TEXAS INSTRUMENTS **MODEM**
USER'S MANUAL

TEXAS INSTRUMENTS

Printed in U.S.A.

1056756-1

Software Option Entries

Software Option	Compact Computer Format	Power-Up Default
Answer/originate mode	M=(A,O)	Originate
Baud rate	B=300	300
Data bits	D=(7,8)	7
Parity	P=(O,E,S,M,N)	Odd parity
Parity check	C=(N,Y)	No check
Stop bits	S=(1,2)	1
Echo	E=(N,Y)	Data echoed
Transfer type	T=(R,C,W)	By record
Data overrun	O=(N,Y)	Overruns reported
Carriage return	R=(L,C,N)	Carriage return and line feed
Carrier detect	NM	Message displayed

Either commas (,) or periods (.) may be used as separators in listing software options for the HX-3100 modem.

Important

In the space below, record the serial number and the FCC registration number from the label on the unit. Also record the purchase date. The serial number is identified by the words "SER. NO." printed on the label. Always refer to this information in any correspondence.

HX-3100	
Model No.	**Serial No.**
FCC Reg. No.	**Purchase Date**

TEXAS INSTRUMENTS MODEM USERS MANUAL

Table of Contents

Introduction

The HX-3100 modem is a telecommunications peripheral for computers that use the Texas Instruments *HEX-BUS*™ Intelligent Peripheral Interface. The modem enables *HEX-BUS*-compatible computers to send and receive data by telephone. With the HX-3100 modem connected to the *HEX-BUS* interface, your computer becomes a communications terminal that can exchange information with remote computers and access subscription data-base services across the country.

As part of the expanding line of TI devices that use the *HEX-BUS* interface (a standardized interconnection system with a uniform set of cabling conventions, control signals, and message structures), the HX-3100 modem plugs directly into any computer compatible with that interface system. The material in this manual applies to operation of the modem with any *HEX-BUS*-compatible computer.

The next few pages contain the FCC requirements pertaining to the modem, followed by a section of general information. The manual then shows you how to connect and test the modem and describes the BASIC instructions available to operate the unit. The software options (parameters that may be altered to configure the modem for telecommunications with a variety of remote systems) are presented next, followed by a section of common applications. A number of useful appendices and a section of service information complete the manual.

FCC Requirements (Texas Instruments Incorporated Model HX–3100 Data Modem)

Installation

When you are ready to install the HX–3100 data modem, call your local telephone company and give them the following information:

1. The telephone number of the line to which you will connect the HX–3100 data modem;
2. The FCC registration number of the HX–3100 data modem; and
3. The ringer equivalence number (REN) of the HX–3100 data modem, which is 0.0B.

The HX–3100 data modem connects to the telephone line by means of standard jacks called USOC RJ11C, RJ11W, RJ13C, RJ13W, RJ14C, or RJ14W. If this type of jack is not available where you want to install the HX–3100 data modem, you will need to order it from the telephone company.

Type of Service

Your HX–3100 data modem is designed to be used on standard-device telephone lines. It should not be used on coin service lines or party lines.

If you have any questions about your telephone line, such as how many pieces of equipment you can connect to it, the telephone company will provide this information upon request.

Telephone Company Procedures

The goal of the telephone company is to provide you with the best service it can. In order to do this, it may occasionally be necessary for them to make changes in their equipment, operations, or procedures. If these changes might affect your service or the operation of your equipment, the telephone company will give you notice, in writing, to allow you to make any changes necessary to maintain uninterrupted service.

FCC Requirements (Texas Instruments Incorporated Model HX–3100 Data Modem)

If Problems Arise

If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When practical, they will notify you in advance of this disconnection. If advance notice is not feasible, you will be notified as soon as possible. When you are notified, you will be given the opportunity to correct the problem and informed of your right to file a complaint with the FCC.

In the event repairs are ever needed on your HX–3100 data modem, they should be performed by Texas Instruments Incorporated or an authorized representative of Texas Instruments Incorporated.

Disconnection

If you should ever decide to permanently disconnect your HX–3100 data modem from its present line, please call the telephone company and let them know of this change.

Radio-Frequency Interference

Texas Instruments computers and peripherals generate and use radio-frequency (RF) energy. If not installed and used properly (as outlined in the instructions provided by Texas Instruments), this equipment may cause interference to radio and television reception.

This equipment has been type-tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Section 68 and in Subpart J of Part 15 of FCC Rules. These rules are designed to provide reasonable protection against radio and television interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

FCC Requirements (Texas Instruments Incorporated Model HX–3100 Data Modem)

If this equipment does cause interference to radio or television reception (which you can determine by turning the equipment off and on), try to correct the interference by one or more of the following measures.

- Reorient the receiving antenna (that is, the antenna for the radio or television that is "receiving" the interference).
- Change the position of the computer with respect to the radio or television equipment that is receiving interference.
- Move the computer away from the equipment that is receiving interference.
- Plug the computer into a different wall outlet so that the computer and the equipment receiving interference are on different branch circuits.

If these measures do not eliminate the interference, please consult your dealer or an experienced radio/television technician for additional suggestions. Also, the Federal Communications Commission has prepared a helpful booklet, "How to Identify and Resolve Radio-TV Interference Problems." This book is available from

The US Government Printing Office
Washington, D.C. 20402

Please specify Stock Number 004–000–00345–4 when ordering copies.

Warning: This equipment has been verified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, etc.) that comply with the Class B limits should be attached to the computer. Operation with noncompliant peripherals is likely to result in interference to radio and TV reception.

General Information

For computer data to be sent or received through the telephone system, the information must be temporarily represented in a different form. Modems are used for this purpose.

"Modem" is an acronym for modulator/demodulator. The modulating portion of a modem converts digital information from a computer into a corresponding pattern of tones for transmission through the telephone system. The demodulating circuitry converts signals received by telephone from another modem into digital information for processing by the computer.

When two modems exchange data, one unit must operate in "answer mode" and the other must be in "originate mode." These terms only distinguish the frequencies at which the respective modems are set to transmit and receive data; a unit in "answer mode" can begin the exchange as well as a unit in "originate mode."

Modems capable of either sending or receiving, but not both, are referred to as simplex devices. Modems that can both send and receive, but not at the same time, are called half-duplex devices. Modems that can simultaneously send and receive are known as full-duplex devices. The HX–3100 modem is a full-duplex device.

Several conventions govern the procedures for sending and receiving data by modem. The HX–3100 modem follows the Bell 103 protocol. It can be linked with any other Bell 103-compatible modem.

The box in which your HX-3100 modem is shipped contains the following items. Save the packing material for storing or transporting the unit.

- The modem.
- A *HEX-BUS* interface cable.
- A telephone cord.
- The user's manual.

Setting up the HX-3100 modem is a simple three-part process. First the batteries are installed. Next, the device is attached to the *HEX-BUS*™ interface and the telephone network. Then its operation is checked. The following pages describe the steps involved in each of these procedures. Please read the background material below before you begin to set up the modem.

Caution: The electronic components of the modem can be damaged by discharges of static electricity. To remove static, touch a metal object (such as a doorknob or desk lamp) before handling the peripheral. Avoid touching the connector contacts.

