Link

To configure the processor for point-to-point communication, do the following using your programming software:

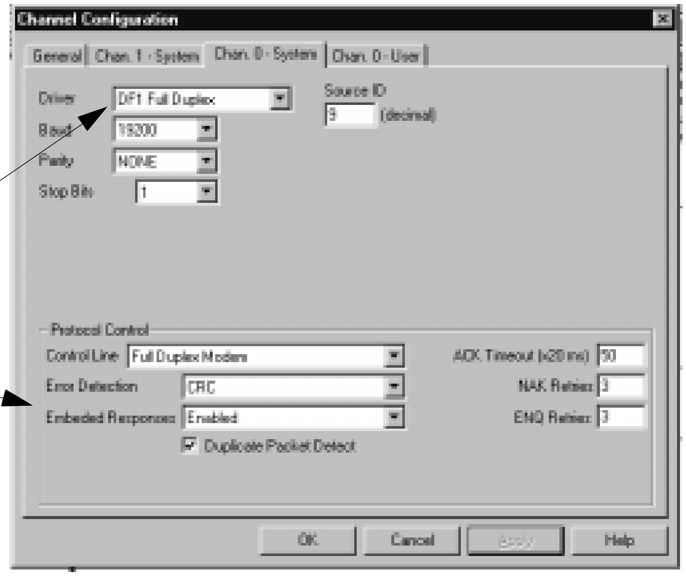
To bring up the Channel Configuration interface, double-click on the Channel Configuration icon.



Define the location of the diagnostic file used for Channel Status here. For diagnostic file details, see Table 4.H on page 4-24.



1. On the Channel 0 tab, choose DF1 Half-Duplex Slave for your Driver.
2. Configure the communication driver characteristics according to Table 4.G.



Use Worksheet 4.4 (page D-12) for an example configuration and to record your station's configuration.

Table 4.G
Define these communication parameters when configuring a SLC 5/03, 5/04, or 5/05 processor for DF1 full-duplex communication.

Tab:	Parameter:	Selections:
General	Diagnostic File	SLC 5/03 (OS 303 or higher), 5/04 (OS 402 or higher) and 5/05 only. Select an unused file to store channel status information. You must define a diagnostic file in order to be able to view channel 0 status. See Table 4.H on page 4-24 for a file description.
Chan. 0 System	Baud Rate	Select a communication rate that all devices in your system support. Configure all devices in the system for the same communication rate.
	Parity	Parity provides additional message packet error detection. To implement even parity checking, choose Even. To implement no parity checking, choose None.
	Stop Bits	Match the number of stop bits to the devices with which you are communicating.
	Source ID	This is the address, in decimal, that is used as the source address in any message initiated by this processor.
	Control Line	This parameter defines the mode in which the driver operates. Choose a method appropriate for your system's configuration: • If you are not using a modem, choose NO HANDSHAKING. • If you are using full-duplex modems, choose FULL-DUPLEX MODEM. See page 4-4 for descriptions of the control line operation settings

Tab:	Parameter:	Selections:
Chan. 0 System	Error Detection	With this selection, you choose the how the processor checks the accuracy of each DF1 packet transmission. BCC: This algorithm provides a medium level of data security. It cannot detect: • transposition of bytes during transmission of a packet • the insertion or deletion of data values of zero within a packet CRC: This algorithm provides a higher level of data security. Select an error detection method that all devices in your configuration can use. When possible, choose CRC.
	Embedded Responses	To use embedded responses, choose Enabled. If you want the processor to use embedded responses only when it detects embedded responses from another device, choose Auto-detect. If you are communicating with another Allen-Bradley device, choose Enabled. Embedded responses increase network traffic efficiency.
	Duplicate Packet Detect	Duplicate Detect lets the SLC detect if it has received a message that is a duplicate of its most recent message from the master station. If you choose duplicate detect, the processor will acknowledge (ACK) the message but will not act on it since it has already performed the message's task when it received the command from the first message. If you want to detect duplicate packets and discard them, check this parameter. If you want to accept duplicate packets and execute them, leave this parameter unchecked.
	ACK Timeout	The amount of time in 20 millisecond increments that you want the processor to wait for an acknowledgment to the message it has sent before sending an enquiry (ENQ) for the reply.
	NAK Retries	The number of times the processor will resend a message packet because the processor received a NAK response to the previous message packet transmission.
	ENQ Retries	The number of enquiries (ENQs) that you want the processor to send after an ACK timeout occurs.

DF1 Full-Duplex Channel Status

Channel Status data is stored in the diagnostic file defined on the Channel 0 Configuration screen. Table 4.H on page 4-24 explains information regarding the diagnostic counter data displayed.

Double-click on the Channel Status Icon Located beneath the Configuration icon to bring up the Channel Status screen.

See Table 4.H for details concerning the DF1 Full-Duplex Channel Status Screen.

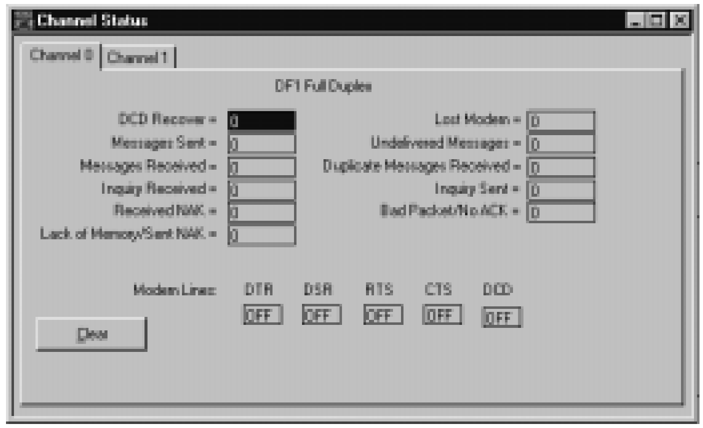
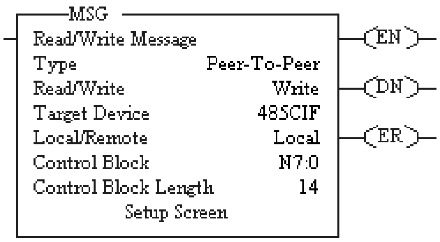


Table 4.H Understanding The DF1 Full-Duplex Status Screen Fields

Status Field	Diagnostic File Location	Definition
DCD Recover	word 11	The number of times the processor detects the DCD handshaking line has gone low to high
Messages Sent	word 1	The total number of DF1 messages sent by the processor (including message retries)
Messages Received	word 2	The number of messages received with no errors
Inquiry Received	word 6	The number of ENQs received by the processor
Received NAK	word 5	The number of NAKs received by the processor
Lack of Memory/Sent NAK	word 8	The number of times the processor could not receive a message because it did not have available memory
Lost Modem	word 12	The number of times the lost modem bit has gone low to high
Undelivered Messages	word 3	The number of messages that were sent by the processor but not acknowledged by the destination device
Duplicate Messages Received	word 9	The number of times the processor received a message packet identical to the previous message packet
Inquiry Sent	word 4	The number of ENQs sent by the processor
Bad Packet/No ACK	word 7	The number of incorrect data packets received by the processor for which a NAK was returned
DTR (Data Terminal Ready)	word 0;bit 4	The status of the DTR handshaking line (asserted by the processor)
DSR (Data Set Ready)	word 0;bit 2	The status of the DSR handshaking line (received by the processor)
RTS (Request to Send)	word 0;bit 1	The status of the RTS handshaking line (asserted by the processor)
CTS (Clear to Send)	word 0;bit 0	The status of the CTS handshaking line (received by the processor)
DCD (Data Carrier Detect)	word 0;bit 3	The status of the DCD handshaking line (received by the processor)

Messaging



For:	See page:
list of considerations	4-26
examples	4-30

Messaging can occur between:

- a master station and a slave station
- a slave station and its master station (See “Polled Report-by-Exception”)
- slave stations or between two processors connected via a point-to-point link

Master Station to Slave Station

A SLC 5/03, 5/04, or 5/05 master station communicates with the slave stations that are connected to it via modems in a point-to-multipoint configuration. A master station sends a slave station message to receive status or issue commands. For sample messaging ladder logic to use as a guide when using Standard or Message-based Polling Modes, see Appendix E-2.

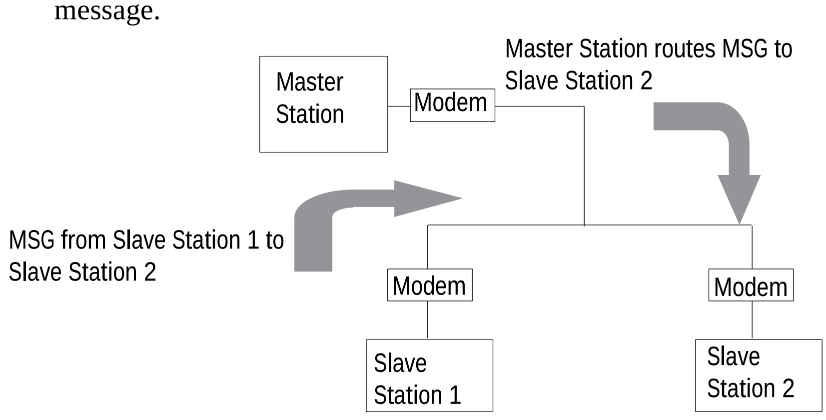
Polled Report-by-Exception

Slave stations can gather information from the I/O points they are responsible for and can send any anomalous readings to the master station. To do this, write ladder logic in the slave station to monitor certain conditions and send the data in an MSG instruction to the master station. For sample messaging ladder logic to use as a guide when using an SLC 500 as a Slave, see page Appendix E-6.

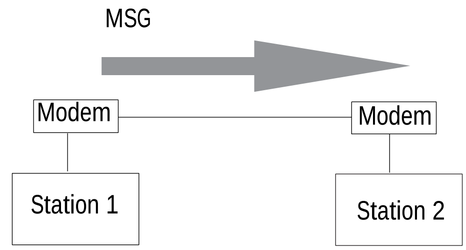
Processor-to-Processor

A processor-to-processor message can be the following types:

- In a point-to-multipoint configuration, the messaging would be between slave stations; the master station automatically routes the message.



- In a point-to-point configuration, the messaging would be between the two connected peer devices.



The configuration of the network (point-to-multipoint vs. point-to-point) and the configuration of the station (master, slave, or peer) does not affect how you configure an MSG instruction. That is, an MSG instruction being sent between two SLC slave stations is configured the same as an MSG instruction between two SLC processors connected point-to-point, which is configured the same as an MSG instruction between a SLC master station and a SLC slave station. See Figure 4.2 through Figure 4.5 for example MSG control blocks.

Considerations When Configuring MSG Control Blocks

Keep these considerations in mind when configuring messages between a SLC 5/03, 5/04, or 5/05 processor and other processors.

For both Point-to-Multipoint and Point-to-Point Link Configurations

- All SLC 5/04 and 5/05 processors, and 5/03 processors with operating system 301or greater have the capability to initiate and reply to PLC-5-type read and write messages by choosing PLC-5 as the Target Device. Use this for both PLC-5 and Logix5550 processors.
- The maximum read or write message for a SLC 5/03, 5/04, or 5/05 processor through Channel 0 is 103 words.
- The maximum read or write message for a MicroLogix 1000 is 41 words.

Minimum Master MSG Block Message Timeout

Once the master ACK timeout is determined (See page 4-10) then a minimum MSG block Message Timeout value can be determined. This value is calculated differently depending on the master polling mode.

Message-based Polling Mode

Message based polling mode messages are executed serially - each message in the queue must complete as done, or in error, before the next message in the queue is executed. For this mode, the minimum MSG Timeout should be:

$$\text{Maximum number of simultaneously triggered MSG instructions} * \left[\text{The sum of ACK Timeouts due to the maximum number of Message Retries for each queued-up message} + \text{Reply Message Wait timeout}\right] = \text{The minimum MSG Timeout}$$

Realize that if the Message Retries is set for the default (3), then the number of ACK Timeout periods is (3)*2+1=7 (message, poll, retry_1, poll, retry_2, poll, retry_3), because a poll packet is sent between every Message Retry.

However, the slave may still respond to retry 3 with an ACK just before the ACK Timeout period expires, and the master would poll after the Reply Message timeout period for the reply...which could take approximately another ACK Timeout period to receive.

Therefore, for message-based polling mode, set the MSG Timeout value to at least:

$$\text{\# of MSG instructions} * \left[2*(\text{Message\_Retries}+1) * \text{ACK Timeout} + \text{Reply Message Timeout}\right] = \text{The minimum MSG Timeout}$$

To continue the example, if Message Retries is configured for 3, ACK Timeout is configured for 16 * 20 ms = 320, and Reply Message Timeout is configured for 1* 20 ms, the MSG Timeout value would be:

$$1 * \left[2*(3+1) * .320 \text{ seconds} + .02\right] = 2.58 \text{ seconds}$$

Round up the MSG Timeout value to the nearest second (3)

If 5 MSG instructions were triggered at the same time, each MSG would need a timeout value of 5*2.58 = 12.9, which would be rounded up to 13 seconds.

Note: leave the channel 0 Message Retries at default (3) unless you have an extremely error free or error prone network.

Standard Polling Mode

For standard polling mode, the transmission of messages by the master can occur anywhere in the poll scan. This means that the master might transmit a message to station A just after it has completed polling station A as part of the poll scan. In this worst case scenario, it will take almost an entire poll scan before station A will be polled again and can reply to the master message so that the message can complete done or in error. In standard polling mode, the MSG Timeout should be at least as long as this maximum poll scan.

The maximum poll scan = The minimum MSG timeout

Standard Polling Mode With Single Message Transfer

For standard polling mode with single message transfer per poll scan, the maximum poll scan would be achieved when every slave had a maximum-sized message packet to transmit when polled. Recall that the ACK Timeout is calculated as being just long enough for the master to receive a maximum sized message packet, so the maximum poll scan time would be approximately:

The number of slave stations * ACK Timeout = The maximum single message transfer poll scan time = The minimum MSG Timeout

Therefore, if there are 10 slave stations and the ACK Timeout is 320 ms, then the maximum single message transfer poll scan time would be:

10 (slave stations) * .320 seconds = 3.20 seconds

Round up the MSG Timeout value to the nearest second (4)

Standard Polling Mode With Multiple Message Transfer

For standard polling mode with multiple message transfer per poll scan, the maximum poll scan would be achieved when every slave had multiple maximum sized message packets to transmit when polled. If the worst case scenario is 2 maximum sized message packet to transmit, then the maximum poll scan time is approximately 2 times the maximum single message transfer poll scan time plus the minimum poll scan time.

The minimum poll scan time occurs when the master sends out a 4 byte poll packet to each slave and in return receives a 2 byte response from each slave. This time is approximately the master modem turnaround time or RTS Send Delay (whichever is greater) plus the slave modem turnaround time or RTS Send Delay (whichever is greater), multiplied by the number of slave stations in the poll range.

[Master modem turnaround time or RTS Send Delay + Slave modem turnaround time or RTS Send Delay] * Number of slave stations = The minimum poll scan time

Use only the greater of these two values (Master modem turnaround time or RTS Send Delay)

Use only the greater of these two values (Slave modem turnaround time or RTS Send Delay)

For example, if the master modem turnaround time and RTS Send Delay are both 0 ms, and the slave modem turnaround time is 50 ms and RTS Send Delay is 60 ms, the minimum poll scan time would be:

0 + 60 ms * 10 (slave stations) = 600 ms

To finish the example:

[# of MSG instructions per slave * Maximum single message transfer poll scan time] + Minimum poll scan time = The maximum multiple message transfer poll scan time = The minimum MSG Timeout

2*(3.20 seconds) + .600 seconds = 7 seconds

For this example, the MSG Timeout value should be at least 7 seconds.

Minimum Slave MSG Block Message Timeout

The minimum slave MSG Block Message Timeout should allow for the Master to go through Message Retries plus one number of maximum poll scans before timing out. Therefore, the minimum MSG Block Message Timeout value should be at least (Slave Channel 0 Poll Timeout) * (Slave channel 0 Message Retries + 1), rounded up to the next whole second. Note: leave the channel 0 Message Retries at default (3) unless you have an extremely error free or extremely error prone network.

Minimum Slave MSG Block Message Timeout = (Slave channel 0 Poll Timeout)*(Slave Channel 0 Message Retries + 1)

Minimum Point-to-Point MSG Block Message Timeout

The minimum point-to-point MSG Block Message Timeout should allow for the processor to go through Message Retries plus one ACK time out. Therefore, the minimum MSG Block Message Timeout value should be at least (ACK Timeout) * (Channel 0 Message Retries + 1), rounded up to the next whole second. Note: leave the channel 0 Message Retries at default (3) unless you have an extremely error free or extremely error prone network.

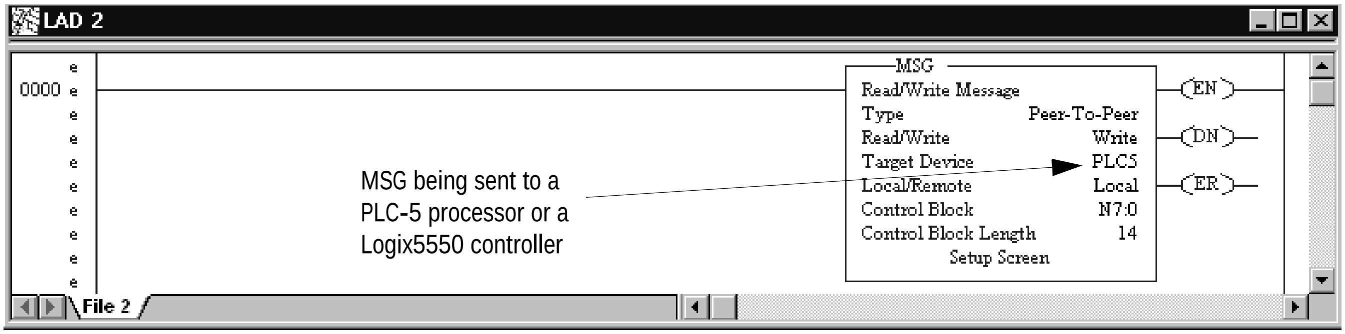
Minimum Point-to-Point MSG Block Message Timeout = (ACK Timeout)*(Channel 0 Message Retries + 1)

Example MSG Control Blocks

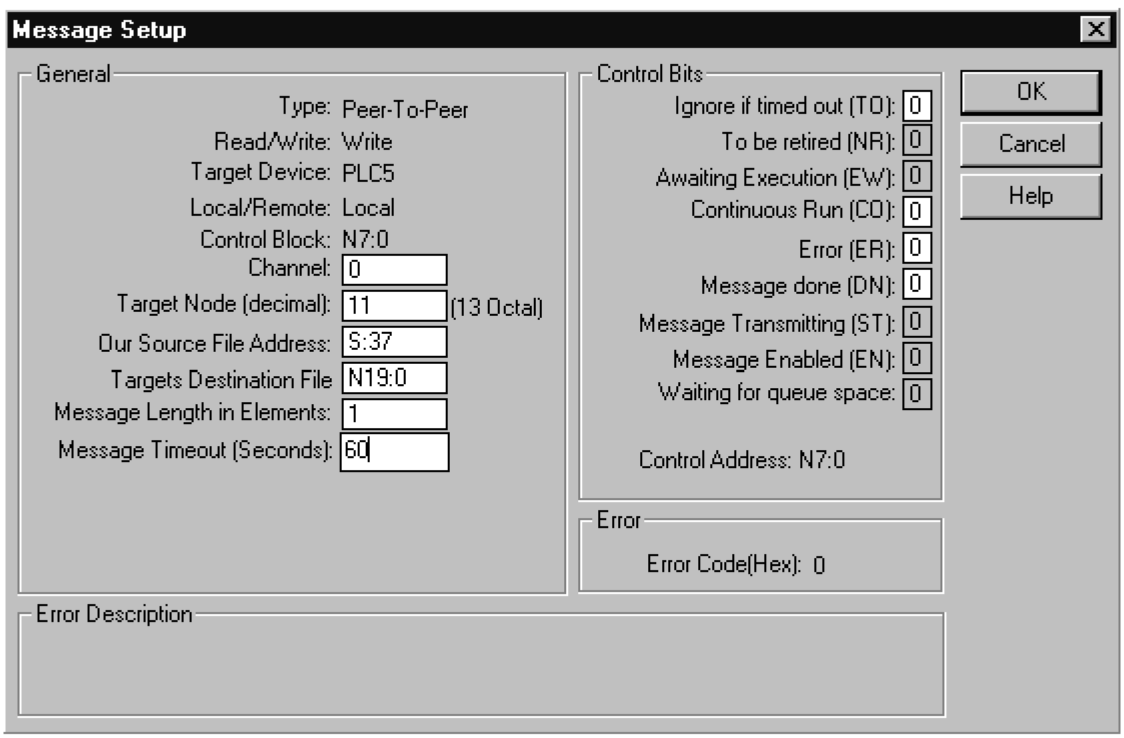
Application:	See page:
SLC 5/03, 5/04, or 5/05 write message to a PLC-5 or Logix5550 processor	4-31
SLC 5/03, 5/04, or 5/05 read message to a PLC-5 or Logix5550 processor	4-32
SLC 5/03, 5/04, or 5/05 write message to another SLC 500 or MicroLogix 1000 processor	4-33
SLC 5/03, 5/04, or 5/05 read message to another SLC 500 or MicroLogix 1000 processor	4-34

Figure 4.2
This is an example of a write MSG from a SLC 5/03, 5/04, or 5/05 processor to a PLC-5 processor or Logix5550 controller.

ladder rung



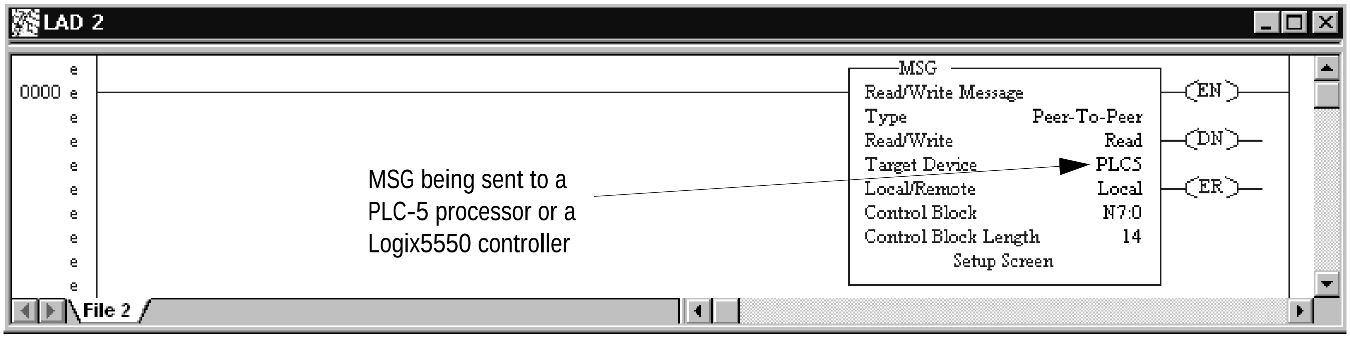
setup screen



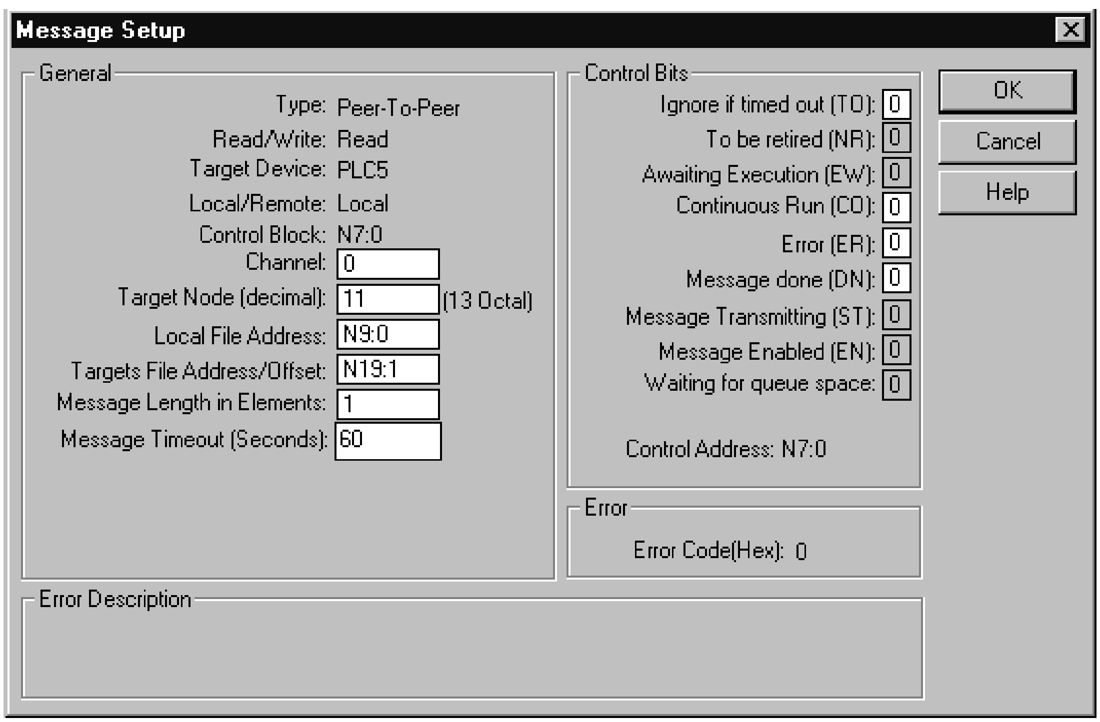
This MSG example tells the SLC 5/03, 5/04, or 5/05 master station to write the information from its S:37 through its serial port (channel 0) to the PLC-5 slave station 11_{10}. The data's destination is N19:0 of the PLC-5 slave station. For a Logix5550 slave station, a tag name would have to already have been mapped to N19. Alternatively, SLC 5/03 (OS 303 or higher), 5/04 (OS 402 or higher) and 5/05 processors support logical ASCII addressing, which means any Logix5550 controller tag can be written to by entering the tag name in double quotes in the Targets Destination File field.

Figure 4.3
This is an example of a read MSG from a SLC 5/03, 5/04, or 5/05 processor to a PLC-5 processor or Logix5550 controller.

ladder rung



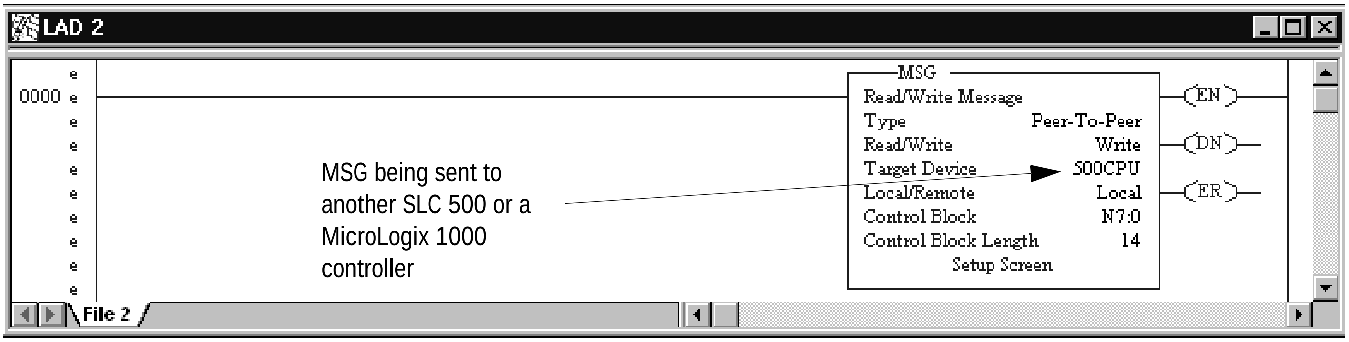
setup screen



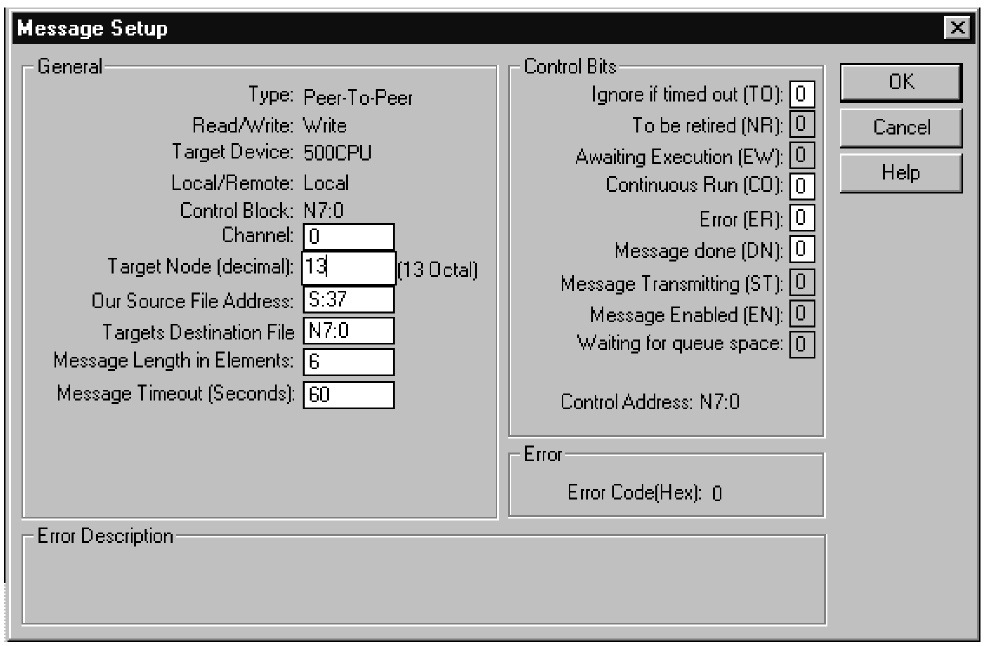
This MSG example tells the SLC 5/03, 5/04, or 5/05 master station to read the information from PLC-5 slave station 11_{10}'s N19:1 and place the information in master station file N9:0. For a Logix5550 slave station, a tag name would have to already have been mapped to N19. Alternatively, SLC 5/03 (OS 303 or higher), 5/04 (OS 402 or higher) and 5/05 processors support logical ASCII addressing, which means any Logix5550 controller tag can be read by entering the tag name in double quotes in the Targets File Address/ Offset field.

Figure 4.4
This is an example of a write MSG from a SLC 5/03, 5/04, or 5/05 processor to another SLC 500 or a MicroLogix 1000 controller.

ladder rung



setup screen

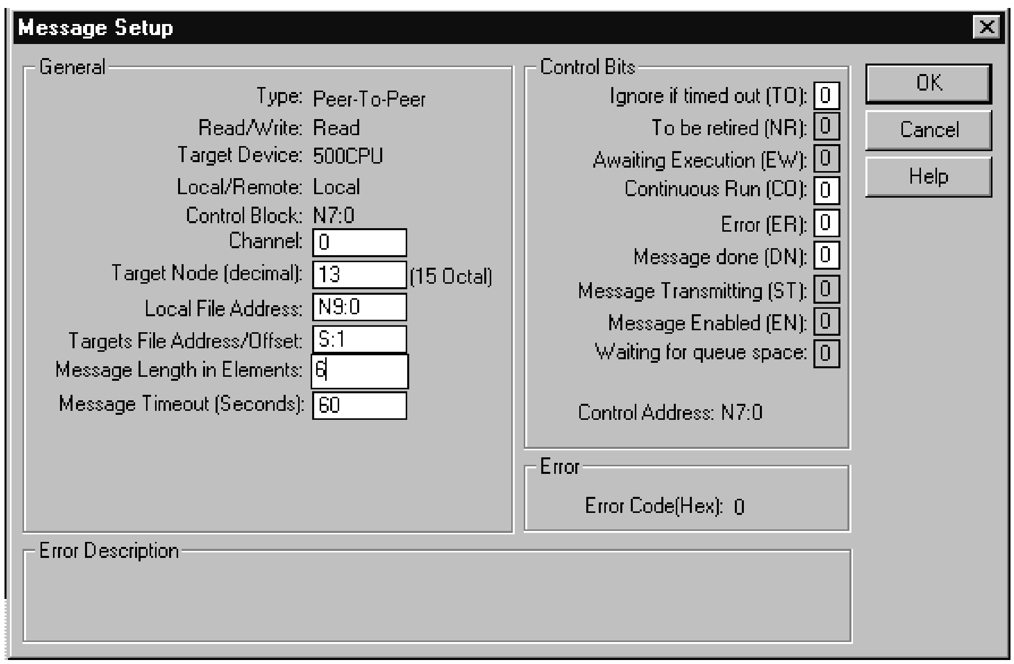


In this example, the SLC master station is issuing a write request through its serial port (channel 0) to SLC station 13_{10}. The master station wants to write the information from S:37 into station 13_{10}'s file N7:0.

Figure 4.5
This is an example of a read MSG from a SLC 5/03, 5/04, or 5/05 processor to another SLC 500 or MicroLogix 1000 controller.

ladder rung

setup screen



In this example, the SLC master station is issuing a read request through its serial port (channel 0) to SLC station 13_{10}. The master station reads the information from station 13_{10}'s file S:1 and puts that information into its own N9:0 file.

Configuring SLC 500™ Processors with 1747-KE Interface Modules

Use This Chapter…

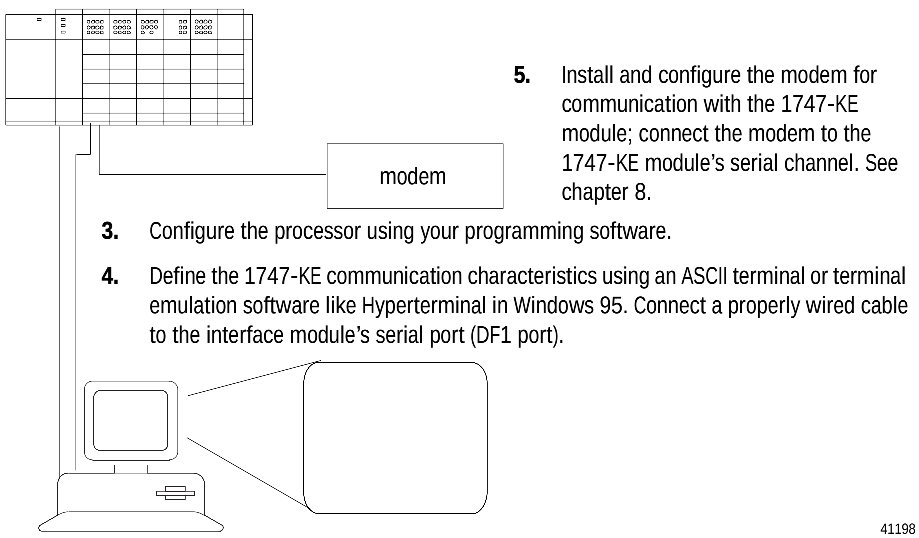
…to help you set up a SLC 500 fixed or modular processor (SLC 5/01 or 5/02 processor) with a 1747-KE as a remote station or as a station on a point-to-point link.

Overview

To configure a SLC 500 processor with a 1747-KE interface module as a remote station, perform these tasks:

1. Install the processor. (modular processors only).

2. Install the 1747-KE module.



5. Install and configure the modem for communication with the 1747-KE module; connect the modem to the 1747-KE module's serial channel. See chapter 8.

3. Configure the processor using your programming software.

4. Define the 1747-KE communication characteristics using an ASCII terminal or terminal emulation software like Hyperterminal in Windows 95. Connect a properly wired cable to the interface module's serial port (DF1 port).

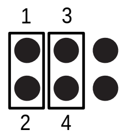
Installing the Processor

For details about installing the modular processor, see SLC 500 Modular Hardware Style Installation and Operation Manual, publication 1747-6.2.

Installing the 1747-KE Interface Module

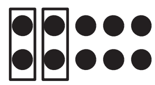
To install the interface module, do the following:

1. To allow an ASCII terminal to communicate with the module, place the module in series B functionality Configuration Mode by setting JW4 as follows:



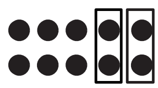
Configuration Mode Setting

2. Since the ASCII terminal communicates with the module via an RS-232 connection, verify that the CONFIG port is configured for RS-232 by verifying this setting for JW1:



CONFIG port is configured for RS-232

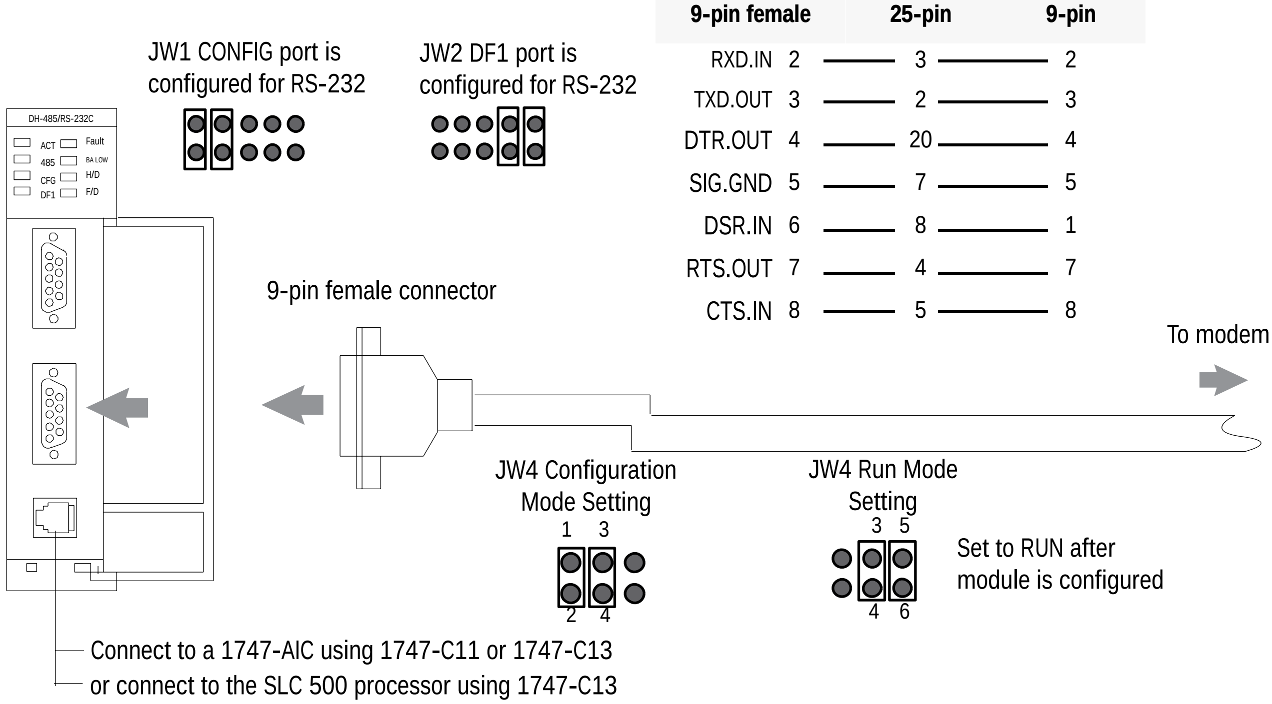
3. Since the DF1 port connects to a modem, verify that the port is configured for RS-232 by verifying this setting for JW2:



DF1 port is configured for RS-232

4. Install the module into a powered-down chassis.

For details about installing the interface module, see the DH-485/RS-232C Interface Module User Manual, publication 1747-6.12.



9-pin female		25-pin	9-pin
RXD.IN	2	3	2
TXD.OUT	3	2	3
DTR.OUT	4	20	4
SIG.GND	5	7	5
DSR.IN	6	8	1
RTS.OUT	7	4	7
CTS.IN	8	5	8

Configuring the Processor

As you are specifying each module within the chassis scanned by the SLC 500 processor, remember to specify a slot for the 1747-KE module. Configure the DH-485 node address of the programming terminal as 0-31; the default is 0.

Also, define a node address for the SLC 500 processor. This address when combined with the group number (configured on the interface module when in remote mode) comprises the remote station's address.

Series A interface modules may only be configured using an ASCII terminal, whiles series B interface modules may be either configured using an ASCII terminal or using ladder logic in the SLC 500 communicating across the backplane.

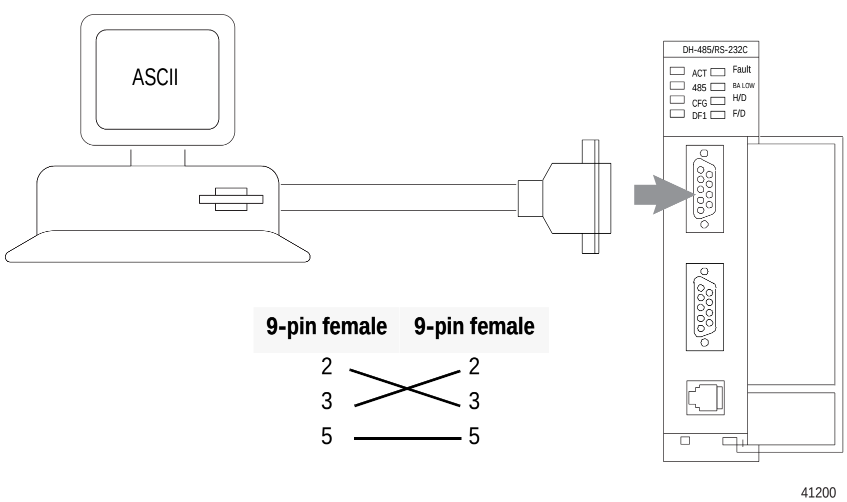
Configuring the 1747-KE Interface Module

To configure the interface module with an ASCII terminal, do the following:

- prepare to configure the driver
- configure the DF1 protocol driver
- save the configuration

Prepare to Configure the Driver

1. Connect an ASCII terminal or personal computer running terminal emulation software to the interface module's CONFIG port.



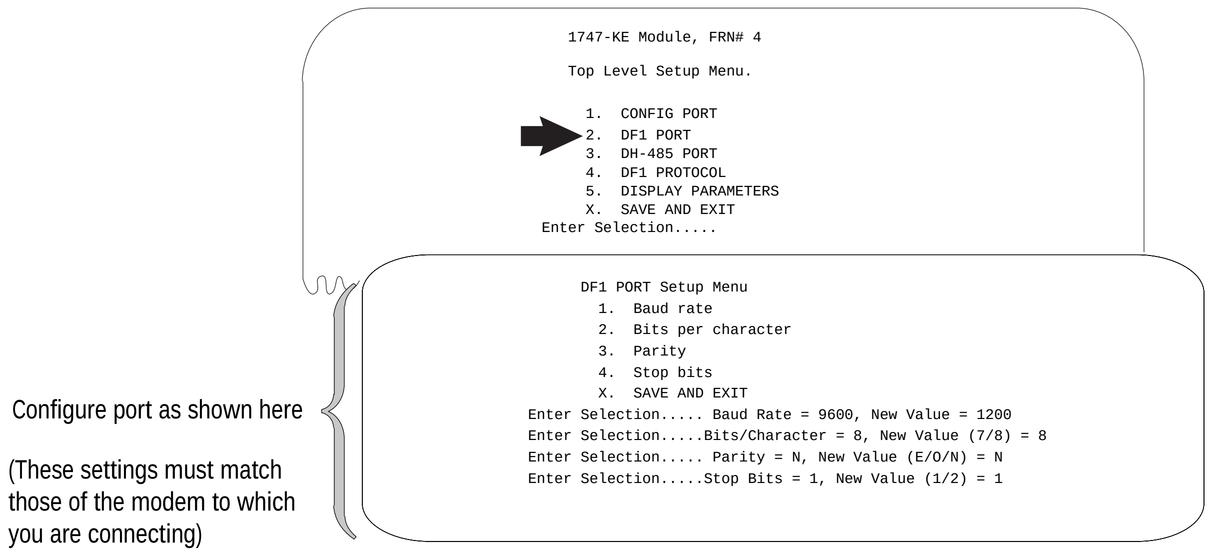
2. Turn on power to the chassis containing the interface module.

3. Run the ASCII terminal emulation software, and configure the software to match the default CONFIG port parameters, which are the following:

Parameter:	Selections:
Baud rate	1200
Bits per character	8
Parity	none
Stop bits	one

4. Configure the DF1 port as shown in Figure 5.1.

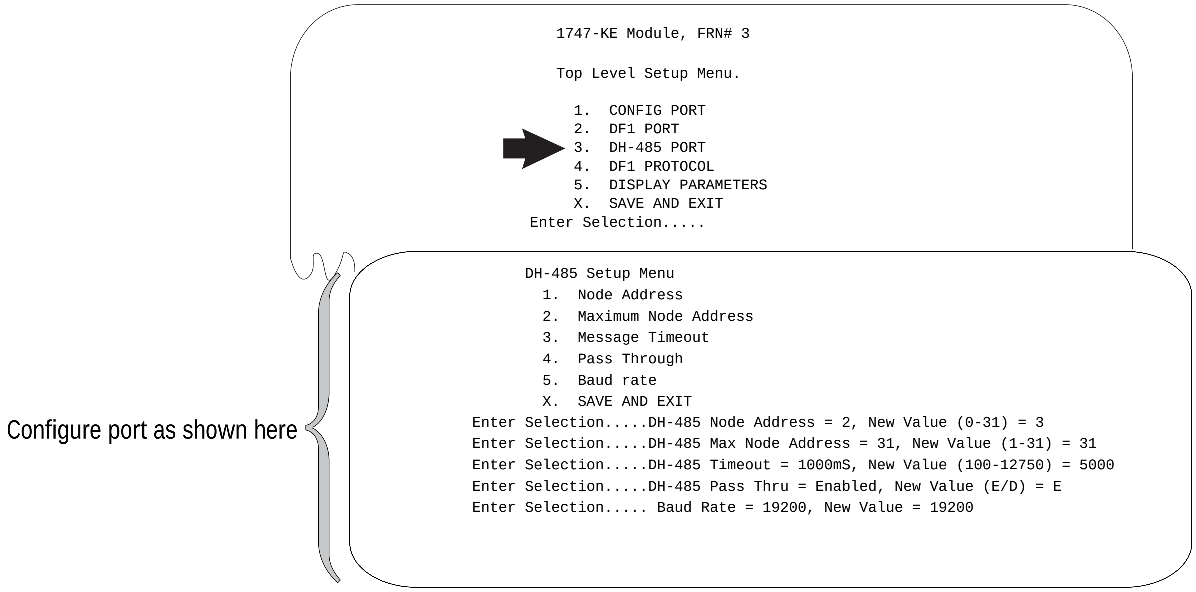
Figure 5.1
Use this figure to help you configure the DF1 port.



Parameter:	Selections:
Baud rate	rate at which the device communicates
Bits per character	the number of bits that make-up a character
Parity	provides additional message packet error detection
Stop bits	delineates data during transfer

5. Configure the DH-485 port as shown in Figure 5.2.

Figure 5.2
Use this figure to help you configure the DH-485 port.

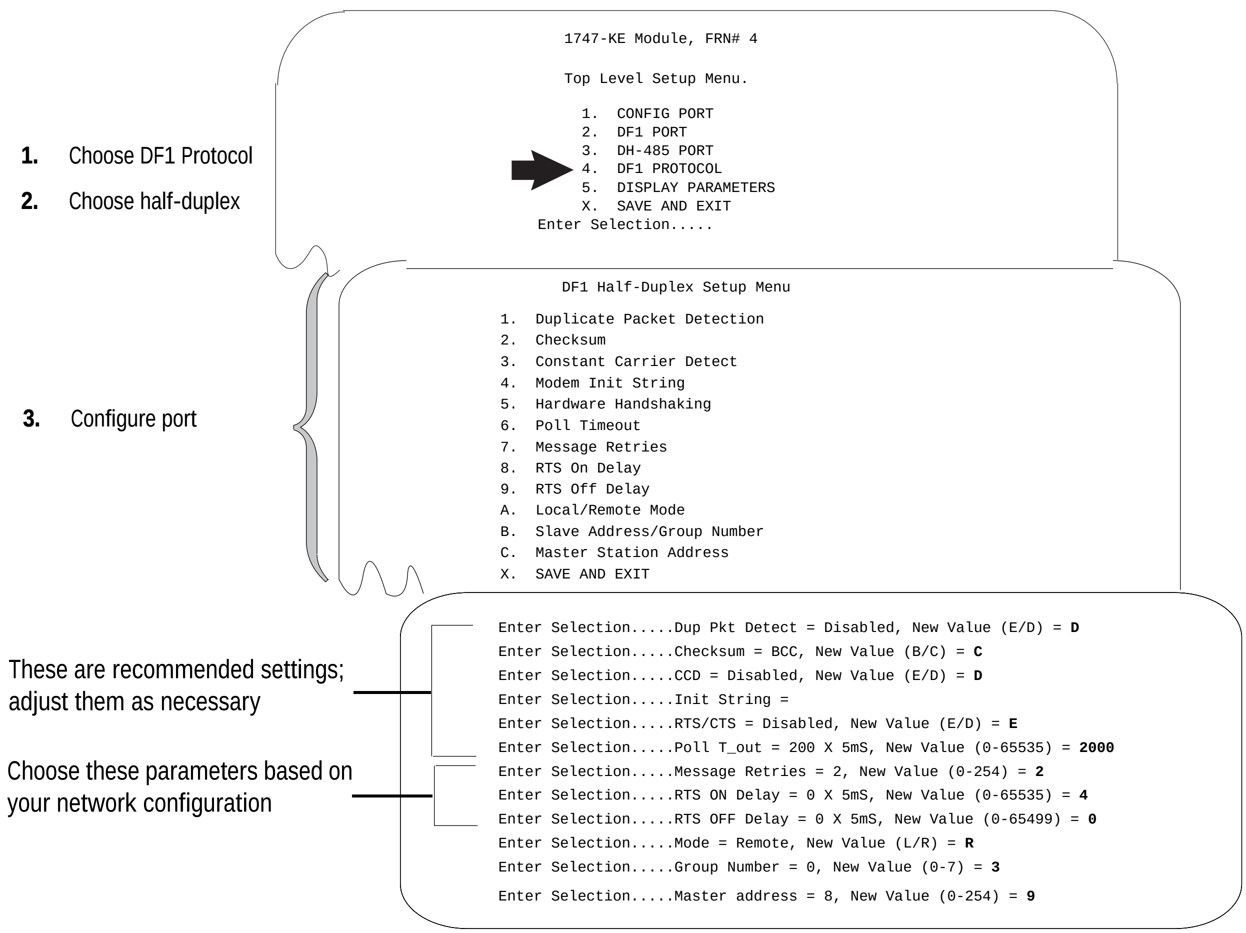


Parameter:	Selections:
Node address	Select a unique address of the module on the DH-485 network.
Maximum node address	Choose the highest address on the DH-485 link. The default is 31.
Message timeout	Choose an amount of time to wait for a response to a message sent on the DH-485 network before the node errors out the message.
Pass through	If you want diagnostic commands: • executed by the module, choose Disabled • passed through to the destination node, choose Enabled
Baud rate	Set all devices on the DH-485 network to the same baud rate.

Configure the DF1 Protocol Driver

If the processor and interface module are part of a:	Then choose:	Go to:
point-to-multipoint configuration	Half-duplex	Figure 5.3
point-to-point configuration	Full-duplex	Figure 5.4

Figure 5.3
Use this figure to help you configure the driver for DF1 half-duplex.



Use Worksheet 5.1 (Appendix D-13) for an example configuration and to record your station's configuration.

Parameter:	Selections:
Duplicate Packet Detection	Duplicate packet detection lets the interface module detect if it has received a message that is a duplicate of its most recent message from the master station. If you choose duplicate packet detection, the processor will acknowledge (ACK) the message but will not act on it since it has already performed the message's task when it received the command from the first message. If you want to detect duplicate packets and discard them, choose Enable. If you want to accept duplicate packets, choose Disable.
Checksum	With this selection, you choose how the interface module checks the accuracy of each DF1 packet transmission. BCC: This algorithm provides a medium level of data security. It cannot detect: • transposition of bytes during transmission of a packet • the insertion or deletion of data values of zero within a packet CRC: This algorithm provides a higher level of data security. Select a method that all your devices on the network can use. When possible, choose CRC.
Constant Carrier Detect	If you want the interface module to monitor the carrier from the modem (DCD signal), choose Enabled. The module will not begin communication until the carrier is detected. If the remote modem does not normally receive a constant carrier from the master modem, choose Disabled.
Modem Init String	Enter an ASCII string to configure your modem by using Hayes commands upon every power cycle of the interface module.
Hardware Handshaking	Choose enabled to use the RTS and CTS signals for controlling the modem.
Poll Timeout	The timer keeps track of how often the station is polled. If the station has a message to send, it starts a timer. If the timer expires before the message is sent, then the error bit is set on the MSG instruction.
Message Retries	The number of times the processor will resend its message to the master station if the processor does not receive an acknowledgment.
RTS On Delay	RTS on delay is the amount of time in 5 millisecond increments that elapses between the assertion of the RTS signal and the beginning of the message transmission. This time allows the modem to prepare to transmit the message.
RTS Off Delay	RTS off delay is the amount of time in 5 millisecond increments that elapses between the end of the message transmission and the de-assertion of the RTS signal. This time delay is a buffer to make sure that the modem has transmitted the message, but should normally be left at zero.
Local/Remote Mode	Local mode requires a master station that is capable of specifying both a station address and a destination address. Because the interface module acts as a slave on a half-duplex network, the half-duplex master's access to the DH-485 node is indirect. The destination address and the station address are generally different. In Remote mode, the module appears transparent to the half-duplex master so that the remote SLC 500s can be polled directly as individual slaves on the half-duplex network. The interface module responds to the half-duplex master if the station address specified corresponds to the node address of *any (token-passing) station* on the DH-485 network connected to that interface module. Remote mode is preferred as it allows remote programming of all SLC 500 processors, as well as polled report-by-exception messages from SLC 5/02 processors on DH-485 to the master station.

Parameter:	Selections:
Slave Address/Group Number	When the module is configured for remote mode, enter a Group Number (octal). Since you can have up to 254 devices on a half-duplex network and 31 devices on a DH-485 network, to allow 255 DH-485 nodes requires using a group number. This parameter defines the address group of the SLC 500 half-duplex address. Each address group can consist of 32 addresses. The address of the SLC 500 processor is determined with the following formula: (32*G)+A, where G is the "group number" (0-7) and A is the DH-485 node address of the SLC 500 processor. One station address within each group of size 32 must be reserved for any KE module interfaces configured with that group number. A second address within each group should also be reserved for local DH-485 programming terminals. These 16 addresses should never have to be polled by the master station. Finally, a remote programming terminal station address should be reserved, even if remote programming is not considered a requirement initially. This address will need to be periodically polled, even though it will remain on the inactive list unless there is an online remote programming terminal. When the module is configured for local mode, enter a slave address. This parameter is the address of the module on the half-duplex link (0-254).
Master Station Address	The address of the master station, ($0\text{-}254_{10}$).

Figure 5.4
Use this figure to help you configure the driver for DF1 full-duplex.

1. Choose DF1 Protocol

2. Choose full duplex

```
1747-KE Module, FRN# 4

Top Level Setup Menu.

  1.  CONFIG PORT
  2.  DF1 PORT
  3.  DH-485 PORT
  4.  DF1 PROTOCOL
  5.  DISPLAY PARAMETERS
  X.  SAVE AND EXIT
Enter Selection.....
```

3. Configure port as shown

```
DF1 Full-Duplex Setup Menu

1.  Duplicate Packet Detection
2.  Checksum
3.  Constant Carrier Detect
4.  Modem Init String
5.  Embedded Response Detect
6.  ACK Timeout
7.  ENQuiry Retries
8.  NAK Receive Retries
X.  SAVE AND EXIT
```

These are recommended settings; adjust them as necessary

```
Enter Selection.....Dup Pkt Detect = Disabled, New Value (E/D) = D
Enter Selection.....Checksum = BCC, New Value (B/C) = C
Enter Selection.....CCD = Disabled, New Value (E/D) = D
Enter Selection.....Init String =
Enter Selection.....Embedded Response Detect = Embedded Response
Enter Selection.....ACK Timeout= 1, New Value (0-327.675) = 1
Enter Selection.....ENQuiry Retries = 2, New Value (0-254) = 2
Enter Selection.....NAK Received Retries= 2, New Value (0-254) =3
```

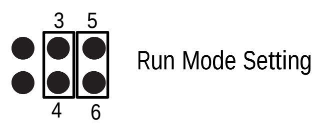
Use Worksheet 5.2 (Appendix D-14) for an example configuration and to record your station's configuration.

