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MAINFRAME LINK
FOR
DISTRIBUTED DEVELOPMENT
USER'S GUIDE

Manual Order Number: 121565-001

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A229/780/2KFL

This manual provides general information, installation procedures, operating instructions, and diagnostic information for the Mainframe Link. The manual is intended for persons who install or operate the Mainframe Link. It is assumed that the reader is familiar with his own communications system and the Intellec microcomputer development system.

The manual is divided into seven chapters:

* Chapter 1 describes the purpose of the Mainframe Link and provides an overview of its features.

* Chapter 2 discusses the Mainframe Link's hardware and software requirements for both the remote processor and the Intellec development system. Chapters 1 and 2 provide an overview of the product and its requirements.

* Chapter 3 provides instructions for installing the Mainframe Link in an Intellec development system. It also provides information on the Mainframe Link's software configuration, along with instructions for reconfiguration.

* Chapter 4 presents the commands used to operate the Mainframe Link. Explanations of each command's syntax and examples of its use are included.

* Chapter 5 contains example communication systems which use the Mainframe Link.

* Chapter 6 discusses the use of two software utilities which enhance the capabilities of the Mainframe Link.

* Chapter 7 describes the Mainframe Link diagnostics and their operation.

Appendices provide information on Mainframe Link error messages, a summary of the Binary Synchronous Communications Protocol, and instructions for constructing a diagnostic loop-back connector and modem interface cable.

For detailed information on the Binary Synchronous Communications Protocol, see the following IBM publication:

GA27-3004   *General Information—Binary Synchronous Communications*

For details of the protocol used by the IBM 2780 and the IBM 3780, refer to the following IBM publications:

GA27-3005   *Component Description: IBM 2780 Data Communication Terminal*

GA27-3065   *Component Information for the IBM 3780 Data Communication Terminal*

For information on the ISIS-II Operating System, refer to the following document:

ISIS-II User's Guide, Order No. 9800306

Hardware information on Intellec microcomputer development systems is in the following publications:

Intellec Series II Installation Manual, Order No. 9800559

Intellec Microcomputer Development System Reference Manual, Order No. 9800132

Information on the Intel iSBC-534 board is in the following publication:

iSBC-534 Four Channel Communications Expansion Board Hardware Reference Manual, Order No. 9800450

Notational Conventions

The following conventions are used to show syntax in this manual:

UPPERCASE   Characters shown in upper case must be entered in upper case.

lower case   Fields shown in lower case enclosed in angle brackets (< >) indicate variable information. The angle brackets show field limits and must not be entered. The variable information must be entered in upper case.

[ ]   Brackets indicate optional fields.

. . .   Ellipses indicate that a field may be repeated.

{ }   Braces indicate a choice. One of the items within the braces must be entered unless the field is also surrounded by brackets.

punctuation   Punctuation other than brackets, ellipses, and braces should be entered as shown.

delimiters   Commands must be separated from their operands by one or more blanks. Multiple operands, where shown, may be separated by a comma, by one or more blanks, or by a comma followed by one or more blanks. Neither blanks nor commas may appear *within* an operand.

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General Description

The Mainframe Link for Distributed Development is a communications protocol emulator which runs on Intel microcomputer development systems under control of the ISIS-II operating system. It is designed to run on Model 800 or Series II microcomputer development systems equipped with at least 64k bytes of memory, a CRT, floppy diskettes, and a communications interface.

Purpose of the Mainframe Link

The Mainframe Link allows the transfer of files between a properly equipped Intellec microcomputer development system and a remote computer system, using standard IBM Binary Synchronous Communications (BSC) protocol for the IBM 2780 or 3780. The use of 2780/3780 protocol allows the transfer of character-coded data (such as source files) and binary-coded data (such as object files) between computers using a standard and commonly supported communication discipline.

The Mainframe Link can also translate character-coded files between the ASCII character set used in the Intellec systems and the EBCDIC character set used by IBM terminals and computers.

The Mainframe Link permits one or more Intellec development systems to be integrated in a network with a mainframe computer. The mainframe provides multi-user access for program editing, file storage and management, source code control, and program listings. Source files may be downloaded to an Intellec system for compilation, assembly, relocation and linkage; and linked binary object files may be downloaded for debugging using an ICE emulator.

The Mainframe Link may be used to communicate with IBM S/360, S/370, and 30-Series computers, DEC PDP-11 and VAX-11 computers, other Intellec development systems, and any computer system or terminal equipped with 2780/3780 binary synchronous communications capability.

IBM 2780/3780 Summary

The IBM 2780 and 3780 Data Communications Terminals allow the transmission and reception of large volumes of data at communications line speed. The terminals consist of an 80-column card reader, a line printer, an optional 80-column card punch, and the buffers and control circuitry necessary to transfer cards from the reader to the communications line, and print or punch images from the line to the printer or punch. The Mainframe Link performs the same functions, creating card images from ISIS-II files for transfer to the line, and accepting print or punch records from the line for transfer to ISIS-II files.

The Mainframe Link software emulates the following 2780/3780 features:
- Full data link control
- Full timeout control
- Cyclic redundancy checking
- Printer carriage control decoding

- Component selection
- Horizontal format control
- EBCDIC transparency
- Processor interrupt
- Space compression/expansion (3780 mode only)
- Multiple Record Transmission (2780 mode only)

The Mainframe Link does not support the Console Alarm, BELL Character, and 3780 Conversational Mode features.

Mainframe Link Functional Features and Options

Chapter 4 of this document describes the Mainframe Link's commands. These commands allow the orderly and controlled transfer of ISIS-II files between an Intellec microcomputer development system running the Mainframe Link program and a remote processor or terminal.

Commands and options provided by the Mainframe Link allow

- The transmission of an ISIS-II file or series of files to the remote computer.
- The reception of data from the remote computer into one of two files defined by user commands: one file for data destined for the printer and one file for data destined for the punch. These files may be defined to contain one transmission from the remote computer or as a sequence of files that contain all transmissions from the remote computer (Receive Chaining).
- Automatic or operator-selectable ASCII/EBCDIC code translation.
- Transmission and reception of character-coded (non-transparent) or binary (transparent) data.
- Automatic record padding and truncation to format transmitted data according to the requirements of the device protocol (2780 or 3780) being used.
- Printer forms control decoding. See Appendix B for a description of the control codes and printer action provided.
- Operator selection of device mode; either 2780 mode, 3780 mode, or INTEL mode. INTEL mode is useful in Intellec-to-Intellec communications where record padding and truncation are not desired.
- Interactive or SUBMIT file operation.
- The direct entry of IBM Remote Job Entry (RJE) console commands on the Intellec development system console. RJE command replies are displayed on the Intellec console.

Mainframe Link Performance

The total throughput of the Mainframe Link is a complex function of the speed of the data line, the device mode of the Mainframe Link, the type of data being transferred, line turnaround delay, and Intellec system disk file data transfer rate.

The Mainframe Link may be used with communications facilities at speeds ranging from 1200 bps to 9600 bps, and with line turnaround delays of 0 to 150 ms.

Intellec Development System Requirements

The Mainframe Link will run on a Model 800 or Series II microcomputer development system that has the ISIS-II operating system and 64k of RAM. The Mainframe Link requires the use of a serial port on the Intellec system.

On 8080-based Series II machines, an IPB serial port should be used if available. On 8085-based Series II machines, an IPC serial port should be used if available. On the Model 800 and on a Series II with no spare port available, a serial port must be provided by an iSBC-534 Four Channel Communications Expansion Board and an iSBC-955 cable. Installation of the iSBC-534 board may require the addition of an Expansion Chassis if no slot is available in the host system.

Table 2-1 summarizes the parts required, identified by Intel part number, for each possible Mainframe Link configuration.

Table 2-1. Equipment Required

Development System	Parts Required	Order Part Number
Series II with available IPB (or IPC) serial channel	Software, modem cable, loop-back test connector	*MDS-384
Series II with no available IPB (or IPC) serial channel, with free card slot	Software, iSBC-534 board, iSBC-955 cable, modem cable, loop-back test connector	*MDS-384 SBC-534 SBC-955
Model 800	Software, iSBC-534 board, iSBC-955 cable, modem cable, loop-back test connector	*MDS-384 SBC-534 SBC-955
Series II with no available serial channel and no available card slot	Software, iSBC-534 board, iSBC-955 cable, Expansion Chassis, modem cable, loop-back test connector	*MDS-201 *MDS-384 SBC-534 SBC-955

* *"MDS"* is an ordering code only, and is not used as a product name or trademark. MDS® is a registered trademark of Mohawk Data Sciences Corp.

Communications Line Requirements

The Mainframe Link will operate at data rates up to 9600 baud with one of the following three communication links (see figure 2-1):

- Point-to-point (leased) or switched (dial-up) telephone lines with synchronous modems
- Hard-wired connections with short-haul synchronous modems
- Hard-wired connections with a synchronous modem eliminator
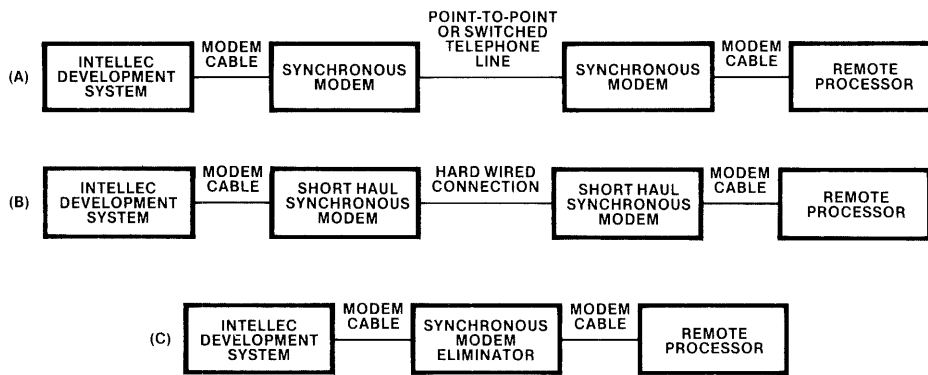
Figure 2-1. Communication Line Configurations   565-6

Interface to the modem or modem eliminator is via a 10-conductor cable equipped with DB-25 type connectors on both ends. Appendix D describes the cable and testing loop-back connector.

The Mainframe Link communicates in half-duplex mode and requires only half-duplex communications facilities. A slight performance advantage may be gained (100 to 300 ms time saving per data block transferred) by using a full-duplex telephone line or direct connection, and configuring the Mainframe Link to assert permanently the modem control line Request-to-Send (RTS). In this configuration the normal 50 or 150 ms line turnaround delays are eliminated. See Chapter 4 of this document for information regarding the permanent assertion of Request-to-Send.

Depending on the data transfer rate selected, a pair of the following modems, or equivalents, is needed for each communications line over three miles long:

MODEM	SPEED
Bell 201C	2400 bits/second (half-duplex, switched line)
Bell 208A	4800 bits/second (full-duplex, leased line)
Bell 208B	4800 bits/second (half-duplex, switched line)
Bell 209A	9600 bits/second (full-duplex, leased line)

The Mainframe Link may also be run with a hard-wired connection and short-haul synchronous modems, or a synchronous modem eliminator when communicating over short distances. The length of the communications path in these configurations is limited by the characteristics of the modems or modem eliminator used. The specifications of the modem or modem eliminator will show the baud rates and cable lengths that may be used with the device.

The Series II is configured to generate a 9600 baud signal (user selectable in the User Configuration Module) at Pin 24 of the rear panel connector (External Transmit Clock) which is used by the loop-back test. The Model 800 generates this signal only when configured for loop-back operation.

Remote Processor Requirements

The remote processor must be equipped with a modem that is compatible with the modem on the microcomputer development system. The remote processor must be set up with the required hardware and software to communicate with an IBM 2780 or 3780.

Typical remote processors include the following:

- IBM S/360*, S/370, and 30xx CPUs with Communications Controllers and IBM operating system RJE support

- IBM 1130, 1800, SYSTEM/3, SYSTEM/7, and SYSTEM/34 Computers

- DEC PDP-11 computers with the 2780 Remote Computer Systems software

- DEC VAX-11 computers with the VAX-11 2780/3780 Protocol Emulator software

- Intellec Microcomputer Development Systems with the Mainframe Link software

*Except Model 44 and Model 67 in multiprocessor mode.

Hardware Installation

To install the Mainframe Link, a serial I/O port must be allocated and configured for the Mainframe Link's use. In the Series II, the IPB or IPC contains two serial ports: one configured at the factory for a teletype and one for a CRT. The use of Serial Channel 2 is recommended, although either of these ports may be used as the communications port if it is otherwise unused.

The Model 800 has no free ports suitable for the Mainframe Link's use, so the user must install an iSBC-534 Four Channel Communications Expansion Board and an iSBC-955 cable. Any serial port on this board may be allocated for Mainframe Link use. The iSBC-534 board and iSBC-955 cable must also be used when all serial channels on a Series II System are in use.

Configuring the Series II

Series II with Available Serial Channel

The user of a Series II with an available serial channel for Mainframe Link use must select the serial channel to be used (Channel 1 or Channel 2), and jumper that channel for synchronous communications. If both channels are free, use Serial Channel 2, since this requires fewer jumper changes and no software reconfiguration.

Serial Channel 1

Configuring the Series II Channel 1 requires changing jumpers on the Series II IPB (or IPC) and IOC. Figures 3-1, 3-2, and 3-3 illustrate the jumper changes required for the IPB, IPC, and IOC, respectively. The user should follow the procedure detailed below:

1. Disconnect the power cord.
2. Remove the IPB (or IPC) from the chassis.

   (Refer to the *Intellec Series II Installation Manual*, Order No. 9800559, for details of the location and removal of the IPB (or IPC) and the location of the IOC.)