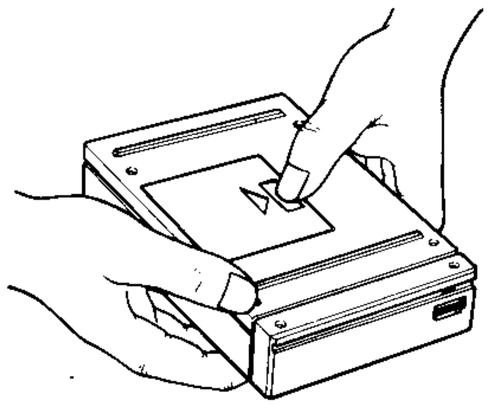
The devices in the TI *HEX-BUS*™ interface system are fitted with identical eight-pin recessed connectors. The computer has one such connector, while each peripheral device has two of them so that a chain of devices may be attached to the computer. The first *HEX-BUS* peripheral is plugged directly into the computer. The second peripheral is cabled to the first, the third to the second, and so on. One connector on the last peripheral is unused.

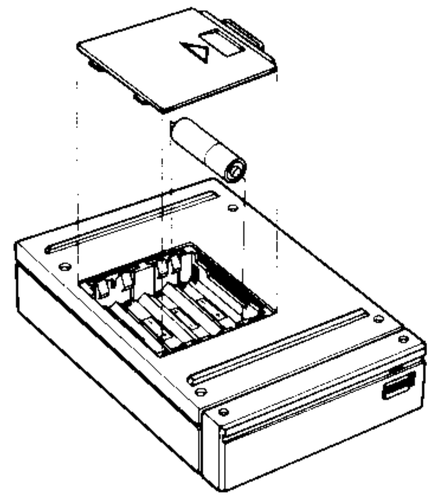
You may link peripherals to the computer in any order. Peripherals are normally placed in a stack next to the computer and connected by the short sections of cable sold with the devices. Longer cables are sold separately if you prefer to arrange the peripherals differently. The plugs are keyed so that you can insert them only one way.

Battery Installation

The modem is powered by four AA dry-cell alkaline batteries (not included). An optional AC adapter model AC9201 is available separately. To install batteries, follow the procedure described below.

1. Ensure that the modem is turned off and disconnected from the *HEX-BUS* interface.
2. Turn the modem over. Locate the thumbnail slot and arrow molded into the battery compartment cover.
3. Release the cover by pressing in the direction shown by the arrow as illustrated below. (This action frees the opposite end of the cover and allows it to pivot away from the modem housing, in the direction of the arrow.) Then take the cover by its free end and lift it clear of the battery compartment.
4. Install the batteries, arranging them as indicated by the polarity markings on the floor of the battery compartment.





5. Reposition the cover over the battery compartment so that the small tab on the end of the cover by the arrow fits under the edge of the peripheral bottom. Press the cover down and in the direction of the arrow until the tabs at the free end drop into place. Set the unit back on its feet.

6. Used batteries should be discarded. Do not burn them.

The batteries have a service life of 20 to 30 hours in normal use. A check for low batteries is performed automatically each time that the modem is readied for communication by the OPEN statement (described under *Using BASIC Statements and Commands*). When an attempt to access the modem returns I/O error code 25 to the Compact Computer (see appendix A), the batteries must be replaced. If a program is running when battery output drops below a minimum level, execution halts with no warning to the user.

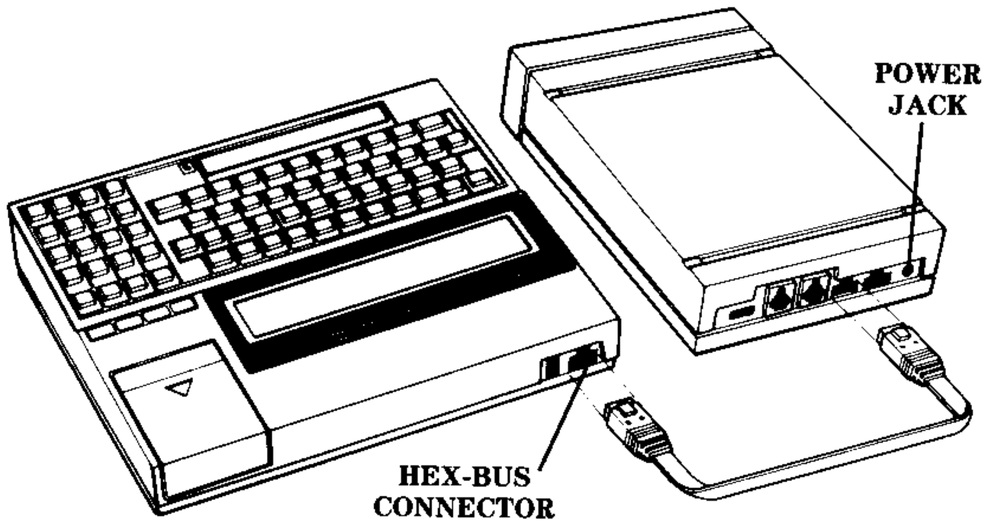
Connecting the Modem to the *HEX-BUS*™ Interface

1. Turn off the computer.

2. If other peripherals are already attached to the *HEX-BUS* interface, turn them off.

3. Locate the device having the one available *HEX-BUS* connector (either the last peripheral on the bus, or the computer if no peripherals are attached yet). Holding that device firmly, plug one end of the *HEX-BUS*™ cable into the connector.

4. Place the modem in position and attach the other end of the cable to either *HEX-BUS* connector on the unit.



5. You may use the optional AC adapter model AC9201 to power the modem. **Do not connect any other adapter to this peripheral.** If you intend to use the AC adapter, attach the power cord to the small jack on the back of the modem and plug the unit into a standard 115-volt AC outlet.

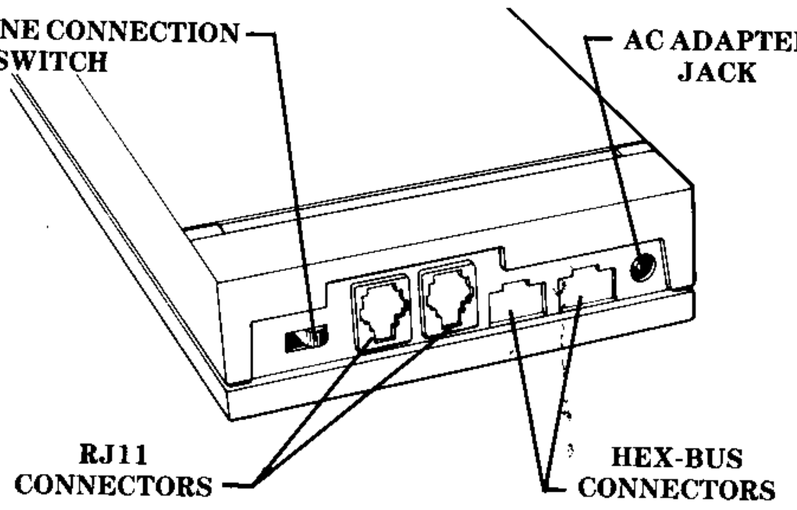
Caution: To prevent damage, disconnect all devices before moving any part of the *HEX-BUS* interface system. The cables and connectors that link the computer and peripherals are subject to accidental strain if not detached. For shipment over long distances repack the system securely, preferably in its original packing materials.

Telephone Connection

1. Be sure that the *HEX-BUS* system is set up within reach of a telephone line having plug connections compatible with those on the modem. The modem is fitted with standard RJ11 modular telephone sockets. One end of your telephone cord must also have an RJ11 plug.

2. Disconnect the telephone cord from the back of the telephone (or from the wall socket) and plug it into either of the RJ11 connectors on the modem. Press the plug into the connector until it snaps into place.