Parameter:	Selections:
Duplicate Packet Detection	Duplicate packet detection lets the interface module detect if it has received a message that is a duplicate of its most recent message from the master station. If you choose duplicate packet detection, the processor will acknowledge (ACK) the message but will not act on it since it has already performed the message's task when it received the command from the first message. If you want to detect duplicate packets and discard them, choose Enable. If you want to accept duplicate packets, choose Disable.
Checksum	With this selection, you choose the how the interface module checks the accuracy of each DF1 packet transmission. BCC: This algorithm provides a medium level of data security. It cannot detect: • transposition of bytes during transmission of a packet • the insertion or deletion of data values of zero within a packet CRC: This algorithm provides a higher level of data security. Select a method that all your devices on the network can use. When possible, choose CRC.
Constant Carrier Detect	If you want the interface module to monitor the carrier from the modem (DCD signal), choose Enabled. The module will not begin communication until the carrier is detected. If the local modem does not normally receive a constant carrier from the remote modem, choose Disabled.
Modem Init String	Enter an ASCII string to configure your modem by using Hayes commands upon every power cycle of the interface module.
Embedded Response Detect	To use embedded responses, choose Enabled. If you want the processor to use embedded responses only when it detects embedded responses from another device, choose Auto-detect. If you are communicating with another Allen-Bradley device, choose Enabled. Embedded responses increase network traffic efficiency.
ACK Timeout	The amount of time in 5 millisecond increments that you want the processor to wait for an acknowledgment to the message it has sent before sending an enquiry (ENQ) for the reply.
ENQuiry Retries	The number of enquiries (ENQs) that you want the processor to send after an ACK timeout occurs.
NAK Receive Retries	The number of times the processor will re-send a message packet because it received a NAK response to the previous message packet transmission.

Save the Configuration

To save the configuration, follow these steps:

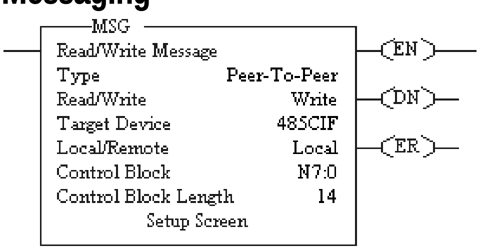
1. To save the configurations and exit from the menus, type **X**.
2. Remove power from the SLC chassis; disconnect the ASCII terminal.
3. Remove interface module; place the module in RUN mode by setting JW4 as follows:



4. Insert module; power the chassis.

For details about alternatively configuring the series B interface module from the SLC through the backplane, see the DH-485/ RS-232C Interface Module User Manual, publication 1747-6.12.

Messaging



For:	See page:
list of considerations	5-12
examples	5-13

SLC 5/01 processor and the fixed controllers can only respond to a master station. These processors cannot initiate messages on their own.

Messaging in a SLC 5/02 processor can occur between:

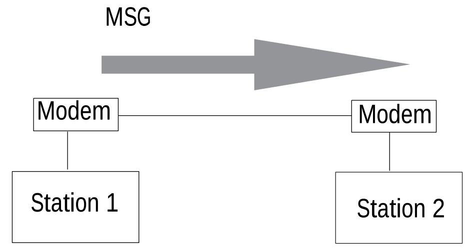
- a master station and a remote station. (For more information see the chapter pertaining to the master device you are using.)
- a remote station and its master station (See “Polled Report-by-Exception”)
- between two processors connected via a point-to-point link.

Polled Report-by-Exception

A remote station can gather information from the I/O points it is responsible for and can send any anomalous readings to the master station. To do this, write logic in the remote station’s processor to monitor certain conditions and send the data in an MSG instruction to the master station. Figure 5.5 is an example MSG instruction and control block that a SLC 5/02 processor in a remote station can send to a PLC-5 master station.

Processor-to-Processor

A SLC 5/02 processor can send messages to another processor in a point-to-point configuration.



Considerations When Configuring MSG Control Blocks

Keep these considerations in mind when configuring messages between a SLC 5/02 processor and a PLC-5 processor.

Point-to-Multipoint and Point-to-Point Link Configurations

- In the SLC 5/02 MSG instruction, Target Node is the decimal DH-485 node address of the 1747-KE module and Target Offset is the decimal "byte-offset," which is the element you want to write data into or read data from.
- The SLC 5/02 processor uses word addressing, while the PLC-5 processor uses byte addressing. In the Target Offset field of the SLC 500 MSG control block, enter a word value equivalent to the byte (element) of the PLC-5 file number you want to write data into or read data from. For example in Figure 5.5, the Target Offset is 20; this corresponds to element 10_{10} in a PLC-5 processor because one word = two bytes. Never enter an odd value for a Target Offset.
- If you are sending messages between a SLC 5/02 processor and a PLC-5 processor, then set S:2/8 in the SLC 5/02 status file to 1. This bit is the CIF (Common Interface File) Addressing Mode selection bit and lets the SLC 5/02 processor accept "byte-offsets" from a PLC-5 processor.
- The SLC 5/02 processor can only directly address words 0_{10}-127_{10} in a PLC-5 data table file. By specifying a byte-offset of 254 in the Target Offset field and specifying a Message Length of 41, you can indirectly address words 128_{10}-167_{10} in a PLC-5 data table file. The maximum read or write message length for a SLC 5/02 processor is 41 elements.

Point-to-Multipoint Link Configurations

- In the PLC-5 processor, create integer files that correspond to the station addresses of the SLC 5/02 processors that will be sending messages to the PLC-5 processor. Because, when a SLC 5/02 sends a MSG instruction to a PLC-5 processor, the SLC 5/02 processor reads data from and writes data to a PLC-5 integer file that is equal to the SLC 5/02 processor's DF1 station address.

Point-to-Point Link Configurations

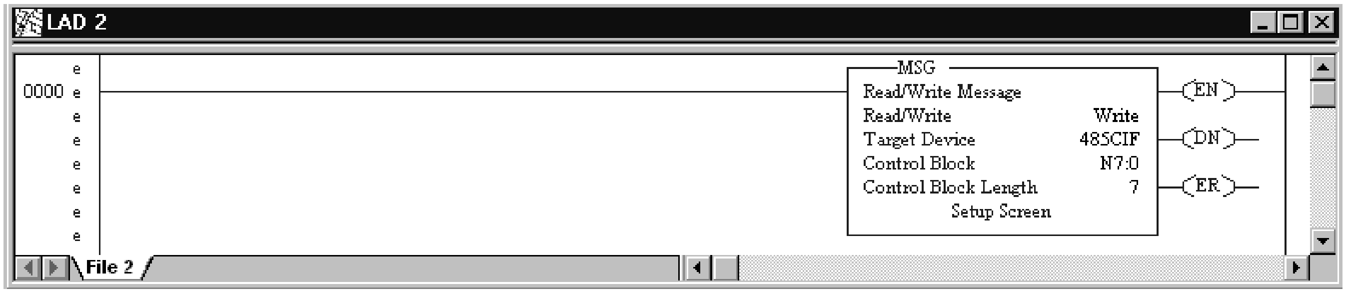
- In the PLC-5 processor, create and make available the file that corresponds to the DH-485 node address of the SLC 500 processor for SLC 5/02 read and write messages.

Example MSG Control Blocks

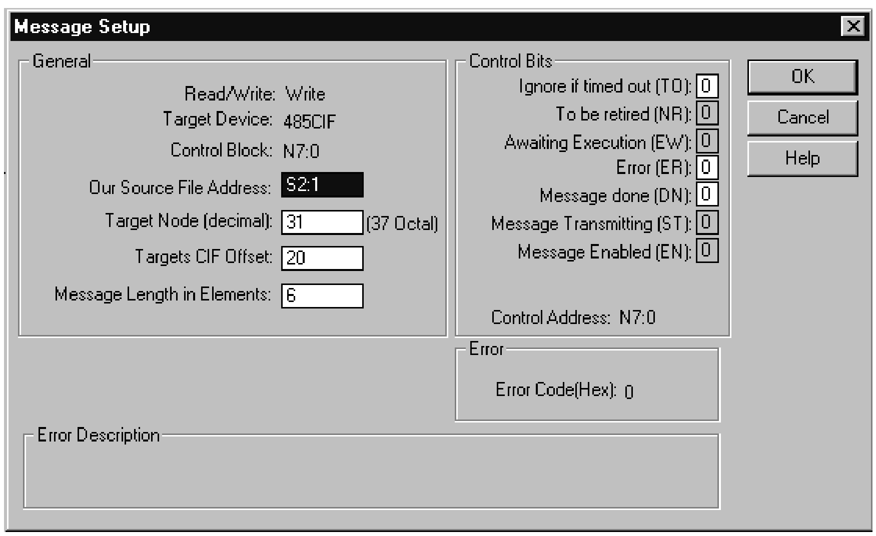
Application:	See:	Page:
SLC 5/02 write message to a PLC-5 processor	Figure 5.5	5-14
SLC 5/02 read message to a PLC-5 processor	Figure 5.6	5-15
SLC 5/02 write MSG to a SLC 500 processor	Figure 5.7	5-16
SLC 5/02 read MSG to a SLC 500 processor	Figure 5.8	5-17

Figure 5.5
This is an example of a write MSG instruction from a SLC 5/02 processor to a PLC-5 processor.

ladder rung



setup screen



This MSG example is telling the SLC 5/02 remote station (station 99_{10}) to write the information from its S:1-S:6 to the PLC-5 master station 9_{10} through the KE module 31_{10}. The data's destination is N99:10 (for a target byte offset of 20_{10}) of the PLC-5 processor.

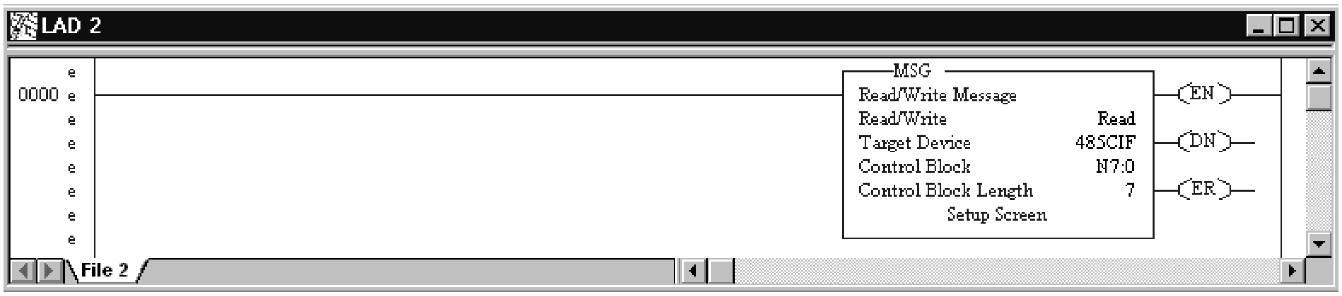
Important: The SLC 5/02 processor writes the information into an integer file in the PLC-5 processor's data table. The integer file number is equal to the SLC 5/02 processor's station address. (This event is called PLC-2 emulation.)

For example, if the SLC 5/02 processor in this example is station 99_{10}, then it writes the data from its S:1-S:6 into N99 of the PLC-5 master station. File N99 must exist in the PLC-5 in order for it to receive data from the SLC 5/02 remote station.

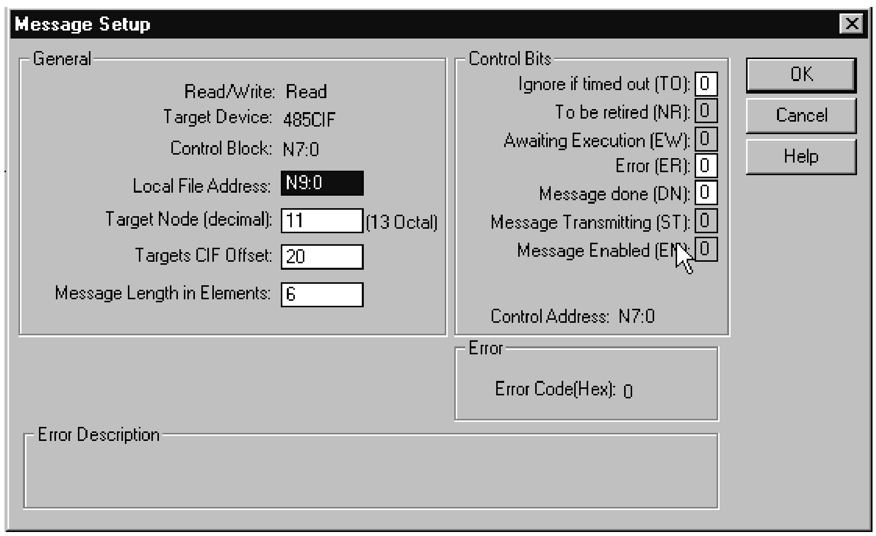
Note that the SLC 5/02 station address 99_{10} in this example is station address 143_8, which is derived by a DH-485 node address of 03 for the SLC 5/02 processor and a group number of 03 defined in the 1747-KE interface module.

Figure 5.6
This is an example of a read MSG instruction from a SLC 5/02 processor to a PLC-5 processor.

ladder rung



setup screen



In this example, SLC 5/02 station 10_{10} is issuing a read command, through a 1747-KE module whose DH-485 node address is 11_{10}, to a PLC-5 station. The SLC 5/02 station (station 10_{10}) reads the information in N10:10-N10:15 of the PLC-5 station and puts that information into its N9:0-N9:5.

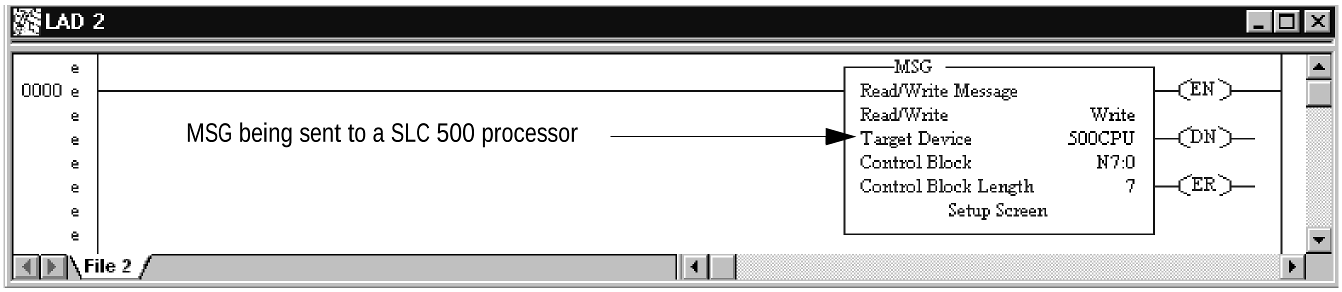
Important: The SLC 5/02 processor reads the information from an integer file in the PLC-5 processor's data table that corresponds to the SLC 5/02 processor's station address. (This event is called PLC-2 emulation.)

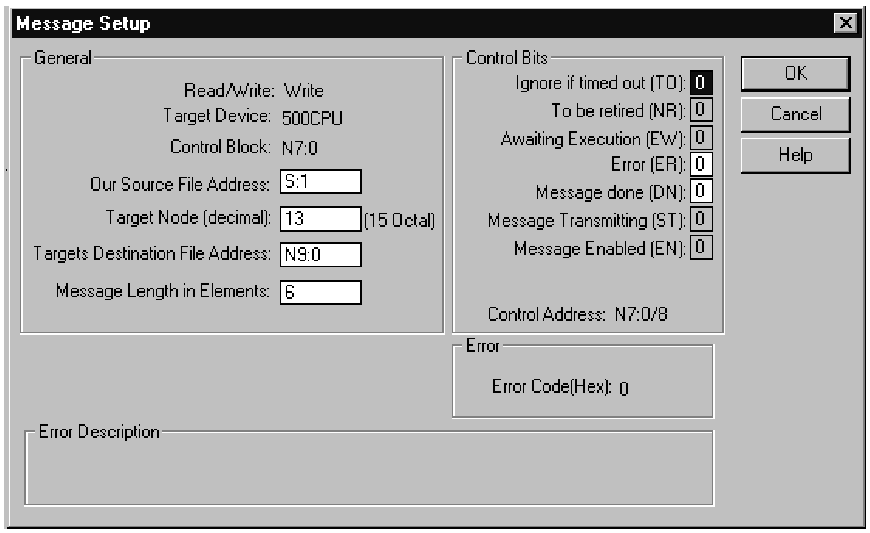
For example, if the SLC 5/02 processor in this example is station 10_{10}, then it reads the data from N10:10-N10:15 in the PLC-5 processor. File N10 must exist in the PLC-5 in order for the SLC 5/02 processor to read data from it.

For an example write MSG instruction from a SLC 5/02 processor to a PLC-5 processor, see Figure 5.5 on page 5-14. The MSG control block is configured the same regardless if the message is being sent from a SLC 5/02 remote station to a PLC-5 master station or a SLC 5/02 processor and a PLC-5 processor that are communicating in a point-to-point configuration.

Figure 5.7
This is an example of a write MSG instruction from a SLC 5/02 processor to a SLC 500 processor.

ladder rung



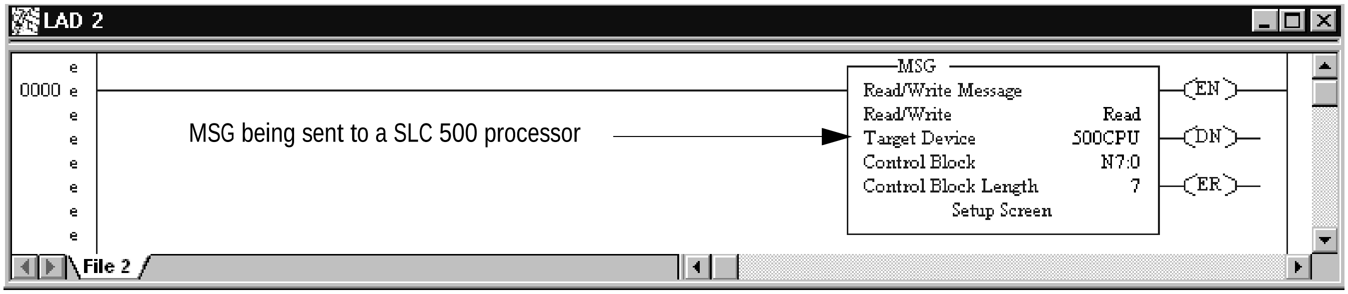


In this example, SLC 5/02 station 3 is issuing a write request, through a 1747-KE module whose DH-485 node address is 13_{10}, to a SLC 5/03 processor.

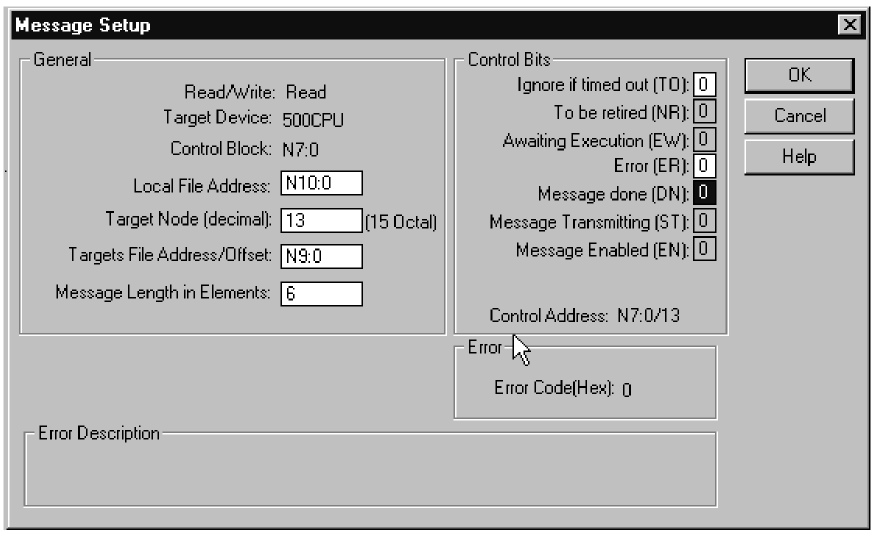
Station 3 wants to write the information from its S:1-S:6 into the SLC 5/03 processor's data files N9:0-N9:5.

Figure 5.8
This is an example of a read MSG instruction from a SLC 5/02 processor to a SLC 500 processor.

ladder rung



setup screen



In this example, SLC 5/02 station 3 is issuing a read request, through a 1747-KE module whose DH-485 node address is 13_{10}, to a SLC 5/03 processor.

Station 3 reads the information from station 13_{10}'s data files N9:0-N9:5 and puts that information into its own N10:0-N10:5.

Notes

Configuring MicroLogix Controllers

Use This Chapter…

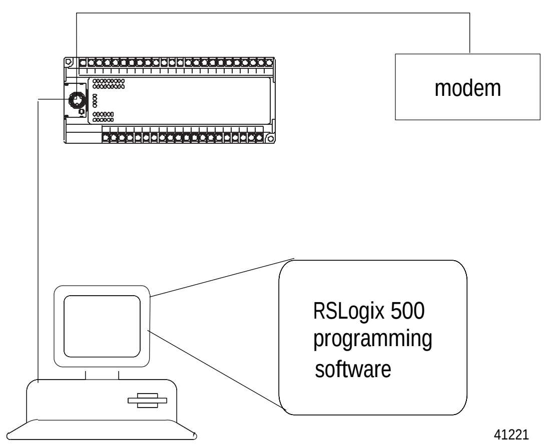
…to help you set up a MicroLogix controller as a slave station, or as a station on a point-to-point link.

Overview

To configure a MicroLogix 1000 controller perform these tasks:

Figure 6.1 Basic Configuration

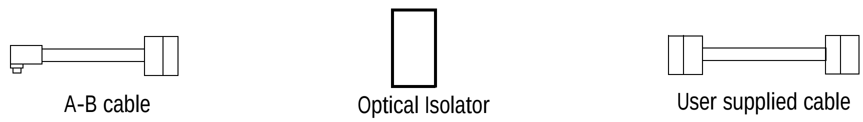
1. Connect the serial cable to the PC. The controller must be on-line to cofigure DF1 half-duplex slave parameters.
2. Define the controller's communication characteristics using RSLogix 500 programming software.
3. Disconnect the controller from the programming PC and install the controller at its working destination.
4. Connect the modem to the controller's serial channel.

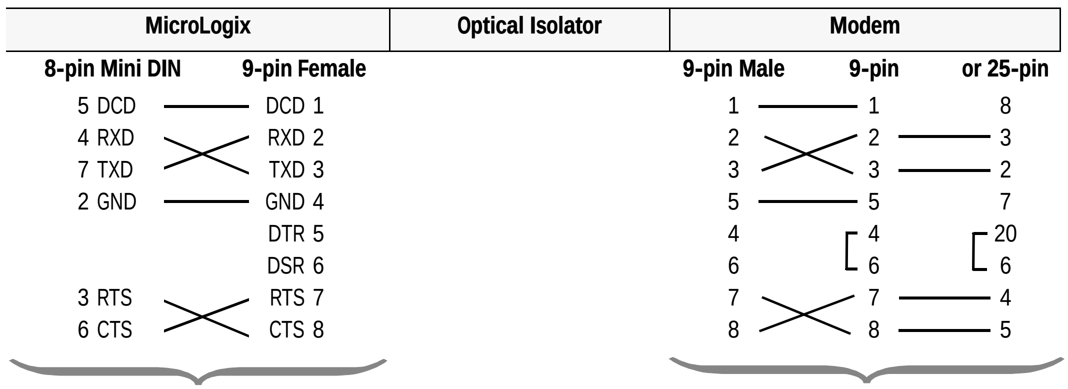


Installing the Controller

For details about installing the controller see the MicroLogix 1000 Programmable Controllers User Manual 1761-6.3. Cable pinouts are shown in each example configuration as well as in Appendix A.

Figure 6.2 MicroLogix cable pinouts



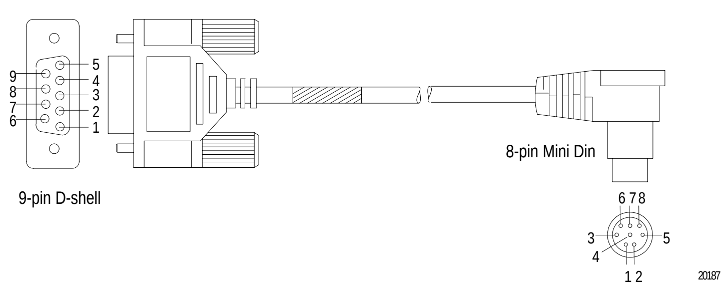


Standard A-B cables:

- 1761-CBL-PM02 Series B or Higher (6.5 feet)
- 1761-CBL-AP00 (17.7 inches)

User supplied modem cable

1761-CBL-PM02 Series B Cable

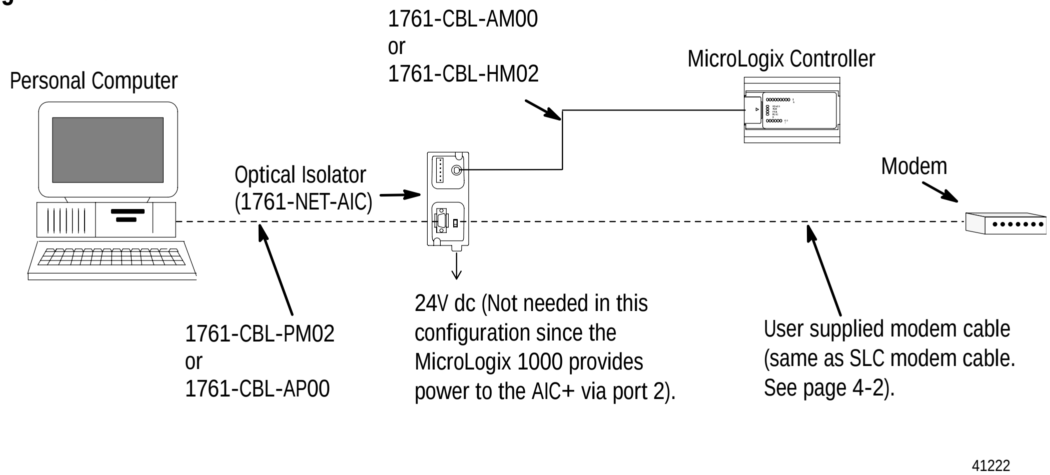


Isolated Connections

MicroLogix controllers should be installed using an Optical Isolator. The AIC+, catalog number 1761-NET-AIC is recommended. Example installations are shown below. Using the AIC+ also provides a communication active LED, which is not standard on the MicroLogix 1000 controller.

Figure 6.3 Isolated Connections Using AIC+

Note: In an actual application, only the personal computer or the modem would be connected to AIC+ port number 1 at any given time.



Automatic Protocol Switching

The MicroLogix 1000 Series D (and higher) discrete and MicroLogix 1000 analog controllers perform automatic protocol switching between DH-485 and the configured DF1 protocol - the controller cannot automatically switch between DF1 full-duplex and DF1 half-duplex slave. With DF1 configured as the primary protocol (S:0/10=0), this feature allows you to switch from active communication on a DF1 half-duplex network to the DH-485 protocol to make program changes.

Simply disconnect the MicroLogix controller from the half-duplex modem and connect it to your personal computer. The controller recognizes the computer is attempting to communicate using the DH-485 protocol and automatically switches to it. When your program changes are complete, you can disconnect your computer, reconnect the modem, and the controller will automatically switch back to DF1 half-duplex slave protocol.

The following baud rate limitations affect autoswitching:

- if the configured DH-485 baud rate is 19200, the configured DF1 baud rate must be 4800 or greater
- if the configured DH-485 baud rate is 9600, the configured DF1 baud rate must be 2400 or greater

If your DF1 half-duplex slave baud rate is 1200 or less, and if your process can tolerate a brief power cycle of the MicroLogix 1000 controller, you may set DH-485 as the primary protocol (S:0/10=1). Upon power cycle, if your programming computer is attempting to communicate using DH-485 protocol it will successfully go in-line. Otherwise, if the modem is connected, upon power cycle the MicroLogix 1000 controller will automatically switch from DH-485 to DF1 protocol.

Using Modems that Support DF1 Communication Protocols

The types of modems that you can use with MicroLogix controllers include dial-up phone modems, leased-line modems, radio modems and line drivers. For point-to-point full-duplex modem connections that do not require any modem handshaking signals to operate, use DF1 full-duplex protocol. For point-to-multipoint modem connections, or point-to-point modem connections that require RTS/CTS handshaking, use DF1 half-duplex slave protocol. In this case, one (and only one) of the other devices must be configured for DF1 half-duplex master protocol.

Important: Do not attempt to use DH-485 protocol through modems under any circumstance.

Important: Only Series D or later MicroLogix 1000 discrete controllers and all MicroLogix 1000 analog controllers support RTS/CTS modem handshaking, and only when configured for DF1 half-duplex slave protocol with the control line parameter set to “Half-Duplex Modem.” No other modem handshaking lines (i.e. Data Set Ready, Carrier Detect and Data Terminal Ready) are supported by any MicroLogix controllers.

Dial-up Phone Modems

Dial-up phone line modems support point-to-point full-duplex communications. Normally, a MicroLogix controller is on the receiving end of the dial-up connection, and is configured for DF1 full-duplex protocol. The modem connected to the MicroLogix controller must support auto-answer and must not require any modem handshaking signals from the MicroLogix (i.e. DTR or RTS) in order to operate. The MicroLogix has no means to cause its modem to initiate or disconnect a phone call, so this must be done from the site of the remote modem.

Leased-Line Modems

Leased-line modems are used with dedicated phone lines that are typically leased from the local phone company. The dedicated lines may be point-to-point topology supporting full-duplex communications between two modems or in a point-to-multipoint topology supporting half-duplex communications between three or more modems. In the point-to-point topology, configure the MicroLogix for DF1 full-duplex protocol (as long as the modems used do not require DTR or RTS to be high in order to operate). In the point-to-multipoint topology, configure the MicroLogix controllers for DF1 half-duplex slave protocol with the control parameter set to "Half-Duplex Modem".

Radio Modems

Radio modems may be implemented in a point-to-point topology supporting either half-duplex or full-duplex communications, or in a point-to-multipoint topology supporting half-duplex communications between three or more modems. In the point-to-point topology using full-duplex radio modems, configure the MicroLogix controllers for DF1 full-duplex protocol (as long as the modems used do not require DTR or RTS to be high in order to operate). In the point-to-point topology using half-duplex radio modems, or point-to-multipoint topology using half-duplex radio modems, configure the MicroLogix controllers for DF1 half-duplex slave protocol. If these radio modems require RTS/CTS handshaking, configure the control line parameter to "Half-Duplex Modem."

Line Drivers

Line drivers, also called short-haul modems, do not actually modulate the serial data, but rather condition the electrical signals to operate reliably over long transmission distances (up to several miles). Allen-Bradley's AIC+ Advanced Interface Converter is a line driver that converts an RS-232 electrical signal into an RS-485 electrical signal, increasing the signal transmission distance from 50 to 4000 feet. In a point-to-point line driver topology, configure the MicroLogix controller for DF1 full-duplex protocol (as long as the modems used do not require DTR or RTS to be high in order to operate). In a point-to-multipoint line driver topology, configure the MicroLogix controllers for DF1 half-duplex slave protocol. If these line drivers require RTS/CTS handshaking, configure the control line parameter to "Half-Duplex Modem."

Modem Control Line Operation

DF1 Full-Duplex Operation

DF1 Full-Duplex protocol (also referred to as DF1 point-to-point protocol) is useful where RS-232 point-to-point communication is required. This type of protocol supports simultaneous transmissions between two devices in both directions. DF1 protocol controls message flow, detects and signals errors, and retries if errors are detected. Its implementation in the MicroLogix 1000 does not support any modem control lines.

DF1 Half-Duplex Slave Operation

DF1 half-duplex slave protocol provides a multi-drop single master/multiple slave network. In contrast to DF1 full duplex, communication takes place in one direction at a time. You can use the RS-232 port on the MicroLogix as both a half-duplex programming port, as well as a half-duplex peer-to-peer messaging port.

The master device initiates all communication by “polling” each slave device. The slave device may only transmit message packets when it is polled by the master. It is the master’s responsibility to poll each slave on a regular and sequential basis to allow slaves to send message packets back to the master. During a polling sequence, the master polls a slave either repeatedly until the slave indicates that it has no more message packets to transmit or just one time per polling sequence, depending on how the master is configured.

An additional feature of the DF1 half-duplex protocol is that it is possible for a slave device to enable a MSG instruction in its ladder program to send or request data to/from another slave. When the initiating slave is polled, the MSG instruction command packet is sent to the master. The master recognizes that the command packet is not intended for it but for another slave, so the master immediately rebroadcasts the command packet to the intended slave. When the intended slave is polled, it sends a reply packet to the master with the data the first slave requested. The master immediately rebroadcasts the reply packet to that slave. This slave-to-slave transfer is a function of the master device and is also used by programming software to upload and download programs to controllers on the DF1 half-duplex link.

DF1 half-duplex supports up to 255 devices (address 0 to 254) with address 255 reserved for master broadcasts. The MicroLogix supports broadcast reception but cannot initiate a broadcast command. The MicroLogix supports half-duplex modems using RTS/CTS hardware handshaking.

DF1 Slave on a Multi-drop Link

When communication is between either your programming software and a MicroLogix controller or between two MicroLogix controllers via a slave-to-slave connection on a larger multi-drop link, the devices depend on a DF1 Master to give each of them polling permission to transmit in a timely manner. As the number of slaves increases on the link (up to 254), the time between when your programming software or the MicroLogix controller is polled also increases. This increase in time becomes larger is you are using low baud rates.

As these time periods grow, the following values may need to be changed to avoid loss of communication:

- programming software - increase poll timeout value and reply timeout values
- MicroLogix controller - increase poll timeout

Ownership Timeout

When a program download sequence is started by a software package to download a ladder logic program to a MicroLogix controller, the software takes "file ownership" of the controller. File ownership prevents other devices from reading from or writing to the controller while the download is in process. If the controller were to respond to a device's read commands during the download, the controller could respond with incorrect information. Similarly, if the controller were to accept information from other devices, the information could be lost because the program download sequence could immediately overwrite the information. Once the download is completed, the programming software returns the file ownership to the controller, so other devices can communicate with it again.

With the addition of DF1 half-duplex slave protocol, the controller clears the file ownership if no supported commands are received from the owner within the timeout period. If the file ownership were not cleared after a download sequence interruption, the controller would not accept commands from any other devices because it would assume another device still had file ownership.

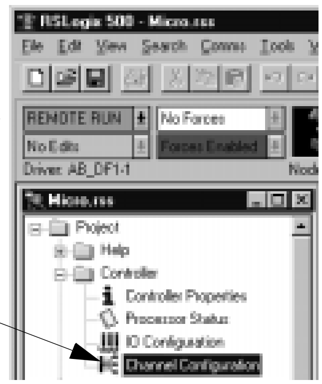
If a download sequence is interrupted, due to noise caused by electromagnetic interference, discontinue communications to the controller for the ownership timeout period and restart the program download. The ownership timeout period is set to 60 seconds as a default for all protocols. However, if you are using DF1 half-duplex and the poll timeout value is set higher than 60 seconds, the poll timeout value will be used instead of the ownership timeout. After the timeout, you can re-establish communications with the controller and try the program download again. The only other way to clear file ownership is to cycle power on the controller.

Configuring a Slave Station

Important: To begin configuring a MicroLogix 1000 controller, the controller must be on-line. Trying to configure the controller off-line will not allow key parameters to be available to set.

To choose the controller as a slave station, do the following using your programming software:

1. Ensure that you are on-line with the controller to be configured. You should see Remote Run or Remote Program.
2. Double-click on the Channel Configuration icon to bring up the Channel Configuration interface.



3. Scroll down the list and choose the desired baud rate.
4. Click the radio button and choose Half-Duplex Slave.
5. Configure the communication driver characteristics according to Table 6.A.

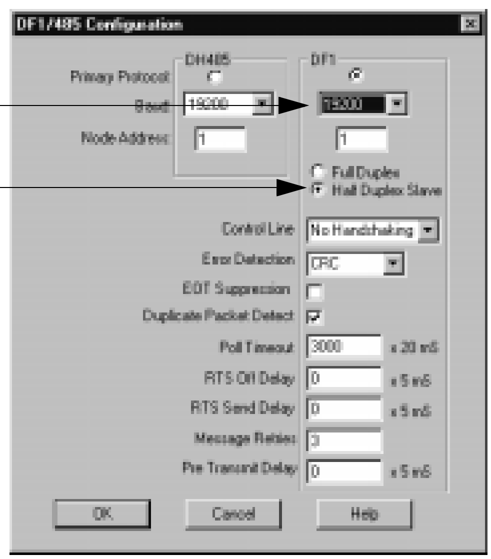


Table 6.A DF1 Half-duplex Slave Configuration Parameters

Parameter	Description	Default
Baud Rate	Toggles between the communication rate of 300, 600, 1200, 2400, 4800, 9600, 19200, and 38.4K.	9600
Node Address	Valid Range is 0-254 decimal.	1
Control Line	Toggles between No Handshaking and Half-duplex Modem.	No Handshaking
Duplicate Packet Detection	Detects and eliminates duplicate responses to a message. Duplicate packets may be sent under "noisy" communication conditions when the sender's retries are not set to 0. Toggles between Enabled and Disabled.	Enabled
Error Detection	Toggles between CRC and BCC.	CRC
RTS Off Delay	Specifies the delay time between when the last serial character is sent to the modem and when RTS will be deactivated. Gives modem extra time to transmit the last character of a packet. The valid range is 0-255 and can be set in increments of 5 ms. Refer to page 6-9 for further details.	0
RTS Send Delay	Specifies the time delay between setting RTS until checking for the CTS response. For use with modems that are not ready to respond with CTS immediately upon receipt of RTS. The valid range is 0-255 and can be set in increments of 5 ms. Refer to page 6-9 for further details.	0
Poll Timeout	Poll Timeout only applies when a slave device initiates a MSG instruction. It is the amount of time that the slave device will wait for a poll from the master device. If the slave device does not receive a poll within the Poll Timeout, a MSG instruction error will be generated, and the ladder program will need to requeue the MSG instruction. The valid range is 0-65535 and can be set in increments of 20 ms. If you are using a MSG instruction, it is recommended that a Poll Timeout value of 0 not be used. Poll Timeout is disabled if set to 0. Refer to page 6-10 for further details.	3000 (60 seconds)
Pre-send Time Delay	Delay time before transmission. Required for 1761-NET-AIC physical half-duplex networks. The 1761-NET-AIC needs delay time to change from transmit to receive mode. The valid range is 0-255 and can be set in increments of 5 ms.	0
Message Retries	Specifies the number of times a slave device will attempt to resend a message packet when it does not receive an ACK from the master device. For use in noisy environments where message packets may become corrupted in transmission. The valid range is 0-255.	3
EOT Suppression	Slave does not respond when polled if no message is queued. Saves modem transmission power when there is no message to transmit. Toggles between Yes and No.	No

Configuring RTS Send Delay and RTS Off Delay

Through your programming software, the parameters RTS Send Delay and RTS Off Delay give you the ability to set how long RTS is on prior to transmission, as well as how long to keep it on after transmission is complete. These parameters only apply when you select half-duplex modem. For maximum communication throughput, leave these parameters at zero.

For use with half-duplex modems that require extra time to turnaround or key-up their transmitter even after they have activated CTS, the RTS Send Delay specifies (in 5 millisecond increments) the amount of delay time after activating RTS to wait before checking to see if CTS has been activated by the modem. If CTS is not yet active, RTS remains active, and as long as CTS is activated within one second, the transmission occurs. After one second, if CTS is still not activated, then RTS is set inactive and the transmission is aborted.

For modems that do not supply a CTS signal but still require RTS to be raised prior to transmission, jumper RTS to CTS and use the shortest delay possible without losing reliable operation.

If an RTS Send Delay of 0 is selected, then transmission starts as soon as CTS is activated. If CTS does not go active within one second after RTS is raised, RTS is set inactive and the transmission is aborted.

Certain modems will drop their carrier link when RTS is set inactive even though the transmission has not quite been finished. The RTS Off Delay parameter specifies in 5 millisecond increments the delay between when the last serial character is sent to the modem and when RTS is deactivated. This gives the modem extra time to transmit the last character of a packet.

ATTENTION:For almost all modem applications, the RTS Off Delay should be left at 0. Never Select an RTS Off Delay that is greater than the RTS Send Delay in the other devices on the network, or you may incur two devices trying to transmit simultaneously.

Configuring Poll Timeout

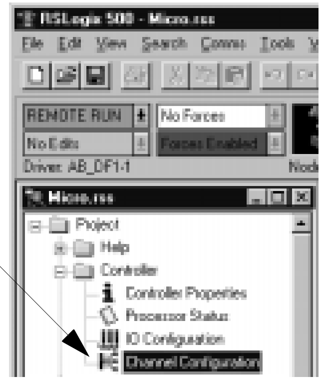
The Poll Timeout is only used when the DF1 half-duplex slave is initiating MSG instructions in ladder logic. This implies that the Master is most likely configured for Standard Polling Mode. The minimum Poll Timeout value is dependent on the maximum Master poll scan rate. Since the Master's polling and the Slave's triggering of a MSG instruction are asynchronous events, it is possible that in the instant just after the slave was polled, the MSG instruction gets triggered. This means the MSG instruction will remain queued-up for transmission until the Master has polled every other slave first. Therefore, the minimum Slave Poll Timeout value is equal to the maximum Master poll scan rate rounded up to the next 20 ms increment.

Minimum Poll Timeout = (maximum Master scan poll rate)

Configuring a Point-to-Point Station

To choose the controller as a point-to-point station, do the following using your programming software:

1. Double-click on the Channel Configuration icon to bring up the Channel Configuration interface.



2. Scroll down the list and choose the desired baud rate.
3. Click the radio button and choose Full Duplex.
4. Communication characteristics are not adjustable in Full Duplex. See Table 6.B for default parameter settings.

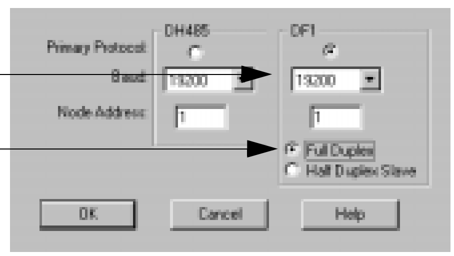
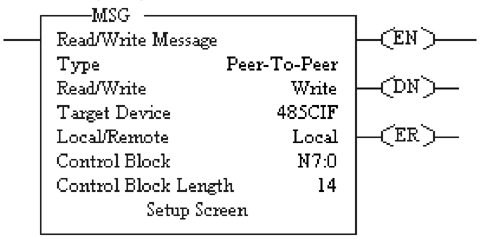


Table 6.B DF1 Full-Duplex Configuration Parameters MicrocroLogix 1000

Parameter	Options	Default
Baud Rate	Toggles between the communication rate of 300,600,1200,2400,4800(1),9600,19200, and 38400(1).	9600(2)
Node Address	Valid range is 0-254 decimal for MicroLogix 1000 Series C and later discrete and all MicroLogix 1000 analog. Not configurable for MicroLogix 1000 Series A and B discrete.	1
Parity	None	No Parity
Stop Bits	None	1
Error Detection	None	CRC
DLE NAK Retries	None	N retries(3)
DLE ENQ Retries	None	N retries(3)
ACK Timeout	None	1 second
Duplicate Packet Detection	None	Enabled
Control Line	None	No Handshaking
Embedded Responses	None	Enabled

(1) Applicable only to MicroLogix 1000 Series D or later discrete and all MicroLogix 1000 analog controllers.
(2) If retentive communication data is lost, the default is 1200 for MicroLogix 1000 Series A, B, or C discrete only. For MicroLogix 1000 Series D or later discrete and all MicroLogix 1000 analog, if retentive communication data is lost, baud rate defaults to 9600.
(3) N=255 for MicroLogix 1000 Series A and B discrete.
N=6 for MicroLogix 1000 Series C and later discrete and all MicroLogix 1000 analog.

Messaging



Messaging in a MicroLogix 1000 controller can occur between:

- a master station and a slave station. For more information see the chapter pertaining to the master device you are using.
- a slave station and its master station. See "Polled Report-by-Exception".
- between two controllers connected via a point-to-point link.

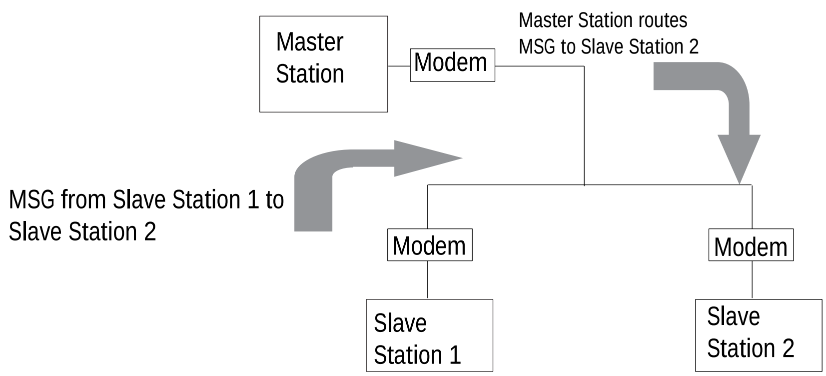
Polled Report-by-Exception

A slave station can gather information from the I/O points it is responsible for and can send any anomalous readings to the master station. To do this, write logic in the slave station's controller to monitor certain conditions and send the data in an MSG instruction to the master station. Figure 6.5 is an example MSG instruction and control block that a MicroLogix 1000 controller slave station can send to a PLC-5 master station. Figure 6.7 is an example MSG instruction and control block that a MicroLogix 1000 controller slave station can send to a SLC 500 or Logix5550 master station. For sample messaging ladder logic when using a MicroLogix 1000 as a slave, Appendix E-14.

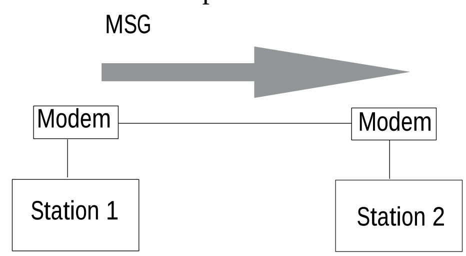
Processor-to-Processor

A processor-to-processor message can be the following types:

- In a point-to-multipoint configuration, the messaging would be between slave stations; the master station automatically routes the message.



- In a point-to-point configuration, the messaging would be between the two connected peer devices.



The configuration of the network (point-to-multipoint vs. point-to-point) and the configuration of the station (slave or peer) does not affect how you configure an MSG instruction. That is, an MSG instruction being sent between two MicroLogix slave stations is configured the same as an MSG instruction between two MicroLogix controllers connected point-to-point. See Figure 6.5 through Figure 6.8 for example MSG control blocks.

Considerations When Configuring MSG Control Blocks

The MicroLogix 1000 can only execute 1 MSG instruction at a time. Each MSG instruction should complete done or in error before the next one is triggered.

Use the “active protocol bit” (S:0/11) as a pre-condition in the MSG instruction rung to restrict message operation to a specific protocol. This is a read-only bit that indicates which communication protocol is currently enabled (0=DF1 and 1=DH-485).

Keep the following considerations in mind when configuring messages between a MicroLogix 1000 controller and a PLC-5 processor:

- In the MicroLogix 1000 485CIF type MSG instruction, Target Node is the decimal node address of the PLC-5 processor and Targets CIF Offset is the decimal “byte-offset,” which is the element you want to write data into or read data from.
- The MicroLogix 1000 controller uses word addressing, while the PLC-5 processor uses byte addressing. In the Targets CIF Offset field of the MicroLogix 1000 MSG control block, enter a word value equivalent to the byte (element) of the PLC-5 file number you want to write data into or read data from. For example in Figure 6.5, the Targets CIF Offset is 20; this corresponds to element 10_{10} in a PLC-5 processor because one word = two bytes. Never enter an odd value for a Targets CIF Offset.
- The MicroLogix 1000 controller can only directly address words 0_{10}-127_{10} in a PLC-5 data table file. By specifying a byte-offset of 254 in the Targets CIF Offset field and specifying a Message Length of 41, you can indirectly address words 128_{10}-167_{10} in a PLC-5 data table file. The maximum read or write message length for a MicroLogix 1000 controller is 41 elements.
- In the PLC-5 processor, create integer files that correspond to the station addresses of the MicroLogix 1000 controllers that will be sending messages to the PLC-5 processor. Because, when a MicroLogix 1000 sends a MSG instruction to a PLC-5 processor, the MicroLogix 1000 controller reads data from and writes data to a PLC-5 integer file that is equal to the MicroLogix 1000 controller’s DF1 station address.

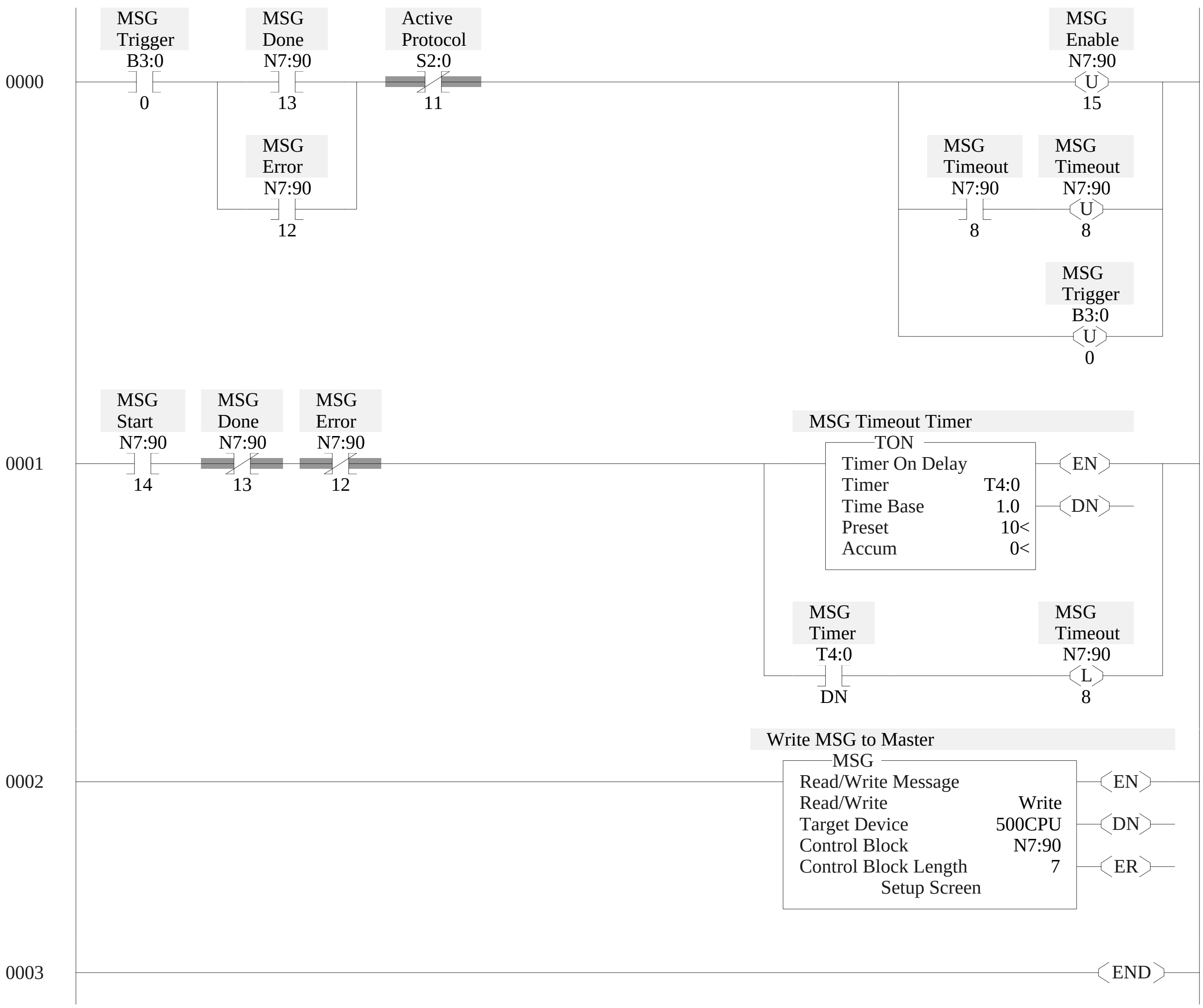
Keep the following considerations in mind when configuring messages between a MicroLogix 1000 controller and another MicroLogix, SLC or a Logix5550 controller

- Use the 500CPU type MSG instruction. The maximum read or write message length is 41 elements.
- In a Logix5550 controller, a controller scoped tagname must be mapped to a “PLC 3, 5/SLC” file number.

Configuring MSG Block Message Timeout

The MicroLogix 1000 does not have a message timeout built into the MSG instruction. So the user should assign a timer with the appropriate MSG timeout bit control for each MSG instruction. See Figure 6.4 for a sample of MSG Timeout ladder logic.

Figure 6.4 Message Timeout Ladder Logic

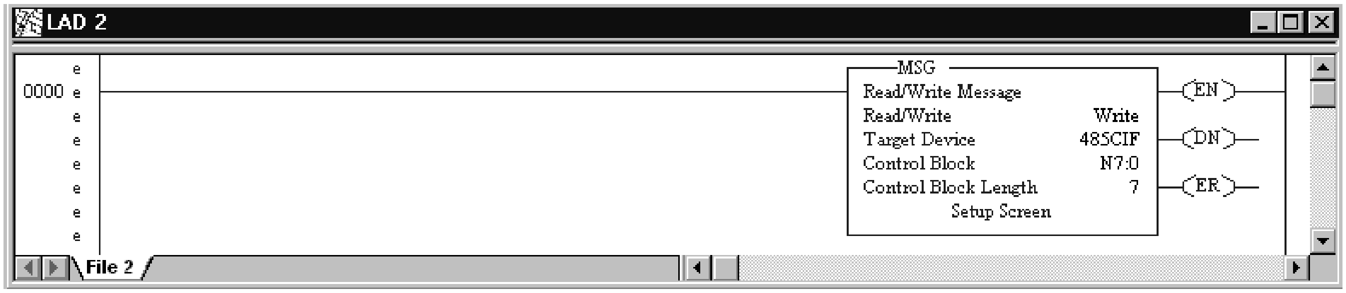


Example MSG Control Blocks

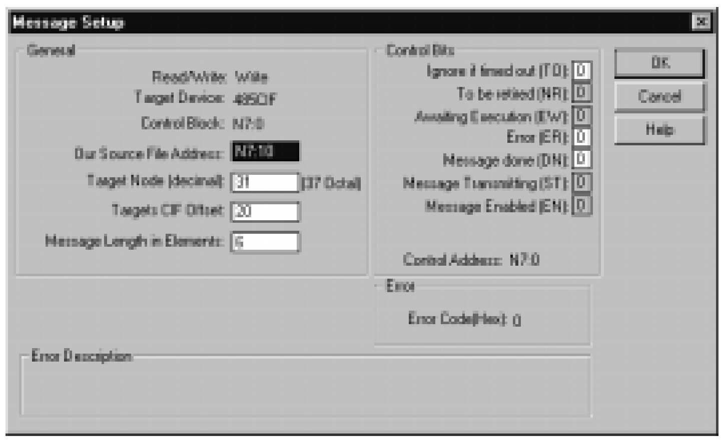
Application:	See:	Page:
MicroLogix 1000 write message to a PLC-5 processor	Figure 6.5	6-17
MicroLogix 1000 read message to a PLC-5 processor	Figure 6.6	6-18
MicroLogix 1000 write MSG to either MicroLogix, SLC 500 or Logix5550	Figure 6.7	6-19
MicroLogix 1000 read MSG to either MicroLogix, SLC 500 or Logix5550	Figure 6.8	6-20

Figure 6.5
This is an example of a write MSG instruction from a MicroLogix 1000 controller to a PLC-5 processor.

ladder rung



setup screen



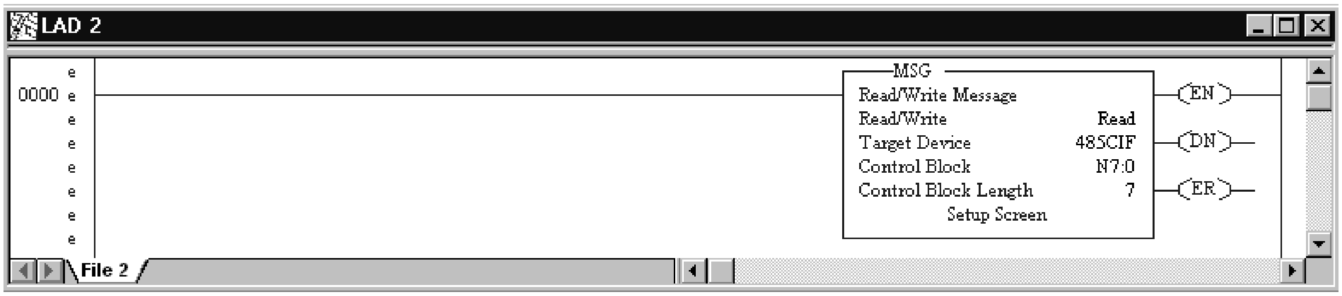
This MSG example is telling the MicroLogix 1000 station (station 99_{10}) to write the information from its N7:10-N7:15 to the PLC-5 station $31_{10.}$ The data's destination is N99:10 (for a target byte offset of 20_{10}) of the PLC-5 processor.