3. Remove the following IPB (or IPC) jumpers:

   7-8
   11-12
   14-15

4. Install the following IPB (or IPC) wirewrap jumpers or shorting plugs:

   8-9
   10-11
   13-14

5. Reinstall the IPB (or IPC) into the chassis.
6. Remove the main chassis top cover and find the IOC.
7. Remove the following jumpers in the top right corner of the IOC:

   Area W5: A-C   Area W6: A-D
                                  B-C
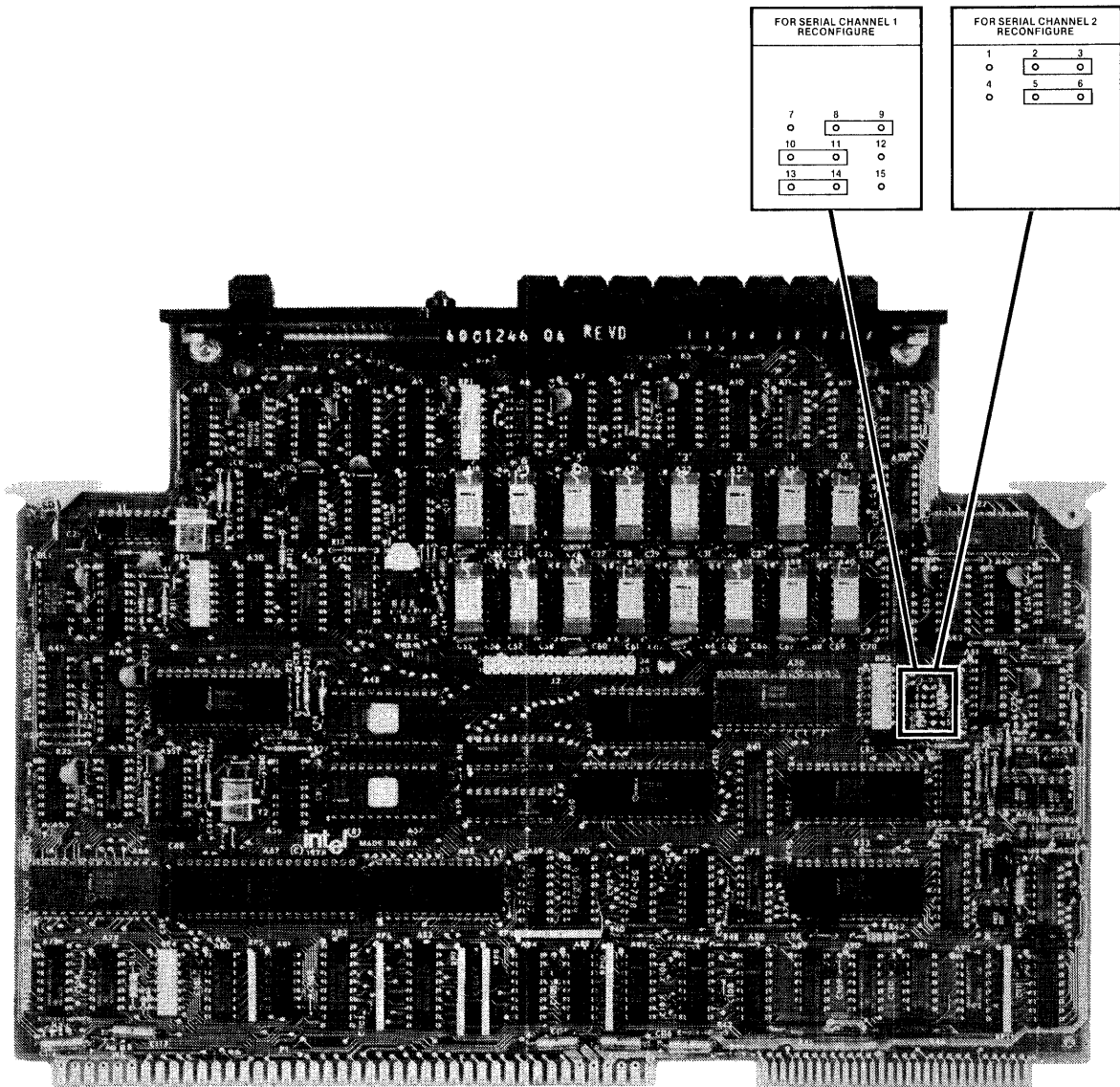
Figure 3-1. Configuring the IPB for Serial Channel 1 or Serial Channel 2   565-1
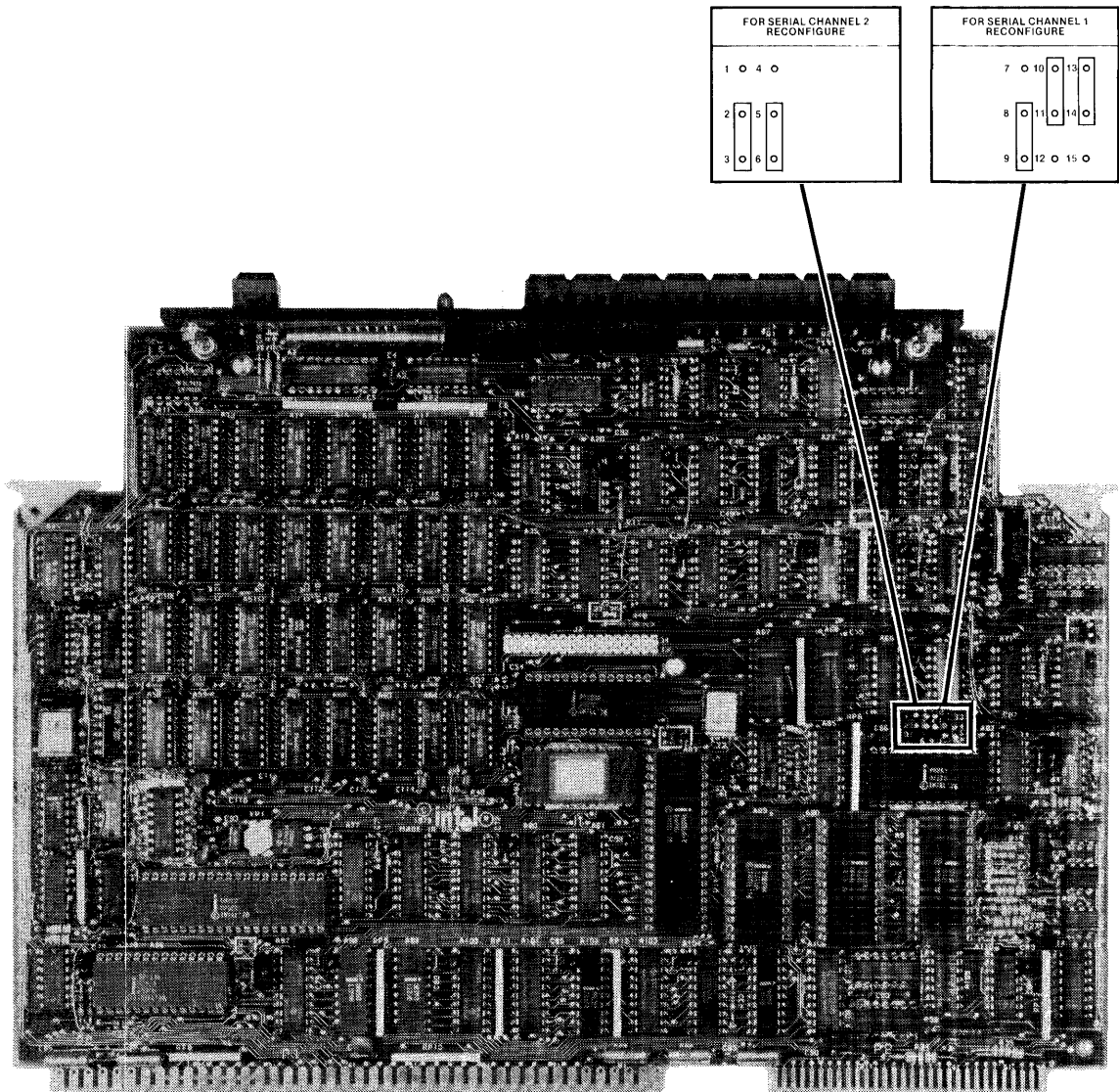
Figure 3-2. Configuring the IPC for Serial Channel 1 or Serial Channel 2   565-2
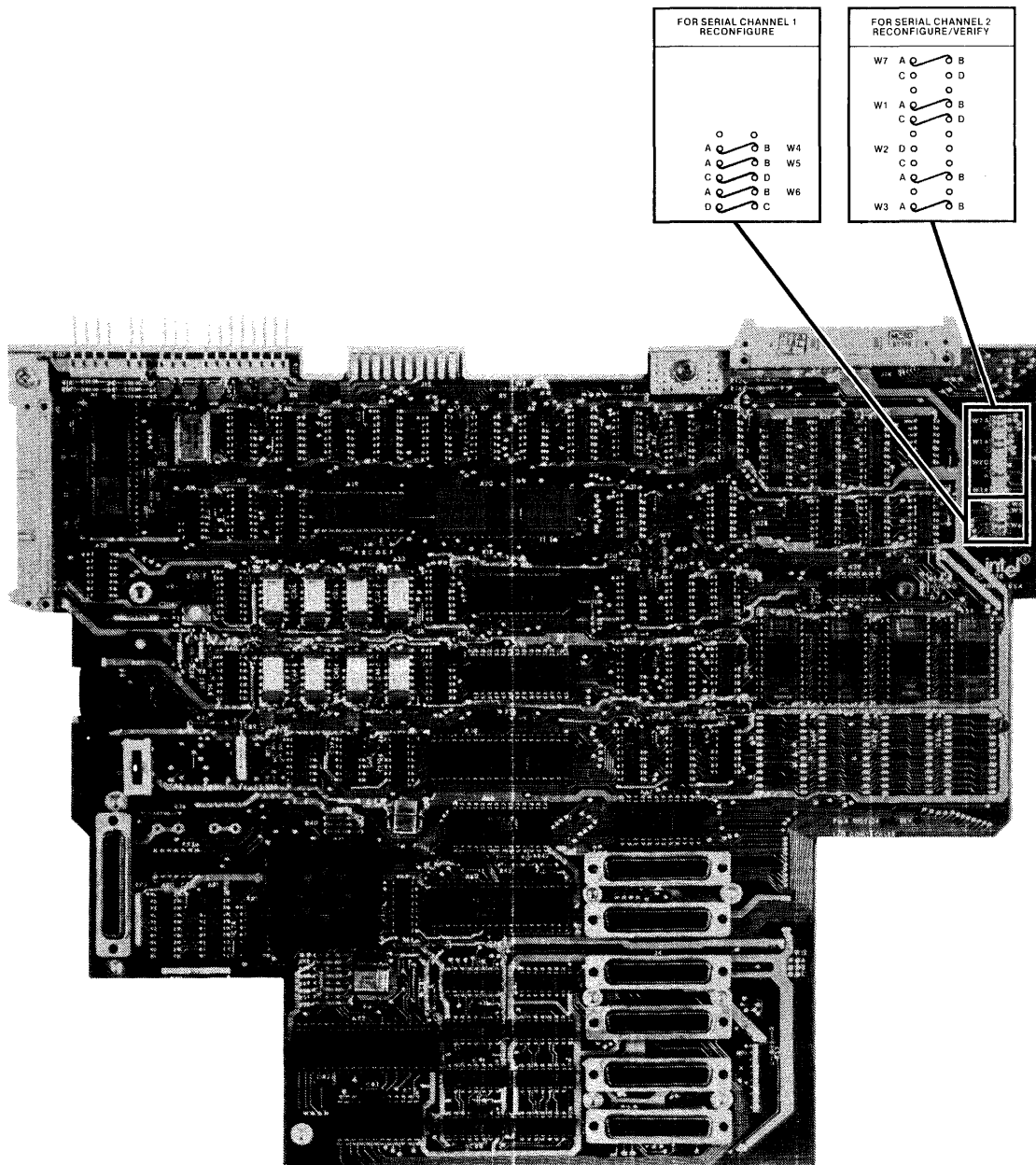
Figure 3-3. Configuring the IOC for Serial Channel 1 or Serial Channel 2   565-3

8. Install the following wirewrap jumpers or shorting plugs in the IOC:

Area W4: A-B   Area W5: A-B   Area W6: A-B
                               C-D   C-D

9. Reinstall the main chassis top cover.

This completes Serial Channel 1 jumpering. Plug the modem cable into the Series II connector marked Serial Channel 1—TTY.

Serial Channel 2

Configuring Serial Channel 2 requires changing jumpers on the Series II IPB (or IPC) and adding one jumper to the IOC. Figures 3-1, 3-2, and 3-3 illustrate the jumper changes required for the IPB, IPC, and IOC, respectively. The user should follow the procedure detailed below:

1. Disconnect the power cord.
2. Remove the IPB (or IPC) from the chassis.

   (Refer to the *Intellec Series-II Installation Manual*, Order No. 9800559, for details of the location and removal of the IPB (or IPC) and the location of the IOC.)

3. Remove the following IPB (or IPC) jumpers:

      1-2
      4-5

4. Install the following IPB (or IPC) wirewrap jumpers or shorting plugs:
      2-3
      5-6

5. Reinstall the IPB (or IPC) into the chassis.
6. Remove the main chassis top cover and find the IOC.
7. Install a wirewrap jumper or shorting plug in the top right corner of the IOC:

      Area W3: A-B

8. Replace the main chassis cover.

This completes Serial Channel 2 jumpering. Plug the modem cable into the Series II connector marked Serial Channel 2— CRT.

