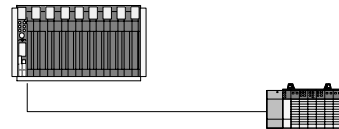# Connecting PLC-5 Procesors and SLC Processors over a DH+ Link

Using SLC 5/04™ Processors

Introduction

This document combines available PLC® and SLC™ documentation to show you how you can communicate between these two types of systems over a DH+™ link.
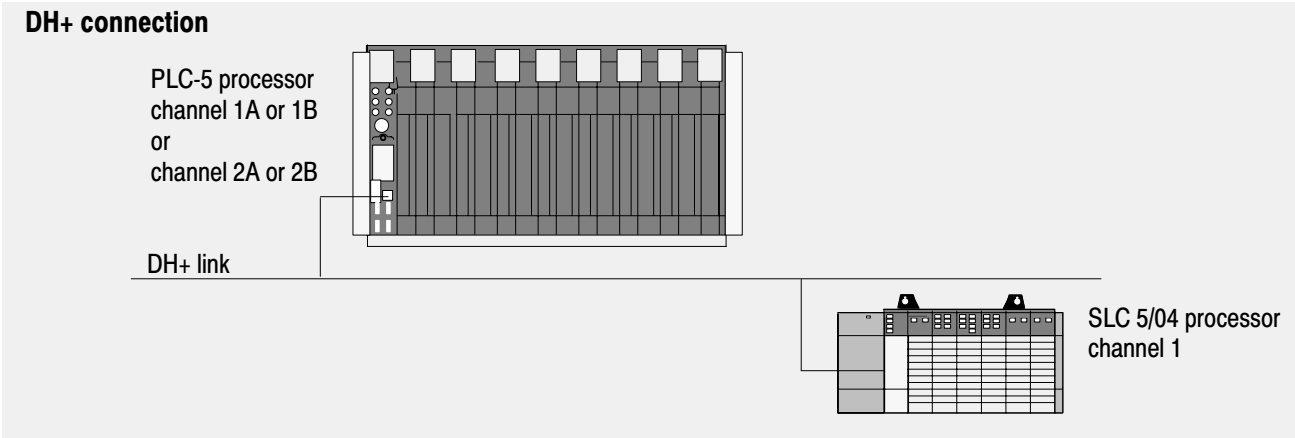
DH+ link

This information is in addition to the user documentation for the processors and communication modules discussed here. You should already have a solid understanding of how to use these processors. Each section in this document lists additional documentation you can refer to for detailed information .
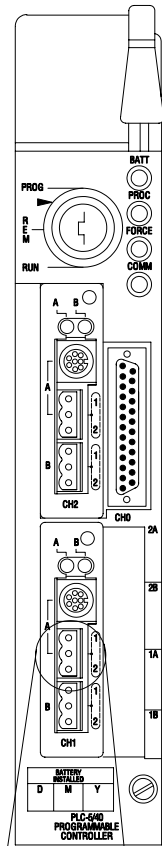
This document is part of a larger set of reference materials to help you better use your PLC-5® processor. The 1785-6.8.*x* series of documents provides individual documents for different applications. This reference set is continually expanding, so see your Allen-Bradley sales representative or distributor for an up-to-date list of available reference documents.