3. Plug one end of the long cord furnished with the modem into the telephone (or the wall socket). Attach the other end of the cord to the remaining RJ11 connector on the modem.



The modem is connected to the telephone line through the sliding switch on the back of the unit. The use of this switch is described in the *Common Applications* section of the manual. Keep the switch in the OFF position when dialing.

The procedure for setting up a telephone link to transfer data through the modem is described under *Common Applications*.

Testing the Modem with a Compact Computer

1. Turn the modem and any other peripherals attached to the *HEX-BUS*™ interface on first. Then turn on the computer. The LED (light-emitting diode) on the front of the modem should illuminate for about half a second as the modem is turned on.

   Note: All peripherals must be turned on for proper operation.

2. Type **CALL IO(70,1)** and press **[ENTER]**. The CALL IO statement causes the I/O (Input/Output) indicator in the computer display and the LED on the modem to turn on for an instant. The message

   ```
   I/O error  4  "70"
   ```

   should then appear in the display as the ERROR indicator comes on. This message tells you that the peripheral is functioning correctly.

   Note: CALL IO(70,1) is a command to end access to the modem. The unit has just been turned on at this point, however, and is not yet enabled for access. In returning error code 4 (device not open), the modem is responding as it should.

3. Press **[CLR]** to clear the error message and restore the cursor. The modem is now ready for use.

If the light is not briefly visible when the CALL IO statement is entered, the modem may not be connected properly. Turn the computer and peripherals off (in that order) and check the cable connections between the computer and the modem. Then repeat the test procedure described above. If a code other than 4 is displayed, refer to appendix A to identify the error.

If the I/O indicator stays on and the computer does not respond to input from the keyboard, first turn off all peripherals. Next, disconnect the *HEX-BUS* cable from the computer (to restore the cursor) and turn off the computer. Then reconnect the cable, check all cable connections, and repeat the test procedure. If results are the same, see the *In Case of Difficulty* section of the manual for further assistance.

After the modem is connected to the *HEX-BUS* interface and tested, you can control its operation from the computer console in one of several ways.

- You can operate the modem with BASIC statements and commands in applications of your own, as described on the following pages.

- Certain separately available *Solid State Software*™ cartridges, such as Memo Processor with Data Communications (for Compact Computers), allow you to access the modem by responding to prompts in prewritten routines for communication with distant modems.

- If you are using a computer equipped with an Editor/Assembler cartridge, you can control the modem in assembly language.

Appendix B gives an example of a BASIC application utilizing some of the assembly-language command codes available in the modem. Further information on the use of *Solid State Software* or Editor/Assembler cartridges with this device can be found in the manuals for those cartridges.

Using BASIC Statements and Commands

Statements are BASIC program instructions that are executed when a program is run. Commands are BASIC instructions for immediate execution that cannot be used within a program. Every instruction belongs to one of these two categories, although some BASIC statements can also be executed immediately. No commands are used with the HX-3100 modem.

The BASIC statements available for use with the modem are summarized below. All of them are implemented in Compact Computers.

- OPEN, CLOSE—Begin and end the use of the modem in communications.

- INPUT, LINPUT, PRINT—Send and receive data.

- CALL IO—Calls a subprogram that is available for communication with peripherals. Offers more control over internal aspects of operations than is otherwise possible in BASIC.

- EOF (End-of-File)—Tests whether a data file open for input contains additional records that can be read. Seldom used with the modem, since this device always shows no end-of-file.

The OPEN statement must be executed before INPUT, LINPUT, PRINT, or EOF can be used to access the modem. The OPEN statement may precede CALL IO as well.

The sample formats in this manual follow the conventions established in the user's guides for Compact Computers. Keywords are capitalized and variables are italicized. Items enclosed in brackets are optional. All other items are required.

The OPEN Statement

The OPEN statement allows a BASIC program to communicate with peripheral devices. When used with the modem, the OPEN statement links this device to a file number and sets parameters for the communication between the computer and the modem and between the modem and the distant system. The OPEN statement has the following general form.

OPEN *#file-number*,"*device-number*[*.software-options*]"[,*file-attributes*]

File-number is a numeric expression that evaluates to an integer between 1 and 255. In BASIC, each open peripheral is treated as a "file" that requires a unique file number.

Device-number is the numeric designation of the peripheral to be operated. Each peripheral has a number of its own. For the HX-3100 modem, *device-number* may range from 70 through 73.

Note: The device number for this peripheral is factory-set at 70. You never need to change it unless you use more than one HX-3100 modem on the *HEX-BUS*™ interface system. If your applications do require more than one of these peripherals, write to Texas Instruments Incorporated, Modem Device Codes, P.O. Box 53, Lubbock, Texas 79408 for information on how to alter device numbers.

Software-options are a set of parameters that you may vary to match the characteristics of the modem to those of a remote system. If you choose not to alter them, these parameters automatically assume certain settings called *default values*. For further information, consult the *Software Options* section of this manual.

File-attributes are keywords that define certain features of the data file itself. If an attribute is not specified, a default value is assumed. The features defined by file attributes are described below.

- File organization—The only file organization that may be used with the modem is SEQUENTIAL. This is the default value and need not be specified in the OPEN statement. RELATIVE (random access) files cannot be used.

- File type—The *HEX-BUS*™ interface system can process data either in ASCII (American Standard Code for Information Interchange) characters as DISPLAY files or in the internal machine format as INTERNAL files. In modem applications, the DISPLAY file type is generally more useful. DISPLAY is the default value and need not be specified.

- Open mode—This entry determines whether the file may be read from (INPUT), written to (OUTPUT), or both (UPDATE). If you do not specify an open mode, the default is UPDATE. The modem cannot be opened in APPEND mode.

- Record type—*Records* are the blocks of data that make up file contents. The *HEX-BUS*™ interface system uses VARIABLE-length records whose length you can define. If no length is specified, the modem supplies an 80-character default. You can set maximum record length to either more or fewer than 80 characters by following the keyword VARIABLE with a number (as in the first example below). Although record length is not a critical parameter in the modem, the VARIABLE feature allows you to set record length to any convenient value (such as the record length used by a remote system).

Examples

```
100 OPEN #1,"70.P=E",VARIABLE 132
```

Prepares the modem to transmit and receive data. Certain software options and file attributes are set to match specific requirements. Others (because they are omitted from the OPEN statement) retain their default values. The peripheral is opened in DISPLAY format and UPDATE mode (both by default). Record length is set to 132 characters. Even parity (described in the *Software Options* section) is used.

```
100 OPEN #2,"70.M=A",INPUT
```

Enables the modem to receive data. The device is opened for input in answer mode (described under *Software Options*). Received data is transferred to the computer in records of 80 characters, the default length for this peripheral.

The CLOSE Statement

A peripheral device made ready for use with an OPEN statement must also be closed when its use is ended. The CLOSE statement for the modem has the following general form.

CLOSE *#file-number*

File-number is the number specified in the associated OPEN statement.

The INPUT Statement

When the INPUT statement is used with the modem, data can be transferred to the computer and assigned to the variables listed in the statement. The INPUT statement has the following general form.

INPUT *#file-number,variable-list*

To use the INPUT statement with the modem, you must open the device in either INPUT or UPDATE mode. The amount of data taken depends on the transfer type and the record length established in the associated OPEN statement. These parameters are discussed in the *Software Options* section of the manual, under the heading *Transfer Type*.