Configuring the Model 800 or Series II with No Available Serial Channel

The user of a Model 800 or Series II with no available serial channel for Mainframe Link use must install and configure an iSBC-534 Four Channel Communications Expansion Board. The next section details the selection of iSBC-534 board options and jumpers.

Configuring an iSBC-534 Four Channel Communications Expansion Board

The user must configure an iSBC-534 board for Mainframe Link use by selecting the base address and serial channel to be used. Four serial channels are available on the board; any channel may be selected. For ease of software configuration, it is recommended that Channel 2 be used.

Refer to the *iSBC-534 Four Channel Communications Expansion Board Hardware Reference Manual*, Order No. 9800450, for details of the selection of the board base address. Figure 3-4 illustrates the jumper changes.

FOR CHANNEL 0   FOR CHANNEL 1   FOR CHANNEL 2

RECONFIGURE
76 77 78 80 82
79 81

RECONFIGURE
83 84 85 87 89
86 88

RECONFIGURE
90 91 92 94 96
93 95

VERIFY
• jumper assembly at W1
• no jumper assembly at W5

VERIFY
• jumper assembly at W2
• no jumper assembly at W6

VERIFY
• jumper assembly at W3
• no jumper assembly at W7

J1   J2   J3   J4

FOR CHANNEL 3

FOR ALL CHANNELS

REMOVE
132-140
131-140

BASE ADDRESS SELECTION JUMPERS

RECONFIGURE
97 98 99 101 103
100 102

VERIFY
• jumper assembly at W4
• no jumper assembly at W7

Figure 3-4. Configuring the iSBC-534™ Board 565-4

NOTE

If the user is installing an iSBC-534 board for the first time, it is strongly recommended that he verify the installation by running the confidence test supplied with the Mainframe Link. To run this test, it may not be necessary to make jumper changes 4 and 5 listed below. Refer to Chapter 7 for more details.

To configure the board:

1. Disconnect the power cord.

2. Remove the board from the chassis, if installed.

3. Remove the following jumpers:
    131-140
    132-140

4. Remove jumpers for

    Channel 0:   79-80
                            80-81

    Channel 1:   86-87
                            87-88

    Channel 2:   93-94
                            94-95

    Channel 3:   100-101
                            101-102

5. Install jumpers for

    Channel 0:   76-79
                            81-82

    Channel 1:   83-86
                            88-89

    Channel 2:   90-93
                            95-96

    Channel 3:   97-100
                            102-103

6. Ensure an 18-pin DIP header jumper assembly is installed for

    Channel 0 at W1
    Channel 1 at W2
    Channel 2 at W3
    Channel 3 at W4

7. Ensure an 18-pin DIP header jumper assembly is NOT installed for

    Channel 0 at W5
    Channel 1 at W6
    Channel 2 at W7
    Channel 3 at W8

8. Select the board base address as described in the iSBC-534 Reference Manual. The factory supplied value of C0H is recommended for operation of the Mainframe Link.

9. Plug the iSBC-955 cable into the iSBC-534 board using one of the connectors J1-J4 as follows:

    J1 for port 0
    J2 for port 1
    J3 for port 2
    J4 for port 3

10. Install the iSBC-534 board in the chassis. Route the iSBC-955 cable to one of the vacant chassis outlets on the rear panel so that the modem cable may be connected. Screws, washers, and nuts are supplied with the Mainframe Link to secure the iSBC-955 cable to one of the vacant outlet holes. An adapter plate is also provided so that the larger outlet holes may be used if desired.

This completes the configuration of the iSBC-534 board.

Software Configuration

The Mainframe Link is distributed on single- and double-density diskettes that contain the following files:

RCOM80	—	The executable code for the Mainframe Link program with configuration parameters supplied by the factory
RCOMCF.ASM	—	The Mainframe Link's User Configuration Module source code
RCOMCF.CSD	—	The Mainframe Link's User Configuration Module Assemble, Link, and Locate Submit File
RCOM80.LNK	—	The Mainframe Link's object module used to link with a newly assembled User Configuration Module
CONSOL	—	ISIS-II utility program described in Chapter 6
STRZ	—	ISIS-II utility program described in Chapter 6

All user-configurable parameters are contained in the User Configuration Module. These parameters are

1. Initial Device Mode (2780, 3780, or INTEL)
2. iSBC-534 board or Series II IPB (or IPC)
3. Serial Channel number
4. iSBC-534 board base address
5. 3780 Mode Blank Compression selection
6. Continuous Request-to-Send (RTS) selection
7. RJE console command identifiers and substitution strings
8. ASCII/EBCDIC translation tables
9. Filename extensions for ASCII/EBCDIC code translation
10. Baud rate clock speed for loop-back diagnostics (Controls the speed of the clock that appears on pin-24 of the DB-25 connector.)

Table 3-1 lists all User Configuration Module parameters, their initial values as supplied by the factory, and the names of the User Configuration Module statements that affect each parameter.

Comments within the module source code show the changes that can be made to each statement and the effect of the change. Most common changes can be accomplished by changing a simple equate statement.

I/O port assignments are made automatically by the assembly process, based on the specification mode for the Communications Device (COMDEV) and Serial Channel (SCHANL). If the iSBC-534 board is being used, I/O port addresses are also affected by the specification of the iSBC-534 board base address (SBCADR).

The continuous assertion of Request-to-Send (RTS) is specified *only* for full-duplex communications facilities. Regardless of this specification, the Mainframe Link operates in half-duplex mode. Some performance improvement can be realized by

Table 3-1. User Configuration Module Parameters

Parameter	U.C.M. Statement Name	Factory Supplied Value	Permissible Values
Device Mode	DVMODE	M2780	M2780—2780 mode M3780—3780 mode MINTEL—Intel mode
Communications Device	COMDEV	IPBBRD	IPBBRD—Series II IPB or IPC SBCBRD—iSBC-534 board
Serial Channel	SCHANL	2	Channel number of the channel in use. For the IPB or IPC, valid serial channels are 1 and 2. For the iSBC-534 board, valid channels are 0, 1, 2, and 3.
iSBC-534 Board Address	SBCADR	0C0H	See iSBC-534 Hardware Reference Manual
3780 Blank Compression	COMPRS	TRUE	TRUE—Blank compression in effect FALSE—Blank compression not in effect
Continuous Request-to-Send	RTSDEF	FALSE	TRUE—Continuously assert RTS FALSE—Otherwise
Baud Rate Clock for Loop-back Diagnostic	BAUDRT	9600	2400—2400 baud 4800—4800 baud 9600—9600 baud
RJE Command Identifier	CMDTAB	$ *	$—identifies HASP command *—identifies POWER command
Translate Tables	ASCEBC EBCASC		ASCII to EBCDIC Table EBCDIC to ASCII Table
Filename Extension Table For No-Translate Files	FILXTB	.OBJ, .LNK, .LIB, .LOC, no extension	Extensions of files not to be translated by default

continuously asserting RTS in a full-duplex environment, since the Mainframe Link need not wait for any modem generated Request-to-Send/Clear-to-Send delay. This delay can range from 9 to 150 ms for each data block transmitted.

Prior to reconfiguring the Mainframe Link, it is recommended that a back-up copy of the release diskette be made. After making the back-up copy, use the ISIS-II Editor or the CRT-Based Text Editor (CREDIT) to modify the User Configuration Module Source Code; then SUBMIT the RCOMCF file to Assemble, Link, and Locate the Mainframe Link program.

Reconfiguration Example

It can be seen from table 3-1 that the Mainframe Link supplied on the release diskette is configured for Series II IPB Serial Channel 2, with 2780 mode in effect at start-up of the Mainframe Link. If the Mainframe Link uses serial channel 3 on an iSBC-534 board with 3780 mode in effect at start-up, the following User Configuration Module changes must be made using the ISIS-II Editor or CREDIT.

1. The Configuration Module statement named DVMODE controls the initial start-up device mode (see table 3-1). DVMODE must be changed from

    ```
    DVMODE  EQU  M2780
    ```
    to
    ```
    DVMODE  EQU  M3780
    ```

2. The Configuration Module statement named COMDEV selects the communication device being used (either IPB or IPC serial channel, or iSBC-534 serial channel). This statement must be changed from

    ```
    COMDEV  EQU  IPBBRD
    ```
    to
    ```
    COMDEV  EQU  SBCBRD
    ```

3. The Configuration Module statement named SCHANL must be changed from

    ```
    SCHANL  EQU  2
    ```
    to
    ```
    SCHANL  EQU  3
    ```

In our example, the iSBC-534 board base address is not changed from the factory supplied 0C0H. If the base address is changed, table 3-1 shows that the Configuration Module statement named SBCADR should be changed to reflect the new address.

After the necessary changes have been made to the Configuration Module using the editor, the ISIS-II Submit facility is used to submit the RCOMCF Assemble, Link, and Locate procedure by entering the command

```
SUBMIT  :F1:RCOMCF
```

The Mainframe Link release diskette is in drive :F1: and a diskette containing the Assembler, Link, and Locate programs is in drive :F0:.

This procedure Assembles the User Configuration Module, Links it into the Mainframe Link program, and Locates the result as RCOM80. Assemble, Link, or Locate errors that occur indicate an error in the configuration procedure. Any such errors must be corrected before attempting to verify the installation with the Link's confidence test.

Verifying The Installation

Before running the Mainframe Link's Confidence Test as detailed in Chapter 7, ensure that the following have been accomplished:

- All hardware jumpers are installed.
- All boards are fully seated.
- The modem cable is connected to the proper connector.
- The User Configuration Module parameters have been set and the RCOMCF Submit File has been processed.

After completion of the above steps, the user should run the Confidence Test detailed in Chapter 7 to verify the installation prior to connecting the Intellec system to a remote processor.

Operational Overview

The Mainframe Link allows the sharing of processing between an Intellec development system and a remote mainframe. To permit this sharing, two types of files may be transferred between machines:

1. Text or character-coded files, such as source and listing files. These files contain only valid ASCII characters on an Intellec system, but may be encoded in EBCDIC on a remote processor, such as an IBM mainframe.

2. Binary-coded files, such as object, link, library, and executable module files. These files may contain data that are not valid ASCII or EBCDIC characters.

The Mainframe Link can transfer both of these file types between machines. The Mainframe Link performs the ASCII/EBCDIC code translation, record padding, and line protocol handling needed to ensure that a file on one machine remains logically equivalent when transferred to another machine.

Transparent Transmission

Since the Binary Synchronous Communications protocol defines some characters as line control characters, a file containing binary data (e.g., object and linked files) will most likely contain data characters that are also line control characters. Consequently, *a special transmission mode, TRANSPARENT MODE, must be used to transfer binary files.* Transparent mode may also be used for character-coded files, although it may be less efficient.

Code Translation

Data may be either binary data, requiring no code translation; or character-coded data, usually requiring translation between ASCII and EBCDIC. The Mainframe Link provides automatic translation for some files, based on the ISIS-II file extension, with explicit override by operator command.

In 2780 and 3780 mode, files named with the following extensions will be transmitted and received with no ASCII/EBCDIC translation unless explicitly specified in the SEND, RECEIVE, or PUNCH command, as explained later in this chapter:

    .OBJ
    .LNK
    .LIB
    .LOC
    No extension

File names with other extensions will be translated unless no-translation is explicitly specified.

The list of file extensions for files not translated is available for user modification. For details on changing the default extension specification, see Chapter 3, Installing the Mainframe Link.

No translation will occur in INTEL mode.

Translation is independent of transparency mode selection. Files transmitted or received transparently may or may not be translated.

Translation occurs on a file-by-file basis, so that each file of a series transmitted as one transmission has an individual translate/no-translate attribute. This permits concatenation of character data which is to be translated (such as Job Control Language (JCL)) with binary data which is not to be translated (such as object files).

When transmitting and translating, ASCII form control characters (such as TAB, FF, etc.) are translated to their EBCDIC equivalents and are sent as a part of the data record containing the character. Carriage Return/Line Feed pairs delimit records and are not transmitted. ASCII line control characters (such as EOT, ETB, etc.) that may be imbedded in a record are also translated to their EBCDIC equivalents. Records containing line control characters must be transmitted transparently.

When receiving and translating, EBCDIC form control escape sequences are translated to appropriate ASCII character sequences (see Appendix B). EBCDIC characters with no ASCII equivalents are translated to 00H.

The translation tables are available for user modification. For details on changing the translation tables, see Chapter 3, Installing the Mainframe Link.

Record Padding and Truncation

Character-coded data is maintained in the Intellec system as a string of variable-length ASCII records, separated by Carriage Return/Line Feed pairs. The IBM 2780 and 3780 terminals, on the other hand, use individual fixed-length card image and variable-length print line image EBCDIC records. When transmitting character-coded files, the Mainframe Link reformats (pads or truncates) ISIS-II file records into 80-byte card images, translates the records to EBCDIC, and transmits them to the line. Records longer than 80 characters are truncated from the right. Records less than 80 characters are padded on the right with spaces. This reformatting is performed for all files that are translated from ASCII to EBCDIC. It is not performed for files that are not translated. Translated character-coded data received from the remote computer is placed into an ISIS-II file as a string of ASCII records, which are separated by Carriage Return/Line Feed pairs inserted by the Mainframe Link.

Binary files are maintained in the Intellec system as a string of bytes with no record delimiters. When transmitting binary files (i.e., no translation is in effect), the Mainframe Link obtains an 80-byte card image from an ISIS-II file and transmits it to the line with no reformatting. No padding is performed except on the last record transmitted, which is padded with binary zeroes to 80 bytes. Non-translated data from the remote computer is placed into an ISIS-II file as a string of bytes with no record delimiters inserted by the Mainframe Link.