Important: The MicroLogix 1000 controller writes the information into an integer file in the PLC-5 processor's data table. The integer file number is equal to the MicroLogix 1000 controller's station address (this event is called PLC-2 emulation).

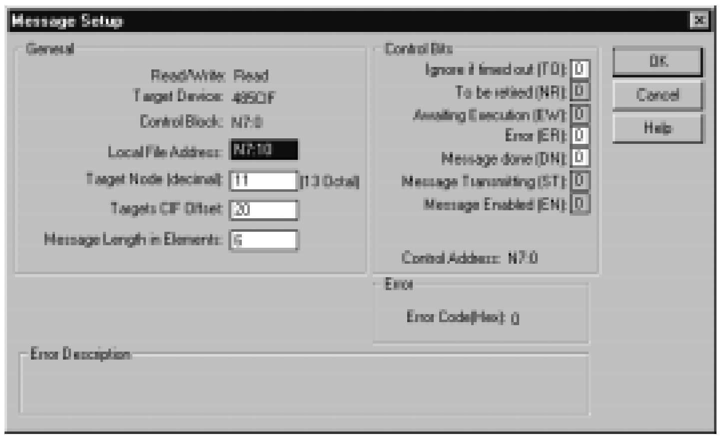
For example, if the MicroLogix 1000 controller in this example is station 99_{10}, then it writes the data from its N7:10 - N:15 into N99 of the PLC-5 station. File N99 must exist in the PLC-5 in order for it to receive data from the MicroLogix 1000 station.

Figure 6.6
This is an example of a read MSG instruction from a MicroLogix 1000 controller to a PLC-5 processor.

ladder rung



setup screen



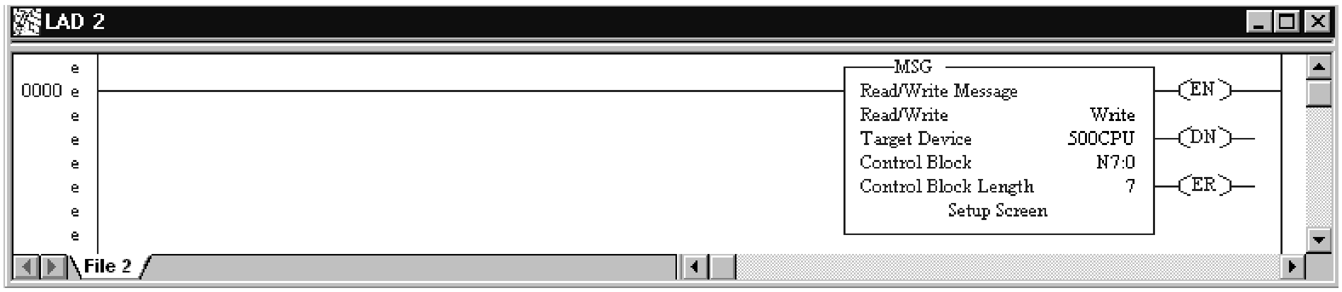
In this example, MicroLogix 1000 station 10_{10} is issuing a read command to a PLC-5 station. The MicroLogix 1000 station (station 10_{10}) reads the information in N10:10-N10:15 of the PLC-5 station and puts that information into its N7:10-N7:15.

Important: The MicroLogix 1000 controller reads the information from an integer file in the PLC-5 processor's data table that corresponds to the MicroLogix 1000 controller's station address (this event is called PLC-2 emulation).

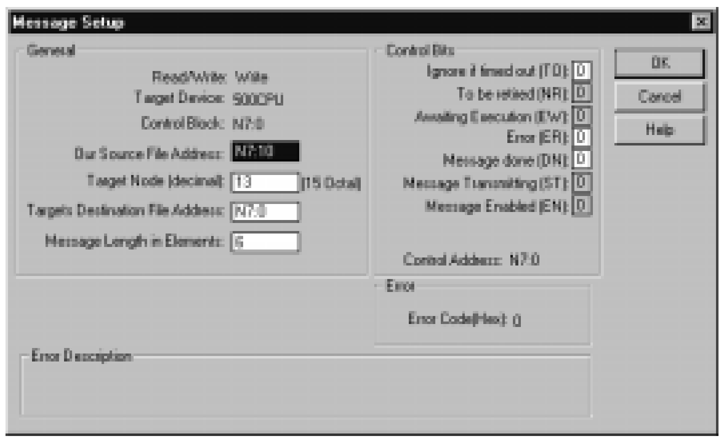
For example, if the MicroLogix 1000 controller in this example is station 10_{10}, then it reads the data from N10:10-N10:15 in the PLC-5 processor. File N10 must exist in the PLC-5 in order for the MicroLogix 1000 controller to read data from it.

Figure 6.7
This is an example of a write MSG instruction from a MicroLogix 1000 controller to either a Micrologix, SLC 500 or Logix5550 controller.

ladder rung



setup screen



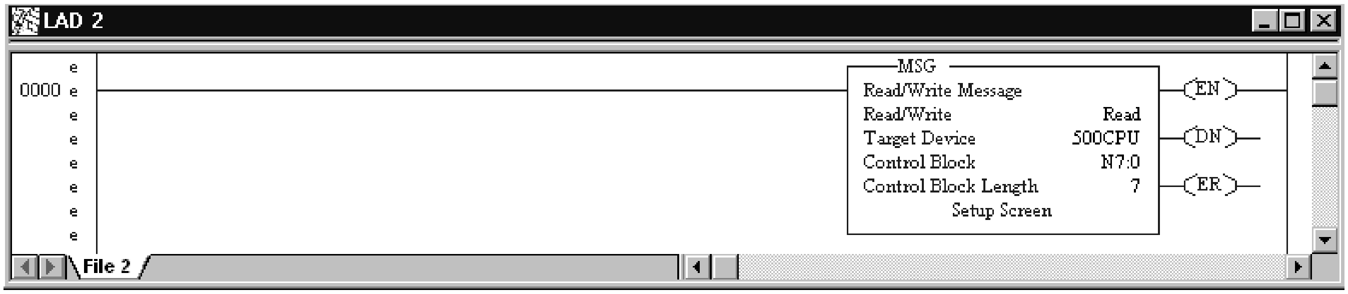
In this example, MicroLogix 1000 station 3 is issuing a write request to station 13_{10}.

Station 3 wants to write the information from its N7:10-N7:15 into the station 13_{10} data files N7:0-N7:5.

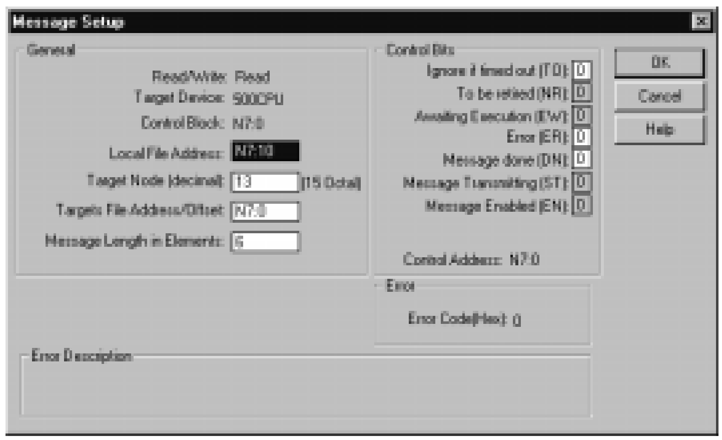
For a Logix5550 controller, a controller scoped tagname must be mapped to N7.

Figure 6.8
This is an example of a read MSG instruction from a MicroLogix 1000 controller to a MicroLogix, SLC 500 or Logix5550 controller.

ladder rung



setup screen



In this example, MicroLogix 1000 station 3 is issuing a read request to station 13_{10}.

Station 3 reads the information from station 13_{10}'s data files N7:0-N7:5 and puts that information into its own N7:10-N7:15.

For a Logix5550 controller, a controller scoped tagname must be mapped to N7.

Configuring Logix5550 Controllers

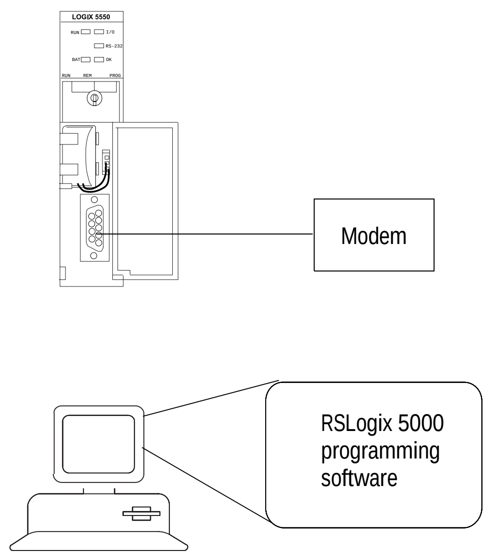
Use This Chapter…

… to help you set up a Logix5550 controller as a master station, as a slave station, or as a station on a point-to-point link.

Overview

To configure a Logix5550 controller, perform these tasks:

1. Install the controller.
2. Install and configure the modem.
3. Define the controller's communication characteristics using RSLogix 5000 programming software.



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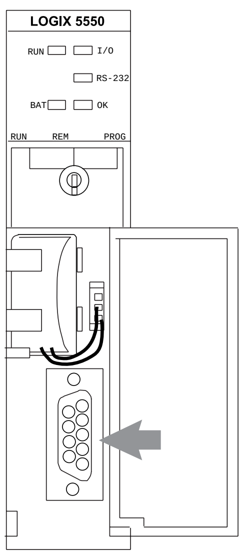
Installing the Controller

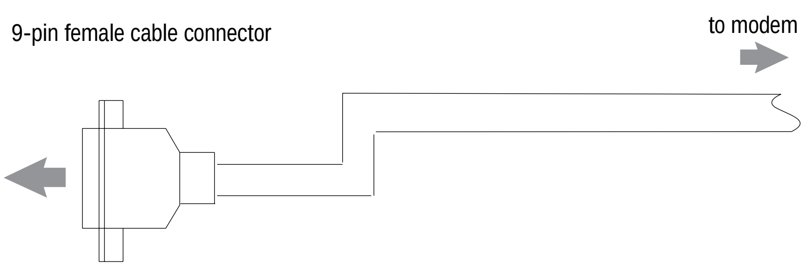
For details about installing the controller, see the Logix5550 Controller Quick Start, publication 1756-10.1.

For cable pinouts, see below, or Appendix A-4.

Figure 7.1
Logix5550 Serial Port Pin Assignments.

9-pin female		25-pin Modem	9-pin Modem
DCD.IN	1	8	1
RXD.IN	2	3	2
TXD.OUT	3	2	3
DTR.OUT	4	20	4
SIG.GND	5	7	5
DSR.IN	6	6	6
RTS.OUT	7	4	7
CTS.IN	8	5	8





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Using Modems that Support DF1 Communication Protocols

The types of modems that you can use with Logix5550 controllers include dial-up phone modems, leased-line modems, radio modems and line drivers. For point-to-point full-duplex modem connections, use DF1 full-duplex protocol. For point-to-multipoint modem connections, use DF1 half-duplex master and slave protocols. In this case, one (and only one) of the other devices must be configured for DF1 half-duplex master protocol.

Dial-up Phone Modems

Dial-up phone line modems support point-to-point full-duplex communications. Normally, a Logix5550 controller on the receiving end of the dial-up connection will be configured for DF1 full-duplex protocol with the control line parameter set for “Full-Duplex Modem.” See page 7-5 for details on the operation of the RS-232 modem control signals when “Full-Duplex Modem” is selected.

Leased-Line Modems

Leased-line modems are used with dedicated phone lines that are typically leased from the local phone company. The dedicated lines may be point-to-point topology supporting full-duplex communications between two modems or in a point-to-multipoint topology supporting half-duplex communications between two or more modems. In the point-to-point topology, configure the Logix5550 controller for DF1 full-duplex protocol with the control line parameter set to “Full-Duplex Modem.” In the point-to-multipoint topology, configure the Logix5550 controller for DF1 half-duplex master or slave protocol with the control parameter set to “Half-Duplex Modem without Continuous Carrier.” See page 7-6 for details on the operation of the RS-232 modem control signals when “Half-Duplex Modem without Continuous Carrier” is selected.

Radio Modems

Radio modems may be implemented in a point-to-point topology supporting either half-duplex or full-duplex communications, or in a point-to-multipoint topology supporting half-duplex communications between two or more modems. In the point-to-point topology using full-duplex radio modems, configure the Logix5550 controllers for DF1 full-duplex protocol. In the point-to-multipoint topology using half-duplex radio modems, configure the Logix5550 controllers for DF1 half-duplex master or slave protocol. If these radio modems require RTS/CTS handshaking, configure the control line parameter to “Half-Duplex Modem without Continuous Carrier.”

Line Drivers

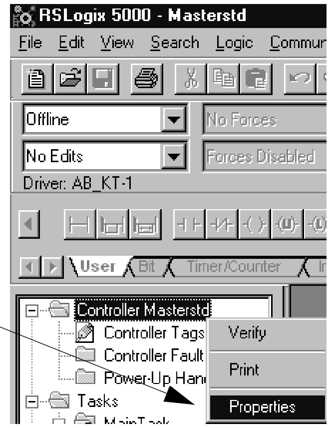
Line drivers, also called short-haul modems, do not actually modulate the serial data, but rather condition the electrical signals to operate reliably over long transmission distances (up to several miles). Allen-Bradley’s AIC+ Advanced Interface Converter is a line driver that converts an RS-232 electrical signal into an RS-485 electrical signal, increasing the signal transmission distance from 50 to 4000 feet. In a point-to-point line driver topology, configure the Logix5550 controller for DF1 full-duplex protocol. In a point-to-multipoint line driver topology, configure the Logix5550 controllers for DF1 half-duplex master or slave protocol. If these line drivers require RTS/CTS handshaking, configure the control line parameter to “Half-Duplex Modem without Continuous Carrier.”

Configuring the Controller to use the Serial Port

To configure the serial port, specify these characteristics (default values are shown in bold):

To bring up the Controller Properties interface:

1. Click once on the Controller icon.
2. Click once on your right mouse button.
3. Click on Properties.



Choose the Serial Port tab and configure according to your specification. Serial Port parameters and defaults can be found in Table 7.A.

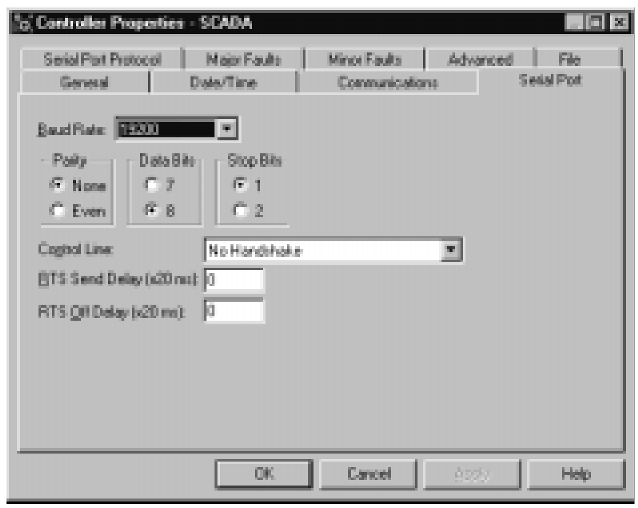


Table 7.A Serial Port Parameters and Defaults

Characteristic:	Description:	Default:
Baud Rate	Specifies the communication rate for the serial port. Select a baud rate that all devices in your system support. Select 110, 300 600, 1200, 2400, 4800, 9600, or 19200 bits/sec.	19200
Parity	Specifies the parity setting for the serial port. Parity provides additional message-packet error detection.	None
Data Bits	Specifies the number of data bits per message character.	8
Stop Bits	Specifies the number of stop bits per message character.	1

Characteristic:	Description:	Default:
Control Line	Specifies the mode in which the serial driver operates. Select No Handshake, Full-Duplex, Half-Duplex with Continuous Carrier, or Half-Duplex without Continuous Carrier. If you are not using a modem, select No Handshake If both modems in a point-to-point link are full-duplex, select Full-Duplex for both controllers. If the master modem is full duplex and the slave modem is half-duplex, select Full-Duplex for the master controller and select Half-Duplex with Continuous Carrier for the slave controller. If all the modems in the system are half-duplex, select Half-Duplex without Continuous Carrier for the controller. See "Modem Control Line Operation" for further details.	No Handshake
RTS Send Delay	Enter a count that represents the number of 20msec periods of time that elapse between the assertion of the RTS signal and the beginning of a message transmission. This time delay lets the modem prepare to transmit a message. The CTS signal must be high for the transmission to occur. See page 7-6 "Configuration Considerations for RTS Send and Off Delays" for further details. The range is 0-32767 periods.	0
RTS Off Delay	Enter a count that represents the number of 20msec periods of time that elapse between the end of a message transmission and the de-assertion of the RTS signal. This time delay is a buffer to make sure the modem successfully transmits the entire message. See "Configuration Considerations for RTS Send and Off Delays" for further details. The range is 0-32767 periods. Normally leave at zero.	0

Modem Control Line Operation

The following explains the operation of the Logix5550 controller serial port control line selections

No Handshake Selected

DTR is always active (high) and RTS is always inactive (low). *Receptions and transmissions take place regardless of the states of DSR, CTS, or DCD inputs.* Only make this selection when the Logix5550 controller is directly connected to another device that does not require handshaking signals.

Full-Duplex Selected

DTR and RTS are always active except:

- If DSR goes inactive, both DTR and RTS are dropped for 1 to 2 seconds, then reactivated. The modem lost minor fault comes on immediately. While DSR is inactive, the state of DCD is ignored. Neither receptions nor transmissions are performed.
- If DCD goes inactive while DSR is active, then receptions are not allowed. If DCD remains inactive for 9 to 10 seconds, DTR is set inactive. At this point, the modem lost minor fault also comes on. If DSR remains active, DTR is raised again in 5 to 6 seconds.

Reception requires DSR and DCD to be active. Transmission requires all three inputs (CTS, DCD, and DSR) to be active. Whenever DSR and DCD are both active, the modem lost minor fault goes off.

Half-Duplex with Continuous Carrier Selected

DTR is always active and RTS is only activated during transmissions (and any programmed delays before or after transmissions). The handling of DCD and DSR are exactly the same as with Full-Duplex Modem. *Reception requires DSR and DCD to be active. Transmissions require CTS, DCD and DSR to be active.* Whenever DSR and DCD are both active, the modem minor fault goes off.

Half-Duplex Modem without Continuous Carrier Selected

This is exactly the same as Half-Duplex Modem with Continuous Carrier except monitoring of DCD is not performed. *DCD is still required for receptions, but is not required for transmissions. Transmissions still require CTS and DSR.* Whenever DSR is active, the modem lost minor fault goes off.

Configuration Considerations for RTS Send and Off Delays

Through your programming software, the parameters RTS Send Delay and RTS Off Delay give you the ability to set how long RTS is on prior to transmission, as well as how long to keep it on after transmission is complete. These parameters only apply when you select half-duplex modem with or without continuous carrier. For maximum communication throughput, leave these parameters at zero.

For use with half-duplex modems that require extra time to turnaround or key-up their transmitter even after they have activated CTS, the RTS Send Delay specifies (in 20 millisecond increments) the amount of delay time after activating RTS to wait before checking to see if CTS has been activated by the modem. If CTS is not yet active, RTS remains active, and as long as CTS is activated within one second, the transmission occurs. After one second, if CTS is still not activated, then RTS is set inactive and the transmission is aborted.

For modems that do not supply a CTS signal but still require RTS to be raised prior to transmission, jumper RTS to CTS and use the shortest delay possible without losing reliable operation.

If an RTS Send Delay of 0 is selected, then transmission starts as soon as CTS is activated. If CTS does not go active within one second after RTS is raised, RTS is set inactive and the transmission is aborted.

Certain modems will drop their carrier link when RTS is set inactive even though the transmission has not quite been finished. The RTS Off Delay parameter specifies in 20 millisecond increments the delay between when the last serial character is sent to the modem and when RTS is deactivated. This gives the modem extra time to transmit the last character of a packet.

ATTENTION: For almost all modem applications, the RTS Off Delay should be left at 0. Never Select an RTS Off Delay that is greater than the RTS Send Delay in the other devices on the network, or you may incur two devices trying to transmit simultaneously

Configuring a Standard-Mode DF1 Half-Duplex Master Station

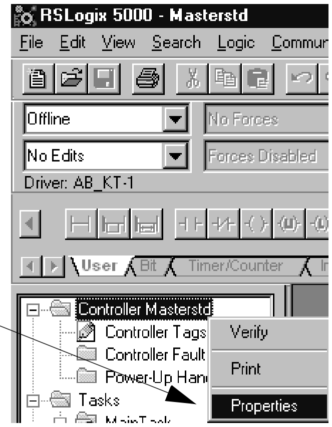
Choose standard-communication mode if you want to query slave stations for information based upon user-configured polling lists. This mode is used most often in point-to-multipoint configurations because it allows polled report-by-exception (page 1-4), slave station-to-station messaging (page 1-5) and slave programming over the telemetry network (chapter 11) to be implemented. In addition, in this mode the master station maintains an active node table which allows an MMI or programming terminal to immediately identify which slave nodes can currently communicate and which nodes cannot.

Configuring a Master Station for Standard Polling Mode

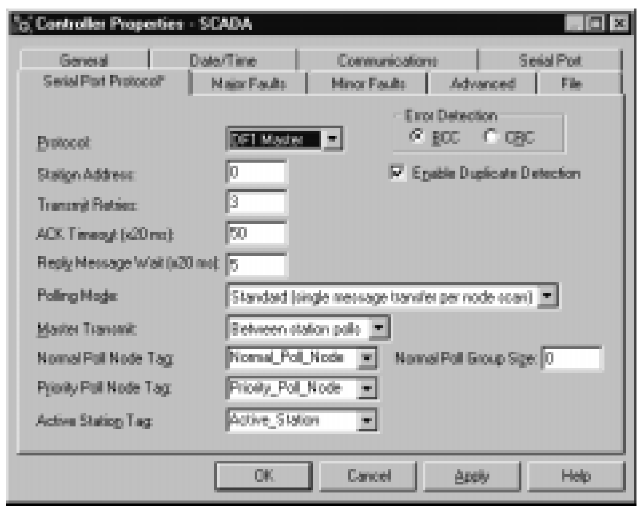
To configure the controller for a master station using standard communication, do the following using your RSLogix 5000 software:

To bring up the Controller Properties interface:

1. Click once on the Controller icon.
2. Click once on your right mouse button.
3. Click on Properties.



Choose the Serial Port Protocol tab and configure according to your specification. Serial Port Protocol parameters and defaults can be found in Table 7.B.



Use Table 7.B to help you understand the communication parameters you need to specify on the Channel Configuration screen for standard-communication mode.

Use SCADA Worksheet 7.1 (Appendix D-16) for an example configuration and to record your station's configuration.

Table 7.B
Define these parameters when configuring a Logix5550 controller as a master station using standard-communication mode to talk to slave stations.

This field:	Description:	Default
Station Address	The station address for the serial port on the DF1 master. Enter a valid DF1 address (0-254).	0
Transmit Retries	Specifies the number of times a message is retried after the first attempt before being declared undeliverable. Enter a value 0-127.	3
ACK Timeout	Specifies the amount of time you want the controller to wait for an acknowledgment to its message transmission. Enter a value 0-32767. Limits are defined in 20ms intervals.	50 (1000 ms)

This field:	Description:	Default
Polling Mode	If you want to receive: • only one message from a slave station per its turn, choose STANDARD (SINGLE MESSAGE TRANSFER PER NODE SCAN) Choose this method only if it is critical to keep the poll list scan time to a minimum. • as many messages from a slave station as it has, choose STANDARD (MULTIPLE MESSAGE TRANSFER PER NODE SCAN)	
Master Transmit	If you want the master station to: • send all of the master station-initiated MSG instructions to the slave stations before polling the next slave station in the poll list, choose Between Station Polls This method makes certain that master station-initiated messages are sent in a timely and regular manner (after every slave station poll). • only send master station-initiated MSG instructions when the master's station number appears in the polling sequence; choose In Poll Sequence With this method, sending master station-initiated messages are dependent upon where and how often the master station appears in the poll list. To achieve the same goal as the Between Station Polls method, the master-station's address would have to appear after every slave-station's address.	Between Station Polls
Normal Poll Node Tag	An integer array (*list* in the format example) that contains the station addresses of the slave stations (in the order in which to poll the stations). Create a single-dimension array of data type INT that is large enough to hold all the normal station addresses. The minimum size is three elements. This tag must be controller-scoped. The format is: *list[0]* contains total number of stations to poll *list[1]* contains address of station currently being polled *list[2]* contains address of first slave station to poll *list[3]* contains address of second slave station to poll *list[n]* contains address of last slave station to poll	
Normal Poll Group Size	The number of normal stations the master station polls after polling all the stations in the priority poll array.	0
Priority Poll Node Tag	An integer array that contains the station addresses of the slave stations you need to poll more frequently (in the order in which to poll the stations). Create a single-dimension array of data type INT that is large enough to hold all the priority station addresses. The minimum size is three elements. This tag must be controller-scoped. The format is: *list[0]* contains total number of stations to be polled *list[1]* contains address of station currently being polled *list[2]* contains address of first slave station to poll *list[3]* contains address of second slave station to poll *list[n]* contains address of last slave station to poll	
Active Station Tag	An array that assigns a bit to every potential DF1 address (0-254). The bit is set if the station is active and cleared if the station is inactive. Both the normal poll array and the priority poll array can have active and inactive stations. A station becomes inactive when it does not respond to the master's poll. Create a single-dimension array of data type SINT that has 32 elements (256 bits). This tag must be controller-scoped.	
Error Detection	Select BCC or CRC error detection. Configure all stations to use the same type of error checking. **BCC:** the controller sends and accepts messages that end with a BCC byte for error checking. BCC is quicker and easier to implement, but does not detect as many errors as CRC **CRC:** the controller sends and accepts messages with a 2-byte CRC for error checking. CRC is a more effective error detection algorithm.	BCC
Enable Duplicate Detection	Select whether or not the controller should detect and ignore duplicate messages.	Enabled

Minimum DF1 Half-Duplex Master ACK Timeout

The governing timeout parameter to configure for a DF1 Half-Duplex Master is the ACK Timeout. The ACK Timeout is the amount of time you want the controller to wait for an acknowledgment of its message transmissions. Set in 20 millisecond intervals, the value is the amount of time the master will wait for:

- an ACK to be returned by a slave when the master has just sent it a message, or
- a poll response or message to be returned by a slave when the master has just sent it a poll packet.

The timeout must be long enough that after the master has transmitted the last character of the poll packet, there is enough time for a slave to transmit (and the master receive) a maximum sized packet before the time expires.

To calculate the minimum ACK timeout, you must know:

- the modem baud rate
- maximum sized data packet (the maximum number of data words that a slave write command or read reply packet might contain)
- the RTS/CTS or “turnaround” delay of the slave modem
- the configured RTS Send Delay in the slave
- the program scan time of the slave

Determining Minimum Master Serial Port ACK Timeout

To determine the minimum ACK Timeout, you must first calculate the transmission time by multiplying the maximum sized data packet for your controller by the modem rate in ms/byte. For an example we will assume communications with SLC 5/03 slaves (103 data words or 224 bytes total packet size including overhead) and a 9600 bps modem, which transmits at approximately 1 ms/byte. Therefore, the message transmission time is 224ms. For approximate modem transmission rates, see the following table.

Table 7.C Approximate modem transmission rates

modem bps	approx. ms/byte
4800	2 ms/byte
9600	1 ms/byte
19200	.5 ms/byte

Next, you need to determine the average slave program scan time. For this example, lets assume an average slave program scan time of 20 ms. Remember, program scan time will vary by application.

Finally, you must determine the larger of two values, either the configured slave RTS Send Delay or the turnaround time of the slave modem. The RTS Send Delay time can be found by double-clicking on the slave's Channel Configuration icon and looking at the Chan. 0 System tab of the Channel Configuration screen. Note that the RTS Send Delay time is in intervals of 20 ms, so with a value of 3 in the box, the RTS Send Delay time would be 20 ms multiplied by 3. Using this value (60 ms) for our example, and assuming that the turnaround time of the modem is 50 ms (which will vary by modem) you would choose to use the RTS Send Delay time of 60 ms for your calculation.

Having determined the maximum message transmission time (224 ms), the average slave program scan time (20 ms) and the largest of either RTS Send Delay (60 ms) or the modem turnaround time, the minimum ACK timeout is simply the sum of these values.

Use only the largest of these two values

Parameter	Example Values (in ms)
Max message transmission time	224
Average program scan time	20
RTS Send Delay	60
modem turnaround time	50
calculated ACK Timeout	304
round up to nearest 20 ms	320

DF1 Half-Duplex Master Diagnostic Counter

DF1 Half-Duplex Master driver status data is stored in the DiagnosticCounter attribute of the DF1 communication object. You must define a controller tag to be the destination for this data and copy the system data to this tag using a GSV instruction. For the required ladder logic, see page 7-26.

To bring up the Controller Properties interface:

1. Click once on the Controller Tab icon.
2. Click once on your right mouse button.
3. Click on Monitor Tags.

For a detail of the Disgnostic Counter files, See Table 7.D.

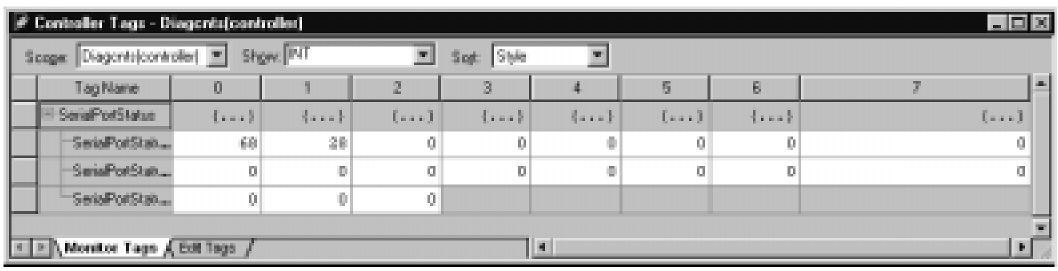


Table 7.D DF1 Half-Duplex Master Diagnostic Counters

Status Field	Diagnostic File Location	Definition
signature (68_{10})	word 0	DF1 Half-Duplex Master is the configured protocol
DTR (Data Terminal Ready)	word 1;bit 4	The status of the DTR handshaking line (asserted by the controller)
DCD (Data Carrier Detect)	word 1;bit 3	The status of the DCD handshaking line (received by the controller)
DSR (Data Set Ready)	word 1;bit 2	The status of the DSR handshaking line (received by the controller)
RTS (Request to Send)	word 1;bit 1	The status of the RTS handshaking line (asserted by the controller)
CTS (Clear to Send)	word 1;bit 0	The status of the CTS handshaking line (received by the controller)
packets sent	word 2	The total number of DF1 packets sent by the controller (including message retries)
packets received	word 3	The number of packets received with no errors
undelivered packets	word 4	The number of packets that were sent by the controller but not acknowledged by the destination device
messages retried	word 5	Defines the number of times a master station retries either: • a message before it declares the message undeliverable • or a poll packet to an active station before the master station declares that station to be inactive

Table 7.D DF1 Half-Duplex Master Diagnostic Counters

Status Field	Diagnostic File Location	Definition
unused	word 6	
unused	word 7	
bad packets not ACKed	word 8	The number of incorrect data packets received by the controller for which an ACK was not returned
unused	word 9	
duplicate packets received	word 10	The number of times the controller received a message packet identical to the previous message packet
unused	word 11	
DCD recoveries count	word 12	The number of times the controller detects the DCD handshaking line has gone low to high
lost modem count	word 13	The number of times the lost modem minor fault has come on.
priority scan time maximum	word 14	Maximum time in 100 ms increments to scan the Priority Poll List
priority scan time last	word 15	The last recorded priority poll scan time (in 100 ms increments)
normal scan time maximum	word 16	Maximum time in 100 ms increments to scan the Normal Poll List
normal scan time last	word 17	The last recorded normal poll scan time (in 100 ms increments)
unused	word 18	

Create Polling List(s)

After defining your polling tag(s) and group size, create polling lists by entering the station address of each slave station into either the normal poll node tag or priority poll node tag. Place each station address in an individual word in a poll tag (normal or priority) starting at word 2.

The normal and priority poll file layout is as follows:

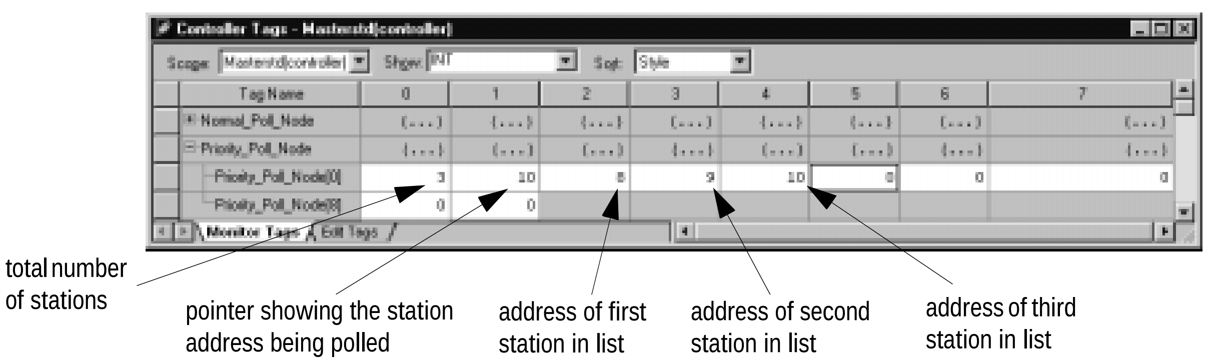
This word in a poll tag:	Contains this information:
word 0	total number of stations to be polled (for a list)
word 1	the address of the station currently being polled This word is automatically updated by the master station as a new slave station is polled.
word 2 through word *xx*	the slave station address in the order that the stations should be polled Store one station address in each word.

To place a station address in a poll file, do the following:

1. Access the Controller Tags.
2. Expand the normal or priority poll node tag.
3. Enter the station addresses of the slave stations you want in the poll list starting at word 2. Put them in the order you want them polled. Enter the total number of slave station addresses in this list into word 0.

Figure 7.2 is an example of a polling list containing three stations: addresses 8, 9, and 10. Station 10 is being polled.

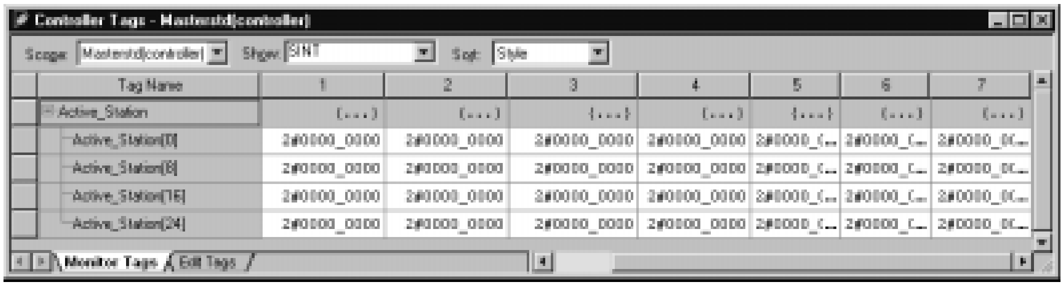
Figure 7.2
Example Station List



Monitor Active Stations

To see what stations are active, view the active station tag. Each bit in the tag represents a station on the link. The stations are numbered in order as a continuous bit-stream file starting with the first bit in the first word (Figure 7.3). If the bit is a one, the station is active; if the bit is a zero, the station is inactive.

Figure 7.3
Example Active Station File



Configuring a Message-based Mode DF1 Half-Duplex Master Station

Choose message-based communication mode if you want to use MSG instructions in user programming to communicate with one station at a time. If your application uses satellite transmission or public switched telephone network transmission, consider choosing message-based. Communication to a slave station can be initiated on an as-needed basis.

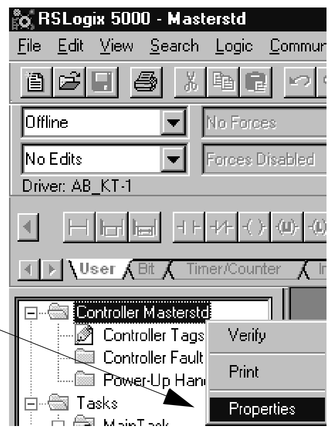
With message-based mode, you do not have an active station file that you can use to monitor station status. Also, you cannot implement slave station-to-slave station messaging over the telemetry network.

Configuring a Master Station for Message-based Polling Mode

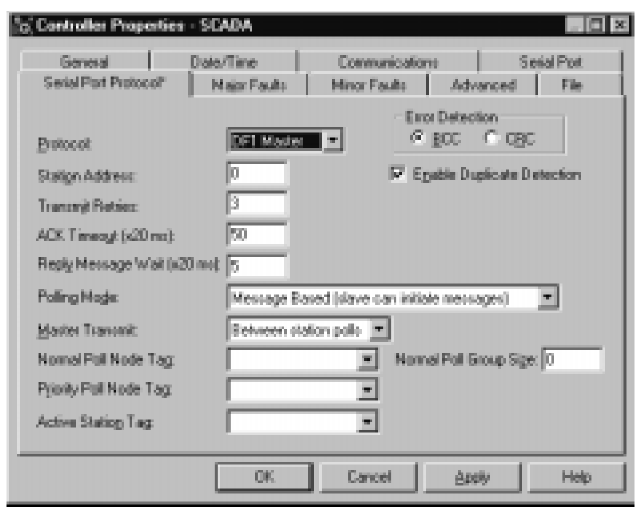
To configure the controller for a master station using message-based communication, do the following using RSLogix 5000:

To bring up the Controller Properties interface:

1. Click once on the Controller icon.
2. Click once on your right mouse button.
3. Click on Properties.



Choose the Serial Port Protocol tab and configure according to your specification. Serial Port Protocol parameters and defaults can be found in Table 7.E.



Use Table 7.E to help you understand the communication parameters you need to specify on the Channel Configuration screen.

Use SCADA Worksheet 7.2 (Appendix D-17) for an example configuration and to record your station's configuration.

Table 7.E
Define these parameters when configuring a Logix5550 controller as a master station using message-based communication mode to talk to slave stations.

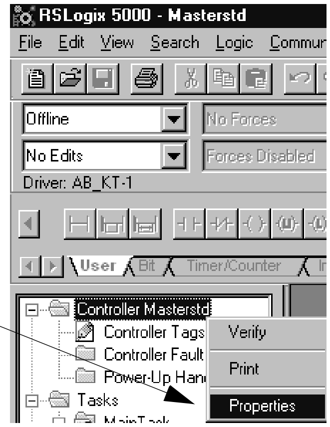
This field:	Description:	Default:
Station Address	The station address for the serial port on the DF1 master. Enter a valid DF1 address (0-254).	0
Transmit Retries	Specifies the number of times a message is retried after the first attempt before being declared undeliverable. Enter a value 0-127.	3
ACK Timeout	Specifies the amount of time you want the controller to wait for an acknowledgment to its message transmission. Enter a value 0-32767. Limits are defined in 20ms intervals.	50 (1000 ms)
Reply Message Wait	Specifies the amount of time the master station waits after receiving an ACK to a master-initiated message before polling the slave station for a reply. Enter a value 0-65535. Limits are defined in 20ms intervals.	5 (100 ms)
Polling Mode	If you want to: • accept unsolicited messages from slave stations, choose MESSAGE BASED (slave can initiate messages) Slave station-initiated messages are acknowledged and processed after all master station-initiated (solicited) messages. **Note:** Slave stations can only send messages when they are polled. If the message-based master station never sends a slave station a message, the master station will never send the slave station a poll. Therefore, to regularly obtain a slave station-initiated message from a slave station, you should choose to use standard communications mode instead. • ignore unsolicited messages from slave stations, choose MESSAGE BASED (slave cannot initiate messages) Slave station-initiated messages are acknowledged and discarded. The master station acknowledges the slave station-initiated message so that the slave station removes the message from its transmit queue, which allows the next packet slated for transmission into the transmit queue.	Message Based (slave can initiate messages)
Error Detection	Select BCC or CRC error detection. Configure all stations to use the same type of error checking. **BCC:** the controller sends and accepts messages that end with a BCC byte for error checking. BCC is quicker and easier to implement, but does not detect as many errors as CRC **CRC:** the controller sends and accepts messages with a 2-byte CRC for error checking. CRC is a more effective error detection algorithm.	BCC
Enable Duplicate Detection	Select whether or not the controller should detect and ignore duplicate messages.	Enabled

Configuring the Controller as a Slave Station

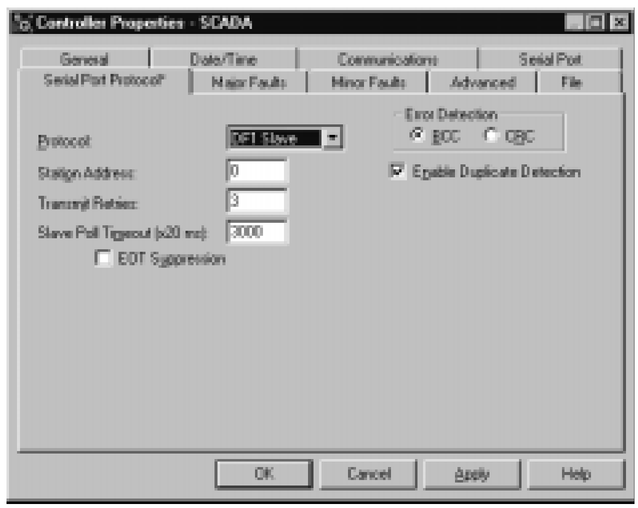
To configure the controller as a slave station, do the following using your programming software:

To bring up the Controller Properties interface:

1. Click once on the Controller icon.
2. Click once on your right mouse button.
3. Click on Properties.



Choose the Serial Port Protocol tab and configure according to your specification. Serial Port Protocol parameters and defaults can be found in Table 7.F.



Use Table 7.F to help you understand the communication parameters you need to specify on the Channel Configuration screen.

Use SCADA Worksheet 7.3 (Appendix D-18) for an example configuration and to record your station's configuration.

Table 7.F
Define these parameters when configuring a Logix5550 controller as a slave station.

This field:	Description:	Default
Station Address	The station address for the serial port on the DF1 slave. Enter a valid DF1 address (0-254).	0
Transmit Retries	The number of times the slave station retries a message after the first attempt before the station declares the message undeliverable. Enter a value 0-127.	3
Slave Poll Timeout	Specifies the amount of time the slave station waits to be polled by a master before indicating a fault. Enter a value 0-32767. Limits are defined in 20ms intervals. See"Configuring Slave Poll Timeout" for further details.	3000 (60,000 ms)
EOT Suppression	Select whether or not to suppress sending EOT packets in response to a poll. The default is not to suppress sending EOT packets.	Do not suppress
Error Detection	Select BCC or CRC error detection. Configure all stations to use the same type of error checking. **BCC:** the controller sends and accepts messages that end with a BCC byte for error checking. BCC is quicker and easier to implement, but does not detect as many errors as CRC **CRC:** the controller sends and accepts messages with a 2-byte CRC for error checking. CRC is a more effective error detection algorithm.	BCC
Enable Duplicate Detection	Select whether or not the controller should detect and ignore duplicate messages.	Enabled

Configuring Slave Poll Timeout

The Slave Poll Timeout is only used when the DF1 half-duplex slave is initiating MSG instructions in ladder logic. This implies that the Master is most likely configured for Standard Polling Mode. The minimum Slave Poll Timeout value is dependent on the maximum Master poll scan rate. Since the Master's polling and the Slave's triggering of a MSG instruction are asynchronous events, it is possible that in the instant just after the slave was polled, the MSG instruction gets triggered. This means the MSG instruction will remain queued-up for transmission until the Master has polled every other slave first. Therefore, the minimum Slave Poll Timeout value is equal to the maximum Master poll scan rate rounded up to the next 20 ms increment.

Minimum Slave Poll Timeout = (maximum Master scan poll rate)

DF1 Half-Duplex Slave Diagnostic Counters

DF1 Half-Duplex Slave driver status data is stored in the DiagnosticCounter attribute of the DF1 communication object. You must define a controller tag to be the destination for this data and copy the system data to this tag using a GSV instruction. For the required ladder logic, see page 7-26.

To bring up the Controller Properties interface:

1. Click once on the Controller Tab icon.
2. Click once on your right mouse button.
3. Click on Monitor Tags.

For a detail of the DisgnosticCounter files, See Table 7.G.

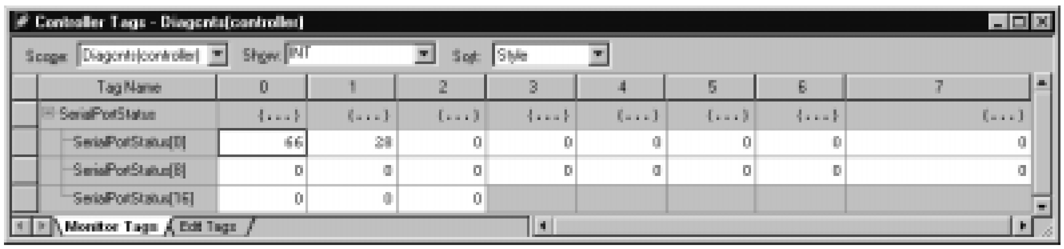


Table 7.G DF1 Half-Duplex Slave Diagnostic Counters

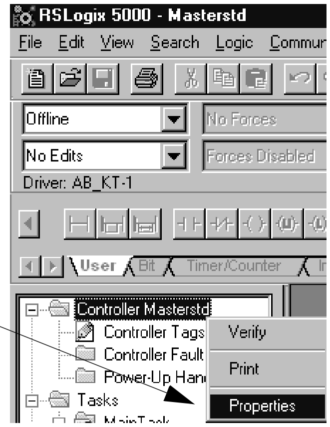
Status Field	Diagnostic File Location	Definition
signature (66_{10})	word 0	DF1 Half-duplex Slave is the configured protocol.
DTR (Data Terminal Ready)	word 1;bit 4	The status of the DTR handshaking line (asserted by the controller)
DCD (Data Carrier Detect)	word 1;bit 3	The status of the DCD handshaking line (received by the controller)
DSR (Data Set Ready)	word 1;bit 2	The status of the DSR handshaking line (received by the controller)
RTS (Request to Send)	word 1;bit 1	The status of the RTS handshaking line (asserted by the controller)
CTS (Clear to Send)	word 1;bit 0	The status of the CTS handshaking line (received by the controller)
packets sent	word 2	The total number of DF1 packets sent by the controller (including message retries)
packets received	word 3	The number of packets received with no errors
undelivered packets	word 4	The number of packets that were sent by the controller but not acknowledged by the destination device
messages retried	word 5	Defines the number of times a slave station retries a message before it declares the message undeliverable.
NAKs received	word 6	The number of NAKs received by the controller
poll packets received	word 7	The number of poll packets received by the controller
bad packets not ACKed	word 8	The number of incorrect data packets received by the controller for which an ACK was not returned
no memory not ACKed	word 9	The number of times the controller could not receive a message because it did not have available memory
duplicate packets received	word 10	The number of times the controller received a message packet identical to the previous message packet
unused	word 11	
DCD recoveries count	word 12	The number of times the controller detects the DCD handshaking line has gone low to high
lost modem count	word 13	The number of times the lost modem minor fault has come on.
unused	word 14	
unused	word 15	
unused	word 16	
unused	word 17	
unused	word 18	

Configuring the Controller as a Station on a Point-to-Point Link

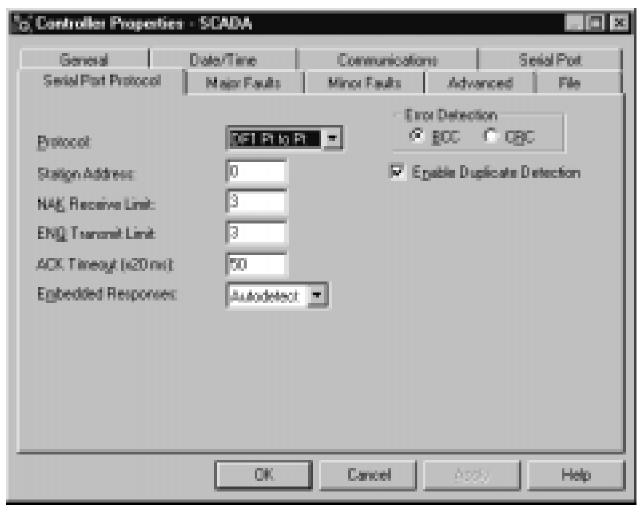
To configure the controller as a station on a point-to-point link, do the following using your programming software:

To bring up the Controller Properties interface:

1. Click once on the Controller icon.
2. Click once on your right mouse button.
3. Click on Properties.



Choose the Serial Port Protocol tab and configure according to your specification. Serial Port Protocol parameters and defaults can be found in Table 7.H.



Use Table 7.H to help you understand the screen parameters you need to specify on the Channel Configuration screen.

Use SCADA Worksheet 7.4 (Appendix D-19) for an example configuration and to record your station's configuration.

Table 7.H
Define these communication parameters when configuring a Logix5550 controller for DF1 full-duplex communication.

This field:	Description:	Default
Station Address	The station address for the serial port on the DF1 point-to-point network. Enter a valid DF1 address (0-254).	0
NAK Receive Limit	Specifies the number of NAKs the controller can receive in response to a message transmission. Enter a value 0-127.	3
ENQ Transmit Limit	Specifies the number of inquiries (ENQs) you want the controller to send after an ACK timeout. Enter a value 0-127.	3
ACK Timeout	Specifies the amount of time you want the controller to wait for an acknowledgment to its message transmission. Enter a value 0-32767. Limits are defined in 20ms intervals.	50 (1000 ms)
Embedded Response	Specifies how to enable embedded responses. Select Autodetect (enabled only after receiving one embedded response) or Enabled.	Autodetect
Error Detection	Select BCC or CRC error detection. Configure all stations to use the same type of error checking. **BCC:** the controller sends and accepts messages that end with a BCC byte for error checking. BCC is quicker and easier to implement, but does not detect as many errors as CRC **CRC:** the controller sends and accepts messages with a 2-byte CRC for error checking. CRC is a more effective error detection algorithm.	BCC
Enable Duplicate Detection	Select whether or not the controller should detect and ignore duplicate messages.	Enabled

DF1 Point-to-Point Diagnostic Counters

DF1 Point-to-Point driver status data is stored in the DiagnosticCounter attribute of the DF1 communication object. You must define a controller tag to be the destination for this data and copy the system data to this tag using a GSV instruction. For the required ladder logic, see page 7-26.

To bring up the Controller Properties interface:

1. Click once on the Controller Tab icon.
2. Click once on your right mouse button.
3. Click on Monitor Tags.

For a detail of the DisgnosticCounter files, See Table 7.I.

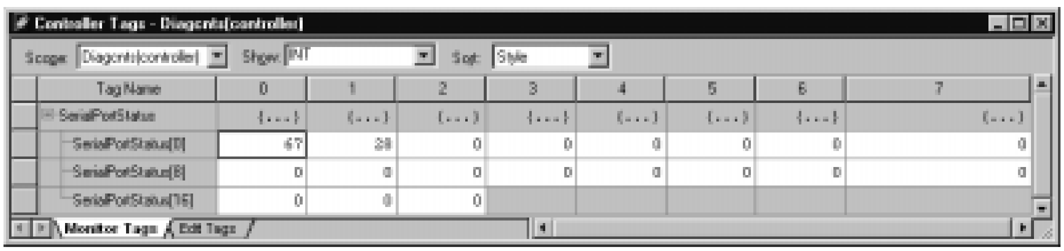


Table 7.I DF1 Full-Duplex (Point-to-Point) Diagnostic Counters

Status Field	Diagnostic File Location	Definition
signature (67_{10})	word 0	DF1 Point-to-Point is the configured protocol
DTR (Data Terminal Ready)	word 1;bit 4	The status of the DTR handshaking line (asserted by the controller)
DCD (Data Carrier Detect)	word 1;bit 3	The status of the DCD handshaking line (received by the controller)
DSR (Data Set Ready)	word 1;bit 2	The status of the DSR handshaking line (received by the controller)
RTS (Request to Send)	word 1;bit 1	The status of the RTS handshaking line (asserted by the controller)
CTS (Clear to Send)	word 1;bit 0	The status of the CTS handshaking line (received by the controller)
packets sent	word 2	The total number of DF1 packets sent by the controller (including message retries)
packets received	word 3	The number of packets received with no errors
undelivered packets	word 4	The number of packets that were sent by the controller but not acknowledged by the destination device
unused	word 5	
NAKs received	word 6	The number of NAKs received by the controller
ENQs received	word 7	The number of ENQs received by the controller

Table 7.I DF1 Full-Duplex (Point-to-Point) Diagnostic Counters

Status Field	Diagnostic File Location	Definition
bad packets NAKed	word 8	The number of incorrect data packets received by the controller for which a NAK was returned.
no memory sent NAK	word 9	The number of times the controller could not receive a message because it did not have available memory.
duplicate packets received	word 10	The number of times the controller received a message packet identical to the previous message packet.
bad characters received	word 11	The number of bad characters received.
DCD recoveries count	word 12	The number of times the controller detects the DCD handshaking line has gone low to high.
lost modem count	word 13	The number of times the lost modem minor fault has come on.
unused	word 14	
unused	word 15	
unused	word 16	
unused	word 17	
ENQs sent	word 18	The number of ENQs sent by the controller

Accessing DF1 Diagnostic Counters

To access the DF1 diagnostic counter array, it is necessary to include a specific rung of ladder logic into your program. The purpose of the ladder logic is to write the DiagnosticCounter values into a named tag, where the values can then be easily viewed

The following instructions explain how to create the DF1 diagnostic counter storage tag, view local and remote DF1 diagnostic counters and reset local DF1 diagnostic counters.

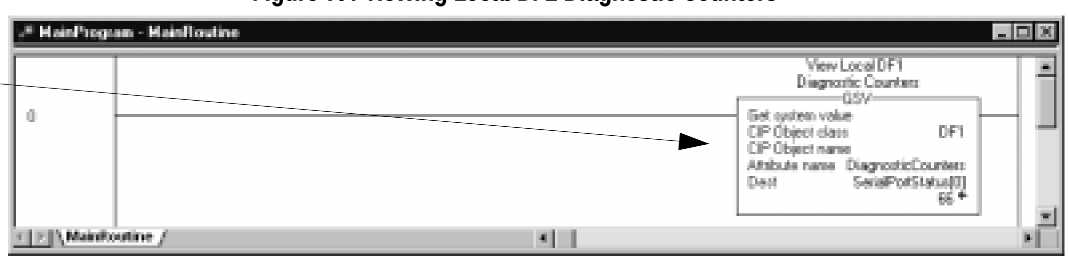
To bring up the Controller Properties interface:

1. Click once on the Controller Tab icon.
2. Click once on your right mouse button.
3. Click on Edit Tags.

From the Edit Tag tab, create a controller tag of type INT [18].