Examples

```
100 INPUT #3,DM$
```

Puts the next character string available from the modem opened as #3 into the string variable DM$.

```
100 INPUT #5,M,S,G
```

Puts the next three values from the modem opened under file number 5 into variables M, S, and G.

Additional examples can be found under *The LINPUT Statement*.

The LINPUT Statement

LINPUT processes any data received during an input operation as a single string variable. The LINPUT statement has the following general form.

LINPUT *#file-number,string-variable*

In contrast to the INPUT statement, LINPUT is unaffected by punctuation or spaces in the data being accepted—information is stored exactly as received. The following table contrasts the operation of the two statements.

Data Received	Program Segment	Data Displayed
"TELL, WILLIAM"	100 INPUT #1,A$ 110 DISPLAY A$	TELL, WILLIAM
"TELL, WILLIAM"	200 LINPUT #1,A$ 210 DISPLAY A$	"TELL, WILLIAM"
TELL, WILLIAM	300 INPUT #1,A$ 310 DISPLAY A$	TELL
TELL, WILLIAM	400 LINPUT #1,A$ 410 DISPLAY A$	TELL, WILLIAM
WILLIAM	500 INPUT #1,A$ 510 DISPLAY A$	WILLIAM
WILLIAM	600 LINPUT #1,A$ 610 DISPLAY A$	WILLIAM

The data string "TELL, WILLIAM", read into memory by INPUT (line 100), is displayed as TELL, WILLIAM without quotation marks. When LINPUT is used (line 200), the display contents match the original data. TELL, WILLIAM without quotation marks is read by LINPUT (line 400) as a single string variable. INPUT (line 300) handles the comma as a separator and treats this data as two distinct variables.

When WILLIAM, preceded by blank spaces, is entered, INPUT (line 500) disregards the blanks. LINPUT (line 600) takes them as actual input and reproduces the entire string, including the blanks.

As the above examples show, LINPUT has great utility in telecommunicating data with punctuation, such as passages of text. In such applications you may often find LINPUT more useful than INPUT.

Example

```
100 LINPUT #4,LN$
```

Puts a record of data from a modem opened under file number 4 into the string variable LN$ (assuming a transfer type of T = R for "record"). Transfer type is discussed in the *Software Options* section of the manual.

Both INPUT and LINPUT read data from the modem. When used without a file number, both statements also accept data from the computer console.

The PRINT Statement

PRINT allows you to transfer data from the computer through the modem to a remote system. The peripheral must be opened in OUTPUT or UPDATE mode before data can be sent. The PRINT statement has the following general forms.

PRINT *#file-number,print-list*

PRINT *#file-number*,USING $\begin{Bmatrix} string\text{-}expression \\ line\text{-}number \end{Bmatrix}$ *,print-list*

The contents of the *print-list* may be string (text) or numeric items. The optional USING clause, available in Compact Computer BASIC, specifies the format to be used in printing or displaying data. *String-expression* defines the format in the same way as the IMAGE statement (described in Compact Computer user's guides). *Line-number* refers to the line number of an IMAGE statement. When used without a file number, both forms of the PRINT statement place data in the computer display.

Examples

```
100 PRINT #9,PARAM$
```

Sends the value of the variable PARAM$ to the device opened as #9.

```
100 PRINT #9,"DONE"
```

Sends the string DONE to the device opened as #9.

```
100 PRINT #9,USING "###.#",357.97
```

Outputs the value 358.0 to the device opened as #9.

When data is transmitted through the HX-3100 modem to another modem, a carriage return followed by a linefeed character is sent after each record unless *carriage return* software options N or C are set. For a description of the carriage return and linefeed functions, refer to the section on the *carriage return* software option.

The EOF Function

As noted under *Using BASIC Statements and Commands*, EOF has little application with the modem. The value returned is always 0, indicating that no end-of-file has been reached.

The CALL IO Statement

CALL IO is a BASIC statement provided in Compact Computers to access special features and capabilities unique to many *HEX-BUS*™ peripherals. With the RS232 peripheral, for instance, CALL IO is used in processing service requests.

The most frequent application of CALL IO with the modem—other than in the power-up check—is to issue a *transmit break* command (see appendix B) during telecommunications with a data-base service. This command returns the modem to the highest command level of the remote system by sending a short break signal to interrupt the data transfer. To use the *transmit break* feature with a modem having a device number of 70, execute the statement **CALL IO(70,16)**.

The modem also supports service requests. You can use CALL IO to enable the modem to issue service requests or to disable it from doing so. An example of this CALL IO application is included in appendix B.

Additional information about the CALL IO statement can be found in the manual for the Editor/Assembler software package.

Software Options

Telecommunication systems differ in how quickly they operate, how much information they can transfer in a given time, etc. You can compensate for such differences by selecting options which are available as part of the OPEN statement in BASIC. Because these options are set within programs, or software, they are known as *software options*.

Eleven software options are available in the HX-3100 modem through the OPEN statement. Because the rest of the BASIC statements and commands that control this peripheral operate on files made ready for access by the OPEN statement, the options are used in BASIC only with OPEN.

The modem automatically assumes certain preset software options, called *default values*. You only have to specify those settings that you wish to change from their default values. When specifying multiple options in an OPEN statement, you can use either periods or commas as separators. The table on the next page summarizes the options, their standard formats, and their default values.

The software options are described in detail on the pages following the table. Examples of their application occur in this section as well as in the *Common Applications* portion of the manual.

HX–3100 Software Options

Option	Power-Up Default	Format	Available Settings
Answer/originate mode	O	M=	A,O
Baud rate	300	B=	300
Data bits	7	D=	7,8
Parity	O	P=	O,E,S,M,N
Parity check	N	C=	N,Y
Stop bits	1	S=	1,2
Echo	Y	E=	N,Y
Transfer type	R	T=	R,C,W
Data overrun	Y	O=	N,Y
Carriage return	L	R=	L,C,N
Carrier detect	Message displayed.	NM	To suppress CARRIER DETECT message, specify NM (no message).

Answer/Originate Mode

Full-duplex modems such as the HX–3100 unit send and receive data simultaneously on different frequencies. When a telecommunications link is set up, the initial communication must be originated at one end of the link and answered at the other. Computer users generally establish the configuration of their respective systems at the beginning of each telecommunications session, so that each modem receives and transmits on the right frequency. The *answer/originate* software option allows the HX–3100 modem to be configured either as the answering or the originating telecommunications device. You can select M = A to place the modem in the answer mode or M = O to place it in the originate mode. The default setting is M = O.

Baud Rate

The *baud rate* is the speed of data transmission. The HX–3100 modem uses a baud rate of 300, which is both the default value and the only available setting. It is not necessary to specify the baud rate in programs written for this peripheral, but the existence of the *baud rate* option provides compatibility with programs developed for RS232-driven modems. In such programs, the baud rate must be specified as B = 300.

Data Bits

The *data bits* option lets you set the number of bits contained in each character transmitted. You have a choice of seven or eight bits. If you specify D = 7, seven-bit characters (the ASCII standard) are sent. The power-up default value is 7. If you set the number of data bits to 8, this setting becomes the new default value until the modem is turned off or 7 is specified.

Parity

Checking parity is a way of detecting errors in data transmission. A *parity bit* can be inserted into each character sent. It may be either 1 or 0, depending on the type of parity chosen. The modem can check certain types of parity. If the type you specify in the OPEN statement is one of those that can be checked, and if the modem is set to monitor parity, any loss or distortion of data during transmission produces an error indication. The parity options are as follows.