Table 4-1 summarizes the file types that are commonly transferred by the Mainframe Link, and shows each file type's translation, transparency, and padding attributes.

Program Operation

Program Initialization

To load the Mainframe Link, enter

```
RCOM80
```

The Mainframe Link will begin execution and issue the following start-up message:

```
ISIS-II, MAINFRAME LINK, Vn.n
```

Table 4-1. File Transmission Summary

File Type	Translated?	Transparent Mode Required?	Padding/ Truncation Performed On Transmit?	Comments
Source	Yes	No	Yes	
List	Yes	No	Yes	
Object	No	Yes	No	Last record padded
Linked	No	Yes	No	Last record padded
Executable	No	Yes	No	Last record padded
Object Library	No	Yes	No	Last record padded

The program is then initialized and ready for communications. At this time, the user may establish a switched data connection to the remote computer.

Commands

Mainframe Link Commands have the following syntax:

<operation>   [<operand >] . . .

where   <operation>   specifies the command to be executed.

<operand>   specifies the operand(s) required by the command. Operands may not contain imbedded commas or spaces.

Commands must be separated from their operands by one or more spaces. Multiple operands must be separated by a comma, by one or more spaces, or by a comma followed by one or more spaces.

Table 4-2 summarizes the Mainframe Link's commands, abbreviations, and use.

Mode Selection—the MODE Command

The Mainframe Link's MODE command may be used to change the following transmission and reception mode options:

• 2780, 3780, or INTEL line protocol

• Transparent or non-transparent transmission

• Receive file chaining or no receive file chaining

Since the 2780, 3780, and INTEL device modes each use a unique protocol, it is imperative that the Mainframe Link be in correct device mode before communications are attempted. The device and transparency mode selection must match the modes expected by the remote computer.

Table 4-2. Mainframe Link Command Summary

Command	Abbreviation	Use
MODE	M	Sets the Mainframe Link's Device Mode to 2780, 3780 or INTEL Mode.
		Sets the Mainframe Link's Transmission Mode for Transparent (TSP) or Non-Transparent (NTSP) data transmission.
		Sets the Mainframe Link's Receive Chaining Mode for Receive Chaining (RC) or No Receive Chaining (NRC).
SEND	S	Directs the Mainframe Link to transmit the file or files specified in the command to the remote computer.
RECEIVE	R	Specifies the name of the file to be created to contain printer-destined data from the remote computer.
PUNCH	P	Specifies the name of the file to be created to contain punch-destined data from the remote computer.
STAT	none	Creates a console display of the current Mainframe Link status and error accumulators.
ASSGNCI	A	Assigns the Mainframe Link's command input device to an ISIS-II file.
ABORT	none	Aborts the current Mainframe Link function and returns the Mainframe Link to the Idle state.
EXIT	none	Terminates Mainframe Link execution.
ALTEST	none	Directs the Mainframe Link to perform a loop-back confidence test. See Chapter 7.
DIAGNOSE	D	Dumps a history of recent communications line activity to the console, printer, or ISIS-II file. See Chapter 7.

The initial start-up device mode setting may be changed by modifying the User Configuration Module as described in Chapter 3, Installing the Mainframe Link.

Transparent Mode must be selected before transmitting binary files.

Receive File Chaining may be used to receive files from the remote computer when an unknown number of files is expected. In this mode, the specification of one RECEIVE command will process all print files from the remote computer. Similarly, one PUNCH command will process all punch files from the remote computer.

The MODE command has the following syntax:

$$\text{MODE} \quad \left[\begin{Bmatrix} 2780 \\ 3780 \\ INTEL \end{Bmatrix}\right] \quad \left[\begin{Bmatrix} TSP \\ NTSP \end{Bmatrix}\right] \quad \left[\begin{Bmatrix} RC \\ NRC \end{Bmatrix}\right]$$

MODE may be abbreviated as M.

2780   Specifies that the Mainframe Link will operate in 2780 mode, using 2780 line protocol and record blocking. This is the start-up device mode supplied on the release diskette. The remote computer must be configured for 2780 communications.

3780   Specifies that the Mainframe Link is operating in 3780 mode, using 3780 line protocol and record blocking. The remote computer must be configured for 3780 communications.

INTEL	Specifies that the Mainframe Link is operating in INTEL mode, transmitting 128-byte transparent records. This mode may be used when communicating with another Intel system.
TSP	Specifies that all following transmissions are to be in transparent mode. The setting of this option has no effect on ASCII/EBCDIC translation. The remote computer must be configured to accept transparent operation.
NTSP	Specifies that all following transmissions are to be in non-transparent mode. This is the start-up transparency mode setting. If the user attempts to transmit a file containing line control characters such as EOT, ETB, etc., in NTSP mode, the Mainframe Link will abort the transmission and issue an error message.
RC	Specifies that the Mainframe Link is operating in Receive Chain mode for all received data. In this mode, each separate transmission from the remote is placed into a separate ISIS-II file. The file name extension specified in the RECEIVE or PUNCH command is ignored (except for setting the translate/no translate attribute) and sequentially-numbered extensions are used. The first transmission from the remote will be placed in *filename*.001, the second in *filename*.002, etc., up to *filename*.999. Respecifying the RECEIVE or PUNCH command resets the extension number for subsequent files. Receive Chain mode is not in effect when the Mainframe Link starts up.
NRC	Specifies that the Mainframe Link is not operating in Receive Chain mode. A new receive or punch file name must be specified for each transmission from the remote computer. *When the console device is assigned to an ISIS-II file (e.g., SUBMIT operation), the Mainframe Link will always operate in NRC mode (no Receive Chaining).* On returning to interactive mode, the prior setting of Receive Chain mode will be restored.

NOTE

If the configuration of the Mainframe Link is incompatible with the configuration of the remote computer, the Mainframe Link may generate unpredictable results.

Example:

To change the Mainframe Link's device mode to 3780, transparent, enter the command

```
MODE 3780, TSP
```
or
```
M 3780, TSP
```

The setting of the Receive Chain mode is not affected by the above commands.

Receiving Data Files—the RECEIVE and PUNCH Commands

All data received from the remote computer (except RJE console command responses) will be placed in an ISIS-II file specified by a previous RECEIVE or PUNCH command. If the remote computer begins to transmit data and no file has been defined for the transmission, the Mainframe Link will issue a console prompt requesting a RECEIVE or PUNCH file definition. The Mainframe Link will wait until the file is defined.

Two separate files, one for print data and one for punch data, may be defined. The receive file definition command therefore has two forms:

        PUNCH   [<:device:>]   <filename>   [<option>]

specifies that punch transmissions from the remote computer will be directed to *filename*. PUNCH may be abbreviated as P.

        RECEIVE   [<:device:>]   <filename>   [<option>]

specifies that print transmissions will be directed to *filename*. RECEIVE may be abbreviated as R.

<:device:> Specifies the drive that is to contain the file. :F0: is the default.

<filename> Specifies the name, including any extension, of the file to be created.

<option>   Specifies the EBCDIC TO ASCII translation mode for the data and overrides the attribute that is based on filename extension.

            (T S L) specifies translation is to take place.

            (N T S L) specifies translation is not to take place.

If Receive Chaining is in effect (the RC operand of the Mode command), all subsequent transmissions from the remote computer will be directed to the specified *filename* with extension .001, .002, etc. If Receive Chaining is not in effect, only the next transmission from the remote computer will be directed to *filename*; after this reception, a new PUNCH or RECEIVE command must be issued.

If the named file already exists when it is needed for data from the remote computer, the Mainframe Link will notify the user who may delete the existing file or enter a new RECEIVE or PUNCH command.

Example 1:

If a document file is received from the remote computer for local inspection and the Mainframe Link is in NRC mode, the command

        RECEIVE FILE.DOC
or
        R FILE.DOC

will direct the Mainframe Link to place the next print transmission from the remote computer into an ISIS-II file named FILE.DOC. If the remote computer transmits the document file to the 2780 or 3780 printer, it will be placed in FILE.DOC by the Mainframe Link.

Example 2:

If the user wishes to receive an object file from the remote computer for linking and locating, and the Mainframe Link is in NRC mode, the command

        PUNCH FILE.OBJ
or
        P FILE.OBJ

will direct the Mainframe Link to place the next punch transmission from the remote computer into an ISIS-II file named FILE.OBJ. If the remote computer transmits the object file to the 2780 or 3780 punch, it will be placed in FILE.OBJ.

Example 3:

If the Mainframe Link is in Receive Chain mode, the command

        RECEIVE MSSG.TXT

will place the first print file received from the remote computer into the ISIS-II file MSSG.001, the second into MSSG.002, and so on.

Transmitting Data Files—the SEND Command

Data files may be transmitted to the remote computer with or without ASCII to EBCDIC translation and in transparent or non-transparent mode. The translation selection may be automatic, depending on filename extension, or explicitly directed by the SEND command. Transparency is selected by the MODE command. The syntax of the command used to transmit data is

```
SEND        [< :device:>]    <filename >      [<option>]
            [[<:device :>]    <filename >      [<option>]]...
```

SEND may be abbreviated as S.

      <:device:>   Specifies the drive containing the file to be transmitted. :F0: is the default drive.

      <filename>   Specifies the name, including any extension, of the file to be transmitted.

      <option>   Specifies the translation option for the file being transmitted and overrides the default that is based on filename extension.

            (T S L) specifies ASCII to EBCDIC translation is to occur.

            (N T S L) specifies ASCII to EBCDIC translation is not to occur.

Multiple file names may be specified to cause concatenation of the files and transmission of the files as one data set. Up to eight file names may be specified.

When multiple files are transmitted, the translation attribute based on filename extension or command option is on a file-by-file basis. It is possible to mix translated and non-translated files in one transmission.

This mix is desirable when submitting a binary file to an IBM remote computer, since the binary file must be surrounded by IBM Job Control Language (JCL) statements that direct the processing of the binary file at the remote computer. The Job Control Language may be a standard ASCII character-coded file. This file is translated and padded by the Mainframe Link, while the binary file is transmitted without translation.

Example 1:

To transmit a Job Control Language (JCL) file named JOB.JCL followed by a binary file named FILE.OBJ, transparent mode must be used.

Enter the commands

```
MODE TSP
SEND JOB.JCL, FILE.OBJ
```
or
```
M TSP
S JOB.JCL, FILE.OBJ
```

In this example, JOB.JCL is translated from ASCII to EBCDIC. FILE.OBJ is transmitted without translation.

Example 2:

To transmit a Job Control Language file named JOB1.JCL followed by a binary file named TEST.FIL in transparent mode, enter

```
MODE TSP
SEND JOB1.JCL, TEST.FIL(NTSL)
```
or
```
M TSP
S JOB1.JCL, TEST.FIL(NTSL)
```

Note that the binary file TEST.FIL would be translated (not what is wanted) if the no-translate option were omitted from the command, since the file name extension (.FIL) is one that by default specifies that translation is to occur.

Status Inquiry—the STAT Command

The Status Inquiry command may be used to obtain the current program status. Entering the command

    STAT

causes the following console display:

- Current transmission mode (transmitting, receiving, idle, or bidding for line)
- Current mode selection options
- Current Receive and Punch file names, if any
- Block counts and error retry counts for the entire current Mainframe Link execution and for the current operation in progress, if any

The block counts and error retry counts displayed are

- Number of data blocks transmitted successfully
- Number of data blocks received successfully
- Number of NAKs received in response to transmitted blocks, indicating the number of errors detected in blocks received by the remote computer
- Number of abnormal or timeout responses to transmitted blocks (number of ENQs sent requesting response), indicating the number of blocks that were not received by the remote computer because of communications errors
- Number of NAKs sent in response to received blocks, indicating the number of errors detected in blocks transmitted by the remote computer
- Number of ENQs received requesting a response to a received block, indicating the number of blocks that were not received by the Mainframe Link due to communications line errors

The block and error retry counts give a good indication of the quality of the communications link. If the error counts are greater than about 1% of the block counts and the communications link is short (less than 500 miles), then the communications link is not performing correctly and end-to-end data tests should be run with the modems being used. Documents provided with most modems detail how to run these tests.

Appendix A describes the format of the Mainframe Link's response to the STAT command. See message number RCOM-016.

Terminating an Operation—the ABORT Command

The user may abort the current operation by entering the command

    ABORT

An EOT (end of transmission) is sent to the remote computer if communications are in progress, and the Mainframe Link returns to the idle state with all data files closed. This command may be used to terminate a transmission or reception at any time.

After an ABORT is processed, the Mainframe Link returns to normal processing. If the remote computer was transmitting data, the current file is closed and the RECEIVE or PUNCH command is considered complete.

Example:

To ABORT a transmission in progress, enter

    ABORT

The current transmission is terminated immediately.

Terminating Execution—the EXIT Command

The user may terminate operation of the Mainframe Link by entering the command

    EXIT

The Mainframe Link returns control to ISIS-II. See "Operation With Console and Submit Files" below for a discussion of EXIT processing when the console is assigned to a file.

Console Assignment—the ASSGNCI Command

The command

    ASSGNCI   [< :device:>] <filename>

may be used to assign the console input device to an ISIS-II file. ASSGNCI may be abbreviated as A. The assigned file may consist of any number of Mainframe Link commands. Parameter substitution, as with the ISIS-II SUBMIT command, is not available with this facility.

    <:device:>   Specifies the drive containing the file. :F0: is the default.

    <filename>   Specifies the name of the file, including any extension, to be assigned to console input.

See "Operation With Console and Submit Files" below for a complete discussion of Mainframe Link operation when console input is assigned to a file.

Example:

To assign console input to a file named LINKCI.SRC, enter

    ASSGNCI LINKCI.SRC
or
    A LINKCI.SRC

The console input device is assigned to the file specified.