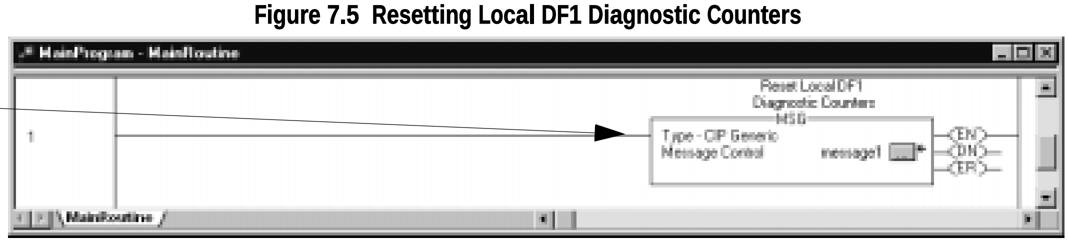
Create the necessary ladder logic to copy the DiagnosticCounter system values to the tag you just created (SerialPortStatus).

Figure 7.4 Viewing Local DF1 Diagnostic Counters

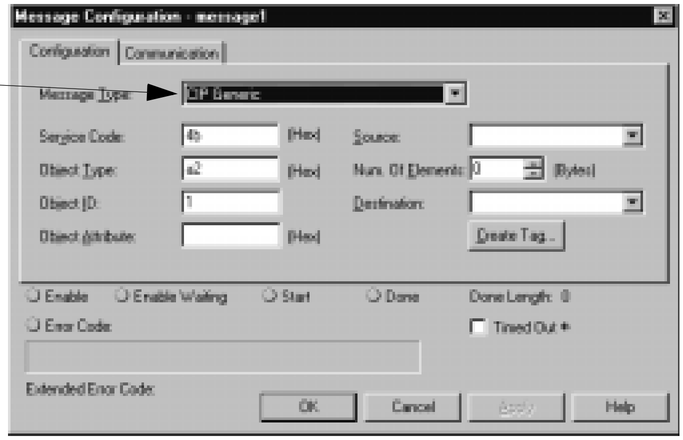


Create a message instruction to clear the DiagnosticCounter system values.

Figure 7.5 Resetting Local DF1 Diagnostic Counters



Enter in the field values exactly as shown.



Enter in 1, s for the Path, where s is the slot number of this controller (slot 0 in this example).

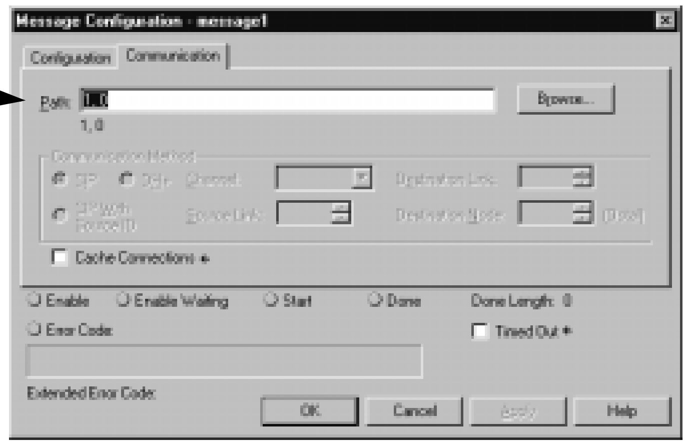
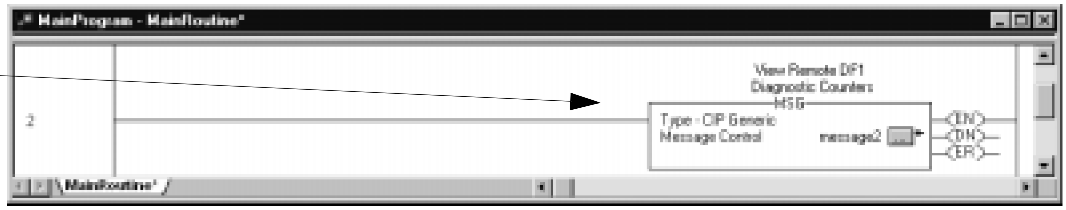
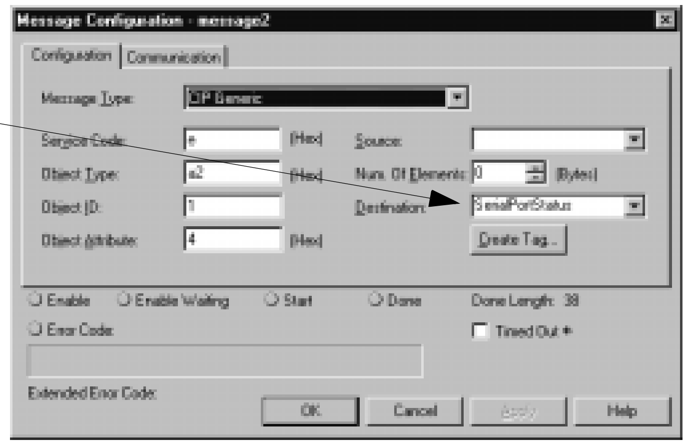


Figure 7.6 Viewing Remote DF1 Diagnostic Counters

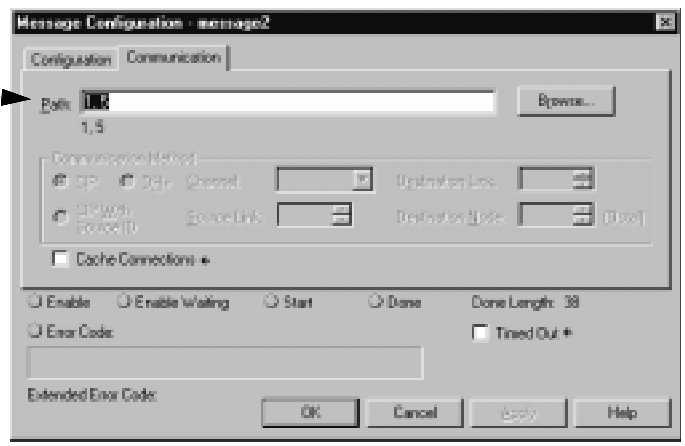
Create a message instruction to read remote DiagnosticCounter system values.



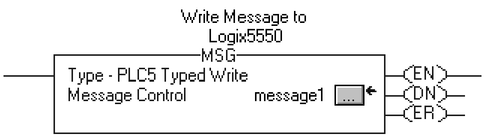
Enter in the field values exactly as shown, using the DF1 diagnostic counter storage tag created previously for the Destination field.



Enter in the path to the remote controller.



Messaging



For:	See page:
list of considerations	
examples	

Messaging can occur between:

- a master station and a slave station
- a slave station and its master station (See “Polled Report-by-Exception”)
- slave stations or between two controllers connected via a point-to-point link

Master Station to Slave Station

A Logix5550 master station communicates with the slave stations that are connected to it via modems in a point-to-multipoint configuration. A master station sends a slave station message to receive status or issue commands. For sample messaging ladder logic to use as a guide when using Standard or Message-based Polling Modes, see Appendix E-16.

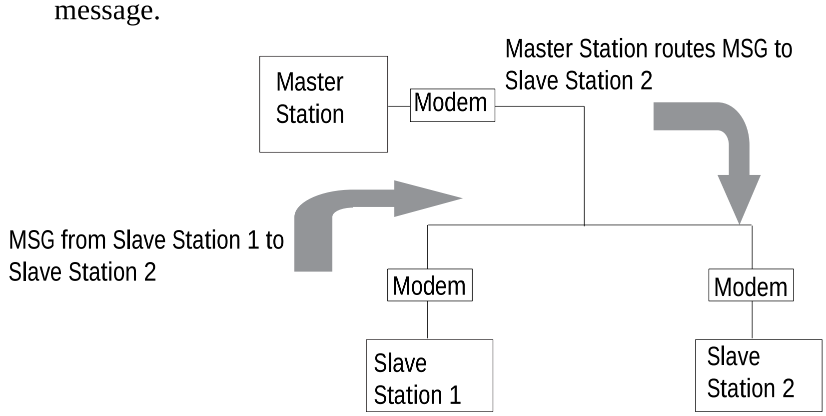
Polled Report-by-Exception

Slave stations can gather information from the I/O points they are responsible for and can send any anomalous readings to the master station. To do this, write ladder logic in the slave station to monitor certain conditions and send the data in an MSG instruction to the master station. For sample messaging ladder logic to use as a guide when using a Logix5550 as a Slave, see page Appendix E-21.

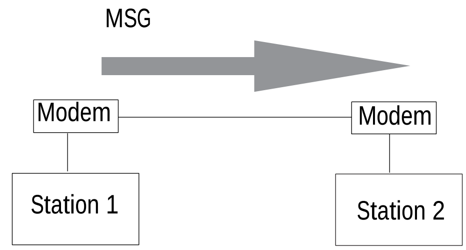
Controller-to-Controller

A controller-to-controller message can be the following types:

- In a point-to-multipoint configuration, the messaging would be between slave stations; the master station automatically routes the message.



- In a point-to-point configuration, the messaging would be between the two connected peer devices.



The configuration of the network (point-to-multipoint vs. point-to-point) and the configuration of the station (master, slave, or peer) does not affect how you configure an MSG instruction. That is, an MSG instruction being sent between two Logix5550 slave stations is configured the same as an MSG instruction between two Logix5550 controllers connected point-to-point, which is configured the same as an MSG instruction between a Logix5550 master station and a Logix5550 slave station. See Figure 7.7 through Figure 7.12 for example MSG control blocks.

Considerations When Configuring MSG Control Blocks

Keep these considerations in mind when configuring serial port messages between a Logix5550 controller and other controllers.

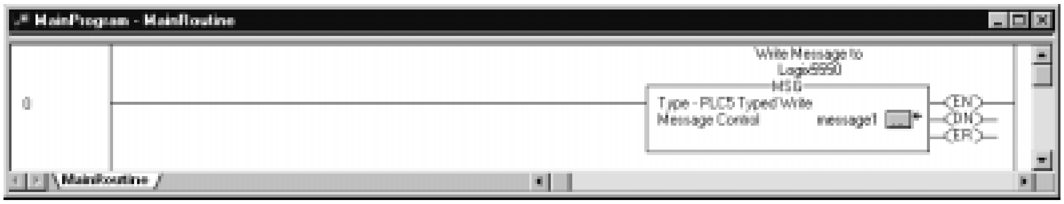
- The connection path for serial port messages always begins with a ‘2’ to indicate send out the serial port (as opposed to a ‘1’, which would indicate send to the backplane).
- Leave Communication Method as “CIP”.
- Leave the message configuration “Cache Connections” unchecked, as message connections passing through the serial port cannot be cached, regardless of this setting.
- CIP Data Table Read and Write message types are sent as connected messages, which means every time a MSG of one of these types is triggered, there are three command packets that are transmitted: a make connection command, the read or write command, and a break connection command. This is very inefficient use of serial communication bandwidth.
- PLC5 and SLC Typed Read and Write message types are sent as unconnected messages, which means only one command packet is transmitted every time a MSG of one of these types is triggered. Therefore, even when initiating to another Logix5550 controller, it is much more efficient to use a PLC5 Typed Read or Write message type.

- The Logix5550 uses either logical ASCII addressing or symbolic addressing for PLC5 Typed Read or Write message types. To address a Logix5550 tag directly, use symbolic addressing by entering in *@tagname* for the Source or Destination Element field, where *tagname* is a defined controller scoped tag in the receiving Logix5550 controller. To address a PLC-5 controller file, use logical ASCII addressing by entering in XY:Z for the Source or Destination Element field, where X is file type status (S), integer (N), bit (B), or float (F), Y is the file number and Z is the starting element number. This format may also be used to read or write a Logix5550 controller tag, if that tag has been mapped in the receiving Logix5550 to a 'PLC 3,5/SLC' file number. For PLC-5 file type float (F), the Source or Destination Tag in the initiating Logix5550 must be of type REAL. For the other valid PLC-5 file types, the Source or Destination Tag in the initiating Logix5550 should be of type INT.
- The SLC Typed Read and Write message types can only be used to read integer (N) and binary (B) data files in SLC 500 and MicroLogix controllers. The Source or Destination Tag in the initiating Logix5550 should be of type INT.
- SLC 5/05, SLC 5/04 (OS401, FRN7 and above) and SLC 5/03 (OS302, FRN10 and above) controllers can respond to PLC5 Typed Read or Write message types that use logical ASCII addressing. Using this message type, the Logix5550 can directly read or write the status (S) file and float (F) file(s) of these SLC controller versions (in addition to the N and B file types.)
- The maximum number of integer file elements that can be transferred with any SLC 5/03, 5/04 or 5/05 controller using a single Logix5550 MSG instruction is 103.
- The maximum number of integer file elements that can be transferred with any MicroLogix 1000 controller using a single Logix5550 MSG instruction is 41.

Example MSG Control Blocks

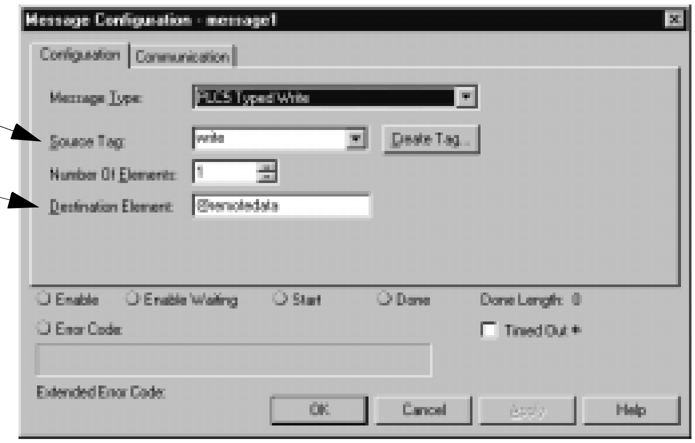
Application:	See page:
Logix5550 write message to another Logix5550 controller	7-32
Logix5550 read message to another Logix5550 controller	7-33
Logix5550 write message to a PLC-5 controller	7-34
Logix5550 read message to a PLC-5 controller	7-35
Logix5550 write message to a SLC 500 or MicroLogix 1000 controller	7-36
Logix5550 read message to a SLC 500 or MicroLogix 1000 controller	7-37

Figure 7.7 Example of a write MSG from a Logix5550 to a Logix5550 controller



Local controller scoped tag containing data to be written.

Remote controller scoped tag where data will be written into.



Path (out serial port) to station (254).

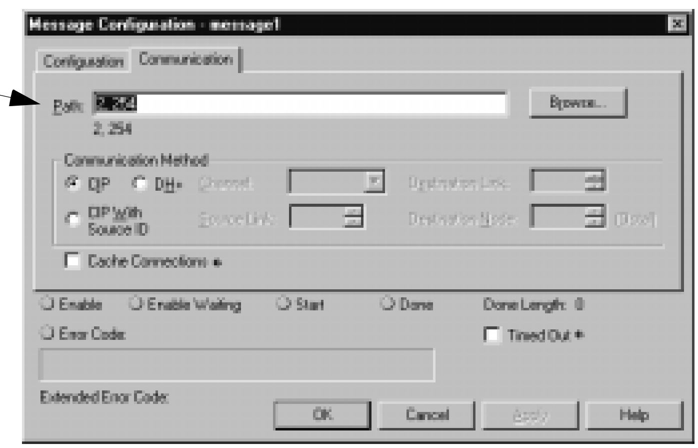
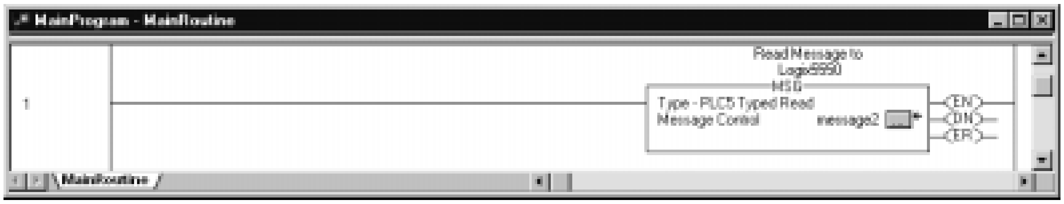
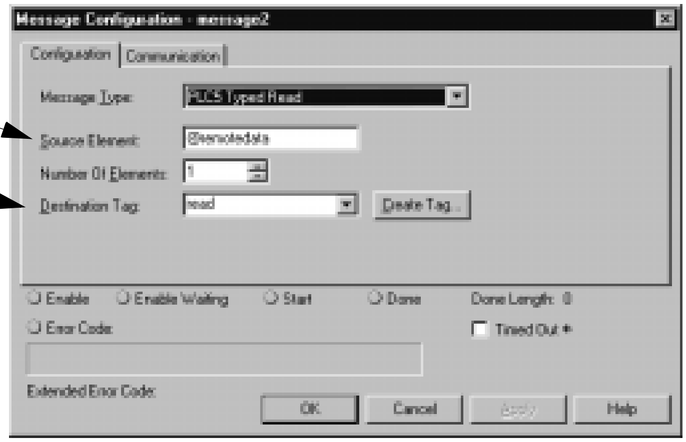


Figure 7.8 Example of a read MSG from a Logix5550 to a Logix5550 controller



Remote controller scoped tag where data will be read from.

Local controller scoped tag where data will be copied into.



Path (out serial port) to station (254).

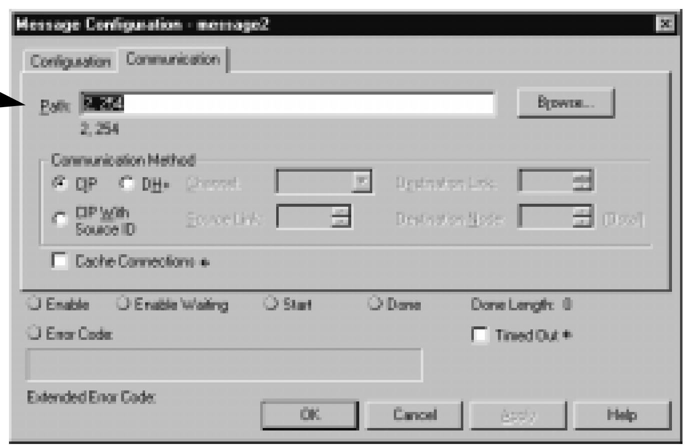


Figure 7.9 Example of a write MSG from a Logix5550 to a PLC-5 controller

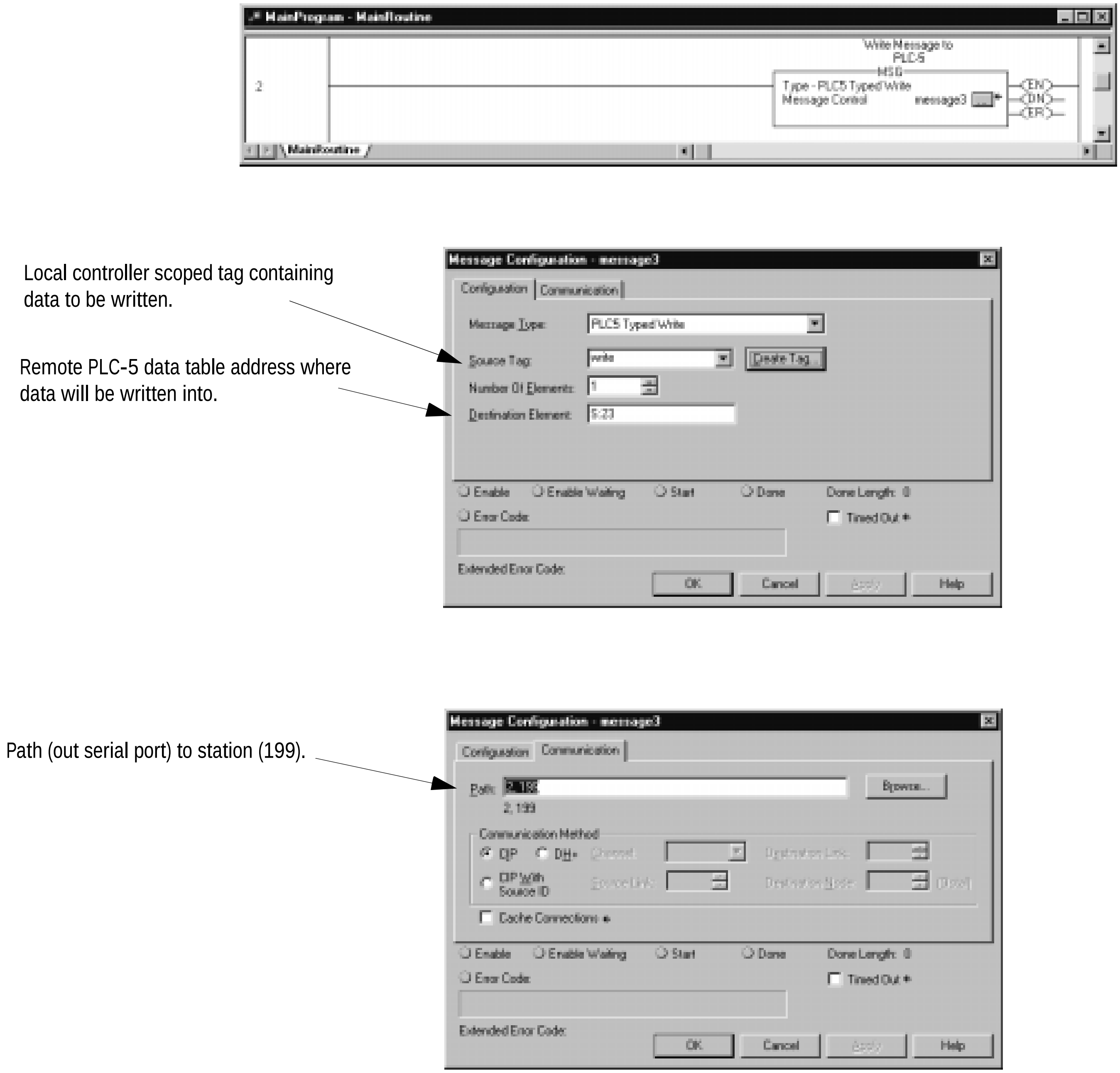
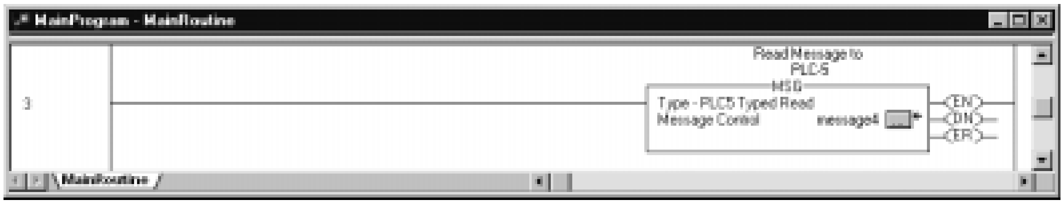
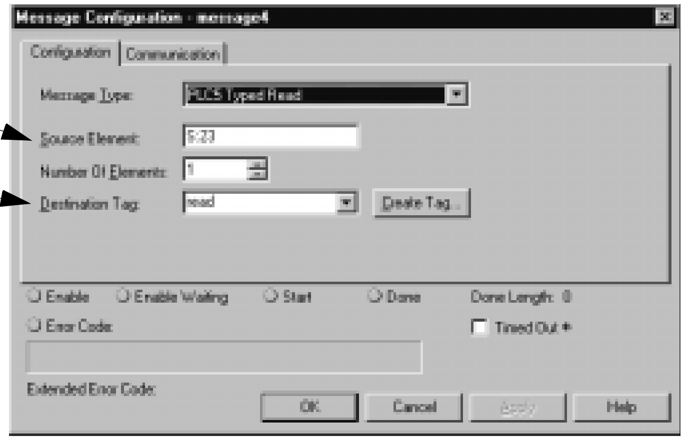


Figure 7.10 Example of a read MSG from a Logix5550 to a PLC-5 controller



Remote PLC-5 data table address where data will be read from.

Local controller scoped tag where data will be copied into.



Path (out serial port) to station (199).

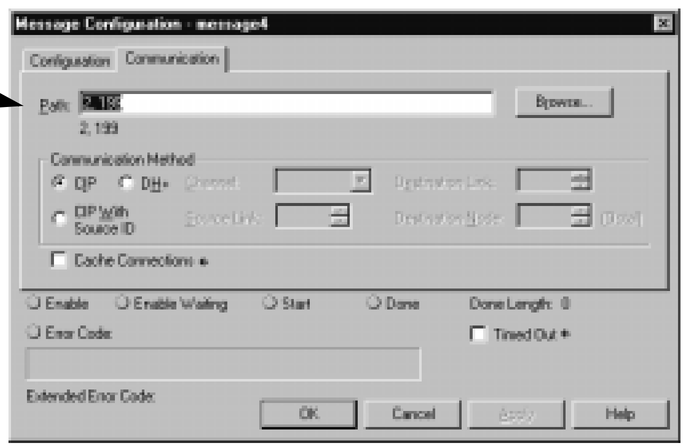
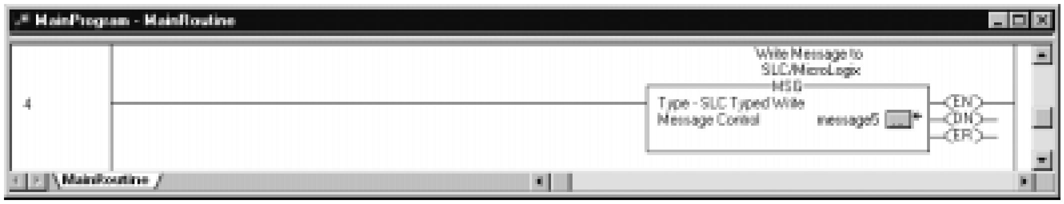
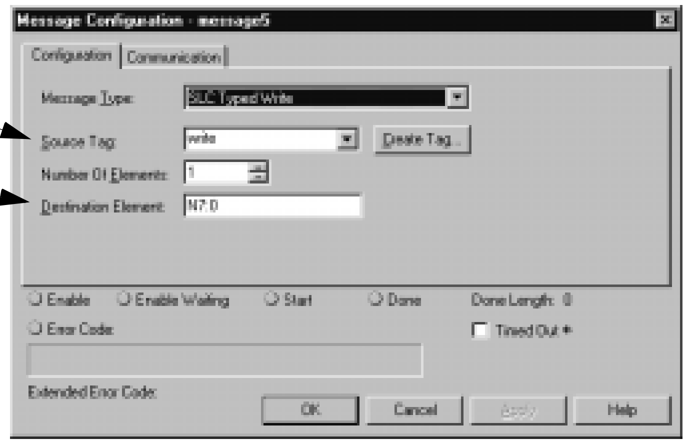


Figure 7.11 Example of a write MSG instruction from a Logix5550 to a SLC or MicroLogix controller



Local controller scoped tag containing data to be written.

Remote SLC data table address where data will be written into.



Path (out serial port) to station (222).

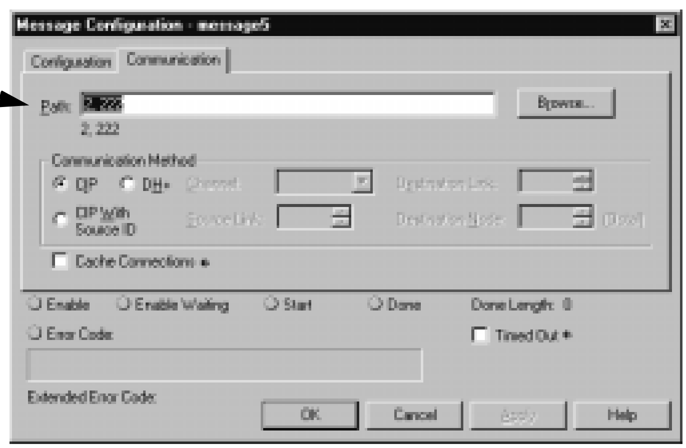
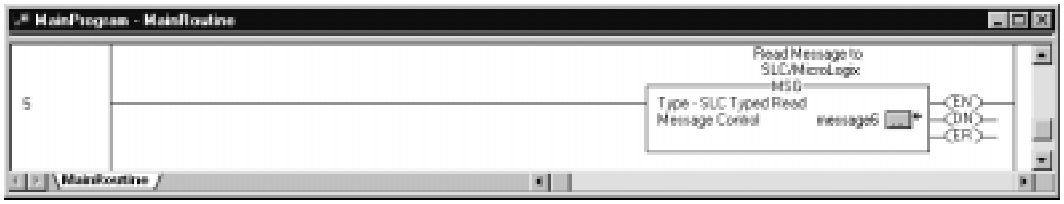
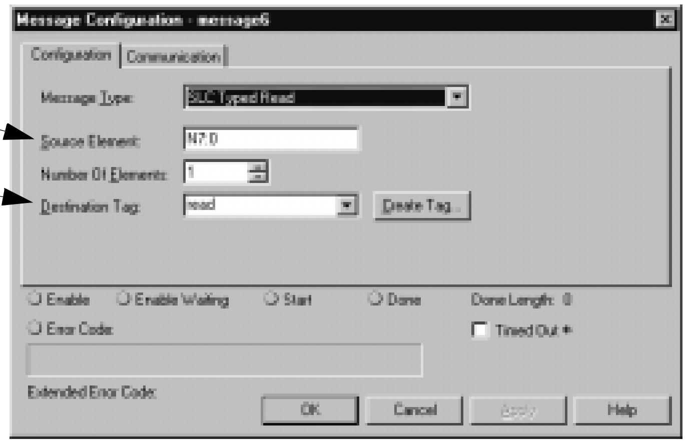


Figure 7.12 Example of a read MSG instruction from a Logix5550 to a SLC or MicroLogix controller

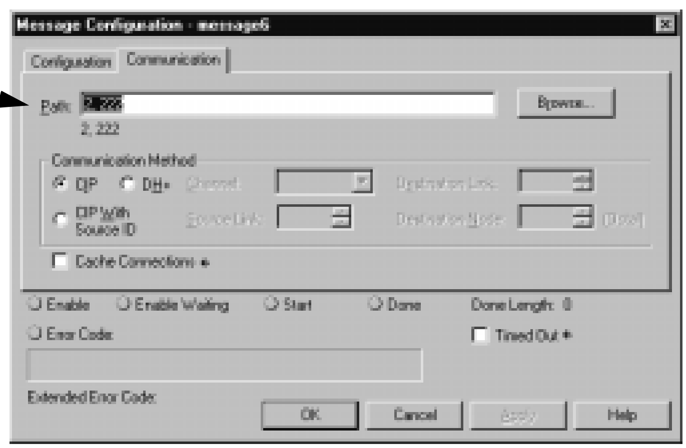


Remote SLC data table address where data will be read from.

Local controller scoped tag where data will be copied into.



Path (out serial port) to station (222).



Notes

Configuring Modems

Use This Chapter…

…as a reference when connecting modems to Allen-Bradley devices.

Included here are cable pin assignments and switch settings for modems manufactured by companies that participate in Rockwell Automation's Encompass Program.

Important: Consult the user documentation provided by the individual vendor. The guidelines presented here are ***not*** intended to replace vendor documentation. Use the vendor documentation as your primary source and these examples as supplemental sources.

Installing a Modem

To install a modem:

1. Configure the modem to communicate with Data-Terminal Equipment (DTE) such as: PLC-5 or SLC processor, PC, etc.
2. Connect the modem to the transmission media (phone line, radio transmitter, etc.).
3. Connect the modem to the DTE.

For details about how to install, configure, and operate a modem, see the modem's user documentation.

Configuration Tips

When configuring modems for communication with Allen-Bradley devices, remember to:

- configure the modem for **asynchronous** communication
- configure the modem's RS-232 communication rate to match that of the connected Allen-Bradley processor and the modem's transmission rate to match that of the receiving modem
- set the modem to transmit 10-bit characters (if applicable)
- assign a unique address to the modem (if applicable)

For information about this modem type:	By this vendor:	See page:
Telephone	DATA-LINC GROUP	8-3
	Miille Applied Research Company, Inc. (MARC)	8-9
Radio	DATA-LINC GROUP	8-20
	Electronic Systems Technology (ESTeem)	8-26
	Microwave Data Systems (MDS)	8-31
Power line	DATA-LINC GROUP	8-35

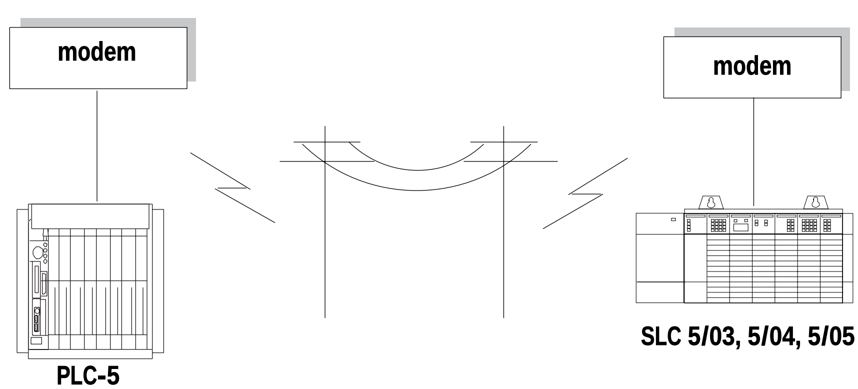
Telephone Modem Configurations

Telephone modems communicate over either dial-up or leased-line wires. When communicating with Allen-Bradley processors, configure these modems according to:

- the cable assignments listed here
- the switch and strap settings listed here
- your application

For information about this vendor's products:	See page:
DATA-LINC GROUP	8-3
Miille Applied Research Company, Inc. (MARC)	8-9

Figure 8.1
Typical Telephone Modem Configuration



DATA-LINC Group

For additional modem specifications consult your DATA-LINC user manual or www.data-linc.com

DATA-LINC GROUP supplies telephone modems compatible with Allen-Bradley processors. The modems provide long-distance communication over leased lines or standard dial-up lines.

Follow these guidelines for connecting an Allen-Bradley processor to these models of DATA-LINC telephone modems. Use the table below to choose the appropriate model for your application

Table 8.A

Link Type:	Transmission Rate:	Topology:	Modem Model:	See page:
digital leased-line	57,600	point-to-point point-to-multipoint	DLM4300[1]	8-3
analog leased-line	1200 (4- wire)	point-to-multipoint	LLM1000-4[1]	8-4
	1200 (4-wire)	point-to-point		
analog leased-line	1200 (2-wire)	point-to-multipoint	LLM1000-2[1]	8-4
dial-up or analog leased-line	28,800 (2-wire)	point-to-point	DLM4000	8-7
dial-up	28,800	point-to-point	DLM4100-SLC	8-8
dial-up	28,800	point-to-point	DLM4100-PLC	8-8

(1) 1746 and 1771 rack mount available

DATA-LINC modems are pre-configured at the factory for each application, and no modem field settings, programming or adapters are required.

DLM4300

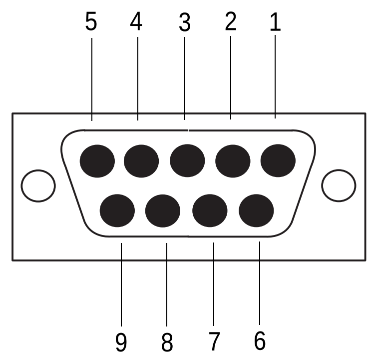
The DATA-LINC DLM4300 Digital Leased Line Modem is a pollable, multi-drop, multi-point modem for connection to telco 56K digital leased lines, know as DDS. The DLM4300 connects to all Allen-Bradley PLCs and supports asynchronous serial data with selectable data rates from 1200 to 38.4K baud. Remote modem response is accomplished by either RTS line control or DATA-LINC's proprietary Data Sense Carrier Control. The DLM4300 employs high level error control and full digital leased line conditioning. Range on properly conditioned leased lines is unlimited. The DLM4300 is encased in a rugged steel enclosure with large mounting flanges for ease of installation.

The DLM4300 connects to the PC/PLC through a DB-9 female connector. All connections and LEDs are located at the front of the modem. Line connection is made through the RJ-45 jack, as are the LEDs for Data Out, Data In, Carrier Detected and Power, providing visible confirmation of modem operation and diagnosis.

Table 8.B DLM4300 DB-9 Pinout

DLM4300 Pin #	PLC-5 25-Pin	AIC+, Logix5550, PC, or SLC 500 9-Pin	Assignment
1	8	1	Carrier Detect
2	3	2	Transmit Data
3	2	3	Receive Data
4	20	4	DTR
5	7	5	Signal Ground
6	6	6	DSR
7	4	7	RTS
8	5	8	CTS
9	NC	NC	Ground

Figure 8.2 DLM4300 pinout



LLM1000-2 and LLM1000-4

The LLM1000 series modems are 2 and 4 wire FSK, halfduplex/simplex, Bell 202/CCITT V.23 compatible, 0 to 1200 baud modem that interface with Allen-Bradley equipment. They are designed to be used on private, leased unswitched telephone lines or any dedicated two conductor wire (twisted or untwisted, shielded or unshielded). The range is twenty miles on any ordinary pair wire, or unlimited on “loaded” telephone company voice grade leased lines

Table 8.C LLM1000-2 Four Position Terminal Block Connections

Terminal Block	Assignment	
1	Carrier	FSK carrier transmission line (no polarity)
2		
3	Power +	Supply power +
4	Power -	Supply power -

Table 8.D LLM1000-2 DB-9 Pinout.

LLM100-2 DB-9 Pin	Assignment
1	Carrier Detect
2	Data Out
3	Data In
4	Not Connected
5	Signal Ground
6	DSR
7	RTS
8	CTS
9	Not Connected

Table 8.E LLM1000-2 Pinout

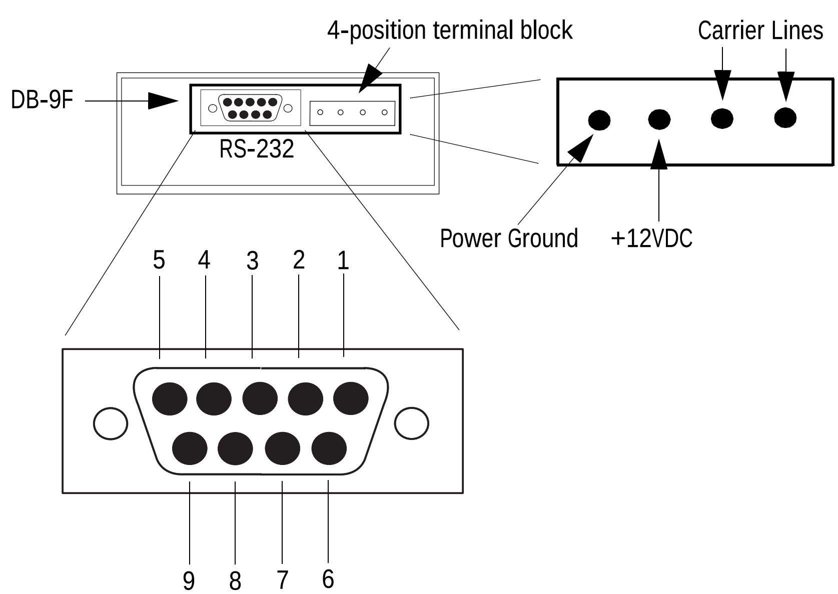


Table 8.F LLM1000 Connecting Cable Assemblies

DATA-LINC Part Number	Description
C232/LLM10/PLC5/CH 0	LLM1000 to PLC-5
C232/LLM10/SLC5/CH 0	LLM1000 to SLC-5
C232/LLM10/1785-KE	LLM1000 to 1785-KE
C232/LLM10/1770-KE	LLM1000 to 1770-KE
C232/LLM10/MLGXCBL	LLM1000 to 1761-CBL-PM02 Series B Cable (A-B MicroLogix cable)
C232/LLM10/1747-KE	LLM1000 to 1747-KE
C232/LLM10/PC	LLM1000 to PC
C232/LLM10/1771-DB	LLM1000 to 1771-DB
C232/LLM10/1770-KF2	LLM1000 to 1770-KF2
C232/LLM10/1770-KF3	LLM1000 to 1770-KF3
C232/LLM10/1770-KFC	LLM1000 to 1770-KFC
C232/LLM10/1770-KFD	LLM1000 to 1770-KFD
C232/LLM10/DUALPLC5/CH 0	LLM1000 to Dual PLC-5
C232/LLM10/1394SERVO	LLM1000 to 1394 Servo
C232/LLM10/PM-II	LLM1000 to A-B Power Monitor II

DLM4000

The DLM4000 is a stand-alone industrial use modem that communicates with Allen-Bradley equipment as either a dial-up or leased line device. It is capable of communication at speeds up to 28.8K baud, and responds to standard AT commands. The DLM4000 has a rugged steel housing with large mounting flanges for ease of installation.

DLM4000 Pin #	Assignment	Assignment	PLC-5 25-Pin	AIC+, Logix5550, PC, or SLC 500 9-Pin
1	PROTECT.GND	SHIELD	1	CASE
2	RXD.IN	TXD.OUT	2	3
3	TXD.OUT	RXD.IN	3	2
4	RTS	RTS.OUT	4	7
5	CTS	CTS.IN	5	8
6	DSR	DSR.IN	6	6
7	SIGNAL GROUND	SIGNAL GROUND	7	5
8	CD	DCD.IN	8	1
20	DTR	DTR.OUT	20	4

Figure 8.3 DLM4000

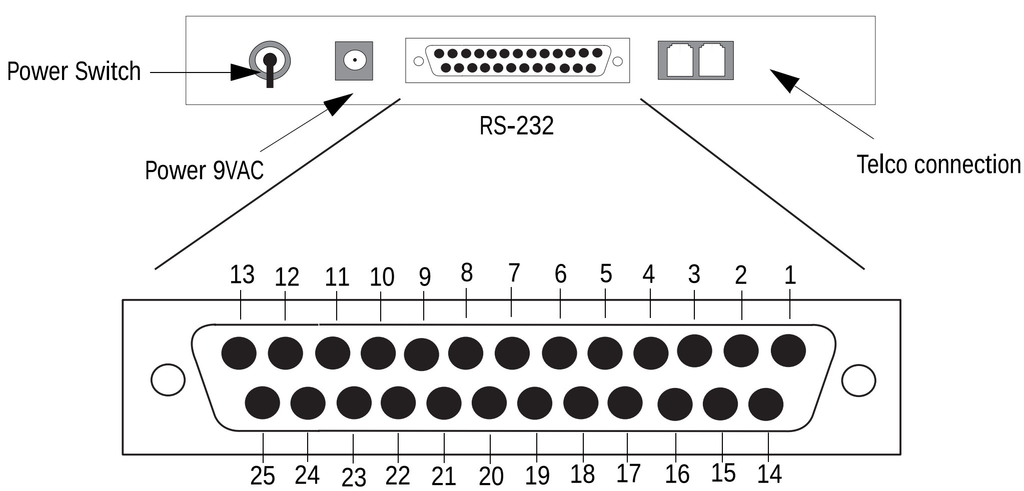


Table 8.G DLM4000 Connecting Cable Assemblies

DATA-LINC Part Number	Description
C232/DLM40/PLC5/CH 0	DLM4000 to PLC-5
C232/DLM40/SLC5/CH 0	DLM4000 to SLC-5
C232/DLM40/1785-KE	DLM4000 to 1785-KE
C232/DLM40/1770-KE	DLM4000 to 1770-KE
C232/DLM40/MLGXCBL	DLM4000 to 1761-CBL-PM02 Series B Cable (A-B MicroLogix cable)
C232/DLM40/1747-KE	DLM4000 to 1747-KE
C232/DLM40/PC	DLM4000 to PC
C232/DLM40/1771-DB	DLM4000 to 1771-DB
C232/DLM40/1770-KF2	DLM4000 to 1770-KF2
C232/DLM40/1770-KF3	DLM4000 to 1770-KF3
C232/DLM40/1770-KFC	DLM4000 to 1770-KFC
C232/DLM40/1770-KFD	DLM4000 to 1770-KFD
C232/DLM40/DUALPLC5/CH 0	DLM4000 to Dual PLC-5
C232/DLM40/1394SERVO	DLM4000 to 1394 Servo
C232/DLM40/PM-II	DLM4000 to A-B Power Monitor II

DLM4100-SLC and DLM4100-PLC

The DLM4100-SLC is a 1746 form factor rackmounted industrial use modem that communicates with the Allen-Bradley SLC 500 as a dial-up device. The DLM4100-PLC is a 1746 form factor rackmounted industrial use modem that communicates with the Allen-Bradley PLC-5 as a dial-up device. Both models are externally powered, capable of communication at speeds up to 28.8K baud, and respond to standard AT commands.

To connect the DLM4100-SLC to a PLC-5 use the DATA-LINC communication cable C232/DLM41/SLC5/CH 0, CABLE ASSEMBLY DLM4100 TO A-B SLC-500. See page Table 8.U on page 8-22 for cable pinout details.

To connect the DLM4100-PLC to a PLC-5 use the DATA-LINC communication cable C232/DLM41/SLC5/CH 0, CABLE ASSEMBLY DLM4100 TO A-B PLC-5. See Table 8.V on page 8-24 for cable pinout details.

Miille Applied Research Company, Inc. (MARC)

For additional modem specifications consult your MARC user manual or www.miille.com

MARC, Inc. supplies telephone modems compatible with Allen-Bradley PLC-5 processors and SLC processors. The modems provide long-distance communication over leased telephone lines or standard dial-up lines.

Follow these guidelines for connecting an Allen-Bradley PLC-5 or SLC processor to these models of MARC telephone modems. Use the table below to choose the appropriate model for your application.

Link Type:	Transmission Rate:	Topology:	Modem Model:	See page:
leased-line	1200 (2- or 4- wire)	point-to-multipoint	166-101 (1746 rack mount)	8-10
	300 (2-wire), 1200 (4-wire)	point-to-point		
leased-line	1200 (2- or 4- wire)	point-to-multipoint	137-001 (1771 rack mount)	8-12
	300 (2-wire), 1200 (4-wire)	point-to-point		
leased-line	1200 (2- or 4-wire)	point-to-multipoint	148-001 (1771 rack mount)	8-14
	300 (2-wire), 1200 4-wire)	point-to-point		
dial-up	2400	point-to-point	166-100 (1746 rack mount)	8-16
dial-up	2400	point-to-point	166-010 (1771 rack mount)	8-17
	14,400		166-010-144 (1771 rack mount)	
	28,800		166-010-288 (1771 rack mount)	

Figure 8.4
Typical SCADA configuration using MARC leased-line modems

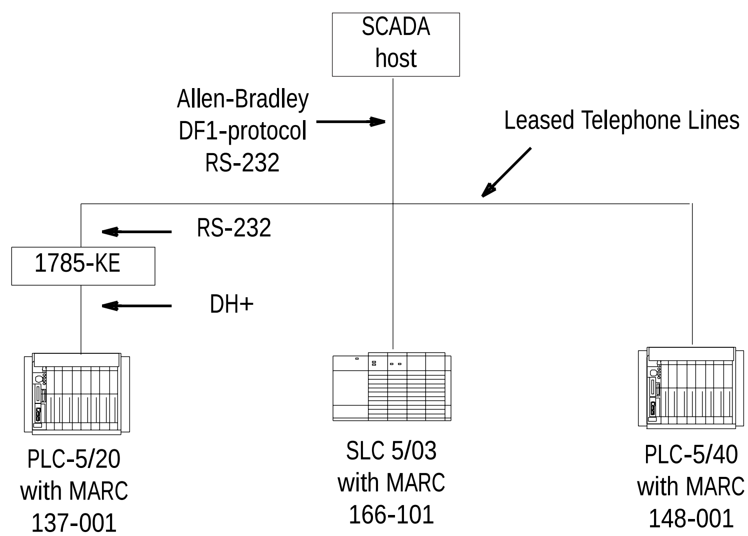
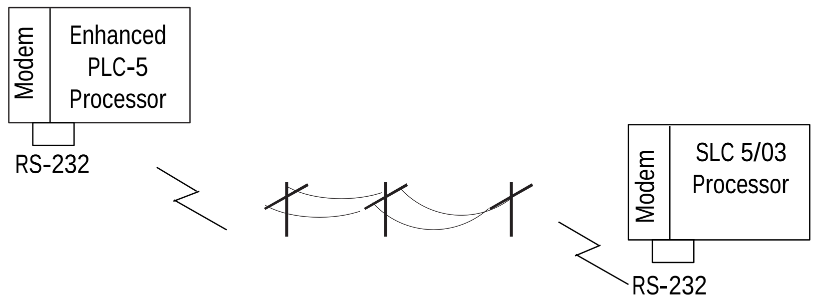


Figure 8.5
Typical SCADA configuration using MARC dial-up modems



MARC Model 166-101

Model 166-101 is an asynchronous frequency-shift keyed (FSK) modem for use on leased lines or local twisted pairs. This modem, which fits into a single slot of the Allen-Bradley 1746 chassis, features switch-selected Bell and CCITT operating modes and adjustable transmit levels.

To connect an Allen-Bradley SLC processor to this module, follow these specifications for:

- cable pin assignments
- switch settings

Cable Pin Assignments

The Model 166-101 requires a RS-232 9-pin D-shell female connector with the pin assignments shown below or these MARC cable assemblies:

- 127-070 (1747-KE to MARC 166-101)
- 127-069 (SLC 5/03, 5/04 or 5/05 to MARC 166-101)

Figure 8.6
MARC, Inc. Model 166-101

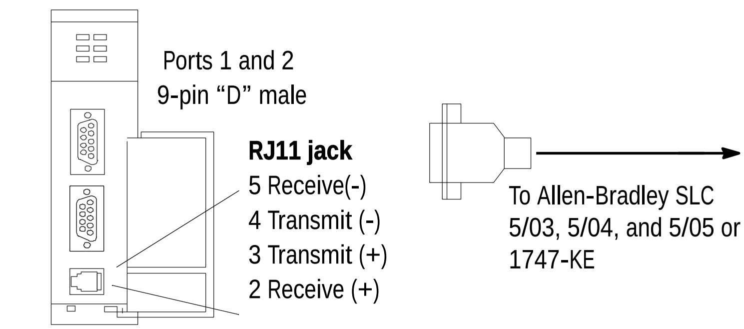


Table 8.H MARC, Inc. Model 166-101 Pin Assignments

Modem 9-pin male	Pin Name		Pin Name	SLC 9-pin male	1747-KE 9-pin male
2	RXD.OUT	—	RXD.IN	2	2
3	TXD.IN	—	TXD.OUT	3	3
4	DTR.IN	—	DTR.OUT	4[1]	4
5	SIG.GND	—	SIG.GND	5	5
6	DCD.OUT	—	DCD/DSR.IN	1	6
7	RTS.IN	—	RTS.OUT	7	7
8	CTS.OUT	—	CTS.IN	8	8

[1] Pin 4 is jumpered (within the connector) to pin 6

Switch Settings

For Bell 202 full-duplex operating mode, set the switches on Model 166-101 according to those in Table 8.I. For Bell 202 half-duplex operating mode (point-to-multipoint), set the switches on Model 166-101 according to those is Table 8.J.

ATTENTION: Switch settings shown here are for modems using RJ11 plugs on 4-wire lines. If you are using 2-wire lines, consult the MARC user manual.

Table 8.I
Model 166-101 Full-Duplex Switch Settings

Switch Assembly	1	2	3	4	5	6	7	8
1 Operating Mode	xxx	xxx	off	on	on	off	on	xxx
2 Transmit Level	off	on	off	off	off	off	off	off

Table 8.J
Model 166-101 Half-Duplex Switch Settings

Switch Assembly	1	2	3	4	5	6	7	8
1 Operating Mode	xxx	xxx	on	on	on	off	on	xxx
2 Transmit Level	off	on	off	off	off	off	off	off

MARC Model 137-001

The MARC 137-001 module is an asynchronous frequency-shift keyed (FSK) modem for use on leased lines or local twisted pairs. This modem, which fits into a single slot of the Allen-Bradley 1771 I/O chassis, features switch-selectable Bell and CCITT operating modes and adjustable transmit levels.

To connect an Allen-Bradley PLC-5 processor to MARC Model 137-001, follow these specifications for:

- cable pin assignments
- switch settings

Cable Pin Assignments

The Model 137-001 requires a 15-pin male connector with the pin assignments shown below or these MARC cable assemblies:

- 127-056 (1785-KE to MARC 137-001)
- 127-067 (1785 PLC-5/xx to MARC 137-001)

Figure 8.7
MARC, Inc. Model 137-001

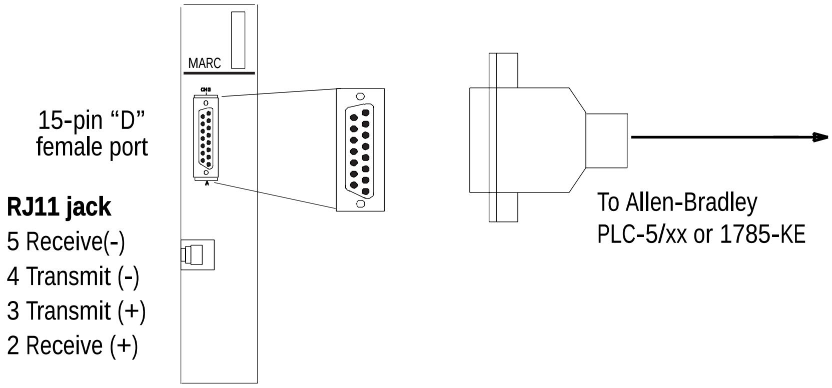


Table 8.K MARC, Inc. Model 137-001 Pin Assignments

Modem 15-pin female	Pin Name		Pin Name	PLC-5 25-pin female	1785-KE 15-pin female
1	DCD.OUT	—	DCD.IN	8	8
2	TXD.IN	—	TXD.OUT	2	2
3	RXD.OUT	—	RXD.IN	3	3
4	DTR.IN	—	DTR.OUT	20[1]	11[2]
5[3]	SIG.GND	—	SIG.GND	7	7[4]
7	RTS.IN	—	RTS.OUT	4	4
8	CTS.OUT	—	CTS.IN	5	5

[1]Pin 6 is jumpered (within the connector) to pin 20
[2]Pin 6 is jumpered (within the connector) to pin 11
[3]Pin 5 is jumpered (within the connector) to pin 9
[4]Pin 7 is jumpered (within the connector) to pin 13

Switch Settings

For Bell 202 full-duplex operating mode, set the switches on Model 137-001 according to those in Table 8.L. For Bell 202 half-duplex mode (point-to-multipoint), set the switches on Model 166-101 according to those in Table 8.M.

ATTENTION: Switch settings shown here are for modems using RJ11 plugs on 4-wire lines. If you are using 2-wire lines, consult the MARC user manual.

Table 8.L
Model 137-001 Full-Duplex Switch Settings

Switch Assembly	1	2	3	4	5	6	7	8
1 Operating Mode	off	on	on	off	on	xxx	xxx	xxx
2 Transmit Level	off	on	off	off	off	off	off	off

Table 8.M
Model 137-001 Half-Duplex Switch Settings

Switch Assembly	1	2	3	4	5	6	7	8
1 Operating Mode	on	on	on	off	on	xxx	xxx	xxx
2 Transmit Level	off	on	off	off	off	off	off	off

MARC Model 148-001

The MARC 148-001 comprises two 137-001 modems in a single package. You can operate the modems independently or in a redundant mode. This model fits into a single slot of the Allen-Bradley 1771 I/O chassis and features switch-selectable Bell and CCITT operating modes and adjustable transmit levels.