- O for odd parity. If a character in the transmission has an even number of 1s, its parity bit is set to 1. Otherwise, its parity bit is set to 0. The modem can check for odd parity.

- E for even parity. If a character in the transmission contains an odd number of 1s, its parity bit becomes 1. If the character has an even number of 1s, its parity bit becomes 0. The modem can check for even parity.

- S for space parity. If you specify space parity, the parity bit is always 0 regardless of whether the character contains an even or odd number of 1s. The modem cannot check for space parity.

- M for mark parity. If you specify mark parity, the parity bit is always 1 regardless of whether the character contains an even or odd number of 1s. The modem cannot check for mark parity.

- N for no parity. The data transmission contains no parity bits.

As an example, specifying P = E for even parity sets the parity bit in a character to 0 if the character has an even number of 1s and to 1 if it has an odd number of 1s. Once the parity is set, it remains as specified until changed by a new OPEN statement or until the modem is turned off. Odd parity is the power-up default.

Parity Check

The modem can check for odd or even parity. The *parity check* option allows you to specify whether parity is checked. C = N is the default value. When this setting is chosen or when no setting is specified, parity is not checked.

Specifying C = Y in an OPEN statement enables the modem to monitor odd or even parity. If a parity error is detected, the modem returns an error code to the computer. The code is interpreted as error 81 by Compact Computers.

If the program you are running has no provision for error handling (such as the ON ERROR routine in the first example under *Common Applications*), execution halts when an error code is received.

Stop Bits

Stop bits are sent after transmission of each character to mark the end of that character. With the *stop bits* software option, you can set the number of stop bits to either 1 or 2. The setting S = 2 directs the modem to end each transmission with two stop bits. The default value is S = 1.

Echo

The *echo* software option provides an additional method of detecting errors in data received by the modem from a remote system. The modem normally retransmits characters, as it receives them, back to the sending device. To have characters echoed back to the sending device, no option entry is necessary (although you may select E = Y). To prevent characters from being echoed back, specify E = N. Only one of the modems in a data link, not both, can operate in echo mode. In accessing a subscription data-base service, you should generally suppress the echo feature.

Transfer Type

Incoming data is temporarily stored by the modem. The *transfer type* software option determines the form in which data is moved from the modem to the computer.

Option T = R, the default setting, sends input to the computer in records of the length established in the associated OPEN statement. If VARIABLE 25 is specified, for example, data is transferred in records 25 characters long. This feature is useful in applications that involve data received in records of some consistent length.

A carriage return indicates the end of a record to the modem. Carriage return and linefeed characters are not transferred to the computer with option T = R. If a carriage return ends the data stream before a record is complete, the record goes to the computer with the remainder of its length padded by blank spaces. If a record does not end with a carriage return but the following record begins with one, the leading carriage return is considered part of the previous record and is ignored.

If a data transmission ends with a series of trailing blanks, the user's choice of input statement determines how the blanks are handled. INPUT removes trailing blanks. LINPUT preserves them as part of the data.

Option T = C transfers data character by character. Up to a point, any characters stored in the modem at the time of an input operation (including carriage returns and linefeeds) are sent to the computer. The number of characters transferred depends on two factors: the record length specified in the OPEN statement and the number of characters available in the modem. The lesser of these two quantities is the number of characters transferred. If no data is present, a null data string is sent to the computer and program execution continues.

Option T = W also transfers data character by character. If data is present in the modem, there is no difference between this option and option T = C. If no data is available, however, the modem causes the computer to wait until a character is ready.

Data Overrun

A data overrun occurs when the modem receives more data than it can send to the computer. Any additional data that arrives during an overrun is lost. The *data overrun* option allows you to specify whether the modem should report data overrun as an error and halt program execution.

Choosing the option O = N allows the HX-3100 modem to disregard data overruns. When you are receiving data from a distant modem, this setting allows the incoming data stream to overflow modem storage without causing an error indication and stopping the program. Characters lost during an overrun are not echoed back to the sending device, regardless of the *echo* option setting.

Selecting the option O = Y (the default value) allows a data overrun to be reported as an error. If an overrun occurs, program execution stops automatically unless the program contains an error-handling routine. This option is helpful when the loss of even a small amount of data would make the rest of a transmission unusable.

Carriage Return

In transmissions of data to a distant modem, the *carriage return* option allows you to specify whether the HX-3100 modem should send either a carriage return and a linefeed or a carriage return alone at the end of each record, or suppress those characters. The following settings are available.

- R = L for carriage return and linefeed.
- R = C for carriage return only.
- R = N for no carriage return or linefeed.

Selecting the option R = C, for example, means that each record sent from the peripheral is followed by a carriage return but not by a linefeed. The default value is R = L.

Carrier Detect

Enabling a modem for telecommunications causes the modem to generate a carrier signal and allows the unit to transmit and receive data through the telephone circuits.

When the HX-3100 modem receives the carrier signal of a distant modem, it automatically generates a CARRIER DETECT message for display by your computer. This message is normally the first input returned to the computer.

The *carrier detect* option allows you to specify whether the CARRIER DETECT message should be sent to the computer. You can specify NM (no message) in the OPEN statement to suppress the CARRIER DETECT message, or omit this entry to allow the message to be displayed.

Recovery from Errors

Most errors that involve the HX-3100 modem occur during input or output with this device as a result of some discrepancy in program statements. These errors are seldom serious, and they are easily corrected. Errors are indicated to the user as a displayed message beginning `I/O error...`

In Compact Computers, the message contains a one- to three-digit error code and the device or file number associated with the modem. If errors occur during program execution, any open files are automatically closed. The error codes that you may encounter when using the modem are listed in appendix A with their meanings and recommended corrective steps.

In the event of an error involving the modem, proceed as follows.

1. First note the code number and look it up in appendix A.
2. Press **[CLR]** to clear the error message and restore the cursor to the display.
3. Then apply the suggestions given in appendix A for the error you encountered and try the operation again.

If the above measures do not solve the problem, turn off all devices attached to the *HEX-BUS* interface, beginning with the computer. Then turn on all devices attached to the interface, ending with the computer, and try the operation again. Successive attempts that produce the same error may indicate a hardware fault. Consult the *In Case of Difficulty* section of this manual for service information and additional troubleshooting suggestions.

The HX-3100 modem enables the computer not only to communicate with a distant computer system, but to access a wide variety of data information services as well. Two examples are given here. The first illustrates how two computer systems may be configured for telecommunication with each other. The second describes the procedure for accessing a subscription data-base service.

Exchanging Messages with a Distant Computer

The following BASIC program listing can be used in a telephone link between a Compact Computer using an HX-3100 modem and a remote computer using another 300-baud modem.

If the distant modem is also an HX-3100 unit attached to a TI Compact Computer, the program can be run in the form shown below on both systems (with one change: the *answer/originate* software option must be set to M = A in one of the programs and M = O in the other). After both systems are set up, communication is carried out as follows.

1. The program is keyed into the Compact Computer as listed below.

2. An equivalent program is entered on the distant computer. (The remote system must be in originate mode because the program shown places the local computer in answer mode.)

3. One user telephones the other to establish the communications link. Either user may call, because the *answer/originate* setting takes effect only after the modem is coupled to the telephone circuit.