This feature permits a user to create an ISIS-II file containing a commonly used sequence of Mainframe Link commands, and to execute this sequence by entering a single ASSGNCI command at the console.

Operation with Console and Submit Files

When the Mainframe Link is invoked from a SUBMIT file or the console is assigned to a file by the ASSGNCI command, special processing considerations are in effect. All commands read are executed immediately, if possible. Since it may not be possible to execute a SEND, RECEIVE, or PUNCH command immediately, these commands may be queued for later execution. Each queue (SEND, RECEIVE and PUNCH) holds two commands. When the third unexecuted SEND, RECEIVE, or PUNCH command is read, console file input is suspended until the respective queue is reduced by one, by completion of a prior command. At that time, console file input resumes.

If console input is assigned to a file, the EXIT command is not processed until all queues are empty and all commands have been completed.

If end-of-file is encountered on a console input file, the console input assignment reverts to the system console device. ASSGNCI commands may be nested (i.e., an ASSGNCI command may appear in a console file) causing a switch of the console input to the new file specified. At end-of-file on the new file, however, console assignment reverts to the system console device—not to the previous console file.

A Control-E command in a console file causes console input to revert to the system console. The user may also enter a Control-E at any time on the system console to achieve the same effect. The Mainframe Link reverts from command file operation to interactive operation. A second Control-E entered as a command during the interactive session will cause the Mainframe Link to resume processing the interrupted console file.

A Receive Chain MODE selection is overridden for the duration of a console file assignment, and no receive chaining is in effect.

To summarize, when the console is assigned to a file:

- SEND, RECEIVE, and PUNCH commands are queued to a depth of two.
- A full queue suspends console input.
- The EXIT command is not processed until all queued commands have been processed.
- Receive Chaining is not in effect.
- End-of-file reverts console input to the initial system console.
- Control-E switches input between a console file and the system console.

RJE Commands

When running in 2780 and 3780 mode, the Mainframe Link emulates an RJE console. This facility allows the user to enter on the Intellec console any IBM HASP, JES, POWER, or RES console command supported by the remote computer, and to display the response from the remote computer on the Intellec console. The use of this feature is highly dependent on the characteristics of the remote computer system.

To be interpreted as an RJE console command, the command string must begin with a dollar sign ($) if the command is a HASP or JES command, or with an asterisk (*) if the command is a POWER or RES command. The Mainframe Link replaces the dollar sign with the HASP string /*$ or the asterisk with the POWER string *b . . b, appends the command, and transmits the result to the remote computer. The next transmission from the remote computer is assumed to be the reply to the command and is displayed on the Intellec console. RJE console commands may not be used with any remote system that does not immediately process the command and transmit back the command response.

The use of the dollar sign and asterisk for the functions specified above are defaults set in the User Configuration Module. These characters and their related string replacements may be modified if desired. See Chapter 3, Installing the Mainframe Link, for a description of the modification process.

An RJE command entered while data is being received from a remote computer will cause interruption of the transmission. The command will be processed, and the transmission will resume after the command reply is received. A new RECEIVE or PUNCH command must be issued to contain the continuation of the data if the Mainframe Link is not in Receive Chain Mode. If the Mainframe Link is in Receive Chain Mode, the next file extension is allocated for the interrupted data.

NOTE

Unsolicited console messages from the remote system, such as remote system broadcast messages, are treated as data and will be placed in the current receive file.

Example 1:

To display the status of a remote HASP system's input and output queues, enter the HASP command

    $ D Q

The command is sent to the remote computer and the display of queue status returned is displayed on the Intellec system console.

Example 2:

To purge a job running on a POWER remote system, with the job identified as JOB 123, enter the POWER command

    * P J 1 23

The job is purged. The confirmation message from the remote computer is displayed on the Intellec system console.

Program Messages

The Mainframe Link issues messages that inform the operator of current execution status, including the start and end of any data transmission operation. Error conditions that result in aborted transmissions are reported, but transient correctable errors are not.

All messages are of the form

    R C O M −*nnn* *message text*

where   *nnn* is a unique message identifier that provides easy reference to the message explanation, and

   message text is a short message which briefly describes the action required, condition found, or program status.

Mainframe Link messages are documented in detail in Appendix A.

IBM Operating Systems

System Generation Parameters

To communicate with the Mainframe Link, the remote IBM operating system must be configured to communicate with an IBM 2780 or IBM 3780. The IBM operating system and the Mainframe Link must be configured for the same device.

If the IBM system is configured for a 2780, the following 2780 options must be specified or taken by default at the IBM end:

* Device = 2780, Model 2
* Multiple Record Transmission Feature
* Printer Line Length of 80, 120, or 144 characters
* EBCDIC Transparency supported (requires IBM hardware option) or not supported (EBCDIC Transparency is required for transferring Binary Files.)
* Point-to-point switched (dial-up) or non-switched (leased) communications
* EBCDIC Transmission Code
* Horizontal Format Control supported or not supported

If the IBM system is configured for a 3780, the following 3780 options must be specified or taken by default at the IBM end:

* Device = 3780 with 3781 Card Punch
* EBCDIC Transparency supported (requires IBM hardware option) or not supported (EBCDIC Transparency is required for transferring Binary Files.)
* EBCDIC Transmission Code
* Point-to-point switched (dial-up) or non-switched (leased) communications
* Horizontal Format Control supported or not supported
* Blank Compression Feature supported or not supported

If the IBM system is being used in RJE mode, the line being used by the Mainframe Link should be defined as having a pseudo-console and should have the output suspension feature specified. Output separator pages should be suppressed.

To determine the procedures necessary to define remote lines and terminals, consult the IBM system generation documentation for the IBM operating system being used.

NOTE:

The IBM examples in the remainder of this chapter assume the use of an IBM System 370 mainframe running the MVS operating system.

Receiving Files from an IBM System

To receive a file from an IBM system, two-things must occur:

1. The Mainframe Link must be configured to receive data by a RECEIVE or PUNCH command.
2. The IBM Mainframe must be directed to send data to the Mainframe Link by a job run on the mainframe.

Routing Job Output

The job on the mainframe may be submitted to the mainframe locally, by another RJE station, or by the Intellec system running the Mainframe Link.

If the job is submitted by the Intellec system, no special action is needed to cause routing of the job output back to the system. If the job is submitted at the mainframe or by another RJE station, a ROUTE control card must be supplied with the Job Control Language (JCL) to cause routing of the job output to the Intellec system.

The ROUTE card has the general format

    / * ROUTE PRINT *remoteid*

for print data and

    / * ROUTE PUNCH *remoteid*

for punch data, where *remoteid* is the IBM identifier used to identify the Mainframe Link remote line.

Eliminating Output Separators

Most IBM systems generate output separator pages or cards at the beginning and end of each job's output. The user should suppress these separators when defining the remote line at the mainframe or, the user should turn off the separator function with an RJE Console command. For example, the HASP RJE command

    $TR*nn*.PR1,S=N

where *nn* is the *remoteid* of the Mainframe Link's line, will turn off the output separator function for the duration of the connection.

Example:

Assuming the Mainframe Link's *remoteid* is 55, the command

    $TR55.PR1,S=N

will turn off the output separator function.

Eliminating Job Control Language Output

When a job is run on a remote IBM system, the Job Control Language (JCL) used to execute the job is normally transmitted with the job's output. The IBM JCL JOB card parameter MSGCLASS may be used to route the JCL to an output class that is not sent to the Mainframe Link. Some installations have a dedicated output class that is, in effect, a JCL Byte Bucket, so that JCL directed to this class is not printed. In other installations, the handling of this unwanted output is left to the person submitting the job.

Example of Receiving a Source File from the Remote IBM System

Assume the user wishes to transfer a remote cataloged file named PLM.SRC to an Intellec system whose *remoteid* is 55.

An IBM utility job submitted by the Intellec system (or by another terminal) is used to transmit the file to the Intellec system. Figure 5-1 illustrates the JCL required. The job output is queued for transmission to the Intellec system.

```
//PLMJOB    JOB  installation  JOB  card  parameters,
//          MSGCLASS=Z
/*ROUTE  PRINT    REMOTE55
//STEP     EXEC  PGM=IEBPTPCH
//SYSPRINT   DD  SYSOUT=Z
//SYSUT2     DD  SYSOUT=A
//SYSUT1     DD  DSN=PLM.SRC,DISP=OLD
//SYSIN      DD  *
 PRINT  TYPORG=PS,MAXFLDS=1
 RECORD  FIELD=(80)
//
```

Figure 5-1: Sample JCL for File Retrieval

On the Intellec console, enter the commands

```
$TR55.PR1,S=N
SEND  JOB.JCL
RECEIVE  PLM.SRC
```

to suppress the output function if necessary, transmit the required JCL, and receive the source file from the IBM mainframe.

Sending Files to an IBM System

To transfer a file to an IBM mainframe, the user must create the IBM Job Control Language (JCL) necessary to direct processing of the file on the remote computer. This JCL is sent to the remote computer as part of the transmission that sends the file. The JCL can direct the remote computer to print the data on a line printer using a ROUTE card (as may be desired when sending a list file); or to place the data in a file at the remote computer (as may be desired for an object file).

The JCL can be created as a standard ISIS-II file. Figures 5-2 and 5-3 show examples of the JCL needed to print an ISIS-II file at the remote computer and to create a file at the remote computer from data transmitted, respectively.

```
//LISTJOB    JOB   installation  JOB  card  parameters,
//           MSGCLASS=Z
/*ROUTE  PRINT    LOCAL
//STEP     EXEC   PGM=IEBPTPCH
//SYSPRINT   DD   SYSOUT=A
//SYSUT1     DD   SYSOUT=A
//SYSIN      DD   *
 PRINT  TYPORG=PS,MAXFLDS=1
 RECORD  FIELD=(80)
//SYSUT1     DD   *
```

Figure 5-2: Sample JCL for Printing a File

```
//FILEJOB    JOB  installation JOB card parameters,
//                MSGCLASS=Z
/*ROUTE PRINT  LOCAL
//STEP    EXEC  PGM=IEBGENER
//SYSPRINT  DD            SYSOUT=A
//SYSUT2    DD            DSN=FILE.OBJ,DISP=(,KEEP),
//                        UNIT=SYSDA,VOL=SER=MYVOL1,
//                        DCB=(LRECL=80,BLKSIZE=80,RECFM=F)
//SYSIN     DD            DUMMY
//SYSUT1    DD            *,DCB=BLKSIZE=80
```

Figure 5-3: Sample JCL for Sending a File

Assume the user wishes to transfer two ISIS-II files to the remote computer: FILE.LST and FILE.OBJ. The .LST file should be listed at the remote computer, and the .OBJ file should be stored in a file at the remote computer. If the JCL shown in figure 5-2 is named JOBLST.JCL, and the JCL shown in figure 5-3 is named JOBOBJ.JCL, the commands

```
SEND  JOBLST.JCL,FILE.LST
MODE  TSP
SEND  JOBOBJ.JCL,FILE.OBJ
```

will accomplish the transfer.

The first SEND command sends the JCL needed to list the .LST file at the remote computer, followed by the list file. The second SEND command sends the JCL needed to create a new file at the remote computer, followed by the file data. The MODE command is required because the .OBJ file contains binary data. No translation overrides are needed in either command, since the .JCL and .LST files will be translated automatically, while the .OBJ file will not.

DEC PDP-11 Equipment with the RSTS/E Operating System

System Generation

To communicate with an Intellec development system running the Mainframe Link software, a remote RSTS/E system must have the KG11A communications arithmetic unit, a DP11, DU11 or DUP11 serial synchronous line interface unit, and the RSTS/2780 software. For detailed operating instructions on the RSTS/2780 software refer to the *RSTS/2780 User's Guide*, Order No. DEC-11-ORJEA-B-D.

The following examples illustrate the use of the Mainframe Link with the RSTS/2780 package. Assume that the user has access to two terminals: one logged into RSTS/E and the other an Intellec Development System Model 800 or Series II.

Start-Up Procedure

On the RSTS/E terminal enter

```
RUN $RJ2780 CR
RJ2780 V068-03 RSTS V068-02 Timesharing RJE
General, 2780 or RSTS-TO-RSTS <2780>? 2780 CR
Normal or Transparency mode <Normal>? NORMAL CR
Default output file <SY:[243,100]RJERCV.*>? INFILE CR
SIGNOFF file name <none>? CR
*
```

(Commands entered by the user are shown in reverse video.)

The preceding dialogue establishes the RSTS/2780 system in 2780, non-transparent mode. Files transmitted to the PDP-11 are stored in INFILE, unless specified otherwise by a subsequent read command. Further details may be found in the *RSTS/2780 User's Guide*.

On the Intel terminal enter (assuming all files are on :F0:)

```
RCOM80
```

If the user has a dial-up telephone link, he should establish the connection at this time. The Intellec system and PDP-11 are ready to receive and transmit files.

Receiving a Source Program from the RSTS/E System

Example:

A source file named PROG1.SRC under RSTS/E is transmitted to an ISIS-II file named PROG2.SRC.

On the Intellec console enter

```
MODE 2780,NRC
RECEIVE PROG2.SRC
```

Then at the RSTS/E terminal enter

```
RJ:=PROG1.SRC
```

This command causes the RSTS/2780 software to transmit the file PROG1.SRC.

The following messages will be displayed on the respective terminals:

Intellec	RSTS/E
RCOM-003 RECEIVING	Sending: PROG1.SRC
RCOM-005 MESSAGE RECEIVED COMPLETE	*nnn* records sent

Sending a Listing File to the RSTS/E System

Example:

An ISIS-II file PROG.LST is sent to a RSTS/E file PROG.LST.