Connecting the processors

DH+ connection

PLC-5 processor
channel 1A or 1B
or
channel 2A or 2B

DH+ link

SLC 5/04 processor
channel 1

PLC 5 processor

BATT

PROG

PROC

R
E
M

FORCE

RUN

COMM

A   B

A

1
2

B

1
2

CH2   CH0

A   B   2A

2B

A

1
2

1A

B

1
2

1B

CH1

BATTERY
INSTALLED

D   M   Y

PLC-5/40
PROGRAMMABLE
CONTROLLER

SLC 5/04 processor

SLC 5/04 CPU

RUN ☐   ☐ FORCE
FLT ☐   ☐ DH+
BATT ☐   ☐ RS232

RUN   REM PROG

1
SHIELD
2
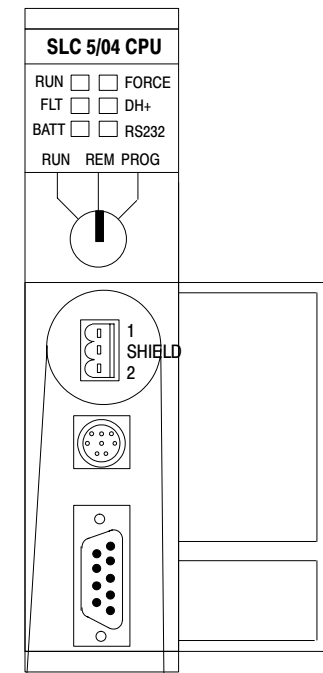
1770-CD
(Belden 9463)

Clear
Shield
Blue

To another
DH+ device

1
2

Clear
Shield
Blue

1
2

82-Ω or
150-Ω
resistor
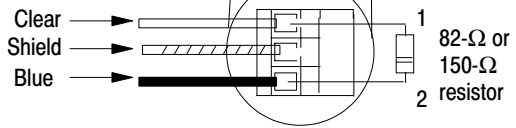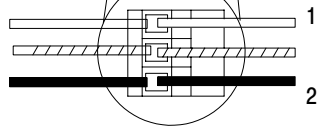
1770-CD
(Belden 9463)

Terminate both ends of a DH+ link

Configuring the processors for the DH+ connection

use your PLC-5 programming software
to configure PLC-5 channel 1A, 1B,
2A, or 2B

```
                          Data Highway Plus
                       Channel 1a Configuration



        Diagnostics file:              N14
        Baud Rate:                     57.6kB
        Global Status flag file:       N12
        Link ID:                       0




   Press a function key or enter a value.
   >
   Rem Prog   Forces:None                          5/40 File BATCHTES
   Accept                                          Chan 0   Select
    Edits                                          Status   Option
     F1                                              F9      F10
```
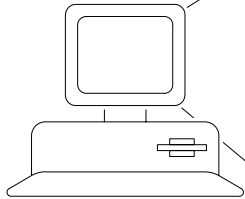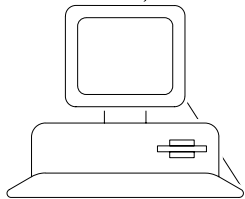
use your SLC programming software
to configure SLC 5/04 channel 1

```
+ - - - - - - - - - - - - - Channel Configuration - - - - - - - - - - - - - - - - +

CHANNEL 0 CONFIGURATION
         Current Communication Mode:  SYSTEM
                 System Mode Driver:  DF1 FULL-DUPLEX
                   User Mode Driver:  SHUTDOWN
                      Write Protect:  DISABLED
                      Mode Changes:   DISABLED
         Mode Attention Character:    /1b
            System Mode Character:    S
              User Mode Character:    U
   Edit Resource/File Owner Timeout:  60   (seconds)
                  Passthru Link ID:   1   (decimal)

CHANNEL 1 CONFIGURATION
                 System Mode Driver:  DH+
                      Write Protect:  DISABLED
   Edit Resource/File Owner Timeout:  60   (seconds)
                  Passthru Link ID:   2   (decimal)
```

```
+ - - - - - - - - - -  CHANNEL 1 SYSTEM MODE CONFIGURATION - - - - - - - - - - - +

   Communication Driver:    DH+

   Diagnostic File:         RESERVED

   Baud Rate:               57600

   Node Address             1 (octal)



+ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - +

 Press a function key

 REM PROG


 ACCEPT          UNDO                          CHANNEL      SELECT
 EDITS           EDITS                         STATUS       OPTION
  F1              F2                             F9           F10
```
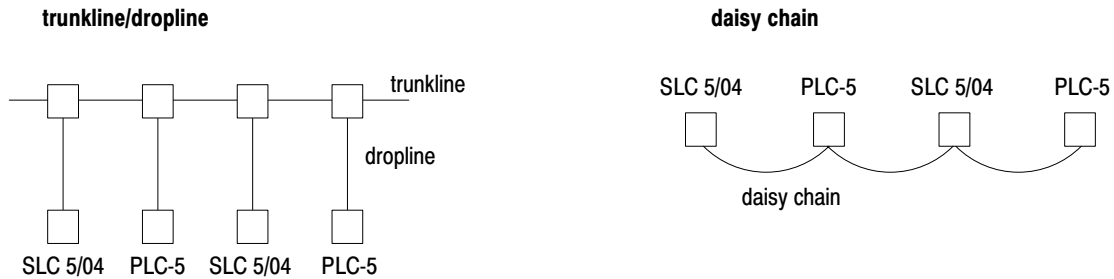
Application requirements