4. Both users enter **[RUN]**. TYPE MESSAGE: should appear in both computer displays.

5. With both telephones off the hook and with both programs running, the users connect their respective modems to the telephone circuit (an HX-3100 user does this by sliding the telephone connection switch on the back of the modem to ON). The connections can be made in either order.

6. Each user should listen for a high-pitched tone (the carrier signal) before hanging up the telephone. When the respective carrier signals are audible, both systems are ready to communicate.

7. Either user may enter a message at this point. The program displays your partner's message after you enter your own message. If your partner has not entered a message, your input is displayed until a communication arrives from your partner. Note that the *carrier detect* option is not suppressed. When the program is run as listed below, CARRIER DETECT is the first message returned to the computer.

Compact Computer Version

```
100 OPEN #1,"70.D=7,P=E,S=2,E=N,O=N,M=A"
110 ON ERROR 170 ! Set up error handling routine
120 LINPUT "TYPE MESSAGE: ";X$ ! Enter message to send
130 PRINT #1,X$ ! Send message to modem
140 LINPUT #1,Y$ ! Receive message from remote system
150 PRINT Y$:PAUSE ! Display message until ENTER pressed
160 GOTO 120 ! Loop to start new message
170 PRINT "I/O ERROR":PAUSE ! Error routine--wait for ENTER
180 RETURN 110 ! Start new message
```

The program first accepts a message from the local keyboard and transmits it to the remote system, where it is input and displayed by the program being run on the other computer. The distant operator may then read the message and respond. The error-handling routine in lines 110, 170, and 180 allows the program to continue in the event of an input or output error.

Because the HX-3100 modem operates in full-duplex mode, it can receive and transmit simultaneously. The exchange of messages can continue for as long as both programs are running. The PAUSE statements in lines 150 and 170 halt the program indefinitely while messages are displayed. After reading a message, press **[ENTER]** to resume the exchange.

The program is suitable for applications such as the simple exchange of messages suggested in this example. To transfer large amounts of data or to access a data-base service, however, specialized telecommunication routines such as those in the Memo Processor with Data Communications package for Compact Computers give best results.

Accessing a Subscription Data-Base Service

This example describes a sample procedure for gaining access to a subscription data-base service. Since you are communicating with the service by telephone, your equipment includes an HX-3100 modem, connected to the computer and tested as described under *Set-Up Instructions*. It is assumed that you are using prewritten software (such as the Memo Processor with Data Communications package for Compact Computers) to access the data base.

Note: For access to a data-base service, you must subscribe to the service and pay any required fees. Most computer-oriented magazines include information on available data-base services.

Before establishing communication with the data-base service, you must determine the software options necessary for proper data exchange with the distant modem. The required values for these parameters can be found in the user's manual furnished by the service.

It is assumed in this example that the service uses a data transmission rate of 300 baud, even parity, and seven data bits. Checking these parameters against the default values of the corresponding HX-3100 software options indicates a match with the default values in each case except the parity type. This option, therefore, must be set to P = E when the telecommunications software you are using prompts for its value.

To prepare for communication with the remote system, perform the following steps.

1. Set up the modem as described under *Set-up Instructions* and install a telecommunications software cartridge in your computer.

2. Start the program. Match the characteristics of the HX-3100 modem to those of the remote modem by answering the displayed prompts of the communications options menu as needed.

3. Enter the communications mode in the manner required by your software.

4. Dial the number of the data-base service. Listen for a high-pitched tone which signals that the distant computer is ready to communicate.

5. Slide the telephone connection switch (located on the right rear of the modem) to the ON position and hang up the telephone. The "working" light on the modem should flicker to show communication between the computer and the modem.

6. At this point the data-base service generally sends a series of input prompts. Begin communication with the remote system by entering your assigned password, log-on code, or other information required. The necessary inputs are described in the user's manual supplied by the service.

After you have properly accessed the data base, the display shows the information being received by your modem. At times the remote system may transmit signals to clear the display or return the cursor to its home position. The computer responds to these signals by clearing the display and moving the cursor to the left side. The next item received is displayed at that position.

When the data transfer is complete, several methods of ending the session are usually available. The user's manuals for the data-base service and for your communications software describe the most effective ways to end the exchange. A few extraneous characters may be displayed if the connection is broken by the remote modem.

Appendix A: Error/Status Codes (Compact Computer)

Listed below are the error codes related to the operation of the HX-3100 modem in BASIC programs.

The error codes marked with an asterisk (*) are those that apply only if you use the CALL IO statement. They do not occur with any other BASIC statements or commands.

Code	Meaning
0*	NO ERRORS.
1	DEVICE/FILE OPTIONS ERROR. Check the software options in the OPEN statement or IO call. Make sure that commas, periods, and equal signs are used correctly.
2	ERROR IN ATTRIBUTES. Check the file attributes given in the OPEN statement or IO call.
4	DEVICE/FILE NOT OPEN. Open the modem for access before using it.
5	DEVICE/FILE ALREADY OPEN. Close the device and try again. If the CLOSE statement in BASIC does not work, use **CALL IO(70,1)** to close the modem. If the above steps are not successful, you can close all peripherals by turning the computer off momentarily.
8*	DATA/FILE TOO LONG. Modify the Peripheral Access Block as described in the Editor/Assembler manual.
10*	NOT REQUESTING SERVICE. This message may be sent by a peripheral in response to a poll by the computer to determine which device issued a service request.
12*	BUFFER SIZE ERROR. The data buffer size specified in the Input/Output subsystem instructions is not large enough for the data returned by a peripheral. Make the buffer larger.
13	UNSUPPORTED COMMAND. The modem generates this message in response to commands that it cannot accept.

14	DEVICE/FILE NOT OPEN FOR OUTPUT. The peripheral's current open mode does not allow you to send data. Reopen the device in OUTPUT or UPDATE mode.
15	DEVICE/FILE NOT OPEN FOR INPUT. The peripheral's current open mode does not allow you to receive data. Reopen the device in INPUT or UPDATE mode.
17	RELATIVE FILES NOT SUPPORTED. The modem processes SEQUENTIAL files exclusively.
19	APPEND MODE NOT SUPPORTED. The modem does not operate in the APPEND mode. It must be opened in INPUT, OUTPUT, or UPDATE mode, depending on its application in a given program.
25	LOW BATTERIES IN PERIPHERAL. Replace the batteries as described under *Set-up Instructions*.
80	DATA OVERRUN. Input data is arriving at the modem faster than it can be sent on to the computer. Input more frequently to save data, or set the *overrun* software option to O = N to ignore the loss of data.
81	PARITY ERROR. Either a data transmission error has occurred or the parity settings of the HX-3100 modem and the remote device do not match. Check that the parity settings are the same.
82	FRAMING ERROR. A disparity exists between the *data bits*, *stop bits*, *baud rate*, or *parity* software option settings of the modem and the characteristics of the remote device. Be sure that these settings match the device characteristics.
255	TIME-OUT ERROR. The computer generates this error code if it cannot communicate with a peripheral. Check the *HEX-BUS* cable connections and make sure that you are using the correct *device-number* (preset to 70 at the factory).

Appendix B: Assembly-Language Command Codes

This appendix is primarily for use in conjunction with the Editor/Assembler manual and software package created for Compact Computers and *HEX-BUS* peripherals. The descriptions given here supplement the explanations and examples found in the Editor/Assembler manual.

Compact Computers have an Input/Output subsystem that you can access to communicate with *HEX-BUS*™ peripherals on an assembly-language level. This communication can take place either entirely in assembly language if you have the Editor/Assembler cartridge, or from BASIC if you use the CALL IO instruction with appropriate command codes.