At the RSTS/E terminal enter

```
PROG.LST=RJ:
```

This command prepares the RSTS/2780 software to place an incoming file from the Intellec system into the RSTS/E file PROG.LST. This overrides the default specified during start-up (INFILE) for the next transmission received.

Enter the following command on the Intellec console:

```
SEND PROG.LST
```

The following messages will be displayed on the respective terminals:

Intellec	RSTS/E
RCOM-002 TRANSMITTING`	Receiving file: PROG.LIST
RCOM-004 TRANSMISSION COMPLETE	*nnn* records received

Printing an Intellec File on a RSTS/E Printer

In this example all files are sent from the Intellec development system directly to a printer in the RSTS/E system. The start-up procedure for RJ2780 is as follows:

```
RUN $RJ2780 CR
RJ2780 V068-03 RSTS V068-02 Timesharing RJE
General, 2780 or RSTS-TO-RSTS <2780>? 2780 CR
Normal or Transparency mode <Normal>? NORMAL CR
Default output file <SY:[243,100]RJERCV.*>? TEMP.*/Q CR
SIGNOFF file name <none>? CR
```

At the Intellec terminal enter the following command:

```
SEND FILE1.TXT
```

The file FILE1.TXT is transmitted and queued for printing at any available printer in the RSTS/E system. Any number of SEND commands can be given.

The first part of this chapter describes the use of two utility programs that are supplied with the Mainframe Link software. They are *not* Mainframe Link commands but freestanding utilities that run directly under ISIS-II.

The final part of this chapter presents a comprehensive example of how to configure an Intellec development system as an unattended processor for program development attached to a mini or mainframe computer system.

The CONSOL Command

The CONSOL command allows the user to change the device or file used as the system console. The syntax of the CONSOL command is

    CONSOL   [< infile>]   [,<outfile >]

where

> <infile> is the path-name of a valid input device or disk file to be used for system console input. If it is a disk file and the drive is not specified, Drive 0 is assumed. Before opening the new file, the current input file is closed unless *infile* is specified as :CI:, which is always open. If the specified file cannot be opened, a fatal error occurs. If *infile* is omitted, then the console assignment for input remains unchanged.

> <outfile>is the path-name of any valid output device or disk file to be used for system console output. Drive 0 is the default. Before opening the new file, the current ouput file is closed unless *outfile* is specified as :CO:, which is never closed. If the specified file cannot be opened, a fatal error occurs. If *outfile* is omitted, then the existing console output file assignment remains.

Example 1:

The following command changes the console input to the ISIS-II file CMND.SEQ on Drive 1:

    CONSOL :F1:CMND.SEQ

Example 2:

The following example additionally changes console output to the ISIS-II file SYSOUT.LOG on Drive 1:

    CONSOL :F1:CMND.SEQ, :F1:SYSOUT.LOG

If a CONTROL/E (∧E) is encountered as a command in the file assigned as console input, control reverts to initial system console, allowing interactive processing. The command sequence file is kept open until a fatal error occurs or console input is reassigned using a CONSOL or SUBMIT command. A CONTROL/E entered at the console anytime before this as an ISIS-II command returns control to the original command sequence file.

If console input is assigned to a disk file using the CONSOL command, the file should terminate with a CONSOL command to reassign console input, since encountering an end-of-file causes a fatal error. A file assigned as console input may

contain a CONSOL command which reassigns the same file as console input, thereby creating a command sequence loop. The following example illustrates the above and the usage of the CONTROL/E feature:

Example 3:

Consider an ISIS-II file named LOOP.CMD containing the following:

```
:F1:PLM80  :F1:MYPROG.SRC
^E
CONSOL LOOP.CMD
```

If the user enters the command CONSOL LOOP.CMD at the Intellec console, the file MYPROG.SRC is compiled, and the CONTROL/E transfers control to the initial system console. After editing the source for errors, a CONTROL/E can be entered at the console to return control to the next statement in the file LOOP.CMD. The final CONSOL command reassigns the file LOOP.CMD as console input causing another compilation. Thus a loop is set up.

The STRZ Command

When transparent binary files are transmitted using standard 2780 or 3780 protocol, data is transmitted to the line in 80-byte records. The last record of a file is padded with binary zeroes as needed to fill the last 80-character record.

Many Intel relocation and linkage products (e.g., LINK86, LIB86) reject input files with trailing zeroes. STRZ removes trailing zeroes from such an object file.

The syntax of the STRZ command is

STRZ <filename>

where <filename> is the path-name of the file containing the object module. STRZ copies the object module to a temporary file named STRZ.TMP on the disk containing the original file, but deletes the extra binary zeroes. The original file is deleted, and the temporary file is renamed with the original file name.

STRZ will process only binary files in standard object module format.

Using an Intellec Development System as an Attached Processor

An Intellec development system with the Mainframe Link can be configured to accept a source file (or files) from a remote processor, assemble or compile them, and send the results back over the link to the remote processor. The process can be repeated without operator intervention. For instance, a user working on a mainframe connected to an Intellec system can go through the edit-transmit-compile-receive-edit loop without entering any commands at the Intellec console after the initial start-up. This is accomplished by executing ISIS-II and RCOM80 commands from a command sequence file and creating a loop in the file for repetitive execution. This section presents two examples of how to configure an Intellec development system as an unattended attached processor, using such command sequence files.

Consider an Intellec system connected to a DEC PDP-11 computer system running the RSTS/E operating system. We assume that the RSTS/E RJ2780 software is configured for 2780, transparent mode with default output file—INFILE.*. The start-up procedure is explained in Chapter 5. In this case, however, transparent mode is selected, since binary files will be transmitted.

Example 1:

An ISIS-II command file (named LOOP.CMD) causes the Intellec system to receive a PL/M-80 source file from the PDP-11, compile it, and send the list file back to the PDP-11.

LOOP.CMD contains the following Mainframe Link and PL/M-80 Compiler commands:

```
RCOM80
RECEIVE FILE.SRC
EXIT
PLM80 FILE.SRC PAGEWIDTH(80)
RCOM80
SEND FILE.LST
EXIT
DELETE FILE.SRC, FILE.LST, FILE.OBJ
CONSOL LOOP.CMD
```

This command file is invoked by typing the following ISIS-II command at the Intellec console:

```
CONSOL LOOP.CMD
```

RCOM80 invokes the Mainframe Link software. The first file received is placed in FILE.SRC. The EXIT command returns control to ISIS-II and the next command compiles the source in FILE.SRC creating a list file. Note that since only 80-byte records can be transmitted, we specify a pagewidth of 80 characters. The next two commands send the list file FILE.LST over the link to the PDP-11. When the CONSOL command in the file is executed, the file LOOP.CMD is closed and reopened, and the command sequence is processed again from the beginning. Thus a loop is created and the Mainframe Link software waits to receive the next file from the remote PDP-11 computer.

On a RSTS/E terminal, the following two commands send a source file to the Intellec system for compilation and receive the resulting list file:

```
*RJ:=PROG.SRC
```
(Send file PROG.SRC to the Intellec system)

```
*PROG.LST=RJ:
```
(Receive list file from the Intellec system into PROG.LST)

Example 2:

In the previous example, the Intellec development system was set up to do one specific task, namely PL/M compilation. In this example, the user sends a general ISIS-II command sequence file from the PDP-11 to be processed by the Intellec system. The following ISIS-II command sequence file named LOOP.CMD sets up the Intellec system to receive this command sequence file from the PDP-11 computer and execute it using the ISIS-II SUBMIT facility:

```
RCOM80
RECEIVE :F1:CMND.CMD
EXIT
SUBMIT :F1:CMND.CMD
DELETE :F1:CMND.CMD
CONSOL :F1:LOOP.CMD
```

The command sequence file from the PDP-11 may contain commands to further receive files, COMPILE/ASSEMBLE/LINK/LOCATE them, and send the resulting files back to the PDP-11.

The user invokes the loop by typing at the Intellec console:

```
CONSOL :F1:LOOP.CMD
```

We have assumed that the Mainframe Link software and CONSOL program reside on Drive 0 and that the command sequence files are stored on Drive 1.

Now suppose that from the RSTS/E terminal the user wishes to send a PL/M source file named PROG.SRC, compile it, link the object module with PLM80.LIB and SYSTEM.LIB, and send the list, map, and object files back to the PDP-11.

The user creates the following command sequence file named CMND.001 under RSTS/E:

```
RCOM80
RECEIVE :F1:PROG.SRC
EXIT
PLM80 :F1:PROG.SRC PAGEWIDTH(80)
LINK :F1:PROG.OBJ,SYSTEM.LIB,PLM80.LIB TO &
:F1:PROG.LNK MAP PRINT(PROG.MAP)
RCOM80
MODE TSP
SEND :F1:PROG.LNK
MODE NTSP
SEND :F1:PROG.LST
SEND :F1:PROG.MAP
EXIT
DELETE :F1:PROG.SRC,:F1:PROG.LST,:F1:PROG.OBJ
DELETE :F1:PROG.LNK,:F1:PROG.MAP
```

The user transmits the ISIS-II command file and then the program source file by entering the following RJ2780 commands at his RSTS/E terminal:

```
*RJ:=CMND.001
*RJ:=PROG.SRC
```

Before the Intellec system starts returning the object and list files to the PDP-11, the user should enter the following RJ2780 command at his RSTS/E terminal:

```
PROG.OBJ=RJ:/B
```

The object file is placed in PROG.OBJ. The /B indicates it is a binary file for which no translation is to take place. Since INFILE.* was specified during RJ2780 invocation as the default output file, the PROG.LST, and PROG.MAP files are returned to the RSTS/E system as INFILE.001, and INFILE.002, respectively.

Configuration Considerations

Before using the Intellec system as an attached processor, the user should be aware of the following considerations:

1. If a fatal error occurs at any time on the Intellec development system, ISIS-II will be reloaded and the console will be assigned to the cold start console. User intervention will then be required to restart the command sequence loop manually. Consequently, it is recommended that the ISIS-II command files be thoroughly debugged before being used as a remote unattended processor in a production programming environment.

2. The Intellec system responds to communications from the remote computer only when RCOM80 is active. Since some remote systems may abort a transmission if no acknowledgement is received from the Intellec system in a certain period of time, the user should suppress the time-out feature on the remote

system if possible. Consult the remote system manuals for detailed instructions. If it is not possible to suppress the time-out, then the user should transmit files from the remote computer only when RCOM80 is active.

3. Command sequence files submitted to the Intellec system must delete any files which they create, otherwise ISIS-II will abort with a fatal error when the disk becomes full, or when RCOM80, invoked in a subsequent command file, attempts to create an ISIS-II file which already exists.

4. If many users are submitting jobs to the Intellec system from a mainframe computer, the mainframe must be configured in such a way that the ISIS-II command sequence file for each user's job is transmitted to the Intellec system *directly preceding* the data files for the same job. Otherwise, different user's jobs will be intermixed, leading to unpredictable results.

Two diagnostic tools are available with the Mainframe Link: a loop-back confidence test that verifies the proper operation of the microcomputer development system, cables, and modem; and a diagnostic dump facility that can help diagnose line protocol problems.

Confidence Test—the ALTEST Command

To direct the Mainframe Link to run a loop-back confidence test enter the following console command:

ALTEST

This command causes transmission and simultaneous reception of data blocks by the development system. When an image of the data transmitted is received by the Mainframe Link, it is compared with the transmitted data. If the data is the same, the development system and other components in the data path are working correctly. If no data is received, some portion of the data path is not working. Similarly, if received data does not match transmitted data, some portion of the data path is at fault.

Loop-back can be accomplished in the following two places (see figure 7-1):

1. At the serial port connector on the rear panel of a Series II or at the end of the iSBC-955 cable from an iSBC-534 board. Use the loop-back connector supplied with the Mainframe Link. This test verifies the software configuration and the serial port.
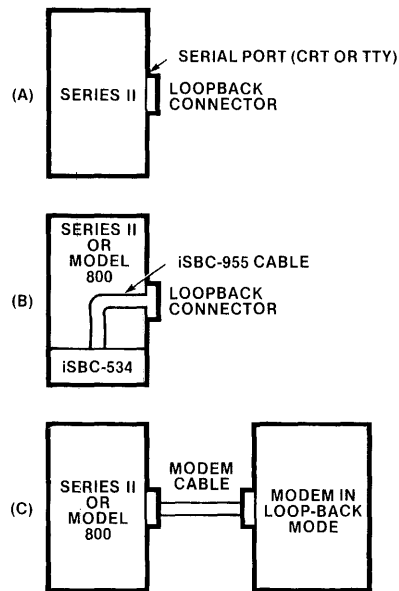

Figure 7-1. Loop-back Configurations   565-10

2. At the modem, if the modem is equipped with the analog loop-back feature. This configuration tests the entire local data path, including the modem and cable.

Hardware Configuration for the Confidence Test

To configure a Series II or Model 800 for running the loop-back test with a modem:

• Ensure that all jumpers are connected as detailed in Chapter 3.

• Ensure that the modem is connected to the Intellec development system using the modem cable supplied with the Mainframe Link.

• Put the modem into analog loop-back mode.

To configure a Series II or Model 800 for running the loop-back test with a modem eliminator:

• Ensure that all jumpers are connected as detailed in Chapter 3.

• Ensure that the modem eliminator is connected to the Intellec development system using the modem cable supplied with the Mainframe Link.

• Remove the remote system cable from the modem eliminator.

• Install the loop-back connector in its place.

To configure a Series II using an IPB or IPC serial channel to run the test with loop-back at the serial port connector:

• Ensure that all jumpers are connected as detailed in Chapter 3.

• Remove the modem cable from the Series II rear panel.

• Install the loop-back connector in its place.

To configure a Model 800 or Series II with an iSBC-534 board for running the test with loop-back at the end of the iSBC-955 cable, the iSBC-534 jumpers must be changed (see figure 7-2).