To connect an Allen-Bradley PLC-5 processor to MARC Model 148-001, follow these specifications for:

- cable pin assignments
- switch settings

Cable Pin Assignments

The Model 148-001 requires an RS-232 15-pin male connector with the pin assignments shown in Figure 8.8 or these MARC cable assemblies:

- 127-058 (1785-KE to MARC 148-001)
- 127-064 (1785 PLC-5/xx to MARC 148-001)

Figure 8.8
MARC, Inc. Model 148-001

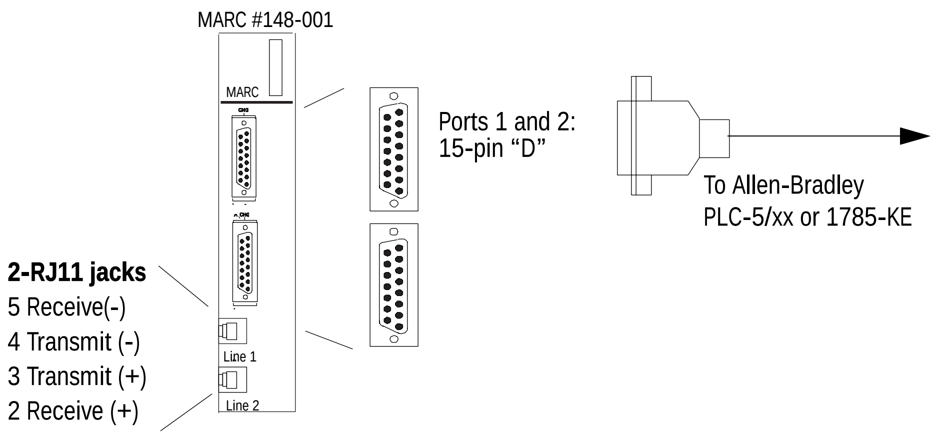


Table 8.N MARC, Inc. Model 148-001 Pin Assignments

Modem 15-pin female	Pin Name		Pin Name	PLC-5 25-pin female	1785-KE 15-pin female
2	TXD.IN	—	TXD.OUT	2	2
3	RXD.OUT	—	RXD.IN	3	3
4	RTS.IN	—	RTS.OUT	4	4
5	CTS.OUT	—	CTS.IN	5	5
7	SIG.GND	—	SIG.GND	7	7[1]
8	DCD.OUT	—	DCD.IN	8	8
11	DTR.IN	—	DTR.OUT	20[2]	11[3]

[1] Pin 7 is jumpered (within the connector) to pin 13
[2] Pin 20 is jumpered (within the connector) to pin 6
[3] Pin 11 is jumpered (within the connector) to pin 6

Switch Settings

For Bell 202 full-duplex operating mode, set the switches on Model 148-001 according to those in Table 8.O. For Bell 202 half-duplex operating mode (point-to-multipoint), set the switches on Model 148-001 to those in Table 8.P.

ATTENTION: Switch settings shown here are for modems using RJ11 plugs on 4-wire lines. If you are using 2-wire lines, consult the MARC user manual.

Table 8.O
Model 148-001 Full-Duplex Switch Settings

Switch Assembly	1	2	3	4	5	6	7	8
1 Operating Mode, Port 1	off	on	on	off	on	xxx	xxx	xxx
2 Transmit Level, Port 1	off	on	off	off	off	off	off	off
3 Operating Mode, Port 2	off	on	on	off	on	xxx	xxx	xxx
4 Transmit Level, Port 2	off	on	off	off	off	off	off	off

Table 8.P
Model 148-001 Half-Duplex Switch Settings

Switch Assembly	1	2	3	4	5	6	7	8
1 Operating Mode, Port 1	on	on	on	off	on	xxx	xxx	xxx
2 Transmit Level, Port 1	off	on	off	off	off	off	off	off
3 Operating Mode, Port 2	on	on	on	off	on	xxx	xxx	xxx
4 Transmit Level, Port 2	off	on	off	off	off	off	off	off

MARC Model 166-100

Model 166-100 Bell and CCITT compatible is a dial-up telephone modem that fits into one slot of the Allen-Bradley 1746 chassis.

To connect an Allen-Bradley SLC processor to this module, follow these specifications for:

- cable pin assignments
- switch settings

Cable Pin Assignments

The Model 166-100 requires a RS-232 9-pin "D"-shell female connector with the pin assignments shown below or these MARC cable assemblies:

- 127-070 (1747-KE to MARC 166-100)
- 127-077 (SLC 5/03, 5/04 or 5/05 to MARC 166-100)

Figure 8.9
MARC, Inc. Model 166-100

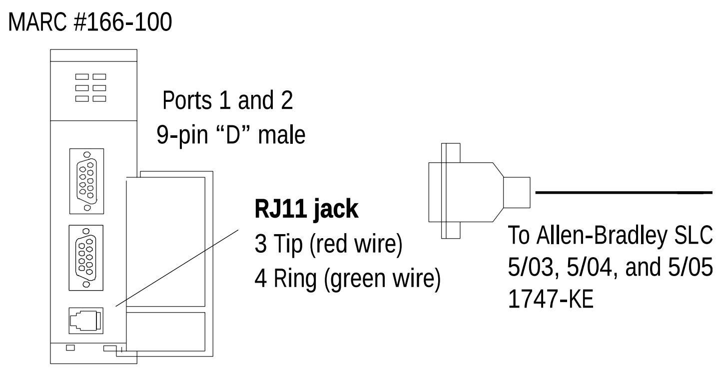


Table 8.Q MARC, Inc. Model 166-100 Pin Assignments

Modem 9-pin male	Pin Name		Pin Name	SLC 9-pin male	1747-KE 9-pin male
2	RXD.OUT	—	RXD.IN	2	2
3	TXD.IN	—	TXD.OUT	3	3
4	DTR.IN	—	DTR.OUT	4	4
5	SIG.GND	—	SIG.GND	5	5
6	DCD.OUT	—	DCD/DSR.IN	1(1)	6
7	RTS.IN	—	RTS.OUT	7	7
8	CTS.OUT	—	CTS.IN	8	8

(1)Pin 4 is jumpered (within the connector) to pin 6

Switch Settings

Set the switches on Model 166-100 according to those is Table 8.R.

Table 8.R
Model 166-100 Switch Settings

Switch Assembly	1	2	3	4	5	6	7	8
Transmit Level	off	on	off	off	off	off	off	off

MARC Model 166-010

Model 166-010 is a Bell and CCITT compatible dial-up telephone model that fits into a single slot of the Allen-Bradley 1771 I/O chassis.

To connect an Allen-Bradley PLC-5 processor to MARC Model 166-010, follow these specifications for:

- cable pin assignments
- switch settings

Cable Pin Assignments

The Model 166-010 requires a 15-pin male connector with the pin assignments shown below or these MARC cable assemblies:

- 127-079 (1785-KE to MARC 166-010)
- 127-078 (1785 PLC-5/xx to MARC 166-010)

Figure 8.10
MARC, Inc. Model 166-010

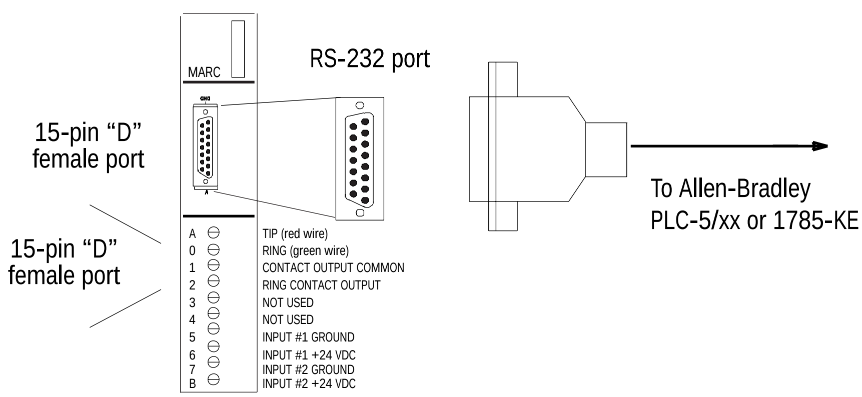


Table 8.S MARC, Inc. Model 166-010 Pin Assignments

Modem 15-pin female	Pin Name		Pin Name	PLC-5 25-pin female	1785-KE 15-pin female
2	TXD.IN	—	TXD.OUT	2	2
3	RXD.OUT	—	RXD.IN	3	3
4	RTS.IN	—	RTS.OUT	4	4
5	CTS.OUT	—	CTS.IN	5	5

Modem 15-pin female	Pin Name		Pin Name	PLC-5 25-pin female	1785-KE 15-pin female
7	SIG.GND	—	SIG.GND	7	7
8	DCD.OUT	—	DCD.IN	8[1]	8[1]
11	DTR.IN	—	DTR.OUT	20	11

[1]Pin 8 is jumpered (within the connector) to pin 6

Switch Settings

The Model 166-010 (-xxx) modems have a set of four 16-position rotary switches, S1 through S4, which are visible through an opening in the side of the module cases. S1 is used to select the number of rings to allow before answering a call. Setting S1 to zero will disable the auto answer mode entirely. S2 is used to select the dialing mode of the modem. Position 0 disables dial-out, position 1 enables dial-out through one of two 24 VDC inputs wired to the module swing arm, and position 2 enables ASCII string dialing using "AT" commands.

Switches S3 and S4 are only used on the Model 166-010-144 and -288 high speed modems. S3 sets the maximum modem connect baud rate, and S4 selects the baud rate used to communicate with the PLC. (Note that for the 2400 baud Model 166-010 modem, the maximum modem connect baud rate is fixed at 2400 and the baud rate to communicate with the PLC is fixed at 9600.) Setting both S3 and S4 to position 8 will allow the high speed modem to connect at the maximum baud rate it can negotiate with the remote modem, up to 14,400 or 28,800 baud, and communicate with the PLC at 19,200 baud.

Radio Modem Configurations

Radio modems communicate over a radio frequency band. The FCC requires that you obtain a license before you operate a radio modem at a particular location and frequency within certain radio frequency bands. Operating within a licensed radio frequency band minimizes the chance of transmission interference from other nearby radio modems. Unfortunately, in populated areas most, if not all, of the radio frequencies are already licensed and in use.

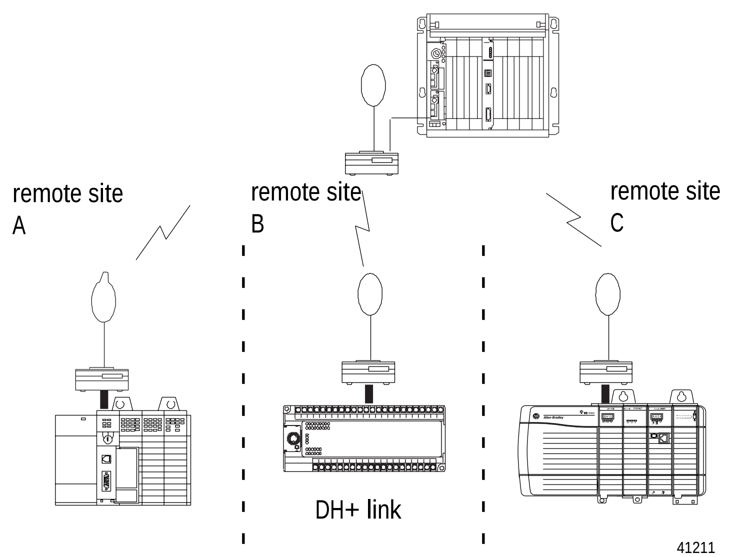
The FCC allows you to use relatively low transmit power spread-spectrum radio modems without a license. Spread-spectrum is a transmission-frequency varying technique that lets many spread-spectrum radios operate within the same radio frequency band with some interference. The amount of interference is directly proportional to the number of users in the area.

You can use radio modems for either point-to-point or point-to-multipoint applications. When communicating with Allen-Bradley programmable controllers, configure radio modems according to:

- the cable assignments listed here
- the switch and settings listed here
- your application

For information about these vendor's products:	See Page:
DATA-LINC GROUP	8-20
Electronic Systems Technology (ESTeem)	8-26
Microwave Data Systems (MDS)	8-31

Figure 8.11
Typical Configuration using Radio Modems and Allen-Bradley processors



DATA-LINC Group

For additional modem specifications consult your DATA-LINC user manual or www.data-linc.com

Use the following table to determine which DATA-LINC radio modem you need. Refer to Table 8.W for cabling information. Consult DATA-LINC for specific information regarding the installation of DATA-LINC products.

Spread-spectrum Frequency	Topology	A-B Protocol	Maximum Distance Line-of-Sight	DATA-LINC Model #
902-928 MHz	Point-to-Point	DF1 Full-duplex	20 miles	SRM 6000
	Point-to-Multipoint	DF1 Half-duplex		SRM 6000-SLC[1]
				SRM 6000-PLC[2]
2400-2484 MHz	Point-to-Point	DF1 Full-duplex	7 miles	SRM 6100
	Point-to-Multipoint	DF1 Half-duplex		SRM 6100-SLC[1]
				SRM 6100-PLC[2]
902-928 MHz	Point-to-Point	Ethernet[3]	15 miles	SRM 6200E
	Point-to-Multipoint			SRM 6200E-SLC[1]
				SRM 6200E-PLC[2]

(1) 1746 rack mount
(2) 1771 rack mount
(3) 10BASE-T connector

SRM6000/6100/6200E

The DATA-LINC SRM6000, SRM6100 and SRM6200E are license-free spread spectrum frequency hopping wireless modems that can interface with Allen-Bradley PLCs. The modems can be configured as master, remote, or repeater (SRM6000/6100 only) and data communications are asynchronous. Baud rates can be set as high as 115.2k.

To connect the SRM6000 and SRM6100 to the PLC, use a communication cable for your specific application - as indicated in the Cable Assemblies List. The modem connector pinout is as follows:

Table 8.T SRM6000 and SRM6100 pinout

SRM6000/6100 Pin #	PLC-5 25-Pin	AIC+, Logix5550, PC, and SLC 500 9-Pin	Assignment
1	8	1	Carrier Detect
2	3	2	Transmit Data
3	2	3	Receive Data
4	20	4	DTR
5	7	5	Signal Ground
6	6	6	DSR
7	4	7	RTS
8	5	8	CTS
9	NC	NC	Ground

Figure 8.12 SRM6000/6100 Front Panel

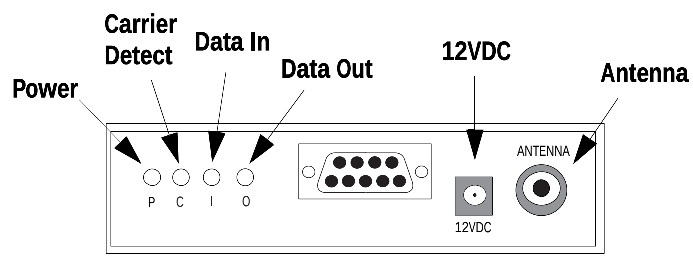
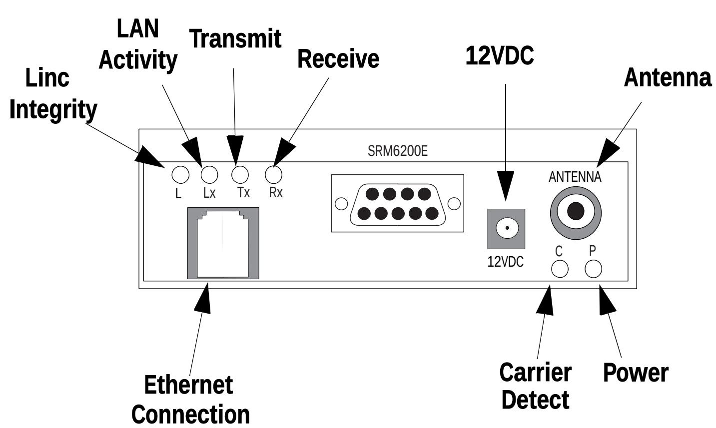


Figure 8.13 SRM6200E Front Panel



Data connection for the SRM6200E is via a RJ45 10BASE-T Ethernet port.

Important: SRM6000 Radio Modems can be installed in any SRM6200E system for use as repeaters (to extend system range or circumvent line-of-sight problems)

Switch Settings

There are no switches or jumpers to be set or adjusted. The SRM6000/6100/6200E comes preconfigured from the factory. Use the SRM6000/6100/6200E Users' Guide (available from DATA-LINC) for changing configuration in the field.

SRM6000/6100/6200E-SLC

The DATA-LINC SRM6000/6100/6200-SLC are license-free, spread spectrum frequency-hopping wireless modem that fits directly into the Allen-Bradley SLC 500 chassis. These modems draw a maximum of 500mA at 24VDC.

Important: For the SRM6000/6100/6200-SLC, the selected Allen-Bradley chassis power supply must be able to sustain the current requirements for all devices installed in the chassis, or communications could be interrupted.

The modems can be configured as master, remote, or repeater (SRM6000/6100-SLC only) and data communications are asynchronous. Baud rates can be set as high as 115.2k.

To connect the SRM6000-SLC or SRM6100-SLC to an SLC 500, use the DATA-LINC communication cable part number:

- C232/SRM60/SLC5/CH 0, CABLE ASSEMBLY SRM6000 to A-B SLC-5

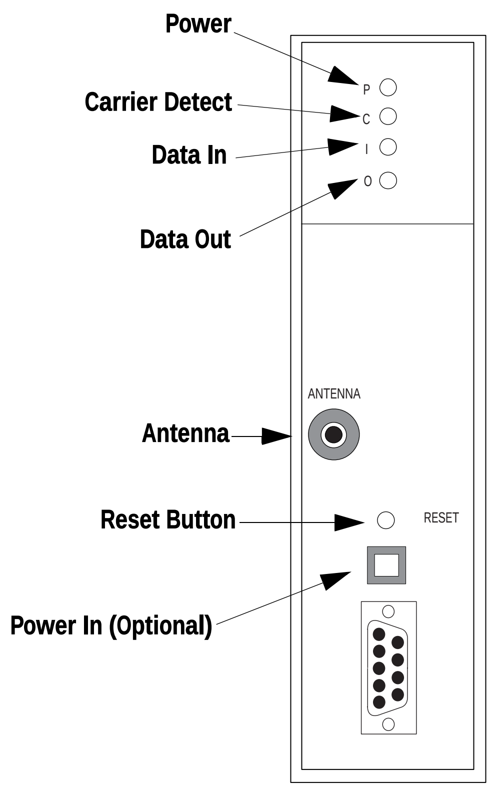
The modem connector pinout is as follows:

Table 8.U SRM6000-SLC and SRM6100-SLC pinout

SRM6000-SLC 6100-SLC Pin #	SLC 500	Assignment
1	1	Carrier Detect
2	2	Transmit Data
3	3	Receive Data
4	4	DTR
5	5	Signal Ground
6	6	DSR
7	7	RTS
8	8	CTS

SRM6000-SLC 6100-SLC Pin #	SLC 500	Assignment
9	NC	Ground

Figure 8.14 SRM6000-SLC and SRM 6100-SLC Front View



Data connection for the SRM6200E-SLC is via a RJ45 10BAST-T Ethernet port.

The SRM6000/6100/6200E-SLC are preconfigured. Use the SRM6000/6100/6200E-SLC User's Guide (available from DATA-LINC) to change configuration in the field.

SRM6000/6100/6200E-PLC

The DATA-LINC SRM6000/6100/6200E-PLC are license-free, spread spectrum frequency-hopping wireless modem that fits directly into the Allen-Bradley PLC-5 chassis. The modems can be configured as master, remote, or repeater (SRM6000/6100-PLC only), and data communications are asynchronous. Baud rates can be set as high as 115.2k.

To connect the SRM6000-PLC or SRM6100-PLC to a PLC-5, use the DATA-LINC communication cable part number:

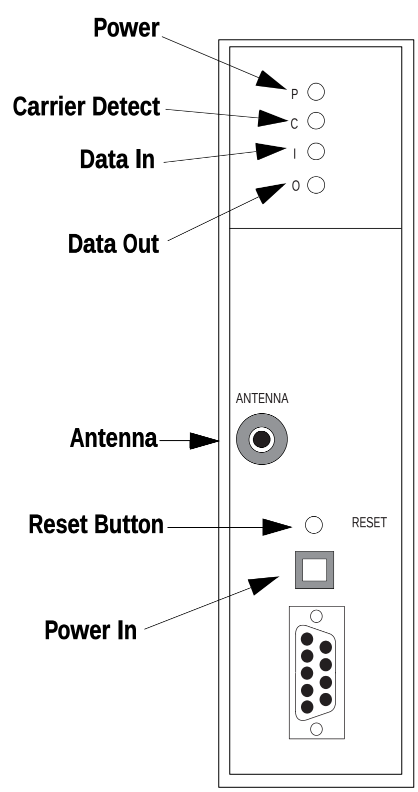
- C232/SRM60/PLC5/CH 0, CABLE ASSEMBLY SRM6000 to A-B PLC-5

The modem pinout is as follows:

Table 8.V SRM6000-PLC and SRM6100-PLC pinout

SRM6000 Pin #	PLC-5 25-Pin	Assignment
1	8	Carrier Detect
2	3	Transmit Data
3	2	Receive Data
4	20	DTR
5	7	Signal Ground
6	6	DSR
7	4	RTS
8	5	CTS
9	NC	Ground

Figure 8.15 SRM6000-PLC and SRM6100-PLC Front View



Data connection for the SRM6200E-PLC is via a RJ45 10BASE-T Ethernet port.

The SRM6000/6100/6200E-PLC are preconfigured from the factory.Use the SRM6000/6100/6200E-PLC User's Guide (available from DATA-LINC) to change configuration in the field via the DB-9 connector on the modem.

Connecting Cable Assemblies

Table 8.W DATA-LINC Connecting Cable Assemblies

DATA-LINC Part Number	Description
C232/SRM60/PLC5/CH 0	SRM6000 to PLC-5
C232/SRM60/SLC5/CH 0	SRM6000 to SLC-5
C232/SRM60/1785-KE	SRM6000 to 1785-KE
C232/SRM60/1770-KE	SRM6000 to 1770-KE
C232/SRM60/MLGXCBL	SRM6000 to 1761-CBL-PM02 Series B Cable (A-B MicroLogix cable)
C232/SRM60/1747-KE	SRM6000 to 1747-KE
C232/SRM60/PC	SRM6000 to PC
C232/SRM60/1771-DB	SRM6000 to 1771-DB
C232/SRM60/1770-KF2	SRM6000 to 1770-KF2
C232/SRM60/1770-KF3	SRM6000 to 1770-KF3
C232/SRM60/1770-KFC	SRM6000 to 1770-KFC
C232/SRM60/1770-KFD	SRM6000 to 1770-KFD
C232/SRM60/DUALPLC5/CH 0	SRM6000 to Dual PLC-5
C232/SRM60/1394SERVO	SRM6000 to 1394 Servo
C232/SRM60/PM-II	SRM6000 to A-B Power Monitor II

Electronic Systems Technology (ESTeem)

For additional modem specifications consult your ESTeem user manual or www.esteem.com

ESTeem licensed frequency radio modems support the Allen-Bradley DF1 communication protocol and provide a radio area network (RAN) interface to Allen-Bradley products, which allows peer-to-peer communications without the use of a conventional hard-wired network.

Using an ESTeem radio modem, Allen-Bradley Logix5550, PLC-5, SLC 500, and MicroLogix 1000 processors can communicate over the RAN using standard MSG instructions. ESTeem modems allow networking of full-duplex-to-full-duplex Allen-Bradley products.

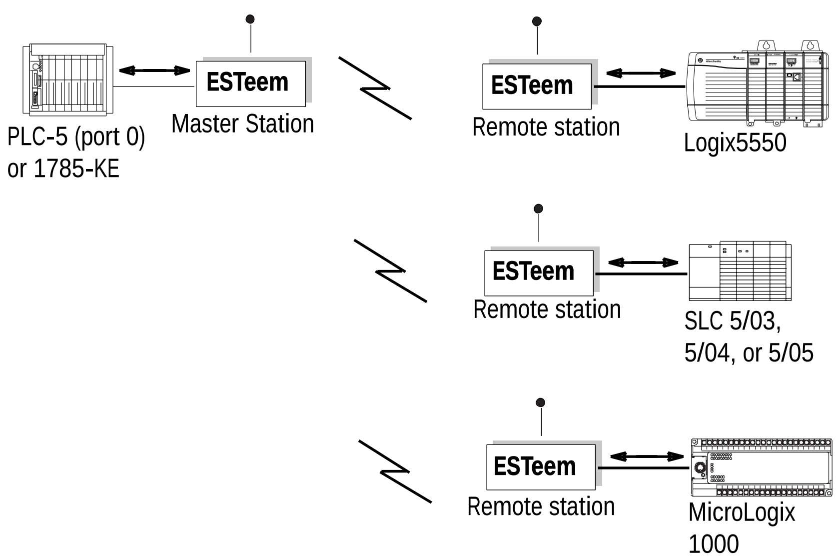
Choose an ESTeem modem based on:

- distance between sites
- operating environment
- frequency on which your application operates

Use the table below to choose the ESTeem model that fits your needs:

For this frequency:	And this distance:	Use this ESTeem Modem:
66-79 MHz	5 miles LOS	Model 192V
150-174 MHz	10 miles LOS - 2 watts 15 miles LOS - 4 watts	Model 192M
400-420 MHz	15 miles LOS	Model 192F
450-470 MHz	10 miles LOS - 2 watts 15 miles LOS - 4 watts	Model 192C

Figure 8.16
Typical ESTeem Modem Configuration



All ESTeem model 192 wireless modems have the following features or available options:

- 19,200 bps RF data rate
- integral digi-repeater
- frequency of operation programmable software
- receiver squelch programmable software
- remote programmability of all features over the RF, infrared or dial-in phone interface
- radio diagnostic programs included
- radio self-test
- packet monitor
- received signal-to-noise ratio
- received signal strength output (optional)
- infrared communication port for local programming and diagnostics
- phone communication port for remote programming and diagnostics (optional)

To connect an Allen-Bradley processor to these modems, follow these specifications for:

- cable pin assignments
- switch settings

For software configuration information, refer to ESTeem Engineering Report #97-001.

Cable Pin Assignments and Dip Switch Settings

ESTeem radio modems require a RS-232, 25-pin male “D”-shell connector with the pin assignments shown in Table 8.X. on the following page. Refer to Figure 8.18 and Table 8.Y for the RS-232 dip switch settings.

Figure 8.17
ESTeem Modem

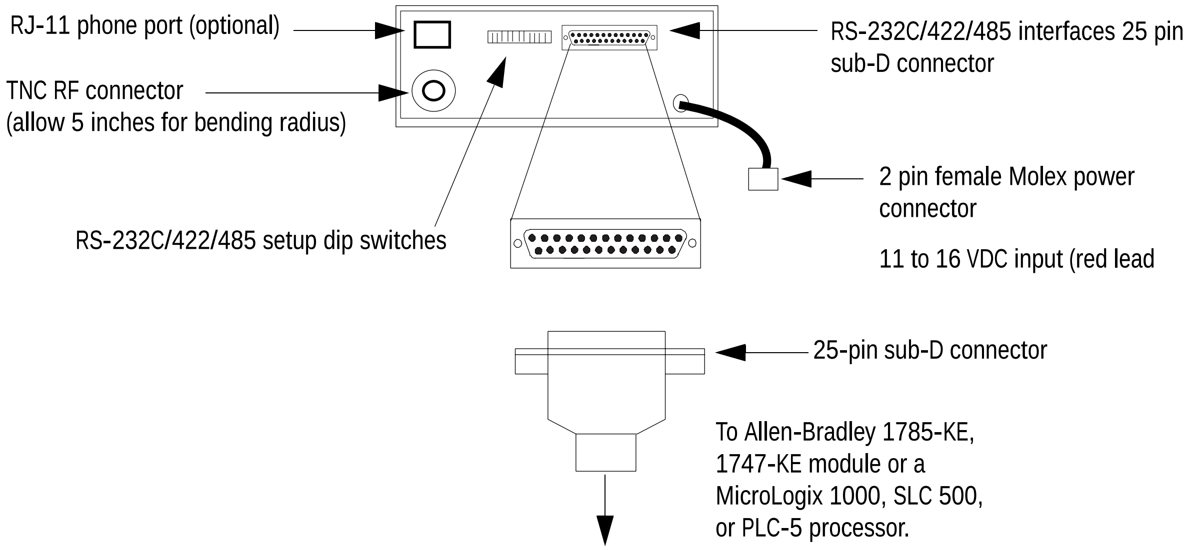


Table 8.X
Cable Pin Assignments for ESTeem Radio Modems

If you are connecting to an Allen-Bradley:	Use these pin assignments for cable interface from the ESTeem modem to the A-B module:				
	Modem 25-pin female[1]	**Pin Name**		**Pin Name**	**PLC-5 25-pin female**
PLC-5/11, -5/20, -5/30, -5/40, -5/60, or -5/80	2	TXD.IN	—	TXD.OUT	2
	3	RXD.OUT	—	RXD.IN	3
	4	RTS.IN	—	RTS.OUT	4
	5	CTS.OUT	—	CTS.IN	5
	6	DSR.OUT	—	DSR.IN	6
	7	SIG.GND	—	SIG.GND	7
	8	DCD.IN	—	DCD.OUT	8
	1	Shield			

[1] ESTeem cable # AA06 (6')

If you are connecting to an Allen-Bradley:	Use these pin assignments for cable interface from the ESTeem modem to the A-B module:
1785-KE	see table below
1747-KE 1746-BAS KF2 or KF3 module PC SLC 5/03, 5/04, or 5/05 Logix5550 or AIC+ for MicroLogix 1000	see table below

1785-KE

Modem 25-pin female(1)	Pin Name		Pin Name	1785-KE 15-pin female
NC	Shield	—	Shield	1
2	TXD.IN	—	TXD.OUT	2
3	RXD.OUT	—	RXD.IN	3
4	RTS.IN	—	RTS.OUT	4
5	CTS.OUT	—	CTS.IN	5
6	DSR.OUT	—	DSR.IN	6
7	SIG.GND	—	Signal	7
11	SIG.GND	—	Ground	13
8	DCD.OUT	—	DCD.IN	8
20	DTR.IN	—	DTR.OUT	11
22	RING	—	RING	9

(1) A-B 1770-CP cable (16.5')

1747-KE, 1746-BAS, KF2 or KF3 module, PC, SLC 5/03, 5/04, or 5/05, Logix5550 or AIC+ for MicroLogix 1000

Modem 25-pin female(1)	Pin Name		Pin Name	KF2, KF3 module 25-pin male	PC, SLC, Logix5550 and AIC+ 9-pin male
2	TXD.IN	—	TXD.OUT	2	3
3	RXD.OUT	—	RXD.IN	3	2
4	RTS.IN	—	RTS.OUT	4	7
5	CTS.OUT	—	CTS.IN	5	8
6	DSR.OUT	—	DSR.IN	6	6
7	SIG.GND	—	SIG.GND	7	5
8	DCD.IN	—	DCD.OUT	8	1
1	Shield				

(1) ESTeem cable # AA07 (6') for KF2, KF3.
ESTeem cable #AA061 (6') for all others.

Figure 8.18
ESTeem Switch Locations

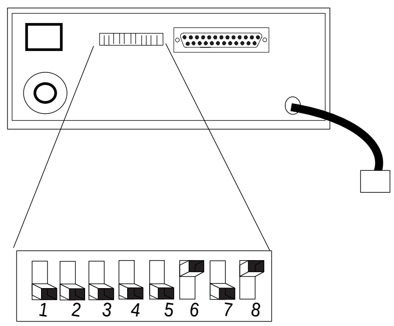


Table 8.Y
ESTeem Modem RS-232 Switch Settings

		Baud Rate (19200)			Data Format (8,N,1)				Auto Connect (Enabled)
Switch Bit		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Setting	for operation	off	off	off	off	off	on	off	on
	for programming[(1)]	off	off	off	off	off	on	off	off

[(1)]For information about programming this modem, see ESTeem Engineering Report #97-001.

Microwave Data Systems (MDS)

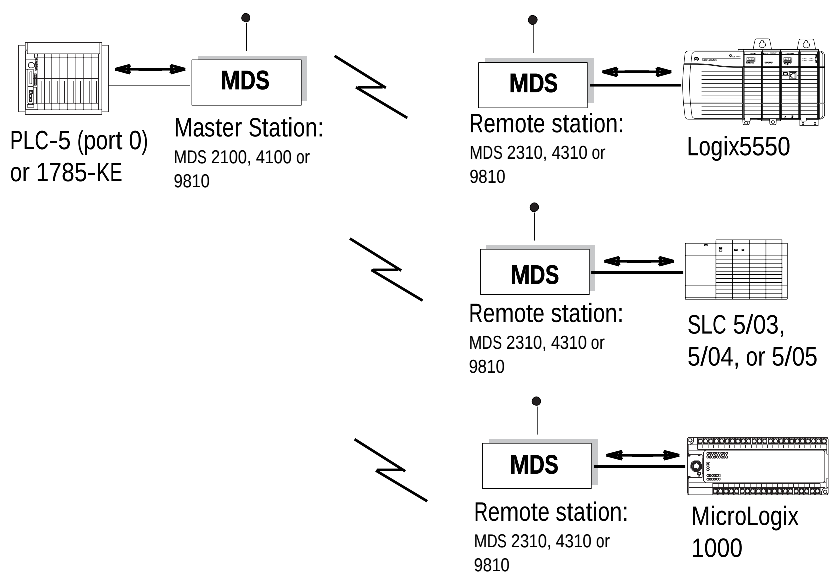
For additional modem specifications consult your MDS user manual or www.microwavedata.com

MDS supplies radio modems that communicate within point-to-point or multiple-address configurations.

The frequency on which your application operates determines the type of modem MDS recommends you use. Use the table below to choose the model that fits your needs:

For this frequency:	Use this MDS modem:	See page:
900-960 MHz	Model 2100 (master)	8-31
350-512 MHz	Model 4100 (master)	8-31
914-960 MHz	Model 2310 (remote)	8-32
350-512 MHz	Model 4310 (remote)	8-32
902-928 MHz (spread spectrum)	Model 9810	8-33

Figure 8.19
Typical SCADA configuration using MDS modems



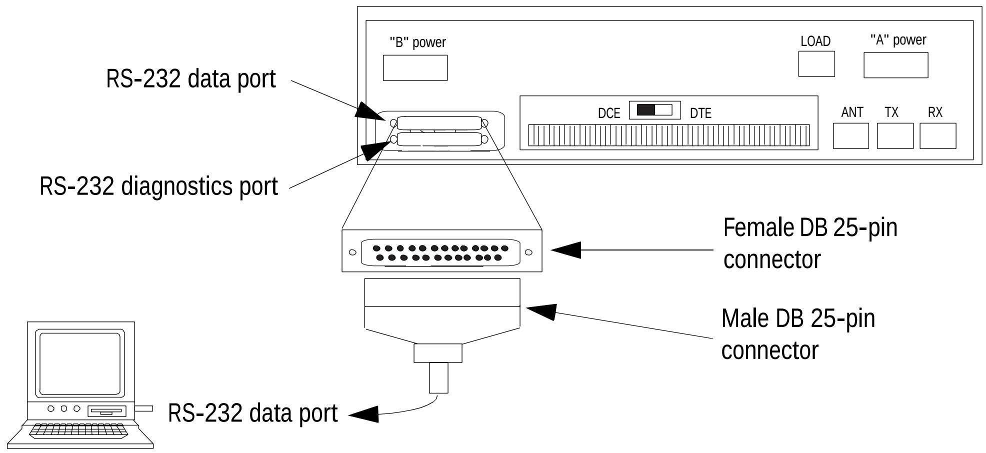
MDS Model 2100 and 4100 Master Stations

Models 2100 and 4100 are full-duplex, multiple address, master radio stations.

Cable Pin Assignments

Each of these models requires a 25-pin male connector with the following pin assignments:

Figure 8.20
MDS Model 2100 and Model 4100 Master Stations



Modem 25-pin female	Pin Name		Pin Name	PLC-5 25-pin female	SLC 9-pin male
1	Protective GND	—	Shield	1	CASE
2	TXD.IN	—	TXD.OUT	2	3
3	RXD.OUT	—	RXD.IN	3	2
4	RTS.IN	—	RTS.OUT	4	7
5	CTS.OUT	—	CTS.IN	5	8
6	DSR.OUT	—	DSR.IN	6	6
7	SIG.GND	—	SIG.GND	7	5
8	DCD.OUT	—	DCD.IN	8	1

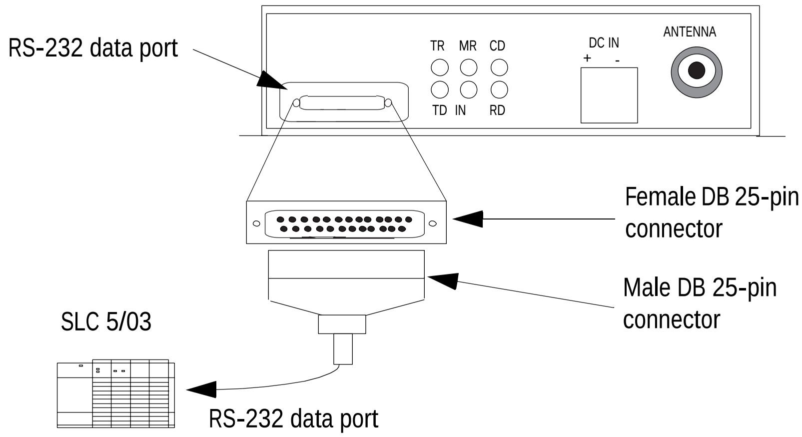
MDS Model 2310 and 4310 Remote Stations

Models 2310 and 4310 are multiple address, remote data transceiver stations.

Cable Pin Assignments

Each of these models requires a 25-pin male connector with the following pin assignments:

Figure 8.21
MDS Model 2310 and Model 4310 Remote Data Transceivers



Modem 25-pin female	Pin Name		Pin Name	PLC-5 25-pin female	SLC 9-pin male
1	Protective GND	—	Shield	1	CASE
2	TXD.IN	—	TXD.OUT	2	3
3	RXD.OUT	—	RXD.IN	3	2
4	RTS.IN	—	RTS.OUT	4	7
5	CTS.OUT	—	CTS.IN	5	8
6	DSR.OUT	—	DSR.IN	6	6
7	SIG.GND	—	SIG.GND	7	5
8	DCD.OUT	—	DCD.IN	8	1

Note: DSR.OUT provides a +8V DC DSR signal through a 1K-ohm resistor.

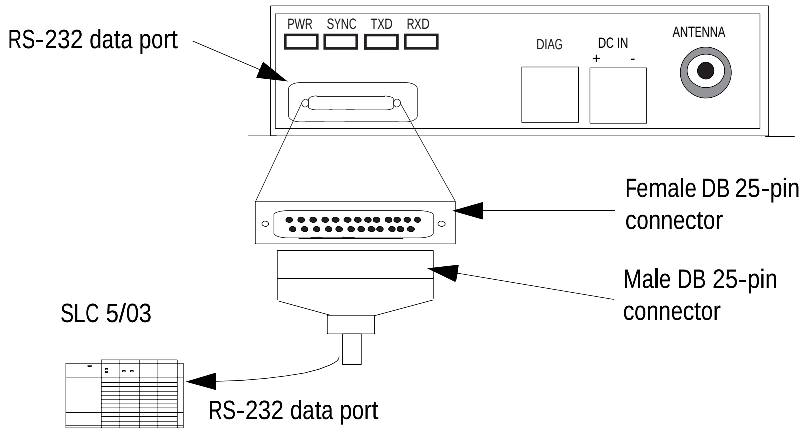
MDS Model 9810 Spread Spectrum

Model 9810 is a spread-spectrum modem, which operates under FCC Part 15 rules to provide unlicensed operation for point-to-point and multipoint radios. Spread-spectrum is a frequency-varying technique that lets several spread-spectrum modems operate within the same radio frequency band.

Cable Pin Assignments

Model 9810 requires a 25-pin male connector with the following pin assignments:

Figure 8.22
MDS Model 9810 Spread Spectrum Data Transceiver



Modem 25-pin female	Pin Name		Pin Name	PLC-5 25-pin female	SLC 9-pin male
1	Protective GND	—	Shield	1	CASE
2	TXD.IN	—	TXD.OUT	2	3
3	RXD.OUT	—	RXD.IN	3	2
4	RTS.IN	—	RTS.OUT	4	7
5	CTS.OUT	—	CTS.IN	5	8
6	DSR.OUT	—	DSR.IN	6	6
7	SIG.GND	—	SIG.GND	7	5
8	DCD.OUT	—	DCD.IN	8	1

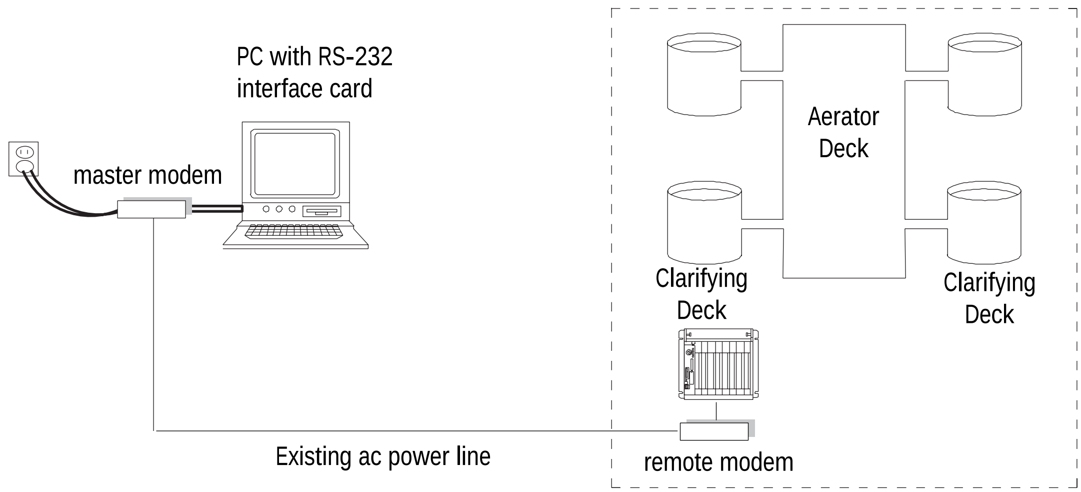
Note: DSR.OUT provides a +8V DC DSR signal through a 1K-ohm resistor.

Power Line Modem Configurations

Power line modems can also be used for SCADA applications. Instead of using dedicated lines to transmit data, power line modems are wired directly to existing ac cables in the plant or factory. You need only a power-delivery medium and an RS-232 interface.

When communicating with Allen-Bradley programmable controllers using power line modems, configure the modems according to the specifications in this section.

Figure 8.23
Typical power line modem configuration



DATA-LINC Group

For additional modem specifications consult your DATA-LINC user manual or www.data-linc.com

LCM100 Line Carrier Modem

Interfacing with Allen-Bradley equipment using facility power lines, the LCM100 permits full duplex asynchronous data communication over 120VAC or 240 VAC power lines at data rates up to 9600 baud. A system consisting of a master and a remote at ranges up to 800 feet through wire. The LCM100 can be configured for RS-232 or RS-422/485 communications. Communication through sliding contacts and brushes is possible with the LCM100.

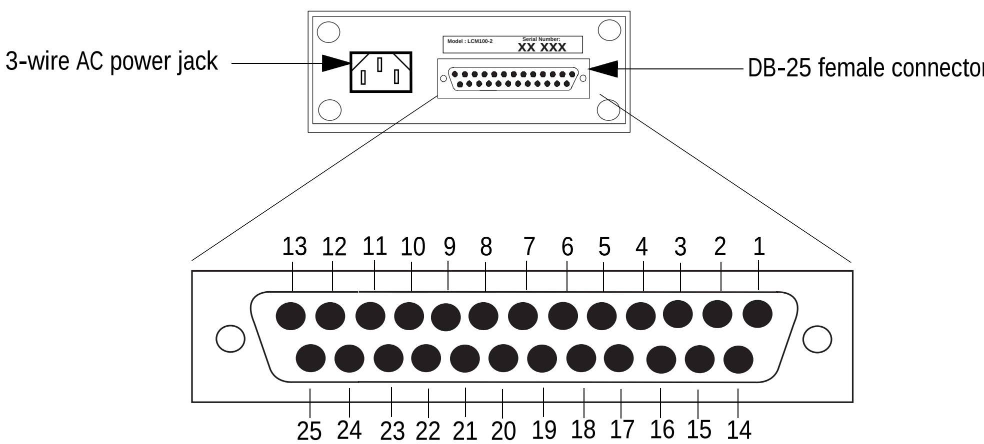
Important: The LCM100 installation must include a PLI500 Power Line Isolator.

Connection to the LCM100 is through the DB-25 female connector and the 3-wire AC powerjack located on the back of the unit

Table 8.Z LCM100 RS-232 Pin Functions and Pinout

LCM100 Pin #	Pin Name	Pin Name	PLC-5 25 Pin	SLC 500 9 Pin
1	PROTECT.GND	SHIELD	1	CASE
2	RXD.IN	TXD.OUT	2	3
3	TXD.OUT	RXD.IN	3	2
4	RTS	RTS.OUT	4	7
5	CTS	CTS.IN	5	8
6	DSR	DSR.IN	6	6
7	SIG.GND	SIG.GND	7	5
8	CD	DCD.IN	8	1
20	DTR	DTR.OUT	20	4

Figure 8.24 .LCM100 Connections and Pinout



Configuring RSLinx Software for DF1 Half-Duplex Communications

Use This Chapter…

…as a reference while configuring Rockwell Software RSLinx communication server software as a DF1 half-duplex polling master station or a DF1 half-duplex slave station.

RSLinx is the communications driver for other Windows-based Rockwell Software products, such as RSView32, which is an operator interface package, and RSLogix 500, which is a SLC programming package. Under Windows 95 or Windows NT, these software packages can all be run on the same PC, which means one PC can function as SCADA master, operator interface, and programming terminal. The Gateway version of RSLinx also adds the capability of allowing other PCs, also running RSLinx and connected to the SCADA master PC via local area or wide area Ethernet, to have the same access to the telemetry network as the SCADA master PC.

Configuring RSLinx Version 2.0 as a Master Station

Figure 9.1 through Figure 9.8 shows some sample screens for configuring the RSLinx DF1 half-duplex polling master communications driver. Some things to note in this example configuration are as follows:

- RTS control (hardware handshaking) is only available under Windows NT. If the master modem requires RTS/CTS or hardware handshaking, RSLinx must be run on a Windows NT personal computer
- The Modem Configuration option should be left as “No Modems” unless the telemetry network consists of dial-up telephone modems.

For more information about specific RSLinx DF1 half-duplex polling master configuration parameters, see the RSLinx online help.

Figure 9.1 General Driver Settings

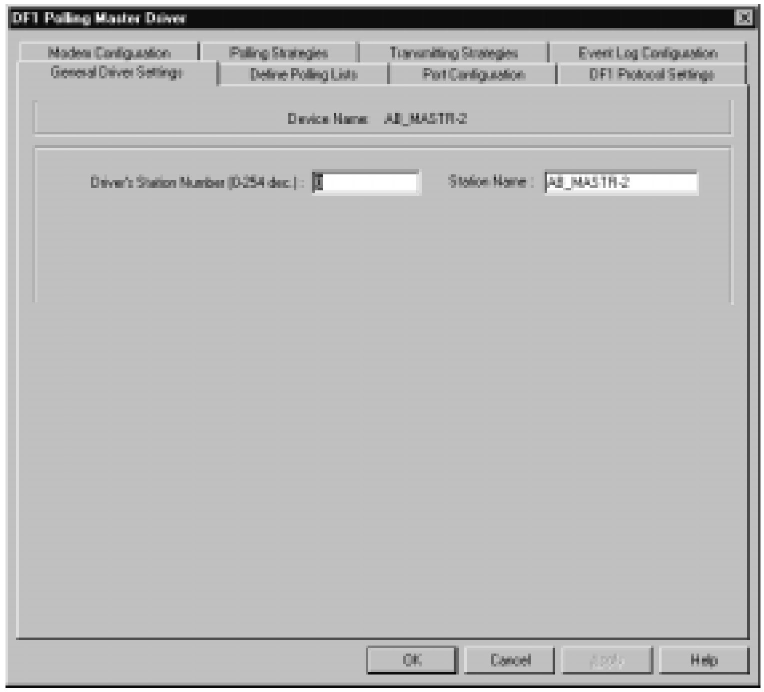


Table 9.A General Driver Settings Parameter Descriptions

Control	Control Text
Driver's Station Number (0-254 decimal)	Enter the station number for this driver. All packets sent to this station address will be forwarded to RSLinx. The default is 0
Station Name	RSLinx automatically gives each communications device a driver name, which consists of a Driver Type and Driver Number. The actual communications device determines the Driver Type, while the Driver Number corresponds with the instance of a given Driver Type. For example, the first instance of this driver is named AB_MSTR-1. The next driver instance would be named AB_MSTR-2.

Figure 9.2 Define Polling Lists

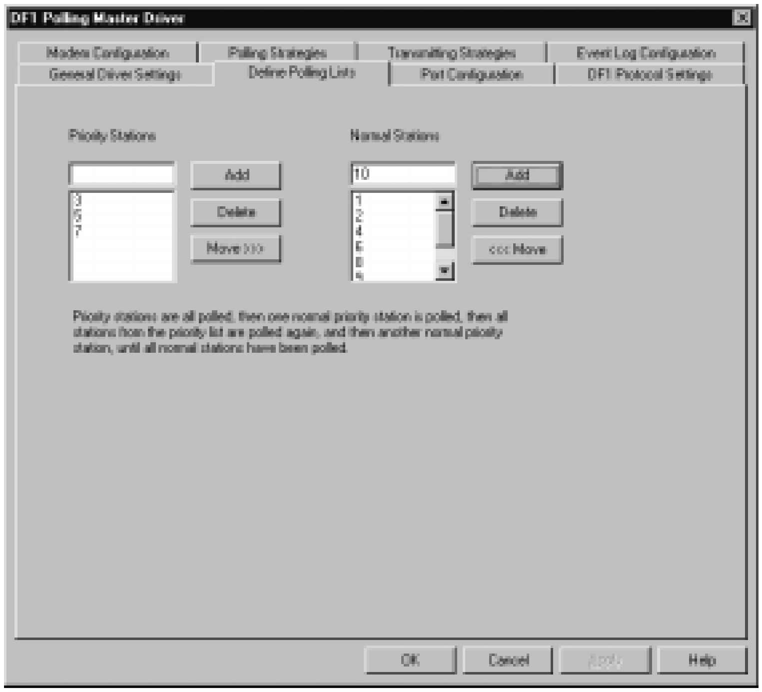


Table 9.B Define Polling Lists Parameter Description

Control	Control Text
Priority Stations	Stations defined as Priority are polled during every polling cycle. All Priority Stations are polled, and then one Normal Station is polled. All Priority Stations are polled again, and then another Normal Station is polled. This cycle continues until all Normal Stations are polled.
Priority Stations	Displays the current list of Priority Stations.
Add	Click this button to add a station to the Priority Stations list.
Delete	Click this button to delete a station from the Priority Stations list.
Move	Click this button to move a station from the Priority Stations list to the Normal Stations list.
Normal Stations	Stations defined as Normal are polled one at a time after each Priority Stations polling cycle. All Priority Stations are polled, and then one Normal Station is polled. All Priority Stations are polled again, and then another Normal Station is polled. This cycle continues until all Normal Stations are polled.
Normal Stations	Displays the current list of Normal Stations.
Add	Click this button to add a station to the Normal Stations list.
Delete	Click this button to delete a station from the Normal Stations list.
Move	Click this button to move a station from the Normal Stations list to the Priority Stations list.

Figure 9.3 Port Configuration

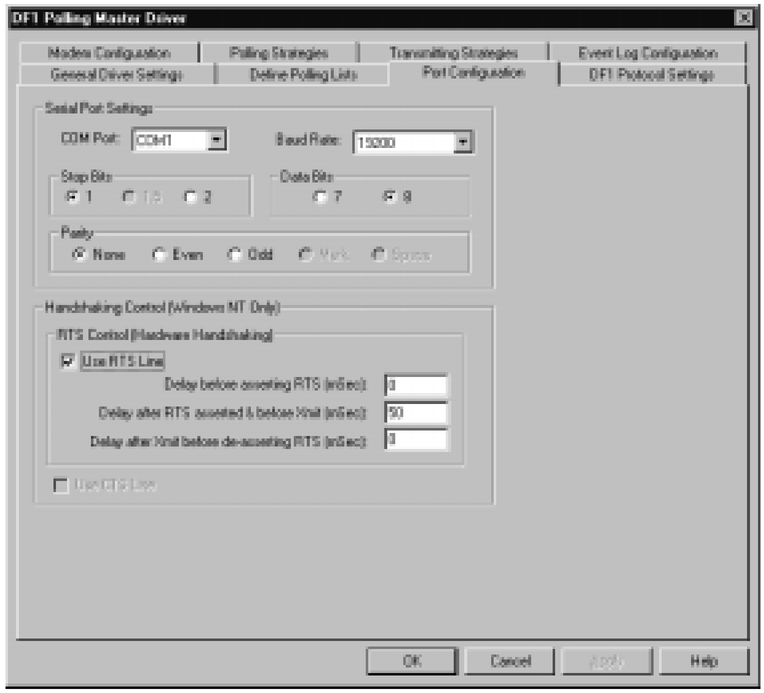


Table 9.C Port Configuration Parameter Descriptions

Control	Control Text
COM Port	Select the serial port of the computer which the polling master driver will use to communicate out of. Default is COM 1.
Baud Rate	Select the baud rate of the device with which the polling master driver will communicate. Default is 19200.
Stop Bits	Select the Stop Bits (1 or 2). Default is 1.
Data Bits	Select the Data Bits (7 or 8). Default is 8.
Parity	Select the parity of the device with which the polling master driver will communicate. Default is none.
Use RTS Line	In Windows NT only, if enabled, RTS is turned on when the polling master driver is about to begin a transmission, and turned off when the transmission is complete. This behavior may change based on the Hardware Handshaking timer values. If cleared, RTS is asserted (turned on) when the port is opened, and remains asserted until the driver is terminated. Default is unchecked.
Delay before asserting RTS (mSec)	This is useful when using half-duplex modems that require an off-delay timer to control the carrier wave. When the driver receives characters, it may assert the RTS line to begin its own transmissions before the sending slave has the opportunity to deassert the RTS line. This provides a minimum time delay between when the driver determines it needs to transmit something, and the time it actually asserts the RTS line. Default is 0.
Delay after RTS asserted & before Xmit (ms)	Some modems require a period of time after the RTS line is asserted for the carrier wave to stabilize. The character transmission is delayed for the period of time specified. These values may be expressed in milliseconds, but RSLinx actually rounds the value down to the nearest 10 milliseconds. Default is 50 ms.
Delay after Xmit before de-asserting RTS (ms)	Some modems require an off-delay after the last character is transmitted out the serial port before the RTS line is deasserted. These values may be expressed in milliseconds, but RSLinx actually rounds the value down to the nearest 10 milliseconds. Default is 0.
Use CTS Line	If enabled, characters will not be transmitted out the serial port unless the CTS line is asserted. Not currently implemented.