As a telecommunications peripheral, the HX-3100 modem is not oriented towards use with files. The commands controlling this device involve the tasks of opening or closing the unit and reading or writing data. (The modem also supports service requests.) The assembly-language command codes with which you can direct the modem to carry out these operations are listed below, together with any applicable restrictions.

Code	Function
0	*Open*. Prepares a device for use. The modem may be opened in INPUT, OUTPUT, or UPDATE mode as required in a given application. SEQUENTIAL files (the default file organization) are always used. The APPEND mode and RELATIVE file organization are not applicable to this peripheral.
1	*Close*. Completes any pending operations by the modem and ends the use of the device until the next *open* instruction.
3	*Read*. Inputs data from the modem. The device must first be opened in INPUT or UPDATE mode.
4	*Write*. Transmits data through the modem to a remote device. The modem must first be opened in OUTPUT or UPDATE mode.

7	*Return Status*. Requests device and file status information from peripherals. When this message is used with the HX-3100 modem, the *end-of-file* bit is always returned set to zero. If the specified I/O buffer size is three or more bytes, the number of characters waiting to be sent to the computer is also returned (least significant byte first).
8	*Enable Service Requests*. Signals a peripheral device that it may issue service requests to the computer. When enabled for service requests, the modem is permitted to interrupt regular program execution so that incoming data is immediately processed by the computer.
9	*Disable Service Requests*. Signals a peripheral device that it may no longer request service.
10	*Service Request Poll*. Determines which device is requesting service. Not used in programming, but automatically sent to peripherals by the computer upon reception of a service request.
15	*Set Options*. Modifies the peripheral options previously specified in an *open* instruction without first closing and reopening the device.
16	*Transmit Break*. Causes the HX-3100 modem to send a continuous break signal for approximately .25 seconds. Used in data-base communications to shift back to the first level of prompts.
80	*Test*. Places the modem in a test configuration. **Reserved for factory use.** If you accidentally execute this command, reset the sysem by turning all devices off and on again in the correct order.

254	*Null Operation*. Defers processing of a service request received while an earlier service interrupt is in progress. Not used in programming, but sent automatically to the peripheral issuing the new service request. Though the computer may enable a number of peripherals for service requests, it can process only one request at a time.
255	*Reset Bus*. Closes all open device files and resets all peripherals attached to the *HEX-BUS* interface. Not normally included in programs.

For a detailed treatment of the Input/Output subsystem and command codes, refer to the manual for the Editor/Assembler cartridge.

Service Requests

Many *HEX-BUS*™ peripherals have unique capabilities which are accessible on an assembly-language level. The modem can be enabled for service requests. It then has the ability to interrupt regular program execution and have data processed by the computer.

When enabled, the HX-3100 modem issues a service request to the computer each time it receives data from a distant modem. The unit is enabled for service requests as follows.

1. Set up a Service Request Peripheral Access Block (SRPAB).

2. Enable interrupts.

3. Open the device.

4. Send the *enable service requests* instruction.

The above steps are executed most efficiently in assembly language. With somewhat reduced efficiency, they can also be performed in BASIC. Since assembly-language programming is not within the scope of this manual, a BASIC example is given here.

The SRPAB, set up in computer memory by the user, supplies the parameters necessary for communication with the modem through the Input/Output subsystem. It contains the one- or two-byte fields diagrammed below, which are filled as needed for each particular application. The diagram shows an SRPAB that allows service requests from the modem.

	SRPAB	
Device number	70	Modem
Command code	0	Don't care
Logical unit number (LUNO)	0	Don't care
Record number	0	Don't care
	0	
Buffer length	10	Size of allocated buffer
	0	
Data length	0	Not sending any data
	0	
Returned status	0	Zeroed initially
Buffer pointer	LSB	Points to highest address in buffer
	MSB	
Link to next SRPAB	LSB2	Points to start of this SRPAB (No other device enabled)
	MSB2	
Service flag	0	Zeroed initially
Pointer to device service routine (DSR)	0	Left zeroed
	0	

As the diagram indicates, the elements that must be specified in building a Service Request PAB for the modem are the device number, buffer length (with a maximum possible length of 65,535 bytes), data length, return status, buffer address, SRPAB pointer, service flag, and device service routine (DSR) pointer. The field for the DSR pointer is provided for future applications. It is not used in the Compact Computer and should be left zeroed as shown.

Data is entered in the fields of an SRPAB with the POKE subprogram. The necessary values are placed in memory starting at the lowest address allocated. The following program segment illustrates the process of enabling the modem for service requests, beginning with the construction of an SRPAB.

```
100 CALL GETMEM(17,SRPABADDR) ! Gets SRPAB
110 CALL GETMEM(10,BUFFADDR) ! Gets buffer
120 CALL SPLIT(BUFFADDR+9,MSB,LSB) ! Splits address into two bytes
130 CALL SPLIT(SRPABADDR+16,MSB2,LSB2)
140 CALL POKE(SRPABADDR,0,0,0,MSB2,LSB2,MSB,LSB,0,0,0,0,10,0,0,
    0,0,70)
150 CALL POKE(2056,MSB2,LSB2) ! Sets up pointer to SRPAB
160 CALL POKE(BUFFADDR,5,10) ! Enables interrupts
170 CALL EXEC(BUFFADDR)
180 CALL PEEK(256,IOCNTRL)
190 IOCNTRL=IOCNTRL OR 1
200 CALL POKE(256,IOCNTRL)
210 OPEN #1,"70.C=Y,P=E,D=7,E=N,T=C",VARIABLE 10
220 CALL IO(70,8) ! Sends enable service requests command
```

Lines 100–140 above prepare memory space for the SRPAB and the data buffer. Line 150 sets up a pointer to the SRPAB for the I/O subsystem. In lines 160–200, interrupts are enabled so that the computer can recognize service requests. In line 210 the peripheral is opened, as required before enabling service requests. The *enable service requests* command is sent in line 220.

The SPLIT subprogram which is called in lines 120 and 130 splits a 16-bit unsigned data value into a Most Significant Byte (MSB) and a Least Significant Byte (LSB), as shown below.

```
1000 SUB SPLIT(DATAVAL,MSB,LSB)
1010 MSB=INT(DATAVAL/256)
1020 LSB=DATAVAL-MSB*256
1030 SUBEND
```

After a device is enabled for service requests, a program can check for received data by testing the service flag in the SRPAB as shown below. The I/O subsystem sets the service flag upon completion of a successful poll.

```
230 CALL PEEK(SRPABADDR+2,SERVICE_FLAG)
240 IF SERVICE_FLAG<>0 THEN 700
250 GOTO 230
```

If the service flag check indicates no reception of data, the main program continues immediately after line 240. If the service flag is set, however, execution of the main program halts and the program branches to line 700. At line 700 the operation status is checked. Data is then removed and processed.

```
700 CALL PEEK(SRPABADDR+7,STATUS)
710 IF STATUS THEN PRINT "Error--";STATUS:PAUSE:STOP
720 CALL PEEK(SRPABADDR+8,MSB,LSB) ! Gets data length
730 DATLEN=MSB*256+LSB ! MSB should always be zero
740 DATA$="" ! Initializes data string
750 FOR I=1 TO DATLEN
760 CALL PEEK(BUFFADDR+10-I,A) ! Gets next character
770 DATA$=DATA$&CHR$(A) ! Appends it to the string
780 NEXT I
790 PRINT DATA$ ! Displays data received
800 PAUSE
810 CALL POKE(SRPABADDR+2,0) ! Resets service flag
820 GOTO 230 ! Returns to main program
```


The number of characters transferred during each service request depends on the buffer length and transfer mode established in the OPEN command. If the option T = R is specified, then a full record of data (or data padded with blanks) having the length of the buffer is sent. If the record is not complete when the computer polls the modem, the peripheral causes the computer to wait until it is complete. If the options T = C or T = W are chosen, any number of characters up to the buffer length may be transferred.