You can connect a DH+ link in two ways:

trunkline/dropline

trunkline

dropline

SLC 5/04   PLC-5   SLC 5/04   PLC-5

daisy chain

SLC 5/04   PLC-5   SLC 5/04   PLC-5

daisy chain

> ⚠ **ATTENTION:** Do not mix trunkline/dropline connections with daisy chain connections in one DH+ link.

When installing DH+ communication links **do not**:

- exceed these cable lengths:
    - trunk line-cable length—3,048 m (10,000 cable-ft)
    - drop-cable length—30.4 m (100 cable-ft)

- connect more than 64 stations on a single DH+ link

Use the 3-pin connector on the processor to connect a DH+ link. The connector's port must be configured to support a DH+ communication link.

DH+ programming cables

The communication cable you use to connect your programming terminal to the DH+ link depends on the communication card in the programming terminal.

When you use this communication card:	Use this cable:
1784-KT, -KT2 1784-KL, -KL/B	• 1784-CP6 • 1784-CP with 1784-CP7 adapter • 1784-CP8 adapter
1784-KTX, -KTXD	• 1784-CP12 with 1784-CP7 adapter
1784-PCMK	• 1784-PCM5 with 1784-CP7 adapter

Communicating over a DH+ link

The SLC 5/04 processor accepts PLC-5 type MSG commands to read and write status, bit, timer, counter, control, integer, floating point, string, and ASCII data. The SLC 5/04 processor does not let the PLC-5 processor read from or write to input or output files due to the differences between the PLC-5 rack/group addressing structure and the SLC slot/word addressing structure.

The PLC-5 processor accepts SLC 500 peer-to-peer read and peer-to-peer write MSG commands. The PLC-5 processor does not let the SLC 5/04 processor read from or write to input or output files due to the differences between the PLC-5 rack/group addressing structure and the SLC slot/word addressing structure.

Additional documentation
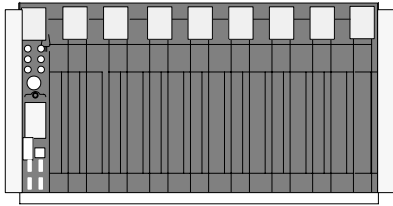
- 1747-6.2 SLC 500 Modular Hardware Style Installation and Operation Manual
- 1785-6.1 PLC-5 Programming Software Instruction Set Reference Manual
- 1770-6.5.16 Data Highway/Data Highway Plus/DH-485 Protocol and Command Set Reference Manual

Programming MSG instructions

PLC-5 MSG instructions

SLC 5/04 MSG instructions

The MSG instruction transfers data in packets. Each DH+ data packet can contain as many as 120 words. If your message transfer contains more words than fit in one packet, the transfer requires more than one packet of transfer data. The more packets to transfer, the longer the transfer takes.

The PLC-5 processor can queue as many as 16 message instructions at one time – for all channels. The processor channels queue message instructions on a first-come-first-served basis.

Data associated with a message write instruction is buffered when you enable the instruction. The SLC 5/04 processor can queue as many as 14 message instructions per channel.

If a MSG instruction is in one of the four "channel-dependent" transmission buffers and is waiting to be transmitted, its control block has status bits EN and EW set. If more than four MSG instructions for that channel are enabled at one time, a "channel dependent" overflow queue stores the MSG instruction header blocks (not the data for a MSG write) from the fifth instruction to the fourteenth.