Figure 9.4 DF1 Protocol Settings

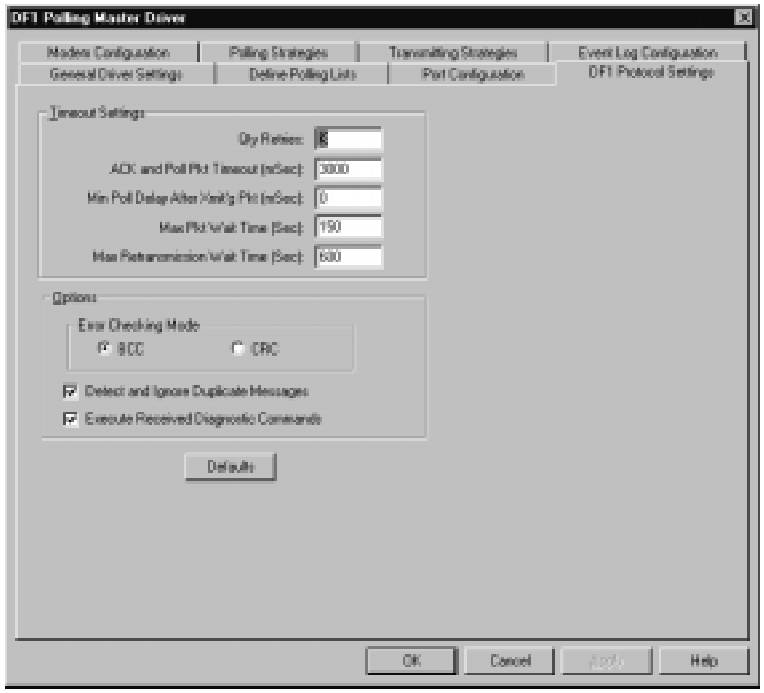


Table 9.D DF1 Protocol Settings Parameter Descriptions

Control	Control Text
Qty Retries	When polling and transmitting, this controls how many attempts are made before giving up on that operation. Zero (0) is not a legal value. Default is 3 retries
ACK and Poll Pkt Timeout (mSec)	Timeout value before the driver assumes that the current operation has failed. After failure, if the retry count has not been exceeded, the driver attempts it again. Default is 3000 ms.
Min Poll Delay After Xmit'g Pkt (mSec)	After the driver transmits a packet to a slave device, this is the minimum time it waits before polling the slave for responses. This is useful when there is a high overhead associated with connecting to the slave device (such as going through a dial-up modem), and the user wants a reply to a packet sent to the slave while still connected to it. Default is zero (0).
Max Pkt Wait Time (Sec)	Maximum period of time the driver keeps a packet buffered in memory while it is waiting for an opportunity to be transmitted to the slave. When this period is exceeded, the packet times out. Default is 150 seconds.
Max Retransmission Wait Time (Sec)	Similar to Mac Pkt Wait Time, except that Max Retransmission Wait Time applies to packets sent from one slave device to another slave device (where the driver acts as a forwarder of messages). Default is 600 seconds.
Error Checking Mode	Select BCC or CRC. All devices on the network must be configured the same. Default is BCC.
Detect and Ignore Duplicate Messages	If selected, the driver keeps the header information of the last packet received from each slave device in memory. If a new packet is identical to the last packet, it is considered a duplicate, so the slave is ACKed and the packet is discarded. Default is checked.
Execute Received Diagnostic Commands	Diagnostic command packets addressed to the same station address as the master are executed and reply packets are sent to the sender. If the checkbox is cleared, an error message is returned to the sender. Default is checked.
Defaults	Resets the default values for each control on the dialog box.

Figure 9.5 Modem Configuration

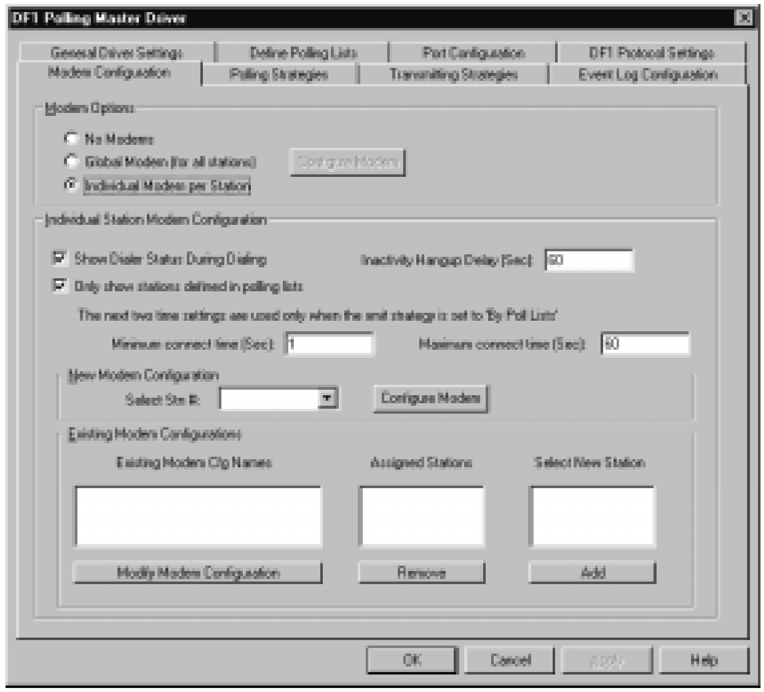


Table 9.E Dial-up Modem Configuration Parameter Description

Control	Control Text
Modem Options	Select to not use dial-up modems, to use one dial-up modem for all drivers, or to specify an individual dial-up modem for each station.
Configure Modem	Click this button to configure the modem after selecting the Global Modem option. This button is disabled if No Modems or Individual Modem per Station option is selected.
Show Dialer Status During Dialing	Enable to display a report of dialer station while dialing.
Only show stations defined in polling lists	Enable to display in the Select Stn # list only stations defined in a polling list. If cleared, all station numbers are displayed.
Inactivity Hangup Delay (Sec)	This is useful when using temporary polling lists, but no stations are defined. In this case, the driver remains connected to the last station it was talking to at the moment the last station was removed from the temporary polling list. After the time indicated here, the modem hangs up. A value of 0 indicates that it never tries to hang up.
Minimum connect time (Sec)	Enter the minimum amount of time in seconds the modem must be connected.
Maximum connect time (Sec)	Enter the maximum amount of time in seconds the modem must be connected.
Select Stn #	Choose a station number to configure.
Configure Modem	Click this to configure the modem dialing parameters for the station chosen in Select Stn #.
Existing Modem Cfg Names	Displays the modem configurations defined in the New Modem Configuration group box.
Modify Modem Configuration	Select a modem configuration listed in the Existing Modem Cfg Names list and click this button to modify the configuration.
Assigned Stations	Contains a list of station numbers assigned to the selected modem configuration name. More than one station may be assigned to a modem configuration.
Remove	Click this to delete an assigned station from the list.
Select New Station	Contains the list of available station numbers or the available station numbers for those stations defined in a polling list. If no station numbers display, there are no available stations to be configured because they have all been configured or no stations have been defined in polling lists, or Only show stations defined in polling lists is enabled.
Add	Select a station number from the Select New Station list and click this button to add the new station.

Figure 9.6 Polling Strategies

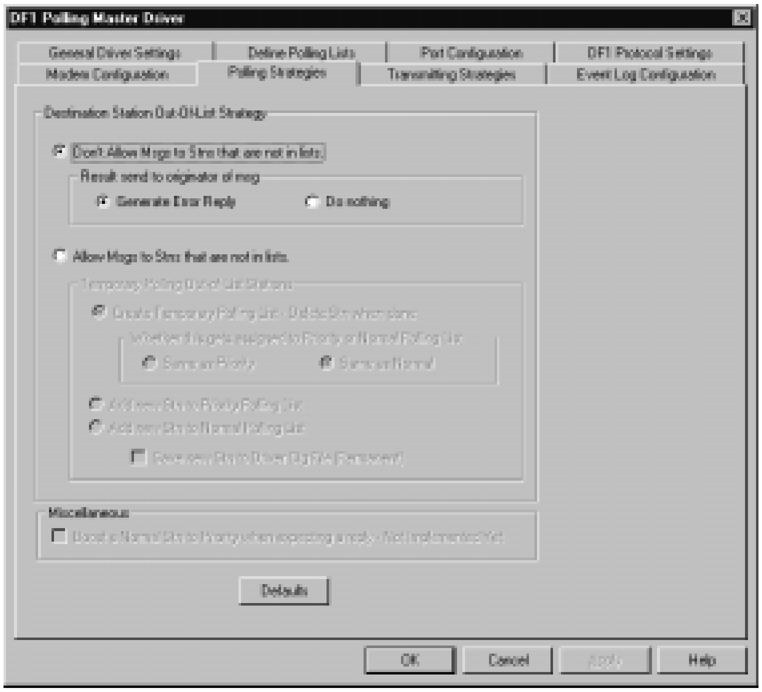


Table 9.F Polling Strategies Parameter Descriptions

Control	Control Text
Don't Allow Msgs to Stns that are not in lists	Enable this to prevent transmissions to stations not already defined in one of the polling lists. Depending on the Result send to originator of msg settings, the sender of the packet may or may not be informed by the driver that the packet was rejected. This is the default setting.
Result send to originator of msg	Select Generate Error Reply to instruct the driver to inform the sender that the station is not on the link by generating a packet with a status code of 2 (station not on a link). Select Do nothing to instruct the driver not to send any indication to the sender. Default is generate error reply.
Allow Msgs to Stns that are not in lists	Enable this to allow transmissions to stations not defined in one of the polling lists. This provides the ability to communicate to slave devices on an event triggered basis.
Create Temporary Polling List - Delete Stn when done	When the expected replies reach zero, the driver requests additional packets. If the slave answers with no packets, and no packets intended for the slave are buffered in the driver, this station is deleted from the dynamic polling list, and all activity to the slave ceases until another packet is received. Also, if the driver sends a polling packet to the slave and the slave is assumed to be inactive, the count is set to zero, and if no other packets are intended for the slave, the slave is removed from the temporary polling list.
Whether this gets assigned to Priority or Normal Polling List	When using temporary polling, the driver must know whether to treat these temporary stations the same as normal or priority polling stations.
Add new Stn to Priority Polling List	When a packet is intended for a slave that is not in one of the polling lists, the station is permanently added to the priority polling list and is treated the same as any other priority slave.
Add new Stn to Normal Polling List	When a packet is intended for a slave that is not in one of the polling lists, the station is permanently added to the normal polling list and is treated the same as any other normal slave.
Save new Stn to Driver Cfg File (Permanent)	When the station is added to the priority or normal polling list, the addition is only in effect until the driver is shut down. If this option is enabled, those stations are permanently added to the polling lists, and will display the next time the driver is used.
Boost a Normal Stn to Priority when expecting a reply	This feature is not yet implemented
Defaults	Resets the default values for each control on the dialog box.

Figure 9.7 Transmitting Strategies

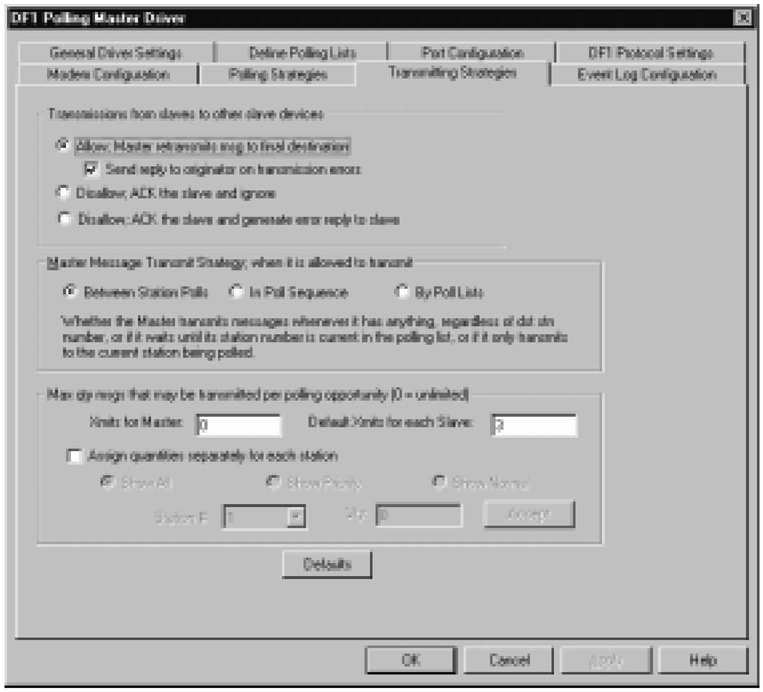


Table 9.G Transmitting Strategies Perameter Descriptions

Control	Control Text
Allow; Master retransmits msg to final destination	Allows slave to slave communications. This is the default setting.
Send reply to originator on transmission errors	When enabled, if the driver fails to forward a command packet (a reply is expected) to another target device, RSLinx generates a reply packet with a status code of 2 (station not on link). Default is checked.
Disallow; ACK the slave and ignore	The message from the slave is discarded with no indication given to the slave. This slave is responsible for timing out the packet and taking any required action.
Disallow; ACK the slave and generate error reply to slave	The message from the slave is discarded and a reply packet to the slave is generated with a status code of hex 10 (illegal command was received by the target station).
Between Station Polls	The master waits until any current polling cycles are complete before transmitting any packets that have buffered. This mode is not recommended when each station has its own dial-up modem configuration. This is default setting.
In Poll Sequence	The master can not transmit any messages buffered until its turn in the polling list is reached. The master station address must appear in either the normal or priority poll lists.
By Poll Lists	The master polls each slave in turn according to the polling lists, but only transmits to the slave which is the current station being polled.
Xmits for Master	When the master has something to transmit, if this is set to a non-zero value, the master ceases transmitting when that quantity of messages is reached and conducts another polling operation. If this is set to zero, the master transmits as many messages as it has buffered.
Default Xmits for each Slave	This limits the maximum number of times the master polls a slave before moving on to another slave to be polled.
Assign quantities separately for each station	The maximum number of polling packets the master sends to the slave may be regulated separately for each slave. Select to display all stations, or either Priority or Normal stations.
Station #	Select the station number to display.
Qty	Enter the number of packets to display.
Accept	Click this to accept the quantity entered for the station number.
Defaults	Resets the default values for each control on the dialog box.

Figure 9.8 Event Log Configuration

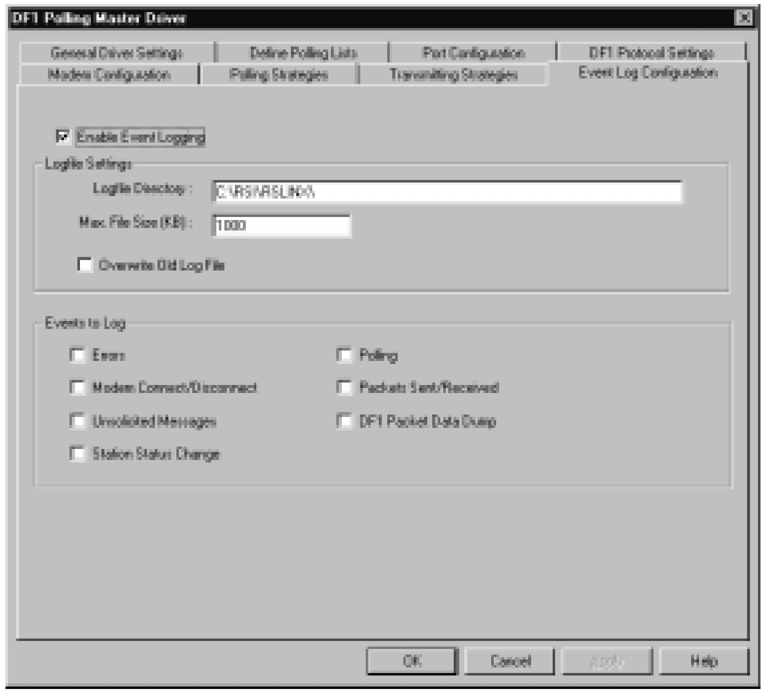


Table 9.H Event Log Configuration Parameter Descriptions

Control	Control Text
Enable Event Logging	Enable this to set the event logging parameters. Default is unchecked.
Logfile Directory	Specify the directory where you want the log file to be generated.
Max. File Size (KB)	Enter the maximum amount (in kilobytes) that the size of the log file can be.
Overwrite Old Log File	Enable this to overwrite the existing log file in the specified directory.
Events to Log	Select the specific events to be included in the log file.

Configuring RSLinx Version 2.1 as a Slave Station

Figure 9.9 through Figure 9.13 shows some sample screens for configuring the RSLinx DF1 half-duplex slave communications driver. Some things to note in this example configuration are as follows:

- RTS control (hardware handshaking) is only available under Windows NT. If the slave modem requires RTS/CTS or hardware handshaking, RSLinx must be run on a Windows NT personal computer.
- The Modem Configuration option should be left as “No Modems” unless the telemetry network consists of dial-up telephone modems.

For more information about specific RSLinx DF1 half-duplex slave configuration parameters, see the RSLinx online help.

Figure 9.9 DF1 Slave Driver General Configuration

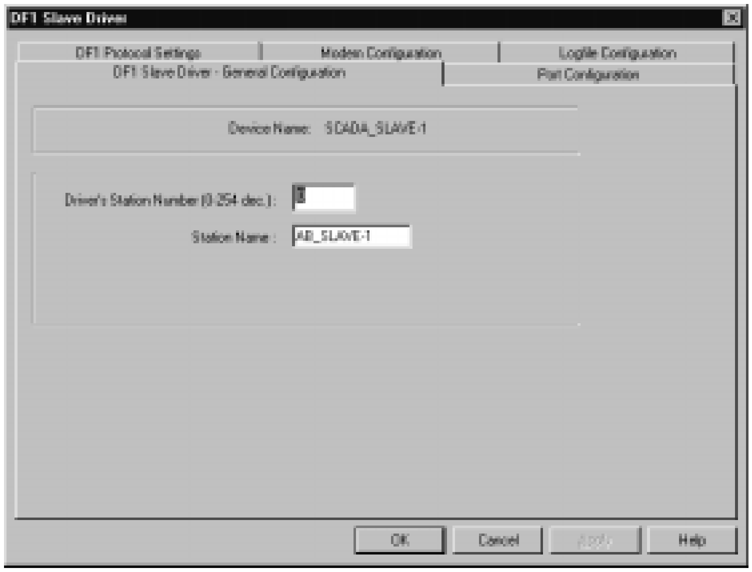


Table 9.I General Driver Settings Parameter Descriptions

Control	Control Text
Driver’s Station Number (0-254 decimal)	Enter the station number for this driver. All packets sent to this station address will be forwarded to RSLinx. Default is 0.
Station Name	RSLinx automatically gives each communications device a driver name, which consists of a Driver Type and Driver Number. The actual communications device determines the Driver Type, while the Driver Number corresponds with the instance of a given Driver Type. For example, the first instance of this driver is named AB_SLAVE-1. The next driver instance would be named AB_SLAVE-2.

Figure 9.10 Slave Port Configuration

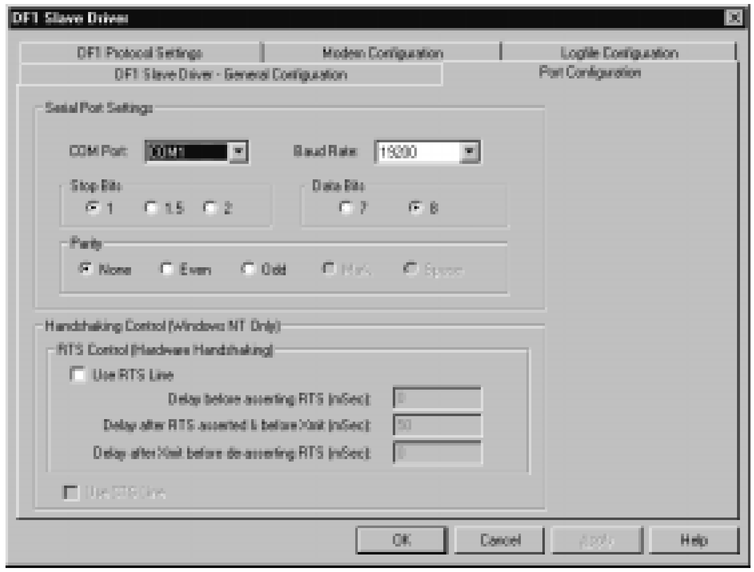


Table 9.J Port Configuration Parameter Descriptions

Control	Control Text
COM Port	Select the serial port of the device with which the polling slave driver will communicate. Default is COM1.
Baud Rate	Select the baud rate of the device with which the polling slave driver will communicate. Default is 19200.
Stop Bits	Select the Stop Bits (1, 1.5 or 2). Default is 1.
Data Bits	Select the Data Bits (7 or 8). Default is 8.
Parity	Select the parity of the device with which the polling slave driver will communicate. Default is None.
Use RTS Line	In Windows NT only, if enabled, RTS is turned on when the polling slave driver is about to begin a transmission, and turned off when the transmission is complete. This behavior may change based on the Hardware Handshaking timer values. If cleared, RTS is asserted (turned on) when the port is opened, and remains asserted until the driver is terminated. Default is unchecked.
Delay before asserting RTS (mSec)	This is useful when using half-duplex modems that require an off-delay timer to control the carrier wave. When the driver receives characters, it may assert the RTS line to begin its own transmissions before the sending slave has the opportunity to deassert the RTS line. This provides a minimum time delay between when the driver determines it needs to transmit something, and the time it actually asserts the RTS line. Default is 0.
Delay after RTS asserted & before Xmit (mSec)	Some modems require a period of time after the RTS line is asserted for the carrier wave to stabilize. The character transmission is delayed for the period of time specified. These values may be expressed in milliseconds, but RSLinx actually rounds the value down to the nearest 10 milliseconds. Default is 50 ms.
Delay after Xmit before de-asserting RTS (mSec)	Some modems require an off-delay after the last character is transmitted out the serial port before the RTS line is deasserted. These values may be expressed in milliseconds, but RSLinx actually rounds the value down to the nearest 10 milliseconds. Default is 0.
Use CTS Line	If enabled, characters will not be transmitted out the serial port unless the CTS line is asserted. Not currently implemented.

Figure 9.11 DF1 Slave Protocol Settings

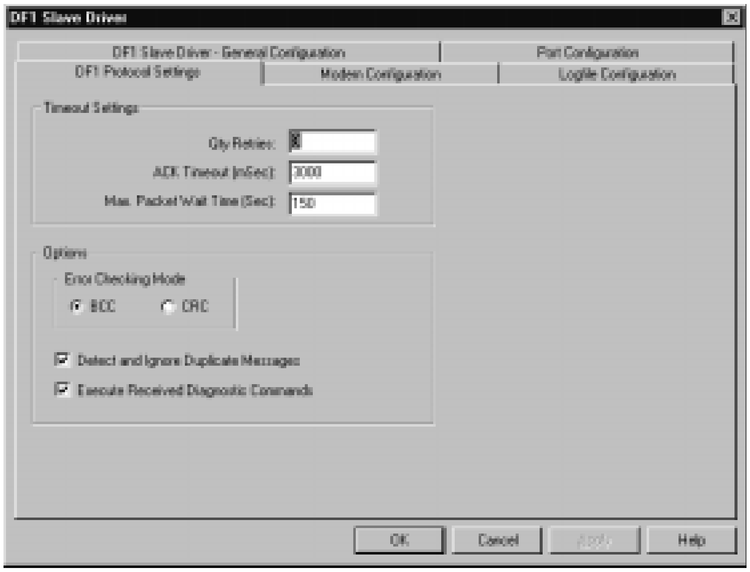


Table 9.K DF1 Protocol Settings Parameter Descriptions

Control	Control Text
Qty Retries	When polling and transmitting, this controls how many attempts are made before giving up on that operation. Zero (0) is not a legal value. Default is 3 retries.
ACK Timeout (mSec)	Timeout value before the driver assumes that the current operation has failed. After failure, if the retry count has not been exceeded, the driver attempts it again. Default is 3000 ms.
Max Pkt Wait Time (Sec)	Maximum period of time the driver keeps a packet buffered in memory while it is waiting for an opportunity to be transmitted to the slave. When this period is exceeded, the packet times out. Default is 150 seconds.
Error Checking Mode	Select BCC or CRC. All devices on the network must be configured the same. Default is BCC.
Detect and Ignore Duplicate Messages	If selected, the driver keeps the header information of the last packet received from the master in memory. If a new packet is identical to the last packet, it is considered a duplicate, so the slave is ACKed and the packet is discarded. Default is checked.
Execute Received Diagnostic Commands	Diagnostic command packets addressed to the same station address as the slave are executed and reply packets are sent to the sender. If the checkbox is cleared, an error message is returned to the sender. Default is checked.

Figure 9.12 Slave Modem Configuration

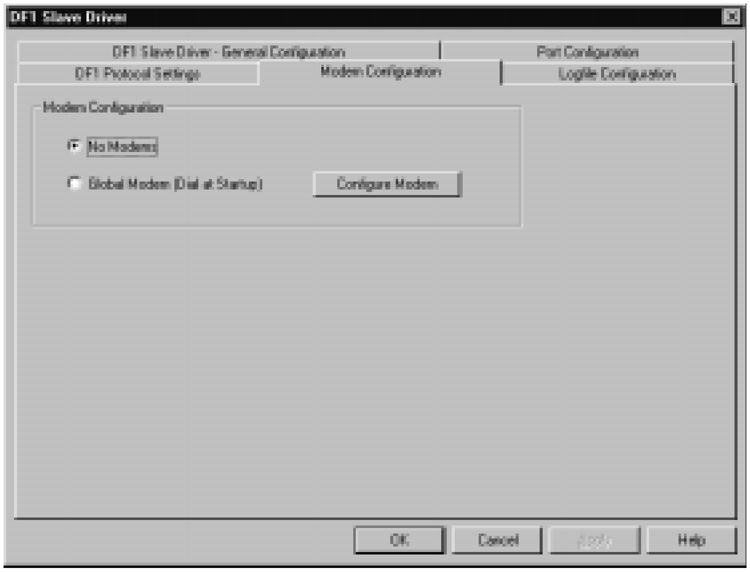


Table 9.L Slave Dial-up Modem Configuration Parameter Description

Control	Control Text
Modem Options	Select to not use or not to use a dial-up modem.
Configure Modem	Click this button to configure the modem after selecting the Global Modem option. This button is disabled if No Modems option is selected.

Figure 9.13 Slave Logfile Configuration

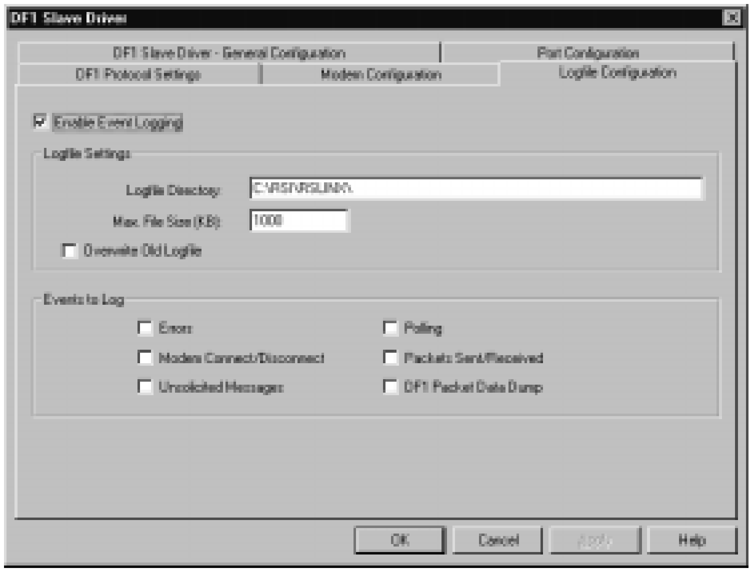


Table 9.M Event Log Configuration Parameter Descriptions

Control	Control Text
Enable Event Logging	Enable this to set the event logging parameters. Default is unchecked.
Logfile Directory	Specify the directory where you want the log file to be generated.
Max. File Size (KB)	Enter the maximum amount (in kilobytes) that the size of the log file can be.
Overwrite Old Log File	Enable this to overwrite the existing log file in the specified directory.
Events to Log	Select the specific events to be included in the log file.

Using Dial-up Telephone Communication

Use This Chapter…

…to set up and initiate dial-up communication. This chapter pertains to only the enhanced PLC-5 processors and the SLC 5/03, 5/04, and 5/05 processors.

Note: A Micrologix 1000 controller may be on the receiving end of a dial-up modem connection using an auto-answer phone modem, but it has no means to cause its modem to initiate or hang-up a phone modem connection.

If you:	Then use this chapter:
are setting up a dial-up communication system for the first time	along with chapters 2, 4, and 8
have set up and configured Enhanced PLC-5 and/or SLC 5/03, 5/04, or 5/05 systems	as a reference

Overview

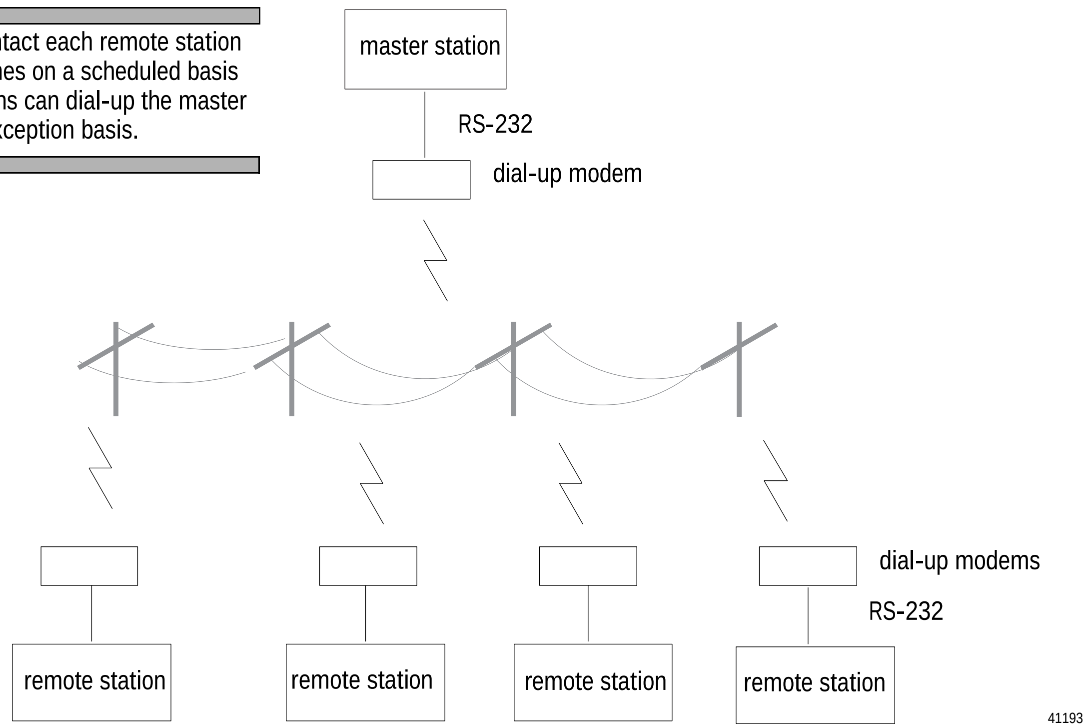
You can implement dial-up communication in a telemetry system as shown in the following configurations (Figure 10.1 and Figure 10.2):

Figure 10.1
Use dial-up communication for peer-to-peer communication between processors.

Useful for applications that do not require extensive communication time.

Figure 10.2
Use the public switched telephone network to communicate between a master station and multiple remote stations.

A master station can contact each remote station through the telephone lines on a scheduled basis and/or the remote stations can dial-up the master station on a report-by-exception basis.



Setting up the System

Before you can begin sending messages over the telephone line, you must:

- install the processor
- configure the processor
- configure the modems

Install the Processor

Use this table to guide you through the steps for installing processors. Follow these steps for every processor in your system.

For this processor:	Do the following:	See:
Enhanced PLC-5	**1.** Define the DH+ station address for the processor by setting switch bank SW1.	1785-5.7
	2. Set switch bank SW2 for RS-232C.	chapter 2
	3. Slide the processor into the leftmost slot of the chassis. Lock the locking bar.	1785-5.7
SLC 5/03, 5/04, 5/05	Slide the processor into the leftmost slot of the chassis	1747-6.2

Configure the Processor

Configure the processor's serial channel (channel 0) for full-duplex DF1 protocol and full-duplex modem using RSLogix software.

For example configurations, see the chapter in this book that pertains to the processor you are configuring.

Configure the Modems

There are three RS-232 control signals critical to the operation of dial-up modems with PLC-5, SLC 5/03, 5/04, and 5/05 processors (when channel zero is configured for full-duplex modem support), as well as to 1785-KE and 1747-KE modules: Data Set Ready (DSR), Carrier Detect (CD), and Data Terminal Ready (DTR). DSR and CD are signals the modem produces and the attached processor or module senses, while DTR is a signal the processor or module produces to control its dial-up modem. DSR must be configured in the modem to be on (or high) whenever a modem connection exists and off (or low) otherwise. CD must be configured in the modem to be on (or high) whenever a modem carrier from a remote modem is being received and off (or low) otherwise. For DTR, the modem should be configured to disconnect an existing connection when the processor or module transitions DTR from on to off (or high to low).

This RS-232 control signal operation is configured into the dial-up modem in at least one of three ways, depending on the model: through dip switch settings, through pushbutton control panels, or by sending standard “AT” ASCII commands to the modem’s RS-232 port. The ASCII string to send to the modem that supports “AT” commands to configure the RS-232 control signals to operate as described above is as follows: `AT &S1 &C1 &D2 Q1 E &W.`

The ASCII string should be sent to the modem followed by carriage return and line feed control characters. Note that the “Q1” and “E” disable response codes and local character echo, and the “&W” saves the configuration to the modem’s nonvolatile memory, if available.

See chapter 8 for example cable configurations for specific dial-up modems.

Communicating over the Telephone Line

To communicate over the telephone line, do the following:

- initiate modem dialing
- verify connection to the remote modem
- transfer data back and forth
- hang up the telephone link

Initiate Modem Dialing

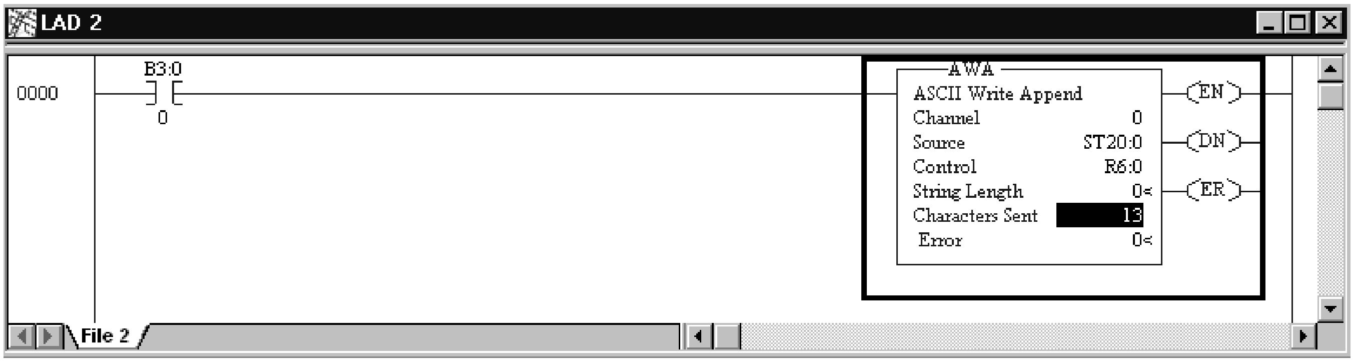
To initiate dialing from an enhanced PLC-5 processor or a SLC 5/03, 5/04, or 5/05 processor, use the ASCII write with append instruction (AWA). This instruction lets you send an ASCII string out the serial port with no protocol framing added, despite the fact that the serial port has been configured for DF1 protocol. By sending the dialing command string to the modem, the modem then dials the telephone number given, which lets the two modems establish a connection.

Figure 10.3 is a sample ladder logic rung used to trigger the AWA instruction to send the dialing string (stored in a data file) to a modem.

Figure 10.3
To dial a modem from the processor, use an AWA instruction and store the telephone number to be dialed in a string file element via the programming software.

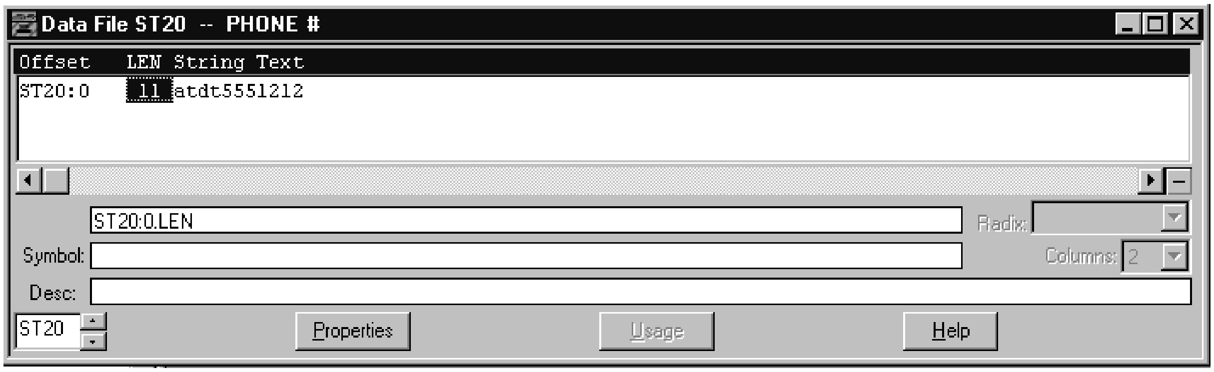
In this example, when the B3:0/0 bit is set, the processor sends the ASCII string atdt5551212 out the serial port. This causes the modem to attempt to dial the number (5551212) and establish the telephone link.

To enter this type of rung into your ladder logic, go to the Instruction Toolbar of your RSLogix programming software and choose the AWA symbol under the ASCII Control tab.



The length of the string being sent is 0, which specifies the whole string. When the instruction is executed, all characters in the string (ST20:0) will be sent.

Use data monitor to store the telephone number within the source address of the AWA. To get there, Double-click the data file icon in the project tree that contains the data you want to monitor. In this case, file ST20.



The number being dialed in this example is a local number. If the number were long distance, the number in the string file would have to include a 1 and the area code, for example: 14145551212. The dialing string must be set to exactly what you would send if you were dialing from a dumb terminal.

Verify Connection to the Remote Modem

To determine whether a connection to a remote modem is established, start a modem connection timer upon triggering the dialing string and monitor the channel zero lost modem bit in the status file to determine when the connection is successful. (Note that the lost modem bit goes from a one to a zero when the connection is established.) In a PLC-5 processor, the lost modem bit address is S:17/5, while in the SLC 5/03, 5/04, and 5/05 processors, the address is S:5/14. If the user-configured connection timer times out before the lost modem bit resets, most likely either the remote modem is not answering or the number is busy. In this case, the modem hangup sequence should be initiated and the phone connection retried later.

Once a successful connection is established, you can begin message-based data transfer. Remember that this link is a peer link, which means that both processors can initiate read and write requests as required over the modem link.

Transfer Data

Messaging using dial-up telephone modems is the same as described in Chapters 2 and 4 of this manual.

Disconnect the Telephone Link

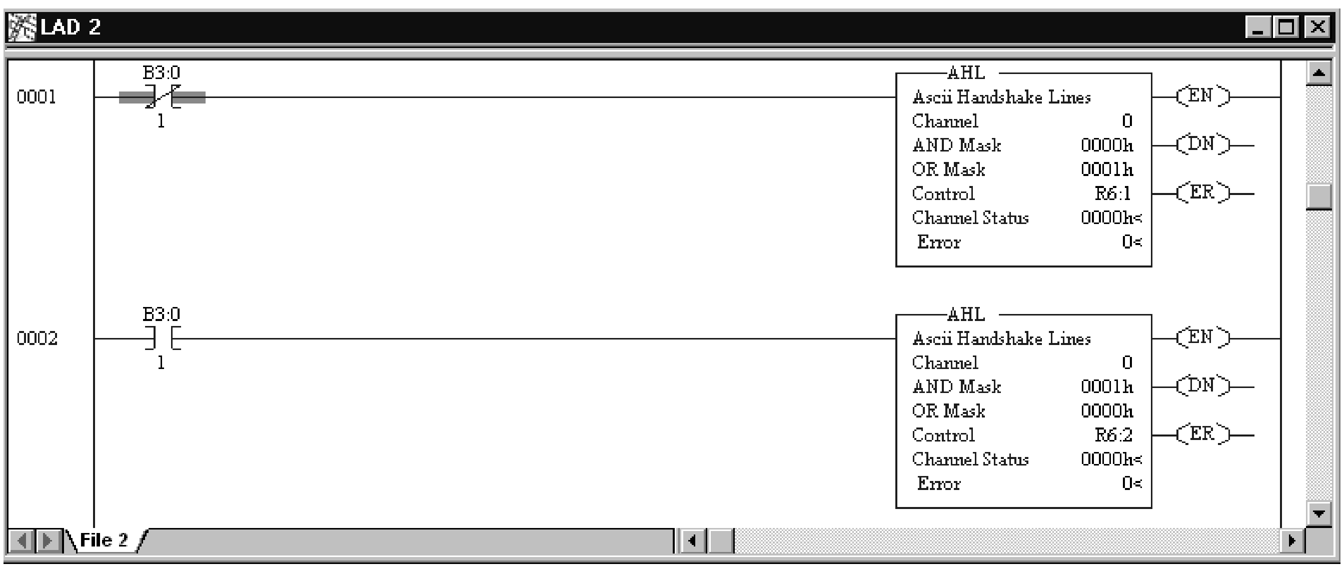
To disconnect the telephone link, use the ASCII handshake lines instruction (AHL) to toggle DTR from high to low and back to high again. To set DTR high, trigger the AHL with an AND mask of 0000 and an OR mask of 0001. To set DTR low, trigger the AHL with an AND mask of 0001 and an OR mask of 0000.

Once the line is disconnected, you can:

- re-establish dial-up modem communications with the same processor
- establish a modem connection with another device by changing the dialing string sent to the modem in ST20:0.

Figure 10.4 shows sample ladder logic rungs used to lower and raise DTR to disconnect a telephone connection.

Figure 10.4
Use the AHL instructions shown to lower and raise DTR to disconnect a telephone connection.



Peer-to-Peer Communication

Peer-to-peer communication is the simplest method. Two units establish a telephone modem link point-to-point using DF1 full-duplex protocol. In this mode, neither unit has control over the other, but is simply a peer. One of the units sends the command string to a telephone modem to dial the other unit. Once the communication has been established, then each unit can send messages back and forth to exchange data. The unit that initiated the connection normally hangs up the connection as well.

This configuration is an extension of peer-to-peer communication in that it involves stations establishing point-to-point telephone modem links using DF1 full-duplex protocol.

Report-by-Exception and/or Master Station-initiated Communication

Report-by-exception communication refers to the remote stations initiating a dial-up connection to the master station upon change of input status or process data in order to update the master station's data table.

Master station-initiated communication refers to the master station initiating the dial-up connections to each of the remote stations on a round robin or time-scheduled basis in order to update the master station's data table.

A combination of report-by-exception and master station-initiated communication is possible but requires two communication ports and modems (one for dial-in and one for dial-out) at the master station in order to be effective. This can be accomplished using a 1785-KE module with a PLC-5 processor or a 1747-KE module with a SLC 5/03.

Remotely Programming PLC-5, SLC 500 and MicroLogix 1000 Processors

Use This Chapter…

…to set up and configure programming terminals to program remote PLC-5, SLC 500 and MicroLogix 1000 processors over a point-to-multipoint telemetry network.

Connecting processor programming software to the remote stations over the same link used by the master station helps you do the following without having to go to the remote site:

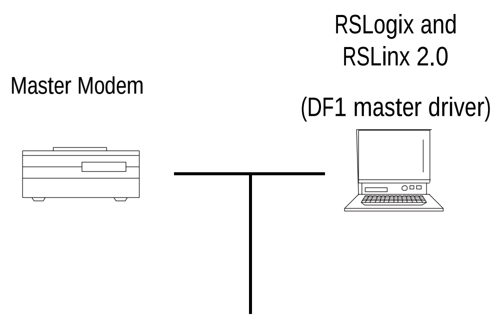
- monitor the online data table
- upload, download, and edit the ladder logic program
- troubleshoot the system

You can remotely connect to your processors while normal telemetry system data acquisition and control functions occur concurrently.

Remote Programming Hardware Configuration

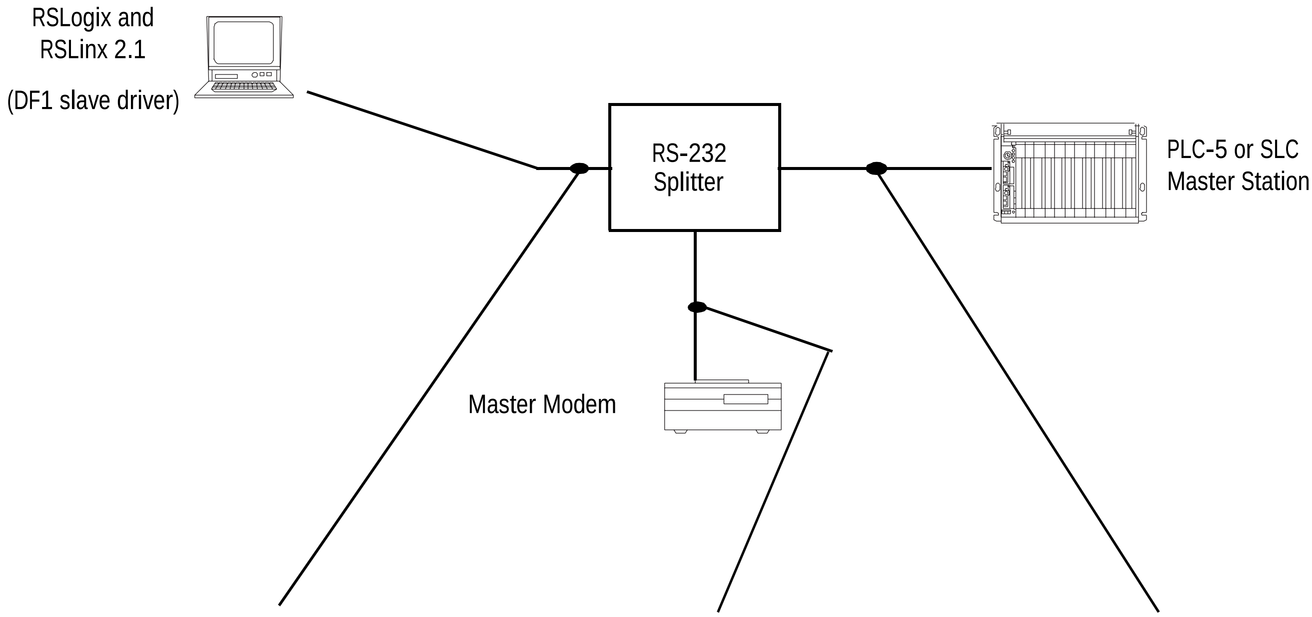
The hardware configuration required for remote programming varies according to the master station being used.

Figure 11.1
Hardware configuration using a PC running RSLinx 2.0 DF1 master driver.



Modem		PC
9-pin	25-pin	9-pin female
1	8	1
2	3	2
3	2	3
2	20	4
5	7	5
6	6	6
7	4	7
8	5	8

Figure 11.2
Hardware configuration using PLC-5 or SLC 500 master station.



PC 9-pin Female	Splitter 25-pin Female
2	3
3	2
5	7

Modem		Splitter
9-pin	25-pin	25-pin male
3	2	2
2	3	3
7	4	4
8	5	5
6	6	6
5	7	7
1	8	8
4	20	20

SLC	PLC-5	Splitter
9-pin female	25-pin male	25-pin female
3	2	2
2	3	3
7	4	4
8	5	5
6	6	6
5	7	7
1	8	8
4	20	20

RS-232 Splitter

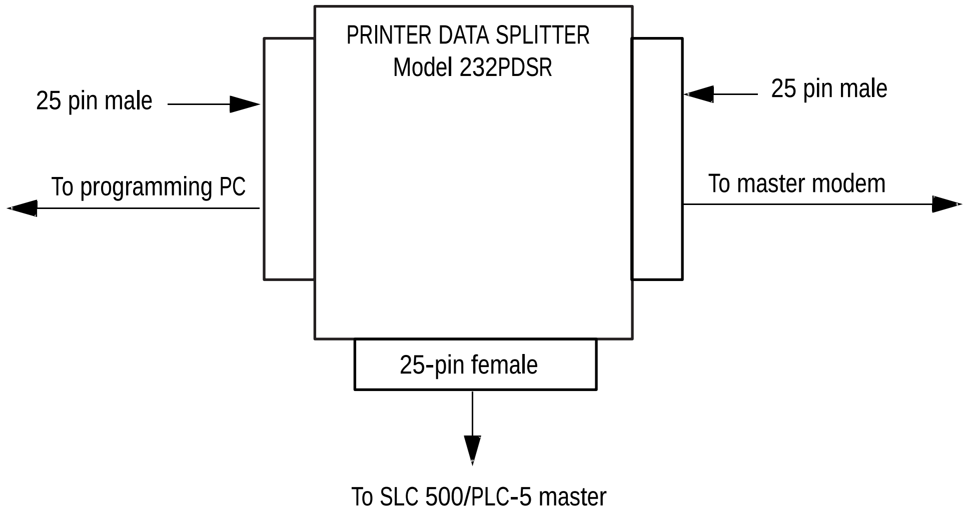
The RS-232 splitter is a passive (no external power required) device that uses diodes to send any signals originating from the master station connected to the “main connector” to both of the other two auxiliary ports. In Figure 11.1, the splitter connects the master station to the master modem and the remote station programming PC.

The signals sent are from connector pins 2-8 and 20 only.

Any signals originating from either of the two auxiliary ports is transmitted only to the “main connector,” not to the other auxiliary port.

One such RS-232 splitter is the Printer Data Splitter (Model 232PDSR) available from B&B Electronics Manufacturing Company of Ottawa, IL. (www.bb-elec.com)

Figure 11.3



Configure RSLogix Programming Software for Remote Communications

Since the RSLogix family of programming software uses RSLinx as the communications driver, refer to chapter 9 for configuring RSLinx as a half-duplex master or slave.

Modem Cable Reference

Use This Appendix…

…as a quick guide for finding the cables you need.

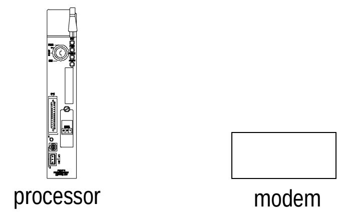
To find modem cabling information on:	See page:
Enhanced PLC-5	A-2
1747-KE Module	A-3
ASCII terminal to 1747-KE Module	A-3
SLC 5/03, 5/04, or 5/05	A-4
Workstations with 9-pin serial port	A-4
AIC+ Advanced Interface Converter for MicroLogix 1000	A-4
Logix5550 controller	A-4
1785-KE Module	A-5
MicroLogix 1000 with serial port	A-6

Enhanced PLC-5

Table A.1

Connection Type	Allen-Bradley Cable
Enhanced PLC-5 processor to a modem	A-B 1770-CY (25-pin male modem connector)

Figure A.1 Enhanced PLC-5 processor to modem cable pinout:



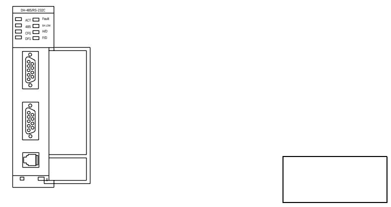
25-pin male		25-pin	9-pin
C.GND	1	1	NC
TXD.OUT	2	2	3
RXD.IN	3	3	2
RTS.OUT	4	4	7
CTS.IN	5	5	8
DSR.IN	6	6	6
SIG.GND	7	7	5
DCD.IN	8	8	1
DTR.OUT	20	20	4

1747-KE Interface Module

Table A.2

Connection Type	Allen-Bradley Cable
1747-KE Interface to a modem	

Figure A.2 1747-KE Interface to modem cable pinout:



	9-pin female	25-pin	9-pin
RXD.IN	2	3	2
TXD.OUT	3	2	3
DTR.OUT	4	20	4
SIG.GND	5	7	5
DSR.IN	6	8	1
RTS.OUT	7	4	7
CTS.IN	8	5	8

ASCII Terminal to 1747-KE module

Table A.3

Connection Type	Allen-Bradley Cable
ASCII terminal to 1747-KE module	A-B 1747-CP3

Figure A.3 ASCII terminal to 1747-KE module cable pinout:

9-pin female			9-pin female	
RXD.IN	2		3	RXD.IN
TXD.OUT	3		2	TXD.OUT
SIG.GND	5		5	SIG.GND

SLC 5/03, 5/04, and 5/05

Table A.4

Connection Type	Allen-Bradley Cable
SLC 5/03, 5/04, or 5/05 processor to a modem	A-B 1784-CAS (25-pin male modem connector)
Workstation with a 9-pin serial port to a modem	
AIC+ Advanced Interface Converter for MicroLogix 1000	
Logix5550 controller to a modem	

Figure A.4 SLC 5/03 - 5/05, Workstation, AIC+, and Logix5550 cable pinout

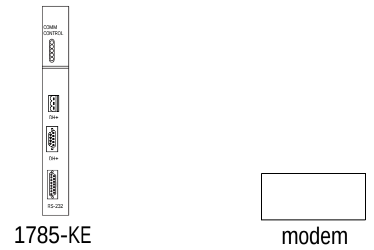
9-pin female		25-pin	9-pin
DCD.IN	1	8	1
RXD.IN	2	3	2
TXD.OUT	3	2	3
DTR.OUT	4	20	4
SIG.GND	5	7	5
DSR.IN	6	6	6
RTS.OUT	7	4	7
CTS.IN	8	5	8

1785-KE Module

Table A.5

Connection Type	Allen-Bradley Cable
1785-KE module to a modem	A-B 1770-CP (25-pin male modem connector)

Figure A.5 1785-KE module to modem cable pinout:



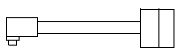
	15-pin male	25-pin	9-pin
C.GND	1	1	NC
TXD.OUT	2	2	3
RXD.IN	3	3	2
RTS.OUT	4	4	7
CTS.IN	5	5	8
DSR.IN	6	6	6
SIG.GND	7	7	5
DCD.IN	8	8	1
DTR.OUT	11	20	4
	13 (jumpered to 7)		

MicroLogix 1000

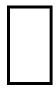
Table A.6

Connection Type	Allen-Bradley Cable
MicroLogic 1000 serial port to a modem	A-B 1761-PM02 Series B (or higher) (MicroLogix Mini-DIN to 9-pin female connector)

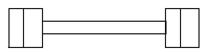
Figure A.6 MicroLogix 1000 serial port to modem cable pinout:



A-B cable



Optical Isolator



User supplied cable

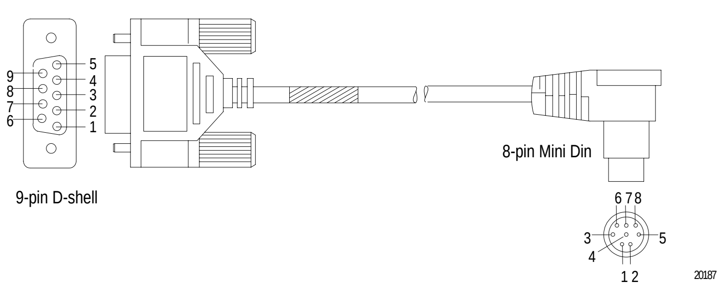
MicroLogix		Optical Isolator	Modem		
8-pin Mini DIN	9-pin Female		9-pin Male	9-pin	or 25-pin
5 DCD	DCD 1		1	1	8
4 RXD	RXD 2		2	2	3
7 TXD	TXD 3		3	3	2
2 GND	GND 4		5	5	7
	DTR 5		4	4	20
	DSR 6		6	6	6
3 RTS	RTS 7		7	7	4
6 CTS	CTS 8		8	8	5

Standard A-B cables:

- 1761-CBL-PM02 Series B or Higher (6.5 feet)
- 1761-CBL-AP00 (17.7 inches)

User supplied modem cable

1761-CBL-PM02 Series B Cable



Basic DF1 Protocol Troubleshooting

Use This Appendix…

…to help you troubleshoot communication problems.

General Tips

When you encounter problems, check these items:

- cabling (cable length, connectors, pinouts, etc.)
- power connections
- communication rate settings for all devices (all settings must match)
- control line configuration
- handshaking parameters
- error detection selection for all devices must match (BCC or CRC)

Communication Troubleshooting

For new installations, if possible, setup the communications in the lab before installing the processors in the field using a directly connected null-modem cable. Verify that the protocol settings and addressing are properly configured for all processors.For multi-drop configurations, you need only verify Master-to-Slave communications. Next, introduce the modems as the link between the devices (remembering to replace the null-modem cable with modem cables) and troubleshoot the modem link(s).

If the MSG instruction errs, follow this troubleshooting sequence:

1. Use the MSG instruction error code and error description for clues. The two most common error codes are:

Error Code:	Description	Analysis and Corrective Action:
07hex	no acknowledgment (ACK) was received when the MSG was sent and retried	The communications link is failing somewhere. Follow through the rest of the numbered steps to determine problem.