To configure the iSBC-534 board:

1. Disconnect the power cord.

2. Remove the iSBC-534 board from the chassis.

3. Remove the following jumpers (installed per instructions in Chapter 3) for:

Channel 0:	76-79
	81-82
Channel 1:	83-86
	88-89
Channel 2:	90-93
	95-96
Channel 3:	97-100
	102-103

4. Install the following jumpers (removed per instructions in Chapter 3) for:

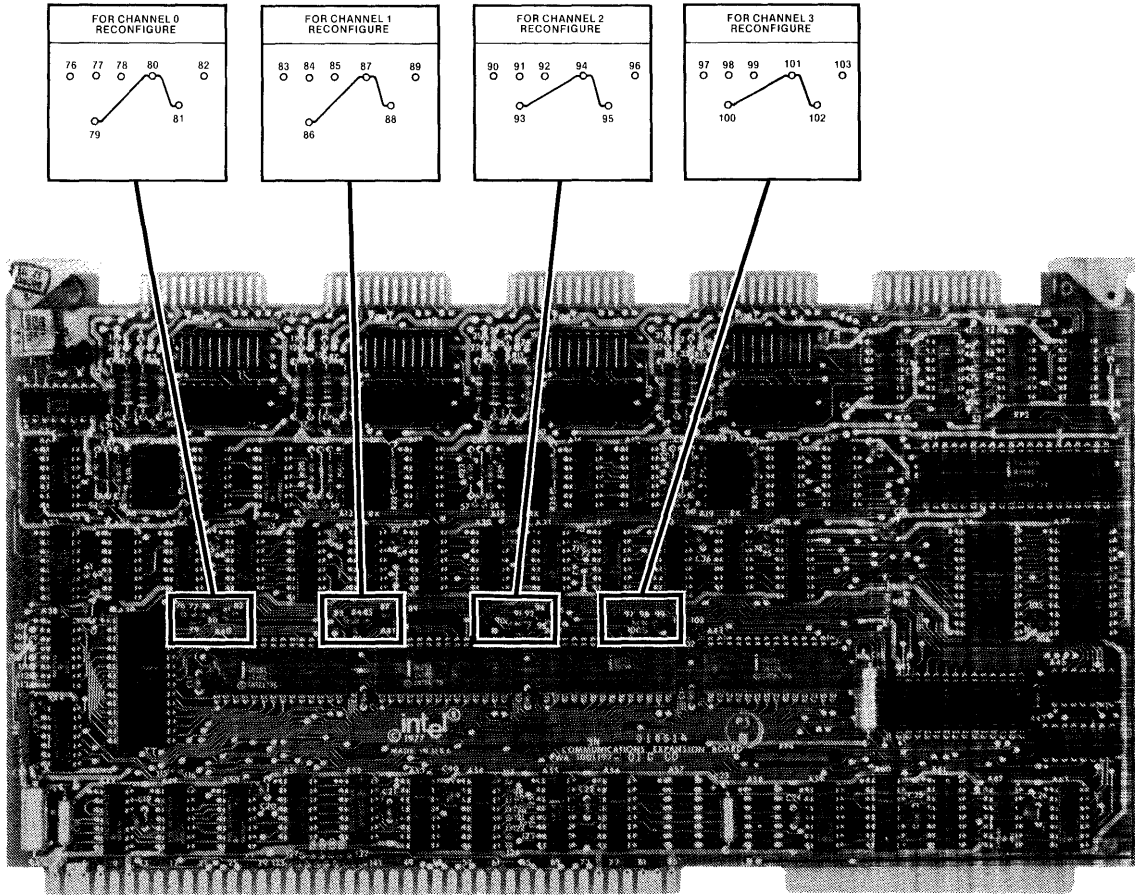|	
Channel 0:	79-80
	80-81
Channel 1:	86-87
	87-88
Channel 2:	93-94
	94-95
Channel 3:	100-101
	101-102

Figure 7-2. Reconfiguring the iSBC-534™ Board for Loop-back Test   565-5

5. Install the iSBC-534 board in the chassis, with the iSBC-955 cable installed and routed out of the chassis.

6. Plug the loop-back connector into the iSBC-955 cable.

7. Reconnect the power cord, and execute the diagnostic loop-back test.

8. After the diagnostic loop-back has been completed successfully, disconnect the power cord, remove the iSBC-534 board from the chassis, remove the jumpers installed in step 4 above, and replace the jumpers removed in step 3 above. The iSBC-534 board is now configured for normal operation.

Operating the Confidence Test

To run the confidence test, configure the hardware as described above, invoke the Mainframe Link, and enter the ALTEST console command. The Mainframe Link will transmit data blocks and simultaneously receive the data sent, comparing the two to ensure a match.

Once started, the test sequence is repeated continuously until any character is entered on the console or until an error occurs.

If an error occurs, a descriptive message is written to the console and the test halts. If the error indicates a mismatch of transmitted and received data, the transmitted and received characters are displayed in the error message.

If the user enters a character on the console and no errors have occurred, the Mainframe Link writes a successful completion message to the console and terminates the test.

Example:

Assuming the loop-back connector is connected to the serial channel, entering

        ALTEST

causes the Mainframe Link to issue the following message:

        RCOM-018 LOOPBACK TEST
                        ENTER ANY CHARACTER TO TERMINATE TEST

If, after some period of running the test, the user enters any character on the system console (a carriage return will suffice), the Mainframe Link issues the following message:

        RCOM-022 LOOPBACK TEST COMPLETED WITHOUT ERROR

If, on the other hand, an error is reported, the cause of the error must be found and corrected before remote communications are attempted.

If a loop-back test using a modem fails, the first step in diagnosing the problem is to eliminate the modem from the test path by connecting the loop-back connector to the Series II backplane or iSBC-955 cable. If the test then runs successfully, the modem cable or modem is at fault. If the test still fails, some part of the Intellec system or Mainframe Link software or hardware configuration is at fault.

Table 7-1 lists the loop-back error types and possible fixes in their most likely occurring order.

Diagnostics—the DIAGNOSE Command

The Mainframe Link software contains a circular buffer that logs all line activity. This buffer may be formatted and dumped to the console, the system list device, or an ISIS-II file by the command

        DIAGNOSE [<:device:>] [<filename>]

Table 7-1. Loop-Back Errors and Possible Causes

Error Message	Possible Cause
INVALID CHANNEL STATUS	User Configuration Module does not reflect the proper serial channel or iSBC-534 board parameters.
	An iSBC-534 board base address is not properly specified or jumpered.
	An iSBC-534 board is not properly seated.
	The serial channel is defective.
TRANSMITTER TIMEOUT	User Configuration Module does not reflect the proper serial channel.
	The serial channel jumpers have not been properly installed.
	The loop-back connector has ,not been attached directly to the Series II backplane or iSBC-534 connector.
	The modem cable or modem, if in the test path, is defective, or the modem is not in Analog Loop-back mode.
	The serial channel is defective.
NO DATA PATH ESTABLISHED	The serial channel jumpers have not been properly installed.
	The User Configuration Module does not reflect the proper serial channel.
	The modem cable or modem, if in the data path, is defective or the modem is not in Analog Loop-back mode.
	The serial channel is defective.
DATA PATH ERROR	The modem cable or modem, if in the data path, is defective.
	The serial channel is defective.

where DIAGNOSE may be abbreviated as D,

      <:device:>   may be specified as:

                      : C O : to dump to the console output device
                      : L P : to dump to the system list device
                      : F n : to specify a device to contain a file that will hold the dump

      <filename>   specifies the name of a file that is to contain the dump.

If <:device:> and <filename> are omitted, :CO: is assumed. If <:device:> is omit-. ted and <filename> is specified, :F0: is assumed.

The DIAGNOSE command produces a display of the line activity that is recorded in the buffer, as shown in figure 7-3. Data transmitted to the line is preceeded by the TRANSMITTED DATA identifier; data received from the line is preceded by the RECEIVED DATA identifier.

The Diagnose Facility is intended· to allow the examination of line activity in the unlikely event that line protocol problems occur. The interpretation of traced activity is a complex task that is beyond the scope of this manual.

The DIAGNOSE command suspends all Mainframe Link activity for the duration of the processing of the command. For this reason, the DIAGNOSE command should be issued only when suspected line protocol problems are encountered.

```
RCOM-030 DIAGNOSTIC DUMP
**TRANSMITTED DATA**
PAD SYN SYN SYN SYN ENQ PAD PAD
**RECEIVED DATA**
DLE AK0 PAD
**TRANSMITTED DATA**
PAD SYN SYN SYN SYN STX AK1 5C E2 C9 C7 D5 D6 D5 40 D9
D4 E3 F5 F5 ETX 45 A6 PAD PAD
***RECEIVED DATA****
DLE AK1 PAD
**TRANSMITTED DATA**
PAD SYN SYN SYN SYN EOT PAD PAD
***END OF DIAGNOSTIC DUMP***
```

Figure 7-3. Sample DIAGNOSE Command Output

RCOM-001   INVALID COMMAND
The command entered was not a valid Mainframe Link command or contained an improper operand. Re-enter the corrected command.

RCOM-002   TRANSMITTING
The Mainframe Link has secured permission to send from the remote computer and is transmitting the file(s) specified in a previous SEND command.

RCOM-003   RECEIVING
The Mainframe Link has granted the remote computer permission to send, has opened the proper print or punch file, and is receiving data from the remote computer.

RCOM-004   TRANSMISSION COMPLETE
The Mainframe Link has successfully completed the current transmission to the remote computer.

RCOM-005   MESSAGE RECEIVED COMPLETE
The Mainframe Link has successfully received the current transmission from the remote computer. The current print or punch file is closed.

RCOM-006   CONSOLE BUFFER OVERFLOW-MESSAGE LOST
The Mainframe Link was unable to display all messages generated for the console and has lost a message. This situation should only occur in high message volume situations (e.g., high numbers of errors).

Correct the condition indicated by the high volume error messages.

RCOM-007   RECEIVE FILE DEFINITION REQUIRED
The remote computer is attempting to send print data to the Mainframe Link, but no file has been defined for the data. The Mainframe Link waits for a RECEIVE file definition.

Enter a RECEIVE command to define a file for the data.

RCOM-008   PUNCH FILE DEFINITION REQUIRED
The remote computer is attempting to send punch data to the Mainframe Link, but no file has been defined for the data. The Mainframe Link waits for a PUNCH file definition.

Enter a PUNCH command to define a file for the data.

RCOM-009   *filename* -DUPLICATE FILE-DELETE?(Y OR N)
The *filename* specified by a RECEIVE or PUNCH command for data from the remote computer already exists.

Enter Y to delete the existing file and create a new file with the same name for data from the remote computer.

Enter N, or any character except Y, to preserve the existing file. The Mainframe Link will prompt for a new file name.

A-1

RCOM-010   REMOTE ABORT
                The operation in progress has been aborted by the remote
                computer. If the Intellec system was receiving data from the
                remote computer, the current RECEIVE or PUNCH file is
                closed. If the operation was a transmission to the remote
                computer, it has been only partially completed. The current
                RECEIVE, PUNCH, or SEND command is satisfied.

RCOM-011   REMOTE DISCONNECTED
                A disconnect sequence has been received from the remote
                computer.

                If further operations with the remote computer are desired, a
                new connection must be established.

RCOM-012   DIAGNOSE FILE OPEN ERROR
                The file specified in the DIAGNOSE command could not be
                opened.

                Ensure a valid file name is specified and re-enter the
                DIAGNOSE command.

RCOM-013   SYSTEM IDLE-NO ABORT REQUIRED
                No operation was in progress when an ABORT command was
                processed. No abort is possible.

RCOM-014   TRANSMISSION ABORTED BY OPERATOR
                The current transmission to the remote computer has been
                aborted by the ABORT command.

RCOM-015   RECEPTION ABORTED BY OPERATOR
                The current reception of data from the remote computer has
                been aborted by the ABORT command. The current
                RECEIVE or PUNCH file is closed.

RCOM-016   CURRENT SYSTEM STATUS:

SYSTEM IS *activity*, IN *device* DEVICE MODE
TRANSPARENCY *is/is not* IN EFFECT (*transparency mode*)
RECEIVE CHAINING *is/is not* IN EFFECT (*chaining mode*)
CURRENT FILES ASSIGNED:

    RECEIVE FILE   —   *filename*
    PUNCH FILE   —   *filename*

TRANSMISSION LINE STATISTICS

                     SENT   RECEIVED
TOTAL BLOCKS: *nnnn*   *nnnn*
TOTAL NAKS: *nnnn*   *nnnn*
TOTAL ENQS: *nnnn*   *nnnn*
CURRENT BLOCKS: *nnnn*   *nnnn*
CURRENT NAKS: *nnnn*   *nnnn*
CURRENT ENQS: *nnnn*   *nnnn*
    END OF STATISTICS DISPLAY

                This message displays the current Mainframe Link operation
                and mode, and shows the block counts and error statistics for
                the line.

RCOM-017   INVALID FILE NAME SPECIFIED
            A filename in the previous command was not specified prop-
            erly. The syntax of the name is not correct.

            Re-enter the command, specifying the corrected file name.

RCOM-018   LOOPBACK TEST - - -
            ENTER ANY CHARACTER TO TERMINATE TEST
            In response to an ALTEST command, the Mainframe Link is
            running the Loop-back Test. The test will continue until any
            console character is entered or until an error occurs. If no
            error is reported, enter a console character (a carriage return
            will suffice) to terminate the test.

RCOM-019   SYSTEM NOT IDLE-ALTEST IGNORED
            An ALTEST console command has been entered, but the
            Mainframe Link is not in the idle state. The ALTEST com-
            mand is ignored.