This instruction, queued in a FIFO, order has control block status bit EN set. If more than 14 MSG instructions are enabled at one time for any one channel, control block status bit WQ is set, as there may be no room available in the overflow queue. This instruction must be re-scanned until space exists in this queue.

SLC 5/04 processors with OS401 and later support global status bits.

When the SLC 5/04 processor responds to a PLC-5 type message, the SLC processor doesn't allow any reading or writing of its input and output image table. If the SLC 5/04 processor initiates the message, it allows reading and writing of its input and output image table.

Considerations when configuring MSG control blocks

Keep these considerations in mind when configuring messages to communicate over a DH+ link between PLC-5 and SLC 5/04 processors.

- The SLC processor can only address words 0 to 255 in a PLC-5 data table.
- In an SLC 5/04 MSG instruction, the maximum number of words you can read from or write to a PLC-5 processor is 100 words.

Choose from the following MSG commands when sending MSG instructions from an SLC 5/04 processor to a PLC-5 processor. These commands simplify sending messages by eliminating the need for creating a PLC-2® compatibility file for both the PLC-5 processor and the SLC 5/04 processor.

If you want the instruction to:	On this type of network:	Select these MSG command parameters:	
read data from a PLC-5 processor	local DH+	**Type:** **Read/Write:** **Target Device:** **Local/Remote:**	Peer-to-Peer Read PLC5 Local
	remote DH+	**Type:** **Read/Write:** **Target Device:** **Local/Remote:**	Peer-to-Peer Read PLC5 Remote
write data to a PLC-5 processor	local DH+	**Type:** **Read/Write:** **Target Device:** **Local/Remote:**	Peer-to-Peer Write PLC5 Local
	remote DH+	**Type:** **Read/Write:** **Target Device:** **Local/Remote:**	Peer-to-Peer Write PLC5 Remote

Use 14 words of bit or integer data for the control block. This is the control block layout if you select a PLC-5 as the target device:

Control block for an SLC MSG instruction to a PLC-5 processor

15 14 13 12 11 10 09 08 07 06 05 04 03 02 01 00	Word
EN ST DN ER CO EW NR TO │ error code	0
node number	1
reserved for length in words	2
file number	3
file type (S, B, T, C, R, N, O, I, M0, M1)	4
element number	5
subelement number	6
reserved (internal messaging bits) │ WQ	7
message timer preset	8
reserved (internal use only)	9
message timer accumulator	10
reserved (internal use only)	11
reserved (internal use only)	12
reserved (internal use only)	13

PLC-5 MSG commands

Choose from the following MSG commands when sending MSG instructions from a PLC-5 processor to an SLC 5/04 processor. These MSG command types are only available with enhanced PLC-5 processors.

If you want the instruction to:	On this type of network:	Select these MSG command parameters:	
read data from an SLC processor without specifying the actual word length of the message	local DH+	**Communication Command:** **Local/Remote:** **Local Node Address:** **Destination Data Table Address:**	PLC-5 Typed Read From SLC Local address of SLC processor address to read in SLC data table
	remote DH+	**Communication Command:** **Local/Remote:** **Local Node Address:** **Destination Data Table Address:**	PLC-5 Typed Read From SLC Remote address of SLC processor address to read in SLC data table
write data to an SLC processor without specifying the actual word length of the message	local DH+	**Communication Command:** **Local/Remote:** **Local Node Address:** **Destination Data Table Address:**	PLC-5 Typed Write To SLC Local address of SLC processor address to write to in SLC data table
	remote DH+	**Communication Command:** **Local/Remote:** **Local Node Address:** **Destination Data Table Address:**	PLC-5 Typed Write To SLC Remote address of SLC processor address to write to in SLC data table
read a specific number of words of data from an SLC processor	local DH+	**Communication Command:** **Local/Remote:** **Local Node Address:** **Destination Data Table Address:**	SLC Typed Logical Read Local address of SLC processor address to read in SLC data table
	remote DH+	**Communication Command:** **Local/Remote:** **Local Node Address:** **Destination Data Table Address:**	SLC Typed Logical Read Remote address of SLC processor address to read in SLC data table
write a specific number of words of data to an SLC processor	local DH+	**Communication Command:** **Local/Remote:** **Local Node Address:** **Destination Data Table Address:**	SLC Typed Logical Write Local address of SLC processor address to write to in SLC data table
	remote DH+	**Communication Command:** **Local/Remote:** **Local Node Address:** **Destination Data Table Address:**	SLC Typed Logical Write Remote address of SLC processor address to write to in SLC data table