Until the SRPAB service flag is reset to zero by line 810, any additional service requests are disregarded. The peripheral requesting service continues doing so until its request is acknowledged.

If the computer transmits an input instruction to a peripheral issuing a service request, the service request is terminated and the peripheral sends the required data instead. Data can also be output to devices enabled for service requests. These operations are executed as usual.

In Case of Difficulty

If the HX-3100 modem or remote devices do not appear to be working properly, check the following.

1. **Power**—Be sure that the batteries are serviceable (or that the optional AC adapter is plugged in) and that the power switch is on. All peripherals must be turned on for proper operation.

2. **Cables**—Verify that the proper cables are being used. Be sure that cables are plugged in securely.

3. **Software Options**—Even when all devices are operating correctly, this peripheral can appear to malfunction if software options are improperly set. Check the user's manual of the device or system with which the modem is communicating and verify that the device characteristics correspond to the options selected in the OPEN statement. Unsuitable *baud rate*, *transfer type*, *data bits*, *parity*, *echo*, or *carriage return* settings may produce undesirable results. In telecommunications with another modem, one modem must operate in the *originate* mode and the other in the *answer* mode. When you are accessing a data-base service, the modem should be in the *originate* mode in most cases.

4. **Attached Devices**—The modem at the other location must be compatible with your modem. The HX-3100 modem can communicate with a similar TI unit or with other Bell 103-compatible modems that support a 300-baud data rate. If the remote unit has a test or local mode, have the remote operator use it if possible to be sure that the device is working properly when disconnected from the telephone link.

5. **Telephone Connection**—Check the telephone line. If it sounds noisy or weak or if you hear voices, dialing sounds, or other tones, slide the telephone connection switch on the back of the modem to OFF and redial the telephone number. (If you redial after making connection with another system, the modem must be reopened with an OPEN statement before you can continue.)

If the HX-3100 modem still does not appear to be working properly, first turn off all devices attached to the *HEX-BUS* interface, beginning with the computer. Next, disconnect the modem from the *HEX-BUS*™ interface and the telephone circuit. Then follow the steps below.

1. **See if the computer itself is working properly.** Turn on the computer and enter **OPEN #1,"70"** (if the modem is set to a device number other than 70, use the number in effect). The error message `I/O error 255 #1` should appear in the computer display, indicating that the modem cannot be opened.

2. **Check that the modem is working properly.** Referring to the set-up instructions, reconnect the modem to the *HEX-BUS* interface and the telephone circuit. Turn all peripherals attached to the *HEX-BUS* interface on first. Then turn on the computer. Type **OPEN #1,"70"** and press **[ENTER]**. The OPEN entry should disappear from the computer display and be replaced by a flashing cursor on the left side, confirming that the modem has been opened.

3. If the modem still does not work when reconnected to the *HEX-BUS* interface, then the unit or its cable may be faulty. If none of the above procedures correct the difficulty, consult the section entitled *If You Have Questions or Need Assistance* or refer to the *Service Information* portion of the *User's Guide* furnished with your computer.

Service Centers

If your HX-3100 modem requires service and you do not wish to return the unit to a service facility for repair or replacement, you may elect to exchange the unit for a factory-reconditioned HX-3100 modem of the same model (or equivalent model specified by TI) by going in person to one of the service centers which have been established across the United States. A handling fee will be charged by the service center for in-warranty exchanges of the HX-3100 modem. Out-of-warranty exchanges will be charged at the rates in effect at the time of the exchange. Please refer to the enclosed Service Center listing or call the Consumer Relations Department for exchange fee information and the location of the nearest service center.

Service Information

If You Have Questions or Need Assistance

If you have questions concerning repair of the HX–3100 modem or peripheral, accessory, or software purchase, please call our Customer Relations Department at 1-800-TI-CARES (toll free within the contiguous United States). The operators at these numbers cannot provide technical assistance.

For technical questions such as programming, specific applications, etc., you can call (806) 741–2663. Please note that this is not a toll-free number and collect calls cannot be accepted.

As an alternative you can write to

Consumer Relations Department
Texas Instruments Incorporated
P.O. Box 53
Lubbock, Texas 79408

Because of the number of suggestions which come to Texas Instruments from many sources containing both new and old ideas, Texas Instruments will consider such suggestions only if they are freely given to Texas Instruments. It is the policy of Texas Instruments to refuse to receive any suggestions in confidence. Therefore, if you wish to share your suggestions with Texas Instruments or if you wish us to review any BASIC language program which you have developed, please include the following statement in your letter.

"All of the information forwarded herewith is presented to Texas Instruments on a nonconfidential, nonobligatory basis; no relationship, confidential or otherwise, expressed or implied, is established with Texas Instruments by this presentation. Texas Instruments may use, copyright, distribute, publish, reproduce, or dispose of the information in any way without compensation to me."

Three-Month Limited Warranty

This Texas Instruments HX–3100 Modem warranty extends to the original Consumer Purchaser of the accessory.

Warranty Duration

This HX–3100 modem is warranted for a period of three (3) months from the date of the original purchase by the consumer.

Warranty Coverage

This HX–3100 modem is warranted against defective materials or workmanship. **This warranty is void if the accessory has been damaged by accident, unreasonable use, neglect, improper service or other causes not arising out of defects in materials or workmanship.**

Warranty Disclaimers

Any implied warranties arising out of this sale, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, are limited in duration to the above three-month period. Texas Instruments shall not be liable for loss of use of the HX–3100 Modem or other incidental or consequential costs, expenses, or damages incurred by the consumer or any other user.

Some states do not allow the exclusion or limitation of implied warranties or consequential damages, so the above limitations or exclusions may not apply to you in those states.

Legal Remedies

This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

Warranty Performance

During the above three-month warranty period, your HX–3100 modem will be repaired or replaced with a new or reconditioned unit of the same or equivalent model (at TI's option) when the unit is returned by prepaid shipment to a Texas Instruments Service Facility listed below. The repaired or replacement unit will be warranted for three months from date of repair or replacement. Other than the postage requirement, no charge will be made for the repair or replacement of in-warranty units.

Texas Instruments strongly recommends that you insure the unit for value, prior to shipment.

Texas Instruments Consumer Service Facilities

U.S. Residents
Texas Instruments
Service Facility
2303 North University
Lubbock, Texas 79415

Canadian Residents
Geophysical Services
Incorporated
41 Shelley Road
Richmond Hill, Ontario,
Canada L4C5G4

Consumers in California and Oregon may contact the following Texas Instruments offices for additional assistance or information.

Texas Instruments
Consumer Service
831 South Douglas Street
El Segundo, California 90245
(213) 643-7403

Texas Instruments
Consumer Service
6700 Southwest 105th Street
Kristin Square
Suite 110
Beaverton, Oregon 97005
(503) 643-6758

ADDENDUM

The Transmit Break Command is not supported by the HX-3100 Modem.

PN 1056763-0001