Error Code:	Description	Analysis and Corrective Action:
037hex	MSG timeout, which indicates an ACK was received but an error free reply was not received before the MSG timed out	Either the MSG timeout parameter is set too short or the reply, if received, has checksum errors, which indicates a marginal modem link. This MSG error may also be seen with radio modems which generate the ACK locally in the modem (ESTeem and Metricom), but don't successfully deliver either the message to its destination or the reply back to the initiator due to modem configuration or network problems. Further analysis with a serial line analyzer may be required

2. Use the initiating processor's RS-232 LED (labeled COMM on PLC-5s) to verify that characters are being transmitted out of the serial port. If characters are not being transmitted, either:

- the MSG is improperly configured to be sent out a different port
- or the required modem handshaking signals (based on the processor serial port Control Line configuration) are not present at the processor's RS-232 port due to improper modem cable or modem configuration.

3. Use the initiating modem's transmit data LED to verify data packets are being sent. If data packets are not being sent:

- check the cable between the processor and its modem to ensure that the receive and transmit pins and modem handshaking pins (if used) are properly connected
- verify that both modem and processor either use or ignore handshaking

4. Use the receiving modem's receive data LED to determine whether data packets are being received by the modem. If data packets are not being received, determine problem with the modem link.

5. Use the receiving processor's RS-232 LED to verify that characters are being transmitted out of the serial port. If troubleshooting the MicroLogix 1000 controller with a modem connection through the AIC+, then the AIC+ TX LEDs provide this indication. If no characters are being transmitted, the receiving processor may not be replying to the message because it was not properly received. Check for:

- incorrect cable between the modem and receiving processor
- or the required modem handshaking signals (based on the processor serial port Control Line configuration) are not present at the processor's RS-232 port due to improper modem cable or modem configuration.
- baud rate mismatch between modems and processors
- error detection (BCC or CRC) mismatch between sending and receiving processors
- destination address mismatch between MSG and receiving processor (DF1 half-duplex protocol only).

6. Use the initiating modem's receive data LED to determine whether data packets are being received back by the modem. If not, determine problem with modem link.

If you are unable to determine the cause of the MSG error after going through this list, then further analysis with a serial line analyzer may be required. Use the following sections to understand the DF1 hex codes you should expect to capture with your serial line analyzer.

DF1 Protocol

A-B products send data asynchronously and serially over the RS-232 interface, one 8-bit byte at a time. The transmission format conforms to ANSI X3.16, CCITT V.4, and ISO 1177, with the exception that the parity bit is retained while the data length is extended to eight bits.

The following summarizes the transmission format:

data bits

start bit	bit 0	bit 1	bit 2	bit 3	bit 4	bit 5	bit 6	bit 7	even parity bit (optional-normally not used)	stop bit

DF1 full- and half-duplex protocols are character-oriented and combine ASCII characters into two symbol types:

- control
- data

A **symbol** is a sequence of one or more bytes having a specific meaning to the link protocol. The component characters of a symbol must be sent one after another with no other characters inserted between them.

Tips about DF1 Half-Duplex Protocol

To help you diagnose communication problems, you can use a serial line analyzer to see the data packets being transmitted on the RS-232 link between the DTE and the DCE. For further details, see the DF1 Protocol and Command Set Reference Manual, Publication 1770-6.5.16.

For this information:	See:
different types of communication packet exchanges between a master station and a remote station	Table B.1
definitions of the packets	Table B.2

Table B.1
This table summarizes DF1 half-duplex protocol packet exchanges.

Message Type:	Master Station's Packet:	Remote Station's Packet:
Master station sending a MSG instruction to a remote station	DLE SOH stn DLE STX message DLE ETX BCC/CRC	DLE ACK
Master station sending a poll; remote station replying to a poll indicating it has no data to transmit	DLE ENQ stn BCC	DLE EOT
Master station sending a poll; remote station sending a MSG instruction as a reply	DLE ENQ stn BCC DLE ACK (master station acknowledges receipt of the remote station's message)	DLE STX message DLE ETX BCC/CRC

Table B.2
Use this table to identify the DF1 half-duplex packets.

Symbol:	Hexadecimal:	Binary:		Type:	Meaning:
DLE SOH	10 01	0001 0000	0000 0001	control symbol	Start of header Sender symbol that indicates the start of a master station's message
DLE STX	10 02	0001 0000	0000 0010	control symbol	Start of text Sender symbol that separates the multi-drop header from the data
DLE ETX BCC/CRC	10 03 xx(xx)	0001 0000	0000 0011	control symbol	End of text and checksum Sender symbol that terminates a message
DLE EOT	10 04	0001 0000	0000 0100	control symbol	End of transmission Response symbol used by remote stations as a response to a poll when they have no messages to send
DLE ENQ STN BCC	10 05 xx xx	0001 0000	0000 0101	control symbol	Enquiry poll packet Sender symbol, issued only by the master station, that starts a poll command
DLE ACK	10 06	0001 0000	0000 0110	control symbol	Acknowledgment Response symbol which signals that a message has been successfully received
DLE DLE	10 10	0001 0000	0001 0000	data symbol	Represents the data value or STN value of 10 (hex)
DLE NAK	10 15	0001 0000	0001 0101	control symbol	Global link reset command only issued by the master station during powerup or a serial port reconfiguration The command causes the remote station to cancel all messages that are ready to transmit to the master station. Typically, the remote station returns an error code to the affected MSG instructions.
STN	application specific			data symbol	Station number of the remote station on your half-duplex link (00-FE)
APP DATA	application specific			data symbol	Single characters having values 00-0F and 11-FF Includes data from application layer including user programs and common application routines

See ANSI X3.4, CCITT V.3, or ISO 646 for the standard definition of these characters.

Tips about DF1 Full-Duplex Protocol

To help you diagnose communication problems, you can use a serial line analyzer to see the data packets being transmitted on the RS-232 link between the DTE and the DCE. For further details, see the DF1 Protocol and Command Set Reference Manual, publication 1770-6.5.16.

For the:	See:
different types of communication packet exchanges between two full-duplex stations	Table B.3
definitions of the packets	Table B.4

Table B.3
This table summarizes DF1 full-duplex protocol packet exchanges.

Message Type:	Sender Station's Packet:	Receiver Station's Packet:
Sender station transmits a MSG instruction to a receiving station; receiver station acknowledges	DLE STX message DLE ETX BCC/CRC	DLE ACK
Sender station transmitting a MSG instruction to a receiver station; receiver station cannot receive the message or error in transmission	DLE STX message DLE ETX BCC/CRC	DLE NAK
Sender station receives a corrupted DLE ACK from the receiver station; sender station requests re-transmission of last control symbol; receiver station sends the DLE ACK again	DLE ENQ	DLE ACK

Table B.4
Use this table to identify the DF1 full-duplex packets.

Symbol:	Hexadecimal:	Binary:		Type:	Meaning:
DLE STX	10 02	0001 0000	0000 0010	control symbol	Start of header Sender symbol that indicates the start of a message
DLE ETX BCC/CRC	10 03 xx(xx)	0001 0000	0000 0011	control symbol	Sender symbol that terminates a message
DLE ENQ	10 05	0001 0000	0000 0101	control symbol	Sender symbol that requests retransmission of a response symbol from the receiver
DLE ACK	10 06	0001 0000	0000 0110	control symbol	Response symbol that signals that a message has been successfully received
DLE DLE	10 10	0001 0000	0001 0000	data symbol	Represents the data value of 10 (hex)
DLE NAK	10 15	0001 0000	0001 0101	control symbol	Negative acknowledgment Response symbol that signals that a message was not received successfully
APP DATA	application specific			data symbol	Single characters having values 00-0F and 11-FF Includes data from the application layer including user programs and common application routines

See ANSI X3.4, CCITT V.3, or ISO 646 for the standard definition of these characters.

Third-Party Supplier Contact Information

Use This Appendix To...

...locate the third-party products mentioned in this document. For more information about either the vendors or products, do any of the following:

- contact the vendor directly
- see the Encompass Product Directory, publication 6873
- contact your local Allen-Bradley office or distributor

Contact List

Please use this as a reference. This list is not inclusive.

Company:	Product types offered:	Contact information:
Black Box Corp.	dial-up and leased line modems, line drivers	Black Box Corp. Customer Service P.O. Box 12800 Pittsburgh, PA 15241 Phone: (412) 746-5500 Fax: (800 or 412) 321-0746 www.blackbox.com
DATA-LINC Group	dial-up, leased-line, spread spectrum radio, and power line modems	DATA-LINC Group 2635 151st Place., NE Redmond, WA 98052 Phone: (425) 882-2206 Fax: (425) 867-0865 www.data-linc.com
Electronic Systems Technology	ESTeem licensed radio modems	Electronic Systems Technology 415 N. Quay Street Kennewick, WA 99336 Phone: (509) 735-9092 Fax: (509) 735-5475 www.esteem.com
Metricom, Inc.	spread spectrum radio modems	Metricom, Inc. 980 University Ave. Los Gatos, CA 95032 Phone: (800) 987-7222 (408) 399-8200 Fax: (408) 354-1024 www.metricom.com
Microwave Data Systems	licensed and spread spectrum radio modems	Sales Coordinator Microwave Data Systems 175 Science Parkway Rochester, NY 14620-4261 Sales and Engineering Phone: (716) 442-4000 General Phone: (716) 242-9600 Fax: (716) 242-9620 www.microwavedata.com

Company:	Product types offered:	Contact information:
Miille Applied Research Co., Inc. (MARC)	protocol converters, 1771 and 1746 chassis mounted modems for dial-up and leased line	Miille Applied Research Co., Inc. 1730 S. Richey Pasadena, TX 77502 Phone: (713) 472-6262 or 800-729-0818 Fax: (713) 472-0318 www.miille.com
ProSoft Technology, Inc.	protocol interfaces for SCADA, plant floor and foreign device interface applications. custom development and tools are also available the ProSoft RTU-5/03 Processor is targeted at SCADA/RTU applications in industries that use the Modbus protocol	ProSoft Technology, Inc. Corporate Office 9801 Camino Media Suite 105 Bakersfield, CA 93311 Phone: (805) 664-7208 Fax: (805) 664-7233 www.prosoft-technology.com
Real Time Automation	protocol interfaces for SCADA, plant floor and foreign device interface applications. custom development and tools are also available	Real Time Automation 2825 N. Mayfair Road Wauwatosa, WI 53222 Phone: (414) 453-5100 Fax: (414) 453-5125 www.execpc.com/~rta

Worksheets

Use These Worksheets…

…to document your serial channel configurations. Each worksheet corresponds to a processor's master or remote station configuration.

Make photocopies of the worksheets. **Do not write on the originals.**

For defining this configuration:	Use:	Found on page:	And configuration screen on page:	With definitions on page:
SCADA system schematic	Worksheet 1.1	D-3	not applicable	not applicable
Enhanced PLC-5 Master Station Configuration Using Standard Communication	Worksheet 2.1	D-4		
Enhanced PLC-5 Master Station Configuration Using Message-based Communication	Worksheet 2.2	D-5		
Enhanced PLC-5 Remote Station Configuration	Worksheet 2.3	D-6		
Enhanced PLC-5 Point-to-Point Configuration	Worksheet 2.4	D-7		
Classic PLC-5 Remote Station Configuration 1785-KE Module Switch Settings	Worksheet 3.1	D-8		
SLC 5/03, 5/04 DF1 Half-Duplex Master Station Configuration Using Standard Communication	Worksheet 4.1	D-9		
SLC 5/03, 5/04, and 5/05 DF1 Half-Duplex Master Station Configuration Using Message-based Communication	Worksheet 4.2	D-10		
SLC 5/03, 5/04, and 5/05 Remote Station Configuration	Worksheet 4.3	D-11		
SLC 5/03, 5/04, and 5/05 Point-to-Point Configuration	Worksheet 4.4	D-12		
SLC 500 Processor with 1747-KE Module Remote Station Configuration	Worksheet 5.1	D-13		
SLC 500 Processor with 1747-KE Module Point-to-Point Configuration	Worksheet 5.2	D-14		
MicroLogix 1000	Worksheet 6.1	D-15		
Logix 5550	Worksheet 7.1	D-16		
Logix 5550	Worksheet 7.2	D-17		
Logix 5550	Worksheet 7.3	D-18		
Logix 5550	Worksheet 7.4	D-19		

When You're Finished

After you complete the worksheets, forward copies to your:

- programmers who need the information to write the PLC ladder-logic programs that control the equipment in your system
- software integrators who need the information for the configuration screens
- hardware installers who need the information to install and connect the equipment

Finally, keep a copy of the completed worksheets as part of the system documentation package. The information contained on the worksheets can be used as part of the system validation process required within certain industries by government agencies and industry associations.

Using the Worksheets

Each SCADA worksheet has different fields that you define, but the basic layout is the same.

Each worksheet refers to the parameter tab location

Each worksheet has an example

Each worksheet has blank columns for you to enter information about your application. Make enough copies of the worksheet for each function that you need.

Tab	Parameter	Example	Your Configuration
Serial Port	Diagnostic File	*9*	
	Remote Mode Change	*DISABLED*	
	Baud Rate	*9600*	
	Stop Bits	*1*	
	Control Line	*HALF DUPLEX WITHOUT CONTINUOUS CARRIER*	
	Parity	*NONE*	
Options	Station Address	*1*	
	Reply MSG Wait	*5*	
	ACK Timeout	*15*	
	DF1 Retries	*3*	
	MSG Application Timeout	*1*	
	Error Detect	*CRC*	

SCADA Worksheet 1.1
SCADA Network Diagram

Use this worksheet to sketch your SCADA system, or include a drafting diagram. Include network addresses for each system component. Make as many copies of this worksheet as you need. Do not write on the original.

SCADA Worksheet 2.1
Enhanced PLC-5 DF1 Half-Duplex Master Station Configuration Using Standard Communication

Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see page 2-4.

Tab	Parameter	Example	Your Configuration
Serial Port	Remote Mode Change	*DISABLED*	
	Diagnostic File	*N19*	
	Baud Rate	*9600*	
	Bits Per Character	*8*	
	Stop Bits	*1*	
	Control Line	*HALF DUPLEX WITHOUT CONTINUOUS CARRIER*	
	Parity	*NONE*	
	Error Detect	*CRC*	
Options	Station Address	*1*	
	DF1 Retries	*3*	
	RTS Send Delay (x20 msec)	*0*	
	RTS Off Delay (x20 msec)	*0*	
	ACK Timeout (x20 msec)	*15*	
	MSG Application Timeout (x20 msec)	*1*	
Polling	Polling Mode	*STANDARD (MULTIPLE MESSAGE TRANSFER PER NODE SCAN)*	
	Master Message Transmit	*BETWEEN STATION POLLS*	
	Normal Poll Node File	*N10*	
	Normal Poll Group Size	*3*	
	Priority Poll Node File	*N11*	
	Active Station File	*B9*	

SCADA Worksheet 2.2
Enhanced PLC-5 DF1 Half-Duplex Master Station Configuration Using Message-based Communication

Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see page 2-9.

Tab	Parameter	Example	Your Configuration
Serial Port	Remote Mode Change	*DISABLED*	
	Diagnostic File	*N19*	
	Baud Rate	*9600*	
	Bits Per Character	*8*	
	Stop Bits	*1*	
	Control Line	*HALF DUPLEX WITHOUT CONTINUOUS CARRIER*	
Options	Parity	*NONE*	
	Error Detect	*CRC*	
	Station Address	*1*	
	DF1 Retries	*3*	
	MSG Application Timeout (x20 msec)	*1*	
	RTS Send Delay (x20 msec)	*0*	
	RTS Off Delay (x20 msec)	*0*	
	ACK Timeout (x20 msec)	*15*	
	Reply MSG Wait (x20 msec)	*5*	
Polling	Polling Mode	*MESSAGE BASED (ALLOW SLAVES TO INITIATE MESSAGES)*	

SCADA Worksheet 2.3
Enhanced PLC-5 DF1 Half-Duplex Slave Station Configuration

Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see page 2-13.

Tab	Parameter	Example	Your Configuration
Serial Port	Remote Mode Change	*DISABLED*	
	Diagnostic File	*N19*	
	Baud Rate	*9600*	
	Bits Per Character	*8*	
	Stop Bits	*1*	
	Control Line	*HALF DUPLEX WITHOUT CONTINUOUS CARRIER*	
	Parity	*NONE*	
	Error Detect	*CRC*	
Options	Station Address	*2*	
	DF1 Retries	*3*	
	Detect Duplicate Messages	*ENABLED*	
	RTS Send Delay (x 20 msec)	*0*	
	RTS Off Delay (x 20 msec)	*0*	
	ACK Timeout (x 20 msec)	*15*	
	MSG Application Timeout (x 30 sec)	*1*	

SCADA Worksheet 2.4
Enhanced PLC-5 DF1 Full-Duplex
Point-to-Point Configuration

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see page 2-16.

Tab	Parameter	Example	Your Configuration
Serial Port	Remote Mode Change	*DISABLED*	
	Diagnostic File	*N19*	
	Baud Rate	*9600*	
	Bits Per Character	*8*	
	Stop Bits	*1*	
	Control Line	*FULL DUPLEX MODEM*	
	Parity	*NONE*	
	Error Detect	*CRC*	
	Detect Duplicate Messages	*ENABLED*	
Options	NAK Receive	*3*	
	DF1 ENQs	*3*	
	ACK Timeout (x 20 msec)	*15*	
	MSG Application Timeout (x 20 msec)	*1*	

SCADA Worksheet 3.1
Classic PLC-5
Remote Station Configuration
1785-KE Module Switch Settings
Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see the 1785-KE DH+ Communications Interface Module User Manual, publication 1785-6.5.2.

	For:	Choose: (*Example*)	Set switch (*Example*)	To: (*Example*)	Config. Choice:	Set switch	To:
Switch Assembly SW1	Protocol	half-duplex	1	on		1	
	Error check	CRC	2	on		2	
	Parity	none	3	on		3	
	Embedded responses	no	4	on		4	
	Duplicate message	ignore	5	on		5	
	Handshaking signals	use	6	on		6	
	Diagnostic command	execute					
Switch Assembly SW2	Station address	7	1	on		1	
			2	on		2	
			3	on		3	
			4	on		4	
			5	on		5	
			6	off		6	
			7	off		7	
			8	off		8	
Switch Assembly SW3	DH+ communication rate	57.6 K	1	on		1	
	RS-232 communication rate	(must match the modem's rate) 9600 in this example	2	on		2	
			3	off		3	
			4	on		4	
			5	on		5	
	Addressing mode	remote	6	off		6	
Switch Assembly SW4			1-4	off	Reserved	1-4	off

SCADA Worksheet 4.1
SLC 5/03, 5/04, and 5/05 DF1 Half-Duplex
Master Station Configuration
Using Standard Communication
Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see Table 4.A on page 4-8.

Tab	Parameter	Example	Your Configuration
Chan. 0 System	Mode Change	*DISABLED*	
	Diagnostic File	*N19*	
	Baud Rate	*9600*	
	Parity	*NONE*	
	Stop Bits	*1*	
	Node Address	*99*	
	Control Line	*HALF-DUPLEX WITHOUT CONTINUOUS CARRIER*	
	Error Detection	*CRC*	
	Polling Mode	*STANDARD (MULTIPLE MESSAGE TRANSFER PER NODE SCAN)*	
	Duplicate Packet Detect	*Enabled*	
	ACK Timeout	*50*	
	RTS Off Delay (x 20 msec)	*0*	
	RTS Send Delay (x 20 msec)	*0*	
	Message Retries	*3*	
	Pre-Transmit Delay (x 1 msec)	*0*	
	Priority Polling Range - High	*0*	
	Priority Polling Range - Low	*255*	
	Normal Polling Range - High	*3*	
	Normal Polling Range - Low	*1*	
	Normal Poll Group Size	*0*	

SCADA Worksheet 4.2
SLC 5/03, 5/04, and 5/05 DF1 Half-Duplex Master Station Configuration Using Message-based Communication

Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see page Table 4.D on page 4-15.

Tab	Parameter	Example	Your Configuration
Chan. 0 System	Mode Change	*DISABLED*	
	Diagnostic File	*N19*	
	Baud Rate	*9600*	
	Parity	*NONE*	
	Stop Bits	*1*	
	Node Address	*99*	
	Control Line	*HALF-DUPLEX WITHOUT CONTINUOUS CARRIER*	
	Error Detection	*CRC*	
	Polling Mode	*MESSAGE BASED (ALLOW SLAVE TO INITIATE MESSAGE)*	
	Duplicate Packet Detect	*Enabled*	
	Reply Message Wait Timeout	*1*	
	ACK Timeout	*50*	
	RTS Off Delay (x 20 msec)	*0*	
	RTS Send Delay (x 20 msec)	*0*	
	Message Retries	*3*	
	Pre-Transmit Delay (x 1 msec)	*0*	

SCADA Worksheet 4.3
SLC 5/03, 5/04, and 5/05 DF1 Half-Duplex Slave Station Configuration
Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see Table 4.E on page 4-18.

Tab	Parameter	Example	Your Configuration
Chan 0. System	Mode Change	*DISABLED*	
	Diagnostic File	*N19*	
	Baud Rate	*9600*	
	Stop Bits	*1*	
	Parity	*NONE*	
	Stop Bits	*1*	
	Node Address	*99*	
	Control Line	*HALF-DUPLEX WITHOUT CONTINUOUS CARRIER*	
	Error Detect	*CRC*	
	EOT Suppression	*DISABLED*	
	Duplicate Detect	*ENABLED*	
	Poll Timeout	*500*	
	RTS Off Delay	*0*	
	RTS Send Delay	*0*	
	Message Retries	*3*	
	Pre-Transmit Delay	*0*	

SCADA Worksheet 4.4
SLC 5/03, 5/04, and 5/05 DF1 Full-Duplex
Point-to-Point Configuration
Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see Table 4.G on page 4-22.

Tab	Parameter	Example	Your Configuration
Chan. 0 System	Mode Change	*DISABLED*	
	Diagnostic File	*N19*	
	Baud Rate	*1200*	
	Parity	*NONE*	
	Stop Bits	*1*	
	Source ID	*0*	
	Control Line	*FULL-DUPLEX MODEM*	
	Error Detection	*CRC*	
	Embedded Responses	*ENABLED*	
	Detect Duplicate Packet	*ENABLED*	
	ACK Timeout (x 20 msec)	*500*	
	NAK Retries	*3*	
	ENQ Retries	*3*	

SCADA Worksheet 5.1 SLC 500 Processor with 1747-KE Module DF1 Half-Duplex Slave Station Configuration

Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see 5-6.

Tab	Parameter	Example	Your Configuration
	Duplicate Packet Detection	*ENABLED*	
	Checksum	*CRC*	
	Constant Carrier Detect	*DISABLED*	
	Modem Init String		
	Message Timeout	*10000*	
	Hardware Handshaking	*ENABLED*	
	Poll Timeout (x 5 msec)	*2000*	
	Message Retries	*2*	
	RTS On Delay (x 5 msec)	*0*	
	RTS Off Delay (x 5 msec)	*0*	
	Local/Remote Mode	*REMOTE*	
	Slave Address/Group Number	*0*	
	Master Station Address	*0*	

SCADA Worksheet 5.2
SLC 500 Processor with 1747-KE Module Point-to-Point Configuration

Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see page 5-6.

Tab	Parameter	Example	Your Configuration
	Duplicate Packet Detection	*ENABLED*	
	Checksum	*CRC*	
	Constant Carrier Detect	*DISABLED*	
	Modem Init String		
	Message Timeout	*10000*	
	Hardware Handshaking	*ENABLED*	
	Embedded Response Detect	*EMBEDDED RESPONSE*	
	ACK Timeout (x 5 msec)	*200*	
	ENQuiry Retries	*2*	
	NAK Received Retries	*2*	

SCADA Worksheet 6.1
MicroLogix 1000 DF1 Half-Duplex
Slave Station Configuration
Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see page .

Tab	Parameter	Example	Your Configuration
	Baud Rate	*9600*	
	Node Address	*99*	
	Control Line	*HALF-DUPLEX MODEM*	
	Error Detection	*CRC*	
	EOT Suppression	*DISABLED*	
	Duplicate Packet Detect	*ENABLED*	
	Poll Timeout (x 20 msec)	*3000*	
	RTS Off Delay (x 5 msec)	*0*	
	RTS Send Delay (x 5 msec)	*0*	
	Message Retries	*3*	
	Pre-Transit Delay (x 5 msec)	*0*	

SCADA Worksheet 7.1
Logix5550 DF1 Half-Duplex
Master Station Configuration
Using Standard Communication

Page 1 of 1

Use this worksheet to record your station’s configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see page .

Tab	Parameter	Example	Your Configuration
	Baud Rate	*9600*	
	Parity	*NONE*	
	Data Bits	*8*	
	Stop Bits	*1*	
	Control Line	*HALF-DUPLEX WITHOUT CONTINUOUS CARRIER*	
	RTS Send Delay (x 20 msec)	*0*	
	RTS Off Delay (x 20 msec)	*0*	
	Station Address	*99*	
	Transmit Retries	*3*	
	ACK Timeout (x 20 msec)	*50*	
	Polling Mode	*STANDARD (MULTIPLE MESSAGE TRANSFER PER NODE SCAN)*	
	Normal Poll Group Size	*0*	
	Normal Poll Node Tag	*Normal_Poll_Array*	
	Priority Poll Node Tag	*Priority_Poll_Array*	
	Active Station Tag	*Active_Station_Array*	
	Master Transmit	*BETWEEN STATION POLLS*	
	Error Detection	*CRC*	
	Duplicate Detection	*ENABLED*	

SCADA Worksheet 7.2
Logix5550 DF1 Half-Duplex
Master Station Configuration
Using Message-based Communication

Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see page .

Tab	Parameter	Example	Your Configuration
	Baud Rate	*9600*	
	Parity	*NONE*	
	Data Bits	*8*	
	Stop Bits	*1*	
	Control Line	*HALF-DUPLEX WITHOUT CONTINUOUS CARRIER*	
	RTS Send Delay (x 20 msec)	*0*	
	RTS Off Delay (x 20 msec)	*0*	
	Station Address	*99*	
	Transmit Retries	*3*	
	ACK Timeout (x 20 msec)	*50*	
	Reply Message Wait Time	*1*	
	Polling Mode	*MESSAGE BASED (ALLOW SLAVE TO INITIATE MESSAGES)*	
	Error Detection	*CRC*	
	Duplicate Detection	*ENABLED*	

SCADA Worksheet 7.3
Logix5550 DF1 Half-Duplex
Slave Station Configuration
Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see page .

Tab	Parameter	Example	Your Configuration
	Baud Rate	*9600*	
	Parity	*NONE*	
	Data Bits	*8*	
	Stop Bits	*1*	
	Control Line	*HALF-DUPLEX WITHOUT CONTINUOUS CARRIER*	
	RTS Send Delay (x 20 msec)	*0*	
	RTS Off Delay (x 20 msec)	*0*	
	Station Address	*99*	
	Transmit Retries	*3*	
	Slave Poll Timeout (x 20 msec)	*1500*	
	EOT Supression	*DISABLED*	
	Error Detection	*CRC*	
	Duplicate Detection	*ENABLED*	

SCADA Worksheet 7.4
Logix5550 DF1 Full-Duplex Point-to-Point Configuration
Page 1 of 1

Use this worksheet to record your station's configuration. Make as many copies of this worksheet as you need. Do not write on the original. For descriptions on each line item, see page .

Tab	Parameter	Example	Your Configuration
	Baud Rate	*1200*	
	Parity	*NONE*	
	Data Bits	*8*	
	Stop Bits	*1*	
	Control Line	*FULL DUPLEX MODEM*	
	RTS Send Delay (x 20 msec)	*0*	
	RTS Off Delay (x 20 msec)	*0*	
	Station Address	*9*	
	NAK Receive Limit	*3*	
	ENQ Transmit Limit	*3*	
	ACK Timeout (x 20 msec)	*500*	
	Embedded Responses	*ENABLED*	
	Error Detection	*CRC*	
	Duplicate Detection	*ENABLED*	

Notes

Sample Ladder Logic

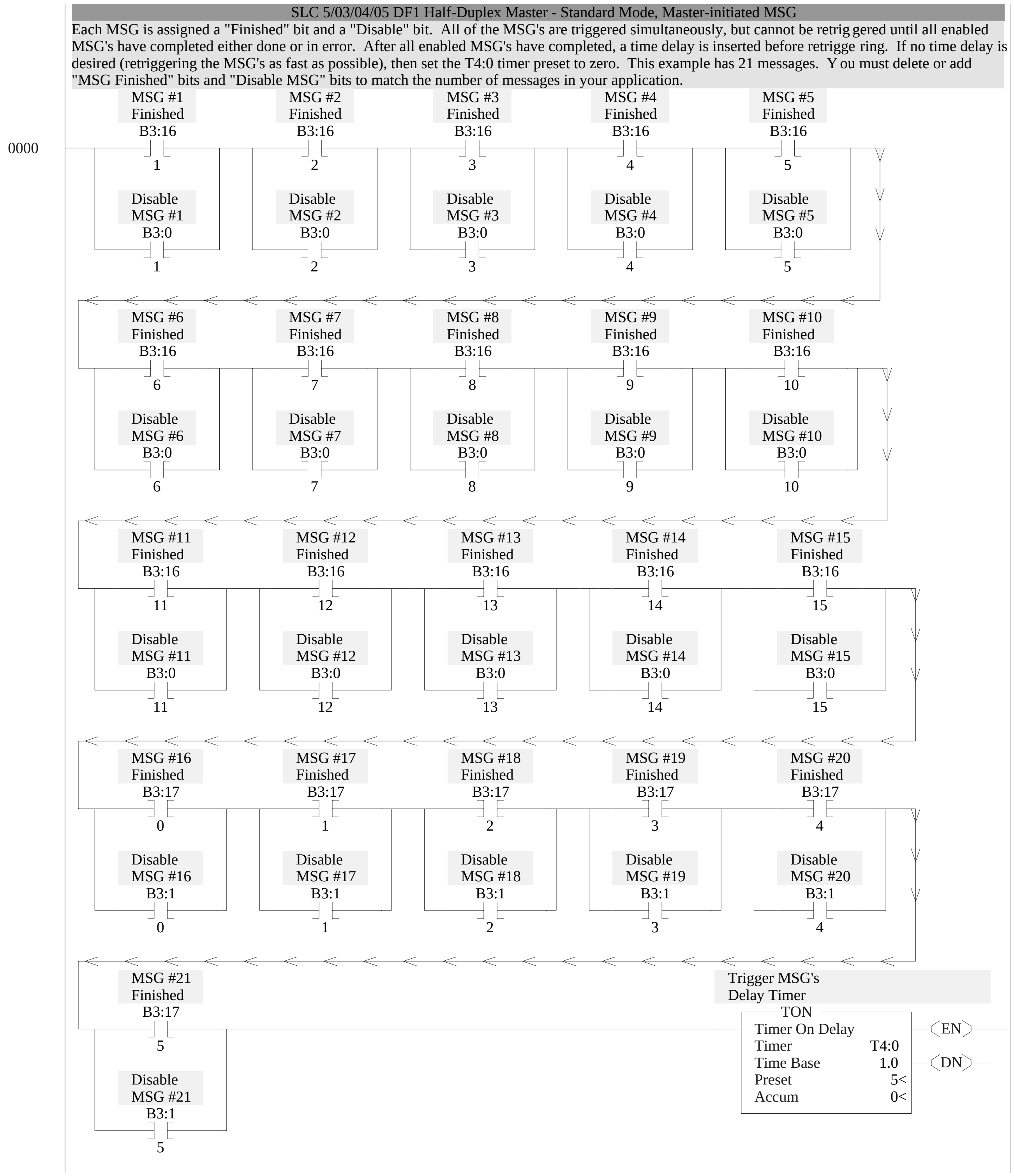
Use This Appendix...

...as a guide for developing your messaging logic for MicroLogix 1000, SLC 500 and PLC-5 processors.

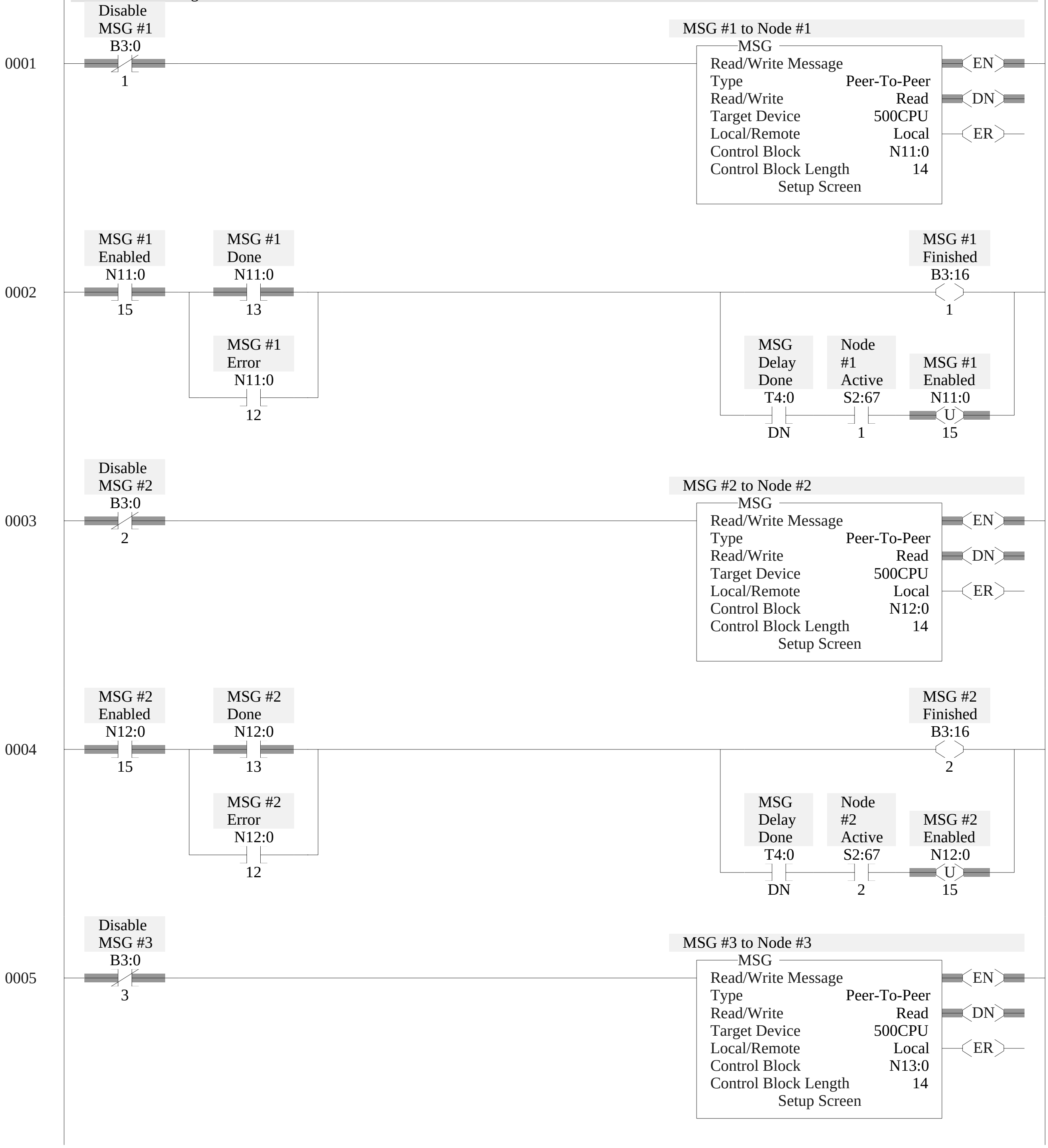
The user of and those responsible for applying the information contained in this appendix must satisfy themselves as to the acceptability of each application and use of the program. In no event will Rockwell Automation be responsible or liable for indirect or consequential damages resulting from the use or application of this information.

The examples shown in this appendix are intended solely to illustrate the principles of the controllers and some of the methods used to apply them. Rockwell Automation cannot assume responsibility or liability for actual use based upon the examples shown.

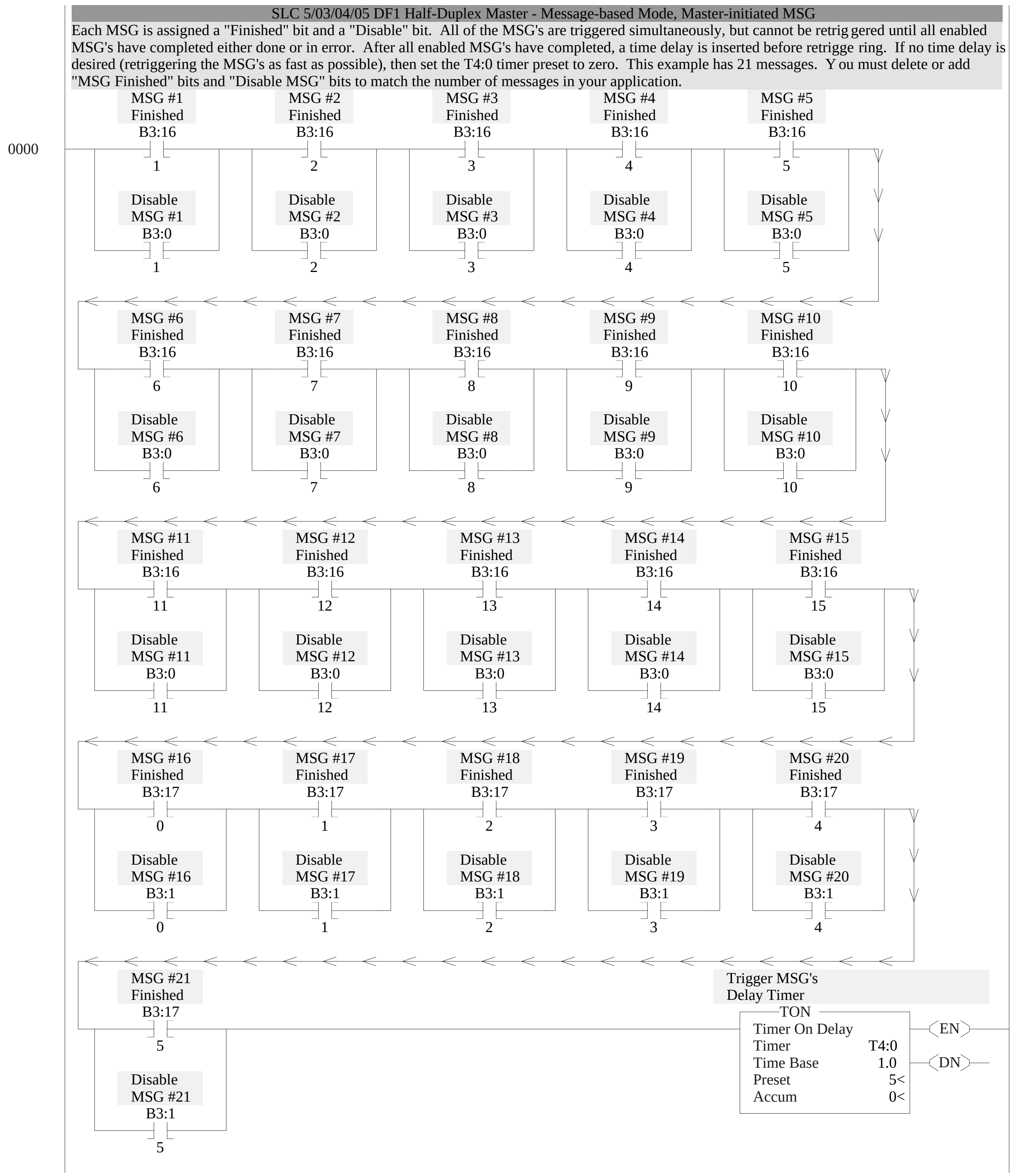
SLC DF1 Half-Duplex Master Standard Mode, Master-initiated MSG

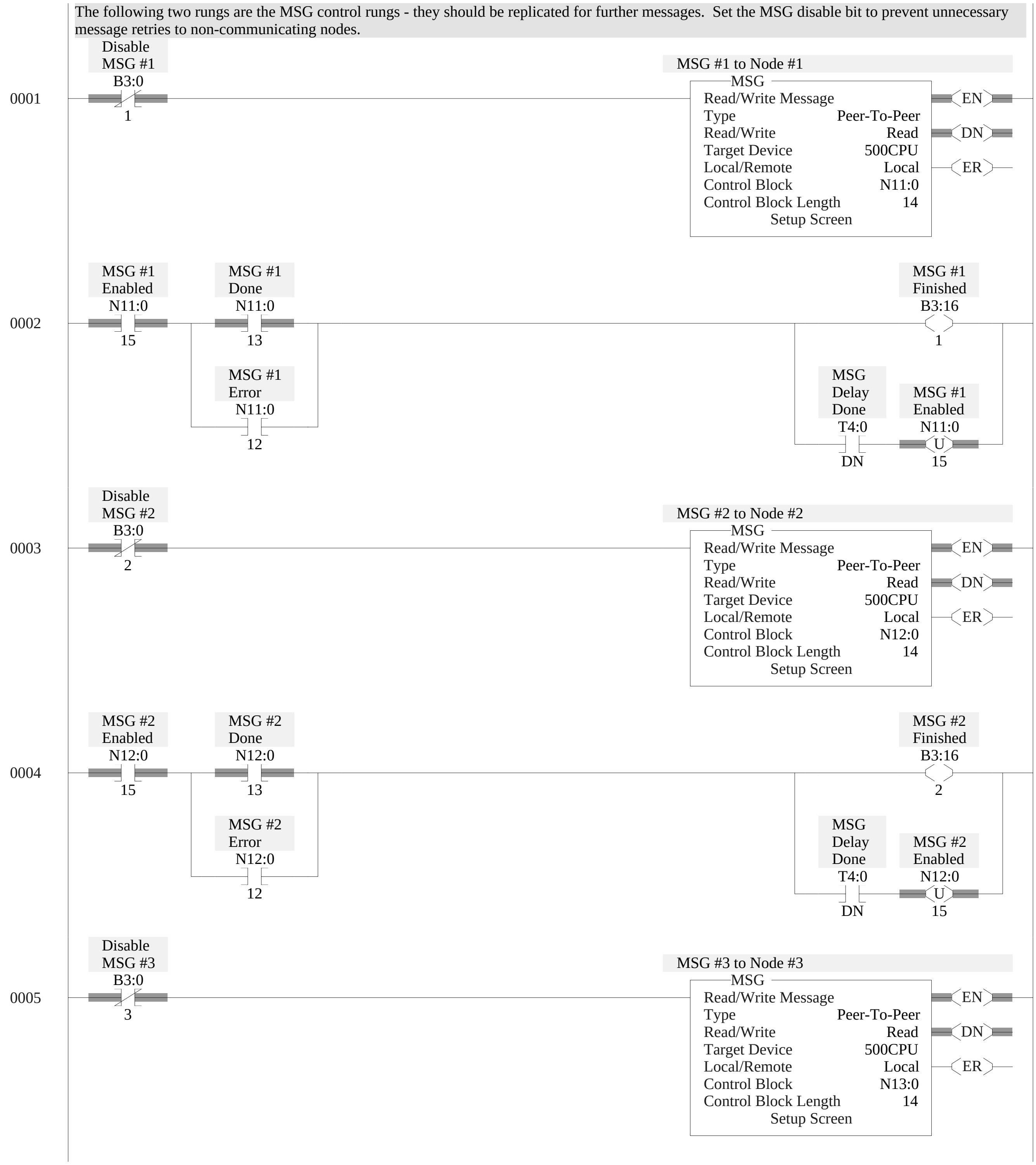


The following two rungs are the MSG control rungs - they should be replicated for further messages. Be sure to use the proper "Active Node Bit" from S:67/0-S:82/14 for nodes 0-254 based on the Target Node Address in the MSG. This assures that messages will not be triggered to nodes that are currently inactive (did not respond the last time they were polled by the Master). This "automatically" helps prevent unnecessary message retries to non-communicating nodes.

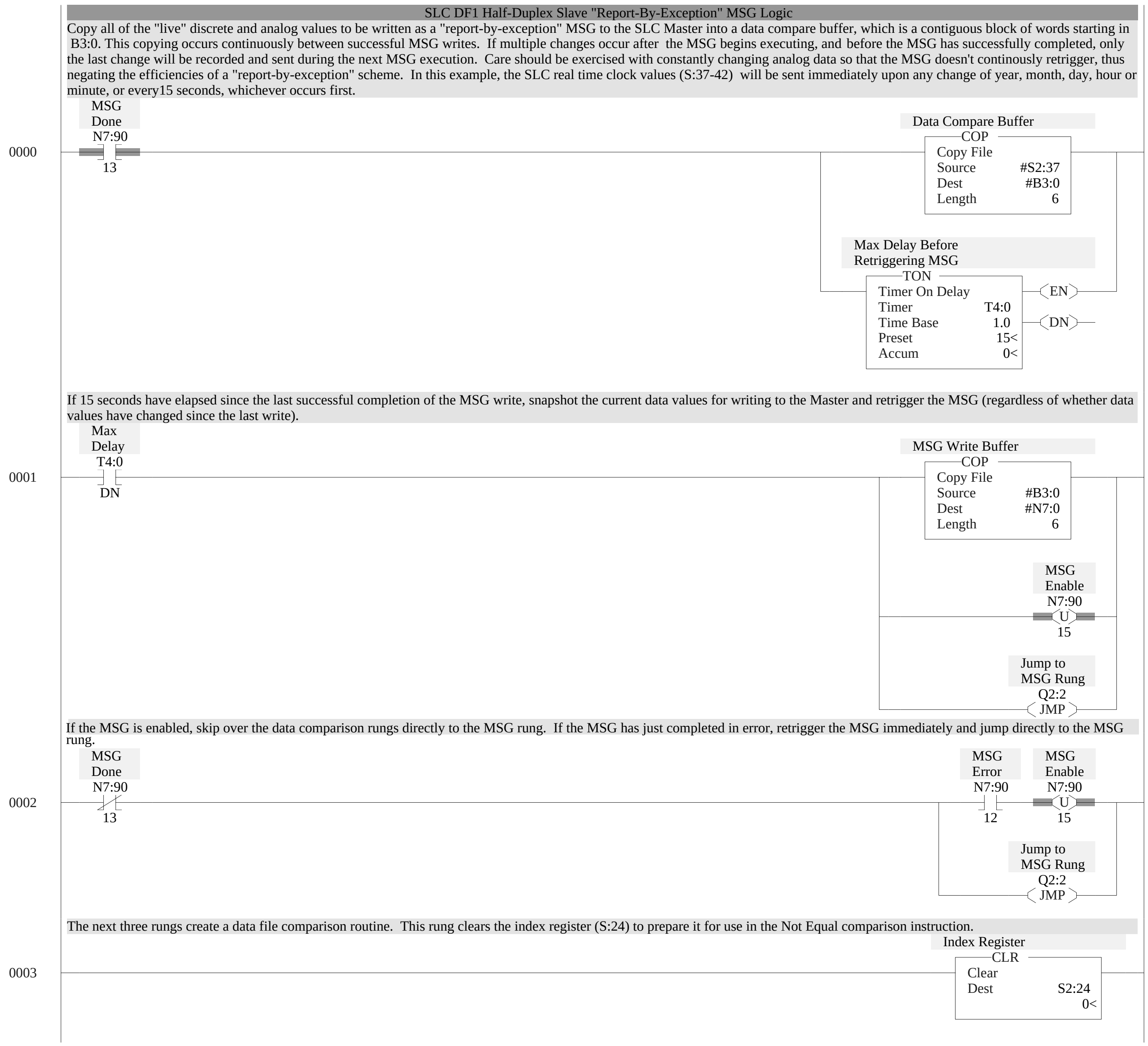


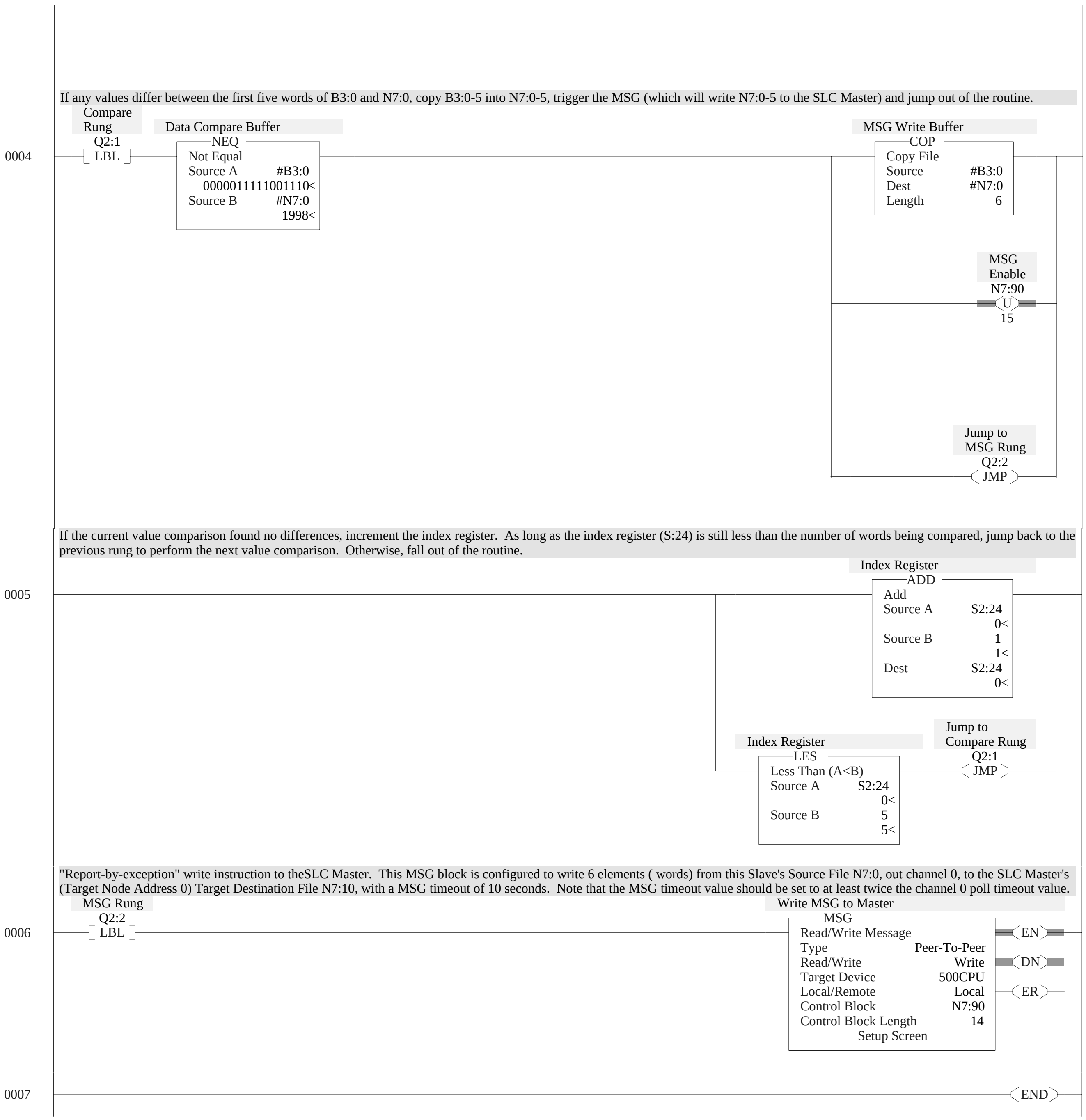
SLC DF1 Half-Duplex Master Message-based Mode Master-initiated MSG



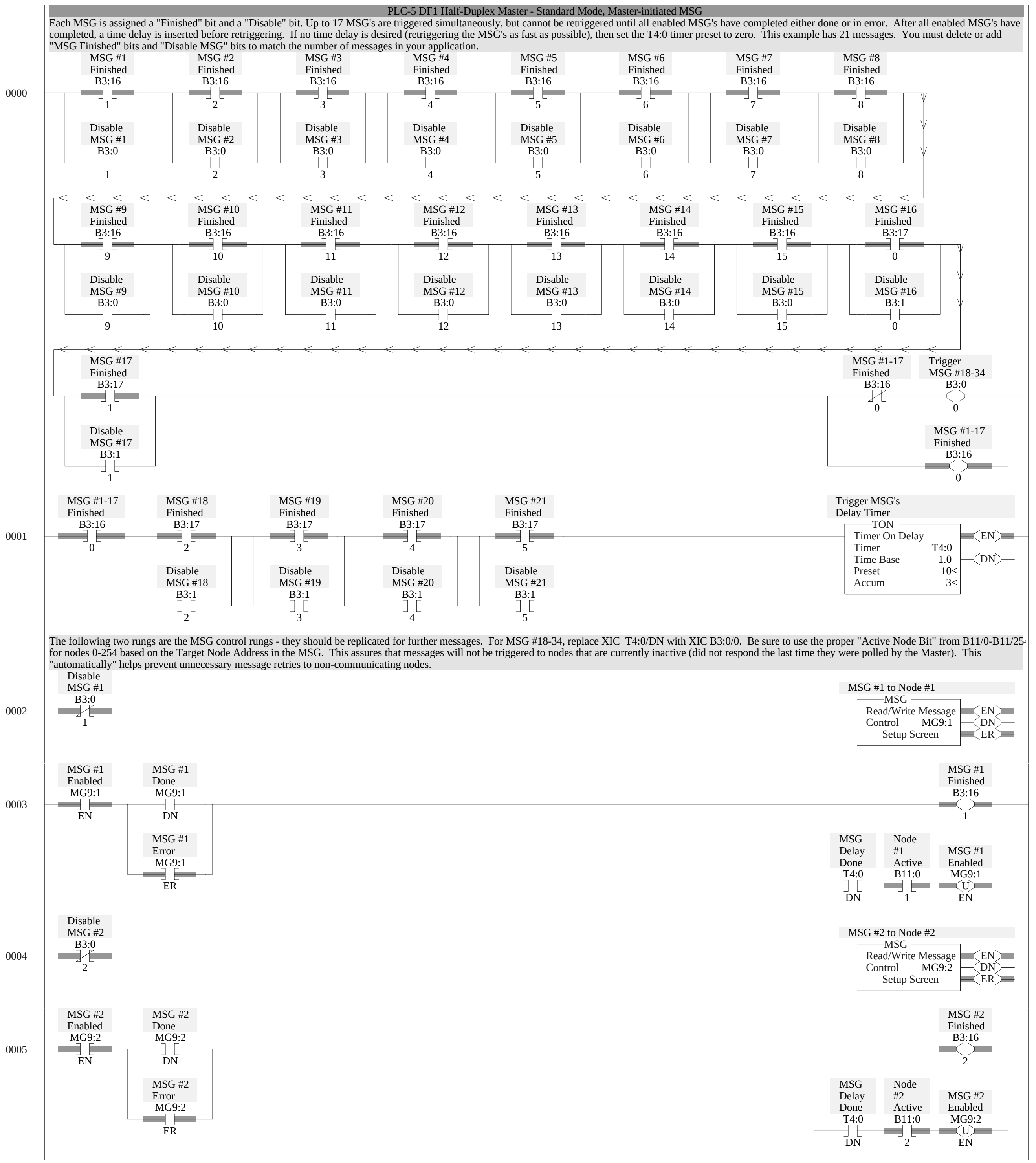

The following two rungs are the MSG control rungs - they should be replicated for further messages. Set the MSG disable bit to prevent unnecessary message retries to non-communicating nodes.
0001
Disable MSG #1
B3:0
1
MSG #1 to Node #1
MSG
Read/Write Message
Type Peer-To-Peer
Read/Write Read
Target Device 500CPU
Local/Remote Local
Control Block N11:0
Control Block Length 14
Setup Screen
EN
DN
ER
0002
MSG #1 Enabled
N11:0
15
MSG #1 Done
N11:0
13
MSG #1 Error
N11:0
12
MSG #1 Finished
B3:16
1
MSG Delay Done
T4:0
DN
MSG #1 Enabled
N11:0
U
15
0003
Disable MSG #2
B3:0
2
MSG #2 to Node #2
MSG
Read/Write Message
Type Peer-To-Peer
Read/Write Read
Target Device 500CPU
Local/Remote Local
Control Block N12:0
Control Block Length 14
Setup Screen
EN
DN
ER
0004
MSG #2 Enabled
N12:0
15
MSG #2 Done
N12:0
13
MSG #2 Error
N12:0
12
MSG #2 Finished
B3:16
2
MSG Delay Done
T4:0
DN
MSG #2 Enabled
N12:0
U
15
0005
Disable MSG #3
B3:0
3
MSG #3 to Node #3
MSG
Read/Write Message
Type Peer-To-Peer
Read/Write Read
Target Device 500CPU
Local/Remote Local
Control Block N13:0
Control Block Length 14
Setup Screen
EN
DN
ER