When deciding how to send data through MSG instructions, keep these requirements in mind:

- The maximum message size for PLC-5 processors is 100 words (200 bytes).

- The maximum message size for SLC 5/04 processors is 112 words (224 bytes).

Important: The `PLC5 Typed Write to SLC` and `PLC5 Typed Read from SLC` commands are accessible only with release 5.0 and later 6200 programming software.

The MG control block is fixed at 56 words. You must use the MG control block if you send messages to an SLC processor using the SLC read and write commands, or if you send a message out any port other than channel 1A. This is the control block layout for a PLC-5 MSG instruction:

Control block for a PLC-5 MSG instruction

15 14 13 12 11 10 09 08 07 06 05 04 03 02 01 00	Word
EN ST DN ER CO EW NR TO	0
error code (.ERR)	1
requested length (.RLEN)	2
done length (.DLEN)	3
modifiers (.DATA [0])	4
module class ∣ push wheel	5
port ID ∣ command type	6
command ∣ function	7
station ID (6 words) .DATA [4] – .DATA [9]	8
local data table address (9 words) .DATA [10] – .DATA [18]	14
length remote address ∣ parameters length	23
remote data table address (15 words) .DATA [20] – .DATA [34]	24
logical address of parameters file (9 words) .DATA [35] – .DATA [43]	39
reply class ∣ reply pushwheel	48
reply mailbox ∣ spare	49
port ID (6 words) .DATA [46] – .DATA [51]	50

ATTENTION: Use care when addressing PLC-5 MG.DATA structures. The information in these structures is vital to your control program. Changing MG.DATA values could severely affect the operation of your process.

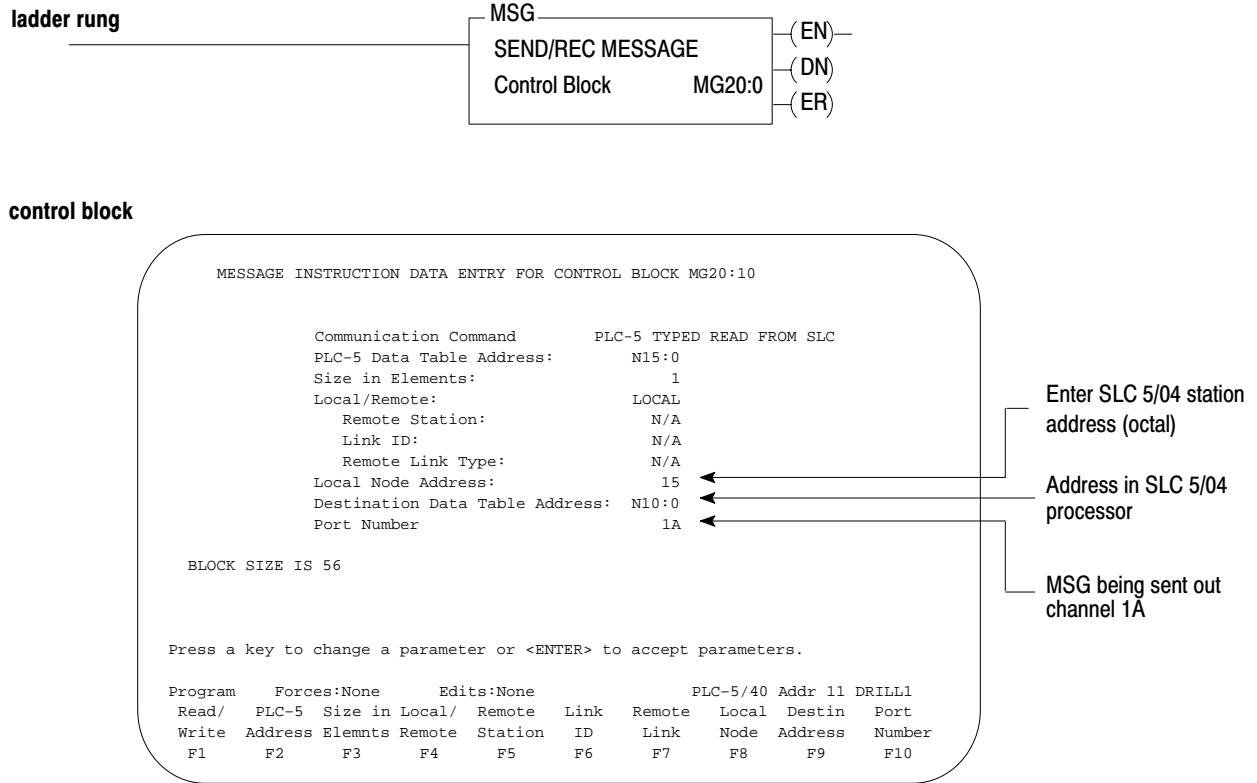### Sending SLC Typed Logical Read and Typed Logical Write commands