            Allow the current operation to complete, then re-enter the
            ALTEST command.

RCOM-020   NO DATA-PATH ESTABLISHED-TEST FAILED
            The Loop-back Test did not receive the data transmitted. The
            Mainframe Link is not operational.

            See Chapter 7 for a list of the possible causes of this failure.

RCOM-021   DATA PATH ERROR-TEST FAILED
            SENT *nn* RECEIVED *nn* - -
            The data received by the Loop-back Test did not match the
            data sent. In the message text, *nn* indicates the hexadecimal
            values of the byte sent and the byte received. The Mainframe
            Link is not operational.

            See Chapter 7 for a list of the possible causes of this failure.

RCOM-022   LOOPBACK TEST COMPLETED WITHOUT ERROR
            The Loop-back Test has been completed successfully. The
            Mainframe Link is operational.

RCOM-023   INVALID CHANNEL STATUS
            The serial channel status obtained by the Mainframe Link is
            invalid. The Mainframe Link is not operational.

            See Chapter 7 for a list of the possible causes of this failure.

RCOM-024   TRANSMITTER TIMEOUT
            The serial channel transmitter used by the Mainframe Link
            would not accept a character for 50ms. The Mainframe Link
            is not operational.

            See Chapter 7 for a list of the possible causes of this failure.

RCOM-025   I/O ERROR HAS OCCURRED STATUS *nn*
            An unrecoverable file I/O error has occurred. The current
            operation in progress is aborted. The *nn* represents the ISIS-II
            error number.

RCOM-026   NO RESPONSE TO LINE BID
            The Mainframe Link has not received a response to fifteen
            consecutive line bids. The remote computer is not connected
            or is not prepared to receive data.

connect the remote computer or prepare the remote computer for communications, then re-enter the SEND command.

RCOM-027   LINE BID REFUSED
The remote computer has refused the Mainframe Link's line bid. The remote computer is not prepared to receive data.

Prepare the remote computer for data transfer.

RCOM-028   LOST ACK SYNCHRONIZATION-ABORTED
The remote computer has sent the improper alternating acknowledgement in response to a data block. The current transmission is aborted.

Retry the operation by re-entering the SEND command. If the message recurs there may be a protocol incompatibility. Issue the DIAGNOSE command and save the results for subsequent analysis.

RCOM-029   15 RETRIES UNSUCCESSFUL-ABORTED
Fifteen successive attempts to transmit a data block were not successful. The transmission is aborted. This failure is probably due to a faulty data connection.

Re-establish the data connection using another line, if possible. If the error persists, run the Loop-back Test described in Chapter 7 and, if this test is successful, run end-to-end modem tests as described in the modem documentation.

RCOM-030   MODE HAS BEEN SET
The mode specified by the previous mode command has been set.

RCOM-031   DIAGNOSTIC DUMP
This message preceeds the diagnostic dump produced by the DIAGNOSE command and identifies the data as a diagnostic dump.

RCOM-032   CONSOLE NOT ASSIGNED TO FILE
A Control/E was entered on the system console, but the Mainframe Link's console input was not assigned to a file. The Control/E is discarded.

RCOM-033   FILE *filename* NOT FOUND
The file shown in the message, specified in a previous SEND command, was not found.

Re-enter the SEND command, specifying the correct filename.

RCOM-034   CONSOLE HAS BEEN ASSIGNED
In response to a previous CONSOLE command, the Mainframe Link's command input has been assigned to the file specified by the command.

RCOM-035   EXIT COMMAND READ OR COMMAND FILE EOF
SYSTEM CONSOLE ACTIVE
An exit command has been read, or an end-of-file has been encountered in a command file. The Mainframe Link's command input is reassigned to the initial system console.

RCOM-036   COMMAND REJECTED-COMMAND QUEUE FULL
Two SEND, RECEIVE, or PUNCH commands were queued for execution when a third SEND, RECEIVE, or PUNCH command was entered. The command is rejected.

Wait until one of the outstanding commands has been executed, then re-enter the command.

RCOM-037   INVALID CHARACTER IN TRANSMIT FILE-ABORTED
A character with a value less than the EBCDIC blank (40H) has been detected in a file being transmitted non- transparently. The transmit operation is aborted.

This error usually occurs because of an attempt to transmit a binary file or an untranslated ASCII file in non-transparent mode. Ensure that the translate attributes are correctly specified, and the Mainframe Link is in transparent mode; then retry the operation.

RCOM-038   TRANSMIT FILE RECORD TOO LONG-TRUNCATED
A record longer than 80 characters was found in a file being transmitted with ASCII-EBCDIC translation. The record is truncated before transmission.

Ensure that all records in files being transmitted with translation are 80 characters or less in length.

RCOM-039   TIMEOUT HAS OCCURRED - ABORTED
The Mainframe Link has not received a response to 15 consecutive ENQs requesting acknowledgement of previously transmitted data block.

Check that the communication link and remote system are functioning correctly.

RCOM-040   EXITED MAINFRAME LINK
Control passes to ISIS-II.

RCOM-041   SYSTEM CONSOLE ACTIVE
Control passes from a command sequence file to the system console. The user may enter Mainframe Link commands at the system console.

RCOM-042   COMMAND SEQUENCE FILE ACTIVE
Response to Control/E entered at the system console. The Mainframe Link resumes processing commands from the previously assigned command sequence file.

RCOM-043   DIAGNOSTIC FILE COMPLETE
The DIAGNOSE command has completed execution.

Printer form control escape sequences received in translated transmissions from the remote computer will be translated into ASCII form control sequences as follows:

Escape Sequence	Translated To	Printer Action
ESC 1	(CR) (LF)	Single Space
ESC S	(CR) (LF) (CR) (LF)	Double Space
ESC T	(CR) (LF) (CR) (LF) (CR) (LF)	Triple Space
ESC A	(CR) (FF)	Form Feed
ESC M	(CR)	Suppress Space
ESC HT		Save horizontal format record
All Others	(CR) (LF)	Single Space

An ESC HT sequence is processed as soon as it is received. Other ESC sequences are processed on receipt of an NL or IRS character (3780 mode), an IUS character (2780 mode), or an ETX or ETB character (2780 and 3780 modes), in keeping with the IBM device protocol.

Other EBCDIC form control characters received from the line are translated as follows:

EBCDIC Character	ASCII Translation	Printer Action
(FF)	(FF)	Form Feed
(NL)	(CR) (LF)	Single Space
(VT)	(CR) (LF)	Single Space
(LF)	(CR) (LF)	Single Space
(IRS) or (IUS) with no ESC outstanding	(CR) (LF)	Single Space

No form control processing is performed for nontranslated data.

BSC Control Characters

The BSC protocol provides a set of rules for synchronous transmission of data. All data is transmitted as a string of binary digits. The transmitter and receiver establish and maintain synchronization through recognition of a specific bit pattern, called the sync pattern, that is transmitted at the beginning of each transmission block.

Control characters are inserted into each data block by the transmitter and deleted from the block by the receiver. These characters are used to delimit records within a block, indicate the start and end of a block, and control such functions as blank compression. Other control characters are used to ensure the orderly and accurate transfer of data between transmitter and receiver.

Table C-1 lists the hex values of the BSC control characters used by the Mainframe Link.

Table C-2 lists the control characters and their meanings.

Table C-1. BSC Control Character Values

Control Character	EBCDIC Hex Value
ACK0	10H, 70H—two bytes
ACK1	10H, 61H—two bytes
DLE	10H
ENQ	2DH
EOT	37H
ESC	27H
ETB	26H
ETX	03H
IRS	1EH
IUS	1FH
NAK	3DH
PAD	FFH
RVI	10H, 7CH—two bytes
SOH	01H
STX	02H
SYN	32H
WACK	10H, 6BH—two bytes

BSC Data Transfer

BSC data transfer operations are initiated by a process known as a "line bid." The station initiating data transfer requests permission to send by transmitting an ENQ character to the remote computer. If the remote computer is prepared to receive data, it responds positively, sending back an ACK0 reply. If the remote computer is not prepared to receive data, it will respond with a negative reply, or NAK.

Once permission to transmit has been secured, the transmitting station formats and transmits a data block. This data block contains line control characters, data, and a cyclic redundancy accumulation used for error detection. If the receiving station receives the block and the cyclic redundancy check calculated by the receiver

Table C-2. BSC Control Characters Used by the Mainframe Link

Control Character	Meaning and Use
ACK0	Positive response to line bid. Positive response to data block, alternating with ACK1 to ensure no blocks are missed.
ACK1	Positive response to data block, alternating with ACK0 to ensure no blocks are missed.
DLE	Provides two-character control sequences (ACK0, ACK1, RVI, WACK). Also used to indicate control characters in transparent mode.
ENQ	Line bid, or request response to last block sent if response not received.
EOT	End-of-Transmission. Releases the line for a new line bid.
ESC	Precedes and identifies forms and format control sequences.
ETB	End of Text block. Signifies the end of the current block and indicates that the block check sequence follows immediately. More data blocks follow after reply from receiver.
ETX	End of Text. Logical end-of-file. Indicates the end of the current block. Block check sequence follows. No more data blocks follow.
IRS	Delimits 3780 records in multi-record block (non-transparent only).
IUS	Delimits 2780 records. Causes error checking without line turnaround.
NAK	Negative reply to line bid or data block. Transmitter must retransmit.
PAD	A trailing pad character ensures that the last significant character (e.g., ETB, BCC, or NAK) is sent before the data set transmitter turns off.
RVI	Reverse Interrupt. Causes suspension of the current transmission and relinquishes control of the line to the remote computer for a high-priority message.
SOH	Not transmitted by the Mainframe Link. Treated as STX if received from a remote computer.
STX	Start of Text. Marks the beginning of a data block. Starts the block error check accumulation.
SYN	Character Synchronization. Precedes all message and control blocks and establishes character phase. Two consecutive SYNs are required for proper sync. The Mainframe Link transmits four consecutive SYNs to the remote computer.
WACK	Wait Acknowledgement. Acknowledges the previous line bid or data block and requests that the transmitter pause before sending more data.

matches the one sent by the transmitter, the data is accepted by the receiver and the receiver replies with an alternating positive acknowledgement. An ACK0 is sent in response to the line bid, an ACK1 is sent in response to the first data block, an ACK0 is sent in response to the second data block, and so forth, with the ACKs alternating between ACK0 and ACK1.

If the receiver's cyclic redundancy check calculation does not match the transmitted value, a line error has occurred and the receiver responds with a NAK. The transmitter retransmits the block, attempting to secure a positive reply.

If the transmitter receives no reply to a block, either the receiver did not receive the block or the receiver's reply was not received by the transmitter. The transmitter transmits an ENQ character, requesting the receiver to resend the last block check

reply. The reply received will be either NAK, indicating the receiver received the block with an error; the proper alternating ACK, indicating the receiver received the block without error; or the improper alternating ACK, indicating the receiver did not receive the block. The transmitter must then resend the current block or send the next block, depending on the reply.

End of transmission, either normal or abnormal, is indicated by the transmitter or receiver sending an EOT character.

Figure C-1 shows samples of the protocol used to transfer data between stations. This figure is representative of the protocol used, but does not show all possible transmitter and receiver actions. The reader is encouraged to consult the IBM publications on BSC protocol listed in the preface for further information.

Normal Transmission:

TRANSMITTER:	**ENQ**	**DATA 1**	**DATA 2**	**EOT**
RECEIVER:		**ACK0**	**ACK1**	**ACK0**

Block Rejected
CRC Error:

TRANSMITTER:	**ENQ**	**DATA 1**	**DATA 1**	**DATA 2**	**EOT**
RECEIVER:		**ACK0**	**NAK**	**ACK1**	**ACK0**

No Response from
Receiver:

TRANSMITTER:	**ENQ**	**DATA 1**	**ENQ**	**DATA 2**	**EOT**
RECEIVER:		**ACK0**		**ACK1**	**ACK0**

Figure C-1. Typical Line Protocol

Cabling

A standard RS-232-C 10 conductor modem cable is supplied with the Mainframe Link for connection between the development system and the modem. This cable is equipped with male DB-25 type connectors on both ends, with the following pins connected:

DB-25 Pin	Designation
1	AA—Protective Ground
2	BA—TXD Transmitted Data
3	BB—RXD Received Data
4	CA—RTS request to Send
5	CB—CTS Clear to Send
6	CC—DSR Data Set Ready
7	AB—Signal Ground
15	DB—TXC Transmit Clock
17	DD—RXC Receive Clock
20	CD—DTR Data Terminal Ready

Pin 24 of the DB-25 must not be connected because this pin is used for clocking by the Mainframe Link's Loop-back test. Connection of this pin may interfere with the operation of some modems.

When running with an iSBC-534 communications board, an iSBC-955 cable is required for connection between the iSBC-534 board and the modem cable.

Loop-back Connector

The Loop-back Connector used for the Loop-back Confidence Tests consists of a single male DB-25 type connector, with pins on the connector interconnected as shown below:

Pin Connection	Designation
2-3	Transmit Data (TXD) to Receive Data (RXD)
4-5	Request-to-Send (RTS) to Clear-to-Send (CTS)
6-20	Data Terminal Ready (DTR) to Data Set Ready (DSR)
15-24	External Clock to Transmit Clock (TXC)
17-24	External Clock to Receive Clock (RXC)

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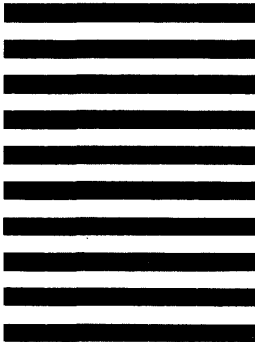CITY_____ STATE _____ ZIP CODE _____

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