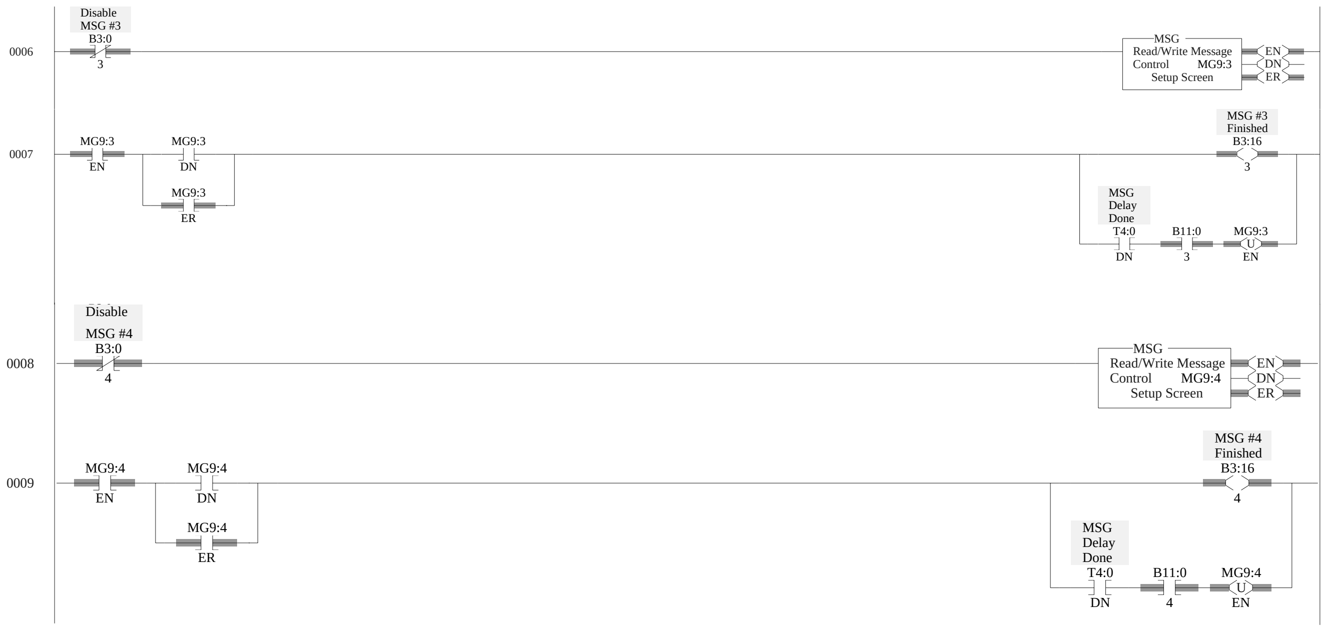
SLC DF1 Half-Duplex Slave Report-by-Exception MSG



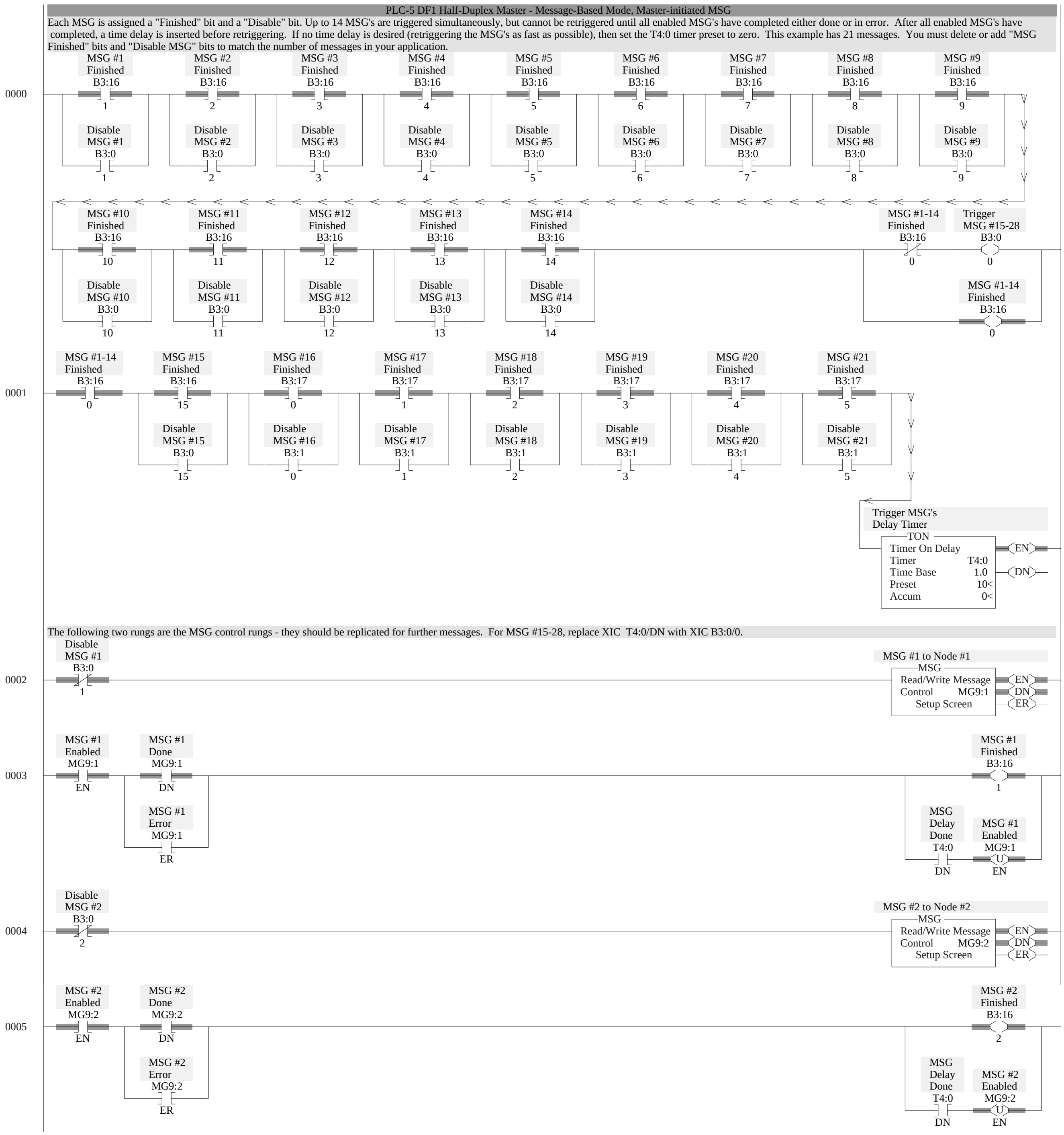

If any values differ between the first five words of B3:0 and N7:0, copy B3:0-5 into N7:0-5, trigger the MSG (which will write N7:0-5 to the SLC Master) and jump out of the routine.
0004
Compare Rung
Q2:1
LBL
Data Compare Buffer
NEQ
Not Equal
Source A #B3:0
0000011111001110<
Source B #N7:0
1998<
MSG Write Buffer
COP
Copy File
Source #B3:0
Dest #N7:0
Length 6
MSG Enable
N7:90
U
15
Jump to MSG Rung
Q2:2
JMP
If the current value comparison found no differences, increment the index register. As long as the index register (S:24) is still less than the number of words being compared, jump back to the previous rung to perform the next value comparison. Otherwise, fall out of the routine.
0005
Index Register
ADD
Add
Source A S2:24
0<
Source B 1
1<
Dest S2:24
0<
Index Register
LES
Less Than (A<B)
Source A S2:24
0<
Source B 5
5<
Jump to Compare Rung
Q2:1
JMP
"Report-by-exception" write instruction to theSLC Master. This MSG block is configured to write 6 elements (words) from this Slave's Source File N7:0, out channel 0, to the SLC Master's (Target Node Address 0) Target Destination File N7:10, with a MSG timeout of 10 seconds. Note that the MSG timeout value should be set to at least twice the channel 0 poll timeout value.
0006
MSG Rung
Q2:2
LBL
Write MSG to Master
MSG
Read/Write Message
Type Peer-To-Peer
Read/Write Write
Target Device 500CPU
Local/Remote Local
Control Block N7:90
Control Block Length 14
Setup Screen
EN
DN
ER
0007
END

PLC-5 DF1 Half-Duplex Master Standard Mode, Master-initiated MSG



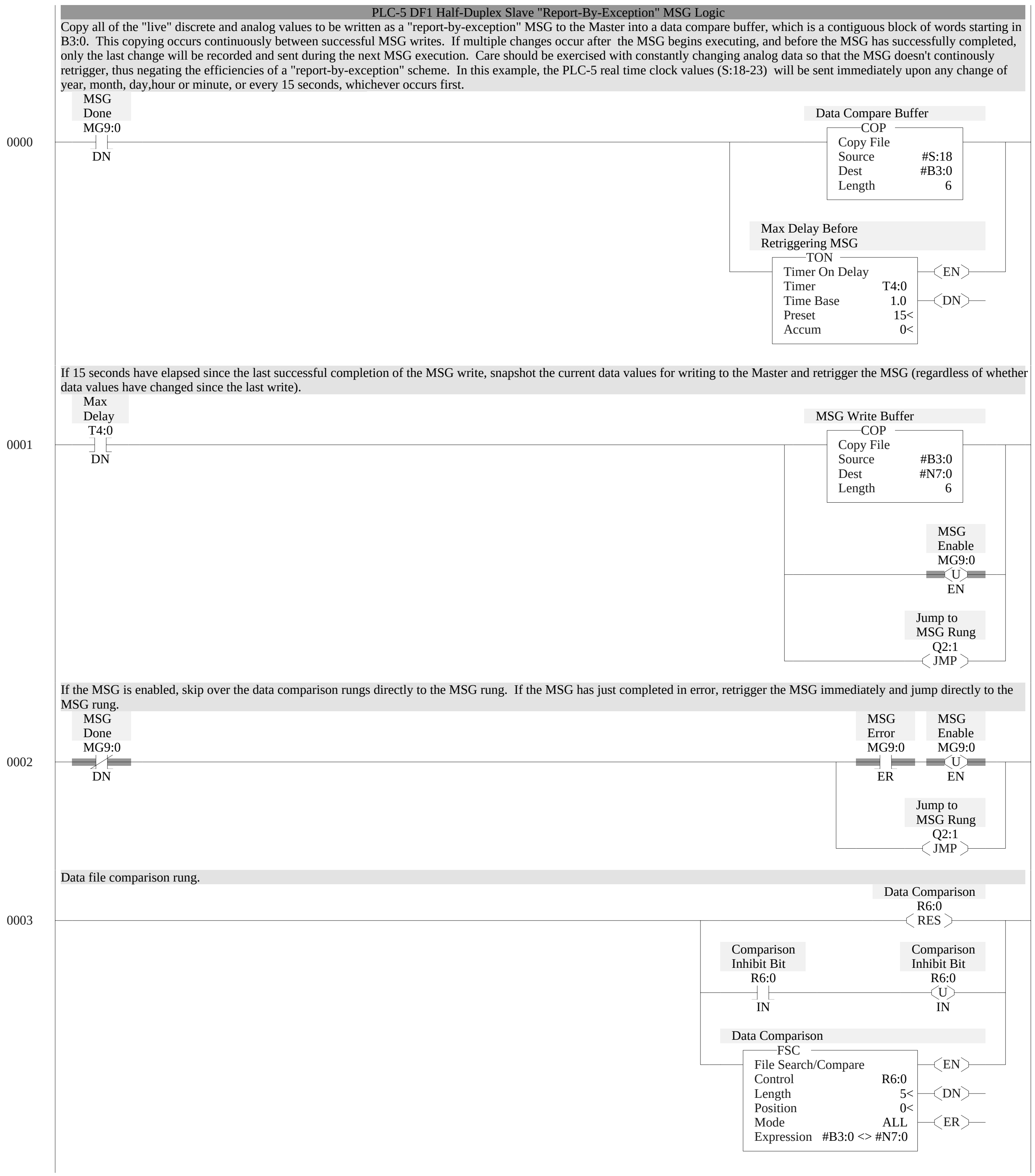

0006
Disable MSG #3
B3:0
3
MSG
Read/Write Message
Control MG9:3
Setup Screen
EN
DN
ER
0007
MG9:3
EN
MG9:3
DN
MG9:3
ER
MSG #3 Finished
B3:16
3
MSG Delay Done
T4:0
DN
B11:0
3
MG9:3
U
EN
0008
Disable MSG #4
B3:0
4
MSG
Read/Write Message
Control MG9:4
Setup Screen
EN
DN
ER
0009
MG9:4
EN
MG9:4
DN
MG9:4
ER
MSG #4 Finished
B3:16
4
MSG Delay Done
T4:0
DN
B11:0
4
MG9:4
U
EN

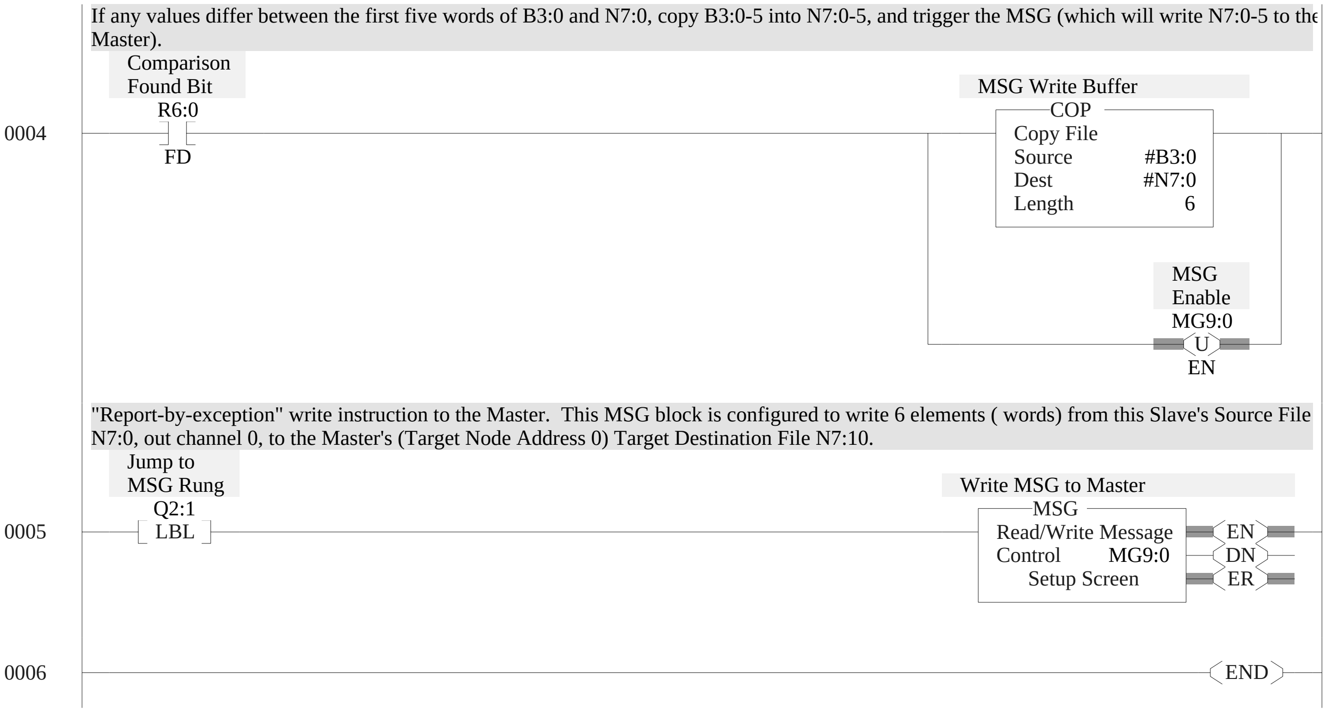
PLC-5 DF1 Half-Duplex Master Message-based, Master-initiated MSG



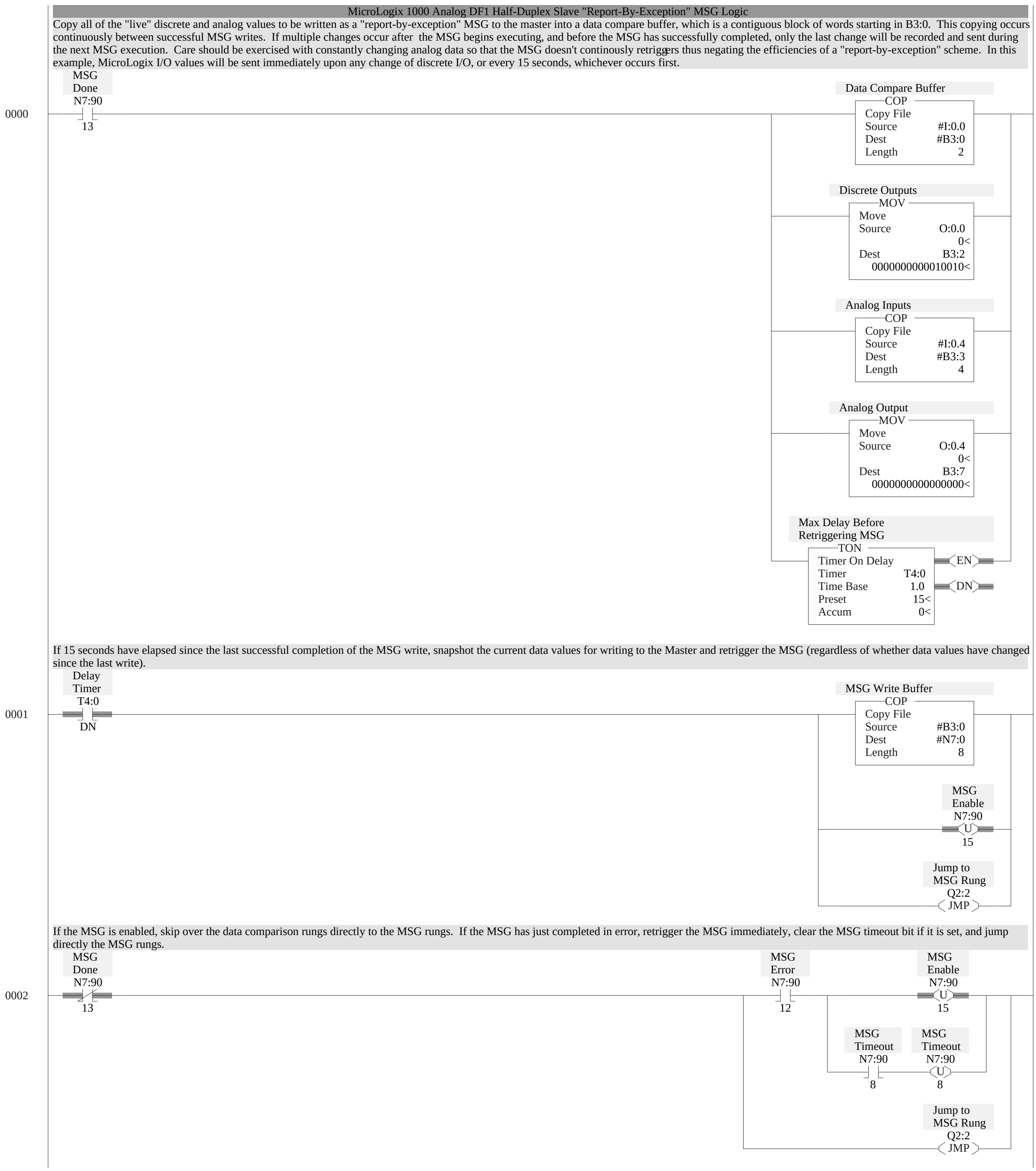

0006
Disable
MSG #3
B3:0
3
MSG
Read/Write Message
Control MG9:3
Setup Screen
EN
DN
ER
0007
MG9:3
EN
MG9:3
DN
MG9:3
ER
MSG #3
Finished
B3:16
3
MSG
Delay
Done
T4:0
DN
MG9:3
U
EN
0008
Disable
MSG #4
B3:0
4
MSG
Read/Write Message
Control MG9:4
Setup Screen
EN
DN
ER
0009
MG9:4
EN
MG9:4
DN
MG9:4
ER
MSG #4
Finished
B3:16
4
MSG
Delay
Done
T4:0
DN
MG9:4
U
EN
0010
Disable
MSG #5
B3:0
5
MSG
Read/Write Message
Control MG9:5
Setup Screen
EN
DN
ER

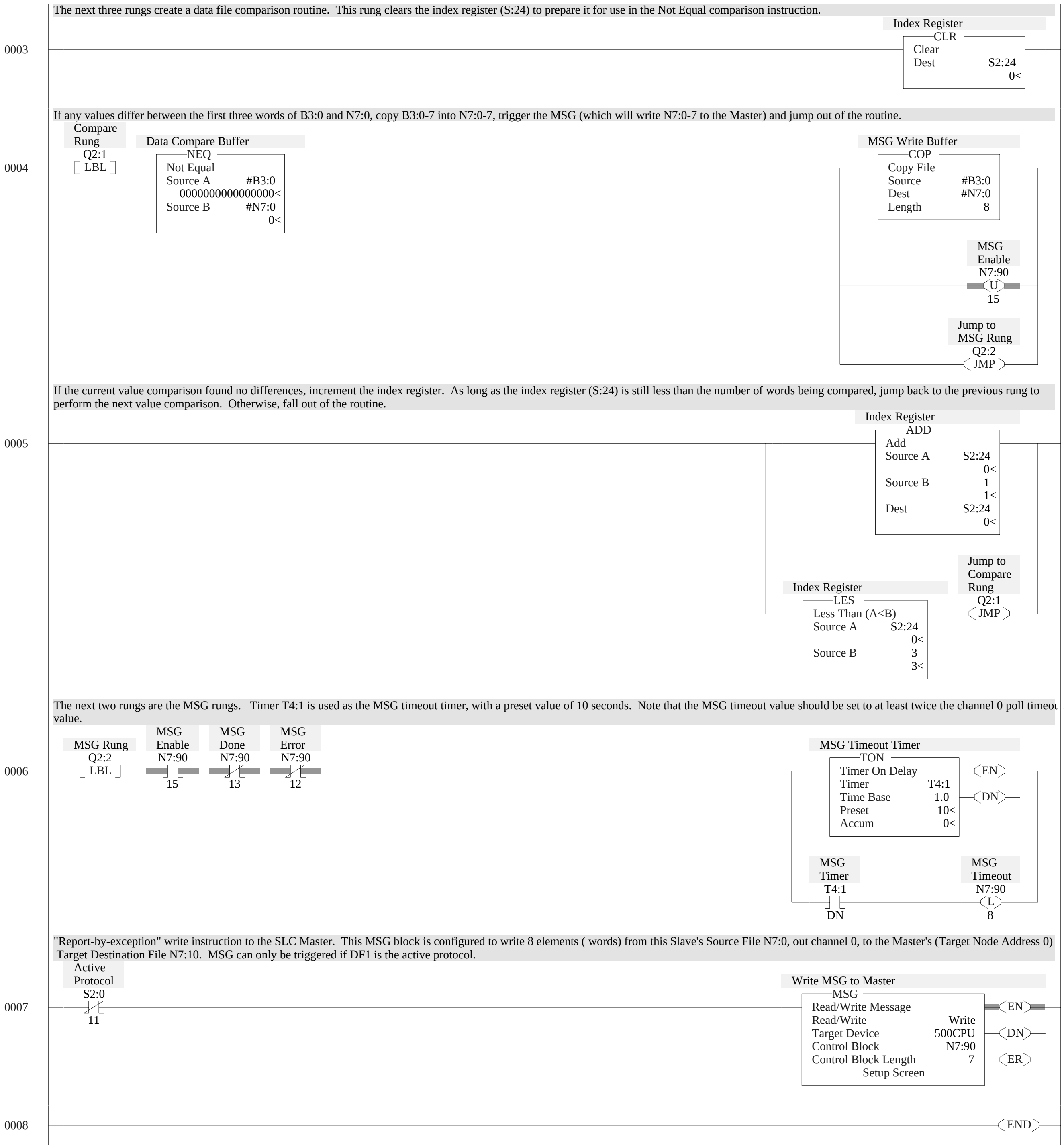
PLC-5 DF1 Half-Duplex Slave Report-by-Exception MSG



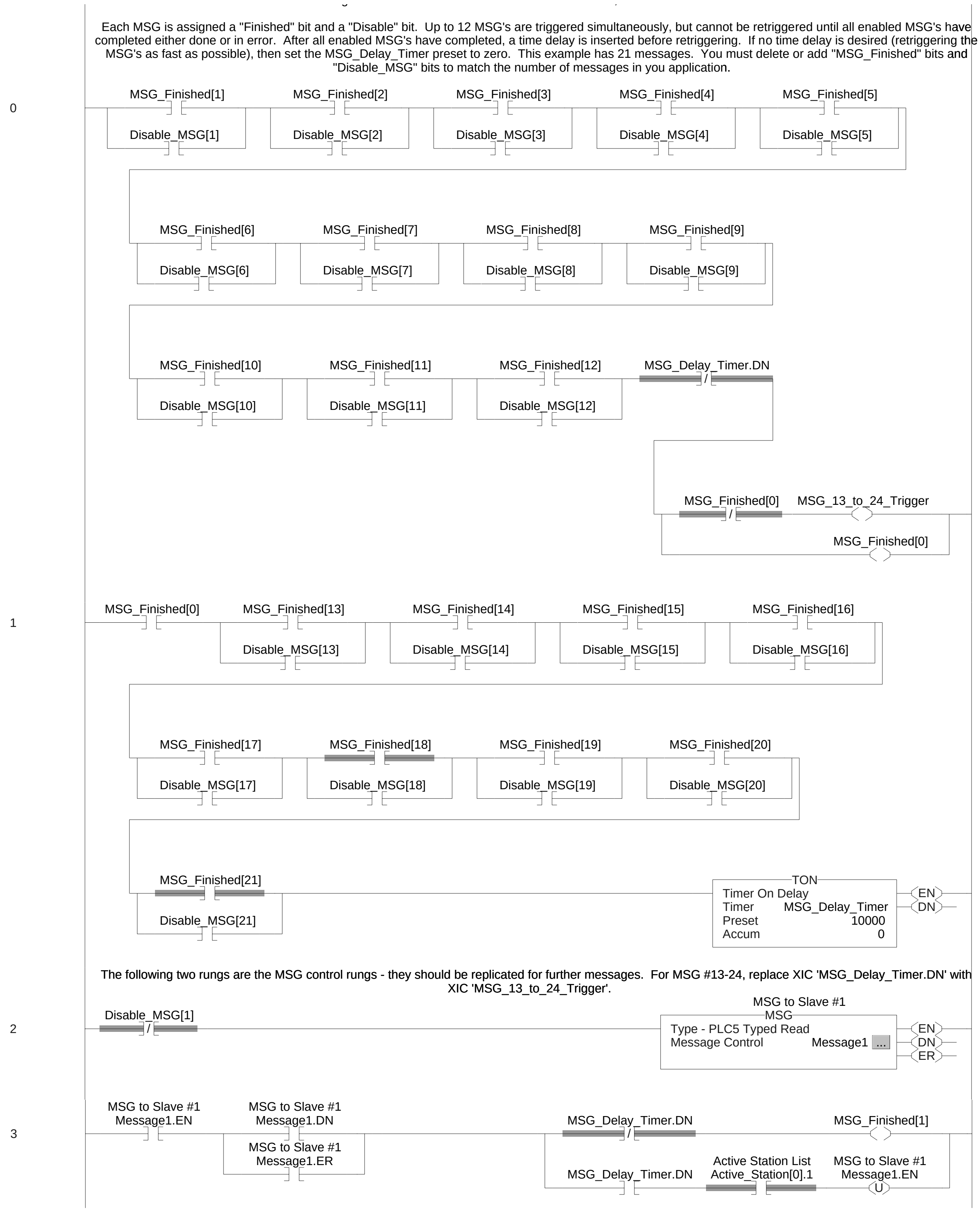

If any values differ between the first five words of B3:0 and N7:0, copy B3:0-5 into N7:0-5, and trigger the MSG (which will write N7:0-5 to the Master).
Comparison Found Bit
R6:0
0004
FD
MSG Write Buffer
COP
Copy File
Source #B3:0
Dest #N7:0
Length 6
MSG Enable
MG9:0
U
EN
"Report-by-exception" write instruction to the Master. This MSG block is configured to write 6 elements (words) from this Slave's Source File N7:0, out channel 0, to the Master's (Target Node Address 0) Target Destination File N7:10.
Jump to MSG Rung
Q2:1
0005
LBL
Write MSG to Master
MSG
Read/Write Message
Control MG9:0
Setup Screen
EN
DN
ER
0006
END

MicroLogix 1000 Analog DF1 Half-Duplex Slave Report-by-Exception MSG

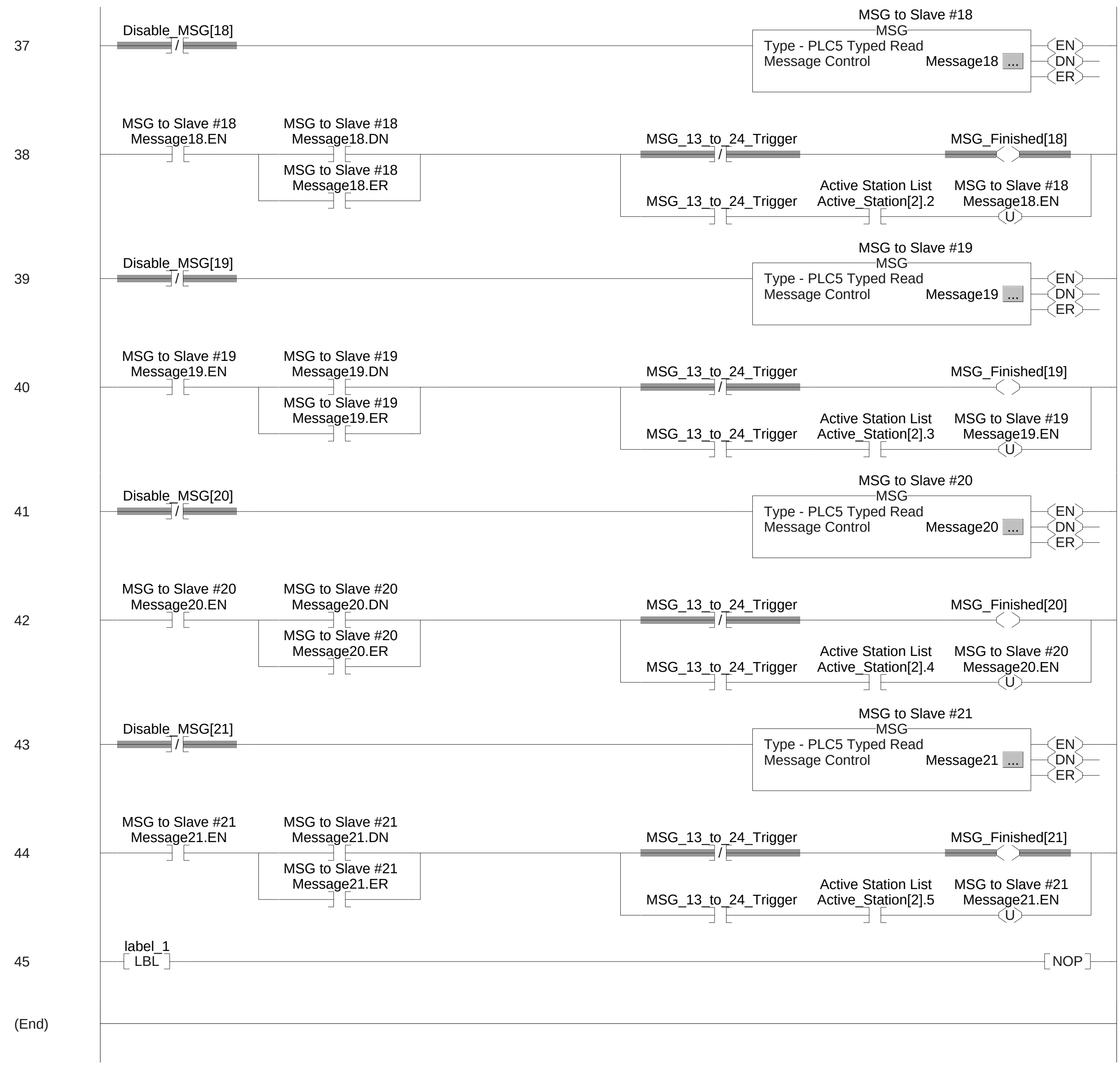



The next three rungs create a data file comparison routine. This rung clears the index register (S:24) to prepare it for use in the Not Equal comparison instruction.
0003
Index Register
CLR
Clear
Dest S2:24
0<
If any values differ between the first three words of B3:0 and N7:0, copy B3:0-7 into N7:0-7, trigger the MSG (which will write N7:0-7 to the Master) and jump out of the routine.
0004
Compare Rung
Q2:1
LBL
Data Compare Buffer
NEQ
Not Equal
Source A #B3:0
0000000000000000<
Source B #N7:0
0<
MSG Write Buffer
COP
Copy File
Source #B3:0
Dest #N7:0
Length 8
MSG Enable
N7:90
U
15
Jump to MSG Rung
Q2:2
JMP
If the current value comparison found no differences, increment the index register. As long as the index register (S:24) is still less than the number of words being compared, jump back to the previous rung to perform the next value comparison. Otherwise, fall out of the routine.
0005
Index Register
ADD
Add
Source A S2:24
0<
Source B 1
1<
Dest S2:24
0<
Jump to Compare Rung
Q2:1
JMP
Index Register
LES
Less Than (A<B)
Source A S2:24
0<
Source B 3
3<
The next two rungs are the MSG rungs. Timer T4:1 is used as the MSG timeout timer, with a preset value of 10 seconds. Note that the MSG timeout value should be set to at least twice the channel 0 poll timeout value.
0006
MSG Rung
Q2:2
LBL
MSG Enable
N7:90
15
MSG Done
N7:90
13
MSG Error
N7:90
12
MSG Timeout Timer
TON
Timer On Delay
Timer T4:1
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
MSG Timer
T4:1
DN
MSG Timeout
N7:90
L
8
"Report-by-exception" write instruction to the SLC Master. This MSG block is configured to write 8 elements (words) from this Slave's Source File N7:0, out channel 0, to the Master's (Target Node Address 0) Target Destination File N7:10. MSG can only be triggered if DF1 is the active protocol.
0007
Active Protocol
S2:0
11
Write MSG to Master
MSG
Read/Write Message
Read/Write Write
Target Device 500CPU
Control Block N7:90
Control Block Length 7
Setup Screen
EN
DN
ER
0008
END

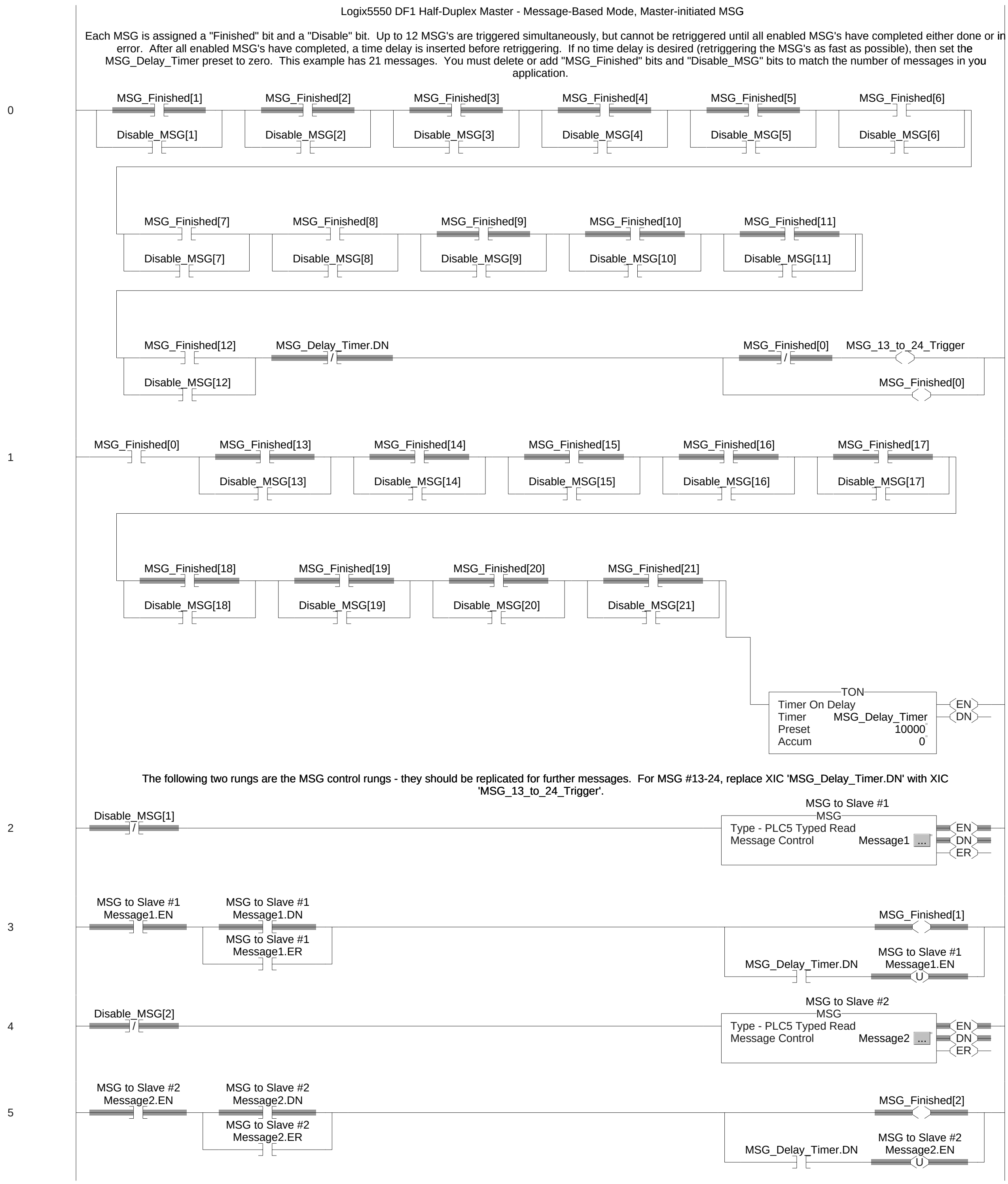
Logix5550 DF1 Half-Duplex Master Standard Mode, Master-Initiated MSG



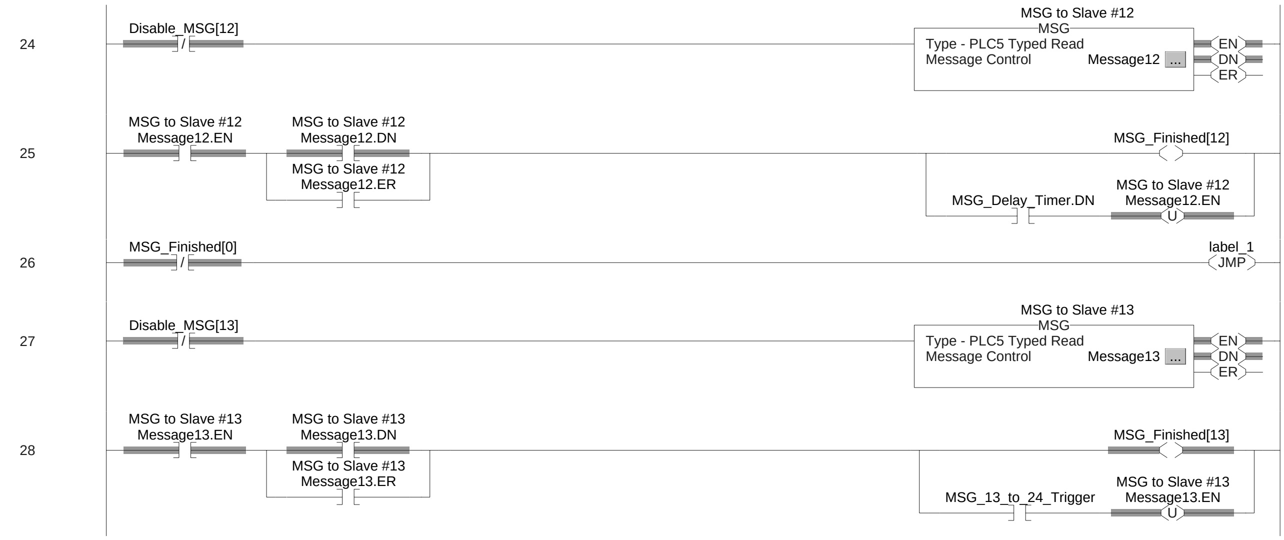
Rungs 4-23 have been omitted


37
Disable_MSG[18]
MSG to Slave #18
MSG
Type - PLC5 Typed Read
Message Control Message18 ...
EN
DN
ER
38
MSG to Slave #18
Message18.EN
MSG to Slave #18
Message18.DN
MSG to Slave #18
Message18.ER
MSG_13_to_24_Trigger
MSG_Finished[18]
MSG_13_to_24_Trigger
Active Station List
Active_Station[2].2
MSG to Slave #18
Message18.EN
U
39
Disable_MSG[19]
MSG to Slave #19
MSG
Type - PLC5 Typed Read
Message Control Message19 ...
EN
DN
ER
40
MSG to Slave #19
Message19.EN
MSG to Slave #19
Message19.DN
MSG to Slave #19
Message19.ER
MSG_13_to_24_Trigger
MSG_Finished[19]
MSG_13_to_24_Trigger
Active Station List
Active_Station[2].3
MSG to Slave #19
Message19.EN
U
41
Disable_MSG[20]
MSG to Slave #20
MSG
Type - PLC5 Typed Read
Message Control Message20 ...
EN
DN
ER
42
MSG to Slave #20
Message20.EN
MSG to Slave #20
Message20.DN
MSG to Slave #20
Message20.ER
MSG_13_to_24_Trigger
MSG_Finished[20]
MSG_13_to_24_Trigger
Active Station List
Active_Station[2].4
MSG to Slave #20
Message20.EN
U
43
Disable_MSG[21]
MSG to Slave #21
MSG
Type - PLC5 Typed Read
Message Control Message21 ...
EN
DN
ER
44
MSG to Slave #21
Message21.EN
MSG to Slave #21
Message21.DN
MSG to Slave #21
Message21.ER
MSG_13_to_24_Trigger
MSG_Finished[21]
MSG_13_to_24_Trigger
Active Station List
Active_Station[2].5
MSG to Slave #21
Message21.EN
U
45
label_1
LBL
NOP
(End)

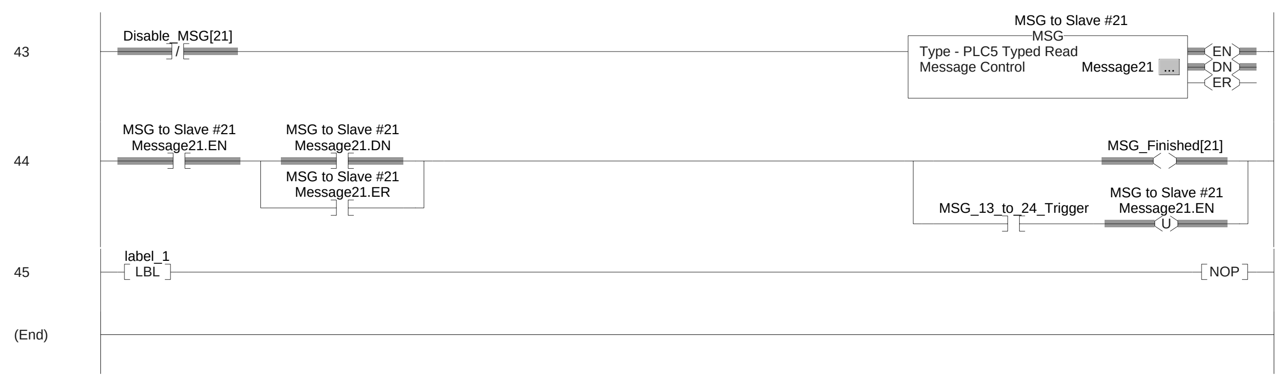
Logix5550 DF1 Half-Duplex Master Message-based Mode, Master-Initiated MSG



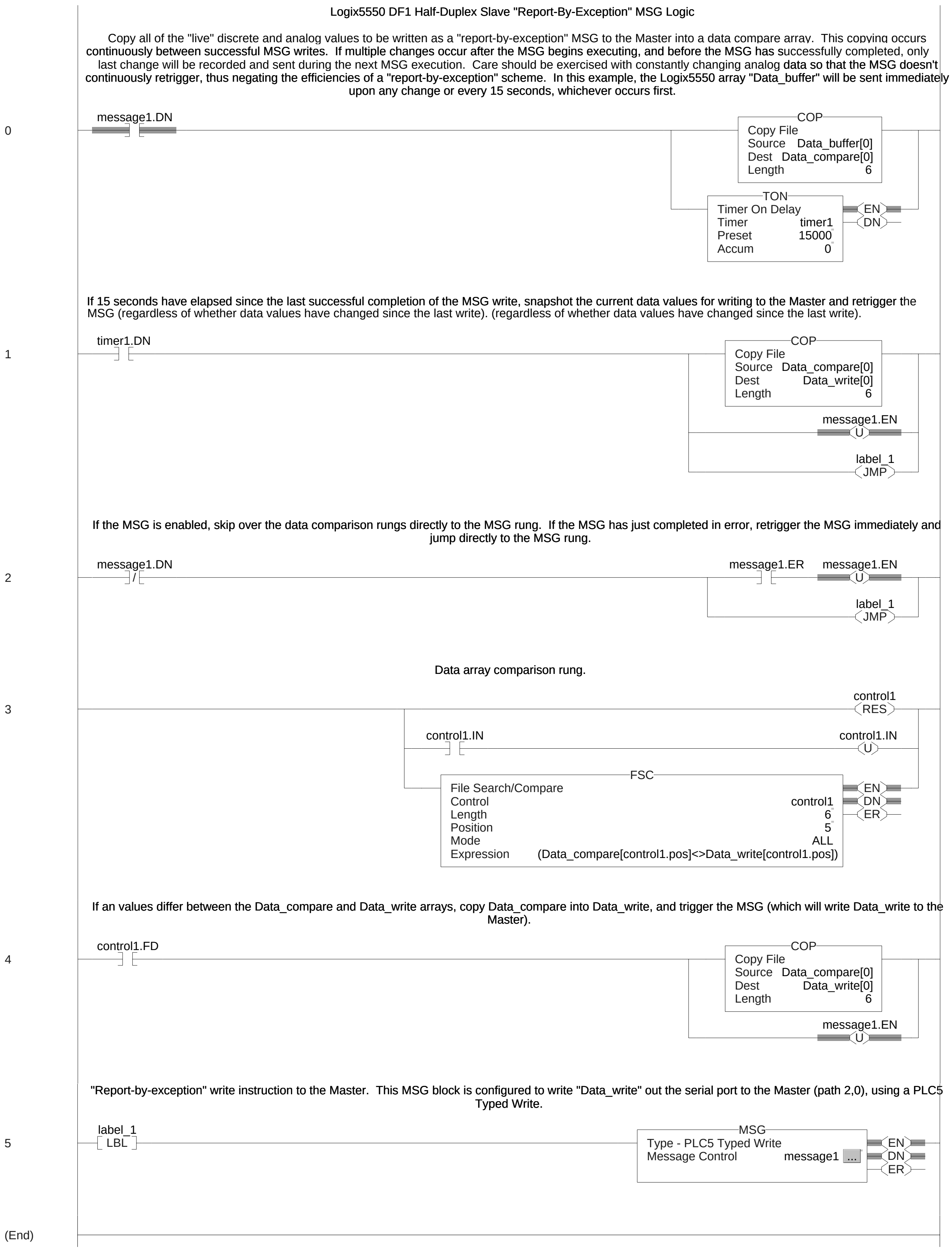
Rungs 6-23 have been omitted



Rungs 28-42 have been omitted



Logix5550 DF1 Half-Duplex Slave Report-By-Exception MSG



Notes

ACK — **See Acknowledgment.**

Acknowledgment — An ASCII control character that indicates the transmission and acceptance of data.

Asynchronous transmission — A method of serial transmission where characters may be transmitted at unequal time intervals. Asynchronous transmission requires that each character contains start/stop elements so the receiver can detect the start and end of each character.

BCC — Block-Check Character. The 2's complement of the 8-bit sum (modulo–256 arithmetic sum) of all data bytes in a transmission block. It provides a means of checking the accuracy of each message transmission.

Bridge — An interface between links in a communication network that routes messages from one link to another when a station on one link addresses a message to a station on another link.

Classic PLC–5™ Processor — A collective name used to refer to PLC–5/10, –5/12, –5/15, and –5/25 processors.

CRC — Cyclic redundancy check. An error detection scheme where all of the characters in a message are treated as a string of bits representing a binary number. This number is divided by a predetermined binary number (a polynomial), and the remainder is appended to the message as a CRC character. A similar operation occurs at the receiving end to prove transmission integrity.

CTS — Clear-to-send. A signal from the modem that tells the transmitting device to start transmitting data.

DCD — Data Carrier Detect; a signal from the modem indicating that the carrier is being received.

DCE — Data Communication Equipment. 1) Equipment that provides the functions required to establish, maintain, or terminate a connection. 2) The signal conversion and coding required for communication between data terminal equipment and data circuits. Examples include modems, line drivers, coaxial cable, satellite links, etc. DCE may or may not be an integral part of a computer.

DF1 HDx — The Allen-Bradley asynchronous half-duplex protocol.

Digital Data Service (DDS) — A special wide-bandwidth Private Leased Line (PLL) that uses digital techniques to transfer data at higher speeds and lower error rate than voice-band, analog PLLs. The line is available 24 hours a day.

DSR — Data-set Ready. A signal from the modem that indicates the modem is connected, powered up, and ready for data transmission.

DTE	Data Terminal Equipment. Equipment that is attached to a network to send or receive data, or both. Programmable controllers, workstations, and interface modules are examples of DTEs.
DTR	Data Terminal Ready. A signal that indicates the transmission device (terminal) is connected, powered up, and ready to transmit.
Enhanced PLC–5 Processors	A collective name used to refer to PLC–5/11, –5/20, –5/30, –5/40, –5/60, and PLC–5/80 processors.
EOT	End Of Transmission; an ASCII control character that indicates the end of a data transmission.
Ethernet PLC–5 Processors	A collective name used to refer to PLC–5/20E, –5/40E, and –5/80E processors.
Extended Local PLC–5E™ Processors	A collective name used to refer to PLC–5/40L and –5/60L processors.
FCC	Federal Communication Commission (United States).
Full-Duplex Circuit	A physical circuit that allows simultaneous, bidirectional transmission of data; also called a “four-wire” circuit.
Full-Duplex Modem	A modem that is capable of simultaneous, bidirectional transmissions.
Full-Duplex Protocol	1) A mode of operation for a point-to-point link with two physical circuits in which messages or transmission blocks can be sent in both directions at the same time. 2) Contrasted with *two-way alternate*.
General Switched Telephone Network	International version of a Public Switched Telephone Network.
Half-Duplex Circuit	A physical circuit that allows transmission of data in either direction but not at the same time.
Half-Duplex Modem	A modem that sends and receives messages on carriers of the same frequency. Therefore, simultaneous, bidirectional transmissions are not possible.
Half-Duplex Protocol	1) A mode of operation for a point-to-point or multipoint baseband link with two physical circuits in which messages or transmission blocks can be sent in one direction or the other but not both at the same time. 2) Contrasted with *two-way simultaneous*. The master station-to-remote station communication uses a half-duplex protocol.
Handshake	A series of signals between a computer (DTE) and a peripheral device (DCE; e.g., a modem) that establishes the parameters required for passing data.
Integrated Service Unit (ISU)	Data communication equipment for a digital data network, which serves as the data transmitting and receiving device. An ISU is a combination of a digital service unit (DSU) and a channel service unit (CSU).

I/O Rack An I/O addressing unit that corresponds to 8 input image table words and 8 output image table words.

Link A data channel established between two or more stations.

Master Station A device (programmable controller with I/O modules or a workstation) that sends data to and collects data from devices connected on a point-to-multipoint, half-duplex network.

Modem A device that modulates digital information from a programmable controller or computer to an analog signal that is transported over phone lines, radio waves, and satellite transmissions and demodulates the analog data back into digital data at the receiving site.

Modem Handshaking A signaling protocol used for transferring information between devices in a synchronized manner at a rate acceptable to both devices. It may be accomplished by hardware or software.

Multidrop Link 1) A link that has more than 2 stations. 2) Contrasted with *point-to-point link.*

NAK Negative Acknowledgment. An ASCII control character transmitted by a receiver as a negative response to the sender.

Node A station on a network.

Octal Numbering System A numbering system that uses only the digits 0–7; also called base-8.

Packet The transmission unit exchanged at the network layer.

Packet Radio Modem An intelligent radio modem that packetizes the data it receives from the transmitting station. The modem places a header and a trailer around the data before it transmits the data to the destination device. The header can also contain routing information. Packet radio modems also perform their own data error checking and will re-transmit the data if an error is encountered.

PAD Packet assembler/disassembler. Equipment used to assemble and disassemble data packets for transmission on a packet-switching network such as a satellite system.

Parallel port An electrical connection on a computer capable of transmitting or receiving two or more bits of data at one time; the communications port to which such devices as parallel printers can be attached.

Point-to-multipoint A network where connections exist between one master station and multiple remote stations.

Point-to-point A network where a connection is made between two and only two terminal installations.

Poll When the master station sends a message to a remote station that allows the remote station an opportunity to return a response to the master or another remote station. In this manual, when the master polls a remote station, it is not initiating a read request.

Polling cycle	The order and frequency in which network nodes in a poll list are polled.
Poll List	A list of nodes or stations on a network to be polled on a regular and repeated basis.
Protocol	A set of conventions governing the format and timing of data transmission between communication devices, including handshaking, error detection, and error recovery.
Private Leased Line Network (PLL)	A dedicated voice-band telephone line between two or more locations primarily used for data transmission.
Public Switched Telephone Network (PSTN)	The standard dial-up telephone network originally used for voice communication.
RS–232	An EIA electrical connection standard, most often used as a standard interface for serial binary communication between data terminal equipment and data communications equipment. Also known as EIA–232.
RTS	Request To Send. A request from the module to the modem to prepare to transmit. It typically turns on the data carrier.
RTU	Remote Terminal Unit. See remote station.
RXD	Received Data; a serialized data input to a receiving device.
Remote Station	A device (programmable controller with I/O modules) that is located in a remote site away from the master station and that controls I/O points at the remote site. A remote station accepts commands from and can send data (if capable) to a master station via a telemetry network.
SCADA	Supervisory Control and Data Acquisition
Slave	See remote station.
Slave Protocol	See Half-Duplex Protocol.
Serial Port	An electrical connection on a computer that handles data bits one after another; the communications port (COM1 or COM2) to which devices such as a modem, a mouse, or a serial printer can be attached.
Spurious Character	A false or unexpected character received when none is expected.
Standard Radio Modem	A standard radio modem is an assembly that contains both a radio and a modem, which transmits data without any special handling. Data error checking is the responsibility of the receiving station (DTE).
Station	Any programmable controller, computer, or data terminal connected to, and communicating by means of, a data channel; a device on a network.
Station Addressing	The syntax allowing packets to be routed correctly between master and remote stations.

Synchronous Transmission A type of serial transmission that maintains a constant time interval between successive events.

Telemetry Transmission and collection of data obtained by sensing real-time conditions.

Topology The way a network is physically structured. Example: a ring, bus, or star configuration.

Transceiver An electronic device that operates as both a radio transmitter and receiver.

TXD Transmitted Data; an output from the module that carries serialized data.

Notes

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