Follow these guidelines when programming SLC Typed Logical Read and SLC Typed Logical Write commands:

- You must use the MG data type for the MSG control block.
- The PLC-5 data table address and the destination address types should match when the data type is supported by the PLC-5 and SLC processors. If you want to send a data type that the SLC processor does not support, the SLC processor interprets that data as integer. This table maps the data types from the PLC-5 processor to the SLC processor.

This PLC-5 data type:	Is interpreted by the SLC 5/04 processor as:	This PLC-5 data type:	Is interpreted by the SLC 5/04 processor as:
Binary (B)	bit	String (ST)	string
Integer (N)	integer	BT control (BT)	integer
Output (O)	integer	Timer (T)	timer
Input (I)	integer	Counter (C)	counter
Status (S)	integer	Control (R)	control
ASCII (A)	ASCII	Float (F)	float
BCD (D)	integer	MSG control (MG)	integer
SFC status (SC)	integer	PID control (PD	integer

- To read/write from the SLC input, output (read only), or status file, specify an integer PLC-5 data table address and specify the address of the SLC input, output, or status file. For example, S:37 for word 37 of the SLC status file. Specify SLC input/output addresses by logical format, i.e., O:001 references slot 1.
- PLC-5 ASCII data is byte data (1/2 word) whereas, an SLC ASCII data element is one word. Therefore, if you request a PLC 5 Typed Read of 10 elements, the SLC processor sends a packet containing 20 bytes (10 words).
- PLC-5 processors allow 1000 elements per file for most data types whereas SLC processors allow 256 elements per file.

Figure 1
Sending a read MSG instruction from a PLC-5 processor to an SLC 5/04 processor

ladder rung

```
 ┌─ MSG ──────────────────┐
 │  SEND/REC MESSAGE       ├─(EN)─
 │                         ├─(DN)
 │  Control Block   MG20:0 ├─(ER)
 └─────────────────────────┘
```

control block

```
        MESSAGE INSTRUCTION DATA ENTRY FOR CONTROL BLOCK MG20:10


                Communication Command      PLC-5 TYPED READ FROM SLC
                PLC-5 Data Table Address:        N15:0
                Size in Elements:                    1
                Local/Remote:                    LOCAL
                   Remote Station:                 N/A
                   Link ID:                        N/A
                   Remote Link Type:               N/A
                Local Node Address:                 15
                Destination Data Table Address:  N10:0
                Port Number                         1A

     BLOCK SIZE IS 56




   Press a key to change a parameter or <ENTER> to accept parameters.

   Program    Forces:None      Edits:None              PLC-5/40 Addr 11 DRILL1
    Read/    PLC-5 Size in Local/  Remote    Link   Remote   Local  Destin   Port
    Write   Address Elemnts Remote Station    ID     Link    Node  Address  Number
     F1       F2      F3     F4      F5       F6      F7       F8     F9      F10
```

Enter SLC 5/04 station address (octal)

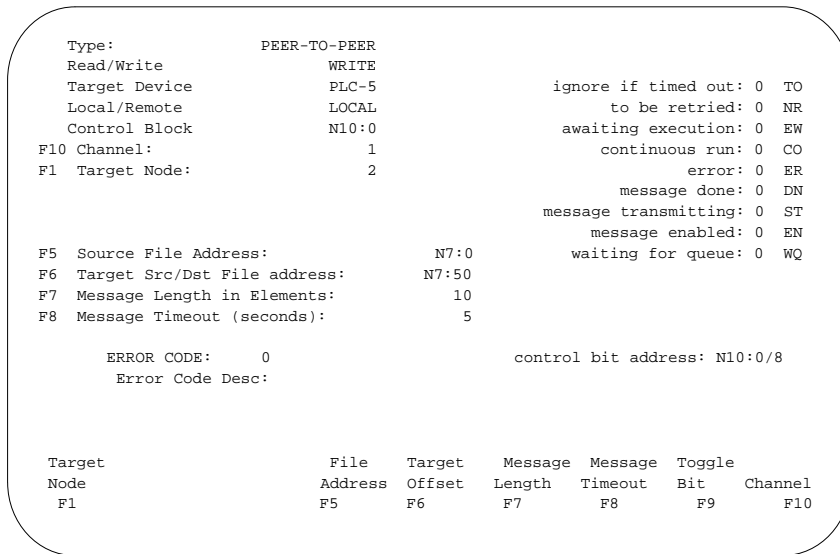Address in SLC 5/04 processor

MSG being sent out channel 1A

This MSG example tells the PLC-5 processor (station 11_8) to read the information from N10:0 in an SLC 5/04 processor station 15_8 and place the information in N15:0 in the PLC-5 processor.

Figure 2
Sending a write MSG instruction from an SLC 5/04
processor to a PLC-5 processor

ladder rung

```
┌─ MSG ──────────────────────────┐    ─(EN)─
│   READ/WRITE MESSAGE           │
│   TYPE          PEER-TO-PEER   │    ─(DN)─
│   Read/Write           WRITE   │
│   Target Device        PLC-5   │    ─(ER)─
│   Local/Remote         LOCAL   │
│   Control Block        N10:0   │
│   Control Block Length    14   │
└────────────────────────────────┘
```

control block

```
     Type:               PEER-TO-PEER
     Read/Write               WRITE
     Target Device            PLC-5            ignore if timed out: 0   TO
     Local/Remote             LOCAL                 to be retried: 0   NR
     Control Block            N10:0            awaiting execution: 0   EW
F10  Channel:                     1               continuous run: 0   CO
F1   Target Node:                 2                        error: 0   ER
                                                    message done: 0   DN
                                            message transmitting: 0   ST
                                                 message enabled: 0   EN
F5   Source File Address:          N7:0           waiting for queue: 0   WQ
F6   Target Src/Dst File address:  N7:50
F7   Message Length in Elements:      10
F8   Message Timeout (seconds):        5

        ERROR CODE:    0                     control bit address: N10:0/8
         Error Code Desc:




  Target                     File    Target   Message  Message  Toggle
  Node                       Address Offset   Length   Timeout  Bit     Channel
   F1                          F5      F6       F7        F8      F9       F10
```

The SLC 5/04 processor writes 10 elements to Target Node 2's N7 file, starting at word N7:50. The words are from the SLC integer file starting at word N7:0. If 5 seconds elapse without a reply, error bit N10:0/12 is set and error code 37h is displayed, indicating that the instruction timed out.

When you program a PLC-5 type MSG command in an SLC 5/04 processor, the source and destination data types should match. The destination type determines the number of words per element to transfer.

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